QGIS User Guide

Publicación 2.2

QGIS Project

04 de December de 2014

Índice general

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CAPÍTULO 1

Preámbulo

Este documento es la guía de usuario original del software QGIS que se describe. El software y el hardware descritos en este documento son el la mayoría de los casos marcas registradas y por lo tanto están sujetos a requisitos legales. QGIS está sujeto a la Licencia Pública General GNU. Encontrará más información en la página de QGIS, http://www.qgis.org.

Los detalles, datos y resultados en este documento han sido escritos y verificados con el mejor de los conocimientos y responsabilidad de los autores y editores. Sin embargo, son posibles errores en el contenido.

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Este documento ha sido compuesto con reStructuredText. Está disponible como código fuente reST vía github y en línea como HTML y PDF en http://www.qgis.org/en/docs/. También se pueden descargar versiones traducidas de este documento en varios formatos en el área de documentación del proyecto QGIS. Para mayor información sobre contribuir a este documento y acerca de la traducción, por favor visite http://www.qgis.org/wiki/.

Enlaces en este documento

Este documento contiene enlaces internos y externos. Pulsando un enlace interno navega dentro del documento, mientras que pulsando un enlace externo abre una dirección de Internet. En formato PDF, los enlaces internos y externos son mostrados en azul y son manejados por el navegador del sistema. En formato HTML, el navegador muestra y maneja ambos de manera idéntica.

Autores y Editores de las Guías de Usuario, Instalación y Programación:

Internet: http://www.qgis.org

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Conventions

This section describes the uniform styles that will be used throughout this manual.

2.1 GUI Conventions

The GUI convention styles are intended to mimic the appearance of the GUI. In general, a style will reflect the non-hover appearance, so a user can visually scan the GUI to find something that looks like the instruction in the manual.

- Menu Options: *Layer* → *Add a Raster Layer* or *Settings* → *Toolbars* → *Digitizing*
- Tool:  Add a Raster Layer
- Button : **[Save as Default]**
- Dialog Box Title: *Layer Properties*
- Tab: *General*
- Checkbox:  *Render*
- Radio Button:  *Postgis SRID*  *EPSG ID*
- Select a number: 

- Select a string: 
- Browse for a file: 
- Select a color: 

- Slider: 
- Input Text: 

A shadow indicates a clickable GUI component.

2.2 Text or Keyboard Conventions

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: http://qgis.org
- Keystroke Combinations: Press `Ctrl+B`, meaning press and hold the Ctrl key and then press the B key.
- Name of a File: `lakes.shp`

- Name of a Class: **NewLayer**
- Method: *classFactory*
- Server: *myhost.de*
- User Text: `qgis --help`

Lines of code are indicated by a fixed-width font:

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

2.3 Platform-specific instructions

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 Macintosh OS X platforms, you should click the QGIS menu first, then Quit.

Larger amounts of text may be formatted as a list:

- Do this
- Do that
- Do something else

or as paragraphs:

Do this and this and this. Then do this and this and this, and this and this and this, and this and this and this.

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 and that, and that and that and that.

Screenshots that appear throughout the user guide have been created on different platforms; the platform is indicated by the platform-specific icon at the end of the figure caption.

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CAPÍTULO 3

Prólogo

¡Bienvenido al maravilloso mundo de los Sistemas de Información Geográfica (SIG)!

QGIS es un Sistema de Información Geográfica de código abierto. El proyecto nació en mayo de 2002 y se estableció como un proyecto en SourceForge en junio del mismo año. Hemos trabajado duro para hacer que el software SIG (tradicionalmente software propietario caro) esté al alcance de cualquiera con acceso básico a un ordenador personal. QGIS actualmente funciona en la mayoría de plataformas Unix, Windows y OS X. QGIS se desarrolla usando el kit de herramientas Qt (http://qt.digia.com) y C++. Esto significa que QGIS es ligero y tiene una interfaz gráfica de usuario (GUI) agradable y fácil de usar.

