

QGIS Desktop 3.16 User Guide

QGIS Project

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CAPÍTULO 1

Preâmbulo

This is the user guide for the geographical information system (GIS) software QGIS. QGIS is subject to the GNU General Public License. More information is available on the QGIS homepage, https://www.qgis.org.

The contents of this document have been written and verified to the best of the knowledge of the authors and editors. Nevertheless, mistakes are possible.

Therefore, the authors, editors and publishers do not take any responsibility or liability for errors in this document and their possible consequences. We encourage you to report possible mistakes.

This document has been typeset with reStructuredText. It is available as reST source code on github, and online as HTML and PDF via https://www.qgis.org/en/docs/. Translated versions of this document can be browsed and downloaded via the documentation area of the QGIS project as well.

For more information about contributing to this document and about translation, please visit https://qgis.org/en/site/getinvolved/index.html.

Links neste Documento

This document contains internal and external links. Clicking on an internal link moves within the document, while clicking on an external link opens an internet address.

Documentation Authors and Editors

The list of the persons who have contributed with writing, reviewing and translating the following documentation is available at *Contributors*.

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Internet: https://www.qgis.org

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1.1 What is new in QGIS 3.16

This release of QGIS includes hundreds of bug fixes and many new features and enhancements, compared to QGIS 3.10. We recommend that you use this version over previous releases. For a list of new features, visit the visual changelogs at https://qgis.org/en/site/forusers/visualchangelogs.html.

CAPÍTULO 2

Preâmbulo

Bem vindo ao mundo maravilhoso dos Sistemas de Informação Geográficas (SIG)!

QGIS is an Open Source Geographic Information System. The project was born in May 2002 and was established as a project on SourceForge in June the same year. We have worked hard to make GIS software (which is traditionally expensive proprietary software) available to anyone with access to a personal computer. QGIS currently runs on most Unix platforms, Windows, and macOS. QGIS is developed using the Qt toolkit (https://www.qt.io) and C++. This means that QGIS feels snappy and has a pleasing, easy-to-use graphical user interface (GUI).

QGIS aims to be a user-friendly GIS, providing common functions and features. The initial goal of the project was to provide a GIS data viewer. QGIS has reached the point in its evolution where it is being used for daily GIS data-viewing needs, for data capture, for advanced GIS analysis, and for presentations in the form of sophisticated maps, atlases and reports. QGIS supports a wealth of raster and vector data formats, with new format support easily added using the plugin architecture.

QGIS is released under the GNU General Public License (GPL). Developing QGIS under this license means that you can inspect and modify the source code, and guarantees that you, our happy user, will always have access to a GIS program that is free of cost and can be freely modified. You should have received a full copy of the license with your copy of QGIS, and you can also find it in Appendix *Apêndice A: Licença Pública Geral GNU*.

Dica: Atualização da Documentação

The latest version of this document can always be found in the documentation area of the QGIS website at https://www.qgis.org/en/docs/.

CAPÍTULO 3

Convenções

Esta seção descreve os estilos uniformes que serão utilizados ao longo deste manual.

3.1 Convenções da Interface Gráfica

Os estilos convenção da GUI, são destinados a similar a aparência gráfica. Em geral, um estilo vai refletir a aparência, para que um usuário possa verificar visualmente a GUI e encontrar algo semelhante com as instruções no manual.

- Menu Opções: *Camada* ► *Adicionar uma camada Raster* ou *Configurações* ► *Barra de Ferramentas* ► *Digitalizar*
- Tool:  Add a Raster Layer
- Button : *Save as Default*
- Caixa de diálogo Título: *Propriedades da camada*
- Aba: *Geral*
- Caixa de seleção:  *Renderizar*
- Radio Button:  *Postgis SRID*  *EPSG ID*
- Selecionar um número: 
- Selecionar uma string: 
- Browse for a file: …
- Selecionar uma cor: 
- Barra deslizante: 
- Input Text: 

Uma sombra indica um componente GUI clicável.

3.2 Convenções do Texto ou Teclado

This manual also includes styles related to text, keyboard commands and coding to indicate different entities, such as classes or methods. These styles do not correspond to the actual appearance of any text or coding within QGIS.

- Hyperlinks: https://qgis.org
- A Combinação das teclas: Press `Ctrl+B`, ou seja, pressione e segure a tecla Ctrl e, em seguida, pressione a tecla B.
- Nome de um arquivo: `lakes.shp`
- Nome de uma classe: **NewLayer**
- Método: *classFactory*
- Servidor: *myhost.de*
- Texto de Usuário: `qgis --help`

Linhas de código serão indicadas por uma fonte de tamanho fixo:

```
PROJCS["NAD_1927_Albers",
  GEOGCS["GCS_North_American_1927",
```

3.3 Instruções especificas da Plataforma

GUI sequences and small amounts of text may be formatted inline: Click *File* ▸ *QGIS* ▸ *Quit to close QGIS*. This indicates that on Linux, Unix and Windows platforms, you should click the File menu first, then Quit, while on macOS platforms, you should click the QGIS menu first, then Quit.

Grandes quantidades de texto podem ser formatados com uma lista:

- Faz isso
- Faz aquilo
- Or do that

ou um parágrafo:

Faz isso, isso e isso. Então faz isso, isso e isso e isso, isso e isso, e isso, isso e isso.

Do that. Then do that and that and that, and that and that and that, and that and that and that, and that and that.

Screenshots that appear throughout the user guide have been created on different platforms.

CAPÍTULO 4

Feições

QGIS offers a wealth of GIS functions, provided by core features and plugins. The locator bar makes it easy to search for functions, datasets and more.

A short summary of six general categories of features and plugins is presented below, followed by first insights into the integrated Python console.

4.1 Visualização de dados

You can view combinations of vector and raster data (in 2D or 3D) in different formats and projections without conversion to an internal or common format. Supported formats include:

- Spatially-enabled tables and views using PostGIS, SpatiaLite and MS SQL Spatial, Oracle Spatial, vector formats supported by the installed OGR library, including GeoPackage, ESRI Shapefile, MapInfo, SDTS, GML and many more. See section *Trabalhando com Dados Vetoriais*.
- Formatos de imagens e Raster suportados pela biblioteca GDAL instalada (Geospatial Data Abstraction Library), como GeoTIFF, ERDAS IMG, ArcInfo ASCII GRID, JPEG, PNG e muitos mais. Consulte a seção *Trabalhando com Dados Raster*.
- Mesh data (TINs and regular grids are supported). See *Working with Mesh Data*.
- Vector tiles
- Dados vetoriais e raster GRASS para base de dados GRASS (location.mapset). Ver seção *Integração com SIG GRASS*.
- Online spatial data served as OGC Web Services, including WMS, WMTS, WCS, WFS, and WFS-T. See section *Working with OGC / ISO protocols*.

  The QGIS authentication infrastructure helps you manage user/password, certificates and keys for web services and other resources.
- Spreadsheets (ODS / XLSX)

Temporal data are supported.

4.2 Exploração de dados e compositores de mapas

Você pode compor mapas e interativamente explorar dados espaciais com uma interface gráfica amigável. As muitas ferramentas úteis disponíveis na GUI incluem:

- QGIS browser
- Reprojeção On-the-fly
- Gerenciador BD
- Print layout
- Report
- Painel de Vista Global
- Marcadores espaciais
- Ferramentas de anotação
- Identificar/selecionar feições
- Editar/ver/procurar atributos
- Data-defined feature labeling
- Ferramentas de simbologia raster e vetorial dado definido
- Compositor de Atlas com camada grade
- North arrow, scale bar and copyright label for maps
- Suporte para salvamento e restauração de projetos

4.3 Criar, editar, gerir e exportar dados

You can create, edit, manage and export vector and raster layers in several formats. QGIS offers the following:

- Vector digitizing tools
- Ability to create and edit multiple file formats and GRASS vector layers
- Complemento Georreferenciador para geocodificar imagens
- GPS tools to import and export GPX format, and convert other GPS formats to GPX or down/upload directly to a GPS unit (on Linux, usb: has been added to list of GPS devices)
- Suporte para visualização e edição de dados OpenStreetMap
- Ability to create spatial database tables from files with the DB Manager plugin
- Tratamento melhorado de tabelas de bases de dados espaciais
- Ferramentas para gerenciamento de tabelas de atributos vetoriais
- Opção para salvar as imagens como imagens georreferenciadas
- ferramenta de exportação DXF com recursos aprimorados para exportar estilos e complementos para executar funções CAD-like

4.4 Analyze data

You can perform spatial data analysis on spatial databases and other OGR-supported formats. QGIS currently offers vector analysis, raster analysis, sampling, geoprocessing, geometry and database management tools. You can also use the integrated GRASS tools, which include the complete GRASS functionality of more than 400 modules (see section *Integração com SIG GRASS*). Or, you can work with the Processing plugin, which provides a powerful geospatial analysis framework to call native and third-party algorithms from QGIS, such as GDAL, SAGA, GRASS, R, and more (see section *Introdução*). All analysis functions are run in the background, allowing you to continue your work before the processing has finished.

The graphical modeller allows you to combine / chain functions into a complete workflow in an intuitive graphical environment.

4.5 Publicação de mapas na internet

QGIS can be used as a WMS, WMTS, WMS-C or WFS and WFS-T client (see section *Working with OGC / ISO protocols*), and QGIS Server (see the QGIS-Server-manual) allows you to publish your data through the WMS, WCS and WFS protocols on the Internet using a webserver.

4.6 Extend QGIS functionality through plugins

QGIS can be adapted to your special needs with the extensible plugin architecture and libraries that can be used to create plugins. You can even create new applications with C++ or Python!

4.6.1 Complementos Core

Complementos incluídos no programa

1. DB Manager (exchange, edit and view layers and tables from/to databases; execute SQL queries)
2. Geometry Checker (check geometries for errors)
3. Georeferencer GDAL (add projection information to rasters using GDAL)
4. GPS Tools (load and import GPS data)
5. GRASS 7 (integrate GRASS GIS)
6. MetaSearch Catalogue Client (interacting with metadata catalog services supporting the OGC Catalog Service for the Web (CSW) standard)
7. Offline Editing (allow offline editing and synchronizing with databases)
8. Processing (the spatial data processing framework for QGIS)
9. Topology Checker (find topological errors in vector layers)

4.6.2 Complementos Externos Python

QGIS offers a growing number of external Python plugins that are provided by the community. These plugins reside in the official Plugins Repository and can be easily installed using the Python Plugin Installer. See Section *Diálogo de Complementos*.

4.7 Console Python

For scripting, it is possible to take advantage of an integrated Python console, which can be opened with: *Plugins* ► *Python Console*. The console opens as a non-modal utility window. For interaction with the QGIS environment, there is the `qgis.utils.iface` variable, which is an instance of `QgisInterface`. This interface provides access to the map canvas, menus, toolbars and other parts of the QGIS application. You can create a script, then drag and drop it into the QGIS window and it will be executed automatically.

For further information about working with the Python console and programming QGIS plugins and applications, please refer to *Terminal Python QGIS* and PyQGIS-Developer-Cookbook.

4.8 Problemas conhecidos

4.8.1 Limitação no número de arquivos abertos

Se você está abrindo um grande projeto QGIS e você tem certeza de que todas as camadas são válidas, mas algumas camadas são sinalizadas como ruim, você provavelmente irá se confrontar com esta questão. O Linux (e outros sistemas operacionais, da mesma forma) tem um limite de arquivos abertos por processo. Limites de recursos por processo e hereditária. O comando `ulimit`, que é um shell integrado, muda os limites apenas para o processo de shell atual; o novo limite será herdado por quaisquer processos filhos.

You can see all current ulimit info by typing:

```
$ ulimit -aS
```

You can see the current allowed number of opened files per process with the following command on a console:

```
$ ulimit -Sn
```

To change the limits for an **existing session**, you may be able to use something like:

```
$ ulimit -Sn #number_of_allowed_open_files
$ ulimit -Sn
$ qgis
```

Para fixar isso sempre

Na maioria dos sistemas Linux, limites de recursos são definidos no login pelo módulo `pam_limits` de acordo com as definições contidas no `/etc/security/limits.conf` ou `/etc/security/limits.d/*.conf`. Você será capaz de editar os arquivos, se você tem privilégios de root (também via sudo), mas você vai precisar fazer login novamente para que as alterações tenham efeito.

Mais informações:

https://www.cyberciti.biz/faq/linux-increase-the-maximum-number-of-open-files/ https://linuxaria.com/article/open-files-in-linux

CAPÍTULO 5

Iniciando

Este capítulo fornece uma visão geral rápida da instalação do QGIS, do download de dados de amostra do QGIS e da execução de uma primeira sessão simples de visualização de dados raster e vetoriais.

5.1 Instalando o QGIS

O projeto QGIS fornece maneiras diferentes de instalar o QGIS, dependendo da sua plataforma.

5.1.1 Instalando a partir de binários

Instaladores padrão estão disponíveis para MS Windows e Mac OS. Pacotes binários (rpm e deb) ou repositórios de software são fornecidos para muitos tipos de GNU/Linux.

Para mais informações e instruções para o seu sistema operacional, verifique https://download.qgis.org.

5.1.2 Instalando a partir da source

If you need to build QGIS from source, please refer to the installation instructions. They are distributed with the QGIS source code in a file called `INSTALL`. You can also find them online at https://github.com/qgis/QGIS/blob/master/INSTALL.md.

Se você deseja compilar uma versão específica e não a versão em desenvolvimento, substitua `master` pelo branch do release (geralmente no formulário `release-X_Y`) no link mencionado acima (as instruções de instalação podem ser diferentes).

5.1.3 Instalando em mídia externa

É possível instalar o QGIS (com todos os complementos e configurações) em um flashdrive, e. g. pendrive. Isto pode ser feito definindo uma opção *–profiles-path* que substitui o caminho padrão *user profile* e força **QSettings** a usar este diretório, também. Veja a seção *System Settings* para informações adicionais..

5.1.4 Baixando dados de amostra

This user guide contains examples based on the QGIS sample dataset (also called the `Alaska dataset`). Download the sample data from https://github.com/qgis/QGIS-Sample-Data/archive/master.zip and unzip the archive on any convenient location on your system.

O conjunto de dados do Alasca inclui todos os dados GIS usados para os exemplos e capturas de tela deste guia do usuário; Ele também inclui um pequeno banco de dados GRASS. A projeção para os conjuntos de dados de amostra QGIS é a Alaska Albers Equal Area com unidades em pés. O código EPSG é 2964.

```
PROJCS["Albers Equal Area",
GEOGCS["NAD27",
DATUM["North_American_Datum_1927",
SPHEROID["Clarke 1866",6378206.4,294.978698213898,
AUTHORITY["EPSG","7008"]],
TOWGS84[-3,142,183,0,0,0,0],
AUTHORITY["EPSG","6267"]],
PRIMEM["Greenwich",0,
AUTHORITY["EPSG","8901"]],
UNIT["degree",0.0174532925199433,
AUTHORITY["EPSG","9108"]],
AUTHORITY["EPSG","4267"]],
PROJECTION["Albers_Conic_Equal_Area"],
PARAMETER["standard_parallel_1",55],
PARAMETER["standard_parallel_2",65],
PARAMETER["latitude_of_center",50],
PARAMETER["longitude_of_center",-154],
PARAMETER["false_easting",0],
PARAMETER["false_northing",0],
UNIT["us_survey_feet",0.3048006096012192]]
```

Se você pretende usar o QGIS como um front end gráfico para o GRASS, pode encontrar uma seleção de locais de amostra (por exemplo, Spearfish ou Dakota do Sul) no site oficial do GRASS GIS, https://grass.osgeo.org/download/sample-data/.

5.2 Iniciando e parando o QGIS

O QGIS pode ser iniciado como qualquer outro aplicativo no seu computador. Isso significa que você pode iniciar o QGIS fazendo:

- using the Applications menu, the Start menu, or the Dock
- clicando duas vezes no ícone na pasta Aplicativos ou no atalho da área de trabalho
- clicando duas vezes em um arquivo de projeto existente do QGIS (com `.qgz` ou `.qgs`). Observe que isso também abrirá o projeto.
- digitando `qgis` em um prompt de comando (assumindo que o QGIS foi adicionado ao seu CAMINHO ou você está na pasta de instalação)

Para parar o QGIS, use:

- a opção do menu *Projeto* ► *Sair do QGIS* ou use o atalho `Ctrl+Q`

- *QGIS* ► *Sair do QGIS*, ou use o atalho `Cmd+Q`
- ou use a cruz vermelha no canto superior direito da interface principal do aplicativo.

5.3 Sessão de amostra: Carregando camadas raster e vetorial

Agora que você tem *QGIS installed* e um *sample dataset* disponíveis, demonstraremos uma primeira sessão de amostra. Neste exemplo, visualizaremos uma camada raster e uma camada vetorial. Nós vamos usar:

- a camada raster `landcover` (`qgis_sample_data/raster/landcover.img`)
- e a camada vetorial `lakes` (`qgis_sample_data/gml/lakes.gml`)

Em que `qgis_sample_data` representa o caminho para o conjunto de dados descompactado.

1. Inicie o QGIS como mostrado em *Iniciando e parando o QGIS*.
2. Para carregar os arquivos no QGIS:
    1. Clique no ícone Abrir Gerenciador de Fonte de Dados. O Gerenciador de Fonte de Dados deve abrir em modo Navegador.
    2. Navegue até a pasta `qgis_sample_data/raster/`
    3. Selecione o arquivo ERDAS IMG `landcover.img` e clique duas vezes nele. A camada de cobertura do solo é adicionada em segundo plano enquanto a janela do Gerenciador de Fonte de Dados permanece aberta.

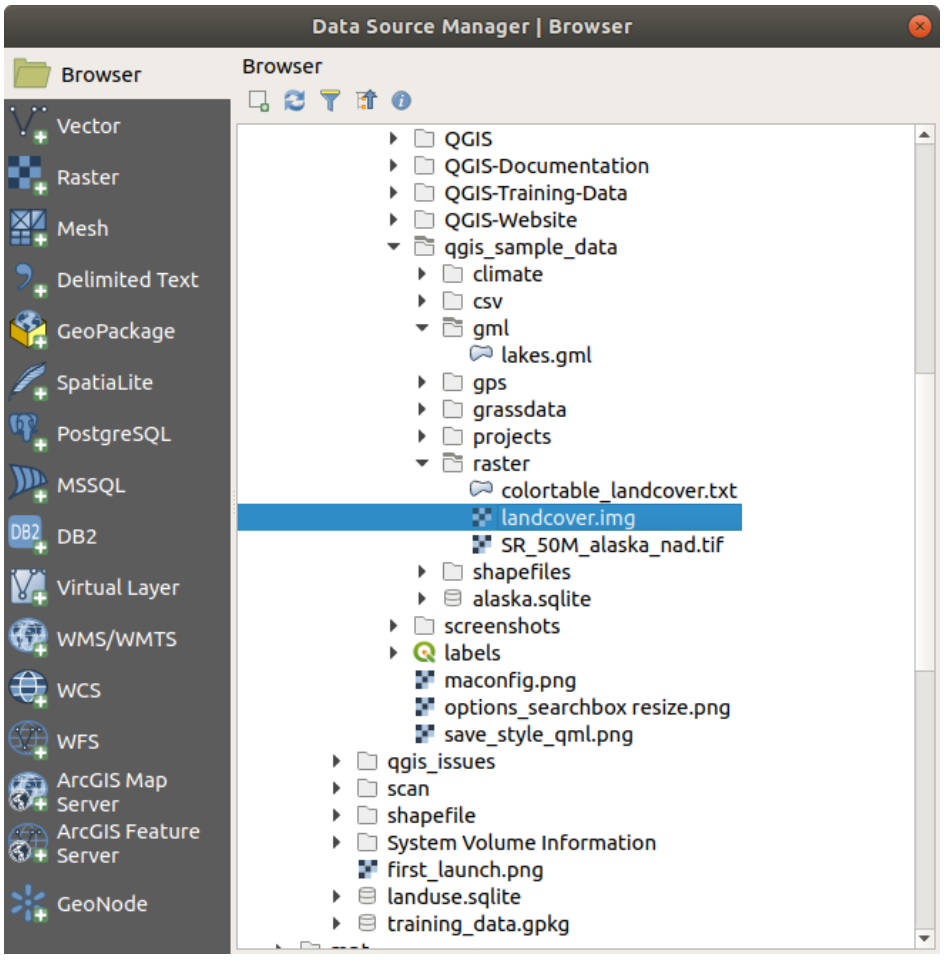


Figura5.1: Adicionando dados a um novo projeto no QGIS

4. Para carregar os dados dos lagos, vá até a pasta `qgis_sample_data/gml/` e clique duas vezes no arquivo `lakes.gml` para abri-lo.
5. Uma caixa de diálogo *Seletor de Sistema de Referência de Coordenadas* é aberta. No menu *Filtrar*, digite `2964`, filtrando a lista de sistemas de referência de coordenadas abaixo.

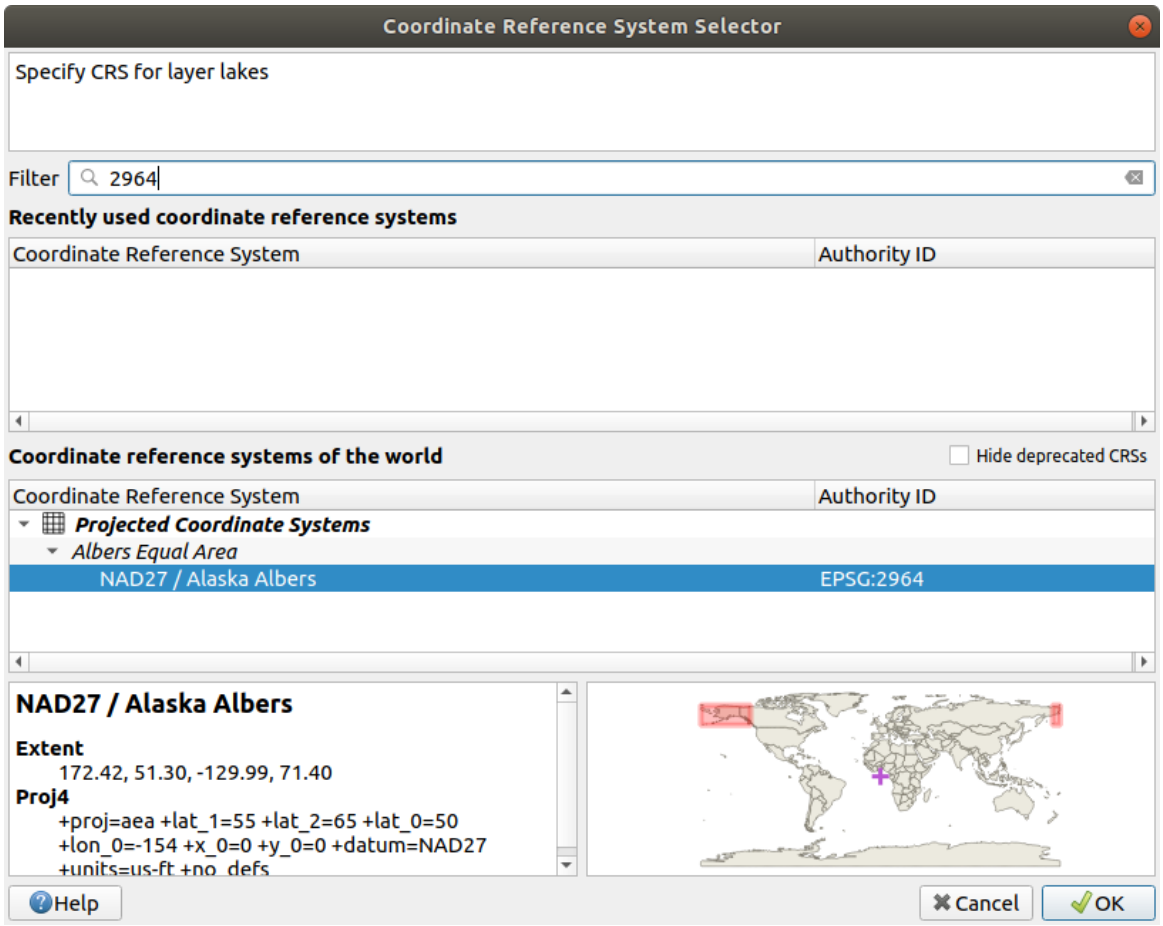


Figura5.2: Selecione o Sistema de Referência de Coordenadas de dados

6. Select the *NAD27 / Alaska Albers* entry
7. Clique *OK*.
8. Feche a janela Gerenciador de Fonte de Dados

Agora você tem as duas camadas disponíveis no seu projeto em algumas cores aleatórias. Vamos fazer algumas personalizações na camada dos lagos.

1. Selecione o Zoom In na barra de ferramentas *Navegação*
2. Zoom para uma área com alguns lagos
3. Clique duas vezes na camada `lakes` na legenda do mapa para abrir a caixa de diálogo *Propriedades*
4. Para mudar a cor dos lagos:
    1. Clique na guia *Simbologia*.
    2. Selecione azul como cor de preenchimento.

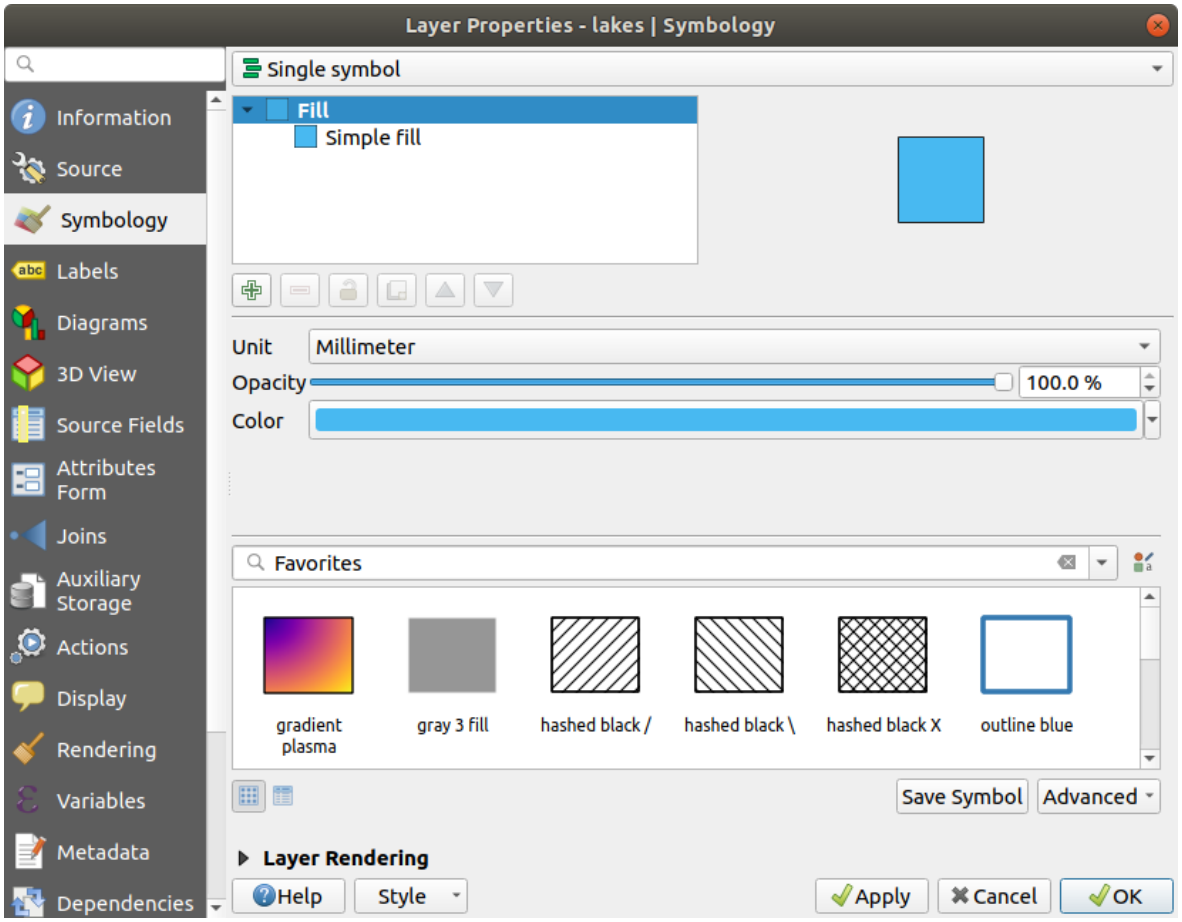


Figura5.3: Selecionando a cor dos lagos

3. Pressione *OK*. Os lagos agora são exibidos em azul na tela do mapa.

5. Para exibir o nome dos lagos:

   1. Reabra a camada `lakes` na caixa de diálogo *Propriedades*
   2. Click on the *Labels* tab
   3. Selecione *Rótulos únicos* no menu drop-down para ativar a marcação.
   4. Na lista *Rotular com*, escolha o campo `NOMES`.

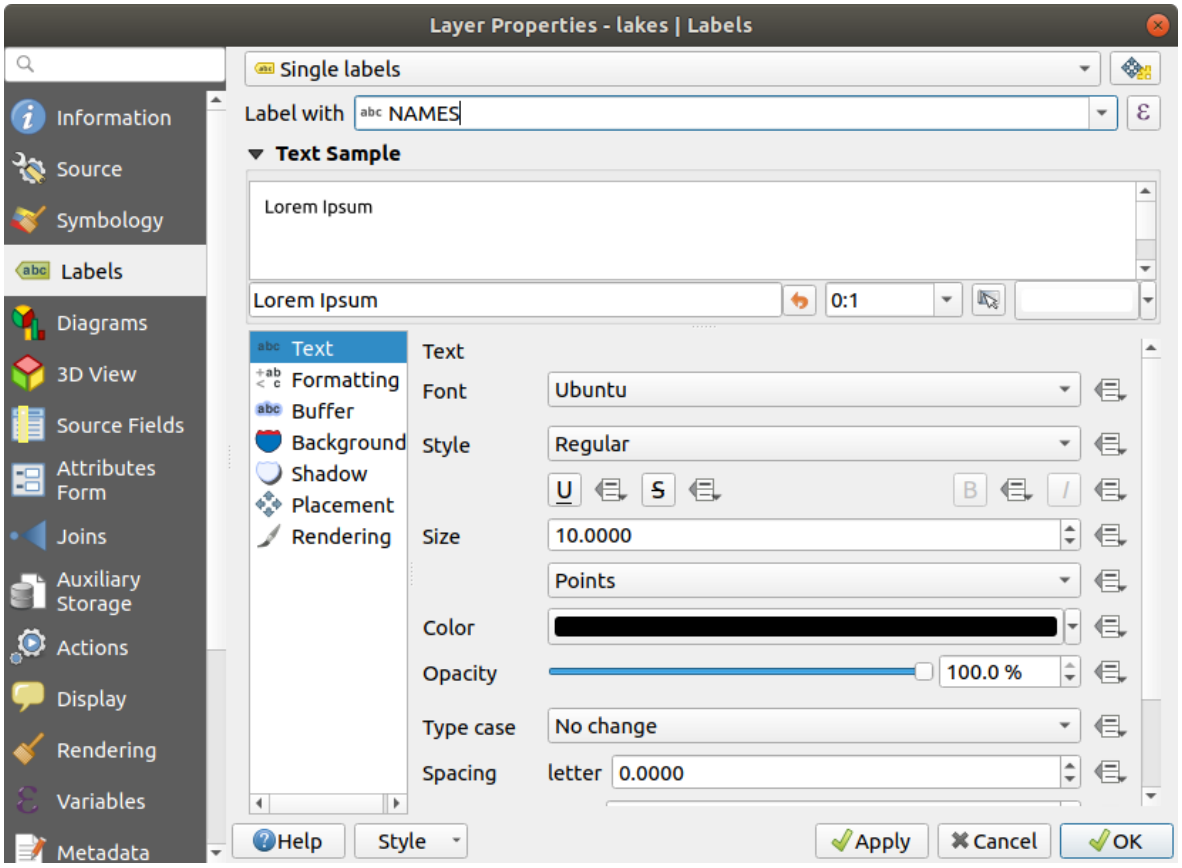


Figura5.4: Mostrar nomes dos Lagos

5. Pressione *Aplicar*. Os nomes agora serão carregados além dos limites.

6. Você pode melhorar a legibilidade dos rótulos adicionando um buffer branco ao redor deles:

   1. Clique na guia *Buffer* na lista à esquerda
   2. Check *Draw text buffer*
   3. Escolha `3` como tamanho do buffer
   4. Clique em *Aplicar*
   5. Verifique se o resultado está bom e atualize o valor, se necessário.
   6. Por fim, clique em *OK* para fechar a caixa de diálogo *Propriedades da Camada* e aplicar as alterações.

Vamos agora adicionar algumas decorações para moldar o mapa e exportá-lo para fora do QGIS:

1. Selecione o menu *Exibir* ► *Decorações* ► *Barra de Escala*
2. Na caixa de diálogo aberta, selecione a opção *Ativar Barra de Escala*
3. Personalize as opções da caixa de diálogo como desejar
4. Pressione *Aplicar*
5. Da mesma forma, no menu de decorações, adicione mais itens (seta norte, direitos autorais…) à tela do mapa com propriedades personalizadas.
6. Clique em *Projeto* ► *Importar/Exportar* ► *Exportar Mapa para Imagem…*
7. Pressione *Salvar* na caixa de diálogo aberta
8. Selecione um local de arquivo, um formato e confirme pressionando *Salvar* novamente.

9. Pressione *Projeto* ►  *Salvar...* para armazenar suas alterações como um arquivo de projeto `.qgz`.

É isso! Você pode ver como é fácil visualizar camadas raster e vetoriais no QGIS, configurá-las e gerar seu mapa em um formato de imagem que você pode usar em outros softwares. Vamos seguir para aprender mais sobre a funcionalidade, recursos e configurações disponíveis e como usá-los.

Nota: Para continuar aprendendo o QGIS através de exercícios passo a passo, siga as instruções em Training manual.

CAPÍTULO 6

Trabalhando com Arquivos de Projetos

6.1 Introduzindo projetos do QGIS

Sua sessão atual do QGIS pode ser chamada de projeto. O QGIS trabalha em um projeto por vez. Uma configuração pode ser específica do projeto ou padrão de toda a aplicação para novos projetos (consulte a seção: ref: *gui_options*). O QGIS pode salvar a sessão do seu espaço de trabalho em: ref: *arquivo de projeto QGIS* usando as opções de menu: menuselection: *Projeto* -> | fileSave | : menuselection: *Salvar* ou: menuselection:` Projeto -> | *fileSaveAs* | *: menuselection: `Salvar como ….*

Nota: If the project has been modified the * symbol will appear in the title bar and QGIS will, by default, ask you if you would like to save the changes. This behavior is controlled by the *Prompt to save project and data source changes when required* setting under *Settings* ► *Options* ► *General*.

Você pode carregar projetos existentes para o QGIS desde o painel do Browser ou através de *Projeto* ► *Abrir…*, *Projeto*► *Novo a partir de modelo* or *Projeto* ► *Abrir Recente* ►.

No início, uma lista de "Modelos de Projetos" e "Projetos Recentes" são mostrados, incluindo capturas de tela, nomes e caminhos de arquivos (para além de dez projetos). A lista de "Projetos Recentes" é conveniente para acessar projetos recentemente utilizados. Duplo-clique numa dessas entradas para abrir o projeto ou o modelo de projeto. Você também pode adicionar uma camada para criar um novo projeto automaticamente. As listas irão assim desaparecer, dando acesso à tela do mapa.

Se você quiser limpar sua sessão e iniciar uma nova, vá para *Projeto* ► **|fileNovo|** *Novo*. Isso irá possibilitar salvar o projeto existente caso mudanças tenham sido feitas desde que este tenha sido aberto ou salvo.

When you open a fresh project, the title bar will show `Untitled Project` until you save it.

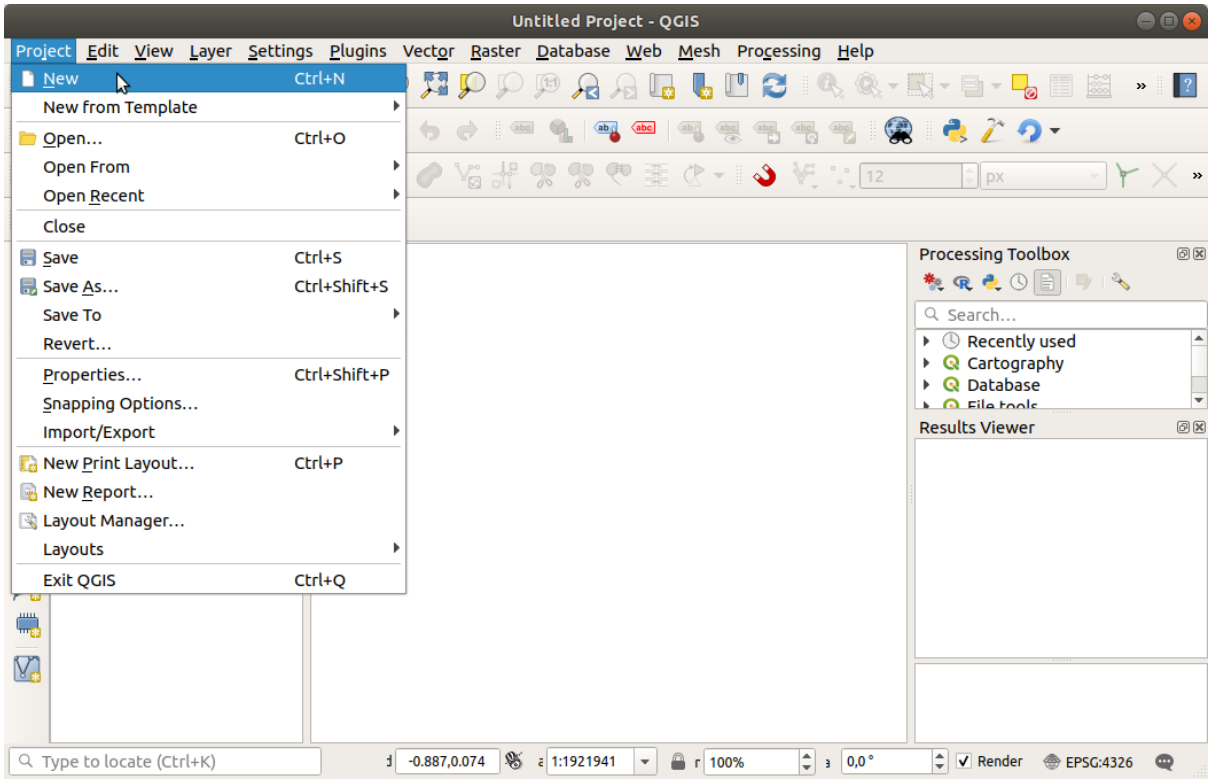


Figura6.1: Iniciando um novo projeto no QGIS

A informação salva em um arquivo de projeto inclui:

- Camadas adicionadas
- Quais camadas podem ser consultadas
- Propriedades das camadas, incluindo simbologia e estilos
- Projeção para a vista do mapa
- A última extensão vista
- Leiautes de impressão
- Elementos de leiaute de impressão com definições
- Definições de leiaute de impressão de atlas
- Definições de digitalização
- Relações de tabelas
- Macros de projetos
- Estilos pré-definidos de projeto
- Definições de plugins
- Definições do QGIS Server a partir das definições de tabela OWS nas propriedades do projeto
- Consultas armazenadas no gestor de banco de dados

O arquivo do projeto é salvo no formato XML (see *QGS/QGZ - O Formato de Arquivo de Projeto QGIS*). Isto significa que é possível editar o arquivo fora do QGIS caso saiba o que está fazendo. O formato do arquivo de projeto foi atualizado diversas vezes. Arquivos de projetos de versões anteriores do QGIS podem não mais funcionar corretamente.

Nota: Por definição, o QGIS irá advertir sobre diferenças nas versões. Este comportamento é controlado no *Geral* tab of *Configurações* ► *Opções* (*Verificar a versão do QGIS ao iniciar*).

Sempre que salvar um arquivo de projeto `.qgs` no QGIS, um backup do arquivo é criado no mesmo diretório do arquivo de projeto, com a extensão `.qgs~`.

A extensão para o projeto do QGIS é `.qgs` mas quando se salva desde o QGIS, o padrão é salvar utilizando um formato comprimido com a extensão `.qgz`. O arquivo `.qgs` é incorporado no arquivo `.qgz` (um arquivo zip), juntamente com sua base de dados associada (`.qgd`) para for auxiliary data 1. Você pode acessar esses arquivos descomprimindo o arquivo `.qgz`.

Nota: O mecanismo *Propriedades de armazenamento auxiliar* torna um projeto zipado particularmente útil, desde que incorpore dados auxiliares

Projetos também podem ser salvos/carregados de/para uma base de dados PostGreSQL usando os seguintes itens do meu Projeto:

- *Projeto* ► *Abrir a partir de*
- *Projeto* ► *Guardar para*

Ambos os itens do meu possuem um sub-menu com uma lista de implementações de armazenamento extra de projeto (PostgreSQL e GeoPackage). Clicando na ação abrirá um diálogo para escolher uma conexão GeoPackage e projeto ou uma conexão PostgreSQL, esquema e projeto.

Projects stored in Geopackage or PostgreSQL can also be loaded through the QGIS browser panel, either by double-clicking them or by dragging them to the map canvas.

6.2 Handling broken file paths

When opening a project, QGIS may fail to reach some data sources due to unavailable service/database, or to a renamed or moved file. QGIS then opens the *Handle Unavailable Layers* dialog, referencing the unfound layers. You can:

- Double-click in the *Datasource* field, adjust the path of each layer and click *Apply changes*;
- Select a row, press *Browse* to indicate the correct location and click *Apply changes*;
- Press *Auto-Find* to browse the folders and try to automatically fix all or selected broken path(s). Be aware that the browsing may take some time.
- Ignore the message and open your project with the broken path(s) by clicking *Keep Unavailable Layers*. Your layer is then displayed in the *Layers* panel, but without any data until you fix the path using the Unavailable layer! icon next to it in the *Layers* panel, or *Repair Data Source…* in the layer contextual menu.

  With the *Repair Data Source…* tool, once a layer path has been fixed, QGIS scans through all other broken paths and tries to auto-fix those that have the same broken file path.
- *Remove Unavailable Layers* from the project.

6.3 Gerando saída

Há diversas maneiras de gerar saída de uma sessão QGIS. Já discutimos salvar como um arquivo de projeto em *Introduzindo projetos do QGIS*. Outras maneiras de produzir arquivos de saída são:

- Criar imagens: *Projeto* ► *Importar/Exportar* ►  *Exportar Mapa como Imagem…* resulta numa tela de mapa renderizada para um formato de imagem (PNG, JPG, TIFF…) em escala personalizada, resolução, tamanho, … É possível georreferenciar a imagem. Veja *Exportando a visualização do mapa* para mais detalhes.
- Exportar para arquivos PDF: *Projeto* ► *Importar/Exportar* ► *Exportar Mapa como PDF…* resulta numa tela de mapa renderizado para PDF em escala e resolução personalizados e com algumas definições avançadas (simplificação, georreferenciamento, …). Veja *Exportando a visualização do mapa* para mais detalhes.
- Exportar para arquivos DXF: *Projeto* ► *Importar/Exportar* ► *Exportar Projeto como DXF…* abre uma caixa de diálogo onde pode-se definir o 'Modo de simbologia', a ' Escala da Simbologia' e as camadas vetoriais que se deseja exportar para DXF. Através do 'Modo de simbologia', símbolos da simbologia orifinal do QGIS podem ser exportados com alta fidelidade (veja seção *Creating new DXF files*).
- Designing maps: *Project* ►  *New Print Layout…* opens a dialog where you can layout and print the current map canvas (see section *Preparando os mapas*).

CAPÍTULO 7

Interface do QGIS

A interface gráfica do usuário do QGIS (GUI) é mostrada na figura abaixo (os números de 1 a 5 em círculos amarelos indicam elementos importantes da GUI do QGIS e são discutidos abaixo).

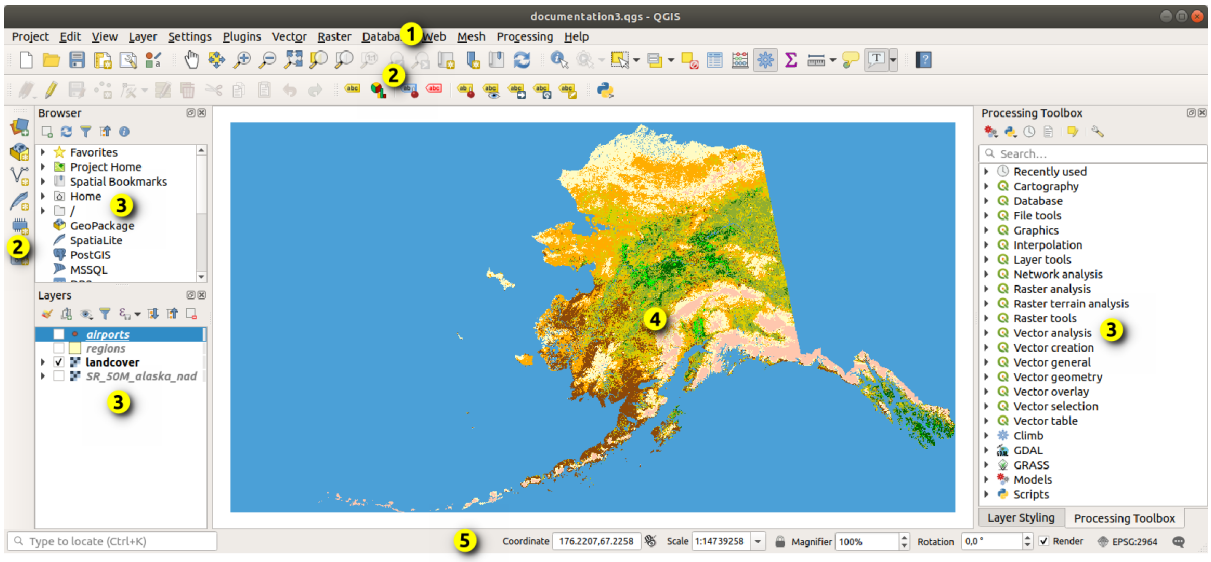


Figura7.1: GUI QGIS com dados de amostra do Alasca

Nota: Suas decorações de janela (barra de título, etc) podem parecer diferentes dependendo do seu sistema operacional e gerenciador de janelas.

The main QGIS GUI (Fig.7.1) consists of five components / component types:

1. *Menu Bar*
2. *Toolbars*
3. *Panels*
4. *Map View*

5. *Status Bar*

Role para baixo para informações mais detalhadas destes.

7.1 Barra de Menu

A barra de menus fornece acesso às funções QGIS usando menus hierárquicos padrão. Os Menus, suas opções, ícones associados e atalhos de teclado são descritos abaixo. Os atalhos de teclado podem ser reconfigurados (*Configurações* ► *Atalhos de Teclado*).

A maioria das opções de menu possui uma ferramenta correspondente e vice-versa. No entanto, os menus não estão organizados exatamente como as barras de ferramentas. Os locais das opções de menu nas barras de ferramentas são indicados abaixo na tabela. Os complementos podem adicionar novas opções aos menus. Para mais informações sobre ferramentas e barras de ferramentas, veja *Barra de ferramentas*.

Nota: O QGIS é um aplicativo multiplataforma. As ferramentas geralmente estão disponíveis em todas as plataformas, mas podem ser colocadas em menus diferentes, dependendo dos sistemas operacionais. As listas abaixo mostram os locais mais comuns, incluindo variações conhecidas.

7.1.1 Projeto

O menu *Projeto* fornece pontos de acesso e saída para *project files*. Fornece ferramentas para:

- Create a *New* project file from scratch or use another project file as a template (see *Project files options* for template configuration)
- *Open…* a project from a file, a GeoPackage or a PostgreSQL database
- *Close* a project or revert it to its last saved state
- *Save* a project in `.qgs` or `.qgz` file format, either as a file or within a GeoPackage or PostgreSQL database
- Exporta a tela do mapa para diferentes formatos ou usa um *print layout* para saída mais complexa
- Set project properties and snapping options for geometry editing.

Opção de menu	Atalho	Barra de Ferramentas	Referência
Novo	Ctrl+N	*Projeto*	*Introduzindo projetos do QGIS*
Novo a partir do modelo ►			*Introduzindo projetos do QGIS*
Abrir…	Ctrl+O	*Projeto*	*Introduzindo projetos do QGIS*
Abrir de ►			
► *GeoPackage…*			*Introduzindo projetos do QGIS*
► *PostgreSQL…*			*Introduzindo projetos do QGIS*
Abrir Recente ►	Alt+J + R		*Introduzindo projetos do QGIS*
Fechar			*Introduzindo projetos do QGIS*
Salvar	Ctrl+S	*Projeto*	*Introduzindo projetos do QGIS*
Guardar Como…	Ctrl+Shift+S	*Projeto*	*Introduzindo projetos do QGIS*
Salvar para ►			
► *Templates…*			*Introduzindo projetos do QGIS*
► *GeoPackage…*			*Introduzindo projetos do QGIS*
► *PostgreSQL…*			*Introduzindo projetos do QGIS*
Reverter…			
Propriedades…	Ctrl+Shift+P		*Propriedades do Projeto*
Snapping Options…			*Configurando a Tolerância de Atracção e Raio de Pesquisa*
Importar/Exportar ►			
► *Export Map to Image…*			*Exportando a visualização do mapa*
► *Exportar Mapa como PDF…*			*Exportando a visualização do mapa*
► *Export Project to DXF…*			*Creating new DXF files*
► *Import Layers from DWG/DXF…*			*Importing a DXF or DWG file*
Nova Composição de Impressão…	Ctrl+P	*Projeto*	*Preparando os mapas*
New Report…			*Criando um Relatório*
Gerenciador de Layout…		*Projeto*	*Preparando os mapas*
Layouts ►			*Preparando os mapas*
Sair do QGIS	Ctrl+Q		

Sob X no macOS, o comando *Sair do QGIS* corresponde a *QGIS* ► *Sair do QGIS* (Cmd+Q).

7.1.2 Editar

O menu *Edit* fornece a maior parte das ferramentas nativas necessárias para editar atributos de camada ou geometria (veja *Editando* para mais detalhes).

Opção de menu	Atalho	Barra de Ferramentas	Referência
Desfazer	Ctrl+Z	*Digitalização*	*Retroceder e Retomar*

continua na próxima página

Tabela 7.1 – continuação da página anterior

Opção de menu	Atalho	Barra de Ferramentas	Referência
Refazer	`Ctrl+Shift+Z`	*Digitalização*	*Retroceder e Retomar*
Cortar Elementos	`Ctrl+X`	*Digitalização*	*Cortando, Copiando e Colando Elementos*
Copiar Feições	`Ctrl+C`	*Digitalização*	*Cortando, Copiando e Colando Elementos*
Colar Feições	`Ctrl+V`	*Digitalização*	*Cortando, Copiando e Colando Elementos*
Colar Feições como ►			*Trabalhando com a tabela de atributos*
► *New Vector Layer…*			*Trabalhando com a tabela de atributos*
► *Temporary Scratch Layer…*	`Ctrl+Alt+V`		*Trabalhando com a tabela de atributos*
Selecionar ►			*Selecionando características*
► *Select Feature(s)*		*Selection*	*Selecionando características*
► *Selecionar Feições por Polígono*		*Selection*	*Selecionando características*
► *Selecionar Feições a Mão LIvre*		*Selection*	*Selecionando características*
► *Select Features by Radius*		*Selection*	*Selecionando características*
► *Select Features by Value…*	`F3`	*Selection*	*Selecionando características*
► *Select Features by Expression…*	`Ctrl+F3`	*Selection*	*Selecionando características*
► *Deselect Features from All Layers*	`Ctrl+Alt+A`	*Selection*	*Selecionando características*
► *Deselect Features from the Current Active Layer*	`Ctrl+Shift+A`	*Selection*	*Selecionando características*
► *Reselect Features*			*Selecionando características*
► *Selecionar Todas as Feições*	`Ctrl+A`	*Selection*	*Selecionando características*
► *Invert Feature Selection*		*Selection*	*Selecionando características*
Adicionar Registro	`Ctrl+.`	*Digitalização*	
Adicionar Feição de Ponto	`Ctrl+.`	*Digitalização*	*Adicionando Elementos*

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Tabela 7.1 – continuação da página anterior

Opção de menu	Atalho	Barra de Ferramentas	Referência
Adiciona Feição de Linha	`Ctrl+.`	*Digitalização*	*Adicionando Elementos*
Add Polygon Feature	`Ctrl+.`	*Digitalização*	*Adicionando Elementos*
Adicionar Linha Circular		*Shape Digitizing*	*Add Circular string*
Adicionar Linha Circular pelo Raio		*Shape Digitizing*	*Add Circular string*
Adicionar Círculo ►		*Shape Digitizing*	*Desenhar círculos*
► *Add Circle from 2 Points*		*Shape Digitizing*	*Desenhar círculos*
► *Add Circle from 3 Points*		*Shape Digitizing*	*Desenhar círculos*
► *Add Circle from 3 Tangents*		*Shape Digitizing*	*Desenhar círculos*
► *Add Circle from 2 Tangents and a Point*		*Shape Digitizing*	*Desenhar círculos*
► *Adicionar Círculo por um Ponto Central e Outro Ponto*		*Shape Digitizing*	*Desenhar círculos*
Adicionar Retângulo ►		*Shape Digitizing*	*Draw Rectangles*
► *Add Rectangle from Extent*		*Shape Digitizing*	*Draw Rectangles*
► *Add Rectangle from Center and a Point*		*Shape Digitizing*	*Draw Rectangles*
► *Add Rectangle from 3 Points (Distance from 2nd and 3rd point)*		*Shape Digitizing*	*Draw Rectangles*
► *Add Rectangle from 3 Points (Distance from projected point on segment p1 and p2)*		*Shape Digitizing*	*Draw Rectangles*
Adicionar Polígono Regular ►		*Shape Digitizing*	*Draw Regular Polygons*
► *Add Regular Polygon from Center and a Point*		*Shape Digitizing*	*Draw Regular Polygons*
► *Adicionar Polígono Regular do Centro e um Vértice*		*Shape Digitizing*	*Draw Regular Polygons*
► *Adicionar Polígono Regular de 2 Pontos*		*Shape Digitizing*	*Draw Regular Polygons*
Adicionar Elipse ►		*Shape Digitizing*	*Draw Ellipses*
► *Add Ellipse from Center and 2 Points*		*Shape Digitizing*	*Draw Ellipses*

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Tabela 7.1 – continuação da página anterior

Opção de menu	Atalho	Barra de Ferramentas	Referência
► *Add Ellipse from Center and a Point*		*Shape Digitizing*	*Draw Ellipses*
► *Add Ellipse from Extent*		*Shape Digitizing*	*Draw Ellipses*
► *Adicionar Elipse de Foci*		*Shape Digitizing*	*Draw Ellipses*
Add Annotation ►			*Ferramentas de anotação*
► *Text Annotation*		*Atributos*	*Ferramentas de anotação*
► *Form Annotation*		*Atributos*	*Ferramentas de anotação*
► *HTML Annotation*		*Atributos*	*Ferramentas de anotação*
► *SVG Annotation*		*Atributos*	*Ferramentas de anotação*
Mover Elemento(s)		*Advanced Digitizing*	*Mover feições*
Copiar e Mover Elemento(s)		*Advanced Digitizing*	*Mover feições*
Delete Selected		*Digitalização*	*Apagando os Elementos Selecionados*
Alterar Atributos dos Elementos Selecionados		*Digitalização*	*Editando valores de atributo*
Rodar Elemento(s)		*Advanced Digitizing*	*Rodar Elemento(s)*
Simplify Feature		*Advanced Digitizing*	*Simplificar elemento*
Adicionar Anel		*Advanced Digitizing*	*Adicionar Anel*
Adicionar Parte		*Advanced Digitizing*	*Adicionar Parte*
Preencher Anel		*Advanced Digitizing*	*Preenchimento Anel*
Apagar Anel		*Advanced Digitizing*	*Apagar Anel*
Eliminar Parte		*Advanced Digitizing*	*Apagar Parte*
Redesenhar Elementos		*Advanced Digitizing*	*Refazer elementos*

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Tabela 7.1 – continuação da página anterior

Opção de menu	Atalho	Barra de Ferramentas	Referência
Curva de Afastamento		*Advanced Digitizing*	*Curvas de Afastamento*
Split Features		*Advanced Digitizing*	*Dividir Elementos*
Split Parts		*Advanced Digitizing*	*Dividindo partes*
Juntar Elementos Selecionados		*Advanced Digitizing*	*Juntar elementos selecionados*
Juntar Atributos dos Elementos Selecionados		*Advanced Digitizing*	*Juntar os atributos dos elementos selecionados*
Ferramenta de Vértice (Todas as Camadas)		*Digitalização*	*Ferramenta Vertex*
Ferramenta de Vértice (Camada atual)		*Digitalização*	*Ferramenta Vertex*
Rotate Point Symbols		*Advanced Digitizing*	*Rodar Símbolos de Pontos*
Afastamento de Símbolos de Pontos		*Advanced Digitizing*	*Offset Point Symbols*
Inverter Linha		*Advanced Digitizing*	*Reverse Line*
Trim/extend Feature		*Advanced Digitizing*	*Recortar / estender o recurso*

Tools that depend on the selected layer geometry type i.e. point, polyline or polygon, are activated accordingly:

Opção de menu	Ponto	Linha	Polígono
Mover Feição(ões)			
Copiar e Mover Elemento(s)			

7.1.3 Ver

O mapa é renderizado nas visualizações de mapa. Você pode interagir com essas visualizações usando as opções :menuselection: *Exibir* (veja *Working with the map canvas* para mais informações). Por exemplo, você pode:

- Criar novas visualizações de mapa 2D ou 3D ao lado da vista principal do mapa
- *Zoom or pan* para qualquer lugar
- Consultar atributos ou geometria dos elementos visualizados
- Aprimore o mapa com modos de visualização, anotações ou decorações
- Acesse qualquer painel ou barra de ferramentas

Este menu também permite reorganizar a própria interface do QGIS usando ações tais como:

- *Alternar Modo de Ecrã Completo*: preenche a totalidade do ecrã e oculta a barra de título

- *Alternar visibilidade do painel*: ativa mostrar ou ocultar *panels* - útil ao digitalizar recursos (para máxima visibilidade da tela) e para apresentações (projetadas/gravadas) usando a tela principal do QGIS
- *Toggle Map Only*: esconde painéis, barras de ferramentas, menus e barras de status e mostra apenas a tela do mapa. Combinada com a opção tela cheia, faz sua tela mostrar apenas o mapa

Opção de menu	Atalho	Barra de Ferramentas	Referência
 *Nova Vista de Mapa*	`Ctrl+M`		*Visualização do mapa*
 *Nova Vista de Mapa 3D*	`Ctrl+Alt+M`		*Visualização de Mapa 3D*
 *Pan Map*		*Map Navigation*	*Ampliar e Deslocar*
 *Mover Vista para a Seleção*		*Map Navigation*	
 *Zoom In*	`Ctrl+Alt++`	*Map Navigation*	*Ampliar e Deslocar*
 *Reduzir Zoom*	`Ctrl+Alt+-`	*Map Navigation*	*Ampliar e Deslocar*
 *Identify Features*	`Ctrl+Shift+I`	*Atributos*	*Identificar Elementos*
Medir ►		*Atributos*	*Medição*
►  *Measure Line*	`Ctrl+Shift+M`	*Atributos*	*Medição*
►  *Measure Area*	`Ctrl+Shift+J`	*Atributos*	*Medição*
►  *Measure Angle*		*Atributos*	*Medição*
 *Statistical Summary*		*Atributos*	*O painel Estatísticas*
 *Zoom Full*	`Ctrl+Shift+F`	*Map Navigation*	*Ampliar e Deslocar*
 *Aproximar à Seleção*	`Ctrl+J`	*Map Navigation*	*Ampliar e Deslocar*
 *Zoom Para Camada*		*Map Navigation*	*Ampliar e Deslocar*
 *Visualizar na Resolução Natural (100%)*		*Map Navigation*	*Ampliar e Deslocar*
 *Última Vista*		*Map Navigation*	*Ampliar e Deslocar*
 *Próxima Vista*		*Map Navigation*	*Ampliar e Deslocar*
Decorações ►	`Alt+V + D`		*Decorações*
►  *Grid…*			*Malha*
►  *Scale Bar…*			*Barra de Escala*
►  *Image…*			*Image Decoration*
►  *North Arrow…*			*Seta Norte*
►  *Title Label…*			*Title Label*

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Tabela 7.2 – continuação da página anterior

Opção de menu	Atalho	Barra de Ferramentas	Referência
► *Copyright Label…*			*Copyright Label*
► *Layout Extents…*			*Extensões de Composição*
Modo de Pré-visualização ►			
► *Normal*			
► *Simulate Photocopy (Grayscale)*			
► *Simulate Fax (Mono)*			
► *Simulate Color Blindness (Protanope)*			
► *Simulate Color Blindness (Deuteronope)*			
Mostrar Dicas de Mapa		*Atributos*	*Display Properties*
New Spatial Bookmark…	`Ctrl+B`	*Map Navigation*	*Favoritos Espaciais*
Show Spatial Bookmarks	`Ctrl+Shift+B`	*Map Navigation*	*Favoritos Espaciais*
Show Spatial Bookmark Manager			*Favoritos Espaciais*
Refresh	`F5`	*Map Navigation*	
Mostrar Todas as Camadas	`Ctrl+Shift+U`		*Painel Camadas*
Ocultar Todas as Camadas	`Ctrl+Shift+H`		*Painel Camadas*
Mostrar Camadas Selecionadas			*Painel Camadas*
Ocultar Camadas Selecionadas			*Painel Camadas*
Toggle Selected Layers			*Painel Camadas*
Toogle Selected Layers Independently			*Painel Camadas*
Ocultar Camadas Não Selecionadas			*Painel Camadas*
Painéis ►			*Painéis e Barras de Ferramentas*
► *Advanced Digitizing*			*O painel Digitalização avançada*
► *Browser*			*The Browser Panel*
► *Browser (2)*			*The Browser Panel*
► *GPS Information*			*Rastreio GPS em tempo real*
► *GRASS Tools*			*Integração com SIG GRASS*
► *Layer Order*			*O painel Ordem das Camadas*
► *Layer Styling*			*Painel de Estilo de Camada*
► *Layers*			*Painel Camadas*
► *Log Messages*			*O painel Registo de Mensagens*
► *Overview*			*O painel Vista Geral*
► *Processing Toolbox*			*The Toolbox*
► *Results Viewer*			*The Toolbox*

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Tabela 7.2 – continuação da página anterior

Opção de menu	Atalho	Barra de Ferramentas	Referência
► *Snapping and Digitizing Options*			*Configurando a Tolerância de Atracção e Raio de Pesquisa*
► *Spatial Bookmark Manager*			*Favoritos Espaciais*
► *Statistics*			*O painel Estatísticas*
► *Tile Scale*			*Mosaicos*
► *Undo/Redo*			*O painel Desfazer/Refazer*
Barra de Ferramentas ►			*Painéis e Barras de Ferramentas*
► *Advanced Digitizing Toolbar*			*Digitalização Avançada*
► *Attributes Toolbar*			
► *Data Source Manager Toolbar*			*Gerenciando fonte de dados*
► *Database Toolbar*			
► *Digitizing Toolbar*			*Digitalizar uma camada existente*
► *Help Toolbar*			
► *Label Toolbar*			*A barra de ferramentas Rótulo*
► *Manage Layers Toolbar*			*Gerenciando fonte de dados*
► *Map Navigation Toolbar*			
► *Plugins Toolbar*			*Plugins*
► *Project Toolbar*			
► *Raster Toolbar*			
► *Selection Toolbar*			*Selecionando características*
► *Shape Digitizing Toolbar*			*Digitalização de forma*
► *Snapping Toolbar*			*Configurando a Tolerância de Atracção e Raio de Pesquisa*
► *Vector Toolbar*			
► *Web Toolbar*			
► *GRASS*			*Integração com SIG GRASS*
Alternar Modo de Tela Cheia	`F11`		
Mostrar / Ocultar Painéis	`Ctrl+Tab`		
Alternar apenas Mapa	`Ctrl+Shift+Tab`		

Under  Linux KDE, *Panels* ►, *Toolbars* ► and *Toggle Full Screen Mode* are in the *Settings* menu.

7.1.4 Camada

O menu *Layer* fornece um grande conjunto de ferramentas para novas fontes de dados *create* , *add* as fontes a um projeto ou *save modifications* a elas. Usando as mesmas fontes de dados, você também pode:

- *Duplicate* a layer to generate a copy where you can modify the name, style (symbology, labels, …), joins, … The copy uses the same data source as the original.
- *Copy* and *Paste* layers or groups from one project to another as a new instance whose properties can be modified independently. As for *Duplicate*, the layers are still based on the same data source.
- ou *Incorporar camadas e grupos …* de outro projeto, como cópias somente leitura que você não pode modificar (veja *Projetos animados*)

The *Layer* menu also contains tools to configure, copy or paste layer properties (style, scale, CRS…).

Opção de menu	Atalho	Barra de Ferramentas	Referência
Data Source Manager	`Ctrl+L`	*Data Source Manager*	*Opening Data*
Criar Camada ►			*Creating new vector layers*
► *New GeoPackage Layer…*	`Ctrl+Shift+N`	*Data Source Manager*	*Creating a new GeoPackage layer*
► *New Shapefile Layer…*		*Data Source Manager*	*Creating a new Shapefile layer*
► *New SpatiaLite Layer…*		*Data Source Manager*	*Creating a new SpatiaLite layer*
► *New Temporary Scratch Layer…*		*Data Source Manager*	*Creating a new Temporary Scratch Layer*
► *New Virtual Layer…*		*Data Source Manager*	*Creating virtual layers*
Adicionar Camada ►			*Abrir Dados*
► *Add Vector Layer……*	`Ctrl+Shift+V`	*Manage Layers*	*Loading a layer from a file*
► *Add Raster Layer…*	`Ctrl+Shift+R`	*Manage Layers*	*Loading a layer from a file*
► *Add Mesh Layer…*		*Manage Layers*	*Loading a mesh layer*
► *Add Delimited Text Layer…*	`Ctrl+Shift+T`	*Manage Layers*	*Importing a delimited text file*
► *Add PostGIS Layer…*	`Ctrl+Shift+D`	*Manage Layers*	*Database related tools*
► *Add SpatiaLite Layer…*	`Ctrl+Shift+L`	*Manage Layers*	*Camadas SpatiaLite*
► *Add MSSQL Spatial Layer…*		*Manage Layers*	*Database related tools*
► *Add Oracle Spatial Layer…*		*Manage Layers*	*Database related tools*
► *Add DB2 Spatial Layer…*	`Ctrl+Shift+2`	*Manage Layers*	*Database related tools*
► *Add/Edit Virtual Layer…*		*Manage Layers*	*Creating virtual layers*
► *Add WMS/WMTS Layer…*	`Ctrl+Shift+W`	*Manage Layers*	*Carregando as camadas WMS/WMTS*
► *Add XYZ Layer…*			*Using XYZ Tile services*
► *Add ArcGIS Map Service Layer…*		*Manage Layers*	

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Tabela 7.3 – continuação da página anterior

Opção de menu	Atalho	Barra de Ferramentas	Referência
► *Add WCS Layer…*		*Manage Layers*	*WCS Cliente*
► *Add WFS Layer…*		*Manage Layers*	*WFS e WFS-T Cliente*
► *Add ArcGIS Feature Service Layer…*		*Manage Layers*	
► *Add Vector Tile Layer…*			
Incorporar Camadas e Grupos…			*Projetos animados*
Add from Layer Definition File…			*Ficheiro de definição de camada*
Copy Style			*Salvar e Compartilhar Propriedades da Camada*
Paste Style			*Salvar e Compartilhar Propriedades da Camada*
Copy Layer			
Paste Layer/Group			
Abrir Tabela de Atributos	`F6`	*Atributos*	*Trabalhando com a tabela de atributos*
Alternar Edição		*Digitalização*	*Digitalizar uma camada existente*
Salvar Edições de Camada		*Digitalização*	*Salvando as Camadas Editadas*
Edições Atuais ►		*Digitalização*	*Salvando as Camadas Editadas*
► *Save for Selected Layer(s)*		*Digitalização*	*Salvando as Camadas Editadas*
► *Rollback for Selected Layer(s)*		*Digitalização*	*Salvando as Camadas Editadas*
► *Cancel for Selected Layer(s)*		*Digitalização*	*Salvando as Camadas Editadas*
► *Save for all Layers*		*Digitalização*	*Salvando as Camadas Editadas*
► *Rollback for all Layers*		*Digitalização*	*Salvando as Camadas Editadas*
► *Cancel for all Layers*		*Digitalização*	*Salvando as Camadas Editadas*
Salvar Como…			*Creating new layers from an existing layer*
Save As Layer Definition File…			*Ficheiro de definição de camada*
Remove Layer/Group	`Ctrl+D`		
Duplicar Camada(s)			
Definir Escala de Visibilidade da(s) Camada(s)			
Set CRS of Layer(s)	`Ctrl+Shift+C`		*Layer Coordinate Reference Systems*
Usar o mesmo SRC da camada no Projecto			*Project Coordinate Reference Systems*

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Tabela 7.3 – continuação da página anterior

Opção de menu	Atalho	Barra de Ferramentas	Referência
Propriedades da Camada…			*Janela de Propriedades de Vetor*, *Caixa de Diálogo de Propriedades do Raster*, *Mesh Dataset Properties*
Filtrar…	`Ctrl+F`		*Criador de consultas*
Labeling			*Propriedades das etiquetas*
Mostrar em Visão Geral			*O painel Vista Geral*
Show All in Overview			*O painel Vista Geral*
Hide All from Overview			*O painel Vista Geral*

7.1.5 Configurações

Opção de menu	Referência
Perfis de Usuário ►	*Working with User Profiles*
► *default*	*Working with User Profiles*
► *Open Active Profile Folder*	*Working with User Profiles*
► *New Profile…*	*Working with User Profiles*
Style Manager…	*The Style Manager*
Custom Projections…	*Sistema de Referência de Coordenadas personalizado*
Keyboard Shortcuts…	*Atalhos do Teclado*
Interface Customization…	*Personalização*
Opções…	*Opções*

Under Linux KDE, you'll find more tools in the *Settings* menu such as *Panels* ►, *Toolbars* ► and *Toggle Full Screen Mode*.

7.1.6 Complementos

Opção de menu	Atalho	Barra de Ferramentas	Referência
Manage and Install Plugins…			*Diálogo de Complementos*
Console Python	`Ctrl+Alt+P`	*Complementos*	*Terminal Python QGIS*

Ao iniciar o QGIS pela primeira vez, nem todos os complementos principais são carregados.

7.1.7 Vetor

This is what the *Vector* menu looks like if all core plugins are enabled.

Opção de menu	Atalho	Barra de Ferra-mentas	Referência
Check Geometries…			*Geometry Checker Plugin*
GPS Tools	Alt+O + G	*Vector*	*Complemento GPS*
Topology Checker		*Vector*	*Topology Checker Plugin*
Geoprocessing Tools ►	Alt+O + G		
► *Buffer…*			*Buffer*
► *Clip…*			*Clip*
► *Convex Hull…*			*Convex hull*
► *Difference…*			*Difference*
► *Dissolve…*			*Dissolver*
► *Intersection…*			*Intersection*
► *Symmetrical Difference…*			*Symmetrical difference*
► *Union…*			*Union*
► *Eliminate Selected Polygons…*			*Eliminate selected polygons*
Geometrias ►	Alt+O + E		
► *Centroids…*			*Centroids*
► *Collect Geometries…*			*Collect geometries*
► *Extract Vertices…*			*Extract vertices*
► *Multipart to Singleparts…*			*Multipart to singleparts*
► *Polygons to Lines…*			*Polygons to lines*
► *Simplify…*			*Simplify*
► *Check Validity…*			*Check validity*
► *Delaunay Triangulation…*			*Delaunay triangulation*
► *Densify by Count…*			*Densify by count*
► *Add Geometry Attributes…*			*Add geometry attributes*
► *Lines to Polygons…*			*Lines to polygons*
► *Voronoi Polygons…*			*Polígonos de Voronoi*
Analysis Tools ►	Alt+O + A		
► *Line Intersection…*			*Line intersections*
► *Mean Coordinate(s)…*			*Mean coordinate(s)*
► *Basic Statistics for Fields…*			*Basic statistics for fields*
► *Count Points in Polygon…*			*Count points in polygon*
► *Distance Matrix…*			*Distance matrix*
► *List Unique Values…*			*List unique values*
► *Nearest Neighbour Analysis…*			*Nearest neighbour analysis*
► *Sum Line Lengths…*			*Sum line lengths*
Data Management Tools ►	Alt+O + D		
► *Merge Vector Layers…*			*Merge vector layers*
► *Reproject Layer…*			*Reproject layer*
► *Create Spatial Index…*			*Create spatial index*
► *Join Attributes by Location…*			*Join attributes by location*
► *Split Vector Layer…*			*Split vector layer*
Research Tools ►	Alt+O + R		
► *Select by Location…*			*Selecionar pela localização*
► *Extract Layer Extent…*			*Extract layer extent*
► *Random Points in Extent…*			*Random points in extent*
► *Random Points in Layer Bounds…*			*Random points in layer bounds*

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Tabela 7.4 – continuação da página anterior

Opção de menu	Atalho	Barra de Ferramentas	Referência
► *Random Points Inside Polygons…*			*Random points inside polygons*
► *Random Selection…*			*Seleção aleatória*
► *Random Selection Within Subsets…*			*Random selection within subsets*
► *Regular Points…*			*Regular points*

Por padrão, o QGIS inclui algortimos *Processing* ao menu *Vector*, agrupado por submenus. Isso fornece atalhos para muitas tarefas GIS baseadas em vetores comuns de diferentes fornecedores. Se nem todos esses submenus estiverem disponíveis, ative o complemento Processing em :menuselection: *Plugins -> Manage and Install Plugins …*.

Note that the list of the *Vector* menu tools can be extended with any Processing algorithms or some external *plugins*.

7.1.8 Raster

É assim que o menu :guilabel: *Raster* se parece se todos os complementos principais estiverem ativados.

Opção de menu	Atalho	Barra de Ferramentas	Referência
Raster calculator…			*Calculadora raster*
Alinhar Raster…			*Alinhamento de raster*
Georeferencer	`Alt+R + G`	*Raster*	*Georeferencer*
Analysis ►			
► *Aspect…*			*Aspecto*
► *Fill nodata…*			*Preencher semdados*
► *Grid (Moving Average)…*			*Grid (média móvel)*
► *Grid (Data Metrics)…*			*Grid (Data metrics)*
► *Grid (Inverse Distance to a Power)…*			*Grid (Inverse distance to a power)*
► *Grid (Nearest Neighbor)…*			*Grid (IDW with nearest neighbor searching)*
► *Hillshade…*			*Sombreamento*
► *Proximity (Raster Distance)…*			*Proximity (raster distance)*
► *Roughness…*			*Roughness*
► *Sieve…*			*Sieve*
► *Slope…*			*Pendiente*
► *Topographic Position Index (TPI)…*			*Topographic Position Index (TPI)*
► *Terrain Ruggedness Index (TRI)…*			*Terrain Ruggedness Index (TRI)*
Projeções ►			
► *Assign Projection…*			*Assign projection*
► *Extract Projection…*			*Extract projection*
► *Warp (Reproject)…*			*Warp (reproject)*
Miscelânea ►			
► *Build Virtual Raster…*			*Construir raster virtual*
► *Raster Information…*			*Informação de raster*
► *Merge…*			*Mesclar*
► *Build Overviews (Pyramids)…*			*Construir Visão geral (Pirâmides)*
► *Tile Index…*			*Índice deslizante*

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Tabela 7.5 – continuação da página anterior

Opção de menu	Atalho	Barra de Ferramentas	Referência
Extraction ►			
► *Clip Raster by Extent…*			*Recortar raster extensão*
► *Clip Raster by Mask Layer…*			*Recortar raster por camada de máscara*
► *Contour…*			*contorno*
Conversão ►			
► *PCT to RGB…*			*PCT para RGB*
► *Polygonize (Raster to Vector)…*			*Poligonizar (raster para vetor)*
► *Rasterize (Vector to Raster)…*			*Rasterize (vector to raster)*
► *RGB to PCT…*			*RGB to PCT*
► *Translate (Convert Format)…*			*Translate (convert format)*

By default, QGIS adds *Processing* algorithms to the *Raster* menu, grouped by sub-menus. This provides a shortcut for many common raster-based GIS tasks from different providers. If not all these sub-menus are available, enable the Processing plugin in *Plugins* ► *Manage and Install Plugins…*.

Observe que a lista das ferramentas do menu *Raster* pode ser estendida com quaisquer algortimos de Processamento ou alguns *plugins* externos.

7.1.9 Base de dados

This is what the *Database* menu looks like if all the core plugins are enabled. If no database plugins are enabled, there will be no *Database* menu.

Opção de menu	Atalho	Barra de Ferramentas	Referência
Offline editing…	Alt+D + O		*Offline Editing Plugin*
► *Convert to Offline Project…*		*Banco de Dados*	*Offline Editing Plugin*
► *Synchronize*		*Banco de Dados*	*Offline Editing Plugin*
DB Manager…		*Banco de Dados*	*DB Manager Plugin*

Ao iniciar o QGIS pela primeira vez, nem todos os complementos principais são carregados.

7.1.10 Web

This is what the *Web* menu looks like if all the core plugins are enabled. If no web plugins are enabled, there will be no *Web* menu.

Opção de menu	Atalho	Barra de Ferramentas	Referência
MetaSearch ►	Alt+W + M		*MetaSearch Catalog Client*
► *Metasearch*		*Web*	*MetaSearch Catalog Client*
► *Help*			*MetaSearch Catalog Client*

Ao iniciar o QGIS pela primeira vez, nem todos os complementos principais são carregados.

7.1.11 Malha

O menu *Mesh* fornece as ferramentas necessárias para manipular *mesh layers*.

Opção de menu	Atalho	Barra de Ferramentas	Referência
Calculadora da Malha…			

7.1.12 Processamento

Opção de menu	Atalho	Barra de Ferra-mentas	Referência
Toolbox	`Ctrl+Alt+T`		*The Toolbox*
Modelos Gráficos…	`Ctrl+Alt+G`		*O modelador gráfico*
History…	`Ctrl+Alt+H`		*Gerenciador do histórico*
Visualizador de Resultados	`Ctrl+Alt+R`		*Configurando as aplicações externas*
Edit Features In-Place			*The Processing in-place layer modifier*

Ao iniciar o QGIS pela primeira vez, nem todos os complementos principais são carregados.

7.1.13 Ajuda

Opção de menu	Atalho	Barra de Ferramentas	Referência
Conteúdos da Ajuda	`F1`	*Ajuda*	
API Documentation			
Complementos ►			
Reportar Problema			
Necessita de suporte comercial?			
QGIS Home Page	`Ctrl+H`		
Check QGIS Version			
About			
QGIS Membros Mantenedores			

7.1.14 QGIS

This menu is only available under macOS and contains some OS related commands.

Opção de menu	Atalho
Preferências	
Sobre o QGIS	
Ocultar QGIS	
Mostrar Todas	
Ocultar os Outros	
Sair do QGIS	`Cmd+Q`

Preferências correspondem a *Configurações* ► *Opções*, *Sobre o QGIS* corresponde to *Ajuda* ► *Sobre* e *Sair do QGIS* corresponde a *Projeto* ► *Sair do QGIS* para outras plataformas.

7.2 Painéis e Barras de Ferramentas

From the *View* menu (or *Settings*), you can switch QGIS widgets (*Panels* ►) and toolbars (*Toolbars* ►) on and off. To (de)activate any of them, right-click the menu bar or toolbar and choose the item you want. Panels and toolbars can be moved and placed wherever you like within the QGIS interface. The list can also be extended with the activation of *Core or external plugins*.

7.2.1 Barra de ferramentas

The toolbars provide access to most of the functions in the menus, plus additional tools for interacting with the map. Each toolbar item has pop-up help available. Hover your mouse over the item and a short description of the tool's purpose will be displayed.

Every toolbar can be moved around according to your needs. Additionally, they can be switched off using the right mouse button context menu, or by holding the mouse over the toolbars.

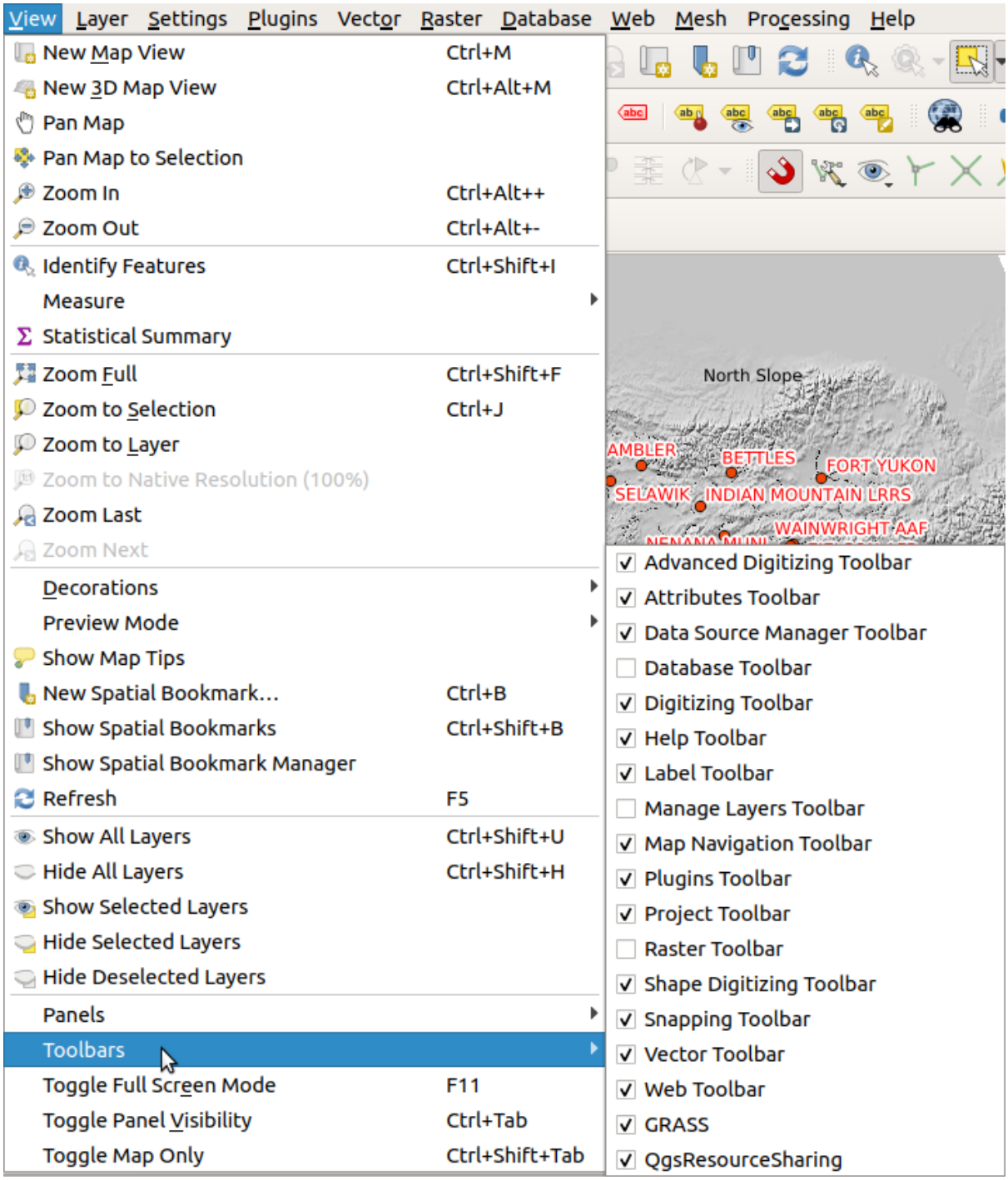


Figura7.2: O menu da Barra de Ferramentas

Dica: Restaurar barra de ferramentas

Se você ocultou acidentalmente uma barra de ferramentas, é possível recuperá-la usando: *Exibir* ► *Barras de Ferramentas* ► (ou *Configurações* ► *Barras de Ferramentas* ►). Se, por algum motivo, uma barra de ferramentas (ou qualquer outro widget) desaparecer totalmente da interface, você encontrará dicas para recuperá-la em *restoring initial GUI*.

7.2.2 Painéis

O QGIS fornece muitos painéis. Painéis são widgets especiais com os quais você pode interagir (selecionar opções, marcar caixas, preencher valores…) para executar tarefas mais complexas.

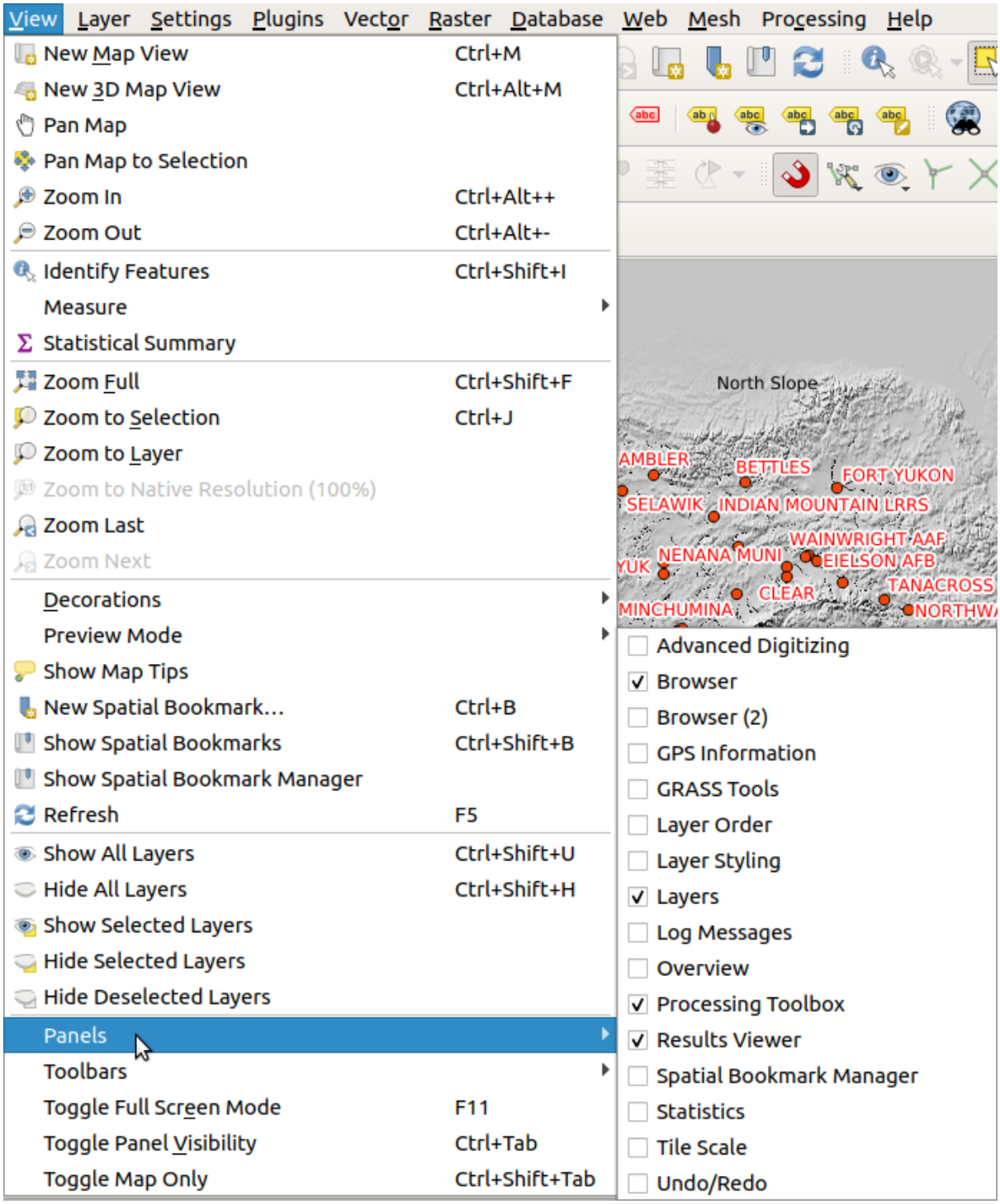


Figura7.3: O Menu de Painéis

Abaixo está uma lista dos painéis padrão fornecidos pelo QGIS:

- o *Advanced Digitizing Panel*
- o *Browser Panel*

- o *GPS Information Panel*
- o *Identify Panel*
- o *Layer Order Panel*
- o *Layer Styling Panel*
- o *Layers Panel*
- o *Log Messages Panel*
- o *Overview Panel*
- o *Processing Toolbox*
- the *Result Viewer Panel*
- o *Spatial Bookmark Manager Panel*
- o *Statistics Panel*
- o *Tile Scale Panel*
- o *Undo/Redo Panel*

7.3 Visualização do mapa

7.3.1 Explorando a visualização do mapa

The map view (also called **Map canvas**) is the "business end" of QGIS — maps are displayed in this area, in 2D. The map displayed in this window will reflect the rendering (symbology, labeling, visibilities…) you applied to the layers you have loaded. It also depends on the layers and the project's Coordinate Reference System (CRS).

When you add a layer (see e.g. *Abrir Dados*), QGIS automatically looks for its CRS. If a different CRS is set by default for the project (see *Project Coordinate Reference Systems*) then the layer extent is "on-the-fly" translated to that CRS, and the map view is zoomed to that extent if you start with a blank QGIS project. If there are already layers in the project, no map canvas resize is performed, so only features falling within the current map canvas extent will be visible.

Click on the map view and you should be able to interact with it:

- it can be panned, shifting the display to another region of the map: this is performed using the Pan Map tool, the arrow keys, moving the mouse while any of the `Space` key, the middle mouse button or the mouse wheel is held down.
- it can be zoomed in and out, with the dedicated Zoom In and Zoom Out tools. Hold the `Alt` key to switch from one tool to the other. Zooming is also performed by rolling the wheel forward to zoom in and backwards to zoom out. The zoom is centered on the mouse cursor position.

  You can customize the *Zoom factor* under the *Settings* ► *Options* ► *Map tools* menu.
- it can be zoomed to the full extent of all loaded layers (Zoom Full), to a layer extent (Zoom to Layer) or to the extent of selected features (Zoom to Selection)
- you can navigate back/forward through the canvas view history with the Zoom Last and Zoom Next buttons or using the back/forward mouse buttons.

Right-click over the map and you should be able to *Copy coordinates* of the clicked point in the map CRS, in WGS84 or in a custom CRS. The copied information can then be pasted in an expression, a script, text editor or spreadsheet…

By default, QGIS opens a single map view (called "main map"), which is tightly bound to the *Layers* panel; the main map *automatically* reflects the changes you do in the *Layers* panel area. But it is also possible to open additional map

views whose content could diverge from the *Layers* panel current state. They can be of 2D or *3D* type, show different scale or extent, or display a different set of the loaded layers thanks to *map themes*.

7.3.2 Setting additional map views

To add a new map view, go to *View* ► *New Map View*. A new floating widget, mimicking the main map view's rendering, is added to QGIS. You can add as many map views as you need. They can be kept floating, placed side by side or stacked on top of each other.

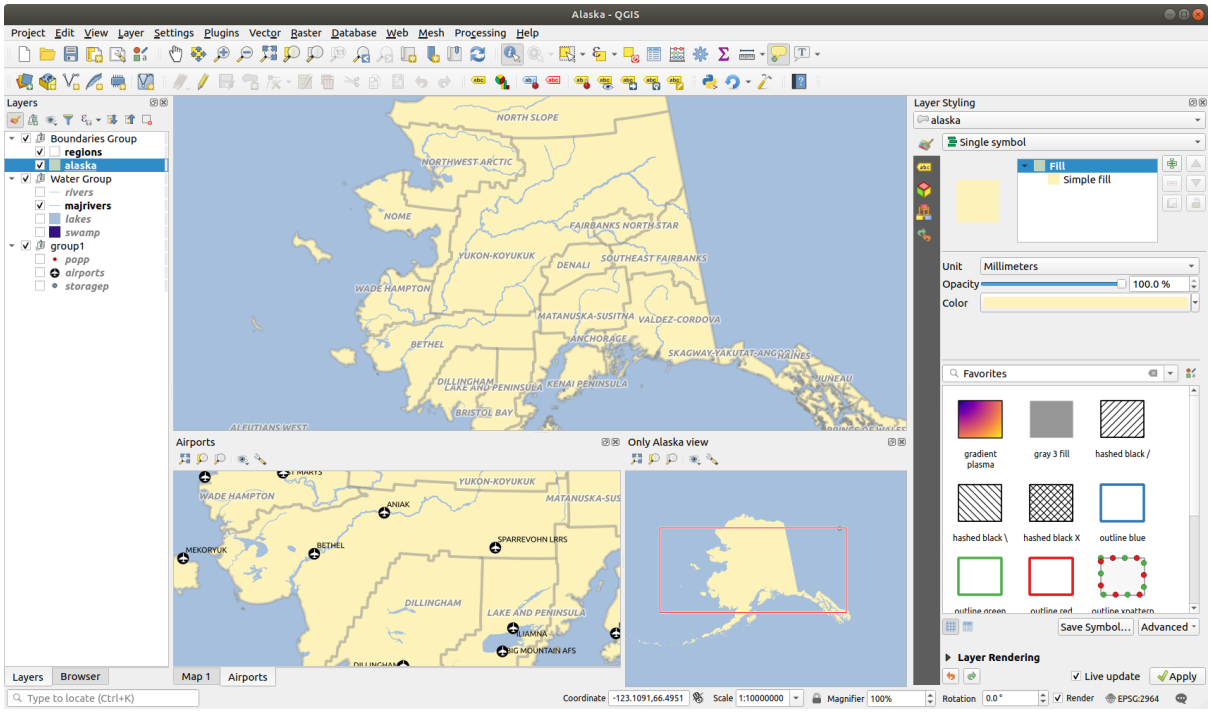


Figura7.4: Multiple map views with different settings

At the top of an additional map canvas, there's a toolbar with the following capabilities:

- Zoom Full, Zoom to Selection and Zoom to Layer to navigate within the view
- Set View Theme to select the *map theme* to display in the map view. If set to `(none)`, the view will follow the *Layers* panel changes.
- View settings to configure the map view:
  - *Synchronize view center with main map*: syncs the center of the map views without changing the scale. This allows you to have an overview style or magnified map which follows the main canvas center.
  - *Synchronize view to selection*: same as zoom to selection
  - *Scale*
  - *Rotation*
  - *Magnification*
  - *Synchronize scale* with the main map scale. A *Scale factor* can then be applied, allowing you to have a view which is e.g. always 2x the scale of the main canvas.
  - *Show annotations*

- *Show cursor position*
- *Show main canvas extent*
- *Show labels*: allows to hide labels regardless they are set in the displayed layers' properties
- *Change map CRS…*
- *Rename view…*

7.3.3 Exportando a visualização do mapa

Maps you make can be layout and exported to various formats using the advanced capabilities of the *print layout or report*. It's also possible to directly export the current rendering, without a layout. This quick "screenshot" of the map view has some convenient features.

To export the map canvas with the current rendering:

1. Vá para *Projeto* ► *Importar/Exportar*
2. Dependendo do seu formato de saída, selecione
   - *Export Map to Image…*
   - ou *Export Map to PDF…*

The two tools provide you with a common set of options. In the dialog that opens:

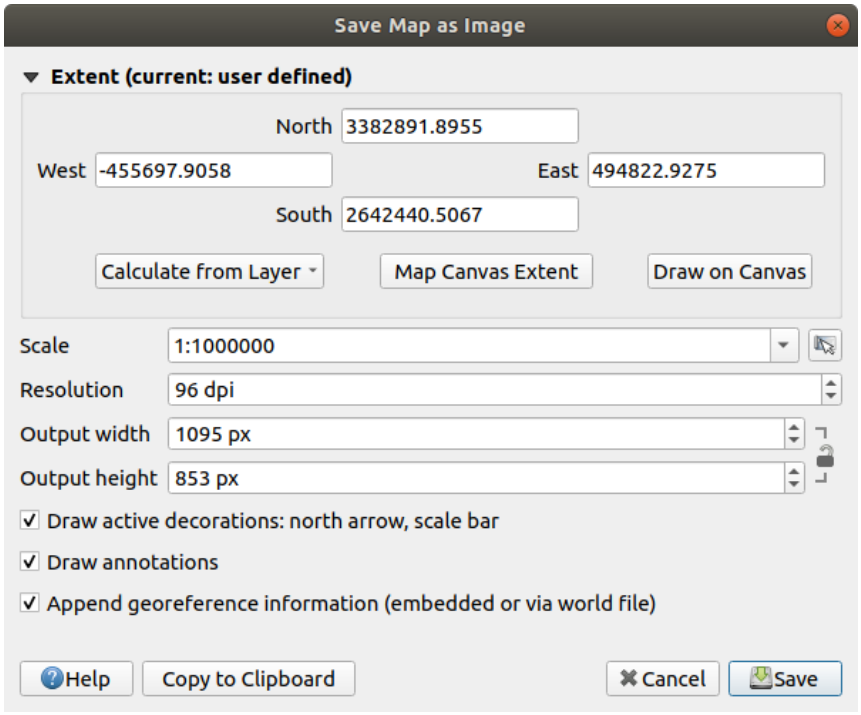


Figura7.5: The Save Map as Image dialog

1. Choose the *Extent* to export: it can be the current view extent (the default), the extent of a layer or a custom extent drawn over the map canvas. Coordinates of the selected area are displayed and manually editable.
2. Enter the *Scale* of the map or select it from the *predefined scales*: changing the scale will resize the extent to export (from the center).
3. Defina a *Resolução* da saída

4. Control the *Output width* and *Output height* in pixels of the image: based by default on the current resolution and extent, they can be customized and will resize the map extent (from the center). The size ratio can be locked, which may be particularly convenient when drawing the extent on the canvas.

5. *Draw active decorations*: in use *decorations* (barra de escala, título, malha, Rosa dos ventos…) são exportados com o mapa

6. *Desenhar anotações* para exportar qualquer *annotation*

7. *Append georeference information (embedded or via world file)*: depending on the output format, a world file of the same name (with extension `PNGW` for `PNG` images, `JPGW` for `JPG`, …) is saved in the same folder as your image. The `PDF` format embeds the information in the PDF file.

8. When exporting to PDF, more options are available in the *Save map as PDF…* dialog:

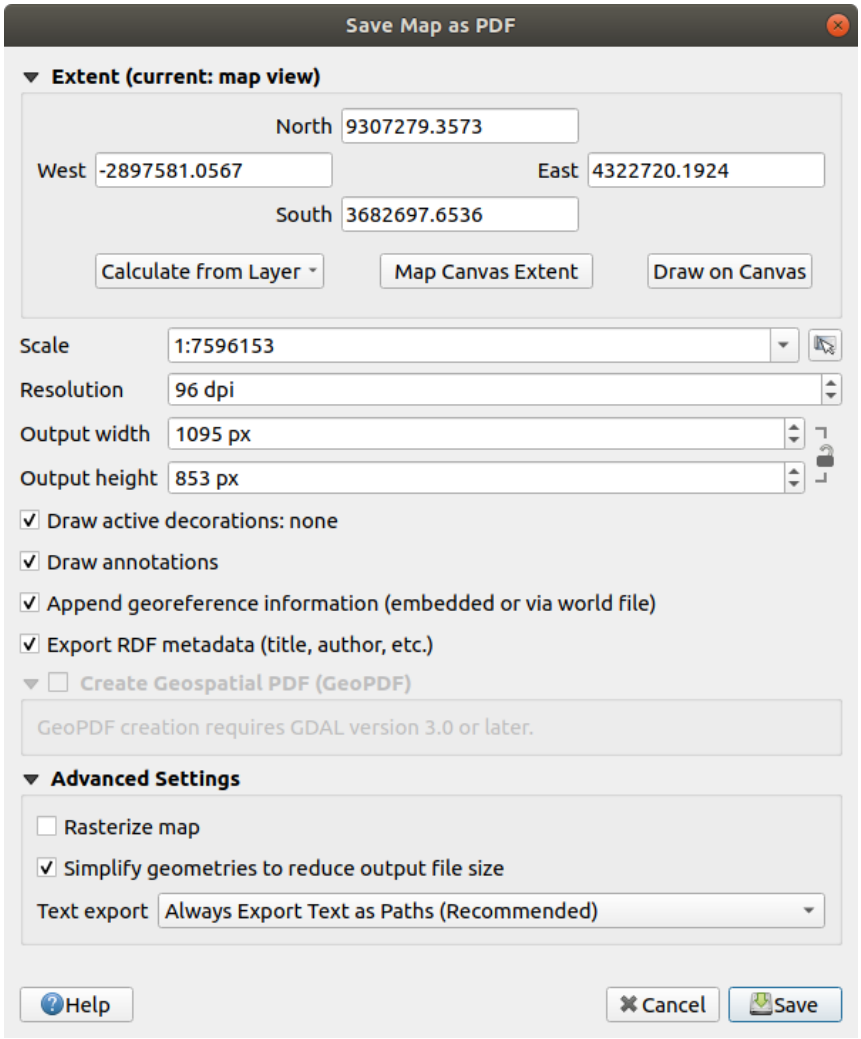


Figura7.6: The Save Map as PDF dialog

- *Exportar metadados RDF* do documento, como título, autor, data, descrição…
- *Criar PDF Geoespacial (GeoPDF)*: Gera um arquivo PDF georreferenciado (requer GDAL versão 3 ou mais recente). Você pode:
  - Choose the GeoPDF *Format*
  - *Include vector feature information* in the GeoPDF file: will include all the geometry and attribute information from features visible within the map in the output GeoPDF file.

Nota: Desde QGIS 3.10, com GDAL 3 um arquivo GeoPDF também pode ser usado como fonte de dados. Para saber mais sobre o suporte GeoPDF em QGIS, veja https://north-road.com/2019/09/03/qgis-3-10-loves-geopdf/.

- *Rasterize map*
- *Simplify geometries to reduce output file size*: Geometries will be simplified while exporting the map by removing vertices that are not discernably different at the export resolution (e.g. if the export resolution is `300 dpi`, vertices that are less than `1/600 inch` apart will be removed). This can reduce the size and complexity of the export file (very large files can fail to load in other applications).
- Defina :guilabel: Exportar texto`: controla se os rótulos de texto são exportados como objetos de texto adequados (*Sempre exportar textos como objetos de texto*) ou apenas como caminhos (*Sempre exporta textos como caminhos*). Se eles forem exportados como objetos de texto, poderão ser editados em aplicativos externos (por exemplo, Inkscape) como texto normal. MAS o efeito colateral é que a qualidade da renderização diminui E há problemas com a renderização quando determinadas configurações de texto, como buffers, estão em vigor. É por isso que a exportação como caminhos é recomendada.

9. Click *Save* to select file location, name and format.

   When exporting to image, it's also possible to *Copy to clipboard* the expected result of the above settings and paste the map in another application such as LibreOffice, GIMP…

7.4 Visualização de Mapa 3D

3D visualization support is offered through the 3D map view. You create and open a 3D map view via *View* ► *New 3D Map View*. A floating QGIS panel will appear. The panel can be docked.

To begin with, the 3D map view has the same extent and view as the 2D main map canvas. A set of navigation tools are available to turn the view into 3D.

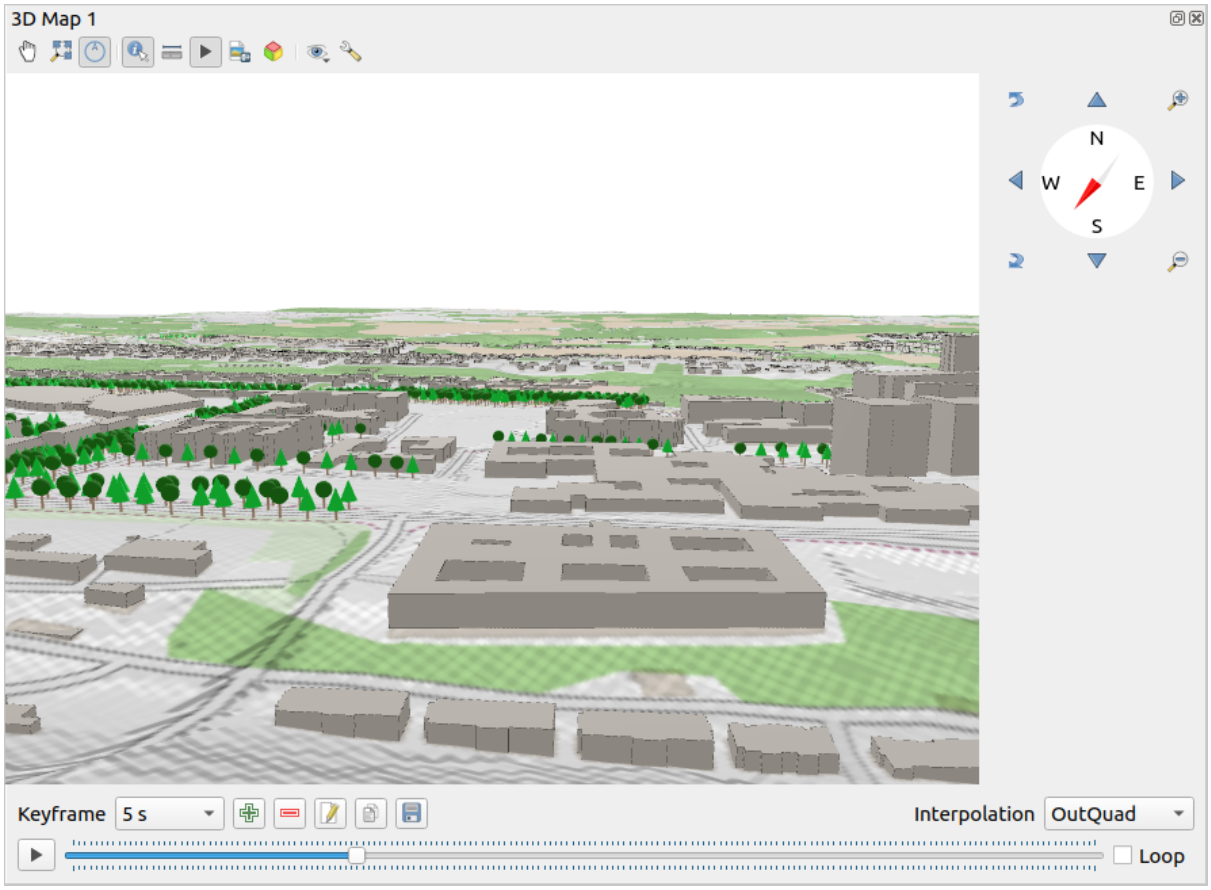


Figura7.7: The 3D Map View dialog

The following tools are provided at the top of the 3D map view panel:

- Camera control: moves the view, keeping the same angle and direction of the camera
- Zoom Full: resizes the view to the whole layers' extent
- Toggle on-screen notification: shows/hides the navigation widget (that is meant to ease controlling of the map view)
- Identify: returns information on the clicked point of the terrain or the clicked 3D feature(s) – More details at *Identificar Elementos*
- Measurement line: measures the horizontal distance between points
- Animations: shows/hides the *animation player* widget
- Save as image…: exports the current view to an image file format
- Export 3D Scene…: exports the current view as a 3D scene (`.obj` file), allowing post-processing in applications like Blender… The terrain and vector features are exported as 3D objects. The export settings, overriding the layers *properties* or map view *configuration*, include:
  - *Scene name* and destination *Folder*
  - *Terrain resolution*
  - *Terrain texture resolution*
  - *Model scale*

  - *Smooth edges*
  - *Export normals*
  - *Export textures*
- Set View Theme: Allows you to select the set of layers to display in the map view from predefined *map themes*.
- Configure the map view *settings*

7.4.1 Navigation options

To explore the map view in 3D:

- Tilt the terrain (rotating it around a horizontal axis that goes through the center of the window)
  - Press the Tilt up and Tilt down tools
  - Press `Shift` and use the up/down keys
  - Drag the mouse forward/backward with the middle mouse button pressed
  - Pressione `Shift` e arraste o mouse para frente/para trás com o botão esquerdo do mouse pressionado
- Rotate the terrain (around a vertical axis that goes through the center of the window)
  - Turn the compass of the navigation widget to the watching direction
  - Pressione `Shift` e use as teclas esquerda/direita
  - Drag the mouse right/left with the middle mouse button pressed
  - Pressione `Shift` e arraste o mouse para a direita/esquerda com o botão esquerdo do mouse pressionado
- Change the camera position (and the view center), moving it around in a horizontal plan
  - Drag the mouse with the left mouse button pressed, and the Camera control button enabled
  - Press the directional arrows of the navigation widget
  - Use the up/down/left/right keys to move the camera forward, backward, right and left, respectively
- Change the camera altitude: press the `Page Up`/`Page Down` keys
- Change the camera orientation (the camera is kept at its position but the view center point moves)
  - Press `Ctrl` and use the arrow keys to turn the camera up, down, left and right
  - Press `Ctrl` and drag the mouse with the left mouse button pressed
- Zoom in and out
  - Press the corresponding Zoom In and Zoom Out tools of the navigation widget
  - Scroll the mouse wheel (keep `Ctrl` pressed results in finer zooms)
  - Drag the mouse with the right mouse button pressed to zoom in (drag down) and out (drag up)

Para redefinir a visualização da câmera, clique no botão :sup:`Zoom completo' na parte superior do painel de tela 3D.

7.4.2 Creating an animation

An animation is based on a set of keyframes - camera positions at particular times. To create an animation:

1. Toggle on the Animations tool, displaying the animation player widget
2. Click the Add keyframe button and enter a *Keyframe time* in seconds. The *Keyframe* combo box now displays the time set.
3. Using the navigation tools, move the camera to the position to associate with the current keyframe time.
4. Repeat the previous steps to add as many keyframes (with time and position) as necessary.
5. Click the button to preview the animation. QGIS will generate scenes using the camera positions/rotations at set times, and interpolating them in between these keyframes. Various *Interpolation* modes for animations are available (eg, linear, inQuad, outQuad, inCirc… – more details at https://doc.qt.io/qt-5/qeasingcurve.html#EasingFunction-typedef).

   The animation can also be previewed by moving the time slider. Keeping the Repeat button pressed will repeatedly run the animation while clicking stops a running animation.

It is possible to browse the different views of the camera, using the *Keyframe* list. Whenever a time is active, changing the map view will automatically update the associated position. You can also Edit keyframe (time only) or Remove keyframe.

Click Export animation frames to generate a series of images representing the scene. Other than the filename *Template* and the *Output directory*, you can set the number of *Frames per second*, the *Output width* and *Output height*.

7.4.3 Scene Configuration

The 3D map view opens with some default settings you can customize. To do so, click the Configure… button at the top of the 3D canvas panel to open the *3D configuration* window.

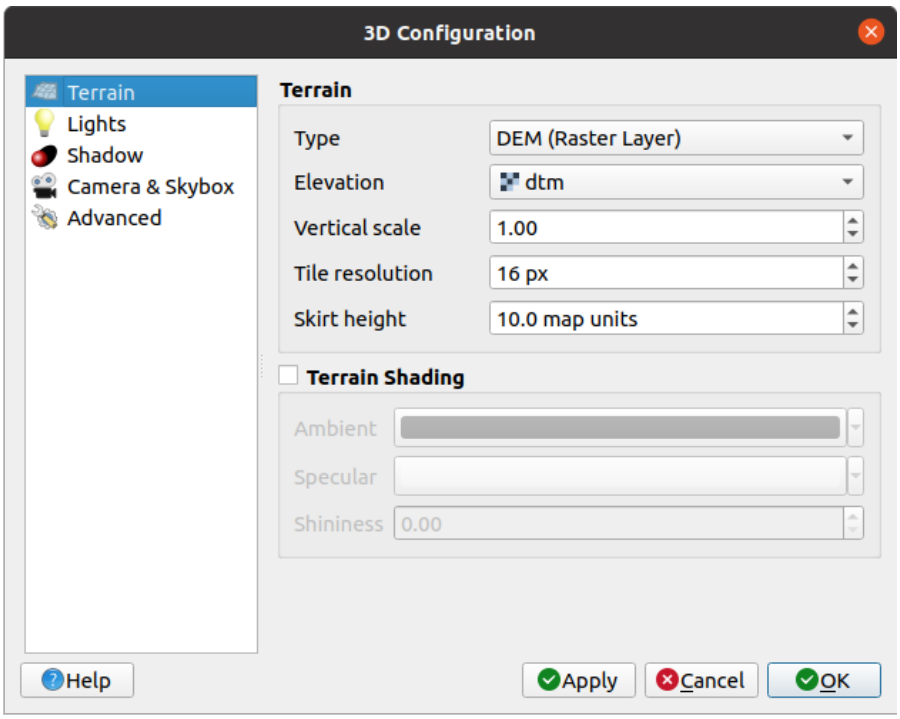


Figura7.8: The 3D Map Configuration dialog

In the 3D Configuration window there are various options to fine-tune the 3D scene:

Terrain

- *Terrain*: Before diving into the details, it is worth noting that the terrain in a 3D view is represented by a hierarchy of terrain tiles and as the camera moves closer to the terrain, existing tiles that do not have sufficient details are replaced by smaller tiles with more details. Each tile has mesh geometry derived from the elevation raster layer and texture from 2D map layers.
  - The elevation terrain *Type* can be:
    - a *Flat terrain*
    - a loaded *DEM (Raster Layer)*
    - an *Online* service, loading elevation tiles produced by Mapzen tools – more details at https://registry.opendata.aws/terrain-tiles/
    - a loaded *Mesh* dataset
  - *Elevation*: Raster or mesh layer to be used for generation of the terrain. The raster layer must contain a band that represents elevation. For a mesh layer, the Z values of the vertices are used.
  - *Vertical scale*: Scale factor for vertical axis. Increasing the scale will exaggerate the height of the landforms.
  - *Tile resolution*: How many samples from the terrain raster layer to use for each tile. A value of 16px means that the geometry of each tile will consist of 16x16 elevation samples. Higher numbers create more detailed terrain tiles at the expense of increased rendering complexity.
  - *Skirt height*: Sometimes it is possible to see small cracks between tiles of the terrain. Raising this value will add vertical walls ("skirts") around terrain tiles to hide the cracks.
- When a mesh layer is used as terrain, you can configure the *Triangles settings* (wireframe display, smooth triangles) and the *Rendering colors settings* (as uniform or depending on terrain level). More details in the *Mesh layer properties* section.
- *Terrain shading*: Permite a você escolher como o terreno deveria ser renderizado:
  - Shading disabled - terrain color is determined only from map texture
  - Shading enabled - terrain color is determined using Phong's shading model, taking into account map texture, the terrain normal vector, scene light(s) and the terrain material's *Ambient* and *Specular* colors and *Shininess*

Lights

From the *Lights* tab, press the menu to add

- up to eight *Point lights*: emits light in all directions, like a sphere of light filling an area. Objects closer to the light will be brighter, and objects further away will be darker. A point light has a set position (*X*, *Y* and *Z*), a *Color*, an *Intensity* and an *Attenuation*
- up to four *Directional lights*: mimics the lighting that you would get from a giant flash light very far away from your objects, always centered and that never dies off (e.g. the sun). It emits parallel light rays in a single direction but the light reaches out into infinity. A directional light can be rotated given an *Azimuth*, have an *Altitude*, a *Color* and an *Intensity*.

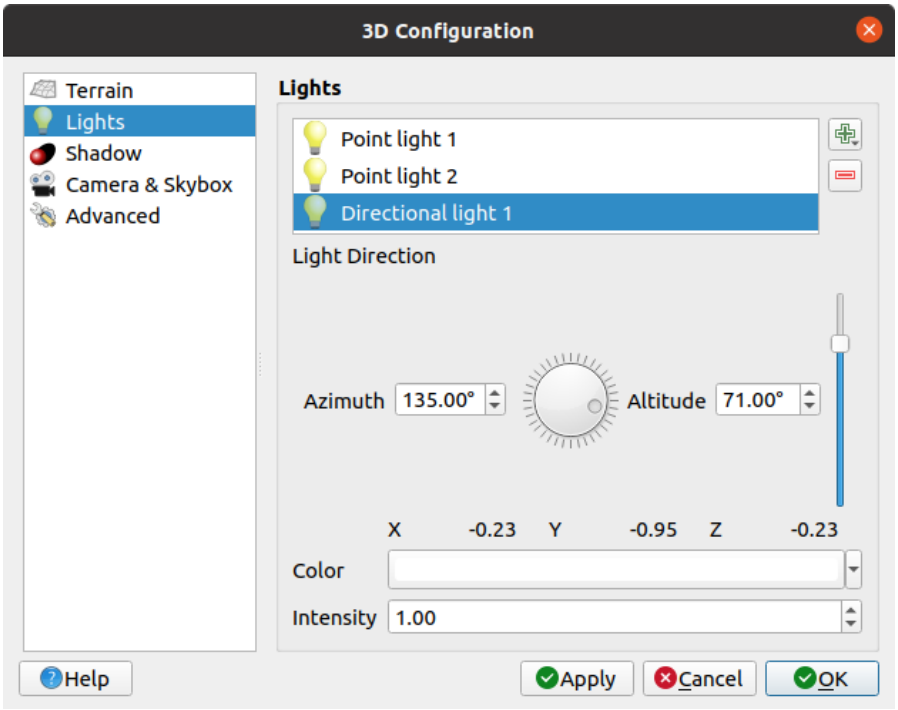


Figura7.9: The 3D Map Lights Configuration dialog

Shadow

Check *Show shadow* to display shadow within your scene, given:

- a *Directional light*
- a *Shadow rendering maximum distance*: to avoid rendering shadow of too distant objects, particularly when the camera looks up along the horizon
- a *Shadow bias*: to avoid self-shadowing effects that could make some areas darker than others, due to differences between map sizes. The lower the better
- a *Shadow map resolution*: to make shadows look sharper. It may result in less performance if the resolution parameter is too high.

Camera & Skybox

- Camera's *Field of view*: allowing to create panoramic scenes. Default value is 45°.
- Check *Show skybox* to enable skybox rendering in the scene. The skybox type can be:
  - *Panoramic texture*, with a single file providing sight on 360°
  - *Distinct faces*, with a texture file for each of the six sides of a box containing the scene

  Texture files can be files on the disk, remote URLs or embedded in the project (*more details*).

Advanced

- *Map tile resolution*: Width and height of the 2D map images used as textures for the terrain tiles. 256px means that each tile will be rendered into an image of 256x256 pixels. Higher numbers create more detailed terrain tiles at the expense of increased rendering complexity.
- *Max. screen error*: Determines the threshold for swapping terrain tiles with more detailed ones (and vice versa) - i.e. how soon the 3D view will use higher quality tiles. Lower numbers mean more details in the scene at the expense of increased rendering complexity.
- *Max. ground error*: The resolution of the terrain tiles at which dividing tiles into more detailed ones will stop (splitting them would not introduce any extra detail anyway). This value limits the depth of the hierarchy of tiles: lower values make the hierarchy deep, increasing rendering complexity.
- *Zoom levels*: Shows the number of zoom levels (depends on the map tile resolution and max. ground error).
- ☐ *Show labels*: Ativa/desativa os rótulos de mapa
- ☐ *Show map tile info*: Include border and tile numbers for the terrain tiles (useful for troubleshooting terrain issues)
- ☐ *Show bounding boxes*: Show 3D bounding boxes of the terrain tiles (useful for troubleshooting terrain issues)
- ☐ *Show camera's view center*
- ☐ *Show light sources*: shows a sphere at light source origins, allowing easier repositioning and placement of light sources relative to the scene contents

7.4.4 Camadas vetoriais 3D

Uma camada vetorial com valores de elevação pode ser mostrada no mapa 3D, marcando *Ativar renderizador 3D* na seção *Vista 3D* das propriedades da camada vetorial. Há várias opções disponíveis para controlar a renderização da camada vetorial 3D.

7.5 Barra de Status

The status bar provides you with general information about the map view and processed or available actions, and offers you tools to manage the map view.

7.5.1 Locator bar

On the left side of the status bar, the locator bar, a quick search widget, helps you find and run any feature or options in QGIS:

1. Click in the text widget to activate the locator search bar or press `Ctrl+K`.
2. Type a text associated with the item you are looking for (name, tag, keyword, …). By default, results are returned for the enabled locator filters, but you can limit the search to a certain scope by prefixing your text with the *locator filters* prefix, ie. typing `l cad` will return only the layers whose name contains `cad`.

   The filter can also be selected with a double-click in the menu that shows when accessing the locator widget.
3. Click on a result to execute the corresponding action, depending on the type of item.

Dica: Limit the lookup to one field of the active layer

By default, a search with the "active layer features" filter (`f`) runs through the whole attribute table of the layer. You can limit the search to a particular field using the `@` prefix. E.g., `f @name sal` or `@name sal` returns only the

features whose "name" attribute contains 'sal'. Text autocompletion is active when writing and the suggestion can be applied using `Tab` key.

Searching is handled using threads, so that results always become available as quickly as possible, even if slow search filters are installed. They also appear as soon as they are encountered by a filter, which means that e.g. a file search filter will show results one by one as the file tree is scanned. This ensures that the UI is always responsive, even if a very slow search filter is present (e.g. one which uses an online service).

Dica: Quick access to the locator's configurations

Click on the  icon inside the locator widget on the status bar to display the list of filters you can use and a *Configure* entry that opens the *Locator* tab of the *Settings* ► *Options…* menu.

7.5.2 Reporting actions

In the area next to the locator bar, a summary of actions you've carried out will be shown when needed (such as selecting features in a layer, removing layer) or a long description of the tool you are hovering over (not available for all tools).

In case of lengthy operations, such as gathering of statistics in raster layers, executing Processing algorithms or rendering several layers in the map view, a progress bar is displayed in the status bar.

7.5.3 Control the map canvas

A opção  *Coordenada* mostra a posição atual do mouse, seguindo-o enquanto se move pela visualização do mapa. Você pode definir as unidades (e precisão) na guia *Projeto* ► *Propriedades…* ► *Geral*. Clique no pequeno botão à esquerda da caixa de texto para alternar entre a opção Coordenada e a opção  *Extensão* que mostra as coordenadas dos cantos inferior-esquerdo e superior direito da visualização do mapa em unidades de mapa.

Next to the coordinate display you will find the *Scale* display. It shows the scale of the map view. There is a scale selector, which allows you to choose between *predefined and custom scales*.

On the right side of the scale display, press the  button to lock the scale to use the magnifier to zoom in or out. The magnifier allows you to zoom in to a map without altering the map scale, making it easier to tweak the positions of labels and symbols accurately. The magnification level is expressed as a percentage. If the *Magnifier* has a level of 100%, then the current map is not magnified. Additionally, a default magnification value can be defined within *Settings* ► *Options* ► *Rendering* ► *Rendering behavior*, which is very useful for high-resolution screens to enlarge small symbols.

À direita da ferramenta de ampliação, você pode definir uma rotação atual no sentido horário para a visualização do mapa em graus.

On the right side of the status bar, there is a small checkbox which can be used temporarily to prevent layers being rendered to the map view (see section *Renderização*).

To the right of the render functions, you find the  *EPSG:code* button showing the current project CRS. Clicking on this opens the *Project Properties* dialog and lets you apply another CRS to the map view.

Dica: Calculando a escala correta do seu Mapa da tela/visualização

When you start QGIS, the default CRS is `WGS 84 (EPSG 4326)` and units are degrees. This means that QGIS will interpret any coordinate in your layer as specified in degrees. To get correct scale values, you can either manually change this setting in the *General* tab under *Project* ► *Properties…* (e.g. to meters), or you can use the  EPSG:code icon seen above. In the latter case, the units are set to what the project projection specifies (e.g., `+units=us-ft`).

Observe que a escolha do SRC no começo pode ser definida em *Configurações* ► *Opções* ► *SRC*.

7.5.4 Messaging

The  Messages button next to it opens the *Log Messages Panel* which has information on underlying processes (QGIS startup, plugins loading, processing tools…)

Depending on the *Plugin Manager settings*, the status bar can sometimes show icons to the right to inform you about the availability of new () or upgradeable () plugins. Click the icon to open the Plugin Manager dialog.

CAPÍTULO 8

The Browser panel

The QGIS Browser panel is a great tool for browsing, searching, inspecting, copying and loading QGIS resources. Only resources that QGIS knows how to handle are shown in the browser.

Using the Browser panel you can locate, inspect and add data, as described in *The Browser Panel*. In addition, the Browser panel supports drag and drop of many QGIS resources, such as project files, Python scripts, Processing scripts and Processing models.

Python scripts, Processing scripts and Processing models can also be opened for editing in an external editor and the graphical modeller.

You can drag and drop layers from the *Layers* panel to the *Browser* panel, for instance into a GeoPackage or a PostGIS database.

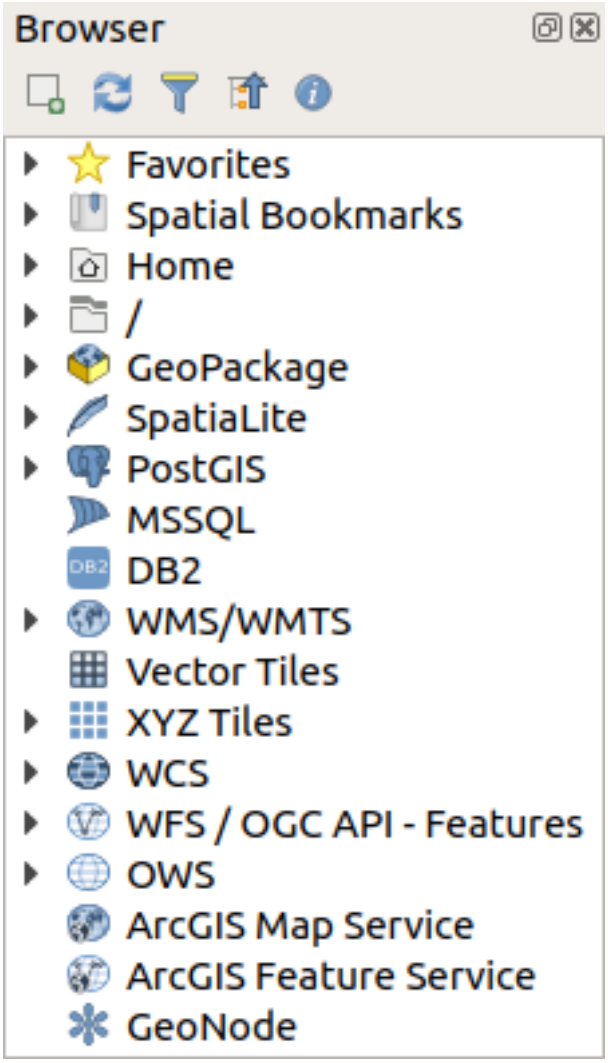


Figura8.1: The Browser panel

The browser panel (Fig.8.1) is organised as an expandable hierarchy with some fixed top-level entries that organise the resources handled by the browser. Node entries are expanded by clicking on ▸ to the left of the entry name. A branch is collapsed by clicking on ▾. The Collapse All button collapses all top-level entries.

In *Settings* ► *Interface Customization* it is possible to disable resources. If you, for instance, would not like to show Python scripts in the browser, you can uncheck the *Browser* ► *py* entry, and if you want to get rid of your home folder in the browser, you can uncheck the *Browser* ► *special:Home* entry.

A filter (Filter Browser) can be used for searching based on entry names (both leaf entries and node entries in the hierarchy). Using the Options pull-down menu next to the filter text field, you can

- toggle *Case Sensitive* search
- set the *Filter pattern syntax* to one of
  - *Normal*
  - *Wildcard(s)*
  - *Regular Expressions*

The *Properties widget*, showing useful information about some entries / resources, can be enabled / disabled using the Enable/disable properties widget button. When enabled, it opens at the bottom of the browser panel, as shown in Fig.8.2.

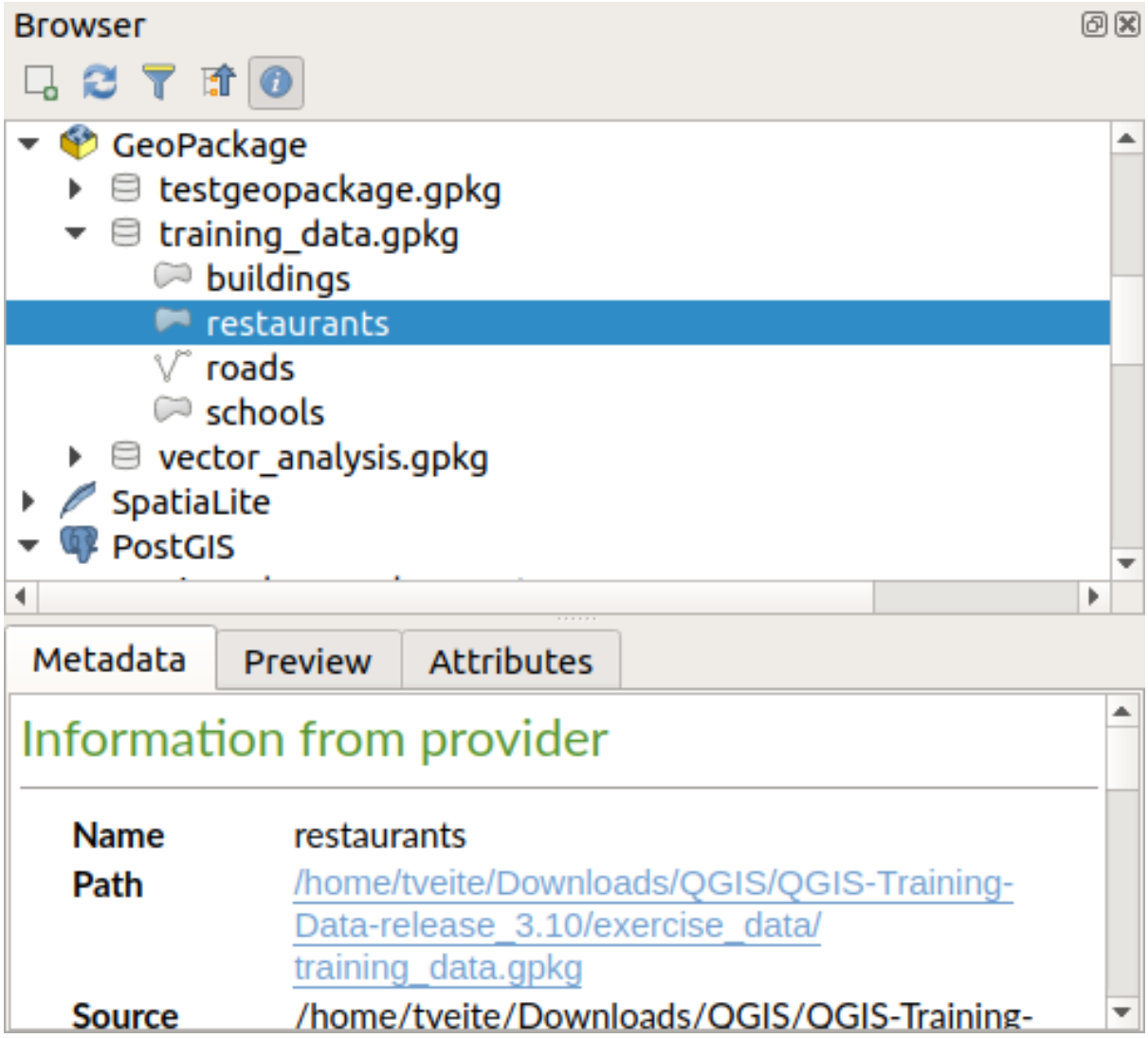


Figura8.2: The properties widget

A second browser panel can be opened by activating the *Browser (2)* panel in *View* ► *Panels*. Having two browser panels can be useful when copying layers between resources that are locationed deep down in different branches of the browser hierarchy.

8.1 Resources that can be opened / run from the Browser

A lot can be accomplished in the Browser panel

- Add vector, raster and mesh layers to your map by double-clicking, dragging onto the map canvas or clicking the Add Selected Layers button (after selecting layers)
- Run Python scripts (including Processing algorithms) by double-clicking or dragging onto the map canvas
- Run models by double-clicking or dragging onto the map canvas
- *Extract Symbols…* from QGIS Project files using the context menu
- Open files with their default applications (*Open <file type> Externally…* in the context menu). Examples: HTML files, spreadsheets, images, PDFs, text files, …
- Copy entries

Resource specific actions are listed for the different resource groups sorted under the top-level entries listed below.

8.2 Browser panel top-level entries

8.2.1 Favorites

Often used file system locations can be tagged as favorites. The ones you have tagged will appear here.

In addition to the operations described under *Home*, the context menu allows you to *Rename Favorite…* and *Remove Favorite*.

8.2.2 Favoritos Espaciais

This is where you will find your spatial bookmarks, organised into *Project Bookmarks* and *User Bookmarks*.

From the top level context menu, you can create a bookmark (*New Spatial Bookmark…*), *Show the Spatial Bookmark Manager*, *Import Spatial Bookmarks…* and *Export Spatial Bookmarks…*.

For bookmark entries you can *Zoom to Bookmark*, *Edit Spatial Bookmark…* and *Delete Spatial Bookmark*

8.2.3 Home

Your file system home directory / folder. By right-clicking on an entry, and choosing *Add as a Favorite*, the location will be added to *Favorites*. From the context menu, you can also

- add a directory, Geopackage or ESRI Shapefile format dataset (*Add*)
- hide the directory (*Hide from Browser*)
- toggle *Fast Scan this Directory*
- open the directory in your file manager (*Open Directory*)
- open the directory in a terminal window (*Open in Terminal*)
- inspect properties (*Properties…*, *Directory Properties…*)

8.2.4 /

Your file system root directory / folder.

8.2.5 Geopackage

Geopackage files / databases. From the top level context menu, you can create a Geopackage file / database (*Create Database…*) or add an existing Geopackage file / database (*New Connection…*).

The context menu of each Geopackage lets you remove it from the list (*Remove connection…*), add a new layer or table to the Geopackage (*Create new Layer or Table…*), delete the Geopackage (*Delete <name of geopackage>*) and *Compact Database (VACUUM)*.

For layer/table entries you can

- rename it (*Rename Layer <layer name>…*)
- export it (*Export Layer ► To file*)
- add it to the project *Add Layer to Project*
- delete it (*Delete Layer*)

- inspect properties (*Layer Properties…*, *File Properties…*)

8.2.6 SpatiaLite

SpatiaLite database connections.

From the top level context menu, you can create a SpatiaLite file / database (*Create Database…*) or add an existing SpatiaLite file / database (*New Connection…*).

The context menu of each SpatiaLite file lets you delete it (*Delete*).

For layer/table entries you can

- export it (*Export Layer ► To file*)
- add it to the project *Add Layer to Project*
- delete it (*Delete Layer*)
- inspect properties (*Layer Properties…*)

8.2.7 PostGIS

PostGIS database connections.

From the top level context menu, you can add a new connection (*New Connection…*).

The context menu of each connection lets you *Refresh* it, edit it *Edit connection…*, delete it (*Delete connection*) or *Create Schema…*.

The context menu of each schema lets you *Refresh*, *Rename Schema…* or *Delete Schema*.

For layers/tables you can

- rename it (*Rename Table…*)
- remove its contents (*Truncate Table…*)
- export it (*Export Layer ► To file*)
- add it to the project (*Add Layer to Project*)
- delete it (*Delete Layer*)
- inspect its properties (*Layer Properties…*)

8.2.8 MSSQL

Microsoft SQL Server connections.

From the top level context menu, you can add a new connection (*New Connection…*).

The context menu of each connection lets you *Refresh* it, edit it *Edit connection…*, delete it (*Delete connection*) or *Create Schema…*.

The context menu of each schema lets you *Refresh*, *Rename Schema…* or *Delete Schema*.

For layers/tables you can

- rename it (*Rename Table…*)
- remove its contents (*Truncate Table…*)
- export it (*Export Layer ► To file*)
- add it to the project (*Add Layer to Project*)
- delete it (*Delete Layer*)

- inspect its properties (*Layer Properties…*)

8.2.9 DB2

IBM DB2 database connections.

From the top level context menu, you can add a new connection (*New Connection…*).

The context menu of each connection lets you *Refresh* it, edit it *Edit connection…*, delete it (*Delete connection*) or *Create Schema…*.

The context menu of each schema lets you *Refresh*, *Rename Schema…* or *Delete Schema*.

For layers/tables you can

- rename it (*Rename Table…*)
- remove its contents (*Truncate Table…*)
- export it (*Export Layer* ► *To file*)
- add it to the project (*Add Layer to Project*)
- delete it (*Delete Layer*)
- inspect its properties (*Layer Properties…*)

8.2.10 WMS/WMTS

Web Map Services (WMS) and Web Map Tile Services (WMTS)

From the top level context menu, you can add a new connection (*New Connection…*).

The context menu of each WSM/WMTS service lets you *Refresh* it, *Edit…* it and delete it (*Delete*).

Group layers can be added by dragging them onto the map canvas.

For WMS/WMTS layer entries you can

- export it (*Export Layer* ► *To file*)
- add it to the project (*Add Layer to Project*)
- inspect properties (*Layer Properties…*)

8.2.11 Vector Tiles

Vector tile services

From the top level context menu, you add an existing service (*New Connection…*), and you can *Save Connections…* or *Load Connections…* to / from XML files.

8.2.12 XYZ Tiles

XYZ tile services

From the top level context menu, you add an existing service (*New Connection…*), and you can *Save Connections…* or *Load Connections…* to / from XML files.

For the XYZ tile service entries you can

- edit it (*Edit…*)
- delete it (*Delete*)
- export it (*Export Layer* ► *To file*)

- add it to the project *Add Layer to Project*
- inspect properties (*Layer Properties…*)

8.2.13 WCS

Web Coverage Services

From the top level context menu, you can add a new connection (*New Connection…*).

The context menu of each WCS lets you *Refresh* it, *Edit…* it and delete it (*Delete*).

For WCS layer entries you can

- export it (*Export Layer* ► *To file*)
- add it to the project (*Add Layer to Project*)
- inspect properties (*Layer Properties…*)

8.2.14 WFS / OGC API - Features

Web Feature Services (WFS) and *OGC API - Features services* (aka WFS3)

From the top level context menu, you can add a new connection (*New Connection…*).

The context menu of each WFS lets you *Refresh* it, *Edit…* it and delete it (*Delete*).

For WFS layer entries you can

- export it (*Export Layer* ► *To file*)
- add it to the project (*Add Layer to Project*)
- inspect properties (*Layer Properties…*)

8.2.15 OWS

Here you will find a read-only list of all your Open Web Services (OWS) - WMS / WCS / WFS / …

8.2.16 ArcGIS Map Service

8.2.17 ArcGIS Features Service

8.2.18 GeoNode

From the top level context menu, you can add a new connection (*New Connection…*).

The context menu of each service lets you *Refresh* it, *Edit…* it and delete it (*Delete*).

For the service layer entries you can

- export it (*Export Layer* ► *To file*)
- add it to the project (*Add Layer to Project*)
- inspect properties (*Layer Properties…*)

8.3 Resources

- Project files. The context menu for QGIS project files allows you to:
  - open it (*Open Project*)
  - extract symbols (*Extract Symbols…*) - opens the style manager that allows you to export symbols to an XML file, add symbols to the default style or export as PNG or SVG.
  - inspect properties (*File Properties…*)

  You can expand the project file to see its layers. The context menu of a layer offers the same actions as elsewhere in the browser.
- QGIS Layer Definition files (QLR). The following actions are available from the context menu:
  - export it (*Export Layer ► To file*)
  - add it to the project (*Add Layer to Project*)
  - inspect properties (*Layer Properties…*)
- Processing models (.model3). The following actions are available from the context menu:
  - *Run Model…*)
  - *Edit Model…*)
- QGIS print composer templates (QPT). The following action is available from the context menu:
  - (*New Layout from Template*)
- Python scripts (.py). The following actions are available from the context menu:
  - (*Run script…*)
  - (*Open in External Editor*)
- Recognized raster formats. The following actions are available from the context menu:
  - delete it (*Delete File <dataset name>*)
  - export it (*Export Layer ► To file*)
  - add it to the project (*Add Layer to Project*)
  - inspect properties (*Layer Properties…*, *File Properties…*)

  For some formats you can also *Open <file type> Externally…*
- Recognized vector formats. The following actions are available from the context menu:
  - delete it (*Delete File <dataset name>*)
  - export it (*Export Layer ► To file*)
  - add it to the project (*Add Layer to Project*)
  - inspect properties (*Layer Properties…*, *File Properties…*)

  For some formats you can also *Open <file type> Externally…*

CAPÍTULO 9

Configuração QGIS

O QGIS é altamente configurável. Através do menu *Configurações*, fornece ferramentas diferentes para:

- *Gerenciador de Estilos...*: cria e gerencia *símbolos, estilos e rampas de cores*.
- *Custom Projections...*: create your own *coordinate reference systems*.
- *Keyboard Shortcuts...*: define your own set of *keyboard shortcuts*. Also, they can be overridden during each QGIS session by the *project properties* (accessible under *Project* menu).
- *Interface Customization...*: configure the *application interface*, hiding dialogs or tools you may not need.
- *Options...*: set global *options* to apply in different areas of the software. These preferences are saved in the active *User profile* settings and applied by default whenever you open a new project with this profile.

9.1 Opções

Some basic options for QGIS can be selected using the *Options* dialog. Select the menu option *Settings* ► *Options*. You can modify the options according to your needs. Some of the changes may require a restart of QGIS before they will be effective.

The tabs where you can customize your options are described below.

Nota: Plugins can embed their settings within the Options dialog

While only Core settings are presented below, note that this list can be extended by *installed plugins* implementing their own options into the standard Options dialog. This avoids each plugin having their own config dialog with extra menu items just for them...

9.1.1 General Settings

Override System Locale

By default, QGIS relies on your Operating System configuration to set language and manipulate numerical values. Enabling this group allows you to customize the behavior.

- Select from *User interface translation* the language to apply to the GUI
- Select in *Locale (number, date and currency formats)* the system on which date and numeric values should be input and rendered
- ☑ *Show group (thousand) separator*

A summary of the selected settings and how they would be interpreted is displayed at the bottom of the frame.

Aplicação

- Select the *Style (QGIS restart required)* ie, the widgets look and placement in dialogs. Possible values depend on your Operating System.
- Define the *UI theme (QGIS restart required)* . It can be 'default', 'Night Mapping', or 'Blend of Gray'
- Define the *Icon size* 
- Define the *Font* and its *Size*. The font can be  *Qt default* or a user-defined one
- Change the *Timeout for timed messages or dialogs*
- ☐ *Hide splash screen at startup*
- ☑ *Show QGIS news feed on welcome page*: displays a curated QGIS news feed on the welcome page, giving you a direct way to be aware of project news (user/developer meetings date and summary, community surveys, releases announcements, various tips…)
- ☑ *Check QGIS version at startup* to keep you informed if a newer version is released
- ☐ *Use native color chooser dialogs* (see *Selector de Cor*)
- ☐ *Modeless data source manager dialog* to keep the *data source manager* dialog opened and allow interaction with QGIS interface while adding layers to project

Arquivos de projeto

- *Open project on launch*
  - 'Welcome Page' (default): can display the "News" feed, the project template(s) and the most recent projects (with thumbnails) of the *user profile*. No project is opened by default.
  - 'New': opens a new project, based on the default template
  - 'Most recent': reopens the last saved project
  - and 'Specific': opens a particular project. Use the … button to define the project to use by default.
- ☑ *Criar um novo projeto como projeto padrão*. Tem a possibilidade de carregar em *Usar projeto atual com padrão* ou em *Resetar padrão*. Pode navegar através dos seus arquivos e definir um diretório onde encontra os modelos de projeto definidos pelo usuário. Isto será adicionado a *Projeto* ► *Novo do modelo*. Primeiro ative ☑ *Criar novo projeto como projeto padrão* e a seguir salve o projeto dentro da pasta de modelos de projeto.
- ☑ *Prompt to save project and data source changes when required* to avoid losing changes you made.
- ☑ *Solicitar confirmação quando uma camada for ser removida*

-  *Warn when opening a project file saved with an older version of QGIS*. You can always open projects created with older version of QGIS but once the project is saved, trying to open with older release may fail because of features not available in that version.
- *Enable macros* . This option was created to handle macros that are written to perform an action on project events. You can choose between 'Never', 'Ask', 'For this session only' and 'Always (not recommended)'.
- *Default project file format*
  -  *QGZ Archive file format, embeds auxiliary data* (see *auxiliary data*)
  -  *QGS Project saved in a clear text, does not embed auxiliary data*: the auxiliary data is stored in a separate `.qgd` file along with the project file.

9.1.2 System Settings

SVG paths

Add or Remove *Path(s) to search for Scalable Vector Graphic (SVG) symbols*. These SVG files are then available to symbolize or label the features or decorate your map composition.

When using an SVG file in a symbol or a label, QGIS allows you to:

- load the file from the file system: the file is identified through the file path and QGIS needs to resolve the path in order to display the corresponding image
- carregue o arquivo de um URL remoto: como acima, a imagem será carregada apenas na recuperação bem-sucedida do recurso remoto
- embed the SVG file into the item: the file is embedded inside the current project, style database, or print layout template. The SVG file is then always rendered as part of the item. This is a convenient way to create self-contained projects with custom SVG symbols which can be easily shared amongst different users and installations of QGIS.

  It is also possible to extract the embedded SVG file from a symbol or label and save it on disk.

Nota: The above mentioned options for loading and storing an SVG file in a project are also applicable to raster images you may want to use for customizing symbols, labels or decorations.

Diretórios dos complementos

Add or Remove *Path(s) to search for additional C++ plugin libraries.*

Documentation paths

Add or Remove *Documentation Path(s)* to use for QGIS help. By default, a link to the official online User Manual corresponding to the version being used is added. You can however add other links and prioritize them from top to bottom: each time you click on a *Help* button in a dialog, the topmost link is checked and if no corresponding page is found, the next one is tried, and so on.

Nota: Documentation is versioned and translated only for QGIS Long Term Releases (LTR), meaning that if you are running a regular release (eg, QGIS 3.0), the help button will by default open the next LTR manual page (ie. 3.4 LTR), which may contain description of features in newer releases (3.2 and 3.4). If no LTR documentation is available then the *testing* doc, with features from newer and development versions, is used.

Settings

It helps you *Reset user interface to default settings (restart required)* if you made any *customization*.

Ambiente

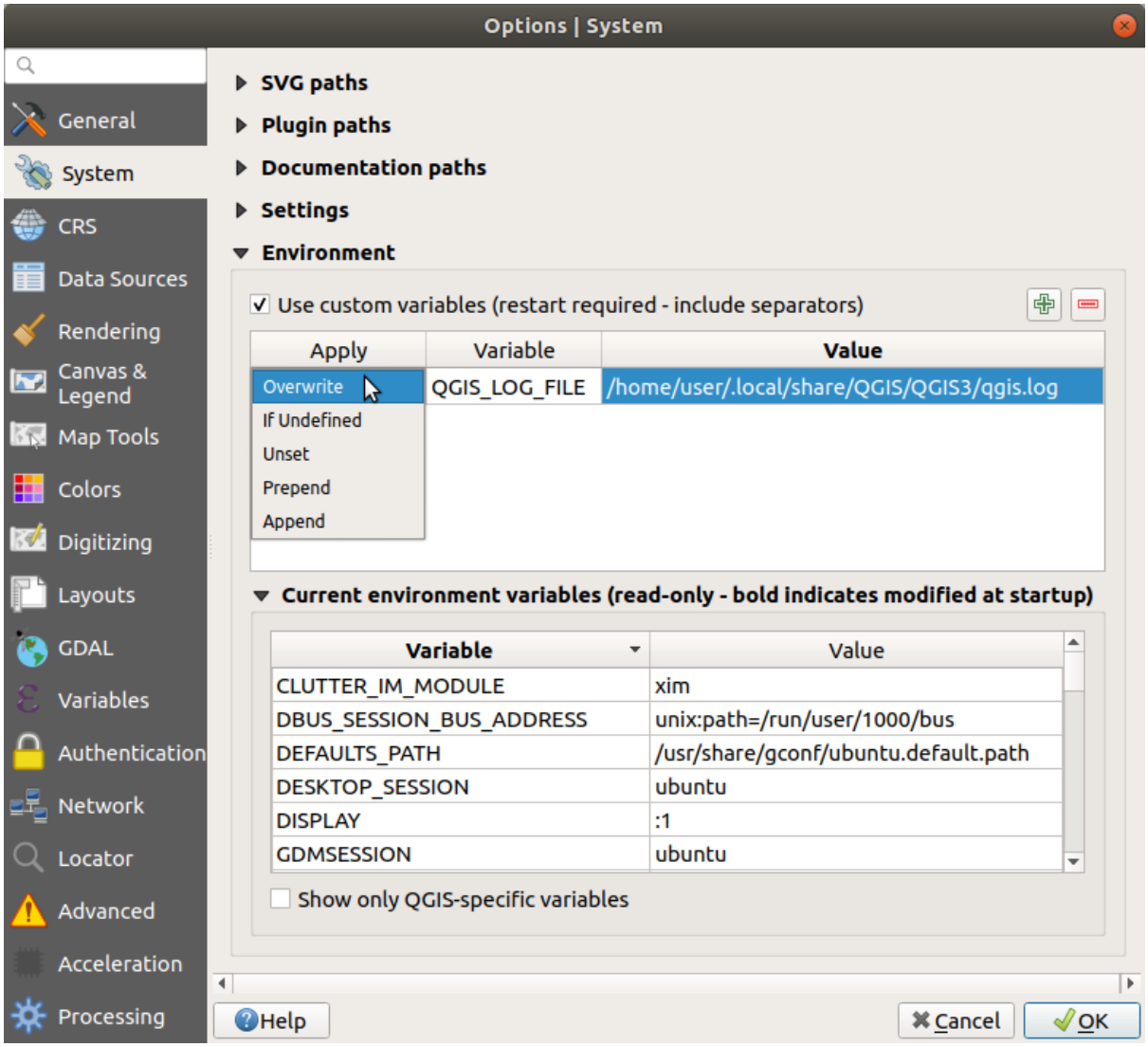


Figura9.1: System environment variables in QGIS

System environment variables can be viewed, and many configured, in the **Environment** group. This is useful for platforms, such as Mac, where a GUI application does not necessarily inherit the user's shell environment. It's also useful for setting and viewing environment variables for the external tool sets controlled by the Processing toolbox (e.g., SAGA, GRASS), and for turning on debugging output for specific sections of the source code.

☑ *Use custom variables (restart required - include separators)*. You can *Add* and *Remove* variables. Already defined environment variables are displayed in *Current environment variables*, and it's possible to filter them by activating ☑ *Show only QGIS-specific variables*.

9.1.3 CRS Settings

Nota: For more information on how QGIS handles layer projection, please read the dedicated section at *Trabalhando com Projeções*.

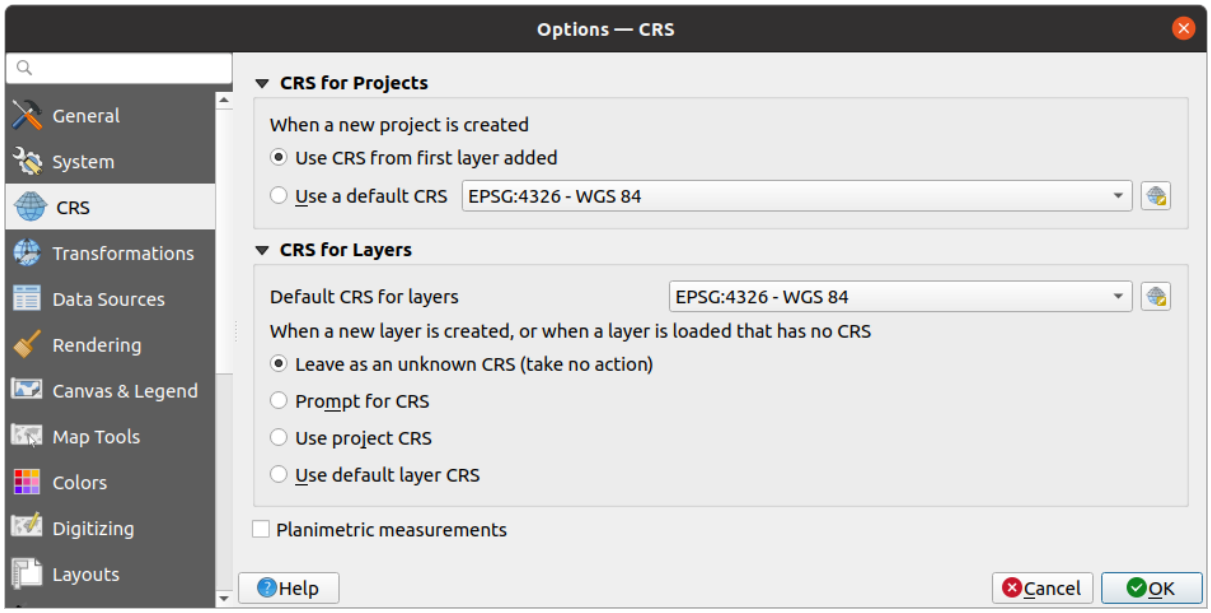


Figura9.2: CRS Settings in QGIS

CRS for projects

There is an option to automatically set new project's CRS:

- *Use CRS from first layer added*: the CRS of the project will be set to the CRS of the first layer loaded into it
- *Use a default CRS*: a preselected CRS is applied by default to any new project and is left unchanged when adding layers to the project.

The choice will be saved for use in subsequent QGIS sessions. The Coordinate Reference System of the project can still be overridden from the *Project* ► *Properties...* ► *CRS* tab.

CRS for layers

Default CRS for layers: select a default CRS to use when you create a layer

You can also define the action to take when a new layer is created, or when a layer without a CRS is loaded.

- *Leave as unknown CRS (take no action)*
- *Prompt for CRS*
- *Usar SRC do projeto*
- *Use a default CRS*

Planimetric measurements: sets the default for the "planimetric measurements" property for newly created projects.

9.1.4 Transformations Settings

The *Transformations* tab helps you set coordinate transformations and operations to apply when loading a layer to a project or reprojecting a layer.

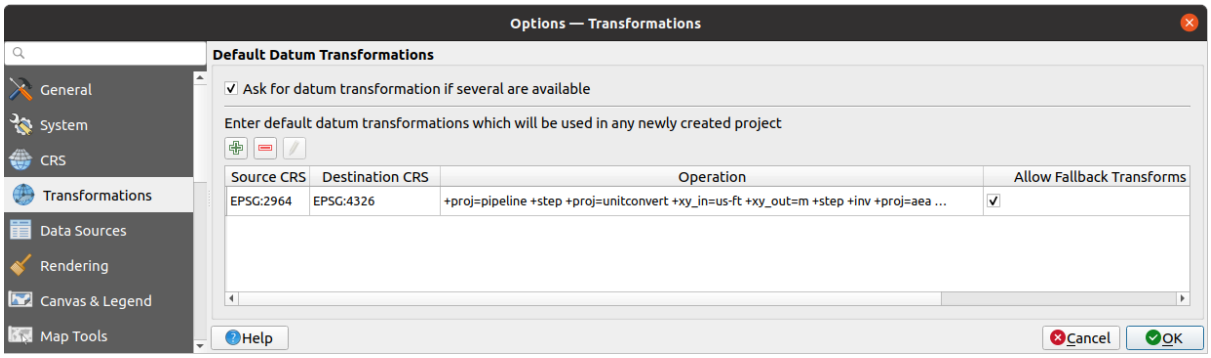


Figura9.3: Transformations Settings

Transformação de datum padrão

In this group, you can control whether reprojecting layers to another CRS should be:

- automatically processed using QGIS default transformations settings;
- and/or more controlled by you with custom preferences such as:
  - *Ask for datum transformation if several are available*
  - a predefined list of datum transformations to apply by default. See *Datum Transformations* for more details.

9.1.5 Data Sources Settings

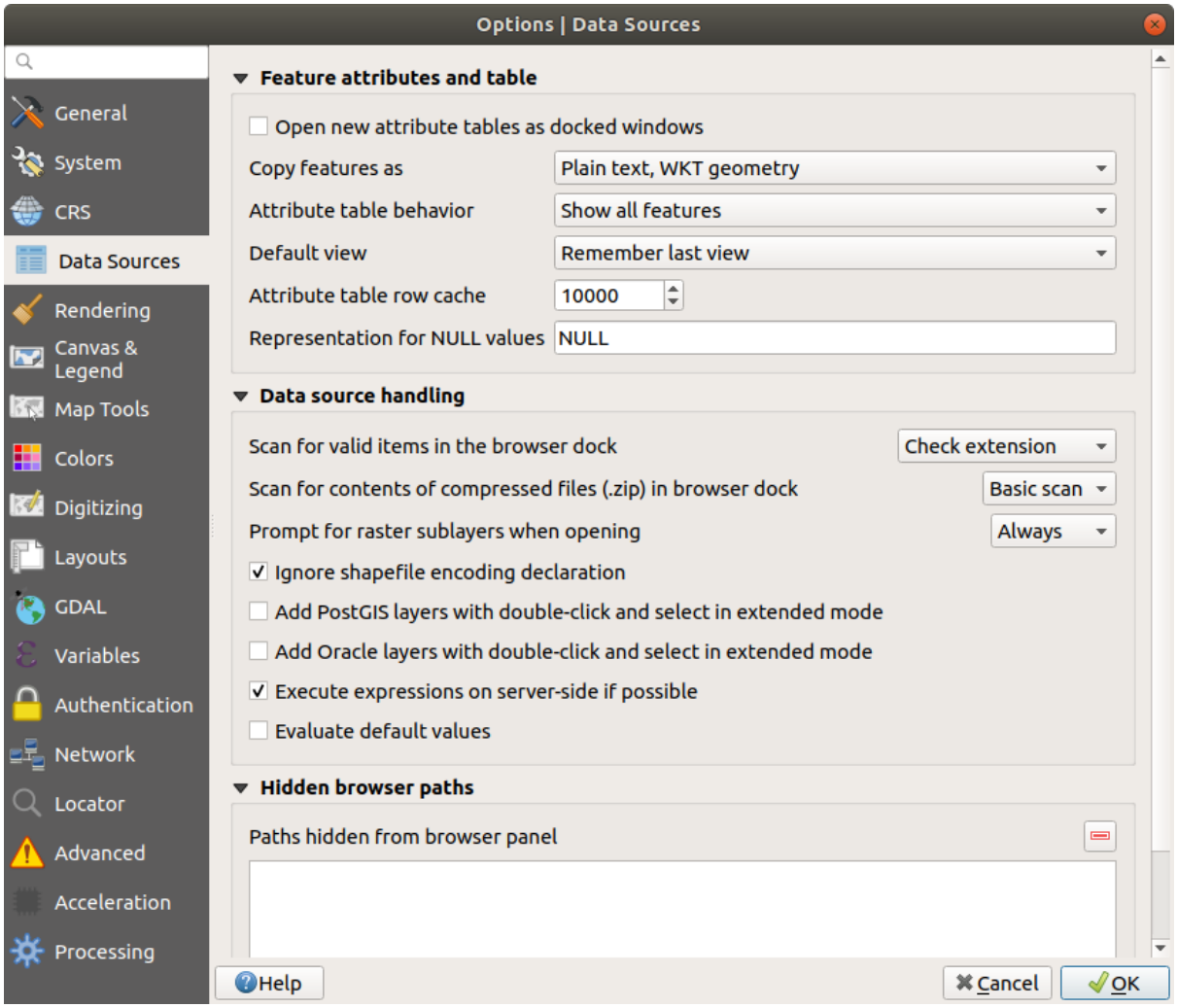


Figura9.4: Data Sources Settings in QGIS

Atributos dos elementos e tabela

- *Open new attribute tables as docked windows*
- *Copy features as* 'Plain text, no geometry', 'Plain text, WKT geometry', or 'GeoJSON' when pasting features in other applications.
- *Attribute table behavior* : set filter on the attribute table at the opening. There are three possibilities: 'Show all features', 'Show selected features' and 'Show features visible on map'.
- *Default view*: define the view mode of the attribute table at every opening. It can be 'Remember last view', 'Table view' or 'Form view'.
- *Attribute table row cache* 1,00 . This row cache makes it possible to save the last loaded N attribute rows so that working with the attribute table will be quicker. The cache will be deleted when closing the attribute table.
- *Representação para valores NULL*. Aqui, pode definir um valor para os campos de dados que contêm valores NULL.

Dica: Improve opening of big data attribute table

When working with layers with big amount of records, opening the attribute table may be slow as the dialog request all the rows in the layer. Setting the *Attribute table behavior* to **Show features visible on map** will make QGIS request only the features in the current map canvas when opening the table, allowing a quick data loading.

Note that data in this attribute table instance will be always tied to the canvas extent it was opened with, meaning that selecting **Show All Features** within such a table will not display new features. You can however update the set of displayed features by changing the canvas extent and selecting **Show Features Visible On Map** option in the attribute table.

Manipulação das fontes de dados

- *Scan for valid items in the browser dock* . You can choose between 'Check extension' and 'Check file contents'.
- *Scan for contents of compressed files (.zip) in browser dock*  defines how detailed is the widget information at the bottom of the Browser panel when querying such files. 'No', 'Basic scan' and 'Full scan' are possible options.
- *Solicitar subcamadas raster ao abrir*. Alguns rasters suportam subcamadas — elas são chamadas de subdatasets no GDAL. Um exemplo são os arquivos netCDF — se há muitas variáveis netCDF, GDAL verá cada variável como um subdataset. A opção permite que você controle como lidar com subcamadas quando um arquivo é aberto com subcamadas. Você tem as seguintes opções:
  - 'Sempre': Perguntar sempre (se existem subcamadas)
  - 'Se necessário': Perguntar se a camada não tem bandas, mas tem subcamadas
  - 'Nunca': Nunca pede, não irá carregar nada
  - 'Carregar tudo': Nunca pede, mas carrega todas as subcamadas
-  *Ignore shapefile encoding declaration*. If a shapefile has encoding information, this will be ignored by QGIS.
-  *Execute expressions on server-side if possible*: When requesting features from a datasource, QGIS will try to optimize requests by sending filter criteria directly to the server and only download the features which match the criteria. For example, if for a list on the user interface only the farmers which live in Bern should be listed, QGIS will send a `WHERE "hometown" = 'Bern'` to the database. In some cases, filter criteria are too complex to be translated from QGIS Expressions to database compatible SQL. In those cases, QGIS will download the whole data and filter locally to be on the safe side, which is much less performant.

  By disabling this option, QGIS can be forced to always download the whole data and filter locally, at the expense of a performance penalty. This option is meant as a safety break and should only be deactivated if you identify a misbehavior of the QGIS expression translation engine.

Hidden Browser Path

This widget lists all the folders you chose to hide from the *Browser panel*. Removing a folder from the list will make it available in the *Browser* panel.

Localized paths

It is possible to use localized paths for any kind of file based data source. They are a list of paths which are used to abstract the data source location. For instance, if `C:\my_maps` is listed in the localized paths, a layer having `C:\my_maps\my_country\ortho.tif` as data source will be saved in the project using `localized:my_country\ortho.tif`.

The paths are listed by order of preference, in other words QGIS will first look for the file in the first path, then in the second one, etc.

9.1.6 Rendering Settings

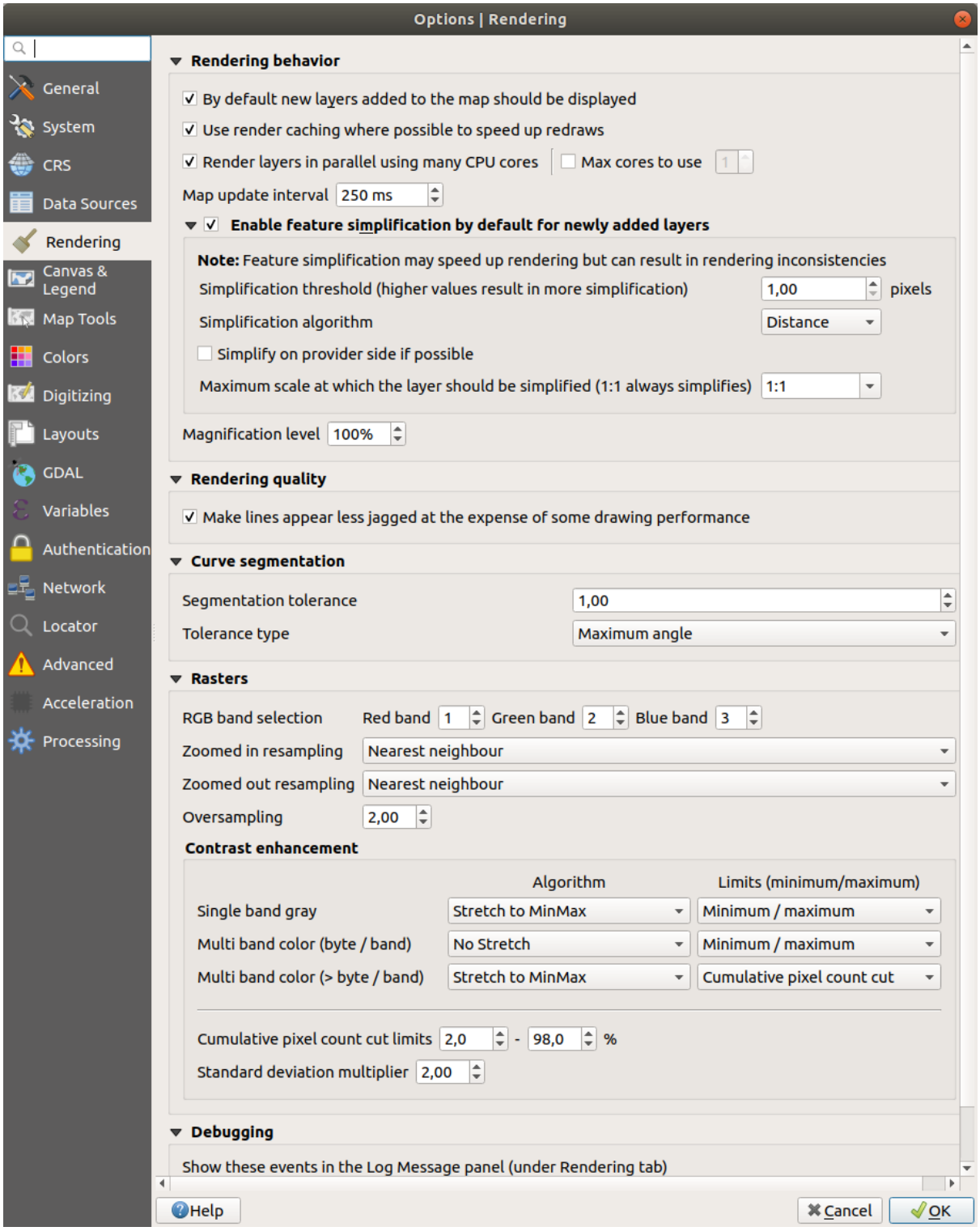


Figura9.5: Rendering tab of Project Properties dialog

Rendering behavior

- *By default new layers added to the map should be displayed*: unchecking this option can be handy when loading multiple layers to avoid each new layer being rendered in the canvas and slow down the process

- *Use tornar cache sempre que possível para acelerar redesenhos*
- *Representação de camadas em paralelo utilizando muitos núcleos CPU*
- *Máximo de núcleos para utilizar*
- *Intervalo de atualização do mapa (por padrão 250 ms)*
- *Enable feature simplification by default for newly added layers*
- *Simplificação de limiar*
- *Simplification algorithm*: This option performs a local "on-the-fly" simplification on feature's and speeds up geometry rendering. It doesn't change the geometry fetched from the data providers. This is important when you have expressions that use the feature geometry (e.g. calculation of area) - it ensures that these calculations are done on the original geometry, not on the simplified one. For this purpose, QGIS provides three algorithms: 'Distance' (default), 'SnapToGrid' and 'Visvalingam'.
- *Simplify on provider side if possible*: the geometries are simplified by the provider (PostGIS, Oracle…) and unlike the local-side simplification, geometry-based calculations may be affected
- *Escala máxima a que a camada deve simplificar*
- *Magnification level* (see the *magnifier*)

Nota: Besides the global setting, feature simplification can be set for any specific layer from its *Layer properties* ► *Rendering* menu.

Qualidade de renderização

- *Faz com que as linhas apareçam menos irregulares, em detrimento de algum desempenho do desenho*

Curve segmentation

- *Segmentation tolerance*: this setting controls the way circular arcs are rendered. **The smaller** maximum angle (between the two consecutive vertices and the curve center, in degrees) or maximum difference (distance between the segment of the two vertices and the curve line, in map units), the **more straight line** segments will be used during rendering.
- *Tolerance type*: it can be *Maximum angle* or *Maximum difference* between approximation and curve.

Matriciais

- Com a *Seleção de banda RGB* pode definir o número para a banda Vermelha, Verde e Azul.
- The *Zoomed in resampling* and the *Zoomed out resampling* methods can be defined. For *Zoomed in resampling* you can choose between three resampling methods: 'Nearest Neighbour', 'Bilinear' and 'Cubic'. For *Zoomed out resampling* you can choose between 'Nearest Neighbour' and 'Average'. You can also set the *Oversampling* value (between 0.0 and 99.99 - a large value means more work for QGIS - the default value is 2.0).

Melhora de contraste

As opções de melhoria de contraste podem ser aplicadas a *Única faixa cinza*, *Banda Multicores (byte/banda)* ou *Banda Multicores (>byte/band)*. Para cada um, você pode definir:

- the *Algorithm* to use, whose values can be 'No stretch', 'Stretch to MinMax', 'Stretch and Clip to MinMax' or 'Clip to MinMax'
- the *Limits (minimum/maximum)* to apply, with values such as 'Cumulative pixel count cut', 'Minimum/Maximum', 'Mean +/- standard deviation'.

For rasters rendering, you can also define the following options:

- *Limites de contagem cumulativa de pixeis de corte*
- *Multiplicador do desvio-padrão*

Corrigindo Erros

- *Map canvas refresh* to debug rendering duration in the *Log Messages* panel.

9.1.7 Canvas and Legend Settings

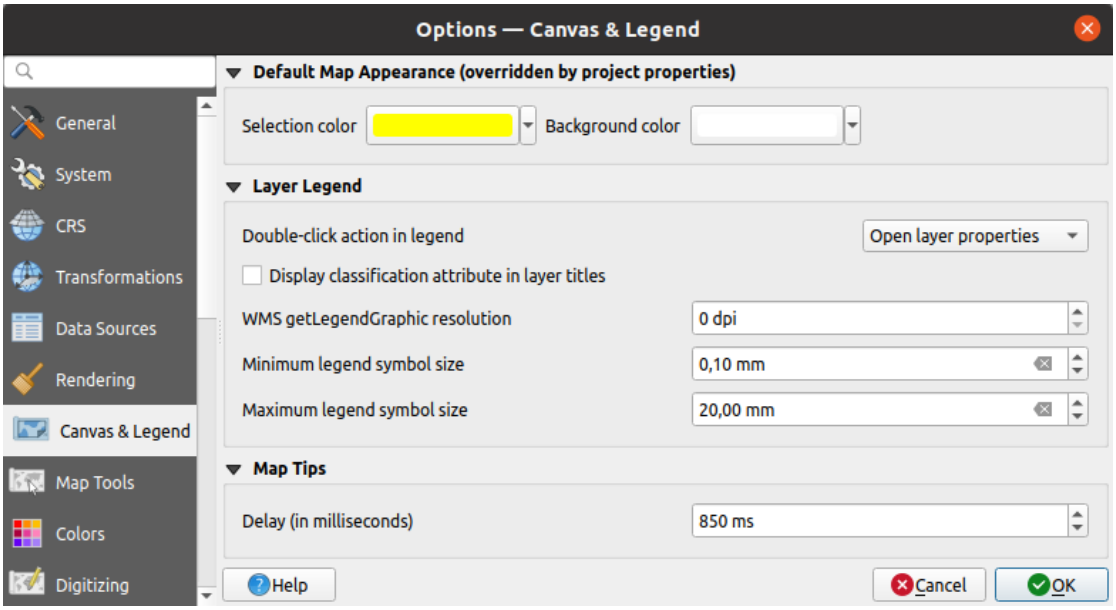


Figura9.6: Canvas and Legend Settings

These properties let you set:

- the **Default map appearance (overridden by project properties)**: the *Selection color* and *Background color*.
- **Layer legend** interaction:
  - *Double click action in legend* . You can either 'Open layer properties', 'Open attribute table' or 'Open layer styling dock' with the double click.
  - *Display classification attribute names* in the Layers panel, e.g. when applying a categorized or rule-based renderer (see *Propriedades da simbologia* for more information).
  - the *WMS getLegendGraphic Resolution*
  - *Minimum* and *Maximum legend symbol size* to control symbol size display in the *Layers* panel
- the *Delay* in milliseconds of layers *map tips* display

9.1.8 Map tools Settings

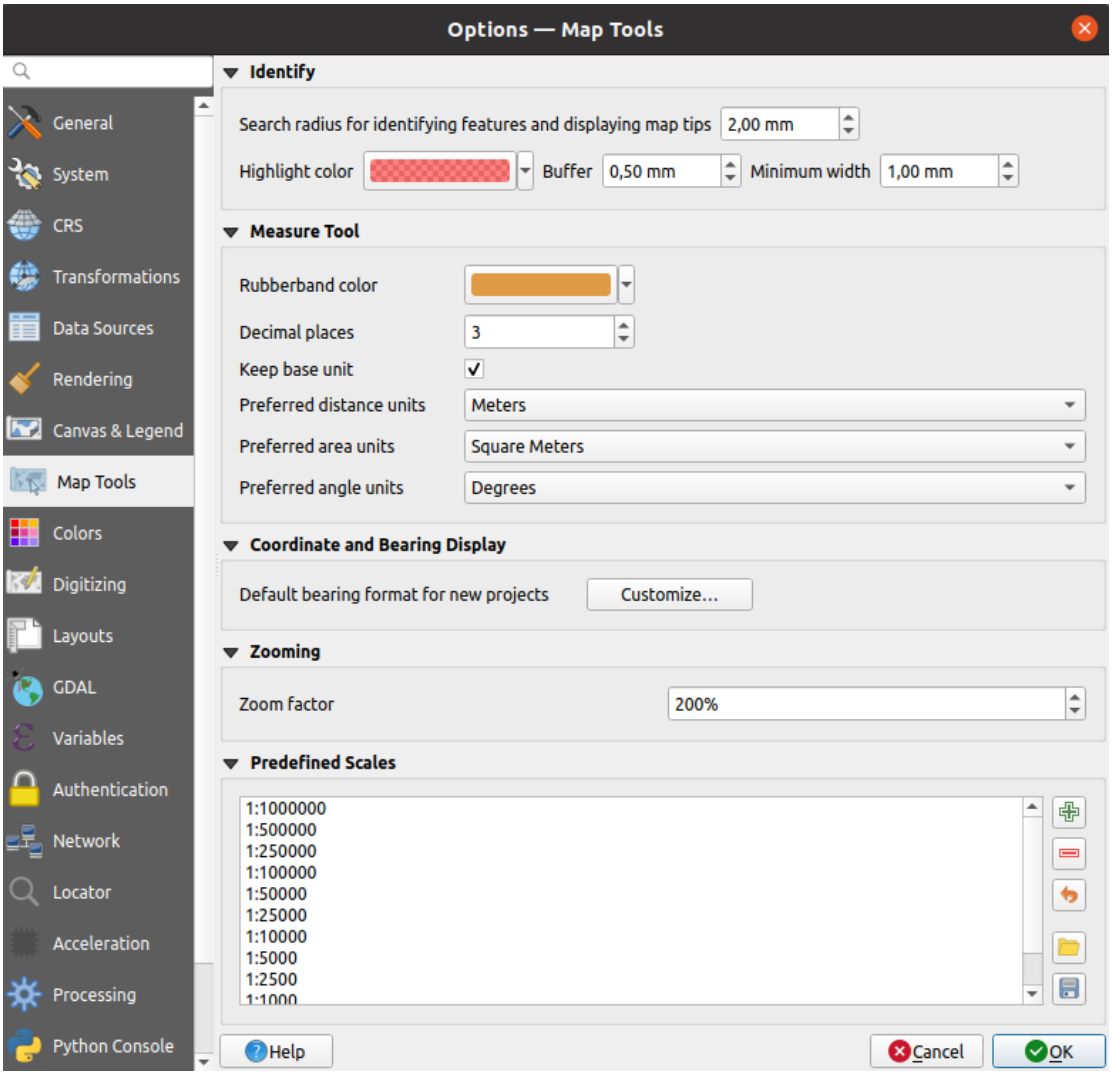


Figura9.7: Map tools Settings in QGIS

This tab offers some options regarding the behavior of the *Identify tool*.

- *Search radius for identifying features and displaying map tips* is a tolerance distance within which the identify tool will depict results as long as you click within this tolerance.
- *Highlight color* allows you to choose with which color features being identified should be highlighted.
- *Buffer* determines a buffer distance to be rendered from the outline of the identify highlight.
- *Minimum width* determines how thick should the outline of a highlighted object be.

Ferramenta de medida

- Define *Cor do elástico* para as ferramentas de medida
- Define *Casas decimais*
- *Keep base unit* to not automatically convert large numbers (e.g., meters to kilometers)
- *Preferred distance units*: options are 'Meters', 'Kilometers', 'Feet', 'Yards', 'Miles', 'Nautical Miles', 'Centimeters', 'Millimeters', 'Degrees' or 'Map Units'

- *Preferred area units*: options are 'Square meters', 'Square kilometers', 'Square feet', 'Square yards', 'Square miles', 'Hectares', 'Acres', 'Square nautical miles', 'Square centimeters', 'Square millimeters', 'Square degrees' or 'Map Units'
- *Preferred angle units*: options are 'Degrees', 'Radians', 'Gon/gradians', 'Minutes of arc', 'Seconds of arc', 'Turns/revolutions', milliradians (SI definition) or mil (NATO/military definition)

Coordinate and Bearing Display

- Define *Default bearing format for new projects*: used to display the mouse coordinate in the status bar when panning the map canvas. It can be overridden in the project properties dialog.

Movendo e ampliando

- Define a *Zoom factor* for zoom tools or wheel mouse

Escalas pré-definidas

Here, you find a list of predefined scales. With the and buttons you can add or remove your personal scales. You can also import or export scales from/to a `.XML` file. Note that you still have the possibility to remove your changes and reset to the predefined list.

9.1.9 Colors Settings

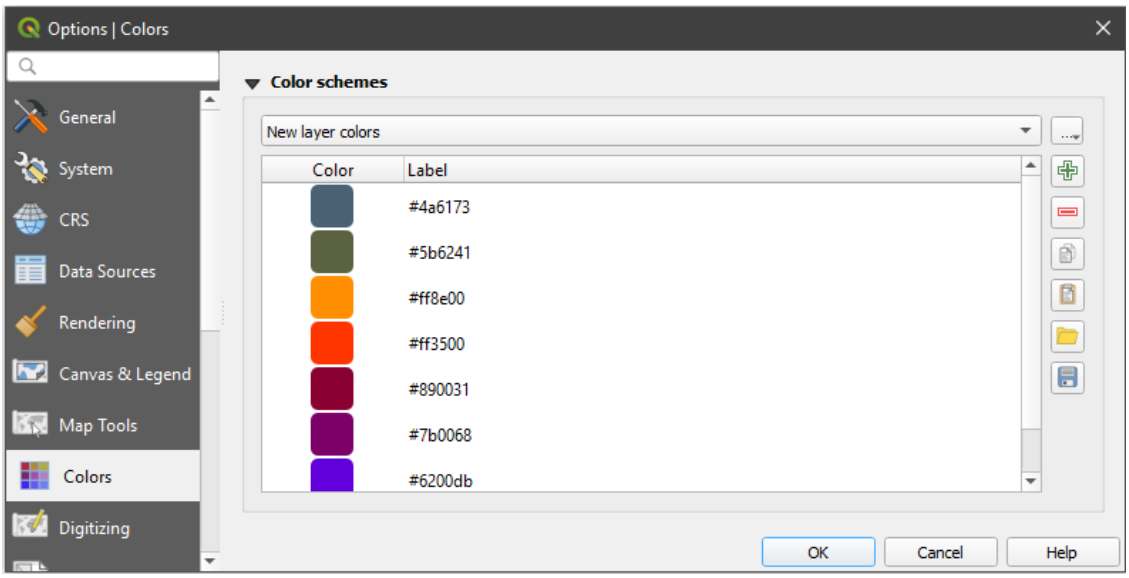


Figura9.8: Colors Settings

This menu allows you to create or update palettes of colors used throughout the application in the *color selector widget*. You can choose from:

- *Recent colors* showing recently used colors
- *Standard colors*, the default palette of colors
- *Project colors*, a set of colors specific to the current project (see *Propriedades de Estilos Padrão* for more details)
- *New layer colors*, a set of colors to use by default when new layers are added to QGIS
- or custom palette(s) you can create or import using the … button next to the palette combobox.

By default, *Recent colors*, *Standard colors* and *Project colors* palettes can not be removed and are set to appear in the color button drop-down. Custom palettes can also be added to this widget thanks to the *Show in Color Buttons* option.

For any of the palettes, you can manage the list of colors using the set of tools next to the frame, ie:

- *Add* or *Remove* color
- *Copy* or *Paste* color
- *Import* or *Export* the set of colors from/to `.gpl` file.

Double-click a color in the list to tweak or replace it in the *Color Selector* dialog. You can also rename it by double-clicking in the *Label* column.

9.1.10 Digitizing Settings

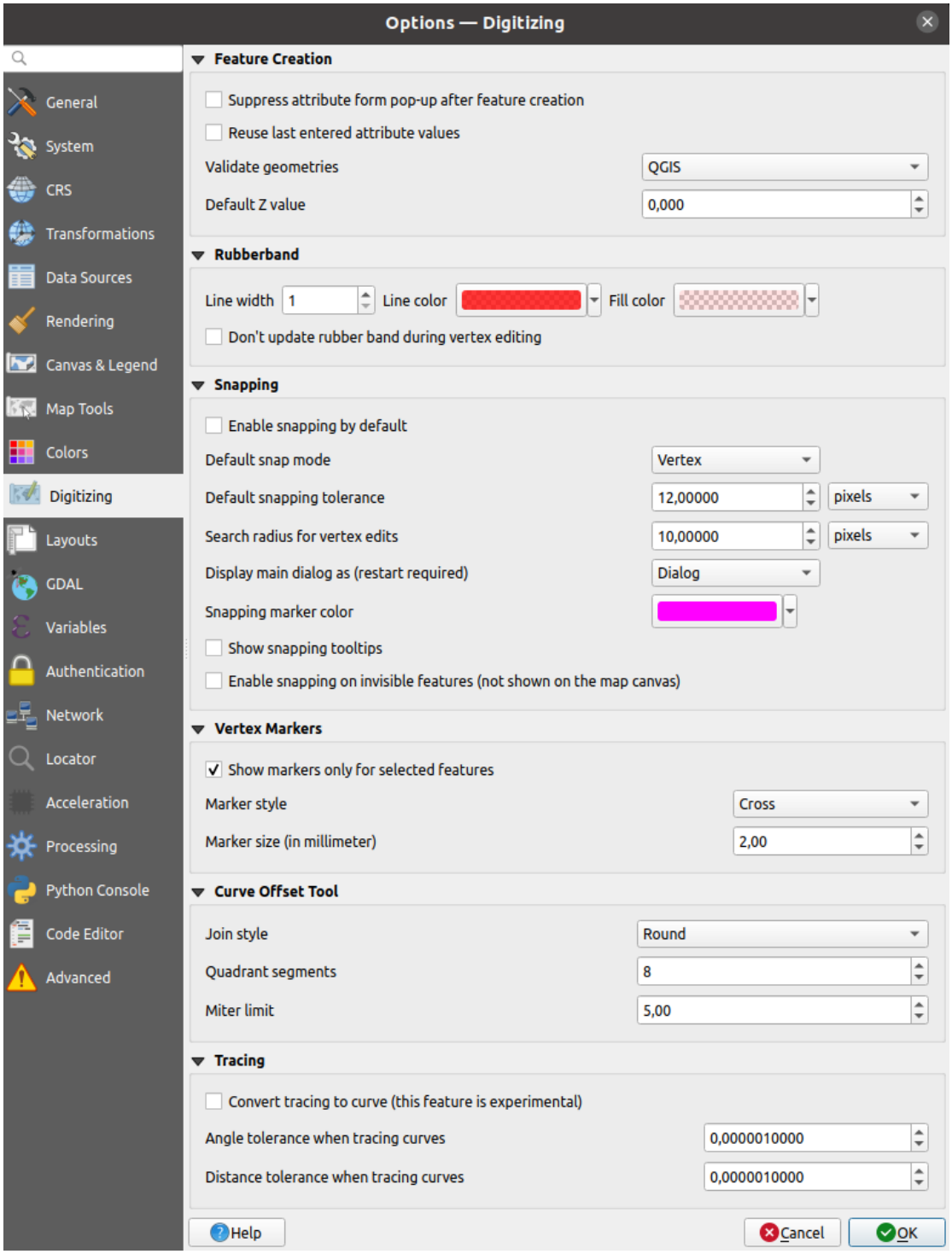


Figura9.9: Digitizing Settings in QGIS

This tab helps you configure general settings when *editing vector layer* (attributes and geometry).

Criação de elementos

- *Suppress attribute form pop-up after feature creation*: this choice can be overridden in each layer properties dialog.

- *Reuse last entered attribute values*: remember the last used value of every attribute and use it as default for the next feature being digitized. Works per layer.
- *Validate geometries*. Editing complex lines and polygons with many nodes can result in very slow rendering. This is because the default validation procedures in QGIS can take a lot of time. To speed up rendering, it is possible to select GEOS geometry validation (starting from GEOS 3.3) or to switch it off. GEOS geometry validation is much faster, but the disadvantage is that only the first geometry problem will be reported.

  Note that depending on the selection, reports of geometry errors may differ (see *Types of error messages and their meanings*)
- *Default Z value* to use when creating new 3D features.

Elástico

- Define Rubberband *Line width*, *Line color* and *Fill color*.
- *Don't update rubberband during vertex editing*.

Ajuste

- *Enable snapping by default* activates snapping when a project is opened
- Define *Default snap mode* (‘Vertex’, ‘Vertex and segment’, ‘Segment’)
- Define *Tolerância de atração pré-definida* em unidades de mapa ou pixeis
- Define o *Raio de pesquisa para editar vértices* em unidades de mapa ou pixeis
- *Display main dialog as (restart required)*: set whether the Advanced Snapping dialog should be shown as ‘Dialog’ or ‘Dock’.
- *Snapping marker color*
- *Show snapping tooltips* such as name of the layer whose feature you are about to snap. Helpful when multiple features overlap.
- *Enable snapping on invisible features (not shown on the map canvas)*

Marcadores de Vértices

- *Mostrar marcadores apenas para elementos selecionados*
- Define vertex *Marker style* (‘Cross’ (default), ‘Semi transparent circle’ or ‘None’)
- Define vertex *Marker size (in millimeter)*

Ferramenta de curva de afastamento

The next 3 options refer to the Offset Curve tool in *Digitalização Avançada*. Through the various settings, it is possible to influence the shape of the line offset. These options are possible starting from GEOS 3.3.

- *Join style*: ‘Round’, ‘Mitre’ or ‘Bevel’
- *Quadrante do Segmento*
- *Limite quadrante*

Tracing

By activating the *Convert tracing to curve* you can create curve segments while digitizing. Keep in mind that your data provider must support this feature.

9.1.11 Layouts Settings

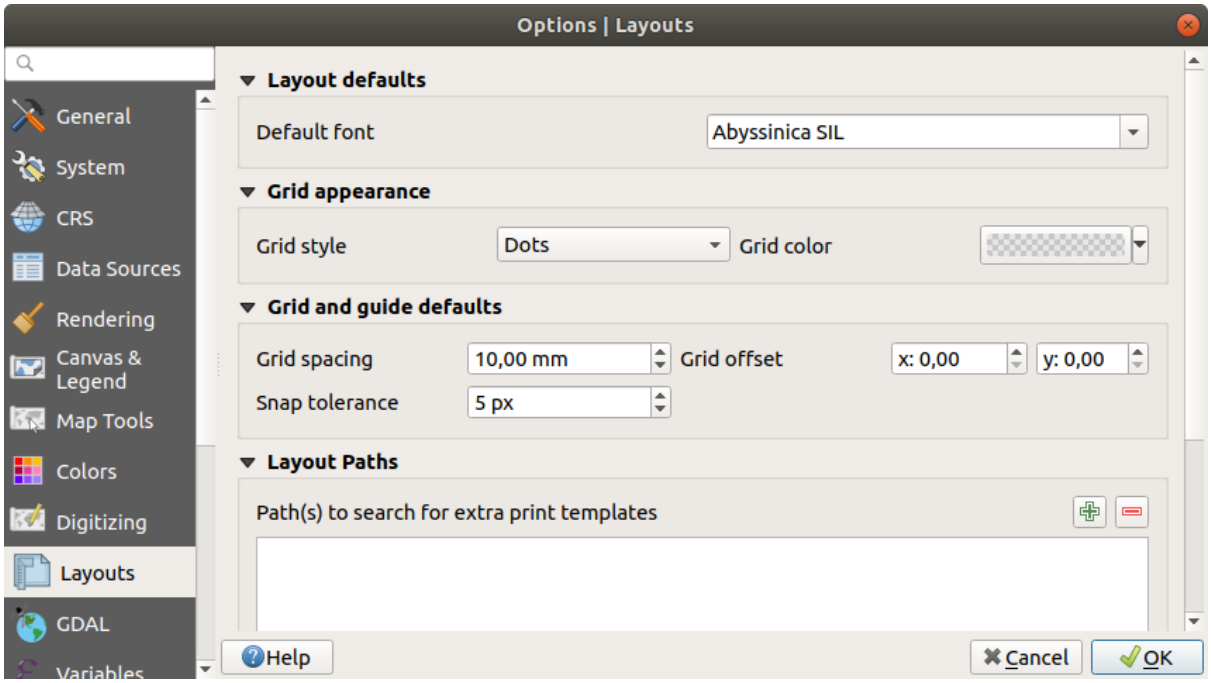


Figura9.10: Layouts Settings in QGIS

Composição padrão

You can define the *Default font* used within the *print layout*.

Aparência do Gride

- Define the *Grid style* (‘Solid’, ‘Dots’, ‘Crosses’)
- Define a *Cor da grade*

Configurações de guia e grade

- Define the *Grid spacing*
- Define the *Grid offset* for X and Y
- Define the *Snap tolerance*

Layout Paths

- Define *Path(s) to search for extra print templates*: a list of folders with custom layout templates to use while creating new one.

9.1.12 GDAL Settings

GDAL is a data exchange library for geospatial data that supports a large number of vector and raster formats. It provides drivers to read and (often) write data in these formats. The *GDAL* tab exposes the drivers for raster and vector formats with their capabilities.

Raster driver options

This frame provides ways to customize the behavior of raster drivers that support read and write access:

- *Edit create options*: allows you to edit or add different profiles of file transformation, i.e. a set of predefined combinations of parameters (type and level of compression, blocks size, overview, colorimetry, alpha…) to use when outputting raster files. The parameters depend on the driver.

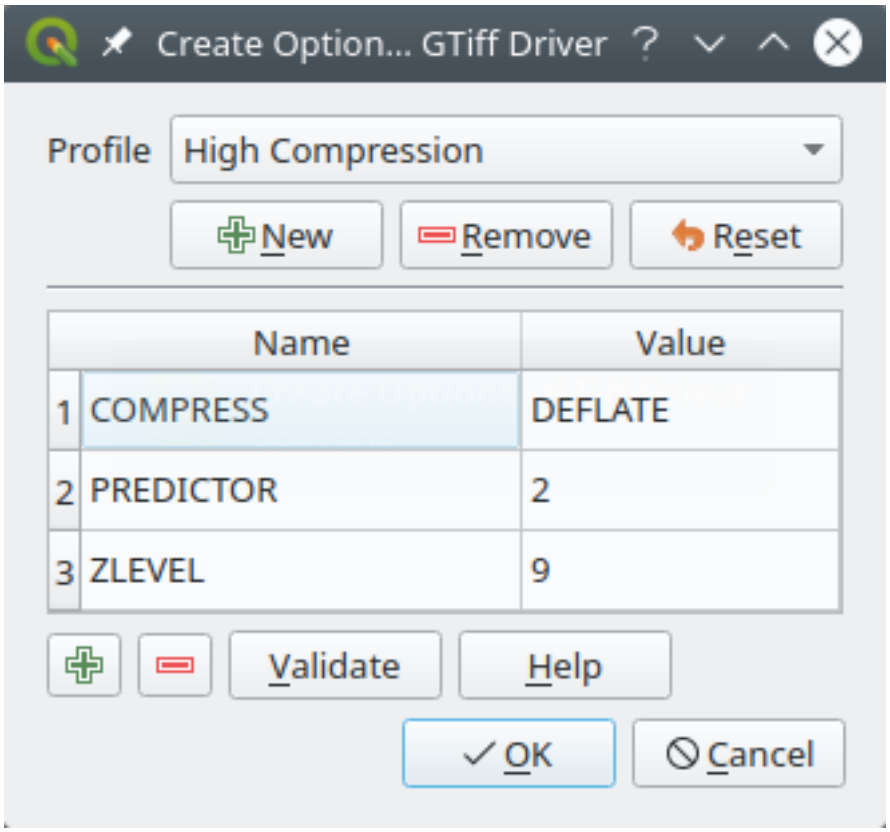


Figura9.11: Sample of create options profile (for GeoTiff)

The upper part of the dialog lists the current profile(s) and allows you to add new ones or remove any of them. You can also reset the profile to its default parameters if you have changed them. Some drivers (eg, GeoTiff) have some sample of profiles you can work with.

At the bottom of the dialog:

  - The button lets you add rows to fill with the parameter name and value
  - The button deletes the selected parameter
  - Click the *Validate* button to check that the creation options entered for the given format are valid
  - Use the *Help* button to find the parameters to use, or refer to the GDAL raster drivers documentation.

- *Edit Pyramids Options*

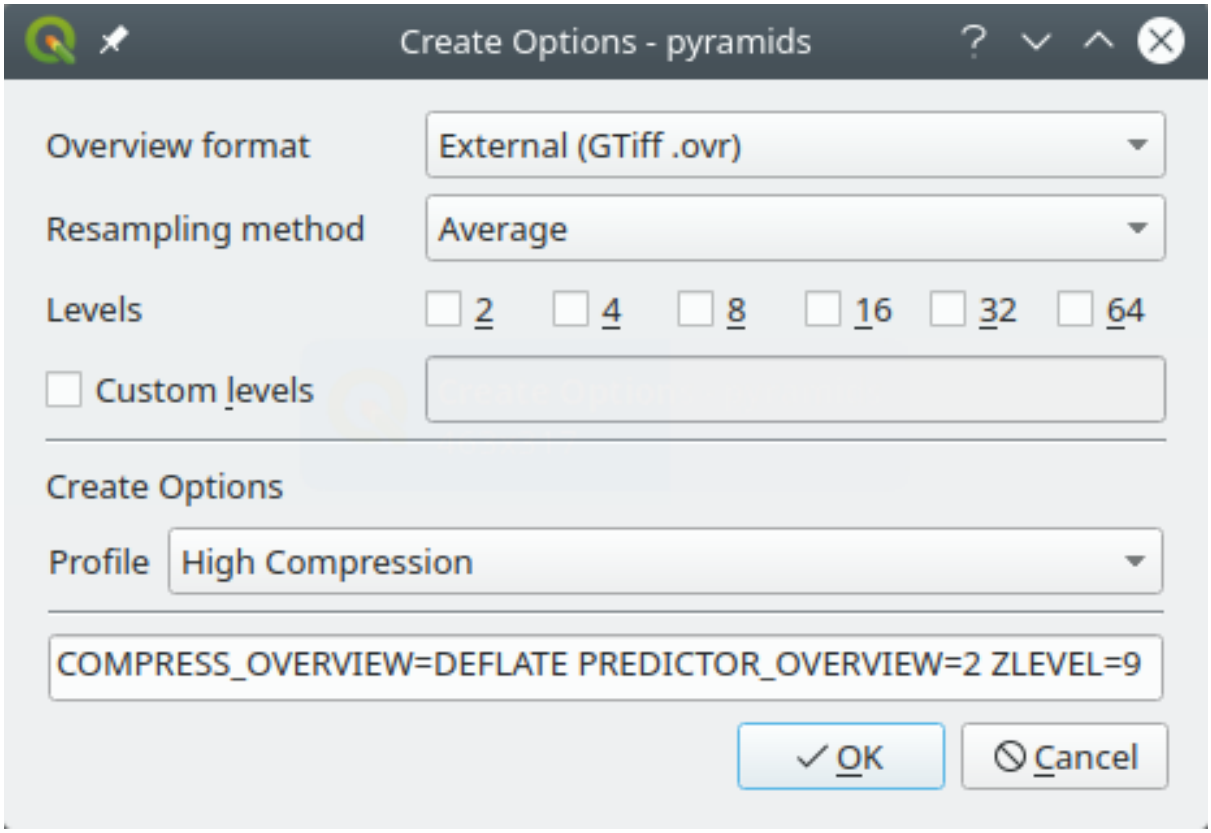


Figura9.12: Sample of Pyramids profile

GDAL raster and vector drivers

The *Raster Drivers* and *Vector Drivers* (in a separated tab) allow you to define which GDAL driver is enabled to read and/or write files, as in some cases more than one GDAL driver is available.

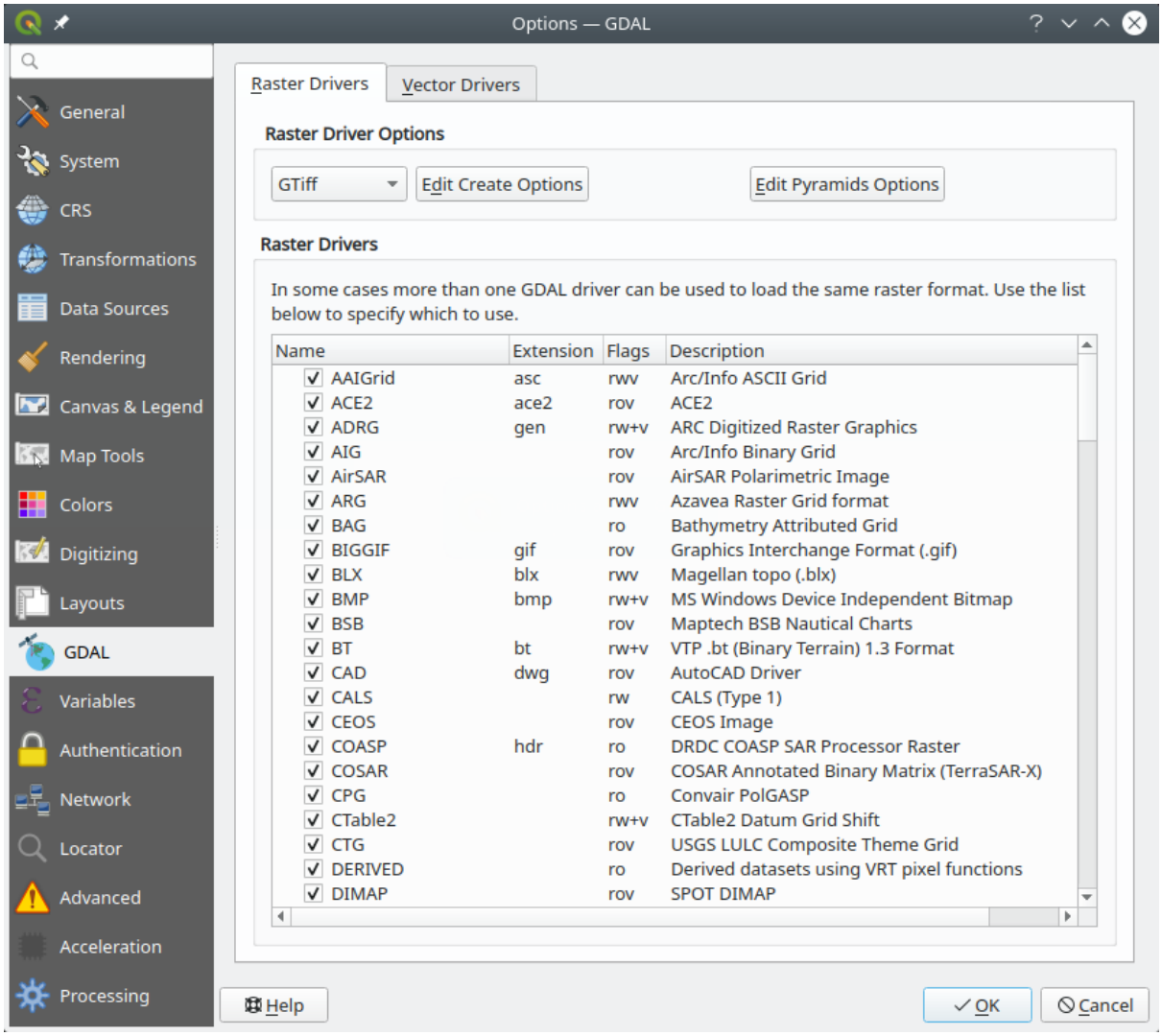


Figura9.13: GDAL Settings in QGIS - Raster drivers

Dica: Double-click a raster driver that allows read and write access (`rw+(v)`) opens the *Edit Create options* dialog for customization.

9.1.13 Variables Settings

The *Variables* tab lists all the variables available at the global-level.

It also allows the user to manage global-level variables. Click the button to add a new custom global-level variable. Likewise, select a custom global-level variable from the list and click the button to remove it.

More information about variables in the *Armazenar valores em Variáveis* section.

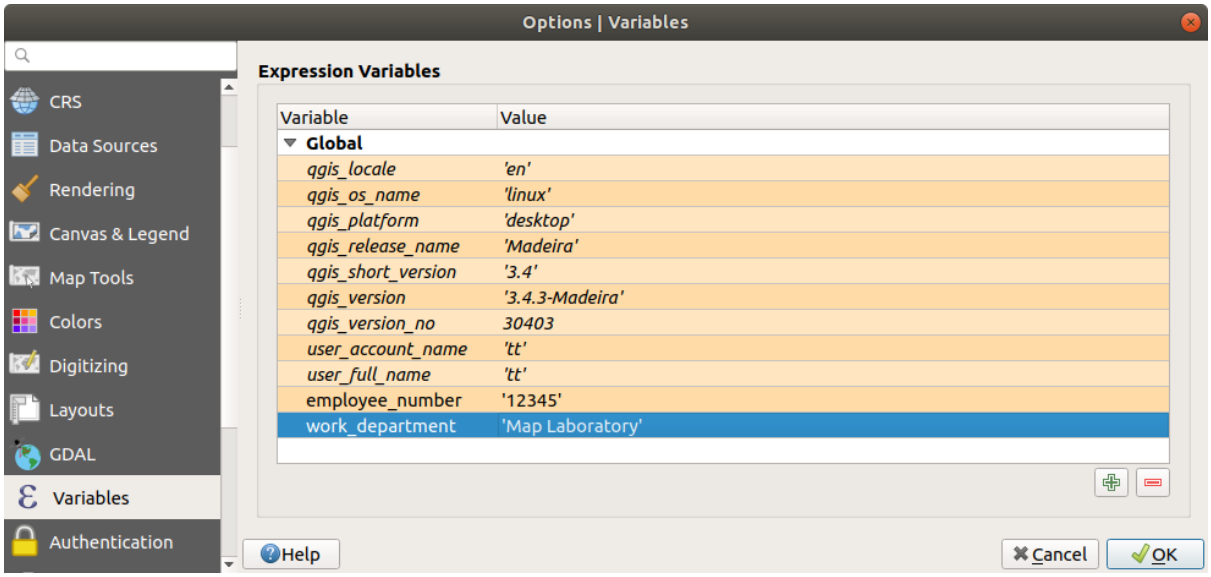


Figura9.14: Variables Settings in QGIS

9.1.14 Authentication Settings

In the *Authentication* tab you can set authentication configurations and manage PKI certificates. See *Sistema de Autenticação* for more details.

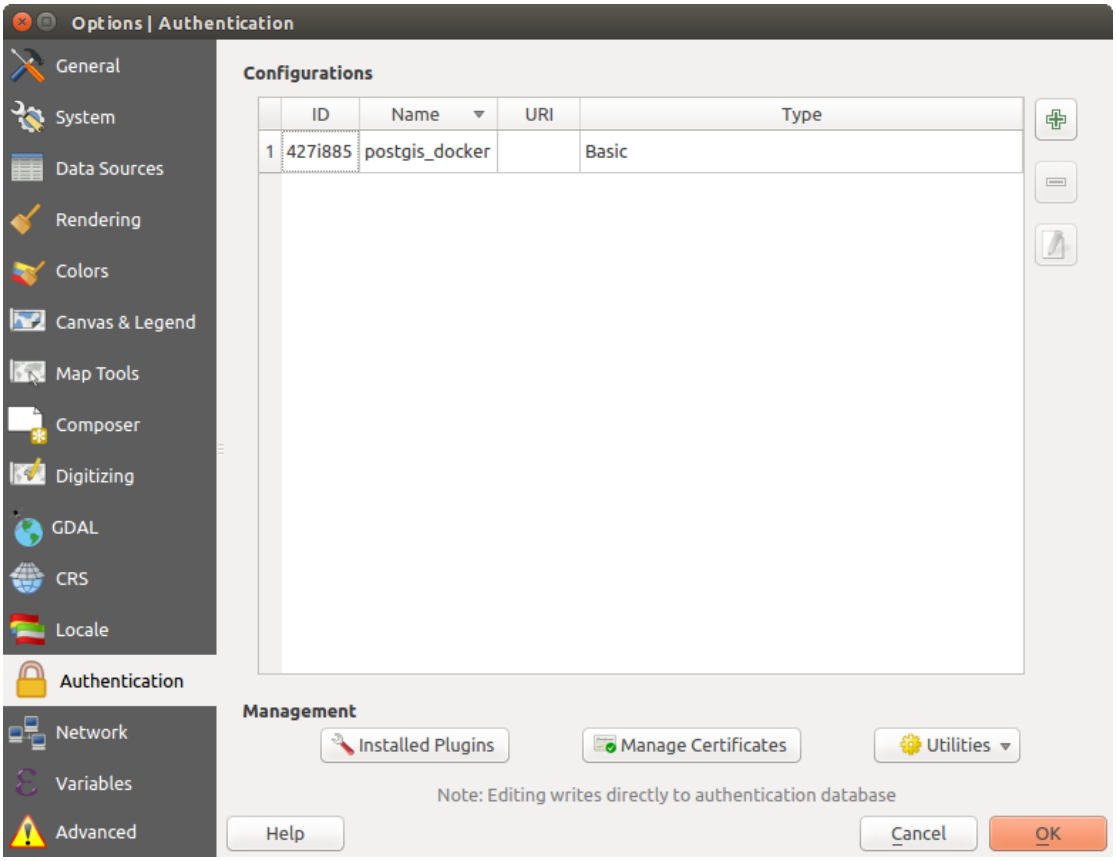


Figura9.15: Authentication Settings in QGIS

9.1.15 Network Settings

Geral

- Define *Tempo esgotado para pedidos de rede (ms)* - o padrão é 60000
- Define *Default expiration period for WMS Capabilities (hours)* - default is 24
- Define *Default expiration period for WMS-C/WMTS tiles (hours)* - default is 24
- Define *Max retry in case of tile or feature request errors*
- Define *Usuário-Agente*

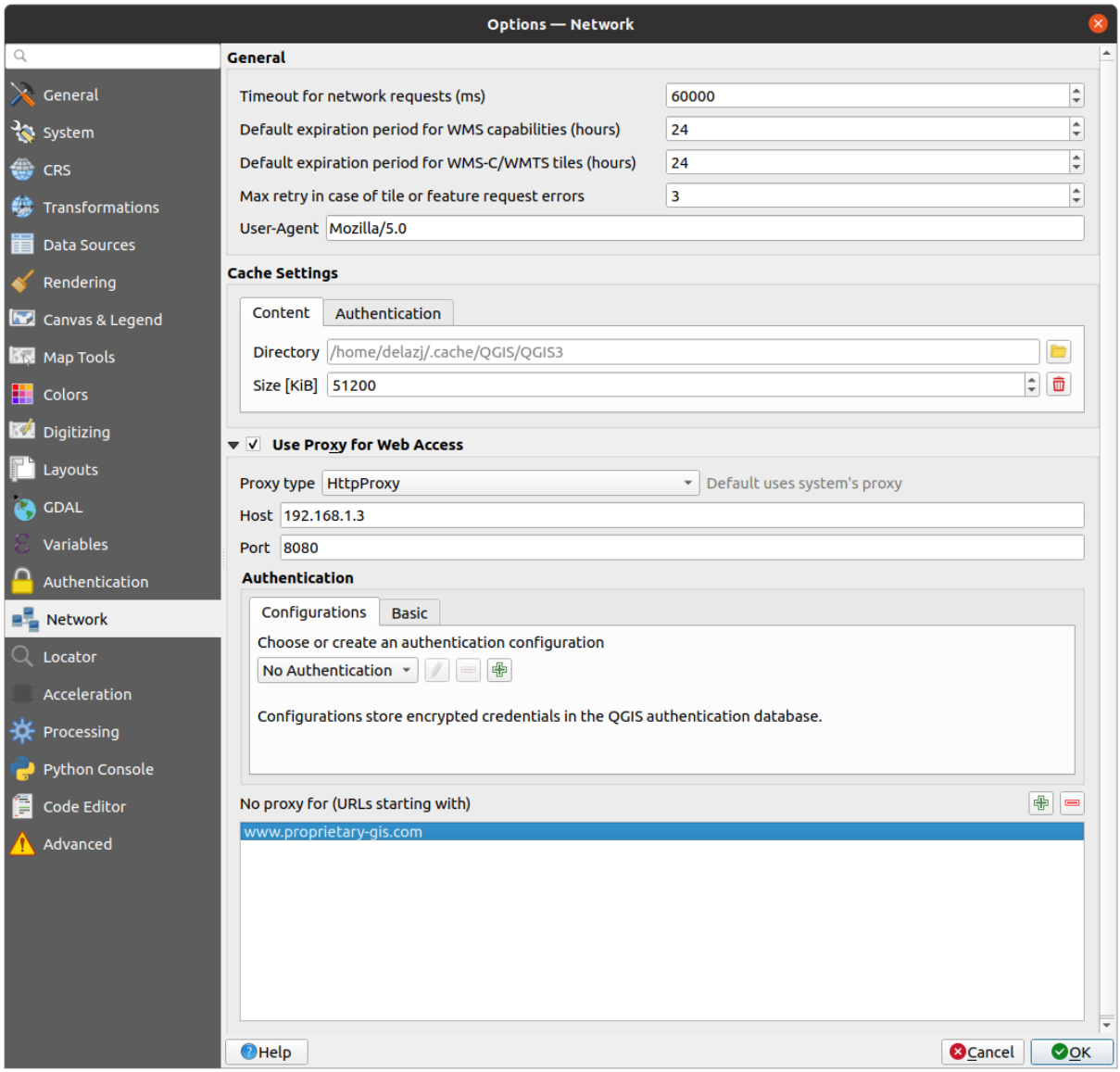


Figura9.16: Proxy-settings in QGIS

Configurações de cache

Defines the *Directory* and a *Size* for the cache. Also offers tools to *automatically clear the connection authentication cache on SSL errors (recommended)*.

Proxy for web access

- *Use proxy for web access*

- Set the *Proxy type*  according to your needs and define 'Host' and 'Port'. Available proxy types are:
  - *Default Proxy*: Proxy is determined based on system's proxy
  - *Socks5Proxy*: Proxy genérico para qualquer tipo de ligação. Suporta TCP, UDP, unindo a uma porta (ligações de entrada) e autenticação.
  - *HttpProxy*: Implementado usando o comando "LIGAR" , apenas suporta ligações TCP de saída; suporta autenticação.
  - *HttpCachingProxy*: Implementado usando comandos HTTP normais, é útil apenas em pedidos no contexto do HTTP.
  - *FtpCachingProxy*: Implementado usando um proxy FTP, é útil no contexto de pedidos FTP.

Credentials of proxy are set using the *authentication widget*.

Excluding some URLs can be added to the text box below the proxy settings (see Fig.9.16). No proxy will be used if the target url starts with one of the string listed in this text box.

If you need more detailed information about the different proxy settings, please refer to the manual of the underlying QT library documentation at https://doc.qt.io/qt-5.9/qnetworkproxy.html#ProxyType-enum

---

Dica: Usando Proxies

Using proxies can sometimes be tricky. It is useful to proceed by 'trial and error' with the above proxy types, to check if they succeed in your case.

9.1.16 Locator Settings

The *Locator* tab lets you configure the *Locator bar*, a quick search widget available on the status bar to help you perform searches in the application. It provides some default filters (with prefix) to use:

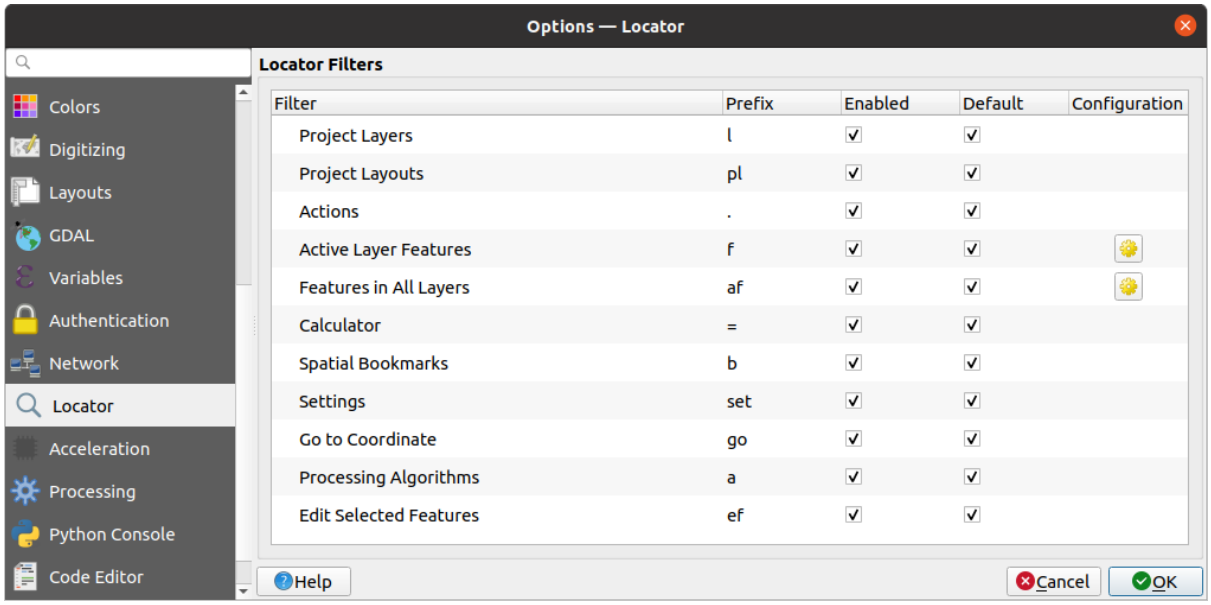


Figura9.17: Locator Settings in QGIS

- Project layers (`l`): finds and selects a layer in the *Layers* panel.
- Project layouts (`pl`): finds and opens a print layout.
- Actions (`.`): finds and executes a QGIS action; actions can be any tool or menu in QGIS, opening a panel…

- Active layer features (`f`): searches for matching attributes in any field from the current active layer and zooms to the selected feature. Press  to configure the maximum number of results.
- Features in all layers (`af`): searches for matching attributes in the *display name* of each *searchable layers* and zooms to the selected feature. Press  to configure the maximum number of results and the maximum number of results per layer.
- Calculator (`=`): allows evaluation of any QGIS expression and, if valid, gives an option to copy the result to the clipboard.
- Spatial bookmarks (`b`): finds and zooms to the bookmark extent.
- Settings (`set`): browses and opens project and application-wide properties dialogs.
- Go to coordinate (`go`): pans the map canvas to a location defined by a comma or space separated pair of x and y coordinates or a formatted URL (e.g., OpenStreetMap, Leaflet, OpenLayer, Google Maps, …). The coordinate is expected in WGS 84 (`epsg:4326`) and/or map canvas CRS.
- Processing algorithms (`a`): searches and opens a Processing algorithm dialog.
- Edit selected features (`ef`): gives quick access and runs a compatible *modify-in-place* Processing algorithm on the active layer.

In the dialog, you can:

- customize the filter *Prefix*, i.e. the keyword to use to trigger the filter
- set whether the filter is *Enabled*: the filter can be used in the searches and a shortcut is available in the locator bar menu
- set whether the filter is *Default*: a search not using a filter returns results from only the default filters categories.
- Some filters provide a way to configure the number of results in a search.

The set of default locator filters can be extended by plugins, eg for OSM nominatim searches, direct database searching, layer catalog searches, …

9.1.17 Advanced Settings

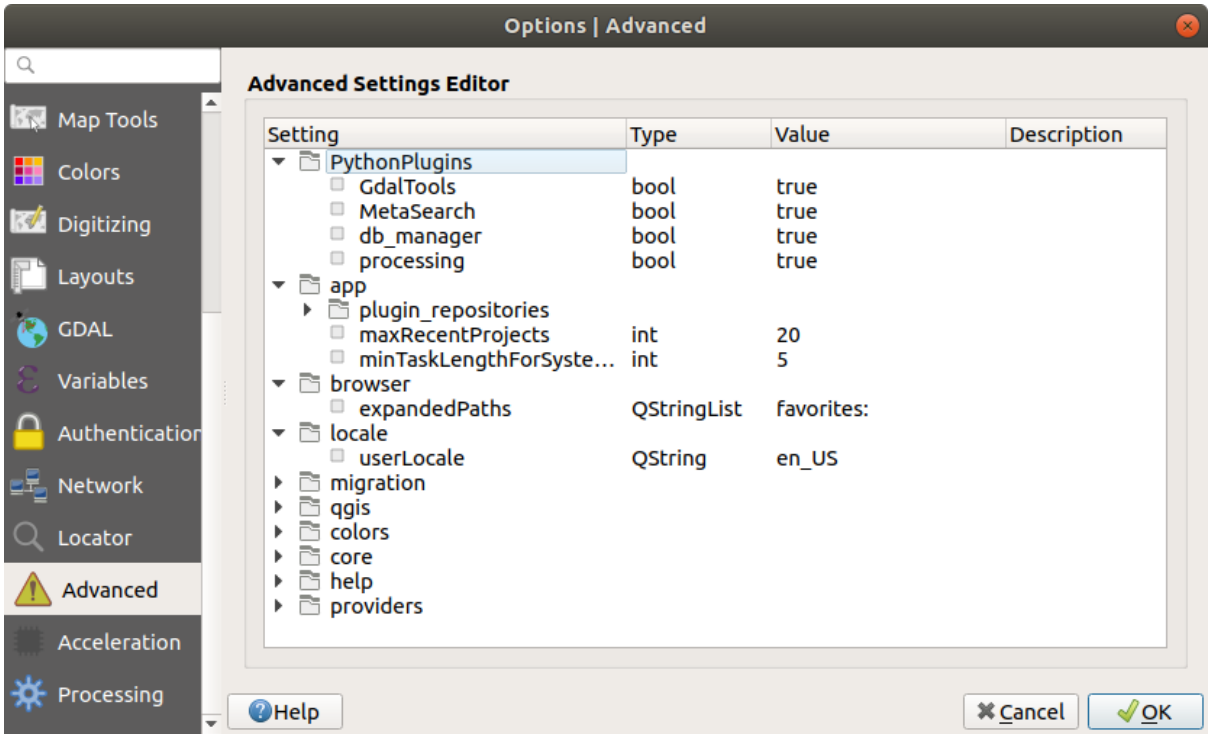


Figura9.18: Advanced Settings tab in QGIS

All the settings related to QGIS (UI, tools, data providers, Processing configurations, default values and paths, plugins options, expressions, geometry checks…) are saved in a `QGIS/QGIS3.ini` file under the active *user profile* directory. Configurations can be shared by copying this file to other installations.

From within QGIS, the *Advanced* tab offers a way to manage these settings through the *Advanced Settings Editor*. After you promise to be careful, the widget is populated with a tree of all the existing settings, and you can edit their value. Right-click over a setting or a group and you can delete it (to add a setting or group, you have to edit the `QGIS3.ini` file). Changes are automatically saved in the `QGIS3.ini` file.

Aviso: Avoid using the Advanced tab settings blindly

Be careful while modifying items in this dialog given that changes are automatically applied. Doing changes without knowledge can break your QGIS installation in various ways.

9.1.18 Acceleration Settings

OpenCL acceleration settings.

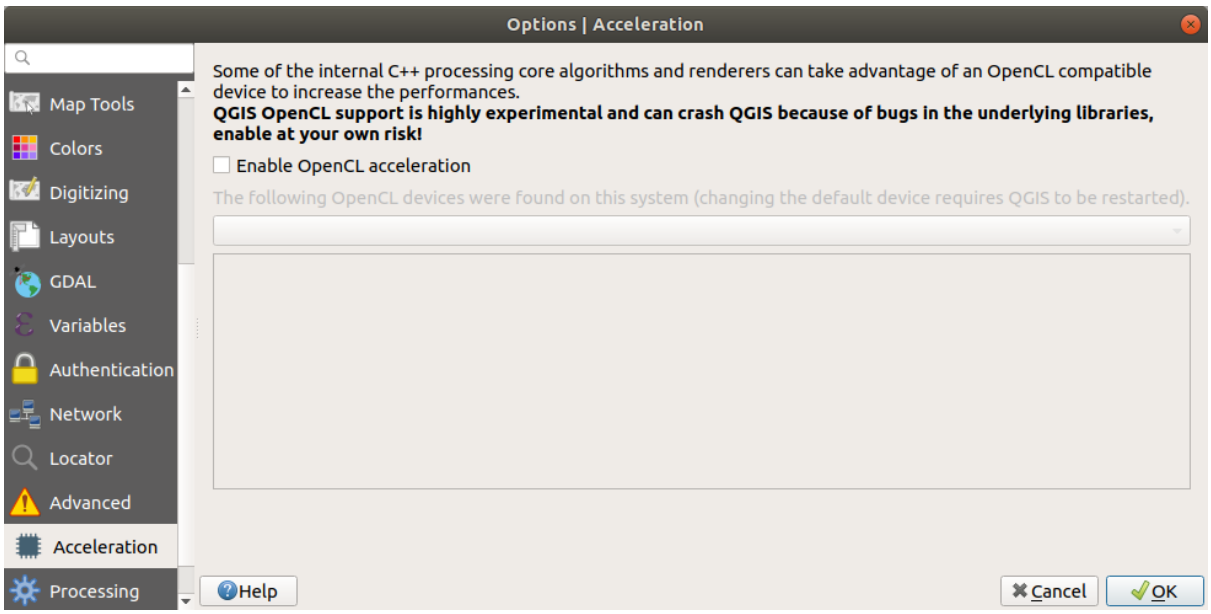


Figura9.19: Acceleration tab

Depending on your hardware and software, you may have to install additional libraries to enable OpenCL acceleration.

9.1.19 Processing Settings

The  *Processing* tab provides you with general settings of tools and data providers that are used in the QGIS Processing framework. More information at *QGIS estrutura de processamento*.

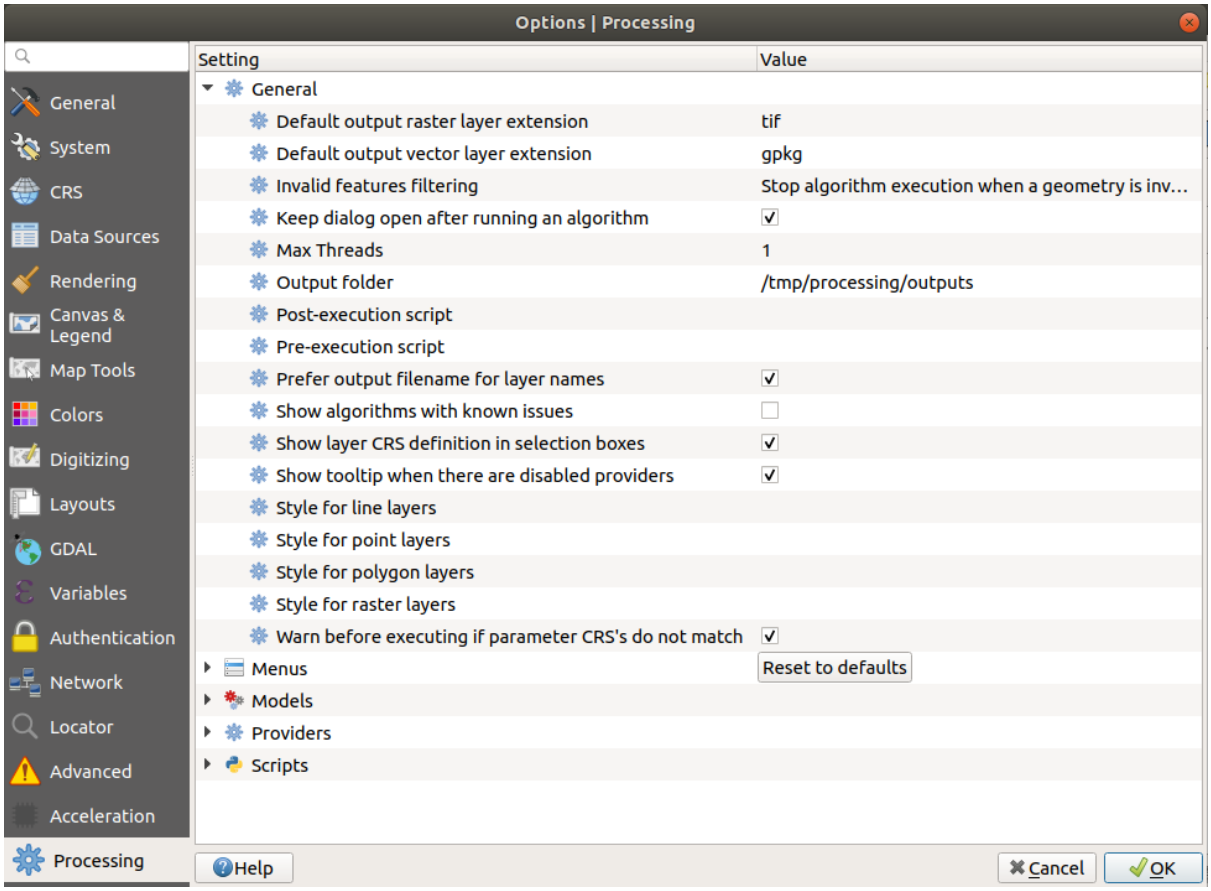


Figura9.20: Processing Settings tab in QGIS

9.1.20 Python Console Settings

The *Python Console* settings help you manage and control the behavior of the Python editors (*interactive console*, *code editor*, *project macros*, *custom expressions*, …). It can also be accessed using the Options… button from:

- the *Python console* toolbar
- the contextual menu of the *Python console* widget
- and the contextual menu of the code editor.

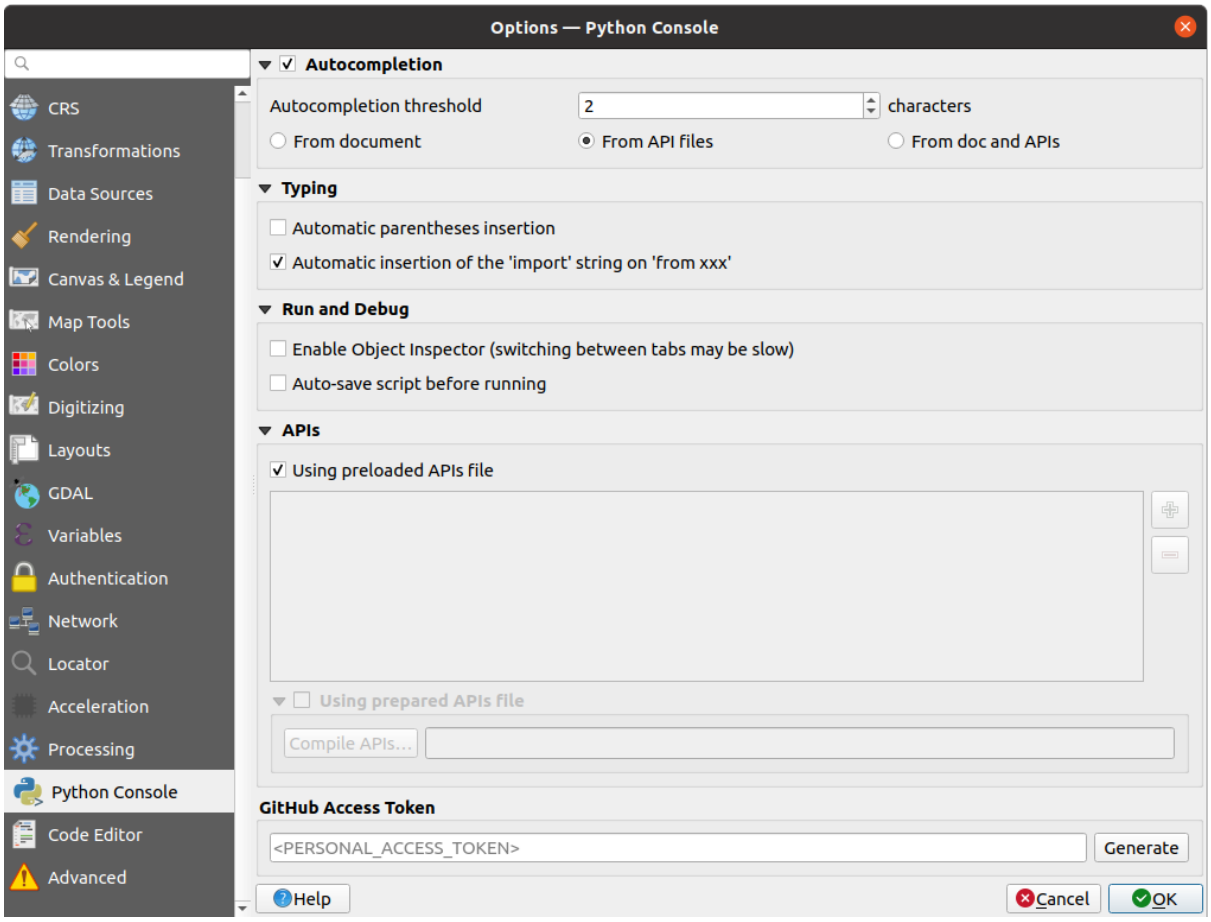


Figura9.21: Python Console Settings tab

You can specify:

- *Autocompletion*: Enables code completion. You can get autocompletion from the current document, the installed API files or both.
  - *Autocompletion threshold*: Sets the threshold for displaying the autocompletion list (in characters)
- under *Typing*
  - *Automatic parentheses insertion*: Enables autoclosing for parentheses
  - *Automatic insertion of the 'import' string on 'from xxx'*: Enables insertion of 'import' when specifying imports
- under *Run and Debug*
  - *Enable Object Inspector (switching between tabs may be slow)*: Enable the object inspector.
  - *Auto-save script before running*: Saves the script automatically when executed. This action will store a temporary file (in the temporary system directory) that will be deleted automatically after running.

For *APIs* you can specify:

- *Using preloaded APIs file*: You can choose if you would like to use the preloaded API files. If this is not checked you can add API files and you can also choose if you would like to use prepared API files (see next option).
- *Using prepared APIs file*: If checked, the chosen `*.pap` file will be used for code completion. To generate a prepared API file you have to load at least one `*.api` file and then compile it by clicking the *Compile APIs...*

button.

- Under *GitHub access token*, you can generate a personal token allowing you to share code snippets from within the Python code editor. More details on GitHub authentication

9.1.21 Code Editor Settings

In the *Code Editor* tab, you can control the appearance and behaviour of code editor widgets (Python interactive console and editor, expression widget and function editor, …).

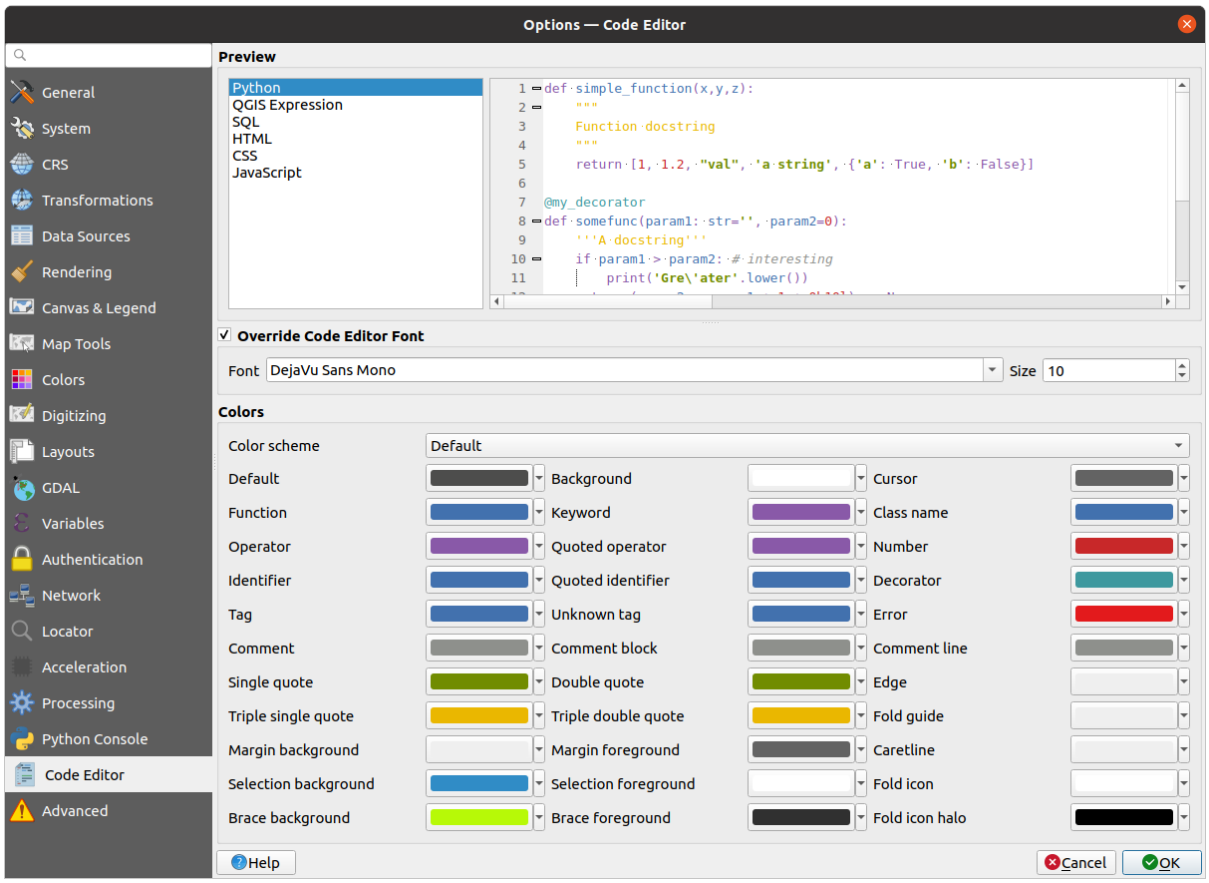


Figura9.22: Code Editor Settings tab

At the top of the dialog, a widget provides a live preview of the current settings, in various coding languages (Python, QGIS expression, HTML, SQL, JavaScript). A convenient way to adjust settings.

- Check *Override code editor font* to modify the default *Font* family and *Size*.
- Under the *Colors* group, you can:
  - select a *Color scheme*: predefined settings are `Default`, `Solarized Dark` and `Solarized Light`. A `Custom` scheme is triggered as soon as you modify a color and can be reset with selecting a predefined scheme.
  - change the *color* of each element in code writing, such as the colors to use for comments, quotes, functions, background, …

9.2 Working with User Profiles

The *Settings* ► *User Profiles* menu provides functions to set and access user profiles. A user profile is a unified application configuration that allows to store in a single folder:

- all the *global settings*, including locale, projections, authentication settings, color palettes, shortcuts…
- GUI configurations and *customization*
- grid files and other proj helper files installed for datum transformation
- installed *plugins* and their configurations
- project templates and history of saved project with their image preview
- *processing settings*, logs, scripts, models.

By default, a QGIS installation contains a single user profile named `default`. But you can create as many user profiles as you want:

1. Click the *New profile…* entry.
2. You'll be prompted to provide a profile name, creating a folder of the same name under `~/<UserProfiles>/` where:
   - `~` represents the **HOME** directory, which on Windows is usually something like `C:\Users\(user)`.
   - and `<UserProfiles>` represents the main profiles folder, i.e.:
     - `.local/share/QGIS/QGIS3/profiles/`
     - `AppData\Roaming\QGIS\QGIS3\profiles\`
     - `Library/Application Support/QGIS/QGIS3/profiles/`

   The user profile folder can be opened from within QGIS using the *Open Active Profile Folder*.
3. A new instance of QGIS is started, using a clean configuration. You can then set your custom configurations.

If you have more than one profile in your QGIS installation, the name of the active profile is shown in the application title bar between square brackets.

As each user profile contains isolated settings, plugins and history they can be great for different workflows, demos, users of the same machine, or testing settings, etc. And you can switch from one to the other by selecting them in the *Settings* ► *User Profiles* menu. You can also run QGIS with a specific user profile from the *command line*.

Unless changed, the profile of the last closed QGIS session will be used in the following QGIS sessions.

Dica: Run QGIS under a new user profile to check for bug persistence

When you encounter weird behavior with some functions in QGIS, create a new user profile and run the commands again. Sometimes, bugs are related to some leftovers in the current user profile and creating a new one may fix them as it restarts QGIS with the new (clean) profile.

9.3 Propriedades do Projeto

In the properties window for the project under *Project* ► *Project Properties*, you can set project-specific options. The project-specific options overwrite their equivalent in the *Options* dialog described above.

9.3.1 General Properties

In the *General* tab, the *General settings* let you:

- see the location of the project file
- set the folder for the project home (available in the `Project Home` item in the browser). The path can be relative to the folder of the project file (type it in) or absolute. The project home can be used for storing data and other content that is useful for the project.
- give a title to the project beside the project file path
- choose the color to use for features when they are selected
- choose the background color: the color to use for the map canvas
- set whether the path to layers in the project should be saved as absolute (full) or as relative to the project file location. You may prefer relative path when both layers and project files can be moved or shared or if the project is accessed from computers on different platforms.
- choose to avoid artifacts when project is rendered as map tiles. Note that checking this option can lead to performance degradation.

Calculating areas and distances is a common need in GIS. However, these values are really tied to the underlying projection settings. The *Measurements* frame lets you control these parameters. You can indeed choose:

- the *Ellipsoid*, on which distance and area calculations are entirely based; it can be:
  - **None/Planimetric**: returned values are in this case cartesian measurements.
  - a **Custom** one: you'll need to set values of the semi-major and semi-minor axes.
  - or an existing one from a predefined list (Clarke 1866, Clarke 1880 IGN, New International 1967, WGS 84…).
- the *units for distance measurements* for length and perimeter and the *units for area measurements*. These settings, which default to the units set in QGIS options but then overrides it for the current project, are used in:
  - Attribute table field update bar
  - Field calculator calculations
  - Identify tool derived length, perimeter and area values
  - Default unit shown in measure dialog

The *Coordinate and Bearing display* allows you to choose and customize the bearing format and the format of units to use to display the mouse coordinate in the status bar and the derived coordinates shown via the identify tool.

Finalmente, você pode definir uma lista :guilabel: Escalas predefinidas do projeto`, que substitui as escalas predefinidas globais.

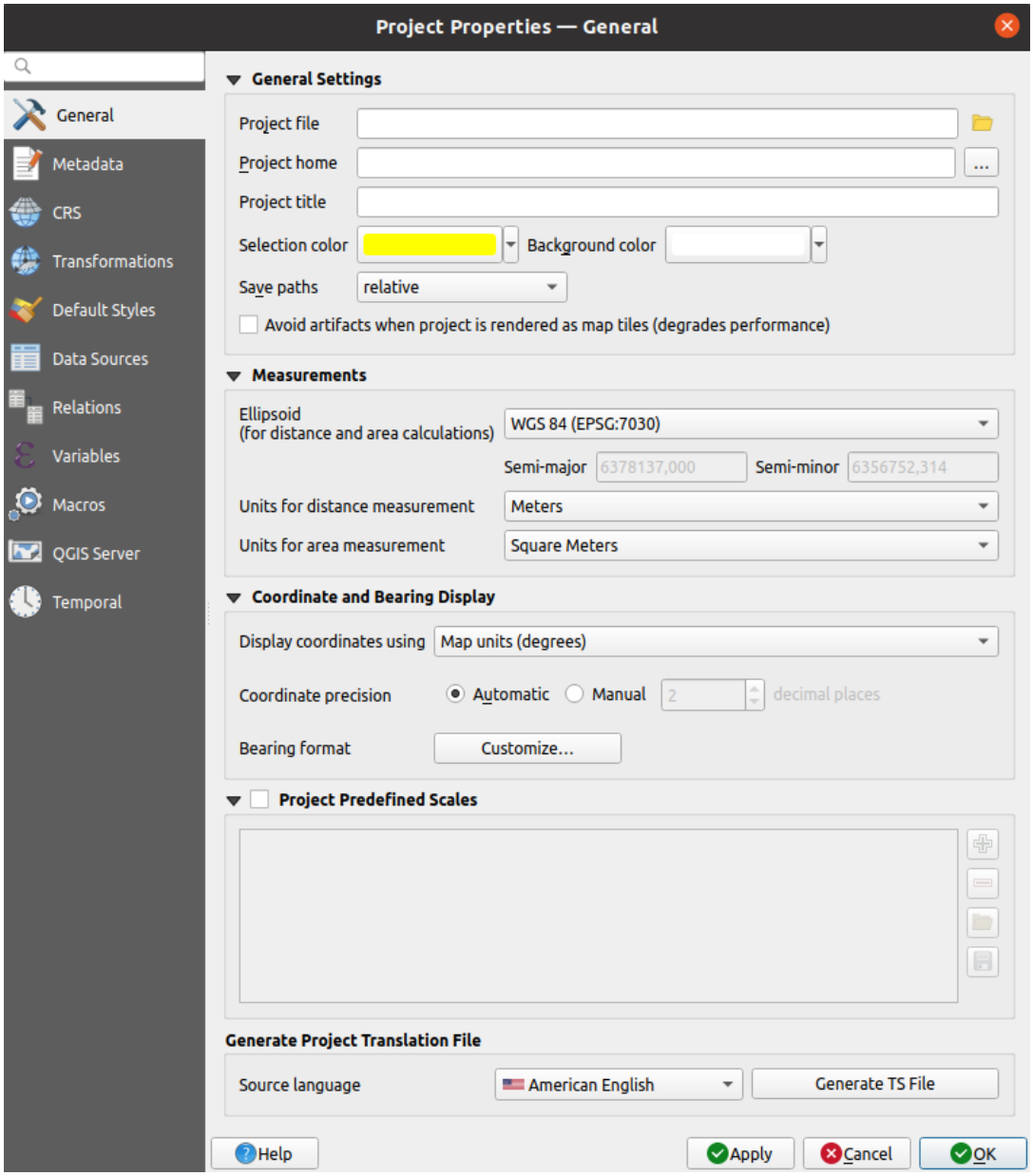


Figura9.23: General tab of the Project Properties dialog

9.3.2 Propriedades dos Metadados

The *Metadata* tab allows detailed metadata to be defined, including (among the others): author, creation date, language, abstracts, categories, keywords, contact details, links, history. There is also a validation functionality that checks if specific fields were filled, anyway this is not enforced. See *vector layer metadata properties* for some details.

9.3.3 CRS Properties

Nota: For more information on how QGIS handles project projection, please read the dedicated section at *Trabalhando com Projeções*.

The  *CRS* tab helps you set the coordinate reference system to use in this project. It can be:

-  *No CRS (or unknown/non-Earth projection)*: layers are drawn based on their raw coordinates
- or an existing coordinate reference system that can be *geographic*, *projected* or *user-defined*. Layers added to the project are translated on-the-fly to this CRS in order to overlay them regardless their original CRS.

9.3.4 Transformations Properties

The  *Transformations* tab helps you control the layers reprojection settings by configuring the datum transformation preferences to apply in the current project. As usual, these override any corresponding global settings. See *Datum Transformations* for more details.

9.3.5 Propriedades de Estilos Padrão

The *Default Styles* tab lets you control how new layers will be drawn in the project when they do not have an existing `.qml` style defined. You can:

- Set default symbols (*Marker*, *Line*, *Fill*) to apply depending on the layer geometry type as well as a default *Color Ramp*
- Apply a default *Opacity* to new layers
-  *Assign random colors to symbols*, modifying the symbols fill colors, hence avoiding same rendering for all layers.

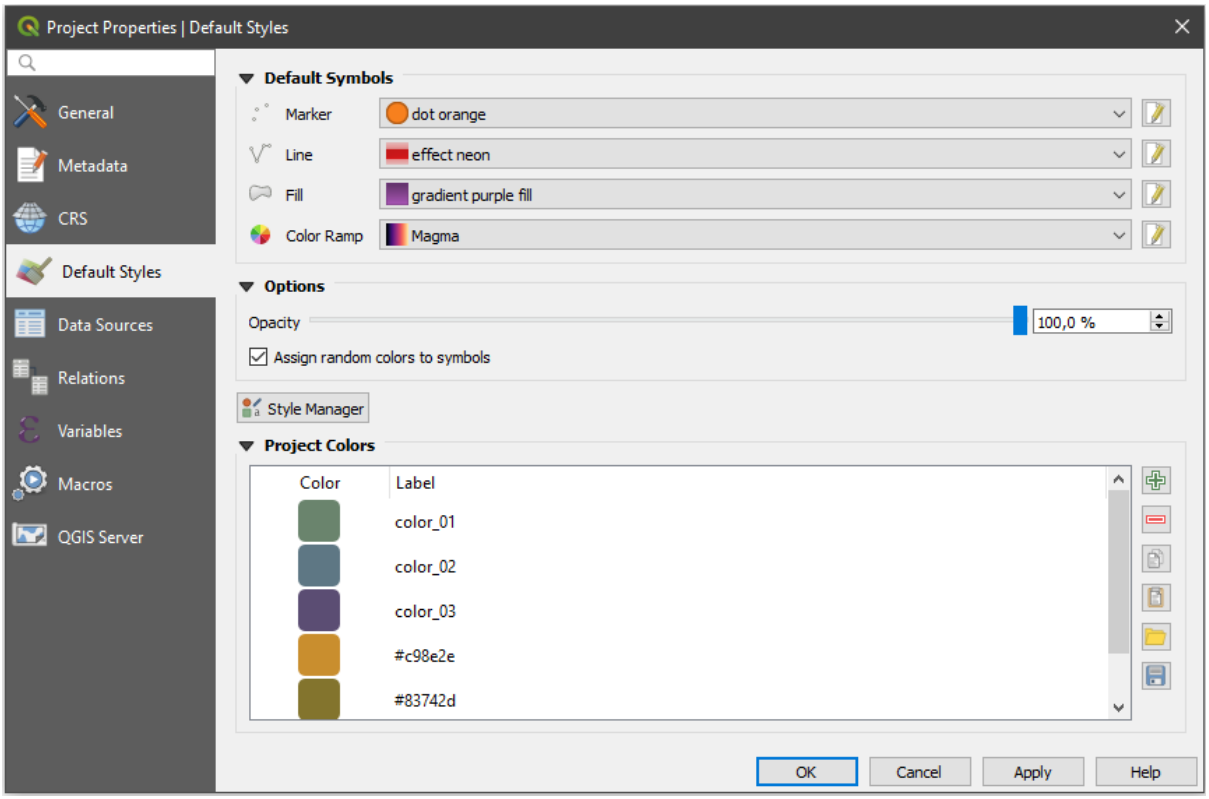


Figura9.24: Default Styles tab

Using the *Style Manager* button, you can also quickly access the *Style Manager* dialog and configure symbols and color ramps.

There is also an additional section where you can define specific colors for the running project. Like the *global colors*, you can:

- *Add* or *Remove* color
- *Copy* or *Paste* color
- *Import* or *Export* the set of colors from/to `.gpl` file.

Double-click a color in the list to tweak or replace it in the *Color Selector* dialog. You can also rename it by double-clicking in the *Label* column.

These colors are identified as *Project colors* and listed as part of *color widgets*.

Dica: Use project colors to quickly assign and update color widgets

Project colors can be refered to using their label and the color widgets they are used in are bound to them. This means that instead of repeatedly setting the same color for many properties and, to avoid a cumbersome update you can:

1. Define the color as a project color
2. Click the *data defined override widget* next to the color property you want to set
3. Hover over the *Color* menu and select the project color. The property is then assigned the expression `project_color('color_label')` and the color widget reflects that color.
4. Repeat steps 2 and 3 as much as needed
5. Update the project color once and the change is reflected EVERYWHERE it's in use.

9.3.6 Data Sources Properties

In the *Data Sources* tab, you can:

- *Automatically create transaction groups where possible*: When this mode is turned on, all layers from the same database are synchronised in their edit state, i.e. when one layer is put into edit state, all are, when one layer is committed or one layer is rolled back, so are the others. Also, instead of buffering edit changes locally, they are directly sent to a transaction in the database which gets committed when the user clicks save layer. Note that you can (de)activate this option only if no layer is being edited in the project.
- *Evaluate default values on provider side*: When adding new features in a PostgreSQL table, fields with default value constraint are evaluated and populated at the form opening, and not at the commit moment. This means that instead of an expression like `nextval('serial')`, the field in the *Add Feature* form will display expected value (e.g., `25`).
- *Trust project when data source has no metadata*: To speed up project loading by skipping data checks. Useful in QGIS Server context or in projects with huge database views/materialized views. The extent of layers will be read from the QGIS project file (instead of data sources) and when using the PostgreSQL provider the primary key unicity will not be checked for views and materialized views.
- Configure the *Layers Capabilities*, i.e.:
  - Set (or disable) which layers are `identifiable`, i.e. will respond to the *identify tool*. By default, layers are set queryable.
  - Set whether a layer should appear as `read-only`, meaning that it can not be edited by the user, regardless of the data provider's capabilities. Although this is a weak protection, it remains a quick and handy configuration to avoid end-users modifying data when working with file-based layers.
  - Define which layers are `searchable`, i.e. could be queried using the *locator widget*. By default, layers are set searchable.
  - Define which layers are defined as `required`. Checked layers in this list are protected from inadvertent removal from the project.

  The *Layers Capabilities* table provides some convenient tools to:
  - Select multiple cells and press *Toggle Selection* to have them change their checkbox state;
  - *Show spatial layers only*, filtering out non-spatial layers from the layers list;
  - *Filter layers…* and quickly find a particular layer to configure.

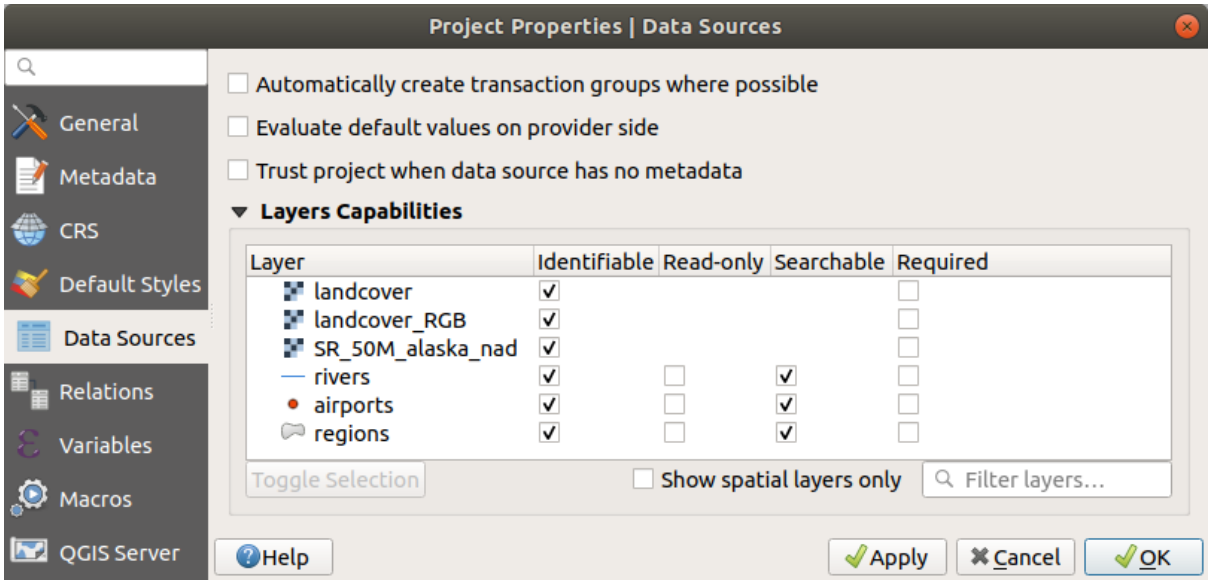


Figura9.25: Data Sources tab

9.3.7 Relations Properties

The *Relations* tab is used to define 1:n relations. The relations are defined in the project properties dialog. Once relations exist for a layer, a new user interface element in the form view (e.g. when identifying a feature and opening its form) will list the related entities. This provides a powerful way to express e.g. the inspection history on a length of pipeline or road segment. You can find out more about 1:n relations support in Section *Creating one or many to many relations*.

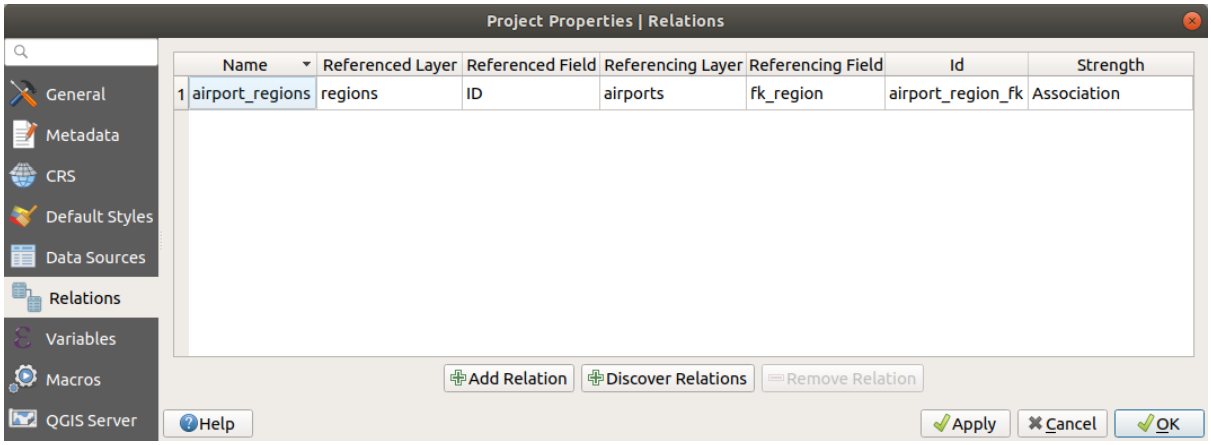


Figura9.26: Relations tab

9.3.8 Propriedades das Variáveis

The *Variables* tab lists all the variables available at the project's level (which includes all global variables). Besides, it also allows the user to manage project-level variables. Click the button to add a new custom project-level variable. Likewise, select a custom project-level variable from the list and click the button to remove it. More information on variables usage in the General Tools *Armazenar valores em Variáveis* section.

9.3.9 Macros Properties

The *Macros* tab is used to edit Python macros for projects. Currently, only three macros are available: `openProject()`, `saveProject()` and `closeProject()`.

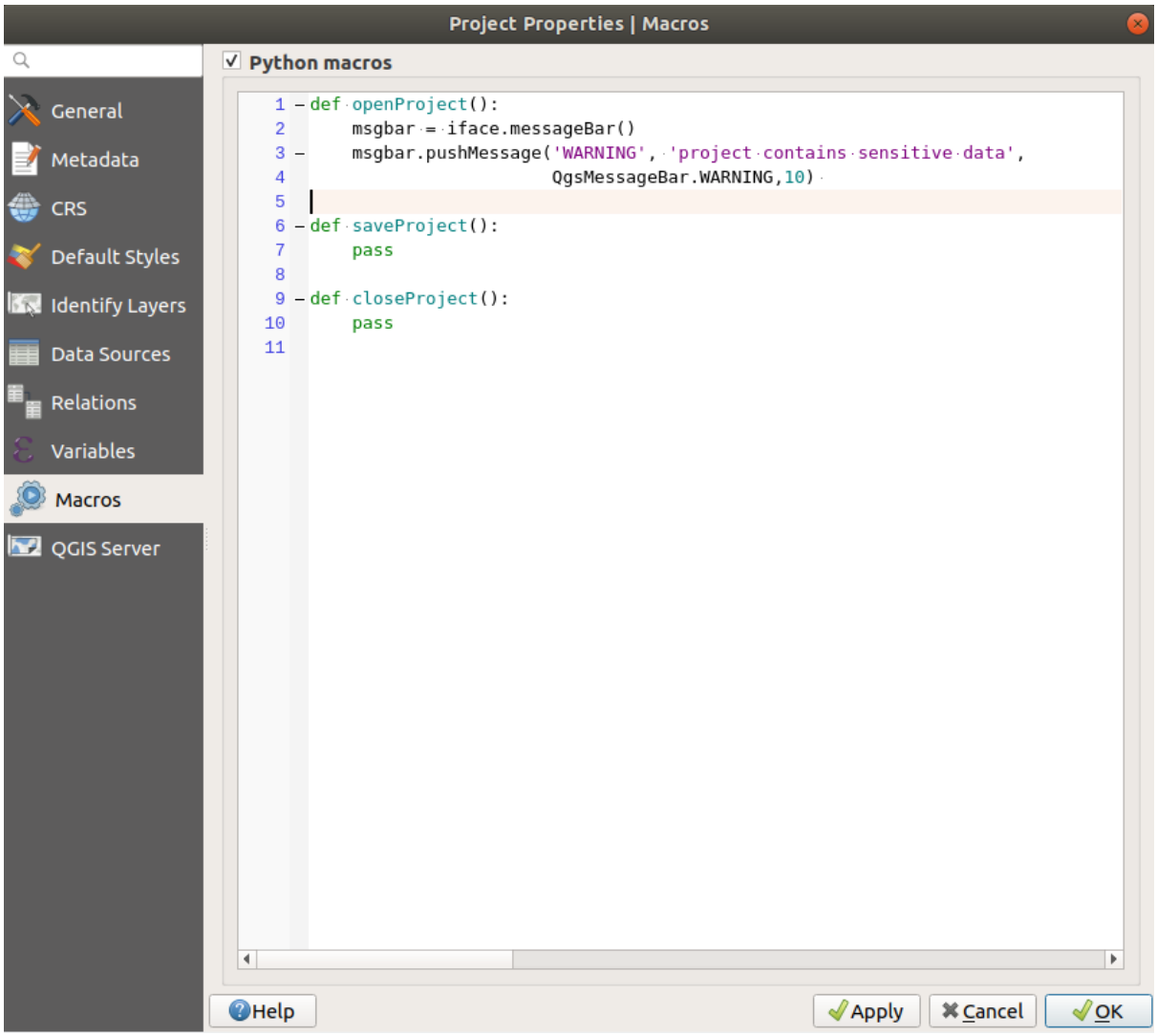


Figura9.27: Macro settings in QGIS

9.3.10 Propriedades do Servidor QGIS

The tab *QGIS Server* allows you to configure your project in order to publish it online. Here you can define information about the QGIS Server WMS and WFS capabilities, extent and CRS restrictions. More information available in section Creatingwmsfromproject and subsequent.

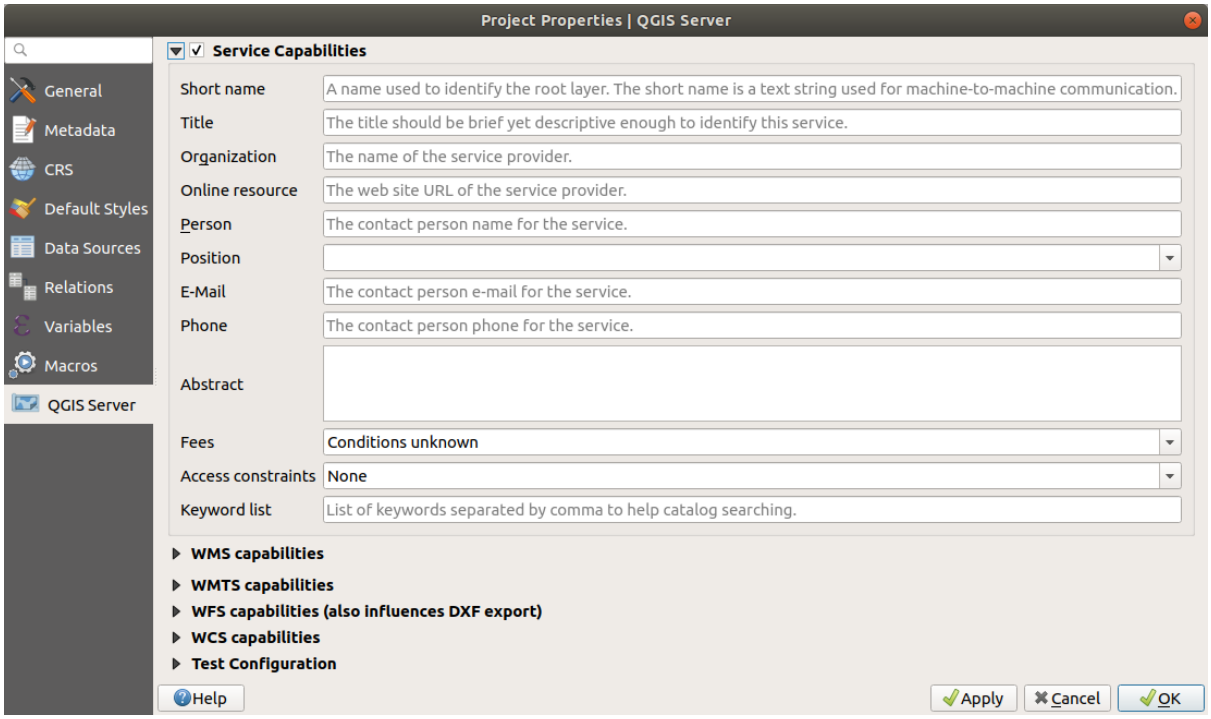


Figura9.28: QGIS Server settings tab

9.3.11 Temporal Properties

The tab *Temporal* is used to set the temporal range of your project, either by using manual input or by calculating it from the current project temporal layers.

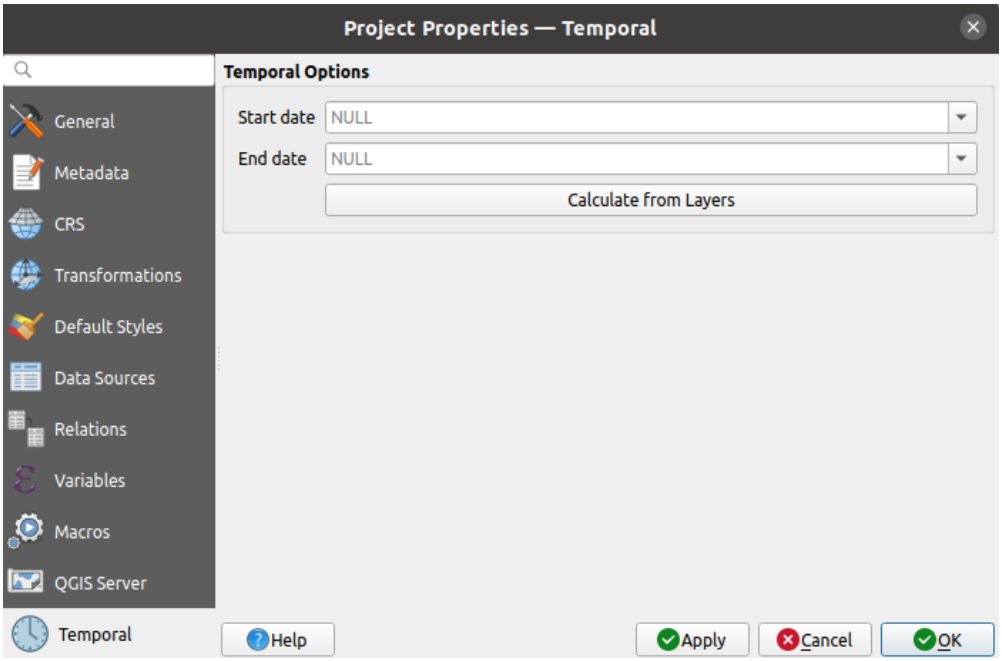


Figura9.29: QGIS Temporal tab

9.4 Personalização

The customization dialog lets you (de)activate almost every element in the QGIS user interface. This can be very useful if you want to provide your end-users with a 'light' version of QGIS, containing only the icons, menus or panels they need.

Nota: Before your changes are applied, you need to restart QGIS.

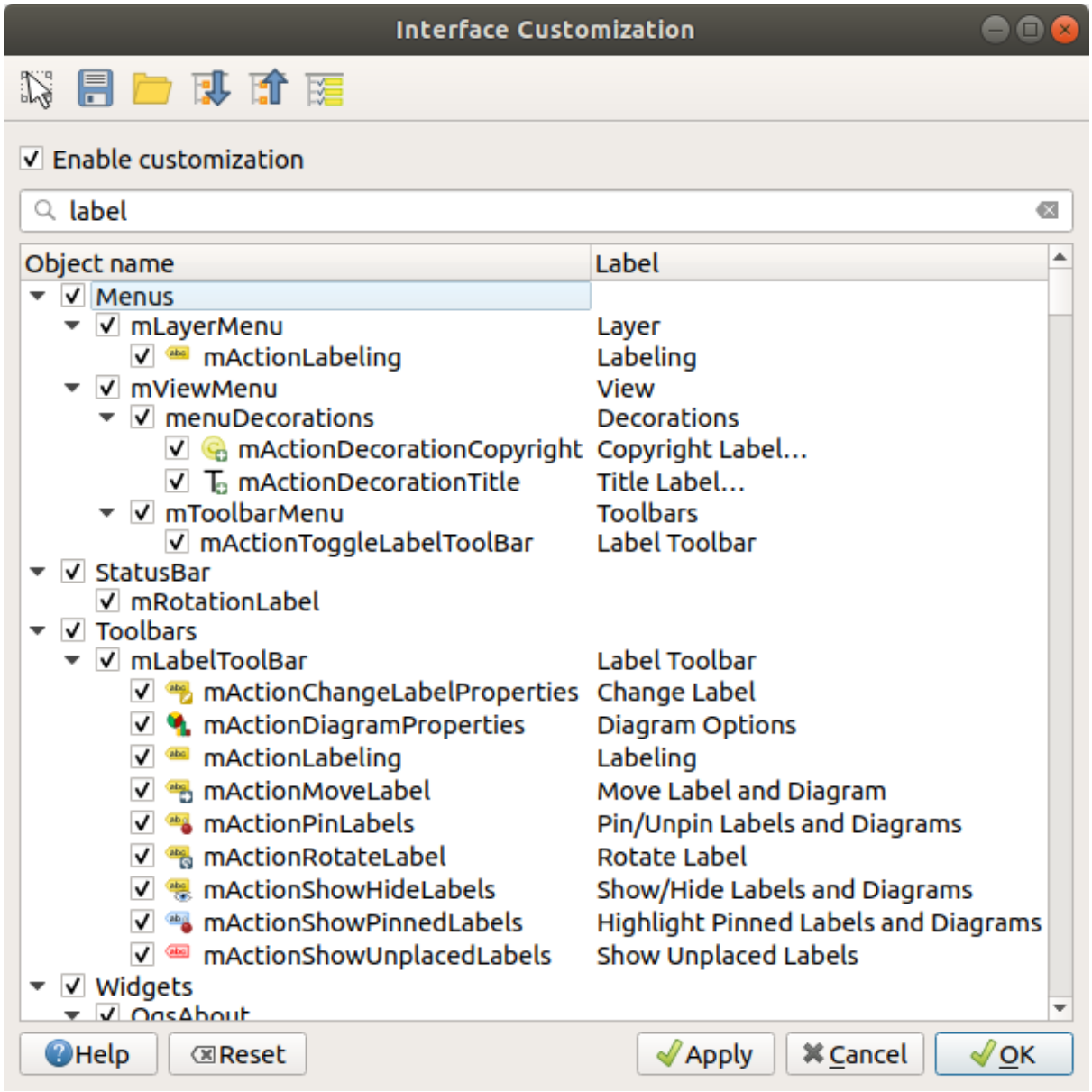


Figura9.30: The Customization dialog

Ticking the *Enable customization* checkbox is the first step on the way to QGIS customization. This enables the toolbar and the widget panel from which you can uncheck and thus disable some GUI items.

The configurable item can be:

- a **Menu** or some of its sub-menus from the *Barra de Menu*
- a whole **Panel** (see *Painéis e Barras de Ferramentas*)
- the **Status bar** described in *Barra de Status* or some of its items
- a **Toolbar**: the whole bar or some of its icons
- or any **widget** from any dialog in QGIS: label, button, combobox…

With Switch to catching widgets in main application, you can click on an item in QGIS interface that you want to be hidden and QGIS automatically unchecks the corresponding entry in the Customization dialog. You can also use the *Search* box to find items by their name or label.

Once you setup your configuration, click *Apply* or *OK* to validate your changes. This configuration becomes the one used by default by QGIS at the next startup.

The modifications can also be saved in a `.ini` file using  Save To File button. This is a handy way to share a common QGIS interface among multiple users. Just click on  Load from File from the destination computer in order to import the `.ini` file. You can also run *command line tools* and save various setups for different use cases as well.

Dica: Easily restore predefined QGIS

The initial QGIS GUI configuration can be restored by one of the methods below:

- unchecking  *Enable customization* option in the Customization dialog or click the  Check All button
- pressing the *Reset* button in the **Settings** frame under *Settings* ► *Options* menu, *System* tab
- launching QGIS at a command prompt with the following command line `qgis --nocustomization`
- setting to `false` the value of *UI* ► *Customization* ► *Enabled* variable under *Settings* ► *Options* menu, *Advanced* tab (see the *warning*).

In most cases, you need to restart QGIS in order to have the change applied.

9.5 Atalhos do Teclado

QGIS provides default keyboard shortcuts for many features. You can find them in section *Barra de Menu*. Additionally, the menu option *Settings* ►  *Keyboard Shortcuts...* allows you to change the default keyboard shortcuts and add new ones to QGIS features.

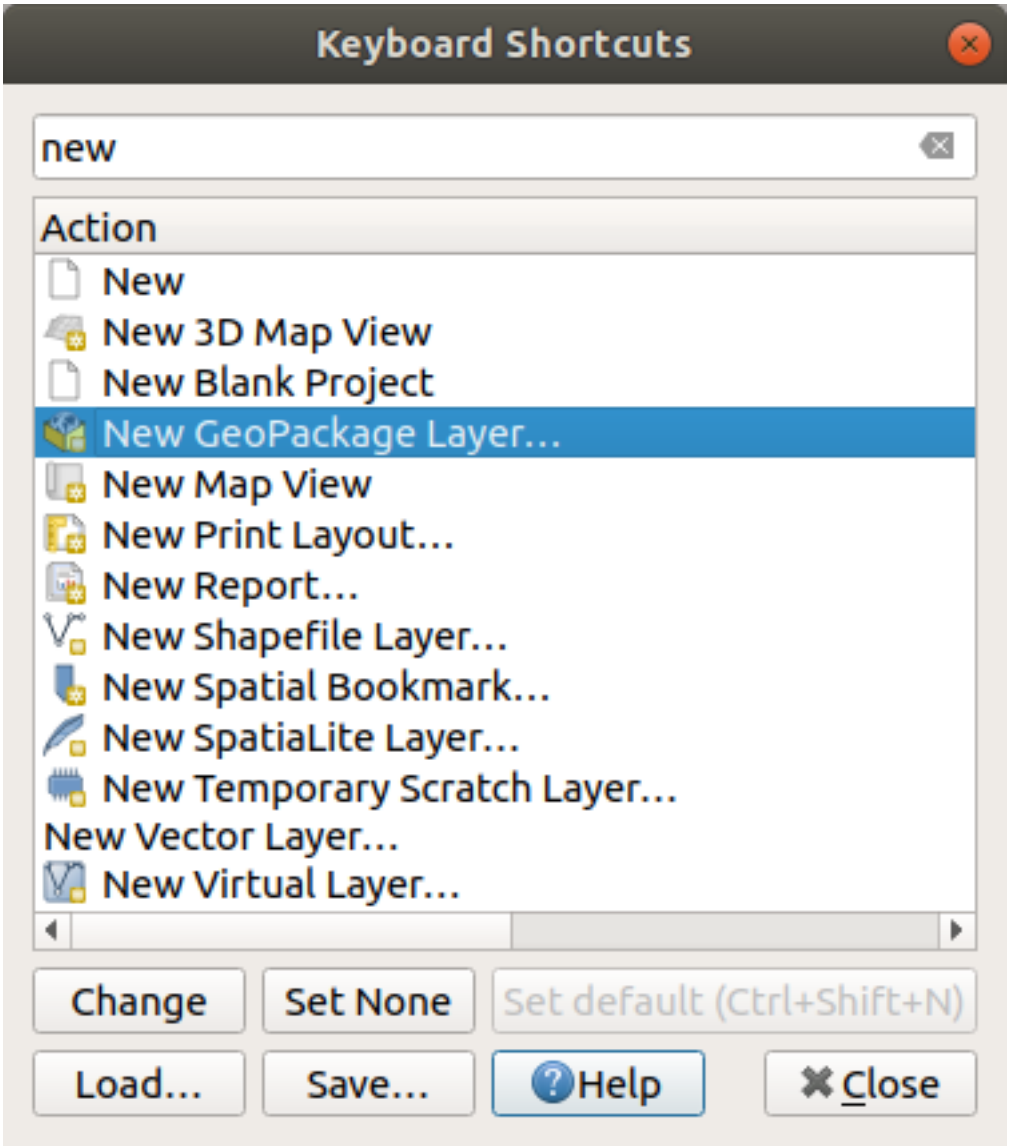


Figura9.31: Define shortcut options

Configuration is very simple. Use the search box at the top of the dialog to find a particular action, select it from the list and click on :

- *Change* and press the new combination you want to assign as new shortcut
- *Set None* to clear any assigned shortcut
- or *Set Default* to backup the shortcut to its original and default value.

Proceed as above for any other tools you wish to customize. Once you have finished your configuration, simply *Close* the dialog to have your changes applied. You can also *Save* the changes as an `.XML` file and *Load* them into another QGIS installation.

9.6 Running QGIS with advanced settings

9.6.1 Command line and environment variables

We've seen that *launching QGIS* is done as for any application on your OS. QGIS provides command line options for more advanced use cases (in some cases you can use an environment variable instead of the command line option). To get a list of the options, enter `qgis --help` on the command line, which returns:

```
QGIS is a user friendly Open Source Geographic Information System.
Usage: /usr/bin/qgis.bin [OPTION] [FILE]
  OPTION:
        [--version]     display version information and exit
        [--snapshot filename]   emit snapshot of loaded datasets to given file
        [--width width] width of snapshot to emit
        [--height height]       height of snapshot to emit
        [--lang language]       use language for interface text (changes existing␣
↪override)
        [--project projectfile] load the given QGIS project
        [--extent xmin,ymin,xmax,ymax]  set initial map extent
        [--nologo]      hide splash screen
        [--noversioncheck]      don't check for new version of QGIS at startup
        [--noplugins]   don't restore plugins on startup
        [--nocustomization]     don't apply GUI customization
        [--customizationfile path]      use the given ini file as GUI customization
        [--globalsettingsfile path]     use the given ini file as Global Settings␣
↪(defaults)
        [--authdbdirectory path] use the given directory for authentication␣
↪database
        [--code path]   run the given python file on load
        [--defaultui]   start by resetting user ui settings to default
        [--hide-browser]        hide the browser widget
        [--dxf-export filename.dxf]     emit dxf output of loaded datasets to␣
↪given file
        [--dxf-extent xmin,ymin,xmax,ymax]      set extent to export to dxf
        [--dxf-symbology-mode none|symbollayer|feature] symbology mode for dxf␣
↪output
        [--dxf-scale-denom scale]       scale for dxf output
        [--dxf-encoding encoding]       encoding to use for dxf output
        [--dxf-map-theme maptheme]      map theme to use for dxf output
        [--take-screenshots output_path]        take screen shots for the user␣
↪documentation
        [--screenshots-categories categories]   specify the categories of␣
↪screenshot to be used (see QgsAppScreenShots::Categories).
        [--profile name]        load a named profile from the user's profiles␣
↪folder.
        [--profiles-path path]  path to store user profile folders. Will create␣
↪profiles inside a {path}\profiles folder
        [--version-migration]   force the settings migration from older version if␣
↪found
        [--openclprogramfolder]         path to the folder containing the sources␣
↪for OpenCL programs.
        [--help]                this text
        [--]            treat all following arguments as FILEs

  FILE:
    Files specified on the command line can include rasters,
    vectors, and QGIS project files (.qgs and .qgz):
     1. Rasters - supported formats include GeoTiff, DEM
        and others supported by GDAL
     2. Vectors - supported formats include ESRI Shapefiles
        and others supported by OGR and PostgreSQL layers using
```

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(continuação da página anterior)

```
        the PostGIS extension
```

Dica: Example Using command line arguments

You can start QGIS by specifying one or more data files on the command line. For example, assuming you are in the `qgis_sample_data` directory, you could start QGIS with a vector layer and a raster file set to load on startup using the following command: `qgis ./raster/landcover.img ./gml/lakes.gml`

`--version`

This option returns QGIS version information.

`--snapshot`

This option allows you to create a snapshot in PNG format from the current view. This comes in handy when you have many projects and want to generate snapshots from your data, or when you need to create snapshots of the same project with updated data.

Currently, it generates a PNG file with 800x600 pixels. The size can be adjusted using the `--width` and `--height` arguments. The filename can be added after `--snapshot`. For example:

```
qgis --snapshot my_image.png --width 1000 --height 600 --project my_project.qgs
```

`--width`

This option returns the width of the snapshot to be emitted (used with `--snapshot`).

`--height`

This option returns the height of the snapshot to be emitted (used with `--snapshot`).

`--lang`

Based on your locale, QGIS selects the correct localization. If you would like to change your language, you can specify a language code. For example, `qgis --lang it` starts QGIS in Italian localization.

`--project`

Starting QGIS with an existing project file is also possible. Just add the command line option `--project` followed by your project name and QGIS will open with all layers in the given file loaded.

--extent

To start with a specific map extent use this option. You need to add the bounding box of your extent in the following order separated by a comma:

```
--extent xmin,ymin,xmax,ymax
```

This option probably makes more sense when paired with the `--project` option to open a specific project at the desired extent.

--nologo

This option hides the splash screen when you start QGIS.

--noversioncheck

Skip searching for a new version of QGIS at startup.

--noplugins

If you have trouble at start-up with plugins, you can avoid loading them at start-up with this option. They will still be available from the Plugins Manager afterwards.

--nocustomization

Using this option, any existing *GUI customization* will not be applied at startup. This means that any hidden buttons, menu items, toolbars, and so on, will show up on QGIS start up. This is not a permanent change. The customization will be applied again if QGIS is launched without this option.

This option is useful for temporarily allowing access to tools that have been removed by customization.

--customizationfile

Using this option, you can define a UI customization file, that will be used at startup.

--globalsettingsfile

Using this option, you can specify the path for a Global Settings file (`.ini`), also known as the Default Settings. The settings in the specified file replace the original inline default ones, but the user profiles' settings will be set on top of those. The default global settings is located in `your_QGIS_PKG_path/resources/qgis_global_settings.ini`.

Presently, there's no way to specify a file to write settings to; therefore, you can create a copy of an original settings file, rename, and adapt it.

Setting the `qgis_global_setting.ini` file path to a network shared folder, allows a system administrator to change global settings and defaults in several machines by only editing one file.

The equivalent environment variable is `QGIS_GLOBAL_SETTINGS_FILE`.

--authdbdirectory

This option is similar to `--globalsettingsfile`, but defines the path to the directory where the authentication database will be stored and loaded.

--code

This option can be used to run a given python file directly after QGIS has started.

For example, when you have a python file named `load_alaska.py` with following content:

```
from qgis.utils import iface
raster_file = "/home/gisadmin/Documents/qgis_sample_data/raster/landcover.img"
layer_name = "Alaska"
iface.addRasterLayer(raster_file, layer_name)
```

Assuming you are in the directory where the file `load_alaska.py` is located, you can start QGIS, load the raster file `landcover.img` and give the layer the name 'Alaska' using the following command:

```
qgis --code load_alaska.py
```

--defaultui

On load, **permanently resets** the user interface (UI) to the default settings. This option will restore the panels and toolbars visibility, position, and size. Unless it's changed again, the default UI settings will be used in the following sessions.

Notice that this option doesn't have any effect on *GUI customization*. Items hidden by GUI customization (e.g. the status bar) will remain hidden even using the `--defaultui` option. See also the `--nocustomization` option.

--hide-browser

On load, hides the *Browser* panel from the user interface. The panel can be enabled by right-clicking a space in the toolbars or using the *View* ► *Panels* (*Settings* ► *Panels* in  Linux KDE).

Unless it's enabled again, the Browser panel will remain hidden in the following sessions.

--dxf-*

These options can be used to export a QGIS project into a DXF file. Several options are available:

- *–dxf-export*: the DXF filename into which to export the layers;
- *–dxf-extent*: the extent of the final DXF file;
- *–dxf-symbology-mode*: several values can be used here: `none` (no symbology), `symbollayer` (Symbol layer symbology), `feature` (feature symbology);
- *–dxf-scale-denom*: the scale denominator of the symbology;
- *–dxf-encoding*: the file encoding;
- *–dxf-map-theme*: choose a *map theme* from the layer tree configuration.

--take-screenshots

Takes screenshots for the user documentation. Can be used together with `--screenshots-categories` to filter which categories/sections of the documentation screenshots should be created (see QgsAppScreenShots::Categories).

--profile

Loads QGIS using a specific profile from the user's profile folder. Unless changed, the selected profile will be used in the following QGIS sessions.

--profiles-path

With this option, you can choose a path to load and save the profiles (user settings). It creates profiles inside a `{path}\profiles` folder, which includes settings, installed plugins, processing models and scripts, and so on.

This option allows you to, for instance, carry all your plugins and settings in a flash drive, or, for example, share the settings between different computers using a file sharing service.

The equivalent environment variable is `QGIS_CUSTOM_CONFIG_PATH`.

--version-migration

If settings from an older version are found (*e.g.*, the `.qgis2` folder from QGIS 2.18), this option will import them into the default QGIS profile.

--openclprogramfolder

Using this option, you can specify an alternative path for your OpenCL programs. This is useful for developers while testing new versions of the programs without needing to replace the existing ones.

The equivalent environment variable is `QGIS_OPENCL_PROGRAM_FOLDER`.

9.6.2 Deploying QGIS within an organization

If you need to deploy QGIS within an organization with a custom configuration file, first you need to copy/paste the content of the default settings file located in `your_QGIS_PKG_path/resources/qgis_global_settings.ini`. This file already contains some default sections identified by a block starting with `[]`. We recommend that you keep these defaults values and add your own sections at the bottom of the file. If a section is duplicated in the file, QGIS will take the last one from top to bottom.

You can change `allowVersionCheck=false` to disable the QGIS version check.

If you do not want to display the migration window after a fresh install, you need the following section:

```
[migration]
fileVersion=2
settings=true
```

If you want to add a custom variable in the global scope:

```
[variables]
organisation="Your organization"
```

To discover the possibilities of the settings `INI` file, we suggest that you set the config you would like in QGIS Desktop and then search for it in your `INI` file located in your profile using a text editor. A lot of settings can be set using the `INI` file such as WMS/WMTS, PostGIS connections, proxy settings, maptips…

Finally, you need to set the environment variable `QGIS_GLOBAL_SETTINGS_FILE` to the path of your customized file.

In addition, you can also deploy files such as Python macros, color palettes, layout templates, project templates… either in the QGIS system directory or in the QGIS user profile.

- Layout templates must be deployed in the `composer_templates` directory.
- Project templates must be deployed in the `project_templates` directory.
- Custom Python macros must be deployed in the `python` directory.

CAPÍTULO 10

Trabalhando com Projeções

A Coordinate Reference System, or CRS, is a method of associating numerical coordinates with a position on the surface of the Earth. QGIS has support for approximately 7,000 standard CRSs, each with different use cases, pros and cons! Choosing an appropriate reference system for your QGIS projects and data can be a complex task, but fortunately QGIS helps guide you through this choice, and makes working with different CRSs as transparent and accurate as possible.

10.1 Visão geral do Suporte a Projeções

QGIS has support for approximately 7,000 known CRSs. These standard CRSs are based on those defined by the European Petroleum Search Group (EPSG) and the Institut Geographique National de France (IGNF), and are made available in QGIS through the underlying "Proj" projection library. Commonly, these standard projections are identified through use of an authority:code combination, where the authority is an organisation name such as "EPSG" or "IGNF", and the code is a unique number associated with a specific CRS. For instance, the common WGS 84 latitude/longitude CRS is known by the identifier `EPSG:4326`, and the web mapping standard CRS is `EPSG:3857`.

Custom, user-created CRSs are stored in a user CRS database. See section *Sistema de Referência de Coordenadas personalizado* for information on managing your custom coordinate reference systems.

10.2 Layer Coordinate Reference Systems

In order to correctly project data into a specific target CRS, either your data must contain information about its coordinate reference system or you will need to manually assign the correct CRS to the layer. For PostGIS layers, QGIS uses the spatial reference identifier that was specified when that PostGIS layer was created. For data supported by OGR or GDAL, QGIS relies on the presence of a recognized means of specifying the CRS. For instance, for the Shapefile format this is a file containing an ESRI Well-Known Text (WKT) representation of the layer's CRS. This projection file has the same base name as the `.shp` file and a `.prj` extension. For example, `alaska.shp` would have a corresponding projection file named `alaska.prj`.

Whenever a layer is loaded into QGIS, QGIS attempts to automatically determine the correct CRS for that layer. In some cases this is not possible, e.g. when a layer has been provided without retaining this information. You can configure QGIS behavior whenever it cannot automatically determine the correct CRS for a layer:

1. Open *Settings* ► *Options...* ► *CRS*

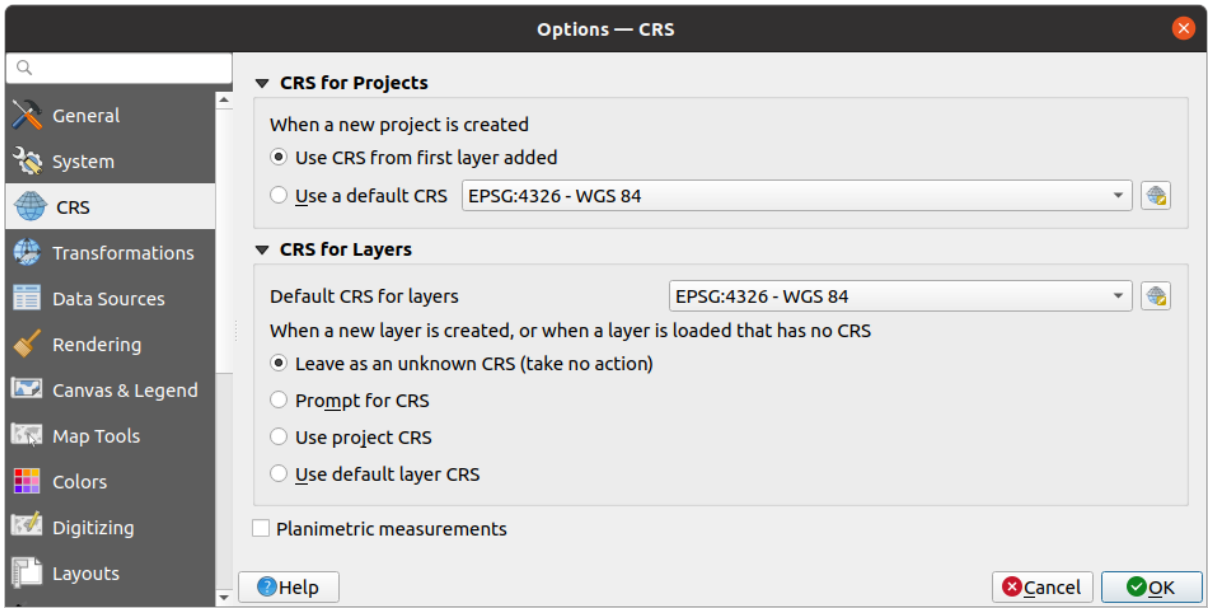


Figura10.1: The CRS tab in the QGIS Options Dialog

2. Under the *CRS for layers* group, set the action to do *when a new layer is created, or when a layer is loaded that has no CRS*. One of:

   - *Leave as unknown CRS (take no action)*: there will be no prompt to select a CRS when a layer without CRS is loaded, defering CRS choice to a later time. Convenient when loading a lot of layers at once. Such layers will be identifiable in the *Layers* panel by the icon next to them. They'll also be un-referenced, with coordinates from the layer treated as purely numerical, non-earth values, i.e. the same behavior as all layers get when *a project is set to have no CRS*.
   - *Prompt for CRS*: it will prompt you to manually select the CRS. Selecting the correct choice is crucial, as a wrong choice will place your layer in the wrong position on the Earth's surface! Sometimes, accompanying metadata will describe the correct CRS for a layer, in other cases you will need to contact the original author of the data to determine the correct CRS to use.
   - *Usar SRC do projeto*
   - *Use default layer CRS*, as set in the *Default CRS for layers* combobox above.

Dica: To assign the same CRS to multiple layers that have no crs or have a wrong one in one operation:

1. Select the layers in the *Layers* panel
2. Press `Ctrl+Shift+C`. You could also right-click over one of the selected layers or go to *Layer* ► *Set CRS of layer(s)*
3. Find and select the right CRS to use
4. And press *OK*. You can confirm that it has been set correctly in the *Source* tab of the layers' properties dialog.

Note that changing the CRS in this setting does not alter the underlying data source in any way, rather it just changes how QGIS interprets the raw coordinates from the layer in the current QGIS project.

10.3 Project Coordinate Reference Systems

Every project in QGIS also has an associated Coordinate Reference System. The project CRS determines how data is projected from its underlying raw coordinates to the flat map rendered within your QGIS map canvas.

QGIS supports "on the fly" CRS transformation for both raster and vector data. This means that regardless of the underlying CRS of particular map layers in your project, they will always be automatically transformed into the common CRS defined for your project. Behind the scenes, QGIS transparently reprojects all layers contained within your project into the project's CRS, so that they will all be rendered in the correct position with respect to each other!

It is important to make an appropriate choice of CRS for your QGIS projects. Choosing an inappropriate CRS can cause your maps to look distorted, and poorly reflect the real-world relative sizes and positions of features. Usually, while working in smaller geographic areas, there will be a number of standard CRSs used within a particular country or administrative area. It's important to research which CRSs are appropriate or standard choices for the area you are mapping, and ensure that your QGIS project follows these standards.

By default, QGIS starts each new project using a global default projection. This default CRS is `EPSG:4326` (also known as "WGS 84"), and it is a global latitude/longitude based reference system. This default CRS can be changed via the *CRS for New Projects* setting in the *CRS* tab under *Settings* ► *Options...* (see Fig.10.1). There is an option to automatically set the project's CRS to match the CRS of the first layer loaded into a new project, or alternatively you can select a different default CRS to use for all newly created projects. This choice will be saved for use in subsequent QGIS sessions.

The project CRS can also be set through the *CRS* tab of the *Project* ► *Properties...* dialog. It will also be shown in the lower-right of the QGIS status bar.

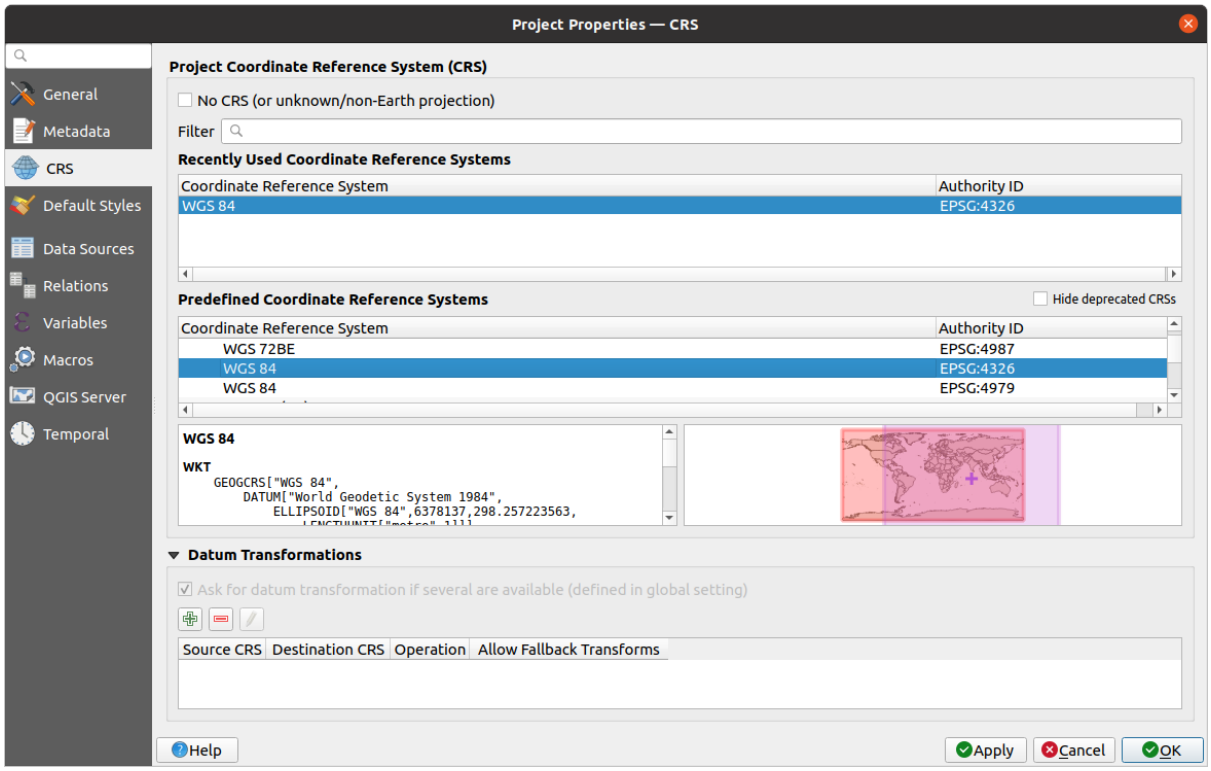


Figura10.2: Project Properties Dialog

As opções disponíveis são:

- *No CRS (or unknown/non-Earth projection)*: Checking this setting will disable ALL projection handling within the QGIS project, causing all layers and map coordinates to be treated as simple 2D Cartesian coordinates, with no relation to positions on the Earth's surface. It can be used to guess a layer CRS (based on

its raw coordinates or when using QGIS for non earth uses like role-playing game maps, building mapping or microscopic stuff. In this case:

  - No reprojection is done while rendering the layers: features are just drawn using their raw coordinates.
  - The ellipsoid is locked out and forced to `None/Planimetric`.
  - The distance and area units, and the coordinate display are locked out and forced to "unknown units"; all measurements are done in unknown map units, and no conversion is possible.

- or an existing coordinate reference system that can be *geographic*, *projected* or *user-defined*. A preview of the CRS extent on earth is displayed to help you select the appropriate one. Layers added to the project are translated on-the-fly to this CRS in order to overlay them regardless their original CRS. Use of units and ellipsoid setting are available and make sense and you can perform calculations accordingly.

Whenever you select a new CRS for your QGIS project, the measurement units will automatically be changed in the *General* tab of the *Project properties* dialog (*Project* ► *Properties...*) to match the selected CRS. For instance, some CRSs define their coordinates in feet instead of meters, so setting your QGIS project to one of these CRSs will also set your project to measure using feet by default.

Dica: Setting the project CRS from a layer

You can assign a CRS to the project using a layer CRS:

1. In the *Layers* panel, right-click on the layer you want to pick the CRS
2. Select *Set project CRS from Layer*.

The project's CRS is redefined using the layer's CRS. Map canvas extent, coordinates display are updated accordingly and all the layers in the project are on-the-fly translated to the new project CRS.

10.4 Coordinate Reference System Selector

This dialog helps you assign a Coordinate Reference System to a project or a layer, provided a set of projection databases. Items in the dialog are:

- **Filter**: If you know the EPSG code, the identifier, or the name for a Coordinate Reference System, you can use the search feature to find it. Enter the EPSG code, the identifier or the name.
- **Recently used coordinate reference systems**: If you have certain CRSs that you frequently use in your everyday GIS work, these will be displayed in this list. Click on one of these items to select the associated CRS.
- **Coordinate reference systems of the world**: This is a list of all CRSs supported by QGIS, including Geographic, Projected and Custom coordinate reference systems. To define a CRS, select it from the list by expanding the appropriate node and selecting the CRS. The active CRS is preselected.
- **PROJ text**: This is the CRS string used by the PROJ projection engine. This text is read-only and provided for informational purposes.

The CRS selector also shows a rough preview of the geographic area for which a selected CRS is valid for use. Many CRSs are designed only for use in small geographic areas, and you should not use these outside of the area they were designed for. The preview map shades an approximate area of use whenever a CRS is selected from the list. In addition, this preview map also shows an indicator of the current main canvas map extent.

10.5 Sistema de Referência de Coordenadas personalizado

If QGIS does not provide the coordinate reference system you need, you can define a custom CRS. To define a CRS, select *Custom CRS...* from the *Settings* menu. Custom CRSs are stored in your QGIS user database. In addition to your custom CRSs, this database also contains your spatial bookmarks and other custom data.

Defining a custom CRS in QGIS requires a good understanding of the PROJ projection library. To begin, refer to "Cartographic Projection Procedures for the UNIX Environment - A User's Manual" by Gerald I. Evenden, U.S. Geological Survey Open-File Report 90-284, 1990 (available at https://pubs.usgs.gov/of/1990/of90-284/ofr90-284.pdf).

This manual describes the use of `proj` and related command line utilities. The cartographic parameters used with `proj` are described in the user manual and are the same as those used by QGIS.

A janela *Definição de Sistema de Referência de Coordenadas personalizado* exige apenas dois parâmetros para definir um SRC ao usuário:

1. Um nome descritivo
2. The cartographic parameters in PROJ or WKT format

To create a new CRS:

1. Click the Add new CRS button
2. Enter a descriptive name
3. Select the format: it can be *Proj String* or *WKT*
4. Add the CRS *Parameters*.

   Nota: Prefer storing the CRS definition in WKT format

   Although both `Proj String` and `WKT` formats are supported, it's highly recommended to store projection definitions in the WKT format. Therefore, if the available definition is in the proj format, select that format, enter the parameters and then switch to WKT format. QGIS will convert the definition to the WKT format that you can later save.

5. Click *Validate* to test whether the CRS definition is an acceptable projection definition.

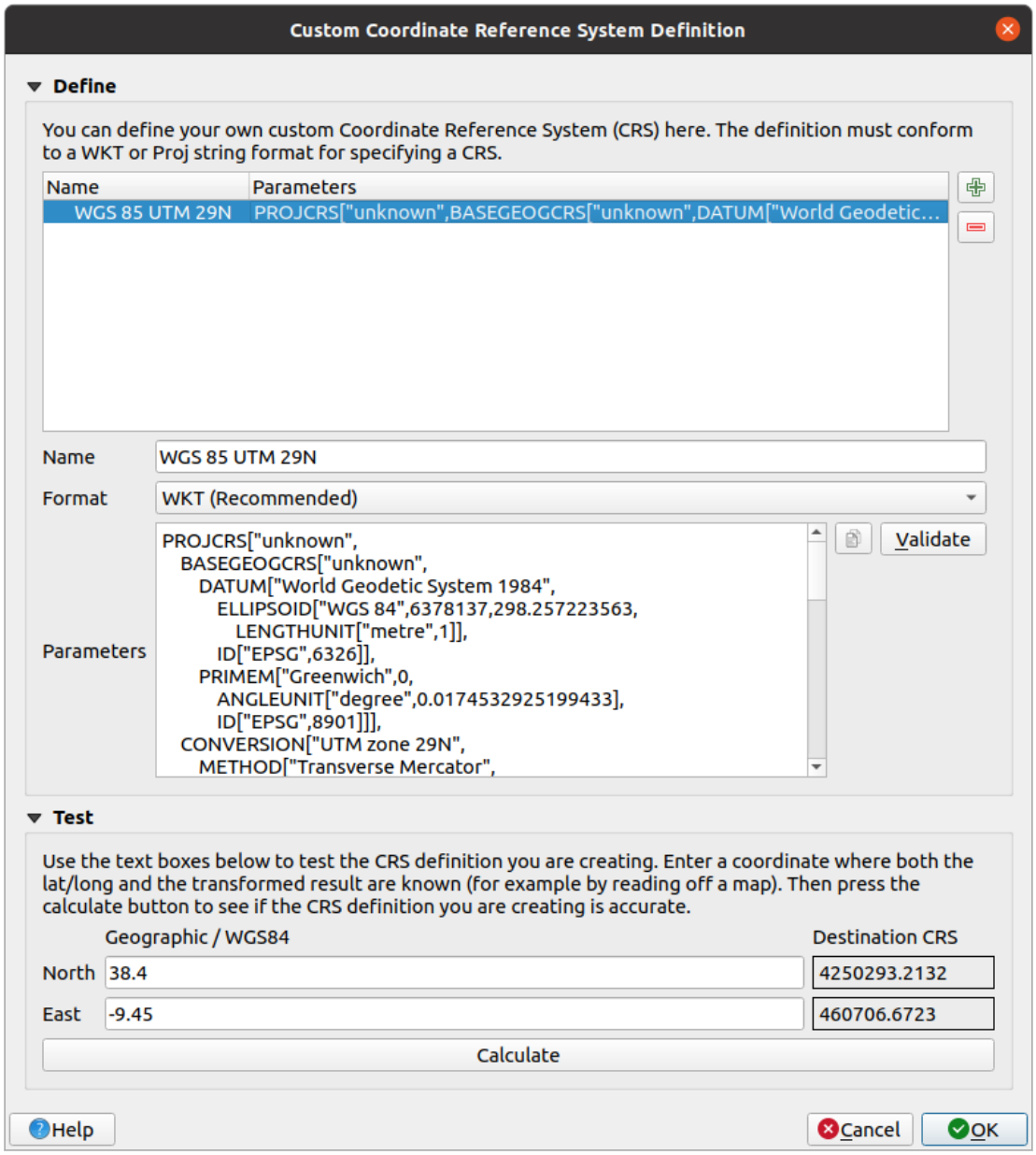


Figura10.3: Custom CRS Dialog

You can test your CRS parameters to see if they give sane results. To do this, enter known WGS 84 latitude and longitude values in *North* and *East* fields, respectively. Click on *Calculate*, and compare the results with the known values in your coordinate reference system.

10.5.1 Integrate an NTv2-transformation in QGIS

To integrate an NTv2 transformation file in QGIS you need one more step:

1. Place the NTv2 file (.gsb) in the CRS/Proj folder that QGIS uses (e.g. `C:\OSGeo4W64\share\proj` for windows users)
2. Add **nadgrids** (`+nadgrids=nameofthefile.gsb`) to the Proj definition in the *Parameters* field of the *Custom Coordinate Reference System Definition* (*Settings* ► *Custom Projections...*).

Figura10.4: Setting an NTv2 transformation

10.6 Datum Transformations

In QGIS, 'on-the-fly' CRS transformation is enabled by default, meaning that whenever you use layers with different coordinate systems QGIS transparently reprojects them to the project CRS. For some CRS, there are a number of possible transforms available to reproject to the project's CRS!

By default, QGIS will attempt to use the most accurate transformation available. However, in some cases this may not be possible, e.g. whenever additional support files are required to use a transformation. Whenever a more accurate transformation is available, but is not currently usable, QGIS will show an informative warning message advising you of the more accurate transformation and how to enable it on your system. Usually, this requires download of an external package of transformation support files, and extracting these to the `proj` folder under your QGIS *user profile* folder.

If desired, QGIS can also prompt you whenever multiple possible transformations can be made between two CRSs, and allow you to make an informed selection of which is the most appropriate transformation to use for your data.

This customization is done in the *Settings* ► *Options* ► *Transformations* tab menu under the *Default datum transformations* group:

- using *Ask for datum transformation if several are available*: when more than one appropriate datum transformation exist for a source/destination CRS combination, a dialog will automatically be opened prompting users to choose which of these datum transformations to use for the project. If the *Make default* checkbox is ticked when selecting a transformation from this dialog, then the choice is remembered and automatically applied to any newly created QGIS projects.
- or defining a list of appropriate datum transformations to use as defaults when loading a layer to a project or reprojecting a layer.

  Use the button to open the *Select Datum Transformations* dialog. Then:

  1. Choose the *Source CRS* of the layer, using the drop-down menu or the Select CRS widget.
  2. Provide the *Destination CRS* in the same way.
  3. A list of available transformations from source to destination will be shown in the table. Clicking a row shows details on the settings applied and the corresponding accuracy and area of use of the transformation.

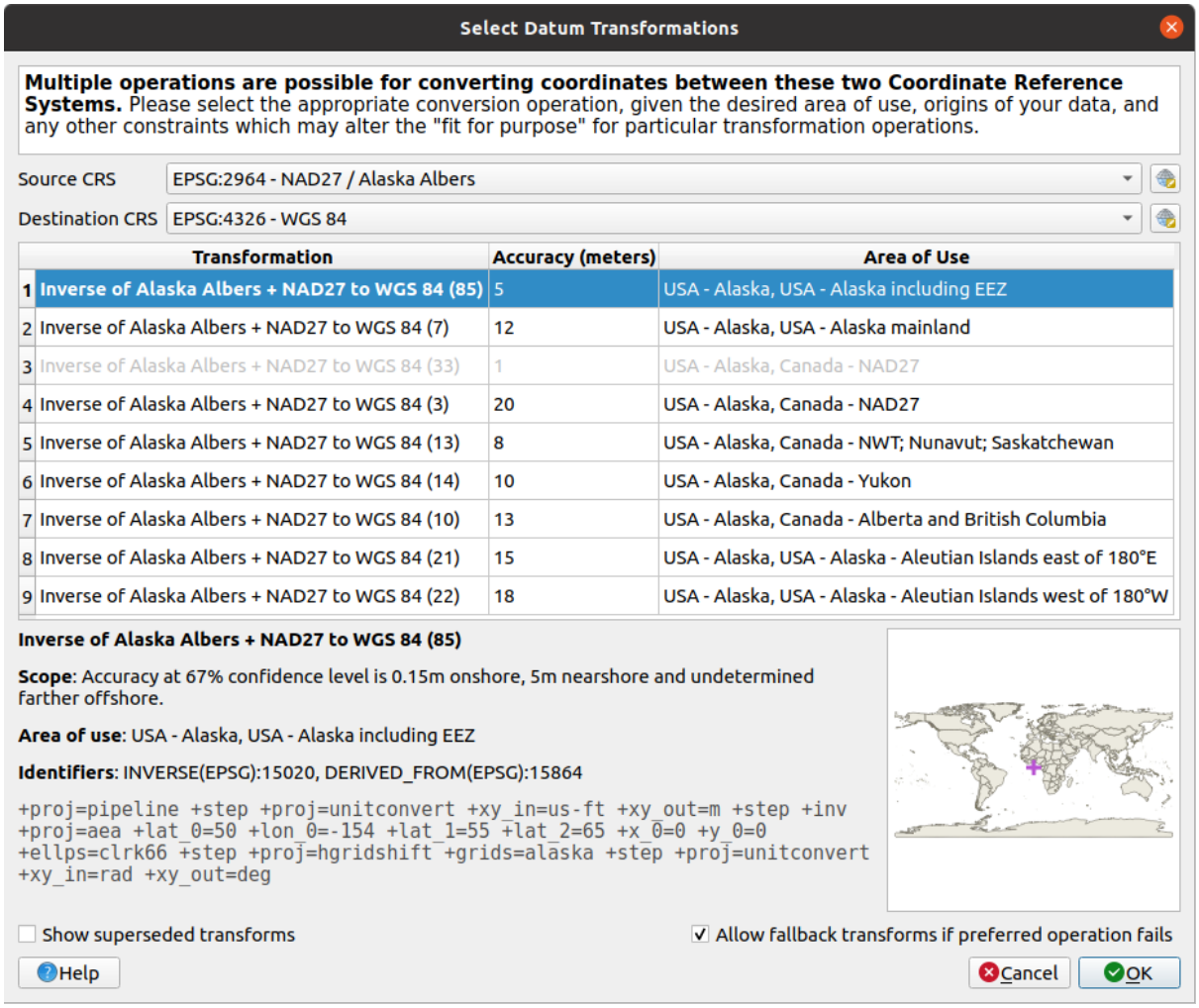


Figura10.5: Selecting a preferred default datum transformation

In some cases a transformation may not be available for use on your system. In this case, the transformation will still be shown (greyed) in this list but can not be picked until you install the required package of transformation support. Usually, a button is provided to download and install the corresponding grid, which is then stored under the `proj` folder in the active *user profile* directory.

4. Find your preferred transformation and select it
5. Set whether you *Allow fallback transforms if preferred operation fails*
6. Click *OK*.

   A row is added to the table under *Default Datum Transformations* with information about the *Source CRS*, the *Destination CRS*, the *Operation* applied for the transformation and whether *Allow fallback Transforms* is enabled.

From now, QGIS automatically uses the selected datum transformations for further transformation between these two CRSs until you remove it ( ) from the list or change the entry ( ) in the list.

Datum transformations set in the *Settings* ► *Options* ► *Transformations* tab will be inherited by all new QGIS projects created on the system. Additionally, a particular project may have its own specific set of transformations specified via the *CRS* tab of the *Project properties* dialog (*Project* ► *Properties…*). These settings apply to the current project only.

CAPÍTULO 11

Ferramentas Gerais

11.1 Conteúdo da ajuda

Sempre que precisar de ajuda sobre um tópico específico, você pode acessar a página correspondente no Manual do Usuário atual, através do botão *Ajuda*, disponível na maioria das caixas de diálogo — por favor, observe que plugins de terceiros podem apontar para páginas da web dedicadas.

11.2 Painéis

By default, QGIS provides many panels to work with. Some of these panels are described below while others may be found in different parts of the document. A complete list of default panels provided by QGIS is available via the *View* ► *Panels* ► menu and mentioned at *Painéis*.

11.2.1 Painel Camadas

The *Layers* panel (also called the `map legend`) lists all the layers in the project and helps you manage their visibility. You can show or hide it by pressing `Ctrl+1`. A layer can be selected and dragged up or down in the legend to change the Z-ordering. Z-ordering means that layers listed nearer the top of the legend are drawn over layers listed lower down in the legend.

Nota: The Z-ordering behavior can be overridden by the *Layer Order* panel.

At the top of the Layers panel, a toolbar allows you to:

-  Open the layer styling dock (F7): toggle the layer styling panel on and off.
-  Add new group
-  Manage Map Themes: control visibility of layers and arrange them in different map themes.
-  Filter Legend by Map Content: only the layers that are set visible and whose features intersect the current map canvas have their style rendered in the layers panel. Otherwise, a generic NULL symbol is applied to the layer.

Based on the layer symbology, this is a convenient way to identify which kind of features from which layers cover your area of interest.

- Filter Legend by Expression: apply an expression to remove styles from the selected layer tree that have no feature satisfying the condition. This can be used to highlight features that are within a given area/feature of another layer. From the drop-down list, you can edit and clear the expression currently applied.
- Expand All or Collapse All layers and groups in the layers panel.
- Remove Layer/Group currently selected.

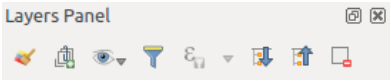


Figura11.1: Layer Toolbar in Layers Panel

Nota: Tools to manage the layers panel are also available for map and legend items in print layouts

Configuring map themes

The Manage Map Themes drop-down button provides access to convenient shortcuts to manipulate visibility of the layers in the *Layers* panel:

- *Mostrar Todas as Camadas*
- *Ocultar Todas as Camadas*
- *Mostrar Camadas Selecionadas*
- *Ocultar Camadas Selecionadas*
- *Toggle Selected Layers*: changes the visibility of the first selected layer in the panel, and applies that state to the other selected layers. Also accesible through `Space` shortcut.
- *Toggle Selected Layers Independently*: changes the visibility status of each selected layer
- *Ocultar Camadas Não Selecionadas*

Beyond the simple control of layer visibility, the Manage Map Themes menu allows you to configure **Map Themes** in the legend and switch from one map theme to another. A map theme is a **snapshot** of the current map legend that records:

- the layers set as visible in the *Layers* panel
- **and** for each visible layer:
  - the reference to the *style* applied to the layer
  - the visible classes of the style, ie the layer checked node items in the *Layers panel*. This applies to *symbologies* other than the single symbol rendering
  - the collapsed/expanded state of the layer node(s) and the group(s) it's placed inside

To create a map theme:

1. Check a layer you want to show
2. Configure the layer properties (symbology, diagram, labels…) as usual

3. Expand the *Style* ► menu at the bottom and click on *Add…* to store the settings as *a new style embedded in the project*

   Nota: A map theme does not remember the current details of the properties: only a reference to the style name is saved, so whenever you apply modifications to the layer while this style is enabled (eg change the symbology rendering), the map theme is updated with new information.

4. Repeat the previous steps as necessary for the other layers
5. If applicable, expand or collapse groups or visible layer nodes in the *Layers* panel
6. Click on the Manage Map Themes button on top of the panel, and *Add Theme…*
7. Enter the map theme's name and click *OK*

The new theme is listed in the lower part of the drop-down menu.

You can create as many map themes as you need: whenever the current combination in the map legend (visible layers, their active style, the map legend nodes) does not match any existing map theme contents as defined above, click on *Add Theme…* to create a new map theme, or use *Replace Theme* ► to update a map theme. You can rename the active map theme with *Rename Current Theme…* or use the *Remove Current Theme* button to delete it.

Map themes are helpful to switch quickly between different preconfigured combinations: select a map theme in the list to restore its combination. All configured themes are also accessible in the print layout, allowing you to create different map items based on specific themes and independent of the current main canvas rendering (see *Map item layers*).

Overview of the context menu of the Layers panel

At the bottom of the toolbar, the main component of the Layers panel is the frame listing vector or raster layers added to the project, optionally organized in groups. Depending on the item selected in the panel, a right-click shows a dedicated set of options presented below.

Opção	Camada Vetorial	Camada Raster	Grupo
Zoom to Layer/Group	✓	✓	✓
Zoom to Selection	✓		
Mostrar em Visão Geral	✓	✓	
Show Feature Count	✓		
Copy Layer/Group	✓	✓	✓
Rename Layer/Group	✓	✓	✓
Zoom to Native Resolution (100%)		✓	
Stretch Using Current Extent		✓	
Atualizar Camada SQL…	✓		
Add Group			✓
Duplicate Layer	✓	✓	
Remove Layer/Group…	✓	✓	✓
Move Out of Group	✓	✓	
Move to Top	✓	✓	✓
Move to Bottom	✓	✓	✓
Check and all its Parents	✓	✓	

continua na próxima página

Tabela 11.1 – continuação da página anterior

Opção	Camada Vetorial	Camada Raster	Grupo
Group Selected	☑	☑	
Abrir Tabela de Atributos	☑		
Alternar Edição	☑		
Edições Atuais ►	☑		
Filtrar…	☑		
Change Data Source…	☑		
Repair Data Source…	☑		
Actions on selections ► (in edit mode)	☑		
► *Duplicate Feature*	☑		
► *Duplicate Feature and Digitize*	☑		
Set Layer Scale Visibility…	☑	☑	
Zoom para escala visível	☑	☑	
Set CRS ►	☑	☑	
► *Set Layer/Group CRS…*	☑	☑	☑
► *Set Project CRS from Layer*	☑	☑	
Set Group WMS Data…			☑
Mutually Exclusive Group			☑
Check and all its children (Ctrl-click)			☑
Uncheck and all its children (Ctrl-click)			☑
Make Permanent	☑		
Exportar ►	☑	☑	☑
► *Save As…*		☑	
► *Save Features As…*	☑		
► *Save Selected Features As…*	☑		
► *Save As Layer Definition File…*	☑	☑	☑
► *Save As QGIS Layer Style File…*	☑	☑	
Estilos ►	☑	☑	
► *Copy Style*	☑	☑	
► *Paste Style*	☑	☑	☑
► *Add…*	☑	☑	
► *Rename Current…*	☑	☑	
► *Edit symbol…*	☑		
► *Copy Symbol*	☑		
► *Paste Symbol*	☑		
Propriedades…	☑	☑	

Table: Context menu from Layers Panel items

For GRASS vector layers, Toggle editing is not available. See section *Digitalizando e editando uma camada vetorial GRASS* for information on editing GRASS vector layers.

Interagir com grupos e camadas

Layers in the legend window can be organized into groups. There are two ways to do this:

1. Press the  icon to add a new group. Type in a name for the group and press `Enter`. Now click on an existing layer and drag it onto the group.
2. Select some layers, right-click in the legend window and choose *Group Selected*. The selected layers will automatically be placed in a new group.

To move a layer out of a group, drag it out, or right-click on it and choose *Move Out of Group*: the layer is moved from the group and placed above it. Groups can also be nested inside other groups. If a layer is placed in a nested group, *Move Out of Group* will move the layer out of all nested groups.

To move a group or layer to the top of the layer panel, either drag it to the top, or choose *Move to Top*. If you use this option on a layer nested in a group, the layer is moved to the top in its current group. The *Move to Bottom* option follows the same logic to move layers and groups down.

The checkbox for a group will show or hide the checked layers in the group with one click. With `Ctrl` pressed, the checkbox will also turn on or off all the layers in the group and its sub-groups.

`Ctrl`-click on a checked / unchecked layer will uncheck / check the layer and all its parents.

Enabling the **Mutually Exclusive Group** option means you can make a group have only one layer visible at the same time. Whenever a layer within the group is set visible the others will be toggled not visible.

É possível selecionar mais de uma camada ou grupo ao mesmo tempo mantendo pressionada a tecla `Ctrl` enquanto clica em camadas adicionais. Você pode mover todas as camadas selecionadas para um novo grupo ao mesmo tempo.

You may also delete more than one layer or group at once by selecting several items with the `Ctrl` key and then pressing `Ctrl+D`: all selected layers or groups will be removed from the layers list.

More information on layers and groups using indicator icon

In some circumstances, icons appears next to the layer or group in the *Layers* panel to give more information about the layer/group. These symbols are:

-  to indicate that the layer is in edit mode and you can modify the data
-  to indicate that the layer being edited has some unsaved changes
-  to indicate *a filter* applied to the layer. Hover over the icon to see the filter expression and double-click to update the setting
-  to identify layers that are *required* in the project, hence non removable
-  to identify an *embedded group or layer* and the path to their original project file
-  to identify a layer whose data source was not available at the project file opening (see *Handling broken file paths*). Click the icon to update the source path or select *Repair Data Source…* entry from the layer contextual menu.
-  to remind you that the layer is a *temporary scratch layer* and its content will be discarded when you close this project. To avoid data loss and make the layer permanent, click the icon to store the layer in any of the OGR vector formats supported by QGIS.
-  to identify a layer that has no/unknown CRS
-  to identify a temporal layer controlled by canvas animation

Editar o estilo da camada vetorial

From the Layers panel, you have shortcuts to change the layer rendering quickly and easily. Right-click on a vector layer and select *Styles* ► in the list in order to:

- see the *styles* currently applied to the layer. If you defined many styles for the layer, you can switch from one to another and your layer rendering will automatically be updated on the map canvas.
- copy part or all of the current style, and when applicable, paste a copied style from another layer

  Dica: Partilhe rapidamente um estilo de camada

  From the context menu, copy the style of a layer and paste it to a group or a selection of layers: the style is applied to all the layers that are of the same type (vector/raster) as the original layer and, for vector layers, have the same geometry type (point, line or polygon).

- rename the current style, add a new style (which is actually a copy of the current one) or delete the current style (when multiple styles are available).

Nota: The previous options are also available for raster or mesh layers.

- update the *symbol color* using a **Color Wheel**. For convenience, the recently used colors are also available at the bottom of the color wheel.
- *Edit Symbol…*: open the *Symbol Selector* dialog and change feature symbol (symbol, size, color…).

When using a classification symbology type (based on *categorized*, *graduated* or *rule-based*), the aforementioned symbol-level options are available from the class entry context menu. Also provided are the *Toggle Items*, *Show All Items* and *Hide All Items* entries to switch the visibility of all the classes of features. These avoid (un)checking items one by one.

Dica: Double-clicking a class leaf entry also opens the *Symbol Selector* dialog.

11.2.2 Painel de Estilo de Camada

O painel *Estilo de Camada* (também ativado com `Ctrl+3`) é um atalho para algumas das funcionalidades da caixa de diálogo *Pripriedades da Camada*. Ele fornece uma maneira rápida e fácil de definir a renderização e o comportamento de uma camada e visualizar seus efeitos sem precisar abrir a caixa de diálogo de propriedades da camada.

In addition to avoiding the blocking (or "modal") layer properties dialog, the layer styling panel also avoids cluttering the screen with dialogs, and contains most style functions (color selector, effects properties, rule edit, label substitution…): e.g., clicking color buttons inside the layer style panel causes the color selector dialog to be opened inside the layer style panel itself rather than as a separate dialog.

From a drop-down list of current layers in the layer panel, select an item and:

- Depending on the layer type, set:
  - *Symbology*, *Transparency*, and *Histogram* properties for raster layer. These options are the same as in the *Caixa de Diálogo de Propriedades do Raster*.
  - *Symbology*, *Labels*, *Mask* and *3D View* properties for vector layer. These options are the same as in the *Janela de Propriedades de Vetor* and can be extended by custom properties introduced by third-party plugins.

  -  *Symbology* and  *3D View* properties for mesh layer. These options are the same as in the *Mesh Dataset Properties*.

- Manage the associated style(s) in the  *Style Manager* (more details at *Gerir Estilos Personalizados*).
- See the  *History* of changes you applied to the layer style in the current project: you can therefore cancel or restore to any state by selecting it in the list and clicking *Apply*.

For Vector Tile layers there is an option to show  *Visible rules only*. This is very useful if you just want to work with rules that fall inside the current map canvas zoom level.

Another powerful feature of this panel is the  *Live update* checkbox. Tick it to render your changes immediately on the map canvas: you no longer need to click the *Apply* button.

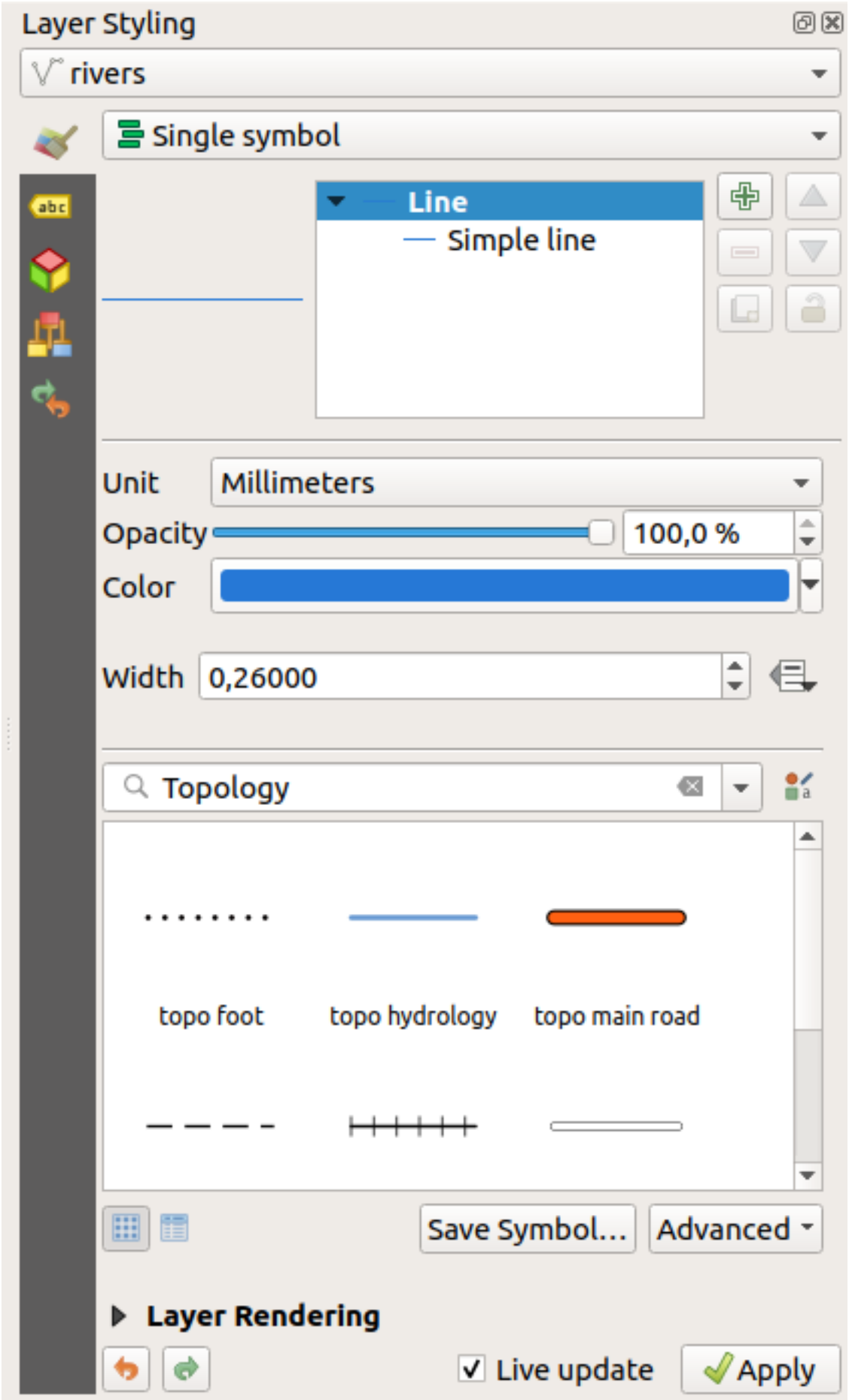


Figura11.2: Defining a layer's symbology from the layer styling panel

11.2.3 O painel Ordem das Camadas

By default, layers shown on the QGIS map canvas are drawn following their order in the *Layers* panel: the higher a layer is in the panel, the higher (hence, more visible) it'll be in the map view.

You can define a drawing order for the layers independent of the order in the layers panel with the *Layer Order* panel enabled in *View* ► *Panels* ► menu or with `Ctrl+9`. Check *Control rendering order* underneath the list of layers and reorganize the layers in the panel as you want. This order becomes the one applied to the map canvas. For example, in Fig.11.3, you can see that the `airports` features are displayed over the `alaska` polygon despite those layers' respective placement in the Layers panel.

Unchecking *Control rendering order* will revert to default behavior.

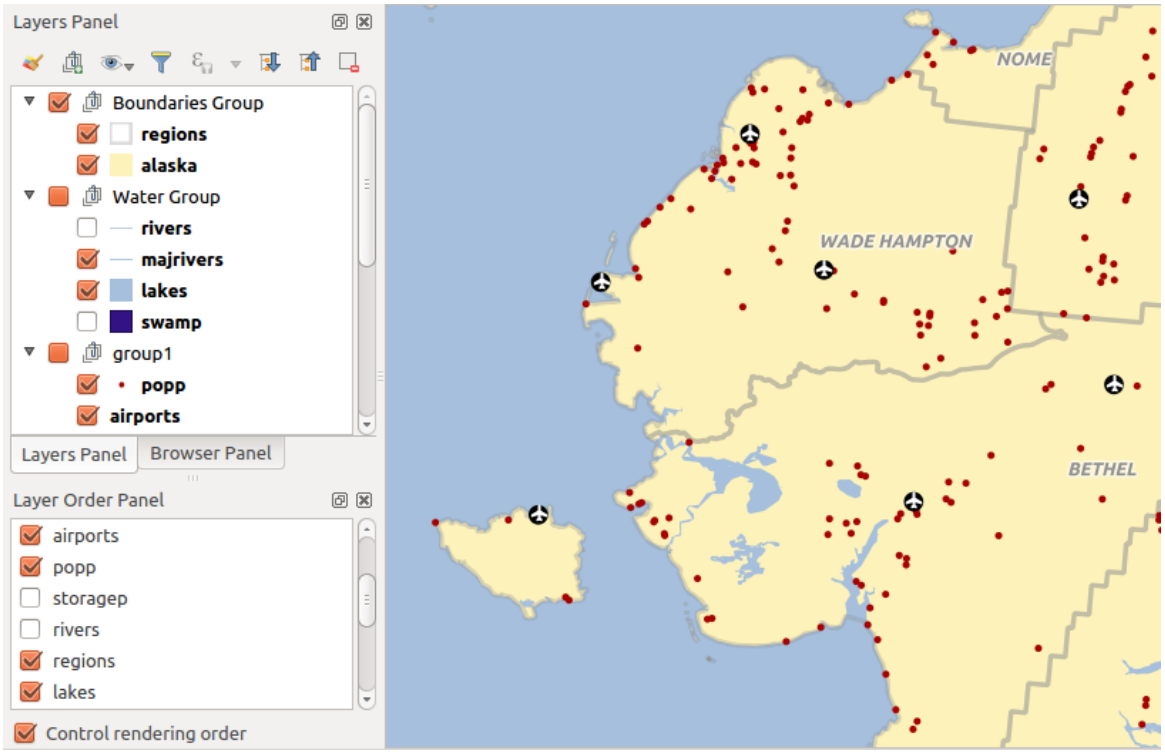


Figura11.3: Define a layer order independent of the legend

11.2.4 O painel Vista Geral

The *Overview* panel (`Ctrl+8`) displays a map with a full extent view of some of the layers. The Overview map is filled with layers using the *Show in Overview* option from the *Layer* menu or in the layer contextual menu. Within the view, a red rectangle shows the current map canvas extent, helping you quickly to determine which area of the whole map you are currently viewing. If you click-and-drag the red rectangle in the overview frame, the main map view extent will update accordingly.

Note that labels are not rendered to the map overview even if the layers used in the map overview have been set up for labeling.

11.2.5 O painel Registo de Mensagens

When loading or processing some operations, you can track and follow messages that appear in different tabs using the  *Log Messages Panel*. It can be activated using the most right icon in the bottom status bar.

11.2.6 O painel Desfazer/Refazer

For each layer being edited, the *Undo/Redo* (`Ctrl+5`) panel shows the list of actions carried out, allowing you quickly to undo a set of actions by selecting the action listed above. More details at *Undo and Redo edits*.

11.2.7 O painel Estatísticas

The *Statistics* panel (`Ctrl+6`) provides summarized information on any vector layer. This panel allows you to select:

- the vector layer to compute the statistics on
- the column to use, or an  *expression*
- the statistics to return using the drop-down button at the bottom-right of the dialog. Depending on the field's (or expression's values) type, available statistics are:

Estatísticas	String	Número inteiro	Float	Data
Contagem	☑	☑	☑	☑
Count Distinct Value	☑			☑
Count Missing value	☑	☑	☑	☑
Soma		☑	☑	
Média		☑	☑	☑
Desvio Padrão		☑	☑	
Desvio Padrão na Amostra		☑	☑	
Valor mínimo	☑	☑	☑	☑
Valor máximo	☑	☑	☑	☑
Intervalo		☑	☑	☑
Minoria	☑	☑	☑	
Maioria	☑	☑	☑	
Variety		☑	☑	
Primeiro Quartil		☑	☑	
Terceiro Quartil		☑	☑	
Inter Quartile Range		☑	☑	
Comprimento Mínimo	☑			
Comprimento Máximo	☑			
Mean Length	☑			

Table: Statistics available for each field type

The statistical summary can be:

- returned for the whole layer or  *selected features only*

- recalculated using the button when the underlying data source changes (eg, new or removed features/fields, attribute modification)
- copied to the clipboard and pasted as a table in another application

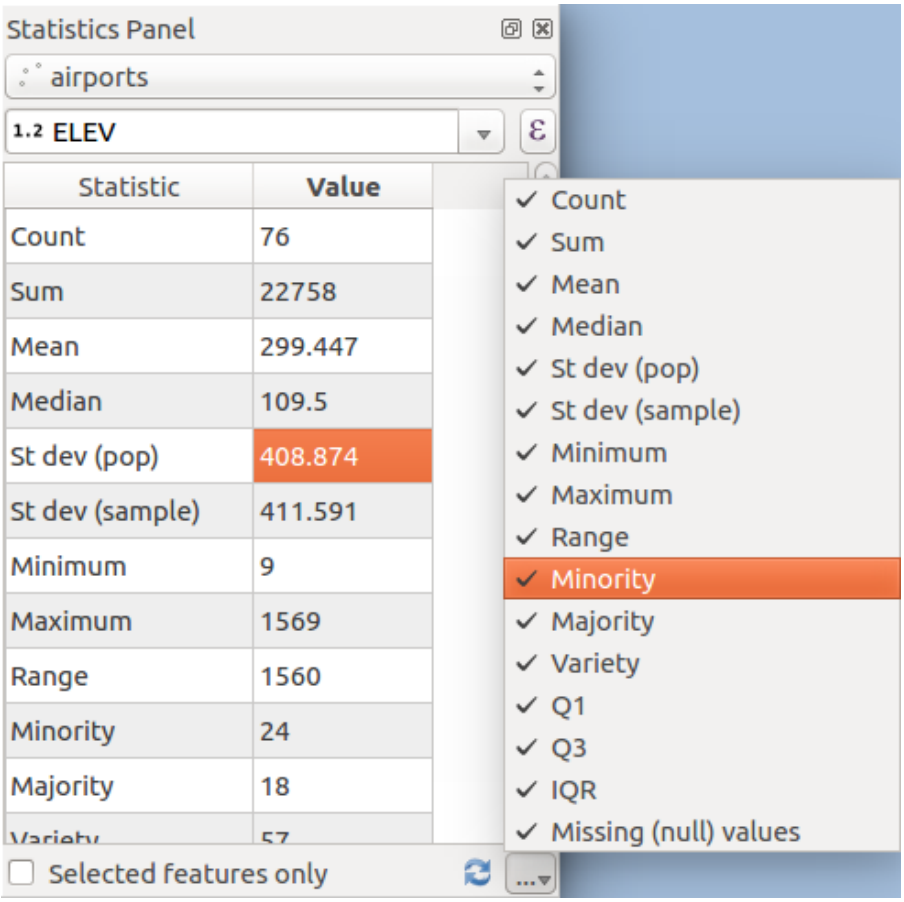


Figura11.4: Show statistics on a field

11.3 Projetos animados

Sometimes, you'd like to keep some layers in different projects, but with the same style. You can either create a *default style* for these layers or embed them from another project to save time and effort.

Embed layers and groups from an existing project has some advantages over styling:

- All types of layers (vector or raster, local or online…) can be added
- Fetching groups and layers, you can keep the same tree structure of the "background" layers in your different projects
- While the embedded layers are editable, you can't change their properties such as symbology, labels, forms, default values and actions, ensuring consistency across projects
- Modifique os itens no projeto original e as alterações são propagadas para todos os outros projetos

If you want to embed content from other project files into your project, select *Layer* ► *Embed Layers and Groups*:

1. Click the … button to look for a project: you can see the content of the project (see Fig.11.5)
2. Hold down `Ctrl` (or `Cmd`) and click on the layers and groups you wish to retrieve

3. Clique *OK*.

The selected layers and groups are embedded in the *Layers* panel and displayed on the map canvas. An icon is added next to their name for recognition and hovering over displays a tooltip with the original project file path.

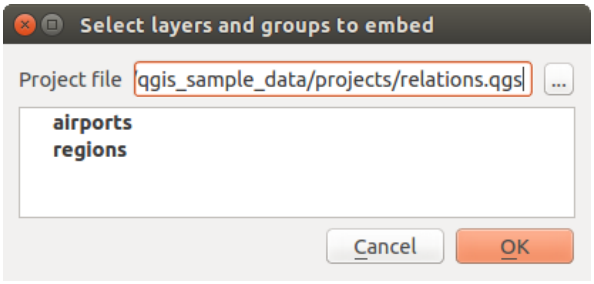


Figura11.5: Select layers and groups to embed

Like any other layer, an embedded layer can be removed from the project by right-clicking on the layer and clicking Remove.

Dica: Change rendering of an embedded layer

It's not possible to change the rendering of an embedded layer, unless you make the changes in the original project file. However, right-clicking on a layer and selecting *Duplicate* creates a layer which is fully-featured and not dependent on the original project. You can then safely remove the linked layer.

11.4 Working with the map canvas

11.4.1 Renderização

By default, QGIS renders all visible layers whenever the map canvas is refreshed. The events that trigger a refresh of the map canvas include:

- adding a layer
- panning or zooming
- redimensionando a janela QGIS
- changing the visibility of a layer or layers

QGIS permite controlar o processo de renderização de várias formas.

Escala dependente da renderização

Scale-dependent rendering allows you to specify the minimum and maximum scales at which a layer (raster or vector) will be visible. To set scale-dependent rendering, open the *Properties* dialog by double-clicking on the layer in the legend. On the *Rendering* tab, tick *Scale dependent visibility* and enter the *Minimum (exclusive)* and *Maximum (inclusive)* scale values.

You can also activate scale dependent visibility on a layer from the Layers panel. Right-click on the layer and in the context menu, select *Set Layer Scale Visibility*.

The Set to current canvas scale button allow you to use the current map canvas scale as boundary of the range visibility.

Nota: When a layer is not rendered in the map canvas because the map scale is out of its visibility scale range, the layer is greyed in the Layers panel and a new option *Zoom to Visible Scale* appears in the layer context menu. Select it and the map is zoomed to the layer's nearest visibility scale.

Controlando a renderização do mapa

Map rendering can be controlled in various ways, as described below.

Suspensão de edição

To suspend rendering, click the *Render* checkbox in the bottom-right corner of the status bar. When *Render* is not checked, QGIS does not redraw the canvas in response to any of the events described in the section *Renderização*. Examples of when you might want to suspend rendering include:

- adding many layers and symbolizing them prior to drawing
- adding one or more large layers and setting scale dependency before drawing
- adding one or more large layers and zooming to a specific view before drawing
- any combination of the above

Caixa de seleção :guilabel: caixa de seleção *Renderizar* permite renderização e causa uma atualização imediata na tela do mapa.

Opções de adicionar configurações da camada

Você pode definir uma opção para sempre carregar novas camadas sem desenhá-las. Isso significa que a camada será adicionada ao mapa, mas sua caixa de seleção de visibilidade na legenda estará desmarcada por padrão. Para definir esta opção, escolha a opção de menu *Configurações* ► *Opções* e clique na guia *Renderizar*. Desmarque *Por padrão, novas camadas adicionadas ao mapa devem ser exibidas*. Qualquer camada adicionada posteriormente ao mapa ficará desativada (invisível) por padrão.

Parar rendirização

To stop the map drawing, press the `Esc` key. This will halt the refresh of the map canvas and leave the map partially drawn. It may take a bit of time between pressing `Esc` for the map drawing to halt.

Influência da qualidade da edição

QGIS has an option to influence the rendering quality of the map. Choose menu option *Settings* ► *Options*, click on the *Rendering* tab and select or deselect *Make lines appear less jagged at the expense of some drawing performance*.

Acelerando a visualização

There are some settings that allow you to improve rendering speed. Open the QGIS options dialog using *Settings* ► *Options*, go to the *Rendering* tab and select or deselect the following checkboxes:

- *Use render caching where possible to speed up redraws*.
- *Render layers in parallel using many CPU cores* and then set the *Max cores to use*.
- The map renders in the background onto a separate image and each *Map Update interval*, the content from this (off-screen) image will be taken to update the visible screen representation. However, if rendering finishes faster than this duration, it will be shown instantaneously.
- With *Enable Feature simplification by default for newly added layers*, you simplify features' geometry (fewer nodes) and as a result, they display more quickly. Be aware that this can cause rendering inconsistencies.

11.4.2 Ampliar e Deslocar

There are multiple ways to zoom and pan to an area of interest. You can use the *Map Navigation* toolbar, the mouse and keyboard on the map canvas and also the menu actions from the *View* menu and the layers' contextual menu in the *Layers* panel.

Icon	Label	Usage	View menu	Map Navigation Toolbar	Layer Contextual Menu
	Pan Map	When activated, left click anywhere on the map canvas to pan the map at the cursor position. You can also pan the map by holding down the left mouse button and dragging the map canvas.	☑	☑	
	Zoom In	When activated, left click anywhere on the map canvas to zoom in one level. The mouse cursor position will be the center of the zoomed area of interest. You can also zoom in to an area by dragging a rectangle on the map canvas with the left mouse button.	☑	☑	
	Zoom Out	When activated, left click anywhere on the map canvas to zoom out one level. The mouse cursor position will be the center of the zoomed area of interest. You can also zoom out from an area by dragging a rectangle on the map canvas with the left mouse button.	☑	☑	
	Pan Map to Selection	Pan the map to the active layer's selected features.	☑	☑	
	Zoom To Selection	Zoom to the active layer's selected features.	☑	☑	☑
	Zoom To Layer	Zoom to the active layer's extent.	☑	☑	☑
	Zoom Full	Zoom to the extent of all the layers in the project.	☑	☑	
	Zoom Last	Zoom the map to the previous extent in history.	☑	☑	
	Zoom Next	Zoom the map to the next extent in history.	☑	☑	
	Zoom to Native Resolution	Zoom the map to a level where one pixel of the active raster layer covers one screen pixel.	☑	☑	☑

A *Zoom factor* can be set under the *Settings* ► *Options* ► *Map tools* menu to define the scale behavior while zooming. There, you can also set a list of *Predefined Scales* that will be available at the bottom of the map canvas.

With the Mouse on the Map Canvas

In addition to using the  Pan  Zoom In and  Zoom Out tools described above, you can hold the mouse wheel inside of the map canvas and drag the mouse cursor (on macOS, you may need to hold down the `cmd` key). You can also roll the mouse wheel to zoom in and out on the map. The mouse cursor position will be the center of the zoomed area of interest. Holding down `Ctrl` while rolling the mouse wheel results in a finer zoom.

With the Keyboard on the Map Canvas

Holding down `spacebar` on the keyboard and moving the mouse cursor will pan the map the same way dragging the map canvas with  Pan does.

Panning the map is possible with the arrow keys. Place the mouse cursor inside the map area, and press on the arrow keys to pan up, down, left and right.

The `PgUp` and `PgDown` keys on the keyboard will cause the map display to zoom in or out following the zoom factor set. Pressing `Ctrl++` or `Ctrl+-` also performs an immediate zoom in/out on the map canvas.

When certain map tools are active (Identify, Measure…), you can perform a zoom by holding down `Shift` and dragging a rectangle on the map to zoom to that area. This is not enabled for selection tools (since they use `Shift` for adding to selection) or edit tools.

11.4.3 Favoritos Espaciais

Spatial Bookmarks allow you to "bookmark" a geographic location and return to it later. By default, bookmarks are saved in the user's profile (as *User Bookmarks*), meaning that they are available from any project the user opens. They can also be saved for a single project (named *Project Bookmarks*) and stored within the project file, which can be helpful if the project is to be shared with other users.

Novo Favorito

Para criar um novo favorito:

1. Zoom and pan to the area of interest.
2. Select the menu option *View* ►  *New Spatial Bookmark…*, press `Ctrl+B` or right-click the  *Spatial Bookmarks* entry in the *Browser* panel and select *New Spatial Bookmark*. The *Bookmark Editor* dialog opens.

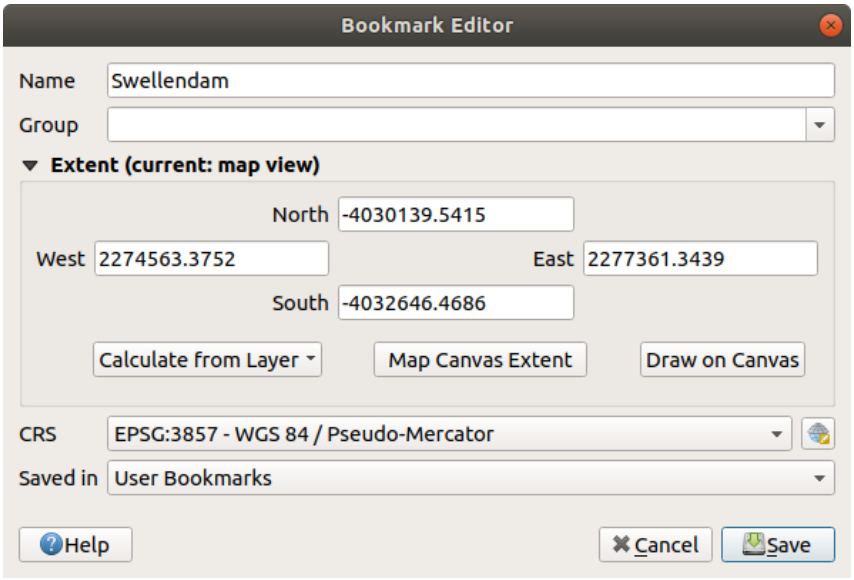


Figura11.6: The Bookmark Editor Dialog

3. Enter a descriptive name for the bookmark
4. Enter or select a group name in which to store related bookmarks
5. Select the extent of the area you wish to save, using the extent selector; the extent can be calculated from a loaded layer extent, the current map canvas or drawn over the current map canvas.
6. Indicate the *CRS* to use for the extent
7. Select whether the bookmark will be *Saved in User Bookmarks* or *Project Bookmarks*
8. Press *Save* to add the bookmark to the list

Note que você pode ter vários favoritos com o mesmo nome.

Trabalhando com favoritos

To use and manage bookmarks, you can either use the *Spatial Bookmarks* panel or *Browser*.

Select *View* ► *Show Spatial Bookmark Manager* or press `Ctrl+7` to open the *Spatial Bookmarks Manager* panel.
Select *View* ► *Show Bookmarks* or `Ctrl+Shift+B` to show the *Spatial Bookmarks* entry in the *Browser* panel.

You can perform the following tasks:

Task	Spatial Bookmark Manager	Navegador
Zoom to a Bookmark	Double-click on it, or select the bookmark and press the *Zoom to bookmark* button.	Double-click on it, drag and drop it to the map canvas, or right-click the bookmark and select *Zoom to Bookmark*.
Delete a bookmark	Select the bookmark and click the *Delete bookmark* button. Confirm your choice.	Right-click the bookmark and select *Delete Spatial Bookmark*. Confirm your choice.

continua na próxima página

Tabela 11.3 – continuação da página anterior

Task	Spatial Bookmark Manager	Navegador
Export bookmarks to XML	Click the *Import/Export Bookmarks* button and select *Export*. All the bookmarks (user or project) are saved in an xml file.	Select one or more folders (user or project) or subfolders (groups), then right-click and select *Export Spatial Bookmarks…*. The selected bookmark subset is saved.
Import bookmarks from XML	Click the *Import/Export Bookmarks* button and select *Import*. All bookmarks in the XML file are imported as user bookmarks.	Right-click the *Spatial Bookmarks* entry or one of its folders (user or project) or subfolders (groups) to determine where to import the bookmarks, then select *Import Spatial Bookmarks*. If performed on the *Spatial Bookmarks* entry, the bookmarks are added to *User Bookmarks*.
Edit bookmark	You can change a bookmark by changing the values in the table. You can edit the name, the group, the extent and if it is stored in the project or not.	Right-click the desired bookmark and select *Edit Spatial Bookmark…*. The *Bookmark Editor* will open, allowing you to redefine every aspect of the bookmark as if you were creating it for the first time. You can also drag and drop the bookmark between folders (user and project) and subfolders (groups).

You can also zoom to bookmarks by typing the bookmark name in the *locator*.

11.4.4 Decorações

Decorations include Grid, Title Label, Copyright Label, Image, North Arrow, Scale Bar and Layout Extents. They are used to 'decorate' the map by adding cartographic elements.

Malha

Grid allows you to add a coordinate grid and coordinate annotations to the map canvas.

1. Select menu option *View* ► *Decorations* ► *Grid…* to open the dialog.

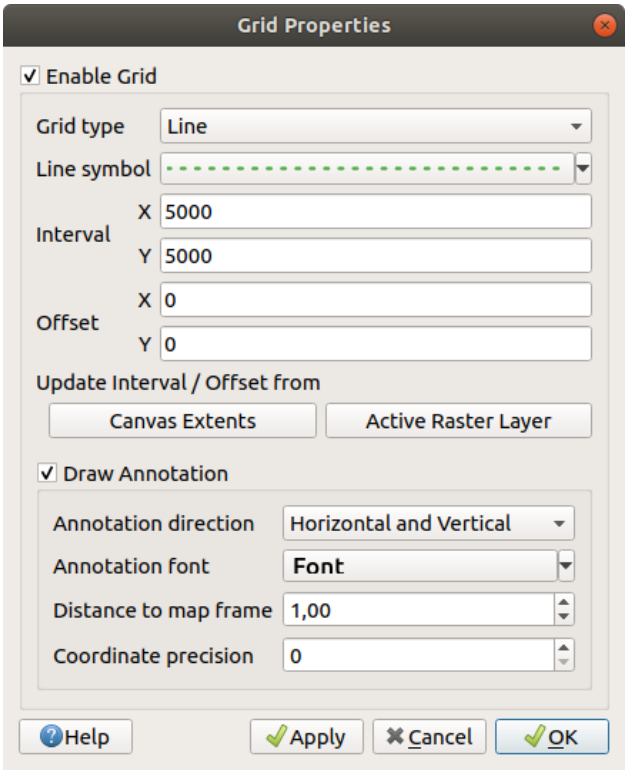


Figura11.7: The Grid Dialog

2. Tick *Enable grid* and set grid definitions according to the layers loaded in the map canvas:
   - The *Grid type*: it can be *Line* or *Marker*
   - The associated *Line symbol* or *marker symbol* used to represent the grid marks
   - The *Interval X* and *Interval Y* between the grid marks, in map units
   - An *Offset X* and *Offset Y* distance of the grid marks from the bottom left corner of the map canvas, in map units
   - The interval and offset parameters can be set based on the:
     - *Canvas Extents*: generates a grid with an interval that is approximatively 1/5 of the canvas width
     - *Active Raster Layer* resolution
3. Tick *Draw annotations* to display the coordinates of the grid marks and set:
   - The *Annotation direction*, ie how the labels would be placed relative to their grid line. It can be:
     - *Horizontal* or *Vertical* for all the labels
     - *Horizontal and Vertical*, ie each label is parallel to the grid mark it refers to
     - *Boundary direction*, ie each label follows the canvas boundary, and is perpendicular to the grid mark it refers to
   - The *Annotation font* (text formatting, buffer, shadow…) using the *font selector widget*
   - The *Distance to map frame*, margin between annotations and map canvas limits. Convenient when *exporting the map canvas* eg to an image format or PDF, and avoid annotations to be on the "paper" limits.
   - The *Coordinate precision*
4. Click *Apply* to verify that it looks as expected or *OK* if you're satisfied.

Title Label

Title Label allows you to decorate your map with a **Title**.

To add a Title Label decoration:

1. Select menu option *View* ► *Decorations* ► *Title Label…* to open the dialog.

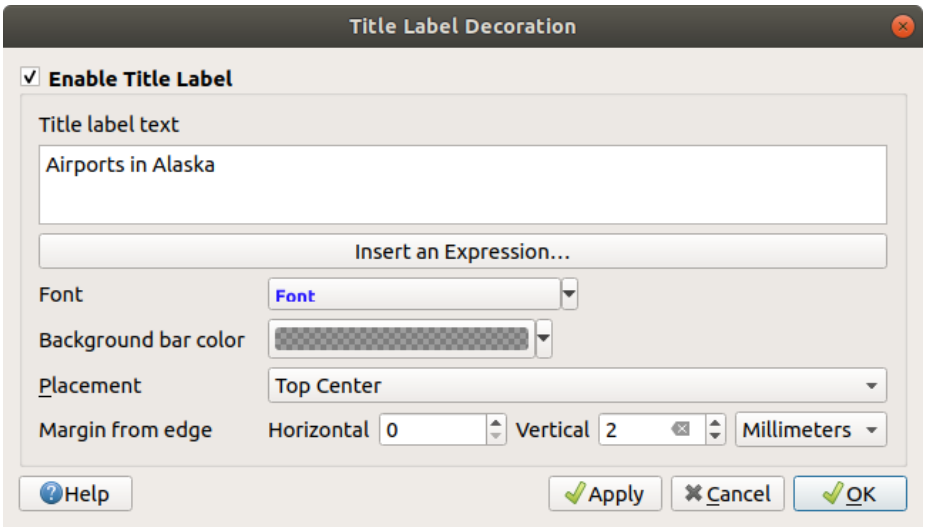


Figura11.8: The Title Decoration Dialog

2. Make sure *Enable Title Label* is checked
3. Enter the title text you want to place on the map. You can make it dynamic using the *Insert or Edit an Expression…* button.
4. Choose the *Font* for the label using the *font selector widget* with full access to QGIS *text formatting* options. Quickly set the font color and opacity by clicking the black arrow to the right of the font combo box.
5. Select the *color* to apply to the title's *Background bar color*.
6. Choose the *Placement* of the label in the canvas: options are *Top left*, *Top Center* (default), *Top Right*, *Bottom left*, *Bottom Center* and *Bottom Right*.
7. Refine the placement of the item by setting a horizontal and/or vertical *Margin from Edge*. These values can be in **Millimeters** or **Pixels** or set as a **Percentage** of the width or height of the map canvas.
8. Click *Apply* to verify that it looks as expected or *OK* if you're satisfied.

Copyright Label

Copyright Label can be used to decorate your map with a **Copyright** label.

To add this decoration:

1. Select menu option *View* ► *Decorations* ► *Copyright Label…* to open the dialog.

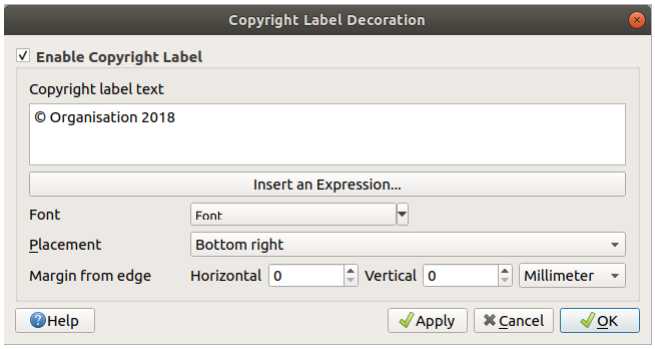


Figura11.9: The Copyright Decoration Dialog

2. Make sure *Enable Copyright Label* is checked
3. Enter the copyright text you want to place on the map. You can make it dynamic using the *Insert or Edit an Expression…* button.
4. Choose the *Font* for the label using the *font selector widget* with full access to QGIS *text formatting* options. Quickly set the font color and opacity by clicking the black arrow to the right of the font combo box.
5. Choose the *Placement* of the label in the canvas: options are *Top left*, *Top Center*, *Top Right*, *Bottom left*, *Bottom Center*, and *Bottom Right* (default for Copyright decoration)
6. Refine the placement of the item by setting a horizontal and/or vertical *Margin from Edge*. These values can be in **Millimeters** or **Pixels** or set as a **Percentage** of the width or height of the map canvas.
7. Click *Apply* to verify that it looks as expected or *OK* if you're satisfied.

Image Decoration

Image allows you to add an image (logo, legend, ..) on the map canvas.

To add an image:

1. Select menu option *View* ► *Decorations* ► *Image…* to open the dialog.

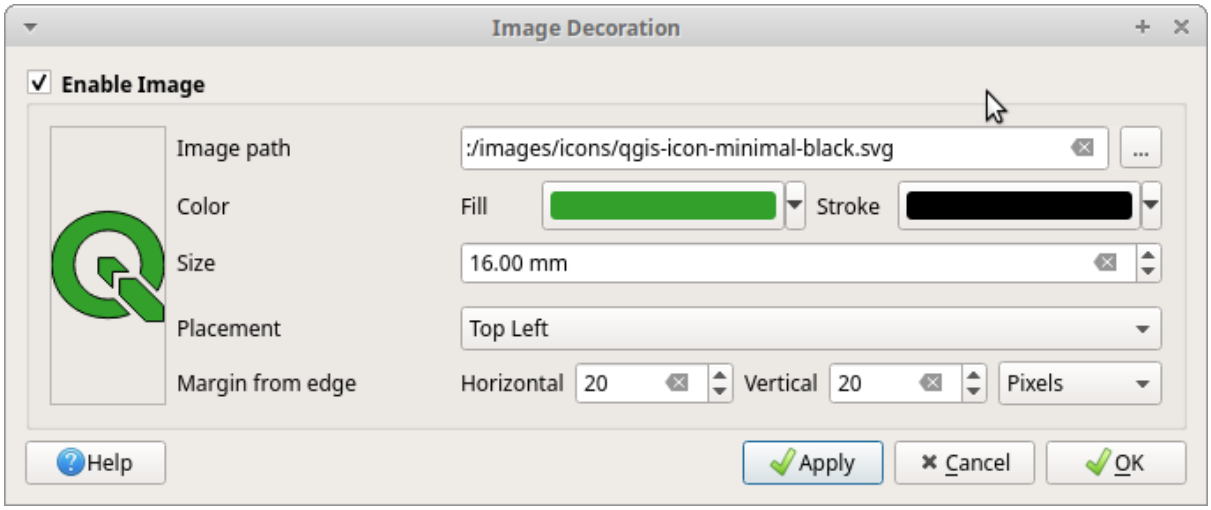


Figura11.10: The Image Decoration Dialog

2. Make sure *Enable Image* is checked
3. Select a bitmap (e.g. png or jpg) or SVG image using the … Browse button

4. If you have chosen a parameter enabled SVG then you can also set a *Fill* or *Stroke* (outline) color. For bitmap images, the color settings are disabled.
5. Set a *Size* of the image in mm. The width of selected image is used to resize it to given *Size*.
6. Choose where you want to place the image on the map canvas with the *Placement* combo box. The default position is *Top Left*.
7. Set the *Horizontal* and *Vertical Margin from (Canvas) Edge*. These values can be set in **Millimeters**, **Pixels** or as a **Percentage** of the width or height of the map canvas.
8. Click *Apply* to verify that it looks as expected and *OK* if you're satisfied.

Seta Norte

North Arrow allows you to add a north arrow on the map canvas.

Para adicionar a seta de norte:

1. Select menu option *View* ► *Decorations* ► *North Arrow…* to open the dialog.

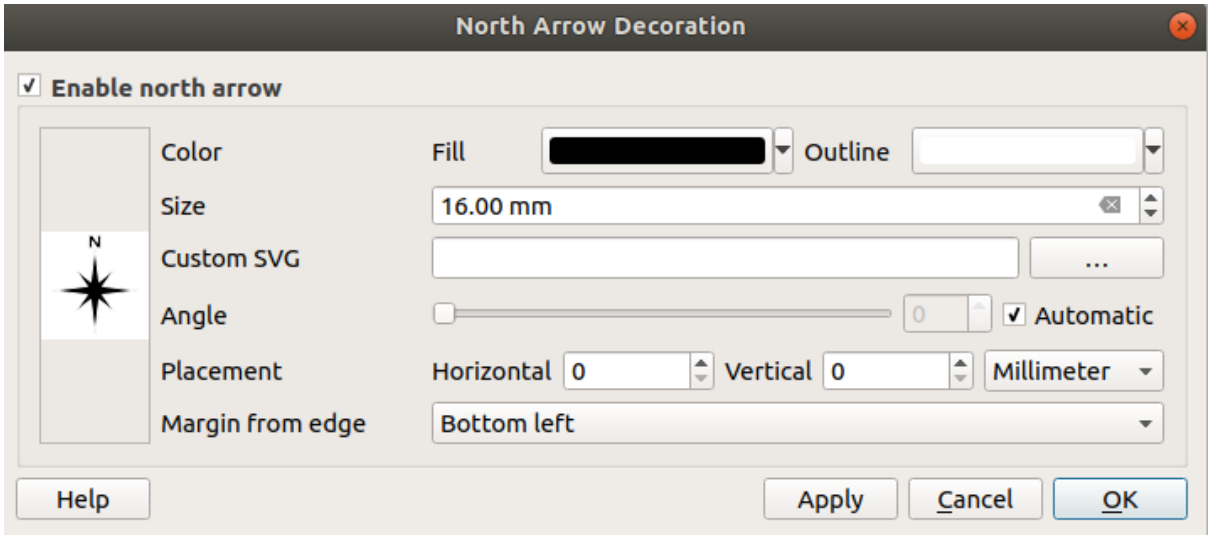


Figura11.11: The North Arrow Dialog

2. Make sure *Enable north arrow* is checked
3. Optionally change the color and size, or choose a custom SVG
4. Optionally change the angle or choose **Automatic** to let QGIS determine the direction
5. Optionally choose the placement from the Placement combo box
6. Optionally refine the placement of the arrow by setting a horizontal and/or vertical *Margin from (Canvas) Edge*. These values can be in **Millimeters** or **Pixels** or set as a **Percentage** of the width or height of the map canvas.
7. Click *Apply* to verify that it looks as expected and *OK* if you're satisfied.

Barra de Escala

Scale Bar adds a simple scale bar to the map canvas. You can control the style and placement, as well as the labelling of the bar.

QGIS only supports displaying the scale in the same units as your map frame. So, if the units of your project's CRS are meters, you can't create a scale bar in feet. Likewise, if you are using decimal degrees, you can't create a scale bar to display distance in meters.