QGIS pretende ser un SIG amigable, proporcionando funciones y características comunes. El objetivo inicial del proyecto era proporcionar un visor de datos SIG. QGIS ha alcanzado un punto en su evolución en el que está siendo usado por muchos para sus necesidades diarias de visualización de datos SIG. QGIS admite diversos formatos de datos ráster y vectoriales, pudiendo añadir nuevos formatos usando la arquitectura de complementos.

QGIS se distribuye bajo la Licencia Pública General GNU (GPL). El desarrollo de QGIS bajo esta licencia significa que se puede revisar y modificar el código fuente y garantiza que usted, nuestro feliz usuario, siempre tendrá acceso a un programa de SIG que es libre de costo y puede ser libremente modificado. Debería haber recibido una copia completa de la licencia con su copia de QGIS, y también podrá encontrarla en el Apéndice :ref:gpl_appendix.

Truco: Documentación al día

La última versión de este documento siempre se puede encontrar en el área de documentación de la web de QGIS en http://www.qgis.org/en/docs/.

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Features

QGIS offers many common GIS functionalities provided by core features and plugins. 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 View data

You can view and overlay vector and raster data 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 ESRI shapefiles, MapInfo, SDTS, GML and many more. See section *Trabajar con catos vectoriales*.
- Raster and imagery formats supported by the installed GDAL (Geospatial Data Abstraction Library) library, such as GeoTIFF, ERDAS IMG, ArcInfo ASCII GRID, JPEG, PNG and many more. See section *Trabajar con catos raster*.
- GRASS raster and vector data from GRASS databases (location/mapset). See section *GRASS GIS Integration*.
- Online spatial data served as OGC Web Services, including WMS, WMTS, WCS, WFS, and WFS-T. See section *Trabajar con datos OGC*.
- OpenStreetMap data. See section *plugins_osm*.

4.2 Explore data and compose maps

You can compose maps and interactively explore spatial data with a friendly GUI. The many helpful tools available in the GUI include:

- QGIS browser
- On-the-fly reprojection
- DB Manager
- Map composer
- Overview panel
- Spatial bookmarks
- Annotation tools
- Identify/select features
- Edit/view/search attributes

- Data-defined feature labeling
- Data-defined vector and raster symbology tools
- Atlas map composition with graticule layers
- North arrow scale bar and copyright label for maps
- Support for saving and restoring projects

4.3 Create, edit, manage and export data

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

- Digitizing tools for OGR-supported formats and GRASS vector layers
- Ability to create and edit shapefiles and GRASS vector layers
- Georeferencer plugin to geocode images
- 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.)
- Support for visualizing and editing OpenStreetMap data
- Ability to create spatial database tables from shapefiles with DB Manager plugin
- Improved handling of spatial database tables
- Tools for managing vector attribute tables
- Option to save screenshots as georeferenced images

4.4 Analyse data

You can perform spatial data analysis on spatial databases and other OGR- supported formats. QGIS currently offers vector 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 *GRASS GIS Integration*.) 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, fTools and more. (See section *Introducción*.)

4.5 Publish maps on the Internet

QGIS can be used as a WMS, WMTS, WMS-C or WFS and WFS-T client, and as a WMS, WCS or WFS server. (See section *Trabajar con datos OGC*.) Additionally, you can publish your data on the Internet using a webserver with UMN MapServer or GeoServer installed.

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 Core Plugins

Core plugins include:

1. Coordinate Capture (Capture mouse coordinates in different CRSs)
2. DB Manager (Exchange, edit and view layers and tables; execute SQL queries)
3. Diagram Overlay (Place diagrams on vector layers)
4. Dxf2Shp Converter (Convert DXF files to shapefiles)
5. eVIS (Visualize events)
6. fTools (Analyze and manage vector data)
7. GDALTools (Integrate GDAL Tools into QGIS)
8. Georeferencer GDAL (Add projection information to rasters using GDAL)
9. GPS Tools (Load and import GPS data)
10. GRASS (Integrate GRASS GIS)
11. Heatmap (Generate raster heatmaps from point data)
12. Interpolation Plugin (Interpolate based on vertices of a vector layer)
13. Offline Editing (Allow offline editing and synchronizing with databases)
14. Oracle Spatial GeoRaster
15. Processing (formerly SEXTANTE)
16. Raster Terrain Analysis (Analyze raster-based terrain)
17. Road Graph Plugin (Analyze a shortest-path network)
18. Spatial Query Plugin
19. SPIT (Import shapefiles to PostgreSQL/PostGIS)
20. SQL Anywhere Plugin (Store vector layers within a SQL Anywhere database)
21. Topology Checker (Find topological errors in vector layers)
22. Zonal Statistics Plugin (Calculate count, sum, and mean of a raster for each polygon of a vector layer)

4.6.2 External Python Plugins

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 *The Plugins Menus*.

4.7 Python Console

For scripting, it is possible to take advantage of an integrated Python console, which can be opened from menu: *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 `QgsInterface`. This interface allows access to the map canvas, menus, toolbars and other parts of the QGIS application.

For further information about working with the Python console and programming QGIS plugins and applications, please refer to http://www.qgis.org/html/en/docs/pyqgis_developer_cookbook/index.html.

4.8 Known Issues

4.8.1 Number of open files limitation

If you are opening a large QGIS project and you are sure that all layers are valid, but some layers are flagged as bad, you are probably faced with this issue. Linux (and other OSs, likewise) has a limit of opened files by process. Resource limits are per-process and inherited. The `ulimit` command, which is a shell built-in, changes the limits only for the current shell process; the new limit will be inherited by any child processes.

You can see all current ulimit info by typing

```
user@host:~$ ulimit -aS
```

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

```
user@host:~$ ulimit -Sn
```

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

```
user@host:~$ ulimit -Sn #number_of_allowed_open_files
user@host:~$ ulimit -Sn
user@host:~$ qgis
```

To fix it forever

On most Linux systems, resource limits are set on login by the `pam_limits` module according to the settings contained in `/etc/security/limits.conf` or `/etc/security/limits.d/*.conf`. You should be able to edit those files if you have root privilege (also via sudo), but you will need to log in again before any changes take effect.

More info:

http://www.cyberciti.biz/faq/linux-increase-the-maximum-number-of-open-files/ http://linuxaria.com/article/open-files-in-linux?lang=en

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Qué es lo nuevo en QGIS 2.2

Please note that this is a release in our ‘cutting edge’ release series. As such, it contains new features and extends the programmatic interface over QGIS 2.0. We recommend that you use this version over previous releases.

This release includes hundreds of bug fixes and many new features and enhancements that will be described in this manual. You may also review the visual changelog at http://changelog.linfiniti.com/qgis/version/21/.

5.1 Aplicación y Opciones del proyecto

- **Support for measurement in nautical miles**: You can now measure distances using nautical miles. To enable this, use the *Settings* → *Options* → *Map Tools* option panel.

5.2 Proveedor de datos

- **One-to-many relations support**: This release supports the ability 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, for instance, the inspection history on a length of pipeline or road segment.
- **DXF Export tool**: A new tool for exporting DXFs has been added to the *Project* menu.
- **Paste as new vector layer**: It is a common activity in a GIS to create a sub-selection and then to create a new layer from the selection. In QGIS you can already do Save Selection As to save a layer from your selection; now, functionality is offered that allows you to create a new file or memory layer from whatever is in your clipboard. Simply select some features, copy them to your clipboard and then do *Edit* → *Paste Features As* and choose either ‘New Vector Layer’ or ‘New Memory Layer’ from the submenu. The best part of this new feature is that if you have some Well Known Text (WKT) features in your clipboard from another app, you can simply paste them into QGIS as a new layer now.
- **WMS legend graphic in table of contents and composer**: Prior to QGIS 2.2 the WMS data provider was not able to display a legend in the table of contents’ layer list. Similarly no legend could be displayed in the map composer. QGIS 2.2 addresses both of these issues.

5.3 Digitising

- **Fill ring digitizing tool**: This new tool is used to cut holes in polygons and automatically fill them with new features. If you hold down `Ctrl` when finalising the feature, the attributes will be taken from the parent feature.