Para adicionar uma barra de escala:

1. Select menu option *View* ► *Decorations* ► *Scale Bar…* to open the dialog

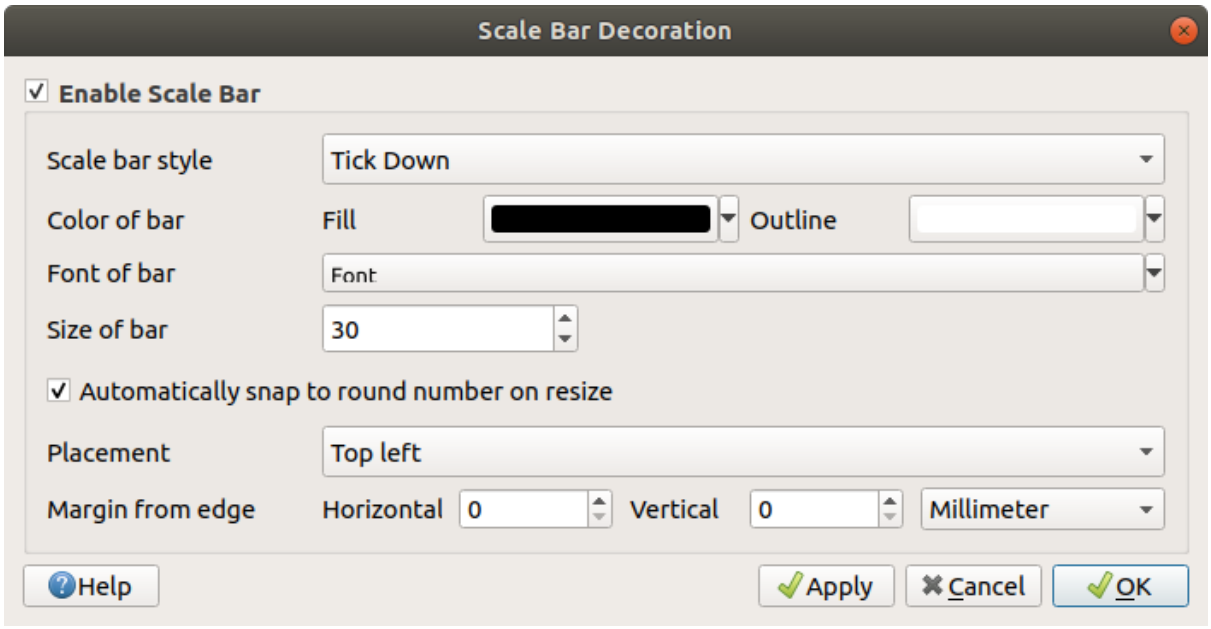


Figura11.12: The Scale Bar Dialog

2. Make sure *Enable scale bar* is checked
3. Choose a style from the *Scale bar style* combo box
4. Select the *Color of bar* by choosing a fill color (default: black) and an outline color (default: white). The scale bar fill and outline can be made opaque by clicking on the down arrow to the right of the color input.
5. Selecione a fonte para a barra de escala na caixa *Fonte da barra*
6. Set the *Size of bar*
7. Optionally check *Automatically snap to round number on resize* to display easy-to-read values
8. Choose the placement from the *Placement* combo box
9. You can refine the placement of the item by setting a horizontal and/or vertical *Margin from (Canvas) Edge*. These values can be in **Millimeters** or **Pixels** or set as a **Percentage** of the width or height of the map canvas.
10. Click *Apply* to verify that it looks as expected or *OK* if you're satisfied.

Extensões de Composição

Layout Extents adds the extents of *map item(s)* in print layout(s) to the canvas. When enabled, the extents of all map items within all print layouts are shown using a lightly dotted border labeled with the name of the print layout and map item. You can control the style and labeling of the displayed layout extents. This decoration is useful when you are tweaking the positioning of map elements such as labels, and need to know the actual visible region of print layouts.



Figura11.13: Example of layout extents displayed in a QGIS project with two print layouts. The print layout named 'Sights' contains two map items, while the other print layout contains one map item.

To add layout extent(s):

1. Select *View* ► *Decorations* ► *Layout Extents* to open the dialog

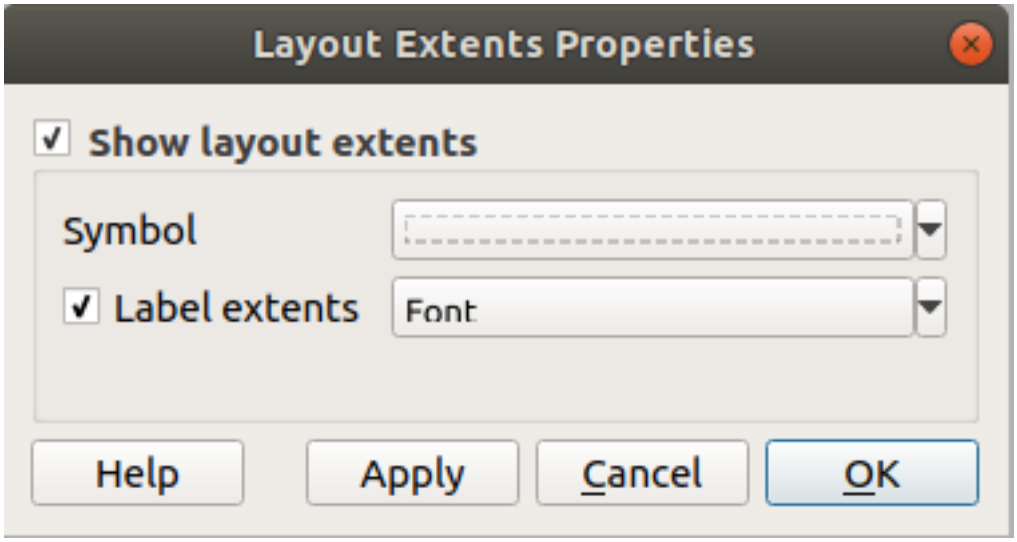


Figura11.14: The Layout Extents Dialog

2. Make sure *Show layout extents* is checked.
3. Optionally change the symbol and labeling of the extents.
4. Click *Apply* to verify that it looks as expected and *OK* if you're satisfied.

Dica: Decorations Settings

When you save a QGIS project file, any changes you have made to Grid, North Arrow, Scale Bar, Copyright and Layout Extents will be saved in the project and restored the next time you load the project.

11.4.5 Ferramentas de anotação

Annotations are information added to the map canvas and shown within a balloon. This information can be of different types and annotations are added using the corresponding tools in the *Attributes Toolbar*:

- Text Annotation for custom formatted text
- HTML Annotation to place the content of an `html` file
- SVG Annotation to add an `SVG` symbol
- Form Annotation: useful to display attributes of a vector layer in a customized `ui` file (see Fig.11.15). This is similar to the *custom attribute forms*, but displayed in an annotation item. Also see this video https://www.youtube.com/watch?v=0pDBuSbQ02o&feature=youtu.be&t=2m25s from Tim Sutton for more information.

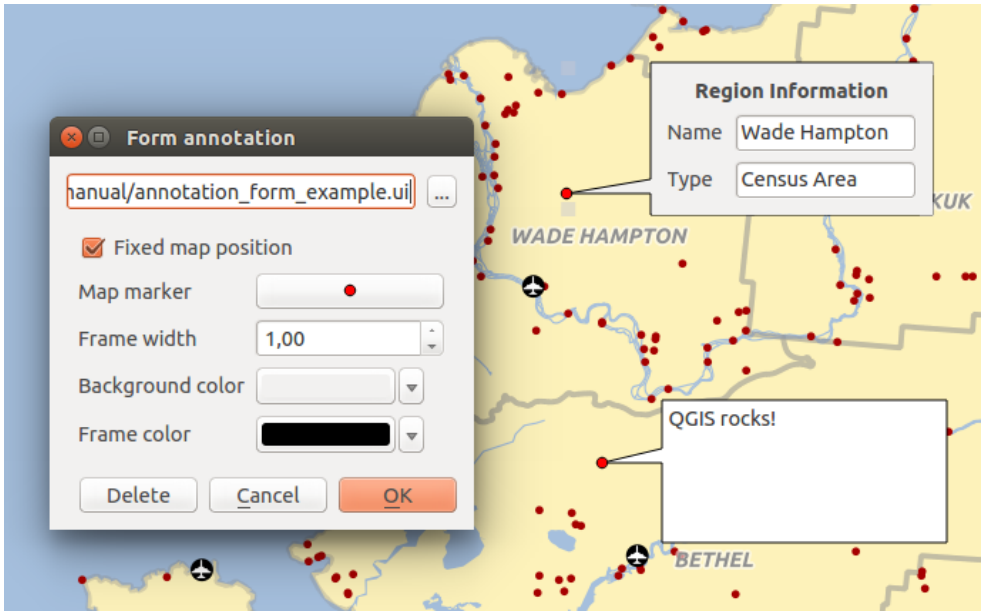


Figura11.15: Customized QT Designer annotation form

To add an annotation, select the corresponding tool and click on the map canvas. An empty balloon is added. Double-click on it and a dialog opens with various options. This dialog is almost the same for all the annotation types:

- Na parte superior, um seletor de arquivo para preencher o caminho para um arquivo `html`, `svg` ou `ui`, dependendo do tipo de anotação. Para anotação de texto, você pode inserir sua mensagem em uma caixa de texto e definir sua renderização com as ferramentas de fonte normais.
- *Fixed map position*: when unchecked, the balloon placement is based on a screen position (instead of the map), meaning that it's always shown regardless the map canvas extent.
- *Linked layer*: associates the annotation with a map layer, making it visible only when that layer is visible.
- *Map marker*: using *QGIS symbols*, sets the symbol to display at the balloon anchor position (shown only when *Fixed map position* is checked).
- *Frame style*: sets the frame background color, transparency, stroke color or width of the balloon using QGIS symbols.
- *Contents margins*: sets interior margins of the annotation frame.

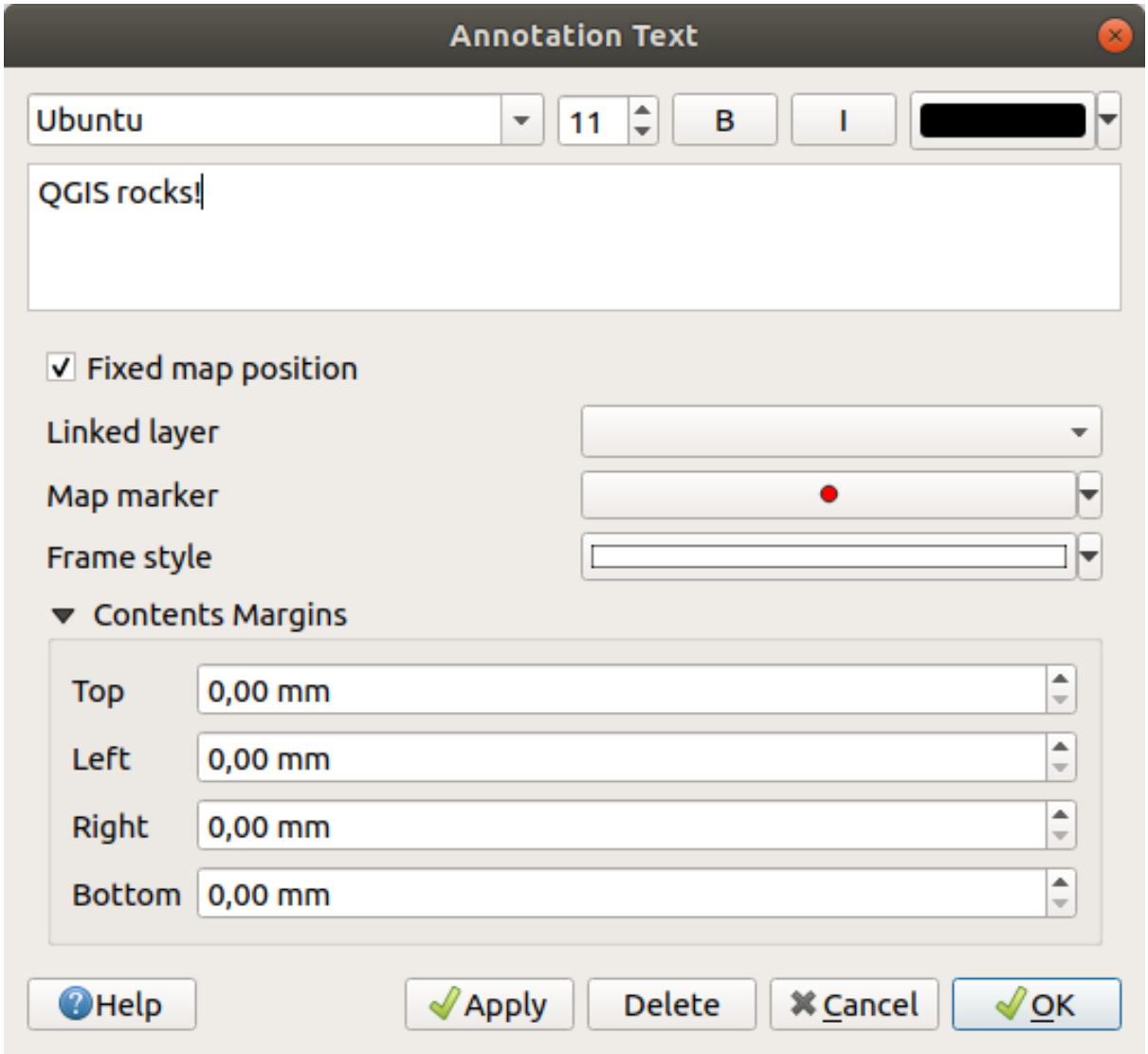


Figura11.16: Annotation text dialog

Annotations can be selected when an annotation tool is enabled. They can then be moved by map position (by dragging the map marker) or by moving only the balloon. The  Move Annotation tool also allows you to move the balloon on the map canvas.

To delete an annotation, select it and either press the `Del` or `Backspace` button, or double-click it and press the *Delete* button in the properties dialog.

Nota: If you press `Ctrl+T` while an *Annotation* tool (move annotation, text annotation, form annotation) is active, the visibility states of the items are inverted.

Dica: Layout the map with annotations

You can print or export annotations with your map to various formats using:

- map canvas export tools available in the *Project* menu
- *print layout*, in which case you need to check *Draw map canvas items* in the corresponding map item properties

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11.4.6 Medição

Informação Geral

O QGIS fornece quatro meios para medir geometrias:

- interactive measurement tools
- measuring in the Field Calculator
- derived measurements in the *Identificar Elementos* tool
- the vector analysis tool: *Vector* ► *Geometry Tools* ► *Export/Add Geometry Columns*

Measuring works within projected coordinate systems (e.g., UTM) and unprojected data. The first three measuring tools behave equally to global project settings:

- Diferentemente da maioria dos outros GIS, a métrica de medição padrão é elipsoidal, usando o elipsóide definido em *Projeto* ► *Propriedades...* ► *Geral*. Isso ocorre quando os sistemas de coordenadas geográficas e projetadas são definidos para o projeto.
- If you want to calculate the projected/planimetric area or distance using cartesian maths, the measurement ellipsoid has to be set to "None/Planimetric" (*Project* ► *Properties...* ► *General*). However, with a geographic (ie unprojected) CRS defined for the data and project, area and distance measurement will be ellipsoidal.

However, neither the identify tool nor the field calculator will transform your data to the project CRS before measuring. If you want to achieve this, you have to use the vector analysis tool: *Vector* ► *Geometry Tools* ► *Add Geometry Attributes*.... Here, measurement is planimetric, unless you choose the ellipsoidal measurement.

Medir interativamente comprimentos, áreas e ângulos

Click the icon in the Attribute toolbar to begin measurements. The down arrow near the icon switches between length, area or angle. The default unit used in the dialog is the one set in *Project* ► *Properties...* ► *General* menu.

Nota: Configurar a ferramenta de medida

While measuring length or area, clicking the *Configuration* button at the bottom of the widget opens the *Settings* ► *Options* ► *Map Tools* menu, where you can select the rubberband color, the precision of the measurements and the unit behavior. You can also choose your preferred measurement or angle units, but keep in mind that those values are overridden in the current project by the selection made in the *Project* ► *Properties...* ► *General* menu, and by the selection made in the measurement widget.

All measuring modules use the snapping settings from the digitizing module (see section *Configurando a Tolerância de Atracção e Raio de Pesquisa*). So, if you want to measure exactly along a line feature, or around a polygon feature, first set its layer snapping tolerance. Now, when using the measuring tools, each mouse click (within the tolerance setting) will snap to that layer.

By default, Measure Line measures real distances between given points according to a defined ellipsoid. The tool then allows you to click points on the map. Each segment length, as well as the total, shows up in the measure window. To stop measuring, click the right mouse button. Now it is possible to copy all your line measurements at once to the clipboard using the *Copy All* button.

Note that you can use the drop-down list near the total to change the measurement units interactively while working with the measure tool ('Meters', 'Kilometers', 'Feet', 'Yards', 'Miles', 'Nautical miles', 'Centimeters', 'Millimeters', 'Degrees', 'Map units'). This unit is retained for the widget until a new project is created or another project is opened.

The *Info* section in the dialog explains how calculations are made according to the CRS settings available.

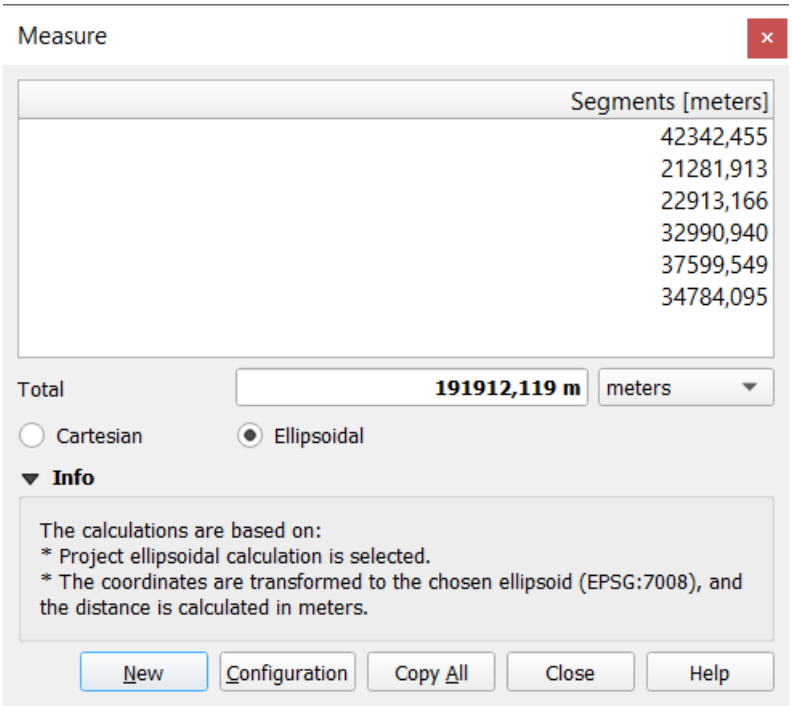


Figura11.17: Medir Distância

Measure Area: Areas can also be measured. In the measure window, the accumulated area size appears. Right-click to stop drawing. The Info section is also available as well as the ability to switch between different area units ('Square meters', 'Square kilometers', 'Square feet', 'Square yards', 'Square miles', 'Hectares', 'Acres', 'Square centimeters', 'Square millimeters', 'Square nautical miles', 'Square degrees', 'Map units').

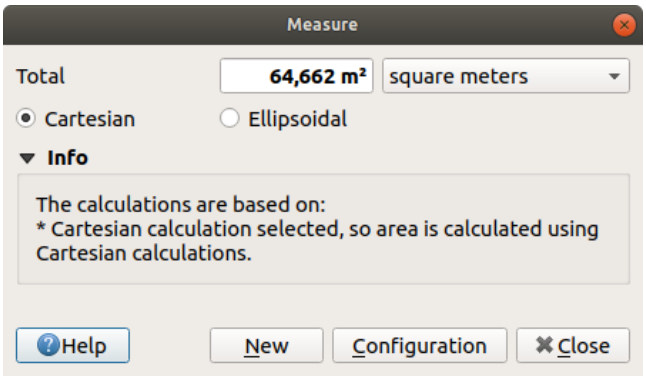


Figura11.18: Medir Área

Measure Angle: You can also measure angles. The cursor becomes cross-shaped. Click to draw the first segment of the angle you wish to measure, then move the cursor to draw the desired angle. The measurement is displayed in a pop-up dialog.

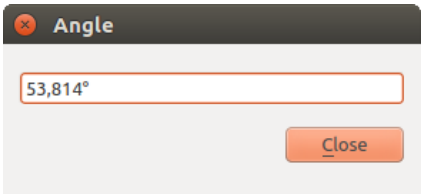


Figura11.19: Medir Ângulo

11.5 Interagir com os elementos

11.5.1 Selecionando características

QGIS provides several tools to select features on the map canvas. Selection tools are available in the *Edit* ► *Select* menu or in the *Selection Toolbar*.

Nota: Selection tools work with the currently active layer.

Selecting manually on the map canvas

To select one or more features with the mouse, you can use one of the following tools:

-  Select Features by area or single click
-  Select Features by Polygon
-  Select Features by Freehand
-  Select Features by Radius

---

Nota: Other than  Select Features by Polygon, these manual selection tools allow you to select feature(s) on the map canvas with a single click.

Nota: Use the  Select Features by Polygon tool to use an existing polygon feature (from any layer) to select overlapping features in the active layer. Right-click in the polygon and choose it from the context menu that shows a list of all the polygons that contain the clicked point. All the overlapping features from the active layer are selected.

Dica: Use the *Edit* ► *Select* ► *Reselect Features* tool to redo your latest selection. Very useful when you have painstakingly made a selection, and then click somewhere else accidentally and clear your selection.

While using the  *Select Feature(s)* tool, holding `Shift` or `Ctrl` toggles whether a feature is selected (ie either adds to the current selection or remove from it).

For the other tools, different behaviors can be performed by holding down:

- `Shift`: add features to the current selection
- `Ctrl`: subtrai feições da seleção atual
- `Ctrl+Shift`: intersect with current selection, ie only keep overlapping features from the current selection
- `Alt`: select features that are totally within the selection shape. Combined with `Shift` or `Ctrl` keys, you can add or substract features to/from the current selection.

Seleção automática

The other selection tools, most of them available from the *Attribute table*, perform a selection based on a feature's attribute or its selection state (note that attribute table and map canvas show the same information, so if you select one feature in the attribute table, it will be selected on the map canvas too):

-  Select By Expression… select features using expression dialog
-  Select Features By Value… or press `F3`
-  Deselect Features from All Layers or press `Ctrl+Alt+A` to deselect all selected features in all layers
-  Deselect Features from the Current Active Layer or press `Ctrl+Shift+A`
-  Select All Features or press `Ctrl+A` to select all features in the current layer
-  Invert Feature Selection to invert the selection in the current layer
-  Select by Location to select the features based on their spatial relationship with other features (in the same or another layer - see *Selecionar pela localização*)

For example, if you want to find regions that are boroughs from `regions.shp` of the QGIS sample data, you can:

1. Use the  Select features using an Expression icon
2. Expand the *Fields and Values* group
3. Double-click the field that you want to query ("TYPE_2")
4. Click *All Unique* in the panel that shows up on the right
5. From the list, double-click 'Borough'. In the *Expression* editor field, write the following query:

```
"TYPE_2"  =  'Borough'
```

6. Click *Select Features*

From the expression builder dialog, you can also use *Function list* ► *Recent (Selection)* to make a selection that you have used before. The dialog remembers the last 20 expressions used. See *Expressões* for more information and examples.

Dica: Guarde a sua seleção num novo ficheiro

Users can save selected features into a **New Temporary Scratch Layer** or a **New Vector Layer** using *Edit* ► *Copy Features* and *Edit* ► *Paste Features as* in the desired format.

Selecionar Feições Por Valor

This selection tool opens the layer's feature form allowing the user to choose which value to look for for each field, whether the search should be case-sensitive, and the operation that should be used. The tool has also autocompletes, automatically filling the search box with existing values.

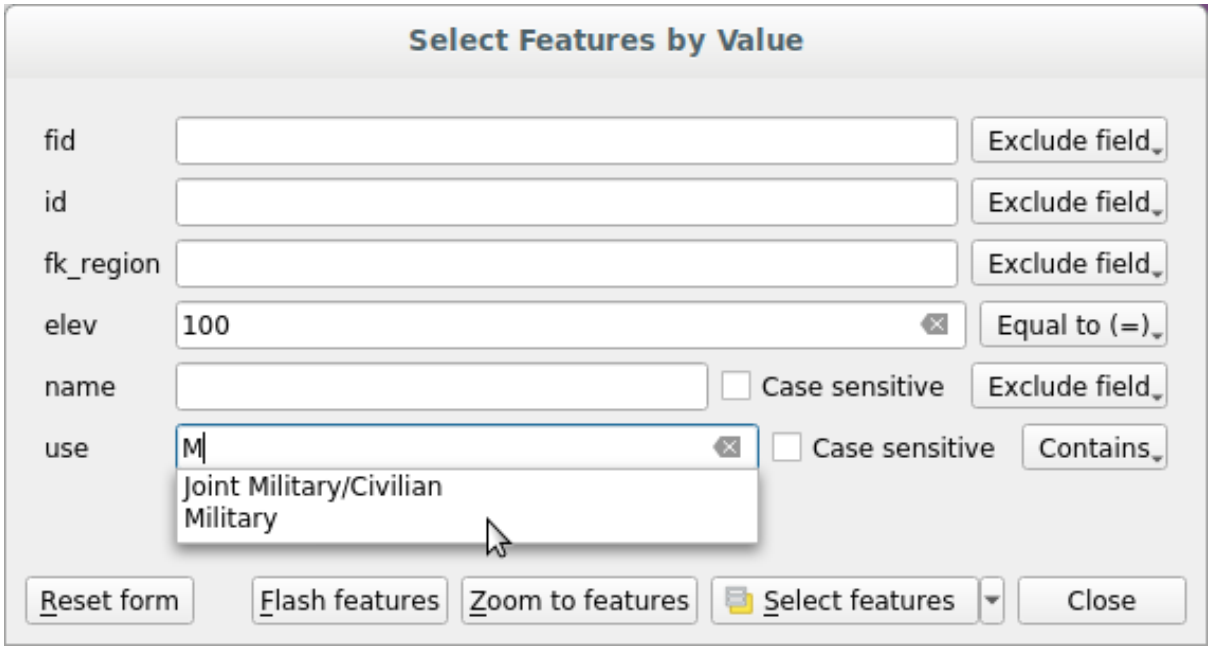


Figura11.20: Filter/Select features using form dialog

Alongside each field, there is a drop-down list with options to control the search behaviour:

Field search option	String	Numérico	Data
Exclude Field from the search	☑	☑	☑
Equal to (=)	☑	☑	☑
Not equal to (≠)	☑	☑	☑
Greater than (>)		☑	☑
Less than (<)		☑	☑
Greater than or equal to (≥)		☑	☑
Less than or equal to (≤)		☑	☑
Between (inclusive)		☑	☑
Not between (inclusive)		☑	☑
Contains	☑		
Does not contain	☑		
Is missing (null)	☑	☑	☑
Is not missing (not null)	☑	☑	☑
Starts with	☑		
Ends with	☑		

For string comparisons, it is also possible to use the ☑ *Case sensitive* option.

After setting all search options, click *Select features* to select the matching features. The drop-down options are:

- *Selecionar feições*
- *Add to current selection*
- *Remove from current selection*
- *Filtrar seleção atual*

You can also clear all search options using the *Reset form* button.

Once the conditions are set, you can also either:

- *Zoom to features* on the map canvas without the need of a preselection
- *Flash features*, highlighting the matching features. This is a handy way to identify a feature without selection or using the Identify tool. Note that the flash does not alter the map canvas extent and would be visible only if the feature is within the bounds of the current map canvas.

11.5.2 Identificar Elementos

The Identify tool allows you to interact with the map canvas and get information on features in a pop-up window. To identify features, use:

- *Exbir* ► *Identificar Feições*
- `Ctrl+Shift+I` (or `Cmd+Shift+I`),
-  Identify Features icon on the Attributes toolbar

Usar a ferramenta Identificar Elementos

QGIS offers several ways to identify features with the  Identify Features tool:

- **left click** identifies features according to the *selection mode* and the *selection mask* set in the *Identify Results* panel
- **right click** with *Identify Feature(s)* as *selection mode* set in the *Identify Results* panel fetches all snapped features from all visible layers. This opens a context menu, allowing the user to choose more precisely the features to identify or the action to execute on them.
- **right click** with *Identify Features by Polygon* as *selection mode* in the *Identify Results* panel identifies the features that overlap with the chosen existing polygon, according to the *selection mask* set in the *Identify Results* panel

---

Dica: Filter the layers to query with the Identify Features tool

Under *Layer Capabilities* in *Project* ► *Properties...* ► *Data Sources*, uncheck the *Identifiable* column next to a layer to avoid it being queried when using the  Identify Features tool in a mode other than **Current Layer**. This is a handy way to return features from only layers that are of interest for you.

If you click on feature(s), the *Identify Results* dialog will list information about the feature(s) clicked. The default view is a tree view in which the first item is the name of the layer and its children are its identified feature(s). Each feature is described by the name of a field along with its value. This field is the one set in *Layer Properties* ► *Display*. All the other information about the feature follows.

Informações da feição

The Identify Results dialog can be customized to display custom fields, but by default it will display the following information:

- The feature *display name*;
- **Actions**: Actions can be added to the identify feature windows. The action is run by clicking on the action label. By default, only one action is added, namely `View feature form` for editing. You can define more actions in the layer's properties dialog (see *Propriedades de Ações*).
- **Derived**: This information is calculated or derived from other information. It includes:
  - Informação geral sobre a geometria do elemento:

        * depending on the geometry type, the cartesian measurements of length, perimeter or area in the layer's CRS units. For 3D line vectors the cartesian line length is available.
        * depending on the geometry type and if an ellipsoid is set in the project properties dialog for *Measurements*, the ellipsoidal values of length, perimeter or area using the specified units
        * the count of geometry parts in the feature and the number of the part clicked
        * the count of vertices in the feature
    - coordinate information, using the project properties *Coordinates display* settings:
        * `X` and `Y` coordinate values of the point clicked
        * the number of the closest vertex to the point clicked
        * `X` and `Y` coordinate values of the closest vertex (and `Z`/`M` if applicable)
        * se você clicar em um segmento curvo, o raio dessa seção também será mostrado.
- **Data attributes**: This is the list of attribute fields and values for the feature that has been clicked.
- information about the related child feature if you defined a *relation*:
    - the name of the relation
    - the entry in reference field, e.g. the name of the related child feature
    - **Actions**: lists actions defined in the layer's properties dialog (see *Propriedades de Ações*) and the default action is `View feature form`.
    - **Data attributes**: This is the list of attributes fields and values of the related child feature.

Nota: Links in the feature's attributes are clickable from the *Identify Results* panel and will open in your default web browser.

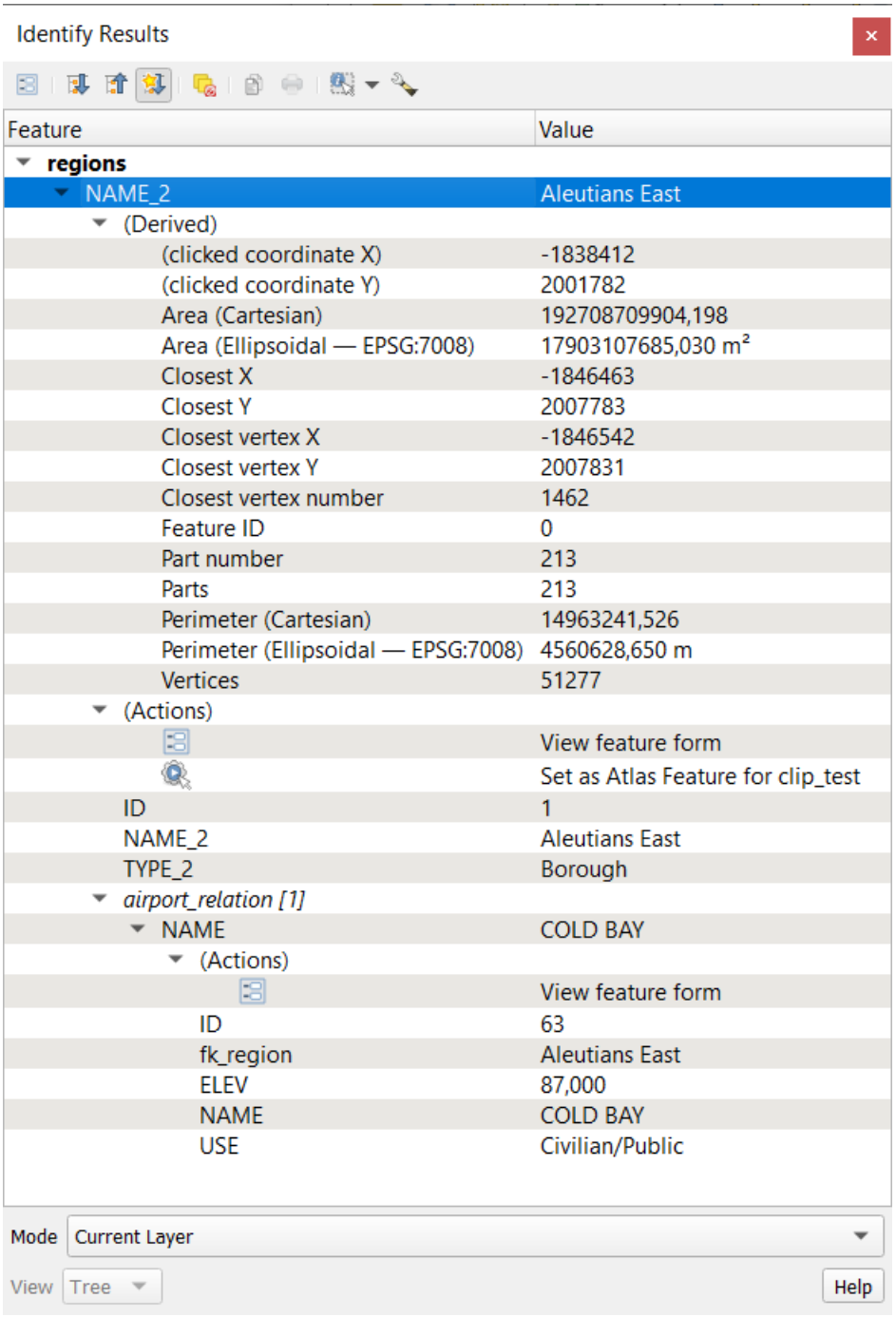


Figura11.21: Identify Results dialog

The Identify Results dialog

At the top of the window, you have a handful of tools:

- Open Form of the current feature
- Expand tree
- Collapse tree
- Expand New Results by Default to define whether the next identified feature's information should be collapsed or expanded

-  Clear Results
-  Copy selected feature to clipboard
-  Print selected HTML response
- selection mode to use to fetch features to identify:
  -  Identify Features by area or single click
  -  Identify Features by Polygon
  -  Identify Features by Freehand
  -  Identify Features by Radius

---

Nota: When using  Identify Features by Polygon, you can right-click any existing polygon and use it to identify overlapping features in another layer.

At the bottom of the window are the *Mode* and *View* combo boxes. *Mode* defines from which layers features should be identified:

- **Current layer**: only features from the selected layer are identified. The layer need not be visible in the canvas.
- **Top down, stop at first**: only features from the upper visible layer.
- **Top down**: all features from the visible layers. The results are shown in the panel.
- **Layer selection**: opens a context menu where the user selects the layer to identify features from, similar to a right-click. Only the chosen features will be shown in the result panel.

The *View* can be set as **Tree**, **Table** or **Graph**. 'Table' and 'Graph' views can only be set for raster layers.

The identify tool allows you to  *Auto open form for single feature results*, found under  Identify Settings. If checked, each time a single feature is identified, a form opens showing its attributes. This is a handy way to quickly edit a feature's attributes.

Outras funções podem ser encontrados no menu de contexto do item identificado. Por exemplo, do menu de contexto, você pode:

- Ver o formulário da feição
- Zoom para feição
- Copiar feição: Copiar todos os atributos e a geometria da feição
- Toggle feature selection: Add identified feature to selection
- Copiar o valor do atributo: Copiar apenas o valor do atributo que clicou.
- Copiar atributos do elemento: Copia todos os atributos do elemento
- Limpar resultados: apaga os resultados na janela
- Limpar destaques: Remover feiçõesdestacadas no mapa
- Destaque todos
- Destaque a camada
- Ativar camada: escolha uma camada a ser ativada
- Propriedades da camada: Abre a janela de propriedades da camada
- Estender tudo
- Encolher tudo

11.6 Salvar e Compartilhar Propriedades da Camada

11.6.1 Gerir Estilos Personalizados

When a vector layer is added to the map canvas, QGIS by default uses a random symbol/color to render its features. However, you can set a default symbol in *Project* ► *Properties…* ► *Default styles* that will be applied to each newly added layer according to its geometry type.

Most of the time, though, you'd rather have a custom and more complex style that can be applied automatically or manually to the layers (with less effort). You can achieve this by using the *Style* menu at the bottom of the Layer Properties dialog. This menu provides you with functions to create, load and manage styles.

A style stores any information set in the layer properties dialog to render or interact with the layer (including symbology, labeling, fields and form definitions, actions, diagrams…) for vector layers, or the pixels (band or color rendering, transparency, pyramids, histogram …) for raster.

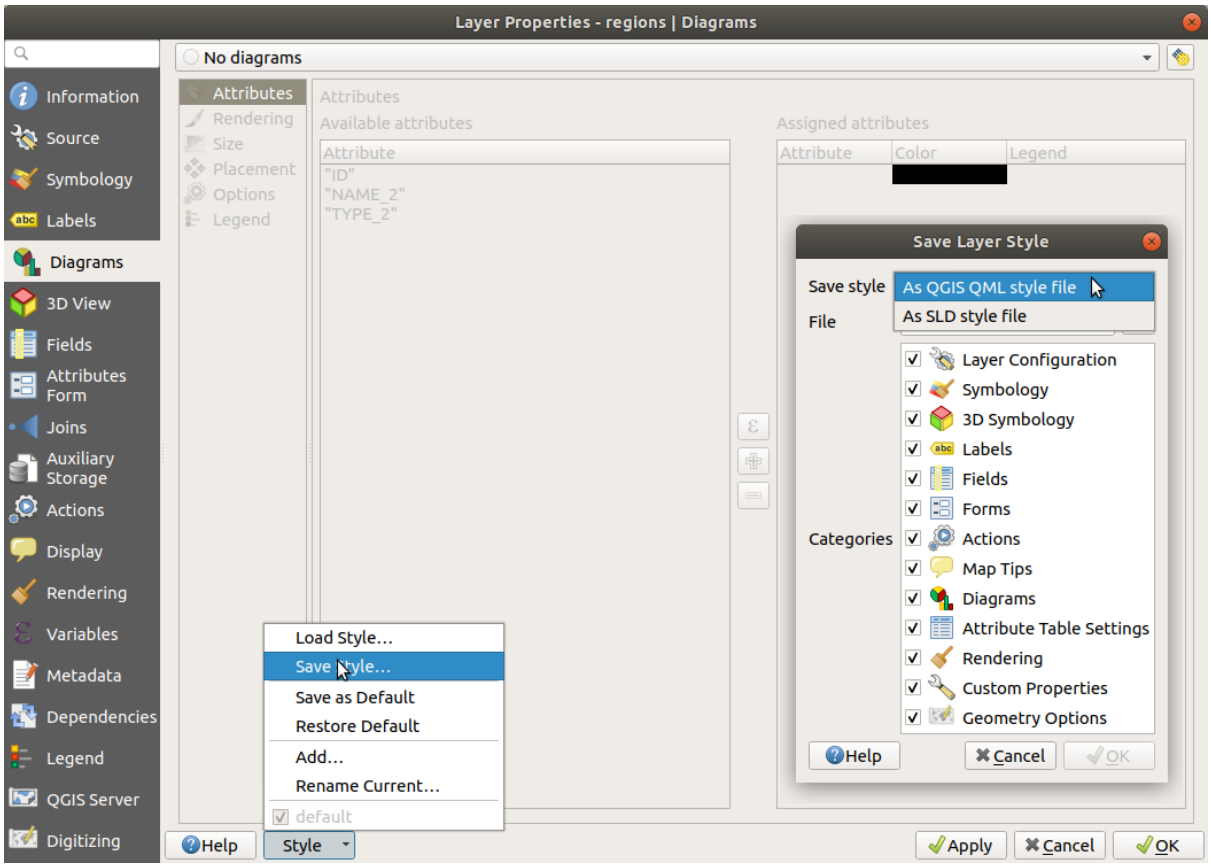


Figura11.22: Vector layer style combo box options

By default, the style applied to a loaded layer is named `default`. Once you have got the ideal and appropriate rendering for your layer, you can save it by clicking the  *Style* combo box and choosing:

- **Rename Current**: The active style is renamed and updated with the current options
- **Add**: A new style is created using the current options. By default, it will be saved in the QGIS project file. See below to save the style in another file or a database
- **Remove**: Delete unwanted style, in case you have more than one style defined for the layer.

At the bottom of the Style drop-down list, you can see the styles set for the layer with the active one checked.

Note that each time you validate the layer properties dialog, the active style is updated with the changes you've made.

You can create as many styles as you wish for a layer but only one can be active at a time. In combination with *Map Themes*, this offers a quick and powerful way to manage complex projects without the need to duplicate any layer in the map legend.

Nota: Given that whenever you apply modifications to the layer properties, changes are stored in the active style, always ensure you are editing the right style to avoid mistakenly altering a style used in a *map theme*.

Dica: Manage styles from layer context menu

Right-click on the layer in the *Layers* panel to copy, paste, add or rename layer styles.

11.6.2 Storing Styles in a File or a Database

While styles created from the *Style* combo box are by default saved inside the project and can be copied and pasted from layer to layer in the project, it's also possible to save them outside the project so that they can be loaded in another project.

Guardar como ficheiro de texto

Clicking the  *Style* ► *Save Style*, you can save the style as a:

- QGIS layer style file (`.qml`)
- Ficheiro SLD (`.sld`), disponível somente para camadas vetoriais

Used on file-based format layers (`.shp`, `.tab`...), *Save as Default* generates a `.qml` file for the layer (with the same name). SLDs can be exported from any type of renderer – single symbol, categorized, graduated or rule-based – but when importing an SLD, either a single symbol or rule-based renderer is created. This means that categorized or graduated styles are converted to rule-based. If you want to preserve those renderers, you have to use the QML format. On the other hand, it can be very handy sometimes to have this easy way of converting styles to rule-based.

Guardar em base de dados

Vector layer styles can also be stored in a database if the layer datasource is a database provider. Supported formats are PostGIS, GeoPackage, SpatiaLite, MSSQL and Oracle. The layer style is saved inside a table (named `layer_styles`) in the database. Click on *Save Style...* ► *Save in database* then fill in the dialog to define a style name, add a description, a `.ui` file if applicable and to check if the style should be the default style.

You can save several styles for a single table in the database. However, each table can have only one default style. Default styles can be saved in the layer database or in `qgis.db`, a local SQLite database in the active *user profile* directory.

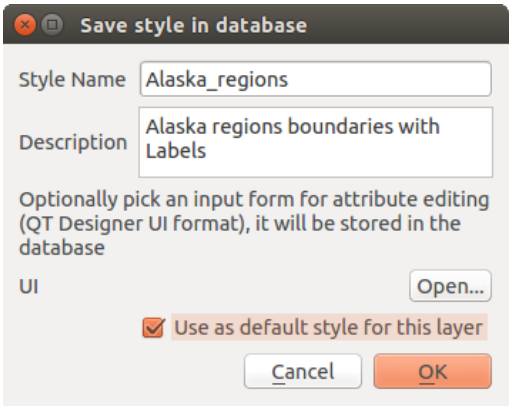


Figura11.23: Save Style in database Dialog

Dica: Sharing style files between databases

You can only save your style in a database if the layer comes from such a database. You can't mix databases (layer in Oracle and style in MSSQL for instance). Use instead a plain text file if you want the style to be shared among databases.

Nota: You may encounter issues restoring the `layer_styles` table from a PostgreSQL database backup. Follow *QGIS layer_style table and database backup* to fix that.

Carregar estilo

When loading a layer in QGIS, if a default style already exists for this layer, QGIS loads the layer with this style. Also *Style* ► *Restore Default* looks for and loads that file, replacing the layer's current style.

Style ► *Load Style* helps you apply any saved style to a layer. While text-file styles (`.sld` or `.qml`) can be applied to any layer whatever its format, loading styles stored in a database is only possible if the layer is from the same database or the style is stored in the QGIS local database.

The *Database Styles Manager* dialog displays a list of styles related to the layer found in the database and all the other styles saved in it, with name and description.

Dica: Quickly share a layer style within the project

You can also share layer styles within a project without importing a file or database style: right-click on the layer in the *Layers Panel* and, from the *Styles* combo box , copy the style of a layer and paste it to a group or a selection of layers: the style is applied to all the layers that are of the same type (vector vs raster) as the original layer and, in the case of vector layers, have the same geometry type (point, line or polygon).

11.6.3 Ficheiro de definição de camada

Layer definitions can be saved as a `Layer Definition File (.qlr)` using *Export ► Save As Layer Definition File...* in the active layers' context menu. A layer definition file (`.qlr`) includes references to the data source of the layers and their styles. `.qlr` files are shown in the Browser Panel and can be used to add the layers (with the saved style) to the Layers Panel. You can also drag and drop `.qlr` files from the system file manager into the map canvas.

11.7 Armazenar valores em Variáveis

In QGIS, you can use variables to store useful recurrent values (e.g. the project's title, or the user's full name) that can be used in expressions. Variables can be defined at the application's global level, project level, layer level, layout level, and layout item's level. Just like CSS cascading rules, variables can be overwritten - e.g., a project level variable will overwrite any application global level variables set with the same name. You can use these variables to build text strings or other custom expressions using the `@` character before the variable name. For example in print layout creating a label with this content:

```
This map was made using QGIS [% @qgis_version %]. The project file for this
map is: [% @project_path %]
```

Renderizará a etiqueta assim:

```
This map was made using QGIS 3.4.4-Madeira. The project file for this map is:
/gis/qgis-user-conference-2019.qgs
```

Besides the *preset read-only variables*, you can define your own custom variables for any of the levels mentioned above. You can manage:

- **global variables** from the *Settings ► Options* menu
- **project variables** from the *Project Properties* dialog (see *Propriedades do Projeto*)
- **vector layer variables** from the *Layer Properties* dialog (see *Janela de Propriedades de Vetor*);
- **layout variables** from the *Layout* panel in the Print layout (see *The Layout Panel*);
- and **layout item variables** from the *Item Properties* panel in the Print layout (see *Layout Items Common Options*).

To differentiate from editable variables, read-only variable names and values are displayed in italic. On the other hand, higher level variables overwritten by lower level ones are strike through.

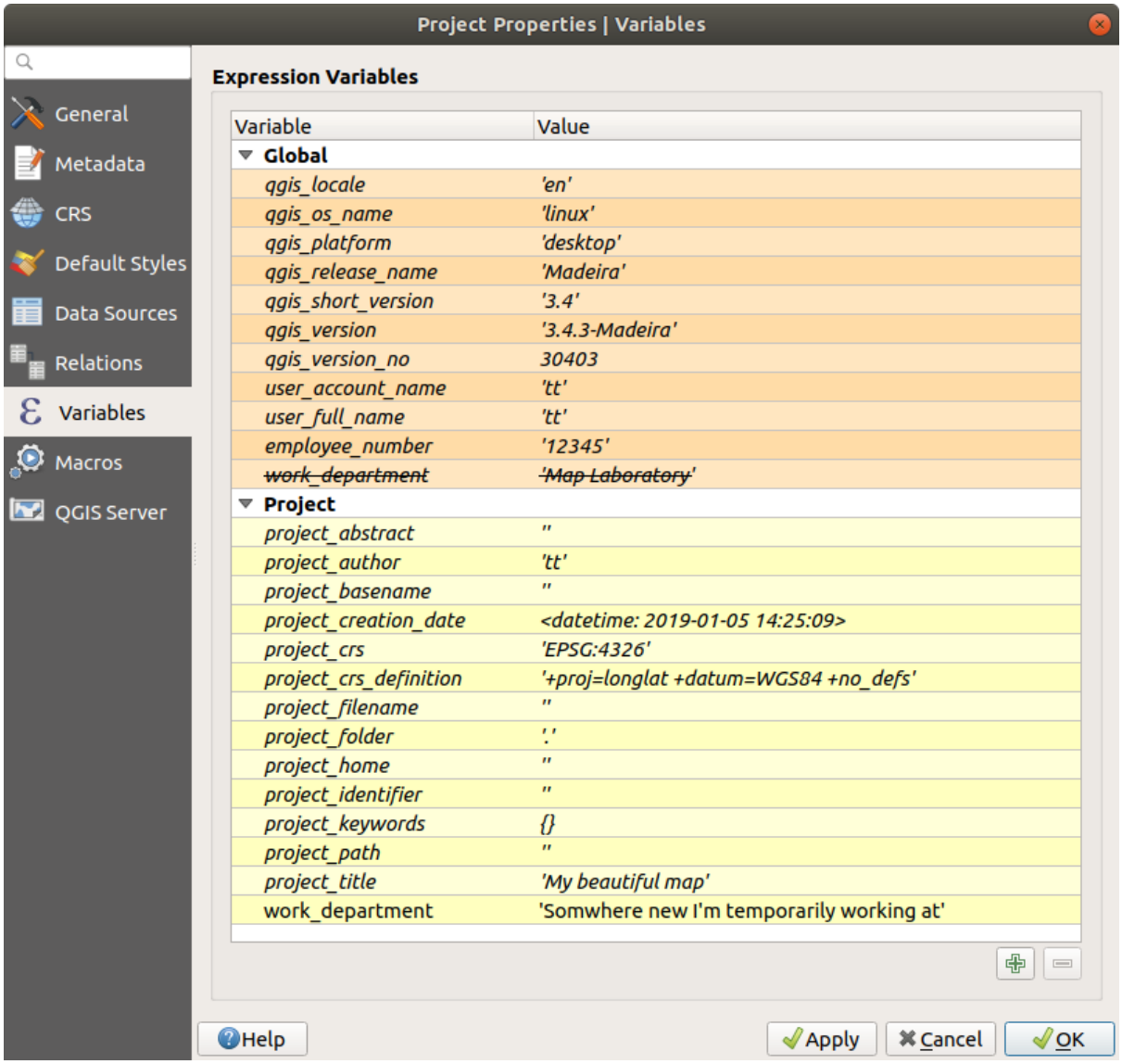


Figura11.24: Editor de variáveis oo nível do projeto

Nota: You can read more about variables and find some examples in Nyall Dawson's Exploring variables in QGIS 2.12, part 1, part 2 and part 3 blog posts.

11.8 Autenticação

QGIS has the facility to store/retrieve authentication credentials in a secure manner. Users can securely save credentials into authentication configurations, which are stored in a portable database, can be applied to server or database connections, and are safely referenced by their ID tokens in project or settings files. For more information see *Sistema de Autenticação*.

A master password needs to be set up when initializing the authentication system and its portable database.

11.9 Common widgets

In QGIS, there are some options you'll often have to work with. For convenience, QGIS provides you with special widgets that are presented below.

11.9.1 Selector de Cor

The color dialog

A caixa de diálogo *Selecionar Cor* aparecerá sempre que você clicar no ícone  para escolher uma cor. Os recursos desta caixa de diálogo dependem do estado da caixa de seleção do parâmetro *Usar caixas de diálogo do seletor de cores nativas* em *Configurações* ► *Opções...*► *Geral*. Quando marcada, a caixa de diálogo colorida usada é a nativa do SO no qual o QGIS está sendo executado. Caso contrário, o seletor de cores personalizado QGIS é usado.

The custom color chooser dialog has four different tabs which allow you to select colors by  Color ramp,  Color wheel,  Color swatches or  Color picker. With the first two tabs, you can browse to all possible color combinations and apply your choice to the item.

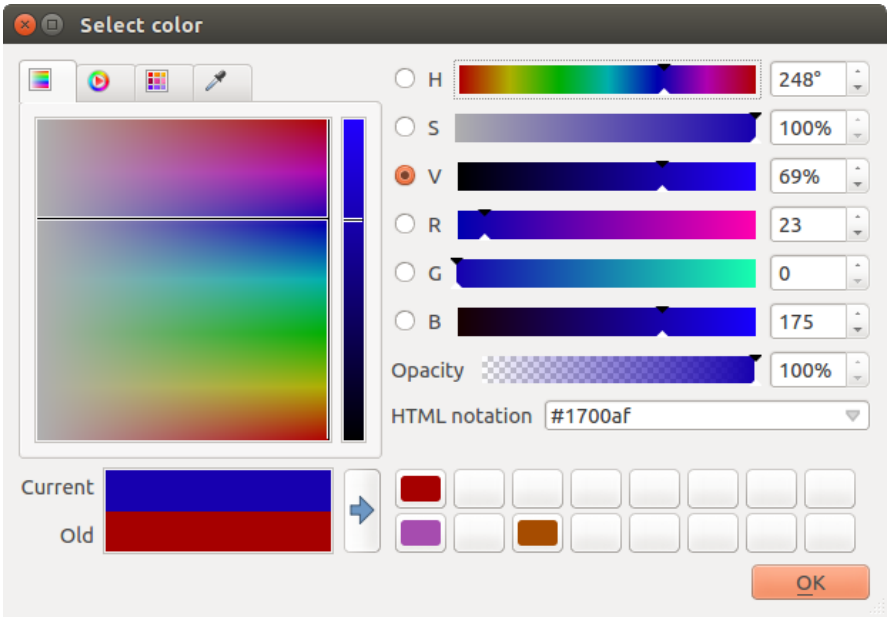


Figura11.25: Color selector ramp tab

In the  Color swatches tab, you can choose from a list of color palettes (see *Colors Settings* for details). All but the *Recent colors* palette can be modified with the  Add current color and  Remove selected color buttons at the bottom of the frame.

The ... button next to the palette combo box also offers several options to:

- copiar, colar, importar ou exportar cores
- criar, importar ou remover paletas de cor
- add the custom palette to the color selector widget with the *Show in Color Buttons* item (see Fig.11.27)

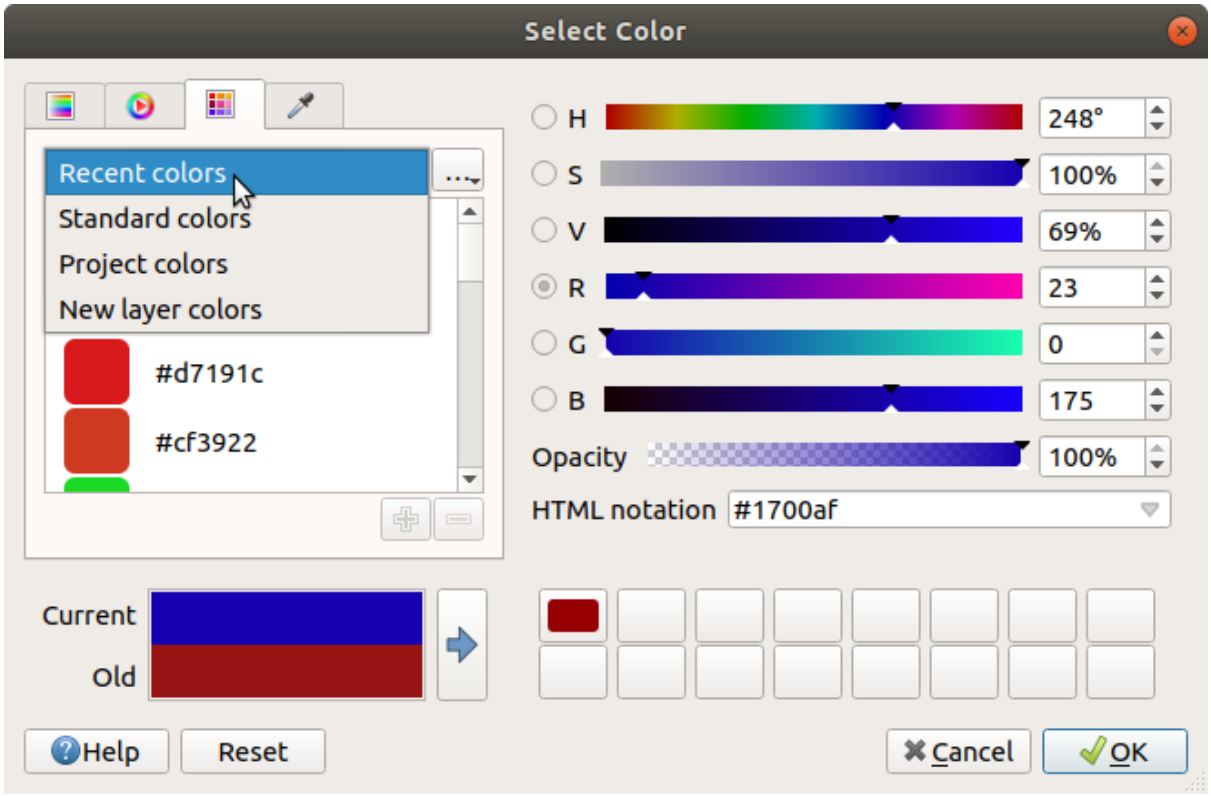


Figura11.26: Color selector swatches tab

Another option is to use the Color picker which allows you to sample a color from under your mouse cursor at any part of the QGIS UI or even from another application: press the space bar while the tab is active, move the mouse over the desired color and click on it or press the space bar again. You can also click the *Sample Color* button to activate the picker.

Whatever method you use, the selected color is always described through color sliders for `HSV` (Hue, Saturation, Value) and `RGB` (Red, Green, Blue) values. The color is also identifiable in *HTML notation*.

Modifying a color is as simple as clicking on the color wheel or ramp or on any of the color parameters sliders. You can adjust such parameters with the spinbox beside or by scrolling the mouse wheel over the corresponding slider. You can also type the color in HTML notation. Finally, there is an *Opacity* slider to set transparency level.

The dialog also provides a visual comparison between the *Old* color (applied to object) and the *Current* one (being selected). Using drag-and-drop or pressing the Add color to swatch button, any of these colors can be saved in a slot for easy access.

Dica: Alteração rápida da cor

Drag-and-drop a color selector widget onto another one to apply its color.

The color drop-down shortcut

Click the drop-down arrow to the right of the  color button to display a widget for quick color selection. This shortcut provides access to:

- a color wheel to pick a color from
- an alpha slider to change color opacity
- the color palettes previously set to *Show in Color Buttons*
- copy the current color and paste it into another widget
- pick a color from anywhere on your computer display
- choose a color from the color selector dialog
- drag-and-drop the color from one widget to another for quick modification

---

Nota: When the color widget is set to a *project color* through the data-defined override properties, the above functions for changing the color are unavailable. You'd first need to *Unlink color* or *Clear* the definition.

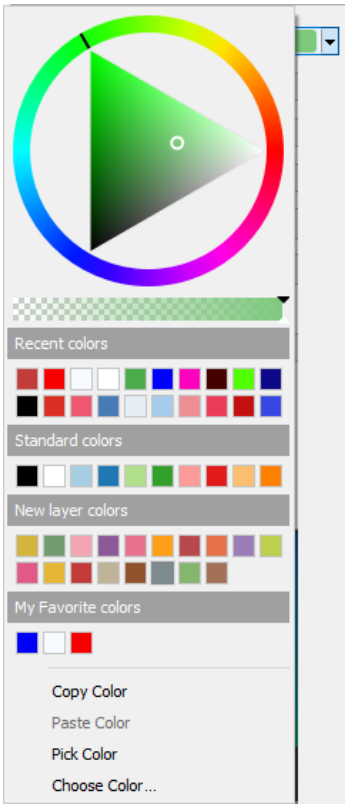


Figura11.27: Quick color selector menu

The color ramp drop-down shortcut

Color ramps are a practical way to apply a set of colors to one or many features. Their creation is described in the *Setting a Color Ramp* section. As for the colors, pressing the  color ramp button opens the corresponding color ramp type dialog allowing you to change its properties.

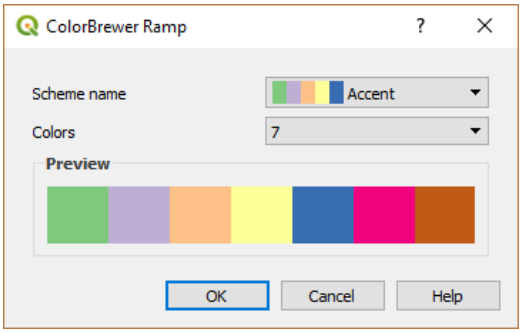


Figura11.28: Customizing a colorbrewer ramp

The drop-down menu to the right of the button gives quick access to a wider set of color ramps and options:

- *Invert Color Ramp*
- a preview of the `gradient` or `catalog: cpt-city` color ramps flagged as **Favorites** in the *Style Manager* dialog
- *All Color Ramps* to access the compatible color ramps database
- *Create New Color Ramp…* of any supported type that could be used in the current widget (note that this color ramp will not be available elsewhere unless you save it in the library)
- *Edit Color Ramp…*, the same as clicking the whole color ramp button
- *Save Color Ramp…*, to save the current color ramp with its customizations in the style library

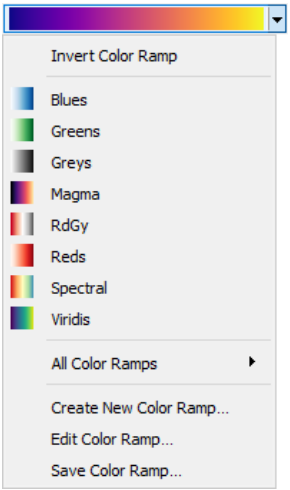


Figura11.29: Quick color ramp selection widget

11.9.2 Symbol Widget

The *Symbol* selector widget is a convenient shortcut when you want to set symbol properties of a feature. Clicking the drop-down arrow shows the following symbol options, together with the features of the *color drop-down widget*:

- *Configure Symbol...*: the same as pressing the symbol selector widget. It opens a dialog to set the *symbol parameters*.
- *Copiar Símbolo* do item atual
- *Paste Symbol* to the current item, speeding configuration

11.9.3 Font Selector

The *Font* selector widget is a convenient shortcut when you want to set font properties for textual information (feature labels, decoration labels, map legend text, ...). Clicking the drop-down arrow shows some or all of the following options:



Figura11.30: Font selector drop-down menu

- *Font Size* in the associated unit
- *Recent Fonts* ► menu with the active font checked (at the top)
- *Configure Format...*: same as pressing the font selector widget. It opens a dialog to set text format parameters. Depending on the context, it can be the OS default *Text format* dialog or the QGIS custom dialog with advanced formatting options (opacity, orientation, buffer, background, shadow, ...) as described in section *Formatting the label text*.
- *Copy Format* of the text
- *Paste Format* to the text, speeding configuration
- the *color widget* for quick color setting

11.9.4 Unit Selector

Size properties of the items (labels, symbols, layout elements, …) in QGIS are not necessarily bound to either the project units or the units of a particular layer. For a large set of properties, the *Unit* selector drop-down menu allows you to tweak their values according to the rendering you want (based on screen resolution, paper size, or the terrain). Available units are:

- *Millimeters*
- *Pontos*
- *Pixels*
- *Polegadas*
- *Meters at Scale*: This allows you to always set the size in meters, regardless of what the underlying map units are (e.g. they can be in inches, feet, geographic degrees, …). The size in meters is calculated based on the current project ellipsoid setting and a projection of the distances in meters at the center of the current map extent.
- and *Map Units*: The size is scaled according to the map view scale. Because this can lead to too big or too small values, use the button next to the entry to constrain the size to a range of values based on:
  - The *Minimum scale* and the *Maximum scale*: The value is scaled based on the map view scale until you reach any of these scale limits. Out of the range of scale, the value at the nearest scale limit is kept.
  - and/or The *Minimum size* and the *Maximum size* in `mm`: The value is scaled based on the map view scale until it reaches any of these limits; Then the limit size is kept.

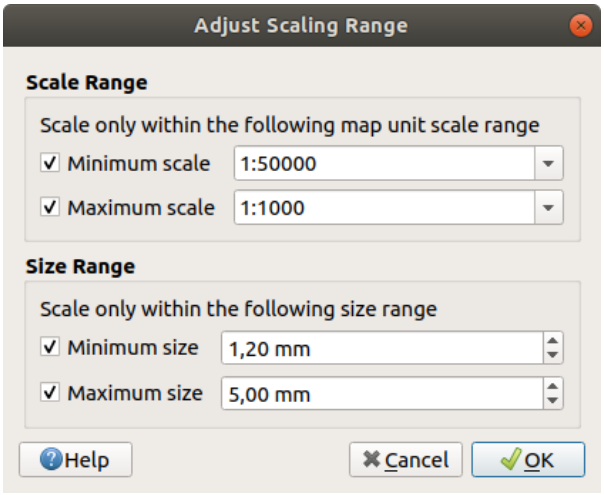


Figura11.31: Adjust scaling range dialog

11.9.5 Number Formatting

Numeric formatters allow formatting of numeric values for display, using a variety of different formatting techniques (for instance scientific notation, currency values, percentage values, etc). One use of this is to set text in a layout scale bar or fixed table.

Different categories of formats are supported. For most of them, you can set part or all of the following numeric options:

- *Show thousands separator*
- *Show plus sign*
- *Show trailing zeros*

But they can also have their custom settings. Provided categories are:

- *General*, the default category: has no setting and displays values as set in the parent widget properties or using the global settings.
- *Number*
  - The value can be *Round to* a self defined number of *Decimal places* or their *Significant figures*
  - customize the *Thousands separator* and *Decimal separator*
- *Bearing* for a text representation of a direction/bearing using:
  - *Format*: possible ranges of values are `0 to 180°, with E/W suffix`, `-180 to +180°` and `0 to 360°`
  - number of *Decimal places*
- *Currency* for a text representation of a currency value.
  - *Prefix*
  - *Suffix*
  - number of *Decimal places*
- *Fraction* for a vulgar fractional representation of a decimal value (e.g. *1/2* instead of *0.5*)
  - ☐ *Use unicode super/subscript* to show. For example $^{1}/_{2}$ instead of 1/2
  - ☐ *Use dedicated Unicode characters*
  - customize the *Thousands separator*
- *Percentage* - appends `%` to the values, with setting of:
  - number of *Decimal places*
  - *Scaling* to indicate whether the actual values already represent percentages (then they will be kept as is) or fractions (then they are converted)
- *Scientific* notation in the form `2.56e+03`. The number of *Decimal places* can be set.

A live preview of the settings is displayed under the *Sample* section.

11.9.6 Modos de Mistura

QGIS offers different options for special rendering effects with these tools that you may previously only know from graphics programs. Blending modes can be applied on layers and features, and also on print layout items:

- ** Normal **: Esse é o modo de mescla padrão, que usa o canal alfa do pixel superior para combinar com o pixel abaixo dele. As cores não são misturadas.
- **Lighten**: This selects the maximum of each component from the foreground and background pixels. Be aware that the results tend to be jagged and harsh.
- **Screen**: Light pixels from the source are painted over the destination, while dark pixels are not. This mode is most useful for mixing the texture of one item with another item (such as using a hillshade to texture another layer).
- **Dodge**: Brighten and saturate underlying pixels based on the lightness of the top pixel. Brighter top pixels cause the saturation and brightness of the underlying pixels to increase. This works best if the top pixels aren't too bright. Otherwise the effect is too extreme.
- **Addition**: Adds pixel values of one item to the other. In case of values above the maximum value (in the case of RGB), white is displayed. This mode is suitable for highlighting features.
- **Darken**: Retains the lowest values of each component of the foreground and background pixels. Like lighten, the results tend to be jagged and harsh.

- **Multiply**: Pixel values of the top item are multiplied with the corresponding values for the bottom item. The results are darker.
- **Burn**: Darker colors in the top item cause the underlying items to darken. Burn can be used to tweak and colorize underlying layers.
- **Overlay**: Combines multiply and screen blending modes. Light parts become lighter and dark parts become darker.
- **Soft light**: Very similar to overlay, but instead of using multiply/screen it uses color burn/dodge. This is supposed to emulate shining a soft light onto an image.
- **Hard light**: Hard light is also very similar to the overlay mode. It's supposed to emulate projecting a very intense light onto an image.
- **Difference**: Subtracts the top pixel from the bottom pixel, or the other way around, in order always to get a positive value. Blending with black produces no change, as the difference with all colors is zero.
- **Subtract**: Subtracts pixel values of one item from the other. In the case of negative values, black is displayed.

11.9.7 Data defined override setup

Next to many options in the vector layer properties dialog or settings in the print layout, you will find a  Data defined override icon. Using *expressions* based on layer attributes or item settings, prebuilt or custom functions and *variables*, this tool allows you to set dynamic values for parameters. When enabled, the value returned by this widget is applied to the parameter regardless of its normal value (checkbox, textbox, slider…).

The data defined override widget

Clicking the  Data defined override icon shows the following entries:

- *Description…* that indicates if the option is enabled, which input is expected, the valid input type and the current definition. Hovering over the widget also pops up this information.
- *Store data in the project*: a button allowing the property to be stored using to the *Propriedades de armazenamento auxiliar* mechanism.
- *Field type*: an entry to select from the layer's fields that match the valid input type.
- *Color*: when the widget is linked to a color property, this menu gives access to the colors defined as part of the current *project's colors* scheme.
- *Variable*: a menu to access the available user-defined *variables*
- *Edit…* button to create or edit the expression to apply, using the *Expression String Builder* dialog. To help you correctly fill in the expression, a reminder of the expected output's format is provided in the dialog.
- botões *Colar* e *Copiar*.
- *Clear* button to remove the setup.
- For numeric and color properties, *Assistant…* to rescale how the feature data is applied to the property (more details *below*)

Dica: Use right-click to (de)activate the data override

When the data-defined override option is set up correctly the icon is yellow  or . If it is broken, the icon is red  or .

You can enable or disable a configured  data-defined override button by simply clicking the widget with the right mouse button.

Using the data-defined assistant interface

When the Data-defined override button is associated with a numeric or color parameter, it has an *Assistant…* option that allows you to change how the data is applied to the parameter for each feature. The assistant allows you to:

- Define the *Input* data, ie:
  - the attribute to represent, using the Field listbox or the Set column expression function (see *Expressões*)
  - the range of values to represent: you can manually enter the values or use the Fetch value range from layer button to fill these fields automatically with the minimum and maximum values returned by the chosen attribute or the expression applied to your data
- *Apply transform curve*: by default, output values (see below for setting) are applied to input features following a linear scale. You can override this logic: enable the transform option, click on the graphic to add break point(s) and drag the point(s) to apply a custom distribution.
- Define the *Output* values: the options vary according to the parameter to define. You can globally set:
  - the minimum and maximum values to apply to the selected property (n case of a color setting, you'll need to provide a *color ramp*)
  - the *Scale method* of representation which can be **Flannery**, **Exponential**, **Surface** or **Radius**
  - the *Exponent* to use for data scaling
  - the output value or *color* to represent features with NULL values

When compatible with the property, a live-update preview is displayed in the right-hand side of the dialog to help you control the value scaling.

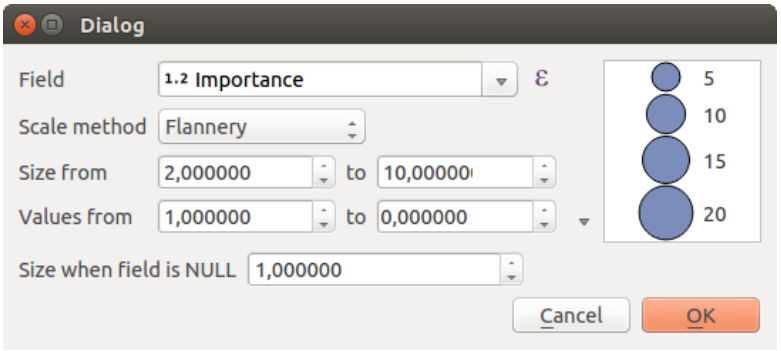


Figura11.32: The data-defined size assistant

The values presented in the varying size assistant above will set the size 'Data-defined override' with:

```
coalesce(scale_exp(Importance, 1, 20, 2, 10, 0.57), 1)
```

CAPÍTULO 12

A biblioteca de estilos

12.1 The Style Manager

12.1.1 The Style Manager dialog

The *Style Manager* is the place where you can manage and create generic style items. These are symbols, color ramps, text formats or label settings that can be used to symbolize features, layers or print layouts. They are stored in the `symbology-style.db` database under the active *user profile* and shared with all the project files opened with that profile. Style items can also be shared with others thanks to the export/import capabilities of the *Style Manager* dialog.

You can open that modeless dialog either:

- from the *Settings* ►  *Style Manager…* menu
- with the  Style Manager button from the Project toolbar
- or with the  Style Manager button from a vector *Layer Properties* ► menu (while *configuring a symbol* or *formatting a text*).

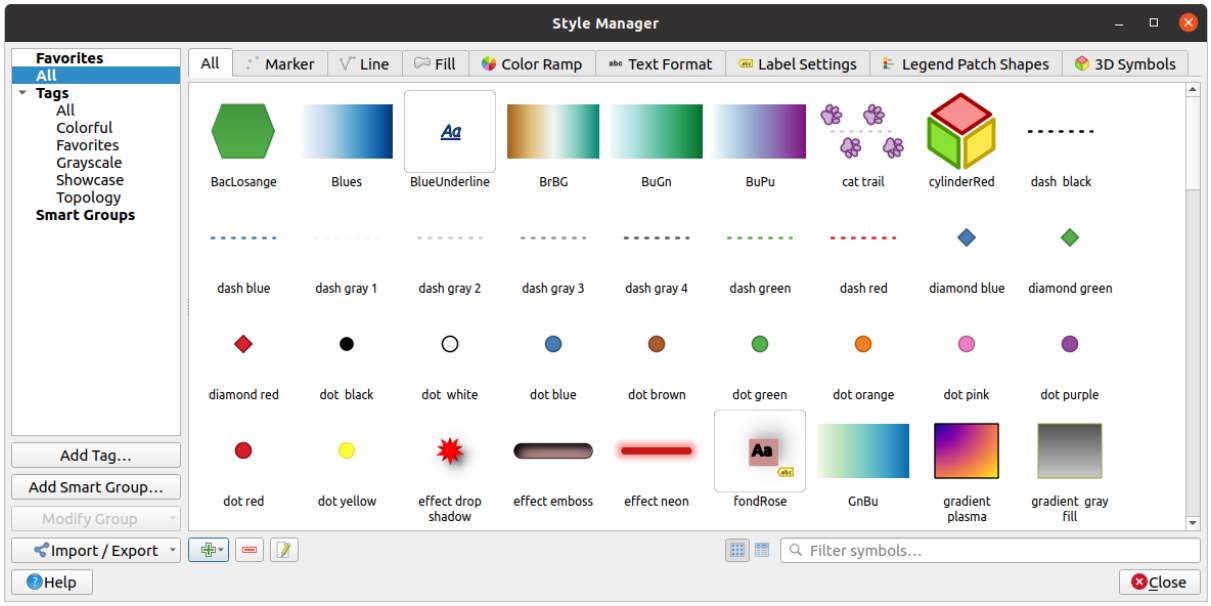


Figura12.1: The Style Manager

Organizing style items

The *Style Manager* dialog displays in its center a frame with previewed items organized into tabs:

- *All* for a complete collection of point, linear and surface symbols and label settings as well as predefined color ramps and text formats;
- *Marker* for point symbols only;
- *Line* for linear symbols only;
- *Fill* for surface symbols only;
- *Color ramp*;
- abc *Text format* to manage *text formats*, which store the font, color, buffers, shadows, and backgrounds of texts (i.e. all the formatting parts of the label settings, which for instance can be used in layouts);
- *Label settings* to manage *label settings*, which include the text formats and some layer-type specific settings such as label placement, priority, callouts, rendering…
- *3D Symbols* to configure symbols with *3D properties* (extrusion, shading, altitude, …) for the features to render in a *3D Map view*

For each family of items, you can organize the elements into different categories, listed in the panel on the left:

- **Favorites**: displayed by default when configuring an item, it shows an extensible set of items;
- **All**: lists all the available items for the active type;
- **Tags**: shows a list of labels you can use to identify the items. An item can be tagged more than once. Select a tag in the list and the tabs are updated to show only their items that belong to it. To create a new tag you could later attach to a set of items, use the *Add Tag...* button or select the *Add Tag...* from any tag contextual menu;
- **Smart Group**: a smart group dynamically fetches its symbols according to conditions set (see eg, Fig.12.2). Click the *Add Smart Group...* button to create smart groups. The dialog box allows you to enter an expression

to filter the items to select (has a particular tag, have a string in its name, etc.). Any symbol, color ramp, text format or label setting that satisfies the entered condition(s) is automatically added to the smart group.

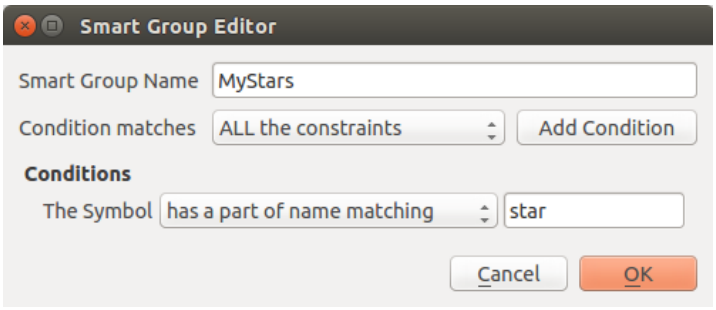


Figura12.2: Creating a Smart Group

Tags and smart groups are not mutually exclusive: they are simply two different ways to organize your style elements. Unlike the smart groups that automatically fetch their belonged items based on the input constraints, tags are filled by the user. To edit any of those categories, you can either:

- select the items, right-click and choose *Add to Tag* ► and then select the tag name or create a new tag;
- select the tag and press *Modify group…* ► *Attach Selected Tag to Symbols*. A checkbox appears next to each item to help you select or deselect it. When selection is finished, press *Modify group…* ► *Finish Tagging*.
- select the smart group, press *Modify group…* ► *Edit smart group…* and configure a new set of constraints in the *Smart Group Editor* dialog. This option is also available in the contextual menu of the smart group.

To remove a tag or a smart group, right-click on it and select the *Remove* button. Note that this does not delete the items grouped in the category.

Adding, editing or removing an item

As seen earlier, style elements are listed under different tabs whose contents depend on the active category (tag, smart group, favorites…). When a tab is enabled, you can:

- Add new items: press the Add item button and configure the item following *symbols*, *color ramps* or *text format and label* builder description.
- Modify an existing item: select an item and press Edit item button and configure as mentioned above.
- Delete existing items: to delete an element you no longer need, select it and click Remove item (also available through right-click). The item will be deleted from the local database.

Note that the *All* tab provides access to these options for every type of item.

Right-clicking over a selection of items also allows you to:

- *Add to Favorites*;
- *Remove from Favorites*;
- *Add to Tag* ► and select the appropriate tag or create a new one to use; the currently assigned tags are checked;
- *Clear Tags*: detaching the symbols from any tag;
- *Remove Item(s)*;
- *Edit Item*: applies to the item you right-click over;
- *Copy Item*;
- *Paste Item* …: pasting to one of the categories of the style manager or elsewhere in QGIS (symbol or color buttons)

- *Export Selected Symbol(s) as PNG…* (only available with symbols);
- *Export Selected Symbol(s) as SVG…* (only available with symbols);

Sharing style items

The *Import/Export* tool, at the left bottom of the Style Manager dialog, offers options to easily share symbols, color ramps, text formats and label settings with others. These options are also available through right-click over the items.

Exporting items

You can export a set of items to an `.XML` file:

1. Expand the *Import/Export* drop-down menu and select *Export Item(s)…*
2. Choose the items you'd like to integrate. Selection can be done with the mouse or using a tag or a group previously set.
3. Press *Export* when ready. You'll be prompted to indicate the destination of the saved file. The XML format generates a single file containing all the selected items. This file can then be imported in another user's style library.

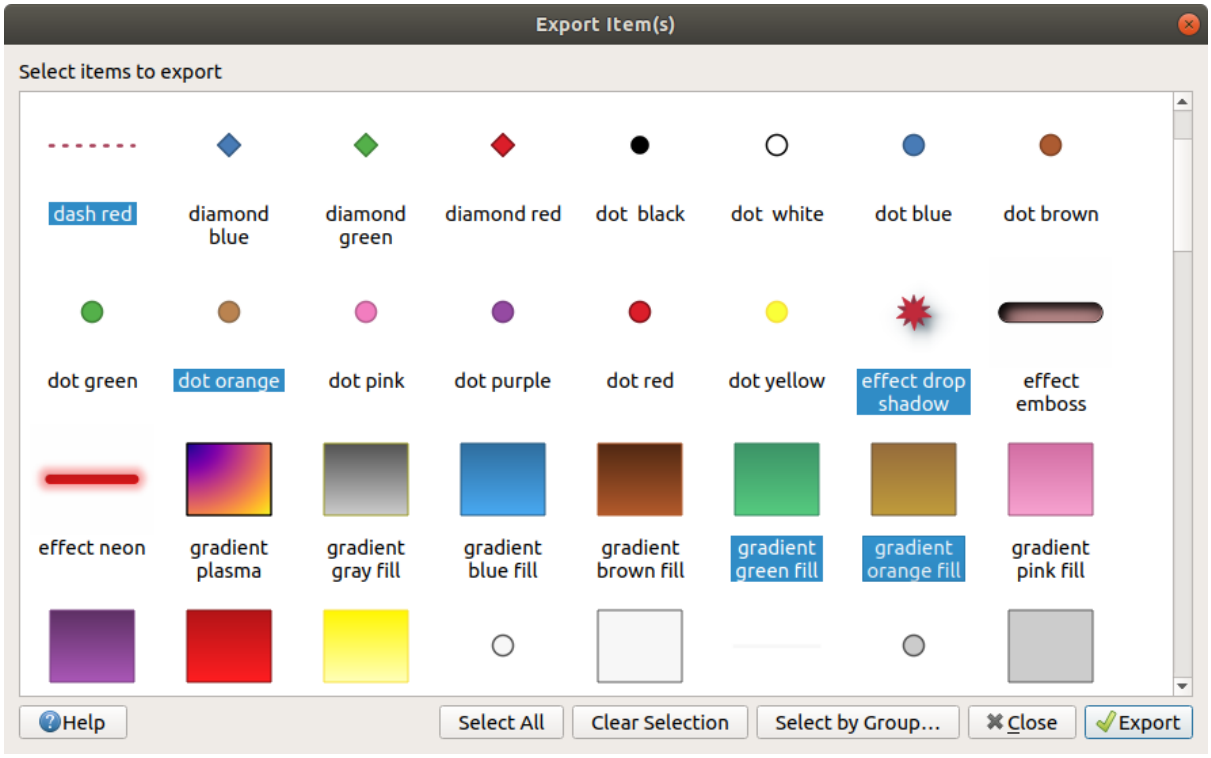


Figura12.3: Exporting style items

When symbols are selected, you can also export them to `.PNG` or `.SVG`. Exporting to `.PNG` or `.SVG` (both not available for other style item types) creates a file for each selected symbol in a given folder. The SVG folder can be added to the *SVG paths* in *Settings* ► *Options* ► *System* menu of another user, allowing him direct access to all these symbols.

Importing items

You can extend your style library by importing new items:

1. Expand the *Import/Export* drop-down menu and select *Import Item(s)* at the left bottom of the dialog.
2. In the new dialog, indicate the source of the style items (it can be an `.xml` file on the disk or a url).
3. Set whether to *Add to favorites* the items to import.
4. Check *Do not import embedded tags* to avoid the import of tags associated to the items being imported.
5. Give the name of any *Additional tag(s)* to apply to the new items.
6. Select from the preview the symbols you want to add to your library.
7. And press *Import*.

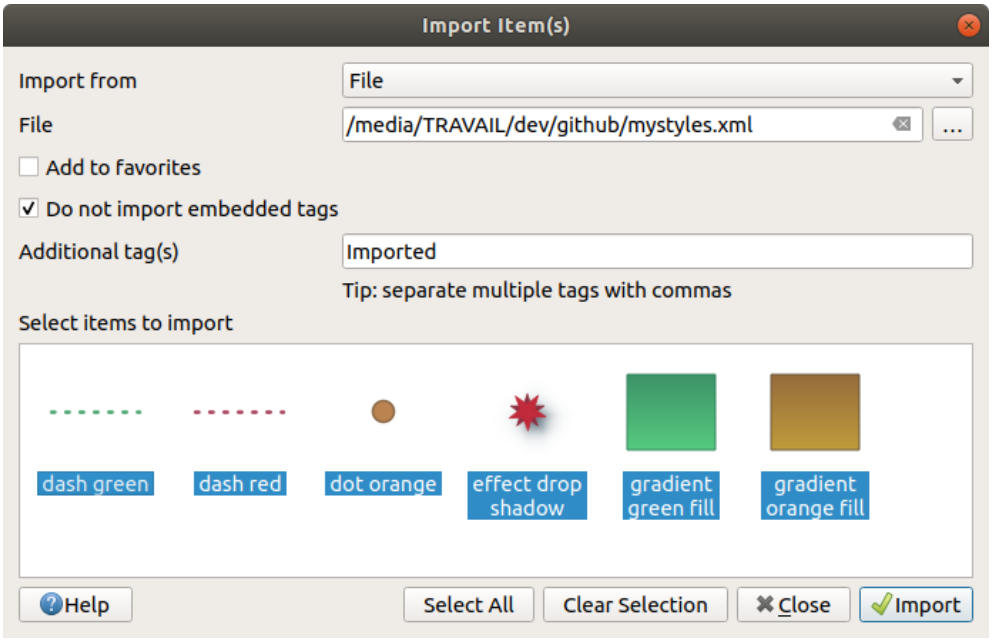


Figura12.4: Importing style items

Using the Browser panel

It's also possible to import style items into the active user profile style database directly from the *Browser* panel:

1. Select the style `.xml` file in the browser
2. Drag-and-drop it over the map canvas or right-click and select *Import Style…*
3. Fill the *Import Items* dialog following *Importing items*
4. Press *Import* and the selected style items are added to the style database

Double-clicking the style file in the browser opens the *Style Manager* dialog showing the items in the file. You can select them and press *Copy to Default Style…* to import them into the active style database. Tags can be assigned to items. Also available through right-click, *Open Style…* command.

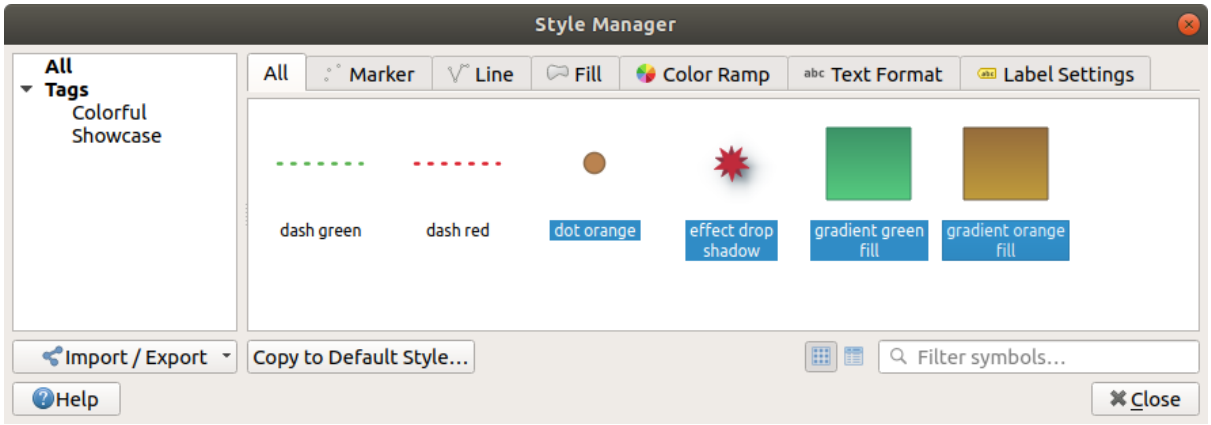


Figura12.5: Opening a style items file

The dialog also allows to export single symbols as `.PNG` or `.SVG` files.

12.1.2 Setting a Color Ramp

The Color ramp tab in the *Style Manager* dialog helps you preview different color ramps based on the category selected in the left panel.

To create a custom color ramp, activate the Color ramp tab and click the Add item button. The button reveals a drop-down list to choose the ramp type:

- *Gradient*: given a start and end colors, generate a color ramp which can be **continuous** or **discrete**. With double-clicking the ramp preview, you can add as many intermediate color stops as you want.

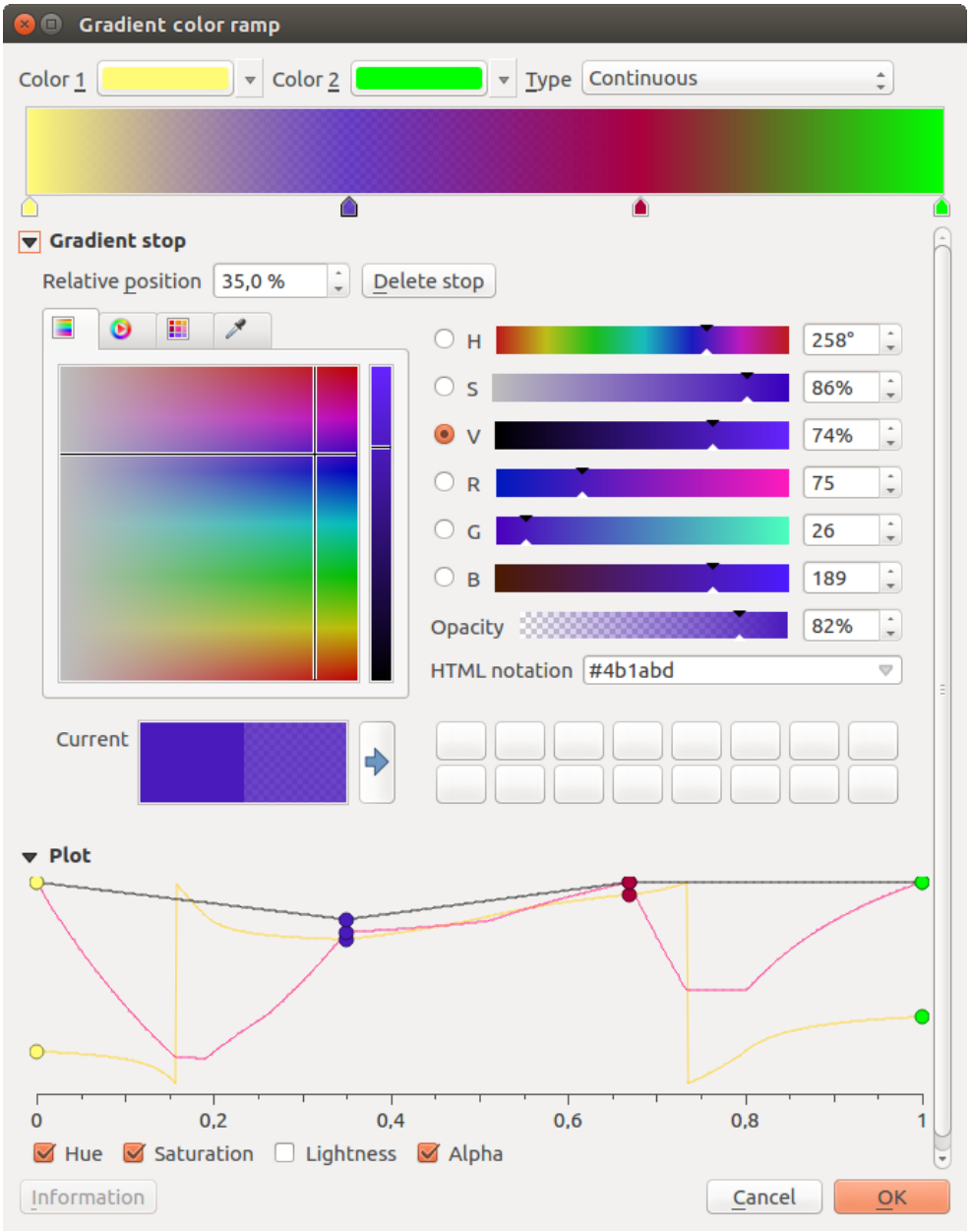


Figura12.6: Example of custom gradient color ramp with multiple stops

- *Color presets*: allows to create a color ramp consisting of a list of colors selected by the user;
- *Random*: creates a random set of colors based on range of values for *Hue*, *Saturation*, *Value* and *Opacity* and a number of colors (*Classes*);
- *Catalog: ColorBrewer*: a set of predefined discrete color gradients you can customize the number of colors in the ramp;
- or *Catalog: cpt-city*: an access to a whole catalog of color gradients to locally *save as standard gradient*. The cpt-city option opens a new dialog with hundreds of themes included 'out of the box'.

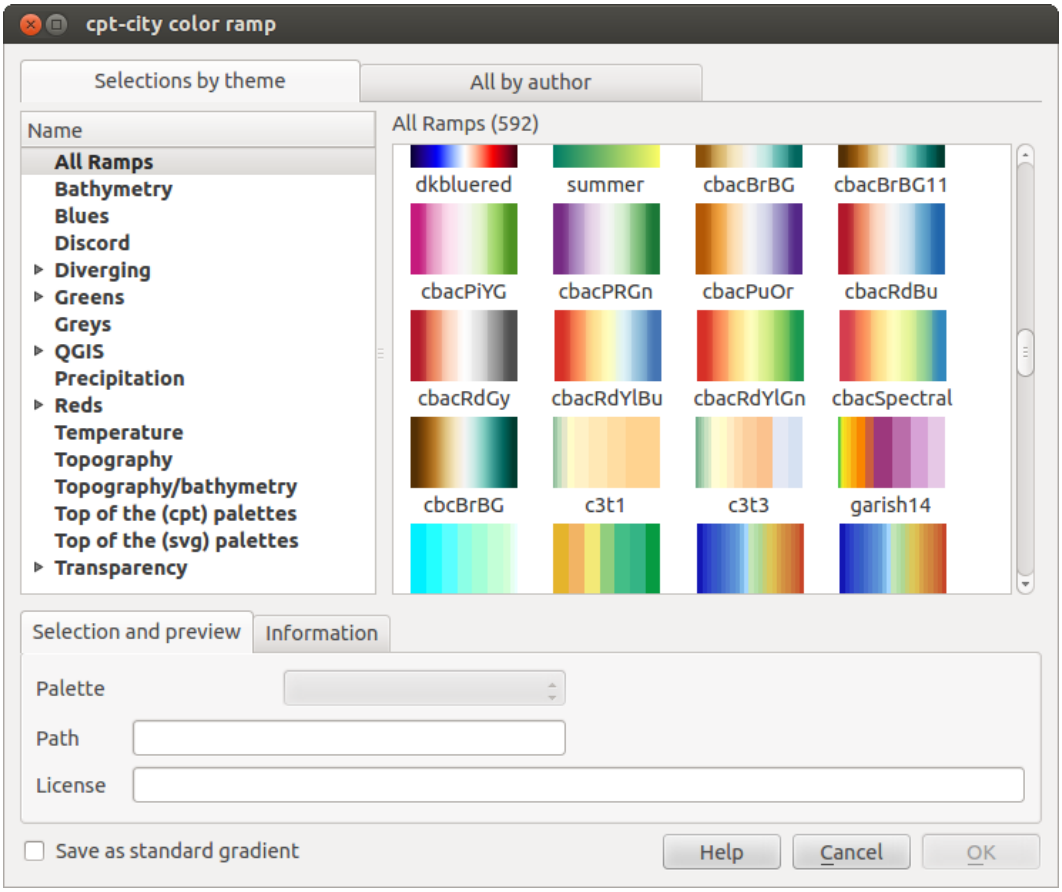


Figura12.7: cpt-city dialog with hundreds of color ramps

Dica: Easily adjust the color stops of the gradient color ramp

Double-clicking the ramp preview or drag-and-drop a color from the color spot onto the ramp preview adds a new color stop. Each color stop can be tweaked using the *Selector de Cor* widgets or by plotting each of its parameters. You can also reposition it using the mouse, the arrow keys (combine with `Shift` key for a larger move) or the *Relative position* spinbox. Pressing *Delete stop* as well as `DEL` key removes the selected color stop.

12.2 The Symbol Selector

The Symbol selector is the main dialog to design a symbol. You can create or edit Marker, Line or Fill Symbols.

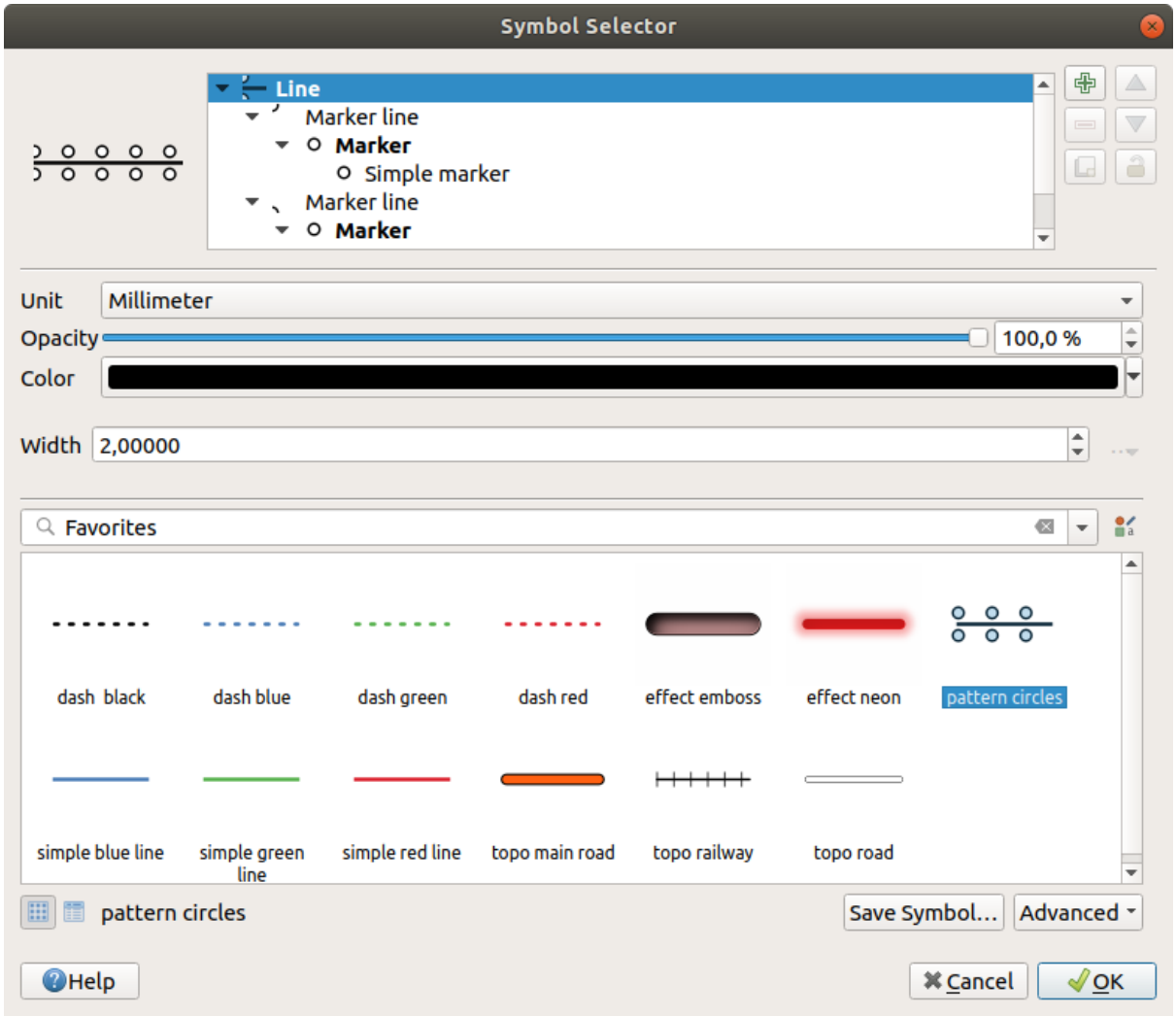


Figura12.8: Designing a Line symbol

Two main components structure the symbol selector dialog:

- the symbol tree, showing symbol layers that are combined afterwards to shape a new global symbol
- and settings to configure the selected symbol layer in the tree.

12.2.1 The symbol layer tree

A symbol can consist of several *Symbol layers*. The symbol tree shows the overlay of these symbol layers that are combined afterwards to shape a new global symbol. Besides, a dynamic symbol representation is updated as soon as symbol properties change.

Depending on the level selected in the symbol tree items, various tools are made available to help you manage the tree:

- add new symbol layer: you can stack as many symbols as you want
- remove the selected symbol layer
- lock colors of symbol layer: a locked color stays unchanged when user changes the color at the global (or upper) symbol level
- duplicate a (group of) symbol layer(s)

- move up or down the symbol layer

12.2.2 Configuring a symbol

In QGIS, configuring a symbol is done in two steps: the symbol and then the symbol layer.

The symbol

At the top level of the tree, it depends on the layer geometry and can be of **Marker**, **Line** or **Fill** type. Each symbol can embed one or more symbols (including, of any other type) or symbol layers.

You can setup some parameters that apply to the global symbol:

- *Unit*: it can be **Millimeters**, **Points**, **Pixels**, **Meters at Scale**, **Map units** or **Inches** (see *Unit Selector* for more details)
- *Opacity*
- *Color*: when this parameter is changed by the user, its value is echoed to all unlocked sub-symbols color
- *Size* and *Rotation* for marker symbols
- *Width* for line symbols

Dica: Use the *Size* (for marker symbols) or the *Width* (for line symbols) properties at the symbol level to proportionally resize all of its embedded *symbol layers* dimensions.

Nota: The *Data-defined override* button next to the width, size or rotation parameters is inactive when setting the symbol from the Style manager dialog. When the symbol is connected to a map layer, this button helps you create *proportional or multivariate analysis* rendering.

- A preview of the *symbols library*: Symbols of the same type are shown and, through the editable drop-down list just above, can be filtered by free-form text or by *categories*. You can also update the list of symbols using the  Style Manager button and open the eponym dialog. There, you can use any capabilities as exposed in *The Style Manager* section.

  The symbols are displayed either:

  - in an icon list (with thumbnail, name and associated tags) using the  List View button below the frame;
  - or as icon preview using the  Icon View button.
- Press the *Save Symbol* button to add the symbol being edited to the symbols library.
- With the *Advanced*  option, you can:
  - for line and fill symbols, *Clip features to canvas extent*.
  - for fill symbols, *Force right-hand rule orientation*: allows forcing rendered fill symbols to follow the standard “right hand rule” for ring orientation (i.e, polygons where the exterior ring is clockwise, and the interior rings are all counter-clockwise).

    The orientation fix is applied while rendering only, and the original feature geometry is unchanged. This allows for creation of fill symbols with consistent appearance, regardless of the dataset being rendered and the ring orientation of individual features.
  - Depending on the *symbology* of the layer a symbol is being applied to, additional settings are available in the *Advanced* menu:
    - *Symbol levels…* to define the order of symbols rendering

    * *Data-defined Size Legend*
    * *Match to Saved Symbols…* and *Match to Symbols from File…* to automatically *assign symbols to classes*

The symbol layer

At a lower level of the tree, you can customize the symbol layers. The available symbol layer types depend on the upper symbol type. You can apply on the symbol layer  *paint effects* to enhance its rendering.

Because describing all the options of all the symbol layer types would not be possible, only particular and significant ones are mentioned below.

Parâmetros comuns

Some common options and widgets are available to build a symbol layer, regardless it's of marker, line or fill sub-type:

- the *color selector* widget to ease color manipulation
- *Units*: it can be **Millimeters**, **Points**, **Pixels**, **Meters at Scale**, **Map units** or **Inches** (see *Unit Selector* for more details)
- the  data-defined override widget near almost all options, extending capabilities of customizing each symbol (see *Data defined override setup* for more information)
- the  *Enable symbol layer* option controls the symbol layer's visibility. Disabled symbol layers are not drawn when rendering the symbol but are saved in the symbol. Being able to hide symbol layers is convenient when looking for the best design of your symbol as you don't need to remove any for the testing. The data-defined override then makes it possible to hide or display different symbol layers based on expressions (using, for instance, feature attributes).
- the  *Draw effects* button for *effects rendering*.

Nota: While the description below assumes that the symbol layer type is bound to the feature geometry, keep in mind that you can embed symbol layers in each others. In that case, the lower level symbol layer parameter (placement, offset…) might be bound to the upper-level symbol, and not to the feature geometry itself.

Marker Symbols

Appropriate for point geometry features, marker symbols have several *Symbol layer types*:

- **Simple marker** (default)

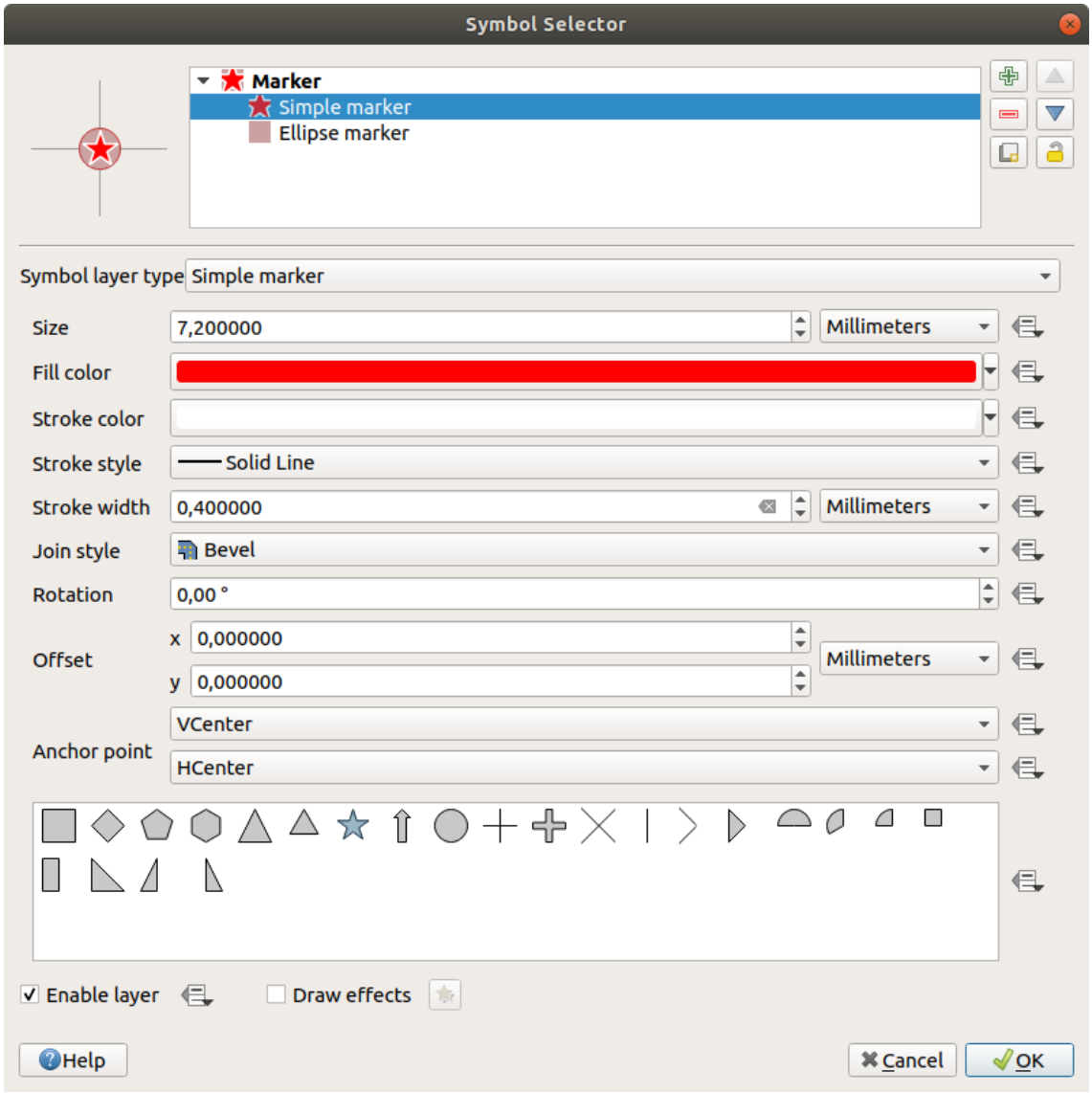


Figura12.9: Designing a Simple Marker Symbol

- **Ellipse marker**: a simple marker symbol layer, with customizable width and height
- **Filled marker**: similar to the simple marker symbol layer, except that it uses a *fill sub symbol* to render the marker. This allows use of all the existing QGIS fill (and stroke) styles for rendering markers, e.g. gradient or shapeburst fills.
- **Font marker**: similar to the simple marker symbol layer, except that it uses installed fonts to render the marker. Its additional properties are:
  - *Font family*
  - *Font style*
  - *Character(s)*, representing the text to display as symbol. They can be typed in or selected from the font characters collection widget and you can live *Preview* them with the selected settings.
- **Geometry generator** (see *The Geometry Generator*)
- **Mask**: its sub-symbol defines a mask shape whose color property will be ignored and only the opacity will be used. This is convenient when the marker symbol overlaps with labels or other symbols whose colors are close, making it hard to decipher. More details at *Masks Properties*.

- **Raster image marker**: use an image (`PNG`, `JPG`, `BMP` ...) as marker symbol. The image can be a file on the disk, a remote URL or embedded in the style database (*more details*). Width and height of the image can be set independently or using the  Lock aspect ratio. The size can be set using any of the *common units* or as a percentage of the image's original size (scaled by the width).
- **Vector Field marker** (see *The Vector Field Marker*)
- **SVG marker**: provides you with images from your SVG paths (set in *Settings* ► *Options...* ► *System* menu) to render as marker symbol. Width and height of the symbol can be set independently or using the  Lock aspect ratio. Each SVG file colors and stroke can also be adapted. The image can be a file on the disk, a remote URL or embedded in the style database (*more details*).

Nota: SVG version requirements

QGIS renders SVG files that follow the SVG Tiny 1.2 profile, intended for implementation on a range of devices, from cellphones and PDAs to laptop and desktop computers, and thus includes a subset of the features included in SVG 1.1 Full, along with new features to extend the capabilities of SVG.

Some features not included in these specifications might not be rendered correctly in QGIS.

Dica: Enable SVG marker symbol customization

To have the possibility to change the colors of a *SVG marker*, you have to add the placeholders `param(fill)` for fill color, `param(outline)` for stroke color and `param(outline-width)` for stroke width. These placeholders can optionally be followed by a default value, e.g.:

```
<svg width="100%" height="100%">
<rect fill="param(fill) #ff0000" stroke="param(outline) #00ff00" stroke-width=
↪"param(outline-width) 10" width="100" height="100">
</rect>
</svg>
```

Line Symbols

Appropriate for line geometry features, line symbols have the following symbol layer types:

- **Simple line** (default): available settings are:

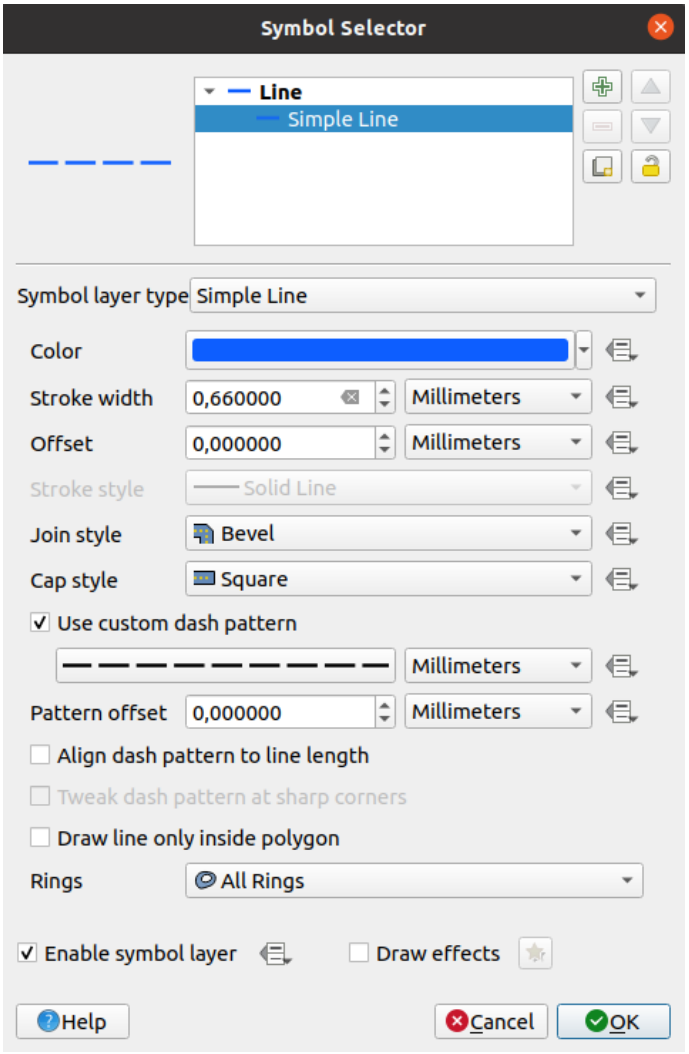


Figura12.10: Designing a Simple Line Symbol

The simple line symbol layer type has many of the same properties as the *simple marker symbol*, and in addition:

- *Cap style*
- *Use custom dash pattern*: overrides the *Stroke style* setting with a custom dash.
- *Align dash pattern to line length*: the dash pattern length will be adjusted so that the line will end with a complete dash element, instead of a gap.
- *Tweak dash pattern at sharp corners*: dynamically adjusts the dash pattern placement so that sharp corners are represented by a full dash element coming into and out of the sharp corner. Dependent on *Align dash pattern to line length*.
- *Draw line only inside polygon*

- **Arrow**: draws lines as curved (or not) arrows with a single or a double head with configurable (and data-defined):
  - *Head type*
  - *Arrow type*
  - *Arrow width*
  - *Arrow width at start*

  - *Head length*
  - *Head thickness*
  - *Offset*

  It is possible to create *Curved arrows* (the line feature must have at least three vertices) and *Repeat arrow on each segment*. It also uses a *fill symbol* such as gradients or shapeburst to render the arrow body. Combined with the geometry generator, this type of layer symbol helps you representing flow maps.

- **Geometry generator** (see *The Geometry Generator*)
- **Marker line**: repeats a *marker symbol* over the length of a line.
  - The markers placement can be at a regular distance or based on the line geometry: first, last or each vertex, on the central point of the line or of each segment, or on every curve point.
  - The markers placement can also be given an offset along the line
  - The *Rotate marker to follow line direction* option sets whether each marker symbol should be oriented relative to the line direction or not.

    Because a line is often a succession of segments of different directions, the rotation of the marker is calculated by averaging over a specified distance along the line. For example, setting the *Average angle over* property to `4mm` means that the two points along the line that are `2mm` before and after the symbol placement are used to calculate the line angle for that marker symbol. This has the effect of smoothing (or removing) any tiny local deviations from the overall line direction, resulting in much nicer visual orientations of the marker line symbols.
  - The marker line can also be offset from the line itself.
- **Hashed line**: repeats a line segment (a hash) over the length of a line symbol, with a line sub-symbol used to render each individual segment. In other words, a hashed line is like a marker line in which marker symbols are replaced with segments. As such, the hashed lines have the *same properties* as marker line symbols, along with:
  - *Hash length*
  - *Hash rotation*
  - *Rotate hash to follow line direction*

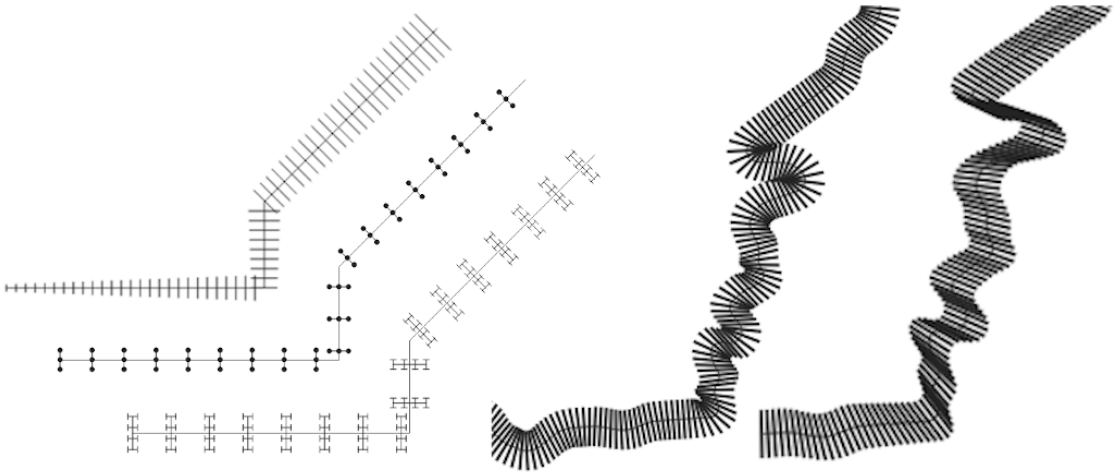


Figura12.11: Examples of hashed lines

Fill Symbols

Appropriate for polygon geometry features, fill symbols have also several symbol layer types:

- **Simple fill** (default): fills a polygon with a uniform color

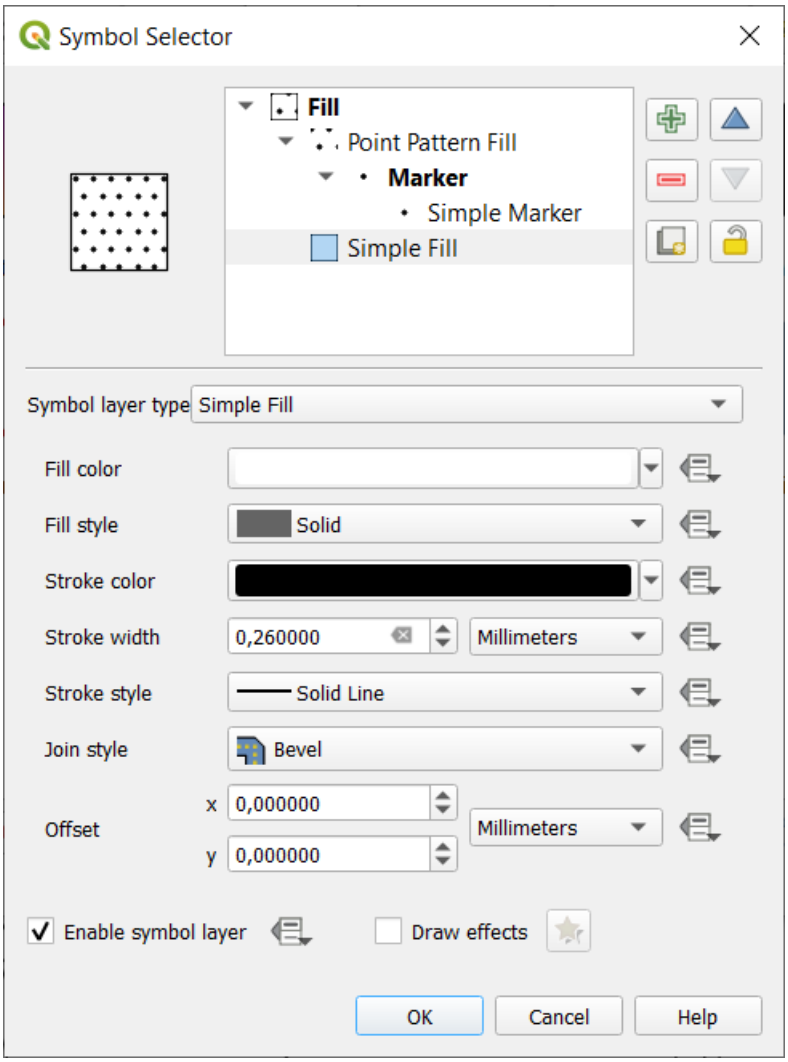


Figura12.12: Designing a Simple Fill Symbol

- **Centroid fill**: places a *marker symbol* at the centroid of the visible feature. The position of the marker may not be the real centroid of the feature, because calculation takes into account the polygon(s) clipped to area visible in map canvas for rendering and ignores holes. Use the *geometry generator symbol* if you want the exact centroid.

  You can:

  - *Force point inside polygon*
  - *Draw point on every part of multi-part feature* or place the point only on its biggest part
  - display the marker symbol(s) in whole or in part, keeping parts overlapping the current feature geometry (*Clip markers to polygon boundary*) or the geometry part the symbol belongs to (*Clip markers to current part boundary only*)

- **Geometry generator** (see *The Geometry Generator*)
- **Gradient fill**: uses a radial, linear or conical gradient, based on either simple two color gradients or a predefined *gradient color ramp* to fill polygons. The gradient can be rotated and applied on a single feature basis or across

the whole map extent. Also start and end points can be set via coordinates or using the centroid (of feature or map). A data-defined offset can be defined;

- **Line pattern fill**: fills the polygon with a hatching pattern of *line symbol layer*. You can set a rotation, the spacing between lines and an offset from the feature boundary;
- **Point pattern fill**: fills the polygon with a hatching pattern of *marker symbol layer*. You can set the distance and a displacement between rows of markers, and an offset from the feature boundary;
- **Random marker fill**: fills the polygon with a *marker symbol* placed at random locations within the polygon boundary. You can set:
  - the number of marker symbols to render, either as an absolute count or as density-based (the fill density will remain the same on different scale / zoom levels)
  - an optional random number seed, to give consistent placement of markers whenever maps are refreshed (also allows random placement to play nice with QGIS server and tile-based rendering)
  - whether markers rendered near the edges of polygons should be clipped to the polygon boundary or not
- **Raster image fill**: fills the polygon with tiles from a raster image (`PNG` `JPG`, `BMP` ...). The image can be a file on the disk, a remote URL or an embedded file encoded as a string (*more details*). Options include (data defined) opacity, image width, coordinate mode (object or viewport), rotation and offset. The image width can be set using any of the *common units* or as a percentage of the original size.
- **SVG fill**: fills the polygon using *SVG markers*;
- **Shapeburst fill**: buffers a gradient fill, where a gradient is drawn from the boundary of a polygon towards the polygon's centre. Configurable parameters include distance from the boundary to shade, use of color ramps or simple two color gradients, optional blurring of the fill and offsets;
- **Outline: Arrow**: uses a line *arrow symbol* layer to represent the polygon boundary. The settings for the outline arrow are the same as for line symbols.
- **Outline: Hashed line**: uses a *hash line symbol* layer to represent the polygon boundary (the interior rings, the exterior ring or all the rings). The settings for the outline hashed line are the same as for line symbols.
- **Outline: Marker line**: uses a *marker line symbol* layer to represent the polygon boundary (the interior rings, the exterior ring or all the rings). The settings for the outline marker line are same as for line symbols.
- **Outline: simple line**: uses a *simple line symbol* layer to represent the polygon boundary (the interior rings, the exterior ring or all the rings). The settings for the outline simple line are the same as for line symbols. The *Draw line only inside polygon* option displays the polygon borders inside the polygon and can be useful to clearly represent adjacent polygon boundaries.

Nota: When geometry type is polygon, you can choose to disable the automatic clipping of lines/polygons to the canvas extent. In some cases this clipping results in unfavourable symbology (e.g. centroid fills where the centroid must always be the actual feature's centroid).

The Geometry Generator

Available with all types of symbols, the *geometry generator* symbol layer allows to use *expression syntax* to generate a geometry on the fly during the rendering process. The resulting geometry does not have to match with the original geometry type and you can add several differently modified symbol layers on top of each other.

Some examples:

```
-- render the centroid of a feature
centroid( $geometry )

-- visually overlap features within a 100 map units distance from a point
-- feature, i.e generate a 100m buffer around the point
```

(continua na próxima página)

(continuação da página anterior)

```
buffer( $geometry, 100 )

-- Given polygon layer1( id1, layer2_id, ...) and layer2( id2, fieldn...)
-- render layer1 with a line joining centroids of both where layer2_id = id2
make_line( centroid( $geometry ),
           centroid( geometry( get_feature( 'layer2', 'id2', attribute(
               $currentfeature, 'layer2_id') ) )
         )

-- Create a nice radial effect of points surrounding the central feature
-- point when used as a MultiPoint geometry generator
collect_geometries(
  array_foreach(
    generate_series( 0, 330, 30 ),
      project( $geometry, .2, radians( @element ) )
  )
)
```

The Vector Field Marker

The vector field marker is used to display vector field data such as earth deformation, tidal flows, and the like. It displays the vectors as lines (preferably arrows) that are scaled and oriented according to selected attributes of data points. It can only be used to render point data; line and polygon layers are not drawn by this symbology.

The vector field is defined by attributes in the data, which can represent the field either by:

- **cartesian** components (`x` and `y` components of the field)
- or **polar** coordinates: in this case, attributes define `Length` and `Angle`. The angle may be measured either clockwise from north, or Counterclockwise from east, and may be either in degrees or radians.
- or as **height only** data, which displays a vertical arrow scaled using an attribute of the data. This is appropriate for displaying the vertical component of deformation, for example.

The magnitude of field can be scaled up or down to an appropriate size for viewing the field.

12.3 Setting a label

Labels are textual information you can display on vector features or maps. They add details you could not necessarily represent using symbols. Two types of text-related items are available in QGIS:

- *Text Format*: defines the appearance of the text, including *font, size, colors*, *shadow*, *background*, *buffer*, …

  They can be used to render texts over the map (layout/map title, decorations, scale bar, …), usually through the *font* widget.

  To create a *Text Format* item:

  1. Open the *Style Manager* dialog
  2. Activate the *Text format* tab

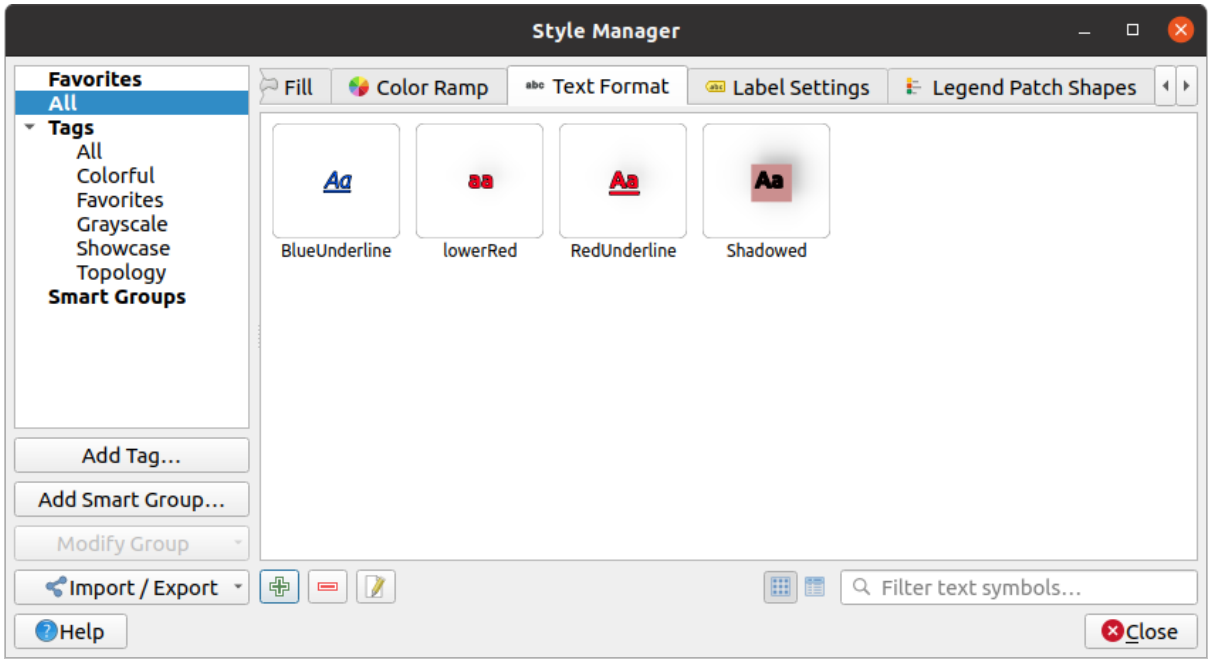


Figura12.13: Text formats in Style Manager dialog

3. Press the Add item button. The *Text Format* dialog opens for *configuration*. As usual, these properties are *data-definable*.

- *Label Settings*: extend the text format settings with properties related to the location or the interaction with other texts or features (*callouts*, *placement*, *overlay, scale visibility*, mask …).

  They are used to configure smart labelling for vector layers through the *Labels* tab of the vector *Layer Properties* dialog or *Layer Styling* panel or using the Layer Labeling Options button of the *Label toolbar*.

  To create a *Label Settings* item:

  1. Open the *Style Manager* dialog
  2. Activate the *Label Settings* tab

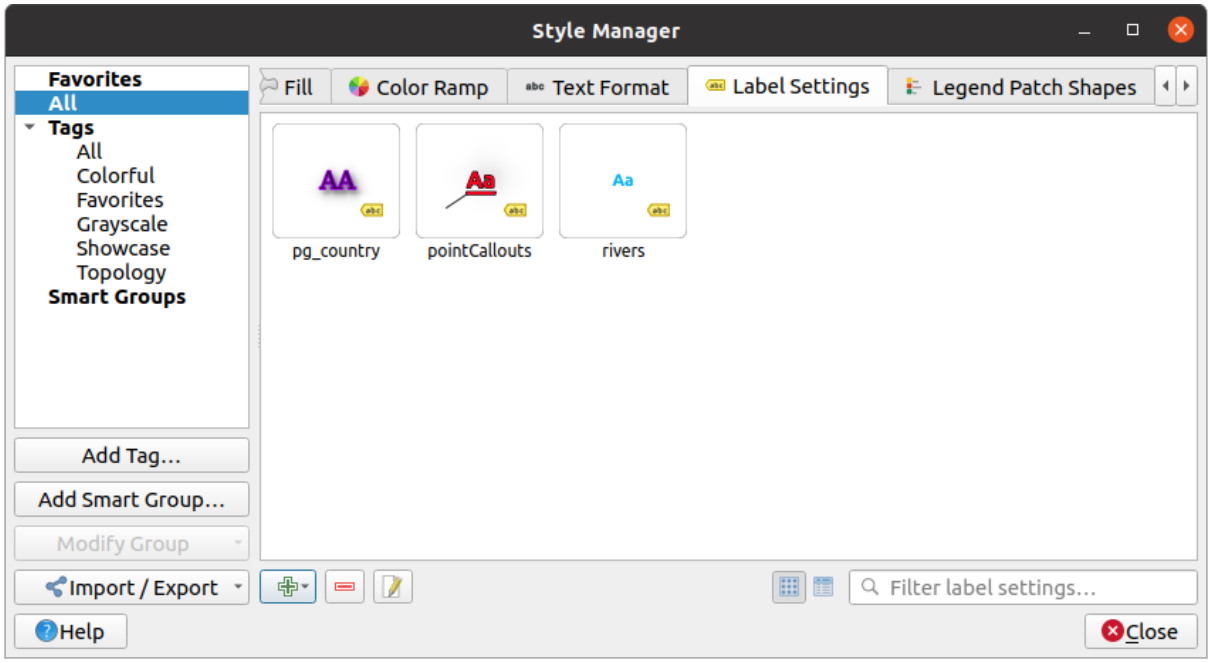


Figura12.14: Label Settings in Style Manager dialog

3. Press the  Add item menu and select the entry corresponding to the geometry type of the features you want to label.

The *Label Settings* dialog opens with the following properties. As usual, these properties are *data-definable*.

12.3.1 Formatting the label text

Most of the following properties are common to *Text Format* and *Label Settings* items.

Text tab

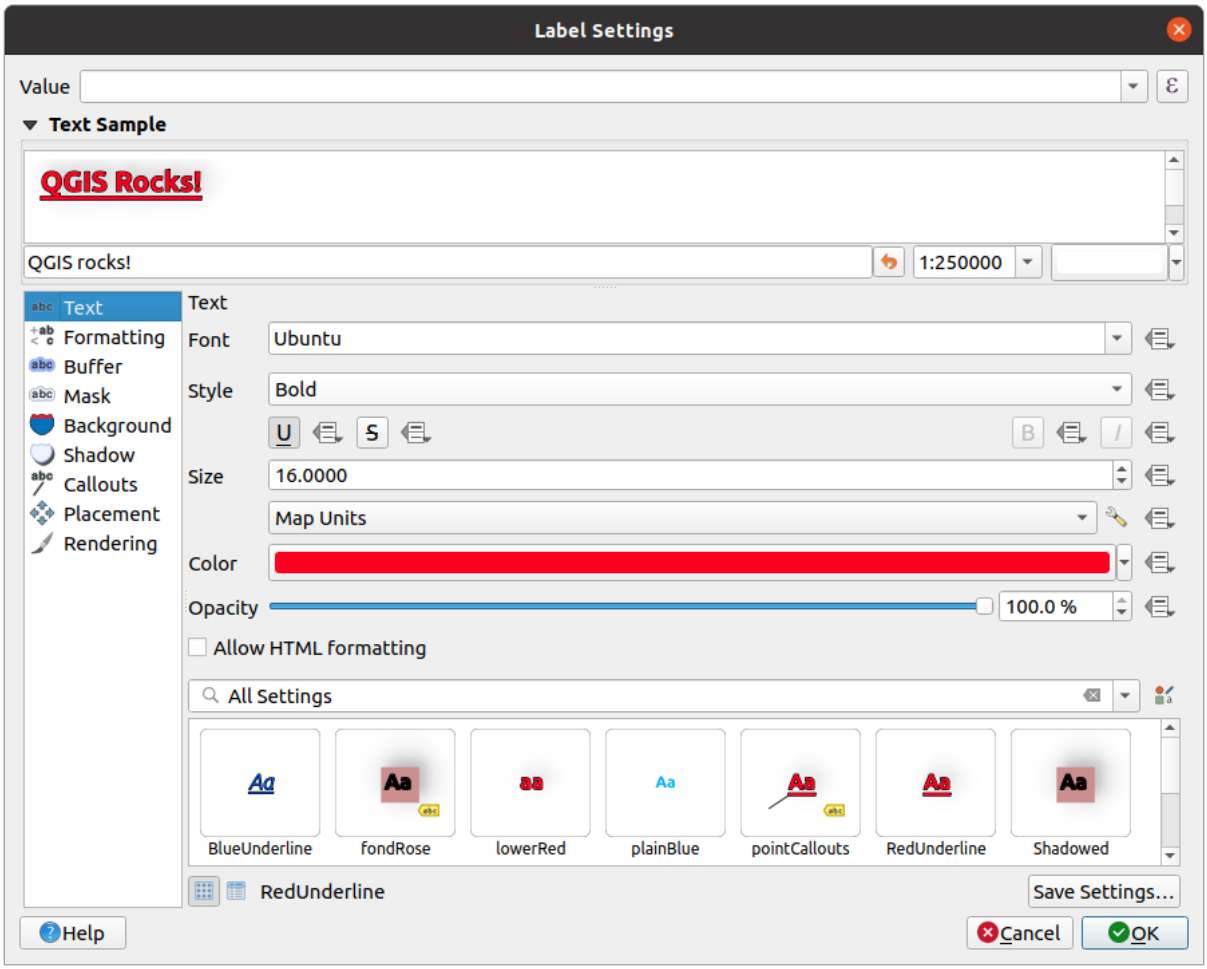


Figura12.15: Labels settings - Text tab

In the abc *Text* tab, you can set:

- the *Font*, from the ones available on your machine
- the *Style*: along with the common styles of the font, you can set whether the text should be underlined or striked through
- the *Size* in any *supported unit*
- the *Color*
- and the *Opacity*.

At the bottom of the tab, a widget shows a filterable list of compatible items stored in your *style manager database*. This allows you to easily configure the current text format or label setting based on an existing one, and also save a new item to the style database: Press the *Save format…* or *Save settings…* button and provide a name and tag(s).

Nota: When configuring a *Label Settings* item, text format items are also available in this widget. Select one to quickly overwrite the current *textual properties* of the label. Likewise, you can create/overwrite a text format from there.

Formatting tab

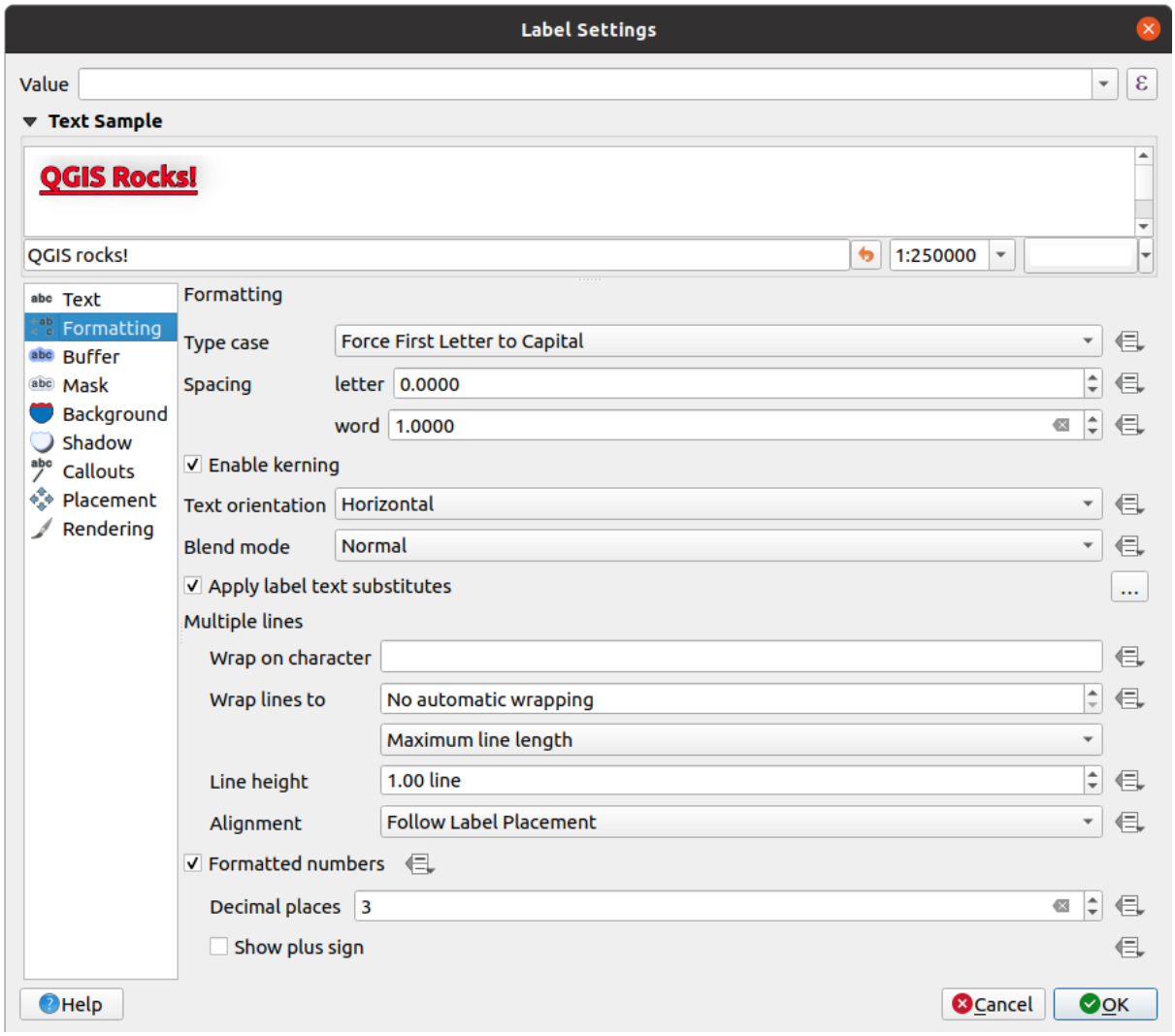


Figura12.16: Label settings - Formatting tab

In the *Formatting* tab, you can:

- Use the *Type case* option to change the capitalization style of the text. You have the possibility to render the text as:
  - *No change*
  - *All uppercase*
  - *All lowercase*
  - *Title case*: modifies the first letter of each word into capital, and turns the other letters into lower case if the original text is using a single type case. In case of mixed type cases in the text, the other letters are left untouched.
  - *Force first letter to capital*: modifies the first letter of each word into capital and leaves the other letters in the text untouched.
- Under *Spacing*, change the space between words and between individual letters.
- *Enable kerning* of the text font

- Set the *Text orientation* which can be *Horizontal* or *Vertical*. It can also be *Rotation-based* when setting a label (e.g., to properly label line features in *parallel* placement mode).
- Use the *Blend mode* option to determine how your labels will mix with the map features below them (more details at *Modos de Mistura*).
- The *Apply label text substitutes* option allows you to specify a list of texts to substitute to texts in feature labels (e.g., abbreviating street types). Replacement texts are used when displaying labels on the map. Users can also export and import lists of substitutes to make reuse and sharing easier.
- Configure *Multiple lines*:
  - Set a character that will force a line break in the text with the *Wrap on character* option
  - Set an ideal line size for auto-wrapping using the *Wrap lines to* option. The size can represent either the *Maximum line length* or the *Minimum line length*.
  - Decide the *Line Height*
  - Format the *Alignment*: typical values available are *Left*, *Right*, *Justify* and *Center*.

    When setting point labels properties, the text alignment can also be *Follow label placement*. In that case, the alignment will depend on the final placement of the label relative to the point. E.g., if the label is placed to the left of the point, then the label will be right aligned, while if it is placed to the right, it will be left aligned.

Nota: The *Multiple lines* formatting is not yet supported by curve based *label placement*. The options will then be deactivated.

- For line labels you can include *Line direction symbol* to help determine the line directions, with symbols to use to indicate the *Left* or *Right*. They work particularly well when used with the *curved* or *Parallel* placement options from the *Placement* tab. There are options to set the symbols position, and to *Reverse direction*.
- Use the *Formatted numbers* option to format numeric texts. You can set the number of *Decimal places*. By default, 3 decimal places will be used. Use the *Show plus sign* if you want to show the plus sign for positive numbers.

Buffer tab

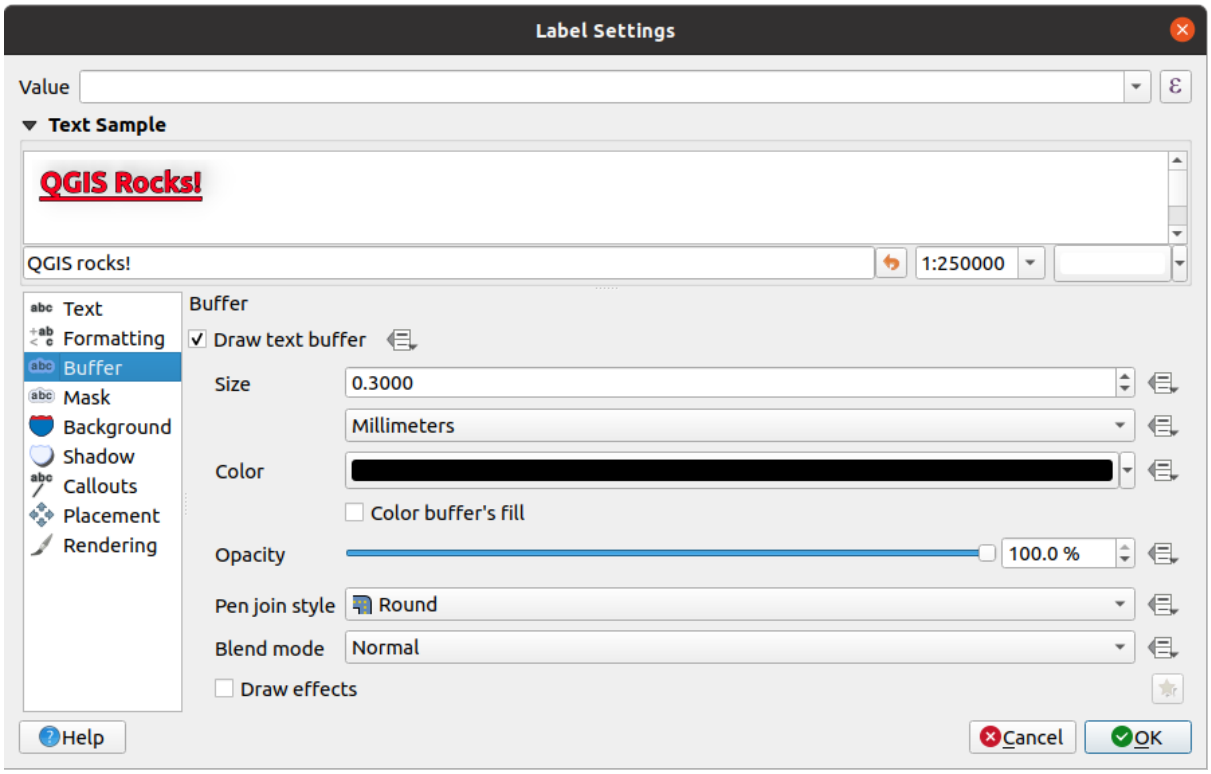


Figura12.17: Label settings - Buffer tab

To create a buffer around the label, activate the *Draw text buffer* checkbox in the *Buffer* tab. Then you can:

- Set the buffer's *Size* in any *supported unit*
- Select the buffer's *Color*
- *Color buffer's fill*: The buffer expands from the label's outline, so, if the option is activated, the label's interior is filled. This may be relevant when using partially transparent labels or with non-normal blending modes, which will allow seeing behind the label's text. Unchecking the option (while using totally transparent labels) will allow you to create outlined text labels.
- Define the buffer's *Opacity*
- Apply a *Pen join style*: it can be *Round*, *Miter* or *Bevel*
- Use the *Blend mode* option to determine how your label's buffer will mix with the map components below them (more details at *Modos de Mistura*).
- Check *Draw effects* to add advanced *paint effects* for improving text readability, eg through outer glows and blurs.

Background tab

The *Background* tab allows you to configure a shape that stays below each label. To add a background, activate the *Draw Background* checkbox and select the *Shape* type. It can be:

- a regular shape such as *Rectangle*, *Square*, *Circle* or *Ellipse*
- an *SVG* symbol from a file, a URL or embedded in the project or style database (*more details*)
- or a *Marker Symbol* you can create or select from the *symbol library*.

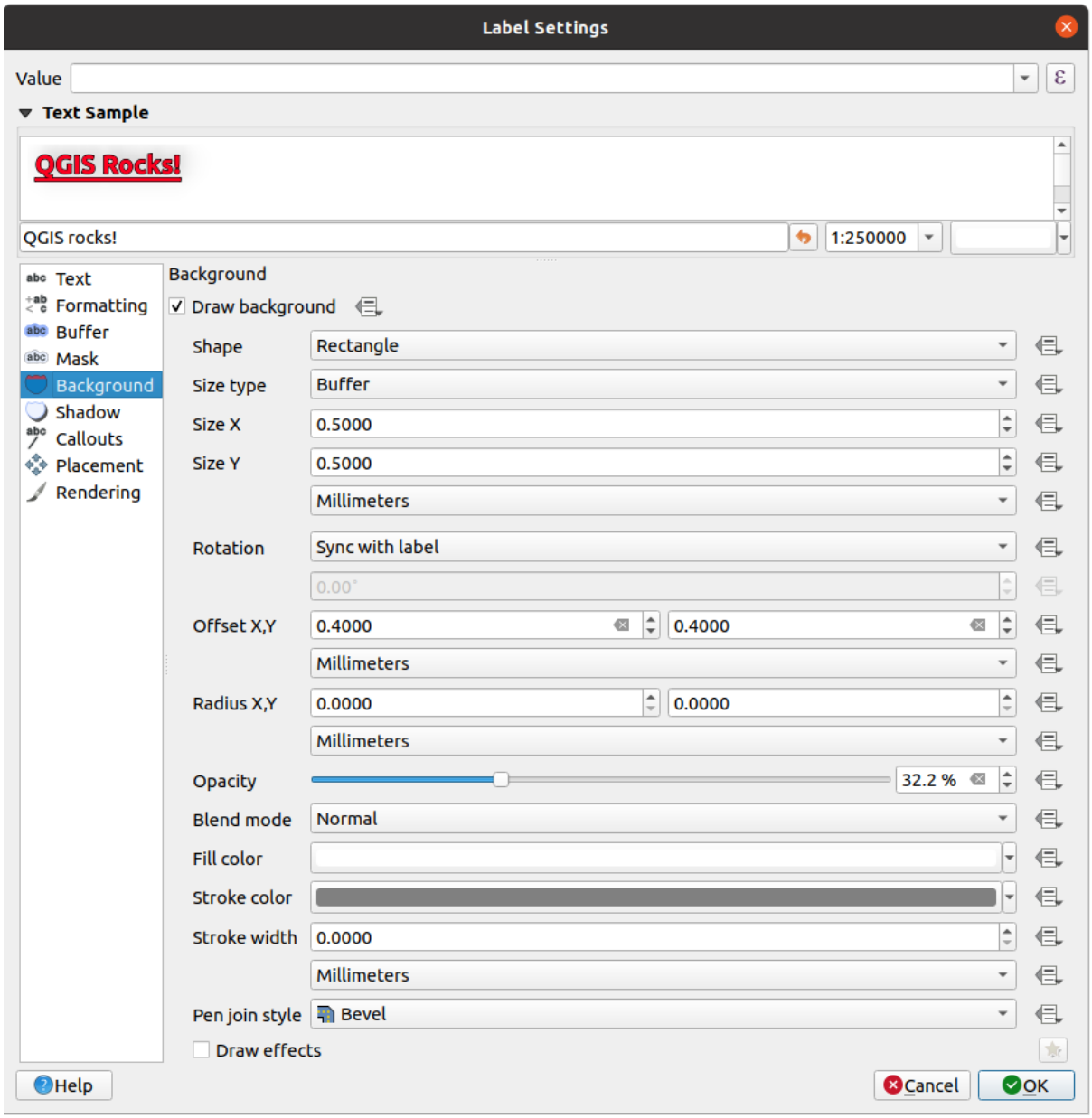


Figura12.18: Label settings - Background tab

Depending on the selected shape, you need to configure some of the following properties:

- The *Size type* of the frame, which can be:
  - *Fixed*: using the same size for all the labels, regardless the size of the text
  - or a *Buffer* over the text's bounding box

- The *Size* of the frame in X and Y directions, using any *supported units*
- A *Rotation* of the background, between *Sync with label*, *Offset of label* and *Fixed*. The last two require an angle in degrees.
- An *Offset X,Y* to shift the background item in the X and/or Y directions
- A *Radius X,Y* to round the corners of the background shape (applies to rectangle and square shapes only)
- An *Opacity* of the background
- A *Blend mode* to mix the background with the other items in the rendering (see *Modos de Mistura*).
- The *Fill color*, *Stroke color* and *Stroke width* for shape types other than the marker symbol. Use the *Load symbol parameters* to revert changes on an SVG symbol to its default settings.
- A *Pen join style*: it can be *Round*, *Miter* or *Bevel* (applies to rectangle and square shapes only)
- *Draw effects* to add advanced *paint effects* for improving text readability, eg through outer glows and blurs.

Shadow tab

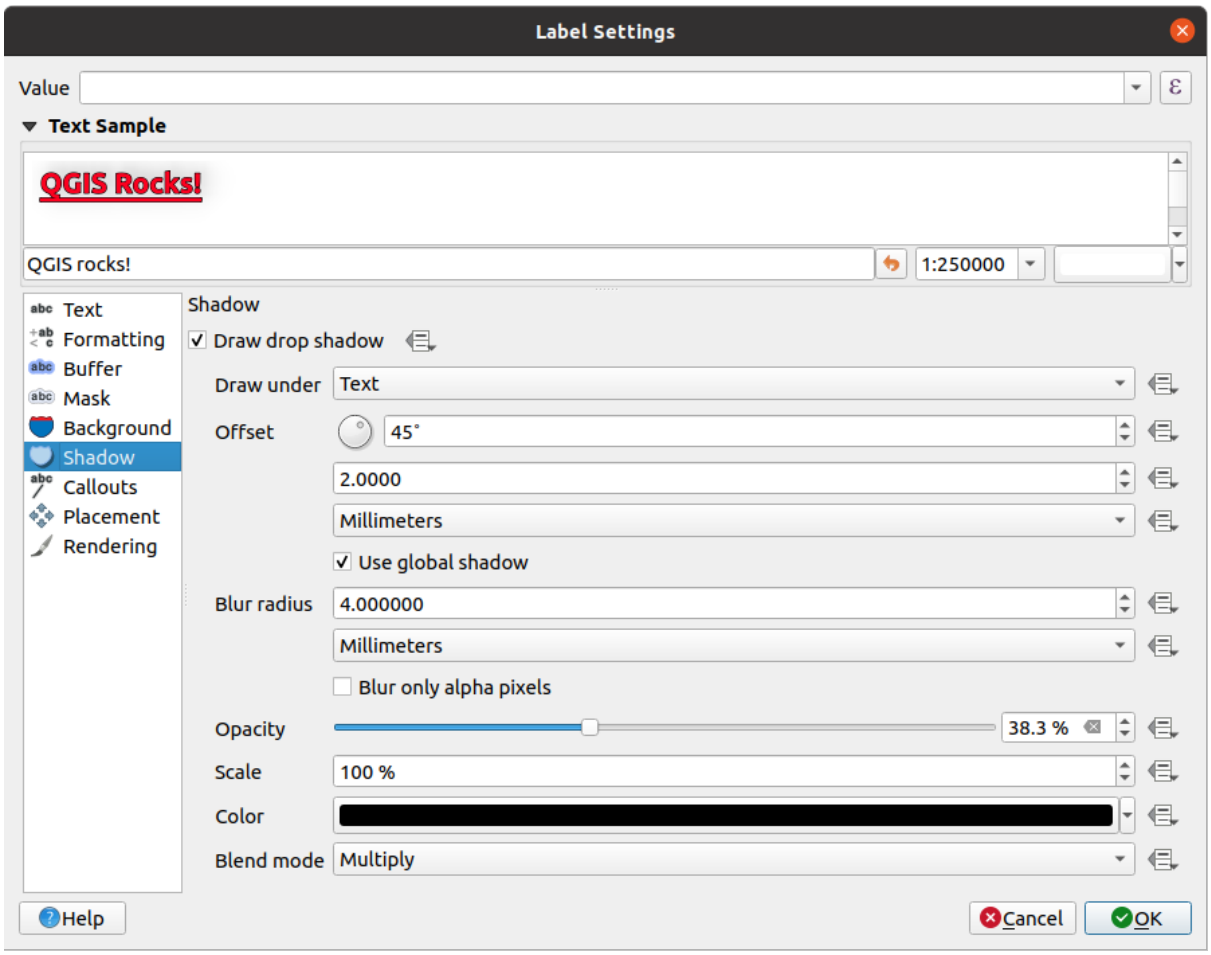


Figura12.19: Label settings - Shadow tab

To add a shadow to the text, enable the *Shadow* tab and activate the *Draw drop shadow*. Then you can:

- Indicate the item used to generate the shadow with *Draw under*. It can be the *Lowest label component* or a particular component such as the *Text* itself, the *Buffer* or the *Background*.

- Set the shadow's *Offset* from the item being shadowded, ie:
  - The angle: clockwise, it depends on the underlying item orientation
  - The distance of offset from the item being shadowded
  - The units of the offset

  If you tick the *Use global shadow* checkbox, then the zero point of the angle is always oriented to the north and doesn't depend on the orientation of the label's item.
- Influence the appearance of the shadow with the *Blur radius*. The higher the number, the softer the shadows, in the units of your choice.
- Define the shadow's *Opacity*
- Rescale the shadow's size using the *Scale* factor
- Choose the shadow's *Color*
- Use the *Blend mode* option to determine how your label's shadow will mix with the map components below them (more details at *Modos de Mistura*).

12.3.2 Configuring interaction with labels

Other than the text formatting settings exposed above, you can also set how labels interact with each others or with the features.

Mask tab

The *Mask* tab allows you to define a mask area around the labels. This feature is very useful when you have overlapping symbols and labels with similar colors, and you want to make the labels visible.

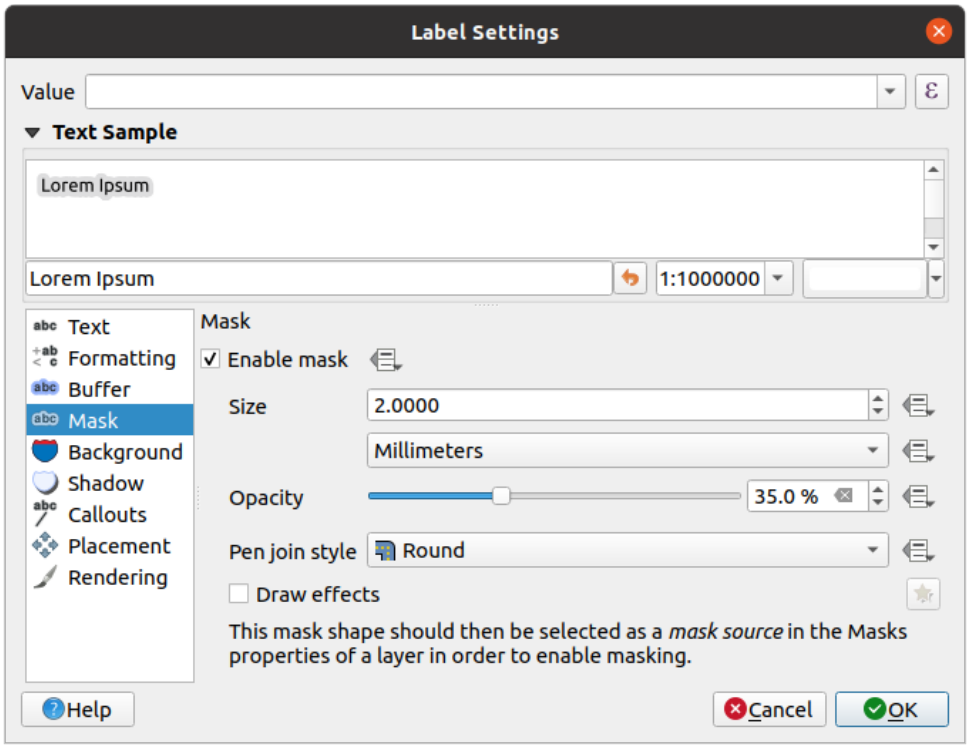


Figura12.20: Labels settings - Mask tab

To create masking effects on labels:

1. Activate the *Enable mask* checkbox in the tab.
2. Then you can set:
   - the mask's *Size* in the *supported units*
   - the *Opacity* of the mask area around the label
   - a *Pen Join Style*
   - *paint effects* through the *Draw effects* checkbox.
3. Select this mask shape as a mask source in the overlapping layer properties *Mask* tab (see *Masks Properties*).

Callouts tab

A common practice when placing labels on a crowded map is to use **callouts** - labels which are placed outside (or displaced from) their associated feature are identified with a dynamic line connecting the label and the feature. If one of the two endings (either the label or the feature) is moved, the shape of the connector is recomputed.



Figura12.21: Labels with various callouts settings

To add a callout to a label, enable the *Callouts* tab and activate the *Draw callouts*. Then you can:

1. Select the *Style* of connector, one of:
   - *Simple lines*: a straight line, the shortest path
   - *Manhattan style*: a 90° broken line
2. Select the *Line style* with full capabilities of a *line symbol* including layer effects, and data-defined settings
3. Set the *Minimum length* of callout lines
4. Set the *Offset from feature* option: controls the distance from the feature (or its anchor point if a polygon) where callout lines end. Eg, this avoids drawing lines right up against the edges of the features.

5. Set the *Offset from label area* option: controls the distance from the label anchor point (where the callout line ends). This avoids drawing lines right up against the text.
6. *Draw lines to all feature parts* from the feature's label
7. Set the *Anchor point* for the (polygon) feature (the end point of the connector line). Available options:
   - *Pole of inaccessibility*
   - *Point on exterior*
   - *Point on surface*
   - *Centroid*
8. Set the *Label anchor point*: controls where the connector line should join to the label text. Available options:
   - *Closest point*
   - *Centroid*
   - Fixed position at the edge (*Top left*, *Top center*, *Top right*, *Left middle*, *Right middle*, *Bottom left*, *Bottom center* and *Bottom right*).

Placement tab

Choose the *Placement* tab for configuring label placement and labeling priority. Note that the placement options differ according to the type of vector layer, namely point, line or polygon, and are affected by the global *PAL setting*.

Placement for point layers

Point labels placement modes available are:

- *Cartographic*: point labels are generated with a better visual relationship with the point feature, following ideal cartographic placement rules. Labels can be placed:
  - at a set *Distance* in *supported units*, either from the point feature itself or from the bounds of the symbol used to represent the feature (set in *Distance offset from*). The latter option is especially useful when the symbol size isn't fixed, e.g. if it's set by a data defined size or when using different symbols in a *categorized* renderer.
  - following a *Position priority* that can be customized or set for an individual feature using a data defined list of prioritised positions. This also allows only certain placements to be used, so e.g. for coastal features you can prevent labels being placed over the land.

    By default, cartographic mode placements are prioritised in the following order (respecting the guidelines from Krygier and Wood (2011) and other cartographic textbooks):

    1. top right
    2. top left
    3. bottom right
    4. bottom left
    5. middle right
    6. middle left
    7. top, slightly right
    8. bottom, slightly left.
- *Around Point*: labels are placed in a circle around the feature. equal radius (set in *Distance*) circle around the feature. The placement priority is clockwise from the "top right". The position can be constrained using the data-defined *Quadrant* option.

- *Offset from Point*: labels are placed at an *Offset X,Y* distance from the point feature, in various units, or preferably over the feature. You can use a data-defined *Quadrant* to constrain the placement and can assign a *Rotation* to the label.

Placement for line layers

Label modes for line layers include:

- *Parallel*: draws the label parallel to a generalised line representing the feature, with preference for placement over straighter portions of the line. You can define:
  - *Allowed positions*: *Above line*, *On line*, *Below line* and *Line orientation dependent position* (placing the label at the left or the right of the line). It's possible to select several options at once. In that case, QGIS will look for the optimal label position.
  - *Distance* between the label and the line
- *Curved*: draws the label following the curvature of the line feature. In addition to the parameters available with the *Parallel* mode, you can set the *Maximum angle between curved characters*, either inside or outside.
- *Horizontal*: draws labels horizontally along the length of the line feature.

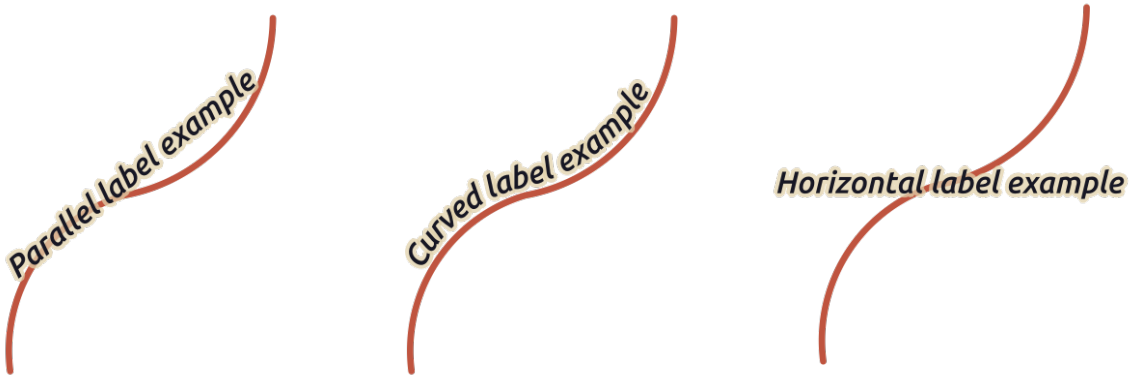


Figura12.22: Label placement examples for lines

Next to placement modes, you can set:

- *Repeating Labels Distance* to display multiple times the label over the length of the feature. The distance can be in `Millimeters`, `Points`, `Pixels`, `Meters at scale`, `Map Units` and `Inches`.
- A *Label Overrun Distance* (not available for horizontal mode): specifies the maximal allowable distance a label may run past the end (or start) of line features. Increasing this value can allow for labels to be shown for shorter line features.
- *Label Anchoring*: controls the placement of the labels along the line feature they refer to. Click on *Settings* ... to choose:
  - the position along the line (as a ratio) which labels will be placed close to. It can be data-defined and possible values are:
    - *Center of Line*
    - *Start of Line*
    - *End of Line*
    - or *Custom*....

  - *Placement Behavior*: use *Preferred Placement Hint* to treat the label anchor only as a hint for the label placement. By choosing *Strict*, labels are placed exactly on the label anchor.

Placement for polygon layers

You can choose one of the following modes for placing labels of polygons:

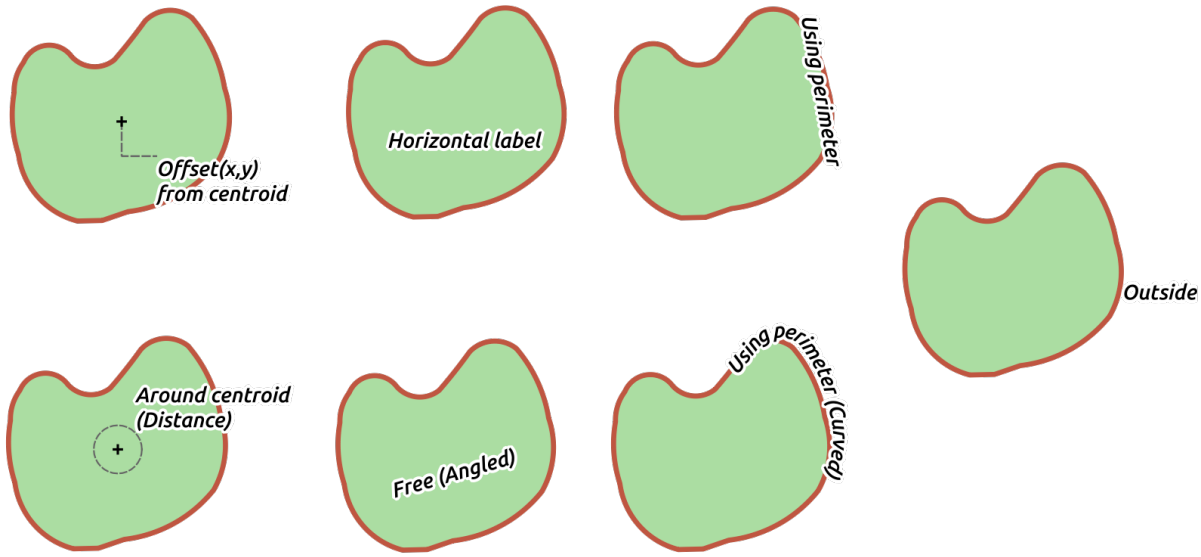


Figura12.23: Label placement examples for polygons

- *Offset from Centroid*: labels are placed over the feature centroid or at a fixed *Offset X,Y* distance (in *supported units*) from the centroid. The reference centroid can be determined based on the part of the polygon rendered in the map canvas (*visible polygon*) or the *whole polygon*, no matter if you can see it. You can also:
  - force the centroid point to lay inside their polygon
  - place the label within a specific quadrant
  - assign a rotation
  - *Allow placing labels outside of polygons* when it is not possible to place them inside the polygon. Thanks to data-defined properties, this makes possible to either allow outside labels, prevent outside labels, or force outside labels on a feature-by-feature basis.
- *Around Centroid*: places the label within a preset distance around the centroid, with a preference for the placement directly over the centroid. Again, you can define whether the centroid is the one of the *visible polygon* or the *whole polygon*, and whether to force the centroid point inside the polygon.
- *Horizontal*: places at the best position a horizontal label inside the polygon. The preferred placement is further from the edges of the polygon. It's possible to *Allow placing labels outside of polygons*.
- *Free (Angled)*: places at the best position a rotated label inside the polygon. The rotation respects the polygon's orientation and the preferred placement is further from the edges of the polygon. It's possible to *Allow placing labels outside of polygons*.
- *Using Perimeter*: draws the label parallel to a generalised line representing the polygon boundary, with preference for straighter portions of the perimeter. You can define:
  - *Allowed positions*: *Above line*, *On line*, *Below line* and *Line orientation dependent position* (placing the label at the left or the right of the polygon's boundary). It's possible to select several options at once. In that case, QGIS will look for the optimal label position.

  - *Distance* between the label and the polygon's outline
  - the *Repeating Labels Distance* to display multiple times the label over the length of the perimeter.
- *Using Perimeter (Curved)*: draws the label following the curvature of the polygon's boundary. In addition to the parameters available with the *Using Perimeter* mode, you can set the *Maximum angle between curved characters polygon*, either inside or outside.
- *Outside Polygons*: always places labels outside the polygons, at a set *Distance*

Common placement settings

Some label placement settings are available for all layer geometry types:

Data Defined

The *Data Defined* group provides direct control on labels placement, on a feature-by-feature basis. It relies on their attributes or an expression to set:

- the *X* and *Y* coordinate
- the text alignment over the custom position set above:
  - *Horizontal*: it can be **Left**, **Center** or **Right**
  - the text *Vertical*: it can be **Bottom**, **Base**, **Half**, **Cap** or **Top**
- the text *Rotation*. Check the *Preserve data rotation values* entry if you want to keep the rotation value in the associated field and apply it to the label, whether the label is pinned or not. If unchecked, unpinning the label rotation is reset and its value cleared from the attribute table.

  Nota: Data-defined rotation with polygon features is currently supported only with the *Around centroid* placement mode.

Nota: Expressions can not be used in combination with the labels map tools (ie the *Rotate label* and *Move label* tools) to *data-define* labels placement. The widget will be reset to the corresponding *auxiliary storage field*.

Priority

In the *Priority* section you can define the placement priority rank of each label, ie if there are different diagrams or labels candidates for the same location, the item with the higher priority will be displayed and the others could be left out.

The priority rank is also used to evaluate whether a label could be omitted due to a greater weighted *obstacle feature*.

Obstacles

In some contexts (eg, high density labels, overlapping features…), the labels placement can result in labels being placed over unrelated features.

An obstacle is a feature over which QGIS avoids placing other features' labels or diagrams. This can be controlled from the *Obstacles* section:

1. Activate the  *Features act as obstacles* option to decide that features of the layer should act as obstacles for any label and diagram (including items from other features in the same layer).

Instead of the whole layer, you can select a subset of features to use as obstacles, using the data-defined override control next to the option.

2. Use the *Settings* button to tweak the obstacle's weighting.
   - For every potential obstacle feature you can assign an *Obstacle weight*: any *label* or *diagram* whose placement priority rank is greater than this value can be placed over. Labels or diagrams with lower rank will be omitted if no other placement is possible.

     This weighting can also be data-defined, so that within the same layer, certain features are more likely to be covered than others.
   - For polygon layers, you can choose the kind of obstacle the feature is:
     - **over the feature's interior**: avoids placing labels over the interior of the polygon (prefers placing labels totally outside or just slightly inside the polygon)
     - or **over the feature's boundary**: avoids placing labels over the boundary of the polygon (prefers placing labels outside or completely inside the polygon). This can be useful for layers where the features cover the whole area (administrative units, categorical coverages, …). In this case, it is impossible to avoid placing labels within these features, and it looks much better when placing them over the boundaries between features is avoided.

Rendering tab

In the *Rendering* tab, you can tune when the labels can be rendered and their interaction with other labels and features.

Label options

Under *Label options*:

- You find the *scale-based* and the *Pixel size-based* visibility settings.
- The *Label z-index* determines the order in which labels are rendered, as well in relation with other feature labels in the layer (using data-defined override expression), as with labels from other layers. Labels with a higher z-index are rendered on top of labels (from any layer) with lower z-index.

  Additionally, the logic has been tweaked so that if two labels have matching z-indexes, then:
  - if they are from the same layer, the smaller label will be drawn above the larger label
  - if they are from different layers, the labels will be drawn in the same order as their layers themselves (ie respecting the order set in the map legend).

  Nota: This setting doesn't make labels to be drawn below the features from other layers, it just controls the order in which labels are drawn on top of all the layers' features.

- While rendering labels and in order to display readable labels, QGIS automatically evaluates the position of the labels and can hide some of them in case of collision. You can however choose to *Show all labels for this layer (including colliding labels)* in order to manually fix their placement (see *A barra de ferramentas Rótulo*).
- With data-defined expressions in *Show label* and *Always Show* you can fine tune which labels should be rendered.
- Allow to *Show upside-down labels*: alternatives are **Never**, **when rotation defined** or **always**.

Feature options

Under *Feature options*:

- You can choose to *Label every part of a multi-part features* and *Limit number of features to be labeled to*.
- Both line and polygon layers offer the option to set a minimum size for the features to be labeled, using *Suppress labeling of features smaller than*.
- For polygon features, you can also filter the labels to show according to whether they completely fit within their feature or not.
- For line features, you can choose to *Merge connected lines to avoid duplicate labels*, rendering a quite airy map in conjunction with the *Distance* or *Repeat* options in the *Placement* tab.

12.4 Creating 3D Symbols

The *Style Manager* helps you create and store 3D symbols for every geometry type to render in the *3D map view*.

As of the other items, enable the  *3D Symbols* tab and expand the  button menu to create:

- *3D point symbols*
- *3D line symbols*
- *3D polygon symbols*

12.4.1 Point Layers

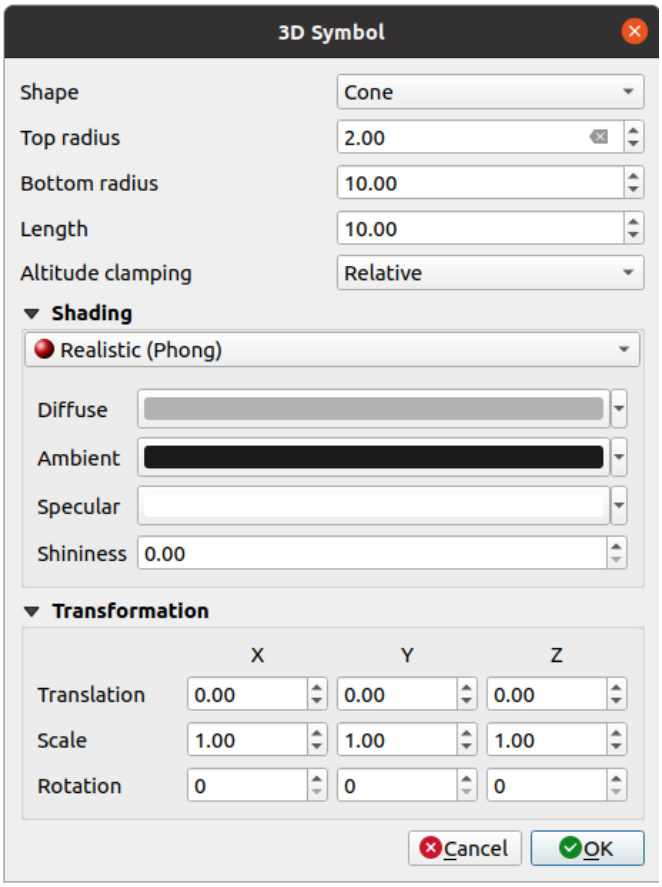


Figura12.24: Properties of a 3D point symbol

- You can define different simple 3D shapes like *Sphere*, *Cylinder*, *Cube*, *Cone*, *Plane* and *Torus* defined by their *Radius*, *Size* or *Length*. The unit of size of the 3D shapes refers to the CRS of the project.
- The shading of the 3D shapes can be defined by the menus *Diffuse*, *Ambient*, *Specular* and *Shininess* (see https://en.wikipedia.org/wiki/Phong_reflection_model#Description)
- If you choose *3D Model*, the location will be determined by a simple point coordinate.
- For visualizing 3D point clouds you can use *Billboard* Shapes defined by the *Billboard Height*, *Billboard symbol* and *Altitude clamping*. The symbol will have a stable size.
- *Altitude clamping* can be set to *Absolute*, *Relative* or *Terrain*. The *Absolute* setting can be used when height values of the 3d vectors are provided as absolute measures from 0. *Relative* and *Terrain* add given elevation values to the underlying terrain elevation.
- *Translation* can be used to move objects in x, y and z axis.
- You can define a *Scale factor* for the 3D shape as well as a *Rotation* around the x-, y- and z-axis.

12.4.2 Line layers

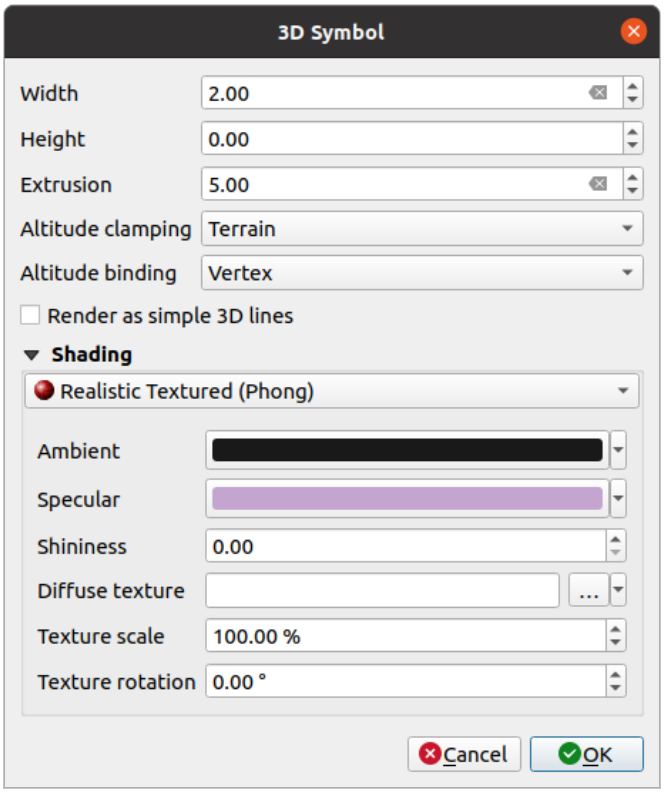


Figura12.25: Properties of a 3D line symbol

- Beneath the *Width* and *Height* settings you can define the *Extrusion* of the vector lines. If the lines do not have z-values, you can define the 3d volumes with this setting.
- With the *Altitude clamping* you define the position of the 3D lines relative to the underlying terrain surface, if you have included raster elevation data or other 3D vectors.
- The *Altitude binding* defines how the feature is clamped to the terrain. Either every *Vertex* of the feature will be clamped to the terrain or this will be done by the *Centroid*.
- It is possible to *Render as simple 3D lines*.
- The shading can be defined in the menus *Diffuse*, *Ambient*, *Specular* and *Shininess*.

12.4.3 Polygon Layers

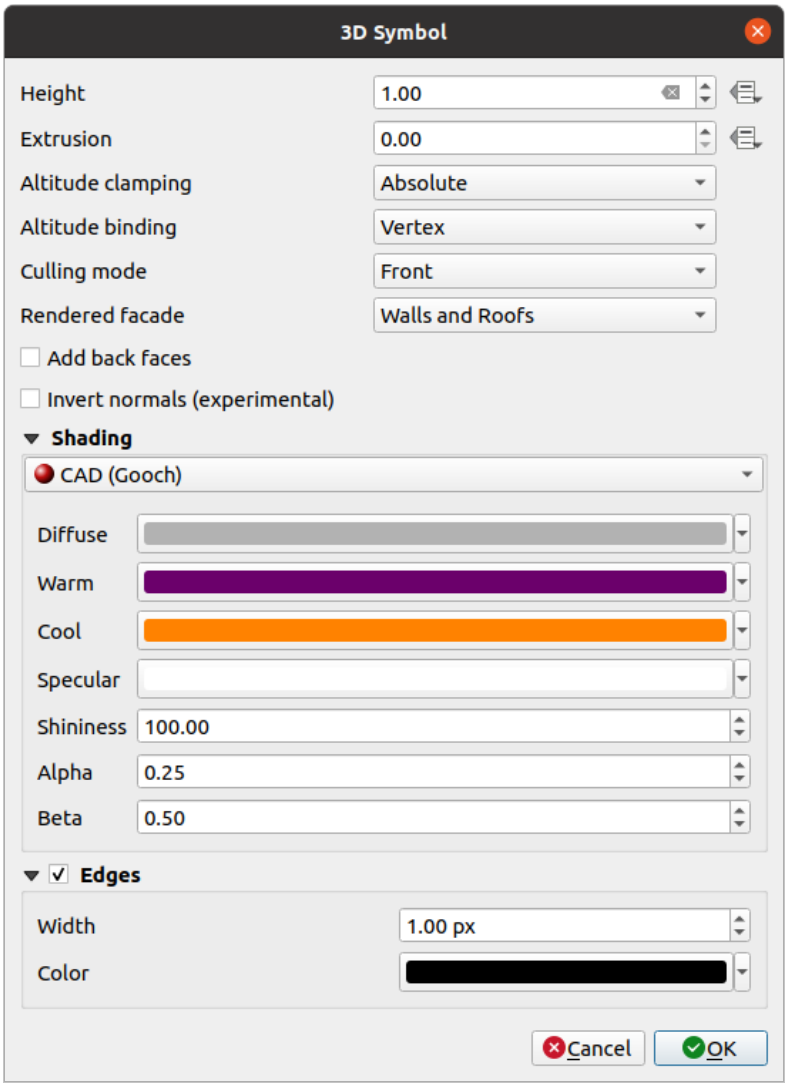


Figura12.26: Properties of a 3D polygon symbol

- As for the other ones, *Height* can be defined in CRS units. You can also use the button to overwrite the value with a custom expression, a variable or an entry of the attribute table
- Again, *Extrusion* is possible for missing z-values. Also for the extrusion you can use the button in order to use the values of the vector layer and have different results for each polygon:

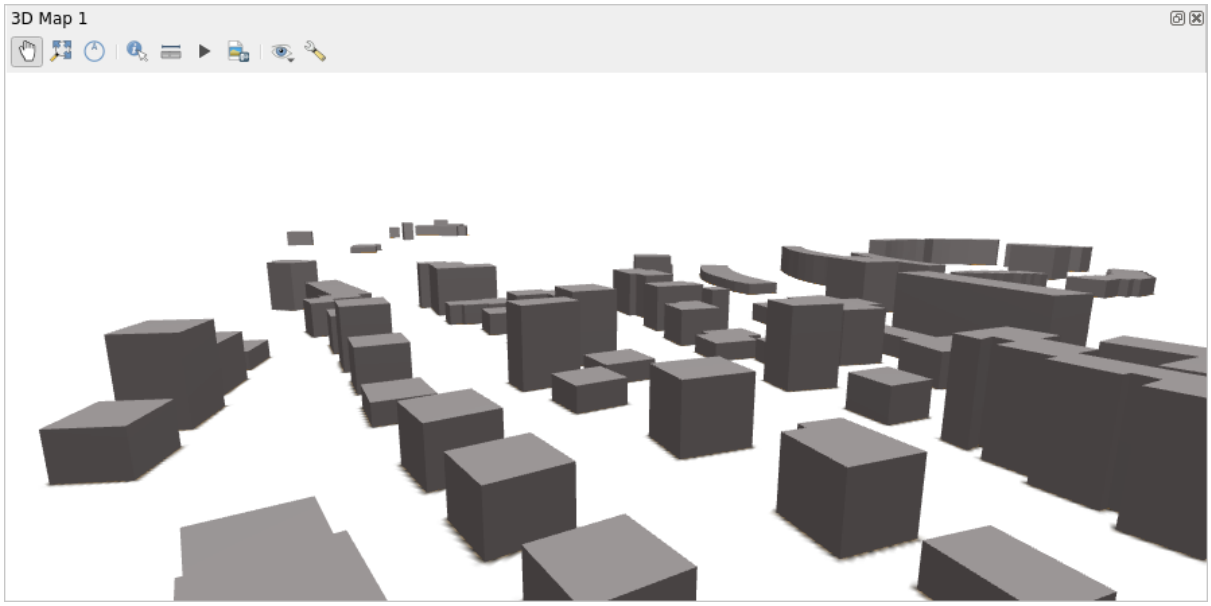


Figura12.27: Data Defined Extrusion

- The *Altitude clamping*, *Altitude binding* can be defined as explained above.
- There is an additional option to *Add back faces* and *Invert normals*.
- You can define *Edges* by *Width* and *Color*.

12.4.4 Application example

To go through the settings explained above you can have a look at https://public.cloudmergin.com/projects/saber/luxembourg/tree.

CAPÍTULO 13

Gerenciando fonte de dados

13.1 Abrir Dados

Como parte de um ecossistema de software de código aberto, o QGIS é baseado em diferentes bibliotecas que, combinadas com seus próprios provedores, oferecem capacidades para ler e muitas vezes escrevem vários formatos:

- Os formatos de dados vetoriais incluem GeoPackage, GML, GeoJSON, GPX, KML, Valores separados por vírgula, formatos ESRI (Shapefile, Geodatabase…), formatos de arquivo MapInfo e MicroStation, AutoCAD DWG/DXF, GRASS e muito mais… Leia o artigo completo lista de formatos vetoriais suportados.
- Raster data formats include GeoTIFF, JPEG, ASCII Gridded XYZ, MBTiles, R or Idrisi rasters, GDAL Virtual, SRTM, Sentinel Data, ERDAS IMAGINE, ArcInfo Binary Grid, ArcInfo ASCII Grid, and many more… Read the complete list of supported raster formats.
- Database formats include PostgreSQL/PostGIS, SQLite/SpatiaLite, Oracle, DB2 or MSSQL Spatial, MySQL…
- Web map and data services (WM(T)S, WFS, WCS, CSW, XYZ tiles, ArcGIS services, …) are also handled by QGIS providers. See *Working with OGC / ISO protocols* for more information about some of these.
- You can read supported files from archived folders and use QGIS native formats such as QML files (*QML - O Formato de Arquivo de Estilo QGIS*) and virtual and memory layers.

Mais de 80 formatos de vetor e 140 raster são suportados pelos provedores nativos GDAL e QGIS.

Nota: Not all of the listed formats may work in QGIS for various reasons. For example, some require external proprietary libraries, or the GDAL/OGR installation of your OS may not have been built to support the format you want to use. To see the list of available formats, run the command line `ogrinfo --formats` (for vector) and `gdalinfo --formats` (for raster), or check the *Settings* ► *Options* ► *GDAL* menu in QGIS.

In QGIS, depending on the data format, there are different tools to open a dataset, mainly available in the *Layer* ► *Add Layer* ► menu or from the *Manage Layers* toolbar (enabled through *View* ► *Toolbars* menu). However, all these tools point to a unique dialog, the *Data Source Manager* dialog, that you can open with the Open Data Source Manager button, available on the *Data Source Manager Toolbar*, or by pressing `Ctrl+L`. The *Data Source Manager* dialog(Fig.13.1) offers a unified interface to open vector or raster file-based data as well as databases or web services supported by QGIS. It can be set modal or not with the *Modeless data source manager dialog* in the *Settings* ► *Options* ► *General* menu.

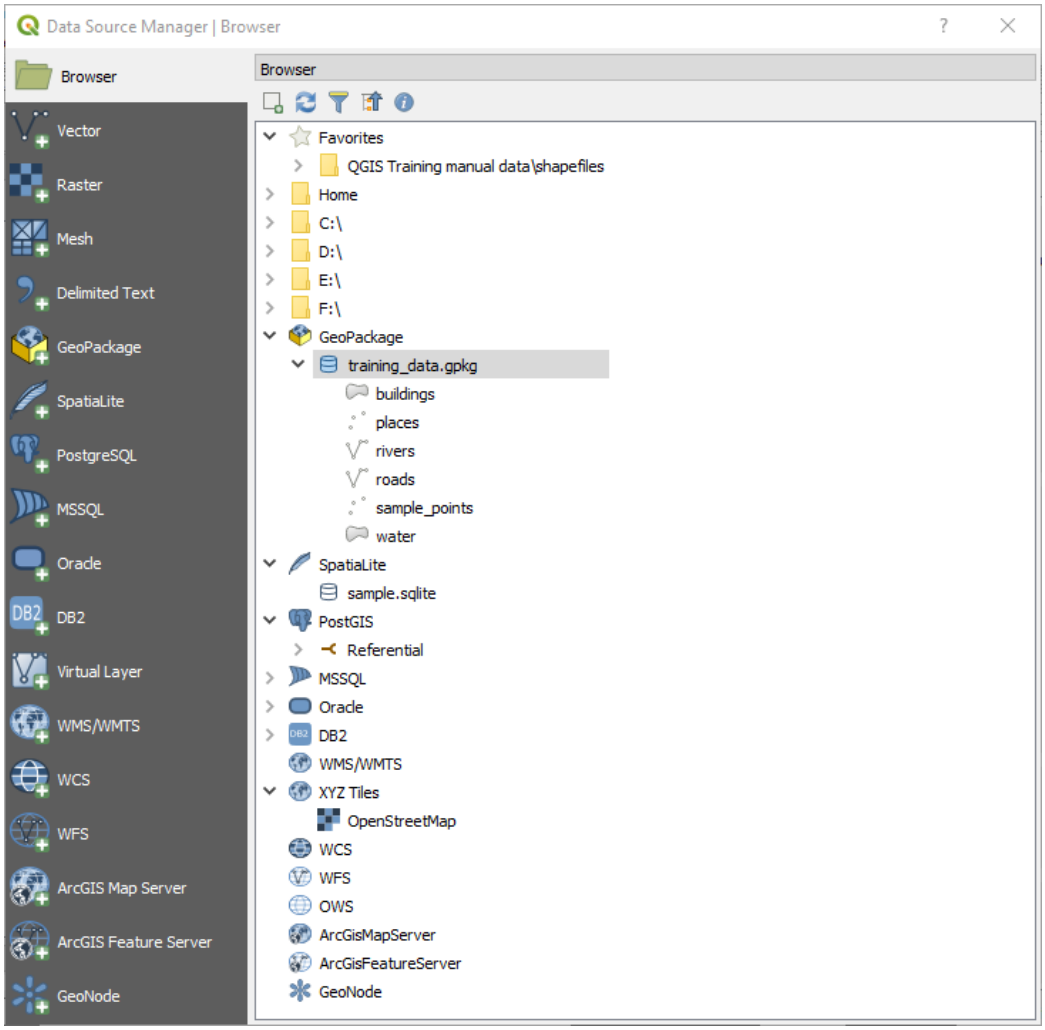


Figura13.1: QGIS Data Source Manager dialog

Beside this main entry point, you also have the *DB Manager* plugin that offers advanced capabilities to analyze and manipulate connected databases. More information on DB Manager capabilities can be found in *DB Manager Plugin*.

Existem muitas outras ferramentas, complementos nativos ou de terceiros, que ajudam a abrir vários formatos de dados.

Este capítulo descreve apenas as ferramentas fornecidas por padrão no QGIS para carregar dados. Ele se concentra principalmente na caixa de diálogo *Gerenciador de Fonte de Dados*, mas, além de descrever cada guia, também explora as ferramentas baseadas no provedor de dados ou nas especificidades do formato.

13.1.1 The Browser Panel

The *Browser* is one of the main ways to quickly and easily add your data to projects. It's available as:

- a *Data Source Manager* tab, enabled pressing the Open Data Source Manager button (`Ctrl+L`);
- as a QGIS panel you can open from the menu *View* ► *Panels* (or *Settings* ► *Panels*) or by pressing `Ctrl+2`.

In both cases, the *Browser* helps you navigate in your file system and manage geodata, regardless the type of layer (raster, vector, table), or the datasource format (plain or compressed files, databases, web services).

Exploring the Interface

At the top of the Browser panel, you find some buttons that help you to:

-  Add Selected Layers: you can also add data to the map canvas by selecting **Add selected layer(s)** from the layer's context menu;
-  Refresh the browser tree;
-  Filter Browser to search for specific data. Enter a search word or wildcard and the browser will filter the tree to only show paths to matching DB tables, filenames or folders – other data or folders won't be displayed. See the Browser Panel(2) example in Fig.13.2. The comparison can be case-sensitive or not. It can also be set to:
  - *Normal*: mostra itens que contêm o texto de pesquisa
  - *Wildcard(s)*: fine tune the search using the `?` and/or `*` characters to specify the position of the search text
  - *Expressão regular*
-  Collapse All the whole tree;
-  Enable/disable properties widget: when toggled on, a new widget is added at the bottom of the panel showing, if applicable, metadata for the selected item.

The entries in the *Browser* panel are organised hierarchically, and there are several top level entries:

1. *Favorites* where you can place shortcuts to often used locations
2. *Spatial Bookmarks* where you can store often used map extents (see *Favoritos Espaciais*)
3. *Project Home*: for a quick access to the folder in which (most of) the data related to your project are stored. The default value is the directory where your project file resides.
4. *Home* directory in the file system and the filesystem root directory.
5. Connected local or network drives
6. Then comes a number of container / database types and service protocols, depending on your platform and underlying libraries:
   -  *GeoPackage*
   -  *SpatiaLite*
   -  *PostGIS*
   -  *MSSQL*
   -  *Oracle*
   -  *DB2*
   -  *WMS/WMTS*
   -  *Vector Tiles*
   -  *XYZ Tiles*
   -  *WCS*
   -  *WFS/OGC API-Features*
   -  *OWS*

-  *ArcGIS Map Service*
-  *ArcGIS Feature Service*
-  *GeoNode*

Interacting with the Browser items

The browser supports drag and drop within the browser, from the browser to the canvas and *Layers* panel, and from the *Layers* panel to layer containers (e.g. GeoPackage) in the browser.

Project file items inside the browser can be expanded, showing the full layer tree (including groups) contained within that project. Project items are treated the same way as any other item in the browser, so they can be dragged and dropped within the browser (for example to copy a layer item to a geopackage file) or added to the current project through drag and drop or double click.

The context menu for an element in the *Browser* panel is opened by right-clicking on it.

For file system directory entries, the context menu offers the following:

- *New* ► to create in the selected entry a:
  - *Diretório…*
  - *GeoPackage…*
  - *ShapeFile…*
- *Add as a Favorite*: favorite folders can be renamed (*Rename favorite…*) or removed (*Remove favorite*) any time.
- *Hide from Browser*: hidden folders can be toggled to visible from the *Settings* ► *Options* ► *Data Sources* ► *Hidden browser paths* setting
- *Fast Scan this Directory*
- *Open Directory*
- *Open in Terminal*
- *Propriedades…*
- *Directory Properties…*

For leaf entries that can act as layers in the project, the context menu will have supporting entries. For example, for non-database, non-service-based vector, raster and mesh data sources:

- *Apagar Arquivo "<name of file>"…*
- *Export Layer –> To File…*
- *Add Layer to Project*
- *Layer Properties*
- *File Properties*

In the *Layer properties* entry, you will find (similar to what you will find in the *vector* and *raster* layer properties once the layers have been added to the project):

- *Metadados* for the layer. para a camada. Grupos de Metadados: *Informações do provedor* (se possível,será um hiperlink para a fonte *Path*), *Identificação*, *Extensão*, *Acesso*, *Campos* (para camadas vetoriais), *Bandas* (para camadas raster), *Contatos*, *Links* (para camadas vetoriais), *Referências* (para camadas raster), *Histórico*.
- A *Preview* panel
- The attribute table for vector sources (in the *Attributes* panel).

Para adicionar uma camada ao projeto usando a *Navegador*:

1. Enable the *Browser* as described above. A browser tree with your file system, databases and web services is displayed. You may need to connect databases and web services before they appear (see dedicated sections).
2. Find the layer in the list.
3. Use the context menu, double-click its name, or drag-and-drop it into the *map canvas*. Your layer is now added to the *Layers panel* and can be viewed on the map canvas.

Dica: Open a QGIS project directly from the browser

You can also open a QGIS project directly from the Browser panel by double-clicking its name or by drag-and-drop into the map canvas.

Depois que um arquivo é carregado, você pode ampliar usando as ferramentas de navegação do mapa. Para alterar o estilo de uma camada, abra a caixa de diálogo :guilabel: *Propriedades da Camada* clicando duas vezes no nome da camada ou clicando com o botão direito do mouse no nome da legenda e escolhendo :menuselection:` Propriedades` no menu de contexto. Veja a seção *Propriedades da simbologia* para mais informações sobre a configuração de simbologia para camadas vetoriais.

Right-clicking an item in the browser tree helps you to:

- for a file or a table, display its metadata or open it in your project. Tables can even be renamed, deleted or truncated.
- para uma pasta, adicione-a aos favoritos ou oculte-a na árvore do navegador. As pastas ocultas podem ser gerenciadas a partir da guia *Configurações* ► *Opções* ► *Fontes de Dados*.
- manage your *spatial bookmarks*: bookmarks can be created, exported and imported as `XML` files.
- crie uma conexão com um banco de dados ou um serviço da web.
- atualizar, renomear ou excluir um esquema.

Você também pode importar arquivos para bancos de dados ou copiar tabelas de um esquema/banco de dados para outro com um simples arrastar e soltar. Há um segundo painel do navegador disponível para evitar rolagem longa enquanto arrasta. Basta selecionar o arquivo e arrastar e soltar de um painel para o outro.

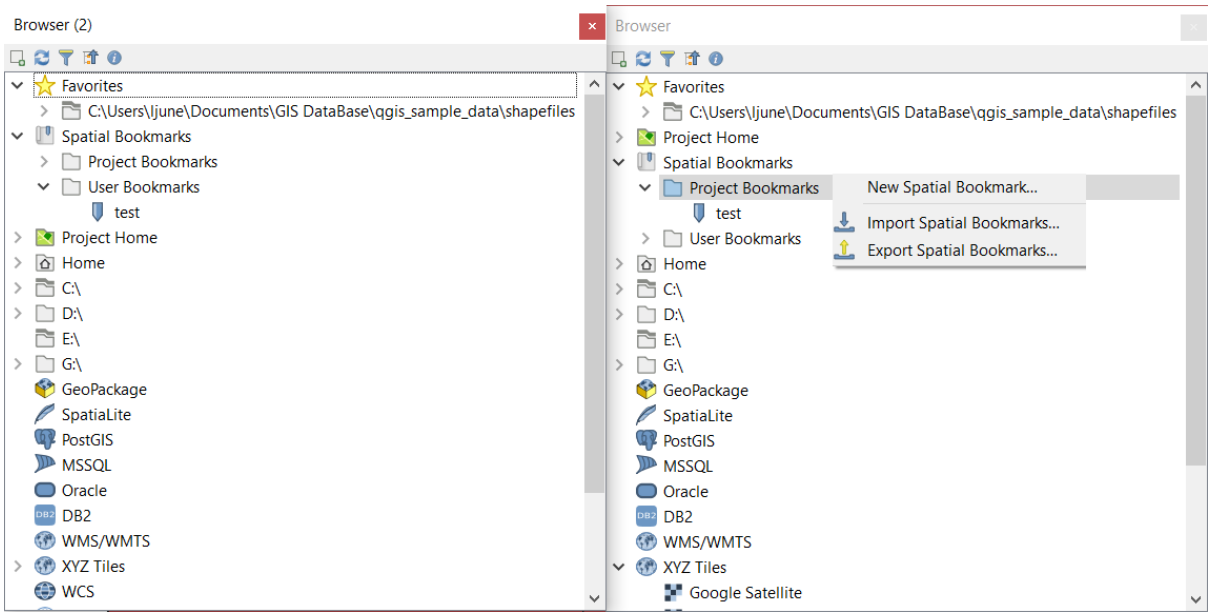


Figura13.2: QGIS Browser panels side-by-side

Dica: Add layers to QGIS by simple drag-and-drop from your OS file browser

You can also add file(s) to the project by drag-and-dropping them from your operating system file browser to the *Layers Panel* or the map canvas.

13.1.2 The DB Manager

The *DB Manager* Plugin is another tool for integrating and managing spatial database formats supported by QGIS (PostGIS, SpatiaLite, GeoPackage, Oracle Spatial, MSSQL, DB2, Virtual layers). It can be activated from the *Plugins* ► *Manage and Install Plugins…* menu.

The DB Manager Plugin provides several features:

- connect to databases and display their structure and contents
- preview tables of databases
- add layers to the map canvas, either by double-clicking or drag-and-drop.
- add layers to a database from the QGIS Browser or from another database
- create SQL queries and add their output to the map canvas
- criar *virtual layers*

More information on DB Manager capabilities is found in *DB Manager Plugin*.

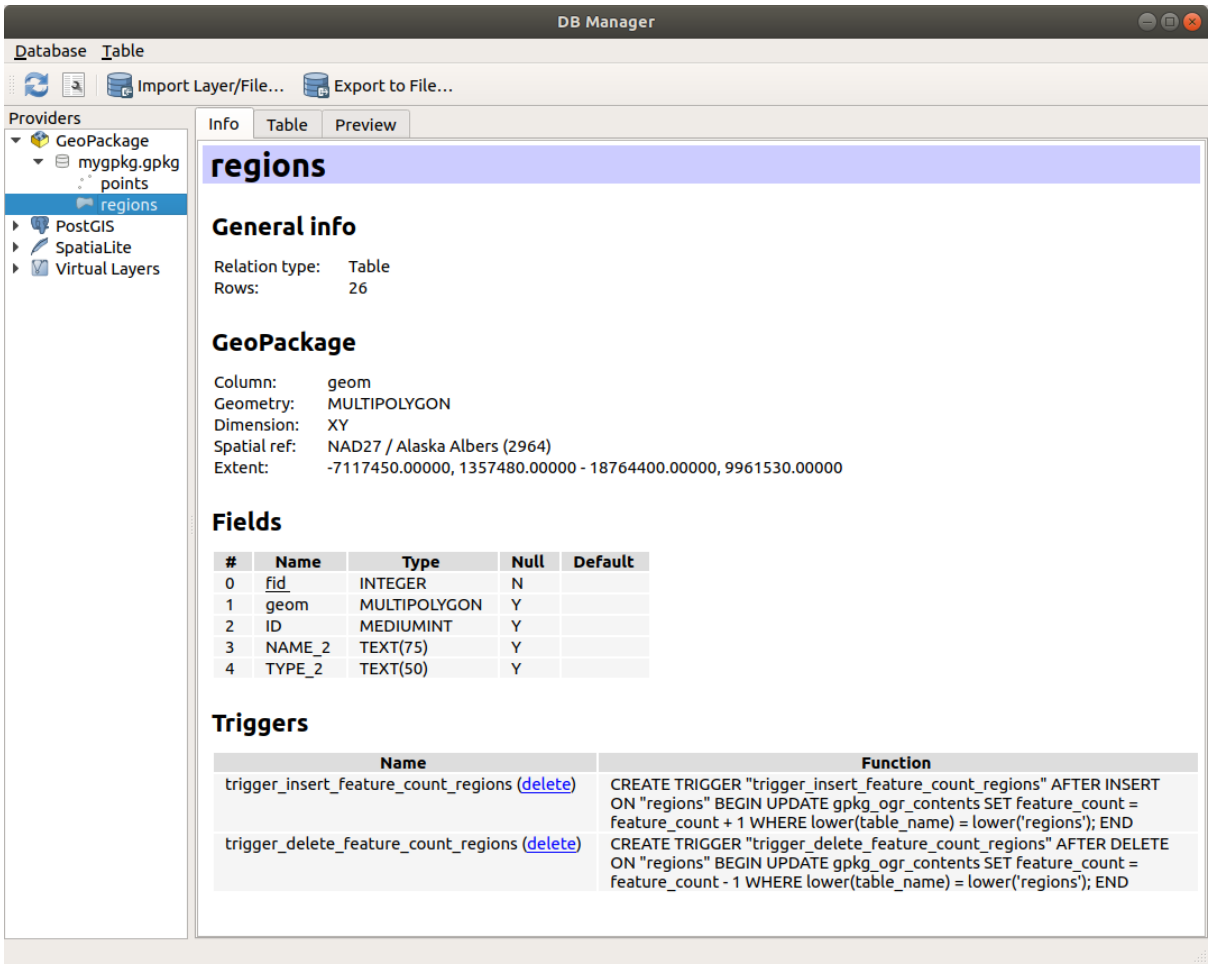


Figura13.3: Caixa de diálogo Gerenciador DB

13.1.3 Provider-based loading tools

Beside the Browser Panel and the DB Manager, the main tools provided by QGIS to add layers, you'll also find tools that are specific to data providers.

Nota: Some *external plugins* also provide tools to open specific format files in QGIS.

Loading a layer from a file

To load a layer from a file:

1. Abra a guia do tipo de camada na caixa de diálogo *Gerenciador de Fonte de Dados*, ou seja, clique no botão Abrir Gerenciador de Fonte de Dados (ou pressione: kbd:*Ctrl+L*) e ative a guia de destino ou:
   - for vector data (like GML, ESRI Shapefile, Mapinfo and DXF layers): press `Ctrl+Shift+V`, select the *Layer* ► *Add Layer* ► *Add Vector Layer* menu option or click on the Add Vector Layer toolbar button.

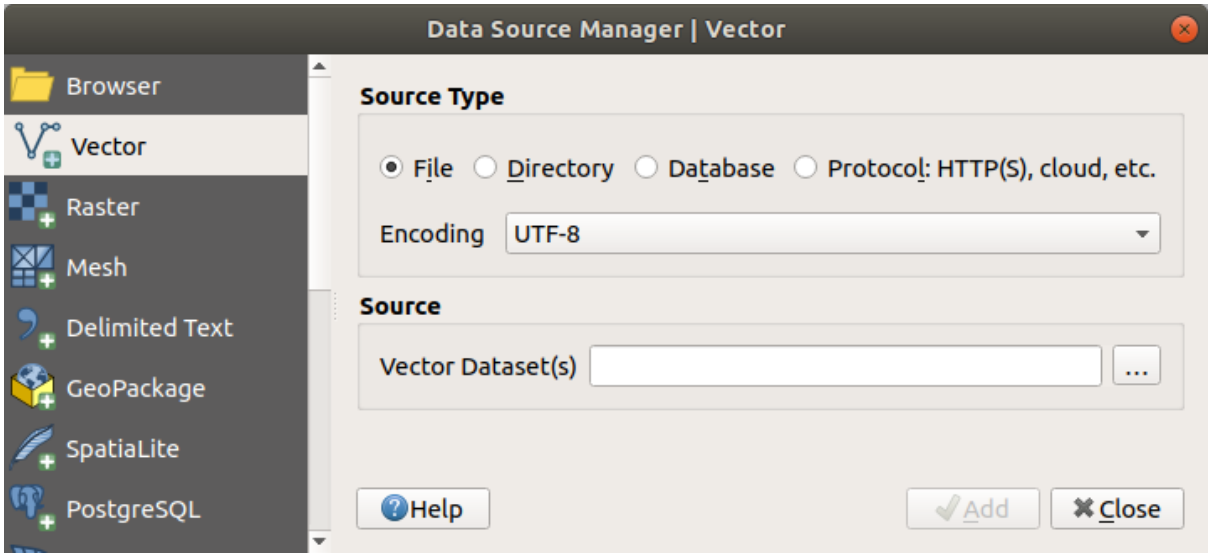


Figura13.4: Add Vector Layer Dialog

   - para dados raster (como camadas GeoTiff, MBTiles, GRIdded Binary e DWG): pressione `Ctrl+Shift+R`, selecione a opção *Camada* ► *Adicionar Camada* ► *Adicionar Camada Raster* do menu ou clique no botão Adicionar Camada Raster da barra de ferramentas.

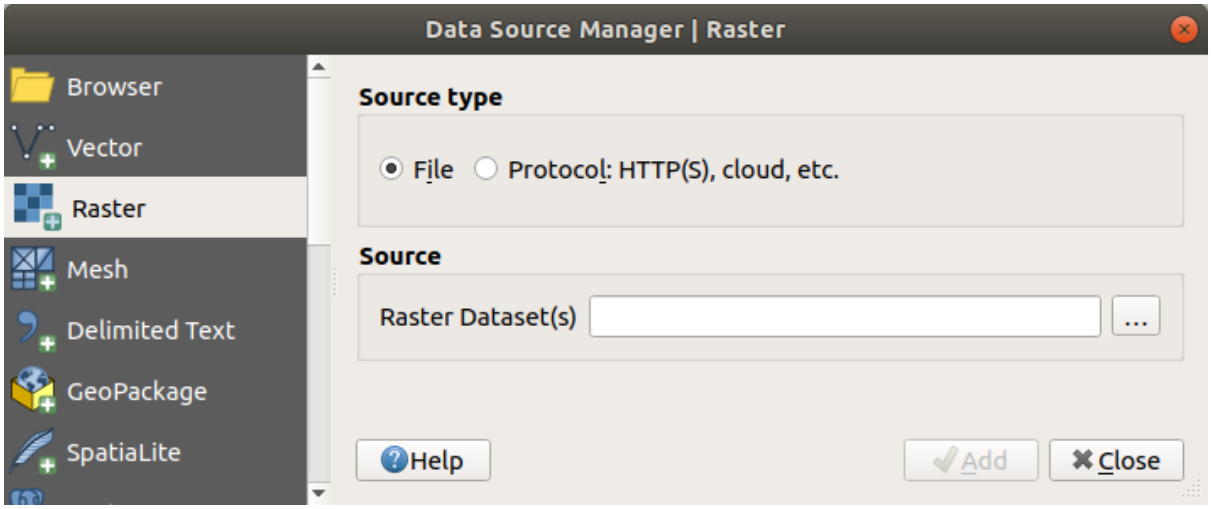


Figura13.5: Add Raster Layer Dialog

2. Check *File* source type
3. Click on the ... Browse button
4. Navegue no sistema de arquivos e carregue uma fonte de dados suportada. É possível carregar mais de uma camada ao mesmo tempo mantendo pressionada a tecla `Ctrl` e clicando em vários itens da caixa de diálogo ou pressionando a tecla `Shift` para selecionar um intervalo de itens clicando em o primeiro e o último item do intervalo. Somente os formatos que foram bem testados aparecem no filtro de formatos. Outros formatos podem ser carregados selecionando `Todos os arquivos` (o item superior no menu pull-down).
5. Press *Open* to load the selected file into *Data Source Manager* dialog

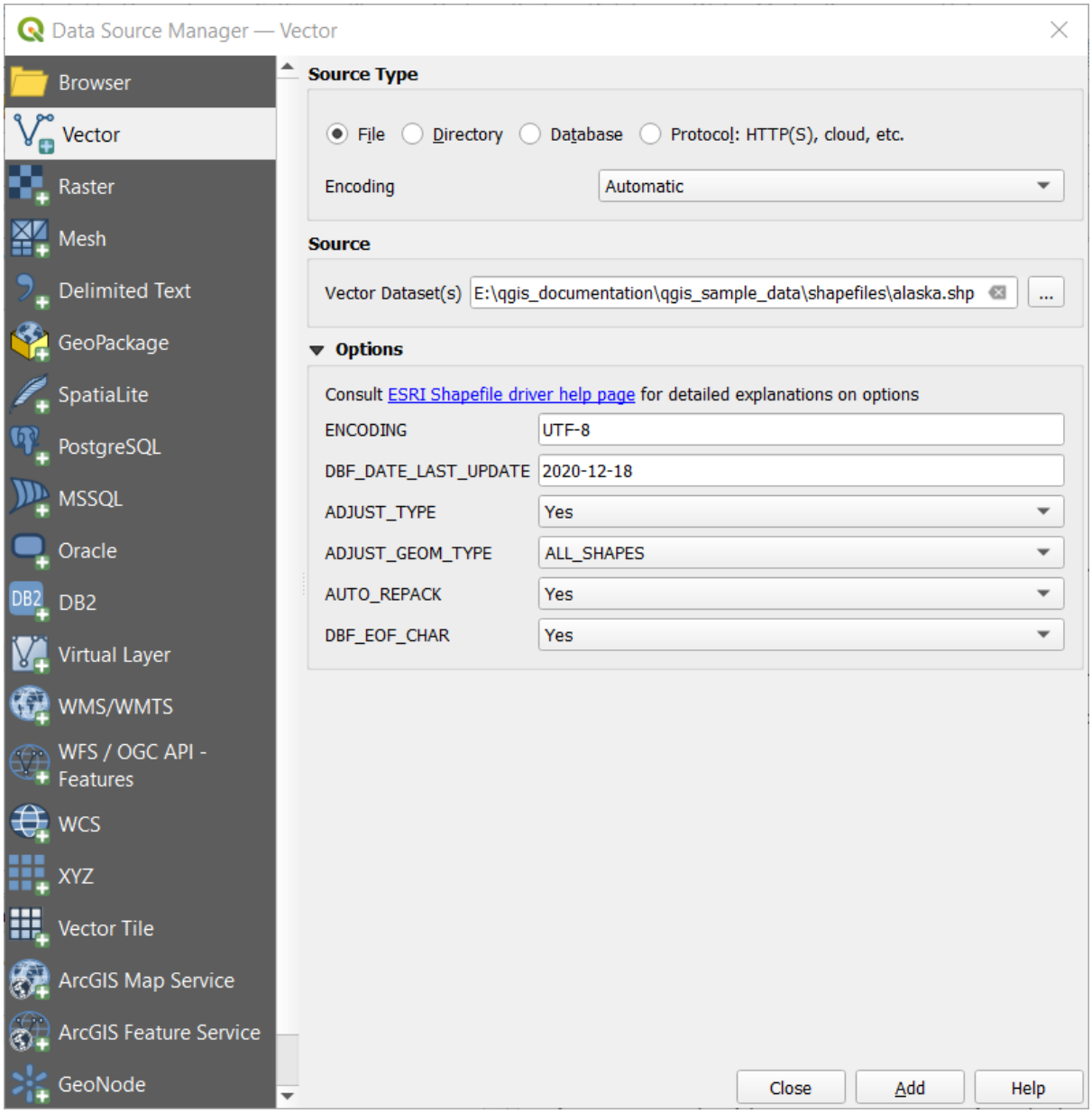


Figura13.6: Loading a Shapefile with open options

6. Press *Add* to load the file in QGIS and display them in the map view. Fig.13.7 shows QGIS after loading the `alaska.shp` file.

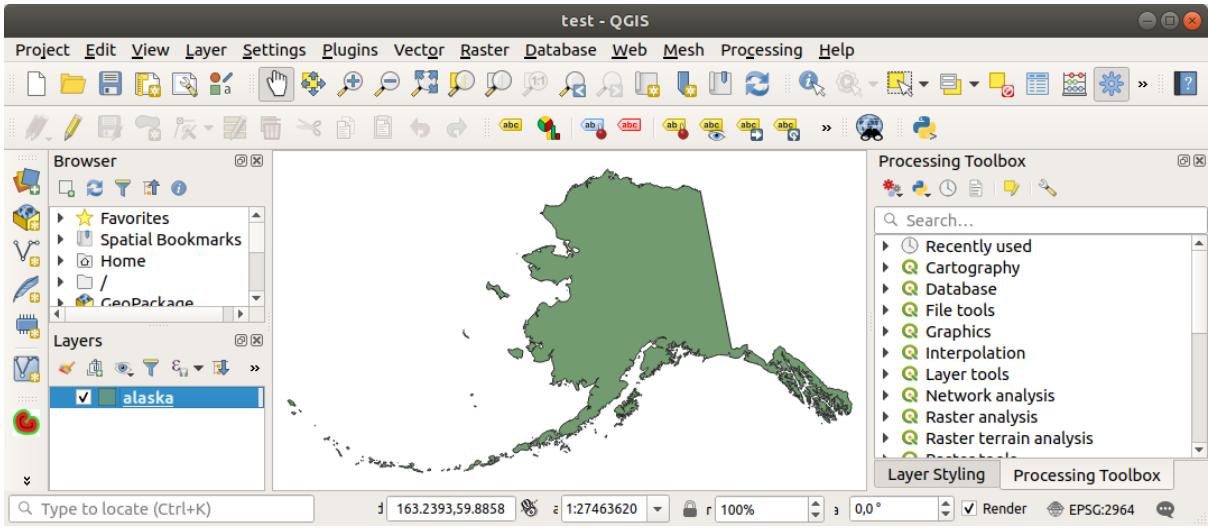


Figura13.7: QGIS with Shapefile of Alaska loaded

Nota: For loading vector files the GDAL driver offers to define open actions. These will be shown when the vector file is selected. Options are described in detail on https://gdal.org/drivers/vector/ .

Nota: Because some formats like MapInfo (e.g., `.tab`) or Autocad (`.dxf`) allow mixing different types of geometry in a single file, loading such datasets opens a dialog to select geometries to use in order to have one geometry per layer.

The Add Vector Layer and Add Raster Layer tabs allow loading of layers from source types other than *File*:

- You can load specific vector formats like `ArcInfo Binary Coverage`, `UK. National Transfer Format`, as well as the raw TIGER format of the `US Census Bureau` or `OpenfileGDB`. To do that, you select *Directory* as *Source type*. In this case, a directory can be selected in the dialog after pressing ... Browse.
- With the *Database* source type you can select an existing database connection or create one to the selected database type. Some possible database types are `ODBC`, `Esri Personal Geodatabase`, `MSSQL` as well as `PostgreSQL` or `MySQL` .

  Pressing the *New* button opens the *Create a New OGR Database Connection* dialog whose parameters are among the ones you can find in *Creating a stored Connection*. Pressing *Open* lets you select from the available tables, for example of PostGIS enabled databases.
- O tipo de fonte *Protocolo: HTTP(S), nuvem, etc.* abre dados armazenados localmente ou na rede sejam publicamente acessíveis, ou em armazenamentos em nuvem particulares fornecidos por serviços comerciais. Os tipos de protocolo suportados são:
  - `HTTP/HTTPS/FTP`, with a *URI* and, if required, an *authentication*.
  - Cloud storage such as `AWS S3`, `Google Cloud Storage`, `Microsoft Azure Blob`, `Alibaba OSS Cloud`, `Open Stack Swift Storage`. You need to fill in the *Bucket or container* and the *Object key*.
  - service supporting OGC `WFS 3` (still experimental), using `GeoJSON` or `GEOJSON - Newline Delimited` format or based on `CouchDB` database. A *URI* is required, with optional *authentication*.
  - For all vector source types it is possible to define the *Encoding* or to use the *Automatic* ► setting.

Loading a mesh layer

A mesh is an unstructured grid usually with temporal and other components. The spatial component contains a collection of vertices, edges and faces in 2D or 3D space. More information on mesh layers at *Working with Mesh Data*.

To add a mesh layer to QGIS:

1. Open the *Data Source Manager* dialog, either by selecting it from the *Layer* ► menu or clicking the Open Data Source Manager button.
2. Ative a guia *Malha* no painel da esquerda
3. Pressione o botão … Buscar para selecionar o arquivo. *Vários formatos* são suportados.
4. Select the layer and press *Add*. The layer will be added using the native mesh rendering.

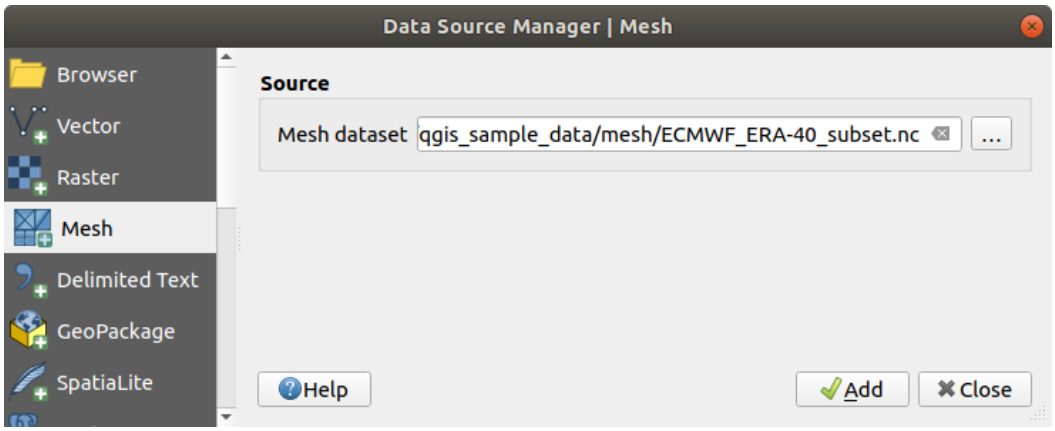


Figura13.8: Mesh tab in Data Source Manager

Importing a delimited text file

Delimited text files (e.g. `.txt`, `.csv`, `.dat`, `.wkt`) can be loaded using the tools described above. This way, they will show up as simple tables. Sometimes, delimited text files can contain coordinates / geometries that you could want to visualize. This is what *Add Delimited Text Layer* is designed for.

1. Click the Open Data Source Manager icon to open the *Data Source Manager* dialog
2. Ative a guia *Texto Delimitado*
3. Select the delimited text file to import (e.g., `qgis_sample_data/csv/elevp.csv`) by clicking on the … Browse button.
4. In the *Layer name* field, provide the name to use for the layer in the project (e.g. `Elevation`).
5. Configure the settings to meet your dataset and needs, as explained below.

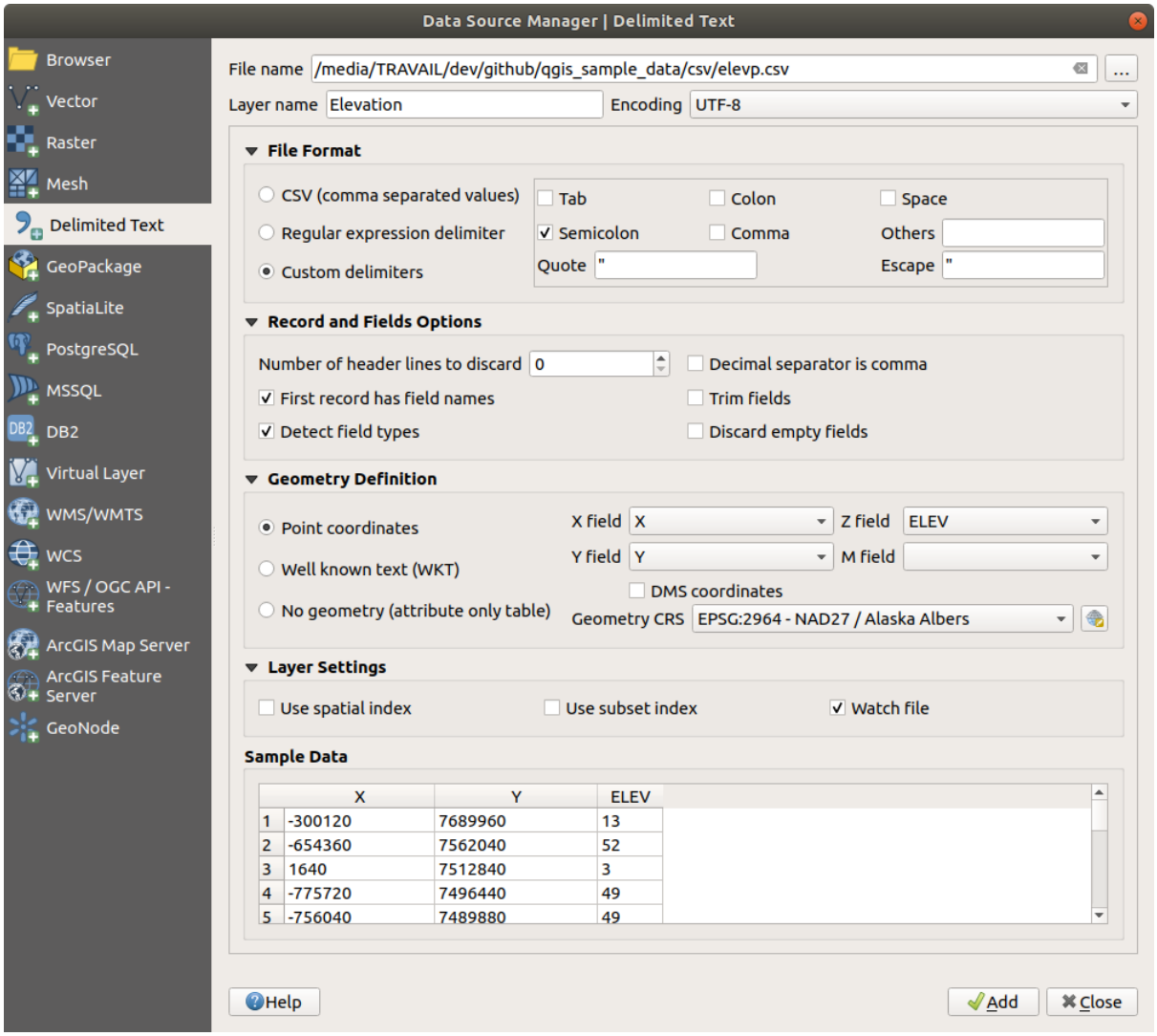


Figura13.9: Delimited Text Dialog

File format

Depois que o arquivo é selecionado, o QGIS tenta analisar o arquivo com o delimitador usado mais recentemente, identificando campos e linhas. Para permitir que o QGIS analise corretamente o arquivo, é importante selecionar o delimitador correto. Você pode especificar um delimitador escolhendo entre:

- *CSV (comma separated values)* to use the comma character.
- *Regular expression delimiter* and enter text into the *Expression* field. For example, to change the delimiter to tab, use `\t` (this is used in regular expressions for the tab character).
- *Custom delimiters*, choosing among some predefined delimiters like `comma`, `space`, `tab`, `semicolon`, ...

Records and fields

Some other convenient options can be used for data recognition:

- *Number of header lines to discard*: convenient when you want to avoid the first lines in the file in the import, either because those are blank lines or with another formatting.
- *First record has field names*: values in the first line are used as field names, otherwise QGIS uses the field names `field_1`, `field_2`...
- *Detect field types*: automatically recognizes the field type. If unchecked then all attributes are treated as text fields.
- *Decimal separator is comma*: you can force decimal separator to be a comma.
- *Trim fields*: allows you to trim leading and trailing spaces from fields.
- *Discard empty fields*.

As you set the parser properties, a sample data preview updates at the bottom of the dialog.

Geometry definition

Once the file is parsed, set *Geometry definition* to

- *Point coordinates* and provide the *X field*, *Y field*, *Z field* (for 3-dimensional data) and *M field* (for the measurement dimension) if the layer is of point geometry type and contains such fields. If the coordinates are defined as degrees/minutes/seconds, activate the *DMS coordinates* checkbox. Provide the appropriate *Geometry CRS* using the Select CRS widget.
- *Well known text (WKT)* option if the spatial information is represented as WKT: select the *Geometry field* containing the WKT geometry and choose the approriate *Geometry field* or let QGIS auto-detect it. Provide the appropriate *Geometry CRS* using the Select CRS widget.
- If the file contains non-spatial data, activate *No geometry (attribute only table)* and it will be loaded as an ordinary table.

Layer settings

Additionally, you can enable:

- *Use spatial index* to improve the performance of displaying and spatially selecting features.
- *Use subset index* to improve performance of *subset filters* (when defined in the layer properties).
- *Watch file* to watch for changes to the file by other applications while QGIS is running.

At the end, click *Add* to add the layer to the map. In our example, a point layer named `Elevation` is added to the project and behaves like any other map layer in QGIS. This layer is the result of a query on the `.csv` source file (hence, linked to it) and would require *to be saved* in order to get a spatial layer on disk.

Importing a DXF or DWG file

`DXF` and `DWG` files can be added to QGIS by simple drag-and-drop from the Browser Panel. You will be prompted to select the sublayers you would like to add to the project. Layers are added with random style properties.

Nota: For DXF files containing several geometry types (point, line and/or polygon), the name of the layers will be generated as *<filename.dxf> entities <geometry type>*.

To keep the dxf/dwg file structure and its symbology in QGIS, you may want to use the dedicated *Project* ► *Import/Export* ► *Import Layers from DWG/DXF…* tool which allows you to:

1. import elements from the drawing file into a GeoPackage database.
2. add imported elements to the project.

In the *DWG/DXF Import* dialog, to import the drawing file contents:

1. Input the location of the *Target package*, i.e. the new GeoPackage file that will store the data. If an existing file is provided, then it will be overwritten.
2. Especifique o sistema de referência de coordenadas dos dados no arquivo de desenho.
3. Check *Expand block references* to import the blocks in the drawing file as normal elements.
4. Check *Use curves* to promote the imported layers to a `curved` geometry type.
5. Use the *Import* button to select the DWG/DXF file to use (one per geopackage). The GeoPackage database will be automatically populated with the drawing file content. Depending on the size of the file, this can take some time.

After the `.dwg` or `.dxf` data has been imported into the GeoPackage database, the frame in the lower half of the dialog is populated with the list of layers from the imported file. There you can select which layers to add to the QGIS project:

1. At the top, set a *Group name* to group the drawing files in the project.
2. Check layers to show: Each selected layer is added to an ad hoc group which contains vector layers for the point, line, label and area features of the drawing layer. The style of the layers will resemble the look they originally had in *CAD.
3. Escolha se a camada deve estar visível na abertura.
4. Marcar a opção *Mesclar camadas* coloca todas as camadas em um único grupo.
5. Press *OK* to open the layers in QGIS.

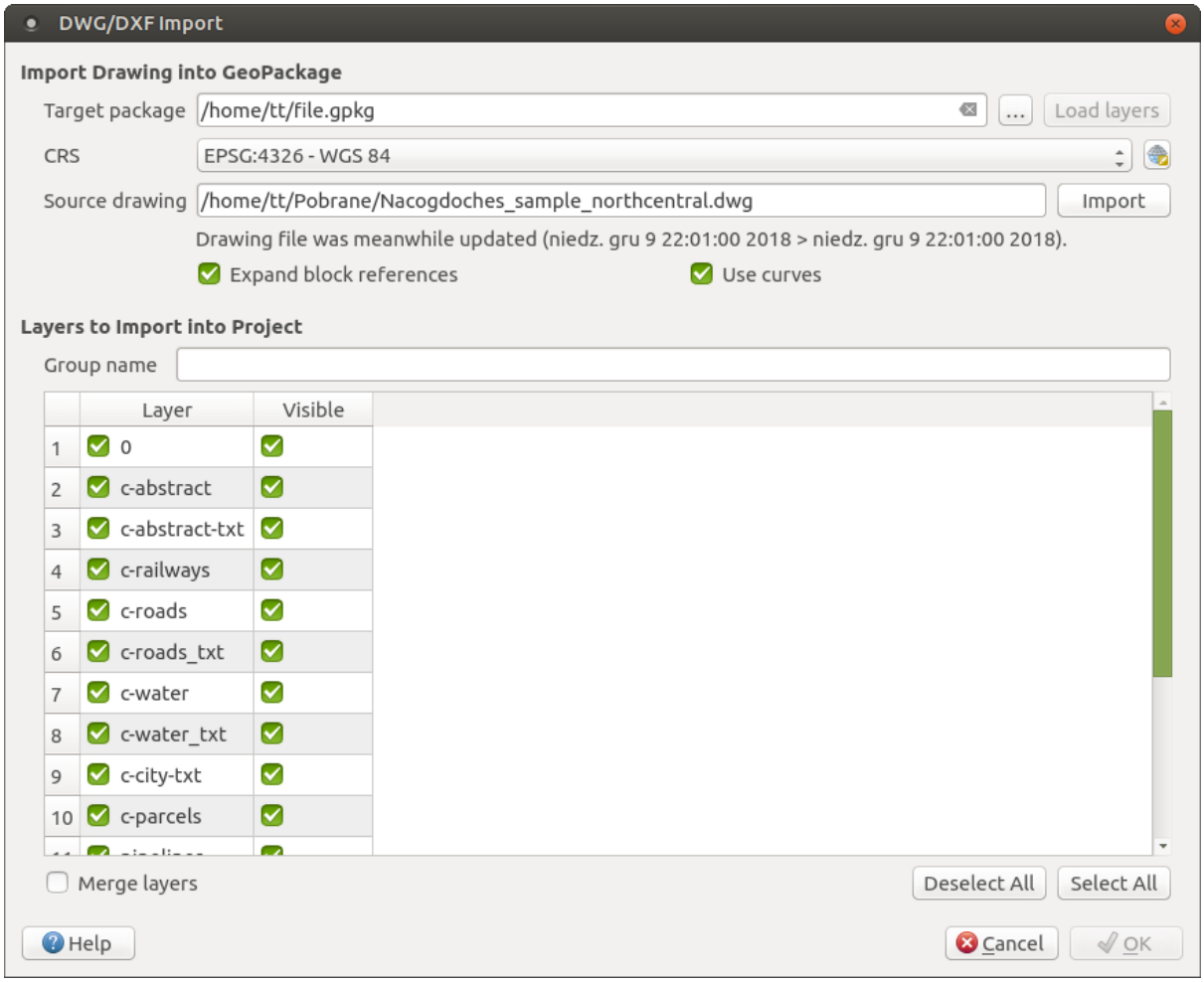


Figura13.10: Import dialog for DWG/DXF files

Importing OpenStreetMap Vectors

The OpenStreetMap project is popular because in many countries no free geodata such as digital road maps are available. The objective of the OSM project is to create a free editable map of the world from GPS data, aerial photography and local knowledge. To support this objective, QGIS provides support for OSM data.

Using the *Browser Panel*, you can load an `.osm` file to the map canvas, in which case you'll get a dialog to select sublayers based on the geometry type. The loaded layers will contain all the data of that geometry type in the `.osm` file, and keep the `osm` file data structure.

Camadas SpatiaLite

The first time you load data from a SpatiaLite database, begin by:

- clicking on the Add SpatiaLite Layer toolbar button
- selecting the *Add SpatiaLite Layer…* option from the *Layer* ► *Add Layer* menu
- ou digitando `Ctrl+Shift+L`

This will bring up a window that will allow you either to connect to a SpatiaLite database already known to QGIS (which you choose from the drop-down menu) or to define a new connection to a new database. To define a new

connection, click on *New* and use the file browser to point to your SpatiaLite database, which is a file with a `.sqlite` extension.

O QGIS também suporta visualizações editáveis no SpatiaLite.

GPS

Loading GPS data in QGIS can be done using the core plugin `GPS Tools`. Instructions are found in section *Complemento GPS*.

GRASS

Working with GRASS vector data is described in section *Integração com SIG GRASS*.

Database related tools

Creating a stored Connection

Para ler e gravar tabelas a partir de um formato de banco de dados, o QGIS oferece suporte à criação de uma conexão com esse banco de dados. Embora *Painel do Navegador QGIS* seja a maneira mais simples e recomendada de conectar-se e usar bancos de dados, o QGIS fornece outras ferramentas para conectar-se a cada um deles e carregar suas tabelas:

- *Adicionar Camada PostGIS...* ou digitando `Ctrl+Shift+D`
- *Add MSSQL Spatial Layer*
- *Add Oracle Spatial Layer...* or by typing `Ctrl+Shift+O`
- *Adicionar Camada Espacial DB2...* ou digitando `Ctrl+Shift+2`

These tools are accessible either from the *Manage Layers Toolbar* and the *Layer* ► *Add Layer* ► menu. Connecting to SpatiaLite database is described at *Camadas SpatiaLite*.

Dica: Create connection to database from the QGIS Browser Panel

Selecting the corresponding database format in the Browser tree, right-clicking and choosing connect will provide you with the database connection dialog.

Most of the connection dialogs follow a common basis that will be described below using the PostgreSQL database tool as an example. For additional settings specific to other providers, you can find corresponding descriptions at:

- *Connecting to MSSQL Spatial*;
- *Conectando ao Oracle Spatial*;
- *Connecting to DB2 Spatial*.

The first time you use a PostGIS data source, you must create a connection to a database that contains the data. Begin by clicking the appropriate button as exposed above, opening an *Add PostGIS Table(s)* dialog (see Fig.13.12). To access the connection manager, click on the *New* button to display the *Create a New PostGIS Connection* dialog.

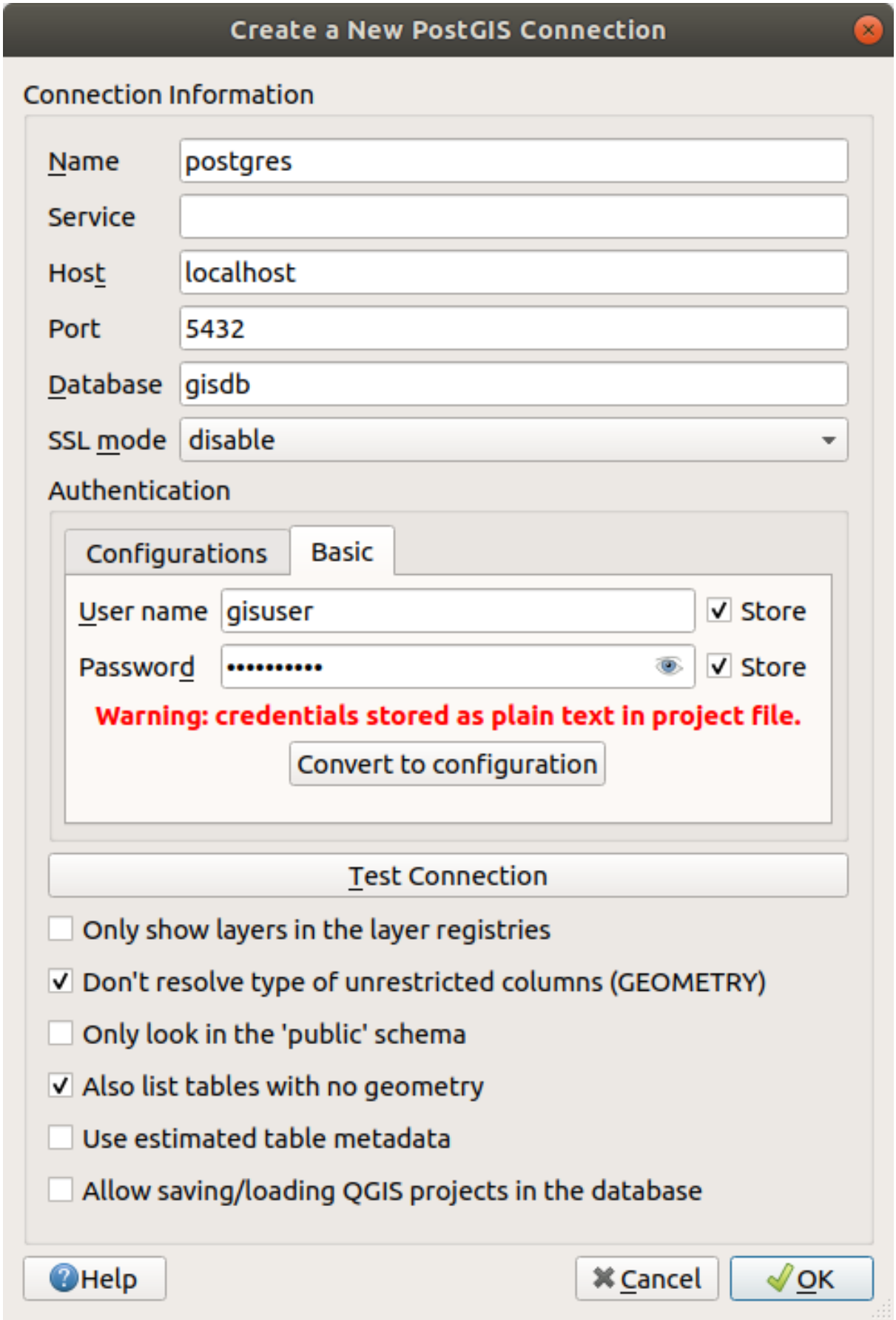


Figura13.11: Criar uma Nova Caixa de Diálogo de Conexão PostGIS

Os parâmetros necessários para uma conexão PostGIS são explicados abaixo. Para os outros tipos de banco de dados, veja suas diferenças em *Particular Connection requirements*.

- *Name*: A name for this connection. It can be the same as *Database*.
- *Service*: Service parameter to be used alternatively to hostname/port (and potentially database). This can be defined in `pg_service.conf`. Check the *PostgreSQL Service connection file* section for more details.
- *Host*: Name of the database host. This must be a resolvable host name such as would be used to open a TCP/IP connection or ping the host. If the database is on the same computer as QGIS, simply enter *localhost* here.
- *Port*: Port number the PostgreSQL database server listens on. The default port for PostGIS is `5432`.
- *Banco de Dados*: Nome do banco de dados.
- *SSL mode*: SSL encryption setup The following options are available:
  - *Prefer* (the default): I don't care about encryption, but I wish to pay the overhead of encryption if the server supports it.
  - *Require*: I want my data to be encrypted, and I accept the overhead. I trust that the network will make sure I always connect to the server I want.
  - *Verify CA*: I want my data encrypted, and I accept the overhead. I want to be sure that I connect to a server that I trust.
  - *Verify Full*: I want my data encrypted, and I accept the overhead. I want to be sure that I connect to a server I trust, and that it's the one I specify.
  - *Allow*: I don't care about security, but I will pay the overhead of encryption if the server insists on it.
  - *Disable*: I don't care about security, and I don't want to pay the overhead of encryption.
- *Authentication*, basic.
  - *User name*: User name used to log in to the database.
  - *Password*: Password used with *Username* to connect to the database.

  You can save any or both of the `User name` and `Password` parameters, in which case they will be used by default each time you need to connect to this database. If not saved, you'll be prompted to supply the credentials to connect to the database in next QGIS sessions. The connection parameters you entered are stored in a temporary internal cache and returned whenever a username/password for the same database is requested, until you end the current QGIS session.

  Aviso: Configurações e segurança do usuário QGIS

  In the *Authentication* tab, saving **username** and **password** will keep unprotected credentials in the connection configuration. Those **credentials will be visible** if, for instance, you share the project file with someone. Therefore, it is advisable to save your credentials in an *Authentication configuration* instead (*Configurations* tab - See *Sistema de Autenticação* for more details) or in a service connection file (see *PostgreSQL Service connection file* for example).

- *Authentication*, configurations. Choose an authentication configuration. You can add configurations using the  button. Choices are:
  - Basic authentication
  - Autenticaão PKI PKCS#12
  - Autenticação de caminhos PKI
  - PKI stored identity certificate

Opcionalmente, dependendo do tipo de banco de dados, você pode ativar as seguintes caixas de seleção:

-  *Only show layers in the layer registries*

- :guilabel:`Não resolva o tipo de colunas irrestritas (GEOMETRIA) `
- *Only look in the 'public' schema*
- *Also list tables with no geometry*
- *Usar metadados estimados da tabela*
- *Permitir salvar/carregar projetos QGIS no banco de dados* - mais detalhes *here*

Dica: Use estimated table metadata to speed up operations

When initializing layers, various queries may be needed to establish the characteristics of the geometries stored in the database table. When the *Use estimated table metadata* option is checked, these queries examine only a sample of the rows and use the table statistics, rather than the entire table. This can drastically speed up operations on large datasets, but may result in incorrect characterization of layers (e.g. the feature count of filtered layers will not be accurately determined) and may even cause strange behaviour if columns that are supposed to be unique actually are not.

Once all parameters and options are set, you can test the connection by clicking the *Test Connection* button or apply it by clicking the *OK* button. From *Add PostGIS Table(s)*, click now on *Connect*, and the dialog is filled with tables from the selected database (as shown in Fig.13.12).

Particular Connection requirements

Because of database type particularities, provided options are not the same. Database specific options are described below.

PostgreSQL Service connection file

The service connection file allows PostgreSQL connection parameters to be associated with a single service name. That service name can then be specified by a client and the associated settings will be used.

It's called `.pg_service.conf` under *nix systems (GNU/Linux, macOS etc.) and `pg_service.conf` on Windows.

The service file can look like this:

```
[water_service]
host=192.168.0.45
port=5433
dbname=gisdb
user=paul
password=paulspass

[wastewater_service]
host=dbserver.com
dbname=water
user=waterpass
```

Nota: There are two services in the above example: `water_service` and `wastewater_service`. You can use these to connect from QGIS, pgAdmin, etc. by specifying only the name of the service you want to connect to (without the enclosing brackets). If you want to use the service with `psql` you need to do something like `export PGSERVICE=water_service` before doing your psql commands.

You can find all the PostgreSQL parameters here

Nota: If you don't want to save the passwords in the service file you can use the .pg_pass option.

On *nix operating systems (GNU/Linux, macOS etc.) you can save the `.pg_service.conf` file in the user's home directory and PostgreSQL clients will automatically be aware of it. For example, if the logged user is `web`, `.pg_service.conf` should be saved in the `/home/web/` directory in order to directly work (without specifying any other environment variables).

You can specify the location of the service file by creating a `PGSERVICEFILE` environment variable (e.g. run the `export PGSERVICEFILE=/home/web/.pg_service.conf` command under your *nix OS to temporarily set the `PGSERVICEFILE` variable)

You can also make the service file available system-wide (all users) either by placing the `.pg_service.conf` file in `pg_config --sysconfdir` or by adding the `PGSYSCONFDIR` environment variable to specify the directory containing the service file. If service definitions with the same name exist in the user and the system file, the user file takes precedence.

Aviso: There are some caveats under Windows:

- The service file should be saved as `pg_service.conf` and not as `.pg_service.conf`.
- The service file should be saved in Unix format in order to work. One way to do it is to open it with Notepad++ and *Edit* ► *EOL Conversion* ► *UNIX Format* ► *File save*.
- Você pode adicionar variáveis ambientais de várias maneiras; um testado, conhecido por funcionar de forma confiável, é **:menuelection:`Painel de controle --> Sistema e segurança --> Sistema --> Configurações avançadas do sistema --> Variáveis de ambiente`** adicionando `PGSERVICEFILE` com o caminho - por exemplo `C:\Users\John\pg_service.conf`
- After adding an environment variable you may also need to restart the computer.

Conectando ao Oracle Spatial

The spatial features in Oracle Spatial aid users in managing geographic and location data in a native type within an Oracle database. In addition to some of the options in *Creating a stored Connection*, the connection dialog proposes:

- **Database**: SID or SERVICE_NAME of the Oracle instance;
- **Port**: Port number the Oracle database server listens on. The default port is `1521`;
- **Options**: Oracle connection specific options (e.g. OCI_ATTR_PREFETCH_ROWS, OCI_ATTR_PREFETCH_MEMORY). The format of the options string is a semicolon separated list of option names or option=value pairs;
- **Workspace**: Workspace to switch to;
- **Schema**: Schema in which the data are stored

Optionally, you can activate the following checkboxes:

- ☑ *Only look in metadata table*: restricts the displayed tables to those that are in the `all_sdo_geom_metadata` view. This can speed up the initial display of spatial tables.
- ☑ *Only look for user's tables*: when searching for spatial tables, restricts the search to tables that are owned by the user.
- ☑ *Also list tables with no geometry*: indicates that tables without geometry should also be listed by default.
- ☑ *Use estatísticas estimadas da tabela para os metadados da camada*: quando a camada é configurada, vários metadados são necessários para a tabela Oracle. Isso inclui informações como a contagem de linhas da tabela, tipo de geometria e extensões espaciais dos dados na coluna geometria. Se a tabela contiver um grande número de linhas, a determinação desses metadados poderá ser demorada. Ao ativar esta opção, as seguintes operações

rápidas de metadados da tabela são concluídas: A contagem de linhas é determinada em `all_tables.num_rows`. As extensões de tabela são sempre determinadas com a função SDO_TUNE.EXTENTS_OF, mesmo se um filtro de camada for aplicado. A geometria da tabela é determinada a partir das primeiras 100 linhas de geometria não nula da tabela.

- ☑ *Only existing geometry types*: only lists the existing geometry types and don't offer to add others.
- ☑ :guilabel:`Incluir atributos adicionais de geometria `.

Dica: Oracle Spatial Layers

Normally, an Oracle Spatial layer is defined by an entry in the **USER_SDO_METADATA** table.

To ensure that selection tools work correctly, it is recommended that your tables have a **primary key**.

Connecting to DB2 Spatial

Além de algumas das opções descritas em *Creating a stored Connection*, a conexão com um banco de dados DB2 (veja *DB2 Spatial Layers* para mais informações) pode ser especificada usando um nome *Service/DSN* definido para ODBC ou *Driver*, *Host* e *Port*.

An ODBC **Service/DSN** connection requires the service name defined to ODBC.

A driver/host/port connection requires:

- **Driver**: Name of the DB2 driver. Typically this would be IBM DB2 ODBC DRIVER.
- **Host do DB2**: Nome do host do banco de dados. Esse deve ser um nome de host resolvível, como seria usado para abrir uma conexão TCP/IP ou executar ping no host. Se o banco de dados estiver no mesmo computador que o QGIS, basta digitar *localhost* aqui.
- **DB2 Port**: Port number the DB2 database server listens on. The default DB2 LUW port is `50000`. The default DB2 z/OS port is `446`.

Dica: DB2 Spatial Layers

A DB2 Spatial layer is defined by a row in the **DB2GSE.ST_GEOMETRY_COLUMNS** view.

Nota: In order to work effectively with DB2 spatial tables in QGIS, it is important that tables have an INTEGER or BIGINT column defined as PRIMARY KEY and if new features are going to be added, this column should also have the GENERATED characteristic.

It is also helpful for the spatial column to be registered with a specific spatial reference identifier (most often `4326` for WGS84 coordinates). A spatial column can be registered by calling the `ST_Register_Spatial_Column` stored procedure.

Connecting to MSSQL Spatial

Além de algumas das opções em *Creating a stored Connection*, a criação de uma nova caixa de diálogo de conexão MSSQL propõe que você preencha um nome **Provider/DSN**. Você também pode exibir bancos de dados disponíveis.

Loading a Database Layer

Once you have one or more connections defined to a database (see section *Creating a stored Connection*), you can load layers from it. Of course, this requires that data are available. See section *Importing Data into PostgreSQL* for a discussion on importing data into a PostGIS database.

To load a layer from a database, you can perform the following steps:

1. Open the "Add <database> table(s)" dialog (see *Creating a stored Connection*).
2. Choose the connection from the drop-down list and click *Connect*.
3. Select or unselect *Also list tables with no geometry*.
4. Optionally, use some *Search Options* to reduce the list of tables to those matching your search. You can also set this option before you hit the *Connect* button, speeding up the database fetching.
5. Find the layer(s) you wish to add in the list of available layers.
6. Select it by clicking on it. You can select multiple layers by holding down the `Shift` or `Ctrl` key while clicking.
7. If applicable, use the *Set Filter* button (or double-click the layer) to start the *Query Builder* dialog (see section *Criador de consultas*) and define which features to load from the selected layer. The filter expression appears in the `sql` column. This restriction can be removed or edited in the *Layer Properties* ► *General* ► *Provider Feature Filter* frame.
8. The checkbox in the `Select at id` column that is activated by default gets the feature ids without the attributes and generally speeds up the data loading.
9. Click on the *Add* button to add the layer to the map.

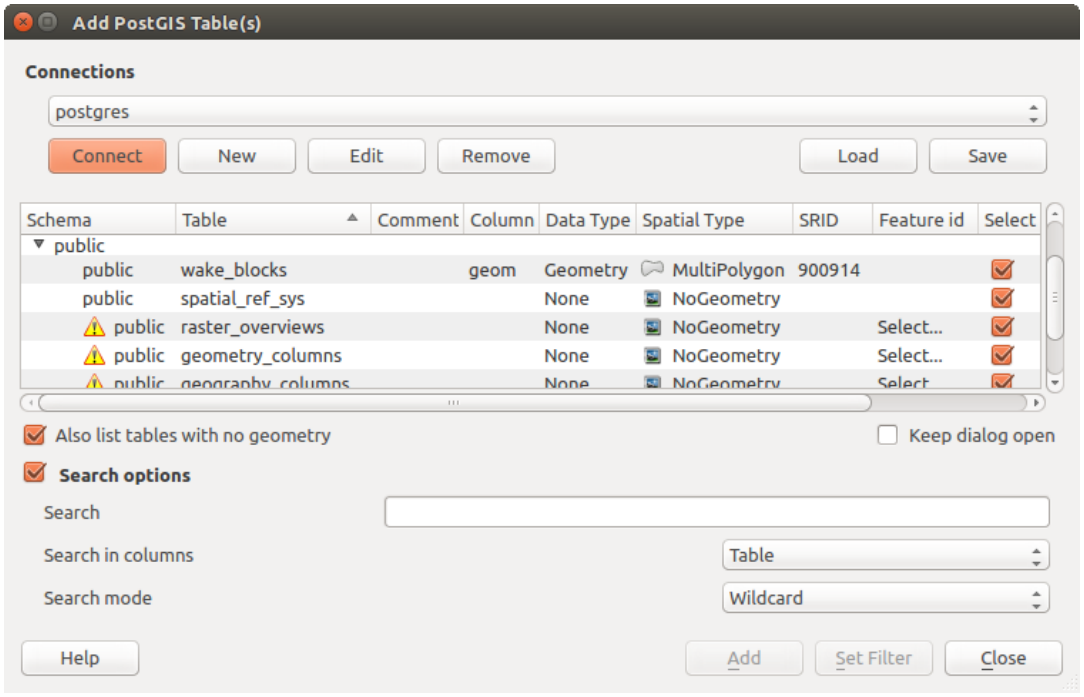


Figura13.12: Add PostGIS Table(s) Dialog

Dica: Use the Browser Panel to speed up loading of database table(s)

A adição de tabelas de BD do *Gerenciador de Fonte de Dados* às vezes pode ser demorado, pois o QGIS busca estatísticas e propriedades (por exemplo, tipo e campo de geometria, SRC, número de recursos) para cada tabela

com antecedência. Para evitar isso, uma vez que *the connection is set*, é melhor usar o *Browser Panel* ou o *DB Manager* para arrastar e soltar as tabelas do banco de dados na tela do mapa.

13.1.4 Formatos personalizados QGIS

QGIS proposes two custom formats:

- Temporary Scratch Layer: a memory layer that is bound to the project (see *Creating a new Temporary Scratch Layer* for more information)
- Virtual Layers: a layer resulting from a query on other layer(s) (see *Creating virtual layers* for more information)

13.1.5 QLR - QGIS Layer Definition File

Layer definitions can be saved as a *Layer Definition File* (QLR - `.qlr`) using *Export* ► *Save As Layer Definition File…* in the layer context menu.

The QLR format makes it possible to share "complete" QGIS layers with other QGIS users. QLR files contain links to the data sources and all the QGIS style information necessary to style the layer.

QLR files are shown in the Browser Panel and can be used to add layers (with their saved styles) to the Layers Panel. You can also drag and drop QLR files from the system file manager into the map canvas.

13.1.6 Connecting to web services

With QGIS you can get access to different types of OGC web services (WM(T)S, WFS(-T), WCS, CSW, …). Thanks to QGIS Server, you can also publish such services. QGIS-Server-manual contains descriptions of these capabilities.

Using Vector Tiles services

Vector Tiles services can be found in the *Vector Tiles* top level entry in the *Browser*. You can add a service by opening the context menu with a right-click and choosing *New Generic Connection …*. You set up a service by adding a *Name* and a *URL*. The Vector Tiles Service must provide tiles in `.pbf` format. The dialog provides two menus to define the ☑ *Min. Zoom Level* and the ☑ *Max. Zoom Level*. Vector Tiles have a pyramid structure. By using these options you have the opportunity to individually generate layers from the tile pyramid. These layers will then be used to render the Vector Tile in QGIS. For Mercator projection (used by OpenStreetMap Vector Tiles) Zoom Level 0 represents the whole world at a scale of 1:500.000.000. Zoom Level 14 represents the scale 1:35.000. Fig.13.13 shows the dialog with the MapTiler planet Vector Tiles service configuration.

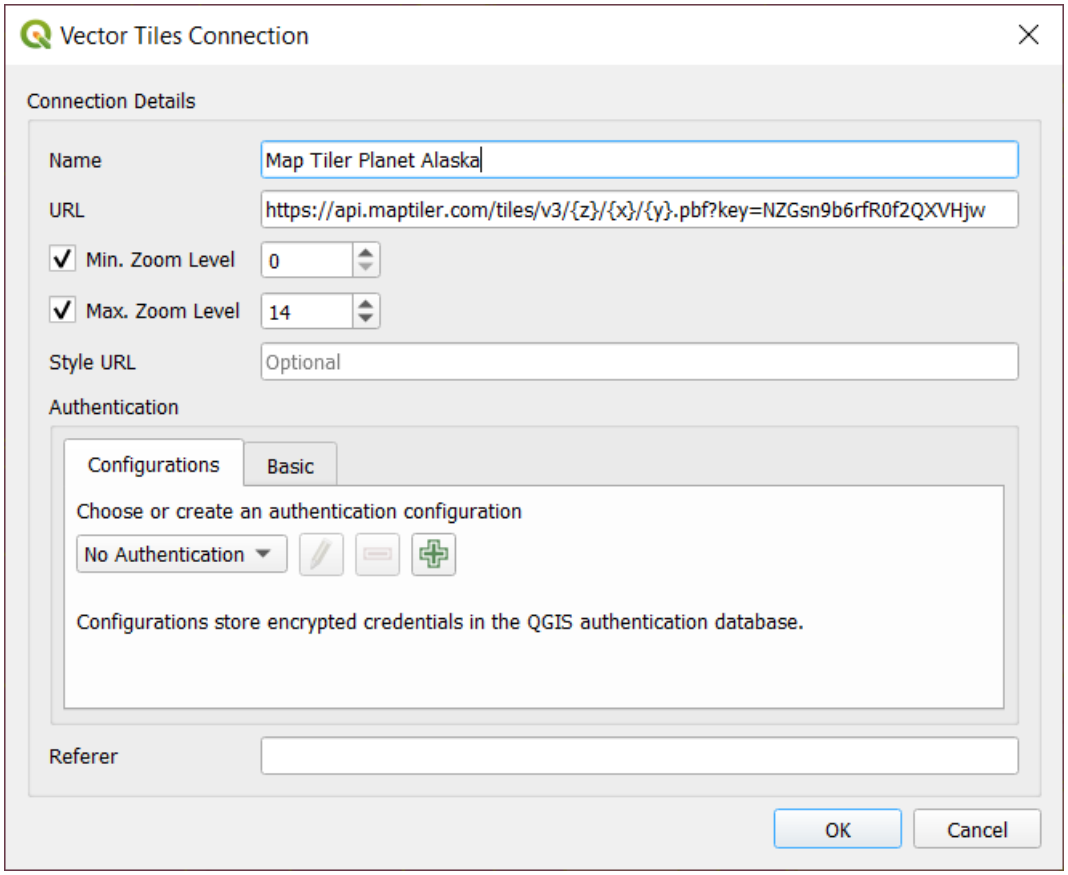


Figura13.13: Vector Tiles - Maptiler Planet configuration

By using *New ArcGIS Vector Tile Service Connection …* you can connect to ArcGIS Vector Tile Services.

Using XYZ Tile services

XYZ Tile services can be found in the *XYZ Tiles* top level entry in the *Browser*. By default, the OpenStreetMap XYZ Tile service is configured. You can add other services that use the XYZ Tile protocol by choosing *New Connection* in the XYZ Tiles context menu (right-click to open). Fig.13.14 shows the dialog with the OpenStreetMap XYZ Tile service configuration.

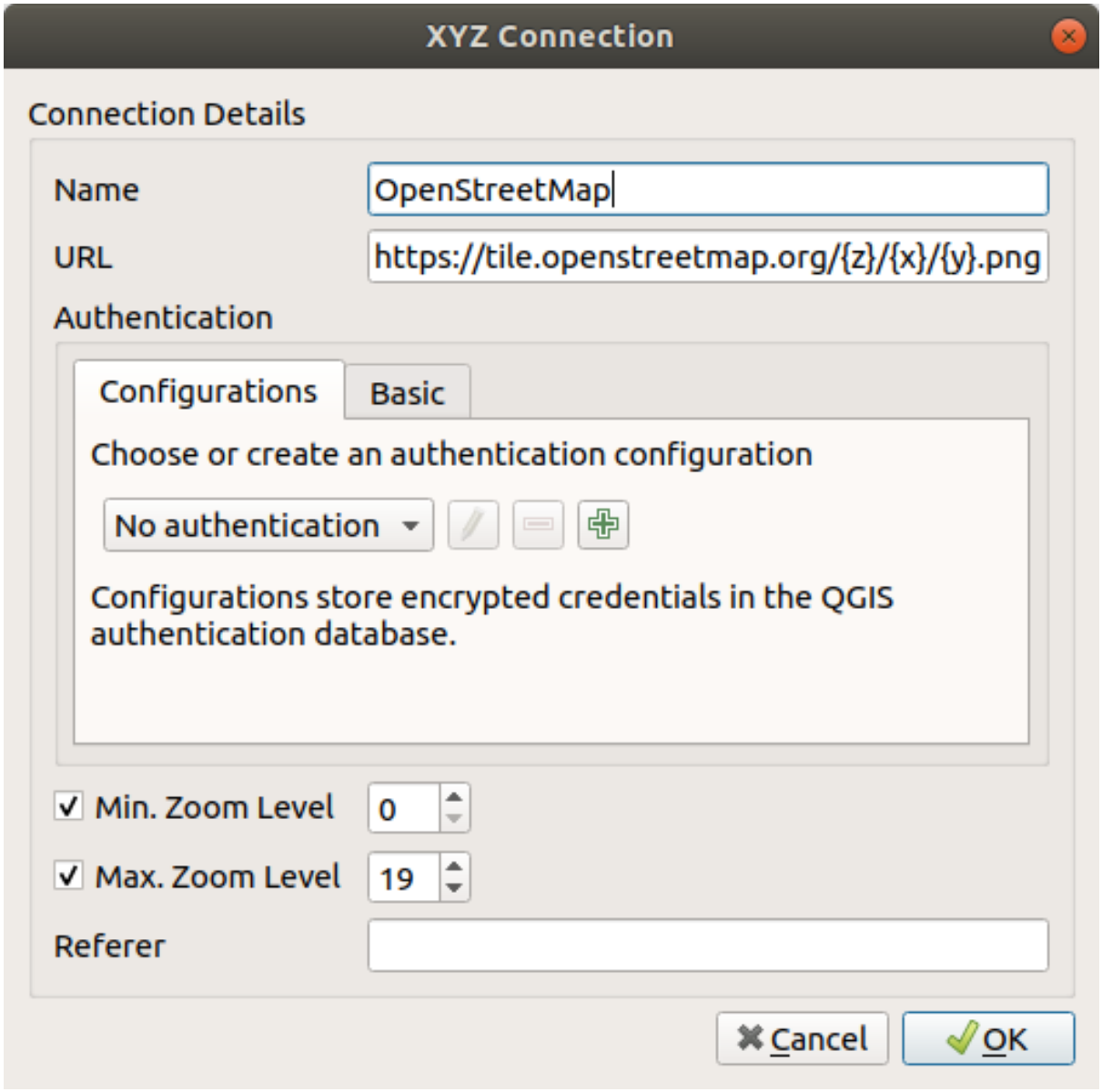


Figura13.14: XYZ Tiles - OpenStreetMap configuration

Configurations can be saved (*Save Connections*) to XML and loaded (*Load Connections*) through the context menu. Authentication configuration is supported. The XML file for OpenStreetMap looks like this:

```
<!DOCTYPE connections>
<qgsXYZTilesConnections version="1.0">
  <xyztiles url="https://tile.openstreetmap.org/{z}/{x}/{y}.png"
   zmin="0" zmax="19" tilePixelRatio="0" password="" name="OpenStreetMap"
   username="" authcfg="" referer=""/>
</qgsXYZTilesConnections>
```

Once a connection to a XYZ tile service is set, right-click over the entry to:

- *Edit…* the XYZ connection settings
- *Delete* the connection
- *Exportar camada…* ► *Para Arquivo*, *saving it as a raster*
- *Add layer to project*: a double-click also adds the layer

- View the *Layer Properties...* and get access to metadata and a preview of the data provided by the service. More settings are available when the layer has been loaded into the project.

Examples of XYZ Tile services:

- OpenStreetMap Monochrome: *URL*: `http://tiles.wmflabs.org/bw-mapnik/{z}/{x}/{y}.png`, *Min. Zoom Level*: 0, *Max. Zoom Level*: 19.
- Google Maps: *URL*: `https://mt1.google.com/vt/lyrs=m&x={x}&y={y}&z={z}`, *Min. Zoom Level*: 0, *Max. Zoom Level*: 19.
- Temperatura do Mapa Meteorológico Aberto: *URL*: `http://tile.openweathermap.org/map/temp_new/{z}/{x}/{y}.png?appid={api_key}` *Nível Mín. de Zoom*: 0, : guilabel: Nível Máx. de Zoom`: 19.

13.2 Creating Layers

Layers can be created in many ways, including:

- empty layers from scratch
- layers from existing layers
- layers from the clipboard
- layers as a result of an SQL-like query based on one or many layers (*virtual layers*)

QGIS also provides tools to import/export from/to different formats.

13.2.1 Creating new vector layers

QGIS allows you to create new layers in different formats. It provides tools for creating GeoPackage, Shapefile, SpatiaLite, GPX format and Temporary Scratch layers (aka memory layers). Creation of a *new GRASS layer* is supported within the GRASS plugin.

Creating a new GeoPackage layer

To create a new GeoPackage layer, press the *New GeoPackage Layer…* button in the *Layer* ► *Create Layer* ► menu or from the *Data Source Manager* toolbar. The *New GeoPackage Layer* dialog will be displayed as shown in Fig.13.15.

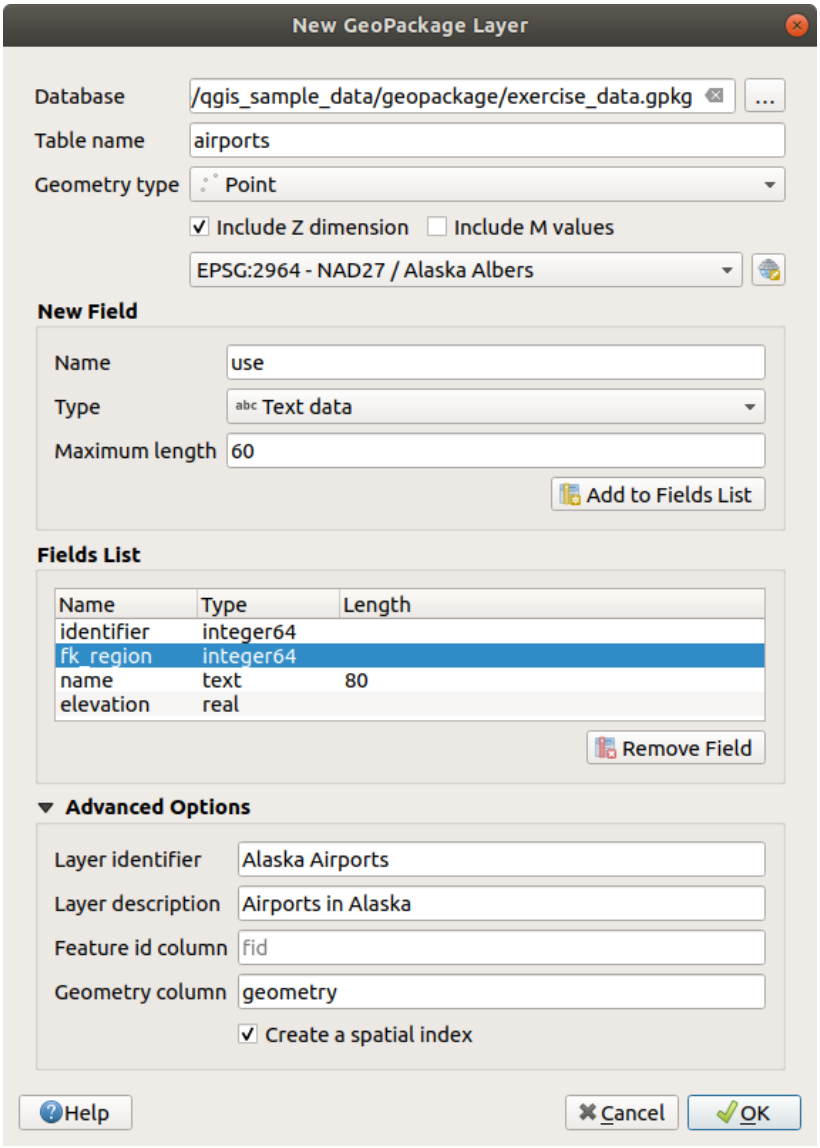


Figura13.15: Creating a New GeoPackage layer dialog

1. The first step is to indicate the database file location. This can be done by pressing the … button to the right of the *Database* field and select an existing GeoPackage file or create a new one. QGIS will automatically add the right extension to the name you provide.
2. Give the new layer / table a name (*Table name*)
3. Define the *Geometry type*. If not a geometryless layer, you can specify whether it should *Include Z dimension* and/or *Include M values*.
4. Specify the coordinate reference system using the button

To add fields to the layer you are creating:

1. Enter the *Name* of the field

2. Select the data *Type*. Supported types are *Text data*, *Whole number* (both integer and integer64), *Decimal number*, *Date* and *Date and time*, *Binary (BLOB)* and *Boolean*.
3. Depending on the selected data format, enter the *Maximum length* of values.
4. Click on the *Add to Fields List* button
5. Reproduce the steps above for each field you need to add
6. Once you are happy with the attributes, click *OK*. QGIS will add the new layer to the legend, and you can edit it as described in section *Digitalizar uma camada existente*.

By default, when creating a GeoPackage layer, QGIS generates a *Feature id column* called `fid` which acts as the primary key of the layer. The name can be changed. The geometry field, if availabe, is named `geometry`, and you can choose to *Create a spatial index* on it. These options can be found under the *Advanced Options* together with the *Layer identifier* (short human readable name of the layer) and the *Layer description*.

Further management of GeoPackage layers can be done with the *DB Manager*.

Creating a new Shapefile layer

To create a new ESRI Shapefile format layer, press the *New Shapefile Layer…* button in the *Layer* ► *Create Layer* ► menu or from the *Data Source Manager* toolbar. The *New Shapefile Layer* dialog will be displayed as shown in Fig.13.16.

1. Provide a path and file name using the … button next to *File name*. QGIS will automatically add the right extension to the name you provide.
2. Next, indicate the *File encoding* of the data
3. Choose the *Geometry type* of the layer: No Geometry (resulting in a `.DBF` format file), point, multipoint, line or polygon
4. Specify whether the geometry should have additional dimensions: *None*, *Z (+ M values)* or *M values*
5. Specify the coordinate reference system using the button

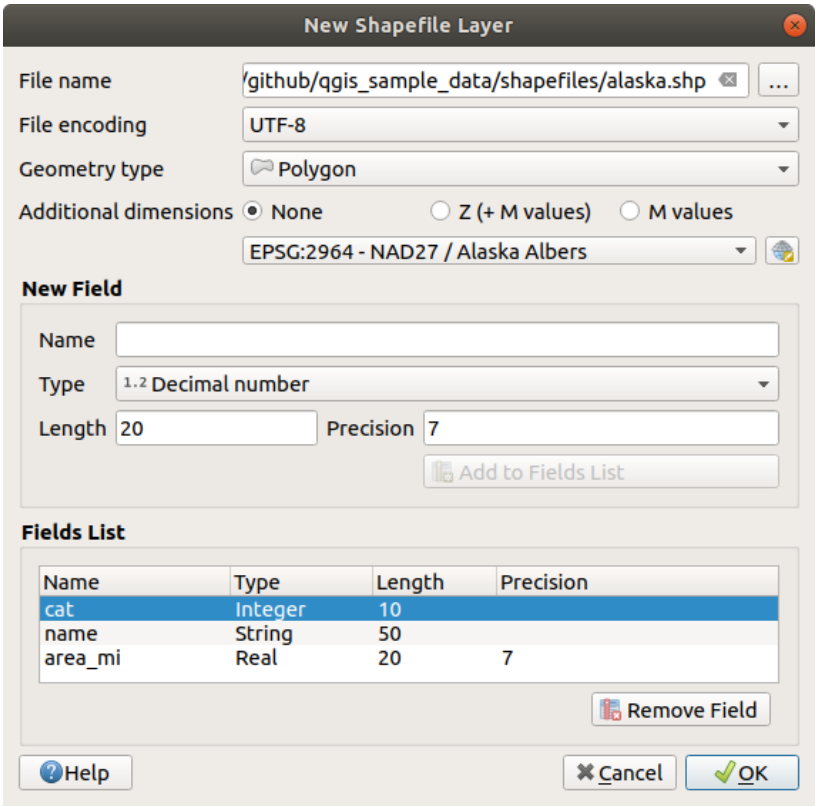


Figura13.16: Creating a new Shapefile layer dialog

To add fields to the layer you are creating:

1. Enter the *Name* of the field
2. Select the data *Type*. Only *Decimal number*, *Whole number*, *Text data* and *Date* attributes are supported.
3. Depending on the selected data format, enter the *Length* and *Precision*.
4. Click on the *Add to Fields List* button
5. Reproduce the steps above for each field you need to add
6. Once you are happy with the attributes, click *OK*. QGIS will add the new layer to the legend, and you can edit it as described in section *Digitalizar uma camada existente*.

By default, a first integer `id` column is added but can be removed.

Creating a new SpatiaLite layer

To create a new SpatiaLite layer, press the *New SpatiaLite Layer…* button in the *Layer* ► *Create Layer* ► menu or from the *Data Source Manager* toolbar. The *New SpatiaLite Layer* dialog will be displayed as shown in Fig.13.17.

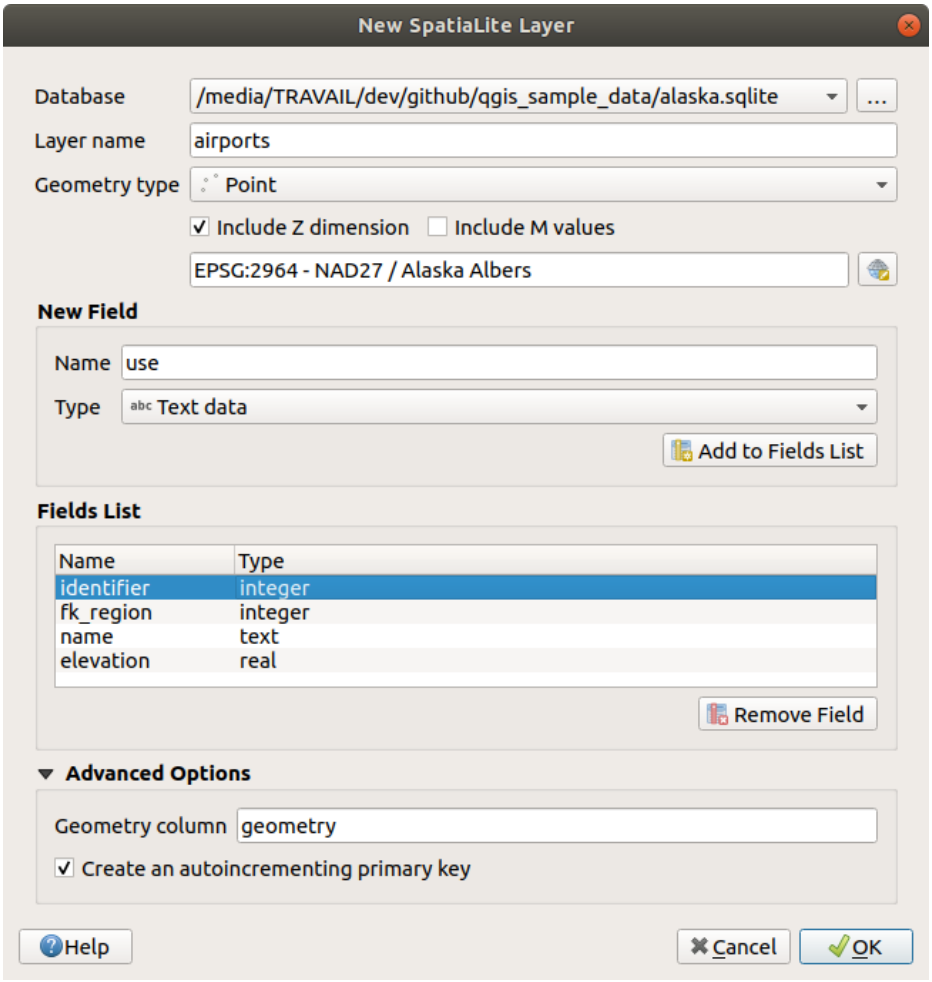


Figura13.17: Creating a New SpatiaLite layer dialog

1. The first step is to indicate the database file location. This can be done by pressing the … button to the right of the *Database* field and select an existing SpatiaLite file or create a new one. QGIS will automatically add the right extension to the name you provide.
2. Provide a name (*Layer name*) for the new layer
3. Define the *Geometry type*. If not a geometryless layer, you can specify whether it should *Include Z dimension* and/or *Include M values*.
4. Specify the coordinate reference system using the button.

To add fields to the layer you are creating:

1. Enter the *Name* of the field
2. Select the data *Type*. Supported types are *Text data*, *Whole number* and *Decimal number*.
3. Click on the *Add to Fields List* button
4. Reproduce the steps above for each field you need to add

5. Once you are happy with the attributes, click *OK*. QGIS will add the new layer to the legend, and you can edit it as described in section *Digitalizar uma camada existente*.

If desired, you can select *Create an autoincrementing primary key* under the guilabel:*Advanced Options* section. You can also rename the *Geometry column* (`geometry` by default).

Further management of SpatiaLite layers can be done with *DB Manager*.

Creating a new GPX layer

To create a new GPX file, you first need to load the GPS plugin. *Plugins* ► *Plugin Manager…* opens the Plugin Manager Dialog. Activate the *GPS Tools* checkbox.

When this plugin is loaded, choose *Create Layer* ► *Create new GPX Layer…* from the *Layer* menu. In the dialog, choose where to save the new file and press *Save*. Three new layers are added to the *Layers Panel*: `waypoints`, `routes` and `tracks`.

Creating a new Temporary Scratch Layer

Temporary Scratch Layers are in-memory layers, meaning that they are not saved on disk and will be discarded when QGIS is closed. They can be handy for storing features you temporarily need or as intermediate layers during geoprocessing operations.

To create a new Temporary Scratch layer, choose the *New Temporary Scratch Layer…* entry in the *Layer* ► *Create Layer* ► menu or in the *Data Source Manager* toolbar. The *New Temporary Scratch Layer* dialog will be displayed as shown in Fig.13.18. Then:

1. Provide the *Layer name*
2. Select the *Geometry type*. Here you can create a:
   - `No geometry` type layer, served as simple table,
   - `Point` or `MultiPoint` layer,
   - `LineString/CompoundCurve` or `MultiLineString/MultiCurve` layer,
   - `Polygon/CurvePolygon` or `MultiPolygon/MultiSurface` layer.
3. For geometric types, specify the dimensions of the dataset: check whether it should *Include Z dimension* and/or *Include M values*
4. Specify the coordinate reference system using the button.
5. Add fields to the layer. Note that unlike many formats, temporary layers can be created without any fields. This step is thus optional.
   1. Enter the *Name* of the field
   2. Select the data *Type*: *Text*, *Whole number*, *Decimal number*, *Boolean*, *Date*, *Time*, *Date & Time* and *Binary (BLOB)* are supported.
   3. Depending on the selected data format, enter the *Length* and *Precision*
   4. Click on the *Add to Fields List* button
   5. Repeat the steps above for each field you need to add
6. Once you are happy with the settings, click *OK*. QGIS will add the new layer to the *Layers* panel, and you can edit it as described in section *Digitalizar uma camada existente*.

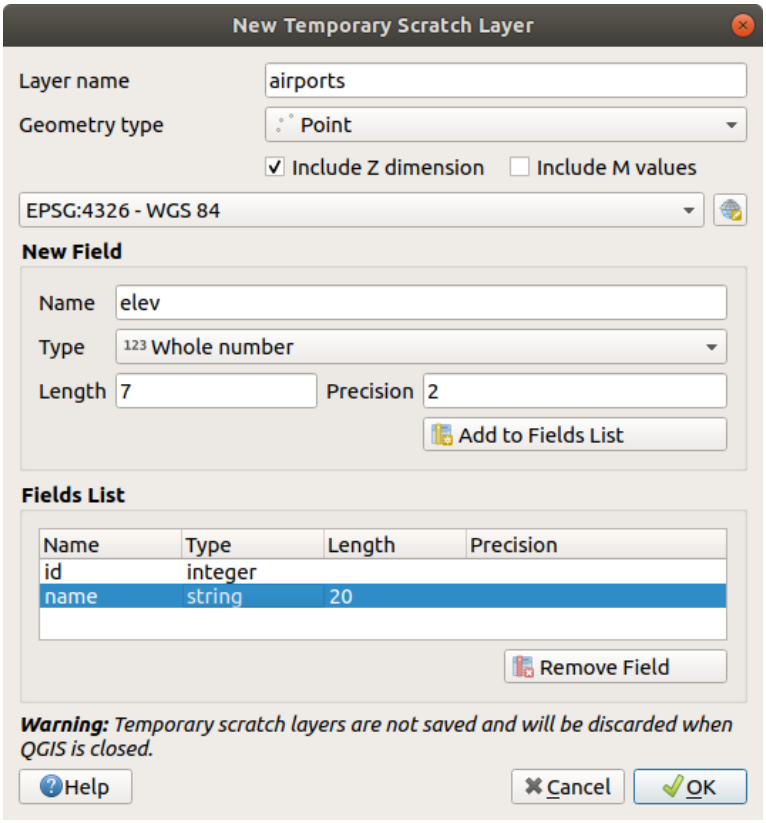


Figura13.18: Creating a new Temporary Scratch layer dialog

You can also create prepopulated temporary scratch layers using e.g. the clipboard (see *Creating new layers from the clipboard*) or as a result of a *Processing algorithm*.

Dica: Permanently store a memory layer on disk

To avoid data loss when closing a project with temporary scratch layers, you can save these layers to any vector format supported by QGIS:

- clicking the indicator icon next to the layer;
- selecting the *Make permanent* entry in the layer contextual menu;
- using the *Export* ► entry from the contextual menu or the *Layer* ► *Save As...* menu.

Each of these commands opens the *Save Vector Layer as* dialog described in the *Creating new layers from an existing layer* section and the saved file replaces the temporary one in the *Layers* panel.

13.2.2 Creating new layers from an existing layer

Both raster and vector layers can be saved in a different format and/or reprojected to a different coordinate reference system (CRS) using the *Layer* ► *Save As...* menu or right-clicking on the layer in the *Layers panel* and selecting:

- *Export* ► *Save As...* for raster layers
- *Export* ► *Save Features As...* or *Export* ► *Save Selected Features As...* for vector layers.
- Drag and drop the layer from the layer tree to the PostGIS entry in the *Browser Panel*. Note that you must have a PostGIS connection in the *Browser Panel*.

Parâmetros comuns

The *Save Layer as...* dialog shows several parameters to change the behavior when saving the layer. Among the common parameters for raster and vector are:

- *File name*: the location of the file on the disk. It can refer to the output layer or to a container that stores the layer (for example database-like formats such as GeoPackage, SpatiaLite or Open Document Spreadsheets).
- *CRS*: can be changed to reproject the data
- *Extent* (possible values are **layer**, **Map view** or **user-defined** extent)
- *Add saved file to map*: to add the new layer to the canvas

However, some parameters are specific to raster and vector formats:

Raster specific parameters

Depending on the format of export, some of these options may not be available:

- *Output mode* (it can be **raw data** or **rendered image**)
- *Format*: exports to any raster format GDAL can write to, such as GeoTiff, GeoPackage, MBTiles, Geospatial PDF, SAGA GIS Binary Grid, Intergraph Raster, ESRI .hdr Labelled…
- *Resolution*
- *Create Options*: use advanced options (file compression, block sizes, colorimetry…) when generating files, either from the *predefined create profiles* related to the output format or by setting each parameter.
- *Pyramids* creation
- *VRT Tiles* in case you opted to *Create VRT*
- *No data values*

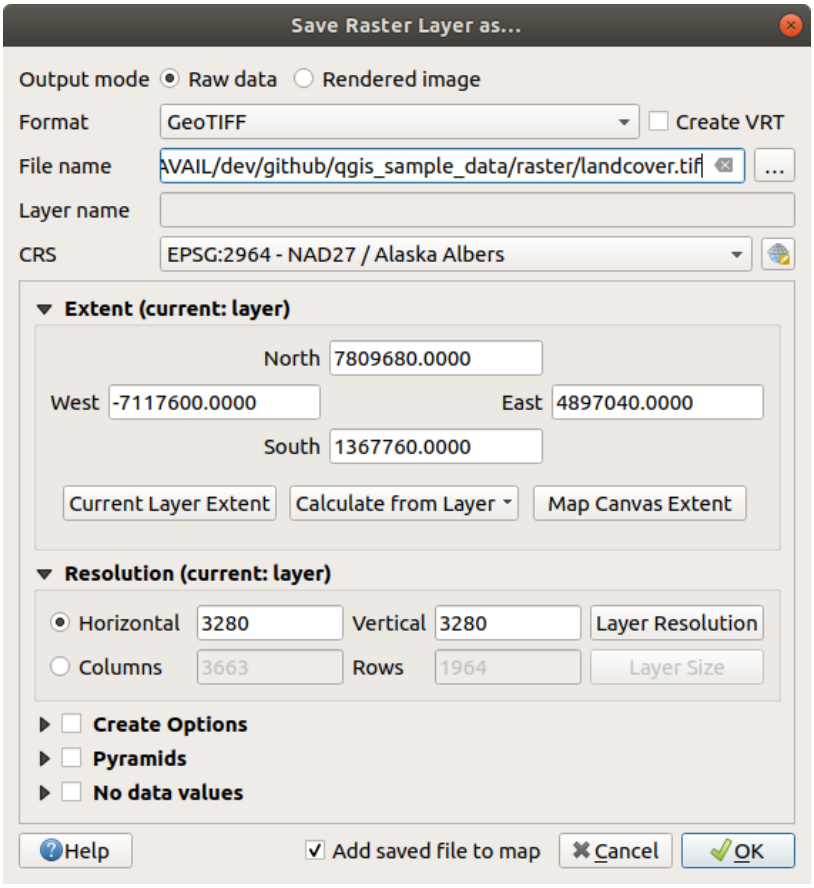


Figura13.19: Saving as a new raster layer

Vector specific parameters

Depending on the format of export, some of these options may be available:

- *Format*: exports to any vector format GDAL can write to, such as GeoPackage, GML, ESRI Shapefile, AutoCAD DXF, ESRI FileGDB, Mapinfo TAB or MIF, SpatiaLite, CSV, KML, ODS, …
- *Layer name*: available when the *File name* refers to a container-like format, this entry represents the output layer.
- *Encoding*
- *Save only selected features*
- *Select fields to export and their export options*. In case you set your fields behavior with some *Edit widgets*, e.g. `value map`, you can keep the displayed values in the layer by checking *Replace all selected raw fields values by displayed values.*
- *Symbology export*: can be used mainly for DXF export and for all file formats who manage OGR feature styles (see note below) as DXF, KML, tab file formats:
  - **No symbology**: default style of the application that reads the data
  - **Feature symbology**: save style with OGR Feature Styles (see note below)
  - **Symbol Layer symbology**: save with OGR Feature Styles (see note below) but export the same geometry multiple times if there are multiple symbology symbol layers used
  - A **Scale** value can be applied to the latest options

Nota: *OGR Feature Styles* are a way to store style directly in the data as a hidden attribute. Only some formats can handle this kind of information. KML, DXF and TAB file formats are such formats. For advanced details, you can read the OGR Feature Styles specification document.

- *Geometry*: you can configure the geometry capabilities of the output layer
  - *geometry type*: keeps the original geometry of the features when set to **Automatic**, otherwise removes or overrides it with any type. You can add an empty geometry column to an attribute table and remove the geometry column of a spatial layer.
  - *Force multi-type*: forces creation of multi-geometry features in the layer.
  - *Include z-dimension* to geometries.

Dica: Overriding layer geometry type makes it possible to do things like save a geometryless table (e.g. `.csv` file) into a shapefile WITH any type of geometry (point, line, polygon), so that geometries can then be manually added to rows with the  Add Part tool.

- *Datasource Options*, *Layer Options* or *Custom Options* which allow you to configure advanced parameters depending on the output format. Some are described in *Exploring Data Formats and Fields* but for full details, see the GDAL driver documentation. Each file format has its own custom parameters, e.g. for the `GeoJSON` format have a look at the GDAL GeoJSON documentation.

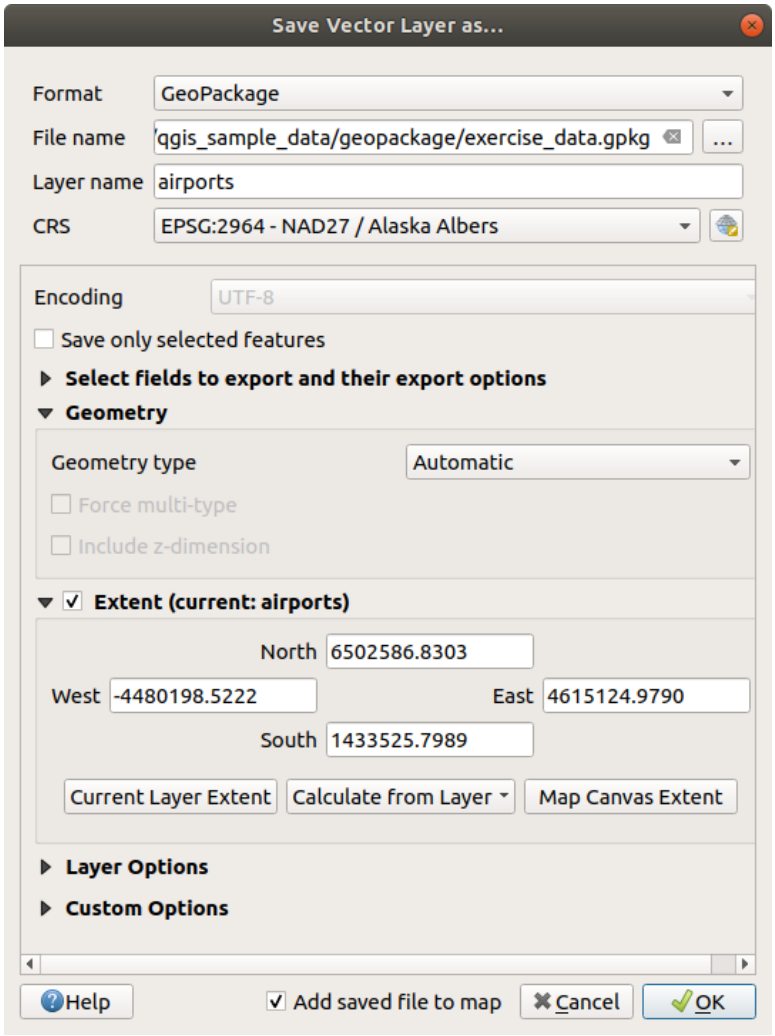


Figura13.20: Saving as a new vector layer

When saving a vector layer into an existing file, depending on the capabilities of the output format (Geopackage, SpatiaLite, FileGDB…), the user can decide whether to:

- overwrite the whole file
- overwrite only the target layer (the layer name is configurable)
- append features to the existing target layer
- append features, add new fields if there are any.

For formats like ESRI Shapefile, MapInfo .tab, feature append is also available.

13.2.3 Creating new DXF files

Besides the *Save As…* dialog which provides options to export a single layer to another format, including `*.DXF`, QGIS provides another tool to export multiple layers as a single DXF layer. It's accessible in the *Project* ► *Import/Export* ► *Export Project to DXF…* menu.

In the *DXF Export* dialog:

1. Provide the destination file.
2. Choose the symbology mode and scale (see the *OGR Feature Styles* note), if applicable.
3. Select the data *Encoding*.

4. Select the *CRS* to apply: the selected layers will be reprojected to the given CRS.
5. Select the layers to include in the DXF files either by checking them in the table widget or automatically picking them from an existing *map theme*. The *Select All* and *Deselect All* buttons can help to quickly set the data to export.

   For each layer, you can choose whether to export all the features in a single DXF layer or rely on a field whose values are used to split the features into layers in the DXF output.

Optionally, you can also choose to:

- *Use the layer title as name if set* instead of the layer name itself;
- *Export features intersecting the current map extent*;
- *Force 2d output (eg. to support polyline width)*;
- *Export label as MTEXT elements* or TEXT elements.

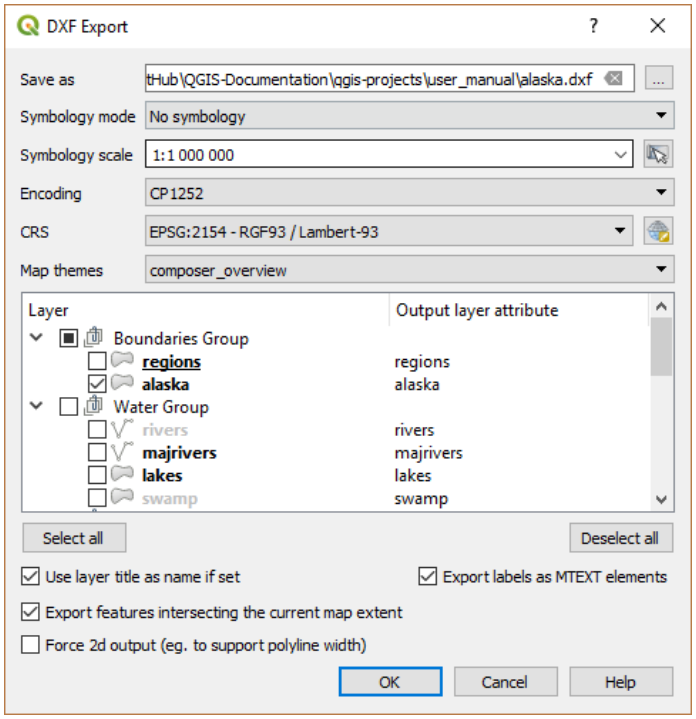


Figura13.21: Exporting a project to DXF dialog

13.2.4 Creating new layers from the clipboard

As feições que estão na área de transferência podem ser colados em uma nova camada. Para fazer isso, selecione algumas feições, copie-as para a área de transferência e cole-as em uma nova camada usando *Editar* ► *Colar Feições como* ► e escolhendo:

- *New Vector Layer…*: the *Save vector layer as…* dialog appears (see *Creating new layers from an existing layer* for parameters)
- or *Temporary Scratch Layer…*: you need to provide a name for the layer

A new layer, filled with selected features and their attributes is created (and added to map canvas).

Nota: Creating layers from the clipboard is possible with features selected and copied within QGIS as well as features from another application, as long as their geometries are defined using well-known text (WKT).

13.2.5 Creating virtual layers

A virtual layer is a special kind of vector layer. It allows you to define a layer as the result of an SQL query involving any number of other vector layers that QGIS is able to open. Virtual layers do not carry data by themselves and can be seen as views.

To create a virtual layer, open the virtual layer creation dialog by:

- choosing the *Add/Edit Virtual Layer* entry in the *Layer* ► *Add Layer* ► menu;
- enabling the *Add Virtual Layer* tab in the *Data Source Manager* dialog;
- or using the *DB Manager* dialog tree.

The dialog allows you to specify a *Layer name* and an SQL *Query*. The query can use the name (or id) of loaded vector layers as tables, as well as their field names as columns.

For example, if you have a layer called `airports`, you can create a new virtual layer called `public_airports` with an SQL query like:

```
SELECT *
FROM airports
WHERE USE = "Civilian/Public"
```

The SQL query will be executed, regardless of the underlying provider of the `airports` layer, even if this provider does not directly support SQL queries.

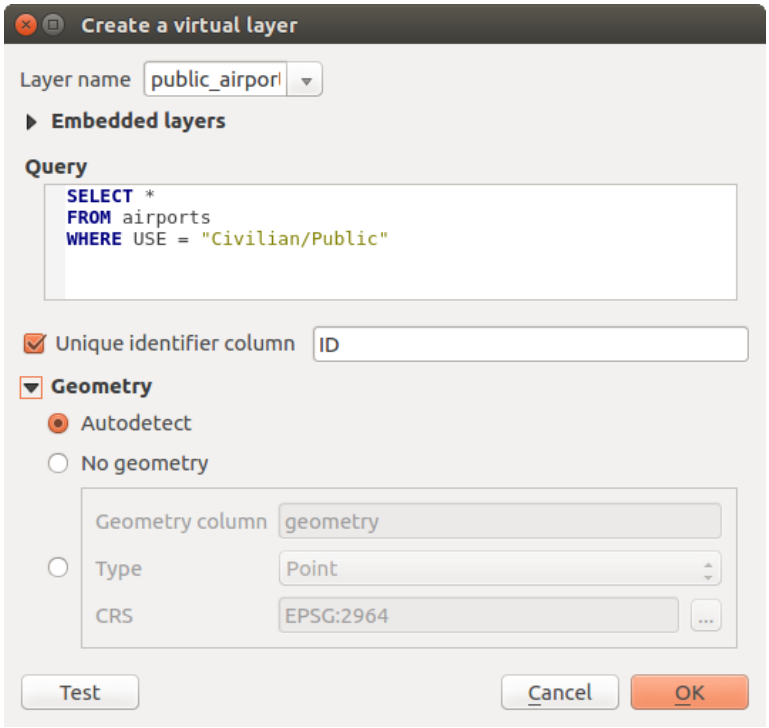


Figura13.22: Criar caixa de diálogo de camadas virtuais

Joins and complex queries can also be created, for example, to join airports and country information:

```
SELECT airports.*, country.population
FROM airports
JOIN country
ON airports.country = country.name
```

Nota: It's also possible to create virtual layers using the SQL window of *DB Manager Plugin*.

Embedding layers for use in queries

Besides the vector layers available in the map canvas, the user can add layers to the *Embedded layers* list, which can be used in queries without the need to have them showing in the map canvas or Layers panel.

To embed a layer, click *Add* and provide the *Local name*, *Provider*, *Encoding* and the path to the *Source*.

The *Import* button allows adding layers in the map canvas into the Embedded layers list. Those layers can then be removed from the Layers panel without breaking existent queries.

Supported query language

The underlying engine uses SQLite and SpatiaLite to operate.

It means you can use all of the SQL your local installation of SQLite understands.

Functions from SQLite and spatial functions from SpatiaLite can also be used in a virtual layer query. For instance, creating a point layer out of an attribute-only layer can be done with a query similar to:

```
SELECT id, MakePoint(x, y, 4326) as geometry
FROM coordinates
```

Functions of QGIS expressions can also be used in a virtual layer query.

To refer the geometry column of a layer, use the name `geometry`.

Contrary to a pure SQL query, all the fields of a virtual layer query must be named. Don't forget to use the `as` keyword to name your columns if they are the result of a computation or a function call.

Performance issues

With default parameters, the virtual layer engine will try its best to detect the type of the different columns of the query, including the type of the geometry column if one is present.

This is done by introspecting the query when possible or by fetching the first row of the query (LIMIT 1) as a last resort. Fetching the first row of the result just to create the layer may be undesirable for performance reasons.

The creation dialog parameters:

- *Unique identifier column*: specifies a field of the query that represents unique integer values that QGIS can use as row identifiers. By default, an autoincrementing integer value is used. Defining a unique identifier column speeds up the selection of rows by id.
- *No geometry*: forces the virtual layer to ignore any geometry field. The resulting layer is an attribute-only layer.
- Geometry *Column*: specifies the name of the geometry column.
- Geometry *Type*: specifies the type of the geometry.
- Geometry *CRS*: specifies the coordinate reference system of the virtual layer.

Special comments

The virtual layer engine tries to determine the type of each column of the query. If it fails, the first row of the query is fetched to determine column types.

The type of a particular column can be specified directly in the query by using some special comments.

The syntax is the following: `/*:type*/`. It has to be placed just after the name of a column. `type` can be either `int` for integers, `real` for floating point numbers or `text`.

For instance:

```
SELECT id+1 as nid /*:int*/
FROM table
```

The type and coordinate reference system of the geometry column can also be set thanks to special comments with the following syntax `/*:gtype:srid*/` where `gtype` is the geometry type (`point`, `linestring`, `polygon`, `multipoint`, `multilinestring` or `multipolygon`) and `srid` an integer representing the EPSG code of a coordinate reference system.

Use of indexes

When requesting a layer through a virtual layer, the source layer indices will be used in the following ways:

- if an = predicate is used on the primary key column of the layer, the underlying data provider will be asked for a particular id (FilterFid)
- for any other predicates (>, <=, !=, etc.) or on a column without a primary key, a request built from an expression will be used to request the underlying vector data provider. It means indexes may be used on database providers if they exist.

A specific syntax exists to handle spatial predicates in requests and triggers the use of a spatial index: a hidden column named `_search_frame_` exists for each virtual layer. This column can be compared for equality to a bounding box. Example:

```
SELECT *
FROM vtab
WHERE _search_frame_=BuildMbr(-2.10,49.38,-1.3,49.99,4326)
```

Spatial binary predicates like `ST_Intersects` are sped up significantly when used in conjunction with this spatial index syntax.

13.3 Exploring Data Formats and Fields

13.3.1 Raster data

GIS raster data are matrices of discrete cells that represent features / phenomena on, above or below the earth's surface. Each cell in the raster grid has the same size, and cells are usually rectangular (in QGIS they will always be rectangular). Typical raster datasets include remote sensing data, such as aerial photography, or satellite imagery and modelled data, such as elevation or temperature.

Unlike vector data, raster data typically do not have an associated database record for each cell. They are geocoded by pixel resolution and the X/Y coordinate of a corner pixel of the raster layer. This allows QGIS to position the data correctly on the map canvas.

The GeoPackage format is convenient for storing raster data when working with QGIS. The popular and powerful GeoTiff format is a good alternative.

QGIS makes use of georeference information inside the raster layer (e.g., GeoTiff) or an associated *world file* to properly display the data.

13.3.2 Dado Vetorial

Many of the features and tools available in QGIS work the same, regardless the vector data source. However, because of the differences in format specifications (GeoPackage, ESRI Shapefile, MapInfo and MicroStation file formats, AutoCAD DXF, PostGIS, SpatiaLite, DB2, Oracle Spatial, MSSQL Spatial databases, and many more), QGIS may handle some of their properties differently. Support is provided by the OGR Simple Feature Library. This section describes how to work with these specificities.

Nota: QGIS supports (multi)point, (multi)line, (multi)polygon, CircularString, CompoundCurve, CurvePolygon, MultiCurve, MultiSurface feature types, all optionally with Z and/or M values.

You should also note that some drivers don't support some of these feature types, like CircularString, CompoundCurve, CurvePolygon, MultiCurve, MultiSurface feature type. QGIS will convert them.

GeoPackage

The GeoPackage (GPKG) format is platform-independent, and is implemented as a SQLite database container, and can be used to store both vector and raster data. The format was defined by the Open Geospatial Consortium (OGC), and was published in 2014.

GeoPackage can be used to store the following in a SQLite database:

- **vector** features
- **tile matrix sets of imagery** and **raster** maps
- attributes (non-spatial data)
- extensions

Since QGIS version 3.8, GeoPackage can also store QGIS projects. GeoPackage layers can have JSON fields.

GeoPackage é o formato padrão para dados vetoriais no QGIS.

ESRI Shapefile format

The ESRI Shapefile format is still one of the most used vector file formats, even if it has some limitations compared to for instance GeoPackage and SpatiaLite.

An ESRI Shapefile format dataset consists of several files. The following three are required:

1. `.shp` file containing the feature geometries
2. `.dbf` arquivo que contém os atributos no formato dBase
3. `.shx` index file

An ESRI Shapefile format dataset can also include a file with a `.prj` suffix, which contains projection information. While it is very useful to have a projection file, it is not mandatory. A Shapefile format dataset can contain additional files. For further details, see the the ESRI technical specification at https://www.esri.com/library/whitepapers/pdfs/shapefile.pdf.

GDAL 3.1 has read-write support for compressed ESRI Shapefile format (`shz` and `shp.zip`).

Improving Performance for ESRI Shapefile format datasets

To improve the drawing performance for an ESRI Shapefile format dataset, you can create a spatial index. A spatial index will improve the speed of both zooming and panning. Spatial indexes used by QGIS have a `.qix` extension.

Use these steps to create the index:

1. Load an ESRI Shapefile format dataset (see *The Browser Panel*)

2. Abra a caixa de diálogo *Propriedades da Camada* clicando duas vezes no nome da camada na legenda ou clicando com o botão direito do mouse e escolhendo *Propriedades...* no menu de contexto
3. In the *Source* tab, click the *Create Spatial Index* button

Problem loading a .prj file

If you load an ESRI Shapefile format dataset with a `.prj` file and QGIS is not able to read the coordinate reference system from that file, you will need to define the proper projection manually in the *Layer Properties* ► *Source* tab of the layer by clicking the  Select CRS button. This is due to the fact that `.prj` files often do not provide the complete projection parameters as used in QGIS and listed in the *CRS* dialog.

For the same reason, if you create a new ESRI Shapefile format dataset with QGIS, two different projection files are created: a `.prj` file with limited projection parameters, compatible with ESRI software, and a `.qpj` file, providing all the parameters of the CRS. Whenever QGIS finds a `.qpj` file, it will be used instead of the `.prj`.

Delimited Text Files

Arquivos de texto delimitados são muito comuns e amplamente utilizados devido à sua simplicidade e legibilidade - os dados podem ser visualizados e editados em um editor de texto simples. Um arquivo de texto delimitado é um dado de tabela com colunas separadas por um caractere definido e linhas separadas por quebras de linha. A primeira linha geralmente contém os nomes das colunas. Um tipo comum de arquivo de texto delimitado é um CSV (Comma Separated Values), com colunas separadas por vírgulas. Arquivos de texto delimitados também podem conter informações posicionais (veja *Storing geometry information in delimited text files*).

QGIS allows you to load a delimited text file as a layer or an ordinary table (see *The Browser Panel* or *Importing a delimited text file*). First check that the file meets the following requirements:

1. The file must have a delimited header row of field names. This must be the first line of the data (ideally the first row in the text file).
2. If geometry should be enabled, the file must contain field(s) that define the geometry. These field(s) can have any name.
3. The X and Y coordinates fields (if geometry is defined by coordinates) must be specified as numbers. The coordinate system is not important.
4. If you have a CSV file with non-string columns, you must have an accompanying CSVT file (see section *Using CSVT file to control field formatting*).

The elevation point data file `elevp.csv` in the QGIS sample dataset (see section *Baixando dados de amostra*) is an example of a valid text file:

```
X;Y;ELEV
-300120;7689960;13
-654360;7562040;52
1640;7512840;3
[...]
```

Some things to note about the text file:

1. The example text file uses `;` (semicolon) as delimiter (any character can be used to delimit the fields).
2. The first row is the header row. It contains the fields `X`, `Y` and `ELEV`.
3. No quotes (`"`) are used to delimit text fields
4. The X coordinates are contained in the `X` field
5. The Y coordinates are contained in the `Y` field

Storing geometry information in delimited text files

Delimited text files can contain geometry information in two main forms:

- As coordinates in separate columns (eg. `Xcol`, `Ycol`...), for point geometry data;
- As well-known text (WKT) representation of geometry in a single column, for any geometry type.

Features with curved geometries (CircularString, CurvePolygon and CompoundCurve) are supported. Here are some examples of geometry types in a delimited text file with geometries coded as WKT:

```
Label;WKT_geom
LineString;LINESTRING(10.0 20.0, 11.0 21.0, 13.0 25.5)
CircularString;CIRCULARSTRING(268 415,227 505,227 406)
CurvePolygon;CURVEPOLYGON(CIRCULARSTRING(1 3, 3 5, 4 7, 7 3, 1 3))
CompoundCurve;COMPOUNDCURVE((5 3, 5 13), CIRCULARSTRING(5 13, 7 15,
  9 13), (9 13, 9 3), CIRCULARSTRING(9 3, 7 1, 5 3))
```

Delimited text files also support Z and M coordinates in geometries:

```
LINESTRINGZ(10.0 20.0 30.0, 11.0 21.0 31.0, 11.0 22.0 30.0)
```

Using CSVT file to control field formatting

When loading CSV files, the OGR driver assumes all fields are strings (i.e. text) unless it is told otherwise. You can create a CSVT file to tell OGR (and QGIS) the data type of the different columns:

Tipo	Nome	Exemplo
Whole number	Número inteiro	4
Decimal number	Real	3.456
Data	Date (YYYY-MM-DD)	2016-07-28
Time	Hora (HH:MM:SS+nn)	18:33:12+00
Date & Time	DateTime (YYYY-MM-DD HH:MM:SS+nn)	2016-07-28 18:33:12+00

The CSVT file is a **ONE line** plain text file with the data types in quotes and separated by commas, e.g.:

```
"Integer","Real","String"
```

You can even specify width and precision of each column, e.g.:

```
"Integer(6)","Real(5.5)","String(22)"
```

This file is saved in the same folder as the `.csv` file, with the same name, but `.csvt` as the extension.

*Você pode encontrar mais informações em * GDAL CSV Driver.

Camadas PostGIS

PostGIS layers are stored in a PostgreSQL database. The advantages of PostGIS are spatial indexing, filtering and querying capabilities. Using PostGIS, vector functions such as select and identify work more accurately than they do with OGR layers in QGIS.

Dica: Camadas PostGIS

Normally, a PostGIS layer is identified by an entry in the geometry_columns table. QGIS can load layers that do not have an entry in the geometry_columns table. This includes both tables and views. Refer to your PostgreSQL manual for information on creating views.

This section contains some details on how QGIS accesses PostgreSQL layers. Most of the time, QGIS should simply provide you with a list of database tables that can be loaded, and it will load them on request. However, if you have trouble loading a PostgreSQL table into QGIS, the information below may help you understand QGIS messages and give you directions for modifying the PostgreSQL table or view definition to allow QGIS to load it.

Primary key

QGIS requires that PostgreSQL layers contain a column that can be used as a unique key for the layer. For tables, this usually means that the table needs a primary key, or a column with a unique constraint on it. In QGIS, this column needs to be of type int4 (an integer of size 4 bytes). Alternatively, the ctid column can be used as primary key. If a table lacks these items, the oid column will be used instead. Performance will be improved if the column is indexed (note that primary keys are automatically indexed in PostgreSQL).

QGIS offers a checkbox **Select at id** that is activated by default. This option gets the ids without the attributes, which is faster in most cases.

Ver

Se a camada do PostgreSQL é uma visualização, o mesmo requisito existe, mas as visualizações nem sempre possuem chaves ou colunas primárias com restrições exclusivas. Você precisa definir um campo de chave primária (deve ser inteiro) na caixa de diálogo QGIS antes de poder carregar a exibição. Se uma coluna adequada não existir na exibição, o QGIS não carregará a camada. Se isso ocorrer, a solução é alterar a exibição para incluir uma coluna adequada (um tipo de número inteiro e uma chave primária ou com uma restrição exclusiva, preferencialmente indexada).

As for table, a checkbox **Select at id** is activated by default (see above for the meaning of the checkbox). It can make sense to disable this option when you use expensive views.

QGIS layer_style table and database backup

If you want to make a backup of your PostGIS database using the `pg_dump` and `pg_restore` commands, and the default layer styles as saved by QGIS fail to restore afterwards, you need to set the XML option to `DOCUMENT` before the restore command:

```
SET XML OPTION DOCUMENT;
```

Filter database side

QGIS allows to filter features already on server side. Check *Settings* ► *Options* ► *Data Sources* ►  *Execute expressions on server-side if possible* to do so. Only supported expressions will be sent to the database. Expressions using unsupported operators or functions will gracefully fallback to local evaluation.

Support of PostgreSQL data types

Data types supported by the PostgreSQL provider include: integer, float, boolean, binary object, varchar, geometry, timestamp, array, hstore and json.

Importing Data into PostgreSQL

Data can be imported into PostgreSQL/PostGIS using several tools, including the DB Manager plugin and the command line tools shp2pgsql and ogr2ogr.

Gerenciador BD

O QGIS vem com um complemento principal chamado  Gerenciador de BD. Ele pode ser usado para carregar dados e inclui suporte para esquemas. Veja a seção *DB Manager Plugin* para mais informações.

shp2pgsql

PostGIS includes a utility called **shp2pgsql**, that can be used to import Shapefile format datasets into a PostGIS-enabled database. For example, to import a Shapefile format dataset named `lakes.shp` into a PostgreSQL database named `gis_data`, use the following command:

```
shp2pgsql -s 2964 lakes.shp lakes_new | psql gis_data
```

This creates a new layer named `lakes_new` in the `gis_data` database. The new layer will have a spatial reference identifier (SRID) of 2964. See section *Trabalhando com Projeções* for more information about spatial reference systems and projections.

Dica: Exporting datasets from PostGIS

There is also a tool for exporting PostGIS datasets to Shapefile format: **pgsql2shp**. It is shipped within your PostGIS distribution.

---

ogr2ogr

In addition to **shp2pgsql** and **DB Manager**, there is another tool for feeding geographical data in PostGIS: **ogr2ogr**. It is part of your GDAL installation.

To import a Shapefile format dataset into PostGIS, do the following:

```
ogr2ogr -f "PostgreSQL" PG:"dbname=postgis host=myhost.de user=postgres
password=topsecret" alaska.shp
```

This will import the Shapefile format dataset `alaska.shp` into the PostGIS database *postgis* using the user *postgres* with the password *topsecret* on the host server *myhost.de*.

Note that OGR must be built with PostgreSQL to support PostGIS. You can verify this by typing (in ):

```
ogrinfo --formats | grep -i post
```

If you prefer to use the PostgreSQL's **COPY** command instead of the default **INSERT INTO** method, you can export the following environment variable (at least available on  and ):

```
export PG_USE_COPY=YES
```

ogr2ogr does not create spatial indexes like **shp2pgsl** does. You need to create them manually, using the normal SQL command **CREATE INDEX** afterwards, as an extra step (as described in the next section *Improving Performance*).

Improving Performance

Retrieving features from a PostgreSQL database can be time-consuming, especially over a network. You can improve the drawing performance of PostgreSQL layers by ensuring that a PostGIS spatial index exists on each layer in the database. PostGIS supports creation of a GiST (Generalized Search Tree) index to speed up spatial searching (GiST index information is taken from the PostGIS documentation available at https://postgis.net).

Dica: You can use the DBManager to create an index for your layer. You should first select the layer and click on *Table* ► *Edit table*, go to *Indexes* tab and click on *Add Spatial Index*.

The syntax for creating a GiST index is:

```
CREATE INDEX [indexname] ON [tablename]
  USING GIST ( [geometryfield] GIST_GEOMETRY_OPS );
```

Note that for large tables, creating the index can take a long time. Once the index is created, you should perform a `VACUUM ANALYZE`. See the PostGIS documentation (POSTGIS-PROJECT in *Referências Bibliográficas e Web*) for more information.

The following example creates a GiST index:

```
gsherman@madison:~/current$ psql gis_data
Welcome to psql 8.3.0, the PostgreSQL interactive terminal.

Type:  \copyright for distribution terms
       \h for help with SQL commands
       \? for help with psql commands
       \g or terminate with semicolon to execute query
       \q to quit

gis_data=# CREATE INDEX sidx_alaska_lakes ON alaska_lakes
gis_data-# USING GIST (the_geom GIST_GEOMETRY_OPS);
CREATE INDEX
gis_data=# VACUUM ANALYZE alaska_lakes;
VACUUM
gis_data=# \q
gsherman@madison:~/current$
```

Vector layers crossing 180° longitude

Many GIS packages don't wrap vector maps with a geographic reference system (lat/lon) crossing the 180 degrees longitude line (http://postgis.refractions.net/documentation/manual-2.0/ST_Shift_Longitude.html). As result, if we open such a map in QGIS, we could see two widely separated locations, that should appear near each other. In Fig.13.23, the tiny point on the far left of the map canvas (Chatham Islands) should be within the grid, to the right of the New Zealand main islands.

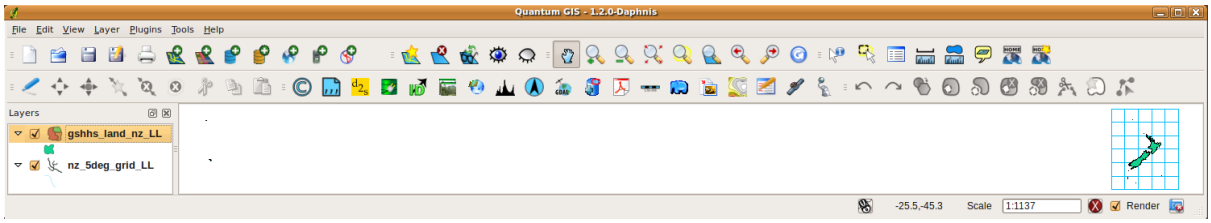


Figura13.23: Map in lat/lon crossing the 180° longitude line

A work-around is to transform the longitude values using PostGIS and the **ST_Shift_Longitude** function. This function reads every point/vertex in every component of every feature in a geometry, and if the longitude coordinate

is < 0°, it adds 360° to it. The result is a 0° - 360° version of the data to be plotted in a 180°-centric map.

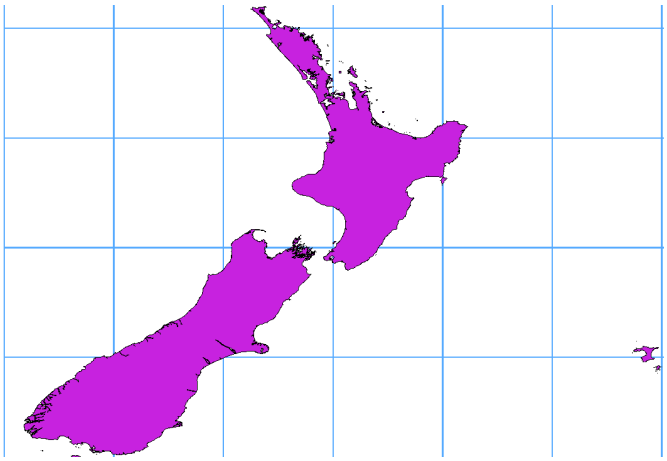


Figura13.24: Crossing 180° longitude applying the **ST_Shift_Longitude** function

Utilização

- Import data into PostGIS (*Importing Data into PostgreSQL*) using, for example, the DB Manager plugin.
- Use the PostGIS command line interface to issue the following command (in this example, "TABLE" is the actual name of your PostGIS table): `gis_data=# update TABLE set the_geom=ST_Shift_Longitude(the_geom);`
- If everything went well, you should receive a confirmation about the number of features that were updated. Then you'll be able to load the map and see the difference (*Figure_vector_crossing_map*).

Camadas SpatiaLite

If you want to save a vector layer using the SpatiaLite format, you can do this by following instructions at *Creating new layers from an existing layer*. You select `SpatiaLite` as *Format* and enter both *File name* and *Layer name*.

Also, you can select `SQLite` as format and then add `SPATIALITE=YES` in the *Custom Options* ► *Data source* field. This tells GDAL to create a SpatiaLite database. See also https://gdal.org/drivers/vector/sqlite.html.

QGIS also supports editable views in SpatiaLite. For SpatiaLite data management, you can also use the core plugin *DB Manager*.

Se você deseja criar uma nova camada SpatiaLite, por favor consulte a seção *Creating a new SpatiaLite layer*.

GeoJSON specific parameters

When *exporting layers* to GeoJSON, there are some specific *Layer Options* available. These options come from GDAL which is responsible for the writing of the file:

- *COORDINATE_PRECISION* the maximum number of digits after the decimal separator to write in coordinates. Defaults to 15 (note: for Lat Lon coordinates 6 is considered enough). Truncation will occur to remove trailing zeros.
- *RFC7946* by default GeoJSON 2008 will be used. If set to YES, the updated RFC 7946 standard will be used. Default is NO (thus GeoJSON 2008). See https://gdal.org/drivers/vector/geojson.html#rfc-7946-write-support for the main differences, in short: only EPSG:4326 is allowed, other crs's will be transformed, polygons will be written such as to follow the right-hand rule for orientation, values of a "bbox" array are [west, south, east, north], not [minx, miny, maxx, maxy]. Some extension member names are forbidden in FeatureCollection, Feature and Geometry objects, the default coordinate precision is 7 decimal digits

- *WRITE_BBOX* set to YES to include the bounding box of the geometries at the feature and feature collection level

Besides GeoJSON there is also an option to export to "GeoJSON - Newline Delimited" (see https://gdal.org/drivers/vector/geojsonseq.html). Instead of a FeatureCollection with Features, you can stream one type (probably only Features) sequentially separated with newlines.

GeoJSON - Newline Delimited has some specific Layer options availabe too:

- *COORDINATE_PRECISION* see above (same as for GeoJSON)
- *RS* whether to start records with the RS=0x1E character. The difference is how the features are separated: only by a newline (LF) character (Newline Delimited JSON, geojsonl) or by also prepending a record-separator (RS) character (giving GeoJSON Text Sequences, geojsons). Default to NO. Files are given the `.json` extension if extension is not provided.

DB2 Spatial Layers

IBM DB2 for Linux, Unix and Windows (DB2 LUW), IBM DB2 for z/OS (mainframe) and IBM DashDB products allow users to store and analyse spatial data in relational table columns. The DB2 provider for QGIS supports the full range of visualization, analysis and manipulation of spatial data in these databases.

User documentation on these capabilities can be found at the DB2 z/OS KnowledgeCenter, DB2 LUW KnowledgeCenter and DB2 DashDB KnowledgeCenter.

For more information about working with the DB2 spatial capabilities, check out the DB2 Spatial Tutorial on IBM DeveloperWorks.

The DB2 provider currently only supports the Windows environment through the Windows ODBC driver.

The client running QGIS needs to have one of the following installed:

- DB2 LUW
- IBM Data Server Driver Package
- IBM Data Server Client

To open a DB2 data in QGIS, see the *The Browser Panel* or *Loading a Database Layer* section.

If you are accessing a DB2 LUW database on the same machine or using DB2 LUW as a client, the DB2 executables and supporting files need to be included in the Windows path. This can be done by creating a batch file like the following with the name **db2.bat** and including it in the directory **%OSGEO4W_ROOT%/etc/ini**:

```
@echo off
REM Point the following to where DB2 is installed
SET db2path=C:\Program Files (x86)\sqllib
REM This should usually be ok - modify if necessary
SET gskpath=C:\Program Files (x86)\ibm\gsk8
SET Path=%db2path%\BIN;%db2path%\FUNCTION;%gskpath%\lib64;%gskpath%\lib;%path%
```

CAPÍTULO 14

Trabalhando com Dados Vetoriais

14.1 Janela de Propriedades de Vetor

A caixa de diálogo: guilabel: `Propriedades da camada ‘para uma camada vetorial fornece configurações gerais para gerenciar a aparência dos recursos da camada no mapa (simbologia, rotulagem, diagramas), interação com o mouse (ações, dicas de mapa, design de formulário). Ele também fornece informações sobre a camada.

Para acessar a caixa de diálogo: guilabel: *Propriedades da camada*:

- No painel: guilabel: *Camadas*, clique duas vezes na camada ou clique com o botão direito do mouse e selecione: guilabel:` Propriedades… `no menu pop-up;
- Vá para: seleção de menu: menu Camada -> Propriedades da camada … `quando a camada estiver selecionada.

O diálogo vetor: guilabel: *Propriedades da camada* fornece as seguintes seções:

metadados | : ref: *Informações<vectorinformationmenu>*	sistema | : ref: *Fonte<vectorsourcemenu>*	simbologia | : ref: *Simbologia<vector_style_menu>*: sup: *[1]*
rotulagem | : ref: *Etiquetas<vector_labels_tab>*: sup: *[1]*	*Mask*[1]	3d | : ref: *Visualização 3D<sec_3_d_view>*: sup: *[1]*
diagrama | : ref: *Diagramas<sec_diagram>*	**|fonteCampos|** : ref: *Campos<vector_fields_menu>*	**|formulárioVisão|** : ref: *Formulário de atributos*
|participar| : ref: *Junta-se a<sec_joins>*	**|Armazenamento auxiliar|** : ref: *Armazenamento Auxiliar<vector_auxiliary_storage>*	ação : ref: *Ações<actions_menu>*
Display	*Rendering*	*Temporal*
|expressão| : ref: *Variáveis<vectorvariablesmenu>*	|editMetadata | : ref: *Metadados<vectormetadatamenu>*	*Dependencies*
Legend	**|sobreposição|** : ref: *Servidor QGIS<vectorservermenu>*	**|digitalização|** : ref: *Digitalizando<digitizingmenu>*
External plugins[2] tabs		

[1] Also available in the *Layer styling panel*

[2] *External plugins* you install can optionally add tabs to this dialog. Those are not presented in this document. Refer to their documentation.

Dica: ** Compartilhe propriedades totais ou parciais dos estilos de camada **

A opção: seleção de menu: *Estilo* na parte inferior da caixa de diálogo permite importar ou exportar essas ou parte dessas propriedades de / para vários destinos (arquivo, área de transferência, banco de dados). Veja: ref: *manage_custom_style*.

Nota: Como as propriedades (simbologia, etiqueta, ações, valores padrão, formulários …) das camadas incorporadas (consulte: ref: ` projetos de aninhamento`) são extraídas do arquivo original do projeto e, para evitar alterações que possam quebrar esse comportamento, o diálogo de propriedades da camada fica indisponível para essas camadas.

14.1.1 Propriedades da informação

|metadados| A guia: guilabel: ` informação` é somente leitura e representa um local interessante para obter rapidamente informações resumidas e metadados na camada atual. As informações fornecidas são:

- com base no provedor da camada (formato de armazenamento, caminho, tipo de geometria, codificação da fonte de dados, extensão …) ;
- escolhido a partir de: ref: *metadados preenchidos<vectormetadatamenu>* (acesso, links, contatos, histórico …);
- ou relacionado à sua geometria (extensão espacial, CRS …) ou seus atributos (número de campos, características de cada …).

14.1.2 Propriedades de origem

|sistema| Use esta guia para definir configurações gerais para a camada vetorial.

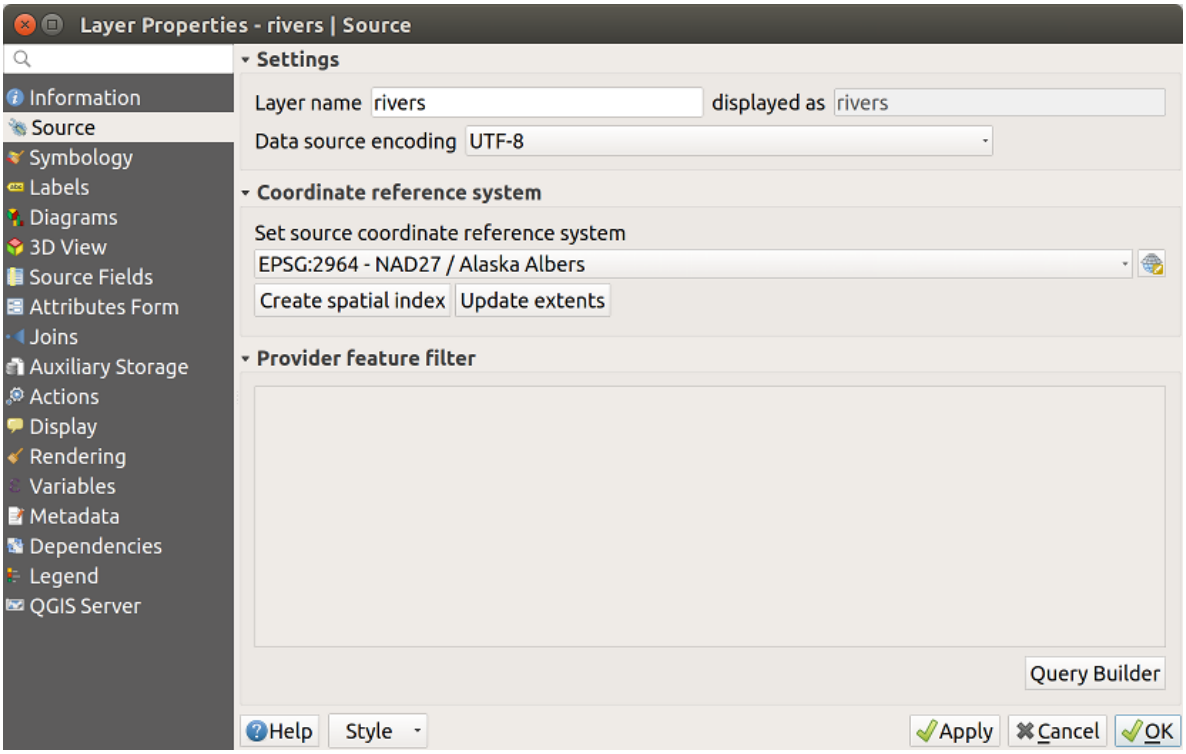


Figura14.1: Guia Origem na caixa de diálogo Propriedades da camada de vetor

Além de definir: guilabel: *Nome da camada* a ser exibido em: guilabel:` Painel Camadas`, as opções disponíveis incluem:

Sistema de Referência de Coordenadas

- Exibe a camada: ref: *Sistema de referência de coordenadas (CRS)<layer_crs>*. Você pode alterar o CRS da camada, selecionando um usado recentemente na lista suspensa ou clicando em **|definir projeção|** : sup: *Selecione o botão CRS* (consulte: ref:` crs_selector`). Use esse processo apenas se o CRS aplicado à camada for incorreto ou se nenhum foi aplicado. Se você deseja reprojetar seus dados em outro CRS, use algoritmos de reprojeção de camadas em Processamento ou: ref: *Salve-os em outra camada<general_saveas>*:
- *Create spatial index* (only for OGR-supported formats).
- *Update extents* information for a layer.

Criador de consultas

A caixa de diálogo: guilabel: *Criador de consultas* está acessível através do botão de epônimo na parte inferior da guia: guilabel:*Fonte* na caixa de diálogo Propriedades da camada, no grupo: guilabel: *Filtro de recursos do provedor*.

O Criador de consultas fornece uma interface que permite definir um subconjunto dos recursos na camada usando uma cláusula WHERE semelhante a SQL e exibir o resultado na janela principal. Enquanto a consulta estiver ativa, apenas os recursos correspondentes ao resultado estarão disponíveis no projeto.

You can use one or more layer attributes to define the filter in the `Query Builder`. The use of more than one attribute is shown in Fig.14.2. In the example, the filter combines the attributes

- Campo `` toa`` (`` Date Time``: `` cast (“toa” como personagem)>> 2017-05-17 “) e `` cast (“toa” como personagem) <’2019-12 -24T18: 00: 00 “),
- campo `` name`` (`` String``: `` “name”> ‘S```) e
- `` FID`` (campo `` Integer``: `` FID> 10``)

usando os operadores AND, OR e NOT e parênteses. Essa sintaxe (incluindo o formato DateTime para o campo `` toa``) funciona para conjuntos de dados Pacote geográfico.

O filtro é feito no nível do provedor de dados (OGR, PostgreSQL, MSSQL …). Portanto, a sintaxe depende do provedor de dados (por exemplo, o Data Hnão é suportado no formato ESRI Shapefile). A expressão completa

```
cast("toa" as character) > '2017-05-17' AND
cast("toa" as character) < '2019-12-24T18:00:00' AND
NOT ("name" > 'S' OR FID > 10)
```

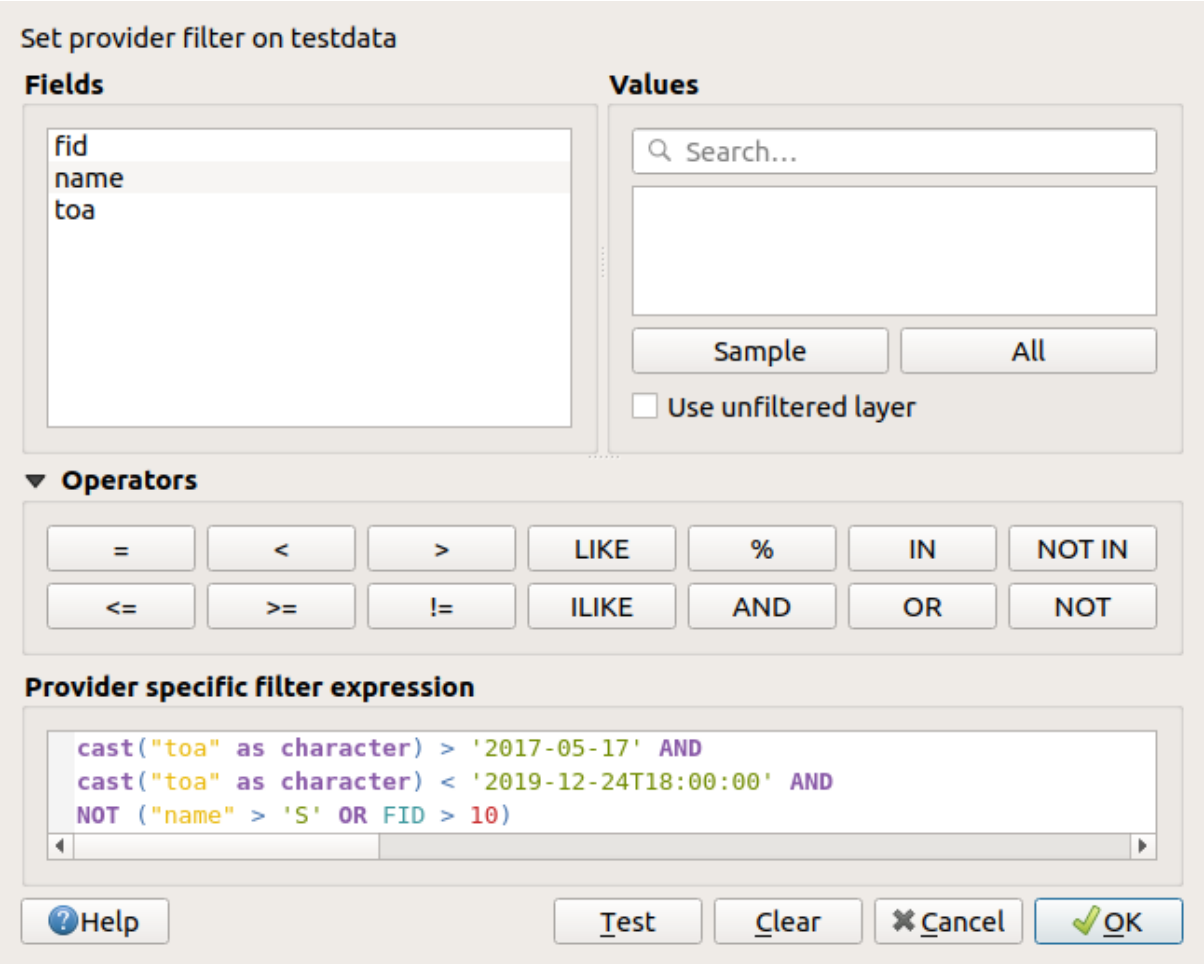


Figura14.2: Criador de consultas

Você também pode abrir a caixa de diálogo: guilabel: *Criador de consultas* usando a opção: guilabel:` Filtro … *da opção: seleção de menus: menu* Camada` ou menu contextual da camada. As seções: guilabel: ` Campos`,: guilabel:` Valores` e: guilabel: *Operadores* na caixa de diálogo ajudam a construir a consulta semelhante a SQL exposta na caixa: guilabel:` Expressão de filtro específica do provedor`.

A lista ** Campos ** contém todos os campos da camada. Para adicionar uma coluna de atributo ao campo da cláusula SQL WHERE, clique duas vezes no nome ou digite-o na caixa SQL.

O quadro ** Valores ** lista os valores do campo selecionado no momento. Para listar todos os valores exclusivos de um campo, clique no botão: guilabel: *Todos*. Para listar os 25 primeiros valores exclusivos da coluna, clique no botão: guilabel: *Amostra*. Para adicionar um valor ao campo da cláusula SQL WHERE, clique duas vezes em seu nome na lista Valores. Você pode usar a caixa de pesquisa na parte superior do quadro Valores para navegar e encontrar facilmente os valores dos atributos na lista.

A seção ** Operadores ** contém todos os operadores utilizáveis. Para adicionar um operador ao campo da cláusula SQL WHERE, clique no botão apropriado. Operadores relacionais (`` = , ``> ``, ...), operador de comparação de cadeias ( LIKE``) e operadores lógicos (`` AND``, `` OR``, …) Estão disponíveis.

O botão: guilabel: *Teste* ajuda a verificar sua consulta e exibe uma caixa de mensagem com o número de recursos que satisfazem a consulta atual. Use o botão: guilabel: *Claro* para limpar a consulta SQL e reverter a camada ao seu estado original (ou seja, carregar totalmente todos os recursos).

Quando um filtro é aplicado, o QGIS trata o subconjunto resultante como se fosse a camada inteira. Por exemplo, se você aplicou o filtro acima para 'Bairro' (`` "TYPE_2" = 'Borough') , não poderá exibir, consultar, salvar ou editar `` Ancoragem, porque é um' Município 'e portanto, não faz parte do subconjunto.

Dica: ** As camadas filtradas são indicadas no painel Camadas **

No painel: guilabel: *Camadas*, a camada filtrada é listada com um | filtro indicador | : sup: *Filtro* ao lado, indicando a consulta usada quando o mouse passa o mouse sobre o botão. Clique duas vezes no ícone para abrir a caixa de diálogo: guilabel: *Criador de consultas* para edição.

14.1.3 Propriedades da simbologia

|simbologia| A guia Simbologia fornece uma ferramenta abrangente para renderizar e simbolizar seus dados vetoriais. Você pode usar ferramentas comuns a todos os dados vetoriais, bem como ferramentas simbólicas especiais que foram projetadas para os diferentes tipos de dados vetoriais. No entanto, todos os tipos compartilham a seguinte estrutura de diálogo: na parte superior, você tem um widget que ajuda a preparar a classificação e o símbolo a serem usados nos recursos e, na parte inferior, o widget: ref: *renderização de camada*.

Dica: ** Alterne rapidamente entre diferentes representações de camada **

Usando a: seleção de menu: *Estilos -> Add* no final da caixa de diálogo: guilabel:*Propriedades da camada*, você pode salvar quantos estilos forem necessários. Um estilo é a combinação de todas as propriedades de uma camada (como simbologia, rotulagem, diagrama, formulário de campos, ações ...) como você deseja. Em seguida, basta alternar entre os estilos no menu de contexto da camada em: guilabel: `Painel de camadas 'para obter automaticamente diferentes representações dos seus dados.

Dica: Exportar simbologia vetorial

Você tem a opção de exportar a simbologia vetorial do QGIS para os arquivos das guias Google *. Kml, *. Dxf e MapInfo *. Basta abrir o menu direito do mouse da camada e clicar em: seleção de menu: *Save As ...* para especificar o nome do arquivo de saída e seu formato. Na caixa de diálogo, use o menu: seleção de menu: *Exportação de simbologia* para salvar a simbologia como: seleção de menu:` Simbologia de recursos -> *ou como: seleção de menu:* Simbologia da camada de símbolo -> `. Se você usou camadas de símbolos, é recomendável usar a segunda configuração.

Apresenta renderização

O renderizador é responsável por desenhar um recurso juntamente com o símbolo correto. Independentemente do tipo de geometria da camada, existem quatro tipos comuns de renderizadores: símbolo único, categorizados, graduados e baseados em regras. Para camadas de ponto, há um deslocamento de ponto e um renderizador de mapa de calor disponível, enquanto as camadas de polígono também podem ser renderizadas com os polígonos invertidos e os renderizadores 2,5 D.

Não há renderizador de cores contínuo, porque na verdade é apenas um caso especial do renderizador graduado. Os renderizadores classificados e graduados podem ser criados especificando um símbolo e uma rampa de cores - eles definirão as cores dos símbolos adequadamente. Para cada tipo de dados (pontos, linhas e polígonos), os tipos de camada de símbolo vetorial estão disponíveis. Dependendo do renderizador escolhido, a caixa de diálogo fornece diferentes seções adicionais.

Nota: Se você alterar o tipo de processador ao definir o estilo de uma camada de vetor as configurações feitas para o símbolo serão mantidas. Esteja ciente de que este procedimento só funciona para uma mudança. Se você repetir a alteração do tipo de renderizador as configurações para o símbolo irão se perder.

Renderizador de símbolo único

O | Símbolo único | : guilabel: o renderizador *Símbolo único* é usado para renderizar todos os recursos da camada usando um único símbolo definido pelo usuário. Veja: ref: `seletor de símbolos 'para mais informações sobre representação de símbolos.

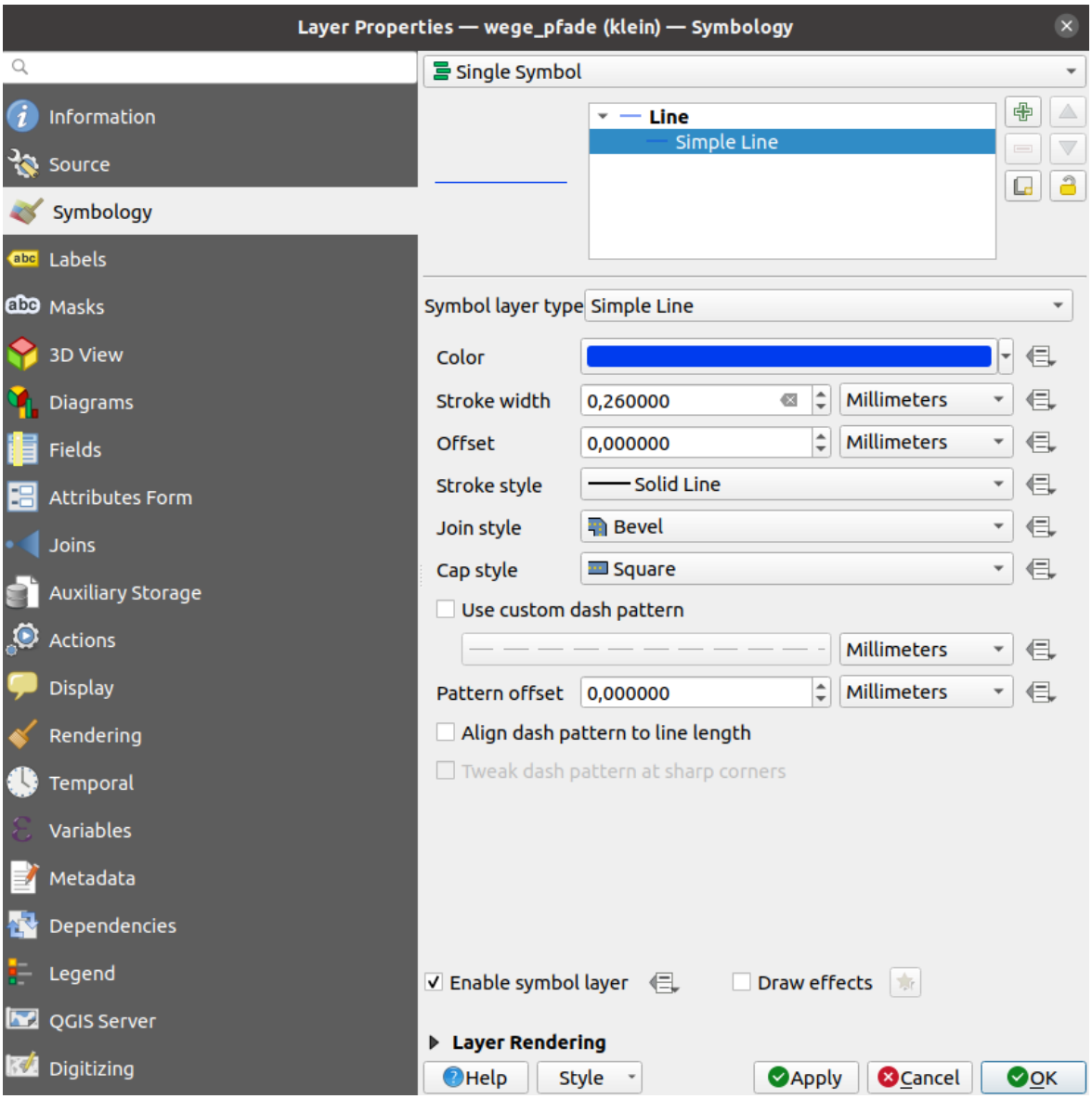


Figura14.3: Propriedades da linha de símbolo único

Renderizador sem símbolos

O | símbolo nulo | : guilabel: o renderizador *Sem símbolos* é um caso de uso especial do renderizador Símbolo único, pois aplica a mesma renderização a todos os recursos. Usando este renderizador, nenhum símbolo será desenhado para os recursos, mas ainda serão mostrados rótulos, diagramas e outras partes que não sejam de símbolos.

Ainda é possível fazer seleções na camada da tela e os recursos selecionados serão renderizados com um símbolo padrão. Os recursos editados também serão mostrados.

Este é um atalho útil para as camadas nas quais você deseja exibir apenas etiquetas ou diagramas e evita a necessidade de renderizar símbolos com preenchimento / borda totalmente transparente para conseguir isso.

Renderizador categorizado

O | símbolo categorizado | : guilabel: o renderizador categorizado é usado para renderizar os recursos de uma camada, usando um símbolo definido pelo usuário cujo aspecto reflete os valores discretos de um campo ou expressão.

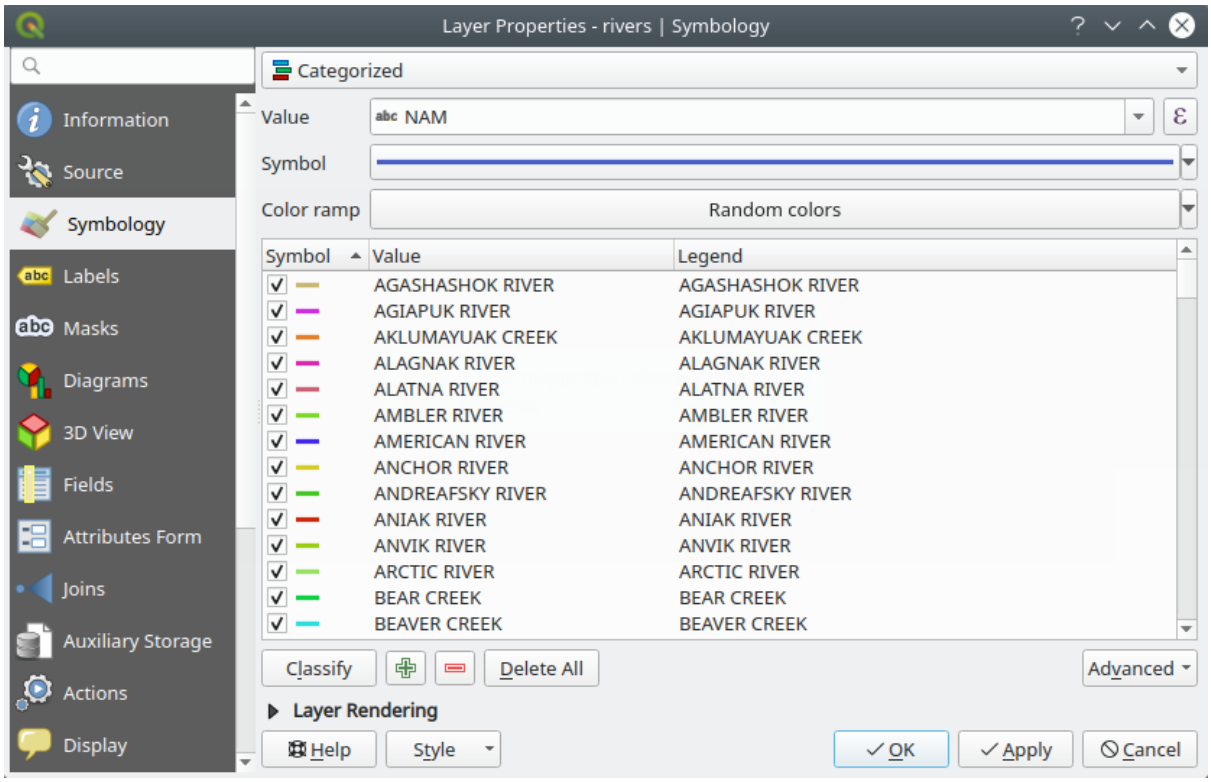


Figura14.4: Opções de simbolização categorizadas

Para usar a simbologia categorizada para uma camada:

1. Selecione a: guilabel: *Valor* da classificação: pode ser um campo existente ou uma expressão: ref:` você pode digitar na caixa ou construir usando a expressão | associada | botão. O uso de expressões para categorizar evita a necessidade de criar um campo ad hoc para fins de simbologia (por exemplo, se seus critérios de classificação forem derivados de um ou mais atributos).

   A expressão usada para classificar recursos pode ser de qualquer tipo; por exemplo, pode:

   - seja uma comparação. Nesse caso, o QGIS retorna os valores `` 1`` (** True) **e `` 0`` (False **). Alguns exemplos:

     ```
     myfield >= 100
     $id = @atlas_featureid
     ```

(continua na próxima página)

(continuação da página anterior)

```
myfield % 2 = 0
within( $geometry, @atlas_geometry )
```

- combine diferentes campos:

```
concat( field_1, ' ', field_2 )
```

- seja um cálculo nos campos:

```
myfield % 2
year( myfield )
field_1 + field_2
substr( field_1, -3 )
```

- ser usado para transformar valores lineares em classes discretas, por exemplo:

```
CASE WHEN x > 1000 THEN 'Big' ELSE 'Small' END
```

- combine vários valores discretos em uma única categoria, por exemplo:

```
CASE
WHEN building IN ('residence', 'mobile home') THEN 'residential'
WHEN building IN ('commercial', 'industrial') THEN 'Commercial and␣
↪Industrial'
END
```

Dica: Embora você possa usar qualquer tipo de expressão para categorizar recursos, para algumas expressões complexas, pode ser mais simples usar: ref: *renderização baseada em regras<rule_based_rendering>*.

---

2. Configure o: ref: 'Símbolol<symbol-selector>`, que será usado como símbolo base para todas as classes;
3. Indique: ref: *Rampa de cores<color-ramp>*, ou seja, a faixa de cores na qual a cor aplicada a cada símbolo é selecionada.

   Além das opções comuns do: ref: *ferramenta de rampa de cores<color_ramp_widget>*, você pode aplicar um | desmarcado | : guilabel: *Random Color Ramp* para as categorias. Você pode clicar na entrada: guilabel: *Aleatório cores aleatórias* para gerar novamente um novo conjunto de cores aleatórias, se você não estiver satisfeito.
4. Em seguida, clique no botão: guilabel: *Classificar* para criar classes a partir dos valores distintos do campo ou expressão fornecido.
5. *Apply* the changes if the *live update* is not in use and each feature on the map canvas will be rendered with the symbol of its class.

   Por padrão, o QGIS anexa uma classe: guilabel: *todos os outros valores* à lista. Enquanto vazia no início, essa classe é usada como uma classe padrão para qualquer recurso que não se enquadre nas outras classes (por exemplo, quando você cria recursos com novos valores para o campo / expressão de classificação).

Outros ajustes podem ser feitos na classificação padrão:

- Você pode | assinar Plus | : sup: *Adicionar* novas categorias, | signMinus | : sup: *Remove* as categorias selecionadas ou: guilabel:` Excluir tudo`.
- Uma classe pode ser desativada desmarcando a caixa de seleção à esquerda do nome da classe; os recursos correspondentes estão ocultos no mapa.
- Arraste e solte as linhas para reordenar as classes
- Para alterar o símbolo, o valor ou a legenda de uma classe, clique duas vezes no item.

Clicar com o botão direito do mouse sobre os item (s) selecionados mostra um menu contextual para:

- : guilabel: *Copiar símbolo* e: guilabel:` Colar símbolo`, uma maneira conveniente de aplicar a representação do item a outras pessoas
- : guilabel: *Alterar Color …* do símbolo (s) selecionado
- *Change Opacity…* of the selected symbol(s)
- : guilabel: *Alterar unidade de saída …* do símbolo (s) selecionado
- : guilabel: *Alterar largura …* do símbolo (s) de linha selecionado
- : guilabel: *Alterar tamanho …* do símbolo (s) de ponto selecionado
- *Change Angle…* of the selected point symbol(s)
- : guilabel: *Mesclar categorias*: agrupa várias categorias selecionadas em uma única. Isso permite um estilo mais simples de camadas com um grande número de categorias, onde pode ser possível agrupar várias categorias distintas em um conjunto menor e mais gerenciável de categorias que se aplicam a vários valores.

  Dica: Como o símbolo mantido para as categorias mescladas é o da categoria selecionada mais no topo da lista, convém mover a categoria cujo símbolo você deseja reutilizar para o topo antes de mesclar.

- : guilabel: *Unmerge Categories* que foram mescladas anteriormente

O menu: guilabel: *Avançado* dá acesso a opções para acelerar a classificação ou ajustar a renderização de símbolos:

- *Match to saved symbols*: Using the *symbols library*, assigns to each category a symbol whose name represents the classification value of the category
- : guilabel: *Corresponde aos símbolos do arquivo …*: Fornece um arquivo com símbolos, atribui a cada categoria um símbolo cujo nome representa o valor de classificação da categoria
- : ref: *Níveis de símbolos …*<*Symbols_levels*> para definir a ordem de renderização dos símbolos.

Dica: ** Edite categorias diretamente no painel **: guilabel: *camadas* ** **

Quando uma simbologia de camada é baseada em um modo de simbologia: ref: *categorizado*<*categorized_renderer*>,: ref: *graduado*<*graduated_renderer*> ou: ref: *baseado em regras*<*rule_based_rendering*>, você pode editar cada uma das categorias do painel: guilabel: *Camadas*. Clique com o botão direito em um subitem da camada e você irá:

-  *Toggle items* visibility
-  *Show all items*
-  *Hide all items*
- Modifique a cor do símbolo graças ao: ref: *seletor de cores*<*color-selector*> roda
- : guilabel: 'Editar símbolo … *da caixa de diálogo: ref:* seletor de símbolo<symbol-selector> `
- : guilabel: *Copiar símbolo*
- : guilabel: *Colar símbolo*

Renderer graduado

O símbolo | graduado | : guilabel: o renderizador *Graduado* é usado para renderizar todos os recursos de uma camada, usando um símbolo definido pelo usuário cuja cor ou tamanho reflete a atribuição do atributo de um recurso selecionado a uma classe.

Como o Renderizador categorizado, o Renderizador graduado permite definir a rotação e a escala de tamanho das colunas especificadas.

Além disso, de forma análoga ao Renderizador Categorizado, permite selecionar:

- O valor (usando a caixa de listagem dos campos ou a função | expression |: sup: *Definir expressão do valor*)
- O símbolo (usando a caixa de diálogo Seletor de símbolos)
- O formato da legenda e a precisão
- O método a ser usado para alterar o símbolo: cor ou tamanho
- As cores (usando a lista Rampa de cores) se o método de cores estiver selecionado
- O tamanho (usando o domínio de tamanho e sua unidade)

Em seguida, você pode usar a guia Histograma, que mostra um histograma interativo dos valores do campo ou expressão atribuído. As quebras de classe podem ser movidas ou adicionadas usando o widget de histograma.

Nota: Você pode usar o painel Resumo Estatístico para obter mais informações sobre sua camada vetorial. Veja: ref: “resumo estatístico”.

De volta à guia Classes, você pode especificar o número de classes e também o modo para classificar os recursos dentro das classes (usando a lista Modo). Os modos disponíveis são:

- Equal Count (Quantile): each class will have the same number of elements (the idea of a boxplot).
- Equal Interval: each class will have the same size (e.g. with the values from 1 to 16 and four classes, each class will have a size of four).
- Logarithmic scale: suitable for data with a wide range of values. Narrow classes for low values and wide classes for large values (e.g. for decimal numbers with range [0..100] and two classes, the first class will be from 0 to 10 and the second class from 10 to 100).
- Natural Breaks (Jenks): the variance within each class is minimized while the variance between classes is maximized.
- Pretty Breaks: computes a sequence of about n+1 equally spaced nice values which cover the range of the values in x. The values are chosen so that they are 1, 2 or 5 times a power of 10. (based on pretty from the R statistical environment https://www.rdocumentation.org/packages/base/topics/pretty).
- Desvio padrão: as classes são construídas dependendo do desvio padrão dos valores.

A caixa de listagem na parte central da guia: guilabel: *Simbologia* lista as classes, juntamente com seus intervalos, rótulos e símbolos que serão renderizados.

Clique no botão ** Classificar ** para criar classes usando o modo escolhido. Cada classe pode ser desativada desmarcando a caixa de seleção à esquerda do nome da classe.

Para alterar o símbolo, valor e/ou rótulo da classe, basta clicar duas vezes no item que você deseja alterar.

Clicar com o botão direito do mouse sobre os item (s) selecionados mostra um menu contextual para:

- : guilabel: *Copiar símbolo* e: guilabel:` Colar símbolo`, uma maneira conveniente de aplicar a representação do item a outras pessoas
- : guilabel: *Alterar Color …* do símbolo (s) selecionado
- *Change Opacity…* of the selected symbol(s)
- : guilabel: *Alterar unidade de saída …* do símbolo (s) selecionado

- : guilabel: *Alterar largura …* do símbolo (s) de linha selecionado
- : guilabel: *Alterar tamanho …* do símbolo (s) de ponto selecionado
- *Change Angle…* of the selected point symbol(s)

The example in Fig.14.5 shows the graduated rendering dialog for the major_rivers layer of the QGIS sample dataset.

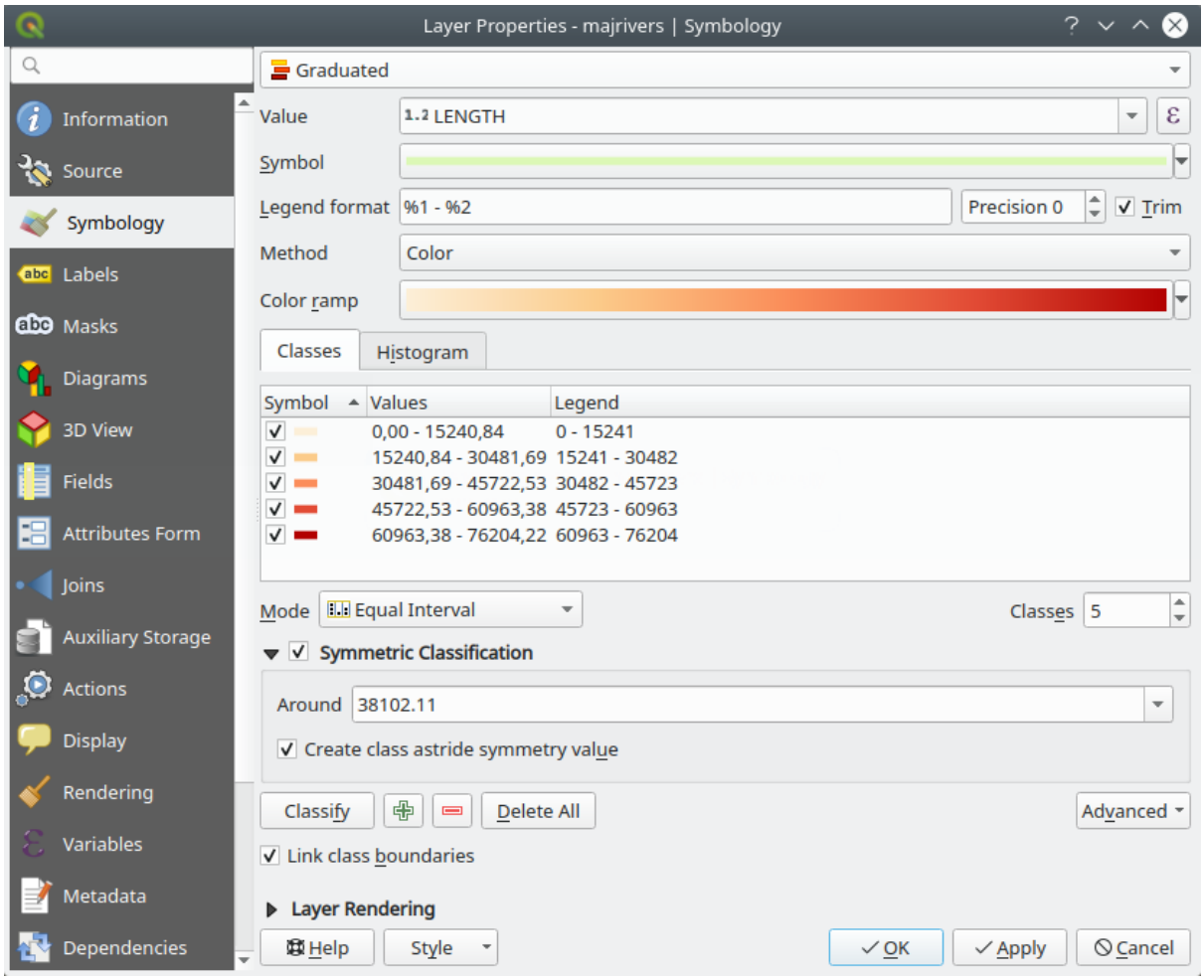


Figura14.5: Opções de simbolização graduadas

Dica: Mapas Temáticos usando uma expressão

Mapas temáticos categorizados e graduados podem ser criados usando o resultado de uma expressão. Na caixa de diálogo de propriedades para camadas vetoriais, o seletor de atributos é estendido com uma expressão | : sup: função "Definir expressão da coluna". Portanto, você não precisa gravar o atributo de classificação em uma nova coluna em sua tabela de atributos se desejar que o atributo de classificação seja composto de vários campos ou uma fórmula de algum tipo.

Símbolo Proporcional e Análise Multivariada

Símbolo proporcional e análise multivariada não são tipos de renderização disponíveis na lista suspensa Renderização de simbologia. No entanto, com as opções: ref: *substituição definida por dados<data_defined>* aplicada a qualquer uma das opções de renderização anteriores, o QGIS permite exibir seus dados de ponto e linha com essa representação.

** Criando símbolo proporcional **

Para aplicar uma renderização proporcional:

1. Primeiro aplique à camada o: ref: *renderizador de símbolo único<single_symbol_renderer>*.
2. Em seguida, defina o símbolo para aplicar aos recursos.
3. Selecione o item no nível superior da árvore de símbolos e use o | dadosDefinidos | : sup: *Substituição definida por dados*: ref:` botão<data_defined> *ao lado da opção: guilabel:`Tamanho* (para camada de pontos) ou: guilabel: *Largura* (para camada de linha).
4. Selecione um campo ou insira uma expressão e, para cada recurso, o QGIS aplicará o valor de saída à propriedade e redimensionará proporcionalmente o símbolo na tela do mapa.

   Se necessário, use a opção: guilabel: *Assistente de tamanho …* da | dadosDefinidos | menu para aplicar alguma transformação (exponencial, flannery …) ao redimensionamento do tamanho do símbolo (consulte: ref: *assistente_dados_definidos* para obter mais detalhes).

Você pode optar por exibir os símbolos proporcionais na: ref: *Camadas do painel* e na: ref:` item da legenda do layout de impressão *: desdobre a lista suspensa: guilabel:* Avançado` na parte inferior da caixa de diálogo principal do : guilabel: aba *Simbologia* e selecione ** Legenda do tamanho definido pelos dados … ** para configurar os itens da legenda (consulte: ref:` legenda_tamanho_multado _dados` para obter detalhes).

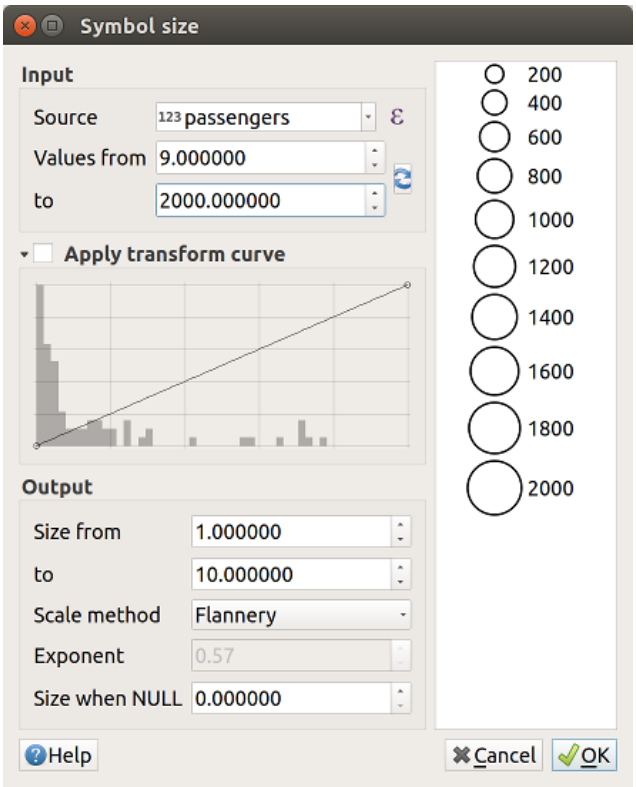


Figura14.6: Escalonar o tamanho dos aeroportos com base na elevação do aeroporto

** Criando análise multivariada **

Uma renderização de análise multivariada ajuda a avaliar o relacionamento entre duas ou mais variáveis, por exemplo, uma pode ser representada por uma rampa de cores enquanto a outra é representada por um tamanho.

A maneira mais simples de criar análises multivariadas no QGIS é:

1. Primeiro, aplique uma renderização categorizada ou graduada em uma camada, usando o mesmo tipo de símbolo para todas as classes.
2. Em seguida, aplique uma simbologia proporcional nas classes:
    1. Clique no botão: guilabel: *Mudança* acima do quadro de classificação: você obtém a caixa de diálogo: ref:` seletor de símbolos`.
    2. Redimensione novamente o tamanho ou a largura da camada de símbolo usando o | dadosDefinidos | : ref: *dados definidos substituem o ferramenta<data_defined>* como visto acima.

Como o símbolo proporcional, a simbologia escalada pode ser adicionada à árvore de camadas, sobre os símbolos das classes categorizadas ou graduadas, usando o recurso: ref: *legenda do tamanho definido dos dados<data_defined_size_legend>*. E ambas as representações também estão disponíveis no item da legenda do layout de impressão.

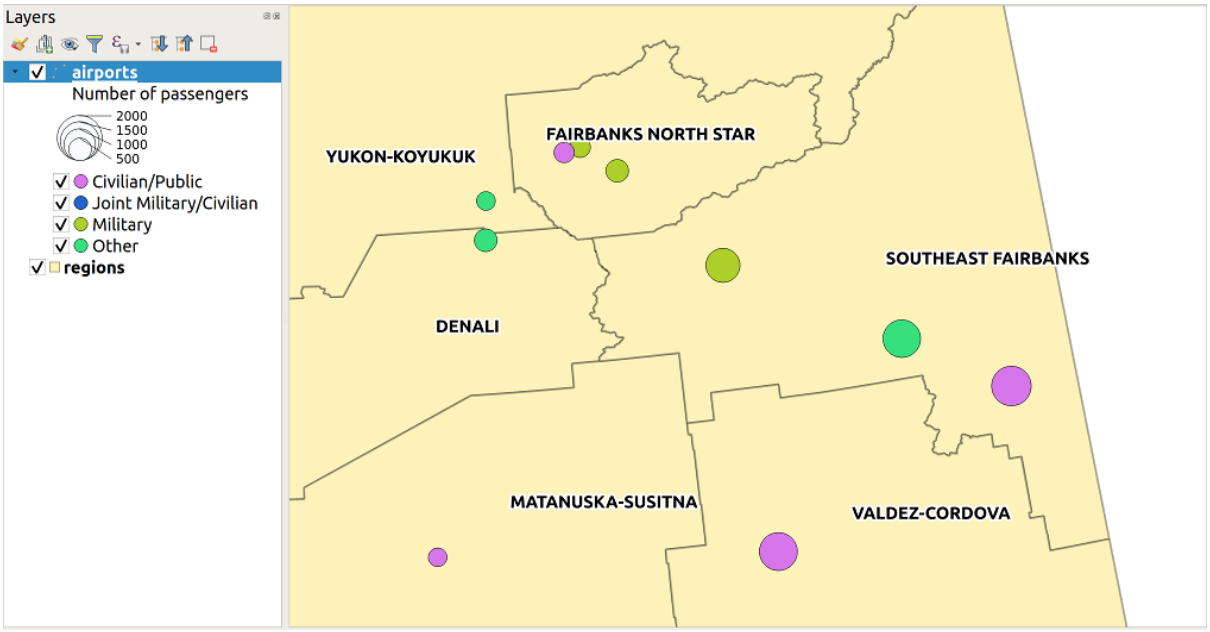


Figura14.7: Exemplo multivariado com legenda de tamanho dimensionado

Renderizador baseado em regras

O | Símbolo baseado em regra | : guilabel: o renderizador baseado em regras é usado para renderizar todos os recursos de uma camada, usando símbolos baseados em regras cujo aspecto reflete a atribuição do atributo de um recurso selecionado a uma classe. As regras são baseadas em instruções SQL e podem ser aninhadas. A caixa de diálogo permite o agrupamento de regras por filtro ou escala e você pode decidir se deseja ativar os níveis de símbolo ou usar apenas a regra de primeira correspondência.

Para criar uma regra:

1. Ative uma linha existente clicando duas vezes nela (por padrão, o QGIS adiciona um símbolo sem uma regra quando o modo de renderização está ativado) ou clique no ícone | Propriedades do projeto | : sup: *Editar regra* ou | assinarPlus | : sup: botão Adicionar regra.
2. Na caixa de diálogo: guilabel: *Editar regra* que é aberta, você pode definir um rótulo para ajudá-lo a identificar cada regra. Este é o rótulo que será exibido em: guilabel: `Painel de camadas 'e também na legenda do compositor de impressão.
3. Insira manualmente uma expressão na caixa de texto ao lado de | botão de opção Ativado | : guilabel: opção *Filtro* ou pressione a expressão | ao lado dele para abrir a caixa de diálogo do construtor de cadeias de expressão.

4. Use as funções fornecidas e os atributos da camada para criar uma expressão: ref:<vector_expressions> *para filtrar os recursos que você deseja recuperar. Pressione o botão: guilabel: `Test* para verificar o resultado da consulta.
5. Você pode inserir um rótulo mais longo para concluir a descrição da regra.
6. Você pode usar a caixa de seleção | : guilabel: opção ` Escala de escala` para definir escalas nas quais a regra deve ser aplicada.
7. Por fim, configure o símbolo: ref: *para usar<symbol-selector>* para esses recursos.
8. E pressione: guilabel: *OK*.

Uma nova linha que resume a regra é adicionada à caixa de diálogo Propriedades da camada. Você pode criar quantas regras forem necessárias, seguindo as etapas acima ou copiar colando uma regra existente. Arraste e solte as regras uma sobre a outra para aninhar e refinar os recursos da regra superior nas subclasses.

Ao selecionar uma regra, você também pode organizar seus recursos nas subclasses usando o menu suspenso: guilabel: *Refinar regras selecionadas*. O refinamento automatizado de regras pode ser baseado em:

- ** escalas **;
- ** categorias **: aplicando a: ref: *renderizador categorizado<categorized_renderer>*;
- ou ** intervalos **: aplicando a: ref: *renderizador graduado<graduated_renderer>*.

Classes refinadas aparecem como subitens da regra, em uma hierarquia de árvore e, como acima, você pode definir a simbologia de cada classe.

Na caixa de diálogo: guilabel: *Editar regra*, você pode evitar escrever todas as regras e usar o | botão de rádio desativado | : guilabel: opção *Outra* para capturar todos os recursos que não correspondem a nenhuma das outras regras, no mesmo nível. Isso também pode ser conseguido escrevendo `Outra` na coluna * Rule * da seção: seleção de menus: *Propriedades da camada -> Simbologia-> Baseado em regras*.

Clicar com o botão direito do mouse sobre os item (s) selecionados mostra um menu contextual para:

- *Copy* and *Paste*, a convenient way to create new item(s) based on existing item(s)
- : guilabel: *Copiar símbolo* e: guilabel:` Colar símbolo`, uma maneira conveniente de aplicar a representação do item a outras pessoas
- : guilabel: *Alterar Color …* do símbolo (s) selecionado
- *Change Opacity…* of the selected symbol(s)
- : guilabel: *Alterar unidade de saída …* do símbolo (s) selecionado
- : guilabel: *Alterar largura …* do símbolo (s) de linha selecionado
- : guilabel: *Alterar tamanho …* do símbolo (s) de ponto selecionado
- *Change Angle…* of the selected point symbol(s)
- : guilabel: *Refinar regra atual*: abre um submenu que permite refinar a regra atual com ** escalas **, ** categorias ** (representante categorizado) ou ** Intervalos ** (representante graduado).

As regras criadas também aparecem em uma hierarquia de árvore na legenda do mapa. Clique duas vezes nas regras na legenda do mapa e a guia Simbologia das propriedades da camada aparece mostrando a regra que é o plano de fundo do símbolo na árvore.

The example in Fig.14.8 shows the rule-based rendering dialog for the rivers layer of the QGIS sample dataset.

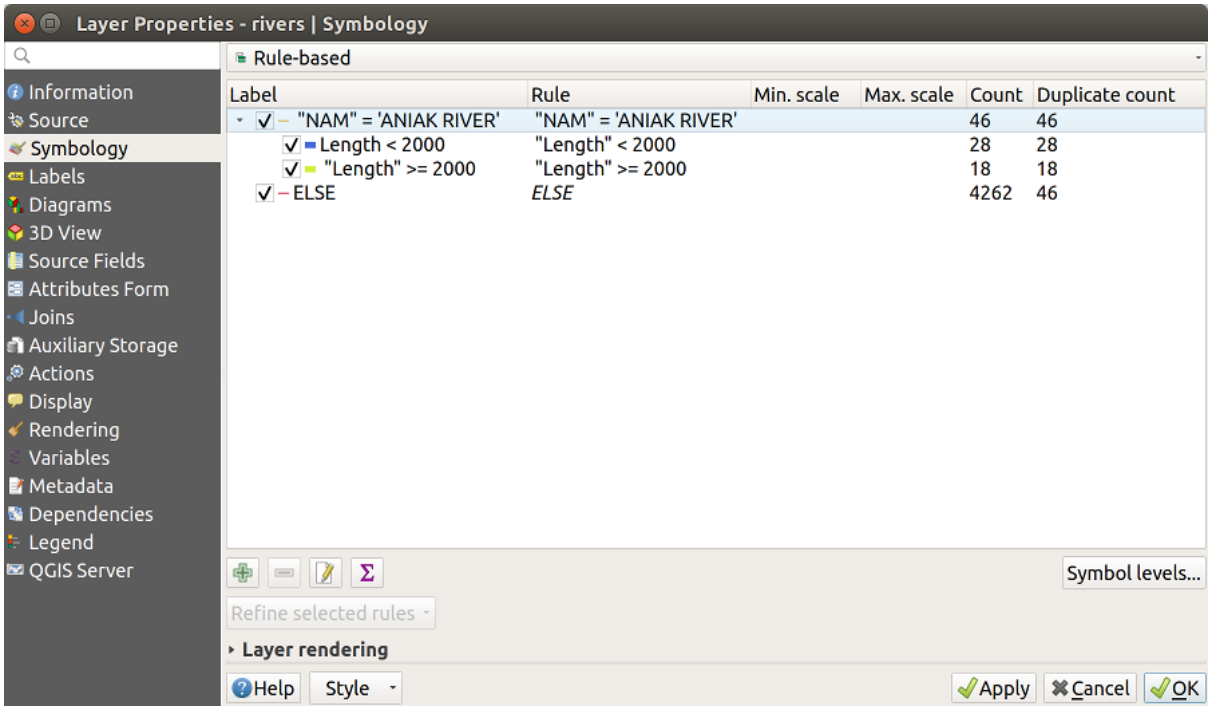


Figura14.8: Opções de simbolização baseadas em regras

Renderizador de deslocamento pontual

O | Símbolo de deslocamento de ponto| : guilabel: o renderizador *Deslocamento de ponto* trabalha para visualizar todos os recursos de uma camada de pontos, mesmo se eles tiverem o mesmo local. Para fazer isso, o renderizador pega os pontos que se enquadram em um dado: guilabel: tolerância à distância um do outro e os coloca ao redor do seu baricentro seguindo diferentes: guilabel: *Métodos de posicionamento*:

- ** Toque **: coloca todos os recursos em um círculo cujo raio depende do número de recursos a serem exibidos.
- ** Anéis concêntricos **: usa um conjunto de círculos concêntricos para mostrar os recursos.
- ** Grade **: gera uma grade regular com um símbolo de ponto em cada interseção.

A ferramenta: guilabel: *Símbolo do centro* ajuda a personalizar o símbolo e a cor do ponto médio. Para os símbolos de pontos distribuídos, você pode aplicar qualquer um dos * Sem símbolos *, * Único símbolo *, * Categorizado *, * Graduado * ou * Baseado em regras * renderizador usando a lista suspensa: guilabel: *Renderer* e personalizar usando o botão: guilabel: *Configurações do renderizador* ….

Embora o espaçamento mínimo de: guilabel: *Linhas de deslocamento* dependa do renderizador do símbolo de ponto, você ainda pode personalizar algumas de suas configurações, como: guilabel:` Largura do traço`,: guilabel: *cor do traço* e: guilabel: *Ajuste de tamanho* (por exemplo, para adicionar mais espaçamento entre os pontos renderizados).

Use as opções de grupo: guilabel: ` Etiquetas` para realizar a rotulagem de pontos: as etiquetas são colocadas perto da posição deslocada do símbolo, e não na posição real do recurso. Além de: guilabel: *Atributo de rótulo*,: guilabel:` Fonte do rótulo` e: guilabel: *Cor da etiqueta*, você pode definir: guilabel:` Escala mínima do mapa` para exibir os rótulos.

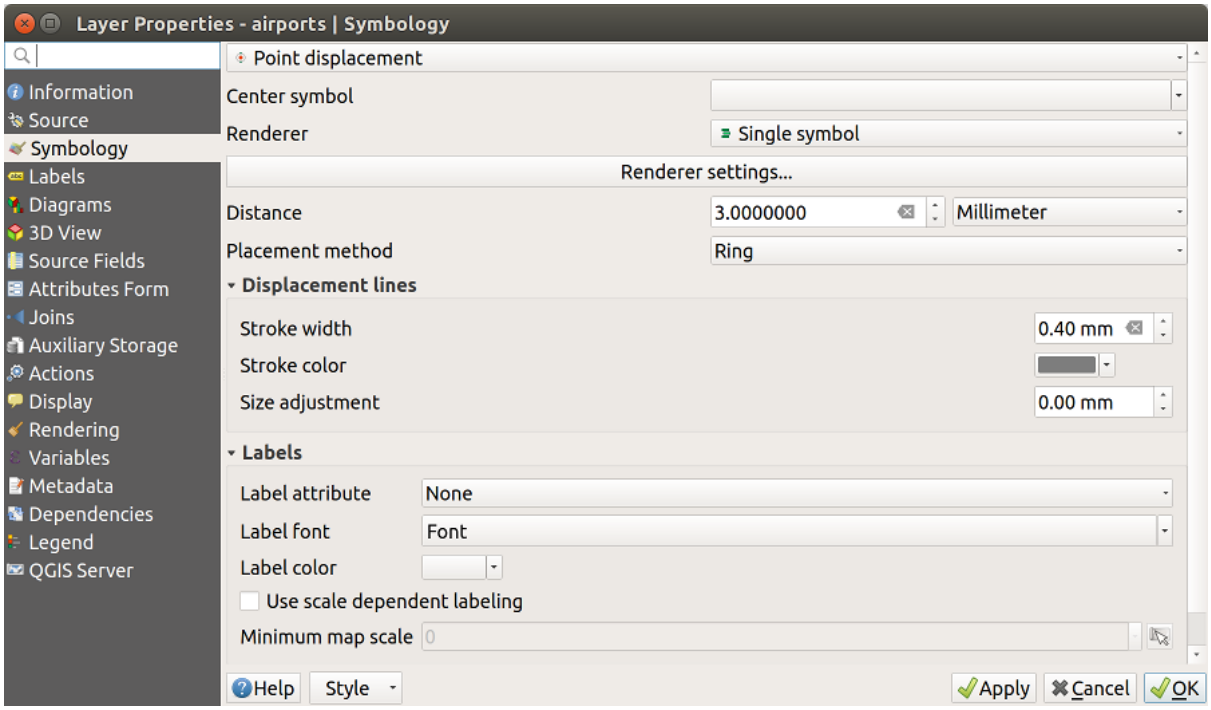


Figura14.9: Diálogo deslocamento de ponto

Nota: O renderizador de deslocamento de ponto não altera a geometria do recurso, o que significa que os pontos não são movidos de sua posição. Eles ainda estão localizados em seu local inicial. As alterações são apenas visuais, para fins de renderização. Em vez disso, use o algoritmo Em processamento: ref: *qgispointsdisplacement* se desejar criar recursos deslocados.

Processador de cluster de pontos

Ao contrário do |Símbolo de deslocamento de ponto| : guilabel: renderizador *Deslocamento de ponto* que explode o posicionamento mais próximo ou sobreposto dos recursos de ponto, o | pointClusterSymbol | : guilabel: o renderizador 'Cluster de pontos' agrupa pontos próximos em um único símbolo de marcador renderizado. Com base em: guilabel: `Distância', os pontos que se encaixam um no outro são mesclados em um único símbolo. A agregação de pontos é feita com base no grupo mais próximo que está sendo formado, em vez de apenas atribuir a eles o primeiro grupo dentro da distância de pesquisa.

Na caixa de diálogo principal, você pode:

- defina o símbolo para representar o cluster de pontos em: guilabel: *Símbolo de cluster*; a renderização padrão exibe o número de recursos agregados, graças à `` @ cluster_size``: ref: *variável<general_tools_variables>* na camada de símbolo do marcador Fonte.
- use a lista suspensa: guilabel: *Renderer* para aplicar qualquer um dos outros tipos de renderização de recursos à camada (única, categorizada, baseada em regras …). Em seguida, pressione o botão: guilabel: *Configurações do renderizador …* para configurar a simbologia dos recursos como de costume. Observe que esse renderizador é visível apenas em recursos que não estão em cluster. Além disso, quando a cor do símbolo é a mesma para todos os recursos de ponto dentro de um cluster, essa cor define a variável `` @ cluster_color`` do cluster.

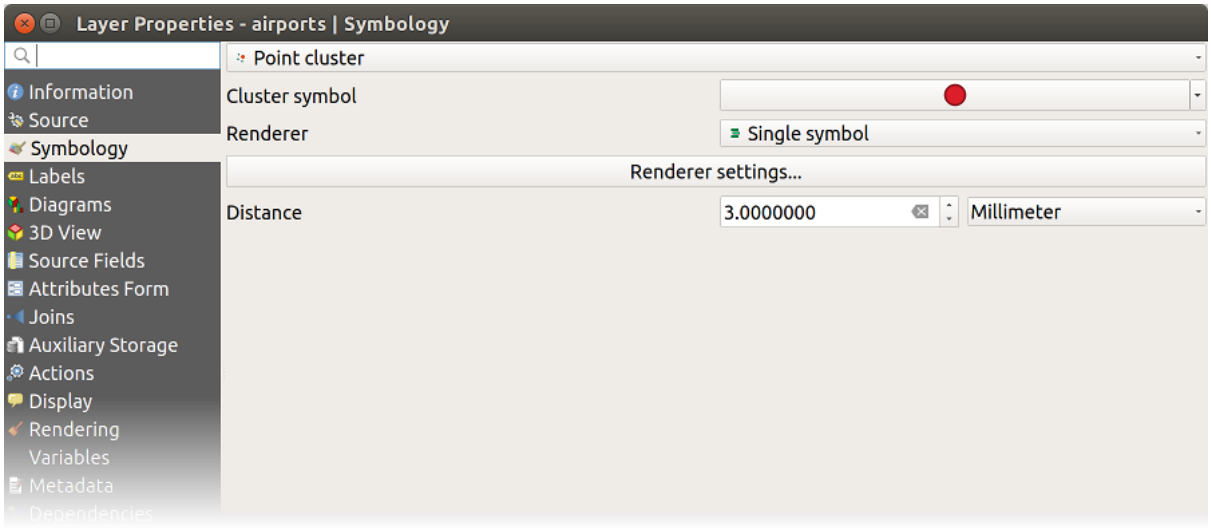


Figura14.10: Caixa de diálogo Cluster de pontos

Nota: O renderizador de cluster de pontos não altera a geometria do recurso, o que significa que os pontos não são movidos de sua posição. Eles ainda estão localizados em seu local inicial. As alterações são apenas visuais, para fins de renderização. Em vez disso, use o algoritmo em processamento: ref: *qgiskmeansclustering* ou: ref:` qgisdbscanclustering` se desejar criar recursos baseados em cluster.

Renderizador de polígono invertido

O | símbolo invertido | : guilabel: O renderizador *Polígono invertido* permite ao usuário definir um símbolo a ser preenchido fora dos polígonos da camada. Como acima, você pode selecionar sub-remetentes, ou seja, renderizador de símbolo único, graduado, categorizado, baseado em regras ou 2.5D.

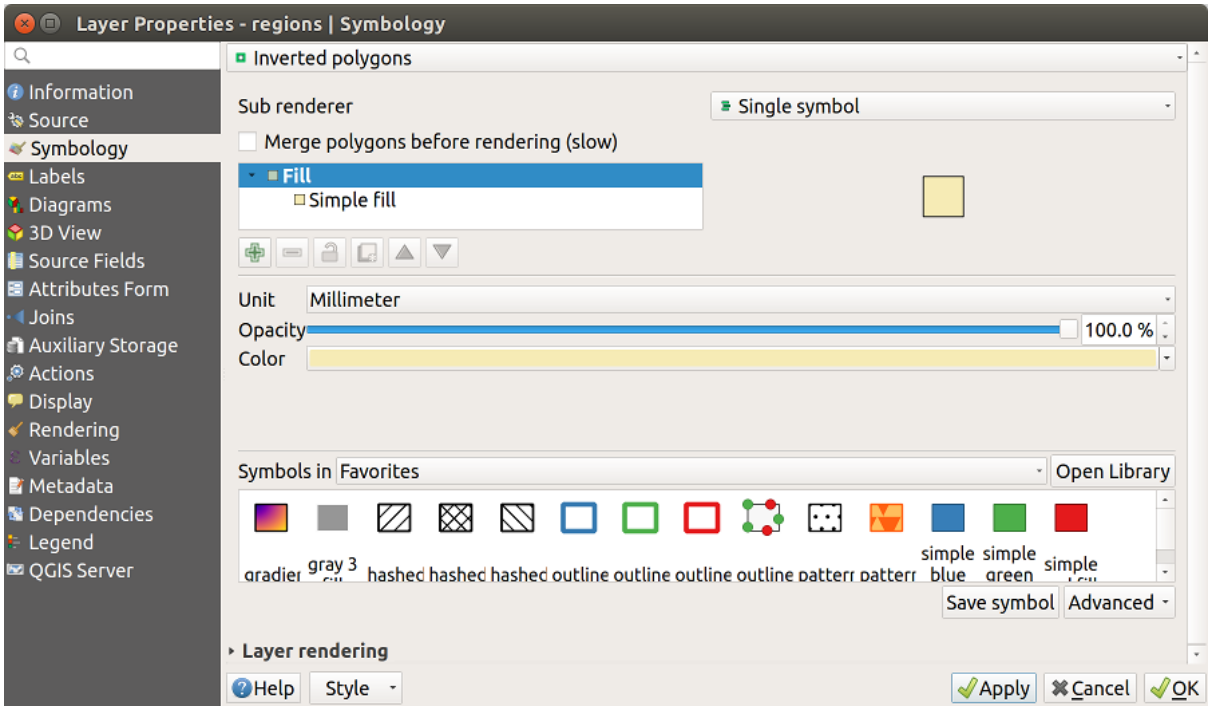


Figura14.11: Caixa de diálogo Polígono invertido

Renderizador de mapa de calor

Com o | Símbolo do mapa de calor | : guilabel: renderizador ` Mapa de calor`, você pode criar mapas de calor dinâmicos ao vivo para camadas de (multi) pontos. Você pode especificar o raio do mapa de calor em milímetros, pontos, pixels, unidades de mapa ou polegadas, escolher e editar uma rampa de cores para o estilo do mapa de calor e usar um controle deslizante para selecionar uma troca entre velocidade e qualidade de renderização. Você também pode definir um limite de valor máximo e atribuir peso a pontos usando um campo ou uma expressão. Ao adicionar ou remover um recurso, o renderizador do mapa de calor atualiza o estilo do mapa de calor automaticamente.

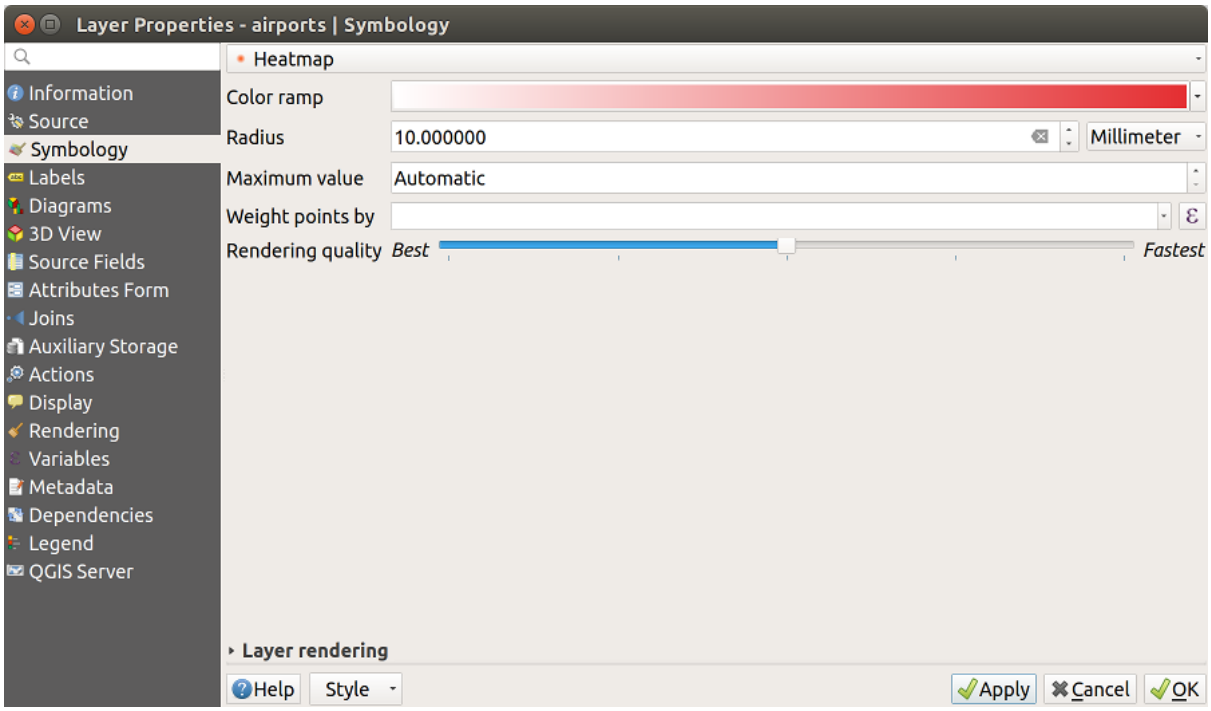


Figura14.12: Caixa de diálogo Mapa de calor

Renderizador 2.5D

Usando o | 25dSymbol | : guilabel: renderizador *2.5D* é possível criar um efeito 2.5D nos recursos da sua camada. Você começa escolhendo um valor: guilabel: *Altura* (em unidades do mapa). Para isso, você pode usar um valor fixo, um dos campos da sua camada ou uma expressão. Você também precisa escolher um: guilabel: *Ângulo* (em graus) para recriar a posição do visualizador (0 | graus | significa oeste, crescendo no sentido anti-horário). Use opções de configuração avançadas para definir: guilabel: *Cor do telhado* e: guilabel:` Cor da parede`. Se você deseja simular radiação solar nas paredes dos recursos, marque a caixa de seleção | : guilabel: opção Paredes sombreadas com base no aspecto. Você também pode simular uma sombra definindo a: guilabel: *Cor* e: guilabel:` Size` (em unidades do mapa).

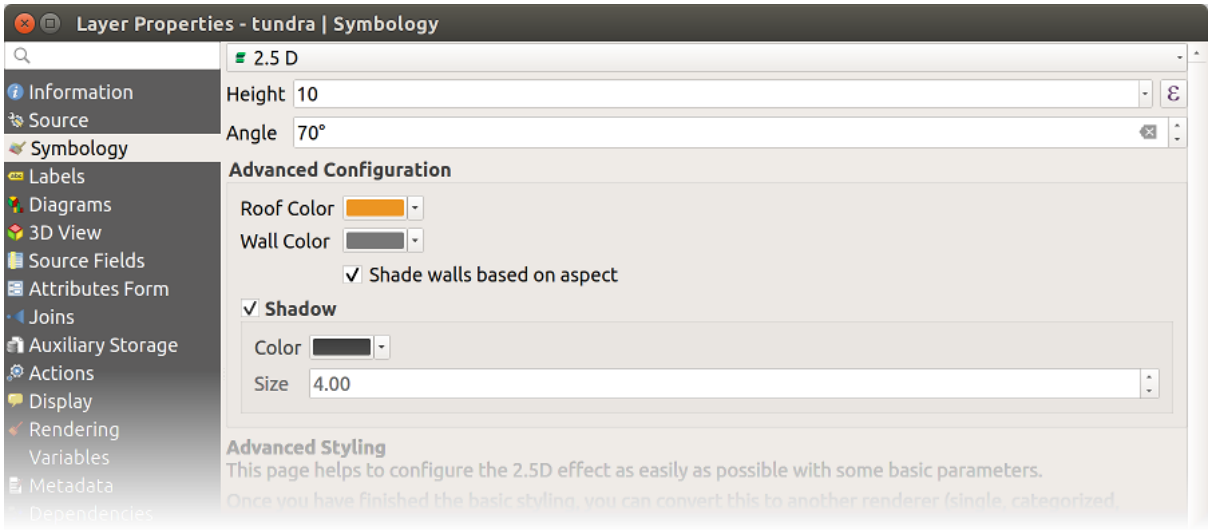


Figura14.13: Caixa de diálogo 2.5D

Dica: ** Usando o efeito 2.5D com outros renderizadores **

Depois de concluir a configuração do estilo básico no renderizador 2.5D, você poderá convertê-lo em outro renderizador (único, categorizado e graduado). Os efeitos 2.5D serão mantidos e todas as outras opções específicas do renderizador estarão disponíveis para você ajustá-los (desta forma, você pode ter, por exemplo, símbolos categorizados com uma boa representação 2.5D ou adicionar um estilo extra aos seus símbolos 2.5D). Para garantir que a sombra e o "edifício" em si não interfiram com outros recursos próximos, pode ser necessário ativar os Níveis de símbolos (: menuelection: *Advanced -> Symbol levels …*). Os valores de altura e ângulo de 2.5D são salvos nas variáveis da camada, para que você possa editá-lo posteriormente na guia variáveis da caixa de diálogo de propriedades da camada.

Renderização da camada

Na guia da Simbologia, você também pode definir algumas opções que atuam invariavelmente em todos os recursos da camada:

- *Opacity* : You can make the underlying layer in the map canvas visible with this tool. Use the slider to adapt the visibility of your vector layer to your needs. You can also make a precise definition of the percentage of visibility in the menu beside the slider.
- : guilabel: *Modo de mesclagem* nos níveis: guilabel:*Camada* e: guilabel: *Característica*: Você pode obter efeitos especiais de renderização com essas ferramentas que antes só conhecia em programas gráficos. Os pixels de suas camadas de sobreposição e de sobreposição são misturados através das configurações descritas em: ref: *modos de mesclagem*.
- Aplique: ref: *efeitos de pintura<draw_effects>* em todos os recursos da camada com o botão: guilabel: *Efeitos de desenho*.
- : guilabel: *Controlar a ordem de renderização do recurso 'permite que você, usando atributos de recursos, defina a ordem z na qual eles serão renderizados. Ative a caixa de seleção e clique no | classificar | botão ao lado. Você então recebe a caixa de diálogo: guilabel: `Definir ordem* na qual você:

  1. Escolha um campo ou crie uma expressão para aplicar aos recursos da camada.
  2. Defina em que ordem os recursos buscados devem ser classificados, ou seja, se você escolher a ordem ** Ascendente **, os recursos com valor mais baixo serão renderizados naqueles com valor mais alto.
  3. Defina quando os recursos que retornam valor NULO devem ser renderizados: ** primeiro ** (inferior) ou ** último ** (superior).

4. Repita as etapas acima quantas vezes você desejar.

A primeira regra é aplicada a todos os recursos da camada, ordenando-os de acordo com o valor retornado. Em seguida, dentro de cada grupo de recursos com o mesmo valor (incluindo aqueles com valor NULO) e, portanto, o mesmo nível z, a próxima regra é aplicada para classificá-los. E assim por diante…

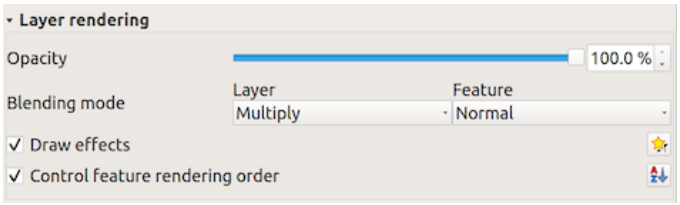


Figura14.14: Opções de renderização de camada

Outros ajustes

Níveis de símbolo

Para renderizadores que permitem camadas de símbolos empilhados (apenas o mapa de calor não), existe uma opção para controlar a ordem de renderização dos níveis de cada símbolo.

Para a maioria dos renderizadores, você pode acessar a opção Níveis de símbolos clicando no botão: guilabel: *Avançado* abaixo da lista de símbolos salvos e escolhendo: guilabel:` Níveis de símbolos`. Para o: ref: *renderização baseada em regras*, a opção está diretamente disponível através do botão: guilabel: *Símbolos Níveis …* `, *enquanto para o renderizador ref:`deslocamento de ponto* o mesmo botão está dentro da caixa de diálogo: guilabel: *Configurações de renderização*

Para ativar os níveis de símbolos, marque a caixa de seleção | : guilabel: *Ativar níveis de símbolo*. Cada linha exibirá uma pequena amostra do símbolo combinado, seu rótulo e a camada de símbolos individuais divididos em colunas com um número ao lado. Os números representam o nível da ordem de renderização no qual a camada de símbolo será desenhada. Os níveis de valores mais baixos são desenhados primeiro, permanecendo na parte inferior, enquanto os valores mais altos são desenhados por último, sobre os outros.

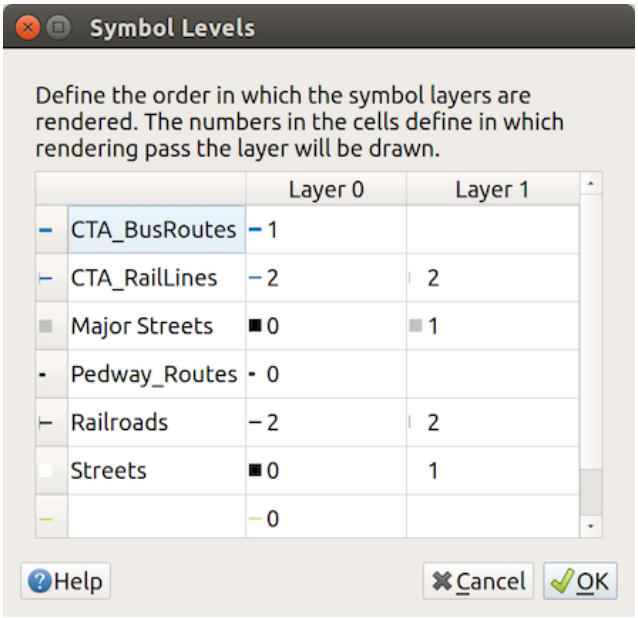


Figura14.15: Caixa de diálogo Níveis de símbolo

Nota: Se os níveis de símbolos estiverem desativados, os símbolos completos serão desenhados de acordo com

a respectiva ordem de recursos. Símbolos sobrepostos simplesmente serão ofuscados para os outros abaixo. Além disso, símbolos semelhantes não “se fundem” entre si.

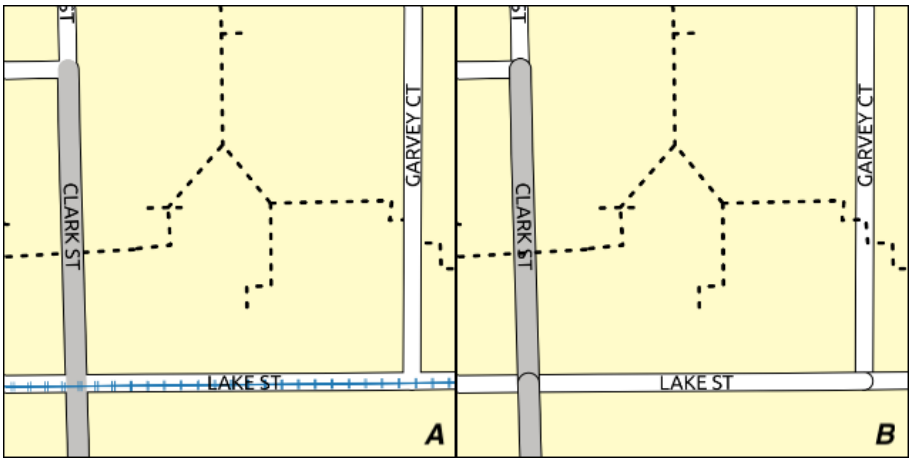


Figura14.16: Diferença nos níveis de símbolo ativado (A) e desativado (B)

Legenda de tamanho definido por dados

Quando uma camada é renderizada com o símbolo: ref: *proporcional ou multivariado<proportional_symbols>* ou quando um: ref: *diagrama de tamanho em escala<diagram_size>* é aplicado à camada, você pode permitir a exibição dos símbolos em escala em ambos: ref: *Camadas do painel<label_legend>* e: ref: *legenda do layout de impressão<layout_legend_item>*.

Para ativar a caixa de diálogo: guilabel: *Legenda do tamanho definido por dados* para renderizar simbologia, selecione a opção de epônimo no botão: guilabel:` Avançado` abaixo da lista de símbolos salvos. Para diagramas, a opção está disponível na guia: guilabel: guia Legenda. A caixa de diálogo fornece as seguintes opções para:

- selecione o tipo de legenda: | botão de opção Ativado | : guilabel: *Legenda não ativada*, | botão de opção Desativado | : guilabel: *Itens de legenda separados* e |botão de opção Desativado | : guilabel: *legenda recolhida*. Para a última opção, você pode selecionar se os itens da legenda estão alinhados na ** Parte inferior ** ou no ** Centro **;
- defina o: ref: *símbolo para usar<symbol-selector>* para representação de legenda;
- insira o título na legenda;
- redimensionar as classes a serem usadas: por padrão, o QGIS fornece uma legenda de cinco classes (com base em pausas bonitas naturais), mas você pode aplicar sua própria classificação usando a caixa de seleção | : guilabel: opção *Classes de tamanho manual*. Use o | assinarPlus | e | assinar menos | para definir seus valores e rótulos de classes personalizadas.

Uma visualização da legenda é exibida no painel direito da caixa de diálogo e atualizada conforme você define os parâmetros. Para legenda recolhida, uma linha de chamada do centro horizontal do símbolo até o texto da legenda correspondente é desenhada.

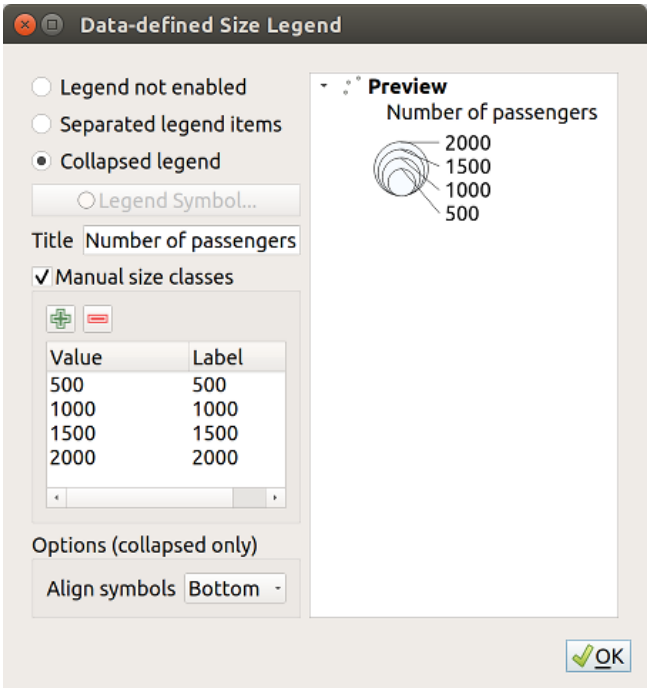


Figura14.17: Configurando legenda em tamanho dimensionado

Nota: Atualmente, a legenda do tamanho definido pelos dados para a simbologia de camada só pode ser aplicada à camada de ponto usando uma simbologia única, categorizada ou graduada.

Desenhar efeitos

Para melhorar a renderização da camada e evitar (ou pelo menos reduzir) o recurso a outro software para a renderização final dos mapas, o QGIS fornece outra funcionalidade poderosa: os | Efeitos de pintura | : guilabel: opções *Efeitos de desenho*, que adicionam efeitos de pintura para personalizar a visualização de camadas vetoriais.

A opção está disponível na caixa de diálogo: seleção de menus: *Propriedades da camada-> Simbologia*, no grupo: ref:` Renderização de camada <layer_rendering>`(aplicável a toda a camada) ou em: ref:` propriedades da camada de símbolo<symbol-selector> `(aplicável às correspondentes recursos). Você pode combinar os dois usos.

Paint effects can be activated by checking the *Draw effects* option and clicking the Customize effects button. That will open the *Effect Properties* Dialog (see Fig.14.18). The following effect types, with custom options are available:

- ** Origem **: desenha o estilo original do recurso de acordo com a configuração das propriedades da camada. O: guilabel: *Opacidade* do seu estilo pode ser ajustado assim como: ref:` Modo de mistura` e: ref: *Modo Draw*. Essas são propriedades comuns para todos os tipos de efeitos.

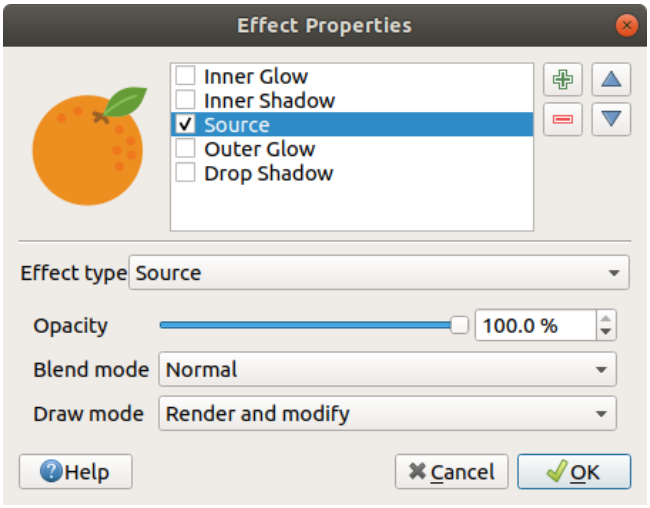


Figura14.18: Efeitos de desenho: caixa de diálogo Origem

- ** Desfoque **: adiciona um efeito de desfoque na camada vetorial. As opções personalizadas que você pode alterar são: guilabel: `Tipo de desfoque` (: guilabel:`Desfoque de pilha (fast) *ou: guilabel:* Desfoque Gaussiano (qualidade) ) *e: guilabel:`Força do borrão*.

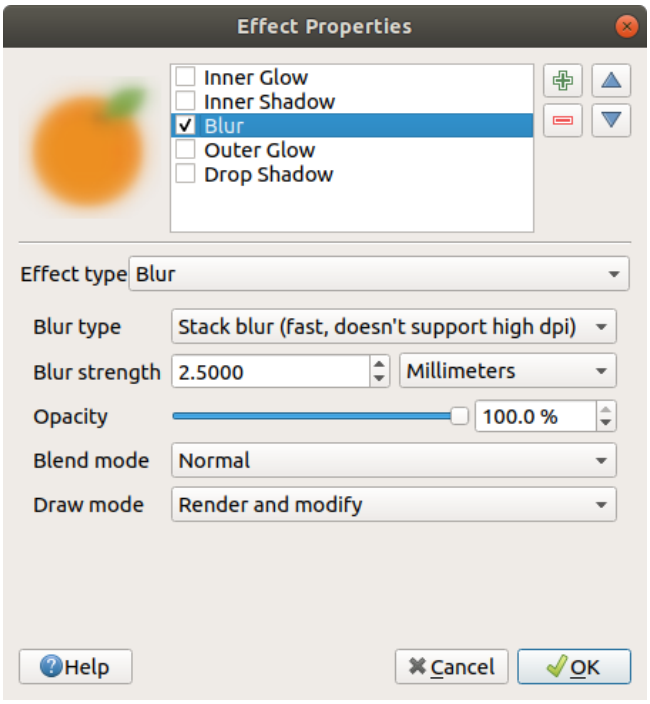


Figura14.19: Efeitos de desenho: caixa de diálogo Blur

- ** Colorizar **: esse efeito pode ser usado para criar uma versão do estilo usando uma única tonalidade. A base sempre será uma versão em escala de cinza do símbolo e você pode:
  - Use o | selecione String | : guilabel: *Escala de cinza* para selecionar como criá-la: as opções são 'Por luminosidade', 'Por luminosidade', 'Por média' e 'Desligado'.
  - Se | caixa de seleção | : guilabel: *Colorise* está selecionado, será possível misturar outra cor e escolher quão forte ela deve ser.
  - Controle os níveis: guilabel: *Brilho*,: guilabel:` Contraste` e: guilabel: *Saturaturação* do símbolo resultante.

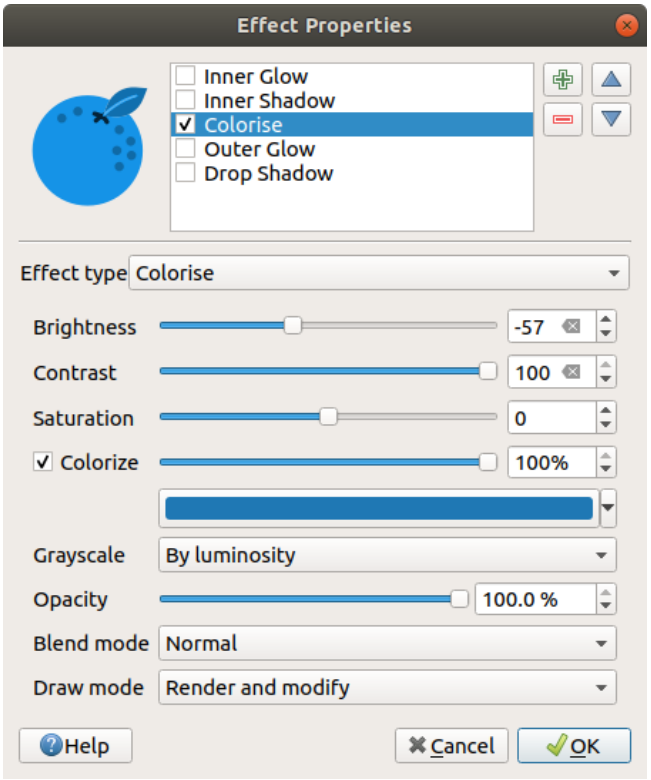


Figura14.20: Efeitos de desenho: caixa de diálogo Colorir

- ** Sombra projetada **: o uso desse efeito adiciona uma sombra ao recurso, que parece adicionar uma dimensão extra. Este efeito pode ser personalizado alterando o: guilabel: ângulo e distância do ` Deslocamento ‘, determinando para onde a sombra se desloca e a proximidade do objeto de origem. : menuselection: *Drop Shadow* também tem a opção de alterar: guilabel:` Raio de desfoque` e: guilabel: *Corr* do efeito.

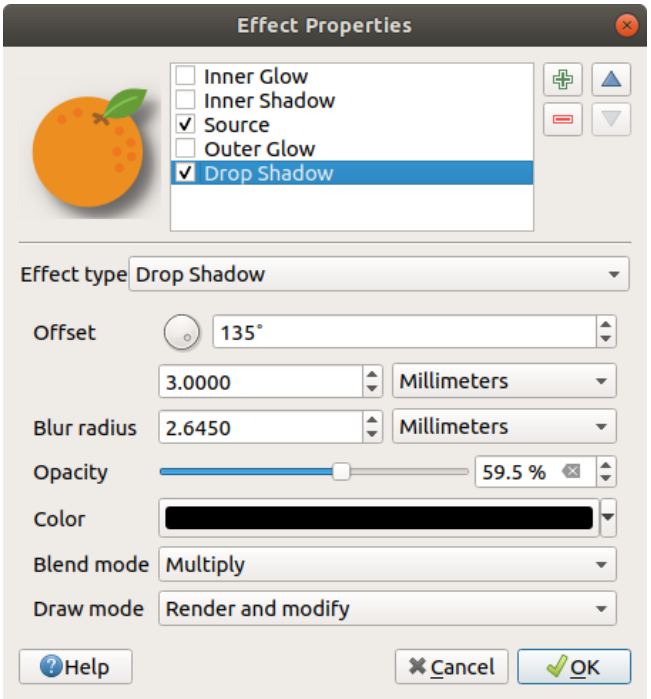


Figura14.21: Caixa de diálogo Efeitos de desenho: Sombra projetada

- ** Sombra interior**: Este efeito é semelhante ao efeito: guilabel: *Drop Shadow*, mas adiciona o efeito de sombra na parte interna das bordas do recurso. As opções disponíveis para personalização são as mesmas do efeito: guilabel: *Sombra projetada*.

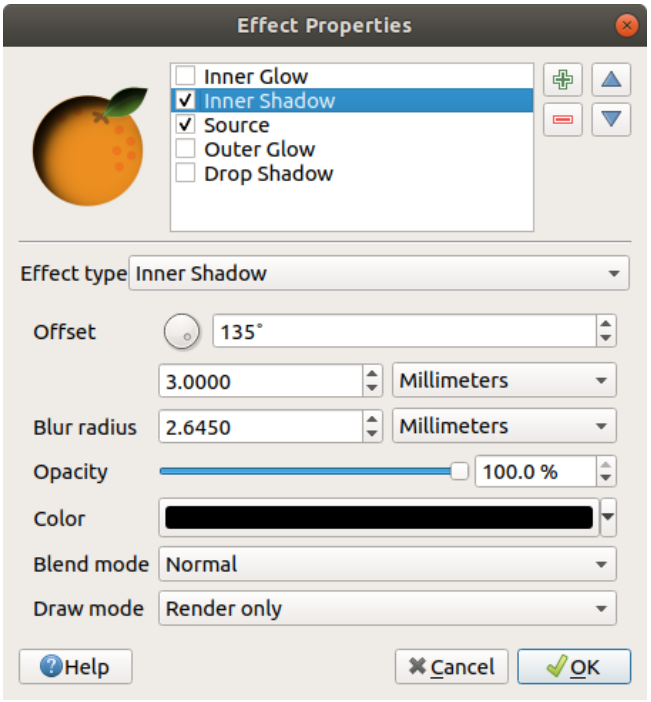


Figura14.22: Caixa de diálogo Efeitos de desenho: Sombra interna

- ** Brilho interno **: adiciona um efeito de brilho dentro do recurso. Este efeito pode ser personalizado ajustando: guilabel: *Espalhe* (largura) do brilho ou: guilabel:` Raio de desfoque`. Este último especifica a proximidade da borda do recurso em que você deseja que ocorra qualquer desfoque. Além disso, existem opções para personalizar a cor do brilho usando a: guilabel: *Única cor* ou a: guilabel:` Rampa de cores`.

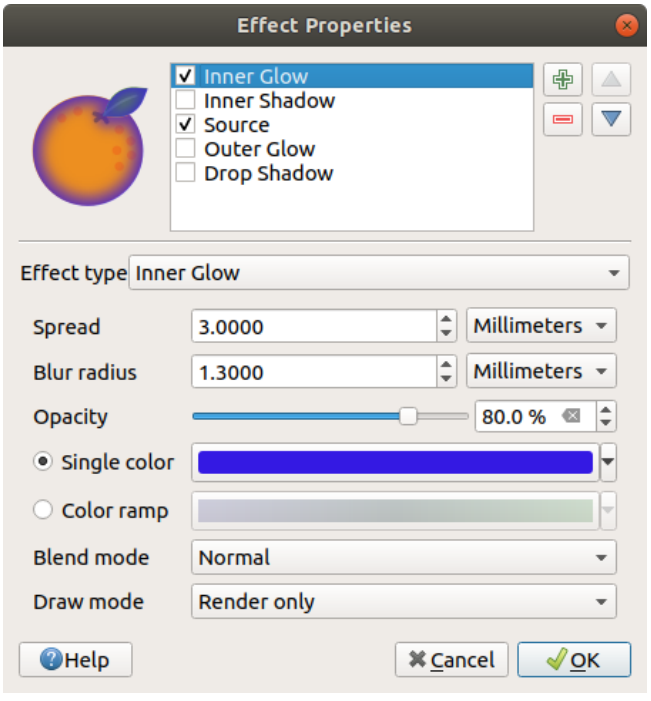


Figura14.23: Caixa de diálogo Efeitos de desenho: Brilho interno

- ** Brilho externo **: Este efeito é semelhante ao efeito: guilabel: *Brilho interno*, mas adiciona o efeito de brilho na parte externa das bordas do recurso. As opções disponíveis para personalização são as mesmas do efeito: guilabel: *Brilho interior*.

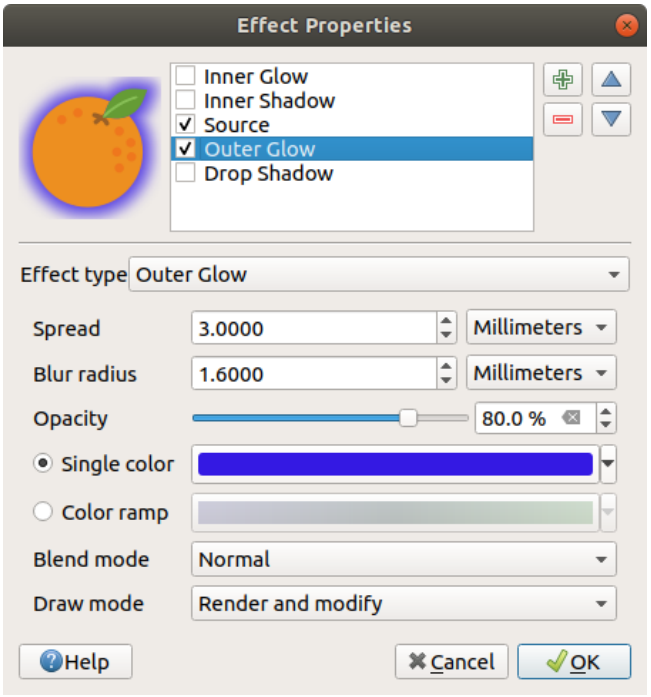


Figura14.24: Caixa de diálogo Draw Effects: Brilho externo

- **Transform**: Adds the possibility of transforming the shape of the symbol. The first options available for customization are the *Reflect horizontal* and *Reflect vertical*, which actually create a reflection on the horizontal and/or vertical axes. The other options are:
  - : guilabel: *Shear X, Y*: inclina o recurso ao longo do eixo X e / ou Y.
  - *Scale X,Y*: Enlarges or minimizes the feature along the X and/or Y axis by the given percentage.
  - : guilabel: *Rotação*: gira o recurso em torno de seu ponto central.
  - e: guilabel: “Traduzir X, Y” altera a posição do item com base na distância indicada no eixo X e / ou Y.

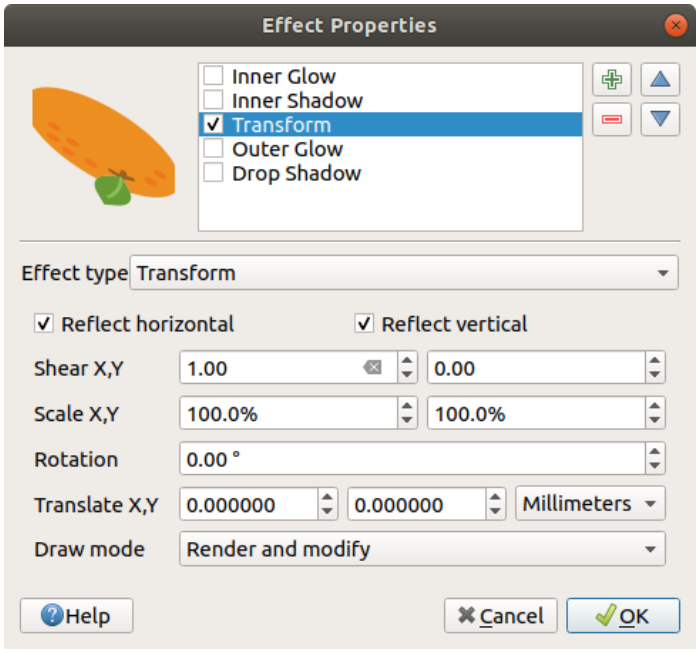


Figura14.25: Caixa de diálogo Efeitos de desenho: transformação

Um ou mais tipos de efeito podem ser usados ao mesmo tempo. Você (des) ativa um efeito usando sua caixa de seleção na lista de efeitos. Você pode alterar o tipo de efeito selecionado usando o | selecione String | : guilabel: opção *Tipo de efeito*. Você pode reordenar os efeitos usando | seta para cima | : sup: *Mover para cima* e | seta para baixo | : sup: botões *Mover para baixo* e também adicionar / remover efeitos usando o | assinar mai | : sup: *Adicionar novo efeito* e | assinar menos | : sup: botões *Remover efeito*.

Existem algumas opções comuns disponíveis para todos os tipos de efeito de desenho. As opções: guilabel: *Opacidade* e: guilabel:` Modo de mistura` funcionam de maneira semelhante às descritas em: ref: *renderização de camada* e podem ser usadas em todos os efeitos de desenho, exceto o de transformação.

Há também uma |selecione String | : guilabel: opção `Draw mode 'disponível para todos os efeitos, e você pode optar por renderizar e / ou modificar o símbolo, seguindo algumas regras:

- Os efeitos são renderizados de cima para baixo.
- *Render only* mode means that the effect will be visible.
- *Modifier only* mode means that the effect will not be visible but the changes that it applies will be passed to the next effect (the one immediately below).
- O modo: guilabel: *Renda e modifique* tornará o efeito visível e passará as alterações para o próximo efeito. Se o efeito estiver no topo da lista de efeitos ou se o efeito imediatamente acima não estiver no modo de modificação, ele usará o símbolo de origem original nas propriedades das camadas (semelhante à origem).

14.1.4 Propriedades das etiquetas

A rotulagem | : guilabel: As propriedades *Etiquetas* fornecem todos os recursos necessários e adequados para configurar a etiquetagem inteligente em camadas vetoriais. Essa caixa de diálogo também pode ser acessada no painel: guilabel: *Estilo da camada* ou usando o rótulo | : sup: botão *Opções de rotulagem de camada* da barra de ferramentas ** Etiquetas **.

O primeiro passo é escolher o método de rotulagem na lista suspensa. Os métodos disponíveis são:

- *No labels*: the default value, showing no labels from the layer
- *Single labels*: Show labels on the map using a single attribute or an expression
- **|com base em regras|** : ref: *Rotulagem baseada em regras<rule_based_labeling>*

- e | rotulagem Obstáculo | : guilabel: *Bloqueio*: permite definir uma camada apenas como um obstáculo para os rótulos de outras camadas sem renderizar nenhum rótulo próprio.

As próximas etapas pressupõem que você selecione a | etiqueta | : guilabel: opção *Etiquetas únicas*, abrindo a seguinte caixa de diálogo.

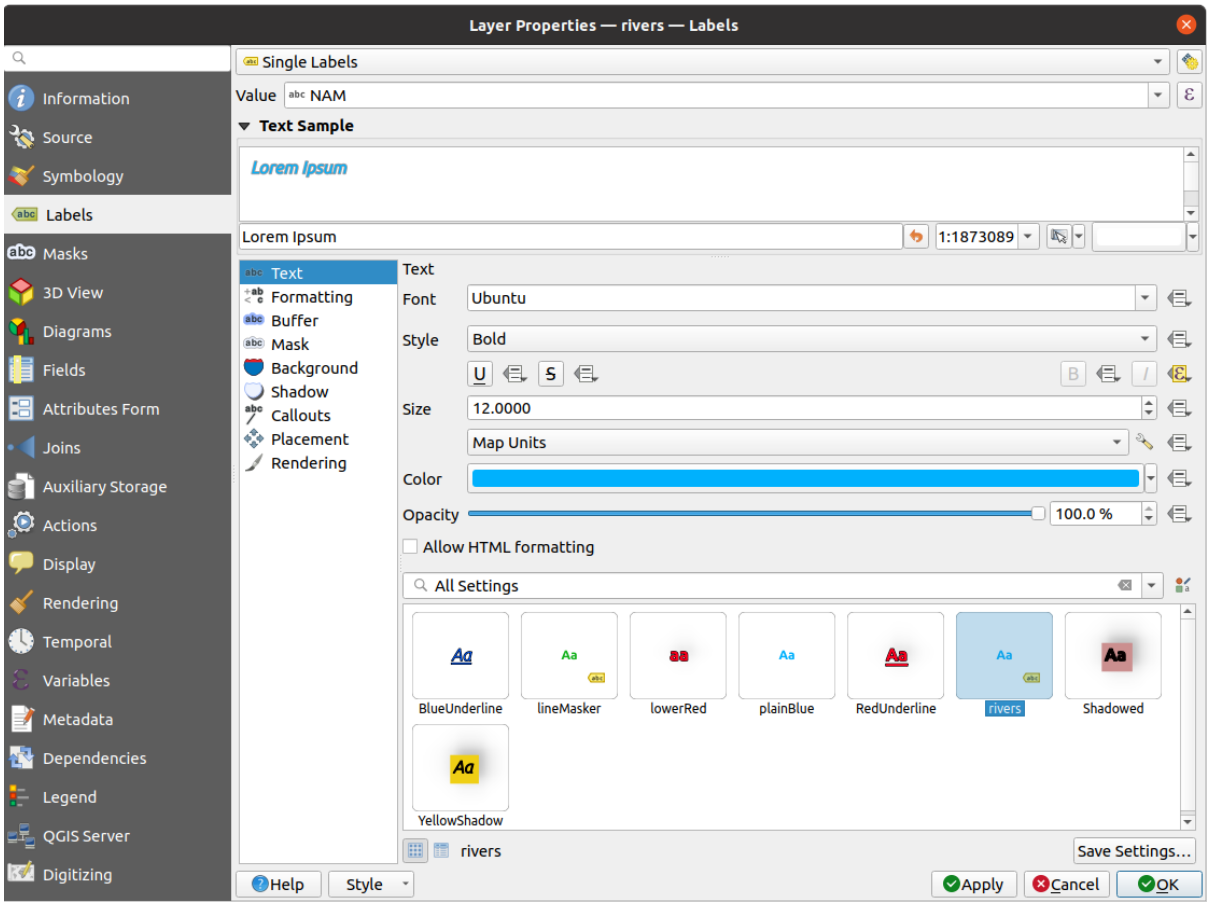


Figura14.26: Configurações de rotulagem de camada - Etiquetas únicas

Na parte superior da caixa de diálogo, uma lista suspensa: guilabel: *Valor* está ativada. Você pode selecionar uma coluna de atributo a ser usada para rotular. Por padrão, o: ref: *campo de exibição<maptips>* é usado. Clique em | expressão | se você deseja definir rótulos com base em expressões - Veja: ref: *rotulando com expressões*.

Abaixo estão as opções exibidas para personalizar os rótulos, em várias guias:

- texto | : ref: *Texto<labels_text>*
- formatação de etiquetas | : ref: *Formatação<labels_formatting>*
- *Buffer*
- *Mask*
- *Background*
- *Shadow*
- *Callouts*
- *Placement*
- *Rendering*

A descrição de como definir cada propriedade é exposta em: ref: *showlabels*.

Configurando o mecanismo de posicionamento automatizado

You can use the automated placement settings to configure a project-level automated behavior of the labels. In the top right corner of the *Labels* tab, click the Automated placement settings (applies to all layers) button, opening a dialog with the following options:

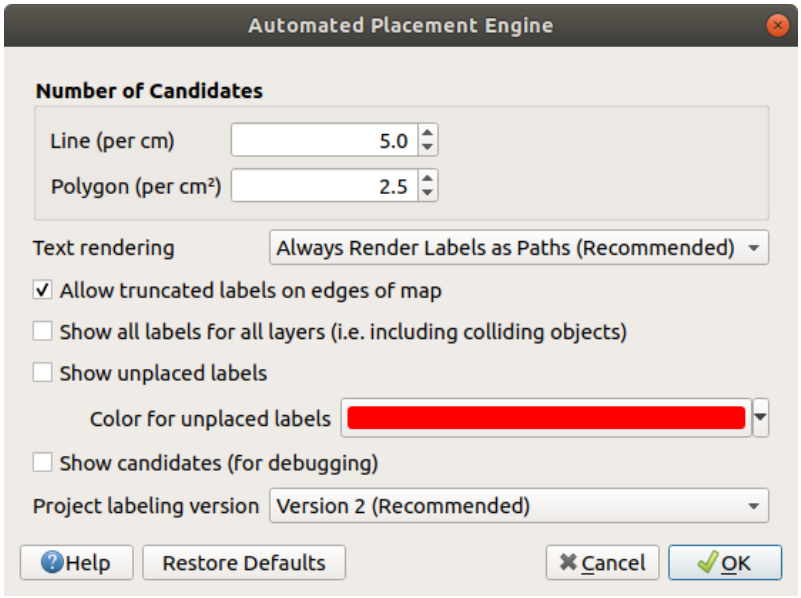


Figura14.27: O mecanismo de posicionamento automatizado de etiquetas

- *Number of candidates*: calculates and assigns to line and polygon features the number of possible labels placement based on their size. The longer or wider a feature is, the more candidates it has, and its labels can be better placed with less risk of collision.
- : guilabel: *Renderização de texto*: define o valor padrão para os widgets de renderização de etiquetas quando: ref:` exportando uma tela de mapa <exportingmapcanvas>`ou: ref:` um layout <create-output>`para PDF ou SVG. Se: guilabel: *Sempre renderizar rótulos como texto* estiver selecionado, os rótulos poderão ser editados em aplicativos externos (por exemplo, Inkscape) como texto normal. MAS o efeito colateral é que a qualidade da renderização diminui e há problemas com a renderização quando certas configurações de texto, como buffers, estão em vigor. É por isso que: guilabel: *Sempre renderize rótulos como caminhos (recomendado)* que exporta rótulos como contornos, é recomendado.
- *Allow truncated labels on edges of map*: controls whether labels which fall partially outside of the map extent should be rendered. If checked, these labels will be shown (when there's no way to place them fully within the visible area). If unchecked then partially visible labels will be skipped. Note that this setting has no effects on labels' display in the *layout map item*.
- |desmarcado | : guilabel: *Mostrar todos os rótulos para todas as camadas (isto é, incluindo objetos em colisão)*. Observe que esta opção também pode ser definida por camada (consulte: ref: *etiquetas que rendem*)
- *Show unplaced labels*: allows to determine whether any important labels are missing from the maps (e.g. due to overlaps or other constraints). They are displayed using a customizable color.
- *Show candidates (for debugging)*: controls whether boxes should be drawn on the map showing all the candidates generated for label placement. Like the label says, it's useful only for debugging and testing the effect different labeling settings have. This could be handy for a better manual placement with tools from the *label toolbar*.
- *Project labeling version*: QGIS supports two different versions of label automatic placement:

- *Version 1*: the old system (used by QGIS versions 3.10 and earlier, and when opening projects created in these versions in QGIS 3.12 or later). Version 1 treats label and obstacle priorities as "rough guides" only, and it's possible that a low-priority label will be placed over a high-priority obstacle in this version. Accordingly, it can be difficult to obtain the desired labeling results when using this version and it is thus recommended only for compatibility with older projects.
- *Version 2 (recommended)*: this is the default system in new projects created in QGIS 3.12 or later. In version 2, the logic dictating when labels are allowed to overlap *obstacles* has been reworked. The newer logic forbids any labels from overlapping any obstacles with a greater obstacle weight compared to the label's priority. As a result, this version results in much more predictable and easier to understand labeling results.

Rotulagem baseada em regras

Com a rotulagem baseada em regras, várias configurações de rótulos podem ser definidas e aplicadas seletivamente na base dos filtros de expressão e no intervalo de escala, como em: ref: *Renderização baseada em regras<rule_based_rendering>*.

Para criar uma regra, selecione o | com base em regras | ** Rotulagem baseada em regras ** na lista suspensa principal da guia: guilabel: *Etiquetas* e clique no | assinar Maior | botão na parte inferior da caixa de diálogo. Em seguida, preencha o novo diálogo com uma descrição e uma expressão para filtrar os recursos. Você também pode definir um: ref: *escala range <label_scaledepend>'no qual a regra do rótulo deve ser aplicada. As outras opções disponíveis nesta caixa de diálogo são: ref: `configurações comuns<showlabels>* vistas anteriormente.

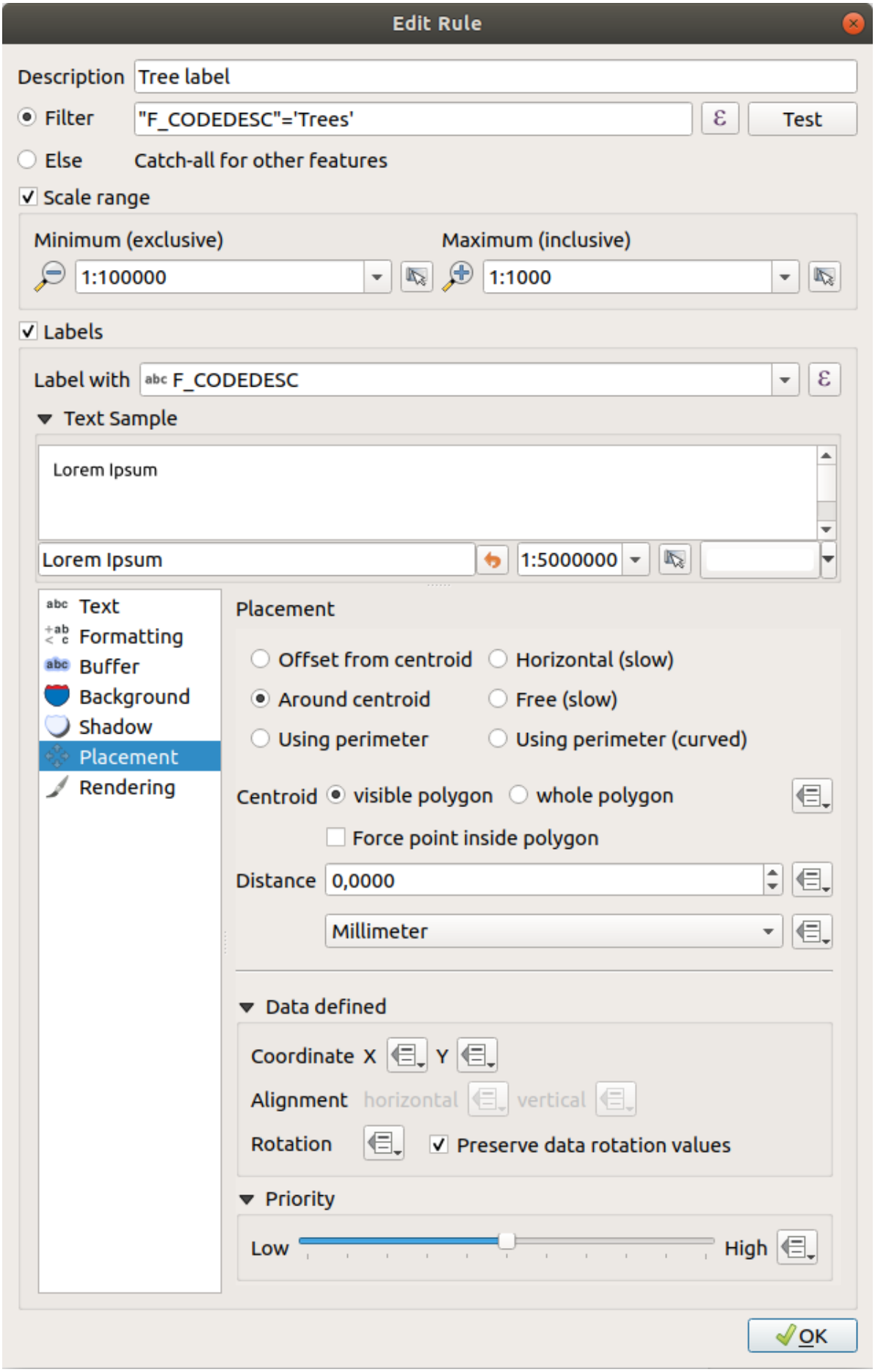


Figura14.28: Configurações de regra

A summary of existing rules is shown in the main dialog (see Fig.14.29). You can add multiple rules, reorder or imbricate them with a drag-and-drop. You can as well remove them with the button or edit them with button or a double-click.

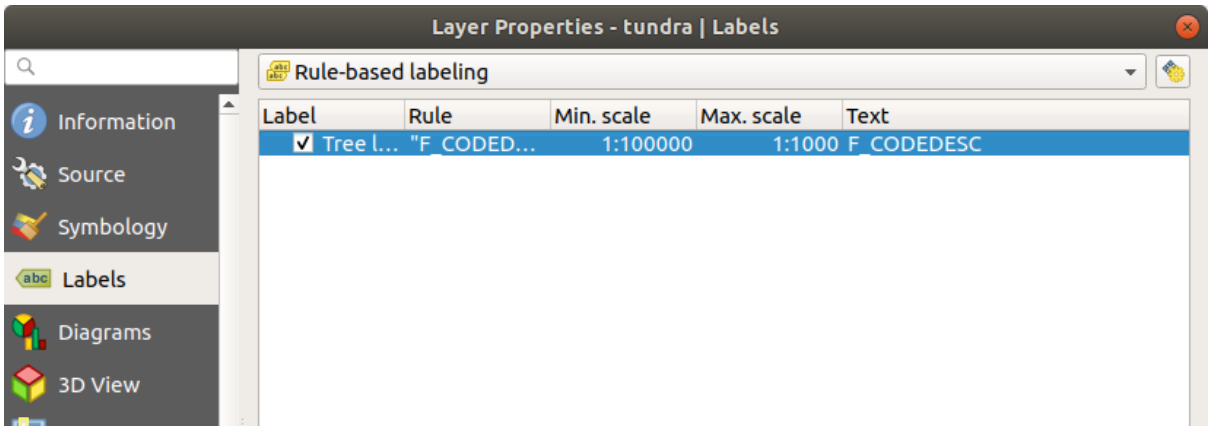


Figura14.29: Painel de rotulagem baseado em regras

Definir rótulos com base em expressões

Se você escolhe o tipo de rotulagem única ou baseada em regras, o QGIS permite o uso de expressões para rotular os recursos.

Supondo que você esteja usando o método: guilabel: *Etiquetas individuais*, clique no | expressão | próximo à lista suspensa: guilabel: *Valor* na | etiqueta | : guilabel: guia *Etiquetas* da caixa de diálogo de propriedades.

In Fig.14.30, you see a sample expression to label the alaska trees layer with tree type and area, based on the field 'VEGDESC', some descriptive text, and the function `$area` in combination with `format_number()` to make it look nicer.

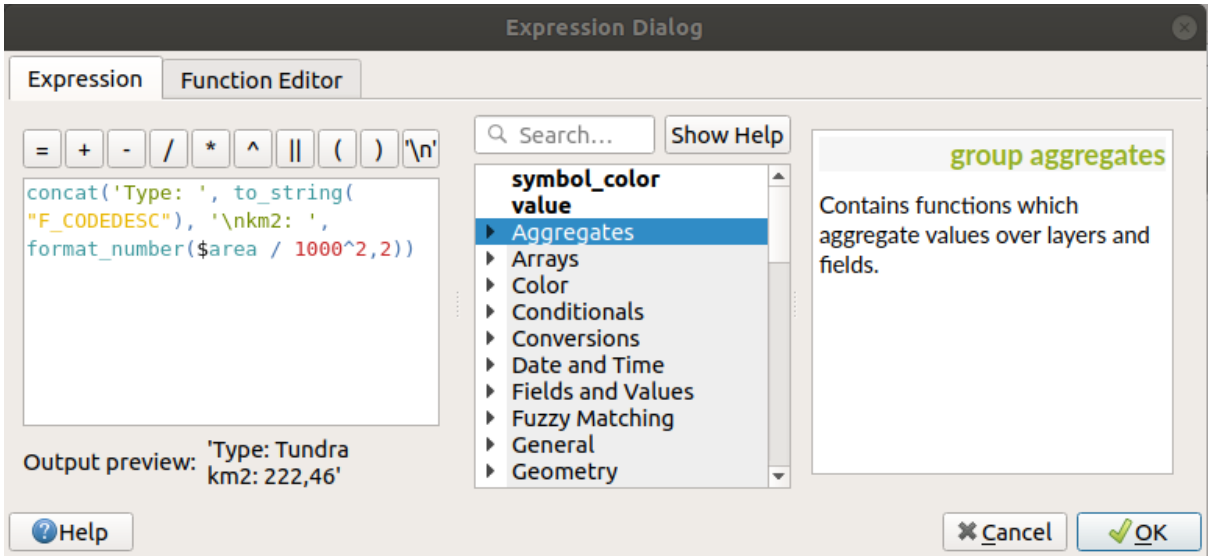


Figura14.30: Usando expressões para rotular

É fácil trabalhar com etiquetas baseadas em expressões. Tudo o que você precisa cuidar é o seguinte:

- Pode ser necessário combinar todos os elementos (strings, campos e funções) com uma função de concatenação de strings, como `` concat``, `` + `` ou `` || ``. Esteja ciente de que, em algumas situações (quando houver valor nulo ou numérico), nem todas essas ferramentas atenderão à sua necessidade.

- As strings são escritas em 'aspas simples'.
- Os campos são escritos em "aspas duplas" ou sem aspas.

Vamos dar uma olhada em alguns exemplos:

1. Rótulo com base em dois campos 'nome' e 'local' com uma vírgula como separador:

```
"name" || ', ' || "place"
```

   Retorna :

```
John Smith, Paris
```

2. Rótulo com base em dois campos 'nome' e 'local' com outros textos:

```
'My name is ' + "name" + 'and I live in ' + "place"
'My name is ' || "name" || 'and I live in ' || "place"
concat('My name is ', name, ' and I live in ', "place")
```

   Retorna :

```
My name is John Smith and I live in Paris
```

3. Rótulo com base em dois campos 'nome' e 'local' com outros textos que combinam diferentes funções de concatenação:

```
concat('My name is ', name, ' and I live in ' || place)
```

   Retorna :

```
My name is John Smith and I live in Paris
```

   Ou, se o campo 'local' for NULO, retornará:

```
My name is John Smith
```

4. Rótulo de várias linhas com base em dois campos 'nome' e 'local' com um texto descritivo:

```
concat('My name is ', "name", '\n' , 'I live in ' , "place")
```

   Retorna :

```
My name is John Smith
I live in Paris
```

5. Rótulo com base em um campo e na função $ area para mostrar o nome do local e seu tamanho da área arredondada em uma unidade convertida:

```
'The area of ' || "place" || ' has a size of '
|| round($area/10000) || ' ha'
```

   Retorna :

```
The area of Paris has a size of 10500 ha
```

6. Crie uma condição CASE ELSE. Se o valor da população no campo "população" for <= 50000, é uma cidade, caso contrário, é uma cidade:

```
concat('This place is a ',
CASE WHEN "population" <= 50000 THEN 'town' ELSE 'city' END)
```

   Retorna :

```
This place is a town
```

7. Nome para exibição das cidades e nenhum rótulo para os outros recursos (para o contexto “cidade”, veja o exemplo acima):

```
CASE WHEN "population" > 50000 THEN "NAME" END
```

Retorna :

```
Paris
```

Como você pode ver no construtor de expressões, você tem centenas de funções disponíveis para criar expressões simples e muito complexas para rotular seus dados no QGIS. Veja o capítulo ref: *vector_expressions* para mais informações e exemplos sobre expressões.

Usando substituição definida por dados para rotular

Com o | dadosDefinidos | : sup: função “Substituição definida dos dados”, as configurações para a rotulagem são substituídas pelas entradas na tabela de atributos ou pelas expressões baseadas nelas. Esse recurso pode ser usado para definir valores para a maioria das opções de rotulagem descritas acima.

Por exemplo, usando o conjunto de dados de amostra QGIS do Alasca, vamos rotular a camada: file: *aeroportos* com seu nome, com base em seu militar` *USE*`, ou seja, se o aeroporto está acessível para:

- militares, em seguida, exibi-lo na cor cinza, tamanho 8;
- outros, em seguida, mostrar na cor azul, tamanho 10.

Para fazer isso, depois de habilitar a identificação no campo `` NAME`` da camada (consulte: ref: *showlabels*):

1. Ative a guia: guilabel: *Texto*.
2. Clique no | dadosDefinidos | ícone ao lado da propriedade: guilabel: *Tamanho*.
3. Selecione: guilabel: *Edit* … e digite

```
CASE
  WHEN "USE" like '%Military%' THEN 8 -- because compatible values are
↪'Military'
                                    -- and 'Joint Military/Civilian'
  ELSE 10
END
```

4. Pressione: guilabel: *OK* para validar. A caixa de diálogo é fechada e o | dadosDefinidos | o botão se torna | data Definir expressão ativada | significando que uma regra está sendo executada.
5. Em seguida, clique no botão ao lado da propriedade color, digite a expressão abaixo e valide:

```
CASE
  WHEN "USE" like '%Military%' THEN '150, 150, 150'
  ELSE '0, 0, 255'
END
```

Da mesma forma, você pode personalizar qualquer outra propriedade do rótulo da maneira que desejar. Veja mais detalhes sobre o | dadosDefinidos | : sup: descrição e manipulação do ferramenta *Substituição de definição de dados* na seção: ref:` data_defined`.

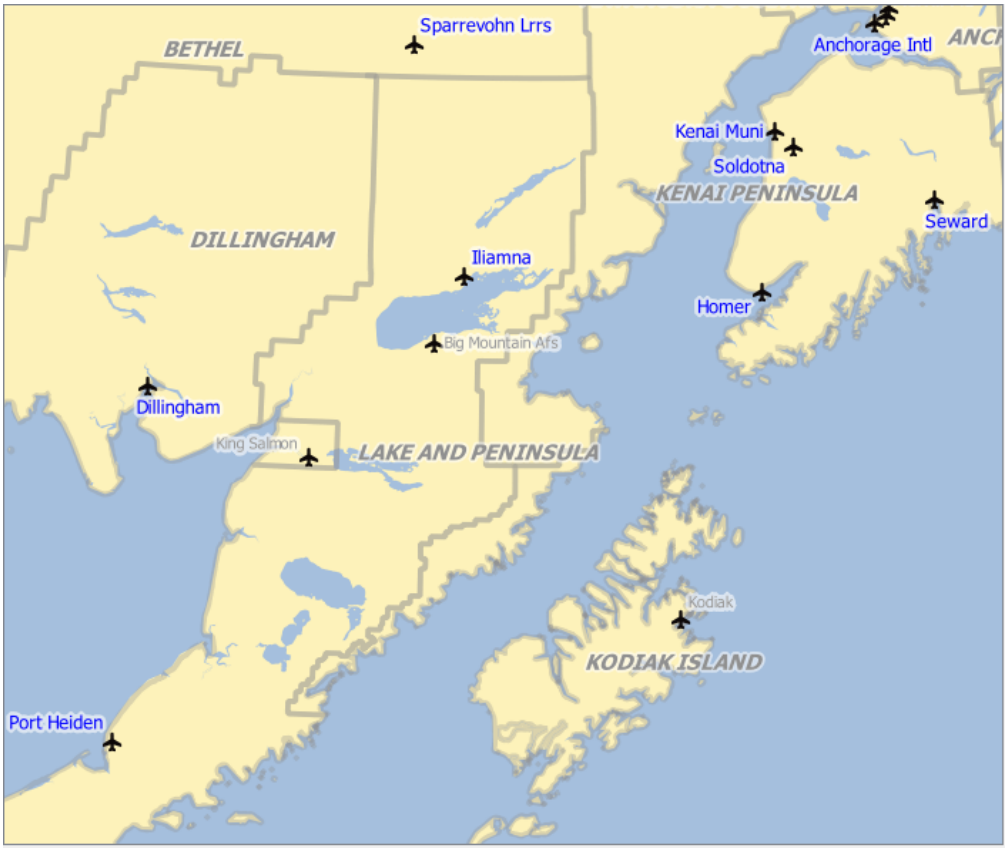


Figura14.31: Os rótulos dos aeroportos são formatados com base em seus atributos

---

Dica: ** Use a substituição definida por dados para rotular todas as partes dos recursos de várias partes **

Há uma opção para definir a rotulagem para recursos de várias partes independentemente das propriedades da sua etiqueta. Escolha o | render | : ref: *Renderização<labels_rendering>*, `` Opções de recursos``, vá para | dadosDefinidos | : sup: botão *Substituição de definição de dados* ao lado da caixa de seleção | desmarcado | : guilabel: *Rotule todas as partes dos recursos de várias partes* e defina os rótulos como descrito em: ref:` data_defined`.

A barra de ferramentas Rótulo

A: guilabel: *Barra de Ferramentas de Etiqueta* fornece algumas ferramentas para manipular | etiquetagem | : ref:<vector_labels_tab> *etiqueta* ou | diagrama | : ref:<sec_diagram> propriedades do *diagrama*.



Figura14.32: A barra de ferramentas Rótulo

Embora, para facilitar a leitura, `Rótulo` tenha sido usado abaixo para descrever a barra de ferramentas Rótulo, observe que, quando mencionadas em seu nome, as ferramentas funcionam quase da mesma maneira com os diagramas:

- Highlight Pinned Labels and Diagrams. If the vector layer of the label is editable, then the highlighting is green, otherwise it's blue.
- Toggles Display of Unplaced Labels: Allows to determine whether any important labels are missing from the maps (e.g. due to overlaps or other constraints). They are displayed with a customizable color (see *Configurando o mecanismo de posicionamento automatizado*).

- Pin/Unpin Labels and Diagrams. By clicking or draging an area, you pin label(s). If you click or drag an area holding `Shift`, label(s) are unpinned. Finally, you can also click or drag an area holding `Ctrl` to toggle the pin status of label(s).
- Show/Hide Labels and Diagrams. If you click on the labels, or click and drag an area holding `Shift`, they are hidden. When a label is hidden, you just have to click on the feature to restore its visibility. If you drag an area, all the labels in the area will be restored.
- Moves a Label or Diagram. You just have to drag the label to the desired place.
- Rotates a Label. Click the label and move around and you get the text rotated.
- Change Label Properties. It opens a dialog to change the clicked label properties; it can be the label itself, its coordinates, angle, font, size, multiline alignment … as long as this property has been mapped to a field. Here you can set the option to *Label every part of a feature*.

Aviso: ** As ferramentas de etiqueta substituem os valores atuais do campo **

O uso da barra de ferramentas: guilabel: *Rótulo* para personalizar a rotulagem realmente grava o novo valor da propriedade no campo mapeado. Portanto, tenha cuidado para não substituir inadvertidamente os dados necessários posteriormente!

Nota: O mecanismo: ref: *vector_auxiliary_storage* pode ser usado para personalizar a identificação (posição e assim por diante) sem modificar a fonte de dados subjacente.

Personalizar os rótulos da tela do mapa

Combined with the *Label Toolbar*, the data defined override setting helps you manipulate labels in the map canvas (move, edit, rotate). We now describe an example using the data-defined override function for the Move label function (see Fig.14.33).

1. Importe: file: *lakes.shp* do conjunto de dados de amostra do QGIS.
2. Clique duas vezes na camada para abrir as propriedades da camada. Clique em: guilabel: *Etiquetas* e: guilabel:*Canal*. Selecione **|botão de opção Ativado|** : guilabel: *Deslocamento do centróide*.
3. Procure as entradas: guilabel: *Dados definidos*. Clique no | Dadosdefinidos | ícone para definir o tipo de campo para: guilabel: *Coordenada*. Escolha `` xlabel`` para X e `` ylabel`` para Y. Os ícones agora estão destacados em amarelo.

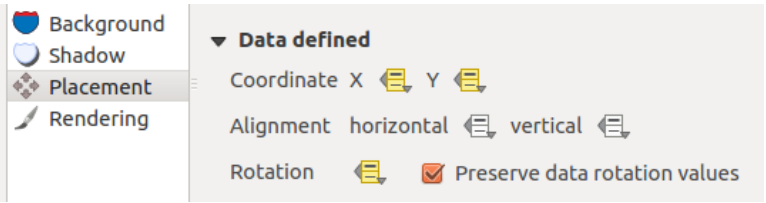


Figura14.33: Rotulagem de camadas de polígono de vetor com substituição definida por dados

4. Zoom em um lago
5. Defina editável a camada usando o | Editar edição | : sup: botão *Alternar edição*.

6. Go to the Label toolbar and click the icon. Now you can shift the label manually to another position (see Fig.14.34). The new position of the label is saved in the `xlabel` and `ylabel` columns of the attribute table.
7. It's also possible to add a line connecting each lake to its moved label using:
   - the label's *callout property*
   - or the *geometry generator symbol layer* with the expression below:

```
make_line( centroid( $geometry ), make_point( "xlabel", "ylabel" ) )
```

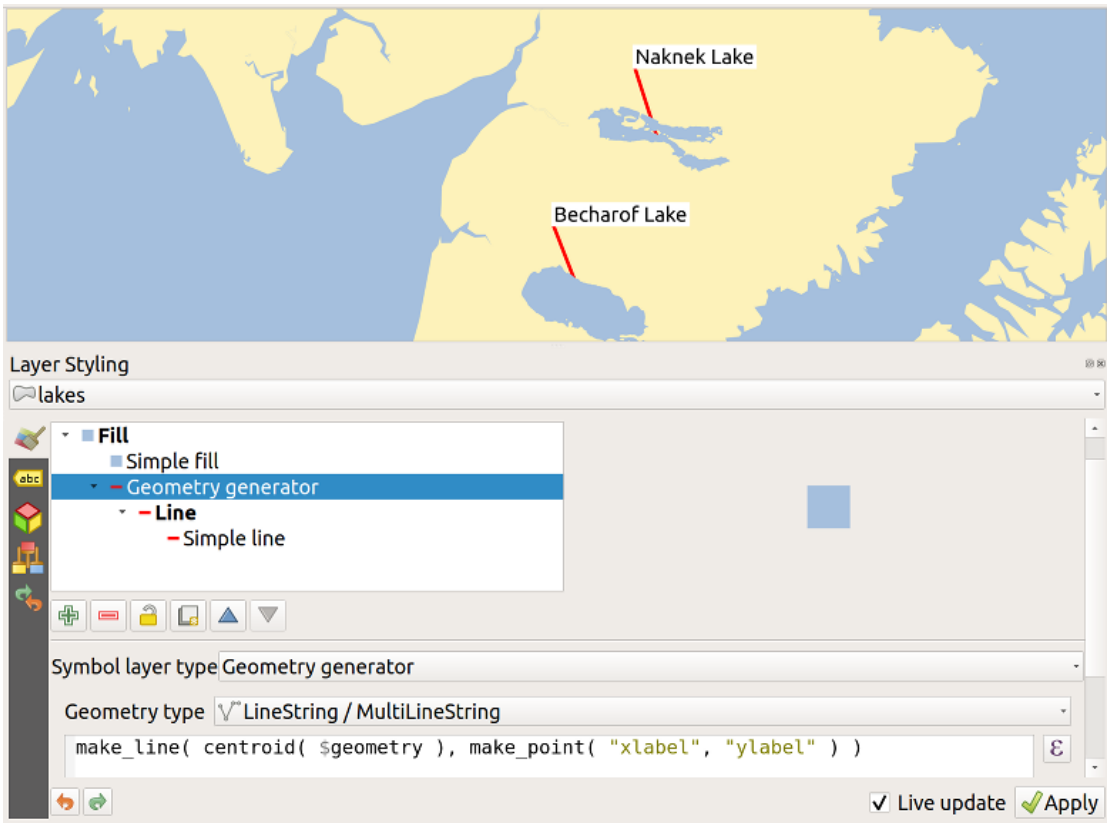


Figura14.34: Etiquetas movidas

Nota: O mecanismo: ref: *vector_auxiliary_storage* pode ser usado com propriedades definidas por dados sem ter uma fonte de dados editável.

14.1.5 Propriedades dos diagramas

The *Diagrams* tab allows you to add a graphic overlay to a vector layer (see Fig.14.35).

A implementação principal atual de diagramas fornece suporte para:

- *No diagrams*: the default value with no diagram displayed over the features;
- *Pie chart*, a circular statistical graphic divided into slices to illustrate numerical proportion. The arc length of each slice is proportional to the quantity it represents;
- abc *Text diagram*, a horizontaly divided circle showing statistics values inside;

- *Histogram*, bars of varying colors for each attribute aligned next to each other
- *Stacked bars*, Stacks bars of varying colors for each attribute on top of each other vertically or horizontally

No canto superior direito da guia: guilabel: *Diagramas*, o | posicionamento automático | O botão: sup: *Configurações automáticas de posicionamento (aplica-se a todas as camadas)* fornece meios para controlar o diagrama: ref: *etiqueta posicionamento<automated_placement>* na tela do mapa.

Dica: ** Alterne rapidamente entre tipos de diagramas **

Como as configurações são quase comuns aos diferentes tipos de diagrama, ao projetar seu diagrama, você pode alterar facilmente o tipo de diagrama e verificar qual é o mais apropriado para seus dados sem perda.

Para cada tipo de diagrama, as propriedades são divididas em várias guias:

- *Attributes*
- : ref: *Renderização<diagram_appearance>*
- *Size*
- *Placement*
- *Options*
- *Legend*

Atributos

: guilabel: *Atributos* define quais variáveis exibir no diagrama. Use | assinarPlus | : sup: botão *adicionar item* para selecionar os campos desejados no painel 'Atributos atribuídos'. Atributos gerados com: ref: *vector_expressions* também podem ser usados.

Você pode mover para cima e para baixo qualquer linha com clique e arraste, classificando como os atributos são exibidos. Você também pode alterar o rótulo na coluna 'Legenda' ou a cor do atributo clicando duas vezes no item.

Esse rótulo é o texto padrão exibido na legenda do layout de impressão ou da árvore de camadas.

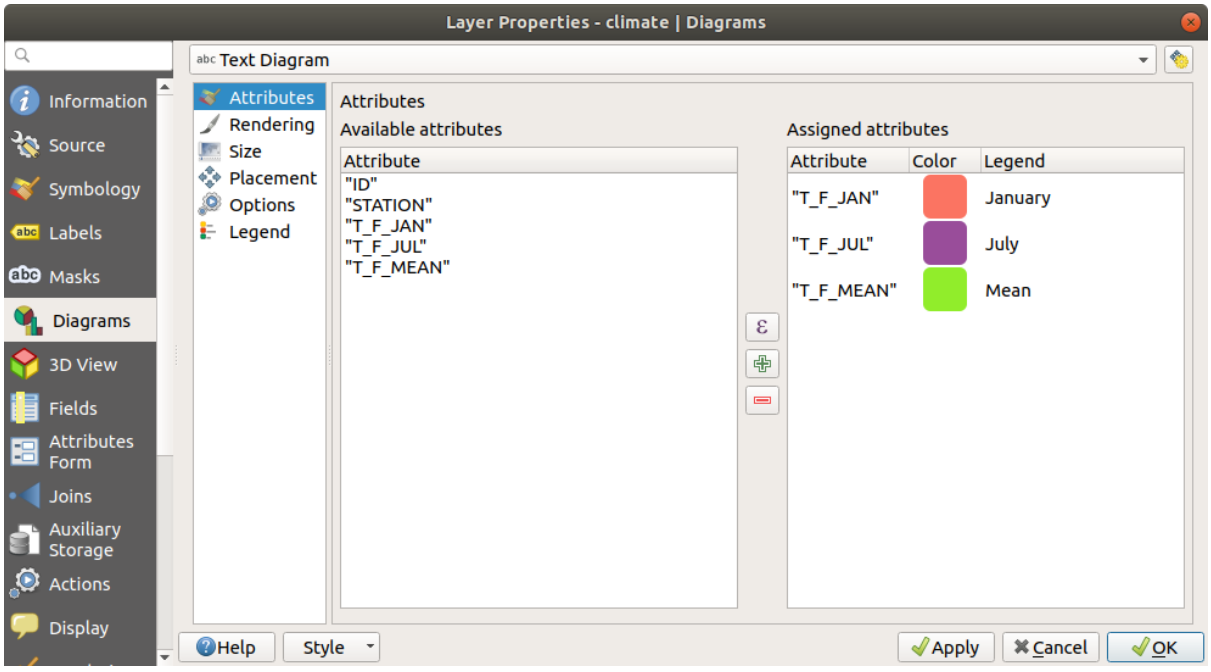


Figura14.35: Diagram properties - Attributes tab

Renderização

Rendering defines how the diagram looks like. It provides general settings that do not interfere with the statistic values such as:

- a opacidade do gráfico, sua largura e cor do contorno;
- depending on the type of diagram:
  - for histogram and stacked bars, the width of the bar and the spacing between the bars. You may want to set the spacing to `0` for stacked bars. Moreover, the *Axis line symbol* can be made visible on the map canvas and customized using *line symbol properties*.
  - for text diagram, the circle background color and the *font* used for texts;
  - for pie charts, the *Start angle* of the first slice and their *Direction* (clockwise or not).
- the use of *paint effects* on the graphics.

Nesta guia, você também pode gerenciar e ajustar a visibilidade do diagrama com diferentes opções:

- : guilabel: *Diagrama z-index*: controla como os diagramas são desenhados um sobre o outro e sobre os rótulos. Um diagrama com um índice alto é desenhado sobre diagramas e etiquetas;
- *Show all diagrams*: shows all the diagrams even if they overlap each other;
- *Show diagram*: allows only specific diagrams to be rendered;
- *Always Show*: selects specific diagrams to always render, even when they overlap other diagrams or map labels;
- configurando: ref: *Visibilidade dependente da escala<label_scaledepend>*;

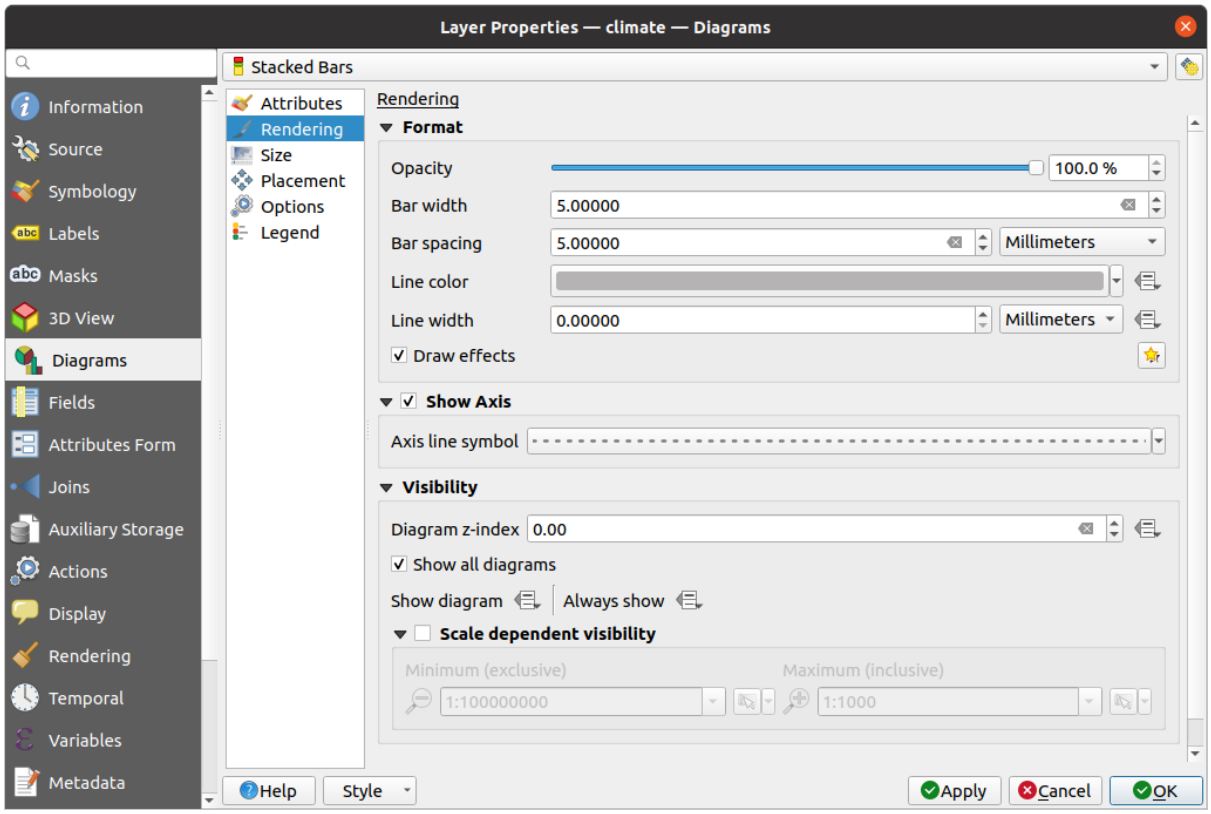


Figura14.36: Propriedades do diagrama - guia Renderização

Tamanho

Size is the main tab to set how the selected statistics are represented. The diagram size *units* can be 'Millimeters', 'Points', 'Pixels', 'Map Units' or 'Inches'. You can use:

- *Fixed size*, a unique size to represent the graphic of all the features (not available for histograms)
- or *Scaled size*, based on an expression using layer attributes:
  1. In *Attribute*, select a field or build an expression
  2. Press *Find* to return the *Maximum value* of the attribute or enter a custom value in the widget.
  3. For histogram and stacked bars, enter a *Bar length* value, used to represent the *Maximum value* of the attributes. For each feature, the bar lenght will then be scaled linearly to keep this matching.
  4. For pie chart and text diagram, enter a *Size* value, used to represent the *Maximum value* of the attributes. For each feature, the circle area or diameter will then be scaled linearly to keep this matching (from `0`). A *Minimum size* can however be set for small diagrams.

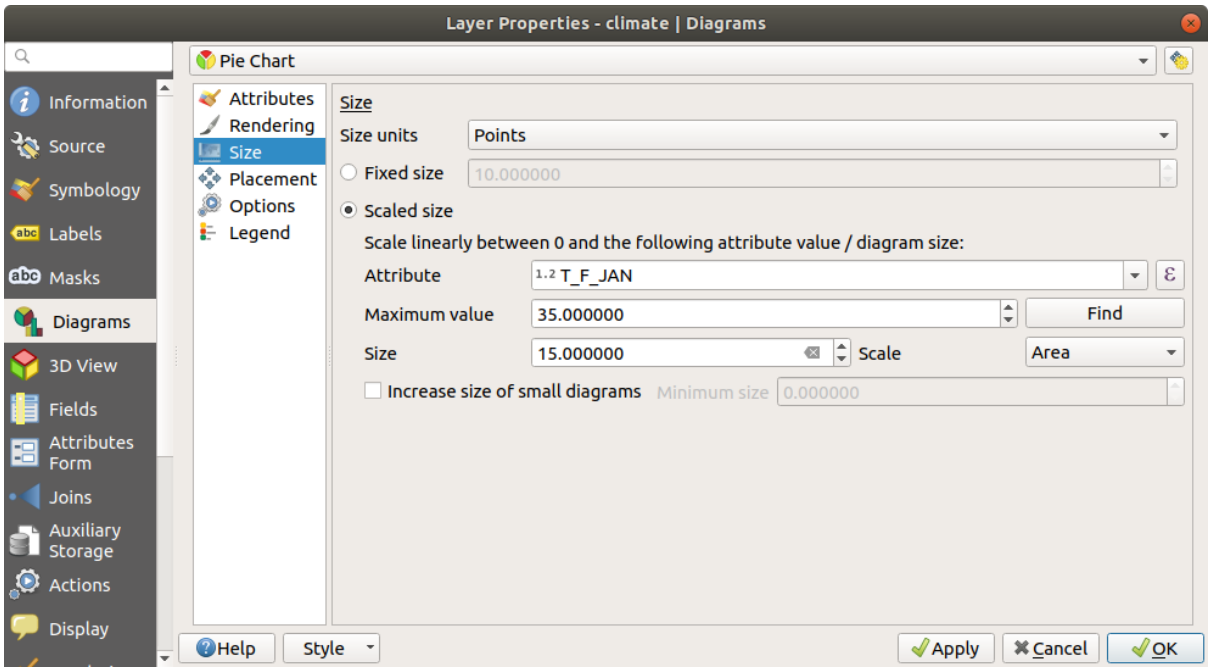


Figura14.37: Propriedades do diagrama - guia Tamanho

Localização

Placement defines the diagram position. Depending on the layer geometry type, it offers different options for the placement (more details at *Placement*):

- *Around point* or *Over point* for point geometry. The former variable requires a radius to follow.
- *Around line* or *Over line* for line geometry. Like point feature, the first variable requires a distance to respect and you can specify the diagram placement relative to the feature ('above', 'on' and/or 'below' the line) It's possible to select several options at once. In that case, QGIS will look for the optimal position of the diagram. Remember that you can also use the line orientation for the position of the diagram.
- *Around centroid* (at a set *Distance*), *Over centroid*, *Using perimeter* and *Inside polygon* are the options for polygon features.

The *Coordinate* group provides direct control on diagram placement, on a feature-by-feature basis, using their attributes or an expression to set the *X* and *Y* coordinate. The information can also be filled using the *Move labels and diagrams* tool.

In the *Priority* section, you can define the placement priority rank of each diagram, ie if there are different diagrams or labels candidates for the same location, the item with the higher priority will be displayed and the others could be left out.

Discourage diagrams and labels from covering features defines features to use as *obstacles*, ie QGIS will try to not place diagrams nor labels over these features. The priority rank is then used to evaluate whether a diagram could be omitted due to a greater weighted obstacle feature.

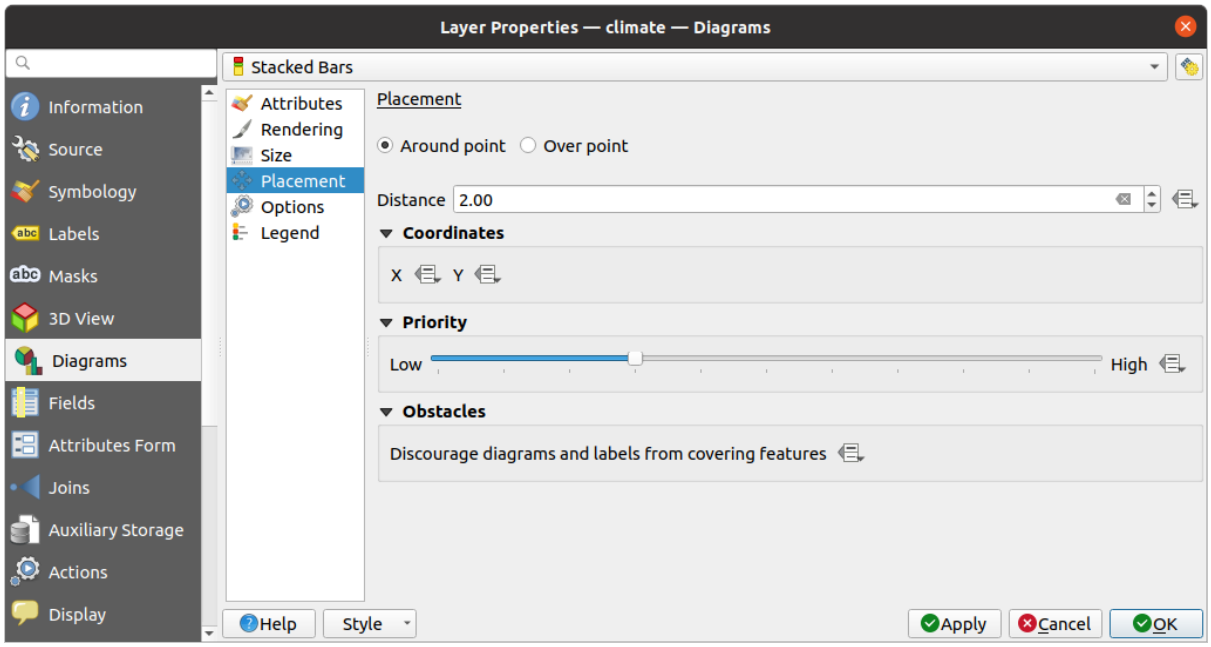


Figura14.38: Caixa de diálogo Propriedades do vetor com propriedades do diagrama, guia Posicionamento

Opções

The *Options* tab has settings for histograms and stacked bars. You can choose whether the *Bar orientation* should be *Up*, *Down*, *Right* or *Left*, for horizontal and vertical diagrams.

Legenda

From the *Legend* tab, you can choose to display items of the diagram in the *Layers panel*, and in the *print layout legend*, next to the layer symbology:

- Verifica: guilabel: *Mostrar entradas de legenda para os atributos do diagrama* para exibir nas legendas as propriedades` *Cor*` e` *Legenda*`, conforme previamente atribuído na guia: guilabel:` Atributos`;
- e, quando um: ref: *tamanho dimensionado<diagram_size>* estiver sendo usado para os diagramas, pressione o botão: guilabel: *Entradas de legenda para o tamanho do diagrama …* para configurar o aspecto do símbolo do diagrama nas legendas. Isso abre a caixa de diálogo: guilabel: *Legenda do tamanho definido por dados* cujas opções são descritas em: ref:` data_defined_size_legend`.

Quando definidos, os itens da legenda do diagrama (atributos com cor e tamanho do diagrama) também são exibidos na legenda do layout de impressão, ao lado da simbologia da camada.

14.1.6 Masks Properties

The *Masks* tab helps you configure the current layer symbols overlay with other symbol layers or labels, from any layer. This is meant to improve the readability of symbols and labels whose colors are close and can be hard to decipher when overlapping; it adds a custom and transparent mask around the items to "hide" parts of the symbol layers of the current layer.

To apply masks on the active layer, you first need to enable in the project either *mask symbol layers* or *mask labels*. Then, from the *Masks* tab, check:

- the *Masked symbol layers*: lists in a tree structure all the symbol layers of the current layer. There you can select the symbol layer item you would like to transparently "cut out" when they overlap the selected mask sources
- the *Mask sources* tab: list all the mask labels and mask symbol layers defined in the project. Select the items that would generate the mask over the selected masked symbol layers

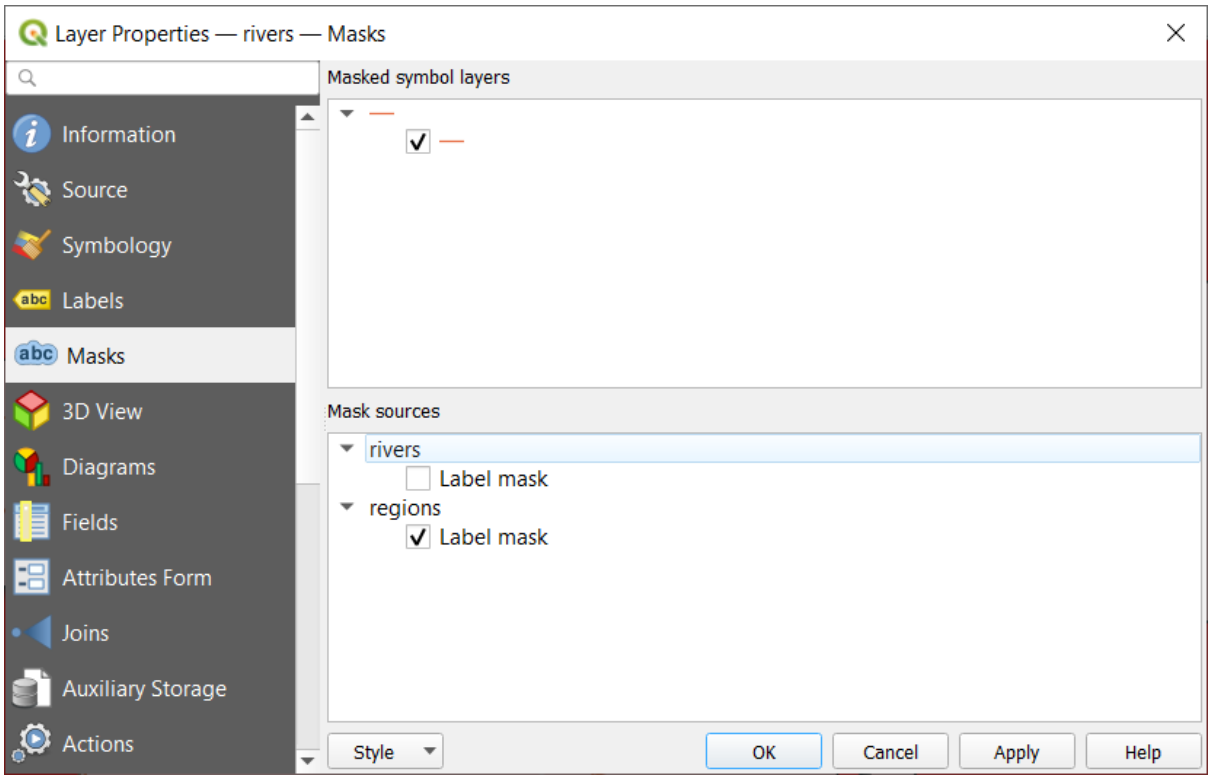


Figura14.39: Layer properties - Masks tab

14.1.7 Propriedades da vista 3D

| 3d | A guia: guilabel: *3D View* fornece configurações para as camadas vetoriais que devem ser representadas na ferramenta: ref:` 3D Map view <label_3dmapview>`.

For better performance, data from vector layers are loaded in the background, using multithreading, and rendered in tiles whose size can be controlled from the *Layer rendering* section of the tab:

- *Zoom levels count*: determines how deep the quadtree will be. For example, one zoom level means there will be a single tile for the whole layer. Three zoom levels means there will be 16 tiles at the leaf level (every extra zoom level multiplies that by 4). The default is `3` and the maximum is `8`.
- *Show bounding boxes of tiles*: especially useful if there are issues with tiles not showing up when they should

Para exibir uma camada em 3D, selecione na caixa de combinação na parte superior da guia:

- *Single symbol*: features are rendered using a common 3D symbol whose properties can be *data-defined* or not. Read details on *setting a 3D symbol* for each layer geometry type.
- : guilabel: *Baseado em regras*: várias configurações de símbolos podem ser definidas e aplicadas seletivamente com base em filtros de expressão e escala de escala. Mais detalhes sobre como fazer em: ref: *Renderização baseada em regras<rule_based_rendering>*.

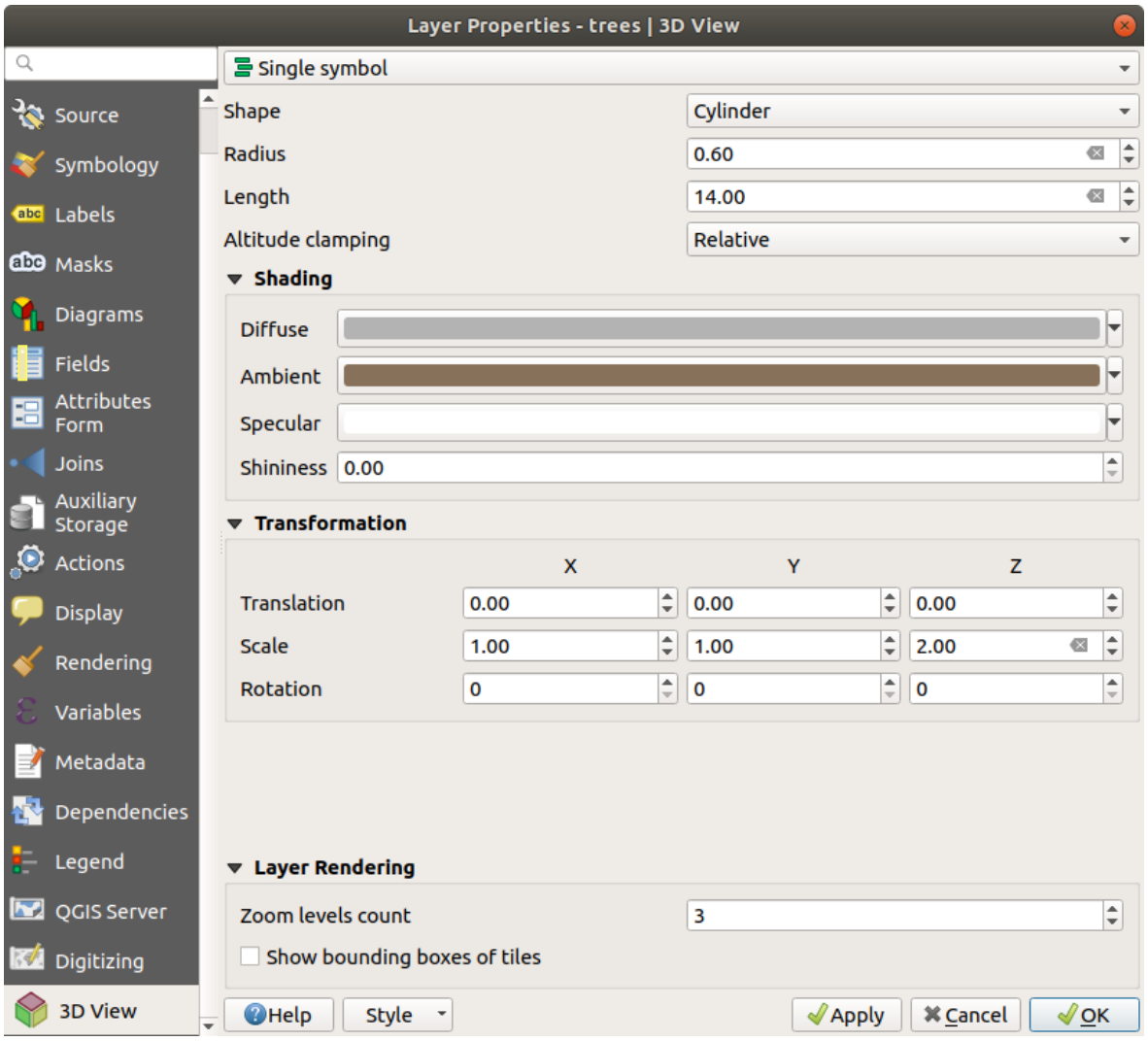


Figura14.40: 3D properties of a point layer

14.1.8 Propriedades dos campos

The *Fields* tab provides information on fields related to the layer and helps you organize them.

A camada pode ser feita: ref: *editável<editingvector>* usando o botão de lalternância Edição | : sup: *Alternar modo de edição*. Neste momento, você pode modificar sua estrutura usando o | novo Atributo | : sup: *Novo campo* e | deletar Atributo | : sup: Botões *Excluir campo*.

Você também pode renomear campos clicando duas vezes em seu nome. Isso só é compatível com provedores de dados como PostgreSQL, Oracle, camada de memória e alguma camada OGR, dependendo do formato e versão dos dados OGR.

Se definido na fonte de dados subjacente ou nas: ref: *propriedades dos formulários<configure_field>*, o alias do campo também é exibido. Um alias é um nome de campo legível por humanos que você pode usar no formulário de recurso

ou na tabela de atributos. Os aliases são salvos no arquivo de projeto.

Dependendo do provedor de dados, você pode associar um comentário a um campo, por exemplo, na sua criação. Essas informações são recuperadas e mostradas na coluna: guilabel: *Comente* e mais tarde são exibidas ao passar o mouse sobre o rótulo do campo em um formulário de recurso.

Além dos campos contidos no conjunto de dados, campos virtuais e: ref: 'Armazenamento auxiliar<vector_auxiliary_storage> *incluídos, a guia: guilabel:* Campos` também lista campos de qualquer: ref: *camadas unidas<sec_joins>*. Dependendo da origem do campo, uma cor de fundo diferente é aplicada a ele.

Para cada campo listado, a caixa de diálogo também lista características somente leitura, como seu `` tipo``, `` nome do tipo``, `` comprimento`` e `` precisão``. Ao servir a camada como `` WMS`` ou `` WFS``, você também pode verificar aqui quais campos podem ser recuperados.

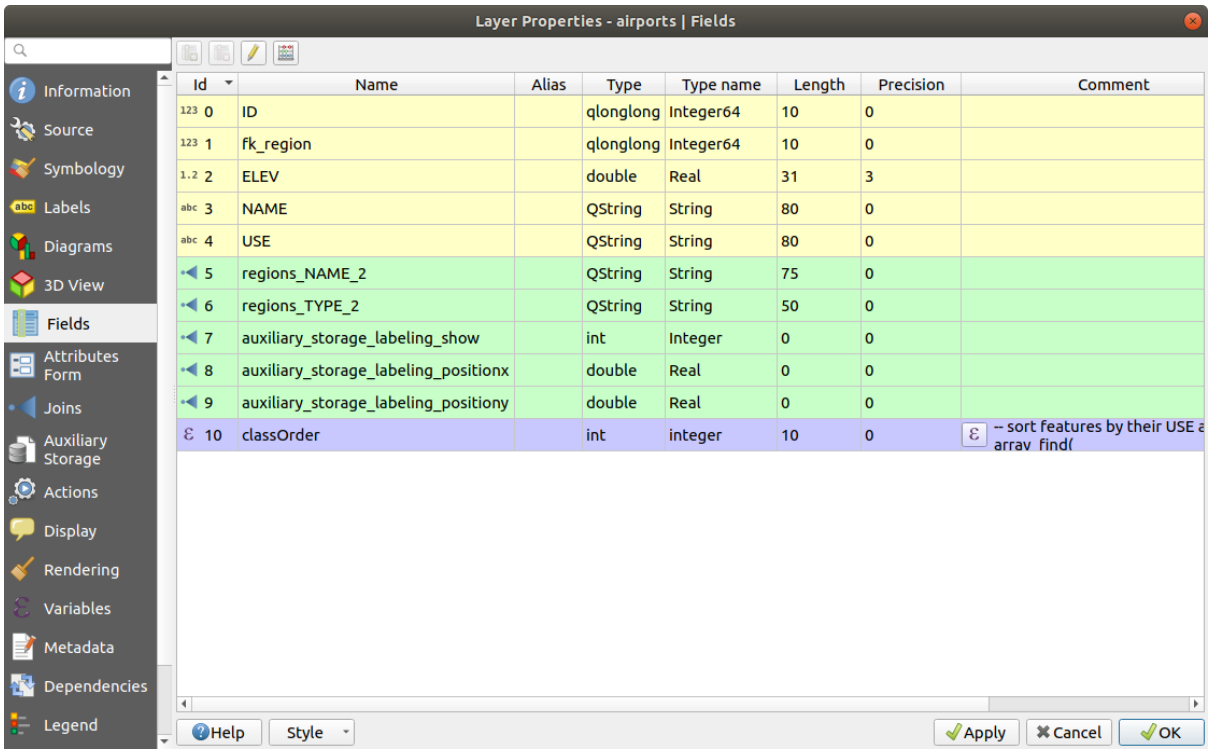


Figura14.41: Guia de propriedades dos campos

14.1.9 Propriedades do formulário de atributos

The *Attributes Form* tab helps you set up the form to display when creating new features or querying existing one. You can define:

- a aparência e o comportamento de cada campo no formulário do recurso ou na tabela de atributos (rótulo, widget, restrições …);
- a estrutura do formulário (personalizada ou gerada automaticamente):
- lógica extra no Python para lidar com a interação com os widgets de formulário ou campo.

No canto superior direito da caixa de diálogo, você pode definir se o formulário é aberto por padrão ao criar novos recursos. Isso pode ser configurado por camada ou globalmente com a opção: guilabel: *Suprimir pop-up do formulário de atributo após a criação do recurso* no menu: menuselection:` Settings -> Options -> Digitizing`.

Personalizando um formulário para seus dados

Por padrão, quando você clica em um recurso com a tecla | identificar | : sup: Ferramenta 'Identificar recursos` ou alternar a tabela de atributos para o modo * modo de exibição *, QGIS exibe um formulário básico com widgets predefinidos (geralmente caixas de rotação e caixas de texto — cada campo é representado em uma linha dedicada por seu rótulo próximo a o widget). Se: ref: *relações<vector_relations>* são definidas na camada, os campos das camadas de referência são mostrados em um quadro embutido na parte inferior do formulário, seguindo a mesma estrutura básica.

Esta renderização é o resultado do valor padrão *'Autogenerate`* da configuração: guilabel: 'Atributo editor layout` na: seleção de menus:` Propriedades da camada -> Formulário de atributos. Esta propriedade possui três valores diferentes:

- *'Autogenerate`*: mantém a estrutura básica de" uma linha - um campo "para o formulário, mas permite personalizar cada widget correspondente.
- `` Drag-and-drop designer``: além da personalização de widgets, a estrutura do formulário pode ser mais complexa, por exemplo, com widgets embutidos em grupos e guias.
- `` Fornecer arquivo ui``: permite usar um arquivo Qt designer, portanto, um template potencialmente mais complexo e completo, como forma de recurso.

A forma autogerada

Quando a opção *'Autogenerate`* está ligada, o painel: guilabel: 'Widgets disponíveis` mostra listas de campos (da camada e suas relações) que seriam mostradas no formulário. Selecione um campo e você pode configurar sua aparência e comportamento no painel direito:

- adicionar: ref: *etiqueta personalizada e verificações automatizadas<configure_field>* ao campo;
- configurando um: ref: *widget particular<edit_widgets>* para usar.

O designer de arrastar e soltar

The drag and drop designer allows you to create a form with several containers (tabs or groups) to present the attribute fields, as shown for example in Fig.14.42.

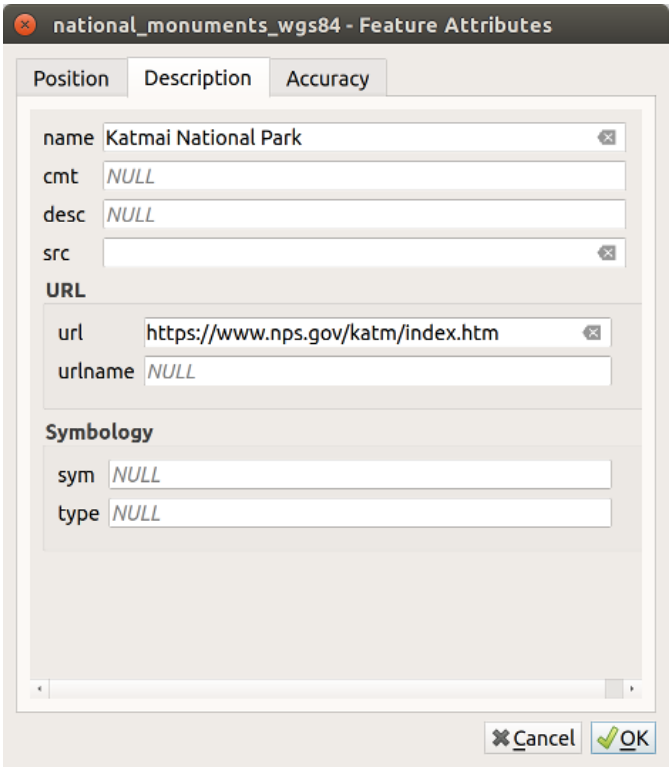


Figura14.42: Formulário integrado resultante com guias e grupos nomeados

1. Choose `Drag and drop designer` from the *Select attribute layout editor* combobox. This enables the *Form Layout* panel next to the *Available widgets* panel, filled with existing fields. The selected field displays its *properties* in a third panel.
2. Selecione os campos que você não deseja usar em seu: guilabel: painel *Form Layout* e clique no botão | signMinus | botão para removê-los. Arraste e solte os campos do outro painel para adicioná-los novamente. O mesmo campo pode ser adicionado várias vezes.
3. Arraste e solte os campos no painel: guilabel: *Layout de formulário* para reordenar suas posições.
4. Adicione containers (quadros de guia ou grupo) para associar campos que pertencem à mesma categoria e estruturar melhor o formulário.
    1. A primeira etapa é usar o | signPlus | ícone para criar uma guia na qual os campos e grupos serão exibidos
    2. Em seguida, defina as propriedades do contêiner, ou seja:
        - o nome
        - o tipo, ou seja, um: guilabel: *tab* ou um: guilabel:` grupo no contêiner` (um grupo dentro de uma guia ou outro grupo)
        - e o: guilabel: *número de colunas* sobre os quais os campos embutidos devem ser distribuídos

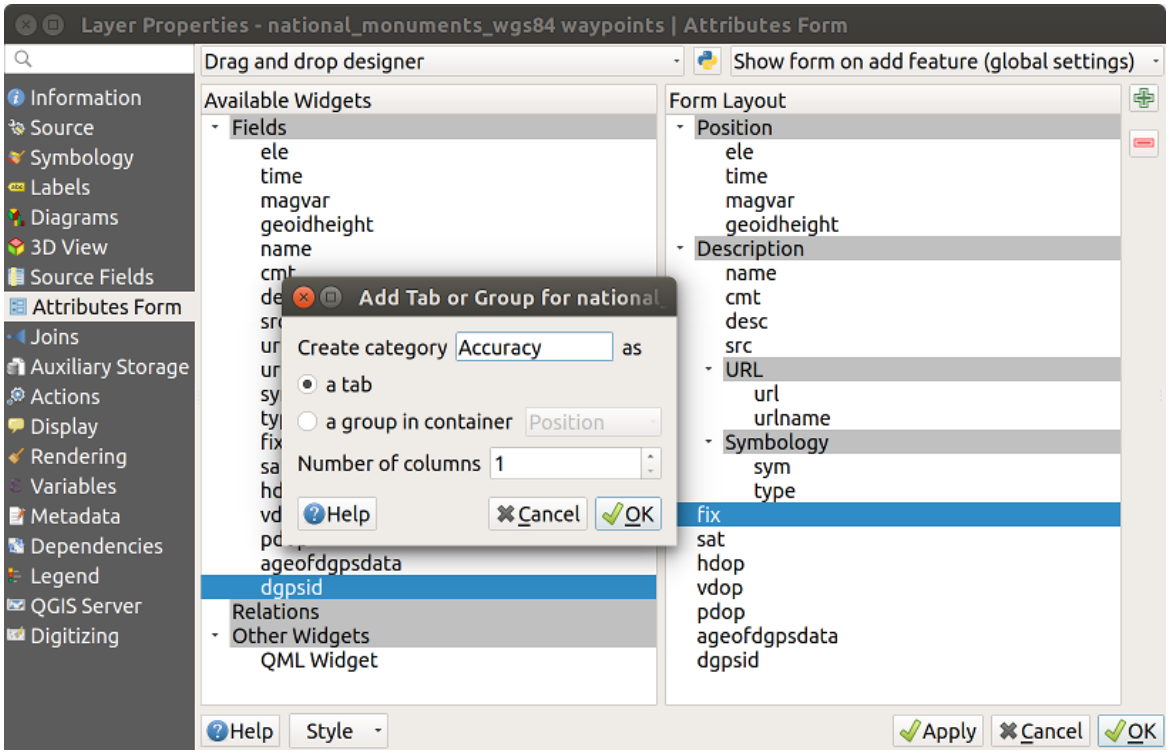


Figura14.43: Caixa de diálogo para criar contêineres com o ** Layout do editor de atributos **

Estas e outras propriedades podem ser atualizadas posteriormente selecionando o item e, no terceiro painel:

- ocultar ou mostrar o rótulo do contêiner
- exibe o container como uma caixa de grupo (disponível apenas para guias).
- renomear o contêiner
- definir o número de colunas
- insira uma expressão para controlar a visibilidade do contêiner. A expressão será reavaliada sempre que os valores no formulário mudarem, e a guia ou caixa de grupo mostrada / oculta de acordo
- adicione uma cor de fundo

3. Você pode criar quantos containers desejar; pressione o | sinal de mais | ícone novamente para criar outra guia ou um quadro de grupo em uma guia existente.

5. A próxima etapa é atribuir os campos relevantes a cada contêiner, simplesmente arrastando e soltando. Grupos e guias também podem ser movidos da mesma maneira.
6. *Customize the widget* of the fields in use
7. Caso a camada esteja envolvida em uma relação: ref: 'um ou muitos para muitos , *arraste e solte o nome da relação do painel: guilabel: 'Widgets disponíveis* para o painel: guilabel:` Form Layout`. O formulário de atributo de camada associado será incorporado no local escolhido no formulário da camada atual. Quanto aos demais itens, selecione o rótulo de relação para configurar algumas propriedades:
   - ocultar ou mostrar o rótulo de relação
   - mostre o botão do link
   - mostre o botão de desvincular
8. mostre o botão de desvincular
9. Abra um formulário de atributo de feição (por exemplo, usando a ferramenta | identificar |: sup: 'Identificar características`) e deve exibir o novo formulário.

Usando arquivo ui personalizado

A opção `` Provide ui-file`` permite que você use diálogos complexos feitos com o Qt-Designer. Usar um arquivo de interface do usuário permite uma grande liberdade na criação de um diálogo. Observe que, para vincular os objetos gráficos (caixa de texto, caixa de combinação …) aos campos da camada, você precisa dar a eles o mesmo nome.

Use: guilabel: ‘Editar IU` para definir o caminho para o arquivo a ser usado.

Os arquivos da IU também podem ser hospedados em um servidor remoto. Neste caso, você fornece a URL do formulário em vez do caminho do arquivo em: guilabel: ‘Editar UI`.

Você encontrará alguns exemplos na: ref: *Criando um novo formulário<creating-new-form>* lição da: ref: *QGIS-training-manual-index-reference*. Para obter informações mais avançadas, consulte https://woostuff.wordpress.com/2011/09/05/qgis-tips-custom-feature-forms-with-python-logic/.

Aprimore seu formulário com funções personalizadas

Os formulários QGIS podem ter uma função Python que é chamada quando a caixa de diálogo é aberta. Use esta função para adicionar lógica extra aos seus diálogos. O código do formulário pode ser especificado de três maneiras diferentes:

- `` carregar do ambiente``: use uma função, por exemplo em: file: *startup.py* ou de um plugin instalado
- `` carregar de um arquivo externo``: um seletor de arquivos permitirá que você selecione um arquivo Python de seu sistema de arquivos ou insira uma URL para um arquivo remoto.
- `` fornecer código nesta caixa de diálogo``: um editor Python aparecerá onde você pode digitar diretamente a função a ser usada.

Em todos os casos, você deve inserir o nome da função que será chamada (‘*open*` no exemplo abaixo).

Um exemplo é (no módulo MyForms.py):

```
def open(dialog,layer,feature):
    geom = feature.geometry()
    control = dialog.findChild(QWidget,"My line edit")
```

Referência na função Python Init como: ‘*open*`

Configure o comportamento do campo

A parte principal da aba: guilabel: 'Formulário de Atributos` ajuda a definir o tipo de widget usado para preencher ou exibir os valores do campo, na tabela de atributos ou no formulário de características: você pode definir como o usuário interage com cada campo e o valores ou intervalo de valores que podem ser adicionados a cada um.

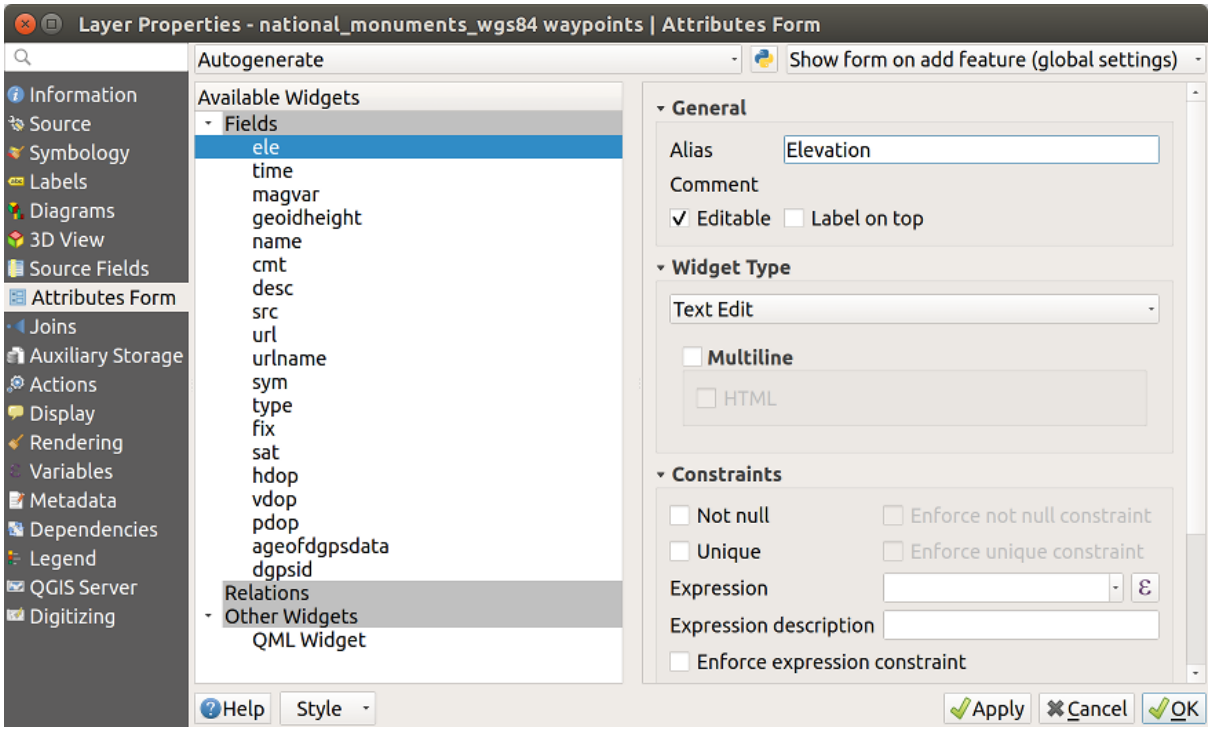


Figura14.44: Caixa de diálogo para selecionar um widget de edição para uma coluna de atributo

Configurações padrão

Independentemente do tipo de widget aplicado ao campo, existem algumas propriedades comuns que você pode definir para controlar se e como um campo pode ser editado.

Tela de widget

Show label: indicates whether the field name should be displayed in the form (only in the *Drag and drop* designer mode).

Opções gerais

- : guilabel: 'Alias`: um nome legível para ser usado em campos. O alias será exibido no formulário do recurso, na tabela de atributos ou no painel: guilabel: *Identificar resultados*. Também pode ser usado como substituição de nome de campo no: ref: *construtor de expressão<vector_expressions>*, facilitando a compreensão e revisão de expressões. Os aliases são salvos no arquivo de projeto.
- : guilabel: *Comentário*: exibe o comentário do campo como mostrado na aba: guilabel:` Campos`, em um estado somente leitura. Essas informações são mostradas como dica de ferramenta ao passar o mouse sobre o rótulo do campo em um formulário de recurso.
- *Editable*: uncheck this option to set the field read-only (not manually modifiable) even when the layer is in edit mode. Note that checking this setting doesn't override any edit limitation from the provider.

- *Label on top*: places the field name above or beside the widget in the feature form.

Valores padrão

- : guilabel: *Valor padrão*: para novos recursos, preenche automaticamente por padrão o campo com um valor pré-definido ou um: ref:` baseado em expressão<vector_expressions> `. Por exemplo, você pode:
  - use `` $ x``, `` $ length``, `` $ area`` para preencher automaticamente um campo com a coordenada X do elemento, comprimento, área ou qualquer informação geométrica em sua criação;
  - incrementa um campo em 1 para cada novo recurso usando `` maximum (“field”) + 1``;
  - salve a data e hora de criação do recurso usando `` now () ``;
  - use: ref: *variáveis<general_tools_variables>* em expressões, tornando mais fácil, por exemplo, insira o nome do operador (`` @ user_full_name``), o caminho do arquivo do projeto (`` @ project_path``), …

  Uma visualização do valor padrão resultante é exibida na parte inferior do widget.

  Nota: A opção `` Valor padrão`` não tem conhecimento dos valores em qualquer outro campo do recurso que está sendo criado, então não será possível usar uma expressão combinando qualquer um desses valores, ou seja, usando uma expressão como `` concat (campo1, field2) `` pode não funcionar.

- *Apply default value on update*: whenever the feature attribute or geometry is changed, the default value is recalculated. This could be handy to save values like last user that modifies data, last time it was changed…

Restrições

Você pode restringir o valor a ser inserido no campo. Essa restrição pode ser:

- *Not null*: requires the user to provide a value;
- *Unique*: guarantee the inserted value to be unique throughout the field;
- based on a custom *expression*: e.g. `not regexp_match(col0,'[^A-Za-z]')` will ensure that the value of the field *col0* has only alphabet letters. A short description can be added to help you remember the constraint.

Sempre que um valor é adicionado ou editado em um campo, ele é submetido às restrições existentes e:

- se atender a todos os requisitos, uma marca de seleção verde é exibida ao lado do campo do formulário;
- if it does not meet all the requirements, then the field is colored in yellow or orange and a corresponding cross is displayed next to the widget. You can hover over the cross to remind which constraints are applied to the field and fix the value:
  - Uma cruz amarela aparece quando a restrição não atendida não é aplicada e não impede que você salve as alterações com os valores “errados”;
  - An orange cross can not be ignored and does not allow you to save your modifications until they meet the constraints. It appears when the *Enforce constraint* option is checked.

Editar widgets

Com base no tipo de campo, o QGIS determina automaticamente e atribui um tipo de widget padrão a ele. Você pode então substituir o widget por qualquer outro compatível com o tipo de campo. Os widgets disponíveis são:

- ** Caixa de seleção **: exibe uma caixa de seleção cujo estado define o valor a ser inserido.
- ** Classificação **: Disponível apenas quando uma: ref: *simbologia categorizada<categorized_renderer>* é aplicada à camada, exibe uma caixa de combinação com os valores das classes.
- ** Cor **: Exibe um: ref: *widget de cor<color-selector>* permitindo selecionar uma cor; o valor da cor é armazenado como uma notação html na tabela de atributos.
- ** Data / Hora **: Exibe um campo de linha que pode abrir um widget de calendário para inserir uma data, hora ou ambos. O tipo de coluna deve ser texto. Você pode selecionar um formato personalizado, abrir um calendário, etc.
- ** Enumeração **: Abre uma caixa de combinação com valores predefinidos buscados no banco de dados. Isso é atualmente suportado apenas pelo provedor PostgreSQL, para campos do tipo *`enum`*.
- ** Anexo **: Usa uma caixa de diálogo "Abrir arquivo" para armazenar o caminho do arquivo em um modo relativo ou absoluto. Também pode ser usado para exibir um hiperlink (para o caminho do documento), uma imagem ou uma página da web.
- ** Oculto **: Uma coluna de atributo oculto é invisível. O usuário não é capaz de ver o seu conteúdo.
- ** Chave / valor **: exibe uma tabela de duas colunas para armazenar conjuntos de pares de chave / valor em um único campo. Isso é atualmente suportado pelo provedor PostgreSQL, para campos do tipo `` hstore``.
- ** Lista **: exibe uma única tabela de coluna para adicionar diferentes valores em um único campo. Isso é atualmente suportado pelo provedor PostgreSQL, para campos do tipo *`array`*.
- **Tamanho**: Permite definir valores numéricos de um tamanho específico. A edição do Widget pode ser um controle deslizante ou uma caixa de rotação.
- **Relation Reference**: This is the default widget assigned to the referencing field (i.e., the foreign key in the child layer) when a *relation* is set. It provides direct access to the parent feature's form which in turn embeds the list and form of its children.
- ** Edição de texto ** (padrão): Isso abre um campo de edição de texto que permite o uso de texto simples ou várias linhas. Se você escolher várias linhas, também poderá escolher o conteúdo html.
- ** Valores únicos **: Você pode selecionar um dos valores já usados na tabela de atributos. Se 'Editável' estiver ativado, uma edição de linha é mostrada com suporte para preenchimento automático, caso contrário, uma caixa de combinação é usada.
- ** Gerador Uuid **: Gera um campo UUID (Universally Unique Identifiers) somente leitura, se vazio.
- ** Mapa de valores **: uma caixa de combinação com itens predefinidos. O valor é armazenado no atributo, a descrição é mostrada na caixa de combinação. Você pode definir valores manualmente ou carregá-los de uma camada ou arquivo CSV.
- ** Relação de valor **: Oferece valores de uma tabela relacionada em uma combobox. Você pode selecionar camada, coluna-chave e coluna de valor. Várias opções estão disponíveis para alterar os comportamentos padrão: permitir valor nulo, ordenar por valor, permitir múltiplas seleções e uso de auto-completer. Os formulários exibirão uma lista suspensa ou um campo de edição de linha quando a caixa de seleção Completer estiver ativada.

Dica: ** Caminho relativo no widget de anexo **

Se o caminho selecionado com o navegador de arquivos estiver localizado no mesmo diretório do arquivo de projeto: file: *.qgs* ou abaixo, os caminhos são convertidos em caminhos relativos. Isso aumenta a portabilidade de um projeto: file: *.qgs* com informações multimídia anexadas.

14.1.10 Propriedades de associações


The *Joins* tab allows you to associate features of the current layer (called `Target layer`) to features from another loaded vector layer (or table). The join is based on an attribute that is shared by the layers. The layers can be geometryless (tables) or not but their join attribute should be of the same type.

Para criar uma junção:

1. Clique no botão | signPlus | : sup: botão ‘Adicionar nova junção`. A caixa de diálogo: guilabel: ‘Adicionar junção de vetor` aparece.
2. Selecione o: guilabel: *camada de junção* que deseja conectar com a camada vetorial de destino
3. Especifique o: guilabel: *Campo de junção* e o: guilabel:` Campo de destino` que são comuns à camada de junção e à camada de destino
4. Pressione: guilabel: ‘OK` e um resumo dos parâmetros selecionados é adicionado ao painel: guilabel: *Join*.

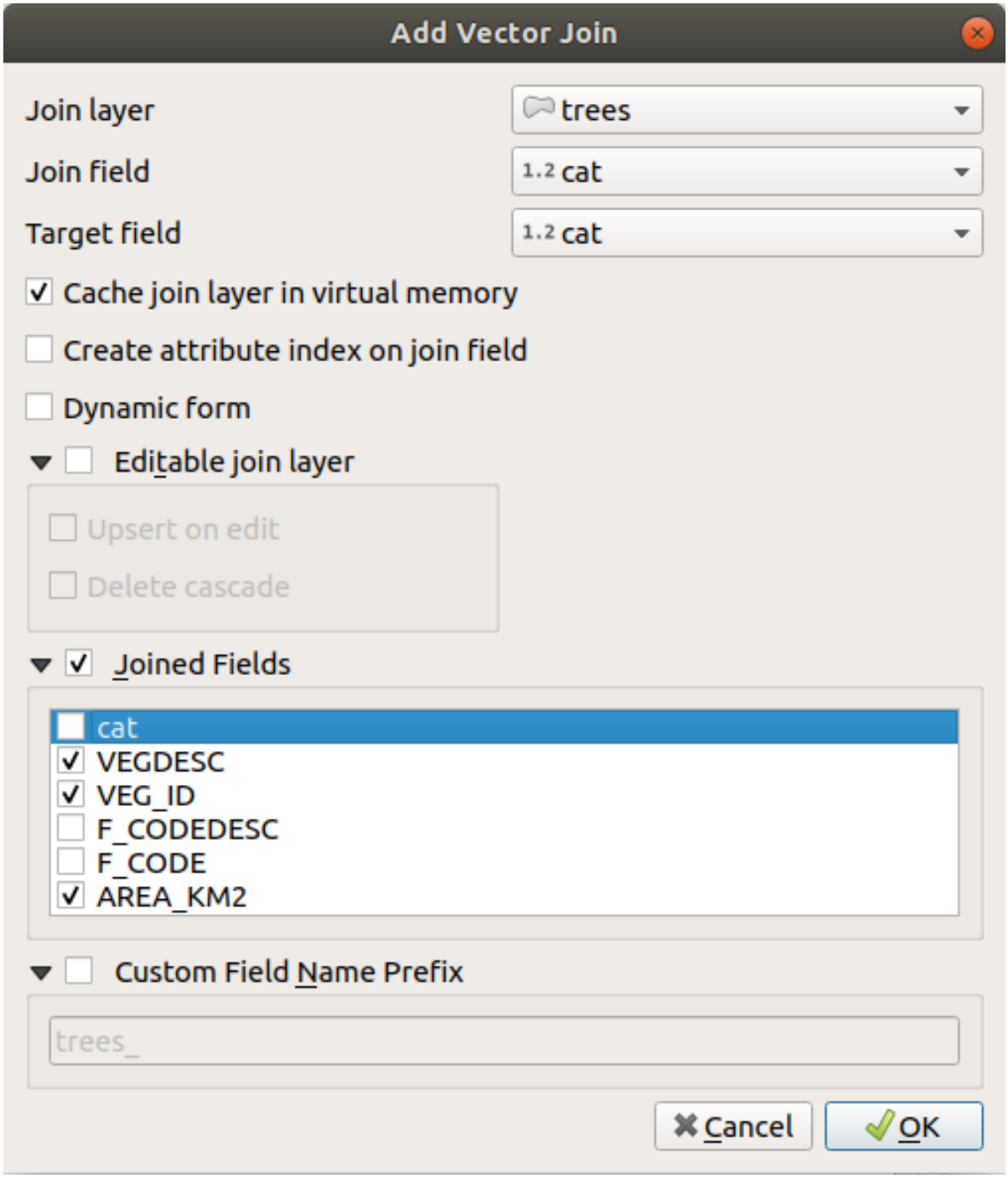


Figura14.45: Una uma tabela de atributos a uma camada vetorial existente

As etapas acima criarão uma junção, onde ** TODOS ** os atributos do primeiro recurso correspondente na camada de junção são adicionados ao recurso da camada de destino. QGIS fornece mais opções para ajustar a junção:

- *Cache join layer in virtual memory*: allows you to cache values in memory (without geometries) from the joined layer in order to speed up lookups.
- *Create attribute index on the join field*
- *Dynamic form*: helps to synchronize join fields on the fly, according to the *Target field*. This way, constraints for join fields are also correctly updated. Note that it's deactivated by default because it may be very time consuming if you have a lot of features or a myriad of joins.

- Caso a camada de destino seja editável, alguns ícones serão exibidos na tabela de atributos ao lado dos campos, para informar sobre o seu estado:
  - : the join layer is not configured to be editable. If you want to be able to edit join features from the target attribute table, then you have to check the option *Editable join layer*.
  - : the join layer is well configured to be editable, but its current status is read only.
  - : the join layer is editable, but synchronization mechanisms are not activated. If you want to automatically add a feature in the join layer when a feature is created in the target layer, then you have to check the option *Upsert on edit*. Symmetrically, the option *Delete cascade* may be activated if you want to automatically delete join features.
- *Joined fields*: instead of adding all the fields from the joined layer, you can specify a subset.
- *Custom field name prefix* for joined fields, in order to avoid name collision

QGIS atualmente tem suporte para juntar formatos de tabelas não espaciais suportados por OGR (por exemplo, CSV, DBF e Excel), texto delimitado e o provedor PostgreSQL.

14.1.11 Propriedades de armazenamento auxiliar

A maneira normal de personalizar o estilo e a rotulação é usar propriedades definidas por dados conforme descrito em: ref: *data_defined*. No entanto, pode não ser possível se os dados subjacentes forem somente leitura. Além disso, configurar essas propriedades definidas por dados pode consumir muito tempo ou não ser desejável! Por exemplo, se você deseja usar totalmente as ferramentas de mapa que vêm com: ref: *label_toolbar*, então você precisa adicionar e configurar mais de 20 campos em sua fonte de dados original (posições X e Y, ângulo de rotação, estilo da fonte, cor e em breve).

O mecanismo de armazenamento auxiliar fornece a solução para essas limitações e configurações inadequadas. Os campos auxiliares são uma forma indireta de gerenciar e armazenar automaticamente essas propriedades definidas por dados (rótulos, diagrama, simbologia …) em um banco de dados SQLite, graças às junções editáveis. Isso permite que você armazene propriedades para camadas que não são editáveis.

Uma guia está disponível na caixa de diálogo de propriedades da camada vetorial para gerenciar o armazenamento auxiliar:

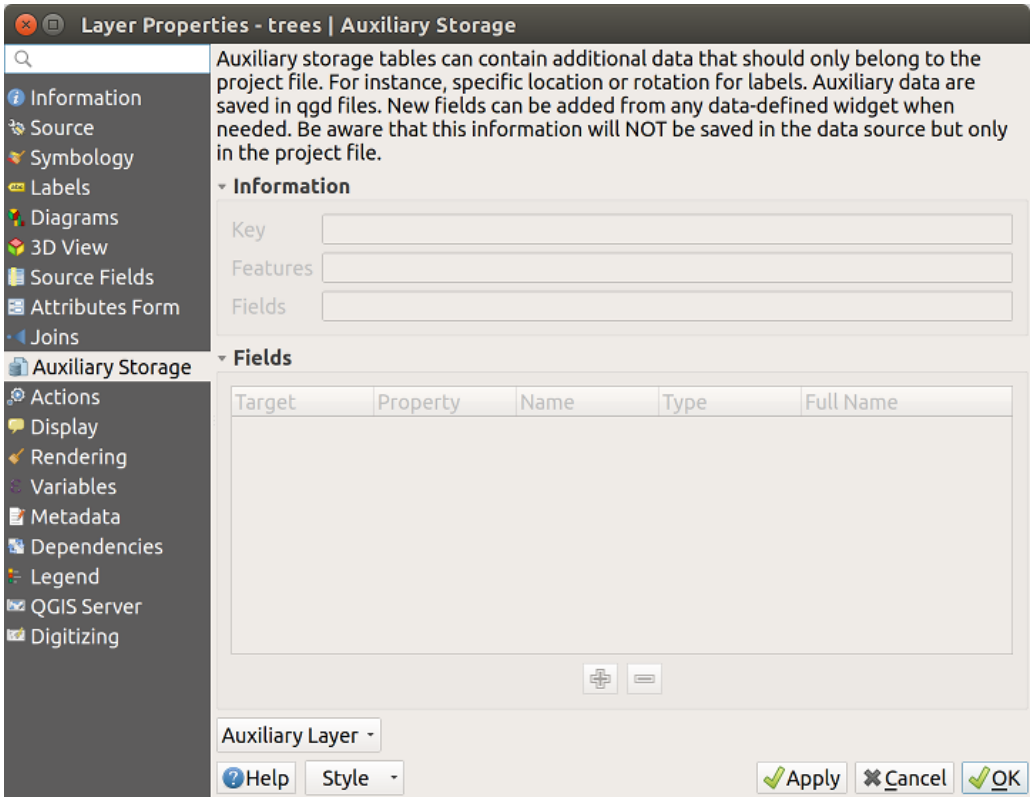


Figura14.46: Guia de armazenamento auxiliar

Marcação

Considerando que a fonte de dados pode ser personalizada graças às propriedades definidas pelos dados sem ser editável, as ferramentas de mapa de rotulagem descritas em: ref: *label_toolbar* estão sempre disponíveis assim que a rotulagem é ativada.

Na verdade, o sistema de armazenamento auxiliar precisa de uma camada auxiliar para armazenar essas propriedades em um banco de dados SQLite (ver: ref: *vector_auxiliary_storage_database*). Seu processo de criação é executado na primeira vez que você clica no mapa enquanto uma ferramenta de mapa de rotulagem está ativada no momento. Em seguida, uma janela é exibida, permitindo que você selecione a chave primária a ser usada para ingressar (para garantir que os recursos sejam identificados exclusivamente):

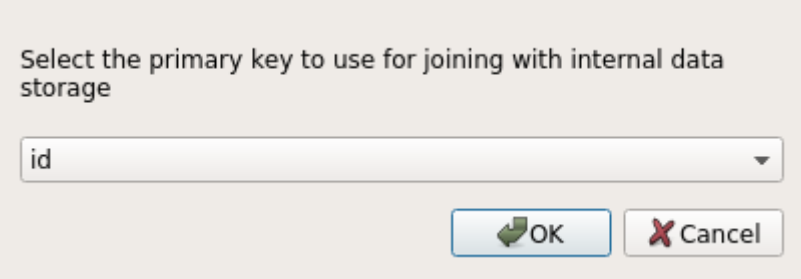


Figura14.47: Caixa de diálogo de criação de camada auxiliar

Assim que uma camada auxiliar é configurada para a fonte de dados atual, você pode recuperar suas informações na guia:

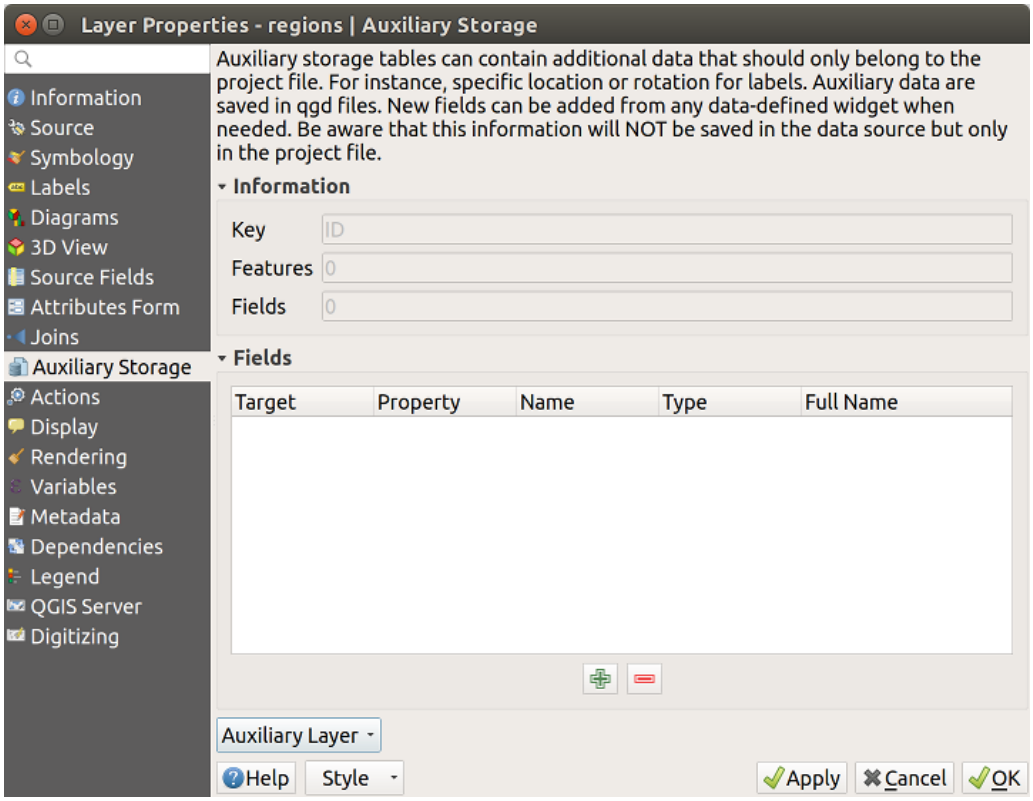


Figura14.48: Chave da camada auxiliar

A camada auxiliar agora tem estas características:

- a chave primária é `` ID``,
- existem recursos `` 0`` usando um campo auxiliar,
- existem campos auxiliares `` 0``.

Agora que a camada auxiliar foi criada, você pode editar os rótulos da camada. Clique em um rótulo enquanto o | changeLabelProperties | : sup: a ferramenta de mapa *Change Label* está ativada, então você pode atualizar as propriedades de estilo como tamanhos, cores e assim por diante. As propriedades definidas por dados correspondentes são criadas e podem ser recuperadas:

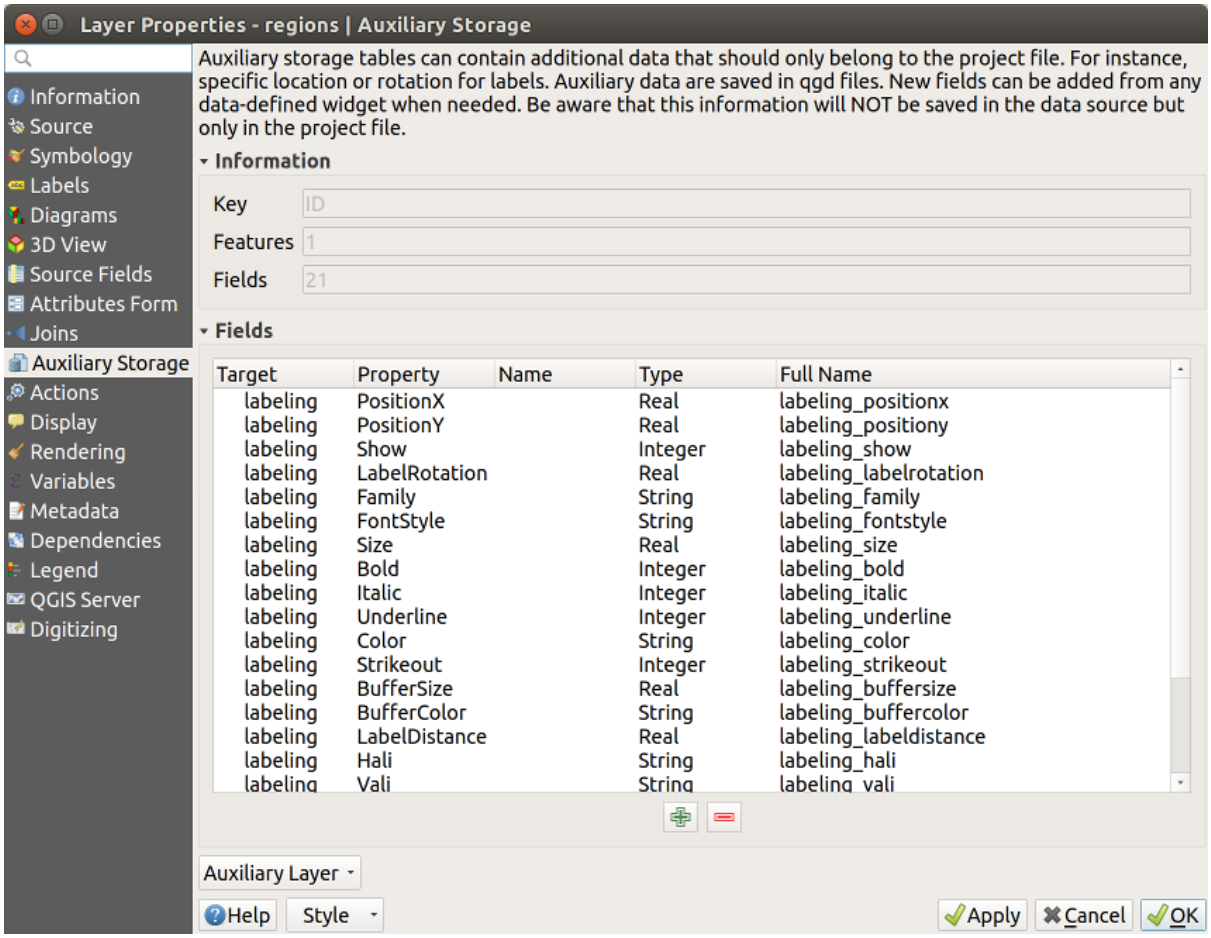


Figura14.49: Campos Auxiliares

Como você pode ver na figura acima, os campos `` 21`` são criados e configurados automaticamente para rotulagem. Por exemplo, o tipo de campo auxiliar `` FontStyle`` é um `` String`` e é denominado `` labeling_fontstyle`` no banco de dados SQLite subjacente. Há também o recurso `` 1`` que está usando esses campos auxiliares.

Observe que o ícone | dataDefineOn | é exibido na guia de propriedades: guilabel: *Labels* indicando que as opções de substituição definidas pelos dados estão configuradas corretamente:

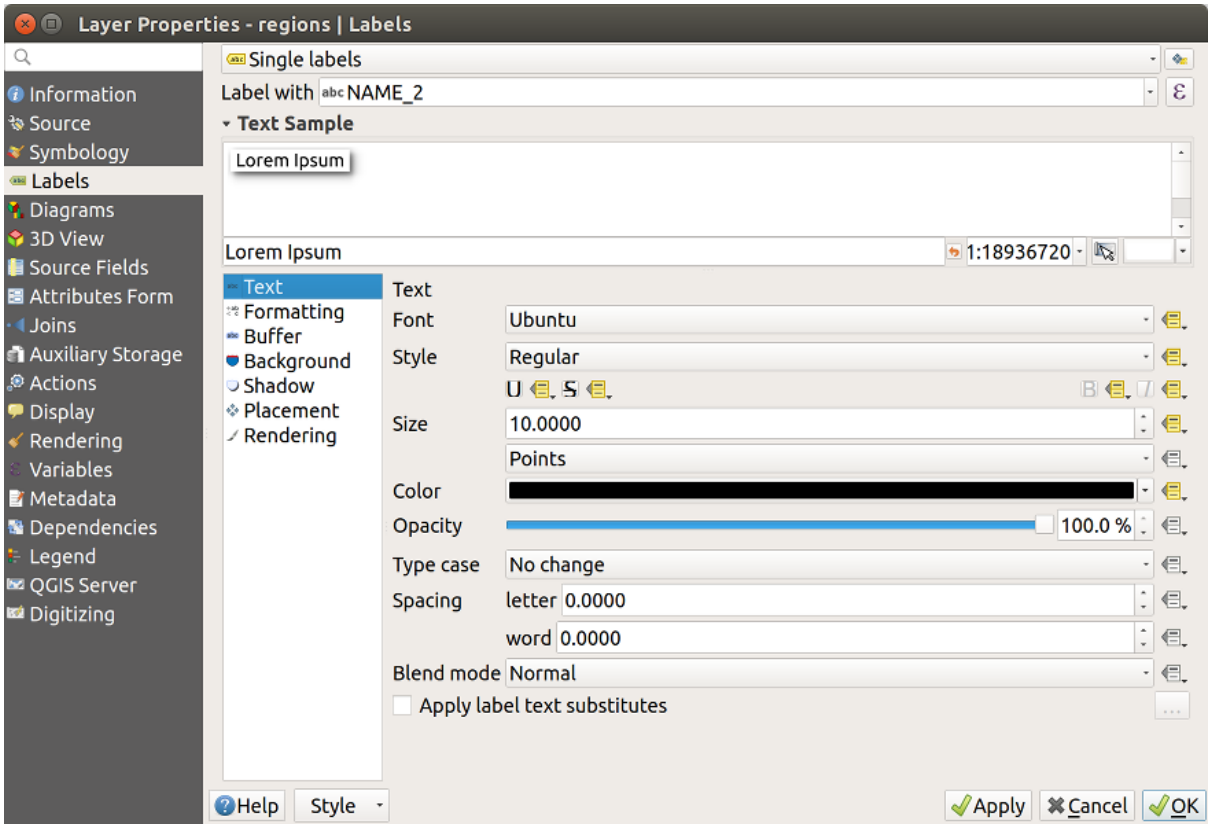


Figura14.50: Propriedades definidas por dados criadas automaticamente

Caso contrário, existe outra maneira de criar um campo auxiliar para uma propriedade específica, graças ao | dataDefined | : sup: botão *data-defined override*. Ao clicar em: guilabel: *Armazenar dados no projeto*, um campo auxiliar é criado automaticamente para o campo: guilabel:` Opacidade`. Se você clicar neste botão e a camada auxiliar ainda não tiver sido criada, uma janela (: numref: *figure_auxiliary_layer_creation*) é primeiro exibida para selecionar a chave primária a ser usada para ingressar.

Simbologia

Como o método descrito acima para personalizar rótulos, os campos auxiliares também podem ser usados para estilizar símbolos e diagramas. Para fazer isso, clique em | dataDefined | : sup: *Substituição definida por dados* e selecione: guilabel:` Armazenar dados no projeto` para uma propriedade específica. Por exemplo, o campo: guilabel: *Cor de preenchimento*:

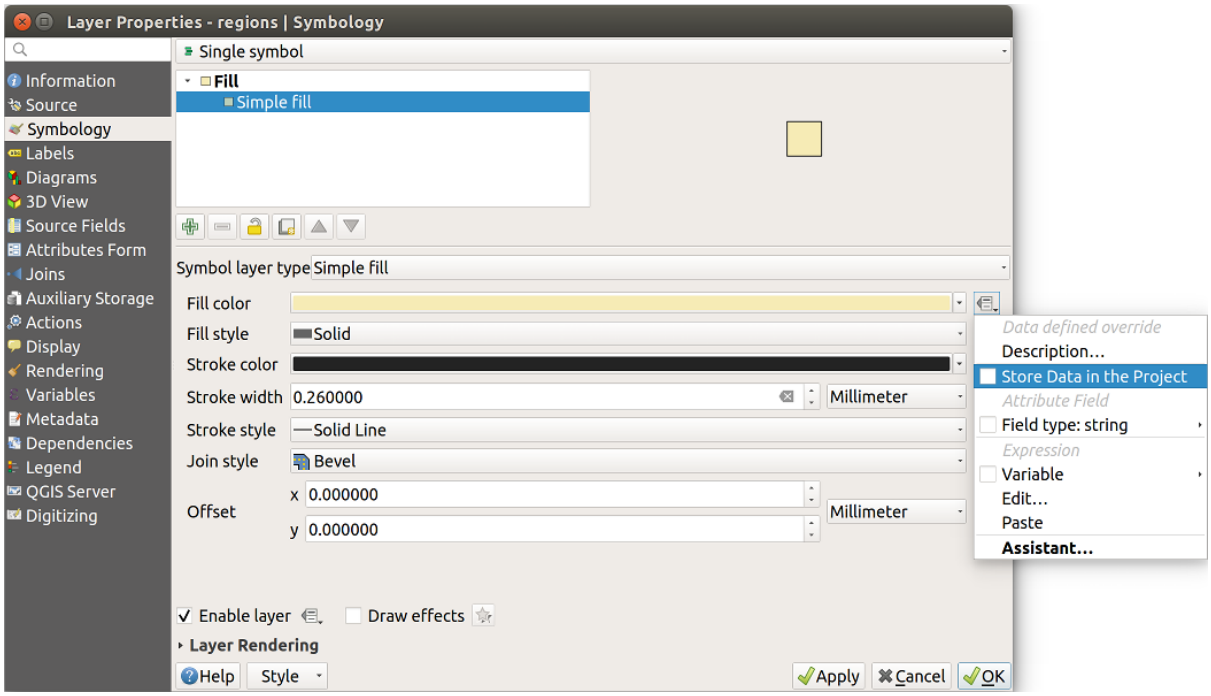


Figura14.51: Menu de propriedades definidas por dados para o símbolo

Existem diferentes atributos para cada símbolo (por exemplo, estilo de preenchimento, cor de preenchimento, cor do traço, etc …), portanto, cada campo auxiliar que representa um atributo requer um nome exclusivo para evitar conflitos. Após selecionar: guilabel: *Armazenar dados no projeto*, uma janela abre e exibe o: guilabel:` Tipo` do campo e solicita que você insira um nome exclusivo para o campo auxiliar. Por exemplo, ao criar um campo auxiliar: guilabel: *Cor de preenchimento*, a seguinte janela é aberta:

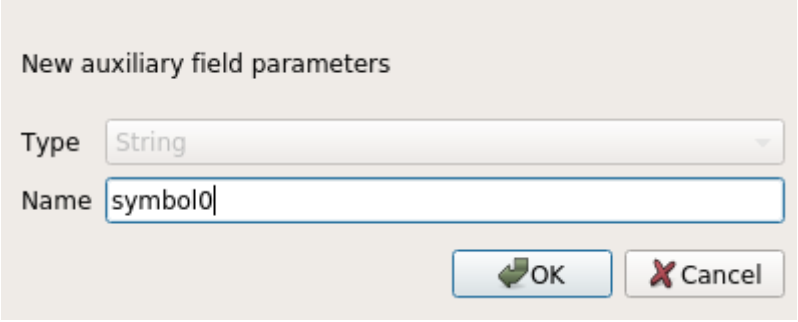


Figura14.52: Nome do campo auxiliar para um símbolo

Depois de criado, o campo auxiliar pode ser recuperado na guia de armazenamento auxiliar:

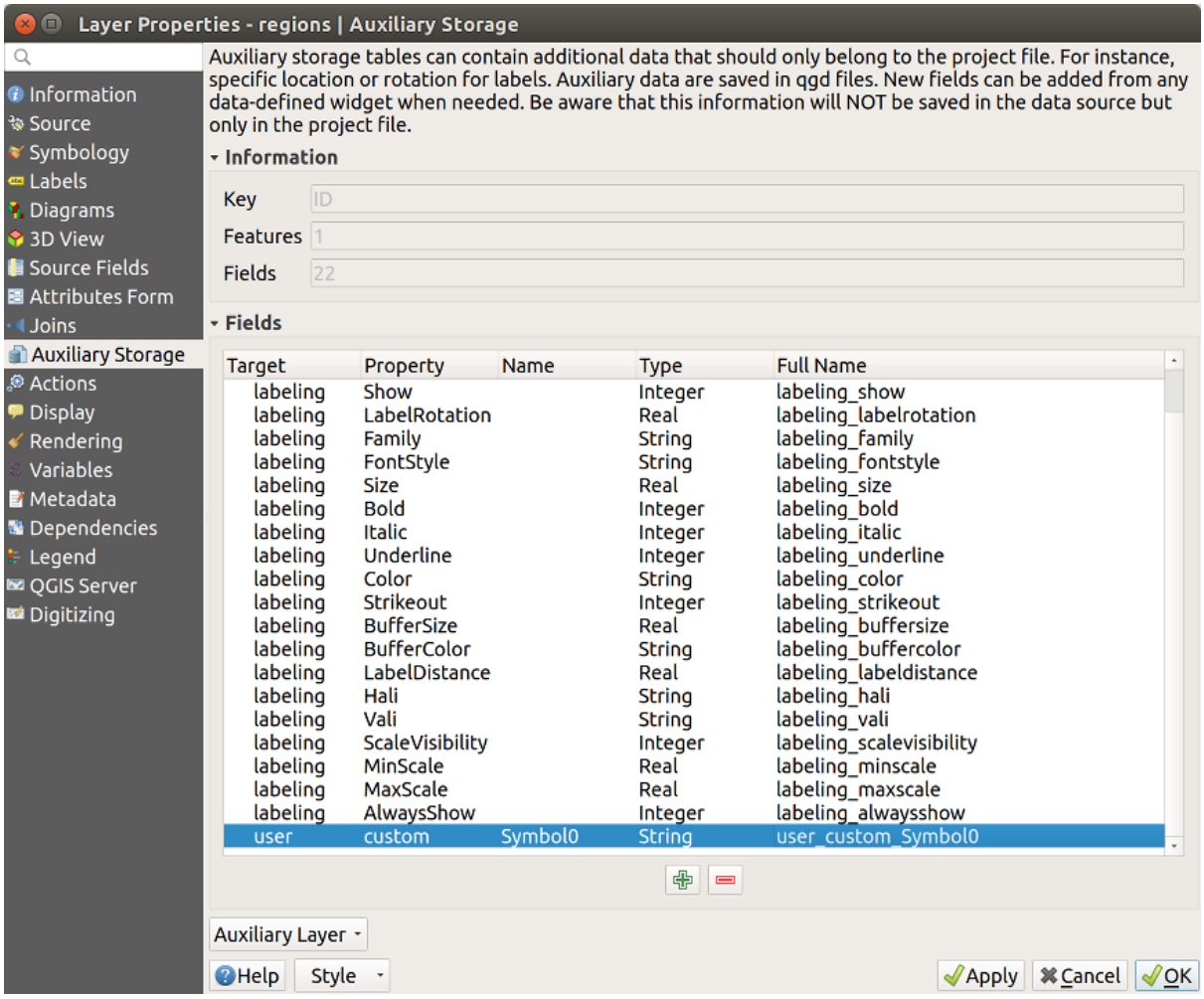


Figura14.53: Símbolo de campo auxiliar

Tabela de atributos e widgets

Os campos auxiliares podem ser editados usando a: ref: *tabela de atributos<sec_attribute_table>*. No entanto, nem todos os campos auxiliares são inicialmente visíveis na tabela de atributos.

Os campos auxiliares que representam os atributos da simbologia, rotulagem, aparência ou diagramas de uma camada aparecerão automaticamente na tabela de atributos. A exceção são os atributos que podem ser modificados usando a: ref: *Barra de ferramentas do rótulo<label_toolbar>* que estão ocultos por padrão. Os campos auxiliares que representam uma `` Cor`` têm um widget ** Cor ** definido por padrão, caso contrário, os campos auxiliares são padronizados para o widget ** Edição de Texto **.

Os campos auxiliares que representam os atributos que podem ser modificados usando a: ref: *Barra de ferramentas do rótulo<label_toolbar>* são ** Ocultos ** na tabela de atributos por padrão. Para tornar um campo visível, abra a: ref: *guia de propriedades do formulário de atributo<vector_attributes_menu>* e altere o valor de um campo auxiliar: guilabel: *Widget Type* de ** Oculto ** para outro valor relevante. Por exemplo, altere ** auxiliary_storage_labeling_size ** para ** Text Edit ** ou altere ** auxiliary_storage_labeling_color ** para o widget ** Color **. Esses campos agora estarão visíveis na tabela de atributos.

Os campos auxiliares na tabela de atributos aparecerão como a seguinte imagem:

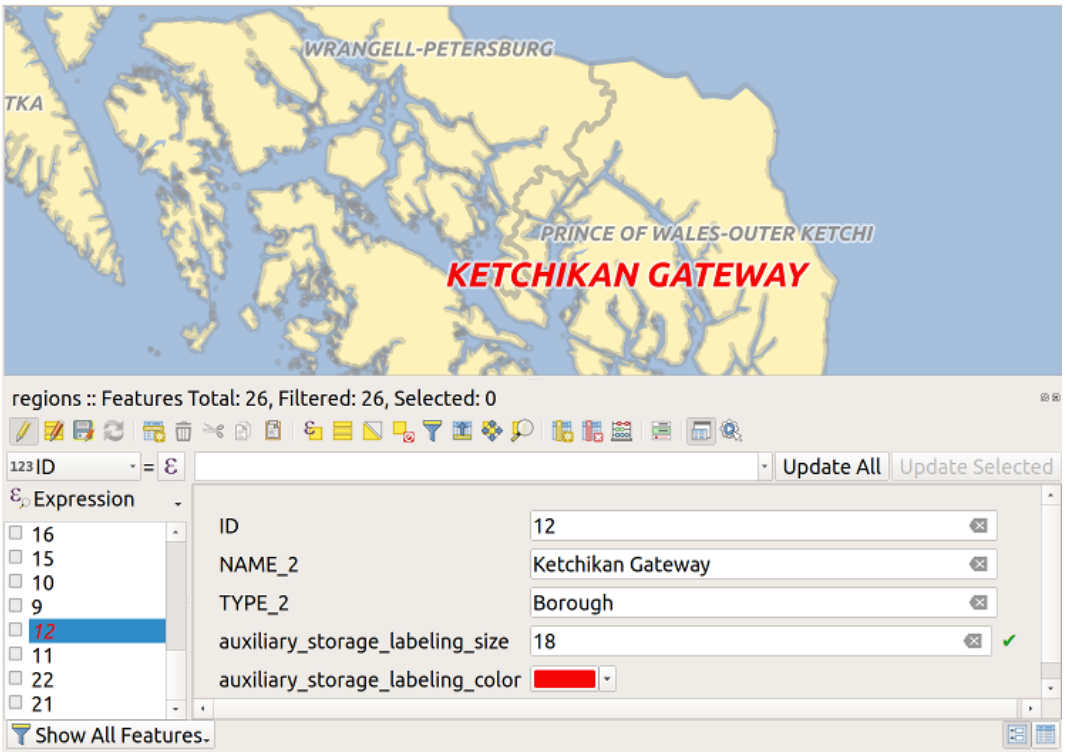


Figura14.54: Formulário com campos auxiliares

Gestão

O menu: guilabel: *Camada Auxiliar* permite que você gerencie os campos auxiliares:

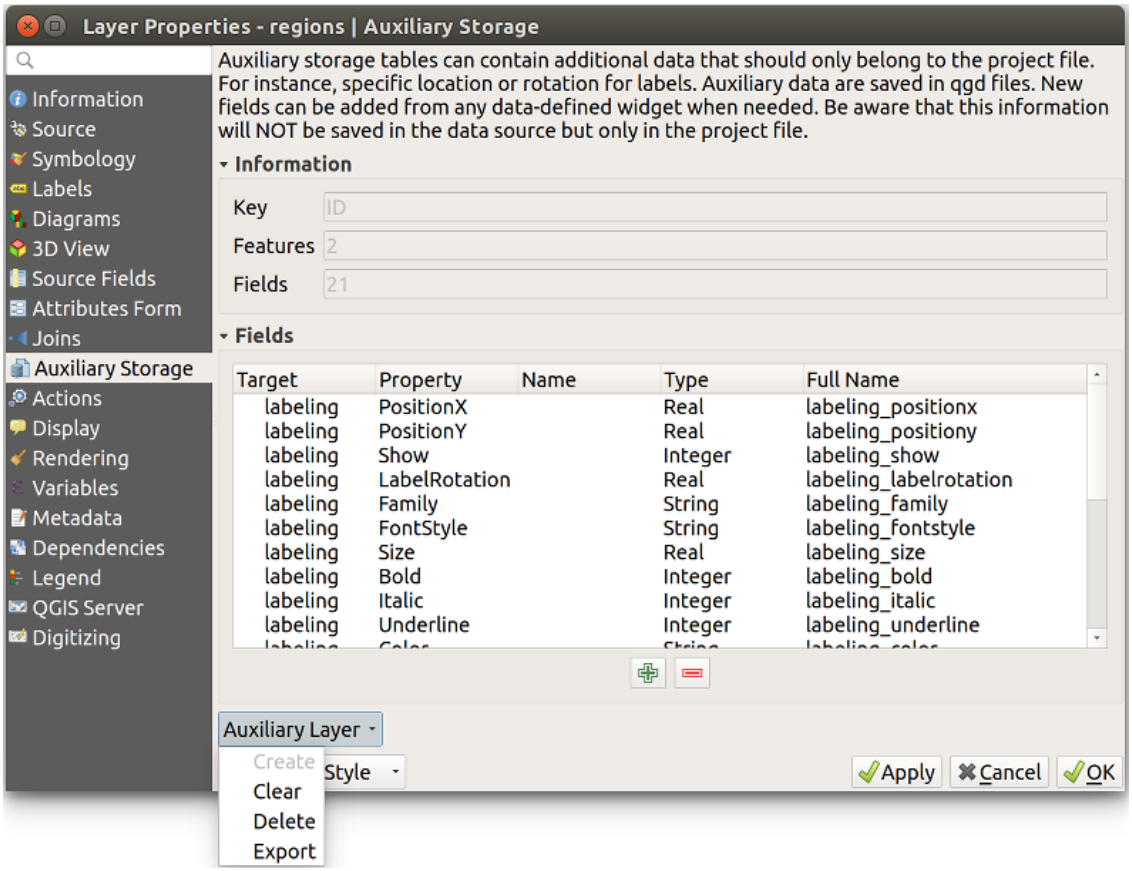


Figura14.55: Gerenciamento de camada auxiliar

O primeiro item: guilabel: *Criar* está desabilitado neste caso porque a camada auxiliar já foi criada. Mas no caso de um novo trabalho, você pode usar esta ação para criar uma camada auxiliar. Conforme explicado em: ref: *vector_auxiliary_storage_key*, uma chave primária será necessária então.

A ação: guilabel: *Clear* permite manter todos os campos auxiliares, mas remover seus conteúdos. Dessa forma, o número de recursos que usam esses campos cairá para `` 0``.

A ação: guilabel: *Delete* remove completamente a camada auxiliar. Em outras palavras, a tabela correspondente é excluída do banco de dados SQLite subjacente e a personalização das propriedades é perdida.

Finalmente, a ação: guilabel: *Export* permite salvar a camada auxiliar como uma: ref:` nova camada vetorial <general_saveas>`. Observe que as geometrias não são armazenadas no armazenamento auxiliar. No entanto, neste caso, as geometrias também são exportadas da fonte de dados original.

Banco de dados de armazenamento auxiliar

Quando você salva seu projeto com o formato `` .qgs``, o banco de dados SQLite usado para armazenamento auxiliar é salvo no mesmo lugar, mas com a extensão `` .qgd``.

Por conveniência, um arquivo pode ser usado graças ao formato `` .qgz``. Neste caso, os arquivos `` .qgd`` e `` .qgs`` são ambos embutidos no arquivo.

14.1.12 Propriedades de Ações



QGIS provides the ability to perform an action based on the attributes of a feature. This can be used to perform any number of actions, for example, running a program with arguments built from the attributes of a feature or passing parameters to a web reporting tool.

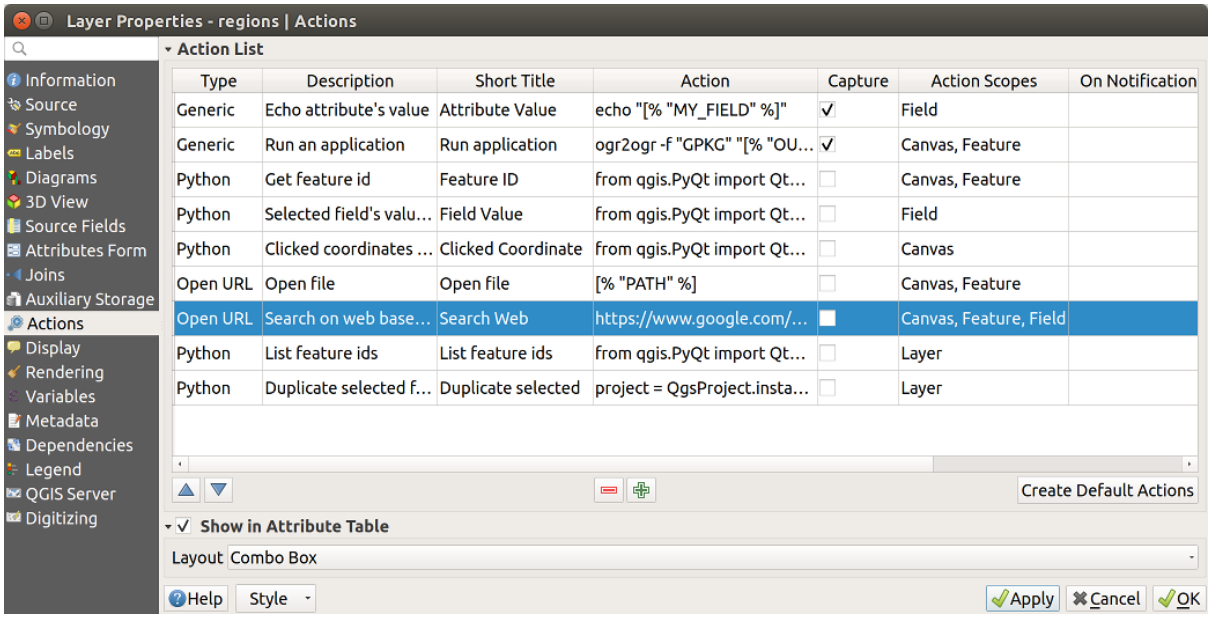


Figura14.56: Diálogo de ação de visão geral com alguns exemplos de ações

Ações são úteis quando você frequentemente deseja executar uma aplicação externa ou visualizar uma página web com base em um ou mais valores em sua camada de vetor. Elas são divididas em seis tipos e pode ser usadas assim:

- Iniciar ações genéricas, Mac, Windows e Unix em um processo externo.
- Executar ações Python uma expressão Python.
- Ações genéricas e Python são visíveis em toda parte.
- Ações Mac, Windows e Unix são visíveis apenas na respectiva plataforma (ou seja, você pode definir ações de três “Editar” para abrir um editor e os usuários só podem ver e executar a ação “Editar” na sua plataforma para executar o editor) .

Existem vários exemplos incluídos na caixa de diálogo. Você pode carregá-los clicando em: guilabel: *Criar ações padrão*. Para editar qualquer um dos exemplos, clique duas vezes em sua linha. Um exemplo é realizar uma pesquisa com base em um valor de atributo. Este conceito é usado na discussão a seguir.

A | caixa de seleção | : guilabel: *Mostrar na Tabela de Atributos* permite que você exiba na caixa de diálogo da tabela de atributos as ações com escopo de recursos verificados, seja como: guilabel:` Combo Box` ou como: guilabel: *Botões Separados* (ver: ref:` configure_table_columns `).

Defining Actions

To define an attribute action, open the vector *Layer Properties* dialog and click on the *Actions* tab. In the *Actions* tab, click the  Add a new action to open the *Edit Action* dialog.

Select the action *Type* and provide a descriptive name for the action. The action itself must contain the name of the application that will be executed when the action is invoked. You can add one or more attribute field values as arguments to the application. When the action is invoked, any set of characters that start with a `%` followed by the name of a field will be replaced by the value of that field. The special characters `%%` will be replaced by the value of the field that was selected from the identify results or attribute table (see *using_actions* below). Double quote marks can be used to group text into a single argument to the program, script or command. Double quotes will be ignored if preceded by a backslash.

The *Action Scopes* allows you to define *where* the action should be available. You have 4 different choices:

1. *Feature Scope*: action is available when right click in the cell within the attribute table.
2. *Field Scope*: action is available when right click in the cell within the attribute table, in the feature form and in the default action button of the main toolbar.
3. *Layer Scope*: action is available in the action button in the attribute table toolbar. Be aware that this type of action involves the entire layer and not the single features.
4. *Canvas*: action is available in the main action button in the toolbar.

If you have field names that are substrings of other field names (e.g., `col1` and `col10`), you should indicate that by surrounding the field name (and the % character) with square brackets (e.g., `[%col10]`). This will prevent the `%col10` field name from being mistaken for the `%col1` field name with a `0` on the end. The brackets will be removed by QGIS when it substitutes in the value of the field. If you want the substituted field to be surrounded by square brackets, use a second set like this: `[[%col10]]`.

Using the *Identify Features* tool, you can open the *Identify Results* dialog. It includes a *(Derived)* item that contains information relevant to the layer type. The values in this item can be accessed in a similar way to the other fields by proceeding the derived field name with `(Derived).`. For example, a point layer has an `X` and `Y` field, and the values of these fields can be used in the action with `%(Derived).X` and `%(Derived).Y`. The derived attributes are only available from the *Identify Results* dialog box, not the *Attribute Table* dialog box.

Two example actions are shown below:

- `konqueror https://www.google.com/search?q=%nam`
- `konqueror https://www.google.com/search?q=%%`

In the first example, the web browser konqueror is invoked and passed a URL to open. The URL performs a Google search on the value of the `nam` field from our vector layer. Note that the application or script called by the action must be in the path, or you must provide the full path. To be certain, we could rewrite the first example as: `/opt/kde3/bin/konqueror https://www.google.com/search?q=%nam`. This will ensure that the konqueror application will be executed when the action is invoked.

O segundo exemplo usa a notação % % , que não depende de um campo específico para o seu valor. Quando a ação é consultado, o % % será substituído pelo valor do campo selecionado na tabela de identificar resultados ou atributo.

Usando ações

O QGIS oferece várias maneiras de executar ações que você ativou em uma camada. Dependendo das configurações, eles podem estar disponíveis:

- no menu suspenso do | ação Executar| : sup: botão *Executar ação de recurso* na: guilabel:` Barra de ferramentas Atributos` ou: guilabel: *Tabela de Atributos*;
- when right-clicking a feature with the  Identify Features tool (see *Identificar Elementos* for more information);
- from the *Identify Results* panel, under the *Actions* section;
- as items of an *Actions* column in the *Attribute Table* dialog.

Se você está chamando uma ação que usa o ``% ``% notação, clique com o botão direito sobre o valor do campo na: guilabel: ` Identificar resultados de diálogo ou o: guilabel: 'Tabela de atributos` diálogo que você deseja passar para a aplicação ou script.

Here is another example that pulls data out of a vector layer and inserts it into a file using bash and the `echo` command (so it will only work on or perhaps). The layer in question has fields for a species name `taxon_name`, latitude `lat` and longitude `long`. We would like to be able to make a spatial selection of localities and export these field values to a text file for the selected record (shown in yellow in the QGIS map area). Here is the action to achieve this:

```
bash -c "echo \"%taxon_name %lat %long\" >> /tmp/species_localities.txt"
```

Depois de selecionar algumas localidades e executar a ação em cada um, a abertura do arquivo de saída irái mostrar algo como isto:

```
Acacia mearnsii -34.0800000000 150.0800000000
Acacia mearnsii -34.9000000000 150.1200000000
Acacia mearnsii -35.2200000000 149.9300000000
Acacia mearnsii -32.2700000000 150.4100000000
```

As an exercise, we can create an action that does a Google search on the `lakes` layer. First, we need to determine the URL required to perform a search on a keyword. This is easily done by just going to Google and doing a simple search, then grabbing the URL from the address bar in your browser. From this little effort, we see that the format is https://www.google.com/search?q=QGIS, where `QGIS` is the search term. Armed with this information, we can proceed:

1. Verifique se a camada `lagos` está carregada.
2. Open the *Layer Properties* dialog by double-clicking on the layer in the legend, or right-click and choose *Properties* from the pop-up menu.
3. Click on the *Actions* tab.
4. Click Add a new action.
5. Choose the *Open* action type,
6. Digite um nome para a ação, por exemplo `` Google Search ``.
7. Additionally you can add a *Short Name* or even an *Icon*.
8. Choose the action *Scope*. See *Defining Actions* for further information. Leave the default settings for this example.
9. Para a ação, precisamos fornecer o nome do programa externo a ser executado. Neste caso, podemos usar o Firefox. Se o programa não estiver em seu caminho, você precisará fornecer o caminho completo.
10. Following the name of the external application, add the URL used for doing a Google search, up to but not including the search term: `https://www.google.com/search?q=`
11. The text in the *Action* field should now look like this: `https://www.google.com/search?q=`
12. Clique na caixa suspensa que contém os nomes dos campos da camada `` lagos``. Ele está localizado à esquerda do botão: guilabel: *Insert*.
13. Na caixa suspensa, selecione 'NAMES' e clique em: guilabel: *Insert*.
14. Seu texto ação agora se parecerá como este:

    `https://www.google.com/search?q=[%NAMES%]`
15. Para finalizar e adicionar a ação, clique no botão: guilabel: *OK*.

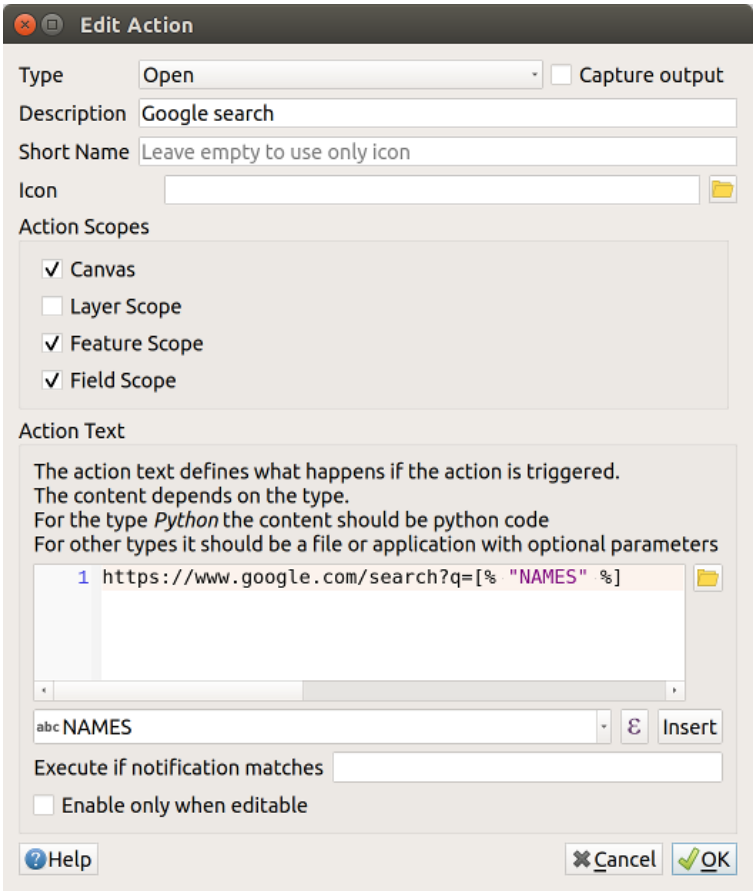


Figura14.57: Caixa de diálogo Editar Ação Configurada com o Exemplo

Isso completa a ação, e ele está pronto para usar. O texto final da ação deve ser semelhante a este:

```
https://www.google.com/search?q=[%NAMES%]
```

Agora podemos utilizar a ação. Feche a: aba de diálogo: 'Propriedades da camada ` e aplique um zoom em uma área de interesse. Certifique-se que a camada `lagos` está ativa e identifique um lago. Na caixa o resultado que você poderá visualizar que a nossa ação está visível:

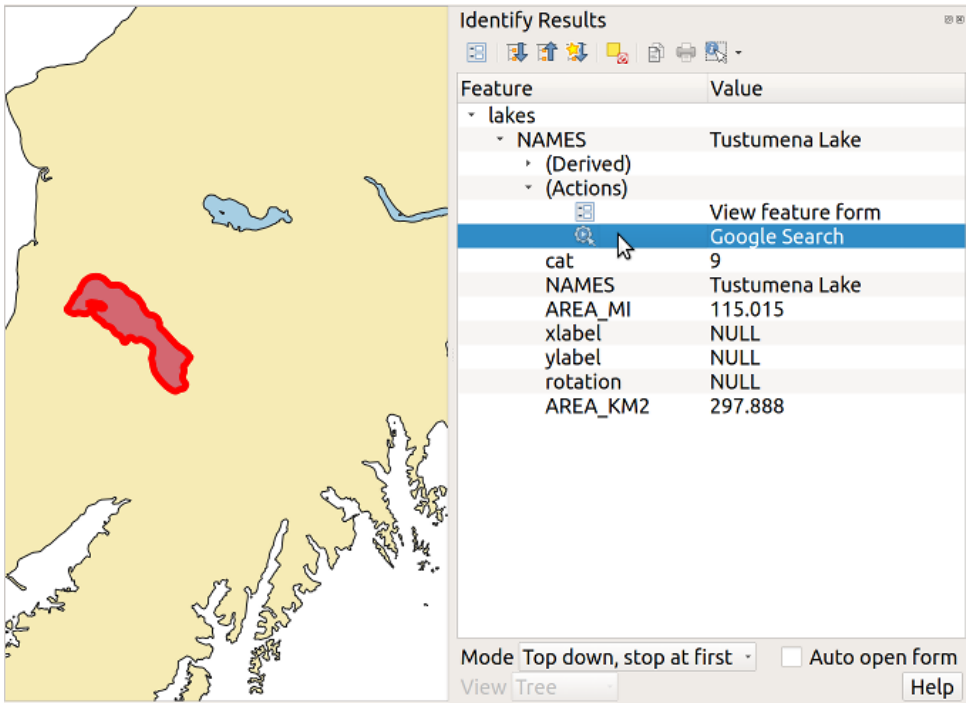


Figura14.58: Selecione o recurso e escolha a ação

When we click on the action, it brings up Firefox and navigates to the URL https://www.google.com/search?q=Tustumena. It is also possible to add further attribute fields to the action. Therefore, you can add a + to the end of the action text, select another field and click on *Insert Field*. In this example, there is just no other field available that would make sense to search for.

Você pode definir várias ações para uma camada, e cada um vai aparecer no diálogo *Identificar resultados*.

You can also invoke actions from the attribute table by selecting a row and right-clicking, then choosing the action from the pop-up menu.

Há todos os tipos de usos para as ações. Por exemplo, se você tem uma camada de pontos que contém as localizações de imagens ou fotos, juntamente com um nome de arquivo, você pode criar uma ação para lançar um visualizador para exibir a imagem. Você também pode usar ações para lançar relatórios baseados na web para um campo de atributo ou combinação de campos, especificando-as da mesma forma que fizemos no nosso exemplo de busca Google.

Nós também podemos fazer exemplos mais complexos, por exemplo, usando ações **Python**.

Usually, when we create an action to open a file with an external application, we can use absolute paths, or eventually relative paths. In the second case, the path is relative to the location of the external program executable file. But what about if we need to use relative paths, relative to the selected layer (a file-based one, like Shapefile or SpatiaLite)? The following code will do the trick:

```
command = "firefox"
imagerelpath = "images_test/test_image.jpg"
layer = qgis.utils.iface.activeLayer()
import os.path
layerpath = layer.source() if layer.providerType() == 'ogr'
  else (qgis.core.QgsDataSourceURI(layer.source()).database()
    if layer.providerType() == 'spatialite' else None)
path = os.path.dirname(str(layerpath))
image = os.path.join(path,imagerelpath)
import subprocess
subprocess.Popen( [command, image ] )
```

Nós apenas temos que lembrar que a ação é um do tipo variáveis *Python* e o *comando* e *imagerelpath* devem ser alteradas para atender as necessidades.

Mas o que dizer se o caminho relativo deve ser relativo ao arquivo de projeto (salvo)? O código da ação Python seria:

```
command = "firefox"
imagerelpath = "images_test/test_image.jpg"
projectpath = qgis.core.QgsProject.instance().fileName()
import os.path
path = os.path.dirname(str(projectpath)) if projectpath != '' else None
image = os.path.join(path, imagerelpath)
import subprocess
subprocess.Popen( [command, image ] )
```

Outro exemplo de ação Python é a que nos permite adicionar novas camadas ao projeto. Por exemplo, os exemplos a seguir irão adicionar ao projeto, respectivamente, um vetor e raster. Os nomes dos arquivos a serem adicionados ao projeto e os nomes a serem indicados para as camadas são conduzidos de dados (*nome do arquivo* e *nome da camada* são nomes da tabela de atributos do vetor, onde a ação foi criada coluna):

```
qgis.utils.iface.addVectorLayer('/yourpath/[% "filename" %].shp',
  '[% "layername" %]', 'ogr')
```

Para adicionar um raster (uma imagem TIF neste exemplo), ele se torna:

```
qgis.utils.iface.addRasterLayer('/yourpath/[% "filename" %].tif',
  '[% "layername" %]')
```

14.1.13 Display Properties

The *Display* tab helps you configure fields to use for feature identification:

- The *Display name*: based on a field or an *expression*. This is:
  - the label shown on top of the feature information in the *Identify tool* results
  - the field used in the *locator bar* when looking for features in all layers
  - the feature identifier in the attribute table *form view*
  - the feature identifier when the map or layout is exported to a layered output format such as GeoPDF
  - the map tip information, i.e. the message displayed in the map canvas when hovering over a feature of the active layer with the Show Map Tips icon pressed. Applicable when no *HTML Map Tip* is set.
- The *HTML Map Tip* is specifically created for the map tips: it's a more complex and full HTML text mixing fields, expressions and html tags (multiline, fonts, images, hyperlink…).

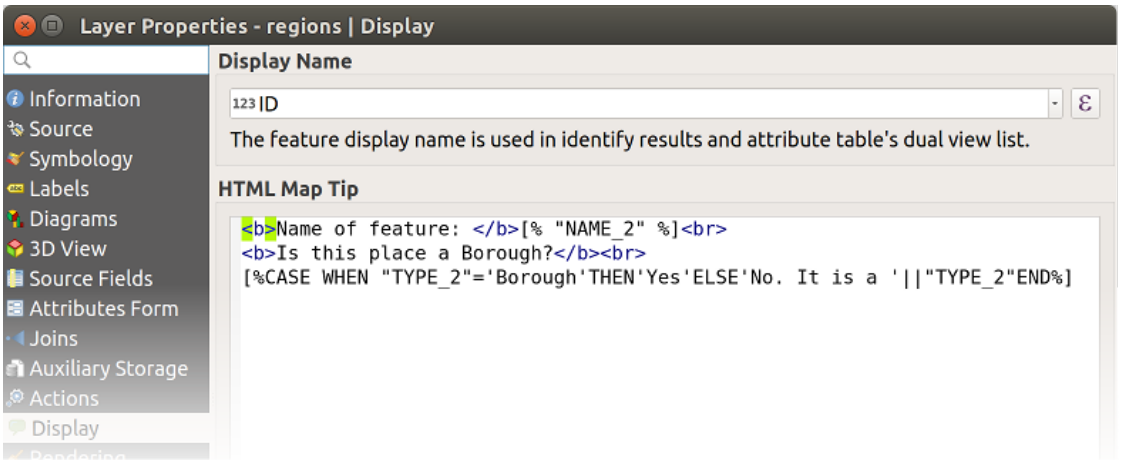


Figura14.59: HTML code for map tip

To activate map tips, select the menu option *View* ► *Show Map Tips* or click on the  Show Map Tips icon of the *Attributes Toolbar*. Map tip is a cross-session feature meaning that once activated, it stays on and apply to any layer in any project, even in future QGIS sessions until it's toggled off.

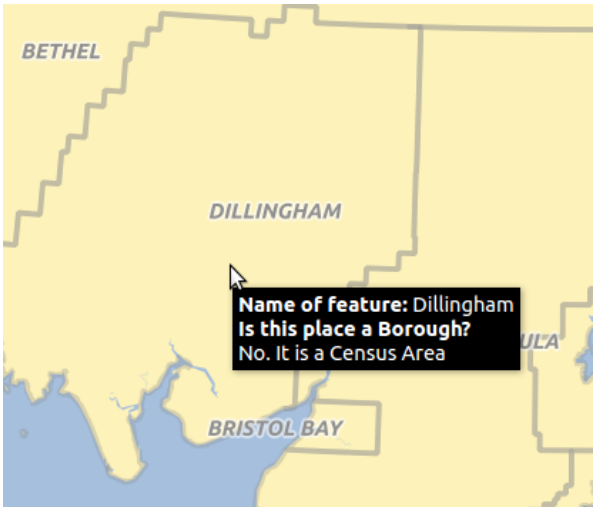


Figura14.60: Map tip made with HTML code

14.1.14 Propriedades de Renderização

Scale dependent visibility

You can set the *Maximum (inclusive)* and *Minimum (exclusive)* scale, defining a range of scale in which features will be visible. Out of this range, they are hidden. The  Set to current canvas scale button helps you use the current map canvas scale as boundary of the range visibility. See *Escala dependente da renderização* for more information.

Simplify geometry

QGIS offers support for on-the-fly feature generalisation. This can improve rendering times when drawing many complex features at small scales. This feature can be enabled or disabled in the layer settings using the  *Simplify geometry* option. There is also a global setting that enables generalisation by default for newly added layers (see *global simplification* for more information).

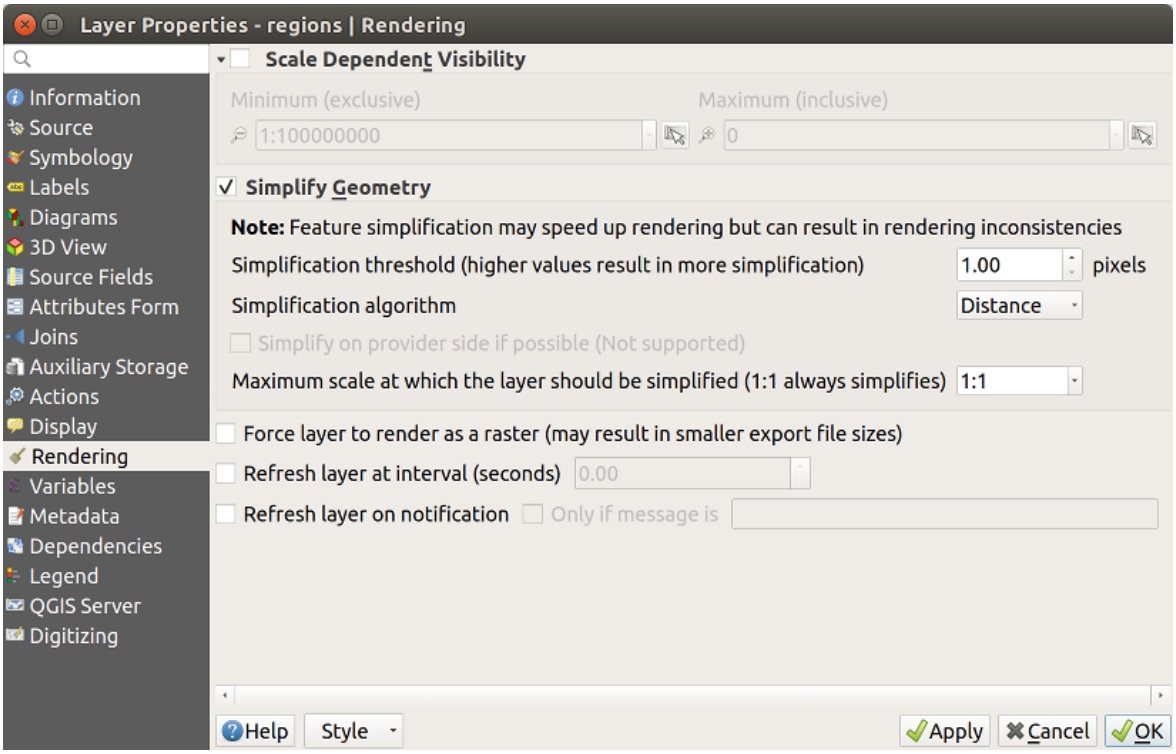


Figura14.61: Layer Geometry Simplification dialog

Nota: Feature generalisation may introduce artefacts into your rendered output in some cases. These may include slivers between polygons and inaccurate rendering when using offset-based symbol layers.

While rendering extremely detailed layers (e.g. polygon layers with a huge number of nodes), this can cause layout exports in PDF/SVG format to be huge as all nodes are included in the exported file. This can also make the resultant file very slow to work with/open in other programs.

Checking *Force layer to render as raster* forces these layers to be rasterised so that the exported files won't have to include all the nodes contained in these layers and the rendering is therefore sped up.

You can also do this by forcing the layout to export as a raster, but that is an all-or-nothing solution, given that the rasterisation is applied to all layers.

Refresh layer at interval (seconds): set a timer to automatically refresh individual layers at a matching interval. Canvas updates are deferred in order to avoid refreshing multiple times if more than one layer has an auto update interval set.

Depending on the data provider (e.g. PostgreSQL), notifications can be sent to QGIS when changes are applied to the data source, out of QGIS. Use the *Refresh layer on notification* option to trigger an update. You can also limit the layer refresh to a specific message set in the *Only if message is* text box.

14.1.15 Propriedades das Variáveis

The *Variables* tab lists all the variables available at the layer's level (which includes all global and project's variables).

It also allows the user to manage layer-level variables. Click the button to add a new custom layer-level variable. Likewise, select a custom layer-level variable from the list and click the button to remove it.

More information on variables usage in the General Tools *Armazenar valores em Variáveis* section.

14.1.16 Propriedades dos Metadados

The *Metadata* tab provides you with options to create and edit a metadata report on your layer. Information to fill concern:

- the data *Identification*: basic attribution of the dataset (parent, identifier, title, abstract, language…);
- the *Categories* the data belongs to. Alongside the **ISO** categories, you can add custom ones;
- the *Keywords* to retrieve the data and associated concepts following a standard based vocabulary;
- the *Access* to the dataset (licenses, rights, fees, and constraints);
- the *Extent* of the dataset, either spatial one (CRS, map extent, altitudes) or temporal;
- the *Contact* of the owner(s) of the dataset;
- the *Links* to ancillary resources and related information;
- the *History* of the dataset.

A summary of the filled information is provided in the *Validation* tab and helps you identify potential issues related to the form. You can then either fix them or ignore them.

Metadata are currently saved in the project file. They can also be saved in a `.qmd` file alongside file based layers or in a local `.sqlite` database for remote layers (e.g. PostGIS).

14.1.17 Dependencies Properties

The *Dependencies* tab allows to declare data dependencies between layers. A data dependency occurs when a data modification in a layer, not by direct user manipulation, may modify data of other layers. This is the case for instance when geometry of a layer is updated by a database trigger or custom PyQGIS scripting after modification of another layer's geometry.

In the *Dependencies* tab, you can select any layers which may externally alter the data in the current layer. Correctly specifying dependent layers allows QGIS to invalidate caches for this layer when the dependent layers are altered.

14.1.18 Propriedades da legenda

The *Legend* properties tab provides you with advanced settings for the *Layers panel* and/or the *print layout legend*. These options include:

- *Text on symbols*: In some cases it can be useful to add extra information to the symbols in the legend. With this frame, you can affect to any of the symbols used in the layer symbology a text that is displayed over the symbol, in both *Layers* panel and print layout legend. This mapping is done by typing each text next to the symbol in the table widget or filling the table using the *Set Labels from Expression* button. Text appearance is handled through the font and color selector widgets of the *Text Format* button.

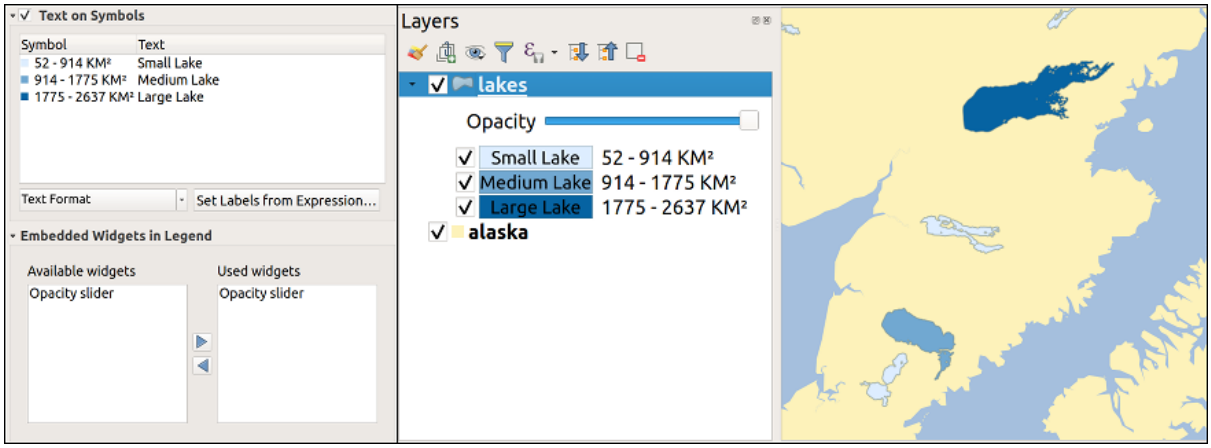


Figura14.62: Setting text on symbols (left) and its rendering in the *Layers* panel (right)

- a list of widgets you can embed within the layer tree in the Layers panel. The idea is to have a way to quickly access some actions that are often used with the layer (setup transparency, filtering, selection, style or other stuff…).

  By default, QGIS provides transparency widget but this can be extended by plugins registering their own widgets and assign custom actions to layers they manage.

14.1.19 Propriedades do Servidor QGIS

The *QGIS Server* tab consists of *Description*, *Attribution*, *MetadataURL*, and *LegendUrl* sections.

From the *Description* section, you can change the *Short name* used to reference the layer in requests (to learn more about short names, read server_short_name). You can also add or edit a *Title* and *Abstract* for the layer, or define a *Keyword list* here. These keyword lists can be used in a metadata catalog. If you want to use a title from an XML metadata file, you have to fill in a link in the *DataUrl* field.

Use *Attribution* to get attribute data from an XML metadata catalog.

In *MetadataUrl*, you can define the general path to the XML metadata catalog. This information will be saved in the QGIS project file for subsequent sessions and will be used for QGIS server.

In the *LegendUrl* section, you can provide the url of a legend image in the url field. You can use the Format drop-down option to apply the appropriate format of the image. Currently png, jpg and jpeg image formats are supported.

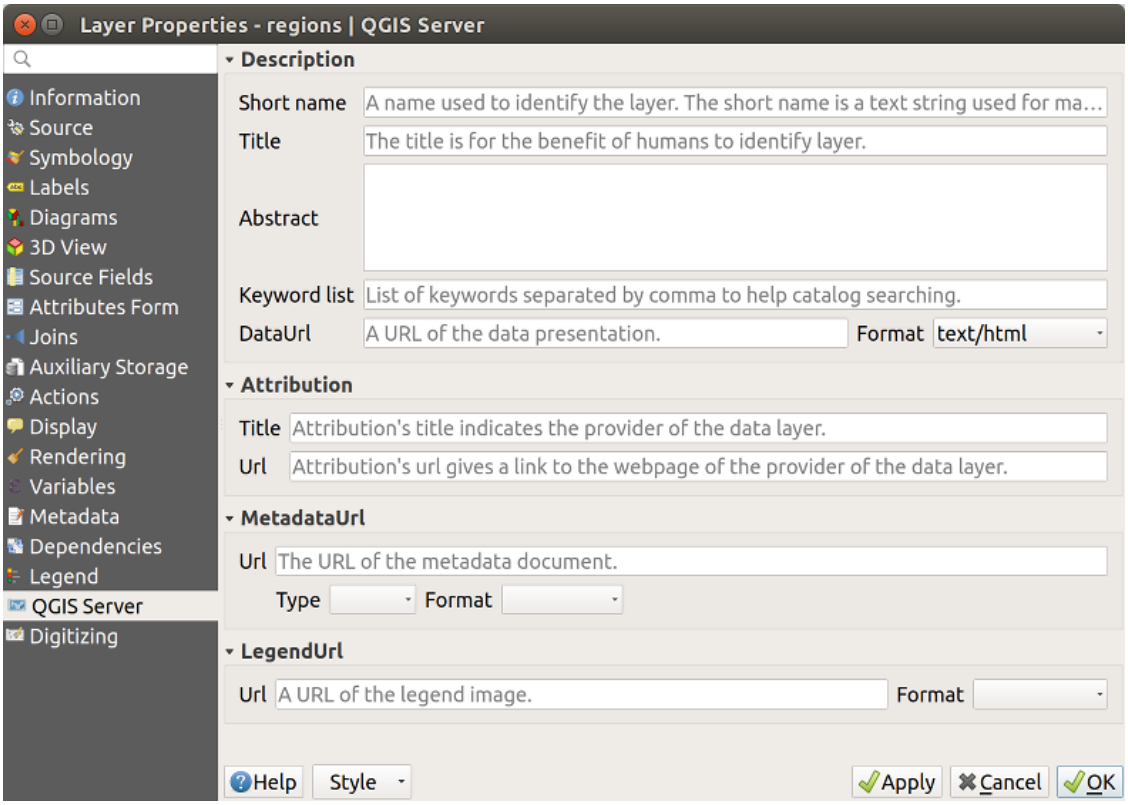


Figura14.63: QGIS Server tab in vector layers properties dialog

To learn more about QGIS Server, read the QGIS-Server-manual.

14.1.20 Digitizing Properties

The *Digitizing* tab gives access to options that help to ensure the quality of digitized geometries.

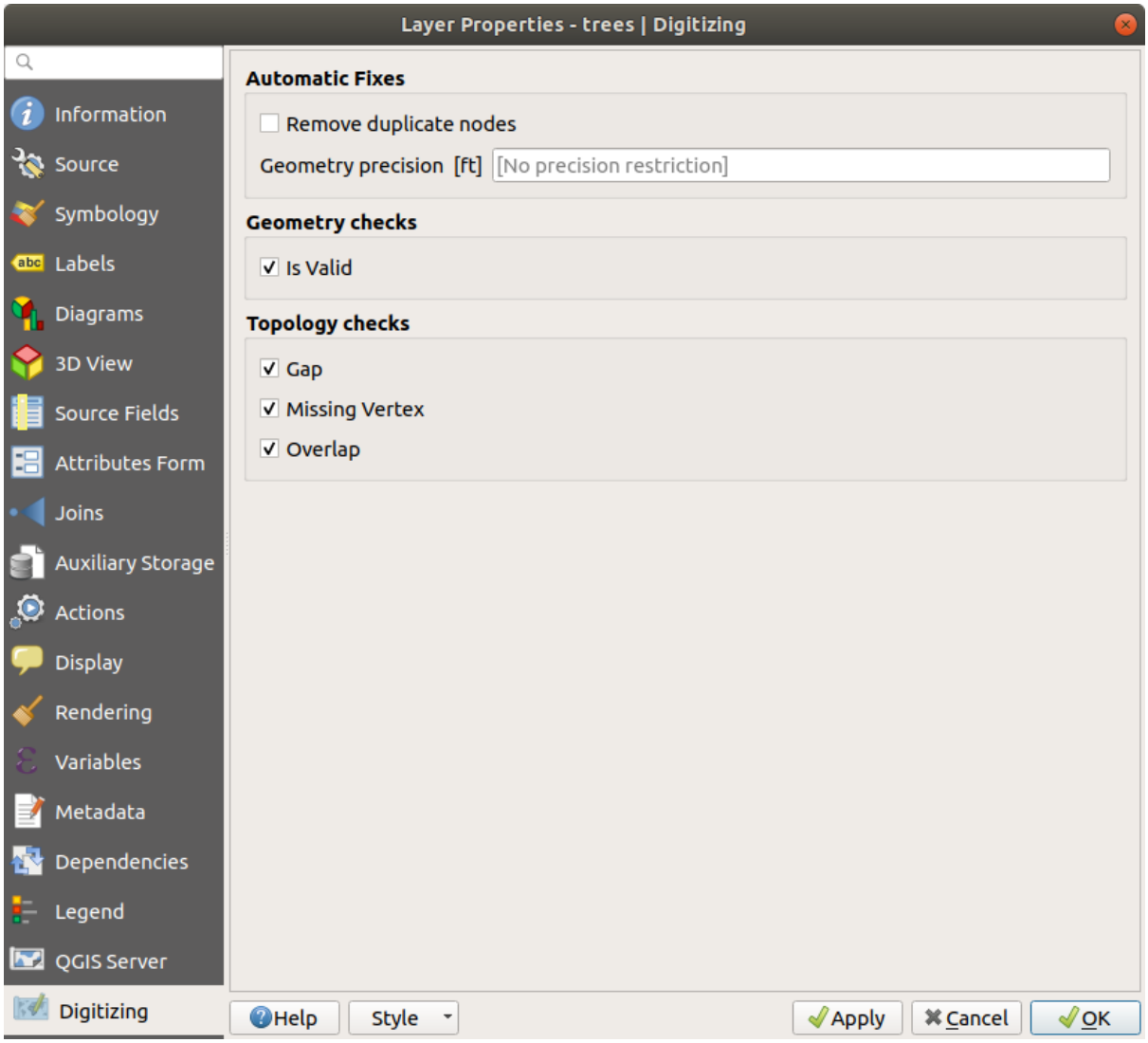


Figura14.64: The QGIS Digitizing tab in the vector layers properties dialog

Automatic Fixes

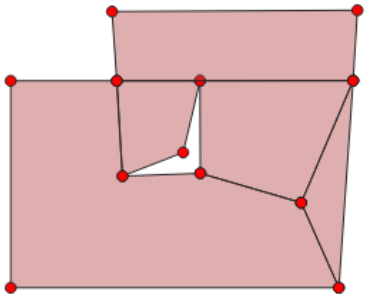
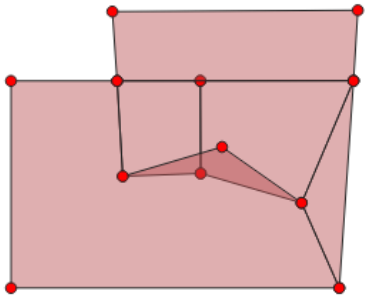
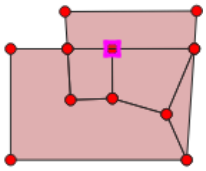
Options in the *Automatic Fixes* section will directly affect the vertices of any geometry which is added or modified. If the *Remove duplicate nodes* option is checked, any two subsequent vertices with exactly the same coordinates will be removed. If the *Geometry precision* is set, all vertices will be rounded to the closest multiple of the configured geometry precision. The rounding will happen in the layer coordinate reference system. Z and M values are not rounded. With many map tools, a grid is shown on the canvas while digitizing.

Geometry Checks

In the *Geometry checks* section, additional validations on a per geometry basis can be activated. Immediately after any geometry modification, failures in these checks are reported to the user in the geometry validation panel. As long as a check is failing, it is not possible to save the layer. The *Is valid* check will run basic validity checks like self intersection on geometries.

Topology Checks

In the *Topology checks* section, additional topology validation checks can be activated. Topology checks will be executed when the user saves the layer. Check errors will be reported in the geometry validation panel. As long as validation errors are present, the layer can not be saved. Topology checks are executed in the area of the bounding box of the modified features. Since other features may be present in the same area, topological errors concerning these features are reported as well as errors introduced in the current edit session.

Topology check option	Illustration
The *Gap* check will check for gaps between neighbouring polygons.	
The *Overlap* check will check for overlaps between neighbouring polygons.	
The *Missing vertex* check will check for shared boundaries of neighbouring polygons where one border misses a vertex which is present on the other one.	

Gap check exceptions

Sometimes it is desirable to keep gaps inside an area in a polygon layer that otherwise is fully covered by polygons. For example, a land use layer may have acceptable holes for lakes. It is possible to define areas that are ignored in the gap check. Since gaps inside these areas are allowed, we will refer to them as *Allowed Gaps* areas.

In the options for the gap checks under *Allowed Gaps*, an *Allowed Gaps layer* can be configured.

Whenever the gap check is executed, gaps which are covered by one or more polygons in the *Allowed Gaps Layer* are not reported as topology errors.

It is also possible to configure an additional *Buffer*. This buffer is applied to each polygon on the *Allowed Gaps Layer*. This makes it possible to make the tests less susceptible to small changes in the outlines at the borders of gaps.

When *Allowed Gaps* are enabled, an additional button (*Add Allowed Gap*) for detected gap errors is available in the geometry validation dock, where gaps are reported during digitizing. If the *Add Allowed Gap* button is pushed, a new polygon with the geometry of the detected gap is inserted into the *Allowed Gaps Layer*. This makes it possible to quickly flag gaps as allowed.

14.2 Expressões

Based on layer data and prebuilt or user defined functions, **Expressions** offer a powerful way to manipulate attribute value, geometry and variables in order to dynamically change the geometry style, the content or position of the label, the value for diagram, the height of a layout item, select some features, create virtual field, …

Nota: A list of the default functions and variables for writing expressions can be found at *Lista de funções*, with detailed information and examples.

14.2.1 O Construtor de expressão string

A plataforma principal para construir expressões, o *Expression string builder* está disponível em muitas partes no QGIS e, pode ser acessado quando:

- clicando no botão expressão;
- ref:*selecionando feições<sec_selection>* com a ferramenta  Selecionar por Expressão…;
- *editando atributos* com a ferramenta  Calculadora de Campo;
- manipulação de parâmetros de simbologia, rótulo ou item de layout com a ferramenta  Substituição de dados definida (veja *Data defined override setup*);
- Construindo uma camada de símbolo de *geradora de geometria* ;
- Realizando algum *geoprocessamento*.

A plataforma de Construção de Expressão oferece acesso a:

- *Aba de Expressão*, a qual ajuda a escrever e verificar a expressão a ser usada, graças a uma lista predefinida de funções;
- *Aba de Editor de Função* a qual ajuda a expandir a lista de funções por meio de criações customizadas de novas funções.

The Interface

The *Expression* tab provides the main interface to write expressions using functions, layer fields and values. It contains the following widgets:

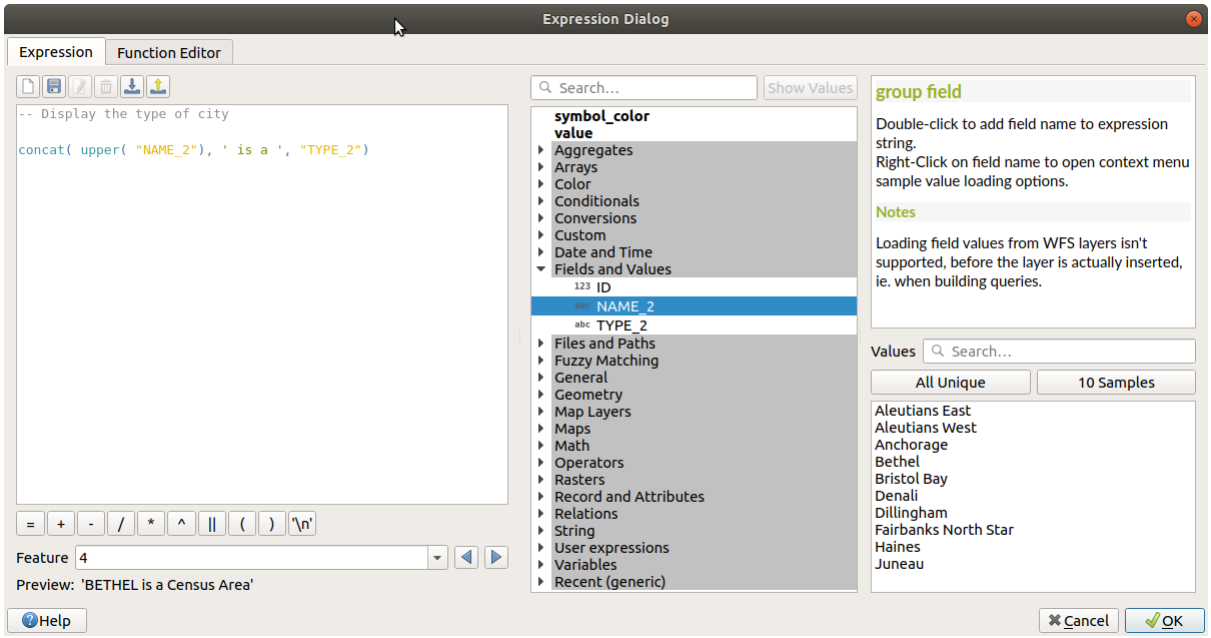


Figura14.65: A guia Expressão

- An expression editor area for typing or pasting expressions. Autocompletion is available to speed expression writing:
  - Variáveis correspondentes, nomes de funções e nomes de campos para o texto de entrada são mostrados abaixo: use as setas `Up` e `Down` para navegar pelos itens e pressione `Tab` para inserir na expressão ou basta clicar no item desejado.
  - Os parâmetros de função são mostrados ao preenchê-los.

  O QGIS também verifica a correção da expressão e destaca todos os erros usando:
  - *Sublinhado*: para funções desconhecidas, argumentos errados ou inválidos;
  - *Marcador*: para todos os outros erros (por exemplo, parênteses ausentes, caracteres inesperados) em um único local.

Dica: Documente sua expressão com comentários

Ao usar expressões complexas, é uma boa prática adicionar texto como um comentário com várias linhas ou comentários embutidos para ajudá-lo a se lembrar.

```
/*
Labels each region with its highest (in altitude) airport(s)
and altitude, eg 'AMBLER : 264m' for the 'Northwest Artic' region
*/
with_variable(
  'airport_alti', -- stores the highest altitude of the region
  aggregate(
    'airports',
    'max',
    "ELEV", -- the field containing the altitude
    -- and limit the airports to the region they are within
    filter := within( $geometry, geometry( @parent ) )
```

(continua na próxima página)

(continuação da página anterior)

```
  ),
    aggregate( -- finds airports at the same altitude in the region
      'airports',
      'concatenate',
      "NAME",
      filter := within( $geometry, geometry( @parent ) )
        and "ELEV" = @airport_alti
    )
    || ' : ' || @airport_alti || 'm'
    -- using || allows regions without airports to be skipped
)
```

- Above the expression editor, a set of tools helps you:
  -  Clear the expression editor
  - create and manage *user expressions*
- Under the expression editor, you find:
  - a set of basic operators to help you build the expression
  - an indication of the expected format of output when you are data-defining feature properties
  - a live *Output preview* of the expression, evaluated on the first feature of the Layer by default. You can browse and evaluate other features of the layer using the *Feature* combobox (the values are taken from the *display name* property of the layer).

    In case of error, it indicates it and you can access the details with the provided hyperlink.
- Um seletor de funções exibe a lista de funções, variáveis, campos … organizados em grupos. Está disponível uma caixa de pesquisa para filtrar a lista e encontrar rapidamente uma função ou campo específico. Clicar duas vezes em um item o adiciona ao editor de expressão.
- Um painel de ajuda exibe ajuda para cada item selecionado no seletor de funções.

Dica: Pressione `Ctrl+Click` ao passar com o mouse sobre o nome de uma função em uma expressão para exibir automaticamente sua ajuda na caixa de diálogo.

A field's values widget shown when a field is selected in the function selector helps to fetch features attributes:

- Look for a particular field value
- Display the list of *All Unique* or *10 Samples* values. Also available from right-click.

  When the field is mapped with another layer or a set of values, i.e. if the *field widget* is of *RelationReference*, *ValueRelation* or *ValueMap* type, it's possible to list all the values of the mapped field (from the referenced layer, table or list). Moreover, you can filter this list to  *Only show values in use* in the current field.

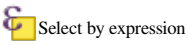
Double-clicking a field value in the widget adds it to the expression editor.

Dica: O painel direito, mostrando as funções de ajuda ou valores de campo, pode ser recolhido (invisível) na caixa de diálogo. Pressione o botão *Mostrar valores* ou *Mostrar ajuda* para recuperá-lo.

Writing an expression

QGIS expressions are used to select features or set values. Writing an expression in QGIS follows some rules:

1. **The dialog defines the context**: if you are used to SQL, you probably know queries of the type *select features from layer where condition* or *update layer set field = new_value where condition*. A QGIS expression also needs all these information but the tool you use to open the expression builder dialog provides parts of them. For example, giving a layer (building) with a field (height):

   - pressing the  tool means that you want to "select features from buildings". The **condition** is the only information you need to provide in the expression text widget, e.g. type `"height" > 20` to select buildings that are higher than 20.
   - with this selection made, pressing the  button and choosing "height" as *Update existing field*, you already provide the command "update buildings set height = ??? where height > 20". The only remaining bits you have to provide in this case is the **new value**, e.g. just enter `50` to set the height of the previously selected buildings.

2. **Pay attention to quotes**: single quotes return a literal, so a text placed between single quotes (`'145'`) is interpreted as a string. Double quotes will give you the value of that text so use them for fields (`"myfield"`). Fields can also be used without quotes (`myfield`). No quotes for numbers (`3.16`).

Nota: Functions normally take as argument a string for field name. Do:

```
attribute( @atlas_feature, 'height' ) -- returns the value stored in the
↪"height" attribute of the current atlas feature
```

And not:

```
attribute( @atlas_feature, "height" ) -- fetches the value of the attribute␣
↪named "height" (e.g. 100), and use that value as a field
                                    -- from which to return the atlas␣
↪feature value. Probably wrong as a field named "100" may not exist.
```

Dica: Use named parameters to ease expression reading

Some functions require many parameters to be set. The expression engine supports the use of named parameters. This means that instead of writing the cryptic expression `clamp( 1, 2, 9)`, you can use `clamp( min:=1, value:=2, max:=9)`. This also allows arguments to be switched, e.g. `clamp( value:=2, max:=9, min:=1)`. Using named parameters helps clarify what the arguments for an expression function refer to, which is helpful when you are trying to interpret an expression later!

Some use cases of expressions

- From the Field Calculator, calculate a "pop_density" field using the existing "total_pop" and "area_km2" fields:

```
"total_pop" / "area_km2"
```

- Label or categorize features based on their area:

```
CASE WHEN $area > 10 000 THEN 'Larger' ELSE 'Smaller' END
```

- Atualiza-se o campo sobre nível de densidade ("density_level") com categorias de acordo com os valores da densidade ("pop_density"):

```
CASE WHEN "pop_density" < 50 THEN 'Low population density'
     WHEN "pop_density" >= 50 and "pop_density" < 150 THEN 'Medium population␣
↪density'
     WHEN "pop_density" >= 150 THEN 'High population density'
END
```

- Aplica-se um estilo categorizado para todas as feições de acordo com condição do valor médio da casa ser maior ou maior do que 10000€ por metro quadrado:

```
"price_m2" > 10000
```

- Usando a ferramenta "Selecionar por Expressão…", seleciona-se todas as feições representativas de áreas de "Alta densidade populacional" e as quais possuem valor médio da casa maior do que 10000€ por metro ^{2}:

```
"density_level" = 'High population density' and "price_m2" > 10000
```

  The previous expression could also be used to define which features to label or show on the map.

- Create a different symbol (type) for the layer, using the geometry generator:

```
point_on_surface( $geometry )
```

- Given a point feature, generate a closed line (using `make_line`) around its geometry:

```
make_line(
  -- using an array of points placed around the original
  array_foreach(
    -- list of angles for placing the projected points (every 90°)
    array:=generate_series( 0, 360, 90 ),
    -- translate the point 20 units in the given direction (angle)
    expression:=project( $geometry, distance:=20, azimuth:=radians( @element )␣
↪)
  )
)
```

- In a print layout label, display the name of the "airports" features that are within the layout "Map 1" item:

```
with_variable( 'extent',
               map_get( item_variables( 'Map 1' ), 'map_extent' ),
               aggregate( 'airports', 'concatenate', "NAME",
                          intersects( $geometry, @extent ), ' ,'
                        )
             )
```

Saving Expressions

Using the  Add current expression to user expressions button above the expression editor frame, you can save important expressions you want to have quick access to. These are available from the **User expressions** group in the middle panel. They are saved under the user profile (`<userprofile>/QGIS/QGIS3.ini` file) and available in all expression dialogs inside all projects of the current user profile.

A set of tools available above the expression editor frame helps you manage the user expressions:

-  Add the current expression to user expressions: store the expression in the user profile. A label and a help text can be added for easy identification.
-  Edit selected expression from user expressions, as well as their help and label
-  Remove selected expression from user expressions

- Import user expressions from a `.json` file into the active user profile folder
- Export user expressions as a `.json` file; all the user expressions in the user profile `QGIS3.ini` file are shared

14.2.2 Editor de Funções

Com a guia *Editor de Funções*, você pode escrever suas próprias funções na linguagem Python. Isso fornece uma maneira prática e confortável de abordar necessidades específicas que não seriam cobertas pelas funções predefinidas.

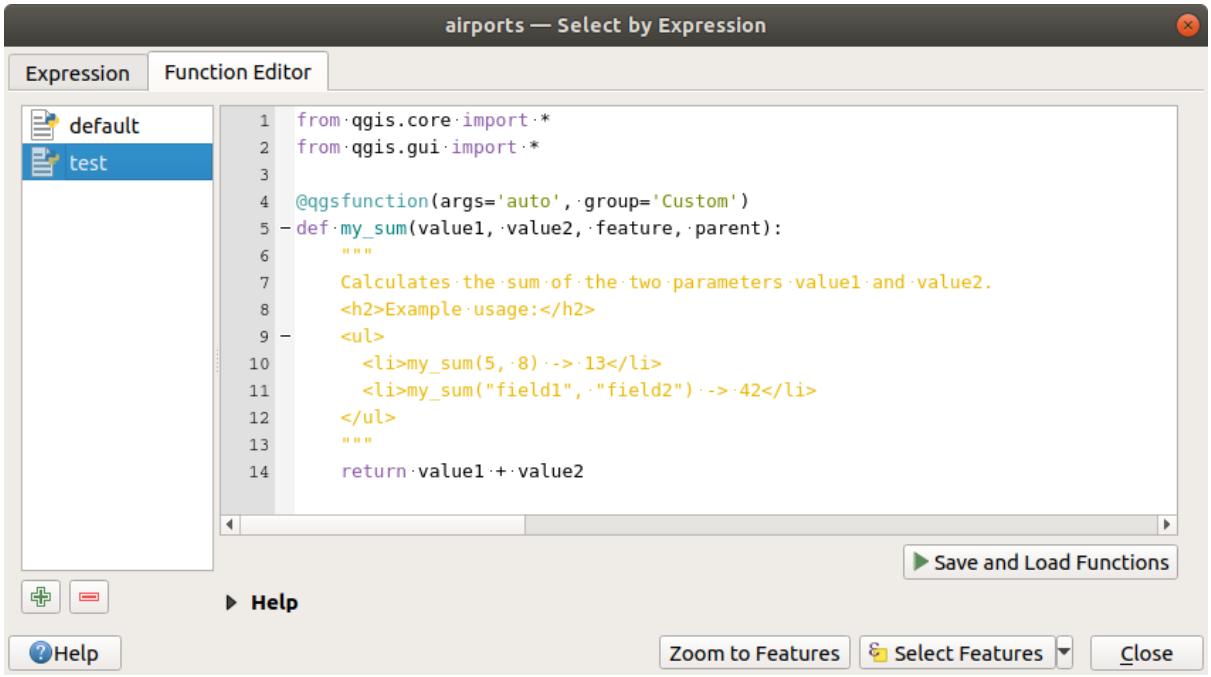


Figura14.66: A guia Editor de Funções

Para criar uma nova função:

1. Pressione o botão Novo Arquivo.
2. Digite um nome para usar no formulário que aparece e pressione *OK*.

   Um novo item com o nome que você fornece é adicionado no painel esquerdo da guia *Editor de Funções*; este é um arquivo Python `.py` baseado no arquivo de modelo QGIS e armazenado na pasta `/python/expressions` no diretório ativo *user profile*.
3. O painel direito exibe o conteúdo do arquivo: um modelo de script python. Atualize o código e sua ajuda de acordo com suas necessidades.
4. Pressione o botão *Salvar e Carregar Funções*. A função que você escreveu é adicionada à árvore de funções na guia *Expressão*, por padrão, no grupo``Personalizada``.
5. Aproveite sua nova função.
6. Se a função precisar de melhorias, ative a guia *Editor de Funções*, faça as alterações e pressione novamente o botão *Salvar e Carregar Funções* para disponibilizá-las no arquivo, e portanto, em qualquer guia de expressão.

As funções personalizadas do Python são armazenadas no diretório de perfil do usuário, o que significa que, a cada inicialização do QGIS, ele carrega automaticamente todas as funções definidas no perfil do usuário atual. Esteja ciente de que novas funções são salvas apenas na pasta `/python/expression` e não no arquivo do projeto. Se você

compartilha um projeto que utiliza uma de suas funções personalizadas, também precisará compartilhar o arquivo `.py` na pasta `/python/expression`.

To delete a custom function:

1. Enable the *Function Editor* tab
2. Select the function in the list
3. Press the Remove selected function. The function is removed from the list and the corresponding `.py` file deleted from the user profile folder.

Example

Here's a short example on how to create your own `my_sum` function that will operate with two values.

```
from qgis.core import *
from qgis.gui import *

@qgsfunction(args='auto', group='Custom')
def my_sum(value1, value2, feature, parent):
    """
    Calculates the sum of the two parameters value1 and value2.
    <h2>Example usage:</h2>
    <ul>
      <li>my_sum(5, 8) -> 13</li>
      <li>my_sum("field1", "field2") -> 42</li>
    </ul>
    """
    return value1 + value2
```

When using the `args='auto'` function argument the number of function arguments required will be calculated by the number of arguments the function has been defined with in Python (minus 2 - `feature`, and `parent`). The `group='Custom'` argument indicates the group in which the function should be listed in the Expression dialog.

It is also possible to add keywords arguments like:

- `usesgeometry=True` if the expression requires access to the features geometry. By default `False`.
- `handlesnull=True` if the expression has custom handling for NULL values. If `False` (default), the result will always be NULL as soon as any parameter is NULL.
- `referenced_columns=[list]`: An array of attribute names that are required to the function. Defaults to `[QgsFeatureRequest.ALL_ATTRIBUTES]`.

The previous example function can then be used in expressions:

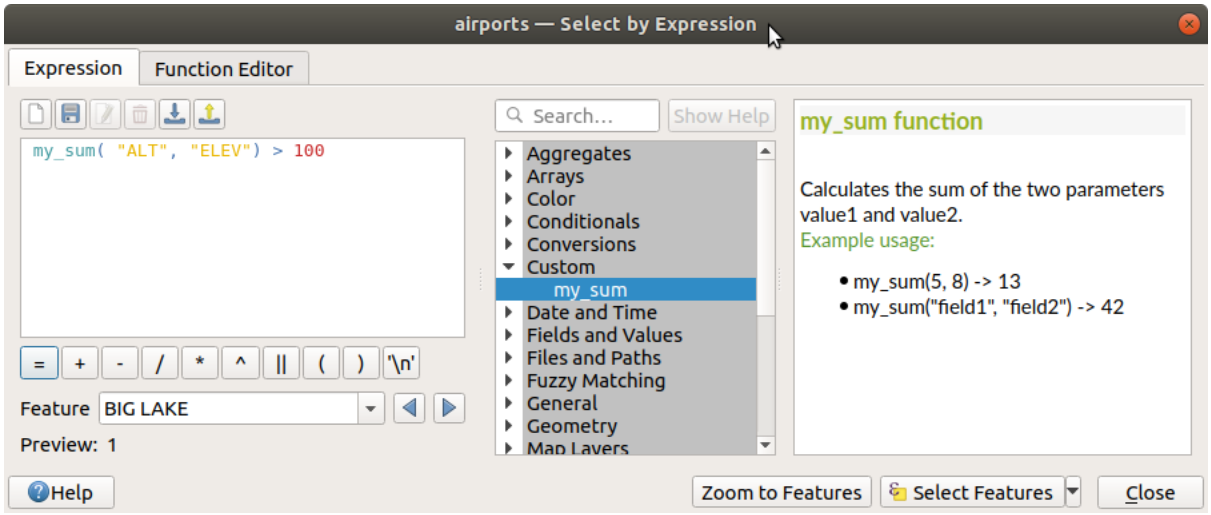


Figura14.67: Função Personalizada adicionada à guia Expressão

Informações adicionais sobre a criação de código Python podem ser encontradas em PyQGIS-Developer-Cookbook.

14.3 Lista de funções

As funções, operadores e variáveis disponíveis no QGIS estão listadas abaixo, agrupadas por categorias.

14.3.1 Funções Agregadas

Este grupo contém funções que agregam valores em camadas e campos.

- *aggregate*
- *array_agg*
- *collect*
- *concatenate*
- *concatenate_unique*
- *count*
- *count_distinct*
- *count_missing*
- *iqr*
- *majority*
- *max_length*
- *maximum*
- *mean*
- *median*
- *min_length*
- *minimum*
- *minority*
- *q1*
- *q3*
- *range*
- *relation_aggregate*
- *stdev*
- *sum*

aggregate

Returns an aggregate value calculated using features from another layer.

Syntax	aggregate(layer, aggregate, expression, [filter], [concatenator=''], [order_by]) [] marks optional arguments
Arguments	• **layer** - a string, representing either a layer name or layer ID • **aggregate** - a string corresponding to the aggregate to calculate. Valid options are: – count – count_distinct – count_missing – min – max – sum – mean – median – stdev – stdevsample – range – minority – majority – q1: first quartile – q3: third quartile – iqr: inter quartile range – min_length: minimum string length – max_length: maximum string length – concatenate: join strings with a concatenator – concatenate_unique: join unique strings with a concatenator – collect: create an aggregated multipart geometry – array_agg: create an array of aggregated values • **expression** - sub expression or field name to aggregate • **filter** - optional filter expression to limit the features used for calculating the aggregate. Fields and geometry are from the features on the joined layer. The source feature can be accessed with the variable @parent. • **concatenator** - optional string to use to join values for 'concatenate' aggregate • **order_by** - optional filter expression to order the features used for calculating the aggregate. Fields and geometry are from the features on the joined layer. By default, the features will be returned in an unspecified order.
Exemplos	• `aggregate(layer:='rail_stations',aggregate:='sum', expression:="passengers")` → sum of all values from the passengers field in the rail_stations layer • `aggregate('rail_stations','sum', "passengers"/7)` → calculates a daily average of "passengers" by dividing the "passengers" field by 7 before summing the values • `aggregate(layer:='rail_stations',aggregate:='sum', expression:="passengers",filter:="class">3)` → sums up all values from the "passengers" field from features where the "class" attribute is greater than 3 only • `aggregate(layer:='rail_stations',aggregate:='concatenate', expression:="name", concatenator:=',')` → comma separated list of the name field for all features in the rail_stations layer • `aggregate(layer:='countries', aggregate:='max', expression:="code", filter:=intersects( $geometry, geometry(@parent) ) )` → The country code of an intersecting country on the layer 'countries' • `aggregate(layer:='rail_stations',aggregate:='sum', expression:="passengers",filter:=contains( @atlas_geometry, $geometry ) )` → sum of all values from the passengers field in the rail_stations within the current atlas feature • `aggregate(layer:='rail_stations', aggregate:='collect', expression:=centroid($geometry), filter:="region_name" = attribute(@parent,'name') )` → aggregates centroid geometries of the rail_stations of the same region as current feature

array_agg

Returns an array of aggregated values from a field or expression.

Syntax	array_agg(expression, [group_by], [filter], [order_by]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate • **order_by** - optional expression to use to order features used to calculate aggregate. By default, the features will be returned in an unspecified order.
Exemplos	• `array_agg("name",group_by:="state")` → list of name values, grouped by state field

collect

Retorna a geometria multipartes de geometrias agregadas de uma expressão

Syntax	collect(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - geometry expression to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `collect( $geometry )` → multipart geometry of aggregated geometries • `collect( centroid($geometry), group_by:="region", filter:= "use" = 'civilian' )` → aggregated centroids of the civilian features based on their region value

concatenate

Returns all aggregated strings from a field or expression joined by a delimiter.

Syntax	concatenate(expression, [group_by], [filter], [concatenator], [order_by]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate • **concatenator** - optional string to use to join values. Empty by default. • **order_by** - optional expression to use to order features used to calculate aggregate. By default, the features will be returned in an unspecified order.
Exemplos	• `concatenate("town_name",group_by:="state", concatenator:=',')` → comma separated list of town_names, grouped by state field

concatenate_unique

Returns all unique strings from a field or expression joined by a delimiter.

Syntax	concatenate_unique(expression, [group_by], [filter], [concatenator], [order_by]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate • **concatenator** - optional string to use to join values. Empty by default. • **order_by** - optional expression to use to order features used to calculate aggregate. By default, the features will be returned in an unspecified order.
Exemplos	• `concatenate_unique("town_name",group_by:="state", concatenator:=',')` → comma separated list of unique town_names, grouped by state field

count

Returns the count of matching features.

Syntax	count(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `count("stations",group_by:="state")` → count of stations, grouped by state field

count_distinct

Returns the count of distinct values.

Syntax	count_distinct(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `count_distinct("stations",group_by:="state")` → count of distinct stations values, grouped by state field

count_missing

Returns the count of missing (NULL) values.

Syntax	count_missing(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `count_missing("stations",group_by:="state")` → count of missing (NULL) station values, grouped by state field

iqr

Returns the calculated inter quartile range from a field or expression.

Syntax	iqr(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `iqr("population",group_by:="state")` → inter quartile range of population value, grouped by state field

majority

Returns the aggregate majority of values (most commonly occurring value) from a field or expression.

Syntax	majority(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `majority("class",group_by:="state")` → most commonly occurring class value, grouped by state field

max_length

Returns the maximum length of strings from a field or expression.

Syntax	max_length(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `max_length("town_name",group_by:="state")` → maximum length of town_name, grouped by state field

maximum

Returns the aggregate maximum value from a field or expression.

Syntax	maximum(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `maximum("population",group_by:="state")` → maximum population value, grouped by state field

mean

Returns the aggregate mean value from a field or expression.

Syntax	mean(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `mean("population",group_by:="state")` → mean population value, grouped by state field

median

Returns the aggregate median value from a field or expression.

Syntax	median(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `median("population",group_by:="state")` → median population value, grouped by state field

min_length

Returns the minimum length of strings from a field or expression.

Syntax	min_length(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `min_length("town_name",group_by:="state")` → minimum length of town_name, grouped by state field

minimum

Returns the aggregate minimum value from a field or expression.

Syntax	minimum(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `minimum("population",group_by:="state")` → minimum population value, grouped by state field

minority

Returns the aggregate minority of values (least occurring value) from a field or expression.

Syntax	minority(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `minority("class",group_by:="state")` → least occurring class value, grouped by state field

q1

Returns the calculated first quartile from a field or expression.

Syntax	q1(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `q1("population",group_by:="state")` → first quartile of population value, grouped by state field

q3

Returns the calculated third quartile from a field or expression.

Syntax	q3(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `q3("population",group_by:="state")` → third quartile of population value, grouped by state field

range

Returns the aggregate range of values (maximum - minimum) from a field or expression.

Syntax	range(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `range("population",group_by:="state")` → range of population values, grouped by state field

relation_aggregate

Returns an aggregate value calculated using all matching child features from a layer relation.

Syntax	relation_aggregate(relation, aggregate, expression, [concatenator=''], [order_by]) [] marks optional arguments
Arguments	• **relation** - a string, representing a relation ID • **aggregate** - a string corresponding to the aggregate to calculate. Valid options are: – count – count_distinct – count_missing – min – max – sum – mean – median – stdev – stdevsample – range – minority – majority – q1: first quartile – q3: third quartile – iqr: inter quartile range – min_length: minimum string length – max_length: maximum string length – concatenate: join strings with a concatenator – concatenate_unique: join unique strings with a concatenator – collect: create an aggregated multipart geometry – array_agg: create an array of aggregated values • **expression** - sub expression or field name to aggregate • **concatenator** - optional string to use to join values for 'concatenate' aggregate • **order_by** - optional expression to order the features used for calculating the aggregate. Fields and geometry are from the features on the joined layer. By default, the features will be returned in an unspecified order.
Exemplos	• `relation_aggregate(relation:='my_relation', aggregate:='mean',expression:="passengers")` → mean value of all matching child features using the 'my_relation' relation • `relation_aggregate('my_relation','sum', "passengers"/7)` → sum of the passengers field divided by 7 for all matching child features using the 'my_relation' relation • `relation_aggregate('my_relation','concatenate', "towns", concatenator:=',')` → comma separated list of the towns field for all matching child features using the 'my_relation' relation • `relation_aggregate('my_relation','array_agg', "id")` → array of the id field from all matching child features using the 'my_relation' relation

Further reading: *Creating one or many to many relations*

stdev

Returns the aggregate standard deviation value from a field or expression.

Syntax	stdev(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `stdev("population",group_by:="state")` → standard deviation of population value, grouped by state field

sum

Returns the aggregate summed value from a field or expression.

Syntax	sum(expression, [group_by], [filter]) [] marks optional arguments
Arguments	• **expression** - sub expression of field to aggregate • **group_by** - optional expression to use to group aggregate calculations • **filter** - optional expression to use to filter features used to calculate aggregate
Exemplos	• `sum("population",group_by:="state")` → summed population value, grouped by state field

14.3.2 Funções Array

Este grupo contém funções para criar e manipular arrays (também conhecidas como estruturas de dados da lista). A ordem dos valores no array é importante, diferentemente da *'map' data structure*, onde a ordem dos pares chave-valor é irrelevante e os valores são identificados por suas chaves.

- *array*
- *array_all*
- *array_append*
- *array_cat*
- *array_contains*
- *array_distinct*
- *array_filter*
- *array_find*
- *array_first*
- *array_foreach*
- *array_get*
- *array_insert*

- *array_intersect*
- *array_last*
- *array_length*
- *array_prepend*
- *array_remove_all*
- *array_remove_at*
- *array_reverse*
- *array_slice*
- *array_sort*
- *array_to_string*
- *generate_series*
- *regexp_matches*
- *string_to_array*

array

Returns an array containing all the values passed as parameter.

Syntax	array(value1, value2, …)
Arguments	• **value** - a value
Exemplos	• `array(2,10)` → [2, 10]

array_all

Returns true if an array contains all the values of a given array.

Syntax	array_all(array_a, array_b)
Arguments	• **array_a** - an array • **array_b** - the array of values to search
Exemplos	• `array_all(array(1,2,3),array(2,3))` → true • `array_all(array(1,2,3),array(1,2,4))` → false

array_append

Returns an array with the given value added at the end.

Syntax	array_append(array, value)
Arguments	• **array** - an array • **value** - the value to add
Exemplos	• `array_append(array(1,2,3),4)` → [1, 2, 3, 4]

array_cat

Returns an array containing all the given arrays concatenated.

Syntax	array_cat(array1, array2, …)
Arguments	• **array** - an array
Exemplos	• `array_cat(array(1,2),array(2,3))` → [1, 2, 2, 3]

array_contains

Returns true if an array contains the given value.

Syntax	array_contains(array, value)
Arguments	• **array** - an array • **value** - the value to search
Exemplos	• `array_contains(array(1,2,3),2)` → true

array_distinct

Returns an array containing distinct values of the given array.

Syntax	array_distinct(array)
Arguments	• **array** - an array
Exemplos	• `array_distinct(array(1,2,3,2,1))` → [1, 2, 3]

array_filter

Returns an array with only the items for which the expression evaluates to true.

Syntax	array_filter(array, expression)
Arguments	• **array** - an array • **expression** - an expression to evaluate on each item. The variable *@element* will be replaced by the current value.
Exemplos	• `array_filter(array(1,2,3),@element < 3)` → [1, 2]

array_find

Retorna o índice (0 para o primeiro) de um valor dentro de um array. Retorna -1 se o valor não for encontrado.

Syntax	array_find(array, value)
Arguments	• **array** - an array • **value** - the value to search
Exemplos	• `array_find(array(1,2,3),2)` → 1

array_first

Returns the first value of an array.

Syntax	array_first(array)
Arguments	• **array** - an array
Exemplos	• `array_first(array('a','b','c'))` → 'a'

array_foreach

Returns an array with the given expression evaluated on each item.

Syntax	array_foreach(array, expression)
Arguments	• **array** - an array • **expression** - an expression to evaluate on each item. The variable *@element* will be replaced by the current value.
Exemplos	• `array_foreach(array('a','b','c'),upper(@element))` → ['A', 'B', 'C'] • `array_foreach(array(1,2,3),@element + 10)` → [11, 12, 13]

array_get

Returns the Nth value (0 for the first one) of an array.

Syntax	array_get(array, index)
Arguments	• **array** - an array • **index** - the index to get (0 based)
Exemplos	• `array_get(array('a','b','c'),1)` → 'b'

array_insert

Returns an array with the given value added at the given position.

Syntax	array_insert(array, pos, value)
Arguments	• **array** - an array • **pos** - the position where to add (0 based) • **value** - the value to add
Exemplos	• `array_insert(array(1,2,3),1,100)` → [1, 100, 2, 3]

array_intersect

Returns true if at least one element of array1 exists in array2.

Syntax	array_intersect(array1, array2)
Arguments	• **array1** - an array • **array2** - another array
Exemplos	• `array_intersect(array(1,2,3,4),array(4,0,2,5))` → true

array_last

Returns the last value of an array.

Syntax	array_last(array)
Arguments	• **array** - an array
Exemplos	• `array_last(array('a','b','c'))` → 'c'

array_length

Returns the number of elements of an array.

Syntax	array_length(array)
Arguments	• **array** - an array
Exemplos	• `array_length(array(1,2,3))` → 3

array_prepend

Returns an array with the given value added at the beginning.

Syntax	array_prepend(array, value)
Arguments	• **array** - an array • **value** - the value to add
Exemplos	• `array_prepend(array(1,2,3),0)` → [0, 1, 2, 3]

array_remove_all

Returns an array with all the entries of the given value removed.

Syntax	array_remove_all(array, value)
Arguments	• **array** - an array • **value** - the values to remove
Exemplos	• `array_remove_all(array('a','b','c','b'),'b')` → ['a', 'c']

array_remove_at

Returns an array with the given index removed.

Syntax	array_remove_at(array, pos)
Arguments	• **array** - an array • **pos** - the position to remove (0 based)
Exemplos	• `array_remove_at(array(1,2,3),1)` → [1, 3]

array_reverse

Returns the given array with array values in reversed order.

Syntax	array_reverse(array)
Arguments	• **array** - an array
Exemplos	• `array_reverse(array(2,4,0,10))` → [10, 0, 4, 2]

array_slice

Returns a portion of the array. The slice is defined by the start_pos and end_pos arguments.

Syntax	array_slice(array, start_pos, end_pos)
Arguments	• **array** - an array • **start_pos** - the index of the start position of the slice (0 based). The start_pos index is included in the slice. If you use a negative start_pos, the index is counted from the end of the list (-1 based). • **end_pos** - the index of the end position of the slice (0 based). The end_pos index is included in the slice. If you use a negative end_pos, the index is counted from the end of the list (-1 based).
Exemplos	• `array_slice(array(1,2,3,4,5),0,3)` → [1, 2, 3, 4] • `array_slice(array(1,2,3,4,5),0,-1)` → [1, 2, 3, 4, 5] • `array_slice(array(1,2,3,4,5),-5,-1)` → [1, 2, 3, 4, 5] • `array_slice(array(1,2,3,4,5),0,0)` → [1] • `array_slice(array(1,2,3,4,5),-2,-1)` → [4, 5] • `array_slice(array(1,2,3,4,5),-1,-1)` → [5] • `array_slice(array('Dufour','Valmiera','Chugiak', 'Brighton'),1,2)` → ['Valmiera', 'Chugiak'] • `array_slice(array('Dufour','Valmiera','Chugiak', 'Brighton'),-2,-1)` → ['Chugiak', 'Brighton']

array_sort

Returns the provided array with its elements sorted.

Syntax	array_sort(array, [ascending=true]) [] marks optional arguments
Arguments	• **array** - an array • **ascending** - set this parameter to false to sort the array in descending order
Exemplos	• `array_sort(array(3,2,1))` → [1, 2, 3]

array_to_string

Concatenates array elements into a string separated by a delimiter and using optional string for empty values.

Syntax	array_to_string(array, [delimiter=','], [empty_value='']) [] marks optional arguments
Arguments	• **array** - the input array • **delimiter** - the string delimiter used to separate concatenated array elements • **empty_value** - the optional string to use as replacement for empty (zero length) matches
Exemplos	• `array_to_string(array('1','2','3'))` → '1,2,3' • `array_to_string(array(1,2,3),'-')` → '1-2-3' • `array_to_string(array('1','','3'),',','0')` → '1,0,3'

generate_series

Creates an array containing a sequence of numbers.

Syntax	generate_series(start, stop, [step=1]) [] marks optional arguments
Arguments	• **start** - first value of the sequence • **stop** - value that ends the sequence once reached • **step** - value used as the increment between values
Exemplos	• `generate_series(1,5)` → [1, 2, 3, 4, 5] • `generate_series(5,1,-1)` → [5, 4, 3, 2, 1]

regexp_matches

Returns an array of all strings captured by capturing groups, in the order the groups themselves appear in the supplied regular expression against a string.

Syntax	regexp_matches(string, regex, [empty_value='']) [] marks optional arguments
Arguments	• **string** - the string to capture groups from against the regular expression • **regex** - the regular expression used to capture groups • **empty_value** - the optional string to use as replacement for empty (zero length) matches
Exemplos	• `regexp_matches('QGIS=>rocks','(.*)=>(.*)')` → ['QGIS', 'rocks'] • `regexp_matches('key=>','(.*)=>(.*)','empty value')` → ['key', 'empty value']

string_to_array

Splits string into an array using supplied delimiter and optional string for empty values.

Syntax	string_to_array(string, [delimiter=','], [empty_value='']) [] marks optional arguments
Arguments	• **string** - the input string • **delimiter** - the string delimiter used to split the input string • **empty_value** - the optional string to use as replacement for empty (zero length) matches
Exemplos	• `string_to_array('1,2,3',',')` → ['1', '2', '3'] • `string_to_array('1,,3',',','0')` → ['1', '0', '3']

14.3.3 Funções Cor

Este grupo contém funções para manipulação de cores.

- *color_cmyk*
- *color_cmyka*
- *color_grayscale_average*
- *color_hsl*
- *color_hsla*
- *color_hsv*
- *color_hsva*
- *color_mix_rgb*
- *color_part*
- *color_rgb*
- *color_rgba*
- *create_ramp*
- *darker*
- *lighter*
- *project_color*
- *ramp_color*
- *set_color_part*

color_cmyk

Retorna uma representação de string de caracteres de uma cor com base em seus componentes ciano, magenta, amarelo e preto

Syntax	color_cmyk(cyan, magenta, yellow, black)
Arguments	• **cyan** - cyan component of the color, as a percentage integer value from 0 to 100 • **magenta** - magenta component of the color, as a percentage integer value from 0 to 100 • **yellow** - yellow component of the color, as a percentage integer value from 0 to 100 • **black** - black component of the color, as a percentage integer value from 0 to 100
Exemplos	• `color_cmyk(100,50,0,10)` → '0,115,230'

color_cmyka

Retorna uma representação de string de caracteres de uma cor com base em seus componentes ciano, magenta, amarelo, preto e alfa (transparência)

Syntax	color_cmyka(cyan, magenta, yellow, black, alpha)
Arguments	• **cyan** - cyan component of the color, as a percentage integer value from 0 to 100 • **magenta** - magenta component of the color, as a percentage integer value from 0 to 100 • **yellow** - yellow component of the color, as a percentage integer value from 0 to 100 • **black** - black component of the color, as a percentage integer value from 0 to 100 • **alpha** - alpha component as an integer value from 0 (completely transparent) to 255 (opaque).
Exemplos	• `color_cmyk(100,50,0,10,200)` → '0,115,230,200'

color_grayscale_average

Applies a grayscale filter and returns a string representation from a provided color.

Syntax	color_grayscale_average(color)
Arguments	• **color** - a color string
Exemplos	• `color_grayscale_average('255,100,50')` → '135,135,135,255'

color_hsl

Returns a string representation of a color based on its hue, saturation, and lightness attributes.

Syntax	color_hsl(hue, saturation, lightness)
Arguments	• **hue** - hue of the color, as an integer value from 0 to 360 • **saturation** - saturation percentage of the color as an integer value from 0 to 100 • **lightness** - lightness percentage of the color as an integer value from 0 to 100
Exemplos	• `color_hsl(100,50,70)` → '166,217,140'

color_hsla

Retorna uma representação de string de uma cor com base em seus atributos de matiz, saturação, brilho e alfa (transparência)

Syntax	color_hsla(hue, saturation, lightness, alpha)
Arguments	• **hue** - hue of the color, as an integer value from 0 to 360 • **saturation** - saturation percentage of the color as an integer value from 0 to 100 • **lightness** - lightness percentage of the color as an integer value from 0 to 100 • **alpha** - alpha component as an integer value from 0 (completely transparent) to 255 (opaque).
Exemplos	• `color_hsla(100,50,70,200)` → '166,217,140,200'

color_hsv

Returns a string representation of a color based on its hue, saturation, and value attributes.

Syntax	color_hsv(hue, saturation, value)
Arguments	• **hue** - hue of the color, as an integer value from 0 to 360 • **saturation** - saturation percentage of the color as an integer value from 0 to 100 • **value** - value percentage of the color as an integer from 0 to 100
Exemplos	• `color_hsv(40,100,100)` → '255,170,0'

color_hsva

Returns a string representation of a color based on its hue, saturation, value and alpha (transparency) attributes.

Syntax	color_hsva(hue, saturation, value, alpha)
Arguments	• **hue** - hue of the color, as an integer value from 0 to 360 • **saturation** - saturation percentage of the color as an integer value from 0 to 100 • **value** - value percentage of the color as an integer from 0 to 100 • **alpha** - alpha component as an integer value from 0 (completely transparent) to 255 (opaque)
Exemplos	• `color_hsva(40,100,100,200)` → '255,170,0,200'

color_mix_rgb

Returns a string representing a color mixing the red, green, blue, and alpha values of two provided colors based on a given ratio.

Syntax	color_mix_rgb(color1, color2, ratio)
Arguments	• **color1** - a color string • **color2** - a color string • **ratio** - a ratio
Exemplos	• `color_mix_rgb('0,0,0','255,255,255',0.5)` → '127,127,127,255'

color_part

Returns a specific component from a color string, e.g., the red component or alpha component.

Syntax	color_part(color, component)
Arguments	• **color** - a color string • **component** - a string corresponding to the color component to return. Valid options are: – red: RGB red component (0-255) – green: RGB green component (0-255) – blue: RGB blue component (0-255) – alpha: alpha (transparency) value (0-255) – hue: HSV hue (0-360) – saturation: HSV saturation (0-100) – value: HSV value (0-100) – hsl_hue: HSL hue (0-360) – hsl_saturation: HSL saturation (0-100) – lightness: HSL lightness (0-100) – cyan: CMYK cyan component (0-100) – magenta: CMYK magenta component (0-100) – yellow: CMYK yellow component (0-100) – black: CMYK black component (0-100)
Exemplos	• `color_part('200,10,30','green')` → 10

color_rgb

Returns a string representation of a color based on its red, green, and blue components.

Syntax	color_rgb(red, green, blue)
Arguments	• **red** - red component as an integer value from 0 to 255 • **green** - green component as an integer value from 0 to 255 • **blue** - blue component as an integer value from 0 to 255
Exemplos	• `color_rgb(255,127,0)` → '255,127,0'

color_rgba

Returns a string representation of a color based on its red, green, blue, and alpha (transparency) components.

Syntax	color_rgba(red, green, blue, alpha)
Arguments	• **red** - red component as an integer value from 0 to 255 • **green** - green component as an integer value from 0 to 255 • **blue** - blue component as an integer value from 0 to 255 • **alpha** - alpha component as an integer value from 0 (completely transparent) to 255 (opaque).
Exemplos	• `color_rgba(255,127,0,200)` → '255,127,0,200'

create_ramp

Returns a gradient ramp from a map of color strings and steps.

Syntax	create_ramp(map, [discrete=false]) [] marks optional arguments
Arguments	• **map** - a map of color strings and steps • **discrete** - set this parameter to true to create a discrete color ramp
Exemplos	• `ramp_color(create_ramp(map(0,'0,0,0',1,'255,0,0')),1)` → '255,0,0,255'

darker

Retorna uma string de cor mais escura (ou mais clara)

Syntax	darker(color, factor)
Arguments	• **color** - a color string • **factor** - an integer corresponding to the darkening factor: – if the factor is greater than 100, this function returns a darker color (e.g., setting factor to 200 returns a color that is half the brightness); – if the factor is less than 100, the return color is lighter, but using the lighter() function for this purpose is recommended; – if the factor is 0 or negative, the return value is unspecified.
Exemplos	• `darker('200,10,30', 200)` → '100,5,15,255'

Further reading: *lighter*

lighter

Retorna uma string de cor mais clara (ou mais escura)

Syntax	lighter(color, factor)
Arguments	• **color** - a color string • **factor** - an integer corresponding to the lightening factor: – if the factor is greater than 100, this function returns a lighter color (e.g., setting factor to 150 returns a color that is 50% brighter); – if the factor is less than 100, the return color is darker, but using the darker() function for this purpose is recommended; – if the factor is 0 or negative, the return value is unspecified.
Exemplos	• `lighter('200,10,30', 200)` → '255,158,168,255'

Further reading: *darker*

project_color

Returns a color from the project's color scheme.

Syntax	project_color(name)
Arguments	• **name** - a color name
Exemplos	• `project_color('Logo color')` → '20,140,50'

Further reading: *setting project colors*

ramp_color

Returns a string representing a color from a color ramp.

Saved ramp variant

Returns a string representing a color from a saved ramp

Syntax	ramp_color(ramp_name, value)
Arguments	• **ramp_name** - the name of the color ramp as a string, for example 'Spectral' • **value** - the position on the ramp to select the color from as a real number between 0 and 1
Exemplos	• `ramp_color('Spectral',0.3)` → '253,190,115,255'

Nota: The color ramps available vary between QGIS installations. This function may not give the expected results if you move your QGIS project between installations.

Expression-created ramp variant

Returns a string representing a color from an expression-created ramp

Syntax	ramp_color(ramp, value)
Arguments	• **ramp** - the color ramp • **value** - the position on the ramp to select the color from as a real number between 0 and 1
Exemplos	• `ramp_color(create_ramp(map(0,'0,0,0',1,'255,0,0')),1)` → '255,0,0,255'

Further reading: *Setting a Color Ramp*, *The color ramp drop-down shortcut*

set_color_part

Sets a specific color component for a color string, e.g., the red component or alpha component.

Syntax	set_color_part(color, component, value)
Arguments	• **color** - a color string • **component** - a string corresponding to the color component to set. Valid options are: – red: RGB red component (0-255) – green: RGB green component (0-255) – blue: RGB blue component (0-255) – alpha: alpha (transparency) value (0-255) – hue: HSV hue (0-360) – saturation: HSV saturation (0-100) – value: HSV value (0-100) – hsl_hue: HSL hue (0-360) – hsl_saturation: HSL saturation (0-100) – lightness: HSL lightness (0-100) – cyan: CMYK cyan component (0-100) – magenta: CMYK magenta component (0-100) – yellow: CMYK yellow component (0-100) – black: CMYK black component (0-100) • **value** - new value for color component, respecting the ranges listed above
Exemplos	• `set_color_part('200,10,30','green',50)` → '200,50,30,255'

14.3.4 Funções Condicionais

Este grupo contém funções para lidar com verificações condicionais em expressões.

- *CASE*
- *coalesce*
- *if*
- *nullif*
- *regexp_match*
- *try*

CASE

CASE is used to evaluate a series of conditions and return a result for the first condition met. The conditions are evaluated sequentially, and if a condition is true, the evaluation stops, and the corresponding result is returned. If none of the conditions are true, the value in the ELSE clause is returned. Furthermore, if no ELSE clause is set and none of the conditions are met, NULL is returned.

CASE

WHEN *condition* THEN *result*

[…n]

[ELSE *result*]

END

[ ] marks optional components

Arguments	• **WHEN condition** - A condition expression to evaluate • **THEN result** - If *condition* evaluates to True then *result* is evaluated and returned. • **ELSE result** - If none of the above conditions evaluated to True then *result* is evaluated and returned.
Exemplos	• `CASE WHEN "name" IS NULL THEN 'None' END` → Returns the string 'None' if the "name" field is NULL • `CASE WHEN $area > 10000 THEN 'Big property' WHEN $area > 5000 THEN 'Medium property' ELSE 'Small property' END` → Returns the string 'Big property' if the area is bigger than 10000, 'Medium property' if the area is between 5000 and 10000, and 'Small property' for others

coalesce

Returns the first non-NULL value from the expression list.

This function can take any number of arguments.

Syntax	coalesce(expression1, expression2, …)
Arguments	• **expression** - any valid expression or value, regardless of type.
Exemplos	• `coalesce(NULL, 2)` → 2 • `coalesce(NULL, 2, 3)` → 2 • `coalesce(7, NULL, 3*2)` → 7 • `coalesce("fieldA", "fallbackField", 'ERROR')` → value of fieldA if it is non-NULL else the value of "fallbackField" or the string 'ERROR' if both are NULL

if

Tests a condition and returns a different result depending on the conditional check.

Syntax	if(condition, result_when_true, result_when_false)
Arguments	• **condition** - the condition which should be checked • **result_when_true** - the result which will be returned when the condition is true or another value that does not convert to false. • **result_when_false** - the result which will be returned when the condition is false or another value that converts to false like 0 or ''. NULL will also be converted to false.
Exemplos	• `if( 1+1=2, 'Yes', 'No' )` → 'Yes' • `if( 1+1=3, 'Yes', 'No' )` → 'No' • `if( 5 > 3, 1, 0)` → 1 • `if( '', 'It is true (not empty)', 'It is false (empty)' )` → 'It is false (empty)' • `if( ' ', 'It is true (not empty)', 'It is false (empty)' )` → 'It is true (not empty)' • `if( 0, 'One', 'Zero' )` → 'Zero' • `if( 10, 'One', 'Zero' )` → 'One'

nullif

Returns a NULL value if value1 equals value2; otherwise it returns value1. This can be used to conditionally substitute values with NULL.

Syntax	nullif(value1, value2)
Arguments	• **value1** - The value that should either be used or substituted with NULL. • **value2** - The control value that will trigger the NULL substitution.
Exemplos	• `nullif('(none)', '(none)')` → NULL • `nullif('text', '(none)')` → 'text' • `nullif("name", '')` → NULL, if name is an empty string (or already NULL), the name in any other case.

regexp_match

Return the first matching position matching a regular expression within an unicode string, or 0 if the substring is not found.

Syntax	regexp_match(input_string, regex)
Arguments	• **input_string** - the string to test against the regular expression • **regex** - The regular expression to test against. Backslash characters must be double escaped (e.g., "\\s" to match a white space character or "\\b" to match a word boundary).
Exemplos	• `regexp_match('QGIS ROCKS','\\sROCKS')` → 5 • `regexp_match('Budač','udač\\b')` → 2

try

Tries an expression and returns its value if error-free. If the expression returns an error, an alternative value will be returned when provided otherwise the function will return NULL.

Syntax	try(expression, [alternative]) [] marks optional arguments
Arguments	• **expression** - the expression which should be run • **alternative** - the result which will be returned if the expression returns an error.
Exemplos	• `try( to_int( '1' ), 0 )` → 1 • `try( to_int( 'a' ), 0 )` → 0 • `try( to_date( 'invalid_date' ) )` → NULL

14.3.5 Funções de Conversão

This group contains functions to convert one data type to another (e.g., string from/to integer, binary from/to string, string to date, …).

- *from_base64*
- *hash*
- *md5*
- *sha256*
- *to_base64*
- *to_date*
- *to_datetime*
- *to_decimal*
- *to_dm*
- *to_dms*
- *to_int*
- *to_interval*
- *to_real*
- *to_string*
- *to_time*

from_base64

Decodes a string in the Base64 encoding into a binary value.

Syntax	from_base64(string)
Arguments	• **string** - the string to decode
Exemplos	• `from_base64('UUdJUw==')` → 'QGIS'

hash

Creates a hash from a string with a given method. One byte (8 bits) is represented with two hex "digits", so 'md4' (16 bytes) produces a 16 * 2 = 32 character long hex string and 'keccak_512' (64 bytes) produces a 64 * 2 = 128 character long hex string.

Syntax	hash(string, method)
Arguments	• **string** - the string to hash • **method** - The hash method among 'md4', 'md5', 'sha1', 'sha224', 'sha384', 'sha512', 'sha3_224', 'sha3_256', 'sha3_384', 'sha3_512', 'keccak_224', 'keccak_256', 'keccak_384', 'keccak_512'
Exemplos	• `hash('QGIS', 'md4')` → 'c0fc71c241cdebb6e888cbac0e2b68eb' • `hash('QGIS', 'md5')` → '57470aaa9e22adaefac7f5f342f1c6da' • `hash('QGIS', 'sha1')` → 'f87cfb2b74cdd5867db913237024e7001e62b114' • `hash('QGIS', 'sha224')` → '4093a619ada631c770f44bc643ead18fb393b93d6a6af1861fcfece0' • `hash('QGIS', 'sha256')` → 'eb045cba7a797aaa06ac58830846e40c8e8c780bc0676d3393605fae50c • `hash('QGIS', 'sha384')` → '91c1de038cc3d09fdd512e99f9dd9922efadc39ed21d3922e69a4305cc2 • `hash('QGIS', 'sha512')` → 'c2c092f2ab743bf8edbeb6d028a745f30fc720408465ed369421f0a4e20 • `hash('QGIS', 'sha3_224')` → '467f49a5039e7280d5d42fd433e80d203439e338eaabd701f0d6c17d • `hash('QGIS', 'sha3_256')` → '540f7354b6b8a6e735f2845250f15f4f3ba4f666c55574d9e9354575 • `hash('QGIS', 'sha3_384')` → '96052da1e77679e9a65f60d7ead961b28797782314478638 6eb4364 • `hash('QGIS', 'sha3_512')` → '900d079dc69761da113980253aa8ac0414a8bd6d09879a916228f87 • `hash('QGIS', 'keccak_224')` → '5b0ce6acef8b0a121d4ac4f3eaa8503c799ad4e26a3392d1fb2014 • `hash('QGIS', 'keccak_256')` → '991c520aa6815392de24087f61b2ae0fd56abbfeee4a8ca019c101 • `hash('QGIS', 'keccak_384')` → 'c57a3aed9d856fa04e5eeee9b62b6e027cca81ba574116d3cc1f0d4

md5

Creates a md5 hash from a string.

Syntax	md5(string)
Arguments	• **string** - the string to hash
Exemplos	• `md5('QGIS')` → '57470aaa9e22adaefac7f5f342f1c6da'

sha256

Creates a sha256 hash from a string.

Syntax	sha256(string)
Arguments	• **string** - the string to hash
Exemplos	• `sha256('QGIS')` → 'eb045cba7a797aaa06ac58830846e40c8e8c780bc0676d3393605fae50c05309'

to_base64

Encodes a binary value into a string, using the Base64 encoding.

Syntax	to_base64(value)
Arguments	• **value** - the binary value to encode
Exemplos	• `to_base64('QGIS')` → 'UUdJUw=='

to_date

Converts a string into a date object. An optional format string can be provided to parse the string; see QDate::fromString for additional documentation on the format.

Syntax	to_date(string, [format], [language]) [] marks optional arguments
Arguments	• **string** - string representing a date value • **format** - format used to convert the string into a date • **language** - language (lowercase, two- or three-letter, ISO 639 language code) used to convert the string into a date
Exemplos	• `to_date('2012-05-04')` → 2012-05-04 • `to_date('June 29, 2019','MMMM d, yyyy')` → 2019-06-29 • `to_date('29 juin, 2019','d MMMM, yyyy','fr')` → 2019-06-29

to_datetime

Converts a string into a datetime object. An optional format string can be provided to parse the string; see QDate::fromString and QTime::fromString for additional documentation on the format.

Syntax	to_datetime(string, [format], [language]) [] marks optional arguments
Arguments	• **string** - string representing a datetime value • **format** - format used to convert the string into a datetime • **language** - language (lowercase, two- or three-letter, ISO 639 language code) used to convert the string into a datetime
Exemplos	• `to_datetime('2012-05-04 12:50:00')` → 2012-05-04T12:50:00 • `to_datetime('June 29, 2019 @ 12:34','MMMM d, yyyy @ HH:mm')` → 2019-06-29T12:34 • `to_datetime('29 juin, 2019 @ 12:34','d MMMM, yyyy @ HH:mm', 'fr')` → 2019-06-29T12:34

to_decimal

Converts a degree, minute, second coordinate to its decimal equivalent.

Syntax	to_decimal(value)
Arguments	• **value** - A degree, minute, second string.
Exemplos	• `to_decimal('6°21\'16.445')` → 6.3545680555

to_dm

Converts a coordinate to degree, minute.

Syntax	to_dm(coordinate, axis, precision, [formatting=]) [] marks optional arguments
Arguments	• **coordinate** - A latitude or longitude value. • **axis** - The axis of the coordinate. Either 'x' or 'y'. • **precision** - Number of decimals. • **formatting** - Designates the formatting type. Acceptable values are NULL (default), 'aligned' or 'suffix'.
Exemplos	• `to_dm(6.1545681, 'x', 3)` → 6°9.274′ • `to_dm(6.1545681, 'y', 4, 'aligned')` → 6°09.2741′N • `to_dm(6.1545681, 'y', 4, 'suffix')` → 6°9.2741′N

to_dms

Converts a coordinate to degree, minute, second.

Syntax	to_dms(coordinate, axis, precision, [formatting=]) [] marks optional arguments
Arguments	• **coordinate** - A latitude or longitude value. • **axis** - The axis of the coordinate. Either 'x' or 'y'. • **precision** - Number of decimals. • **formatting** - Designates the formatting type. Acceptable values are NULL (default), 'aligned' or 'suffix'.
Exemplos	• `to_dms(6.1545681, 'x', 3)` → 6°9′16.445″ • `to_dms(6.1545681, 'y', 4, 'aligned')` → 6°09′16.4452″N • `to_dms(6.1545681, 'y', 4, 'suffix')` → 6°9′16.4452″N

to_int

Converts a string to integer number. Nothing is returned if a value cannot be converted to integer (e.g '123asd' is invalid).

Syntax	to_int(string)
Arguments	• **string** - string to convert to integer number
Exemplos	• `to_int('123')` → 123

to_interval

Converts a string to an interval type. Can be used to take days, hours, month, etc of a date.

Syntax	to_interval(string)
Arguments	• **string** - a string representing an interval. Allowable formats include {n} days {n} hours {n} months.
Exemplos	• `to_interval('1 day 2 hours')` → interval: 1.08333 days • `to_interval( '0.5 hours' )` → interval: 30 minutes • `to_datetime('2012-05-05 12:00:00') - to_interval('1 day 2 hours')` → 2012-05-04T10:00:00

to_real

Converts a string to a real number. Nothing is returned if a value cannot be converted to real (e.g '123.56asd' is invalid). Numbers are rounded after saving changes if the precision is smaller than the result of the conversion.

Syntax	to_real(string)
Arguments	• **string** - string to convert to real number
Exemplos	• `to_real('123.45')` → 123.45

to_string

Converts a number to string.

Syntax	to_string(number)
Arguments	• **number** - Integer or real value. The number to convert to string.
Exemplos	• `to_string(123)` → '123'

to_time

Converts a string into a time object. An optional format string can be provided to parse the string; see QTime::fromString for additional documentation on the format.

Syntax	to_time(string, [format], [language]) [] marks optional arguments
Arguments	• **string** - string representing a time value • **format** - format used to convert the string into a time • **language** - language (lowercase, two- or three-letter, ISO 639 language code) used to convert the string into a time
Exemplos	• `to_time('12:30:01')` → 12:30:01 • `to_time('12:34','HH:mm')` → 12:34:00 • `to_time('12:34','HH:mm','fr')` → 12:34:00

14.3.6 Funções Personalizadas

Este grupo contém funções criadas pelo usuário. Veja *Editor de Funções* para mais detalhes.

14.3.7 Funções Data e Hora

This group contains functions for handling date and time data. This group shares several functions with the *Funções de Conversão* (to_date, to_time, to_datetime, to_interval) and *Funções String* (format_date) groups.

Nota: Storing date, datetime and intervals on fields

The ability to store *date*, *time* and *datetime* values directly on fields depends on the data source's provider (e.g., Shapefile accepts *date* format, but not *datetime* or *time* format). The following are some suggestions to overcome this limitation:

- *date*, *datetime* and *time* can be converted and stored in text type fields using the *format_date()* function.
- *Intervals* can be stored in integer or decimal type fields after using one of the date extraction functions (e.g., *day()* to get the interval expressed in days)

- *age*
- *datetime_from_epoch*
- *day*
- *day_of_week*
- *epoch*
- *format_date*
- *hour*
- *make_date*
- *make_datetime*
- *make_interval*
- *make_time*
- *minute*
- *month*
- *now*
- *second*
- *to_date*
- *to_datetime*
- *to_interval*
- *to_time*
- *week*
- *year*

age

Returns the difference between two dates or datetimes.

The difference is returned as an `Interval` and needs to be used with one of the following functions in order to extract useful information:

- `year`
- `month`
- `week`
- `day`
- `hour`
- `minute`
- `second`

Syntax	age(datetime1, datetime2)
Arguments	• **datetime1** - a string, date or datetime representing the later date • **datetime2** - a string, date or datetime representing the earlier date
Exemplos	• `day(age('2012-05-12','2012-05-02'))` → 10 • `hour(age('2012-05-12','2012-05-02'))` → 240

datetime_from_epoch

Returns a datetime whose date and time are the number of milliseconds, msecs, that have passed since 1970-01-01T00:00:00.000, Coordinated Universal Time (Qt.UTC), and converted to Qt.LocalTime.

Syntax	datetime_from_epoch(int)
Arguments	• **int** - number (milliseconds)
Exemplos	• `datetime_from_epoch(1483225200000)` → 2017-01-01T00:00:00

day

Extracts the day from a date, or the number of days from an interval.

Date variant

Extracts the day from a date or datetime.

Syntax	day(date)
Arguments	• **date** - a date or datetime value
Exemplos	• `day('2012-05-12')` → 12

Interval variant

Calculates the length in days of an interval.

Syntax	day(interval)
Arguments	• **interval** - interval value to return number of days from
Exemplos	• `day(to_interval('3 days'))` → 3 • `day(to_interval('3 weeks 2 days'))` → 23 • `day(age('2012-01-01','2010-01-01'))` → 730

day_of_week

Returns the day of the week for a specified date or datetime. The returned value ranges from 0 to 6, where 0 corresponds to a Sunday and 6 to a Saturday.

Syntax	day_of_week(date)
Arguments	• **date** - date or datetime value
Exemplos	• `day_of_week(to_date('2015-09-21'))` → 1

epoch

Returns the interval in milliseconds between the unix epoch and a given date value.

Syntax	epoch(date)
Arguments	• **date** - a date or datetime value
Exemplos	• `epoch(to_date('2017-01-01'))` → 1483203600000

format_date

Formats a date type or string into a custom string format. Uses Qt date/time format strings. See QDateTime::toString.

<table>
<tr><td>Syntax</td><td>format_date(datetime, format, [language])
[] marks optional arguments</td></tr>
<tr><td>Arguments</td><td>

datetime - date, time or datetime value
format - String template used to format the string.

<table>
<tr><th>Expressão</th><th>Output</th></tr>
<tr><td>d</td><td>the day as number without a leading zero (1 to 31)</td></tr>
<tr><td>dd</td><td>the day as number with a leading zero (01 to 31)</td></tr>
<tr><td>ddd</td><td>the abbreviated localized day name (e.g. ‘Mon’ to ‘Sun’)</td></tr>
<tr><td>dddd</td><td>the long localized day name (e.g. ‘Monday’ to ‘Sunday’)</td></tr>
<tr><td>M</td><td>the month as number without a leading zero (1-12)</td></tr>
<tr><td>MM</td><td>the month as number with a leading zero (01-12)</td></tr>
<tr><td>MMM</td><td>the abbreviated localized month name (e.g. ‘Jan’ to ‘Dec’)</td></tr>
<tr><td>MMMM</td><td>the long localized month name (e.g. ‘January’ to ‘December’)</td></tr>
<tr><td>yy</td><td>the year as two digit number (00-99)</td></tr>
<tr><td>yyyy</td><td>the year as four digit number</td></tr>
</table>
These expressions may be used for the time part of the format string:
<table>
<tr><th>Expressão</th><th>Output</th></tr>
<tr><td>h</td><td>the hour without a leading zero (0 to 23 or 1 to 12 if AM/PM display)</td></tr>
<tr><td>hh</td><td>the hour with a leading zero (00 to 23 or 01 to 12 if AM/PM display)</td></tr>
<tr><td>H</td><td>the hour without a leading zero (0 to 23, even with AM/PM display)</td></tr>
<tr><td>HH</td><td>the hour with a leading zero (00 to 23, even with AM/PM display)</td></tr>
<tr><td>m</td><td>the minute without a leading zero (0 to 59)</td></tr>
<tr><td>mm</td><td>the minute with a leading zero (00 to 59)</td></tr>
<tr><td>s</td><td>the second without a leading zero (0 to 59)</td></tr>
<tr><td>ss</td><td>the second with a leading zero (00 to 59)</td></tr>
<tr><td>z</td><td>the milliseconds without trailing zeroes (0 to 999)</td></tr>
<tr><td>zzz</td><td>the milliseconds with trailing zeroes (000 to 999)</td></tr>
<tr><td>AP or A</td><td>interpret as an AM/PM time. AP must be either ‘AM’ or ‘PM’.</td></tr>
<tr><td>ap or a</td><td>Interpret as an AM/PM time. ap must be either ‘am’ or ‘pm’.</td></tr>
</table>

language - language (lowercase, two- or three-letter, ISO 639 language code) used to format the date into a custom string

</td></tr>
<tr><td>Exemplos</td><td>

<code>format_date('2012-05-15','dd.MM.yyyy')</code> → ‘15.05.2012’
<code>format_date('2012-05-15','d MMMM yyyy','fr')</code> → ‘15 mai 2012’
<code>format_date('2012-05-15','dddd')</code> → ‘Tuesday’
<code>format_date('2012-05-15 13:54:20','dd.MM.yy')</code> → ‘15.05.12’
<code>format_date('13:54:20','hh:mm AP')</code> → ‘01:54 PM’

</td></tr>
</table>

hour

Extracts the hour part from a datetime or time, or the number of hours from an interval.

Time variant

Extracts the hour part from a time or datetime.

Syntax	hour(datetime)
Arguments	• **datetime** - a time or datetime value
Exemplos	• `hour( to_datetime('2012-07-22 13:24:57') )` → 13

Interval variant

Calculates the length in hours of an interval.

Syntax	hour(interval)
Arguments	• **interval** - interval value to return number of hours from
Exemplos	• `hour(to_interval('3 hours'))` → 3 • `hour(age('2012-07-22T13:00:00','2012-07-22T10:00:00'))` → 3 • `hour(age('2012-01-01','2010-01-01'))` → 17520

make_date

Creates a date value from year, month and day numbers.

Syntax	make_date(year, month, day)
Arguments	• **year** - Year number. Years 1 to 99 are interpreted as is. Year 0 is invalid. • **month** - Month number, where 1=January • **day** - Day number, beginning with 1 for the first day in the month
Exemplos	• `make_date(2020,5,4)` → date value 2020-05-04

make_datetime

Creates a datetime value from year, month, day, hour, minute and second numbers.

Syntax	make_datetime(year, month, day, hour, minute, second)
Arguments	• **year** - Year number. Years 1 to 99 are interpreted as is. Year 0 is invalid. • **month** - Month number, where 1=January • **day** - Day number, beginning with 1 for the first day in the month • **hour** - Hour number • **minute** - Minutes • **second** - Seconds (fractional values include milliseconds)
Exemplos	• `make_datetime(2020,5,4,13,45,30.5)` → datetime value 2020-05-04 13:45:30.500

make_interval

Creates an interval value from year, month, weeks, days, hours, minute and seconds values.

Syntax	make_interval([years=0], [months=0], [weeks=0], [days=0], [hours=0], [minutes=0], [seconds=0]) [] marks optional arguments
Arguments	• **years** - Number of years (assumes a 365.25 day year length). • **months** - Number of months (assumes a 30 day month length) • **weeks** - Number of weeks • **days** - Number of days • **hours** - Number of hours • **minutes** - Number of minutes • **seconds** - Number of seconds
Exemplos	• `make_interval(hours:=3)` → interval: 3 hours • `make_interval(days:=2, hours:=3)` → interval: 2.125 days • `make_interval(minutes:=0.5, seconds:=5)` → interval: 35 seconds

make_time

Creates a time value from hour, minute and second numbers.

Syntax	make_time(hour, minute, second)
Arguments	• **hour** - Hour number • **minute** - Minutes • **second** - Seconds (fractional values include milliseconds)
Exemplos	• `make_time(13,45,30.5)` → time value 13:45:30.500

minute

Extracts the minutes part from a datetime or time, or the number of minutes from an interval.

Time variant

Extracts the minutes part from a time or datetime.

Syntax	minute(datetime)
Arguments	• **datetime** - a time or datetime value
Exemplos	• `minute( to_datetime('2012-07-22 13:24:57') )` → 24

Interval variant

Calculates the length in minutes of an interval.

Syntax	minute(interval)
Arguments	• **interval** - interval value to return number of minutes from
Exemplos	• `minute(to_interval('3 minutes'))` → 3 • `minute(age('2012-07-22T00:20:00','2012-07-22T00:00:00'))` → 20 • `minute(age('2012-01-01','2010-01-01'))` → 1051200

month

Extracts the month part from a date, or the number of months from an interval.

Date variant

Extracts the month part from a date or datetime.

Syntax	month(date)
Arguments	• **date** - a date or datetime value
Exemplos	• `month('2012-05-12')` → 05

Interval variant

Calculates the length in months of an interval.

Syntax	month(interval)
Arguments	• **interval** - interval value to return number of months from
Exemplos	• `month(to_interval('3 months'))` → 3 • `month(age('2012-01-01','2010-01-01'))` → 4.03333

now

Returns the current date and time. The function is static and will return consistent results while evaluating. The time returned is the time when the expression is prepared.

Syntax	now()
Exemplos	• `now()` → 2012-07-22T13:24:57

second

Extracts the seconds part from a datetime or time, or the number of seconds from an interval.

Time variant

Extracts the seconds part from a time or datetime.

Syntax	second(datetime)
Arguments	• **datetime** - a time or datetime value
Exemplos	• `second( to_datetime('2012-07-22 13:24:57') )` → 57

Interval variant

Calculates the length in seconds of an interval.

Syntax	second(interval)
Arguments	• **interval** - interval value to return number of seconds from
Exemplos	• `second(to_interval('3 minutes'))` → 180 • `second(age('2012-07-22T00:20:00','2012-07-22T00:00:00'))` → 1200 • `second(age('2012-01-01','2010-01-01'))` → 63072000

to_date

Converts a string into a date object. An optional format string can be provided to parse the string; see QDate::fromString for additional documentation on the format.

Syntax	to_date(string, [format], [language]) [] marks optional arguments
Arguments	• **string** - string representing a date value • **format** - format used to convert the string into a date • **language** - language (lowercase, two- or three-letter, ISO 639 language code) used to convert the string into a date
Exemplos	• `to_date('2012-05-04')` → 2012-05-04 • `to_date('June 29, 2019','MMMM d, yyyy')` → 2019-06-29 • `to_date('29 juin, 2019','d MMMM, yyyy','fr')` → 2019-06-29

to_datetime

Converts a string into a datetime object. An optional format string can be provided to parse the string; see QDate::fromString and QTime::fromString for additional documentation on the format.

Syntax	to_datetime(string, [format], [language]) [] marks optional arguments
Arguments	• **string** - string representing a datetime value • **format** - format used to convert the string into a datetime • **language** - language (lowercase, two- or three-letter, ISO 639 language code) used to convert the string into a datetime
Exemplos	• `to_datetime('2012-05-04 12:50:00')` → 2012-05-04T12:50:00 • `to_datetime('June 29, 2019 @ 12:34','MMMM d, yyyy @ HH:mm')` → 2019-06-29T12:34 • `to_datetime('29 juin, 2019 @ 12:34','d MMMM, yyyy @ HH:mm', 'fr')` → 2019-06-29T12:34

to_interval

Converts a string to an interval type. Can be used to take days, hours, month, etc of a date.

Syntax	to_interval(string)
Arguments	• **string** - a string representing an interval. Allowable formats include {n} days {n} hours {n} months.
Exemplos	• `to_interval('1 day 2 hours')` → interval: 1.08333 days • `to_interval( '0.5 hours' )` → interval: 30 minutes • `to_datetime('2012-05-05 12:00:00') - to_interval('1 day 2 hours')` → 2012-05-04T10:00:00

to_time

Converts a string into a time object. An optional format string can be provided to parse the string; see QTime::fromString for additional documentation on the format.

Syntax	to_time(string, [format], [language]) [] marks optional arguments
Arguments	• **string** - string representing a time value • **format** - format used to convert the string into a time • **language** - language (lowercase, two- or three-letter, ISO 639 language code) used to convert the string into a time
Exemplos	• `to_time('12:30:01')` → 12:30:01 • `to_time('12:34','HH:mm')` → 12:34:00 • `to_time('12:34','HH:mm','fr')` → 12:34:00

week

Extracts the week number from a date, or the number of weeks from an interval.

Date variant

Extracts the week number from a date or datetime.

Syntax	week(date)
Arguments	• **date** - a date or datetime value
Exemplos	• `week('2012-05-12')` → 19

Interval variant

Calculates the length in weeks of an interval.

Syntax	week(interval)
Arguments	• **interval** - interval value to return number of months from
Exemplos	• `week(to_interval('3 weeks'))` → 3 • `week(age('2012-01-01','2010-01-01'))` → 104.285

year

Extracts the year part from a date, or the number of years from an interval.

Date variant

Extracts the year part from a date or datetime.

Syntax	year(date)
Arguments	• **date** - a date or datetime value
Exemplos	• `year('2012-05-12')` → 2012

Interval variant

Calculates the length in years of an interval.

Syntax	year(interval)
Arguments	• **interval** - interval value to return number of years from
Exemplos	• `year(to_interval('3 years'))` → 3 • `year(age('2012-01-01','2010-01-01'))` → 1.9986

Alguns exemplos:

Além dessas funções, subtrair datas, datas ou horas usando o operador − (menos) retornará um intervalo.

Adicionar ou subtrair um intervalo a datas, data/hora ou horas, usando os operadores + (mais) e − (menos), retornará uma data/hora.

- Obtenha o número de dias até o lançamento do QGIS 3.0:

```
to_date('2017-09-29') - to_date(now())
-- Returns <interval: 203 days>
```

- O mesmo com o tempo:

```
to_datetime('2017-09-29 12:00:00') - now()
-- Returns <interval: 202.49 days>
```

- Obtenha a data/hora de 100 dias a partir de agora:

```
now() + to_interval('100 days')
-- Returns <datetime: 2017-06-18 01:00:00>
```

14.3.8 Campos e Valores

Contém uma lista de campos da camada.

Clique duas vezes no nome de um campo para adicioná-lo à sua expressão. Você também pode digitar o nome do campo (de preferência entre aspas duplas) ou seu *alias*.

Para recuperar os valores dos campos a serem usados em uma expressão, selecione o campo apropriado e, no widget mostrado, escolha entre *10 Amostras* e *Todos os Únicos*. Os valores solicitados são exibidos e você pode usar a caixa *Pesquisar* na parte superior da lista para filtrar o resultado. Valores de amostra também podem ser acessados clicando com o botão direito do mouse em um campo.

Para adicionar um valor à expressão que você está escrevendo, clique duas vezes nela na lista. Se o valor for de um tipo de string, deve ser simples entre aspas, caso contrário, nenhuma citação será necessária.

14.3.9 Funções de Arquivos e Caminhos

Este grupo contém funções que manipulam nomes de arquivos e caminhos.

- *base_file_name*
- *file_exists*
- *file_name*
- *file_path*
- *file_size*
- *file_suffix*
- *is_directory*
- *is_file*

base_file_name

Retorna o nome base do arquivo sem o diretório ou sufixo do arquivo.

Syntax	base_file_name(path)
Arguments	• **path** - a file path
Exemplos	• `base_file_name('/home/qgis/data/country_boundaries.shp')` → 'country_boundaries'

file_exists

Retorna verdadeiro se existir um caminho de arquivo.

Syntax	file_exists(path)
Arguments	• **path** - a file path
Exemplos	• `file_exists('/home/qgis/data/country_boundaries.shp')` → true

file_name

Retorna o nome de um arquivo (incluindo a extensão do arquivo), excluindo o diretório.

Syntax	file_name(path)
Arguments	• **path** - a file path
Exemplos	• `file_name('/home/qgis/data/country_boundaries.shp')` → 'country_boundaries.shp'

file_path

Returns the directory component of a file path. This does not include the file name.

Syntax	file_path(path)
Arguments	• **path** - a file path
Exemplos	• `file_path('/home/qgis/data/country_boundaries.shp')` → '/home/qgis/data'

file_size

Retorna o tamanho (em bytes) de um arquivo.

Syntax	file_size(path)
Arguments	• **path** - a file path
Exemplos	• `file_size('/home/qgis/data/country_boundaries.geojson')` → 5674

file_suffix

Returns the file suffix (extension) from a file path.

Syntax	file_suffix(path)
Arguments	• **path** - a file path
Exemplos	• `file_suffix('/home/qgis/data/country_boundaries.shp')` → 'shp'

is_directory

Retorna verdadeiro se um caminho corresponder a um diretório.

Syntax	is_directory(path)
Arguments	• **path** - a file path
Exemplos	• `is_directory('/home/qgis/data/country_boundaries.shp')` → false • `is_directory('/home/qgis/data/')` → true

is_file

Retorna verdadeiro se um caminho corresponder a um arquivo.

Syntax	is_file(path)
Arguments	• **path** - a file path
Exemplos	• `is_file('/home/qgis/data/country_boundaries.shp')` → true • `is_file('/home/qgis/data/')` → false

14.3.10 Form Functions

This group contains functions that operate exclusively under the attribute form context. For example, in *field's widgets* settings.

- *current_parent_value*
- *current_value*

current_parent_value

Only usable in an embedded form context, this function returns the current, unsaved value of a field in the parent form currently being edited. This will differ from the parent feature's actual attribute values for features which are currently being edited or have not yet been added to a parent layer. When used in a value-relation widget filter expression, this function should be wrapped into a 'coalesce()' that can retrieve the actual parent feature from the layer when the form is not used in an embedded context.

Syntax	current_parent_value(field_name)
Arguments	• **field_name** - a field name in the current parent form
Exemplos	• `current_parent_value( 'FIELD_NAME' )` → The current value of a field 'FIELD_NAME' in the parent form.

current_value

Returns the current, unsaved value of a field in the form or table row currently being edited. This will differ from the feature's actual attribute values for features which are currently being edited or have not yet been added to a layer.

Syntax	current_value(field_name)
Arguments	• **field_name** - a field name in the current form or table row
Exemplos	• `current_value( 'FIELD_NAME' )` → The current value of field 'FIELD_NAME'.

14.3.11 Fuzzy Matching Functions

This group contains functions for fuzzy comparisons between values.

- *hamming_distance*
- *levenshtein*
- *longest_common_substring*
- *soundex*

hamming_distance

Returns the Hamming distance between two strings. This equates to the number of characters at corresponding positions within the input strings where the characters are different. The input strings must be the same length, and the comparison is case-sensitive.

Syntax	hamming_distance(string1, string2)
Arguments	• **string1** - a string • **string2** - a string
Exemplos	• `hamming_distance('abc','xec')` → 2 • `hamming_distance('abc','ABc')` → 2 • `hamming_distance(upper('abc'),upper('ABC'))` → 0

levenshtein

Returns the Levenshtein edit distance between two strings. This equates to the minimum number of character edits (insertions, deletions or substitutions) required to change one string to another.

The Levenshtein distance is a measure of the similarity between two strings. Smaller distances mean the strings are more similar, and larger distances indicate more different strings. The distance is case sensitive.

Syntax	levenshtein(string1, string2)
Arguments	• **string1** - a string • **string2** - a string
Exemplos	• `levenshtein('kittens','mitten')` → 2 • `levenshtein('Kitten','kitten')` → 1 • `levenshtein(upper('Kitten'),upper('kitten'))` → 0

longest_common_substring

Returns the longest common substring between two strings. This substring is the longest string that is a substring of the two input strings. For example, the longest common substring of “ABABC” and “BABCA” is “BABC”. The substring is case sensitive.

Syntax	longest_common_substring(string1, string2)
Arguments	• **string1** - a string • **string2** - a string
Exemplos	• `longest_common_substring('ABABC','BABCA')` → ‘BABC’ • `longest_common_substring('abcDeF','abcdef')` → ‘abc’ • `longest_common_substring(upper('abcDeF'),upper('abcdex'))` → ‘ABCDE’

soundex

Returns the Soundex representation of a string. Soundex is a phonetic matching algorithm, so strings with similar sounds should be represented by the same Soundex code.

Syntax	soundex(string)
Arguments	• **string** - a string
Exemplos	• `soundex('robert')` → 'R163' • `soundex('rupert')` → 'R163' • `soundex('rubin')` → 'R150'

14.3.12 Funções Gerais

Este grupo contém funções gerais variadas.

- *env*
- *eval*
- *eval_template*
- *is_layer_visible*
- *layer_property*
- *var*
- *with_variable*

env

Gets an environment variable and returns its content as a string. If the variable is not found, NULL will be returned. This is handy to inject system specific configuration like drive letters or path prefixes. Definition of environment variables depends on the operating system, please check with your system administrator or the operating system documentation how this can be set.

Syntax	env(name)
Arguments	• **name** - The name of the environment variable which should be retrieved.
Exemplos	• `env( 'LANG' )` → 'en_US.UTF-8' • `env( 'MY_OWN_PREFIX_VAR' )` → 'Z:' • `env( 'I_DO_NOT_EXIST' )` → NULL

eval

Avalia uma expressão que é passada em uma string. Útil para expandir parâmetros dinâmicos passados como campos ou variáveis de contexto.

Syntax	eval(expression)
Arguments	• **expression** - an expression string
Exemplos	• `eval('\'nice\'')` → 'nice' • `eval(@expression_var)` → [whatever the result of evaluating @expression_var might be…]

eval_template

Evaluates a template which is passed in a string. Useful to expand dynamic parameters passed as context variables or fields.

Syntax	eval_template(template)
Arguments	• **template** - a template string
Exemplos	• `eval_template('QGIS [% upper(\'rocks\') %]')` → QGIS ROCKS

is_layer_visible

Returns true if a specified layer is visible.

Syntax	is_layer_visible(layer)
Arguments	• **layer** - a string, representing either a layer name or layer ID
Exemplos	• `is_layer_visible('baseraster')` → True

layer_property

Returns a matching layer property or metadata value.

Syntax	layer_property(layer, property)
Arguments	• **layer** - a string, representing either a layer name or layer ID • **property** - a string corresponding to the property to return. Valid options are: – name: layer name – id: layer ID – title: metadata title string – abstract: metadata abstract string – keywords: metadata keywords – data_url: metadata URL – attribution: metadata attribution string – attribution_url: metadata attribution URL – source: layer source – min_scale: minimum display scale for layer – max_scale: maximum display scale for layer – is_editable: if layer is in edit mode – crs: layer CRS – crs_definition: layer CRS full definition – crs_description: layer CRS description – extent: layer extent (as a geometry object) – distance_units: layer distance units – type: layer type, e.g., Vector or Raster – storage_type: storage format (vector layers only) – geometry_type: geometry type, e.g., Point (vector layers only) – feature_count: approximate feature count for layer (vector layers only) – path: File path to the layer data source. Only available for file based layers.
Exemplos	• `layer_property('streets','title')` → 'Basemap Streets' • `layer_property('airports','feature_count')` → 120 • `layer_property('landsat','crs')` → 'EPSG:4326'

Further reading: *vector*, *raster* and *mesh* layer properties

var

Returns the value stored within a specified variable.

Syntax	var(name)
Arguments	• **name** - a variable name
Exemplos	• `var('qgis_version')` → '2.12'

Further reading: List of default *variables*

with_variable

This function sets a variable for any expression code that will be provided as 3rd argument. This is only useful for complicated expressions, where the same calculated value needs to be used in different places.

Syntax	with_variable(name, value, expression)
Arguments	• **name** - the name of the variable to set • **value** - the value to set • **expression** - the expression for which the variable will be available
Exemplos	• `with_variable('my_sum', 1 + 2 + 3, @my_sum * 2 + @my_sum * 5)` → 42

14.3.13 Funções Geometria

Este grupo contém funções que operam em objetos de geometria (por exemplo, buffer, transform, $ área).

- *angle_at_vertex*
- *$area*
- *area*
- *azimuth*
- *boundary*
- *bounds*
- *bounds_height*
- *bounds_width*
- *buffer*
- *buffer_by_m*
- *centroid*
- *close_line*
- *closest_point*
- *collect_geometries*
- *combine*
- *contains*
- *convex_hull*
- *crosses*
- *difference*
- *disjoint*
- *distance*
- *distance_to_vertex*
- *end_point*
- *extend*

- *exterior_ring*
- *extrude*
- *flip_coordinates*
- *force_rhr*
- *geom_from_gml*
- *geom_from_wkb*
- *geom_from_wkt*
- *geom_to_wkb*
- *geom_to_wkt*
- *$geometry*
- *geometry*
- *geometry_n*
- *hausdorff_distance*
- *inclination*
- *interior_ring_n*
- *intersection*
- *intersects*
- *intersects_bbox*
- *is_closed*
- *is_empty*
- *is_empty_or_null*
- *is_multipart*
- *is_valid*
- *$length*
- *length*
- *line_interpolate_angle*
- *line_interpolate_point*
- *line_locate_point*
- *line_merge*
- *line_substring*
- *m*
- *m_max*
- *m_min*
- *main_angle*
- *make_circle*
- *make_ellipse*
- *make_line*
- *make_point*

- *make_point_m*
- *make_polygon*
- *make_rectangle_3points*
- *make_regular_polygon*
- *make_square*
- *make_triangle*
- *minimal_circle*
- *nodes_to_points*
- *num_geometries*
- *num_interior_rings*
- *num_points*
- *num_rings*
- *offset_curve*
- *order_parts*
- *oriented_bbox*
- *overlaps*
- *overlay_contains*
- *overlay_crosses*
- *overlay_disjoint*
- *overlay_equals*
- *overlay_intersects*
- *overlay_nearest*
- *overlay_touches*
- *overlay_within*
- *$perimeter*
- *perimeter*
- *point_n*
- *point_on_surface*
- *pole_of_inaccessibility*
- *project*
- *relate*
- *reverse*
- *rotate*
- *segments_to_lines*
- *shortest_line*
- *simplify*
- *simplify_vw*
- *single_sided_buffer*

- *smooth*
- *start_point*
- *sym_difference*
- *tapered_buffer*
- *touches*
- *transform*
- *translate*
- *union*
- *wedge_buffer*
- *within*
- *$x*
- *x*
- *$x_at*
- *x_max*
- *x_min*
- *$y*
- *y*
- *$y_at*
- *y_max*
- *y_min*
- *z*
- *z_max*
- *z_min*

angle_at_vertex

Returns the bisector angle (average angle) to the geometry for a specified vertex on a linestring geometry. Angles are in degrees clockwise from north.

Syntax	angle_at_vertex(geometry, vertex)
Arguments	• **geometry** - a linestring geometry • **vertex** - vertex index, starting from 0; if the value is negative, the selected vertex index will be its total count minus the absolute value
Exemplos	• `angle_at_vertex(geometry:=geom_from_wkt('LineString(0 0, 10 0, 10 10)'),vertex:=1)` → 45.0

$area

Returns the area of the current feature. The area calculated by this function respects both the current project's ellipsoid setting and area unit settings. For example, if an ellipsoid has been set for the project then the calculated area will be ellipsoidal, and if no ellipsoid is set then the calculated area will be planimetric.

Syntax	$area
Exemplos	• `$area` → 42

area

Returns the area of a geometry polygon object. Calculations are always planimetric in the Spatial Reference System (SRS) of this geometry, and the units of the returned area will match the units for the SRS. This differs from the calculations performed by the $area function, which will perform ellipsoidal calculations based on the project's ellipsoid and area unit settings.

Syntax	area(geometry)
Arguments	• **geometry** - polygon geometry object
Exemplos	• `area(geom_from_wkt('POLYGON((0 0, 4 0, 4 2, 0 2, 0 0))'))` → 8.0

azimuth

Returns the north-based azimuth as the angle in radians measured clockwise from the vertical on point_a to point_b.

Syntax	azimuth(point_a, point_b)
Arguments	• **point_a** - point geometry • **point_b** - point geometry
Exemplos	• `degrees( azimuth( make_point(25, 45), make_point(75, 100) ) )` → 42.273689 • `degrees( azimuth( make_point(75, 100), make_point(25,45) ) )` → 222.273689

boundary

Returns the closure of the combinatorial boundary of the geometry (ie the topological boundary of the geometry). For instance, a polygon geometry will have a boundary consisting of the linestrings for each ring in the polygon. Some geometry types do not have a defined boundary, e.g., points or geometry collections, and will return NULL.

Syntax	boundary(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `geom_to_wkt(boundary(geom_from_wkt('Polygon((1 1, 0 0, -1 1, 1 1))')))` → 'LineString(1 1,0 0,-1 1,1 1)' • `geom_to_wkt(boundary(geom_from_wkt('LineString(1 1,0 0,-1 1)')))` → 'MultiPoint ((1 1),(-1 1))'

Further reading: *Boundary* algorithm

bounds

Returns a geometry which represents the bounding box of an input geometry. Calculations are in the Spatial Reference System of this geometry.

Syntax	bounds(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `bounds($geometry)` → bounding box of the current feature's geometry • `geom_to_wkt(bounds(geom_from_wkt('Polygon((1 1, 0 0, -1 1, 1 1))')))` → 'Polygon ((-1 0, 1 0, 1 1, -1 1, -1 0))'

Further reading: *Bounding boxes* algorithm

bounds_height

Returns the height of the bounding box of a geometry. Calculations are in the Spatial Reference System of this geometry.

Syntax	bounds_height(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `bounds_height($geometry)` → height of bounding box of the current feature's geometry • `bounds_height(geom_from_wkt('Polygon((1 1, 0 0, -1 1, 1 1))'))` → 1

bounds_width

Returns the width of the bounding box of a geometry. Calculations are in the Spatial Reference System of this geometry.

Syntax	bounds_width(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `bounds_width($geometry)` → width of bounding box of the current feature's geometry • `bounds_width(geom_from_wkt('Polygon((1 1, 0 0, -1 1, 1 1))'))` → 2

buffer

Returns a geometry that represents all points whose distance from this geometry is less than or equal to distance. Calculations are in the Spatial Reference System of this geometry.

Syntax	buffer(geometry, distance, [segments=8]) [] marks optional arguments
Arguments	• **geometry** - a geometry • **distance** - buffer distance in layer units • **segments** - number of segments to use to represent a quarter circle when a round join style is used. A larger number results in a smoother buffer with more nodes.
Exemplos	• `buffer($geometry, 10.5)` → polygon of the current feature's geometry buffered by 10.5 units

Further reading: *Buffer* algorithm

buffer_by_m

Creates a buffer along a line geometry where the buffer diameter varies according to the m-values at the line vertices.

Syntax	buffer_by_m(geometry, [segments=8]) [] marks optional arguments
Arguments	• **geometry** - input geometry. Must be a (multi)line geometry with m values. • **segments** - number of segments to approximate quarter-circle curves in the buffer.
Exemplos	• `buffer_by_m(geometry:=geom_from_wkt('LINESTRINGM(1 2 0.5, 4 2 0.2)'),segments:=8)` → A variable width buffer starting with a diameter of 0.5 and ending with a diameter of 0.2 along the linestring geometry.

Further reading: *Variable width buffer (by M value)* algorithm

centroid

Returns the geometric center of a geometry.

Syntax	centroid(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `centroid($geometry)` → a point geometry

Further reading: *Centroids* algorithm

close_line

Returns a closed line string of the input line string by appending the first point to the end of the line, if it is not already closed. If the geometry is not a line string or multi line string then the result will be NULL.

Syntax	close_line(geometry)
Arguments	• **geometry** - a line string geometry
Exemplos	• `geom_to_wkt(close_line(geom_from_wkt('LINESTRING(0 0, 1 0, 1 1)')))` → 'LineString (0 0, 1 0, 1 1, 0 0)' • `geom_to_wkt(close_line(geom_from_wkt('LINESTRING(0 0, 1 0, 1 1, 0 0)')))` → 'LineString (0 0, 1 0, 1 1, 0 0)'

closest_point

Returns the point on geometry1 that is closest to geometry2.

Syntax	closest_point(geometry1, geometry2)
Arguments	• **geometry1** - geometry to find closest point on • **geometry2** - geometry to find closest point to
Exemplos	• `geom_to_wkt(closest_point(geom_from_wkt('LINESTRING (20 80, 98 190, 110 180, 50 75 )'),geom_from_wkt('POINT(100 100)')))` → 'Point(73.0769 115.384)'

collect_geometries

Collects a set of geometries into a multi-part geometry object.

List of arguments variant

Geometry parts are specified as separate arguments to the function.

Syntax	collect_geometries(geometry1, geometry2, …)
Arguments	• **geometry** - a geometry
Exemplos	• `geom_to_wkt(collect_geometries(make_point(1,2), make_point(3,4), make_point(5,6)))` → 'MultiPoint ((1 2),(3 4),(5 6))'

Array variant

Geometry parts are specified as an array of geometry parts.

Syntax	collect_geometries(array)
Arguments	• **array** - array of geometry objects
Exemplos	• `geom_to_wkt(collect_geometries(array(make_point(1,2), make_point(3,4), make_point(5,6))))` → 'MultiPoint ((1 2),(3 4),(5 6))'

Further reading: *Collect geometries* algorithm

combine

Returns the combination of two geometries.

Syntax	combine(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `geom_to_wkt( combine( geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ), geom_from_wkt( 'LINESTRING(3 3, 4 4, 2 1)' ) ) )` → 'MULTILINESTRING((4 4, 2 1), (3 3, 4 4), (4 4, 5 5))' • `geom_to_wkt( combine( geom_from_wkt( 'LINESTRING(3 3, 4 4)' ), geom_from_wkt( 'LINESTRING(3 3, 6 6, 2 1)' ) ) )` → 'LINESTRING(3 3, 4 4, 6 6, 2 1)'

contains

Tests whether a geometry contains another. Returns true if and only if no points of geometry2 lie in the exterior of geometry1, and at least one point of the interior of geometry2 lies in the interior of geometry1.

Syntax	contains(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `contains( geom_from_wkt( 'POLYGON((0 0, 0 1, 1 1, 1 0, 0 0))' ), geom_from_wkt( 'POINT(0.5 0.5 )' ) )` → true • `contains( geom_from_wkt( 'POLYGON((0 0, 0 1, 1 1, 1 0, 0 0))' ), geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ) )` → false

Further reading: *overlay_contains*

convex_hull

Returns the convex hull of a geometry. It represents the minimum convex geometry that encloses all geometries within the set.

Syntax	convex_hull(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `geom_to_wkt( convex_hull( geom_from_wkt( 'LINESTRING(3 3, 4 4, 4 10)' ) ) )` → 'POLYGON((3 3, 4 10, 4 4, 3 3))'

Further reading: *Convex hull* algorithm

crosses

Tests whether a geometry crosses another. Returns true if the supplied geometries have some, but not all, interior points in common.

Syntax	crosses(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `crosses( geom_from_wkt( 'LINESTRING(3 5, 4 4, 5 3)' ), geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ) )` → true • `crosses( geom_from_wkt( 'POINT(4 5)' ), geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ) )` → false

Further reading: *overlay_crosses*

difference

Returns a geometry that represents that part of geometry1 that does not intersect with geometry2.

Syntax	difference(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `geom_to_wkt( difference( geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ), geom_from_wkt( 'LINESTRING(3 3, 4 4)' ) ) )` → 'LINESTRING(4 4, 5 5)'

Further reading: *Difference* algorithm

disjoint

Tests whether geometries do not spatially intersect. Returns true if the geometries do not share any space together.

Syntax	disjoint(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `disjoint( geom_from_wkt( 'POLYGON((0 0, 0 1, 1 1, 1 0, 0 0))' ), geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ) )` → true • `disjoint( geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ), geom_from_wkt( 'POINT(4 4)' ))` → false

Further reading: *overlay_disjoint*

distance

Returns the minimum distance (based on spatial ref) between two geometries in projected units.

Syntax	distance(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `distance( geom_from_wkt( 'POINT(4 4)' ), geom_from_wkt( 'POINT(4 8)' ) )` → 4

distance_to_vertex

Returns the distance along the geometry to a specified vertex.

Syntax	distance_to_vertex(geometry, vertex)
Arguments	• **geometry** - a linestring geometry • **vertex** - vertex index, starting from 0; if the value is negative, the selected vertex index will be its total count minus the absolute value
Exemplos	• `distance_to_vertex(geometry:=geom_from_wkt('LineString(0 0, 10 0, 10 10)'),vertex:=1)` → 10.0

end_point

Returns the last node from a geometry.

Syntax	end_point(geometry)
Arguments	• **geometry** - geometry object
Exemplos	• `geom_to_wkt(end_point(geom_from_wkt('LINESTRING(4 0, 4 2, 0 2)')))` → 'Point (0 2)'

Further reading: *Extract specific vertices* algorithm

extend

Extends the start and end of a linestring geometry by a specified amount. Lines are extended using the bearing of the first and last segment in the line. For a multilinestring, all the parts are extended. Distances are in the Spatial Reference System of this geometry.

Syntax	extend(geometry, start_distance, end_distance)
Arguments	• **geometry** - a (multi)linestring geometry • **start_distance** - distance to extend the start of the line • **end_distance** - distance to extend the end of the line.
Exemplos	• `geom_to_wkt(extend(geom_from_wkt('LineString(0 0, 1 0, 1 1)'),1,2))` → 'LineString (-1 0, 1 0, 1 3)' • `geom_to_wkt(extend(geom_from_wkt('MultiLineString((0 0, 1 0, 1 1), (2 2, 0 2, 0 5))'),1,2))` → 'MultiLineString ((-1 0, 1 0, 1 3),(3 2, 0 2, 0 7))'

Further reading: *Extend lines* algorithm

exterior_ring

Returns a line string representing the exterior ring of a polygon geometry. If the geometry is not a polygon then the result will be NULL.

Syntax	exterior_ring(geometry)
Arguments	• **geometry** - a polygon geometry
Exemplos	• `geom_to_wkt(exterior_ring(geom_from_wkt('POLYGON((-1 -1, 4 0, 4 2, 0 2, -1 -1),( 0.1 0.1, 0.1 0.2, 0.2 0.2, 0.2, 0.1, 0.1 0.1))')))` → 'LineString (-1 -1, 4 0, 4 2, 0 2, -1 -1)'

extrude

Returns an extruded version of the input (Multi-)Curve or (Multi-)Linestring geometry with an extension specified by x and y.

Syntax	extrude(geometry, x, y)
Arguments	• **geometry** - a polygon geometry • **x** - x extension, numeric value • **y** - y extension, numeric value
Exemplos	• `geom_to_wkt(extrude(geom_from_wkt('LineString(1 2, 3 2, 4 3)'), 1, 2))` → 'Polygon ((1 2, 3 2, 4 3, 5 5, 4 4, 2 4, 1 2))' • `geom_to_wkt(extrude(geom_from_wkt('MultiLineString((1 2, 3 2), (4 3, 8 3))'), 1, 2))` → 'MultiPolygon (((1 2, 3 2, 4 4, 2 4, 1 2)),((4 3, 8 3, 9 5, 5 5, 4 3)))'

flip_coordinates

Returns a copy of the geometry with the x and y coordinates swapped. Useful for repairing geometries which have had their latitude and longitude values reversed.

Syntax	flip_coordinates(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `geom_to_wkt(flip_coordinates(make_point(1, 2)))` → 'Point (2 1)'

Further reading: *Swap X and Y coordinates* algorithm

force_rhr

Forces a geometry to respect the Right-Hand-Rule, in which the area that is bounded by a polygon is to the right of the boundary. In particular, the exterior ring is oriented in a clockwise direction and the interior rings in a counter-clockwise direction.

Syntax	force_rhr(geometry)
Arguments	• **geometry** - a geometry. Any non-polygon geometries are returned unchanged.
Exemplos	• `geom_to_wkt(force_rhr(geometry:=geom_from_wkt('POLYGON((-1 -1, 4 0, 4 2, 0 2, -1 -1))')))` → 'Polygon ((-1 -1, 0 2, 4 2, 4 0, -1 -1))'

Further reading: *Force right-hand-rule* algorithm

geom_from_gml

Returns a geometry from a GML representation of geometry.

Syntax	geom_from_gml(gml)
Arguments	• **gml** - GML representation of a geometry as a string
Exemplos	• `geom_from_gml('<gml:LineString srsName="EPSG:4326"><gml:coordinates>4, 4 5,5 6,6</gml:coordinates></gml:LineString>')` → a line geometry object

geom_from_wkb

Returns a geometry created from a Well-Known Binary (WKB) representation.

Syntax	geom_from_wkb(binary)
Arguments	• **binary** - Well-Known Binary (WKB) representation of a geometry (as a binary blob)
Exemplos	• `geom_from_wkb( geom_to_wkb( make_point(4,5) ) )` → a point geometry object

geom_from_wkt

Returns a geometry created from a Well-Known Text (WKT) representation.

Syntax	geom_from_wkt(text)
Arguments	• **text** - Well-Known Text (WKT) representation of a geometry
Exemplos	• `geom_from_wkt( 'POINT(4 5)' )` → a geometry object

geom_to_wkb

Returns the Well-Known Binary (WKB) representation of a geometry

Syntax	geom_to_wkb(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `geom_to_wkb( $geometry )` → binary blob containing a geometry object

geom_to_wkt

Returns the Well-Known Text (WKT) representation of the geometry without SRID metadata.

Syntax	geom_to_wkt(geometry, [precision=8]) [] marks optional arguments
Arguments	• **geometry** - a geometry • **precision** - numeric precision
Exemplos	• `geom_to_wkt( make_point(6, 50) )` → 'POINT(6 50)' • `geom_to_wkt(centroid(geom_from_wkt('Polygon((1 1, 0 0, -1 1, 1 1))')))` → 'POINT(0 0.66666667)' • `geom_to_wkt(centroid(geom_from_wkt('Polygon((1 1, 0 0, -1 1, 1 1))')), 2)` → 'POINT(0 0.67)'

$geometry

Returns the geometry of the current feature. Can be used for processing with other functions.

Syntax	$geometry
Exemplos	• `geom_to_wkt( $geometry )` → 'POINT(6 50)'

geometry

Returns a feature's geometry.

Syntax	geometry(feature)
Arguments	• **feature** - a feature object
Exemplos	• `geom_to_wkt( geometry( get_feature( layer, attributeField, value ) ) )` → 'POINT(6 50)' • `intersects( $geometry, geometry( get_feature( layer, attributeField, value ) ) )` → true

geometry_n

Returns a specific geometry from a geometry collection, or NULL if the input geometry is not a collection.

Syntax	geometry_n(geometry, index)
Arguments	• **geometry** - geometry collection • **index** - index of geometry to return, where 1 is the first geometry in the collection
Exemplos	• `geom_to_wkt(geometry_n(geom_from_wkt('GEOMETRYCOLLECTION(POINT(0 1), POINT(0 0), POINT(1 0), POINT(1 1))'),3))` → 'Point (1 0)'

hausdorff_distance

Returns the Hausdorff distance between two geometries. This is basically a measure of how similar or dissimilar 2 geometries are, with a lower distance indicating more similar geometries.

The function can be executed with an optional densify fraction argument. If not specified, an approximation to the standard Hausdorff distance is used. This approximation is exact or close enough for a large subset of useful cases. Examples of these are:

- computing distance between Linestrings that are roughly parallel to each other, and roughly equal in length. This occurs in matching linear networks.
- Testing similarity of geometries.

If the default approximate provided by this method is insufficient, specify the optional densify fraction argument. Specifying this argument performs a segment densification before computing the discrete Hausdorff distance. The parameter sets the fraction by which to densify each segment. Each segment will be split into a number of equal-length subsegments, whose fraction of the total length is closest to the given fraction. Decreasing the densify fraction parameter will make the distance returned approach the true Hausdorff distance for the geometries.

Syntax	hausdorff_distance(geometry1, geometry2, [densify_fraction]) [] marks optional arguments
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry • **densify_fraction** - densify fraction amount
Exemplos	• `hausdorff_distance( geometry1:= geom_from_wkt('LINESTRING (0 0, 2 1)'),geometry2:=geom_from_wkt('LINESTRING (0 0, 2 0)'))` → 2 • `hausdorff_distance( geom_from_wkt('LINESTRING (130 0, 0 0, 0 150)'),geom_from_wkt('LINESTRING (10 10, 10 150, 130 10)'))` → 14.142135623 • `hausdorff_distance( geom_from_wkt('LINESTRING (130 0, 0 0, 0 150)'),geom_from_wkt('LINESTRING (10 10, 10 150, 130 10)'),0.5)` → 70.0

inclination

Retorna a inclinação medida do zênite (0) ao nadir (180) no ponto_a ao ponto_b.

Syntax	inclination(point_a, point_b)
Arguments	• **point_a** - point geometry • **point_b** - point geometry
Exemplos	• `inclination( make_point( 5, 10, 0 ), make_point( 5, 10, 5 ) )` → 0.0 • `inclination( make_point( 5, 10, 0 ), make_point( 5, 10, 0 ) )` → 90.0 • `inclination( make_point( 5, 10, 0 ), make_point( 50, 100, 0 ) )` → 90.0 • `inclination( make_point( 5, 10, 0 ), make_point( 5, 10, -5 ) )` → 180.0

interior_ring_n

Returns a specific interior ring from a polygon geometry, or NULL if the geometry is not a polygon.

Syntax	interior_ring_n(geometry, index)
Arguments	• **geometry** - polygon geometry • **index** - index of interior to return, where 1 is the first interior ring
Exemplos	• `geom_to_wkt(interior_ring_n(geom_from_wkt('POLYGON((-1 -1, 4 0, 4 2, 0 2, -1 -1),(-0.1 -0.1, 0.4 0, 0.4 0.2, 0 0.2, -0.1 -0.1),(-1 -1, 4 0, 4 2, 0 2, -1 -1))'),1))` → 'LineString (-0.1 -0.1, 0.4 0, 0.4 0.2, 0 0.2, -0.1 -0.1)'

intersection

Returns a geometry that represents the shared portion of two geometries.

Syntax	intersection(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `geom_to_wkt( intersection( geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ), geom_from_wkt( 'LINESTRING(3 3, 4 4)' ) ) )` → 'LINESTRING(3 3, 4 4)' • `geom_to_wkt( intersection( geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ), geom_from_wkt( 'MULTIPOINT(3.5 3.5, 4 5)' ) ) )` → 'POINT(3.5 3.5)'

Further reading: *Intersection* algorithm

intersects

Tests whether a geometry intersects another. Returns true if the geometries spatially intersect (share any portion of space) and false if they do not.

Syntax	intersects(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `intersects( geom_from_wkt( 'POINT(4 4)' ), geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ) )` → true • `intersects( geom_from_wkt( 'POINT(4 5)' ), geom_from_wkt( 'POINT(5 5)' ) )` → false

Further reading: *overlay_intersects*

intersects_bbox

Tests whether a geometry's bounding box overlaps another geometry's bounding box. Returns true if the geometries spatially intersect the bounding box defined and false if they do not.

Syntax	intersects_bbox(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `intersects_bbox( geom_from_wkt( 'POINT(4 5)' ), geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ) )` → true • `intersects_bbox( geom_from_wkt( 'POINT(6 5)' ), geom_from_wkt( 'POLYGON((3 3, 4 4, 5 5, 3 3))' ) )` → false

is_closed

Returns true if a line string is closed (start and end points are coincident), or false if a line string is not closed. If the geometry is not a line string then the result will be NULL.

Syntax	is_closed(geometry)
Arguments	• **geometry** - a line string geometry
Exemplos	• `is_closed(geom_from_wkt('LINESTRING(0 0, 1 1, 2 2)'))` → false • `is_closed(geom_from_wkt('LINESTRING(0 0, 1 1, 2 2, 0 0)'))` → true

is_empty

Returns true if a geometry is empty (without coordinates), false if the geometry is not empty and NULL if there is no geometry. See also is_empty_or_null.

Syntax	is_empty(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `is_empty(geom_from_wkt('LINESTRING(0 0, 1 1, 2 2)'))` → false • `is_empty(geom_from_wkt('LINESTRING EMPTY'))` → true • `is_empty(geom_from_wkt('POINT(7 4)'))` → false • `is_empty(geom_from_wkt('POINT EMPTY'))` → true

is_empty_or_null

Returns true if a geometry is NULL or empty (without coordinates) or false otherwise. This function is like the expression '$geometry IS NULL or is_empty($geometry)'

Syntax	is_empty_or_null(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `is_empty_or_null(NULL)` → true • `is_empty_or_null(geom_from_wkt('LINESTRING(0 0, 1 1, 2 2)'))` → false • `is_empty_or_null(geom_from_wkt('LINESTRING EMPTY'))` → true • `is_empty_or_null(geom_from_wkt('POINT(7 4)'))` → false • `is_empty_or_null(geom_from_wkt('POINT EMPTY'))` → true

is_multipart

Returns true if the geometry is of Multi type.

Syntax	is_multipart(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `is_multipart(geom_from_wkt('MULTIPOINT ((0 0),(1 1),(2 2))'))` → true • `is_multipart(geom_from_wkt('POINT (0 0)'))` → false

is_valid

Returns true if a geometry is valid; if it is well-formed in 2D according to the OGC rules.

Syntax	is_valid(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `is_valid(geom_from_wkt('LINESTRING(0 0, 1 1, 2 2, 0 0)'))` → true • `is_valid(geom_from_wkt('LINESTRING(0 0)'))` → false

$length

Returns the length of a linestring. If you need the length of a border of a polygon, use $perimeter instead. The length calculated by this function respects both the current project's ellipsoid setting and distance unit settings. For example, if an ellipsoid has been set for the project then the calculated length will be ellipsoidal, and if no ellipsoid is set then the calculated length will be planimetric.

Syntax	$length
Exemplos	• `$length` → 42.4711

length

Returns the number of characters in a string or the length of a geometry linestring.

String variant

Returns the number of characters in a string.

Syntax	length(string)
Arguments	• **string** - string to count length of
Exemplos	• `length('hello')` → 5

Geometry variant

Calculate the length of a geometry line object. Calculations are always planimetric in the Spatial Reference System (SRS) of this geometry, and the units of the returned length will match the units for the SRS. This differs from the calculations performed by the $length function, which will perform ellipsoidal calculations based on the project's ellipsoid and distance unit settings.

Syntax	length(geometry)
Arguments	• **geometry** - line geometry object
Exemplos	• `length(geom_from_wkt('LINESTRING(0 0, 4 0)'))` → 4.0

line_interpolate_angle

Retorna o ângulo paralelo à geometria a uma distância especificada ao longo de uma geometria de linhas. Os ângulos estão em graus no sentido horário do norte.

Syntax	line_interpolate_angle(geometry, distance)
Arguments	• **geometry** - a linestring geometry • **distance** - distance along line to interpolate angle at
Exemplos	• `line_interpolate_angle(geometry:=geom_from_wkt('LineString(0 0, 10 0)'),distance:=5)` → 90.0

line_interpolate_point

Returns the point interpolated by a specified distance along a linestring geometry.

Syntax	line_interpolate_point(geometry, distance)
Arguments	• **geometry** - a linestring geometry • **distance** - distance along line to interpolate
Exemplos	• `geom_to_wkt(line_interpolate_point(geometry:=geom_from_wkt('LineString(0 0, 10 0)'),distance:=5))` → 'Point (5 0)'

Further reading: *Interpolate point on line* algorithm

line_locate_point

Retorna a distância ao longo de uma linha correspondente à posição mais próxima da linha a uma geometria de ponto especificada.

Syntax	line_locate_point(geometry, point)
Arguments	• **geometry** - a linestring geometry • **point** - point geometry to locate closest position on linestring to
Exemplos	• `line_locate_point(geometry:=geom_from_wkt('LineString(0 0, 10 0)'),point:=geom_from_wkt('Point(5 0)'))` → 5.0

line_merge

Returns a LineString or MultiLineString geometry, where any connected LineStrings from the input geometry have been merged into a single linestring. This function will return NULL if passed a geometry which is not a LineString/MultiLineString.

Syntax	line_merge(geometry)
Arguments	• **geometry** - a LineString/MultiLineString geometry
Exemplos	• `geom_to_wkt(line_merge(geom_from_wkt('MULTILINESTRING((0 0, 1 1),(1 1, 2 2))')))` → 'LineString(0 0,1 1,2 2)' • `geom_to_wkt(line_merge(geom_from_wkt('MULTILINESTRING((0 0, 1 1),(11 1, 21 2))')))` → 'MultiLineString((0 0, 1 1),(11 1, 21 2)'

line_substring

Returns the portion of a line (or curve) geometry which falls between the specified start and end distances (measured from the beginning of the line). Z and M values are linearly interpolated from existing values.

Syntax	line_substring(geometry, start_distance, end_distance)
Arguments	• **geometry** - a linestring or curve geometry • **start_distance** - distance to start of substring • **end_distance** - distance to end of substring
Exemplos	• `geom_to_wkt(line_substring(geometry:=geom_from_wkt('LineString(0 0, 10 0)'),start_distance:=2,end_distance=6))` → 'LineString (2 0,6 0)'

Further reading: *Line substring* algorithm

m

Returns the m value of a point geometry.

Syntax	m(geometry)
Arguments	• **geometry** - a point geometry
Exemplos	• `m( geom_from_wkt( 'POINTM(2 5 4)' ) )` → 4

m_max

Returns the maximum m (measure) value of a geometry.

Syntax	m_max(geometry)
Arguments	• **geometry** - a geometry containing m values
Exemplos	• `m_max( make_point_m( 0,0,1 ) )` → 1 • `m_max(make_line( make_point_m( 0,0,1 ), make_point_m( -1, -1,2 ), make_point_m( -2,-2,0 ) ) )` → 2

m_min

Returns the minimum m (measure) value of a geometry.

Syntax	m_min(geometry)
Arguments	• **geometry** - a geometry containing m values
Exemplos	• `m_min( make_point_m( 0,0,1 ) )` → 1 • `m_min(make_line( make_point_m( 0,0,1 ), make_point_m( -1, -1,2 ), make_point_m( -2,-2,0 ) ) )` → 0

main_angle

Returns the main angle of a geometry (clockwise, in degrees from North), which represents the angle of the oriented minimal bounding rectangle which completely covers the geometry.

Syntax	main_angle(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `main_angle(geom_from_wkt('Polygon ((321577 129614, 321581 129618, 321585 129615, 321581 129610, 321577 129614))'))` → 38.66

make_circle

Creates a circular polygon.

Syntax	make_circle(center, radius, [segments=36]) [] marks optional arguments
Arguments	• **center** - center point of the circle • **radius** - radius of the circle • **segments** - optional argument for polygon segmentation. By default this value is 36
Exemplos	• `geom_to_wkt(make_circle(make_point(10,10), 5, 4))` → 'Polygon ((10 15, 15 10, 10 5, 5 10, 10 15))' • `geom_to_wkt(make_circle(make_point(10,10,5), 5, 4))` → 'PolygonZ ((10 15 5, 15 10 5, 10 5 5, 5 10 5, 10 15 5))' • `geom_to_wkt(make_circle(make_point(10,10,5,30), 5, 4))` → 'PolygonZM ((10 15 5 30, 15 10 5 30, 10 5 5 30, 5 10 5 30, 10 15 5 30))'

make_ellipse

Creates an elliptical polygon.

Syntax	make_ellipse(center, semi_major_axis, semi_minor_axis, azimuth, [segments=36]) [] marks optional arguments
Arguments	• **center** - center point of the ellipse • **semi_major_axis** - semi-major axis of the ellipse • **semi_minor_axis** - semi-minor axis of the ellipse • **azimuth** - orientation of the ellipse • **segments** - optional argument for polygon segmentation. By default this value is 36
Exemplos	• `geom_to_wkt(make_ellipse(make_point(10,10), 5, 2, 90, 4))` → 'Polygon ((15 10, 10 8, 5 10, 10 12, 15 10))' • `geom_to_wkt(make_ellipse(make_point(10,10,5), 5, 2, 90, 4))` → 'PolygonZ ((15 10 5, 10 8 5, 5 10 5, 10 12 5, 15 10 5))' • `geom_to_wkt(make_ellipse(make_point(10,10,5,30), 5, 2, 90, 4))` → 'PolygonZM ((15 10 5 30, 10 8 5 30, 5 10 5 30, 10 12 5 30, 15 10 5 30))'

make_line

Creates a line geometry from a series of point geometries.

List of arguments variant

Line vertices are specified as separate arguments to the function.

Syntax	make_line(point1, point2, …)
Arguments	• **point** - a point geometry (or array of points)
Exemplos	• `geom_to_wkt(make_line(make_point(2,4),make_point(3,5)))` → 'LineString (2 4, 3 5)' • `geom_to_wkt(make_line(make_point(2,4),make_point(3,5),make_point(9,7)))` → 'LineString (2 4, 3 5, 9 7)'

Array variant

Line vertices are specified as an array of points.

Syntax	make_line(array)
Arguments	• **array** - array of points
Exemplos	• `geom_to_wkt(make_line(array(make_point(2,4),make_point(3,5),make_point(9,7))))` → 'LineString (2 4, 3 5, 9 7)'

make_point

Creates a point geometry from an x and y (and optional z and m) value.

Syntax	make_point(x, y, [z], [m]) [] marks optional arguments
Arguments	• **x** - x coordinate of point • **y** - y coordinate of point • **z** - optional z coordinate of point • **m** - optional m value of point
Exemplos	• `geom_to_wkt(make_point(2,4))` → 'Point (2 4)' • `geom_to_wkt(make_point(2,4,6))` → 'PointZ (2 4 6)' • `geom_to_wkt(make_point(2,4,6,8))` → 'PointZM (2 4 6 8)'

make_point_m

Creates a point geometry from an x, y coordinate and m value.

Syntax	make_point_m(x, y, m)
Arguments	• **x** - x coordinate of point • **y** - y coordinate of point • **m** - m value of point
Exemplos	• `geom_to_wkt(make_point_m(2,4,6))` → 'PointM (2 4 6)'

make_polygon

Creates a polygon geometry from an outer ring and optional series of inner ring geometries.

Syntax	make_polygon(outerRing, [innerRing1], [innerRing2], …) [] marks optional arguments
Arguments	• **outerRing** - closed line geometry for polygon's outer ring • **innerRing** - optional closed line geometry for inner ring
Exemplos	• `geom_to_wkt(make_polygon(geom_from_wkt('LINESTRING( 0 0, 0 1, 1 1, 1 0, 0 0 )')))` → 'Polygon ((0 0, 0 1, 1 1, 1 0, 0 0))' • `geom_to_wkt(make_polygon(geom_from_wkt('LINESTRING( 0 0, 0 1, 1 1, 1 0, 0 0 )'),geom_from_wkt('LINESTRING( 0.1 0.1, 0.1 0.2, 0.2 0.2, 0.2 0.1, 0.1 0.1 )'), geom_from_wkt('LINESTRING( 0.8 0.8, 0.8 0.9, 0.9 0.9, 0.9 0.8, 0.8 0.8 )')))` → 'Polygon ((0 0, 0 1, 1 1, 1 0, 0 0),(0.1 0.1, 0.1 0.2, 0.2 0.2, 0.2 0.1, 0.1 0.1),(0.8 0.8, 0.8 0.9, 0.9 0.9, 0.9 0.8, 0.8 0.8))'

make_rectangle_3points

Creates a rectangle from 3 points.

Syntax	make_rectangle_3points(point1, point2, point3, [option=0]) [] marks optional arguments
Arguments	• **point1** - First point. • **point2** - Second point. • **point3** - Third point. • **option** - An optional argument to construct the rectangle. By default this value is 0. Value can be 0 (distance) or 1 (projected). Option distance: Second distance is equal to the distance between 2nd and 3rd point. Option projected: Second distance is equal to the distance of the perpendicular projection of the 3rd point on the segment or its extension.
Exemplos	• `geom_to_wkt(make_rectangle(make_point(0, 0), make_point(0, 5), make_point(5, 5), 0)))` → 'Polygon ((0 0, 0 5, 5 5, 5 0, 0 0))' • `geom_to_wkt(make_rectangle(make_point(0, 0), make_point(0, 5), make_point(5, 3), 1)))` → 'Polygon ((0 0, 0 5, 5 5, 5 0, 0 0))'

make_regular_polygon

Creates a regular polygon.

Syntax	make_regular_polygon(center, radius, number_sides, [circle=0]) [] marks optional arguments
Arguments	• **center** - center of the regular polygon • **radius** - second point. The first if the regular polygon is inscribed. The midpoint of the first side if the regular polygon is circumscribed. • **number_sides** - Number of sides/edges of the regular polygon • **circle** - Optional argument to construct the regular polygon. By default this value is 0. Value can be 0 (inscribed) or 1 (circumscribed)
Exemplos	• `geom_to_wkt(make_regular_polygon(make_point(0,0), make_point(0,5), 5))` → 'Polygon ((0 5, 4.76 1.55, 2.94 -4.05, -2.94 -4.05, -4.76 1.55, 0 5))' • `geom_to_wkt(make_regular_polygon(make_point(0,0), project(make_point(0,0), 4.0451, radians(36)), 5))` → 'Polygon ((0 5, 4.76 1.55, 2.94 -4.05, -2.94 -4.05, -4.76 1.55, 0 5))'

make_square

Creates a square from a diagonal.

Syntax	make_square(point1, point2)
Arguments	• **point1** - First point of the diagonal • **point2** - Last point of the diagonal
Exemplos	• `geom_to_wkt(make_square( make_point(0,0), make_point(5, 5)))` → 'Polygon ((0 0, -0 5, 5 5, 5 0, 0 0))' • `geom_to_wkt(make_square( make_point(5,0), make_point(5, 5)))` → 'Polygon ((5 0, 2.5 2.5, 5 5, 7.5 2.5, 5 0))'

make_triangle

Creates a triangle polygon.

Syntax	make_triangle(point1, point2, point3)
Arguments	• **point1** - first point of the triangle • **point2** - second point of the triangle • **point3** - third point of the triangle
Exemplos	• `geom_to_wkt(make_triangle(make_point(0,0), make_point(5, 5), make_point(0,10)))` → 'Triangle ((0 0, 5 5, 0 10, 0 0))' • `geom_to_wkt(boundary(make_triangle(make_point(0,0), make_point(5,5), make_point(0,10))))` → 'LineString (0 0, 5 5, 0 10, 0 0)'

minimal_circle

Returns the minimal enclosing circle of a geometry. It represents the minimum circle that encloses all geometries within the set.

Syntax	minimal_circle(geometry, [segments=36]) [] marks optional arguments
Arguments	• **geometry** - a geometry • **segments** - optional argument for polygon segmentation. By default this value is 36
Exemplos	• `geom_to_wkt( minimal_circle( geom_from_wkt( 'LINESTRING(0 5, 0 -5, 2 1)' ), 4 ) )` → 'Polygon ((0 5, 5 -0, -0 -5, -5 0, 0 5))' • `geom_to_wkt( minimal_circle( geom_from_wkt( 'MULTIPOINT(1 2, 3 4, 3 2)' ), 4 ) )` → 'Polygon ((3 4, 3 2, 1 2, 1 4, 3 4))'

Further reading: *Minimum enclosing circles* algorithm

nodes_to_points

Returns a multipoint geometry consisting of every node in the input geometry.

Syntax	nodes_to_points(geometry, [ignore_closing_nodes=false]) [] marks optional arguments
Arguments	• **geometry** - geometry object • **ignore_closing_nodes** - optional argument specifying whether to include duplicate nodes which close lines or polygons rings. Defaults to false, set to true to avoid including these duplicate nodes in the output collection.
Exemplos	• `geom_to_wkt(nodes_to_points(geom_from_wkt('LINESTRING(0 0, 1 1, 2 2)')))` → 'MultiPoint ((0 0),(1 1),(2 2))' • `geom_to_wkt(nodes_to_points(geom_from_wkt('POLYGON((-1 -1, 4 0, 4 2, 0 2, -1 -1))'),true))` → 'MultiPoint ((-1 -1),(4 0),(4 2),(0 2))'

Further reading: *Extract vertices* algorithm

num_geometries

Returns the number of geometries in a geometry collection, or NULL if the input geometry is not a collection.

Syntax	num_geometries(geometry)
Arguments	• **geometry** - geometry collection
Exemplos	• `num_geometries(geom_from_wkt('GEOMETRYCOLLECTION(POINT(0 1), POINT(0 0), POINT(1 0), POINT(1 1))'))` → 4

num_interior_rings

Returns the number of interior rings in a polygon or geometry collection, or NULL if the input geometry is not a polygon or collection.

Syntax	num_interior_rings(geometry)
Arguments	• **geometry** - input geometry
Exemplos	• `num_interior_rings(geom_from_wkt('POLYGON((-1 -1, 4 0, 4 2, 0 2, -1 -1),(-0.1 -0.1, 0.4 0, 0.4 0.2, 0 0.2, -0.1 -0.1))'))` → 1

num_points

Returns the number of vertices in a geometry.

Syntax	num_points(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `num_points($geometry)` → number of vertices in the current feature's geometry

num_rings

Returns the number of rings (including exterior rings) in a polygon or geometry collection, or NULL if the input geometry is not a polygon or collection.

Syntax	num_rings(geometry)
Arguments	• **geometry** - input geometry
Exemplos	• `num_rings(geom_from_wkt('POLYGON((-1 -1, 4 0, 4 2, 0 2, -1 -1),(-0.1 -0.1, 0.4 0, 0.4 0.2, 0 0.2, -0.1 -0.1))'))` → 2

offset_curve

Returns a geometry formed by offsetting a linestring geometry to the side. Distances are in the Spatial Reference System of this geometry.

Syntax	offset_curve(geometry, distance, [segments=8], [join=1], [miter_limit=2.0]) [] marks optional arguments
Arguments	• **geometry** - a (multi)linestring geometry • **distance** - offset distance. Positive values will be buffered to the left of lines, negative values to the right • **segments** - number of segments to use to represent a quarter circle when a round join style is used. A larger number results in a smoother line with more nodes. • **join** - join style for corners, where 1 = round, 2 = miter and 3 = bevel • **miter_limit** - limit on the miter ratio used for very sharp corners (when using miter joins only)
Exemplos	• `offset_curve($geometry, 10.5)` → line offset to the left by 10.5 units • `offset_curve($geometry, -10.5)` → line offset to the right by 10.5 units • `offset_curve($geometry, 10.5, segments=16, join=1)` → line offset to the left by 10.5 units, using more segments to result in a smoother curve • `offset_curve($geometry, 10.5, join=3)` → line offset to the left by 10.5 units, using a beveled join

Further reading: *Offset lines* algorithm

order_parts

Ordena as partes de um MultiGeometry por um determinado critério

Syntax	order_parts(geometry, orderby, ascending)
Arguments	• **geometry** - a multi-type geometry • **orderby** - an expression string defining the order criteria • **ascending** - boolean, True for ascending, False for descending
Exemplos	• `geom_to_wkt(order_parts(geom_from_wkt('MultiPolygon (((1 1, 5 1, 5 5, 1 5, 1 1)),((1 1, 9 1, 9 9, 1 9, 1 1)))'), 'area($geometry)', False))` → 'MultiPolygon (((1 1, 9 1, 9 9, 1 9, 1 1)),((1 1, 5 1, 5 5, 1 5, 1 1)))' • `geom_to_wkt(order_parts(geom_from_wkt('LineString(1 2, 3 2, 4 3)'), '1', True))` → 'LineString(1 2, 3 2, 4 3)'

oriented_bbox

Returns a geometry which represents the minimal oriented bounding box of an input geometry.

Syntax	oriented_bbox(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `geom_to_wkt( oriented_bbox( geom_from_wkt( 'MULTIPOINT(1 2, 3 4, 3 2)' ) ) )` → 'Polygon ((3 2, 3 4, 1 4, 1 2, 3 2))'

Further reading: *Oriented minimum bounding box* algorithm

overlaps

Tests whether a geometry overlaps another. Returns true if the geometries share space, are of the same dimension, but are not completely contained by each other.

Syntax	overlaps(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `overlaps( geom_from_wkt( 'LINESTRING(3 5, 4 4, 5 5, 5 3)' ), geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ) )` → true • `overlaps( geom_from_wkt( 'LINESTRING(0 0, 1 1)' ), geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ) )` → false

overlay_contains

Returns whether the current feature spatially contains at least one feature from a target layer, or an array of expression-based results for the features in the target layer contained in the current feature.

Read more on the underlying GEOS "Contains" predicate, as described in PostGIS ST_Contains function.

Syntax	overlay_contains(layer, [expression], [filter], [limit], [cache=false]) [] marks optional arguments
Arguments	• **layer** - the layer whose overlay is checked • **expression** - an optional expression to evaluate on the features from the target layer. If not set, the function will just return a boolean indicating whether there is at least one match. • **filter** - an optional expression to filter the target features to check. If not set, all the features will be checked. • **limit** - an optional integer to limit the number of matching features. If not set, all the matching features will be returned. • **cache** - set this to true to build a local spatial index (most of the time, this is unwanted, unless you are working with a particularly slow data provider)
Exemplos	• `overlay_contains('regions')` → true if the current feature spatially contains a region • `overlay_contains('regions', filter:= population > 10000)` → true if the current feature spatially contains a region with a population greater than 10000 • `overlay_contains('regions', name)` → an array of names, for the regions contained in the current feature • `array_to_string(overlay_contains('regions', name))` → a string as a comma separated list of names, for the regions contained in the current feature • `array_length(overlay_contains('regions', name))` → the number of regions contained in the current feature • `array_sort(overlay_contains(layer:='regions', expression:="name", filter:= population > 10000))` → an ordered array of names, for the regions contained in the current feature and with a population greater than 10000 • `overlay_contains(layer:='regions', expression:= geom_to_wkt($geometry), limit:=2)` → an array of geometries (in WKT), for up to two regions contained in the current feature

Further reading: *contains*, *array manipulation*, *Selecionar pela localização* algorithm

overlay_crosses

Returns whether the current feature spatially crosses at least one feature from a target layer, or an array of expression-based results for the features in the target layer crossed by the current feature.

Read more on the underlying GEOS "Crosses" predicate, as described in PostGIS ST_Crosses function.

Syntax	overlay_crosses(layer, [expression], [filter], [limit], [cache=false]) [] marks optional arguments
Arguments	• **layer** - the layer whose overlay is checked • **expression** - an optional expression to evaluate on the features from the target layer. If not set, the function will just return a boolean indicating whether there is at least one match. • **filter** - an optional expression to filter the target features to check. If not set, all the features will be checked. • **limit** - an optional integer to limit the number of matching features. If not set, all the matching features will be returned. • **cache** - set this to true to build a local spatial index (most of the time, this is unwanted, unless you are working with a particularly slow data provider)
Exemplos	• `overlay_crosses('regions')` → true if the current feature spatially crosses a region • `overlay_crosses('regions', filter:= population > 10000)` → true if the current feature spatially crosses a region with a population greater than 10000 • `overlay_crosses('regions', name)` → an array of names, for the regions crossed by the current feature • `array_to_string(overlay_crosses('regions', name))` → a string as a comma separated list of names, for the regions crossed by the current feature • `array_sort(overlay_crosses(layer:='regions', expression:="name", filter:= population > 10000))` → an ordered array of names, for the regions crossed by the current feature and with a population greater than 10000 • `overlay_crosses(layer:='regions', expression:= geom_to_wkt($geometry), limit:=2)` → an array of geometries (in WKT), for up to two regions crossed by the current feature

Further reading: *crosses*, *array manipulation*, *Selecionar pela localização* algorithm

overlay_disjoint

Returns whether the current feature is spatially disjoint from all the features of a target layer, or an array of expression-based results for the features in the target layer that are disjoint from the current feature.

Read more on the underlying GEOS "Disjoint" predicate, as described in PostGIS ST_Disjoint function.

Syntax	overlay_disjoint(layer, [expression], [filter], [limit], [cache=false]) [] marks optional arguments
Arguments	• **layer** - the layer whose overlay is checked • **expression** - an optional expression to evaluate on the features from the target layer. If not set, the function will just return a boolean indicating whether there is at least one match. • **filter** - an optional expression to filter the target features to check. If not set, all the features will be checked. • **limit** - an optional integer to limit the number of matching features. If not set, all the matching features will be returned. • **cache** - set this to true to build a local spatial index (most of the time, this is unwanted, unless you are working with a particularly slow data provider)
Exemplos	• `overlay_disjoint('regions')` → true if the current feature is spatially disjoint from all the regions • `overlay_disjoint('regions', filter:= population > 10000)` → true if the current feature is spatially disjoint from all the regions with a population greater than 10000 • `overlay_disjoint('regions', name)` → an array of names, for the regions spatially disjoint from the current feature • `array_to_string(overlay_disjoint('regions', name))` → a string as a comma separated list of names, for the regions spatially disjoint from the current feature • `array_sort(overlay_disjoint(layer:='regions', expression:="name", filter:= population > 10000))` → an ordered array of names, for the regions spatially disjoint from the current feature and with a population greater than 10000 • `overlay_disjoint(layer:='regions', expression:= geom_to_wkt($geometry), limit:=2)` → an array of geometries (in WKT), for up to two regions spatially disjoint from the current feature

Further reading: *disjoint*, *array manipulation*, *Selecionar pela localização* algorithm

overlay_equals

Returns whether the current feature spatially equals to at least one feature from a target layer, or an array of expression-based results for the features in the target layer that are spatially equal to the current feature.

Read more on the underlying GEOS "Equals" predicate, as described in PostGIS ST_Equals function.

Syntax	overlay_equals(layer, [expression], [filter], [limit], [cache=false]) [] marks optional arguments
Arguments	• **layer** - the layer whose overlay is checked • **expression** - an optional expression to evaluate on the features from the target layer. If not set, the function will just return a boolean indicating whether there is at least one match. • **filter** - an optional expression to filter the target features to check. If not set, all the features will be checked. • **limit** - an optional integer to limit the number of matching features. If not set, all the matching features will be returned. • **cache** - set this to true to build a local spatial index (most of the time, this is unwanted, unless you are working with a particularly slow data provider)
Exemplos	• `overlay_equals('regions')` → true if the current feature is spatially equal to a region • `overlay_equals('regions', filter:= population > 10000)` → true if the current feature is spatially equal to a region with a population greater than 10000 • `overlay_equals('regions', name)` → an array of names, for the regions spatially equal to the current feature • `array_to_string(overlay_equals('regions', name))` → a string as a comma separated list of names, for the regions spatially equal to the current feature • `array_sort(overlay_equals(layer:='regions', expression:="name", filter:= population > 10000))` → an ordered array of names, for the regions spatially equal to the current feature and with a population greater than 10000 • `overlay_equals(layer:='regions', expression:= geom_to_wkt($geometry), limit:=2)` → an array of geometries (in WKT), for up to two regions spatially equal to the current feature

Further reading: *array manipulation*, *Selecionar pela localização* algorithm

overlay_intersects

Returns whether the current feature spatially intersects at least one feature from a target layer, or an array of expression-based results for the features in the target layer intersected by the current feature.

Read more on the underlying GEOS “Intersects” predicate, as described in PostGIS ST_Intersects function.

Syntax	overlay_intersects(layer, [expression], [filter], [limit], [cache=false]) [] marks optional arguments
Arguments	• **layer** - the layer whose overlay is checked • **expression** - an optional expression to evaluate on the features from the target layer. If not set, the function will just return a boolean indicating whether there is at least one match. • **filter** - an optional expression to filter the target features to check. If not set, all the features will be checked. • **limit** - an optional integer to limit the number of matching features. If not set, all the matching features will be returned. • **cache** - set this to true to build a local spatial index (most of the time, this is unwanted, unless you are working with a particularly slow data provider)
Exemplos	• `overlay_intersects('regions')` → true if the current feature spatially intersects a region • `overlay_intersects('regions', filter:= population > 10000)` → true if the current feature spatially intersects a region with a population greater than 10000 • `overlay_intersects('regions', name)` → an array of names, for the regions intersected by the current feature • `array_to_string(overlay_intersects('regions', name))` → a string as a comma separated list of names, for the regions intersected by the current feature • `array_sort(overlay_intersects(layer:='regions', expression:="name", filter:= population > 10000))` → an ordered array of names, for the regions intersected by the current feature and with a population greater than 10000 • `overlay_intersects(layer:='regions', expression:= geom_to_wkt($geometry), limit:=2)` → an array of geometries (in WKT), for up to two regions intersected by the current feature

Further reading: *intersects*, *array manipulation*, *Selecionar pela localização* algorithm

overlay_nearest

Returns whether the current feature has feature(s) from a target layer within a given distance, or an array of expression-based results for the features in the target layer within a distance from the current feature.