5.4 General

- **Recent expressions saved**: The expression builder will now remember the last 20 used expressions.
- **Paste WKT from clipboard**: QGIS can now paste and create a new feature based on WKT that is found in the clipboard. Simply copy some WKT and paste into an editable layer. You can also create a new layer by selecting *Edit* → *Paste As* → *New Memory Layer*.

5.5 Diseñador de impresión de Mapa

- **Zebra map border improvements**: You can now set the colours of the Zebra border on the map element in the map composer.
- **Element rotation support**: Every type of element in the composer can now be rotated, including scale bars, tables and legends. For example, you can rotate a label on the composition so that it fits into your page layout better (as illustrated). Resizing of rotated elements has also been improved.
- **Composer scale added and ruler improvements**: The appearance of rulers has been improved by adjusting the scale logic and by adding smaller ruler divisions, and by making vertical rulers use rotated text. There is also a new composer action for hiding/showing rulers. You can now quickly zoom to 100 % page scale using the new Zoom to 100 % tool on the toolbar. The composer window now lets you quickly switch the page scaling via a new scale combobox in the status bar. In addition, a new indicator has been added to show you the precise pixel position of your cursor. The **[Close]** and **[Help]** buttons have been removed from the bottom of the composer window to give you the maximum amount of screen space for working with your compositions.
- **World file generation**: In the composer, you can now create georeferenced maps! Simply ensure that you choose the correct map element in the Composition tab and then export your map as a PNG file. An accompanying world file will be written, allowing you to load your exported composition in QGIS as a raster layer.
- **Working with multiple items**: Support has been added for moving and resizing multiple items simultaneously. You can now hold `Shift` while resizing to maintain an item's ratio while resizing, or hold `Ctrl` to resize from the item's centre. These shortcut keys also apply to moving items, so holding `Shift` while moving an item constrains the movement to horizontal or vertical movement, and holding `Ctrl` temporarily disables item snapping. You can also hold `Shift` while pressing a cursor key to shift all selected items by a larger amount.
- **Atlas enhancements**: You can now preview the individual pages of the map atlas that will be generated in the composer. While in atlas preview mode, you can output the current page without outputting the entire atlas. You can also tweak the map extent or scale for each feature while previewing the atlas page. Atlas map settings have been moved from the atlas panel to the map properties panel, so now, more than one map can be controlled by the atlas generation. There's a new option to automatically centre an overview map, which comes in handy when creating atlas-based maps. More context information is also now available so that you can adjust your symbology based on whether the feature is the current atlas feature or not.
- **Improved item selection**: You can now select more than one item by clicking and dragging a box to select multiple items, and there are shortcuts for adding to a selection (holding `Shift` while dragging), subtracting from a selection (holding `Ctrl` while dragging) and switching to "within" selection mode (holding `Alt` while dragging). Shift-clicking an already-selected item will remove it from the selection. There are also shortcuts and menu items for selecting all items, clearing a selection, and inverting a selection. It's also now possible to select items that are hidden below other items by Ctrl-clicking an item, or by using 'Select Next Item Above/Below' in the new composer Edit menu.
- **Better navigation of compositions**: QGIS 2.2 includes many improvements to help you navigate your compositions. You can now zoom in or out from a composition by using the mouse scroll wheel. A dedicated pan tool has been added, which allows you to drag the composition around, and you can also switch immediately to pan mode by holding the space bar or by holding the mouse scroll wheel. There's also a new zoom tool, which allows you to precisely zoom to a specific area of your composition. You can also switch to zoom mode at any time by pressing and holding Ctrl-Space and drawing a zoom region on the composition.

- **Improved styling of pages and shapes**: You can now control the style of the composition background using the full range of QGIS' symbology options. It's now possible to export compositions with a transparent (or semi-transparent) background. Shape items (rectangles, triangles and ellipses) can also be styled using the same options as polygon map layers. You can even style the page background or shapes by using data-defined settings based on the current atlas feature! There's also a new option for rounding the corners of rectangle shapes.

5.6 Servidor QGIS

- **WCS Support added to QGIS Server**: QGIS Server already supports various standards, including Web Map Service (WMS version 1.3.0 and 1.1.1), Web Feature Service (WFS version 1.0.0) and Web Feature Service with Transaction (WFS-T). With this new release of QGIS, you can now serve raster layers using the Web Coverage Service (WCS version 1.0.0) standard.