Note: This function can be slow and consume a lot of memory for large layers.

Syntax	overlay_nearest(layer, [expression], [filter], [limit=1], [max_distance], [cache=false]) [] marks optional arguments
Arguments	• **layer** - the target layer • **expression** - an optional expression to evaluate on the features from the target layer. If not set, the function will just return a boolean indicating whether there is at least one match. • **filter** - an optional expression to filter the target features to check. If not set, all the features in the target layer will be used. • **limit** - an optional integer to limit the number of matching features. If not set, only the nearest feature will be returned. If set to -1, returns all the matching features. • **max_distance** - an optional distance to limit the search of matching features. If not set, all the features in the target layer will be used. • **cache** - set this to true to build a local spatial index (most of the time, this is unwanted, unless you are working with a particularly slow data provider)
Exemplos	• `overlay_nearest('airports')` → true if the "airports" layer has at least one feature • `overlay_nearest('airports', max_distance:= 5000)` → true if there is an airport within a distance of 5000 map units from the current feature • `overlay_nearest('airports', name)` → the name of the closest airport to the current feature, as an array • `array_to_string(overlay_nearest('airports', name))` → the name of the closest airport to the current feature, as a string • `overlay_nearest(layer:='airports', expression:= name, max_distance:= 5000)` → the name of the closest airport within a distance of 5000 map units from the current feature, as an array • `overlay_nearest(layer:='airports', expression:="name", filter:= "Use"='Civilian', limit:=3)` → an array of names, for up to the three closest civilian airports ordered by distance • `overlay_nearest(layer:='airports', expression:="name", limit:= -1, max_distance:= 5000)` → an array of names, for all the airports within a distance of 5000 map units from the current feature, ordered by distance

Further reading: *array manipulation*, *Join attributes by nearest* algorithm

overlay_touches

Returns whether the current feature spatially touches at least one feature from a target layer, or an array of expression-based results for the features in the target layer touched by the current feature.

Read more on the underlying GEOS "Touches" predicate, as described in PostGIS ST_Touches function.

Syntax	overlay_touches(layer, [expression], [filter], [limit], [cache=false]) [] marks optional arguments
Arguments	• **layer** - the layer whose overlay is checked • **expression** - an optional expression to evaluate on the features from the target layer. If not set, the function will just return a boolean indicating whether there is at least one match. • **filter** - an optional expression to filter the target features to check. If not set, all the features will be checked. • **limit** - an optional integer to limit the number of matching features. If not set, all the matching features will be returned. • **cache** - set this to true to build a local spatial index (most of the time, this is unwanted, unless you are working with a particularly slow data provider)
Exemplos	• `overlay_touches('regions')` → true if the current feature spatially touches a region • `overlay_touches('regions', filter:= population > 10000)` → true if the current feature spatially touches a region with a population greater than 10000 • `overlay_touches('regions', name)` → an array of names, for the regions touched by the current feature • `string_to_array(overlay_touches('regions', name))` → a string as a comma separated list of names, for the regions touched by the current feature • `array_sort(overlay_touches(layer:='regions', expression:="name", filter:= population > 10000))` → an ordered array of names, for the regions touched by the current feature and with a population greater than 10000 • `overlay_touches(layer:='regions', expression:= geom_to_wkt($geometry), limit:=2)` → an array of geometries (in WKT), for up to two regions touched by the current feature

Further reading: *touches*, *array manipulation*, *Selecionar pela localização* algorithm

overlay_within

Returns whether the current feature is spatially within at least one feature from a target layer, or an array of expression-based results for the features in the target layer that contain the current feature.

Read more on the underlying GEOS “Within” predicate, as described in PostGIS ST_Within function.

Syntax	overlay_within(layer, [expression], [filter], [limit], [cache=false]) [] marks optional arguments
Arguments	• **layer** - the layer whose overlay is checked • **expression** - an optional expression to evaluate on the features from the target layer. If not set, the function will just return a boolean indicating whether there is at least one match. • **filter** - an optional expression to filter the target features to check. If not set, all the features will be checked. • **limit** - an optional integer to limit the number of matching features. If not set, all the matching features will be returned. • **cache** - set this to true to build a local spatial index (most of the time, this is unwanted, unless you are working with a particularly slow data provider)
Exemplos	• `overlay_within('regions')` → true if the current feature is spatially within a region • `overlay_within('regions', filter:= population > 10000)` → true if the current feature is spatially within a region with a population greater than 10000 • `overlay_within('regions', name)` → an array of names, for the regions containing the current feature • `array_to_string(overlay_within('regions', name))` → a string as a comma separated list of names, for the regions containing the current feature • `array_sort(overlay_within(layer:='regions', expression:="name", filter:= population > 10000))` → an ordered array of names, for the regions containing the current feature and with a population greater than 10000 • `overlay_within(layer:='regions', expression:= geom_to_wkt($geometry), limit:=2)` → an array of geometries (in WKT), for up to two regions containing the current feature

Further reading: *within*, *array manipulation*, *Selecionar pela localização* algorithm

$perimeter

Returns the perimeter length of the current feature. The perimeter calculated by this function respects both the current project's ellipsoid setting and distance unit settings. For example, if an ellipsoid has been set for the project then the calculated perimeter will be ellipsoidal, and if no ellipsoid is set then the calculated perimeter will be planimetric.

Syntax	$perimeter
Exemplos	• `$perimeter` → 42

perimeter

Returns the perimeter of a geometry polygon object. Calculations are always planimetric in the Spatial Reference System (SRS) of this geometry, and the units of the returned perimeter will match the units for the SRS. This differs from the calculations performed by the $perimeter function, which will perform ellipsoidal calculations based on the project's ellipsoid and distance unit settings.

Syntax	perimeter(geometry)
Arguments	• **geometry** - polygon geometry object
Exemplos	• `perimeter(geom_from_wkt('POLYGON((0 0, 4 0, 4 2, 0 2, 0 0))'))` → 12.0

point_n

Returns a specific node from a geometry.

Syntax	point_n(geometry, index)
Arguments	• **geometry** - geometry object • **index** - index of node to return, where 1 is the first node; if the value is negative, the selected vertex index will be its total count minus the absolute value
Exemplos	• `geom_to_wkt(point_n(geom_from_wkt('POLYGON((0 0, 4 0, 4 2, 0 2, 0 0))'),2))` → 'Point (4 0)'

Further reading: *Extract specific vertices* algorithm

point_on_surface

Returns a point guaranteed to lie on the surface of a geometry.

Syntax	point_on_surface(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `point_on_surface($geometry)` → a point geometry

Further reading: *Point on Surface* algorithm

pole_of_inaccessibility

Calculates the approximate pole of inaccessibility for a surface, which is the most distant internal point from the boundary of the surface. This function uses the 'polylabel' algorithm (Vladimir Agafonkin, 2016), which is an iterative approach guaranteed to find the true pole of inaccessibility within a specified tolerance. More precise tolerances require more iterations and will take longer to calculate.

Syntax	pole_of_inaccessibility(geometry, tolerance)
Arguments	• **geometry** - a geometry • **tolerance** - maximum distance between the returned point and the true pole location
Exemplos	• `geom_to_wkt(pole_of_inaccessibility( geom_from_wkt('POLYGON((0 1, 0 9, 3 10, 3 3, 10 3, 10 1, 0 1))'), 0.1))` → 'Point(1.546875 2.546875)'

Further reading: *Pole of inaccessibility* algorithm

project

Returns a point projected from a start point using a distance, a bearing (azimuth) and an elevation in radians.

Syntax	project(point, distance, azimuth, [elevation]) [] marks optional arguments
Arguments	• **point** - start point • **distance** - distance to project • **azimuth** - azimuth in radians clockwise, where 0 corresponds to north • **elevation** - angle of inclination in radians
Exemplos	• `geom_to_wkt(project(make_point(1, 2), 3, radians(270)))` → 'Point(-2, 2)'

Further reading: *Project points (Cartesian)* algorithm

relate

Tests the Dimensional Extended 9 Intersection Model (DE-9IM) representation of the relationship between two geometries.

Relationship variant

Returns the Dimensional Extended 9 Intersection Model (DE-9IM) representation of the relationship between two geometries.

Syntax	relate(geometry, geometry)
Arguments	• **geometry** - a geometry • **geometry** - a geometry
Exemplos	• `relate( geom_from_wkt( 'LINESTRING(40 40,120 120)' ), geom_from_wkt( 'LINESTRING(40 40,60 120)' ) )` → 'FF1F00102'

Pattern match variant

Tests whether the DE-9IM relationship between two geometries matches a specified pattern.

Syntax	relate(geometry, geometry, pattern)
Arguments	• **geometry** - a geometry • **geometry** - a geometry • **pattern** - DE-9IM pattern to match
Exemplos	• `relate( geom_from_wkt( 'LINESTRING(40 40,120 120)' ), geom_from_wkt( 'LINESTRING(40 40,60 120)' ), '**1F001**' )` → True

reverse

Reverses the direction of a line string by reversing the order of its vertices.

Syntax	reverse(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `geom_to_wkt(reverse(geom_from_wkt('LINESTRING(0 0, 1 1, 2 2)')))` → 'LINESTRING(2 2, 1 1, 0 0)'

Further reading: *Reverse line direction* algorithm

rotate

Returns a rotated version of a geometry. Calculations are in the Spatial Reference System of this geometry.

Syntax	rotate(geometry, rotation, [center]) [] marks optional arguments
Arguments	• **geometry** - a geometry • **rotation** - clockwise rotation in degrees • **center** - rotation center point. If not specified, the center of the geometry's bounding box is used.
Exemplos	• `rotate($geometry, 45, make_point(4, 5))` → geometry rotated 45 degrees clockwise around the (4, 5) point • `rotate($geometry, 45)` → geometry rotated 45 degrees clockwise around the center of its bounding box

segments_to_lines

Returns a multi line geometry consisting of a line for every segment in the input geometry.

Syntax	segments_to_lines(geometry)
Arguments	• **geometry** - geometry object
Exemplos	• `geom_to_wkt(segments_to_lines(geom_from_wkt('LINESTRING(0 0, 1 1, 2 2)')))` → 'MultiLineString ((0 0, 1 1),(1 1, 2 2))'

Further reading: *Explode lines* algorithm

shortest_line

Returns the shortest line joining geometry1 to geometry2. The resultant line will start at geometry1 and end at geometry2.

Syntax	shortest_line(geometry1, geometry2)
Arguments	• **geometry1** - geometry to find shortest line from • **geometry2** - geometry to find shortest line to
Exemplos	• `geom_to_wkt(shortest_line(geom_from_wkt('LINESTRING (20 80, 98 190, 110 180, 50 75 )'),geom_from_wkt('POINT(100 100)')))` → 'LineString(73.0769 115.384, 100 100)'

simplify

Simplifies a geometry by removing nodes using a distance based threshold (ie, the Douglas Peucker algorithm). The algorithm preserves large deviations in geometries and reduces the number of vertices in nearly straight segments.

Syntax	simplify(geometry, tolerance)
Arguments	• **geometry** - a geometry • **tolerance** - maximum deviation from straight segments for points to be removed
Exemplos	• `geom_to_wkt(simplify(geometry:=geom_from_wkt('LineString(0 0, 5 0.1, 10 0)'),tolerance:=5))` → 'LineString(0 0, 10 0)'

Further reading: *Simplify* algorithm

simplify_vw

Simplifies a geometry by removing nodes using an area based threshold (ie, the Visvalingam-Whyatt algorithm). The algorithm removes vertices which create small areas in geometries, e.g., narrow spikes or nearly straight segments.

Syntax	simplify_vw(geometry, tolerance)
Arguments	• **geometry** - a geometry • **tolerance** - a measure of the maximum area created by a node for the node to be removed
Exemplos	• `geom_to_wkt(simplify_vw(geometry:=geom_from_wkt('LineString(0 0, 5 0, 5.01 10, 5.02 0, 10 0)'),tolerance:=5))` → 'LineString(0 0, 10 0)'

Further reading: *Simplify* algorithm

single_sided_buffer

Returns a geometry formed by buffering out just one side of a linestring geometry. Distances are in the Spatial Reference System of this geometry.

Syntax	single_sided_buffer(geometry, distance, [segments=8], [join=1], [miter_limit=2.0]) [] marks optional arguments
Arguments	• **geometry** - a (multi)linestring geometry • **distance** - buffer distance. Positive values will be buffered to the left of lines, negative values to the right • **segments** - number of segments to use to represent a quarter circle when a round join style is used. A larger number results in a smoother buffer with more nodes. • **join** - join style for corners, where 1 = round, 2 = miter and 3 = bevel • **miter_limit** - limit on the miter ratio used for very sharp corners (when using miter joins only)
Exemplos	• `single_sided_buffer($geometry, 10.5)` → line buffered to the left by 10.5 units • `single_sided_buffer($geometry, -10.5)` → line buffered to the right by 10.5 units • `single_sided_buffer($geometry, 10.5, segments=16, join=1)` → line buffered to the left by 10.5 units, using more segments to result in a smoother buffer • `single_sided_buffer($geometry, 10.5, join=3)` → line buffered to the left by 10.5 units, using a beveled join

Further reading: *Single sided buffer* algorithm

smooth

Smooths a geometry by adding extra nodes which round off corners in the geometry. If input geometries contain Z or M values, these will also be smoothed and the output geometry will retain the same dimensionality as the input geometry.

Syntax	smooth(geometry, [iterations=1], [offset=0.25], [min_length=-1], [max_angle=180]) [] marks optional arguments
Arguments	• **geometry** - a geometry • **iterations** - number of smoothing iterations to apply. Larger numbers result in smoother but more complex geometries. • **offset** - value between 0 and 0.5 which controls how tightly the smoothed geometry follow the original geometry. Smaller values result in a tighter smoothing, larger values result in looser smoothing. • **min_length** - minimum length of segments to apply smoothing to. This parameter can be used to avoid placing excessive additional nodes in shorter segments of the geometry. • **max_angle** - maximum angle at node for smoothing to be applied (0-180). By lowering the maximum angle intentionally sharp corners in the geometry can be preserved. For instance, a value of 80 degrees will retain right angles in the geometry.
Exemplos	• `geom_to_wkt(smooth(geometry:=geom_from_wkt('LineString(0 0, 5 0, 5 5)'),iterations:=1,offset:=0.2,min_length:=-1, max_angle:=180))` → 'LineString (0 0, 4 0, 5 1, 5 5)'

Further reading: *Smooth* algorithm

start_point

Returns the first node from a geometry.

Syntax	start_point(geometry)
Arguments	• **geometry** - geometry object
Exemplos	• `geom_to_wkt(start_point(geom_from_wkt('LINESTRING(4 0, 4 2, 0 2)')))` → 'Point (4 0)'

Further reading: *Extract specific vertices* algorithm

sym_difference

Returns a geometry that represents the portions of two geometries that do not intersect.

Syntax	sym_difference(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `geom_to_wkt( sym_difference( geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ), geom_from_wkt( 'LINESTRING(3 3, 8 8)' ) ) )` → 'LINESTRING(5 5, 8 8)'

Further reading: *Symmetrical difference* algorithm

tapered_buffer

Creates a buffer along a line geometry where the buffer diameter varies evenly over the length of the line.

Syntax	tapered_buffer(geometry, start_width, end_width, [segments=8]) [] marks optional arguments
Arguments	• **geometry** - input geometry. Must be a (multi)line geometry. • **start_width** - width of buffer at start of line, • **end_width** - width of buffer at end of line. • **segments** - number of segments to approximate quarter-circle curves in the buffer.
Exemplos	• `tapered_buffer(geometry:=geom_from_wkt('LINESTRING(1 2, 4 2)'),start_width:=1,end_width:=2,segments:=8)` → A tapered buffer starting with a diameter of 1 and ending with a diameter of 2 along the linestring geometry.

Further reading: *Tapered buffers* algorithm

touches

Tests whether a geometry touches another. Returns true if the geometries have at least one point in common, but their interiors do not intersect.

Syntax	touches(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `touches( geom_from_wkt( 'LINESTRING(5 3, 4 4)' ), geom_from_wkt( 'LINESTRING(3 3, 4 4, 5 5)' ) )` → true • `touches( geom_from_wkt( 'POINT(4 4)' ), geom_from_wkt( 'POINT(5 5)' ) )` → false

Further reading: *overlay_touches*

transform

Returns the geometry transformed from a source CRS to a destination CRS.

Syntax	transform(geometry, source_auth_id, dest_auth_id)
Arguments	• **geometry** - a geometry • **source_auth_id** - the source auth CRS ID • **dest_auth_id** - the destination auth CRS ID
Exemplos	• `geom_to_wkt( transform( make_point(488995.53240249, 7104473.38600835), 'EPSG:2154', 'EPSG:4326' ) )` → 'POINT(0 51)'

Further reading: *Reproject layer* algorithm

translate

Returns a translated version of a geometry. Calculations are in the Spatial Reference System of this geometry.

Syntax	translate(geometry, dx, dy)
Arguments	• **geometry** - a geometry • **dx** - delta x • **dy** - delta y
Exemplos	• `translate($geometry, 5, 10)` → a geometry of the same type like the original one

Further reading: *Translate* algorithm

union

Returns a geometry that represents the point set union of the geometries.

Syntax	union(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `geom_to_wkt( union( make_point(4, 4), make_point(5, 5) ) )` → 'MULTIPOINT(4 4, 5 5)'

wedge_buffer

Returns a wedge shaped buffer originating from a point geometry.

Syntax	wedge_buffer(center, azimuth, width, outer_radius, [inner_radius=0.0]) [] marks optional arguments
Arguments	• **center** - center point (origin) of buffer. Must be a point geometry. • **azimuth** - angle (in degrees) for the middle of the wedge to point. • **width** - buffer width (in degrees). Note that the wedge will extend to half of the angular width either side of the azimuth direction. • **outer_radius** - outer radius for buffers • **inner_radius** - optional inner radius for buffers
Exemplos	• `wedge_buffer(center:=geom_from_wkt('POINT(1 2)'), azimuth:=90,width:=180,outer_radius:=1)` → A wedge shaped buffer centered on the point (1,2), facing to the East, with a width of 180 degrees and outer radius of 1.

Further reading: *Create wedge buffers* algorithm

within

Tests whether a geometry is within another. Returns true if the geometry1 is completely within geometry2.

Syntax	within(geometry1, geometry2)
Arguments	• **geometry1** - a geometry • **geometry2** - a geometry
Exemplos	• `within( geom_from_wkt( 'POINT( 0.5 0.5)' ), geom_from_wkt( 'POLYGON((0 0, 0 1, 1 1, 1 0, 0 0))' ) )` → true • `within( geom_from_wkt( 'POINT( 5 5 )' ), geom_from_wkt( 'POLYGON((0 0, 0 1, 1 1, 1 0, 0 0 ))' ) )` → false

Further reading: *overlay_within*

$x

Returns the x coordinate of the current point feature. If the feature is a multipoint feature, then the x-coordinate of the first point will be returned.

Syntax	$x
Exemplos	• `$x` → 42

x

Returns the x coordinate of a point geometry, or the x coordinate of the centroid for a non-point geometry.

Syntax	x(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `x( geom_from_wkt( 'POINT(2 5)' ) )` → 2 • `x( $geometry )` → x coordinate of the current feature's centroid

$x_at

Retrieves a x coordinate of the current feature's geometry.

Syntax	$x_at(i)
Arguments	• **i** - index of point of a line (indices start at 0; negative values apply from the last index, starting at -1)
Exemplos	• `$x_at(1)` → 5

x_max

Returns the maximum x coordinate of a geometry. Calculations are in the spatial reference system of this geometry.

Syntax	x_max(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `x_max( geom_from_wkt( 'LINESTRING(2 5, 3 6, 4 8)') )` → 4

x_min

Returns the minimum x coordinate of a geometry. Calculations are in the spatial reference system of this geometry.

Syntax	x_min(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `x_min( geom_from_wkt( 'LINESTRING(2 5, 3 6, 4 8)') )` → 2

$y

Returns the y coordinate of the current point feature. If the feature is a multipoint feature, then the y-coordinate of the first point will be returned.

Syntax	$y
Exemplos	• `$y` → 42

y

Returns the y coordinate of a point geometry, or the y coordinate of the centroid for a non-point geometry.

Syntax	y(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `y( geom_from_wkt( 'POINT(2 5)' ) )` → 5 • `y( $geometry )` → y coordinate of the current feature's centroid

$y_at

Retrieves a y coordinate of the current feature's geometry.

Syntax	$y_at(i)
Arguments	• **i** - index of point of a line (indices start at 0; negative values apply from the last index, starting at -1)
Exemplos	• `$y_at(1)` → 2

y_max

Returns the maximum y coordinate of a geometry. Calculations are in the spatial reference system of this geometry.

Syntax	y_max(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `y_max( geom_from_wkt( 'LINESTRING(2 5, 3 6, 4 8)') )` → 8

y_min

Returns the minimum y coordinate of a geometry. Calculations are in the spatial reference system of this geometry.

Syntax	y_min(geometry)
Arguments	• **geometry** - a geometry
Exemplos	• `y_min( geom_from_wkt( 'LINESTRING(2 5, 3 6, 4 8)') )` → 5

z

Returns the z coordinate of a point geometry, or NULL if the geometry has no z value.

Syntax	z(geometry)
Arguments	• **geometry** - a point geometry
Exemplos	• `z( geom_from_wkt( 'POINTZ(2 5 7)' ) )` → 7

z_max

Returns the maximum z coordinate of a geometry, or NULL if the geometry has no z value.

Syntax	z_max(geometry)
Arguments	• **geometry** - a geometry with z coordinate
Exemplos	• `z_max( geom_from_wkt( 'POINT ( 0 0 1 )' ) )` → 1 • `z_max( geom_from_wkt( 'MULTIPOINT ( 0 0 1 , 1 1 3 )' ) )` → 3 • `z_max( make_line( make_point( 0,0,0 ), make_point( -1,-1,-2 ) ) )` → 0 • `z_max( geom_from_wkt( 'LINESTRING( 0 0 0, 1 0 2, 1 1 -1 )' ) )` → 2 • `z_max( geom_from_wkt( 'POINT ( 0 0 )' ) )` → NULL

z_min

Returns the minimum z coordinate of a geometry, or NULL if the geometry has no z value.

Syntax	z_min(geometry)
Arguments	• **geometry** - a geometry with z coordinate
Exemplos	• `z_min( geom_from_wkt( 'POINT ( 0 0 1 )' ) )` → 1 • `z_min( geom_from_wkt( 'MULTIPOINT ( 0 0 1 , 1 1 3 )' ) )` → 1 • `z_min( make_line( make_point( 0,0,0 ), make_point( -1,-1,-2 ) ) )` → -2 • `z_min( geom_from_wkt( 'LINESTRING( 0 0 0, 1 0 2, 1 1 -1 )' ) )` → -1 • `z_min( geom_from_wkt( 'POINT ( 0 0 )' ) )` → NULL

14.3.14 Funções de Layout

Este grupo contém funções para manipular as propriedades dos itens de layout de impressão.

- *item_variables*

item_variables

Returns a map of variables from a layout item inside this print layout.

Syntax	item_variables(id)
Arguments	• **id** - layout item ID
Exemplos	• `map_get( item_variables('Map 0'), 'map_scale')` → scale of the item 'Map 0' in the current print layout

Further reading: List of default *variables*

14.3.15 Camadas do mapa

Este grupo contém uma lista das camadas disponíveis no projeto atual. Isso oferece uma maneira conveniente de escrever expressões referentes a várias camadas, como quando se fazem consultas usando *aggregates*, *attribute* ou *spatial*.

Também fornece algumas funções convenientes para manipular camadas.

- *decode_uri*

decode_uri

Takes a layer and decodes the uri of the underlying data provider. It depends on the dataprovider, which data is available.

Syntax	decode_uri(layer, [part]) [] marks optional arguments
Arguments	• **layer** - The layer for which the uri should be decoded. • **part** - The part of the uri to return. If unspecified, a map with all uri parts will be returned.
Exemplos	• `decode_uri(@layer)` → {'layerId': '0', 'layerName': '', 'path': '/home/qgis/shapefile.shp'} • `decode_uri(@layer)` → {'layerId': NULL, 'layerName': 'layer', 'path': '/home/qgis/geopackage.gpkg'} • `decode_uri(@layer, 'path')` → 'C:\my_data\qgis\shape.shp'

14.3.16 Funções de mapas

Este grupo contém funções para criar ou manipular chaves e valores de estruturas de dados de mapas (também conhecidos como objetos de dicionário, pares de valores-chave ou arrays associativos). Ao contrário de *list data structure* em que a ordem dos valores importa, a ordem dos pares de valores-chave no objeto de mapa não é relevante e os valores são identificados por suas chaves.

- *from_json*
- *hstore_to_map*
- *json_to_map*
- *map*
- *map_akeys*
- *map_avals*
- *map_concat*
- *map_delete*
- *map_exist*
- *map_get*
- *map_insert*
- *map_to_hstore*
- *map_to_json*
- *to_json*

from_json

Loads a JSON formatted string.

Syntax	from_json(string)
Arguments	• **string** - JSON string
Exemplos	• `from_json('{"qgis":"rocks"}')` → { 'qgis': 'rocks' } • `from_json('[1,2,3]')` → [1,2,3]

hstore_to_map

Creates a map from a hstore-formatted string.

Syntax	hstore_to_map(string)
Arguments	• **string** - the input string
Exemplos	• `hstore_to_map('qgis=>rocks')` → { 'qgis': 'rocks' }

json_to_map

Creates a map from a json-formatted string.

Syntax	json_to_map(string)
Arguments	• **string** - the input string
Exemplos	• `json_to_map('{"qgis":"rocks"}')` → { 'qgis': 'rocks' }

map

Returns a map containing all the keys and values passed as pair of parameters.

Syntax	map(key1, value1, key2, value2, …)
Arguments	• **key** - a key (string) • **value** - a value
Exemplos	• `map('1','one','2', 'two')` → { '1': 'one', '2': 'two' }

map_akeys

Returns all the keys of a map as an array.

Syntax	map_akeys(map)
Arguments	• **map** - a map
Exemplos	• `map_akeys(map('1','one','2','two'))` → ['1', '2']

map_avals

Returns all the values of a map as an array.

Syntax	map_avals(map)
Arguments	• **map** - a map
Exemplos	• `map_avals(map('1','one','2','two'))` → ['one', 'two']

map_concat

Retorna um mapa contendo todas as entradas dos mapas fornecidos. Se dois mapas contiverem a mesma chave, o valor do segundo mapa será usado.

Syntax	map_concat(map1, map2, …)
Arguments	• **map** - a map
Exemplos	• `map_concat(map('1','one', '2','overridden'),map('2','two', '3','three'))` → { '1': 'one', '2': 'two', '3': 'three' }

map_delete

Returns a map with the given key and its corresponding value deleted.

Syntax	map_delete(map, key)
Arguments	• **map** - a map • **key** - the key to delete
Exemplos	• `map_delete(map('1','one','2','two'),'2')` → { '1': 'one' }

map_exist

Returns true if the given key exists in the map.

Syntax	map_exist(map, key)
Arguments	• **map** - a map • **key** - the key to lookup
Exemplos	• `map_exist(map('1','one','2','two'),'3')` → false

map_get

Returns the value of a map, given its key. Returns NULL if the key does not exist.

Syntax	map_get(map, key)
Arguments	• **map** - a map • **key** - the key to lookup
Exemplos	• `map_get(map('1','one','2','two'),'2')` → 'two' • `map_get( item_variables('Map 0'), 'map_scale')` → scale of the item 'Map 0' (if it exists) in the current print layout

map_insert

Returns a map with an added key/value. If the key already exists, its value is overridden.

Syntax	map_insert(map, key, value)
Arguments	• **map** - a map • **key** - the key to add • **value** - the value to add
Exemplos	• `map_insert(map('1','one'),'3','three')` → { '1': 'one', '3': 'three' } • `map_insert(map('1','one','2','overridden'),'2','two')` → { '1': 'one', '2': 'two' }

map_to_hstore

Merge map elements into a hstore-formatted string.

Syntax	map_to_hstore(map)
Arguments	• **map** - the input map
Exemplos	• `map_to_hstore(map('qgis','rocks'))` → '"qgis"=>"rocks"'

map_to_json

Merge map elements into a json-formatted string.

Syntax	map_to_json(map)
Arguments	• **map** - the input map
Exemplos	• `map_to_json(map('qgis','rocks'))` → {"qgis":"rocks"}

to_json

Create a JSON formatted string from a map, array or other value.

Syntax	to_json(value)
Arguments	• **value** - The input value
Exemplos	• `to_json(map('qgis','rocks'))` → {"qgis":"rocks"} • `to_json(array(1,2,3))` → [1,2,3]

14.3.17 Funções Matemáticas

Este grupo contém funções matemáticas (por exemplo, raiz quadrada, sen e cos).

- *abs*
- *acos*
- *asin*
- *atan*
- *atan2*
- *azimuth*
- *ceil*
- *clamp*
- *cos*
- *degrees*
- *exp*
- *floor*
- *inclination*
- *ln*
- *log*
- *log10*
- *max*
- *min*

- *pi*
- *radians*
- *rand*
- *randf*
- *round*
- *scale_exp*
- *scale_linear*
- *sin*
- *sqrt*
- *tan*

abs

Returns the absolute value of a number.

Syntax	abs(value)
Arguments	• **value** - a number
Exemplos	• `abs(-2)` → 2

acos

Returns the inverse cosine of a value in radians.

Syntax	acos(value)
Arguments	• **value** - cosine of an angle in radians
Exemplos	• `acos(0.5)` → 1.0471975511966

asin

Returns the inverse sine of a value in radians.

Syntax	asin(value)
Arguments	• **value** - sine of an angle in radians
Exemplos	• `asin(1.0)` → 1.5707963267949

atan

Returns the inverse tangent of a value in radians.

Syntax	atan(value)
Arguments	• **value** - tan of an angle in radians
Exemplos	• `atan(0.5)` → 0.463647609000806

atan2

Returns the inverse tangent of dy/dx by using the signs of the two arguments to determine the quadrant of the result.

Syntax	atan2(dy, dx)
Arguments	• **dy** - y coordinate difference • **dx** - x coordinate difference
Exemplos	• `atan2(1.0, 1.732)` → 0.523611477769969

azimuth

Returns the north-based azimuth as the angle in radians measured clockwise from the vertical on point_a to point_b.

Syntax	azimuth(point_a, point_b)
Arguments	• **point_a** - point geometry • **point_b** - point geometry
Exemplos	• `degrees( azimuth( make_point(25, 45), make_point(75, 100) ) )` → 42.273689 • `degrees( azimuth( make_point(75, 100), make_point(25,45) ) )` → 222.273689

ceil

Rounds a number upwards.

Syntax	ceil(value)
Arguments	• **value** - a number
Exemplos	• `ceil(4.9)` → 5 • `ceil(-4.9)` → -4

clamp

Restricts an input value to a specified range.

Syntax	clamp(minimum, input, maximum)
Arguments	• **minimum** - the smallest value *input* is allowed to take. • **input** - a value which will be restricted to the range specified by *minimum* and *maximum* • **maximum** - the largest value *input* is allowed to take
Exemplos	• `clamp(1,5,10)` → 5 *input* is between 1 and 10 so is returned unchanged • `clamp(1,0,10)` → 1 *input* is less than minimum value of 1, so function returns 1 • `clamp(1,11,10)` → 10 *input* is greater than maximum value of 10, so function returns 10

cos

Returns cosine of an angle.

Syntax	cos(angle)
Arguments	• **angle** - angle in radians
Exemplos	• `cos(1.571)` → 0.000796326710733263

degrees

Converts from radians to degrees.

Syntax	degrees(radians)
Arguments	• **radians** - numeric value
Exemplos	• `degrees(3.14159)` → 180 • `degrees(1)` → 57.2958

exp

Returns exponential of an value.

Syntax	exp(value)
Arguments	• **value** - number to return exponent of
Exemplos	• `exp(1.0)` → 2.71828182845905

floor

Rounds a number downwards.

Syntax	floor(value)
Arguments	• **value** - a number
Exemplos	• `floor(4.9)` → 4 • `floor(-4.9)` → -5

inclination

Retorna a inclinação medida do zênite (0) ao nadir (180) no ponto_a ao ponto_b.

Syntax	inclination(point_a, point_b)
Arguments	• **point_a** - point geometry • **point_b** - point geometry
Exemplos	• `inclination( make_point( 5, 10, 0 ), make_point( 5, 10, 5 ) )` → 0.0 • `inclination( make_point( 5, 10, 0 ), make_point( 5, 10, 0 ) )` → 90.0 • `inclination( make_point( 5, 10, 0 ), make_point( 50, 100, 0 ) )` → 90.0 • `inclination( make_point( 5, 10, 0 ), make_point( 5, 10, -5 ) )` → 180.0

ln

Returns the natural logarithm of a value.

Syntax	ln(value)
Arguments	• **value** - numeric value
Exemplos	• `ln(1)` → 0 • `ln(2.7182818284590452354)` → 1

log

Returns the value of the logarithm of the passed value and base.

Syntax	log(base, value)
Arguments	• **base** - any positive number • **value** - any positive number
Exemplos	• `log(2, 32)` → 5 • `log(0.5, 32)` → -5

log10

Returns the value of the base 10 logarithm of the passed expression.

Syntax	log10(value)
Arguments	• **value** - any positive number
Exemplos	• `log10(1)` → 0 • `log10(100)` → 2

max

Returns the largest value in a set of values.

Syntax	max(value1, value2, …)
Arguments	• **value** - a number
Exemplos	• `max(2,10.2,5.5)` → 10.2 • `max(20.5,NULL,6.2)` → 20.5

min

Returns the smallest value in a set of values.

Syntax	min(value1, value2, …)
Arguments	• **value** - a number
Exemplos	• `min(20.5,10,6.2)` → 6.2 • `min(2,-10.3,NULL)` → -10.3

pi

Returns value of pi for calculations.

Syntax	pi()
Exemplos	• `pi()` → 3.14159265358979

radians

Converts from degrees to radians.

Syntax	radians(degrees)
Arguments	• **degrees** - numeric value
Exemplos	• `radians(180)` → 3.14159 • `radians(57.2958)` → 1

rand

Returns a random integer within the range specified by the minimum and maximum argument (inclusive). If a seed is provided, the returned will always be the same, depending on the seed.

Syntax	rand(min, max, [seed=NULL]) [] marks optional arguments
Arguments	• **min** - an integer representing the smallest possible random number desired • **max** - an integer representing the largest possible random number desired • **seed** - any value to use as seed
Exemplos	• `rand(1, 10)` → 8

randf

Returns a random float within the range specified by the minimum and maximum argument (inclusive). If a seed is provided, the returned will always be the same, depending on the seed.

Syntax	randf([min=0.0], [max=1.0], [seed=NULL]) [] marks optional arguments
Arguments	• **min** - an float representing the smallest possible random number desired • **max** - an float representing the largest possible random number desired • **seed** - any value to use as seed
Exemplos	• `randf(1, 10)` → 4.59258286403147

round

Rounds a number to number of decimal places.

Syntax	round(value, [places=0]) [] marks optional arguments
Arguments	• **value** - decimal number to be rounded • **places** - Optional integer representing number of places to round decimals to. Can be negative.
Exemplos	• `round(1234.567, 2)` → 1234.57 • `round(1234.567)` → 1235

scale_exp

Transforms a given value from an input domain to an output range using an exponential curve. This function can be used to ease values in or out of the specified output range.

Syntax	scale_exp(value, domain_min, domain_max, range_min, range_max, exponent)
Arguments	• **value** - A value in the input domain. The function will return a corresponding scaled value in the output range. • **domain_min** - Specifies the minimum value in the input domain, the smallest value the input value should take. • **domain_max** - Specifies the maximum value in the input domain, the largest value the input value should take. • **range_min** - Specifies the minimum value in the output range, the smallest value which should be output by the function. • **range_max** - Specifies the maximum value in the output range, the largest value which should be output by the function. • **exponent** - A positive value (greater than 0), which dictates the way input values are mapped to the output range. Large exponents will cause the output values to 'ease in', starting slowly before accelerating as the input values approach the domain maximum. Smaller exponents (less than 1) will cause output values to 'ease out', where the mapping starts quickly but slows as it approaches the domain maximum.
Exemplos	• `scale_exp(5,0,10,0,100,2)` → 25 easing in, using an exponent of 2 • `scale_exp(3,0,10,0,100,0.5)` → 54.772 easing out, using an exponent of 0.5

scale_linear

Transforms a given value from an input domain to an output range using linear interpolation.

Syntax	scale_linear(value, domain_min, domain_max, range_min, range_max)
Arguments	• **value** - A value in the input domain. The function will return a corresponding scaled value in the output range. • **domain_min** - Specifies the minimum value in the input domain, the smallest value the input value should take. • **domain_max** - Specifies the maximum value in the input domain, the largest value the input value should take. • **range_min** - Specifies the minimum value in the output range, the smallest value which should be output by the function. • **range_max** - Specifies the maximum value in the output range, the largest value which should be output by the function.
Exemplos	• `scale_linear(5,0,10,0,100)` → 50 • `scale_linear(0.2,0,1,0,360)` → 72 scaling a value between 0 and 1 to an angle between 0 and 360 • `scale_linear(1500,1000,10000,9,20)` → 9.6111111 scaling a population which varies between 1000 and 10000 to a font size between 9 and 20

sin

Returns the sine of an angle.

Syntax	sin(angle)
Arguments	• **angle** - angle in radians
Exemplos	• `sin(1.571)` → 0.999999682931835

sqrt

Returns square root of a value.

Syntax	sqrt(value)
Arguments	• **value** - a number
Exemplos	• `sqrt(9)` → 3

tan

Returns the tangent of an angle.

Syntax	tan(angle)
Arguments	• **angle** - angle in radians
Exemplos	• `tan(1.0)` → 1.5574077246549

14.3.18 Operadores

Este grupo contém operadores (por exemplo, +, -, *). Observe que, para a maioria das funções matemáticas abaixo, se uma das entradas for NULL, o resultado será NULL.

Função	Descrição
a + b	Adição de dois valores (a mais b)
a - b	Subtração de dois valores (a menos b)
a * b	Multiplicação de dois valores (a multiplicado por b)
a / b	Divisão de dois valores (a dividido por b)
a % b	Resto da divisão de a por b (por exemplo, 7% 2 = 1 ou 2 cabe em 7 três vezes com resto 1)
a ^ b	Potência de dois valores (por exemplo, 2^2=4 ou 2^3=8)
a < b	Compara dois valores e avalia como 1 se o valor da esquerda for menor que o valor da direita (a é menor que b)
a <= b	Compara dois valores e avalia como 1 se o valor da esquerda for menor ou igual ao valor da direita
a <> b	Compara dois valores e avalia como 1 se eles não forem iguais
a = b	Compara dois valores e avalia como 1 se forem iguais
a != b	a e b não são iguais
a > b	Compara dois valores e avalia como 1 se o valor da esquerda for maior que o valor da direita (a é maior que b)
a >= b	Compara dois valores e avalia como 1 se o valor da esquerda for maior ou igual ao valor da direita
a ~ b	a corresponde à expressão regular b
||	Une dois valores em uma string. Se um dos valores for NULL, o resultado será NULL
'\n'	Insere uma nova linha em uma string
LIKE	Retorna 1 se o primeiro parâmetro corresponder ao padrão fornecido
ILIKE	Retorna 1 se o primeiro parâmetro corresponder a maiúsculas e minúsculas o padrão fornecido (ILIKE pode ser usado em vez de LIKE para fazer a correspondência sem maiúsculas e minúsculas)
a IS b	Testa se dois valores são idênticos. Retorna 1 se a for igual a b
a OR b	Retorna 1 quando a condição a ou a condição b for verdadeira
a AND b	Retorna 1 quando as condições a e b forem verdadeiras
NOT	Nega uma condição
"Column_name"	Value of the field *Column_name*, take care to not be confused with simple quote, see below
'string'	um valor de string, tome cuidado para não se confundir com aspas duplas, veja acima
NULL	valor nulo
a IS NULL	a não tem valor
a IS NOT NULL	a tem um valor

continua na próxima página

Tabela 14.1 – continuação da página anterior

Função	Descrição
a IN (value[,value])	a está abaixo dos valores listados
a NOT IN (value[,value])	a não está abaixo dos valores listados

Alguns exemplos:

- Juntando um texto e um valor a partir de um nome de coluna:

```
'My feature''s id is: ' || "gid"
```

- Testa se o campo de atributo "description" começa com a string 'Hello' no valor (observe a posição do caractere `%`):

```
"description" LIKE 'Hello%'
```

14.3.19 Funções de Processamento

Este grupo contém funções que operam em algoritmos de processamento.

- *parameter*

parameter

Returns the value of a processing algorithm input parameter.

Syntax	parameter(name)
Arguments	• **name** - name of the corresponding input parameter
Exemplos	• `parameter('BUFFER_SIZE')` → 5.6

14.3.20 Funções Rasters

Este grupo contém funções para operar na camada raster.

- *raster_statistic*
- *raster_value*

raster_statistic

Returns statistics from a raster layer.

Syntax	raster_statistic(layer, band, property)
Arguments	• **layer** - a string, representing either a raster layer name or layer ID • **band** - integer representing the band number from the raster layer, starting at 1 • **property** - a string corresponding to the property to return. Valid options are: – min: minimum value – max: maximum value – avg: average (mean) value – stdev: standard deviation of values – range: range of values (max - min) – sum: sum of all values from raster
Exemplos	• `raster_statistic('lc',1,'avg')` → Average value from band 1 from 'lc' raster layer • `raster_statistic('ac2010',3,'min')` → Minimum value from band 3 from 'ac2010' raster layer

raster_value

Returns the raster value found at the provided point.

Syntax	raster_value(layer, band, point)
Arguments	• **layer** - the name or id of a raster layer • **band** - the band number to sample the value from. • **point** - point geometry (for multipart geometries having more than one part, a NULL value will be returned)
Exemplos	• `raster_value('dem', 1, make_point(1,1))` → 25

14.3.21 Funções de Registro e Atributos

Este grupo contém funções que operam na identificação da registros.

- *attribute*
- *attributes*
- *$currentfeature*
- *display_expression*
- *get_feature*
- *get_feature_by_id*
- *$id*
- *is_selected*
- *maptip*
- *num_selected*
- *represent_value*
- *sqlite_fetch_and_increment*

- *uuid*

attribute

Returns an attribute from a feature.

Variant 1

Returns the value of an attribute from the current feature.

Syntax	attribute(attribute_name)
Arguments	• **attribute_name** - name of attribute to be returned
Exemplos	• `attribute( 'name' )` → value stored in 'name' attribute for the current feature

Variant 2

Allows the target feature and attribute name to be specified.

Syntax	attribute(feature, attribute_name)
Arguments	• **feature** - a feature • **attribute_name** - name of attribute to be returned
Exemplos	• `attribute( @atlas_feature, 'name' )` → value stored in 'name' attribute for the current atlas feature

attributes

Returns a map containing all attributes from a feature, with field names as map keys.

Variant 1

Returns a map of all attributes from the current feature.

Syntax	attributes()
Exemplos	• `attributes()['name']` → value stored in 'name' attribute for the current feature

Variant 2

Allows the target feature to be specified.

Syntax	attributes(feature)
Arguments	• **feature** - a feature
Exemplos	• `attributes( @atlas_feature )['name']` → value stored in 'name' attribute for the current atlas feature

Further reading: *Funções de mapas*

$currentfeature

Retorna a feição atual que está sendo avaliada. Isso pode ser usado com a função 'attribute' para avaliar os valores de atributo da feição atual.

Syntax	$currentfeature
Exemplos	• `attribute( $currentfeature, 'name' )` → value stored in 'name' attribute for the current feature

display_expression

Returns the display expression for a given feature in a layer. The expression is evaluated by default. Can be used with zero, one or more arguments, see below for details.

No parameters

If called with no parameters, the function will evaluate the display expression of the current feature in the current layer.

Syntax	display_expression()
Exemplos	• `display_expression()` → The display expression of the current feature in the current layer.

One 'feature' parameter

If called with a 'feature' parameter only, the function will evaluate the specified feature from the current layer.

Syntax	display_expression(feature)
Arguments	• **feature** - The feature which should be evaluated.
Exemplos	• `display_expression(@atlas_feature)` → The display expression of the current atlas feature.

Layer and feature parameters

If the function is called with both a layer and a feature, it will evaluate the specified feature from the specified layer.

Syntax	display_expression(layer, feature, [evaluate=true]) [] marks optional arguments
Arguments	• **layer** - The layer (or its ID or name) • **feature** - The feature which should be evaluated. • **evaluate** - If the expression must be evaluated. If false, the expression will be returned as a string literal only (which could potentially be later evaluated using the 'eval' function).
Exemplos	• `display_expression( 'streets', get_feature_by_id('streets', 1))` → The display expression of the feature with the ID 1 on the layer 'streets'. • `display_expression('a_layer_id', $currentfeature, 'False')` → The display expression of the given feature not evaluated.

get_feature

Returns the first feature of a layer matching a given attribute value.

Syntax	get_feature(layer, attribute, value)
Arguments	• **layer** - layer name or ID • **attribute** - attribute name • **value** - attribute value to match
Exemplos	• `get_feature('streets','name','main st')` → first feature found in "streets" layer with "main st" value in the "name" field

get_feature_by_id

Returns the feature with an id on a layer.

Syntax	get_feature_by_id(layer, feature_id)
Arguments	• **layer** - layer, layer name or layer id • **feature_id** - the id of the feature which should be returned
Exemplos	• `get_feature_by_id('streets', 1)` → the feature with the id 1 on the layer "streets"

Further reading: *$id*

$id

Returns the feature id of the current row.

Syntax	$id
Exemplos	• `$id` → 42

is_selected

Returns True if a feature is selected. Can be used with zero, one or two arguments, see below for details.

No parameters

If called with no parameters, the function will return true if the current feature in the current layer is selected.

Syntax	is_selected()
Exemplos	• `is_selected()` → True if the current feature in the current layer is selected.

One 'feature' parameter

If called with a 'feature' parameter only, the function returns true if the specified feature from the current layer is selected.

Syntax	is_selected(feature)
Arguments	• **feature** - The feature which should be checked for selection.
Exemplos	• `is_selected(@atlas_feature)` → True if a selected feature on the current layer is the active atlas feature. • `is_selected(get_feature(@layer, 'name', 'Main St.'))` → True if the unique named "Main St." feature on the current layer is selected. • `is_selected(get_feature_by_id(@layer, 1))` → True if the feature with the id 1 on the current layer is selected.

Two parameters

If the function is called with both a layer and a feature, it will return true if the specified feature from the specified layer is selected.

Syntax	is_selected(layer, feature)
Arguments	• **layer** - The layer (its ID or name) on which the selection will be checked. • **feature** - The feature which should be checked for selection.
Exemplos	• `is_selected( 'streets', get_feature('streets', 'name', "street_name"))` → True if the current building's street is selected (assuming the building layer has a field named 'street_name' and the 'streets' layer has a field called 'name' with unique values). • `is_selected( 'streets', get_feature_by_id('streets', 1))` → True if the feature with the id 1 on the "streets" layer is selected.

maptip

Returns the maptip for a given feature in a layer. The expression is evaluated by default. Can be used with zero, one or more arguments, see below for details.

No parameters

If called with no parameters, the function will evaluate the maptip of the current feature in the current layer.

Syntax	maptip()
Exemplos	• `maptip()` → The maptip of the current feature in the current layer.

One 'feature' parameter

If called with a 'feature' parameter only, the function will evaluate the specified feature from the current layer.

Syntax	maptip(feature)
Arguments	• **feature** - The feature which should be evaluated.
Exemplos	• `maptip(@atlas_feature)` → The maptip of the current atlas feature.

Layer and feature parameters

If the function is called with both a layer and a feature, it will evaluate the specified feature from the specified layer.

Syntax	maptip(layer, feature, [evaluate=true]) [] marks optional arguments
Arguments	• **layer** - The layer (or its ID or name) • **feature** - The feature which should be evaluated. • **evaluate** - If the expression must be evaluated. If false, the expression will be returned as a string literal only (which could potentially be later evaluated using the 'eval_template' function).
Exemplos	• `maptip('streets', get_feature_by_id('streets', 1))` → The maptip of the feature with the ID 1 on the layer 'streets'. • `maptip('a_layer_id', $currentfeature, 'False')` → The maptip of the given feature not evaluated.

num_selected

Returns the number of selected features on a given layer. By default works on the layer on which the expression is evaluated.

Syntax	num_selected([layer=current layer]) [] marks optional arguments
Arguments	• **layer** - The layer (or its id or name) on which the selection will be checked.
Exemplos	• `num_selected()` → The number of selected features on the current layer. • `num_selected('streets')` → The number of selected features on the layer streets

represent_value

Returns the configured representation value for a field value. It depends on the configured widget type. Often, this is useful for 'Value Map' widgets.

Syntax	represent_value(value, fieldName)
Arguments	• **value** - The value which should be resolved. Most likely a field. • **fieldName** - The field name for which the widget configuration should be loaded. (Optional)
Exemplos	• `represent_value("field_with_value_map")` → Description for value • `represent_value('static value', 'field_name')` → Description for static value

Further reading: *widget types*

sqlite_fetch_and_increment

Manage autoincrementing values in sqlite databases.

SQlite default values can only be applied on insert and not prefetched.

This makes it impossible to acquire an incremented primary key via AUTO_INCREMENT before creating the row in the database. Sidenote: with postgres, this works via the option *evaluate default values*.

When adding new features with relations, it is really nice to be able to already add children for a parent, while the parents form is still open and hence the parent feature uncommitted.

To get around this limitation, this function can be used to manage sequence values in a separate table on sqlite based formats like gpkg.

The sequence table will be filtered for a sequence id (filter_attribute and filter_value) and the current value of the id_field will be incremented by 1 and the incremented value returned.

If additional columns require values to be specified, the default_values map can be used for this purpose.

Note

This function modifies the target sqlite table. It is intended for usage with default value configurations for attributes.

When the database parameter is a layer and the layer is in transaction mode, the value will only be retrieved once during the lifetime of a transaction and cached and incremented. This makes it unsafe to work on the same database from several processes in parallel.

Syntax	sqlite_fetch_and_increment(database, table, id_field, filter_attribute, filter_value, [default_values]) [] marks optional arguments
Arguments	• **database** - Path to the sqlite file or geopackage layer • **table** - Name of the table that manages the sequences • **id_field** - Name of the field that contains the current value • **filter_attribute** - Name the field that contains a unique identifier for this sequence. Must have a UNIQUE index. • **filter_value** - Name of the sequence to use. • **default_values** - Map with default values for additional columns on the table. The values need to be fully quoted. Functions are allowed.
Exemplos	• `sqlite_fetch_and_increment(@layer, 'sequence_table', 'last_unique_id', 'sequence_id', 'global', map('last_change', 'date(''now'')', 'user', '''' || @user_account_name || '''')) → 0` • `sqlite_fetch_and_increment(layer_property(@layer, 'path'), 'sequence_table', 'last_unique_id', 'sequence_id', 'global', map('last_change', 'date(''now'')', 'user', '''' || @user_account_name || '''')) → 0`

Further reading: *Data Sources Properties*, *Creating one or many to many relations*

uuid

Generates a Universally Unique Identifier (UUID) for each row using the Qt QUuid::createUuid method. Each UUID is 38 characters long.

Syntax	uuid()
Exemplos	• `uuid()` → '{0bd2f60f-f157-4a6d-96af-d4ba4cb366a1}'

14.3.22 Relations

This group contains the list of the *relations* available in the current project, with their description. It provides a quick access to the relation ID for writing an expression (with e.g. the *relation_aggregate* function) or customizing a form.

14.3.23 Funções String

Este grupo contém funções que operam em textos (por exemplo, quer substituir, converter para maiúsculas).

- *ascii*
- *char*
- *concat*
- *format*
- *format_date*
- *format_number*
- *left*
- *length*
- *lower*
- *lpad*
- *regexp_match*
- *regexp_replace*
- *regexp_substr*
- *replace*
- *right*
- *rpad*
- *strpos*
- *substr*
- *title*
- *to_string*
- *trim*
- *upper*
- *wordwrap*

ascii

Returns the unicode code associated with the first character of a string.

Syntax	ascii(string)
Arguments	• **string** - the string to convert to unicode code
Exemplos	• `ascii('Q')` → 81

char

Returns the character associated with a unicode code.

Syntax	char(code)
Arguments	• **code** - a unicode code number
Exemplos	• `char(81)` → 'Q'

concat

Concatenates several strings to one. NULL values are converted to empty strings. Other values (like numbers) are converted to strings.

Syntax	concat(string1, string2, …)
Arguments	• **string** - a string value
Exemplos	• `concat('sun', 'set')` → 'sunset' • `concat('a','b','c','d','e')` → 'abcde' • `concat('Anno ', 1984)` → 'Anno 1984' • `concat('The Wall', NULL)` → 'The Wall'

Sobre a concatenação de campos

You can also concatenate strings or field values using either `||` or + operators, with some special characteristics:

- O operador + também significa somar expressão; portanto, se você tiver um operando inteiro (valor numérico ou de campo), isso pode ser propenso a erros e é melhor usar os outros:

```
'My feature id is: ' + "gid" => triggers an error as gid returns an integer
```

- Quando qualquer um dos argumentos for um valor NULL, `||` ou + retornará um valor NULL. Para retornar os outros argumentos independentemente do valor NULL, convém usar a função `concat`:

```
'My feature id is: ' + NULL ==> NULL
'My feature id is: ' || NULL => NULL
concat('My feature id is: ', NULL) => 'My feature id is: '
```

format

Format a string using supplied arguments.

Syntax	format(string, arg1, arg2, …)
Arguments	• **string** - A string with place holders for the arguments. Use %1, %2, etc for placeholders. Placeholders can be repeated. • **arg** - any type. Any number of arguments.
Exemplos	• `format('This %1 a %2','is', 'test')` → 'This is a test'

format_date

Formats a date type or string into a custom string format. Uses Qt date/time format strings. See QDateTime::toString.

<table>
<tr><td>Syntax</td><td>format_date(datetime, format, [language])
[] marks optional arguments</td></tr>
<tr><td>Arguments</td><td>

datetime - date, time or datetime value
format - String template used to format the string.

<table>
<tr><th>Expressão</th><th>Output</th></tr>
<tr><td>d</td><td>the day as number without a leading zero (1 to 31)</td></tr>
<tr><td>dd</td><td>the day as number with a leading zero (01 to 31)</td></tr>
<tr><td>ddd</td><td>the abbreviated localized day name (e.g. ‘Mon’ to ‘Sun’)</td></tr>
<tr><td>dddd</td><td>the long localized day name (e.g. ‘Monday’ to ‘Sunday’)</td></tr>
<tr><td>M</td><td>the month as number without a leading zero (1-12)</td></tr>
<tr><td>MM</td><td>the month as number with a leading zero (01-12)</td></tr>
<tr><td>MMM</td><td>the abbreviated localized month name (e.g. ‘Jan’ to ‘Dec’)</td></tr>
<tr><td>MMMM</td><td>the long localized month name (e.g. ‘January’ to ‘December’)</td></tr>
<tr><td>yy</td><td>the year as two digit number (00-99)</td></tr>
<tr><td>yyyy</td><td>the year as four digit number</td></tr>
</table>
These expressions may be used for the time part of the format string:
<table>
<tr><th>Expressão</th><th>Output</th></tr>
<tr><td>h</td><td>the hour without a leading zero (0 to 23 or 1 to 12 if AM/PM display)</td></tr>
<tr><td>hh</td><td>the hour with a leading zero (00 to 23 or 01 to 12 if AM/PM display)</td></tr>
<tr><td>H</td><td>the hour without a leading zero (0 to 23, even with AM/PM display)</td></tr>
<tr><td>HH</td><td>the hour with a leading zero (00 to 23, even with AM/PM display)</td></tr>
<tr><td>m</td><td>the minute without a leading zero (0 to 59)</td></tr>
<tr><td>mm</td><td>the minute with a leading zero (00 to 59)</td></tr>
<tr><td>s</td><td>the second without a leading zero (0 to 59)</td></tr>
<tr><td>ss</td><td>the second with a leading zero (00 to 59)</td></tr>
<tr><td>z</td><td>the milliseconds without trailing zeroes (0 to 999)</td></tr>
<tr><td>zzz</td><td>the milliseconds with trailing zeroes (000 to 999)</td></tr>
<tr><td>AP or A</td><td>interpret as an AM/PM time. AP must be either ‘AM’ or ‘PM’.</td></tr>
<tr><td>ap or a</td><td>Interpret as an AM/PM time. ap must be either ‘am’ or ‘pm’.</td></tr>
</table>

language - language (lowercase, two- or three-letter, ISO 639 language code) used to format the date into a custom string

</td></tr>
<tr><td>Exemplos</td><td>

<code>format_date('2012-05-15','dd.MM.yyyy')</code> → ‘15.05.2012’
<code>format_date('2012-05-15','d MMMM yyyy','fr')</code> → ‘15 mai 2012’
<code>format_date('2012-05-15','dddd')</code> → ‘Tuesday’
<code>format_date('2012-05-15 13:54:20','dd.MM.yy')</code> → ‘15.05.12’
<code>format_date('13:54:20','hh:mm AP')</code> → ‘01:54 PM’

</td></tr>
</table>

format_number

Returns a number formatted with the locale separator for thousands. Also truncates the decimal places to the number of supplied places.

Syntax	format_number(number, places, [language]) [] marks optional arguments
Arguments	• **number** - number to be formatted • **places** - integer representing the number of decimal places to truncate the string to. • **language** - language (lowercase, two- or three-letter, ISO 639 language code) used to format the number into a string
Exemplos	• `format_number(10000000.332,2)` → '10,000,000.33' • `format_number(10000000.332,2,'fr')` → '10 000 000,33'

left

Returns a substring that contains the *n* leftmost characters of the string.

Syntax	left(string, length)
Arguments	• **string** - a string • **length** - integer. The number of characters from the left of the string to return.
Exemplos	• `left('Hello World',5)` → 'Hello'

length

Returns the number of characters in a string or the length of a geometry linestring.

String variant

Returns the number of characters in a string.

Syntax	length(string)
Arguments	• **string** - string to count length of
Exemplos	• `length('hello')` → 5

Geometry variant

Calculate the length of a geometry line object. Calculations are always planimetric in the Spatial Reference System (SRS) of this geometry, and the units of the returned length will match the units for the SRS. This differs from the calculations performed by the $length function, which will perform ellipsoidal calculations based on the project's ellipsoid and distance unit settings.

Syntax	length(geometry)
Arguments	• **geometry** - line geometry object
Exemplos	• `length(geom_from_wkt('LINESTRING(0 0, 4 0)'))` → 4.0

lower

Converts a string to lower case letters.

Syntax	lower(string)
Arguments	• **string** - the string to convert to lower case
Exemplos	• `lower('HELLO World')` → 'hello world'

lpad

Returns a string padded on the left to the specified width, using a fill character. If the target width is smaller than the string's length, the string is truncated.

Syntax	lpad(string, width, fill)
Arguments	• **string** - string to pad • **width** - length of new string • **fill** - character to pad the remaining space with
Exemplos	• `lpad('Hello', 10, 'x')` → 'xxxxxHello' • `lpad('Hello', 3, 'x')` → 'Hel'

regexp_match

Return the first matching position matching a regular expression within an unicode string, or 0 if the substring is not found.

Syntax	regexp_match(input_string, regex)
Arguments	• **input_string** - the string to test against the regular expression • **regex** - The regular expression to test against. Backslash characters must be double escaped (e.g., "\\s" to match a white space character or "\\b" to match a word boundary).
Exemplos	• `regexp_match('QGIS ROCKS','\\sROCKS')` → 5 • `regexp_match('Budač','udač\\b')` → 2

regexp_replace

Returns a string with the supplied regular expression replaced.

Syntax	regexp_replace(input_string, regex, replacement)
Arguments	• **input_string** - the string to replace matches in • **regex** - The regular expression to replace. Backslash characters must be double escaped (e.g., "\\s" to match a white space character). • **replacement** - The string that will replace any matching occurrences of the supplied regular expression. Captured groups can be inserted into the replacement string using \\1, \\2, etc.
Exemplos	• `regexp_replace('QGIS SHOULD ROCK','\\sSHOULD\\s',' DOES ')` → 'QGIS DOES ROCK' • `regexp_replace('ABC123','\\d+','')` → 'ABC' • `regexp_replace('my name is John','(.*) is (.*)','\\2 is \\1')` → 'John is my name'

regexp_substr

Returns the portion of a string which matches a supplied regular expression.

Syntax	regexp_substr(input_string, regex)
Arguments	• **input_string** - the string to find matches in • **regex** - The regular expression to match against. Backslash characters must be double escaped (e.g., "\\s" to match a white space character).
Exemplos	• `regexp_substr('abc123','(\\d+)')` → '123'

replace

Returns a string with the supplied string, array, or map of strings replaced.

String & array variant

Returns a string with the supplied string or array of strings replaced by a string or an array of strings.

Syntax	replace(string, before, after)
Arguments	• **string** - the input string • **before** - the string or array of strings to replace • **after** - the string or array of strings to use as a replacement
Exemplos	• `replace('QGIS SHOULD ROCK','SHOULD','DOES')` → 'QGIS DOES ROCK' • `replace('QGIS ABC',array('A','B','C'),array('X','Y','Z'))` → 'QGIS XYZ' • `replace('QGIS',array('Q','S'),'')` → 'GI'

Map variant

Returns a string with the supplied map keys replaced by paired values.

Syntax	replace(string, map)
Arguments	• **string** - the input string • **map** - the map containing keys and values
Exemplos	• `replace('APP SHOULD ROCK',map('APP','QGIS','SHOULD', 'DOES'))` → 'QGIS DOES ROCK'

right

Returns a substring that contains the *n* rightmost characters of the string.

Syntax	right(string, length)
Arguments	• **string** - a string • **length** - integer. The number of characters from the right of the string to return.
Exemplos	• `right('Hello World',5)` → 'World'

rpad

Returns a string padded on the right to the specified width, using a fill character. If the target width is smaller than the string's length, the string is truncated.

Syntax	rpad(string, width, fill)
Arguments	• **string** - string to pad • **width** - length of new string • **fill** - character to pad the remaining space with
Exemplos	• `rpad('Hello', 10, 'x')` → 'Helloxxxxx' • `rpad('Hello', 3, 'x')` → 'Hel'

strpos

Return the first matching position of a substring within another string, or 0 if the substring is not found.

Syntax	strpos(haystack, needle)
Arguments	• **haystack** - string that is to be searched • **needle** - string to search for
Exemplos	• `strpos('HELLO WORLD','WORLD')` → 7 • `strpos('HELLO WORLD','GOODBYE')` → 0

substr

Returns a part of a string.

Syntax	substr(string, start, [length]) [] marks optional arguments
Arguments	• **string** - the full input string • **start** - integer representing start position to extract beginning with 1; if start is negative, the return string will begin at the end of the string minus the start value • **length** - integer representing length of string to extract; if length is negative, the return string will omit the given length of characters from the end of the string
Exemplos	• `substr('HELLO WORLD',3,5)` → 'LLO W' • `substr('HELLO WORLD',6)` → ' WORLD' • `substr('HELLO WORLD',-5)` → 'WORLD' • `substr('HELLO',3,-1)` → 'LL' • `substr('HELLO WORLD',-5,2)` → 'WO' • `substr('HELLO WORLD',-5,-1)` → 'WORL'

title

Converts all words of a string to title case (all words lower case with leading capital letter).

Syntax	title(string)
Arguments	• **string** - the string to convert to title case
Exemplos	• `title('hello WOrld')` → 'Hello World'

to_string

Converts a number to string.

Syntax	to_string(number)
Arguments	• **number** - Integer or real value. The number to convert to string.
Exemplos	• `to_string(123)` → '123'

trim

Removes all leading and trailing whitespace (spaces, tabs, etc) from a string.

Syntax	trim(string)
Arguments	• **string** - string to trim
Exemplos	• `trim(' hello world ')` → 'hello world'

upper

Converts a string to upper case letters.

Syntax	upper(string)
Arguments	• **string** - the string to convert to upper case
Exemplos	• `upper('hello WOrld')` → 'HELLO WORLD'

wordwrap

Returns a string wrapped to a maximum/minimum number of characters.

Syntax	wordwrap(string, wrap_length, [delimiter_string]) [] marks optional arguments
Arguments	• **string** - the string to be wrapped • **wrap_length** - an integer. If wrap_length is positive the number represents the ideal maximum number of characters to wrap; if negative, the number represents the minimum number of characters to wrap. • **delimiter_string** - Optional delimiter string to wrap to a new line.
Exemplos	• `wordwrap('UNIVERSITY OF QGIS',13)` → 'UNIVERSITY OF QGIS' • `wordwrap('UNIVERSITY OF QGIS',-3)` → 'UNIVERSITY OF QGIS'

14.3.24 User Expressions

This group contains the expressions saved as *user expressions*.

14.3.25 Variáveis

Este grupo contém variáveis dinâmicas relacionadas ao aplicativo, ao arquivo do projeto e outras configurações. A disponibilidade das variáveis depende do contexto:

- da caixa de diálogo  Selecionar por expressão
- da caixa de diálogo **|CalculeField|** Calculadora de campo
- na caixa de diálogo de propriedades da camada
- do layout de impressão

Para usar essas variáveis em uma expressão, elas devem ser precedidas pelo caractere `@` (por exemplo, `@row_number`).

Variable	Descrição
algorithm_id	O ID exclusivo de um algoritmo
animation_end_time	End of the animation's overall temporal time range (as a datetime value)
animation_interval	Duration of the animation's overall temporal time range (as an interval value)
animation_start_time	Start of the animation's overall temporal time range (as a datetime value)
atlas_feature	A feição atual do atlas (como objeto de feição)

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Tabela 14.2 – continuação da página anterior

Variable	Descrição
atlas_featureid	O ID da feição do atlas atual
atlas_featurenumber	O número atual da feição do atlas no layout
atlas_filename	O nome do arquivo do atlas atual
atlas_geometry	A geometria da feição do atlas atual
atlas_layerid	O ID da camada de cobertura do atlas atual
atlas_layername	O nome atual da camada de cobertura do atlas
atlas_pagename	O nome da página atual do atlas
atlas_totalfeatures	O número total de feições no atlas
canvas_cursor_point	A última posição do cursor na tela nas coordenadas geográficas do projeto
cluster_color	A cor dos símbolos em um cluster ou NULL se os símbolos tiverem cores misturadas
cluster_size	O número de símbolos contidos em um cluster
current_feature	A feição atualmente sendo editada no formulário de atributo ou na linha da tabela
current_geometry	A geometria da feição atualmente sendo editada no formulário ou na linha da tabela
current_parent_feature	represents the feature currently being edited in the parent form. Only usable in an embedded form context.
current_parent_geometry	represents the geometry of the feature currently being edited in the parent form. Only usable in an embedded form context.
form_mode	What the form is used for, like AddFeatureMode, SingleEditMode, MultiEditMode, SearchMode, AggregateSearchMode or IdentifyMode as string.
frame_duration	Temporal duration of each animation frame (as an interval value)
frame_number	Current frame number during animation playback
frame_rate	Number of frames per second during animation playback
fullextent_maxx	Valor máximo de x da extensão completa da tela (incluindo todas as camadas)
fullextent_maxy	Valor y máximo da extensão total da tela (incluindo todas as camadas)
fullextent_minx	Valor mínimo de x da extensão completa da tela (incluindo todas as camadas)
fullextent_miny	Valor y mínimo da extensão completa da tela (incluindo todas as camadas)
geometry_part_count	O número de partes na geometria da feição renderizada
geometry_part_num	O número da parte da geometria atual para a feiição que está sendo renderizada
geometry_point_count	O número de pontos na parte da geometria renderizada
geometry_point_num	O número do ponto atual na parte da geometria renderizada
grid_axis	O eixo de anotação da grade atual (por exemplo, 'x' para longitude, 'y' para latitude)
grid_number	O valor atual da anotação da grade
item_id	O ID do usuário do item de layout (não necessariamente exclusivo)
item_uuid	O ID exclusivo do item de layout
layer	A camada atual
layer_id	O ID da camada atual
layer_ids	The IDs of all the map layers in the current project as a list
layer_name	O nome da camada atual
layers	All the map layers in the current project as a list
layout_dpi	A resolução da composição (DPI)
layout_name	O nome do layout
layout_numpages	O número de páginas no layout
layout_page	O número da página do item atual no layout
layout_pageheight	A altura da página ativa no layout (em mm)
layout_pagewidth	A largura da página ativa no layout (em mm)
legend_column_count	O número de colunas na legenda
legend_filter_by_map	Indica se o conteúdo da legenda é filtrado pelo mapa
legend_filter_out_atlas	Indica se o atlas é filtrado para fora da legenda
legend_split_layers	Indica se as camadas podem ser divididas na legenda
legend_title	O título da lenda
legend_wrap_string	O(s) caractere(s) usados para quebrar o texto da legenda
map_crs	O Sistema de referência de coordenadas do mapa atual

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Tabela 14.2 – continuação da página anterior

Variable	Descrição
map_crs_acronym	A sigla do Sistema de referência de coordenadas do mapa atual
map_crs_definition	A definição completa do Sistema de referência de coordenadas do mapa atual
map_crs_description	O nome do Sistema de referência de coordenadas do mapa atual
map_crs_ellipsoid	A sigla do elipsóide do Sistema de referência de coordenadas do mapa atual
map_crs_proj4	A definição do Proj4 do Sistema de referência de coordenadas do mapa atual
map_crs_wkt	A definição WKT do Sistema de referência de coordenadas do mapa atual
map_end_time	The end of the map's temporal time range (as a datetime value)
map_extent	A geometria que representa a extensão atual do mapa
map_extent_center	A feição de ponto no centro do mapa
map_extent_height	A altura atual do mapa
map_extent_width	A largura atual do mapa
map_id	O ID do destino atual do mapa. Será 'canvas' para renderizações de tela, e o ID do item para renderizações de mapa de layout
map_interval	The duration of the map's temporal time range (as an interval value)
map_layer_ids	A lista de IDs da camada do mapa visíveis no mapa
map_layers	A lista de camadas do mapa visíveis no mapa
map_rotation	A rotação atual do mapa
map_scale	A escala atual do mapa
map_start_time	The start of the map's temporal time range (as a datetime value)
map_units	As unidades de medidas do mapa
model_path	Full path (including file name) of current model (or project path if model is embedded in a project).
model_folder	Folder containing current model (or project folder if model is embedded in a project).
model_name	Name of current model
model_group	Group for current model
notification_message	Conteúdo da mensagem de notificação enviada pelo provedor (disponível apenas para ações acionadas por notificações do provedor).
parent	Refere-se ao recurso atual na camada pai, fornecendo acesso aos seus atributos e geometria ao filtrar uma função *aggregate*
project_abstract	O resumo do projeto, extraído dos metadados do projeto
project_area_units	A unidade de área do projeto atual, usada no cálculo de áreas de geometrias
project_author	O autor do projeto, extraído dos metadados do projeto
project_basename	O nome base do nome do arquivo do projeto atual (sem caminho e extensão)
project_creation_date	A data de criação do projeto, extraída dos metadados do projeto
project_crs	O Sistema de referência de coordenadas do projeto
project_crs_arconym	A sigla do Sistema de referência de coordenadas do projeto
project_crs_definition	A definição completa do Sistema de referência de coordenadas do projeto
project_crs_description	A descrição do Sistema de referência de coordenadas do projeto
project_crs_ellipsoid	O elipsóide do Sistema de referência de coordenadas do projeto
project_crs_proj4	A representação do Proj4 do Sistema de referência de coordenadas do projeto
project_crs_wkt	A representação WKT (well known text) do Sistema de referência de coordenadas do projeto
project_distance_units	A unidade de distância para o projeto atual, usada no cálculo de comprimentos de geometrias e distâncias
project_ellipsoid	O nome do elipsóide do projeto atual, usado no cálculo de áreas geodésicas ou comprimentos de geometrias
project_filename	O nome do arquivo do projeto atual
project_folder	A pasta do projeto atual
project_home	O caminho inicial do projeto atual
project_identifier	O identificador do projeto, obtido dos metadados do projeto
project_keywords	As palavras-chave do projeto, extraídas dos metadados do projeto
project_last_saved	Data/hora em que o projeto foi salvo pela última vez.
project_path	O caminho completo (incluindo o nome do arquivo) do projeto atual

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Tabela 14.2 – continuação da página anterior

Variable	Descrição
project_title	O título do projeto atual
project_units	As unidades do SRC do projeto
qgis_locale	O idioma atual do QGIS
qgis_os_name	O nome atual do sistema operacional, por exemplo, 'windows', 'linux' ou 'osx'
qgis_platform	A plataforma QGIS, por exemplo, 'desktop' ou 'servidor'
qgis_release_name	O nome da versão atual do QGIS
qgis_short_version	A string curta da versão atual do QGIS
qgis_version	A string de versão atual do QGIS
qgis_version_no	O número da versão atual do QGIS
row_number	Armazena o número da linha atual
snapping_results	Gives access to snapping results while digitizing a feature (only available in add feature)
scale_value	O valor atual da distância da barra de escala
symbol_angle	O ângulo do símbolo usado para renderizar a feição (válido apenas para símbolos de marcador)
symbol_color	A cor do símbolo usado para renderizar a feição
symbol_count	O número de feições representadas pelo símbolo (na legenda do layout)
symbol_id	O ID interno do símbolo (na legenda do layout)
symbol_label	O rótulo do símbolo (um rótulo definido pelo usuário ou o rótulo gerado automaticamente por padrão - na legenda do layout)
symbol_layer_count	Total number of symbol layers in the symbol
symbol_layer_index	Current symbol layer index
symbol_marker_column	Column number for marker (valid for point pattern fills only).
symbol_marker_row	Row number for marker (valid for point pattern fills only).
user_account_name	O nome da conta do sistema operacional do usuário atual
user_full_name	O nome do usuário do sistema operacional do usuário atual
value	O valor atual
with_variable	Permite definir uma variável para uso em uma expressão e evitar recalcular o mesmo valor repetidamente
zoom_level	Zoom level of the tile that is being rendered (derived from the current map scale). Normally in interval [0, 20].

Alguns exemplos:

- Retorna a coordenada X de um centro de item de mapa no layout:

```
x( map_get( item_variables( 'map1'), 'map_extent_center' ) )
```

- Retorne, para cada feição na camada atual, o número de feições de aeroporto sobrepostas:

```
aggregate( layer:='airport', aggregate:='count', expression:="code",
               filter:=intersects( $geometry, geometry( @parent ) ) )
```

- Obtém o object_id do primeiro ponto ajustado de uma linha:

```
with_variable(
  'first_snapped_point',
  array_first( @snapping_results ),
  attribute(
    get_feature_by_id(
      map_get( @first_snapped_point, 'layer' ),
      map_get( @first_snapped_point, 'feature_id' )
    ),
    'object_id'
  )
)
```

14.3.26 Funções Recentes

Este grupo contém funções usadas recentemente. Dependendo do contexto de seu uso (seleção de feição, calculadora de campo, genérico), as expressões aplicadas recentemente são adicionadas à lista correspondente (até dez expressões), ordenadas de mais para menos recente. Isso facilita a rápida recuperação e reaplicação de expressões usadas anteriormente.

14.4 Trabalhando com a tabela de atributos

A tabela de atributos exibe informações sobre as feições de uma camada selecionada. Cada linha da tabela representa uma feição (com ou sem geometria) e cada coluna contém uma informação específica sobre a feição. As feições da tabela podem ser pesquisadas, selecionadas, movidas ou mesmo editadas.

14.4.1 Prefácio: Tabelas espaciais e não espaciais

O QGIS permite carregar camadas espaciais e não espaciais. Atualmente, isso inclui tabelas suportadas pelo OGR e texto delimitado, bem como o provedor PostgreSQL, MSSQL, SpatiaLite, DB2 e Oracle. Todas as camadas carregadas estão listadas no painel: guilabel: *Camadas*. Se uma camada está espacialmente ativada ou não, determina se você pode interagir com ela no mapa.

As tabelas não espaciais podem ser navegadas e editadas usando a visualização da tabela de atributos. Além disso, eles podem ser usados para pesquisas de campo. Por exemplo, você pode usar colunas de uma tabela não espacial para definir valores de atributos ou um intervalo de valores permitidos para serem adicionados a uma camada vetorial específica durante a digitalização. Dê uma olhada no widget de edição na seção *Propriedades do formulário de atributos* para descobrir mais.

14.4.2 Apresentando a Interface da Tabela de Atributos

Para abrir a tabela de atributos para uma camada vetorial, ative a camada clicando nela *Painel Camadas*. Em seguida, no menu principal: seleção de menus: menu *Camada*, escolha :menuselection: *Abrir tabela de atributos*. Também é possível clicar com o botão direito do mouse na camada e escolher  *Abrir Tabela de Atributo* no menu suspenso ou clique em  :guilabel: botão *Abrir tabela de atributos* na barra de ferramentas Atributos. Se você preferir atalhos, `F6` abrirá a tabela de atributos. `Shift+F6` abrirá a tabela de atributos filtrada para os recursos selecionados e: kbd:*Ctrl+F6* abrirá a tabela de atributos filtrados para os recursos visíveis.

Isso abrirá uma nova janela que exibe os atributos da feição para a camada (*figure_attributes_table*). De acordo com a configuração em :menuselection: menu *Configurações –> Opções –> Fonte de dados*, a tabela de atributos será aberta em uma janela encaixada ou em uma janela regular. O número total de feições na camada e o número de feições atualmente selecionados/filtrados são mostrados no título da tabela de atributos, bem como se a camada é espacialmente limitada.

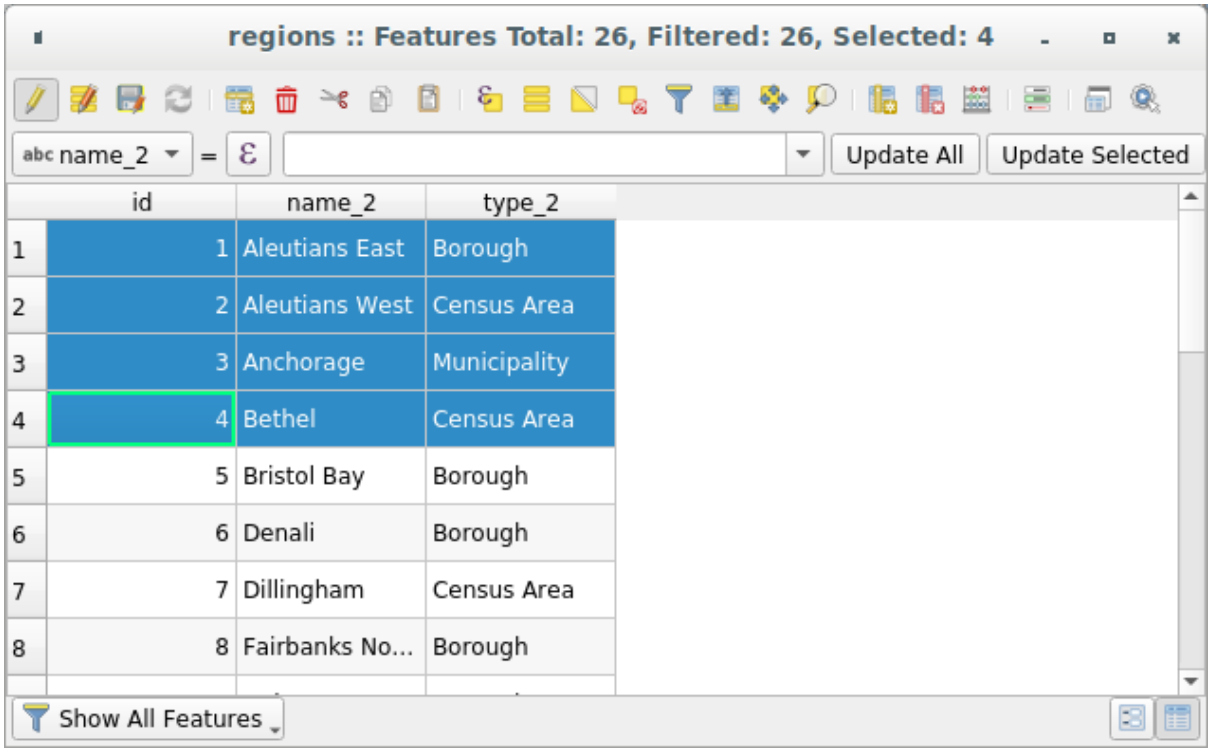


Figura14.68: Tabela de atributos para a camada de regiões

Os botões na parte superior da janela da tabela de atributos fornecem a seguinte funcionalidade:

Tabela14.3: Ferramentas Disponíveis

Ícone	Etiqueta	Finalidade	Atalh
	Alternar modo de edição	Habilitar funcionalidades de edição	Ctr
	Alternar modo multi edição	Atualize vários campos de várias feições	
	Salvar Edições	Salvar modificações atuais	
	Recarregar a tabela		
	Adicionar feição	Adicionar nova feição sem geometria	
	Excluir feições selecionadas	Remover feições selecionadas para a camada	
	Cortar feições selecionadas para área de transferência		Ctr
	Copiar feições selecionadas para a área de transferência		Ctr
	Colar feições da área de transferência	Inserir novas feições das copiadas	Ctr
	Selecionar feições usando uma expressão		
	Selecionar Todas	Selecionar todas feições em uma camada	Ctr
	Seleção invertida	Inverter a seleção atual na camada	Ctr
	Desselecionar todas	Desselecionar todas as feições na camada atual	Ctr
	Filtrar/Selecionar feições usando formulário		Ctr
	Mover selecionadas para o topo	Mover linhas selecionadas para o todo da tabela	
	Mapa panorâmico para selecionar linhas		Ctr

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Tabela 14.3 – continuação da página anterior

Ícone	Etiqueta	Finalidade	Atalh
	Aproximar mapa para selecionar linhas		Ctr
	Novo campo	Adicionar um novo campo para uma fonte de dados	Ctr
	Excluir campo	Remover um campo a partir da fonte de dados	
	Abrir calculadora de campo	Atualização de campo para muitas feições em uma linha	Ctr
	Formatação condicional	Ativar formatação de tabela	
	Tabela de Atributos do Dock	Permite encaixar/desencaixar a tabela de atributos	
	Ações	Listas de ações relatadas para uma camada	

Nota: Dependendo do formato dos dados e da biblioteca OGR criada com a sua versão do QGIS, algumas ferramentas podem não estar disponíveis.

Abaixo desses botões está a barra Cálculo de campo rápido (ativada apenas em *modo de edição*), que permite aplicar rapidamente cálculos a todos ou parte das feições da camada. Esta barra usa o mesmo: ref:*expressões<vector_expressions>`como o |calcula campo| :sup:`Calculadora de campo* (consulte: ref:` calcule_campos_valores`).

Visualização da tabela versus visualização do formulário

O QGIS fornece dois modos de exibição para manipular facilmente os dados na tabela de atributos:

- O  :sup: *Visualização da tabela*, exibe valores de várias feições em modo tabular, cada linha representando uma feição e cada coluna um campo.
- The  Form view shows *feature identifiers* in a first panel and displays only the attributes of the clicked identifier in the second one. There is a pull-down menu at the top of the first panel where the "identifier" can be specified using an attribute (*Column preview*) or an *Expression*. The pull-down also includes the last 10 expressions for re-use. Form view uses the layer fields configuration (see *Propriedades do formulário de atributos*). You can browse through the feature identifiers with the arrows on the bottom of the first panel. Once you markered the feature in yellow in the list it is selected in yellow on the canvas. Use the  on top of the attribute table to zoom to the feature. Clicking on an entry in the list (without using the rectangles) makes a feature flash in red color once so you can see where it is situated.

Você pode alternar de um modo para outro clicando no ícone correspondente no canto inferior direito da caixa de diálogo.

Você também pode especificar o modo :guilabel: *Visualização padrão* na abertura da tabela de atributos em :menuselection: menu *Configurações -> Opções -> Fonte de Dados*. Pode ser 'Lembrar última visualização', 'Tabela' ou 'Formulário'.

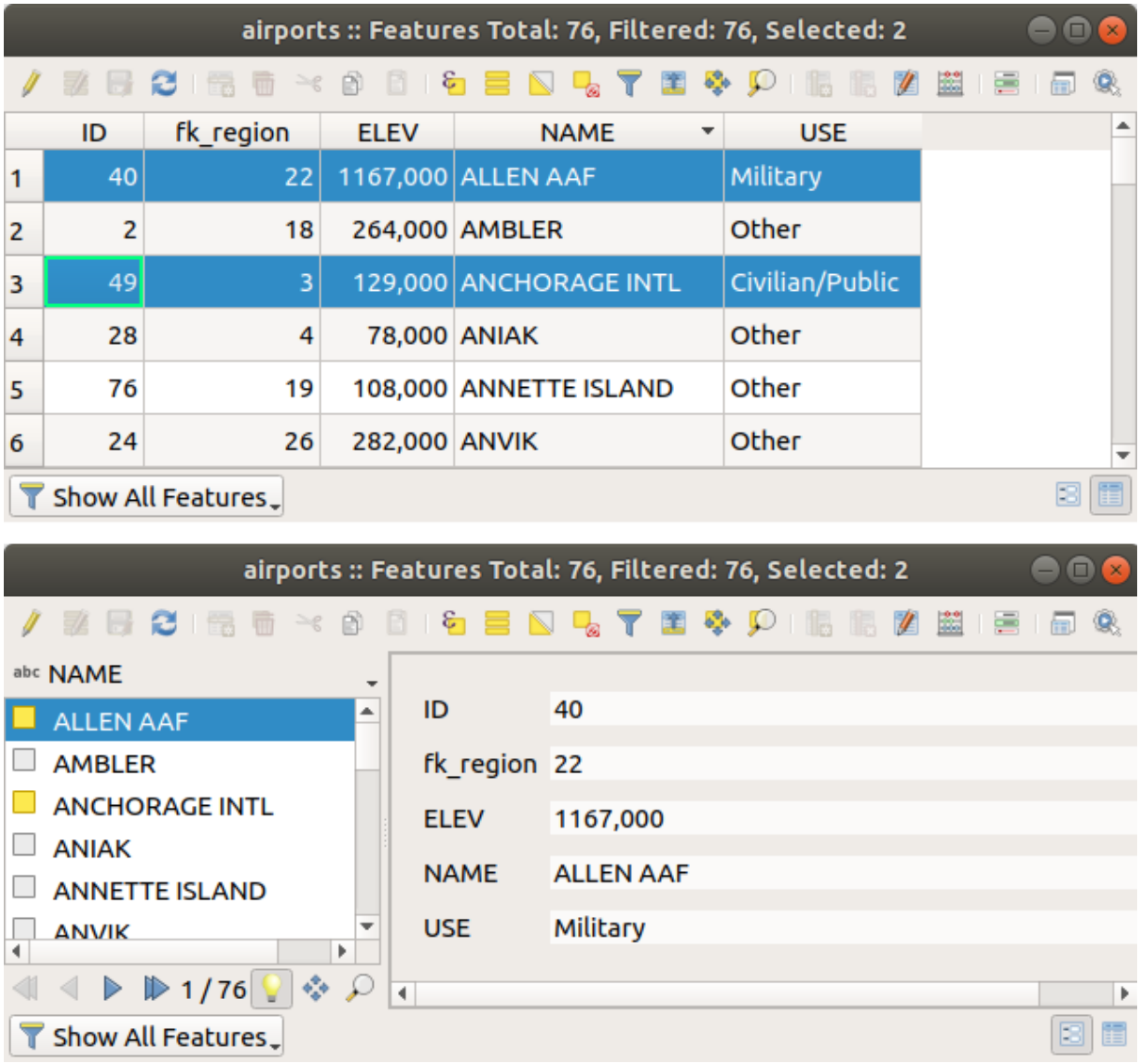


Figura14.69: Tabela de atributos na exibição de tabela (superior) vs exibição de formulário (inferior)

Configurando as colunas

Clique com o botão direito do mouse em um cabeçalho de coluna quando estiver na exibição de tabela para ter acesso a ferramentas que ajudam a configurar o que pode ser exibido na tabela de atributos e como.

Ocultando e organizando colunas e permitindo ações

Ao clicar com o botão direito do mouse em um cabeçalho de coluna, você pode ocultá-lo da tabela de atributos. Para alterar o comportamento de várias colunas ao mesmo tempo, reexibir uma coluna ou alterar a ordem das colunas, escolha *Organizar colunas* …. Na nova caixa de diálogo, você pode:

- marque / desmarque as colunas que deseja mostrar ou ocultar
- arraste e solte itens para reordenar as colunas na tabela de atributos. Observe que essa alteração é para a renderização da tabela e não altera a ordem dos campos na fonte de dados da camada
- ative uma nova coluna virtual *Açõess* que exibe em cada linha uma caixa suspensa ou uma lista de ações de cada linha, consulte *Propriedades de Ações* para obter mais informações sobre ações.

Redimensionando larguras de colunas

A largura das colunas pode ser definida através de um clique com o botão direito do mouse no cabeçalho da coluna e selecione:

- *Defina a largura…* para inserir o valor desejado. Por padrão, o valor atual é exibido no widget
- *Autodimensionar* para redimensionar da melhor forma possível a coluna.

Também pode ser alterado arrastando o limite à direita do cabeçalho da coluna. O novo tamanho da coluna é mantido para a camada e restaurado na próxima abertura da tabela de atributos.

Classificando colunas

A tabela pode ser classificada por qualquer coluna, clicando no cabeçalho da coluna. Uma seta pequena indica a ordem de classificação (apontar para baixo significa valores decrescentes da linha superior para baixo, apontar para cima significa valores ascendentes da linha superior para baixo). Você também pode optar por classificar as linhas com a opção: guilabel:*sort* do menu de contexto do cabeçalho da coluna e escrever uma expressão, por exemplo. para classificar a linha usando várias colunas, você pode escrever `concat (col0, col1)`.

Na exibição de formulário, o identificador de feições pode ser classificado usando o  :guilabel: opção Classificar por expressão de visualização.

Dica: Classificação com base em colunas de diferentes tipos

Tentar classificar uma tabela de atributos com base em colunas de tipos string e numéricos pode levar a resultados inesperados devido à expressão `concat(("USE", "ID")` retornando valores de string (ou seja,``'Borough105' < 'Borough6'). Você pode contornar isso usando, por exemplo, ``concat("USE", lpad("ID", 3, 0))``, que retorna `'Borough105' > 'Borough006'`.

Formatação de células da tabela usando condições

As configurações de formatação condicional podem ser usadas para realçar nas feições da tabela de atributos nos quais você deseja enfatizar, usando condições personalizadas nas feições:

- geometria (por exemplo, identificando características de várias partes, áreas pequenas ou em uma extensão de mapa definida …);
- ou valor do campo (por exemplo, comparando valores com um limite, identificando células vazias …).

Você pode ativar o painel de formatação condicional clicando em  no canto superior direito da janela de atributos na exibição de tabela (não disponível na exibição de formulário).

O novo painel permite que o usuário adicione novas regras para formatar a renderização de *Campo* ou *Linha completa*. Adicionar nova regra abre um formulário para definir:

- o nome da regra;
- uma condição usando qualquer uma das funções *construtor de expressões*;
- a formatação: pode ser escolhida de uma lista de formatos predefinidos ou criada com base em propriedades como:
  - cores de fundo e texto;
  - uso de ícone;
  - negrito, itálico, sublinhado ou strikeout;
  - fonte.

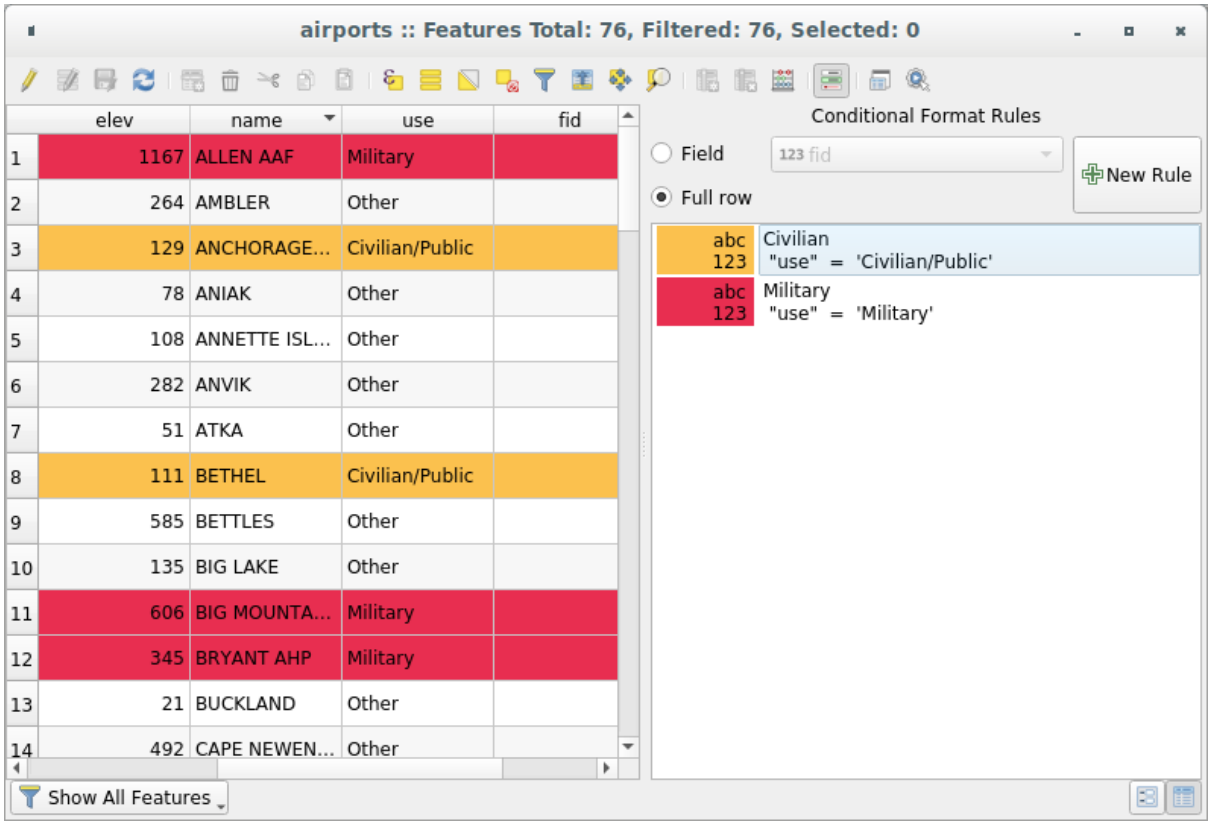


Figura14.70: Formatação condicional de uma tabela de atributo

14.4.3 Interagindo com feições em uma tabela de atributos

Selecionando características

Na exibição de tabela, cada linha da tabela de atributos exibe os atributos de um recurso exclusivo da camada. Selecionar uma linha seleciona o recurso e, da mesma forma, selecionar um recurso na tela do mapa (no caso de camada ativada para geometria) seleciona a linha na tabela de atributos. Se o conjunto de recursos selecionados na tela do mapa (ou tabela de atributos) for alterado, a seleção também será atualizada na tabela de atributos (ou tela do mapa) de acordo.

As linhas podem ser selecionadas clicando no número da linha no lado esquerdo da linha. **Múltiplas linhas** podem ser marcadas pressionando a tecla: kbd:*Ctrl*. Uma **seleção contínua** pode ser feita pressionando a tecla: kbd:*Shift* e clicando em vários cabeçalhos de linha no lado esquerdo das linhas. Todas as linhas entre a posição atual do cursor e a linha clicada são selecionadas. Mover a posição do cursor na tabela de atributos, clicando em uma célula na tabela, não altera a seleção de linha. Alterar a seleção na tela principal não move a posição do cursor na tabela de atributos.

Na exibição de formulário da tabela de atributos, as feições são identificados por padrão no painel esquerdo pelo valor do campo exibido (consulte: ref: *maptips*). Esse identificador pode ser substituído usando a lista suspensa na parte superior do painel, selecionando um campo existente ou usando uma expressão personalizada. Você também pode optar por classificar a lista de recursos no menu suspenso.

Clique em um valor no painel esquerdo para exibir os atributos da feição no caminho certo. Para selecionar uma feição, você precisa clicar dentro do símbolo quadrado à esquerda do identificador. Por padrão, o símbolo fica amarelo. Como na exibição de tabela, você pode executar várias seleções de recursos usando as combinações de teclado expostas anteriormente.

Além de selecionar feições com o mouse, você pode executar a seleção automática com base no atributo da feição, usando as ferramentas disponíveis na barra de ferramentas da tabela de atributos, como (consulte a seção: ref:*automatic_selection* e a seguir para obter mais informações e casos de uso):

-  *Selecione por expressão…*
-  *Selecionar Feição pelo Valor…*
-  *Deselect All Features from the Layer*
-  *Selecionar Todas as Feições*
-  *Inverter Feições Selecionadas.*

Também é possível selecionar recursos usando o :ref: *filter_select_form*.

Filtragem de feições

Depois de selecionar as feições na tabela de atributos, você pode exibir apenas esses registros na tabela. Isso pode ser feito facilmente usando o item *Mostrar feições selecionadas* na lista suspensa no canto inferior esquerdo da caixa de diálogo da tabela de atributos. Esta lista oferece os seguintes filtros:

- *Mostrar Todas as Feições*
- *Mostrar Feições Selecionadas*
- *Mostrar Feições visíveis no mapa*
- *Mostrar Feições Novas e Editadas*
- *Filtro de Campo* - permite ao usuário filtrar com base no valor de um campo: escolha uma coluna da lista, digite um valor e pressione :kbd:` Enter` para filtrar. Em seguida, apenas as feições correspondentes são mostrados na tabela de atributos.
- *Filtro avançado (Expressão)* - Abre a caixa de diálogo Construtor de expressões. Dentro dele, você pode criar: ref: *expressões complexas<vector_expressions>* para corresponder às linhas da tabela. Por exemplo, você pode filtrar a tabela usando mais de um campo. Quando aplicada, a expressão do filtro será exibida na parte inferior do formulário.

Também é possível: ref: *filtrar recursos usando formulários <filter_select_form>*.

Nota: A filtragem de registros da tabela de atributos não filtra feições da camada; eles são simplesmente ocultados momentaneamente da tabela e podem ser acessados na tela do mapa ou removendo o filtro. Para filtros que ocultam recursos da camada, use o *Query Builder*.

Dica: **Atualize a filtragem da fonte de dados com** `Mostrar feições visíveis no mapa`

Quando, por motivos de desempenho, os recursos mostrados na tabela de atributos são espacialmente limitados à extensão da tela em sua abertura (consulte: ref: *Opções da fonte de dados<tip_table_filtering>* para obter instruções), selecionando: guilabel: *Mostrar feições visíveis no mapa* em um nova extensão de tela atualiza a restrição espacial.

Filtrando e selecionando feições usando formulários

Clicando no  :sup: *Filtre/selecione recursos usando o formulário* ou pressione :kbd:Ctrl+F` fará com que a caixa de diálogo da tabela de atributos mude para a exibição do formulário e substitua cada widget por sua variante de pesquisa.

A partir deste ponto, a funcionalidade desta ferramenta é semelhante à descrita em: ref: *select_by_value*, onde é possível encontrar descrições de todos os operadores e selecionar modos.

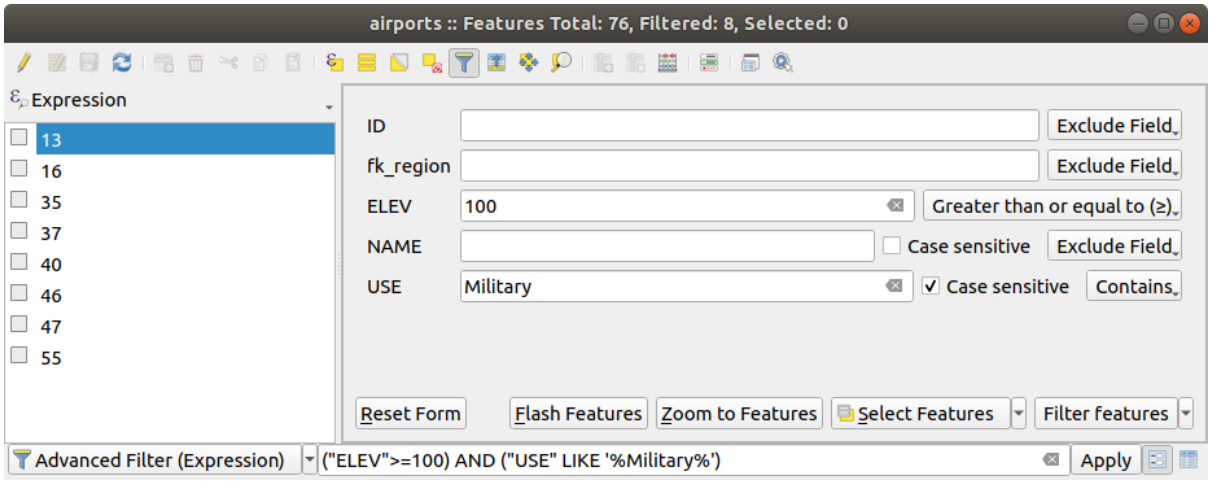


Figura14.71: Tabela de atributos filtrada pelo formulário de filtro

Ao selecionar / filtrar feições da tabela de atributos, existe um botão *Filtro de feições* que permite definir e refinar filtros. Seu uso aciona a opção: guilabel: *Filtro avançado (Expressão)* e exibe a expressão de filtro correspondente em um widget de texto editável na parte inferior do formulário.

Se já houver feições filtradas, você poderá refinar o filtro usando a lista suspensa ao lado do botão *Filtro de feições*. As opções são:

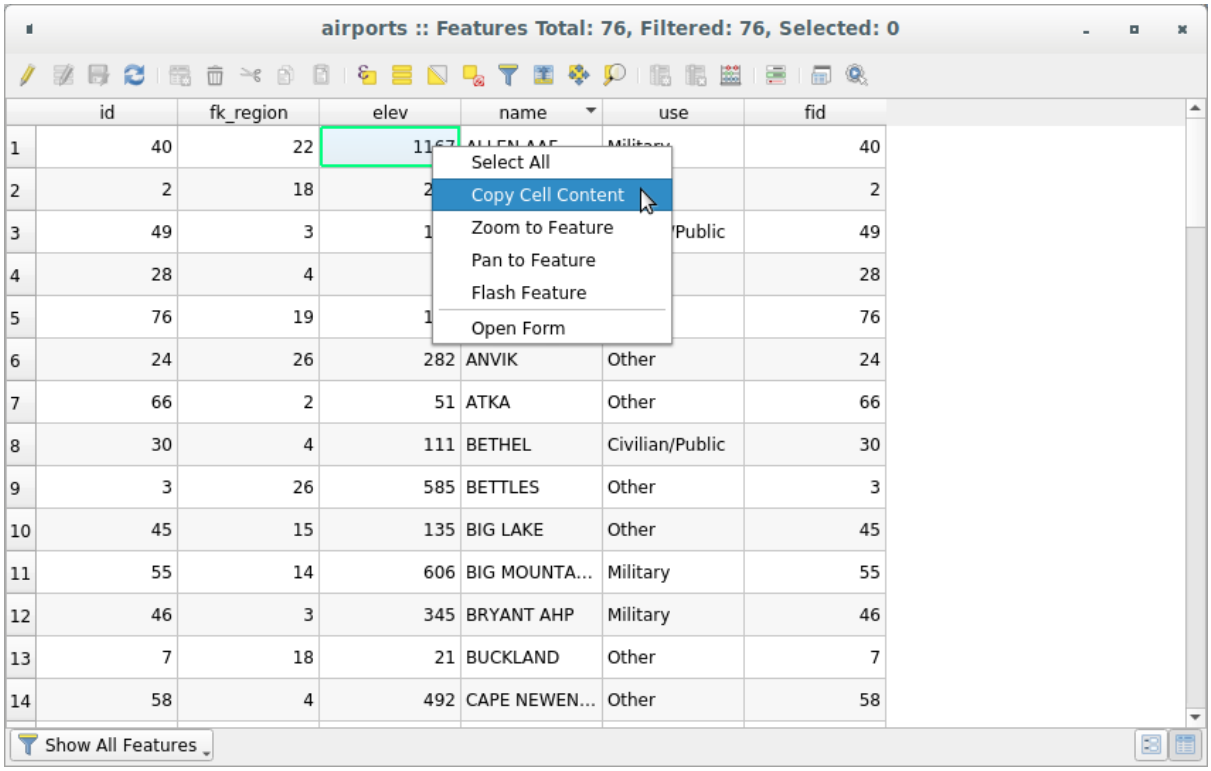
- *Filtrar dentro de ("AND")*
- *Estender filtro ("OR")*

Para limpar o filtro, selecione a opção *Mostrar todas as feições* no menu suspenso inferior esquerdo ou limpe a expressão e clique em *Aplicar* ou pressione `Enter`.

14.4.4 Usando ação em feições

Os usuários têm várias possibilidades de manipular feições com o menu contextual, como:

- *Selecionar todas* (`Ctrl+A`) as feições;
- Copie o conteúdo de uma célula na área de transferência com: guilabel:*Copiar conteúdo da célula*;
- *Aproximar na feição* sem ter que selecioná-lo previamente;
- *Panorâmica da feição* sem ter que selecioná-lo previamente;
- *Destacar feição*, para destacá-la na tela do mapa;
- *Abrir formulário*: alterna a tabela de atributos para a exibição de formulários, com foco na feição clicado.



	id	fk_region	elev	name	use	fid
1	40	22	11			40
2	2	18	2			2
3	49	3	1		Public	49
4	28	4				28
5	76	19	1			76
6	24	26	282	ANVIK	Other	24
7	66	2	51	ATKA	Other	66
8	30	4	111	BETHEL	Civilian/Public	30
9	3	26	585	BETTLES	Other	3
10	45	15	135	BIG LAKE	Other	45
11	55	14	606	BIG MOUNTA...	Military	55
12	46	3	345	BRYANT AHP	Military	46
13	7	18	21	BUCKLAND	Other	7
14	58	4	492	CAPE NEWEN...	Other	58

Figura14.72: Copiar botão de conteúdo da célula

Se você deseja usar dados de atributo em programas externos (como Excel, LibreOffice, QGIS ou um aplicativo Web personalizado), selecione uma ou mais linhas e use o Copie as linhas selecionadas para a área de transferência ou pressione: kbd:*Ctrl+C*.

Em: menuselection: menu *Configurações* -> *Opções* -> *Fonte de Dado*, você pode definir o formato no qual colar *Copiar feições como* lista suspensa:

- Texto simples, sem geometria,
- Texto simples, geometria WKT,
- GeoJSON

Você também pode exibir uma lista de ações neste menu contextual. Isso é ativado na guia *Propriedades da camada* ► *Ações*. Veja *Propriedades de Ações* para mais informações sobre ações.

Salvando feições selecionadas como nova camada

As feições selecionadas podem ser salvas como qualquer formato vetorial suportado pelo OGR e também transformadas em outro sistema de referência de coordenadas (SRC). No menu contextual da camada, no painel *Camadas*, clique em *Exportar* ► *Salvar feições selecionadas como…* para definir o nome do conjunto de dados de saída, seu formato e SRC (veja a seção *Creating new layers from an existing layer*). Você notará que *Salvar apenas as feições selecionadas* está marcado. Também é possível especificar opções de criação de OGR dentro da caixa de diálogo.

14.4.5 Editando valores de atributo

A edição dos valores dos atributos pode ser feita por:

- digitando o novo valor diretamente na célula, esteja a tabela de atributos na visualização de tabela ou formulário. As mudanças são feitas célula por célula, feição por feição;
- using the *field calculator*: update in a row a field that may already exist or to be created but for multiple features. It can be used to create virtual fields;
- using the quick field *calculation bar*: same as above but for only existing field;
- or using the *multi edit* mode: update in a row multiple fields for multiple features.

Using the Field Calculator

The  Field Calculator button in the attribute table allows you to perform calculations on the basis of existing attribute values or defined functions, for instance, to calculate length or area of geometry features. The results can be used to update an existing field, or written to a new field (that can be a *virtual* one).

The field calculator is available on any layer that supports edit. When you click on the field calculator icon the dialog opens (see Fig.14.73). If the layer is not in edit mode, a warning is displayed and using the field calculator will cause the layer to be put in edit mode before the calculation is made.

Based on the *Expression Builder* dialog, the field calculator dialog offers a complete interface to define an expression and apply it to an existing or a newly created field. To use the field calculator dialog, you must select whether you want to:

1. apply calculation on the whole layer or on selected features only
2. create a new field for the calculation or update an existing one.

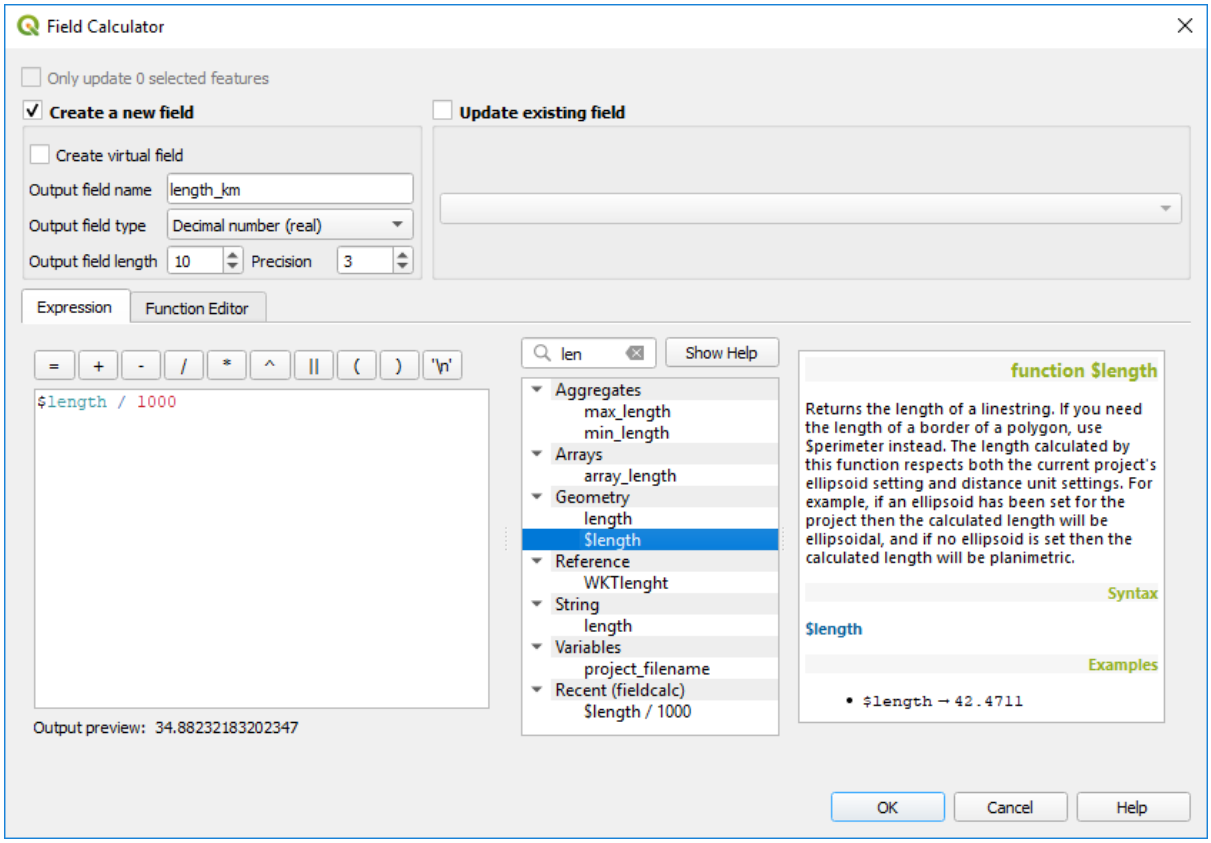


Figura14.73: Field Calculator

If you choose to add a new field, you need to enter a field name, a field type (integer, real, date or string) and if needed, the total field length and the field precision. For example, if you choose a field length of 10 and a field precision of 3, it means you have 7 digits before the dot, and 3 digits for the decimal part.

A short example illustrates how field calculator works when using the *Expression* tab. We want to calculate the length in km of the `railroads` layer from the QGIS sample dataset:

1. Load the shapefile `railroads.shp` in QGIS and press Open Attribute Table.
2. Click on Toggle editing mode and open the Field Calculator dialog.
3. Select the *Create a new field* checkbox to save the calculations into a new field.
4. Set *Output field name* to `length_km`
5. Select `Decimal number (real)` as *Output field type*
6. Set the *Output field length* to `10` and the *Precision* to `3`
7. Double click on `$length` in the *Geometry* group to add the length of the geometry into the Field calculator expression box.
8. Complete the expression by typing `/ 1000` in the Field calculator expression box and click *OK*.
9. You can now find a new *length_km* field in the attribute table.

Creating a Virtual Field

A virtual field is a field based on an expression calculated on the fly, meaning that its value is automatically updated as soon as an underlying parameter changes. The expression is set once; you no longer need to recalculate the field each time underlying values change. For example, you may want to use a virtual field if you need area to be evaluated as you digitize features or to automatically calculate a duration between dates that may change (e.g., using `now()` function).

Nota: Use of Virtual Fields

- Virtual fields are not permanent in the layer attributes, meaning that they're only saved and available in the project file they've been created.
- A field can be set virtual only at its creation. Virtual fields are marked with a purple background in the fields tab of the layer properties dialog to distinguish them from regular physical or joined fields. Their expression can be edited later by pressing the expression button in the Comment column. An expression editor window will be opened to adjust the expression of the virtual field.

Using the Quick Field Calculation Bar

While Field calculator is always available, the quick field calculation bar on top of the attribute table is only visible if the layer is in edit mode. Thanks to the expression engine, it offers a quicker access to edit an already existing field:

1. Select the field to update in the drop-down list.
2. Fill the textbox with a value, an expression you directly write or build using the ε expression button.
3. Click on *Update All*, *Update Selected* or *Update Filtered* button according to your need.

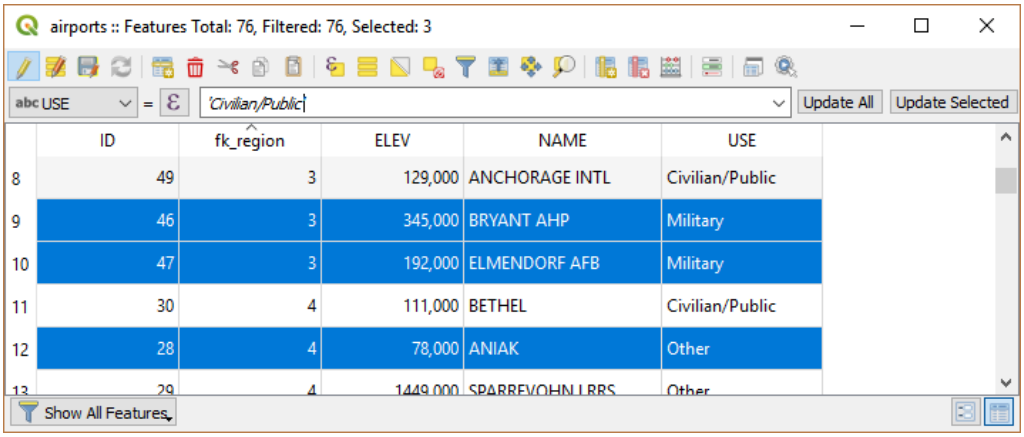


Figura14.74: Quick Field Calculation Bar

Editing multiple fields

Unlike the previous tools, multi edit mode allows multiple attributes of different features to be edited simultaneously. When the layer is toggled to edit, multi edit capabilities are accessible:

- using the Toggle multi edit mode button from the toolbar inside the attribute table dialog;
- or selecting *Edit* ► *Modify attributes of selected features* menu.

Nota: Unlike the tool from the attribute table, hitting the *Edit* ► *Modify Attributes of Selected Features* option provides you with a modal dialog to fill attributes changes. Hence, features selection is required before execution.

In order to edit multiple fields in a row:

1. Select the features you want to edit.
2. From the attribute table toolbar, click the button. This will toggle the dialog to its form view. Feature selection could also be made at this step.
3. At the right side of the attribute table, fields (and values) of selected features are shown. New widgets appear next to each field allowing for display of the current multi edit state:
   - The field contains different values for selected features. It's shown empty and each feature will keep its original value. You can reset the value of the field from the drop-down list of the widget.
   - All selected features have the same value for this field and the value displayed in the form will be kept.
   - The field has been edited and the entered value will be applied to all the selected features. A message appears at the top of the dialog, inviting you to either apply or reset your modification.

   Clicking any of these widgets allows you to either set the current value for the field or reset to original value, meaning that you can roll back changes on a field-by-field basis.

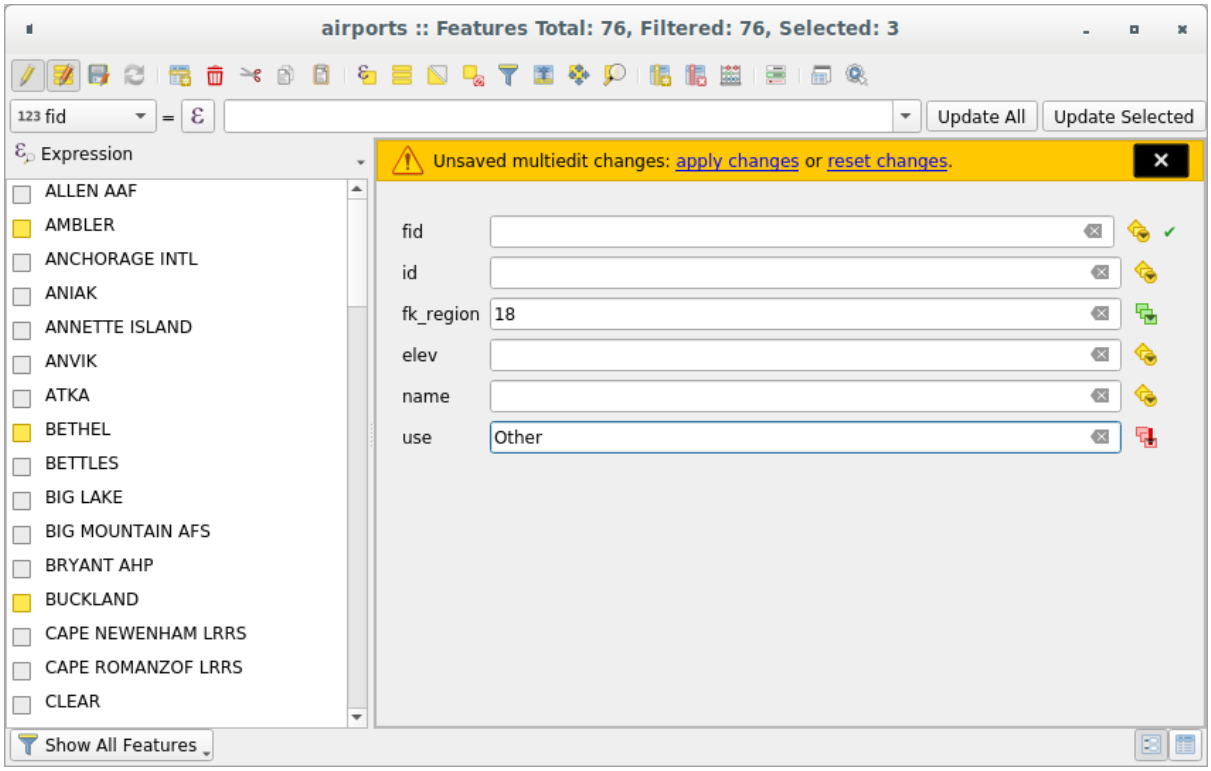


Figura14.75: Editing fields of multiple features

4. Make the changes to the fields you want.
5. Click on **Apply changes** in the upper message text or any other feature in the left panel.

Changes will apply to **all selected features**. If no feature is selected, the whole table is updated with your changes. Modifications are made as a single edit command. So pressing Undo will rollback the attribute changes for all

selected features at once.

Nota: Multi edit mode is only available for auto generated and drag and drop forms (see *Personalizando um formulário para seus dados*); it is not supported by custom ui forms.

14.4.6 Creating one or many to many relations

Relations are a technique often used in databases. The concept is that features (rows) of different layers (tables) can belong to each other.

Introducing 1-N relations

As an example you have a layer with all regions of alaska (polygon) which provides some attributes about its name and region type and a unique id (which acts as primary key).

Then you get another point layer or table with information about airports that are located in the regions and you also want to keep track of these. If you want to add them to the regions layer, you need to create a one to many relation using foreign keys, because there are several airports in most regions.

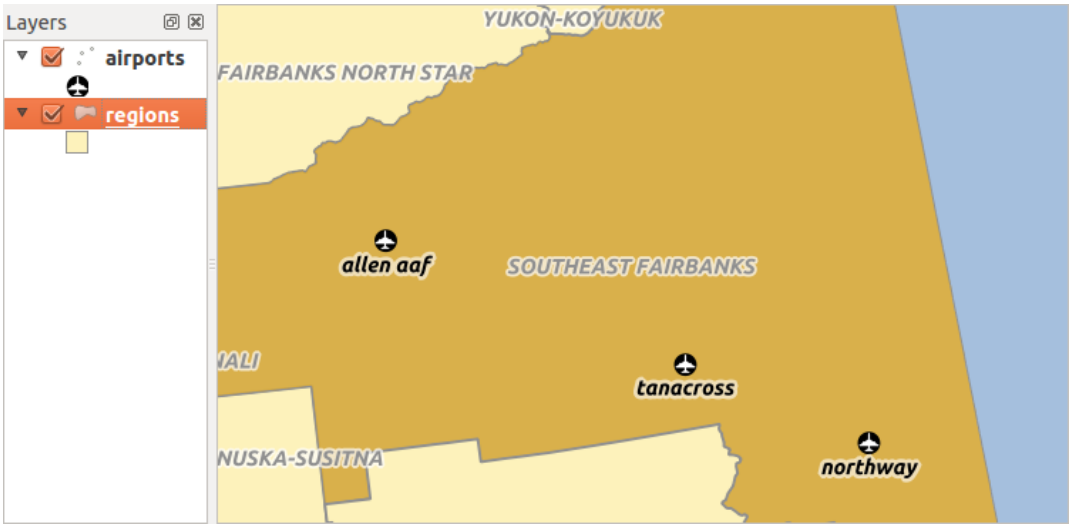


Figura14.76: Alaska region with airports

Layers in 1-N relations

QGIS makes no difference between a table and a vector layer. Basically, a vector layer is a table with a geometry. So you can add your table as a vector layer. To demonstrate the 1-n relation, you can load the `regions` shapefile and the `airports` shapefile which has a foreign key field (`fk_region`) to the layer regions. This means, that each airport belongs to exactly one region while each region can have any number of airports (a typical one to many relation).

Foreign keys in 1-N relations

In addition to the already existing attributes in the airports attribute table, you'll need another field `fk_region` which acts as a foreign key (if you have a database, you will probably want to define a constraint on it).

This field fk_region will always contain an id of a region. It can be seen like a pointer to the region it belongs to. And you can design a custom edit form for editing and QGIS takes care of the setup. It works with different providers (so you can also use it with shape and csv files) and all you have to do is to tell QGIS the relations between your tables.

Defining 1-N relations

The first thing we are going to do is to let QGIS know about the relations between the layers. This is done in *Project* ► *Properties...* Open the *Relations* tab and click on *Add Relation*.

- **Name** is going to be used as a title. It should be a human readable string, describing, what the relation is used for. We will just call say **airport_relation** in this case.
- **Referenced Layer (Parent)** also considered as parent layer, is the one with the primary key, pointed to, so here it is the `regions` layer. You need to define the primary key of the referenced layer, so it is `ID`.
- **Referencing Layer (Child)** also considered as child layer, is the one with the foreign key field on it. In our case, this is the `airports` layer. For this layer you need to add a referencing field which points to the other layer, so this is `fk_region`.

Nota: Sometimes, you need more than a single field to uniquely identify features in a layer. Creating a relation with such a layer requires a **composite key**, ie more than a single pair of matching fields. Use the Add new field pair as part of a composite foreign key button to add as many pairs as necessary.

- **Id** will be used for internal purposes and has to be unique. You may need it to build *custom forms*. If you leave it empty, one will be generated for you but you can assign one yourself to get one that is easier to handle
- **Relationship strength** sets the strength of the relation between the parent and the child layer. The default *Association* type means that the parent layer is *simply* linked to the child one while the *Composition* type allows you to duplicate also the child features when duplicating the parent ones.

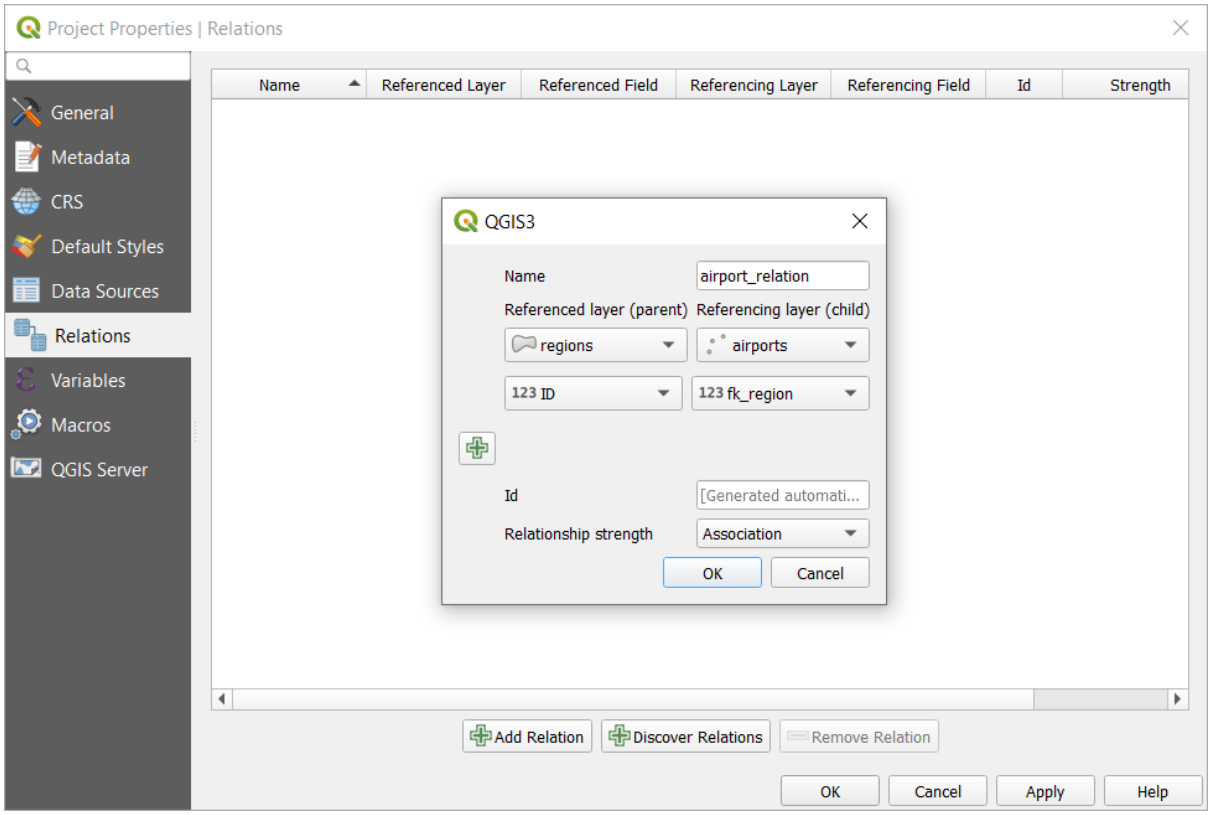


Figura14.77: Adding a relation between regions and airports layers

From the *Relations* tab, you can also press the *Discover Relation* button to fetch the relations available from the providers of the loaded layers. This is possible for layers stored in data providers like PostgreSQL or SpatiaLite.

Forms for 1-N relations

Now that QGIS knows about the relation, it will be used to improve the forms it generates. As we did not change the default form method (autogenerated) it will just add a new widget in our form. So let's select the layer region in the legend and use the identify tool. Depending on your settings, the form might open directly or you will have to choose to open it in the identification dialog under actions.

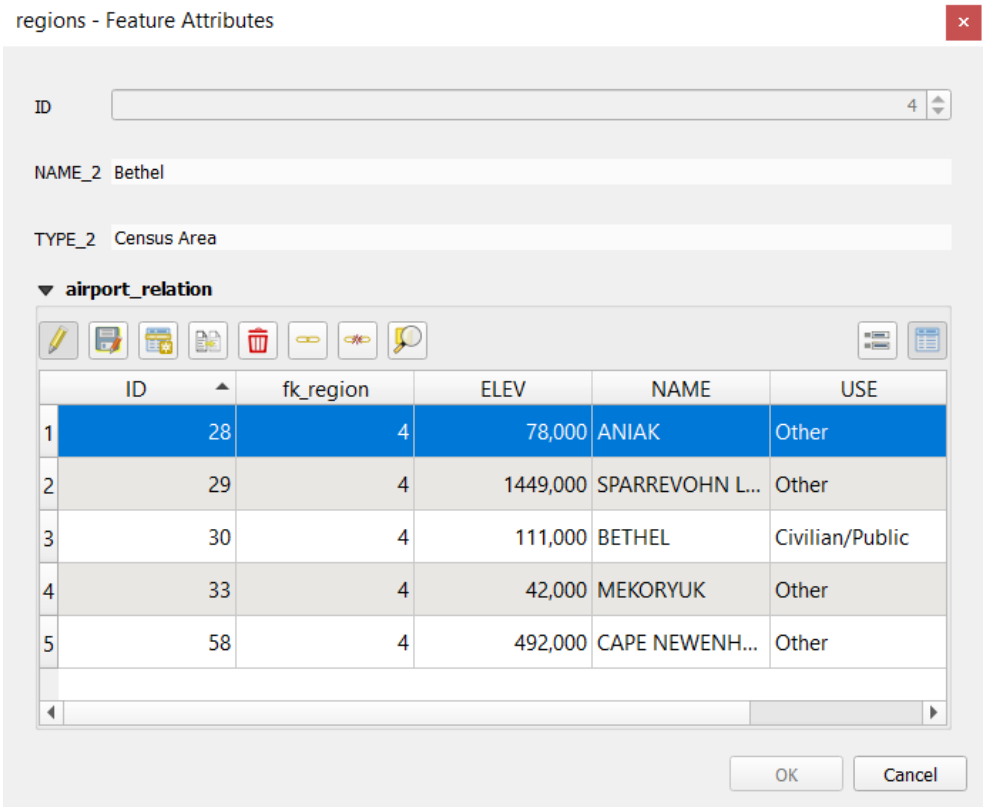


Figura14.78: Identification dialog regions with relation to airports

As you can see, the airports assigned to this particular region are all shown in a table. And there are also some buttons available. Let's review them shortly:

- The button is for toggling the edit mode. Be aware that it toggles the edit mode of the airport layer, although we are in the feature form of a feature from the region layer. But the table is representing features of the airport layer.
- The button is for saving all the edits.
- The button will add a new record to the airport layer attribute table. And it will assign the new airport to the current region by default.
- The is the same as but lets you digitize the airport geometry in the map canvas beforehand. Note that the icon will change according to geometry type.
- The button allows you to copy one or more child features.
- The button will delete the selected airport permanently.
- The symbol will open a new dialog where you can select any existing airport which will then be assigned to the current region. This may be handy if you created the airport on the wrong region by accident.
- The symbol will unlink the selected airport from the current region, leaving them unassigned (the foreign key is set to NULL) effectively.
- With the button you can zoom the map to the selected child features.
- The two buttons and to the right switch between table view and form view where the later let's you view all the airports in their respective form.

In the above example the referencing layer has geometries (so it isn't just an alphanumeric table) so the above steps will create an entry in the layer attribute table that has no corresponding geometric feature. To add the geometry:

1. Choose *Open Attribute Table* for the referencing layer.
2. Select the record that has been added previously within the feature form of the referenced layer.
3. Use the Add Part digitizing tool to attach a geometry to the selected attributes table record.

If you work on the airport table, the widget Relation Reference is automatically set up for the `fk_region` field (the one used to create the relation), see *Relation Reference widget*.

In the airport form you will see the button at the right side of the `fk_region` field: if you click on the button the form of the region layer will be opened. This widget allows you to easily and quickly open the forms of the linked parent features.

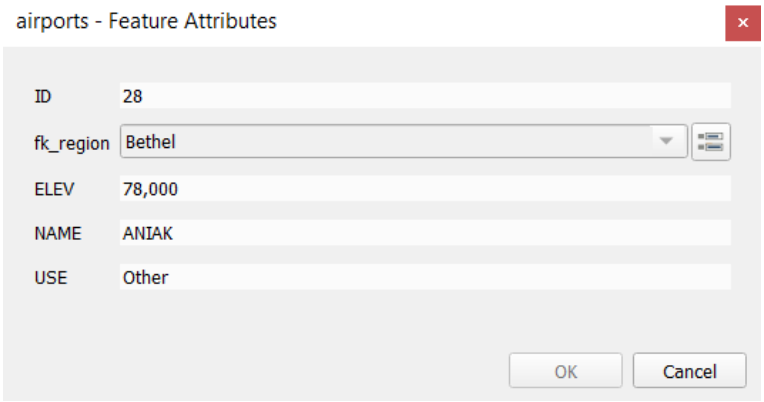
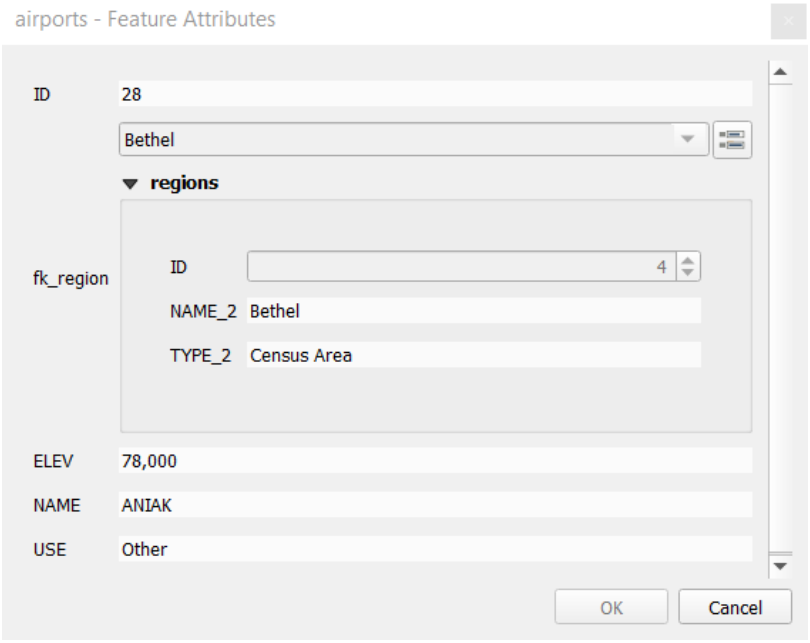


Figura14.79: Identification dialog airport with relation to regions

The Relation Reference widget has also an option to embed the form of the parent layer within the child one. It is available in the *Properties* ► *Attributes Form* menu of the airport layer: select the `fk_region` field and check the `Show embedded form` option.

If you look at the feature dialog now, you will see, that the form of the region is embedded inside the airports form and will even have a combobox, which allows you to assign the current airport to another region.



Moreover if you toggle the editing mode of the airport layer, the `fk_region` field has also an autocompleter function: while typing you will see all the values of the `id` field of the region layer. Here it is possible to digitize a polygon for the region layer using the button if you chose the option `Allow adding new features` in the *Properties* ► *Attributes Form* menu of the airport layer.

The child layer can also be used in the *Selecionar Feições Por Valor* tool in order to select features of the parent layer based on attributes of their children.

In Fig.14.80, all the regions where the mean altitude of the airports is greater than 500 meters above sea level are selected.

You will find that many different aggregation functions are available in the form.

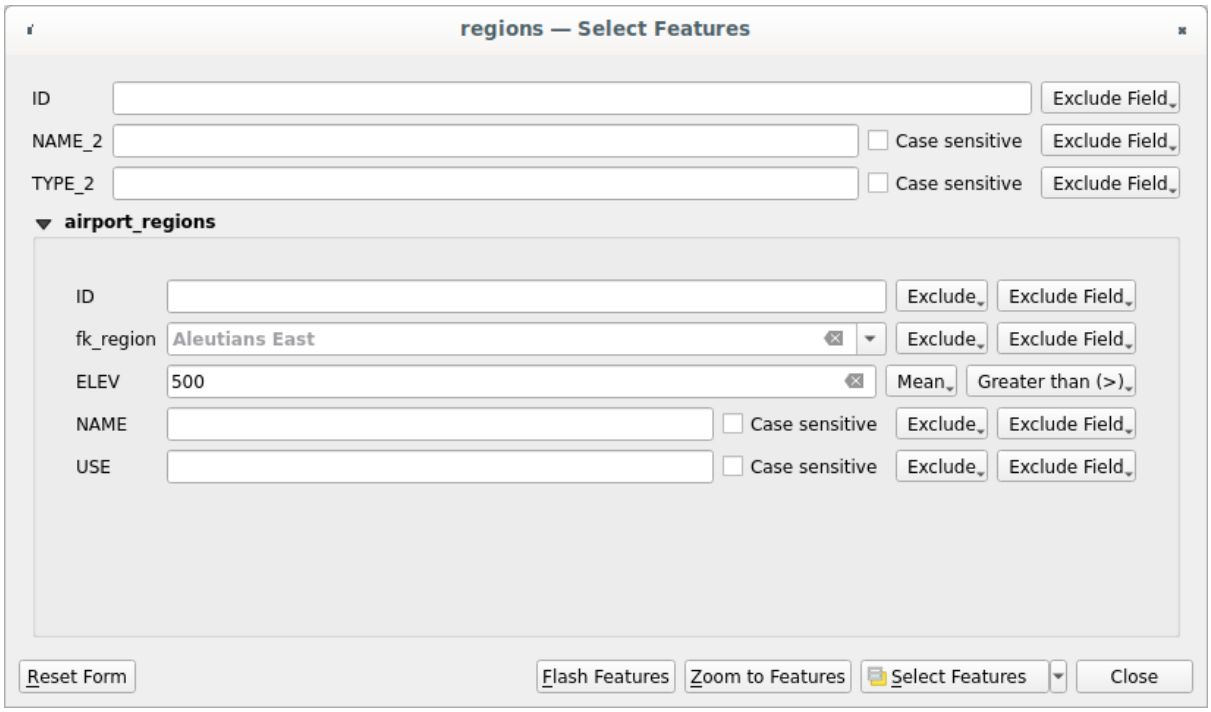


Figura14.80: Select parent features with child values

Introducing many-to-many (N-M) relations

N-M relations are many-to-many relations between two tables. For instance, the `airports` and `airlines` layers: an airport receives several airline companies and an airline company flies to several airports.

This SQL code creates the three tables we need for an N-M relationship in a PostgreSQL/PostGIS schema named *locations*. You can run the code using the *Database* ► *DB Manager*… for PostGIS or external tools such as pgAdmin. The airports table stores the `airports` layer and the airlines table stores the `airlines` layer. In both tables few fields are used for clarity. The *tricky* part is the `airports_airlines` table. We need it to list all airlines for all airports (or vice versa). This kind of table is known as a *pivot table*. The *constraints* in this table force that an airport can be associated with an airline only if both already exist in their layers.

```
CREATE SCHEMA locations;

CREATE TABLE locations.airports
(
   id serial NOT NULL,
   geom geometry(Point, 4326) NOT NULL,
   airport_name text NOT NULL,
   CONSTRAINT airports_pkey PRIMARY KEY (id)
```

(continua na próxima página)

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```
);

CREATE INDEX airports_geom_idx ON locations.airports USING gist (geom);

CREATE TABLE locations.airlines
(
   id serial NOT NULL,
   geom geometry(Point, 4326) NOT NULL,
   airline_name text NOT NULL,
   CONSTRAINT airlines_pkey PRIMARY KEY (id)
);

CREATE INDEX airlines_geom_idx ON locations.airlines USING gist (geom);

CREATE TABLE locations.airports_airlines
(
   id serial NOT NULL,
   airport_fk integer NOT NULL,
   airline_fk integer NOT NULL,
   CONSTRAINT airports_airlines_pkey PRIMARY KEY (id),
   CONSTRAINT airports_airlines_airport_fk_fkey FOREIGN KEY (airport_fk)
      REFERENCES locations.airports (id)
      ON DELETE CASCADE
      ON UPDATE CASCADE
      DEFERRABLE INITIALLY DEFERRED,
   CONSTRAINT airports_airlines_airline_fk_fkey FOREIGN KEY (airline_fk)
      REFERENCES locations.airlines (id)
      ON DELETE CASCADE
      ON UPDATE CASCADE
      DEFERRABLE INITIALLY DEFERRED
 );
```

Instead of PostgreSQL you can also use GeoPackage. In this case, the three tables can be created manually using the *Database* ► *DB Manager*.... In GeoPackage there are no schemas so the *locations* prefix is not needed.

Foreign key constraints in `airports_airlines` table can´t be created using *Table* ► *Create Table*... or *Table* ► *Edit Table*... so they should be created using *Database* ► *SQL Window*.... GeoPackage doesn't support *ADD CONSTRAINT* statements so the `airports_airlines` table should be created in two steps:

1. Set up the table only with the `id` field using *Table* ► *Create Table*...
2. Using *Database* ► *SQL Window*..., type and execute this SQL code:

```
ALTER TABLE airports_airlines
   ADD COLUMN airport_fk INTEGER
   REFERENCES airports (id)
   ON DELETE CASCADE
   ON UPDATE CASCADE
   DEFERRABLE INITIALLY DEFERRED;

ALTER TABLE airports_airlines
   ADD COLUMN airline_fk INTEGER
   REFERENCES airlines (id)
   ON DELETE CASCADE
   ON UPDATE CASCADE
   DEFERRABLE INITIALLY DEFERRED;
```

Then in QGIS, you should set up two *one-to-many relations* as explained above:

- a relation between `airlines` table and the pivot table;
- and a second one between `airports` table and the pivot table.

An easier way to do it (only for PostgreSQL) is using the *Discover Relations* in *Project* ► *Properties* ► *Relations*.

QGIS will automatically read all relations in your database and you only have to select the two you need. Remember to load the three tables in the QGIS project first.

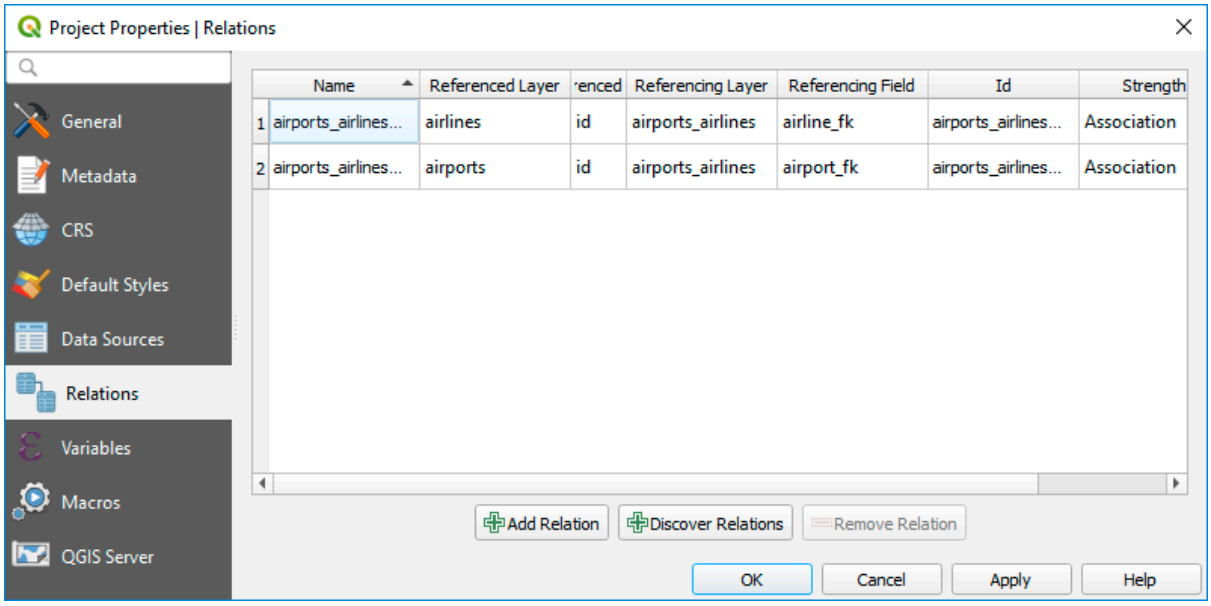


Figura14.81: Relations and autodiscover

In case you want to remove an `airport` or an `airline`, QGIS won't remove the associated record(s) in `airports_airlines` table. This task will be made by the database if we specify the right *constraints* in the pivot table creation as in the current example.

Nota: Combining N-M relation with automatic transaction group

You should enable the transaction mode in *Project Properties* ► *Data Sources* ► when working on such context. QGIS should be able to add or update row(s) in all tables (airlines, airports and the pivot tables).

Finally we have to select the right cardinalilty in the *Layer Properties* ► *Attributes Form* for the `airports` and `airlines` layers. For the first one we should choose the **airlines (id)** option and for the second one the **airports (id)** option.

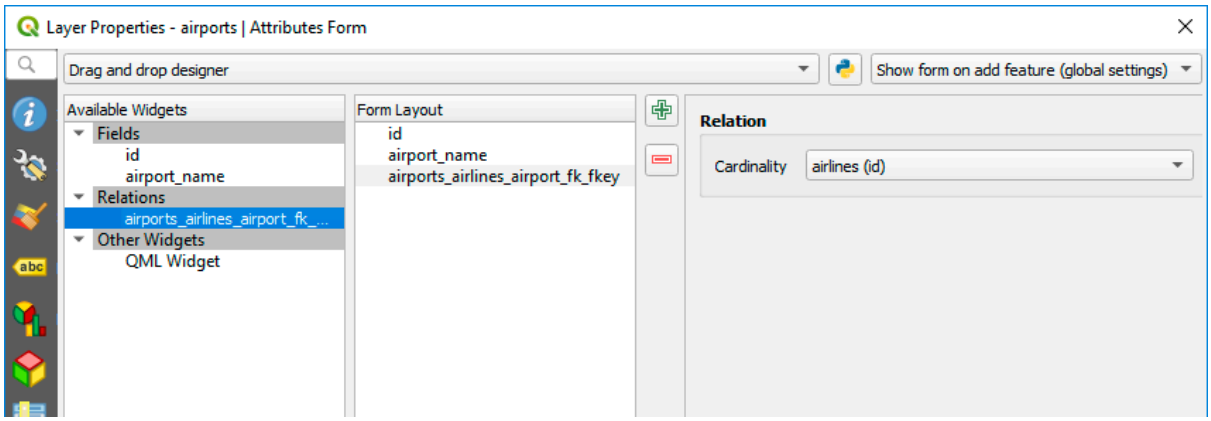


Figura14.82: Set relationship cardinality

Now you can associate an airport with an airline (or an airline with an airport) using *Add child feature* or *Link existing child feature* in the subforms. A record will automatically be inserted in the `airports_airlines` table.

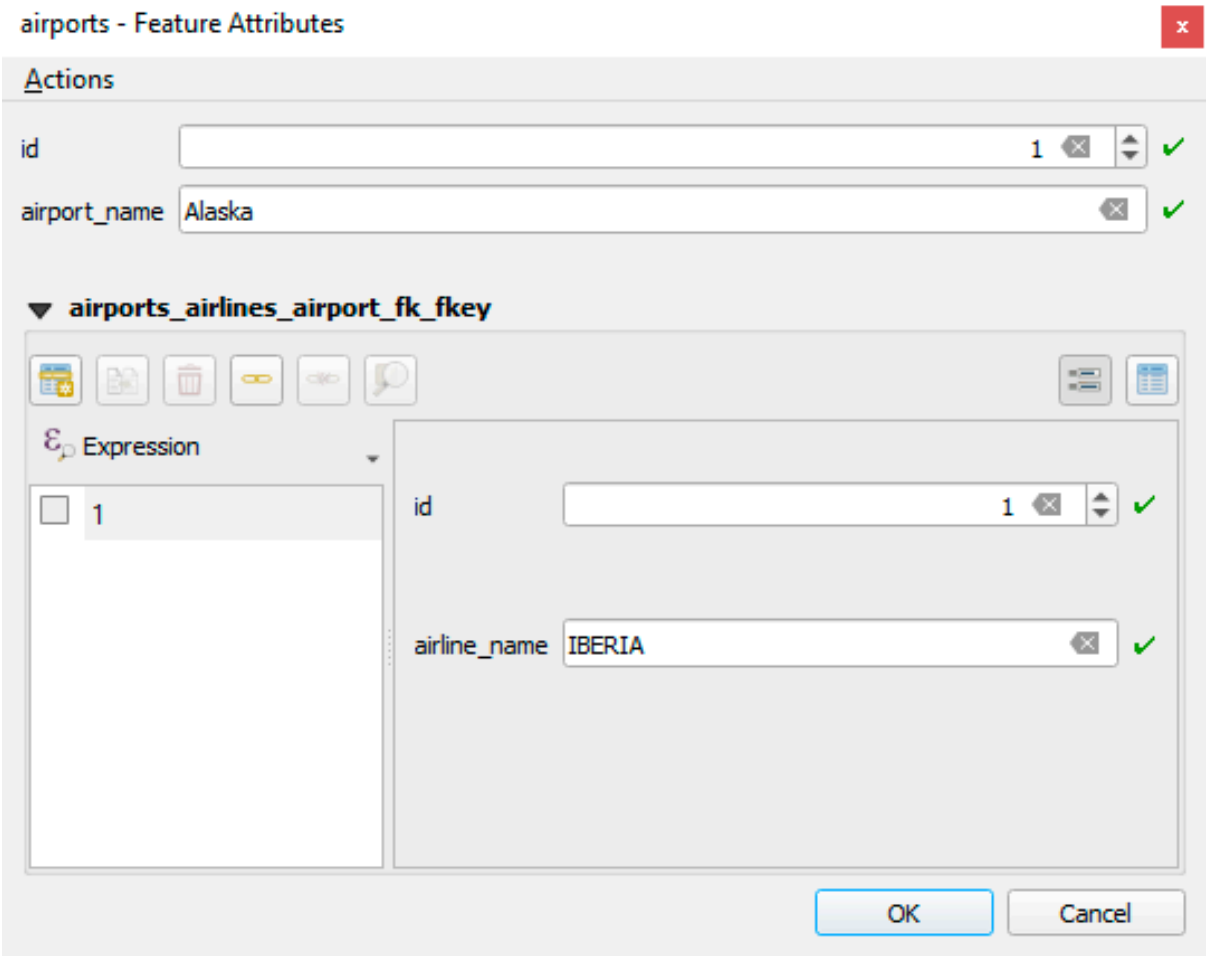


Figura14.83: N-M relationship between airports and airlines

Nota: Using **Many to one relation** cardinality

Sometimes hiding the pivot table in an N-M relationship is not desirable. Mainly because there are attributes in the relationship that can only have values when a relationship is established. If your tables are layers (have a geometry field) it could be interesting to activate the *On map identification* option (*Layer Properties* ► *Attributes Form* ► *Available widgets* ► *Fields*) for the foreign key fields in the pivot table.

Nota: **Pivot table primary key**

Avoid using multiple fields in the primary key in a pivot table. QGIS assumes a single primary key so a constraint like `constraint airports_airlines_pkey primary key (airport_fk, airline_fk)` will not work.

14.5 Editando

O QGIS possui vários recursos para editar camadas e tabelas de vetores OGR, SpatiaLite, PostGIS, MSSQL Spatial e Oracle Spatial.

Nota: O procedimento para editar camadas do GRASS é diferente - consulte a seção *Digitalizando e editando uma camada vetorial GRASS* para mais detalhes.

Dica: Edições Simultâneas

Esta versão do QGIS não rastreia se outra pessoa estiver editando o mesmo recurso ao mesmo tempo que você. A última pessoa a salvar as edições vence.

14.5.1 Configurando a Tolerância de Atracção e Raio de Pesquisa

Para uma edição otimizada e precisa das geometrias da camada vetorial, precisamos definir um valor apropriado de tolerância de snap e raio de pesquisa para vértices de feições.

Tolerância de Atração

Quando você adiciona um novo vértice ou move um existente, a tolerância de snap é a distância que o QGIS usa para procurar o vértice ou segmento mais próximo ao qual você está tentando se conectar. Se você não estiver dentro da tolerância de encaixe, o QGIS deixará o vértice onde você solta o botão do mouse, em vez de encaixá-lo em um vértice ou segmento existente.

A configuração de tolerância de encaixe afeta todas as ferramentas que funcionam com tolerância.

Você pode ativar / desativar o snapping usando o | snapping | : sup: *Ative o snapping* no: guilabel:` Snapping Toolbar` ou pressione: kbd: *s*. O modo de encaixe, o valor de tolerância e as unidades também podem ser configurados nesta barra de ferramentas.

A configuração de encaixe também pode ser definida em: seleção de menu: *Projeto -> Opções de encaixe ...*.

Existem três opções para selecionar as camadas nas quais ajustar:

- : guilabel: *Todas as camadas*: configuração rápida para todas as camadas visíveis no projeto, para que o ponteiro se encaixe em todos os vértices e / ou segmentos. Na maioria dos casos, é suficiente usar esse modo de ajuste, mas tenha cuidado ao usá-lo em projetos com muitas camadas de vetores, pois isso pode afetar o desempenho.
- : guilabel: *Camada atual*: somente a camada ativa é usada, uma maneira conveniente de garantir consistência topológica na camada que está sendo editada.
- *Advanced Configuration*: allows you to enable and adjust snapping mode and tolerance on a layer basis (see Fig.14.84). If you need to edit a layer and snap its vertices to another, make sure that the target layer is checked and increase the snapping tolerance to a higher value. Snapping will not occur to a layer that is not checked in the snapping options dialog.

Quanto ao modo de encaixe, você pode escolher entre `` Para o vértice``, `` Para o segmento`` e `` Para o vértice e o segmento``.

Os valores de tolerância podem ser definidos nas `` unidades de mapa`` do projeto ou em `` pixels``. A vantagem de escolher `` pixels '' é que ele mantém o snap constante em diferentes escalas do mapa. 10 a 12 pixels é normalmente um bom valor, mas depende do DPI da sua tela. O uso de unidades de mapa permite que a tolerância esteja relacionada às distâncias reais do solo. Por exemplo, se você tem uma distância mínima entre elementos, essa opção pode ser útil para garantir que você não adicione vértices muito próximos um do outro.

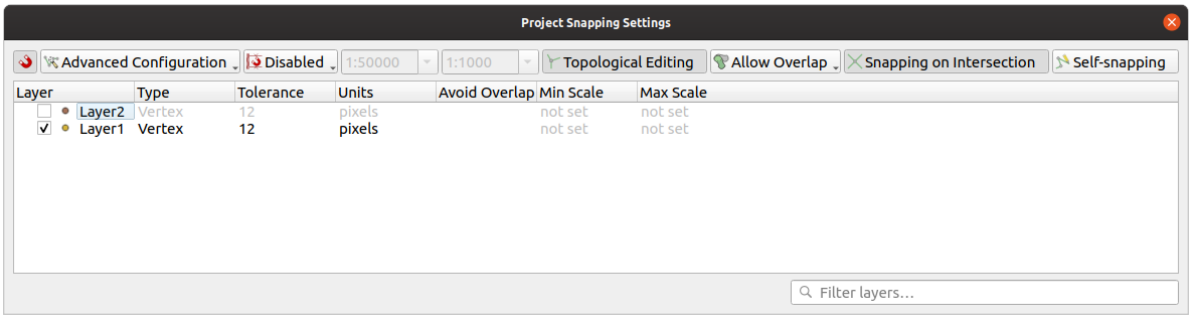


Figura14.84: Opções de ajuste (modo de configuração avançada)

Nota: Por padrão, somente os recursos visíveis (os recursos cujo estilo é exibido, exceto as camadas em que a simbologia é "Nenhum símbolo") podem ser ajustados. Você pode ativar o snap em recursos invisíveis marcando | desmarcado | : guilabel: *Habilite o snap em recursos invisíveis* na seção: menuselection:` Settings -> Options -> Digitizing`

Dica: ** Ativar ajuste por padrão **

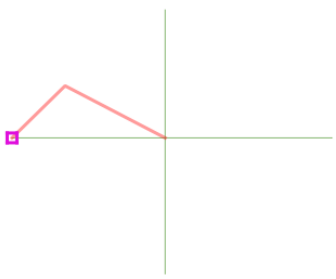
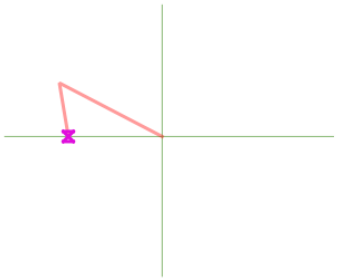
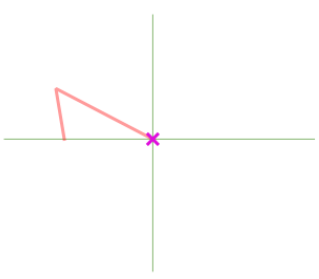
Você pode definir o encaixe para ser ativado por padrão em todos os novos projetos na: menuselection: *Settings -> Options -> Digitizing* Você também pode definir o modo de snap padrão, o valor de tolerância e as unidades, que preencherão a caixa de diálogo: guilabel: opções de snap.

Activar atracção nas intersecções

Outra opção disponível é usar | snappingIntersection | : guilabel: *encaixe na interseção*, que permite encaixar nas interseções geométricas das camadas habilitadas para encaixe, mesmo que não haja vértices nas interseções.

Snapping icons

QGIS will show different *snap* icons depending on the kind of *snap*:

		
Snapping to a vertex: box icon	Snapping to a segment: hourglass icon	Snapping to an intersection: cross icon

Note that it is possible to change the color of these icons in the *Digitizing* part of your settings.

Raio de pesquisa

: guilabel: *Raio de pesquisa por edições de vértices* é a distância que o QGIS usa para` *pesquisar*` o vértice a ser selecionado quando você clica no mapa. Se você não estiver dentro do raio de pesquisa, o QGIS não encontrará e selecionará nenhum vértice para edição. O raio de pesquisa para edições de vértices pode ser definido em: menuselection: *Settings* -> | options | : menuselection: aba *Options* -> *Digitizing* (é aqui que você define os valores padrão do snap).

A tolerância ao snap e o raio de pesquisa são definidos em `` unidades de mapa`` ou `` pixels``. Pode ser necessário experimentar para acertar. Se você especificar uma tolerância muito grande, o QGIS poderá se ajustar ao vértice errado, especialmente se você estiver lidando com um grande número de vértices nas proximidades. Quanto menor o raio de pesquisa, mais difícil será atingir o que você deseja mover.

Limit snapping to a scale range

In some cases snapping can become very slow. This is often caused by the amount of features in some layers that require a heavy index to compute and maintain. Some parameters exist to enable snapping only when the map view is inside a relevant scale range. This allows to only do the costly index computation related to snapping at a scale where drawing is relevant.

Scale limit to snapping is configured in *Project* ► *Snapping Options…*. Limiting snapping to scale is only available in *Advanced Configuration* mode.

To limit snapping to a scale range you have three modes available:

- *Disabled*: Snapping is enabled whatever the current map scale is. This is the default mode.
- *Global*: Snapping is limited and only enabled when the current scale of the map is between a global minimum and a global maximum value. When selecting this mode two widgets become available to configure the range of scales in which snapping is enabled.
- *Per layer*: The snapping scale range limit is defined for each layer. When selecting this mode two columns become available to configure the minimum and maximum scales for each layer.

Please note that the minimum and maximum scales follow the QGIS convention: minimum scale is the most "zoomed out" scale while maximum scale is the most "zoomed in". A minimum or maximum scale that is set to "0" or "not set" is considered not limiting.

14.5.2 Edição Topológica

In addition to these snapping options, the *Snapping options…* dialog (*Project* ► *Snapping options*) and the *Snapping* toolbar allow you to enable / disable some other topological functionalities.

Ativar edição topológica

A | edição topopológica | : sup: botão *Edição topológica* ajuda na edição e manutenção de recursos com limites comuns. Com esta opção ativada, o QGIS 'detecta' limites compartilhados. Quando você move vértices / segmentos comuns, o QGIS também os move nas geometrias dos recursos vizinhos.

A edição topológica funciona com recursos de diferentes camadas, desde que as camadas estejam visíveis e no modo de edição.

Evite a sobreposição de novos polígonos

Quando o modo de ajuste é definido como `` Configuração avançada``, para camadas de polígono, existe uma opção chamada | checkbox | : guilabel: *Evite sobreposição*. Essa opção impede que você desenhe novos recursos que se sobrepõem aos existentes na camada selecionada, acelerando a digitalização de polígonos adjacentes.

Com a opção Evitar sobreposição ativada, se você já possui um polígono, pode digitalizar um segundo para que eles se cruzem. O QGIS cortará o segundo polígono no limite do existente. A vantagem é que você não precisa digitalizar todos os vértices do limite comum.

Nota: Se a nova geometria for totalmente coberta pelas existentes, ela será limpa e o QGIS mostrará uma mensagem de erro.

Aviso: ** Use com cuidado a opção **: guilabel: *Evitar sobreposição* ** **

Como essa opção cortará novas geometrias sobrepostas de qualquer camada de polígono, você poderá obter geometrias inesperadas se esquecer de desmarcá-la quando não for mais necessária.

Verificador de Geometria

Um plug-in principal pode ajudar o usuário a encontrar a invalidez da geometria. Você pode encontrar mais informações sobre este plugin em: ref: *geometry_checker*.

Rastreamento automático

Geralmente, ao usar as ferramentas de captura de mapas (adicionar recurso, adicionar peça, adicionar anel, remodelar e dividir), você precisa clicar em cada vértice do recurso. Com o modo de rastreamento automático, você pode acelerar o processo de digitalização, pois não precisa mais colocar manualmente todos os vértices durante a digitalização:

1. Ative o | rastreio | : sup: *Tracing* (na barra de ferramentas: guilabel:` Snapping`) pressionando o ícone ou pressionando: kbd: tecla *T*.
2. : ref: *Ajustar para* um vértice ou segmento de um recurso que você deseja rastrear.
3. Move the mouse over another vertex or segment you'd like to snap and, instead of the usual straight line, the digitizing rubber band represents a path from the last point you snapped to the current position. The tool also works with curved geometries.

   O QGIS realmente usa a topologia de recursos subjacente para criar o caminho mais curto entre os dois pontos. O rastreamento exige que o snap seja ativado em camadas rastreáveis para criar o caminho. Você também deve encaixar em um vértice ou segmento existente ao digitalizar e garantir que os dois nós sejam topologicamente conectáveis pelas bordas dos recursos existentes; caso contrário, o QGIS não poderá conectá-los e, portanto, traçará uma única linha reta.
4. Clique e QGIS posiciona os vértices intermediários seguindo o caminho exibido.

Desdobre o | rastreio | : sup: *Ative o rastreio* e defina a opção: guilabel:` Offset` para digitalizar um caminho paralelo aos recursos em vez de rastreá-los. Um valor positivo desloca o novo desenho para o lado esquerdo da direção de rastreamento e um valor negativo faz o oposto.

Nota: ** Ajuste as configurações de escala ou ajuste do mapa para um rastreamento ideal **

Se houver muitos recursos na exibição do mapa, o rastreamento será desativado para evitar a preparação potencialmente longa da estrutura de rastreamento e a sobrecarga de memória. Após ampliar ou desativar algumas camadas, o rastreamento é ativado novamente.

Nota: ** Não adiciona pontos topológicos **

Esta ferramenta não adiciona pontos às geometrias poligonais existentes, mesmo que: guilabel: *Edição topológica* esteja ativada. Se a precisão da geometria estiver ativada na camada editada, a geometria resultante poderá não seguir exatamente uma geometria existente.

Dica: ** Ative ou desative rapidamente o rastreio automático pressionando a tecla **: kbd: *T* **

Pressionando a tecla: kbd: *T*, o rastreamento pode ser ativado / desativado a qualquer momento (mesmo durante a digitalização de um recurso), para que seja possível digitalizar partes do recurso com o rastreamento ativado e outras partes com o rastreamento desativado. As ferramentas se comportam como de costume quando o rastreamento está desativado.

Dica: Convert tracing to curved geometries

By using *Settings* ► *Options* ► *Digitizing* ► *Tracing* you can create curved geometries while digitizing. See *digitizing options*.

14.5.3 Digitalizar uma camada existente

Por padrão, o QGIS carrega camadas somente leitura. Essa é uma salvaguarda para evitar a edição acidental de uma camada, se houver um deslizamento do mouse. No entanto, você pode optar por editar qualquer camada, desde que o provedor de dados a suporte (consulte: ref: *supported_format*), e a fonte de dados subjacente é gravável (ou seja, seus arquivos não são somente leitura).

Dica: ** Restrinja a permissão de edição em camadas dentro de um projeto **

Na tabela: menuselection: *Projeto -> Propriedades ... -> Fontes de dados -> Recursos de camadas*, você pode optar por definir qualquer camada somente leitura, independentemente da permissão do provedor. Essa pode ser uma maneira prática, em um ambiente de vários usuários, para evitar que usuários não autorizados editem camadas por engano (por exemplo, Shapefile), portanto, dados potencialmente corrompidos. Observe que essa configuração se aplica apenas ao projeto atual.

Em geral, as ferramentas para editar camadas vetoriais são divididas em uma barra de ferramentas de digitalização e uma avançada, descritas na seção: ref: *sec_advanced_edit*. Você pode selecionar e desmarcar os dois em: menuelection: *View -> Barras de ferramentas ->*.

Usando as ferramentas básicas de digitalização, você pode executar as seguintes funções:

Ícone	Finalidade	Ícone	Finalidade
	Edições actuais		Alternar edição
	Salvar edições da camada		
	Adicionar novo registro		Add Feature: Capture Point
	Adicionar recurso: Linha de captura		Adicionar recurso: Capturar polígono
Ferramenta de vértice	Ferramenta de Vértice (todas as camadas)	**|Camada ativa da ferramenta vértice|**	Ferramenta Vértice (camada atual)
	Modifique os atributos de todos os recursos selecionados simultaneamente		
	Apagar Selecionados		Cortar Elementos
	Copiar Elementos		Colar Elementos
	Retroceder		Retomar

Edição da Tabela: Edição básica da camada vectorial pela barra de ferramentas

Observe que, ao usar qualquer uma das ferramentas de digitalização, você ainda pode: ref: *ampliar ou deslocar* na tela do mapa sem perder o foco na ferramenta.

Todas as sessões de edição começam escolhendo o | toggleEditing | : sup: *Alterna a edição* encontrada no menu de contexto de uma determinada camada, no diálogo da tabela de atributos, na barra de ferramentas de digitalização ou na seleção: menuselection:` Edit`.

Quando a camada estiver no modo de edição, botões de ferramentas adicionais na barra de ferramentas de edição ficarão disponíveis e os marcadores aparecerão nos vértices de todos os recursos, a menos que: guilabel: *Mostrar marcadores apenas para os recursos selecionados* opção em: menuelection:` Settings -> Opções ... -> O menu Digitalizar` está marcado.

Dica: Salvar Regularmente

Remember to  Save Layer Edits regularly. This will also check that your data source can accept all the changes.

Adicionando Elementos

Dependendo do tipo de camada, você pode usar o | newTableRow | : sup: *Adicionar registro*, | capturePoint | : sup: *Adicionar recurso de ponto*, | captureLine | : sup: *Adicionar recurso de linha* ou | capturePolygon | : sup: ícones Adicionar recurso de polígono na barra de ferramentas para adicionar novos recursos à camada atual.

Para adicionar um recurso sem geometria, clique no | newTableRow | : sup: botão Adicionar registro e você pode inserir atributos no formulário do recurso que é aberto. Para criar recursos com as ferramentas ativadas espacialmente, primeiro digitalize a geometria e, em seguida, insira seus atributos. Para digitalizar a geometria:

1. Clique com o botão esquerdo na área do mapa para criar o primeiro ponto do seu novo recurso. Para recursos de ponto, isso deve ser suficiente e acionar, se necessário, o formulário de recurso para preencher seus atributos. Após definir: ref: *geometry precision* nas propriedades da camada, você pode usar: ref: *snap to grid* aqui para criar recursos com base em uma distância regular.
2. Para geometrias de linha ou polígono, clique com o botão esquerdo do mouse em cada ponto adicional que você deseja capturar ou usar: ref: *rastreio automático* capacidade de acelerar a digitalização. Isso criará linhas retas consecutivas entre os vértices que você coloca.

Nota: Pressionar: kbd: *Excluir* ou: kbd: tecla Backspace `reverte o último nó y ou adicione.

3. Quando você terminar de adicionar pontos, clique com o botão direito do mouse em qualquer lugar na área do mapa para confirmar que você terminou de inserir a geometria desse recurso.

Nota: Ao digitalizar geometrias de linhas ou polígonos, você pode alternar entre linear: guilabel: *Adicionar recurso `tools e: ref:* ferramentas de cordas circulares `para criar geometrias curvas compostas.

Dica: ** Personalize a faixa de borracha digitalizada **

Ao capturar o polígono, o elástico vermelho por padrão pode ocultar recursos ou locais subjacentes que você deseja capturar um ponto. Isso pode ser corrigido configurando uma opacidade mais baixa (ou canal alfa) no menu: guilabel: *Cor de preenchimento* do elástico em: seleção de menu: *Configurações -> Opções -> Digitalização*. Você também pode evitar o uso do elástico marcando: guilabel: *Não atualize o elástico durante a edição do nó*.

4. The attribute window will appear, allowing you to enter the information for the new feature. Fig.14.85 shows setting attributes for a fictitious new river in Alaska. However, in the *Digitizing* menu under the *Settings* ► *Options* menu, you can also activate:

   - *Suppress attributes pop-up windows after each created feature* to avoid the form opening;
   - ou | caixa de seleção | : guilabel: *Reutilizar os últimos valores de atributo inseridos* para ter campos automaticamente preenchidos na abertura do formulário e apenas digitar valores alterados.

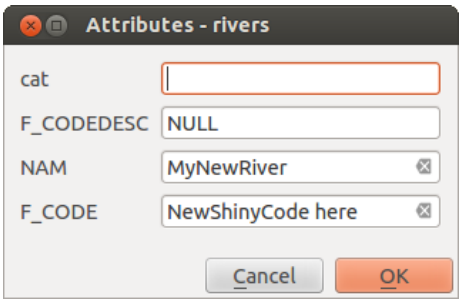


Figura14.85: Caixa de diálogo Inserir valores de atributo após digitalizar um novo recurso de vetor

Ferramenta Vertex

Nota: ** QGIS 3 grandes mudanças **

No QGIS 3, a ferramenta do nó foi totalmente redesenhada e renomeada para * ferramenta de vértice *. Ele estava trabalhando anteriormente com a ergonomia “clique e arraste” e agora usa um fluxo de trabalho “clique e clique”. Isso permite grandes melhorias, como tirar proveito do painel de digitalização avançado com a ferramenta vértice, enquanto digitaliza ou edita objetos de várias camadas ao mesmo tempo.

For any editable vector layer, the Vertex tool (Current Layer) provides manipulation capabilities of feature vertices similar to CAD programs. It is possible to simply select multiple vertices at once and to move, add or delete them altogether. The vertex tool also supports the topological editing feature. This tool is selection persistent, so when some operation is done, selection stays active for this feature and tool.

It is important to set the property *Settings* ► *Options* ► *Digitizing* ► *Search Radius:* 1,00 to a number greater than zero. Otherwise, QGIS will not be able to tell which vertex is being edited and will display a warning.

Dica: Marcadores de Vértice

A versão atual do QGIS suporta três tipos de marcadores de vértice: 'Círculo semitransparente', 'Cruz' e 'Nenhum'. Para alterar o estilo do marcador, escolha | opções | : menuselection: *Options* no menu: menu:` Settings *, clique na guia: guilabel:* Digitizing `e selecione a entrada apropriada.

Operações Básicas

Comece ativando a | Camada ativa da ferramenta | vértice | : sup: *Ferramenta Vertex (camada atual)*. Círculos vermelhos aparecerão ao pairar vértices.

- **Selecting vertices**: You can select vertices by clicking on them one at a time holding `Shift` key pressed, or by clicking and dragging a rectangle around some vertices. When a vertex is selected, its color changes to blue. To add more vertices to the current selection, hold down the `Shift` key while clicking. To remove vertices from the selection, hold down `Ctrl`.
- **Batch vertex selection mode**: The batch selection mode can be activated by pressing `Shift+R`. Select a first node with one single click, and then hover **without clicking** another vertex. This will dynamically select all the nodes in between using the shortest path (for polygons).

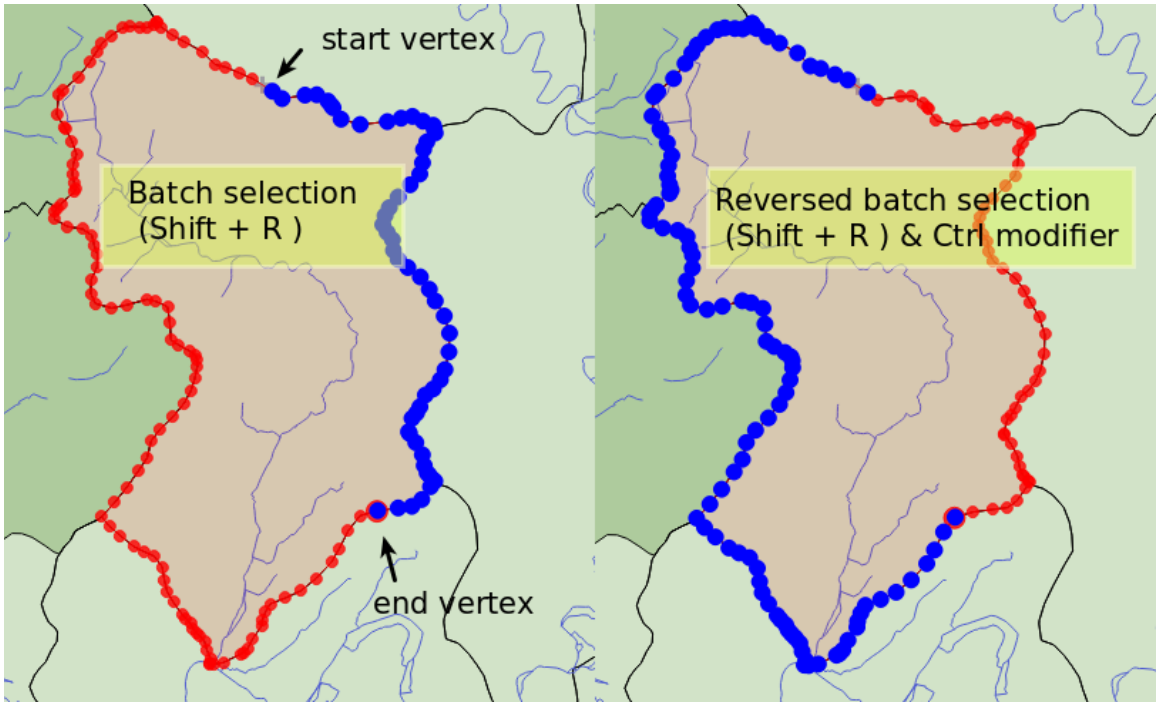


Figura14.86: Batch vertex selection using `Shift+R`

  Press `Ctrl` will invert the selection, selecting the longest path along the feature boundary. Ending your node selection with a second click, or pressing `Esc` will escape the batch mode.

- **Adding vertices**: To add a vertex, a virtual new node appears on the segment center. Simply grab it to add a new vertex. A double-click on any location of the boundary also creates a new node. For lines, a virtual node is also proposed at both extremities of a line to extend it.

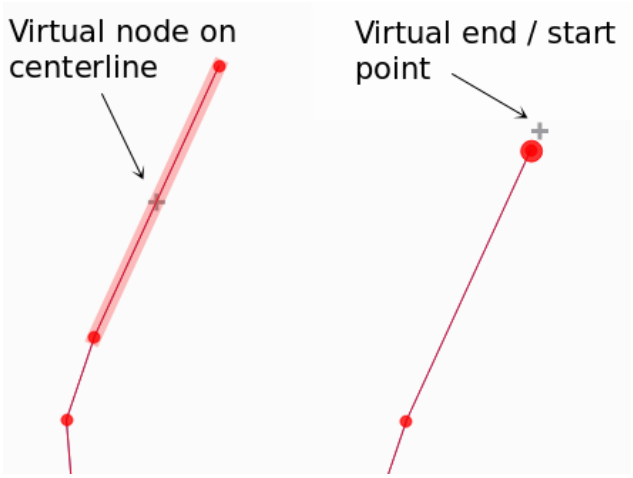


Figura14.87: Nós virtuais para adicionar vértices

- ** Excluindo vértices **: selecione os vértices e clique na tecla: kbd: *Excluir*. A exclusão de todos os vértices de um recurso gera, se compatível com a fonte de dados, um recurso sem geometria. Observe que isso não exclui o recurso completo, apenas a parte da geometria. Para excluir um recurso completo, use o | deleteSelectedFeatures | : sup: ferramenta *Excluir selecionados*.
- **Moving vertices**: Select all the vertices you want to move, click on a selected vertex or edge, and click again on the desired new location. All the selected vertices will move together. If snapping is enabled, the whole selection can jump to the nearest vertex or line. You can use Advanced Digitizing Panel constraints for distance, angles, exact X Y location before the second click.

  Here you can use the snap-to-grid feature. Having set a value for the *geometry precision* in the layer properties, a grid appears on a zoom level according to the Geometry precision.

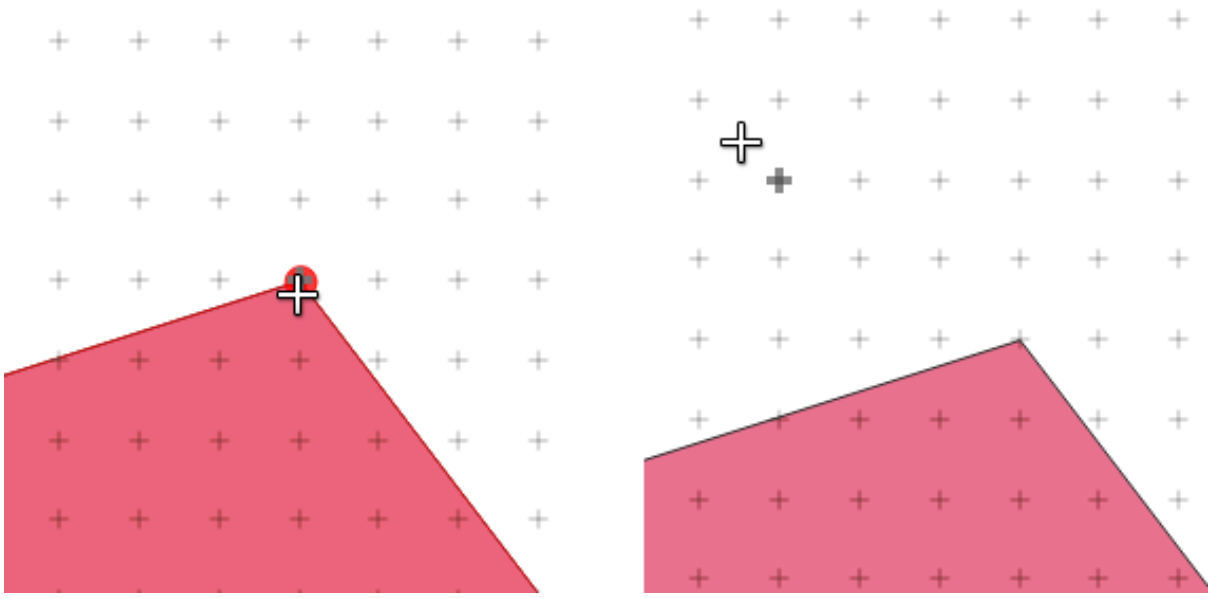


Figura14.88: Selecionando um vértice e movendo os vértices para a grade

Each change made with the vertex is stored as a separate entry in the *Undo* dialog. Remember that all operations support topological editing when this is turned on. On-the-fly projection is also supported, and the vertex tool provides tooltips to identify a vertex by hovering the pointer over it.

O painel do editor de vértices

When using the *Vertex tool* on a feature, it is possible to right click to open the *Vertex Editor* panel listing all the vertices of the feature with their *x*, *y* (*z*, *m* if applicable) coordinates and *r* (for the radius, in case of circular geometry). Simply select a row in the table does select the corresponding vertex in the map canvas, and vice versa. Simply change a coordinate in the table and your vertex position is updated. You can also select multiple rows and delete them altogether.

Nota: ** Comportamento alterado no QGIS 3.4 **

Right click on a feature will immediately show the vertex editor and lock this feature, thus disabling the editing of any other features. While being locked, a feature is exclusive for editing: Selecting and moving of vertices and segments by clicking or dragging is only possible for this feature. New vertices can only be added to the locked feature. Also, the vertex editor panel now opens itself automatically upon activating the vertex tool, and its position/docked state remembered across uses.

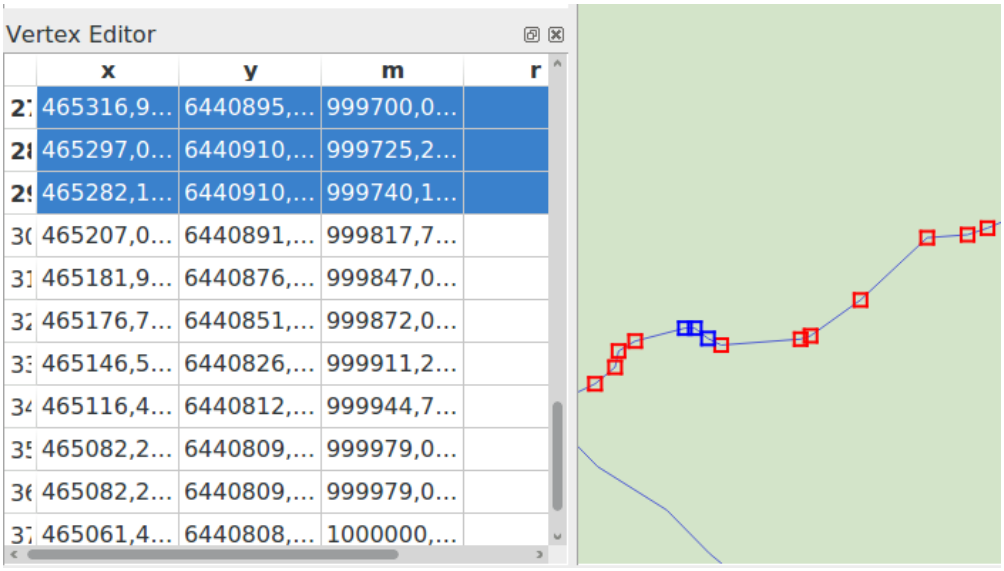


Figura14.89: Painel do editor de vértices mostrando os nós selecionados

Cortando, Copiando e Colando Elementos

Os recursos selecionados podem ser recortados, copiados e colados entre as camadas no mesmo projeto QGIS, desde que as camadas de destino estejam definidas como | toggleEditing | : sup: *Alterna a edição* de antemão.

Dica: ** Transforme o polígono em linha e vice-versa usando copiar / colar **

Copie um recurso de linha e cole-o em uma camada de polígono: O QGIS cola na camada de destino um polígono cujo limite corresponde à geometria fechada do recurso de linha. Essa é uma maneira rápida de gerar geometrias diferentes dos mesmos dados.

Features can also be pasted to external applications as text. That is, the features are represented in CSV format, with the geometry data appearing in the OGC Well-Known Text (WKT) format. WKT and GeoJSON features from outside QGIS can also be pasted to a layer within QGIS.

When would the copy and paste function come in handy? Well, it turns out that you can edit more than one layer at a time and copy/paste features between layers. Why would we want to do this? Say we need to do some work on a new layer but only need one or two lakes, not the 5,000 on our `big_lakes` layer. We can create a new layer and use copy/paste to plop the needed lakes into it.

Como exemplo, vamos copiar alguns lagos para uma nova camada:

1. Carregue a camada que quer copiar a partir (camada de origem)
2. Carregue ou crie a camada que quer copiar para (camada de destino)
3. Começar a editar a camada de destino
4. Ative a camada de origem clicando nela na legenda
5. Use the  Select Features by area or single click tool to select the feature(s) on the source layer
6. Click on the  Copy Features tool
7. Ative a camada de destino clicando na legenda
8. Clique no | editar Colar | : sup: ferramenta *Colar recursos*
9. Parar a edição e salvar as alterações

What happens if the source and target layers have different schemas (field names and types are not the same)? QGIS populates what matches and ignores the rest. If you don't care about the attributes being copied to the target layer, it doesn't matter how you design the fields and data types. If you want to make sure everything - the feature and its attributes - gets copied, make sure the schemas match.

Nota: Congruência dos Elementos Colados

If your source and destination layers use the same projection, then the pasted features will have geometry identical to the source layer. However, if the destination layer is a different projection, then QGIS cannot guarantee the geometry is identical. This is simply because there are small rounding-off errors involved when converting between projections.

Dica: ** Copiar atributo da string para outro **

If you have created a new column in your attribute table with type 'string' and want to paste values from another attribute column that has a greater length the length of the column size will be extended to the same amount. This is because the GDAL Shapefile driver starting with GDAL/OGR 1.10 knows to auto-extend string and integer fields to dynamically accommodate for the length of the data to be inserted.

Apagando os Elementos Selecionados

Se quisermos excluir um recurso inteiro (atributo e geometria), podemos fazer isso selecionando primeiro a geometria usando o regular | select Rectangle | : sup: *Selecione Recursos por área ou clique único*. A seleção também pode ser feita na tabela de atributos. Depois de definir a seleção, pressione: kbd: *Excluir* ou: kbd: *Backspace* ou use a tecla | delete Features Selecionadas | : sup: ferramenta *Delete Selected* para excluir os recursos. Vários recursos selecionados podem ser excluídos de uma só vez.

The  Cut Features tool on the digitizing toolbar can also be used to delete features. This effectively deletes the feature but also places it on a "spatial clipboard". So, we cut the feature to delete. We could then use the  Paste Features tool to put it back, giving us a one-level undo capability. Cut, copy, and paste work on the currently selected features, meaning we can operate on more than one at a time.

Retroceder e Retomar

The Undo and Redo tools allows you to undo or redo vector editing operations. There is also a dockable widget, which shows all operations in the undo/redo history (see Fig.14.90). This widget is not displayed by default; it can be displayed by right-clicking on the toolbar and activating the *Undo/Redo Panel* checkbox. The Undo/Redo capability is however active, even if the widget is not displayed.

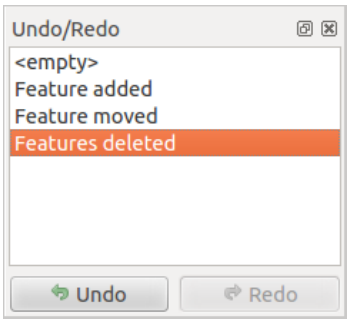


Figura14.90: Refazer e desfazer etapas de digitalização

When Undo is hit or `Ctrl+Z` (or `Cmd+Z`) pressed, the state of all features and attributes are reverted to the state before the reverted operation happened. Changes other than normal vector editing operations (for example, changes done by a plugin) may or may not be reverted, depending on how the changes were performed.

Para usar a tela histórico de desfazer / refazer, basta clicar para selecionar uma operação na lista de histórico. Todas as feições serão revertidas para o estado em que estavam depois da operação selecionada.

Salvando as Camadas Editadas

When a layer is in editing mode, any changes remain in the memory of QGIS. Therefore, they are not committed/saved immediately to the data source or disk. If you want to save edits to the current layer but want to continue editing without leaving the editing mode, you can click the Save Layer Edits button. When you turn editing mode off with Toggle editing (or quit QGIS for that matter), you are also asked if you want to save your changes or discard them.

Se as alterações não puderem ser salvas (por exemplo, disco cheio ou os atributos tiverem valores fora do intervalo), o estado na memória do QGIS será preservado. Isso permite que você ajuste suas edições e tente novamente.

Dica: Integridade dos dados

É sempre uma boa idéia fazer backup da fonte de dados antes de começar a editar. Embora os autores do QGIS tenham se esforçado para preservar a integridade dos seus dados, não oferecemos garantia a esse respeito.

Salvando várias camadas ao mesmo tempo

Esse recurso permite a digitalização de várias camadas. Escolha | arquivo Salvar como | : guilabel: *Salvar para camadas selecionadas* para salvar todas as alterações feitas em várias camadas. Você também tem a oportunidade de | reverter edições | : guilabel: *Reversão para camadas selecionadas*, para que a digitalização possa ser retirada para todas as camadas selecionadas. Se você deseja parar de editar as camadas selecionadas, cancele Edições | : guilabel: *Cancelar para a (s) camada (s) selecionada (s)* é uma maneira fácil.

As mesmas funções estão disponíveis para a edição de todas as camadas do projeto.

Dica: ** Use o grupo de transações para editar, salvar ou reverter várias alterações de camada ao mesmo tempo **

When working with layers from the same PostGreSQL database, activate the *Automatically create transaction groups where possible* option in *Project* ► *Properties…* ► *Data Sources* to sync their behavior (enter or exit the edit mode, save or rollback changes at the same time).

14.5.4 Digitalização Avançada

Ícone	Finalidade	Ícone	Finalidade
	Ativar ferramentas avançadas de digitalização		Ativar rastreamento
	Mover feições	mover cópia de recurso | | mover Linha de Cópia de Recursos | | mover Ponto de Cópia de Recurso |	Copy and Move Feature(s)
	Rodar Elemento(s)		Simplificar elemento
	Adicionar Anel		Adicionar Parte
	Preenchimento Anel		Swap direction
	Apagar Anel		Apagar Parte
	Curva de Afastamento		Refazer elementos
	Dividindo partes		Dividir Elementos
	Juntar Atributos dos Elementos Selecionados		Juntar Elementos Selecionados
	Rodar Símbolos de Pontos		Offset Point Symbols
	Trim or Extend Feature		

Tabela de edição avançada: Barra de ferramentas de edição avançada de camadas vetoriais

Mover feições

The  Move Feature(s) tool allows you to move existing features:

1. Select the feature(s) to move.
2. Click on the map canvas to indicate the origin point of the displacement; you can rely on snapping capabilities to select an accurate point.

   You can also take advantages of the *advanced digitizing constraints* to accurately set the origin point coordinates. In that case:

   1. Primeiro clique no | cad | para ativar o painel.

2. Digite `` x`` e insira o valor correspondente ao ponto de origem que você deseja usar. Em seguida, pressione o botão | bloqueado | ao lado da opção para bloquear o valor.
3. Do the same for the `y` coordinate.
4. Click on the map canvas and your origin point is placed at the indicated coordinates.

3. Move over the map canvas to indicate the destination point of the displacement, still using snapping mode or, as above, use the advanced digitizing panel which would provide complementary `distance` and `angle` placement constraints to place the end point of the translation.
4. Click on the map canvas: the whole features are moved to new location.

Likewise, you can create a translated copy of the feature(s) using the  Copy and Move Feature(s) tool.

Nota: If no feature is selected when you first click on the map canvas with any of the *Move Feature(s)* or *Copy and Move Feature(s)* tools, then only the feature under the mouse is affected by the action. So, if you want to move several features, they should be selected first.

Rodar Elemento(s)

Use the  Rotate Feature(s) tool to rotate one or multiple features in the map canvas:

1. Press the  Rotate Feature(s) icon
2. Then click on the feature to rotate. The feature's centroid is referenced as rotation center, a preview of the rotated feature is displayed and a widget opens showing the current *Rotation* angle.
3. Click on the map canvas when you are satisfied with the new placement or manually enter the rotation angle in the text box. You can also use the *Snap to* ° box to constrain the rotation values.
4. If you want to rotate several features at once, they shall be selected first, and the rotation is by default around the centroid of their combined geometries.

You can also use an anchor point different from the default feature centroid: press the `Ctrl` button, click on the map canvas and that point will be used as the new rotation center.

If you hold `Shift` before clicking on the map, the rotation will be done in 45 degree steps, which can be modified afterwards in the user input widget.

To abort feature rotation, press the `ESC` button or click on the  Rotate Feature(s) icon.

Simplificar elemento

The  Simplify Feature tool allows you to interactively reshape a line or polygon geometry by reducing or densifying the number of vertices, as long as the geometry remains valid:

1. Select the  Simplify Feature tool.
2. Click on the feature or drag a rectangle over the features.
3. A dialog pops up allowing you to define the *Method* to apply, ie whether you would like to:
   - *simplify the geometry*, meaning less vertices than the original. Available methods are `Simplify by distance`, `Simplify by snapping to grid` or `simplify by area (Visvalingam)`. You'd then need to indicate the value of *Tolerance* in `Layer units`, `Pixels` or `map units` to use for simplification. The higher the tolerance is the more vertices can be deleted.

- or *densify the geometries* with new vertices thanks to the `Smooth` option: for each existing vertex, two vertices are placed on each of the segments originated from it, at an *Offset* distance representing the percentage of the segment length. You can also set the number of *Iterations* the placement would be processed: the more iterations, the more vertices and smoother is the feature.

Settings that you used will be saved when leaving a project or an edit session. So you can go back to the same parameters the next time you simplify a feature.

4. A summary of the modifications that would apply is shown at the bottom of the dialog, listing number of features and number of vertices (before and after the operation and the ratio the change represents). Also, in the map canvas, the expected geometry is displayed over the existing one, using the rubberband color.
5. When the expected geometry fits your needs, click *OK* to apply the modification. Otherwise, to abort the operation, you can either press *Cancel* or right-click in the map canvas.

Nota: Unlike the feature simplification option in *Settings* ► *Options* ► *Rendering* menu which simplifies the geometry just for rendering, the  Simplify Feature tool permanently modifies feature's geometry in data source.

Adicionar Parte

You can  Add Part to a selected feature generating a multipoint, multiline or multipolygon feature. The new part must be digitized outside the existing one which should be selected beforehand.

The  Add Part can also be used to add a geometry to a geometryless feature. First, select the feature in the attribute table and digitize the new geometry with the  Add Part tool.

Apagar Parte

The  Delete Part tool allows you to delete parts from multifeatures (e.g., to delete polygons from a multi-polygon feature). This tool works with all multi-part geometries: point, line and polygon. Furthermore, it can be used to totally remove the geometric component of a feature. To delete a part, simply click within the target part.

Adicionar Anel

You can create ring polygons using the  Add Ring icon in the toolbar. This means that inside an existing area, it is possible to digitize further polygons that will occur as a 'hole', so only the area between the boundaries of the outer and inner polygons remains as a ring polygon.

Preenchimento Anel

The  Fill Ring tool helps you create polygon feature that totally falls within another one without any overlapping area; that is the new feature covers a hole within the existing one. To create such a feature:

1. Select the  Fill Ring tool.
2. Desenhe um novo polígono sobre o recurso existente: o QGIS adiciona um anel à sua geometria (como se você usasse a ferramenta | addRing |: sup: *Add Ring*) e cria um novo recurso cuja geometria corresponde ao anel (como se você: ref : *traçado* sobre os limites internos com a ferramenta | capturePolygon |: sup: *Adicionar recurso de polígono*).

3. Or alternatively, if the ring already exists on the feature, place the mouse over the ring and left-click while pressing `Shift`: a new feature filling the hole is drawn at that place.

   The *Feature Attributes* form of the new feature opens, pre-filled with values of the "parent" feature and/or *fields constraints*.

Apagar Anel

The Delete Ring tool allows you to delete rings within an existing polygon, by clicking inside the hole. This tool only works with polygon and multi-polygon features. It doesn't change anything when it is used on the outer ring of the polygon.

Refazer elementos

You can reshape line and polygon features using the Reshape Features tool on the toolbar. For lines, it replaces the line part from the first to the last intersection with the original line.

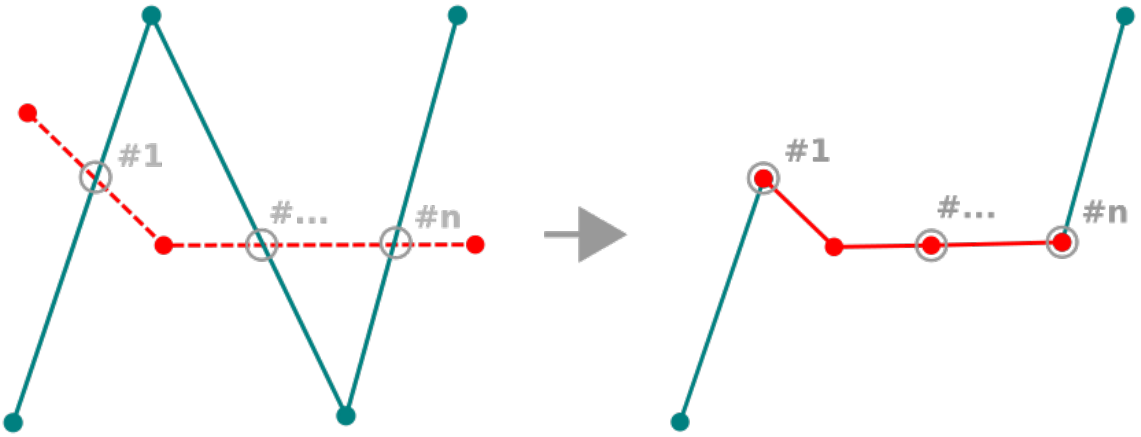


Figura14.91: Reshape line

Dica: Extend linestring geometries with reshape tool

Use the Reshape Features tool to extend existing linestring geometries: snap to the first or last vertex of the line and draw a new one. Validate and the feature's geometry becomes the combination of the two lines.

For polygons, it will reshape the polygon's boundary. For it to work, the reshape tool's line must cross the polygon's boundary at least twice. To draw the line, click on the map canvas to add vertexes. To finish it, just right-click. Like with the lines, only the segment between the first and the last intersections is considered. The reshape line's segments that are inside the polygon will result in cropping it, where the ones outside the polygon will extend it.

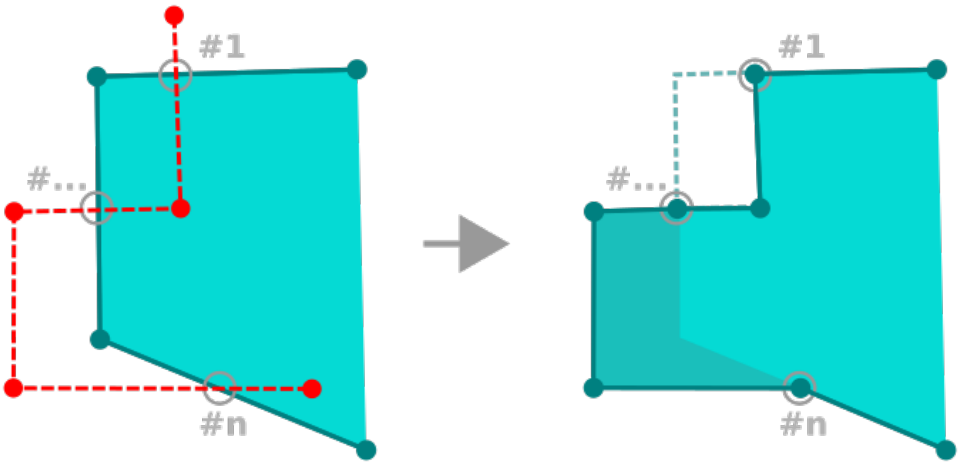


Figura14.92: Reshape polygon

With polygons, reshaping can sometimes lead to unintended results. It is mainly useful to replace smaller parts of a polygon, not for major overhauls, and the reshape line is not allowed to cross several polygon rings, as this would generate an invalid polygon.

Nota: A ferramenta de mudança de forma pode alterar a posição inicial de um anel ou de uma linha poligonal fechada. Assim, o ponto que está representada 'duas vezes' não será o mesmo mais. Isto pode não ser um problema para a maioria das aplicações, mas é algo a considerar.

Curvas de Afastamento

The Offset Curve tool creates parallel shifts of line layers. The tool can be applied to the edited layer (the geometries are modified) or also to background layers (in which case it creates copies of the lines / rings and adds them to the edited layer). It is thus ideally suited for the creation of distance line layers. The *User Input* dialog pops-up, showing the displacement distance.

To create a shift of a line layer, you must first go into editing mode and activate the Offset Curve tool. Then click on a feature to shift it. Move the mouse and click where wanted or enter the desired distance in the user input widget. Your changes may then be saved with the Save Layer Edits tool.

QGIS options dialog (Digitizing tab then **Curve offset tools** section) allows you to configure some parameters like **Join style**, **Quadrant segments**, **Miter limit**.

Reverse Line

Changing the direction of a line geometry can be useful for cartographical purposes or when preparing for network analysis.

To change a line direction:

1. Activate the reverse line tool by clicking Reverse line.
2. Click on the line. The direction of the line is reversed.

Dividir Elementos

Use the  Split Features tool to split a feature into two or more new and independent features, ie. each geometry corresponding to a new row in the attribute table.

To split line or polygon features:

1. Select the  Split Features tool.
2. Draw a line across the feature(s) you want to split. If a selection is active, only selected features are split. When set, *default values or clauses* are applied to corresponding fields and other attributes of the parent feature are by default copied to the new features.
3. You can then as usually modify any of the attributes of any resulting feature.

Dica: Split a polyline into new features in one-click

Using the  Split Features tool, snap and click on an existing vertex of a polyline feature to split that feature into two new features.

Dividindo partes

No QGIS, é possível dividir as partes de um recurso de várias partes para aumentar o número de partes. Basta desenhar uma linha na parte que você deseja dividir usando o | peças separadas | : sup: ícone *Split Parts*.

Dica: ** Divida uma polilinha em novas peças com um clique **

Using the  Split Parts tool, snap and click on an existing vertex of a polyline feature to split the feature into two new polylines belonging to the same feature.

Juntar elementos selecionados

The  Merge Selected Features tool allows you to create a new feature by merging existing ones: their geometries are merged to generate a new one. If features don't have common boundaries, a multipolygon/multipolyline/multipoint feature is created.

1. Primeiro, selecione os recursos que você deseja combinar.
2. Em seguida, pressione o | mergeFeatures | : sup: botão "Mesclar recursos selecionados".
3. Na nova caixa de diálogo, a linha: guilabel: *Merge* na parte inferior da tabela mostra os atributos do recurso resultante. Você pode alterar qualquer um desses valores:
   - manually replacing the value in the corresponding cell;
   - selecting a row in the table and pressing *Take attributes from selected feature* to use the values of this initial feature;
   - pressing *Skip all fields* to use empty attributes;
   - or, expanding the drop down menu at the top of the table, select any of the above options to apply to the corresponding field only. There, you can also choose to aggregate the initial features attributes (Minimum, Maximum, Median, Sum, Count, Concatenation… depending on the type of the field. see *O painel Estatísticas* for the full list of functions).

Nota: If the layer has default values or clauses present on fields, these are used as the initial value for the merged feature.

4. Press *OK* to apply the modifications. A single (multi)feature is created in the layer, replacing the previously selected ones.

Juntar os atributos dos elementos selecionados

The Merge Attributes of Selected Features tool allows you to apply same attributes to features without merging their boundaries. The dialog is the same as the `Merge Selected Features` tool's except that unlike that tool, selected objects are kept with their geometry while some of their attributes are made identical.

Rodar Símbolos de Pontos

The Rotate Point Symbols allows you to individually change the rotation of point symbols in the map canvas.

1. First, you need to indicate the field to store the rotation value in. This is made by assigning a field to the symbol *data-defined* rotation property:
   1. In the *Layer Properties* ► *Symbology* dialog, browse to the symbol editor dialog.
   2. Click the *Data-defined override* widget near the *Rotation* option of the top *Marker* level (preferably) of the symbol layers.
   3. Choose a field in the *Field Type* combobox. Values of this field are hence used to rotate each feature's symbol accordingly.

      You can also check the Store data in project entry to generate an *auxiliary data storage* field to control the rotation value.

Nota: Make sure that the same field is assigned to all the symbol layers

A configuração do campo de rotação definido por dados no nível mais alto da árvore de símbolos o propagará automaticamente para todas as camadas de símbolos, um pré-requisito para executar a rotação gráfica de símbolos com a ferramenta: guilabel: *Rotate Point Symbols*. De fato, se uma camada de símbolo não tiver o mesmo campo anexado à sua propriedade de rotação, a ferramenta não funcionará.

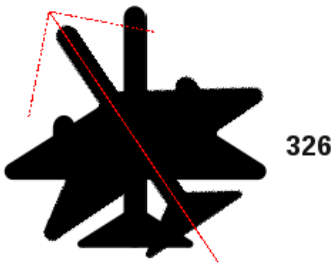


Figura14.93: Girando um símbolo de ponto

2. Then click on a point symbol in the map canvas with the Rotate Point Symbols tool

3. Move the mouse around. A red arrow with the rotation value will be visualized (see Fig.14.93). If you hold the `Ctrl` key while moving, the rotation will be done in 15 degree steps.
4. When you get the expected angle value, click again. The symbol is rendered with this new rotation and the associated field is updated accordingly.

   You can right-click to abort symbol rotation.

Offset Point Symbols

The Offset Point Symbols allows you to interactively change the rendered position of point symbols in the map canvas. This tool behaves like the Rotate Point Symbols tool except that it requires you to connect a field to the data-defined *Offset (X,Y)* property of each layer of the symbol. The field will then be populated with the offset coordinates for the features whose symbol is moved in the map canvas.

1. Associate a field to the data-defined widget of the *Offset (X,Y)* property of the symbol. If the symbol is made with many layers, you may want to assign the field to each of them
2. Select the Offset Point Symbols tool
3. Click a point symbol
4. Move to a new location
5. Click again. The symbol is moved to the new place. Offset values from the original position are stored in the linked field.

   You can right-click to abort symbol offset.

Nota: The Offset Point Symbols tool doesn't move the point feature itself; you should use the Vertex Tool (Current Layer) or Move Feature tool for this purpose.

Recortar / estender o recurso

Quando uma linha digitalizada é muito curta ou muito longa para encaixar em outra linha (faltando ou cruzando a linha), é necessário poder estender ou encurtar o segmento.

The Trim/Extend tool allows you to also modify (multi)lines AND (multi)polygons. Moreover, it is not necessarily the end of the lines that is concerned; any segment of a geometry can be modified.

Nota: Isso pode levar a geometrias inválidas.

Nota: Você deve ativar o snap do segmento para que esta ferramenta funcione.

The tool asks you to select a limit (a segment) with respect to which another segment will be extended or trimmed. Unlike the vertex tool, a check is performed to modify only the layer being edited.

When both segments are in 3D, the tool performs an interpolation on the limit segment to get the Z value.

No caso de um corte, você deve selecionar a parte que será reduzida clicando nela.

14.5.5 Digitalização de forma

The *Shape Digitizing* toolbar offers a set of tools to draw regular shapes and curved geometries.

Add Circular string

The  Add circular string or  Add circular string by radius buttons allow users to add line or polygon features with a circular geometry.

Creating features with these tools follow the same rule as of other digitizing tools: left-click to place vertices and right-click to finish the geometry. While drawing the geometry, you can switch from one tool to the other as well as to the *linear geometry tools*, creating some coumpound geometries.

Nota: Curved geometries are stored as such only in compatible data provider

Although QGIS allows to digitize curved geometries within any editable data format, you need to be using a data provider (e.g. PostGIS, memory layer, GML or WFS) that supports curves to have features stored as curved, otherwise QGIS segmentizes the circular arcs.

Desenhar círculos

Há um conjunto de ferramentas para desenhar círculos. As ferramentas são descritas abaixo.

Circles are converted into circular strings. Therefore, as explained in *Add Circular string*, if allowed by the data provider, it will be saved as a curved geometry, if not, QGIS will segmentize the circular arcs.

-  Add circle from 2 points: The two points define the diameter and the orientation of the circle. (Left-click, right-click)
-  Add circle from 3 points: Draws a circle from three known points on the circle. (Left-click, left-click, right-click)
-  Add circle from center and a point: Draws a circle with a given center and a point on the circle (Left-click, right-click). When used with the *O painel Digitalização avançada* this tool can become a "Add circle from center and radius" tool by setting and locking the distance value after first click.
-  Add circle from 3 tangents: Draws a circle that is tangential to three segments. **Note that you must activate snapping to segments** (See *Configurando a Tolerância de Atracção e Raio de Pesquisa*). Click on a segment to add a tangent. If two tangents are parallel, an error message appears and the input is cleared. (Left-click, left-click, right-click)
-  Add circle from 2 tangents and a point: Similar to circle from 3 tangents, except that you have to select two tangents, enter a radius and select the desired center.

Draw Ellipses

There is a set of tools for drawing ellipses. The tools are described below.

Ellipses cannot be converted as circular strings, so they will always be segmented.

-  Add Ellipse from center and two points: Draws an ellipse with a given center, major axis and minor axis. (Left-click, left-click, right-click)
-  Add Ellipse from center and a point: Draws an ellipse into a bounding box with the center and a corner. (Left-click, right-click)
-  Add Ellipse from extent: Draws an ellipse into a bounding box with two opposite corners. (Left-click, right-click)

- Add Ellipse from foci: Draws an ellipse by 2 points for foci and a point on the ellipse. (Left-click, left-click, right-click)

Draw Rectangles

There is a set of tools for drawing rectangles. The tools are described below.

- Rectangle from center and a point: Draws a rectangle from the center and a corner. (Left-click, right-click)
- Rectangle from extent: Draws a rectangle from two opposite corners. (Left-click, right-click)
- Rectangle from 3 points (distance): Draws an oriented rectangle from three points. The first and second points determine the length and angle of the first edge. The third point determines the length of the other edge. One can use *O painel Digitalização avançada* to set the length of the edges. (Left-click, left-click, right-click)
- Rectangle from 3 points (projected): Same as the preceding tool, but the length of the second edge is computed from the projection of the third point on the first edge. (Left-click, left-click, right-click)

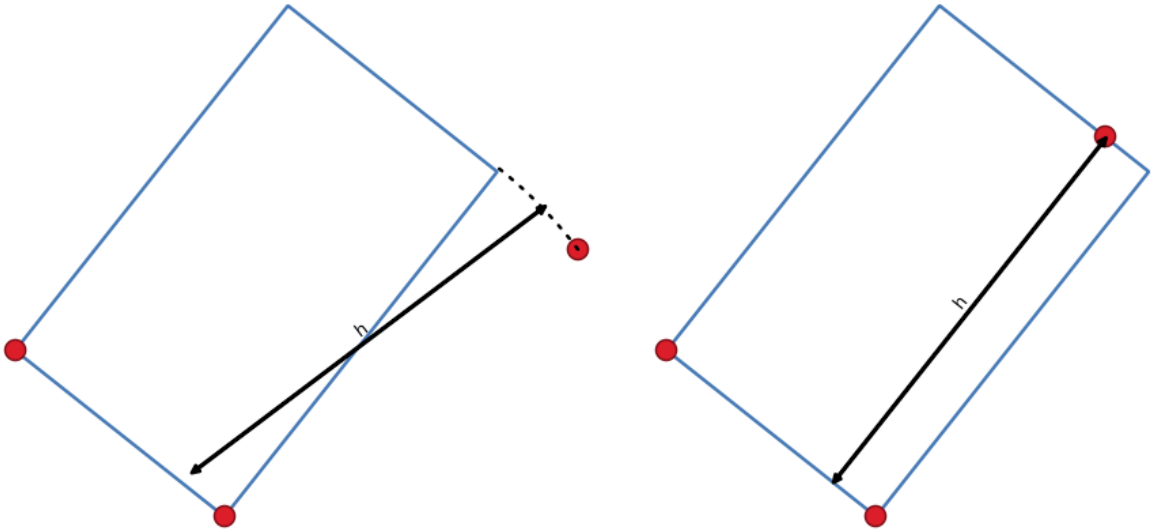


Figura14.94: Draw rectangle from 3 points using distance (right) and projected (left)

Draw Regular Polygons

There is a set of tools for drawing regular polygons. The tools are described below. Left-click to place the first point. A dialog appears, where you can set the number of polygon edges. Right-click to finish the regular polygon.

- Regular polygon from two points: Draws a regular polygon where the two points determine the length and angle of the first edge.
- Regular polygon from center and a point: Draws a regular polygon from the provided center point. The second point determines the angle and distance to the middle of an edge.
- Regular polygon from center and a corner: Same as the preceding tool, but the second point determines the angle and distante to a vertex.

14.5.6 O painel Digitalização avançada

When capturing, reshaping, splitting new or existing geometries you also have the possibility to use the Advanced Digitizing panel. You can digitize lines exactly parallel or perpendicular to a particular angle or lock lines to specific angles. Furthermore, you can enter coordinates directly so that you can make a precise definition of your new geometry.

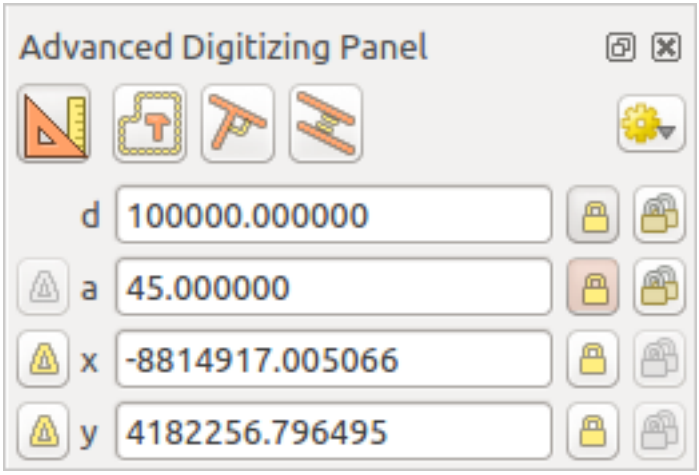


Figura14.95: O painel Digitalização avançada

The *Advanced Digitizing* panel can be open either with a right-click on the toolbar, from *View* ► *Panels* ► menu or pressing `Ctrl+4`. Once the panel is visible, click the Enable advanced digitizing tools button to activate the set of tools.

Nota: As ferramentas não são habilitadas se a visão do mapa está em coordenadas geográficas.

Concepts

The aim of the Advanced Digitizing tool is to lock coordinates, lengths, and angles when moving the mouse during the digitalizing in the map canvas.

You can also create constraints with relative or absolute reference. Relative reference means that the next vertex constraints' values will be relative to the previous vertex or segment.

Snapping Settings

Click the button to set the Advanced Digitizing Tool snapping settings. You can make the tool snap to common angles. The options are:

- *Do not snap to common angles*
- *Snap to 30º angles*
- *Snap to 45º angles*
- *Snap to 90º angles*

You can also control the snapping to features. The options are:

- *Do not snap to vertices or segments*
- *Snap according to project configuration*
- *Snap to all layers*

Atalhos do Teclado

To speed up the use of Advanced Digitizing Panel, there are a couple of keyboard shortcuts available:

Key	Simple	Ctrl+ ou Alt+	Shift+
D	Set distance	Lock distance	
A	Set angle	Lock angle	Toggle relative angle to last segment
X	Set X coordinate	Lock X coordinate	Toggle relative X to last vertex
Y	Set Y coordinate	Lock Y coordinate	Toggle relative Y to last vertex
C	Alternar modo de construção		
P	Alternar entre modos perpendicular e paralelo		

Absolute reference digitizing

When drawing a new geometry from scratch, it is very useful to have the possibility to start digitizing vertexes at given coordinates.

For example, to add a new feature to a polygonal layer, click the button. You can choose the X and Y coordinates where you want to start editing the feature, then:

- Click the *x* text box (or use the X keyboard shortcut).
- Type the X coordinate value you want and press Enter or click the button to their right to lock the mouse to the X axis on the map canvas.
- Click the *y* text box (or use the Y keyboard shortcut).
- Type the Y coordinate value you want and press Enter or click the button to their right to lock the mouse to the Y axis on the map canvas.

Two blue dotted lines and a green cross identify the exact coordinates you entered. Start digitizing by clicking on the map canvas; the mouse position is locked at the green cross.

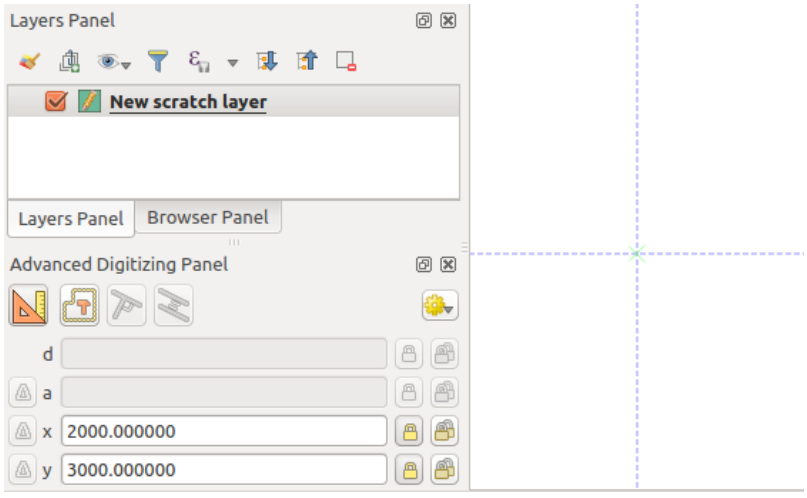


Figura14.96: Start drawing at given coordinates

You can continue digitizing by free hand, adding a new pair of coordinates, or you can type the segment's **length** (distance) and **angle**.

If you want to draw a segment of a given length, click the *d (distance)* text box (keyboard shortcut D), type the distance value (in map units) and press Enter or click the button on the right to lock the mouse in the map canvas to

the length of the segment. In the map canvas, the clicked point is surrounded by a circle whose radius is the value entered in the distance text box.

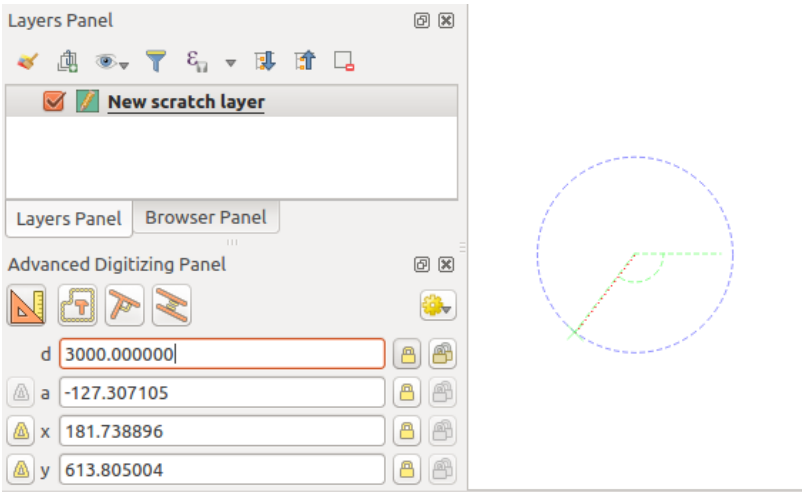


Figura14.97: Fixed length segment

Finally, you can also choose the angle of the segment. As described before , click the *a (angle)* text box (keyboard shortcut `A`), type the angle value (in degrees), and press `Enter` or click the buttons on the right to lock it. In this way the segment will follow the desired angle:

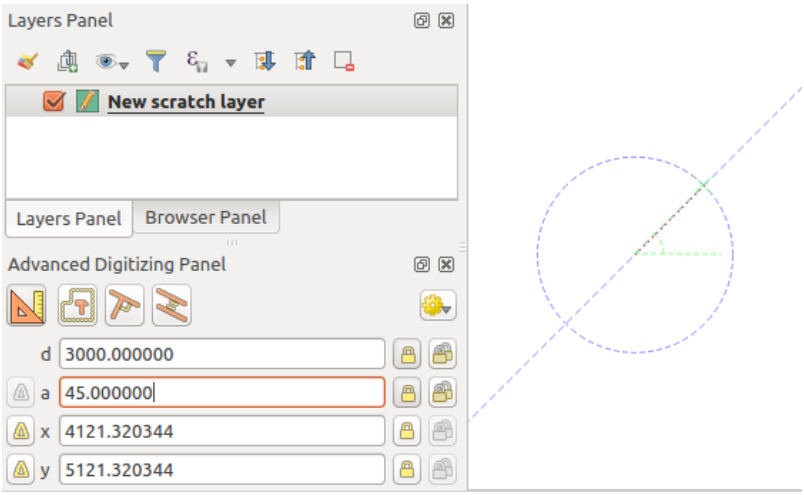


Figura14.98: Fixed angle segment

Relative reference digitizing

Instead of using absolute values of angles or coordinates, you can also use values relative to the last digitized vertex or segment.

For angles, you can click the button on the left of the *a* text box (or press `Shift+A`) to toggle relative angles to the previous segment. With that option on, angles are measured between the last segment and the mouse pointer.

For coordinates, click the buttons to the left of the *x* or *y* text boxes (or press `Shift+X` or `Shift+Y`) to toggle relative coordinates to the previous vertex. With these options on, coordinates measurement will consider the last vertex to be the X and Y axes origin.

Continuous lock

Both in absolute or relative reference digitizing, angle, distance, X and Y constraints can be locked continuously by clicking the *Continuous lock* buttons. Using continuous lock allows you to digitize several points or vertexes using the same constraints.

Parallel and perpendicular lines

All the tools described above can be combined with the Perpendicular and Parallel tools. These two tools allow drawing segments perfectly perpendicular or parallel to another segment.

To draw a *perpendicular* segment, during the editing click the Perpendicular icon (keyboard shortcut `P`) to activate it. Before drawing the perpendicular line, click on the segment of an existing feature that you want to be perpendicular to (the line of the existing feature will be colored in light orange); you should see a blue dotted line where your feature will be snapped:

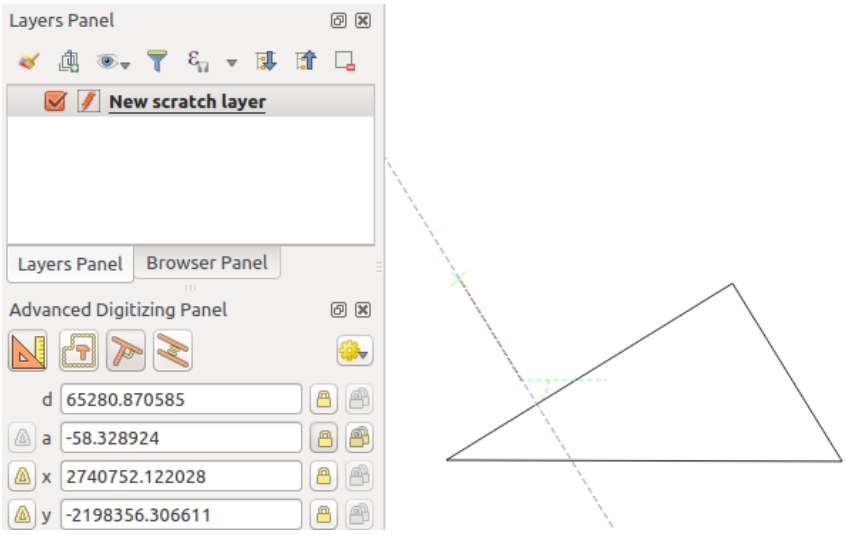


Figura14.99: Perpendicular digitizing

To draw a *parallel* feature, the steps are the same: click on the Parallel icon (keyboard shortcut `P` twice), click on the segment you want to use as reference and start drawing your feature:

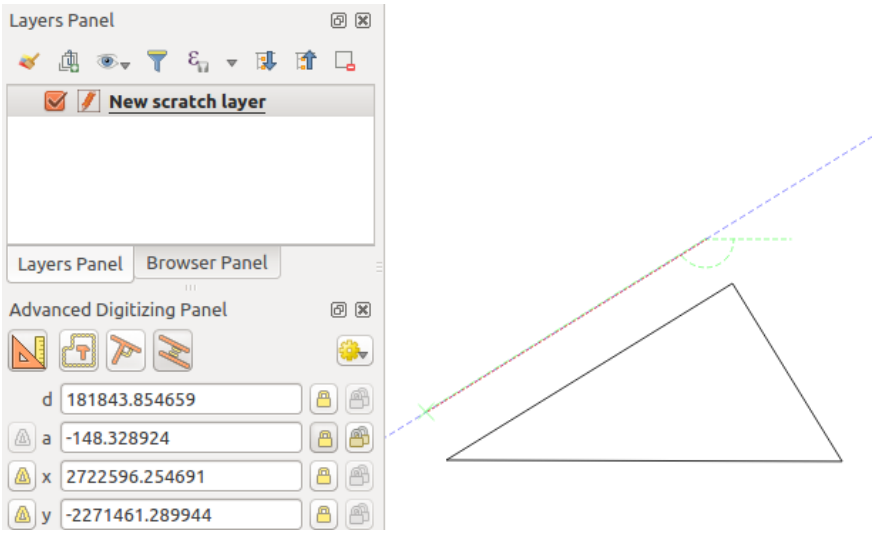


Figura14.100: Parallel digitizing

These two tools just find the right angle of the perpendicular and parallel angle and lock this parameter during your editing.

Construction mode

You can enable and disable *construction* mode by clicking on the Construction icon or with the `C` keyboard shortcut. While in construction mode, clicking the map canvas won't add new vertexes, but will capture the clicks' positions so that you can use them as reference points to then lock distance, angle or X and Y relative values.

As an example, the construction mode can be used to draw some point at an exact distance from an existing point.

With an existing point in the map canvas and the snapping mode correctly activated, you can easily draw other points at given distances and angles from it. In addition to the button, you have to activate also the *construction* mode by clicking the Construction icon or with the `C` keyboard shortcut.

Click next to the point from which you want to calculate the distance and click on the *d* box (`D` shortcut) type the desired distance and press `Enter` to lock the mouse position in the map canvas:

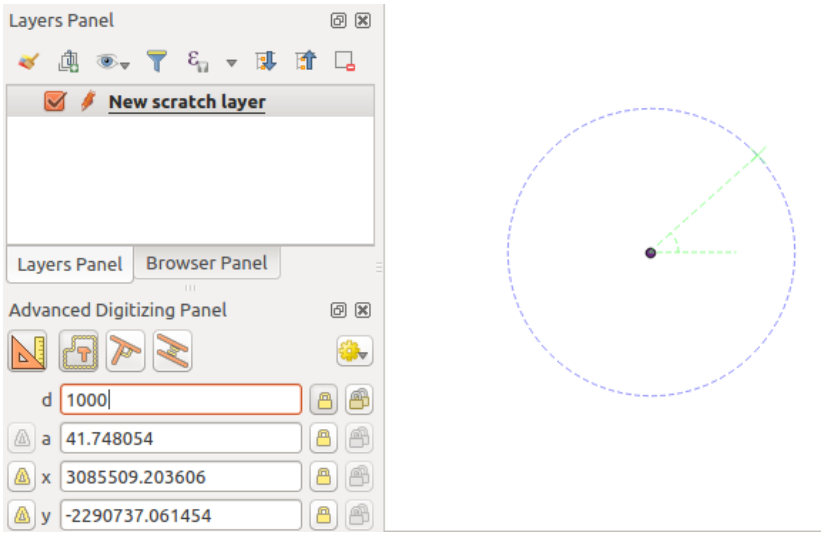


Figura14.101: Distance from point

Before adding the new point, press `C` to exit the construction mode. Now, you can click on the map canvas, and the point will be placed at the distance entered.

You can also use the angle constraint to, for example, create another point at the same distance of the original one, but at a particular angle from the newly added point. Click the  Construction icon or with the `C` keyboard shortcut to enter construction mode. Click the recently added point, and then the other one to set a direction segment. Then, click on the *d* text box (`D` shortcut) type the desired distance and press `Enter`. Click the *a* text box (`A` shortcut) type the angle you want and press `Enter`. The mouse position will be locked both in distance and angle.

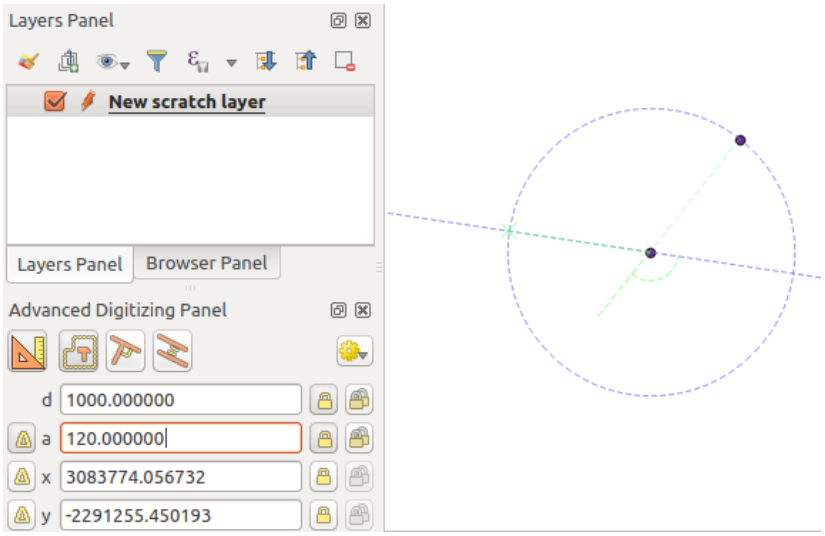


Figura14.102: Distance and angle from points

Before adding the new point, press `C` to exit the construction mode. Now, you can click on the map canvas, and the point will be placed at the distance and angle entered. Repeating the process, several points can be added.

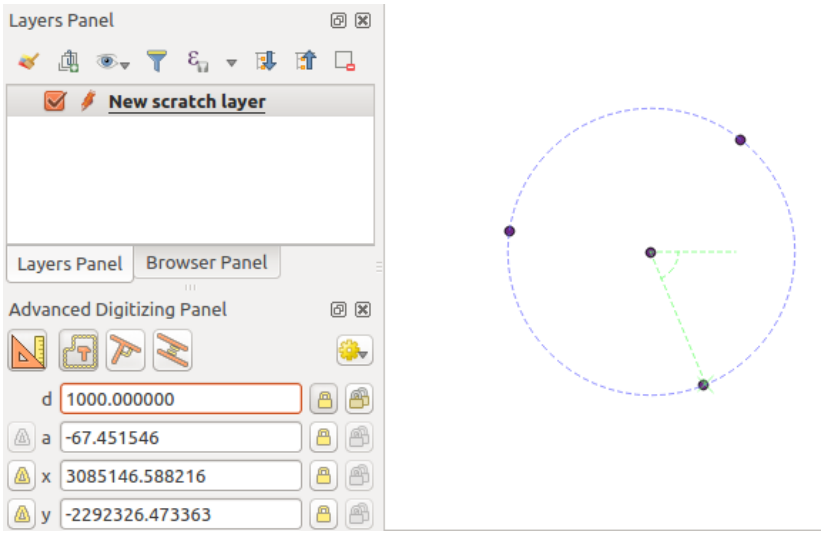


Figura14.103: Points at given distance and angle

14.5.7 The Processing in-place layer modifier

The *Processing menu* provides access to a large set of tools to analyze and create new features based on the properties of the input features or their relations with other features (within the same layer or not). While the common behavior is to create new layers as outputs, some algorithms also allow modifications to the input layer. This is a handy way to automate multiple features modification using advanced and complex operations.

To edit features in-place:

1. Select the layer to edit in the *Layers* panel.
2. Select the concerned features. You can skip this step, in which case the modification will apply to the whole layer.
3. Press the Edit Features In-Place button at the top of the *Processing toolbox*. The list of algorithms is filtered, showing only those compatible with in-place modifications, i.e.:
   - They work at the feature source and not at the layer level.
   - They do not change the layer structure, e.g. adding or removing fields.
   - They do not change the geometry type, e.g. from line to point layer.

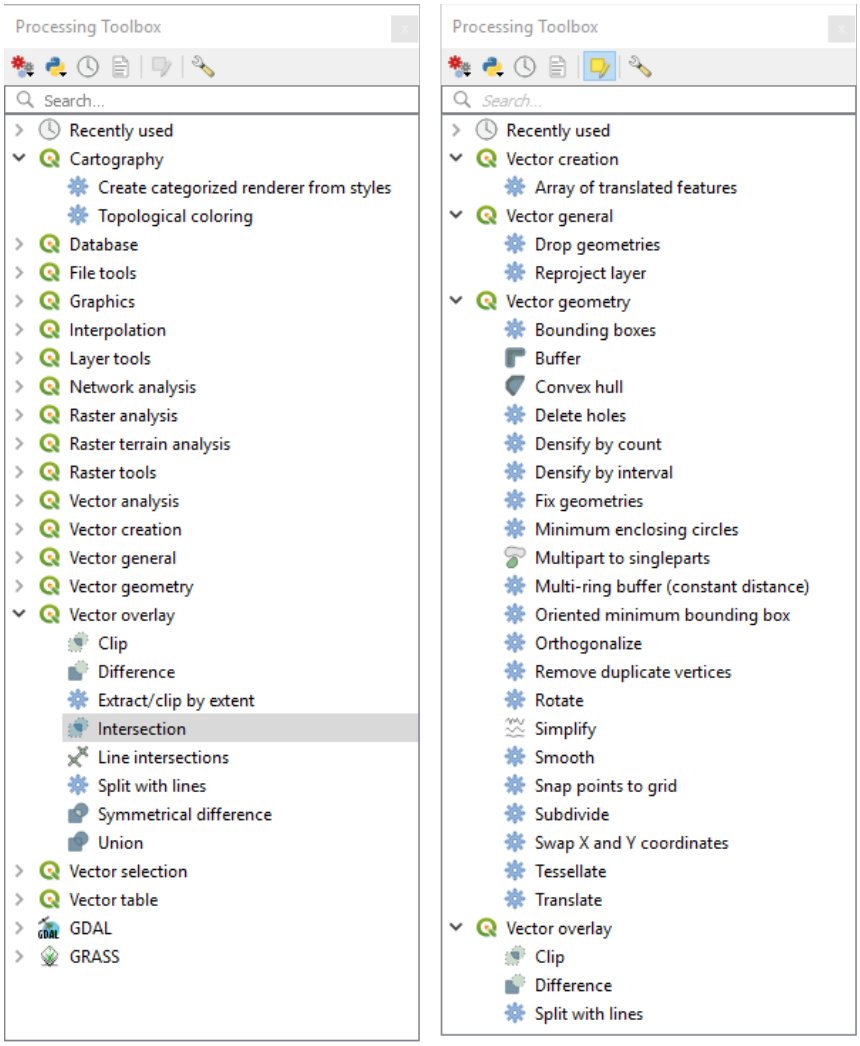


Figura14.104: Processing algorithms: all (left) vs polygon in-place editors (right)

4. Find the algorithm you'd like to run and double-click it.

Nota: If the algorithm does not need any additional user-set parameters (excluding the usual input and output layer parameters), then the algorithm is run immediately without any dialog popup.

1. If parameters other than the usual input or output layers are needed, the algorithm dialog pops up. Fill in the required information.
2. Click *Modify Selected Features* or *Modify All Features* depending on whether there's an active selection.

Changes are applied to the layer and placed in the edit buffer: the layer is indeed toggled to editing mode with unsaved modification as indicated by the  icon next to the layer name.

5. As usual, press  Save layer edits to commit the changes in the layer. You can also press  Undo to rollback the whole modification.

CAPÍTULO 15

Trabalhando com Dados Raster

15.1 Caixa de Diálogo de Propriedades do Raster

Para visualizar e definir as propriedades de uma camada raster, clique duas vezes no nome da camada na legenda do mapa ou clique com o botão direito do mouse no nome da camada e escolha *Propriedades* no menu de contexto. Isso abrirá a caixa de diálogo *Propriedades da Camada Raster*.

Existem várias guias na caixa de diálogo:

-  *Information*
-  *Source*
-  *Symbology*
-  *Transparency*
-  *Histogram*
-  *Rendering*
-  *Pyramids*
-  *Metadata*
-  *Legend*
-  *QGIS Server*

Dica: Renderização de atualização ao vivo

O *Painel de Estilo de Camada* fornece alguns dos recursos comuns da caixa de diálogo Propriedades da Camada e é um bom widget sem modelo que você pode usar para acelerar a configuração dos estilos de camada e visualizar suas alterações na tela do mapa.

Nota: Como as propriedades (simbologia, rótulo, ações, valores padrão, formulários…) das camadas incorporadas (veja *Projetos animados*) são extraídas do arquivo original do projeto, e para evitar alterações que possam quebrar

esse comportamento, a caixa de diaĺogo das propriedades da camada fica indisponível para essas camadas.

15.1.1 Propriedades da informação

A guia *Informações* é somente leitura e representa um local interessante para obter rapidamente informações e metadados resumidos da camada atual. As informações fornecidas são:

- com base no provedor da camada (formato de armazenamento, caminho, tipo de dados, extensão, largura / altura, compactação, tamanho de pixel, estatísticas em bandas, número de colunas, linhas e valores sem dados do raster…);
- selecionado a partir de the *provided metadata*: acesso, links, contatos, histórico … bem como informações de conjunto de dados (SRC, Extensão, bandas…).

15.1.2 Propriedades de origem

A guia *Fonte* exibe informações básicas sobre o raster selecionado, incluindo:

- o *Nome da Camada* para ser mostrado no *Painel de Camadas*;
- the *Coordinate Reference System*: Displays the layer's *Coordinate Reference System (CRS)*. You can change the layer's CRS, by selecting a recently used one in the drop-down list or clicking on the Select CRS button (see *Coordinate Reference System Selector*). Use this process only if the layer CRS is a wrong or not specified. If you wish to reproject your data, use a reprojection algorithm from Processing or *Save it as new dataset*.

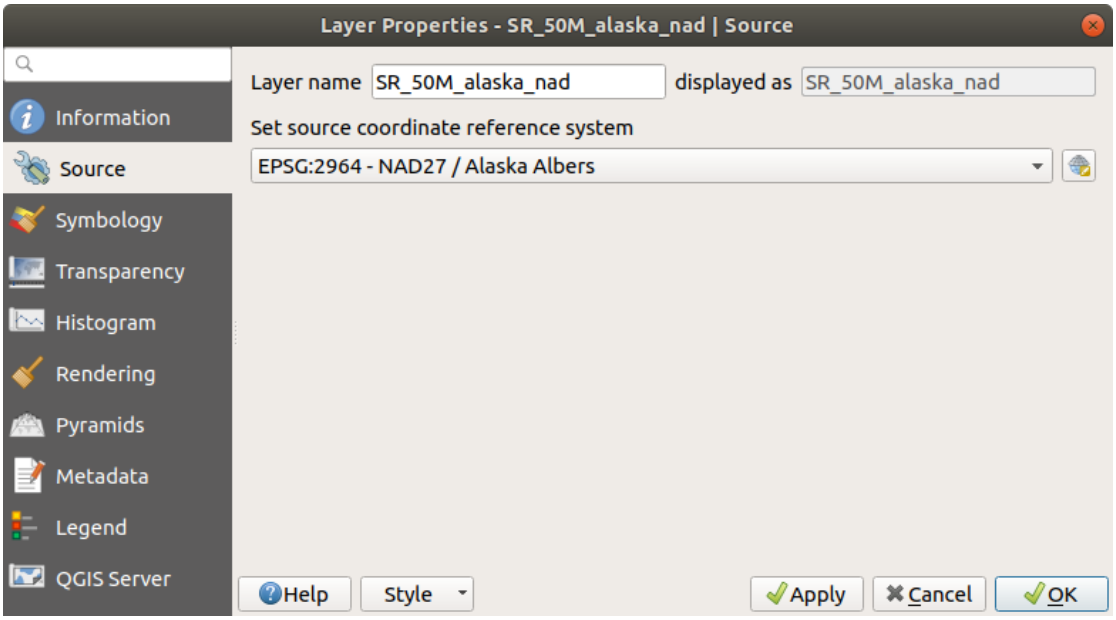


Figura15.1: Raster Layer Properties - Source Dialog

15.1.3 Propriedades da simbologia

Representar a banda

QGIS offers many different *Render types*. The choice of renderer depends on the data type and the information you'd like to highlight.

1. *Multiband color* - if the file comes with several bands (e.g. a satellite image with several bands).
2. *Paletted/Unique values* - for single band files that come with an indexed palette (e.g. a digital topographic map) or for general use of palettes for rendering raster layers.
3. *Singleband gray* - (one band of) the image will be rendered as gray. QGIS will choose this renderer if the file is neither multiband nor paletted (e.g. a shaded relief map).
4. *Singleband pseudocolor* - this renderer can be used for files with a continuous palette or color map (e.g. an elevation map).
5. *Hillshade* - Creates hillshade from a band.
6. *Contours* - Generates contours on the fly for a source raster band.

Multiband color

With the multiband color renderer, three selected bands from the image will be used as the red, green or blue component of the color image. QGIS automatically fetches *Min* and *Max* values for each band of the raster and scales the coloring accordingly. You can control the value ranges in the *Min/Max Value Settings* section.

A *Contrast enhancement* method can be applied to the values: 'No enhancement', 'Stretch to MinMax', 'Stretch and clip to MinMax' and 'Clip to min max'.

Nota: Melhora do contraste

When adding GRASS rasters, the option *Contrast enhancement* will always be set automatically to *stretch to min max*, even if this is set to another value in the QGIS general options.

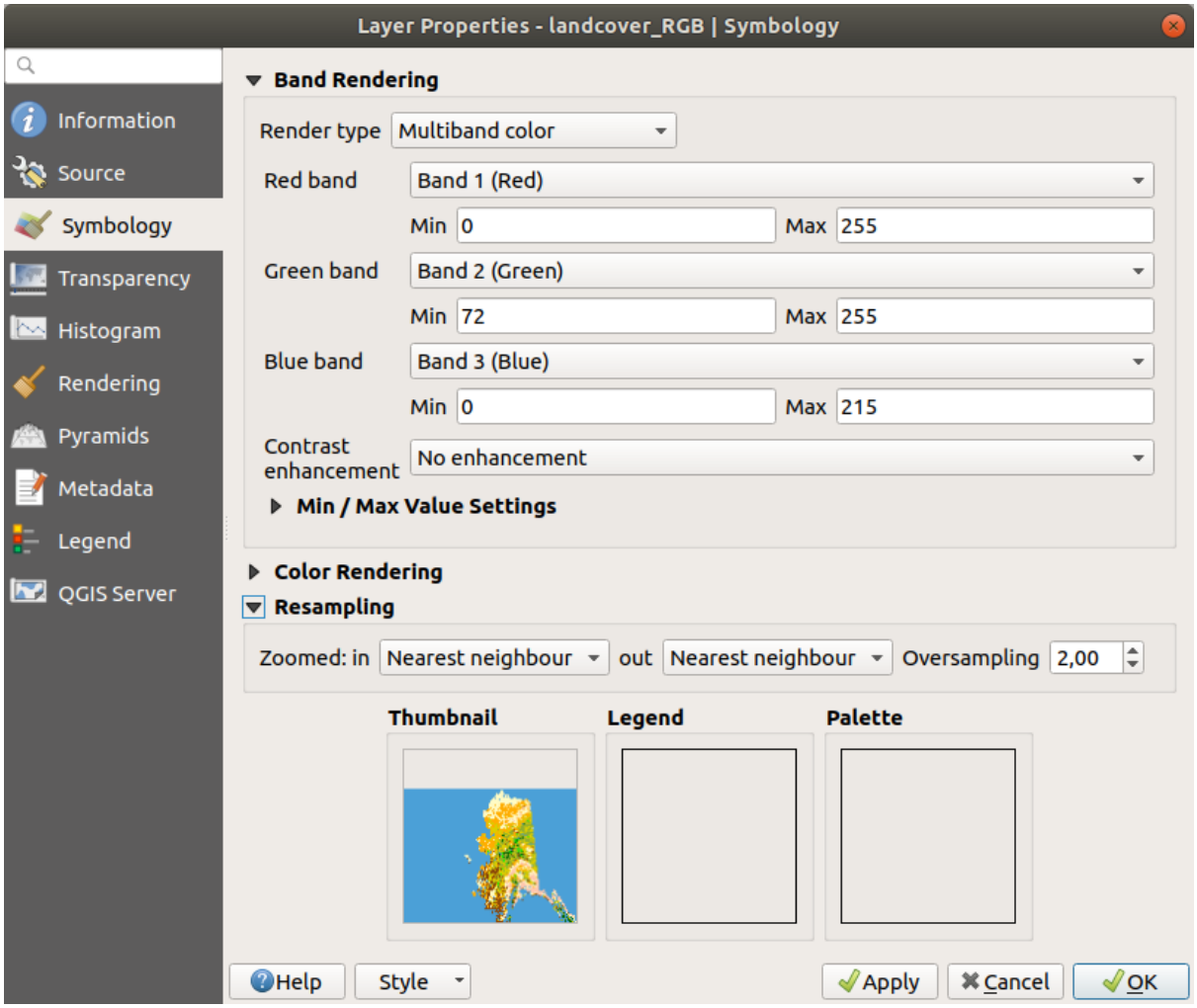


Figura15.2: Raster Symbology - Multiband color rendering

Dica: Visualizando uma única banda do Raster Multibanda

If you want to view a single band of a multiband image (for example, Red), you might think you would set the Green and Blue bands to *Not Set*. But the preferred way of doing this is to set the image type to *Singleband gray*, and then select Red as the *Gray band* to use.

Paletted/Unique values

This is the standard render option for singleband files that include a color table, where a certain color is assigned to each pixel value. In that case, the palette is rendered automatically.

It can be used for all kinds of raster bands, assigning a color to each unique raster value.

If you want to change a color, just double-click on the color and the *Select color* dialog appears.

It is also possible to assign labels to the colors. The label will then appear in the legend of the raster layer.

Right-clicking over selected rows in the color table shows a contextual menu to:

- *Change Color…* for the selection
- *Change Opacity…* for the selection
- *Change Label…* for the selection

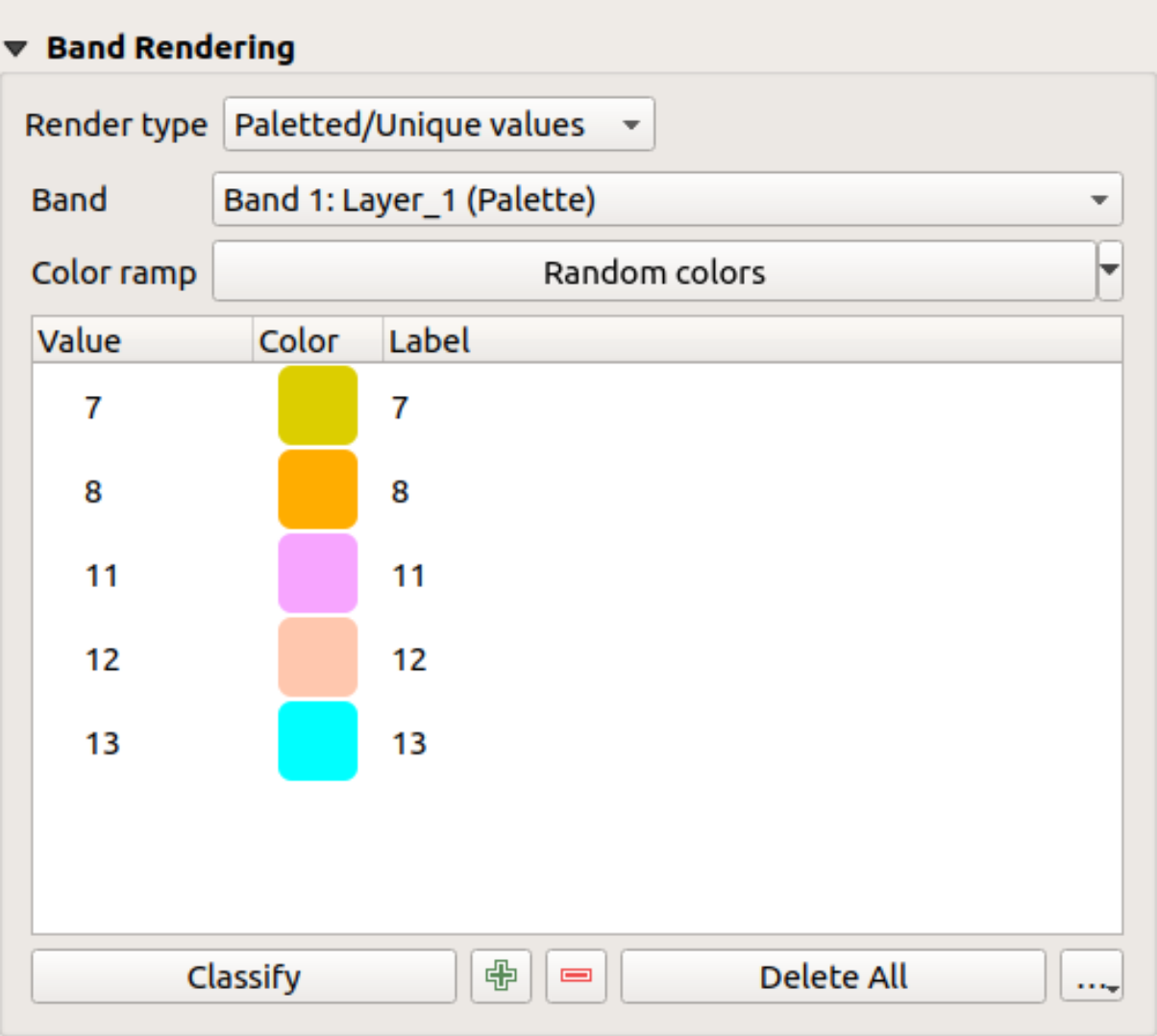


Figura15.3: Raster Symbology - Paletted unique value rendering

The pulldown menu, that opens when clicking the … (*Advanced options*) button below the color map to the right, offers color map loading (*Load Color Map from File…*) and exporting (*Export Color Map to File…*), and loading of classes (*Load Classes from Layer*).

Singleband gray

This renderer allows you to render a single band layer with a *Color gradient*: 'Black to white' or 'White to black'. You can change the range of values to color (*Min* and *Max*) in the *Min/Max Value Settings*.

A *Contrast enhancement* method can be applied to the values: 'No enhancement', 'Stretch to MinMax', 'Stretch and clip to MinMax' and 'Clip to min max'.

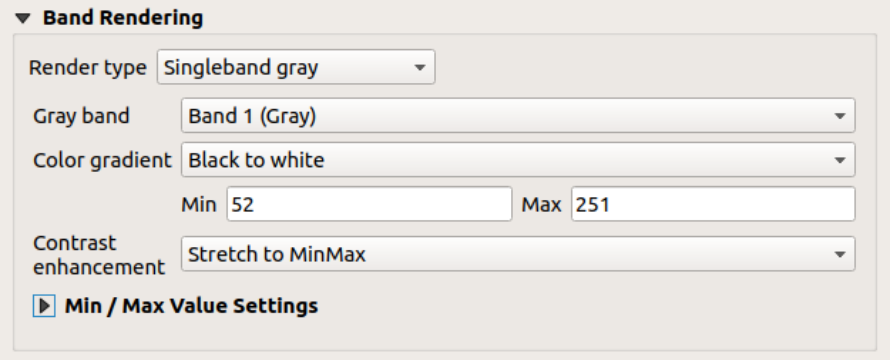


Figura15.4: Raster Symbology - Singleband gray rendering

Singleband pseudocolor

This is a render option for single-band files that include a continuous palette. You can also create color maps for a bands of a multiband raster.

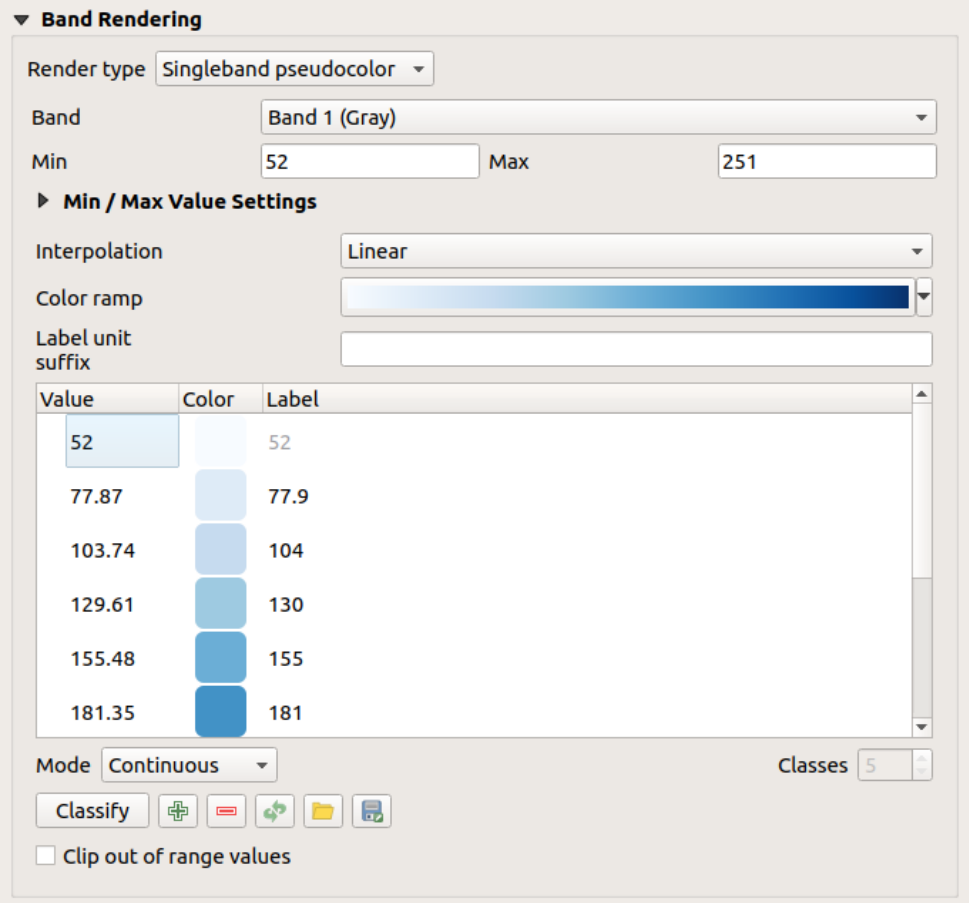


Figura15.5: Raster Symbology - Singleband pseudocolor rendering

Using a *Band* of the layer and a *values range*, three types of color *Interpolation* are available:

- Discrete (a <= symbol appears in the header of the *Value* column)
- Método Linear

- Exact (an = symbol appears in the header of the *Value* column)

The *Color ramp* drop down lists the available color ramps. You can create a new one and edit or save the currently selected one. The name of the color ramp will be saved in the configuration and in the QML file.

O *Sufixo da unidade de rótulo* é um rótulo adicionado após o valor na legenda.

For classification *Mode*  'Equal interval', you only need to select the *number of classes*  and press the button *Classify*. For *Mode*  'Continuous', QGIS creates classes automatically depending on *Min* and *Max*.

The button  Add values manually adds a value to the table. The button  Remove selected row deletes a value from the table. Double clicking in the *Value* column lets you insert a specific value. Double clicking in the *Color* column opens the dialog *Change color*, where you can select a color to apply for that value. Further, you can also add labels for each color, but this value won't be displayed when you use the identify feature tool.

Right-clicking over selected rows in the color table shows a contextual menu to:

- *Change Color…* for the selection
- *Change Opacity…* for the selection

You can use the buttons  Load color map from file or  Export color map to file to load an existing color table or to save the color table for later use.

The  *Clip out of range values* allows QGIS to not render pixel greater than the *Max* value.

Sombreamento do relevo

Render a band of the raster layer using hillshading.

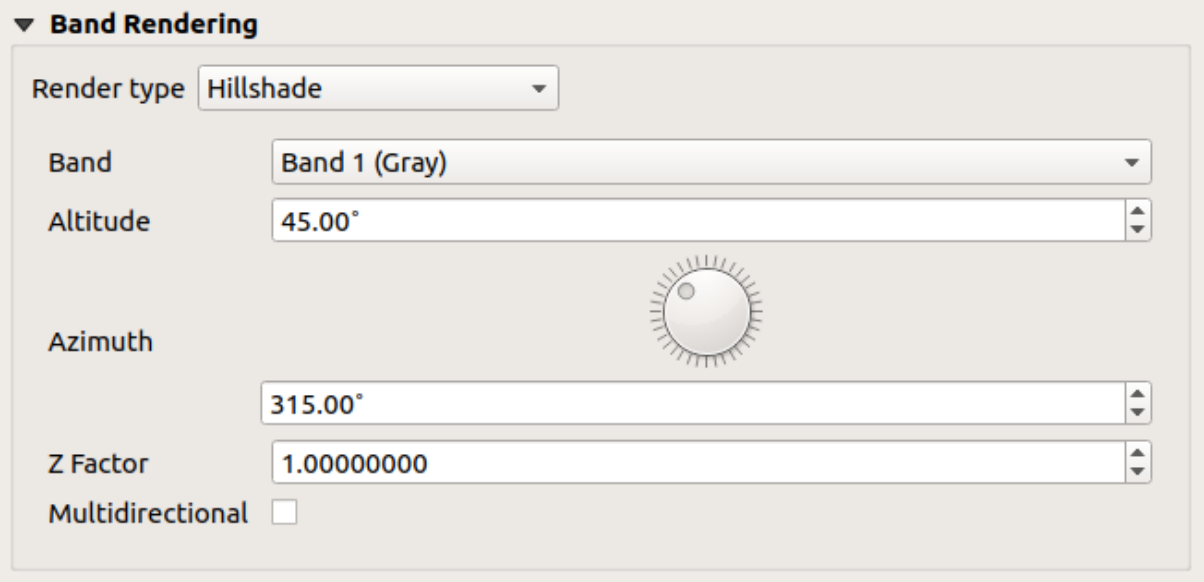


Figura15.6: Raster Symbology - Hillshade rendering

Opções:

- *Band*: The raster band to use.
- *Altitude*: The elevation angle of the light source (default is `45°`).
- *Azimuth*: The azimuth of the light source (default is `315°`).
- *Z Factor*: Scaling factor for the values of the raster band (default is `1`).

- *Multidirectional*: Specify if multidirectional hillshading is to be used (default is `off`).

Contours

This renderer draws contour lines that are calculated on the fly from the source raster band.

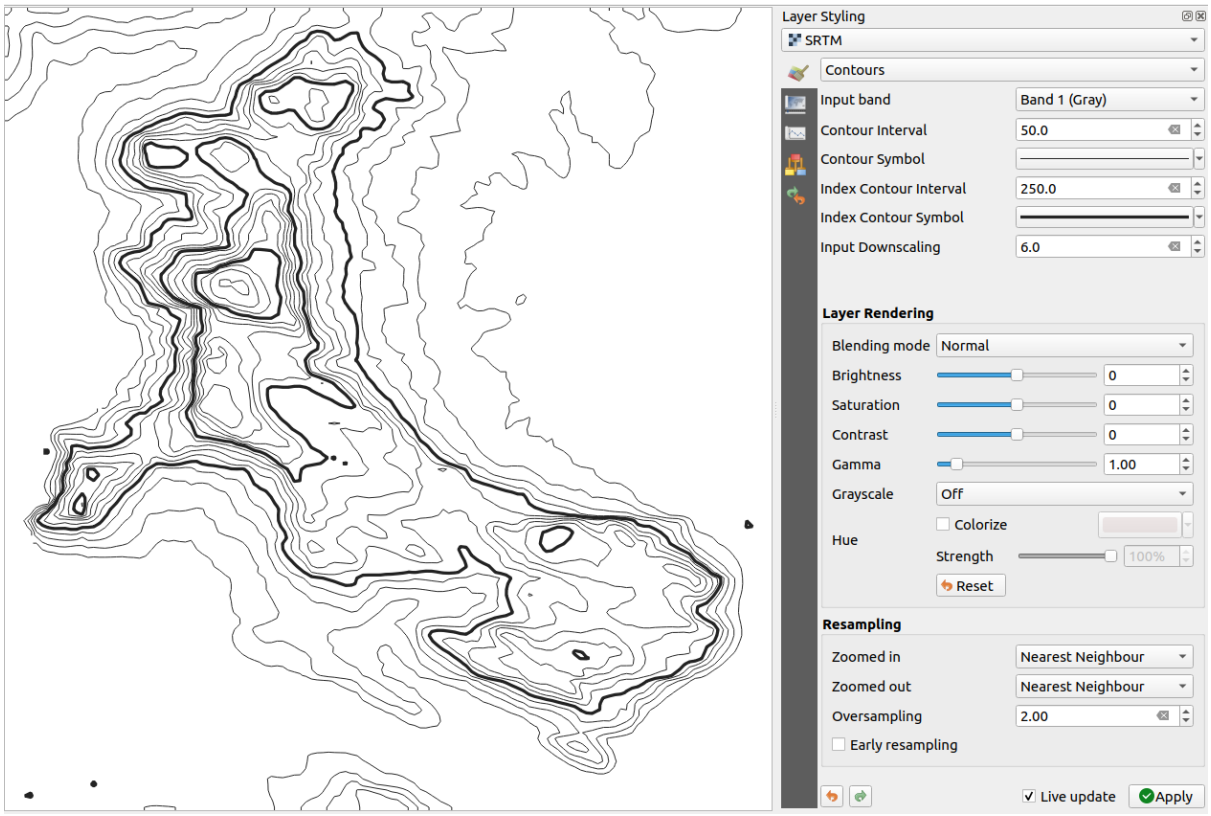


Figura15.7: Raster Symbology - Contours rendering

Opções:

- *Input band*: the raster band to use.
- *Contour interval*: the distance between two consecutive contour lines
- *Contour symbol*: the *symbol* to apply to the common contour lines.
- *Index contour interval*: the distance between two consecutive **index contours**, that is the lines shown in a distinctive manner for ease of identification, being commonly printed more heavily than other contour lines and generally labeled with a value along its course.
- *Index contour symbol*: the symbol to apply to the index contour lines
- *Input downscaling*: Indicates by how much the renderer will scale down the request to the data provider (default is `4.0`).

  For example, if you generate contour lines on input raster block with the same size as the output raster block, the generated lines would contain too much detail. This detail can be reduced by the "downscale" factor, requesting lower resolution of the source raster. For a raster block 1000x500 with downscale 10, the renderer will request raster 100x50 from provider. Higher downscale makes contour lines more simplified (at the expense of losing some detail).

Setting the min and max values

By default, QGIS reports the *Min* and *Max* values of the band(s) of the raster. A few very low and/or high values can have a negative impact on the rendering of the raster. The *Min/Max Value Settings* frame helps you control the rendering.

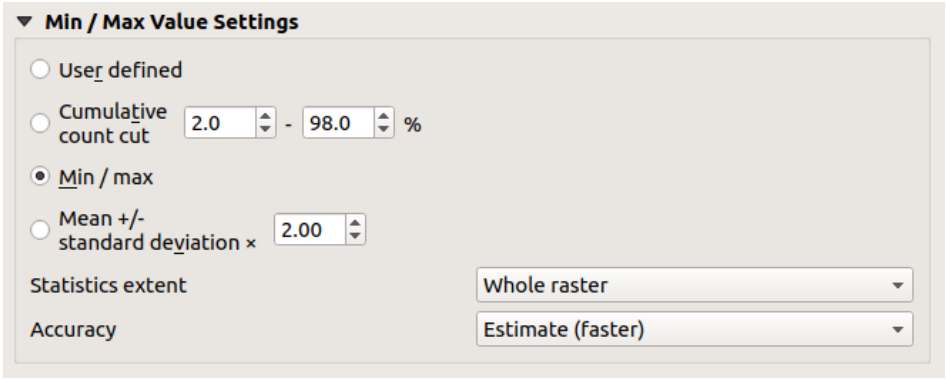


Figura15.8: Raster Symbology - Min and Max Value Settings

As opções disponíveis são:

- *User defined*: The default *Min* and *Max* values of the band(s) can be overridden
- *Cumulative count cut*: Removes outliers. The standard range of values is `2%` to `98%`, but it can be adapted manually.
- *Min / max*: Uses the whole range of values in the image band.
- *Mean +/- standard deviation x*: Creates a color table that only considers values within the standard deviation or within multiple standard deviations. This is useful when you have one or two cells with abnormally high values in a raster layer that impact the rendering of the raster negatively.

Calculations of the min and max values of the bands are made based on the:

- *Statistics extent*: it can be *Whole raster*, *Current canvas* or *Updated canvas*. *Updated canvas* means that min/max values used for the rendering will change with the canvas extent (dynamic stretching).
- *Accuracy*, which can be either *Estimate (faster)* or *Actual (slower)*.

Nota: For some settings, you may need to press the *Apply* button of the layer properties dialog in order to display the actual min and max values in the widgets.

Representação das cores

For all kinds of *Band rendering*, the *Color rendering* set.

You can achieve special rendering effects for your raster file(s) by using one of the blending modes (see *Modos de Mistura*).

Further settings can be made by modifying the *Brightness*, *Saturation*, *Gamma* and *Contrast*. You can also use a *Grayscale* option, where you can choose between 'Off', 'By lightness', 'By luminosity' and 'By average'. For one *Hue* in the color table, you can modify the 'Strength'.

Reamostragem

The *Resampling* option has effect when you zoom in and out of an image. Resampling modes can optimize the appearance of the map. They calculate a new gray value matrix through a geometric transformation.

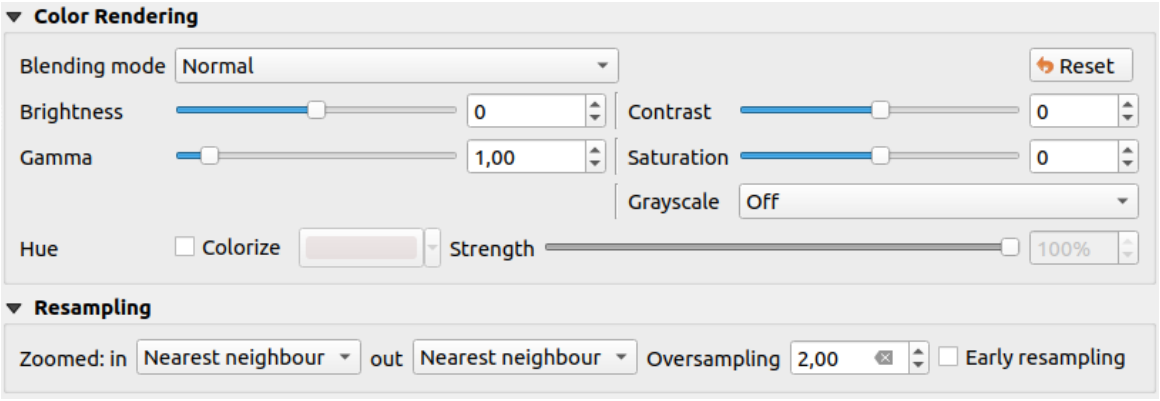
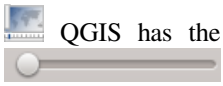


Figura15.9: Raster Symbology - Color rendering and Resampling settings

When applying the 'Nearest neighbour' method, the map can get a pixelated structure when zooming in. This appearance can be improved by using the 'Bilinear' or 'Cubic' method, which cause sharp edges to be blurred. The effect is a smoother image. This method can be applied to for instance digital topographic raster maps.

At the bottom of the *Symbology* tab, you can see a thumbnail of the layer, its legend symbol, and the palette.

15.1.4 Transparency Properties



QGIS has the ability to set the transparency level of a raster layer. Use the transparency slider to set to what extent the underlying layers (if any) should be visible through the current raster layer. This is very useful if you overlay raster layers (e.g., a shaded relief map overlayed by a classified raster map). This will make the look of the map more three dimensional.

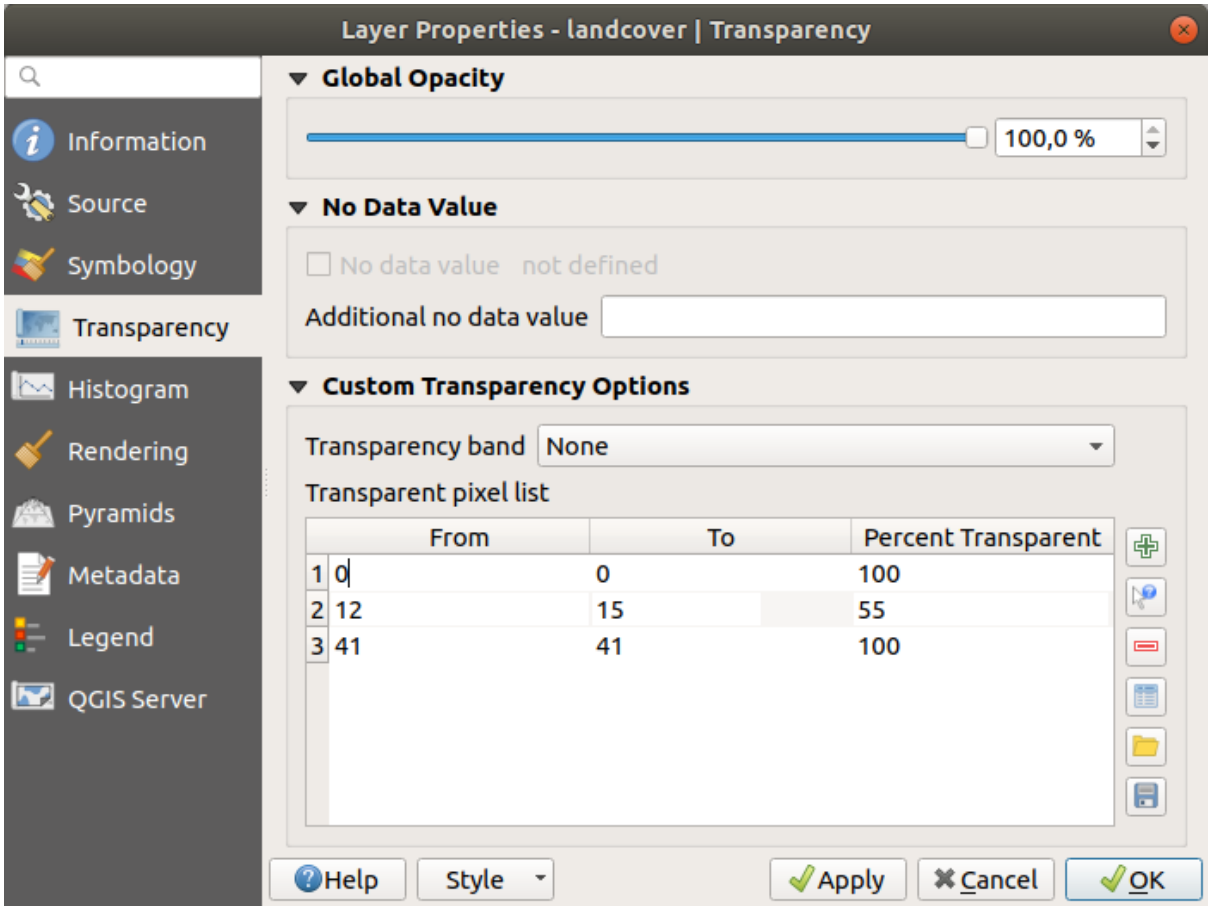


Figura15.10: Raster Transparency

Additionally, you can enter a raster value that should be treated as an *Additional no data value*.

An even more flexible way to customize the transparency is available in the *Custom transparency options* section:

- Use *Transparency band* to apply transparency for an entire band.
- Provide a list of pixels to make transparent with corresponding levels of transparency:

  1. Click the Add values manually button. A new row will appear in the pixel list.
  2. Enter the **Red**, **Green** and **Blue** values of the pixel and adjust the **Percent Transparent** to apply.
  3. Alternatively, you can fetch the pixel values directly from the raster using the Add values from display button. Then enter the transparency value.
  4. Repeat the steps to adjust more values with custom transparency.
  5. Press the *Apply* button and have a look at the map.

  As you can see, it is quite easy to set custom transparency, but it can be quite a lot of work. Therefore, you can use the button Export to file to save your transparency list to a file. The button Import from file loads your transparency settings and applies them to the current raster layer.

15.1.5 Histogram Properties

The *Histogram* tab allows you to view the distribution of the values in your raster. The histogram is generated when you press the *Compute Histogram* button. All existing bands will be displayed together. You can save the histogram as an image with the button.

At the bottom of the histogram, you can select a raster band in the drop-down menu and *Set min/max style for* it. The *Prefs/Actions* drop-down menu gives you advanced options to customize the histogram:

- With the *Visibility* option, you can display histograms for individual bands. You will need to select the option *Show selected band*.
- The *Min/max options* allow you to 'Always show min/max markers', to 'Zoom to min/max' and to 'Update style to min/max'.
- The *Actions* option allows you to 'Reset' or 'Recompute histogram' after you have changed the min or max values of the band(s).

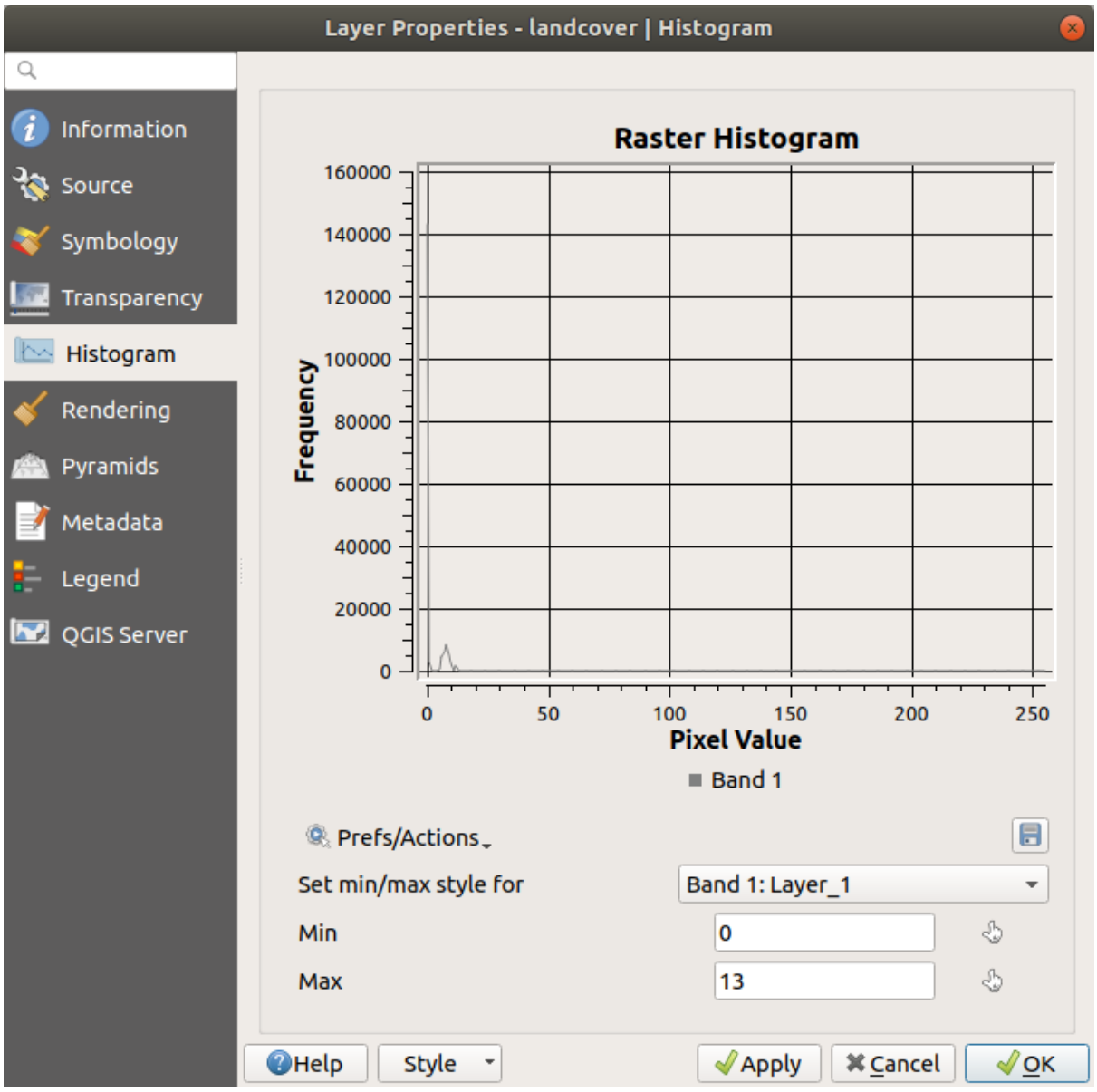


Figura15.11: Raster Histogram

15.1.6 Propriedades de Renderização

In the *Rendering* tab, it's possible to:

- set *Scale dependent visibility* for the layer: You can set the *Maximum (inclusive)* and *Minimum (exclusive)* scale, defining a range of scales in which the layer will be visible. It will be hidden outside this range. The Set to current canvas scale button helps you use the current map canvas scale as a boundary. See *Escala dependente da renderização* for more information.
- *Refresh layer at interval (seconds)*: set a timer to automatically refresh individual layers. Canvas updates are deferred in order to avoid refreshing multiple times if more than one layer has an auto update interval set.

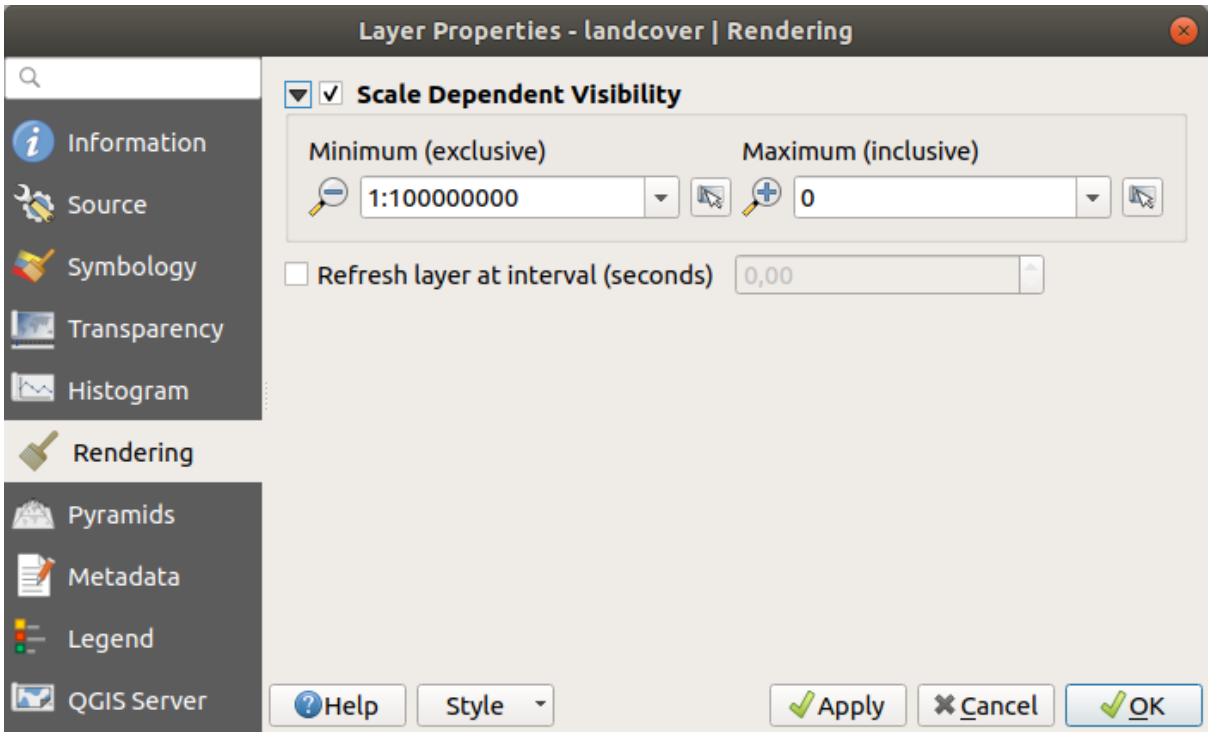


Figura15.12: Raster Rendering

15.1.7 Pyramids Properties

High resolution raster layers can slow navigation in QGIS. By creating lower resolution copies of the data (pyramids), performance can be considerably improved, as QGIS selects the most suitable resolution to use depending on the zoom level.

Você deve pode ter direito de gravação no diretório onde os dados originais são armazenados para construir pirâmides.

From the *Resolutions* list, select resolutions at which you want to create pyramid levels by clicking on them.

If you choose **Internal (if possible)** from the *Overview format* drop-down menu, QGIS tries to build pyramids internally.

Nota: Please note that building pyramids may alter the original data file, and once created they cannot be removed. If you wish to preserve a 'non-pyramided' version of your raster, make a backup copy prior to pyramid building.

If you choose **External** and **External (Erdas Imagine)** the pyramids will be created in a file next to the original raster with the same name and a `.ovr` extension.

Several *Resampling methods* can be used for pyramid calculation:

- Vizinho mais próximo
- Média
- Gauss
- Cúbico
- Cubic Spline
- Laczos
- Modo
- Nenhum

Finally, click *Build Pyramids* to start the process.

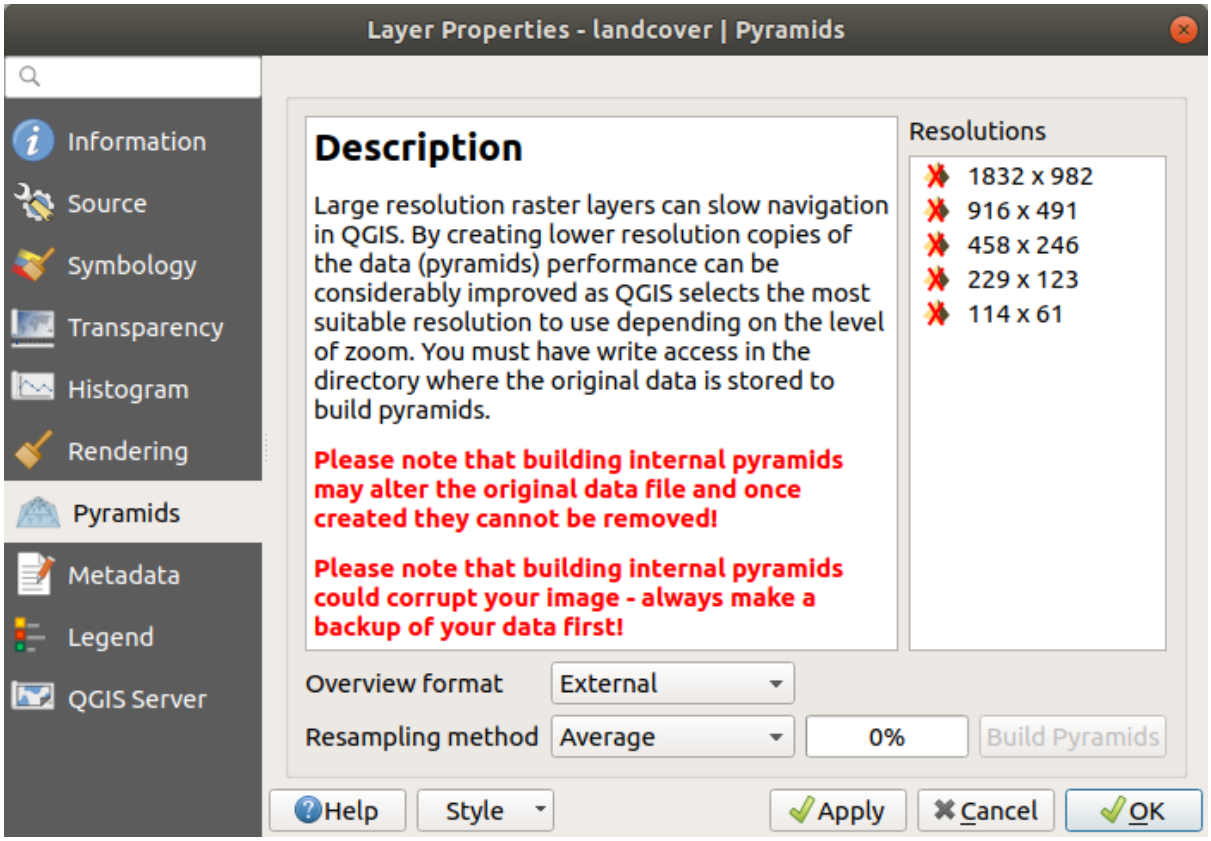


Figura15.13: Raster Pyramids

15.1.8 Propriedades dos Metadados

The *Metadata* tab provides you with options to create and edit a metadata report on your layer. See *vector layer metadata properties* for more information.

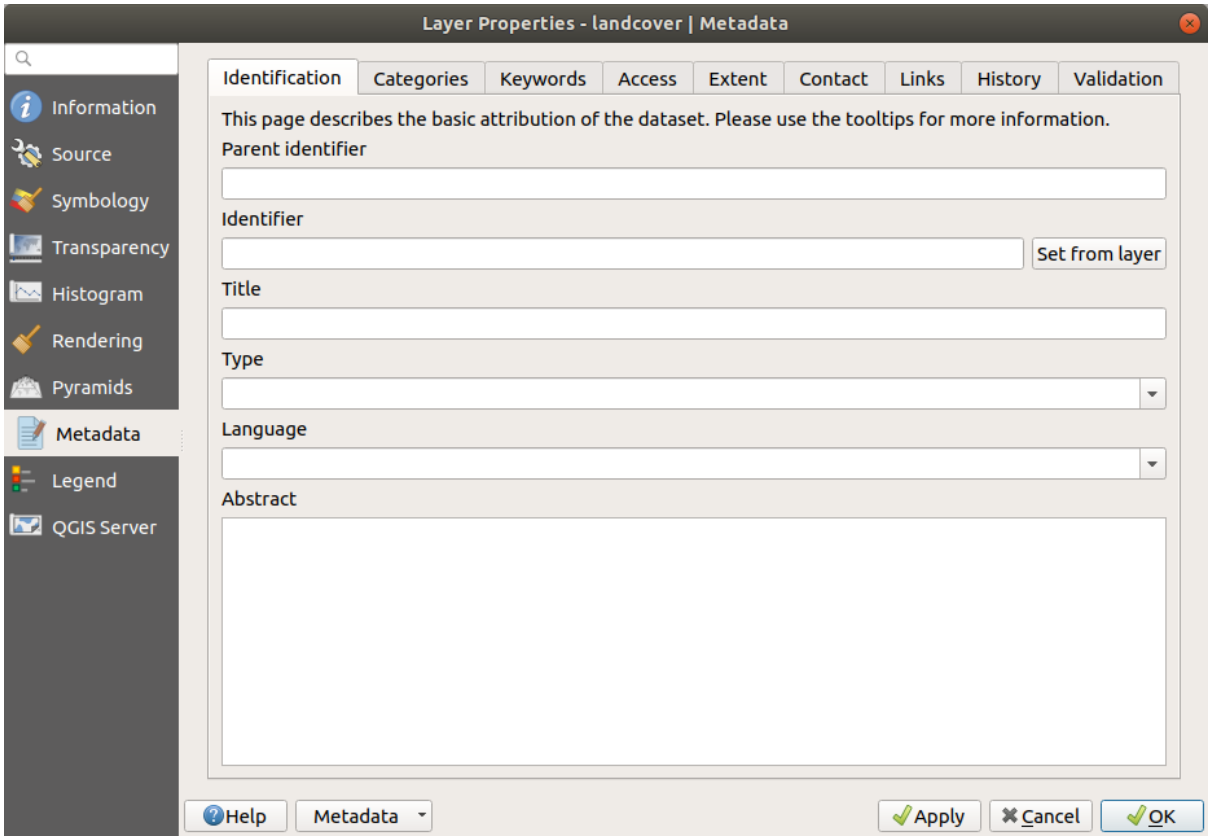


Figura15.14: Raster Metadata

15.1.9 Propriedades da legenda

The *Legend* tab provides you with a list of widgets you can embed within the layer tree in the Layers panel. The idea is to have a way to quickly access some actions that are often used with the layer (setup transparency, filtering, selection, style or other stuff…).

By default, QGIS provides a transparency widget but this can be extended by plugins that register their own widgets and assign custom actions to layers they manage.

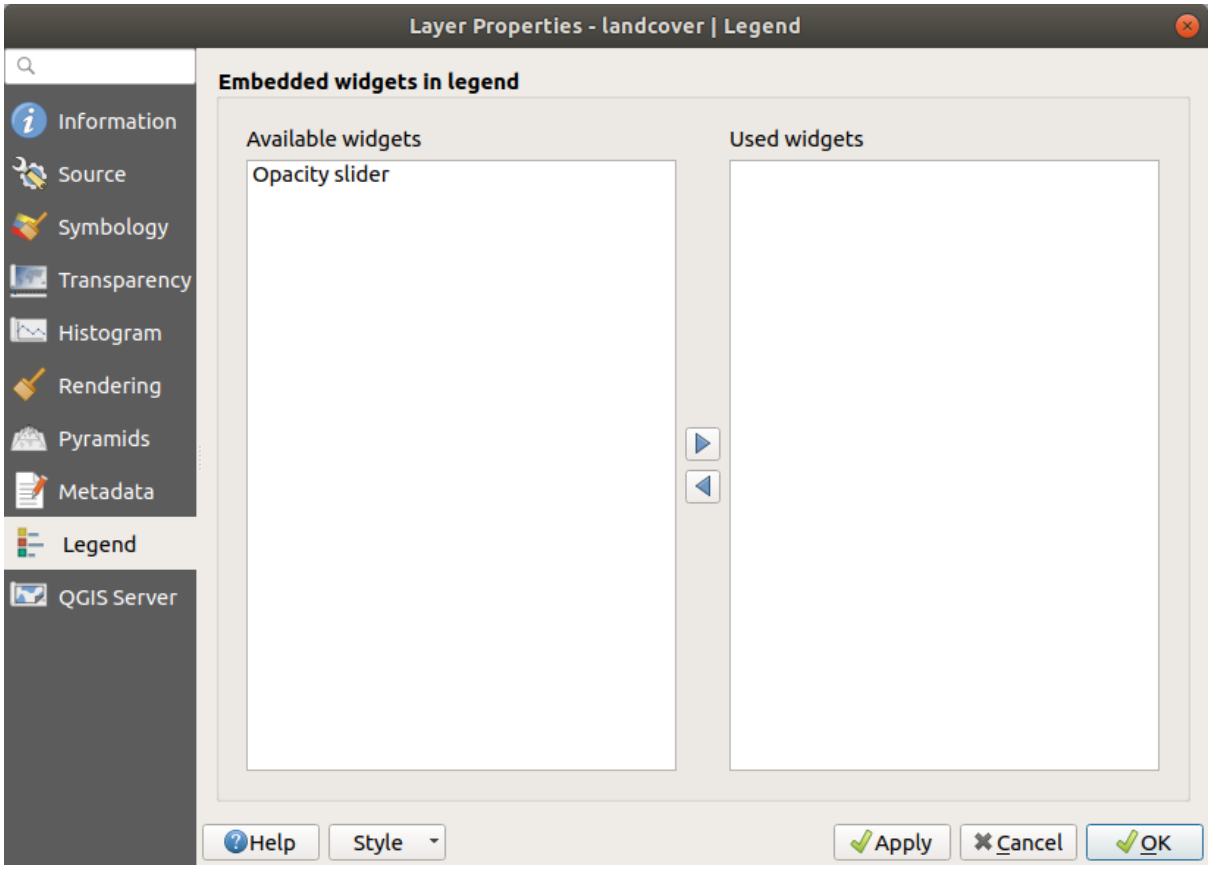


Figura15.15: Raster Legend

15.1.10 Propriedades do Servidor QGIS

From the *QGIS Server* tab, information can be provided for *Description*, *Attribution*, *MetadataUrl* and *LegendUrl*.

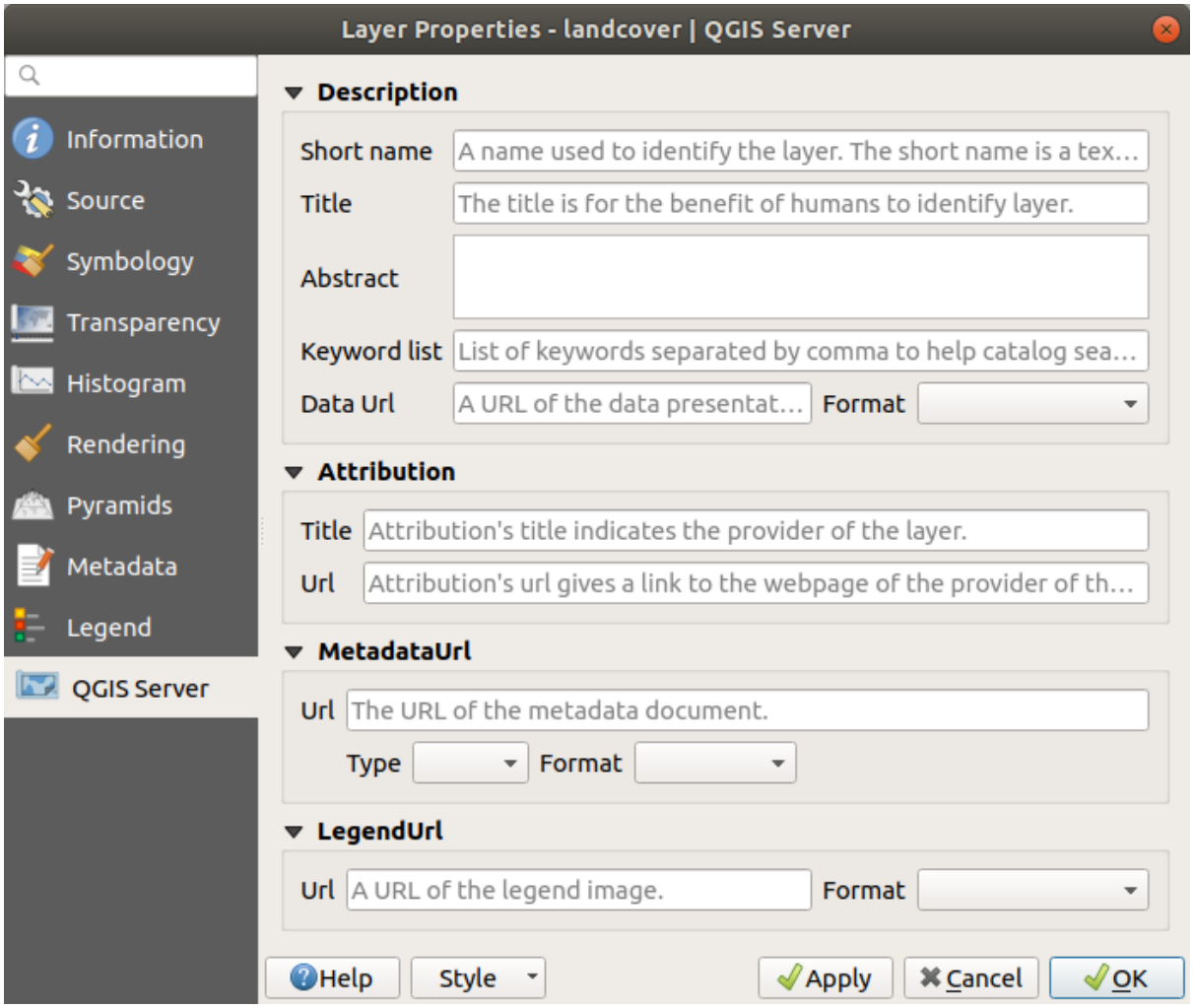


Figura15.16: QGIS Server in Raster Properties

15.2 Análise raster

15.2.1 Calculadora raster

The *Raster Calculator* in the *Raster* menu allows you to perform calculations on the basis of existing raster pixel values (see Fig.15.17). The results are written to a new raster layer in a GDAL-supported format.

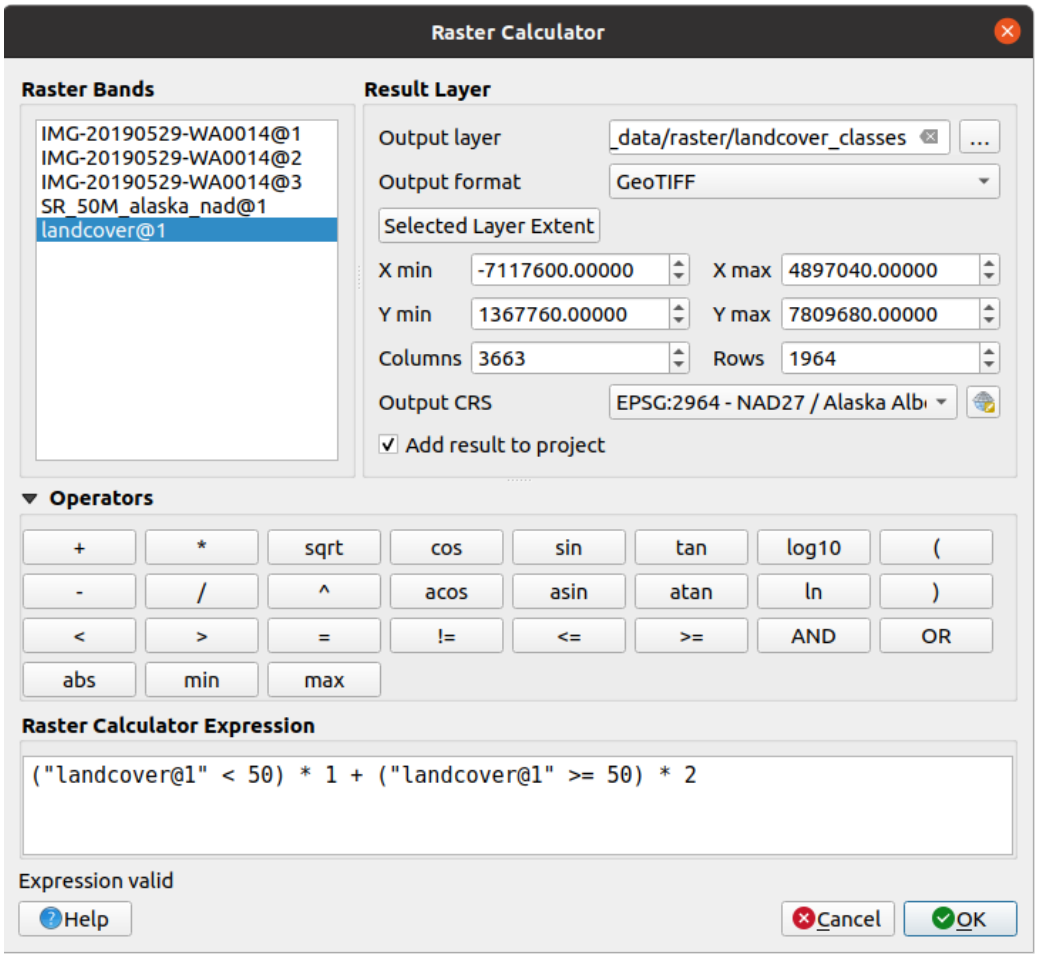


Figura15.17: Calculadora raster

A lista **Bandas raster** contém todas as camadas raster carregadas que podem ser usadas. Para adicionar um raster ao campo de expressão da calculadora, clique duas vezes em seu nome na lista Campos. Você pode usar os operadores para construir expressões de cálculo ou apenas digitá-las na caixa.

Na seção **Camada de resultado**, você precisará definir uma camada de saída. Você pode definir a extensão da área de cálculo com base em uma camada raster de entrada ou com base nas coordenadas X,Y e em colunas e linhas, para definir a resolução da camada de saída. Se a camada de entrada tiver uma resolução diferente, os valores serão redefinidos com o algoritmo vizinho mais próximo.

The **Operators** section contains all available operators. To add an operator to the raster calculator expression box, click the appropriate button. Mathematical calculations (+, −, *, …) and trigonometric functions (`sin`, `cos`, `tan`, …) are available. Conditional expressions (=, ! =, <, >=, …) return either 0 for false or 1 for true, and therefore can be used with other operators and functions.

Com a caixa de seleção | :guilabel: *Adicionar resultado ao projeto*, a camada resultante será automaticamente adicionada à área de legenda e pode ser visualizada.

Dica: Veja também o algoritmo *Calculadora Raster*.

Exemplos

Converter valores de elevação de metros para pés

Para criar um raster de elevação em pés a partir de um raster em metros, você precisa usar o fator de conversão de metros para pés: 3,28. A expressão é:

```
"elevation@1" * 3.28
```

Usando uma máscara

Se você deseja mascarar partes de um raster – digamos, por exemplo, porque você só está interessado em elevações acima de 0 metros – você pode usar a seguinte expressão para criar uma máscara e aplicar o resultado a um raster em um passo.

```
("elevation@1" >= 0) * "elevation@1"
```

Em outras palavras, para cada célula maior ou igual a 0, a expressão condicional é avaliada como 1, o que mantém o valor original multiplicando-o por 1. Caso contrário, a expressão condicional é avaliada como 0, que define o valor raster como 0. Isso cria a máscara em vôo.

Se você deseja classificar um raster – por exemplo, em duas classes de elevação, é possível usar a expressão a seguir para criar um raster com dois valores 1 e 2 em um passo.

```
("elevation@1" < 50) * 1 + ("elevation@1" >= 50) * 2
```

Em outras palavras, para cada célula menor que 50, defina seu valor como 1. Para cada célula maior ou igual a 50, defina seu valor como 2.

15.2.2 Alinhamento de raster

Essa ferramenta é capaz de receber vários rasters como entrada e alinhá-los perfeitamente, ou seja:

- reprojetar para o mesmo SRC,
- reamostrar para o mesmo tamanho de célula e deslocamento na grade,
- recortar a uma região de interesse,
- redimensionar valores quando requerido.

Todos os rasters serão salvos em outros arquivos.

Primeiro, abra as ferramentas de *Raster* ► *Alinhar Raster...* e pressione no botão  Adicionar novo raster para escolher um raster existente no QGIS. Selecione um arquivo de saída para salvar o raster após o alinhamento, o método de reamostragem e se as ferramentas devem *Redimensionar valores de acordo com o tamanho da célula*. O método de reamostragem pode ser (veja Fig.15.18):

- **Vizinho mais próximo**
- **Bilinear (2x2 kernel)**
- **Cúbica (núcleo 4x4)**: Aproximação da Convolução Cúbica
- **B-Spline Cúbica (kernel 4x4)**: Aproximação da B-Spline Cúbica
- **Lanczos (6x6 kernel)**: Interpolação Lanczos com janela sinc
- **Média**: computa a média de todos os pixels contribuintes exceto aqueles SEM DADO
- **Moda**: seleciona o valor que aparece com mais frequência de todos os pontos amostrados
- **Máximo**, **Mínimo**, **Mediana**, **Primeiro quartil (Q1)** ou **Terceiro Quartil (Q3)** de todos os pixels que contribuintes exceto aqueles SEM DADO

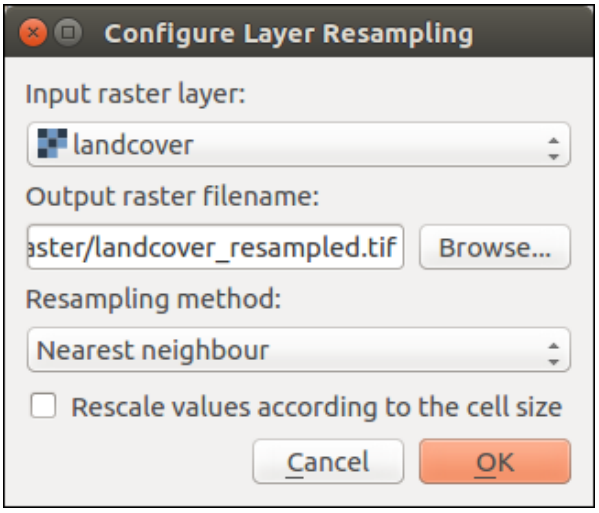


Figura15.18: Selecione as opções de reamostragem raster

Na caixa de diálogo principal *Alinhar raster*, você pode ainda Editar configurações do arquivo ou Remover um arquivo existente da lista de camadas raster. Você também pode escolher uma ou mais opções adicionais (veja Fig.15.19):

- Selecionar a *Camada de refêrencia*,
- Transforme para um novo *SRC*,
- Configure um diferente *Tamanho de célula*,
- Configure um diferente *Deslocamento de grade*,
- *Recortar à extensão*: pode ser definida pelo usuário, ligada a uma camada ou à tela do mapa
- *Tamanho de saída*,
- *Adicionar raster alinhado à tela do mapa*.

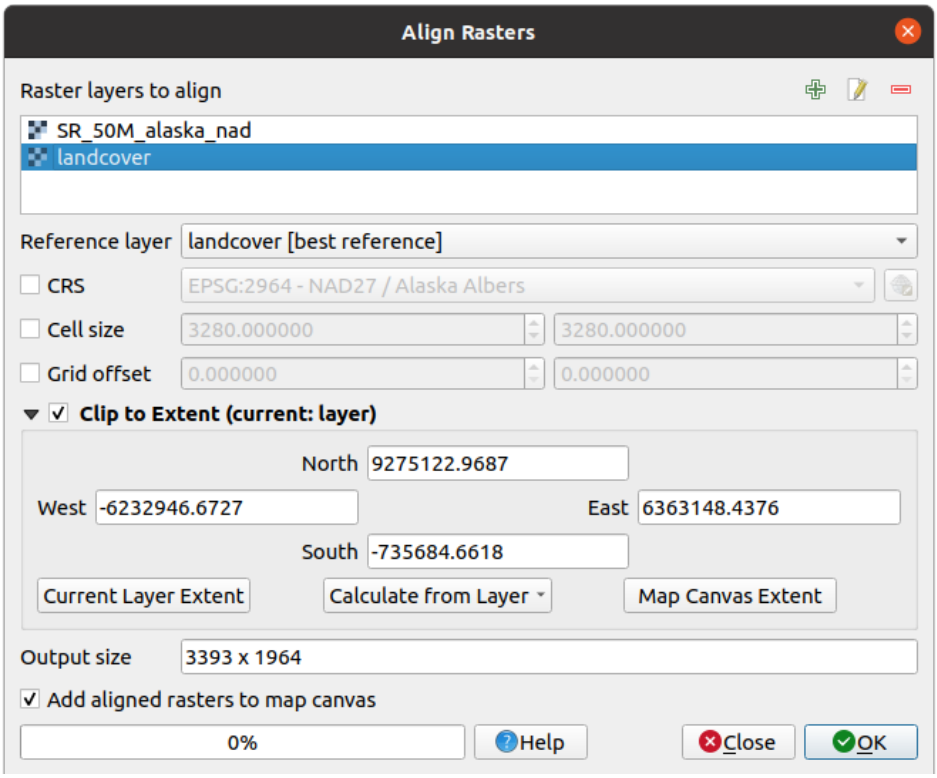


Figura15.19: Alinhamento de raster

15.3 Georeferencer

The Georeferencer is a tool for generating world files for rasters. It allows you to reference rasters to geographic or projected coordinate systems by creating a new GeoTiff or by adding a world file to the existing image. The basic approach to georeferencing a raster is to locate points on the raster for which you can accurately determine coordinates.

Features

Ícone	Finalidade	Ícone	Finalidade
	Open raster		Start georeferencing
	Generate GDAL Script		Load GCP Points
	Save GCP Points As		Transformation settings
	Add Point		Delete Point
	Move GCP Point		Pan
	Zoom In		Zoom Out
!zoomParaCamada!	Zoom To Layer		Zoom Last
	Zoom Next		Link Georeferencer to QGIS
	Link QGIS to Georeferencer		Full histogram stretch
	Local histogram stretch		

Table Georeferencer: Georeferencer Tools

15.3.1 Usual procedure

As X and Y coordinates (DMS (dd mm ss.ss), DD (dd.dd) or projected coordinates (mmmm.mm)), which correspond with the selected point on the image, two alternative procedures can be used:

- The raster itself sometimes provides crosses with coordinates "written" on the image. In this case, you can enter the coordinates manually.
- Using already georeferenced layers. This can be either vector or raster data that contain the same objects/features that you have on the image that you want to georeference and with the projection that you want for your image. In this case, you can enter the coordinates by clicking on the reference dataset loaded in the QGIS map canvas.

The usual procedure for georeferencing an image involves selecting multiple points on the raster, specifying their coordinates, and choosing a relevant transformation type. Based on the input parameters and data, the Georeferencer will compute the world file parameters. The more coordinates you provide, the better the result will be.

The first step is to start QGIS and click on *Raster* ► *Georeferencer*, which appears in the QGIS menu bar. The Georeferencer dialog appears as shown in Fig.15.20.

For this example, we are using a topo sheet of South Dakota from SDGS. It can later be visualized together with the data from the GRASS `spearfish60` location. You can download the topo sheet here: https://grass.osgeo.org/sampledata/spearfish_toposheet.tar.gz.

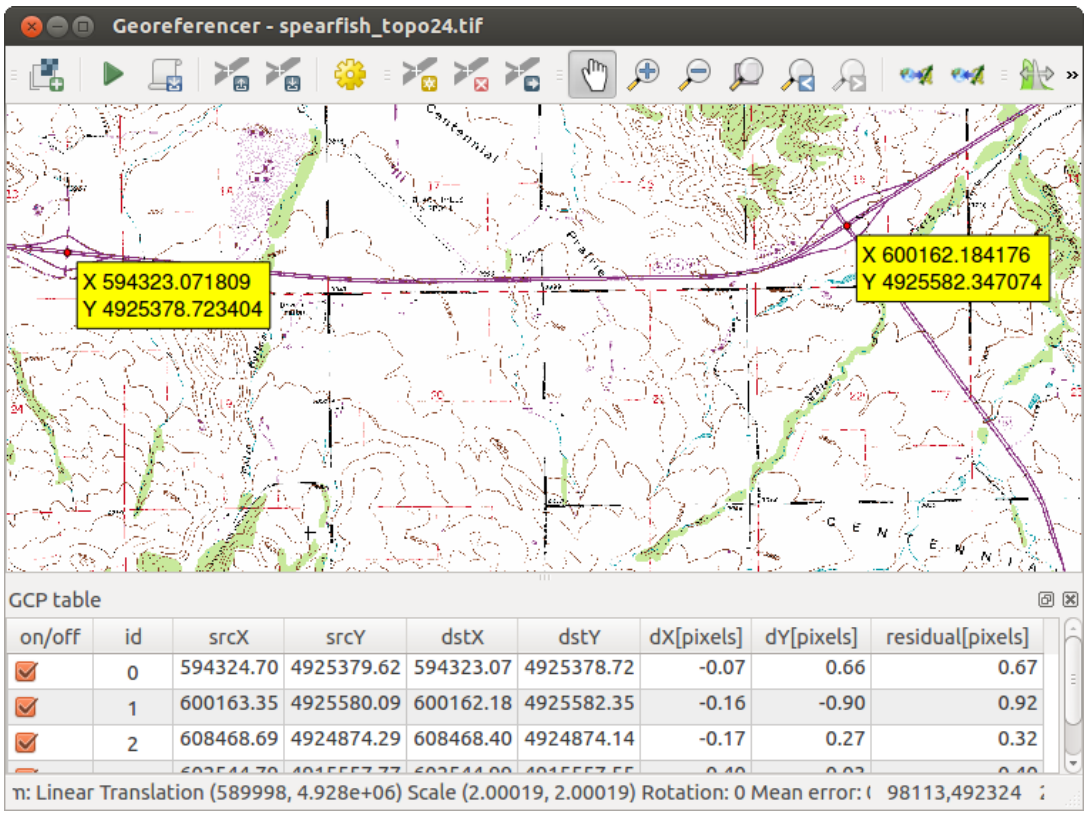


Figura15.20: Georeferencer Dialog

Entering ground control points (GCPs)

1. To start georeferencing an unreferenced raster, we must load it using the button. The raster will show up in the main working area of the dialog. Once the raster is loaded, we can start to enter reference points.
2. Using the Add Point button, add points to the main working area and enter their coordinates (see Figure Fig.15.21). For this procedure you have three options:
   - Click on a point in the raster image and enter the X and Y coordinates manually.
   - Click on a point in the raster image and choose the From map canvas button to add the X and Y coordinates with the help of a georeferenced map already loaded in the QGIS map canvas.
   - With the button, you can move the GCPs in both windows, if they are at the wrong place.
3. Continue entering points. You should have at least four points, and the more coordinates you can provide, the better the result will be. There are additional tools for zooming and panning the working area in order to locate a relevant set of GCP points.

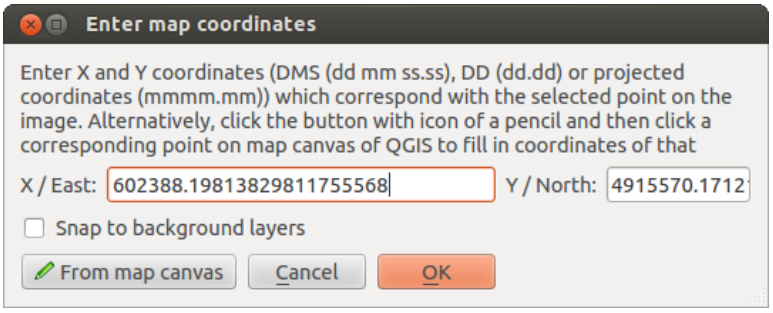


Figura15.21: Add points to the raster image

The points that are added to the map will be stored in a separate text file (`[filename].points`) usually together with the raster image. This allows us to reopen the Georeferencer at a later date and add new points or delete existing ones to optimize the result. The points file contains values of the form: `mapX, mapY, pixelX, pixelY`. You can use the Load GCP points and Save GCP points as buttons to manage the files.

Defining the transformation settings

After you have added your GCPs to the raster image, you need to define the transformation settings for the georeferencing process.

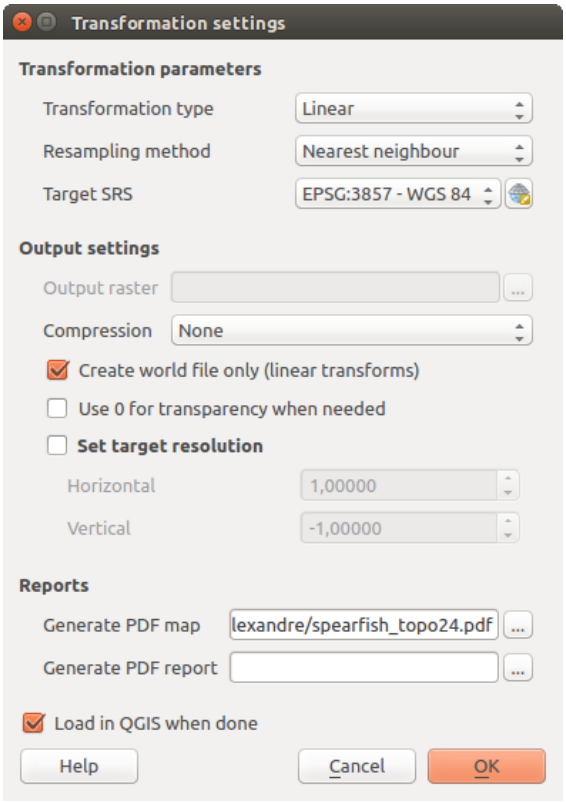


Figura15.22: Defining the georeferencer transformation settings

Available Transformation algorithms

A number of transformation algorithms are available, dependent on the type and quality of input data, the nature and amount of geometric distortion that you are willing to introduce to the final result, and the number of ground control points (GCPs).

Currently, the following *Transformation types* are available:

- The **Linear** algorithm is used to create a world file and is different from the other algorithms, as it does not actually transform the raster pixels. It allows positioning (translating) the image and uniform scaling, but no rotation or other transformations. It is the most suitable if your image is a good quality raster map, in a known CRS, but is just missing georeferencing information. At least 2 GCPs are needed.
- The **Helmert** transformation also allows rotation. It is particularly useful if your raster is a good quality local map or orthorectified aerial image, but not aligned with the grid bearing in your CRS. At least 2 GCPs are needed.
- The **Polynomial 1** algorithm allows a more general affine transformation, in particular also a uniform shear. Straight lines remain straight (i.e., collinear points stay collinear) and parallel lines remain parallel. This is particularly useful for georeferencing data cartograms, which may have been plotted (or data collected) with different ground pixel sizes in different directions. At least 3 GCP's are required.
- The **Polynomial** algorithms 2-3 use more general 2nd or 3rd degree polynomials instead of just affine transformation. This allows them to account for curvature or other systematic warping of the image, for instance photographed maps with curving edges. At least 6 (respectively 10) GCP's are required. Angles and local scale are not preserved or treated uniformly across the image. In particular, straight lines may become curved, and there may be significant distortion introduced at the edges or far from any GCPs arising from extrapolating the data-fitted polynomials too far.
- The **Projective** algorithm generalizes Polynomial 1 in a different way, allowing transformations representing a central projection between 2 non-parallel planes, the image and the map canvas. Straight lines stay straight, but parallelism is not preserved and scale across the image varies consistently with the change in perspective.

This transformation type is most useful for georeferencing angled photographs (rather than flat scans) of good quality maps, or oblique aerial images. A minimum of 4 GCPs is required.

- Finally, the **Thin Plate Spline** (TPS) algorithm "rubber sheets" the raster using multiple local polynomials to match the GCPs specified, with overall surface curvature minimized. Areas away from GCPs will be moved around in the output to accommodate the GCP matching, but will otherwise be minimally locally deformed. TPS is most useful for georeferencing damaged, deformed, or otherwise slightly inaccurate maps, or poorly orthorectified aerials. It is also useful for approximately georeferencing and implicitly reprojecting maps with unknown projection type or parameters, but where a regular grid or dense set of ad-hoc GCPs can be matched with a reference map layer. It technically requires a minimum of 10 GCPs, but usually more to be successful.

In all of the algorithms except TPS, if more than the minimum GCPs are specified, parameters will be fitted so that the overall residual error is minimized. This is helpful to minimize the impact of registration errors, i.e. slight imprecisions in pointer clicks or typed coordinates, or other small local image deformations. Absent other GCPs to compensate, such errors or deformations could translate into significant distortions, especially near the edges of the georeferenced image. However, if more than the minimum GCPs are specified, they will match only approximately in the output. In contrast, TPS will precisely match all specified GCPs, but may introduce significant deformations between nearby GCPs with registration errors.

Define the Resampling method

The type of resampling you choose will likely depend on your input data and the ultimate objective of the exercise. If you don't want to change statistics of the raster (other than as implied by nonuniform geometric scaling if using other than the Linear, Helmert, or Polynomial 1 transformations), you might want to choose 'Nearest neighbour'. In contrast, 'cubic resampling', for instance, will usually generate a visually smoother result.

It is possible to choose between five different resampling methods:

1. Nearest neighbour
2. Método Linear
3. Cúbico
4. Cubic Spline
5. Lanczos

Define the transformation settings

There are several options that need to be defined for the georeferenced output raster.

- The  *Create world file* checkbox is only available if you decide to use the linear transformation type, because this means that the raster image actually won't be transformed. In this case, the *Output raster* field is not activated, because only a new world file will be created.
- For all other transformation types, you have to define an *Output raster*. As default, a new file ([filename]_modified) will be created in the same folder together with the original raster image.
- As a next step, you have to define the *Target SRS* (Spatial Reference System) for the georeferenced raster (see *Trabalhando com Projeções*).
- If you like, you can **generate a pdf map** and also **a pdf report**. The report includes information about the used transformation parameters, an image of the residuals and a list with all GCPs and their RMS errors.
- Furthermore, you can activate the  *Set Target Resolution* checkbox and define the pixel resolution of the output raster. Default horizontal and vertical resolution is 1.
- The  *Use 0 for transparency when needed* can be activated, if pixels with the value 0 shall be visualized transparent. In our example toposheet, all white areas would be transparent.

- Finally, *Load in QGIS when done* loads the output raster automatically into the QGIS map canvas when the transformation is done.

Show and adapt raster properties

Clicking on the *Raster properties* option in the *Settings* menu opens the *Layer properties* dialog of the raster file that you want to georeference.

Configure the georeferencer

- You can define whether you want to show GCP coordinates and/or IDs.
- As residual units, pixels and map units can be chosen.
- For the PDF report, a left and right margin can be defined and you can also set the paper size for the PDF map.
- Finally, you can activate to *Show Georeferencer window docked*.

Running the transformation

After all GCPs have been collected and all transformation settings are defined, just press the Start georeferencing button to create the new georeferenced raster.

CAPÍTULO 16

Working with Mesh Data

16.1 What's a mesh?

A mesh is an unstructured grid usually with temporal and other components. The spatial component contains a collection of vertices, edges and faces in 2D or 3D space:

- **vertices** - XY(Z) points (in the layer's coordinate reference system)
- **edges** - connect pairs of vertices
- **faces** - a face is a set of edges forming a closed shape - typically a triangle or a quadrilateral (quad), rarely polygons with more vertices

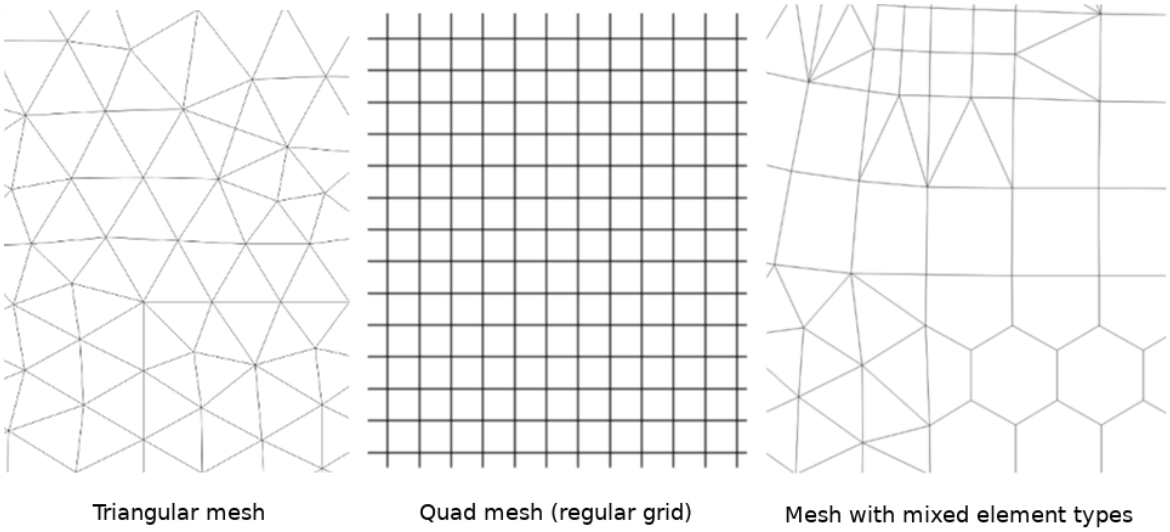


Figura16.1: Different mesh types

QGIS can currently render mesh data using triangles or regular quads.

Mesh provides information about the spatial structure. In addition, the mesh can have datasets (groups) that assign a value to every vertex. For example, having a triangular mesh with numbered vertices as shown in the image below:

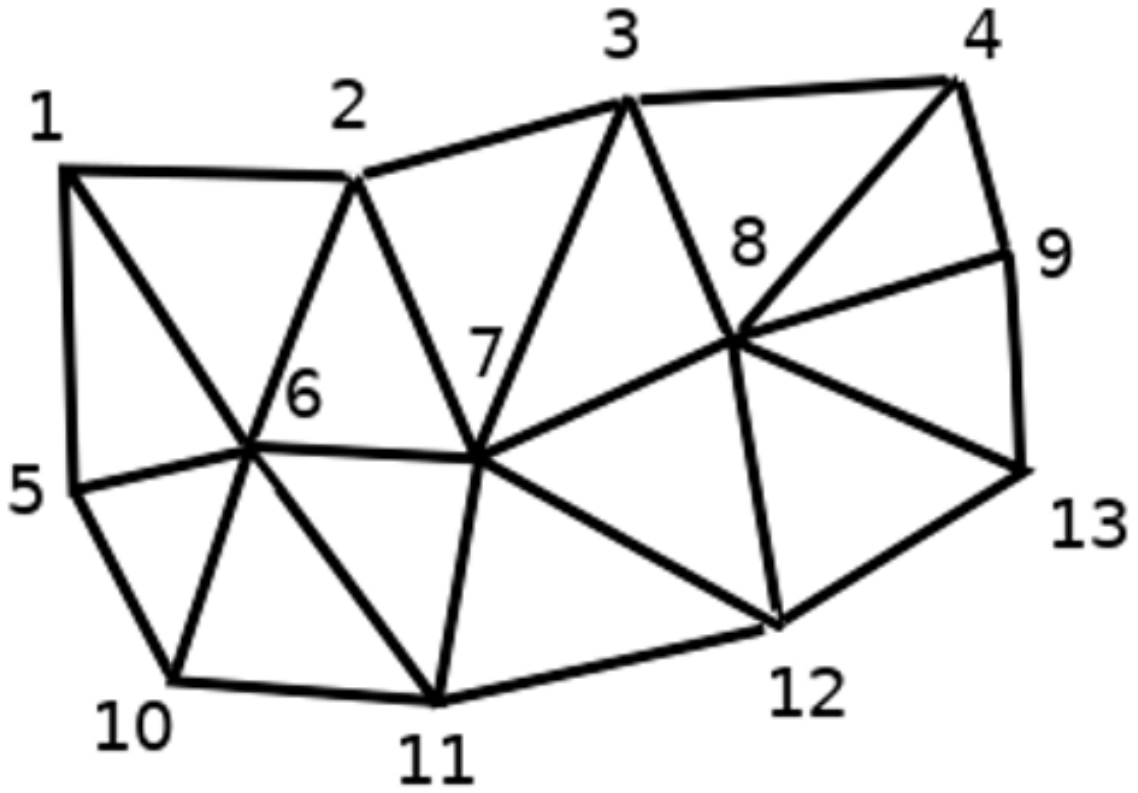


Figura16.2: Triangular grid with numbered vertices

Each vertex can store different datasets (typically multiple quantities), and those datasets can also have a temporal dimension. Thus, a single file may contain multiple datasets.

The following table gives an idea about the information that can be stored in mesh datasets. Table columns represent indices of mesh vertices, each row represents one dataset. Datasets can have different datatypes. In this case, it stores wind velocity at 10m at a particular moments in time (t1, t2, t3).

In a similar way, the mesh dataset can also store vector values for each vertex. For example, wind direction vector at the given time stamps:

10 metre wind	1	2	3	...
10 metre speed at time=t1	17251	24918	32858	…
10 metre speed at time=t2	19168	23001	36418	…
10 metre speed at time=t3	21085	30668	17251	…
…	…	…	…	…
10m wind direction time=t1	[20,2]	[20,3]	[20,4.5]	…
10m wind direction time=t2	[21,3]	[21,4]	[21,5.5]	…
10m wind direction time=t3	[22,4]	[22,5]	[22,6.5]	…
…	…	…	…	…

We can visualize the data by assigning colors to values (similarly to how it is done with *Singleband pseudocolor* raster rendering) and interpolating data between vertices according to the mesh topology. It is common that some quantities are 2D vectors rather than being simple scalar values (e.g. wind direction). For such quantities it is desirable to display arrows indicating the directions.

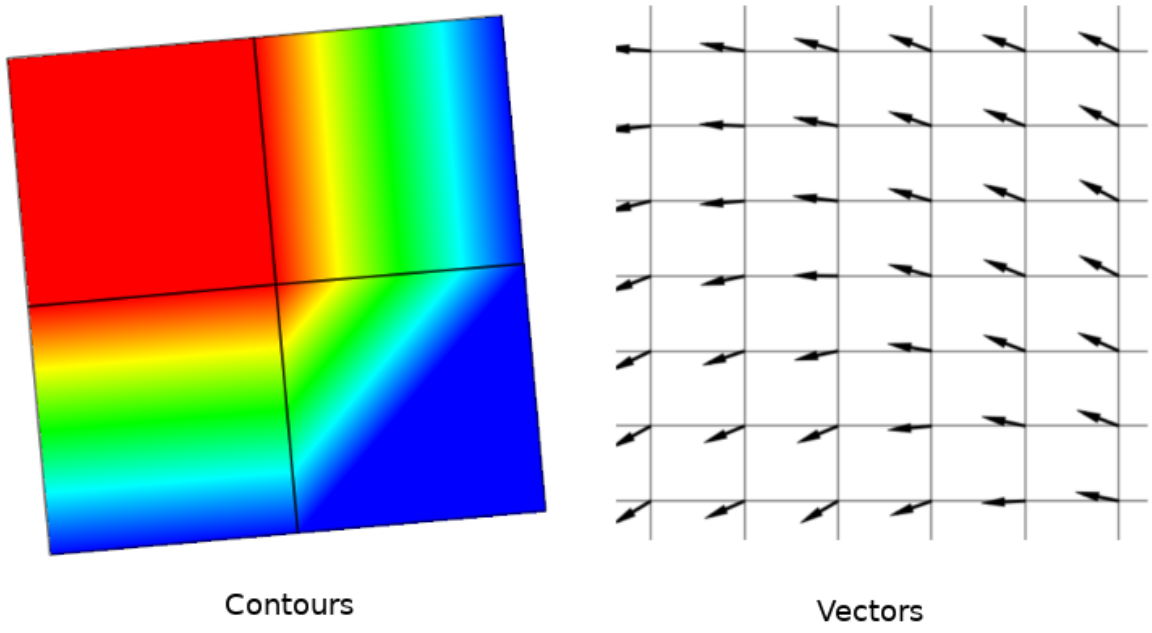


Figura16.3: Possible visualisation of mesh data

16.2 Supported formats

QGIS accesses mesh data using the MDAL drivers. Hence, the natively supported formats are:

- `NetCDF`: Generic format for scientific data
- `GRIB`: Format commonly used in meteorology
- `XMDF`: As an example, hydraulic outputs from TUFLOW modelling package
- `DAT`: Outputs of various hydrodynamic modelling packages (e.g. BASEMENT, HYDRO_AS-2D, TUFLOW)
- `3Di`: 3Di modelling package format based on Climate and Forecast Conventions (http://cfconventions.org/)
- Some examples of mesh datasets can be found at https://apps.ecmwf.int/datasets/data/interim-full-daily/levtype=sfc/

To load a mesh dataset into QGIS, use the  *Mesh* tab in the *Data Source Manager* dialog. Read *Loading a mesh layer* for more details.

16.3 Mesh Dataset Properties

16.3.1 Propriedades da informação

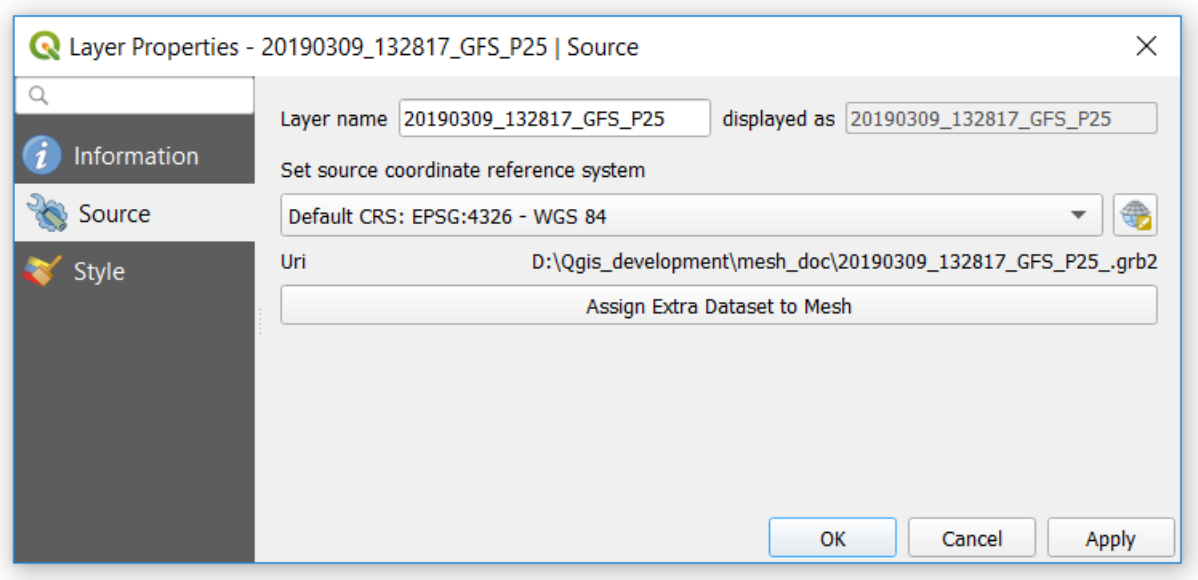


Figura16.4: Mesh Layer Properties

The *Information* tab is read-only and represents an interesting place to quickly grab summarized information and metadata on the current layer. Provided information are (based on the provider of the layer) uri, vertex count, face count and dataset groups count.

16.3.2 Propriedades de origem

The *Source* tab displays basic information about the selected mesh, including:

- the Layer name to display in the *Layers* panel
- setting the Coordinate Reference System: Displays the layer's *Coordinate Reference System (CRS)*. You can change the layer's CRS by selecting a recently used one in the drop-down list or clicking on *Select CRS* button (see *Coordinate Reference System Selector*). Use this process only if the CRS applied to the layer is wrong or if none was applied.

Use the *Assign Extra Dataset to Mesh* button to add more groups to the current mesh layer.

16.3.3 Propriedades da simbologia

Click the *Symbology* button to activate the dialog as shown in the following image:

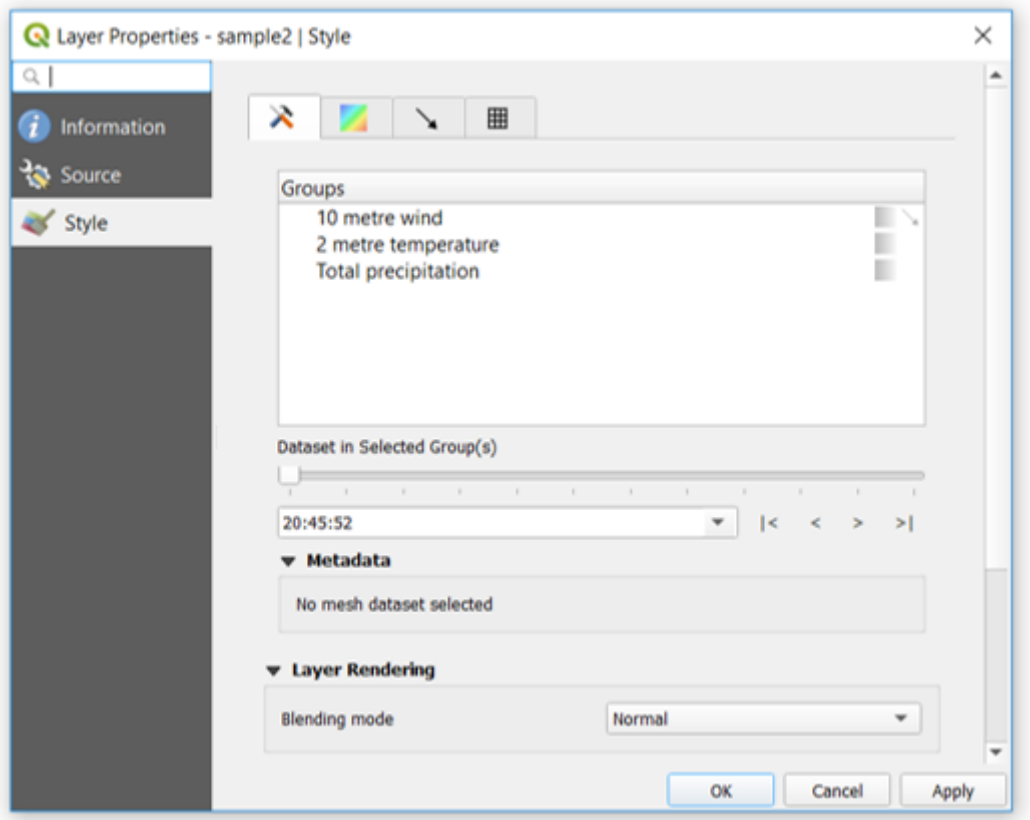


Figura16.5: Mesh Layer Symbology

Symbology properties are divided in several tabs:

- *General*
- *Contours Symbology*
- *Vectors Symbology*
- *Rendering*

General

The tab presents the following items:

- groups available in the mesh dataset
- dataset in the selected group(s), for example, if the layer has a temporal dimension
- metadata if available
- *blending mode* available for the selected dataset.

The slider , the combo box and the |<, <, >, >| buttons allow to explore another dimension of the data, if available. As the slider moves, the metadata is presented accordingly. See the figure *Mesh groups* below as an example. The map canvas will display the selected dataset group as well.

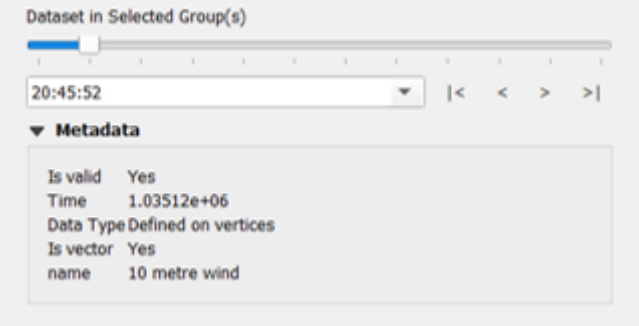


Figura16.6: Dataset in Selected Group(s)

You can apply symbology to each group using the tabs.

Contours Symbology

Under *Groups*, click on  to show contours with default visualization parameters.

In the tab  you can see and change the current visualization options of contours for the selected group, as shown in Fig.16.7 below:

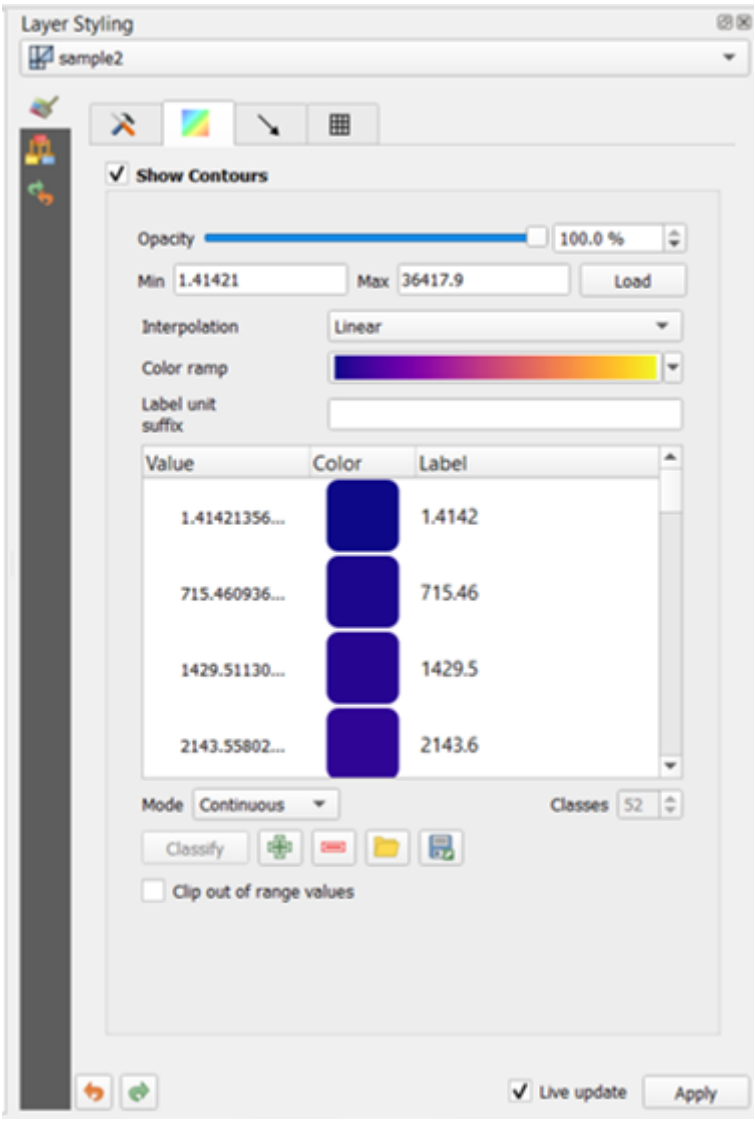


Figura16.7: Styling Contours in a Mesh Layer

Use the slide bar or combo box to set the opacity of the current group.

Use *Load* to adjust the min and max values of the current group.

The *Interpolation* list contains three options to render contours: *Linear*, *Discrete* and *Exact*.

The *Color ramp* widget opens the *color ramp drop-down shortcut*.

O *Sufixo da unidade de rótulo* é um rótulo adicionado após o valor na legenda.

By selecting *Continuous* in the classification *Mode*, QGIS creates classes automatically considering the *Min* and *Max* values. With 'Equal interval', you only need to select the number of classes using the combo box *Classes* and press the button *Classify*.

The button Add values manually adds a value to the individual color table. The button Remove selected row deletes a value from the individual color table. Double clicking on the value column lets you insert a specific value. Double clicking on the color column opens the dialog *Change color*, where you can select a color to apply on that value.

Vectors Symbology

In the tab , click on to display vectors if available. The map canvas will display the vectors in the selected group with default parameters. Click on the tab to change the visualization parameters for vectors as shown in the image below:

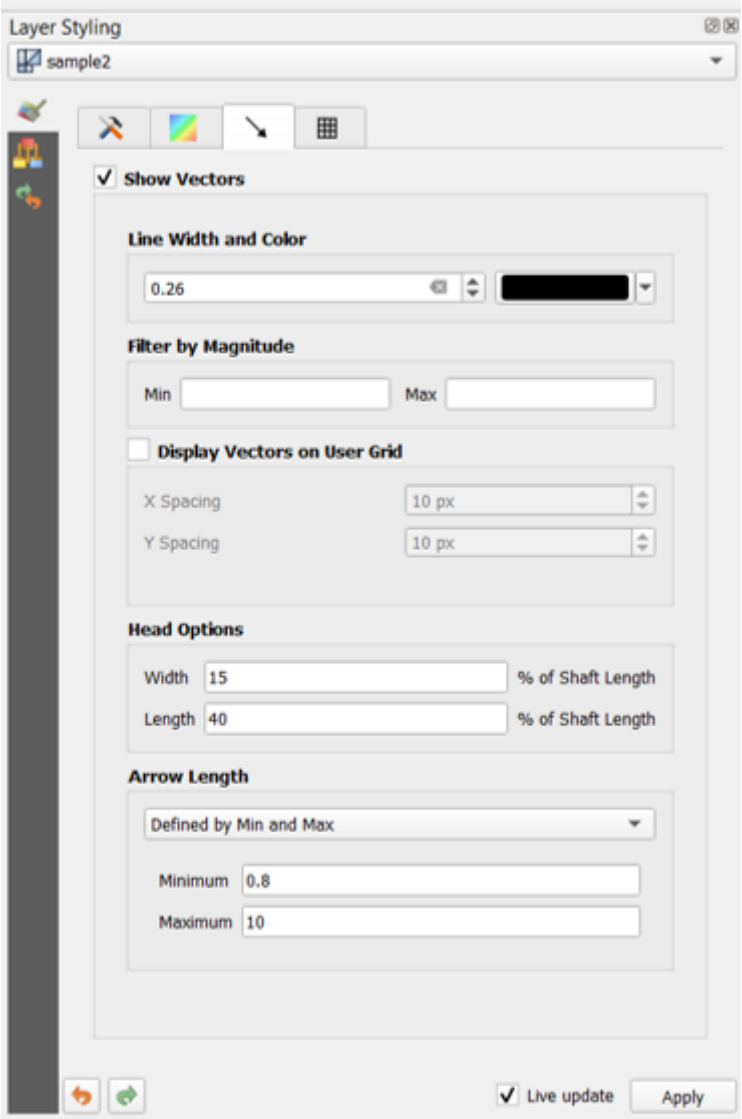


Figura16.8: Styling Vectors in a Mesh Layer

The line width can be set using the combo box or typing the value. The color widget opens the dialog *Change color*, where you can select a color to apply to vectors.

Enter values for *Min* and *Max* to filter vectors according to their magnitude.

Check on the box *Display Vectors on User Grid* and specify the *X spacing* and the *Y spacing*, QGIS will render the vector considering the given spacing.

With the Head Options *Head Options*, QGIS allows the shape of the arrow head to be set by specifying width and length (in percentage).

Vector's *Arrow length* can be rendered in QGIS in three different ways:

- Defined by Min and Max: You specify the minimum and maximum length for the vectors, QGIS will adjust their visualization accordingly
- Scale to magnitude: You specify the (multiplying) factor to use
- Fixed: all the vectors are shown with the same length

Renderização

In the tab , QGIS offers two possibilities to display the grid, as shown in Fig.16.9:

- `Native Mesh Rendering` that shows quadrants
- `Triangular Mesh Rendering` that display triangles

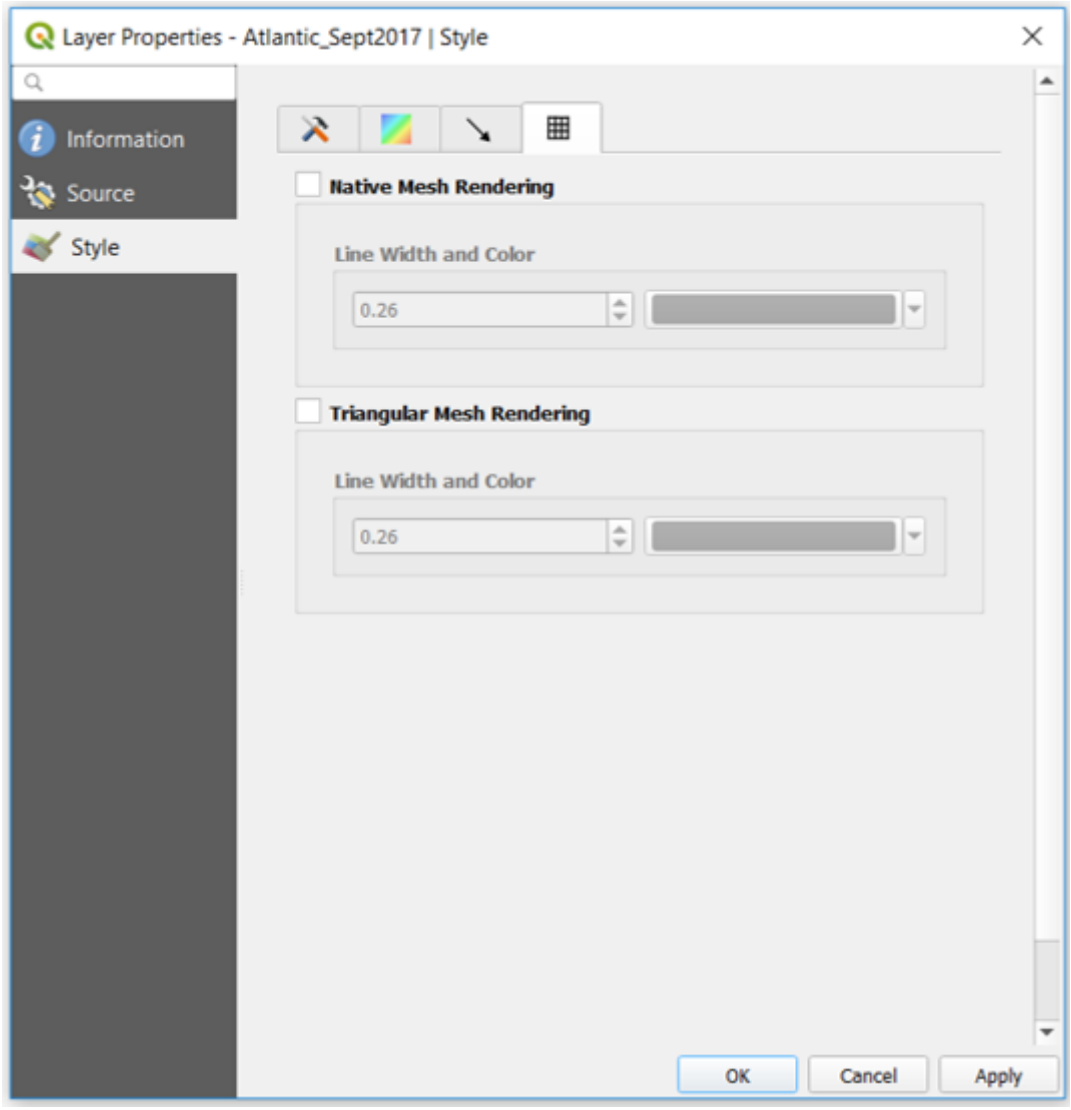


Figura16.9: Mesh Rendering

The line width and color can be changed in this dialog, and both the grid renderings can be turned off.

CAPÍTULO 17

Working with Vector Tiles

17.1 What are Vector Tiles?

Vector tiles are packets of geographic data, packaged into pre-defined roughly-square shaped “tiles” for transfer over the web. They combine pre-rendered raster map tiles and vector map tiles. The vector tile server returns vector map data, which has been clipped to the boundaries of each tile, instead of a pre-rendered map image. The clipped tiles represent the zoom-levels of the vector tile service, derived from a pyramid approach. Using this structure, the data-transfer is reduced in comparison to un-tiled vector maps. Only data within the current map view, and at the current zoom level need to be transferred. Also, compared to a tiled raster map, data transfer is also greatly reduced, as vector data is typically much smaller than a rendered bitmap. Vector tiles do not have any styling information assigned so QGIS needs to apply a cartographic style in order to display the data.

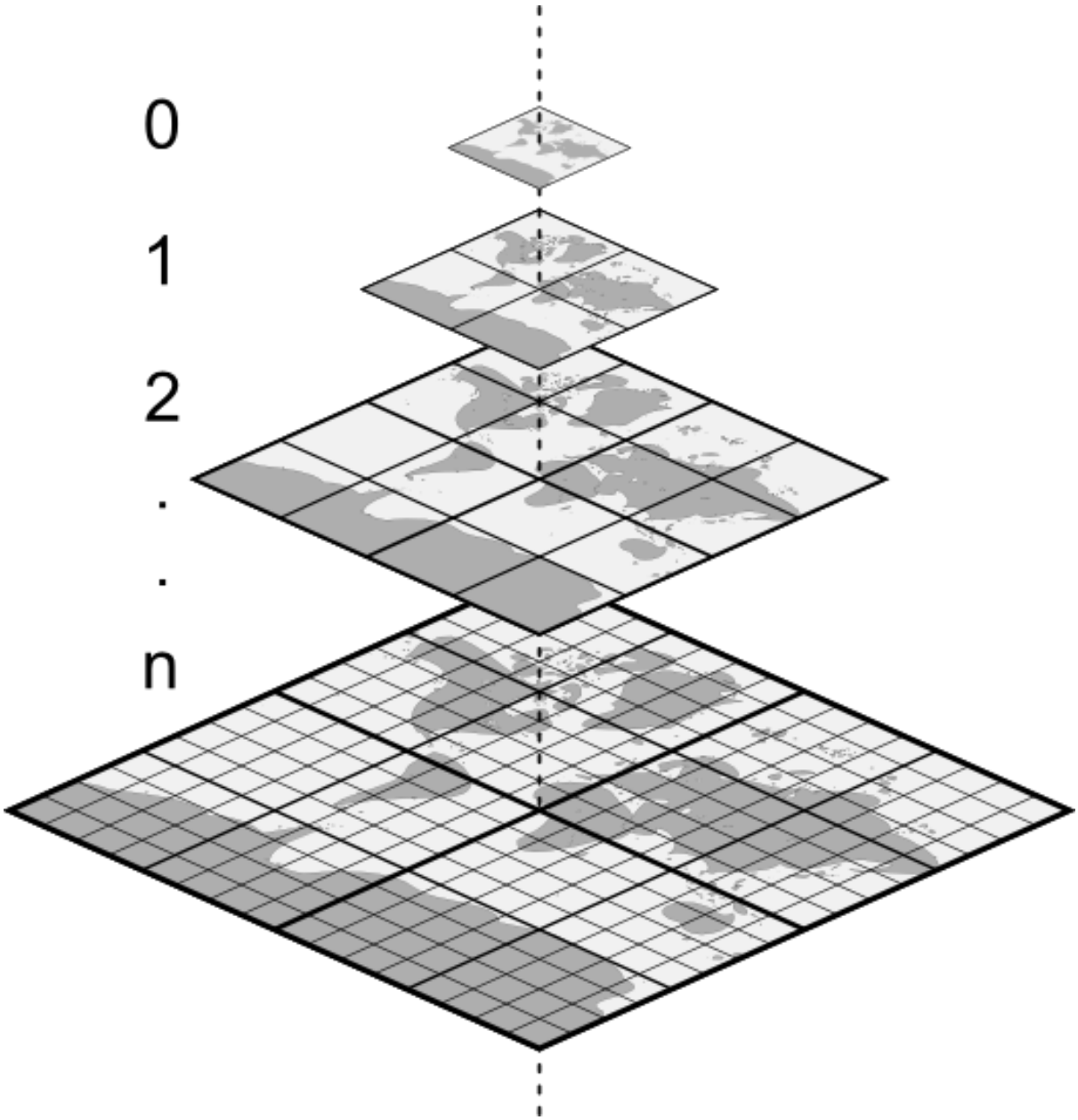


Figura17.1: Pyramid structure of vector tiles with zoom-levels

17.2 Supported Formats

There is support for vector tiles through:

- remote sources (HTTP/S) - with XYZ template - `type=xyz&url=http://example.com/{z}/{x}/{y}.pbf`
- local files - with XYZ template - e.g. `type=xyz&url=file:///path/to/tiles/{z}/{x}/{y}.pbf`
- local MBTiles database - e.g. `type=mbtiles&url=file:///path/to/file.mbtiles`

CAPÍTULO 18

Preparando os mapas

Com layouts de impressão e relatórios, pode criar mapas e atlas, e imprimi-los ou gravá-los como imagem, PDF ou SVG.

18.1 Visão Geral do Layout de Impressão

O layout de impressão fornece recursos de layout e impressão crescentes. Ele permite que você adicione elementos como a tela do mapa QGIS, rótulos de texto, imagens, legendas, barras de escala, formas básicas, setas, tabelas de atributos e quadros HTML. Você pode dimensionar, agrupar, alinhar, posicionar e girar cada elemento e ajustar suas propriedades para criar seu layout. O layout pode ser impresso ou exportado para formatos de imagem, PostScript, PDF ou SVG. Você pode salvar o layout como um modelo e carregá-lo novamente em outra sessão. Finalmente, a geração de vários mapas com base em um modelo pode ser feita por meio do gerador de atlas.

18.1.1 Sessão de Amostra para iniciantes

Before you start to work with the print layout, you need to load some raster or vector layers in the QGIS map canvas and adapt their properties to suit your own convenience. After everything is rendered and symbolized to your liking, click the New Print Layout icon in the toolbar or choose *File* ► *New Print Layout*. You will be prompted to choose a title for the new layout.

To demonstrate how to create a map please follow the next instructions.

1. On the left side, select the Add map toolbar button and draw a rectangle on the canvas holding down the left mouse button. Inside the drawn rectangle the QGIS map view to the canvas.

2. Select the Add scalebar toolbar button and click with the left mouse button on the print layout canvas. A scalebar will be added to the canvas.

3. Select the Add legend toolbar button and draw a rectangle on the canvas holding down the left mouse button. Inside the drawn rectangle the legend will be drawn.

4. Select the Select/Move item icon to select the map on the canvas and move it a bit.

5. While the map item is still selected you can also change the size of the map item. Click while holding down the left mouse button, in a white little rectangle in one of the corners of the map item and drag it to a new location to change its size.
6. Click the *Item Properties* panel on the left down side and find the setting for the orientation. Change the value of the setting *Map orientation* to '15.00° '. You should see the orientation of the map item change.
7. Now, you can print or export your print layout to image formats, PDF or to SVG with the export tools in *Layout* menu.
8. Finally, you can save your print layout within the project file with the Save Project button.

You can add multiple elements to the print layout. It is also possible to have more than one map view or legend or scale bar in the print layout canvas, on one or several pages. Each element has its own properties and, in the case of the map, its own extent. If you want to remove any elements from the layout canvas you can do that with the `Delete` or the `Backspace` key.

18.1.2 The Layout Manager

The *Layout Manager* is the main window to manage print layouts in the project. It gives you an overview of existing print layouts and reports in the project and offers tools to:

- search for a layout;
- add new print layout or new report from scratch, template or duplicating an existing one;
- rename or delete any of them;
- open them in the project.

To open the layout manager dialog:

- from the main QGIS dialog, select *Project* ► *Layout Manager…* menu or click on the Layout Manager button in the *Project Toolbar*;
- from a print layout or report dialog, select *Layout* ► *Layout Manager…* menu or click on the Layout Manager button in the *Layout Toolbar*.

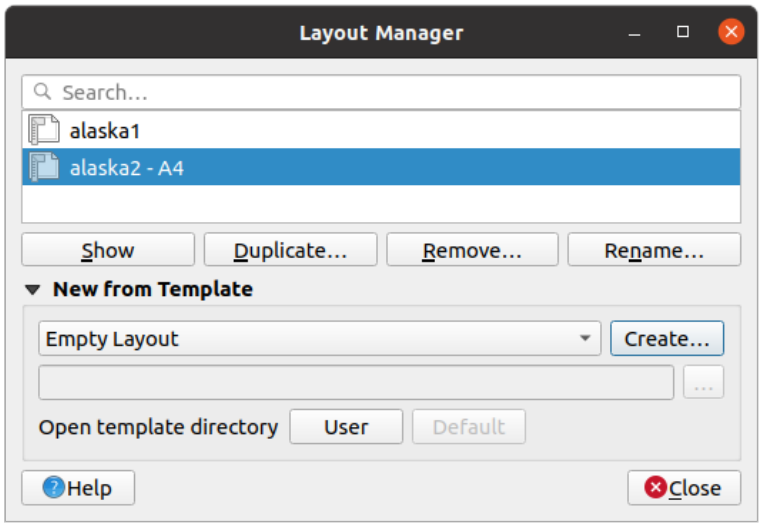


Figura18.1: The Print Layout Manager

The layout manager lists in its upper part all the available print layouts or reports in the project with tools to:

- show the selection: you can select multiple reports and/or print layout(s) and open them in one-click. Double-click a name also opens it;

- duplicate the selected print layout or report (available only if one item is selected): it creates a new dialog using the selected one as template. You'll be prompted to choose a new title for the new layout;
- rename the report or layout (available only if one item is selected): you'll be prompted to choose a new title for the layout;
- remove the layout: the selected print layout(s) will be deleted from the project.

In the lower part, it's possible to create new print layouts or reports from scratch or a template. By default, QGIS will look for templates in the user profile and the application template directories (accessible with the two buttons at the bottom of the frame) but also in any folder declared as *Path(s) to search for extra print templates* in *Settings* ► *Options* ► *Layouts*. Found templates are listed in the combobox. Select an item and press the *Create* button to generate a new report or print layout.

You can also use layout templates from a custom folder; in that case, select *specific* in the templates drop-down list, browse to the template and press *Create*.

Dica: Creating template-based print layouts from Browser panel

Drag-and-drop a print layout template `.qpt` file from any file browser onto the map canvas or double-click it in the *Browser panel* generates a new print layout from the template.

18.1.3 Menus, tools and panels of the print layout

Opening the print layout provides you with a blank canvas that represents the paper surface when using the print option. Initially you find buttons on the left beside the canvas to add print layout items: the current QGIS map canvas, text labels, images, legends, scale bars, basic shapes, arrows, attribute tables and HTML frames. In this toolbar you also find buttons to navigate, zoom in on an area and pan the view on the layout a well as buttons to select any layout item and to move the contents of the map item.

Fig.18.2 shows the initial view of the print layout before any elements are added.

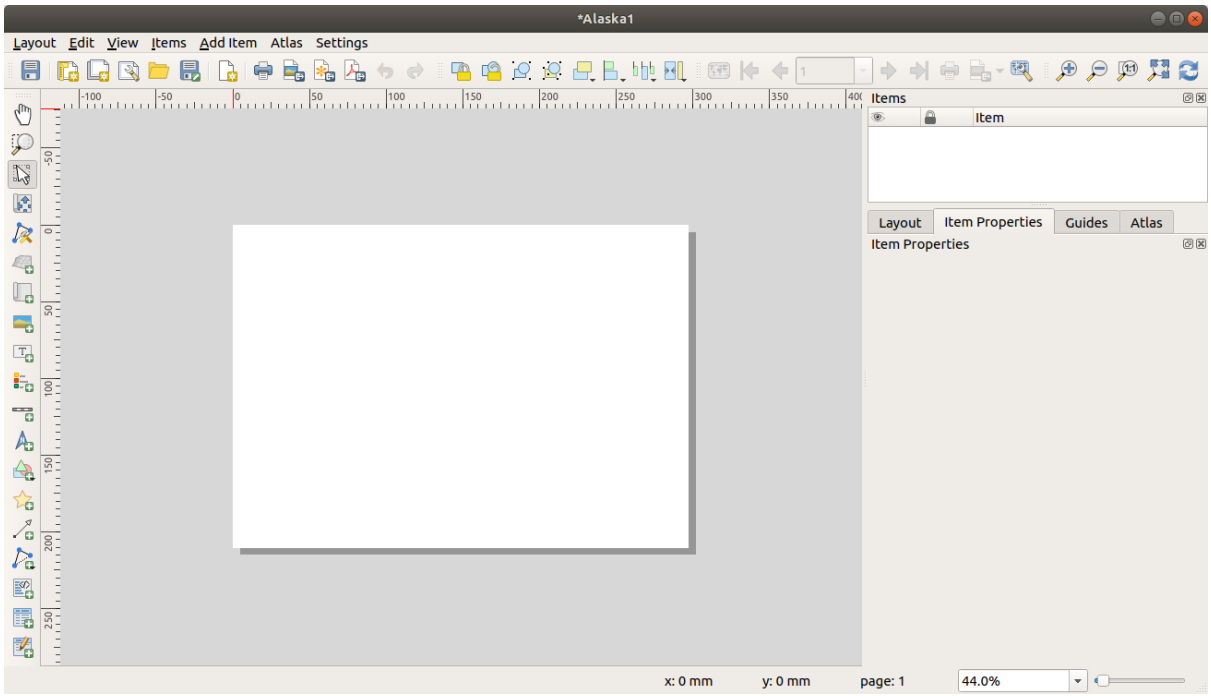


Figura18.2: Layout de impressão

On the right beside the canvas you find two set of panels. The upper one holds the panels *Items* and *Undo History* and the lower holds the panels *Layout*, *Item properties* and *Atlas generation*.

- The *Items* panel provides a list of all the print layout items added to the canvas and ways to globally interact with them (see *The Items Panel* for more information).
- The *Undo History* panel displays a history of all changes applied to the layout. With a mouse click, it is possible to undo and redo layout steps back and forth to a certain status.
- The *Layout* panel allows you to set general parameters to apply to the layout when exporting or working within (see *The Layout Panel* for more details);
- The *Item Properties* panel displays the properties for the selected item. Click the  Select/Move item icon to select an item (e.g., legend, scale bar or label) on the canvas. Then click the *Item Properties* panel and customize the settings for the selected item (see *Elementos do Layout* for detailed information on each item settings).
- The *Atlas* panel allows you to enable the generation of an atlas for the current layout and gives access to its parameters (see *Generate an Atlas* for detailed information on atlas generation usage).

In the bottom part of the print layout window, you can find a status bar with mouse position, current page number, a combo box to set the zoom level, the number of selected items if applicable and, in the case of atlas generation, the number of features.

In the upper part of the print layout window, you can find menus and other toolbars. All print layout tools are available in menus and as icons in a toolbar.

The toolbars and the panels can be switched off and on using the right mouse button over any toolbar or through *View* ► *Toolbars* ► or *View* ► *Panels* ►.

Menus and Tools

Layout menu

The *Layout* provides action to manage the layout:

- Save the project file directly from the print layout window.
- Create a new and blank print layout with  *New Layout…*.
-  *Duplicate Layout…* : Create a new print layout by duplicating the current one.
- Remove the current layout with  *Delete Layout…*.
- Open the  *Layout Manager…*.
- *Layouts* ► : Open an existing print layout.

Once the layout is designed, with  *Save as Template* and  *Add Items from Template* icons, you can save the current state of a print layout session as a `.qpt` template file and load its items again in another session/print layout.

In the *Layout* menu, there are also powerful ways to share geographical information produced with QGIS that can be included in reports or published. These tools are  *Export as Image…*,  *Export as PDF…*,  *Export as SVG…* and  *Print…*.

Below is a list of all the available tools in this menu with some convenient information.

Ferramenta	Atalho	Barra de Ferramentas	Referência
Save Project	`Ctrl+S`	*Layout*	*Introduzindo projetos do QGIS*
New Layout	`Ctrl+N`	*Layout*	*The Layout Manager*
Duplicate Layout		*Layout*	*The Layout Manager*
Delete Layout			
Gerenciador de Layout…		*Layout*	*The Layout Manager*
Layouts ►			
Layout Properties…			*The Layout Panel*
Rename Layout…			
Add Pages…		*Layout*	*Working with the page properties*
Add Items from Template		*Layout*	*Creating a layout item*
Save as Template…		*Layout*	*The Layout Manager*
Export as Image…		*Layout*	*Exportar como Imagem*
Export as SVG…		*Layout*	*Export as SVG*
Export as PDF…		*Layout*	*Export as PDF*
Page Setup…	`Ctrl+Shift+P`		
Print…	`Ctrl+P`	*Layout*	*Criando um arquivo de Saída*
Fechar	`Ctrl+Q`		

Edit menu

The *Edit* menu offers tools to manipulate print layout items. It includes common actions like selection tools, Copy/Cut/Paste and undo/redo (see *The Undo History Panel: Revert and Restore actions*) functionality for the items in the layout.

When using the Paste action, the elements will be pasted according to the current mouse position. Using the *Edit* ► *Paste in Place* action or pressing `Ctrl+Shift+V` will paste the items into the current page, at the same position they were in their initial page. It ensures to copy/paste items at the same place, from page to page.

Below is a list of all the available tools in this menu with some convenient information.

Tabela18.1: Ferramentas Disponíveis

Ferramenta	Atalho	Barra de Ferramentas	Referência
Undo (last change)	`Ctrl+Z`	*Layout*	*The Undo History Panel: Revert and Restore actions*
Redo (last reverted change)	`Ctrl+Y`	*Layout*	*The Undo History Panel: Revert and Restore actions*
Delete	`Del`		
Cut	`Ctrl+X`		
Copy	`Ctrl+C`		
Paste	`Ctrl+V`		
Paste in place	`Ctrl+Shift+V`		
Select All	`Ctrl+A`		
Deselect all	`Ctrl+Shift+A`		
Invert Selection			
Select Next Item Below	`Ctrl+Alt+[`		
Select Next Item above	`Ctrl+Alt+]`		
Pan Layout	`P`	*Toolbox*	
Zoom	`Z`	*Toolbox*	
Select/Move Item	`V`	*Toolbox*	*Interacting with layout items*
Move Content	`C`	*Toolbox*	*Ítem do Mapa*
Edit Nodes Item		*Toolbox*	*The Node-Based Shape Items*

View menu

The *View* menu gives access to navigation tools and helps to configure general behavior of the print layout. Beside the common zoom tools, you have means to:

- Refresh view (if you find the view in an inconsistent state);
- enable a *grid* you could snap items to when moving or creating them. Grids setting is done in *Settings* ► *Layout Options…* or in the *Layout Panel*;
- enable *guides* you could snap items to when moving or creating them. Guides are red lines that you can create by clicking in the ruler (above or at the left side of the layout) and drag and drop to the desired location;
- *Smart Guides*: uses other layout items as guides to dynamically snap to as you move or reshape an item;
- *Clear Guides* to remove all current guides;
- *Show Bounding box* around the items to better identify your selection;
- *Show Rules* around the layout;
- *Show Pages* or set up pages to transparent. Often layout is used to create non-print layouts, e.g. for inclusion in presentations or other documents, and it's desirable to export the composition using a totally transparent background. It's sometimes referred to as "infinite canvas" in other editing packages.

In the print layout, you can change the zoom level using the mouse wheel or the slider and combo box in the status bar. If you need to switch to pan mode while working in the layout area, you can hold the `Spacebar` or the mouse

wheel. With `Ctrl+Spacebar`, you can temporarily switch to Zoom In mode, and with `Ctrl+Alt+Spacebar`, to Zoom Out mode.

Panels and toolbars can be enabled from the *View* ► menu. To maximise the space available to interact with a composition you can check the *View* ► *Toggle Panel Visibility* option or press `Ctrl+Tab`; all panels are hidden and only previously visible panels are restored when unchecked.

It's also possible to switch to a full screen mode to have more space to interact with by pressing `F11` or using *View* ► *Toggle Full Screen*.

Ferramenta	Atalho	Barra de Ferramentas	Referência
Refresh	`F5`	*Navigation*	
Preview ►			
Zoom In	`Ctrl++`	*Navigation*	
Reduzir Zoom	`Ctrl+-`	*Navigation*	
Zoom to 100%	`Ctrl+1`	*Navigation*	
Zoom Full	`Ctrl+0`	*Navigation*	
Zoom to Width			
Show Grid	`Ctrl+'`		*Guides and Grid*
Snap to Grid	`Ctrl+Shift+'`		*Guides and Grid*
Show Guides	`Ctrl+;`		*Guides and Grid*
Snap to Guides	`Ctrl+Shift+;`		*Guides and Grid*
Smart Guides	`Ctrl+Alt+;`		
Manage Guides...			*The Guides Panel*
Clear Guides			*The Guides Panel*
Show Rulers	`Ctrl+R`		
Show Bounding Boxes	`Ctrl+Shift+B`		
Show Pages			
Barra de Ferramentas ►			*Painéis e Barras de Ferramentas*
Painéis ►			*Painéis e Barras de Ferramentas*
Toggle Full Screen	`F11`		*Ver*
Toggle Panel Visibility	`Ctrl+Tab`		*Ver*

Items menu

The *Items* helps you configure items' position in the layout and the relations between them (see *Interacting with layout items*).

Ferramenta	Atalho	Barra de Ferramentas	Referência
 *Group*	`Ctrl+G`	*Actions*	*Grouping items*
 *Ungroup*	`Ctrl+Shift+G`	*Actions*	*Grouping items*
 *Raise*	`Ctrl+]`	*Actions*	*Alignment*
 *Lower*	`Ctrl+[`	*Actions*	*Alignment*
 *Bring to Front*	`Ctrl+Shift+]`	*Actions*	*Alignment*
 *Send to Back*	`Ctrl+Shift+[`	*Actions*	*Alignment*
 *Lock Selected Items*	`Ctrl+L`	*Actions*	*Locking items*
 *Unlock All*	`Ctrl+Shift+L`	*Actions*	*Locking items*
Align Items ►		*Actions*	*Alignment*
Distribute Items ►		*Actions*	*Moving and resizing items*
Resize ►		*Actions*	*Moving and resizing items*

Add Item menu

These are tools to create layout items. Each of them is deeply described in *Elementos do Layout* chapter.

Ferramenta	Barra de Ferramentas	Referência
Add Map	*Toolbox*	*Ítem do Mapa*
Add Picture	*Toolbox*	*O Item de Imagem*
Add Label	*Toolbox*	*A rotulagem de item*
Add Legend	*Toolbox*	*O Item Legenda*
Add Scale Bar	*Toolbox*	*Item da Barra de Escala*
Add North Arrow	*Toolbox*	*O Item de Seta Norte*
Add Shape ►	*Toolbox*	*Os Itens regulares do Shape*
► *Add Rectangle*	*Toolbox*	*Os Itens regulares do Shape*
► *Add Ellipse*	*Toolbox*	*Os Itens regulares do Shape*
► *Add Triangle*	*Toolbox*	*Os Itens regulares do Shape*
Add Marker	*Toolbox*	
Add Arrow	*Toolbox*	*Item da Seta*
Adicionar Nó ►	*Toolbox*	*The Node-Based Shape Items*
► *Add Polygon*	*Toolbox*	*The Node-Based Shape Items*
► *Add Polyline*	*Toolbox*	*The Node-Based Shape Items*
Add HTML	*Toolbox*	*O quadro com item em HTML*
Add Attribute Table	*Toolbox*	*Item da tabela de atributos*
Add Fixed Table	*Toolbox*	*The fixed table item*
Add 3D Map	*Toolbox*	*The 3D Map Item*

Atlas menu

Ferramenta	Atalho	Barra de Ferramentas	Referência
Preview Atlas	`Ctrl+ALt+/`	*Atlas*	*Preview and generate an atlas*
First Feature	`Ctrl+<`	*Atlas*	*Preview and generate an atlas*
Previous Feature	`Ctrl+,`	*Atlas*	*Preview and generate an atlas*
Next Feature	`Ctrl+.`	*Atlas*	*Preview and generate an atlas*
Last feature	`Ctrl+>`	*Atlas*	*Preview and generate an atlas*
Print Atlas…		*Atlas*	*Preview and generate an atlas*
Export Atlas as Images…		*Atlas*	*Preview and generate an atlas*
Export Atlas as SVG…		*Atlas*	*Preview and generate an atlas*
Export Atlas as PDF…		*Atlas*	*Preview and generate an atlas*
Atlas Settings		*Atlas*	*Generate an Atlas*

Settings Menu

The *Settings* ► *Layout Options...* menu is a shortcut to *Settings* ► *Options* ► *Layouts* menu of QGIS main canvas. Here, you can set some options that will be used as default on any new print layout:

- *Layout defaults* let you specify the default font to use;
- With *Grid appearance*, you can set the grid style and its color. There are three types of grid: **Dots**, **Solid** lines and **Crosses**;
- *Grid and guide defaults* defines spacing, offset and tolerance of the grid (see *Guides and Grid* for more details);
- *Layout Paths*: to manage list of custom paths to search print templates.

Contextual menus

Depending on where you right-click in the print layout dialog, you open a contextual menu with various features:

- Right-click on the menu bar or any toolbar and you get the list of layout panels and toolbars you can enable or disable in one-click.
- Right-click over a ruler and you can *Show Guides*, *Snap to Guides*, *Manage Guides...* opening the *Guides panel* or *Clear Guides*. It's also possible to hide the rulers.
- Right-click in the print layout canvas and:
  - You'll be able to *Undo* and *Redo* recent changes, or *Paste* any copied item (only available if no item is selected).
  - If you click over a page, you can additionally access the current *Page Properties* panel or *Remove Page*.
  - If you click on a selected item then you can cut or copy it as well as open the *Item Properties* panel.
  - If more than one item are selected, then you can either group them and/or ungroup if at least one group is already in the selection.
- Right-click inside a text box or spinbox widget of any layout panel provides edit options to manipulate its content.

The Layout Panel

In the *Layout* panel, you can define the global settings of your print layout.

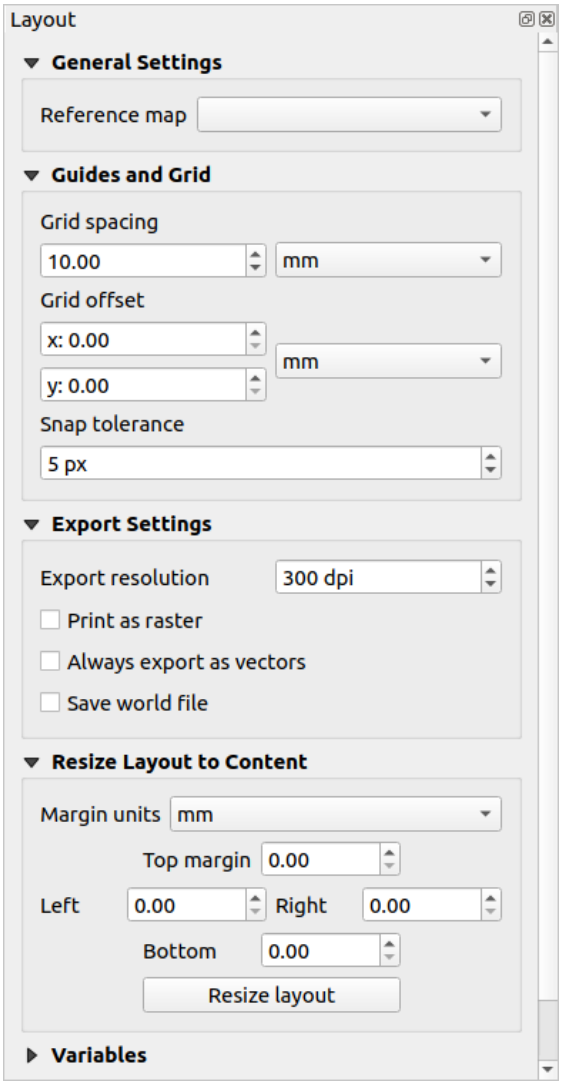


Figura18.3: Layout Settings in the Print Layout

General settings

In a print layout, you can use more than one map item. The *Reference map* represents the map item to use as the layout's master map. It's assigned as long as there's a map item in the layout. The layout will use this map in any of their properties and variables calculating units or scale. This includes exporting the print layout to georeferenced formats.

Moreover, new layout items such as scale bar, legend or north arrow have by default their settings (orientation, displayed layers, scale, …) bound to the map item they are drawn over, and fall back to the reference map if no overlapping map.

Guides and Grid

You can put some reference marks on your paper sheet to help you accurately place some items. These marks can be:

- simple horizontal or vertical lines (called **Guides**) put at the position you want (see *The Guides Panel* for guides creation).
- or regular **Grid**: a network of horizontal and vertical lines superimposed over the layout.

Settings like *Grid spacing* or *Grid offset* can be adjusted in this group as well as the *Snap tolerance* to use for items. The tolerance is the maximum distance below which the mouse cursor is snapped to a grid or a guide, while moving, resizing or creating an item.

Whether grid or guides should be shown is set in *View* menu. There, you can also decide if they might be used to snap layout items. When both a grid line and a guide line are within tolerance of a point, guides will always take precedence - since they have been manually set (hence, assumption that they have been explicitly placed at highly desirable snapping locations, and should be selected over the general grid).

Nota: In the *Settings* ► *Layout Options* menu, you can also set the grid and guides parameters exposed above. However, these options will only apply as defaults to new print layouts.

Definições para exportação

You can define a resolution to use for all exported maps in *Export resolution*. This setting can then be overridden each time you export a map.

Because of some advanced rendering options (*blending mode*, *effects*…), a layout item may need rasterization in order to be exported correctly. QGIS will individually rasterize it without forcing every other item to also be rasterized. This allows printing or saving as PostScript or PDF to keep items as much as possible as vectors, e.g. a map item with layer opacity won't force labels, scale bars, etc to be rasterized too. You can however:

- force all the items to be rasterized checking the *Print as raster* box;
- or use the opposite option, i.e. *Always export as vectors*, to force the export to keep items as vectors when exported to a compatible format. Note that in some cases, this could cause the output to look different to layout.

Where the format makes it possible (e.g., `.TIF`, `.PDF`) exporting a print layout results by default in a georeferenced file (based on the *Reference map* item in the *General settings* group). For other formats, georeferenced output requires you to generate a world file by checking *Save world file*. The world file is created beside the exported map(s), has the name of the page output with the reference map item and contains information to georeference it easily.

Resize layout to content

Using the *Resize page* tool in this group, you create a unique page composition whose extent covers the current contents of the print layout (with some optional *margins* around the cropped bounds).

Note that this behavior is different from the *crop to content* option in that all the items are placed on a real and unique page in replacement of all the existing pages.

Variáveis

The *Variables* lists all the variables available at the layout's level (which includes all global and project's variables).

It also allows the user to manage layout-level variables. Click the button to add a new custom layout-level variable. Likewise, select a custom layout-level variable from the list and click the button to remove it.

More information on variables usage in the *General Tools* section.

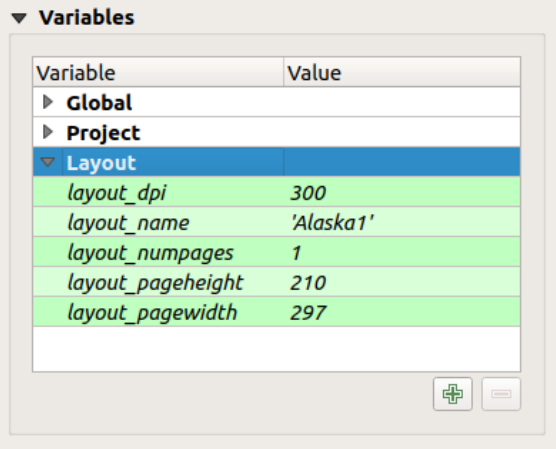


Figura18.4: Variables Editor in the Print Layout

Working with the page properties

A layout can be composed of several pages. For instance, a first page can show a map canvas, and a second page can show the attribute table associated with a layer, while a third one shows an HTML frame linking to your organization website. Or you can add many types of items on each page.

Adding a new page

Futhermore, a layout can be made using different size and/or orientation of pages. To add a page, select the *Add Pages...* tool from the *Layout* menu or *Layout Toolbar*. The *Insert Pages* dialog opens and you are asked to fill:

- the number of pages to insert;
- the position of the page(s): before or after a given page or at the end of the print layout;
- The *Page size*: it could be of a preset format page (`A4`, `B0`, `Legal`, `Letter`, `ANSI A`, `Arch A` and their derivatives as well as a resolution type, such as `1920x1080` or `1024x768`) with associated *Orientation* (Portrait or Landscape).

  The page size can also be of a `custom` format; In that case, you'd need to enter its *Width* and *Height* (with locked size ratio if needed) and select the unit to use among `mm`, `cm`, `px`, `pt`, `in`, `ft`... Conversion of entered values is automatically applied when switching from one unit to another.

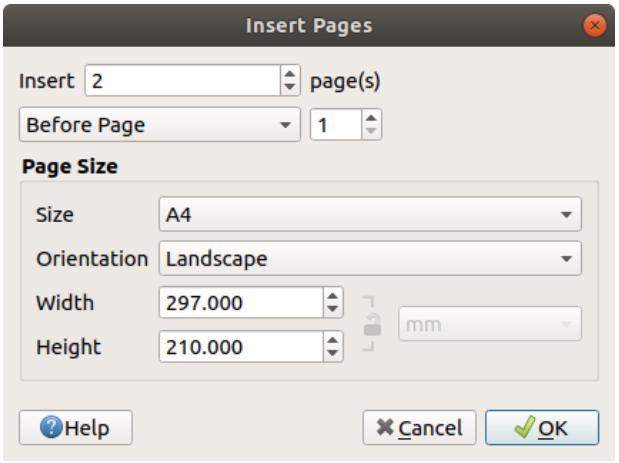


Figura18.5: Creating a new page in the Print Layout

Updating page properties

Any page can be later customized through the Page *Item Properties* panel. Right-click on a page and select *Page Properties…*. The *Item Properties* panel opens with settings such as:

- the *Page size* frame described above. You can modify each property using the data defined override options (see *Explore Data-defined override buttons with atlas* for a use case);
- the *Exclude page from exports* to control whether the current page with its content should be included in the *layout output*;
- the *Background* of the current page using the *color* or *symbol* you want.

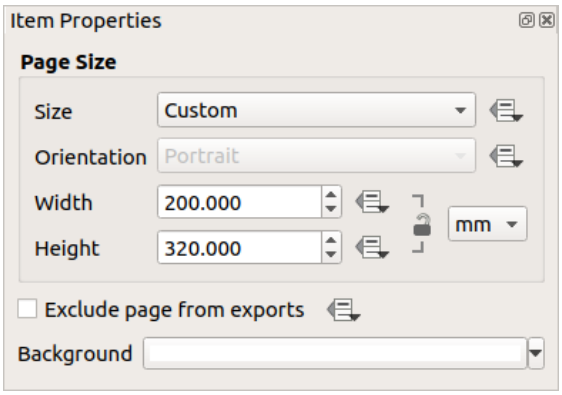


Figura18.6: Page properties dialog

The Guides Panel

Guides are vertical or horizontal line references you can place on a layout page to assist you on items placement, when creating, moving or resizing them. To be active, guides require the *View* ► *Show Guides* and *View* ► *Snap to Guides* options to be checked. To create a guide, there are two different methods:

- if the *View* ► *Show Rulers* option is set, drag out a ruler and release the mouse button within the page area, at the desired position.
- for more precision, use the *Guides* panel from the *View* ► *Toolbox* ► or by selecting *Manage guides for page…* from the page's contextual menu.

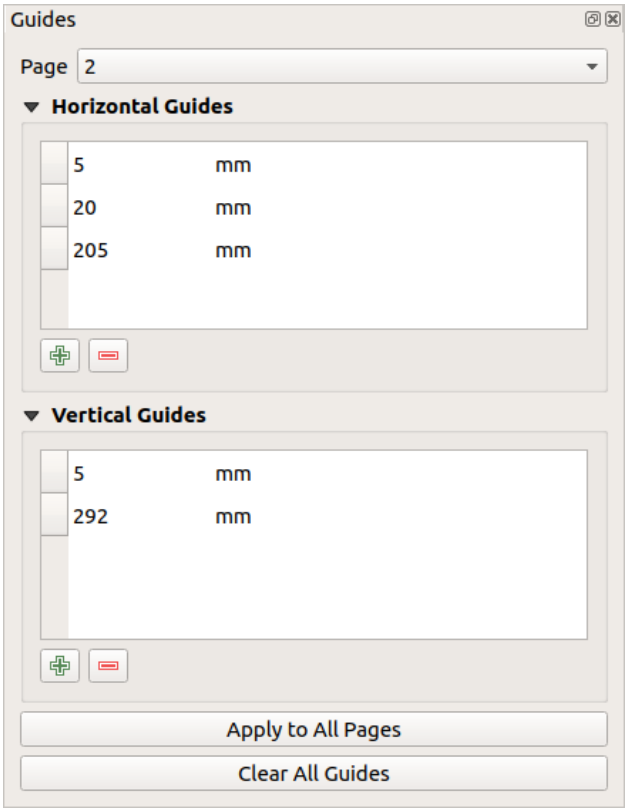


Figura18.7: The Guides panel

The *Guides* panel allows creation of snap lines at specific locations:

1. Select the *Page* you'd like to add the guides to
2. Click the Add new guide button and enter the coordinates of the horizontal or vertical line. The origin is at the top left corner. Different units are available for this.

   The panel also allows adjusting the position of existing guides to exact coordinates: double-click and replace the value.
3. The *Guides* panel lists only the items for the current page. It allows creation or removal of guides only in the current page. However, you can use the *Apply to All Pages* button to replicate the guide configuration of the current page to the other pages in the layout.
4. To delete a guide, select it and press the Remove selected guide button. Use *Clear All Guides* to remove all the guides in the current page.

Dica: Snapping to existing layout items

Other than guides and grids, you can use existing items as snapping references when moving, resizing or creating new items; these are called **smart guides** and require *View* ► *Smart Guides* option to be checked. Anytime the mouse pointer is close to an item's bound, a snapping cross appears.

The Items Panel

The *Items* panel offers some options to manage selection and visibility of items. All the items added to the print layout canvas (including *items group*) are shown in a list and selecting an item makes the corresponding row selected in the list as well as selecting a row does select the corresponding item in the print layout canvas. This is thus a handy way to select an item placed behind another one. Note that a selected row is shown as bold.

For any selected item, you can :

- set it visible or not;
- lock or unlock its position;
- sort its Z position. You can move up and down each item in the list with a click and drag. The upper item in the list will be brought to the foreground in the print layout canvas. By default, a newly created item is placed in the foreground.
- change the item ID by double-clicking the text;
- right-click an item and copy or delete it or open its *properties panel*.

Once you have found the correct position for an item, you can lock it by ticking the box in column. Locked items are **not** selectable on the canvas. Locked items can be unlocked by selecting the item in the *Items* panel and unchecking the tickbox or you can use the icons on the toolbar.

The Undo History Panel: Revert and Restore actions

During the layout process, it is possible to revert and restore changes. This can be done with the revert and restore tools available in the *Edit* menu, the *Layout* toolbar or the contextual menu any time you right-click in the print layout area:

- Revert last change
- Restore last change

This can also be done by mouse click within the *Undo history* panel (see Fig.18.8). The History panel lists the last actions done within the print layout. Just select the point you want to revert to and once you do new action all the actions done after the selected one will be removed.

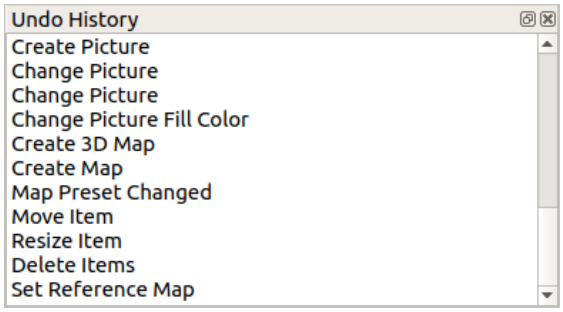


Figura18.8: Undo History in the Print Layout

18.2 Elementos do Layout

18.2.1 Layout Items Common Options

QGIS provides a large set of items to layout a map. They can be of map, legend, scale bar, picture, table, north arrow, image type… They however share some common options and behavior that are exposed below.

Creating a layout item

Items can be created using different tools, either from scratch or based on existing items.

To create a layout item from scratch:

1. Select the corresponding tool either from the *Add Item* menu or the *Toolbox* bar.
2. Then:
   - Click on the page and fill the size and placement information requested in the *New Item Properties* dialog that pops up (for details, see *Position and Size*);

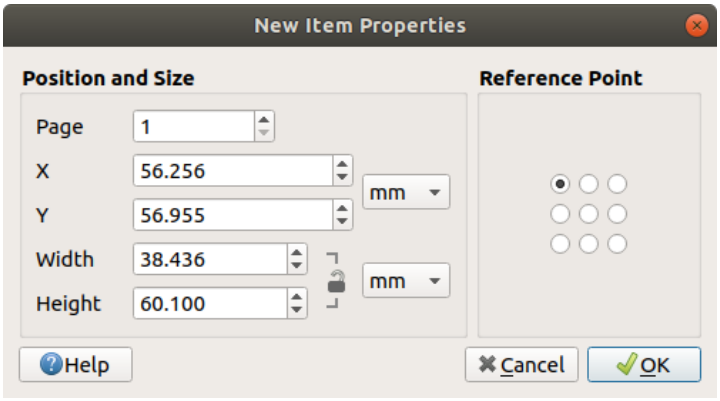


Figura18.9: New Item properties dialog

   - Or click-and-drag to define the initial size and placement of the item. You can rely on *grids and guides* snapping for a better position.

Nota: Because they can have particular shapes, drawing node or arrow items does not work with one-click nor click-and-drag methods; you need to click and place each node of the item. See *The Node-Based Shape Items* for more details.

You can also:

1. Select an existing item with the  Select/Move item button from the *Toolbox* toolbar
2. Use the contextual menu or the *Edit* menu tools to copy/cut the item and paste it at the mouse position as a new item.

   You can also use the *Paste in Place* (`Ctrl+Shift+V`) command to duplicate an item from one page to another and place it in the new page at the same coordinates as the original.

Moreover, you can create items using a print layout template (for details, see *The Layout Manager*) through the *Layout* ► *Add Items from Template…* command.

Dica: Add layout items using the file browser

From your file browser or using the *Browser* panel, drag-and-drop a print layout template (`.qpt` file) onto a print layout dialog and QGIS automatically adds all items from that template to the layout.

Interacting with layout items

Each item inside the print layout can be moved and resized to create a perfect layout. For both operations the first step is to activate the  Select/Move item tool and click on the item.

You can select multiple items with the  Select/Move item button: click and drag over the items or hold the `Shift` button and click on each of the items you want. To deselect an item, click on it holding the `Shift` button.

Each time there's a selection, count of selected items is displayed on the status bar. Inside the *Edit* menu, you can find actions to select all the items, clear all selections, invert the current selection and more…

Moving and resizing items

Unless *View* ► *Show Bounding Boxes* option is unchecked, a selected item will show squares on its boundaries ; moving one of them with the mouse will resize the item in the corresponding direction. While resizing, holding `Shift` will maintain the aspect ratio. Holding `Alt` will resize from the item center.

To move a layout item, select it with the mouse and move while holding the left button. If you need to constrain the movements to the horizontal or vertical axis, just hold the `Shift` button on the keyboard while moving the mouse. You can also move a selected item using the `Arrow keys` on the keyboard; if the movement is too slow, you can speed it up by holding `Shift`. If you need better precision, use the *Position and size* properties, or grid/guides snapping as explained above for item's creation.

Resizing or moving several items at once is made the same way as for a single item. QGIS however provides some advanced tools to automatically resize a selection of items following different rules:

- each item height matches the  tallest or the  shortest selected item;
- each item width matches the  widest or the  narrowest selected item;
- resizes items to  squares: each item is enlarged to form a square.

Likewise, automated tools are available to organize multiple items position by distributing equidistantly:

- edges (left, right, top or bottom) of items;
- centers of items either horizontally or vertically.

Grouping items

Grouping items allows you to manipulate a set of items like a single one: you can easily resize, move, delete, copy the items as a whole.

To create a group of items, select more than one and press the . *Group* button on the *View* menu or the *Actions* toolbar or from the right-click menu. A row named `Group` is added to the *Items* panel and can be locked or hidden like any other *Items panel's object*. Grouped items are **not individually** selectable on the canvas; use the Items panel for direct selection and access the item's properties panel.

Locking items

Once you have found the correct position for an item, you can lock it by using the *Lock selected items* button in the *Items* menu or the *Actions* toolbar or ticking the box next to the item in the *Items* panel. Locked items are **not** selectable on the canvas.

Locked items can be unlocked by selecting the item in the *Items* panel and unchecking the tickbox or you can use the icons on the toolbar.

Alignment

Raising or lowering the visual hierarchy for elements are inside the Raise selected items pull-down menu. Choose an element on the print layout canvas and select the matching functionality to raise or lower the selected element compared to the other elements. This order is shown in the *Items* panel. You can also raise or lower objects in the *Items* panel by clicking and dragging an object's label in this list.

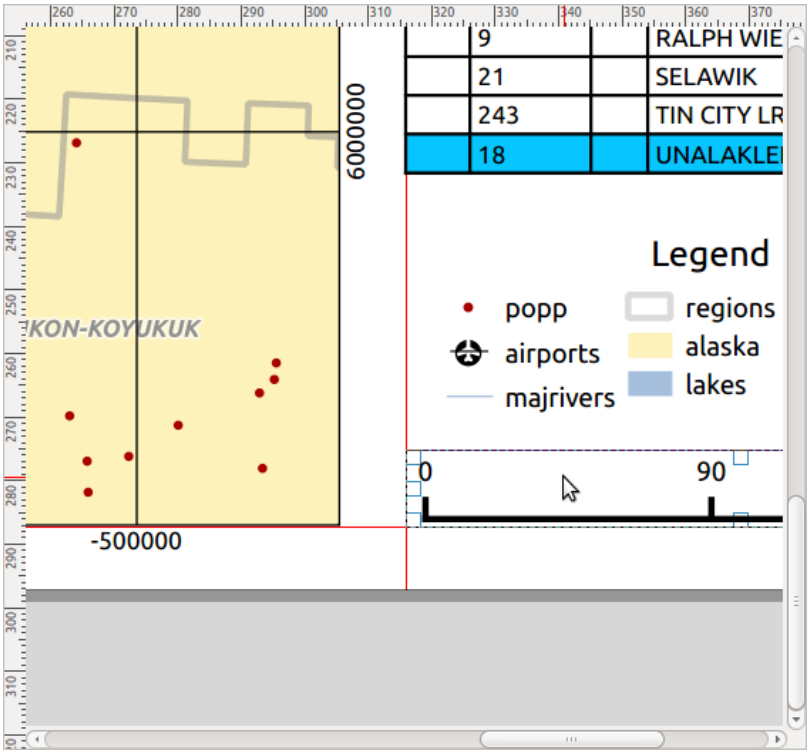


Figura18.10: Alignment helper lines in the print layout

There are several alignment options available within the Align selected items pull-down menu (see Fig.18.10). To use an alignment function, you first select the elements and then click on one of the alignment icons:

- *Align Left* or *Align Right*;
- *Align Top* or *Align Bottom*;
- *Align Center* horizontally or *Align Center Vertical*.

All selected elements will then be aligned to their common bounding box. When moving items on the layout canvas, alignment helper lines appear when borders, centers or corners are aligned.

Items Common Properties

Layout items have a set of common properties you will find at the bottom of the *Item Properties* panel: Position and size, Rotation, Frame, Background, Item ID, Variables and Rendering (See Fig.18.11).

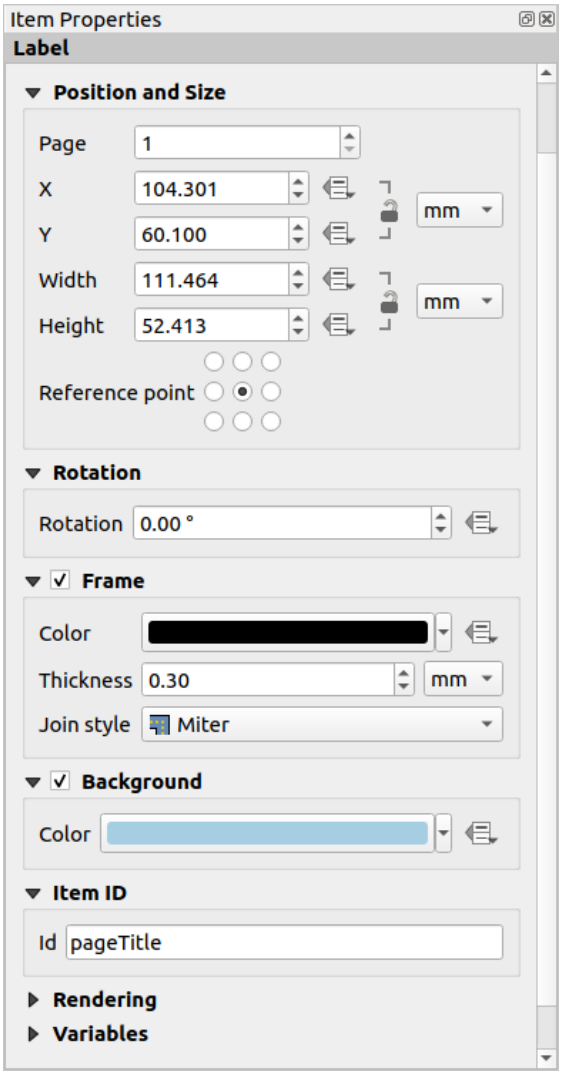


Figura18.11: Common Item Properties groups

Nota: The Data defined override icon next to most of the options means that you can associate that property with a layer, features attributes, geometry or with any other layout item's property, using *expressions* or *variables*. For more information see *Data defined override setup*.

- The *Position and size* group lets you define the size and position of the frame which contains the item (see *Position and Size* for more information).
- The *Rotation* sets the rotation of the element (in degrees).
- The *Frame* shows or hides the frame around the item. Use the *Color*, *Thickness* and *Join style* widgets to adjust those properties.
- Use the *Background color* menu for setting a background color. Click on the [Color…] button to display a dialog where you can pick a color or choose from a custom setting. Transparency can be adjusted through altering the alpha field settings.

- Use the *Item ID* to create a relationship to other print layout items. This is used with QGIS server and other potential web clients. You can set an ID on an item (for example, a map or a label), and then the web client can send data to set a property (e.g., label text) for that specific item. The GetProjectSettings command will list the items and IDs which are available in a layout.
- *Rendering* mode helps you set whether and how the item can be displayed: you can, for instance, apply *blending mode*, adjust the opacity of the item or *Exclude item from exports*.

Position and Size

Extending the features of the *New Item Properties* dialog with data-defined capabilities, this group allows you to place the items accurately.

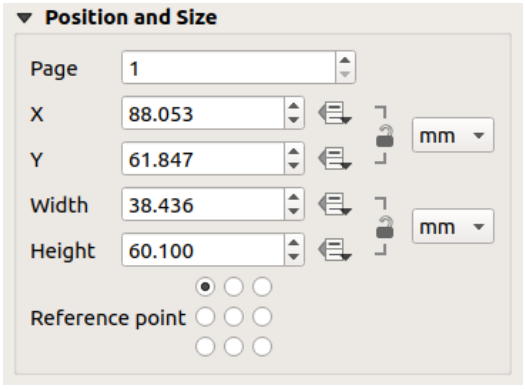


Figura18.12: Position and size

- the actual number of the page to place the item on;
- the reference point of the item;
- the *X* and *Y* coordinates of the *Reference point* of the item on the chosen page. The ratio between these values can be locked by clicking on the button. Changes made to a value using the widget or the Select/Move item tool will be reflected in both of them;
- the *Width* and *Height* of the item bounding box. As for coordinates, the ratio between width and height can be locked.

Modo de renderização

QGIS allows advanced rendering for layout items just like vector and raster layers.

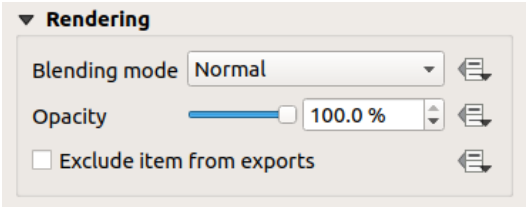


Figura18.13: Modo de renderização

- *Blending mode*: With this tool you can achieve effects which would otherwise only be achieved using graphic rendering software. The pixels of your overlaying and underlaying items can be mixed according to the mode set (see *Modos de Mistura* for description of each effect).

- *Transparency* : You can make the underlying item in the layout visible with this tool. Use the slider to adapt the visibility of your item to your needs. You can also make a precise definition of the percentage of visibility in the menu beside the slider.
-  *Exclude item from exports*: You can decide to make an item invisible in all exports. After activating this checkbox, the item will not be included in export to PDF, print etc..

Variáveis

The *Variables* lists all the variables available at the layout item's level (which includes all global, project and composition's variables). Map items also include Map settings variables that provide easy access to values like the map's scale, extent, and so on.

In *Variables*, it's also possible to manage item-level variables. Click the  button to add a new custom variable. Likewise, select any custom item-level variable from the list and click the  button to remove it.

More information on variables usage in the *Armazenar valores em Variáveis* section.

18.2.2 Ítem do Mapa

The map item is the main frame that displays the map you've designed in the map canvas. Use the  *Add Map* tool following *items creation instructions* to add a new map item that you can later manipulate the same way as exposed in *Interacting with layout items*.

By default, a new map item shows the current status of the *map canvas* with its extent and visible layers. You can customize it thanks to the *Item Properties* panel. Other than the *items common properties*, this feature has the following functionalities:

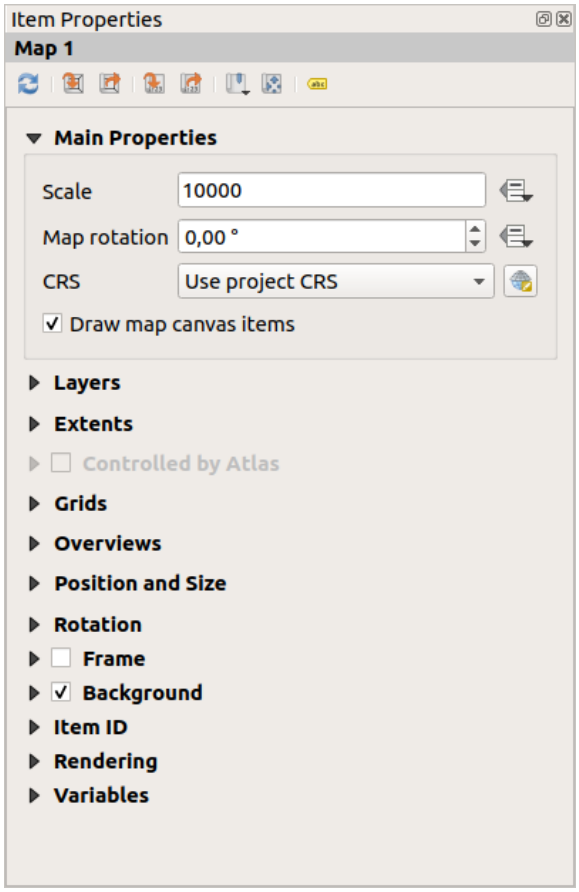


Figura18.14: Map Item Properties Panel

A Barra de Ferramentas

The Map *Item Properties* panel embeds a toolbar with the following functionalities:

- Update map preview
- Set map canvas to match main canvas extent
- View current map extent in main canvas
- Set map scale to match main canvas scale
- Set main canvas to match current map scale
- Bookmarks: set the map item extent to match an existing spatial bookmark
- Interactively edit map extent: pan and zoom interactively within the map item
- Labeling settings: control feature label behaviour (placement, visibility…) in the layout map item extent:
  - set a *Margin from map edges*, a data definable distance from the map item's limits inside which no label should be displayed
  - *Allow truncated labels on edges of map*: controls whether labels which fall partially outside of the map item allowed extent should be rendered. If checked, these labels will be shown (when there's no way to place them fully within the visible area). If unchecked then partially visible labels will be skipped.
  - *Label blocking items*: allows other layout items (such as scalebars, north arrows, inset maps, etc) to be marked as a blockers for the map labels in the **active** map item. This prevents any map labels from being

placed under those items - causing the labeling engine to either try alternative placement for these labels or discard them altogether.

If a *Margin from map edges* is set, the map labels are not placed closer than the specified distance from the checked layout items.

- *Show unplaced labels*: can be used to determine whether labels are missing from the layout map (e.g. due to conflicts with other map labels or due to insufficient space to place the label) by highlighting them in a *predefined color*.

- Clipping settings: allows to clip the map item to the atlas feature and to shape and polygon items:
  - *Clip to atlas feature*: you can determine that the layout map item will be clipped automatically to the current *atlas feature*.

    There are different clipping modes available:

    * *Clip During Render Only*: applies a painter based clip, so that portions of vector features which sit outside the atlas feature become invisible
    * *Clip Feature Before Render*: applies the clip before rendering features, so borders of features which fall partially outside the atlas feature will still be visible on the boundary of the atlas feature
    * *Render Intersecting Features Unchanged*: renders all features which intersect the current atlas feature, but without clipping their their geometry.

    You can *Force labels inside atlas feature*. If you don't want to *Clip all layers* to the atlas feature you can use the *Clip selected layers* option.
  - *Clip to item*: it is possible to change the shape of the map item by using a *shape* or *polygon* item from the print layout. When you enable this option the map will be automatically clipped to the selected shape in the combobox. Again, the above mentioned clipping modes are available and labels can be forced to display only inside the clipping shape.

Propriedades principais

In the *Main properties* group (see Fig.18.14) of the map *Item Properties* panel, available options are:

- The *Update Preview* button to refresh the map item rendering if the view in map canvas has been modified. Note that most of the time, the map item refresh is automatically triggered by the changes;
- The *Scale* to manually set the map item scale;
- The *Map rotation* allows you to rotate the map item content clockwise in degrees. The rotation of the map canvas can be imitated here;
- The *CRS* allows you to display the map item content in any *CRS*. It defaults to `Use project CRS`;
- *Draw map canvas items* lets you show in the print layout *annotations* that are placed on the main map canvas.

Camadas

By default, map item appearance is synced with the map canvas rendering meaning that toggling visibility of the layers or modifying their style in the *Layers Panel* is automatically applied to the map item. Because, like any other item, you may want to add multiple map items to a print layout, there's a need to break this synchronization in order to allow showing different areas, layer combinations, at different scales… The *Layers* properties group (see Fig.18.15) helps you do that.

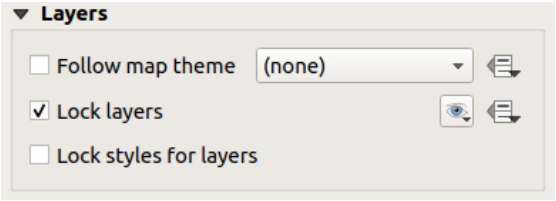


Figura18.15: Map Layers group

If you want to keep the map item consistent with an existing *map theme*, check *Follow map theme* and select the desired theme in the drop-down list. Any changes applied to the theme in QGIS' main window (using the replace theme function) will automatically affect the map item. If a map theme is selected, the *Lock styles for layers* option is disabled because *Follow map theme* also updates the style (symbology, labels, diagrams) of the layers.

To lock the layers shown in a map item to the current map canvas visibility, check *Lock layers*. When this option is enabled, any changes on the layers' visibility in QGIS' main window will not affect the layout's map item. Nevertheless, style and labels of locked layers are still refreshed according to QGIS' main window. You can prevent this by using *Lock styles for layers*.

Instead of using the current map canvas, you can also lock the layers of the map item to those of an existing map theme: select a map theme from the Set layer list from a map theme drop-down button, and the *Lock layers* is activated. The set of visible layers in the map theme is from now on used for the map item until you select another map theme or uncheck the *Lock layers* option. You then may need to refresh the view using the Refresh view button of the *Navigation* toolbar or the *Update Preview* button seen above.

Note that, unlike the *Follow map theme* option, if the *Lock layers* option is enabled and set to a map theme, the layers in the map item will not be refreshed even if the map theme is updated (using the replace theme function) in QGIS' main window.

Locked layers in the map item can also be *data-defined*, using the icon beside the option. When used, this overrides the selection set in the drop-down list. You need to pass a list of layers separated by `|` character. The following example locks the map item to use only layers `layer 1` and `layer 2`:

```
concat ('layer 1', '|', 'layer 2')
```

Extensões

The *Extents* group of the map item properties panel provides the following functionalities (see Fig.18.16):

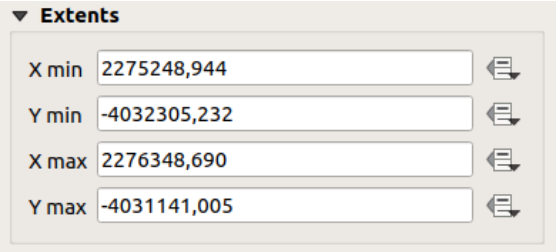


Figura18.16: Map Extents group

The **Extents** area displays `X` and `Y` coordinates of the area shown in the map item. Each of these values can be manually replaced, modifying the map canvas area displayed and/or map item size. Clicking the *Set to Map Canvas Extent* button sets the extent of the layout map item to the extent of the main map canvas. The button *View Extent in Map Canvas* does exactly the opposite; it updates the extent of the main map canvas to the extent of the layout map item.

You can also alter a map item extent using the Move item content tool: click-and-drag within the map item to modify its current view, keeping the same scale. With the tool enabled, use the mouse wheel to zoom in or out, modifying the scale of the shown map. Combine the movement with `Ctrl` key pressed to have a smaller zoom.

Controlled by atlas

The *Controlled by atlas* group properties is available only if an *atlas* is active in the print layout. Check this option if you want the map item being ruled by the atlas; when iterating over the coverage layer, the map item extent is panned/zoomed to the atlas feature following:

- *Margin around features*: zooms to the feature at the best scale, keeping around each a margin representing a percentage of the map item width or height. The margin can be the same for all features or *set variable*, e.g., depending on map scale;
- *Predefined scale (best fit)*: zooms to the feature at the project *predefined scale* where the atlas feature best fits;
- *Fixed scale*: atlas features are panned from one to another, keeping the same scale of the map item. Ideal when working with features of same size (e.g., a grid) or willing to highlight size differences among atlas features.

Grids

With grids, you can add, over your map, information relative to its extent or coordinates, either in the map item projection or a different one. The *Grids* group provides the possibility to add several grids to a map item.

- With the and buttons you can add or remove a selected grid;
- With the and buttons you can move up and down a grid in the list, hence move it on top or bottom of another one, over the map item.

Double-click the added grid to rename it.

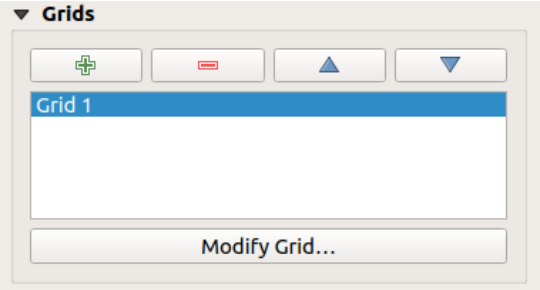


Figura18.17: Map Grids Dialog

To modify a grid, select it and press the *Modify Grid...* button to open the *Map Grid Properties* panel and access its configuration options.

Grid Appearance

In the *Map Grid Properties* panel, check *Grid enabled* to show the grid on the map item.

As grid type, you can specify to use a:

- *Solid*: shows a line across the grid frame. The *Line style* can be customized using *color* and *symbol* selector widget;
- *Cross*: displays segment at the grid lines intersection for which you can set the *Line style* and the *Cross width*;
- *Markers*: only displays customizable markers symbol at grid lines intersection;
- or *Frame and annotations only*.

Other than the grid type, you can define:

- the *CRS* of the grid. If not changed, it will follow the Map CRS. The *Change* button lets you set it to a different CRS. Once set, it can be changed back to default by selecting any group heading (e.g **Geographic Coordinate System**) under *Predefined Coordinate Reference Systems* in the CRS selection dialog.
- the *Interval* type to use for the grid references. Available options are `Map Unit`, `Fit Segment Width`, `Millimeter` or `Centimeter`:
  - choosing `Fit Segment Width` will dynamically select the grid interval based on the map extent to a "pretty" interval. When selected, the `Minimum` and `Maximum` intervals can be set.
  - the other options allow you to set the distance between two consecutive grid references in the `X` and `Y` directions.
- the *Offset* from the map item edges, in the `X` and/or the `Y` direction
- and the *Blend mode* of the grid (see *Modos de Mistura*) when compatible.

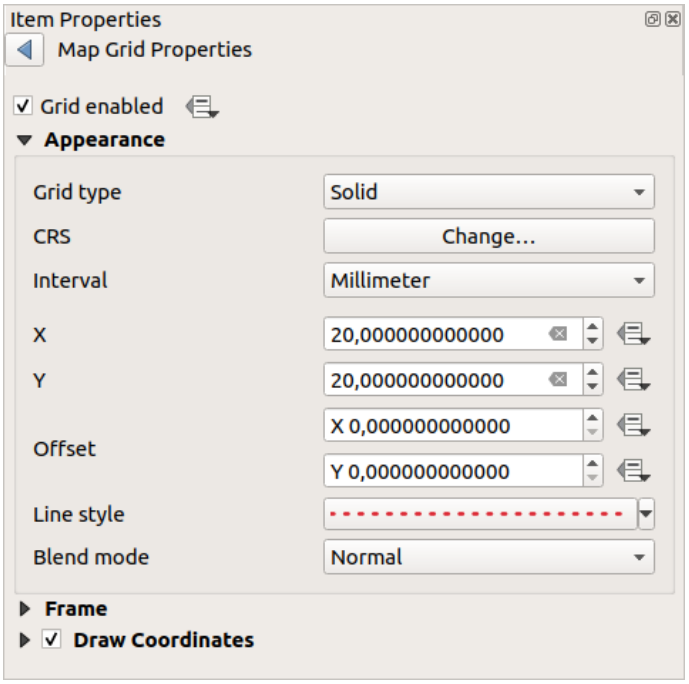


Figura18.18: Grid Appearance Dialog

Grid Frame

There are different options to style the frame that holds the map. The following options are available: `No Frame`, `Zebra`, `Zebra (nautical)`, `Interior ticks`, `Exterior ticks`, `Interior and Exterior ticks`, `Line border` and `Line border (nautical)`.

When compatible, it's possible to set the *Frame size*, a *Frame margin*, the *Frame line thickness* with associated color and the *Frame fill colors*.

Using `Latitude/Y only` and `Longitude/X only` values in the divisions section you can prevent a mix of latitude/Y and longitude/X coordinates showing on each side when working with rotated maps or reprojected grids. Also you can choose to set visible or not each side of the grid frame.

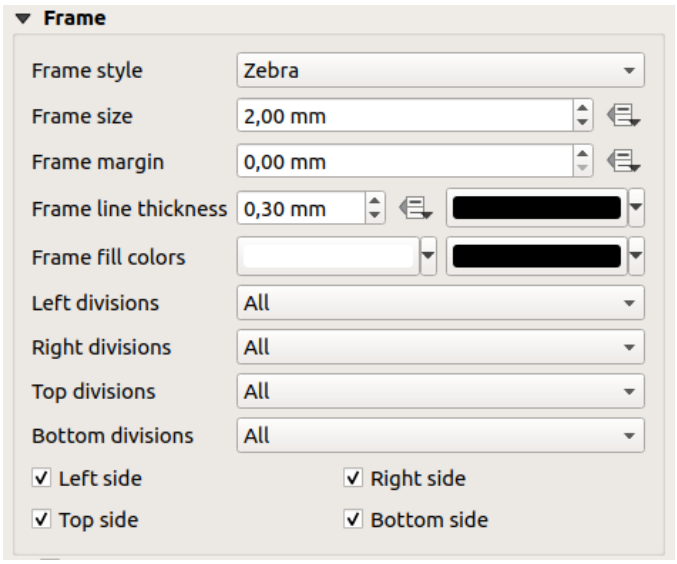


Figura18.19: Grid Frame Dialog

Coordenadas

The *Draw coordinates* checkbox allows you to add coordinates to the map frame. You can choose the annotation numeric format, the options range from decimal to degrees, minute and seconds, with or without suffix, aligned or not and a custom format using the expression dialog.

You can choose which annotation to show. The options are: show all, latitude only, longitude only, or disable(none). This is useful when the map is rotated. The annotation can be drawn inside or outside the map frame. The annotation direction can be defined as horizontal, vertical ascending or vertical descending.

Finally, you can define the annotation font, font color, distance from the map frame and the precision of the drawn coordinates.

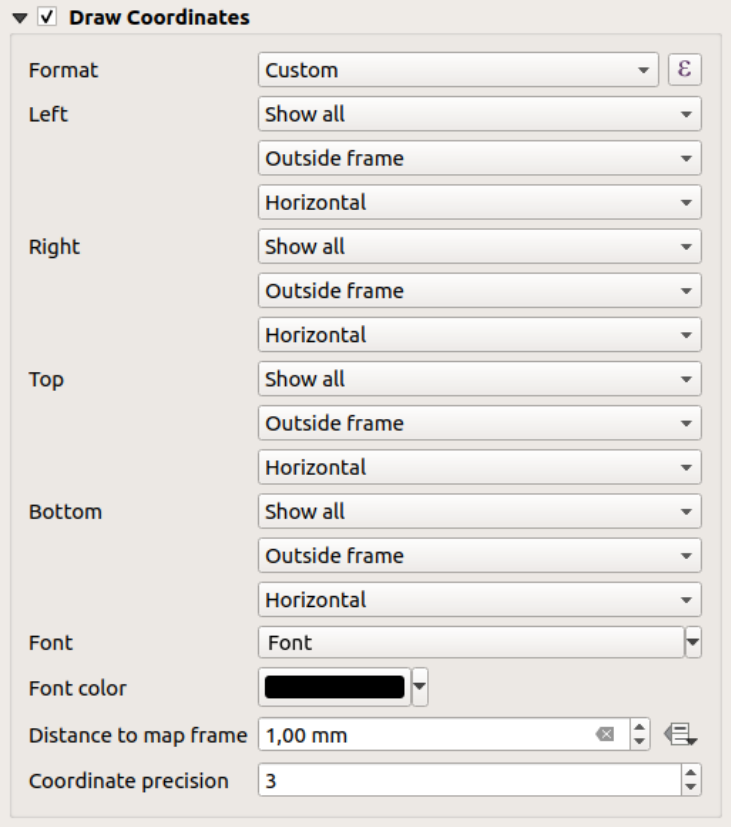


Figura18.20: Grid Draw Coordinates dialog

Visões gerais

Sometimes you may have more than one map in the print layout and would like to locate the study area of one map item on another one. This could be for example to help map readers identify the area in relation with its larger geographic context shown in the second map.

The *Overviews* group of the map panel helps you create the link between two different maps extent and provides the following functionalities:

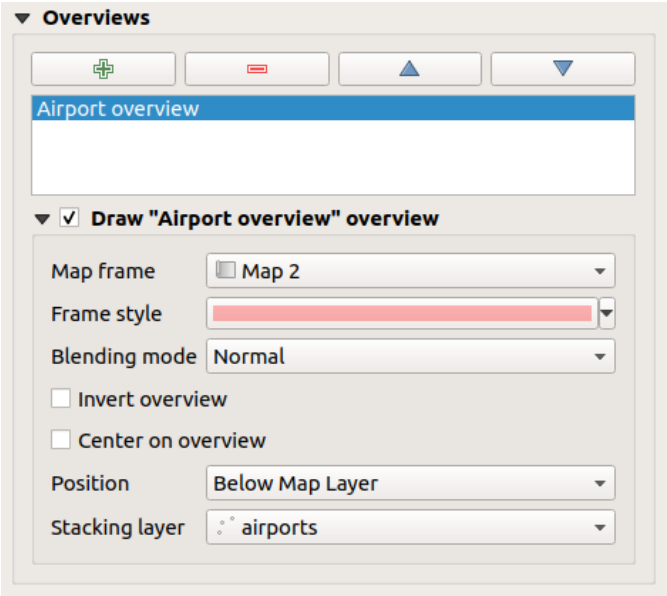


Figura18.21: Map Overviews group

To create an overview, select the map item on which you want to show the other map item's extent and expand the *Overviews* option in the *Item Properties* panel. Then press the button to add an overview.

Initially this overview is named 'Overview 1' (see Fig.18.21). You can:

- Rename it with a double-click
- With the and buttons, add or remove overviews
- With the and buttons, move an overview up and down in the list, placing it above or below other overviews in the map item (when they are at the same *stack position*).

Then select the overview item in the list and check the *Draw "<name_overview>" overview* to enable the drawing of the overview on the selected map frame. You can customize it with:

- The *Map frame* selects the map item whose extents will be shown on the present map item.
- The *Frame Style* uses the *symbol properties* to render the overview frame.
- The *Blending mode* allows you to set different transparency blend modes.
- The *Invert overview* creates a mask around the extents when activated: the referenced map extents are shown clearly, whereas the rest of the map item is blended with the frame fill color (if a fill color is used).
- The *Center on overview* pans the map item content so that the overview frame is displayed at the center of the map. You can only use one overview item to center, when you have several overviews.
- The *Position* controls exactly where in the map item's layer stack the overview will be placed, e.g. allowing an overview extent to be drawn below some feature layers such as roads whilst drawing it above other background layers. Available options are:
  - *Below map*
  - *Below map layer* and *Above map layer*: place the overview frame below and above the geometries of a layer, respectively. The layer is selected in the *Stacking layer* option.
  - *Below map labels*: given that labels are always rendered above all the feature geometries in a map item, places the overview frame above all the geometries and below any label.
  - *Above map labels*: places the overview frame above all the geometries and labels in the map item.

18.2.3 The 3D Map Item

The 3D Map item is used to display a *3D map view*. Use the *Add 3D Map* button, and follow *items creation instructions* to add a new 3D Map item that you can later manipulate the same way as demonstrated in *Interacting with layout items*.

By default, a new 3D Map item is empty. You can set the properties of the 3D view and customize it in the *Item Properties* panel. In addition to the *common properties*, this feature has the following functionalities (Fig.18.22):

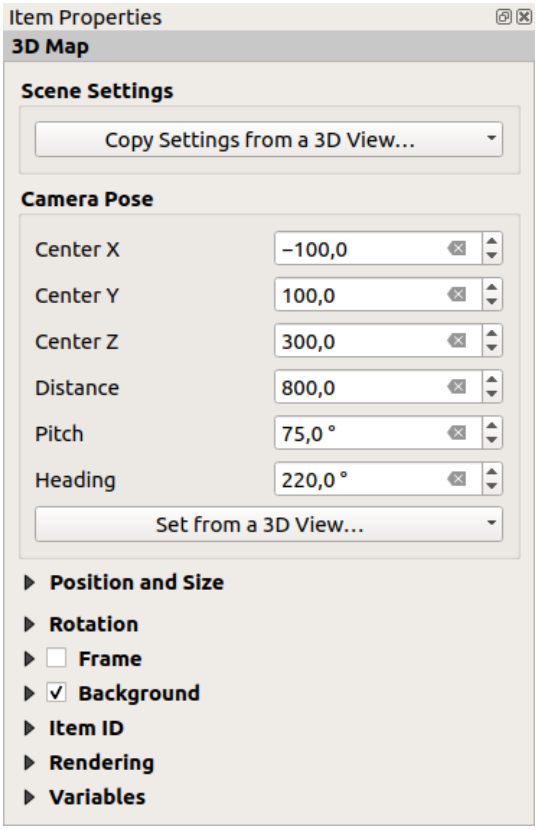


Figura18.22: 3D Map Item Properties

Scene settings

Press *Copy Settings from a 3D View…* to choose the 3D map view to display.

The 3D map view is rendered with its current configuration (layers, terrain, lights, camera position and angle…).

Camera pose

- *Center X* sets the X coordinate of the point the camera is pointing at
- *Center Y* sets the Y coordinate of the point the camera is pointing at
- *Center Z* sets the Z coordinate of the point the camera is pointing at
- *Distance* sets the distance from the camera center to the point the camera is pointing at
- *Pitch* sets the rotation of the camera around the X-axis (vertical rotation). Values from 0 to 360 (degrees). 0°: terrain seen straight from above; 90°: horizontal (from the side); 180°: straight from below; 270°: horizontal, upside down; 360°: straight from above.

- *Heading* sets the rotation of the camera around the Y-axis (horizontal rotation - 0 to 360 degrees). 0°/360°: north; 90°: west; 180°: south; 270°: east.

The *Set from a 3D View…* pull-down menu lets you populate the items with the parameters of a 3D View.

18.2.4 A rotulagem de item

o item: guilabel: *Label 'é uma ferramenta que ajuda a decorar seu mapa com textos que ajudam a entendê-lo; pode ser o título, autor, fontes de dados ou qualquer outra informação…Você pode adicionar um rótulo com o | label | : guilabel: `Adicionar etiqueta* ferramenta a seguir: ref:` itens instruções de criação <create_layout_item>`e manipule-a da mesma maneira como exposto em: ref:` interact_layout_item

By default, the label item provides a default text that you can customize using its *Item Properties* panel. Other than the *items common properties*, this feature has the following functionalities (see Fig.18.23):

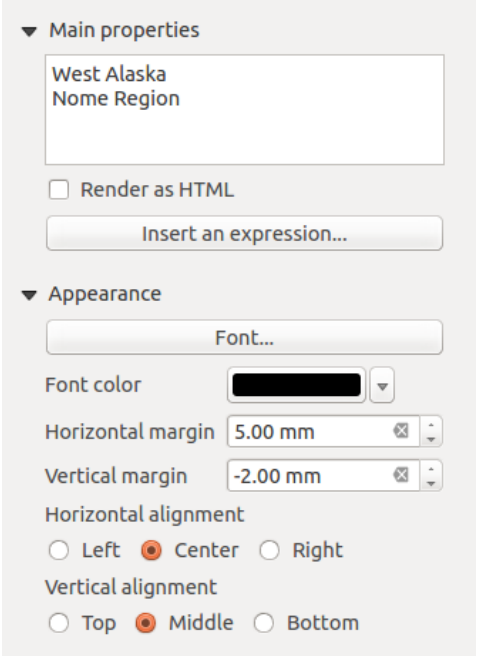


Figura18.23: Painel de propriedades do item de etiqueta

Propriedades principais

O grupo: guilabel: *Propriedades principais* é o local para fornecer o texto (ele pode estar em HTML) ou a expressão para criar o rótulo. As expressões precisam estar entre `` [% `` e ``%] `` para serem interpretadas como tal.

- As etiquetas podem ser interpretados como código HTML: check | caixa de seleção | : guilabel: *Renderizar como HTML*. Agora você pode inserir um URL, uma imagem clicável vinculada a uma página da Web ou algo mais complexo.
- You can also use *expressions*: click on *Insert or Edit an expression…* button, write your formula as usual and when the dialog is applied, QGIS automatically adds the surrounding characters.

Nota: Clicking the *Insert or Edit an Expression…* button when no selection is made in the textbox will append the new expression to the existing text. If you want to update an existing text, you need to select it the part of interest beforehand.

You can combine HTML rendering with expressions, leading to advanced labeling. The following code will output Fig.18.24:

```
<html>
 <head>
   <style>
      /* Define some custom styles, with attribute-based size */
      name {color:red; font-size: [% ID %]px; font-family: Verdana; text-shadow:␣
↪grey 1px 0 10px;}
      use {color:blue;}
   </style>
 </head>

 <body>
   <!-- Information to display -->
   <u>Feature Information</u>
   <ul style="list-style-type:disc">
     <li>Feature Id: [% ID %]</li>
     <li>Airport: <name>[% NAME %]</name></li>
     <li>Main use: <use>[% USE %]</use></li>
   </ul>
   Last check: [% concat( format_date( "control_date", 'yyyy-MM-dd'), ' by <b><i>',
↪ @user_full_name, '</i></b>' ) %]

   <!-- Insert an image -->
   <p align=center><img src="path/to/logos/qgis-logo-made-with-color.svg" alt=
↪"QGIS icon" style="width:80px;height:50px;"</p>
 </body>
</html>
```



Figura18.24: Leveraging a label with HTML styling

Aparência

- Define *Font* by clicking on the *Font...* button or a *Font color* by pushing the *color widget*.
- You can specify different horizontal and vertical margins in mm. This is the margin from the edge of the layout item. The label can be positioned outside the bounds of the label e.g. to align label items with other items. In this case you have to use negative values for the margin.
- Using the text alignment is another way to position your label. It can be:
  - *Left*, *Center*, *Right* or *Justify* for *Horizontal alignment*
  - and *Top*, *Middle*, *Bottom* for *Vertical alignment*.

Explorando expressões em um item de etiqueta

Below some examples of expressions you can use to populate the label item with interesting information - remember that the code, or at least the calculated part, should be surrounded by `[%` and `%]` in the *Main properties* frame:

- Display a title with the current atlas feature value in "field1":

```
'This is the map for ' || "field1"
```

  or, written in the *Main properties* section:

```
This is the map for [% "field1" %]
```

- Adicione uma paginação para recursos de atlas processados (por exemplo, `` Página 1/10 ")

```
concat( 'Page ', @atlas_featurenumber, '/', @atlas_totalfeatures )
```

- Return the name of the airports of the current atlas region feature, based on their common attributes:

```
aggregate( layer := 'airports',
           aggregate := 'concatenate',
           expression := "NAME",
           filter := fk_regionId = attribute( @atlas_feature, 'ID' ),
           concatenator := ', '
         )
```

  Or, if an *attributes relation* is set:

```
relation_aggregate( relation := 'airports_in_region_relation',
                    aggregate := 'concatenate',
                    expression := "NAME",
                    concatenator := ', '
                  )
```

- Return the name of the airports contained in the current atlas region feature, based on their spatial relationship:

```
aggregate( layer := 'airports',
           aggregate := 'concatenate',
           expression := "NAME",
           filter := contains( geometry( @parent ), $geometry ),
           concatenator := ', '
         )
```

  OR:

```
array_to_string( array:= overlay_contains( layer := 'airports',
                                           expression := "NAME" ),
                 delimiter:= ', '
               )
```

- Return the lower X coordinate of the `Map 1` item's extent:

```
x_min( map_get( item_variables( 'Map 1' ), 'map_extent' ) )
```

- Retrieve the name of the layers in the current layout `Map 1` item, and formats in one name by line:

```
array_to_string(
 array_foreach(
  map_get( item_variables( 'Map 1' ), 'map_layers' ), -- retrieve the layers␣
↪list
  layer_property( @element, 'name' ) -- retrieve each layer name
 ),
```

(continua na próxima página)

(continuação da página anterior)

```
  '\n' -- converts the list to string separated by breaklines
)
```

18.2.5 O Item Legenda

O item *Legenda' é uma caixa ou tabela que explica o significado os símbolos usados no mapa. A legenda está então ligada a um item de mapa. Você pode adicionar um item de legenda com a ferramenta \addLegend\ :guilabel:`Adicionar legenda* seguindo as *instruções de criação de items* e manipular ela da mesma maneira que exposto em *Interacting with layout items*.

Por padrão, o item de legenda mostra todas as camadas disponíveis e pode ser refinada usando seu painel de *Propriedades do item*. Diferente das *propriedades comuns de itens*, está ferramenta possui as seguintes funcionalidades (veja Fig.18.25):

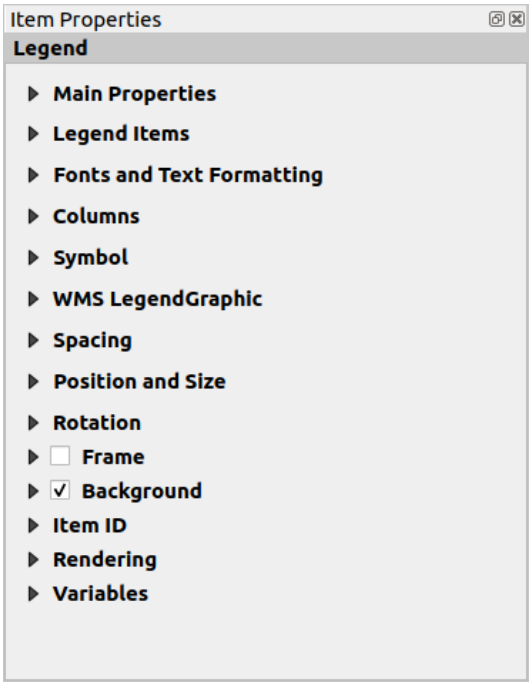


Figura18.25: Painel de Propriedades do Item Legenda

Propriedades principais

The *Main properties* group of the legend *Item Properties* panel provides the following functionalities (see Fig.18.26):

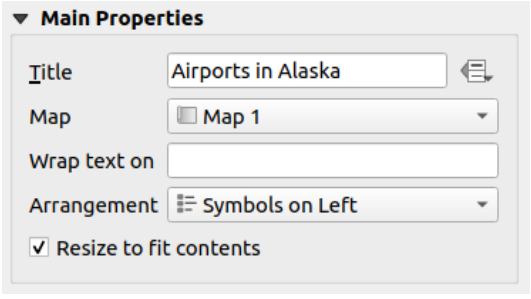


Figura18.26: Grupo de propriedades principais da legenda

Em Propriedades principais você pode:

- Change the *Title* of the legend. It can be made dynamic using the *data-defined override* setting, useful for example when generating an atlas;
- Choose which *Map* item the current legend will refer to. By default, the map over which the legend item is drawn is picked. If none, then it falls back to the *reference map*.

Nota: *Variables* of the linked map item (@map_id, @map_scale, @map_extent…) are also accessible from data-defined properties of the legend.

- Wrap the text of the legend on a given character: each time the character appears, it's replaced with a line break;
- Set the symbols and text placement in the legend: the *Arrangement* can be *Symbols on left* or *Symbols on right*. The default value depends on the locale in use (right-to-left based or not).
- Use *Resize to fit contents* to control whether or not a legend should be automatically resized to fit its contents. If unchecked, then the legend will never resize and instead just stick to whatever size the user has set. Any content which doesn't fit the size is cropped out.

Itens da legenda

The *Legend items* group of the legend *Item Properties* panel provides the following functionalities (see Fig.18.27):

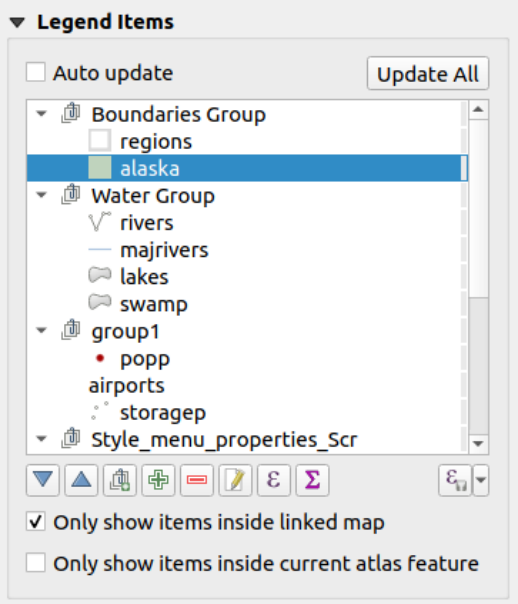


Figura18.27: Grupo de itens da legenda

- The legend will be updated automatically if *Auto update* is checked. When *Auto update* is unchecked this will give you more control over the legend items. All the icons below the legend items list will be activated.
- The legend items window lists all legend items and allows you to change item order, group layers, remove and restore items in the list, edit layer names and add a filter.
  - The item order can be changed using the and buttons or with 'drag-and-drop' functionality. The order can not be changed for WMS legend graphics.
  - Use the button to add a legend group.

  - Use the button to add layers and button to remove groups, layers or symbol classes.
  - The button is used to edit the layer, group name or title. First you need to select the legend item. Double-clicking the item also opens the text box to rename it.
  - The button uses expressions to customize each symbol label of the selected layer (see *Data-define the legend labels*)
  - The button adds a feature count for each class of vector layer.
  - The Filter legend by expression helps you filter which of the legend items of a layer will be displayed, i.e. using a layer that has different legend items (e.g., from a rule-based or categorized symbology), you can specify a boolean expression to remove from the legend tree, styles that have no feature satisfying a condition. Note that the features are nevertheless kept and shown in the layout map item.

  While the default behavior of the legend item is to mimic the *Layers* panel tree, displaying the same groups, layers and classes of symbology, right-click any item offers you options to hide layer's name or raise it as a group or subgroup. In case you have made some changes to a layer, you can revert them by choosing *Reset to defaults* from the contextual menu of the legend entry.

  After changing the symbology in the QGIS main window, you can click on *Update All* to adapt the changes in the legend element of the print layout.

- With the *Only show items inside linked map*, only the legend items visible in the linked map will be listed in the legend. This tool remains available when *Auto-update* is active
- While generating an atlas with polygon features, you can filter out legend items that lie outside the current atlas feature. To do that, check the *Only show items inside current atlas feature* option.

Data-define the legend labels

allows you to add *expressions* to each symbol label of a given layer. New variables (`@symbol_label`, `@symbol_id` and `@symbol_count`) help you interact with the legend entry.

For example, given a `regions` layer categorized by its `type` field, you can append to each class in the legend their number of features and total area, e.g. `Borough (3) - 850ha`:

1. Select the layer entry in the legend tree
2. Press the button, opening the *Expression String Builder* dialog
3. Enter the following expression (*assuming symbol labels have not been edited*):

```
concat( @symbol_label,
        ' (', @symbol_count, ') - ',
        round( aggregate(@layer, 'sum', $area, filter:= "type"=@symbol_label)/
↪10000 ),
        'ha'
      )
```

4. Pressione *OK*

Fontes

The *Fonts* group of the legend *Item Properties* panel provides the following functionalities:

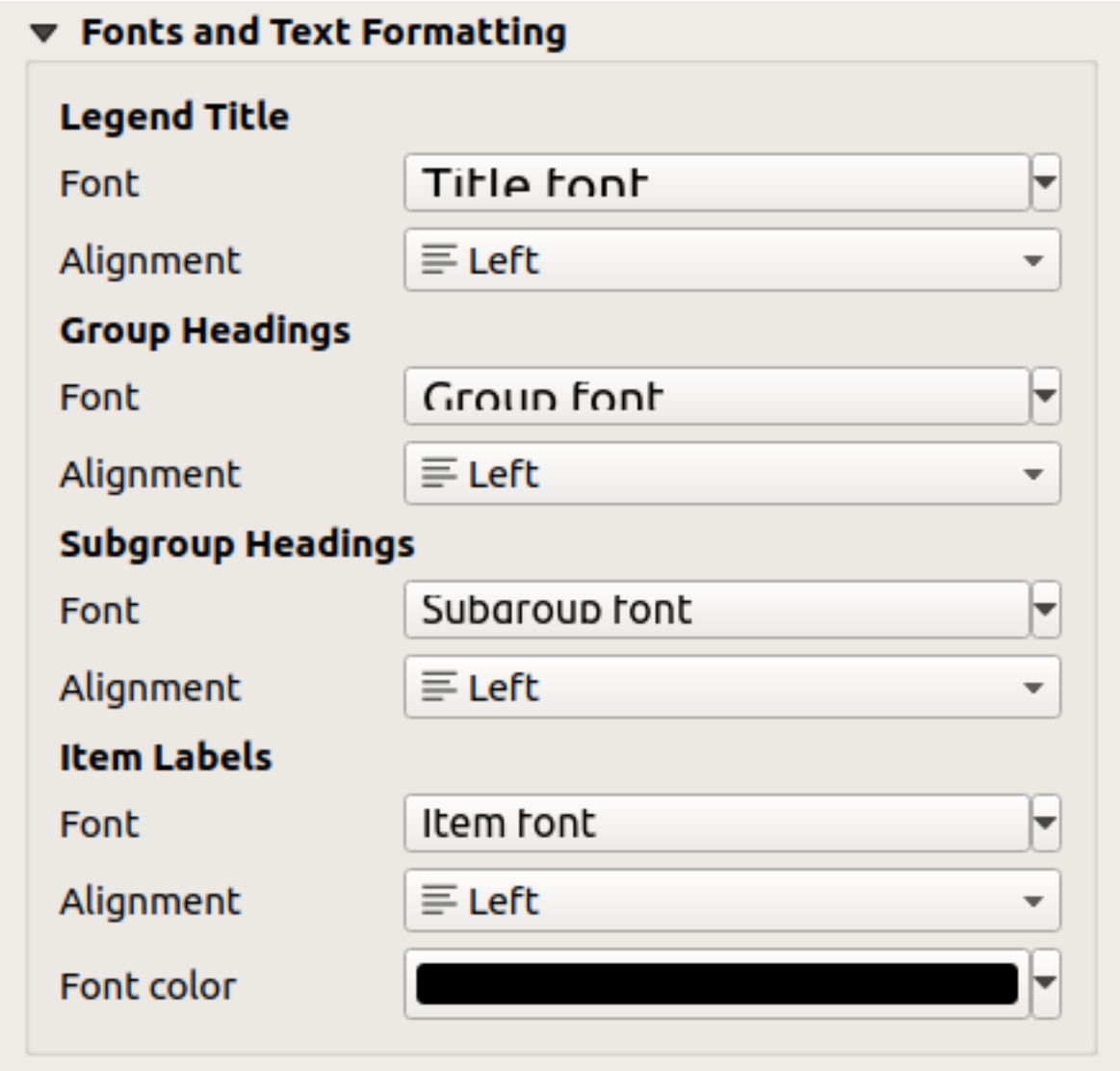


Figura18.28: Propriedades das fontes da legenda

- You can change the font of the legend title, group, subgroup and item (feature) in the legend item using the *font selector* widget
- For each of these levels you can set the text *Alignment*: it can be *Left* (default for left-to-right based locales), *Center* or *Right* (default for right-to-left based locales).
- You set the *Color* of the labels using the *color selector* widget. The selected color will apply to all the font items in the legend.

Colunas

Under the *Columns* group of the legend *Item Properties* panel, legend items can be arranged over several columns:

- Set the number of columns in the *Count* 1,00 field. This value can be made dynamic e.g., following atlas features, legend contents, the frame size…
- *Equal column widths* sets how legend columns should be adjusted.
- The *Split layers* option allows a categorized or a graduated layer legend to be divided between columns.

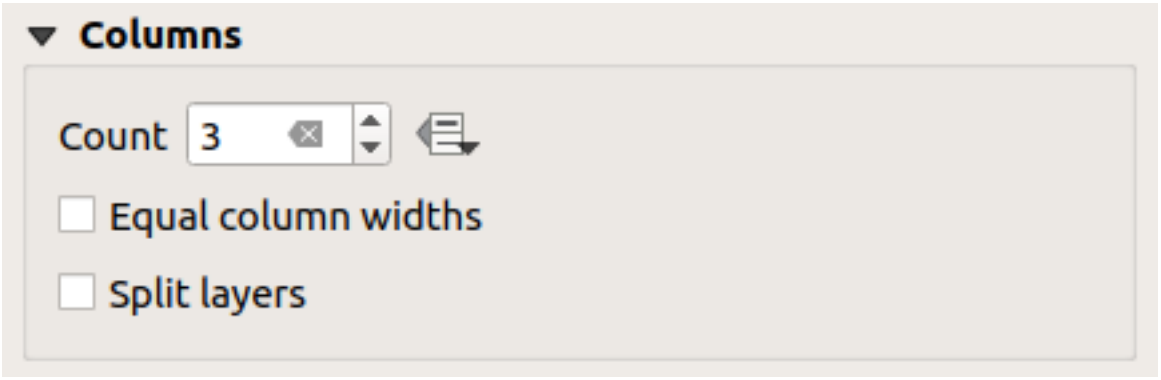


Figura18.29: Configurações das colunas da legenda

Símbolo

The *Symbol* group of the legend *Item Properties* panel configures the size of symbols displayed next to the legend labels. You can:

- Set the *Symbol width* and *Symbol height*
- Set the markers' *Min symbol size* and *Max symbol size*: `0.00mm` means there is no value set.
- *Draw stroke for raster symbols*: this adds an outline to the symbol representing the band color of the raster layer; you can set both the *Stroke color* and *Tickness*.

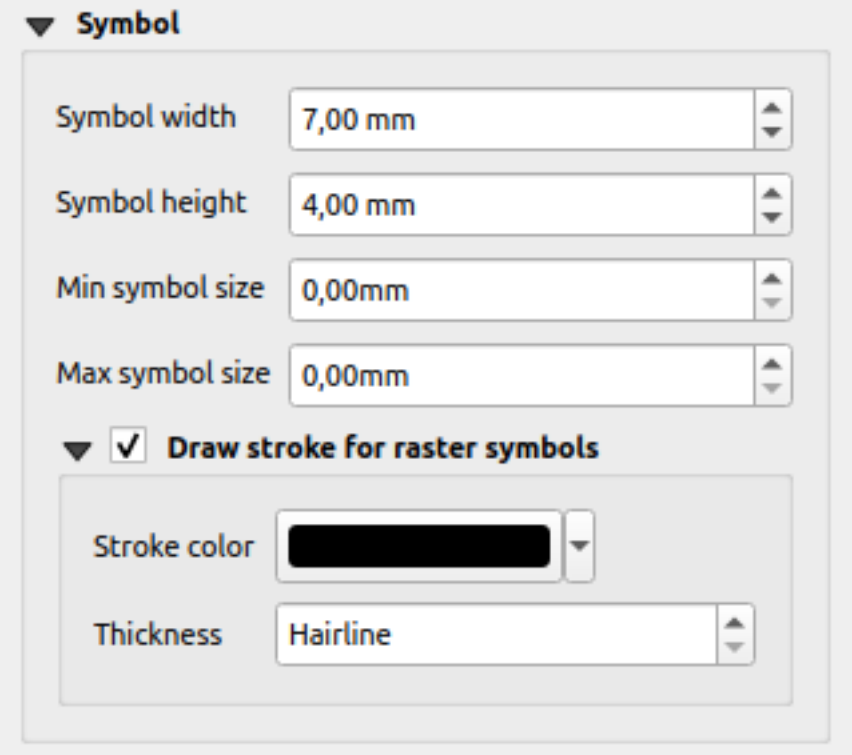


Figura18.30: Configuração dos símbolos da legenda

WMS LegendGraphic and Spacing

The *WMS LegendGraphic* and *Spacing* groups of the legend *Item Properties* panel provide the following functionalities (see Fig.18.31):

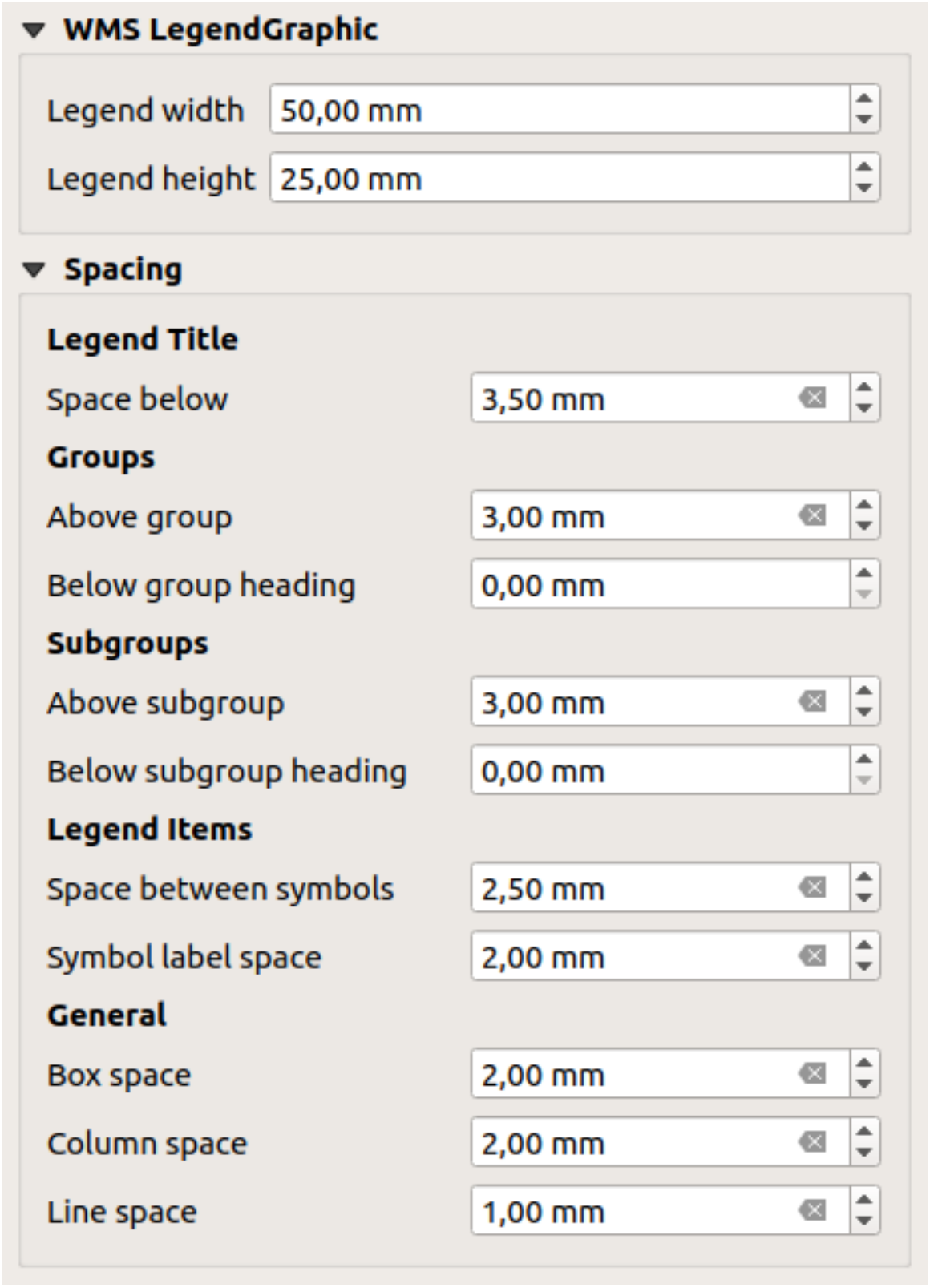


Figura18.31: WMS LegendGraphic and Spacing groups

When you have added a WMS layer and you insert a legend item, a request will be sent to the WMS server to provide a WMS legend. This Legend will only be shown if the WMS server provides the GetLegendGraphic capability. The WMS legend content will be provided as a raster image.

WMS LegendGraphic is used to be able to adjust the *Legend width* and the *Legend height* of the WMS legend raster

image.

Spacing around title, groups, subgroups, symbols, labels, boxes, columns and lines can be customized through this dialog.

18.2.6 Item da Barra de Escala

Scale bars provide a visual indication of the size of features, and distance between features, on the map item. A scale bar item requires a map item. Use the *Add Scale Bar* tool following *items creation instructions* to add a new scale bar item that you can later manipulate the same way as exposed in *Interacting with layout items*.

By default, a new scale bar item shows the scale of the map item over which it is drawn. If there is no map item below, the *reference map* is used. You can customize it in the *Item Properties* panel. Other than the *items common properties*, this feature has the following functionalities (see Fig.18.32):

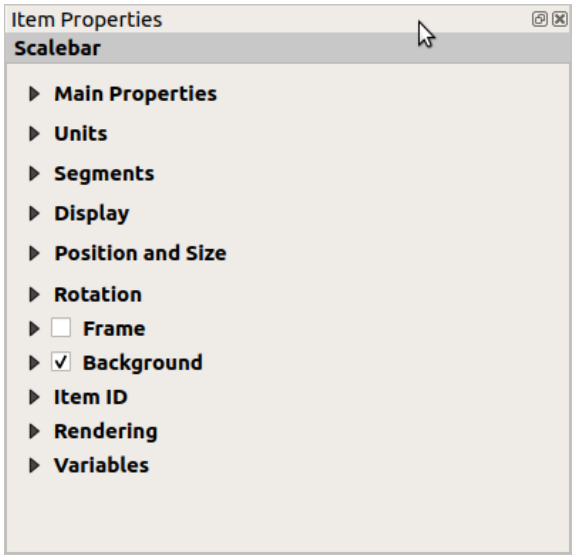


Figura18.32: Scale Bar Item Properties Panel

Propriedades Principais

The *Main properties* group of the scale bar *Item Properties* panel provides the following functionalities (see Fig.18.33):



Figura18.33: Scale Bar Main properties group

1. First, choose the map the scale bar will be attached to
2. Then, choose the style of the scale bar. Available styles are:
   - **Single box** and **Double box** styles, which contain one or two lines of boxes alternating colors;
   - **Middle**, **Up** or **Down** line ticks;
   - **Stepped line** style that draws a stepped line representation of a scalebar
   - **Hollow** style that draws a single box with alternating color for the segments, with horizontal lines through alternating segments

- **Numeric**, where the scale ratio is printed (e.g., `1:50000`).

3. Set properties as appropriate

Units

The *Units* group of the scale bar *Item Properties* panel provides the functionalities to set the units of display and some text formatting (see Fig.18.34):

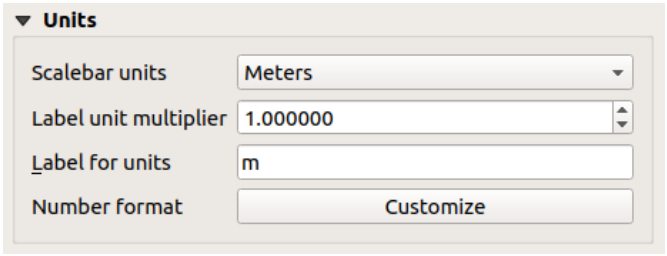


Figura18.34: Scale Bar Units group

- Select the units you want to use with *Scalebar units*. There are many possible choices: **Map Units** (the default one), **Meters**, **Feet**, **Miles** or **Nautical Miles**... and some derivatives. Units conversion is handled automatically.
- The *Label unit multiplier* specifies how many scale bar units per labeled unit. Eg, if your scale bar units are set to "meters", a multiplier of 1000 will result in the scale bar labels in "kilometers".
- The *Label for units* field defines the text used to describe the units of the scale bar, eg `m` or `km`. This should be matched to reflect the multiplier above.
- Press *Customize* next to *Number format* to have control over all the formatting properties for the numbers in the scale bar, including thousand separators, decimal places, scientific notation, etc. (see *Number Formatting* for more details). Very useful in the case of making maps for audiences outside of the current QGIS locale, or when you would like to vary the style from the locale defaults (e.g. adding thousands separators when the locale default is to hide them).

Segments

The *Segments* group of the scale bar *Item Properties* panel provides the functionalities to configure the number and size of segments and subdivisions (see Fig.18.35):

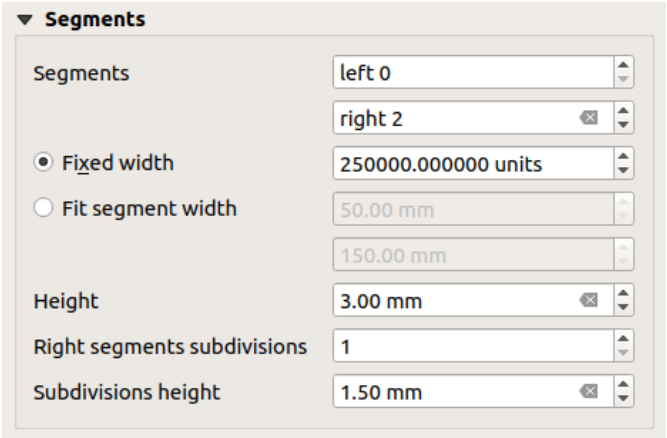


Figura18.35: Scale Bar Segments group

- You can define the number of *Segments* that will be drawn at the left and right sides of the `0` of the scale bar:

  - number of subdivisions of a unique segment on the *Left* side
  - number of segments on the *Right* side
- You can set how long a segment will be (*Fixed width*), or limit the scale bar size in `mm` with *Fit segment width* option. In the latter case, each time the map scale changes, the scale bar is resized (and its label updated) to fit the range set.
- *Height* is used to define the height of the bar.
- *Right segment subdivisions* is used to define the number of sections the right-side segments of the scale bar can have (for *Line Ticks Down*, *Line Ticks Middle* and *Line Ticks Up* scale bar styles) .
- *Subdivision height* is used to define the height of the subdivision segment.

Display

The *Display* group of the scale bar *Item Properties* panel provides the following functionalities:

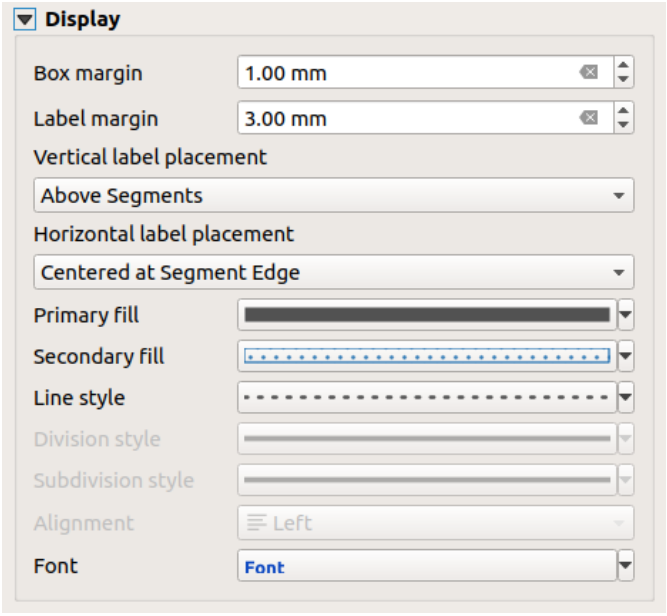


Figura18.36: Scale Bar Display group

You can define how the scale bar will be displayed in its frame.

- *Box margin* : space between text and frame borders
- *Label margin* : space between text and scale bar drawing
- *Vertical label placement*: it can be above or below the scale bar segment
- *Horizontal label placement*: which would be centered at the scale bar segment's edge or center
- *Primary fill* and *Secondary fill* of the scale bar drawing using *fill symbols properties* (color, opacity, patterns, effects…) — for *Single Box*, *Double Box* and *Hollow* styles
- *Line style* of the scale bar drawing using *line symbols properties* (color, stroke, join, cap style, patterns, effects…) — for all but *Numeric* style
- *Division style* and *Subdivision style* respectively for division and subdivision segments in *Line Ticks Up*, *Line Ticks Middle* and *Line Ticks Down* scale bar styles using *line symbols properties* (color, stroke, join, cap style, patterns, effects…)
- *Alignment* puts text on the left, center or right side of the frame (only for *Numeric* scale bar style)
- *Font* to set the *properties* (size, font, color, letter spacing, shadow, background…) of the scale bar label.

Since most of the display properties of the scale bar rely on symbols whose properties can be data-defined, it's possible to render data-defined scale bars.

Example: The following code applied to the bold property of the scale labels will display numbers in bold when they are a multiple of 500:

```
-- returns True (or 1) if the value displayed on the bar
-- is a multiple of 500

@scale_value % 500 = 0
```

18.2.7 Os itens da tabela

Você pode usar os itens da tabela para decorar e explicar o seu mapa:

- Tabela de atributos: mostra um subconjunto de atributos de uma camada, baseada em regras predefinidas
- Tabela Fixa: insere uma tabela de texto manual onde a informação pode ser independente das camadas.

Item da tabela de atributos

Qualquer camada no projeto pode ter seus atributos mostrados no layout de impressão. Use a ferramenta *Adicionar Tabela de Atributos* seguindo as instruções de criação dos itens. <create_layout_item>Para adicionar um novo item tabela você pode manipular depois da mesma forma como exposto em "interagir com item de layout"

Por padrão, um novo item da tabela de atributos mostra colunas da primeira camada (listada alfabeticamente), com todos os campos. Você pode entretanto personalizar a tabela graças ao painel *Propriedades do Item*. Diferente das *propriedades comuns de itens*, esta opção tem as seguintes funções (veja Fig.18.37):

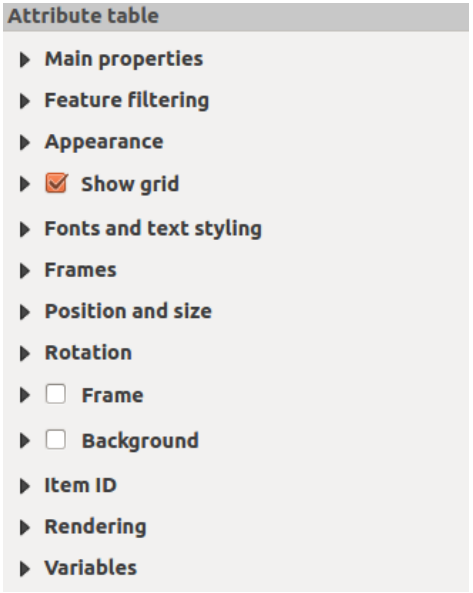


Figura18.37: Tabela de atributos no Painel de Propriedades do Item

Propriedades Principais

A tabela do grupo de atributos *Main properties* oferece as seguintes funcionalidades (veja Fig.18.38):

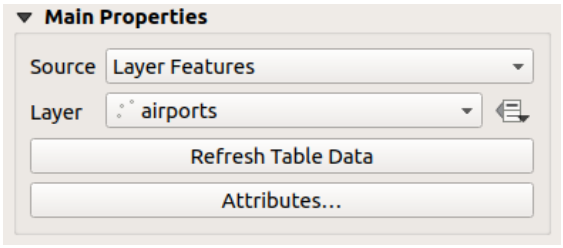


Figura18.38: Tabela de atributos Grupo de propriedades principais

- Para *Source* você pode por pardrão apenas selecionar **Feições de camada** permitido que você selecione uma *Layer* das camadas de vetores carregadas no projeto.

  The data-defined override button near the layer list allows you to dynamically change the layer which is used to populate the table, e.g. you could fill the attribute table with different layer attributes per atlas page. Note that the table structure used (Fig.18.41) is the one of the layer shown in the *Layer* drop-down list and it is left intact, meaning that setting a data defined table to a layer with different field(s) will result in empty column(s) in the table.

  In case you activate the *Generate an atlas* option in the *Atlas* panel (see *Generate an Atlas*), there are two additional *Source* possible:

  - **Current atlas feature** (see Fig.18.39): you won't see any option to choose the layer, and the table item will only show a row with the attributes from the current feature of the atlas coverage layer.
  - and **Relation children** (see Fig.18.40): an option with the relation names will show up. This feature can only be used if you have defined a *relation* using your atlas coverage layer as parent, and the table will show the children rows of the atlas coverage layer's current feature.
- The button *Refresh Table Data* can be used to refresh the table when the actual contents of the table has changed.

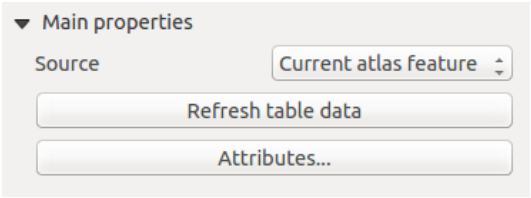


Figura18.39: Attribute table Main properties for 'Current atlas feature'



Figura18.40: Attribute table Main properties for 'Relation children'

- The button *Attributes…* starts the *Select Attributes* dialog, (see Fig.18.41) that can be used to change the visible contents of the table. The upper part of the window shows the list of the attributes to display and the lower part helps you sort the data.

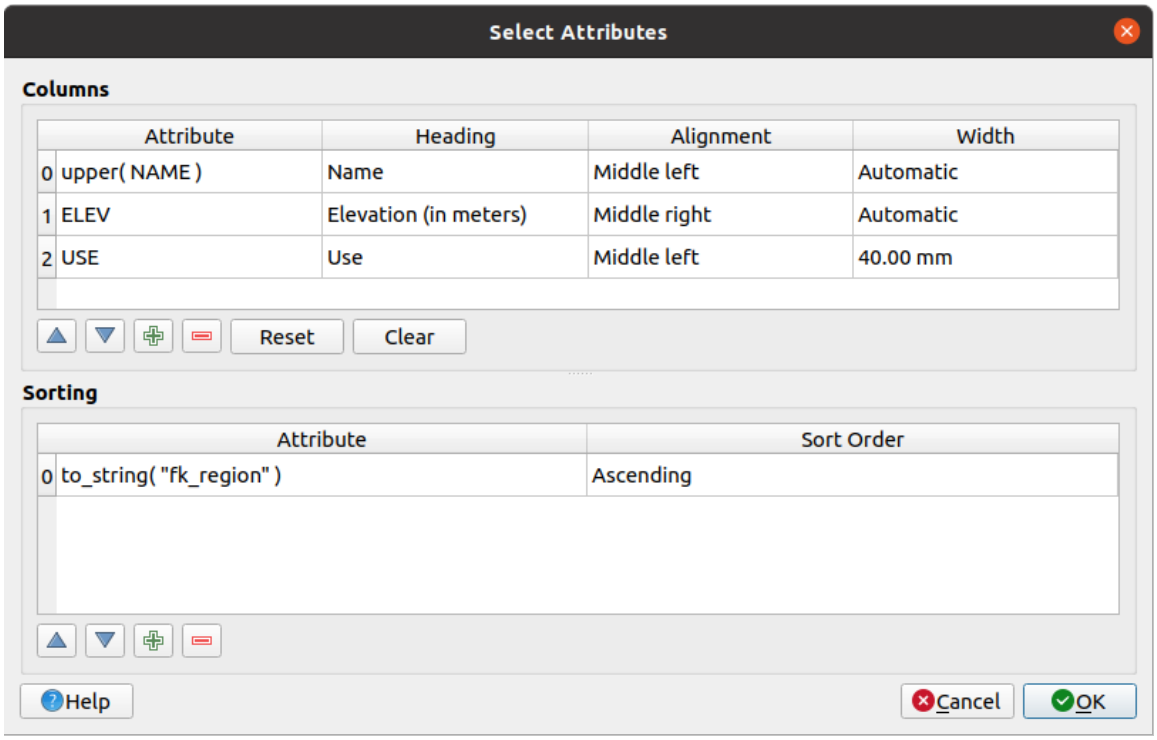


Figura18.41: Attribute table Select attributes Dialog

In the *Columns* section you can:

- Move attributes up or down the list by selecting the rows and then using the and buttons to shift the rows. Multiple rows can be selected and moved at any one time.
- Add an attribute with the button. This will add an empty row at the bottom of the table where you can select a field to be the attribute value or create an attribute via a regular expression.
- Remove an attribute with the button. Multiple rows can be selected and removed at any one time.
- Reset the attribute table back to its default state with the *Reset* button.
- Clear the table using the *Clear* button. This is useful when you have a large table but only want to show a small number of attributes. Instead of manually removing each row, it may be quicker to clear the table and add the rows needed.
- Cell headings can be altered by adding the custom text in the *Heading* column.
- Cell alignment can be managed with the *Alignment* column which will dictate the texts position within the table cell.
- Cell width can be manually managed by adding custom values to the *width* column.

In the *Sorting* section you can:

- Add an attribute to sort the table with: press the button and a new empty row is added. Insert a field or an expression in the *Attribute* column and set the *Sort order* to **Ascending** or **Descending**.
- Select a row in the list and use the and buttons to change the sort priority on attribute level. Selecting a cell in the *Sort Order* column helps you change the sorting order of the attribute field.
- Use the button to remove an attribute from the sorting list.

Feature filtering

The *Feature filtering* group of the attribute table provides the following functionalities (see Fig.18.42):

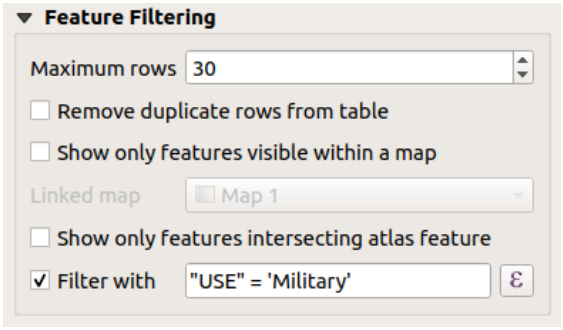


Figura18.42: Attribute table Feature filtering Group

Você pode:

- Define the *Maximum rows* to be displayed.
- Activate *Remove duplicate rows from table* to show unique records only.
- Activate *Show only visible features within a map* and select the corresponding *Linked map* whose visible features attributes will be displayed.
- Activate *Show only features intersecting Atlas feature* is only available when *Generate an atlas* is activated. When activated it will show a table with only the features which intersect the current atlas feature.
- Activate *Filter with* and provide a filter by typing in the input line or insert a regular expression using the given expression button. A few examples of filtering statements you can use when you have loaded the airports layer from the Sample dataset:
  - `ELEV > 500`
  - `NAME = 'ANIAK'`
  - `NAME NOT LIKE 'AN%'`
  - `regexp_match( attribute( $currentfeature, 'USE' ) , '[i]')`

  The last regular expression will include only the airports that have a letter 'i' in the attribute field 'USE'.

Aparência

The *Appearance* group of the attribute table provides the following functionalities (see Fig.18.43):

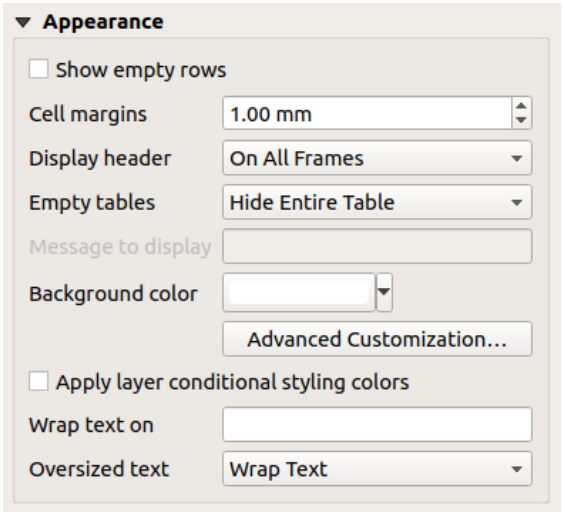


Figura18.43: Attribute table appearance Group

- Click *Show empty rows* to fill the attribute table with empty cells. This option can also be used to provide additional empty cells when you have a result to show!
- With *Cell margins* you can define the margin around text in each cell of the table.
- With *Display header* you can select from a list one of 'On first frame', 'On all frames' default option, or 'No header'.
- The option *Empty table* controls what will be displayed when the result selection is empty.
  - **Draw headers only**, will only draw the header except if you have chosen 'No header' for *Display header*.
  - **Hide entire table**, will only draw the background of the table. You can activate *Don't draw background if frame is empty* in *Frames* to completely hide the table.
  - **Show set message**, will draw the header and adds a cell spanning all columns and display a message like 'No result' that can be provided in the option *Message to display*
- The option *Message to display* is only activated when you have selected **Show set message** for *Empty table*. The message provided will be shown in the table in the first row, when the result is an empty table.
- With *Background color* you can set the background color of the table using the *color selector* widget. The *Advanced customization* option helps you define different background colors for each cell (see Fig.18.44)

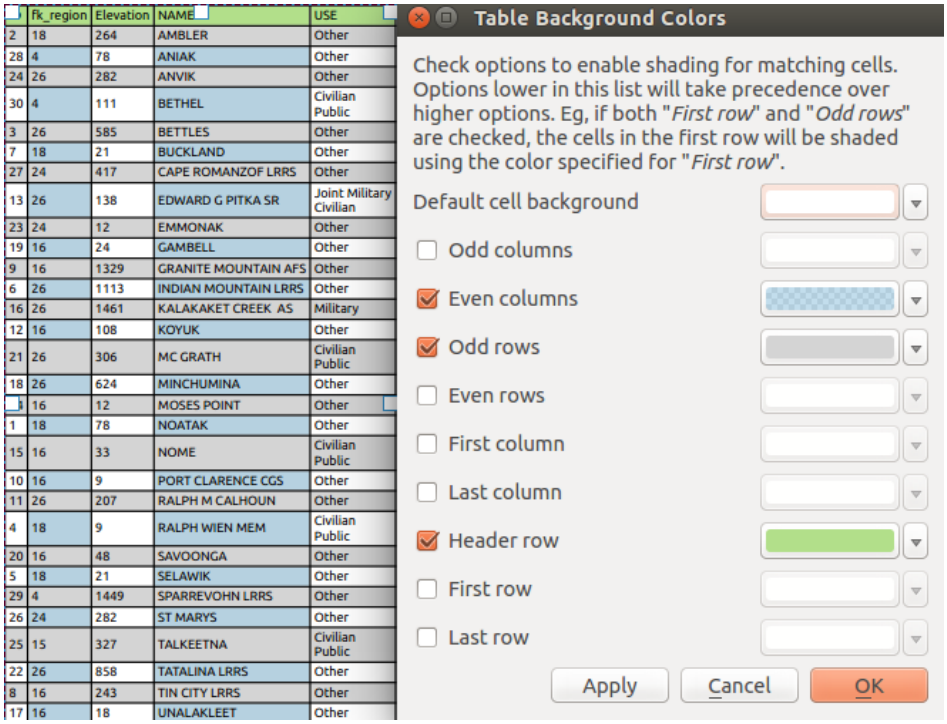


Figura18.44: Attribute table Advanced Background Dialog

- *Apply layer conditional styling colors*: the *conditional table formatting* present in the layer is applied inside the layout attribute table (*only background and foreground colors are currently supported*). Conditional formatting rules take precedence over other layout table formatting settings, e.g. they will override other cell background color settings such as alternating row colors.
- With the *Wrap text on* option, you can define a character on which the cell content will be wraped each time it is met
- With *Oversized text* you define the behavior when the width set for a column is smaller than its content's length. It can be **Wrap text** or **Truncate text**.

Nota: More properties of the attribute table item are described in the *Tables common functionalities* section.

The fixed table item

Additional information about the map can be inserted manually into a table by choosing *Add Fixed Table* and by following *items creation instructions* to add a new table item that you can later manipulate the same way as exposed in *Interacting with layout items*.

By default, an empty table with two minimized columns and rows appears in the map layout. You have to customize the table in the *Item Properties* panel. Other than the *items common properties*, this feature has the following functionalities:

Propriedades Principais

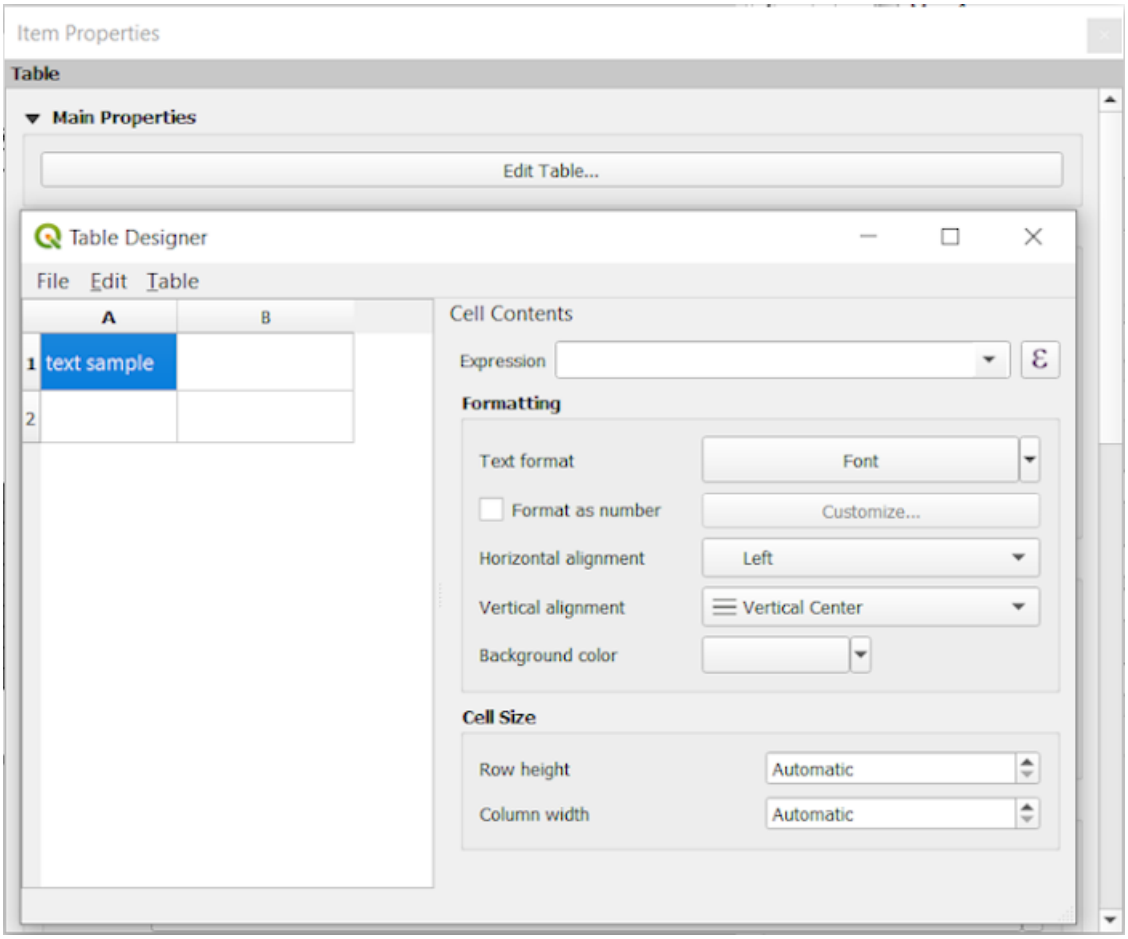


Figura18.45: Fixed table Item Properties Panel with Table designer

In *Main properties* you can work with the *Table designer* when clicking the *Edit table …*:

- You can click into the table and insert texts manually.
- Through the menus on top it is possible to:
  - *Import Content From Clipboard* by going to *File* (it overrides given inputs).
  - work with selection functionalities for rows and columns by going to *Edit*.
  - *Insert rows*, *Insert columns*, *Delete Rows*, *Delete Columns* as well as using the option to *Include Header Row*.
- You can work with the *Cell Contents* section on the right and:
  - Define the text format of selected cells in *Formatting*
    - by clicking on the given expression button and using a regular expression for the input of the cell
    - by choosing the *Text format*
    - by *Format as number* (several formats are available)
    - by defining the *Horizontal alignment* and the *Vertical alignment*
    - by choosing a *Background color*

- Define the *Cell Size* with *Row height* and *Column width*.

Aparência

The *Appearance* group of the fixed table provides the following functionalities:

- Click *Show empty rows* to fill the attribute table with empty cells.
- With *Cell margins* you can define the margin around text in each cell of the table.
- With *Display header* you can select from a list one of 'On first frame', 'On all frames' default option, or 'No header'.
- With *Background color* you can set the background color of the table using the *color selector* widget. The *Advanced customization* option helps you define different background colors for each cell.
- With *Oversized text* you define the behavior when the width set for a column is smaller than its content's length. It can be **Wrap text** or **Truncate text**.

Nota: More properties of the fixed table item are described in the *Tables common functionalities* section.

Tables common functionalities

Show grid

The *Show grid* group of the table items provides the following functionalities (see Fig.18.46):

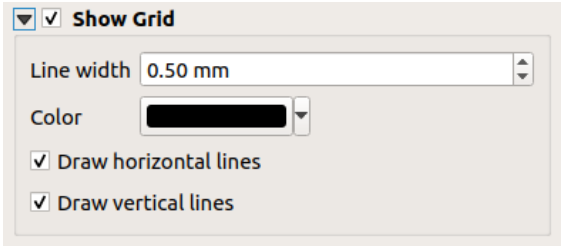


Figura18.46: Attribute table Show grid Group

- Activate *Show grid* when you want to display the grid, the outlines of the table cells. You can also select to either *Draw horizontal lines* or *Draw vertical lines* or both.
- With *Line width* you can set the thickness of the lines used in the grid.
- The *Color* of the grid can be set using the color selection widget.

Fonts and text styling

The *Fonts and text styling* group of the table items provides the following functionalities (see Fig.18.47):



Figura18.47: Attribute table Fonts and text styling Group

- You can define *Font* properties for *Table heading* and *Table contents*, using the advanced *text settings* widget (with buffer, shadow, paint effects, transparence, background, coloring, …). Note that these changes do not affect the cells that have custom font assigned, either from the *Appearance* section or the *Table Designer* dialog. Only cells with the default rendering are overwritten.
- For *Table heading* you can additionally set the *Alignment* to `Follow column alignment` or override this setting by choosing `Left`, `Center` or `Right`. The column alignment is set using the *Select Attributes* dialog (see Fig.18.41).

Frames

The *Frames* group of the table item properties provides the following functionalities (see Fig.18.48):

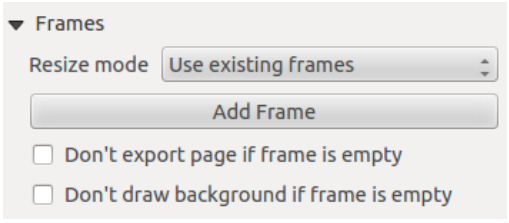


Figura18.48: Attribute table Frames Group

- With *Resize mode* you can select how to render the attribute table contents:
  - `Use existing frames` displays the result in the first frame and added frames only.
  - `Extend to next page` will create as many frames (and corresponding pages) as necessary to display the full selection of attribute table. Each frame can be moved around on the layout. If you resize a frame, the resulting table will be divided up between the other frames. The last frame will be trimmed to fit the table.
  - `Repeat until finished` will also create as many frames as the *Extend to next page* option, except all frames will have the same size.
- Use the *Add Frame* button to add another frame with the same size as selected frame. The result of the table that will not fit in the first frame will continue in the next frame when you use the Resize mode `Use existing frames`.
- Activate  *Don't export page if frame is empty* prevents the page to be exported when the table frame has no contents. This means all other layout items, maps, scalebars, legends etc. will not be visible in the result.
- Activate  *Don't draw background if frame is empty* prevents the background to be drawn when the table frame has no contents.

18.2.8 Os Items de Imagem e Seta Norte

The *Picture* item is a tool that helps decorate your map with pictures, logos… It can also be used to add north arrows, despite the dedicated *North arrow* tool.

O Item de Imagem

You can add a picture by dragging it from your file manager onto the canvas, or by using the Add Picture, following *items creation instructions*. Then you can manipulate it, as explained in *Interacting with layout items*.

When using Add Picture, the picture item will be a blank frame that you can customize using its *Item Properties* panel. Other than the *items common properties*, this feature has the following functionalities (see Fig.18.49):

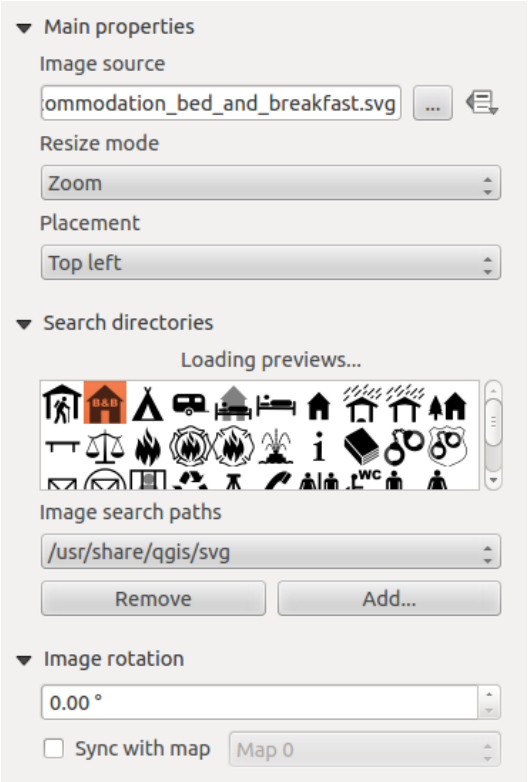


Figura18.49: Painel de Propriedades do Item de Imagem

There are several ways to set the *Image source* (to select the image you want to display):

1. In the *Main properties* group, use the … Browse button of *image source* to select a file on your computer. The browser will start in the SVG-libraries provided with QGIS. You can also select other image formats (like `.png` or `.jpg`).
2. You can enter the source directly in the *Image source* text field. You can even provide a remote URL that points to a picture.
3. From the *Search directories* area you can select an image from the loaded previews to set the image source. These images are by default provided by folders set in *Settings* ► *Options* ► *System* ► *SVG Paths*.
4. Use the data defined override button to set the image source from a feature attribute or using a regular expression.

Nota: In the *Search directories* group, you can use the *Add* and *Remove* buttons to customize the list of folders to fetch and preview images from.

With the *Resize mode* option, you can set how the image is displayed when the frame is resized:

- `Zoom`: enlarges/reduces the image to the frame while maintaining the aspect ratio of picture
- `Stretch`: stretches the image to fit inside the frame
- `Clip`: use this mode for raster images only, it sets the size of the image to the original image size without scaling, and the frame is used to clip the image. So only the part of the image that is inside the frame will be visible.
- `Zoom and resize frame`: enlarges the image to fit the frame, and then resizes frame to fit the resulting image dimensions
- `Resize frame to image size`: sets the size of the frame to match the original size of the image (no scaling)

Depending on the selected *Resize mode*, the *Placement* and *Image rotation* options may be disabled. *Placement* lets you select the position of the image inside its frame.

The QGIS provided (default) `.SVG` files are customizable, meaning that you can easily apply other *Fill color*, *Stroke color* (including opacity) and *Stroke width* than the original, using their corresponding feature in the *SVG Parameters* group. These properties can also be *data-defined*.

If you add an `.SVG` file that does not enable these properties, you may need to add the following tags to the file in order to add support e.g. for transparency:

- *fill-opacity="param(fill-opacity)"*
- *stroke-opacity="param(outline-opacity)"*

You can read this blog post to see an example.

Images can be rotated with the *Image rotation* field. Activating the *Sync with map* checkbox synchronizes the rotation of the image with the rotation applied to a selected map item. This is a convenient feature for north arrows that you can align with either:

- **Grid north**: the direction of a grid line which is parallel to the central meridian of the national/local grid
- **True north**: direction of a meridian of longitude.

You can also apply a declination *Offset* to the picture rotation.

O Item de Seta Norte

You can add a north arrow with the  Add North Arrow button, following *items creation instructions* and manipulate it the same way as exposed in *Interacting with layout items*.

Since north arrows are images, the *North Arrow* item has the same properties as the *picture item*. The main differences are:

- A default north arrow is used when adding the item, instead of a blank frame
- The north arrow item is synced with a map item by default: the *Sync with map* property is the map over which the north arrow item is drawn. If none, it falls back to the *reference map*.

Nota: Many of the north arrows do not have an 'N' added in the north arrow. This is done on purpose, since there are languages that do not use an 'N' for North.

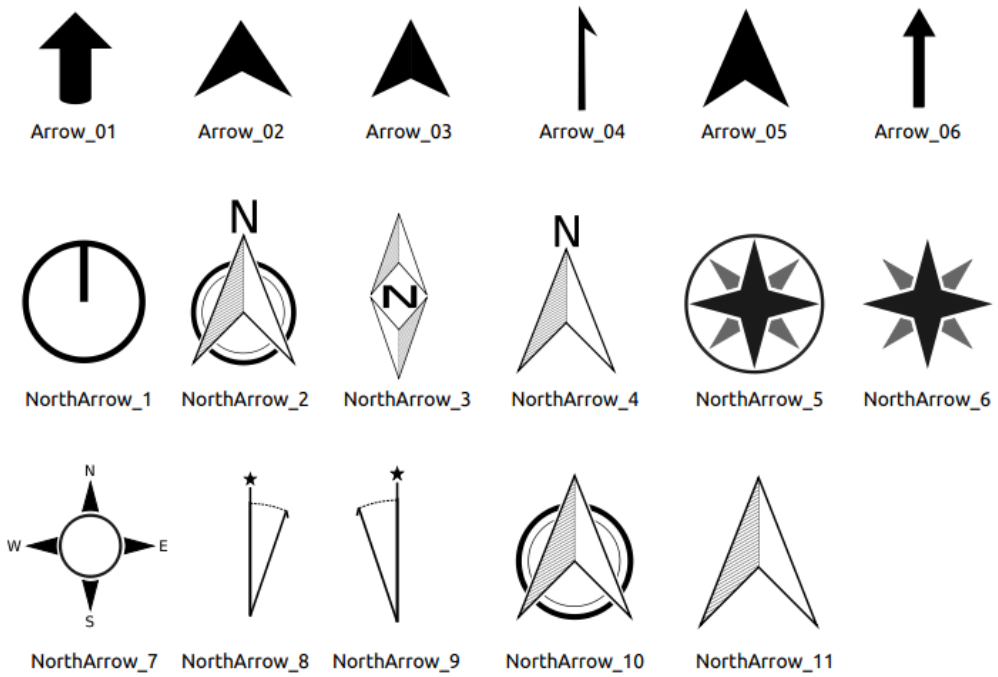


Figura18.50: North arrows available for selection in provided SVG library

18.2.9 O quadro com item em HTML

It is possible to add a frame that displays the contents of a website or even create and style your own HTML page and display it! You can add a picture with the  *Add HTML* following *items creation instructions* and manipulate it the same way as exposed in *Interacting with layout items*. Note that the HTML scale is controlled by the layout export resolution at the time the HTML frame is created.

The HTML item can be customized using its *Item Properties* panel. Other than the *items common properties*, this feature has the following functionalities (see Fig.18.51):

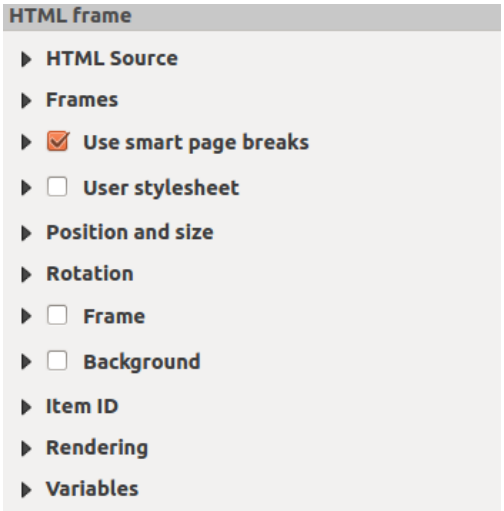


Figura18.51: HTML Frame, the Item Properties Panel

HTML Source

The *HTML Source* group of the HTML frame *Item Properties* panel provides the following functionalities (see Fig.18.52):

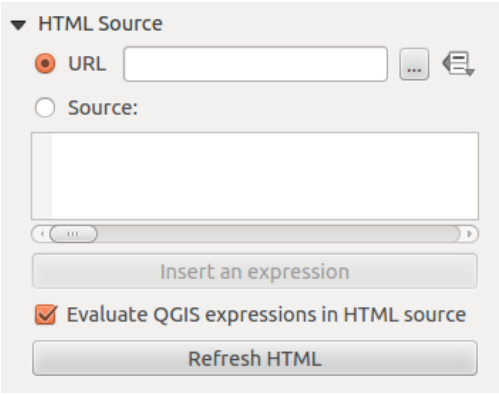


Figura18.52: HTML frame, the HTML Source properties

- In *URL* you can enter the URL of a webpage you copied from your Internet browser or select an HTML file using the … Browse button. There is also the option to use the Data-defined override button, to provide a URL from the contents of an attribute field of a table or using a regular expression.
- In *Source* you can enter text in the textbox with some HTML tags or provide a full HTML page.
- The *Insert or Edit an Expression…* button can be used to add an expression like `[%Year($now)%]` in the Source textbox to display the current year. This button is only activated when radiobutton *Source* is selected. After inserting the expression click somewhere in the textbox before refreshing the HTML frame, otherwise you will lose the expression.
- Activate *Evaluate QGIS expressions in HTML code* to see the result of the expression you have included, otherwise you will see the expression instead.
- Use the *Refresh HTML* button to refresh the HTML frame(s) and see the result of changes.

Frames

The *Frames* group of the HTML frame *Item Properties* panel provides the following functionalities (see Fig.18.53):

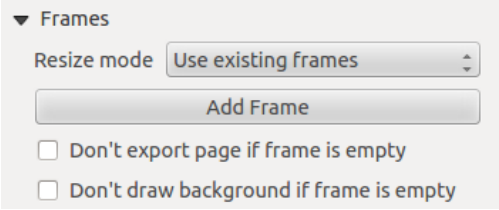


Figura18.53: HTML frame, the Frames properties

- With *Resize mode* you can select how to render the HTML contents:
  - `Use existing frames` displays the result in the first frame and added frames only.
  - `Extend to next page` will create as many frames (and corresponding pages) as necessary to render the height of the web page. Each frame can be moved around on the layout. If you resize a frame, the webpage will be divided up between the other frames. The last frame will be trimmed to fit the web page.
  - `Repeat on every page` will repeat the upper left of the web page on every page in frames of the same size.

  - `Repeat until finished` will also create as many frames as the `Extend to next page` option, except all frames will have the same size.

- Use the *Add Frame* button to add another frame with the same size as selected frame. If the HTML page does not fit in the first frame it will continue in the next frame when you use *Resize mode* or *Use existing frames*.
- Activate *Don't export page if frame is empty* prevents the page from being exported when the frame has no HTML contents. This means all other layout items, maps, scale bars, legends etc. will not be visible in the result.
- Activate *Don't draw background if frame is empty* prevents the HTML frame being drawn if the frame is empty.

Use smart page breaks and User style sheet

The *Use smart page breaks* dialog and *User style sheet* dialog of the HTML frame *Item Properties* panel provides the following functionalities (see Fig.18.54):

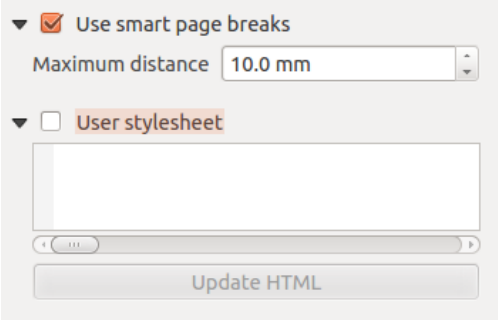


Figura18.54: HTML frame, Use smart page breaks and User style sheet properties

- Activate *Use smart page breaks* to prevent the html frame contents from breaking mid-way a line of text so it continues nice and smooth in the next frame.
- Set the *Maximum distance* allowed when calculating where to place page breaks in the html. This distance is the maximum amount of empty space allowed at the bottom of a frame after calculating the optimum break location. Setting a larger value will result in better choice of page break location, but more wasted space at the bottom of frames. This is only used when *Use smart page breaks* is activated.
- Activate *User style sheet* to apply HTML styles that often is provided in cascading style sheets. An example of style code is provided below to set the color of `<h1>` header tag to green and set the font and font size of text included in paragraph tags `<p>`.

```
h1 {color: #00ff00;
}
p {font-family: "Times New Roman", Times, serif;
   font-size: 20px;
}
```

- Use the *Update HTML* button to see the result of the style sheet settings.

18.2.10 Itens do shape

Qgis proporciona um leque de ferramentas para desenhar formas complexas ou regulares sobre o layout de impressão.

Nota: Ao contrário de outros itens do layout de impressão, você não pode definir o estilo do quadro, nem da cor de fundo do quadro delimitador de formas (definido como transparente por padrão).

Os Itens regulares do Shape

The *Shape* item is a tool that helps to decorate your map with regular shapes like triangle, rectangle, ellipse… You can add a regular shape using the Add Shape tool which gives access to particular tools like Add Rectangle, Add Ellipse and Add Triangle. Once you have selected the appropriate tool, you can draw the item following *items creation instructions*. Like other layout items, a regular shape can be manipulated the same way as exposed in *Interacting with layout items*.

Nota: Holding down the `Shift` key while drawing the basic shape with the click and drag method helps you create a perfect square, circle or triangle.

The default shape item can be customized using its *Item Properties* panel. Other than the *items common properties*, this feature has the following functionalities (see Fig.18.55):

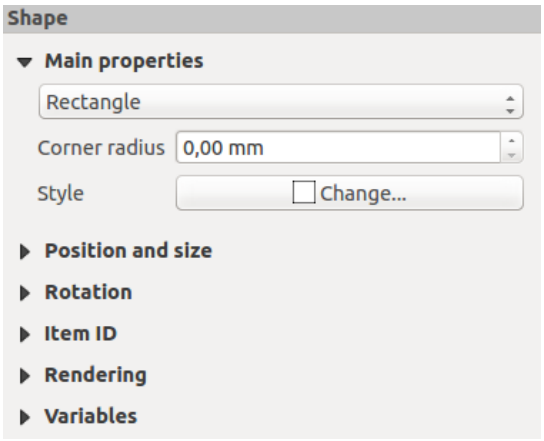


Figura18.55: Painel propriedades do Item Shape

The *Main properties* group shows and allows you to switch the type of the shape item (**Ellipse**, **Rectangle** or **Triangle**) inside the given frame.

You can set the style of the shape using the advanced *symbol* and *color* selector widget…

For the rectangle shape, you can set in different units the value of the *Corner radius* to round of the corners.

The Node-Based Shape Items

While the *Add Shape* tool provides way to create simple and predefined geometric item, the *Add Node Item* tool helps you create a custom and more advanced geometric item. For polylines or polygons, you can draw as many lines or sides as you want and vertices of the items can be independently and directly manipulated using the *Edit Nodes Item*. The item itself can be manipulated as exposed in *Interacting with layout items*.

To add a node-based shape:

1. Click the Add Node Item icon
2. Select either Add Polygon or Add Polyline tool
3. Perform consecutive left clicks to add nodes of your item. If you hold down the `Shift` key while drawing a segment, it is constrained to follow an orientation multiple of 45°.
4. When you're done, right-click to terminate the shape.

You can customize the appearance of the shape in the *Item Properties* panel.

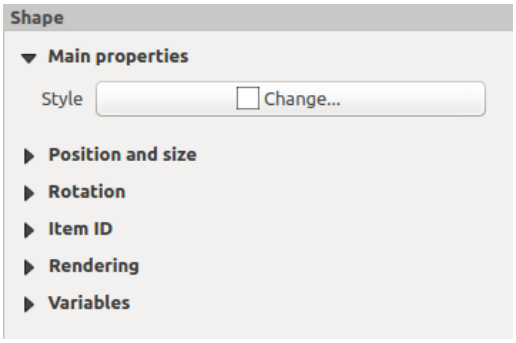


Figura18.56: Polygon Node Shape Item Properties Panel

In the *Main properties*, you can set the style of the shape using the advanced *symbol* and *color* selector widget…

For polyline node items, you can also parameterize the *Line markers* i.e. add:

- start and/or end markers with options:
  - *None*: draws a simple polyline.
  - *Arrow*: adds a regular triangular arrow head that you can customize.
  - *SVG* marker: uses an `SVG` file as arrow head of the item.
- customize the arrow head:
  - *Arrow stroke color*: sets the stroke color of the arrow head.
  - *Cor de preenchimento da seta*: Defina a cor de preenchimento da seta.
  - *Largura do contorno da seta* : Defina a largura do contorno da seta.
  - *Espessura da ponta da seta*: Defina a espessura da seta.

SVG images are automatically rotated with the line. Stroke and fill colors of QGIS predefined SVG images can be changed using the corresponding options. Custom SVG may require some tags following this *instruction*.

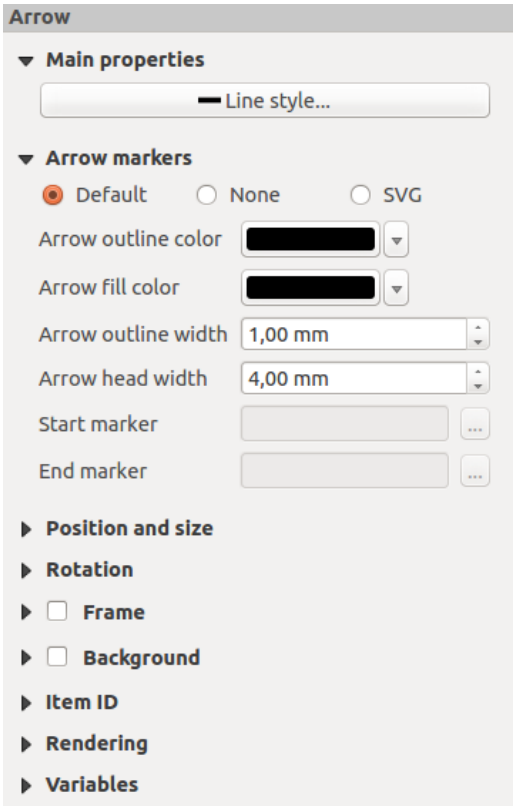


Figura18.57: Painel propriedades do Item Shape Nó Polilinha

Item da Seta

The Add Arrow tool is a shortcut to create an arrow-enabled polyline by default and thus has the same properties and behavior as a *polyline node item*.

Actually, the arrow item can be used to add a simple arrow, for example, to show the relation between two different print layout items. However, to create a north arrow, the *image item* should be considered first as it gives access to a set of north arrows in `.SVG` format that you can sync with a map item so that it rotates automatically with it.

Editar um ítem nó na geometria

A specific tool is provided to edit node-based shapes through Edit Nodes Item. Within this mode, you can select a node by clicking on it (a marker is displayed on the selected node). A selected node can be moved either by dragging it or by using the arrow keys. Moreover, in this mode, you are able to add nodes to an existing shape: double-click on a segment and a node is added at the place you click. Finally, you can remove the currently selected node by hitting the `Del` key.

18.3 Criando um arquivo de Saída

Fig.18.58 shows an example print layout including all the types of layout items described in the previous section.

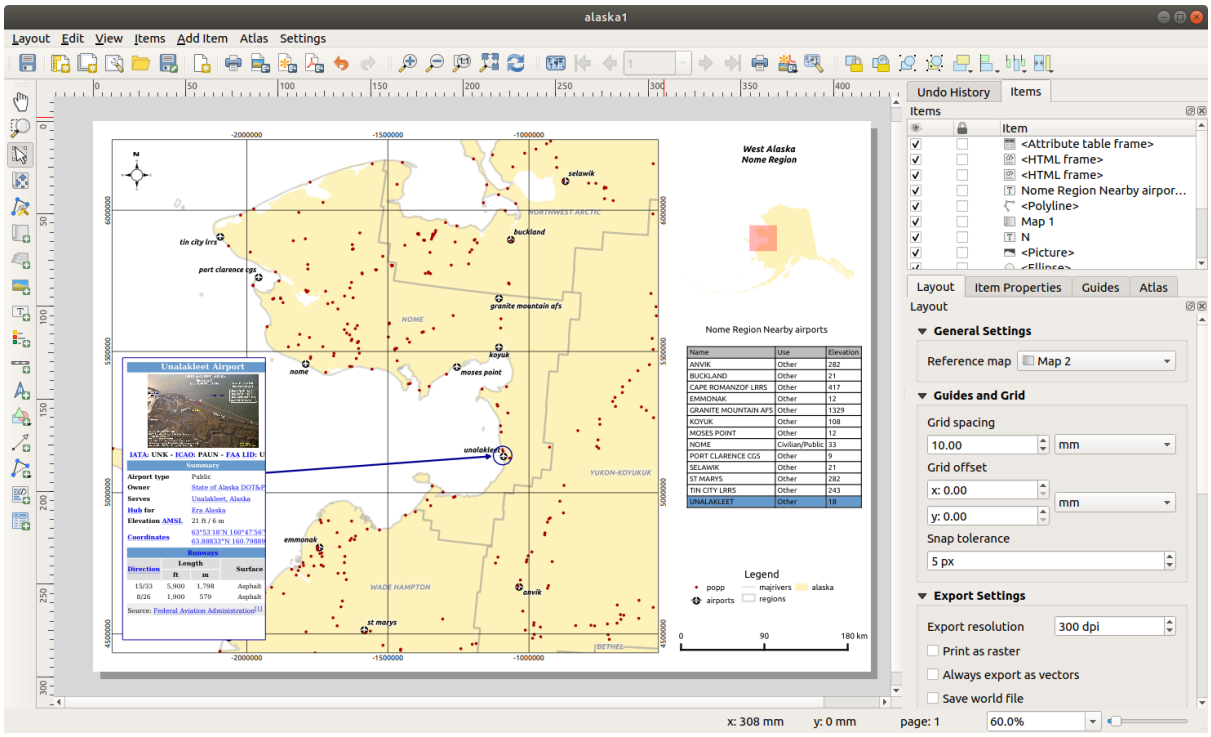


Figura18.58: Print Layout with map view, legend, image, scale bar, coordinates, text and HTML frame added

From the *Layout* menu or toolbar, you can output the print layout to different file formats, and it is possible to modify the resolution (print quality) and paper size:

- The Print icon allows you to print the layout to a connected printer or a PostScript file, depending on the installed printer drivers.
- The Export as image icon exports the print layout image formats such as `PNG`, `BMP`, `TIF`, `JPG`, and many others…
- The Export as SVG icon saves the print layout as an `SVG` (Scalable Vector Graphic).
- O ícone Exportar como PDF salva o layout de impressão definido diretamente como um arquivo `PDF` (Portable Document Format).

18.3.1 Definições para exportação

Whenever you export a print layout, there are a selection of export settings QGIS needs to check in order to produce the most appropriate output. These configurations are:

- The *Export settings* of the *Layout* panel, such as *Export resolution*, *Print as raster* *Always export as vectors* or *Save world file*
- *Exclude page from exports* in the *page item properties* panel
- *Exclude item from exports* in the *item properties* panel

18.3.2 Exportar como Imagem

To export a layout as an image:

1. Click the Export as image icon
2. Select the image format, the folder and filename (e.g. `myill.png`) to use. If the layout contains more than one page, each page will be exported to a file with the given filename with the page number appended (e.g. `myill_2.png`).
3. Na próxima caixa de diálogo (*Opções de Exportação de Imagem*):
   - You can override the print layout *Export resolution* and the exported page dimensions (as set in *Layout* panel).
   - Image rendering can also be improved with the *Enable antialiasing* option.
   - If you want to export your layout as a **georeferenced image** (e.g., to share with other projects), check the *Generate world file* option, and an *ESRI World File* with the same name as the exported image, but a different extension (`.tfw` for TIFF, `.pnw` for PNG, `jgw` for JPEG, ...) will be created when exporting. This option can also be checked by default in the *layout panel*.

     Nota: For multi-page output, only the page that contains the *reference map* will get a world file (assuming that the *Generate world file* option is checked).

   - By checking *Crop to content* option, the image output by the layout will include the minimal area enclosing all the items (map, legend, scale bar, shapes, label, image...) of each page of the composition:
     - Se a composição incluir uma única página, a saída será redimensionada para incluir TUDO na composição. A página pode ser reduzida ou estendida a todos os itens, dependendo da sua posição (na, acima, abaixo, esquerda ou direita da página).
     - In case of a multi-page layout, each page will be resized to include items in its area (left and right sides for all pages, plus top for the first page and bottom for the last page). Each resized page is exported to a separate file.

     The *Crop to content* dialog also lets you add margins around the cropped bounds.

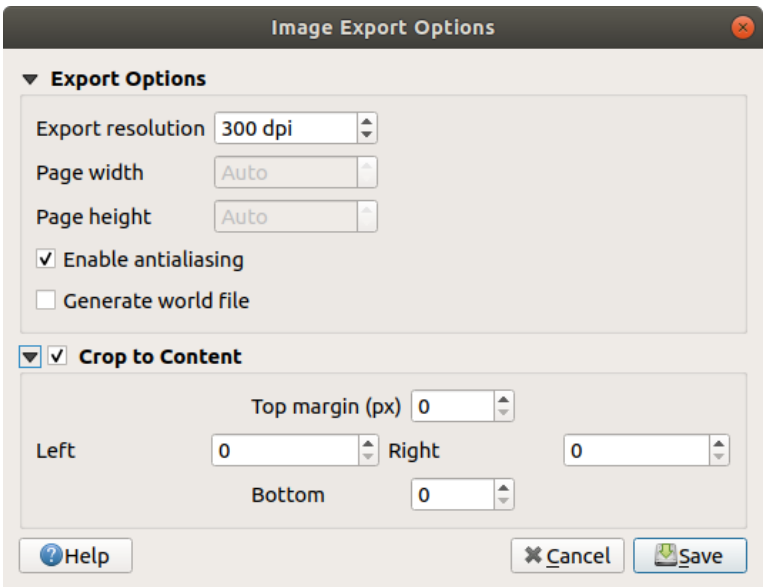


Figura18.59: Image Export Options, output is resized to items extent

Dica: Use image formats that support transparency when items extend beyond the paper extent

Layout items may be placed outside the paper extent. When exporting with the *Crop to content* option, the resulting image may therefore extend beyond the paper extent. Since the background outside of the paper extent will be transparent, for image formats that do not support transparency (e.g. `BMP` and `JPG`) the transparent background will be rendered as full black, "corrupting" the image. Use transparency-compatible formats (e.g. `TIFF` and `PNG`) in such cases.

Nota: When supported by the format (e.g. `PNG`) and the underlying Qt library, the exported image may include *project metadata* (author, title, date, description…)

18.3.3 Export as SVG

To export a layout as SVG:

1. Click the Export as SVG icon
2. Fill in the path and filename (used as a base name for all the files in case of multi-page composition, as for image export)
3. In the next *SVG Export Options* dialog, you can override the layout default *export settings* or configure new ones:
   - *Export map layers as SVG groups*: exported items are grouped within layers whose name matches the layer names from QGIS, making it much easier to understand the contents of the document.
   - *Always export as vectors*: some rendering options require items to be rasterized for a better rendering. Check this option to keep the objects as vectors with the risk that the appearance of the output file may not match the print layout preview (for more details, see *Definições para exportação*).
   - *Exportar metadados RDF* do documento, como título, autor, data, descrição…
   - *Simplify geometries to reduce output file size*: this avoids exporting ALL geometry vertices, which can result in a ridiculously complex and large export file size that could fail to load in other applications. Geometries will be simplified while exporting the layout in order to remove any redundant vertices which are not discernably different at the export resolution (e.g. if the export resolution is `300 dpi`, vertices that are less than `1/600 inch` apart will be removed).
   - Defina a *Exportação de texto*: controla se os rótulos de texto são exportados como objetos de texto adequados (*Sempre exportar textos como objetos de texto*) ou apenas como caminhos (*Sempre exportar textos como caminhos*). Se forem exportados como objetos de texto, poderão ser editados em aplicativos externos (por exemplo, Inkscape) como texto normal. MAS o efeito colateral é que a qualidade da renderização é reduzida E há problemas com a renderização quando determinadas configurações de texto, como buffers, estão em vigor. É por isso que a exportação como caminhos é recomendada.
   - Apply *Crop to content option*
   - *Disable tiled raster layer exports*: When exporting files, QGIS uses a built-in raster layer tiled rendering that saves memory. Sometimes, this can cause visible "seams" in the rasters for generated files. Checking this option would fix that, at the cost of a higher memory usage during exports.

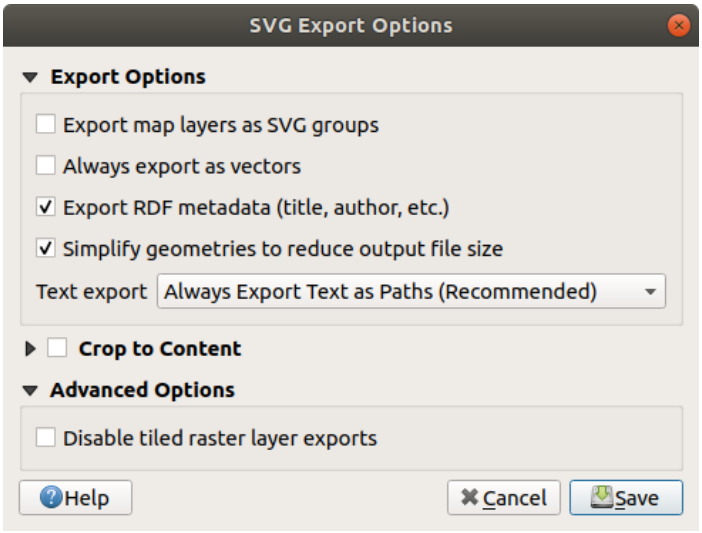


Figura18.60: SVG Export Options

Nota: Currently, the SVG output is very basic. This is not a QGIS problem, but a problem with the underlying Qt library. This will hopefully be sorted out in future versions.

18.3.4 Export as PDF

To export a layout as PDF:

1. Click the Export as PDF icon
2. Preencha o caminho e o nome do arquivo: diferente da exportação de imagem e SVG, todas as páginas do layout são exportadas para um único arquivo PDF.
3. In the next *PDF Export Options* dialog, you can override the layout default *export settings* or configure new ones:
   - *Always export as vectors*: some rendering options require items to be rasterized for a better rendering. Check this option to keep the objects as vectors with the risk that the appearance of the output file may not match the print layout preview (for more details, see *Definições para exportação*).
   - *Append georeference information*: available only if the *reference map*, from which the information is taken, is on the first page.
   - *Exportar metadados RDF* do documento, como título, autor, data, descrição…
   - Defina :guilabel: Exportar texto`: controla se os rótulos de texto são exportados como objetos de texto adequados (*Sempre exportar textos como objetos de texto*) ou apenas como caminhos (*Sempre exporta textos como caminhos*). Se eles forem exportados como objetos de texto, poderão ser editados em aplicativos externos (por exemplo, Inkscape) como texto normal. MAS o efeito colateral é que a qualidade da renderização diminui E há problemas com a renderização quando determinadas configurações de texto, como buffers, estão em vigor. É por isso que a exportação como caminhos é recomendada.
   - Control the PDF *Image compression* using:
     - *Lossy (JPEG)*, which is the default compression mode
     - or *Lossless*, which creates bigger files in most cases, but is much more suitable for printing outputs or for post-production in external applications (requires Qt 5.13 or later).
   - *Create Geospatial PDF (GeoPDF)*: Generate a georeferenced PDF file (requires GDAL version 3 or later).

- *Disable tiled raster layer exports*: When exporting files, QGIS uses tiled based rendering that saves memory. Sometimes, this can cause visible "seams" in the rasters for generated files. Checking this option would fix that, at the cost of a higher memory usage during exports.
- *Simplify geometries to reduce output file size*: Geometries will be simplified while exporting the layout by removing vertices that are not discernably different at the export resolution (e.g. if the export resolution is `300 dpi`, vertices that are less than `1/600 inch` apart will be removed). This can reduce the size and complexity of the export file (very large files can fail to load in other applications).

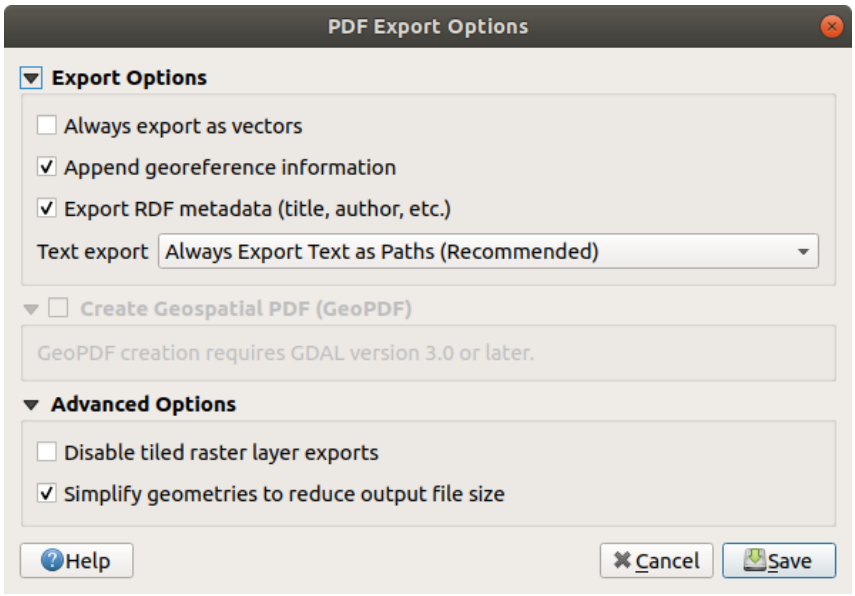


Figura18.61: Opções de exportação de PDF

Nota: Since QGIS 3.10, with GDAL 3, GeoPDF export is supported, and a number of GeoPDF specific options are available:

- *Format* (GeoPDF format - there are some GeoPDF variations),
- *Include multiple map themes* (specify map themes to include),
- *Include vector feature information* (choose the layers and group them into logical PDF groups).

Nota: Exporting a print layout to formats that supports georeferencing (e.g. `PDF` and `TIFF`) creates a georeferenced output by default.

18.3.5 Generate an Atlas

Atlas functions allow you to create map books in an automated way. Atlas uses the features of a table or vector layer (*Coverage layer*) to create an output for each feature (**atlas feature**) in the table / layer. The most common usage is to zoom a map item to the current atlas feature. Further use cases include:

- um item de mapa mostrando, para outra camada, apenas feições que compartilham o mesmo atributo que a feição atlas ou estão dentro de sua geometria.
- a label or HTML item whose text is replaced as features are iterated over
- a table item showing attributes of associated *parent or children* features of the current atlas feature…

For each feature, the output is processed for all pages and items according to their exports settings.

Dica: Use variables for more flexibility

QGIS provides a large panel of functions and *variables*, including atlas related ones, that you can use to manipulate the layout items, but also the symbology of the layers, according to atlas status. Combining these features gives you a lot of flexibility and helps you easily produce advanced maps.

To enable the generation of an atlas and access atlas parameters, refer to the *Atlas* panel. This panel contains the following (see Fig.18.62):

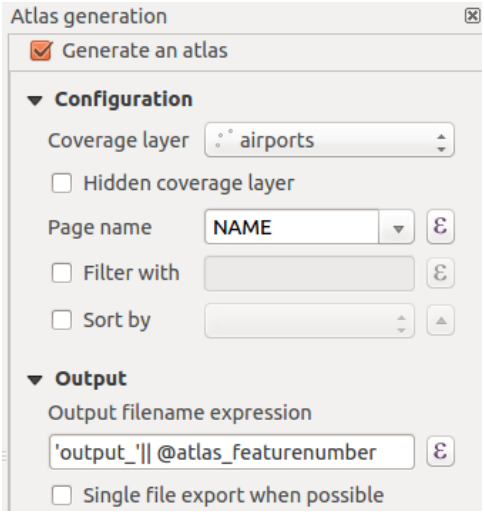


Figura18.62: Atlas Panel

- *Generate an atlas* enables or disables atlas generation.
- *Configuração*
  - A *Coverage layer* combo box that allows you to choose the table or vector layer containing the features to iterate over.
  - An optional *Hidden coverage layer* that, if checked, will hide the coverage layer (but not the other layers) during the generation.
  - An optional *Page name* combo box to specify the name for the feature page(s). You can select a field of the coverage layer or set an *expression*. If this option is empty, QGIS will use an internal ID, according to the filter and/or the sort order applied to the layer.
  - An optional *Filter with* text area that allows you to specify an expression for filtering features from the coverage layer. If the expression is not empty, only features that evaluate to `True` will be processed.
  - An optional *Sort by* that allows you to sort features of the coverage layer (and the output), using a field of the coverage layer or an expression. The sort order (either ascending or descending) is set by the two-state *Sort direction* button that displays an up or a down arrow.
- *Output* - this is where the output of the atlas can be configured:
  - An *Output filename expression* textbox that is used to generate a filename for each atlas feature. It is based on expressions. is meaningful only for rendering to multiple files.
  - A *Single file export when possible* that allows you to force the generation of a single file if this is possible with the chosen output format (`PDF`, for instance). If this field is checked, the value of the *Output filename expression* field is meaningless.

- Uma lista drop-down *Formato de exportação de imagem* para selecionar o formato de saída quando usar o botão  Exportar atlas como Imagens … .

Control map by atlas

The most common usage of atlas is with the map item, zooming to the current atlas feature, as iteration goes over the coverage layer. This behavior is set in the *Controlled by atlas* group properties of the map item. See *Controlled by atlas* for different settings you can apply on the map item.

Customize labels with expression

Para adaptar rótulos ao recurso em que o atlas repete, você pode incluir expressões. Certifique-se de colocar a parte da expressão (incluindo funções, campos ou variáveis) entre `[%` e `%]` (veja *A rotulagem de item* para mais detalhes).

For example, for a city layer with fields `CITY_NAME` and `ZIPCODE`, you could insert this:

```
The area of [% concat( upper(CITY_NAME), ',', ZIPCODE, ' is ',
format_number($area/1000000, 2) ) %] km2
```

ou outra combinação:

```
The area of [% upper(CITY_NAME)%],[%ZIPCODE%] is
[%format_number($area/1000000,2) %] km2
```

The information `[% concat( upper(CITY_NAME), ',', ZIPCODE, ' is ', format_number($area/1000000, 2) ) %]` is an expression used inside the label. Both expressions would result in the following type of label in the generated atlas:

```
The area of PARIS,75001 is 1.94 km2
```

Explore Data-defined override buttons with atlas

There are several places where you can use a Data defined override button to override the selected setting. This is particularly useful with atlas generation. See *Data defined override setup* for more details on this widget.

For the following examples the `Regions` layer of the QGIS sample dataset is used and selected as *Coverage layer* for the atlas generation. We assume that it is a single page layout containing a map item and a label item.

When the height (north-south) of a region extent is greater than its width (east-west), you should use *Portrait* instead of *Landscape* orientation to optimize the use of paper. With a Data Defined Override button you can dynamically set the paper orientation.

Right-click on the page and select *Page Properties* to open the panel. We want to set the orientation dynamically, using an expression depending on the region geometry, so press the button of field *Orientation*, select *Edit…* to open the *Expression string builder* dialog and enter the following expression:

```
CASE WHEN bounds_width(@atlas_geometry) > bounds_height(@atlas_geometry)
THEN 'Landscape' ELSE 'Portrait' END
```

Now if you *preview the atlas*, the paper orients itself automatically, but item placements may not be ideal. For each Region you need to reposition the location of the layout items as well. For the map item you can use the button of its *Width* property to set it dynamic using the following expression:

```
@layout_pagewidth - 20
```

Likewise, use the button of the *Height* property to provide the following expression to constrain map item size:

```
@layout_pageheight - 20
```

To ensure the map item is centered in the page, set its *Reference point* to the upper left radio button and enter `10` for its *X* and *Y* positions.

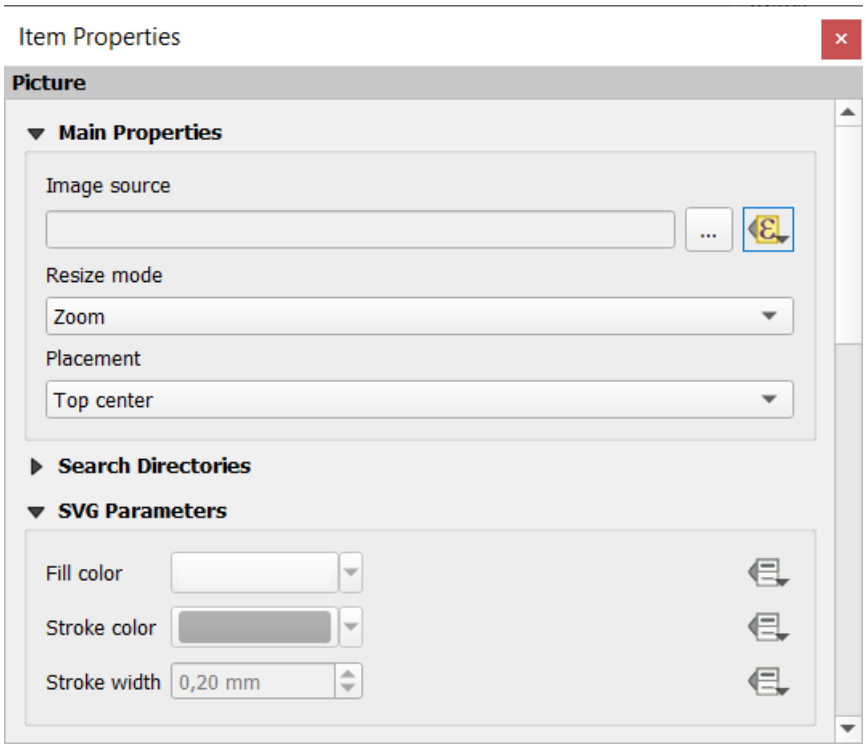
Let's add a title above the map in the center of the page. Select the label item and set the horizontal alignment to  *Center*. Next move the label to the right position, choose the middle button for the *Reference point*, and provide the following expression for field *X*:

```
@layout_pagewidth / 2
```

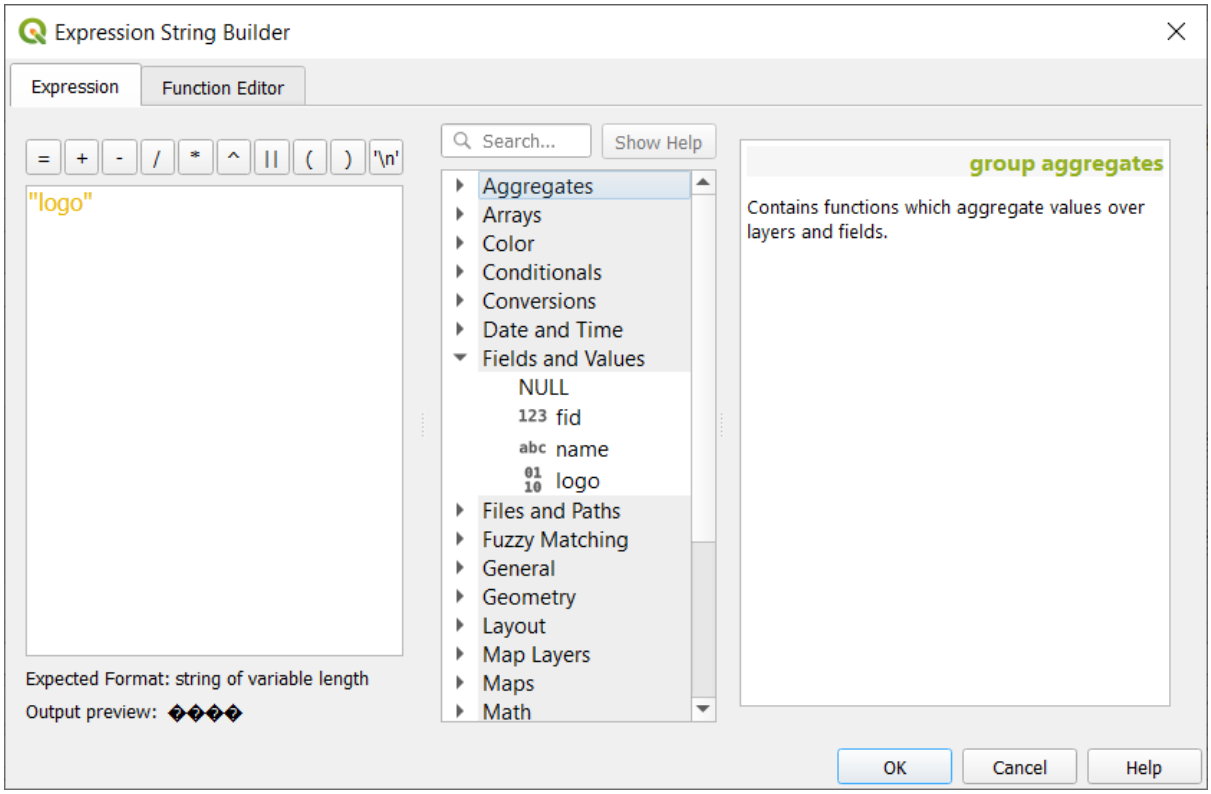
For all other layout items you can set the position in a similar way so they are correctly positioned both for portrait and landscape. You can also do more tweaks such as customizing the title with feature attributes (see *Customize labels with expression* example), changing images, resizing the number of legend columns number according to page orientation, …

The information provided here is an update of the excellent blog (in English and Portuguese) on the Data Defined Override options Multiple_format_map_series_using_QGIS_2.6 .

Another example for using data-defined override buttons is the usage of a dynamic picture. For the following examples we use a geopackage layer containing a BLOB field called `logo` with the field type binary (see *Creating a new GeoPackage layer*). For every feature there is defined a different picture so that the atlas can iterate over as described in *Preview and generate an atlas*. All you need to do is add a picture in the print layout and go to its *Item properties* in the atlas context. There you can find a data-defined override button in the *Image source* section of the *Main Properties*.



In the following window choose *Edit* so that the *Expression String Builder* opens. From the *Fields and values* section you can find the BLOB field that was defined in the geopackage layer. Double-click the field name `logo` and click *OK*.



The atlas iterates over the entries in the BLOB field provided that you choose the geopackage layer as *Coverage layer* (further instructions you can find in *Preview and generate an atlas*).

These are just two examples of how you can use some advanced settings with atlas.

Preview and generate an atlas



Figura18.63: Atlas Preview toolbar

Once the atlas settings have been configured, and layout items (map, table, image…) linked to it, you can create a preview of all the pages by choosing *Atlas* ► *Preview Atlas* or clicking the Preview Atlas icon. You can then use the arrows to navigate through all the features:

- First feature
- Previous feature
- Next feature
- Last feature

You can also use the combo box to select and preview a specific feature. The combo box shows atlas feature names according to the expression set in the atlas *Page name* option.

As for simple compositions, an atlas can be generated in different ways (see *Criando um arquivo de Saída* for more information - just use tools from the *Atlas* menu or toolbar instead of the *Layout* menu.

This means that you can directly print your compositions with *Atlas* ► *Print Atlas*. You can also create a PDF using *Atlas* ► *Export Atlas as PDF…*: You will be asked for a directory to save all the generated PDF files, except if the *Single file export when possible* has been selected. In that case, you'll be prompted to give a filename.

With *Atlas* ► *Export Atlas as Images…* or *Atlas* ► *Export Atlas as SVG…* tool, you're also prompted to select a folder. Each page of each atlas feature composition is exported to the image file format set in *Atlas* panel or to SVG.

Nota: With multi-page output, an atlas behaves like a layout in that only the page that contains the *General settings* will get a world file (for each feature output).

Dica: Print a specific atlas feature

If you want to print or export the composition of only one feature of the atlas, simply start the preview, select the desired feature in the drop-down list and click on *Layout* ► *Print* (or *Export…* to any supported file format).

Use project defined relations for atlas creation

For users with HTML and Javascript knowledge it is possible to operate on GeoJSON objects and use project defined relations from the QGIS project. The difference between this approach and using expressions directly inserted into the HTML is that it gives you a full, unstructured GeoJSON feature to work with. This means that you can use existing Javascript libraries and functions that operate on GeoJSON feature representations.

The following code includes all related child features from the defined relation. Using the JavaScript `setFeature` function it allows you to make flexible HTML which represents relations in whatever format you like (lists, tables, etc). In the code sample, we create a dynamic bullet list of the related child features.

```
// Declare the two HTML div elements we will use for the parent feature id
// and information about the children
<div id="parent"></div>
<div id="my_children"></div>

<script type="text/javascript">
   function setFeature(feature)
   {
     // Show the parent feature's identifier (using its "ID" field)
     document.getElementById('parent').innerHTML = feature.properties.ID;
     //clear the existing relation contents
     document.getElementById('my_children').innerHTML = '';
     feature.properties.my_relation.forEach(function(child_feature) {
     // for each related child feature, create a list element
     // with the feature's name (using its "NAME" field)
       var node = document.createElement("li");
       node.appendChild(document.createTextNode(child_feature.NAME));
       document.getElementById('my_children').appendChild(node);
     });
   }
</script>
```

During atlas creation there will be an iteration over the coverage layer containing the parent features. On each page, you will see a bullet list of the related child features following the parent's identifier.

18.4 Criando um Relatório

This section will help you set up a report in QGIS.

18.4.1 O que é?

By definition, a GIS report is a document containing information organized in a narrative way, containing maps, text, graphics, tables, etc. A report can be prepared ad hoc, periodic, recurring, regular, or as required. Reports may refer to specific periods, events, occurrences, subjects or locations.

No QGIS, um *Relatório* é uma extensão de um *Layouts*.

Reports allow users to output their GIS projects in a simple, quick and structured way.

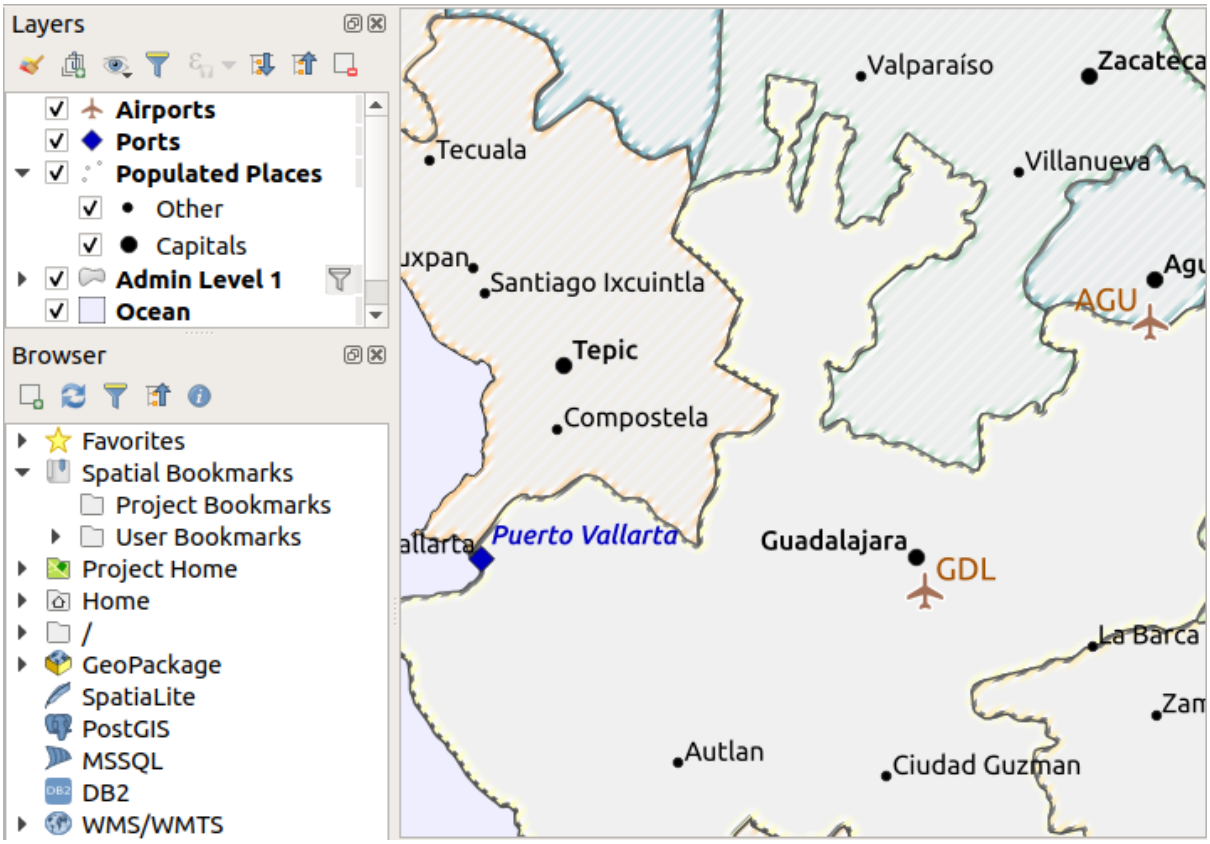
A report can be created with *Project* ► *New Report* or inside the *Project* ► *Layout Manager*.

Nota: The maps in QGIS reports behave in the same way as maps in print layouts and atlases. We will concentrate on the specifics of QGIS reports. For details on map handling, see the sections on *print layouts* and *atlases*.

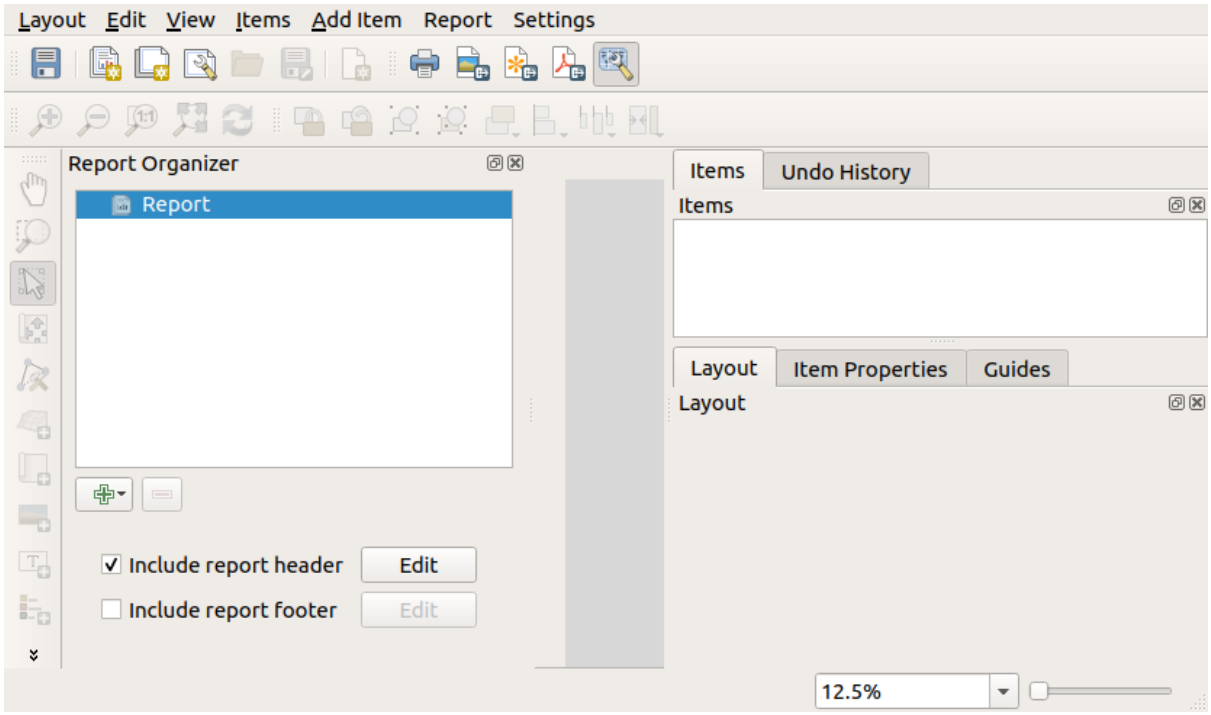
18.4.2 Iniciando

In the *Layout Manager* dialog a report can be created through *New from template* by selecting the dropdown option *Empty Report* and hitting the *Create…* button.

Para este exemplo, usamos alguns limites administrativos, locais com população, portos e aeroportos do Natural Earth dataset (1: 10M).

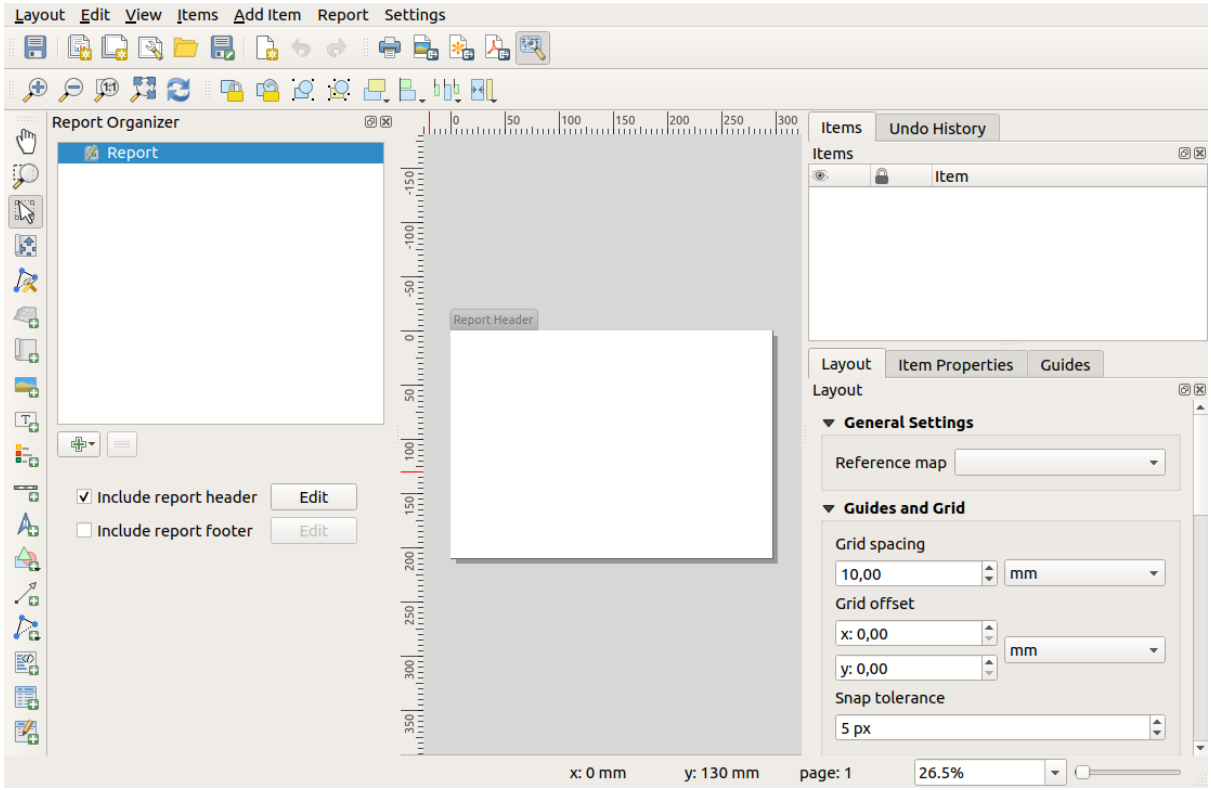


Using the *Project* ► *New Report* command, we create a blank report. Initially, there is not much to look at – the dialog which is displayed looks much like the print layout designer, except for the *Report Organizer* panel to the left:



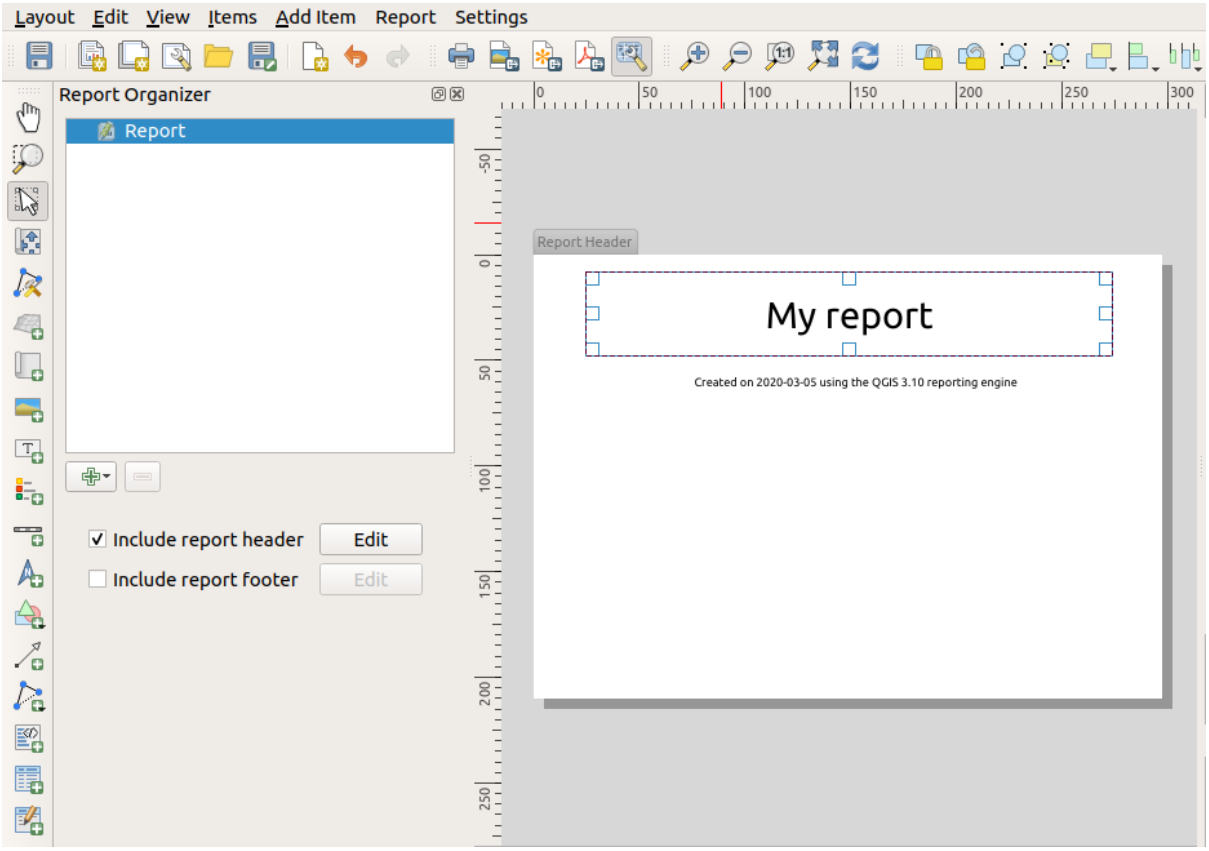
18.4.3 Espaço de Trabalho do Compositor de Relatório

QGIS reports can consist of multiple, nested sections. In our new blank report we initially only have the main report section. The only options for this report section is *Include report header* and *Include report footer*. If we enable these options, a header will be included as the first page(s) (individual parts of reports can be multi-page if desired) in the report, and a footer will constitute the last page(s). Enable the header (*Include report header*), and hit the *Edit* button next to it:

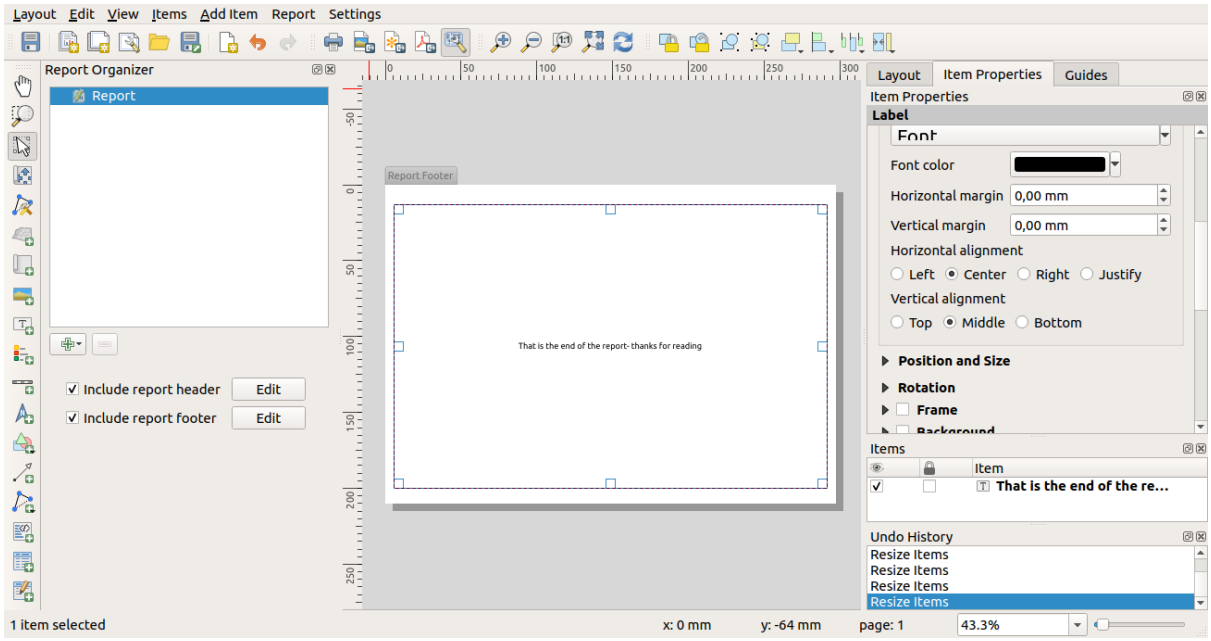


A few things happen as a result. Firstly, an edit pencil is shown next to *Report* in the *Report Organizer*, indicating that the report section is currently being edited in the designer. We also see a new page with a small *Report Header* title. The page has *landscape* orientation by default, but this (and other properties of the page) can be changed by right-clicking on the page and choosing *Page properties*. This will bring up the *Item properties* tab for the page, and page *Size*, *Width*, *Height*, and more can be specified.

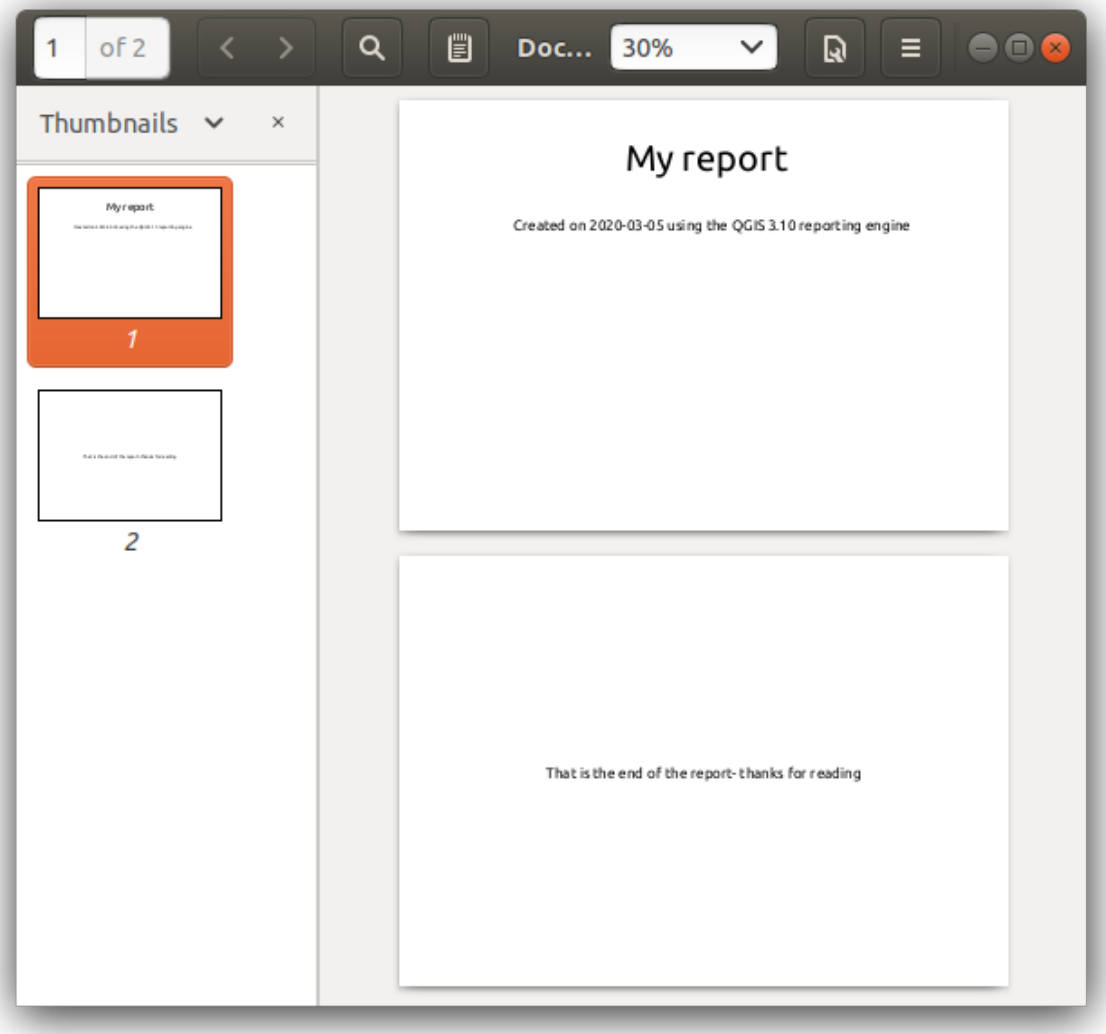
Nos relatórios QGIS, todos os componentes do relatório são compostos por layouts individuais. Eles podem ser criados e modificados usando as mesmas ferramentas dos layouts de impressão padrão - para que você possa usar qualquer combinação desejada de rótulos, figuras, mapas, tabelas etc. Vamos adicionar alguns itens ao cabeçalho do nosso relatório para demonstrar:



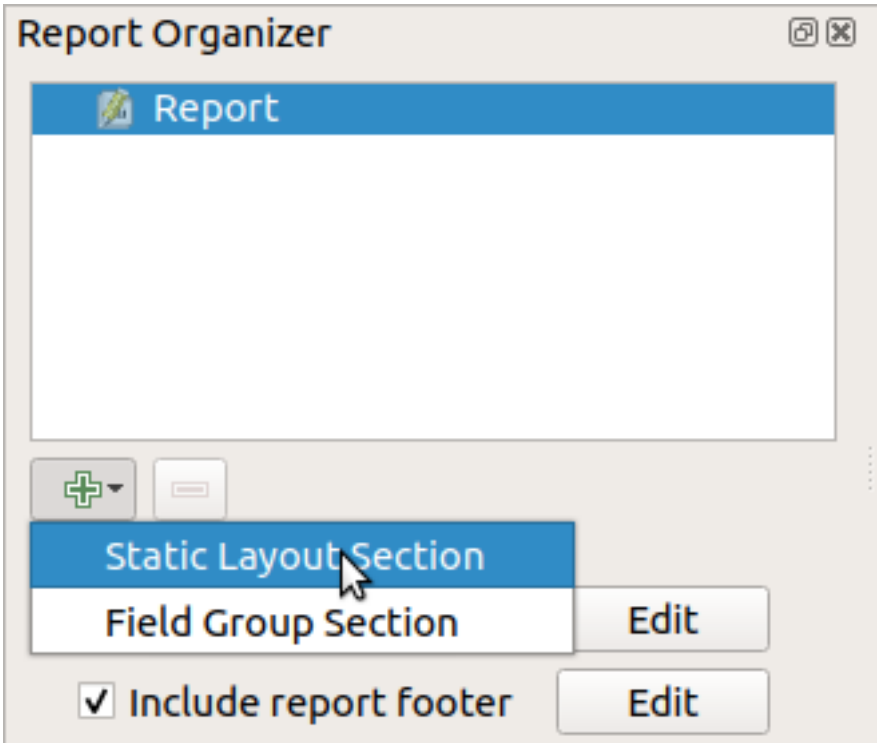
We will also create a simple footer for the report by checking the *Include report footer* option and hitting *Edit*.



Before proceeding further, let us export this report and see what we get. Exporting is done from the *Report* menu – in this case we select *Export Report as PDF…* to render the whole report to a PDF file. Here is the not-very-impressive result – a two page PDF consisting of our header and footer:



Let us make things more interesting. By hitting the Add Section button in the *Report Organizer*, we are given a choice of new sections to add to our report.

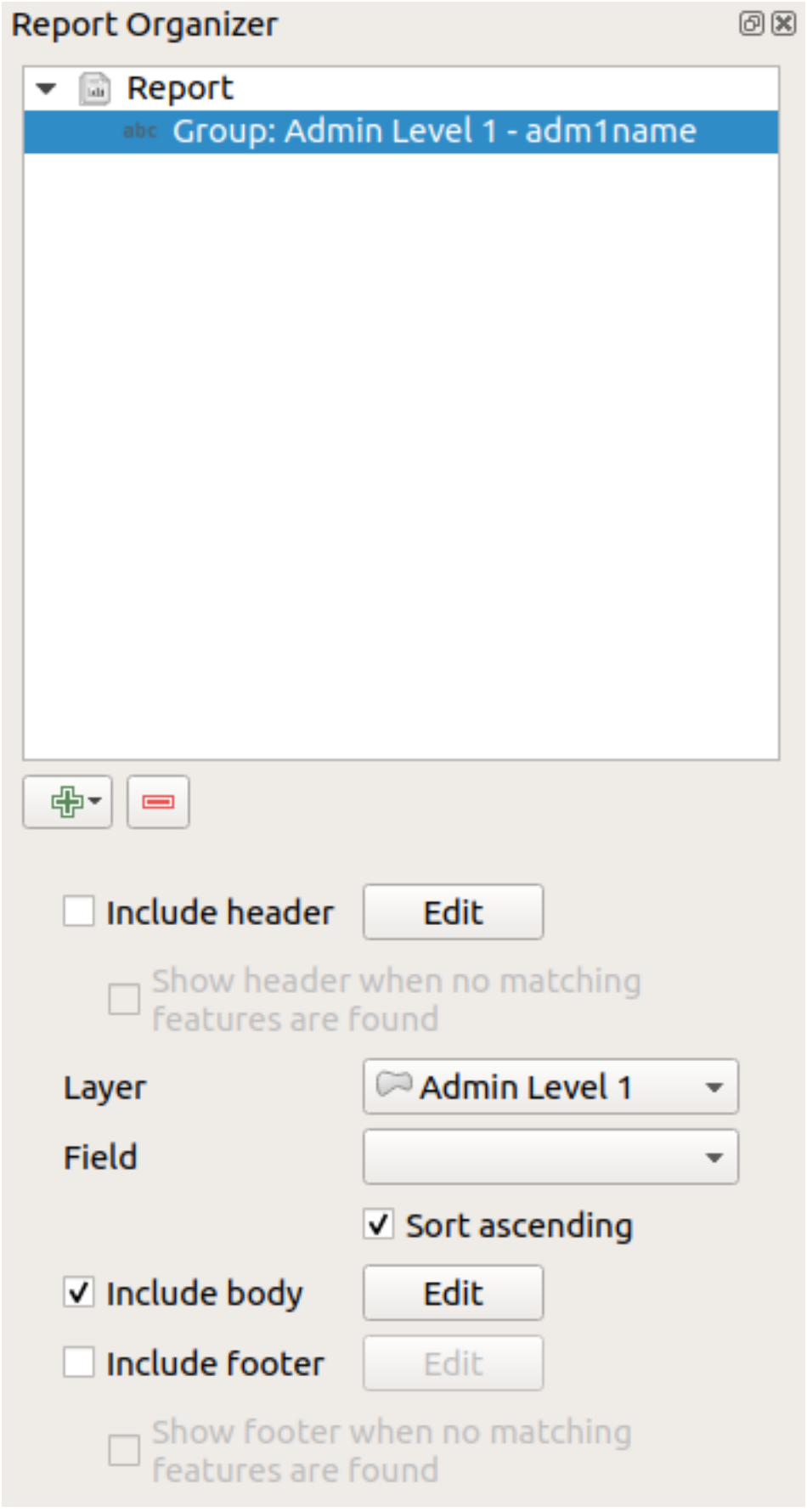


There are two options: *Static Layout Section* and *Field Group Section*.

The *Add Static Layout Section* is a single, static body layout. This can be used to embed static layouts mid-way through a report.

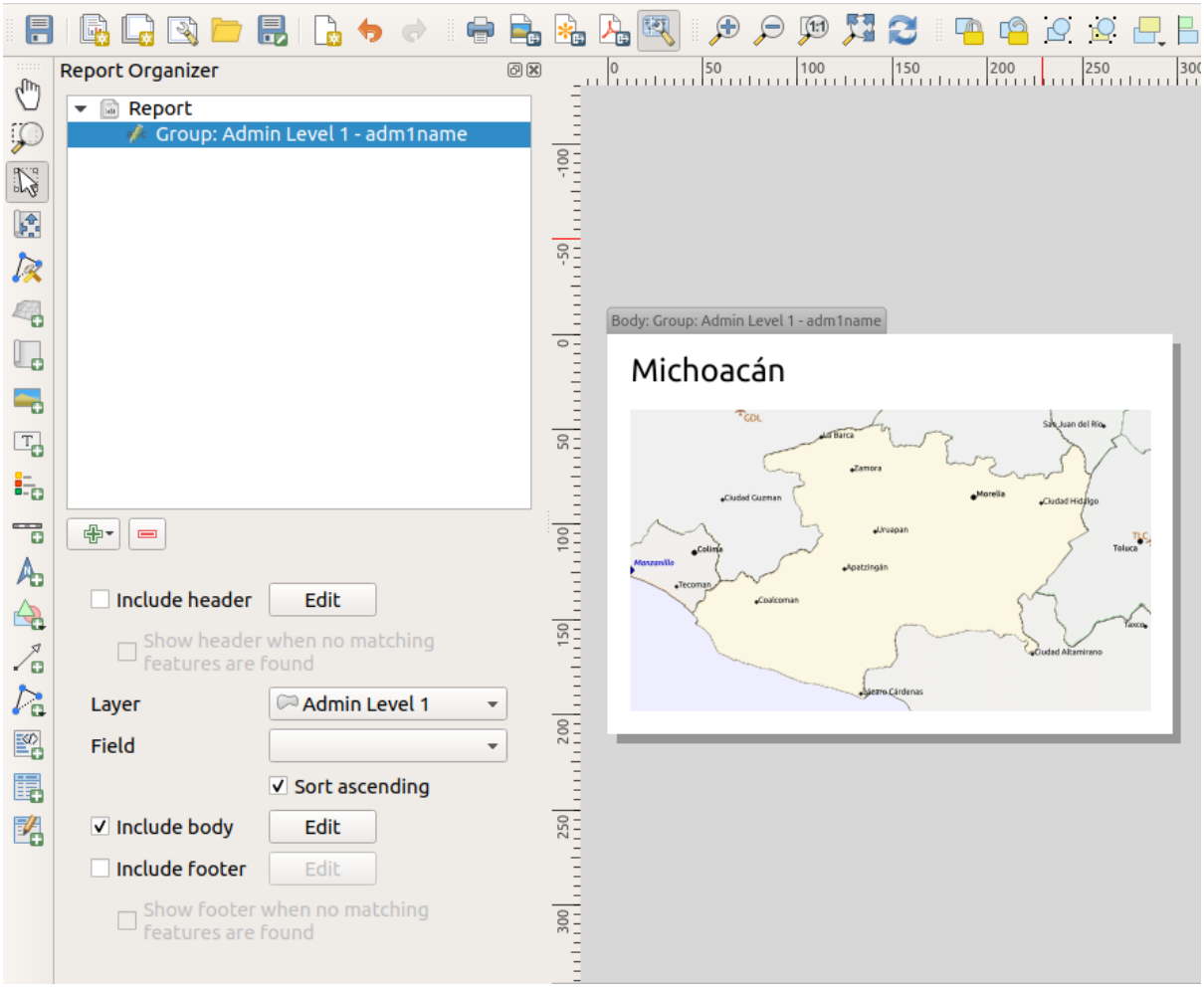
The *Field Group Section* repeats its body layout for every feature of a layer. The features are sorted by the selected grouping feature (with an option for ascending/descending sort). If a field group section has child sections (e.g. another field group section with a different field), then only features with unique values for the group feature are iterated over. This allows nested reports.

For now we will add a *Field Group Section* to our report. At its most basic level, you can think of a *Field Group Section* as the equivalent of a *print atlas*: you select a layer to iterate over, and the report will insert a section for each feature found. Selecting the new *Field Group Section* reveals a number of new related settings:



In this case we've setup our Field Group so that we iterate over all the states from the *Admin Level 1* layer, using the

values from the *adm1name* field. The same options to include header and footer are present, together with a new option to include a *body* for this section. We'll do that, and edit the body:

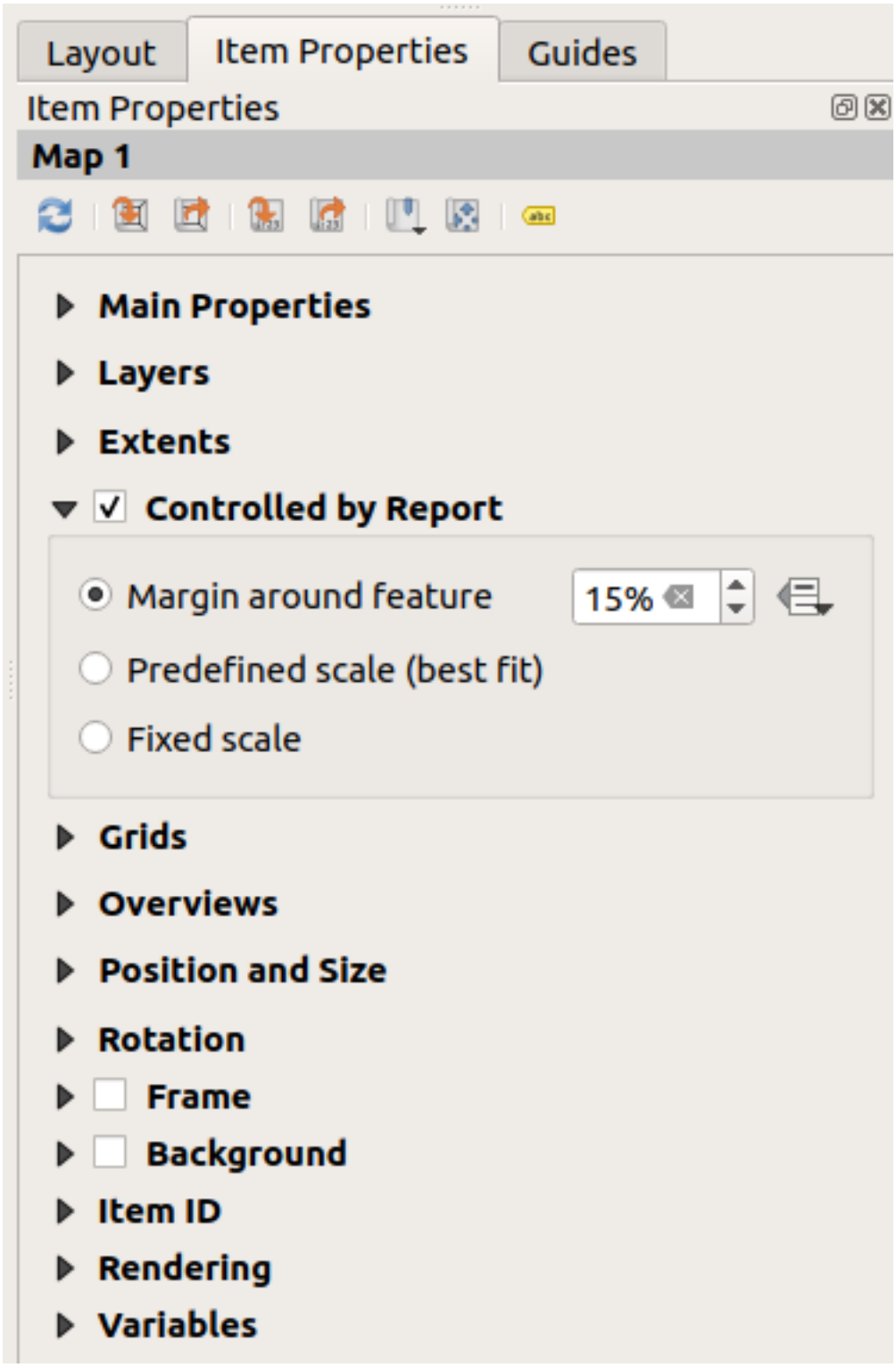


Our body now consists of a map and a label showing the name of the state. To include the name of the state, we selected *Add Item* ► *Add Label* and data defined the text under *Main Properties* with the help of *Insert or Edit an Expression*….

The result was the following expression (*name* is the name of the attribute in the *Admin Level 1* layer that contains the name of the state):

```
[% "name" %]
```

The map is set to follow the current report feature (enabled by checking *Controlled by Report* – just like a map item in an atlas will follow the current atlas feature when *Controlled by Atlas* is checked):



If we went ahead and exported our report now, we'd get something like this:

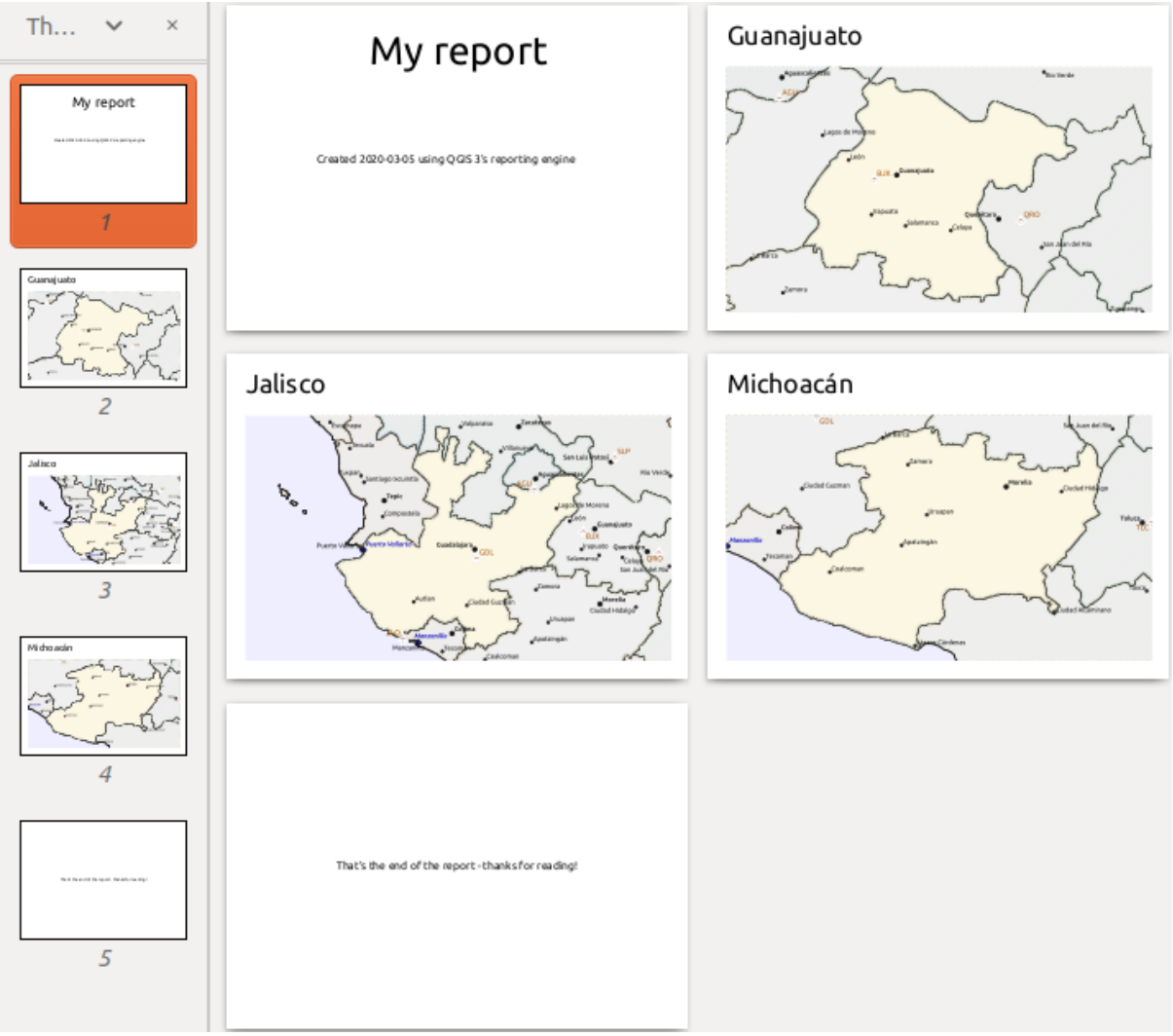
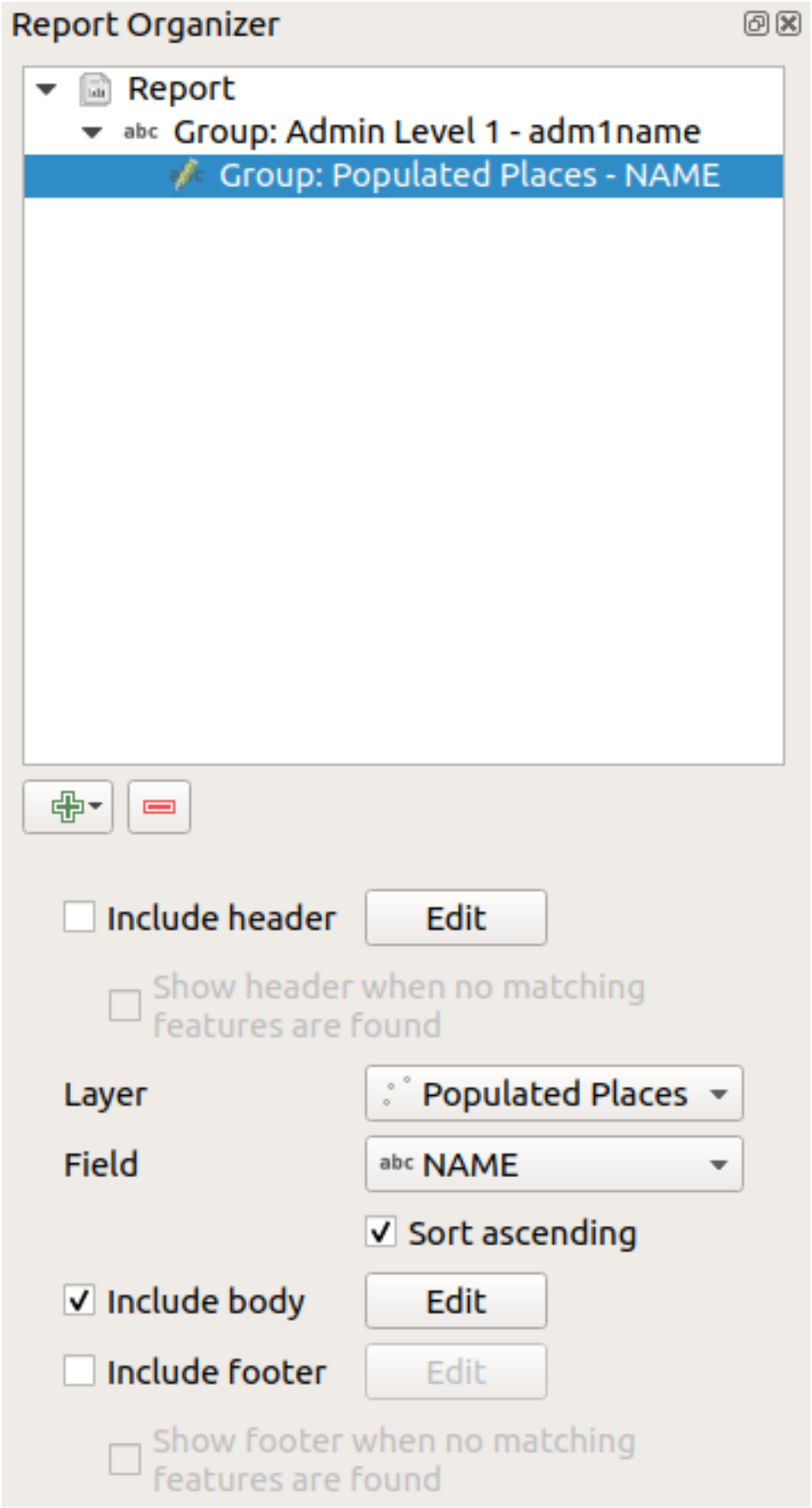


Figura18.64: The report header, a page for each state, and the report footer.

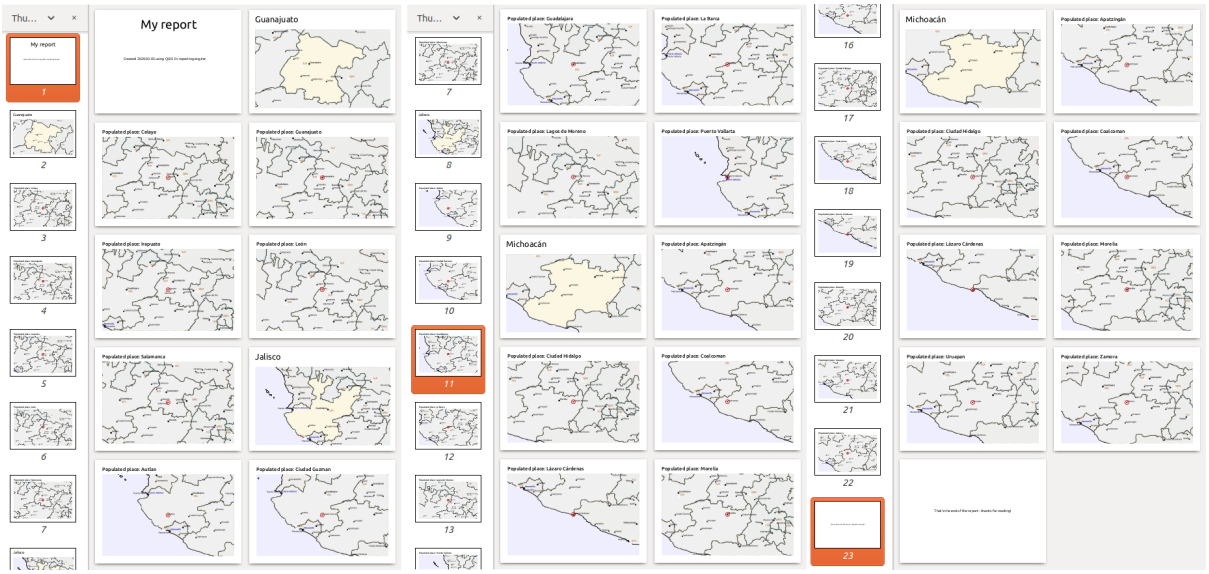
So more or less an atlas, but with a header and footer page.

Let us make things more interesting by adding a subsection to our state group. We do this by first selecting the *Admin Level 1* field group in the organizer, then hitting the Add Field button and adding a new *Field Group Section*:



When iterating over the features of a *Field Group Section*, the features will be filtered to match the defining field

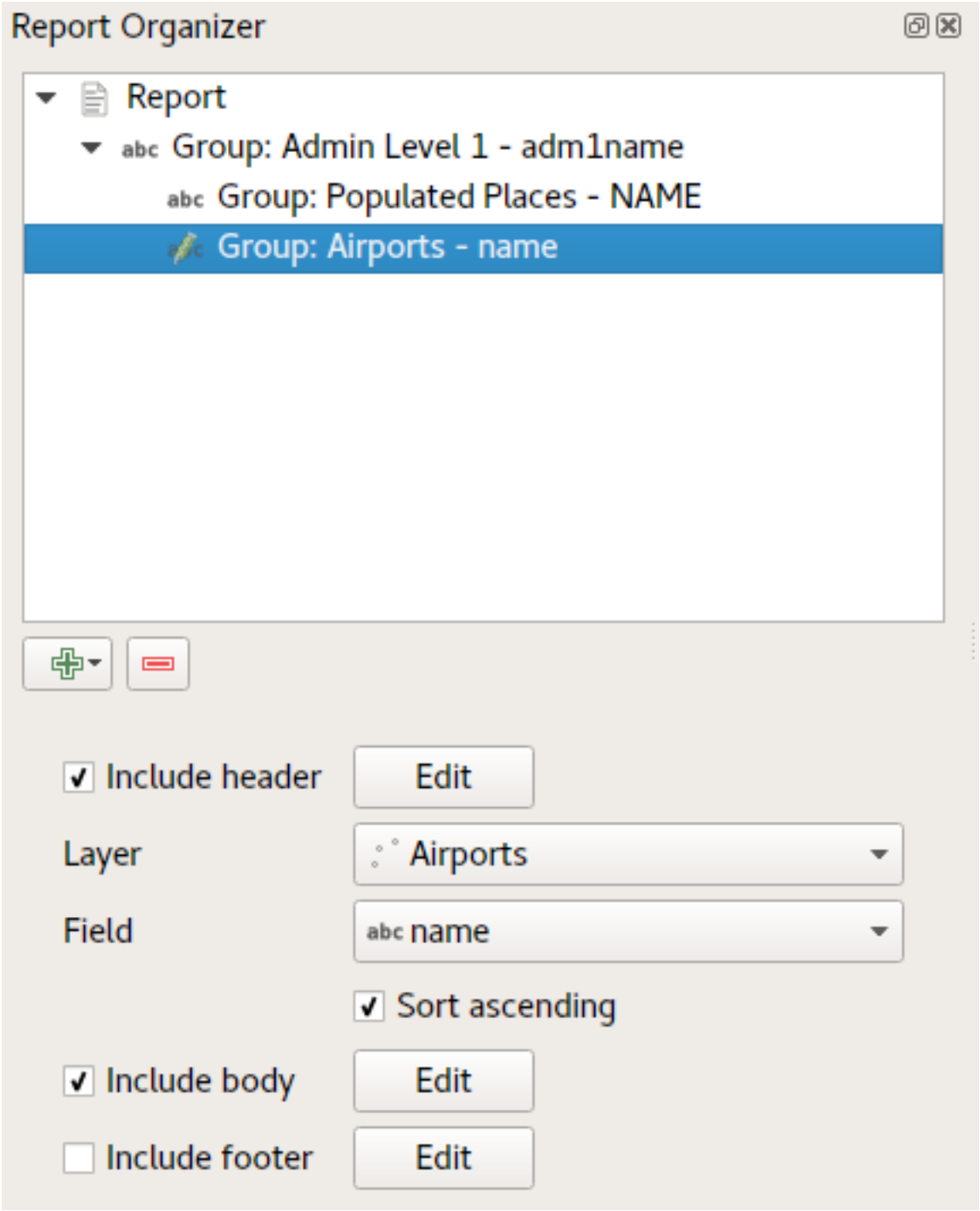
of its parent group (`adm1name` in this case). Here, the subsection we added will iterate over a *Populated Places* layer, including a body section for each place encountered. The magic here is that the *Populated Places* layer has an attribute with the same name as the defining field in the parent layer, *adm1name*, tagging each place with the state it is contained within (if you're lucky your data will already be structured like this – if not, run the *Join Attributes by Location* Processing algorithm and create your own field). When we export this report, QGIS will grab the first state from the *Admin Level 1* layer, and then iterate over all the *Populated Places* with a matching *adm1name* value. Here's what we get:



Here we created a basic body for the Populated Places group, including a map of the place and a table of some place attributes. So our report is now a report header, a page for the first state, followed by a page for every populated place within that state, then the rest of the states with their populated places, and finally the report footer. If we were to add a header for the Populated Places group, it would be included just before listing the populated places for each state, as shown in the illustration below.

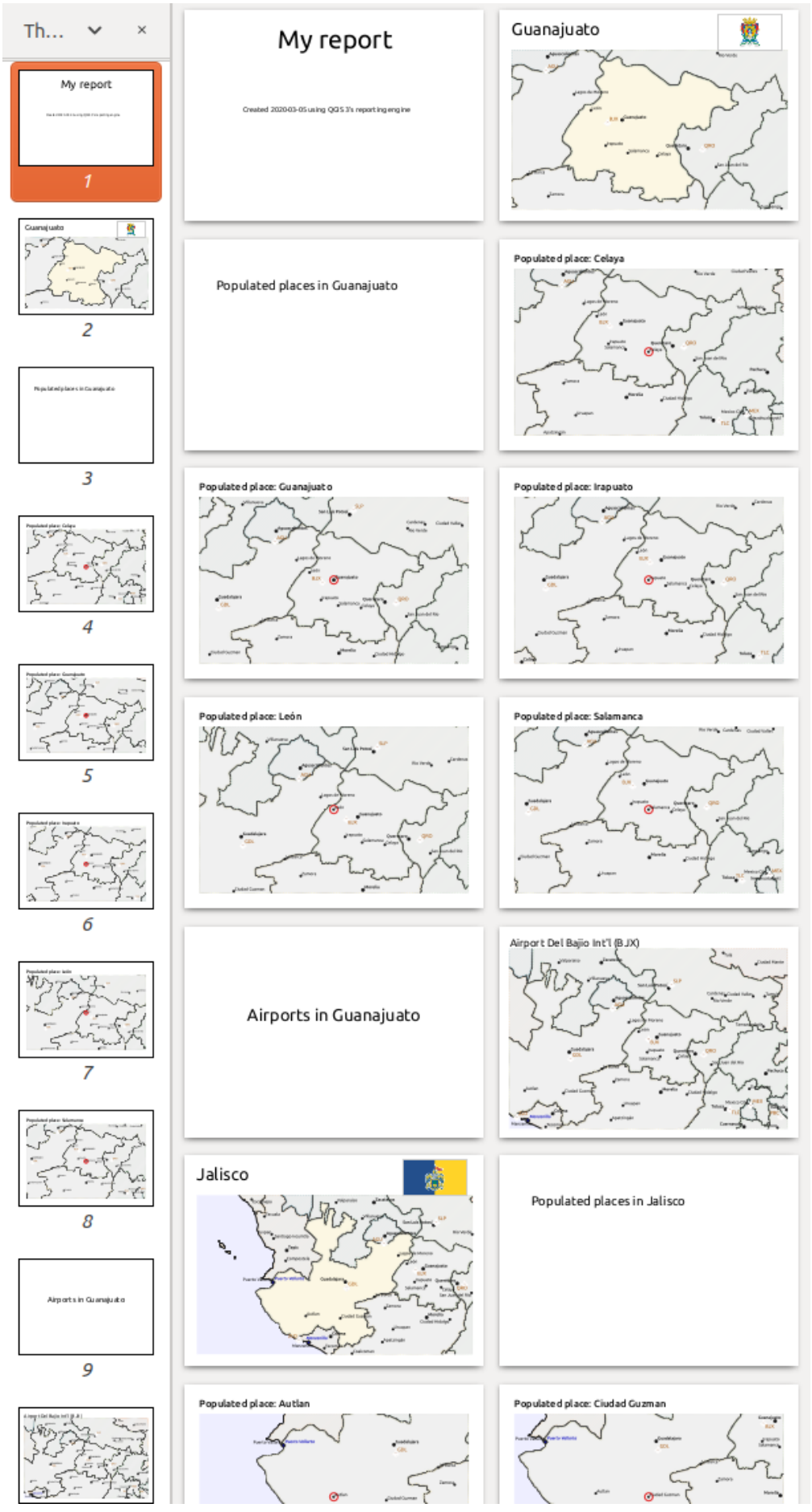
Similarly, a footer for the Populated Places group would be inserted after the final place for each state is included.

In addition to nested subsections, subsections in a report can also be included consecutively. If we add a second subsection to the *Admin Level 1 group* for *Airports*, then (if the *Airports* layer has an attribute *adm1name* that can link it to the parent group) our report will first list ALL the populated places for each state, followed by all the airports within that state, before proceeding to the next state.



The key point here is that our *Airports group* is a subsection of the *Admin Level 1 group* – not the *Populated Places group*.

In this case our report would be structured like this (note that state flags have also been included - the procedure for adding feature specific pictures in this way is described below):


Th...
My report
1
2
3
4
5
6
7
8
9
My report
Created 2020-03-05 using QGIS 3's reporting engine
Guanajuato
Populated places in Guanajuato
Populated place: Celaya
Populated place: Guanajuato
Populated place: Irapuato
Populated place: León
Populated place: Salamanca
Airports in Guanajuato
Airport Del Bajio Int'l (BJX)
Jalisco
Populated places in Jalisco
Populated place: Autlan
Populated place: Ciudad Guzman

Including pictures in a report

Pictures can be quite useful in reports, and QGIS allows pictures in both the static and dynamic parts of a report. Pictures are added in the same way as for standard print layouts, and for the static report parts (and static pictures in dynamic parts) there is not more to it.

But if you want illustrations that are tailored to the report features, your layer must have an attribute that can be used to define the picture to include.

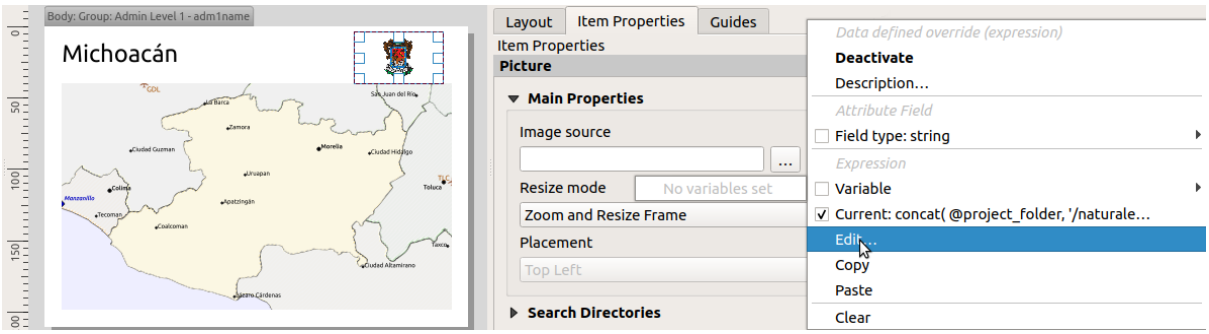
QGIS depends on absolute file names for images in reports.

Para imagens dinâmicas, você primeiro adiciona uma imagem à parte do corpo do grupo, como de costume. No *Propriedades do Item* da imagem, você define *Fonte da Imagem* usando o botão Substituição definida dos dados e selecione um atributo que contenha o caminho absoluto das imagens ou :guilabel:`Editar …`(para inserir uma expressão que gere o caminho absoluto da imagem).

Below is an example expression that uses string concatenation to specify the absolute path to the pictures, using the directory where the project file is located (`@project_path`) and an attribute (`adm1name`) from which the file name is generated (in this case by transforming the string in the `adm1name` attribute to uppercase, and appending '_flag.png'):

```
concat(@project_folder, '/naturalearth/pictures/' ,
       upper("adm1name"), '_flag.png')
```

This means that the pictures are located in the `naturalearth/pictures` subdirectory of the project file directory.



Highlighting the current report feature in a map

In the above report, the report features are emphasized in the maps using highlighting (state) and circles (populated places). To emphasize the report features in the maps (apart from placing them at the centre of the maps), you must data define the style using a comparison between its `@id` and the `@atlas_featureid`, as for atlases.

For instance, if you would like to use a thicker line / border for the report feature than the other features you can data define the line width:

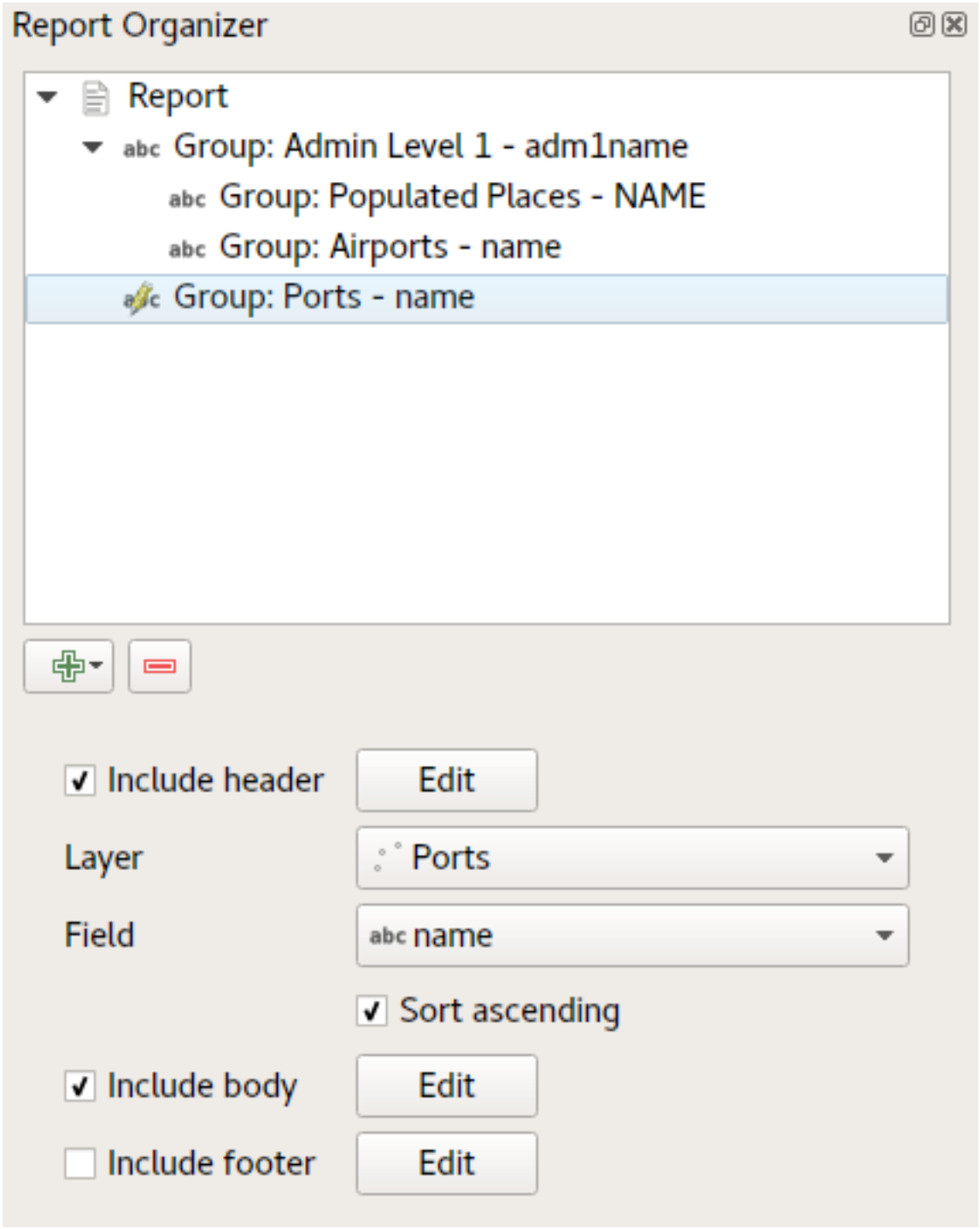
```
if($id=@atlas_featureid, 2.0, 0.1)
```

The report feature will get a 2 units wide polygon outline, while all other features will get a 0.1 units wide line. It is also possible to data define the colour (non-transparent dark magenta for the report feature and semi-transparent light gray for the other features):

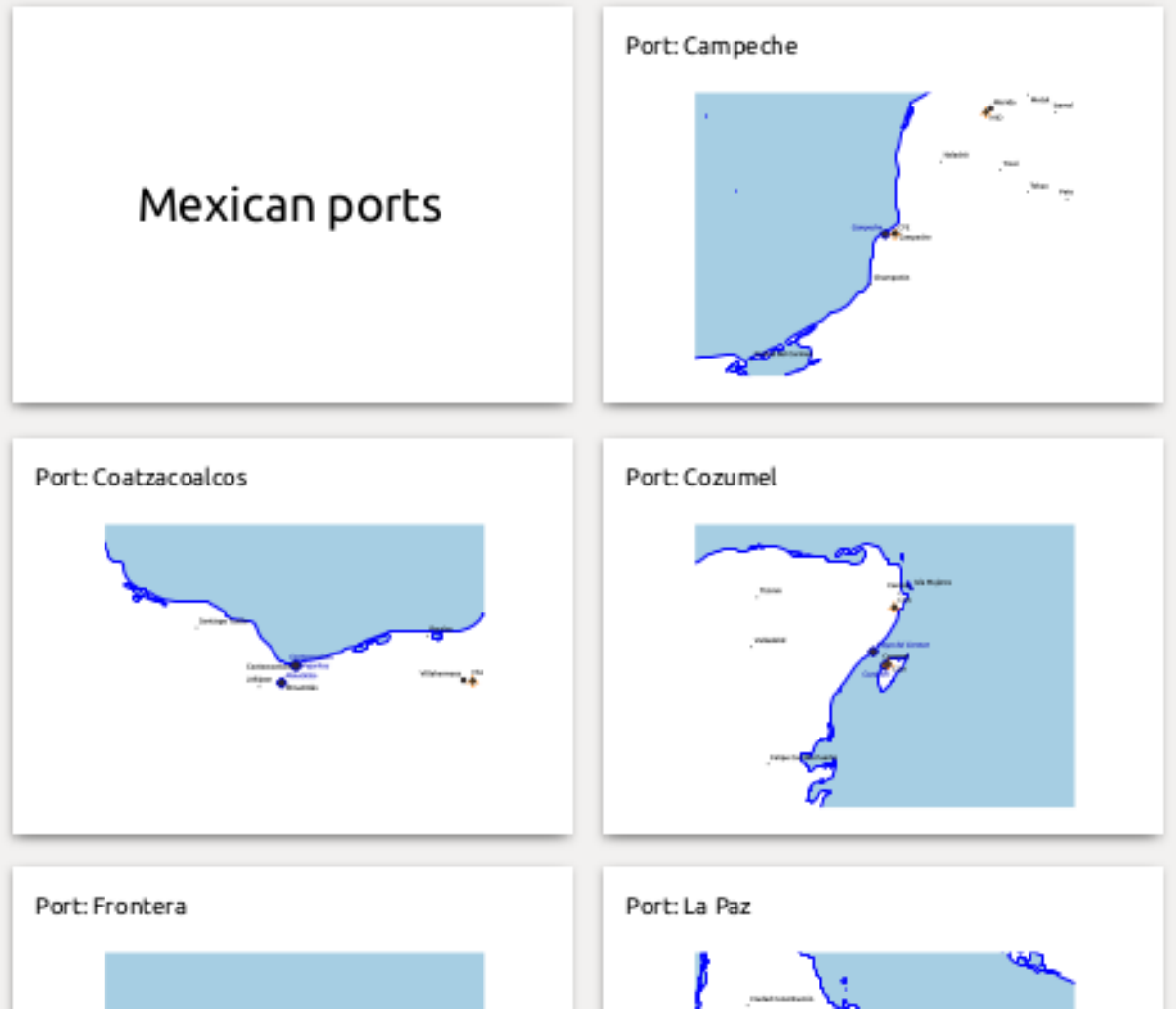
```
if($id=@atlas_featureid, '#FF880088', '#88CCCCCC')
```

More level 1 groups

Combining nested and consecutive sections, together with section headers and footers allows for tons of flexibility. For instance, in the below report we add another field group as a child of the main report for the :guilabel`Ports` layer. Now, after listing the states together with their populated places and airports, we'll get a summary list of all the ports in the region:



This results in the last part of our report exporting as:



18.4.4 Definições para exportação

When you export a report (*Report* ► *Export Report as Images… / SVG… / PDF…*), you will be asked for a file name, and then you get the opportunity to tune the export settings to get the most appropriate output.

As you see, reports in QGIS are extremely powerful and flexible!

Nota: The current information was adapted from a North Road blog, Exploring Reports in QGIS 3.0 - the Ultimate Guide!

CAPÍTULO 19

Working with OGC / ISO protocols

O Consórcio Geoespacial Aberto (OGC), é uma organização internacional como mais de 300 organizações em todo mundo do tipo comerciais, sem fins lucrativos e de investigação. Os membros desenvolvem e implementam padrões para os conteúdos e serviços geoespaciais, processamento e troca de dados SIG.

Describing a basic data model for geographic features, an increasing number of specifications are developed by OGC to serve specific needs for interoperable location and geospatial technology, including GIS. Further information can be found at https://www.opengeospatial.org/.

Important OGC specifications supported by QGIS are:

- **WMS** — Serviço de Mapas Web (*Cliente WMS/WMTS*)
- **WMTS** — Serviço de Mosaicos de Mapa Web (*Cliente WMS/WMTS*)
- **WFS** — Serviços de Elementos Web (*WFS e WFS-T Cliente*)
- **WFS-T** — Serviços de Elementos Web - Transacionais (*WFS e WFS-T Cliente*)
- **WCS** — Serviços de Cobertura Web (*WCS Cliente*)
- **WPS** — Web Processing Service
- **CSW** — Catalog Service for the Web
- **SFS** — Elementos Simples para SQL (*Camadas PostGIS*)
- **GML** — Linguagem de Marcadores Geográfico

OGC services are increasingly being used to exchange geospatial data between different GIS implementations and data stores. QGIS can deal with the above specifications as a client, being **SFS** (through support of the PostgreSQL / PostGIS data provider, see section *Camadas PostGIS*).

You can also share your maps and data through the WMS, WMTS, WFS, WFS-T and WCS protocols using a web-server with QGIS Server, UMN MapServer or GeoServer installed.

19.1 Cliente WMS/WMTS

19.1.1 Visão Global do Suporte WMS

QGIS currently can act as a WMS client that understands WMS 1.1, 1.1.1 and 1.3 servers. In particular, it has been tested against publicly accessible servers such as DEMIS.

A WMS server acts upon requests by the client (e.g., QGIS) for a raster map with a given extent, set of layers, symbolization style, and transparency. The WMS server then consults its local data sources, rasterizes the map, and sends it back to the client in a raster format. For QGIS, this format would typically be JPEG or PNG.

WMS is generically a REST (Representational State Transfer) service rather than a full-blown Web service. As such, you can actually take the URLs generated by QGIS and use them in a web browser to retrieve the same images that QGIS uses internally. This can be useful for troubleshooting, as there are several brands of WMS server on the market and they all have their own interpretation of the WMS standard.

As camadas WMS podem ser adicionadas facilmente, desde que conheça o acesso URL para o servidor WMS, tenha uma ligação de serviço a esse servidor, e o servidor compreenda HTTP como um mecanismos de transporte de dados.

Additionally, QGIS will cache your WMS responses (i.e. images) for 24h as long as the GetCapabilities request is not triggered. The GetCapabilities request is triggered everytime the *Connect* button in the *Add Layer(s) from WMS(T) Server* dialog is used to retrieve the WMS server capabilities. This is an automatic feature meant to optimize project loading time. If a project is saved with a WMS layer, the corresponding WMS tiles will be loaded from the cache the next time the project is opened as long as they are no older than 24H.

19.1.2 Visão Global do Suporte WMTS

QGIS can also act as a WMTS client. WMTS is an OGC standard for distributing tile sets of geospatial data. This is a faster and more efficient way of distributing data than WMS because with WMTS, the tile sets are pre-generated, and the client only requests the transmission of the tiles, not their production. A WMS request typically involves both the generation and transmission of the data. A well-known example of a non-OGC standard for viewing tiled geospatial data is Google Maps.

De maneira a exibir os dados a várias escalas perto do que o utilizador queira ver, os conjuntos de mosaicos WMTS são produzidos em vários diferentes níveis de escala e são disponibilizados para o cliente SIG a seu pedido.

Este diagrama ilustra o conceito dos conjuntos de mosaicos

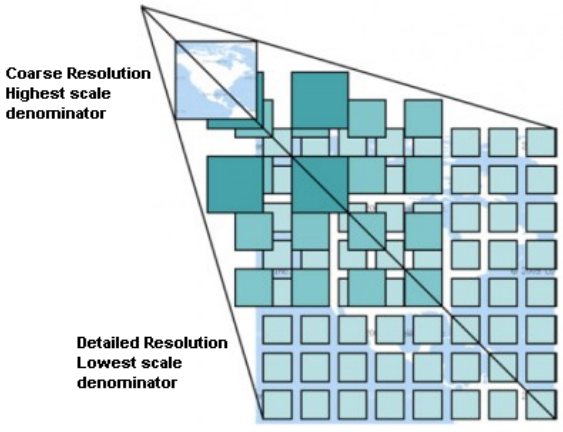


Figura19.1: Conceito dos conjuntos de mosaicos do WMTS

The two types of WMTS interfaces that QGIS supports are via Key-Value-Pairs (KVP) and RESTful. These two interfaces are different, and you need to specify them to QGIS differently.

1. In order to access a **WMTS KVP** service, a QGIS user must open the WMS/WMTS interface and add the following string to the URL of the WMTS tile service:

```
"?SERVICE=WMTS&REQUEST=GetCapabilities"
```

Um exemplo deste tipo de endereço é

```
https://opencache.statkart.no/gatekeeper/gk/gk.open_wmts?\
  service=WMTS&request=GetCapabilities
```

A camada topo2 funciona lindamente para testar neste WMTS. Adicionando esta linha e texto indica que é um serviço web WMTS que deverá ser usado em vez de o serviço WMS.

2. O serviço **WMTS RESTful** torna-se uma forma diferente, é um URL simples, a forma recomendada pela OGC é:

```
{WMTSBaseURL}/1.0.0/WMTSCapabilities.xml
```

This format helps you to recognize that it is a RESTful address. A RESTful WMTS is accessed in QGIS by simply adding its address in the WMS setup in the URL field of the form. An example of this type of address for the case of an Austrian basemap is https://maps.wien.gv.at/basemap/1.0.0/WMTSCapabilities.xml.

Nota: You can still find some old services called WMS-C. These services are quite similar to WMTS (i.e., same purpose but working a little bit differently). You can manage them the same as you do WMTS services. Just add `?tiled=true` at the end of the url. See https://wiki.osgeo.org/wiki/Tile_Map_Service_Specification for more information about this specification.

Quando lê o WMTS pode muitas vezes pensar em WMS-C.

19.1.3 Selecionando os Servidores WMS/WMTS

The first time you use the WMS feature in QGIS, there are no servers defined.

You then need to create connections to the server you are targeting:

1. Go to the *WMS/WMTS* tab of the *Data Source Manager* dialog, either by:
   - clicking the Open Data Source Manager button (or pressing `Ctrl+L`) and enabling the tab
   - clicking the Add WMS layer button on the *Manage Layers* toolbar
   - or selecting *Layer* ► *Add Layer* ► *Add WMS/WMTS Layer…* menu
2. Press *New* from the *Layers* tab. The *Create a New WMS/WMTS Connection…* dialog appears.

Dica: Right-click the *WMS/WMTS* entry from within the *Browser panel* and select *New Connection…* also opens the *Create a New WMS/WMTS Connection…* dialog.

---

3. Then enter the parameters to connect to your desired WMS server, as listed below:

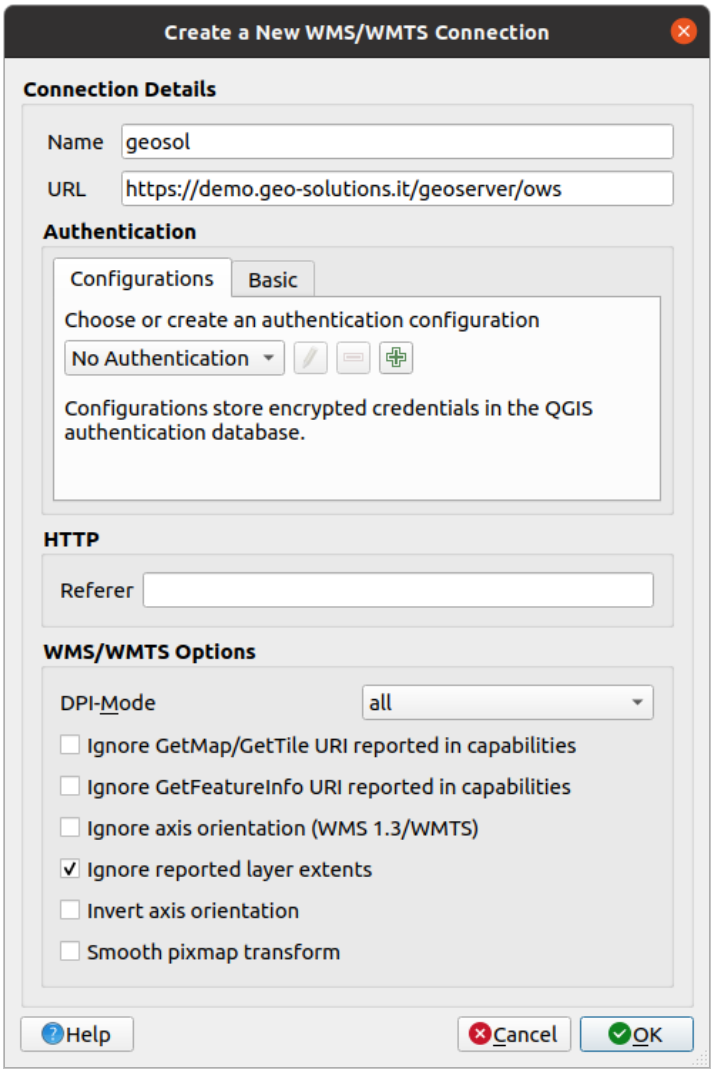


Figura19.2: Creating a connection to a WMS server

- *Name*: A name for the connection. This name will be used in the Server Connections drop-down box so that you can distinguish it from other WMS servers.
- *URL*: URL of the server providing the data. This must be a resolvable host name – the same format as you would use to open a telnet connection or ping a host, i.e. the base URL only. For example, you shouldn't have fragments such as `request=GetCapabilities` or `version=1.0.0` in your URL.
- *Authentication* (optional): using a *stored configuration* or a basic authentication with *Username* and *Password*.

> **Aviso:** Entering **username** and **password** in the *Authentication* tab will keep unprotected credentials in the connection configuration. Those **credentials will be visible** if, for instance, you shared the project file with someone. Therefore, it's advisable to save your credentials in a *Authentication configuration* instead (*configurations* tab). See *Sistema de Autenticação* for more details.

- HTTP *Referer*
- *DPI-Mode*: Available options are **all**, **off**, **QGIS**, **UMN** and **GeoServer**
- ☐ *Ignore GetMap/GetTile URI reported in capabilities*: if checked, use given URI from the *URL* field above.

- *Ignore GetFeatureInfo URI reported in capabilities*: if checked, use given URI from the *URL* field above.
- *Ignore axis orientation (WMS 1.3/WMTS)*
- *Ignore reported layer extents*: because the extent reported by raster layers may be smaller than the actual area which can be rendered (notably for WMS servers with symbology which takes more space than the data extent), check this option to avoid cropping raster layers to their reported extents, resulting in truncated symbols on the borders of these layers.
- *Invert axis orientation*
- *Smooth pixmap transformation*

4. Press *OK*

Once the new WMS server connection has been created, it will be preserved for future QGIS sessions.

If you need to set up a proxy server to be able to receive WMS services from the internet, you can add your proxy server in the options. Choose *Settings* ► *Options* and click on the *Network* tab. There, you can add your proxy settings and enable them by setting *Use proxy for web access*. Make sure that you select the correct proxy type from the *Proxy type* drop-down menu.

19.1.4 Carregando as camadas WMS/WMTS

Once you have successfully filled in your parameters, you can use the *Connect* button to retrieve the capabilities of the selected server. This includes the image encoding, layers, layer styles and projections. Since this is a network operation, the speed of the response depends on the quality of your network connection to the WMS server. While downloading data from the WMS server, the download progress is visualized in the lower left corner of the main QGIS dialog.

Your screen should now look a bit like Fig.19.3, which shows the response provided by a WMS server.

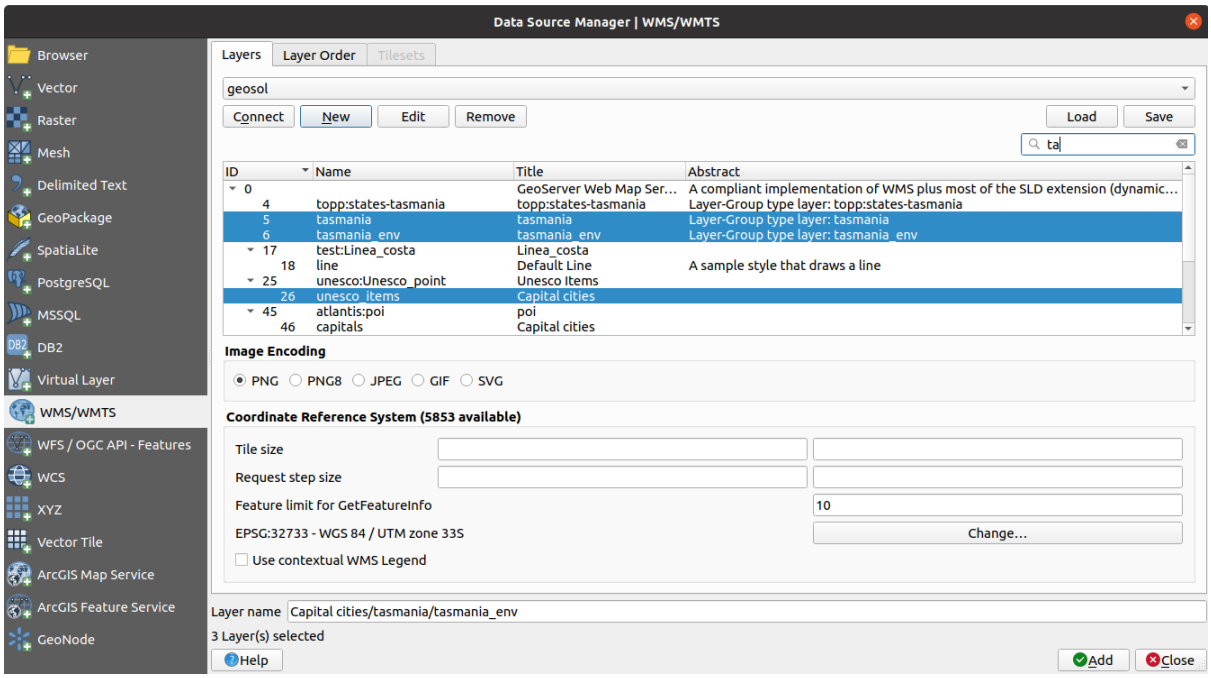


Figura19.3: Dialog for adding a WMS server, with filter on available layers

The upper part of the *Layers* tab of the dialog shows a tree structure that can include layer groups embedding layers with their associated image style(s) served by the server. Each item can be identified by:

- an *ID*
- a *Name*
- a *Title*
- and an *Abstract*.

The list can be filtered using the  widget in the top right corner.

Codificação da Imagem

A seção *Codificação de Imagem* agora apresenta uma lista de formatos suportados pelo cliente e servidor. Escolha de acordo com as exigências de precisão da sua imagem.

Dica: Codificação da Imagem

Tipicamente irá encontrar servidores WMS que oferecem a escolha da codificação de imagem JPEG ou PNG. O JPEG é um formato de perda de compressão, enquanto que o PNG reprodução fielmente os dados raster brutos.

Use JPEG se espera dados WMS para fotografia na natureza e/ou não se importa da perda de alguma qualidade na imagem. Este típico trade-off reduz em 5 vezes o requerimento de transferência comparado ao PNG.

Use o PNG se necessitar representações precisas dos dados originais, e não se importa dos requerimentos de transferência de dados.

Opções

The Options area of the dialog provides means to configure the WMS requests. You can define:

- *Tile size* if you want to set tile sizes (e.g., 256x256) to split up the WMS request into multiple requests.
- The *Request step size*
- The *Feature limit for GetFeatureInfo* defines the maximum number of GetFeatureInfo results from the server.
- If you select a WMS from the list, a field with the default projection provided by the web server appears. Press the *Change…* button to replace the default projection of the WMS with another CRS supported by the WMS server.
- Finally you can activate  *Use contextual WMS Legend* if the WMS Server supports this feature. Then only the relevant legend for your current map view extent will be shown and thus will not include legend items for items you can't see in the current map.

At the bottom of the dialog, a *Layer name* text field displays the selected item's *Title*. You can change the name at your will. This name will appear in the *Layers* panel after you pressed the *Add* button and loaded the layer(s) in QGIS.

You can select several layers at once, but only one image style per layer. When several layers are selected, they will be combined at the WMS server and transmitted to QGIS in one go, as a single layer. The default name is a slash (/) separated list of their original title.

Ordem das Camadas

The *Layer Order* tab lists the selected layers available from the current connected WMS server.

WMS layers rendered by a server are overlaid in the order listed in the *Layers* tab, from top to bottom of the list. If you want to change the overlay order, you can use the *Up* and *Down* buttons of the *Layer Order* tab.

Transparência

The *Global transparency* setting from the *Layer Properties* is hard coded to be always on, where available.

Dica: Transparência da Camada WMS

Disponibilidade da transparência da imagem do WMS depende da codificação da imagem usada: PNG e GIF suportam transparência enquanto que o JPEG deixa como não suportado.

Sistema de Referência de Coordenadas

A coordinate reference system (CRS) is the OGC terminology for a QGIS projection.

Cada Camada WMS pode ser apresentada em múltiplos SRC, depedendo da capacidade do servidor WMS.

To choose a CRS, select *Change…* and a dialog similar to the one shown in Fig.10.3 will appear. The main difference with the WMS version of the dialog is that only those CRSs supported by the WMS server will be shown.

19.1.5 Mosaicos

Ao usar Serviços WMTS (WMS em cache) como

```
https://opencache.statkart.no/gatekeeper/gk/gk.open_wmts?\
  service=WMTS&request=GetCapabilities
```

you are able to browse through the *Tilesets* tab given by the server. Additional information like tile size, formats and supported CRS are listed in this table. In combination with this feature, you can use the tile scale slider by selecting *View* ► *Panels* (or *Settings* ► *Panels*), then choosing *Tile Scale Panel*. This gives you the available scales from the tile server with a nice slider docked in.

19.1.6 Usando a Ferramenta Identificar

Once you have added a WMS server, and if any layer from a WMS server is queryable, you can then use the Identify tool to select a pixel on the map canvas. A query is made to the WMS server for each selection made. The results of the query are returned in plain text. The formatting of this text is dependent on the particular WMS server used.

Seleção do formato

Se múltiplos formatos são suportados pelo servidor, uma caixa de combinação com os formatos suportados é automaticamente adicionado aos resultados da janela de identificação e o formato selecionado irá armazenar no projeto para a camada.

Suporte do formato GML

The Identify tool supports WMS server response (GetFeatureInfo) in GML format (it is called Feature in the QGIS GUI in this context). If "Feature" format is supported by the server and selected, results of the Identify tool are vector features, as from a regular vector layer. When a single feature is selected in the tree, it is highlighted in the map and it can be copied to the clipboard and pasted to another vector layer. See the example setup of the UMN Mapserver below to support GetFeatureInfo in GML format.

```
# in layer METADATA add which fields should be included and define geometry␣
↪(example):

"gml_include_items"   "all"
"ows_geometries"      "mygeom"
"ows_mygeom_type"     "polygon"

# Then there are two possibilities/formats available, see a) and b):

# a) basic (output is generated by Mapserver and does not contain XSD)
# in WEB METADATA define formats (example):
"wms_getfeatureinfo_formatlist" "application/vnd.ogc.gml,text/html"

# b) using OGR (output is generated by OGR, it is send as multipart and contains␣
↪XSD)
# in MAP define OUTPUTFORMAT (example):
OUTPUTFORMAT
```

(continua na próxima página)

(continuação da página anterior)

```
    NAME "OGRGML"
    MIMETYPE "ogr/gml"
    DRIVER "OGR/GML"
    FORMATOPTION "FORM=multipart"
END

# in WEB METADATA define formats (example):
"wms_getfeatureinfo_formatlist" "OGRGML,text/html"
```

Propriedades de Visualização

Uma vez ter adicionado o servidor WMS, pode ver as suas propriedades clicando com o direito do mouse na legenda, e selecionando *Propriedades*.

Separador de Metadados

O separador *Metadados* exibem a riqueza de informação sobre o servidor WMS, geralmente recolhidos a partir da declaração de de Capacidades devolvidos a partir desse servidor. Muitas das definições podem ser removidas através da leitura dos padrões WMS (veja OPEN-GEOSPATIAL-CONSORTIUM *Referências Bibliográficas e Web*), mas aqui estão algumas definições úteis:

- **Propriedades do Servidor**
  - **Versão do WMS** — Versão do WMS suportada pelo servidor.
  - **Image Formats** — The list of MIME-types the server can respond with when drawing the map. QGIS supports whatever formats the underlying Qt libraries were built with, which is typically at least `image/png` and `image/jpeg`.
  - **Identity Formats** — The list of MIME-types the server can respond with when you use the Identify tool. Currently, QGIS supports the `text-plain` type.
- **Propriedades da Camada**
  - **Selecionado** — Querendo ou não esta camada selecionado quando o seu servidor foi adicionado a este projeto.
  - **Visible** — Whether or not this layer is selected as visible in the legend (not yet used in this version of QGIS).
  - **Pode Identificar** — Camada que retorna ou não resultados através do uso da ferramenta Identificar.
  - **Can be Transparent** — Whether or not this layer can be rendered with transparency. This version of QGIS will always use transparency if this is `Yes` and the image encoding supports transparency.
  - **Can Zoom In** — Whether or not this layer can be zoomed in by the server. This version of QGIS assumes all WMS layers have this set to `Yes`. Deficient layers may be rendered strangely.
  - **Contagem em cascata** — Os servidores WMS pode funcionar como proxy para outros servidores WMS para obter dados raster para uma camada. Esta entrada mostra quantas vezes o pedido para esta camada é avançada por peer nos servidores WMS para o resultado.
  - **Fixed Width, Fixed Height** — Whether or not this layer has fixed source pixel dimensions. This version of QGIS assumes all WMS layers have this set to nothing. Deficient layers may be rendered strangely.
  - **WGS 84 Bounding Box** — The bounding box of the layer, in WGS 84 coordinates. Some WMS servers do not set this correctly (e.g., UTM coordinates are used instead). If this is the case, then the initial view of this layer may be rendered with a very 'zoomed-out' appearance by QGIS. The WMS webmaster should be informed of this error, which they may know as the WMS XML elements `LatLonBoundingBox`, `EX_GeographicBoundingBox` or the CRS:84 `BoundingBox`.
  - **SRC disponíveis** — As projeções desta camada podem ser renderizadas pelo servidor WMS. Os mesmos estão listados num formato nativo WMS.
  - **Disponível em estilo** — Os estilos da imagem desta camada podem ser renderizadas pelo o servidor WMS.

19.1.7 Show WMS legend graphic in table of contents and layout

The QGIS WMS data provider is able to display a legend graphic in the table of contents' layer list and in the print layout. The WMS legend will be shown only if the WMS server has GetLegendGraphic capability and the layer has getCapability url specified, so you additionally have to select a styling for the layer.

Se uma legendGraphic está disponível, será mostrada abaixo da camada. É pequena, e você tem que clicar sobre ela para abrir na dimensão real (devido à limitação arquitetônica QgsLegendInterface). Clicando sobre a legenda da camada abrirá um quadro com a legenda em resolução máxima.

In the print layout, the legend will be integrated at it's original (downloaded) dimension. Resolution of the legend graphic can be set in the item properties under *Legend* ► *WMS LegendGraphic* to match your printing requirements.

A legenda irá exibir informações contextuais com base em sua escala atual. A legenda WMS será exibida somente se o servidor WMS tiver capacidade GetLegendGraphic e a camada getCapability url for especificada, então você tem que selecionar um estilo.

19.1.8 Limitações do Cliente WMS

Not all possible WMS client functionality had been included in this version of QGIS. Some of the more noteworthy exceptions follow.

Editando as Configurações da Camada WMS

Once you've completed the  Add WMS layer procedure, there is no way to change the settings. A work-around is to delete the layer completely and start again.

Servidores WMS que Requerem Autenticação

Atualmente o acesso público e serviços WMS protegidos são suportados. Os servidores WMS protegidos podem ser acedidos pela autenticação pública. Pode adicionar credenciais (opcionais) quando adiciona o servidor WMS. Veja a seção *Selecionando os Servidores WMS/WMTS* para detalhes.

Dica: Acedendo a camadas protegidas OGC

If you need to access secured layers with secured methods other than basic authentication, you can use InteProxy as a transparent proxy, which does support several authentication methods. More information can be found in the InteProxy manual at https://inteproxy.wald.intevation.org.

Dica: QGIS WMS Mapserver

Since Version 1.7.0, QGIS has its own implementation of a WMS 1.3.0 Mapserver. Read more about this in QGIS-Server-manual.

19.2 WCS Cliente

 O Serviço Web de Cobertura (WCS) fornecem acesso aos dados matriciais de forma a serem úteis à renderização cliente, como entrada a modelos científicos, e para outros clientes. O WCS pode ser comprado ao WFS e ao WMS. Como as instâncias WMS e WFS, o WCS permite aos clientes escolher porções de informação salvadas de servidores baseados condicionantes espaciais e outros critérios de consulta.

QGIS has a native WCS provider and supports both version 1.0 and 1.1 (which are significantly different), but currently it prefers 1.0, because 1.1 has many issues (i.e., each server implements it in a different way with various particularities).

The native WCS provider handles all network requests and uses all standard QGIS network settings (especially proxy). It is also possible to select cache mode ('always cache', 'prefer cache', 'prefer network', 'always network'), and the provider also supports selection of time position, if temporal domain is offered by the server.

Aviso: Entering **username** and **password** in the *Authentication* tab will keep unprotected credentials in the connection configuration. Those **credentials will be visible** if, for instance, you shared the project file with someone. Therefore, it's advisable to save your credentials in a *Authentication configuration* instead (*configurations* tab). See *Sistema de Autenticação* for more details.

19.3 WFS e WFS-T Cliente

In QGIS, a WFS layer behaves pretty much like any other vector layer. You can identify and select features, and view the attribute table. QGIS supports WFS 1.0.0, 1.1.0, 2.0 and WFS3 (OGC API - Features), including editing (through WFS-T).

In general, adding a WFS layer is very similar to the procedure used with WMS. There are no default servers defined, so you have to add your own. You can find WFS servers by using the *MetaSearch plugin* or your favourite web search engine. There are a number of lists with public URLs, some of them maintained and some not.

Carregando uma camada WFS

As an example, we use the Gateway Geomatics WFS server and display a layer. https://demo.gatewaygeomatics.com/cgi-bin/wfs_gateway?REQUEST=GetCapabilities&VERSION=1.0.0&SERVICE=WFS

To be able to load a WFS Layer, first create a connection to the WFS server:

1. Open the *Data Source Manager* dialog by pressing the Open Data Source Manager button
2. Enable the *WFS/OGC API-Features* tab
3. Click on *New…* to open the *Create a New WFS Connection* dialog
4. Enter `Gateway Geomatics` as name
5. Enter the URL (see above)

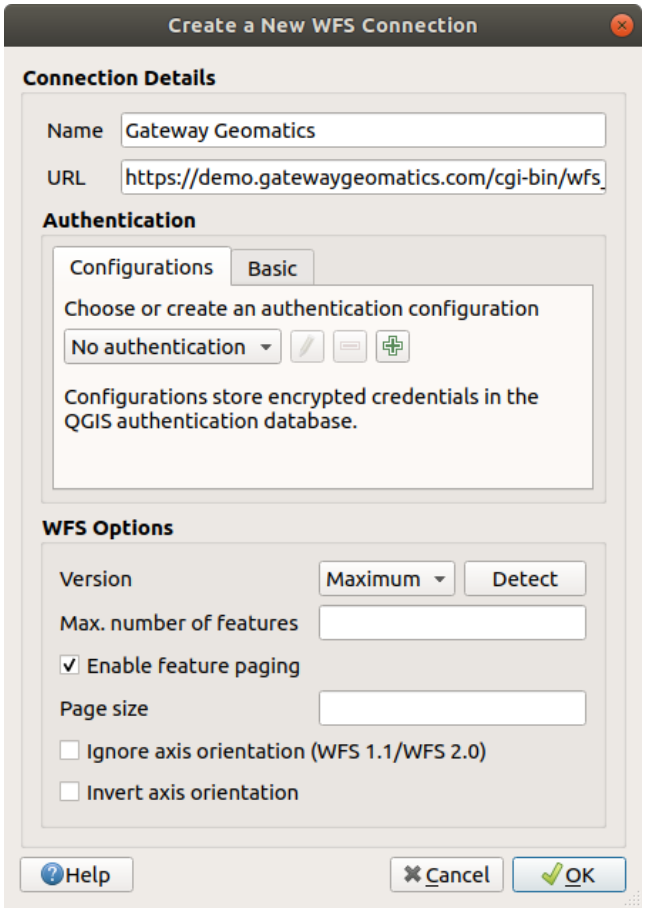


Figura19.4: Creating a connection to a WFS server

Nota: In case of an OGC API - Features (WFS3), the URL to provide should be the landing page, ie the main page from which it is possible to navigate to all the available service endpoints.

6. In the WFS settings dialog, you can:
   - Indicate the WFS version of the server. If unknown, press the *Detect* button to automatically retrieve it.
   - Define the *maximum number of features* retrieved in a single GetFetFeature request. If empty, no limit is set.
   - *Invert axis orientation*.
   - And depending on the WFS version:
     - Force to *Ignore axis orientation (WFS 1.1/WFS 2.0)*
     - *Enable feature paging* and specify the maximum number of features to retrieve with *Page size*. If no limit is defined, then the server default is applied.

Aviso: Entering **username** and **password** in the *Authentication* tab will keep unprotected credentials in the connection configuration. Those **credentials will be visible** if, for instance, you shared the project file with someone. Therefore, it's advisable to save your credentials in an *Authentication configuration* instead (*Configurations* tab). See *Sistema de Autenticação* for more details.

7. Press *OK* to create the connection.

Repare que as configurações proxy que definiu nas suas preferências são também reconhecidas.

Now we are ready to load WFS layers from the above connection.

1. Choose 'Gateway Geomatics' from the *Server Connections* drop-down list.
2. Click *Connect*
3. Select the *Parks* layer in the list
4. You can also choose whether to:
   - *Use title for layer name*, showing the layer's title as defined on the server in the *Layers* panel instead of its *Name*
   - *Only request features overlapping the view extent*
   - *Change* the layer's CRS
   - or *Build query* to specify particular features to retrieve, by either using the corresponding button or double-clicking the target layer.
5. Click *Add* to add the layer to the map.

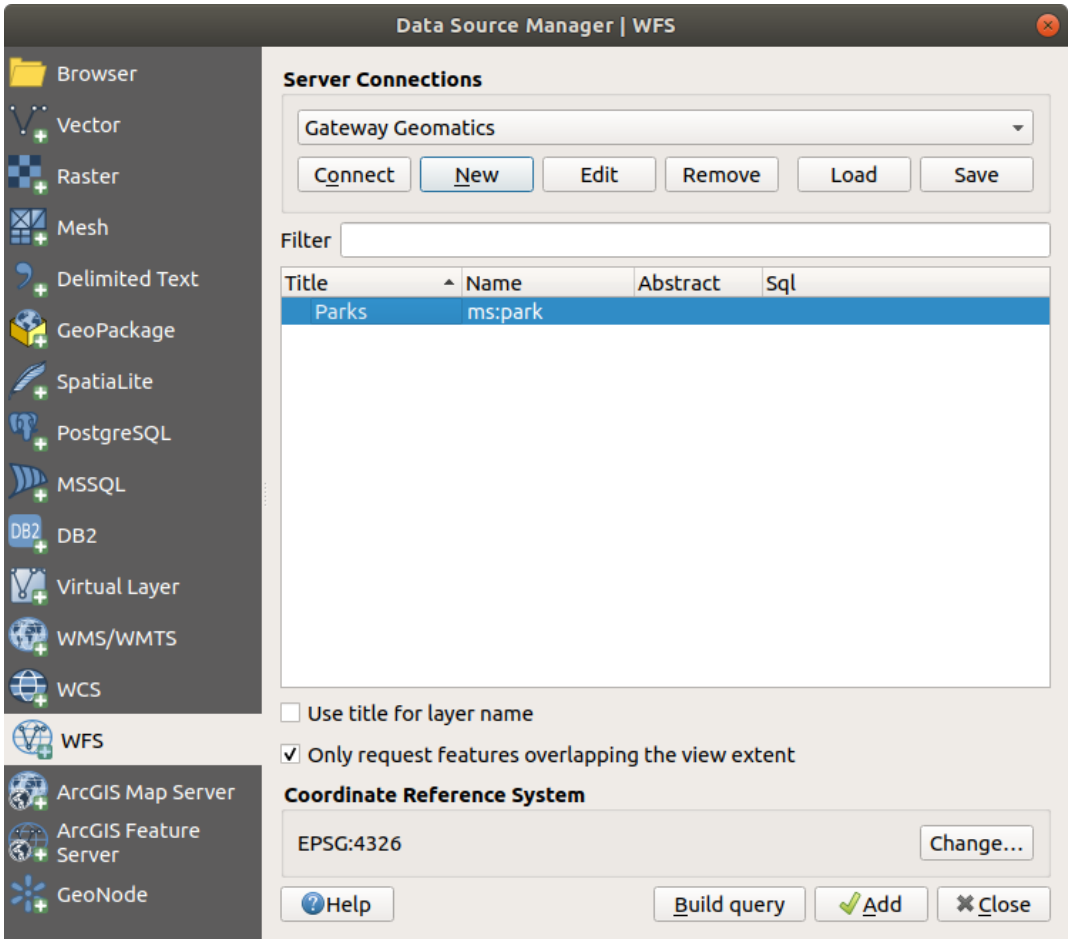


Figura19.5: Adding a WFS layer

You'll notice the download progress is visualized in the lower left of the QGIS main window. Once the layer is loaded, you can identify and select a couple of features and view the attribute table.

Nota: QGIS supports different versions of the WFS protocol, with background download and progressive rendering, on-disk caching of downloaded features and version autodetection.

CAPÍTULO 20

Trabalhando com dados GPS

20.1 Complemento GPS

20.1.1 O que é GPS?

GPS, the Global Positioning System, is a satellite-based system that allows anyone with a GPS receiver to find their exact position anywhere in the world. GPS is used as an aid in navigation, for example in airplanes, in boats and by hikers. The GPS receiver uses the signals from the satellites to calculate its latitude, longitude and (sometimes) elevation. Most receivers also have the capability to store locations (known as **waypoints**), sequences of locations that make up a planned **route** and a tracklog or **track** of the receiver's movement over time. Waypoints, routes and tracks are the three basic feature types in GPS data. QGIS displays waypoints in point layers, while routes and tracks are displayed in linestring layers.

Nota: QGIS supports also GNSS receivers. But we keep using the term GPS in this documentation.

20.1.2 Carregando dados GPS de um arquivo

There are dozens of different file formats for storing GPS data. The format that QGIS uses is called GPX (GPS eXchange format), which is a standard interchange format that can contain any number of waypoints, routes and tracks in the same file.

To load a GPX file, you first need to load the plugin. *Plugins* ►  *Plugin Manager…* opens the Plugin Manager Dialog. Activate the  *GPS Tools* checkbox. When this plugin is loaded, a button with a small handheld GPS device will show up in the toolbar and in *Layer* ► *Create Layer* ► :

-  GPS Tools
-  *Create new GPX Layer*

For working with GPS data, we provide an example GPX file available in the QGIS sample dataset: `qgis_sample_data/gps/national_monuments.gpx`. See section *Baixando dados de amostra* for more information about the sample data.

1. Select *Vector* ► *GPS Tools* or click the GPS Tools icon in the toolbar and open the *Load GPX file* tab (see Fig.20.1).
2. Browse to the folder `qgis_sample_data/gps/`, select the GPX file `national_monuments.gpx` and click *Open*.

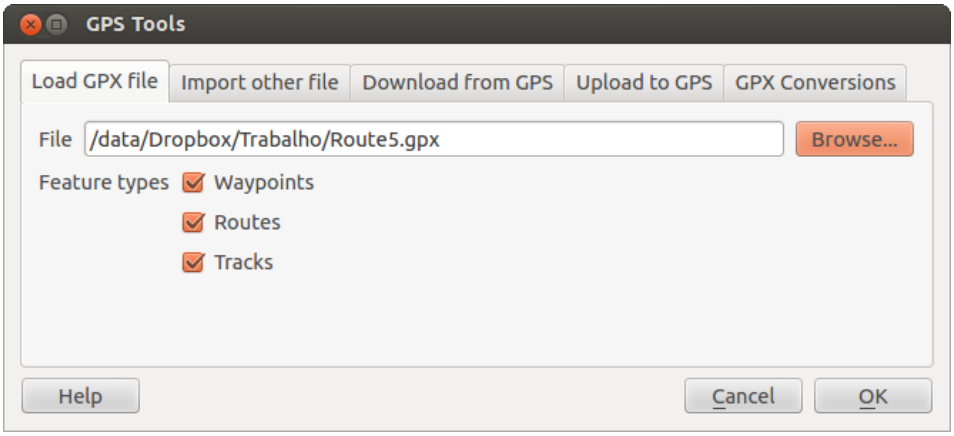


Figura20.1: The *GPS Tools* dialog window

Use the *Browse...* button to select the GPX file, then use the checkboxes to select the feature types you want to load from that GPX file. Each feature type will be loaded in a separate layer when you click *OK*. The file `national_monuments.gpx` only includes waypoints.

Nota: GPS units allow you to store data in different coordinate systems. When downloading a GPX file (from your GPS unit or a web site) and then loading it in QGIS, be sure that the data stored in the GPX file uses WGS 84 (latitude/longitude). QGIS expects this, and it is the official GPX specification. See https://www.topografix.com/GPX/1/1/.

20.1.3 GPSBabel

Since QGIS uses GPX files, you need a way to convert other GPS file formats to GPX. This can be done for many formats using the free program GPSBabel, which is available at https://www.gpsbabel.org. This program can also transfer GPS data between your computer and a GPS device. QGIS uses GPSBabel to do these things, so it is recommended that you install it. However, if you just want to load GPS data from GPX files you will not need it. Version 1.2.3 of GPSBabel is known to work with QGIS, but you should be able to use later versions without any problems.

20.1.4 Importando dados GPS

Para importar dados de GPS de um arquivo que não é GPX, você irá usar a ferramenta: guilabel: na caixa de diálogo Ferramentas GPS. Aqui, você seleciona o arquivo que deseja importar (e o tipo de arquivo), e onde você deseja armazenar o arquivo GPX convertido e qual o nome da nova camada. Note-se que nem todos os formatos de dados GPS irá suportar todos os três tipos de recurso, portanto, para muitos formatos você só será capaz de escolher entre um ou dois tipos.

20.1.5 Descarregando dados de um receptor GPS

QGIS can use GPSBabel to download data from a GPS device directly as new vector layers. For this we use the *Download from GPS* tab of the GPS Tools dialog (see Fig.20.2). Here, we select the type of GPS device, the port that it is connected to (or USB if your GPS supports this), the feature type that you want to download, the GPX file where the data should be stored, and the name of the new layer.

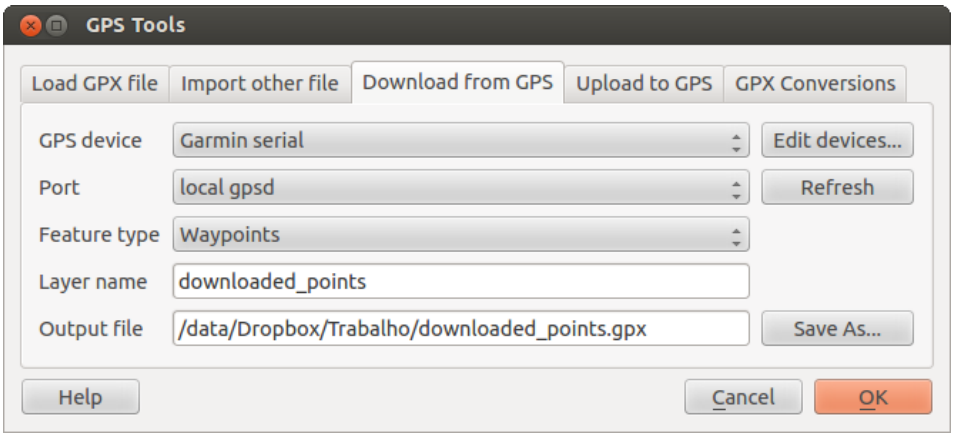


Figura20.2: Ferramenta de download

O tipo de dispositivo que você selecionar no menu do aparelho GPS determina como GPSBabel tenta se comunicar com o seu dispositivo GPS. Se nenhum dos tipos disponíveis funcionar com o seu dispositivo GPS, você pode criar um novo tipo (ver seção ref: definindo-novo-dispositivo).

A porta pode ser um nome de arquivo ou algum outro nome que o seu sistema operacional utiliza como referência para a porta física em seu computador que o dispositivo GPS está conectado. Também pode ser simplesmente USB, para unidades de GPS habilitados para USB.

- On Linux, this is something like `/dev/ttyS0` or `/dev/ttyS1`.
- No Windows, é “COM1” ou “COM2”.

When you click *OK*, the data will be downloaded from the device and appear as a layer in QGIS.

20.1.6 Carregando dados no receptor GPS

You can also upload data directly from a vector layer in QGIS to a GPS device using the *Upload to GPS* tab of the GPS Tools dialog. To do this, you simply select the layer that you want to upload (which must be a GPX layer), your GPS device type, and the port (or USB) that it is connected to. Just as with the download tool, you can specify new device types if your device isn’t in the list.

This tool is very useful in combination with the vector-editing capabilities of QGIS. It allows you to load a map, create waypoints and routes, and then upload them and use them on your GPS device.

20.1.7 Definindo novos tipos de dispositivo

There are lots of different types of GPS devices. The QGIS developers can’t test all of them, so if you have one that does not work with any of the device types listed in the *Download from GPS* and *Upload to GPS* tools, you can define your own device type for it. You do this by using the GPS device editor, which you start by clicking the *Edit Devices* button in the download or the upload tab.

To define a new device, you simply click the *New Device* button, enter a name, enter download and upload commands for your device, and click the *Update Device* button. The name will be listed in the device menus in the upload and download windows – it can be any string. The download command is the command that is used to download data from the device to a GPX file. This will probably be a GPSBabel command, but you can use any other command

line program that can create a GPX file. QGIS will replace the keywords `%type`, `%in`, and `%out` when it runs the command.

"% type" será substituído por "-w" se você estiver baixando "Locais", "-r" para "Rotas" e "-t" para "Trilhas". Estas são as opções de comando que o GPSBabel possui para download.

`%in` will be replaced by the port name that you choose in the download window and `%out` will be replaced by the name you choose for the GPX file that the downloaded data should be stored in. So, if you create a device type with the download command `gpsbabel %type -i garmin -o gpx %in %out` (this is actually the download command for the predefined device type 'Garmin serial') and then use it to download waypoints from port `/dev/ttyS0` to the file `output.gpx`, QGIS will replace the keywords and run the command `gpsbabel -w -i garmin -o gpx /dev/ttyS0 output.gpx`.

Os comandos indicados nas linhas de 'Carregar' são aqueles utilizados para carregar os dados no dispositivo. As mesmas palavras-chave são utilizadas, porém `%in` é substituído pelo nome do arquivo GPS que é utilizado e `%out` é substituído pelo nome da porta.

You can learn more about GPSBabel and its available command line options at https://www.gpsbabel.org.

Depois de ter criado um novo tipo de dispositivo, ele aparecerá na lista de dispositivos para baixar e atualizar as ferramentas.

20.1.8 Download de pontos/trilhas para GPS

As described in previous sections QGIS uses GPSBabel to download points/tracks directly in the project. QGIS comes out of the box with a pre-defined profile to download from Garmin devices. Unfortunately there is a bug #6318 that does not allow create other profiles, so downloading directly in QGIS using the GPS Tools is at the moment limited to Garmin USB units.

Garmin GPSMAP 60cs

MS Windows

Install the Garmin USB drivers from https://www8.garmin.com/support/download_details.jsp?id=591

Ligue o aparelho de GPS, abra e digite "type = serial Garmin" e "port = usb". Preencha os campos guilabel: 'Nome da Camada' e: guilabel: 'Arquivo de Saída'. Às vezes, parece ter problemas em uma determinada pasta, use algo como "c:temp" que geralmente funciona.

Ubuntu/Mint GNU/Linux

É necessário em primeiro lugar discutir sobre as permissões do dispositivo, conforme descrito no site: https://wiki.openstreetmap.org/wiki/USB_Garmin_on_GNU/Linux. Você pode tentar criar um arquivo: '/ etc / udev / rules.d / 51 garmin.rules' contendo esta regra

```
ATTRS{idVendor}=="091e", ATTRS{idProduct}=="0003", MODE="666"
```

Depois disso, é necessário ter certeza de que o módulo do kernel "garmin_gps" não está carregando.

```
rmmod garmin_gps
```

and then you can use the GPS Tools. Unfortunately there seems to be a bug #7182 and usually QGIS freezes several times before the operation work fine.

Registro de dados BTGP-38KM (somente Bluetooth)

MS Windows

O erro já referido não permite fazer o download dos dados a partir do QGIS, por isso é necessário utilizar o GPSBabel a partir do comando ou usando a sua interface.

```
gpsbabel -t -i skytraq,baud=9600,initbaud=9600 -f COM9 -o gpx -F C:/GPX/aaa.gpx
```

Ubuntu/Mint GNU/Linux

Use o mesmo comando (ou as configurações do GPSBabel GUI) no Windows. No Linux de alguma forma pode obter uma mensagem

```
skytraq: Too many read errors on serial port
```

seria a questão de desligar e ligar o registro de dados novamente.

Registro de dados BlueMax GPS-4044 (BT e USB).

MS Windows

Nota: Precisa instalar os drivers antes de usá-lo no Windows 7. Veja no site do fabricante qual o download adequado.

Baixando com GPSBabel, ambos com USB e BT retorna sempre um erro.

```
gpsbabel -t -i mtk -f COM12 -o gpx -F C:/temp/test.gpx
mtk_logger: Can't create temporary file data.bin
Error running gpsbabel: Process exited unsuccessfully with code 1
```

Ubuntu/Mint GNU/Linux

Com USB

Depois de ter ligado o cabo e utilizar o comando "dmesg" para a porta que está sendo usada, digite por exemplo "/dev/ttyACM3". Então,será usado o GPSBabel para CLI ou GUI.

```
gpsbabel -t -i mtk -f /dev/ttyACM3 -o gpx -F /home/user/bluemax.gpx
```

Com Bluetooth

Use Blueman como gerenciador de dispositivos para associar o dispositivo e disponibilizá-lo através de uma porta do sistema executando o GPSBabel.

```
gpsbabel -t -i mtk -f /dev/rfcomm0 -o gpx -F /home/user/bluemax_bt.gpx
```

20.2 Rastreio GPS em tempo real

Para ativar o rastreamento GPS ao vivo no QGIS, é necessário selecionar: menuselection:*Ver -> Paineis* *Painel de informações do GPS* ou pressione: kbd:*Ctrl+0*. Você receberá uma nova janela encaixada no lado esquerdo da tela.

Existem quatro telas possíveis nesta janela de monitoramento GPS

- |metadado| Coordenadas de posição GPS e uma interface para inserir manualmente vértices e feições
- Intensidade do sinal GPS das conexões de satélite
- GPS options screen (see Fig.20.5)

Com um receptor GPS conectado (deve ser suportado pelo seu sistema operacional), um simples clique em *Conectar* conecta o GPS ao QGIS. Um segundo clique (agora :guilabel: *Desconectar*) desconecta o receptor GPS do seu computador. Para o GNU/Linux, o suporte ao gpsd é integrado para oferecer suporte à conexão com a maioria dos receptores GPS. Portanto, primeiro você precisa configurar o gpsd corretamente para conectar o QGIS a ele.

Aviso: Se você quer gravar a sua posição para a tela, você tem que criar uma nova camada vetorial primeiro e mudar para o estado editável para gravar o seu caminho.

20.2.1 Posição e atributos adicionais

Se o GPS estiver recebendo sinais de satélites, você verá sua posição em latitude, longitude e altitude, juntamente com atributos adicionais.

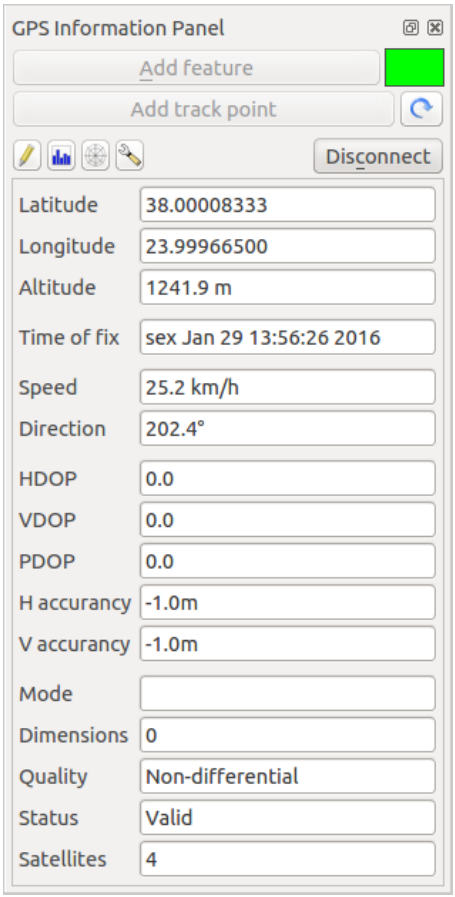


Figura20.3: Posição de rastreamento GPS e atributos adicionais

20.2.2 Força do sinal GPS

 Aqui, você pode ver a intensidade do sinal dos satélites dos quais você está recebendo sinais.

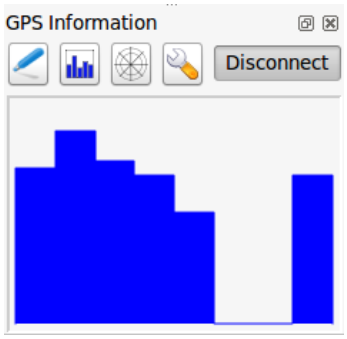


Figura20.4: Intensidade do sinal de rastreamento GPS

20.2.3 Opções GPS

|opções| Em caso de problemas de conexão, você pode alternar entre:

- *Autodetectar*
- *Interno*
- *Dispositivo serial*
- *gpsd* (selecionando o host, porta e dispositivo ao qual seu GPS está conectado)

Um clique em: guilabel: *Connect* inicia novamente a conexão com o receptor GPS.

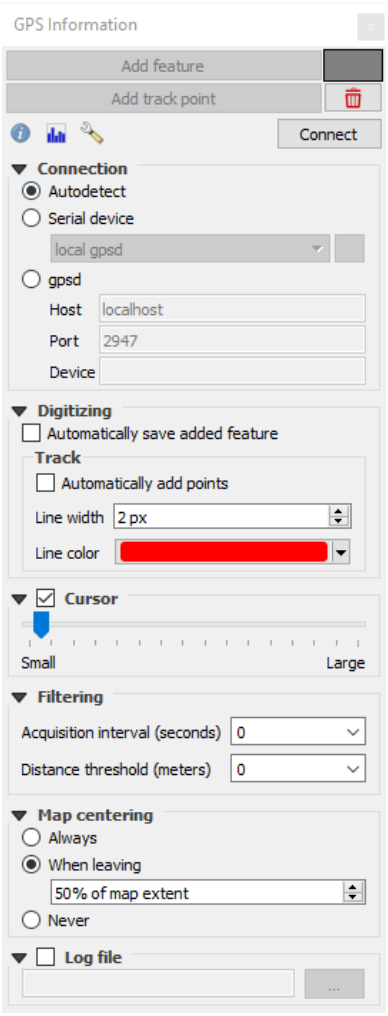


Figura20.5: Janela de opções de rastreamento GPS

Você pode ativar |caixa| *salvar automaticamente feições adicionadas* quando você está em modo de edição. Ou você pode ativar |caixa| :guilabel:'Adicionar pontos automaticamente` para a tela mapa com uma determinada largura e cor.

Ativando |caixa| *Cursor*, você pode usar um controle deslizante |barra| para diminuir e aumentar a posição do cursor na tela.

Você também pode definir os parâmetros *Intervalo de aquisição (segundos)* e a *Limiar de distância (metros)* para manter o cursor ainda ativo quando o receptor estiver em condições estáticas.

Ativando  *Centralização do mapa* permite que você decida de que maneira a tela será atualizada. Isso inclui 'sempre', 'ao sair', se as coordenadas gravadas começarem a sair da tela, ou 'nunca', para manter a extensão do mapa.

Finalmente, você pode ativar |caixa| *Arquivo Log* e definir um caminho e um arquivo onde as mensagens de log sobre o rastreamento GPS serão registradas.

Se você deseja definir uma feição manualmente, é necessário voltar para |metadados| Posição e clique em :guilabel:` Adicionar Ponto` ou *Adicionar ponto de passagem*.

20.2.4 Conectar um GPS com Bluetooth para rasteamento ao vivo

Com QGIS você pode conectar um GPS via Bluetooth para a coleta de dados em campo. Para executar esta tarefa, você precisa de um dispositivo GPS com Bluetooth e um receptor Bluetooth em seu computador.

Em primeiro lugar você deve deixar seu aparelho de GPS ser reconhecido e emparelhado com o computador. Ligue o GPS, vá até o ícone Bluetooth na área de notificação e busca de um novo dispositivo.

No lado direito da máscara de seleção de dispositivos, verifique se todos os dispositivos estão selecionados, para que sua unidade GPS provavelmente apareça entre os disponíveis. Na próxima etapa, um serviço de conexão serial deve estar disponível, selecione-o e clique em :guilabel: botão *Configure*.

Lembre-se o número da porta COM atribuído à conexão GPS como resultante pelas propriedades Bluetooth.

Após o reconhecimento do GPS, faça o emparelhamento para a conexão. Normalmente, o código de autorização é `0000`.

Agora abra :guilabel: painel *informações de GPS* e alterne para **|opções|** Tela de opções de GPS. Selecione a porta COM atribuída à conexão GPS e clique em *Conectar*. Depois de um tempo, um cursor indicando sua posição deve aparecer.

Se QGIS não pode receber dados do GPS, então você deve reiniciar seu dispositivo GPS, espere 5-10 segundos, em seguida, tente se conectar novamente. Normalmente este trabalho soluciona. Se você receber um erro de conexão novamente certifique-se que você não tem outro receptor Bluetooth perto de você, emparelhado com a mesma unidade GPS.

20.2.5 Utilizando GPSMAP 60cs

MS Windows

A maneira mais fácil de fazê-lo funcionar é usar um middleware (freeware, não aberto) chamado GPSGate.

Inicie o programa, faça a varredura de dispositivos GPS (funciona tanto para USB quanto para BT) e, em seguida, no QGIS, clique em *Conectar* no painel Live tracking usando o  :guilabel: modo de *Autodetecção*.

Ubuntu/Mint GNU/Linux

Como para Windows a maneira mais fácil é usar um servidor no meio, neste caso GPSD, assim

```
sudo apt install gpsd
```

Em seguida, carregar o módulo do kernel `garmin_gps`

```
sudo modprobe garmin_gps
```

E, em seguida, ligue a unidade. Em seguida, verifique com `dmesg` o dispositivo real que está sendo utilizado bu da unidade, por exemplo `/dev/ttyUSB0`. Agora você pode iniciar gpsd

```
gpsd /dev/ttyUSB0
```

E, finalmente, conectar-se com a ferramenta de acompanhamento ao vivo do QGIS.

20.2.6 Usando BTGP-38KM datalogger (somente Bluetooth)

Usando GPSD (no Linux) ou GPSGate (no Windows) é fácil.

20.2.7 Usando datalogger BlueMax GPS-4044 (ambos BT e USB)

MS Windows

O rastreamento ao vivo funciona nos modos USB e BT, usando o GPSGate ou mesmo sem ele, basta usar o  :guilabel: modo de autodetecção, ou aponte a ferramenta para a porta correta.

Ubuntu/Mint GNU/Linux

Para USB

O acompanhamento ao vivo funciona tanto com GPSD

```
gpsd /dev/ttyACM3
```

ou sem ela, ligando a ferramenta de acompanhamento ao vivo QGIS diretamente para o dispositivo (por exemplo, `/dev/ttyACM3`).

Para Bluetooth

O acompanhamento ao vivo funciona tanto com GPSD

```
gpsd /dev/rfcomm0
```

ou sem ela, ligando a ferramenta de acompanhamento ao vivo QGIS diretamente para o dispositivo (por exemplo, `/dev/rfcomm0`).

CAPÍTULO 21

Sistema de Autenticação

21.1 Visão Geral do Sistema de Autenticação

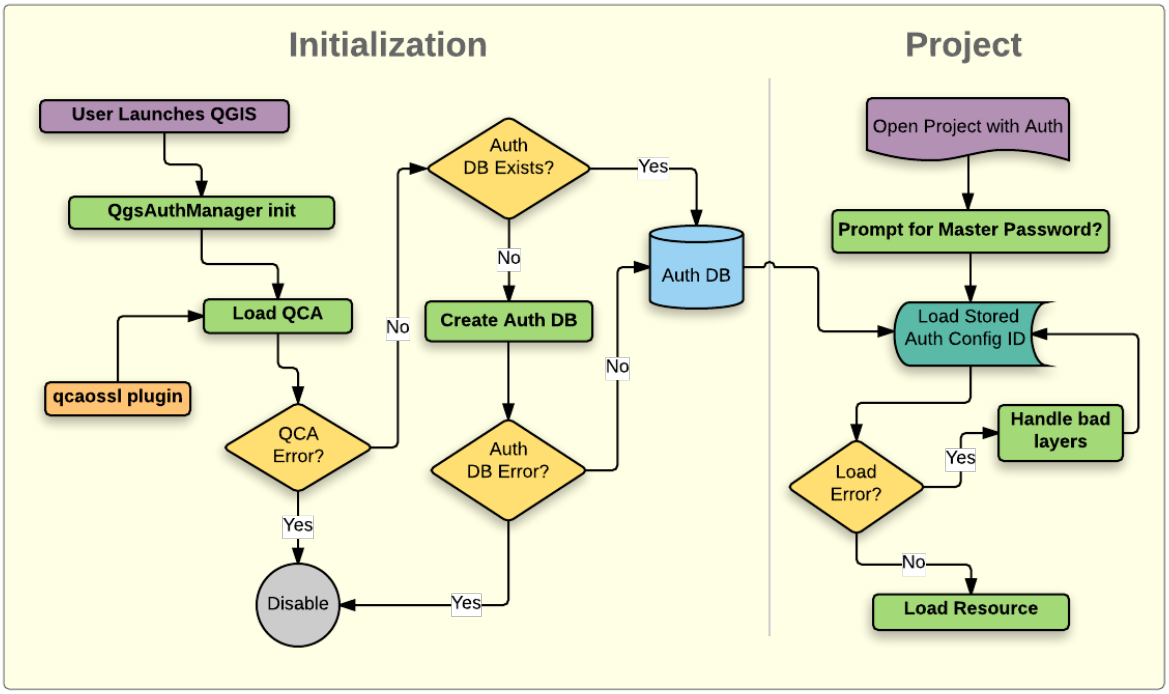


Figura21.1: Anatomia do sistema de autenticação

21.1.1 Banco de Dados de Autenticação

The new authentication system stores authentication configurations in an SQLite database file located, by default, at `<profile directory>/qgis-auth.db`.

Este banco de dados de autenticação pode ser movido entre as instalações do QGIS sem afetar outras preferências do usuário QGIS atuais, já que é completamente separado das configurações normais do QGIS. Um ID de configuração

(uma strig alfanumérica aleatória de 7 caracteres) é gerado ao armazenar inicialmente uma configuração no banco de dados. Isso representa a configuração, permitindo que o ID seja armazenado em componentes de aplicativo de texto simples (como arquivos de projeto, complemento ou configurações) sem a divulgação de suas credenciais associadas.

Nota: O diretório pai do *qgis-auth.db* pode ser definido usando a seguinte variável de ambiente,``QGIS_AUTH_DB_DIR_PATH``, ou definido na linha de comando durante o lançamento com a opção `--authdbdirectory`.

21.1.2 Senha mestra

To store or access sensitive information within the database, a user must define a *master password*. A new master password is requested and verified when initially storing any encrypted data to the database. When sensitive information is accessed, the user is prompted for the master password. The password is then cached for the remainder of the session (until application is quit), unless the user manually chooses an action to clear its cached value. Some instances of using the authentication system do not require input of the master password, such as when selecting an existing authentication configuration, or applying a configuration to a server configuration (such as when adding a WMS layer).

You can choose to save the password in the `Wallet/Keyring` of your computer.

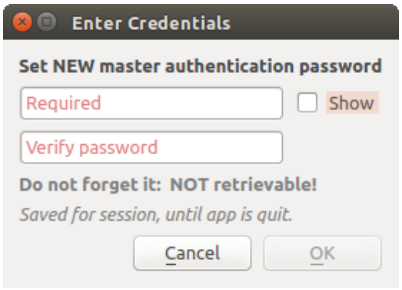


Figura21.2: Insira uma nova senha mestra

Nota: Um caminho para um arquivo contendo a senha mestra pode ser definido usando a seguinte variável de ambiente, `QGIS_AUTH_PASSWORD_FILE`.

Gerenciando a senha mestre

Uma vez definida, a senha mestra pode ser redefinida; a senha mestra atual será necessária antes da redefinição. Durante este processo, existe a opção de gerar um backup completo do banco de dados atual.



Figura21.3: Redefinindo a senha mestre

Se o usuário esquecer a senha mestra, não haverá como recuperá-la ou substituí-la. Também não há meio de recuperar informações criptografadas sem saber a senha mestra.

Se um usuário inserir sua senha existente incorretamente três vezes, a caixa de diálogo se oferecerá para apagar o banco de dados.

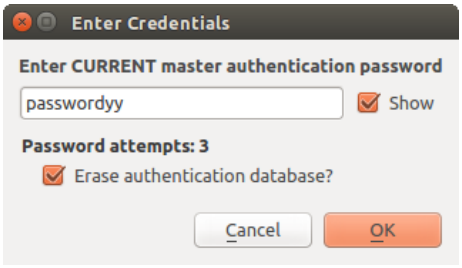


Figura21.4: Solicitação de senha após três tentativas inválidas

21.1.3 Configurações de Autenticação

Você pode gerenciar as configurações de autenticação de *Configurações* na guia *Autenticação* da caixa de diálogo Opções do QGIS (*Configurações* ► *Opções*).

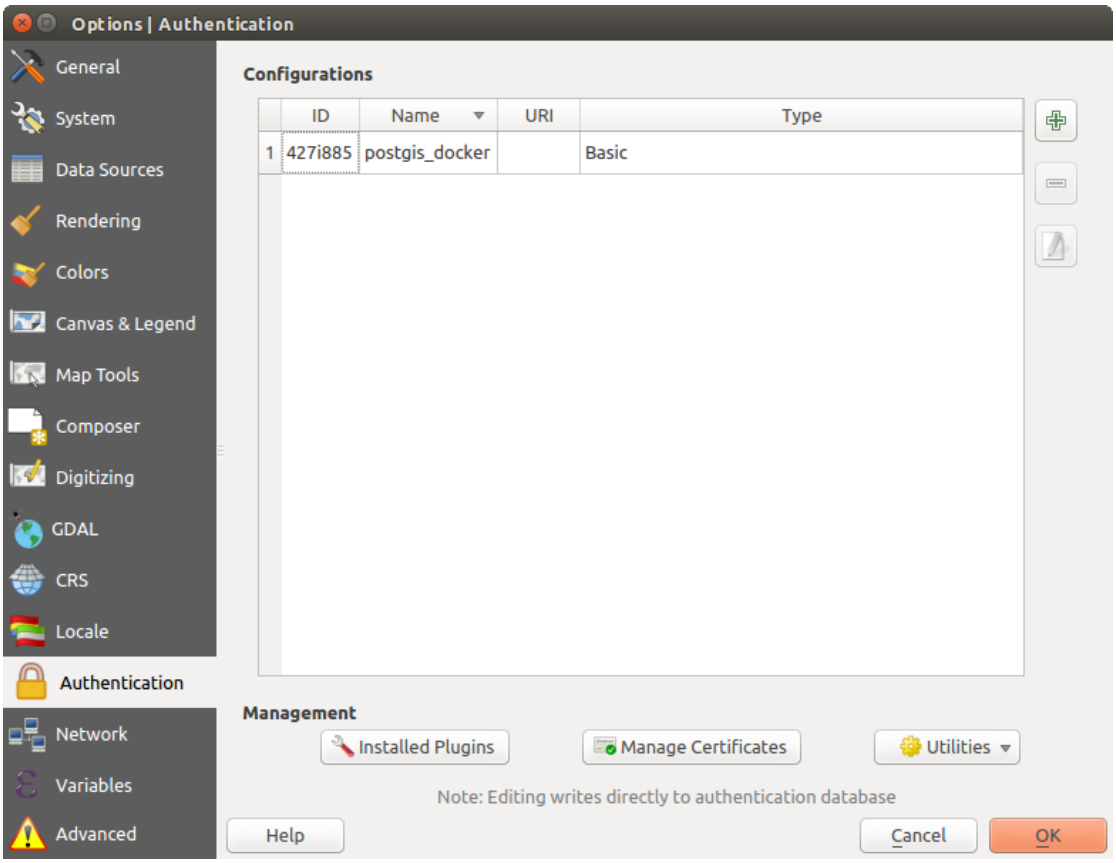


Figura21.5: Configurations editor

Use the button to add a new configuration, the button to remove configurations, and the button to modify existing ones.

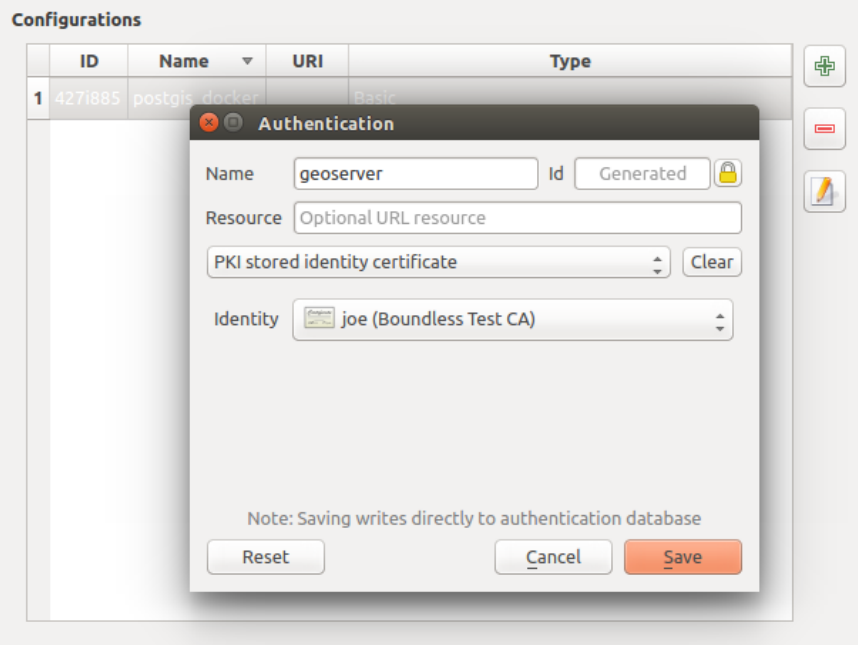


Figura21.6: Adding config from within Configuration editor

The same type of operations for authentication configuration management (Add, Edit and Remove) can be done when configuring a given service connection, such as configuring an OWS service connection. For that, there are action buttons within the configuration selector for fully managing configurations found within the authentication database. In this case, there is no need to go to the *configurations* in *Authentication* tab of QGIS options unless you need to do more comprehensive configuration management.

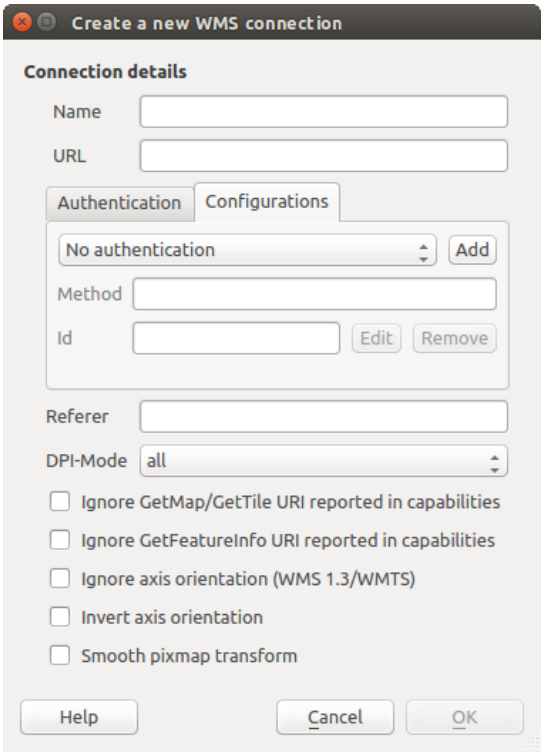


Figura21.7: WMS connection dialog showing *Add*, *Edit*, and *Remove* authentication configuration buttons

When creating or editing an authentication configuration, the info required is a name, an authentication method

and any other info that the authentication method requires (see more about the available authentication types in *Authentication Methods*).

21.1.4 Authentication Methods

Available authentications are provided by C++ plugins much in the same way data provider plugins are supported by QGIS. The method of authentication that can be selected is relative to the access needed for the resource/provider, e.g. HTTP(S) or database, and whether there is support in both QGIS code and a plugin. As such, some authentication method plugins may not be applicable everywhere an authentication configuration selector is shown. A list of available authentication method plugins and their compatible resource/providers can be accessed going to *Settings* ► *Options* and, in the *Authentication* tab, click the *Installed Plugins* button.

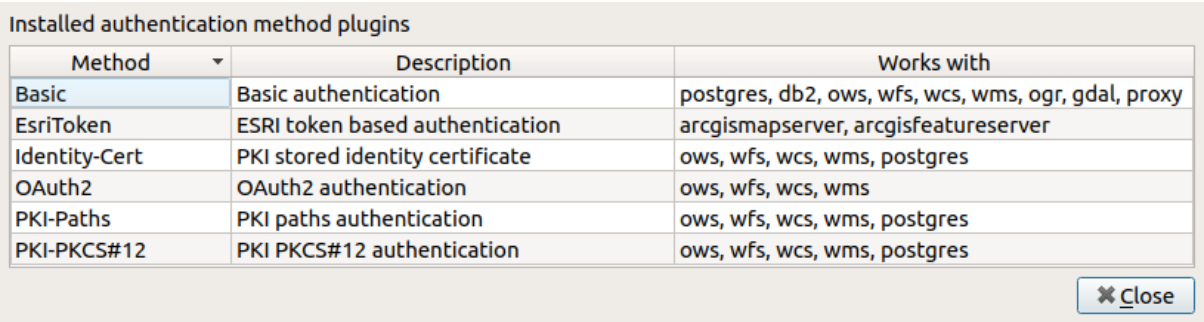


Figura21.8: Available method plugins list

Plugins can be created for new authentication methods that do not require QGIS to be recompiled. Since the support for plugins is currently C++-only, QGIS will need to be restarted for the new dropped-in plugin to become available to the user. Ensure your plugin is compiled against the same target version of QGIS if you intend to add it to an existing target install.

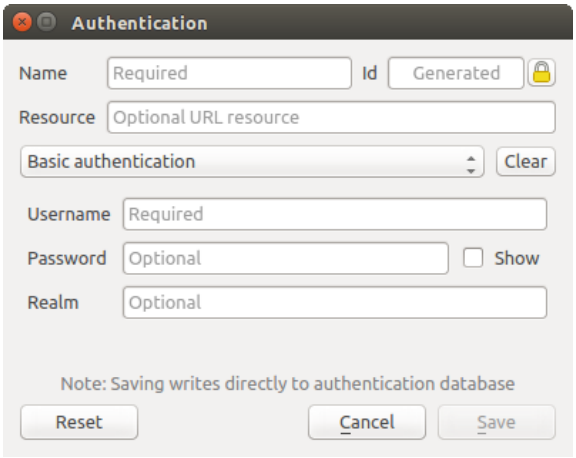


Figura21.9: Basic HTTP authentication configs

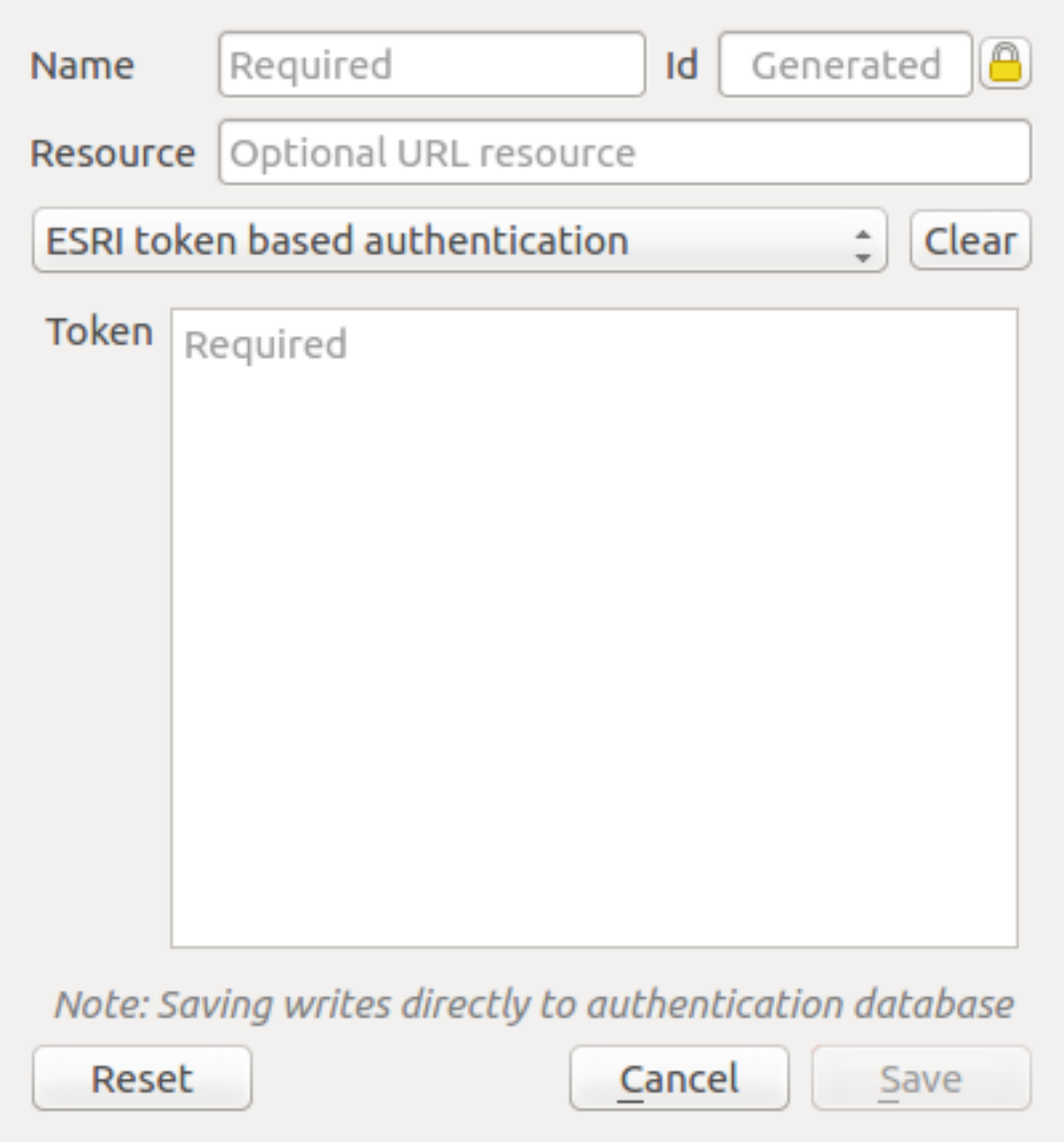


Figura21.10: ESRI Token authentication configs

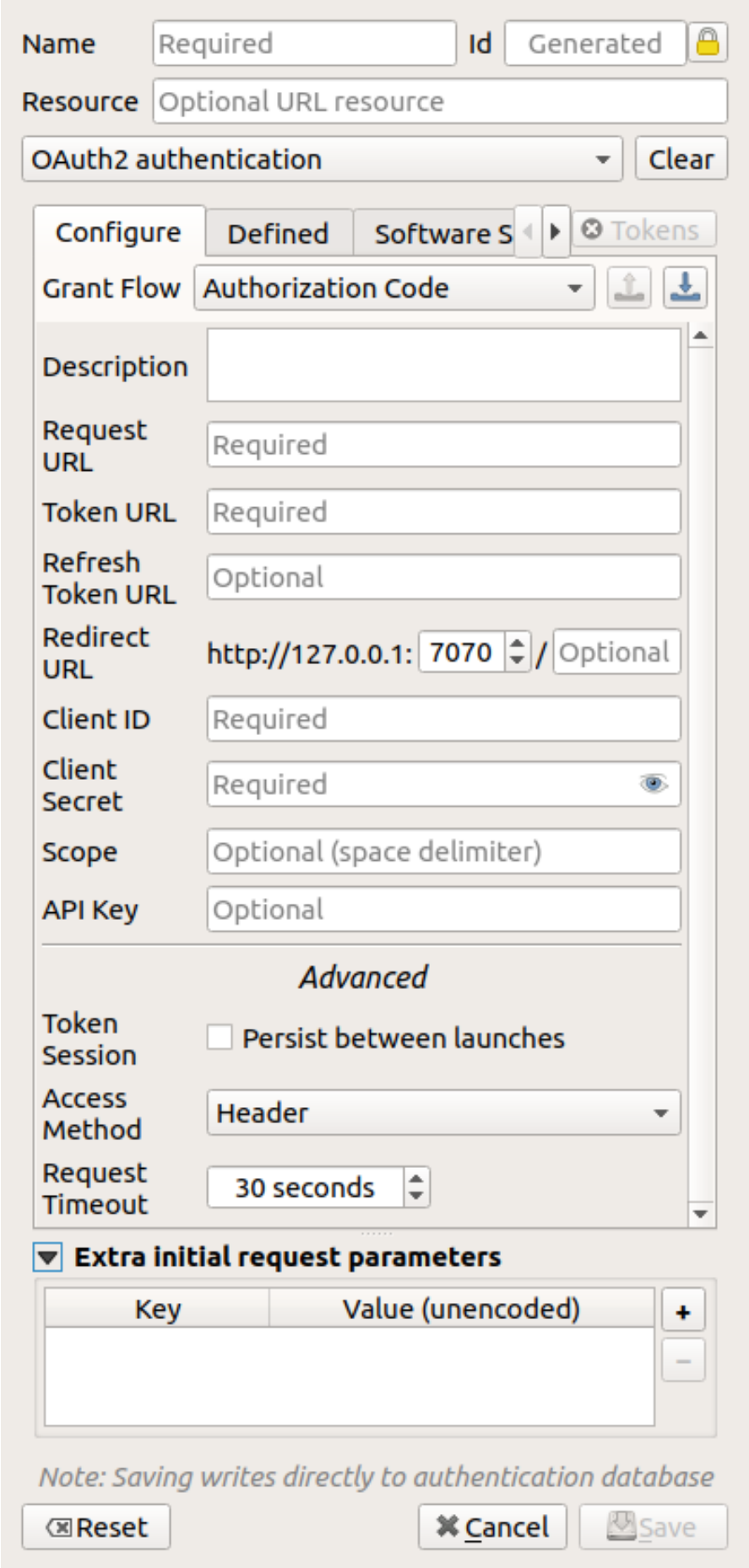


Figura21.11: OAuth2 authentication configs

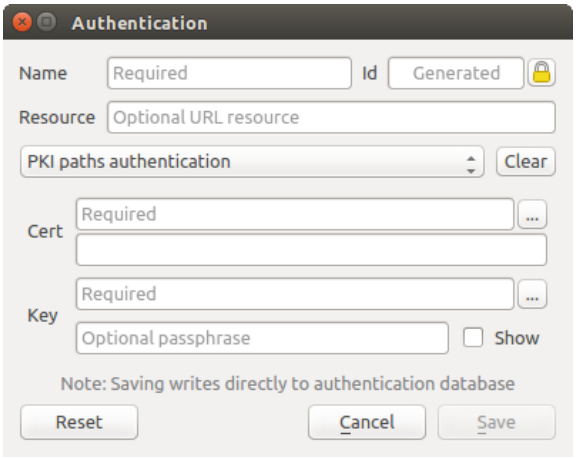


Figura21.12: PKI paths authentication configs

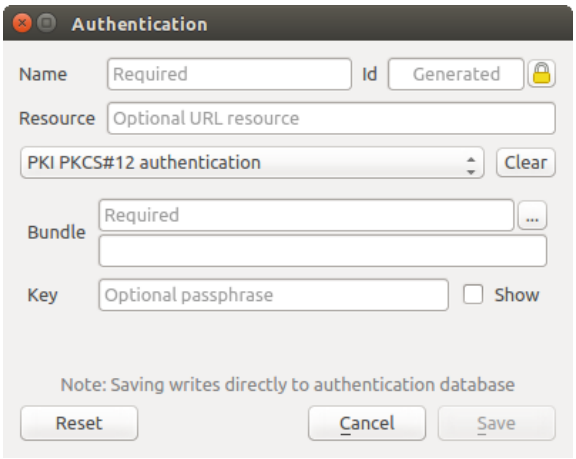


Figura21.13: PKI PKCS#12 file paths authentication configs

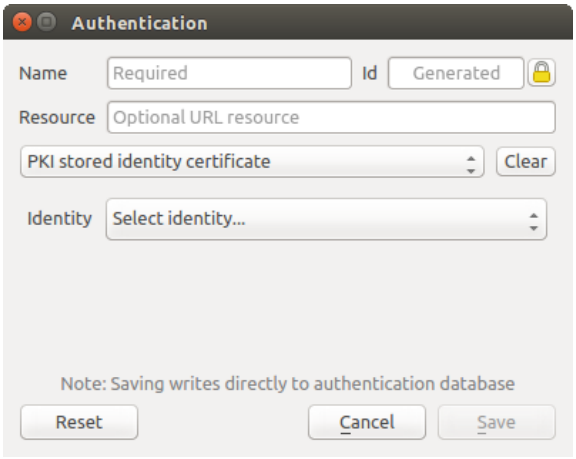


Figura21.14: Stored Identity authentication configs

Nota: The Resource URL is currently an *unimplemented* feature that will eventually allow a particular configuration to be auto-chosen when connecting to resources at a given URL.

21.1.5 Master Password and Auth Config Utilities

Under the Options menu (*Settings* ► *Options*) in the *Authentication* tab, there are several utility actions to manage the authentication database and configurations:

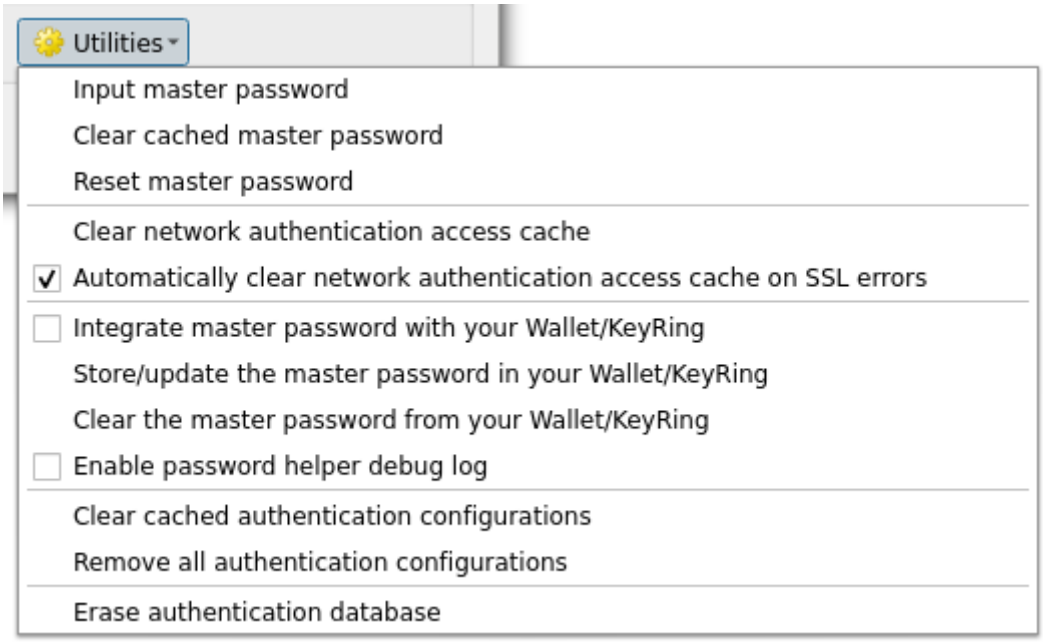


Figura21.15: Utilities menu

- **Input master password**: opens the master password input dialog, independent of performing any authentication database command
- **Clear cached master password**: unsets the master password if it has been set
- **Reset master password**: opens a dialog to change the master password (the current password must be known) and optionally back up the current database
- **Clear network authentication access cache**: clears the authentication cache of all connections
- **Automatically clear network authentication access cache on SSL errors**: the connection cache stores all authentication data for connections, also when the connection fails. If you change authentication configurations or certification authorities, you should clear the authentication cache or restart QGIS. When this option is checked, the authentication cache will be automatically cleared every time an SSL error occurs and you choose to abort the connection
- **Integrate master password with your Wallet/Keyring**: adds the master password to your personal Wallet/Keyring
- **Store/update the master password in your Wallet/Keyring**: updates the changed master password in your Wallet/Keyring
- **Clear the master password from your Wallet/Keyring**: deletes the master password from your Wallet/Keyring
- **Enable password helper debug log**: enables a debug tool that will contain all the log information of the authentication methods
- **Clear cached authentication configurations**: clears the internal lookup cache for configurations, used to speed up network connections. This does not clear QGIS's core network access manager's cache, which requires a relaunch of QGIS.
- **Remove all authentication configurations**: clears the database of all configuration records, without removing other stored records.

- **Erase authentication database**: schedules a backup of the current database and complete rebuild of the database table structure. The actions are scheduled for a later time, to ensure that other operations, like project loading, do not interrupt the operation or cause errors due to a temporarily missing database.

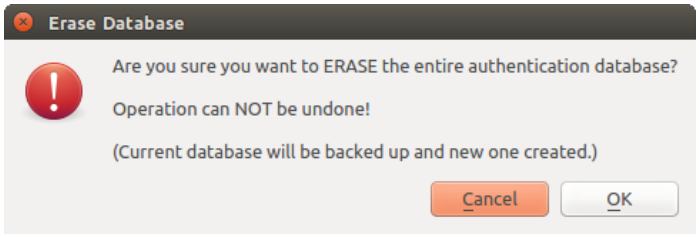


Figura21.16: DB erase verification menu

21.1.6 Using authentication configurations

Typically, an authentication configuration is selected in a configuration dialog for a network services (such as WMS). However, the selector widget can be embedded anywhere authentication is needed or in non-core functionality, like in third-party PyQGIS or C++ plugins.

When using the selector, *No authentication* is displayed in the pop-up menu control when nothing is selected, when there are no configurations to choose from, or when a previously assigned configuration can no longer be found in the database. The *Type* and *Id* fields are read-only and provide a description of the authentication method and the config's ID respectively.

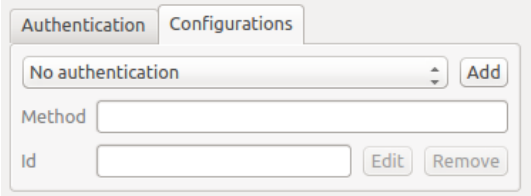


Figura21.17: Authentication configuration selector with no authentication

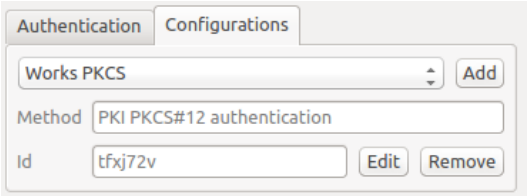


Figura21.18: Authentication configuration selector with selected config

21.1.7 Python bindings

All classes and public functions have sip bindings, except `QgsAuthCrypto`, since management of the master password hashing and auth database encryption should be handled by the main app, and not via Python. See *Security Considerations* concerning Python access.

21.2 Fluxos de trabalho de autenticação de usuário

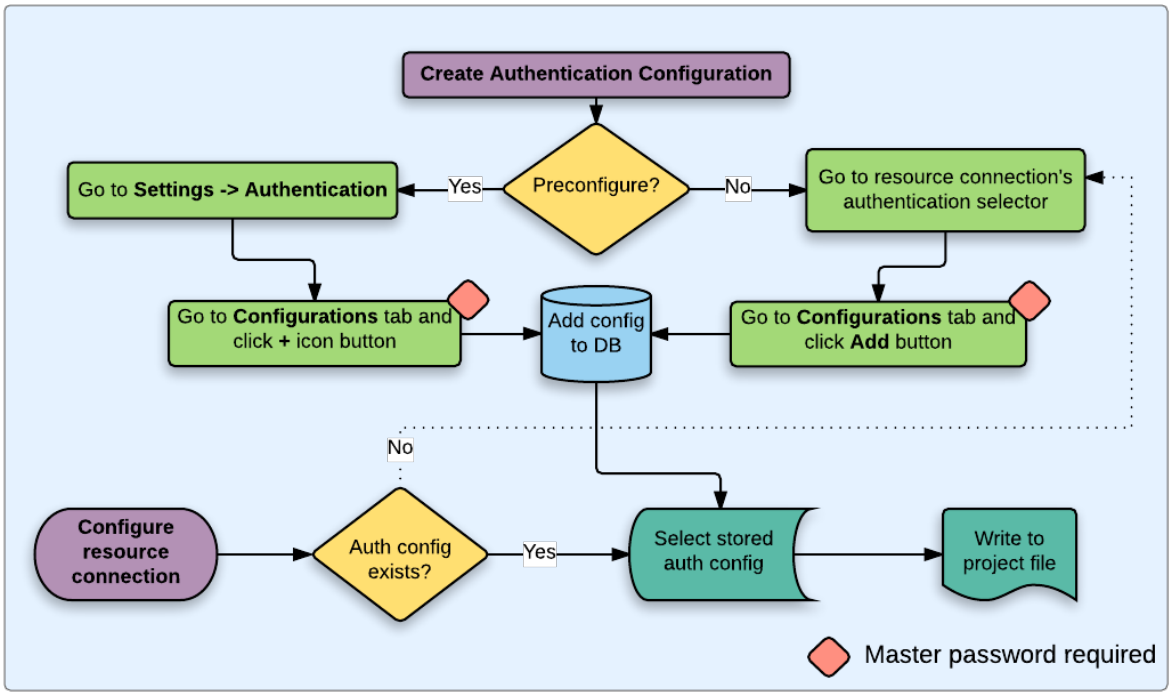


Figura21.19: Fluxos de trabalho de usuário genérico

21.2.1 Autenticação HTTP(S)

One of the most common resource connections is via HTTP(S), e.g. web mapping servers, and authentication method plugins often work for these types of connections. Method plugins have access to the HTTP request object and can manipulate both the request as well as its headers. This allows for many forms of internet-based authentication. When connecting via HTTP(S) using the standard username/password authentication method will attempt HTTP BASIC authentication upon connection.

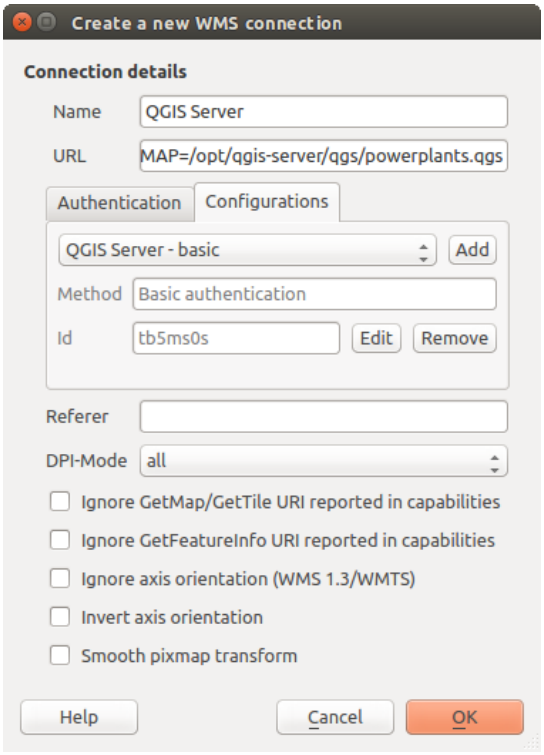


Figura21.20: Configurando uma conexão WMS para um HTTP básico

21.2.2 Autenticação de Base de Dados

Connections to database resources are generally stored as `key=value` pairs, which will expose usernames and (optionally) passwords, if *not* using an authentication configuration. When configuring with the auth system, the `key=value` will be an abstracted representation of the credentials, e.g. `authfg=81t21b9`.

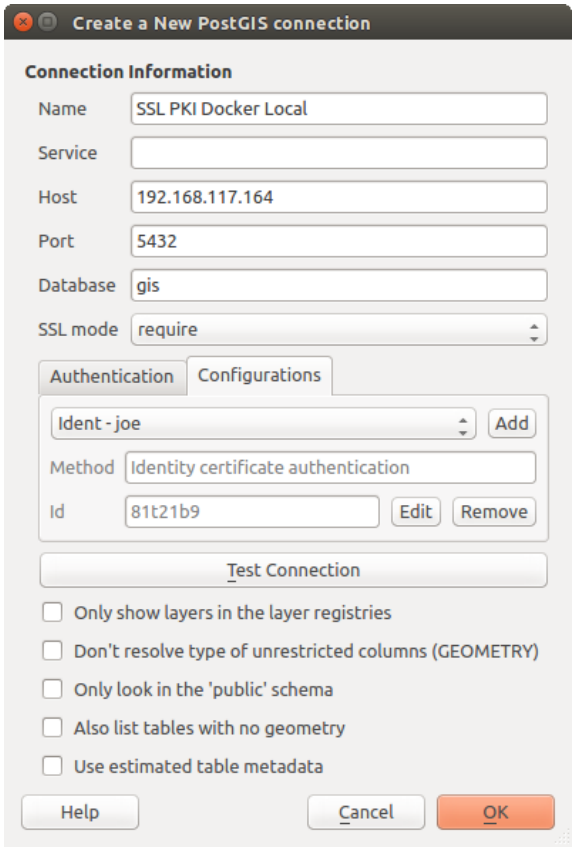


Figura21.21: Configuring a Postgres SSL-with-PKI connection

21.2.3 PKI authentication

When configuring PKI components within the authentication system, you have the option of importing components into the database or referencing component files stored on your filesystem. The latter may be useful if such components change frequently, or where the components will be replaced by a system administrator. In either instance you will need to store any passphrase needed to access private keys within the database.

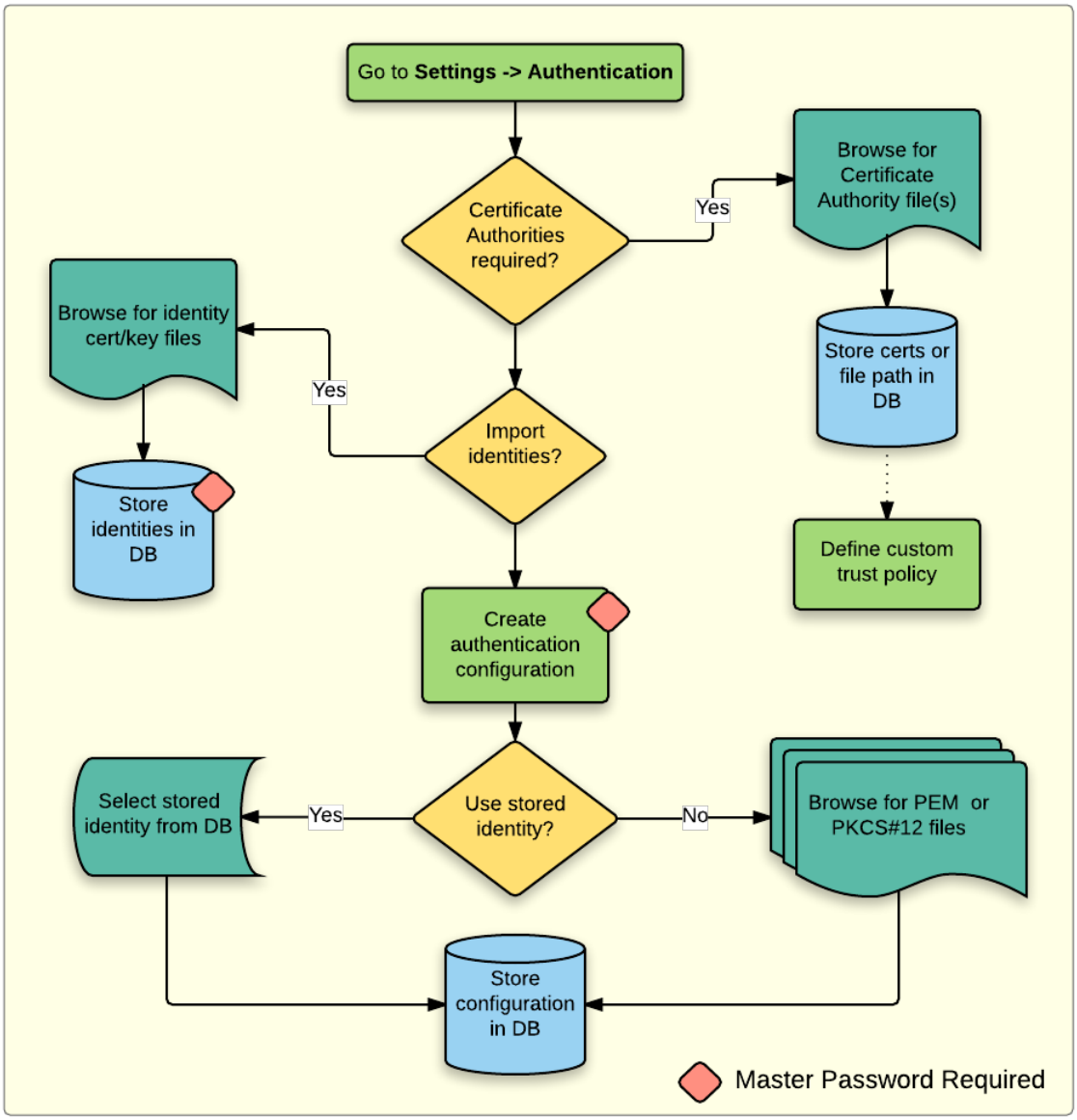


Figura21.22: PKI configuration workflow

All PKI components can be managed in separate editors within the **Certificate Manager**, which can be accessed in the *Authentication* tab in QGIS *Options* dialog (*Settings* ► *Options*) by clicking the *Manage Certificates* button.

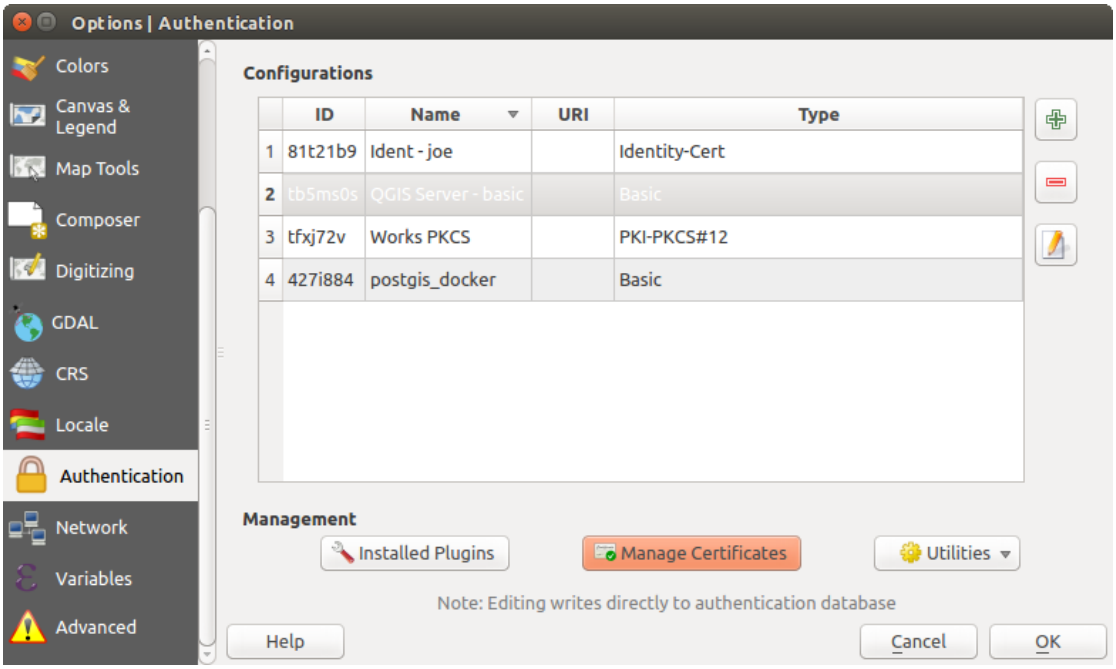


Figura21.23: Opening the Certificate Manager

In the *Certificate Manager*, there are editors for **Identities**, **Servers** and **Authorities**. Each of these are contained in their own tabs, and are described below in the order they are encountered in the workflow chart above. The tab order is relative to frequently accessed editors once you are accustomed to the workflow.

Nota: Because all authentication system edits write immediately to the authentication database, there is no need to click the *Options* dialog *OK* button for any changes to be saved. This is unlike other settings in the Options dialog.

Authorities

You can manage available Certificate Authorities (CAs) from the **Authorities** tab in the **Certificate manager** from the **Authentication** tab of the QGIS **Options** dialog.

As referenced in the workflow chart above, the first step is to import or reference a file of CAs. This step is optional, and may be unnecessary if your PKI trust chain originates from root CAs already installed in your operating system (OS), such as a certificate from a commercial certificate vendor. If your authenticating root CA is not in the OS's trusted root CAs, it will need to be imported or have its file system path referenced. (Contact your system administrator if unsure.)

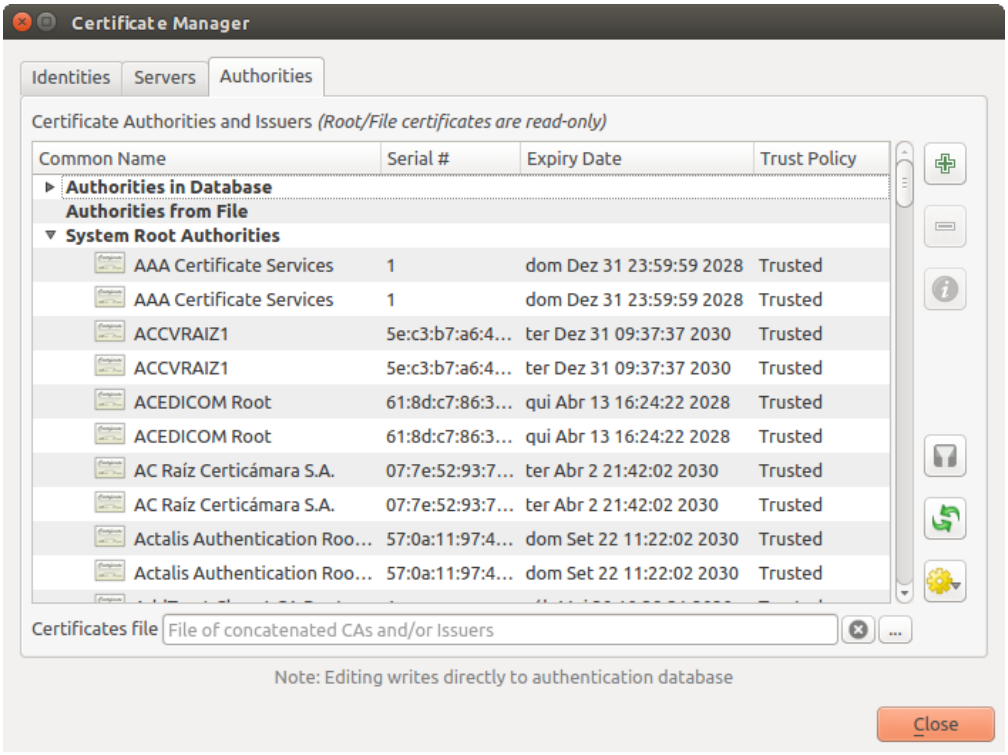


Figura21.24: Authorities editor

By default, the root CAs from your OS are available; however, their trust settings are not inherited. You should review the certificate trust policy settings, especially if your OS root CAs have had their policies adjusted. Any certificate that is expired will be set to untrusted and will not be used in secure server connections, unless you specifically override its trust policy. To see the QGIS-discoverable trust chain for any certificate, select it and click the Show information for certificate.

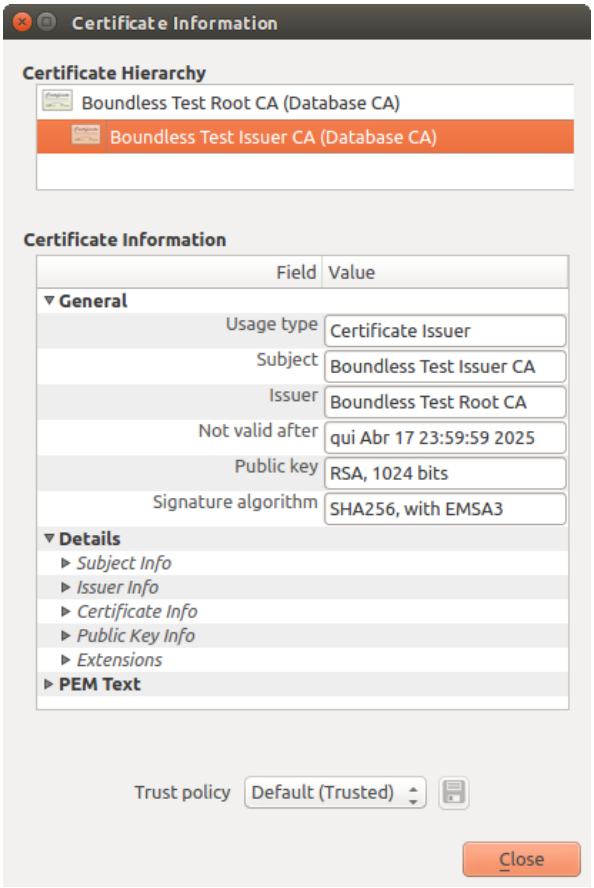


Figura21.25: Certificate info dialog

You can edit the *Trust policy*  for any selected certificate within the chain. Any change in trust policy to a selected certificate will not be saved to the database unless the  Save certificate trust policy change to database button is clicked *per* selected certification. Closing the dialog will **not** apply the policy changes.

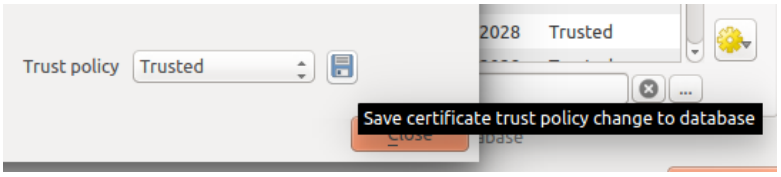


Figura21.26: Saving the trust policy changes

You can review the filtered CAs, both intermediate and root certificates, that will be trusted for secure connections or change the default trust policy by clicking the **Options** button.

Aviso: Changing the default trust policy may result in problems with secure connections.

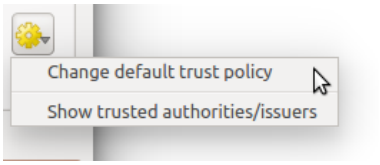


Figura21.27: Authorities options menu

You can import CAs or save a file system path from a file that contains multiple CAs, or import individual CAs. The standard PEM format for files that contain multiple CA chain certifications has the root cert at the bottom of the file and all subsequently signed child certificates above, towards the beginning of the file.

The CA certificate import dialog will find all CA certificates within the file, regardless of order, and also offers the option to import certificates that are considered invalid (in case you want to override their trust policy). You can override the trust policy upon import, or do so later within the **Authorities** editor.

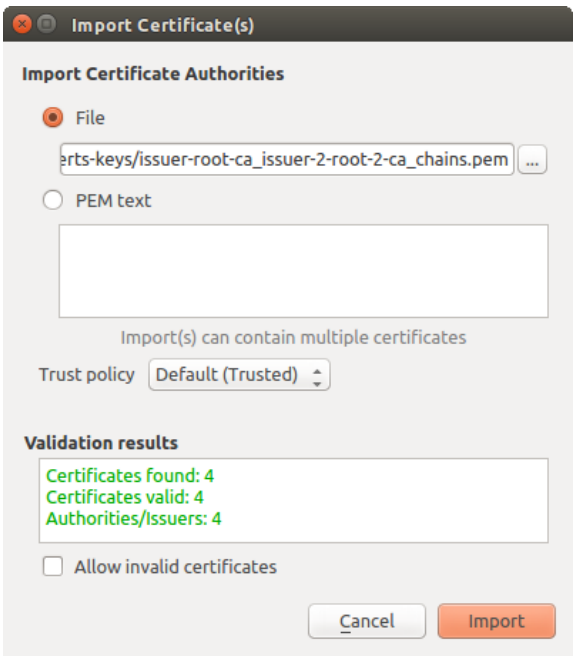


Figura21.28: Import certificates dialog

Nota: If you are pasting certificate information into the *PEM text* field, note that encrypted certificates are not supported.

Identities

You can manage available client identity bundles from the *Identities* tab in the *Certificate manager* from the **Authentication** tab of the QGIS **Options** dialog. An identity is what authenticates you against a PKI-enabled service and usually consists of a client certificate and private key, either as separate files or combined into a single "bundled" file. The bundle or private key is often passphrase-protected.

Once you have any Certificate Authorities (CAs) imported you can optionally import any identity bundles into the authentication database. If you do not wish to store the identities, you can reference their component file system paths within an individual authentication configuration.

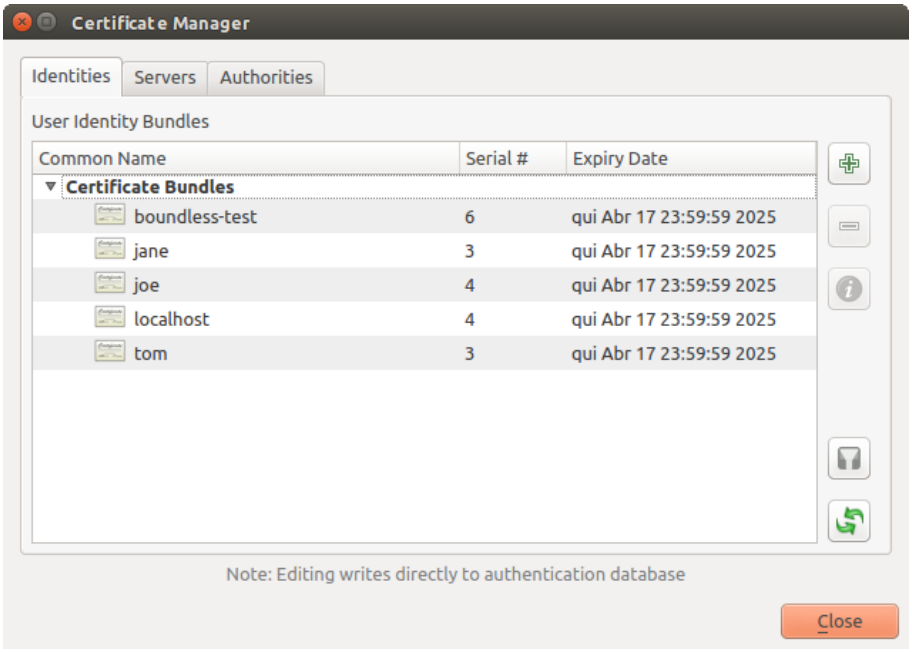


Figura21.29: Identities editor

When importing an identity bundle, it can be passphrase-protected or unprotected, and can contain CA certificates forming a trust chain. Trust chain certifications will not be imported here; they can be added separately under the *Authorities* tab.

Upon import the bundle's certificate and private key will be stored in the database, with the key's storage encrypted using the QGIS master password. Subsequent usage of the stored bundle from the database will only require input of the master password.

Personal identity bundles consisting of PEM/DER (.pem/.der) and PKCS#12 (.p12/.pfx) components are supported. If a key or bundle is passphrase-protected, the password will be required to validate the component prior to import. Likewise, if the client certificate in the bundle is invalid (for example, its effective date has not yet started or has elapsed) the bundle can not be imported.

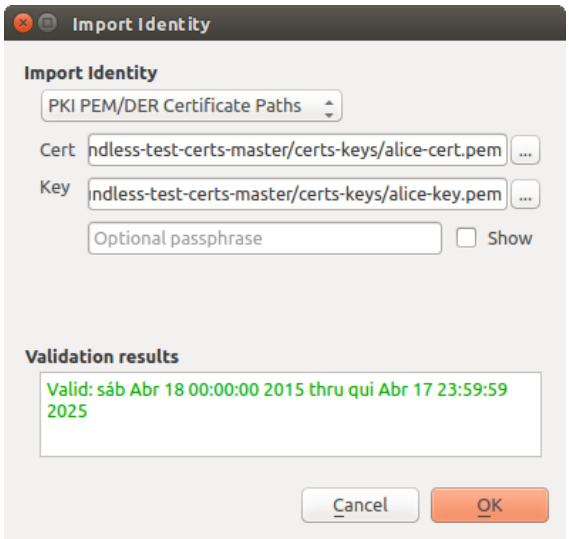


Figura21.30: PEM/DER identity import

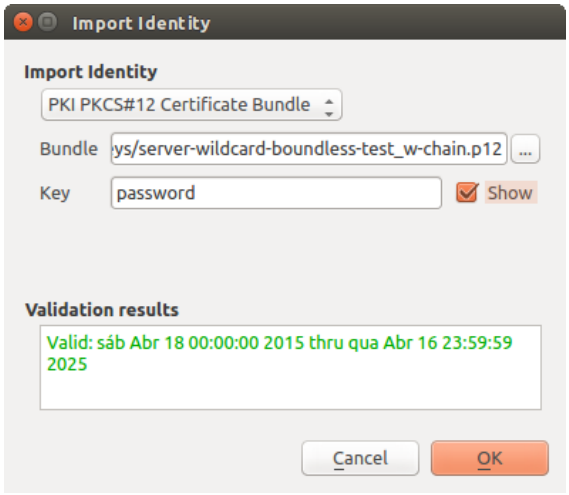


Figura21.31: PKCS#12 identity import

21.2.4 Handling bad layers

Occasionally, the authentication configuration ID that is saved with a project file is no longer valid, possibly because the current authentication database is different than when the project was last saved, or due to a credentials mismatch. In such cases the *Handle bad layers* dialog will be presented upon QGIS launch.

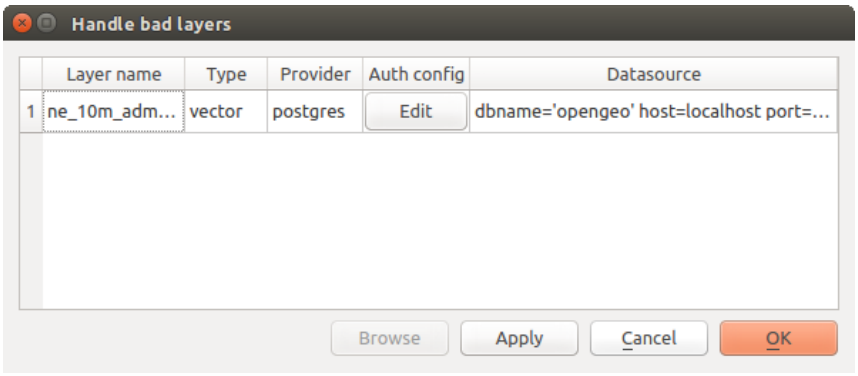


Figura21.32: Handle bad layers with authentication

If a data source is found to have an authentication configuration ID associated with it, you will be able to edit it. Doing so will automatically edit the data source string, much in the same way as opening the project file in a text editor and editing the string.

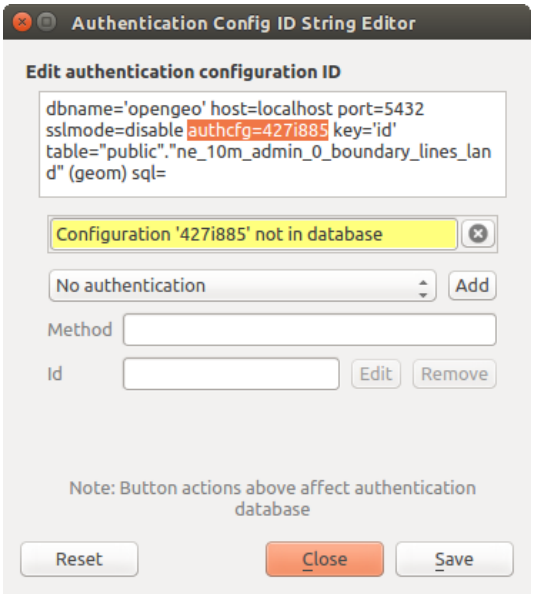


Figura21.33: Edit bad layer's authentication config ID

21.2.5 Changing authentication config ID

Occasionally, you will need to change the authentication configuration ID that is associated with accessing a resource. There are instances where this is useful:

- **Resource auth config ID is no longer valid**: This can occur when you have switched auth databases add need to *align* a new configuration to the ID already associated with a resource.
- **Shared project files**: If you intended to share projects between users, e.g. via a shared file server, you can *predefine* a 7-character (containing **a-z** and/or **0-9**) that is associated with the resource. Then, individual users change the ID of an authentication configuration that is specific to their credentials of the resource. When the project is opened, the ID is found in the authentication database, but the credentials are different per user.

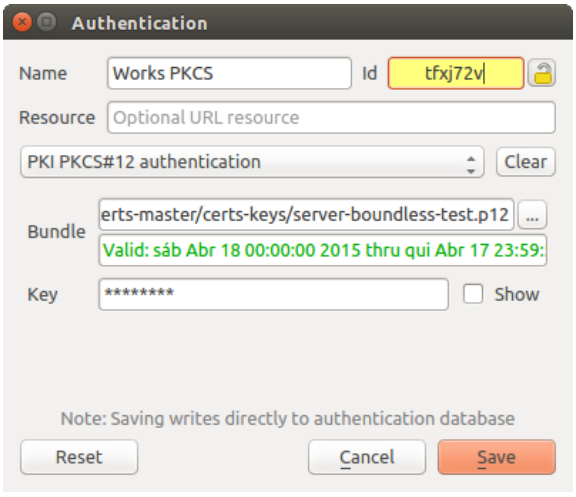


Figura21.34: Changing a layer's authentication config ID (unlocked yellow text field)

Aviso: Changing the auth config ID is considered an advanced operation and should only be done with full knowledge as to why it is necessary. This is why there is a lock button that needs clicked, to unlock the ID's text field prior to editing the ID.

21.2.6 QGIS Server support

When using a project file, with layers that have authentication configurations, as a basis for a map in QGIS Server, there are a couple of additional setup steps necessary for QGIS to load the resources:

- Authentication database needs to be available
- Authentication database's master password needs to be available

When instantiating the authentication system, Server will create or use `qgis-auth.db` file in the active *user profile*, or the directory defined by the `QGIS_AUTH_DB_DIR_PATH` environment variable. It may be that the Server's user has no HOME directory, in which case, use the environment variable to define a directory that the Server's user has read/write permissions and is not located within the web-accessible directories.

To pass the master password to Server, write it to the first line of file at a path on the file system readable by the Server processes user and defined using the `QGIS_AUTH_PASSWORD_FILE` environment variable. Ensure to limit the file as only readable by the Server's process user and to not store the file within web-accessible directories.

Nota: `QGIS_AUTH_PASSWORD_FILE` variable will be removed from the Server environment immediately after accessing.

21.2.7 SSL server exceptions

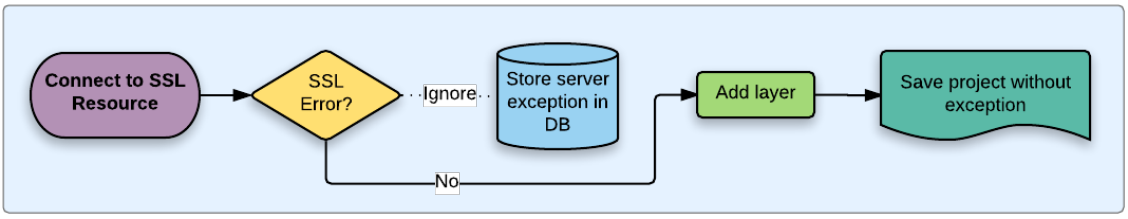


Figura21.35: SSL server exception

You can manage SSL server configurations and exceptions from the **Servers** tab in the **Authentication** section of the QGIS **Options** dialog.

Sometimes, when connecting to an SSL server, there are errors with the SSL "handshake" or the server's certificate. You can ignore those errors or create an SSL server configuration as an exception. This is similar to how web browsers allow you to override SSL errors, but with more granular control.

Aviso: You should not create an SSL server configuration unless you have complete knowledge of the entire SSL setup between the server and client. Instead, report the issue to the server administrator.

Nota: Some PKI setups use a completely different CA trust chain to validate client identities than the chain used to validate the SSL server certificate. In such circumstances, any configuration created for the connecting server will not necessarily fix an issue with the validation of your client identity, and only your client identity's issuer or server administrator can fix the issue.

You can pre-configure an SSL server configuration by clicking the button. Alternatively, you can add a configuration when an SSL error occurs during a connection and you are presented with an **SSL Error** dialog (where the error can be ignored temporarily or saved to the database and ignored):

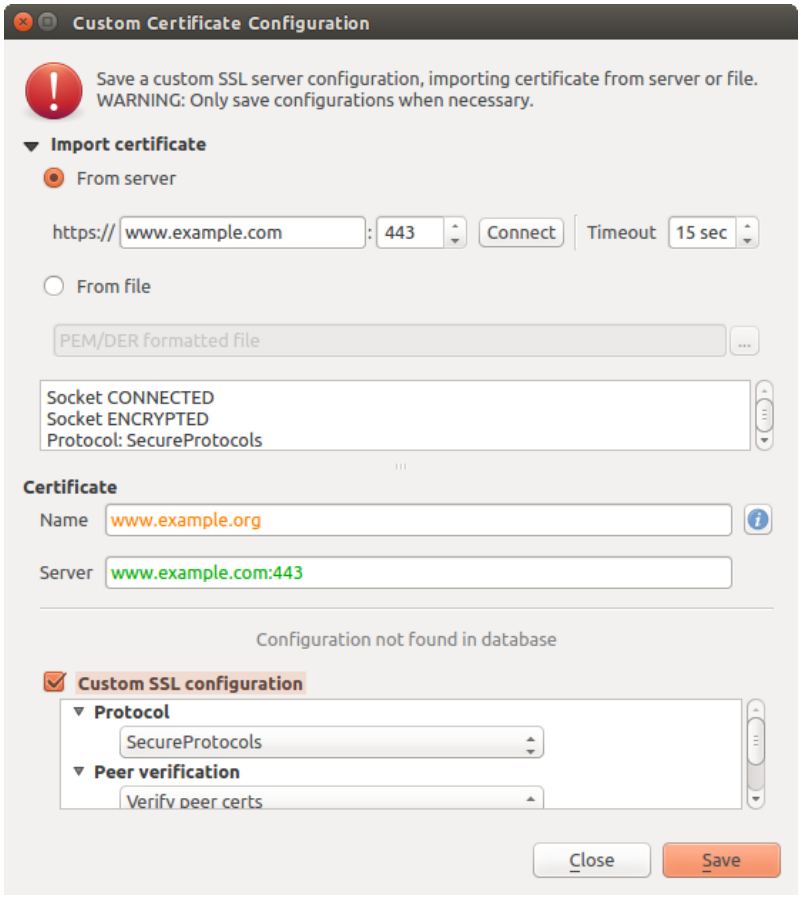


Figura21.36: Manually adding configuration

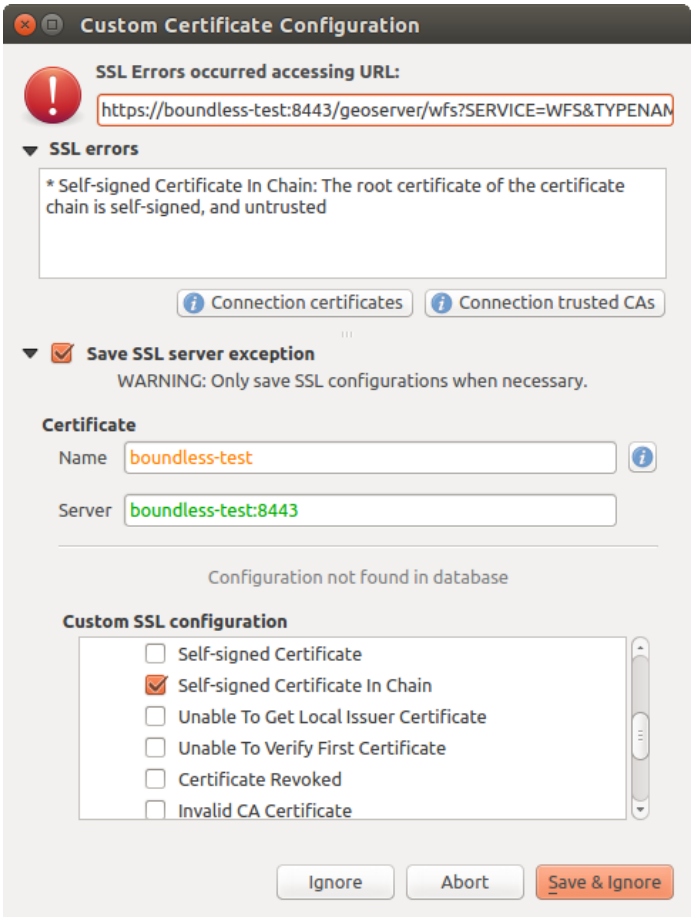


Figura21.37: Adding configuration during SSL error

Once an SSL configuration is saved to the database, it can be edited or deleted.

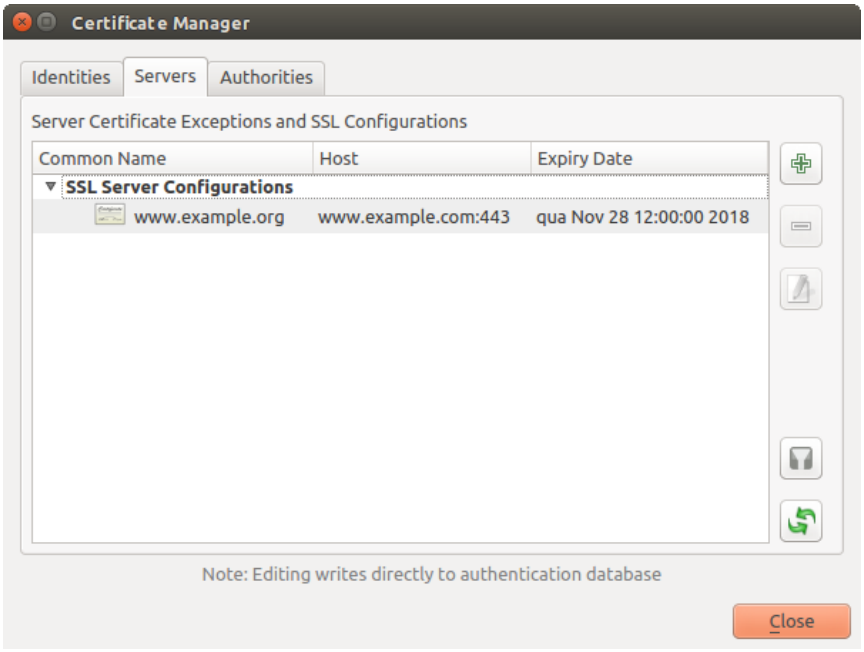


Figura21.38: Existing SSL configuration

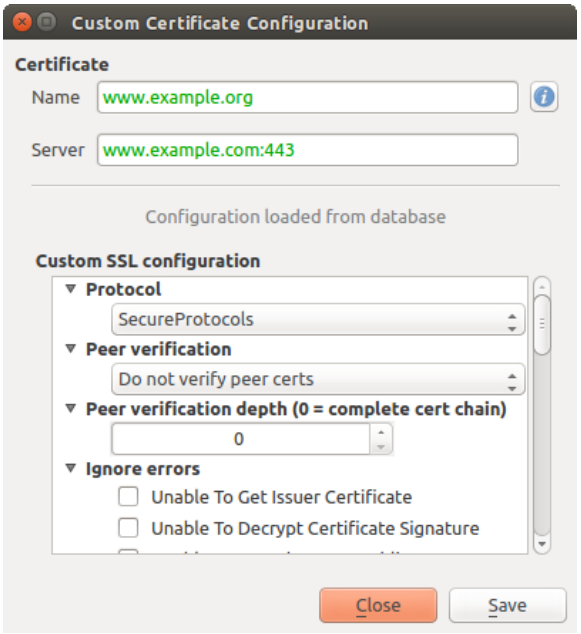


Figura21.39: Editing an existing SSL configuration

If you want to pre-configure an SSL configuration and the import dialog is not working for your server's connection, you can manually trigger a connection via the **Python Console** by running the following code (replace `https://bugreports.qt-project.org` with the URL of your server):