5.7 Simbología

- **Gradient fill support**: The new gradient fill feature lets you create better cartography than ever before. The feature has numerous options providing for great flexibility in how you apply gradients to your features. These include:
  - Two-colour or ramp-based fills
  - Canvas- or object-based origin for your gradients
  - Gradients originating from the centroid of a feature
  - Conical, linear and radial gradient types
  - Data-defined options (i.e., to use an expression or a table

  column) for all gradient properties
- **Label support for palleted rasters**: Rasters that use a fixed colour pallette (for instance, a land cover map) can now have category labels assigned which will be shown in the map legend and in the composer legend.
- **Colour ramps can be inverted**: A new option has been added to symbology dialogs that deal with colour ramps to allow you to invert the colour ramp when it is created.
- **Copy and Paste in rule-based renderer**: In the rule-based renderer, you can now right-click on a rule and then copy and paste the rule as a new rule.
- **On-the-fly feature generalisation**: QGIS 2.2 introduces 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. There is also a new global setting that enables generalisation by default for newly added layers. **Note**: 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.
- **Anchor points can be set for marker layers**: When defining symbology with marker layers (e.g., a point layer symbolized with SVG markers) you can now specify what part of the image should correspond to the 'anchor point'. For example, you can indicate that the bottom-left corner of the image should coincide with the position of the feature. You can also use the **data-defined properties** to have this property set at render time based on an attribute in the data table for that layer (or an arbitrary expression).
- **Thematic maps based on expressions**: Categorized and graduated thematic maps can now be created using the result of an expression. In the Properties dialog for vector layers, the attribute chooser has been augmented with an expression builder. So now, you no longer need to write the classification attribute to a new column in your attribute table if you want the classification attribute to be a composite of multiple fields, or a formula of some sort.

- **Expression support in symbol diagrams for size and attributes**: You can now use an expression to define the size and attributes when using the diagramming capabilities of QGIS.
- **Else rule in rule-based renderer**: The rule-based renderer now supports an Else rule that will be run if none of the other rules on that level match. Else rules can be nested just like any other rules. An example might be:

  ```
  type = 'water' (style grey) ELSE (style red)
  ```

- **Inner stroke support for polygons**: Support has been added for polygon strokes to be limited to the interior of the polygon (so as not to overflow into a neighbouring polygon).

5.8 Interfaz de Usuario

- **Improved properties dialogs**: All properties dialogs have had their main property menus updated so that they look slicker, with an inverse-coloured side bar. This is purely cosmetic but should make it easier to know what your current context is in a dialog.
- **Expression dialog improvements**: We have made some tweaks to the expression dialog - power users can now hide the operator buttons. There are also now splitters between the function list and function help areas, and between the expression and function list area.
- **New keybindings**: We have updated the keyboard shortcuts in QGIS to make it more efficient to carry out repetitive tasks.
  - `Ctrl-d`: Remove selected layers in table of contents
  - `>`: Select next vertex when using the node tool
  - `<`: Select previous vertex when using the node tool
  - `Delete` or `Backspace`: Delete the selected features (you can undo these actions), or nodes when using the node tool
  - `F5`: Update the canvas (instead of Ctrl-r)

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CAPÍTULO 6

Comenzar

Este capítulo da una vista general rápida sobre la instalación de QGIS, algunos datos de ejemplo de la web de QGIS y ejecutar una primera sesión sencilla visualizando capas ráster y vectoriales.

6.1 Instalación

La instalación de QGIS es muy sencilla. Hay disponibles paquetes de instalación estándar para MS Windows y Mac OS X. Se proporcionan paquetes binarios (rpm y deb) o repositorios de software para añadir a su gestor de paquetes para muchos sabores de GNU/Linux. Consiga la última información sobre paquetes binarios en la web de QGIS en http://download.qgis.org.