```
from qgis.PyQt.QtNetwork import QNetworkRequest
from qgis.PyQt.QtCore import QUrl
from qgis.core import QgsNetworkAccessManager

req = QNetworkRequest(QUrl('https://bugreports.qt-project.org'))
reply = QgsNetworkAccessManager.instance().get(req)
```

This will open an SSL error dialog if any errors occur, where you can choose to save the configuration to the database.

21.3 Security Considerations

Once the master password is entered, the API is open to access authentication configs in the authentication database, similar to how Firefox works. However, in the initial implementation, no wall against PyQGIS access has been defined. This may lead to issues where a user downloads/installs a malicious PyQGIS plugin or standalone app that gains access to authentication credentials.

The quick solution for initial release of feature is to just not include most PyQGIS bindings for the authentication system.

Another simple, though not robust, fix is to add a combobox in *Settings* ► *Options* ► *Authentication* (defaults to "never"):

```
"Allow Python access to authentication system"
Choices: [ confirm once per session | always confirm | always allow | never]
```

Such an option's setting would need to be saved in a location non-accessible to Python, e.g. the authentication database, and encrypted with the master password.

- Another option may be to track which plugins the user has specifically
- allowed to access the authentication system, though it may be tricky to deduce which plugin is actually making the call.

- Sandboxing plugins, possibly in their own virtual environments, would reduce 'cross-plugin' hacking of authentication configs from another plugin that is authorized. This might mean limiting cross-plugin communication as well, but maybe only between third-party plugins.
- Another good solution is to issue code-signing certificates to vetted plugin authors. Then validate the plugin's certificate upon loading. If need be the user can also directly set an untrusted policy for the certificate associated with the plugin using existing certificate management dialogs.
- Alternatively, access to sensitive authentication system data from Python
- could never be allowed, and only the use of QGIS core widgets, or duplicating authentication system integrations, would allow the plugin to work with resources that have an authentication configuration, while keeping master password and authentication config loading in the realm of the main app.

The same security concerns apply to C++ plugins, though it will be harder to restrict access, since there is no function binding to simply be removed as with Python.

21.3.1 Restrições

The confusing licensing and exporting issues associated with OpenSSL apply. In order for Qt to work with SSL certificates, it needs access to the OpenSSL libraries. Depending upon how Qt was compiled, the default is to dynamically link to the OpenSSL libs at run-time (to avoid the export limitations).

QCA follows a similar tactic, whereby linking to QCA incurs no restrictions, because the qca-ossl (OpenSSL) plugin is loaded at run-time. The qca-ossl plugin is directly linked to the OpenSSL libs. Packagers would be the ones needing to ensure any OpenSSL-linking restrictions are met, if they ship the plugin. Maybe. I don't really know. I'm not a lawyer.

The authentication system safely disables itself when `qca-ossl` is not found at run-time.

CAPÍTULO 22

Integração com SIG GRASS

A integração do GRASS fornece acesso aos bancos de dados e funcionalidades do GRASS GIS (veja GRASS-PROJECT em *Referências Bibliográficas e Web*). A integração consiste em duas partes: provedor e complemento. O provedor permite navegar, gerenciar e visualizar camadas raster e vetor GRASS. O complemento pode ser usado para criar novos locations e mapasets GRASS, alterar a região GRASS, criar e editar camadas vetoriais e analisar dados GRASS 2-D e 3-D com mais de 400 módulos GRASS. Nesta seção, apresentaremos as funcionalidades do provedor e do complemento e forneceremos alguns exemplos de gerenciamento e trabalho com dados GRASS.

The provider supports GRASS version 6 and 7, the plugin supports GRASS 6 and 7 (starting from QGIS 2.12). QGIS distribution may contain provider/plugin for either GRASS 6 or GRASS 7 or for both versions at the same time (binaries have different file names). Only one version of the provider/plugin may be loaded on runtime however.

22.1 Demo dataset

As an example, we will use the QGIS Alaska dataset (see section *Baixando dados de amostra*). It includes a small sample GRASS `LOCATION` with three vector layers and one raster elevation map. Create a new folder called `grassdata`, download the QGIS 'Alaska' dataset `qgis_sample_data.zip` from https://qgis.org/downloads/data/ and unzip the file into `grassdata`.

More sample GRASS `LOCATIONs` are available at the GRASS website at https://grass.osgeo.org/download/sample-data/.

22.2 Carregando camadas raster e vetorial GRASS

If the provider is loaded in QGIS, the location item with GRASS  icon is added in the browser tree under each folder item which contains GRASS location. Go to the folder `grassdata` and expand location `alaska` and mapset `demo`.

Você pode carregar as camadas raster e vetorial GRASS como qualquer outra camada do navegador, clicando duas vezes no item da camada ou arrastando e soltando na tela ou legenda do mapa.

Dica: Carregando dados GRASS

If you don't see GRASS location item, verify in *Help* ► *About* ► *Providers* if GRASS vector provider is loaded.

22.3 Importing data into a GRASS LOCATION via drag and drop

This section gives an example of how to import raster and vector data into a GRASS mapset.

1. In QGIS browser navigate to the mapset you want to import data into.
2. In QGIS browser find a layer you want to import to GRASS, note that you can open another instance of the browser (*Browser Panel (2)*) if source data are too far from the mapset in the tree.
3. Drag a layer and drop it on the target mapset. The import may take some time for larger layers, you will see animated icon in front of new layer item until the import finishes.

When raster data are in different CRS, they can be reprojected using an *Approximate* (fast) or *Exact* (precise) transformation. If a link to the source raster is created (using `r.external`), the source data are in the same CRS and the format is known to GDAL, the source data CRS will be used. You can set these options in the *Browser* tab in *Opções do GRASS*.

If a source raster has more bands, a new GRASS map is created for each layer with **.<band number>** suffix and group of all maps with icon is created. External rasters have a different icon .

22.4 Managing GRASS data in QGIS Browser

- Copying maps: GRASS maps may be copied between mapsets within the same location using drag and drop.
- Deleting maps: Right click on a GRASS map and select *Delete* from context menu.
- Renaming maps: Right click on a GRASS map and select *Rename* from context menu.

22.5 Opções do GRASS

As opções do GRASS podem ser definidas na caixa de diálogo *Opções do GRASS*, que pode ser aberta clicando com o botão direito do mouse no local ou no item do conjunto de mapas no navegador e escolhendo :guilabel:`Opções do GRASS ‘.

22.6 Iniciando o complemento GRASS

To use GRASS functionalities in QGIS, you must select and load the GRASS plugin using the Plugin Manager. To do this, go to the menu *Plugins* ► *Manage and Install Plugins…*, select *GRASS* and click *OK*.

The following main features are provided with the GRASS menu (*Plugins* ► *GRASS*) when you start the GRASS plugin:

- Open Mapset
- New Mapset
- Close Mapset
- Open GRASS Tools
- Display Current GRASS Region
- GRASS Options

22.7 Abrindo o mapset GRASS

A GRASS mapset must be opened to get access to GRASS Tools in the plugin (the tools are disabled if no mapset is open). You can open a mapset from the browser: right click on mapset item and then choose *Open mapset* from context menu.

22.8 Localização e MAPSET GRASS

GRASS data are stored in a directory referred to as GISDBASE. This directory, often called `grassdata`, must be created before you start working with the GRASS plugin in QGIS. Within this directory, the GRASS GIS data are organized by projects stored in subdirectories called `LOCATIONs`. Each `LOCATION` is defined by its coordinate system, map projection and geographical boundaries. Each `LOCATION` can have several `MAPSETs` (subdirectories of the `LOCATION`) that are used to subdivide the project into different topics or subregions, or as workspaces for individual team members (see Neteler & Mitasova 2008 in *Referências Bibliográficas e Web*). In order to analyse vector and raster layers with GRASS modules, you generally have to import them into a GRASS `LOCATION`. (This is not strictly true – with the GRASS modules `r.external` and `v.external` you can create read-only links to external GDAL/OGR-supported datasets without importing them. This is not the usual way for beginners to work with GRASS, therefore this functionality will not be described here.)

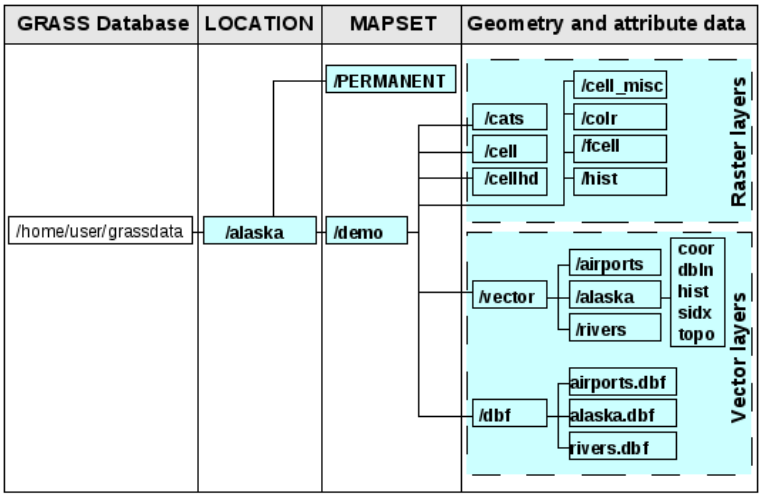


Figura22.1: Dados GRASS em LOCATION alaska

22.9 Importando dados para uma localização GRASS

See section *Importing data into a GRASS LOCATION via drag and drop* to find how data can be easily imported by dragging and dropping in the browser.

This section gives an example of how to import raster and vector data into the 'alaska' GRASS `LOCATION` provided by the QGIS 'Alaska' dataset in traditional way, using standard GRASS modules. Therefore, we use the landcover raster map `landcover.img` and the vector GML file `lakes.gml` from the QGIS 'Alaska' dataset (see *Baixando dados de amostra*).

1. Inicie o QGIS e verifique se o complemento GRASS está carregado.
2. In the GRASS toolbar, click the Open MAPSET icon to bring up the *MAPSET* wizard.
3. Select as GRASS database the folder `grassdata` in the QGIS Alaska dataset, as `LOCATION` 'alaska', as `MAPSET` 'demo' and click *OK*.
4. Now click the Open GRASS tools icon. The GRASS Toolbox (see section *Ferramentas GRASS*) dialog appears.

5. Para importar o mapa raster: arquivo: *landcover.img*, clique no módulo: arquivo:` r.in.gdal` no: guilabel: guia módulos em árvore. Este módulo GRASS permite importar arquivos raster GDAL que suporta GRASS: arquivo: 'local'. O módulo para: arquivo: *aparece r.in.gdal*.
6. Navegue até a pasta `raster` no conjunto de dados QGIS 'Alaska' e selecione o arquivo `landcover.img`.
7. As raster output name, define `landcover_grass` and click *Run*. In the *Output* tab, you see the currently running GRASS command `r.in.gdal -o input=/path/to/landcover.img output=landcover_grass`.
8. When it says **Successfully finished**, click *View Output*. The `landcover_grass` raster layer is now imported into GRASS and will be visualized in the QGIS canvas.
9. Para importar o arquivo vetorial GML: arquivo *lakes.gml*, clique no módulo: arquivo:` v.in.ogr` no: guilabel: *módulos em árvores*. Este módulo GRASS permite importar arquivos vetoriais OGR apoiados na GRASS: arquivo: *local*. A caixa de diálogo para o arquivo *aparece v.in.ogr*.
10. Browse to the folder `gml` in the QGIS 'Alaska' dataset and select the file `lakes.gml` as OGR file.
11. As vector output name, define `lakes_grass` and click *Run*. You don't have to care about the other options in this example. In the *Output* tab you see the currently running GRASS command `v.in.ogr -o dsn=/path/to/lakes.gml output=lakes\_grass`.
12. When it says **Succesfully finished**, click *View Output*. The `lakes_grass` vector layer is now imported into GRASS and will be visualized in the QGIS canvas.

22.9.1 Criando uma nova Localização GRASS

As an example, here is the sample GRASS `LOCATION alaska`, which is projected in the Albers Equal Area projection using feet as units. This sample GRASS `LOCATION alaska` will be used for all examples and exercises in the following GRASS-related sections. It is useful to download and install the dataset on your computer (see *Baixando dados de amostra*).

1. Inicie o QGIS e verifique se o complemento GRASS está carregado.
2. Visualize o shapefile `alaska.shp` (veja a seção *Loading a layer from a file*) do conjunto de dados do QGIS Alaska (veja *Baixando dados de amostra*).
3. In the GRASS toolbar, click on the  New mapset icon to bring up the *MAPSET* wizard.
4. Select an existing GRASS database (GISDBASE) folder `grassdata`, or create one for the new `LOCATION` using a file manager on your computer. Then click *Next*.
5. We can use this wizard to create a new `MAPSET` within an existing `LOCATION` (see section *Adicionando um novo MAPSET*) or to create a new `LOCATION` altogether. Select *Create new location* (see Fig.22.2).
6. Digite um nome para `LOCATION` – usamos 'alaska' - e clique em *Próximo*.
7. Define the projection by clicking on the radio button  *Projection* to enable the projection list.
8. We are using Albers Equal Area Alaska (feet) projection. Since we happen to know that it is represented by the EPSG ID 2964, we enter it in the search box. (Note: If you want to repeat this process for another `LOCATION` and projection and haven't memorized the EPSG ID, click on the  CRS Status icon in the lower right-hand corner of the status bar (see section *Trabalhando com Projeções*)).
9. Na *Filtro*, insira 2964 para selecionar a projeção.
10. Haz clic en *Siguiente*.
11. To define the default region, we have to enter the `LOCATION` bounds in the north, south, east, and west directions. Here, we simply click on the button *Set Current QGIS Extent*, to apply the extent of the loaded layer `alaska.shp` as the GRASS default region extent.
12. Haz clic en *Siguiente*.

13. We also need to define a MAPSET within our new LOCATION (this is necessary when creating a new LOCATION). You can name it whatever you like - we used 'demo'. GRASS automatically creates a special MAPSET called PERMANENT, designed to store the core data for the project, its default spatial extent and coordinate system definitions (see Neteler & Mitasova 2008 in *Referências Bibliográficas e Web*).
14. Check out the summary to make sure it's correct and click *Finish*.
15. O novo: arquivo 'LOCALIZAÇÃO': 'Alaska', e dois: arquivos: *CONJUNTO DE MAPAS*, demonstração e" permanente ", são criados. O conjunto de trabalho aberto no momento é 'demonstração', como você definiu.
16. Note que algumas das ferramentas na barra de ferramentas GRASS que foram desativadas estão agora habilitadas.

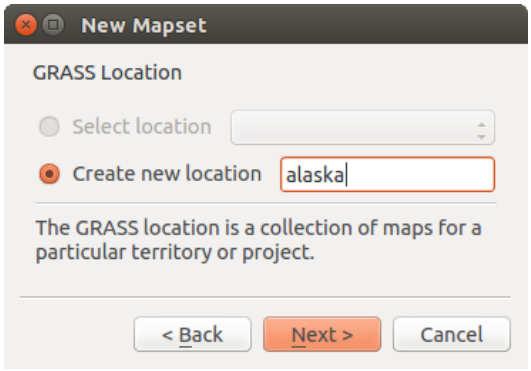


Figura22.2: Creating a new GRASS LOCATION or a new MAPSET in QGIS

If that seemed like a lot of steps, it's really not all that bad and a very quick way to create a LOCATION. The LOCATION 'alaska' is now ready for data import (see section *Importando dados para uma localização GRASS*). You can also use the already-existing vector and raster data in the sample GRASS LOCATION 'alaska', included in the QGIS 'Alaska' dataset *Baixando dados de amostra*, and move on to section *O modelo de dados vetorial do GRASS*.

22.9.2 Adicionando um novo MAPSET

A user has write access only to a GRASS MAPSET which he or she created. This means that besides access to your own MAPSET, you can read maps in other users' MAPSETs (and they can read yours), but you can modify or remove only the maps in your own MAPSET.

Todos: arquivos: 'CONJUNTO DE MAPAS' inclui um arquivo 'WIND' que armazena as coordenadas dos valores e a resolução selecionada (ver Neteler & Mitasova de 2008, em: ref:` literatura web` e seção: ref: *sec_regiao_grass*) .

1. Inicie o QGIS e verifique se o complemento GRASS está carregado.
2. In the GRASS toolbar, click on the  New mapset icon to bring up the *MAPSET* wizard.
3. Selecione a pasta do banco de dados GRASS (GISDBASE): arquivo *grassdata* com o arquivo:` local` 'Alaska', onde queremos adicionar mais um: arquivo: *CONJUNTO DE MAPAS* chamado 'teste'.
4. Haz clic en *Siguiente*.
5. We can use this wizard to create a new MAPSET within an existing LOCATION or to create a new LOCATION altogether. Click on the radio button  *Select location* (see Fig.22.2) and click *Next*.
6. Enter the name `test` for the new MAPSET. Below in the wizard, you see a list of existing MAPSETs and corresponding owners.
7. Click *Next*, check out the summary to make sure it's all correct and click *Finish*.

22.10 O modelo de dados vetorial do GRASS

It is important to understand the GRASS vector data model prior to digitizing. In general, GRASS uses a topological vector model. This means that areas are not represented as closed polygons, but by one or more boundaries. A boundary between two adjacent areas is digitized only once, and it is shared by both areas. Boundaries must be connected and closed without gaps. An area is identified (and labelled) by the **centroid** of the area.

Além de limites e centróides, um mapa vetor também pode conter pontos e linhas. Todos estes elementos de geometria podem ser misturados em um vetor e será representado em diferentes 'camadas' dentro de um GRASS vetor. Então, no GRASS, uma camada não é um vetor ou raster, mas um nível dentro de uma camada vetorial. Isso é importante para distinguir cuidadosamente. (Embora seja possível misturar elementos de geometria, é incomum e, mesmo no GRASS, utilizado somente em casos especiais, tais como rede de análise vetorial. Normalmente, você deve preferir armazenar diferentes elementos geométricos em diferentes camadas.)

É possível armazenar várias "camadas" em um conjunto de dados vetoriais. Por exemplo, campos, florestas e lagos pode ser armazenado em um vetor. Uma floresta adjacente e um lago podem compartilhar o mesmo limite, mas eles têm tabelas de atributos separados. Também é possível fixar atributos limites. Um exemplo pode ser o caso em que a fronteira entre um lago e uma floresta é um caminho, para que ele possa ter uma tabela de atributos diferentes.

A "camada" do recurso é definido pela "camada" dentro do GRASS. 'Camada' é o número que define, se houver mais do que uma camada interior do conjunto de dados (por exemplo, se a geometria for uma floresta ou lago). Por enquanto, ele pode ser apenas um número. No futuro, o GRASS também apoiará nomes como campos na interface do usuário.

Os atributos podem ser armazenados dentro do GRASS `LOCATION` como dBase, SQLite3 ou em tabelas externas de banco de dados, por exemplo, PostgreSQL, MySQL, Oracle, etc.

Atributos em tabelas de base de dados estão ligados a elementos geométricos usando um valor 'categoria'.

'Categoria' (chave, ID) é um número inteiro ligado a geometrias primitivas, e que é usada como ligação a uma coluna chave na tabela de base de dados.

Dica: Aprendendo um Modelo Vetor GRASS

The best way to learn the GRASS vector model and its capabilities is to download one of the many GRASS tutorials where the vector model is described more deeply. See https://grass.osgeo.org/documentation/manuals/ for more information, books and tutorials in several languages.

22.11 Criando uma nova camada vetorial GRASS

To create a new GRASS vector layer, select one of following items from mapset context menu in the browser:

- New Point Layer
- New Line Layer
- New Polygon Layer

and enter a name in the dialog. A new vector map will be created and layer will be added to canvas and editing started. Selecting type of the layer does not restrict geometry types which can be digitized in the vector map. In GRASS, it is possible to organize all sorts of geometry types (point, line and polygon) in one vector map. The type is only used to add the layer to the canvas, because QGIS requires a layer to have a specific type.

It is also possible to add layers to existing vector maps selecting one of the items described above from context menu of existing vector map.

In GRASS, it is possible to organize all sorts of geometry types (point, line and area) in one layer, because GRASS uses a topological vector model, so you don't need to select the geometry type when creating a new GRASS vector. This is different from shapefile creation with QGIS, because shapefiles use the Simple Feature vector model (see section *Creating new vector layers*).

22.12 Digitalizando e editando uma camada vetorial GRASS

As camadas de vetor GRASS podem ser digitalizadas usando as ferramentas de digitalização QGIS padrão. No entanto, existem algumas particularidades que você deve conhecer devido a

- GRASS topological model versus QGIS simple feature
- complexity of GRASS model
  - multiple layers in single maps
  - multiple geometry types in single map
  - geometry sharing by multiple features from multiple layers

The particularities are discussed in the following sections.

Save, discard changes, undo, redo

> **Aviso:** All the changes done during editing are immediately written to vector map and related attribute tables.

Changes are written after each operation, it is however, possible to do undo/redo or discard all changes when closing editing. If undo or discard changes is used, original state is rewritten in vector map and attribute tables.

There are two main reasons for this behaviour:

- It is the nature of GRASS vectors coming from conviction that user wants to do what he is doing and it is better to have data saved when the work is suddenly interrupted (for example, blackout)
- A necessidade de edição eficaz dos dados topológicos é uma informação visualizada sobre a correção topológica; essas informações só podem ser adquiridas no mapa vetorial GRASS se as alterações forem gravadas no mapa.

Barra de Ferramentas

The 'Digitizing Toolbar' has some specific tools when a GRASS layer is edited:

Ícone	Ferramenta	Propósito
	Novo Ponto	Digitaliza novo ponto
	Nova Linha	Digitaliza nova linha
	Nova Fronteira	Digitize new boundary
	Novo Centróide	Digitaliza novo centróide (etiqueta da área existente)
	New Closed Boundary	Digitalizar novo limite fechado

Table GRASS Digitizing: GRASS Digitizing Tools

Dica: Digitalizando polígonos no GRASS

If you want to create a polygon in GRASS, you first digitize the boundary of the polygon. Then you add a centroid (label point) into the closed boundary. The reason for this is that a topological vector model links the attribute information of a polygon always to the centroid and not to the boundary.

Category

Category, often called cat, is sort of ID. The name comes from times when GRASS vectors had only singly attribute "category". Category is used as a link between geometry and attributes. A single geometry may have multiple categories and thus represent multiple features in different layers. Currently it is possible to assign only one category per layer using QGIS editing tools. New features have automatically assigned new unique category, except boundaries.

Boundaries usually only form areas and do not represent linear features, it is however possible to define attributes for a boundary later, for example in different layer.

New categories are always created only in currently being edited layer.

It is not possible to assign more categories to geometry using QGIS editing, such data are properly represented as multiple features, and individual features, even from different layers, may be deleted.

Attributes

Attributes of currently edited layer can only be modified. If the vector map contains more layers, features of other layers will have all attributes set to '<not editable (layer #)>' to warn you that such attribute is not editable. The reason is, that other layers may have and usually have different set of fields while QGIS only supports one fixed set of fields per layer.

If a geometry primitive does not have a category assigned, a new unique category is automatically assigned and new record in attribute table is created when an attribute of that geometry is changed.

Dica: If you want to do bulk update of attributes in table, for example using 'Field Calculator' (*Using the Field Calculator*), and there are features without category which you don't want to update (typically boundaries), you can filter them out by setting 'Advanced Filter' to `cat is not null`.

Editing style

The topological symbology is essential for effective editing of topological data. When editing starts, a specialized 'GRASS Edit' renderer is set on the layer automatically and original renderer is restored when editing is closed. The style may be customized in layer properties 'Style' tab. The style can also be stored in project file or in separate file as any other style. If you customize the style, do not change its name, because it is used to reset the style when editing is started again.

Dica: Do not save project file when the layer is edited, the layer would be stored with 'Edit Style' which has no meaning if layer is not edited.

The style is based on topological information which is temporarily added to attribute table as field 'topo_symbol'. The field is automatically removed when editing is closed.

Dica: Não remova o campo 'topo_symbol' da tabela de atributos, isso tornaria os recursos invisíveis porque o renderizador é baseado nessa coluna.

Ajuste

To form an area, vertices of connected boundaries must have **exactly** the same coordinates. This can be achieved using snapping tool only if canvas and vector map have the same CRS. Otherwise, due conversion from map coordinates to canvas and back, the coordinate may become slightly different due to representation error and CRS transformations.

Dica: Use layer's CRS also for canvas when editing.

Limitations

Simultaneous editing of multiple layers within the same vector at the same time is not supported. This is mainly due to the impossibility of handling multiple undo stacks for a single data source.

 On Linux and macOS only one GRASS layer can be edited at time. This is due to a bug in GRASS which does not allow to close database drivers in random order. This is being solved with GRASS developers.

Dica: GRASS Edita Permissões

Você deve ser o proprietário do GRASS: arquivo: 'CONJUNTO DE MAPAS' que deseja editar. É impossível editar camadas de dados em: arquivo: 'CONJUNTO DE MAPAS' que não é seu, mesmo que você tenha permissão de gravação.

22.13 A ferramenta região GRASS

A região (definição de uma janela de trabalho espacial) no GRASS é importante para trabalhar com camadas. Análise Vetorial é, por padrão, não se limitando a quaisquer definições de região definida. Mas todos os vetores recém-criados terá a extensão espacial e a resolução da região GRASS atualmente definido, independentemente da sua extensão e da resolução original. A região GRASS atual é armazenado no: arquivo: '$ LOCAL / $ mapset / WIND', e define o norte, sul, leste e oeste como limites, o número de colunas e linhas, resolução espacial horizontal e vertical.

It is possible to switch on and off the visualization of the GRASS region in the QGIS canvas using the  Display current GRASS region button.

The region can be modified in 'Region' tab in 'GRASS Tolls' dock widget. Type in the new region bounds and resolution, and click *Apply*. If you click on *Select the extent by dragging on canvas* you can select a new region interactively with your mouse on the QGIS canvas dragging a rectangle.

O módulo GRASS: arquivo: *g.região* fornece muito mais parâmetros para definir uma medida para a região e resolução adequados para sua análise. Você pode usar esses parâmetros com as Ferramentas GRASS, descrito na seção: ref: *subseção_grass_ferramentas*.

22.14 Ferramentas GRASS

The  Open GRASS Tools box provides GRASS module functionalities to work with data inside a selected GRASS `LOCATION` and `MAPSET`. To use the GRASS Toolbox you need to open a `LOCATION` and `MAPSET` that you have write permission for (usually granted, if you created the `MAPSET`). This is necessary, because new raster or vector layers created during analysis need to be written to the currently selected `LOCATION` and `MAPSET`.

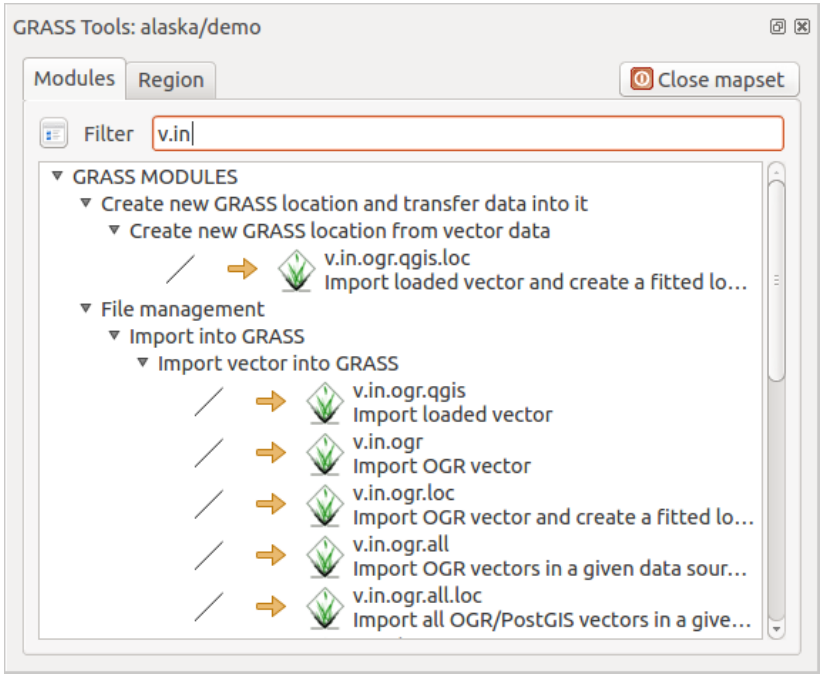


Figura22.3: GRASS Toolbox and Module Tree

22.14.1 Trabalhando com módulos GRASS

O comando GRASS dentro do GRASS Ferramentas fornece acesso a quase todos os módulos (mais de 300) grass em uma interface de linha de comando. Para oferecer um ambiente de trabalho mais amigável, cerca de 200 dos módulos GRASS disponíveis e funcionalidades também são fornecidos por gráficos dentro do plugin Ferramentas GRASS.

Uma lista completa dos módulos GRASS disponíveis na Caixa de Ferramentas gráficas na versão QGIS 3.16 está disponível no wiki do GRASS em https://grasswiki.osgeo.org/wiki/GRASS-QGIS_relevant_module_list.

Também é possível personalizar o conteúdo Ferramentas GRASS. Este procedimento é descrito na seção: ref: *sec_customizacao_ferramentas*.

As shown in Fig.22.3, you can look for the appropriate GRASS module using the thematically grouped *Modules Tree* or the searchable *Modules List* tab.

Clicando em um ícone do módulo gráfico, uma nova aba será adicionada ao diálogo da caixa de ferramentas, oferecendo três novas sub-abas :guilabel: 'Opções', :guilabel:'Saída' e :guilabel:'Manual'.

Opções

The *Options* tab provides a simplified module dialog where you can usually select a raster or vector layer visualized in the QGIS canvas and enter further module-specific parameters to run the module.

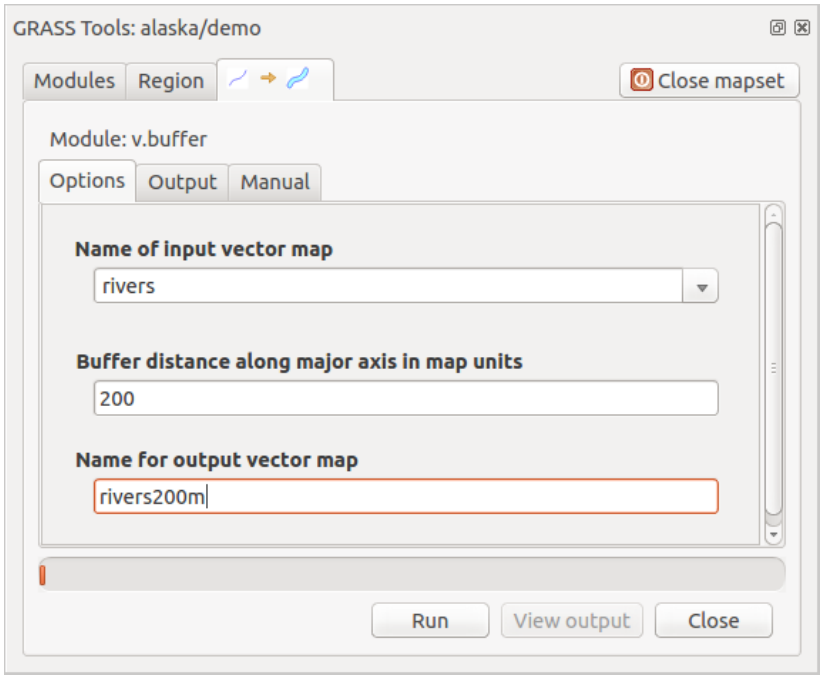


Figura22.4: Opções do módulo Caixa de Ferramentas GRASS

Os parâmetros do módulo fornecidos geralmente não estão completos para manter a caixa de diálogo simples. Se você deseja usar parâmetros e sinalizadores adicionais do módulo, é necessário iniciar o shell GRASS e executar o módulo na linha de comando.

Um novo recurso do QGIS 1.8 é o suporte ao botão *Mostrar Opções Avançadas* abaixo da caixa de diálogo do módulo simplificado na guia *Opções*. No momento, ele é adicionado apenas ao módulo `v.in.ascii` como exemplo de uso, mas provavelmente fará parte de mais ou de todos os módulos da Caixa de Ferramentas GRASS em versões futuras do QGIS. Isso permite que você use as opções completas do módulo GRASS sem a necessidade de alternar para o shell GRASS.

Saída

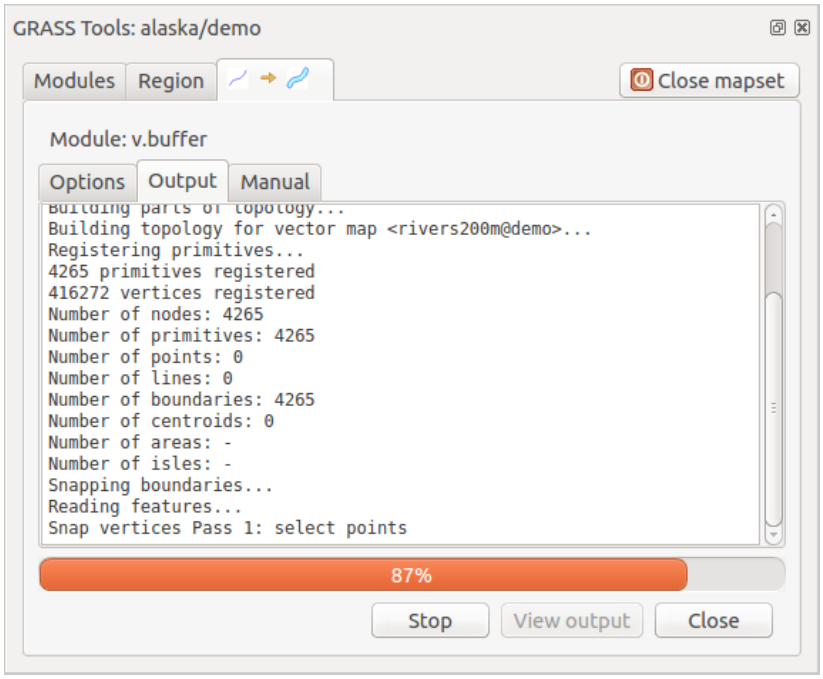


Figura22.5: GRASS Toolbox Module Output

The *Output* tab provides information about the output status of the module. When you click the *Run* button, the module switches to the *Output* tab and you see information about the analysis process. If all works well, you will finally see a `Successfully finished` message.

Manual

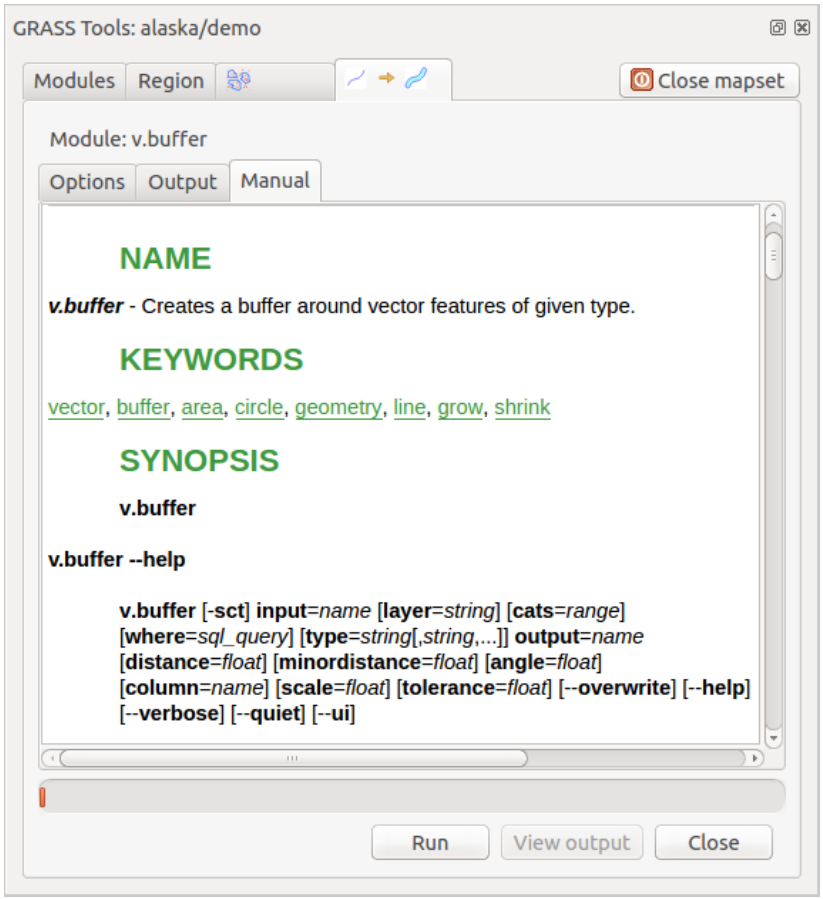


Figura22.6: GRASS Toolbox Module Manual

A: guilabel: 'Manual' mostra a página de ajuda em HTML do módulo grass. Você pode usá-lo para verificar outros parâmetros do módulo e sinalizadores ou para obter um conhecimento mais profundo sobre o objetivo do módulo. No final de cada página do manual, você vê outras ligações a: arquivo: 'Ajuda', o arquivo: 'Temática' e do: arquivo: 'Completo'. Estas ligações fornecem a mesma informação que o módulo: arquivo: *g.manual*.

Dica: Mostra Resultados Imediatamente

Se você quiser exibir os resultados de cálculo imediatamente em sua tela do mapa, você pode usar o botão "Ver Saída" na parte inferior da aba módulo.

22.14.2 Exemplos de módulos GRASS

Os exemplos seguintes demonstrarão o poder de alguns dos módulos grama.

Criando linhas de contorno

O primeiro exemplo cria um mapa de contorno vetorial de elevação (DEM). Aqui, presume-se que você tem o Alasca: arquivo: 'local' configurado como explicado na seção: ref:` sec_import_loc_data

- Primeiro, abra o local clicando no botão  Abrir mapset e escolher a localização do Alasca.
- Now open the Toolbox with the  Open GRASS tools button.
- Na lista de categorias de ferramentas, clique duas vezes no: menu: 'Raster -> Gestão de Superfície -> Gerar linhas de contorno do vetor'.
- Now a single click on the tool **r.contour** will open the tool dialog as explained above (see *Trabalhando com módulos GRASS*).
- In the *Name of input raster map* enter `gtopo30`.
- Type into the *Increment between Contour levels*  the value 100. (This will create contour lines at intervals of 100 meters.)
- Digite no :guilabel: *Nome para a saída do vetor mapa* o nome `ctour_100`.
- Click *Run* to start the process. Wait for several moments until the message `Successfully finished` appears in the output window. Then click *View Output* and *Close*.

Como se trata de uma grande região, vai demorar um pouco para exibir. Depois de terminar a renderização, você pode abrir a janela de propriedades da camada para alterar a cor da linha para que os contornos apareçam claramente sobre o raster elevação, como em: ref: *vector_properties_dialog*.

Em seguida, amplie uma pequena área montanhosa no centro do Alasca. Aproxima-se, você vai notar que os contornos têm cantos afiados. GRASS oferece a ferramenta **v.generalize** para alterar ligeiramente mapas vetoriais, mantendo sua forma original. A ferramenta usa diversos algoritmos diferentes, com finalidades diferentes. Alguns dos algoritmos (ie, Douglas Peuker e redução da Vertex) simplificam a linha removendo alguns dos vértices. O vetor resultante irá carregar mais rápido. Este processo é útil quando você tem um vetor altamente detalhado, mas você está criando um mapa muito pequena em escala, de modo que o detalhe é desnecessário.

Dica: A ferramenta simplificar

Note que o QGIS possui uma *Vetor* ► *Ferramentas de Geometria* ► *Simplificar geometrias* que funciona exatamente como o algoritmo GRASS **v.generalize** Douglas-Peuker.

No entanto, o objetivo do exemplo é diferente. As linhas de contorno criado pelo "r.contour" têm ângulos agudos que devem ser suavizadas. Entre o algoritmo ** v.generalize ** , há Chaiken que faz exatamente isso (também ranhuras de Hermite). Esteja ciente de que estes algoritmos podem ** adicionar vértices** ao vetor, fazendo-a carregar ainda mais lentamente.

- Abra o GRASS Ferramentas e clique duas vezes na categoria: menu: 'Vetor -> Desenvolver mapa -> Geral', em seguida, clique no módulo **v.generalize** para abrir a janela de opções.
- Verifique se o vetor 'ctour_100' aparece como *Nome do vetor de entrada*.
- From the list of algorithms, choose Chaiken's. Leave all other options at their default, and scroll down to the last row to enter in the field *Name for output vector map* 'ctour_100_smooth', and click *Run*.
- The process takes several moments. Once `Successfully finished` appears in the output windows, click *View Output* and then *Close*.

- É possível mudar a cor do vetor para apresentar claramente o fundo matricial e para contrastar com as linhas de contorno originais. Você notará que as novas linhas de contorno têm cantos mais suaves do que o original, enquanto permanecer fiel à forma geral de origem.



Figura22.7: Módulo GRASS v.generalize para suavizar um mapa vetorial

Dica: Outros usos para r.contour

O processo descrito acima pode ser utilizado em outras situações equivalentes. Se você tem um mapa de dados de precipitação, por exemplo, então o mesmo método será utilizado para criar um mapa de vetor de linhas (chuvas constantes).

Criando um efeito de sombreamento 3D

Vários métodos são usados para exibir as camadas de elevação e dar um efeito 3-D para mapas. O uso de curvas de nível, como mostrado acima, é um método popular, muitas vezes escolhido para produzir mapas topográficos. Outra forma de apresentar um efeito 3-D é de sombreamento. O efeito Sombra é criado a partir de um DEM (elevação) que calcula a inclinação e o aspecto de cada célula, em seguida, simula a posição do sol no céu dando um valor de reflexo para cada célula. Assim, você tem pistas virada para o sol; as encostas viradas longe do sol (na sombra) são escurecidas.

- Comece este exemplo carregando o 'raster de elevação gtopo30'. Inicie o GRASS Ferramentas, e sob a categoria Raster, clique duas vezes para abrir: menu: 'Análise espacial -> Análise do Terreno'.
- Então, clique **r.shaded.relief** para abrir o módulo.
- Change the *azimuth angle* 1,00 270 to 315.
- Enter `gtopo30_shade` for the new hillshade raster, and click *Run*.
- Quando o processo termina, adicione o raster sombreado ao mapa. Você deve vê-lo exibido em escala de cinza.
- Para visualizar tanto o sombreamento da colina e as cores do "gtopo30", mova o mapa sombreado abaixo "mapa gtopo30" na tabela de conteúdo, em seguida, abra o: menu: 'Propriedades de' `"GTOPO30", mude para o: guilabel: 'transparência': e defina seu nível de transparência a cerca de 25%.

Agora você deve ter a elevação `gtopo30` com o seu mapa de cores e configuração de transparência apresentada **acima** o tons de cinza mapa sombreado. Para ver os efeitos visuais do sombreamento, desligue o mapa `gtopo30_shade` em seguida, ligue-o novamente.

Usando a linha de comando GRASS

The GRASS plugin in QGIS is designed for users who are new to GRASS and not familiar with all the modules and options. As such, some modules in the Toolbox do not show all the options available, and some modules do not appear

at all. The GRASS shell (or console) gives the user access to those additional GRASS modules that do not appear in the Toolbox tree, and also to some additional options to the modules that are in the Toolbox with the simplest default parameters. This example demonstrates the use of an additional option in the **r.shaded.relief** module that was shown above.

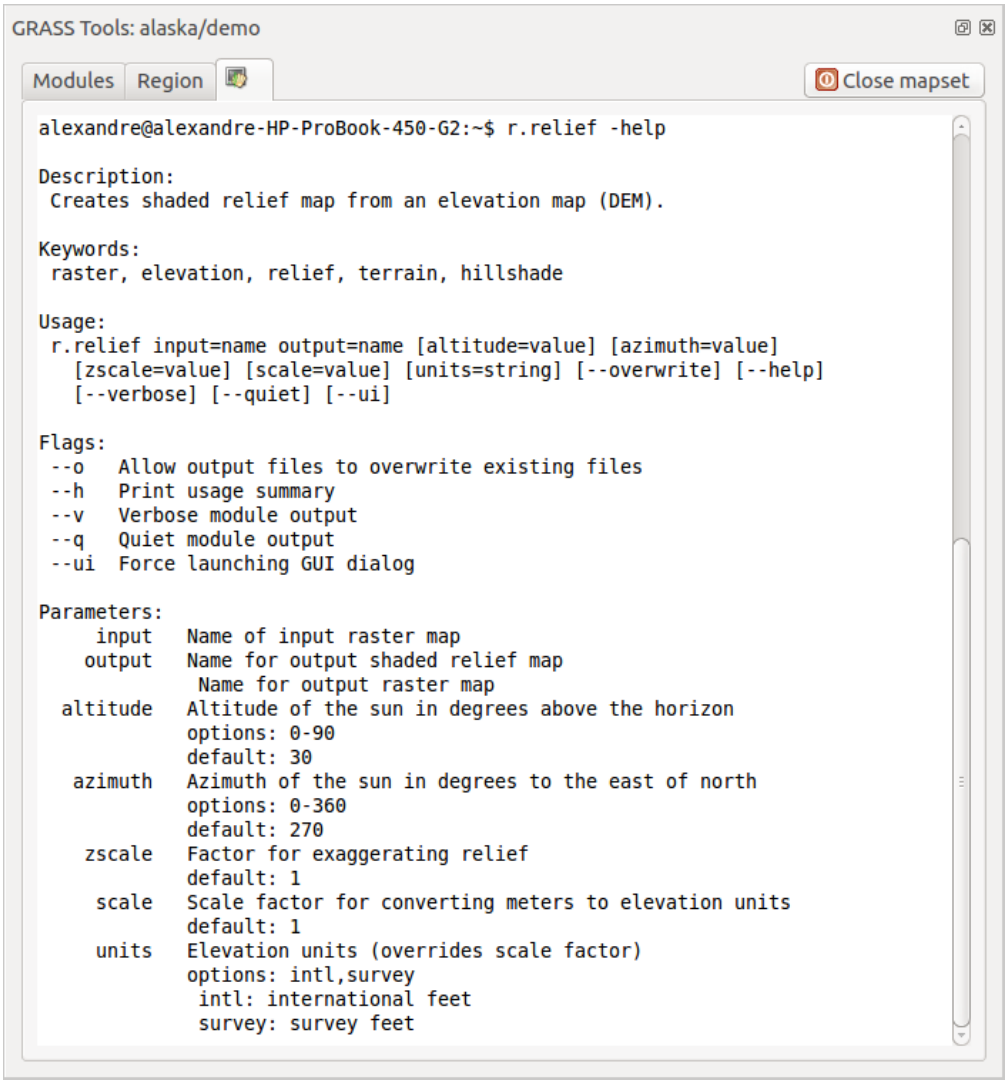


Figura22.8: The GRASS shell, r.shaded.relief module

O módulo ** r.shaded.relief ** pode ter um parâmetro “zmult”, que multiplica os valores de elevação em relação ao XY unidades de coordenadas de modo a que o efeito de sombreamento é ainda a mais usada.

- Carregue o raster de elevação `gtopo30` como acima, inicie a Caixa de Ferramentas GRASS e clique no shell GRASS. Na janela do shell, digite o comando `r.shaded.relief map=gtopo30 shade=gtopo30_shade2 azimuth=315 zmult=3` e pressione `Enter`.
- After the process finishes, shift to the *Browse* tab and double-click on the new `gtopo30_shade2` raster to display it in QGIS.
- Como explicado acima, mova o raster com o relevo sombreado abaixo da tabela de conteúdo “raster gtopo30” em seguida, verifique a transparência da “camada gtopo30” colorida. Você deverá ver que o efeito 3-D se destaca mais fortemente em relação ao primeiro mapa com relevo sombreado.

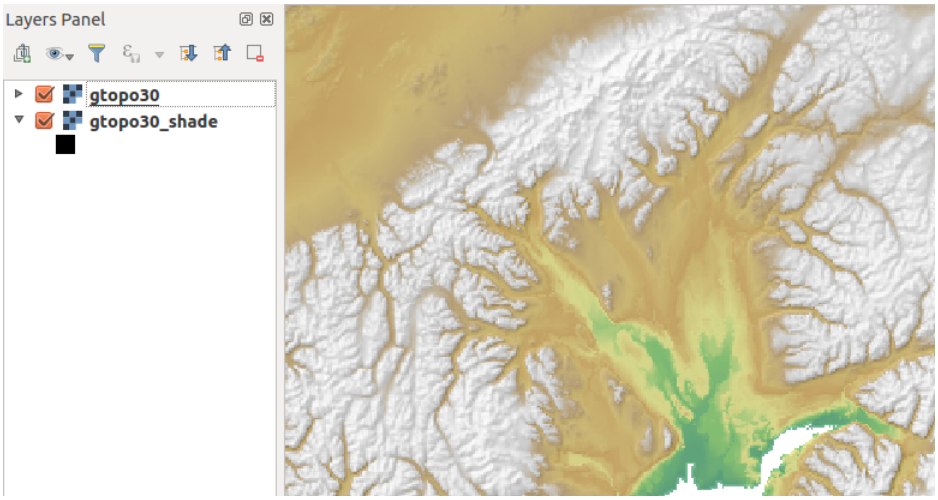


Figura22.9: Displaying shaded relief created with the GRASS module r.shaded.relief

Estatísticas Raster em um mapa vetor

O próximo exemplo mostra como um módulo GRASS pode agregar dados raster e adicionar colunas de estatísticas para cada polígono em um mapa vetor.

- Again using the Alaska data, refer to *Importando dados para uma localização GRASS* to import the `shapefiles/trees.shp` file into GRASS.
- Agora, um passo intermediário é necessária: centroides deve ser adicionado ao mapa importando as árvores para torná-lo num vetor de área de grass completo (incluindo os limites e centróide).
- Na caixa de ferramentas, escolha: menu: `Vetor -> Gerenciar recursos, e abra o módulo ** v.centroids **.
- Digite como *mapa vetor de saída* 'forest_areas' e rode o módulo.
- Now load the `forest_areas` vector and display the types of forests - deciduous, evergreen, mixed - in different colors: In the layer *Properties* window, *Symbology* tab, choose from *Legend type*  'Unique value' and set the *Classification field* to 'VEGDESC'. (Refer to the explanation of the symbology tab in *Propriedades da simbologia* of the vector section.)
- Em seguida, reabrir o GRASS Ferramentas no: menu: 'Vetor -> Atualização do Vetor' para outros mapas.
- Clique no módulo **v.rast.stats**. Digite "gtopo30" e "forest_areas".
- Only one additional parameter is needed: Enter *column prefix* `elev`, and click *Run*. This is a computationally heavy operation, which will run for a long time (probably up to two hours).
- Finalmente, abra o *"areas_floresta" na tabela de atributos, e verifique que várias novas colunas foram adicionadas, incluindo* `elev_min`, `elev_max`, `elev_média`, etc, para cada polígono florestal.

22.14.3 Personalizando a caixa de ferramentas GRASS

Quase todos os módulos de GRASS podem ser adicionados a caixa de ferramentas. Uma interface XML é fornecido para analisar os arquivos mais simples que configuram a aparência e os parâmetros dos módulos dentro da caixa de ferramentas.

Um exemplo de arquivo XML para gerar o módulo `v.buffer` (v.buffer.qgm) se parece com isto:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE qgisgrassmodule SYSTEM "http://mrcc.com/qgisgrassmodule.dtd">

<qgisgrassmodule label="Vector buffer" module="v.buffer">
```

(continua na próxima página)

(continuação da página anterior)

```
        <option key="input" typeoption="type" layeroption="layer" />
        <option key="buffer"/>
        <option key="output" />
</qgisgrassmodule>
```

The parser reads this definition and creates a new tab inside the Toolbox when you select the module. A more detailed description for adding new modules, changing a module's group, etc., can be found at https://qgis.org/en/site/getinvolved/development/addinggrasstools.html.

CAPÍTULO 23

QGIS estrutura de processamento

23.1 Introdução

This chapter introduces the QGIS processing framework, a geoprocessing environment that can be used to call native and third-party algorithms from QGIS, making your spatial analysis tasks more productive and easy to accomplish.

As a *Core plugin*, Processing is installed by default but you need to activate it:

1. Go to *Plugins* ► *Manage and install plugins…*
2. Click on the *Installed* tab at the left
3. Check the box next to the  *Processing* entry
4. Cierra el cuadro de diálogo.

   A *Processing* menu is now available in the top menu bar. From there you can reach the main components of this framework.

Nas seções seguintes, vamos analisar como usar os elementos gráficos deste quadro e tirar o máximo proveito de cada um deles.

There are four basic elements in the framework GUI, which are used to run algorithms for different purposes. Choosing one tool or another will depend on the kind of analysis that is to be performed and the particular characteristics of each user and project. All of them (except for the batch processing interface, which is called from the toolbox or the algorithm execution dialog, as we will see) can be accessed from the *Processing* menu item (you will see more entries; the remaining ones are not used to execute algorithms and will be explained later in this chapter).

- The *Toolbox*: The main element of the GUI, it is used to execute a single algorithm or run a batch process based on that algorithm.

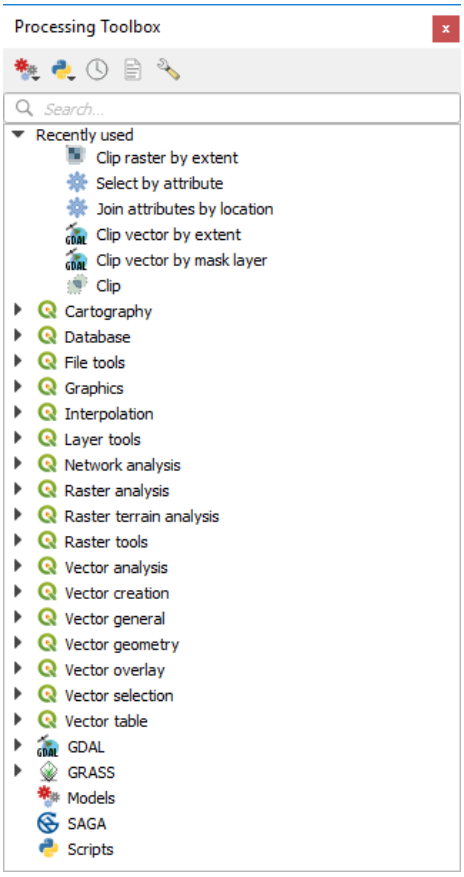


Figura23.1: Processamento

- The *Graphical Modeler*: Several algorithms can be combined graphically using the modeler to define a workflow, creating a single process that involves several subprocesses.

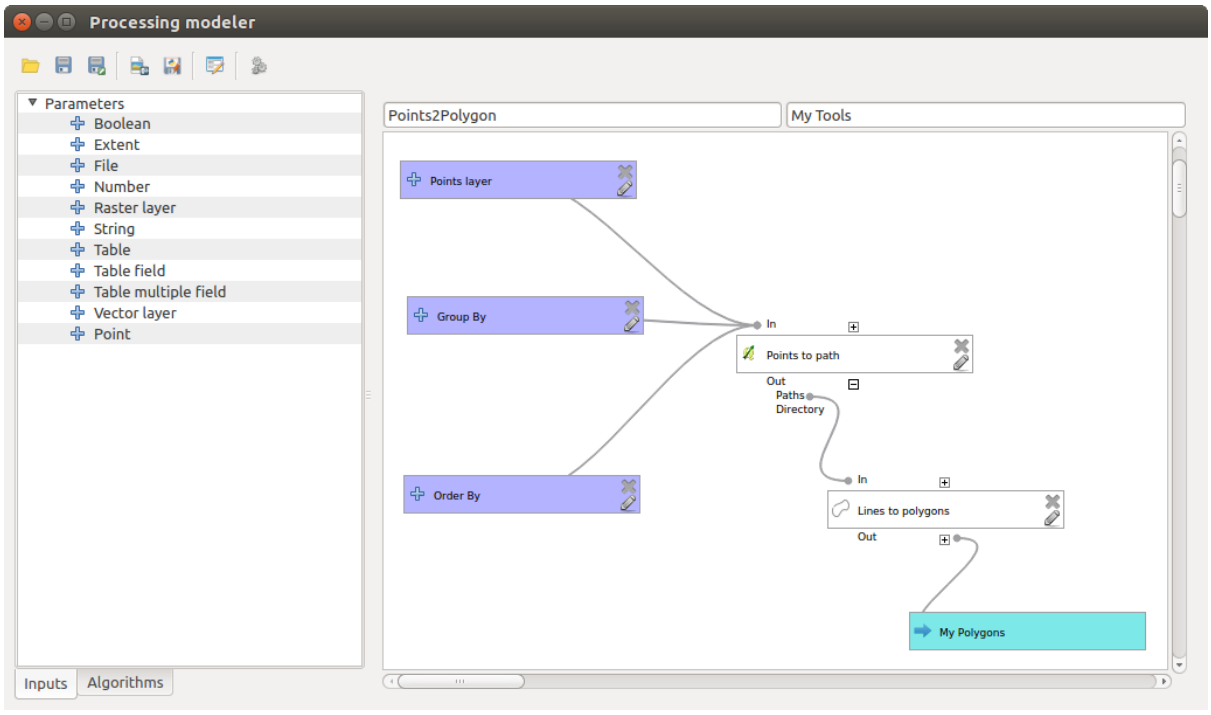


Figura23.2: Processing Modeler

- The *History* manager: All actions performed using any of the aforementioned elements are stored in a history file and can be later easily reproduced using the history manager.

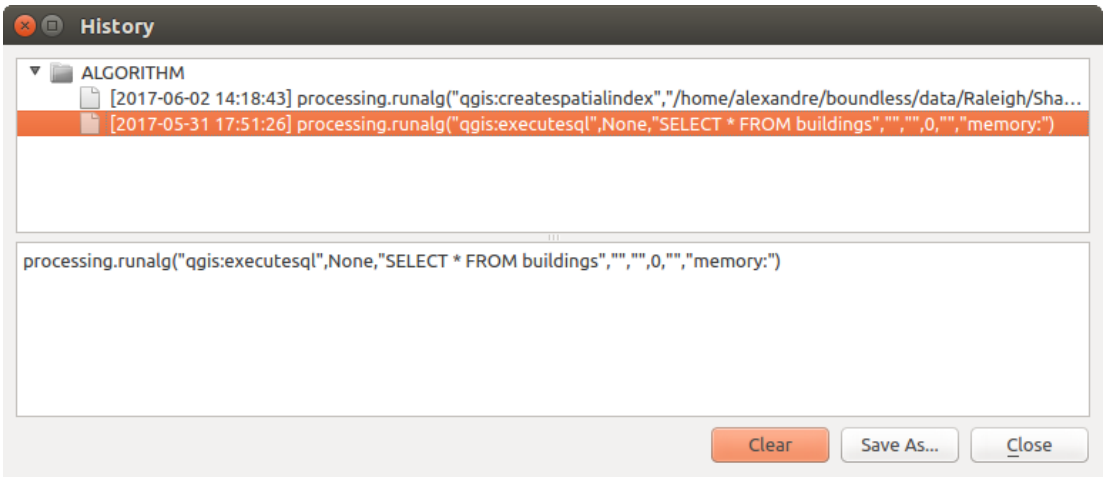


Figura23.3: Histórico de Processamento

- The *Batch Processing* interface: This interface allows you to execute batch processes and automate the execution of a single algorithm on multiple datasets.

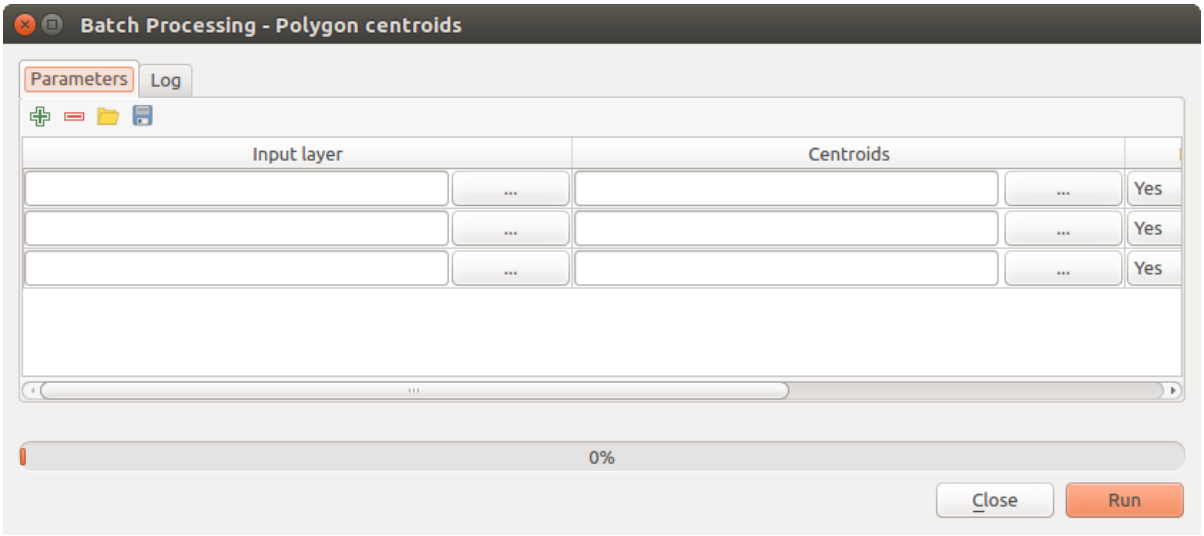


Figura23.4: Batch Processing interface

Nas seções seguintes, vamos analisar cada um desses elementos em detalhe.

23.2 Configuring the Processing Framework

The Processing Options menu (*Settings*► *Options* ► *Processing* tab) allows you to configure how algorithms work. Configuration parameters are structured in separate blocks that you can select on the left-hand side of the dialog.

The *General* block contains a number of interesting parameters.

- *Default output raster layer extension* is by default `tif`
- *Default output vector layer extension* is by default `gpkg`
- *Invalid features filtering*

- *Keep dialog open after running algorithm*. Once an algorithm has finished execution and its output layers are loaded into the QGIS project, the algorithm dialog is closed. If you want to keep it open (to run the algorithm again with different parameters, or to better check the output that is written to the log tab), check this option.
- *Max Threads*
- *Output folder*
- *Pre-execution script* and *Post-execution script*. These parameters point to files that contain scripts written using the processing scripting functionality, explained in the section covering scripting and the console.
- *Prefer output filename for layer names*. The name of each resulting layer created by an algorithm is defined by the algorithm itself. In some cases, a fixed name might be used, meaning that the same output name will be used, no matter which input layer is used. In other cases, the name might depend on the name of the input layer or some of the parameters used to run the algorithm. If this checkbox is checked, the name will be taken from the output filename instead. Notice that, if the output is saved to a temporary file, the filename of this temporary file is usually a long and meaningless one intended to avoid collision with other already existing filenames.
- *Results group name*. If you want to obtain all processing result layers in a group in the *Layers* panel, set a group name for this parameter. The group may exist already or not. QGIS will add all output layers to such a group. By default, this parameter is empty, so all output layers are added to different places in the *Layers* panel, depending on the item that is active when running an algorithm. Note that output layers will be loaded to the *Layers* panel only if *Open output file after running algorithm* is checked in the algorithm dialog.
- *Show algorithms with known issues*
- *Show layer CRS definition in selection boxes*
- *Show tooltip when there are disabled providers*
- *Style for line layers*, *Style for point layers*, *Style for polygons layers* and *Style for raster layers* are used for setting the default rendering style for output layers (that is, layers generated by processing algorithms). Just create the style you want using QGIS, save it to a file, and then enter the path to that file in the settings so the algorithms can use it. Whenever a layer is loaded by Processing and added to the QGIS canvas, it will be rendered with that style.

  Rendering styles can be configured individually for each algorithm and each one of its outputs. Just right-click on the name of the algorithm in the toolbox and select *Edit rendering styles for outputs*. You will see a dialog like the one shown next.

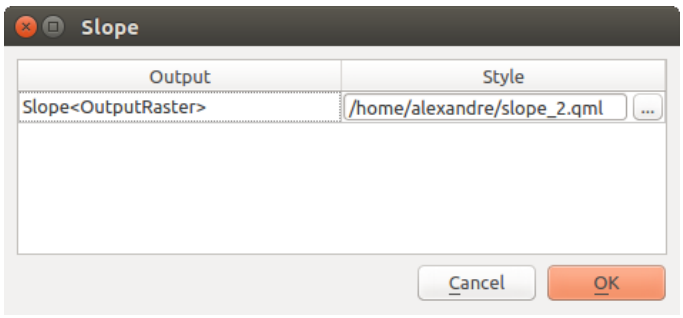


Figura23.5: Rendering Styles

  Select the style file (`.qml`) that you want for each output and press *OK*.
- *Temporary output folder path*
- *Warn before executing if parameter CRS's do not match*

You will also find a block for algorithm *Providers*. Each entry in this block contains an *Activate* item that you can use to make algorithms appear or not in the toolbox. Some algorithm providers have their own configuration items, which will be explained when covering particular algorithm providers.

23.3 The Toolbox

The *Processing Toolbox* is the main element of the processing GUI, and the one that you are more likely to use in your daily work. It shows the list of all available **algorithms** grouped in different blocks called *Providers*, and custom **models** and **scripts** you can add to extend the set of tools. Hence the toolbox is the access point to run them, whether as a single process or as a batch process involving several executions of the same algorithm on different sets of inputs.

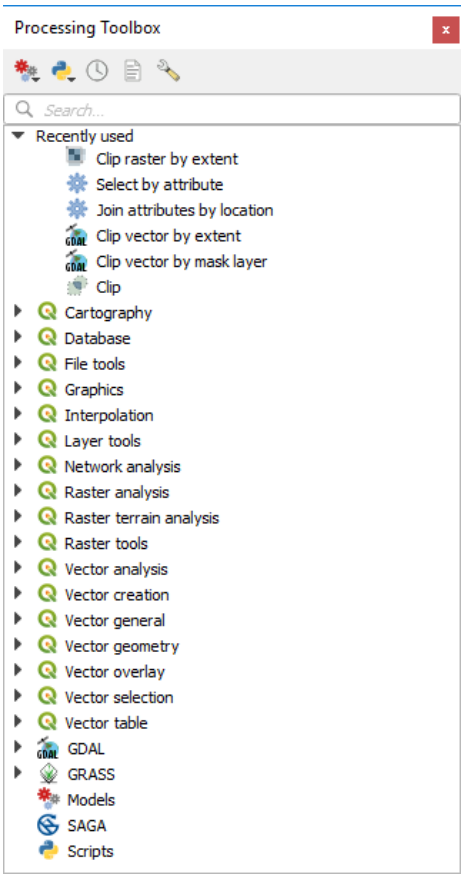


Figura23.6: Processamento

Providers can be (de)activated in the *Processing settings dialog*. By default, only providers that do not rely on third-party applications (that is, those that only require QGIS elements to be run) are active. Algorithms requiring external applications might need additional configuration. Configuring providers is explained in a *later chapter* in this manual.

In the upper part of the toolbox dialog, you will find a set of tools to:

- work with Models: *Create New Model…*, *Open Existing Model…* and *Add Model to Toolbox…*;
- work with Scripts: *Create New Script…*, *Create New Script from Template…*, *Open Existing Script…* and *Add Script to Toolbox…*;
- open the History panel;
- open the Results Viewer panel;
- toggle the toolbox to the *in-place modification mode* using the Edit Features In-Place button: only the algorithms that are suitable to be executed on the active layer without outputting a new layer are displayed;
- open the Options dialog.

Below this toolbar is a *Search...* box to help you easily find the tools you need. You can enter any word or phrase on the text box. Notice that, as you type, the number of algorithms, models or scripts in the toolbox is reduced to just those that contain the text you have entered in their names or keywords.

Nota: At the top of the list of algorithms are displayed the most recent used tools; handy if you want to reexecute any.

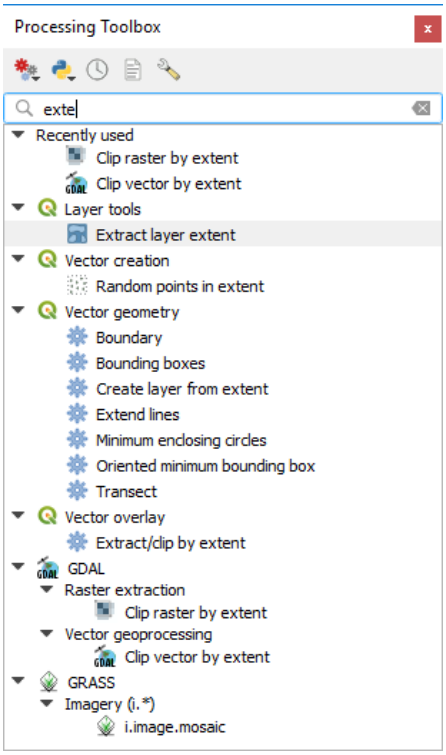


Figura23.7: Processing Toolbox showing search results

To execute a tool, just double-click on its name in the toolbox.

23.3.1 O diálogo do algoritmo

Once you double-click on the name of the algorithm that you want to execute, a dialog similar to that in the Fig.23.8 below is shown (in this case, the dialog corresponds to the `Centroids` algorithm).

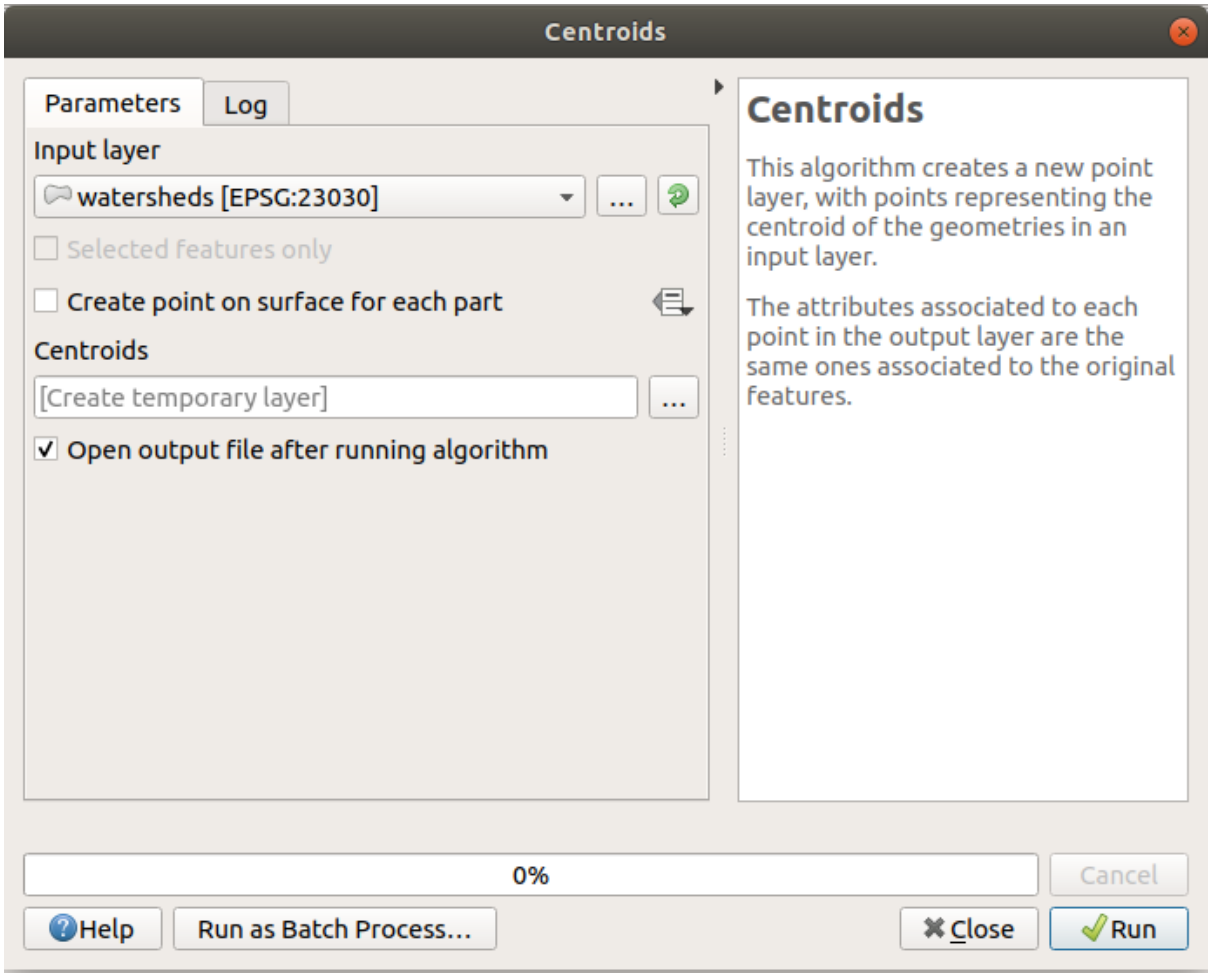


Figura23.8: Algorithm Dialog - Parameters

The dialog shows two tabs (*Parameters* and *Log*) on the left part, the algorithm description on the right, and a set of buttons at the bottom.

The *Parameters* tab is used to set the input values that the algorithm needs to be executed. It shows a list of input values and configuration parameters to be set. It of course has a different content, depending on the requirements of the algorithm to be executed, and is created automatically based on those requirements.

Embora o número e tipo de parâmetros dependerem das características do algoritmo, a estrutura é semelhante para todos eles. Os parâmetros encontrados na tabela podem ser de um dos seguintes tipos.

- A **raster layer**, to select from a list of all such layers available (currently opened) in QGIS. The selector contains as well a button on its right-hand side, to let you select filenames that represent layers currently not loaded in QGIS.
- A **vector layer**, to select from a list of all vector layers available in QGIS. Layers not loaded in QGIS can be selected as well, as in the case of raster layers, but only if the algorithm does not require a table field selected from the attributes table of the layer. In that case, only opened layers can be selected, since they need to be open so as to retrieve the list of field names available.

  You will see an iterator button by each vector layer selector, as shown in the figure below.

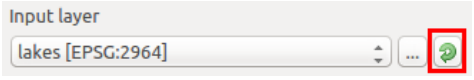


Figura23.9: Vector iterator button

Se o algoritmo contém vários deles, você será capaz de alternar apenas um deles. Se o botão que corresponde a um vetor de entrada é alternado, o algoritmo será executado de forma iterativa em cada uma de suas características, em vez de apenas uma vez para toda a camada, produzindo o maior número de saídas em vezes do algoritmo ser executado. Isto permite a automatização do processo quando todas as características de uma camada ter que ser tratada separadamente.

Nota: By default, the parameters dialog will show a description of the CRS of each layer along with its name. If you do not want to see this additional information, you can disable this functionality in the Processing Settings dialog, unchecking the *General* ► *Show layer CRS definition in selection boxes* option.

- A **table**, to select from a list of all available in QGIS. Non-spatial tables are loaded into QGIS like vector layers, and in fact they are treated as such by the program. Currently, the list of available tables that you will see when executing an algorithm that needs one of them is restricted to tables coming from files in dBase (`.dbf`) or Comma-Separated Values (`.csv`) formats.
- An **option**, to choose from a selection list of possible options.
- A **numerical value**, to be introduced in a spin box. In some contexts (when the parameter applies at the feature level and not at the layer's), you will find a  Data-defined override button by its side, allowing you to open the *expression builder* and enter a mathematical expression to generate variable values for the parameter. Some useful variables related to data loaded into QGIS can be added to your expression, so you can select a value derived from any of these variables, such as the cell size of a layer or the northernmost coordinate of another one.

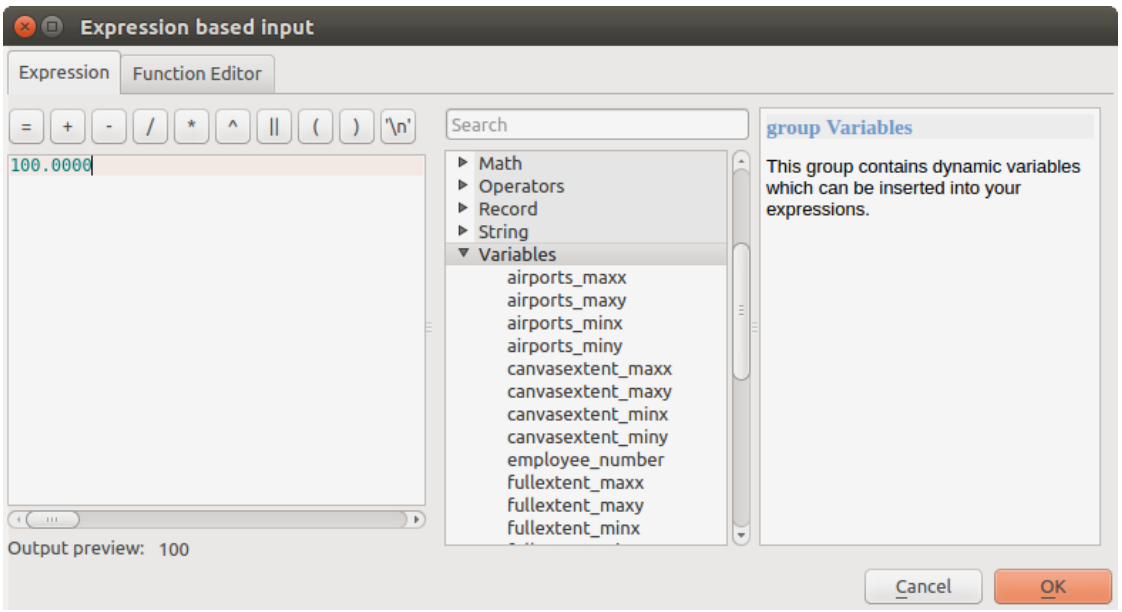


Figura23.10: Expression based input

- A **range**, with min and max values to be introduced in two text boxes.
- A **text string**, to be introduced in a text box.
- A **field**, to choose from the attributes table of a vector layer or a single table selected in another parameter.
- A **coordinate reference system**. You can select it among the recently used ones from the drop-down list or from the *CRS selection* dialog that appears when you click on the button on the right-hand side.
- An **extent**, a text box defining a rectangle through its corners coordinate in the format `xmin, xmax, ymin, ymax`. Clicking on the button on the right-hand side of the value selector, a pop-up menu will appear, giving you options to:

- *Calculate from layer*: fills the text box with the coordinates of the bounding box of a layer to select among the loaded ones
- *Use map canvas extent*
- *Draw on canvas*: the parameters window will hide itself, so you can click and drag onto the canvas. Once you have defined the extent rectangle, the dialog will reappear, containing the values in the extent text box.

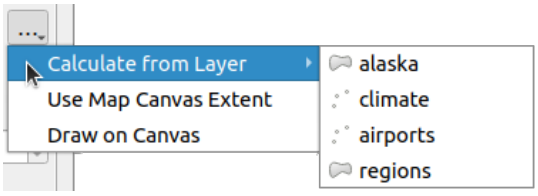


Figura23.11: Extent selector

- A **list of elements** (whether raster or vector layers, tables, fields) to select from. Click on the … button at the left of the option to see a dialog like the following one. Multiple selection is allowed and when the dialog is closed, number of selected items is displayed in the parameter text box widget.

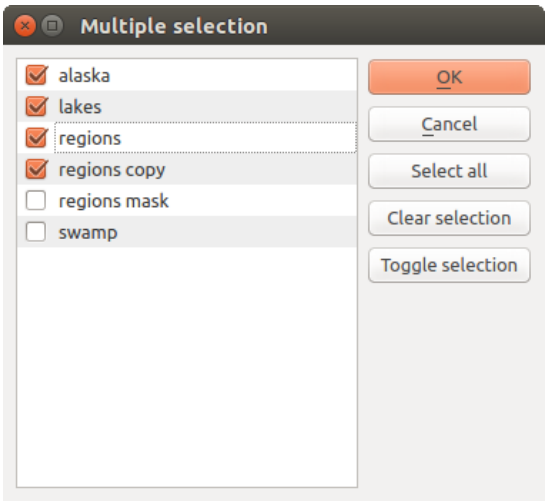


Figura23.12: Multiple Selection

- A **small table** to be edited by the user. These are used to define parameters like lookup tables or convolution kernels, among others.

  Clique no botão do lado direito para ver a tabela e editar os seus valores.

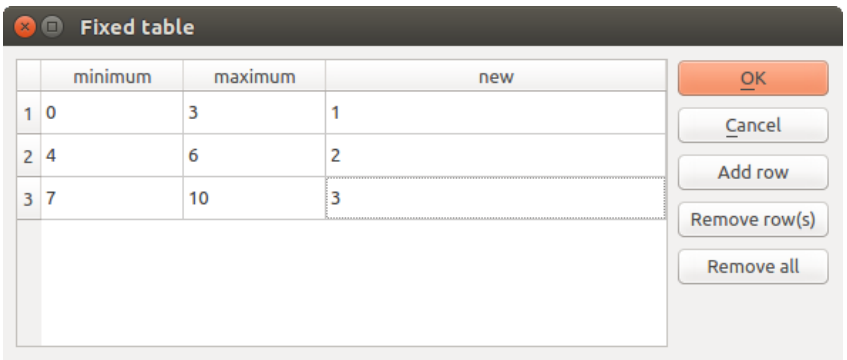


Figura23.13: Fixed Table

Dependendo do algoritmo, o número de linhas pode ser modificado ou não, utilizando os botões do lado direito da janela.

Nota: Some algorithms require many parameters to run, e.g. in the *Calculadora Raster* you have to specify manually the cell size, the extent and the CRS. You can avoid to choose all the parameters manually when the algorithm has the `Reference layers` parameter. With this parameter you can choose the reference layer and all its properties (cell size, extent, CRS) will be used.

Along with the *Parameters* tab, there is another tab named *Log* (see Fig.23.14 below). Information provided by the algorithm during its execution is written in this tab, and allow you to track the execution and be aware and have more details about the algorithm as it runs. Information on algorithm execution is also output in the *View* ► *Panels* ► *Log Messages Panel*.

Notice that not all algorithms write information to the *Log* tab, and many of them might run silently without producing any output other than the final files. Check the *Log Messages Panel* in that case.

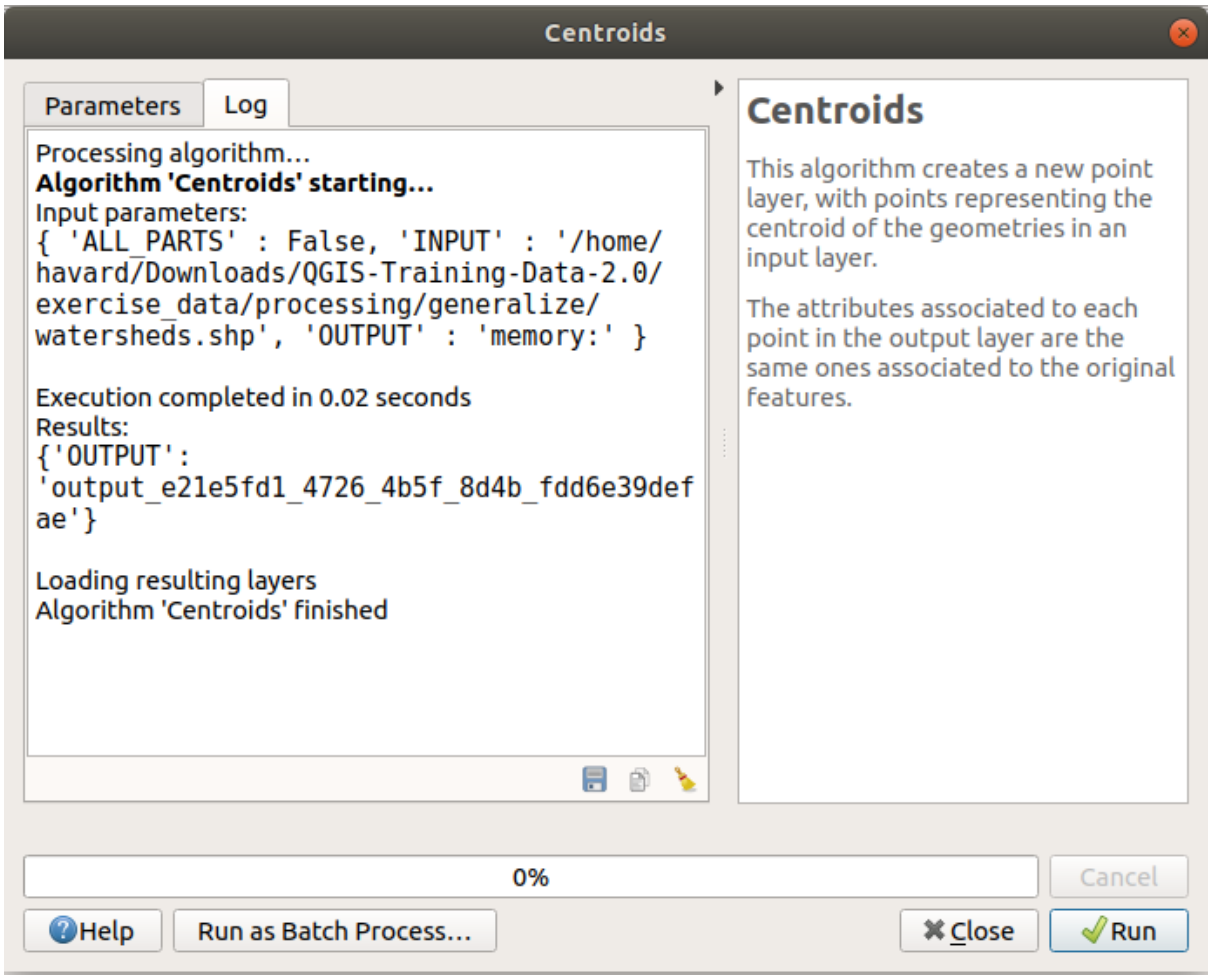


Figura23.14: Algorithm Dialog - Log

At the bottom of the *Log* tab you will find buttons to *Save Log to File*, *Copy Log to Clipboard* and *Clear Log*. These are particularly handy when you have checked the *Keep dialog open after running algorithm* in the *General* part of the Processing options.

On the right hand side of the dialog you will find a short description of the algorithm, which will help you understand its purpose and its basic ideas. If such a description is not available, the description panel will not be shown.

For a more detailed help file, which might include description of every parameter it uses, or examples, you will find

a *Help* button at the bottom of the dialog bringing you to the *Processing algorithms documentation* or to the provider documentation (for some third-party providers).

The *Run as batch process* button triggers the *batch processing mode* allowing to configure and run multiple instances of the algorithm with a variety of parameters.

Uma nota nas projeções

Processing algorithm execution are always performed in the input layer coordinate reference system (CRS). Due to QGIS's on-the-fly reprojecting capabilities, although two layers might seem to overlap and match, that might not be true if their original coordinates are used without reprojecting them onto a common coordinate system. Whenever you use more than one layer as input to a *QGIS native algorithm*, whether vector or raster, the layers will all be reprojected to match the coordinate reference system of the first input layer.

This is however less true for most of the external applications whose algorithms are exposed through the processing framework as they assume that all of the layers are already in a common coordinate system and ready to be analyzed.

By default, the parameters dialog will show a description of the CRS of each layer along with its name, making it easy to select layers that share the same CRS to be used as input layers. If you do not want to see this additional information, you can disable this functionality in the Processing settings dialog, unchecking the *Show layer CRS definition in selection boxes* option.

If you try to execute an algorithm using as input two or more layers with unmatching CRSs, a warning dialog will be shown. This occurs thanks to the *Warn before executing if layer CRS's do not match* option.

Pode continuar a executar o algoritmo, mas tenha atenção que na maioria dos casos irá produzir resultados errados, tais como, camadas vazias devido à falta de sobreposição das camadas usadas como arquivos de entrada.

Dica: Use Processing algorithms to do intermediate reprojection

When an algorithm can not successfully perform on multiple input layers due to unmatching CRSs, use QGIS internal algorithm such as *Reproject layer* to perform layers' reprojection to the same CRS before executing the algorithm using these outputs.

23.3.2 Objetos de dados gerados por algoritmos

Objetos de dados gerado por um algoritmo podem ser dos seguintes tipos:

- Uma camada raster
- Uma camada vetorial
- Uma tabela
- Um arquivo HTML (usado para arquivo de saída de texto e gráficos)

These are all saved to disk, and the parameters table will contain a text box corresponding to each one of these outputs, where you can type the output channel to use for saving it. An output channel contains the information needed to save the resulting object somewhere. In the most usual case, you will save it to a file, but in the case of vector layers, and when they are generated by native algorithms (algorithms not using external applications) you can also save to a PostGIS, GeoPackage or SpatiaLite database, or a memory layer.

To select an output channel, just click on the button on the right side of the text box, and you will see a small context menu with the available options.

In the most usual case, you will select saving to a file. If you select that option, you will be prompted with a save file dialog, where you can select the desired file path. Supported file extensions are shown in the file format selector of the dialog, depending on the kind of output and the algorithm.

The format of the output is defined by the filename extension. The supported formats depend on what is supported by the algorithm itself. To select a format, just select the corresponding file extension (or add it, if you are directly typing the file path instead). If the extension of the file path you entered does not match any of the supported formats,

a default extension will be appended to the file path, and the file format corresponding to that extension will be used to save the layer or table. Default extensions are `.dbf` for tables, `.tif` for raster layers and `.gpkg` for vector layers. These can be modified in the setting dialog, selecting any other of the formats supported by QGIS.

If you do not enter any filename in the output text box (or select the corresponding option in the context menu), the result will be saved as a *temporary file* in the corresponding default file format, and it will be deleted once you exit QGIS (take care with that, in case you save your project and it contains temporary layers).

You can set a default folder for output data objects. Go to the settings dialog (you can open it from the *Settings* ► *Options* ► *Processing* menu), and in the *General* group, you will find a parameter named *Output folder*. This output folder is used as the default path in case you type just a filename with no path (i.e., `myfile.shp`) when executing an algorithm.

Ao executar um algoritmo que usa uma camada de vetor no modo interativo, o caminho do arquivo digitado é utilizado como o caminho de base para todos os arquivos gerados, que são nomeados com o nome de base e acrescentando-se um número que representa o índice da iteração. A extensão do arquivo (e formato) é usado para todos esses arquivos gerados.

Apart from raster layers and tables, algorithms also generate graphics and text as HTML files. These results are shown at the end of the algorithm execution in a new dialog. This dialog will keep the results produced by any algorithm during the current session, and can be shown at any time by selecting *Processing* ► *Results Viewer* from the QGIS main menu.

Some external applications might have files (with no particular extension restrictions) as output, but they do not belong to any of the categories above. Those output files will not be processed by QGIS (opened or included into the current QGIS project), since most of the time they correspond to file formats or elements not supported by QGIS. This is, for instance, the case with LAS files used for LiDAR data. The files get created, but you won't see anything new in your QGIS working session.

Para todos os outros tipos de saída, você encontrará uma caixa de verificação que você pode usar para dizer o algoritmo para saber se carregará o arquivo, uma vez que é gerado pelo algoritmo ou não. Por padrão, todos os arquivos são abertos.

Optional outputs are not supported. That is, all outputs are created. However, you can uncheck the corresponding checkbox if you are not interested in a given output, which essentially makes it behave like an optional output (in other words, the layer is created anyway, but if you leave the text box empty, it will be saved to a temporary file and deleted once you exit QGIS).

23.4 Gerenciador do histórico

23.4.1 O histórico do processamento

Every time you execute an algorithm, information about the process is stored in the history manager. The date and time of the execution are saved, along with the parameters used, making it is easy to track and control all the work that has been developed using the Processing framework, and to reproduce it.

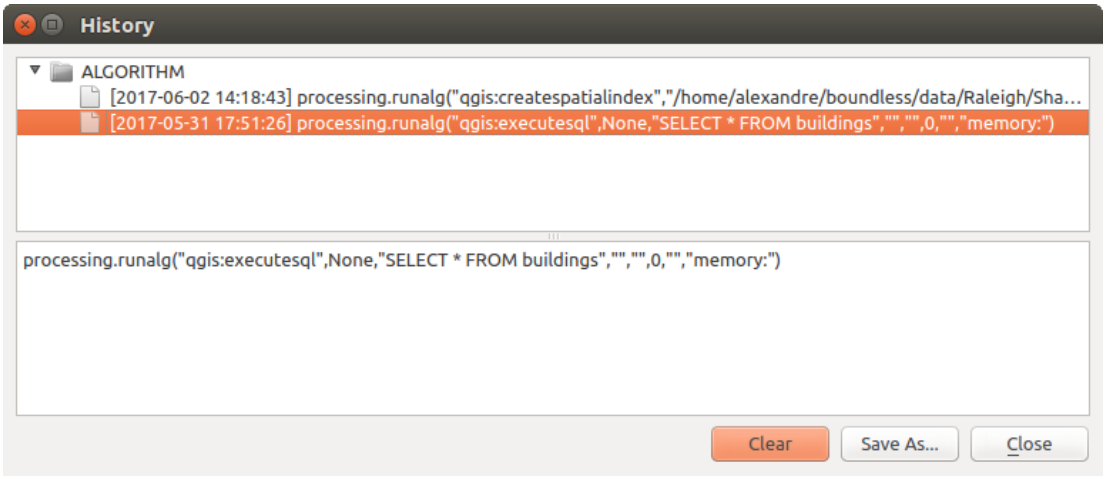


Figura23.15: History

Process information is kept as a command-line expression, even if the algorithm was launched from the toolbox. This makes it useful for those learning how to use the command-line interface, since they can call an algorithm using the toolbox and then check the history manager to see how it could be called from the command line.

Apart from browsing the entries in the registry, you can also re-execute processes by simply double-clicking on the entry. The algorithm dialog then opens with parameters already set, and you can change any of them to fit your needs and re-run the algorithm.

The *History* dialog also provides a convenient way to contribute to the consolidation of the testing infrastructure of QGIS Processing algorithms and scripts. When you right-click on an entry, you can *Create Test...* using the concerned algorithm and parameters, following instructions at https://github.com/qgis/QGIS/blob/release-3_16/python/plugins/processing/tests/README.md.

23.4.2 O log do processamento

The history dialog only contains the execution calls, but not the information produced by the algorithm when executed. That information is written to the QGIS log (*View* ► *Panels* ► *Log Messages Panel*).

Third-party algorithms are usually executed by using their command-line interfaces, which communicate with the user via the console. Although that console is not shown, usually a full dump of it is written to the log each time you run one of those algorithms. To avoid cluttering the log with that information, you can disable it for each provider in the settings dialog.

Some algorithms, even if they can produce a result with the given input data, output comments or additional information to log when they detect potential problems with the data, in order to warn you. Make sure you check those messages in the log if you get unexpected results.

23.5 O modelador gráfico

The *graphical modeler* allows you to create complex models using a simple and easy-to-use interface. When working with a GIS, most analysis operations are not isolated, rather part of a chain of operations. Using the graphical modeler, that chain of operations can be wrapped into a single process, making it convenient to execute later with a different set of inputs. No matter how many steps and different algorithms it involves, a model is executed as a single algorithm, saving time and effort.

The graphical modeler can be opened from the Processing menu (*Processing* ► *Graphical Modeler*).

The modeler has a working canvas where the structure of the model and the workflow it represents are shown. The left part of the window is a section with five panels that can be used to add new elements to the model:

1. `Model Properties`: you can specify the name of the model and the group that will contain it

2. `Inputs`: all the inputs that will shape your model
3. `Algorithms`: the Processing algorithms available
4. `Variables`: you can also define variables that will only be available in the Processing Modeler
5. `Undo History`: this panel will register everything that happens in the modeler, making it easy to cancel things you did wrong.

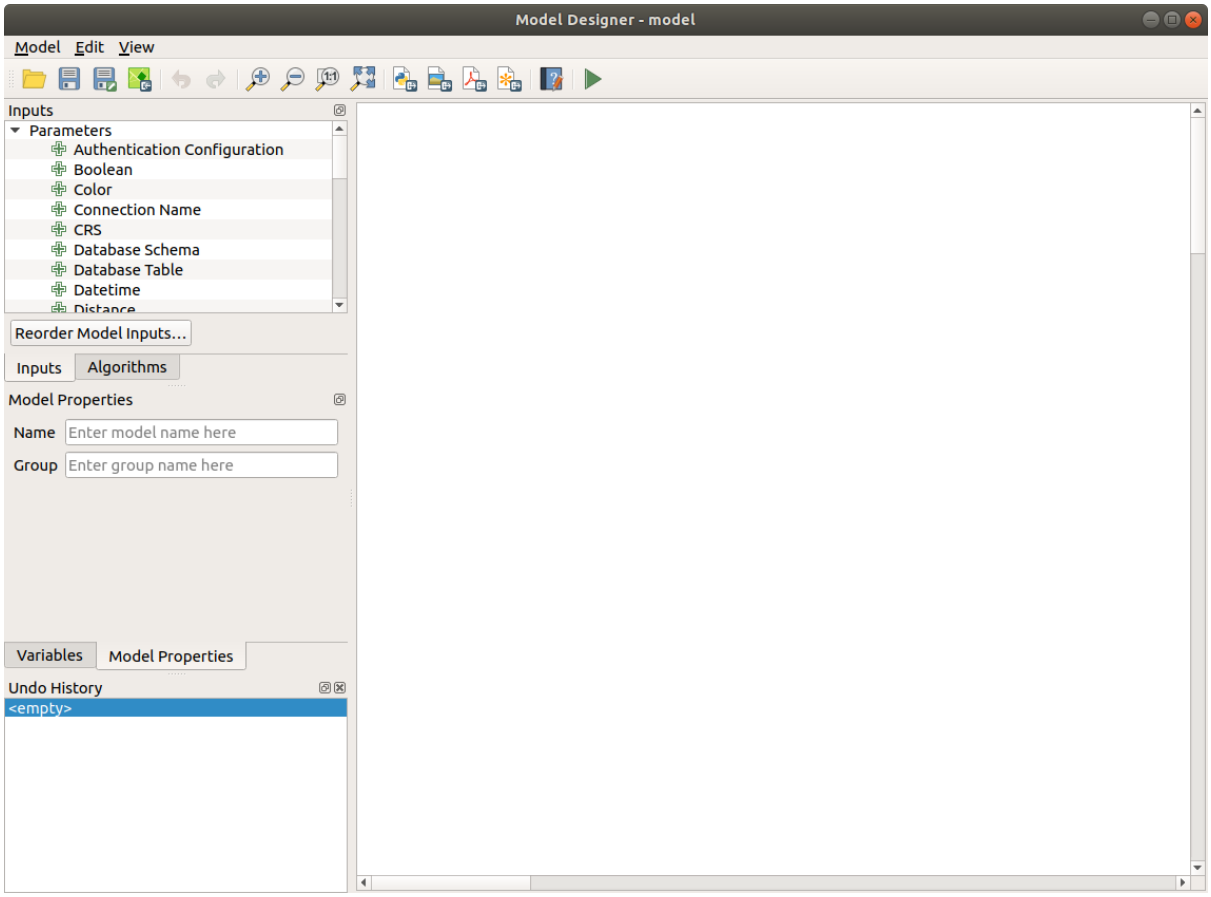


Figura23.16: Modeler

Creating a model involves two basic steps:

1. *Definition of necessary inputs*. These inputs will be added to the parameters window, so the user can set their values when executing the model. The model itself is an algorithm, so the parameters window is generated automatically as for all algorithms available in the Processing framework.
2. *Definition of the workflow*. Using the input data of the model, the workflow is defined by adding algorithms and selecting how they use the defined inputs or the outputs generated by other algorithms in the model.

23.5.1 Definição das entradas

The first step is to define the inputs for the model. The following elements are found in the *Inputs* panel on the left side of the modeler window:

- Configuração de Autenticação
- Booleano
- Cor
- Connection Name
- Coordinate Operation
- SRC
- Database Schema
- Database Table
- Datetime
- Distance
- Enum
- Expressão
- Extensão
- Field Aggregates
- Fields Mapper
- File/Folder
- Geometry
- Map Layer
- Map Theme
- Matriz
- Camada Mesh
- Multiple Input
- Número
- Ponto
- Layout de impressão
- Print Layout Item
- Intervalo
- Raster Band
- Camada Raster
- Escala
- Cadeia de texto
- TIN Creation Layers
- Vector Features
- Vector Field
- Camada Vetorial
- Vector Tile Writer Layers

Nota: Hovering with the mouse over the inputs will show a tooltip with additional information.

When double-clicking on an element, a dialog is shown that lets you define its characteristics. Depending on the parameter, the dialog will contain at least one element (the description, which is what the user will see when executing the model). For example, when adding a numerical value, as can be seen in the next figure, in addition to the description of the parameter, you have to set a default value and the range of valid values.

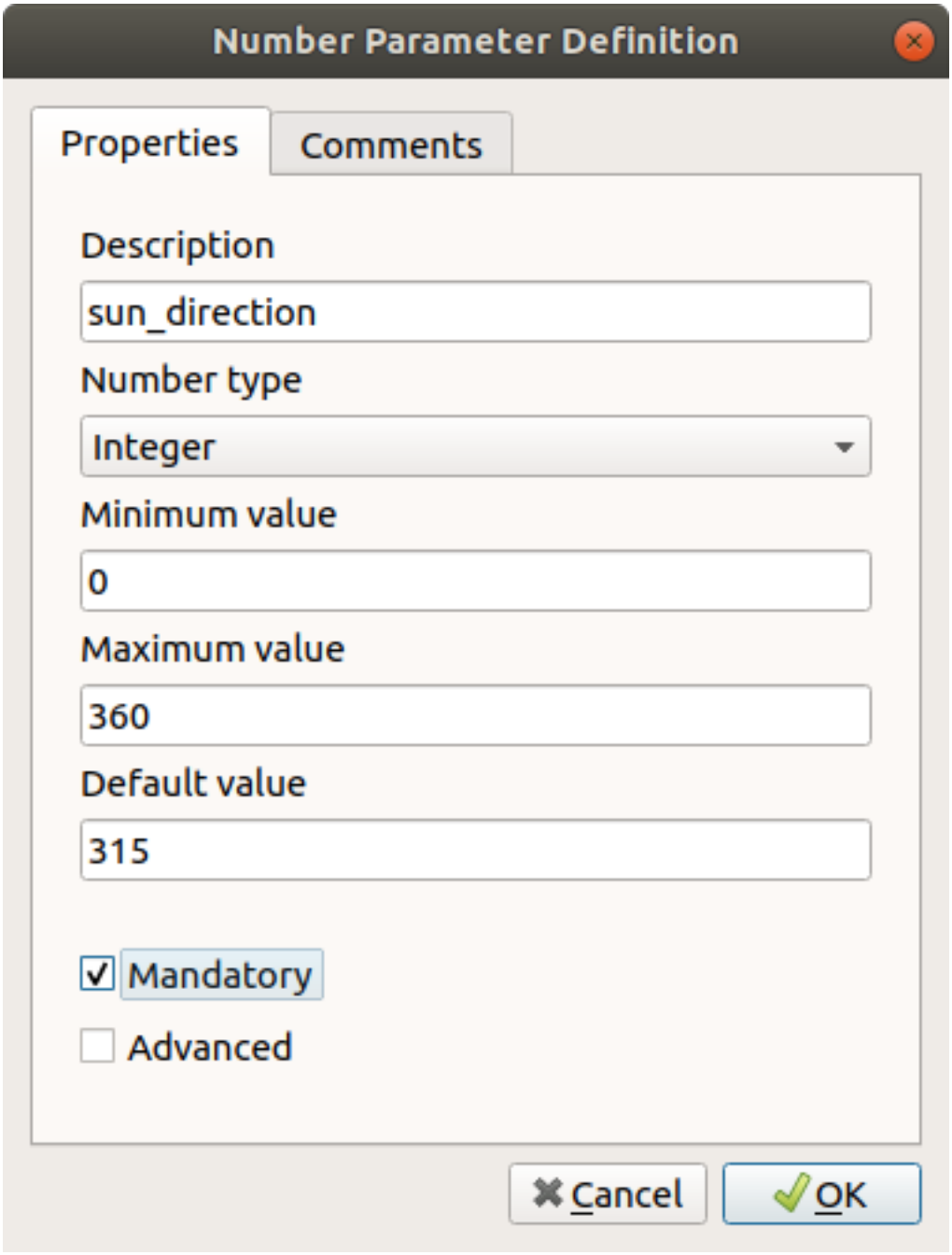


Figura23.17: Model Parameters Definition

You can define your input as mandatory for your model by checking the `Mandatory` option and by checking the `Advanced` checkbox you can set the input to be within the `Advanced` section. This is particularly useful when the model has many parameters and some of them are not trivial, but you still want to choose them.

The `Comments` tab allows you to tag the input with more information, to better describe the parameter. Comments are visible only in the modeler canvas and not in the final algorithm dialog.

For each added input, a new element is added to the modeler canvas.



Figura23.18: Model Parameters

You can also add inputs by dragging the input type from the list and dropping it at the position where you want it in the modeler canvas. If you want to change a parameter of an existing input, just double click on it, and the same dialog will pop up.

23.5.2 Definição do fluxo de trabalho

In the following example we will add two inputs and two algorithms. The aim of the model is to copy the elevation values from a DEM raster layer to a line layer using the `Drape` algorithm, and then calculate the total ascent of the line layer using the `Climb Along Line` algorithm.

In the *Inputs* tab, choose the two inputs as `Vector Layer` for the line and `Raster Layer` for the DEM. We are now ready to add the algorithms to the workflow.

Algorithms can be found in the *Algorithms* panel, grouped much in the same way as they are in the Processing toolbox.

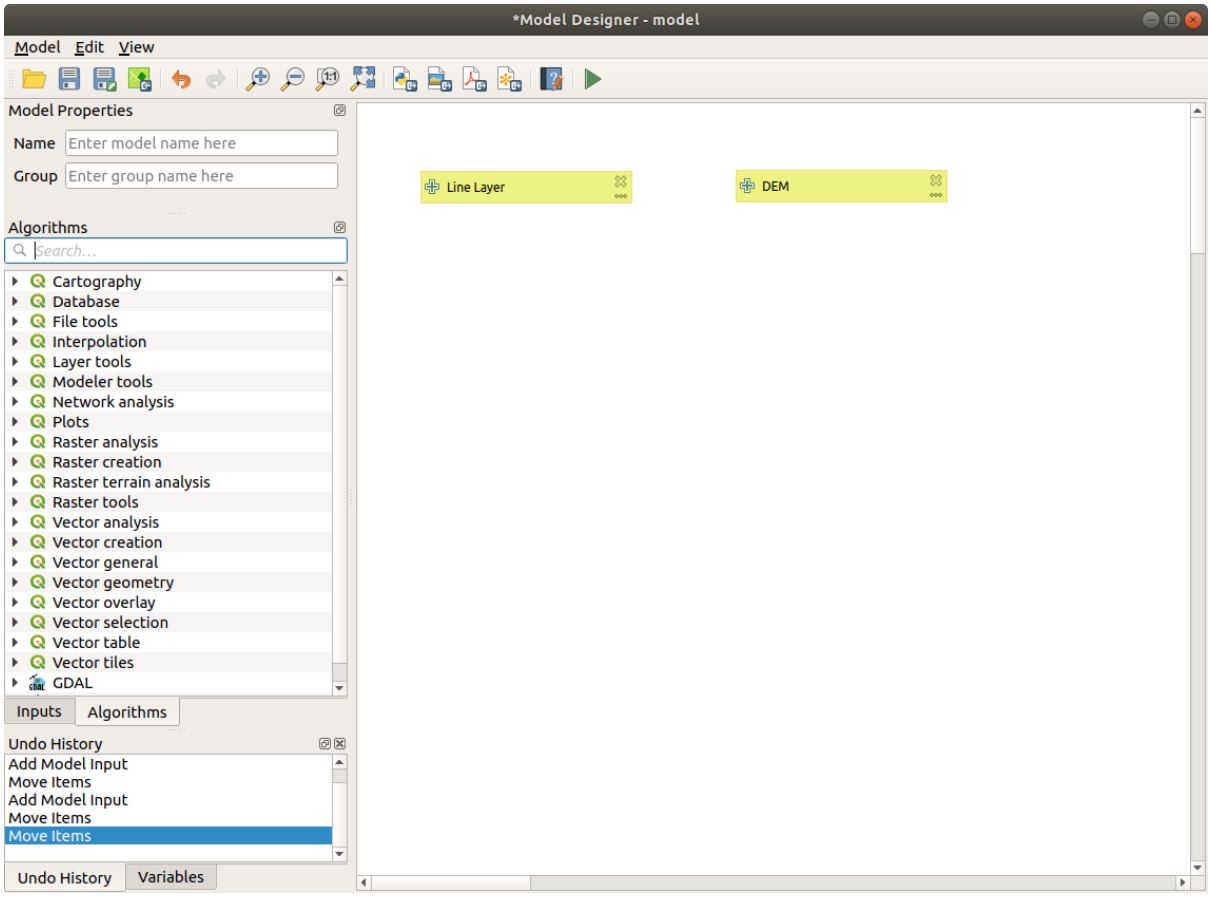


Figura23.19: Model Inputs

To add an algorithm to a model, double-click on its name or drag and drop it, just like for inputs. As for the inputs you can change the description of the algorithm and add a comment. When adding an algorithm, an execution dialog will appear, with a content similar to the one found in the execution panel that is shown when executing the algorithm from the toolbox. The following picture shows both the `Drape (set Z value from raster)` and the `Climb along line` algorithm dialogs.

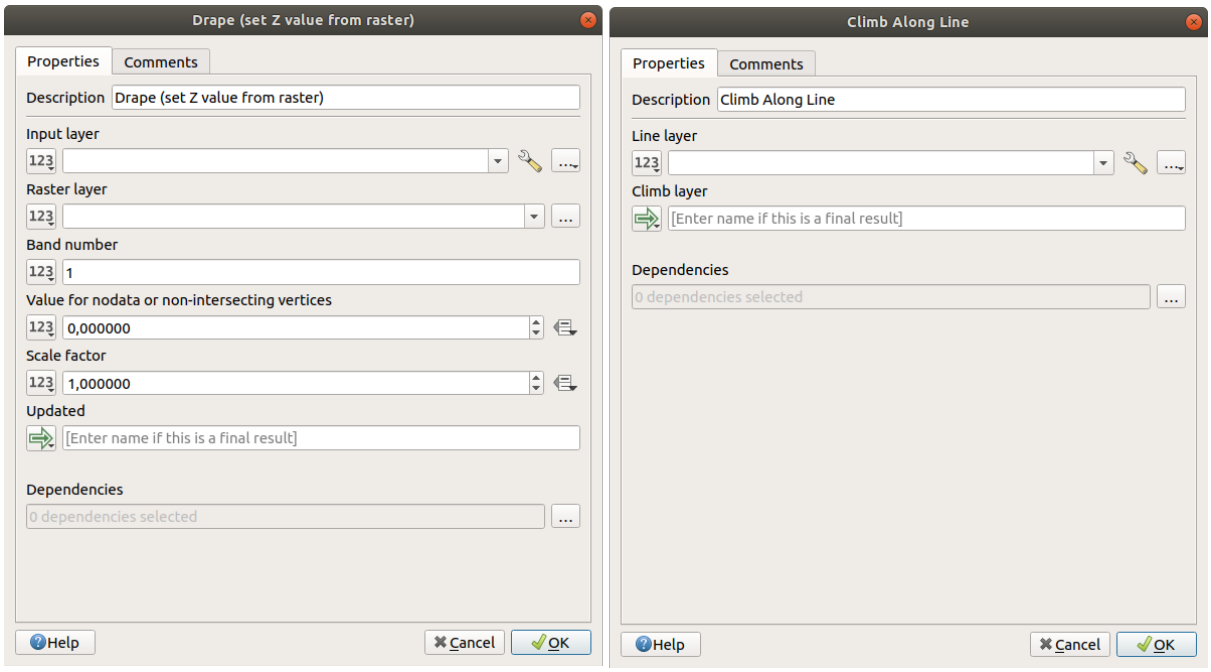


Figura23.20: Model Algorithm parameters

As you can see there are some differences.

You have four choices to define the algorithm **inputs**:

- `Value`: allows you to set the parameter from a loaded layer in the QGIS project or to browse a layer from a folder
- `Pre-calculated Value`: with this option you can open the Expression Builder and define your own expression to fill the parameter. Model inputs together with some other layer statistics are available as **variables** and are listed at the top of the Search dialog of the Expression Builder
- `Model Input`: choose this option if the parameter comes from an input of the model you have defined. Once clicked, this option will list all the suitable inputs for the parameter
- `Algorithm Output`: is useful when the input parameter of an algorithm is an output of another algorithm

Algorithm **outputs** have the addditional `Model Output` option that makes the output of the algorithm available in the model.

If a layer generated by the algorithm is only to be used as input to another algorithm, don't edit that text box.

In the following picture you can see the two input parameters defined as `Model Input` and the temporary output layer:

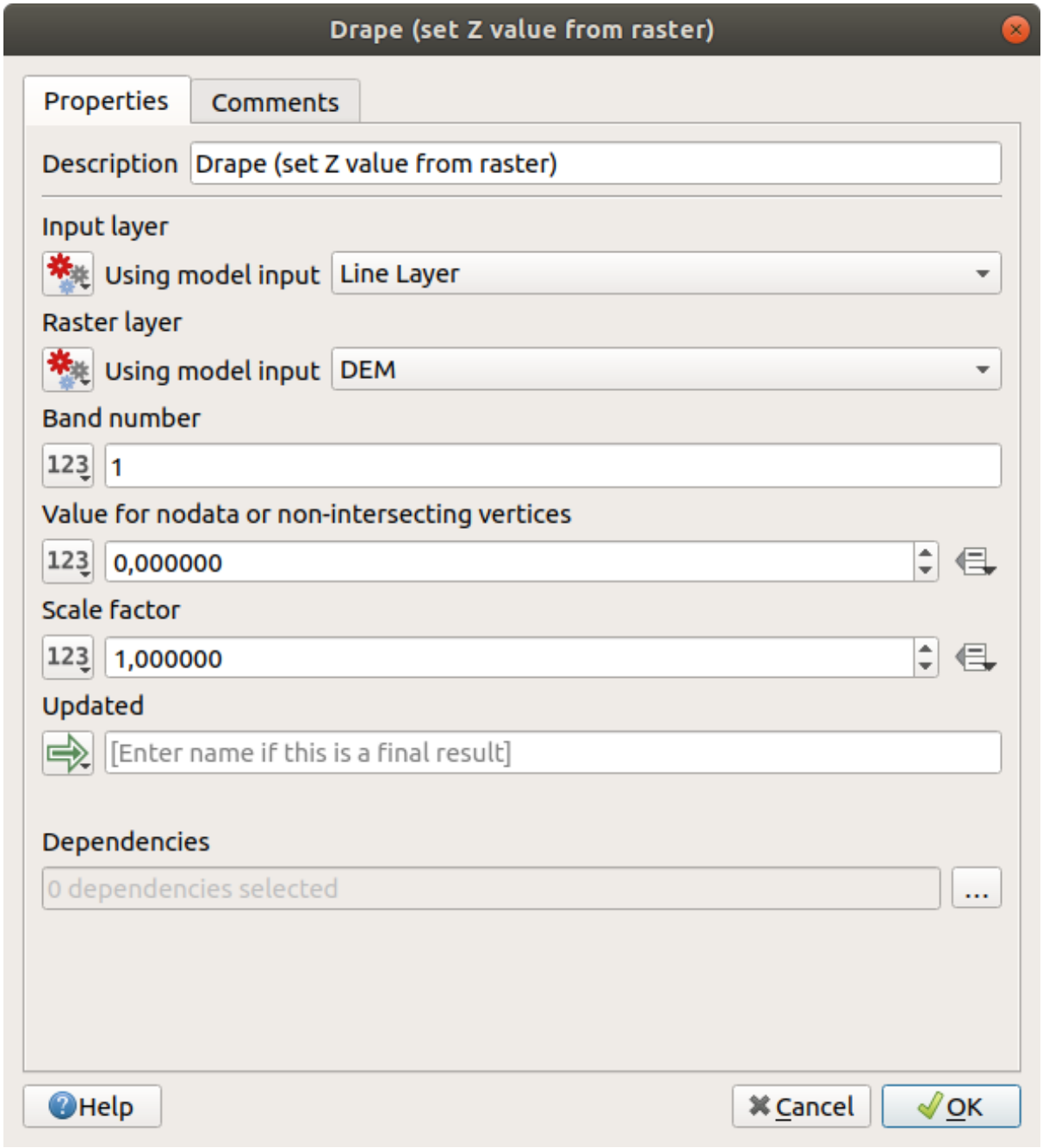


Figura23.21: Algorithm Input and Output parameters

In all cases, you will find an additional parameter named *Dependencies* that is not available when calling the algorithm from the toolbox. This parameter allows you to define the order in which algorithms are executed, by explicitly defining one algorithm as a *parent* of the current one. This will force the *parent* algorithm to be executed before the current one.

When you use the output of a previous algorithm as the input of your algorithm, that implicitly sets the previous algorithm as parent of the current one (and places the corresponding arrow in the modeler canvas). However, in some cases an algorithm might depend on another one even if it does not use any output object from it (for instance, an algorithm that executes a SQL sentence on a PostGIS database and another one that imports a layer into that same database). In that case, just select the previous algorithm in the *Dependencies* parameter and they will be executed in the correct order.

Once all the parameters have been assigned valid values, click on *OK* and the algorithm will be added to the canvas. It will be linked to the elements in the canvas (algorithms or inputs) that provide objects that are used as inputs for

the algorithm.

Elements can be dragged to a different position on the canvas. This is useful to make the structure of the model more clear and intuitive. You can also resize elements. This is particularly useful if the description of the input or algorithm is long.

Links between elements are updated automatically and you can see a plus button at the top and at the bottom of each algorithm. Clicking the button will list all the inputs and outputs of the algorithm so you can have a quick overview.

You can zoom in and out by using the mouse wheel.

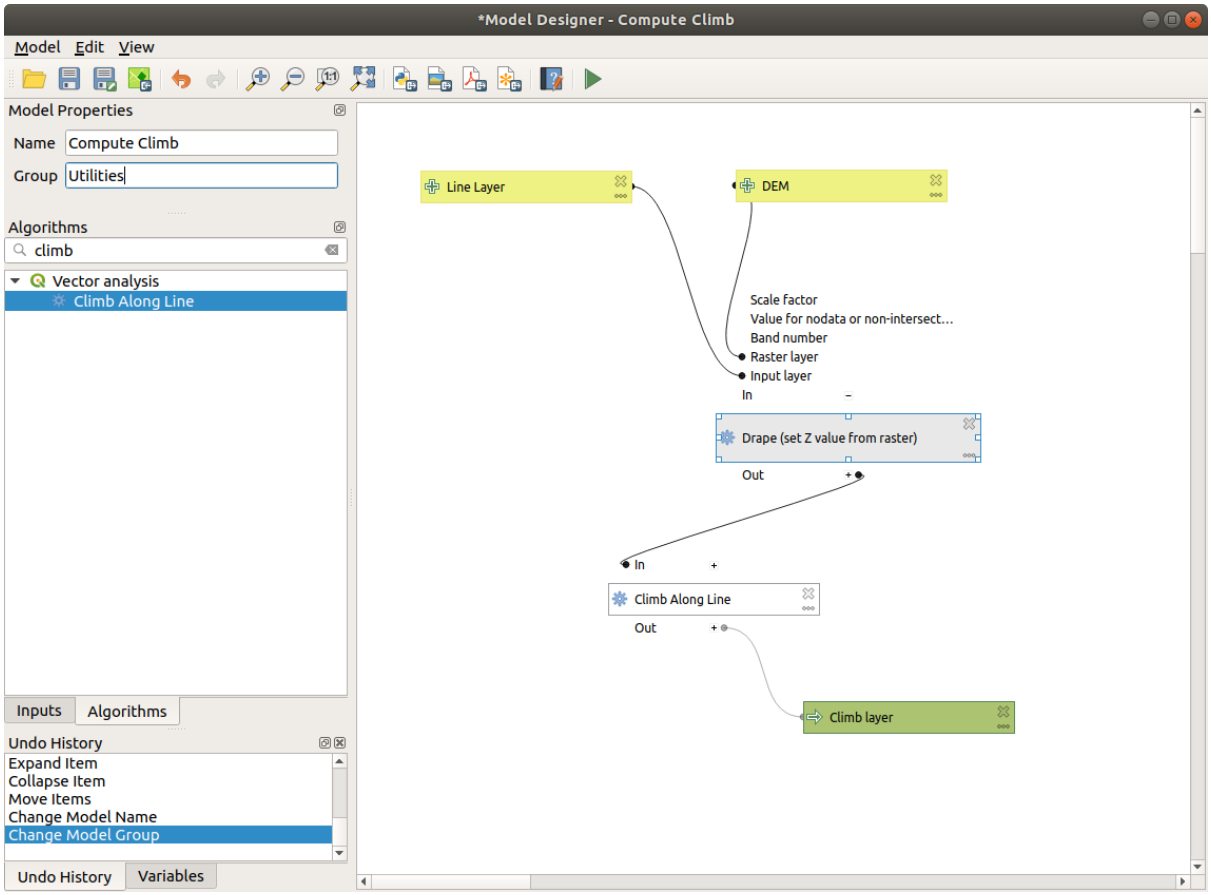


Figura23.22: A complete model

You can run your algorithm any time by clicking on the button. In order to use the algorithm from the toolbox, it has to be saved and the modeler dialog closed, to allow the toolbox to refresh its contents.

23.5.3 Interacting with the canvas and elements

You can use the , , and buttons to zoom the modeler canvas. The behavior of the buttons is basically the same of the main QGIS toolbar.

The `Undo History` panel together with the and buttons are extremely useful to quickly rollback to a previous situation. The `Undo History` panel lists everything you have done when creating the workflow.

You can move or resize many elements at the same time by first selecting them, dragging the mouse.

If you want to snap the elements while moving them in the canvas you can choose *View* ► *Enable Snapping*.

The *Edit* menu contains some very useful options to interact with your model elements:

- Select All: select all elements of the model
- `Snap Selected Components to Grid`: snap and align the elements into a grid
- Undo: undo the last action
- Redo: redo the last action
- Cut: cut the selected elements
- Copy: copy the selected elements
- Paste: paste the elements
- Delete Selected Components: delete all the selected elements from the model
- `Add Group Box`: add a draggable *box* to the canvas. This feature is very useful in big models to group elements in the modeler canvas and to keep the workflow clean. For example we might group together all the inputs of the example:

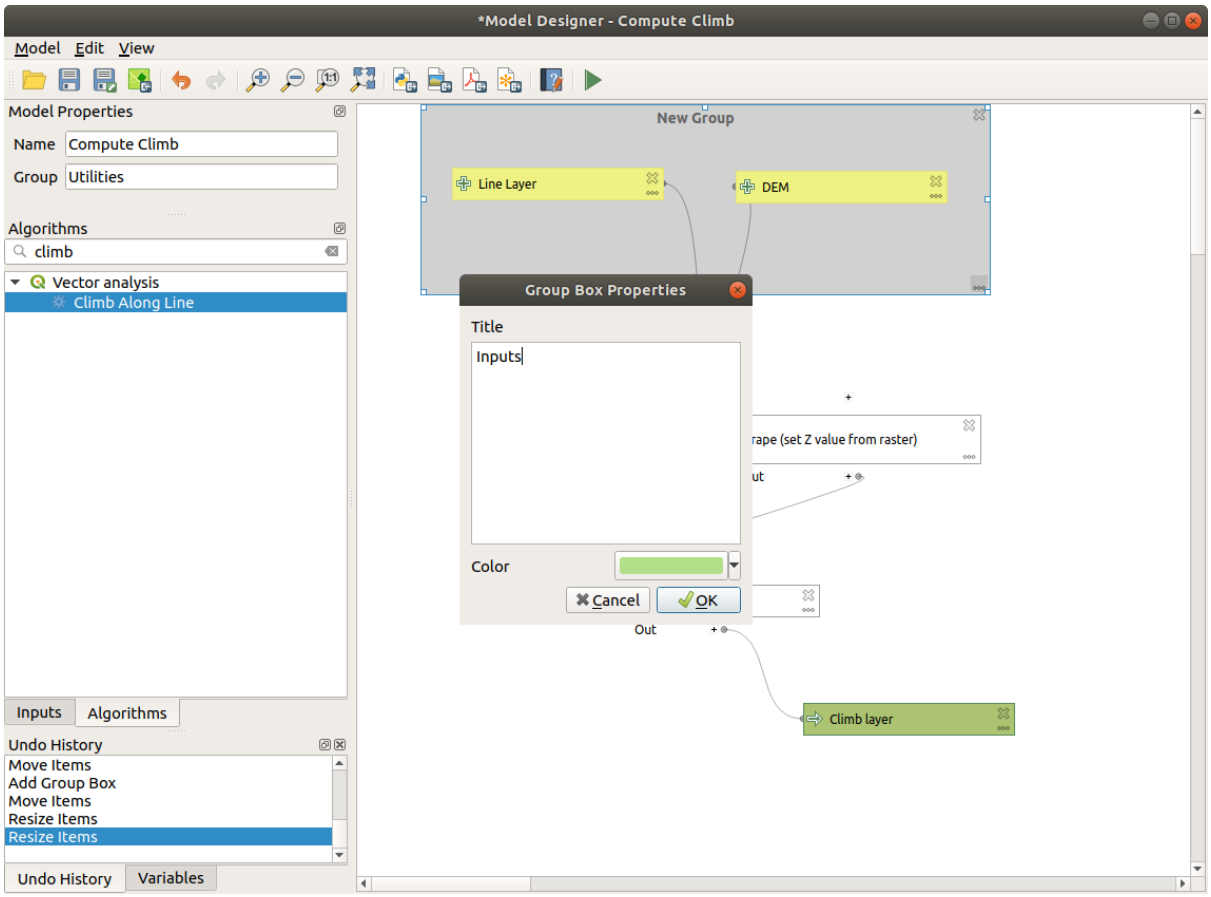


Figura23.23: Model Group Box

You can change the name and the color of the boxes. Group boxes are very useful when used together with *View* ► *Zoom To*. This allows you to zoom to a specific part of the model.

You might want to change the order of the inputs and how they are listed in the main model dialog. At the bottom of the `Input` panel you will find the `Reorder Model Inputs...` button and by clicking on it a new dialog pops up allowing you to change the order of the inputs:

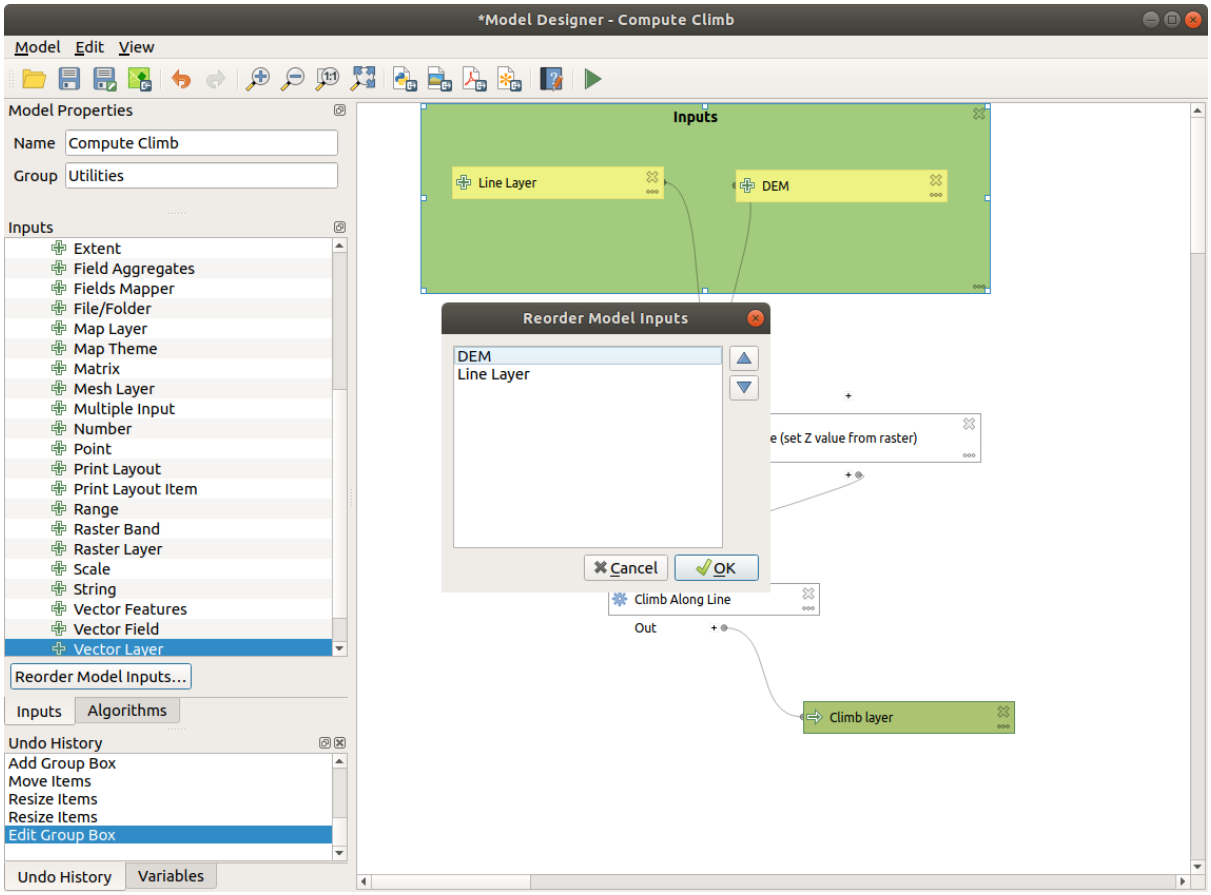


Figura23.24: Reorder Model Inputs

23.5.4 Salvando e carregando os modelos

Use the Save model button to save the current model and the Open Model button to open a previously saved model. Models are saved with the `.model3` extension. If the model has already been saved from the modeler window, you will not be prompted for a filename. Since there is already a file associated with the model, that file will be used for subsequent saves.

Before saving a model, you have to enter a name and a group for it in the text boxes in the upper part of the window.

Models saved in the `models` folder (the default folder when you are prompted for a filename to save the model) will appear in the toolbox in the corresponding branch. When the toolbox is invoked, it searches the `models` folder for files with the `.model3` extension and loads the models they contain. Since a model is itself an algorithm, it can be added to the toolbox just like any other algorithm.

Models can also be saved within the project file using the Save model in project button. Models saved using this method won't be written as `.model3` files on the disk but will be embedded in the project file.

Project models are available in the *Project models* menu of the toolbox.

The models folder can be set from the Processing configuration dialog, under the *Modeler* group.

Models loaded from the `models` folder appear not only in the toolbox, but also in the algorithms tree in the *Algorithms* tab of the modeler window. That means that you can incorporate a model as a part of a bigger model, just like other algorithms.

Models will show up in the *Browser* panel and can be run from there.

Exporting a model as an image, PDF or SVG

A model can also be exported as an image, SVG or PDF (for illustration purposes) by clicking Export as image, Export as PDF or Export as SVG.

23.5.5 Editando um modelo

You can edit the model you are currently creating, redefining the workflow and the relationships between the algorithms and inputs that define the model.

If you right-click on an algorithm in the canvas, you will see a context menu like the one shown next:

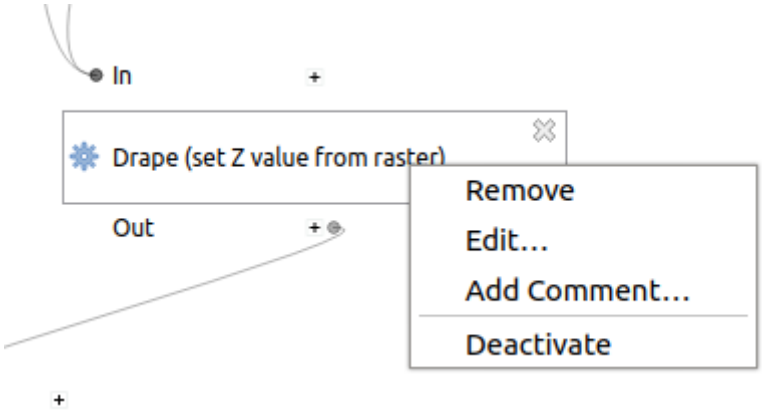


Figura23.25: Modeler Right Click

Selecionando a opção *Remover* irá fazer com que o algoritmo seja removido. Um algoritmo só pode ser removido apenas se existir outros algoritmos dependentes dele. Isto é, se não estiver sendo usado num arquivo de saída de um algoritmo usado como arquivo de entrada diferente. Se tentar remover um algoritmo que tenha outros que dependam dele, uma mensagem de aviso igual à que vê aqui em baixo:

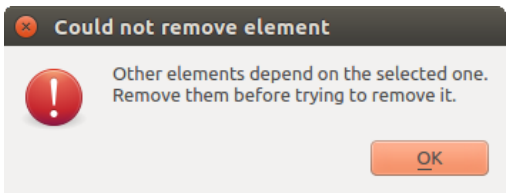


Figura23.26: Cannot Delete Algorithm

Selecting the *Edit...* option will show the parameter dialog of the algorithm, so you can change the inputs and parameter values. Not all input elements available in the model will appear as available inputs. Layers or values generated at a more advanced step in the workflow defined by the model will not be available if they cause circular dependencies.

Select the new values and click on the *OK* button as usual. The connections between the model elements will change in the modeler canvas accordingly.

The *Add comment...* allows you to add a comment to the algorithm to better describe the behavior.

A model can be run partially by deactivating some of its algorithms. To do it, select the *Deactivate* option in the context menu that appears when right-clicking on an algorithm element. The selected algorithm, and all the ones in the model that depend on it will be displayed in grey and will not be executed as part of the model.

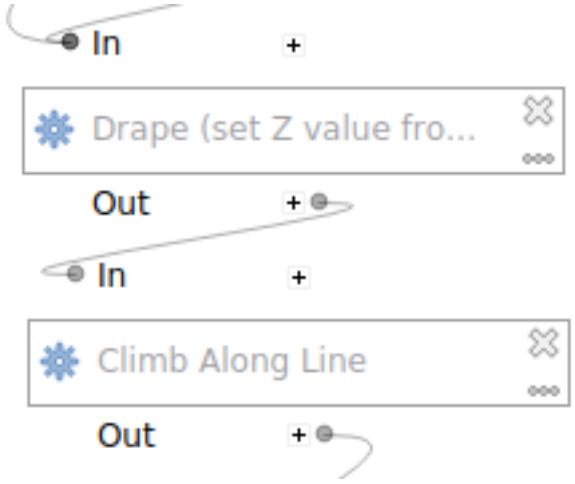


Figura23.27: Model With Deactivated Algorithms

When right-clicking on an algorithm that is not active, you will see a *Activate* menu option that you can use to reactivate it.

23.5.6 Editando os arquivos de ajuda do modelo e a meta-informação

You can document your models from the modeler itself. Click on the Edit model help button, and a dialog like the one shown next will appear.

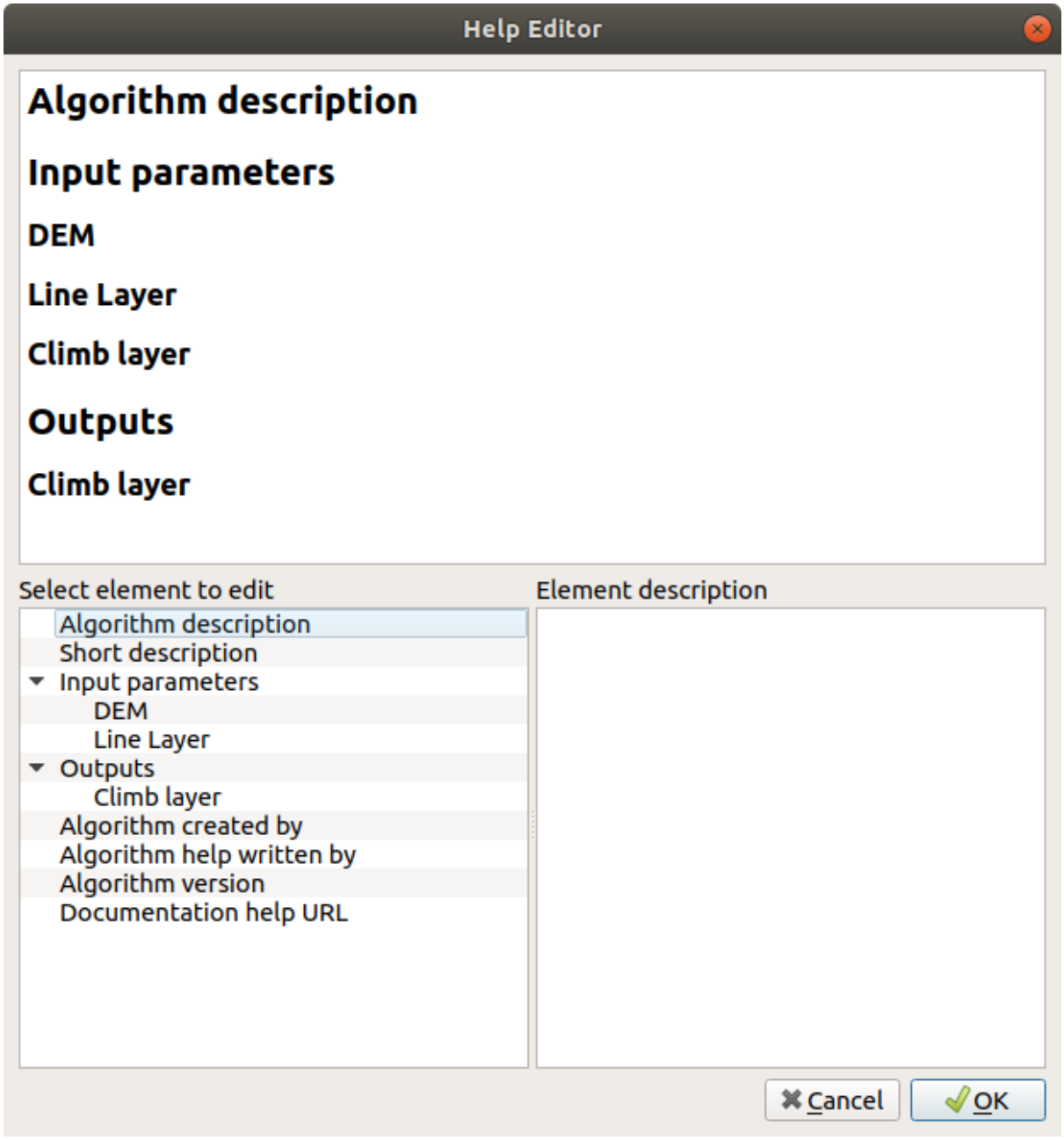


Figura23.28: Editing Help

No lado direito irá ver uma página simples HTML, criada usando a descrição dos parâmetros de entrada e de saída do algoritmo, juntamente com itens adicionais como uma descrição geral do modelo ou o seu autor. A primeira vez que abre o editor da ajuda, todas as ajudas estão vazias, mas pode editá-los usando os elementos do lado esquerdo do diálogo. Selecione um elemento na parte superior e escreva a descrição na caixa de texto em baixo.

Model help is saved as part of the model itself.

23.5.7 Exporting a model as a Python script

As we will see in a later chapter, Processing algorithms can be called from the QGIS Python console, and new Processing algorithms can be created using Python. A quick way to create such a Python script is to create a model and then export it as a Python file.

To do so, click on the Export as Script Algorithm… in the modeler canvas or right click on the name of the model in the Processing Toolbox and choose Export Model as Python Algorithm….

23.5.8 Sobre os algoritmos disponíveis

You might notice that some algorithms that can be executed from the toolbox do not appear in the list of available algorithms when you are designing a model. To be included in a model, an algorithm must have the correct semantic. If an algorithm does not have such a well-defined semantic (for instance, if the number of output layers cannot be known in advance), then it is not possible to use it within a model, and it will not appear in the list of algorithms that you can find in the modeler dialog.

23.6 A interface de processamento em lote

23.6.1 Introdução

All algorithms (including models) can be executed as a batch process. That is, they can be executed using not just a single set of inputs, but several of them, executing the algorithm as many times as needed. This is useful when processing large amounts of data, since it is not necessary to launch the algorithm many times from the toolbox.

Para executar um algoritmo como um processamento em lote, clique com o direito do mouse na caixa de ferramentas e selecione a opção *Executar como processamento em lote* no balão de opções que irá aparecer.

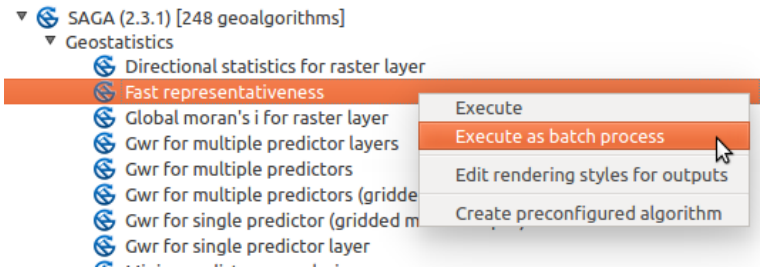


Figura23.29: Batch Processing from right-click

If you have the execution dialog of the algorithm open, you can also start the batch processing interface from there, clicking on the *Run as batch process…* button.

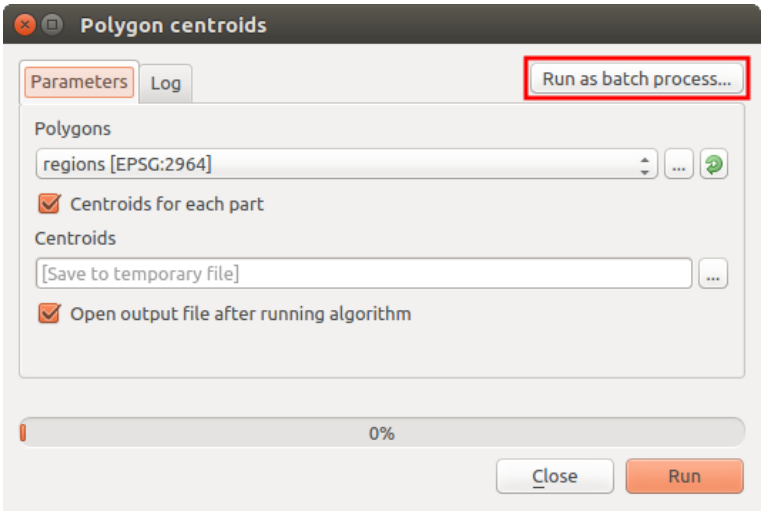


Figura23.30: Batch Processing From Algorithm Dialog

23.6.2 Os parâmetros da tabela

A execução de um processamento em lote é semelhante à execução única de um algoritmo. Os valores do parâmetro têm de ser definidos, mas neste caso nós necessitamos um conjunto de parâmetros, uma para cada vez que o algoritmo é executado. Os valores são introduzidos usando uma tabela como é mostrada a seguir.

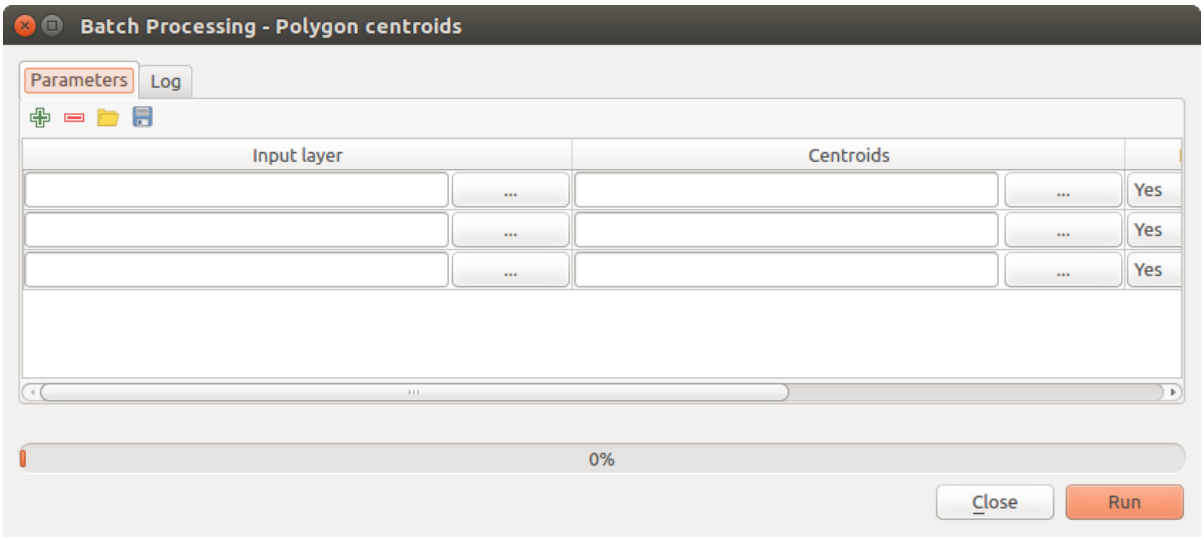


Figura23.31: Batch Processing

Cada linha desta tabela representa uma única execução do algoritmo, e cada célula contém o valor de um dos parâmetros. É semelhante aos parâmetros do diálogo que vê quando executa o algoritmo a partir da caixa de ferramentas, mas com uma diferente disposição.

Por defeito, a tabela contém apenas duas linhas. Pode adicionar ou remover linhas usando os botões na parte inferior da janela.

Uma vez que o tamanho da tabela for configurado, terá de ser preenchido com os valores desejados.

23.6.3 Preenchendo os parâmetros da tabela

Para a maioria dos parâmetros, a configuração do valor é trivial. Basta digitar o valor ou selecioná-lo na lista de opções disponíveis, dependendo do tipo de parâmetro.

Filenames for input data objects are introduced directly typing or, more conveniently, clicking on the … button on the right hand of the cell, which will show a context menu with two option: one for selecting from the layers currently opened and another to select from the filesystem. This second option, when selected, shows a typical file chooser dialog. Multiple files can be selected at once. If the input parameter represents a single data object and several files are selected, each one of them will be put in a separate row, adding new ones if needed. If the parameter represents a multiple input, all the selected files will be added to a single cell, separated by semicolons (`;`).

Layer identifiers can be directly typed in the parameter text box. You can enter the full path to a file or the name of a layer that is currently loaded in the current QGIS project. The name of the layer will be automatically resolved to its source path. Notice that, if several layers have the same name, this might cause unexpected results due to ambiguity.

Output data objects are always saved to a file and, unlike when executing an algorithm from the toolbox, saving to a temporary file or database is not permitted. You can type the name directly or use the file chooser dialog that appears when clicking on the accompanying button.

Um vez selecionado o arquivo, um novo diálogo será exibido para permitir que faça o auto-preenchimento das outras células na mesma coluna (o mesmo parâmetro).

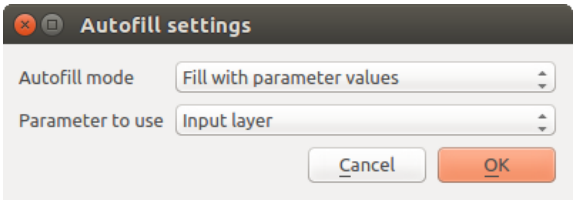


Figura23.32: Salvar Processamento em Lote

Se o valor padrão (‘Não efetuar auto-preenchimento’) é selecionado, irá apenas por o nome do arquivo selecionado na célula selecionada da tabela de parâmetros. Se alguma das outras opções estiver selecionada, todas as células abaixo da selecionada irão automaticamente ser preenchidas baseando-se no critério definido. Desta forma, é mais fácil preencher a tabela, e o processamento em lote pode ser definido com menor esforço.

O preenchimento automático pode ser feito simplesmente adicionando números relativos ao caminho do arquivo selecionado, ou acrescentando o valor de outro campo na mesma linha. Isto é particularmente útil para nomear objetos de dados de saída de acordo com os de entrada.

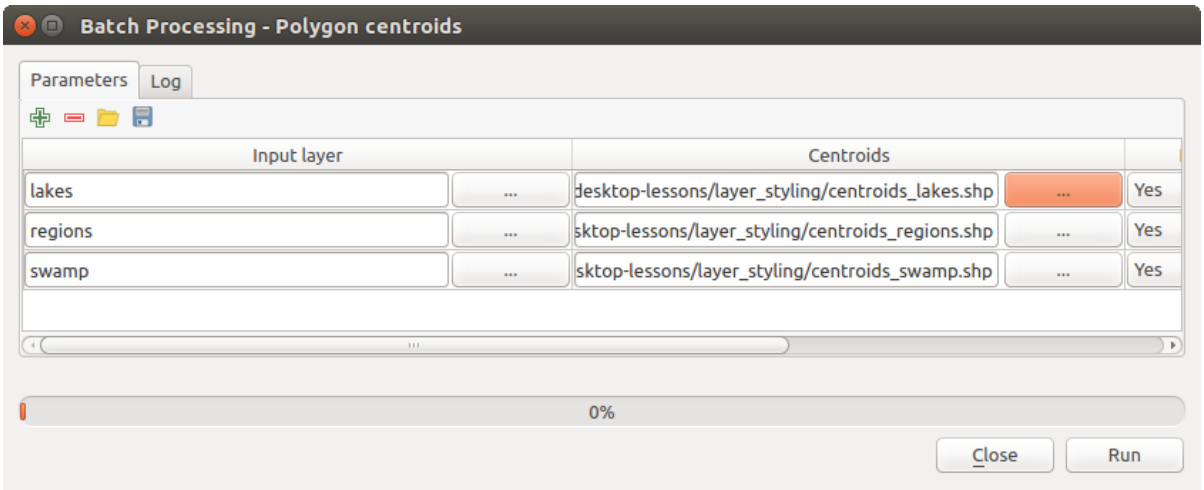


Figura23.33: Batch Processing File Path

23.6.4 Executando o processo em lote

To execute the batch process once you have introduced all the necessary values, just click on *OK*. Progress of the global batch task will be shown in the progress bar in the lower part of the dialog.

23.7 Usando os algoritmos do processamento a partir do Terminal Python.

O terminal permite que usuários avançados aumente sua produtividade e execute operações complexas que não podem ser utilizados através dos outros elementos GUI da caixa de processamento. Modelos envolvendo vários algoritmos podem ser definidos usando a interface de linha de comando e operações adicionais como loops e sentenças condicionais podem ser adicionados para criar fluxos de trabalho mais flexíveis e poderosos.

There is not a processing console in QGIS, but all processing commands are available instead from the QGIS built-in *Python console*. That means that you can incorporate those commands into your console work and connect processing algorithms to all the other features (including methods from the QGIS API) available from there.

O código que pode executar a partir do Terminal Python, mesmo quando não chama nenhum método específico do processamento, pode ser convertido num novo algoritmo que pode mais tarde chamar da caixa de ferramentas, o modelador gráfico ou qualquer outro componente, como faz para outro algoritmo. De fato, alguns algoritmos que encontra na caixa de ferramentas são scripts simples.

In this section, we will see how to use processing algorithms from the QGIS Python console, and also how to write algorithms using Python.

23.7.1 Chamando os algoritmos a partir do Terminal Python

A primeira coisa que tem de fazer é importar as funções do processamento com a seguinte linha:

```
>>> from qgis import processing
```

Now, there is basically just one (interesting) thing you can do with that from the console: execute an algorithm. That is done using the `run()` method, which takes the name of the algorithm to execute as its first parameter, and then a variable number of additional parameters depending on the requirements of the algorithm. So the first thing you need to know is the name of the algorithm to execute. That is not the name you see in the toolbox, but rather a unique command–line name. To find the right name for your algorithm, you can use the `processingRegistry`. Type the following line in your console:

```
>>> for alg in QgsApplication.processingRegistry().algorithms():
        print(alg.id(), "->", alg.displayName())
```

You will see something like this (with some extra dashes added to improve readability).

```
3d:tessellate ---------------> Tessellate
gdal:aspect -----------------> Aspect
gdal:assignprojection -------> Assign projection
gdal:buffervectors ----------> Buffer vectors
gdal:buildvirtualraster -----> Build Virtual Raster
gdal:cliprasterbyextent -----> Clip raster by extent
gdal:cliprasterbymasklayer --> Clip raster by mask layer
gdal:clipvectorbyextent -----> Clip vector by extent
gdal:clipvectorbypolygon ----> Clip vector by mask layer
gdal:colorrelief ------------> Color relief
gdal:contour ----------------> Contour
gdal:convertformat ----------> Convert format
gdal:dissolve ---------------> Dissolve
...
```

That's a list of all the available algorithm IDs, sorted by provider name and algorithm name, along with their corresponding names.

Once you know the command-line name of the algorithm, the next thing to do is to determine the right syntax to execute it. That means knowing which parameters are needed when calling the `run()` method.

There is a method to describe an algorithm in detail, which can be used to get a list of the parameters that an algorithm requires and the outputs that it will generate. To get this information, you can use the `algorithmHelp(id_of_the_algorithm)` method. Use the ID of the algorithm, not the full descriptive name.

Calling the method with `native:buffer` as parameter (`qgis:buffer` is an alias for `native:buffer` and will also work), you get the following description:

```
>>> processing.algorithmHelp("native:buffer")
Buffer (native:buffer)

This algorithm computes a buffer area for all the features in an
input layer, using a fixed or dynamic distance.

The segments parameter controls the number of line segments to
use to approximate a quarter circle when creating rounded
offsets.

The end cap style parameter controls how line endings are handled
in the buffer.

The join style parameter specifies whether round, miter or
beveled joins should be used when offsetting corners in a line.

The miter limit parameter is only applicable for miter join
styles, and controls the maximum distance from the offset curve
to use when creating a mitered join.


----------------
Input parameters
----------------

INPUT: Input layer

   Parameter type: QgsProcessingParameterFeatureSource

   Accepted data types:
            - str: layer ID
            - str: layer name
            - str: layer source
            - QgsProcessingFeatureSourceDefinition
            - QgsProperty
            - QgsVectorLayer

DISTANCE: Distance

   Parameter type: QgsProcessingParameterDistance

   Accepted data types:
            - int
            - float
            - QgsProperty

SEGMENTS: Segments

   Parameter type: QgsProcessingParameterNumber
```

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```
   Accepted data types:
           - int
           - float
           - QgsProperty

END_CAP_STYLE: End cap style

   Parameter type: QgsProcessingParameterEnum

   Available values:
           - 0: Round
           - 1: Flat
           - 2: Square

   Accepted data types:
           - int
           - str: as string representation of int, e.g. '1'
           - QgsProperty

JOIN_STYLE: Join style

   Parameter type: QgsProcessingParameterEnum

   Available values:
           - 0: Round
           - 1: Miter
           - 2: Bevel

   Accepted data types:
           - int
           - str: as string representation of int, e.g. '1'
           - QgsProperty

MITER_LIMIT: Miter limit

   Parameter type: QgsProcessingParameterNumber

   Accepted data types:
           - int
           - float
           - QgsProperty

DISSOLVE: Dissolve result

   Parameter type: QgsProcessingParameterBoolean

   Accepted data types:
           - bool
           - int
           - str
           - QgsProperty

OUTPUT: Buffered

   Parameter type: QgsProcessingParameterFeatureSink

   Accepted data types:
           - str: destination vector file, e.g. 'd:/test.shp'
           - str: 'memory:' to store result in temporary memory layer
           - str: using vector provider ID prefix and destination URI,
                  e.g. 'postgres:...' to store result in PostGIS table
```

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```
           - QgsProcessingOutputLayerDefinition
           - QgsProperty

----------------
Outputs
----------------

OUTPUT:  <QgsProcessingOutputVectorLayer>
   Buffered
```

Now you have everything you need to run any algorithm. As we have already mentioned, algorithms can be run using: `run()`. Its syntax is as follows:

```
>>> processing.run(name_of_the_algorithm, parameters)
```

Where parameters is a dictionary of parameters that depend on the algorithm you want to run, and is exactly the list that the `algorithmHelp()` method gives you.

```
>>> processing.run("native:buffer", {'INPUT': '/data/lines.shp',
               'DISTANCE': 100.0,
               'SEGMENTS': 10,
               'DISSOLVE': True,
               'END_CAP_STYLE': 0,
               'JOIN_STYLE': 0,
               'MITER_LIMIT': 10,
               'OUTPUT': '/data/buffers.shp'})
```

If a parameter is optional and you do not want to use it, then don't include it in the dictionary.

If a parameter is not specified, the default value will be used.

Dependendo do tipo de parâmetro, os valores são introduzidos diferentemente. A próxima explicação é uma rápida revisão de como introduzir valores para cada tipo de parâmetro de entrada:

- Raster Layer, Vector Layer or Table. Simply use a string with the name that identifies the data object to use (the name it has in the QGIS Table of Contents) or a filename (if the corresponding layer is not opened, it will be opened but not added to the map canvas). If you have an instance of a QGIS object representing the layer, you can also pass it as parameter.
- Enumeration. If an algorithm has an enumeration parameter, the value of that parameter should be entered using an integer value. To know the available options, you can use the `algorithmHelp()` command, as above. For instance, the `native:buffer` algorithm has an enumeration called JOIN_STYLE:

  ```
  JOIN_STYLE: Join style

     Parameter type: QgsProcessingParameterEnum

     Available values:
             - 0: Round
             - 1: Miter
             - 2: Bevel

     Accepted data types:
             - int
             - str: as string representation of int, e.g. '1'
             - QgsProperty
  ```

  In this case, the parameter has three options. Notice that ordering is zero-based.

- Boolean. Use `True` or `False`.
- Múltiplas entradas. O valor é uma cadeia de texto com descritores de entrada separados por ponto e vírgula (`;`). Como no caso das camadas ou tabelas únicas, cada descritor de entrada pode ser o nome do objeto ou o

caminho do arquivo.

- Campo da Tabela de XXX. Use uma cadeia de texto com o nome do campo a usar. O parâmetro é caso sensitivo.
- Tabela Fixa. Digite a lista de todos os valores da tabela separadas por vírgulas (`,`) e feche entre aspas (`"`). Os valores começam na linha superior e vai da esquerda para a direita. Pode também usar uma matriz 2D de valores que representam a tabela.
- SRC. Introduza o número do código EPSG do SRC desejado.
- Extensão. Deve usar uma cadeia de texto com `xmin`, `xmax`, `ymin` e `ymax` valores separados por vírgulas (`,`).

Os parâmetros booleanos, de arquivo, cadeia de texto e numéricos não necessitam de explicações adicionais.

Input parameters such as strings, booleans, or numerical values have default values. The default value is used if the corresponding parameter entry is missing.

For output data objects, type the file path to be used to save it, just as it is done from the toolbox. If the output object is not specified, the result is saved to a temporary file (or skipped if it is an optional output). The extension of the file determines the file format. If you enter a file extension not supported by the algorithm, the default file format for that output type will be used, and its corresponding extension appended to the given file path.

Unlike when an algorithm is executed from the toolbox, outputs are not added to the map canvas if you execute that same algorithm from the Python console using `run()`, but `runAndLoadResults()` will do that.

The `run()` method returns a dictionary with one or more output names (the ones shown in the algorithm description) as keys and the file paths of those outputs as values:

```
>>> myresult = processing.run("native:buffer", {'INPUT': '/data/lines.shp',
                'DISTANCE': 100.0,
                'SEGMENTS': 10,
                'DISSOLVE': True,
                'END_CAP_STYLE': 0,
                'JOIN_STYLE': 0,
                'MITER_LIMIT': 10,
                'OUTPUT': '/data/buffers.shp'})
>>> myresult['OUTPUT']
/data/buffers.shp
```

You can load feature output by passing the corresponding file paths to the `load()` method. Or you could use `runAndLoadResults()` instead of `run()` to load them immediately.

If you want to open an algorithm dialog from the console you can use the `createAlgorithmDialog` method. The only mandatory parameter is the algorithm name, but you can also define the dictionary of parameters so that the dialog will be filled automatically:

```
>>> my_dialog = processing.createAlgorithmDialog("native:buffer", {
                'INPUT': '/data/lines.shp',
                'DISTANCE': 100.0,
                'SEGMENTS': 10,
                'DISSOLVE': True,
                'END_CAP_STYLE': 0,
                'JOIN_STYLE': 0,
                'MITER_LIMIT': 10,
                'OUTPUT': '/data/buffers.shp'})
>>> my_dialog.show()
```

The `execAlgorithmDialog` method opens the dialog immediately:

```
>>> processing.execAlgorithmDialog("native:buffer", {
                'INPUT': '/data/lines.shp',
                'DISTANCE': 100.0,
                'SEGMENTS': 10,
```

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```
                'DISSOLVE': True,
                'END_CAP_STYLE': 0,
                'JOIN_STYLE': 0,
                'MITER_LIMIT': 10,
                'OUTPUT': '/data/buffers.shp'})
```

23.7.2 Criando scripts e correndo-os a partir da caixa de ferramentas

You can create your own algorithms by writing Python code. Processing scripts extend `QgsProcessingAlgorithm`, so you need to add some extra lines of code to implement mandatory functions. You can find *Create new script* (clean sheet) and *Create New Script from Template* (template that includes code for mandatory functions of `QgsProcessingAlgorithm`) under the *Scripts* dropdown menu on the top of the Processing toolbox. The Processing Script Editor will open, and that's where you should type your code. Saving the script from there in the `scripts` folder (the default folder when you open the save file dialog) with a `.py` extension should create the corresponding algorithm.

The name of the algorithm (the one you will see in the toolbox) is defined within the code.

Let's have a look at the following code, which defines a Processing algorithm that performs a buffer operation with a user defined buffer distance on a vector layer that is specified by the user, after first smoothing the layer.

```
from qgis.core import (QgsProcessingAlgorithm,
       QgsProcessingParameterNumber,
       QgsProcessingParameterFeatureSource,
       QgsProcessingParameterFeatureSink)

from qgis import processing

class algTest(QgsProcessingAlgorithm):
    INPUT_BUFFERDIST = 'BUFFERDIST'
    OUTPUT_BUFFER = 'OUTPUT_BUFFER'
    INPUT_VECTOR = 'INPUT_VECTOR'

    def __init__(self):
        super().__init__()

    def name(self):
        return "algTest"

    def displayName(self):
        return "algTest script"

    def createInstance(self):
        return type(self)()

    def initAlgorithm(self, config=None):
        self.addParameter(QgsProcessingParameterFeatureSource(
            self.INPUT_VECTOR, "Input vector"))
        self.addParameter(QgsProcessingParameterNumber(
            self.INPUT_BUFFERDIST, "Buffer distance",
            QgsProcessingParameterNumber.Double,
            100.0))
        self.addParameter(QgsProcessingParameterFeatureSink(
            self.OUTPUT_BUFFER, "Output buffer"))

    def processAlgorithm(self, parameters, context, feedback):
        #DO SOMETHING
        algresult = processing.run("native:smoothgeometry",
            {'INPUT': parameters[self.INPUT_VECTOR],
```

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```
            'ITERATIONS':2,
            'OFFSET':0.25,
            'MAX_ANGLE':180,
            'OUTPUT': 'memory:'},
        context=context, feedback=feedback, is_child_algorithm=True)
    smoothed = algresult['OUTPUT']
    algresult = processing.run('native:buffer',
        {'INPUT': smoothed,
        'DISTANCE': parameters[self.INPUT_BUFFERDIST],
        'SEGMENTS': 5,
        'END_CAP_STYLE': 0,
        'JOIN_STYLE': 0,
        'MITER_LIMIT': 10,
        'DISSOLVE': True,
        'OUTPUT': parameters[self.OUTPUT_BUFFER]},
        context=context, feedback=feedback, is_child_algorithm=True)
    buffered = algresult['OUTPUT']
    return {self.OUTPUT_BUFFER: buffered}
```

After doing the necessary imports, the following `QgsProcessingAlgorithm` functions are specified:

- `name()`: The id of the algorithm (lowercase).
- `displayName()`: A human readable name for the algorithm.
- `createInstance()`: Create a new instance of the algorithm class.
- `initAlgorithm()`: Configure the parameterDefinitions and outputDefinitions.

  Here you describe the parameters and output of the algorithm. In this case, a feature source for the input, a feature sink for the result and a number for the buffer distance.

- `processAlgorithm()`: Do the work.

  Here we first run the `smoothgeometry` algorithm to smooth the geometry, and then we run the `buffer` algorithm on the smoothed output. To be able to run algorithms from within another algorithm we have to set the `is_child_algorithm` argument to `True`. You can see how input and output parameters are used as parameters to the `smoothgeometry` and `buffer` algorithms.

There are a number of different parameter types available for input and output. Below is an alphabetically sorted list:

- `QgsProcessingParameterAggregate`
- `QgsProcessingParameterAuthConfig`
- `QgsProcessingParameterBand`
- `QgsProcessingParameterBoolean`
- `QgsProcessingParameterColor`
- `QgsProcessingParameterCoordinateOperation`
- `QgsProcessingParameterCrs`
- `QgsProcessingParameterDatabaseSchema`
- `QgsProcessingParameterDatabaseTable`
- `QgsProcessingParameterDateTime`
- `QgsProcessingParameterDistance`
- `QgsProcessingParameterEnum`
- `QgsProcessingParameterExpression`
- `QgsProcessingParameterExtent`
- `QgsProcessingParameterFeatureSink`

- QgsProcessingParameterFeatureSource
- QgsProcessingParameterField
- QgsProcessingParameterFieldMapping
- QgsProcessingParameterFile
- QgsProcessingParameterFileDestination
- QgsProcessingParameterFolderDestination
- QgsProcessingParameterLayout
- QgsProcessingParameterLayoutItem
- QgsProcessingParameterMapLayer
- QgsProcessingParameterMapTheme
- QgsProcessingParameterMatrix
- QgsProcessingParameterMeshLayer
- QgsProcessingParameterMultipleLayers
- QgsProcessingParameterNumber
- QgsProcessingParameterPoint
- QgsProcessingParameterProviderConnection
- QgsProcessingParameterRange
- QgsProcessingParameterRasterDestination
- QgsProcessingParameterRasterLayer
- QgsProcessingParameterScale
- QgsProcessingParameterString
- QgsProcessingParameterVectorDestination
- QgsProcessingParameterVectorLayer
- QgsProcessingParameterVectorTileWriterLayers

The first parameter to the constructors is the name of the parameter, and the second is the description of the parameter (for the user interface). The rest of the constructor parameters are parameter type specific.

The input can be turned into QGIS classes using the `parameterAs` functions of QgsProcessingAlgorithm. For instance to get the number provided for the buffer distance as a double:

```
self.parameterAsDouble(parameters, self.INPUT_BUFFERDIST, context)).
```

The `processAlgorithm` function should return a dictionary containing values for every output defined by the algorithm. This allows access to these outputs from other algorithms, including other algorithms contained within the same model.

Well behaved algorithms should define and return as many outputs as makes sense. Non-feature outputs, such as numbers and strings, are very useful when running your algorithm as part of a larger model, as these values can be used as input parameters for subsequent algorithms within the model. Consider adding numeric outputs for things like the number of features processed, the number of invalid features encountered, the number of features output, etc. The more outputs you return, the more useful your algorithm becomes!

Feedback

The `feedback` object passed to `processAlgorithm()` should be used for user feedback / interaction. You can use the `setProgress()` function of the `feedback` object to update the progress bar (0 to 100) to inform the user about the progress of the algorithm. This is very useful if your algorithm takes a long time to complete.

The `feedback` object provides an `isCanceled()` method that should be monitored to enable cancelation of the algorithm by the user. The `pushInfo()` method of `feedback` can be used to send information to the user, and `reportError()` is handy for pushing non-fatal errors to users.

Algorithms should avoid using other forms of providing feedback to users, such as print statements or logging to `QgsMessageLog`, and should always use the feedback object instead. This allows verbose logging for the algorithm, and is also thread-safe (which is important, given that algorithms are typically run in a background thread).

Handling errors

If your algorithm encounters an error which prevents it from executing, such as invalid input values or some other condition from which it cannot or should not recover, then you should raise a `QgsProcessingException`. E.g.:

```
if feature['value'] < 20:
  raise QgsProcessingException('Invalid input value {}, must be >= 20'.
↪format(feature['value']))
```

Try to avoid raising `QgsProcessingException` for non-fatal errors (e.g. when a feature has a null geometry), and instead just report these errors via `feedback.reportError()` and skip the feature. This helps make your algorithm "model-friendly", as it avoids halting the execution of an entire algorithm when a non-fatal error is encountered.

Documentando os seus scripts

As in the case of models, you can create additional documentation for your scripts, to explain what they do and how to use them.

`QgsProcessingAlgorithm` provides the `helpString()`, `shortHelpString()` and `helpUrl()` functions for that purpose. Specify / override these to provide more help to the user.

`shortDescription()` is used in the tooltip when hovering over the algorithm in the toolbox.

23.7.3 Pré- e pós-execução de encaixe da script

Scripts can also be used as pre- and post-execution hooks that are run before and after an algorithm is run, respectively. This can be used to automate tasks that should be performed whenever an algorithm is executed.

A sintaxe é identica à sintaxe explicada em cima, mas uma variável global `alg` está disponível, representando o algoritmo que foi (ou está prestes a ser) executado.

In the *General* group of the processing options dialog, you will find two entries named *Pre-execution script* and *Post-execution script* where the filenames of the scripts to be run in each case can be entered.

23.8 Using processing from the command line

QGIS comes with a tool called `QGIS Processing Executor` which allows you to run Processing algorithms and models (built-in or provided by plugins) directly from the command line without starting QGIS Desktop itself.

From a command line tool, run `qgis_process` and you should get:

```
QGIS Processing Executor - 3.16.8-Hannover 'Hannover' (3.16.8-Hannover)
Usage: C:\OSGeo4W\apps\qgis-ltr\bin\qgis_process.exe [--json] [command] [algorithm␣
↪id or path to model file] [parameters]

Options:

  --json          Output results as JSON objects

Available commands:

  plugins          list available and active plugins
  plugins enable   enables an installed plugin. The plugin name must be specified,␣
↪e.g. "plugins enable cartography_tools"
  plugins disable  disables an installed plugin. The plugin name must be specified,
↪ e.g. "plugins disable cartography_tools"
  list             list all available processing algorithms
  help             show help for an algorithm. The algorithm id or a path to a␣
↪model file must be specified.
  run              runs an algorithm. The algorithm id or a path to a model file␣
↪and parameter values must be specified.
                   Parameter values are specified after -- with PARAMETER=VALUE␣
↪syntax.
                   Ordered list values for a parameter can be created by␣
↪specifying the parameter multiple times,
                   e.g. --LAYERS=layer1.shp --LAYERS=layer2.shp
                   If required, the ellipsoid to use for distance and area␣
↪calculations can be specified via the "--ELLIPSOID=name" argument.
                   If required, an existing QGIS project to use during the␣
↪algorithm execution can be specified via the "--PROJECT_PATH=path" argument.
```

Nota: Only installed plugins that advertize `hasProcessingProvider=yes` in their `metadata.txt` file are recognized and can be activated or loaded by qgis_process tool.

The command `list` can be used to get a list of all available providers and algorithms.

```
qgis_process list
```

The command `help` can be used to get further information about commands or algorithms.

```
qgis_process help qgis:regularpoints
```

The command `run` can be used to run an algorithm or model. Specify the name of the algorithm or a path to a model as first parameter.

```
qgis_process run qgis:buffer -- INPUT=source.shp DISTANCE=2 OUTPUT=buffered.shp
```

Where a parameter accepts a list of values, set the same variable multiple times.

```
qgis_process run native:mergevectorlayers -- LAYERS=input1.shp LAYERS=input2.shp␣
↪OUTPUT=merged.shp
```

While running an algorithm a text-based feedback bar is shown, and the operation can be cancelled via `CTRL+C`. The `run` command also supports further parameters.

- `--json` will format stdout output in a JSON structured way.
- `--ellipsoid` will set the ellipsoid to the specified one.
- `--distance_units` will use the specified distance units.
- `--area_units` will use the specified area units.
- `--project_path` will load the specified project for running the algorithm.

23.9 Writing new Processing algorithms as Python scripts

There are two options for writing Processing algorithms using Python.

- *Extending* `QgsProcessingAlgorithm`
- *Using the @alg decorator*

Within QGIS, you can use *Create new script* in the *Scripts* menu at the top of the *Processing Toolbox* to open the *Processing Script Editor* where you can write your code. To simplify the task, you can start with a script template by using *Create new script from template* from the same menu. This opens a template that extends `QgsProcessingAlgorithm`.

If you save the script in the `scripts` folder (the default location) with a `.py` extension, the algorithm will become available in the *Processing Toolbox*.

23.9.1 Extending QgsProcessingAlgorithm

The following code

1. takes a vector layer as input
2. counts the number of features
3. does a buffer operation
4. creates a raster layer from the result of the buffer operation
5. returns the buffer layer, raster layer and number of features

```
from qgis.PyQt.QtCore import QCoreApplication
from qgis.core import (QgsProcessing,
                       QgsProcessingAlgorithm,
                       QgsProcessingException,
                       QgsProcessingOutputNumber,
                       QgsProcessingParameterDistance,
                       QgsProcessingParameterFeatureSource,
                       QgsProcessingParameterVectorDestination,
                       QgsProcessingParameterRasterDestination)
from qgis import processing


class ExampleProcessingAlgorithm(QgsProcessingAlgorithm):
    """
    This is an example algorithm that takes a vector layer,
    creates some new layers and returns some results.
    """

    def tr(self, string):
        """
        Returns a translatable string with the self.tr() function.
        """
        return QCoreApplication.translate('Processing', string)
```

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```
    def createInstance(self):
        # Must return a new copy of your algorithm.
        return ExampleProcessingAlgorithm()

    def name(self):
        """
        Returns the unique algorithm name.
        """
        return 'bufferrasterextend'

    def displayName(self):
        """
        Returns the translated algorithm name.
        """
        return self.tr('Buffer and export to raster (extend)')

    def group(self):
        """
        Returns the name of the group this algorithm belongs to.
        """
        return self.tr('Example scripts')

    def groupId(self):
        """
        Returns the unique ID of the group this algorithm belongs
        to.
        """
        return 'examplescripts'

    def shortHelpString(self):
        """
        Returns a localised short help string for the algorithm.
        """
        return self.tr('Example algorithm short description')

    def initAlgorithm(self, config=None):
        """
        Here we define the inputs and outputs of the algorithm.
        """
        # 'INPUT' is the recommended name for the main input
        # parameter.
        self.addParameter(
            QgsProcessingParameterFeatureSource(
                'INPUT',
                self.tr('Input vector layer'),
                types=[QgsProcessing.TypeVectorAnyGeometry]
            )
        )
        self.addParameter(
            QgsProcessingParameterVectorDestination(
                'BUFFER_OUTPUT',
                self.tr('Buffer output'),
            )
        )
        # 'OUTPUT' is the recommended name for the main output
        # parameter.
        self.addParameter(
            QgsProcessingParameterRasterDestination(
                'OUTPUT',
                self.tr('Raster output')
```

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```
            )
        )
        self.addParameter(
            QgsProcessingParameterDistance(
                'BUFFERDIST',
                self.tr('BUFFERDIST'),
                defaultValue = 1.0,
                # Make distance units match the INPUT layer units:
                parentParameterName='INPUT'
            )
        )
        self.addParameter(
            QgsProcessingParameterDistance(
                'CELLSIZE',
                self.tr('CELLSIZE'),
                defaultValue = 10.0,
                parentParameterName='INPUT'
            )
        )
        self.addOutput(
            QgsProcessingOutputNumber(
                'NUMBEROFFEATURES',
                self.tr('Number of features processed')
            )
        )

    def processAlgorithm(self, parameters, context, feedback):
        """
        Here is where the processing itself takes place.
        """
        # First, we get the count of features from the INPUT layer.
        # This layer is defined as a QgsProcessingParameterFeatureSource
        # parameter, so it is retrieved by calling
        # self.parameterAsSource.
        input_featuresource = self.parameterAsSource(parameters,
                                                     'INPUT',
                                                     context)
        numfeatures = input_featuresource.featureCount()

        # Retrieve the buffer distance and raster cell size numeric
        # values. Since these are numeric values, they are retrieved
        # using self.parameterAsDouble.
        bufferdist = self.parameterAsDouble(parameters, 'BUFFERDIST',
                                            context)
        rastercellsize = self.parameterAsDouble(parameters, 'CELLSIZE',
                                                context)
        if feedback.isCanceled():
            return {}
        buffer_result = processing.run(
            'native:buffer',
            {
                # Here we pass on the original parameter values of INPUT
                # and BUFFER_OUTPUT to the buffer algorithm.
                'INPUT': parameters['INPUT'],
                'OUTPUT': parameters['BUFFER_OUTPUT'],
                'DISTANCE': bufferdist,
                'SEGMENTS': 10,
                'DISSOLVE': True,
                'END_CAP_STYLE': 0,
                'JOIN_STYLE': 0,
                'MITER_LIMIT': 10
```

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```
            },
            # Because the buffer algorithm is being run as a step in
            # another larger algorithm, the is_child_algorithm option
            # should be set to True
            is_child_algorithm=True,
            #
            # It's important to pass on the context and feedback objects to
            # child algorithms, so that they can properly give feedback to
            # users and handle cancelation requests.
            context=context,
            feedback=feedback)

        # Check for cancelation
        if feedback.isCanceled():
            return {}

        # Run the separate rasterization algorithm using the buffer result
        # as an input.
        rasterized_result = processing.run(
            'qgis:rasterize',
            {
                # Here we pass the 'OUTPUT' value from the buffer's result
                # dictionary off to the rasterize child algorithm.
                'LAYER': buffer_result['OUTPUT'],
                'EXTENT': buffer_result['OUTPUT'],
                'MAP_UNITS_PER_PIXEL': rastercellsize,
                # Use the original parameter value.
                'OUTPUT': parameters['OUTPUT']
            },
            is_child_algorithm=True,
            context=context,
            feedback=feedback)

        if feedback.isCanceled():
            return {}

        # Return the results
        return {'OUTPUT': rasterized_result['OUTPUT'],
                'BUFFER_OUTPUT': buffer_result['OUTPUT'],
                'NUMBEROFFEATURES': numfeatures}
```

Processing algorithm standard functions:

- **createInstance (mandatory)** Must return a new copy of your algorithm. If you change the name of the class, make sure you also update the value returned here to match!
- **name (mandatory)** Returns the unique algorithm name, used for identifying the algorithm.
- **displayName (mandatory)** Returns the translated algorithm name.
- **group** Returns the name of the group this algorithm belongs to.
- **groupId** Returns the unique ID of the group this algorithm belongs to.
- **shortHelpString** Returns a localised short help string for the algorithm.
- **initAlgorithm (mandatory)** Here we define the inputs and outputs of the algorithm.

  `INPUT` and `OUTPUT` are recommended names for the main input and main output parameters, respectively.

  If a parameter depends on another parameter, `parentParameterName` is used to specify this relationship (could be the field / band of a layer or the distance units of a layer).

- **processAlgorithm (mandatory)** This is where the processing takes place.

Parameters are retrieved using special purpose functions, for instance `parameterAsSource` and `parameterAsDouble`.

`processing.run` can be used to run other processing algorithms from a processing algorithm. The first parameter is the name of the algorithm, the second is a dictionary of the parameters to the algorithm. `is_child_algorithm` is normally set to `True` when running an algorithm from within another algorithm. `context` and `feedback` inform the algorithm about the environment to run in and the channel for communicating with the user (catching cancel request, reporting progress, providing textual feedback). When using the (parent) algorithm's parameters as parameters to "child" algorithms, the original parameter values should be used (e.g. `parameters['OUTPUT']`).

It is good practice to check the feedback object for cancelation as much as is sensibly possible! Doing so allows for responsive cancelation, instead of forcing users to wait for unwanted processing to occur.

The algorithm should return values for all the output parameters it has defined as a dictionary. In this case, that's the buffer and rasterized output layers, and the count of features processed. The dictionary keys must match the original parameter/output names.

23.9.2 The @alg decorator

Using the @alg decorator, you can create your own algorithms by writing the Python code and adding a few extra lines to supply additional information needed to make it a proper Processing algorithm. This simplifies the creation of algorithms and the specification of inputs and outputs.

One important limitation with the decorator approach is that algorithms created in this way will always be added to a user's Processing Scripts provider – it is not possible to add these algorithms to a custom provider, e.g. for use in plugins.

The following code uses the @alg decorator to

1. use a vector layer as input
2. count the number of features
3. do a buffer operation
4. create a raster layer from the result of the buffer operation
5. returns the buffer layer, raster layer and number of features

```
from qgis import processing
from qgis.processing import alg
from qgis.core import QgsProject

@alg(name='bufferrasteralg', label='Buffer and export to raster (alg)',
     group='examplescripts', group_label='Example scripts')
# 'INPUT' is the recommended name for the main input parameter
@alg.input(type=alg.SOURCE, name='INPUT', label='Input vector layer')
# 'OUTPUT' is the recommended name for the main output parameter
@alg.input(type=alg.RASTER_LAYER_DEST, name='OUTPUT',
           label='Raster output')
@alg.input(type=alg.VECTOR_LAYER_DEST, name='BUFFER_OUTPUT',
           label='Buffer output')
@alg.input(type=alg.DISTANCE, name='BUFFERDIST', label='BUFFER DISTANCE',
           default=1.0)
@alg.input(type=alg.DISTANCE, name='CELLSIZE', label='RASTER CELL SIZE',
           default=10.0)
@alg.output(type=alg.NUMBER, name='NUMBEROFFEATURES',
            label='Number of features processed')

def bufferrasteralg(instance, parameters, context, feedback, inputs):
    """
    Description of the algorithm.
```

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```
    (If there is no comment here, you will get an error)
    """
    input_featuresource = instance.parameterAsSource(parameters,
                                                     'INPUT', context)
    numfeatures = input_featuresource.featureCount()
    bufferdist = instance.parameterAsDouble(parameters, 'BUFFERDIST',
                                            context)
    rastercellsize = instance.parameterAsDouble(parameters, 'CELLSIZE',
                                                context)
    if feedback.isCanceled():
        return {}
    buffer_result = processing.run('native:buffer',
                                   {'INPUT': parameters['INPUT'],
                                    'OUTPUT': parameters['BUFFER_OUTPUT'],
                                    'DISTANCE': bufferdist,
                                    'SEGMENTS': 10,
                                    'DISSOLVE': True,
                                    'END_CAP_STYLE': 0,
                                    'JOIN_STYLE': 0,
                                    'MITER_LIMIT': 10
                                    },
                                   is_child_algorithm=True,
                                   context=context,
                                   feedback=feedback)
    if feedback.isCanceled():
        return {}
    rasterized_result = processing.run('qgis:rasterize',
                                   {'LAYER': buffer_result['OUTPUT'],
                                    'EXTENT': buffer_result['OUTPUT'],
                                    'MAP_UNITS_PER_PIXEL': rastercellsize,
                                    'OUTPUT': parameters['OUTPUT']
                                   },
                                   is_child_algorithm=True, context=context,
                                   feedback=feedback)
    if feedback.isCanceled():
        return {}
    return {'OUTPUT': rasterized_result['OUTPUT'],
            'BUFFER_OUTPUT': buffer_result['OUTPUT'],
            'NUMBEROFFEATURES': numfeatures}
```

As you can see, it involves two algorithms ('native:buffer' and 'qgis:rasterize'). The last one ('qgis:rasterize') creates a raster layer from the buffer layer that was generated by the first one ('native:buffer').

The part of the code where this processing takes place is not difficult to understand if you have read the previous chapter. The first lines, however, need some additional explanation. They provide the information that is needed to turn your code into an algorithm that can be run from any of the GUI components, like the toolbox or the graphical modeler.

These lines are all calls to the `@alg` decorator functions that help simplify the coding of the algorithm.

- The @alg decorator is used to define the name and location of the algorithm in the Toolbox.
- The @alg.input decorator is used to define the inputs of the algorithm.
- The @alg.output decorator is used to define the outputs of the algorithm.

23.9.3 Input and output types for Processing Algorithms

Here is the list of input and output types that are supported in Processing with their corresponding alg decorator constants (`algfactory.py` contains the complete list of alg constants). Sorted on class name.

Input types

Classes	Alg constant	Descrição
QgsProcessingParameterAuthConfig	alg.AUTH_CFG	Allows users to select from available authentication configurations or create new authentication configurations
QgsProcessingParameterBand	alg.BAND	A band of a raster layer
QgsProcessingParameterBoolean	alg.BOOL	A boolean value
QgsProcessingParameterColor	alg.COLOR	A color
QgsProcessingParameterCoordinateOperation	alg.COORDINATE_OPERATION	A coordinate operation (for CRS transformations)
QgsProcessingParameterCrs	alg.CRS	A Coordinate Reference System
QgsProcessingParameterDatabaseSchema	alg.DATABASE_SCHEMA	A database schema
QgsProcessingParameterDatabaseTable	alg.DATABASE_TABLE	A database table
QgsProcessingParameterDateTime	alg.DATETIME	A datetime (or a pure date or time)
QgsProcessingParameterDistance	alg.DISTANCE	A double numeric parameter for distance values
QgsProcessingParameterEnum	alg.ENUM	An enumeration, allowing for selection from a set of predefined values
QgsProcessingParameterExpression	alg.EXPRESSION	An expression
QgsProcessingParameterExtent	alg.EXTENT	A spatial extent defined by xmin, xmax, ymin, ymax
QgsProcessingParameterField	alg.FIELD	A field in the attribute table of a vector layer
QgsProcessingParameterFile	alg.FILE	A filename of an existing file
QgsProcessingParameterFileDestination	alg.FILE_DEST	A filename for a newly created output file
QgsProcessingParameterFolderDestination	alg.FOLDER_DEST	A folder (destination folder)
QgsProcessingParameterNumber	alg.INT	An integer
QgsProcessingParameterLayout	alg.LAYOUT	A layout
QgsProcessingParameterLayoutItem	alg.LAYOUT_ITEM	A layout item
QgsProcessingParameterMapLayer	alg.MAPLAYER	A map layer
QgsProcessingParameterMapTheme	alg.MAP_THEME	A project map theme
QgsProcessingParameterMatrix	alg.MATRIX	A matrix
QgsProcessingParameterMeshLayer	alg.MESH_LAYER	A mesh layer

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Classes	Alg constant	Descrição
QgsProcessingParameterMultipleLayers	alg.MULTILAYER	A set of layers
QgsProcessingParameterNumber	alg.NUMBER	A numerical value
QgsProcessingParameterPoint	alg.POINT	A point
QgsProcessingParameterProviderConnection	alg.PROVIDER_CONNECTION	An available connection for a database provider
QgsProcessingParameterRange	alg.RANGE	A number range
QgsProcessingParameterRasterLayer	alg.RASTER_LAYER	Uma camada raster
QgsProcessingParameterRasterDestination	alg.RASTER_LAYER_DEST	Uma camada raster
QgsProcessingParameterScale	alg.SCALE	A map scale
QgsProcessingParameterFeatureSink	alg.SINK	A feature sink
QgsProcessingParameterFeatureSource	alg.SOURCE	A feature source
QgsProcessingParameterString	alg.STRING	A text string
QgsProcessingParameterVectorLayer	alg.VECTOR_LAYER	Uma camada vetorial
QgsProcessingParameterVectorDestination	alg.VECTOR_LAYER_DEST	Uma camada vetorial

Output types

Classes	Alg constant	Descrição
QgsProcessingOutputBoolean	alg.BOOL	A boolean value
QgsProcessingOutputNumber	alg.DISTANCE	A double numeric parameter for distance values
QgsProcessingOutputFile	alg.FILE	A filename of an existing file
QgsProcessingOutputFolder	alg.FOLDER	A folder
QgsProcessingOutputHtml	alg.HTML	HTML
QgsProcessingOutputNumber	alg.INT	A integer
QgsProcessingOutputLayerDefinition	alg.LAYERDEF	A layer definition
QgsProcessingOutputMapLayer	alg.MAPLAYER	A map layer
QgsProcessingOutputMultipleLayers	alg.MULTILAYER	A set of layers
QgsProcessingOutputNumber	alg.NUMBER	A numerical value
QgsProcessingOutputRasterLayer	alg.RASTER_LAYER	Uma camada raster
QgsProcessingOutputString	alg.STRING	A text string
QgsProcessingOutputVectorLayer	alg.VECTOR_LAYER	Uma camada vetorial

23.9.4 Handing algorithm output

When you declare an output representing a layer (raster or vector), the algorithm will try to add it to QGIS once it is finished.

- Raster layer output: QgsProcessingParameterRasterDestination / alg.RASTER_LAYER_DEST.
- Vector layer output: QgsProcessingParameterVectorDestination / alg.VECTOR_LAYER_DEST.

So even if the `processing.run()` method does not add the layers it creates to the user's current project, the two output layers (buffer and raster buffer) will be loaded, since they are saved to the destinations entered by the user (or to temporary destinations if the user does not specify destinations).

If a layer is created as output of an algorithm, it should be declared as such. Otherwise, you will not be able to properly use the algorithm in the modeler, since what is declared will not match what the algorithm really creates.

You can return strings, numbers and more by specifying them in the result dictionary (as demonstrated for "NUMBEROFFEATURES"), but they should always be explicitly defined as outputs from your algorithm. We encourage algorithms to output as many useful values as possible, since these can be valuable for use in later algorithms when your algorithm is used as part of a model.

23.9.5 Comunicação com o usuário

If your algorithm takes a long time to process, it is a good idea to inform the user about the progress. You can use `feedback` (`QgsProcessingFeedback`) for this.

The progress text and progressbar can be updated using two methods: `setProgressText(text)` and `setProgress(percent)`.

You can provide more information by using `pushCommandInfo(text)`, `pushDebugInfo(text)`, `pushInfo(text)` and `reportError(text)`.

If your script has a problem, the correct way of handling it is to raise a `QgsProcessingException`. You can pass a message as an argument to the constructor of the exception. Processing will take care of handling it and communicating with the user, depending on where the algorithm is being executed from (toolbox, modeler, Python console, …)

23.9.6 Documentando seus scripts

You can document your scripts by overloading the `helpString()` and `helpUrl()` methods of `QgsProcessingAlgorithm`.

23.9.7 Flags

You can override the `flags()` method of `QgsProcessingAlgorithm` to tell QGIS more about your algorithm. You can for instance tell QGIS that the script shall be hidden from the modeler, that it can be canceled, that it is not thread safe, and more.

Dica: By default, Processing runs algorithms in a separate thread in order to keep QGIS responsive while the processing task runs. If your algorithm is regularly crashing, you are probably using API calls which are not safe to do in a background thread. Try returning the QgsProcessingAlgorithm.FlagNoThreading flag from your algorithm's flags() method to force Processing to run your algorithm in the main thread instead.

23.9.8 Melhores práticas para algoritmos de script escrito

Here's a quick summary of ideas to consider when creating your script algorithms and, especially, if you want to share them with other QGIS users. Following these simple rules will ensure consistency across the different Processing elements such as the toolbox, the modeler or the batch processing interface.

- Não coloque resultados das camadas. Vamos trabalhar o Processamento com seus resultados e carregar suas camadas se necessárias.
- Always declare the outputs your algorithm creates.
- Do not show message boxes or use any GUI element from the script. If you want to communicate with the user, use the methods of the feedback object (`QgsProcessingFeedback`) or throw a `QgsProcessingException`.

There are already many processing algorithms available in QGIS. You can find code on https://github.com/qgis/QGIS/blob/release-3_16/python/plugins/processing/algs/qgis.

23.10 Configurando as aplicações externas

The processing framework can be extended using additional applications. Algorithms that rely on external applications are managed by their own algorithm providers. Additional providers can be found as separate plugins, and installed using the QGIS Plugin Manager.

This section will show you how to configure the Processing framework to include these additional applications, and it will explain some particular features of the algorithms based on them. Once you have correctly configured the system, you will be able to execute external algorithms from any component like the toolbox or the graphical modeler, just like you do with any other algorithm.

By default, algorithms that rely on an external application not shipped with QGIS are not enabled. You can enable them in the Processing settings dialog if they are installed on your system.

23.10.1 Uma nota para usuários Windows

If you are not an advanced user and you are running QGIS on Windows, you might not be interested in reading the rest of this chapter. Make sure you install QGIS in your system using the standalone installer. That will automatically install SAGA and GRASS in your system and configure them so they can be run from QGIS. All the algorithms from these providers will be ready to be run without needing any further configuration. If installing with the OSGeo4W application, make sure that you also select SAGA and GRASS for installation.

23.10.2 Uma nota para os formatos dos arquivos

When using external software, opening a file in QGIS does not mean that it can be opened and processed in that other software. In most cases, other software can read what you have opened in QGIS, but in some cases, that might not be true. When using databases or uncommon file formats, whether for raster or vector layers, problems might arise. If that happens, try to use well-known file formats that you are sure are understood by both programs, and check the console output (in the log panel) to find out what is going wrong.

You might for instance get trouble and not be able to complete your work if you call an external algorithm with a GRASS raster layers as input. For this reason, such layers will not appear as available to algorithms.

You should, however, not have problems with vector layers, since QGIS automatically converts from the original file format to one accepted by the external application before passing the layer to it. This adds extra processing time, which might be significant for large layers, so do not be surprised if it takes more time to process a layer from a DB connection than a layer from a Shapefile format dataset of similar size.

Providers not using external applications can process any layer that you can open in QGIS, since they open it for analysis through QGIS.

All raster and vector output formats produced by QGIS can be used as input layers. Some providers do not support certain formats, but all can export to common formats that can later be transformed by QGIS automatically. As for input layers, if a conversion is needed, that might increase the processing time.

23.10.3 Uma nota para as seleções da camada vetorial

External applications may also be made aware of the selections that exist in vector layers within QGIS. However, that requires rewriting all input vector layers, just as if they were originally in a format not supported by the external application. Only when no selection exists, or the *Use only selected features* option is not enabled in the processing general configuration, can a layer be directly passed to an external application.

In other cases, exporting only selected features is needed, which causes longer execution times.

23.10.4 SAGA

SAGA algorithms can be run from QGIS if SAGA is included with the QGIS installation.

If you are running Windows, both the stand-alone installer and the OSGeo4W installer include SAGA.

Sobre as limitações do sistema de grid do SAGA

Most SAGA algorithms that require several input raster layers require them to have the same grid system. That is, they must cover the same geographic area and have the same cell size, so their corresponding grids match. When calling SAGA algorithms from QGIS, you can use any layer, regardless of its cell size and extent. When multiple raster layers are used as input for a SAGA algorithm, QGIS resamples them to a common grid system and then passes them to SAGA (unless the SAGA algorithm can operate with layers from different grid systems).

A definição do sistema de projeção comum é controlado pelo usuário, você vai encontrar vários parâmetros no grupo SAGA da janela de configuração para definí-lo. Existem duas maneiras de definir o sistema de projeção:

- Configure-o manualmente. Você define a extensão configurando os valores dos seguintes parâmetros:
  - *Reamostragem do X min*
  - *Reamostragem do X máx*
  - *Reamostragem do Y min*
  - *Reamostragem do Y máx*
  - *Reamostragem do tamanho da célula*

  Notice that QGIS will resample input layers to that extent, even if they do not overlap with it.
- Configurando automaticamente a partir das camadas de entrada. Para selecionar esta opção, verifique a opção:guilabel:*Use min covering grid system for resampling*. Todas as outras configurações irão ser ignoradas e a extensão mínima que cobre todas as camadas de entrada serão usadas. O tamanho de célula da camada de destino é o máximo de tamanho de célula de todas as camadas de entrada.

Para algoritmos que não usam camadas raster múltiplas, ou para aquelas que não necessitam de um único sistema de grid de entrada, não será feito uma reamostragem antes de chamar o SAGA, e esses parâmetros não serão usados.

Limitações para camadas multi-banda

Unlike QGIS, SAGA has no support for multi-band layers. If you want to use a multiband layer (such as an RGB or multispectral image), you first have to split it into single-banded images. To do so, you can use the 'SAGA/Grid - Tools/Split RGB image' algorithm (which creates three images from an RGB image) or the 'SAGA/Grid - Tools/Extract band' algorithm (to extract a single band).

Limitações na resolução espacial

O SAGA pressupõe que as camadas raster têm o mesmo tamanho de célula no eixo X e Y. Se estiver trabalhando com uma camada com diferentes valores para o tamanho de célula horizontal e vertical, deverá obter resultados inesperados. Nesse caso, um aviso será adicionado ao registo do processamento, indicando que a camada de entrada não se adapta de forma a ser processado pelo SAGA.

Registrando

When QGIS calls SAGA, it does so using its command-line interface, thus passing a set of commands to perform all the required operations. SAGA shows its progress by writing information to the console, which includes the percentage of processing already done, along with additional content. This output is filtered and used to update the progress bar while the algorithm is running.

Both the commands sent by QGIS and the additional information printed by SAGA can be logged along with other processing log messages, and you might find them useful to track what is going on when QGIS runs a SAGA algorithm. You will find two settings, namely *Log console output* and *Log execution commands*, to activate that logging mechanism.

Most other providers that use external applications and call them through the command-line have similar options, so you will find them as well in other places in the processing settings list.

23.10.5 R scripts

To enable R in Processing you need to install the **Processing R Provider** plugin and configure R for QGIS.

Configuration is done in *Provider* ► *R* in the *Processing* tab of *Settings* ► *Options*.

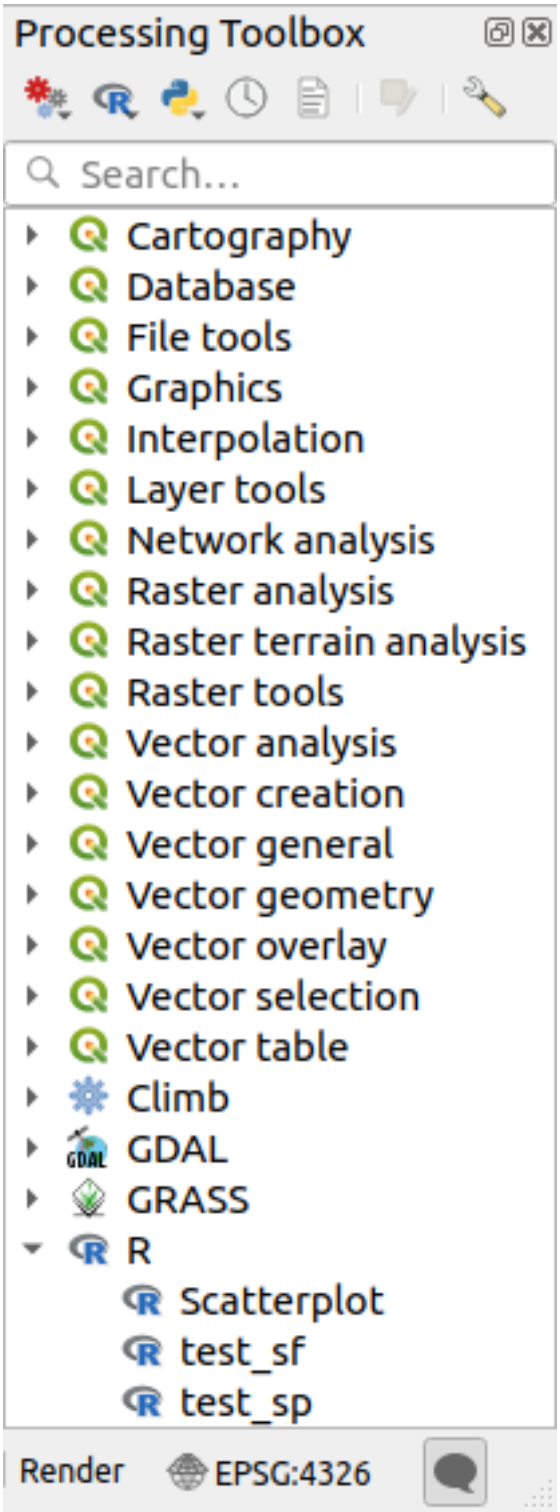
Depending on your operating system, you may have to use *R folder* to specify where your R binaries are located.

Nota: On **Windows** the R executable file is normally in a folder (`R-<version>`) under `C:\Program Files\R\`. Specify the folder and **NOT** the binary!

On **Linux** you just have to make sure that the R folder is in the PATH environment variable. If `R` in a terminal window starts R, then you are ready to go.

After installing the **Processing R Provider** plugin, you will find some example scripts in the *Processing Toolbox*:

- *Scatterplot* runs an R function that produces a scatter plot from two numerical fields of the provided vector layer.
- *test_sf* does some operations that depend on the `sf` package and can be used to check if the R package `sf` is installed. If the package is not installed, R will try to install it (and all the packages it depends on) for you, using the *Package repository* specified in *Provider* ► *R* in the Processing options. The default is https://cran.at.r-project.org/. Installing may take some time…
- *test_sp* can be used to check if the R package `sp` is installed. If the package is not installed, R will try to install it for you.



If you have R configured correctly for QGIS, you should be able to run these scripts.

Adding R scripts from the QGIS collection

R integration in QGIS is different from that of SAGA in that there is not a predefined set of algorithms you can run (except for some example script that come with the *Processing R Provider* plugin).

A set of example R scripts is available in the QGIS Repository. Perform the following steps to load and enable them using the *QGIS Resource Sharing* plugin.

1. Add the *QGIS Resource Sharing* plugin (you may have to enable *Show also experimental plugins* in the Plugin Manager *Settings*)
2. Open it (Plugins –> Resource Sharing –> Resource Sharing)
3. Choose the *Settings* tab
4. Click *Reload repositories*
5. Choose the *All* tab
6. Select *QGIS R script collection* in the list and click on the *Install* button
7. The collection should now be listed in the *Installed* tab
8. Close the plugin
9. Open the *Processing Toolbox*, and if everything is OK, the example scripts will be present under R, in various groups (only some of the groups are expanded in the screenshot below).

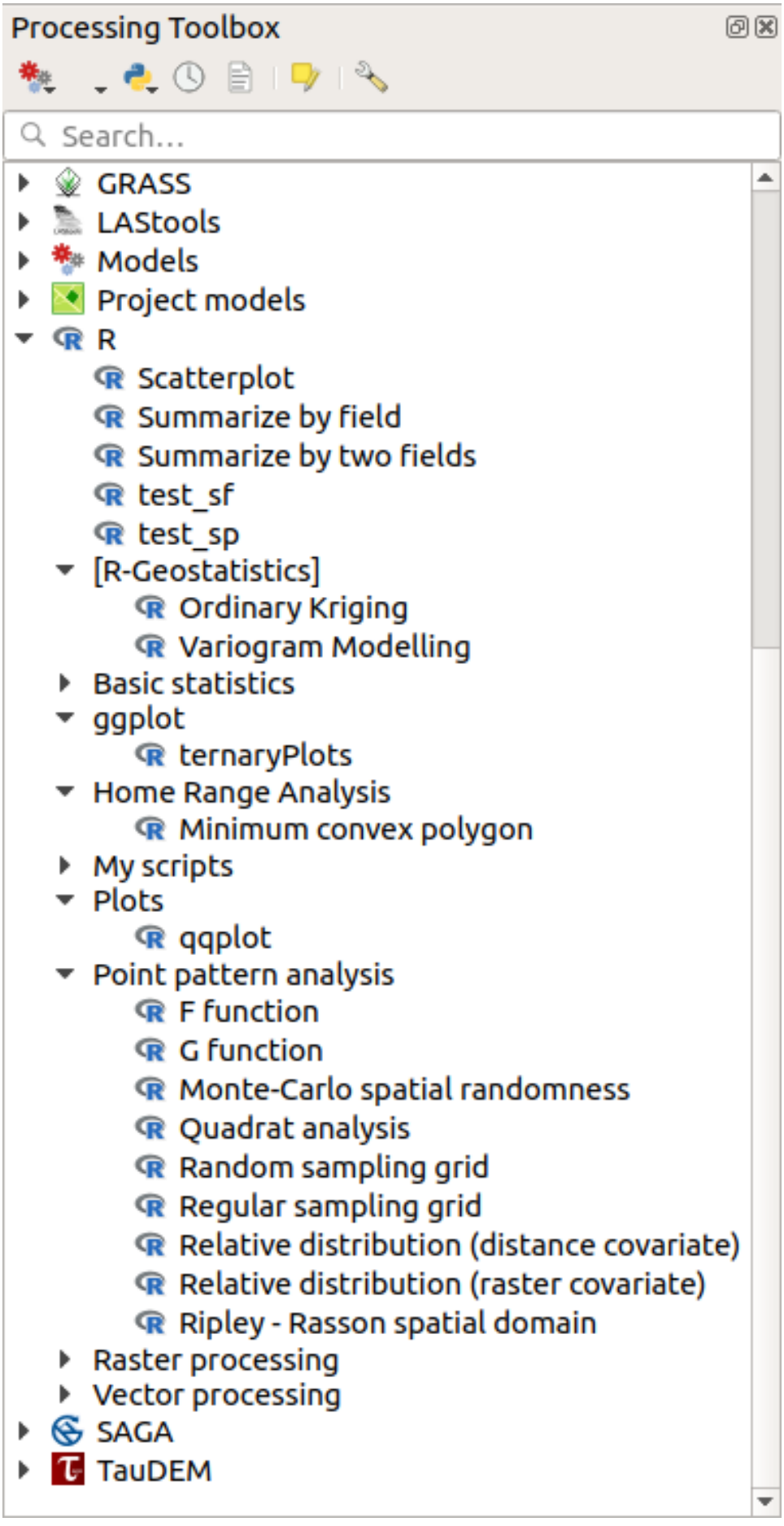
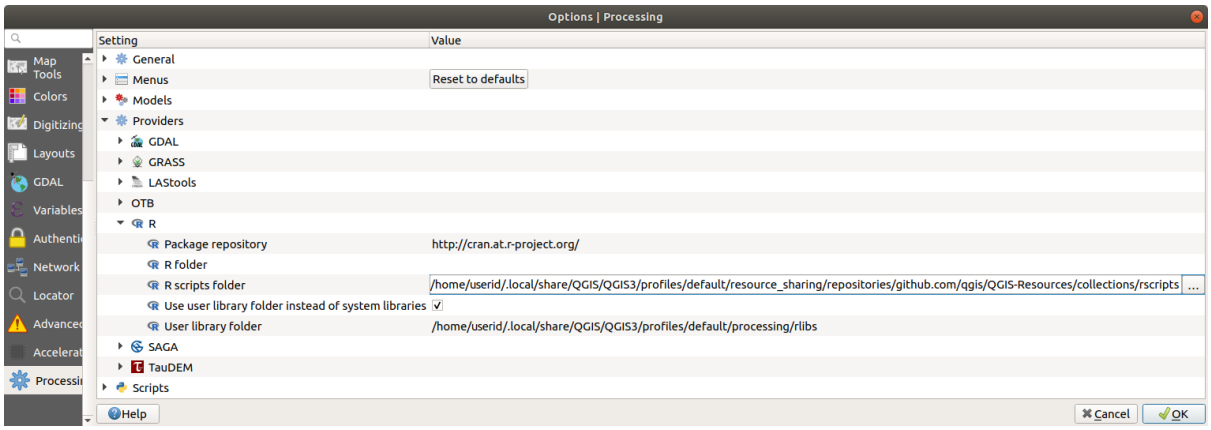


Figura23.34: The *Processing Toolbox* with some R scripts shown

The scripts at the top are the example scripts from the *Processing R Provider* plugin.

10. If, for some reason, the scripts are not available in the *Processing Toolbox*, you can try to:
    1. Open the Processing settings (*Settings* ► *Options* ► *Processing* tab)
    2. Go to *Providers* ► *R* ► *R scripts folder*
       - On Ubuntu, set the path to (or, better, include in the path):

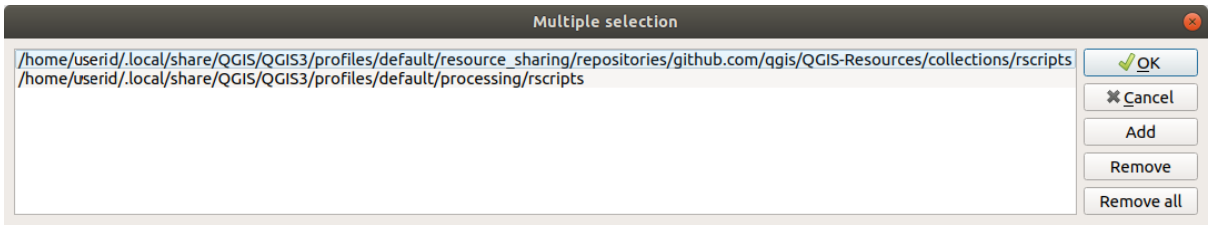
         /home/<user>/.local/share/QGIS/QGIS3/profiles/default/resource_sharing/repositories/github.com/qgis/QGIS-Resources/collections/rscripts



       - On Windows, set the path to (or, better, include in the path):

         C:\Users\<user>\AppData\Roaming\QGIS\QGIS3\profiles\default\resource_sharing\repositories\github.com\qgis\QGIS-Resources\collections\rscripts

    To edit, double-click. You can then choose to just paste / type the path, or you can navigate to the directory by using the … button and press the *Add* button in the dialog that opens. It is possible to provide several directories here. They will be separated by a semicolon (";").



If you would like to get all the R scrips from the QGIS 2 on-line collection, you can select *QGIS R script collection (from QGIS 2)* instead of *QGIS R script collection*. You will probably find that scripts that depend on vector data input or output will not work.

Creating R scripts

You can write scripts and call R commands, as you would do from R. This section shows you the syntax for using R commands in QGIS, and how to use QGIS objects (layers, tables) in them.

To add an algorithm that calls an R function (or a more complex R script that you have developed and you would like to have available from QGIS), you have to create a script file that performs the R commands.

R script files have the extension `.rsx`, and creating them is pretty easy if you just have a basic knowledge of R syntax and R scripting. They should be stored in the R scripts folder. You can specify the folder (*R scripts folder*) in the *R* settings group in Processing settings dialog).

Let's have a look at a very simple script file, which calls the R method `spsample` to create a random grid within the boundary of the polygons in a given polygon layer. This method belongs to the `maptools` package. Since almost all the algorithms that you might like to incorporate into QGIS will use or generate spatial data, knowledge of spatial packages like `maptools` and `sp`/`sf`, is very useful.

```
##Random points within layer extent=name
##Point pattern analysis=group
##Vector_layer=vector
##Number_of_points=number 10
##Output=output vector
library(sp)
spatpoly = as(Vector_layer, "Spatial")
pts=spsample(spatpoly,Number_of_points,type="random")
spdf=SpatialPointsDataFrame(pts, as.data.frame(pts))
Output=st_as_sf(spdf)
```

The first lines, which start with a double Python comment sign (`##`), define the display name and group of the script, and tell QGIS about its inputs and outputs.

Nota: To find out more about how to write your own R scripts, have a look at the R Intro section in the training manual and consult the *QGIS R Syntax* section.

When you declare an input parameter, QGIS uses that information for two things: creating the user interface to ask the user for the value of that parameter, and creating a corresponding R variable that can be used as R function input.

In the above example, we have declared an input of type `vector`, named `Vector_layer`. When executing the algorithm, QGIS will open the layer selected by the user and store it in a variable named `Vector_layer`. So, the name of a parameter is the name of the variable that you use in R for accessing the value of that parameter (you should therefore avoid using reserved R words as parameter names).

Spatial parameters such as vector and raster layers are read using the `st_read()` (or `readOGR`) and `brick()` (or `readGDAL`) commands (you do not have to worry about adding those commands to your description file – QGIS will do it), and they are stored as `sf` (or `Spatial*DataFrame`) objects.

Table fields are stored as strings containing the name of the selected field.

Vector files can be read using the `readOGR()` command instead of `st_read()` by specifying `##load_vector_using_rgdal`. This will produce a `Spatial*DataFrame` object instead of an `sf` object.

Raster files can be read using the `readGDAL()` command instead of `brick()` by specifying `##load_raster_using_rgdal`.

If you are an advanced user and do not want QGIS to create the object for the layer, you can use `##pass_filenames` to indicate that you prefer a string with the filename. In this case, it is up to you to open the file before performing any operation on the data it contains.

With the above information, it is possible to understand the first lines of the R script (the first line not starting with a Python comment character).

```
library(sp)
spatpoly = as(Vector_layer, "Spatial")
pts=spsample(polyg,numpoints,type="random")
```

The `spsample` function is provided by the *sp* library, so the first thing we do is to load that library. The variable `Vector_layer` contains an `sf` object. Since we are going to use a function (`spsample`) from the *sp* library, we must convert the `sf` object to a `SpatialPolygonsDataFrame` object using the `as` function.

Then we call the `spsample` function with this object and the `numpoints` input parameter (which specifies the number of points to generate).

Since we have declared a vector output named `Output`, we have to create a variable named `Output` containing an `sf` object.

We do this in two steps. First we create a `SpatialPolygonsDataFrame` object from the result of the function, using the *SpatialPointsDataFrame* function, and then we convert that object to an `sf` object using the `st_as_sf` function (of the *sf* library).

You can use whatever names you like for your intermediate variables. Just make sure that the variable storing your final result has the defined name (in this case `Output`), and that it contains a suitable value (an `sf` object for vector layer output).

In this case, the result obtained from the `spsample` method had to be converted explicitly into an `sf` object via a `SpatialPointsDataFrame` object, since it is itself an object of class `ppp`, which can not be returned to QGIS.

If your algorithm generates raster layers, the way they are saved will depend on whether or not you have used the `##dontuserasterpackage` option. If you have used it, layers are saved using the `writeGDAL()` method. If not, the `writeRaster()` method from the `raster` package will be used.

If you have used the `##pass_filenames` option, outputs are generated using the `raster` package (with `writeRaster()`).

If your algorithm does not generate a layer, but a text result in the console instead, you have to indicate that you want the console to be shown once the execution is finished. To do so, just start the command lines that produce the results you want to print with the > ('greater than') sign. Only output from lines prefixed with > are shown. For instance, here is the description file of an algorithm that performs a normality test on a given field (column) of the attributes of a vector layer:

```
##layer=vector
##field=field layer
##nortest=group
library(nortest)
>lillie.test(layer[[field]])
```

The output of the last line is printed, but the output of the first is not (and neither are the outputs from other command lines added automatically by QGIS).

If your algorithm creates any kind of graphics (using the `plot()` method), add the following line (`output_plots_to_html` used to be `showplots`):

```
##output_plots_to_html
```

This will cause QGIS to redirect all R graphical outputs to a temporary file, which will be opened once R execution has finished.

Both graphics and console results will be available through the processing results manager.

For more information, please check the R scripts in the official QGIS collection (you download and install them using the *QGIS Resource Sharing* plugin, as explained elsewhere). Most of them are rather simple and will greatly help you understand how to create your own scripts.

Nota: The `sf`, `rgdal` and `raster` libraries are loaded by default, so you do not have to add the corresponding `library()` commands. However, other libraries that you might need have to be explicitly loaded by typing: `library(ggplot2)` (to load the `ggplot2` library). If the package is not already installed on your machine, Processing will try to download and install it. In this way the package will also become available in R Standalone. **Be aware** that if the package has to be downloaded, the script may take a long time to run the first time.

23.10.6 R libraries

The R script `sp_test` tries to load the R packages `sp` and `raster`.

R libraries installed when running sf_test

The R script *sf_test* tries to load `sf` and `raster`. If these two packages are not installed, R may try to load and install them (and all the libraries that they depend on).

The following R libraries end up in `~/.local/share/QGIS/QGIS3/profiles/default/processing/rscripts` after `sf_test` has been run from the Processing Toolbox on Ubuntu with version 2.0 of the *Processing R Provider* plugin and a fresh install of *R* 3.4.4 (*apt* package `r-base-core` only):

`abind, askpass, assertthat, backports, base64enc, BH, bit, bit64, blob, brew, callr, classInt, cli, colorspace, covr, crayon, crosstalk, curl, DBI, deldir, desc, dichromat, digest, dplyr, e1071, ellipsis, evaluate, fansi, farver, fastmap, gdtools, ggplot2, glue, goftest, gridExtra, gtable, highr, hms, htmltools, htmlwidgets, httpuv, httr, jsonlite, knitr, labeling, later, lazyeval, leafem, leaflet, leaflet.providers, leafpop, leafsync, lifecycle, lwgeom, magrittr, maps, mapview, markdown, memoise, microbenchmark, mime, munsell, odbc, openssl, pillar, pkgbuild, pkgconfig, pkgload, plogr, plyr, png, polyclip, praise, prettyunits, processx, promises, ps, purrr, R6, raster, RColorBrewer, Rcpp, reshape2, rex, rgeos, rlang, rmarkdown, RPostgres, RPostgreSQL, rprojroot, RSQLite, rstudioapi, satellite, scales, sf, shiny, sourcetools, sp, spatstat, spatstat.data, spatstat.utils, stars, stringi, stringr, svglite, sys, systemfonts, tensor, testthat, tibble, tidyselect, tinytex, units, utf8, uuid, vctrs, viridis, viridisLite, webshot, withr, xfun, XML, xtable`

23.10.7 GRASS

Configuring GRASS is not much different from configuring SAGA. First, the path to the GRASS folder has to be defined, but only if you are running Windows.

By default, the Processing framework tries to configure its GRASS connector to use the GRASS distribution that ships along with QGIS. This should work without problems for most systems, but if you experience problems, you might have to configure the GRASS connector manually. Also, if you want to use a different GRASS installation, you can change the setting to point to the folder where the other version is installed. GRASS 7 is needed for algorithms to work correctly.

If you are running Linux, you just have to make sure that GRASS is correctly installed, and that it can be run without problem from a terminal window.

GRASS algorithms use a region for calculations. This region can be defined manually using values similar to the ones found in the SAGA configuration, or automatically, taking the minimum extent that covers all the input layers used to execute the algorithm each time. If the latter approach is the behavior you prefer, just check the *Use min covering region* option in the GRASS configuration parameters.

23.10.8 LAStools

To use LAStools in QGIS, you need to download and install LAStools on your computer and install the LAStools plugin (available from the official repository) in QGIS.

On Linux platforms, you will need Wine to be able to run some of the tools.

LAStools is activated and configured in the Processing options (*Settings* ► *Options*, *Processing* tab, *Providers* ► *LAStools*), where you can specify the location of LAStools (*LAStools folder*) and Wine (*Wine folder*). On Ubuntu, the default Wine folder is `/usr/bin`.

23.10.9 OTB Applications

OTB applications are fully supported within the QGIS Processing framework.

OTB (Orfeo ToolBox) is an image processing library for remote sensing data. It also provides applications that provide image processing functionalities. The list of applications and their documentation are available in OTB CookBook

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Nota: Note that OTB is not distributed with QGIS and needs to be installed separately. Binary packages for OTB can be found on the download page.

To configure QGIS processing to find the OTB library:

1. Open the processing settings: *Settings* ► *Options* ► *Processing* (left panel)*
2. You can see OTB under "Providers":
    1. Expand the *OTB* tab
    2. Tick the *Activate* option
    3. Set the *OTB folder*. This is the location of your OTB installation.
    4. Set the *OTB application folder*. This is the location of your OTB applications (`<PATH_TO_OTB_INSTALLATION>/lib/otb/applications`)
    5. Click "ok" to save the settings and close the dialog.

If settings are correct, OTB algorithms will be available in the *Processing Toolbox*.

Documentation of OTB settings available in QGIS Processing

- **Activate**: This is a checkbox to activate or deactivate the OTB provider. An invalid OTB setting will uncheck this when saved.
- **OTB folder**: This is the directory where OTB is available.
- **OTB application folder**: This is the location(s) of OTB applications.

  Multiple paths are allowed.
- **Logger level** (optional): Level of logger to use by OTB applications.

  The level of logging controls the amount of detail printed during algorithm execution. Possible values for logger level are `INFO`, `WARNING`, `CRITICAL`, `DEBUG`. This value is `INFO` by default. This is an advanced user configuration.
- **Maximum RAM to use** (optional): by default, OTB applications use all available system RAM.

  You can, however, instruct OTB to use a specific amount of RAM (in MB) using this option. A value of 256 is ignored by the OTB processing provider. This is an advanced user configuration.

- **Geoid file** (optional): Path to the geoid file.

  This option sets the value of the elev.dem.geoid and elev.geoid parameters in OTB applications. Setting this value globally enables users to share it across multiple processing algorithms. Empty by default.

- **SRTM tiles folder** (optional): Directory where SRTM tiles are available.

  SRTM data can be stored locally to avoid downloading of files during processing. This option sets the value of elev.dem.path and elev.dem parameters in OTB applications. Setting this value globally enables users to share it across multiple processing algorithms. Empty by default.

Compatibility between QGIS and OTB versions

All OTB versions (from OTB 6.6.1) are compatible with the latest QGIS version.

Troubleshoot

If you have issues with OTB applications in QGIS Processing, please open an issue on the OTB bug tracker, using the `qgis` label.

Additional information about OTB and QGIS can be found here

CAPÍTULO 24

Fornece algoritmos e processamento

Algoritmos de processamento e os seus parâmetros (tal como apresentados no interface do utilizador) são documentados aqui.

24.1 Provedor de algorítmo QGIS

O fornecedor de algoritmos QGIS implementa várias operações de análise e geoprocessamento usando praticamente apenas a API do QGIS. Assim quase todos os algoritmos deste fornecedor funcionam "out of the box" sem necessidade de configuração adicional.

Este fornecedor inclui algoritmos próprios e provenientes de plugins.

24.1.1 Cartography

Align points to features

Calculates the rotation required to align point features with their nearest feature from another reference layer. A new field is added to the output layer which is filled with the angle (in degrees, clockwise) to the nearest reference feature.

Optionally, the output layer's symbology can be set to automatically use the calculated rotation field to rotate marker symbols. If desired, a maximum distance to use when aligning points can be set, to avoid aligning isolated points to distant features.

Dica: This algorithm is designed for use cases like aligning building point symbols to follow the nearest road direction.

Allows *features in-place modification*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: point]	Point features to calculate the rotation for
Reference layer	`REFERENCE_LAYER`	[vector: any]	Layer to find the closest feature from for rotation calculation
Maximum distance to consider Opcional	`MAX_DISTANCE`	[number] Default: Not set	If no reference feature is found within this distance, no rotation is assigned to the point feature.
Angle field name	`FIELD_NAME`	[string] Default: 'rotation'	Field in which to store the rotation value.
Automatically apply symbology	`APPLY_SYMBOLOGY`	[boolean] Default: True	Rotates the symbol marker of the features using the angle field value
Aligned layer	`SAÍDA`	[vector: point] Default: `[Save to temporary file]`	Specify the rotated output vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Save to Database Table… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Aligned layer	`SAÍDA`	[vector: point]	The point layer appended with a rotation field. If loaded to QGIS, it is applied by default the input layer symbology, with a data-defined rotation of its marker symbol.

Python code

Algorithm ID: `native:angletonearest`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Combine style databases

Combines multiple QGIS style databases into a single style database. If items of the same type with the same name exist in different source databases these will be renamed to have unique names in the output combined database.

Ver também:

Create style database from project

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input databases	`ENTRADA`	[file] [list]	Files containing QGIS style items
Objects to combine	`OBJECTS`	[enumeration] [list]	Types of style items in the input databases you would like to put in the new database. These can be: • 0 — *Symbols* • 1 — *Color ramps* • 2 — *Text formats* • 3 — *Label settings*
Output style database	`SAÍDA`	[file] Default: `[Save to temporary file]`	Output `.XML` file combining the selected style items. One of: • Save to a Temporary File • Salvar para Arquivo…

Saídas

Etiqueta	Nome	Tipo	Descrição
Color ramp count	`COLORRAMPS`	[number]	
Label settings count	`LABELSETTINGS`	[number]	
Output style database	`SAÍDA`	[file]	Output `.XML` file combining the selected style items
Symbol count	`SYMBOLS`	[number]	
Text format count	`TEXTFORMATS`	[number]	

Python code

Algorithm ID: `native:combinestyles`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create categorized renderer from styles

Sets a vector layer's renderer to a categorized renderer using matching symbols from a style database. If no style file is specified, symbols from the user's current *symbol library* are used instead.

A specified expression or field is used to create categories for the renderer. Each category is individually matched to the symbols which exist within the specified QGIS XML style database. Whenever a matching symbol name is found, the category's symbol will be set to this matched symbol.

If desired, outputs can also be tables containing lists of the categories which could not be matched to symbols, and symbols which were not matched to categories.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Vector layer to apply a categorized style to
Categorize using expression	`CAMPO`	[expression]	Field or expression to categorize the features
Style database (leave blank to use saved symbols)	`ESTILO`	[file]	File (`.XML`) containing the symbols to apply to the input layer categories. The file can be obtained from the Style Manager *Share symbols* tool. If no file is specified, QGIS local symbols library is used.
Use case-sensitive match to symbol names	`CASE_SENSITIVE`	[boolean] Padrão: Falso	If True (checked), applies a case sensitive comparison between the categories and symbols names
Ignore non-alphanumeric characters while matching	`TOLERANT`	[boolean] Padrão: Falso	If True (checked), non-alphanumeric characters in the categories and symbols names will be ignored, allowing greater tolerance during the match.
Non-matching categories Opcional	`NON_MATCHING_CATEGORIES`	[table] Default: `[Skip output]`	Output table for categories which do not match any symbol in the database. One of: • Skip Output • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Save to Database Table… A codificação do arquivo também pode ser alterada aqui.
Non-matching symbol names Opcional	`NON_MATCHING_SYMBOLS`	[table] Default: `[Skip output]`	Output table for symbols from the provided style database which do not match any category. One of: • Skip Output • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Save to Database Table… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Non-matching categories	`NON_MATCHING_CATEGORIES`	[table]	Lists categories which could not be matched to any symbol in the provided style database
Non-matching symbol names	`NON_MATCHING_SYMBOLS`	[table]	Lists symbols from the provided style database which could not match any category
Categorized layer	`SAÍDA`	[same as input]	The input vector layer with the categorized style applied. No new layer is output.

Python code

Algorithm ID: `native:categorizeusingstyle`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create style database from project

Extracts all style objects (symbols, color ramps, text formats and label settings) from a QGIS project.

The extracted symbols are saved to a QGIS style database (`XML` format), which can be managed and imported via the *Style Manager* dialog.

Ver também:

Combine style databases

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input project (leave blank to use current) Opcional	`ENTRADA`	[file]	A QGIS project file to extract the style items from
Objects to extract	`OBJECTS`	[enumeration] [list]	Types of style items in the input project you would like to put in the new database. These can be: • 0 — *Symbols* • 1 — *Color ramps* • 2 — *Text formats* • 3 — *Label settings*
Output style database	`SAÍDA`	[file] Default: `[Save to temporary file]`	Specify the output `.XML` file for the selected style items. One of: • Save to a Temporary File • Salvar para Arquivo…

Saídas

Etiqueta	Nome	Tipo	Descrição
Color ramp count	`COLORRAMPS`	[number]	Number of color ramps
Label settings count	`LABELSETTINGS`	[number]	Number of label settings
Output style database	`SAÍDA`	[file]	Output `.XML` file for the selected style items
Symbol count	`SYMBOLS`	[number]	Number of symbols
Text format count	`TEXTFORMATS`	[number]	Number of text formats

Python code

Algorithm ID: `native:stylefromproject`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Export atlas layout as image

Exports the atlas of a print layout as image files (e.g. PNG or JPEG images).

If a coverage layer is set, the selected layout's atlas settings exposed in this algorithm will be overwritten. In this case, an empty filter or sort by expression will turn those settings off.

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Atlas layout	`LAYOUT`	[layout]	Layout to export
Coverage layer Opcional	`COVERAGE_LAYER`	[vector: any]	Layer to use to generate the atlas
Filter expression	`FILTER_EXPRESSION`	[expression]	Expression to use to filter out atlas features
Sort expression Opcional	`SORTBY_EXPRESSION`	[expression]	Expression to use to sort the atlas features
Reverse sort order Opcional	`SORTBY_REVERSE`	[boolean]	Determines if sorting should be inverted. Used when a sort expression is provided.
Output filename expression	`FILENAME_EXPRESSION`	[expression] Default: 'output_'||@atlas_featurenumber	Expression for use to generate filenames
Output folder	`FOLDER`	[folder]	Destination folder where the images will be generated

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Map layers to assign to unlocked map item(s) Opcional	`LAYERS`	[enumeration] [layer]	Layers to display in the map item(s) whose contents are not locked
Image format	`EXTENSION`	[list] Default: png	File format of the generated output(s). The list of available formats varies depending on OS and installed drivers.
DPI Opcional	`DPI` Default: Not set	[number]	DPI of the output file(s). If not set, the value in the print layout settings will be used.
Generate world file	`GEOREFERENCE`	[boolean] Default: True	Determines if a world file should be generated
Export RDF metadata	`INCLUDE_METADATA`	[boolean] Default: True	Determines if RDF metadata (title, author, …) should be generated
Enable antialiasing	`ANTIALIAS`	[boolean] Default: True	Determines if antialiasing should be enabled

Saídas

Etiqueta	Nome	Tipo	Descrição
Image file	`SAÍDA`	[file]	Image files generated by the atlas layout

Python code

Algorithm ID: `native:atlaslayouttoimage`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Export atlas layout as PDF

Exports the atlas of a print layout as a PDF file(s).

If a coverage layer is set, the selected layout's atlas settings exposed in this algorithm will be overwritten. In this case, an empty filter or sort by expression will turn those settings off.

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Atlas layout	`LAYOUT`	[layout]	Layout to export
Coverage layer Opcional	`COVERAGE_LAYER`	[vector: any]	Layer to use to generate the atlas
Filter expression	`FILTER_EXPRESSION`	[expression]	Expression to use to filter out atlas features
Sort expression Opcional	`SORTBY_EXPRESSION`	[expression]	Expression to use to sort the atlas features
Reverse sort order Opcional	`SORTBY_REVERSE`	[boolean]	Determines if sorting should be inverted. Used when a sort expression is provided.

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Map layers to assign to unlocked map item(s) Opcional	`LAYERS`	[enumeration] [layer]	Layers to display in the map item(s) whose contents are not locked
DPI Opcional	`DPI` Default: Not set	[number]	DPI of the output file(s). If not set, the value in the print layout settings will be used.
Always export as vectors	`FORCE_VECTOR`	[boolean] Padrão: Falso	Determines if vectorial data should be left as vectors
Append georeference information	`GEOREFERENCE`	[boolean] Default: True	Determines if a world file should be generated
Export RDF metadata	`INCLUDE_METADATA`	[boolean] Default: True	Determines if RDF metadata (title, author, …) should be generated
Disable tiled raster layer exports	`DISABLE_TILED`	[boolean] Padrão: Falso	Determines if raster should be tiled
Simplify geometries to reduce output file size	`SIMPLIFY`	[boolean] Default: True	Determines if geometries should be simplified to reduce output file size
Text export	`TEXT_FORMAT`	[list] Padrão: 0	Determines if text should be exported as path or text objects. Possible options are: • 0 - Always export text as paths (recommended) • 1 - Always export texts as text objects
PDF file	`SAÍDA`	[file] Default: [Save to temporary file]	Name (including path) of the output file. One of: • Save to a Temporary File • Salvar para Arquivo…

Saídas

Etiqueta	Nome	Tipo	Descrição
PDF file	`SAÍDA`	[file]	PDF file corresponding to the exported atlas layout

Python code

Algorithm ID: `native:atlaslayouttopdf`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Export print layout as image

Exports a print layout as an image file (e.g. PNG or JPEG images)

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Print layout	`LAYOUT`	[layout]	Layout to export
Image file	`SAÍDA`	[file] Default: [Save to temporary file]	Name (including path) of the output file. One of: • Save to a Temporary File • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Map layers to assign to unlocked map item(s) Opcional	`LAYERS`	[enumeration] [layer]	Layers to display in the map item(s) whose contents are not locked
DPI Opcional	`DPI` Default: Not set	[number]	DPI of the output file(s). If not set, the value in the print layout settings will be used.
Generate world file	`GEOREFERENCE`	[boolean] Default: True	Determines if a world file should be generated
Export RDF metadata	`INCLUDE_METADATA`	[boolean] Default: True	Determines if RDF metadata (title, author, …) should be generated
Enable antialiasing	`ANTIALIAS`	[boolean] Default: True	Determines if antialiasing should be enabled

Saídas

Etiqueta	Nome	Tipo	Descrição
Image file	`SAÍDA`	[file]	Image file corresponding to the exported print layout

Python code

Algorithm ID: `native:printlayouttoimage`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Export print layout as pdf

Exports a print layout as a PDF file.

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Print Layout	`LAYOUT`	[layout]	Layout to export
PDF file	`SAÍDA`	[file] Default: [Save to temporary file]	Name (including path) of the output file. One of: • Save to a Temporary File • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Map layers to assign to unlocked map item(s) Opcional	`LAYERS`	[enumeration] [layer]	Layers to display in the map item(s) whose contents are not locked
DPI Opcional	`DPI` Default: Not set	[number]	DPI of the output file(s). If not set, the value in the print layout settings will be used.
Always export as vectors	`FORCE_VECTOR`	[boolean] Padrão: Falso	Determines if vectorial data should be left as vectors
Append georeference information	`GEOREFERENCE`	[boolean] Default: True	Determines if a world file should be generated
Export RDF metadata	`INCLUDE_METADATA`	[boolean] Default: True	Determines if RDF metadata (title, author, …) should be generated
Disable tiled raster layer exports	`DISABLE_TILED`	[boolean] Padrão: Falso	Determines if raster should be tiled
Simplify geometries to reduce output file size	`SIMPLIFY`	[boolean] Default: True	Determines if geometries should be simplified to reduce output file size
Text export	`TEXT_FORMAT`	[list] Padrão: 0	Determines if text should be exported as path or text objects. Possible options are: • 0 - Always export text as paths (recommended) • 1 - Always export texts as text objects
Export layers as separate PDF files	`SEPARATE_LAYERS`	[boolean] Padrão: Falso	If True, then a separate PDF file will be created per layer per map item in the layout. Additionally, separate PDF files may be created for other complex layout items, resulting in a set of PDF files which contain logical atomic components of the layout.

Saídas

Etiqueta	Nome	Tipo	Descrição
PDF file	`SAÍDA`	[file]	PDF file(s) corresponding to the exported print layout

Python code

Algorithm ID: `native:printlayouttopdf`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Print layout map extent to layer

Creates a polygon layer containing the extent of a print layout map item (or items), with attributes specifying the map size (in layout units, i.e. the *reference map* units), scale and rotation.

If the map item parameter is specified, then only the matching map extent will be exported. If it is not specified, all map extents from the layout will be exported.

Optionally, a specific output CRS can be specified. If it is not specified, the original map item CRS will be used.

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Print layout	`LAYOUT`	[enumeration]	A print layout in the current project
Map item Opcional	`MAP`	[enumeration] Default: *All the map items*	The map item(s) whose information you want to extract. If none is provided then all the map items are processed.
Extent	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output vector layer for the extent(s). One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Save to Database Table… A codificação do arquivo também pode ser alterada aqui.

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Overrride CRS Opcional	`SRC`	[crs] Default: *The layout CRS*	Select the CRS for the layer in which the information will be reported.

Saídas

Etiqueta	Nome	Tipo	Descrição
Map height	`ALTURA`	[number]	
Extent	`SAÍDA`	[vector: polygon]	Output polygon vector layer containing extents of all the input layout map item(s)
Map rotation	`ROTAÇÃO`	[number]	
Map scale	`ESCALA`	[number]	
Map width	`LARGURA`	[number]	

Python code

Algorithm ID: `native:printlayoutmapextenttolayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Set layer style

Applies a provided style to a layer. The style must be defined in a `QML` file.

No new output are created: the style is immediately assigned to the layer.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Layer	`ENTRADA`	[layer]	Input layer you want to apply the style to
Style file	`ESTILO`	[file]	Path to the `.qml` file of the style

Saídas

Etiqueta	Nome	Tipo	Descrição
	`SAÍDA`	[same as input]	The input layer with the new style assigned. No new layer is created.

Python code

Algorithm ID: `native:setlayerstyle`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Topological coloring

Assigns a color index to polygon features in such a way that no adjacent polygons share the same color index, whilst minimizing the number of colors required.

The algorithm allows choice of method to use when assigning colors.

A minimum number of colors can be specified if desired. The color index is saved to a new attribute named **color_id**.

The following example shows the algorithm with four different colors chosen; as you can see each color class has the same amount of features.

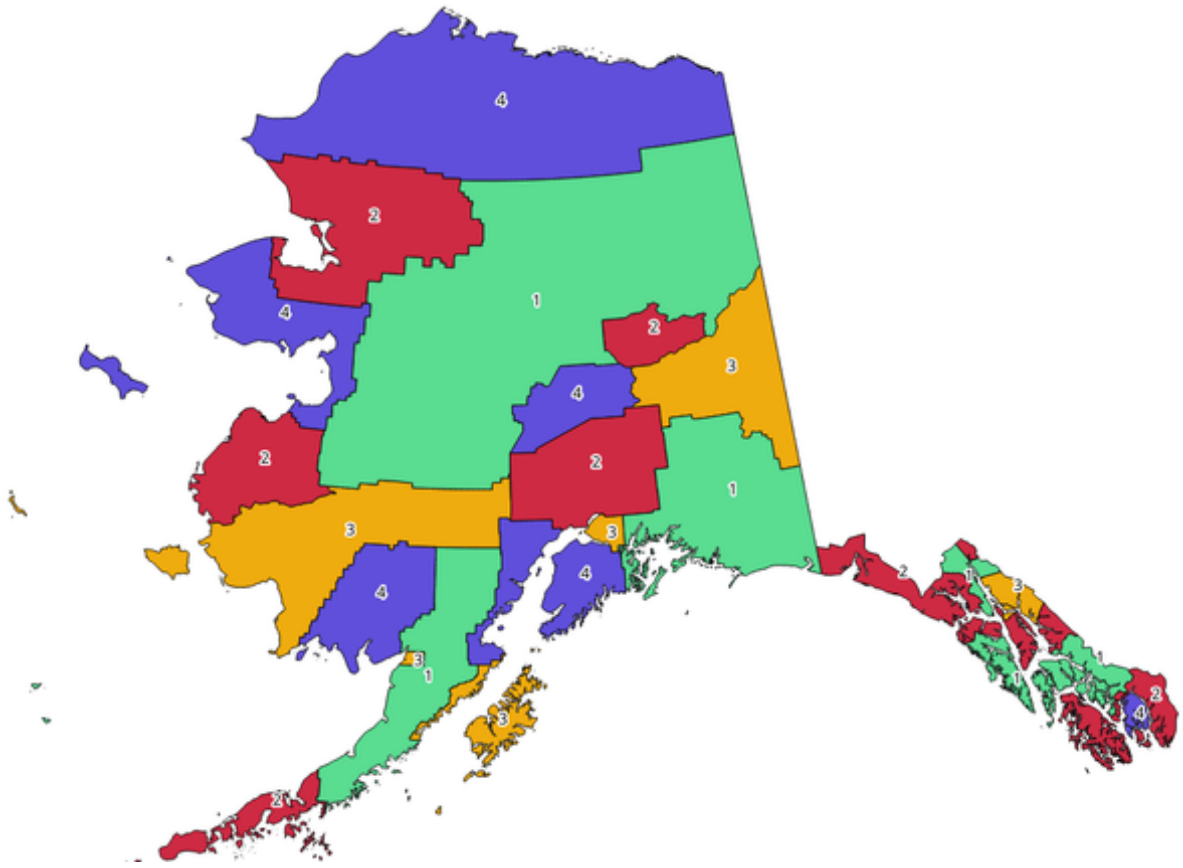


Figura24.1: Topological colors example

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: polygon]	The input polygon layer
Minimum number of colors	`MIN_COLORS`	[number] Padrão: 4	The minimum number of colors to assign. Minimum 1, maximum 1000.
Minimum distance between features	`MIN_DISTANCE`	[number] Padrão: 0.0	Prevent nearby (but non-touching) features from being assigned equal colors. Minimum 0.0.

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Tabela 24.2 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Balance color assignment	`BALANCE`	[enumeration] Padrão: 0	Options are: • 0 — By feature count Attempts to assign colors so that the count of features assigned to each individual color index is balanced. • 1 — By assigned area Assigns colors so that the total area of features assigned to each color is balanced. This mode can be useful to help avoid large features resulting in one of the colors appearing more dominant on a colored map. • 2 — By distance between colors Assigns colors in order to maximize the distance between features of the same color. This mode helps to create a more uniform distribution of colors across a map.
Colored	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada da linha de saída. Um de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Save to Database Table… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Colored	`SAÍDA`	[vector: polygon]	Polygon vector layer with an added `color_id` column

Python code

Algorithm ID: `qgis:topologicalcoloring`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.2 Base de dados

Export to PostgreSQL

Exports a vector layer to a PostgreSQL database, creating a new relation. If a relation with the same name exists, it can be removed before the new relation is created. Prior to this a connection between QGIS and the PostgreSQL database has to be created (see eg *Creating a stored Connection*).

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Layer to import	`ENTRADA`	[vector: any]	Vector layer to add to the database
Banco de dados (nome da conexão)	`BANCO DE DADOS`	[string]	Name of the database connection (not the database name). Existing connections will be shown in the combobox.
Esquema (nome do esquema) Opcional	`ESQUEMA`	[string] Padrão: 'público'	Name of the schema to store the data. It can be a new one or already exist.
Table to import to (leave blank to use layer name) Opcional	`TABLENAME`	[string] Padrão: ''	Defines a table name for the imported vector file. If nothing is added, the layer name will be used.
Primary key field Opcional	`PRIMARY_KEY`	[tablefield: any]	Sets the primary key field from an existing field in the vector layer. A column with **unique** values can be used as Primary key for the database.
Geometry column	`GEOMETRY_COLUMN`	[string] Padrão: 'geom'	Defines the name of the geometry column in the new PostGIS table. Geometry information for the features is stored in this column.
Encoding Opcional	`ENCODING`	[string] Default: 'UTF-8'	Defines the encoding of the output layer
Overwrite	`OVERWRITE`	[boolean] Padrão: Verdadeiro	If the specified table exists, setting this option to `True` will make sure that it is deleted and a new table will be created before the features are added. If this option is `False` and the table exists, the algorithm will throw an exception ("relation already exists").
Create spatial index	`CREATEINDEX`	[boolean] Padrão: Verdadeiro	Specifies whether to create a spatial index or not
Convert field names to lowercase	`LOWERCASE_NAMES`	[boolean] Padrão: Verdadeiro	Converts the field names of the input vector layer to lowercase
Drop length constraint on character fields	`DROP_STRING_LENGTH`	[boolean] Padrão: Falso	Should length constraints on character fields be dropped or not
Create single-part geometries instead of multi-part	`FORCE_SINGLEPART`	[boolean] Padrão: Falso	Should the features of the output layer be single-part instead of multi-part. By default the existing geometries information are preserved.

Saídas

The algorithm has no output.

Python code

Algorithm ID: `qgis:importintopostgis`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Export to SpatiaLite

Exports a vector layer to a SpatiaLite database. Prior to this a connection between QGIS and the SpatiaLite database has to be created (see eg *Camadas SpatiaLite*).

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Layer to import	`ENTRADA`	[vector: any]	Vector layer to add to the database
File database	`BANCO DE DADOS`	[vector: any]	The SQLite/SpatiaLite database file to connect to
Table to import to (leave blank to use layer name) Opcional	`TABLENAME`	[string] Padrão: ''	Defines the table name for the imported vector file. If nothing is specified, the layer name will be used.
Primary key field Opcional	`PRIMARY_KEY`	[tablefield: any]	Use a field in the input vector layer as the primary key
Geometry column	`GEOMETRY_COLUMN`	[string] Padrão: 'geom'	Defines the name of the geometry column in the new SpatiaLite table. Geometry information for the features is stored in this column.
Encoding Opcional	`ENCODING`	[string] Default: 'UTF-8'	Defines the encoding of the output layer
Overwrite	`OVERWRITE`	[boolean] Padrão: Verdadeiro	If the specified table exists, setting this option to `True` will make sure that it is deleted and a new table will be created before the features of the layer is added. If this option is `False` and the table exists, the algorithm will throw an exception ("table already exists").
Create spatial index	`CREATEINDEX`	[boolean] Padrão: Verdadeiro	Specifies whether to create a spatial index or not
Convert field names to lowercase	`LOWERCASE_NAMES`	[boolean] Padrão: Verdadeiro	Convert the field names of the input vector layer to lowercase
Drop length constraint on character fields	`DROP_STRING_LENGTH`	[boolean] Padrão: Falso	Should length constraints on character fields be dropped or not

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Tabela 24.4 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Create single-part geometries instead of multi-part	`FORCE_SINGLEPART`	[boolean] Padrão: Falso	Should the features of the output layer be single-part instead of multi-part. By default the existing geometries information are preserved.

Saídas

The algorithm has no output.

Python code

Algorithm ID: `qgis:importintospatialite`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Package layers

Adds layers to a GeoPackage.

If the GeoPackage exists and `Overwrite existing GeoPackage` is checked, it will be overwritten (removed and recreated). If the GeoPackage exists and `Overwrite existing GeoPackage` is not checked, the layer will be appended.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camadas de entrada	`CAMADAS`	[vector: any] [list]	The (vector) layers to import into the GeoPackage. Raster layers are not supported. If a raster layer is added, a `QgsProcessingException` will be thrown.
Overwrite existing GeoPackage	`OVERWRITE`	[boolean] Padrão: Falso	If the specified GeoPackage exists, setting this option to `True` will make sure that it is deleted and a new one will be created before the layers are added. If set to `False`, layers will be appended.
Save layer styles into GeoPackage	`SAVE_STYLES`	[boolean] Padrão: Verdadeiro	Save the layer styles
Destination GeoPackage	`SAÍDA`	[file] Default: `[Save to temporary file]`	Specify where to store the GeoPackage file. One of • Save to a Temporary File • Save to File…

Saídas

Etiqueta	Nome	Tipo	Descrição
Layers within new package	`OUTPUT_LAYERS`	[string] [list]	The list of layers added to the GeoPackage.

Python code

Algorithm ID: `native:package`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

PostgreSQL execute and load SQL

Allows a SQL database query to be performed on a PostgreSQL database connected to QGIS and loads the result. The algorithm **won't** create a new layer: it is designed to run queries on the layer itself.

Exemplo

1. Set all the values of an existing field to a fixed value. The SQL query string will be:

   ```
   UPDATE your_table SET field_to_update=20;
   ```

   In the example above, the values of the field `field_to_update` of the table `your_table` will be all set to `20`.

2. Create a new `area` column and calculate the area of each feature with the `ST_AREA` PostGIS function.

   ```
   -- Create the new column "area" on the table your_table"
   ALTER TABLE your_table ADD COLUMN area double precision;
   -- Update the "area" column and calculate the area of each feature:
   UPDATE your_table SET area=ST_AREA(geom);
   ```

Ver também:

PostgreSQL execute SQL, *Executar SQL*, *SpatiaLite execute SQL*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Banco de dados (nome da conexão)	`BANCO DE DADOS`	[string]	The database connection (not the database name). Existing connections will be shown in the combobox.
SQL query	`SQL`	[string]	Defines the SQL query, for example `'UPDATE my_table SET field=10'`.
Unique ID field name	`ID_FIELD`	[string] Default: id	Sets the primary key field (a column in the result table)
Geometry field name Opcional	`GEOMETRY_FIELD`	[string] Padrão: 'geom'	Name of the geometry column (a column in the result table)

Saídas

Etiqueta	Nome	Tipo	Descrição
SQL layer	`SAÍDA`	[vector: any]	The resulting vector layer to be loaded into QGIS.

Python code

Algorithm ID: `qgis:postgisexecuteandloadsql`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

PostgreSQL execute SQL

Allows a SQL database query to be performed on a PostgreSQL database connected to QGIS. The algorithm **won't** create a new layer: it is designed to run queries on the layer itself.

Exemplo

1. Set all the values of an existing field to a fixed value. The SQL query string will be:

   ```
   UPDATE your_table SET field_to_update=20;
   ```

   In the example above, the values of the field `field_to_update` of the table `your_table` will be all set to `20`.

2. Create a new `area` column and calculate the area of each feature with the `ST_AREA` PostGIS function.

   ```
   -- Create the new column "area" on the table your_table"
   ALTER TABLE your_table ADD COLUMN area double precision;
   -- Update the "area" column and calculate the area of each feature:
   UPDATE your_table SET area=ST_AREA(geom);
   ```

Ver também:

PostgreSQL execute and load SQL, *Executar SQL*, *SpatiaLite execute SQL*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Banco de dados (nome da conexão)	`BANCO DE DADOS`	[string]	The database connection (not the database name). Existing connections will be shown in the combobox.
SQL query	`SQL`	[string]	Defines the SQL query, for example `'UPDATE my_table SET field=10'`.

Saídas

No output is created. The SQL query is executed in place.

Python code

Algorithm ID: `native:postgisexecutesql`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

SpatiaLite execute SQL

Allows a SQL database query to be performed on a SpatiaLite database. The algorithm **won't** create a new layer: it is designed to run queries on the layer itself.

Ver também:

PostgreSQL execute SQL, *Executar SQL*

For some SQL query examples see *PostGIS SQL Query Examples*.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
File Database	`BANCO DE DADOS`	[vector]	The SQLite/SpatiaLite database file to connect to
SQL query	`SQL`	[string] Padrão: ''	Defines the SQL query, for example `'UPDATE my_table SET field=10'`.

Saídas

No output is created. The SQL query is executed in place.

Python code

Algorithm ID: `native:spatialiteexecutesql`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

SpatiaLite execute SQL (registered DB)

Allows a SQL database query to be performed on a SpatiaLite database connected to QGIS. The algorithm **won't** create a new layer: it is designed to run queries on the layer itself.

Ver também:

PostgreSQL execute SQL, *Executar SQL*

For some SQL query examples see *PostGIS SQL Query Examples*.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Database	`BANCO DE DADOS`	[enumeration] Default: not set	Select a SQLite/SpatiaLite database connected to the current session
SQL query	`SQL`	[string] Padrão: ''	Defines the SQL query, for example `'UPDATE my_table SET field=10'`.

Saídas

No output is created. The SQL query is executed in place.

Python code

Algorithm ID: `native:spatialiteexecutesqlregistered`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.3 File tools

Download file

Downloads a file specified using a URL (using for instance `http:` or `file:`). In other words you can copy/paste a URL and download the file.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
URL	`URL`	[string]	The URL of the file to download.
File destination	`SAÍDA`	[string] Default: `[Save to temporary file]`	Specification of the file destination. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
File destination	`SAÍDA`	[string]	The location of the downloaded file

Python code

Algorithm ID: `qgis:filedownloader`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.4 Interpolação

Heatmap (kernel density estimation)

Creates a density (heatmap) raster of an input point vector layer using kernel density estimation.

The density is calculated based on the number of points in a location, with larger numbers of clustered points resulting in larger values. Heatmaps allow easy identification of *hotspots* and clustering of points.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de pontos	`ENTRADA`	[vector: point]	Point vector layer to use for the heatmap
Radius	`RAIO`	[number] Padrão: 100.0	Heatmap search radius (or kernel bandwidth) in map units. The radius specifies the distance around a point at which the influence of the point will be felt. Larger values result in greater smoothing, but smaller values may show finer details and variation in point density.
Output raster size	`PIXEL_SIZE`	[number] Padrão: 0.1	Pixel size of the output raster layer in layer units. In the GUI, the size can be specified by the number of rows (`Number of rows`) / columns (`Number of columns`) **or** the pixel size(`Pixel Size X` / `Pixel Size Y`). Increasing the number of rows or columns will decrease the cell size and increase the file size of the output raster. The values in `Rows`, `Columns`, `Pixel Size X` and `Pixel Size Y` will be updated simultaneously - doubling the number of rows will double the number of columns, and the cell size will be halved. The extent of the output raster will remain the same (approximately).

continua na próxima página

Tabela 24.5 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Radius from field Opcional	RADIUS_FIELD	[tablefield: numeric]	Sets the search radius for each feature from an attribute field in the input layer.
Weight from field Opcional	WEIGHT_FIELD	[tablefield: numeric]	Allows input features to be weighted by an attribute field. This can be used to increase the influence certain features have on the resultant heatmap.
Kernel shape	KERNEL	[enumeration] Padrão: *0*	Controls the rate at which the influence of a point decreases as the distance from the point increases. Different kernels decay at different rates, so a triweight kernel gives features greater weight for distances closer to the point then the Epanechnikov kernel does. Consequently, triweight results in "sharper" hotspots and Epanechnikov results in "smoother" hotspots. There are many shapes available (please see the Wikipedia page for further information): • 0 — Quartic • 1 — Triangular • 2 — Uniform • 3 — Triweight • 4 — Epanechnikov
Decay ratio (Triangular kernels only) Opcional	DECAY	[number] Default: *0.0*	Can be used with Triangular kernels to further control how heat from a feature decreases with distance from the feature. • A value of 0 (=minimum) indicates that the heat will be concentrated in the center of the given radius and completely extinguished at the edge. • A value of 0.5 indicates that pixels at the edge of the radius will be given half the heat as pixels at the center of the search radius. • A value of 1 means the heat is spread evenly over the whole search radius circle. (This is equivalent to the 'Uniform' kernel.) • A value greater than 1 indicates that the heat is higher towards the edge of the search radius than at the center.
Output value scaling	OUTPUT_VALUE	[enumeration] Default: *Raw*	Allow to change the values of the output heatmap raster. One of: • 0 — Raw • 1 — Scaled
Heatmap	SAÍDA	[raster] Default: `[Save to temporary file]`	Specify the output raster layer with kernel density values. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Heatmap	`SAÍDA`	[raster]	Raster layer with kernel density values

Example: Creating a Heatmap

For the following example, we will use the `airports` vector point layer from the QGIS sample dataset (see *Baixando dados de amostra*). Another excellent QGIS tutorial on making heatmaps can be found at http://qgistutorials.com.

In Fig.24.2, the airports of Alaska are shown.

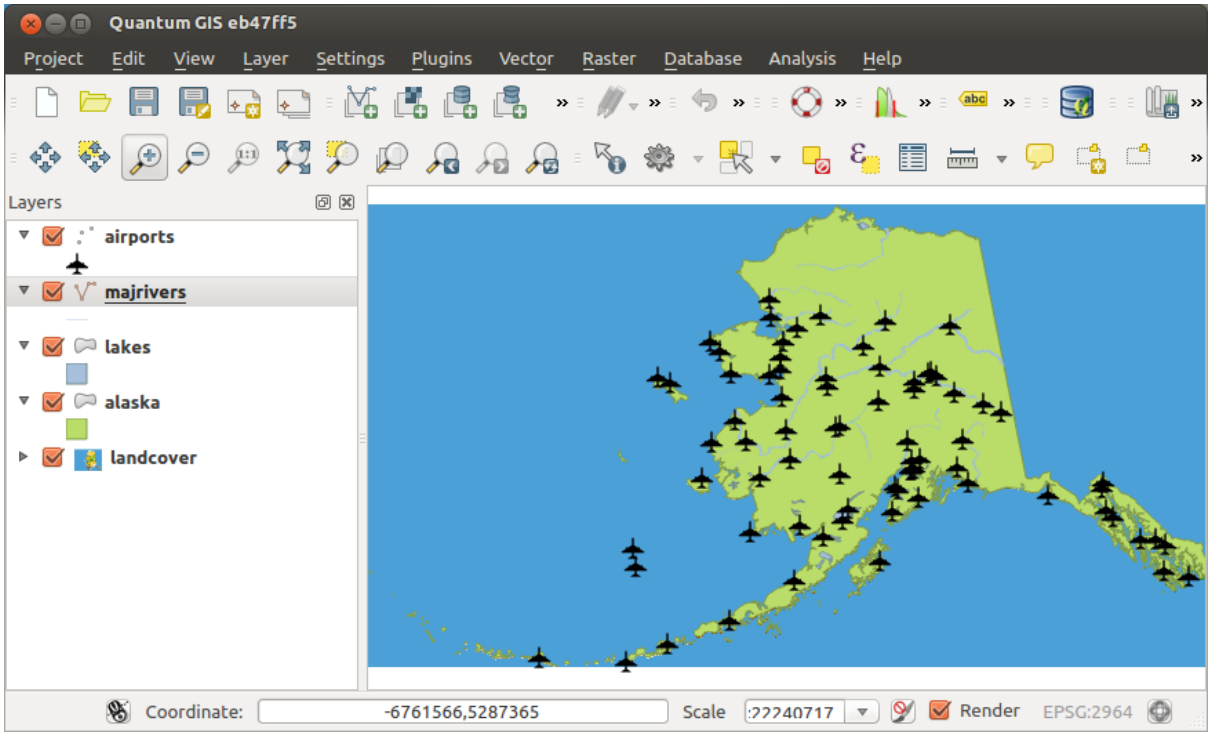


Figura24.2: Airports of Alaska

1. Open the *Heatmap (Kernel Density Estimation)* algorithm from the QGIS *Interpolation* group
2. In the *Point layer* field, select `airports` from the list of point layers loaded in the current project.
3. Change the *Radius* to `1000000` meters.
4. Change the *Pixel size X* to `1000`. The *Pixel size Y*, *Rows* and *Columns* will be automatically updated.
5. Click on *Run* to create and load the airports heatmap (see Fig.24.4).

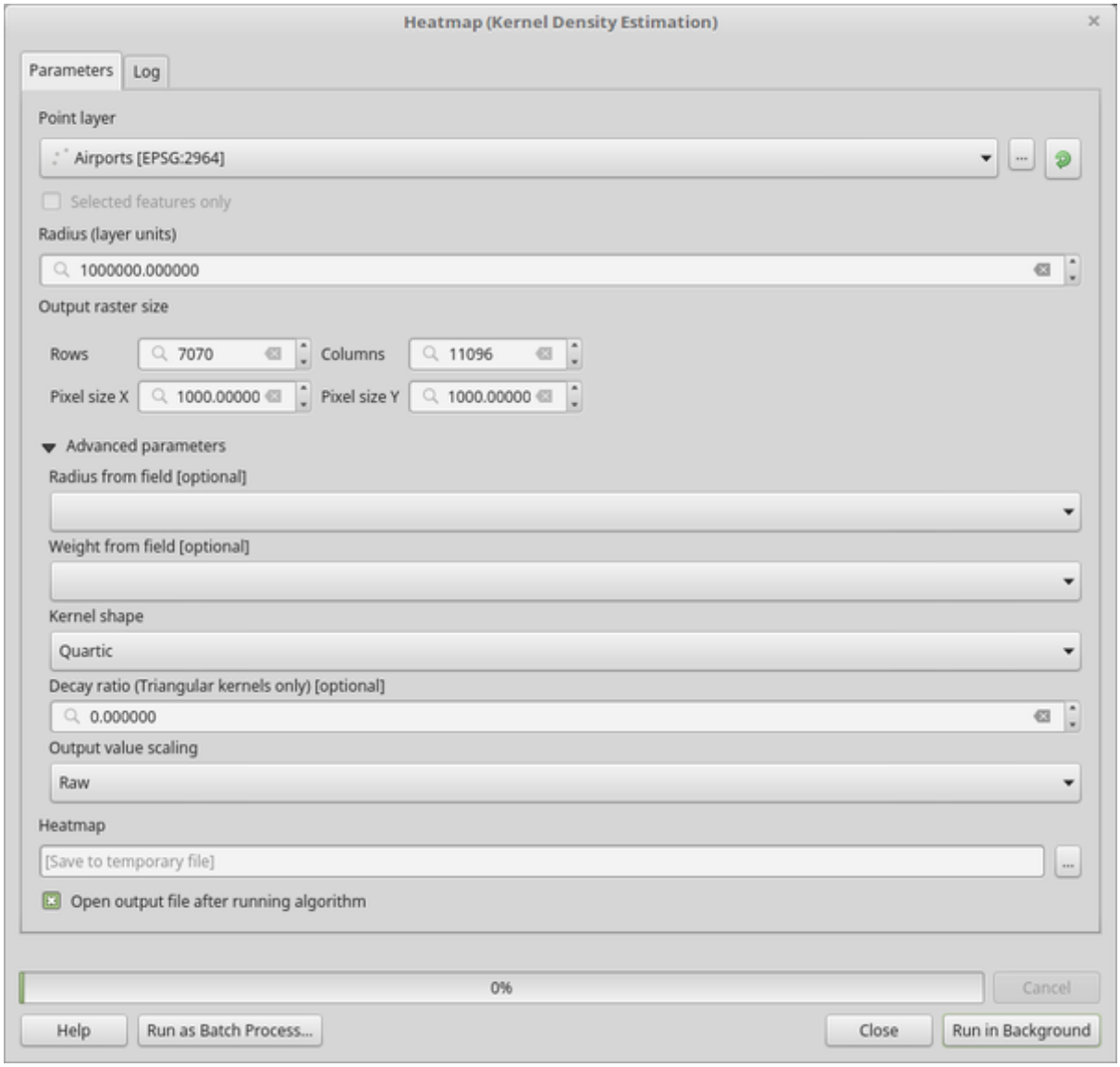


Figura24.3: The Heatmap Dialog

QGIS will generate the heatmap and add it to your map window. By default, the heatmap is shaded in greyscale, with lighter areas showing higher concentrations of airports. The heatmap can now be styled in QGIS to improve its appearance.

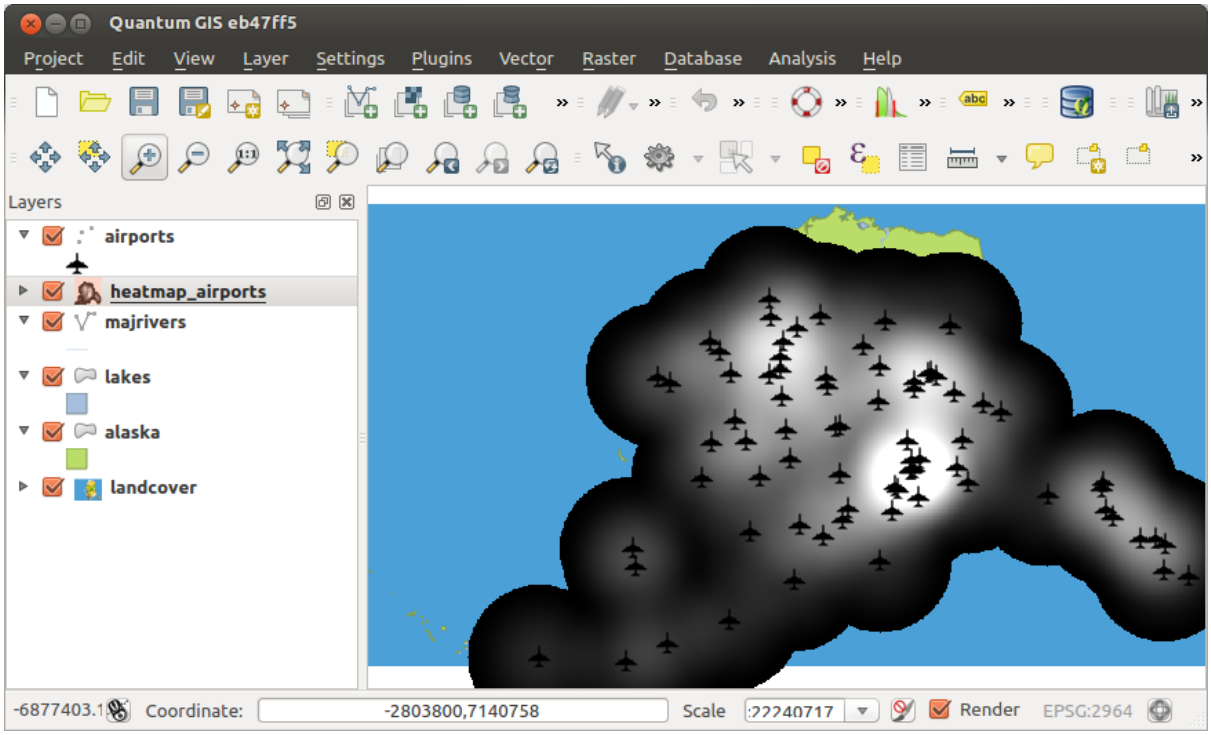


Figura24.4: The heatmap after loading looks like a grey surface

1. Open the properties dialog of the `heatmap_airports` layer (select the layer `heatmap_airports`, open the context menu with the right mouse button and select *Properties*).
2. Select the *Symbology* tab.
3. Change the *Render type*  to 'Singleband pseudocolor'.
4. Select a suitable *Color ramp* , for instance `YlOrRd`.
5. Click the *Classify* button.
6. Press *OK* to update the layer.

The final result is shown in Fig.24.5.

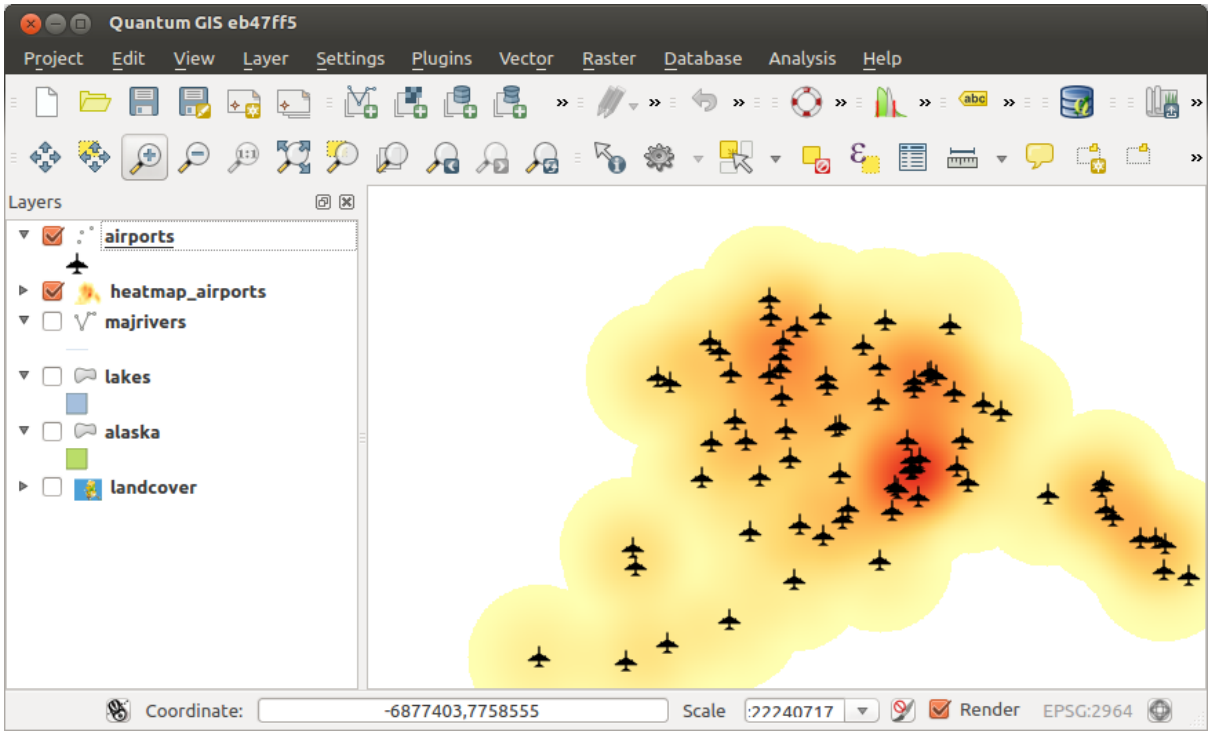


Figura24.5: Styled heatmap of airports of Alaska

Python code

Algorithm ID: `qgis:heatmapkerneldensityestimation`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

IDW Interpolation

Generates an Inverse Distance Weighted (IDW) interpolation of a point vector layer.

Sample points are weighted during interpolation such that the influence of one point relative to another declines with distance from the unknown point you want to create.

The IDW interpolation method also has some disadvantages: the quality of the interpolation result can decrease, if the distribution of sample data points is uneven.

Furthermore, maximum and minimum values in the interpolated surface can only occur at sample data points.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input layer(s)	`INTERPOLATION_DATA`	[string]	Vector layer(s) and field(s) to use for the interpolation, coded in a string (see the `ParameterInterpolationData` class in InterpolationWidgets for more details). The following GUI elements are provided to compose the interpolation data string: • **Vector layer** [vector: any] • **Interpolation attribute** [tablefield: numeric]: Attribute to use in the interpolation • **Use Z-coordinate for interpolation** [boolean]: Uses the layer's stored Z values (Default: False) For each of the added layer-field combinations, a type can be chosen: • *Pontos* • *Structured lines* • *Break lines* In the string, the layer-field elements are separated by `'::|::'`. The sub-elements of the layer-field elements are separated by `'::~::'`.
Distance coefficient P	`DISTANCE_COEFFICIENT`	[number] Padrão: 2.0	Sets the distance coefficient for the interpolation. Minimum: 0.0, maximum: 100.0.
Extent (xmin, xmax, ymin, ymax)	`EXTENT`	[extent]	Extent of the output raster layer. You have to declare the output extent by either choosing it from the map canvas, selecting it from another layer or type it manually.
Output raster size	`PIXEL_SIZE`	[number] Padrão: 0.1	Pixel size of the output raster layer in layer units. In the GUI, the size can be specified by the number of rows (`Number of rows`) / columns (`Number of columns`) **or** the pixel size(`Pixel Size X` / `Pixel Size Y`). Increasing the number of rows or columns will decrease the cell size and increase the file size of the output raster. The values in `Rows`, `Columns`, `Pixel Size X` and `Pixel Size Y` will be updated simultaneously - doubling the number of rows will double the number of columns, and the cell size will be halved. The extent of the output raster will remain the same (approximately).
Interpolated	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Raster layer of interpolated values. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Interpolated	`SAÍDA`	[raster]	Raster layer of interpolated values

Python code

Algorithm ID: `qgis:idwinterpolation`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Line Density

Calculates for each raster cell, the density measure of linear features within a circular neighbourhood. This measure is obtained by summing all the line segments intersecting the circular neighbourhood and dividing this sum by the area of such neighbourhood. A weighting factor can be applied to the line segments.

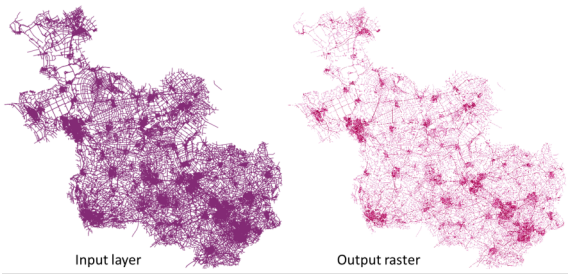


Figura24.6: Line density example. Input layer source: Roads Overijssel - The Netherlands (OSM).

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input line layer	`ENTRADA`	[vector: any]	Input vector layer containing line features
Weight field	`WEIGHT`	[number]	Field of the layer containing the weight factor to use during the calculation
Search Radius	`RAIO`	[number] Default: 10	Radius of the circular neighbourhood. Units can be specified here.
Pixel size	`PIXEL_SIZE`	[number] Default: 10	Pixel size of the output raster layer in layer units. The raster has square pixels.
Line density raster	`SAÍDA`	[raster] Default: `[Save to temporary file]`	The output as a raster layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Line density raster	`SAÍDA`	[raster]	The output line density raster layer.

Python code

Algorithm ID: `native:linedensity`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

TIN Interpolation

Generates a Triangulated Irregular Network (TIN) interpolation of a point vector layer.

With the TIN method you can create a surface formed by triangles of nearest neighbor points. To do this, circumcircles around selected sample points are created and their intersections are connected to a network of non overlapping and as compact as possible triangles. The resulting surfaces are not smooth.

The algorithm creates both the raster layer of the interpolated values and the vector line layer with the triangulation boundaries.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input layer(s)	`INTERPOLATION_DATA`	[string]	Vector layer(s) and field(s) to use for the interpolation, coded in a string (see the `ParameterInterpolationData` class in InterpolationWidgets for more details). The following GUI elements are provided to compose the interpolation data string: • **Vector layer** [vector: any] • **Interpolation attribute** [tablefield: numeric]: Attribute to use in the interpolation • **Use Z-coordinate for interpolation** [boolean]: Uses the layer's stored Z values (Default: False) For each of the added layer-field combinations, a type can be chosen: • *Pontos* • *Structured lines* • *Break lines* In the string, the layer-field elements are separated by `'::|::'`. The sub-elements of the layer-field elements are separated by `'::~::'`.

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Tabela 24.11 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Interpolation method	`MÉTODO`	[enumeration] Padrão: 0	Set the interpolation method to be used. One of: • *Linear* • *Clough-Toucher (cubic)*
Extent (xmin, xmax, ymin, ymax)	`EXTENT`	[extent]	Extent of the output raster layer. You have to declare the output extent by either choosing it from the map canvas, selecting it from another layer or type it manually.
Output raster size	`PIXEL_SIZE`	[number] Padrão: 0.1	Pixel size of the output raster layer in layer units. In the GUI, the size can be specified by the number of rows (`Number of rows`) / columns (`Number of columns`) **or** the pixel size(`Pixel Size X` / `Pixel Size Y`). Increasing the number of rows or columns will decrease the cell size and increase the file size of the output raster. The values in `Rows`, `Columns`, `Pixel Size X` and `Pixel Size Y` will be updated simultaneously - doubling the number of rows will double the number of columns, and the cell size will be halved. The extent of the output raster will remain the same (approximately).
Interpolated	`SAÍDA`	[raster] Default: `[Save to temporary file]`	The output TIN interpolation as a raster layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.
Triangulation	`TRIANGULATION`	[vector: line] Default: `[Skip output]`	The output TIN as a vector layer. One of: • Ignorar Saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS…

Saídas

Etiqueta	Nome	Tipo	Descrição
Interpolated	`SAÍDA`	[raster]	The output TIN interpolation as a raster layer
Triangulation	`TRIANGULATION`	[vector: line]	The output TIN as a vector layer.

Python code

Algorithm ID: `qgis:tininterpolation`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.5 Layer tools

Extract layer extent

Generates a vector layer with the minimum bounding box (rectangle with N-S orientation) that covers all the input features.

The output layer contains a single bounding box for the whole input layer.

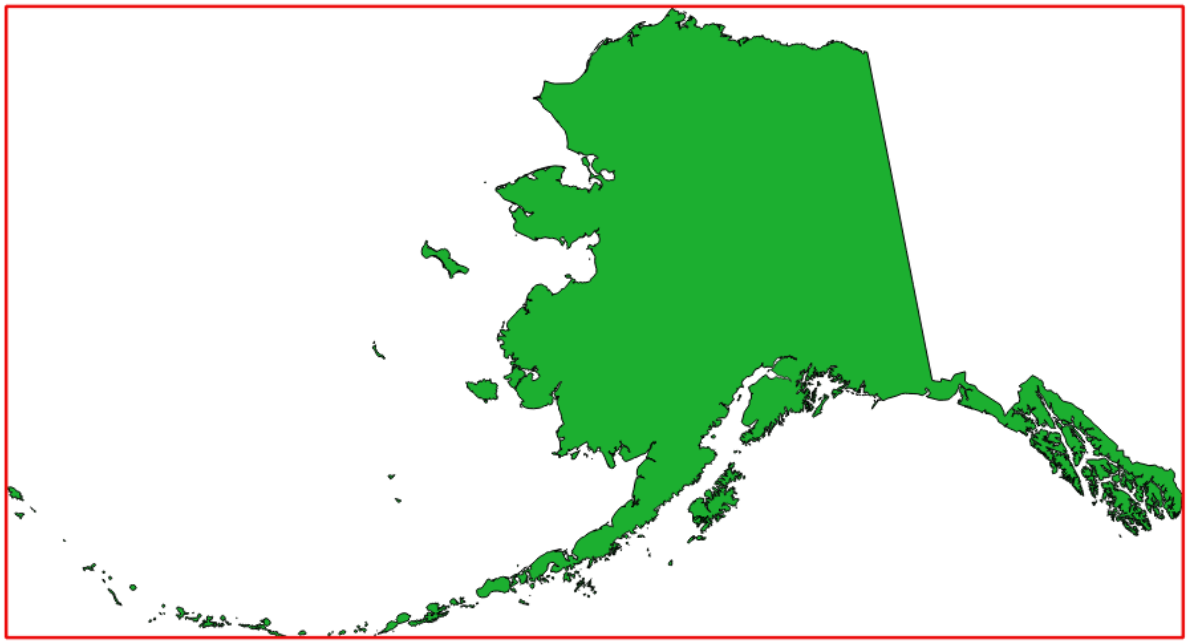


Figura24.7: In red the bounding box of the source layer

Default menu: *Vector* ► *Research Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada	`ENTRADA`	[layer]	Camada de entrada
Extent	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the polygon vector layer for the output extent. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Extent	`SAÍDA`	[vector: polygon]	Output (polygon) vector layer with the extent (minimum bounding box)

Python code

Algorithm ID: `qgis:polygonfromlayerextent`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.6 Modeler tools

These tools are only available in the Graphical Modeler. They are not available in the Processing Toolbox.

Conditional branch

Adds a conditional branch into a model, allowing parts of the model to be executed based on the result of an expression evaluation. Mostly by using tool dependencies to control the flow of a model.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Field	`BRANCH`	[string]	Name of the condition
Field	`CONDITION`	[expression]	Expression to evaluate

Saídas

None.

Python code

Algorithm ID: `native:condition`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Load layer into project

Loads a layer to the current project.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada	`ENTRADA`	[layer]	Layer to load in the legend
Loaded layer name	`NAME`	[string]	Name of the loaded layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada	`SAÍDA`	[same as input]	The (renamed) loaded layer

Python code

Algorithm ID: `qgis:loadlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raise exception

Raises an exception and cancels a model's execution. The exception message can be customized, and optionally an expression based condition can be specified. If an expression condition is used, then the exception will only be raised if the expression result is true. A false result indicates that no exception will be raised, and the model execution can continue uninterrupted.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Message	`MESSAGE`	[string]	Message to display
Condition	`CONDITION`	[expression]	Expression to evaluate if true

Saídas

None.

Python code

Algorithm ID: `native:raiseexception`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raise warning

Raises a warning message in the log. The warning message can be customized, and optionally an expression based condition can be specified. If an expression condition is used, then the warning will only be logged if the expression result is true. A false result indicates that no warning will be logged.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Message	`MESSAGE`	[string]	Message to display
Condition	`CONDITION`	[expression]	Expression to evaluate if true

Saídas

None.

Python code

Algorithm ID: `native:raisewarning`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Rename layer

Renames a layer.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada	`ENTRADA`	[layer]	Layer to rename
New name	`NAME`	[string]	The new name of the layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada	`SAÍDA`	[same as input]	The (renamed) output layer

Python code

Algorithm ID: `native:renamelayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Save log to file

Saves the model's execution log to a file. Optionally, the log can be saved in a HTML formatted version.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Use HTML	`USE_HTML`	[Boolean] Default: False	Use HTML formatting

Saídas

Etiqueta	Nome	Tipo	Descrição
File	`SAÍDA`	[string]	Destination of the log

Python code

Algorithm ID: `native:savelog`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Set project variable

Sets an expression variable for the current project.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Variable name	`NAME`	[string]	Name of the variable
Variable value	`VALUE`	[string]	Value to be stored

Saídas

None.

Python code

Algorithm ID: `native:setprojectvariable`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

String concatenation

Concatenates two strings into a single one in the Processing Modeler.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input 1	`INPUT_1`	[string]	First string
Input 2	`INPUT_2`	[string]	Second string

Saídas

Etiqueta	Nome	Tipo	Descrição
Concatenation	`CONCATENATION`	[string]	The concatenated string

Python code

Algorithm ID: `qgis:stringconcatenation`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.7 Network analysis

Service area (from layer)

Returns all the edges or parts of edges of a network that can be reached within a distance or a time, starting from a point layer. This allows evaluation of accessibility within a network, e.g. what are the places I can navigate to on a road network without spending cost greater than a given value (the cost can be distance or time).

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Vector layer representing network	`ENTRADA`	[vector: line]	Line vector layer representing the network to be covered
Vector layer with start points	`START_POINTS`	[vector: point]	Point vector layer whose features are used as start points to generate the service areas
Path type to calculate	`STRATEGY`	[enumeration] Padrão: 0	The type of path to calculate. One of: • 0 — Shortest • 1 — Fastest
Travel cost (distance for "Shortest", time for "Fastest")	`TRAVEL_COST`	[number] Padrão: 0	The value is estimated as a distance (in the network layer units) when looking for the *Shortest* path and as time (in hours) for the *Fastest* path.

Campo de direção Opcional	DIREC- TION_FIELD	[tablefield: string] Padrão: 0.0	The field used to specify directions for the network edges. Os valores usados neste campo são especificados com os três parâmetros `Valor para direção direta`, `Valor para direção inversa` e `Valor para ambas as direções`. As direções para frente e para trás correspondem a uma borda de mão única, "ambas as direções" indicam uma borda de mão dupla. Se uma feição não tiver um valor nesse campo ou se nenhum campo estiver definido, a configuração de direção padrão (fornecida com o parâmetro `Direção padrão`) será usada.
Value for forward direction Opcional	VALUE_FORWARD	[string] Padrão: '' (string vazia)	Value set in the direction field to identify edges with a forward direction
Value for backward direction Opcional	VALUE_BACKWARD	[string] Padrão: '' (string vazia)	Value set in the direction field to identify edges with a backward direction
Value for both directions Opcional	VALUE_BOTH	[string] Padrão: '' (string vazia)	Value set in the direction field to identify bidirectional edges
Direção padrão Opcional	DI- REÇÃO_PADRÃO	[enumeration] Padrão: 2	If a feature has no value set in the direction field or if no direction field is set, then this direction value is used. One of: • 0 — Forward direction • 1 — Backward direction • 2 — Both directions
Campo de velocidade Opcional	SPEED_FIELD	[tablefield: string]	Field providing the speed value (in `km/h`) for the edges of the network when looking for the fastest path. Se uma feição não tiver um valor nesse campo ou nenhum campo estiver definido, o valor da velocidade padrão (fornecido com o parâmetro `Velocidade padrão`) será usado.
Velocidade padrão (km/h) Opcional	VELOCI- DADE_PADRÃO	[number] Padrão: 50.0	Value to use to calculate the travel time if no speed field is provided for an edge
Topology tolerance Opcional	TOLERANCE	[number] Padrão: 0.0	Duas linhas com nós mais próximos que a tolerância especificada são consideradas conectadas

Include upper/lower bound points	IN- CLUDE_BOUNDS	[boolean] Padrão: Falso	Creates a point layer output with two points for each edge at the boundaries of the service area. One point is the start of that edge, the other is the end.

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Tabela 24.15 – continuação da página anterior

Service area (lines)	OUTPUT_LINES	[vector: line] Default: [Create temporary layer]	Specify the output line layer for the service area. One of: • Ignorar saída • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Service area (boundary nodes)	SAÍDA	[vector: point] Default: [Skip output]	Specify the output point layer for the service area boundary nodes. One of: • Ignorar saída • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Service area (boundary nodes)	SAÍDA	[vector: point]	The output point layer with the service area boundary nodes.
Service area (lines)	OUTPUT_LINES	[vector: line]	Line layer representing the parts of the network that can be serviced by the start points, for the given cost.

Python code

Algorithm ID: `qgis:serviceareafromlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Service area (from point)

Returns all the edges or parts of edges of a network that can be reached within a given distance or time, starting from a point feature. This allows the evaluation of accessibility within a network, e.g. what are the places I can navigate to on a road network without spending a cost greater than a given value (the cost can be distance or time).

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Vector layer representing the network	`ENTRADA`	[vector: line]	Line vector layer representing the network to be covered
Start point (x, y)	`START_POINT`	[coordinates]	Coordinate of the point to calculate the service area around.
Path type to calculate	`STRATEGY`	[enumeration] Padrão: 0	The type of path to calculate. One of: • 0 — Shortest • 1 — Fastest
Travel cost	`TRAVEL_COST`	[number] Padrão: 0	The value is estimated as a distance (in the network layer units) when looking for the *Shortest* path and as time (in hours) for the *Fastest* path.
Advanced parameters	Apenas GUI		Group of advanced network analysis parameters - see below.
Service area (lines)	`OUTPUT_LINES`	[vector: line] Default: `[Create temporary layer]`	Specify the output line layer for the service area. One of: • Ignorar saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Service area (boundary nodes)	`SAÍDA`	[vector: point] Default: `[Skip output]`	Specify the output point layer for the service area boundary nodes. One of: • Ignorar saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Parâmetros avançados

Etiqueta	Nome	Tipo	Descrição
Campo de direção Opcional	DIREC-TION_FIELD	[tablefield: string] Padrão: 0.0	The field used to specify directions for the network edges. Os valores usados neste campo são especificados com os três parâmetros Valor para direção direta, Valor para direção inversa e Valor para ambas as direções. As direções para frente e para trás correspondem a uma borda de mão única, "ambas as direções" indicam uma borda de mão dupla. Se uma feição não tiver um valor nesse campo ou se nenhum campo estiver definido, a configuração de direção padrão (fornecida com o parâmetro Direção padrão) será usada.
Value for forward direction Opcional	VALUE_FORWARD	[string] Padrão: '' (string vazia)	Value set in the direction field to identify edges with a forward direction
Value for backward direction Opcional	VALUE_BACKWARD	[string] Padrão: '' (string vazia)	Value set in the direction field to identify edges with a backward direction
Value for both directions Opcional	VALUE_BOTH	[string] Padrão: '' (string vazia)	Value set in the direction field to identify bidirectional edges
Direção padrão Opcional	DI-REÇÃO_PADRÃO	[enumeration] Padrão: 2	If a feature has no value set in the direction field or if no direction field is set, then this direction value is used. One of: • 0 — Forward direction • 1 — Backward direction • 2 — Both directions
Campo de velocidade Opcional	SPEED_FIELD	[tablefield: string]	Field providing the speed value (in km/h) for the edges of the network when looking for the fastest path. Se uma feição não tiver um valor nesse campo ou nenhum campo estiver definido, o valor da velocidade padrão (fornecido com o parâmetro Velocidade padrão) será usado.
Velocidade padrão (km/h) Opcional	VELOCI-DADE_PADRÃO	[number] Padrão: 50.0	Value to use to calculate the travel time if no speed field is provided for an edge
Topology tolerance Opcional	TOLERANCE	[number] Padrão: 0.0	Duas linhas com nós mais próximos que a tolerância especificada são consideradas conectadas
Include upper/lower bound points	IN-CLUDE_BOUNDS	[boolean] Padrão: Falso	Creates a point layer output with two points for each edge at the boundaries of the service area. One point is the start of that edge, the other is the end.

Saídas

Etiqueta	Nome	Tipo	Descrição
Service area (boundary nodes)	`SAÍDA`	[vector: point]	The output point layer with the service area boundary nodes.
Service area (lines)	`OUTPUT_LINES`	[vector: line]	Line layer representing the parts of the network that can be serviced by the start point, for the given cost.

Python code

Algorithm ID: `qgis:serviceareafrompoint`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Shortest path (layer to point)

Computes the optimal (shortest or fastest) routes from multiple start points defined by a vector layer and a given end point.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Vector layer representing network	`ENTRADA`	[vector: line]	Line vector layer representing the network to be covered
Path type to calculate	`STRATEGY`	[enumeration] Padrão: 0	The type of path to calculate. One of: • 0 — Shortest • 1 — Fastest
Vector layer with start points	`START_POINTS`	[vector: point]	Point vector layer whose features are used as start points of the routes
End point (x, y)	`END_POINT`	[coordinates]	Point feature representing the end point of the routes
Advanced parameters	Apenas GUI		The **Advanced parameters** group:

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Tabela 24.18 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Campo de direção Opcional	DIREC-TION_FIELD	[tablefield: string] Padrão: 0.0	The field used to specify directions for the network edges. Os valores usados neste campo são especificados com os três parâmetros Valor para direção direta, Valor para direção inversa e Valor para ambas as direções. As direções para frente e para trás correspondem a uma borda de mão única, "ambas as direções" indicam uma borda de mão dupla. Se uma feição não tiver um valor nesse campo ou se nenhum campo estiver definido, a configuração de direção padrão (fornecida com o parâmetro Direção padrão) será usada.
Value for forward direction Opcional	VALUE_FORWARD	[string] Padrão: '' (string vazia)	Value set in the direction field to identify edges with a forward direction
Value for backward direction Opcional	VALUE_BACKWARD	[string] Padrão: '' (string vazia)	Value set in the direction field to identify edges with a backward direction
Value for both directions Opcional	VALUE_BOTH	[string] Padrão: '' (string vazia)	Value set in the direction field to identify bidirectional edges
Direção padrão Opcional	DI-REÇÃO_PADRÃO	[enumeration] Padrão: 2	If a feature has no value set in the direction field or if no direction field is set, then this direction value is used. One of: • 0 — Forward direction • 1 — Backward direction • 2 — Both directions
Campo de velocidade Opcional	SPEED_FIELD	[tablefield: string]	Field providing the speed value (in km/h) for the edges of the network when looking for the fastest path. Se uma feição não tiver um valor nesse campo ou nenhum campo estiver definido, o valor da velocidade padrão (fornecido com o parâmetro Velocidade padrão) será usado.
Velocidade padrão (km/h) Opcional	VELOCI-DADE_PADRÃO	[number] Padrão: 50.0	Value to use to calculate the travel time if no speed field is provided for an edge
Topology tolerance Opcional	TOLERANCE	[number] Padrão: 0.0	Duas linhas com nós mais próximos que a tolerância especificada são consideradas conectadas
			End of the **Advanced parameters** group
Shortest path	SAÍDA	[vector: line]	Specify the output line layer for the shortest paths. One of: • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Shortest path	`SAÍDA`	[vector: line]	Line layer of the shortest or fastest path from each of the start points to the end point

Python code

Algorithm ID: `qgis:shortestpathlayertopoint`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Shortest path (point to layer)

Computes the optimal (shortest or fastest) routes between a given start point and multiple end points defined by a point vector layer.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Vector layer representing network	`ENTRADA`	[vector: line]	Line vector layer representing the network to be covered
Path type to calculate	`STRATEGY`	[enumeration] Padrão: 0	The type of path to calculate. One of: • 0 — Shortest • 1 — Fastest
Start point (x, y)	`START_POINT`	[coordinates]	Point feature representing the start point of the routes
Vector layer with end points	`END_POINTS`	[vector: point]	Point vector layer whose features are used as end points of the routes
Campo de direção Optional *Advanced*	`DIRECTION_FIELD`	[tablefield: string] Padrão: 0.0	The field used to specify directions for the network edges. Os valores usados neste campo são especificados com os três parâmetros `Valor para direção direta`, `Valor para direção inversa` e `Valor para ambas as direções`. As direções para frente e para trás correspondem a uma borda de mão única, "ambas as direções" indicam uma borda de mão dupla. Se uma feição não tiver um valor nesse campo ou se nenhum campo estiver definido, a configuração de direção padrão (fornecida com o parâmetro `Direção padrão`) será usada.

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Tabela 24.19 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Value for forward direction Optional *Advanced*	VALUE_FORWARD	[string] Padrão: '' (string vazia)	Value set in the direction field to identify edges with a forward direction
Value for backward direction Optional *Advanced*	VALUE_BACKWARD	[string] Padrão: '' (string vazia)	Value set in the direction field to identify edges with a backward direction
Value for both directions Optional *Advanced*	VALUE_BOTH	[string] Padrão: '' (string vazia)	Value set in the direction field to identify bidirectional edges
Direção padrão Optional *Advanced*	DIREÇÃO_PADRÃO	[enumeration] Padrão: 2	If a feature has no value set in the direction field or if no direction field is set, then this direction value is used. One of: • 0 — Forward direction • 1 — Backward direction • 2 — Both directions
Campo de velocidade Optional *Advanced*	SPEED_FIELD	[tablefield: string]	Field providing the speed value (in km/h) for the edges of the network when looking for the fastest path. Se uma feição não tiver um valor nesse campo ou nenhum campo estiver definido, o valor da velocidade padrão (fornecido com o parâmetro Velocidade padrão) será usado.
Velocidade padrão (km/h) Optional *Advanced*	VELOCIDADE_PADRÃO	[number] Padrão: 50.0	Value to use to calculate the travel time if no speed field is provided for an edge
Topology tolerance Optional *Advanced*	TOLERANCE	[number] Padrão: 0.0	Duas linhas com nós mais próximos que a tolerância especificada são consideradas conectadas
Shortest path	SAÍDA	[vector: line]	Specify the output line layer for the shortest paths. One of: • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Shortest path	SAÍDA	[vector: line]	Line layer of the shortest or fastest path from each of the start points to the end point

Python code

Algorithm ID: `qgis:shortestpathpointtolayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Shortest path (point to point)

Computes the optimal (shortest or fastest) route between a given start point and a given end point.

Parâmetros

Etiqueta	Nome	Advanced	Tipo	Descrição
Vector layer representing network	`ENTRADA`		[vector: line]	Line vector layer representing the network to be covered
Path type to calculate	`STRATEGY`		[enumeration] Padrão: 0	The type of path to calculate. One of: • 0 — Shortest • 1 — Fastest
Start point (x, y)	`START_POINT`		[coordinates]	Point feature representing the start point of the routes
End point (x, y)	`END_POINT`		[coordinates]	Point feature representing the end point of the routes
Campo de direção Opcional	`DIRECTION_FIELD`	X	[tablefield: string] Padrão: 0.0	The field used to specify directions for the network edges. Os valores usados neste campo são especificados com os três parâmetros `Valor para direção direta`, `Valor para direção inversa` e `Valor para ambas as direções`. As direções para frente e para trás correspondem a uma borda de mão única, "ambas as direções" indicam uma borda de mão dupla. Se uma feição não tiver um valor nesse campo ou se nenhum campo estiver definido, a configuração de direção padrão (fornecida com o parâmetro `Direção padrão`) será usada.
Value for forward direction Opcional	`VALUE_FORWARD`	X	[string] Padrão: '' (string vazia)	Value set in the direction field to identify edges with a forward direction
Value for backward direction Opcional	`VALUE_BACKWARD`	X	[string] Padrão: '' (string vazia)	Value set in the direction field to identify edges with a backward direction

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Tabela 24.20 – continuação da página anterior

Etiqueta	Nome	Advanced	Tipo	Descrição
Value for both directions Opcional	VALUE_BOTH	X	[string] Padrão: '' (string vazia)	Value set in the direction field to identify bidirectional edges
Direção padrão Opcional	DIREÇÃO_PADRÃO	X	[enumeration] Padrão: 2	If a feature has no value set in the direction field or if no direction field is set, then this direction value is used. One of: • 0 — Forward direction • 1 — Backward direction • 2 — Both directions
Campo de velocidade Opcional	SPEED_FIELD	X	[tablefield: string]	Field providing the speed value (in km/h) for the edges of the network when looking for the fastest path. Se uma feição não tiver um valor nesse campo ou nenhum campo estiver definido, o valor da velocidade padrão (fornecido com o parâmetro Velocidade padrão) será usado.
Velocidade padrão (km/h) Opcional	VELOCIDADE_PADRÃO	X	[number] Padrão: 50.0	Value to use to calculate the travel time if no speed field is provided for an edge
Topology tolerance Opcional	TOLERANCE	X	[number] Padrão: 0.0	Duas linhas com nós mais próximos que a tolerância especificada são consideradas conectadas
Shortest path	SAÍDA		[vector: line]	Specify the output line layer for the shortest paths. One of: • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Shortest path	SAÍDA	[vector: line]	Line layer of the shortest or fastest path from each of the start point to the end point

Python code

Algorithm ID: `qgis:shortestpathpointtopoint`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.8 Plots

Bar plot

Creates a bar plot from a category and a layer field.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Category field name	`NAME_FIELD`	[tablefield: any]	Categorical field to use for grouping the bars (X axis)
Value field	`VALUE_FIELD`	[tablefield: any]	Value to use for the plot (Y axis).
Bar plot	`SAÍDA`	[html] Default: `[Save to temporary file]`	Specify the HTML file for the plot. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Bar plot	`SAÍDA`	[html]	HTML file with the plot. Available in the *Processing* ► *Result Viewer*.

Python code

Algorithm ID: `qgis:barplot`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Box plot

Creates a box plot from a category field and a numerical layer field.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Category name field	`NAME_FIELD`	[tablefield: any]	Categorical field to use for grouping the boxes (X axis)
Value field	`VALUE_FIELD`	[tablefield: any]	Value to use for the plot (Y axis).
Additional statistic lines	`MSD`	[enumeration] Padrão: 0	Additional statistics information to add to the plot. One of: • 0 — Show Mean • 1 — Show Standard Deviation • 2 — Don't show mean and standard deviation
Box plot	`SAÍDA`	[html] Default: `[Save to temporary file]`	Specify the HTML file for the plot. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Box plot	`SAÍDA`	[html]	HTML file with the plot. Available in the *Processing* ► *Result Viewer*.

Python code

Algorithm ID: `qgis:boxplot`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Mean and standard deviation plot

Creates a box plot with mean and standard deviation values.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input table	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Category name field	`NAME_FIELD`	[tablefield: any]	Categorical field to use for grouping the boxes (X axis)
Value field	`VALUE_FIELD`	[tablefield: any]	Value to use for the plot (Y axis).
Plot	`SAÍDA`	[html] Default: `[Save to temporary file]`	Specify the HTML file for the plot. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Plot	`SAÍDA`	[html]	HTML file with the plot. Available in the *Processing* ► *Result Viewer*.

Python code

Algorithm ID: `qgis:meanandstandarddeviationplot`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Polar plot

Generates a polar plot based on the value of an input vector layer.

Two fields must be entered as parameters: one that defines the category each feature (to group features) and another one with the variable to plot (this has to be a numeric one).

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Category name field	`NAME_FIELD`	[tablefield: any]	Categorical field to use for grouping the features (X axis)
Value field	`VALUE_FIELD`	[tablefield: any]	Value to use for the plot (Y axis).
Polar plot	`SAÍDA`	[html] Default: `[Save to temporary file]`	Specify the HTML file for the plot. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Polar plot	`SAÍDA`	[html]	HTML file with the plot. Available in the *Processing* ► *Result Viewer*.

Python code

Algorithm ID: `qgis:polarplot`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raster layer histogram

Generates a histogram with the values of a raster layer.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de entrada
Band number	`BAND`	[raster band]	Raster band to use for the histogram
number of bins	`BINS`	[number] Padrão: 10	The number of bins to use in the histogram (X axis). Minimum 2.
Histogram	`SAÍDA`	[html] Default: `[Save to temporary file]`	Specify the HTML file for the plot. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Histogram	`SAÍDA`	[html]	HTML file with the plot. Available in the *Processing* ► *Result Viewer*.

Python code

Algorithm ID: `qgis:rasterlayerhistogram`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Vector layer histogram

Generates a histogram with the values of the attribute of a vector layer.

The attribute to use for computing the histogram must be numeric.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Atributo	`CAMPO`	[tablefield: any]	Value to use for the plot (Y axis).
number of bins	`BINS`	[number] Padrão: 10	The number of bins to use in the histogram (X axis). Minimum 2.
Histogram	`SAÍDA`	[html] Default: `[Save to temporary file]`	Specify the HTML file for the plot. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Histogram	`SAÍDA`	[html]	HTML file with the plot. Available in the *Processing* ► *Result Viewer*.

Python code

Algorithm ID: `qgis:vectorlayerhistogram`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Vector layer scatterplot

Creates a simple `X` - `Y` scatter plot for a vector layer.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
X attribute	`XFIELD`	[tablefield: any]	Field to use for the X axis
Y attribute	`YFIELD`	[tablefield: any]	Field to use for the Y axis
Scatterplot	`SAÍDA`	[html] Default: `[Save to temporary file]`	Specify the HTML file for the plot. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Scatterplot	`SAÍDA`	[html]	HTML file with the plot. Available in the *Processing* ► *Result Viewer*.

Python code

Algorithm ID: `qgis:vectorlayerscatterplot`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Vector layer scatterplot 3D

Creates a 3D scatter plot for a vector layer.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
X attribute	`XFIELD`	[tablefield: any]	Field to use for the X axis
Y attribute	`YFIELD`	[tablefield: any]	Field to use for the Y axis
Z attribute	`ZFIELD`	[tablefield: any]	Field to use for the Z axis
Histogram	`SAÍDA`	[html] Default: `[Save to temporary file]`	Specify the HTML file for the plot. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Histogram	`SAÍDA`	[html]	HTML file with the plot. Available in the *Processing* ► *Result Viewer*.

Python code

Algorithm ID: `qgis:scatter3dplot`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.9 Análise Raster

Cell statistics

Computes per-cell statistics based on input raster layers and for each cell writes the resulting statistics to an output raster. At each cell location, the output value is defined as a function of all overlaid cell values of the input rasters.

By default, a NoData cell in ANY of the input layers will result in a NoData cell in the output raster. If the *Ignore NoData values* option is checked, then NoData inputs will be ignored in the statistic calculation. This may result in NoData output for locations where all cells are NoData.

The *Reference layer* parameter specifies an existing raster layer to use as a reference when creating the output raster. The output raster will have the same extent, CRS, and pixel dimensions as this layer.

Calculation details: Input raster layers that do not match the cell size of the reference raster layer will be resampled using `nearest neighbor resampling`. The output raster data type will be set to the most complex data type present in the input datasets except when using the functions `Mean`, `Standard deviation` and `Variance` (data type is always `Float32` or `Float64` depending on input float type) or `Count` and `Variety` (data type is always `Int32`).

- `Count`: The count statistic will always result in the number of cells without NoData values at the current cell location.
- `Median`: If the number of input layers is even, the median will be calculated as the arithmetic mean of the two middle values of the ordered cell input values.
- `Minority/Majority`: If no unique minority or majority could be found, the result is NoData, except all input cell values are equal.

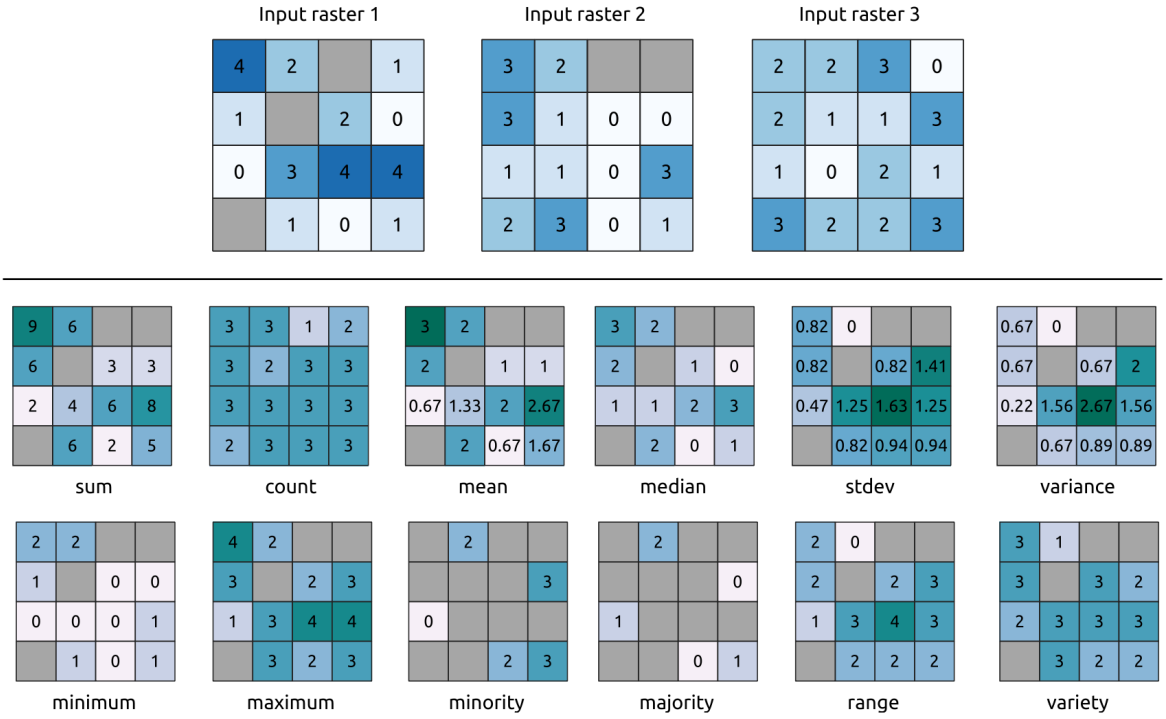


Figura24.8: Example with all the statistic functions. `NoData` cells (grey) are taken into account.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camadas de entrada	ENTRADA	[raster] [list]	Input raster layers
Statistic	STATISTIC	[enumeration] Padrão: 0	Available statistics. Options: • 0 — Sum • 1 — Count • 2 — Mean • 3 — Median • 4 — Standard deviation • 5 — Variance • 6 — Minimum • 7 — Maximum • 8 — Minority (least common value) • 9 — Majority (most common value) • 10 — Range (max - min) • 11 — Variety (unique value count)
Ignore NoData values	IGNORE_NODATA	[boolean] Default: True	Calculate statistics also for all cells stacks, ignoring NoData occurrence.
Camada de referência	REF_LAYER	[raster]	The reference layer to create the output layer from (extent, CRS, pixel dimensions)
Output no data value Opcional	OUTPUT_NO_DATA_VALUE	[number] Default: -9999.0	Value to use for nodata in the output layer
Camada de saída	SAÍDA	[same as input]	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
CRS authority identifier	CRS_AUTHID	[crs]	The coordinate reference system of the output raster layer
Extent	EXTENT	[extent]	The spatial extent of the output raster layer
Height in pixels	HEIGHT_IN_PIXELS	[integer]	The height in pixels of the output raster layer
Output raster	SAÍDA	[raster]	Output raster layer containing the result
Total pixel count	TOTAL_PIXEL_COUNT	[integer]	The count of pixels in the output raster layer
Width in pixels	WIDTH_IN_PIXELS	[integer]	The width in pixels of the output raster layer

Python code

Algorithm ID: `qgis:cellstatistics`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Equal to frequency

Evaluates on a cell-by-cell basis the frequency (number of times) the values of an input stack of rasters are equal to the value of a value layer. The output raster extent and resolution are defined by the input raster layer and is always of `Int32` type.

If multiband rasters are used in the data raster stack, the algorithm will always perform the analysis on the first band of the rasters - use GDAL to use other bands in the analysis. The output NoData value can be set manually.

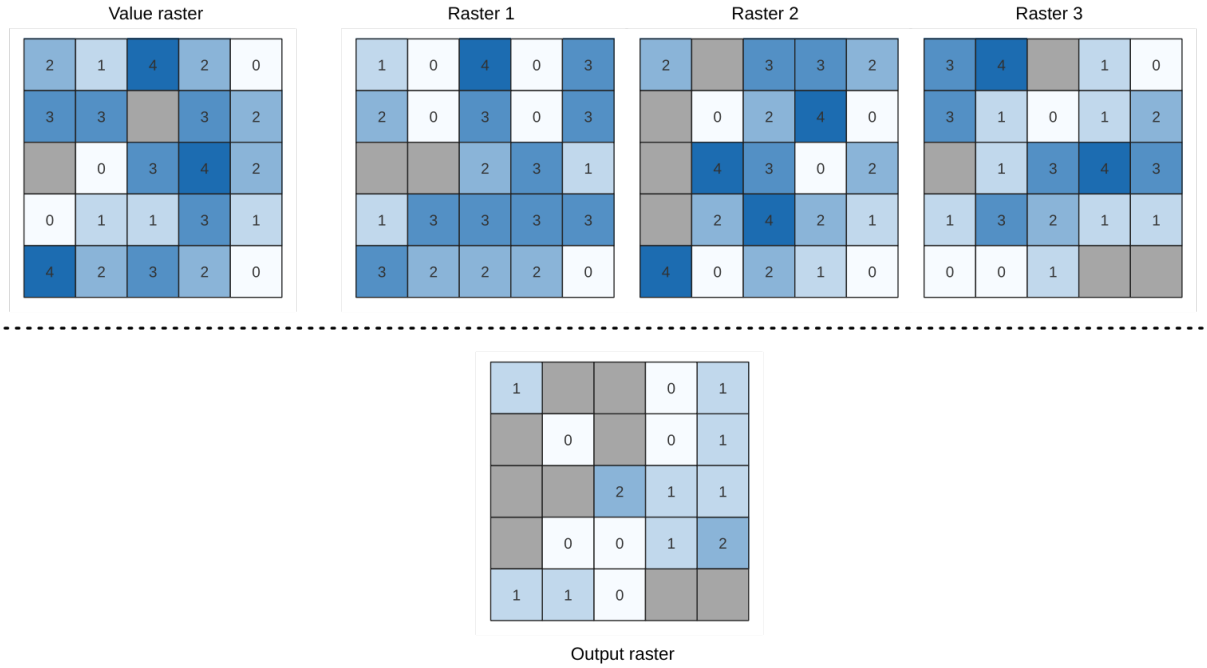


Figura24.9: For each cell in the output raster, the value represents the number of times that the corresponding cells in the list of rasters are the same as the value raster. `NoData` cells (grey) are taken into account.

Ver também:

Greater than frequency, *Less than frequency*

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Input value raster	`INPUT_VALUE_RASTER`	[raster]	The input value layer serves as reference layer for the sample layers
Value raster band	`INPUT_VALUE_RASTER_BAND`	[raster band] Default: The first band of the raster layer	Select the band you want to use as sample
Input raster layers	`INPUT_RASTERS`	[raster] [list]	Raster layers to evaluate. If multiband rasters are used in the data raster stack, the algorithm will always perform the analysis on the first band of the rasters
Ignore NoData values	`IGNORE_NODATA`	[boolean] Padrão: Falso	If unchecked, any NoData cells in the value raster or the data layer stack will result in a NoData cell in the output raster
Camada de saída	`SAÍDA`	[same as input] Default: `[Save to temporary file]`	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Output no data value Opcional	`OUTPUT_NO_DATA_VALUE`	[number] Default: -9999.0	Value to use for nodata in the output layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de saída	`SAÍDA`	[raster]	Output raster layer containing the result
CRS authority identifier	`CRS_AUTHID`	[string]	The coordinate reference system of the output raster layer
Extent	`EXTENT`	[string]	The spatial extent of the output raster layer
Count of cells with equal value occurrences	`FOUND_LOCATIONS_COUNT`	[number]	
Height in pixels	`HEIGHT_IN_PIXELS`	[number]	The number of rows in the output raster layer
Total pixel count	`TOTAL_PIXEL_COUNT`	[integer]	The count of pixels in the output raster layer
Mean frequency at valid cell locations	`MEAN_FREQUENCY_IN_LOCATION`	[number]	
Count of value occurrences	`OCCURRENCE_COUNT`	[number]	
Width in pixels	`WIDTH_IN_PIXELS`	[integer]	The number of columns in the output raster layer

Python code

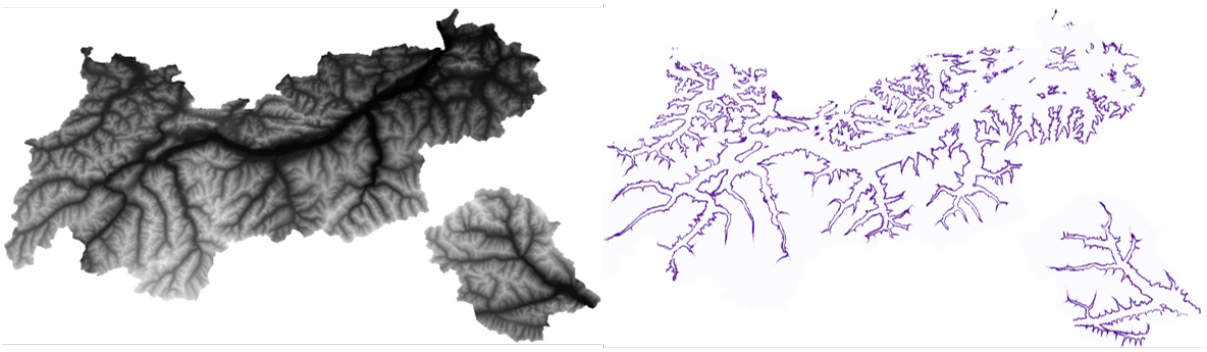
Algorithm ID: `native:equaltofrequency`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Fuzzify raster (gaussian membership)

Transforms an input raster to a fuzzified raster by assigning a membership value to each pixel, using a Gaussian membership function. Membership values range from 0 to 1. In the fuzzified raster, a value of 0 implies no membership of the defined fuzzy set, whereas a value of 1 means full membership. The gaussian membership function is defined as $\mu(x) = e^{-f1*(x-f2)^2}$, where *f1* is the spread and *f2* the midpoint.



Input raster Fuzzified raster

Figura24.10: Fuzzify raster example. Input raster source: Land Tirol - data.tirol.gv.at.

Ver também:

Fuzzify raster (large membership) *Fuzzify raster (linear membership)*, *Fuzzify raster (near membership)*, *Fuzzify raster (power membership)*, *Fuzzify raster (small membership)*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Raster	`ENTRADA`	[raster]	Camada raster de entrada
Band Number	`BAND`	[raster band] Default: The first band of the raster layer	If the raster is multiband, choose the band that you want to fuzzify.
Function midpoint	`FUZZYMIDPOINT`	[number] Default: 10	Midpoint of the gaussian function
Function spread	`FUZZYSPREAD`	[number] Default: 0.01	Spread of the gaussian function

continua na próxima página

Tabela 24.24 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Fuzzified raster	`SAÍDA`	[same as input]	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Fuzzified raster	`SAÍDA`	[same as input]	Output raster layer containing the result
CRS authority identifier	`CRS_AUTHID`	[crs]	The coordinate reference system of the output raster layer
Extent	`EXTENT`	[extent]	The spatial extent of the output raster layer
Width in pixels	`WIDTH_IN_PIXELS`	[integer]	The width in pixels of the output raster layer
Height in pixels	`HEIGHT_IN_PIXELS`	[integer]	The height in pixels of the output raster layer
Total pixel count	`TOTAL_PIXEL_COUNT`	[integer]	The count of pixels in the output raster layer

Python code

Algorithm ID: `qgis:fuzzifyrastergaussianmembership`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Fuzzify raster (large membership)

Transforms an input raster to a fuzzified raster by assigning a membership value to each pixel, using a Large membership function. Membership values range from 0 to 1. In the fuzzified raster, a value of 0 implies no membership of the defined fuzzy set, whereas a value of 1 means full membership. The large membership function is defined as $\mu(x) = \frac{1}{1 + \left(\frac{x}{f2}\right)^{-f1}}$, where *f1* is the spread and *f2* the midpoint.

Ver também:

Fuzzify raster (gaussian membership), *Fuzzify raster (linear membership)*, *Fuzzify raster (near membership)*, *Fuzzify raster (power membership)*, *Fuzzify raster (small membership)*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Raster	`ENTRADA`	[raster]	Camada raster de entrada
Band Number	`BAND`	[raster band] Default: The first band of the raster layer	If the raster is multiband, choose the band that you want to fuzzify.
Function mid-point	`FUZZYMIDPOINT`	[number] Default: 50	Midpoint of the large function
Function spread	`FUZZYSPREAD`	[number] Padrão: 5	Spread of the large function
Fuzzified raster	`SAÍDA`	[same as input]	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Fuzzified raster	`SAÍDA`	[same as input]	Output raster layer containing the result
CRS authority identifier	`CRS_AUTHID`	[crs]	The coordinate reference system of the output raster layer
Extent	`EXTENT`	[extent]	The spatial extent of the output raster layer
Width in pixels	`WIDTH_IN_PIXELS`	[integer]	The width in pixels of the output raster layer
Height in pixels	`HEIGHT_IN_PIXELS`	[integer]	The height in pixels of the output raster layer
Total pixel count	`TOTAL_PIXEL_COUNT`	[integer]	The count of pixels in the output raster layer

Python code

Algorithm ID: `qgis:fuzzifyrasterlargemembership`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Fuzzify raster (linear membership)

Transforms an input raster to a fuzzified raster by assigning a membership value to each pixel, using a Linear membership function. Membership values range from 0 to 1. In the fuzzified raster, a value of 0 implies no membership of the defined fuzzy set, whereas a value of 1 means full membership. The linear function is defined as $\mu(X)\begin{cases}0 & x \leq a \\ \frac{x-a}{b-a} & a < x < b \\ 1 & x \geq b\end{cases}$, where a is the low bound and b the high bound. This equation assigns membership values using a linear transformation for pixel values between the low and high bounds. Pixels values smaller than the low bound are given 0 membership whereas pixel values greater than the high bound are given 1 membership.

Ver também:

Fuzzify raster (gaussian membership), *Fuzzify raster (large membership)*, *Fuzzify raster (near membership)*, *Fuzzify raster (power membership)*, *Fuzzify raster (small membership)*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Raster	`ENTRADA`	[raster]	Camada raster de entrada
Band Number	`BAND`	[raster band] Default: The first band of the raster layer	If the raster is multiband, choose the band that you want to fuzzify.
Low fuzzy membership bound	`FUZZYLOWBOUND`	[number] Padrão: 0	Low bound of the linear function
High fuzzy membership bound	`FUZZYHIGHBOUND`	[number] Padrão: 1	High bound of the linear function
Fuzzified raster	`SAÍDA`	[same as input]	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Fuzzified raster	`SAÍDA`	[same as input]	Output raster layer containing the result
CRS authority identifier	`CRS_AUTHID`	[crs]	The coordinate reference system of the output raster layer
Extent	`EXTENT`	[extent]	The spatial extent of the output raster layer
Width in pixels	`WIDTH_IN_PIXELS`	[integer]	The width in pixels of the output raster layer
Height in pixels	`HEIGHT_IN_PIXELS`	[integer]	The height in pixels of the output raster layer
Total pixel count	`TOTAL_PIXEL_COUNT`	[integer]	The count of pixels in the output raster layer

Python code

Algorithm ID: `qgisfuzzifyrasterlinearmembership`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Fuzzify raster (near membership)

Transforms an input raster to a fuzzified raster by assigning a membership value to each pixel, using a Near membership function. Membership values range from 0 to 1. In the fuzzified raster, a value of 0 implies no membership of the defined fuzzy set, whereas a value of 1 means full membership. The near membership function is defined as $\mu(x) = \frac{1}{1 + f1 * (x - f2)^2}$, where *f1* is the spread and *f2* the midpoint.

Ver também:

Fuzzify raster (gaussian membership), *Fuzzify raster (large membership)*, *Fuzzify raster (linear membership)*, *Fuzzify raster (power membership)*, *Fuzzify raster (small membership)*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Raster	`ENTRADA`	[raster]	Camada raster de entrada
Band Number	`BAND`	[raster band] Default: The first band of the raster layer	If the raster is multiband, choose the band that you want to fuzzify.
Function midpoint	`FUZZYMIDPOINT`	[number] Default: 50	Midpoint of the near function
Function spread	`FUZZYSPREAD`	[number] Default: 0.01	Spread of the near function
Fuzzified raster	`SAÍDA`	[same as input]	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Fuzzified raster	`SAÍDA`	[same as input]	Output raster layer containing the result
CRS authority identifier	`CRS_AUTHID`	[crs]	The coordinate reference system of the output raster layer
Extent	`EXTENT`	[extent]	The spatial extent of the output raster layer
Width in pixels	`WIDTH_IN_PIXELS`	[integer]	The width in pixels of the output raster layer
Height in pixels	`HEIGHT_IN_PIXELS`	[integer]	The height in pixels of the output raster layer
Total pixel count	`TOTAL_PIXEL_COUNT`	[integer]	The count of pixels in the output raster layer

Python code

Algorithm ID: `qgis:fuzzifyrasternearmembership`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Fuzzify raster (power membership)

Transforms an input raster to a fuzzified raster by assigning a membership value to each pixel, using a Power membership function. Membership values range from 0 to 1. In the fuzzified raster, a value of 0 implies no membership of the defined fuzzy set, whereas a value of 1 means full membership. The power function is defined as $\mu(x)\begin{cases}0 & x \leq a \\ \left(\frac{x-a}{b-a}\right)^{f1} & a < x < b \\ 1 & x \geq b\end{cases}$, where a is the low bound, b is the high bound, and $f1$ the exponent. This equation assigns membership values using the power transformation for pixel values between the low and high bounds. Pixels values smaller than the low bound are given 0 membership whereas pixel values greater than the high bound are given 1 membership.

Ver também:

Fuzzify raster (gaussian membership), *Fuzzify raster (large membership)*, *Fuzzify raster (linear membership)*, *Fuzzify raster (near membership)*, *Fuzzify raster (small membership)*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Raster	`ENTRADA`	[raster]	Camada raster de entrada
Band Number	`BAND`	[raster band] Default: The first band of the raster layer	If the raster is multiband, choose the band that you want to fuzzify.
Low fuzzy membership bound	`FUZZYLOWBOUND`	[number] Padrão: 0	Low bound of the power function
High fuzzy membership bound	`FUZZYHIGHBOUND`	[number] Padrão: 1	High bound of the power function
High fuzzy membership bound	`FUZZYEXPONENT`	[number] Default: 2	Exponent of the power function
Fuzzified raster	`SAÍDA`	[same as input]	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Fuzzified raster	SAÍDA	[same as input]	Output raster layer containing the result
CRS authority identifier	CRS_AUTHID	[crs]	The coordinate reference system of the output raster layer
Extent	EXTENT	[extent]	The spatial extent of the output raster layer
Width in pixels	WIDTH_IN_PIXELS	[integer]	The width in pixels of the output raster layer
Height in pixels	HEIGHT_IN_PIXELS	[integer]	The height in pixels of the output raster layer
Total pixel count	TOTAL_PIXEL_COUNT	[integer]	The count of pixels in the output raster layer

Python code

Algorithm ID: `qgisfuzzifyrasterpowermembership`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Fuzzify raster (small membership)

Transforms an input raster to a fuzzified raster by assigning a membership value to each pixel, using a Small membership function. Membership values range from 0 to 1. In the fuzzified raster, a value of 0 implies no membership of the defined fuzzy set, whereas a value of 1 means full membership. The small membership function is defined as $\mu(x) = \frac{1}{1 + \left(\frac{x}{f2}\right)^{f1}}$, where *f1* is the spread and *f2* the midpoint.

Ver também:

Fuzzify raster (gaussian membership), *Fuzzify raster (large membership)* *Fuzzify raster (linear membership)*, *Fuzzify raster (near membership)*, *Fuzzify raster (power membership)*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Raster	ENTRADA	[raster]	Camada raster de entrada
Band Number	BAND	[raster band] Default: The first band of the raster layer	If the raster is multiband, choose the band that you want to fuzzify.
Function midpoint	FUZZYMIDPOINT	[number] Default: 50	Midpoint of the small function
Function spread	FUZZYSPREAD	[number] Padrão: 5	Spread of the small function
Fuzzified raster	SAÍDA	[same as input]	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Fuzzified raster	`SAÍDA`	[same as input]	Output raster layer containing the result
CRS authority identifier	`CRS_AUTHID`	[crs]	The coordinate reference system of the output raster layer
Extent	`EXTENT`	[extent]	The spatial extent of the output raster layer
Width in pixels	`WIDTH_IN_PIXELS`	[integer]	The width in pixels of the output raster layer
Height in pixels	`HEIGHT_IN_PIXELS`	[integer]	The height in pixels of the output raster layer
Total pixel count	`TOTAL_PIXEL_COUNT`	[integer]	The count of pixels in the output raster layer

Python code

Algorithm ID: `qgisfuzzifyrastersmallmembership`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Greater than frequency

Evaluates on a cell-by-cell basis the frequency (number of times) the values of an input stack of rasters are equal to the value of a value raster. The output raster extent and resolution is defined by the input raster layer and is always of `Int32` type.

If multiband rasters are used in the data raster stack, the algorithm will always perform the analysis on the first band of the rasters - use GDAL to use other bands in the analysis. The output NoData value can be set manually.

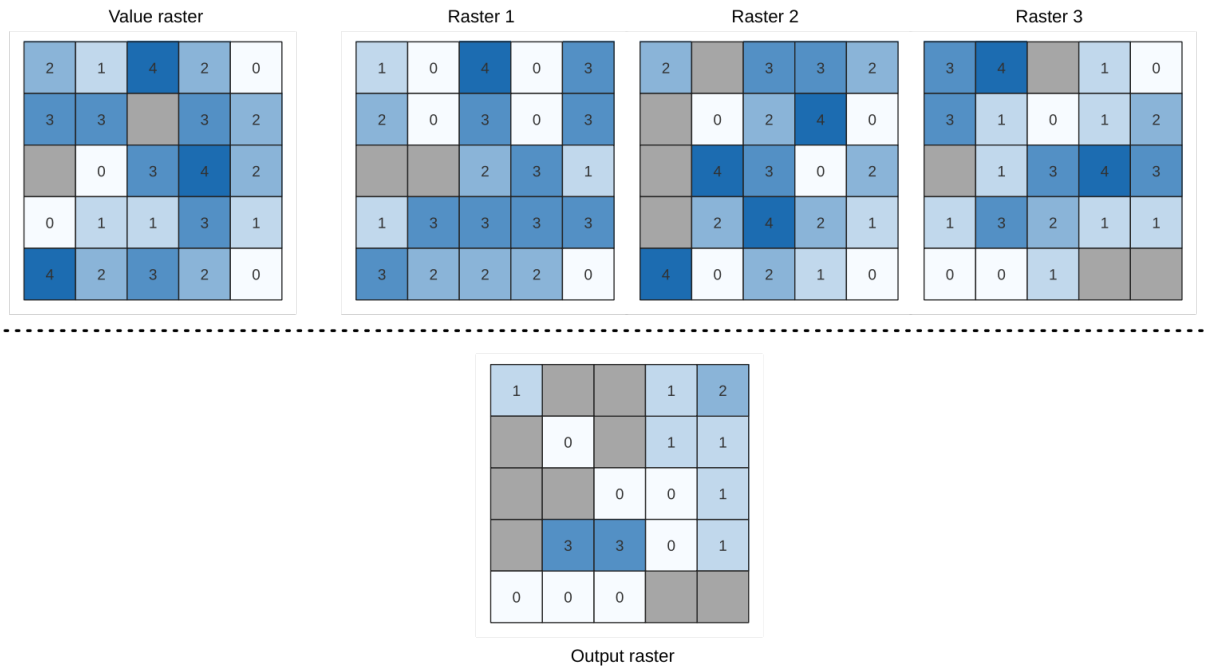


Figura24.11: For each cell in the output raster, the value represents the number of times that the corresponding cells in the list of rasters are greater than the value raster. `NoData` cells (grey) are taken into account.

Ver também:

Equal to frequency, *Less than frequency*

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Input value raster	`INPUT_VALUE_RASTER`	[raster]	The input value layer serves as reference layer for the sample layers
Value raster band	`INPUT_VALUE_RASTER_BAND`	[raster band] Default: The first band of the raster layer	Select the band you want to use as sample
Input raster layers	`INPUT_RASTERS`	[raster] [list]	Raster layers to evaluate. If multiband rasters are used in the data raster stack, the algorithm will always perform the analysis on the first band of the rasters
Ignore NoData values	`IGNORE_NODATA`	[boolean] Padrão: Falso	If unchecked, any NoData cells in the value raster or the data layer stack will result in a NoData cell in the output raster
Camada de saída	`SAÍDA`	[same as input] Default: `[Save to temporary file]`	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Output no data value Opcional	OUTPUT_NO_DATA_VALUE	[number] Default: -9999.0	Value to use for nodata in the output layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de saída	SAÍDA	[raster]	Output raster layer containing the result
CRS authority identifier	CRS_AUTHID	[string]	The coordinate reference system of the output raster layer
Extent	EXTENT	[string]	The spatial extent of the output raster layer
Count of cells with equal value occurrences	FOUND_LOCATIONS_COUNT	[number]	
Height in pixels	HEIGHT_IN_PIXELS	[number]	The number of rows in the output raster layer
Total pixel count	TOTAL_PIXEL_COUNT	[integer]	The count of pixels in the output raster layer
Mean frequency at valid cell locations	MEAN_FREQUENCY_AT_LOCATION	[number]	
Count of value occurrences	OCCURRENCE_COUNT	[number]	
Width in pixels	WIDTH_IN_PIXELS	[integer]	The number of columns in the output raster layer

Python code

Algorithm ID: `native:greaterthanfrequency`

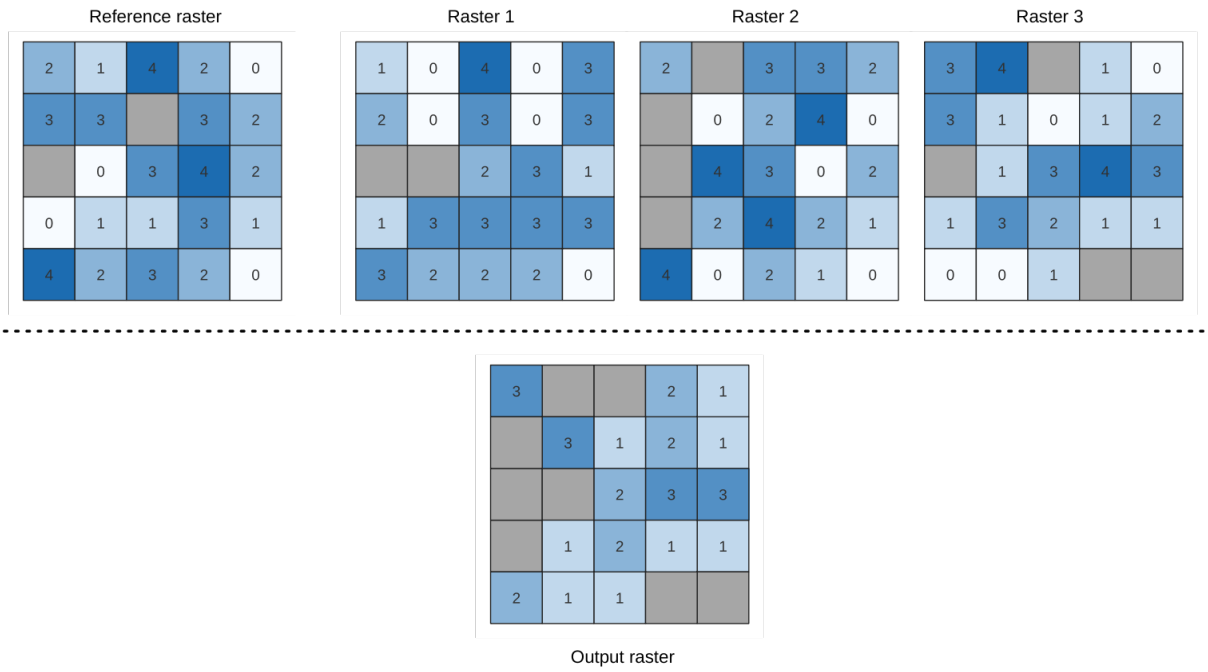
```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Highest position in raster stack

Evaluates on a cell-by-cell basis the position of the raster with the highest value in a stack of rasters. Position counts start with 1 and range to the total number of input rasters. The order of the input rasters is relevant for the algorithm. If multiple rasters feature the highest value, the first raster will be used for the position value.

If multiband rasters are used in the data raster stack, the algorithm will always perform the analysis on the first band of the rasters - use GDAL to use other bands in the analysis. Any NoData cells in the raster layer stack will result in a NoData cell in the output raster unless the "ignore NoData" parameter is checked. The output NoData value can be set manually. The output rasters extent and resolution is defined by a reference raster layer and is always of `Int32` type.



Ver também:

Lowest position in raster stack

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Input raster layers	`INPUT_RASTERS`	[raster] [list]	List of raster layers to compare with
Camada de referência	`REFERENCE_LAYER`	[raster]	The reference layer for the output layer creation (extent, CRS, pixel dimensions)
Ignore NoData values	`IGNORE_NODATA`	[boolean] Padrão: Falso	If unchecked, any NoData cells in the data layer stack will result in a NoData cell in the output raster
Camada de saída	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Specification of the output raster containing the result. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Output no data value	`OUTPUT_NODATA_VALUE`	[number] Default: -9999.0	Value to use for nodata in the output layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de saída	`SAÍDA`	[raster]	Output raster layer containing the result
CRS authority identifier	`CRS_AUTHID`	[string]	The coordinate reference system of the output raster layer
Extent	`EXTENT`	[string]	The spatial extent of the output raster layer
Width in pixels	`WIDTH_IN_PIXELS`	[integer]	The number of columns in the output raster layer
Height in pixels	`HEIGHT_IN_PIXELS`	[integer]	The number of rows in the output raster layer
Total pixel count	`TOTAL_PIXEL_COUNT`	[integer]	The count of pixels in the output raster layer

Python code

Algorithm ID: `native:highestpositioninrasterstack`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Less than frequency

Evaluates on a cell-by-cell basis the frequency (number of times) the values of an input stack of rasters are less than the value of a value raster. The output raster extent and resolution is defined by the input raster layer and is always of `Int32` type.

If multiband rasters are used in the data raster stack, the algorithm will always perform the analysis on the first band of the rasters - use GDAL to use other bands in the analysis. The output NoData value can be set manually.

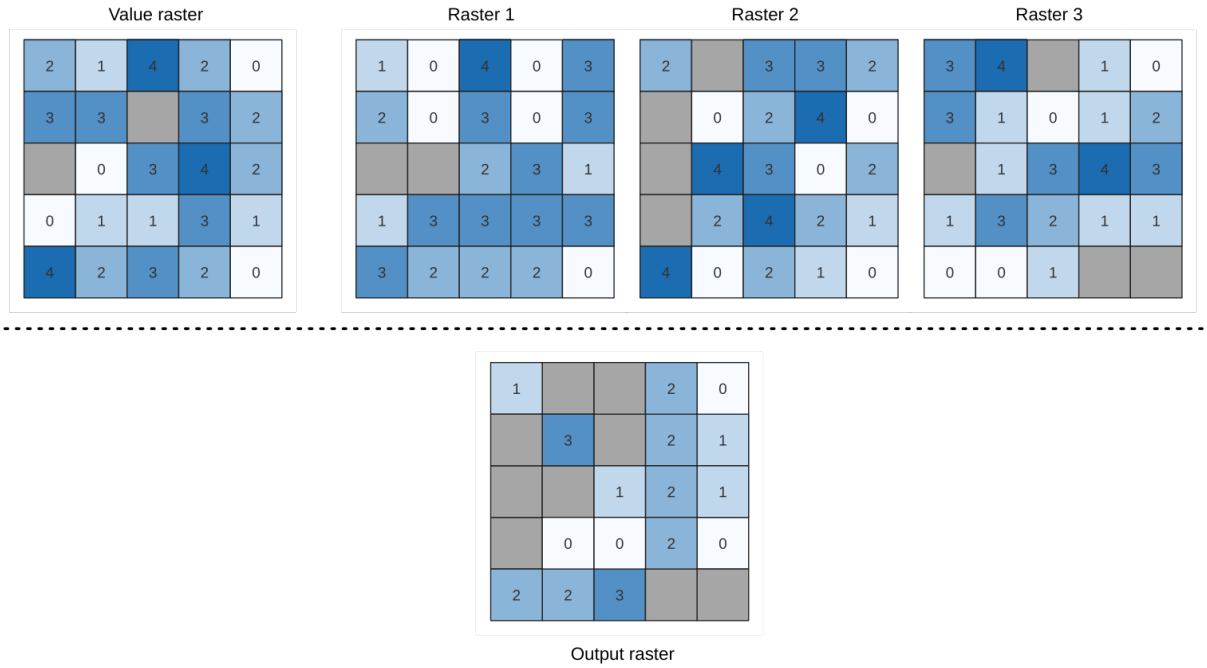


Figura24.12: For each cell in the output raster, the value represents the number of times that the corresponding cells in the list of rasters are less than the value raster. `NoData` cells (grey) are taken into account.

Ver também:

Equal to frequency, *Greater than frequency*

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Input value raster	`INPUT_VALUE_RASTER`	[raster]	The input value layer serves as reference layer for the sample layers
Value raster band	`INPUT_VALUE_RASTER_BAND`	[raster band] Default: The first band of the raster layer	Select the band you want to use as sample
Input raster layers	`INPUT_RASTERS`	[raster] [list]	Raster layers to evaluate. If multiband rasters are used in the data raster stack, the algorithm will always perform the analysis on the first band of the rasters
Ignore NoData values	`IGNORE_NODATA`	[boolean] Padrão: Falso	If unchecked, any NoData cells in the value raster or the data layer stack will result in a NoData cell in the output raster
Camada de saída	`SAÍDA`	[same as input] Default: `[Save to temporary file]`	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Output no data value Opcional	OUTPUT_NO_DATA_VALUE	[number] Default: -9999.0	Value to use for nodata in the output layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de saída	SAÍDA	[raster]	Output raster layer containing the result
CRS authority identifier	CRS_AUTHID	[string]	The coordinate reference system of the output raster layer
Extent	EXTENT	[string]	The spatial extent of the output raster layer
Count of cells with equal value occurrences	FOUND_LOCATIONS_COUNT	[number]	
Height in pixels	HEIGHT_IN_PIXELS	[number]	The number of rows in the output raster layer
Total pixel count	TOTAL_PIXEL_COUNT	[integer]	The count of pixels in the output raster layer
Mean frequency at valid cell locations	MEAN_FREQUENCY_AT_LOCATION	[number]	
Count of value occurrences	OCCURRENCE_COUNT	[number]	
Width in pixels	WIDTH_IN_PIXELS	[integer]	The number of columns in the output raster layer

Python code

Algorithm ID: `native:lessthanfrequency`

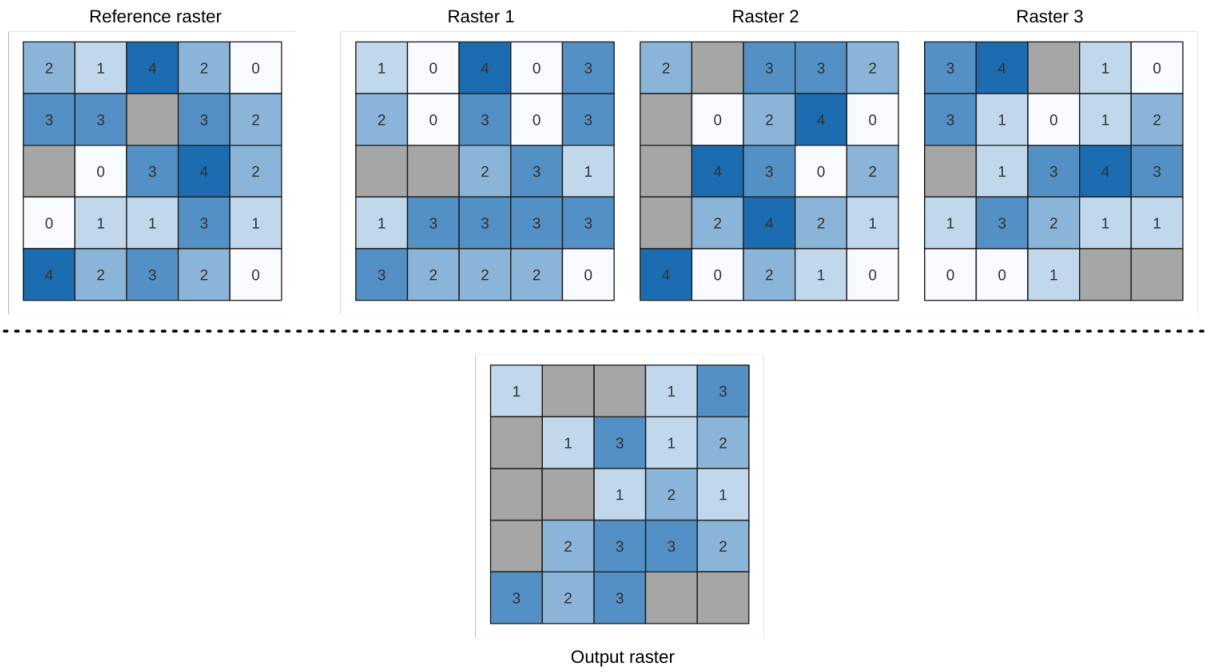
```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Lowest position in raster stack

Evaluates on a cell-by-cell basis the position of the raster with the lowest value in a stack of rasters. Position counts start with 1 and range to the total number of input rasters. The order of the input rasters is relevant for the algorithm. If multiple rasters feature the lowest value, the first raster will be used for the position value.

If multiband rasters are used in the data raster stack, the algorithm will always perform the analysis on the first band of the rasters - use GDAL to use other bands in the analysis. Any NoData cells in the raster layer stack will result in a NoData cell in the output raster unless the “ignore NoData” parameter is checked. The output NoData value can be set manually. The output rasters extent and resolution is defined by a reference raster layer and is always of `Int32` type.



Ver também:

Highest position in raster stack

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Input raster layers	`INPUT_RASTERS`	[raster] [list]	List of raster layers to compare with
Camada de referência	`REFERENCE_LAYER`	[raster]	The reference layer for the output layer creation (extent, CRS, pixel dimensions)
Ignore NoData values	`IGNORE_NODATA`	[boolean] Padrão: Falso	If unchecked, any NoData cells in the data layer stack will result in a NoData cell in the output raster
Camada de saída	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Specification of the output raster containing the result. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Output no data value	`OUTPUT_NODATA_VALUE`	[number] Default: -9999.0	Value to use for nodata in the output layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de saída	SAÍDA	[raster]	Output raster layer containing the result
CRS authority identifier	CRS_AUTHID	[string]	The coordinate reference system of the output raster layer
Extent	EXTENT	[string]	The spatial extent of the output raster layer
Width in pixels	WIDTH_IN_PIXELS	[integer]	The number of columns in the output raster layer
Height in pixels	HEIGHT_IN_PIXELS	[integer]	The number of rows in the output raster layer
Total pixel count	TOTAL_PIXEL_COUNT	[integer]	The count of pixels in the output raster layer

Python code

Algorithm ID: `native:lowestpositioninrasterstack`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raster boolean AND

Calculates the boolean AND for a set of input rasters. If all of the input rasters have a non-zero value for a pixel, that pixel will be set to 1 in the output raster. If any of the input rasters have 0 values for the pixel it will be set to 0 in the output raster.

The reference layer parameter specifies an existing raster layer to use as a reference when creating the output raster. The output raster will have the same extent, CRS, and pixel dimensions as this layer.

By default, a nodata pixel in ANY of the input layers will result in a nodata pixel in the output raster. If the *Treat nodata values as false* option is checked, then nodata inputs will be treated the same as a 0 input value.

Ver também:

Raster boolean OR

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camadas de entrada	ENTRADA	[raster] [list]	List of input raster layers
Camada de referência	REF_LAYER	[raster]	The reference layer to create the output layer from (extent, CRS, pixel dimensions)
Treat nodata values as false	NODATA_AS_FALSE	[boolean] Padrão: Falso	Treat nodata values in the input files as 0 when performing the operation
Output no data value	NO_DATA	[number] Default: -9999.0	Value to use for nodata in the output layer

continua na próxima página

Tabela 24.33 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Tipo de dados de saída	DATA_TYPE	[enumeration] Padrão: 5	Output raster data type. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Camada de saída	SAÍDA	[raster]	Camada raster de saída

Saídas

Etiqueta	Nome	Tipo	Descrição
Extent	EXTENT	[extent]	The extent of the output raster layer
CRS authority identifier	CRS_AUTHID	[crs]	The coordinate reference system of the output raster layer
Width in pixels	WIDTH_IN_PIXELS	[integer]	The width in pixels of the output raster layer
Height in pixels	HEIGHT_IN_PIXELS	[integer]	The height in pixels of the output raster layer
Total pixel count	TOTAL_PIXEL_COUNT	[integer]	The count of pixels in the output raster layer
NODATA pixel count	NODATA_PIXEL_COUNT	[integer]	The count of nodata pixels in the output raster layer
True pixel count	TRUE_PIXEL_COUNT	[integer]	The count of True pixels (value = 1) in the output raster layer
False pixel count	FALSE_PIXEL_COUNT	[integer]	The count of False pixels (value = 0) in the output raster layer
Camada de saída	SAÍDA	[raster]	Output raster layer containing the result

Python code

Algorithm ID: `qgis:rasterbooleanand`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raster boolean OR

Calculates the boolean `OR` for a set of input rasters. If all of the input rasters have a zero value for a pixel, that pixel will be set to `0` in the output raster. If any of the input rasters have `1` values for the pixel it will be set to `1` in the output raster.

The reference layer parameter specifies an existing raster layer to use as a reference when creating the output raster. The output raster will have the same extent, CRS, and pixel dimensions as this layer.

By default, a nodata pixel in ANY of the input layers will result in a nodata pixel in the output raster. If the *Treat nodata values as false* option is checked, then nodata inputs will be treated the same as a `0` input value.

Ver também:

Raster boolean AND

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camadas de entrada	`ENTRADA`	[raster] [list]	List of input raster layers
Camada de referência	`REF_LAYER`	[raster]	The reference layer to create the output layer from (extent, CRS, pixel dimensions)
Treat nodata values as false	`NODATA_AS_FALSE`	[boolean] Padrão: Falso	Treat nodata values in the input files as 0 when performing the operation
Output no data value	`NO_DATA`	[number] Default: -9999.0	Value to use for nodata in the output layer
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Output raster data type. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Camada de saída	`SAÍDA`	[raster]	Camada raster de saída

Saídas

Etiqueta	Nome	Tipo	Descrição
Extent	`EXTENT`	[extent]	The extent of the output raster layer
CRS authority identifier	`CRS_AUTHID`	[crs]	The coordinate reference system of the output raster layer
Width in pixels	`WIDTH_IN_PIXELS`	[integer]	The width in pixels of the output raster layer
Height in pixels	`HEIGHT_IN_PIXELS`	[integer]	The height in pixels of the output raster layer
Total pixel count	`TOTAL_PIXEL_COUNT`	[integer]	The count of pixels in the output raster layer
NODATA pixel count	`NODATA_PIXEL_COUNT`	[integer]	The count of nodata pixels in the output raster layer

continua na próxima página

Tabela 24.36 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
True pixel count	`TRUE_PIXEL_COUNT`	[integer]	The count of True pixels (value = 1) in the output raster layer
False pixel count	`FALSE_PIXEL_COUNT`	[integer]	The count of False pixels (value = 0) in the output raster layer
Camada de saída	`SAÍDA`	[raster]	Output raster layer containing the result

Python code

Algorithm ID: `qgis:rasterbooleanor`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Calculadora Raster

Performs algebraic operations using raster layers.

The resulting layer will have its values computed according to an expression. The expression can contain numerical values, operators and references to any of the layers in the current project.

Nota: When using the calculator in *A interface de processamento em lote* or from the *Terminal Python QGIS* the files to use have to be specified. The corresponding layers are referred using the base name of the file (without the full path). For instance, if using a layer at `path/to/my/rasterfile.tif`, the first band of that layer will be referred as `rasterfile.tif@1`.

Ver também:

Calculadora raster

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Layers	Apenas GUI		Shows the list of all raster layers loaded in the legend. These can be used to fill the expression box (double click to add). Raster layers are referred by their name and the number of the band: `layer_name@band_number`. For instance, the first band from a layer named `DEM` will be referred as `DEM@1`.
Operators	Apenas GUI		Contains some calculator like buttons that can be used to fill the expression box.
Expressão	`EXPRESSÃO`	[string]	Expression that will be used to calculate the output raster layer. You can use the operator buttons provided to type directly the expression in this box.

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Tabela 24.37 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Predefined expressions	Apenas GUI		You can use the predefined `NDVI` expression or you can define new expressions for calculations. The *Add...* button loads a defined expression (and lets you set the parameters). The *Save...* button lets you define a new expression.
Reference layer(s) (used for automated extent, cellsize, and CRS) Opcional	`CAMADAS`	[raster] [list]	Layer(s) that will be used to fetch extent, cell size and CRS. By choosing the layer in this box you avoid filling in all the other parameters by hand. Raster layers are referred by their name and the number of the band: `layer_name@band_number`. For instance, the first band from a layer named `DEM` will be referred as `DEM@1`.
Cell size (use 0 or empty to set it automatically) Opcional	`CELLSIZE`	[number]	Cell size of the output raster layer. If the cell size is not specified, the minimum cell size of the selected reference layer(s) will be used. The cell size will be the same for the X and Y axes.
Output extent (xmin, xmax, ymin, ymax) Opcional	`EXTENT`	[extent]	Extent of the output raster layer. If the extent is not specified, the minimum extent that covers all the selected reference layers will be used.
SRC de Saída Opcional	`SRC`	[crs]	CRS of the output raster layer. If the output CRS is not specified, the CRS of the first reference layer will be used.
Saída	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo... A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Saída	`SAÍDA`	[raster]	Output raster file with the calculated values.

Python code

Algorithm ID: `qgis:rastercalculator`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raster layer statistics

Calculates basic statistics from the values in a given band of the raster layer. The output is loaded in the *Processing* ► *Results viewer* menu.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de entrada
Band number	`BAND`	[raster band] Default: The first band of the input layer	If the raster is multiband, choose the band you want to get statistics for.
Saída	`OUTPUT_HTML_FILE`	[html] Default: `[Save to temporary file]`	Specification of the output file: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Valor máximo	`MAX`	[number]	
Mean value	`MEAN`	[number]	
Valor mínimo	`MIN`	[number]	
Saída	`OUTPUT_HTML_FILE`	[html]	The output file contains the following information: • Analyzed file: path of the raster layer • Minimum value: minimum value of the raster • Maximum value: maximum value of the raster • Range: difference between the maximum and minimum values • Sum: total sum of the values • Mean value: mean of the values • Standard deviation: standard deviation of the values • Sum of the squares: sum of the squared differences of each observation from the overall mean
Range	`RANGE`	[number]	
Standard deviation	`STD_DEV`	[number]	
Soma	`SOMA`	[number]	
Sum of the squares	`SUM_OF_SQUARES`	[number]	

Python code

Algorithm ID: `qgis:rasterlayerstatistics`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raster layer unique values report

Returns the count and area of each unique value in a given raster layer.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de entrada
Band number	`BAND`	[raster band] Default: The first band of the input layer	If the raster is multiband, choose the band you want to get statistics for.
Unique values report	`OUTPUT_HTML_FILE`	[file] Default: `[Save to temporary file]`	Specification of the output file: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.
Unique values table	`OUTPUT_TABLE`	[table] Default: `[Skip output]`	Specification of the table for unique values: • Ignorar Saída • Criar Camada Temporária • Salvar para Arquivo… • Save to GeoPackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
CRS authority identifier	`CRS_AUTHID`	[crs]	
Extent	`EXTENT`	[extent]	
Height in pixels	`HEIGHT_IN_PIXELS`	[number]	
NODATA pixel count	`NODATA_PIXEL_COUNT`	[number]	
Total pixel count	`TOTAL_PIXEL_COUNT`	[number]	

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Tabela 24.40 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Unique values report	`OUTPUT_HTML_FILE`	[html]	The output HTML file contains the following information: • Analyzed file: the path of the raster layer • Extent: xmin, ymin, xmax, ymax coordinates of the extent • Projection: projection of the layer • Width in pixels: number of columns and pixel width size • Height in pixels: number of rows and pixel width size • Total pixel count: count of all the pixels • NODATA pixel count: count of pixels with NODATA value
Unique values table	`OUTPUT_TABLE`	[table]	A table with three columns: • *value*: pixel value • *count*: count of pixels with this value • m^2: total area in square meters of pixels with this value.
Width in pixels	`WIDTH_IN_PIXELS`	[number]	

Python code

Algorithm ID: `qgis:rasterlayeruniquevaluesreport`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raster layer zonal statistics

Calculates statistics for a raster layer's values, categorized by zones defined in another raster layer.

Ver também:

Zonal statistics

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de entrada
Band number	`BAND`	[raster band] Default: The first band of the raster layer	If the raster is multiband choose the band for which you want to calculate the statistics.

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Tabela 24.41 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Zones layer	ZONES	[raster]	Raster layer defining zones. Zones are given by contiguous pixels having the same pixel value.
Zones band number	ZONES_BAND	[raster band] Default: The first band of the raster layer	If the raster is multiband, choose the band that defines the zones
Camada de referência Opcional	REF_LAYER	[enumeration] Padrão: 0	Raster layer used to calculate the centroids that will be used as reference when determining the zones in the output layer. One of: • 0 — Input layer • 1 — Zones layer
Estatísticas	OUTPUT_TABLE	[table]	Table with the calculated statistics

Saídas

Etiqueta	Nome	Tipo	Descrição
CRS authority identifier	CRS_AUTHID	[crs]	
Extent	EXTENT	[extent]	
Height in pixels	HEIGHT_IN_PIXELS	[number]	
NODATA pixel count	NODATA_PIXEL_COUNT	[number]	
Estatísticas	OUTPUT_TABLE	[table]	The output layer contains the following information **for each zone**: • Area: the area in square raster units in the zone; • Sum: the total sum of the pixel values in the zone; • Count: the number of pixels in the zone; • Min: the minimum pixel value in the zone; • Max: the maximum pixel value in the zone; • Mean: the mean of the pixel values in the zone;
Total pixel count	TOTAL_PIXEL_COUNT	[number]	
Width in pixels	WIDTH_IN_PIXELS	[number]	

Python code

Algorithm ID: `qgis:rasterlayerzonalstats`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raster surface volume

Calculates the volume under a raster surface relative to a given base level. This is mainly useful for Digital Elevation Models (DEM).

Parâmetros

Etiqueta	Nome	Tipo	Descrição
INPUT layer	`ENTRADA`	[raster]	Input raster, representing a surface
Band number	`BAND`	[raster band] Default: The first band of the raster layer	If the raster is multiband, choose the band that shall define the surface.
Base level	`LEVEL`	[number] Padrão: 0.0	Define a base or reference value. This base is used in the volume calculation according to the `Method` parameter (see below).
Método	`MÉTODO`	[enumeration] Padrão: 0	Define the method for the volume calculation given by the difference between the raster pixel value and the `Base level`. Options: • 0 — Count Only Above Base Level: only pixels above the base level will add to the volume. • 1 — Count Only Below Base Level: only pixels below the base level will add to the volume. • 2 — Subtract Volumes Below Base level: pixels above the base level will add to the volume, pixels below the base level will subtract from the volume. • 3 — Add Volumes Below Base level: Add the volume regardless whether the pixel is above or below the base level. This is equivalent to sum the absolute values of the difference between the pixel value and the base level.

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Tabela 24.43 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Surface volume report	`OUTPUT_HTML_FILE`	[html] Default: `[Save to temporary file]`	Specification of the output HTML report. One of: • Ignorar saída • Save to Temporary File • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.
Surface volume table	`OUTPUT_TABLE`	[table] Default: `[Skip output]`	Specification of the output table. One of: • Ignorar saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Volume	`VOLUME`	[number]	The calculated volume
Area	`AREA`	[number]	The area in square map units
Pixel_count	`PIXEL_COUNT`	[number]	The total number of pixels that have been analyzed
Surface volume report	`OUTPUT_HTML_FILE`	[html]	The output report (containing volume, area and pixel count) in HTML format
Surface volume table	`OUTPUT_TABLE`	[table]	The output table (containing volume, area and pixel count)

Python code

Algorithm ID: `qgis:rastersurfacevolume`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Reclassify by layer

Reclassifies a raster band by assigning new class values based on the ranges specified in a vector table.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada raster	`INPUT_RASTER`	[raster]	Raster layer to reclassify
Band number	`RASTER_BAND`	[raster band] Default: The first band of the raster layer	If the raster is multiband, choose the band you want to reclassify.
Layer containing class breaks	`INPUT_TABLE`	[vector: any]	Vector layer containing the values to use for classification.
Minimum class value field	`MIN_FIELD`	[tablefield: numeric]	Field with the minimum value of the range for the class.
Maximum class value field	`MAX_FIELD`	[tablefield: numeric]	Field with the maximum value of the range for the class.
Output value field	`VALUE_FIELD`	[tablefield: numeric]	Field with the value that will be assigned to the pixels that fall in the class (between the corresponding min and max values).
Output no data value	`NO_DATA`	[number] Default: -9999.0	Value to apply to no data values.
Range boundaries	`RANGE_BOUNDARIES`	[enumeration] Padrão: 0	Defines comparison rules for the classification. Options: • 0 — min < value <= max • 1 — min <= value < max • 2 — min <= value <= max • 3 — min < value < max
Use no data when no range matches value	`NO_DATA_FOR_MISSING`	[boolean] Padrão: Falso	Values that do not belong to a class will result in the no data value. If False, the original value is kept.
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Defines the data type of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Reclassified raster	`SAÍDA`	[raster]	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Reclassified raster	`SAÍDA`	[raster]	Output raster layer with reclassified band values

Python code

Algorithm ID: `qgis:reclassifybylayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Reclassify by table

Reclassifies a raster band by assigning new class values based on the ranges specified in a fixed table.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada raster	`INPUT_RASTER`	[raster]	Raster layer to reclassify
Band number	`RASTER_BAND`	[raster band] Padrão: 1	Raster band for which you want to recalculate values.
Reclassification table	`TABELA`	[table]	A 3-columns table to fill with the values to set the boundaries of each class (`Minimum` and `Maximum`) and the new `Value` to assign to the band values that fall in the class.
Output no data value	`NO_DATA`	[number] Default: -9999.0	Value to apply to no data values.
Range boundaries	`RANGE_BOUNDARIES`	[enumeration] Padrão: 0	Defines comparison rules for the classification. Options: • 0 — min < value <= max • 1 — min <= value < max • 2 — min <= value <= max • 3 — min < value < max
Use no data when no range matches value	`NODATA_FOR_MISSING`	[boolean] Padrão: Falso	Applies the no data value to band values that do not fall in any class. If False, the original value is kept.

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Tabela 24.45 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Define o formato do arquivo de raster saída. Opções: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Reclassified raster	`SAÍDA`	[raster] Default: '[Save to temporary file]'	Especificação da camada raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Reclassified raster	`SAÍDA`	[raster] Default: '[Save to temporary file]'	The output raster layer.

Python code

Algorithm ID: `qgis:reclassifybytable`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Rescale raster

Rescales raster layer to a new value range, while preserving the shape (distribution) of the raster's histogram (pixel values). Input values are mapped using a linear interpolation from the source raster's minimum and maximum pixel values to the destination minimum and miximum pixel range.

By default the algorithm preserves the original NODATA value, but there is an option to override it.

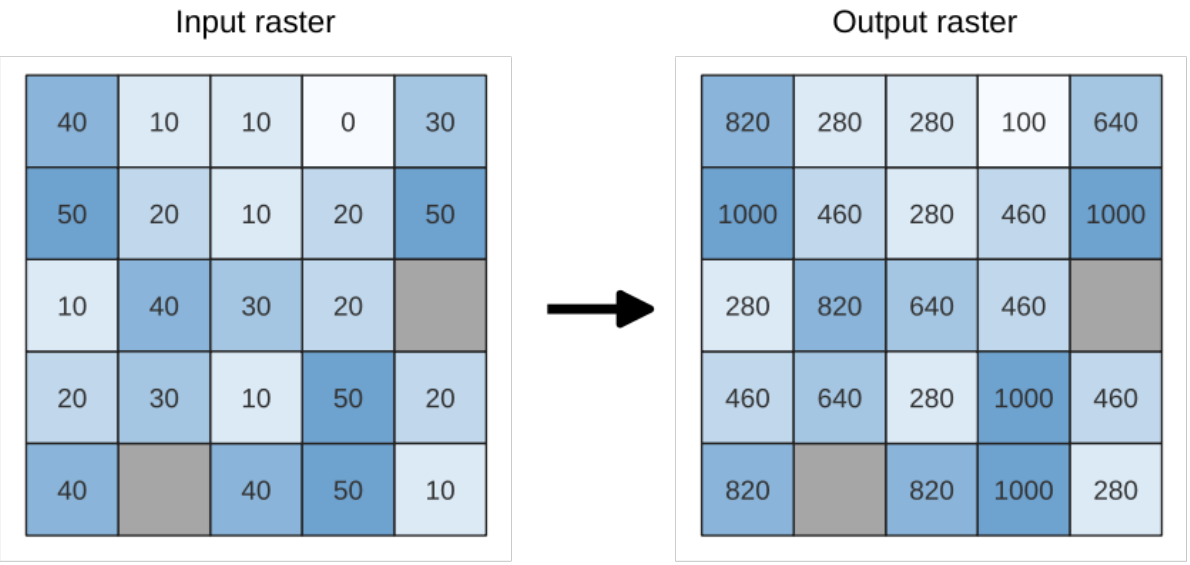


Figura24.13: Rescaling values of a raster layer from [0 - 50] to [100 - 1000]

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Raster	`ENTRADA`	[raster]	Raster layer to use for rescaling
Band number	`Band`	[raster band] Default: The first band of the input layer	If the raster is multiband, choose a band.
New minimum value	`MINIMUM`	[number] Default value: 0.0	Minimum pixel value to use in the rescaled layer
New maximum value	`MAXIMUM`	[number] Default value: 255.0	Maximum pixel value to use in the rescaled layer
New NODATA value Opcional	`NODATA`	[number] Default value: Not set	Value to assign to the NODATA pixels. If unset, original NODATA values are preserved.
Rescaled	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Especificação da camada raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Saídas

Etiqueta	Nome	Tipo	Descrição
Rescaled	`SAÍDA`	[raster]	Output raster layer with rescaled band values

Python code

Algorithm ID: `native:rescaleraster`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Round raster

Rounds the cell values of a raster dataset according to the specified number of decimals.

Alternatively, a negative number of decimal places may be used to round values to powers of a base n. For example, with a Base value n of 10 and Decimal places of -1, the algorithm rounds cell values to multiples of 10, -2 rounds to multiples of 100, and so on. Arbitrary base values may be chosen, the algorithm applies the same multiplicative principle. Rounding cell values to multiples of a base n may be used to generalize raster layers.

The algorithm preserves the data type of the input raster. Therefore byte/integer rasters can only be rounded to multiples of a base n, otherwise a warning is raised and the raster gets copied as byte/integer raster.

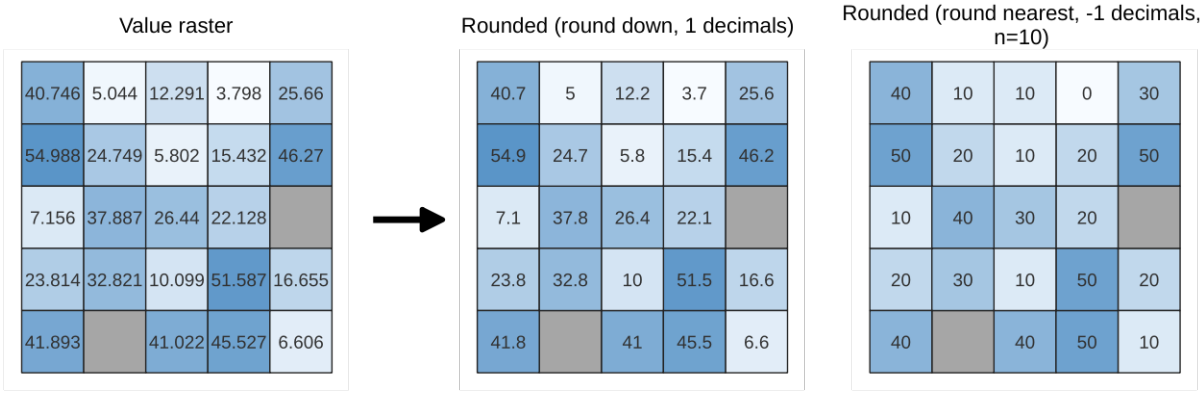


Figura24.14: Rounding values of a raster

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Input raster	`ENTRADA`	[raster]	The raster to process.
Band number	`BAND`	[number] Padrão: 1	The band of the raster
Rounding direction	`ROUNDING_DIRECTION`	[list] Padrão: 1	How to choose the target rounded value. Options are: 0 - Round up 1 - Round to nearest 2 - Round down
Number of decimals places	`DECIMAL_PLACES`	[number] Default: 2	Number of decimals places to round to. Use negative values to round cell values to a multiple of a base n

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Tabela 24.46 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Output raster	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Specification of the output file. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Base n for rounding to multiples of n	`BASE_N`	[number] Default: 10	When the `DECIMAL_PLACES` parameter is negative, raster values are rounded to multiples of the base n value

Saídas

Etiqueta	Nome	Tipo	Descrição
Output raster	`SAÍDA`	[raster]	The output raster layer with values rounded for the selected band.

Python code

Algorithm ID: `native:roundrastervalues`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Sample raster values

Extracts raster values at the point locations. If the raster layer is multiband, each band is sampled.

The attribute table of the resulting layer will have as many new columns as the raster layer band count.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Point Layer	`ENTRADA`	[vector: point]	Point vector layer to use for sampling
Raster Layer to sample	`RASTERCOPY`	[raster]	Raster layer to sample at the given point locations.
Output column prefix	`COLUMN_PREFIX`	[string] Default: 'rvalue'	Prefix for the names of the added columns.
Sampled Points Opcional	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Specify the output layer containing the sampled values. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Save to Database Table… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Sampled Points Opcional	`SAÍDA`	[vector: point]	The output layer containing the sampled values.

Python code

Algorithm ID: `qgis:rastersampling`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Zonal histogram

Appends fields representing counts of each unique value from a raster layer contained within polygon features.

The output layer attribute table will have as many fields as the unique values of the raster layer that intersects the polygon(s).

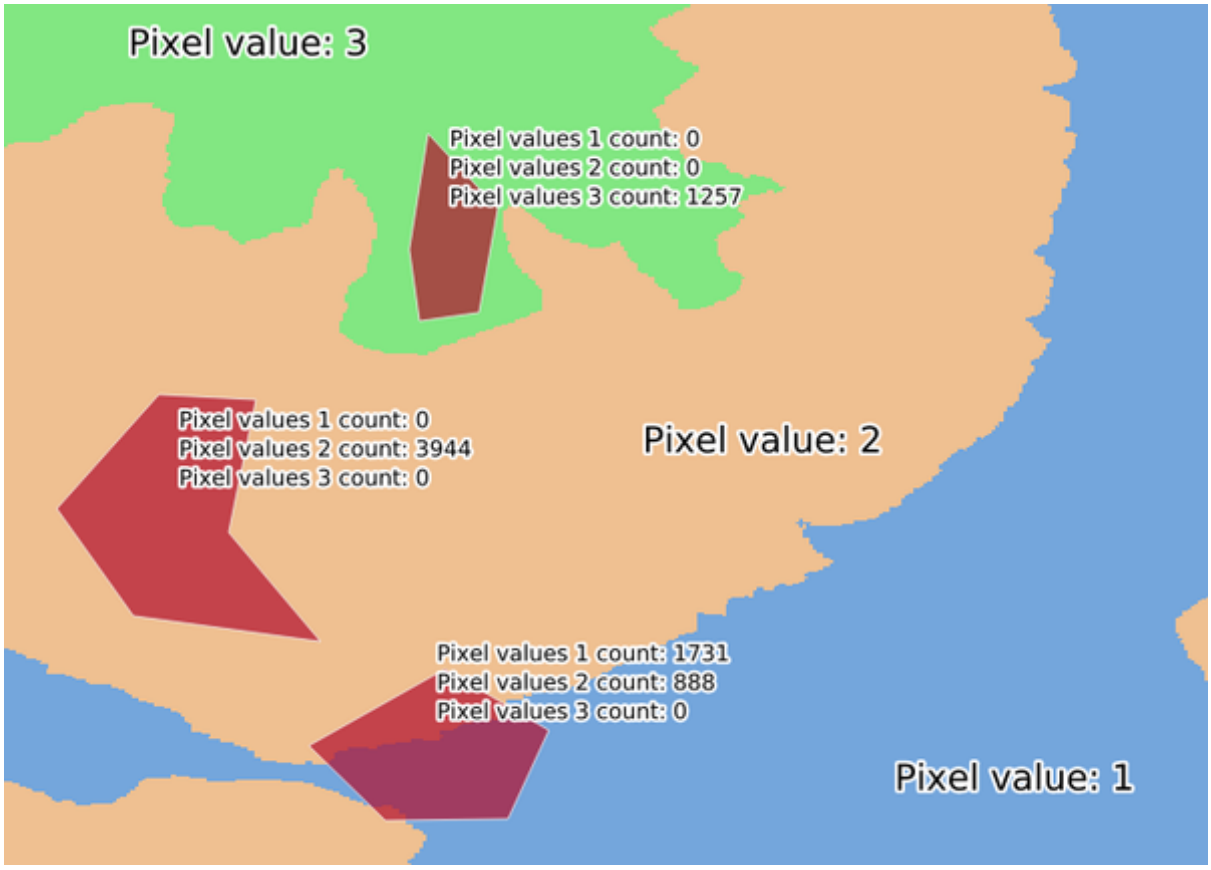


Figura24.15: Raster layer histogram example

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada raster	`INPUT_RASTER`	[raster]	Input raster layer.
Band number	`RASTER_BAND`	[raster band] Default: The first band of the input layer	If the raster is multiband, choose a band.
Vector layer containing zones	`INPUT_VECTOR`	[vector: polygon]	Vector polygon layer that defines the zones.
Output column prefix	`COLUMN_PREFIX` Opcional	[string] Default: 'HISTO_'	Prefix for the output columns names.
Output zones	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output vector polygon layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Save to Database Table… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output zones Opcional	SAÍDA	[vector: polygon] Default: [Create temporary layer]	The output vector polygon layer.

Python code

Algorithm ID: qgis:zonalhistogram

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Zonal statistics

Calculates statistics of a raster layer for each feature of an overlapping polygon vector layer.

Prior to QGIS 3.16, the algorithm edited the layer in-place, adding the new statistics fields to it. Now, it outputs a new layer with these statistics.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: polygon]	Vector polygon layer that contains the zones.
Camada raster	INPUT_RASTER	[raster]	Input raster layer.
Raster band	RASTER_BAND	[raster band] Default: The first band of the input layer	If the raster is multiband, choose a band for the statistics.
Output column prefix	COLUMN_PREFIX	[string] Default: '_'	Prefix for the output columns names.
Statistics to calculate	STATISTICS	[enumeration] [list] Default: [0,1,2]	List of statistical operator for the output. Options: • 0 — Count • 1 — Sum • 2 — Mean • 3 — Median • 4 — St. dev. • 5 — Minimum • 6 — Maximum • 7 — Range • 8 — Minority • 9 — Majority • 10 — Variety • 11 — Variance

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Tabela 24.48 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Zonal Statistics `NEW in 3.16`	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output vector polygon layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Save to File… • Save to Geopackage… • Save to Database Table… • Append to Layer… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Zonal Statistics `NEW in 3.16`	`SAÍDA`	[vector: polygon]	The zone vector layer with added statistics.

Python code

Algorithm ID: `qgis:zonalstatisticsfb`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.10 Raster Creation

Create constant raster layer

Generates raster layer for given extent and cell size filled with the specified value.

Additionally an output data type can be specified. The algorithm will abort if a value has been entered that cannot be represented by the selected output raster data type.

Parameters

Basic parameters

Label	Name	Type	Description
Desired extent	`EXTENT`	[extent]	Specify the extent (xmin, xmax, ymin, ymax) of the output raster layer. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Target CRS	`TARGET_CRS`	[crs] Default: Project CRS	CRS for the output raster layer
Pixel size	`PIXEL_SIZE`	[number] Default: 0.1	Pixel size (X=Y) in map units. Minimum value: 0.01
Constant value	`NUMBER`	[number] Default: 1	Constant pixel value for the output raster layer.
Constant	`OUTPUT`	[raster] Default: `[Save to temporary file]`	Specification of the output raster. One of: • Save to a Temporary File • Save to File…

Advanced parameters

Label	Name	Type	Description
Output raster data type	`OUTPUT_TYPE` Default: 5	[enumeration]	Defines the data type of the output raster file. Options: • 0 — Byte • 1 — Integer16 • 2 — Unsigned Integer16 • 3 — Integer32 • 4 — Unsigned Integer32 • 5 — Float32 • 6 — Float64

Outputs

Label	Name	Type	Description
Constant	`OUTPUT`	[raster]	Raster covering the desired extent with the specified pixel size and value.

Python code

Algorithm ID: `native:createconstantrasterlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create random raster layer (binomial distribution)

Generates a raster layer for given extent and cell size filled with binomially distributed random values.

By default, the values will be chosen given an N of 10 and a probability of 0.5. This can be overridden by using the advanced parameter for N and probability. The raster data type is set to Integer types (Integer16 by default). The binomial distribution random values are defined as positive integer numbers. A floating point raster will represent a cast of integer values to floating point.

Parameters

Basic parameters

Label	Name	Type	Description
Desired extent	`EXTENT`	[extent]	Specify the extent (xmin, xmax, ymin, ymax) of the output raster layer. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Target CRS	`TARGET_CRS`	[crs] Default: Project CRS	CRS for the output raster layer
Pixel size	`PIXEL_SIZE`	[number] Default: 0.1	Pixel size (X=Y) in map units. Minimum value: 0.01
Output raster	`OUTPUT`	[raster] Default: `[Save to temporary file]`	Specification of the output raster. One of: • Save to a Temporary File • Save to File…

Advanced parameters

Label	Name	Type	Description
Output raster data type	`OUTPUT_TYPE` Default: 0	[enumeration]	Defines the data type of the output raster file. Options: • 0 — Integer16 • 1 — Unsigned Integer16 • 2 — Integer32 • 3 — Unsigned Integer32 • 4 — Float32 • 5 — Float64
N	`N`	[number] Default: 10	
Probability	`PROBABILITY`	[number] Default: 0.5	

Outputs

Label	Name	Type	Description
Output raster	`OUTPUT`	[raster]	Raster covering the desired extent with the cell size filled with random values

Python code

Algorithm ID: `native:createrandombinomialrasterlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create random raster layer (exponential distribution)

Generates a raster layer for given extent and cell size filled with exponentially distributed random values.

By default, the values will be chosen given a lambda of 1.0. This can be overridden by using the advanced parameter for lambda. The raster data type is set to Float32 by default as the exponential distribution random values are floating point numbers.

Parameters

Basic parameters

Label	Name	Type	Description
Desired extent	`EXTENT`	[extent]	Specify the extent (xmin, xmax, ymin, ymax) of the output raster layer. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Target CRS	`TARGET_CRS`	[crs] Default: Project CRS	CRS for the output raster layer
Pixel size	`PIXEL_SIZE`	[number] Default: 1.0	Pixel size (X=Y) in map units. Minimum value: 0.01
Output raster	`OUTPUT`	[raster] Default: `[Save to temporary file]`	Specification of the output raster. One of: • Save to a Temporary File • Save to File…

Advanced parameters

Label	Name	Type	Description
Output raster data type	`OUTPUT_TYPE` Default: 0	[enumeration]	Defines the data type of the output raster file. Options: • 0 — Float32 • 1 — Float64
Lambda	`LAMBDA`	[number] Default: 1.0	

Outputs

Label	Name	Type	Description
Output raster	`OUTPUT`	[raster]	Raster covering the desired extent with the cell size filled with random values

Python code

Algorithm ID: `native:createrandomexponentialrasterlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create random raster layer (gamma distribution)

Generates a raster layer for given extent and cell size filled with gamma distributed random values.

By default, the values will be chosen given an alpha and beta value of 1.0. This can be overridden by using the advanced parameter for alpha and beta. The raster data type is set to Float32 by default as the gamma distribution random values are floating point numbers.

Parameters

Basic parameters

Label	Name	Type	Description
Desired extent	`EXTENT`	[extent]	Specify the extent (xmin, xmax, ymin, ymax) of the output raster layer. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Target CRS	`TARGET_CRS`	[crs] Default: Project CRS	CRS for the output raster layer
Pixel size	`PIXEL_SIZE`	[number] Default: 1.0	Pixel size (X=Y) in map units. Minimum value: 0.01
Output raster	`OUTPUT`	[raster] Default: `[Save to temporary file]`	Specification of the output raster. One of: • Save to a Temporary File • Save to File…

Advanced parameters

Label	Name	Type	Description
Output raster data type	`OUTPUT_TYPE` Default: 0	[enumeration]	Defines the data type of the output raster file. Options: • 0 — Float32 • 1 — Float64
Alpha	`ALPHA`	[number] Default: 1.0	
Beta	`BETA`	[number] Default: 1.0	

Outputs

Label	Name	Type	Description
Output raster	`OUTPUT`	[raster]	Raster covering the desired extent with the cell size filled with randomly distributed values

Python code

Algorithm ID: `native:createrandomgammarasterlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create random raster layer (geometric distribution)

Generates a raster layer for given extent and cell size filled with geometrically distributed random values.

By default, the values will be chosen given a probability of 0.5. This can be overridden by using the advanced parameter for mean value. The raster data type is set to Integer types (Integer16 by default). The geometric distribution random values are defined as positive integer numbers. A floating point raster will represent a cast of integer values to floating point.

Parameters

Basic parameters

Label	Name	Type	Description
Desired extent	`EXTENT`	[extent]	Specify the extent (xmin, xmax, ymin, ymax) of the output raster layer. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Target CRS	`TARGET_CRS`	[crs] Default: Project CRS	CRS for the output raster layer
Pixel size	`PIXEL_SIZE`	[number] Default: 1.0	Pixel size (X=Y) in map units. Minimum value: 0.01
Output raster	`OUTPUT`	[raster] Default: `[Save to temporary file]`	Specification of the output raster. One of: • Save to a Temporary File • Save to File…

Advanced parameters

Label	Name	Type	Description
Output raster data type	`OUTPUT_TYPE` Default: 0	[enumeration]	Defines the data type of the output raster file. Options: • 0 — Integer16 • 1 — Unsigned Integer16 • 2 — Integer32 • 3 — Unsigned Integer32 • 4 — Float32 • 5 — Float64
Probability	`PROBABILITY`	[number] Default: 0.5	

Outputs

Label	Name	Type	Description
Output raster	`OUTPUT`	[raster]	Raster covering the desired extent with the cell size filled with randomly distributed values

Python code

Algorithm ID: `native:createrandomgeometricrasterlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create random raster layer (negative binomial distribution)

Generates a raster layer for given extent and cell size filled with negative binomially distributed random values.

By default, the values will be chosen given a distribution parameter k of 10.0 and a probability of 0.5. This can be overridden by using the advanced parameters for k and probability. The raster data type is set to Integer types (Integer16 by default). The negative binomial distribution random values are defined as positive integer numbers. A floating point raster will represent a cast of integer values to floating point.

Parameters

Basic parameters

Label	Name	Type	Description
Desired extent	`EXTENT`	[extent]	Specify the extent (xmin, xmax, ymin, ymax) of the output raster layer. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Target CRS	`TARGET_CRS`	[crs] Default: Project CRS	CRS for the output raster layer
Pixel size	`PIXEL_SIZE`	[number] Default: 1.0	Pixel size (X=Y) in map units. Minimum value: 0.01
Output raster	`OUTPUT`	[raster] Default: `[Save to temporary file]`	Specification of the output raster. One of: • Save to a Temporary File • Save to File…

Advanced parameters

Label	Name	Type	Description
Output raster data type	`OUTPUT_TYPE` Default: 0	[enumeration]	Defines the data type of the output raster file. Options: • 0 — Integer16 • 1 — Unsigned Integer16 • 2 — Integer32 • 3 — Unsigned Integer32 • 4 — Float32 • 5 — Float64
Distribution parameter k	`K_PARAMETER`	[number] Default: 10	
Probability	`PROBABILITY`	[number] Default: 0.5	

Outputs

Label	Name	Type	Description
Output raster	`OUTPUT`	[raster]	Raster covering the desired extent with the cell size filled with randomly distributed values

Python code

Algorithm ID: `native:createrandomnegativebinomialrasterlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create random raster layer (normal distribution)

Generates a raster layer for given extent and cell size filled with normally distributed random values.

By default, the values will be chosen given a mean of 0.0 and a standard deviation of 1.0. This can be overridden by using the advanced parameters for mean and standard deviation value. The raster data type is set to Float32 by default as the normal distribution random values are floating point numbers.

Parameters

Basic parameters

Label	Name	Type	Description
Desired extent	`EXTENT`	[extent]	Specify the extent (xmin, xmax, ymin, ymax) of the output raster layer. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Target CRS	`TARGET_CRS`	[crs] Default: Project CRS	CRS for the output raster layer
Pixel size	`PIXEL_SIZE`	[number] Default: 1.0	Pixel size (X=Y) in map units. Minimum value: 0.01
Output raster	`OUTPUT`	[raster] Default: `[Save to temporary file]`	Specification of the output raster. One of: • Save to a Temporary File • Save to File…

Advanced parameters

Label	Name	Type	Description
Output raster data type	`OUTPUT_TYPE` Default: 0	[enumeration]	Defines the data type of the output raster file. Options: • 0 — Float32 • 1 — Float64
Mean of normal distribution	`MEAN`	[number] Default: 0.0	
Standard deviation of normal distribution	`STDDEV`	[number] Default: 1.0	

Outputs

Label	Name	Type	Description
Output raster	`OUTPUT`	[raster]	Raster covering the desired extent with the cell size filled with randomly distributed values

Python code

Algorithm ID: `native:createrandomnormalrasterlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create random raster layer (poisson distribution)

Generates a raster layer for given extent and cell size filled with poisson distributed random values.

By default, the values will be chosen given a mean of 1.0. This can be overridden by using the advanced parameter for mean value. The raster data type is set to Integer types (Integer16 by default). The poisson distribution random values are positive integer numbers. A floating point raster will represent a cast of integer values to floating point.

Parameters

Basic parameters

Label	Name	Type	Description
Desired extent	`EXTENT`	[extent]	Specify the extent (xmin, xmax, ymin, ymax) of the output raster layer. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Target CRS	`TARGET_CRS`	[crs] Default: Project CRS	CRS for the output raster layer
Pixel size	`PIXEL_SIZE`	[number] Default: 1.0	Pixel size (X=Y) in map units. Minimum value: 0.01
Output raster	`OUTPUT`	[raster] Default: `[Save to temporary file]`	Specification of the output raster. One of: • Save to a Temporary File • Save to File…

Advanced parameters

Label	Name	Type	Description
Output raster data type	`OUTPUT_TYPE` Default: 0	[enumeration]	Defines the data type of the output raster file. Options: • 0 — Integer16 • 1 — Unsigned Integer16 • 2 — Integer32 • 3 — Unsigned Integer32 • 4 — Float32 • 5 — Float64
Mean	`MEAN`	[number] Default: 1.0	

Outputs

Label	Name	Type	Description
Output raster	`OUTPUT`	[raster]	Raster covering the desired extent with the cell size filled with randomly distributed values

Python code

Algorithm ID: `native:createrandompoissonrasterlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create random raster layer (uniform distribution)

Generates a raster layer for given extent and cell size filled with random values.

By default, the values will range between the minimum and maximum value of the specified output raster type. This can be overridden by using the advanced parameters for lower and upper bound value. If the bounds have the same value or both are zero (default) the algorithm will create random values in the full value range of the chosen raster data type. Choosing bounds outside the acceptable range of the output raster type will abort the algorithm.

Parameters

Basic parameters

Label	Name	Type	Description
Desired extent	`EXTENT`	[extent]	Specify the extent (xmin, xmax, ymin, ymax) of the output raster layer. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Target CRS	`TARGET_CRS`	[crs] Default: Project CRS	CRS for the output raster layer
Pixel size	`PIXEL_SIZE`	[number] Default: 1.0	Pixel size (X=Y) in map units. Minimum value: 0.01
Output raster	`OUTPUT`	[raster] Default: `[Save to temporary file]`	Specification of the output raster. One of: • Save to a Temporary File • Save to File…

Advanced parameters

Label	Name	Type	Description
Output raster data type	`OUTPUT_TYPE` Default: 5	[enumeration]	Defines the data type of the output raster file. Options: • 0 — Byte • 1 — Integer16 • 2 — Unsigned Integer16 • 3 — Integer32 • 4 — Unsigned Integer32 • 5 — Float32 • 6 — Float64
Lower bound for random number range	`LOWER_BOUND`	[number] Default: 0.0	
Upper bound for random number range	`UPPER_BOUND`	[number] Default: 0.0	

Outputs

Label	Name	Type	Description
Output raster	`OUTPUT`	[raster]	Raster covering the desired extent with the cell size filled with randomly distributed values

Python code

Algorithm ID: `native:createrandomuniformrasterlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.11 Análise espacial Raster (Matricial)

Aspecto

Calculates the aspect of the Digital Terrain Model in input. The final aspect raster layer contains values from 0 to 360 that express the slope direction, starting from north (0°) and continuing clockwise.

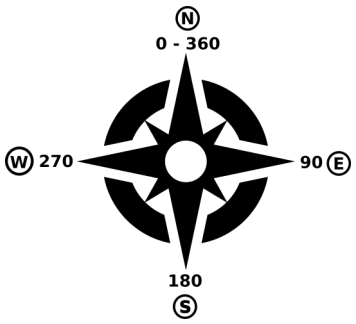


Figura24.16: Gama de valores da Exposição

A figura seguinte apresenta a camada de orientações reclassificada através de uma paleta (de cores).

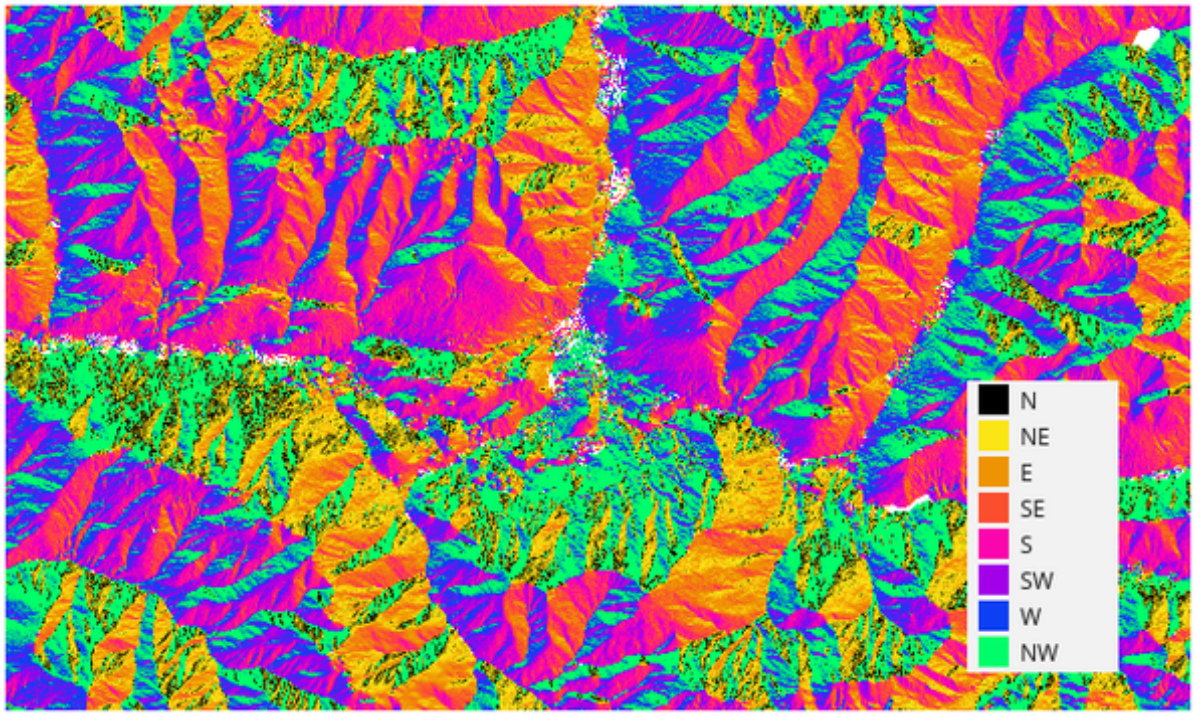


Figura24.17: Camada de Exposição reclassificada

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Elevation layer	`ENTRADA`	[raster]	Digital Terrain Model raster layer
Z factor	`Z_FACTOR`	[number] Padrão: 1.0	Vertical exaggeration. This parameter is useful when the Z units differ from the X and Y units, for example feet and meters. You can use this parameter to adjust for this. The default is 1 (no exaggeration).
Aspecto	`SAÍDA`	[raster]	Specify the output aspect raster layer. One of: • Save to a Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Aspecto	`SAÍDA`	[raster]	The output aspect raster layer

Python code

Algorithm ID: `qgis:aspect`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Sombreamento

Calculates the hillshade raster layer given an input Digital Terrain Model.

O sombreado da camada é calculado de acordo com a posição do sol com a opção de escolha, quer do seu ângulo horizontal (azimute), quer do seu ângulo vertical (elevação).

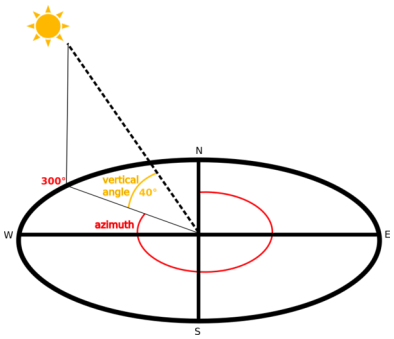


Figura24.18: Azimute e ângulo vertical

A camada de sombreados compreende valores entre 0 (sombra total) até 255 (claridade total). O método dos sombreados é habitualmente utilizado para aumentar a percepção do relevo do terreno.

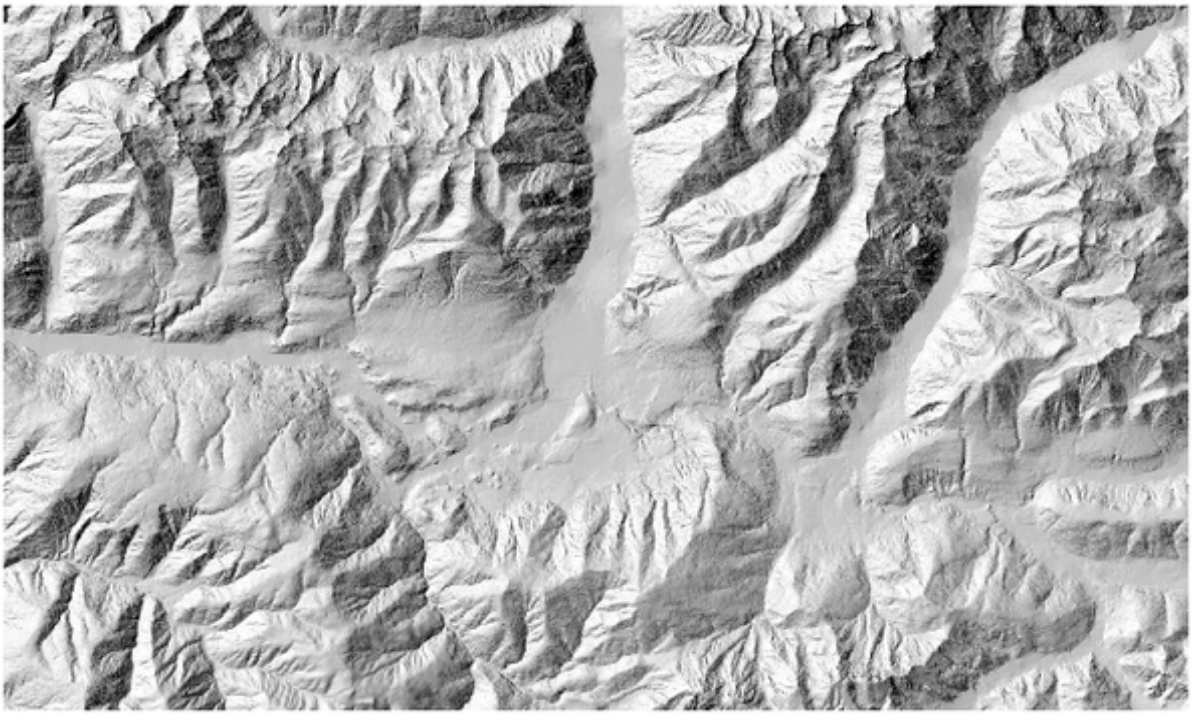


Figura24.19: Camada de sombreados de azimute 300 e ângulo vertical 45

É particularmente interessante atribuir à camada de sombreados um nível de transparência que possibilite sobrepô-la ao raster de altitudes:

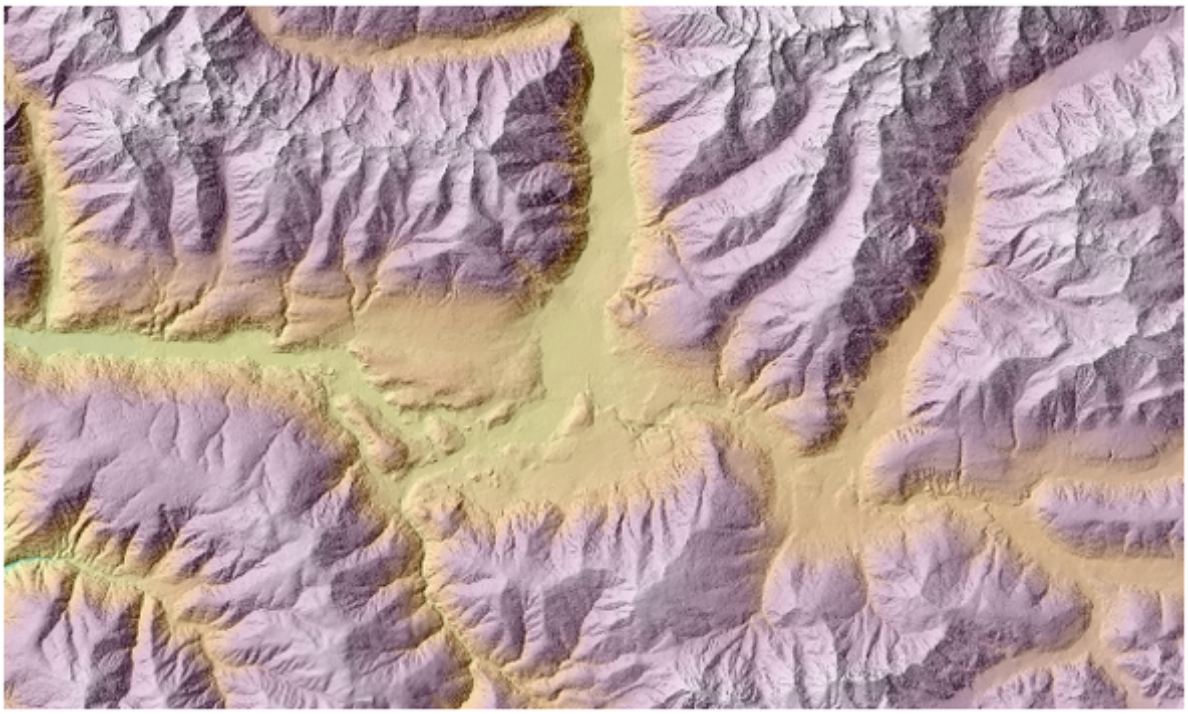


Figura24.20: Sobreposição dos sombreados à camada de altitudes

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Elevation layer	ENTRADA	[raster]	Digital Terrain Model raster layer
Z factor	Z_FACTOR	[number] Padrão: 1.0	Vertical exaggeration. This parameter is useful when the Z units differ from the X and Y units, for example feet and meters. You can use this parameter to adjust for this. Increasing the value of this parameter will exaggerate the final result (making it look more "hilly"). The default is 1 (no exaggeration).
Azimuth (horizontal angle)	AZIMUTH	[number] Default: 300.0	Set the horizontal angle (in degrees) of the sun (clockwise direction). Range: 0 to 360. 0 is north.
Vertical angle	V_ANGLE	[number] Default: 40.0	Define o ângulo vertical (graus) ou altura do sol. Os valores variam entre 0 (altura mínima) e 90 (altura máxima).
Sombreamento	SAÍDA	[raster]	Specify the output hillshade raster layer. One of: • Save to a Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Sombreamento	SAÍDA	[raster]	The output hillshade raster layer

Python code

Algorithm ID: `qgis:hillshade`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Curvas Hipsométricas

Calculates hypsometric curves for an input Digital Elevation Model. Curves are produced as CSV files in an output folder specified by the user.

A hypsometric curve is a cumulative histogram of elevation values in a geographical area.

You can use hypsometric curves to detect differences in the landscape due to the geomorphology of the territory.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
DEM to analyze	`INPUT_DEM`	[raster]	Digital Terrain Model raster layer to use for calculating altitudes
Boundary layer	`BOUNDARY_LAYER`	[vector: polygon]	Polygon vector layer with boundaries of areas used to calculate hypsometric curves
Step	`STEP`	[number] Padrão: 100.0	Vertical distance between curves
Use % of area instead of absolute value	`USE_PERCENTAGE`	[boolean] Padrão: Falso	Write area percentage to "Area" field of the CSV file instead of the absolute area
Hypsometric curves	`OUTPUT_DIRECTORY`	[folder]	Specify the output folder for the hypsometric curves. One of: • Save to a Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Hypsometric curves	`OUTPUT_DIRECTORY`	[folder]	Directory containing the files with the hypsometric curves. For each feature from the input vector layer, a CSV file with area and altitude values will be created. The file names start with `histogram_`, followed by layer name and feature ID.

	A	B
1	Area	Elevation
2	177475194.383	307
3	233206029.24	407
4	295553735.793	507
5	394718815.615	607
6	501801102.615	707
7	624399019.792	807
8	828877274.39	907
9	1042693465.68	1007
10	1277373021.81	1107
11	1556443975.41	1207
12	1888617494.27	1307
13	2248520437.31	1407
14	2627916813.17	1507
15	3010880212.04	1607
16	3411087555.34	1707

Python code

Algorithm ID: `qgis:hypsometriccurves`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Relevo

Creates a shaded relief layer from digital elevation data. You can specify the relief color manually, or you can let the algorithm choose automatically all the relief classes.



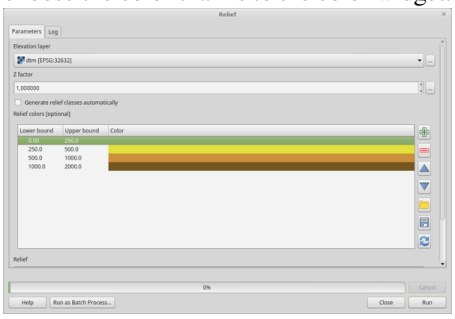
Figura24.21: Camada de relevo

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Elevation layer	`ENTRADA`	[raster]	Digital Terrain Model raster layer
Z factor	`Z_FACTOR`	[number] Padrão: 1.0	Vertical exaggeration. This parameter is useful when the Z units differ from the X and Y units, for example feet and meters. You can use this parameter to adjust for this. Increasing the value of this parameter will exaggerate the final result (making it look more “hilly”). The default is 1 (no exaggeration).
Generate relief classes automatically	`AUTO_COLORS`	[boolean] Padrão: Falso	If you check this option the algorithm will create all the relief color classes automatically

continua na próxima página

Tabela 24.51 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Relief colors Opcional	`COLORS`	[table widget]	Use the table widget if you want to choose the relief colors manually. You can add as many color classes as you want: for each class you can choose the lower and upper bound and finally by clicking on the color row you can choose the color thanks to the color widget.  Figura24.22: Manually setting of relief color classes The buttons in the right side panel give you the chance to: add or remove color classes, change the order of the color classes already defined, open an existing file with color classes and save the current classes as file.
Relief	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Specify the output relief raster layer. One of: • Save to a Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.
Frequency distribution	`FREQUENCY_DISTRIBUTION`	[table] Default: `[Skip output]`	Specify the CSV table for the output frequency distribution. One of: • Ignorar Saída • Save to a Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Relief	`SAÍDA`	[raster]	The output relief raster layer
Frequency distribution	`SAÍDA`	[table]	The output frequency distribution

Python code

Algorithm ID: `qgis:relief`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Acidentado do Terreno/Índice de Rugosidade

Determina a medida quantitativa da heterogeneidade do terreno descrita por Riley et al. (1999). É calculado para cada ponto analisando as diferenças de elevação existentes na grelha de células 3x3 em cujo centro está contido (ponto).

Cada célula contêm o somatório das diferenças absolutas de elevação entre uma célula central e as oito que a envolvem.

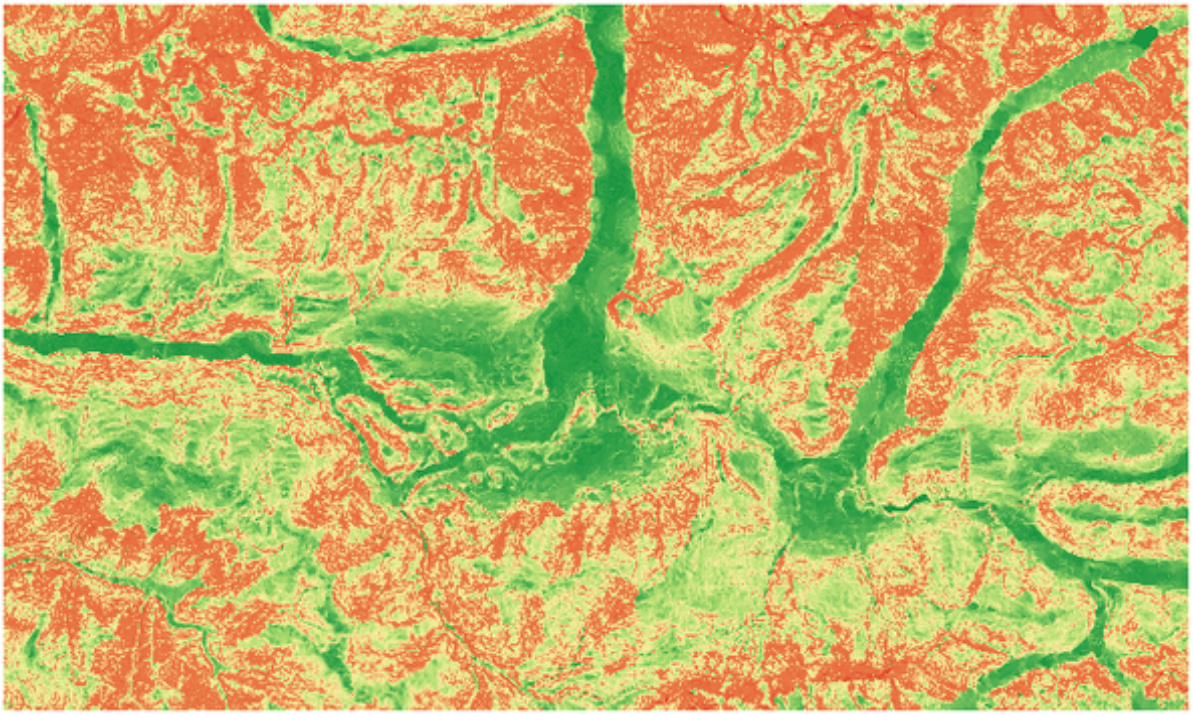


Figura24.23: Camada do Acidentado do Terreno desenvolvendo-se dos baixos (vermelho) para os altos (verde) índices.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Elevation layer	`ENTRADA`	[raster]	Digital Terrain Model raster layer
Z factor	`Z_FACTOR`	[number] Padrão: 1.0	Vertical exaggeration. This parameter is useful when the Z units differ from the X and Y units, for example feet and meters. You can use this parameter to adjust for this. Increasing the value of this parameter will exaggerate the final result (making it look more rugged). The default is 1 (no exaggeration).
Ruggedness	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Specify the output ruggedness raster layer. One of: • Save to a Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Ruggedness	`SAÍDA`	[raster]	The output ruggedness raster layer

Python code

Algorithm ID: `qgis:ruggednessindex`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Pendiente

Calcula os declives (em unidades angulares) de uma dada camada raster. O declive, aqui entendido como o ângulo de inclinação do terreno, é expresso em **graus**.

Na figura seguinte pode ver-se à esquerda a camada DEM que contêm a elevação do terreno e à direita o cálculo dos declives:

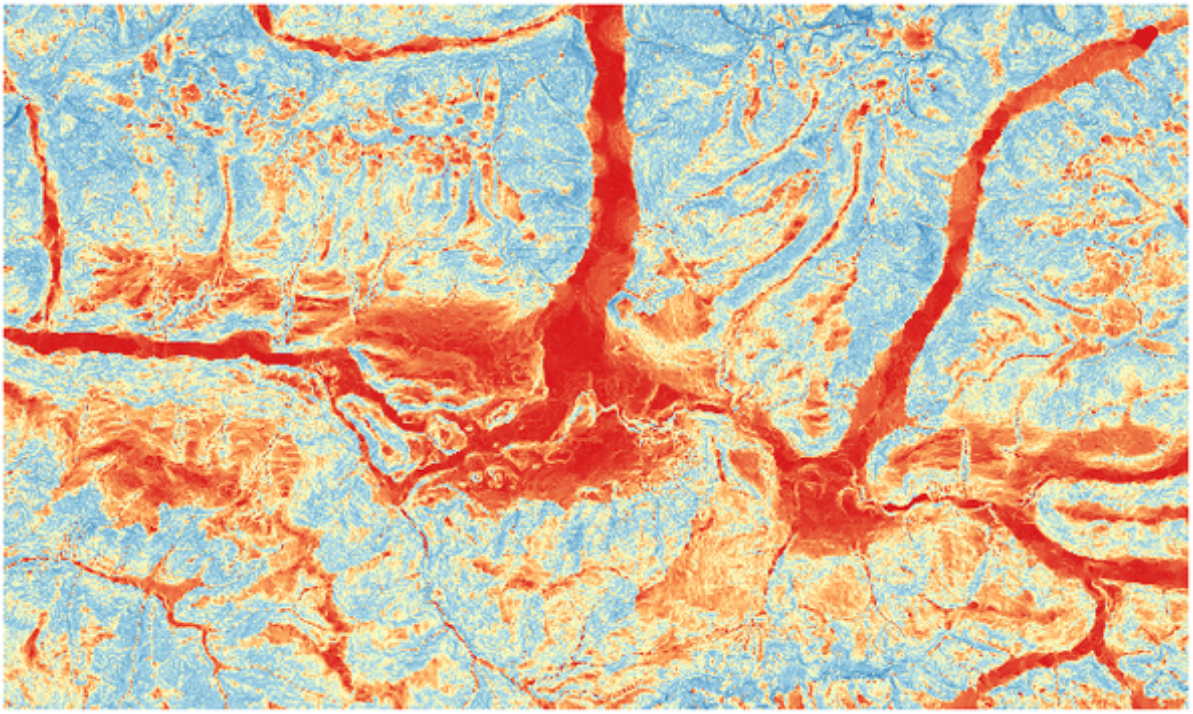


Figura24.24: Áreas planas a vermelho, áreas inclinadas a azul

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Elevation layer	`ENTRADA`	[raster]	Digital Terrain Model raster layer
Z factor	`Z_FACTOR`	[number] Padrão: 1.0	Vertical exaggeration. This parameter is useful when the Z units differ from the X and Y units, for example feet and meters. You can use this parameter to adjust for this. Increasing the value of this parameter will exaggerate the final result (making it steeper). The default is 1 (no exaggeration).
Slope	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Specify the output slope raster layer. One of: • Save to a Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Slope	`SAÍDA`	[raster]	The output slope raster layer

Python code

Algorithm ID: `qgis:slope`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.12 Raster tools

Convert map to raster

Creates a raster image of map canvas content.

A *map theme* can be selected to render a predetermined set of layers with a defined style for each layer.

Alternatively, a single layer can be selected if no map theme is set.

If neither map theme nor layer is set, the current map content will be rendered. The minimum extent entered will internally be extended to be a multiple of the tile size.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Minimum extent to render (xmin, xmax, ymin, ymax)	`EXTENT`	[extent]	Specify the extent of the output raster layer. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Tile size	`TILE_SIZE`	[number] Default: 1024	Size of the tile of the output raster layer. Minimum value: 64.
Map units per pixel	`MAP_UNITS_PER_PIXEL`	[number] Padrão: 100.0	Pixel size (in map units). Minimum value: 0.0
Make background transparent	`MAKE_BACKGROUND_TRANSPARENT`	[boolean] Padrão: Falso	Allows exporting the map with a transparent background. Outputs an RGBA (instead of RGB) image if set to `True`.
Map theme to render Opcional	`MAP_THEME`	[enumeration]	Use an existing *map theme* for the rendering.
Single layer to render Opcional	`LAYER`	[enumeration]	Choose a single layer for the rendering

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Tabela 24.52 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Camada de saída	`SAÍDA`	[raster] Padrão: Salvar para arquivo temporário	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de saída	`SAÍDA`	[raster]	Camada raster de saída

Python code

Algorithm ID: `qgis:rasterize`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Fill NoData cells

Resets the NoData values in the input raster to a chosen value, resulting in raster dataset with no NoData pixels.

The algorithm respects the input raster data type, e.g. a floating point fill value will be truncated when applied to an integer raster.

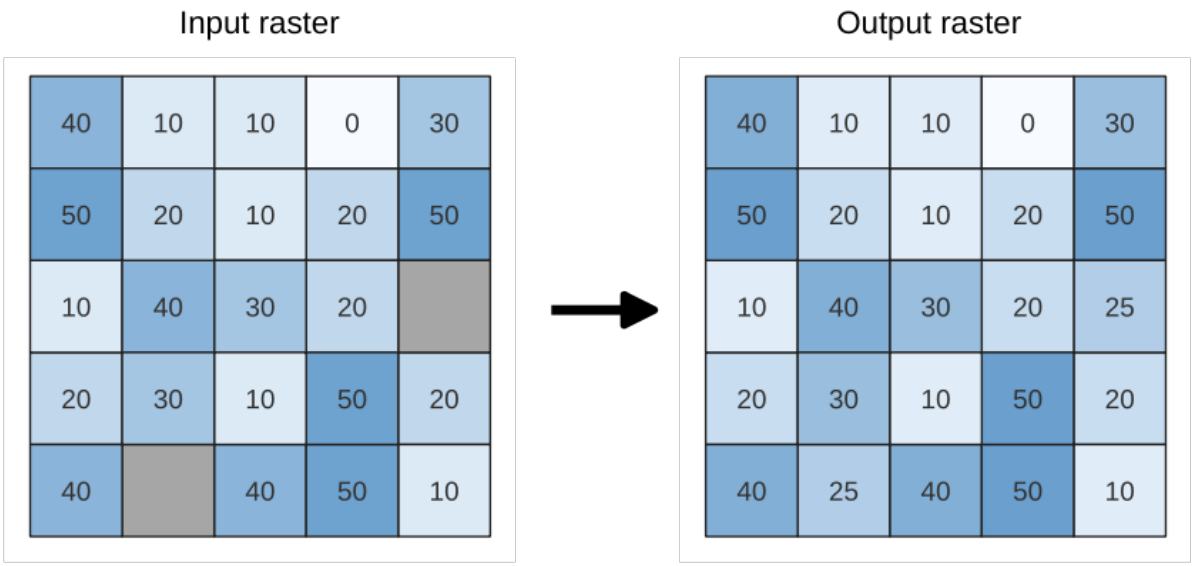


Figura24.25: Filling NoData values (in grey) of a raster

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input raster	`INPUT`	[raster]	The raster to process.
Band number	`BAND`	[number] Padrão: 1	The band of the raster
Fill value	`FILL_VALUE`	[number] Default: 1.0	Set the value to use for the NoData pixels
Output raster	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Saídas

Etiqueta	Nome	Tipo	Descrição
Output raster	`SAÍDA`	[raster]	The output raster layer with filled data cells.

Python code

Algorithm ID: `native:fillnodata`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Generate XYZ tiles (Directory)

Generates raster "XYZ" tiles using the current QGIS project as individual images to a directory structure.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Extent (xmin, xmax, ymin, ymax)	`EXTENT`	[extent]	Specify the extent of the tiles. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Minimum zoom	`ZOOM_MIN`	[number] Padrão: 12	Minimum 0, maximum 25.
Maximum zoom	`ZOOM_MAX`	[number] Padrão: 12	Minimum 0, maximum 25.
DPI	`DPI`	[number] Default: 96	Minimum 48, maximum 600.

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Tabela 24.53 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Background color Opcional	BACKGROUND_COLOR	[color] Default: QColor(0, 0, 0, 0)	Choose the background color for the tiles
Tile format	TILE_FORMAT	[enumeration] Padrão: 0	Um de: • 0 — PNG • 1 — JPG
Quality (JPG only) Opcional	QUALITY	[number] Default: 75	Minimum 1, maximum 100.
Metatile size Opcional	METATILESIZE	[number] Padrão: 4	Specify a custom metatile size when generating XYZ tiles. Larger values may speed up the rendering of tiles and provide better labelling (fewer gaps without labels) at the expense of using more memory. Minimum 1, maximum 20.
Tile width Opcional	TILE_WIDTH	[number] Padrão: 256	Minimum 1, maximum 4096.
Tile height Opcional	TILE_HEIGHT	[number] Padrão: 256	Minimum 1, maximum 4096.
Use inverted tile Y axis (TMS conventions) Opcional	TMS_CONVENTION	[boolean] Padrão: Falso	
Diretório de saída	OUTPUT_DIRECTORY	[folder] Default: [Save to temporary folder]	Especificação do raster de saída. Um de: • Ignorar Saída • Salvar como Diretório Temporário • Salvar para Diretório… A codificação do arquivo também pode ser alterada aqui.
Output html (Leaflet)	OUTPUT_HTML	[html] Default: [Save to temporary file]	Specification of the output HTML file. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo…

Saídas

Etiqueta	Nome	Tipo	Descrição
Diretório de saída	OUTPUT_DIRECTORY	[folder]	Output directory (for the tiles)
Output html (Leaflet)	OUTPUT_HTML	[html]	The output HTML (Leaflet) file

Python code

Algorithm ID: `qgis:tilesxyzdirectory`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Generate XYZ tiles (MBTiles)

Generates raster "XYZ" tiles using the current QGIS project as a single file in the "MBTiles" format.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Extent (xmin, xmax, ymin, ymax)	`EXTENT`	[extent]	Specify the extent of the tiles. One of: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent… It will internally be extended to a multiple of the tile size.
Minimum zoom	`ZOOM_MIN`	[number] Padrão: 12	Minimum 0, maximum 25.
Maximum zoom	`ZOOM_MAX`	[number] Padrão: 12	Minimum 0, maximum 25.
DPI	`DPI`	[number] Default: 96	Minimum 48, maximum 600.
Background color Opcional	`BACKGROUND_COLOR`	[color] Default: QColor(0, 0, 0, 0)	Choose the background color for the tiles
Tile format	`TILE_FORMAT`	[enumeration] Padrão: 0	Um de: • 0 — PNG • 1 — JPG
Quality (JPG only) Opcional	`QUALITY`	[number] Default: 75	Minimum 1, maximum 100.
Metatile size Opcional	`METATILESIZE`	[number] Padrão: 4	Specify a custom metatile size when generating XYZ tiles. Larger values may speed up the rendering of tiles and provide better labelling (fewer gaps without labels) at the expense of using more memory. Minimum 1, maximum 20.
Output file (for MBTiles)	`OUTPUT_FILE`	[file] Default: `[Save to temporary file]`	Especificação do arquivo de saída. Um de: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output file (for MBTiles)	`OUTPUT_FILE`	[file]	The output file.

Python code

Algorithm ID: `qgis:tilesxyzmbtiles`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.13 Vector analysis

Basic statistics for fields

Generates basic statistics for a field of the attribute table of a vector layer.

Numeric, date, time and string fields are supported.

The statistics returned will depend on the field type.

Statistics are generated as an HTML file and are available in the *Processing* ► *Results viewer*.

Default menu: *Vector* ► *Analysis Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input vector	`INPUT_LAYER`	[vector: any]	Vector layer to calculate the statistics on
Field to calculate statistics on	`FIELD_NAME`	[tablefield: any]	Any supported table field to calculate the statistics
Estatísticas	`OUTPUT_HTML_FILE`	[html]	HTML file for the calculated statistics

Saídas

Etiqueta	Nome	Tipo	Descrição
Estatísticas	`OUTPUT_HTML_FILE`	[html]	HTML file with the calculated statistics
Count	`COUNT`	[number]	
Number of unique values	`UNIQUE`	[number]	
Number of empty (null) values	`EMPTY`	[number]	
Number of non-empty values	`FILLED`	[number]	
Valor mínimo	`MIN`	[same as input]	
Valor máximo	`MAX`	[same as input]	
Minimum length	`MIN_LENGTH`	[number]	

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Tabela 24.55 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Maximum length	MAX_LENGTH	[number]	
Mean length	MEAN_LENGTH	[number]	
Coefficient of Variation	CV	[number]	
Soma	SOMA	[number]	
Mean value	MEAN	[number]	
Standard deviation	STD_DEV	[number]	
Range	RANGE	[number]	
Median	MEDIAN	[number]	
Minority (rarest occurring value)	MINORITY	[same as input]	
Majority (most frequently occurring value)	MAJORITY	[same as input]	
First quartile	FIRSTQUARTILE	[number]	
Third quartile	THIRDQUARTILE	[number]	
Interquartile Range (IQR)	IQR	[number]	

Python code

Algorithm ID: `qgis:basicstatisticsforfields`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Climb along line

Calculates the total climb and descent along line geometries. The input layer must have Z values present. If Z values are not available, the *Drape (set Z value from raster)* algorithm may be used to add Z values from a DEM layer.

The output layer is a copy of the input layer with additional fields that contain the total climb (`climb`), total descent (`descent`), the minimum elevation (`minelev`) and the maximum elevation (`maxelev`) for each line geometry. If the input layer contains fields with the same names as these added fields, they will be renamed (field names will be altered to “name_2”, “name_3”, etc, finding the first non-duplicate name).

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Line layer	ENTRADA	[vector: line]	Line layer to calculate the climb for. Must have Z values
Climb layer	SAÍDA	[vector: line]	The output (line) layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Climb layer	`SAÍDA`	[vector: line]	Line layer containing new attributes with the results from climb calculations.
Total climb	`TOTALCLIMB`	[number]	The sum of the climb for all the line geometries in the input layer
Total descent	`TOTALDESCENT`	[number]	The sum of the descent for all the line geometries in the input layer
Minimum elevation	`MINELEVATION`	[number]	The minimum elevation for the geometries in the layer
Maximum elevation	`MAXELEVATION`	[number]	The maximum elevation for the geometries in the layer

Python code

Algorithm ID: `qgis:climbalongline`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Count points in polygon

Takes a point and a polygon layer and counts the number of points from the point layer in each of the polygons of the polygon layer.

A new polygon layer is generated, with the exact same content as the input polygon layer, but containing an additional field with the points count corresponding to each polygon.

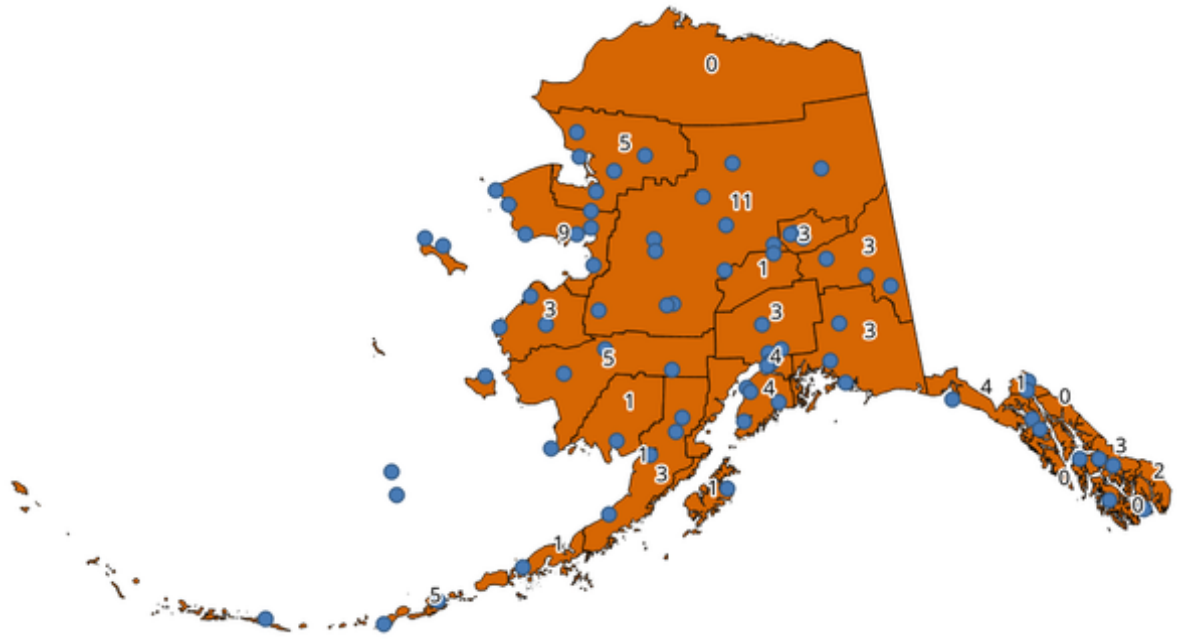


Figura24.26: The labels in the polygons show the point count

An optional weight field can be used to assign weights to each point. Alternatively, a unique class field can be specified. If both options are used, the weight field will take precedence and the unique class field will be ignored.

`Menu padrão`: *Vetor ► Analisar*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Polígonos	`POLYGONS`	[vector: polygon]	Polygon layer whose features are associated with the count of points they contain
Points	`POINTS`	[vector: point]	Point layer with features to count
Weight field Opcional	`WEIGHT`	[tablefield: any]	A field from the point layer. The count generated will be the sum of the weight field of the points contained by the polygon. If the weight field is not numeric, the count will be `0`.
Class field Opcional	`CLASSFIELD`	[tablefield: any]	Points are classified based on the selected attribute and if several points with the same attribute value are within the polygon, only one of them is counted. The final count of the points in a polygon is, therefore, the count of different classes that are found in it.
Count field name	`CAMPO`	[string] Default: 'NUMPOINTS'	The name of the field to store the count of points
Count	`SAÍDA`	[vector: polygon]	Specification of the output layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Count	`SAÍDA`	[vector: polygon]	Resulting layer with the attribute table containing the new column with the points count

DBSCAN clustering

Clusters point features based on a 2D implementation of Density-based spatial clustering of applications with noise (DBSCAN) algorithm.

The algorithm requires two parameters, a minimum cluster size, and the maximum distance allowed between clustered points.

Ver também:

K-means clustering

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: point]	Layer to analyze
Minimum cluster size	`MIN_SIZE`	[number] Padrão: 5	Minimum number of features to generate a cluster
Maximum distance between clustered points	`EPS`	[number] Padrão: 1.0	Distance beyond which two features can not belong to the same cluster (eps)
Cluster field name	`FIELD_NAME`	[string] Default: 'CLUSTER_ID'	Name of the field where the associated cluster number shall be stored
Treat border points as noise (DBSCAN*) Opcional	`DBSCAN*`	[boolean] Padrão: Falso	If checked, points on the border of a cluster are themselves treated as unclustered points, and only points in the interior of a cluster are tagged as clustered.
Clusters	`SAÍDA`	[vector: point]	Vector layer for the result of the clustering

Saídas

Etiqueta	Nome	Tipo	Descrição
Clusters	`SAÍDA`	[vector: point]	Vector layer containing the original features with a field setting the cluster they belong to
Number of clusters	`NUM_CLUSTERS`	[number]	The number of clusters discovered

Python code

Algorithm ID: `qgis:dbscanclustering`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Distance matrix

Calculates for point features distances to their nearest features in the same layer or in another layer.

Default menu: *Vector ► Analysis Tools*

Ver também:

Join attributes by nearest

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input point layer	`ENTRADA`	[vector: point]	Point layer for which the distance matrix is calculated (**from** points)
Input unique ID field	`INPUT_FIELD`	[tablefield: any]	Field to use to uniquely identify features of the input layer. Used in the output attribute table.
Target point layer	`TARGET`	[vector: point]	Point layer containing the nearest point(s) to search (**to** points)
Target unique ID field	`TARGET_FIELD`	[tablefield: any]	Field to use to uniquely identify features of the target layer. Used in the output attribute table.
Output matrix type	`MATRIX_TYPE`	[enumeration] Padrão: 0	Different types of calculation are available: • 0 — Linear (N * *k* x 3) distance matrix: for each input point, reports the distance to each of the *k* nearest target points. The output matrix consists of up to *k* rows per input point, and each row has three columns: *InputID*, *TargetID* and *Distance*. • 1 — Standard (N x T) distance matrix • 2 — Summary distance matrix (mean, std. dev., min, max): for each input point, reports statistics on the distances to its target points.
Use only the nearest (k) target points	`NEAREST_POINTS`	[number] Padrão: 0	You can choose to calculate the distance to all the points in the target layer (*0*) or limit to a number (*k*) of closest features.
Distance matrix	`SAÍDA`	[vector: point]	

Saídas

Etiqueta	Nome	Tipo	Descrição
Distance matrix	`SAÍDA`	[vector: point]	Point (or MultiPoint for the "Linear (N * *k* x 3)" case) vector layer containing the distance calculation for each input feature. Its features and attribute table depend on the selected output matrix type.

Python code

Algorithm ID: `qgis:distancematrix`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Distance to nearest hub (line to hub)

Creates lines that join each feature of an input vector to the nearest feature in a destination layer. Distances are calculated based on the *center* of each feature.

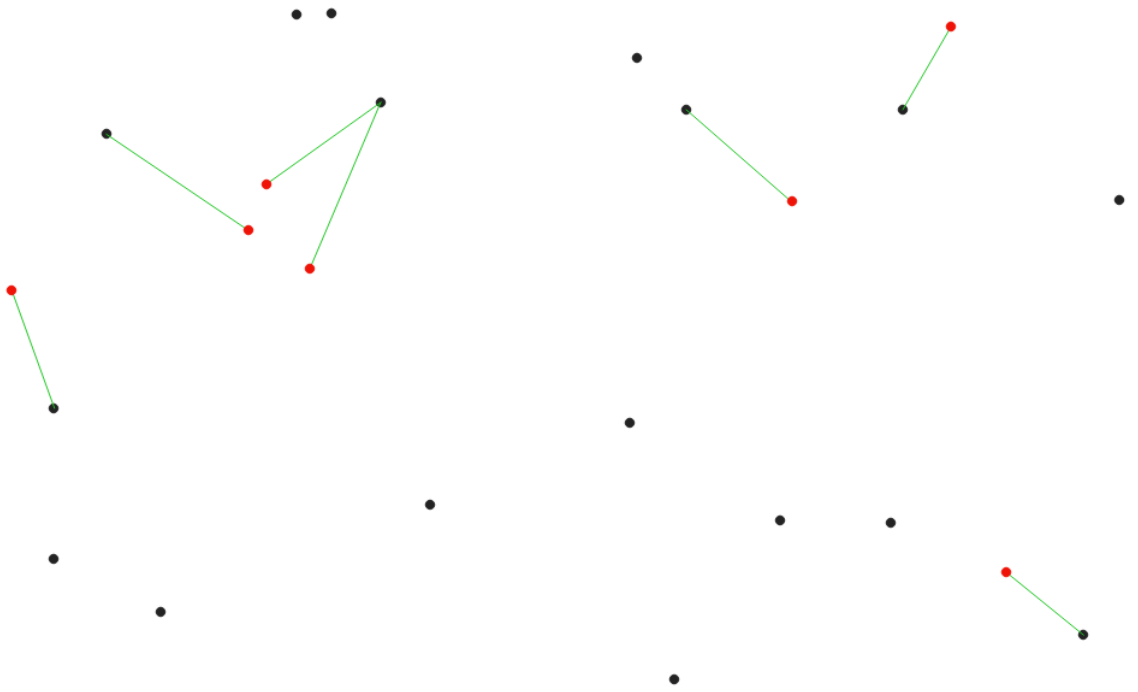


Figura24.27: Display the nearest hub for the red input features

Ver também:

Distance to nearest hub (points), *Join attributes by nearest*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Source points layer	`ENTRADA`	[vector: any]	Vector layer for which the nearest feature is searched
Destination hubs layer	`HUBS`	[vector: any]	Vector layer containing the features to search for
Hub layer name attribute	`CAMPO`	[tablefield: any]	Field to use to uniquely identify features of the destination layer. Used in the output attribute table
Measurement unit	`UNIT`	[enumeration] Padrão: 0	Units in which to report the distance to the closest feature: • 0 — Meters • 1 — Feet • 2 — Miles • 3 — Kilometers • 4 — Layer units
Hub distance	`SAÍDA`	[vector: line]	Line vector layer for the distance matrix output

Saídas

Etiqueta	Nome	Tipo	Descrição
Hub distance	`SAÍDA`	[vector: line]	Line vector layer with the attributes of the input features, the identifier of their closest feature and the calculated distance.

Python code

Algorithm ID: `qgis:distancetonearesthublinetohub`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Distance to nearest hub (points)

Creates a point layer representing the *center* of the input features with the addition of two fields containing the identifier of the nearest feature (based on its center point) and the distance between the points.

Ver também:

Distance to nearest hub (line to hub), *Join attributes by nearest*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Source points layer	`ENTRADA`	[vector: any]	Vector layer for which the nearest feature is searched
Destination hubs layer	`HUBS`	[vector: any]	Vector layer containing the features to search for
Hub layer name attribute	`CAMPO`	[tablefield: any]	Field to use to uniquely identify features of the destination layer. Used in the output attribute table
Measurement unit	`UNIT`	[enumeration] Padrão: 0	Units in which to report the distance to the closest feature: • 0 — Meters • 1 — Feet • 2 — Miles • 3 — Kilometers • 4 — Layer units
Hub distance	`SAÍDA`	[vector: point]	Point vector layer for the distance matrix output.

Saídas

Etiqueta	Nome	Tipo	Descrição
Hub distance	`SAÍDA`	[vector: point]	Point vector layer with the attributes of the input features, the identifier of their closest feature and the calculated distance.

Python code

Algorithm ID: `qgis:distancetonearesthubpoints`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Join by lines (hub lines)

Creates hub and spoke diagrams by connecting lines from points on the Spoke layer to matching points in the Hub layer.

Determination of which hub goes with each point is based on a match between the Hub ID field on the hub points and the Spoke ID field on the spoke points.

If input layers are not point layers, a point on the surface of the geometries will be taken as the connecting location.

Optionally, geodesic lines can be created, which represent the shortest path on the surface of an ellipsoid. When geodesic mode is used, it is possible to split the created lines at the antimeridian (±180 degrees longitude), which can improve rendering of the lines. Additionally, the distance between vertices can be specified. A smaller distance results in a denser, more accurate line.

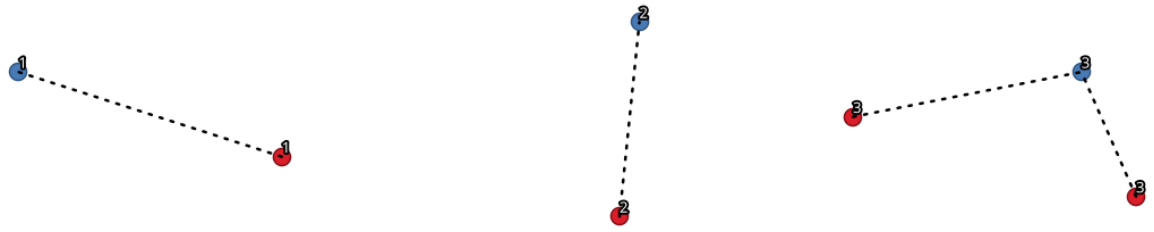


Figura24.28: Join points based on a common field / attribute

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Hub layer	`HUBS`	[vector: any]	Camada de entrada
Hub ID field	`HUB_FIELD`	[tablefield: any]	Field of the hub layer with ID to join
Hub layer fields to copy (leave empty to copy all fields) Opcional	`HUB_FIELDS`	[tablefield: any] [list]	The field(s) of the hub layer to be copied. If no field(s) are chosen all fields are taken.
Spoke layer	`SPOKES`	[vector: any]	Additional spoke point layer
Spoke ID field	`SPOKE_FIELD`	[tablefield: any]	Field of the spoke layer with ID to join
Spoke layer fields to copy (leave empty to copy all fields) Opcional	`SPOKE_FIELDS`	[tablefield: any] [list]	Field(s) of the spoke layer to be copied. If no fields are chosen all fields are taken.
Create geodesic lines	`GEODESIC`	[boolean] Padrão: Falso	Create geodesic lines (the shortest path on the surface of an ellipsoid)
Distance between vertices (geodesic lines only)	`GEODESIC_DISTANCE`	[number] Default: 1000.0 (kilometers)	Distance between consecutive vertices (in kilometers). A smaller distance results in a denser, more accurate line
Split lines at antimeridian (±180 degrees longitude)	`ANTIMERIDIAN_SPLIT`	[boolean] Padrão: Falso	Split lines at ±180 degrees longitude (to improve rendering of the lines)
Hub lines	`SAÍDA`	[vector: line]	The resulting line layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Hub lines	`SAÍDA`	[vector: line]	The resulting line layer

Python code

Algorithm ID: `qgis:hublines`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

K-means clustering

Calculates the 2D distance based k-means cluster number for each input feature.

K-means clustering aims to partition the features into k clusters in which each feature belongs to the cluster with the nearest mean. The mean point is represented by the barycenter of the clustered features.

If input geometries are lines or polygons, the clustering is based on the centroid of the feature.

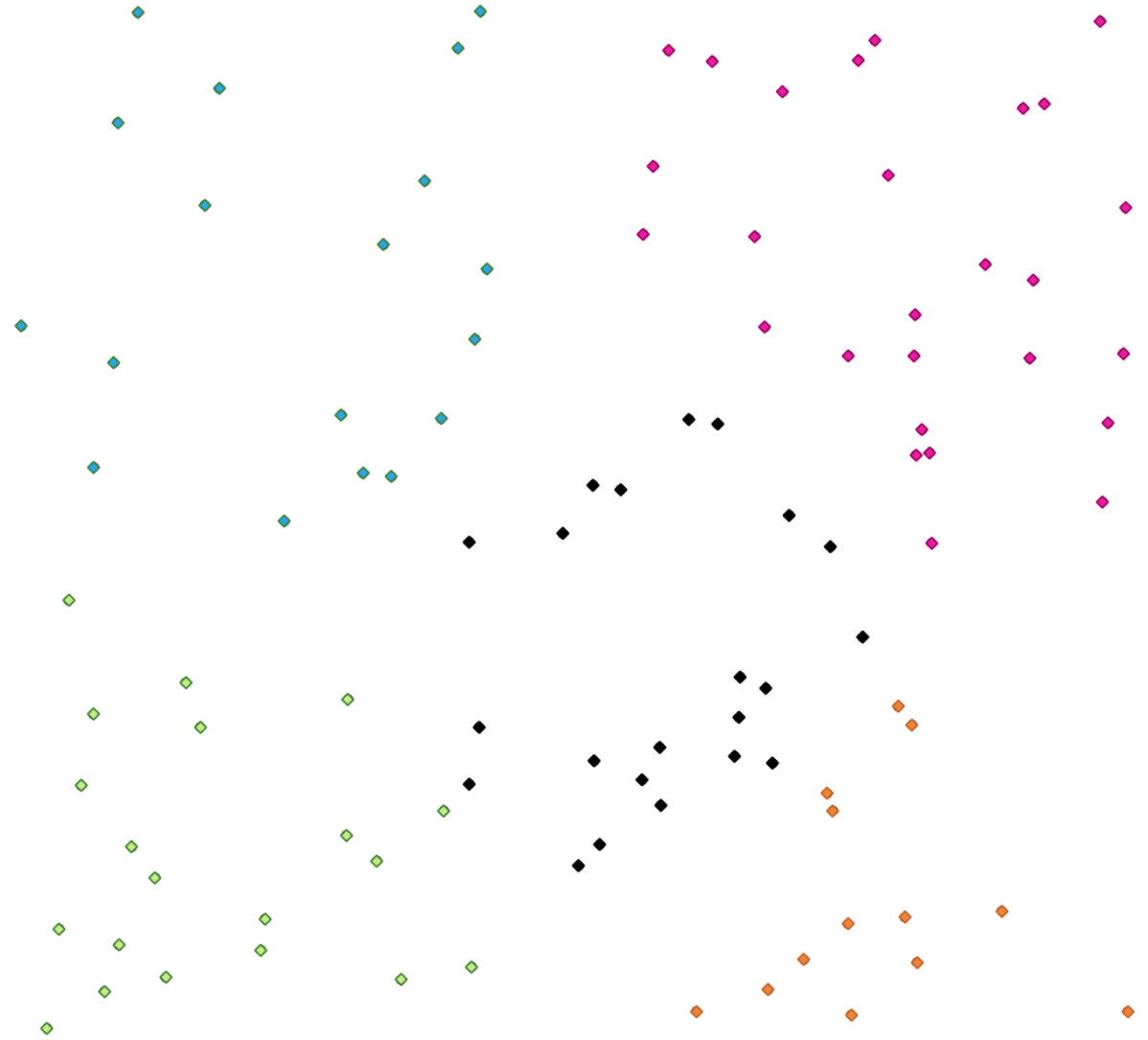


Figura24.29: A five class point clusters

Ver também:

DBSCAN clustering

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Layer to analyze
Number of clusters	`CLUSTERS`	[number] Padrão: 5	Number of clusters to create with the features
Cluster field name	`FIELD_NAME`	[string] Default: 'CLUSTER_ID'	Name of the cluster number field
Clusters	`SAÍDA`	[vector: any]	Vector layer for generated the clusters

Saídas

Etiqueta	Nome	Tipo	Descrição
Clusters	`SAÍDA`	[vector: any]	Vector layer containing the original features with a field specifying the cluster they belong to

Python code

Algorithm ID: `qgis:kmeansclustering`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

List unique values

Lists unique values of an attribute table field and counts their number.

Default menu: *Vector* ► *Analysis Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Layer to analyze
Target field(s)	`CAMPOS`	[tablefield: any]	Field to analyze
Unique values	`SAÍDA`	[table]	Summary table layer with unique values
HTML report	`OUTPUT_HTML_FILE`	[html]	HTML report of unique values in the *Processing* ► *Results viewer*

Saídas

Etiqueta	Nome	Tipo	Descrição
Unique values	`SAÍDA`	[table]	Summary table layer with unique values
HTML report	`OUTPUT_HTML_FILE`	[html]	HTML report of unique values. Can be opened from the *Processing* ► *Results viewer*
Total unique values	`TOTAL_VALUES`	[number]	The number of uniqe values in the input field
UNIQUE_VALUES	`Unique values`	[string]	A string with the comma separated list of unique values found in the input field

Python code

Algorithm ID: `qgis:listuniquevalues`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Mean coordinate(s)

Computes a point layer with the center of mass of geometries in an input layer.

An attribute can be specified as containing weights to be applied to each feature when computing the center of mass.

If an attribute is selected in the parameter, features will be grouped according to values in this field. Instead of a single point with the center of mass of the whole layer, the output layer will contain a center of mass for the features in each category.

Default menu: *Vector ► Analysis Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Weight field Opcional	`WEIGHT`	[tablefield: numeric]	Field to use if you want to perform a weighted mean
Unique ID field	`UID`	[tablefield: numeric]	Unique field on which the calculation of the mean will be made
Mean coordinates	`SAÍDA`	[vector: point]	The (point vector) layer for the result

Saídas

Etiqueta	Nome	Tipo	Descrição
Mean coordinates	`SAÍDA`	[vector: point]	Resulting point(s) layer

Python code

Algorithm ID: `qgis:meancoordinates`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

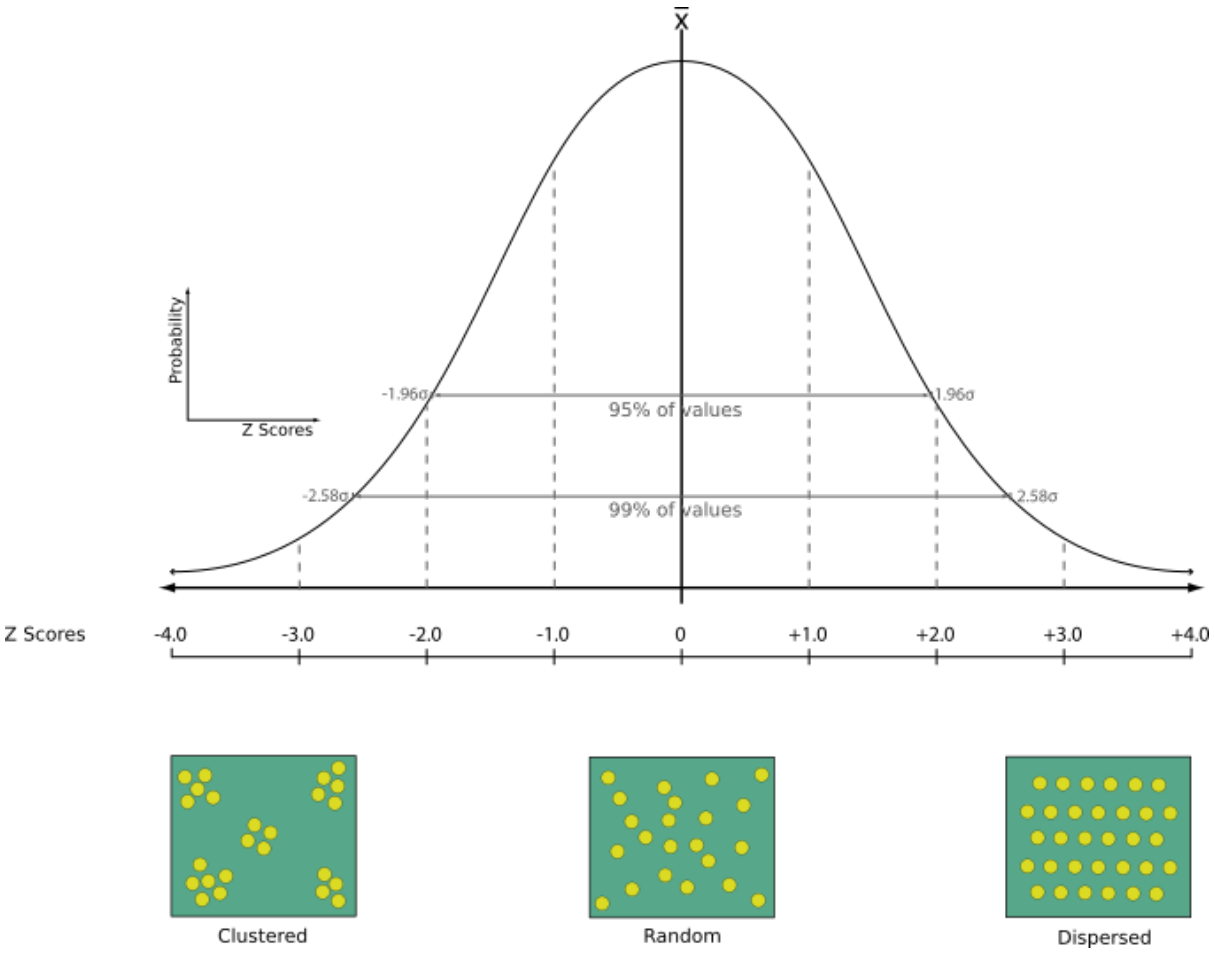
The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Nearest neighbour analysis

Performs nearest neighbor analysis for a point layer. The output tells you how your data are distributed (clustered, randomly or distributed).

Output is generated as an HTML file with the computed statistical values:

- Observed mean distance
- Expected mean distance
- Nearest neighbour index
- Number of points
- Z-Score: Comparing the Z-Score with the normal distribution tells you how your data are distributed. A low Z-Score means that the data are unlikely to be the result of a spatially random process, while a high Z-Score means that your data are likely to be a result of a spatially random process.



Default menu: *Vector ► Analysis Tools*

Ver também:

Join attributes by nearest

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: point]	Point vector layer to calculate the statistics on
Nearest neighbour	`OUTPUT_HTML_FILE`	[html]	HTML file for the computed statistics

Saídas

Etiqueta	Nome	Tipo	Descrição
Nearest neighbour	`OUTPUT_HTML_FILE`	[html]	HTML file with the computed statistics
Observed mean distance	`OBSERVED_MD`	[number]	Observed mean distance
Expected mean distance	`EXPECTED_MD`	[number]	Expected mean distance
Nearest neighbour index	`NN_INDEX`	[number]	Nearest neighbour index
Número de pontos	`POINT_COUNT`	[number]	Number of points
Z-Score	`Z_SCORE`	[number]	Z-Score

Python code

Algorithm ID: `qgis:nearestneighbouranalysis`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Overlap analysis

Calculates the area and percentage cover by which features from an input layer are overlapped by features from a selection of overlay layers.

New attributes are added to the output layer reporting the total area of overlap and percentage of the input feature overlapped by each of the selected overlay layers.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada de entrada.
Overlap layers	`CAMADAS`	[vector: any] [list]	The overlay layers.
Camada de saída	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de saída	`SAÍDA`	[same as input]	The output layer with additional fields reporting the overlap (in map units and percentage) of the input feature overlapped by each of the selected layers.

Python code

Algorithm ID: `qgis:calculatevectoroverlaps`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Statistics by categories

Calculates statistics of a field depending on a parent class. The parent class is a combination of values from other fields.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input vector layer	ENTRADA	[vector: any]	Input vector layer with unique classes and values
Field to calculate statistics on (if empty, only count is calculated) Opcional	VALUES_FIELD_NAME	[tablefield: any]	If empty only the count will be calculated
Field(s) with categories	CATEGORIES_FIELD_NAME	[vector: any] [list]	The fields that (combined) define the categories
Statistics by category	SAÍDA	[table]	Table for the generated statistics

Saídas

Etiqueta	Nome	Tipo	Descrição
Statistics by category	SAÍDA	[table]	Table containing the statistics

Depending on the type of the field being analyzed, the following statistics are returned for each grouped value:

Estatísticas	String	Numérico	Data
Count (COUNT)	✓	✓	✓
Unique values (UNIQUE)	✓		✓
Empty (null) values (EMPTY)	✓		✓
Non-empty values (FILLED)	✓		✓
Minimal value (MIN)	✓	✓	✓
Maximal value (MAX)	✓	✓	✓
Range (RANGE)		✓	
Sum (SUM)		✓	
Mean value (MEAN)		✓	
Median value (MEDIAN)		✓	
Standard Deviation (STD_DEV)		✓	
Coefficient of variation (CV)		✓	
Minority (rarest occurring value - MINORITY)		✓	
Majority (most frequently occurring value - MAJORITY)		✓	
First Quartile (FIRSTQUARTILE)		✓	
Third Quartile (THIRDQUARTILE)		✓	
Inter Quartile Range (IQR)		✓	
Minimum Length (MIN_LENGTH)	✓		
Mean Length (MEAN_LENGTH)	✓		
Maximum Length (MAX_LENGTH)	✓		

Python code

Algorithm ID: `qgis:statisticsbycategories`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Sum line lengths

Takes a polygon layer and a line layer and measures the total length of lines and the total number of them that cross each polygon.

The resulting layer has the same features as the input polygon layer, but with two additional attributes containing the length and count of the lines across each polygon.

Default menu: *Vector ► Analysis Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Linhas	`LINES`	[vector: line]	Input vector line layer
Polígonos	`POLYGONS`	[vector: polygon]	Polygon vector layer
Lines length field name	`LEN_FIELD`	[string] Default: 'LENGTH'	Name of the field for the lines length
Lines count field name	`COUNT_FIELD`	[string] Default: 'COUNT'	Name of the field for the lines count
Line length	`SAÍDA`	[vector: polygon]	The output polygon vector layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Line length	`SAÍDA`	[vector: polygon]	Polygon output layer with fields of lines length and line count

Python code

Algorithm ID: `qgis:sumlinelengths`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.14 Vector creation

Array of offset (parallel) lines

Creates copies of line features in a layer, by creating multiple offset versions of each feature. Each new version is incrementally offset by a specified distance.

Positive distance will offset lines to the left, and negative distances will offset them to the right.

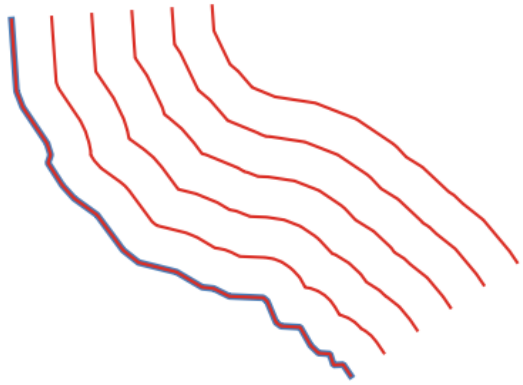


Figura24.30: In blue the source layer, in red the offset one

Permite *features in-place modification*

Ver também:

Offset lines, *Array of translated features*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer to use for the offsets.
Number of features to create	`COUNT`	[number] Padrão: 10	Number of offset copies to generate for each feature
Offset step distance	`OFFSET`	[number] Padrão: 1.0	Distance between two consecutive offset copies
Segmentos	`SEGMENTOS`	[number] Padrão: 8	Number of line segments to use to approximate a quarter circle when creating rounded offsets
Join style	`JOIN_STYLE`	[enumeration] Padrão: 0	Specify whether round, miter or beveled joins should be used when offsetting corners in a line. One of: • 0 — Round • 1 — Miter • 2 — Bevel
Miter limit	`MITER_LIMIT`	[number] Padrão: 2.0	Only applicable for mitered join styles, and controls the maximum distance from the offset curve to use when creating a mitered join.

continua na próxima página

Tabela 24.63 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Offset lines	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Specify the output line layer with offset features. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Offset lines	`SAÍDA`	[vector: line]	Output line layer with offset features. The original features are also copied.

Python code

Algorithm ID: `qgis:arrayoffsetlines`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Array of translated features

Creates copies of features in a layer by creating multiple translated versions of each. Each copy is incrementally displaced by a preset amount in the X, Y and/or Z axis.

M values present in the geometry can also be translated.

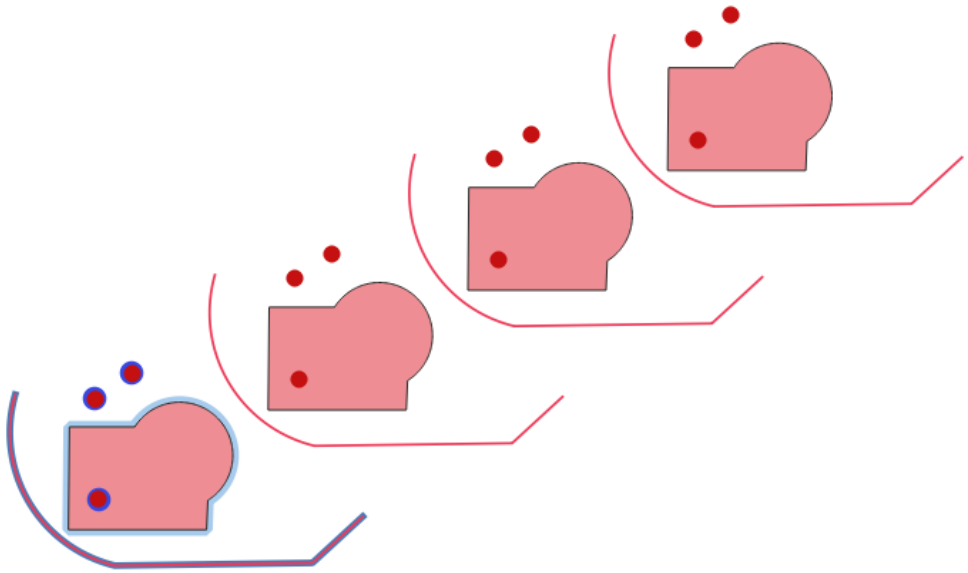


Figura24.31: Input layers in blue tones, output layers with translated features in red tones

Permite *features in-place modification*

Ver também:

Translate, *Array of offset (parallel) lines*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Input vector layer to translate
Number of features to create	`COUNT`	[number] Padrão: 10	Number of copies to generate for each feature
Step distance (x-axis)	`DELTA_X`	[number] Padrão: 0.0	Delocamento a ser aplicado ao eixo X
Step distance (y-axis)	`DELTA_Y`	[number] Padrão: 0.0	Delocamento a ser aplicado ao eixo Y
Step distance (z-axis)	`DELTA_Z`	[number] Padrão: 0.0	Displacement to apply on the Z axis
Step distance (m values)	`DELTA_M`	[number] Padrão: 0.0	Displacement to apply on M
Traduzido	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Output vector layer with translated (moved) copies of the features. The original features are also copied. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Traduzido	`SAÍDA`	[same as input]	Output vector layer with translated (moved) copies of the features. The original features are also copied.

Python code

Algorithm ID: `qgis:arraytranslatedfeatures`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create grid

Creates a vector layer with a grid covering a given extent. Grid cells can have different shapes:

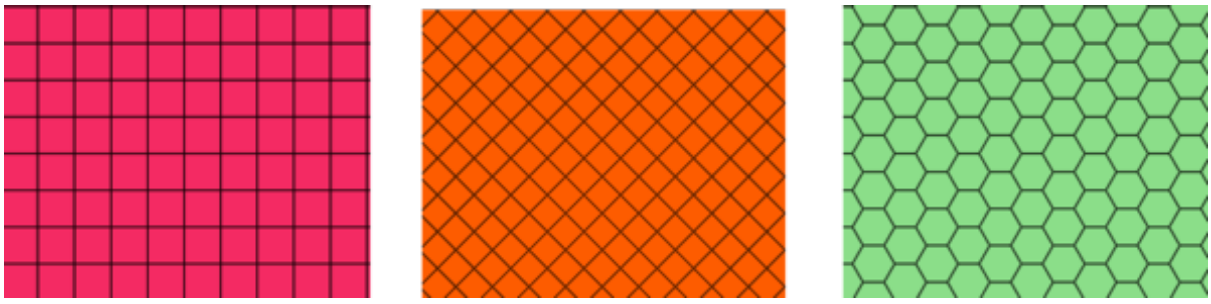


Figura24.32: Different grid cell shapes

The size of each element in the grid is defined using a horizontal and vertical spacing.

The CRS of the output layer must be defined.

The grid extent and the spacing values must be expressed in the coordinates and units of this CRS.

Default menu: *Vector ► Research Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Grid type	`TIPO`	[enumeration] Padrão: 0	Shape of the grid. One of: • 0 — Point • 1 — Line • 2 — Rectangle (polygon) • 3 — Diamond (polygon) • 4 — Hexagon (polygon)
Grid extent	`EXTENT`	[extent]	Extent of the grid

continua na próxima página

Tabela 24.65 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Horizontal spacing	`HSPACING`	[number] Padrão: 1.0	Size of a grid cell on the X-axis
Vertical spacing	`VSPACING`	[number] Padrão: 1.0	Size of a grid cell on the Y-axis
Horizontal overlay	`HOVERLAY`	[number] Padrão: 0.0	Overlay distance between two consecutive grid cells on the X-axis
Vertical overlay	`VOVERLAY`	[number] Padrão: 0.0	Overlay distance between two consecutive grid cells on the Y-axis
Grid CRS	`SRC`	[crs] Default: *Project CRS*	Coordinate reference system to apply to the grid
Grid	`SAÍDA`	[vector: any] Default: `[Create temporary layer]`	Resulting vector grid layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Grid	`SAÍDA`	[vector: any]	Resulting vector grid layer. The output geometry type (point, line or polygon) depends on the *Grid type*.

Python code

Algorithm ID: `qgis:creategrid`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create points layer from table

Creates points layer from a table with columns that contain coordinates fields.

Besides X and Y coordinates you can also specify Z and M fields.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Input vector layer or a table.
X field	`XFIELD`	[tablefield: any]	Field containing the X coordinate
Y field	`YFIELD`	[tablefield: any]	Field containing the Y coordinate
Z field Opcional	`ZFIELD`	[tablefield: any]	Field containing the Z coordinate
M field Opcional	`MFIELD`	[tablefield: any]	Field containing the M value
SRC Alvo	`SRC_ALVO`	[crs] Padrão: `EPSG:4326`	Coordinate reference system to use for layer. The provided coordinates are assumed to be compliant.
Points from table	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Specify the resulting point layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Points from table	`SAÍDA`	[vector: point]	The resulting point layer

Python code

Algorithm ID: `qgis:createpointslayerfromtable`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Generate points (pixel centroids) along line

Generates a point vector layer from an input raster and line layer.

The points correspond to the pixel centroids that intersect the line layer.

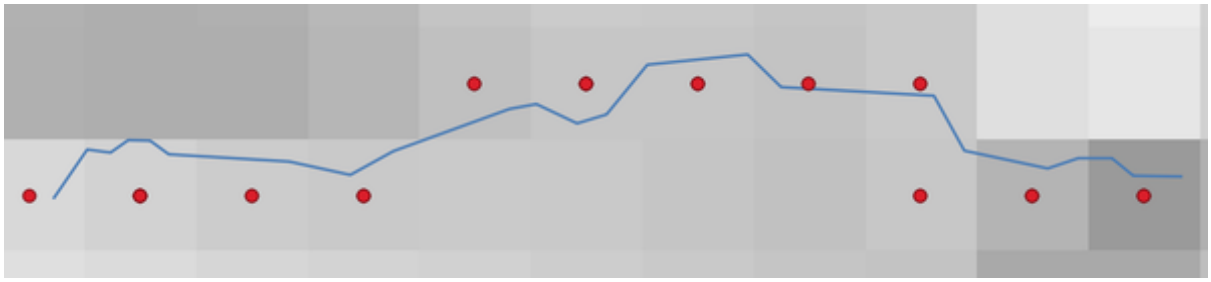


Figura24.33: Points of the pixel centroids

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada raster	`INPUT_RASTER`	[raster]	Camada raster de entrada
Vector layer	`INPUT_VECTOR`	[vector: line]	Input line vector layer
Points along line	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Resulting point layer with pixel centroids. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Points along line	`SAÍDA`	[vector: point]	Resulting point layer with pixel centroids

Python code

Algorithm ID: `qgis:generatepointspixelcentroidsalongline`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Generate points (pixel centroids) inside polygon

Generates a point vector layer from an input raster and polygon layer.

The points correspond to the pixel centroids that intersect the polygon layer.

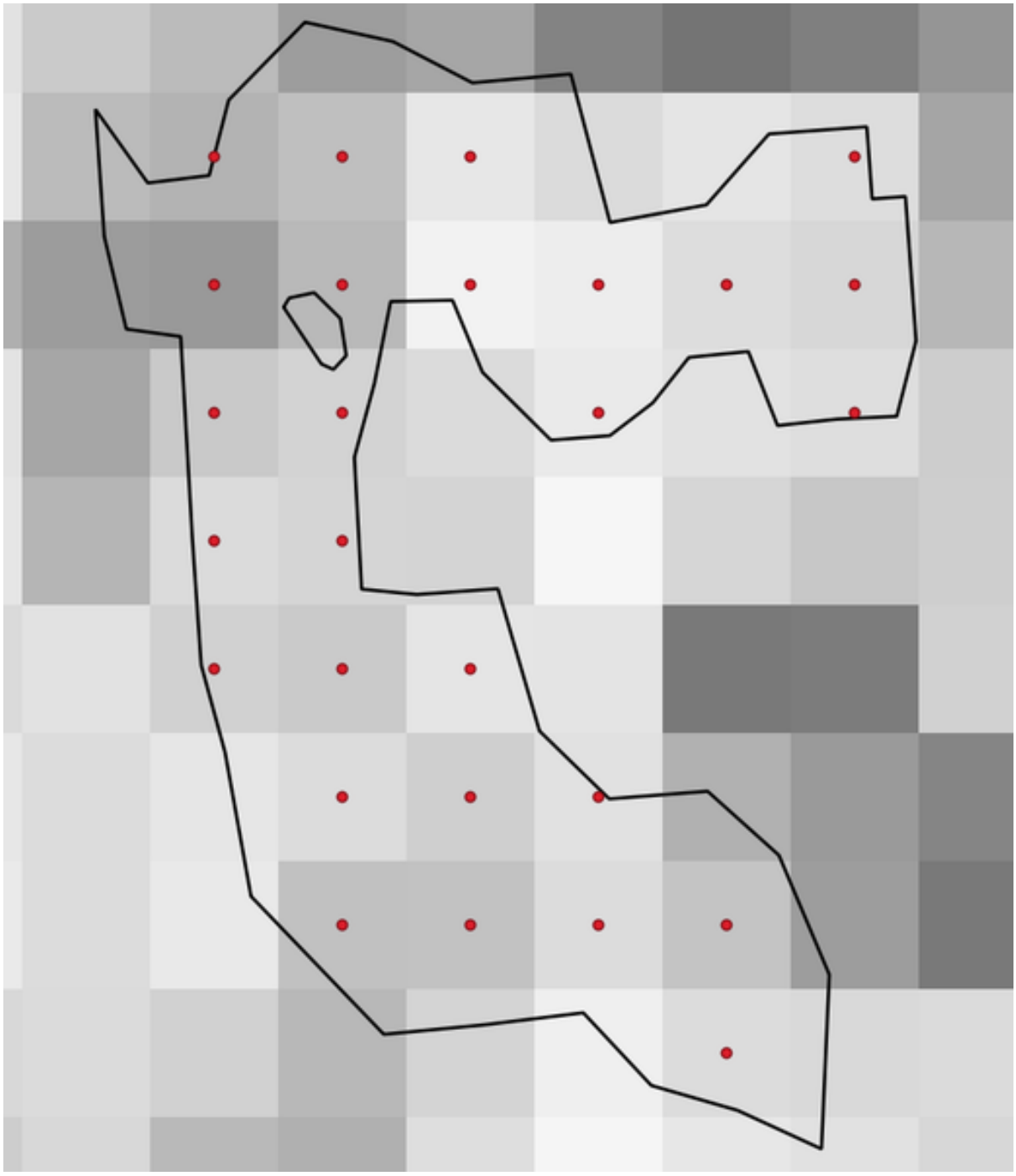


Figura24.34: Points of the pixel centroids

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada raster	`INPUT_RASTER`	[raster]	Camada raster de entrada
Vector layer	`INPUT_VECTOR`	[vector: polygon]	Input polygon vector layer
Points inside polygons	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Resulting point layer of pixel centroids. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Points inside polygons	`SAÍDA`	[vector: point]	Resulting point layer of pixel centroids

Python code

Algorithm ID: `qgis:generatepointspixelcentroidsinsidepolygons`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Import geotagged photos

Creates a point layer corresponding to the geotagged locations from JPEG images from a source folder.

The point layer will contain a single PointZ feature per input file from which the geotags could be read. Any altitude information from the geotags will be used to set the point's Z value.

Besides longitude and latitude also altitude, direction and timestamp information, if present in the photo, will be added to the point as attributes.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input folder	`FOLDER`	[folder]	Path to the source folder containing the geotagged photos
Scan recursively	`RECURSIVE`	[boolean] Padrão: Falso	If checked, the folder and its subfolders will be scanned

continua na próxima página

Tabela 24.67 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Photos	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Specify the point vector layer for the geotagged photos. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Invalid photos table Opcional	`INVALID`	[table] Default: `[Skip output]`	Specify the table of unreadable or non-geotagged photos. One of: • Ignorar Saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Photos	`SAÍDA`	[vector: point]	Point vector layer with geotagged photos. The form of the layer is automatically filled with paths and photo previews settings.
Invalid photos table Opcional	`INVALID`	[table]	Table of unreadable or non-geotagged photos can also be created.

Python code

Algorithm ID: `qgis:importphotos`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Points to path

Converts a point layer to a line layer, by joining points in an order defined by a field in the input point layer (if the order field is a date/time field, the format must be specified).

Points can be grouped by a field to distinguish line features.

In addition to the line vector layer, a text file is output that describes the resulting line as a start point and a sequence of bearings / directions (relative to azimuth) and distances.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input point layer	ENTRADA	[vector: point]	Input point vector layer
Close path	CLOSE_PATH	[boolean] Padrão: Falso	If checked, the first and last points of the line will be connected and close the generated path
Order field	ORDER_FIELD	[tablefield: any]	Field containing the order to connect the points in the path
Group field Opcional	GROUP_FIELD	[tablefield: any]	Point features of the same value in the field will be grouped in the same line. If not set, a single path is drawn with all the input points.
Date format (if order field is DateTime) Opcional	DATE_FORMAT	[string]	The format to use for the `Order field` parameter. Specify this only if the `Order field` is of type Date/Time.
Paths	SAÍDA	[vector: line] Default: `[Create temporary layer]`	Specify the line vector layer of the path. One of: • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Directory for text output	OUTPUT_TEXT_DIR	[folder] Default: `[Skip output]`	Specify the directory that will contain the description files of points and paths. One of: • Ignorar Saída • Salvar como Diretório Temporário • Salvar para Diretório… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Paths	SAÍDA	[vector: line]	Line vector layer of the path
Directory for text output	OUTPUT_TEXT_DIR	[folder]	Directory containing description files of points and paths

Python code

Algorithm ID: `qgis:pointstopath`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Random points along line

Creates a new point layer, with points placed on the lines of another layer.

For each line in the input layer, a given number of points is added to the resulting layer. The procedure for adding a point is to:

1. randomly select a line feature from the input layer
2. if the feature is multi-part, randomly select a part of it
3. randomly select a segment of that line
4. randomly select a position on that segment.

The procedure means that curved parts of the lines (with relatively short segments) will get more points than straight parts (with relatively long segments), as demonstrated in the illustration below, where the output of the *Random points along lines* algorithm can be compared with the output of the *Random points on lines* algorithm (that produces points with an, on average, even distribution along the lines).

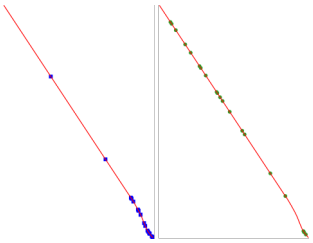


Figura24.35: Example algorithm output. Left: *Random points along line*, right: *Random points on lines*

A minimum distance can be specified, to avoid points being too close to each other.

Ver também:

Random points on lines

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input point layer	`ENTRADA`	[vector: line]	Input line vector layer
Número de pontos	`POINTS_NUMBER`	[number] Padrão: 1	Number of points to create
Minimum distance between points	`MIN_DISTANCE`	[number] Padrão: 0.0	The minimum distance between points
Random points	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	The output random points. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Random points	`SAÍDA`	[vector: point]	The output random points layer.

Python code

Algorithm ID: `qgis:qgisrandompointsalongline`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Random points in extent

Creates a new point layer with a given number of random points, all of them within a given extent.

A distance factor can be specified, to avoid points being too close to each other. If the minimum distance between points makes it impossible to create new points, either distance can be decreased or the maximum number of attempts may be increased.

Default menu: *Vector ► Research Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input extent	`EXTENT`	[extent]	Map extent for the random points
Número de pontos	`POINTS_NUMBER`	[number] Padrão: 1	Number of point to create
Minimum distance between points	`MIN_DISTANCE`	[number] Padrão: 0.0	The minimum distance between points
SRC Alvo	`SRC_ALVO`	[crs] Default: *Project CRS*	CRS of the random points layer
Maximum number of search attempts given the minimum distance	`MAX_ATTEMPTS`	[number] Default: 200	Maximum number of attempts to place the points
Random points	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	The output random points. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Random points	`SAÍDA`	[vector: point]	The output random points layer.

Python code

Algorithm ID: `native:randompointsinextent`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Random points in layer bounds

Creates a new point layer with a given number of random points, all of them within the extent of a given layer.

A minimum distance can be specified, to avoid points being too close to each other.

Default menu: *Vector ► Research Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: polygon]	Input polygon layer defining the area
Número de pontos	`POINTS_NUMBER`	[number] Padrão: 1	Number of points to create
Minimum distance between points	`MIN_DISTANCE`	[number] Padrão: 0.0	The minimum distance between points
Random points	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	The output random points. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Random points	`SAÍDA`	[vector: point]	The output random points layer.

Python code

Algorithm ID: `qgis:randompointsinlayerbounds`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Random points in polygons

Creates a point layer with points placed inside the polygons of another layer.

For each feature (polygon / multi-polygon) geometry in the input layer, the given number of points is added to the result layer.

Per feature and global minimum distances can be specified in order to avoid points being too close in the output point layer. If a minimum distance is specified, it may not be possible to generate the specified number of points for each feature. The total number of generated points and missed points are available as output from the algorithm.

The illustration below shows the effect of per feature and global minimum distances and zero/non-zero minimum distances (generated with the same seed, so at least the first point generated will be the same).

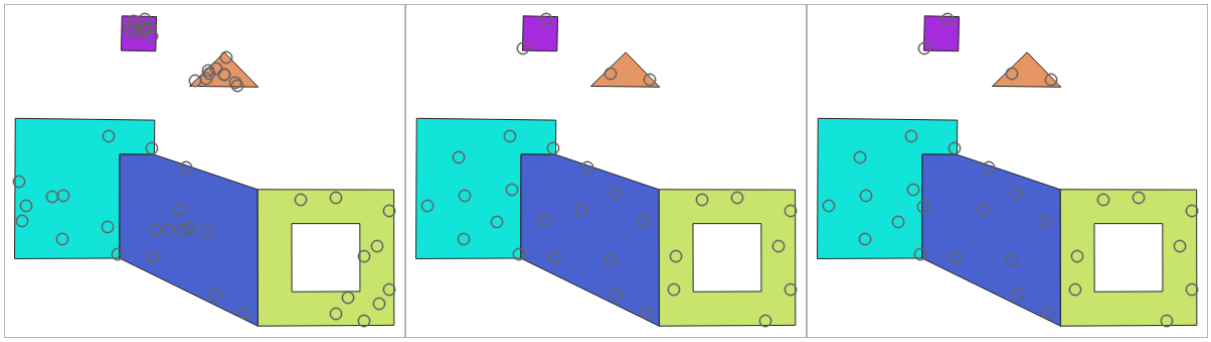


Figura24.36: Ten points per polygon feature, *left*: min. distances = 0, *middle*: min.distances = 1, *right*: min. distance = 1, global min. distance = 0

The maximum number of tries per point can be specified. This is only relevant for non-zero minimum distance.

A seed for the random number generator can be provided, making it possible to get identical random number sequences for different runs of the algorithm.

The attributes of the polygon feature on which a point was generated can be included (*Include polygon attributes*).

If you want approximately the same point density for all the features, you can data-define the number of points using the area of the polygon feature geometry.

Ver também:

Random points inside polygons

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input polygon layer	`ENTRADA`	[vector: line]	Input polygon vector layer
Number of points for each feature	`POINTS_NUMBER`	[number] Padrão: 1	Number of points to create
Minimum distance between points Opcional	`MIN_DISTANCE`	[number] Padrão: 0.0	The minimum distance between points within one polygon feature
Global minimum distance between points Opcional	`MIN_DISTANCE_GLOBAL`	[number] Padrão: 0.0	The global minimum distance between points. Should be smaller than the *Minimum distance between points (per feature)* for that parameter to have an effect.
Maximum number of search attempts (for Min. dist. > 0) Opcional	`MAX_TRIES_PER_POINT`	[number] Padrão: 10	The maximum number of tries per point. Only relevant if the minimum distance between points is set (and greater than 0).
Random seed Opcional	`SEED`	[number] Default: Not set	The seed to use for the random number generator.
Include polygon attributes	`INCLUDE_POLYGON_ATTRIBUTES`	[boolean] Padrão: Verdadeiro	If set, a point will get the attributes from the line on which it is placed.
Random points in polygons	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	The output random points. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Random points in polygons	`SAÍDA`	[vector: point]	The output random points layer.
Number of features with empty or no geometry	`FEATURES_WITH_EMPTY_OR_NO_GEOMETRY`	[number]	
Total number of points generated	`OUTPUT_POINTS`	[number]	
Number of missed points	`POINTS_MISSED`	[number]	The number of points that could not be generated due to the minimum distance constraint.
Number of features with missed points	`POLYGONS_WITH_MISSED_POINTS`	[number]	Not including features with empty or no geometry

Python code

Algorithm ID: `qgis:randompointsinpolygons`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Random points inside polygons

Creates a new point layer with a given number of random points inside each polygon of the input polygon layer.

Two sampling strategies are available:

- Points count: number of points for each feature
- Densidade de pontos: densidade de pontos para cada feição

A minimum distance can be specified, to avoid points being too close to each other.

Default menu: *Vector ► Research Tools*

Ver também:

Random points in polygons

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: polygon]	Input polygon vector layer
Sampling strategy	`STRATEGY`	[enumeration] Padrão: 0	Sampling strategy to use. One of: • 0 — Points count: number of points for each feature • 1 — Points density: density of points for each feature
Point count or density	`VALOR`	[number] Padrão: 1.0	The number or density of points, depending on the chosen *Sampling strategy*.
Minimum distance between points	`MIN_DISTANCE`	[number] Padrão: 0.0	The minimum distance between points
Random points	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	The output random points. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Random points	`SAÍDA`	[vector: point]	The output random points layer.

Python code

Algorithm ID: `qgis:randompointsinsidepolygons`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Random points on lines

Creates a point layer with points placed on the lines of another layer.

For each feature (line / multi-line) geometry in the input layer, the given number of points is added to the result layer.

Per feature and global minimum distances can be specified in order to avoid points being too close in the output point layer. If a minimum distance is specified, it may not be possible to generate the specified number of points for each feature. The total number of generated points and missed points are available as output from the algorithm.

The illustration below shows the effect of per feature and global minimum distances and zero/non-zero minimum distances (generated with the same seed, so at least the first point generated will be the same).

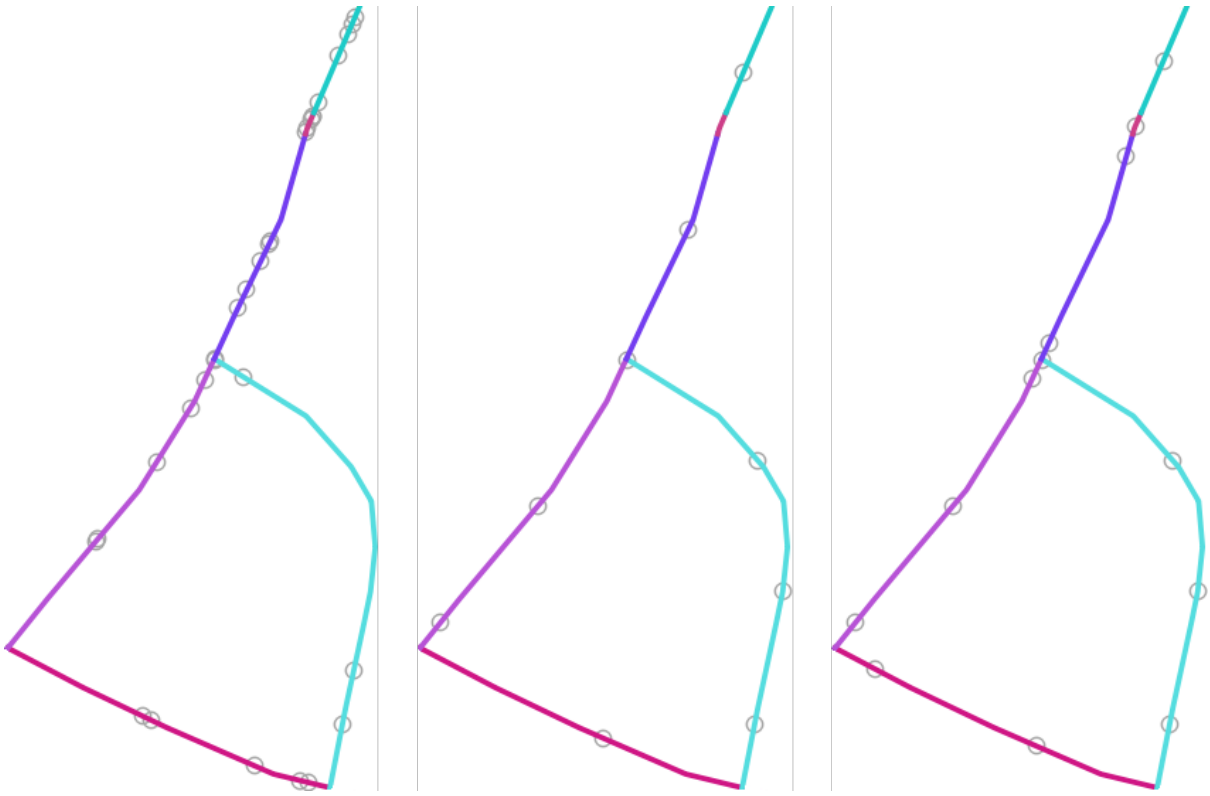


Figura24.37: Five points per line feature, *left*: min. distances = 0, *middle*: min.distances != 0, *right*: min. distance != 0, global min. distance = 0

The maximum number of tries per point can be specified. This is only relevant for non-zero minimum distance.

A seed for the random number generator can be provided, making it possible to get identical random number sequences for different runs of the algorithm.

The attributes of the line feature on which a point was generated can be included (*Include line attributes*).

If you want approximately the same point density for all the line features, you can data-define the number of points using the length of the line feature geometry.

Ver também:

Random points along line

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input line layer	`ENTRADA`	[vector: line]	Input line vector layer
Number of points for each feature	`POINTS_NUMBER`	[number] Padrão: 1	Number of points to create
Minimum distance between points (per feature) Opcional	`MIN_DISTANCE`	[number] Padrão: 0.0	The minimum distance between points within one line feature
Global minimum distance between points Opcional	`MIN_DISTANCE_GLOBAL`	[number] Padrão: 0.0	The global minimum distance between points. Should be smaller than the *Minimum distance between points (per feature)* for that parameter to have an effect.
Maximum number of search attempts (for Min. dist. > 0) Opcional	`MAX_TRIES_PER_POINT`	[number] Padrão: 10	The maximum number of tries per point. Only relevant if the minimum distance between points is set (and greater than 0).
Random seed Opcional	`SEED`	[number] Default: Not set	The seed to use for the random number generator.
Include line attributes	`INCLUDE_LINE_ATTRIBUTES`	[boolean] Padrão: Verdadeiro	If set, a point will get the attributes from the line on which it is placed.
Random points on lines	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	The output random points. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Random points on lines	SAÍDA	[vector: point]	The output random points layer.
Number of features with empty or no geometry	FEATURES_WITH_EMPTY_OR_NO_GEOMETRY	[number]	
Number of features with missed points	LINES_WITH_MISSED_POINTS	[number]	Not including features with empty or no geometry
Total number of points generated	OUTPUT_POINTS	[number]	
Number of missed points	POINTS_MISSED	[number]	The number of points that could not be generated due to the minimum distance constraint.

Python code

Algorithm ID: `qgis:randompointsonlines`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raster pixels to points

Creates a vector layer of points corresponding to each pixel in a raster layer.

Converts a raster layer to a vector layer, by creating point features for each individual pixel's center in the raster layer. Any nodata pixels are skipped in the output.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada raster	INPUT_RASTER	[raster]	Camada raster de entrada
Band number	RASTER_BAND	[raster band]	Raster band to extract data from
Field name	FIELD_NAME	[string] Default: 'VALUE'	Name of the field to store the raster band value
Vector points	SAÍDA	[vector: point] Default: [Create temporary layer]	Specify the resulting point layer of pixels centroids. One of: • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Vector points	SAÍDA	[vector: point]	Resulting point layer with pixels centroids

Python code

Algorithm ID: qgis:pixelstopoints

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Raster pixels to polygons

Creates a vector layer of polygons corresponding to each pixel in a raster layer.

Converts a raster layer to a vector layer, by creating polygon features for each individual pixel's extent in the raster layer. Any nodata pixels are skipped in the output.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada raster	INPUT_RASTER	[raster]	Camada raster de entrada
Band number	RASTER_BAND	[raster band]	Raster band to extract data from
Field name	FIELD_NAME	[string] Default: 'VALUE'	Name of the field to store the raster band value
Vector polygons	SAÍDA	[vector: polygon] Default: [Create temporary layer]	Specify the resulting polygon layer of pixel extents. One of: • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Vector polygons	SAÍDA	[vector: polygon]	Resulting polygon layer of pixel extents

Python code

Algorithm ID: `qgis:pixelstopolygons`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Regular points

Creates a new point layer with its points placed in a regular grid within a given extent.

The grid is specified either by the spacing between the points (same spacing for all dimensions) or by the number of points to generate. In the latter case, the spacing will be determined from the extent. In order to generate a full rectangular grid, at least the number of points specified by the user is generated for the latter case.

Random offsets to the point spacing can be applied, resulting in a non-regular point pattern.

Default menu: *Vector ► Research Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input extent (xmin, xmax, ymin, ymax)	`EXTENT`	[extent]	Map extent for the random points
Point spacing/count	`SPACING`	[number] Default: 100	Spacing between the points, or the number of points, depending on whether `Use point spacing` is checked or not.
Initial inset from corner (LH side)	`INSET`	[number] Padrão: 0.0	Offsets the points relative to the upper left corner. The value is used for both the X and Y axis.
Apply random offset to point spacing	`RANDOMIZE`	[boolean] Padrão: Falso	If checked the points will have a random spacing
Use point spacing	`IS_SPACING`	[boolean] Padrão: Verdadeiro	If unchecked the point spacing is not taken into account
Output layer CRS	`SRC`	[crs] Default: *Project CRS*	CRS of the random points layer
Regular points	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Specify the output regular point layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Regular points	`SAÍDA`	[vector: point]	The output regular point layer.

Python code

Algorithm ID: `qgis:regularpoints`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.15 Vector general

Assign projection

Assigns a new projection to a vector layer.

It creates a new layer with the exact same features and geometries as the input one, but assigned to a new CRS. The geometries are **not** reprojected, they are just assigned to a different CRS.

This algorithm can be used to repair layers which have been assigned an incorrect projection.

Attributes are not modified by this algorithm.

Ver também:

Define Shapefile projection, *Find projection*, *Reproject layer*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Vector layer with wrong or missing CRS
Assigned CRS	`SRC`	[crs] Default: `EPSG:4326 - WGS84`	Select the new CRS to assign to the vector layer
Assigned CRS Opcional	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output layer containing only the duplicates. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Assigned CRS	SAÍDA	[same as input]	Vector layer with assigned projection

Python code

Algorithm ID: `native:assignprojection`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Convert layer to spatial bookmarks

Creates spatial bookmarks corresponding to the extent of features contained in a layer.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: line, polygon]	A camada vetorial de entrada
Bookmark destination	DESTINATION	[enumeration] Padrão: 0	Select the destination for the bookmarks. One of: • 0 — Project bookmarks • 1 — User bookmarks
Name field	NAME_EXPRESSION	[expression]	Field or expression that will give names to the generated bookmarks
Group field	GROUP_EXPRESSION	[expression]	Field or expression that will provide groups for the generated bookmarks

Saídas

Etiqueta	Nome	Tipo	Descrição
Count of bookmarks added	COUNT	[number]	

Python code

Algorithm ID: `native:layertobookmarks`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Convert spatial bookmarks to layer

Creates a new layer containing polygon features for stored spatial bookmarks. The export can be filtered to only bookmarks belonging to the current project, to all user bookmarks, or a combination of both.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Bookmark source	`SOURCE`	[enumeration] [list] Default: [0,1]	Select the source(s) of the bookmarks. One or more of: • 0 — Project bookmarks • 1 — User bookmarks
SRC de Saída	`SRC`	[crs] Default: `EPSG:4326 - WGS 84`	O SRC da camada de saída
Saída	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada da linha de saída. Um de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Saída	`SAÍDA`	[vector: polygon]	The output (bookmarks) vector layer

Python code

Algorithm ID: `native:bookmarkstolayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create attribute index

Creates an index against a field of the attribute table to speed up queries. The support for index creation depends on both the layer's data provider and the field type.

No outputs are created: the index is stored on the layer itself.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Select the vector layer you want to create an attribute index for
Attribute to index	`CAMPO`	[tablefield: any]	Field of the vector layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Indexed layer	`SAÍDA`	[same as input]	A copy of the input vector layer with an index for the specified field

Python code

Algorithm ID: `native:createattributeindex`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create spatial index

Creates an index to speed up access to the features in a layer based on their spatial location. Support for spatial index creation is dependent on the layer's data provider.

No new output layers are created.

Default menu: *Vector ► Data Management Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada

Saídas

Etiqueta	Nome	Tipo	Descrição
Indexed layer	`SAÍDA`	[same as input]	A copy of the input vector layer with a spatial index

Python code

Algorithm ID: `native:createspatialindex`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Define Shapefile projection

Sets the CRS (projection) of an existing Shapefile format dataset to the provided CRS. It is very useful when a Shapefile format dataset is missing the `prj` file and you know the correct projection.

Contrary to the *Assign projection* algorithm, it modifies the current layer and will not output a new layer.

Nota: For Shapefile datasets, the `.prj` and `.qpj` files will be overwritten - or created if missing - to match the provided CRS.

Default menu: *Vector ► Data Management Tools*

Ver também:

Assign projection, *Find projection*, *Reproject layer*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Vector layer with missing projection information
CRS	`SRC`	[crs]	Select the CRS to assign to the vector layer

Saídas

Etiqueta	Nome	Tipo	Descrição
	`ENTRADA`	[same as input]	The input vector layer with the defined projection

Python code

Algorithm ID: `qgis:definecurrentprojection`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Delete duplicate geometries

Finds and removes duplicated geometries.

Attributes are not checked, so in case two features have identical geometries but different attributes, only one of them will be added to the result layer.

Ver também:

Drop geometries, *Remove null geometries*, *Delete duplicates by attribute*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	The layer with duplicate geometries you want to clean
Cleaned	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada da linha de saída. Um de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Count of discarded duplicate records	`DUPLICATE_COUNT`	[number]	Count of discarded duplicate records
Cleaned	`SAÍDA`	[same as input]	The output layer without any duplicated geometries
Count of retained records	`RETAINED_COUNT`	[number]	Count of unique records

Python code

Algorithm ID: `native:deleteduplicategeometries`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Delete duplicates by attribute

Deletes duplicate rows by only considering the specified field / fields. The first matching row will be retained, and duplicates will be discarded.

Optionally, these duplicate records can be saved to a separate output for analysis.

Ver também:

Delete duplicate geometries

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada de entrada
Fields to match duplicates by	`CAMPOS`	[tablefield: any] [list]	Fields defining duplicates. Features with identical values for all these fields are considered duplicates.
Filtered (no duplicates)	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output layer containing the unique features. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

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Tabela 24.75 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Filtered (duplicates) Opcional	`DUPLICATES`	[same as input] Default: `[Skip output]`	Specify the output layer containing only the duplicates. One of: • Ignorar saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Filtered (duplicates) Opcional	`DUPLICATES`	[same as input] Default: `[Skip output]`	Vector layer containing the removed features. Will not be produced if not specified (left as `[Skip output]`).
Count of discarded duplicate records	`DUPLICATE_COUNT`	[number]	Count of discarded duplicate records
Filtered (no duplicates)	`SAÍDA`	[same as input]	Vector layer containing the unique features.
Count of retained records	`RETAINED_COUNT`	[number]	Count of unique records

Python code

Algorithm ID: `native:removeduplicatesbyattribute`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Detect dataset changes

Compares two vector layers, and determines which features are unchanged, added or deleted between the two. It is designed for comparing two different versions of the same dataset.

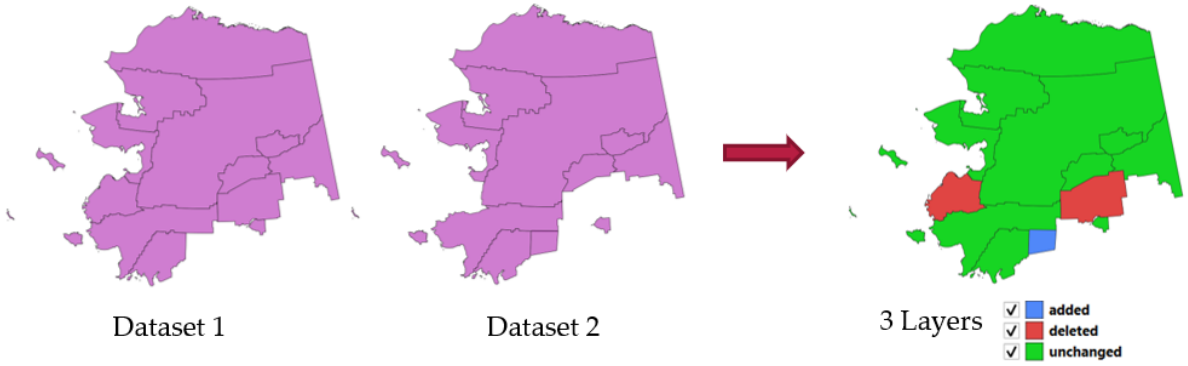


Figura24.38: Detect dataset change example

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Original layer	`ORIGINAL`	[vector: any]	The vector layer considered as the original version
Revised layer	`REVISED`	[vector: any]	The revised or modified vector layer
Attributes to consider for match Opcional	`COMPARE_ATTRIBUTES`	[tablefield: any] [list]	Attributes to consider for match. By default, all attributes are compared.
Geometry comparison behavior Opcional	`MATCH_TYPE`	[enumeration] Padrão: 1	Defines the criteria for comparison. Options: • 0 — Exact Match: includes the order and vertices count of geometries • 1 — Tolerant Match (Topological Equality): geometries are considered equal
Unchanged features	`UNCHANGED`	[vector: same as Original layer]	Specify the output vector layer containing the unchanged features. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

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Tabela 24.77 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Added features	`ADDED`	[vector: same as Original layer]	Specify the output vector layer containing the added features. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Deleted features	`DELETED`	[vector: same as Original layer]	Specify the output vector layer containing the deleted features. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Unchanged features	`UNCHANGED`	[vector: same as Original layer]	Vector layer containing the unchanged features.
Added features	`ADDED`	[vector: same as Original layer]	Vector layer containing the added features.
Deleted features	`DELETED`	[vector: same as Original layer]	Vector layer containing the deleted features.
Count of unchanged features	`UNCHANGED_COUNT`	[number]	Count of unchanged features.
Count of features added in revised layer	`ADDED_COUNT`	[number]	Count of features added in revised layer.
Count of features deleted from original layer	`DELETED_COUNT`	[number]	Count of features deleted from original layer.

Python code

Algorithm ID: `native:detectvectorchanges`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Drop geometries

Creates a simple *geometryless* copy of the input layer attribute table. It keeps the attribute table of the source layer.

If the file is saved in a local folder, you can choose between many file formats.

Permite *features in-place modification*

Ver também:

Delete duplicate geometries, *Remove null geometries*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada vetorial de entrada
Dropped geometries	`SAÍDA`	[table]	Specify the output geometryless layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Dropped geometries	`SAÍDA`	[table]	The output geometryless layer. A copy of the original attribute table.

Python code

Algorithm ID: `native:dropgeometries`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Executar SQL

Runs a simple or complex query with SQL syntax on the source layer.

Input datasources are identified with input1, input2... inputN and a simple query will look like SELECT * FROM input1.

Beside a simple query, you can add expressions or variables within the SQL query parameter itself. This is particulary useful if this algorithm is executed within a Processing model and you want to use a model input as a parameter of the query. An example of a query will then be SELECT * FROM [% @table %] where @table is the variable that identifies the model input.

The result of the query will be added as a new layer.

Ver também:

SpatiaLite execute SQL, *PostgreSQL execute SQL*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Additional input datasources (called input1, .., inputN in the query)	INPUT_DATASOURCES	[vector: any] [list]	List of layers to query. In the SQL editor you can refer these layers with their **real** name or also with **input1**, **input2**, **inputN** depending on how many layers have been chosen.
SQL query	INPUT_QUERY	[string]	Type the string of your SQL query, e.g. SELECT * FROM input1.
Unique identifier field Opcional	INPUT_UID_FIELD	[string]	Specify the column with unique ID
Geometry field Opcional	INPUT_GEOMETRY_FIELD	[string]	Specify the geometry field
Tipo de Geometria Opcional	INPUT_GEOMETRY_TYPE	[enumeration] Padrão: 0	Choose the geometry of the result. By default the algorithm will autodetect it. One of: • 0 — Autodetect • 1 — No geometry • 2 — Point • 3 — LineString • 4 — Polygon • 5 — MultiPoint • 6 — MultiLineString • 7 — MultiPolygon
CRS Opcional	INPUT_GEOMETRY_CRS	[crs]	The CRS to assign to the output layer
SQL Output	SAÍDA	[vector: any] Default: [Create temporary layer]	Specify the output layer created by the query. One of: • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
SQL Output	`SAÍDA`	[vector: any]	Camada vetorial criada pela consulta

Python code

Algorithm ID: `qgis:executesql`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract selected features

Saves the selected features as a new layer.

Nota: If the selected layer has no selected features, the newly created layer will be empty.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Layer to save the selection from
Selected features	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the vector layer for the selected features. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Selected features	`SAÍDA`	[same as input]	Vector layer with only the selected features, or no feature if none was selected.

Python code

Algorithm ID: `native:saveselectedfeatures`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract Shapefile encoding

Extracts the attribute encoding information embedded in a Shapefile. Both the encoding specified by an optional `.cpg` file and any encoding details present in the `.dbf` LDID header block are considered.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	ESRI Shapefile (`.SHP`) Layer to extract the encoding information.

Saídas

Etiqueta	Nome	Tipo	Descrição
Shapefile encoding	`ENCODING`	[string]	Encoding information specified in the input file
CPG encoding	`CPG_ENCODING`	[string]	Encoding information specified in any optional `.CPG` file
LDID encoding	`LDID_ENCODING`	[string]	Encoding information specified in `.dbf` LDID header block

Python code

Algorithm ID: `native:shpencodinginfo`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Find projection

Creates a shortlist of candidate coordinate reference systems, for instance for a layer with an unknown projection.

The area that the layer is expected to cover must be specified via the target area parameter. The coordinate reference system for this target area must be known to QGIS.

The algorithm operates by testing the layer's extent in every known reference system and then listing any for which the bounds would be near the target area if the layer was in this projection.

Ver também:

Assign projection, *Define Shapefile projection*, *Reproject layer*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Layer with unknown projection
Target area for layer (xmin, xmax, ymin, ymax)	`TARGET_AREA`	[extent]	The area that the layer covers. The options for specifying the extent are: • Use Canvas Extent • Select Extent on Canvas • Use Layer Extent It is also possible to provide the extent coordinates directly (xmin, xmax, ymin, ymax).
CRS candidates	`SAÍDA`	[table] Default: `[Create temporary layer]`	Specify the table (geometryless layer) for the CRS suggestions (EPSG codes). One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
CRS candidates	`SAÍDA`	[table]	A table with all the CRS (EPSG codes) of the matching criteria.

Python code

Algorithm ID: `qgis:findprojection`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Flatten relationship

Flattens a *relationship* for a vector layer, exporting a single layer containing one parent feature per related child feature. This master feature contains all the attributes for the related features. This allows to have the relation as a plain table that can be e.g. exported to CSV.

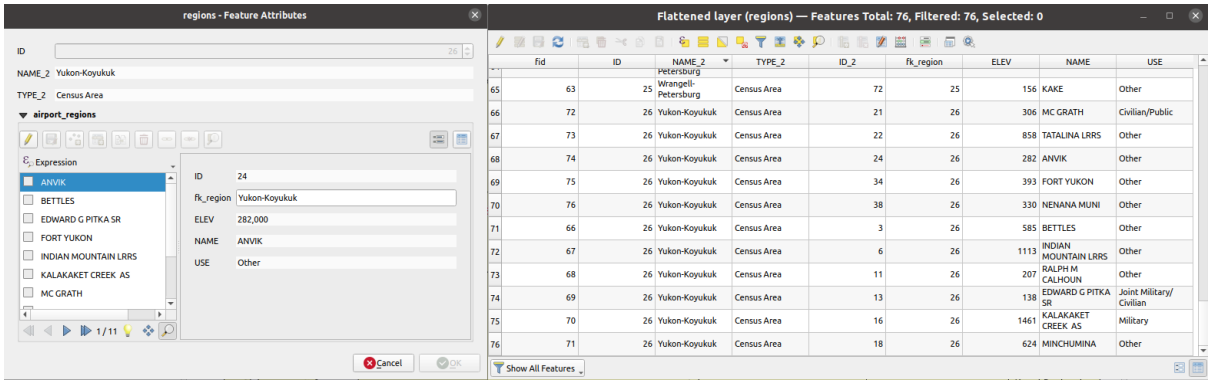


Figura24.39: Form of a region with related children (left) - A duplicate region feature for each related child, with joined attributes (right)

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Layer with the relationship that should be de-normalized
Flattened Layer Opcional	`SAÍDA`	[same as input] Default: `[Save to temporary file]`	Specify the output (flattened) layer. One of: • Save to a Temporary File • Salvar para Arquivo… • Save To GeoPackage… • Save to Database Table… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Flattened layer	`SAÍDA`	[same as input]	A layer containing master features with all the attributes for the related features

Python code

Algorithm ID: `native:flattenrelationships`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Join attributes by field value

Takes an input vector layer and creates a new vector layer that is an extended version of the input one, with additional attributes in its attribute table.

The additional attributes and their values are taken from a second vector layer. An attribute is selected in each of them to define the join criteria.

Ver também:

Join attributes by nearest, *Join attributes by location*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Input vector layer. The output layer will consist of the features of this layer with attributes from matching features in the second layer.
Table field	`CAMPO`	[tablefield: any]	Field of the source layer to use for the join
Input layer 2	`INPUT_2`	[vector: any]	Layer with the attribute table to join
Table field 2	`FIELD_2`	[tablefield: any]	Field of the second (join) layer to use for the join The type of the field must be equal to (or compatible with) the input table field type.
Layer 2 fields to copy Opcional	`FIELDS_TO_COPY`	[tablefield: any] [list]	Select the specific fields you want to add. By default all the fields are added.
Join type	`MÉTODO`	[enumeration] Padrão: 1	The type of the final joined layer. One of: • 0 — Create separate feature for each matching feature (one-to-many) • 1 — Take attributes of the first matching feature only (one-to-one)
Discard records which could not be joined	`DISCARD_NONMATCHING`	[boolean] Padrão: Verdadeiro	Check if you don't want to keep the features that could not be joined
Joined field prefix Opcional	`PREFIX`	[string]	Add a prefix to joined fields in order to easily identify them and avoid field name collision
Joined layer	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer for the join. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

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Tabela 24.83 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Unjoinable features from first layer	`NON_MATCHING`	[same as input] Default: `[Skip output]`	Specify the output vector layer for unjoinable features from first layer. One of: • Ignorar saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Number of joined features from input table	`JOINED_COUNT`	[number]	
Unjoinable features from first layer Opcional	`NON_MATCHING`	[same as input]	Vector layer with the non-matched features
Joined layer	`SAÍDA`	[same as input]	Output vector layer with added attributes from the join
Number of unjoinable features from input table Opcional	`UNJOINABLE_COUNT`	[number]	

Python code

Algorithm ID: `native:joinattributestable`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Join attributes by location

Takes an input vector layer and creates a new vector layer that is an extended version of the input one, with additional attributes in its attribute table.

The additional attributes and their values are taken from a second vector layer. A spatial criteria is applied to select the values from the second layer that are added to each feature from the first layer.

Default menu: *Vector ► Data Management Tools*

Ver também:

Join attributes by nearest, *Join attributes by field value*, *Join attributes by location (summary)*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	Input vector layer. The output layer will consist of the features of this layer with attributes from matching features in the second layer.
Join layer	JOIN	[vector: any]	The attributes of this vector layer will be **added** to the source layer attribute table.
Geometric predicate	PREDICATE	[enumeration] [list] Padrão: [0]	Select the geometric criteria. One or more of: • 0 — intersects • 1 — contains • 2 — equals • 3 — touches • 4 — overlaps • 5 — within • 6 — crosses
Fields to add (leave empty to use all fields) Opcional	JOIN_FIELDS	[tablefield: any] [list]	Select the specific fields you want to add. By default all the fields are added.
Join type	MÉTODO	[enumeration]	The type of the final joined layer. One of: • 0 — Create separate feature for each matching feature (one-to-many) • 1 — Take attributes of the first matching feature only (one-to-one) • 2 — Take attributes of the feature with largest overlap only (one-to-one)
Discard records which could not be joined	DISCARD_NONMATCHING	[boolean] Padrão: Falso	Remove from the output the input layer records which could not be joined
Joined field prefix Opcional	PREFIX	[string]	Add a prefix to joined fields in order to easily identify them and avoid field name collision
Joined layer	SAÍDA	[same as input] Default: [Create temporary layer]	Specify the output vector layer for the join. One of: • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

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Tabela 24.84 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Unjoinable features from first layer	`NON_MATCHING`	[same as input] Default: `[Skip output]`	Specify the output vector layer for unjoinable features from first layer. One of: • Ignorar saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Number of joined features from input table	`JOINED_COUNT`	[number]	
Unjoinable features from first layer Opcional	`NON_MATCHING`	[same as input]	Vector layer of the non-matched features
Joined layer	`SAÍDA`	[same as input]	Output vector layer with added attributes from the join

Python code

Algorithm ID: `native:joinattributesbylocation`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Join attributes by location (summary)

Takes an input vector layer and creates a new vector layer that is an extended version of the input one, with additional attributes in its attribute table.

The additional attributes and their values are taken from a second vector layer. A spatial criteria is applied to select the values from the second layer that are added to each feature from the first layer.

The algorithm calculates a statistical summary for the values from matching features in the second layer (e.g. maximum value, mean value, etc).

Ver também:

Join attributes by location

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	Input vector layer. The output layer will consist of the features of this layer with attributes from matching features in the second layer.
Join layer	JOIN	[vector: any]	The attributes of this vector layer will be **added** to the source layer attribute table.
Geometric predicate	PREDICATE	[enumeration] [list] Padrão: [0]	Select the geometric criteria. One or more of: • 0 — intersects • 1 — contains • 2 — equals • 3 — touches • 4 — overlaps • 5 — within • 6 — crosses
Fields to summarize (leave empty to use all fields) Opcional	JOIN_FIELDS	[tablefield: any] [list]	Select the specific fields you want to add and summarize. By default all the fields are added.
Summaries to calculate (leave empty to use all fields) Opcional	SUMMARIES	[enumeration] [list] Padrão: []	Choose which type of summary you want to add to each field and for each feature. One or more of: • 0 — count • 1 — unique • 2 — min • 3 — max • 4 — range • 5 — sum • 6 — mean • 7 — median • 8 — stddev • 9 — minority • 10 — majority • 11 — q1 • 12 — q3 • 13 — iqr • 14 — empty • 15 — filled • 16 — min_length • 17 — max_length • 18 — mean_length
Discard records which could not be joined	DISCARD_NONMATCHING	[boolean] Padrão: Falso	Remove from the output the input layer records which could not be joined

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Tabela 24.85 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Joined layer	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer for the join. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Joined layer	`SAÍDA`	[same as input]	Output vector layer with summarized attributes from the join

Python code

Algorithm ID: `qgis:joinbylocationsummary`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Join attributes by nearest

Takes an input vector layer and creates a new vector layer with additional fields in its attribute table. The additional attributes and their values are taken from a second vector layer. Features are joined by finding the closest features from each layer.

By default only the nearest feature is joined, but the join can also join to the k-nearest neighboring features.

If a maximum distance is specified, only features which are closer than this distance will be matched.

Ver também:

Nearest neighbour analysis, *Join attributes by field value*, *Join attributes by location*, *Distance matrix*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada de entrada.
Input layer 2	`INPUT_2`	[vector: any]	The join layer.
Layer 2 fields to copy (leave empty to copy all fields)	`FIELDS_TO_COPY`	[fields]	Join layer fields to copy (if empty, all fields will be copied).

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Tabela 24.86 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Discard records which could not be joined	DISCARD_NONMATCHING	[boolean] Padrão: Falso	Remove from the output the input layer records which could not be joined
Joined field prefix	PREFIX	[string]	Joined field prefix
Maximum nearest neighbors	NEIGHBORS	[number] Padrão: 1	Maximum number of nearest neighbors
Maximum distance	MAX_DISTANCE	[number]	Maximum search distance
Joined layer	SAÍDA	[same as input] Default: [Create temporary layer]	Specify the vector layer containing the joined features. One of: • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Unjoinable features from first layer	NON_MATCHING	[same as input] Default: [Skip output]	Specify the vector layer containing the features that could not be joined. One of: • Ignorar saída • Create Temporary Layer (TEMPORARY_OUTPUT) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Joined layer	SAÍDA	[same as input]	The output joined layer.
Unjoinable features from first layer	NON_MATCHING	[same as input]	Layer containing the features from first layer that could not be joined to any features in the join layer.
Number of joined features from input table	JOINED_COUNT	[number]	Number of features from the input table that have been joined.
Number of unjoinable features from input table	UNJOINABLE_COUNT	[number]	Number of features from the input table that could not be joined.

Python code

Algorithm ID: `native:joinbynearest`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Merge vector layers

Combines multiple vector layers of the **same geometry** type into a single one.

The attribute table of the resulting layer will contain the fields from all input layers. If fields with the same name but different types are found then the exported field will be automatically converted into a string type field. New fields storing the original layer name and source are also added.

If any input layers contain Z or M values, then the output layer will also contain these values. Similarly, if any of the input layers are multi-part, the output layer will also be a multi-part layer.

Optionally, the destination coordinate reference system (CRS) for the merged layer can be set. If it is not set, the CRS will be taken from the first input layer. All layers will be reprojected to match this CRS.



Default menu: *Vector ► Data Management Tools*

Ver também:

Split vector layer

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Layers	`CAMADAS`	[vector: any] [list]	The layers that are to be merged into a single layer. Layers should be of the same geometry type.
Destination CRS Opcional	`SRC`	[crs]	Choose the CRS for the output layer. If not specified, the CRS of the first input layer is used.
Mesclado	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Mesclado	`SAÍDA`	[same as input]	Output vector layer containing all the features and attributes from the input layers.

Python code

Algorithm ID: `native:mergevectorlayers`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Order by expression

Sorts a vector layer according to an expression: changes the feature index according to an expression.

Be careful, it might not work as expected with some providers, the order might not be kept every time.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Input vector layer to sort
Expressão	`EXPRESSÃO`	[expression]	Expression to use for the sorting
Ordernar ascendente	`ASCENDING`	[boolean] Padrão: Verdadeiro	If checked the vector layer will be sorted from small to large values.
Sort nulls first	`NULLS_FIRST`	[boolean] Padrão: Falso	If checked, Null values are placed first
Ordered	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Ordered	`SAÍDA`	[same as input]	Output (sorted) vector layer

Python code

Algorithm ID: `native:orderbyexpression`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Repair Shapefile

Repairs a broken ESRI Shapefile dataset by (re)creating the SHX file.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input Shapefile	`ENTRADA`	[file]	Full path to the ESRI Shapefile dataset with a missing or broken SHX file

Saídas

Etiqueta	Nome	Tipo	Descrição
Repaired layer	`SAÍDA`	[vector: any]	The input vector layer with the SHX file repaired

Python code

Algorithm ID: `native:repairshapefile`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Reproject layer

Reprojects a vector layer in a different CRS. The reprojected layer will have the same features and attributes of the input layer.

Permite *features in-place modification*

Ver também:

Assign projection, *Define Shapefile projection*, *Find projection*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Input vector layer to reproject
SRC Alvo	`SRC_ALVO`	[crs] Default: `EPSG:4326 - WGS 84`	Destination coordinate reference system
Coordinate Operation Opcional	`OPERATION`	[string]	Specific operation to use for a particular reprojection task, instead of always forcing use of the current project's transformation settings. Useful when reprojecting a particular layer and control over the exact transformation pipeline is required. Requires proj version >= 6. Read more at *Datum Transformations*.
Reprojetado	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Reprojetado	`SAÍDA`	[same as input]	Output (reprojected) vector layer

Python code

Algorithm ID: `native:reprojectlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Save vector features to file

Saves vector features to a specified file dataset.

For dataset formats supporting layers, an optional layer name parameter can be used to specify a custom string. Optional GDAL-defined dataset and layer options can be specified. For more information on this, read the online GDAL documentation on the format.

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Vector features	`ENTRADA`	[vector: any]	Input vector layer.
Saved features	`SAÍDA`	[same as input] Default: `[Save to temporary file]`	Specify the file to save the features to. One of: • Save to a Temporary File • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Layer name Opcional	`LAYER_NAME`	[string]	Name to use for the output layer
GDAL dataset options Opcional	`DATASOURCE_OPTIONS`	[string]	GDAL dataset creation options of the output format. Separate individual options with semicolons.
GDAL layer options Opcional	`LAYER_OPTIONS`	[string]	GDAL layer creation options of the output format. Separate individual options with semicolons.

Saídas

Etiqueta	Nome	Tipo	Descrição
Saved features	`SAÍDA`	[same as input]	Vector layer with the saved features.
File name and path	`FILE_PATH`	[string]	Output file name and path.
Layer name	`LAYER_NAME`	[string]	Name of the layer, if any.

Python code

Algorithm ID: `native:savefeatures`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Set layer encoding

Sets the encoding used for reading a layer's attributes. No permanent changes are made to the layer, rather it affects only how the layer is read during the current session.

Nota: Changing the encoding is only supported for some vector layer data sources.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Saved features	`ENTRADA`	[vector: any]	Vector layer to set the encoding.
Encoding	`ENCODING`	[string]	Text encoding to assign to the layer in the current QGIS session.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output layer	`SAÍDA`	[same as input]	Input vector layer with the set encoding.

Python code

Algorithm ID: `native:setlayerencoding`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Split features by character

Features are split into multiple output features by splitting a field's value at a specified character. For instance, if a layer contains features with multiple comma separated values contained in a single field, this algorithm can be used to split these values up across multiple output features. Geometries and other attributes remain unchanged in the output. Optionally, the separator string can be a regular expression for added flexibility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Split using values in the field	`CAMPO`	[tablefield: any]	Field to use for splitting
Split value using character	`CHAR`	[string]	Character to use for splitting
Use regular expression separator	`REGEX`	[boolean] Padrão: Falso	

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Tabela 24.88 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Split	`SAÍDA`	[same as input] Default: `Create temporary layer`	Specify output vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Split	`SAÍDA`	[same as input]	A camada vetorial de saída.

Python code

Algorithm ID: `native:splitfeaturesbycharacter`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Split vector layer

Creates a set of vectors in an output folder based on an input layer and an attribute. The output folder will contain as many layers as the unique values found in the desired field.

The number of files generated is equal to the number of different values found for the specified attribute.

It is the opposite operation of *merging*.

Default menu: *Vector ► Data Management Tools*

Ver também:

Merge vector layers

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Unique ID field	`CAMPO`	[tablefield: any]	Field to use for splitting
Diretório de saída	`SAÍDA`	[folder] Default: `[Save to temporary folder]`	Specify the directory for the output layers. One of: • Salvar como Diretório Temporário • Salvar para Diretório… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Diretório de saída	`SAÍDA`	[folder]	The directory for the output layers
Output layers	`OUTPUT_LAYERS`	[same as input] [list]	The output vector layers resulting from the split.

Python code

Algorithm ID: `native:splitvectorlayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Truncate table

Truncates a layer, by deleting all features from within the layer.

> **Aviso:** This algorithm modifies the layer in place, and deleted features cannot be restored!

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada

Saídas

Etiqueta	Nome	Tipo	Descrição
Truncated layer	`SAÍDA`	[folder]	The truncated (empty) layer

Python code

Algorithm ID: `native:truncatetable`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.16 Vector geometry

Add geometry attributes

Computes geometric properties of the features in a vector layer and includes them in the output layer.

It generates a new vector layer with the same content as the input one, but with additional attributes, containing geometric measurements based on a selected CRS.

The attributes added to the table depend on the geometry type and dimension of the input layer:

- for **point** layers: X (`xcoord`), Y (`ycoord`), Z (`zcoord`) coordinates and/or M value (`mvalue`)
- for **line** layers: `length` and, for the LineString and CompoundCurve geometry types, the feature `sinuosity` and straight distance (`straightdis`)
- for **polygon** layers: `perimeter` and `area`

Default menu: *Vector ► Geometry Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Calculate using	`CALC_METHOD`	[enumeration] Padrão: 0	Calculation parameters to use for the geometric properties. One of: • 0 — Layer CRS • 1 — Project CRS • 2 — Ellipsoidal
Added geom info	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output (input copy with geometry) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Added geom info	`SAÍDA`	[same as input]	Copy of the input vector layer with the addition of the geometry fields

Python code

Algorithm ID: `qgis:exportaddgeometrycolumns`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Affine transform

Applies an affine transformation to the layer geometries. Affine transformations can include translation, scaling and rotation. The operations are performed in the following order: scale, rotation, and translation.

Z and M values (if present) can be translated and scaled.

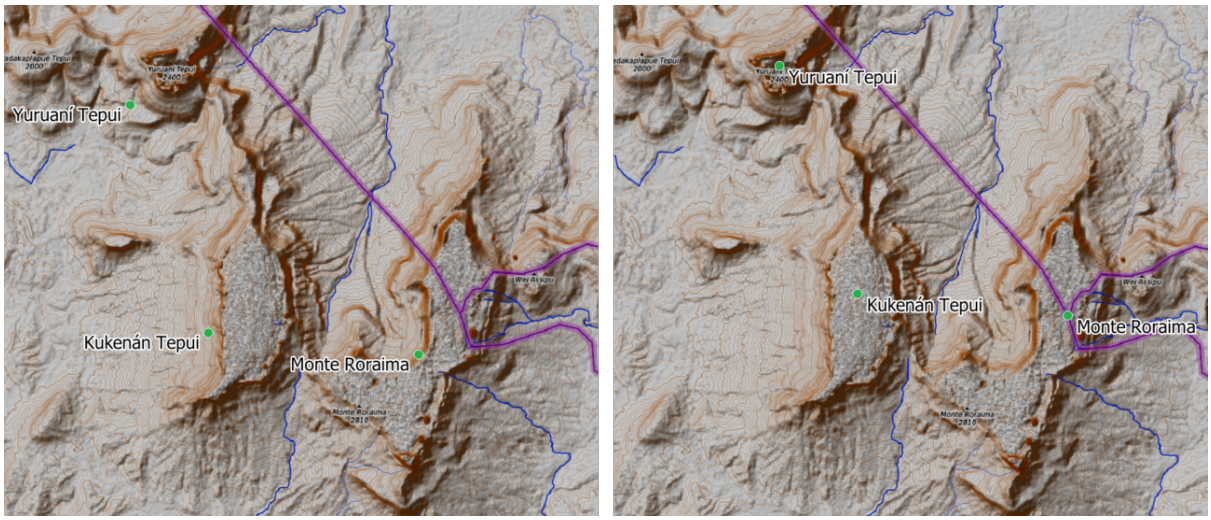


Figura24.40: Vector point layer (green dots) before (left), and after (rigth) an affine transformation (translation).

Ver também:

Translate

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Translation (x-axis)	`DELTA_X`	[number] Padrão: 0	Displacement to apply on the X axis.
Translation (y-axis)	`DELTA_Y`	[number] Padrão: 0	Displacement to apply on the Y axis.
Translation (z-axis)	`DELTA_Z`	[number] Padrão: 0	Displacement to apply on the Z axis.

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Tabela 24.91 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Translation (m-values)	`DELTA_M`	[number] Padrão: 0	Offset to apply on m values.
Scale factor (x-axis)	`SCALE_X`	[number] Padrão: 1	Scaling value (expansion or contraction) to apply on the X axis.
Scale factor (y-axis)	`SCALE_Y`	[number] Padrão: 1	Scaling value (expansion or contraction) to apply on the Y axis.
Scale factor (z-axis)	`SCALE_Z`	[number] Padrão: 1	Scaling value (expansion or contraction) to apply on the Z axis.
Scale factor (m-values)	`SCALE_M`	[number] Padrão: 1	Scaling value (expansion or contraction) to apply on m values.
Rotation around z-axis (degrees counter-clockwise)	`ROTATION_Z`	[number] Padrão: 0	Angle of the rotation in degrees.
Transformed	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Transformed	`SAÍDA`	[same as input]	Output (transformed) vector layer.

Python code

Algorithm ID: `native:affinetransform`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Aggregate

Takes a vector or table layer and creates a new layer by aggregating features based on a `group by` expression.

Features for which `group by` expression returns the same value are grouped together.

It is possible to group all source features together using constant value in `group by` parameter, example: NULL.

It is also possible to group features by multiple fields using Array function, example: Array("Field1", "Field2").

Geometries (if present) are combined into one multipart geometry for each group. Output attributes are computed depending on each given aggregate definition.

This algorithm allows to use the default *aggregates functions* of the QGIS Expression engine.

Ver também:

Collect geometries, *Dissolver*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Group by expression	`GROUP_BY`	[tablefield: any] Default: 'NULL'	Choose the grouping field. If *NULL* all features will be grouped.

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Tabela 24.93 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Aggregates	`AGGREGATES`	[list]	List of output layer field definitions. Example of a field definition: *{'aggregate': 'sum', 'delimiter': ',', 'input': ' $area', 'length': 10, 'name': 'totarea', 'precision': 0, 'type': 6}* By default, the list contains all the fields of the input layer. In the GUI, you can edit these fields and their definitions, and you can also: • Click the  button to add a new field. • Click  to delete the selected field. • Use  and  to change order of the fields. • Click  to reset to the default (the fields of the input layer). For each of the fields you'd like to retrieve information from, you need to define the following: **`Input expression` [expression] (`input`)** Campo ou expressão da camada de entrada **`Aggregate function` [enumeration] (`aggregate`)** *Function* to use on the input expression to return the aggregated value. Default: *concatenate* (for string data type), *sum* (for numeric data type) **`Delimiter` [string] (`delimiter`)** Text string to separate aggregated values, for example in case of concatenation. Default: , **`Output field name` [string] (`name`)** Name of the aggregated field in the output layer. By default input field name is kept. **`Type` [enumeration] (`type`)** Data type of the output field. One of: • 1 — Boolean • 2 — Integer • 4 — Integer64 • 6 — Double • 10 — String • 14 — Date • 16 — DateTime **`Length` [number] (`length`)** Comprimento do campo de saída. **`Precision` [number] (`precision`)** Precisão do campo de saída.
Load fields from layer	Apenas GUI	[vector: any]	You can load fields from another layer and use them for the aggregation

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Tabela 24.93 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Aggregated	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output (aggregate) layer One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Aggregated	`SAÍDA`	[same as input]	Multigeometry vector layer with the aggregated values

Python code

Algorithm ID: `native:aggregate`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Boundary

Returns the closure of the combinatorial boundary of the input geometries (i.e. the topological boundary of the geometry).

Only for polygon and line layers.

For **polygon geometries** , the boundary consists of all the lines making up the rings of the polygon.

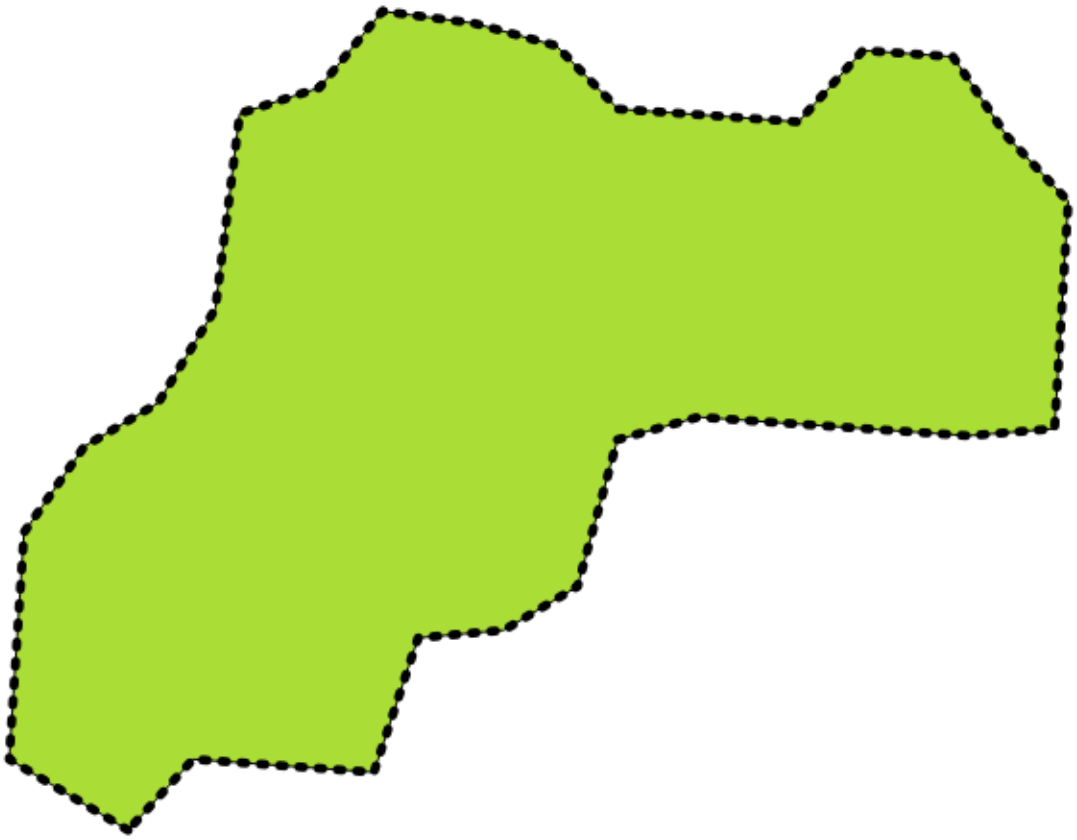


Figura24.41: Boundaries (black dashed line) of the source polygon layer

For **lines geometries**, the boundaries are their end points.

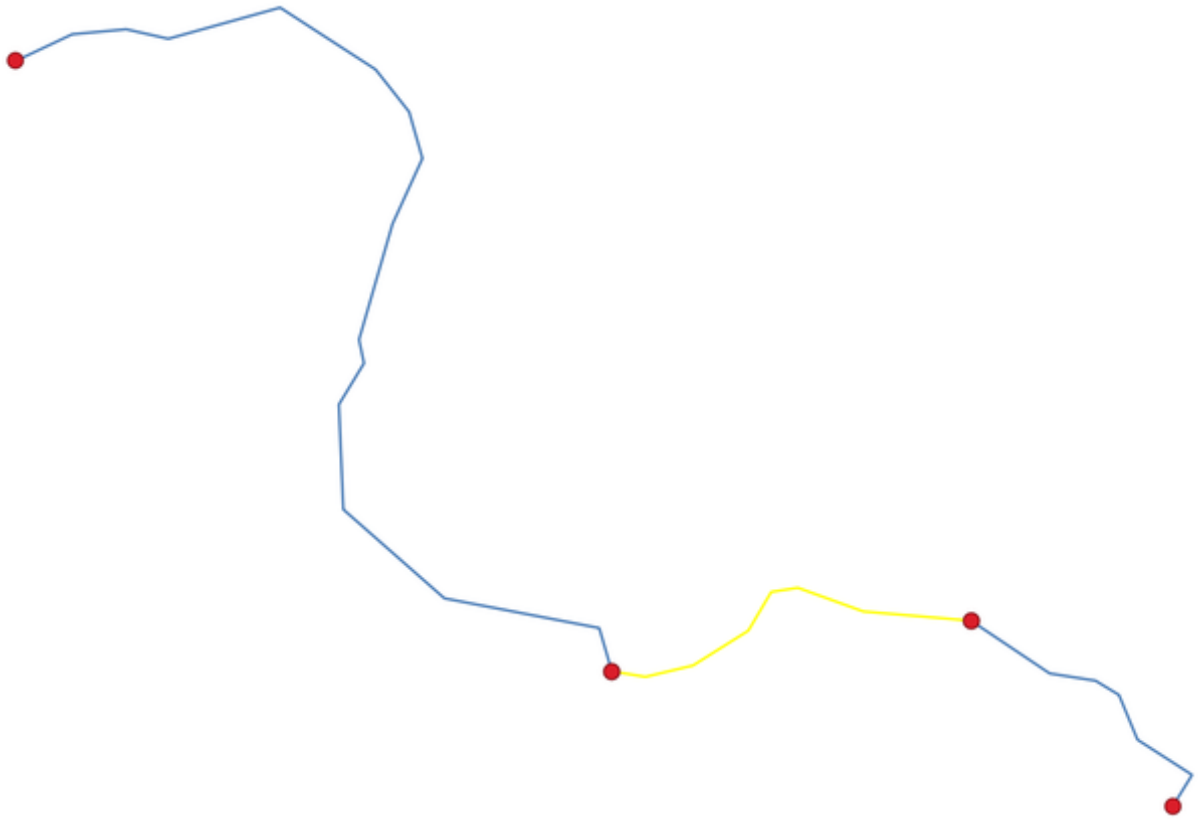


Figura24.42: Boundary layer (red points) for lines. In yellow a selected feature.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Boundary	`SAÍDA`	[vector: point, line] Default: `[Create temporary layer]`	Specify the output (boundary) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Boundary	`SAÍDA`	[vector: point, line]	Boundaries from the input layer (point for line, and line for polygon)

Python code

Algorithm ID: `native:boundary`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Bounding boxes

Calculates the bounding box (envelope) of each feature in an input layer. Polygon and line geometries are supported.

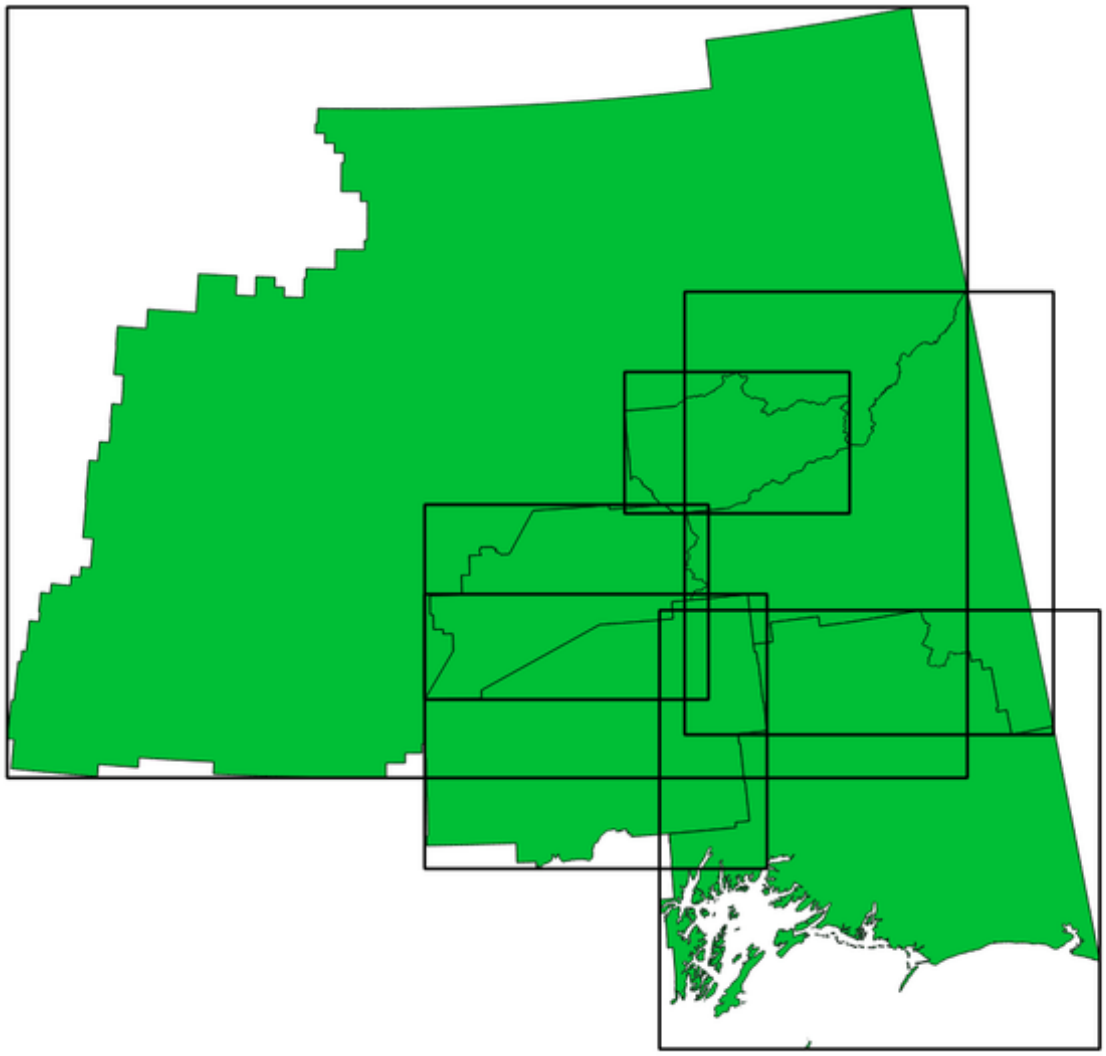


Figura24.43: Black lines represent the bounding boxes of each polygon feature

Permite *features in-place modification*

Ver também:

Minimum bounding geometry

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Bounds	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output (bounding box) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Bounds	`SAÍDA`	[vector: polygon]	Bounding boxes of input layer

Python code

Algorithm ID: `native:boundingboxes`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Buffer

Computes a buffer area for all the features in an input layer, using a fixed distance.

It is possible to use a negative distance for polygon input layers. In this case the buffer will result in a smaller polygon (setback).

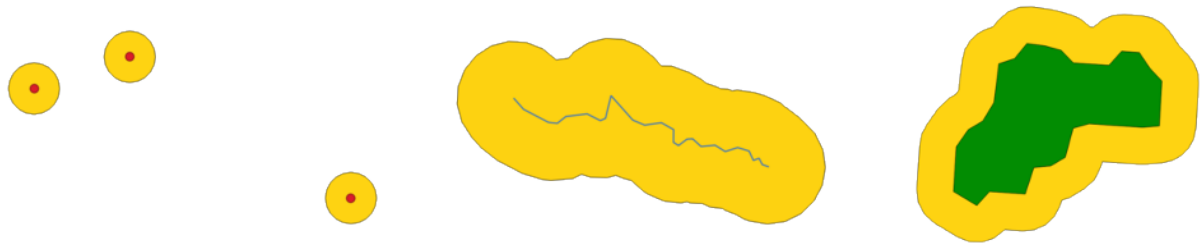


Figura24.44: Buffer (in yellow) of points, line and polygon

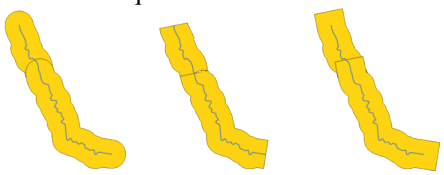
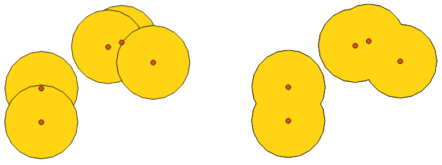
Permite *features in-place modification*

Default menu: *Vector ► Geoprocessing Tools*

Ver também:

Variable distance buffer, *Multi-ring buffer (constant distance)*, *Variable width buffer (by M value)*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Distance	`DISTÂNCIA`	[number] Padrão: 10.0	Buffer distance (from the boundary of each feature). You can use the Data Defined button on the right to choose a field from which the radius will be calculated. This way you can have different radius for each feature (see *Variable distance buffer*).
Segmentos	`SEGMENTOS`	[number] Padrão: 5	Controls the number of line segments to use to approximate a quarter circle when creating rounded offsets.
End cap style	`END_CAP_STYLE`	[enumeration] Padrão: 0	Controls how line endings are handled in the buffer. One of: • 0 — Round • 1 — Flat • 2 — Square  Figura24.45: Round, flat and square cap styles
Join style	`JOIN_STYLE`	[enumeration] Padrão: *0*	Specifies whether round, miter or beveled joins should be used when offsetting corners in a line. Options are: • 0 — Round • 1 — Miter • 2 — Bevel
Miter limit	`MITER_LIMIT`	[number] Padrão: 2.0	Controls the maximum distance from the offset curve to use when creating a mitered join (only applicable for miter join styles). Minimum: 1.
Dissolve result	`DISSOLVER`	[boolean] Padrão: Falso	Dissolve the final buffer. If `True` (checked), overlapping buffers will be dissolved (combined) into a new feature.  Figura24.46: Standard and dissolved buffer

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Tabela 24.94 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Buffered	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output (buffer) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Buffered	`SAÍDA`	[vector: polygon]	Output (buffer) polygon layer

Python code

Algorithm ID: `native:buffer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Centroids

Creates a new point layer, with points representing the centroids of the geometries of the input layer.

The centroid is a single point representing the barycenter (of all parts) of the feature, so it can be outside the feature borders. But can also be a point on each part of the feature.

The attributes of the points in the output layer are the same as for the original features.

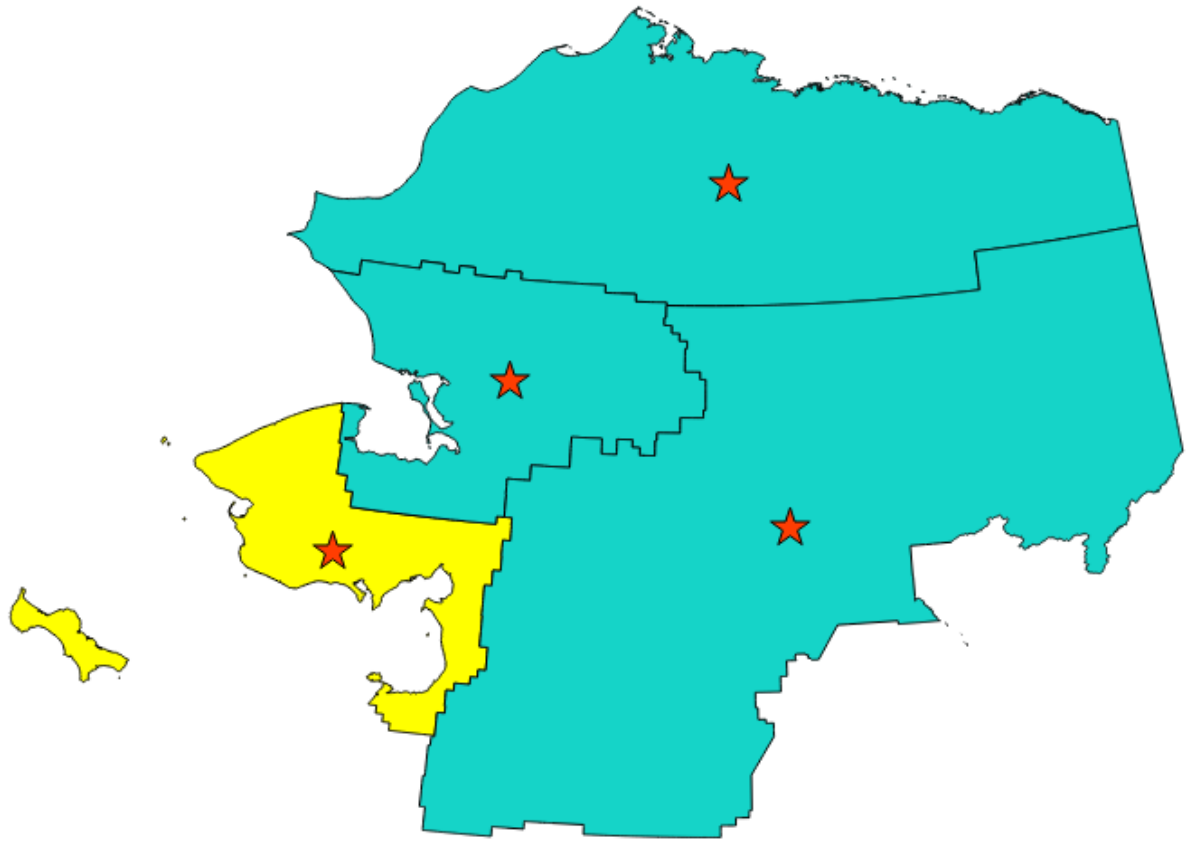


Figura24.47: The red stars represent the centroids of the features of the input layer.

Permite *features in-place modification*

Default menu: *Vector ► Geometry Tools*

Ver também:

Point on Surface

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Create centroid for each part	`ALL_PARTS`	[boolean] Padrão: Falso	If True (checked), a centroid will be created for each part of the geometry
Centroids	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Specify the output (centroid) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Centroids	`SAÍDA`	[vector: point]	Output point vector layer (centroids)

Python code

Algorithm ID: `native:centroids`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Check validity

Performs a validity check on the geometries of a vector layer.

The geometries are classified in three groups (valid, invalid and error) and for each group, a vector layer with its features is generated:

- The **Valid output** layer contains only the valid features (without topological errors).
- The **Invalid output** layer contains all the invalid features found by the algorithm.
- The **Error output** layer is a point layer that points to where the invalid features were found.

The attribute tables of the generated layers will contain some additional information ("message" for the **error** layer, "FID" and "_errors" for the **invalid** layer and only "FID" for the **valid** layer):

The attribute table of each generated vector layer will contain some additional information (number of errors found and types of error):

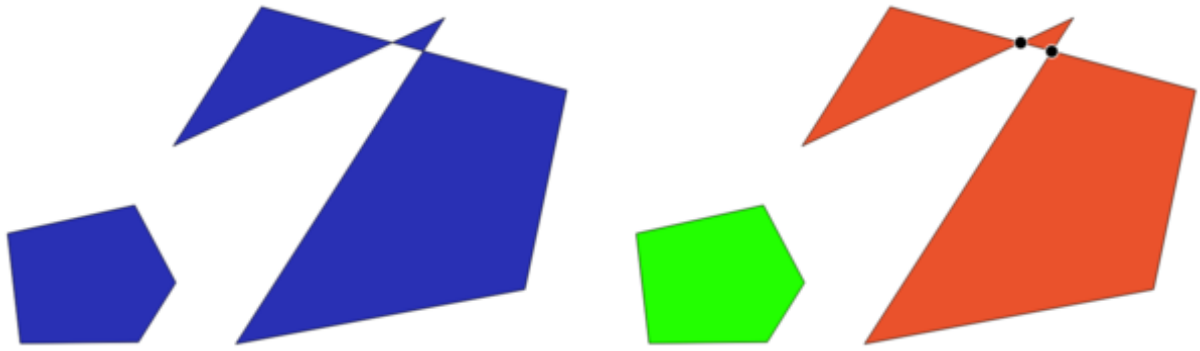


Figura24.48: Left: the input layer. Right: the valid layer (green), the invalid layer (orange)

Default menu: *Vector* ► *Geometry Tools*

Ver também:

Fix geometries and the core plugin *Geometry Checker Plugin*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`INPUT_LAYER`	[vector: any]	Camada vetorial de entrada
Método	`MÉTODO`	[enumeration] Padrão: 2	Method to use to check validity. Options: • 0: The one selected in digitizing settings • 1: QGIS • 2: GEOS
Ignore ring self intersection	`IGNORE_RING_SELF_INTERSECTION`	[boolean] Padrão: False	Ignore self intersecting rings when checking for validity.
Valid output	`VALID_OUTPUT`	[same as input] Default: `[Create temporary layer]`	Specify the vector layer to contain a copy of the valid features of the source layer. One of: • Ignorar saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Invalid output	`INVALID_OUTPUT`	[same as input] Default: `[Create temporary layer]`	Vector layer containing copy of the invalid features of the source layer with the field `_errors` listing the summary of the error(s) found. One of: • Ignorar saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pém pode ser alterada aqui.
Error output	`ERROR_OUTPUT`	[vector: point] Default: `[Create temporary layer]`	Point layer of the exact position of the validity problems detected with the `message` field describing the error(s) found. One of: • Ignorar saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Count of errors	`ERROR_COUNT`	[number]	The number of geometries that caused errors.
Error output	`ERROR_OUTPUT`	[vector: point]	Point layer of the exact position of the validity problems detected with the `message` field describing the error(s) found.
Count of invalid features	`INVALID_COUNT`	[number]	The number of invalid geometries.
Invalid output	`INVALID_OUTPUT`	[same as input]	Vector layer containing copy of the invalid features of the source layer with the field `_errors` listing the summary of the error(s) found.
Count of valid features	`VALID_COUNT`	[number]	The number of valid geometries.
Valid output	`VALID_OUTPUT`	[same as input]	Vector layer containing a copy of the valid features of the source layer.

Python code

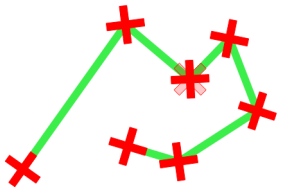
Algorithm ID: `qgis:checkvalidity`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Types of error messages and their meanings

Tabela24.97: If the GEOS method is used the following error messages can occur:

Error message	Explanation	Exemplo
Repeated point	This error happens when a given vertex is repeated.	

continua na próxima página

Tabela 24.97 – continuação da página anterior

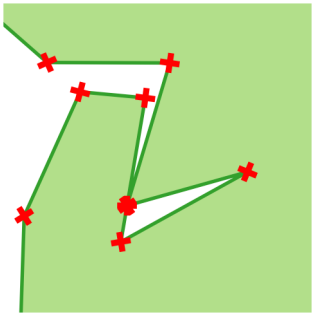
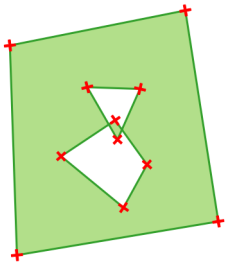
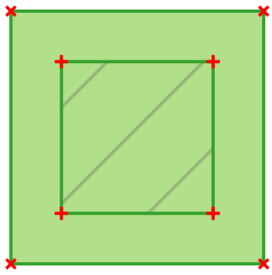
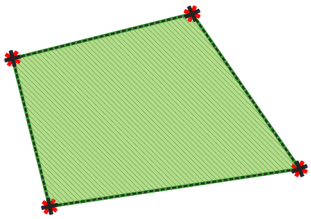
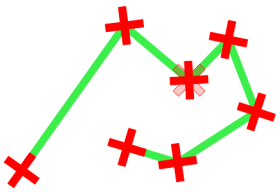
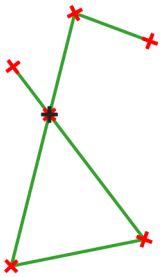
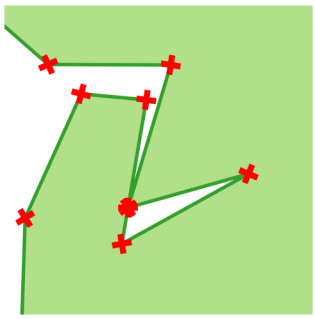
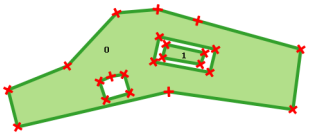
Error message	Explanation	Exemplo
Ring self-intersection	This error happens when a geometry touches itself and generates a ring.	
Self-intersection	This error happens when a geometry touches itself.	
Topology validation error		
Hole lies outside shell		
Holes are nested		
Interior is disconnected		
Nested shells	This error happens when a polygon geometry is on top of another polygon geometry.	
Duplicate rings	This error happens when two rings (exterior or interior) of a polygon geometry are identical	
Too few points in geometry component		
Invalid coordinate	For a point geometry, this error happens when the geometry does not have a proper coordinate pair. The coordinate pair does not contain a latitude value and a longitude value in that order.	
Ring is not closed		

Tabela24.98: If the QGIS method is used the following error messages can occur:

Error message	Explanation	Exemplo
Segment %1 of ring %2 of polygon %3 intersects segment %4 of ring %5 of polygon %6 at %7		
Ring %1 with less than four points		
Ring %1 not closed		
Line %1 with less than two points		
Line %1 contains %n duplicate node(s) at %2	This error happens when consecutive points on a line have the same coordinates.	
Segments %1 and %2 of line %3 intersect at %4	This error happens when a line self intersects (two segments of the line intersect each other).	
Ring self-intersection	This error happens when an outer or inner (island) ring / boundary of a polygon geometry intersects itself.	
Ring %1 of polygon %2 not in exterior ring		
Polygon %1 lies inside polygon %2	This error happens when a part of a MultiPolygon geometry is inside a hole of a MultiPolygon geometry.	

Collect geometries

Takes a vector layer and collects its geometries into new multipart geometries.

One or more attributes can be specified to collect only geometries belonging to the same class (having the same value for the specified attributes), alternatively all geometries can be collected.

All output geometries will be converted to multi geometries, even those with just a single part. This algorithm does not dissolve overlapping geometries - they will be collected together without modifying the shape of each geometry part.

See the 'Promote to multipart' or 'Aggregate' algorithms for alternative options.

Default menu: *Vector ► Geometry Tools*

Ver também:

Aggregate, *Promote to multipart*, *Dissolver*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Unique ID fields	`CAMPO`	[tablefield: any] [list]	Choose one or more attributes to collect the geometries
Collected	`SAÍDA`	[same as input]	Vector layer with collected geometries

Saídas

Etiqueta	Nome	Tipo	Descrição
Collected	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer for the collected geometries. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Python code

Algorithm ID: `native:collect`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Concave hull (alpha shapes)

Computes the concave hull of the features in an input point layer.

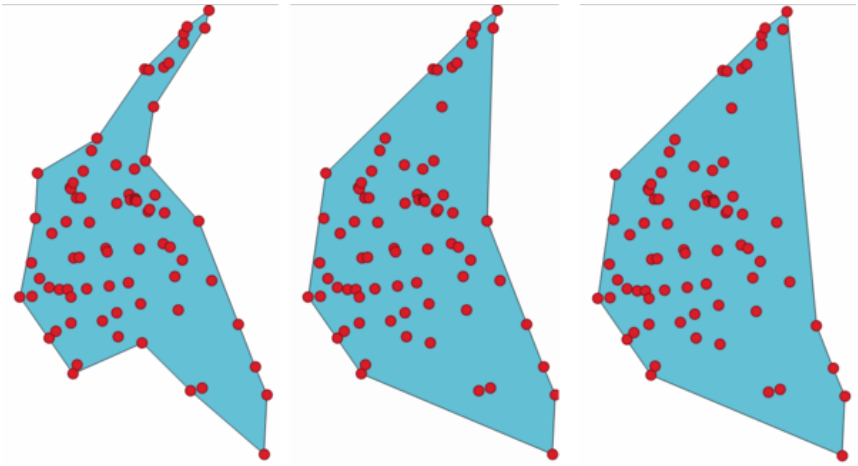


Figura24.49: Concave hulls with different thresholds (0.3, 0.6, 0.9)

Ver também:

Convex hull, *Concave hull (k-nearest neighbor)*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input point layer	`ENTRADA`	[vector: point]	Input point vector layer
Threshold	`ALPHA`	[number] Default: 0.3	Number from 0 (maximum concave hull) to 1 (convex hull).
Allow holes	`HOLES`	[boolean] Padrão: Verdadeiro	Choose whether to allow holes in the final concave hull
Split multipart geometry into singlepart geometries	`NO_MULTIGEOMETRY`	[boolean] Padrão: Verdadeiro	Check if you want to have singlepart geometries instead of multipart ones.
Concave hull	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Concave hull	`SAÍDA`	[vector: polygon]	A camada vetorial de saída.

Python code

Algorithm ID: `qgis:concavehull`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Concave hull (k-nearest neighbor)

Generates a concave hull polygon from a set of points. If the input layer is a line or polygon layer, it will use the vertices.

The number of neighbors to consider determines the concaveness of the output polygon. A lower number will result in a concave hull that follows the points very closely, while a higher number will have a smoother shape. The minimum number of neighbor points to consider is 3. A value equal to or greater than the number of points will result in a convex hull.

If a field is selected, the algorithm will group the features in the input layer using unique values in that field and generate individual polygons in the output layer for each group.

Ver também:

Concave hull (alpha shapes)

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Number of neighboring points to consider (a lower number is more concave, a higher number is smoother)	`KNEIGHBORS`	[number] Padrão: 3	Determines the concaveness of the output polygon. A small number will result in a concave hull that follows the points very closely, while a high number will make the polygon look more like the convex hull (if the number is equal to or larger than the number of features, the result will be the convex hull). Minimum value: 3.
Field Opcional	`CAMPO`	[tablefield: any] Padrão: Nenhum	If specified, one concave hull polygon is generated for each unique value of the field (by selecting features using this value).
Concave hull	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Concave hull	`SAÍDA`	[vector: polygon]	A camada vetorial de saída.

Python code

Algorithm ID: `qgis:knearestconcavehull`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Convert geometry type

Generates a new layer based on an existing one, with a different type of geometry.

The attribute table of the output layer is the same as the one of the input layer.

Not all conversions are possible. For instance, a line layer can be converted to a point layer, but a point layer cannot be converted to a line layer.

Ver também:

Polygonize, *Lines to polygons*, *Polygons to lines*, *Points to path*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
New geometry type	`TIPO`	[enumeration] Padrão: 0	Geometry type to apply to the output features. One of: • 0 — Centroids • 1 — Nodes • 2 — Linestrings • 3 — Multilinestrings • 4 — Polygons
Convertido	`SAÍDA`	[vector: any] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Convertido	`SAÍDA`	[vector: any]	Output vector layer - the type depends on the parameters

Python code

Algorithm ID: `qgis:convertgeometrytype`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Convert to curved geometries

Converts a geometry into its curved geometry equivalent.

Already curved geometries will be retained without change.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line or polygon]	Camada vetorial de entrada
Maximum distance tolerance	`DISTÂNCIA`	[number] Default: 0.000001	The maximum distance allowed between the original location of vertices and where they would fall on the converted curved geometries
Maximum angle tolerance	`ÂNGULO`	[number] Default: 0.000001	Segments are considered as suitable for replacing with an arc if the points are all regularly spaced on the candidate arc. This parameter specifies the maximum angular deviation (in degrees) allowed when testing for regular point spacing. Between 0 and 45°.
Curves	`SAÍDA`	[vector: compoundcurve or curvepolygon] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Save to File… • Save to Geopackage… • Save to Database Table… • Append to Layer… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Curves	`SAÍDA`	[vector: compoundcurve or curvepolygon]	Output vector layer with curved geometries

Python code

Algorithm ID: `native:converttocurves`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Convex hull

Calculates the convex hull for each feature in an input layer.

See the 'Minimum bounding geometry' algorithm for a convex hull calculation which covers the whole layer or grouped subsets of features.

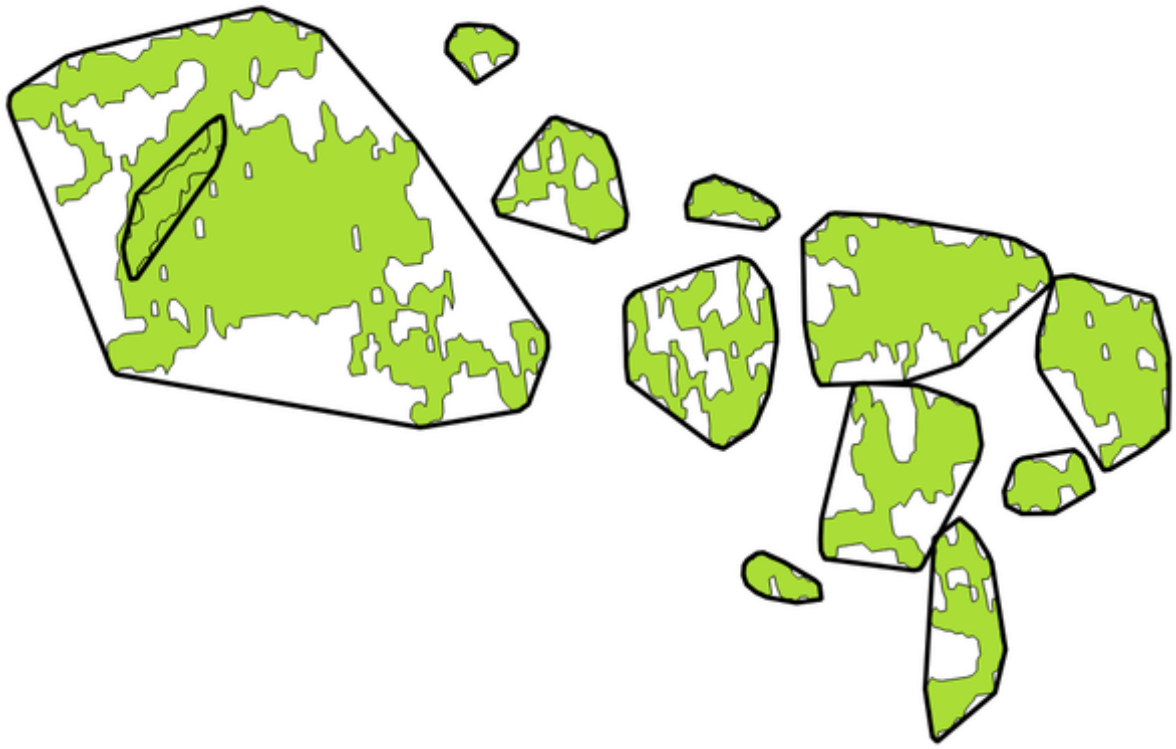


Figura24.50: Black lines identify the convex hull for each layer feature

Permite *features in-place modification*

Default menu: *Vector ► Geoprocessing Tools*

Ver também:

Minimum bounding geometry, *Concave hull (alpha shapes)*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Convex hull	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Convex hull	`SAÍDA`	[vector: polygon]	The output (convex hull) vector layer

Python code

Algorithm ID: `native:convexhull`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create layer from extent

Creates a new vector layer that contains a single feature with geometry matching the extent of the input layer.

It can be used in models to convert a literal extent (`xmin`, `xmax`, `ymin`, `ymax` format) into a layer which can be used for other algorithms which require a layer based input.

Ver também:

Create layer from point

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Extent (xmin, xmax, ymin, ymax)	`ENTRADA`	[extent]	Input extent
Extent	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Extent	`SAÍDA`	[vector: polygon]	The output (extent) vector layer

Python code

Algorithm ID: `native:extenttolayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create layer from point

Creates a new vector layer that contains a single feature with geometry matching a point parameter. It can be used in models to convert a point into a point layer for algorithms which require a layer based input.

Ver também:

Create layer from extent

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Point	`ENTRADA`	[coordinates]	Input point, including CRS info (example: `397254,6214446 [EPSG:32632]`). If the CRS is not provided, the Project CRS will be used. The point can be specified by clicking on the map canvas.
Point	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Especifique a camada da linha de saída. Um de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Point	`SAÍDA`	[vector: point]	The output point vector layer containing the input point.

Python code

Algorithm ID: `native:pointtolayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Create wedge buffers

Creates wedge shaped buffers from input points.

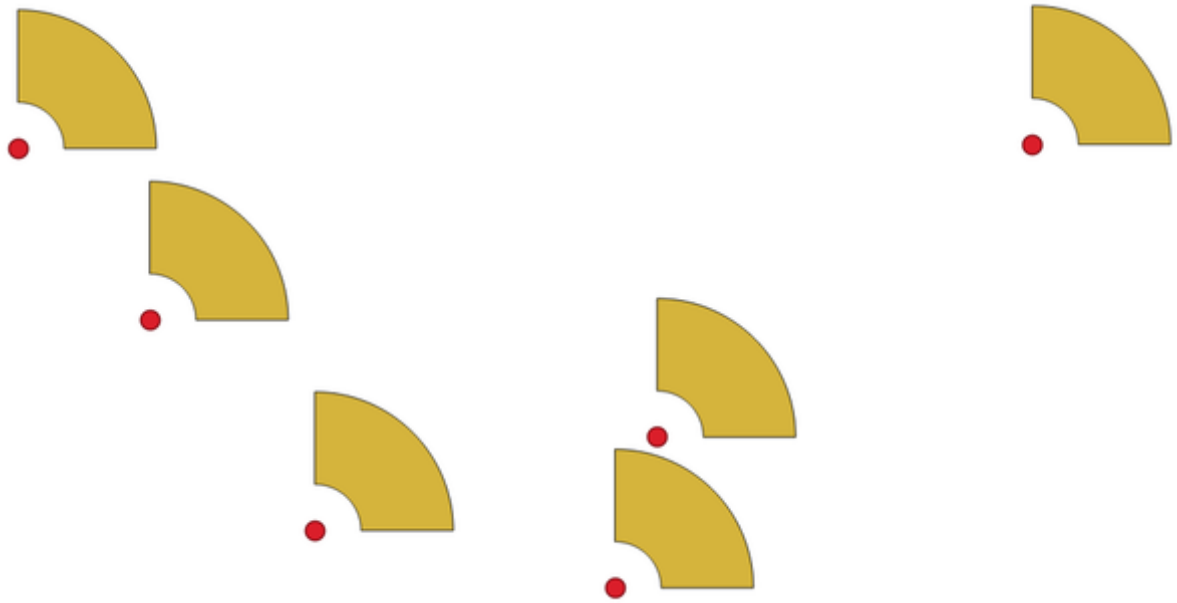


Figura24.51: Wedge buffers

The native output from this algorithm are CurvePolygon geometries, but these may be automatically segmentized to Polygons depending on the output format.

Ver também:

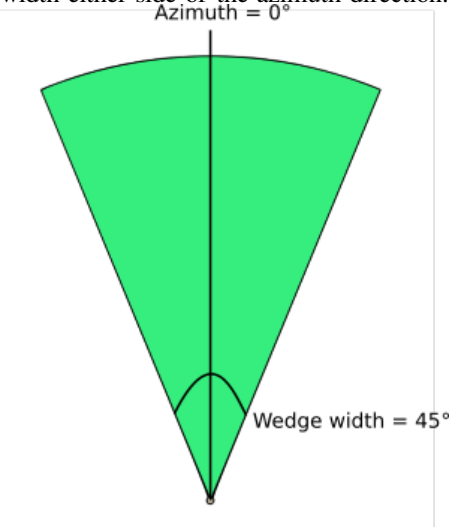
Buffer, *Variable width buffer (by M value)*, *Tapered buffers*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: point]	Input point vector layer
Azimuth (degrees from North)	`AZIMUTH`	[number] Padrão: 0.0	Angle (in degrees) as the middle value of the wedge

continua na próxima página

Tabela 24.101 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Wedge width (in degrees)	`LARGURA`	[number] Padrão: 45.0	Width (in degrees) of the buffer. The wedge will extend to half of the angular width either side of the azimuth direction.  Figura24.52: Azimuth and width values of the wedge buffer
Outer radius	`OUTER_RADIUS`	[number] Padrão: 1.0	The outer *size* (length) of the wedge: the size is meant from the source point to the edge of the wedge shape.
Inner radius Opcional	`INNER_RADIUS`	[number] Padrão: 0.0	Inner radius value. If 0 the wedge will begin from the source point.
Buffers	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Buffers	`SAÍDA`	[vector: polygon]	The output (wedge buffer) vector layer

Python code

Algorithm ID: `native:wedgebuffers`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Delaunay triangulation

Creates a polygon layer with the Delaunay triangulation corresponding to the input point layer.

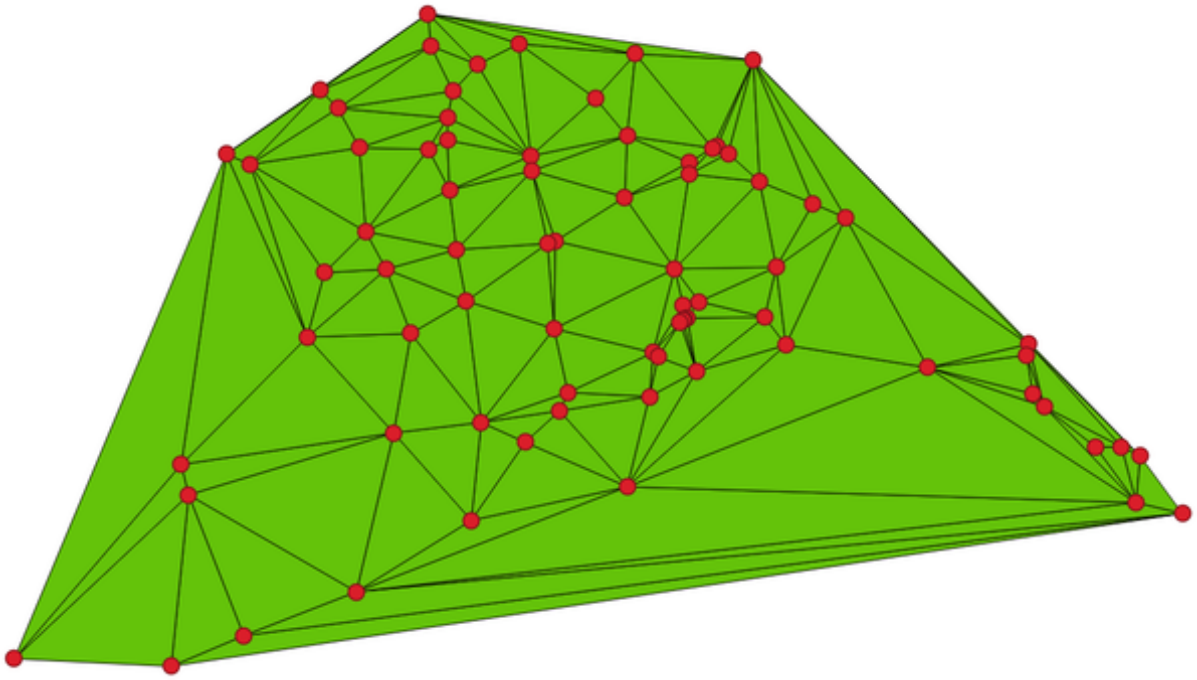


Figura24.53: Delaunay triangulation on points

Default menu: *Vector* ► *Geometry Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: point]	Input point vector layer
Delaunay triangulation	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Delaunay triangulation	`SAÍDA`	[vector: polygon]	The output (Delaunay triangulation) vector layer

Python code

Algorithm ID: `qgis:delaunaytriangulation`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Delete holes

Takes a polygon layer and removes holes in polygons. It creates a new vector layer in which polygons with holes have been replaced by polygons with only their external ring. Attributes are not modified.

An optional minimum area parameter allows removing only holes which are smaller than a specified area threshold. Leaving this parameter at `0.0` results in all holes being removed.

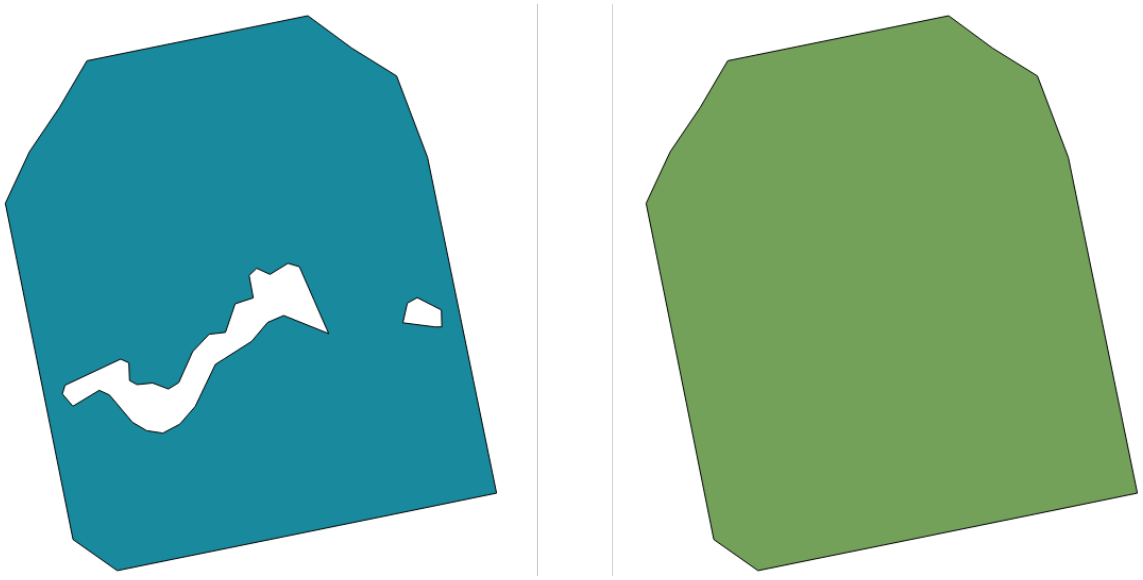


Figura24.54: Before and after the cleaning

Permite *features in-place modification*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: polygon]	Input polygon vector layer
Remove holes with area less than Opcional	`MIN_AREA`	[number] Padrão: 0.0	Only holes with an area less than this threshold will be deleted. With a value of `0.0`, **all** the holes will be deleted.
Cleaned	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Cleaned	`SAÍDA`	[same as input]	The output (cleaned) vector layer

Python code

Algorithm ID: `native:deleteholes`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Densify by count

Takes a polygon or line layer and generates a new one in which the geometries have a larger number of vertices than the original one.

If the geometries have Z or M values present then these will be linearly interpolated at the added vertices.

The number of new vertices to add to each segment is specified as an input parameter.

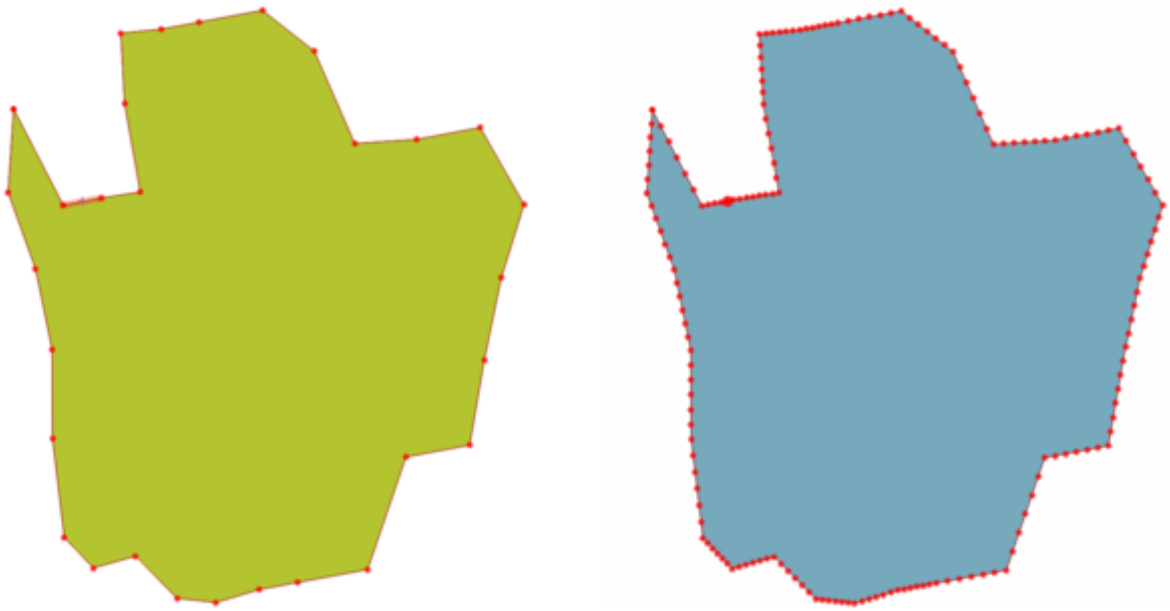


Figura24.55: Red points show the vertices before and after the densify

Permite *features in-place modification*

Default menu: *Vector ► Geometry Tools*

Ver também:

Densify by interval

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Vertices to add	`VERTICES`	[number] Padrão: 1	Number of vertices to add to each segment
Densified	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Densified	`SAÍDA`	[same as input]	The output (densified) vector layer

Python code

Algorithm ID: `native:densifygeometries`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Densify by interval

Takes a polygon or line layer and generates a new one in which the geometries have a larger number of vertices than the original one.

The geometries are densified by adding regularly placed extra vertices inside each segment so that the maximum distance between any two vertices does not exceed the specified distance.

If the geometries have Z or M values present then these will be linearly interpolated at the added vertices.

Exemplo

Specifying a distance of 3 would cause the segment `[0 0] -> [10 0]` to be converted to `[0 0] -> [2.5 0] -> [5 0] -> [7.5 0] -> [10 0]`, since 3 extra vertices are required on the segment and spacing these at 2.5 increments allows them to be evenly spaced over the segment.

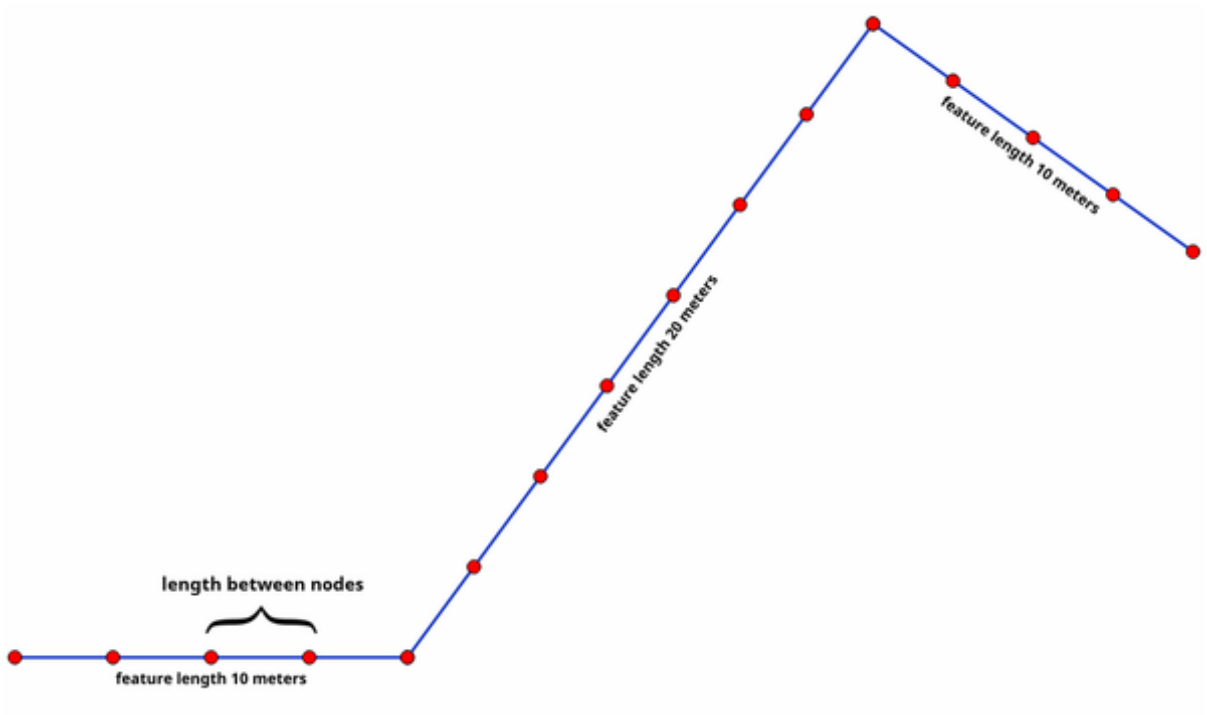


Figura24.56: Densify geometry at a given interval

Permite *features in-place modification*

Ver também:

Densify by count

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Interval between vertices to add	`INTERVALO`	[number] Padrão: 1.0	Maximum distance between two consecutive vertices
Densified	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Densified	`SAÍDA`	[same as input]	The output (densified) vector layer

Python code

Algorithm ID: `native:densifygeometriesgivenaninterval`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Dissolver

Takes a vector layer and combines its features into new features. One or more attributes can be specified to dissolve features belonging to the same class (having the same value for the specified attributes), alternatively all features can be dissolved to a single feature.

All output geometries will be converted to multi geometries. In case the input is a polygon layer, common boundaries of adjacent polygons being dissolved will get erased.

The resulting attribute table will have the same fields as the input layer. The values in the output layer's fields are the ones of the first input feature that happens to be processed.

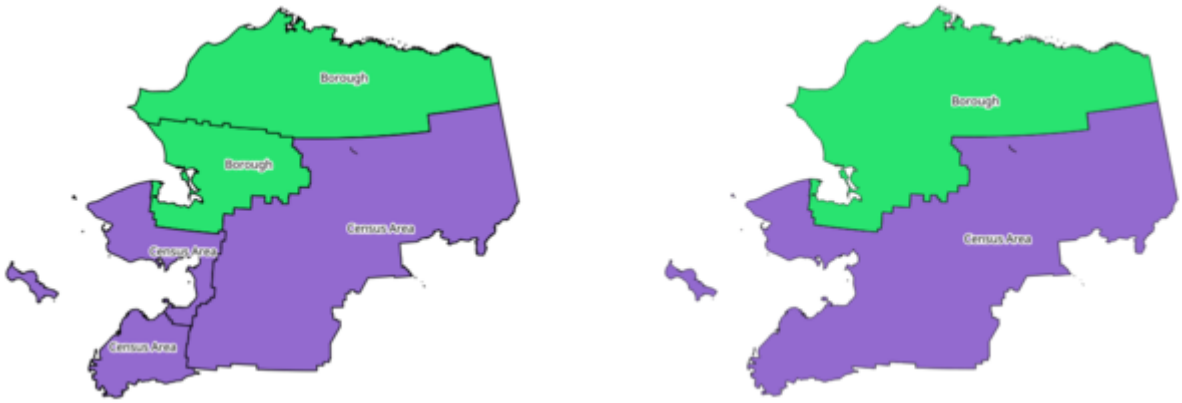


Figura24.57: Dissolve the polygon layer on a common attribute

Default menu: *Vector* ► *Geoprocessing Tools*

Ver também:

Aggregate, *Collect geometries*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Dissolve field(s) Opcional	`CAMPO`	[tablefield: any] [list] Padrão: []	Features having the same value for the selected field(s) will be replaced with a single one and their geometries are merged. If no field is provided then all the features are dissolved, resulting in a single (multipart) feature.
Dissolvido	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Dissolvido	`SAÍDA`	[same as input]	The output vector layer with dissolved geometries

Python code

Algorithm ID: `native:dissolve`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Drape (set Z value from raster)

Uses values sampled from a band within a raster layer to set the Z value for every overlapping vertex in the feature geometry. The raster values can optionally be scaled by a preset amount.

If Z values already exist in the layer, they will be overwritten with the new value. If no Z values exist, the geometry will be upgraded to include the Z dimension.

Ver também:

Set M value from raster, *Set Z value*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Camada raster	`RASTER`	[raster]	Raster layer with Z values
Band number	`BAND`	[raster band] Padrão: 1	The raster band to take the Z values from
Value for nodata or non-intersecting vertices	`NODATA`	[number] Padrão: 0	Value to use in case the vertex does not intersect (a valid pixel of) the raster
Scale factor	`ESCALA`	[number] Padrão: 1.0	Scaling value: the band values are multiplied by this value.
Updated	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer (with Z values from the raster layer). One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Updated	`SAÍDA`	[same as input]	The output vector layer with Z values from the raster layer

Python code

Algorithm ID: `native:setzfromraster`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Drop M/Z values

Removes M (measure) or Z (altitude) values from input geometries.

Ver também:

Set M value, *Set Z value*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Input vector layer with M or Z values
Drop M Values	`DROP_M_VALUES`	[boolean] Padrão: Falso	Removes the M values from the geometries
Drop Z Values	`DROP_Z_VALUES`	[boolean] Padrão: Falso	Removes the Z values from the geometries
Z/M Dropped	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Z/M Dropped	`SAÍDA`	[same as input]	The output vector layer (identical to the input layer, except that the M and/or Z dimensions have been removed from the geometries).

Python code

Algorithm ID: `native:dropmzvalues`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Eliminate selected polygons

Combines selected polygons of the input layer with certain adjacent polygons by erasing their common boundary. The adjacent polygon can be either the one with the largest or smallest area or the one sharing the largest common boundary with the polygon to be eliminated.

Eliminate is normally used to get rid of sliver polygons, i.e. tiny polygons that are a result of polygon intersection processes where boundaries of the inputs are similar but not identical.

Default menu: *Vector ► Geoprocessing Tools*

Ver também:

Fix geometries

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: polygon]	Input polygon vector layer
Merge selection with the neighboring polygon with the	`MODE`	[enumeration] Padrão: Nenhum	Choose the parameter to use in order to get rid of the selected polygons: • 0 — Largest Area • 1 — Smallest Area • 2 — Largest Common Boundary
Eliminated	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Eliminated	`SAÍDA`	[vector: polygon]	The output polygon vector layer.

Python code

Algorithm ID: `qgis:eliminateselectedpolygons`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Explode lines

Takes a lines layer and creates a new one in which each line layer is replaced by a set of lines representing the segments in the original line.

Each line in the resulting layer contains only a start and an end point, with no intermediate vertices between them.

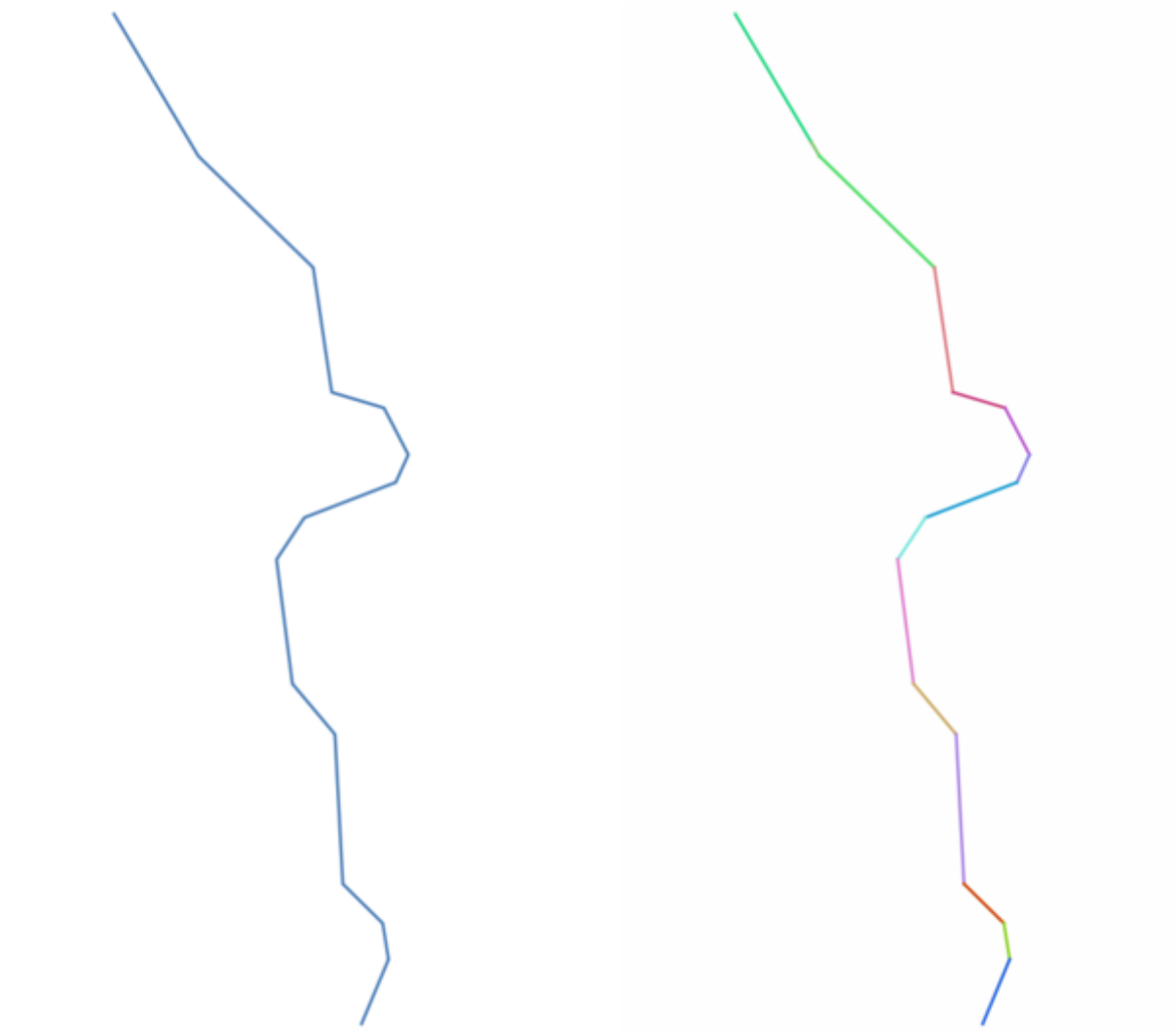


Figura24.58: The original line layer and the exploded one

Permite *features in-place modification*

Ver também:

Subdivide, *Line substring*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Exploded	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Exploded	`SAÍDA`	[vector: line]	The output line vector layer with features representing each segment of the input layer.

Python code

Algorithm ID: `native:explodelines`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extend lines

Extends line geometry by a specified amount at the start and end of the line.

Lines are extended using the bearing of the first and last segment in the line.

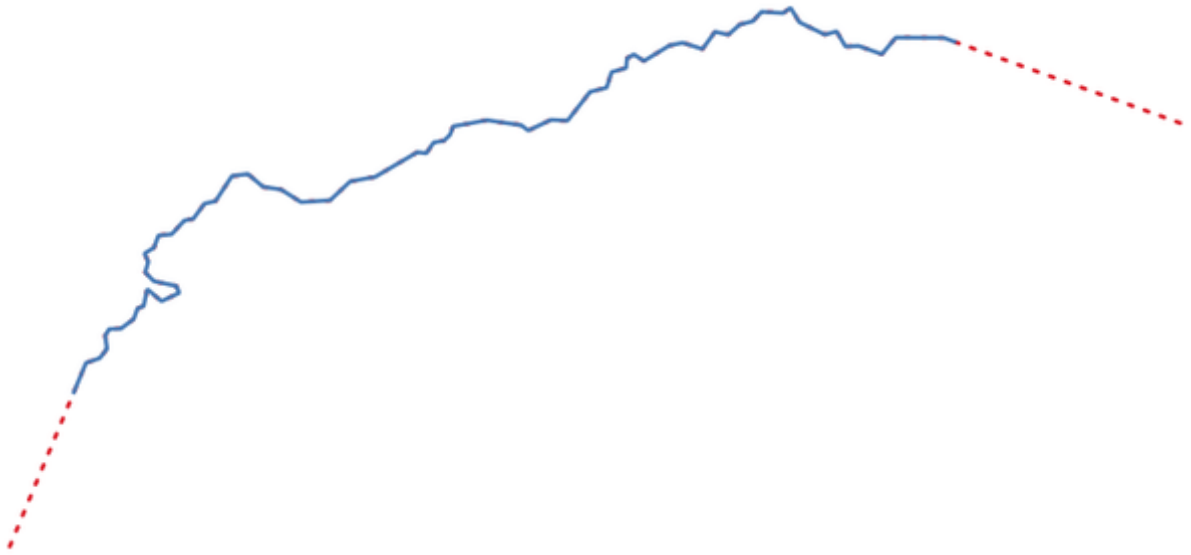


Figura24.59: The red dashes represent the initial and final extension of the original layer

Permite *features in-place modification*

Ver também:

Line substring

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Start distance	`START_DISTANCE`	[number]	Distance by which to extend the first segment of the line (starting point)
End distance	`END_DISTANCE`	[number]	Distance by which to extend the last segment of the line (ending point)
Extended	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Extended	`SAÍDA`	[vector: line]	The output (extended) line vector layer.

Python code

Algorithm ID: `native:extendlines`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract M values

Extracts M values from geometries into feature attributes.

By default only the M value from the first vertex of each feature is extracted, however the algorithm can optionally calculate statistics on all of the geometry's M values, including sum, mean, minimum and maximum.

Ver também:

Extract Z values, *Set M value*, *Drop M/Z values*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Summaries to calculate	`SUMMARIES`	[enumeration] Padrão: [0]	Statistics on the M values of a geometry. One or more of: • 0 — First • 1 — Last • 2 — Count • 3 — Sum • 4 — Mean • 5 — Median • 6 — St.dev (pop) • 7 — Minimum • 8 — Maximum • 9 — Range • 10 — Minority • 11 — Majority • 12 — Variety • 13 — Q1 • 14 — Q3 • 15 — IQR
Output column prefix	`COLUMN_PREFIX`	[string] Default: 'm_'	The prefix for the output (M) column
Extracted	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada da linha de saída. Um de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Extracted	`SAÍDA`	[same as input]	The output vector layer (with M values)

Python code

Algorithm ID: `native:extractmvalues`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract specific vertices

Takes a vector layer and generates a point layer with points representing specific vertices in the input geometries.

For instance, this algorithm can be used to extract the first or last vertices in the geometry. The attributes associated to each point are the same ones associated to the feature that the vertex belongs to.

The vertex indices parameter accepts a comma separated string specifying the indices of the vertices to extract. The first vertex corresponds to an index of 0, the second vertex has an index of 1, etc. Negative indices can be used to find vertices at the end of the geometry, e.g., an index of -1 corresponds to the last vertex, -2 corresponds to the second last vertex, etc.

Additional fields are added to the vertices indicating the specific vertex position (e.g., 0, -1, etc), the original vertex index, the vertex's part and its index within the part (as well as its ring for polygons), distance along the original geometry and bisector angle of vertex for the original geometry.

Ver também:

Extract vertices, *Filter vertices by M value*, *Filter vertices by Z value*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Vertex indices	`VERTICES`	[string] Default: '0'	Comma-separated string of the indices of the vertices to extract.
Vertices	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Vertices	`SAÍDA`	[vector: point]	The output (point) vector layer containing the specified vertices from the input layer geometries.

Python code

Algorithm ID: `native:extractspecificvertices`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract vertices

Takes a vector layer and generates a point layer with points representing the vertices in the input geometries.

The attributes associated to each point are the same ones associated to the feature that the vertex belongs to.

Additional fields are added to the vertices indicating the vertex index (beginning at 0), the feature's part and its index within the part (as well as its ring for polygons), distance along original geometry and bisector angle of vertex for original geometry.

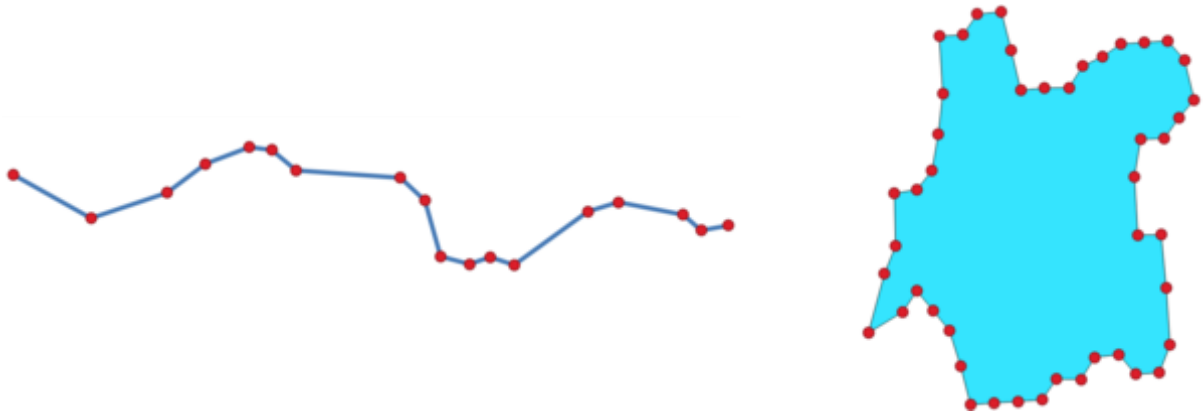


Figura24.60: Vertices extracted for line and polygon layer

Default menu: *Vector ► Geometry Tools*

Ver também:

Extract specific vertices, *Filter vertices by M value*, *Filter vertices by Z value*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Vertices	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Vertices	SAÍDA	[vector: point]	The output (point) vector layer containing the vertices from the input layer geometries.

Python code

Algorithm ID: native:extractvertices

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract Z values

Extracts Z values from geometries into feature attributes.

By default only the Z value from the first vertex of each feature is extracted, however the algorithm can optionally calculate statistics on all of the geometry's Z values, including sum, mean, minimum and maximum.

Ver também:

Extract M values, *Set Z value*, *Drop M/Z values*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	Camada vetorial de entrada
Summaries to calculate	SUMMARIES	[enumeration] Padrão: [0]	Statistics on the Z values of a geometry. One or more of: • 0 — First • 1 — Last • 2 — Count • 3 — Sum • 4 — Mean • 5 — Median • 6 — St.dev (pop) • 7 — Minimum • 8 — Maximum • 9 — Range • 10 — Minority • 11 — Majority • 12 — Variety • 13 — Q1 • 14 — Q3 • 15 — IQR
Output column prefix	COLUMN_PREFIX	[string] Default: 'z_'	The prefix for the output (Z) column

continua na próxima página

Tabela 24.104 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Extracted	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada da linha de saída. Um de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Extracted	`SAÍDA`	[same as input]	The output vector layer (with Z values)

Python code

Algorithm ID: `native:extractzvalues`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Filter vertices by M value

Filters away vertices based on their M value, returning geometries with only vertex points that have a M value greater than or equal to the specified minimum value and/or less than or equal to the maximum value.

If the minimum value is not specified then only the maximum value is tested, and similarly if the maximum value is not specified then only the minimum value is tested.

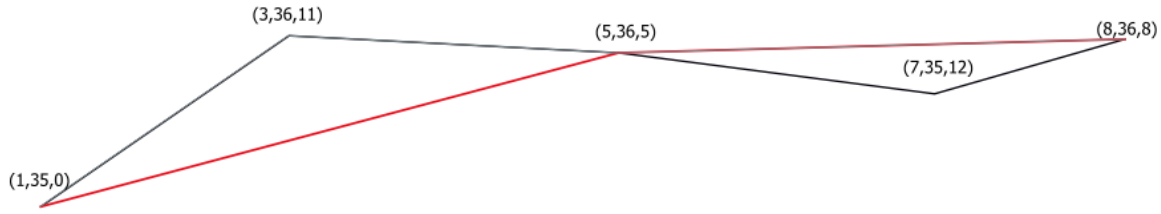


Figura24.61: The red line represents the black line with only vertices whose M value is <=10.

Nota: Depending on the input geometry attributes and the filters used, the resultant geometries created by this algorithm may no longer be valid.

Ver também:

Filter vertices by Z value, *Extract vertices*, *Extract specific vertices*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer to remove vertices from
Minimum Opcional	`MIN`	[number] Default: *Not set*	Minimum of M values allowed
Maximum Opcional	`MAX`	[number] Default: *Not set*	Maximum of M values allowed
Filtered	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Filtered	`SAÍDA`	[same as input]	The output vector layer of features with only the filtered vertices.

Python code

Algorithm ID: `native:filterverticesbym`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Filter vertices by Z value

Filters away vertices based on their Z value, returning geometries with only vertex points that have a Z value greater than or equal to the specified minimum value and/or less than or equal to the maximum value.

If the minimum value is not specified then only the maximum value is tested, and similarly if the maximum value is not specified then only the minimum value is tested.

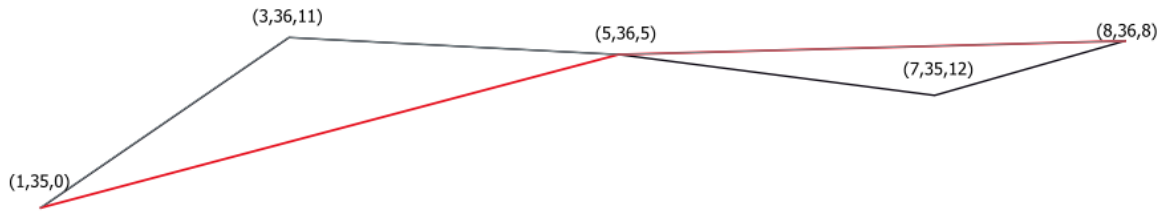


Figura24.62: The red line represents the black line with only vertices whose Z value is <=10.

Nota: Depending on the input geometry attributes and the filters used, the resultant geometries created by this algorithm may no longer be valid. You may need to run the *Fix geometries* algorithm to ensure their validity.

Ver também:

Filter vertices by M value, *Extract vertices*, *Extract specific vertices*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer to remove vertices from
Minimum Opcional	`MIN`	[number] Default: *Not set*	Minimum of Z values allowed
Maximum Opcional	`MAX`	[number] Default: *Not set*	Maximum of Z values allowed
Filtered	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Filtered	`SAÍDA`	[same as input]	The output vector layer of features with only the filtered vertices.

Python code

Algorithm ID: `native:filterverticesbyz`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Fix geometries

Attempts to create a valid representation of a given invalid geometry without losing any of the input vertices. Already valid geometries are returned without further intervention. Always outputs multi-geometry layer.

Nota: M values will be dropped from the output.

Permite *features in-place modification*

Ver também:

Check validity

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Fixed geometries	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Fixed geometries	`SAÍDA`	[same as input]	The output vector layer with fixed geometries.

Python code

Algorithm ID: `native:fixgeometries`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Force right-hand-rule

Forces polygon geometries to respect the Right-Hand-Rule, in which the area that is bounded by a polygon is to the right of the boundary. In particular, the exterior ring is oriented in a clockwise direction and any interior rings in a counter-clockwise direction.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: polygon]	Camada vetorial de entrada
Reoriented	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Reoriented	`SAÍDA`	[vector: polygon]	The output vector layer with reoriented geometries.

Python code

Algorithm ID: `native:forcerhr`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Geodesic line split at antimeridian

Splits a line into multiple geodesic segments, whenever the line crosses the antimeridian (±180 degrees longitude).

Splitting at the antimeridian helps the visual display of the lines in some projections. The returned geometry will always be a multi-part geometry.

Whenever line segments in the input geometry cross the antimeridian, they will be split into two segments, with the latitude of the breakpoint being determined using a geodesic line connecting the points either side of this segment. The current project ellipsoid setting will be used when calculating this breakpoint.

If the input geometry contains M or Z values, these will be linearly interpolated for the new vertices created at the antimeridian.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Split	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Specify the output line vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Split	`SAÍDA`	[vector: line]	The output line vector layer split at the antimeridian.

Python code

Algorithm ID: `native:antimeridiansplit`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Geometry by expression

Updates existing geometries (or creates new geometries) for input features by use of a QGIS expression.

This allows complex geometry modifications which can utilize all the flexibility of the QGIS expression engine to manipulate and create geometries for output features.

For help with QGIS expression functions, see the inbuilt help available in the *expression builder*.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Tipo de geometria de saída	`OUTPUT_GEOMETRY`	[enumeration] Padrão: 0	The output geometry strongly depends on the expression: for instance, if you create a buffer the geometry type has to be polygon. One of: • 0 — Polygon • 1 — Line • 2 — Point
Output geometry has z values	`WITH_Z`	[boolean] Padrão: Falso	Choose if the output geometry should include the Z dimension
Output geometry has m values	`WITH_M`	[boolean] Padrão: Falso	Choose if the output geometry should include the M dimension
Geometry expression	`EXPRESSÃO`	[expression] Default: '$geometry'	Add the geometry expression you want to use. You can use the button to open the Expression Dialog. The dialog lists all the relevant expressions, together with their help and guide.
Modified geometry	`SAÍDA`	[vector: any] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Modified geometry	`SAÍDA`	[vector: any]	A camada vetorial de saída.

Python code

Algorithm ID: `native:geometrybyexpression`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Interpolate point on line

Creates a point geometry interpolated at a set distance along line or curve geometries.

Z and M values are linearly interpolated from existing values.

If a multipart geometry is encountered, only the first part is considered when calculating the substring.

If the specified distance is greater than the input feature's length, the resultant feature will have a null geometry.



Figura24.63: Interpolated point at 500m of the beginning of the line

Ver também:

Points along geometry

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Distance	`DISTÂNCIA`	[number] Padrão: 0.0	Distance from the beginning of the line

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Tabela 24.106 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Interpolated points	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Interpolated points	`SAÍDA`	[vector: point]	The output point vector layer with features at a set distance along the line or polygon boundary

Python code

Algorithm ID: `native:interpolatepoint`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Keep N biggest parts

Takes a layer with polygons or multipolygons and returns a new layer in which only the *n* largest polygons of each multipolygon feature are kept. If a feature has *n* or fewer parts, the feature will just be copied.



Figura24.64: Clockwise from top left: original multipart feature, one, two and three biggest parts kept

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Polígonos	`ENTRADA`	[vector: polygon]	Input polygon vector layer
Parts to keep	`PARTS`	[number] Padrão: 1	Number of parts to keep. If 1, only the biggest part of the feature will be kept.
Parts	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output polygon vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Parts	`SAÍDA`	[vector: polygon]	The output polygon vector layer with the N biggest parts of each feature

Python code

Algorithm ID: `qgis:keepnbiggestparts`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Line substring

Returns the portion of a line (or curve) which falls between the specified start and end distances (measured from the beginning of the line).

Z and M values are linearly interpolated from existing values.

If a multipart geometry is encountered, only the first part is considered when calculating the substring.



Figura24.65: Substring line with starting distance set at 0 meters and the ending distance at 250 meters.

Permite *features in-place modification*

Ver também:

Extend lines

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Start distance	`START_DISTANCE`	[number]	Distance along the input line to the start point of the output feature
End distance	`END_DISTANCE`	[number]	Distance along the input line to the end point of the output feature
Substring	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Specify the output line vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Substring	`SAÍDA`	[vector: line]	The output line vector layer.

Python code

Algorithm ID: `native:linesubstring`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Lines to polygons

Generates a polygon layer using as polygon rings the lines from an input line layer.

The attribute table of the output layer is the same as the one of the input layer.

Default menu: *Vector ► Geometry Tools*

Ver também:

Polygons to lines, *Polygonize*, *Convert geometry type*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Polígonos	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output polygon vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Polígonos	`SAÍDA`	[vector: polygon]	The output polygon vector layer.

Python code

Algorithm ID: `qgis:linestopolygons`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Merge lines

Joins all connected parts of MultiLineString geometries into single LineString geometries.

If any parts of the input MultiLineString geometries are not connected, the resultant geometry will be a MultiLineString containing any lines which could be merged and any non-connected line parts.

Permite *features in-place modification*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Mesclado	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Specify the output line vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Mesclado	`SAÍDA`	[vector: line]	The output (merged) line vector layer.

Python code

Algorithm ID: `native:mergelines`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Minimum bounding geometry

Creates geometries which enclose the features from an input layer. The features can be grouped by a field. The output layer will then contain one feature per group value with a geometry (MBB) that covers the geometries of the features with matching value.

The following enclosing geometry types are supported:

- bounding box (envelope)
- oriented rectangle
- circle
- convex hull

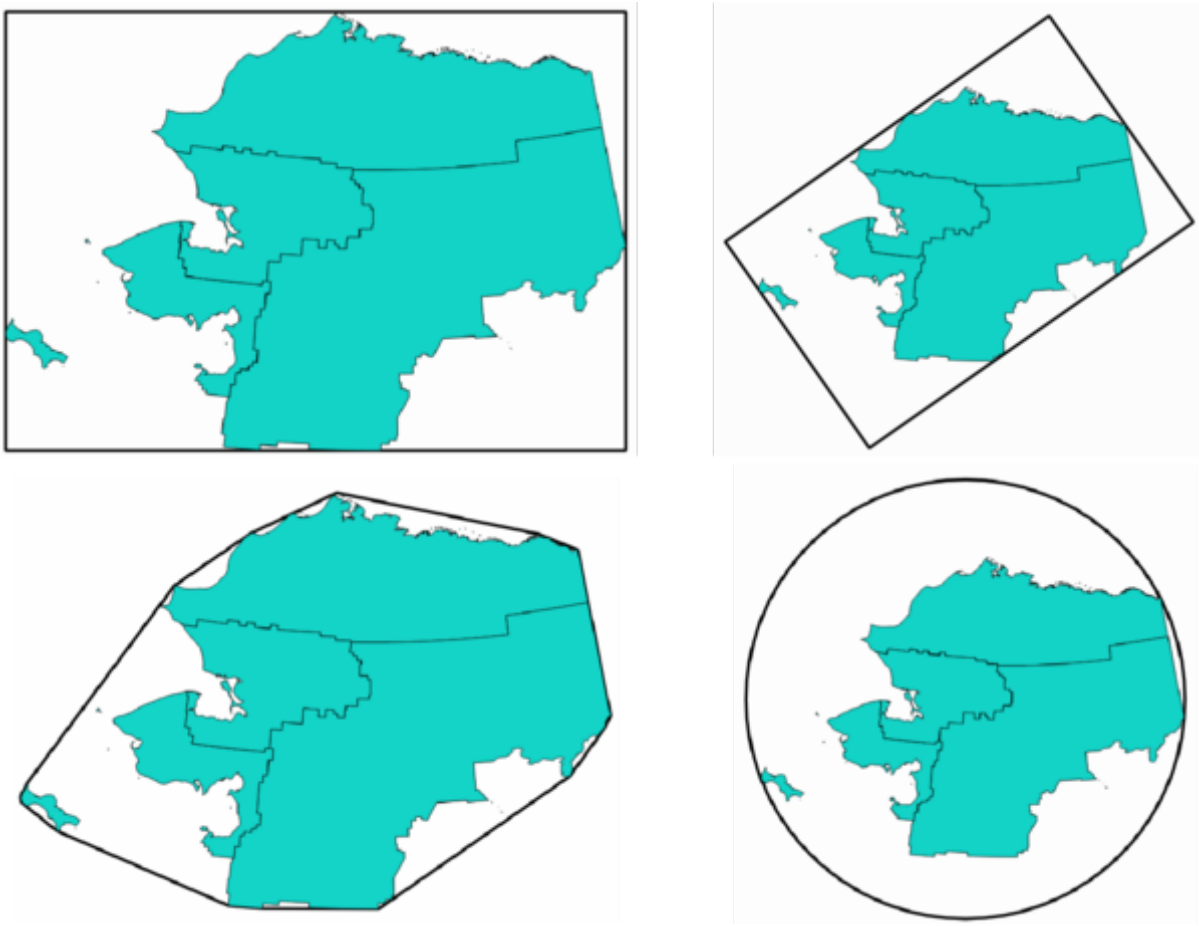


Figura24.66: Clockwise from top left: envelope, oriented rectangle, circle, convex hull

Ver também:

Minimum enclosing circles

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Field Opcional	`CAMPO`	[tablefield: any]	Features can be grouped by a field. If set, this causes the output layer to contain one feature per grouped value with a minimal geometry covering only the features with matching values.
Tipo de Geometria	`TIPO`	[enumeration] Padrão: 0	Enclosing geometry types. One of: • 0 — Envelope (Bounding Box) • 1 — Minimum Oriented Rectangle • 2 — Minimum Enclosing Circle • 3 — Convex Hull

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Tabela 24.107 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Bounding geometry	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output polygon vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Bounding geometry	`SAÍDA`	[vector: polygon]	The output (bounding) polygon vector layer.

Python code

Algorithm ID: `qgis:minimumboundinggeometry`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Minimum enclosing circles

Calculates the minimum enclosing circles of the features in the input layer.

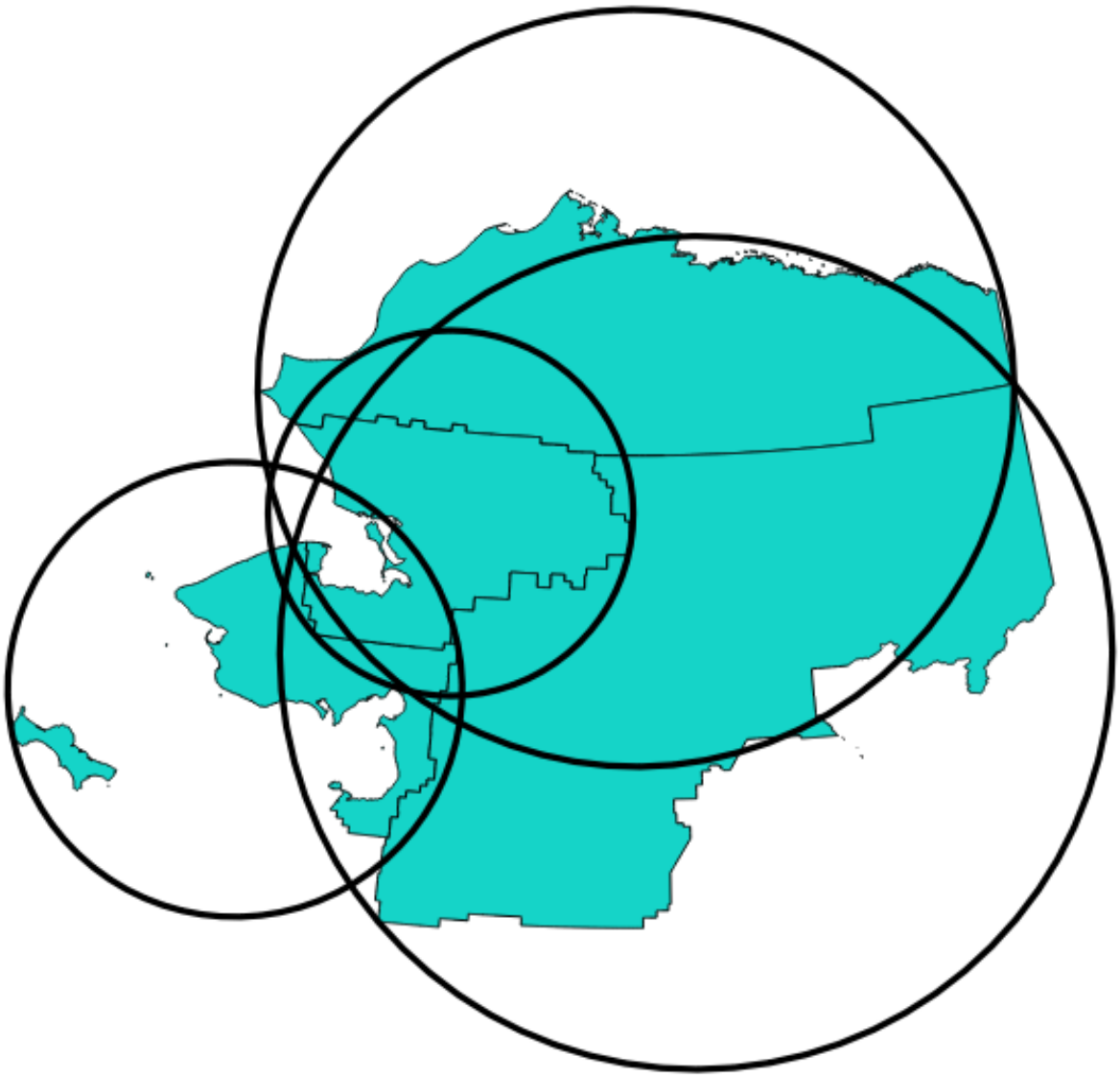


Figura24.67: Enclosing circles for each feature

Permite *features in-place modification*

Ver também:

Minimum bounding geometry

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Number of segment in circles	`SEGMENTOS`	[number] Default: 72	The number of segment used to approximate a circle. Minimum 8, maximum 100000.
Minimum enclosing circles	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output polygon vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Minimum enclosing circles	`SAÍDA`	[vector: polygon]	The output polygon vector layer.

Python code

Algorithm ID: `native:minimumenclosingcircle`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Multi-ring buffer (constant distance)

Computes multi-ring (*donut*) buffer for the features of the input layer, using a fixed or dynamic distance and number of rings.

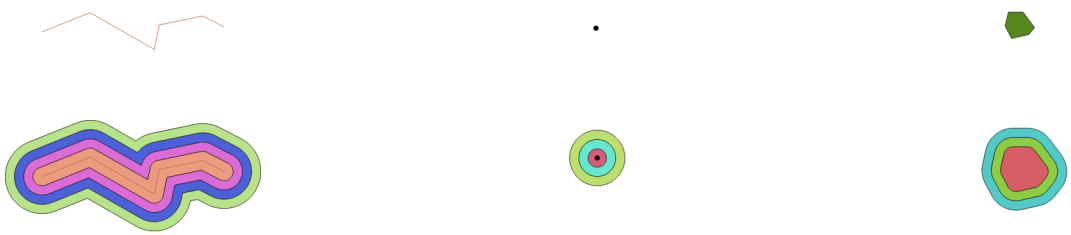


Figura24.68: Multi-ring buffer for a line, point and polygon layer

Permite *features in-place modification*

Ver também:

Buffer, *Variable distance buffer*, *Rectangles, ovals, diamonds*, *Single sided buffer*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Number of rings	`RINGS`	[number] Padrão: 1	The number of rings. It can be a unique value (same number of rings for all the features) or it can be taken from features data (the number of rings depends on feature values).
Distance between rings	`DISTÂNCIA`	[number] Padrão: 1.0	Distance between the rings. It can be a unique value (same distance for all the features) or it can be taken from features data (the distance depends on feature values).
Multi-ring buffer (constant distance)	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output polygon vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Multi-ring buffer (constant distance)	`SAÍDA`	[vector: polygon]	The output polygon vector layer.

Python code

Algorithm ID: `native:multiringconstantbuffer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Multipart to singleparts

Splits multipart features in the input layer into singlepart features.

The attributes of the output layer are the same as the original ones but divided into single features.



Figura24.69: Left the multipart source layer and right the single part output result

Permite *features in-place modification*

Default menu: *Vector ► Geometry Tools*

Ver também:

Collect geometries, *Promote to multipart*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Single parts	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output polygon vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Single parts	`SAÍDA`	[same as input]	A camada vetorial de saída.

Python code

Algorithm ID: `native:multiparttosingleparts`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Offset lines

Desloca as linhas por uma distância especificada. Distâncias positivas deslocarão as linhas à esquerda e distâncias negativas deslocarão as linhas à direita.

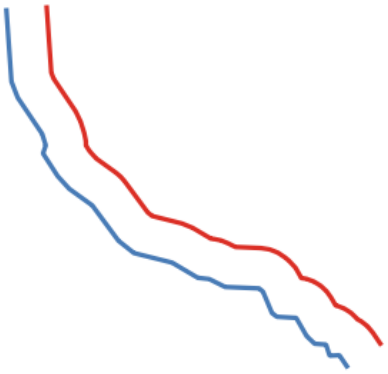


Figura24.70: In blue the source layer, in red the offset one

Permite *features in-place modification*

Ver também:

Array of offset (parallel) lines, *Translate*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Distance	`DISTÂNCIA`	[number] Padrão: 10.0	Offset distance. You can use the Data Defined button on the right to choose a field from which the radius will be calculated. This way you can have different radius for each feature (see *Variable distance buffer*).
Segmentos	`SEGMENTOS`	[number] Padrão: 8	Controls the number of line segments to use to approximate a quarter circle when creating rounded offsets.

continua na próxima página

Tabela 24.109 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Join style	`JOIN_STYLE`	[enumeration] Padrão: *0*	Specifies whether round, miter or beveled joins should be used when offsetting corners in a line. Options are: • 0 — Round • 1 — Miter • 2 — Bevel
Miter limit	`MITER_LIMIT`	[number] Padrão: 2.0	Controls the maximum distance from the offset curve to use when creating a mitered join (only applicable for miter join styles). Minimum: 1.
Offset	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Specify the output (offset) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Offset	`SAÍDA`	[vector: line]	Output (offset) line layer

Python code

Algorithm ID: `native:offsetline`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Oriented minimum bounding box

Calculates the minimum area rotated rectangle for each feature in the input layer.

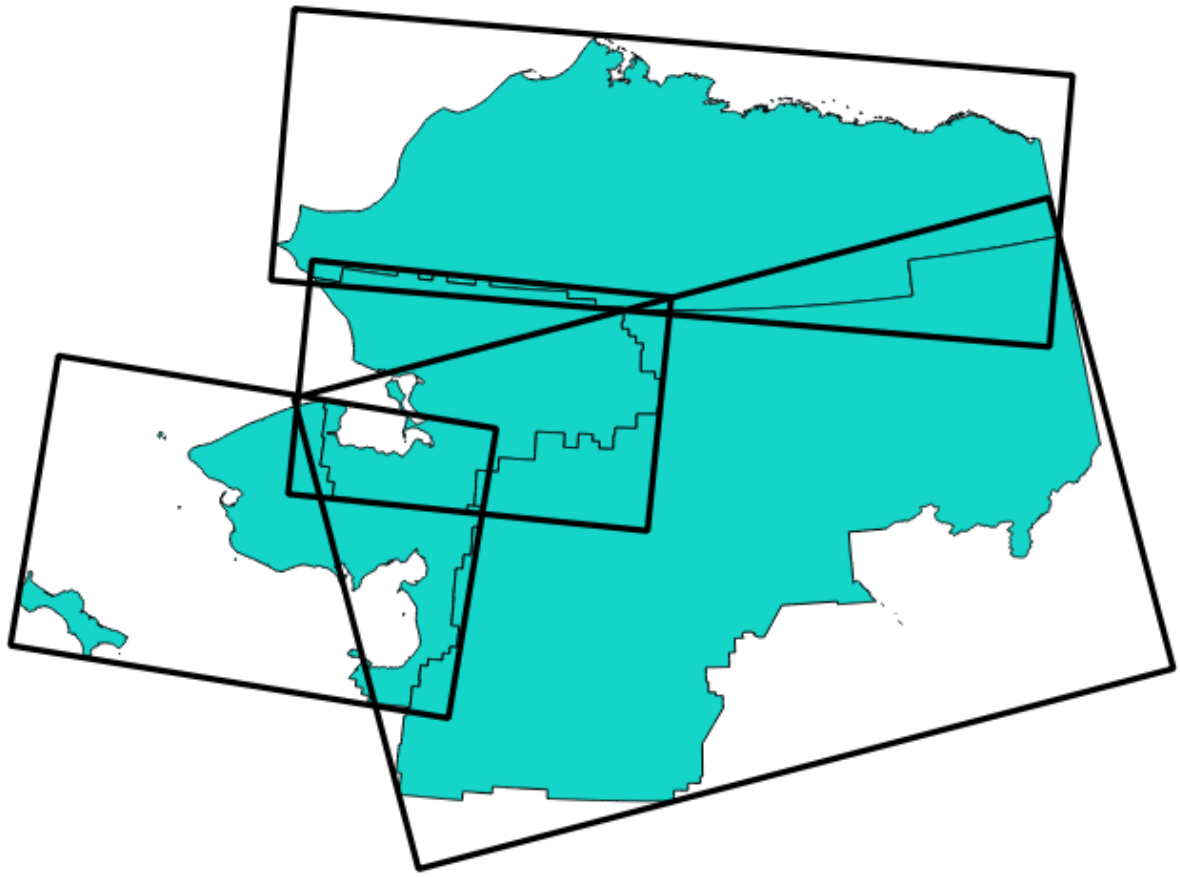


Figura24.71: Oriented minimum bounding box

Permite *features in-place modification*

Ver também:

Minimum bounding geometry

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Bounding boxes	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output polygon vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Bounding boxes	`SAÍDA`	[vector: polygon]	The output polygon vector layer.

Python code

Algorithm ID: `native:orientedminimumboundingbox`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Orthogonalize

Attempts to orthogonalize the geometries of the input line or polygon layer. This process shifts the vertices in the geometries to try to make every angle in the geometry either a right angle or a straight line.



Figura24.72: In blue the source layer and in the red orthogonalized result

Permite *features in-place modification*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Maximum angle tolerance (degrees)	`ANGLE_TOLERANCE`	[number] Padrão: 15	Specify the maximum deviation from a right angle or straight line a vertex can have for it to be adjusted. Smaller tolerances mean that only vertices which are already closer to right angles will be adjusted, and larger tolerances mean that vertices which deviate further from right angles will also be adjusted.
Maximum algorithm iterations	`MAX_ITERATIONS`	[number] Default: 1000	Setting a larger number for the maximum number of iterations will result in a more orthogonal geometry at the cost of extra processing time.
Orthogonalized	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output polygon vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Orthogonalized	`SAÍDA`	[same as input]	The output polygon vector layer with adjusted angles.

Python code

Algorithm ID: `native:orthogonalize`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Point on Surface

For each feature of the input layer, returns a point that is guaranteed to lie on the surface of the feature geometry.

Permite *features in-place modification*

Ver também:

Centroids

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Create point on surface for each part	`ANGLE_TOLERANCE`	[boolean]	If checked, a point will be created for each part of the geometry.
Point	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Specify the output point vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Point	`SAÍDA`	[vector: point]	The output point vector layer.

Python code

Algorithm ID: `native:pointonsurface`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Points along geometry

Creates points at regular intervals along line or polygon geometries. Created points will have new attributes added for the distance along the geometry and the angle of the line at the point.

An optional start and end offset can be specified, which controls how far from the start and end of the geometry the points should be created.

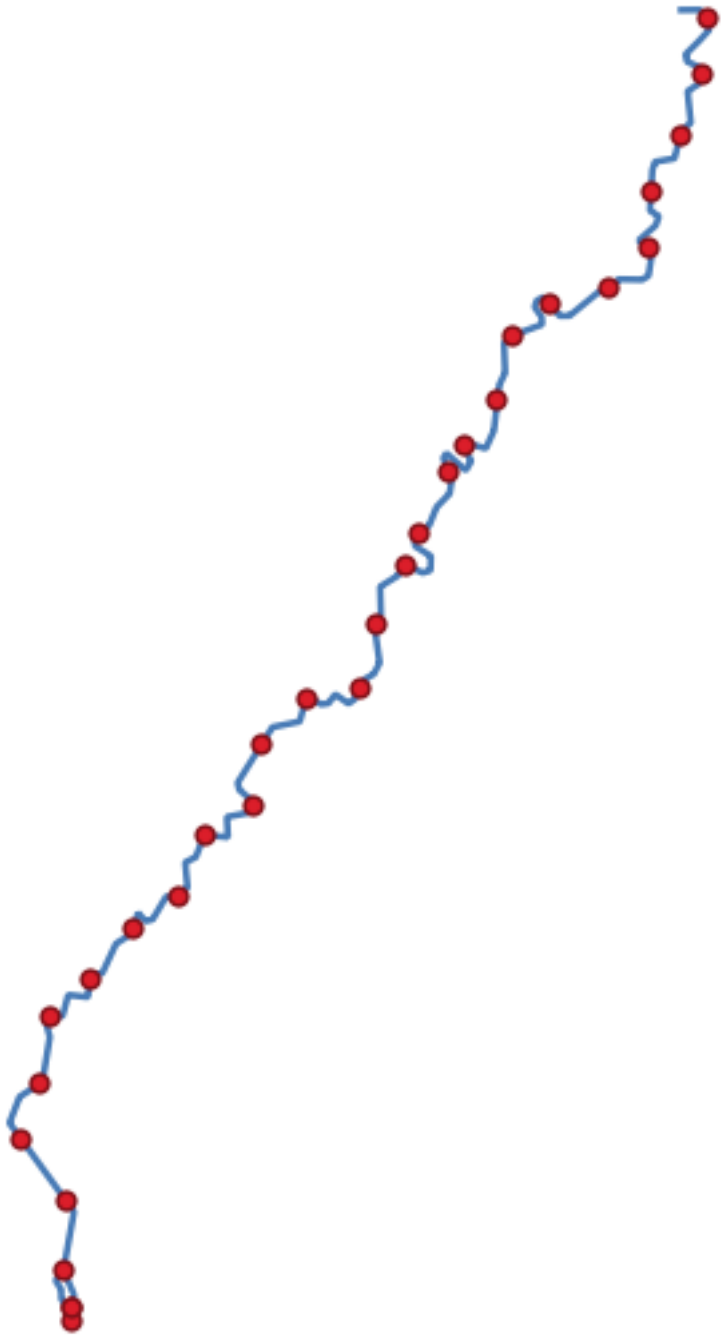


Figura24.73: Points created along the source line layer

Ver também:

Interpolate point on line

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Distance	`DISTÂNCIA`	[number] Padrão: 1.0	Distance between two consecutive points along the line
Start offset	`START_OFFSET`	[number] Padrão: 0.0	Distance from the beginning of the input line, representing the position of the first point.
End offset	`END_OFFSET`	[number] Padrão: 0.0	Distance from the end of the input line, representing the position beyond which no point feature shoud be created.
Interpolated points	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Interpolated points	`SAÍDA`	[vector: point]	Point vector layer with features placed along lines or polygon boundaries of the input layer.

Python code

Algorithm ID: `native:pointsalonglines`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Points displacement

Given a distance of proximity, identifies nearby point features and radially distributes them over a circle whose center represents their barycenter. A convenient tool to scatter overlaid features.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: point]	Input point vector layer
Minimum distance to other points	`PROXIMITY`	[number] Padrão: 1.0	Distance below which point features are considered close. Close features are distributed altogether.
Displacement distance	`DISTÂNCIA`	[number] Padrão: 1.0	Radius of the circle on which close features are placed
Horizontal distribution for two point case	`HORIZONTAL`	[boolean] Padrão: Falso	When only two points are identified as close, aligns them horizontally on the circle instead of vertically.
Displaced	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Displaced	`SAÍDA`	[vector: point]	Output point vector layer

Python code

Algorithm ID: `qgis:pointsdisplacement`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Pole of inaccessibility

Calculates the pole of inaccessibility for a polygon layer, which is the most distant internal point from the boundary of the surface.

This algorithm uses the 'polylabel' algorithm (Vladimir Agafonkin, 2016), which is an iterative approach guaranteed to find the true pole of inaccessibility within a specified tolerance. A more precise tolerance (lower value) requires more iterations and will take longer to calculate.

The distance from the calculated pole to the polygon boundary will be stored as a new attribute in the output layer.



Figura24.74: Pole of inaccessibility

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: polygon]	Camada vetorial de entrada
Tolerance	`TOLERANCE`	[number] Padrão: 1.0	Set the tolerance for the calculation
Point	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Specify the output polygon vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Point	`SAÍDA`	[vector: point]	The output point vector layer

Python code

Algorithm ID: `native:poleofinaccessibility`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Polygonize

Creates a polygon layer whose features boundaries are generated from a line layer of **closed** features.

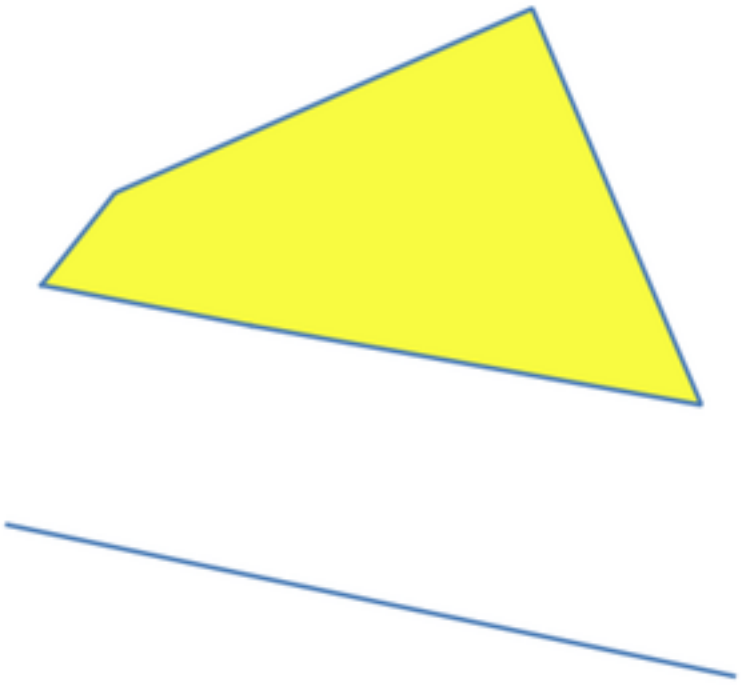


Figura24.75: The yellow polygons generated from the closed lines

Nota: The line layer must have closed shapes in order to be transformed into a polygon.

Ver também:

Polygons to lines, *Lines to polygons*, *Convert geometry type*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Keep table structure of line layer Opcional	`KEEP_FIELDS`	[boolean] Padrão: Falso	Check to keep the fields (only the table structure, not the values) of the input layer
Polygons from lines	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output polygon vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Polygons from lines	`SAÍDA`	[vector: polygon]	The output polygon vector layer from lines

Python code

Algorithm ID: `native:polygonize`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Polygons to lines

Takes a polygon layer and creates a line layer, with lines representing the boundaries of the polygons in the input layer.

The attribute table of the output layer is the same as the one of the input layer.



Figura24.76: Black lines as the result of the algorithm

Default menu: *Vector ► Geometry Tools*

Ver também:

Lines to polygons, *Polygonize*, *Convert geometry type*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: polygon]	Input polygon vector layer
Linhas	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Specify the output line vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Linhas	`SAÍDA`	[vector: line]	The output line vector layer from polygons

Python code

Algorithm ID: `native:polygonstolines`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Project points (Cartesian)

Projects point geometries by a specified distance and bearing (azimuth).

Permite *features in-place modification*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: point]	Input point vector layer
Bearing (degrees from North)	`BEARING`	[number] Padrão: 0.0	Clockwise angle starting from North, in degree (°) unit

continua na próxima página

Tabela 24.113 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Distance	`DISTÂNCIA`	[number] Padrão: 1.0	Distance to offset geometries, in layer units
Projected	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Specify the output point vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Projected	`SAÍDA`	[vector: point]	The output (projected) point vector layer

Python code

Algorithm ID: `native:projectpointcartesian`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Promote to multipart

Takes a vector layer with singlepart geometries and generates a new one in which all geometries are multipart.

Input features which are already multipart features will remain unchanged.

This algorithm can be used to force geometries to multipart types in order to be compatible with data providers that require multipart features.

Permite *features in-place modification*

Ver também:

Aggregate, *Collect geometries*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Multiparts	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output multipart vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Multiparts	`SAÍDA`	[same as input]	The output multipart vector layer

Python code

Algorithm ID: `native:promotetomulti`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Rectangles, ovals, diamonds

Creates a buffer area with a rectangle, oval or diamond shape for each feature of the input point layer.

The shape parameters can be fixed for all features or dynamic using a field or an expression.



Figura24.77: Different buffer shapes with dynamic parameters

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: point]	Input point vector layer
Buffer shape	`SHAPE`	[enumeration]	The shape to use. One of: • 0 — Rectangles • 1 — Ovals • 2 — Diamonds
Width	`LARGURA`	[number] Padrão: 1.0	Width of the buffer shape
Height	`ALTURA`	[number] Padrão: 1.0	Height of the buffer shape
Rotation Opcional	`ROTAÇÃO`	[number] Padrão: Nenhum	Rotation of the buffer shape
Number of segment	`SEGMENTOS`	[number] Default: 36	Number of segments for a full circle (*Ovals* shape)
Saída	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Saída	`SAÍDA`	[vector: polygon]	The output vector layer (with the buffer shapes)

Python code

Algorithm ID: `native:rectanglesovalsdiamonds`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Remove duplicate vertices

Removes duplicate vertices from features, wherever removing the vertices does not result in a degenerate geometry.

The tolerance parameter specifies the tolerance for coordinates when determining whether vertices are identical.

By default, Z values are not considered when detecting duplicate vertices. E.g. two vertices with the same X and Y coordinate but different Z values will still be considered duplicate and one will be removed. If the *Use Z Value* parameter is true, then the Z values are also tested and vertices with the same X and Y but different Z will be maintained.

Nota: Duplicate vertices are not tested between different parts of a multipart geometry, e.g. a multipoint geometry with overlapping points will not be changed by this method.

 Permite *features in-place modification*

Ver também:

Extract vertices, *Extract specific vertices*, *Delete duplicate geometries*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Tolerance	`TOLERANCE`	[number ] Default: 0.000001	Vertices closer than the specified distance are considered duplicates
Use Z value	`USE_Z_VALUE`	[boolean ] Padrão: Falso	If the *Use Z Value* parameter is true, then the Z values are also tested and vertices with the same X and Y but different Z will be maintained.
Cleaned	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Cleaned	`SAÍDA`	[same as input]	The output vector layer (without duplicate vertices)

Python code

Algorithm ID: `native:removeduplicatevertices`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Remove null geometries

Removes any features which do not have a geometry from a vector layer. All other features will be copied unchanged.

The features with null geometries can be saved to a separate layer.

If *Also remove empty geometries* is checked, the algorithm removes features whose geometries have no coordinates, i.e., geometries that are empty. In that case, also the null output will reflect this option, containing both null and empty geometries.

Ver também:

Delete duplicate geometries

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Input vector layer (with non-NULL geometries)
Also remove empty geometries	`REMOVE_EMPTY`	[boolean]	
Non null geometries	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer for the non-NULL (and non-empty) geometries. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Null geometries	`NULL_OUTPUT`	[same as input] Default: `[Skip output]`	Specify the output vector layer for the NULL (and empty) geometries. One of: • Ignorar Saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Null geometries	`NULL_OUTPUT`	[same as input]	Output vector layer (for NULL and, if chosen, empty geometries)
Non null geometries	`SAÍDA`	[same as input]	The output vector layer (without NULL and, if chosen, empty geometries)

Python code

Algorithm ID: `native:removenullgeometries`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Reverse line direction

Inverts the direction of a line layer.

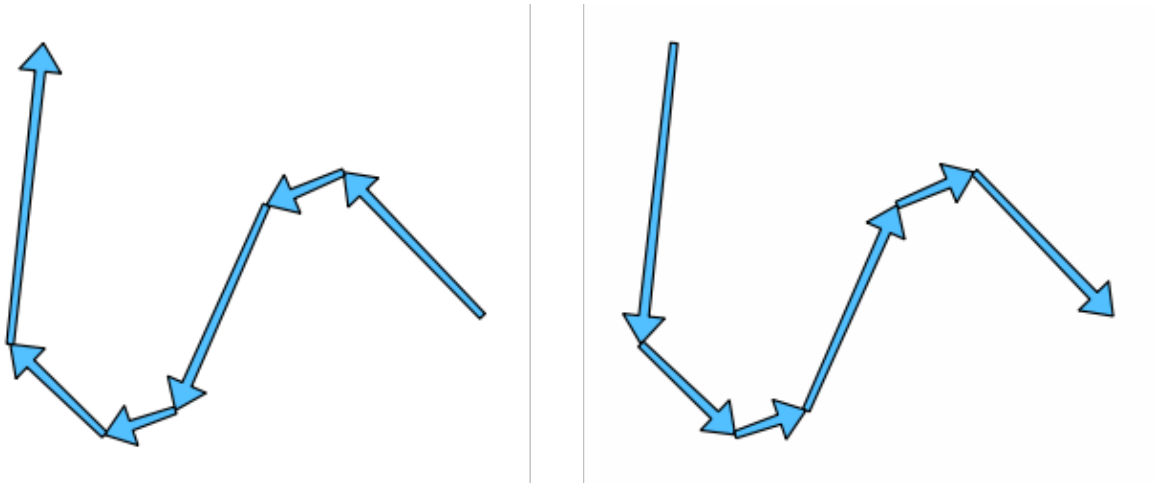


Figura24.78: Before and after the direction inversion

Permite *features in-place modification*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Reversed	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Specify the output line vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Reversed	`SAÍDA`	[vector: line]	The output line vector layer (with reversed lines)

Python code

Algorithm ID: `native:reverselinedirection`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Rotate

Rotates feature geometries by the specified angle clockwise. The rotation occurs around each feature's centroid, or optionally around a unique preset point.

Permite *features in-place modification*

Ver também:

Translate, *Swap X and Y coordinates*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Rotation (degrees clockwise)	`ÂNGULO`	[number] Padrão: 0.0	Angle of the rotation in degrees
Rotation anchor point (x, y) Opcional	`ANCHOR`	[point] Padrão: Nenhum	X,Y coordinates of the point to rotate the features around. If not set the rotation occurs around each feature's centroid.
Rotated	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer (with rotated geometries). One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Rotated	`SAÍDA`	[same as input]	The output vector layer with rotated geometries

Python code

Algorithm ID: `native:rotatefeatures`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Segmentize by maximum angle

Segmentizes a geometry by converting curved sections to linear sections.

The segmentization is performed by specifying the maximum allowed radius angle between vertices on the straightened geometry (e.g the angle of the arc created from the original arc center to consecutive output vertices on the linearized geometry). Non-curved geometries will be retained without change.

Ver também:

Segmentize by maximum distance, *Simplify*, *Smooth*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Maximum angle between vertices (degrees)	`ÂNGULO`	[number] Default: 5.0	Maximum allowed radius angle between vertices on the straightened geometry
Segmentized	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer (with segmentized geometries). One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Segmentized	`SAÍDA`	[same as input]	The output vector layer with segmentized geometries

Python code

Algorithm ID: `native:segmentizebymaxangle`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Segmentize by maximum distance

Segmentizes a geometry by converting curved sections to linear sections.

The segmentization is performed by specifying the maximum allowed offset distance between the original curve and the segmentized representation. Non-curved geometries will be retained without change.

Ver também:

Segmentize by maximum angle, *Simplify*, *Smooth*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Maximum offset distance	`DISTÂNCIA`	[number] Padrão: 1.0	Maximum allowed offset distance between the original curve and the segmentized representation, in the layer units.
Segmentized	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer (with segmentized geometries). One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Segmentized	`SAÍDA`	[same as input]	The output vector layer with segmentized geometries

Python code

Algorithm ID: `native:segmentizebymaxdistance`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Set M value

Sets the M value for geometries in a layer.

If M values already exist in the layer, they will be overwritten with the new value. If no M values exist, the geometry will be upgraded to include M values and the specified value used as the initial M value for all geometries.

Dica: Use the Identify Features button to check the added M value: the results are available in the *Identify Results* dialog.

Ver também:

Set M value from raster, *Set Z value*, *Drop M/Z values*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
M Value	`M_VALUE`	[number] Padrão: 0.0	M value to assign to the feature geometries
M Added	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
M Added	`SAÍDA`	[same as input]	The output vector layer (with M values assigned to the geometries)

Python code

Algorithm ID: `native:setmvalue`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Set M value from raster

Uses values sampled from a band within a raster layer to set the M value for every overlapping vertex in the feature geometry. The raster values can optionally be scaled by a preset amount.

If M values already exist in the layer, they will be overwritten with the new value. If no M values exist, the geometry will be upgraded to include M values.

Ver também:

Drape (set Z value from raster), *Set M value*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Camada raster	`RASTER`	[raster]	Raster layer with M values
Band number	`BAND`	[raster band] Padrão: 1	The raster band from which the M values are taken
Value for no-data or non-intersecting vertices	`NODATA`	[number] Default: 0.0	Value to use in case the vertex does not intersect (a valid pixel of) the raster
Scale factor	`ESCALA`	[number] Padrão: 1.0	Scaling value: the band values are multiplied by this value.
Updated	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer (with updated M values). One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Updated	`SAÍDA`	[same as input]	The output vector layer (with updated M values)

Python code

Algorithm ID: `native:setmfromraster`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Set Z value

Sets the Z value for geometries in a layer.

If Z values already exist in the layer, they will be overwritten with the new value. If no Z values exist, the geometry will be upgraded to include Z values and the specified value used as the initial Z value for all geometries.

Dica: Use the Identify Features button to check the added Z value: the results are available in the *Identify Results* dialog.

Ver também:

Drape (set Z value from raster), *Set M value*, *Drop M/Z values*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Z Value	`Z_VALUE`	[number] Padrão: 0.0	Z value to assign to the feature geometries
Z Added	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Z Added	`SAÍDA`	[same as input]	The output vector layer (with Z values assigned)

Python code

Algorithm ID: `native:setzvalue`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Simplify

Simplifies the geometries in a line or polygon layer. It creates a new layer with the same features as the ones in the input layer, but with geometries containing a lower number of vertices.

The algorithm gives a choice of simplification methods, including distance based (the “Douglas-Peucker” algorithm), area based (“Visvalingam” algorithm) and snapping geometries to grid.



Figura24.79: Clockwise from top left: source layer and increasing simplification tolerances

Permite *features in-place modification*

Default menu: *Vector* ► *Geometry Tools*

Ver também:

Smooth, *Densify by count*, *Densify by interval*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Simplification method	`MÉTODO`	[enumeration] Padrão: 0	Simplification method. One of: • 0 — Distance (Douglas-Peucker) • 1 — Snap to grid • 2 — Area (Visvalingam)
Tolerance	`TOLERANCE`	[number] Padrão: 1.0	Threshold tolerance (in units of the layer): if the distance between two nodes is smaller than the tolerance value, the segment will be simplified and vertices will be removed.
Simplified	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output (simplified) vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Simplified	`SAÍDA`	[same as input]	The output (simplified) vector layer

Python code

Algorithm ID: `native:simplifygeometries`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Single sided buffer

Computes a buffer on lines by a specified distance on one side of the line only.

Buffer always results in a polygon layer.



Figura24.80: Left versus right side buffer on the same vector line layer

Ver também:

Buffer

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Distance	`DISTÂNCIA`	[number] Padrão: 10.0	Buffer distance.
Side	`SIDE`	[enumeration]	Which side to create the buffer on. One of: • 0 – Left • 1 – Right
Segmentos	`SEGMENTOS`	[number] Padrão: 8	Controls the number of line segments to use to approximate a quarter circle when creating rounded offsets.
Join style	`JOIN_STYLE`	[enumeration]	Specifies whether round, miter or beveled joins should be used when offsetting corners in a line. Options are: • 0 — Round • 1 — Miter • 2 — Bevel
Miter limit	`MITER_LIMIT`	[number] Padrão: 2.0	Controls the maximum distance from the offset curve to use when creating a mitered join (only applicable for miter join styles). Minimum: 1.0

continua na próxima página

Tabela 24.119 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Buffer	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output (buffer) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Buffer	`SAÍDA`	[vector: polygon]	Output (buffer) polygon layer

Python code

Algorithm ID: `native:singlesidedbuffer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Smooth

Smooths the geometries in a line or polygon layer by adding more **vertices and corners** to the feature geometries.

The iterations parameter dictates how many smoothing iterations will be applied to each geometry. A higher number of iterations results in smoother geometries with the cost of greater number of nodes in the geometries.



Figura24.81: Increasing number of iterations causes smoother geometries

The offset parameter controls how “tightly” the smoothed geometries follow the original geometries. Smaller values results in a tighter fit, and larger values will create a looser fit.

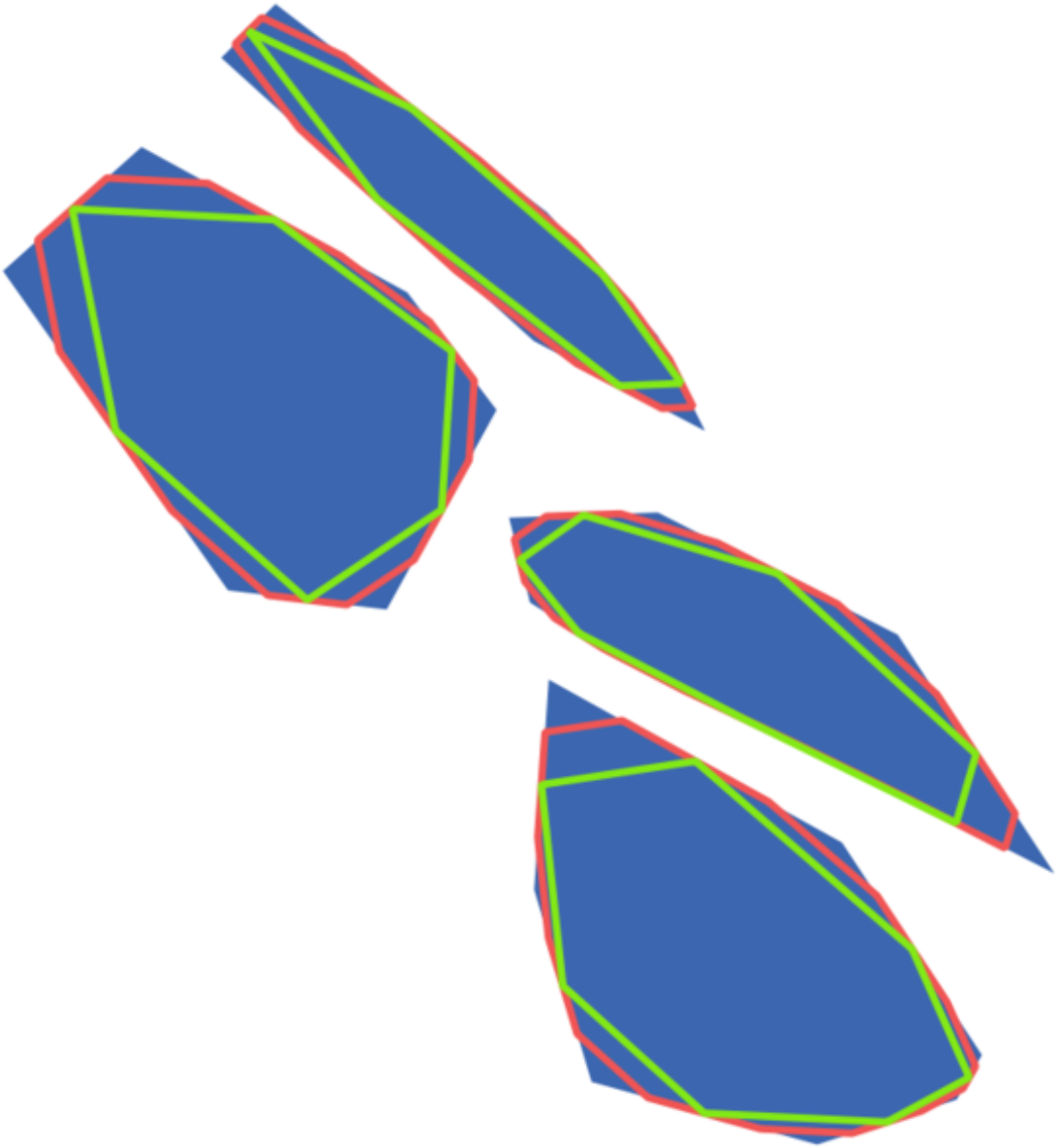


Figura24.82: Blue: the input layer. Offset 0.25 gives the red line, while offset 0.50 gives the green line.

The maximum angle parameter can be used to prevent smoothing of nodes with large angles. Any node where the angle of the segments to either side is larger than this will not be smoothed. For example, setting the maximum angle to 90 degrees or lower would preserve right angles in the geometry.

Permite *features in-place modification*

Ver também:

Simplify, *Densify by count*, *Densify by interval*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Input line or polygon vector layer
Iterations	`ITERAÇÕES`	[number] Padrão: 1	Increasing the number of iterations will give smoother geometries (and more vertices).
Offset	`OFFSET`	[number] Default: 0.25	Increasing values will *move* the smoothed lines / boundaries further away from the input lines / boundaries.
Maximum node angle to smooth	`MAX_ANGLE`	[number] Default: 180.0	Every node below this value will be smoothed
Smoothed	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output (smoothed) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Smoothed	`SAÍDA`	[same as input]	Output (smoothed) vector layer

Python code

Algorithm ID: `native:smoothgeometry`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Snap geometries to layer

Snaps the geometries in a layer either to the geometries from another layer, or to geometries within the same layer.

Matching is done based on a tolerance distance, and vertices will be inserted or removed as required to make the geometries match the reference geometries.

Ver também:

Snap points to grid

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Camada de referência	`REFERENCE_LAYER`	[vector: any]	Vector layer to snap to
Tolerance	`TOLERANCE`	[number] Padrão: 10.0	Control how close input vertices need to be to the reference layer geometries before they are snapped.
Behavior	`BEHAVIOR`	[enumeration] Padrão: 0	Snapping can be done to an existing node or a segment (its closest point to the vertex to move). Available snapping options: • 0 — Prefer aligning nodes, insert extra vertices where required Prefer to snap to nodes, even when a segment may be closer than a node. New nodes will be inserted to make geometries follow each other exactly when inside allowable tolerance. • 1 — Prefer closest point, insert extra vertices where required Snap to closest point, regardless of it is a node or a segment. New nodes will be inserted to make geometries follow each other exactly when inside allowable tolerance. • 2 — Prefer aligning nodes, don't insert new vertices Prefer to snap to nodes, even when a segment may be closer than a node. No new nodes will be inserted. • 3 — Prefer closest point, don't insert new vertices Snap to closest point, regardless of it is a node or a segment. No new nodes will be inserted. • 4 — Move end points only, prefer aligning nodes Only snap start/end points of lines (point features will also be snapped, polygon features will not be modified), prefer to snap to nodes. • 5 — Move end points only, prefer closest point Only snap start/end points of lines (point features will also be snapped, polygon features will not be modified), snap to closest point • 6 — Snap end points to end points only Only snap the start/end points of lines to other start/end points of lines • 7 — Snap to anchor nodes (single layer only)

continua na próxima página

Tabela 24.121 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Snapped geometry	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output (snapped) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Snapped geometry	`SAÍDA`	[same as input]	Output (snapped) vector layer

Python code

Algorithm ID: `native:snapgeometries`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Snap points to grid

Modifies the coordinates of geometries in a vector layer, so that all points or vertices are snapped to the closest point of a grid.

If the snapped geometry cannot be calculated (or is totally collapsed) the feature's geometry will be cleared.

Snapping can be performed on the X, Y, Z or M axis. A grid spacing of 0 for any axis will disable snapping for that axis.

Nota: Snapping to grid may generate an invalid geometry in some corner cases.

 Permite *features in-place modification*

Ver também:

Snap geometries to layer

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
X Grid Spacing	`HSPACING`	[number] Padrão: 1.0	Grid spacing on the X axis
Y Grid Spacing	`VSPACING`	[number] Padrão: 1.0	Grid spacing on the Y axis
Z Grid Spacing	`ZSPACING`	[number] Padrão: 0.0	Grid spacing on the Z axis
M Grid Spacing	`MSPACING`	[number] Padrão: 0.0	Grid spacing on the M axis
Snapped	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output (snapped) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Snapped	`SAÍDA`	[same as input]	Output (snapped) vector layer

Python code

Algorithm ID: `native:snappointstogrid`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Split lines by maximum length

Takes a line (or curve) layer and splits each feature into multiple parts, where each part is of a specified maximum length. Z and M values at the start and end of the new line substrings are linearly interpolated from existing values.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	The input line vector layer
Maximum line length	`LENGTH`	[number] Padrão: 10.0	The maximum length of a line in the output.
Split	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Specify the output line vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Split	`SAÍDA`	[vector: line]	The new line vector layer - the length of the feature geometries is less than or equal to the length specified in the LENGTH parameter.

Python code

Algorithm ID: `native:splitlinesbylength`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Subdivide

Subdivides the geometry. The returned geometry will be a collection containing subdivided parts from the original geometry, where no part has more than the specified maximum number of nodes.

This is useful for dividing a complex geometry into less complex parts, easier to spatially index and faster to perform spatial operations. Curved geometries will be segmentized before subdivision.

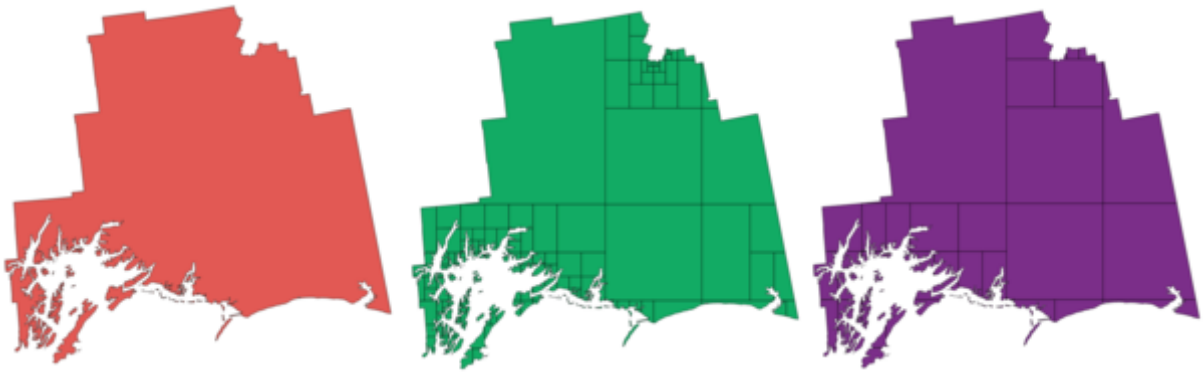


Figura24.83: Left the input layer, middle maximum nodes value is 100 and right maximum value is 200

Nota: Subdividing a geometry can generate geometry parts that may not be valid and may contain self-intersections.

Permite *features in-place modification*

Ver também:

Explode lines, *Line substring*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada vetorial de entrada
Maximum nodes in parts	`MAX_NODES`	[number] Padrão: 256	Maximum number of vertices each new geometry part is allowed to have. Fewer *subparts* for higher values.
Subdivided	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output (subdivided) vector layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Subdivided	`SAÍDA`	[same as input]	Output vector layer

Python code

Algorithm ID: `native:subdivide`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Swap X and Y coordinates

Switches the X and Y coordinate values in input geometries.

It can be used to repair geometries which have accidentally had their latitude and longitude values reversed.

Permite *features in-place modification*

Ver também:

Translate, *Rotate*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada vetorial de entrada
Swapped	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Swapped	`SAÍDA`	[same as input]	Output (swapped) vector layer

Python code

Algorithm ID: `native:swapxy`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Tapered buffers

Creates tapered buffer along line geometries, using a specified start and end buffer diameter.

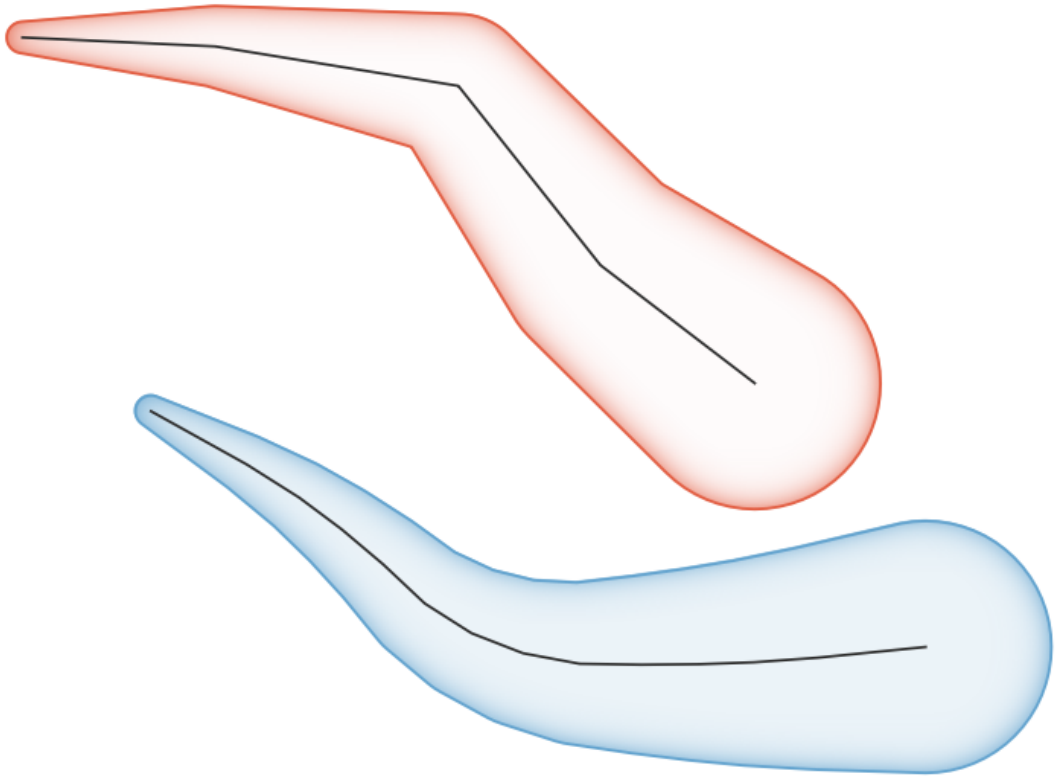


Figura24.84: Tapered buffer example

Ver também:

Variable width buffer (by M value), *Buffer*, *Create wedge buffers*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Start width	`START_WIDTH`	[number] Padrão: 0.0	Represents the radius of the buffer applied at the start point of the line feature
End width	`END_WIDTH`	[number] Padrão: 0.0	Represents the radius of the buffer applied at the end point of the line feature.
Segmentos	`SEGMENTOS`	[number] Default: 16	Controls the number of line segments to use to approximate a quarter circle when creating rounded offsets.

continua na próxima página

Tabela 24.123 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Buffered	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output (buffer) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Buffered	`SAÍDA`	[vector: polygon]	Output (buffer) polygon layer

Python code

Algorithm ID: `native:taperedbuffer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Tessellate

Tessellates a polygon geometry layer, dividing the geometries into triangular components.

The output layer consists of multipolygon geometries for each input feature, with each multipolygon consisting of multiple triangle component polygons.

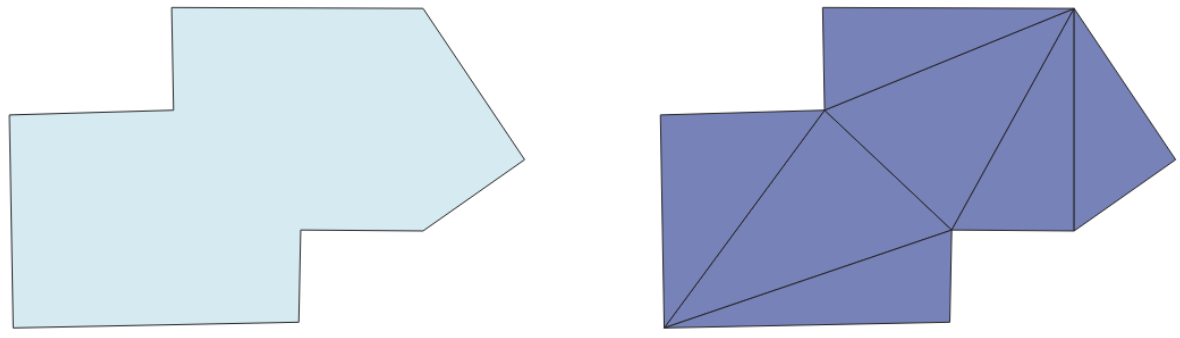


Figura24.85: Tessellated polygon (right)

Permite *features in-place modification*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: polygon]	Input polygon vector layer
Tesselated	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Especifique a camada da linha de saída. Um de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Tesselated	`SAÍDA`	[vector: polygon]	Output multipolygonZ layer

Python code

Algorithm ID: `3d:tessellate`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Transect

Creates transects on vertices for (multi)linestring.

A transect is a line oriented from an angle (by default perpendicular) to the input polylines (at vertices).

Field(s) from feature(s) are returned in the transect with these new fields:

- TR_FID: ID of the original feature
- TR_ID: ID of the transect. Each transect have an unique ID
- TR_SEGMENT: ID of the segment of the linestring
- TR_ANGLE: Angle in degrees from the original line at the vertex
- TR_LENGTH: Total length of the transect returned
- TR_ORIENT: Side of the transect (only on the left or right of the line, or both side)

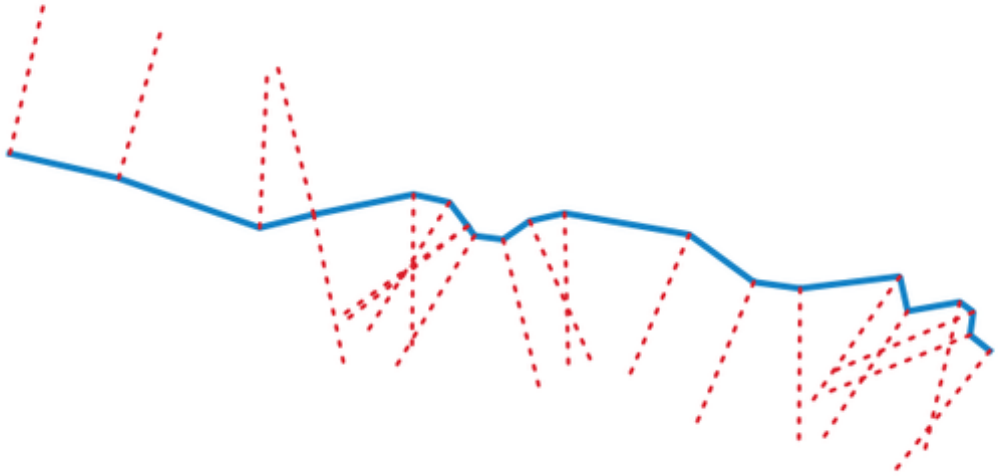


Figura24.86: Dashed red lines represent the transect of the input line layer

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Length of the transect	`LENGTH`	[number] Default: 5.0	Length in map unit of the transect
Angle in degrees from the original line at the vertices	`ÂNGULO`	[number] Default: 90.0	Change the angle of the transect
Side to create the transect	`SIDE`	[enumeration]	Choose the side of the transect. Available options are: • 0 — Left • 1 — Right • 2 — Both
Transect	`SAÍDA`	[vector: line] Default: `[Create temporary layer]`	Especifique a camada da linha de saída. Um de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Transect	`SAÍDA`	[vector: line]	Output line layer

Python code

Algorithm ID: `native:transect`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Translate

Moves the geometries within a layer, by offsetting with a predefined X and Y displacement.

Z and M values present in the geometry can also be translated.

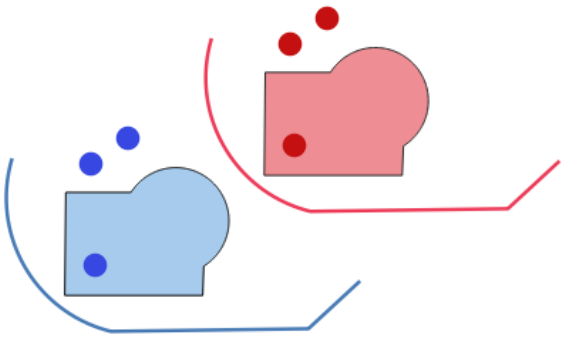


Figura24.87: Dashed lines represent the translated geometry of the input layer

Permite *features in-place modification*

Ver também:

Array of translated features, *Offset lines*, *Rotate*, *Swap X and Y coordinates*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Offset distance (x-axis)	`DELTA_X`	[number] Padrão: 0.0	Delocamento a ser aplicado ao eixo X
Offset distance (y-axis)	`DELTA_Y`	[number] Padrão: 0.0	Delocamento a ser aplicado ao eixo Y

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Tabela 24.125 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Offset distance (z-axis)	`DELTA_Z`	[number] Padrão: 0.0	Displacement to apply on the Z axis
Offset distance (m values)	`DELTA_M`	[number] Padrão: 0.0	Displacement to apply on the M axis
Traduzido	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Traduzido	`SAÍDA`	[same as input]	Output vector layer

Python code

Algorithm ID: `native:translategeometry`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Variable distance buffer

Computes a buffer area for all the features in an input layer.

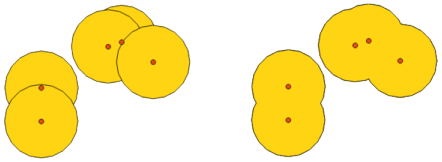
The size of the buffer for a given feature is defined by an attribute, so it allows different features to have different buffer sizes.

Nota: Este algoritmo só está disponível em *Graphical modeler*.

Ver também:

Buffer

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Distance field	`DISTÂNCIA`	[tablefield: numeric]	Attribute for the distance radius of the buffer
Segmentos	`SEGMENTOS`	[number] Padrão: *5*	Controls the number of line segments to use to approximate a quarter circle when creating rounded offsets.
Dissolve result	`DISSOLVER`	[boolean] Padrão: *Falso*	Choose to dissolve the final buffer, resulting in a single feature covering all input features.  Figura24.88: Normal and dissolved buffer
End cap style	`END_CAP_STYLE`	[enumeration]	Controls how line endings are handled in the buffer.  Figura24.89: Round, flat and square cap styles
Join style	`JOIN_STYLE`	[enumeration]	Specifies whether round, miter or beveled joins should be used when offsetting corners in a line.
Miter limit	`MITER_LIMIT`	[number] Padrão: 2.0	Only applicable for mitered join styles, and controls the maximum distance from the offset curve to use when creating a mitered join.

Saídas

Etiqueta	Nome	Tipo	Descrição
Buffer	`SAÍDA`	[vector: polygon]	Buffer polygon vector layer.

Python code

Algorithm ID: `qgis:variabledistancebuffer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Variable width buffer (by M value)

Creates variable width buffers along lines, using the M value of the line geometries as the diameter of the buffer at each vertex.

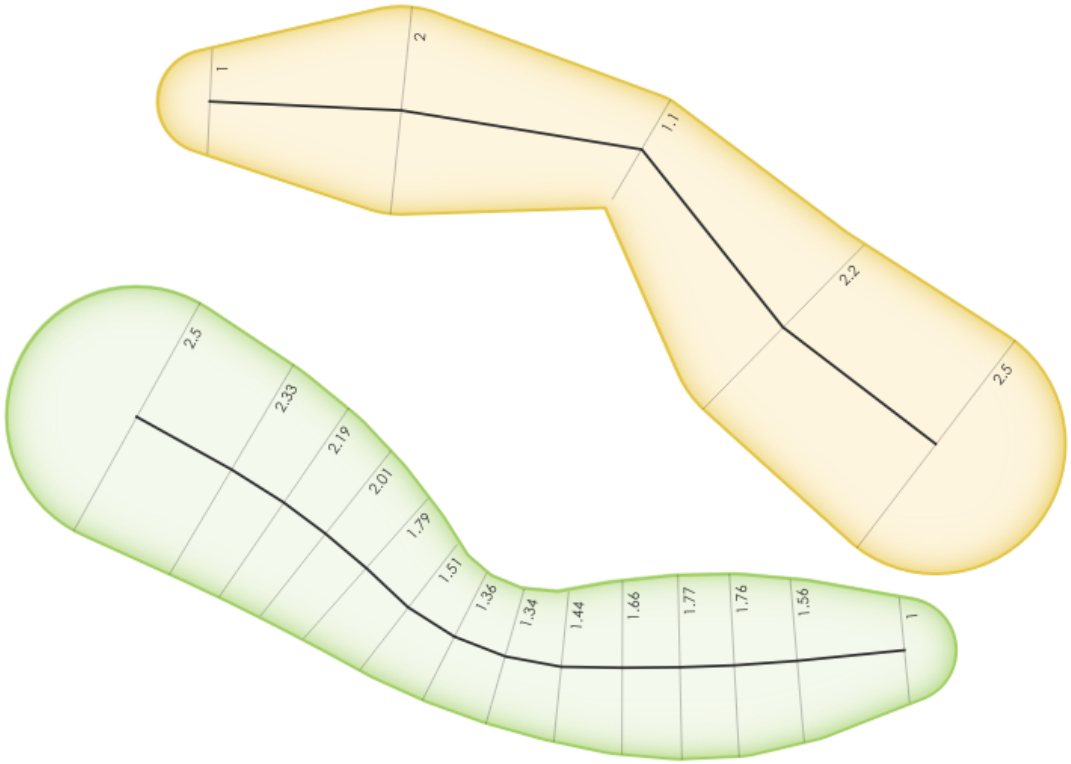


Figura24.90: Variable buffer example

Ver também:

Tapered buffers, *Buffer*, *Set M value*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line vector layer
Segmentos	`SEGMENTOS`	[number] Default: 16	Number of the buffer segments per quarter circle. It can be a unique value (same value for all the features), or it can be taken from features data (the value can depend on feature attributes).
Buffered	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output (buffer) layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Buffered	`SAÍDA`	[vector: polygon]	Variable buffer polygon layer

Python code

Algorithm ID: `native:bufferbym`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Polígonos de Voronoi

cria uma camada de pontos e gera uma camada de polígonos contendo os polígonos de Voronoi (também conhecidos como polígonos de Thiessen) correspondentes a esses pontos de entrada.

Any location within a Voronoi polygon is closer to the associated point than to any other point.

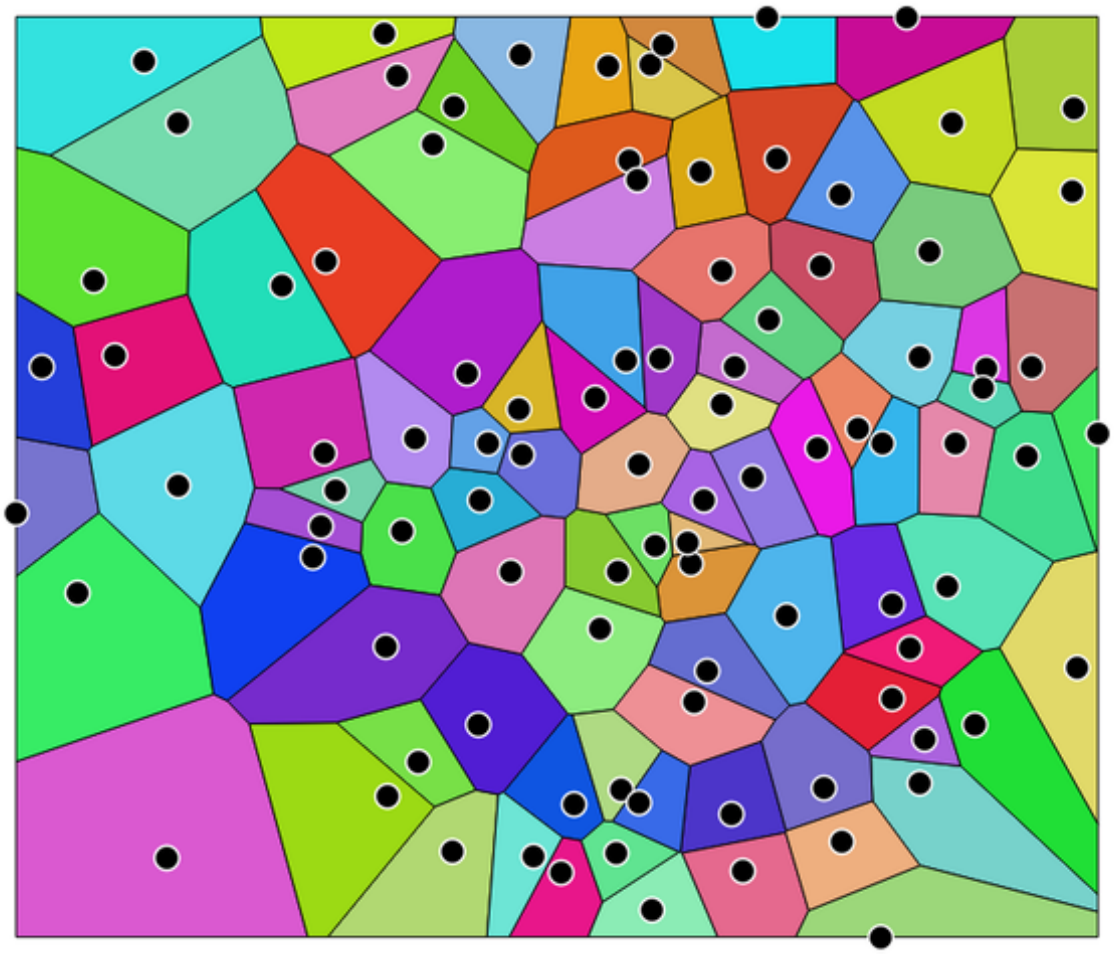


Figura24.91: Polígonos de Voronoi

Default menu: *Vector* ► *Geometry Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: point]	Input point vector layer
Buffer region (% of extent)	`BUFFER`	[number] Padrão: 0.0	The extent of the output layer will be this much bigger than the extent of the input layer
Voronoi polygons	`SAÍDA`	[vector: polygon] Default: `[Create temporary layer]`	Specify the output layer (with the Voronoi polygons). One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Voronoi polygons	`SAÍDA`	[vector: polygon]	Voronoi polygons of the input point vector layer

Python code

Algorithm ID: `qgis:voronoipolygons`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.17 Vector overlay

Clip

Clips a vector layer using the features of an additional polygon layer.

Only the parts of the features in the input layer that fall within the polygons of the overlay layer will be added to the resulting layer.

Aviso: Feature modification

The attributes of the features are **not modified**, although properties such as area or length of the features will be modified by the clipping operation. If such properties are stored as attributes, those attributes will have to be manually updated.

This algorithm uses spatial indexes on the providers, prepared geometries and apply a clipping operation if the geometry isn't wholly contained by the mask geometry.

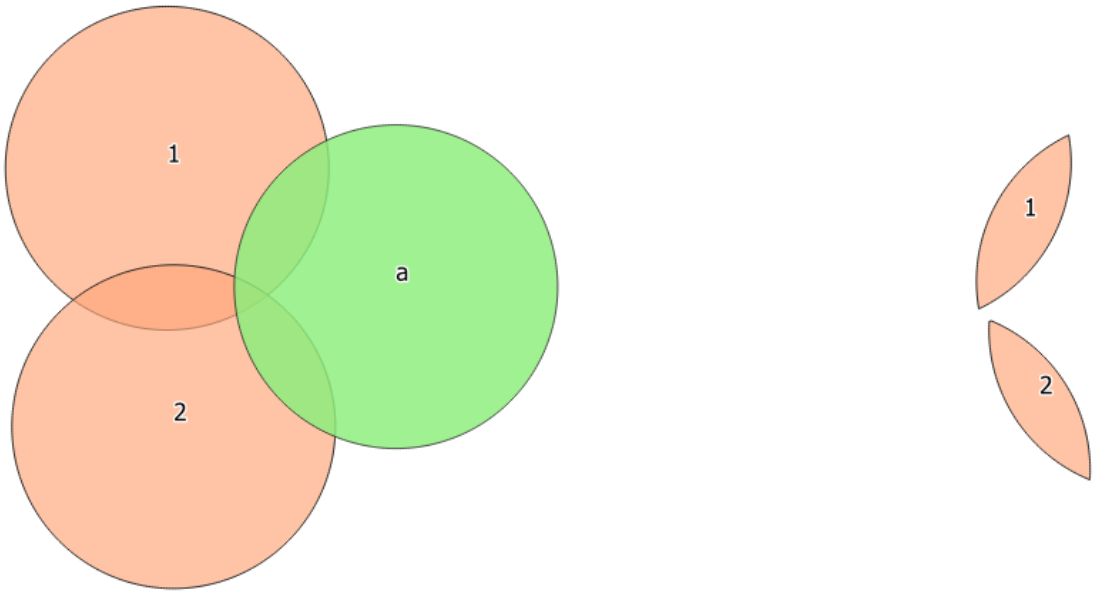


Figura24.92: Clipping operation between a two-features input layer and a single feature overlay layer (left) - resulting features are moved for clarity (right)

Permite *features in-place modification*

Default menu: *Vector* ► *Geoprocessing Tools*

Ver também:

Intersection, *Difference*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Layer containing the features to be clipped
Overlay layer	`OVERLAY`	[vector: polygon]	Layer containing the clipping features
Clipped	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the layer to contain the features from the input layer that are inside the overlay (clipping) layer. One of: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Clipped	`SAÍDA`	[same as input]	Layer containing features from the input layer split by the overlay layer.

Python code

Algorithm ID: `qgis:clip`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Difference

Extracts features from the input layer that don't fall within the boundaries of the overlay layer.

Input layer features that partially overlap the overlay layer feature(s) are split along the boundary of those feature(s) and only the portions outside the overlay layer features are retained.

Attributes are not modified (see *warning*).

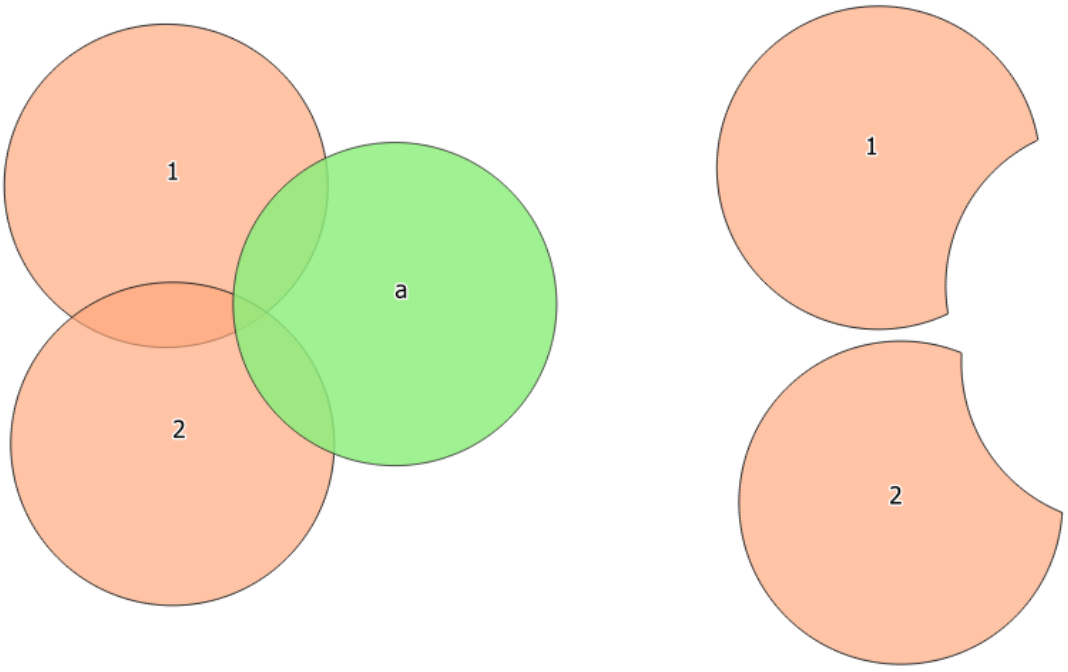


Figura24.93: Difference operation between a two-features input layer and a single feature overlay layer (left) - resulting features are moved for clarity (right)

Permite *features in-place modification*

Default menu: *Vector* ► *Geoprocessing Tools*

Ver também:

Symmetrical difference, *Clip*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Layer to extract (parts of) features from.
Overlay layer	`OVERLAY`	[vector: any]	Layer containing the geometries that will be subtracted from the input layer geometries. It is expected to have at least as many dimensions (point: 0D, line: 1D, polygon: 2D, volume: 3D) as the input layer geometries.
Difference	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the layer to contain the (parts of) features from the input layer that are not inside the overlay layer. One of: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Difference	`SAÍDA`	[same as input]	Layer containing (parts of) features from the input layer not overlapping the overlay layer.

Python code

Algorithm ID: `qgis:difference`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract/clip by extent

Creates a new vector layer that only contains features which fall within a specified extent.

Any features which intersect the extent will be included.

Ver também:

Clip

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Layer to extract (parts of) features from.
Extent (xmin, xmax, ymin, ymax)	`EXTENT`	[extent]	Extent for clipping.
Clip features to extent	`CLIP`	[boolean] Padrão: Falso	If checked, output geometries will be automatically converted to multi geometries to ensure uniform output types. Moreover the geometries will be clipped to the extent chosen instead of taking the whole geometry as output.
Extracted	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the layer to contain the features from the input layer that are inside the clip extent. One of: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Extracted	`SAÍDA`	[same as input]	Layer containing the clipped features.

Python code

Algorithm ID: `qgis:extractbyextent`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Intersection

Extracts the portions of features from the input layer that overlap features in the overlay layer.

Features in the intersection layer are assigned the attributes of the overlapping features from both the input and overlay layers.

Attributes are not modified (see *warning*).

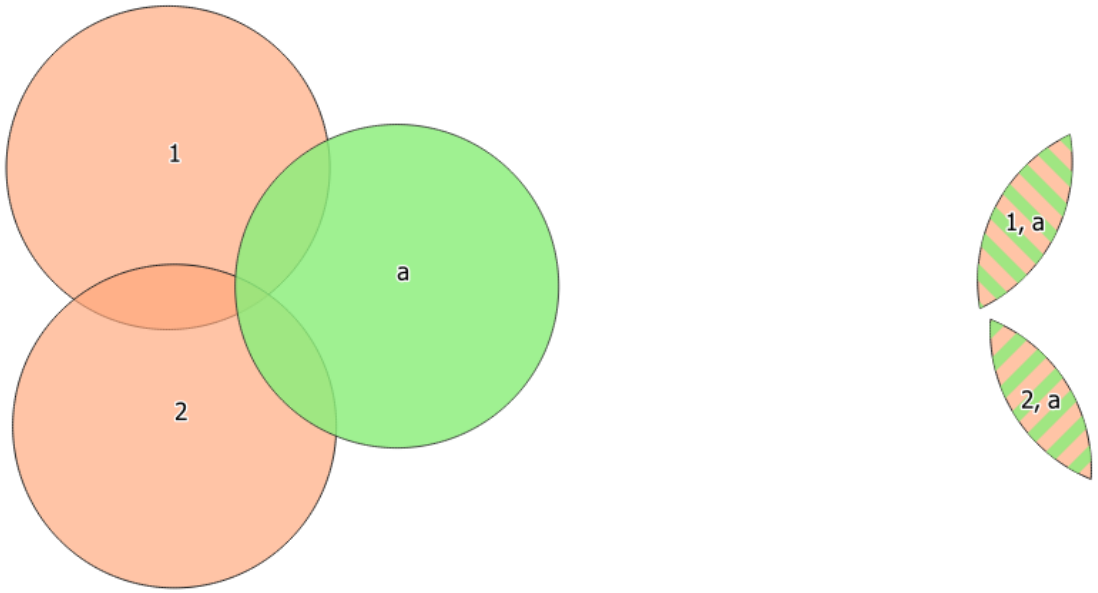


Figura24.94: The intersection operation: A two-features input layer and a single feature overlay layer (left) - resulting features are moved for clarity (right)

Default menu: *Vector ► Geoprocessing Tools*

Ver também:

Clip, *Difference*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Layer to extract (parts of) features from.
Overlay layer	`OVERLAY`	[vector: any]	Layer containing the features to check for overlap. Its features' geometry is expected to have at least as many dimensions (point: 0D, line: 1D, polygon: 2D, volume: 3D) as the input layer's.
Input fields to keep (leave empty to keep all fields) Opcional	`INPUT_FIELDS`	[tablefield: any] [list] Padrão: Nenhum	Field(s) of the input layer to keep in the output. If no fields are chosen all fields are taken.
Overlay fields to keep (leave empty to keep all fields) Opcional	`OVERLAY_FIELDS`	[tablefield: any] [list] Padrão: Nenhum	Field(s) of the overlay layer to keep in the output. If no fields are chosen all fields are taken.

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Tabela 24.127 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Overlay fields prefix Opcional	`OVERLAY_FIELDS_PREFIX`	[string]	Prefix to add to the field names of the intersect layer's fields to avoid name collisions with fields in the input layer.
Intersection	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the layer to contain (the parts of) the features from the input layer that overlap one or more features from the overlay layer. One of: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Intersection	`SAÍDA`	[same as input]	Layer containing (parts of) features from the input layer that overlap the overlay layer.

Python code

Algorithm ID: `qgis:intersection`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Line intersections

Creates point features where the lines from the two layers intersect.

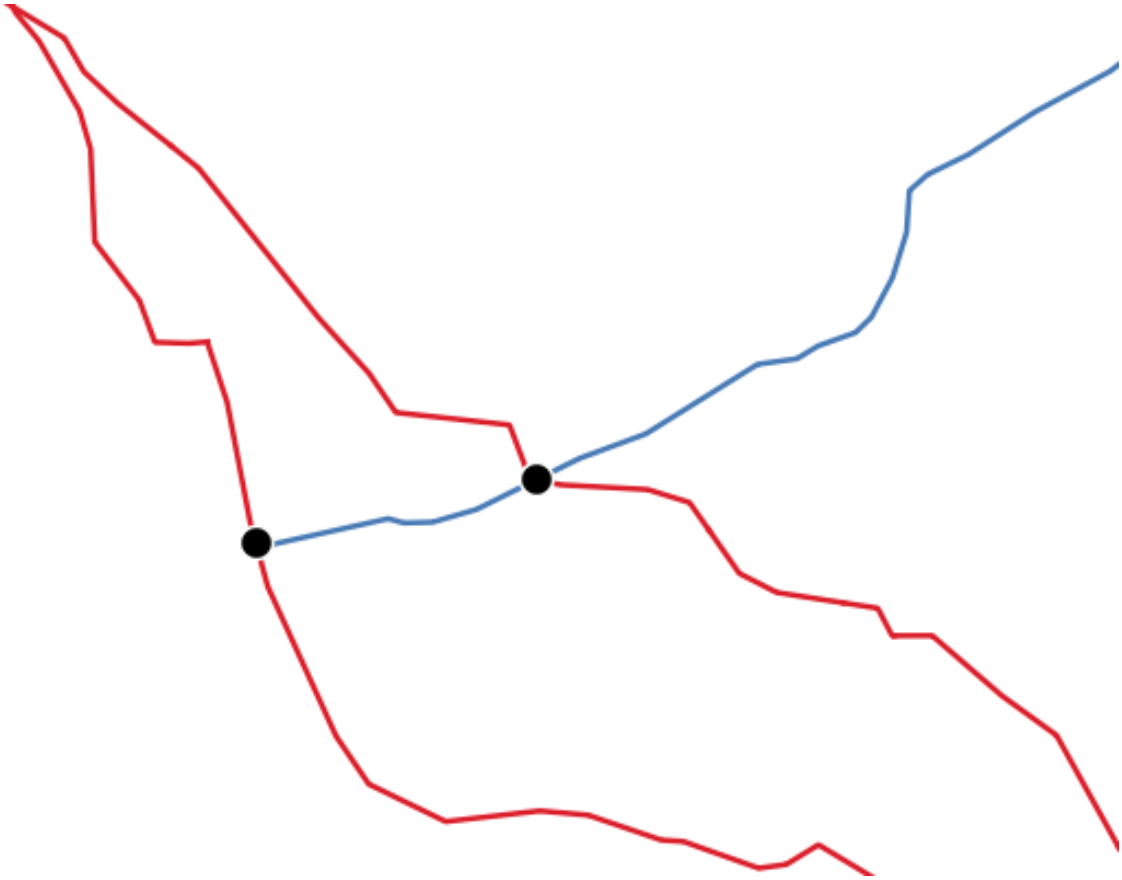


Figura24.95: Points of intersection

Default menu: *Vector* ► *Analysis Tools*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	Input line layer.
Intersect layer	`INTERSECT`	[vector: line]	Layer to use to find line intersections.
Input fields to keep (leave empty to keep all fields) Opcional	`INPUT_FIELDS`	[tablefield: any] [list] Padrão: Nenhum	Field(s) of the input layer to keep in the output. If no fields are chosen all fields are taken.
Intersect fields to keep (leave empty to keep all fields) Opcional	`INTERSECT_FIELDS`	[tablefield: any] [list] Padrão: Nenhum	Field(s) of the intersect layer to keep in the output. If no fields are chosen all fields are taken.
Intersect fields prefix Opcional	`OVERLAY_FIELDS_PREFIX`	[string]	Prefix to add to the field names of the intersect layer's fields to avoid name collisions with fields in the input layer.

continua na próxima página

Tabela 24.129 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Intersection	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Specify the layer to contain the intersection points of the lines from the input and overlay layers. One of: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Intersections	`SAÍDA`	[vector: point]	Point vector layer with the intersections.

Python code

Algorithm ID: `qgis:lineintersections`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Split with lines

Splits the lines or polygons in one layer using the lines in another layer to define the breaking points. Intersection between geometries in both layers are considered as split points.

Output will contain multi geometries for split features.

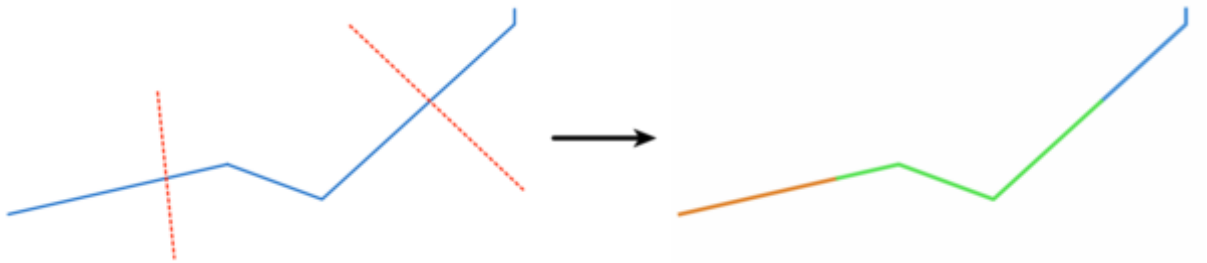


Figura24.96: Split lines

Permite *features in-place modification*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line, polygon]	Layer containing the lines or polygons to split.
Split layer	`LINES`	[vector: line]	Line layer whose lines are used to define the breaking points.
Split	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the layer to contain the splitted (in case they are intersected by a line in the split layer) line/polygon features from the input layer. One of: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Split	`SAÍDA`	[same as input]	Output vector layer with split lines or polygons from input layer.

Python code

Algorithm ID: `qgis:splitwithlines`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Symmetrical difference

Creates a layer containing features from both the input and overlay layers but with the overlapping areas between the two layers removed.

The attribute table of the symmetrical difference layer contains attributes and fields from both the input and overlay layers.

Attributes are not modified (see *warning*).

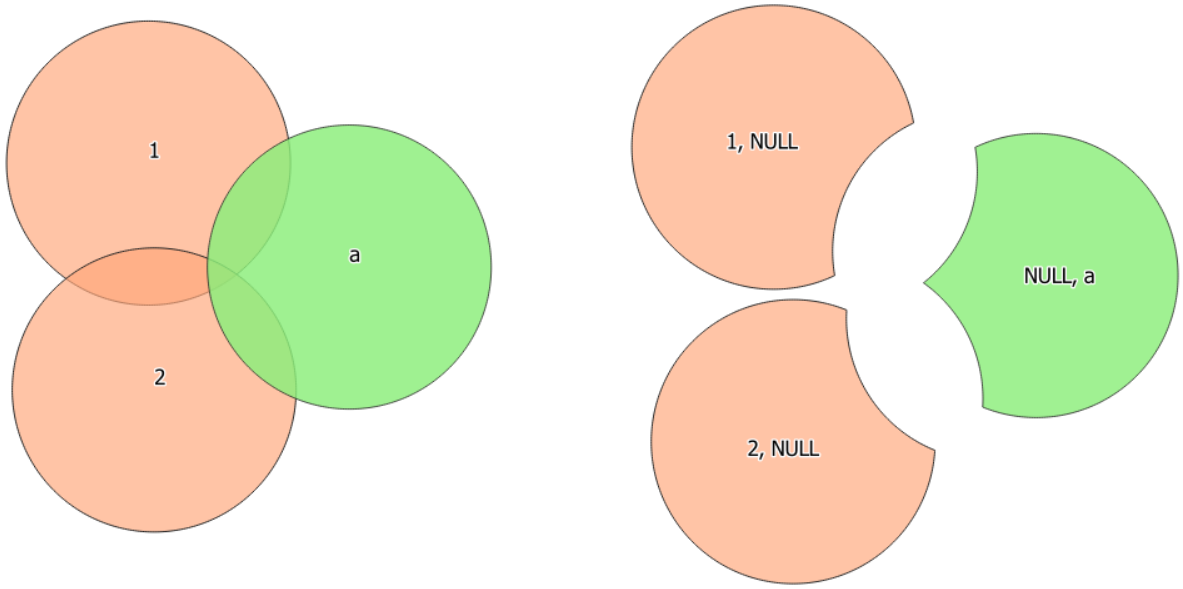


Figura24.97: Symmetrical difference operation between a two-features input layer and a single feature overlay layer (left) - resulting features are moved for clarity (right)

Default menu: *Vector ► Geoprocessing Tools*

Ver também:

Difference, *Clip*, *Intersection*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	First layer to extract (parts of) features from.
Overlay layer	`OVERLAY`	[vector: any]	Second layer to extract (parts of) features from. Ideally the geometry type should be the same as input layer.
Overlay fields prefix Opcional	`OVERLAY_FIELDS_PREFIX`	[string]	Prefix to add to the field names of the overlay layer's fields to avoid name collisions with fields in the input layer.
Symmetrical difference	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the layer to contain (the parts of) the features from the input and overlay layers that do not overlap features from the other layer. One of: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Symmetrical difference	`SAÍDA`	[same as input]	Layer containing (parts of) features from each layer not overlapping the other layer.

Python code

Algorithm ID: `qgis:symmetricaldifference`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Union

Checks overlaps between features within the input layer and creates separate features for overlapping and non-overlapping parts. The area of overlap will create as many identical overlapping features as there are features that participate in that overlap.

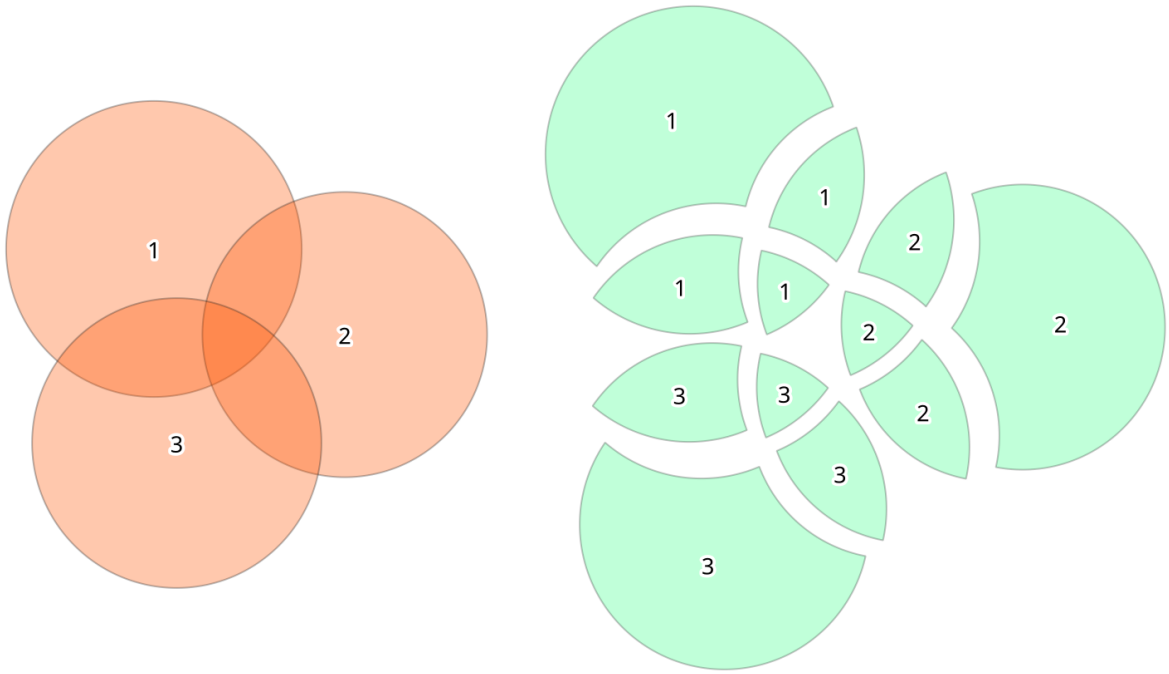


Figura24.98: Union operation with a single input layer of three overlapping features (left) - resulting features are moved for clarity (right)

An overlay layer can also be used, in which case features from each layer are split at their overlap with features from the other one, creating a layer containing all the portions from both input and overlay layers. The attribute table of the union layer is filled with attribute values from the respective original layer for non-overlapping features, and attribute values from both layers for overlapping features.

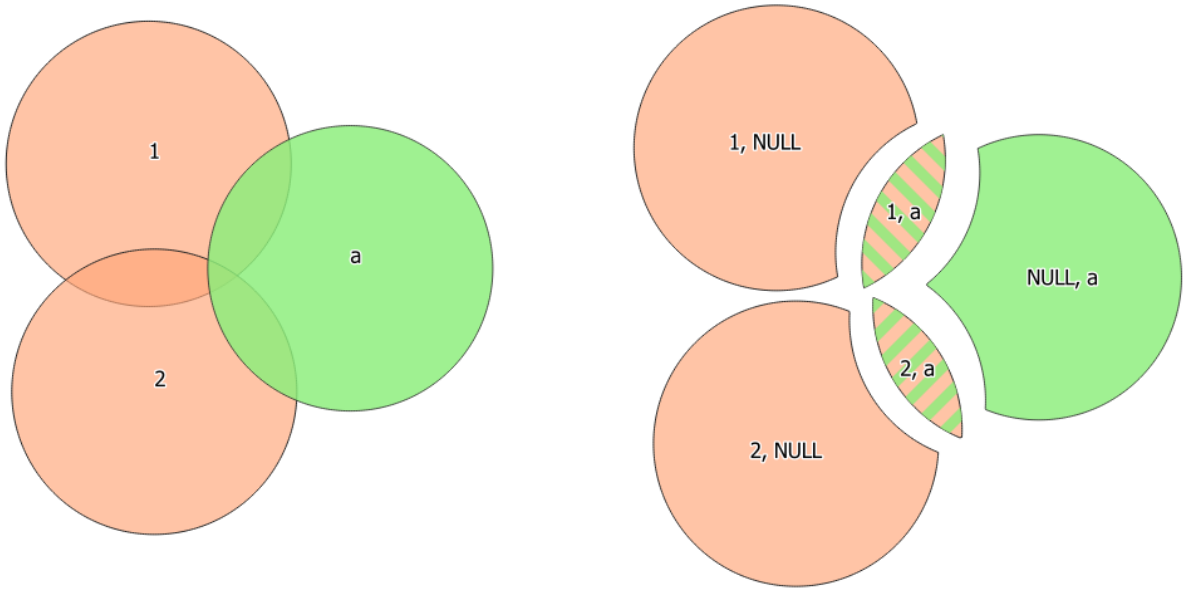


Figura24.99: Union operation between a two-features input layer and a single feature overlay layer (left) - resulting features are moved for clarity (right)

Nota: For `union(A,B)` algorithm, if there are overlaps among geometries of layer A or among geometries of layer B, these are not resolved: you need to do `union(union(A,B))` to resolve all overlaps, i.e. run single layer `union(X)` on the produced result `X=union(A,B)`.

Default menu: *Vector* ► *Geoprocessing Tools*

Ver também:

Clip, *Difference*, *Intersection*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Input vector layer to split at any intersections.
Overlay layer Opcional	`OVERLAY`	[vector: any]	Layer that will be combined to the first one. Ideally the geometry type should be the same as input layer.
Overlay fields prefix Opcional	`OVERLAY_FIELDS_PREFIX`	[string]	Prefix to add to the field names of the overlay layer's fields to avoid name collisions with fields in the input layer.
Union	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the layer to contain the (split and duplicated) features from the input layer and the overlay layer. One of: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Union	`SAÍDA`	[same as input]	Layer containing all the overlapping and non-overlapping parts from the processed layer(s).

Python code

Algorithm ID: `qgis:union`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.18 Vector selection

Extract by attribute

Creates two vector layers from an input layer: one will contain only matching features while the second will contain all the non-matching features.

The criteria for adding features to the resulting layer is based on the values of an attribute from the input layer.

Ver também:

Select by attribute

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Layer to extract features from.
Selection attribute	`CAMPO`	[tablefield: any]	Filtering field of the layer
Operator	`OPERATOR`	[enumeration] Padrão: 0	Many different operators are available: • 0 — = • 1 — ≠ • 2 — >>• 3 — >= • 4 — < • 5 — <= • 6 — begins with • 7 — contains • 8 — is null • 9 — is not null • 10 — does not contain
Value Opcional	`VALOR`	[string]	Value to be evaluated

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Tabela 24.130 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Extracted (attribute)	`SAÍDA`	[same as input] Default: `[Create Temporary Layer]`	Specify the output vector layer for matching features. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Extracted (non-matching)	`FAIL_OUTPUT`	[same as input] Default: `[Skip output]`	Specify the output vector layer for non-matching features. One of: • Ignorar Saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS…

Saídas

Etiqueta	Nome	Tipo	Descrição
Extracted (attribute)	`SAÍDA`	[same as input]	Vector layer with matching features from the input layer
Extracted (non-matching)	`FAIL_OUTPUT`	[same as input]	Vector layer with non-matching features from the input layer

Python code

Algorithm ID: `qgis:extractbyattribute`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract by expression

Creates two vector layers from an input layer: one will contain only matching features while the second will contain all the non-matching features.

The criteria for adding features to the resulting layer is based on a QGIS expression. For more information about expressions see the *Expressões*.

Ver também:

Select by expression

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Expressão	`EXPRESSÃO`	[expression]	Expression to filter the vector layer
Matching features	`SAÍDA`	[same as input] Default: `[Create Temporary Layer]`	Specify the output vector layer for matching features. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Non-matching	`FAIL_OUTPUT`	[same as input] Default: `[Skip output]`	Specify the output vector layer for non-matching features. One of: • Ignorar Saída • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS…

Saídas

Etiqueta	Nome	Tipo	Descrição
Matching features	`SAÍDA`	[same as input]	Vector layer with matching features from the input layer
Non-matching	`FAIL_OUTPUT`	[same as input]	Vector layer with non-matching features from the input layer

Python code

Algorithm ID: `qgis:extractbyexpression`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract by location

Creates a new vector layer that only contains matching features from an input layer.

The criteria for adding features to the resulting layer is based on the spatial relationship between each feature and the features in an additional layer.

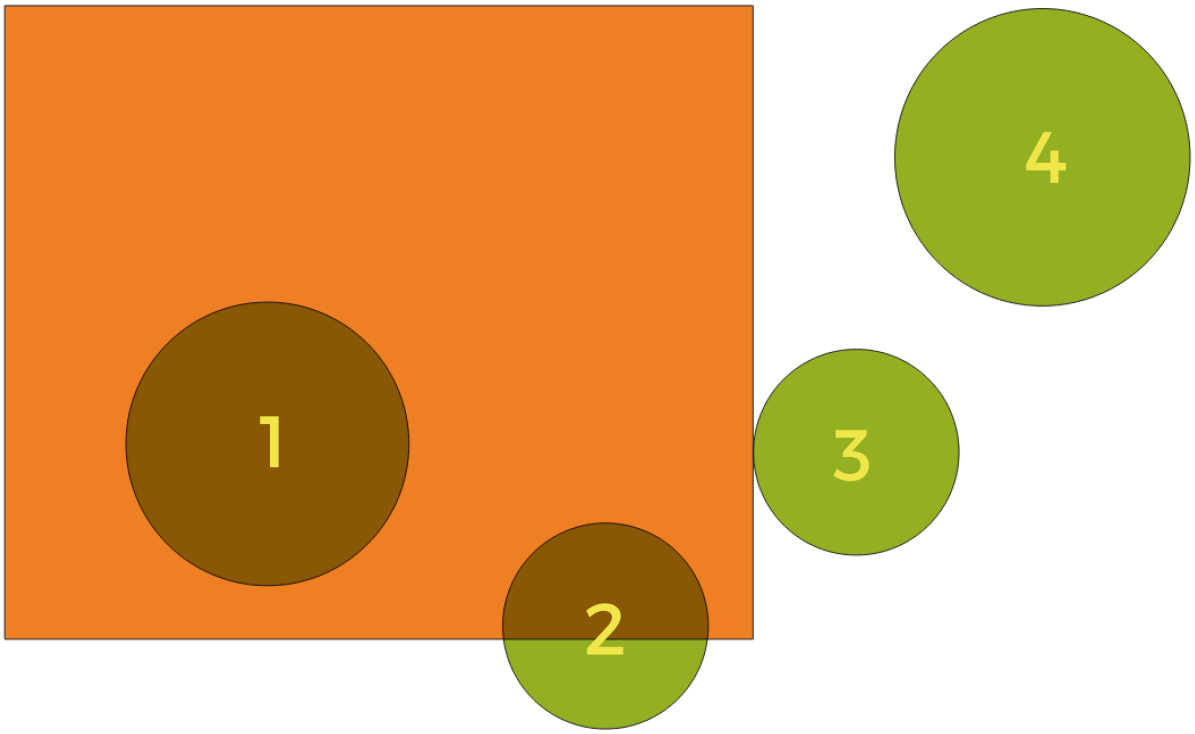


Figura24.100: In this example, the dataset from which we want to select (the *source vector layer*) consists of the green circles, the orange rectangle is the dataset that it is being compared to (the *intersection vector layer*).

Available geometric predicates are:

Intersect Tests whether a geometry intersects another. Returns 1 (true) if the geometries spatially intersect (share any portion of space - overlap or touch) and 0 if they don't. In the picture above, this will select circles 1, 2 and 3.

Contain Retorna 1 (verdadeiro) se e somente se nenhum ponto de b estiver no exterior de a e pelo menos um ponto do interior de b estiver no interior de a. Na imagem, nenhum círculo é selecionado, mas o retângulo seria se você o selecionasse ao contrário, pois ele contém um círculo completamente. Este é o oposto de *are within*.

Disjoint Returns 1 (true) if the geometries do not share any portion of space (no overlap, not touching). Only circle 4 is selected.

Igual Retorna 1 (verdadeiro) se e somente se as geometrias forem exatamente iguais. Nenhum círculo será selecionado.

Touch Testa se uma geometria toca em outra. Retorna 1 (verdadeiro) se as geometrias tiverem pelo menos um ponto em comum, mas seus interiores não se cruzam. Somente o círculo 3 está selecionado.

Overlap Testa se uma geometria sobrepõe outra. Retorna 1 (verdadeiro) se as geometrias compartilharem espaço, têm a mesma dimensão, mas não estão completamente contidas uma na outra. Somente o círculo 2 está selecionado.

Are within Tests whether a geometry is within another. Returns 1 (true) if geometry a is completely inside geometry b. Only circle 1 is selected.

Cross Retorna 1 (verdadeiro) se as geometrias fornecidas tiverem alguns pontos internos em comum, mas não todos, e o cruzamento real tiver uma dimensão menor que a maior geometria fornecida. Por exemplo, uma linha

cruzando um polígono cruzará como uma linha (selecionada). O cruzamento de duas linhas cruzará como um ponto (selecionado). Dois polígonos cruzam como um polígono (não selecionado).

Ver também:

Selecionar pela localização

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Extract features from	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Where the features (geometric predicate)	`PREDICATE`	[enumeration] [list] Padrão: [0]	Spatial condition for the selection. One or more of: • 0 — intersect • 1 — contain • 2 — disjoint • 3 — equal • 4 — touch • 5 — overlap • 6 — are within • 7 — cross If more than one condition is chosen, at least one of them (OR operation) has to be met for a feature to be extracted.
By comparing to the features from	`INTERSECT`	[vector: any]	Intersection vector layer
Extracted (location)	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer for the features that have the chosen spatial relationship(s) with one or more features in the comparison layer. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS…

Saídas

Etiqueta	Nome	Tipo	Descrição
Extracted (location)	`SAÍDA`	[same as input]	Vector layer with features from the input layer that have the chosen spatial relationship(s) with one or more features in the comparison layer.

Python code

Algorithm ID: `qgis:extractbylocation`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Random extract

Takes a vector layer and generates a new one that contains only a subset of the features in the input layer.

The subset is defined randomly, based on feature IDs, using a percentage or count value to define the total number of features in the subset.

Ver também:

Seleção aleatória

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Source vector layer to select the features from
Método	`MÉTODO`	[enumeration] Padrão: 0	Random selection methods. One of: • 0 — Number of selected features • 1 — Percentage of selected features
Number/percentage of selected features	`NÚMERO`	[number] Padrão: 10	Number or percentage of features to select
Extracted (random)	`SAÍDA`	[vector: any] Default: `[Create temporary layer]`	Specify the output vector layer for the randomly selected features. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… Vector layer containing randomly selected features

Saídas

Etiqueta	Nome	Tipo	Descrição
Extracted (random)	`SAÍDA`	[same as input]	Vector layer containing randomly selected features from the input layer

Python code

Algorithm ID: `qgis:randomextract`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Random extract within subsets

Takes a vector layer and generates a new one that contains only a subset of the features in the input layer.

The subset is defined randomly, based on feature IDs, using a percentage or count value to define the total number of features in the subset. The percentage/count value is not applied to the whole layer, but instead to each category. Categories are defined according to a given attribute.

Ver também:

Random selection within subsets

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Vector layer to select the features from
ID field	`CAMPO`	[tablefield: any]	Category of the source vector layer to select the features from
Método	`MÉTODO`	[enumeration] Padrão: 0	Random selection method. One of: • 0 — Number of selected features • 1 — Percentage of selected features
Number/percentage of selected features	`NÚMERO`	[number] Padrão: 10	Number or percentage of features to select
Extracted (random stratified)	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer for the randomly selected features. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Extracted (random stratified)	`SAÍDA`	[same as input]	Vector layer containing randomly selected features from the input layer

Python code

Algorithm ID: `qgis:randomextractwithinsubsets`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Seleção aleatória

Takes a vector layer and selects a subset of its features. No new layer is generated by this algorithm.

The subset is defined randomly, based on feature IDs, using a percentage or count value to define the total number of features in the subset.

Default menu: *Vector ► Research Tools*

Ver também:

Random extract

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Vector layer for the selection
Método	`MÉTODO`	[enumeration] Padrão: 0	Random selection method. One of: • 0 — Number of selected features • 1 — Percentage of selected features
Number/percentage of selected features	`NÚMERO`	[number] Padrão: 10	Number or percentage of features to select

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[same as input]	The input layer with features selected

Python code

Algorithm ID: `qgis:randomselection`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Random selection within subsets

Takes a vector layer and selects a subset of its features. No new layer is generated by this algorithm.

The subset is defined randomly, based on feature IDs, using a percentage or count value to define the total number of features in the subset.

The percentage/count value is not applied to the whole layer, but instead to each category.

Categories are defined according to a given attribute, which is also specified as an input parameter for the algorithm.

No new outputs are created.

Default menu: *Vector ► Research Tools*

Ver também:

Random extract within subsets

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	Vector layer to select features in
ID field	CAMPO	[tablefield: any]	Category of the input layer to select the features from
Método	MÉTODO	[enumeration] Padrão: 0	Random selection method. One of: • 0 — Number of selected features • 1 — Percentage of selected features
Number/percentage of selected features	NÚMERO	[number] Padrão: 10	Number or percentage of features to select

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[same as input]	The input layer with features selected

Python code

Algorithm ID: `qgis:randomselectionwithinsubsets`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Select by attribute

Creates a selection in a vector layer.

The criteria for selecting features is based on the values of an attribute from the input layer.

Ver também:

Extract by attribute

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	Vector layer to select features in
Selection attribute	CAMPO	[tablefield: any]	Filtering field of the layer
Operator	OPERATOR	[enumeration] Padrão: 0	Many different operators are available: • 0 — = • 1 — ≠ • 2 — >>• 3 — >= • 4 — < • 5 — <= • 6 — begins with • 7 — contains • 8 — is null • 9 — is not null • 10 — does not contain
Value Opcional	VALOR	[string]	Value to be evaluated

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Tabela 24.134 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Modify current selection by	MÉTODO	[enumeration] Padrão: 0	How the selection of the algorithm should be managed. One of: • 0 — creating new selection • 1 — adding to current selection • 2 — removing from current selection • 3 — selecting within current selection

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[same as input]	The input layer with features selected

Python code

Algorithm ID: `qgis:selectbyattribute`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Select by expression

Creates a selection in a vector layer.

The criteria for selecting features is based on a QGIS expression. For more information about expressions see the *Expressões*.

Ver também:

Extract by expression

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	Camada vetorial de entrada
Expressão	EXPRESSÃO	[expression]	Expression to filter the input layer
Modify current selection by	MÉTODO	[enumeration] Padrão: 0	How the selection of the algorithm should be managed. One of: • 0 — creating new selection • 1 — adding to current selection • 2 — removing from current selection • 3 — selecting within current selection

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[same as input]	The input layer with features selected

Python code

Algorithm ID: `qgis:selectbyexpression`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Selecionar pela localização

Creates a selection in a vector layer.

The criteria for selecting features is based on the spatial relationship between each feature and the features in an additional layer.

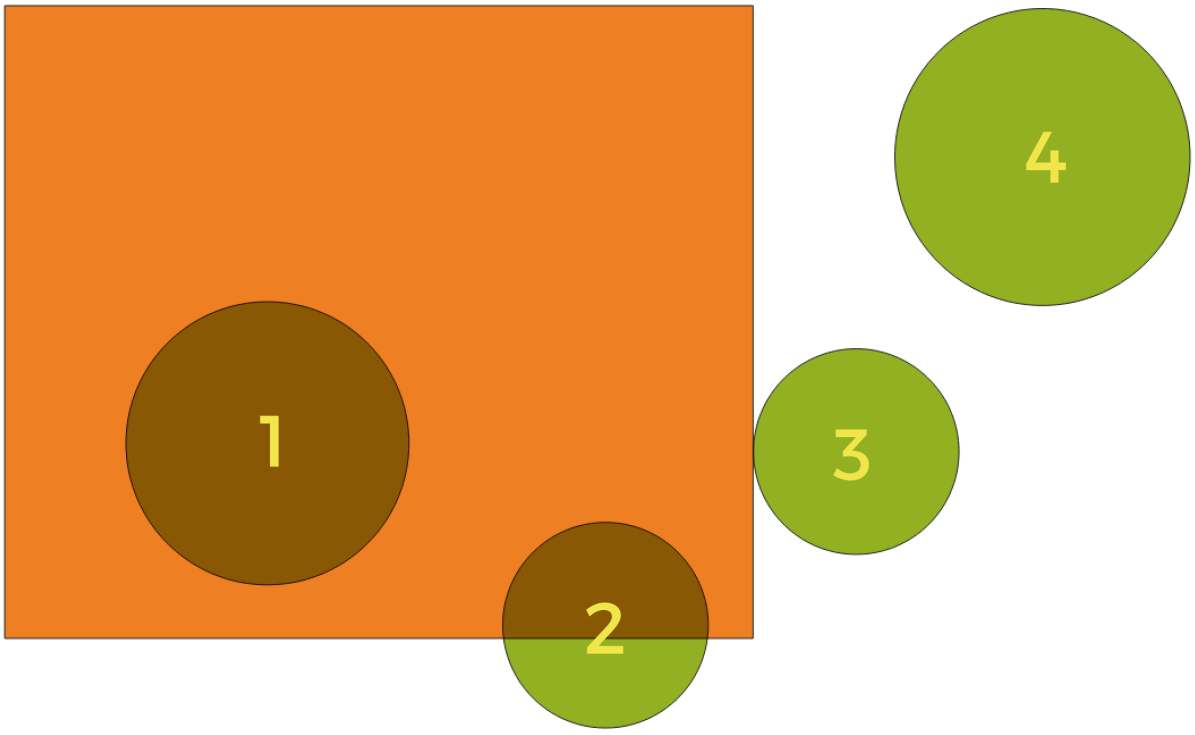


Figura24.101: In this example, the dataset from which we want to select (the *source vector layer*) consists of the green circles, the orange rectangle is the dataset that it is being compared to (the *intersection vector layer*).

Available geometric predicates are:

Intersect Tests whether a geometry intersects another. Returns 1 (true) if the geometries spatially intersect (share any portion of space - overlap or touch) and 0 if they don't. In the picture above, this will select circles 1, 2 and 3.

Contain Retorna 1 (verdadeiro) se e somente se nenhum ponto de b estiver no exterior de a e pelo menos um ponto do interior de b estiver no interior de a. Na imagem, nenhum círculo é selecionado, mas o retângulo seria se você o selecionasse ao contrário, pois ele contém um círculo completamente. Este é o oposto de *are within*.

Disjoint Returns 1 (true) if the geometries do not share any portion of space (no overlap, not touching). Only circle 4 is selected.

Igual Retorna 1 (verdadeiro) se e somente se as geometrias forem exatamente iguais. Nenhum círculo será selecionado.

Touch Testa se uma geometria toca em outra. Retorna 1 (verdadeiro) se as geometrias tiverem pelo menos um ponto em comum, mas seus interiores não se cruzam. Somente o círculo 3 está selecionado.

Overlap Testa se uma geometria sobrepõe outra. Retorna 1 (verdadeiro) se as geometrias compartilharem espaço, têm a mesma dimensão, mas não estão completamente contidas uma na outra. Somente o círculo 2 está selecionado.

Are within Tests whether a geometry is within another. Returns 1 (true) if geometry a is completely inside geometry b. Only circle 1 is selected.

Cross Retorna 1 (verdadeiro) se as geometrias fornecidas tiverem alguns pontos internos em comum, mas não todos, e o cruzamento real tiver uma dimensão menor que a maior geometria fornecida. Por exemplo, uma linha cruzando um polígono cruzará como uma linha (selecionada). O cruzamento de duas linhas cruzará como um ponto (selecionado). Dois polígonos cruzam como um polígono (não selecionado).

Default menu: *Vector ► Research Tools*

Ver também:

Extract by location

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Select features from	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Where the features (geometric predicate)	`PREDICATE`	[enumeration] [list] Padrão: [0]	Spatial condition for the selection. One or more of: • 0 — intersect • 1 — contain • 2 — disjoint • 3 — equal • 4 — touch • 5 — overlap • 6 — are within • 7 — cross If more than one condition is chosen, at least one of them (OR operation) has to be met for a feature to be extracted.
By comparing to the features from	`INTERSECT`	[vector: any]	Intersection vector layer
Modify current selection by	`MÉTODO`	[enumeration] Padrão: 0	How the selection of the algorithm should be managed. One of: • 0 — creating new selection • 1 — adding to current selection • 2 — selecting within current selection • 3 — removing from current selection

Saídas

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[same as input]	The input layer with features selected

Python code

Algorithm ID: `qgis:selectbylocation`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.19 Tabela de vetores

Adicionar campo de autoincremento

Adiciona um novo campo inteiro a uma camada vetorial, com um valor sequencial para cada feição.

Este campo pode ser usado como um ID exclusivo para as feições da camada. O novo atributo não é adicionado à camada de entrada, mas uma nova camada é gerada.

O valor inicial para a série incremental pode ser especificado. Opcionalmente, a série incremental pode ser baseada em campos de agrupamento e uma ordem de classificação para feições também pode ser especificada.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	The input vector layer.
Field name	FIELD_NAME	[string] Padrão: 'AUTO'	Name of the field with autoincremental values
Start values at Opcional	START	[number] Padrão: 0	Choose the initial number of the incremental count
Group values by Opcional	GROUP_FIELDS	[tablefield: any] [list]	Select grouping field(s): instead of a single count run for the whole layer, a separate count is processed for each value returned by the combination of these fields.
Sort expression Opcional	SORT_EXPRESSION	[expression]	Use an expression to sort the features in the layer either globally or if set, based on group fields.
Ordernar ascendente	SORT_ASCENDING	[boolean] Padrão: Verdadeiro	When a `sort expression` is set, use this option to control the order in which features are assigned values.
Sort nulls first	SORT_NULLS_FIRST	[boolean] Padrão: Falso	When a `sort expression` is set, use this option to set whether *Null* values are counted first or last.

continua na próxima página

Tabela 24.136 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Incremented	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer with the auto increment field. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Incremented	`SAÍDA`	[same as input]	Vector layer with auto incremental field

Python code

Algorithm ID: `qgis:addautoincrementalfield`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Adicionar um campo à tabela de atributos

Adds a new field to a vector layer.

The name and characteristics of the attribute are defined as parameters.

O novo atributo não é adicionado à camada de entrada, mas uma nova camada é gerada.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada de entrada
Field name	`FIELD_NAME`	[string]	Name of the new field
Field type	`FIELD_TYPE`	[enumeration] Padrão: 0	Tipo do novo campo. Você pode escolher entre: • 0 — Inteiro • 1 — Flutuante • 2 — Texto
Field length	`FIELD_LENGTH`	[number] Padrão: 10	Length of the field
Field precision	`FIELD_PRECISION`	[number] Padrão: 0	Precisão do campo. Usual com campo tipo flutuante.

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Tabela 24.137 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Added	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Added	`SAÍDA`	[same as input]	Vector layer with new field added

Python code

Algorithm ID: `qgis:addfieldtoattributestable`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Adicionar índice do campo valores únicos

Takes a vector layer and an attribute and adds a new numeric field.

Values in this field correspond to values in the specified attribute, so features with the same value for the attribute will have the same value in the new numeric field.

This creates a numeric equivalent of the specified attribute, which defines the same classes.

O novo atributo não é adicionado à camada de entrada, mas uma nova camada é gerada.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada de entrada.
Class field	`CAMPO`	[tablefield: any]	Features that have the same value for this field will get the same index.
Output field name	`FIELD_NAME`	[string] Default: 'NUM_FIELD'	Name of the new field containing the indexes.

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Tabela 24.138 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Layer with index field	`SAÍDA`	[vector: any] Default: `[Create temporary layer]`	Vector layer with the numeric field containing indexes. One of: • Ignorar Saída • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.
Class summary	`SUMMARY_OUTPUT`	[table] Default: `[Skip output]`	Specify the table to contain the summary of the class field mapped to the corresponding unique value. One of: • Ignorar Saída • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Layer with index field	`SAÍDA`	[same as input]	Vector layer with the numeric field containing indexes.
Class summary	`SUMMARY_OUTPUT`	[table] Default: `[Skip Output]`	Table with summary of the class field mapped to the corresponding unique value.

Python code

Algorithm ID: `qgis:adduniquevalueindexfield`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Add X/Y fields to layer

Adds X and Y (or latitude/longitude) fields to a point layer. The X/Y fields can be calculated in a different CRS to the layer (e.g. creating latitude/longitude fields for a layer in a projected CRS).

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: point]	A camada de entrada.
Coordinate system	`SRC`	[crs] Default: "EPSG:4326"	Coordinate reference system to use for the generated x and y fields.
Field prefix Opcional	`PREFIX`	[string]	Prefix to add to the new field names to avoid name collisions with fields in the input layer.
Added fields	`SAÍDA`	[vector: point] Default: `[Create temporary layer]`	Especifique a camada da linha de saída. Um de: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Added fields	`SAÍDA`	[vector: point]	The output layer - identical to the input layer but with two new double fields, `x` and `y`.

Python code

Algorithm ID: `qgis:addxyfieldstolayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Calculadora de campo avançada Python

Adds a new attribute to a vector layer, with values resulting from applying an expression to each feature.

The expression is defined as a Python function.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Result field name	`FIELD_NAME`	[string] Default: 'NewField'	Name of the new field

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Tabela 24.140 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Field type	`FIELD_TYPE`	[enumeration] Padrão: 0	Type of the new field. One of: • 0 — Inteiro • 1 — Flutuante • 2 — Texto
Field length	`FIELD_LENGTH`	[number] Padrão: 10	Length of the field
Field precision	`FIELD_PRECISION`	[number] Padrão: 3	Precisão do campo. Usual com campo tipo flutuante.
Global expression Opcional	`GLOBAL`	[string]	The code in the global expression section will be executed only once before the calculator starts iterating through all the features of the input layer. Therefore, this is the correct place to import necessary modules or to calculate variables that will be used in subsequent calculations.
Formula	`FORMULA`	[string]	The Python formula to evaluate. Example: To calculate the area of an input polygon layer you can add: `value = $geom.area()`
Calculado	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the vector layer with the new calculated field. One of: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Calculado	`SAÍDA`	[same as input]	Vector layer with the new calculated field

Python code

Algorithm ID: `qgis:advancedpythonfieldcalculator`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Descartar campo(s)

Takes a vector layer and generates a new one that has the same features but without the selected columns.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Input vector layer to drop field(s) from
Fields to drop	`COLUMN`	[tablefield: any] [list]	The field(s) to drop
Remaining fields	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Specify the output vector layer with the remaining fields. One of: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Remaining fields	`SAÍDA`	[same as input]	Vector layer with the remaining fields

Python code

Algorithm ID: `qgis:deletecolumn`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Explode HStore Field

Creates a copy of the input layer and adds a new field for every unique key in the HStore field.

The expected field list is an optional comma separated list. If this list is specified, only these fields are added and the HStore field is updated. By default, all unique keys are added.

The PostgreSQL HStore is a simple key-value store used in PostgreSQL and OGR (when reading an OSM file with the `other_tags` field.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
HStore field	`CAMPO`	[tablefield: any]	The field(s) to drop
Expected list of fields separated by a comma Opcional	`EXPECTED_FIELDS`	[string] Padrão: ''	Comma-separated list of fields to extract. The HStore field will be updated by removing these keys.
Exploded	`SAÍDA`	[same as input] Default: `[Create temporary layer]`	Especifique a camada vetorial de saída. Uma de: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Exploded	`SAÍDA`	[same as input]	Output vector layer

Python code

Algorithm ID: `qgis:explodehstorefield`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract binary field

Extracts contents from a binary field, saving them to individual files. Filenames can be generated using values taken from an attribute in the source table or based on a more complex expression.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Input vector layer containing the binary data
Binary field	`CAMPO`	[tablefield: any]	Field containing the binary data
File name	`FILENAME`	[expression]	Field or expression-based text to name each output file
Destination folder	`FOLDER`	[folder] Default: `[Save to a temporary folder]`	Folder in which to store the output files. One of: • Salvar como Diretório Temporário • Salvar para Diretório… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Folder	`FOLDER`	[folder]	The folder that contains the output files.

Python code

Algorithm ID: `qgis:extractbinary`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Feature filter

Filters features from the input layer and redirects them to one or several outputs. If you do not know about any attribute names that are common to all possible input layers, filtering is only possible on the feature geometry and general record mechanisms, such as `$id` and `uuid`.

Nota: Este algoritmo só está disponível em *Graphical modeler*.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada de entrada.
Outputs and filters (one or more)	`OUTPUT_<name of the filter>`	[same as input]	The output layers with filters (as many as there are filters).

Saídas

Etiqueta	Nome	Tipo	Descrição
Saída (one or more)	native:filter_1:OUTPUT_<name of filter>	[same as input]	The output layers with filtered features (as many as there are filters).

Python code

Algorithm ID: `qgis:featurefilter`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Calculadora de campo

Opens the field calculator (see *Expressões*). You can use all the supported expressions and functions.

A new layer is created with the result of the expression.

The field calculator is very useful when used in *O modelador gráfico*.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	The layer to calculate on
Output field name	FIELD_NAME	[string]	The name of the field for the results
Output field type	FIELD_TYPE	[enumeration] Padrão: 0	The type of the field. One of: • 0 — Float • 1 — Integer • 2 — Texto • 3 — Date
Output field width	FIELD_LENGTH	[number] Padrão: 10	The length of the result field (minimum 0)
Field precision	FIELD_PRECISION	[number] Padrão: 3	The precision of the result field (minimum 0, maximum 15)
Create new field	NEW_FIELD	[boolean] Padrão: Verdadeiro	Should the result field be a new field
Formula	FORMULA	[expression]	The formula to use to calculate the result
Output file	SAÍDA	[vector: any] Default: [Save to temporary file]	Specification of the output layer.

Saídas

Etiqueta	Nome	Tipo	Descrição
Calculado	`SAÍDA`	[vector: any]	Output layer with the calculated field values

Python code

Algorithm ID: `qgis:fieldcalculator`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Editar campos

Allows editing the structure of the attribute table of a vector layer.

Fields can be modified in their type and name, using a fields mapping.

The original layer is not modified. A new layer is generated, which contains a modified attribute table, according to the provided fields mapping.