6.1.1 Instalación a partir de las fuentes

Si necesita compilar QGIS a partir de las fuentes, por favor consulte las instrucciones de instalación. Se distribuyen con el código fuente de QGIS en un archivo llamado `INSTALL`. También puede encontrarlas en línea en http://htmlpreview.github.io/?https://raw.github.com/qgis/QGIS/master/doc/INSTALL.html

6.1.2 Instalación en medios extraíbles

QGIS le permite definir una opción `--configpath` que suplanta la ruta predeterminada para la configuración de usuario (ej.: `~/.qgis2` bajo Linux) y fuerza a **QSettings** a usar ese directorio. Esto le permite, por ejemplo, llevar una instalación de QGIS en una memoria flash junto con todos los complementos y la configuración. Vea la sección *Menú Sistema* para información adicional.

6.2 Datos de ejemplo

La guía de usuario contiene ejemplos basados en el conjunto de datos de ejemplo de QGIS.

El instalador de Windows tiene una opción para descargar el conjunto de datos de muestra de QGIS. Si se marca, los datos se decargarán en su carpeta `Mis Documentos` y se colocarán en una carpeta llamada `GIS Database`. Puede usar el Explorador de Windows para mover esta carpeta a una ubicación adecuada. Si no marcó la casilla de verificación para instalar el conjunto de datos de muestra durante la instalación inicial de QGIS, puede hacer algo de lo siguiente:

- Usar datos SIG que ya tenga
- Descargar datos de muestra de http://download.osgeo.org/qgis/data/qgis_sample_data.zip
- Desinstalar QGIS y volver a instalarlo con la opción de descarga de datos marcada (sólo recomendado si las soluciones anteriores no funcionaron).

Para GNU/Linux y Mac OS X, aún no hay disponibles paquetes de instalación del conjunto de datos en forma de rpm, deb o dmg. Para usar el conjunto de datos de muestra descargue el archivo `qgis_sample_data` como un archivo ZIP de http://download.osgeo.org/qgis/data/qgis_sample_data.zip y descomprima el archivo en su equipo.