Refactor layer fields allows to:

- Change field names and types
- Add and remove fields
- Reordenar campos
- Calcular novos campos baseado nas expressões
- Load field list from another layer

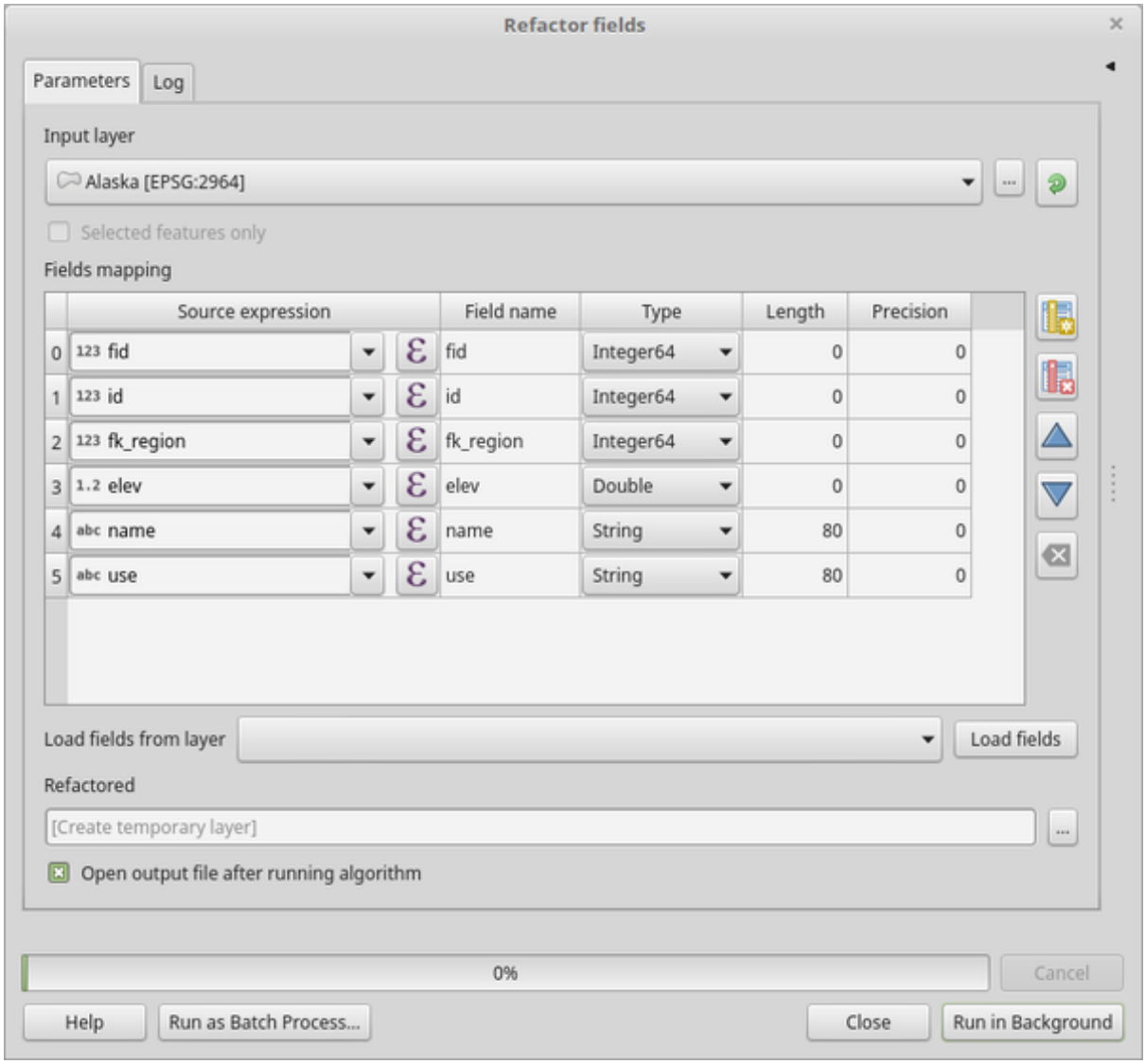


Figura24.102: Refactor fields dialog

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	The layer to modify

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Tabela 24.143 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Fields mapping	`FIELDS_MAPPING`	[list]	List of output fields with their definitions. The embedded table lists all the fields of the source layer and allows you to edit them: • Click  to create a new field. • Click  to remove a field. • Use  and  to change the selected field order. • Click  to reset to the default view. For each of the fields you'd like to reuse, you need to fill the following options: ***Source expression*** **(`expression`) [expression]** Campo ou expressão da camada de entrada ***Field name*** **(`name`) [string]** Name of the field in the output layer. By default input field name is kept. ***Type*** **(`type`) [enumeration]** Data type of the output field. One of: • Date (14) • DateTime (16) • Double (6) • Integer (2) • Integer64 (4) • String (10) • Boolean (1) ***Length*** **(`length`) [number]** Comprimento do campo de saída. ***Precision*** **(`precision`) [number]** Precisão do campo de saída. Fields from another layer can be loaded into the field list in *Load fields from layer*.
Refactored	`SAÍDA`	[vector: any] Default: `[Create temporary layer]`	Especificação da camada de saída. Uma de: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Refactored	`SAÍDA`	[vector: any]	Output layer with refactored fields

Python code

Algorithm ID: `qgis:refactorfields`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Rename vector field

Renames an existing field from a vector layer.

The original layer is not modified. A new layer is generated where the attribute table contains the renamed field.

Ver também:

Editar campos

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	The input vector layer
Field to rename	`CAMPO`	[string]	The field to be altered
New field name	`NEW_NAME`	[string]	The new field name
Renamed	`SAÍDA`	[vector: same as input] Default: `[Create temporary layer]`	Especificação da camada de saída. Uma de: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Renamed	`SAÍDA`	[vector: same as input]	Output layer with the renamed field

Python code

Algorithm ID: `qgis:renametablefield`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Texto para flutuante

Modifies the type of a given attribute in a vector layer, converting a text attribute containing numeric strings into a numeric attribute (e.g. '1' to `1.0`).

The algorithm creates a new vector layer so the source one is not modified.

If the conversion is not possible the selected column will have `NULL` values.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	The input vector layer.
Text attribute to convert to float	`CAMPO`	[tablefield: string]	The string field for the input layer that is to be converted to a float field.
Float from text	`SAÍDA`	[same as input] Default: `[Create Temporary Layer]`	Especifique a camada da linha de saída. Um de: • Criar Camada Temporária • Salvar para Arquivo… • Salvar para Geopackage… • Salvar para Tabela PostGIS… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Float from text	`SAÍDA`	[same as input]	Output vector layer with the string field converted into a float field

Python code

Algorithm ID: `qgis:texttofloat`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.1.20 Vector Tiles

Write vector tiles (MBTiles)

Exports one or more vector layers to vector tiles, a data format optimized for fast map rendering and small data size.

MBTiles is a specification for storing tiled map data in SQLite databases for immediate usage and for transfer. MBTiles files are known as tilesets.

Parameters

Label	Name	Type	Description
Input layers	`INPUT`	[vector: any][list]	A list of layers to combine to generate the vector tiles
Minimum zoom level	`MIN_ZOOM`	[number] Default: 0	The lowest zoom level for which the tileset provides data. Set between 0 and 24.
Maximum zoom level	`MAX_ZOOM`	[number] Default: 3	The highest zoom level for which the tileset provides data. Set between 0 and 24.
Extent Optional	`EXTENT`	[extent] Default: Not set	The maximum extent of the rendered map area. Bounds must define an area covered by all zoom levels.
Metadata: Name Optional	`META_NAME`	[string]	Name of the tileset
Metadata: Description Optional	`META_DESCRIPTION`	[string]	A description of the tileset's contents
Metadata: Attribution Optional	`META_ATTRIBUTION`	[string]	An attribution string, which explains the sources of data and/or style for the map.
Metadata: Version Optional	`META_VERSION`	[string]	The version of the tileset. This refers to a revision of the tileset itself, not of the MBTiles specification.
Metadata: Type Optional	`META_TYPE`	[string]	Type of tileset. Possible values are `overlay` or `baselayer`.
Metadata: Center Optional	`META_CENTER`	[string]	The center (string of comma-separated numbers: the longitude, latitude, and zoom level) of the default view of the map. Example: `-122.1906,37.7599,11`
Destination MBTiles	`OUTPUT`	[vector tiles] Default: [Save to temporary file]	Specification of the output MBTiles file. One of: • Save to a Temporary File • Save to File…

Outputs

Label	Name	Type	Description
Destination MBTiles	`OUTPUT`	[file]	Output vector tiles `.mbtiles` file.

Python code

Algorithm ID: `native:writevectortiles_mbtiles`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Write vector tiles (XYZ)

Exports one or more vector layers to vector tiles, a data format optimized for fast map rendering and small data size.

Parameters

Label	Name	Type	Description
File template	`XYZ_TEMPLATE`	[string] Default: '{z}/{x}/{y}.pbf'	Template to generate the vector tiles url
Input layers	`INPUT`	[vector: any][list]	A list of layers to combine to generate the vector tiles
Minimum zoom level	`MIN_ZOOM`	[number] Default: 0	The lowest zoom level for which the tileset provides data. Set between 0 and 24.
Maximum zoom level	`MAX_ZOOM`	[number] Default: 3	The highest zoom level for which the tileset provides data. Set between 0 and 24.
Extent Optional	`EXTENT`	[extent] Default: Not set	The maximum extent of the rendered map area. Bounds must define an area covered by all zoom levels.
Output directory	`OUTPUT_DIRECTORY`	[folder] Default: [Save to temporary folder]	Specification of the output vector tiles folder. One of: • Save to a Temporary Directory • Save to Directory

Outputs

Label	Name	Type	Description
Output directory	`OUTPUT_DIRECTORY`	[folder]	A folder containing different subsets of the vector tiles files (`.pbf`) stored in subfolders corresponding to the zoom levels.

Python code

Algorithm ID: `native:writevectortiles_xyz`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.2 Provedor de algoritmo geoespacial GDAL

GDAL (Geospatial Data Abstraction Library) é uma biblioteca de conversão raster e vectorial entre formatos de dados geoespaciais. Os algoritmos na framework de processamento têm origem nos GDAL raster programs e GDAL vector programs.

24.2.1 Análise raster

Aspecto

Gera um mapa de aspecto de qualquer elevação raster suportada pelo GDAL. Aspecto é a direção da bússola que um declive enfrenta. Os píxels terão um valor de 0-360° medidos em graus a partir do norte indicando o azimute. No hemisfério norte, o lado norte dos declives é frequentemente sombreado (pequeno azimute de 0-90°), enquanto o lado sul recebe mais radiação solar (azimute maior de 180-270°).

This algorithm is derived from the GDAL DEM utility.

Default menu: *Raster* ► *Analysis*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de elevação de entrada
Número da banda	`BANDA`	[banda do raster] Padrão: 1	O número da banda a ser usada como elevação
Return trigonometric angle instead of azimuth	`TRIG_ANGLE`	[booleano] Padrão: Falso	Activating the trigonometric angle results in different categories: 0° (East), 90° (North), 180° (West), 270° (South).
Return 0 for flat instead of -9999	`ZERO_FLAT`	[booleano] Padrão: Falso	Ativando esta opção será inserido um valor 0 para o valor -9999 em áreas planas.
Compute edges	`COMPUTE_EDGES`	[booleano] Padrão: Falso	Generates edges from the elevation raster
Use Zevenbergen&Thorne formula instead of the Horn's one	`ZEVENBERGEN`	[booleano] Padrão: Falso	Activates Zevenbergen&Thorne formula for smooth landscapes
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL

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Tabela 24.145 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Aspecto	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Output raster layer. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Aspecto	`SAÍDA`	[raster]	Output raster with angle values in degrees

Python code

Algorithm ID: `gdal:aspect`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Cor do relevo

Gera um mapa de relevo colorido a partir de qualquer elevação raster suportada pelo GDAL. Os relevos coloridos podem ser usados particularmente para retratar elevações. A saída do algoritmo produz uma imagem raster de 4 bandas com valores calculados a partir da elevação e um arquivo de configuração de cor baseado em texto. Por padrão, as cores entre os valores de elevação fornecidos são combinadas suavemente e o resultado é uma boa imagem raster com elevação colorida.

This algorithm is derived from the GDAL DEM utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de elevação de entrada
Número da banda	`BANDA`	[banda do raster] Padrão: 1	O número da banda a ser usada como elevação
Compute edges	`COMPUTE_EDGES`	[booleano] Padrão: Falso	Generates edges from the elevation raster
Color configuration file	`COLOR_TABLE`	[file]	A text-based color configuration file
Matching mode	`MATCH_MODE`	[enumeration] Padrão: 2	Um de: • 0 — Use strict color matching • 1 — Use closest RGBA quadruples • 2 — Use smoothly blended colours

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Tabela 24.146 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Color relief	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Output raster layer. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Color relief	`SAÍDA`	[raster]	A 4-band output raster

Python code

Algorithm ID: `gdal:colorrelief`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Preencher semdados

Preencha as regiões de raster com sem valores de dados por interpolação das bordas. Os valores para as regiões sem dados são calculados pelos valores de píxels ao redor usando ponderação pelo inverso da distância. Após a interpolação uma suavização dos resultados ocorre. A entrada pode ser qualquer camada raster suportada pelo GDAL. Esse algoritmo é geralmente adequado para interpolar regiões ausentes de rasters de variação bastante contínua (como modelos de elevação por exemplo). Também é adequado para preencher pequenos buracos e rachaduras em imagens com variações mais irregulares (como fotos aéreas). Geralmente não é tão bom em interpolar um raster de dados pontuais esparsos.

This algorithm is derived from the GDAL fillnodata utility.

Default menu: *Raster* ► *Analysis*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de entrada
Número da banda	`BANDA`	[banda do raster] Padrão: 1	A banda para operar. Sem valores de dados deve ser representado pelo valor 0.
Maximum distance (in pixels) to search out for values to interpolate	`DISTÂNCIA`	[número] Padrão: 10	The number of pixels to search in all directions to find values to interpolate from
Number of smoothing iterations to run after the interpolation	`ITERAÇÕES`	[número] Padrão: 0	O número de filtros 3x3 passa a ser executado (0 ou mais) para suavizar os resultados da interpolação.
Do not use default validity mask for the input band	`SEM_MÁSCARA`	[booleano] Padrão: Falso	Activates the user-defined validity mask
Validity mask	`CAMADA_MÁSCARA`	[raster]	A raster layer that defines the areas to fill.
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Filled	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Especificação da camada raster de saída. Um de: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Filled	`SAÍDA`	[raster]	Raster de saída

Python code

Algorithm ID: `gdal:fillnodata`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Grid (Data metrics)

Computes some data metrics using the specified window and output grid geometry.

This algorithm is derived from the GDAL grid utility.

Default menu: *Raster* ► *Analysis*

Ver também:

GDAL grid tutorial

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de pontos	`ENTRADA`	[vector: point]	Input point vector layer
Data metric to use	`MÉTRICA`	[enumeration] Padrão: 0	Um de: • 0 — Minimum, minimum value found in grid node search ellipse • 1 — Maximum, maximum value found in grid node search ellipse • 2 — Range, a difference between the minimum and maximum values found in grid node search ellipse • 3 — Count, a number of data points found in grid node search ellipse • 4 — Average distance, an average distance between the grid node (center of the search ellipse) and all of the data points found in grid node search ellipse • 5 — Average distance between points, an average distance between the data points found in grid node search ellipse. The distance between each pair of points within ellipse is calculated and average of all distances is set as a grid node value
The first radius of search ellipse	`RADIUS_1`	[número] Padrão: 0,0	The first radius (X axis if rotation angle is 0) of the search ellipse
The second radius of search ellipse	`RADIUS_2`	[número] Padrão: 0,0	The second radius (Y axis if rotation angle is 0) of the search ellipse

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Tabela 24.148 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Angle of search ellipse rotation in degrees (counter clockwise)	`ÂNGULO`	[número] Padrão: 0,0	Ângulo de rotação da elipse em graus. A elipse é rotacionada no sentido horário.
Minimum number of data points to use	`MIN_POINTS`	[número] Padrão: 0,0	Número mínimo de pontos de dados para calcular a média. Se a quantia de pontos encontrada é baixa o nó da grid é considerado vazio e será preenchido com o marcador SEM DADOS.
Semdados	`SEMDADOS`	[número] Padrão: 0,0	No data marker to fill empty points
Z value from field Opcional	`CAMPO_Z`	[tablefield: numeric]	Field for the interpolation
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Defines the data type of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Interpolated (data metrics)	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer with interpolated values. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Interpolated (data metrics)	`SAÍDA`	[raster]	Output raster with interpolated values

Python code

Algorithm ID: `gdal:griddatametrics`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Grid (IDW with nearest neighbor searching)

Computes the Inverse Distance to a Power gridding combined to the nearest neighbor method. Ideal when a maximum number of data points to use is required.

This algorithm is derived from the GDAL grid utility.

Ver também:

GDAL grid tutorial

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de pontos	`ENTRADA`	[vector: point]	Input point vector layer
Weighting power	`POTÊNCIA`	[número] Padrão: 2.0	Weighting power
Suavização	`SUAVIZAÇÃO`	[número] Padrão: 0,0	Parâmetro de suavização
O raio do círculo de busca	`RAIO`	[número] Padrão: 1.0	O raio do círculo de busca
Número máximo de pontos de dados a usar	`MAX_PONTOS`	[número] Padrão: 12	Do not search for more points than this number.
Minimum number of data points to use	`MIN_POINTS`	[número] Padrão: 0	Número mínimo de pontos de dados para calcular a média. Se a quantia de pontos encontrada é baixa o nó da grid é considerado vazio e será preenchido com o marcador SEM DADOS.
Semdados	`SEMDADOS`	[número] Padrão: 0,0	No data marker to fill empty points
Z value from field Opcional	`CAMPO_Z`	[tablefield: numeric]	Field for the interpolation

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Tabela 24.149 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Defines the data type of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Interpolated (IDW with NN search)	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer with interpolated values. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Interpolated (IDW with NN search)	`SAÍDA`	[raster]	Output raster with interpolated values

Python code

Algorithm ID: `gdal:gridinversedistancenearestneighbor`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Grid (Inverse distance to a power)

The Inverse Distance to a Power gridding method is a weighted average interpolator.

You should supply the input arrays with the scattered data values including coordinates of every data point and output grid geometry. The function will compute interpolated value for the given position in output grid.

This algorithm is derived from the GDAL grid utility.

Default menu: *Raster ► Analysis*

Ver também:

GDAL grid tutorial

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de pontos	`ENTRADA`	[vector: point]	Input point vector layer
Weighting power	`POTÊNCIA`	[número] Padrão: 2.0	Weighting power
Smothing	`SUAVIZAÇÃO`	[número] Padrão: 0,0	Parâmetro de suavização
The first radius of search ellipse	`RADIUS_1`	[número] Padrão: 0,0	The first radius (X axis if rotation angle is 0) of the search ellipse
The second radius of search ellipse	`RADIUS_2`	[número] Padrão: 0,0	The second radius (Y axis if rotation angle is 0) of the search ellipse
Angle of search ellipse rotation in degrees (counter clockwise)	`ÂNGULO`	[número] Padrão: 0,0	Ângulo de rotação da elipse em graus. A elipse é rotacionada no sentido horário.
Número máximo de pontos de dados a usar	`MAX_PONTOS`	[número] Padrão: 0	Do not search for more points than this number.
Minimum number of data points to use	`MIN_POINTS`	[número] Padrão: 0	Número mínimo de pontos de dados para calcular a média. Se a quantia de pontos encontrada é baixa o nó da grid é considerado vazio e será preenchido com o marcador SEM DADOS.
Semdados	`SEMDADOS`	[número] Padrão: 0,0	No data marker to fill empty points
Z value from field Opcional	`CAMPO_Z`	[tablefield: numeric]	Field for the interpolation
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ”	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL

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Tabela 24.150 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Defines the data type of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Interpolated (IDW)	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer with interpolated values. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Interpolated (IDW)	`SAÍDA`	[raster]	Output raster with interpolated values

Python code

Algorithm ID: `gdal:gridinversedistance`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Grid (Linear)

The Linear method perform linear interpolation by computing a Delaunay triangulation of the point cloud, finding in which triangle of the triangulation the point is, and by doing linear interpolation from its barycentric coordinates within the triangle. If the point is not in any triangle, depending on the radius, the algorithm will use the value of the nearest point or the NODATA value.

This algorithm is derived from the GDAL grid utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de pontos	`ENTRADA`	[vector: point]	Input point vector layer
Distância de busca	`RAIO`	[número] Padrão: -1,0	In case the point to be interpolated does not fit into a triangle of the Delaunay triangulation, use that maximum distance to search a nearest neighbour, or use nodata otherwise. If set to `-1`, the search distance is infinite. If set to `0`, no data value will be used.
Semdados	`SEMDADOS`	[número] Padrão: 0,0	No data marker to fill empty points
Z value from field Opcional	`CAMPO_Z`	[tablefield: numeric]	Field for the interpolation
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ”	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Defines the data type of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Interpolated (Linear)	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer with interpolated values. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Interpolated (Linear)	`SAÍDA`	[raster]	Output raster with interpolated values

Python code

Algorithm ID: `gdal:gridlinear`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Grid (média móvel)

A média móvel é um algoritmo simples que calcula a média de dados. Ele usa uma janela móvel de formato elíptico para procurar valores e calcular a média de todos os pontos de dados dentro da janela. A elipse de pesquisa pode ser rotacionada por um ângulo especificado, o centro da elipse localizado no nó da grid. Além disso, o número mínimo de pontos de dados para a média pode ser definido, se não houver pontos suficientes na janela, o nó da grid é considerado vazio e será preenchido com o valor SEM DADOS especificado.

This algorithm is derived from the GDAL grid utility.

Default menu: *Raster* ► *Analysis*

Ver também:

GDAL grid tutorial

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de pontos	`ENTRADA`	[vector: point]	Input point vector layer
The first radius of search ellipse	`RADIUS_1`	[número] Padrão: 0,0	The first radius (X axis if rotation angle is 0) of the search ellipse
The second radius of search ellipse	`RADIUS_2`	[número] Padrão: 0,0	The second radius (Y axis if rotation angle is 0) of the search ellipse
Angle of search ellipse rotation in degrees (counter clockwise)	`ÂNGULO`	[número] Padrão: 0,0	Ângulo de rotação da elipse em graus. A elipse é rotacionada no sentido horário.
Minimum number of data points to use	`MIN_POINTS`	[número] Padrão: 0,0	Número mínimo de pontos de dados para calcular a média. Se a quantia de pontos encontrada é baixa o nó da grid é considerado vazio e será preenchido com o marcador SEM DADOS.
Semdados	`SEMDADOS`	[número] Padrão: 0,0	No data marker to fill empty points
Z value from field Opcional	`CAMPO_Z`	[tablefield: numeric]	Field for the interpolation

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Tabela 24.152 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Defines the data type of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Interpolated (moving average)	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Interpolated (moving average)	`SAÍDA`	[raster]	Output raster with interpolated values

Python code

Algorithm ID: `gdal:gridaverage`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Grid (Nearest neighbor)

The Nearest Neighbor method doesn't perform any interpolation or smoothing, it just takes the value of nearest point found in grid node search ellipse and returns it as a result. If there are no points found, the specified NODATA value will be returned.

This algorithm is derived from the GDAL grid utility.

Default menu: *Raster* ► *Analysis*

Ver também:

GDAL grid tutorial

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de pontos	`ENTRADA`	[vector: point]	Input point vector layer
The first radius of search ellipse	`RADIUS_1`	[número] Padrão: 0,0	The first radius (X axis if rotation angle is 0) of the search ellipse
The second radius of search ellipse	`RADIUS_2`	[número] Padrão: 0,0	The second radius (Y axis if rotation angle is 0) of the search ellipse
Angle of search ellipse rotation in degrees (counter clockwise)	`ÂNGULO`	[número] Padrão: 0,0	Ângulo de rotação da elipse em graus. A elipse é rotacionada no sentido horário.
Semdados	`SEMDADOS`	[número] Padrão: 0,0	No data marker to fill empty points
Z value from field Opcional	`CAMPO_Z`	[tablefield: numeric]	Field for the interpolation
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Defines the data type of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64

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Tabela 24.153 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Interpolated (Nearest neighbour)	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer with interpolated values. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Interpolated (Nearest neighbour)	`SAÍDA`	[raster]	Output raster with interpolated values

Python code

Algorithm ID: `gdal:gridnearestneighbor`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Sombreamento

Outputs a raster with a nice shaded relief effect. It's very useful for visualizing the terrain. You can optionally specify the azimuth and altitude of the light source, a vertical exaggeration factor and a scaling factor to account for differences between vertical and horizontal units.

This algorithm is derived from the GDAL DEM utility .

Default menu: *Raster* ► *Analysis*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Input Elevation raster layer
Número da banda	`BANDA`	[banda do raster] Padrão: 1	Band containing the elevation information
Z factor (vertical exaggeration)	`FATOR_Z`	[número] Padrão: 1.0	The factor exaggerates the height of the output elevation raster
Scale (ratio of vert. units to horiz.)	`ESCALA`	[número] Padrão: 1.0	The ratio of vertical units to horizontal units
Azimuth of the light	`AZIMUTH`	[número] Padrão: 315,0	Defines the azimuth of the light shining on the elevation raster in degrees. If it comes from the top of the raster the value is 0, if it comes from the east it is 90 a.s.o.

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Tabela 24.154 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Altitude of the light	`ALTITUDE`	[número] Padrão: 45,0	Defines the altitude of the light, in degrees. 90 if the light comes from above the elevation raster, 0 if it is raking light.
Compute edges	`COMPUTE_EDGES`	[booleano] Padrão: Falso	Generates edges from the elevation raster
Use Zevenbergen&Thorne formula (instead of the Horn's one)	`ZEVENBERGEN`	[booleano] Padrão: Falso	Activates Zevenbergen&Thorne formula for smooth landscapes
Combined shading	`COMBINED`	[booleano] Padrão: Falso	
Multidirectional shading	`MULTIDIRECTIONAL`	[booleano] Padrão: Falso	
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Sombreamento	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer with interpolated values. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Sombreamento	`SAÍDA`	[raster]	Output raster with interpolated values

Python code

Algorithm ID: `gdal:hillshade`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Near black

Converts nearly black/white borders to black.

This algorithm will scan an image and try to set all pixels that are nearly or exactly black, white or one or more custom colors around the collar to black or white. This is often used to "fix up" lossy compressed airphotos so that color pixels can be treated as transparent when mosaicking.

This algorithm is derived from the GDAL nearblack utility.

Default menu: *Raster* ► *Analysis*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Input Elevation raster layer
How far from black (white)	`NEAR`	[número] Padrão: 15	Select how far from black, white or custom colors the pixel values can be and still considered near black, white or custom color.
Search for nearly white pixels instead of nearly black	`BRANCO`	[booleano] Padrão: Falso	Search for nearly white (255) pixels instead of nearly black pixels
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Nearblack	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Nearblack	`SAÍDA`	[raster]	Raster de saída

Python code

Algorithm ID: `gdal:nearblack`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Proximity (raster distance)

Generates a raster proximity map indicating the distance from the center of each pixel to the center of the nearest pixel identified as a target pixel. Target pixels are those in the source raster for which the raster pixel value is in the set of target pixel values.

This algorithm is derived from the GDAL proximity utility.

Default menu: *Raster* ► *Analysis*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Input Elevation raster layer
Número da banda	`BANDA`	[banda do raster] Padrão: 1	Band containing the elevation information
A list of pixel values in the source image to be considered target pixels Opcional	`VALUES`	[string] Padrão: ''	A list of target pixel values in the source image to be considered target pixels. If not specified, all non-zero pixels will be considered target pixels.
Distance units	`UNIDADES`	[enumeration] Padrão: 1	Indicate whether distances generated should be in pixel or georeferenced coordinates. One of: • 0 — Georeferenced coordinates • 1 — Pixel coordinates
The maximum distance to be generated Opcional	`MAX_DISTANCE`	[número] Padrão: 0,0	The maximum distance to be generated. The nodata value will be used for pixels beyond this distance. If a nodata value is not provided, the output band will be queried for its nodata value. If the output band does not have a nodata value, then the value 65535 will be used. Distance is interpreted according to the value of *Distance units*.
Value to be applied to all pixels that are within the maxdist of target pixels Opcional	`REPLACE`	[número] Padrão: 0,0	Specify a value to be applied to all pixels that are closer than the maximum distance from target pixels (including the target pixels) instead of a distance value.

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Tabela 24.156 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Nodata value to use for the destination proximity raster Opcional	`SEMDADOS`	[número] Padrão: 0,0	Specify the nodata value to use for the output raster
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ”	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Defines the data type of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Proximity map	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Proximity map	`SAÍDA`	[raster]	Raster de saída

Python code

Algorithm ID: `gdal:proximity`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Roughness

Outputs a single-band raster with values computed from the elevation. Roughness is the degree of irregularity of the surface. It's calculated by the largest inter-cell difference of a central pixel and its surrounding cell. The determination of the roughness plays a role in the analysis of terrain elevation data, it's useful for calculations of the river morphology, in climatology and physical geography in general.

This algorithm is derived from the GDAL DEM utility.

Default menu: *Raster* ► *Analysis*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de elevação de entrada
Número da banda	`BANDA`	[banda do raster] Padrão: 1	O número da banda a ser usada como elevação
Compute edges	`COMPUTE_EDGES`	[booleano] Padrão: Falso	Generates edges from the elevation raster
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Roughness	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Roughness	`SAÍDA`	[raster]	Single-band output roughness raster. The value -9999 is used as nodata value.

Python code

Algorithm ID: `gdal:roughness`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Sieve

Removes raster polygons smaller than a provided threshold size (in pixels) and replaces them with the pixel value of the largest neighbour polygon. It is useful if you have a large amount of small areas on your raster map.

This algorithm is derived from the GDAL sieve utility.

Default menu: *Raster* ► *Analysis*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de elevação de entrada
Threshold	`THRESHOLD`	[número] Padrão: 10	Only raster polygons smaller than this size will be removed
Use 8-connectedness	`EIGHT_CONNECTEDNESS`	[booleano] Padrão: Falso	Use eight connectedness instead of four connectedness
Do not use the default validity mask for the input band	`SEM_MÁSCARA`	[booleano] Padrão: Falso	
Validity mask Opcional	`CAMADA_MÁSCARA`	[raster]	Validity mask to use instead of the default
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Sieved	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Sieved	`SAÍDA`	[raster]	Camada raster de saída

Python code

Algorithm ID: `gdal:sieve`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Pendiente

Generates a slope map from any GDAL-supported elevation raster. Slope is the angle of inclination to the horizontal. You have the option of specifying the type of slope value you want: degrees or percent slope.

This algorithm is derived from the GDAL DEM utility.

Default menu: *Raster* ► *Analysis*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Input Elevation raster layer
Número da banda	`BANDA`	[banda do raster] Padrão: 1	Band containing the elevation information
Ratio of vertical units to horizontal	`ESCALA`	[número] Padrão: 1.0	The ratio of vertical units to horizontal units
Slope expressed as percent (instead of degrees)	`AS_PERCENT`	[booleano] Padrão: Falso	Express slope as percent instead of degrees
Compute edges	`COMPUTE_EDGES`	[booleano] Padrão: Falso	Generates edges from the elevation raster
Use Zevenbergen&Thorne formula (instead of the Horn's one)	`ZEVENBERGEN`	[booleano] Padrão: Falso	Activates Zevenbergen&Thorne formula for smooth landscapes
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Slope	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Slope	`SAÍDA`	[raster]	Raster de saída

Python code

Algorithm ID: `gdal:slope`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Terrain Ruggedness Index (TRI)

Outputs a single-band raster with values computed from the elevation. TRI stands for Terrain Ruggedness Index, which is defined as the mean difference between a central pixel and its surrounding cells.

This algorithm is derived from the GDAL DEM utility.

Default menu: *Raster* ► *Analysis*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de elevação de entrada
Número da banda	`BANDA`	[banda do raster] Padrão: 1	O número da banda a ser usada como elevação
Compute edges	`COMPUTE_EDGES`	[booleano] Padrão: Falso	Generates edges from the elevation raster
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Terrain Ruggedness Index	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Terrain Ruggedness Index	`SAÍDA`	[raster]	Output ruggedness raster. The value -9999 is used as nodata value.

Python code

Algorithm ID: `gdal:triterrainruggednessindex`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Topographic Position Index (TPI)

Outputs a single-band raster with values computed from the elevation. TPI stands for Topographic Position Index, which is defined as the difference between a central pixel and the mean of its surrounding cells.

This algorithm is derived from the GDAL DEM utility.

Default menu: *Raster* ► *Analysis*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de elevação de entrada
Número da banda	`BANDA`	[banda do raster] Padrão: 1	The number of the band to use for elevation values
Compute edges	`COMPUTE_EDGES`	[booleano] Padrão: Falso	Generates edges from the elevation raster
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ”	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Terrain Ruggedness Index	`SAÍDA`	[raster] Padrão: `[Salvar em arquivo temporário]`	Specify the output raster layer. One of: • Salvar em arquivo temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Terrain Ruggedness Index	`SAÍDA`	[raster]	Output raster.

Python code

Algorithm ID: `gdal:tpitopographicpositionindex`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.2.2 Conversão de raster

gdal2xyz

Converte dados raster em formato de arquivo ASCII XYZ

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Raster layer to convert
Band number	`BAND`	[raster band] Default: The first band of the input layer	If the raster is multiband, choose the band you want to convert
Output comma-separated values	`CSV`	[boolean] Padrão: Falso	Sets whether the output file should be of type comma-separated values (csv).
XYZ ASCII file	`SAÍDA`	[file] Default: `[Save to temporary file]`	Especificação do arquivo de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
XYZ ASCII file	`ENTRADA`	[table]	Arquivo de tabela que contém os valores exportados da banda raster

Python code

Algorithm ID: `gdal:gdal2xyz`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

PCT para RGB

Converts an 8 bit paletted image to a 24 bit RGB. It will convert a pseudocolor band from the input file to an RGB file of the desired format.

This algorithm is derived from the GDAL pct2rgb utility.

Default menu: *Raster* ► *Conversion*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Input 8 bit raster image
Band number	`BAND`	[raster band] Default: The first band of the input layer	If the raster is multiband, choose the band you want to convert
Generate a RGBA file	`RGBA`	[boolean] Padrão: Falso	Sets whether the output file should be of type RGBA.
PCT to RGB	`SAÍDA`	[file] Default: `[Save to temporary file]`	Especificação do arquivo de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
PCT to RGB	`SAÍDA`	[raster]	24 bit RGB raster image

Python code

Algorithm ID: `gdal:pcttorgb`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Poligonizar (raster para vetor)

Cria polígonos vetoriais para todas as regiões conectadas de pixels no raster que compartilha um valor de pixel comum. Cada polígono é criado com um atributo que indica o valor de pixel desse polígono.

This algorithm is derived from the GDAL polygonize utility.

Default menu: *Raster* ► *Conversion*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de entrada
Band number	`BAND`	[raster band] Default: The first band of the input layer	If the raster is multiband, choose the band you want to use
Name of the field to create	`CAMPO`	[string] Default: 'DN'	Specify the field name for the attributes of the connected regions.
Use 8-connectedness	`EIGHT_CONNECTEDNESS`	[boolean] Padrão: Falso	If not set, raster cells must have a common border to be considered connected (*4-connected*). If set, touching raster cells are also considered connected (*8-connected*).
Parâmetros adicionais da linha de comando Opcional.	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Vectorized	`SAÍDA`	[vector: polygon] Default: `[Save to temporary file]`	Specification of the output (polygon) vector layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Vectorized	`SAÍDA`	[vector: polygon]	Output vector layer

Python code

Algorithm ID: `gdal:polygonize`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Reorganizar bandas

Cria um novo raster usando banda (s) selecionada de uma determinada camada raster. O algoritmo também torna possível reordenar as bandas para o raster recém-criado.

This algorithm is derived from the GDAL translate utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de entrada
Selected band(s)	`BANDS`	[raster band] [list] Padrão: Nenhum	Ordered list of the bands to use to create the new raster
Opções de criação adicionais Opcional.	`OPÇÕES`	[string] Padrão: ‘’	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 0	Defines the data type of the output raster file. Options: • 0 — Use Input Layer Data Type • 1 — Byte • 2 — Int16 • 3 — UInt16 • 4 — UInt32 • 5 — Int32 • 6 — Float32 • 7 — Float64 • 8 — CInt16 • 9 — CInt32 • 10 — CFloat32 • 11 — CFloat64

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Tabela 24.165 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Convertido	`SAÍDA`	[raster] Padrão: Salvar para arquivo temporário	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Convertido	`SAÍDA`	[raster]	Output raster layer with rearranged bands.

Python code

Algorithm ID: `gdal:rearrange_bands`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

RGB to PCT

Converts a 24 bit RGB image into a 8 bit paletted. Computes an optimal pseudo-color table for the given RGB-image using a median cut algorithm on a downsampled RGB histogram. Then it converts the image into a pseudo-colored image using the color table. This conversion utilizes Floyd-Steinberg dithering (error diffusion) to maximize output image visual quality.

Se você quiser classificar um mapa raster e quiser reduzir o número de classes que pode ser útil para downsample sua imagem com este algoritmo antes.

This algorithm is derived from the GDAL rgb2pct utility.

Default menu: *Raster* ► *Conversion*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Input (RGB) raster layer
Number of colors	`NCOLORS`	[number] Padrão: 2	O número de cores que a imagem resultante conterá. Um valor de 2-256 é possível.
RGB to PCT	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
RGB to PCT	`SAÍDA`	[raster]	Camada raster de saída

Python code

Algorithm ID: `gdal:rgbtopct`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Translate (convert format)

Converts raster data between different formats.

This algorithm is derived from the GDAL translate utility.

Default menu: *Raster* ► *Conversion*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de entrada
Override the projection of the output file Opcional.	`SRC_ALVO`	[crs]	Specify a projection for the output file
Assign a specified nodata value to output bands Opcional.	`NODATA`	[number] Default: Not set	Defines the value to use for nodata in the output raster
Copy all subdatasets of this file to individual output files	`COPY_SUBDATASETS`	[boolean] Padrão: Falso	Create individual files for subdatasets
Opções de criação adicionais Opcional.	`OPÇÕES`	[string] Padrão: ”	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando Opcional.	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL

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Tabela 24.167 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 0	Defines the data type of the output raster file. Options: • 0 — Use Input Layer Data Type • 1 — Byte • 2 — Int16 • 3 — UInt16 • 4 — UInt32 • 5 — Int32 • 6 — Float32 • 7 — Float64 • 8 — CInt16 • 9 — CInt32 • 10 — CFloat32 • 11 — CFloat64
Convertido	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Specification of the output (translated) raster layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Convertido	`SAÍDA`	[raster]	Output (translated) raster layer.

Python code

Algorithm ID: `gdal:translate`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.2.3 Extrair raster

Recortar raster extensão

Clips qualquer GDAL suportado raster arquivo para um dado extensão

This algorithm is derived from the GDAL warp utility.

Default menu: *Raster ► Extraction*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[raster]	The input raster
Clipping extent	EXTENT	[extent]	Extent that should be used for the output raster. Only pixels within the specified bounding box will be included in the output.
Assign a specified nodata value to output bands Opcional	NODATA	[number] Padrão: Nenhum	Defines a value that should be inserted for the nodata values in the output raster
Opções de criação adicionais Opcional	OPÇÕES	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Tipo de dados de saída	DATA_TYPE	[enumeration] Padrão: 0	Define o formato do arquivo de raster saída. Opções: • 0 — Use Input Layer Data Type • 1 — Byte • 2 — Int16 • 3 — UInt16 • 4 — UInt32 • 5 — Int32 • 6 — Float32 • 7 — Float64 • 8 — CInt16 • 9 — CInt32 • 10 — CFloat32 • 11 — CFloat64
Parâmetros adicionais da linha de comando Opcional	EXTRA	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Clipped (extent)	SAÍDA	[raster] Default: '[Save to temporary file]'	Especificação da camada raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Clipped (extent)	`SAÍDA`	[raster]	Output raster layer clipped by the given extent

Python code

Algorithm ID: `gdal:cliprasterbyextent`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Recortar raster por camada de máscara

Clips qualquer raster com suporte a GDAL por uma camada de máscara de Vetorial.

This algorithm is derived from the GDAL warp utility.

Default menu: *Raster ► Extraction*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	The input raster
Mask layer	`MASK`	[vector: polygon]	Vector mask for clipping the raster
SRC de Origem	`SRC_ORIGEM`	[crs]	Set the coordinate reference to use for the input raster
SRC Alvo	`SRC_ALVO`	[crs]	Set the coordinate reference to use for the mask layer
Assign a specified nodata value to output bands Opcional	`NODATA`	[number] Padrão: Nenhum	Defines a value that should be inserted for the nodata values in the output raster
Create an output alpha band	`ALPHA_BAND`	[boolean] Padrão: Falso	Cria uma banda alfa para o resultado, resulta. A banda alfa inclui os valores de transparência dos pixels.
Match the extent of the clipped raster to the extent of the mask layer	`CROP_TO_CUTLINE`	[boolean] Padrão: Verdadeiro	Aplica a extensão da camada vetorial à saída raster se checado.
Keep resolution of input raster	`KEEP_RESOLUTION`	[boolean] Padrão: Falso	The resolution of the output raster will not be changed
Set output file resolution	`SET_RESOLUTION`	[boolean] Padrão: Falso	Shall the output resolution (cell size) be specified
X Resolution to output bands Opcional	`X_RESOLUTION`	[number] Padrão: Nenhum	The width of the cells in the output raster
Y Resolution to output band Opcional	`Y_RESOLUTION`	[number] Padrão: Nenhum	The height of the cells in the output raster

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Tabela 24.169 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Use multithreaded warping implementation	`MULTITHREADING`	[boolean] Padrão: Falso	Two threads will be used to process chunks of image and perform input/output operation simultaneously. Note that computation is not multithreaded itself.
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ‘’	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 0	Define o formato do arquivo de raster saída. Opções: • 0 — Use Input Layer Data Type • 1 — Byte • 2 — Int16 • 3 — UInt16 • 4 — UInt32 • 5 — Int32 • 6 — Float32 • 7 — Float64 • 8 — CInt16 • 9 — CInt32 • 10 — CFloat32 • 11 — CFloat64
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL
Clipped (mask)	`SAÍDA`	[raster] Default: ‘[Save to temporary file]’	Especificação da camada raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Clipped (mask)	`SAÍDA`	[raster]	Output raster layer clipped by the vector layer

Python code

Algorithm ID: `gdal:cliprasterbymasklayer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

contorno

Extrai linhas de contorno de qualquer raster de elevação suportada pelo GDAL.

This algorithm is derived from the GDAL contour utility.

Default menu: *Raster* ► *Extraction*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Input raster
Band number	`BAND`	[raster band] Default: 1	Raster band to create the contours from
Interval between contour lines	`INTERVALO`	[number] Padrão: 10.0	Defines the interval between the contour lines in the given units of the elevation raster (minimum value 0)
Attribute name (if not set, no elevation attribute is attached) Opcional	`FIELD_NAME`	[string] Default: 'ELEV'	Provides a name for the attribute in which to put the elevation.
Offset from zero relative to which to interpret intervals Opcional	`OFFSET`	[number] Padrão: 0.0	
Produce 3D vector	`CREATE_3D`	[boolean] Padrão: Falso	Força a produção de vetores 3D em vez de 2D. Inclui elevação em todos os vértice.
Treat all raster values as valid	`IGNORE_NODATA`	[boolean] Padrão: Falso	Ignora todos os valores de nodata no conjunto de dados.
Input pixel value to treat as "nodata" Opcional	`NODATA`	[number] Padrão: Nenhum	Defines a value that should be inserted for the nodata values in the output raster

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Tabela 24.170 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Parâmetros adicionais da linha de comando Opcional	EXTRA	[string] Padrão: Nenhum	Add extra GDAL command line options. Refer to the corresponding GDAL utility documentation.
Contours	SAÍDA	[vector: line] Default: '[Save to temporary file]'	Specification of the output vector layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Contours	SAÍDA	[vector: line]	Output vector layer with contour lines

Python code

Algorithm ID: `gdal:contour`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Contour Polygons

Extracts contour polygons from any GDAL-supported elevation raster.

This algorithm is derived from the GDAL contour utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[raster]	Input raster
Band number	BAND	[raster band] Default: 1	Raster band to create the contours from
Interval between contour lines	INTERVALO	[number] Padrão: 10.0	Defines the interval between the contour lines in the given units of the elevation raster (minimum value 0)
Offset from zero relative to which to interpret intervals Opcional	OFFSET	[number] Padrão: 0.0	

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Tabela 24.171 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Attribute name for minimum elevation of contour polygon Opcional	FIELD_NAME_MIN	[string] Default: 'ELEV_MIN'	Provides a name for the attribute in which to put the minimum elevation of contour polygon. If not provided no minimum elevation attribute is attached.
Attribute name for maximum elevation of contour polygon Opcional	FIELD_NAME_MAX	[string] Default: 'ELEV_MAX'	Provides a name for the attribute in which to put the maximum elevation of contour polygon. If not provided no maximum elevation attribute is attached.
Produce 3D vector	CREATE_3D	[boolean] Padrão: Falso	Força a produção de vetores 3D em vez de 2D. Inclui elevação em todos os vértice.
Treat all raster values as valid	IGNORE_NODATA	[boolean] Padrão: Falso	Ignora todos os valores de nodata no conjunto de dados.
Input pixel value to treat as "nodata" Opcional	NODATA	[number] Padrão: Nenhum	Defines a value that should be inserted for the nodata values in the output raster
Parâmetros adicionais da linha de comando Opcional	EXTRA	[string] Padrão: Nenhum	Add extra GDAL command line options. Refer to the corresponding GDAL utility documentation.
Contours	SAÍDA	[vector: polygon] Default: '[Save to temporary file]'	Specification of the output vector layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Contours	SAÍDA	[vector: polygon]	Output vector layer with contour polygons

Python code

Algorithm ID: `gdal:contour_polygon`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.2.4 Miscelânea de Raster

Construir Visão geral (Pirâmides)

Para acelerar o tempo de renderização de visões de camadas as pirâmides podem ser criadas. As visões gerais são cópias de resolução mais baixa dos dados que o QGIS usa dependendo do nível de zoom.

This algorithm is derived from the GDAL addo utility.

Default menu: *Raster ► Miscellaneous*

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Camada raster de entrada
Remove all existing overviews	`CLEAN`	[boolean] Padrão: Falso	Removes existing overviews from the raster. By default these are not removed.

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Overview levels	`LEVELS`	[string] Default: '2 4 8 16'	Define o número de níveis de visão geral calculados pela resolução original da camada de rastreio de entrada. Por padrão, 4 níveis serão levados em consideração.
Resampling method Opcional	`RESAMPLING`	[enumeration] Padrão: 0	Calculates the overviews with a defined resampling method. Possible resampling methods are: • 0 – Nearest Neighbour (`nearest`) • 1 – Average (`average`) • 2 – Gaussian (`gauss`) • 3 – Cubic Convolution (`cubic`) • 4 – B-Spline Convolution (`cubicspline`) • 5 – Lanczos Windowed Sinc (`lanczos`) • 6 – Average MP (`average_mp`) • 7 – Average in Mag/Phase Space (`average_magphase`) • 8 – Mode (`mode`)
Overviews format Opcional	`FORMAT`	[enumeration] Padrão: 0	The overviews can be stored internally, or externally as GTiff or ERDAS Imagine file. By default the overviews are stored in the output raster. Possible formats methods are: • 0 – Internal (if possible) • 1 – External (GTiff .ovr) • 2 – External (ERDAS Imagine .aux)
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL

Saídas

Etiqueta	Nome	Tipo	Descrição
Pyramidized	`SAÍDA`	[raster]	Output raster layer with overviews

Python code

Algorithm ID: `gdal:overviews`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Construir raster virtual

Cria um VRT (Coleção Virtual) que é um mosaico da lista de rasteres suportados pelo GDAL de entrada. Com um mosaico você pode mesclar vários arquivos raster.

This algorithm is derived from the GDAL buildvrt utility.

Default menu: *Raster* ► *Miscellaneous*

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Camadas de entrada	`ENTRADA`	[raster] [list]	Importar raster suportado GDAL
Resolution	`RESOLUTION`	[enumeration] Padrão: 0	The output resolution of the mosaic. By default the average resolution of the raster files will be chosen. Opções: • 0 — Average (`average`) • 1 — Highest (`highest`) • 2 — Lowest (`lowest`)
Place each input file into a separate band	`SEPARATE`	[boolean] Padrão: Falso	Com 'Verdadeiro' você pode definir que cada arquivo de raster vai para uma banda separada na faixa da banda VRT.
Allow projection difference	`PROJ_DIFFERENCE`	[boolean] Padrão: Falso	Permite que as bandas de saída tenham diferentes projeções derivadas da projeção das camadas de varredura de entrada.
Virtual	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Especificação da camada raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Add alpha mask band to VRT when source raster has none	`ADD_ALPHA`	[boolean] Padrão: Falso	Adicionar canal de máscara alfa para VTR quando não houver nenhum raster
Override projection for the output file Opcional	`ASSIGN_CRS`	[crs] Padrão: Nenhum	Substituir a projeção do arquivo de saída. Sem reprojeção estar pronta.
Resampling algorithm	`RESAMPLING`	[enumeration] Padrão: 0	The resampling algorithm to be used Options: • 0 — Nearest Neighbour (`nearest`) • 1 — Bilinear (`bilinear`) • 2 — Cubic Convolution (`cubic`) • 3 — B-Spline Convolution (`cubicspline`) • 4 — Lanczos Windowed Sinc (`lanczos`) • 5 — Average (`average`) • 6 — Mode (`mode`)
Nodata value(s) for input bands (space separated) Opcional	`SRC_NODATA`	[string] Padrão: Nenhum	Space separated Nodata value(s) for input band(s)
Parâmetros adicionais da linha de comando	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL

Saídas

Etiqueta	Nome	Tipo	Descrição
Virtual	`SAÍDA`	[raster]	Camada raster de saída

Python code

Algorithm ID: `gdal:buildvirtualraster`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

gdal2tiles

Generates a directory with small tiles and metadata, following the OSGeo Tile Map Service Specification. See also the OpenGIS Web Map Tile Service Implementation Standard. Simple web pages with viewers based on Google Maps, OpenLayers and Leaflet are generated as well. To explore your maps on-line in the web browser, you only need to upload the generated directory onto a web server.

This algorithm also creates the necessary metadata for Google Earth (KML SuperOverlay), in case the supplied map uses `EPSG:4326` projection.

ESRI world files and embedded georeferencing is used during tile generation, but you can publish a picture without proper georeferencing too.

This algorithm is derived from the GDAL gdal2tiles utility.

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	GDAL-supported raster layer.
Tile cutting profile	`PROFILE`	[enumeration] Padrão: 0	Um de: • 0 — Mercator (`mercator`) • 1 — Geodetic (`geodetic`) • 2 — Raster (`raster`)
Zoom levels to render Opcional	`ZOOM`	[string] Padrão: ‘’	
Web viewer to generate	`VIEWER`	[enumerate] Padrão: 0	Um de: • 0 — All (`all`) • 1 — GoogleMaps (`google`) • 2 — OpenLayers (`openlayers`) • 3 — Leaflet (`leaflet`) • 4 — None (`none`)
Title of the map Opcional	`TITLE`	[string] Padrão: ‘’	
Copyright of the map	`COPYRIGHT`	[string] Padrão: ‘’	
Diretório de saída	`SAÍDA`	[folder] Default: `[Save to temporary folder]`	Specify the output folder for the tiles. One of: • Save to a Temporary Directory • Save to Directory

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Resampling method	`RESAMPLING`	[enumeration] Padrão: 0	The resampling algorithm to be used Options: • 0 — Average (`average`) • 1 — Nearest neighbour (`near`) • 2 — Bilinear (`bilinear`) • 3 — Cubic (`cubic`) • 4 — Cubic spline (`cubicspline`) • 5 — Lanczos Windowed sinc (`lanczos`) • 6 — Antialias (`antialias`)
The spatial reference system used for the source input data Opcional	`SRC_ORIGEM`	[crs] Padrão: Nenhum	
Transparency value to assign to the input data Opcional	`NODATA`	[number] Padrão: 0.0	
URL address where the generated tiles are going to be published Opcional	`URL`	[string] Padrão: ''	
Google Maps API key (http://code.google.com/apis/maps/signup.html) Opcional	`GOOGLE_KEY`	[string] Padrão: ''	Your Google maps API key.
Bing Maps API key (https://www.bingmapsportal.com/) Opcional	`BING_KEY`	[string] Padrão: ''	Your Bing maps API key.
Generate only missing files	`RESUME`	[boolean] Padrão: Falso	
Generate KML for Google Earth	`KML`	[boolean] Padrão: Falso	
Avoid automatic generation of KML files for EPSG:4326	`NO_KML`	[boolean] Padrão: Falso	

Saídas

Etiqueta	Nome	Tipo	Descrição
Diretório de saída	`SAÍDA`	[folder]	The output folder (for the tiles)

Python code

Algorithm ID: `gdal:gdal2tiles`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Mesclar

Mescla arquivos raster de maneira simples. Aqui você pode usar uma tabela pseudocor de uma entrada raster e definir o tipo de rasterização de saída. Todas as imagens devem estar no mesmo sistema de coordenadas.

This algorithm is derived from the GDAL merge utility.

Default menu: *Raster ► Miscellaneous*

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Camadas de entrada	`ENTRADA`	[raster] [list]	Input raster layers
Grab pseudocolor table from first layer	`PCT`	[boolean] Padrão: Falso	The pseudocolor table from the first layer will be used for the coloring
Place each input file into a separate band	`SEPARATE`	[boolean] Padrão: Falso	Place each input file into a separate band
Tipo de dados de saída	`DATA_TYPE`	[enumeration] Padrão: 5	Defines the format of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64

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Tabela 24.175 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Mesclado	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Especificação da camada raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Input pixel value to treat as "no-data" Opcional	`NODATA_INPUT`	[number] Padrão: Nenhum	Ignores pixels from files being merged in with this pixel value
Assign specified "nodata" value to output Opcional	`NODATA_OUTPUT`	[number] Padrão: Nenhum	Fixa um valor de "sem dado" as bandas de saída.
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL

Saídas

Etiqueta	Nome	Tipo	Descrição
Mesclado	`SAÍDA`	[raster]	Camada raster de saída

Python code

Algorithm ID: `gdal:merge`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Pansharpening

Performs a pan-sharpening operation. It can create a "classic" output dataset (such as GeoTIFF), or a VRT dataset describing the pan-sharpening operation.

See GDAL Pansharpen.

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Spectral dataset	`SPECTRAL`	[raster]	Input (spectral) raster layer
Panchromatic dataset	`PANCHROMATIC`	[raster]	Input (panchromatic) raster layer
Saída	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Specify the output (sharpened) raster layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Resampling algorithm	`RESAMPLING`	[enumeration] Padrão: 2	The resampling algorithm to be used Options: • 0 — Nearest Neighbour (`nearest`) • 1 — Bilinear (`bilinear`) • 2 — Cubic (`cubic`) • 3 — Cubic Spline (`cubicspline`) • 4 — Lanczos Windowed Sinc (`lanczos`) • 5 — Average (`average`)
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (`|`).
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL

Saídas

Etiqueta	Nome	Tipo	Descrição
Saída	`SAÍDA`	[raster]	Output (sharpened) raster layer

Python code

Algorithm ID: `gdal:pansharp`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Calculadora Raster

Command line raster calculator with numpy syntax. Use any basic arithmetic supported by numpy arrays, such as +, -, *, and / along with logical operators, such as >. Note that all input rasters must have the same dimensions, but no projection checking is performed.

See the GDAL Raster Calculator utility docs.

Ver também:

Calculadora Raster

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Input layer A	`INPUT_A`	[raster]	First input raster layer (mandatory)
Number of raster band for A	`BAND_A`	[raster band]	Band for input layer A (mandatory)
Input layer B Opcional	`INPUT_B`	[raster] Padrão: Nenhum	Second input raster layer
Number of raster band for B Opcional	`BAND_B`	[raster band]	Band for input layer B
Input layer C Opcional	`INPUT_C`	[raster] Padrão: Nenhum	Third input raster layer
Number of raster band for C Opcional	`BAND_C`	[raster band]	Band for input layer C
Input layer D Opcional	`INPUT_D`	[raster] Padrão: Nenhum	Fourth input raster layer
Number of raster band for D Opcional	`BAND_D`	[raster band]	Band for input layer D
Input layer E Opcional	`INPUT_E`	[raster] Padrão: Nenhum	Fifth input raster layer

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Tabela 24.177 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Number of raster band for E Opcional	`BAND_E`	[raster band]	Band for input layer E
Input layer F Opcional	`INPUT_F`	[raster]	Sixth input raster layer
Number of raster band for F Opcional	`BAND_F`	[raster band] Padrão: Nenhum	Band for input layer F
Calculation in gdalnumeric syntax using +-/* or any numpy array functions (i.e. logical_and())	`FORMULA`	[string] Padrão: ''	The calculation formula. Examples: • `A*(A>0)` — outputs the value of the raster A if the value of A is greater than 0. If not, outputs 0. • `A*(A>0 and A>B)` — outputs the value of A if that value is bigger than 0 and bigger than the value of B. If not, outputs 0. • `A*logical_or(A<=177, A>=185)` — outputs the value of A if A <= 177 or A >= 185. If not, outputs 0. • `sqrt(A*A+B*B)` — Outputs the square root of the sum of the value of A squared and the value of B squared.
Set output nodata value Opcional	`NO_DATA`	[number] Padrão: Nenhum	Value to use for nodata
Output raster type	`RTYPE`	[enumeration] Padrão: 5	Defines the format of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64
Calculado	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Specify the output (calculated) raster layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Opções de criação adicionais Opcional	OPÇÕES	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Parâmetros adicionais da linha de comando Opcional	EXTRA	[string] Padrão: ''	Adicionar opções extras de linha de comando GDAL

Saídas

Etiqueta	Nome	Tipo	Descrição
Calculado	SAÍDA	[raster]	Output (calculated) raster layer

Python code

Algorithm ID: `gdal:rastercalculator`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Informação de raster

Este utilitário cria uma lista com várias informações sobre o conjunto de dados matricial GDAL suportado.

This algorithm is derived from the GDAL info utility.

Default menu: *Raster ► Miscellaneous*

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[raster]	Camada raster de entrada
Force computation of the actual min/max values for each band	MIN_MAX	[boolean] Padrão: Falso	Forces computation of the actual min/max values for each band in the dataset

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Tabela 24.179 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Read and display image statistics (force computation if necessary)	`STATS`	[boolean] Padrão: Falso	Lê e exibe estatísticas da imagem. Força o cálculo se nenhuma estatística for armazenada em uma imagem.
Suppress GCP info	`NO_GCP`	[boolean] Padrão: Falso	Suprime a impressão da lista de pontos de controle no solo. Pode ser útil para conjuntos de dados com grande quantidade de GCPs, como L1B AVHRR ou HDF4 MODIS, que contêm milhares deles.
Suprimir informação dos metadados	`SEM_METADADOS`	[boolean] Padrão: Falso	Suprime a impressão de metadados. Alguns conjuntos de dados podem conter muitas cadeias de metadados.
Informação da camada	`SAÍDA`	[html] Default: `[Save to temporary file]`	Specify the HTML file for output. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL

Saídas

Etiqueta	Nome	Tipo	Descrição
Informação da camada	`SAÍDA`	[html]	The HTML file containing information about the input raster layer

Python code

Algorithm ID: `gdal:gdalinfo`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Retile

Retiles a set of input tiles. All the input tiles must be georeferenced in the same coordinate system and have a matching number of bands. Optionally pyramid levels are generated.

This algorithm is derived from the GDAL Retile utility.

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Input files	`ENTRADA`	[raster] [list]	The input raster files
Tile width	`TILE_SIZE_X`	[number] Padrão: 256	Width of the tiles in pixels (minimum 0)
Tile height	`TILE_SIZE_Y`	[number] Padrão: 256	Height of the tiles in pixels (minimum 0)
Overlap in pixels between consecutive tiles	`OVERLAP`	[number] Padrão: 0	
Number of pyramid levels to build	`LEVELS`	[number] Padrão: 1	Minimum: 0
Diretório de saída	`SAÍDA`	[folder] Default: `[Save to temporary folder]`	Specify the output folder for the tiles. One of: • Save to a Temporary Directory • Save to Directory
CSV file containing the tile(s) georeferencing information	`OUTPUT_CSV`	[file] Default: `[Skip output]`	Specify the output file for the tiles. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Source coordinate reference system Opcional	`SRC_ORIGEM`	[crs] Padrão: Nenhum	
Resampling method	`RESAMPLING`	[enumeration] Padrão: 0	The resampling algorithm to be used Options: • 0 — Nearest Neighbour (`nearest`) • 1 — Bilinear (`bilinear`) • 2 — Cubic (`cubic`) • 3 — Cubic Spline (`cubicspline`) • 4 — Lanczos Windowed Sinc (`lanczos`)
Column delimiter used in the CSV file Opcional	`DELIMITER`	[string] Default: ‘;’	Delimiter to use in the CSV file containing the tile(s) georeferencing information

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Tabela 24.182 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Opções de criação adicionais Opcional	OPÇÕES	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Parâmetros adicionais da linha de comando Opcional	EXTRA	[string] Padrão: ''	Adicionar opções extras de linha de comando GDAL
Tipo de dados de saída	DATA_TYPE	[enumeration] Padrão: 5	Defines the format of the output raster file. Options: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Build only the pyramids	ONLY_PYRAMIDS	[boolean] Padrão: Falso	
Use separate directory for each tile row	DIR_FOR_ROW	[boolean] Padrão: Falso	

Saídas

Etiqueta	Nome	Tipo	Descrição
Diretório de saída	SAÍDA	[folder]	The output folder for the tiles.
CSV file containing the tile(s) georeferencing information	OUTPUT_CSV	[file]	The CSV file with georeferencing information for the tiles.

Python code

Algorithm ID: `gdal:retile`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Índice deslizante

Cria uma camada vetorial com um registro para cada arquivo de varredura de entrada, um atributo contendo o nome do arquivo e uma geometria de polígono definindo a varredura. Essa saída é adequada para uso com o MapServer como um indexador de rasterização.

This algorithm is derived from the GDAL Tile Index utility.

Default menu: *Raster* ► *Miscellaneous*

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Input files	`CAMADAS`	[raster] [list]	Arquivos de rasterização de entrada. Podem ser vários arquivos.
Field name to hold the file path to the indexed rasters Optional	`PATH_FIELD_NAME`	[string] Default: 'location'	Nome do arquivo para manter o caminho do arquivo para os rasteres indexados
Store absolute path to the indexed rasters	`ABSOLUTE_PATH`	[boolean] Padrão: Falso	Defina se o caminho absoluto para os arquivos raster é armazenado no arquivo de índice tile. Por padrão, os nomes dos arquivos raster serão colocados no arquivo exatamente como são especificados no comando.
Skip files with different projection reference	`PROJ_DIFFERENCE`	[boolean] Padrão: Falso	Somente arquivos com a mesma projeção dos arquivos já inseridos no índice de blocos serão inseridos. O padrão não verifica a projeção e aceita todas as entradas.
Tile index	`SAÍDA`	[vector: polygon] Default: `[Save to temporary file]`	Specify the polygon vector layer to write the index to. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Transform geometries to the given CRS Opcional	`SRC_ALVO`	[crs]	Geometries of input files will be transformed to the specified target coordinate reference system. Default creates simple rectangular polygons in the same coordinate reference system as the input rasters.
The name of the field to store the SRS of each tile Opcional	`CRS_FIELD_NAME`	[string]	The name of the field to store the SRS of each tile

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Tabela 24.184 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
The format in which the CRS of each tile must be written	`CRS_FORMAT`	[enumeration] Padrão: 0	Format for the CRS. One of: • 0 – Auto (`AUTO`) • 1 – Well-known text (`WKT`) • 2 – EPSG (`EPSG`) • 3 – Proj.4 (`PROJ`)

Saídas

Etiqueta	Nome	Tipo	Descrição
Tile index	`SAÍDA`	[vector: polygon]	The polygon vector layer with the tile index.

Python code

Algorithm ID: `gdal:tileindex`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Viewshed

Calculates a viewshed raster from an input raster DEM using method defined in Wang2000 for a user defined point.

Parâmetros

Basic parameters

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Input elevation raster layer
Band number	`BAND`	[raster band] Padrão: 1	The number of the band to use as elevation
Observer location	`OBSERVER`	[point]	The location of the observer
Observer height	`OBSERVER_HEIGHT`	[number] Default: 1.0	The altitude of the observer, in the DEM units
Target height	`TARGET_HEIGHT`	[number] Default: 1.0	The altitude of the target element, in the DEM units
Maximum distance from observer to compute visibility	`MAX_DISTANCE`	[number] Default: 100.0	Maximum distance from observer to compute visibility, in the DEM units
Saída	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Output raster layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo…

Advanced parameters

Etiqueta	Nome	Tipo	Descrição
Opções de criação adicionais Opcional	OPÇÕES	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Parâmetros adicionais da linha de comando	EXTRA	[string] Padrão: Nenhum	Adicionar opções extras de linha de comando GDAL

Saídas

Etiqueta	Nome	Tipo	Descrição
Saída	SAÍDA	[raster]	The raster layer displaying the viewshed.

Python code

Algorithm ID: `gdal:viewshed`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.2.5 Raster projections

Assign projection

Applies a coordinate system to a raster dataset.

This algorithm is derived from the GDAL edit utility.

Default menu: *Raster ► Projections*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	INPUT_LAYER	[raster]	Camada raster de entrada
Desired CRS	SRC	[crs]	The projection (CRS) of the output layer

Saídas

Etiqueta	Nome	Tipo	Descrição
Layer with projection	`SAÍDA`	[raster]	The output raster layer (with the new projection information)

Python code

Algorithm ID: `gdal:assignprojection`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Extract projection

Extracts the projection of a raster file and writes it into a *world* file with extension `.wld`.

This algorithm is derived from the GDAL srsinfo utility.

Default menu: *Raster* ► *Projections*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input file	`INPUT_LAYER`	[raster]	Input raster The raster layer has to be file based, as the algorithm uses the path to the raster file as the location of the generated `.wld` file. Using a non-file raster layer will lead to an error.
Create also .prj file	`PRJ_FILE_CREATE`	[boolean] Padrão: Falso	If this is activated a `.prj` file containing the projection information is also created.

Saídas

Etiqueta	Nome	Tipo	Descrição
World file	`WORLD_FILE`	[file]	Text file with extension `.wld` containing transformation parameters for the raster file.
ESRI Shapefile prj file	`PRJ_FILE`	[file]	Text file with `.prj` extension that describes the CRS. Will be `None` if *Create also .prj file* is False.

Python code

Algorithm ID: `gdal:extractprojection`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Warp (reproject)

Reprojects a raster layer into another Coordinate Reference System (CRS). The output file resolution and the resampling method can be chosen.

This algorithm is derived from the GDAL warp utility.

Default menu: *Raster ► Projections*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[raster]	Input raster layer to reproject
SRC de Origem Opcional	`SRC_ORIGEM`	[crs]	Defines the CRS of the input raster layer
SRC Alvo Opcional	`SRC_ALVO`	[crs] Padrão: `EPSG:4326`	O SRC da camada de saída
Resampling method to use	`RESAMPLING`	[enumeration] Padrão: 0	Pixel value resampling method to use. Options: • 0 — Nearest neighbour • 1 — Bilinear • 2 — Cubic • 3 — Cubic spline • 4 — Lanczos windowed sinc • 5 — Average • 6 — Mode • 7 — Maximum • 8 — Minimum • 9 — Median • 10 — First quartile • 11 — Third quartile
Nodata value for output bands Opcional	`NODATA`	[number] Padrão: Nenhum	Sets nodata value for output bands. If not provided, then nodata values will be copied from the source dataset.
Output file resolution in target georeferenced units Opcional	`TARGET_RESOLUTION`	[number] Padrão: Nenhum	Defines the output file resolution of reprojection result

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Tabela 24.187 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Opções de criação adicionais Opcional	OPÇÕES	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Tipo de dados de saída	DATA_TYPE	[enumeration] Padrão: 0	Define o formato do arquivo de raster saída. Opções: • 0 — Use input layer data type • 1 — Byte • 2 — Int16 • 3 — UInt16 • 4 — UInt32 • 5 — Int32 • 6 — Float32 • 7 — Float64 • 8 — CInt16 • 9 — CInt32 • 10 — CFloat32 • 11 — CFloat64
Georeferenced extents of output file to be created Opcional	TARGET_EXTENT	[extent]	Sets the georeferenced extent of the output file to be created (in the *Target CRS* by default. In the *CRS of the target raster extent*, if specified).
CRS of the target raster extent Opcional	TARGET_EXTENT_CRS	[crs]	Specifies the CRS in which to interpret the coordinates given for the extent of the output file. This must not be confused with the target CRS of the output dataset. It is instead a convenience e.g. when knowing the output coordinates in a geodetic long/lat CRS, but wanting a result in a projected coordinate system.
Use multithreaded warping implementation	MULTITHREADING	[boolean] Padrão: Falso	Two threads will be used to process chunks of the image and perform input/output operations simultaneously. Note that the computation itself is not multithreaded.
Parâmetros adicionais da linha de comando Opcional	EXTRA	[string] Padrão: Nenhum	Add extra GDAL command line options.
Reprojetado	SAÍDA	[raster] Default: '[Save to temporary file]'	Especificação da camada raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Reprojetado	`SAÍDA`	[raster] Default: `[Save to temporary file]`	Reprojected output raster layer

Python code

Algorithm ID: `gdal:warpreproject`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.2.6 Vector conversion

Convert format

Converts any OGR-supported vector layer into another OGR-supported format.

This algorithm is derived from the ogr2ogr utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.
Convertido	`SAÍDA`	[same as input]	Specification of the output vector layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui. For `Save to File`, the output format has to be specified. All GDAL vector formats are supported. For `Save to a Temporary File` the QGIS default vector format will be used.

Saídas

Etiqueta	Nome	Tipo	Descrição
Convertido	SAÍDA	[same as input]	A camada vetorial de saída.

Python code

Algorithm ID: `gdal:convertformat`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Rasterize (overwrite with attribute)

Overwrites a raster layer with values from a vector layer. New values are assigned based on the attribute value of the overlapping vector feature.

This algorithm is derived from the GDAL rasterize utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	Camada vetorial de entrada
Input raster layer	INPUT_RASTER	[raster]	Camada raster de entrada
Field to use for a burn-in value Opcional	CAMPO	[tablefield: numeric]	Defines the attribute field to use to set the pixels values
Add burn in values to existing raster values	ADD	[boolean] Padrão: Falso	If False, pixels are assigned the selected field's value. If True, the selected field's value is added to the value of the input raster layer.
Parâmetros adicionais da linha de comando Opcional	EXTRA	[string] Padrão: ''	Adicionar opções extras de linha de comando GDAL

Saídas

Etiqueta	Nome	Tipo	Descrição
Rasterized	`SAÍDA`	[raster]	The overwritten input raster layer

Python code

Algorithm ID: `gdal:rasterize_over`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Rasterize (overwrite with fixed value)

Overwrites parts of a raster layer with a fixed value. The pixels to overwrite are chosen based on the supplied (overlapping) vector layer.

This algorithm is derived from the GDAL rasterize utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Input raster layer	`INPUT_RASTER`	[raster]	Camada raster de entrada
A fixed value to burn	`BURN`	[number] Padrão: 0.0	The value to burn
Add burn in values to existing raster values	`ADD`	[boolean] Padrão: Falso	If False, pixels are assigned the fixed value. If True, the fixed value is added to the value of the input raster layer.
Parâmetros adicionais da linha de comando Opcional	`EXTRA`	[string] Padrão: ''	Adicionar opções extras de linha de comando GDAL

Saídas

Etiqueta	Nome	Tipo	Descrição
Rasterized	`SAÍDA`	[raster]	The overwritten input raster layer

Python code

Algorithm ID: `gdal:rasterize_over_fixed_value`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Rasterize (vector to raster)

Converts vector geometries (points, lines and polygons) into a raster image.

This algorithm is derived from the GDAL rasterize utility.

Default menu: *Raster* ► *Conversion*

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	Camada vetorial de entrada
Field to use for a burn-in value Opcional	CAMPO	[tablefield: numeric]	Defines the attribute field from which the attributes for the pixels should be chosen
A fixed value to burn Opcional	BURN	[number] Padrão: 0.0	A fixed value to burn into a band for all features.
Output raster size units	UNIDADES	[enumeration] Padrão: 0	Units to use when defining the output raster size/resolution. One of: • 0 — Pixels • 1 — Georeferenced units
Width/Horizontal resolution	LARGURA	[number] Padrão: 0.0	Sets the width (if size units is “Pixels”) or horizontal resolution (if size units is “Georeferenced units”) of the output raster. Minimum value: 0.0.
Height/Vertical resolution	ALTURA	[number] Padrão: 0.0	Sets the height (if size units is “Pixels”) or vertical resolution (if size units is “Georeferenced units”) of the output raster.
Output extent	EXTENT	[extent]	Extent of the output raster layer. If the extent is not specified, the minimum extent that covers the selected reference layer(s) will be used.
Assign a specified nodata value to output bands Opcional	NODATA	[number] Padrão: 0.0	Assigns a specified nodata value to output bands

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Tabela 24.190 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Opções de criação adicionais Opcional	OPÇÕES	[string] Padrão: ''	Para adicionar uma ou mais opções de criação que controlam o raster a ser criado (cores, tamanho do bloco, compactação de arquivos …). Por conveniência, você pode contar com perfis predefinidos (veja *seção de opções do driver GDAL*). For Batch Process: separate multiple options with a pipe character (|).
Tipo de dados de saída	DATA_TYPE	[enumeration] Padrão: 5	Define o formato do arquivo de raster saída. Opções: • 0 — Byte • 1 — Int16 • 2 — UInt16 • 3 — UInt32 • 4 — Int32 • 5 — Float32 • 6 — Float64 • 7 — CInt16 • 8 — CInt32 • 9 — CFloat32 • 10 — CFloat64
Pre-initialize the output image with value Opcional	INIT	[number]	Pre-initializes the output image bands with this value. Not marked as the nodata value in the output file. The same value is used in all the bands.
Invert rasterization	INVERT	[boolean] Padrão: Falso	Burns the fixed burn value, or the burn value associated with the first feature into all parts of the image not inside the provided polygon.
Rasterized	SAÍDA	[raster] Default: '[Save to temporary file]'	Especificação da camada raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… The file encoding can also be changed here For `Save to File`, the output format has to be specified. All GDAL raster formats are supported. For `Save to a Temporary File` the QGIS default raster format will be used.

Saídas

Etiqueta	Nome	Tipo	Descrição
Rasterized	SAÍDA	[raster]	Camada raster de saída

Python code

Algorithm ID: `gdal:rasterize`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.2.7 Vector geoprocessing

Buffer vectors

Create buffers around the features of a vector layer.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada vetorial de entrada
Nome da coluna geometria	`GEOMETRY`	[string] Default: 'geometry'	The name of the input layer geometry column to use
Buffer distance	`DISTÂNCIA`	[number] Padrão: 10.0	Minimum: 0.0
Dissolve by attribute Opcional	`CAMPO`	[tablefield: any] Padrão: Nenhum	Field to use for dissolving
Dissolve results	`DISSOLVER`	[boolean] Padrão: Falso	If set, the result is dissolved. If no field is set for dissolving, all the buffers are dissolved into one feature.
Produce one feature for each geometry in any kind of geometry collection in the source file	`EXPLODE_COLLECTIONS`	[boolean] Padrão: Falso	
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.
Buffer	`SAÍDA`	[vector: polygon] Default: `[Save to temporary file]`	Specify the output buffer layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Buffer	`SAÍDA`	[vector: polygon]	The output buffer layer

Python code

Algorithm ID: `gdal:buffervectors`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Clip vector by extent

Clips any OGR-supported vector file to a given extent.

This algorithm is derived from the GDAL ogr2ogr utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada vetorial de entrada
Clip extent	`EXTENT`	[extent]	Defines the bounding box that should be used for the output vector file. It has to be defined in target CRS coordinates.
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.
Clipped (extent)	`SAÍDA`	[same as input] Default: `[Save to temporary file]`	Specify the output (clipped) layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Clipped (extent)	`SAÍDA`	[same as input]	The output (clipped) layer. The default format is "ESRI Shapefile".

Python code

Algorithm ID: `gdal:clipvectorbyextent`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Clip vector by mask layer

Clips any OGR-supported vector layer by a mask polygon layer.

This algorithm is derived from the GDAL ogr2ogr utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	A camada vetorial de entrada
Mask layer	`MASK`	[vector: polygon]	Layer to be used as clipping extent for the input vector layer.
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.
Clipped (mask)	`SAÍDA`	[same as input] Default: `[Save to temporary file]`	The output (masked) layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Clipped (mask)	`SAÍDA`	[same as input]	The output (masked) layer. The default format is "ESRI Shapefile".

Python code

Algorithm ID: `gdal:clipvectorbypolygon`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Dissolver

Dissolve (combine) geometries that have the same value for a given attribute / field. The output geometries are multipart.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	The input layer to dissolve
Dissolve field Opcional	CAMPO	[tablefield: any]	The field of the input layer to use for dissolving
Nome da coluna geometria	GEOMETRY	[string] Default: 'geometry'	The name of the input layer geometry column to use for dissolving.
Produce one feature for each geometry in any kind of geometry collection in the source file	EXPLODE_COLLECTIONS	[boolean] Padrão: Falso	Produce one feature for each geometry in any kind of geometry collection in the source file
Keep input attributes	KEEP_ATTRIBUTES	[boolean] Padrão: Falso	Keep all attributes from the input layer
Count dissolved features	COUNT_FEATURES	[boolean] Padrão: Falso	Count the dissolved features and include it in the output layer.
Compute area and perimeter of dissolved features	COMPUTE_AREA	[boolean] Padrão: Falso	Compute the area and perimeter of dissolved features and include them in the output layer
Compute min/max/sum/mean for attribute	COMPUTE_STATISTICS	[boolean] Padrão: Falso	Calculate statistics (min, max, sum and mean) for the numeric attribute specified and include them in the output layer
Numeric attribute to calculate statistics on Opcional	STATISTICS_ATTRIBUTE	[tablefield: numeric]	The numeric attribute to calculate statistics on
Opções de criação adicionais Opcional	OPÇÕES	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.
Dissolvido	SAÍDA	[same as input] Default: [Save to temporary file]	Especifique a camada de saída. Uma de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Dissolvido	`SAÍDA`	[same as input]	The output multipart geometry layer (with dissolved geometries)

Python code

Algorithm ID: `gdal:dissolve`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Offset curve

Desloca as linhas por uma distância especificada. Distâncias positivas deslocarão as linhas à esquerda e distâncias negativas deslocarão as linhas à direita.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	The input line layer
Nome da coluna geometria	`GEOMETRY`	[string] Default: 'geometry'	The name of the input layer geometry column to use
Offset distance (left-sided: positive, right-sided: negative)	`DISTÂNCIA`	[number] Padrão: 10.0	
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.
Offset curve	`SAÍDA`	[vector: line] Default: `[Save to temporary file]`	Especifique a camada da linha de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Offset curve	SAÍDA	[vector: line]	The output offset curve layer

Python code

Algorithm ID: `gdal:offsetcurve`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

One side buffer

Creates a buffer on one side (right or left) of the lines in a line vector layer.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: line]	The input line layer
Nome da coluna geometria	GEOMETRY	[string] Default: 'geometry'	The name of the input layer geometry column to use
Buffer distance	DISTÂNCIA	[number] Padrão: 10.0	
Buffer side	BUFFER_SIDE	[enumeration] Padrão: 0	Um de: • 0 — Right • 1 — Left
Dissolve by attribute Opcional	CAMPO	[tablefield: any] Padrão: Nenhum	Field to use for dissolving
Dissolve all results	DISSOLVER	[boolean] Padrão: Falso	If set, the result is dissolved. If no field is set for dissolving, all the buffers are dissolved into one feature.
Produce one feature for each geometry in any kind of geometry collection in the source file	EXPLODE_COLLECTIONS	[boolean] Padrão: Falso	
Opções de criação adicionais Opcional	OPÇÕES	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.

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Tabela 24.194 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
One-sided buffer	`SAÍDA`	[vector: polygon] Default: `[Save to temporary file]`	Specify the output buffer layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
One-sided buffer	`SAÍDA`	[vector: polygon]	The output buffer layer

Python code

Algorithm ID: `gdal:onesidebuffer`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Points along lines

Generates a point on each line of a line vector layer at a distance from start. The distance is provided as a fraction of the line length.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: line]	The input line layer
Nome da coluna geometria	`GEOMETRY`	[string] Default: 'geometry'	The name of the input layer geometry column to use
Distance from line start represented as a fraction of line length	`DISTÂNCIA`	[number] Default: 0.5 (middle of the line)	
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.
Points along line	`SAÍDA`	[vector: point] Default: `[Save to temporary file]`	Specify the output point layer. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Points along line	`SAÍDA`	[vector: point]	The output point layer

Python code

Algorithm ID: `gdal:pointsalonglines`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.2.8 Vector miscellaneous

Build virtual vector

Creates a virtual vector layer that contains a set of vector layers. The output virtual vector layer will not be opened in the current project.

This algorithm is especially useful in case another algorithm needs multiple layers but accept only one `vrt` in which the layers are specified.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Input datasources	`ENTRADA`	[vector: any] [list]	Select the vector layers you want to use to build the virtual vector
Create "unioned" VRT	`UNIONED`	[boolean] Padrão: Falso	Check if you want to unite all the vectors in a single `vrt` file
Virtual vector	`SAÍDA`	[same as input] Default: `[Save to temporary file]`	Specify the output layer containing only the duplicates. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Virtual vector	`SAÍDA`	[vector: any]	The output virtual vector made from the chosen sources

Python code

Algorithm ID: `gdal:buildvirtualvector`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Executar SQL

Runs a simple or complex query with SQL syntax on the source layer. The result of the query will be added as a new layer.

This algorithm is derived from the GDAL ogr2ogr utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	OGR-supported input vector layer
SQL expression	`SQL`	[string]	Defines the SQL query, for example `SELECT * FROM my_table WHERE name is not null`.
SQL dialect	`DIALECT`	[enumeration] Padrão: 0	SQL dialect to use. One of: • 0 — None • 1 — OGR SQL • 2 — SQLite
Opções de criação adicionais Opcional	`OPÇÕES`	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.
SQL result	`SAÍDA`	[vector: any]	Especificação da camada de saída. Uma de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui. For `Save to File`, the output format has to be specified. All GDAL vector formats are supported. For `Save to a Temporary File` the default output vector layer format will be used.

Saídas

Etiqueta	Nome	Tipo	Descrição
SQL result	SAÍDA	[vector: any]	Camada vetorial criada pela consulta

Python code

Algorithm ID: `gdal:executesql`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Export to PostgreSQL (available connections)

Imports vector layers inside a PostgreSqL database on the basis of an available connection. The connection has to *be defined properly* beforehand. Be aware that the checkboxes 'Save Username' and 'Save Password' are activated. Then you can use the algorithm.

This algorithm is derived from the GDAL ogr2ogr utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Banco de dados (nome da conexão)	BANCO DE DADOS	[string]	The PostgreSQL database to connect to
Camada de entrada	ENTRADA	[vector: any]	OGR-supported vector layer to export to the database
Shape encoding Opcional	SHAPE_ENCODING	[string] Padrão: ''	Sets the encoding to apply to the data
Tipo de geometria de saída	GTYPE	[enumeration] Padrão: 0	Defines the output geometry type. One of: • 0 — • 1 — NONE • 2 — GEOMETRY • 3 — POINT • 4 — LINESTRING • 5 — POLYGON • 6 — GEOMETRYCOLLECTION • 7 — MULTIPOINT • 8 — MULTIPOLYGON • 9 — MULTILINESTRING
Assign an output CRS Opcional	A_SRS	[crs] Padrão: Nenhum	Defines the output CRS of the database table
Reproject to this CRS on output Opcional	T_SRS	[crs] Padrão: Nenhum	Reprojects/transforms to this CRS on output

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Tabela 24.197 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Override source CRS Opcional	S_SRS	[crs] Padrão: Nenhum	Overrides the input layer CRS
Esquema (nome do esquema) Opcional	ESQUEMA	[string] Padrão: 'público'	Defines the schema for the database table
Table to export to (leave blank to use layer name) Opcional	TABELA	[string] Padrão: ''	Defines a name for the table that will be imported into the database. By default the table name is the name of the input vector file.
Primary Key (new field) Opcional	PK	[string] Default: 'id'	Defines which attribute field will be the primary key of the database table
Primary Key (existing field, used if the above option is left empty) Opcional	PRIMARY_KEY	[tablefield: any] Padrão: Nenhum	Defines which attribute field in the exported layer will be the primary key of the database table
Nome da coluna geometria Opcional	GEOCOLUMN	[string] Padrão: 'geom'	Defines in which attribute field of the database there will be the geometry information
Vector dimensions Opcional	DIM	[enumeration] Default: 0 (2D)	Defines if the vector file to be imported has 2D or 3D data. One of: • 0 — 2 • 1 — 3
Distance tolerance for simplification Opcional	SIMPLIFY	[string] Padrão: ''	Defines a distance tolerance for the simplification of the vector geometries to be imported. By default there is no simplification.
Maximum distance between 2 nodes (densification) Opcional	SEGMENTIZE	[string] Padrão: ''	The maximum distance between two nodes. Used to create intermediate points. By default there is no densification.
Select features by extent (defined in input layer CRS) Opcional	SPAT	[extent] Padrão: Nenhum	You can select features from a given extent that will be in the output table.
Clip the input layer using the above (rectangle) extent Opcional	CLIP	[boolean] Padrão: Falso	The input layer will be clipped by the extent you defined before
Select features using a SQL "WHERE" statement (Ex: column="value") Opcional	WHERE	[string] Padrão: ''	Defines with a SQL "WHERE" statement which features should be selected from the input layer
Group N features per transaction (Default: 2000) Opcional	GT	[string] Padrão: ''	You can group the input features in transactions where N defines the size. By default N limits the transaction size to 20000 features.

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Tabela 24.197 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Overwrite existing table Opcional	OVERWRITE	[boolean] Padrão: Verdadeiro	If there is a table with the same name in the database, and if this option is set to True, the table will be overwritten.
Append to existing table Opcional	APPEND	[boolean] Padrão: Falso	If checked / True the vector data will be appended to an existing table. New fields found in the input layer are ignored. By default a new table will be created.
Append and add new fields to existing table Opcional	ADDFIELDS	[boolean] Padrão: Falso	If activated the vector data will be appended to an existing table, there won't be a new table created. New fields found in input layer are added to the table. By default a new table will be created.
Do not launder columns/table names Opcional	LAUNDER	[boolean] Padrão: Falso	With this option checked you can prevent the default behaviour (converting column names to lowercase, removing spaces and other invalid characters).
Do not create Spatial Index Opcional	INDEX	[boolean] Padrão: Falso	Prevents a spatial index for the output table from being created. By default, a spatial index is added.
Continue after a failure, skipping the failed feature Opcional	SKIPFAILURES	[boolean] Padrão: Falso	
Promote to Multipart Opcional	PROMOTETOMULTI	[boolean] Padrão: Verdadeiro	Casts features geometry type to multipart in the output table
Keep width and precision of input attributes Opcional	PRECISION	[boolean] Padrão: Verdadeiro	Avoids modifying column attributes to comply with input data
Opções de criação adicionais Opcional	OPÇÕES	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.

Saídas

This algorithm has no output.

Python code

Algorithm ID: `gdal:importvectorintopostgisdatabaseavailableconnections`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Export to PostgreSQL (new connection)

Imports vector layers inside a PostGreSQL database. A new connection to the PostGIS database must be created.

This algorithm is derived from the GDAL ogr2ogr utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	ENTRADA	[vector: any]	OGR-supported vector layer to export to the database
Shape encoding Opcional	SHAPE_ENCODING	[string] Padrão: ‘’	Sets the encoding to apply to the data
Tipo de geometria de saída	GTYPE	[enumeration] Padrão: 0	Defines the output geometry type. One of: • 0 — • 1 — NONE • 2 — GEOMETRY • 3 — POINT • 4 — LINESTRING • 5 — POLYGON • 6 — GEOMETRYCOLLECTION • 7 — MULTIPOINT • 8 — MULTIPOLYGON • 9 — MULTILINESTRING
Assign an output CRS Opcional	A_SRS	[crs] Padrão: Nenhum	Defines the output CRS of the database table
Reproject to this CRS on output Opcional	T_SRS	[crs] Padrão: Nenhum	Reprojects/transforms to this CRS on output
Override source CRS Opcional	S_SRS	[crs] Padrão: Nenhum	Overrides the input layer CRS
Host Opcional	HOST	[string] Default: ‘localhost’	Name of the database host
Port Opcional	PORT	[string] Default: ‘5432’	Port number the PostgreSQL database server listens on
Username Opcional	USER	[string] Padrão: ‘’	User name used to log in to the database
Database name Opcional	DBNAME	[string] Padrão: ‘’	Name of the database
Password Opcional	PASSWORD	[string] Padrão: ‘’	Password used with Username to connect to the database
Esquema (nome do esquema) Opcional	ESQUEMA	[string] Padrão: ‘público’	Defines the schema for the database table
Table name, leave blank to use input name Opcional	TABELA	[string] Padrão: ‘’	Defines a name for the table that will be imported into the database. By default the table name is the name of the input vector file.
Primary Key (new field) Opcional	PK	[string] Default: ‘id’	Defines which attribute field will be the primary key of the database table

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Tabela 24.198 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Primary Key (existing field, used if the above option is left empty) Opcional	PRIMARY_KEY	[tablefield: any] Padrão: Nenhum	Defines which attribute field in the exported layer will be the primary key of the database table
Nome da coluna geometria Opcional	GEOCOLUMN	[string] Padrão: 'geom'	Defines in which attribute field to store the geometry information
Vector dimensions Opcional	DIM	[enumeration] Default: 0 (2D)	Defines if the vector file to be imported has 2D or 3D data. One of: • 0 — 2D • 1 — 3D
Distance tolerance for simplification Opcional	SIMPLIFY	[string] Padrão: ''	Defines a distance tolerance for the simplification of the vector geometries to be imported. By default no simplification there is no simplification.
Maximum distance between 2 nodes (densification) Opcional	SEGMENTIZE	[string] Padrão: ''	The maximum distance between two nodes. Used to create intermediate points. By default there is no densification.
Select features by extent (defined in input layer CRS) Opcional	SPAT	[extent] Padrão: Nenhum	You can select features from a given extent that will be in the output table.
Clip the input layer using the above (rectangle) extent Opcional	CLIP	[boolean] Padrão: Falso	The input layer will be clipped by the extent you defined before
Fields to include (leave empty to use all fields) Opcional	CAMPOS	[string] [list] Padrão: []	Defines fields to keep from the imported vector file. If none is selected, all the fields are imported.
Select features using a SQL "WHERE" statement (Ex: column="value") Opcional	WHERE	[string] Padrão: ''	Defines with a SQL "WHERE" statement which features should be selected for the output table
Group N features per transaction (Default: 2000) Opcional	GT	[string] Padrão: ''	You can group the input features in transactions where N defines the size. By default N limits the transaction size to 20000 features.
Overwrite existing table Opcional	OVERWRITE	[boolean] Padrão: Verdadeiro	If there is a table with the same name in the database, and if this option is set to True, the table will be overwritten.
Append to existing table Opcional	APPEND	[boolean] Padrão: Falso	If checked / True the vector data will be appended to an existing table. New fields found in the input layer are ignored. By default a new table will be created.

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Tabela 24.198 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Append and add new fields to existing table Opcional	ADDFIELDS	[boolean] Padrão: Falso	If activated the vector data will be appended to an existing table, there won't be created a new table. New fields found in input layer are added to the table. By default a new table will be created.
Do not launder columns/table names Opcional	LAUNDER	[boolean] Padrão: Falso	With this option checked you can prevent the default behaviour (converting column names to lowercase, removing spaces and other invalid characters).
Do not create Spatial Index Opcional	INDEX	[boolean] Padrão: Falso	Prevents a spatial index for the output table from being created. By default, a spatial index is added.
Continue after a failure, skipping the failed feature Opcional	SKIPFAILURES	[boolean] Padrão: Falso	
Promote to Multipart Opcional	PROMOTETOMULTI	[boolean] Padrão: Verdadeiro	Casts features geometry type to multipart in the output table
Keep width and precision of input attributes Opcional	PRECISION	[boolean] Padrão: Verdadeiro	Avoids modifying column attributes to comply with input data
Opções de criação adicionais Opcional	OPÇÕES	[string] Padrão: '' (sem opções adicionais)	Opções adicionais de criação de GDAL.

Saídas

This algorithm has no output.

Python code

Algorithm ID: `gdal:importvectorintopostgisdatabasenewconnection`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Vector Information

Creates an information file that lists information about an OGR-supported data source. The output will be shown in a 'Result' window and can be written into a HTML-file. The information includes the geometry type, feature count, the spatial extent, the projection information and many more.

This algorithm is derived from the GDAL ogrinfo utility.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Camada de entrada	`ENTRADA`	[vector: any]	Camada vetorial de entrada
Summary output only Opcional	`SUMMARY_ONLY`	[boolean] Padrão: Verdadeiro	
Suprimir informação dos metadados Opcional	`SEM_METADADOS`	[boolean] Padrão: Falso	
Informação da camada	`SAÍDA`	[html] Default: `[Save to temporary file]`	Specify the output HTML file that includes the file information. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… The file encoding can also be changed here. If no HTML-file is defined the output will be written to a temporary file

Saídas

Etiqueta	Nome	Tipo	Descrição
Informação da camada	`SAÍDA`	[html]	The output HTML-file that includes the file information.

Python code

Algorithm ID: `gdal:ogrinfo`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3 Provedor de algoritmo LAStools

LAStools is a collection of highly efficient, multicore command line tools for LiDAR data processing.

24.3.1 blast2dem

Descrição

Turns points (up to billions) via seamless Delaunay triangulation implemented using streaming into large elevation, intensity, or RGB rasters.

For more info see the blast2dem page and its online README file.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file containing the points to be rastered in LAS/LAZ format.
filter (by return, classification, flag)	`FIL-TER_RETURN_CLASS_FLAGS`	[enumeration] Padrão: 0	Specifies which points to use to construct the temporary TIN that is then rasterized. One of: • 0 — — • 1 — keep_last • 2 — keep_first • 3 — keep_middle • 4 — keep_single • 5 — drop_single • 6 — keep_double • 7 — keep_class 2 • 8 — keep_class 2 8 • 9 — keep_class 8 • 10 — keep_class 6 • 11 — keep_class 9 • 12 — keep_class 3 4 5 • 13 — keep_class 2 6 • 14 — drop_class 7 • 15 — drop_withheld • 16 — drop_synthetic • 17 — drop_overlap • 18 — keep_withheld • 19 — keep_synthetic • 20 — keep_keypoint • 21 — keep_overlap
step size / pixel size	`STEP`	[number] Padrão: 1.0	Specifies the size of the cells of the grid the TIN is rasterized onto

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Tabela 24.200 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Atributo	`ATTRIBUTE`	[enumeration] Padrão: 0	Specifies the attribute that is to be rastered. One of: • 0 — elevation • 1 — slope • 2 — intensity • 3 — rgb
Product	`PRODUCT`	[enumeration] Padrão: 0	Specifies how the attribute is to be turned into raster values. One of: • 0 — actual values • 1 — hillshade • 2 — gray • 3 — false
Use tile bounding box (after tiling with buffer)	`USE_TILE_BB`	[boolean] Padrão: Falso	Specifies to limit the rastered area to the tile bounding box (only meaningful for input LAS/LAZ tiles that were created with lastile).
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ''	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output raster file	`OUTPUT_RASTER`	[raster] Default: `[Skip output]`	Specifies where the output raster is stored. Use image rasters like TIF, PNG, and JPG for false color, gray ramps, and hillshades. Use value rasters like TIF, BIL, IMG, ASC, DTM, FLT, XYZ, and CSV for actual values. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output raster file	`OUTPUT_RASTER`	[raster]	The output raster

Python code

Algorithm ID: `lastools:blast2dem`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.2 blast2iso

Descrição

Turns points (up to billions) via seamless Delaunay triangulation implemented using streaming into iso-contour lines.

For more info see the blast2iso page and its online README file.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file containing the points to be used for creating iso-contour lines.
smooth underlying TIN	`SMOOTH`	[number] Padrão: 0	Specifies if and with how many passes the temporary TIN should be smoothed
extract isoline with a spacing of	`ISO_EVERY`	[number] Padrão: 10.0	Specifies spacing at which iso-contour lines are getting extracted (contour interval)
clean isolines shorter than (0 = do not clean)	`CLEAN`	[number] Padrão: 0.0	Omits iso-contour lines that are shorter than the specified length
simplify segments shorter than (0 = do not simplify)	`SIMPLIFY_LENGTH`	[number] Padrão: 0.0	Rudimentary simplification of iso-contour line segments that are shorter than the specified length.
simplify segment pairs with area less than (0 = do not simplify)	`SIMPLIFY_AREA`	[number] Padrão: 0.0	Rudimentary simplification of bumps formed by consecutive line segments whose area is smaller than the specified size.
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ''	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output vector file	`OUTPUT_VECTOR`	[vector: line] Default: `[Skip output]`	Specifies where the output vector is stored. Use SHP or WKT output files. If your input LiDAR file is in geographic coordinates (long/lat) or has geo-referencing information (but only then) you can also create a KML output file. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output vector file	`OUTPUT_VECTOR`	[vector: line]	The output line vector layer with contours

Python code

Algorithm ID: `lastools:blast2iso`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.3 las2dem

Descrição

Turns points (up to 20 million) via a temporary Delaunay triangulation that is rasterized with a user-defined step size into an elevation, intensity, or RGB raster.

For more info see the las2dem page and its online README file.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file containing the points to be rastered in LAS/LAZ format.

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Tabela 24.202 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
filter (by return, classification, flags)	FIL-TER_RETURN_CLASS_FLAGS	[enumeration] Padrão: 0	Specifies which points to use to construct the temporary TIN that is then rasterized. One of: • 0 — — • 1 — keep_last • 2 — keep_first • 3 — keep_middle • 4 — keep_single • 5 — drop_single • 6 — keep_double • 7 — keep_class 2 • 8 — keep_class 2 8 • 9 — keep_class 8 • 10 — keep_class 6 • 11 — keep_class 9 • 12 — keep_class 3 4 5 • 13 — keep_class 3 • 14 — keep_class 4 • 15 — keep_class 5 • 16 — keep_class 2 6 • 17 — drop_class 7 • 18 — drop_withheld • 19 — drop_synthetic • 20 — drop_overlap • 21 — keep_withheld • 22 — keep_synthetic • 23 — keep_keypoint • 24 — keep_overlap
step size / pixel size	STEP	[number] Padrão: 1.0	Specifies the size of the cells of the grid the TIN is rasterized onto
Atributo	ATTRIBUTE	[enumeration] Padrão: 0	Specifies the attribute to rasterise. One of: • 0 — elevation • 1 — slope • 2 — intensity • 3 — rgb • 4 — edge_longest • 5 — edge_shortest
Product	PRODUCT	[enumeration] Padrão: 0	Specifies how the attribute is to be turned into raster values. One of: • 0 — actual values • 1 — hillshade • 2 — gray • 3 — false
Use tile bounding box (after tiling with buffer)	USE_TILE_BB	[boolean] Padrão: Falso	Specifies to limit the rastered area to the tile bounding box (only meaningful for input LAS/LAZ tiles that were created with lastile).
additional command line parameter(s) Opcional	ADDI-TIONAL_OPTIONS	[string] Padrão: ”	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.

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Tabela 24.202 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Output raster file	`OUTPUT_RASTER`	[raster] Default: `[Skip output]`	Specifies where the output raster is stored. Use image rasters like TIF, PNG, and JPG for false color, gray ramps, and hillshades. Use value rasters like TIF, BIL, IMG, ASC, DTM, FLT, XYZ, and CSV for actual values. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output raster file	`OUTPUT_RASTER`	[raster]	The output raster

Python code

Algorithm ID: `lastools:las2dem`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.4 las2iso

Descrição

Turns point clouds (up to 20 million per file) into iso-contour lines by creating a temporary Delaunay triangulation on which the contours are then traced.

For more info see the las2iso page and its online README file.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with prepopulated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file containing the points to be used for creating iso-contour lines.
smooth underlying TIN	`SMOOTH`	[number] Padrão: 0	Specifies if and with how many passes the temporary TIN should be smoothed

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Tabela 24.203 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
extract isoline with a spacing of	`ISO_EVERY`	[number] Padrão: 10.0	Specifies spacing at which iso-contour lines are getting extracted (contour interval)
clean isolines shorter than (0 = do not clean)	`CLEAN`	[number] Padrão: 0.0	Omits iso-contour lines that are shorter than the specified length
simplify segments shorter than (0 = do not simplify)	`SIMPLIFY_LENGTH`	[number] Padrão: 0.0	Rudimentary simplification of iso-contour line segments that are shorter than the specified length.
simplify segment pairs with area less than (0 = do not simplify)	`SIMPLIFY_AREA`	[number] Padrão: 0.0	Rudimentary simplification of bumps formed by consecutive line segments whose area is smaller than the specified size.
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ''	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output vector file	`OUTPUT_VECTOR`	[vector: line] Default: `[Skip output]`	Specifies where the output vector is stored. Use SHP or WKT output files. If your input LiDAR file is in geographic coordinates (long/lat) or has geo-referencing information (but only then) you can also create a KML output file. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output vector file	`OUTPUT_VECTOR`	[vector: line]	The output line vector layer with contours

Python code

Algorithm ID: `lastools:las2iso`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.5 las2las_filter

Descrição

Uses las2las to filter LiDAR points based on different attributes and to write the surviving subset of points to a new LAZ or LAS file.

For more info see the las2las page and its online README file.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file containing the points to be used for creating iso-contour lines.
filter (by return, classification, flags)	`FILTER_RETURN_CLASSIFICATION`	[enumeration] Padrão: 0	Filters points based on various options such as return, classification, or flags. One of: • 0 — — • 1 — keep_last • 2 — keep_first • 3 — keep_middle • 4 — keep_single • 5 — drop_single • 6 — keep_double • 7 — keep_class 2 • 8 — keep_class 2 8 • 9 — keep_class 8 • 10 — keep_class 6 • 11 — keep_class 9 • 12 — keep_class 3 4 5 • 13 — keep_class 3 • 14 — keep_class 4 • 15 — keep_class 5 • 16 — keep_class 2 6 • 17 — drop_class 7 • 18 — drop_withheld • 19 — drop_synthetic • 20 — drop_overlap • 21 — keep_withheld • 22 — keep_synthetic • 23 — keep_keypoint • 24 — keep_overlap

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Tabela 24.204 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
second filter (by return, classification, flags)	`FILTER_RETURN_CLASS_FLAGS_2`	[enumeration] Padrão: 0	Filters points based on various options such as return, classification, or flags. One of: • 0 — — • 1 — keep_last • 2 — keep_first • 3 — keep_middle • 4 — keep_single • 5 — drop_single • 6 — keep_double • 7 — keep_class 2 • 8 — keep_class 2 8 • 9 — keep_class 8 • 10 — keep_class 6 • 11 — keep_class 9 • 12 — keep_class 3 4 5 • 13 — keep_class 3 • 14 — keep_class 4 • 15 — keep_class 5 • 16 — keep_class 2 6 • 17 — drop_class 7 • 18 — drop_withheld • 19 — drop_synthetic • 20 — drop_overlap • 21 — keep_withheld • 22 — keep_synthetic • 23 — keep_keypoint • 24 — keep_overlap
filter (by coordinate, intensity, GPS time, …)	`FILTER_COORDS_INTENSITY_1`	[enumeration] Padrão: 0	Filters points based on various other options (that require a value as argument). One of: • 0 — — • 1 — drop_x_above • 2 — drop_x_below • 3 — drop_y_above • 4 — drop_y_below • 5 — drop_z_above • 6 — drop_z_below • 7 — drop_intensity_above • 8 — drop_intensity_below • 9 — drop_gps_time_above • 10 — drop_gps_time_below • 11 — drop_scan_angle_above • 12 — drop_scan_angle_below • 13 — keep_point_source • 14 — drop_point_source • 15 — drop_point_source_above • 16 — drop_point_source_below • 17 — keep_user_data • 18 — drop_user_data • 19 — drop_user_data_above • 20 — drop_user_data_below • 21 — keep_every_nth • 22 — keep_random_fraction • 23 — thin_with_grid

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Tabela 24.204 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
value for filter (by coordinate, intensity, GPS time, …)	`FILTER_COORDS_INTENSITY_ARG1`	[number] Padrão: 1.0	The value to use as the argument for the filter selected above
second filter (by coordinate, intensity, GPS time, …)	`FILTER_COORDS_INTENSITY2`	[enumeration] Padrão: 0	Filters points based on various other options (that require a value as argument). One of: • 0 — — • 1 — drop_x_above • 2 — drop_x_below • 3 — drop_y_above • 4 — drop_y_below • 5 — drop_z_above • 6 — drop_z_below • 7 — drop_intensity_above • 8 — drop_intensity_below • 9 — drop_gps_time_above • 10 — drop_gps_time_below • 11 — drop_scan_angle_above • 12 — drop_scan_angle_below • 13 — keep_point_source • 14 — drop_point_source • 15 — drop_point_source_above • 16 — drop_point_source_below • 17 — keep_user_data • 18 — drop_user_data • 19 — drop_user_data_above • 20 — drop_user_data_below • 21 — keep_every_nth • 22 — keep_random_fraction • 23 — thin_with_grid
value for second filter (by coordinate, intensity, GPS time, …)	`FILTER_COORDS_INTENSITY_ARG2`	[number] Padrão: 1.0	The value to use as the argument for the filter selected above
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ”	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[file] Default: `[Skip output]`	Specifies where the output point cloud is stored. Use LAZ for compressed output, LAS for uncompressed output, and TXT for ASCII. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[file]	The output LAS/LAZ format file

Python code

Algorithm ID: `lastools:las2las_filter`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.6 las2las_project

Transform LAS/LAZ files in a folder to another CRS.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	Input LAS/LAZ file
source projection	`SOURCE_PROJECTION`	[enumeration] Padrão: 0	Um de: • 0 — — • 1 — epsg • 2 — utm • 3 — sp83 • 4 — sp27 • 5 — longlat • 6 — latlong • 7 — ecef

continua na próxima página

Tabela 24.205 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
source utm zone	SOURCE_UTM	[enumeration] Padrão: 0	Um de: • 0 — — • 1 — 1 (norte) • 2 — 2 (norte) • 3 — 3 (norte) • 4 — 4 (norte) • 5 — 5 (norte) • 6 — 6 (norte) • 7 — 7 (norte) • 8 — 8 (norte) • 9 — 9 (norte) • 10 — 10 (norte) • 11 — 11 (norte) • 12 — 12 (norte) • 13 — 13 (norte) • 14 — 14 (norte) • 15 — 15 (norte) • 16 — 16 (norte) • 17 — 17 (norte) • 18 — 18 (norte) • 19 — 19 (norte) • 20 — 20 (norte) • 21 — 21 (norte) • 22 — 22 (norte) • 23 — 23 (norte) • 24 — 24 (norte) • 25 — 25 (norte) • 26 — 26 (norte) • 27 — 27 (norte) • 28 — 28 (norte) • 29 — 29 (norte) • 30 — 30 (norte) • 31 — 31 (norte) • 32 — 32 (norte) • 33 — 33 (norte) • 34 — 34 (norte) • 35 — 35 (norte) • 36 — 36 (norte) • 37 — 37 (norte) • 38 — 38 (norte) • 39 — 39 (norte) • 40 — 40 (norte) • 41 — 41 (norte) • 42 — 42 (norte) • 43 — 43 (norte) • 44 — 44 (norte) • 45 — 45 (norte) • 46 — 46 (norte) • 47 — 47 (norte) • 48 — 48 (norte) • 49 — 49 (norte) • 50 — 50 (norte) • 51 — 51 (norte) • 52 — 52 (norte) • 53 — 53 (norte) • 54 — 54 (norte) • 55 — 55 (norte) • 56 — 56 (norte) • 57 — 57 (norte) • 58 — 58 (norte) • 59 — 59 (norte) • 60 — 60 (norte) • 61 — 1 (sul)

Tabela 24.205 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
source state plane code	SOURCE_SP	[enumeration] Padrão: 0	Um de: • 0 — — • 1 — AK_10 • 2 — AK_2 • 3 — AK_3 • 4 — AK_4 • 5 — AK_5 • 6 — AK_6 • 7 — AK_7 • 8 — AK_8 • 9 — AK_9 • 10 — AL_E • 11 — AL_W • 12 — AR_N • 13 — AR_S • 14 — AZ_C • 15 — AZ_E • 16 — AZ_W • 17 — CA_I • 18 — CA_II • 19 — CA_III • 20 — CA_IV • 21 — CA_V • 22 — CA_VI • 23 — CA_VII • 24 — CO_C • 25 — CO_N • 26 — CO_S • 27 — CT • 28 — DE • 29 — FL_E • 30 — FL_N • 31 — FL_W • 32 — GA_E • 33 — GA_W • 34 — HI_1 • 35 — HI_2 • 36 — HI_3 • 37 — HI_4 • 38 — HI_5 • 39 — IA_N • 40 — IA_S • 41 — ID_C • 42 — ID_E • 43 — ID_W • 44 — IL_E • 45 — IL_W • 46 — IN_E • 47 — IN_W • 48 — KS_N • 49 — KS_S • 50 — KY_N • 51 — KY_S • 52 — LA_N • 53 — LA_S • 54 — MA_I • 55 — MA_M • 56 — MD • 57 — ME_E • 58 — ME_W • 59 — MI_C • 60 — MI_N • 61 — MI_S

Tabela 24.205 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
target projection	`TARGET_PROJECTION`	[enumeration] Padrão: 0	Um de: • 0 — — • 1 — epsg • 2 — utm • 3 — sp83 • 4 — sp27 • 5 — longlat • 6 — latlong • 7 — ecef

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Tabela 24.205 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
target utm zone	`TARGET_UTM`	[enumeration] Padrão: 0	Um de: • 0 — — • 1 — 1 (norte) • 2 — 2 (norte) • 3 — 3 (norte) • 4 — 4 (norte) • 5 — 5 (norte) • 6 — 6 (norte) • 7 — 7 (norte) • 8 — 8 (norte) • 9 — 9 (norte) • 10 — 10 (norte) • 11 — 11 (norte) • 12 — 12 (norte) • 13 — 13 (norte) • 14 — 14 (norte) • 15 — 15 (norte) • 16 — 16 (norte) • 17 — 17 (norte) • 18 — 18 (norte) • 19 — 19 (norte) • 20 — 20 (norte) • 21 — 21 (norte) • 22 — 22 (norte) • 23 — 23 (norte) • 24 — 24 (norte) • 25 — 25 (norte) • 26 — 26 (norte) • 27 — 27 (norte) • 28 — 28 (norte) • 29 — 29 (norte) • 30 — 30 (norte) • 31 — 31 (norte) • 32 — 32 (norte) • 33 — 33 (norte) • 34 — 34 (norte) • 35 — 35 (norte) • 36 — 36 (norte) • 37 — 37 (norte) • 38 — 38 (norte) • 39 — 39 (norte) • 40 — 40 (norte) • 41 — 41 (norte) • 42 — 42 (norte) • 43 — 43 (norte) • 44 — 44 (norte) • 45 — 45 (norte) • 46 — 46 (norte) • 47 — 47 (norte) • 48 — 48 (norte) • 49 — 49 (norte) • 50 — 50 (norte) • 51 — 51 (norte) • 52 — 52 (norte) • 53 — 53 (norte) • 54 — 54 (norte) • 55 — 55 (norte) • 56 — 56 (norte) • 57 — 57 (norte) • 58 — 58 (norte) • 59 — 59 (norte) • 60 — 60 (norte) • 61 — 1 (sul)

Tabela 24.205 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
target state plane code	TARGET_SP	[enumeration] Padrão: 0	Um de: • 0 — — • 1 — AK_10 • 2 — AK_2 • 3 — AK_3 • 4 — AK_4 • 5 — AK_5 • 6 — AK_6 • 7 — AK_7 • 8 — AK_8 • 9 — AK_9 • 10 — AL_E • 11 — AL_W • 12 — AR_N • 13 — AR_S • 14 — AZ_C • 15 — AZ_E • 16 — AZ_W • 17 — CA_I • 18 — CA_II • 19 — CA_III • 20 — CA_IV • 21 — CA_V • 22 — CA_VI • 23 — CA_VII • 24 — CO_C • 25 — CO_N • 26 — CO_S • 27 — CT • 28 — DE • 29 — FL_E • 30 — FL_N • 31 — FL_W • 32 — GA_E • 33 — GA_W • 34 — HI_1 • 35 — HI_2 • 36 — HI_3 • 37 — HI_4 • 38 — HI_5 • 39 — IA_N • 40 — IA_S • 41 — ID_C • 42 — ID_E • 43 — ID_W • 44 — IL_E • 45 — IL_W • 46 — IN_E • 47 — IN_W • 48 — KS_N • 49 — KS_S • 50 — KY_N • 51 — KY_S • 52 — LA_N • 53 — LA_S • 54 — MA_I • 55 — MA_M • 56 — MD • 57 — ME_E • 58 — ME_W • 59 — MI_C • 60 — MI_N

Tabela 24.205 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ''	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[folder] Default: `[Save to temporary folder]`	Specifies where the folder for the output point clouds. One of: • Ignorar Saída • Salvar como Diretório Temporário • Salvar para Diretório… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[file]	The output LAS/LAZ format file

Python code

Algorithm ID: `lastools:las2las_project`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.7 las2las_transform

Descrição

Uses las2las to filter LiDAR points based on different attributes and to write the surviving subset of points to a new LAZ or LAS file.

For more info see the las2las page and its online README file.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The first file containing points to be merged

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Tabela 24.206 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
transform (coordinates)	TRANSFORM_COORDINATE1	[enumeration] Padrão: 0	Either translate, scale, or clamp the X, Y, or Z coordinate by the value specified below. One of: • 0 — — • 1 — translate_x • 2 — translate_y • 3 — translate_z • 4 — scale_x • 5 — scale_y • 6 — scale_z • 7 — clamp_z_above • 8 — clamp_z_below
value for transform (coordinates)	TRANSFORM_COORDINATE1_ARG	[string] Padrão: ‘’	The value that specifies the amount of translating, scaling, or clamping done by the transform selected above.
second transform (coordinates)	TRANSFORM_COORDINATE2	[enumeration] Padrão: 0	Either translate, scale, or clamp the X, Y, or Z coordinate by the value specified below. One of: • 0 — — • 1 — translate_x • 2 — translate_y • 3 — translate_z • 4 — scale_x • 5 — scale_y • 6 — scale_z • 7 — clamp_z_above • 8 — clamp_z_below
value for second transform (coordinates)	TRANSFORM_COORDINATE2_ARG	[string] Padrão: ‘’	The value that specifies the amount of translating, scaling, or clamping done by the transform selected above.
transform (intensities, scan angles, GPS times, …)	TRANSFORM_OTHER1	[enumeration] Padrão: 0	Either translate, scale, or clamp the X, Y, or Z coordinate by the value specified below. One of: • 0 — — • 1 — scale_intensity • 2 — translate_intensity • 3 — clamp_intensity_above • 4 — clamp_intensity_below • 5 — scale_scan_angle • 6 — translate_scan_angle • 7 — translate_gps_time • 8 — set_classification • 9 — set_user_data • 10 — set_point_source • 11 — scale_rgb_up • 12 — scale_rgb_down • 13 — repair_zero_returns
value for transform (intensities, scan angles, GPS times, …)	TRANSFORM_OTHER1_ARG	[string] Padrão: ‘’	The value that specifies the amount of scaling, translating, clamping or setting that is done by the transform selected above.

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Tabela 24.206 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
second transform (intensities, scan angles, GPS times, …)	TRANS-FORM_OTHER2	[enumeration] Padrão: 0	Either translate, scale, or clamp the X, Y, or Z coordinate by the value specified below. One of: • 0 — — • 1 — scale_intensity • 2 — translate_intensity • 3 — clamp_intensity_above • 4 — clamp_intensity_below • 5 — scale_scan_angle • 6 — translate_scan_angle • 7 — translate_gps_time • 8 — set_classification • 9 — set_user_data • 10 — set_point_source • 11 — scale_rgb_up • 12 — scale_rgb_down • 13 — repair_zero_returns
value for second transform (intensities, scan angles, GPS times, …)	TRANS-FORM_OTHER2_ARG	[string] Padrão: ”	The value that specifies the amount of scaling, translating, clamping or setting that is done by the transform selected above.
operations (first 7 need an argument)	OPERATION	[enumeration] Padrão: 0	Um de: • 0 — — • 1 — set_point_type • 2 — set_point_size • 3 — set_version_minor • 4 — set_version_major • 5 — start_at_point • 6 — stop_at_point • 7 — remove_vlr • 8 — auto_reoffset • 9 — week_to_adjusted • 10 — adjusted_to_week • 11 — auto reoffset • 12 — scale_rgb_up • 13 — scale_rgb_down • 14 — remove_all_vlrs • 15 — remove_extra • 16 — clip_to_bounding_box
argument for operation	OPERATIONARG	[string] Padrão: ”	The value to use as the argument for the operation selected above
additional command line parameter(s) Opcional	ADDI-TIONAL_OPTIONS	[string] Padrão: ”	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.

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Tabela 24.206 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[file] Default: `[Skip output]`	Specifies where the output point cloud is stored. Use LAZ for compressed output, LAS for uncompressed output, and TXT for ASCII. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[file]	The output (merged) LAS/LAZ format file

Python code

Algorithm ID: `lastools:las2las_transform`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.8 las2txt

Descrição

Translates a LAS/LAZ file to a text file.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	
input LAS/LAZ file	`INPUT_LASLAZ`	[file] Padrão: Nenhum	
parse_string	`PARSE`	[string] Default: ‘xyz’	
additional command line parameters Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ‘’	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.

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Tabela 24.207 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Output ASCII file	`OUTPUT_GENERIC`	[file] Default: `[Create temporary layer]`	Specify the output file. One of: • Create Temporary Layer (`TEMPORARY_OUTPUT`) • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output ASCII file	`OUTPUT_GENERIC`	[file]	The output file

Python code

Algorithm ID: `lastools:las2txt`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.9 lasindex

Descrição

<Inserir a descrição do algoritmo aqui>

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	
input LAS/LAZ file	`INPUT_LASLAZ`	[file] Padrão: Nenhum	
append *.lax file to *.laz file	`APPEND_LAX`	[boolean] Padrão: Falso	
is mobile or terrestrial LiDAR (not airborne)	`MOBILE_OR_TERRESTRIAL`	[boolean] Padrão: Falso	
additional command line parameters Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ”	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.

Saídas

The algorithm has no output.

Python code

Algorithm ID: `lastools:lasindex`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.10 lasgrid

Grids a selected attribute (e.g. elevation, intensity, classification, scan angle, …) of a large point clouds with a user-defined step size onto raster using a particular method (e.g. min, max, average).

For more info see the lasgrid page and its online README file.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file containing the points to be rastered in LAS/LAZ format.

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Tabela 24.209 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
filter (by return, classification, flags)	FIL-TER_RETURN_CLASS_FLAGS	[enumeration] Padrão: 0	Specifies the subset of points to use for the gridding. One of: • 0 — — • 1 — keep_last • 2 — keep_first • 3 — keep_middle • 4 — keep_single • 5 — drop_single • 6 — keep_double • 7 — keep_class 2 • 8 — keep_class 2 8 • 9 — keep_class 8 • 10 — keep_class 6 • 11 — keep_class 9 • 12 — keep_class 3 4 5 • 13 — keep_class 3 • 14 — keep_class 4 • 15 — keep_class 5 • 16 — keep_class 2 6 • 17 — drop_class 7 • 18 — drop_withheld • 19 — drop_synthetic • 20 — drop_overlap • 21 — keep_withheld • 22 — keep_synthetic • 23 — keep_keypoint • 24 — keep_overlap
step size / pixel size	STEP	[number] Padrão: 1.0	Specifies the size of the cells of the grid the TIN is rasterized onto
Atributo	ATTRIBUTE	[enumeration] Padrão: 0	Specifies the attribute to rasterise. One of: • 0 — elevation • 1 — intensity • 2 — rgb • 3 — classification
Método	MÉTODO	[enumeration] Padrão: 0	Specifies how the attributes falling into one cell are turned into a raster value. One of: • 0 — lowest • 1 — heighest • 2 — average • 3 — stddev
use tile bounding box (after tiling with buffer)	USE_TILE_BB	[boolean] Padrão: Falso	Specifies to limit the rastered area to the tile bounding box (only meaningful for input LAS/LAZ tiles that were created with lastile).
additional command line parameter(s) Opcional	ADDI-TIONAL_OPTIONS	[string] Padrão: ”	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.

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Tabela 24.209 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Output raster file	`OUTPUT_RASTER`	[raster] Default: `[Skip output]`	Specifies where the output raster is stored. Use image rasters like TIF, PNG, and JPG for false color, gray ramps, and hillshades. Use value rasters like TIF, BIL, IMG, ASC, DTM, FLT, XYZ, and CSV for actual values. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output raster file	`OUTPUT_RASTER`	[raster]	The output raster

Python code

Algorithm ID: `lastools:lasgrid`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.11 lasinfo

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file to get information about.
compute density	`COMPUTE_DENSITY`	[boolean] Padrão: Falso	
repair bounding box	`REPAIR_BB`	[boolean] Padrão: Falso	
repair counters	`REPAIR_COUNTERS`	[boolean] Padrão: Falso	

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Tabela 24.210 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
histogram	`HISTO1`	[enumeration] Padrão: 0	First histogram. One of: • 0 — — • 1 — x • 2 — y • 3 — z • 4 — intensity • 5 — classification • 6 — scan_angle • 7 — user_data • 8 — point_source • 9 — gps_time • 10 — X • 11 — Y • 12 — Z • 13 — attribute0 • 14 — attribute1 • 15 — attribute2
bin size	`HISTO1_BIN`	[number] Padrão: 1.0	
histogram	`HISTO2`	[enumeration] Padrão: 0	Second histogram. One of: • 0 — — • 1 — x • 2 — y • 3 — z • 4 — intensity • 5 — classification • 6 — scan_angle • 7 — user_data • 8 — point_source • 9 — gps_time • 10 — X • 11 — Y • 12 — Z • 13 — attribute0 • 14 — attribute1 • 15 — attribute2
bin size	`HISTO2_BIN`	[number] Padrão: 1.0	

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Tabela 24.210 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
histogram	`HISTO3`	[enumeration] Padrão: 0	Third histogram. One of: • 0 — — • 1 — x • 2 — y • 3 — z • 4 — intensity • 5 — classification • 6 — scan_angle • 7 — user_data • 8 — point_source • 9 — gps_time • 10 — X • 11 — Y • 12 — Z • 13 — attribute0 • 14 — attribute1 • 15 — attribute2
bin size	`HISTO3_BIN`	[number] Padrão: 1.0	
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ''	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output ASCII file	`OUTPUT_GENERIC`	[file] Default: `[Skip output]`	Specifies where the output is stored. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output ASCII file	`OUTPUT_GENERIC`	[file]	The file with the output

Python code

Algorithm ID: `lastools:lasinfo`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.12 lasmerge

Merge up to seven LAS/LAZ files into one.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
files are flightlines	`FILES_ARE_FLIGHTLINES`	[boolean] Padrão: Falso	
apply file source ID	`APPLY_FILE_SOURCE_ID`	[boolean] Padrão: Falso	
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The first file containing points to be merged
2nd file Opcional	`FILE2`	[file]	The second file to merge
3rd file Opcional	`FILE3`	[file]	The third file to merge
4th file Opcional	`FILE4`	[file]	The fourth file to merge
5th file Opcional	`FILE5`	[file]	The fifth file to merge
6th file Opcional	`FILE6`	[file]	The sixth file to merge
7th file Opcional	`FILE7`	[file]	The seventh file to merge
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ''	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[file] Default: `[Skip output]`	Specifies where the output point cloud is stored. Use LAZ for compressed output, LAS for uncompressed output, and TXT for ASCII. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[file]	The output (merged) LAS/LAZ format file

Python code

Algorithm ID: `lastools:lasmerge`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.13 lasprecision

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file the input point cloud
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ''	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output ASCII file	`OUTPUT_GENERIC`	[file] Default: `[Skip output]`	Specifies where the output ASCII file is stored. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output ASCII file	`OUTPUT_GENERIC`	[file]	The output ASCII file

Python code

Algorithm ID: `lastools:lasprecision`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.14 lasquery

Descrição

<Inserir a descrição do algoritmo aqui>

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file the input point cloud
area of interest	`AOI`	[extent]	The extent
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ‘’	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.

Saídas

Python code

Algorithm ID: `lastools:lasquery`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.15 lasvalidate

Parâmetros

Etiqueta	Nome	Tipo	Descrição
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file the input point cloud
save report to '*_LVS.xml'	`ONE_REPORT_PER_FILE`	[boolean]	
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ''	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output XML file	`OUTPUT_GENERIC`	[file] Default: `[Skip output]`	Specifies where the output XML file is stored. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output XML file	`OUTPUT_GENERIC`	[file]	The output XML file

Python code

Algorithm ID: `lastools:lasvalidate`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.16 laszip

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file to be zipped

continua na próxima página

Tabela 24.215 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
only report size	`REPORT_SIZE`	[boolean] Padrão: Falso	
create spatial indexing file (*.lax)	`CREATE_LAX`	[boolean] Padrão: Falso	
append *.lax into *.laz file	`APPEND_LAX`	[boolean] Padrão: Falso	
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ''	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[file] Default: `[Skip output]`	Specifies where the output point cloud is stored. Use LAZ for compressed output, LAS for uncompressed output, and TXT for ASCII. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[file]	The output file

Python code

Algorithm ID: `lastools:laszip`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.3.17 txt2las

Parâmetros

Etiqueta	Nome	Tipo	Descrição
verbose	`VERBOSE`	[boolean] Padrão: Falso	Generates more textual control output to the console
run new 64 bit executable	`CPU64`	[boolean] Padrão: Falso	
open LAStools GUI	`GUI`	[boolean] Padrão: Falso	Starts the GUI of LAStools with pre-populated input files
input LAS/LAZ file	`INPUT_LASLAZ`	[file]	The file to be zipped

continua na próxima página

Tabela 24.216 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
parse lines as	PARSE	[string] Default: 'xyz'	
skip the first n lines	SKIP	[number] Padrão: 0	
resolution of x and y coordinate	SCALE_FACTOR_XY	[number] Default: 0.01	
resolution of z coordinate	SCALE_FACTOR_Z	[number] Default: 0.01	
resolution of z coordinate	SCALE_FACTOR_Z	[number] Default: 0.01	
source projection	PROJECTION	[enumeration] Padrão: 0	Um de: • 0 — — • 1 — epsg • 2 — utm • 3 — sp83 • 4 — sp27 • 5 — longlat • 6 — latlong • 7 — ecef
source epsg code	EPSG_CODE	[number]	

continua na próxima página

Tabela 24.216 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
utm zone	`UTM`	[enumeration] Padrão: 0	Um de: • 0 — — • 1 — 1 (norte) • 2 — 2 (norte) • 3 — 3 (norte) • 4 — 4 (norte) • 5 — 5 (norte) • 6 — 6 (norte) • 7 — 7 (norte) • 8 — 8 (norte) • 9 — 9 (norte) • 10 — 10 (norte) • 11 — 11 (norte) • 12 — 12 (norte) • 13 — 13 (norte) • 14 — 14 (norte) • 15 — 15 (norte) • 16 — 16 (norte) • 17 — 17 (norte) • 18 — 18 (norte) • 19 — 19 (norte) • 20 — 20 (norte) • 21 — 21 (norte) • 22 — 22 (norte) • 23 — 23 (norte) • 24 — 24 (norte) • 25 — 25 (norte) • 26 — 26 (norte) • 27 — 27 (norte) • 28 — 28 (norte) • 29 — 29 (norte) • 30 — 30 (norte) • 31 — 31 (norte) • 32 — 32 (norte) • 33 — 33 (norte) • 34 — 34 (norte) • 35 — 35 (norte) • 36 — 36 (norte) • 37 — 37 (norte) • 38 — 38 (norte) • 39 — 39 (norte) • 40 — 40 (norte) • 41 — 41 (norte) • 42 — 42 (norte) • 43 — 43 (norte) • 44 — 44 (norte) • 45 — 45 (norte) • 46 — 46 (norte) • 47 — 47 (norte) • 48 — 48 (norte) • 49 — 49 (norte) • 50 — 50 (norte) • 51 — 51 (norte) • 52 — 52 (norte) • 53 — 53 (norte) • 54 — 54 (norte) • 55 — 55 (norte) • 56 — 56 (norte) • 57 — 57 (norte) • 58 — 58 (norte) • 59 — 59 (norte) • 60 — 60 (norte) • 61 — 1 (sul)

Tabela 24.216 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
state plane code	`SP`	[enumeration] Padrão: 0	Um de: • 0 — — • 1 — AK_10 • 2 — AK_2 • 3 — AK_3 • 4 — AK_4 • 5 — AK_5 • 6 — AK_6 • 7 — AK_7 • 8 — AK_8 • 9 — AK_9 • 10 — AL_E • 11 — AL_W • 12 — AR_N • 13 — AR_S • 14 — AZ_C • 15 — AZ_E • 16 — AZ_W • 17 — CA_I • 18 — CA_II • 19 — CA_III • 20 — CA_IV • 21 — CA_V • 22 — CA_VI • 23 — CA_VII • 24 — CO_C • 25 — CO_N • 26 — CO_S • 27 — CT • 28 — DE • 29 — FL_E • 30 — FL_N • 31 — FL_W • 32 — GA_E • 33 — GA_W • 34 — HI_1 • 35 — HI_2 • 36 — HI_3 • 37 — HI_4 • 38 — HI_5 • 39 — IA_N • 40 — IA_S • 41 — ID_C • 42 — ID_E • 43 — ID_W • 44 — IL_E • 45 — IL_W • 46 — IN_E • 47 — IN_W • 48 — KS_N • 49 — KS_S • 50 — KY_N • 51 — KY_S • 52 — LA_N • 53 — LA_S • 54 — MA_I • 55 — MA_M • 56 — MD • 57 — ME_E • 58 — ME_W • 59 — MI_C • 60 — MI_N

Tabela 24.216 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
additional command line parameter(s) Opcional	`ADDITIONAL_OPTIONS`	[string] Padrão: ''	Specifies other command-line switches not available via this menu but known to the (advanced) LAStools user.
Output LAS/LAZ file	`OUTPUT_LASLAZ`	[file] Default: `[Skip output]`	Specifies where the output point cloud is stored. Use LAZ for compressed output, LAS for uncompressed output, and TXT for ASCII. One of: • Ignorar Saída • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
output LAS/LAZ file	`OUTPUT_LASLAZ`	[file]	The output file

Python code

Algorithm ID: `lastools:txt2las`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.4 Provedor de algoritmo TauDEM

TauDEM (Terrain Analysis Using Digital Elevation Models) is a set of Digital Elevation Model (DEM) tools for the extraction and analysis of hydrologic information from topography as represented by a DEM. This is software developed at Utah State University (USU) for hydrologic digital elevation model analysis and watershed delineation.

TauDEM é distribuída como um conjunto de programas executáveis de linha de comando independente para um Windows e código fonte para compilar e usar em outros sistemas.

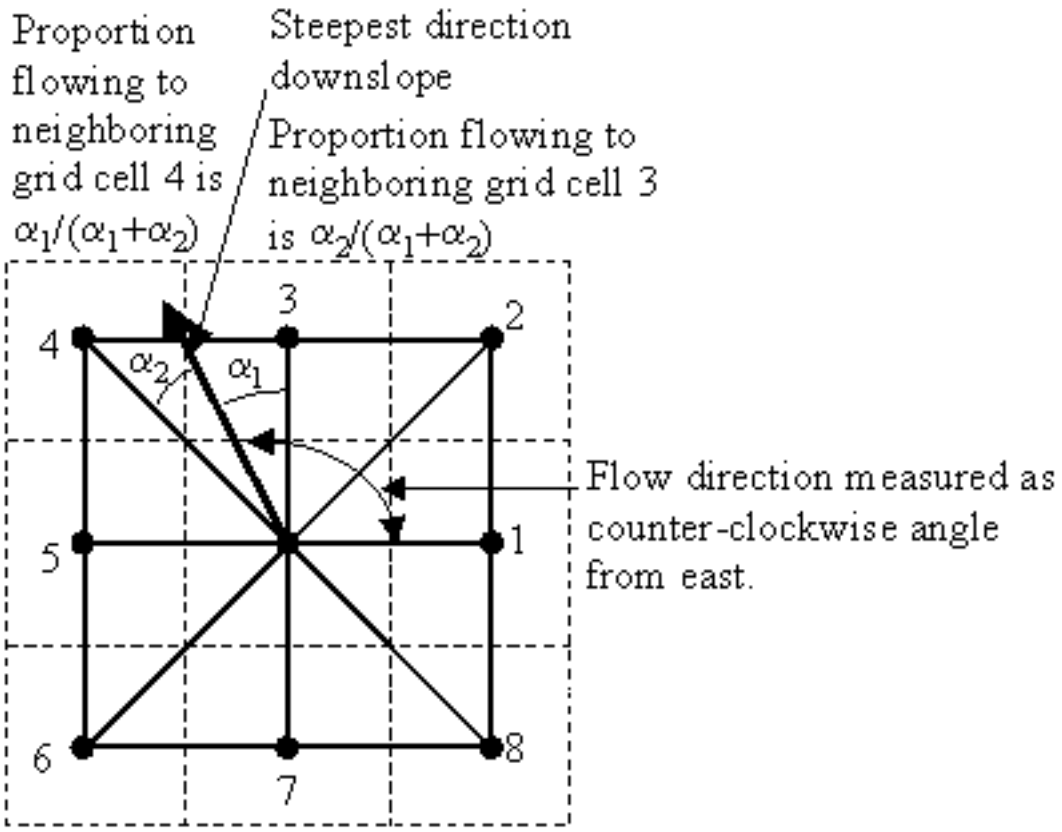
Nota: Por favor, lembre-se que o Processamento contém apenas a descrição da interface, então você precisa instalar TauDEM 5.0.6 por conta própria e configurar o processamento corretamente.

Documentação para algoritmos TauDEM derivados do oficial Documentação TauDEM

24.4.1 Análise Básica de Grade

Área de contribuição D-Infinidade

Calculates a grid of specific catchment area which is the contributing area per unit contour length using the multiple flow direction D-infinity approach. D-infinity flow direction is defined as steepest downward slope on planar triangular facets on a block centered grid. The contribution at each grid cell is taken as the grid cell length (or when the optional weight grid input is used, from the weight grid). The contributing area of each grid cell is then taken as its own contribution plus the contribution from upslope neighbors that have some fraction draining to it according to the D-infinity flow model. The flow from each cell either all drains to one neighbor, if the angle falls along a cardinal (0, π/2, π, 3π/2) or ordinal (π/4, 3π/4, 5π/4, 7π/4) direction, or is on an angle falling between the direct angle to two adjacent neighbors. In the latter case the flow is proportioned between these two neighbor cells according to how close the flow direction angle is to the direct angle to those cells. The contour length used here is the grid cell size. The resulting units of the specific catchment area are length units the same as those of the grid cell size.



When the optional weight grid is not used, the result is reported in terms of specific catchment area, the upslope area per unit contour length, taken here as the number of cells times grid cell length (cell area divided by cell length). This assumes that grid cell length is the effective contour length, in the definition of specific catchment area and does not distinguish any difference in contour length dependent upon the flow direction. When the optional weight grid is used, the result is reported directly as a summation of weights, without any scaling.

If the optional outlet point shapefile is used, only the outlet cells and the cells upslope (by the D-infinity flow model) of them are in the domain to be evaluated.

By default, the tool checks for edge contamination. This is defined as the possibility that a contributing area value may be underestimated due to grid cells outside of the domain not being counted. This occurs when drainage is inwards from the boundaries or areas with “no data” values for elevation. The algorithm recognizes this and reports “no data” for the contributing area. It is common to see streaks of “no data” values extending inwards from boundaries along flow paths that enter the domain at a boundary. This is the desired effect and indicates that contributing area for these grid cells is unknown due to it being dependent on terrain outside of the domain of data available. Edge

contamination checking may be turned off in cases where you know it is not an issue or want to ignore these problems, if for example, the DEM has been clipped along a watershed outline.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
D-infinity flow directions	`DINF_FLOWDIR`	[raster]	A grid of flow directions based on the D-infinity flow method using the steepest slope of a triangular facet. Flow direction is determined as the direction of the steepest downward slope on the 8 triangular facets of a 3x3 block centered grid. Flow direction is encoded as an angle in radians, counter-clockwise from east as a continuous (floating point) quantity between 0 and 2π. The resulting flow in a grid is then usually interpreted as being proportioned between the two neighboring cells that define the triangular facet with the steepest downward slope.
Outlets Opcional	`OUTLETS`	[vector: point]	A point shapefile defining the outlets of interest. If this input file is used, only the cells upslope of these outlet cells are considered to be within the domain being evaluated.
Weight grid Opcional	`WEIGHT_GRID`	[raster]	A grid giving contribution to flow for each cell. These contributions (also sometimes referred to as weights or loadings) are used in the contributing area accumulation. If this input file is not used, the result is reported in terms of specific catchment area (the upslope area per unit contour length) taken as the number of cells times grid cell length (cell area divided by cell length).

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Tabela 24.217 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Check for edge contamination	`EDGE_CONTAMINATION`	[boolean] Padrão: Verdadeiro	A flag that indicates whether the tool should check for edge contamination. Edge contamination is defined as the possibility that a contributing area value may be underestimated due to the fact that grid cells outside of the domain have not been evaluated. This occurs when drainage is inwards from the boundaries or areas with NODATA values for elevation. The algorithm recognizes this and reports NODATA for the impated cells. It is common to see streaks of NODATA values extending inwards from boundaries along flow paths that enter the domain at a boundary. This is the desired effect and indicates that contributing area for these grid cells is unknown due to it being dependent on terrain outside of the domain of available data. Edge contamination checking may be turned off in cases where you know this is not an issue, or want to ignore these problems, if for example, the DEM has been clipped along a watershed outline.
D-infinity specific catchment area	`DINF_CONTRIB_AREA`	[raster] Default: `[Save to temporary file]`	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
D-infinity specific catchment area	`DINF_CONTRIB_AREA`	[raster]	A grid of specific catchment area which is the contributing area per unit contour length using the multiple flow direction D-infinity approach. The contributing area of each grid cell is then taken as its own contribution plus the contribution from upslope neighbors that have some fraction draining to it according to the D-infinity flow model.

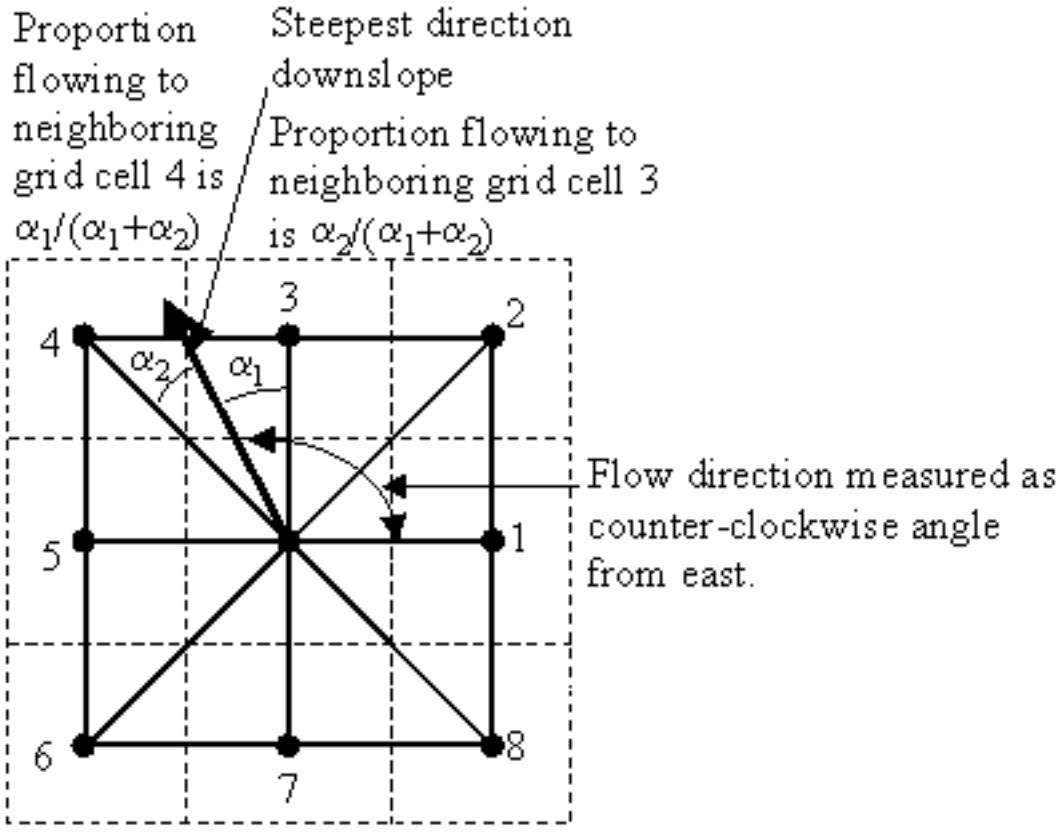
Algorithm ID: `taudem:areadinf`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Direções de fluxo D-Infinidade

Assigns a flow direction based on the D-infinity flow method using the steepest slope of a triangular facet (Tarboton, 1997, "A New Method for the Determination of Flow Directions and Contributing Areas in Grid Digital Elevation Models", Water Resources Research, 33(2): 309-319). Flow direction is defined as steepest downward slope on planar triangular facets on a block centered grid. Flow direction is encoded as an angle in radians counter-clockwise from east as a continuous (floating point) quantity between 0 and 2π. The flow direction angle is determined as the direction of the steepest downward slope on the eight triangular facets formed in a 3 x 3 grid cell window centered on the grid cell of interest. The resulting flow in a grid is then usually interpreted as being proportioned between the two neighboring cells that define the triangular facet with the steepest downward slope.



A block-centered representation is used with each elevation value taken to represent the elevation of the center of the corresponding grid cell. Eight planar triangular facets are formed between each grid cell and its eight neighbors. Each of these has a downslope vector which when drawn outwards from the center may be at an angle that lies within or outside the 45 degree ($\pi/4$ radian) angle range of the facet at the center point. If the slope vector angle is within the facet angle, it represents the steepest flow direction on that facet. If the slope vector angle is outside a facet, the steepest flow direction associated with that facet is taken along the steepest edge. The slope and flow direction associated with the grid cell is taken as the magnitude and direction of the steepest downslope vector from all eight facets. Slope is measured as drop/distance, i.e. tan of the slope angle.

In the case where no slope vectors are positive (downslope), the flow direction is set using the method of Garbrecht and Martz (1997) for the determination of flow across flat areas. This makes flat areas drain away from high ground and towards low ground. The flow path grid to enforce drainage along existing streams is an optional input, and if used, takes precedence over elevations for the setting of flow directions.

The D-infinity flow direction algorithm may be applied to a DEM that has not had its pits filled, but it will then result in "no data" values for the D-infinity flow direction and slope associated with the lowest point of the pit.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Pit filled elevation	`PIT_FILLED`	[raster]	A grid of elevation values. This is usually the output of the **"Pit Remove"** tool, in which case it is elevations with pits removed. Pits are low elevation areas in digital elevation models (DEMs) that are completely surrounded by higher terrain. They are generally taken to be artifacts of the digitation process that interfere with the processing of flow across DEMs. So they are removed by raising their elevation to the point where they just drain off the domain. This step is not essential if you have reason to believe that the pits in your DEM are real. If a few pits actually exist and so should not be removed, while at the same time others are believed to be artifacts that need to be removed, the actual pits should have NODATA elevation values inserted at their lowest point. NODATA values serve to define edges of the domain in the flow field, and elevations are only raised to where flow is off an edge, so an internal NODATA value will stop a pit from being removed, if necessary.
D-infinity flow directions	`DINF_FLOWDIR`	[raster] Default: `[Save to temporary file]`	Specification of the output flow direction raster. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.
D-infinity slope	`DINF_SLOPE`	[raster] Default: `[Save to temporary file]`	Specification of the output slope raster. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
D-infinity flow directions	`DINF_FLOWDIR`	[raster]	A grid of flow directions based on the D-infinity flow method using the steepest slope of a triangular facet. Flow direction is determined as the direction of the steepest downward slope on the 8 triangular facets of a 3x3 block centered grid. Flow direction is encoded as an angle in radians, counter-clockwise from east as a continuous (floating point) quantity between 0 and 2π. The resulting flow in a grid is then usually interpreted as being proportioned between the two neighboring cells that define the triangular facet with the steepest downward slope.
D-infinity slope	`DINF_SLOPE`	[raster]	A grid of slope evaluated using the D-infinity method described in Tarboton, D. G., (1997), "A New Method for the Determination of Flow Directions and Contributing Areas in Grid Digital Elevation Models", Water Resources Research, 33(2): 309-319. This is the steepest outwards slope on one of eight triangular facets centered at each grid cell, measured as drop/distance, i.e. tan of the slope angle.

Algorithm ID: `taudem:dinfflowdir`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Área de Contribuição D8

Calculates a grid of contributing areas using the single direction D8 flow model. The contribution of each grid cell is taken as one (or when the optional weight grid is used, the value from the weight grid). The contributing area for each grid cell is taken as its own contribution plus the contribution from upslope neighbors that drain in to it according to the D8 flow model.

If the optional outlet point shapefile is used, only the outlet cells and the cells upslope (by the D8 flow model) of them are in the domain to be evaluated.

By default, the tool checks for edge contamination. This is defined as the possibility that a contributing area value may be underestimated due to grid cells outside of the domain not being counted. This occurs when drainage is inwards from the boundaries or areas with "no data" values for elevation. The algorithm recognizes this and reports "no data" for the contributing area. It is common to see streaks of "no data" values extending inwards from boundaries along flow paths that enter the domain at a boundary. This is the desired effect and indicates that contributing area for these grid cells is unknown due to it being dependent on terrain outside of the domain of data available. Edge contamination checking may be turned off in cases where you know this is not an issue or want to ignore these problems, if for example, the DEM has been clipped along a watershed outline.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
D8 flow directions	`D8_FLOWDIR`	[raster]	A grid of D8 flow directions which are defined, for each cell, as the direction of the one of its eight adjacent or diagonal neighbors with the steepest downward slope. This grid can be obtained as the output of the **"D8 Flow Directions"** tool.
Outlets Opcional	`OUTLETS`	[vector: point]	A point shapefile defining the outlets of interest. If this input file is used, only the cells upslope of these outlet cells are considered to be within the domain being evaluated.
Weight grid Opcional	`WEIGHT_GRID`	[raster]	A grid giving contribution to flow for each cell. These contributions (also sometimes referred to as weights or loadings) are used in the contributing area accumulation. If this input file is not used, the contribution to flow will assumed to be one for each grid cell.
Check for edge contamination	`EDGE_CONTAMINATION`	[boolean] Padrão: Verdadeiro	A flag that indicates whether the tool should check for edge contamination. Edge contamination is defined as the possibility that a contributing area value may be underestimated due to the fact that grid cells outside of the domain have not been evaluated. This occurs when drainage is inwards from the boundaries or areas with NODATA values for elevation. The algorithm recognizes this and reports NODATA for the impated cells. It is common to see streaks of NODATA values extending inwards from boundaries along flow paths that enter the domain at a boundary. This is the desired effect and indicates that contributing area for these grid cells is unknown due to it being dependent on terrain outside of the domain of available data. Edge contamination checking may be turned off in cases where you know this is not an issue, or want to ignore these problems, if for example, the DEM has been clipped along a watershed outline.
D8 specific catchment area	`D8_CONTRIB_AREA`	[raster] Default: `[Save to temporary file]`	Especificação do raster de saída. Um de: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
D8 specific catchment area	`D8_CONTRIB_AREA`	[raster]	A grid of contributing area values calculated as the cells own contribution plus the contribution from upslope neighbors that drain in to it according to the D8 flow model.

Algorithm ID: `taudem:aread8`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

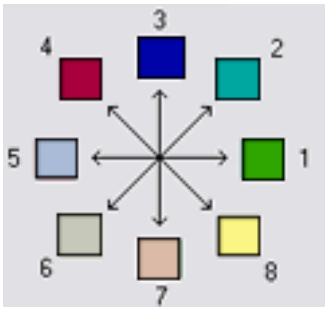
The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Direções de Fluxo D8

Creates 2 grids. The first contains the flow direction from each grid cell to one of its adjacent or diagonal neighbors, calculated using the direction of steepest descent. The second contain the slope, as evaluated in the direction of steepest descent, and is reported as drop/distance, i.e. tan of the angle. Flow direction is reported as NODATA for any grid cell adjacent to the edge of the DEM domain, or adjacent to a NODATA value in the DEM. In flat areas, flow directions are assigned away from higher ground and towards lower ground using the method of Garbrecht and Martz (1997). The D8 flow direction algorithm may be applied to a DEM that has not had its pits filled, but it will then result in NODATA values for flow direction and slope at the lowest point of each pit.

D8 Flow Direction Coding:

- 1 — Leste
- 2 — Nordeste
- 3 — Norte
- 4 — Noroeste
- 5 — Oeste
- 6 — Sudoeste
- 7 – Sul
- 8 — Sudeste



The flow direction routing across flat areas is performed according to the method described by Garbrecht, J. and L. W. Martz, (1997), “The Assignment of Drainage Direction Over Flat Surfaces in Raster Digital Elevation Models”, Journal of Hydrology, 193: 204-213.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Pit filled elevation	`PIT_FILLED`	[raster]	A grid of elevation values. This is usually the output of the **"Pit Remove"** tool, in which case it is elevations with pits removed. Pits are low elevation areas in digital elevation models (DEMs) that are completely surrounded by higher terrain. They are generally taken to be artifacts of the digitation process that interfere with the processing of flow across DEMs. So they are removed by raising their elevation to the point where they just drain off the domain. This step is not essential if you have reason to believe that the pits in your DEM are real. If a few pits actually exist and so should not be removed, while at the same time others are believed to be artifacts that need to be removed, the actual pits should have NODATA elevation values inserted at their lowest point. NODATA values serve to define edges of the domain in the flow field, and elevations are only raised to where flow is off an edge, so an internal NODATA value will stop a pit from being removed, if necessary.
D8 flow directions	`D8_FLOWDIR`	[raster] Default: `[Save to temporary file]`	Specification of the output flow direction raster. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.
D8 slope	`D8_SLOPE`	[raster] Default: `[Save to temporary file]`	Specification of the output slope raster. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
D8 flow directions	`D8_FLOWDIR`	[raster]	A grid of D8 flow directions which are defined, for each cell, as the direction of the one of its eight adjacent or diagonal neighbors with the steepest downward slope.
D8 slope	`D8_SLOPE`	[raster]	A grid giving slope in the D8 flow direction. This is measured as drop/distance.

Algorithm ID: `taudem:d8flowdir`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Rede da grada

Creates 3 grids that contain for each grid cell: 1) the longest path, 2) the total path, and 3) the Strahler order number. These values are derived from the network defined by the D8 flow model.

The longest upslope length is the length of the flow path from the furthest cell that drains to each cell. The total upslope path length is the length of the entire grid network upslope of each grid cell. Lengths are measured between cell centers taking into account cell size and whether the direction is adjacent or diagonal.

Strahler order is defined as follows: A network of flow paths is defined by the D8 Flow Direction grid. Source flow paths have a Strahler order number of one. When two flow paths of different order join the order of the downstream flow path is the order of the highest incoming flow path. When two flow paths of equal order join the downstream flow path order is increased by 1. When more than two flow paths join the downstream flow path order is calculated as the maximum of the highest incoming flow path order or the second highest incoming flow path order + 1. This generalizes the common definition to cases where more than two flow paths join at a point.

Where the optional mask grid and threshold value are input, the function is evaluated only considering grid cells that lie in the domain with mask grid value greater than or equal to the threshold value. Source (first order) grid cells are taken as those that do not have any other grid cells from inside the domain draining in to them, and only when two of these flow paths join is order propagated according to the ordering rules. Lengths are also only evaluated counting paths within the domain greater than or equal to the threshold.

If the optional outlet point shapefile is used, only the outlet cells and the cells upslope (by the D8 flow model) of them are in the domain to be evaluated.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
D8 flow directions	`D8_FLOWDIR`	[raster]	A grid of D8 flow directions which are defined, for each cell, as the direction of the one of its eight adjacent or diagonal neighbors with the steepest downward slope. This grid can be obtained as the output of the **"D8 Flow Directions"** tool.
Mask Grid Opcional	`MASK_GRID`	[raster]	A grid that is used to determine the domain do be analyzed. If the mask grid value >= mask threshold (see below), then the cell will be included in the domain. While this tool does not have an edge contamination flag, if edge contamination analysis is needed, then a mask grid from a function like **"D8 Contributing Area"** that does support edge contamination can be used to achieve the same result.
Mask threshold Opcional	`THRESHOLD`	[number] Padrão: 100.0	This input parameter is used in the calculation mask grid value >= mask threshold to determine if the grid cell is in the domain to be analyzed.
Outlets Opcional	`OUTLETS`	[vector: point]	A point shapefile defining the outlets of interest. If this input file is used, only the cells upslope of these outlet cells are considered to be within the domain being evaluated.

continua na próxima página

Tabela 24.222 – continuação da página anterior

Etiqueta	Nome	Tipo	Descrição
Longest upslope length	`LONGEST_PATH`	[raster] Default: `[Save to temporary file]`	Specification of the output raster with total upslope lengths. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.
Total upslope length	`TOTAL_PATH`	[raster] Default: `[Save to temporary file]`	Specification of the output raster with upslope lengths. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.
Strahler network order	`STRAHLER_ORDER`	[raster] Default: `[Save to temporary file]`	Specification of the output raster with Strahler network order. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Longest upslope length	`LONGEST_PATH`	[raster]	A grid that gives the length of the longest upslope D8 flow path terminating at each grid cell. Lengths are measured between cell centers taking into account cell size and whether the direction is adjacent or diagonal.
Total upslope length	`TOTAL_PATH`	[raster]	The total upslope path length is the length of the entire D8 flow grid network upslope of each grid cell. Lengths are measured between cell centers taking into account cell size and whether the direction is adjacent or diagonal.
Strahler network order	`STRAHLER_ORDER`	[raster]	A grid giving the Strahler order number for each cell. A network of flow paths is defined by the D8 Flow Direction grid. Source flow paths have a Strahler order number of one. When two flow paths of different order join the order of the downstream flow path is the order of the highest incoming flow path. When two flow paths of equal order join the downstream flow path order is increased by 1. When more than two flow paths join the downstream flow path order is calculated as the maximum of the highest incoming flow path order or the second highest incoming flow path order + 1. This generalizes the common definition to cases where more than two flow paths join at a point.

Algorithm ID: `taudem:gridnet`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Remover depressão

Identifies all pits in the DEM and raises their elevation to the level of the lowest pour point around their edge. Pits are low elevation areas in digital elevation models (DEMs) that are completely surrounded by higher terrain. They are generally taken to be artifacts that interfere with the routing of flow across DEMs, so are removed by raising their elevation to the point where they drain off the edge of the domain. The pour point is the lowest point on the boundary of the "watershed" draining to the pit. This step is not essential if you have reason to believe that the pits in your DEM are real. If a few pits actually exist and so should not be removed, while at the same time others are believed to be artifacts that need to be removed, the actual pits should have NODATA elevation values inserted at their lowest point. NODATA values serve to define edges in the domain, and elevations are only raised to where flow is off an edge, so an internal NODATA value will stop a pit from being removed, if necessary.

Parâmetros

Etiqueta	Nome	Tipo	Descrição
Elevation	`ELEVATION`	[raster]	A digital elevation model (DEM) grid to serve as the base input for the terrain analysis and stream delineation.
Depression mask Opcional	`DEPRESSION_MASK`	[raster]	
Consider only 4 way neighbors	`FOUR_NEIGHBOURS`	[boolean] Padrão: Falso	
Pit removed elevation	`PIT_FILLED`	[raster] Default: `[Save to temporary file]`	Specification of the (pit filled) output raster. One of: • Salvar como Arquivo Temporário • Salvar para Arquivo… A codificação do arquivo também pode ser alterada aqui.

Saídas

Etiqueta	Nome	Tipo	Descrição
Pit removed elevation	`PIT_FILLED`	[raster]	A grid of elevation values with pits removed so that flow is routed off of the domain.

Algorithm ID: `taudem:pitremove`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.4.2 Análise de grade especializadas

D8 distância para canais

Calcula a distância horizontal para transmitir para cada célula da grade, movendo-se downslope de acordo com o modelo de fluxo de D8, até que uma célula de grade fluxo é encontrado.

Parâmetros

Label	Name	Type	Descrição
D8 Flow Direction Grid		[raster]	This input is a grid of flow directions that are encoded using the D8 method where all flow from a cells goes to a single neighboring cell in the direction of steepest descent. This grid can be obtained as the output of the **"D8 Flow Directions"** tool.
Stream Raster Grid		[raster]	A grid indicating streams. Such a grid can be created by several of the tools in the **"Stream Network Analysis"** toolset. However, the tools in the **"Stream Network Analysis"** toolset only create grids with a value of 0 for no stream, or 1 for stream cells. This tool can also accept grids with values greater than 1, which can be used in conjunction with the `Threshold` parameter to determine the location of streams. This allows Contributing Area grids to be used to define streams as well as the normal Stream Raster grids. This grid expects integer (long integer) values and any non-integer values will be truncated to an integer before being evaluated.
Threshold		[number] Default: 50	This value acts as threshold on the `Stream Raster Grid` to determine the location of streams. Cells with a `Stream Raster Grid` value greater than or equal to the `Threshold` value are interpreted as streams.

Saídas

Label	Name	Type	Descrição
Output Distance to Streams		[raster]	A grid giving the horizontal distance along the flow path as defined by the D8 Flow Directions Grid to the streams in the Stream Raster Grid.

Python code

Algorithm ID: `taudem:d8hdisttostrm`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

D-Infinidade de Distância Abaixo

Identifies an avalanche's affected area and the flow path length to each cell in that affacted area. All cells downslope from each source area cell, up to the point where the slope from the source to the affected area is less than a threshold angle called the Alpha Angle can be in the affected area. This tool uses the D-infinity multiple flow direction method for determining flow direction. This will likely cause very small amounts of flow to be dispersed to some downslope cells that might overstate the affected area, so a threshold proportion can be set to avoid this excess dispersion. The flow path length is the distance from the cell in question to the source cell that has the highest angle.

All points downslope from the source area are potentially in the affected area, but not beyond a point where the slope from the source to the affected area is less than a threshold angle called the Alpha Angle.

Elevations

10	10	10	10	10	10	Yellow cell is the source
10	9	9	9	9	10	Green: downslope of source
10	9	8	7	6.99	10	
10	9	9	8	6.98	10	
10	9	8	7	6.97	10	
10	10	10	10	6.96	10	

Straight-line distance from highest point of source

0	1	2	3	4	5	Yellow cell is the source
1	1.414214	2.236068	3.162278	4.123106	5.09902	Green: downslope of source
2	2.236068	2.828427	3.605551	4.472136	5.385165	
3	3.162278	3.605551	4.242641	5	5.830952	
4	4.123106	4.472136	5	5.656854	6.403124	
5	5.09902	5.385165	5.830952	6.403124	7.071068	

Drop in elevation from highest point in source

0	0	0	0	0	0	Yellow cell is the source
0	1	1	1	1	0	Green: downslope of source
0	1	2	3	3.01	0	
0	1	1	2	3.02	0	
0	1	2	3	3.03	0	
0	0	0	0	3.04	0	

2 The cell size (a fiddle factor for me to make sensible values)
18 The threshold angle for being in the runout zone

The slope angle from the highest point in the source to each cell

0	0	0	0	0	0	Yellow cell is the source
0	19	13	9	7	0	Green: downslope of source
0	13	19	23	19	0	Grey cells are BOTH
0	9	8	13	17	0	downslope of the source AND
0	7	13	17	15	0	have a sufficiently steep
0	0	0	0	13	0	angle to be in the runout zone

Slope is to be measured using the straight line distance from source point to evaluation point.

It makes more physical sense to me for the angle to be measured along the flow path. Nevertheless it is equally easy to code straight line angles as angles along the flow path, so an option that allows switching will be provided. The most practical way to evaluate avalanche runout is to keep track of the source point with the greatest angle to each point. Then the recursive upslope flow algebra approach will look at a grid cell and all its upslope neighbors that flow to it. Information from the upslope neighbors will be used to calculate the angle to the grid cell in question and retain it in the runout zone if the angle exceeds the alpha angle. This procedure makes the assumption that the maximum angle at a grid cell will be from the set of cells that have maximum angles to the inflowing neighbors. This will always be true of angle is calculated along a flow path, but I can conceive of cases where flow paths bend back on themselves where this would not be the case for straight line angles.

The D-infinity multiple flow direction field assigns flow from each grid cell to multiple downslope neighbors using

proportions (`Pik`) that vary between 0 and 1 and sum to 1 for all flows out of a grid cell. It may be desirable to specify a threshold `T` that this proportion has to exceed before a grid cell is counted as flowing to a downslope grid cell, e.g. `Pik > T` (=0.2 say) to avoid dispersion to grid cells that get very little flow. `T` will be specified as a user input. If all upslope grid cells are to be used `T` may be input as 0.

Avalanche source sites are to be input as a short integer grid (name suffix `*ass`, e.g. `demass`) comprised of positive values where avalanches may be triggered and 0 values elsewhere.

The following grids are output:

- rz — A runout zone indicator with value 0 to indicate that this grid cell is not in the runout zone and value > 0 to indicate that this grid cell is in the runout zone. Since there may be information in the angle to the associated source site, this variable will be assigned the angle to the source site (in degrees)
- dm — Along flow distance from the source site that has the highest angle to the point in question

Parâmetros

Label	Name	Type	Descrição
D-Infinity Flow Direction Grid		[raster]	A grid giving flow direction by the D-infinity method. Flow direction is measured in radians, counter clockwise from east. This can be created by the tool **"D-Infinity Flow Directions"**.
Pit Filled Elevation Grid		[raster]	This input is a grid of elevation values. As a general rule, it is recommended that you use a grid of elevation values that have had the pits removed for this input. Pits are generally taken to be artifacts that interfere with the analysis of flow across them. This grid can be obtained as the output of the **"Pit Remove"** tool, in which case it contains elevation values where the pits have been filled to the point where they just drain.
Avalanche Source Site Grid		[raster]	This is a grid of source areas for snow avalanches that are commonly identified manually using a mix of experience and visual interpretation of maps. Avalanche source sites are to be input as a short integer grid (name suffix `*ass`, e.g. `demass`) comprised of positive values where avalanches may be triggered and 0 values elsewhere.
Proportion Threshold		[number] Default: 0.2	This value is a threshold proportion that is used to limit the dispersion of flow caused by using the D-infinity multiple flow direction method for determining flow direction. The D-infinity multiple flow direction method often causes very small amounts of flow to be dispersed to some downslope cells that might overstate the affected area, so a threshold proportion can be set to avoid this excess dispersion.
Alpha Angle Threshold		[number] Default: 18	This value is the threshold angle, called the Alpha Angle, that is used to determine which of the cells downslope from the source cells are in the affected area. Only the cells downslope from each source area cell, up to the point where the slope from the source to the affected area is less than a threshold angle are in the affected area.
Measure distance along flow path		[boolean] Default: True	This option selects the method used to measure the distance used to calculate the slope angle. If option is *True* then measure it along the flow path, where the *False* option causes the slope to be measure along the straight line distance from the source cell to the evaluation cell.

Saídas

Label	Name	Type	Descrição
Runout Zone Grid		[raster]	This grid Identifies the avalanche's runout zone (affected area) using a runout zone indicator with value 0 to indicate that this grid cell is not in the runout zone and value > 0 to indicate that this grid cell is in the runout zone. Since there may be information in the angle to the associated source site, this variable will be assigned the angle to the source site (in degrees).
Path Distance Grid		[raster]	This is a grid of the flow distance from the source site that has the highest angle to each cell.

Python code

Algorithm ID: `taudem:dinfavalanche`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Concentração de Transportes Limitada D-Infinidade

This function applies to the situation where an unlimited supply of a substance is loaded into flow at a concentration or solubility threshold Csol over a region indicated by an indicator grid (dg). It a grid of the concentration of a substance at each location in the domain, where the supply of substance from a supply area is loaded into the flow at a concentration or solubility threshold. The flow is first calculated as a D-infinity weighted contributing area of an input Effective Runoff Weight Grid (notionally excess precipitation). The concentration of substance over the supply area (indicator grid) is at the concentration threshold. As the substance moves downslope with the D-infinity flow field, it is subject to first order decay in moving from cell to cell as well as dilution due to changes in flow. The decay multiplier grid gives the fractional (first order) reduction in quantity in moving from grid cell `x` to the next downslope cell. If the outlets shapefile is used, the tool only evaluates the part of the domain that contributes flow to the locations given by the shapefile. This is useful for a tracking a contaminant or compound from an area with unlimited supply of that compound that is loaded into a flow at a concentration or solubility threshold over a zone and flow from the zone may be subject to decay or attenuation.

The indicator grid (`dg`) is used to delineate the area of the substance supply using the (0, 1) indicator function `i(x)`. `A[]` denotes the weighted accumulation operator evaluated using the D-Infinity Contributing Area function. The Effective Runoff Weight Grid gives the supply to the flow (e.g. the excess rainfall if this is overland flow) denoted as `w(x)`. The specific discharge is then given by:

```
Q(x)=A[w(x)]
```

This weighted accumulation `Q(x)` is output as the Overland Flow Specific Discharge Grid. Over the substance supply area concentration is at the threshold (the threshold is a saturation or solubility limit). If `i(x) = 1`, then

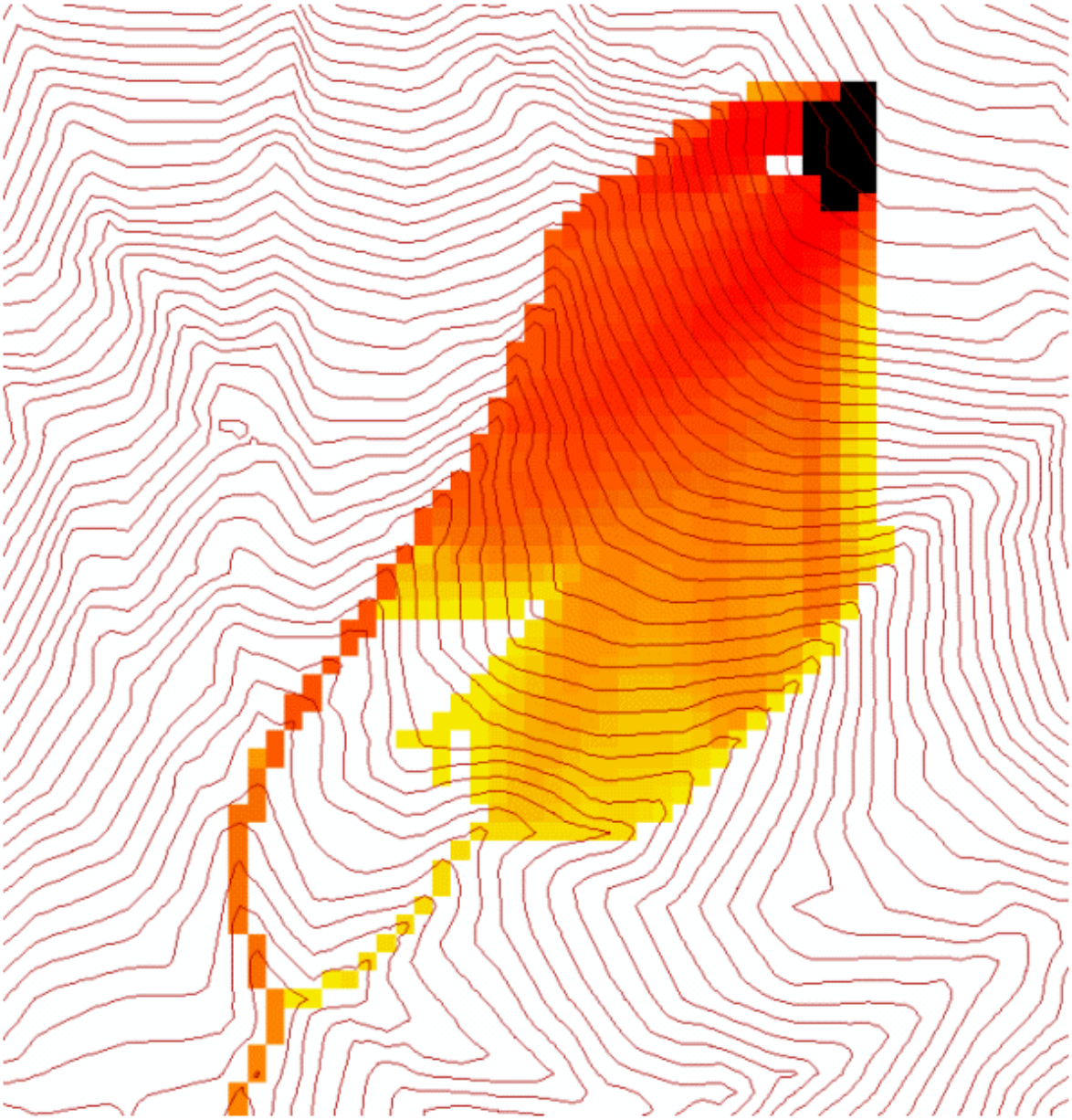
```
C(x) = Csol, and L(x) = Csol Q(x),
```

where `L(x)` denotes the load being carried by the flow. At remaining locations, the load is determined by load accumulation and the concentration by dilution:

$$L(x) = L(i, j) = \sum_{k \text{ contributing neighbors}} p_k d(i_k, j_k) L(i_k, j_k)$$

$$C(x) = L(x)/Q(x)$$

Here `d(x) = d(i, j)` is a decay multiplier giving the fractional (first order) reduction in mass in moving from grid cell `x` to the next downslope cell. If travel (or residence) times `t(x)` associated with flow between cells are available `d(x)` may be evaluated as `exp(-k t(x))` where `k` is a first order decay parameter. The Concentration grid output is `C(x)`. If the outlets shapefile is used, the tool only evaluates the part of the domain that contributes flow to the locations given by the shapefile.



Useful for a tracking a contaminant released or partitioned to flow at a fixed threshold concentration.

Parâmetros

Label	Name	Type	Descrição
D-Infinity Flow Direction Grid		[raster]	A grid giving flow direction by the D-infinity method. Flow direction is measured in radians, counter clockwise from east. This grid can be created by the function **"D-Infinity Flow Directions"**.
Disturbance Indicator Grid		[raster]	A grid that indicates the source zone of the area of substance supply and must be 1 inside the zone and 0 or NODATA over the rest of the domain.
Decay Multiplier Grid		[raster]	A grid giving the factor by which flow leaving each grid cell is multiplied before accumulation on downslope grid cells. This may be used to simulate the movement of an attenuating or decaying substance. If travel (or residence) times `t(x)` associated with flow between cells are available `d(x)` may be evaluated as `exp(-k t(x))` where `k` is a first order decay parameter.
Effective Runoff Weight Grid		[raster]	A grid giving the input quantity (notionally effective runoff or excess precipitation) to be used in the D-infinity weighted contributing area evaluation of Overland Flow Specific Discharge.
Outlets shapefile Opcional		[vector: point]	This optional input is a point shapefile defining outlets of interest. If this file is used, the tool will only evaluate the area upslope of these outlets.
Concentration Threshold		[number] Default: 1.0	The concentration or solubility threshold. Over the substance supply area, concentration is at this threshold.
Check for edge contamination		[boolean] Default: True	This option determines whether the tool should check for edge contamination. Edge contamination is defined as the possibility that a value may be underestimated due to grid cells outside of the domain not being considered when determining contributing area.

Saídas

Label	Name	Type	Descrição
Concentration Grid		[raster]	A grid giving the resulting concentration of the compound of interest in the flow.

Python code

Algorithm ID: `taudem:dinfconclimaccum`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

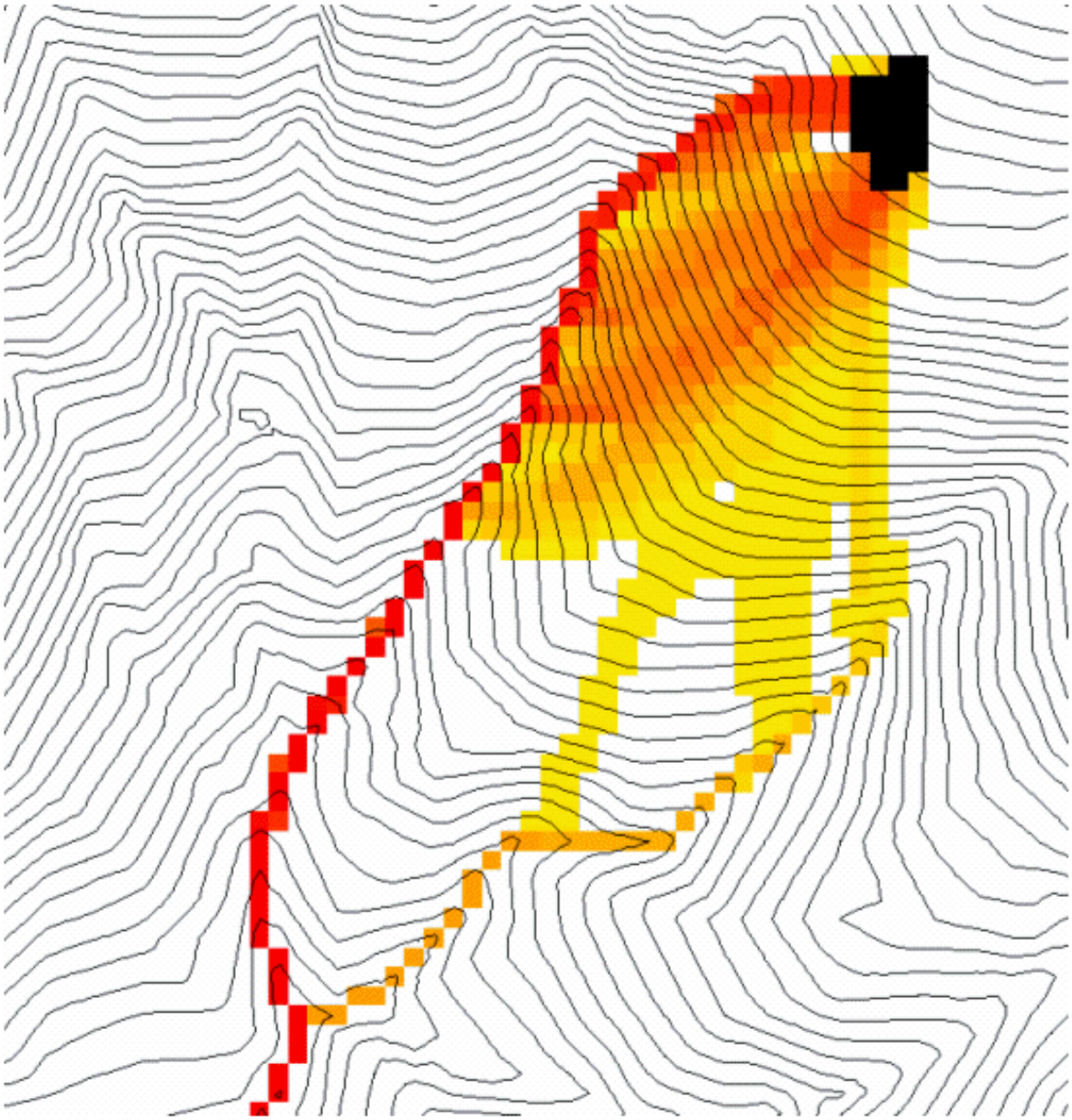
Acumulação decadente D-infinidade

The D-Infinity Decaying Accumulation tool creates a grid of the accumulated quantity at each location in the domain where the quantity accumulates with the D-infinity flow field, but is subject to first order decay in moving from cell to cell. By default, the quantity contribution of each grid cell is the cell length to give a per unit width accumulation, but can optionally be expressed with a weight grid. The decay multiplier grid gives the fractional (first order) reduction in quantity in accumulating from grid cell `x` to the next downslope cell.

A decayed accumulation operator `DA[.]` takes as input a mass loading field `m(x)` expressed at each grid location as `m(i, j)` that is assumed to move with the flow field but is subject to first order decay in moving from cell to cell. The output is the accumulated mass at each location `DA(x)`. The accumulation of `m` at each grid cell can be numerically evaluated.

$$DA[m(x)] = DA(i, j) = m(i, j)\,\Delta^2 + \sum_{k \text{ contributing neighbors}} p_k d(i_k, j_k) DA(i_k, j_k)$$

Here `d(x) = d(i ,j)` is a decay multiplier giving the fractional (first order) reduction in mass in moving from grid cell `x` to the next downslope cell. If travel (or residence) times `t(x)` associated with flow between cells are available `d(x)` may be evaluated as `exp(-k t(x))` where `k` is a first order decay parameter. The weight grid is used to represent the mass loading `m(x)`. If not specified this is taken as 1. If the outlets shapefile is used the function is only evaluated on that part of the domain that contributes flow to the locations given by the shapefile.



Useful for a tracking contaminant or compound subject to decay or attenuation.

Parâmetros

Label	Name	Type	Descrição
D-Infinity Flow Direction Grid		[raster]	A grid giving flow direction by the D-infinity method. Flow direction is measured in radians, counter clockwise from east. This grid can be created by the function **"D-Infinity Flow Directions"**.
Decay Multiplier Grid		[raster]	A grid giving the factor by which flow leaving each grid cell is multiplied before accumulation on downslope grid cells. This may be used to simulate the movement of an attenuating substance.
Weight Grid Opcional		[raster]	A grid giving weights (loadings) to be used in the accumulation. If this optional grid is not specified, weights are taken as the linear grid cell size to give a per unit width accumulation.
Outlets Shapefile Opcional		[vector: point]	This optional input is a point shapefile defining outlets of interest. If this file is used, the tool will only evaluate the area upslope of these outlets.
Check for edge contamination		[boolean] Default: True	This option determines whether the tool should check for edge contamination. Edge contamination is defined as the possibility that a value may be underestimated due to grid cells outside of the domain not being considered when determining contributing area.

Saídas

Label	Name	Type	Descrição
Decayed Specific Catchment Area Grid		[raster]	The D-Infinity Decaying Accumulation tool creates a grid of the accumulated mass at each location in the domain where mass moves with the D-infinity flow field, but is subject to first order decay in moving from cell to cell.

Python code

Algorithm ID: `taudem:dinfdecayaccum`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

D-Infinity Distance Down

Calculates the distance downslope to a stream using the D-infinity flow model. The D-infinity flow model is a multiple flow direction model, because the outflow from each grid cell is proportioned between up to 2 downslope grid cells. As such, the distance from any grid cell to a stream is not uniquely defined. Flow that originates at a particular grid cell may enter the stream at a number of different cells. The statistical method may be selected as the longest, shortest or weighted average of the flow path distance to the stream. Also one of several ways of measuring distance may be selected: the total straight line path (Pythagoras), the horizontal component of the straight line path, the vertical component of the straight line path, or the total surface flow path.

Parâmetros

Label	Name	Type	Descrição
D-Infinity Flow Direction Grid		[raster]	A grid giving flow direction by the D-infinity method. Flow direction is measured in radians, counter clockwise from east. This can be created by the tool **"D-Infinity Flow Directions"**.
Pit Filled Elevation Grid		[raster]	This input is a grid of elevation values. As a general rule, it is recommended that you use a grid of elevation values that have had the pits removed for this input. Pits are generally taken to be artifacts that interfere with the analysis of flow across them. This grid can be obtained as the output of the **"Pit Remove"** tool, in which case it contains elevation values where the pits have been filled to the point where they just drain.
Stream Raster Grid		[raster]	A grid indicating streams, by using a grid cell value of 1 on streams and 0 off streams. This is usually the output of one of the tools in the **"Stream Network Analysis"** toolset.
Weight Path Grid Opcional		[raster]	A grid giving weights (loadings) to be used in the distance calculation. This might be used for example where only flow distance through a buffer is to be calculated. The weight is then 1 in the buffer and 0 outside it. Alternatively the weight may reflect some sort of cost function for travel over the surface, perhaps representing travel time or attenuation of a process. If this input file is not used, the loadings will assumed to be one for each grid cell.
Statistical Method		[enumeration] Default: 2	Statistical method used to calculate the distance down to the stream. In the D-Infinity flow model, the outflow from each grid cell is proportioned between two downslope grid cells. Therefore, the distance from any grid cell to a stream is not uniquely defined. Flow that originates at a particular grid cell may enter the stream at a number of cells. The distance to the stream may be defined as the longest (maximum), shortest (minimum) or weighted average of the distance down to the stream. Opções: • 0 —Mínimo • 1 — Máximo • 2 — Average
Distance Method		[enumeration] Default: 1	Distance method used to calculate the distance down to the stream. One of several ways of measuring distance may be selected: the total straight line path (Pythagoras), the horizontal component of the straight line path (horizontal), the vertical component of the straight line path (vertical), or the total surface flow path (surface). Opções: • 0 — Pythagoras • 1 — Horizontal • 2 — Vertical • 3 — Superfície
Check for edge contamination		[boolean] Default: True	A flag that determines whether the tool should check for edge contamination. This is defined as the possibility that a value may be underestimated due to grid cells outside of the domain not being counted. In the context of Distance Down this occurs when part of a flow path traced downslope from a grid cell leaves the domain without reaching a stream grid cell. With edge contamination checking selected, the algorithm recognizes this and reports no data for the result. This is the

Saídas

Label	Name	Type	Descrição
D-Infinity Drop to Stream Grid		[raster]	Grid containing the distance to stream calculated using the D-infinity flow model and the statistical and path methods chosen.

Python code

Algorithm ID: `taudem:dinfdistdown`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

D-Infinidade de distância acima

This tool calculates the distance from each grid cell up to the ridge cells along the reverse D-infinity flow directions. Ridge cells are defined to be grid cells that have no contribution from grid cells further upslope. Given the convergence of multiple flow paths at any grid cell, any given grid cell can have multiple upslope ridge cells. There are three statistical methods that this tool can use: maximum distance, minimum distance and waited flow average over these flow paths. A variant on the above is to consider only grid cells that contribute flow with a proportion greater than a user specified threshold (t) to be considered as upslope of any given grid cell. Setting t=0.5 would result in only one flow path from any grid cell and would give the result equivalent to a D8 flow model, rather than D-infinity flow model, where flow is proportioned between two downslope grid cells. Finally there are several different optional paths that can be measured: the total straight line path (Pythagoras), the horizontal component of the straight line path, the vertical component of the straight line path, or the total surface flow path.

Parâmetros

Label	Name	Type	Descrição
D-Infinity Flow Direction Grid		[raster]	A grid giving flow direction by the D-infinity method. Flow direction is measured in radians, counter clockwise from east. This can be created by the tool **"D-Infinity Flow Directions"**.
Pit Filled Elevation Grid		[raster]	This input is a grid of elevation values. As a general rule, it is recommended that you use a grid of elevation values that have had the pits removed for this input. Pits are generally taken to be artifacts that interfere with the analysis of flow across them. This grid can be obtained as the output of the **"Pit Remove"** tool, in which case it contains elevation values where the pits have been filled to the point where they just drain.
Slope Grid		[raster]	This input is a grid of slope values. This is measured as drop/distance and it is most often obtained as the output of the **"D-Infinity Flow Directions"** tool.
Statistical Method		[enumeration] Default: 2	Statistical method used to calculate the distance down to the stream. In the D-Infinity flow model, the outflow from each grid cell is proportioned between two downslope grid cells. Therefore, the distance from any grid cell to a stream is not uniquely defined. Flow that originates at a particular grid cell may enter the stream at a number of cells. The distance to the stream may be defined as the longest (maximum), shortest (minimum) or weighted average of the distance down to the stream. Opções: • 0 —Mínimo • 1 — Máximo • 2 — Average
Distance Method		[enumeration] Default: 1	Distance method used to calculate the distance down to the stream. One of several ways of measuring distance may be selected: the total straight line path (Pythagoras), the horizontal component of the straight line path (horizontal), the vertical component of the straight line path (vertical), or the total surface flow path (surface). Opções: • 0 — Pythagoras • 1 — Horizontal • 2 — Vertical • 3 — Superfície
Proportion Threshold		[number] Default: 0.5	The proportion threshold parameter where only grid cells that contribute flow with a proportion greater than this user specified threshold (`t`) is considered to be upslope of any given grid cell. Setting `t=0.5` would result in only one flow path from any grid cell and would give the result equivalent to a D8 flow model, rather than D-Infinity flow model, where flow is proportioned between two downslope grid cells.
Check for edge contamination		[boolean] Default: True	A flag that determines whether the tool should check for edge contamination. This is defined as the possibility that a value may be underestimated due to grid cells outside of the domain not being counted.

Saídas

Label	Name	Type	Descrição
D-Infinity Distance Up		[raster]	Grid containing the distances up to the ridge calculated using the D-Infinity flow model and the statistical and path methods chosen.

Python code

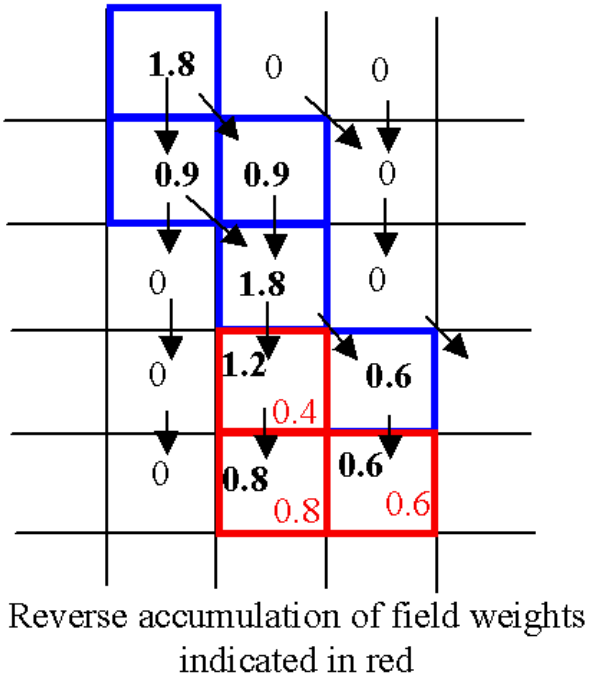
Algorithm ID: `taudem:dinfdistup`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Acumulação Reversa D-Infinidade

This works in a similar way to evaluation of weighted Contributing area, except that the accumulation is by propagating the weight loadings upslope along the reverse of the flow directions to accumulate the quantity of weight loading downslope from each grid cell. The function also reports the maximum value of the weight loading downslope from each grid cell in the Maximum Downslope grid.



Reverse accumulation of field weights indicated in red



This function is designed to evaluate and map the hazard due to activities that may have an effect downslope. The example is land management activities that increase runoff. Runoff is sometimes a trigger for landslides or debris flows, so the weight grid here could be taken as a terrain stability map. Then the reverse accumulation provides a measure of the amount of unstable terrain downslope from each grid cell, as an indicator of the danger of activities that may increase runoff, even though there may be no potential for any local impact.

Parâmetros

Label	Name	Type	Descrição
D-Infinity Flow Direction Grid		[raster]	A grid giving flow direction by the D-infinity method. Flow direction is measured in radians, counter clockwise from east. This can be created by the tool **"D-Infinity Flow Directions"**.
Weight Grid		[raster]	A grid giving weights (loadings) to be used in the accumulation.

Saídas

Label	Name	Type	Descrição
Reverse Accumulation Grid		[raster]	The grid giving the result of the **"Reverse Accumulation"** function. This works in a similar way to evaluation of weighted Contributing area, except that the accumulation is by propagating the weight loadings upslope along the reverse of the flow directions to accumulate the quantity of loading downslope from each grid cell.
Maximum Downslope Grid		[raster]	The grid giving the maximum of the weight loading grid downslope from each grid cell.

Python code

Algorithm ID: `taudem:dinfrevaccum`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

D-Infinidade acumulação de transportes limitada - 2

This function is designed to calculate the transport and deposition of a substance (e.g. sediment) that may be limited by both supply and the capacity of the flow field to transport it. This function accumulates substance flux (e.g. sediment transport) subject to the rule that transport out of any grid cell is the minimum between supply and transport capacity, `Tcap`. The total supply at a grid cell is calculated as the sum of the transport in from upslope grid cells, `Tin`, plus the local supply contribution, `E` (e.g. erosion). This function also outputs deposition, `D`, calculated as total supply minus actual transport.

$$T_{out} = \min(E + \sum T_{in}, T_{cap})$$

$$D = E + \sum T_{in} - T_{out}$$

Here `E` is the supply. `Tout` at each grid cell becomes `Tin` for downslope grid cells and is reported as Transport limited accumulation (`tla`). `D` is deposition (`tdep`). The function provides the option to evaluate concentration of a compound (contaminant) adhered to the transported substance. This is evaluated as follows:

$$L_{in} = \sum T_{in} C_{in}$$

Where `Lin` is the total incoming compound loading and `Cin` and `Tin` refer to the Concentration and Transport entering from each upslope grid cell.

$$T_{out} < \sum T_{in}$$

If

$$L_{out} = L_{in} \left(T_{out} / \sum T_{in} \right)$$

else

$$L_{out} = L_{in} + C_s \left(T_{out} - \sum T_{in} \right)$$

where `Cs` is the concentration supplied locally and the difference in the second term on the right represents the additional supply from the local grid cell. Then,

$$C_{out} = L_{out} / T_{out}$$

`Cout` at each grid cell comprises is the concentration grid output from this function.

If the outlets shapefile is used the tool only evaluates that part of the domain that contributes flow to the locations given by the shapefile.

Transport limited accumulation is useful for modeling erosion and sediment delivery, including the spatial dependence of sediment delivery ratio and contaminant that adheres to sediment.

Parâmetros

Label	Name	Type	Descrição
D-Infinity Flow Direction Grid		[raster]	A grid giving flow direction by the D-infinity method. Flow direction is measured in radians, counter clockwise from east. This can be created by the tool **"D-Infinity Flow Directions"**.
Supply Grid		[raster]	A grid giving the supply (loading) of material to a transport limited accumulation function. In the application to erosion, this grid would give the erosion detachment, or sediment supplied at each grid cell.
Transport Capacity Grid		[raster]	A grid giving the transport capacity at each grid cell for the transport limited accumulation function. In the application to erosion this grid would give the transport capacity of the carrying flow.
Input Concentration Grid		[raster]	A grid giving the concentration of a compound of interest in the supply to the transport limited accumulation function. In the application to erosion, this grid would give the concentration of say phosphorous adhered to the eroded sediment.
Outlets Shapefile Opcional		[vector: point]	This optional input is a point shapefile defining outlets of interest. If this file is used, the tool will only evaluate the area upslope of these outlets.
Check for edge contamination		[boolean] Default: True	This option determines whether the tool should check for edge contamination. Edge contamination is defined as the possibility that a value may be underestimated due to grid cells outside of the domain not being considered when determining the result.

Saídas

Label	Name	Type	Descrição
Transport Limited Accumulation Grid		[raster]	This grid is the weighted accumulation of supply accumulated respecting the limitations in transport capacity and reports the transport rate calculated by accumulating the substance flux subject to the rule that the transport out of any grid cell is the minimum of the total supply (local supply plus transport in) to that grid cell and the transport capacity.
Deposition Grid		[raster]	A grid giving the deposition resulting from the transport limited accumulation. This is the residual from the transport in to each grid cell minus the transport capacity out of the grid cell. The deposition grid is calculated as the transport in + the local supply - the transport out.
Output Concentration Grid		[raster]	If an input concentration in supply grid is given, then this grid is also output and gives the concentration of a compound (contaminant) adhered or bound to the transported substance (e.g. sediment) is calculated.

Python code

Algorithm ID: unknown

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

D-Infinity Transport Limited Accumulation

This function is designed to calculate the transport and deposition of a substance (e.g. sediment) that may be limited by both supply and the capacity of the flow field to transport it. This function accumulates substance flux (e.g. sediment transport) subject to the rule that transport out of any grid cell is the minimum between supply and transport capacity, `Tcap`. The total supply at a grid cell is calculated as the sum of the transport in from upslope grid cells, `Tin`, plus the local supply contribution, `E` (e.g. erosion). This function also outputs deposition, `D`, calculated as total supply minus actual transport.

$$T_{out} = \min(E + \sum T_{in}, T_{cap})$$

$$D = E + \sum T_{in} - T_{out}$$

Here `E` is the supply. `Tout` at each grid cell becomes `Tin` for downslope grid cells and is reported as Transport limited accumulation (`tla`). `D` is deposition (`tdep`). The function provides the option to evaluate concentration of a compound (contaminant) adhered to the transported substance. This is evaluated as follows:

$$L_{in} = \sum T_{in} C_{in}$$

Where `Lin` is the total incoming compound loading and `Cin` and `Tin` refer to the Concentration and Transport entering from each upslope grid cell.

$$T_{out} < \sum T_{in}$$

If

$$L_{out} = L_{in}\left(T_{out} / \sum T_{in}\right)$$

else

$$L_{out} = L_{in} + C_s\left(T_{out} - \sum T_{in}\right)$$

where `Cs` is the concentration supplied locally and the difference in the second term on the right represents the additional supply from the local grid cell. Then,

$$C_{out} = L_{out} / T_{out}$$

`Cout` at each grid cell comprises is the concentration grid output from this function.

If the outlets shapefile is used the tool only evaluates that part of the domain that contributes flow to the locations given by the shapefile.

Transport limited accumulation is useful for modeling erosion and sediment delivery, including the spatial dependence of sediment delivery ratio and contaminant that adheres to sediment.

Parâmetros

Label	Name	Type	Descrição
D-Infinity Flow Direction Grid		[raster]	A grid giving flow direction by the D-infinity method. Flow direction is measured in radians, counter clockwise from east. This can be created by the tool **"D-Infinity Flow Directions"**.
Supply Grid		[raster]	A grid giving the supply (loading) of material to a transport limited accumulation function. In the application to erosion, this grid would give the erosion detachment, or sediment supplied at each grid cell.
Transport Capacity Grid		[raster]	A grid giving the transport capacity at each grid cell for the transport limited accumulation function. In the application to erosion this grid would give the transport capacity of the carrying flow.
Outlets Shapefile Opcional		[vector: point]	This optional input is a point shapefile defining outlets of interest. If this file is used, the tool will only evaluate the area upslope of these outlets.
Check for edge contamination		[boolean] Default: True	This option determines whether the tool should check for edge contamination. Edge contamination is defined as the possibility that a value may be underestimated due to grid cells outside of the domain not being considered when determining the result.

Saídas

Label	Name	Type	Descrição
Transport Limited Accumulation Grid		[raster]	This grid is the weighted accumulation of supply accumulated respecting the limitations in transport capacity and reports the transport rate calculated by accumulating the substance flux subject to the rule that the transport out of any grid cell is the minimum of the total supply (local supply plus transport in) to that grid cell and the transport capacity.
Deposition Grid		[raster]	A grid giving the deposition resulting from the transport limited accumulation. This is the residual from the transport in to each grid cell minus the transport capacity out of the grid cell. The deposition grid is calculated as the transport in + the local supply - the tranport out.

Python code

Algorithm ID: `taudem:dinftranslimaccum`

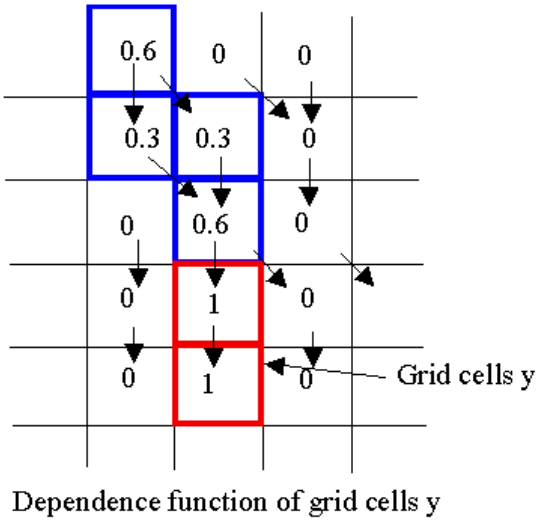
```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

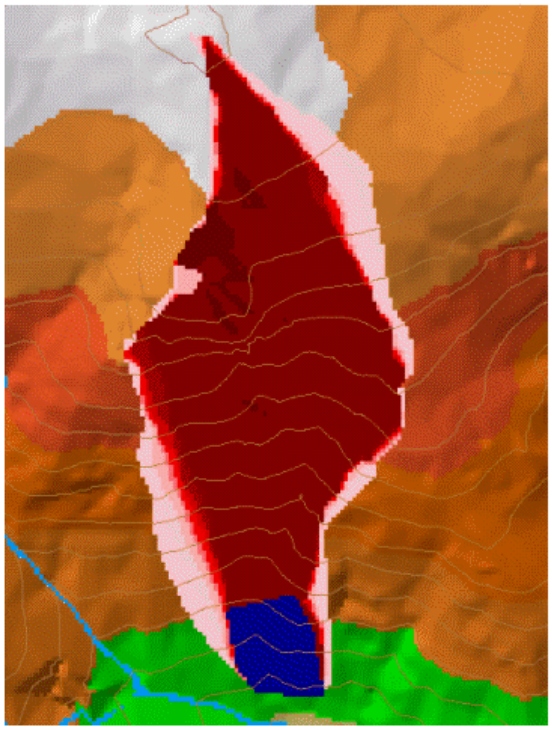
Dependência de curvatura D-Infinidade

The D-Infinity Upslope Dependence tool quantifies the amount each grid cell in the domain contributes to a destination set of grid cells. D-Infinity flow directions proportion flow from each grid cell between multiple downslope grid cells. Following this flow field downslope the amount of flow originating at each grid cell that reaches the destination zone is defined. Upslope influence is evaluated using a downslope recursion, examining grid cells downslope from each grid cell, so that the map produced identifies the area upslope where flow through the destination zone originates, or the area it depends on, for its flow.

The figures below illustrate the amount each source point in the domain `x` (blue) contributes to the destination point or zone `y` (red). If the indicator weighted contributing area function is denoted `I(y; x)` giving the weighted contribution using a unit value (1) from specific grid cells `y` to grid cells `x`, then the upslope dependence is: `D(x; y) = I(y; x)`.



Dependence function of grid cells y



This is useful for example to track where flow or a flow related substance or contaminant that enters a destination area may come from.

Parâmetros

Label	Name	Type	Descrição
D-Infinity Flow Direction Grid		[raster]	A grid giving flow direction by the D-Infinity method where the flow direction angle is determined as the direction of the steepest downward slope on the eight triangular facets formed in a 3x3 grid cell window centered on the grid cell of interest. This grid can be produced using the **"D-Infinity Flow Direction"** tool.
Destination Grid		[raster]	A grid that encodes the destination zone that may receive flow from upslope. This grid must be 1 inside the zone y and 0 over the rest of the domain.

Saídas

Label	Name	Type	Descrição
Output Upslope Dependence Grid		[raster]	A grid quantifing the amount each source point in the domain contributes to the zone defined by the destination grid.

Python code

Algorithm ID: `taudem:dinfupdependence`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Declividade média baixa

This tool computes slope in a D8 downslope direction averaged over a user selected distance. Distance should be specified in horizontal map units.

Parâmetros

Label	Name	Type	Descrição
D8 Flow Direction Grid		[raster]	This input is a grid of flow directions that are encoded using the D8 method where all flow from a cells goes to a single neighboring cell in the direction of steepest descent. This grid can be obtained as the output of the **"D8 Flow Directions"** tool.
Pit Filled Elevation Grid		[raster]	This input is a grid of elevation values. As a general rule, it is recommended that you use a grid of elevation values that have had the pits removed for this input. Pits are generally taken to be artifacts that interfere with the analysis of flow across them. This grid can be obtained as the output of the **"Pit Remove"** tool, in which case it contains elevation values where the pits have been filled to the point where they just drain.
Downslope Distance		[number] Default: 50	Input parameter of downslope distance over which to calculate the slope (in horizontal map units).

Saídas

Label	Name	Type	Descrição
Slope Average Down Grid		[raster]	This output is a grid of slopes calculated in the D8 downslope direction, averaged over the selected distance.

Python code

Algorithm ID: `taudem:slopeavedown`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Razão da área pela declividade

Calculates the ratio of the slope to the specific catchment area (contributing area). This is algebraically related to the more common ln(a/tan beta) wetness index, but contributing area is in the denominator to avoid divide by 0 errors when slope is 0.

Parâmetros

Label	Name	Type	Descrição
Slope Grid		[raster]	A grid of slope. This grid can be generated using ether the **"D8 Flow Directions"** tool or the **"D-Infinity Flow Directions"** tool.
Specific Catchment Area Grid		[raster]	A grid giving the contributing area value for each cell taken as its own contribution plus the contribution from upslope neighbors that drain in to it. Contributing area is counted in terms of the number of grid cells (or summation of weights). This grid can be generated using either the **"D8 Contributing Area"** tool or the **"D-Infinity Contributing Area"** tool.

Saídas

Label	Name	Type	Descrição
Slope Divided By Area Ratio Grid		[raster]	A grid of the ratio of slope to specific catchment area (contributing area). This is algebraically related to the more common `ln(a/tan beta)` wetness index, but contributing area is in the denominator to avoid divide by 0 errors when slope is 0.

Python code

Algorithm ID: `taudem:slopearearatio`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Topographic wetness index

Calculates the topographic wetness index (TWI).

Parâmetros

Label	Name	Type	Descrição
Slope		[raster]	A grid of slope. This grid can be generated using ether the **"D8 Flow Directions"** tool or the **"D-Infinity Flow Directions"** tool.
Specific catchment area		[raster]	A grid giving the contributing area value for each cell taken as its own contribution plus the contribution from upslope neighbors that drain in to it. Contributing area is counted in terms of the number of grid cells (or summation of weights). This grid can be generated using either the **"D8 Contributing Area"** tool or the **"D-Infinity Contributing Area"** tool.

Saídas

Label	Name	Type	Descrição
Wetness index		[raster]	A grid of the wetness index (TWI).

Python code

Algorithm ID: `taudem:twi`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.4.3 Análise da rede de drenagem

Connect down

For each zone in a raster entered (e.g. HUC converted to grid) it identifies the point with largest AreaD8. This is taken to be the outlet. A OGR file is created. Using flow directions each outlet is moved downflow a specified number of grid cells which is user controllable (Default is 1). The ID of the location the point has moved to is taken as iddown. Two OGR files are created one with the initial points and one with the moved points. Both contain id, iddown and AreaD8.

Parâmetros

Label	Name	Type	Descrição
D8 flow directions		[raster]	A grid of flow directions that are encoded using the D8 method where all flow from a cells goes to a single neighboring cell in the direction of steepest descent
D8 contribution area		[raster]	A grid giving the contributing area value in terms of the number of grid cells (or the summation of weights) for each cell taken as its own contribution plus the contribution from upslope neighbors that drain in to it using the D8 algorithm. This is usually the output of the **"D8 Contributing Area"** tool.
Watershed		[raster]	Watershed grid delineated from gage watershed function or streamreachwatershed function. Other watershed (e.g. HUC) raster also can be used as watershed grid.
Grid cells move to downstream		[number]	Number of grid cells move to downstream based on flow directions.

Saídas

Label	Name	Type	Descrição
Outlets		[vector: point]	A point OGR file where each point is created from watershed grid having the largest contributing area for each zone.
Moved Outlets		[vector: point]	A point OGR file defining moved outlets of interest. where each outlet is moved downflow a specified number of grid cells using flow directions.

Python code

Algorithm ID: `taudem:connectdown`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Valor de curvatura alta Extrema D8

Evaluates the extreme (either maximum or minimum) upslope value from an input grid based on the D8 flow model. This is intended initially for use in stream raster generation to identify a threshold of the slope times area product that results in an optimum (according to drop analysis) stream network.

If the optional outlet point shapefile is used, only the outlet cells and the cells upslope (by the D8 flow model) of them are in the domain to be evaluated.

By default, the tool checks for edge contamination. This is defined as the possibility that a result may be underestimated due to grid cells outside of the domain not being counted. This occurs when drainage is inwards from the boundaries or areas with "no data" values for elevation. The algorithm recognizes this and reports "no data" for the result for these grid cells. It is common to see streaks of "no data" values extending inwards from boundaries along flow paths that enter the domain at a boundary. This is the desired effect and indicates that the result for these grid cells is unknown due to it being dependent on terrain outside of the domain of data available. Edge contamination checking may be turned off in cases where you know this is not an issue or want to ignore these problems, if for example, the DEM has been clipped along a watershed outline.

Parâmetros

Label	Name	Type	Descrição
D8 Flow Directions Grid		[raster]	A grid of D8 flow directions which are defined, for each cell, as the direction of the one of its eight adjacent or diagonal neighbors with the steepest downward slope. This grid can be obtained as the output of the **"D8 Flow Directions"** tool.
Upslope Values Grid		[raster]	This is the grid of values of which the maximum or minimum upslope value is selected. The values most commonly used are the slope times area product needed when generating stream rasters according to drop analysis.
Outlets Shapefile Opcional		[vector: point]	A point shape file defining outlets of interest. If this input file is used, only the area upslope of these outlets will be evaluated by the tool.
Check for edge contamination		[boolean] Default: True	A flag that indicates whether the tool should check for edge contamination.
Use max upslope value		[boolean] Default: True	A flag to indicate whether the maximum or minimum upslope value is to be calculated.

Saídas

Label	Name	Type	Descrição
Extreme Upslope Values Grid		[raster]	A grid of the maximum/minimum upslope values.

Python code

Algorithm ID: `taudem:d8flowpathextremeup`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Gage Watershed

Calculates Gage Watersheds Grid. Each grid cell is labeled with the identifier (from column `id`) of the gage to which it drains directly without passing through any other gages.

Parâmetros

Label	Name	Type	Descrição
A suppr **D-infinity flow directions**	`DINF_FLOWDIR`	[raster]	A grid of flow directions based on the D-infinity flow method
D8 Flow Directions Grid		[raster]	A grid of D8 flow directions which are defined, for each cell, as the direction of the one of its eight adjacent or diagonal neighbors with the steepest downward slope. This grid can be obtained as the output of the **"D8 Flow Directions"** tool.
Gages Shapefile		[vector: point]	A point shapefile defining the gages to which watersheds will be delineated. This shapefile should have a colmun `id`. Grid cells draining directly to each point in this shapefile will be labeled with this id.

Saídas

Label	Name	Type	Descrição
Gage Watershed Grid		[raster]	A grid identifies each gage watershed. Each grid cell is labeled with the identifier (from column `id`) of the gage to which it drains directly without passing through any other gages.
Downstream Identifiers File		[file]	Text file giving watershed downslope connectivity

Python code

Algorithm ID: `taudem:gagewatershed`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Comprimento de Área da Fonte da Corrente

Creates an indicator grid (1, 0) that evaluates `A >= (M)(Ly)` based on upslope path length, D8 contributing area grid inputs, and parameters `M` and `y`. This grid indicates likely stream source grid cells. This is an experimental method with theoretical basis in Hack's law which states that for streams `L ~ A 0.6`. However for hillslopes with parallel flow `L ~ A`. So a transition from hillslopes to streams may be represented by `L ~ A 0.8` suggesting identifying grid cells as stream cells if `A > M (L (1/0.8))`.

Parâmetros

Label	Name	Type	Descrição
Length Grid		[raster]	A grid of the maximum upslope length for each cell. This is calculated as the length of the flow path from the furthest cell that drains to each cell. Length is measured between cell centers taking into account cell size and whether the direction is adjacent or diagonal. It is this length (`L`) that is used in the formula, `A >(M)(Ly)`, to determine which cells are considered stream cells. This grid can be obtained as an output from the **"Grid Network"** tool.
Contributing Area Grid		[raster]	A grid of contributing area values for each cell that were calculated using the D8 algorithm. The contributing area for a cell is the sum of its own contribution plus the contribution from all upslope neighbors that drain to it, measured as a number of cells. This grid is typically obtained as the output of the **"D8 Contributing Area"** tool. In this tool, it is the contributing area (`A`) that is compared in the formula `A > (M)(Ly)` to determine the transition to a stream.
Threshold		[number] Default: 0.03	The multiplier threshold (`M`) parameter which is used in the formula: `A > (M)(Ly)`, to identify the beginning of streams.
Exponent		[number] Default: 1.3	The exponent (`y`) parameter which is used in the formula: `A > (M)(Ly)`, to identify the beginning of streams. In branching systems, Hack's law suggests that `L = 1/M A(1/y)` with `1/y = 0.6` (or 0.56) (`y` about 1.7). In parallel flow systems `L` is proportional to `A` (`y` about 1). This method tries to identify the transition between these two paradigms by using an exponent `y` somewhere in between (`y` about 1.3).

Saídas

Label	Name	Type	Descrição
Stream Source Grid		[raster]	An indicator grid (1,0) that evaluates A >= (M)(L^y), based on the maximum upslope path length, the D8 contributing area grid inputs, and parameters `M` and `y`. This grid indicates likely stream source grid cells.

Python code

Algorithm ID: `taudem:lengtharea`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Mover os exutórios para o rio

Moves outlet points that are not aligned with a stream cell from a stream raster grid, downslope along the D8 flow direction until a stream raster cell is encountered, the "max_dist" number of grid cells are examined, or the flow path exits the domain (i.e. a "no data" value is encountered for the D8 flow direction). The output file is a new outlets shapefile where each point has been moved to coincide with the stream raster grid, if possible. A field "dist_moved" is added to the new outlets shapefile to indicate the changes made to each point. Points that are already on a stream cell are not moved and their "dist_moved" field is assigned a value 0. Points that are initially not on a stream cell are moved by sliding them downslope along the D8 flow direction until one of the following occurs: a) A stream raster grid cell is encountered before traversing the "max_dist" number of grid cells. In which case, the point is moved and the "dist_moved" field is assigned a value indicating how many grid cells the point was moved. b) More than the "max_number" of grid cells are traversed, or c) the traversal ends up going out of the domain (i.e., a "no data" D8 flow direction value is encountered). In which case, the point is not moved and the "dist_moved" field is assigned a value of -1.

Parâmetros

Label	Name	Type	Descrição
D8 Flow Direction Grid		[raster]	A grid of D8 flow directions which are defined, for each cell, as the direction of the one of its eight adjacent or diagonal neighbors with the steepest downward slope. This grid can be obtained as the output of the **"D8 Flow Directions"** tool.
Stream Raster Grid		[raster]	This output is an indicator grid (1, 0) that indicates the location of streams, with a value of 1 for each of the stream cells and 0 for the remainder of the cells. This file is produced by several different tools in the **"Stream Network Analysis"** toolset.
Outlets Shapefile		[vector: point]	A point shape file defining points of interest or outlets that should ideally be located on a stream, but may not be exactly on the stream due to the fact that the shapefile point locations may not have been accurately registered with respect to the stream raster grid.
Maximum Number of Grid Cells to traverse		[number] Default: 50	This input parameter is the maximum number of grid cells that the points in the input outlet shapefile will be moved before they are saved to the output outlet shapefile.

Saídas

Label	Name	Type	Descrição
Output Outlet Shapefile		[vector: point]	A point shape file defining points of interest or outlets. This file has one point in it for each point in the input outlet shapefile. If the original point was located on a stream, then the point was not moved. If the original point was not on a stream, the point was moved downslope according to the D8 flow direction until it reached a stream or the maximum distance had been reached. This file has an additional field "dist_moved" added to it which is the number of cells that the point was moved. This field is 0 if the cell was originally on a stream, -1 if it was not moved because there was not a stream within the maximum distance, or some positive value if it was moved.

Python code

Algorithm ID: `taudem:moveoutletstostreams`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Peuker Douglas

Creates an indicator grid (1, 0) of upward curved grid cells according to the Peuker and Douglas algorithm.

With this tool, the DEM is first smoothed by a kernel with weights at the center, sides, and diagonals. The Peuker and Douglas (1975) method (also explained in Band, 1986), is then used to identify upwardly curving grid cells. This technique flags the entire grid, then examines in a single pass each quadrant of 4 grid cells, and unflags the highest. The remaining flagged cells are deemed "upwardly curved", and when viewed, resemble a channel network. This proto-channel network generally lacks connectivity and requires thinning, issues that were discussed in detail by Band (1986).

Parâmetros

Label	Name	Type	Descrição
Elevation Grid		[raster]	A grid of elevation values. This is usually the output of the **"Pit Remove"** tool, in which case it is elevations with pits removed.
Center Smoothing Weight		[number] Default: 0.4	The center weight parameter used by a kernel to smooth the DEM before the tool identifies upwardly curved grid cells.
Side Smoothing Weight		[number] Default: 0.1	The side weight parameter used by a kernel to smooth the DEM before the tool identifies upwardly curved grid cells.

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Tabela 24.234 – continuação da página anterior

Diagonal Smoothing Weight		[number] Default: 0.05	The diagonal weight parameter used by a kernel to smooth the DEM before the tool identifies upwardly curved grid cells.

Saídas

Label	Name	Type	Descrição
Stream Source Grid		[raster]	An indicator grid (1, 0) of upward curved grid cells according to the Peuker and Douglas algorithm, and if viewed, resembles a channel network. This proto-channel network generally lacks connectivity and requires thinning, issues that were discussed in detail by Band (1986).

Python code

Algorithm ID: `taudem:peukerdouglas`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Veja tambem

- Band, L. E., (1986), "Topographic partition of watersheds with digital elevation models", Water Resources Research, 22(1): 15-24.
- Peuker, T. K. and D. H. Douglas, (1975), "Detection of surface-specific points by local parallel processing of discrete terrain elevation data", Comput. Graphics Image Process., 4: 375-387.

Peuker Douglas stream

Combines the functionality of the "Peuker Douglas", "D8 Contributing Area", "Stream Drop Analysis" and "Stream Definition by Threshold" tools in order to generate a stream indicator grid (1,0) where the streams are located using a DEM curvature-based method. With this method, the DEM is first smoothed by a kernel with weights at the center, sides, and diagonals. The Peuker and Douglas (1975) method (also explained in Band, 1986), is then used to identify upwardly curving grid cells. This technique flags the entire grid, then examines in a single pass each quadrant of 4 grid cells, and unflags the highest. The remaining flagged cells are deemed 'upwardly curved', and when viewed, resemble a channel network. This proto-channel network sometimes lacks connectivity, and/or requires thinning, issues that were discussed in detail by Band (1986). The thinning and connecting of these grid cells is achieved here by computing the D8 contributing area using only these upwardly curving cells. An accumulation threshold on the number of these cells is then used to map the channel network where this threshold is optionally set by the user, or determined via drop analysis.

If drop analysis is used, then instead of providing a value for the accumulation threshold, the accumulation threshold value is determined by searching the range between the Drop Analysis Parameters "Lowest" and "Highest", using the number of steps in the parameter "Number". For the science behind drop analysis, see Tarboton, et al. (1991, 1992), and Tarboton and Ames (2001). The value of accumulation threshold that is selected is the smallest value where the absolute value of the t-statistic is less than 2. This is written to the drop analysis table text file. Drop analysis is only possible when outlets have been specified, because if an entire grid domain is analyzed, as the threshold varies, shorter

streams draining off the edge may not meet the threshold criterion and be excluded from the analysis. This makes defining drainage density problematic and it is somewhat inconsistent to compare statistics evaluated over differing domains.

Parâmetros

Saídas

Label	Name	Type	Descrição
Stream source		[raster]	An indicator grid (1, 0) of upward curved grid cells according to the Peuker and Douglas algorithm, and if viewed, resembles a channel network. This proto-channel network generally lacks connectivity and requires thinning, issues that were discussed in detail by Band (1986).

Python code

Algorithm ID: `taudem:peukerdouglasstreamdef`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Declive da Área Combinada

Creates a grid of slope-area values = `(Sm) (An)` based on slope and specific catchment area grid inputs, and parameters `m` and `n`. This tool is intended for use as part of the slope-area stream raster delineation method.

Parâmetros

Label	Name	Type	Descrição
Slope Grid		[raster]	This input is a grid of slope values. This grid can be obtained from the **"D-Infinity Flow Directions"** tool.
Contributing Area Grid		[raster]	A grid giving the specific catchment area for each cell taken as its own contribution (grid cell length or summation of weights) plus the proportional contribution from upslope neighbors that drain in to it. This grid is typically obtained from the **"D-Infinity Contributing Area"** tool.
Slope Exponent		[number] Default: 2	The slope exponent (`m`) parameter which will be used in the formula: `(Sm) (An)`, that is used to create the slope-area grid.
Area Exponent		[number] Default: 1	The area exponent (`n`) parameter which will be used in the formula: `(Sm) (An)`, that is used to create the slope-area grid.

Saídas

Label	Name	Type	Descrição
Slope Area Grid		[raster]	A grid of slope-area values = `(Sm) (An)` calculated from the slope grid, specific catchment area grid, `m` slope exponent parameter, and `n` area exponent parameter.

Python code

Algorithm ID: `taudem:slopearea`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Slope area stream definition

Creates a grid of slope-area values = `(Sm) (An)` based on slope and specific catchment area grid inputs, and parameters `m` and `n`. This tool is intended for use as part of the slope-area stream raster delineation method.

Parâmetros

Label	Name	Type	Descrição
D8 flow directions		[raster]	
D-infinity Contributing Area		[raster]	A grid giving the specific catchment area for each cell taken as its own contribution (grid cell length or summation of weights) plus the proportional contribution from upslope neighbors that drain in to it. This grid is typically obtained from the **"D-Infinity Contributing Area"** tool.
Slope		[raster]	This input is a grid of slope values. This grid can be obtained from the **"D-Infinity Flow Directions"** tool.
Mask grid		[raster]	
Outlets		[vector: point]	
Pit-filled grid for drop analysis		[raster]	
D8 contributing area for drop analysis		[raster]	
Slope Exponent		[number] Default: 2	The slope exponent (`m`) parameter which will be used in the formula: `(Sm) (An)`, that is used to create the slope-area grid.
Area Exponent		[number] Default: 1	The area exponent (`n`) parameter which will be used in the formula: `(Sm) (An)`, that is used to create the slope-area grid.
Accumulation threshold		[number]	

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Tabela 24.239 – continuação da página anterior

Minimum threshold		[number]	
Maximum threshold		[number]	
Number of drop thresholds		[number]	
Type of threshold step		[enumeration] Default: 0	Opções: • 0 — Logarithmic • 1 — Linear
Check for edge contamination		[boolean]	
Select threshold by drop analysis		[boolean]	

Saídas

Label	Name	Type	Descrição
Stream raster		[raster]	
Slope area		[raster]	A grid of slope-area values = `(Sm)(An)` calculated from the slope grid, specific catchment area grid, `m` slope exponent parameter, and `n` area exponent parameter.
Maximum upslope		[raster]	
Drop analysis		[file]	

Python code

Algorithm ID: `taudem:slopeareastreamdef`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Definição de fluxo para limiar

Operates on any grid and outputs an indicator (1, 0) grid identifying cells with input values >= the threshold value. The standard use is to use an accumulated source area grid to as the input grid to generate a stream raster grid as the output. If you use the optional input mask grid, it limits the domain being evaluated to cells with mask values >= 0. When you use a D-infinity contributing area grid (`*sca`) as the mask grid, it functions as an edge contamination mask. The threshold logic is:

```
src = ((ssa >= thresh) & (mask >= s0)) ? 1:0
```

Parâmetros

Label	Name	Type	Descrição
Accumulated Stream Source Grid		[raster]	This grid nominally accumulates some characteristic or combination of characteristics of the watershed. The exact characteristic(s) varies depending on the stream network raster algorithm being used. This grid needs to have the property that grid cell values are monotonically increasing downslope along D8 flow directions, so that the resulting stream network is continuous. While this grid is often from an accumulation, other sources such as a maximum upslope function will also produce a suitable grid.
Threshold		[number] Default: 100	This parameter is compared to the value in the Accumulated Stream Source grid (`*ssa`) to determine if the cell should be considered a stream cell. Streams are identified as grid cells for which ssa value is >= this threshold.
Mask Grid Opcional		[raster]	This optional input is a grid that is used to mask the domain of interest and output is only provided where this grid is >= 0. A common use of this input is to use a D-Infinity contributing area grid as the mask so that the delineated stream network is constrained to areas where D-infinity contributing area is available, replicating the functionality of an edge contamination mask.

Saídas

Label	Name	Type	Descrição
Stream Raster Grid		[raster]	This is an indicator grid (1, 0) that indicates the location of streams, with a value of 1 for each of the stream cells and 0 for the remainder of the cells.

Python code

Algorithm ID: `taudem:threshold`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Stream definition with drop analysis

Combines the function of the "Stream Drop Analysis" tool and the "Stream Definition by Threshold" tools. It applies a series of thresholds (determined from the input parameters) to the input accumulated stream source grid (`ssa`) grid and outputs the results in the stream drop statistics table (`drp.txt`). Then it outputs a stream raster grid, which is an indicator (1,0) grid of stream cells. Stream cells are defined as those cells where the accumulated stream source value is >= the optimal threshold as determined from the stream drop statistics. There is an option to include a mask input to replicate the functionality for using the `*sca` file as an edge contamination mask. The threshold logic should be: `src = ((ssa >= thresh) & (mask >=0)) ? 1:0`

Parâmetros

Saídas

Python code

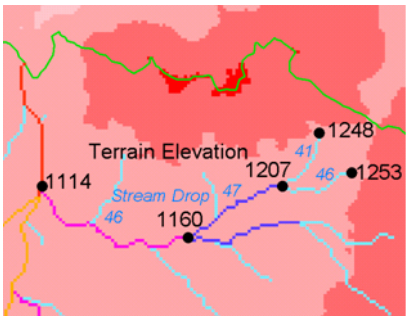
Algorithm ID: `taudem:streamdefdropanalysis`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Análise de gota de fluxo

Applies a series of thresholds (determined from the input parameters) to the input accumulated stream source grid (`*ssa`) grid and outputs the results in the `*drp.txt` file the stream drop statistics table. This function is designed to aid in the determination of a geomorphologically objective threshold to be used to delineate streams. Drop Analysis attempts to select the right threshold automatically by evaluating a stream network for a range of thresholds and examining the constant drop property of the resulting Strahler streams. Basically it asks the question: Is the mean stream drop for first order streams statistically different from the mean stream drop for higher order streams, using a T-test. Stream drop is the difference in elevation from the beginning to the end of a stream defined as the sequence of links of the same stream order. If the T-test shows a significant difference then the stream network does not obey this "law" so a larger threshold needs to be chosen. The smallest threshold for which the T-test does not show a significant difference gives the highest resolution stream network that obeys the constant stream drop "law" from geomorphology, and is the threshold chosen for the "objective" or automatic mapping of streams from the DEM. This function can be used in the development of stream network rasters, where the exact watershed characteristic(s) that were accumulated in the accumulated stream source grid vary based on the method being used to determine the stream network raster.



The constant stream drop "law" was identified by Broscoe (1959). For the science behind using this to determine a stream delineation threshold, see Tarboton et al. (1991, 1992), Tarboton and Ames (2001).

Parâmetros

Label	Name	Type	Descrição
D8 Contributing Area Grid		[raster]	A grid of contributing area values for each cell that were calculated using the D8 algorithm. The contributing area for a cell is the sum of its own contribution plus the contribution from all upslope neighbors that drain to it, measured as a number of cells or the sum of weight loadings. This grid can be obtained as the output of the **"D8 Contributing Area"** tool. This grid is used in the evaluation of drainage density reported in the stream drop table.
D8 Flow Direction Grid		[raster]	A grid of D8 flow directions which are defined, for each cell, as the direction of the one of its eight adjacent or diagonal neighbors with the steepest downward slope. This grid can be obtained as the output of the **"D8 Flow Directions"** tool.
Pit Filled Elevation Grid		[raster]	A grid of elevation values. This is usually the output of the **"Pit Remove"** tool, in which case it is elevations with pits removed.
Accumulated Stream Source Grid		[raster]	This grid must be monotonically increasing along the downslope D8 flow directions. It it compared to a series of thresholds to determine the beginning of the streams. It is often generated by accumulating some characteristic or combination of characteristics of the watershed with the **"D8 Contributing Area"** tool, or using the maximum option of the **"D8 Flow Path Extreme"** tool. The exact method varies depending on the algorithm being used.
Outlets Shapefile		[vector: point]	A point shapefile defining the outlets upstream of which drop analysis is performed.
Minimum Threshold		[number] Default: 5	This parameter is the lowest end of the range searched for possible threshold values using drop analysis. This technique looks for the smallest threshold in the range where the absolute value of the t-statistic is less than 2. For the science behind the drop analysis see Tarboton et al. (1991, 1992), Tarboton and Ames (2001).
Maximum Threshold		[number] Default: 500	This parameter is the highest end of the range searched for possible threshold values using drop analysis. This technique looks for the smallest threshold in the range where the absolute value of the t-statistic is less than 2. For the science behind the drop analysis see Tarboton et al. (1991, 1992), Tarboton and Ames (2001).
Number of Threshold Values		[number] Default: 10	The parameter is the number of steps to divide the search range into when looking for possible threshold values using drop analysis. This technique looks for the smallest threshold in the range where the absolute value of the t-statistic is less than 2. For the science behind the drop analysis see Tarboton et al. (1991, 1992), Tarboton and Ames (2001).

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Tabela 24.243 – continuação da página anterior

Spacing for Threshold Values		[enumeration] Default: 0	This parameter indicates whether logarithmic or linear spacing should be used when looking for possible threshold values using drop analysis. Opções: • 0 — Logarithmic • 1 — Linear

Saídas

Label	Name	Type	Descrição

D-Infinity Drop to Stream Grid		[file]	This is a comma delimited text file with the following header line:
			`Threshold,DrainDen,NoFirstOrd,`
			`↪NoHighOrd,MeanDFirstOrd,MeanDHighOrd,`
			`↪StdDevFirstOrd,StdDevHighOrd,T`
			The file then contains one line of data for each threshold value examined, and then a summary line that indicates the optimum threshold value. This technique looks for the smallest threshold in the range where the absolute value of the t-statistic is less than 2. For the science behind the drop analysis, see Tarboton et al. (1991, 1992), Tarboton and Ames (2001).

Python code

Algorithm ID: `taudem:dropanalysis`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

Veja tambem

- Broscoe, A. J., (1959), "Quantitative analysis of longitudinal stream profiles of small watersheds", Office of Naval Research, Project NR 389-042, Technical Report No. 18, Department of Geology, Columbia University, New York.
- Tarboton, D. G., R. L. Bras and I. Rodriguez-Iturbe, (1991), "On the Extraction of Channel Networks from Digital Elevation Data", Hydrologic Processes, 5(1): 81-100.
- Tarboton, D. G., R. L. Bras and I. Rodriguez-Iturbe, (1992), "A Physical Basis for Drainage Density", Geomorphology, 5(1/2): 59-76.
- Tarboton, D. G. and D. P. Ames, (2001), "Advances in the mapping of flow networks from digital elevation data", World Water and Environmental Resources Congress, Orlando, Florida, May 20-24, ASCE, https://www.researchgate.net/publication/2329568_Advances_in_the_Mapping_of_Flow_Networks_From_Digital_Elevation_Data.

Afluentes e Bacias Hidrográficas

This tool produces a vector network and shapefile from the stream raster grid. The flow direction grid is used to connect flow paths along the stream raster. The Strahler order of each stream segment is computed. The subwatershed draining to each stream segment (reach) is also delineated and labeled with the value identifier that corresponds to the WSNO (watershed number) attribute in the Stream Reach Shapefile.

This tool orders the stream network according to the Strahler ordering system. Streams that don't have any other streams draining in to them are order 1. When two stream reaches of different order join the order of the downstream reach is the order of the highest incoming reach. When two reaches of equal order join the downstream reach order is increased by 1. When more than two reaches join the downstream reach order is calculated as the maximum of the highest incoming reach order or the second highest incoming reach order + 1. This generalizes the common definition to cases where more than two reaches join at a point. The network topological connectivity is stored in the Stream Network Tree file, and coordinates and attributes from each grid cell along the network are stored in the Network Coordinates file.

The stream raster grid is used as the source for the stream network, and the flow direction grid is used to trace connections within the stream network. Elevations and contributing area are used to determine the elevation and contributing area attributes in the network coordinate file. Points in the outlets shapefile are used to logically split stream reaches to facilitate representing watersheds upstream and downstream of monitoring points. The program uses the attribute field "id" in the outlets shapefile as identifiers in the Network Tree file. This tool then translates the text file vector network representation in the Network Tree and Coordinates files into a shapefile. Further attributes are also evaluated. The program has an option to delineate a single watershed by representing the entire area draining to the Stream Network as a single value in the output watershed grid.

Parâmetros

Label	Name	Type	Descrição
Pit Filled Elevation Grid		[raster]	A grid of elevation values. This is usually the output of the **"Pit Remove"** tool, in which case it is elevations with pits removed.
D8 Flow Direction Grid		[raster]	A grid of D8 flow directions which are defined, for each cell, as the direction of the one of its eight adjacent or diagonal neighbors with the steepest downward slope. This grid can be obtained as the output of the **"D8 Flow Directions"** tool.
D8 Drainage Area		[raster]	A grid giving the contributing area value in terms of the number of grid cells (or the summation of weights) for each cell taken as its own contribution plus the contribution from upslope neighbors that drain in to it using the D8 algorithm. This is usually the output of the **"D8 Contributing Area"** tool and is used to determine the contributing area attribute in the Network Coordinate file.
Stream Raster Grid		[raster]	An indicator grid indicating streams, by using a grid cell value of 1 on streams and 0 off streams. Several of the **"Stream Network Analysis"** tools produce this type of grid. The Stream Raster Grid is used as the source for the stream network.

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Tabela 24.245 – continuação da página anterior

Outlets Shapefile as Network Nodes Opcional		[vector: point]	A point shape file defining points of interest. If this file is used, the tool will only deliniate the stream network upstream of these outlets. Additionally, points in the Outlets Shapefile are used to logically split stream reaches to facilitate representing watersheds upstream and downstream of monitoring points. This tool REQUIRES THAT THERE BE an integer attribute field "id" in the Outlets Shapefile, because the "id" values are used as identifiers in the Network Tree file.
Delineate Single Watershed		[boolean] Default: True	This option causes the tool to delineate a single watershed by representing the entire area draining to the Stream Network as a single value in the output watershed grid. Otherwise a seperate watershed is delineated for each stream reach. Default is *False* (seperate watershed).

Saídas

Label	Name	Type	Descrição
Stream Order Grid		[raster]	The Stream Order Grid has cells values of streams ordered according to the Strahler order system. The Strahler ordering system defines order 1 streams as stream reaches that don't have any other reaches draining in to them. When two stream reaches of different order join the order of the downstream reach is the order of the highest incoming reach. When two reaches of equal order join the downstream reach order is increased by 1. When more than two reaches join the downstream reach order is calculated as the maximum of the highest incoming reach order or the second highest incoming reach order + 1. This generalizes the common definition to cases where more than two flow paths reaches join at a point.
Watershed Grid		[raster]	This output grid identified each reach watershed with a unique ID number, or in the case where the delineate single watershed option was checked, the entire area draining to the stream network is identified with a single ID.

continua na próxima página

Tabela 24.246 – continuação da página anterior

Stream Reach Shapefile		[vector: line]	This output is a polyline shapefile giving the links in a stream network. The columns in the attribute table are: • LINKNO — Link Number. A unique number associated with each link (segment of channel between junctions). This is arbitrary and will vary depending on number of processes used • DSLINKNO — Link Number of the downstream link. -1 indicates that this does not exist • USLINKNO1 — Link Number of first upstream link. (-1 indicates no link upstream, i.e. for a source link) • USLINKNO2 — Link Number of second upstream link. (-1 indicates no second link upstream, i.e. for a source link or an internal monitoring point where the reach is logically split but the network does not bifurcate) • DSNODEID — Node identifier for node at downstream end of stream reach. This identifier corresponds to the "id" attribute from the Outlets shapefile used to designate nodes • Order — Strahler Stream Order • Length — Length of the link. The units are the horizontal map units of the underlying DEM grid • Magnitude — Shreve Magnitude of the link. This is the total number of sources upstream • DS_Cont_Ar — Drainage area at the downstream end of the link. Generally this is one grid cell upstream of the downstream end because the drainage area at the downstream end grid cell includes the area of the stream being joined • Drop — Drop in elevation from the start to the end of the link • Slope — Average slope of the link (computed as drop/length) • Straight_L — Straight line distance from the start to the end of the link • US_Cont_Ar — Drainage area at the upstream end of the link • WSNO — Watershed number. Cross reference to the `*w.shp` and `*w` grid files giving the identification number of the watershed draining directly to the link • DOUT_END — Distance to the eventual outlet (i.e. the most downstream point in the stream network) from the downstream end of the link • DOUT_START — Distance to the eventual outlet from the upstream end of the link • DOUT_MID — Distance to the eventual outlet from the midpoint of the link

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Tabela 24.246 – continuação da página anterior

Network Connectivity Tree		[file]	This output is a text file that details the network topological connectivity is stored in the Stream Network Tree file. Columns are as follows: • Link Number (Arbitrary — will vary depending on number of processes used) • Start Point Number in Network coordinates (`*coord.dat`) file (Indexed from 0) • End Point Number in Network coordinates (`*coord.dat`) file (Indexed from 0) • Next (Downstream) Link Number. Points to Link Number. -1 indicates no links downstream, i.e. a terminal link • First Previous (Upstream) Link Number. Points to Link Number. -1 indicates no upstream links • Second Previous (Upstream) Link Numbers. Points to Link Number. -1 indicates no upstream links. Where only one previous link is -1, it indicates an internal monitoring point where the reach is logically split, but the network does not bifurcate • Strahler Order of Link • Monitoring point identifier at downstream end of link. -1 indicates downstream end is not a monitoring point • Network magnitude of the link, calculated as the number of upstream sources (following Shreve)
Network Coordinates		[file]	This output is a text file that contains the coordinates and attributes of points along the stream network. Columns are as follows: • Coordenada X • Coordenada Y • Distance along channels to the downstream end of a terminal link • Elevação • Área de Contribuição

Python code

Algorithm ID: `taudem:streamnet`

```
import processing
processing.run("algorithm_id", {parameter_dictionary})
```

The *algorithm id* is displayed when you hover over the algorithm in the Processing Toolbox. The *parameter dictionary* provides the parameter NAMEs and values. See *Usando os algoritmos do processamento a partir do Terminal Python.* for details on how to run processing algorithms from the Python console.

24.5 OTB applications provider

OTB (Orfeo ToolBox) is an image processing library for remote sensing data. It also provides applications that provide image processing functionalities. The list of applications and their documentation are available in OTB CookBook

CAPÍTULO 25

Plugins

25.1 Complementos QGIS

QGIS has been designed with a plugin architecture. This allows many new features and functions to be easily added to the application. Some of the features in QGIS are actually implemented as plugins.

25.1.1 Core and External plugins

QGIS plugins are implemented either as **Core Plugins** or **External Plugins**.

Core Plugins are maintained by the QGIS Development Team and are automatically part of every QGIS distribution. They are written in one of two languages: **C++** or **Python**.

Most of External Plugins are currently written in Python. They are stored either in the 'Official' QGIS Repository at https://plugins.qgis.org/plugins/ or in external repositories and are maintained by the individual authors. Detailed documentation about the usage, minimum QGIS version, home page, authors,and other important information are provided for the plugins in the Official repository. For other external repositories, documentation might be available with the external plugins themselves. External plugins documentation is not included in this manual.

To install or activate a plugin, go to *Plugins* menu and select  *Manage and install plugins...*. Installed external python plugins are placed under the `python/plugins` folder of the active *user profile* path.

Paths to Custom C++ plugins libraries can also be added under *Settings* ► *Options* ► *System*.

Nota: According to the *plugin manager settings*, QGIS main interface can display an icon on the right of the status bar to inform you that there are updates for your installed plugins or new plugins available.

25.1.2 Diálogo de Complementos

The tabs in the Plugins dialog allow the user to install, uninstall and upgrade plugins in different ways. Each plugin has some metadata displayed in the right panel:

- information on whether the plugin is experimental
- descrição
- rating vote(s) (you can vote for your preferred plugin!)
- etiquetas
- some useful links to the home page, tracker and code repository
- autor(es)
- versão disponível

At the top of the dialog, a *Search* function helps you find any plugin using metadata information (author, name, description…). It is available in nearly every tab (except *Settings*).

The Settings tab

The *Settings* tab is the main place you can configure which plugins can be displayed in your application. You can use the following options:

- *Check for updates on startup*. Whenever a new plugin or a plugin update is available, QGIS will inform you 'every time QGIS starts', 'once a day', 'every 3 days', 'every week', 'every 2 weeks' or 'every month'.
- *Show also experimental plugins*. QGIS will show you plugins in early stages of development, which are generally unsuitable for production use.
- *Show also deprecated plugins*. Because they use functions that are no longer available in QGIS, these plugins are set deprecated and generally unsuitable for production use. They appear among invalid plugins list.

By default, QGIS provides you with its official plugin repository with the URL https://plugins.qgis.org/plugins/plugins.xml?qgis=3.0 (in case of QGIS 3.0) in the *Plugin repositories* section. To add external author repositories, click *Add…* and fill in the *Repository Details* form with a name and the URL. The URL can be of `http://` or `file://` protocol type.

The default QGIS repository is an open repository and you don't need any authentication to access it. You can however deploy your own plugin repository and require an authentication (basic authentication, PKI). You can get more information on QGIS authentication support in *Autenticação* chapter.

If you do not want one or more of the added repositories, they can be disabled from the Settings tab via the *Edit…* button, or completely removed with the *Delete* button.

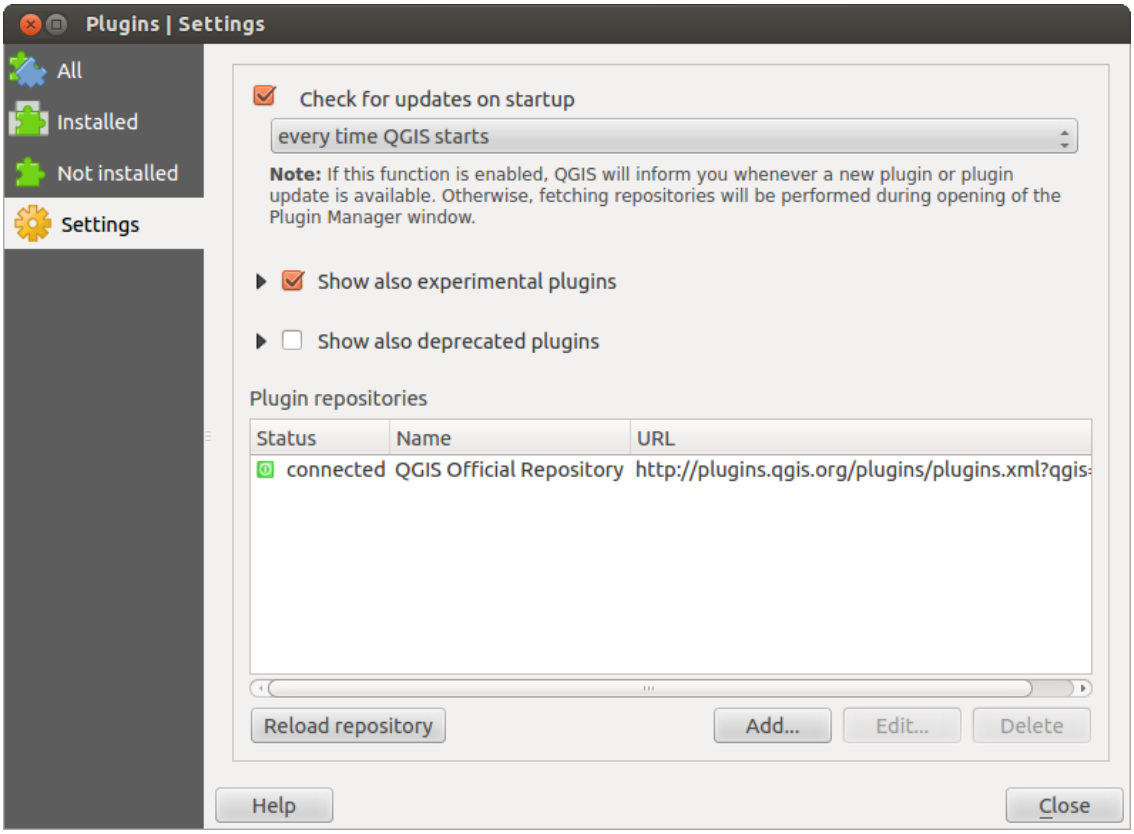


Figura25.1: The *Settings* tab

The All tab

In the *All* tab, all the available plugins are listed, including both core and external plugins. Use *Upgrade All* to look for new versions of the plugins. Furthermore, you can use *Install Plugin* if a plugin is listed but not installed, *Uninstall Plugin* as well as *Reinstall Plugin* if a plugin is installed. An installed plugin can be temporarily de/activated using the checkbox.

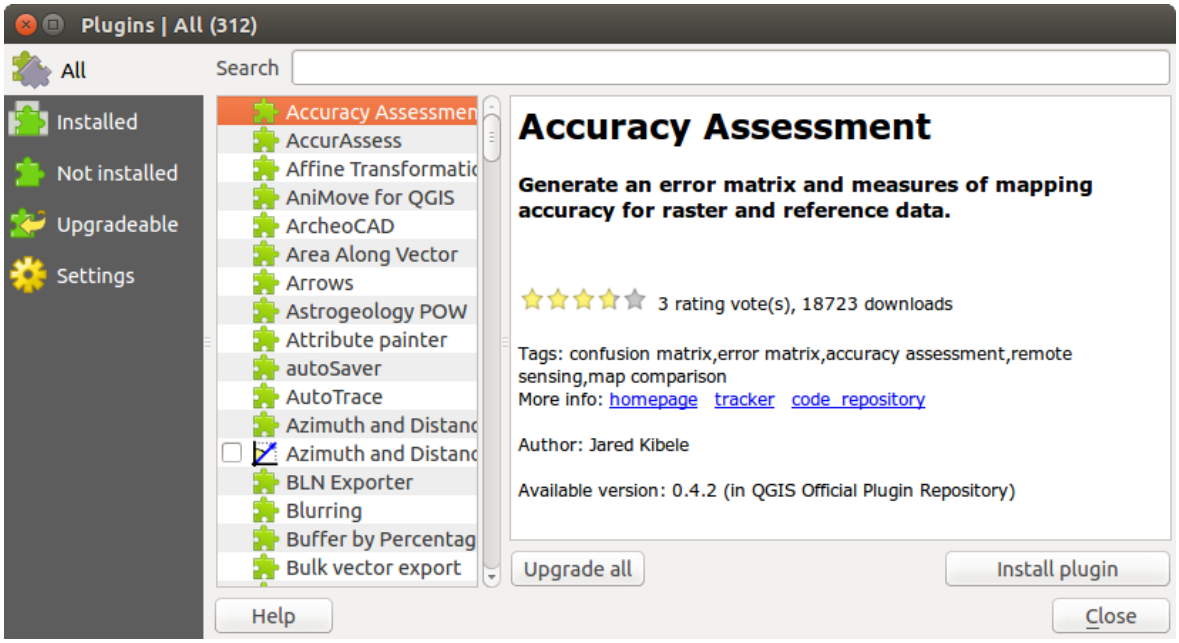


Figura25.2: The *All* tab

The Installed tab

In the *Installed* tab, you'll find listed the Core plugins, that you can not uninstall. You can extend this list with external plugins that can be uninstalled and reinstalled any time, using the *Uninstall Plugin* and *Reinstall Plugin* buttons. You can *Upgrade All* the plugins here as well.

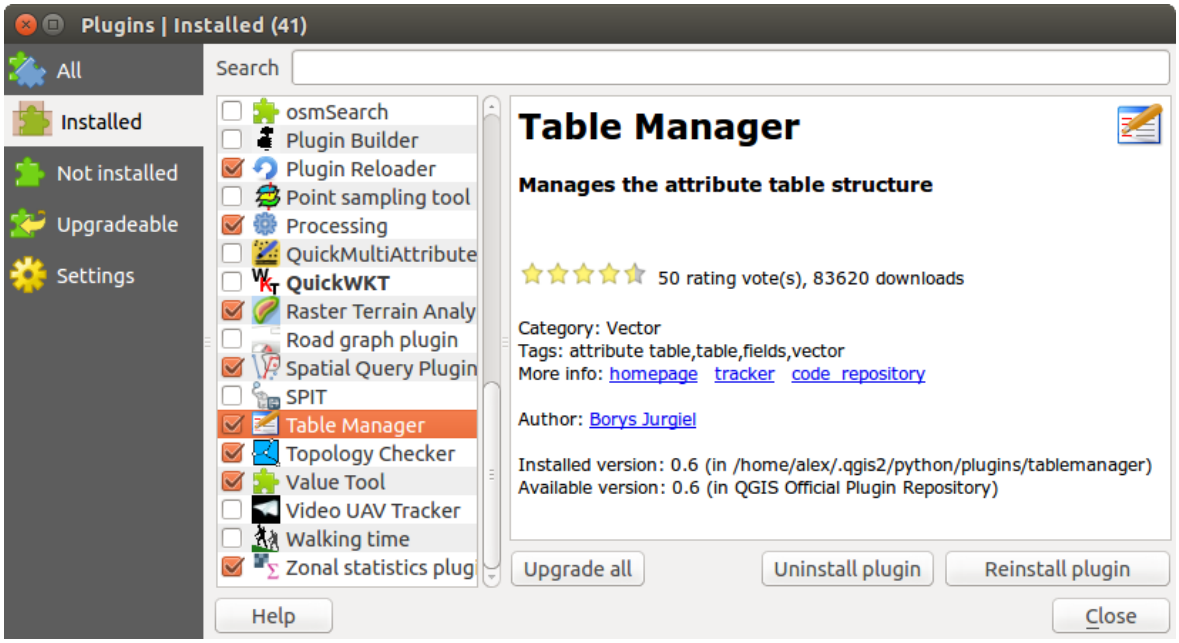


Figura25.3: The *Installed* tab

The Not installed tab

The *Not installed* tab lists all plugins available that are not installed. You can use the *Install Plugin* button to implement a plugin into QGIS.

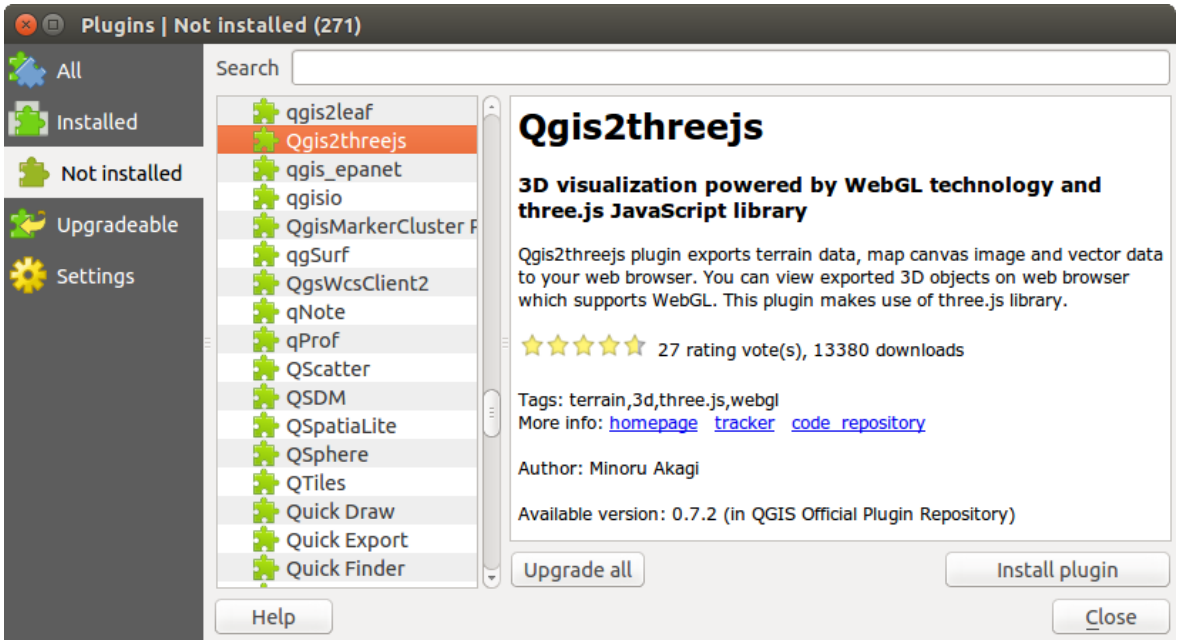


Figura25.4: The *Not installed* tab

The Upgradeable and New tabs

The *Upgradeable* and *New* tabs are enabled when new plugins are added to the repository or a new version of an installed plugin is released. If you activated *Show also experimental plugins* in the *Settings* menu, those also appear in the list giving you opportunity to early test upcoming tools.

Installation can be done with the *Install Plugin*, *Upgrade Plugin* or *Upgrade All* buttons.

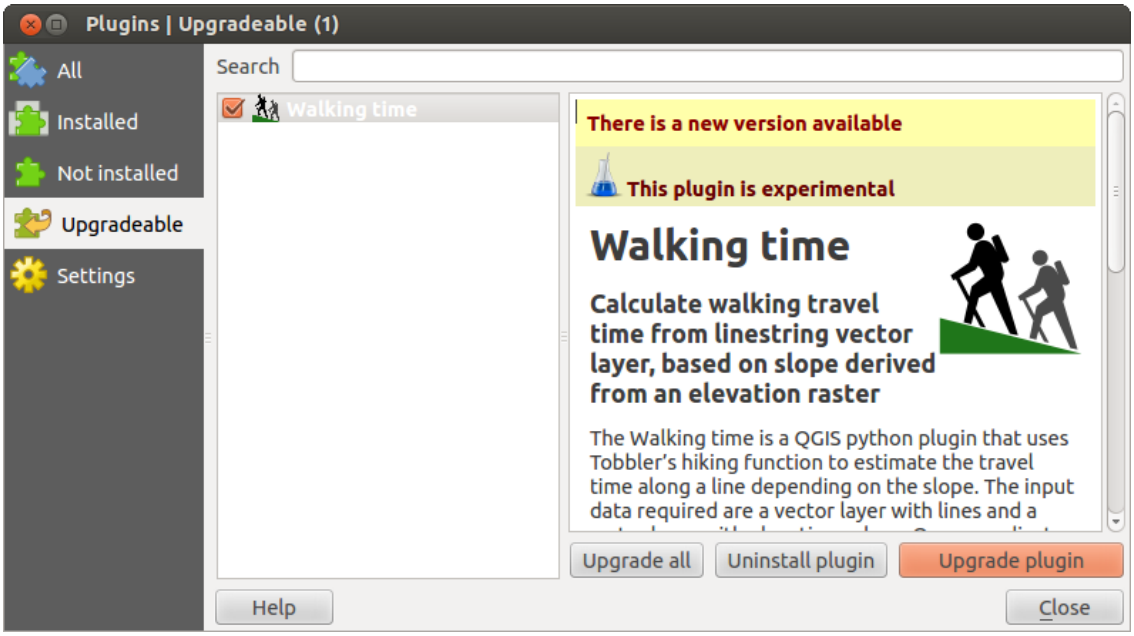


Figura25.5: The *Upgradeable* tab

The Invalid tab

The *Invalid* tab lists all installed plugins that are currently broken for any reason (missing dependency, errors while loading, incompatible functions with QGIS version…). You can try the *Reinstall Plugin* button to fix an invalidated plugin but most of the times the fix will be elsewhere (install some libraries, look for another compatible plugin or help to upgrade the broken one).

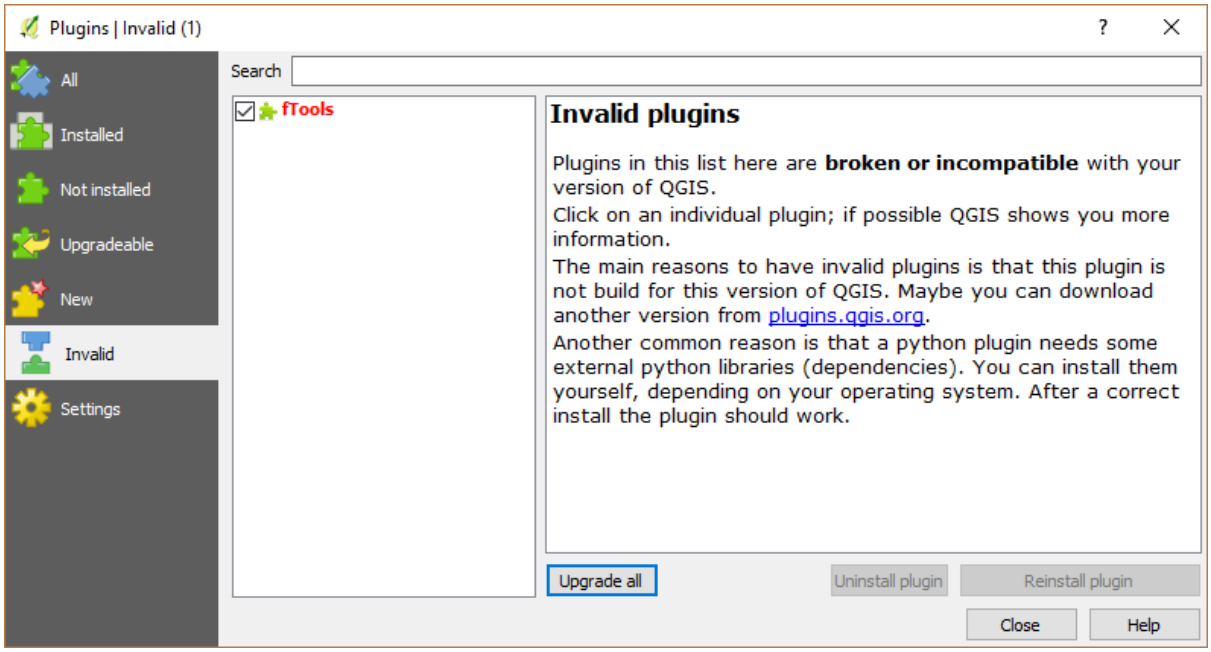


Figura25.6: The *Invalid* tab

The Install from ZIP tab

The *Install from ZIP* tab provides a file selector widget to import plugins in a zipped format, e.g. plugins downloaded directly from their repository.

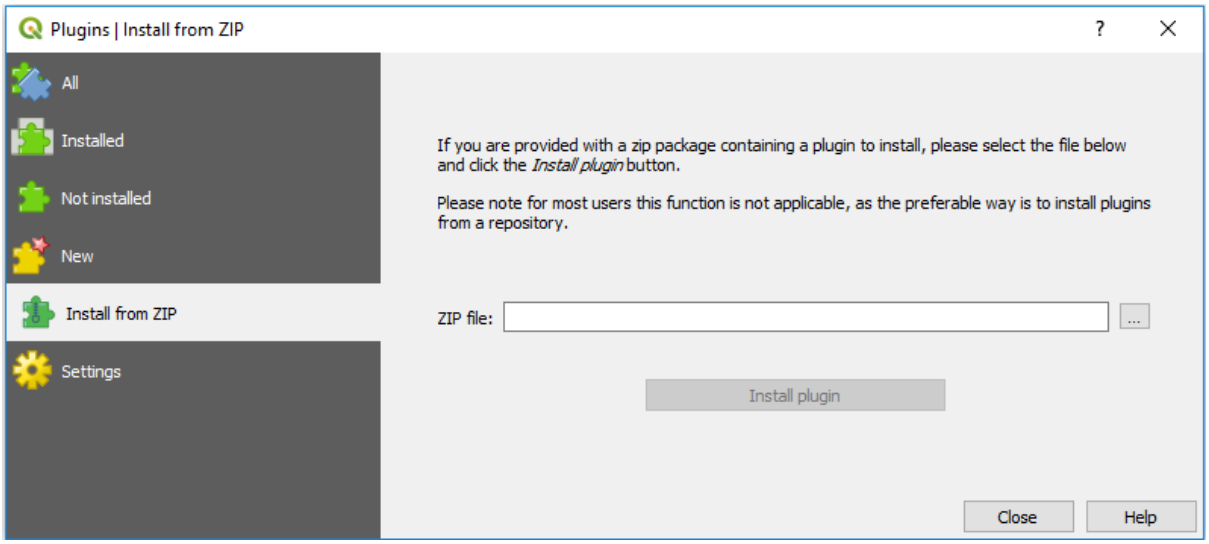


Figura25.7: The *Install from zip* tab

25.2 Using QGIS Core Plugins

25.2.1 DB Manager Plugin

The DB Manager Plugin is intended to be the main tool to integrate and manage spatial database formats supported by QGIS (PostGIS, SpatiaLite, GeoPackage, Oracle Spatial, Virtual layers) in one user interface. The DB Manager Plugin provides several features. You can drag layers from the QGIS Browser into the DB Manager, and it will import your layer into your spatial database. You can drag and drop tables between spatial databases and they will get imported.

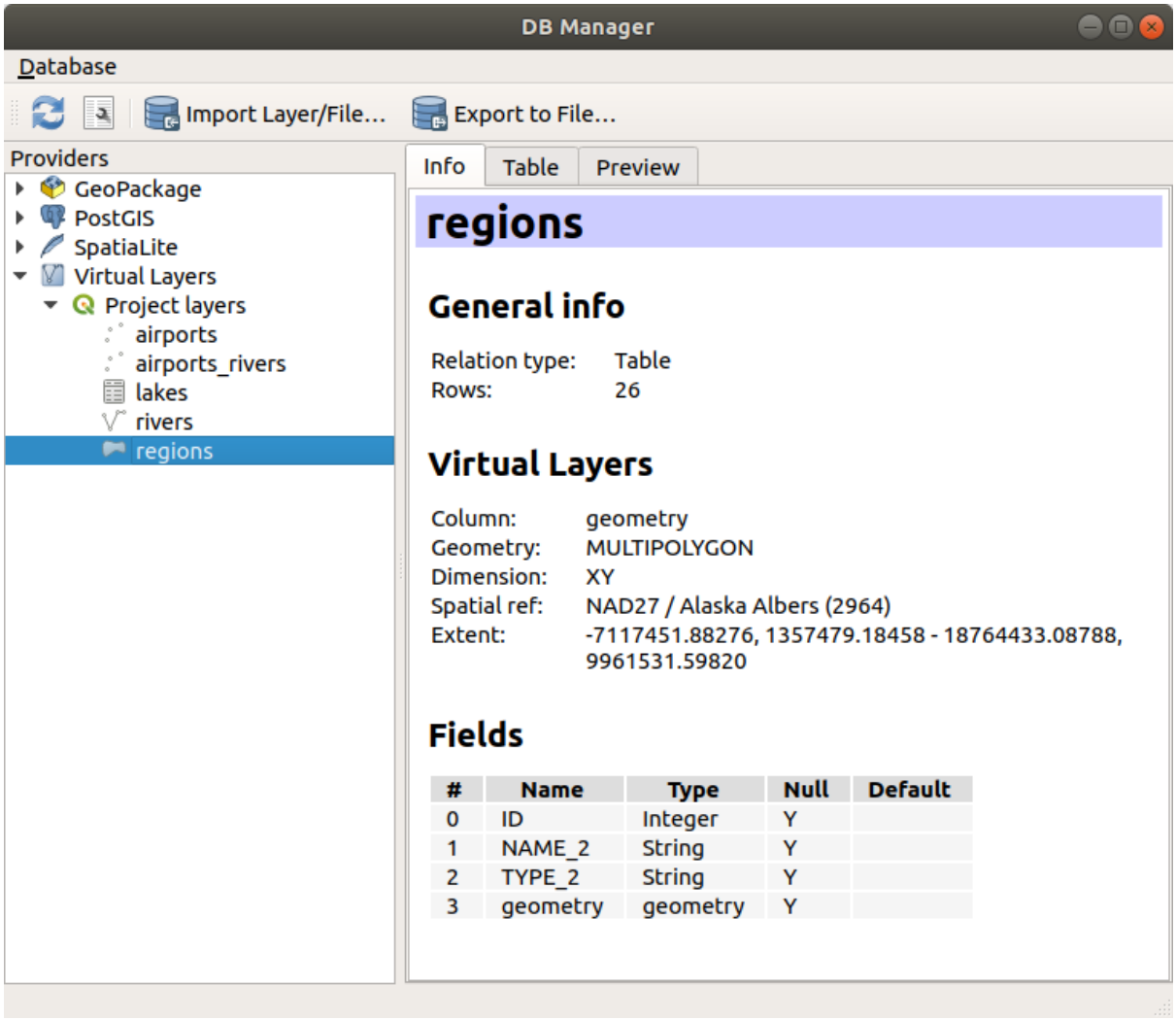


Figura25.8: Caixa de diálogo Gerenciador DB

The *Database* menu allows you to connect to an existing database, to start the SQL window and to exit the DB Manager Plugin. Once you are connected to an existing database, the menus *Schema* (relevant for DBMSs, such as PostGIS / PostgreSQL) and *Table* will appear.

The *Schema* menu includes tools to create and delete (only if empty) schemas and, if topology is available (e.g. with PostGIS topology), to start a *TopoViewer*.

The *Table* menu allows you to create and edit tables and to delete tables and views. It is also possible to empty tables and to move tables between schemas. You can *Run Vacuum Analyze* for the selected table. *Vacuum* reclaims space and makes it available for reuse, and *analyze* updates statistics that is used to determine the most efficient way to execute a query. *Change Logging...* allows you to add change logging support to a table. Finally, you can *Import Layer/File...* and *Export to File...*.

The *Providers* window lists all existing databases supported by QGIS. With a double-click, you can connect to the database. With the right mouse button, you can rename and delete existing schemas and tables. Tables can also be added to the QGIS canvas with the context menu.

If connected to a database, the **main** window of the DB Manager offers four tabs. The *Info* tab provides information about the table and its geometry, as well as about existing fields, constraints and indexes. It allows you to create a spatial index on a the selected table. The *Table* tab shows the table, and the *Preview* tab renders the geometries as preview. When you open an *SQL Window*, it will be placed in a new tab.

Working with the SQL Window

You can use the DB Manager to execute SQL queries against your spatial database. Queries can be saved and loaded, and there the *SQL Query Builder* will help you formulate your queries. You can even view spatial output by checking *Load as new layer* and specifying *Column(s) with unique values* (IDs), *Geometry column* and *Layer name (prefix)*. It is possible to highlight a portion of the SQL to only execute that portion when pressing `Ctrl+R` or clicking the *Execute* button.

The *Query History* button stores the last 20 queries of each database and provider.

Double clicking on an entry will add the string to the SQL window.

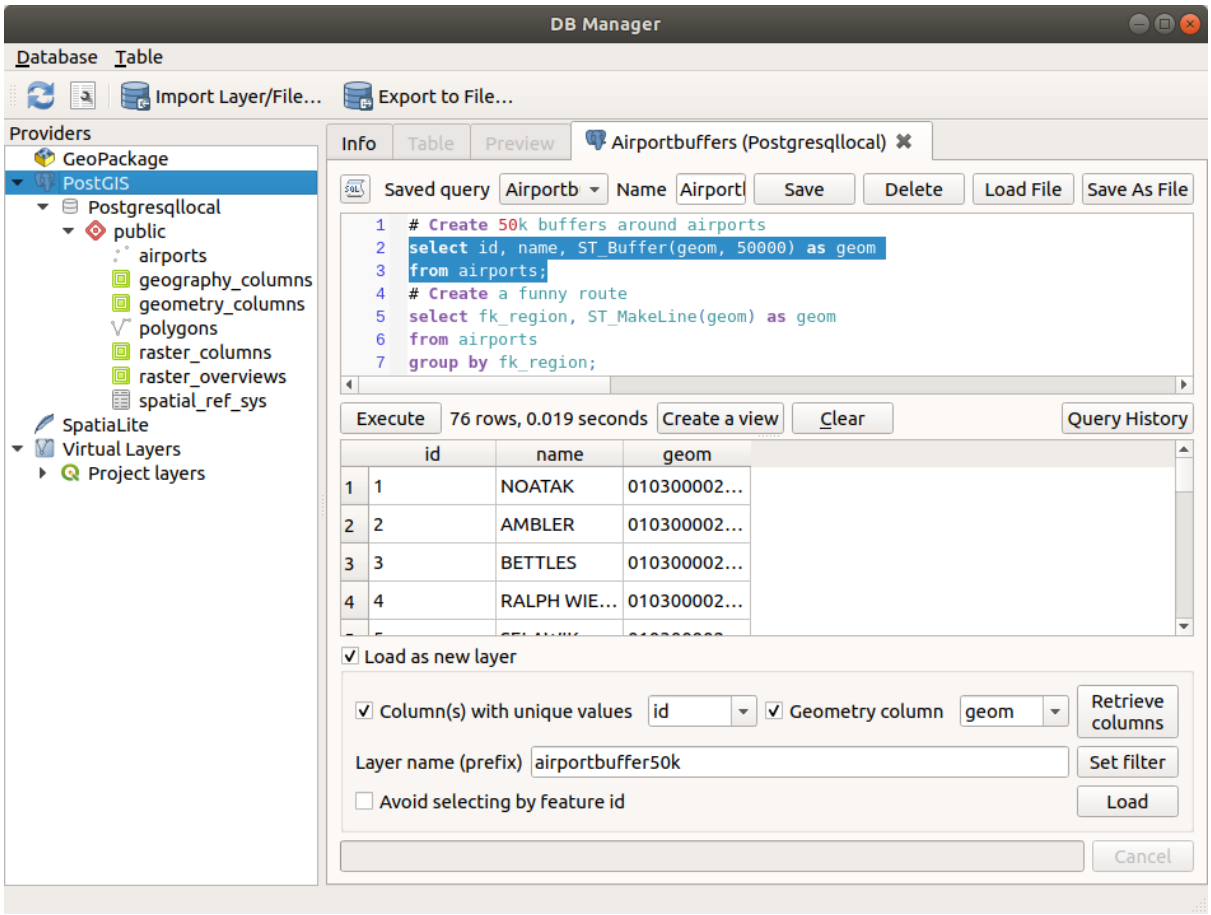


Figura25.9: Executing SQL queries in the DB Manager SQL window

Nota: The SQL Window can also be used to create Virtual Layers. In that case, instead of selecting a database, select **QGIS Layers** under **Virtual Layers** before opening the SQL Window. See *Creating virtual layers* for instructions on the SQL syntax to use.

25.2.2 Geometry Checker Plugin

Geometry Checker is a powerful core plugin to check and fix the geometry validity of a layer. It is available from the *Vector* menu ( *Check Geometries…*).

Configuring the checks

The *Check Geometries* dialog shows different grouped settings in the first tab (*Setup*):

- *Input vector layers*: to select the layers to check. A *Only selected features* checkbox can be used to restrict the checking to the geometries of the selected features.
- *Allowed geometry types* gives the chance to restrict the geometry type of the input layer(s) to:
  - Point
  - Multipoint
  - Line
  - Multiline
  - Polygon
  - Multipolygon
- *Geometry validity*. Depending on geometry types you can choose between:
  - *Self intersections*
  - *Duplicate nodes*
  - *Self contacts*
  - *Polygon with less than 3 nodes*.
- *Geometry properties*. Depending on geometry types, different options are available:
  - *Polygons and multipolygons may not contain any holes*
  - *Multipart objects must consist of more than one part*
  - *Lines must not have dangles*
- *Geometry conditions*. Allows you to add some condition to validate the geometries with:
  - *Minimal segment length (map units)* 1,00
  - *Minimum angle between segment (deg)* 1,00
  - *Minimal polygon area (map units sqr.)* 1,00
  - *No sliver polygons* with a *Maximum thinness* 1,00 and a *Max. area (map units sqr.)* 1,00
- *Topology checks*. Depending on geometry types, many different options are available:
  - *Checks for duplicates*
  - *Checks for features within other features*
  - *Checks for overlaps smaller than* 1,00
  - *Checks for gaps smaller than* 1,00

  - *Points must be covered by lines*
  - *Points must properly lie inside a polygon*
  - *Lines must not intersect any other lines*
  - *Lines must not intersect with features of layer*
  - *Polygons must follow boundaries of layer*
- *Tolerance*. You can define the tolerance of the check in map layer units.
- *Output vector layer* gives the choice to:
  - *Modify input layer*
  - *Create new layers*

When you are happy with the configuration, you can click on the *Run* button.

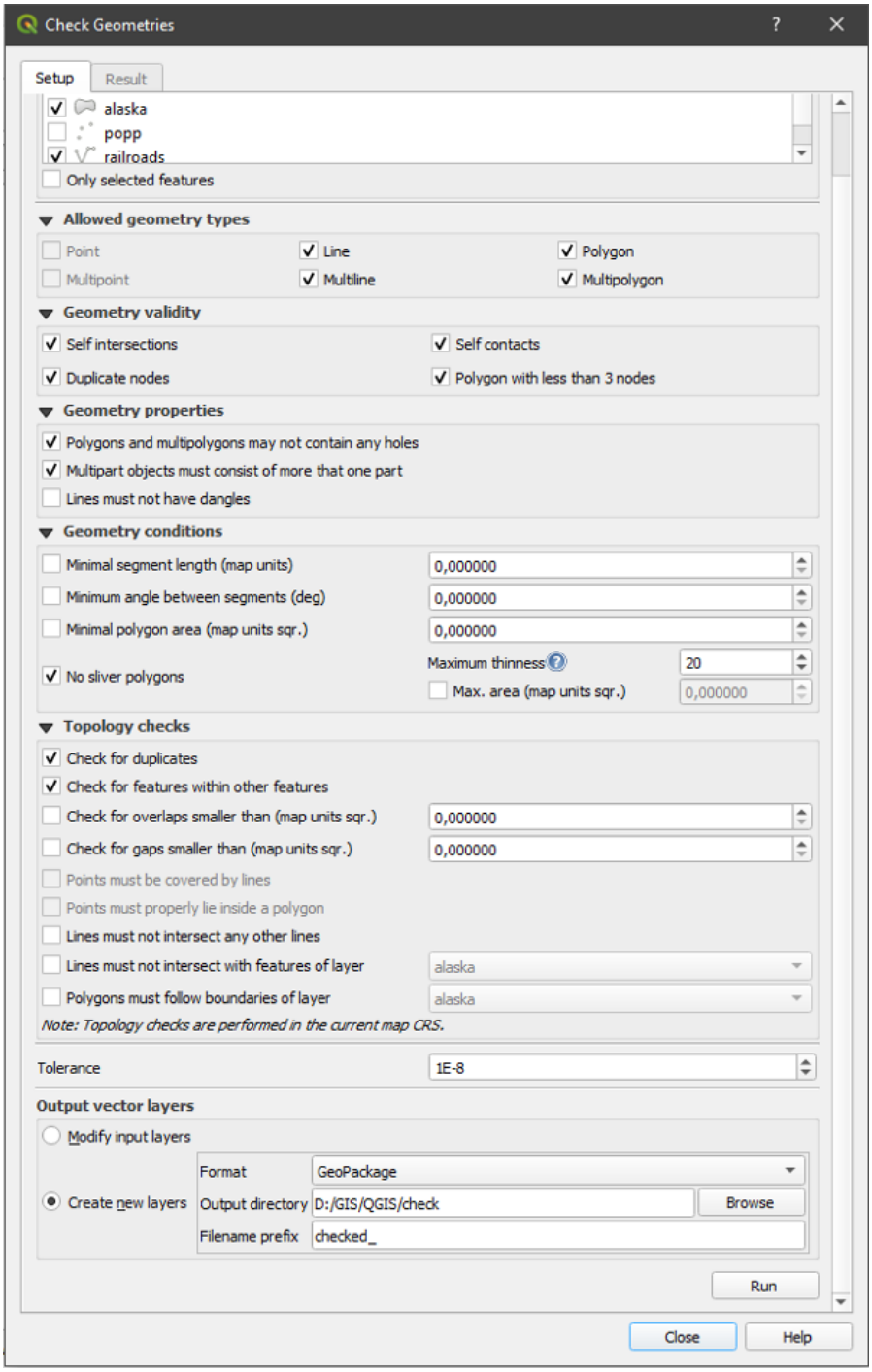


Figura25.10: The Geometry Checker Plugin

The *Geometry Checker Plugin* can find the following errors:

- Self intersections: a polygon with a self intersection
- Duplicate nodes: two duplicates nodes in a segment
- Holes: hole in a polygon
- Segment length: a segment length lower than a threshold
- Minimum angle: two segments with an angle lower than a threshold
- Minimum area: polygon area lower than a threshold

- Silver polygon: this error come from very small polygon (with small area) with a large perimeter
- Duplicates features
- Feature within feature
- Overlaps: polygon overlapping
- Gaps: gaps between polygons

The following figure shows the different checks made by the plugin.

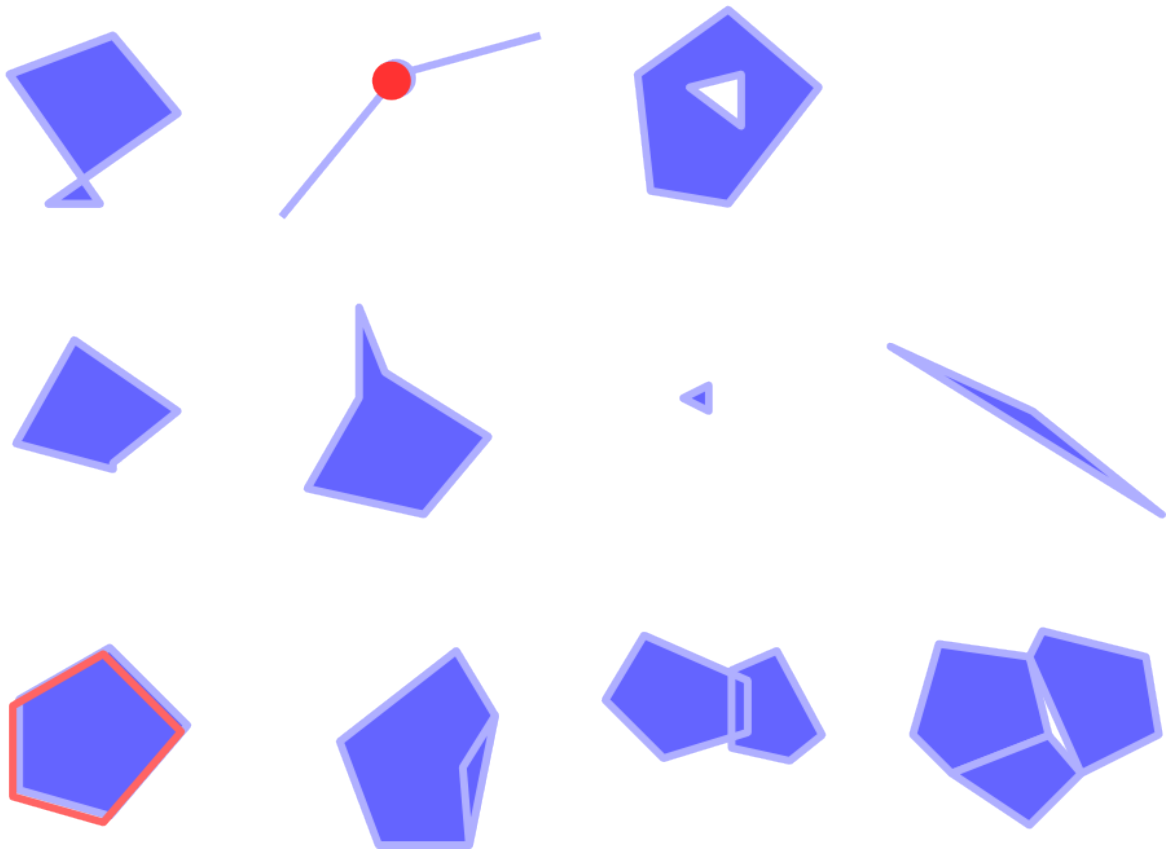


Figura25.11: Some checks supported by the plugin

Analysing the results

The results appear in the second tab (*Result*) and as an overview layer of the errors in the canvas (its name has the default prefix `checked_`). A table lists the *Geometry check result* with one error per row and columns containing: the layer name, an ID, the error type, then the coordinates of the error, a value (depending on the type of the error) and finally the resolution column which indicates the resolution of the error. At the bottom of this table, you can *Export* the error into different file formats. You also have a counter with the number of total errors and fixed ones.

You can select a row to see the location of the error. You can change this behavior by selecting another action between *Error* (default), *Feature*, *Don't move*, and *Highlight contour of selected features*.

Below the zoom action when clicking on the table row, you can:

- *Show selected features in attribute table*
- *Fix selected errors using default resolution*
- *Fix selected errors, prompt for resolution method* You will see a window to choose the resolution's method among which:

  - Merge with neighboring polygon with longest shared edge
  - Merge with neighboring polygon with largest area
  - Merge with neighboring polygon with identical attribute value, if any, or leave as is
  - Delete feature
  - No action
- *Error resolution settings* allows you to change the default resolution method depending on the error type

Dica: Fix multiple errors

You can fix multiple errors by selecting more than one row in the table with the *CTRL + click* action.

Finally, you can choose which *Attribute to use when merging features by attribute value*.

25.2.3 MetaSearch Catalog Client

Introdução

MetaSearch is a QGIS plugin to interact with metadata catalog services, supporting the OGC Catalog Service for the Web (CSW) standard.

MetaSearch provides an easy and intuitive approach and user-friendly interface to searching metadata catalogs within QGIS.

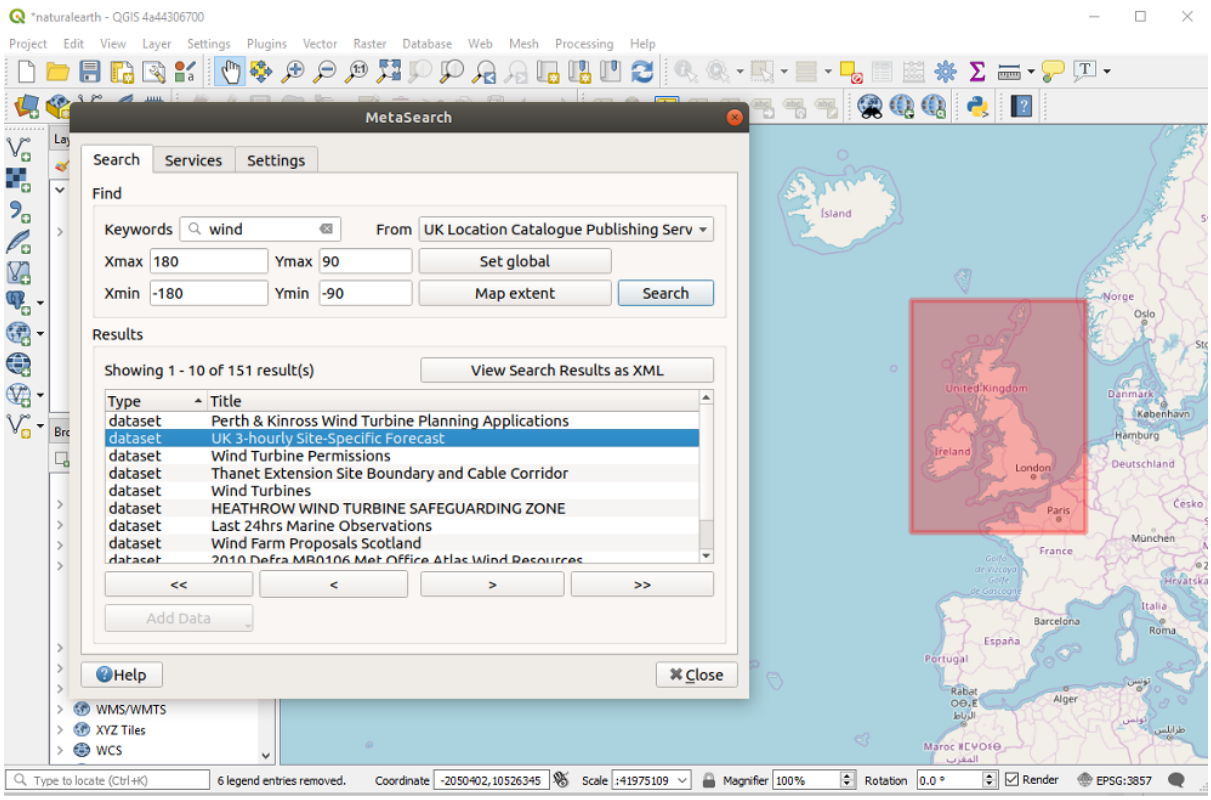


Figura25.12: Search and results of Services in MetaSearch

Working with Metadata Catalogs in QGIS

MetaSearch is included by default in QGIS, with all of its dependencies, and can be enabled from the QGIS Plugin Manager.

CSW (Catalog Service for the Web)

CSW (Catalog Service for the Web) is an OGC (Open Geospatial Consortium) specification that defines common interfaces to discover, browse and query metadata about data, services, and other potential resources.

Startup

To start MetaSearch, click the  icon or select *Web* ► *MetaSearch* ► *MetaSearch* via the QGIS main menu. The MetaSearch dialog will appear. The main GUI consists of three tabs: *Services*, *Search* and *Settings*.

Managing Catalog Services

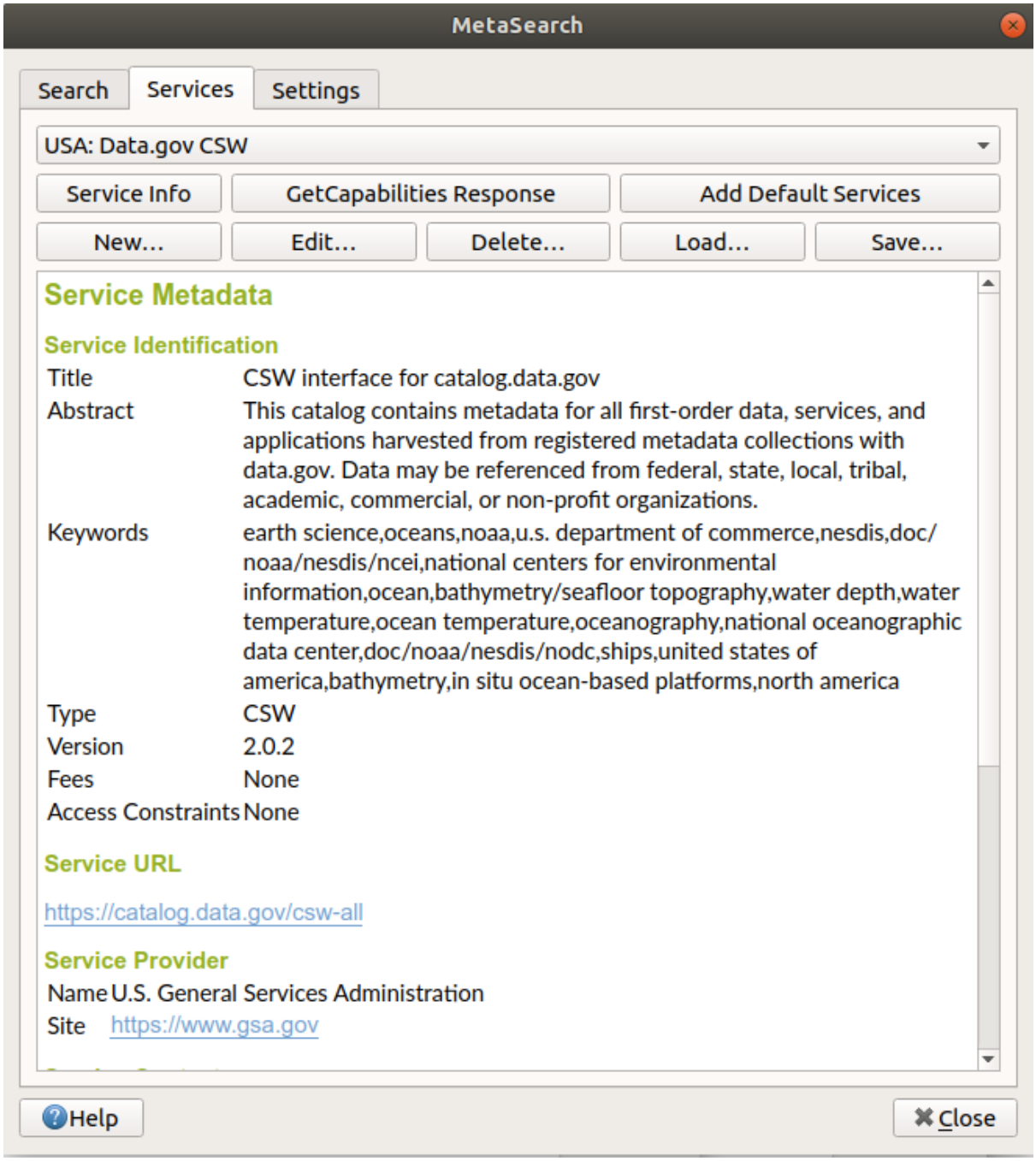


Figura25.13: Managing Catalog Services

The *Services* tab allows the user to manage all available catalog services. MetaSearch provides a default list of Catalog Services, which can be added by pressing the *Add Default Services* button.

To find all listed Catalog Service entries, click the dropdown select box.

To add a Catalog Service entry:

1. Click the *New* button
2. Enter a *Name* for the service, as well as the *URL* (endpoint). Note that only the base URL is required (not a full GetCapabilities URL).

3. If the CSW requires authentication, enter the appropriate *User name* and *Password* credentials.
4. Click *OK* to add the service to the list of entries.

To edit an existing Catalog Service entry:

1. Select the entry you would like to edit
2. Click the *Edit* button
3. And modify the *Name* or *URL* values
4. Haz clic en *OK*.

To delete a Catalog Service entry, select the entry you would like to delete and click the *Delete* button. You will be asked to confirm deleting the entry.

MetaSearch allows loading and saving connections to an XML file. This is useful when you need to share settings between applications. Below is an example of the XML file format.

```
<?xml version="1.0" encoding="UTF-8"?>
<qgsCSWConnections version="1.0">
    <csw name="Data.gov CSW" url="https://catalog.data.gov/csw-all"/>
    <csw name="Geonorge - National CSW service for Norway" url="https://www.
↪geonorge.no/geonetwork/srv/eng/csw"/>
    <csw name="Geoportale Nazionale - Servizio di ricerca Italiano" url="http://
↪www.pcn.minambiente.it/geoportal/csw"/>
    <csw name="LINZ Data Service" url="http://data.linz.govt.nz/feeds/csw"/>
    <csw name="Nationaal Georegister (Nederland)" url="http://www.
↪nationaalgeoregister.nl/geonetwork/srv/eng/csw"/>
    <csw name="RNDT - Repertorio Nazionale dei Dati Territoriali - Servizio di␣
↪ricerca" url="http://www.rndt.gov.it/RNDT/CSW"/>
    <csw name="UK Location Catalogue Publishing Service" url="http://csw.data.gov.
↪uk/geonetwork/srv/en/csw"/>
    <csw name="UNEP/GRID-Geneva Metadata Catalog" url="http://metadata.grid.unep.
↪ch:8080/geonetwork/srv/eng/csw"/>
</qgsCSWConnections>
```

To load a list of entries:

1. Click the *Load* button. A new window will appear.
2. Click the *Browse* button and navigate to the XML file of entries you wish to load.
3. Click *Open*. The list of entries will be displayed.
4. Select the entries you wish to add from the list and click *Load*.

Click the *Service Info* button to display information about the selected Catalog Service such as service identification, service provider and contact information. If you would like to view the raw XML response, click the *GetCapabilities Response* button. A separate window will open displaying the Capabilities XML.

Searching Catalog Services

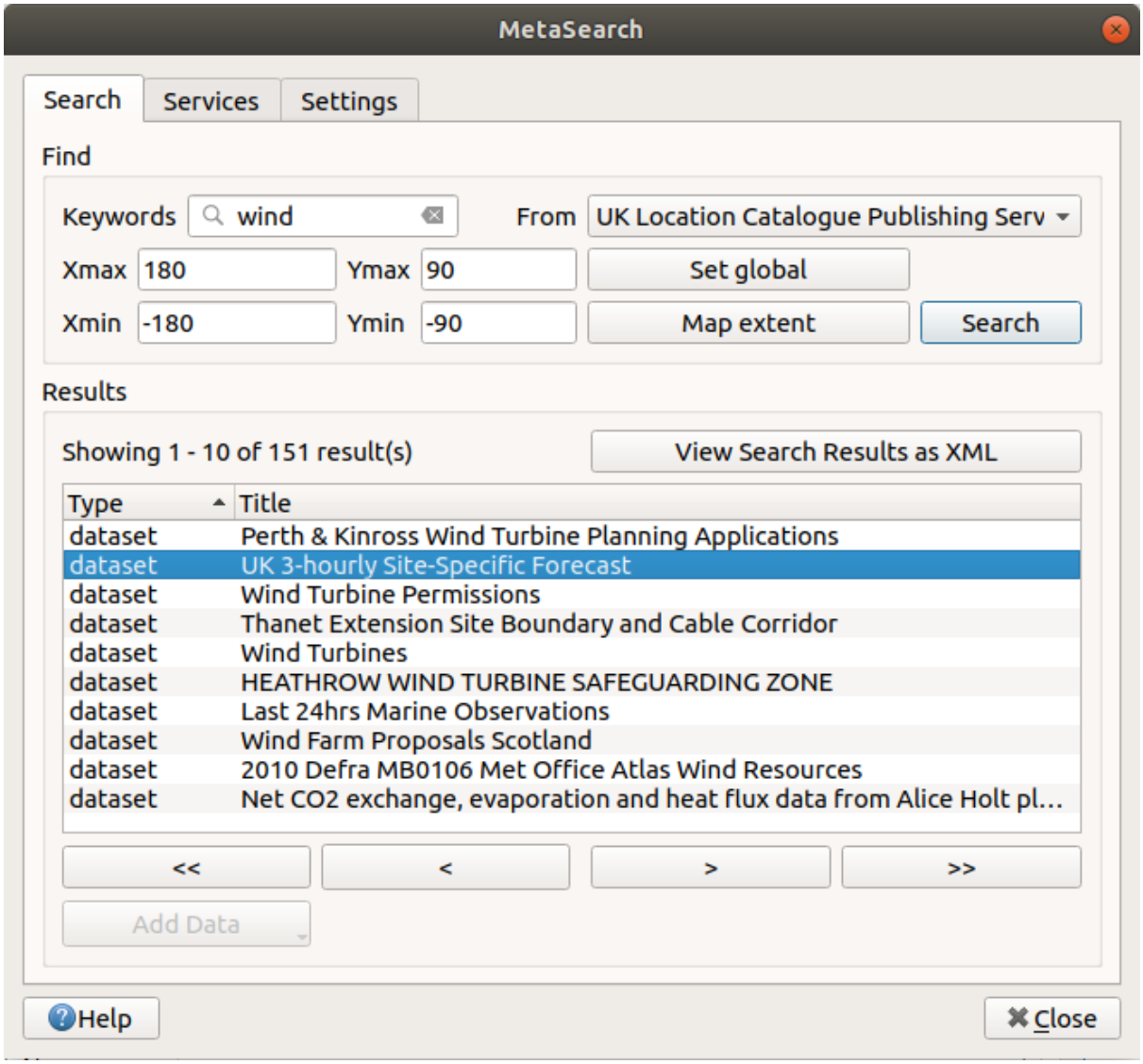


Figura25.14: Searching catalog services

The *Search* tab allows the user to query Catalog Services for data and services, set various search parameters and view results.

The following search parameters are available:

- *Keywords*: free text search keywords;
- *From*: the Catalog Service to perform the query against;
- **Bounding box**: the spatial area of interest to filter, defined by *Xmax*, *Xmin*, *Ymax*, and *Ymin*. Click *Set Global* to do a global search, click *Map Extent* to do a search in the visible area, or enter values manually.

Clicking the *Search* button will search the selected Metadata Catalog. Search results are displayed in a list, and can be sorted by clicking on the column header. You can navigate through search results with the directional buttons below the search results.

Select a result and:

- Click the *View Search Results as XML* button to open a window with the service response in raw XML format.

- If the metadata record has an associated bounding box, a footprint of the bounding box will be displayed on the map.
- Double-click the record to display the record metadata with any associated access links. Clicking a link opens the link in the user's web browser.
- If the record is a supported web service (WMS/WMTS, WFS, WCS, ArcGIS Map Service, ArcGIS Feature Service, etc.), the *Add Data* button will be enabled. When clicking this button, MetaSearch will verify if this is a valid OWS. The service will then be added to the appropriate QGIS connection list, and the appropriate connection dialog will appear.

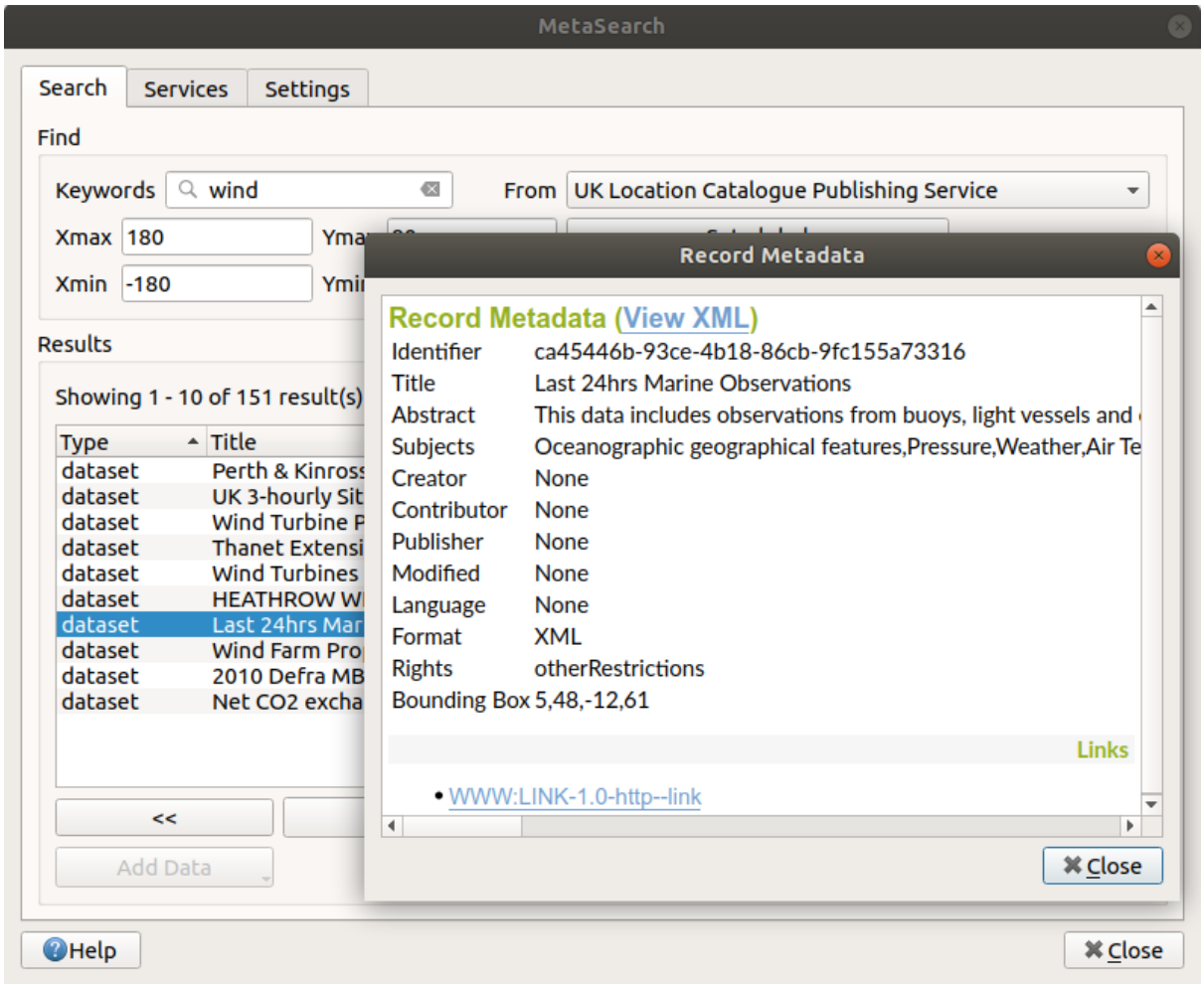


Figura25.15: Metadata record display

Configurações

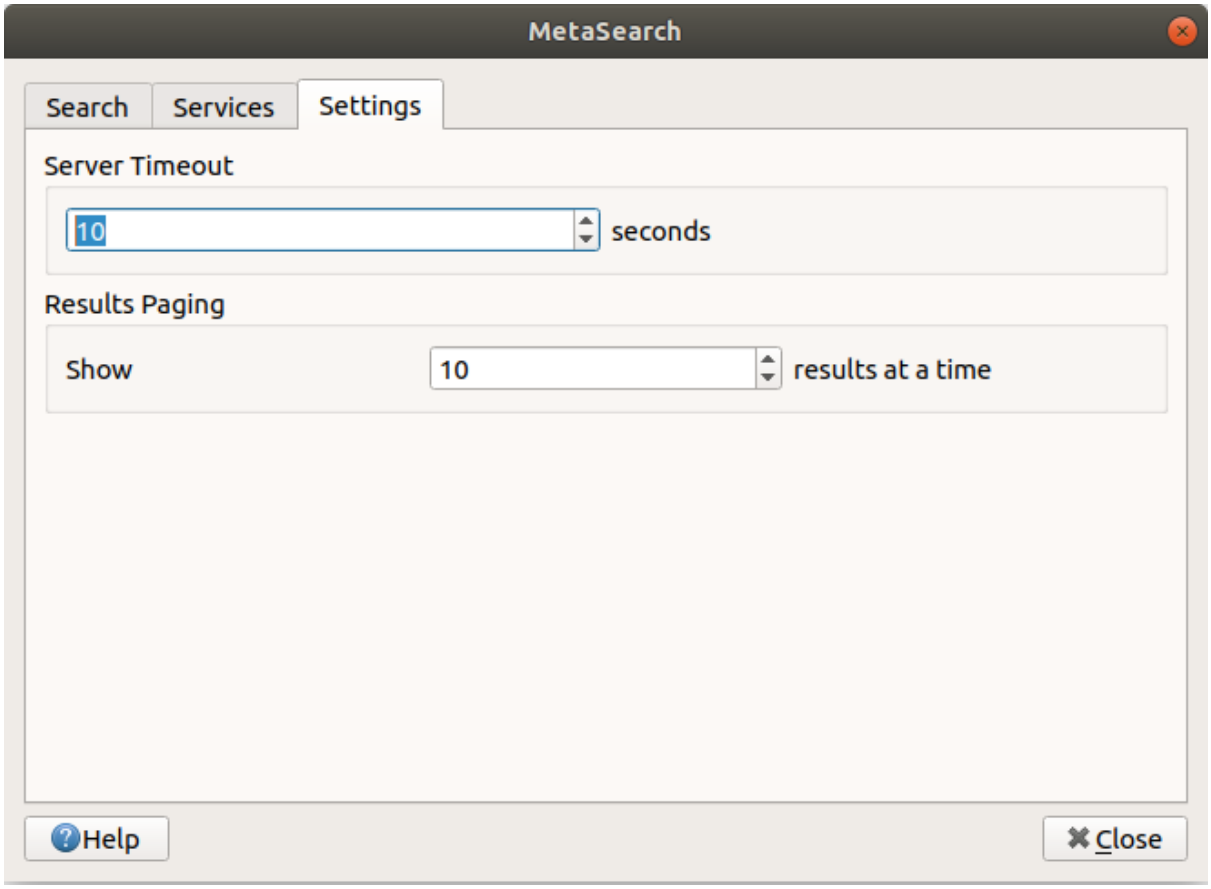


Figura25.16: MetaSearch settings

You can fine tune MetaSearch with the following *Settings*:

- *Server Timeout*: when searching metadata catalogs, the number of seconds for blocking connection attempt. Default value is 10.
- *Results paging*: when searching metadata catalogs, the number of results to show per page. Default value is 10.

CSW Server Errors

In some cases, the CSW will work in a web browser, but not in MetaSearch. This may be due to the CSW server's configuration/setup. CSW server providers should ensure URLs are consistent and up to date in their configuration (this is common in HTTP -> HTTPS redirection scenarios). Please see the pycsw FAQ item for a deeper explanation of the issue and fix. Although the FAQ item is pycsw specific it can also apply in general to other CSW servers.

25.2.4 Offline Editing Plugin

For data collection, it is a common situation to work with a laptop or a cell phone offline in the field. Upon returning to the network, the changes need to be synchronized with the master datasource (e.g., a PostGIS database). If several persons are working simultaneously on the same datasets, it is difficult to merge the edits by hand, even if people don't change the same features.

The  Offline Editing Plugin automates the synchronisation by copying the content of a datasource (usually PostGIS or WFS-T) to a SpatiaLite or GeoPackage database and storing the offline edits to dedicated tables. After being connected to the network again, it is possible to apply the offline edits to the master dataset.

To use the plugin:

1. Open a project with some vector layers (e.g., from a PostGIS or WFS-T datasource).
2. Assuming you have already enabled the plugin (see *Core and External plugins*) go to *Database* ► *Offline Editing* ►  *Convert to offline project*. The eponym dialog opens.
3. Select the *Storage type*. It can be of *GeoPackage* or *SpatiaLite* database type.
4. Use the *Browse* button to indicate the location of the database in which to store the *Offline data*. It can be an existing file or one to create.
5. In the *Select remote layers* section, check the layers you'd like to save. The content of the layers is saved to database tables.
6. You can check  *Only synchronize selected features if a selection is present* allowing to only save and work on a subset. It can be invaluable in case of large layers.

   This is all!
7. Save your project and bring it on the field.
8. Edit the layers offline.
9. After being connected again, upload the changes using *Database* ► *Offline Editing* ►  *Synchronize*.

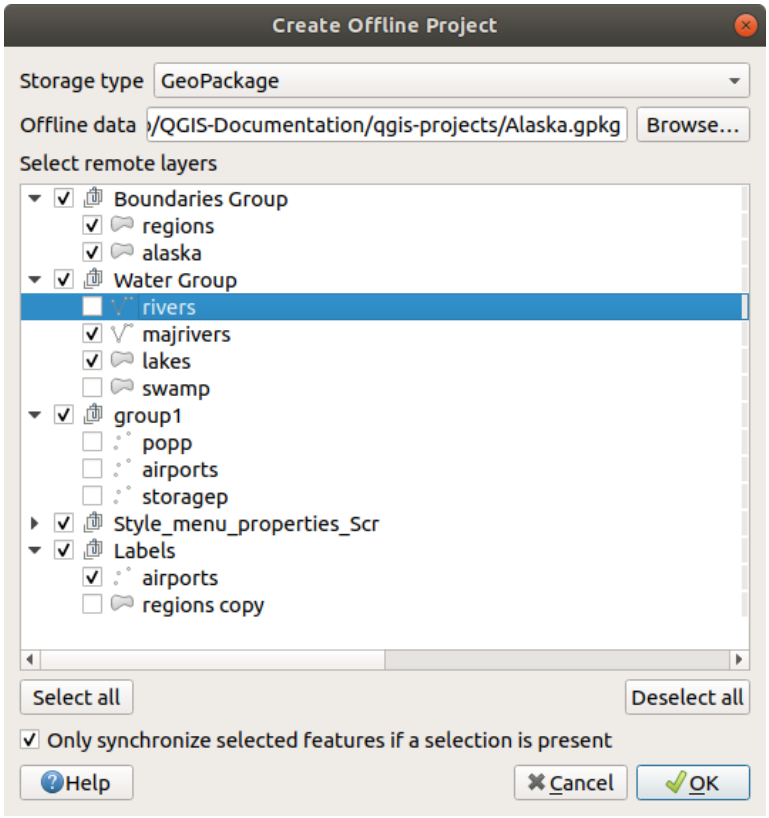


Figura25.17: Create an offline project

25.2.5 Topology Checker Plugin

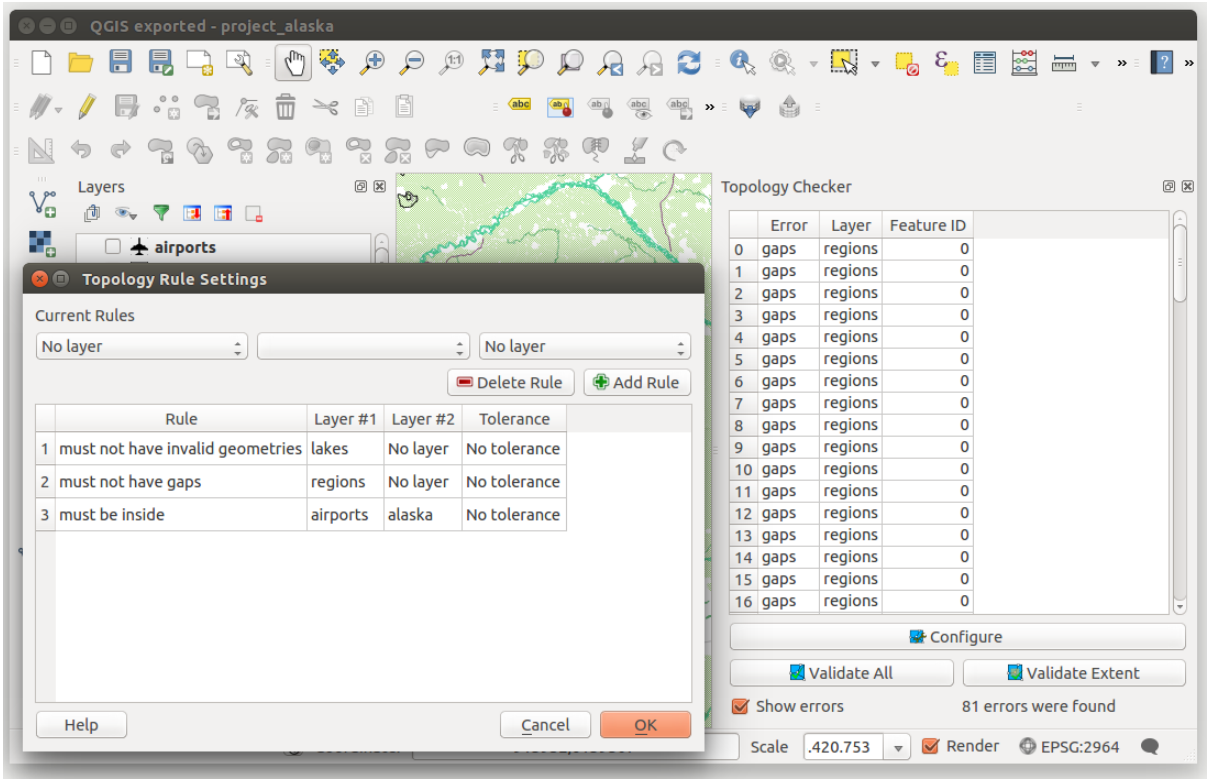


Figura25.18: The Topology Checker Plugin

Topology describes the relationships between points, lines and polygons that represent the features of a geographic region. With the Topology Checker plugin, you can look over your vector files and check the topology with several topology rules. These rules check with spatial relations whether your features 'Equal', 'Contain', 'Cover', are 'CoveredBy', 'Cross', are 'Disjoint', 'Intersect', 'Overlap', 'Touch' or are 'Within' each other. It depends on your individual questions which topology rules you apply to your vector data (e.g., normally you won't accept overshoots in line layers, but if they depict dead-end streets you won't remove them from your vector layer).

QGIS has a built-in topological editing feature, which is great for creating new features without errors. But existing data errors and user-induced errors are hard to find. This plugin helps you find such errors through a list of rules.

It is very simple to create topology rules with the Topology Checker plugin.

On **point layers** the following rules are available:

- **Must be covered by**: Here you can choose a vector layer from your project. Points that aren't covered by the given vector layer occur in the 'Error' field.
- **Must be covered by endpoints of**: Here you can choose a line layer from your project.
- **Must be inside**: Here you can choose a polygon layer from your project. The points must be inside a polygon. Otherwise, QGIS writes an 'Error' for the point.
- **Must not have duplicates**: Whenever a point is represented twice or more, it will occur in the 'Error' field.
- **Must not have invalid geometries**: Checks whether the geometries are valid.
- **Must not have multi-part-geometries**: All multi-part points are written into the 'Error' field.

On **line layers**, the following rules are available:

- **End points must be covered by**: Here you can select a point layer from your project.
- **Must not have dangles**: This will show the overshoots in the line layer.

- **Must not have duplicates**: Whenever a line feature is represented twice or more, it will occur in the 'Error' field.
- **Must not have invalid geometries**: Checks whether the geometries are valid.
- **Must not have multi-part geometries**: Sometimes, a geometry is actually a collection of simple (single-part) geometries. Such a geometry is called multi-part geometry. If it contains just one type of simple geometry, we call it multi-point, multi-linestring or multi-polygon. All multi-part lines are written into the 'Error' field.
- **Must not have pseudos**: A line geometry's endpoint should be connected to the endpoints of two other geometries. If the endpoint is connected to only one other geometry's endpoint, the endpoint is called a pseudo node.

On **polygon layers**, the following rules are available:

- **Must contain**: Polygon layer must contain at least one point geometry from the second layer.
- **Must not have duplicates**: Polygons from the same layer must not have identical geometries. Whenever a polygon feature is represented twice or more it will occur in the 'Error' field.
- **Must not have gaps**: Adjacent polygons should not form gaps between them. Administrative boundaries could be mentioned as an example (US state polygons do not have any gaps between them…).
- **Must not have invalid geometries**: Checks whether the geometries are valid. Some of the rules that define a valid geometry are:
  - Polygon rings must close.
  - Rings that define holes should be inside rings that define exterior boundaries.
  - Rings may not self-intersect (they may neither touch nor cross one another).
  - Rings may not touch other rings, except at a point.
- **Must not have multi-part geometries**: Sometimes, a geometry is actually a collection of simple (single-part) geometries. Such a geometry is called multi-part geometry. If it contains just one type of simple geometry, we call it multi-point, multi-linestring or multi-polygon. For example, a country consisting of multiple islands can be represented as a multi-polygon.
- **Must not overlap**: Adjacent polygons should not share common area.
- **Must not overlap with**: Adjacent polygons from one layer should not share common area with polygons from another layer.

Below is the list of Core plugins provided with QGIS. They are not necessarily enabled by default.

Ícone	Plugin	Descrição	Manual Reference
	Gerenciador BD	Manage your databases within QGIS	*DB Manager Plugin*
	Verificador de Geometria	Check and repair errors in vector geometries	*Geometry Checker Plugin*
	GPS Tools	Tools for loading and importing GPS data	*Complemento GPS*
	GRASS	GRASS functionality	*Integração com SIG GRASS*
	MetaSearch Catalog Client	Interact with metadata catalog services (CSW)	*MetaSearch Catalog Client*
	Offline Editing	Offline editing and synchronizing with database	*Offline Editing Plugin*
	Processamento	Spatial data processing framework	*QGIS estrutura de processamento*
	Topology Checker	Find topological errors in vector layers	*Topology Checker Plugin*

25.3 Terminal Python QGIS

As you will see later in this chapter, QGIS has been designed with a plugin architecture. Plugins can be written in Python, a very famous language in the geospatial world.

QGIS brings a Python API (see PyQGIS Developer Cookbook for some code sample) to let the user interact with its objects (layers, feature or interface). QGIS also has a Python console.

The QGIS Python Console is an interactive shell for the python command executions. It also has a python file editor that allows you to edit and save your python scripts. Both console and editor are based on PyQScintilla2 package. To open the console go to *Plugins* ► *Python Console* (`Ctrl+Alt+P`).

25.3.1 The Interactive Console

The interactive console is composed of a toolbar, an input area and an output one.

Barra de Ferramentas

The toolbar proposes the following tools:

-  Clear Console to wipe the output area;
-  Run Command available in the input area: same as pressing `Enter`;
-  Show Editor: toggles *The Code Editor* visibility;
-  Options...: opens a dialog to configure console properties (see *Python Console Settings*);
-  Help...: browses the current documentation.

Console

The console main features are:

- Code completion, highlighting syntax and calltips for the following APIs:
  - Python
  - PyQGIS
  - PyQt5
  - QScintilla2
  - osgeo-gdal-ogr
- `Ctrl+Alt+Space` to view the auto-completion list if enabled in the *Python Console Settings*;
- Execute trechos de código da área de entrada digitando e pressionando `Enter` ou *Executar Comando*;
- Execute code snippets from the output area using the *Enter Selected* from the contextual menu or pressing `Ctrl+E`;
- Browse the command history from the input area using the `Up` and `Down` arrow keys and execute the command you want;
- `Ctrl+Shift+Space` to view the command history: double-clicking a row will execute the command. The *Command History* dialog can also be accessed from context menu of input area;
- Save and clear the command history. The history will be saved into the `console_history.txt` file under the active *user profile* folder;
- Open QGIS C++ API documentation by typing `_api`;

- Open QGIS Python API documentation by typing `_pyqgis`.
- Open PyQGIS Cookbook by typing `_cookbook`.

Dica: Reuse executed commands from the output panel

You can execute code snippets from the output panel by selecting some text and pressing `Ctrl+E`. No matter if selected text contains the interpreter prompt (`>>>`, `...`).



Figura25.19: The Python Console

25.3.2 The Code Editor

Use the  Show Editor button to enable the editor widget. It allows editing and saving Python files and offers advanced functionalities to manage your code (comment and uncomment code, check syntax, share the code via codepad.org and much more). Main features are:

- Code completion, highlighting syntax and calltips for the following APIs:
  - Python
  - PyQGIS
  - PyQt5
  - QScintilla2
  - osgeo-gdal-ogr
- `Ctrl+Space` to view the auto-completion list.
- Sharing code snippets via codepad.org.
- `Ctrl+4` Syntax check.
- Search bar (open it with the default Desktop Environment shortcut, usually `Ctrl+F`):
  - Use the default Desktop Environment shortcut to find next/previous (`Ctrl+G` and `Shift+Ctrl+G`);
  - Automatically find first match when typing in find box;
  - Set initial find string to selection when opening find;
  - Pressing `Esc` closes the find bar.
- Object inspector: a class and function browser;
- Go to an object definition with a mouse click (from Object inspector);

- Execute code snippets with the *Run Selected* command in contextual menu;
- Execute the whole script with the *Run Script* command (this creates a byte-compiled file with the extension `.pyc`).

Nota: Running partially or totally a script from the *Code Editor* outputs the result in the Console output area.

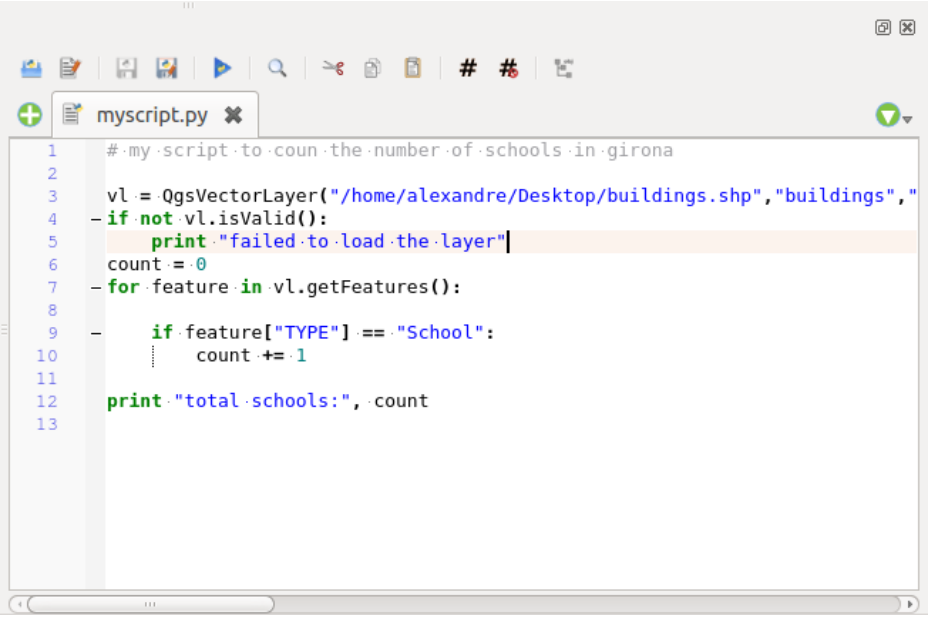


Figura25.20: The Python Console editor

Dica: Save the options

To save the state of console's widgets you have to close the Python Console from the close button. This allows you to save the geometry to be restored to the next start.

CAPÍTULO 26

Ajuda e Suporte

26.1 Listas de Discurssão

QGIS is under active development and as such it won't always work like you expect it to. The preferred way to get help is by joining the qgis-users mailing list. Your questions will reach a broader audience and answers will benefit others.

26.1.1 QGIS Users

This mailing list is used for discussion about QGIS in general, as well as specific questions regarding its installation and use. You can subscribe to the qgis-users mailing list by visiting the following URL: https://lists.osgeo.org/mailman/listinfo/qgis-user

26.1.2 QGIS Developers

If you are a developer facing problems of a more technical nature, you may want to join the qgis-developer mailing list. This list is also a place where people can chime in and collect and discuss QGIS related UX (User Experience) / usability issues. It's here: https://lists.osgeo.org/mailman/listinfo/qgis-developer

26.1.3 QGIS Community Team

This list deals with topics like documentation, context help, user guide, web sites, blog, mailing lists, forums, and translation efforts. If you would like to work on the user guide as well, this list is a good starting point to ask your questions. You can subscribe to this list at: https://lists.osgeo.org/mailman/listinfo/qgis-community-team

26.1.4 QGIS Translations

This list deals with the translation efforts. If you like to work on the translation of the website, manuals or the graphical user interface (GUI), this list is a good starting point to ask your questions. You can subscribe to this list at: https://lists.osgeo.org/mailman/listinfo/qgis-tr

26.1.5 QGIS Project Steering Committee (PSC)

This list is used to discuss Steering Committee issues related to overall management and direction of QGIS. You can subscribe to this list at: https://lists.osgeo.org/mailman/listinfo/qgis-psc

26.1.6 QGIS User groups

In order to locally promote QGIS and contribute to its development, some QGIS communities are organized into QGIS User Groups. These groups are places to discuss local topics, organize regional or national user meetings, organize sponsoring of features… The list of current user groups is available at https://qgis.org/en/site/forusers/usergroups.html

You are welcome to subscribe to any of the lists. Please remember to contribute to the list by answering questions and sharing your experiences.

26.2 IRC

We also maintain a presence on IRC - visit us by joining the #qgis channel on irc.freenode.net. Please wait for a response to your question, as many folks on the channel are doing other things and it may take a while for them to notice your question. If you missed a discussion on IRC, not a problem! We log all discussion, so you can easily catch up. Just go to http://irclogs.geoapt.com/qgis/ and read the IRC-logs.

26.3 Commercial support

Commercial support for QGIS is also available. Check the website https://qgis.org/en/site/forusers/commercial_support.html for more information.

26.4 Rastreador de Erros

While the qgis-users mailing list is useful for general 'How do I do XYZ in QGIS?'-type questions, you may wish to notify us about bugs in QGIS. You can submit bug reports using the QGIS bug tracker.

Por favor tenha em atenção que o seu erro pode nem sempre ter a prioridade que deseja (vai depender da severidade). Alguns erros podem requer esforços significativos de programadores para remediar e a mão-de-obra nem sempre está disponível para isso.

Feature requests can be submitted as well using the same ticket system as for bugs. Please make sure to select the type `Feature request`.

If you have found a bug and fixed it yourself, you can submit a Pull Request on the Github QGIS Project.

Read Bugs, Features and Issues and submit_patch for more details.

26.5 Blog

The QGIS community also runs a weblog at https://plugins.qgis.org/planet/, which has some interesting articles for users and developers. Many other QGIS blogs exist, and you are invited to contribute with your own QGIS blog!

26.6 Plugins

The website https://plugins.qgis.org is the official QGIS plugins web portal. Here, you find a list of all stable and experimental QGIS plugins available via the 'Official QGIS Plugin Repository'.

26.7 Wiki

Lastly, we maintain a WIKI web site at https://github.com/qgis/QGIS/wiki where you can find a variety of useful information relating to QGIS development, release plans, links to download sites, message-translation hints and more. Check it out, there are some goodies inside!

CAPÍTULO 27

Contributors

QGIS is an open source project developed by a team of dedicated volunteers and organisations. We strive to be a welcoming community for people of all race, creed, gender and walks of life. At any moment, you can get involved.

27.1 Autores

Below are listed people who dedicate their time and energy to write, review, and update the whole QGIS documentation.

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Ko Nagase	Nyall Dawson	Matthias Kuhn	Andreas Neumann	Harrissou Sant-anna
Manel Clos	David Willis	Larissa Junek	Paul Blottière	Sebastian Dietrich
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Andre Mano	Mie Winstrup	Frank Sokolic	Vincent Picavet	Jean-Roc Morreale
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David Adler	Lars Luthman	Brendan Morely	Raymond Nijssen	Carson J.Q. Farmer
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Ramon	Andrei	zstadler	icephale	Rosa Aguilar

27.2 Translators

QGIS is a multi-language application and as is, also publishes a documentation translated into several languages. Many other languages are being translated and would be released as soon as they reach a reasonable percentage of translation. If you wish to help improving a language or request a new one, please see https://qgis.org/en/site/getinvolved/index.html.

The current translations are made possible thanks to:

Language	Contributors
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French	Arnaud Morvan, Augustin Roche, Didier Vanden Berghe, Dofabien, Etienne Trimaille, Francis Gasc, Harrissou Sant-anna, Jean-Roc Morreale, Jérémy Garniaux, Loïc Buscoz, Lsam, Marc-André Saia, Marie Silvestre, Mathieu Bossaert, Mathieu Lattes, Mayeul Kauffmann, Médéric Ribreux, Mehdi Semchaoui, Michael Douchin, Nicolas Boisteault, Nicolas Rochard, Pascal Obstetar, Robin Prest, Rod Bera, Stéphane Henriod, Stéphane Possamai, sylther, Sylvain Badey, Sylvain Maillard, Vincent Picavet, Xavier Tardieu, Yann Leveille-Menez, yoda89
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Ukrainian	Alexander Bruy

27.3 Statistics of translation

Efforts of translation for QGIS 3.16 Long Term Release are provided below.

(last update: 2022-03-11)

Number of strings	Number of target languages	Overall Translation ratio
32361	**59**	**12.3%**

Language	Translation ratio (%)	Language	Translation ratio (%)	Language	Translation ratio (%)
Albanian	0.23	Arabic	4.02	Azerbaijani	0.02
Basque	1.42	Bengali	0.19	Bulgarian	2.59
Burmese	0.1	Catalan	1.51	Chinese Simplified	8.53
Chinese Traditional	0.69	Croatian	0.12	Czech	6.0
Danish	0.66	Dutch	100.0	Estonian	1.3
Finnish	1.81	French	98.49	Galician	0.59
Georgian	0.11	German	21.73	Greek	0.37
Hebrew	0.74	Hindi	0.31	Hungarian	9.3
Igbo	0.01	Indonesian	2.77	Italian	88.87
Japanese	71.07	Kabyle	0.11	Korean	88.58
Lao	0.0	Lithuanian	6.06	Macedonian	0.13
Malay	0.05	Malayalam	0.1	Marathi	0.19
Mongolian	0.11	N'ko	1.82	Norwegian Bokmål	3.32
Panjabi (Punjabi)	0.0	Persian	0.48	Polish	1.85
Portuguese (Brazil)	37.01	Portuguese (Portugal)	8.5	Romanian	30.61
Russian	14.94	Serbian	0.11	Slovak	1.55
Slovenian	3.2	Spanish	96.0	Swedish	1.19
Tagalog	0.1	Tamil	0.52	Telugu	0.03
Thai	0.11	Turkish	2.82	Ukrainian	2.37
Urdu	0.0	Vietnamese	0.33		

CAPÍTULO 28

Apêndices

28.1 Apêndice A: Licença Pública Geral GNU

Versão 2, Junho 1991

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Seguem os precisos termos e condições para cópia, ditribuiçao e modificaçao. TERMOS E CONDIÇÕES PARA CÓPIA, DISTRIBUIÇAO E MODIFICAÇÃO

0. Esta licença se aplica a qualquer programa ou outro trabalho que contenha um aviso inserido pelo detentor dos direitos autorais informando que o mesmo pode ser distribuído sob as condições desta Licença Pública Geral.O "Programa" abaixo refere-se a qualquer programa ou trabalho, e "trabalho baseado no Programa" significa tanto o Programa em si como quaisquer trabalhos derivados, de acordo com a lei de direitos autorais: isto quer dizer um trabalho que contenha o Programa ou parte dele, tanto originalmente ou com modificações, e/ou tradução para outros idiomas. (Doravante o processo de tradução está incluído sem limites no termo "modificação".) Cada licenciado é mencionado como "você".

   Atividades outras que a cópia, a distribuição e modificação não estão cobertas por esta Licença; elas estão fora de seu escopo. O ato de executar o Programa não é restringido e o resultado do Programa é coberto apenas se seu conteúdo contenha trabalhos baseados no Programa (independentemente de terem sido gerados pela execução do Programa). Se isso é verdadeiro depende do que o programa faz.

1. Você pode copiar e distribuir cópias fiéis do código-fonte do Programa da mesma forma que você o recebeu, usando qualquer meio, deste que você conspícua e apropriadamente publique em cada cópia um aviso de direitos autorais e uma declaração de inexistência de garantias; mantenha intactas todos os avisos que se referem a esta Licença e à ausência total de garantias; e forneça a outros recebedores do Programa uma cópia desta Licença, junto com o Programa.

   Você pode cobrar uma taxa pelo ato físico de transferir uma cópia e pode, opcionalmente, oferecer garantia em troca de pagamento.

2. Você pode modificar sua cópia ou cópias do Programa, ou qualquer parte dele, assim gerando um trabalho baseado no Programa, e copiar e distribuir essas modificações ou trabalhos sob os termos da seção 1 acima, desde que você também se enquadre em todas estas condições:

   a) Você tem que fazer com que os arquivos modificados levem avisos proeminentes afirmando que você alterou os arquivos, incluindo a data de qualquer alteração.

   b) Você tem que fazer com que quaisquer trabalhos que você distribua ou publique, e que integralmente ou em partes contenham ou sejam derivados do Programa ou de suas partes, sejam licenciados, integralmente e sem custo algum para quaisquer terceirose, sob os termos desta Licnça.

   c) Se qualquer programa modificado normalmente lê comandos interativamente quando executados, você tem que fazer com que, quando iniciado tal uso interativo da forma mais simples, seja impresso ou mostrado um anúncio de que não há qualquer garantia (ou então que você fornece a garantia) e que os usuários podem redistribuir o programa sob estas condições, ainda informando os usuários como consultar uma cópia desta Licença. (Exceção: se o Programa em si é interativo mas normalmente não imprime estes tipos de anúncios, seu trabalho baseado no Programa não precisa imprimir um anúncio.)

   Estas exigências aplicam-se ao trabalho modificado como um todo. Se seções identificáveis de tal trabalho não são derivadas do Programa, e podem ser razoavelmente consideradas trabalhos independentes e separados por si só, então esta Licença, e seus termos, não se aplicam a estas seções quando você distribui-las como trabalhos em separado. Mas quando você distribuir as mesmas seções como parte de um todo que é trabalho baseado no Programa, a distribuição como um todo tem que se enquadrar nos termos desta Licença, cujas permissões para outros licenciados se estendem ao todo, portanto também para cada e toda parte independente de quem a escreveu.

   Desta forma, esta seção não tem a intenção de reclamar direitos os contestar seus direitos sobre o trabalho escrito completamente por você; ao invés disso, a intenção é a de exercitar o direito de controlar a distribuição de trabalhos, derivados ou coletivos, baseados no Programa.

   Adicionalmente, a mera adição ao Programa de outro trabalho não baseado no Programa (ou de trabalho baseado no Programa) em um volume de armazenamento ou meio de distribuição não faz o outro trabalho parte do escopo desta Licença.

3. Você pode copiar e distribuir o Programa (ou trabalho baseado nele, conforme descrito na Seção 2) em código-objeto ou em forma executável sob os termos das Seções 1 e 2 acima, desde que você faça um dos seguintes:

a) O acompanhe com o código-fonte completo e em forma acessível por máquinas, que tem que ser distribuído sob os termos das Seções 1 e 2 acima e em meio normalmente utilizado para o intercâmbio de software; ou,

b) O acompanhe com uma oferta escrita, válida por pelo menos três anos, de fornecer a qualquer um, com um custo não superior ao custo de distribuição física do material, uma cópia do código-fonte completo e em forma acessível por máquinas, que tem que ser distribuído sob os termos das Seções 1 e 2 acima e em meio normalmente utilizado para o intercâmbio de software; ou,

c) O acompanhe com a informação que você recebeu em relação à oferta de distribuição do código-fonte correspondente. (Esta alternativa é permitida somente em distribuição não comerciais, e apenas se você recebeu o programa em forma de código-objeto ou executável, com oferta de acordo com a Subseção b acima.)

O código-fonte de um trabalho corresponde à forma de trabalho preferida para se fazer modificações. Para um trabalho em forma executável, o código-fonte completo significa todo o código-fonte de todos os módulos que ele contém, mais quaisquer arquivos de definição de "interface", mais os "scripts" utilizados para se controlar a compilação e a instalação do executável. Contudo, como exceção especial, o código-fonte distribuído não precisa incluir qualquer componente normalmente distribuído (tanto em forma original quanto binária) com os maiores componentes (o compilador, o "kernel" etc.) do sistema operacional sob o qual o executável funciona, a menos que o componente em si acompanhe o executável.

Se a distribuição do executável ou código-objeto é feita através da oferta de acesso a cópias de algum lugar, então ofertar o acesso equivalente a cópia, do mesmo lugar, do código-fonte equivale à distribuição do código-fonte, mesmo que terceiros não sejam compelidos a copiar o código-fonte com o código-objeto.

4. Você não pode copiar, modificar, sub-licenciar ou distribuir o Programa, exceto de acordo com as condições expressas nesta Licença. Qualquer outra tentativa de cópia, modificação, sub-licenciamento ou distribuição do Programa não é valida, e cancelará automaticamente os direitos que lhe foram fornecidos por esta Licença. No entanto, terceiros que de você receberam cópias ou direitos, fornecidos sob os termos desta Licença, não terão suas licenças terminadas, desde que permaneçam em total concordância com ela.

5. Você não é obrigado a aceitar esta Licença já que não a assinou. No entanto, nada mais o dará permissão para modificar ou distribuir o Programa ou trabalhos derivados deste. Estas ações são proibidas por lei, caso você não aceite esta Licença. Desta forma, ao modificar ou distribuir o Programa (ou qualquer trabalho derivado do Programa), você estará indicando sua total aceitação desta Licença para fazê-los, e todos os seus termos e condições para copiar, distribuir ou modificar o Programa, ou trabalhos baseados nele.

6. Cada vez que você redistribuir o Programa (ou qualquer trabalho baseado nele), os recebedores adquirirão automaticamente do licenciador original uma licença para copiar, distribuir ou modificar o Programa, sujeitos a estes termos e condições. Você não poderá impor aos recebedores qualquer outra restrição ao exercício dos direitos então adquiridos. Você não é responsável em garantir a concordância de terceiros a esta Licença.

7. Se, em conseqüência de decisões judiciais ou alegações de infringimento de patentes ou quaisquer outras razões (não limitadas a assuntos relacionados a patentes), condições forem impostas a você (por ordem judicial, acordos ou outras formas) e que contradigam as condições desta Licença, elas não o livram das condições desta Licença. Se você não puder distribuir de forma a satisfazer simultaneamente suas obrigações para com esta Licença e para com as outras obrigações pertinentes, então como conseqüência você não poderá distribuir o Programa. Por exemplo, se uma licença de patente não permitirá a redistribuição, livre de "royalties", do Programa, por todos aqueles que receberem cópias direta ou indiretamente de você, então a única forma de você satisfazer a ela e a esta Licença seria a de desistir completamente de distribuir o Programa.

   Se qualquer parte desta seção for considerada inválida ou não aplicável em qualquer circunstância particular, o restante da seção se aplica, e a seção como um todo se aplica em outras circunstâncias.

   O propósito desta seção não é o de induzi-lo a infringir quaisquer patentes ou reivindicação de direitos de propriedade outros, ou a contestar a validade de quaisquer dessas reivindicações; esta seção tem como único propósito proteger a integridade dos sistemas de distribuição de software livres, o que é implementado pela prática de licenças públicas. Várias pessoas têm contribuído generosamente e em grande escala para os software distribuídos usando este sistema, na certeza de que sua aplicação é feita de forma consistente; fica a critério do autor/doador decidir se ele ou ela está disposto a distribuir software utilizando outro sistema, e um licenciado não pode impor esta escolha.

   Esta seção destina-se a tornar bastante claro o que se acredita ser conseqüência do restante desta Licença.

8. Se a distribuição e/ou uso do Programa são restringidos em certos países por patentes ou direitos autorais, o detentor dos direitos autorais original, e que colocou o Programa sob esta Licença, pode incluir uma limitação geográfica de distribuição, excluindo aqueles países de forma a tornar a distribuição permitida apenas naqueles ou entre aqueles países então não excluídos. Nestes casos, esta Licença incorpora a limitação como se a mesma constasse escrita nesta Licença.

9. A Free Software Foundation (Fundação do Software Livre) pode publicar versões revisadas e/ou novas da Licença Pública Geral de tempos em tempos. Estas novas versões serão similares em espírito à versão atual, mas podem diferir em detalhes que resolvem novos problemas ou situações.

   A cada versão é dada um número distinto. Se o Programa especifica um número de versão específico desta Licença que se aplica a ele e a "qualquer nova versão", você tem a opção de aceitar os termos e condições daquela versão ou de qualquer outra versão publicada pela Free Software Foundation. Se o programa não especifica um número de versão desta Licença, você pode escolher qualquer versão já publicada pela Free Software Foundation.

10. Se você pretende incorporar partes do Programa em outros programas livres cujas condições de distribuição são diferentes, escreva ao autor e solicite permissão. Para o software que a Free Software Foundation detém direitos autorais, escreva à Free Software Foundation; às vezes nós permitimos exceções a este caso. Nossa decisão será guiada pelos dois objetivos de preservar a condição de liberdade de todas as derivações do nosso software livre, e de promover o compartilhamento e reutilização de software em aspectos gerais.

AUSÊNCIA DE GARANTIA

11. PELO PROGRAMA SER LICENCIADO SEM ÔNUS, NÃO HÁ QUALQUER GARANTIA PARA O PROGRAMA, NA EXTENSÃO PERMITIDA PELAS LEIS APLICÁVEIS. EXCETO QUANDO EXPRESSADO DE FORMA ESCRITA, OS DETENTORES DOS DIREITOS AUTORAIS E/OU TERCEIROS DISPONIBILIZAM O PROGRAMA "NO ESTADO", SEM QUALQUER TIPO DE GARANTIAS, EXPRESSAS OU IMPLÍCITAS, INCLUINDO, MAS NÃO LIMITADO A, AS GARANTIAS IMPLÍCITAS DE COMERCIALIZAÇÃO E AS DE ADEQUAÇÃO A QUALQUER PROPÓSITO. O RISCO TOTAL COM A QUALIDADE E DESEMPENHO DO PROGRAMA É SEU. SE O PROGRAMA SE MOSTRAR DEFEITUOSO, VOCÊ ASSUME OS CUSTOS DE TODAS AS MANUTENÇÕES, REPAROS E CORREÇÕES.

12. EM NENHUMA OCASIÃO, A MENOS QUE EXIGIDO PELAS LEIS APLICÁVEIS OU ACORDO ESCRITO, OS DETENTORES DOS DIREITOS AUTORAIS, OU QUALQUER OUTRA PARTE QUE POSSA MODIFICAR E/OU REDISTRIBUIR O PROGRAMA CONFORME PERMITIDO ACIMA, SERÃO RESPONSABILIZADOS POR VOCÊ POR DANOS, INCLUINDO QUALQUER DANO EM GERAL, ESPECIAL, ACIDENTAL OU CONSEQÜENTE, RESULTANTES DO USO OU INCAPACIDADE DE USO DO PROGRAMA (INCLUINDO, MAS NÃO LIMITADO A, A PERDA DE DADOS OU DADOS TORNADOS INCORRETOS, OU PERDAS SOFRIDAS POR VOCÊ OU POR OUTRAS PARTES, OU FALHAS DO PROGRAMA AO OPERAR COM QUALQUER OUTRO PROGRAMA), MESMO QUE TAL DETENTOR OU PARTE TENHAM SIDO AVISADOS DA POSSIBILIDADE DE TAIS DANOS.

QGIS Qt exceções a GPL

Além disso, como uma exceção especial, a equipe de desenvolvimento do QGIS dá permissão para vincular o código deste programa à biblioteca Qt, incluindo, entre outras, as seguintes versões (gratuitas e comerciais): Qt/Windows não comercial, Qt/Windows, Qt/X11, Qt/Mac e Qt/Embedded (ou com versões modificadas do Qt que usam a mesma licença que o Qt) e distribuem combinações vinculadas, incluindo as duas. Você deve obedecer à Licença Pública Geral GNU em todos os aspectos para todo o código usado que não seja o Qt. Se você modificar este arquivo, poderá estender essa exceção à sua versão do arquivo, mas não é obrigado a fazê-lo. Se você não desejar, exclua esta declaração de exceção da sua versão.

28.2 Apêndice B: Licença de Documentação Livre GNU

Versão 1.3, Novembro de 2008

Direitos Autorais 2000, 2001, 2002, 2007, 2008 Free Software Foundation (Fundação do Software Livre)

http://fsf.org/

É permitido a todos a cópia e distribuição de cópias escritas deste documento de licença, mas não é permitido alterá-lo.

Preâmbulo

O propósito desta Licença é criar um manual, guia, ou outro tipo de documento útil e funcional, que seja livre: assegurar a liberdade de cópia e sua distribuição, com modificações ou não, a nível comercial ou não comercial. Secundariamente, esta licença providencia ao autor e editor o devido crédito pelo seu trabalho, nunca permitindo que sejam considerados responsáveis por possíveis modificações efetuadas por terceiros.

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Esta Licença enquadra-se a qualquer manual ou outro tipo de trabalho, em qualquer meio, que contenha uma referência efetuada pelo detentor dos seus direitos de cópia mencionando que pode ser distribuído dentro dos termos desta mesma licença. Tal referência garante uma licença mundial a título gratuito, sem limite de duração, que permite a utilização desse trabalho sob as condições acima descritas. O **Document**, abaixo, enquadra-se neste tipo de manual ou trabalho. Qualquer pessoa do público é um detentor da Licença, e é endereçado como **you**. Você aceita a licença se copiar, modificar ou distribuir o trabalho requerendo permissão sob os direitos de cópia.

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Pode também emprestar cópias, segundo as mesmas condições acima descritas, e pode mostrar cópias publicamente.

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A copy of the license is included in the section entitled "GNU
Free Documentation License".
```

Se você tiver Seções Invariantes, Textos de Capa Frontal e Textos de Cópias anteriores, substitua o "com … Textos". linha com esta:

```
with the Invariant Sections being LIST THEIR TITLES, with the
Front-Cover Texts being LIST, and with the Back-Cover Texts being LIST.
```

Se você tiver Seções Invariantes sem Textos de Capa, ou alguma outra combinação dos três, mesclar essas duas alternativas para se adequar à situação.

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28.3 Apêndice C: Formatos de arquivo QGIS

28.3.1 QGS/QGZ - O Formato de Arquivo de Projeto QGIS

O formato **QGS** é um formato XML para armazenar projetos QGIS. O formato **QGZ** é um arquivo compactado (zip) que contém um arquivo QGS e um arquivo QGD. O arquivo **QGD** é o banco de dados sqlite associado do projeto qgis que contém dados auxiliares para o projeto. Se não houver dados auxiliares, o arquivo QGD estará vazio.

Um arquivo QGIS contém tudo o que é necessário para armazenar um projeto QGIS, incluindo:

- título do projeto
- SRC do projeto
- a árvore de camadas
- snapping settings
- relações
- the map canvas extent
- modelos do projeto
- legenda
- mapview docks (2D and 3D)
- as camadas com links para os conjuntos de dados subjacentes (fontes de dados) e outras propriedades da camada, incluindo extensão, SRS, junções, estilos, renderizador, modo de mescla, opacidade e muito mais.
- propriedades do projeto

The figures below show the top level tags in a QGS file and the expanded `ProjectLayers` tag.

```
−<qgis version="3.4.13-Madeira" projectname="">
    <homePath path=""/>
    <title/>
    <autotransaction active="0"/>
    <evaluateDefaultValues active="0"/>
    <trust active="0"/>
  +<projectCrs></projectCrs>
  +<layer-tree-group></layer-tree-group>
  +<snapping-settings tolerance="12" unit="1" enabled="0" type="1" mode="2" intersection-snapping="0">
    </snapping-settings>
    <relations/>
  −<mapcanvas name="theMapCanvas" annotationsVisible="1">
      <units>meters</units>
    +<extent></extent>
      <rotation>0</rotation>
    +<destinationsrs></destinationsrs>
      <rendermaptile>0</rendermaptile>
    </mapcanvas>
    <projectModels/>
  +<legend updateDrawingOrder="true"></legend>
    <mapViewDocks/>
    <mapViewDocks3D/>
  +<projectlayers></projectlayers>
  +<layerorder></layerorder>
  +<properties></properties>
    <visibility-presets/>
    <transformContext/>
  +<projectMetadata></projectMetadata>
    <Annotations/>
    <Layouts/>
  </qgis>
```

Figura28.1: The top level tags in a QGS file

```
−<projectlayers>
 −<maplayer styleCategories="AllStyleCategories" readOnly="0" autoRefreshTime="0" autoRefreshEnabled="0" refreshOnNotifyEnabled="0" maxScale="0"
  geometry="Polygon" labelsEnabled="0" type="vector" simplifyDrawingHints="1" hasScaleBasedVisibilityFlag="0" simplifyDrawingTol="1"
  simplifyMaxScale="1" minScale="1e+8" simplifyAlgorithm="0" simplifyLocal="1" refreshOnNotifyMessage="">
  +<extent></extent>
   <id>watersheds_b62efa19_8809_4406_b6ec_2951ac4c94c5</id>
  −<datasource>
     ./QGIS-Training-Data-2.0/exercise_data/processing/generalize/watersheds.shp
   </datasource>
  +<keywordList></keywordList>
   <layername>watersheds</layername>
  +<srs></srs>
  +<resourceMetadata></resourceMetadata>
   <provider encoding="UTF-8">ogr</provider>
   <vectorjoins/>
   <layerDependencies/>
   <dataDependencies/>
   <legend type="default-vector"/>
   <expressionfields/>
  +<map-layer-style-manager current="default"></map-layer-style-manager>
   <auxiliaryLayer/>
  +<flags></flags>
  +<renderer-v2 symbollevels="0" enableorderby="0" type="singleSymbol" forceraster="0"></renderer-v2>
  +<customproperties></customproperties>
   <blendMode>0</blendMode>
   <featureBlendMode>0</featureBlendMode>
   <layerOpacity>1</layerOpacity>
  +<SingleCategoryDiagramRenderer diagramType="Histogram" attributeLegend="1"></SingleCategoryDiagramRenderer>
  +<DiagramLayerSettings priority="0" linePlacementFlags="18" dist="0" showAll="1" placement="1" obstacle="0" zIndex="0"></DiagramLayerSettings>
  +<geometryOptions removeDuplicateNodes="0" geometryPrecision="0"></geometryOptions>
  +<fieldConfiguration></fieldConfiguration>
  +<aliases></aliases>
   <excludeAttributesWMS/>
   <excludeAttributesWFS/>
  +<defaults></defaults>
  +<constraints></constraints>
  +<constraintExpressions></constraintExpressions>
   <expressionfields/>
  +<attributeactions></attributeactions>
  +<attributetableconfig actionWidgetStyle="dropDown" sortExpression="" sortOrder="0"></attributetableconfig>
  +<conditionalstyles></conditionalstyles>
   <editform tolerant="1"/>
   <editforminit/>
   <editforminitcodesource>0</editforminitcodesource>
   <editforminitfilepath/>
  +<editforminitcode></editforminitcode>
   <featformsuppress>0</featformsuppress>
   <editorlayout>generatedlayout</editorlayout>
  +<editable></editable>
  +<labelOnTop></labelOnTop>
   <widgets/>
   <previewExpression>ID</previewExpression>
   <mapTip/>
 </maplayer>
</projectlayers>
```


Figura28.2: The expanded top level ProjectLayers tag of a QGS file

28.3.2 QLR - O arquivo de definição de camada QGIS

Um arquivo de Definição de Camada (QLR) é um arquivo XML que contém um ponteiro para a fonte de dados da camada, além das informações de estilo QGIS para a camada.

O caso de uso desse arquivo é simples: ter um único arquivo para abrir uma fonte de dados e trazer todas as informações de estilo relacionadas. Os arquivos QLR também permitem mascarar a fonte de dados subjacente em um arquivo fácil de abrir.

Um exemplo de uso de QLR é para abrir camadas do MS SQL. Em vez de ter que ir para a caixa de diálogo de conexão do MS SQL, conectar, selecionar, carregar e finalmente aplicar o esyilo, você pode simplesmente adicionar um arquivo .qlr que aponte para a camada correta do MS SQL com todo o estilo necessário incluído.

No futuro, um arquivo .qlr pode conter uma referência a mais de uma camada.

```
−<qlr>
  +<layer-tree-group name="" checked="Qt::Checked" expanded="1"></layer-tree-group>
  −<maplayers>
    −<maplayer autoRefreshEnabled="0" labelsEnabled="0" autoRefreshTime="0" readOnly="0" refreshOnNotifyMessage=""
     geometry="Line" simplifyDrawingTol="1" simplifyMaxScale="1" styleCategories="AllStyleCategories" simplifyDrawingHints="1"
     maxScale="0" simplifyLocal="1" hasScaleBasedVisibilityFlag="0" type="vector" refreshOnNotifyEnabled="0" minScale="1e+8"
     simplifyAlgorithm="0">
      +<extent></extent>
        <id>inputnew_6740bb2e_0441_4af5_8dcf_305c5c4d8ca7</id>
      +<datasource></datasource>
      +<keywordList></keywordList>
        <layername>inputnew</layername>
      +<srs></srs>
      +<resourceMetadata></resourceMetadata>
        <provider encoding="UTF-8">ogr</provider>
        <vectorjoins/>
        <layerDependencies/>
        <dataDependencies/>
        <legend type="default-vector"/>
        <expressionfields/>
      +<map-layer-style-manager current="default"></map-layer-style-manager>
        <auxiliaryLayer/>
      +<flags></flags>
      +<renderer-v2 enableorderby="0" type="singleSymbol" forceraster="0" symbollevels="0"></renderer-v2>
      +<customproperties></customproperties>
        <blendMode>0</blendMode>
        <featureBlendMode>0</featureBlendMode>
        <layerOpacity>1</layerOpacity>
      +<geometryOptions removeDuplicateNodes="0" geometryPrecision="0"></geometryOptions>
      +<fieldConfiguration></fieldConfiguration>
      +<aliases></aliases>
        <excludeAttributesWMS/>
        <excludeAttributesWFS/>
      +<defaults></defaults>
      +<constraints></constraints>
      +<constraintExpressions></constraintExpressions>
        <expressionfields/>
      +<attributeactions></attributeactions>
      +<attributetableconfig sortExpression="" actionWidgetStyle="dropDown" sortOrder="0"></attributetableconfig>
      +<conditionalstyles></conditionalstyles>
        <editform tolerant="1">../src/qgisplugins/qgisbostaskdepplugin/data</editform>
        <editforminit/>
        <editforminitcodesource>0</editforminitcodesource>
        <editforminitfilepath/>
        <editforminitcode></editforminitcode>
        <featformsuppress>0</featformsuppress>
        <editorlayout>generatedlayout</editorlayout>
        <editable/>
        <labelOnTop/>
        <widgets/>
        <previewExpression>"FID"</previewExpression>
        <mapTip/>
      </maplayer>
    </maplayers>
  </qlr>
```

Figura28.3: The top level tags of a QLR file

28.3.3 QML - O Formato de Arquivo de Estilo QGIS

QML é um formato XML para armazenar o estilo da camada.

Um arquivo QML contém todas as informações que o QGIS pode manipular para a renderização de geometrias de feições, incluindo definições de símbolos, tamanhos e rotações, inclusão de rótulos, opacidade e modo de mescla e muito mais.

The figure below shows the top level tags of a QML file (with only `renderer_v2` and its `symbol` tag expanded).

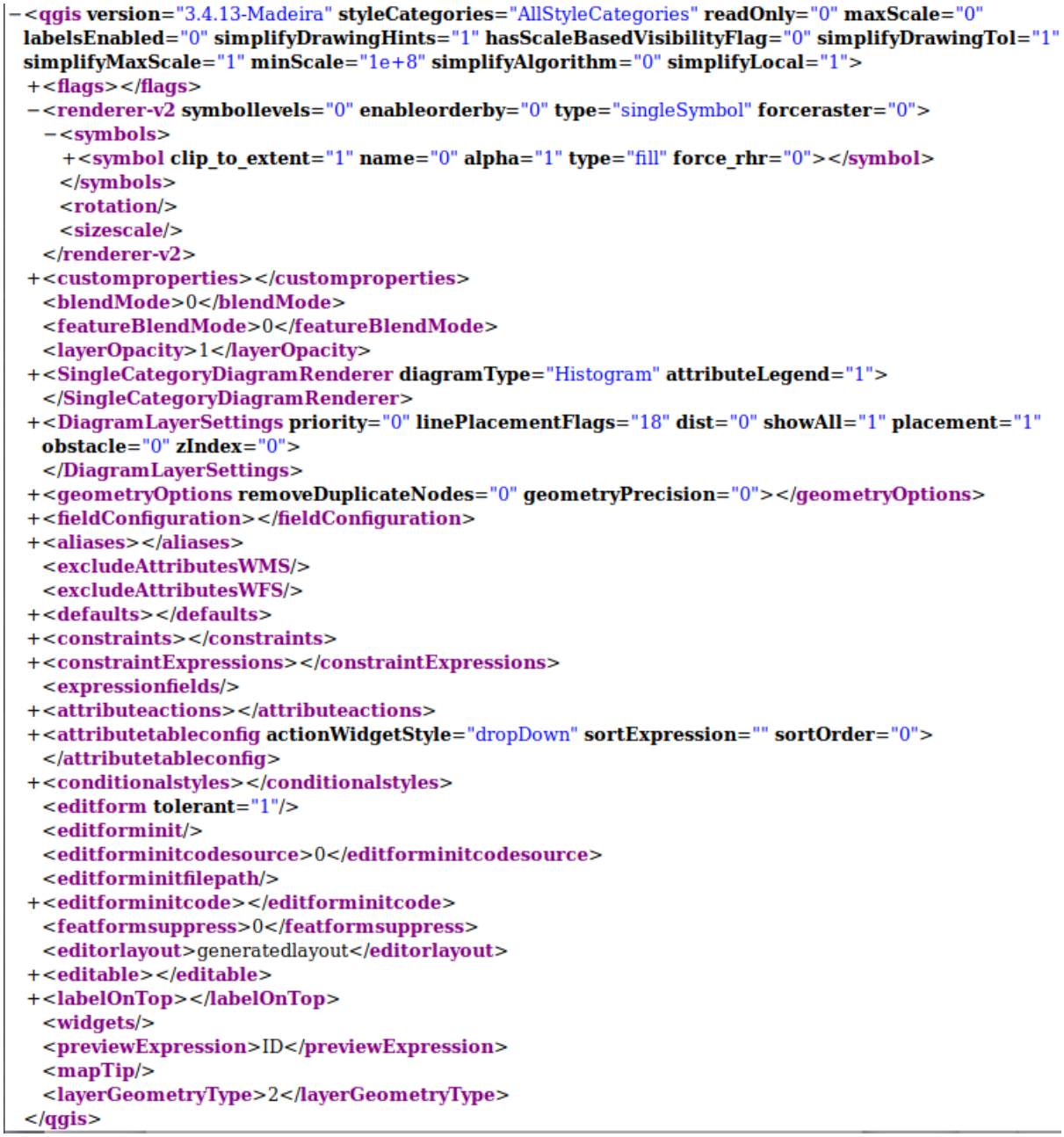


Figura28.4: The top level tags of a QML file (only the renderer_v2 tag with its symbol tag is expanded)

28.4 Apêndice D: sintaxe de script QGIS R

Contributed by Matteo Ghetta - funded by Scuola Superiore Sant'Anna

Escrever scripts R scripts em Processamento é um pouco complicado em função da sintaxe específica.

Um script de Processamento R começa com a definição de suas **Entradas** e **Saídas**, cada uma precedida de caracteres tralha duplos (`##`).

Pode-se especificar o grupo para colocar o algoritmo antes das entradas. Se o grupo já existe, o algoritmo será adicionado a ele e, se não, o grupo será criado. No exemplo abaixo, o nome do grupo é "Meu grupo":

```
##Meu Grupo=grupo
```

28.4.1 Entradas

Todos os dados de entrada e parâmetros devem ser especificados. Existem vários tipos de entradas:

- vetor: `##Camada = vetor`
- vector field: `##F = Field Layer` (where *Layer* is the name of an input vector layer the field belongs to)
- raster: `##r = raster`
- tabela: `##t = tabela`
- número: `##Num = número`
- string: `##Str = string`
- boolean: `##Bol = boolean`
- elementos em um menu dropdown. Os items devem ser separados com ponto e vírgula `;`: `##tipo=pontos;linhas;pontos+linhas`

28.4.2 Saídas

Quanto às entradas, cada saída tem de ser definida no início do script:

- vetor: `##saída= vetor de saída`
- raster: `##saída= saída raster`
- tabela: `##saída= tabela de saída`
- gráfico: `##saída_gráfico_para_html` (##showplots em versões anteriores)
- To show R output in the *Result Viewer*, put > in front of the command whose output you would like to show.

28.4.3 Sumário de Sintaxe para scripts QGIS R

Vários tipos de parâmetros de entrada e saída são oferecidos.

Tipos de parâmetros de entrada

Parâmetros	Exemplo de sintaxe	Retornando objetos
vetor	Camada = vetor	sf object (or SpatialDataFrame object, if ##load_vector_using_rgdal is specified)
vetor de pontos	Camada = vetor de pontos	sf object (or SpatialDataFrame object, if ##load_vector_using_rgdal is specified)
vetor de linha	Camada = vetor de linha	sf object (or SpatialDataFrame object, if ##load_vector_using_rgdal is specified)
vetor de poligono	Camada = polígono de vetor	sf object (or SpatialPolygonsDataFrame object, if ##load_vector_using_rgdal is used)
vetores multiplos	Camada = vetores múltiplos	sf object (or SpatialDataFrame objects if ##load_vector_using_rgdal is specified)
Tabela	Camada = tabela	quadro de conversão de csv, objeto padrão da função “read.csv”
campo	Campo = Camada Campo	nome do campo selecionado, e.g. “Area”
imagem	Camada = imagem	Objeto RasterBrick, padrão do pacote de objetos “raster”
múltiplas imagens	Camada = Múltiplas imagens	Objeto RasterBrick, padrão do pacote de objetos “raster”
número	N = número	número escolhido inteiro ou flutuante
texto	S = texto	texto adicionado na caixa
texto longo	LS= texto longo	texto adicionado na caixa, pode ser maior que o texto normal
seleção	S = primeira seleção; segunda; terceira	texto do item selecionado escolhido no menu suspenso.
crs	C = crs	string do SRC resultante escolhido, no formato: `"EPSG:4326"`
Extensão	E = extensão	Extensão do pacote de objeto “raster”, você pode extrair valores como “E@xmin”
ponto	P = ponto	Quando clicado no mapa, você terá as coordenadas do ponto
arquivo	F = arquivo	caminho do arquivo escolhido, e.g “/home/matteo/file.txt”
pasta	F = pasta	caminho do arquivo escolhido, e.g “/home/matteo/Downloads”

Um parâmetro poder ser **OPCIONAL**, o que significa que pode ser ignorado.

Para definir uma entrada como opcional, adicione a string `opcional` **antes** da entrada, como por exemplo:

```
##Layer = vector
##Field1 = Field Layer
##Field2 = optional Field Layer
```

Tipos de parâmetros de saída

Parâmetros	Exemplo de sintaxe
vetor	Saída = vetor de saída
imagem	Saída = imagem de saída
Tabela	Saída = tabela de saída
arquivo	Saída = arquivo de saída

Nota: Você pode salvar gráficos como `png` do *Visualizador de Resultado em Processamento*, ou salvar o gráfico diretamente da interface do algoritmo.

Cuerpo de lineas de codigo

O corpo do script segue a sintaxe R e o painel **Log** pode ajudar se houver algo errado com o seu script

Remember that you have to load all additional libraries in the script:

```
library(sp)
```

28.4.4 Exemplos

Exemplo com saída em vetor

Vamos pegar um algoritmo da coleção online que cria pontos aleatórios a partir da extensão de uma camada de entrada:

```
##Point pattern analysis=group
##Layer=vector polygon
##Size=number 10
##Output=output vector
library(sp)
spatpoly = as(Layer, "Spatial")
pts=spsample(spatpoly,Size,type="random")
spdf=SpatialPointsDataFrame(pts, as.data.frame(pts))
Output=st_as_sf(spdf)
```

Explanation (per line in the script):

1. `Point pattern analysis` is the group of the algorithm
2. `Camada` é a camada de entrada **vetorial**
3. `Size` is a **numerical** parameter with a default value of 10
4. `Saída` é a camada **vetorial** que será criada pelo algoritmo
5. `library(sp)` loads the **sp** library
6. `spatpoly = as(Layer, "Spatial")` translate to an sp object
7. Call the `spsample` function of the `sp` library and run it using the input defined above (`Layer` and `Size`)
8. Create a *SpatialPointsDataFrame* object using the `SpatialPointsDataFrame` function
9. Create the output vector layer using the `st_as_sf` function

É isso! Agora você só precisa rodar o algoritmo com uma camada vetorial que você tenha na Legenda QGIS, escolhendo o número de ponto aleatório. A camada resultante será adicionada ao seu mapa.

Exemplo com saída raster

The following script will perform basic ordinary kriging to create a raster map of interpolated values from a specified field of the input point vector layer by using the `autoKrige` function of the `automap` R package. It will first calculate the kriging model and then create a raster. The raster is created with the `raster` function of the raster R package:

```
##Basic statistics=group
##Layer=vector point
##Field=Field Layer
##Output=output raster
##load_vector_using_rgdal
require("automap")
require("sp")
```

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```
require("raster")
table=as.data.frame(Layer)
coordinates(table)= ~coords.x1+coords.x2
c = Layer[[Field]]
kriging_result = autoKrige(c~1, table)
prediction = raster(kriging_result$krige_output)
Output<-prediction
```

By using `##load_vector_using_rgdal`, the input vector layer will be made available as a `SpatialDataFrame` objects, so we avoid having to translate it from an `sf` object.

Exemplo com saída em tabela

Vamos editar o algoritmo do `Sumário de Estatísticas` para que a saída seja um arquivo de dados em tabela (csv).

O corpo do script é o seguinte:

```
##Basic statistics=group
##Layer=vector
##Field=Field Layer
##Stat=Output table
Summary_statistics<-data.frame(rbind(
    sum(Layer[[Field]]),
    length(Layer[[Field]]),
    length(unique(Layer[[Field]])),
    min(Layer[[Field]]),
    max(Layer[[Field]]),
    max(Layer[[Field]])-min(Layer[[Field]]),
    mean(Layer[[Field]]),
    median(Layer[[Field]]),
    sd(Layer[[Field]]))),
  row.names=c("Sum:","Count:","Unique values:","Minimum value:","Maximum value:",
↪"Range:","Mean value:","Median value:","Standard deviation:"))
colnames(Summary_statistics)<-c(Field)
Stat<-Summary_statistics
```

A terceira linha especifica o **Campo vetorial** na entrada e a quarta linha informa ao algoritmo que a saída deve ser uma tabela.

A última linha pegará o objeto `Stat` criado no script e o converterá em uma tabela `csv`.

Exemplo com saída do console

Você pode usar o exemplo anterior e ao invés de criar uma tabela, pode imprimir o resultado no **Visualizador de Resultado**:

```
##Basic statistics=group
##Layer=vector
##Field=Field Layer
Summary_statistics<-data.frame(rbind(
sum(Layer[[Field]]),
length(Layer[[Field]]),
length(unique(Layer[[Field]])),
min(Layer[[Field]]),
max(Layer[[Field]]),
max(Layer[[Field]])-min(Layer[[Field]]),
mean(Layer[[Field]]),
median(Layer[[Field]]),
```

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```
sd(Layer[[Field]])),row.names=c("Sum:","Count:","Unique values:","Minimum value:",
↪"Maximum value:","Range:","Mean value:","Median value:","Standard deviation:"))
colnames(Summary_statistics)<-c(Field)
>Summary_statistics
```

O script é exatamente o mesmo que foi usado acima exceto por duas edições:

1. nenhuma saída especificada (a quarta linha foi removida)
2. a última linha começa com >, informando ao Processamento que deve deixar o objeto disponível no visualizador de resultado

Exemplo com gráfico

To create plots, you have to use the `##output_plots_to_html` parameter as in the following script:

```
##Basic statistics=group
##Layer=vector
##Field=Field Layer
##output_plots_to_html
####output_plots_to_html
qqnorm(Layer[[Field]])
qqline(Layer[[Field]])
```

The script uses a field (`Field`) of a vector layer (`Layer`) as input, and creates a *QQ Plot* (to test the normality of the distribution).

The plot is automatically added to the Processing *Result Viewer*.

CAPÍTULO 29

Referências Bibliográficas e Web

GDAL-SOFTWARE-SUITE. Geospatial data abstraction library. https://gdal.org, 2013.

GRASS-PROJECT. Geographic resource analysis support system. https://grass.osgeo.org, 2013.

NETELER, M., AND MITASOVA, H. Open source gis: A grass gis approach, 2008.

OGR-SOFTWARE-SUITE. Geospatial data abstraction library. https://gdal.org, 2013.

OPEN-GEOSPATIAL-CONSORTIUM. Web map service (1.1.1) implementation specification. https://portal.opengeospatial.org, 2002.

OPEN-GEOSPATIAL-CONSORTIUM. Web map service (1.3.0) implementation specification. https://portal.opengeospatial.org, 2004.

POSTGIS-PROJECT. Spatial support for postgresql. http://postgis.refractions.net/, 2013.