El conjunto de datos de Alaska incluye todos los datos SIG que se usan para los ejemplos y capturas de pantalla de la guía de usuario; también incluye una pequeña base de datos de GRASS. La proyección del conjunto de datos de QGIS es Alaska Albers Equal Area con unidades en pies. El código EPSG es 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]]
```

Si pretende usar QGIS como un visor gráfico para GRASS, puede encontrar una selección de localizaciones de ejemplo (ej.., Spearfish o Dakota de Sur) en la web oficial de GRASS GIS, http://grass.osgeo.org/download/sample-data/.

6.3 Sesión de ejemplo

Ahora que tiene QGIS instalado y un dispone de un conjunto de datos, nos gustaría mostrarle una sesión de muestra de QGIS corta y sencilla. Visualizaremos una capa ráster y otra vectorial. Usaremos la capa ráster `landcover`, `qgis_sample_data/raster/landcover.img` y la capa vectorial `lakes`, `qgis_sample_data/gml/lakes.gml`.

6.3.1 Iniciar QGIS

- Arranque QGIS tecleando "QGIS" en la línea de órdenes o si usa un binario precompilado, usando el menú Aplicaciones.
- Iniciar QGIS usando el menú Inicio o accesos directos en el escritorio o haciendo doble clic en un archivo de proyecto de QGIS.
- Hacer doble clic en el icono de su carpeta Aplicaciones.

6.3.2 Cargar capas ráster y vectoriales del conjunto de datos de ejemplo

1. Clic en el icono Cargar ráster.
2. Navegue a la carpeta `qgis_sample_data/raster/`, seleccione el archivo ERDAS IMG `landcover.img` y haga clic en **[Abrir]**.

3. If the file is not listed, check if the *Files of type* combo box at the bottom of the dialog is set on the right type, in this case "Erdas Imagine Images (*.img, *.IMG)".
4. Ahora hacer clic en el icono Cargar vectorial.
5. *Archivo* debería estar seleccionado como *Tipo de origien* en el nuevo diálogo *Añadir capa vectorial*. Ahora haga clic en **[Explorar]** para seleccionar la capa vectorial.
6. Browse to the folder `qgis_sample_data/gml/`, select 'Geography Markup Language [GML] [OGR] (.gml,.GML)' from the *Files of type* combo box, then select the GML file `lakes.gml` and click **[Open]**. In the *Add vector layer* dialog, click **[OK]**.
7. Acerque el zoom un poco a la zona que prefiera con algunos lagos.
8. Haga doble clic en la capa `lakes` en el panel Capas para abrir el diálogo *Propiedades*.
9. Clic en la pestaña *Estilo* y seleccionar un azul como color de relleno.
10. Haga clic en la pestaña *Etiquetas'y marque la casilla |checkbox| :guilabel:'Etiquetar esta capa con* para habilitar el etiquetado. Seleccione el campo "NAMES" como el campo que contiene las etiquetas.
11. Para mejorar la lectura de las etiquetas, puede añadir una zona blanca a su alrederor haciendo clic en "Márgen" en la lista de la izquierda, marcando *Dibujar buffer de texto* y eligiendo 3 como tamaño de buffer.
12. Haga clik en **[Aplicar]**. Compruebe si el resultado le gusta y finalmente pulse **[Aceptar]**.

Puede ver lo fácil que es visualizar capas ráster y vectoriales en QGIS. Vayamos a las secciones que siguen para aprender más sobre las funcionalidades, características y configuración disponibles y cómo usarlas.

6.4 Iniciar y cerrar QGIS

En la sección *Sesión de ejemplo* ya aprendió como iniciar QGIS. Repetiremos esto aquí y verá que QGIS también proporciona otras opciones de línea de órdenes.

- Asumiendo que QGIS está instalado en el PATH, puede iniciar QGIS tecleando `qgis` en la consola o haciendo doble clic en el enlace (o acceso directo) a la aplicación QGIS en el escritorio o en el menú Aplicaciones.
- Iniciar QGIS usando el menú Inicio o accesos directos en el escritorio o haciendo doble clic en un archivo de proyecto de QGIS.
- Haga doble clic en el icono en su carpeta Aplicaciones. Si necesita iniciar QGIS en una consola, ejecute `/path-to-installation-executable/Contents/MacOS/Qgis`.

Para detener QGIS, haga clic en la opción de menú *Archivo* *QGIS → Salir*, o use use el atajo `Ctrl+Q`.

6.5 Opciones de la línea de órdenes

QGIS admite diversas opciones cuando se arranca desde la línea de órdenes. Para obteter una lista de las opciones, introduzca `qgis --help` en la línea de órdenes. La sentencia de uso para QGIS es:

```
qgis --help
QGIS - 2.2.0-Valmiera 'Valmiera' (exported)
QGIS is a user friendly Open Source Geographic Information System.
Usage: qgis [OPTION] [FILE]
options:
 [--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
```

```
[--project projectfile]         load the given QGIS project
[--extent xmin,ymin,xmax,ymax]  set initial map extent
[--nologo]                      hide splash screen
[--noplugins]                   don't restore plugins on startup
[--nocustomization]             don't apply GUI customization
[--customizationfile]           use the given ini file as GUI customization
[--optionspath path]            use the given QSettings path
[--configpath path]             use the given path for all user configuration
[--code path]                   run the given python file on load
[--help]                        this text

FILES:
      Files specified on the command line can include rasters,
      vectors, and QGIS project files (.qgs):
      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
         the PostGIS extension
```

Truco: Ejemplo usando argumentos de la línea de órdenes

Puede iniciar QGIS especificando uno o más archivos de datos en la línea de órdenes. Por ejemplo, asumiendo que está en el directorio `qgis_sample_data`, podría iniciar QGIS con una capa vectorial y un archivo ráster establecidos para que se carguen al inicio usando la siguiente orden: `qgis ./raster/landcover.img ./gml/lakes.gml`

Opción de la línea de órdenes `--snapshot`

Esta opción permite crear una captura de pantalla en formato PNG de la vista actual. Esto es práctico cuando tiene muchos proyectos y quiere generar capturas de pantalla de sus datos.

Actualmente genera un archivo PNG con 800x600 píxeles. Esto se puede ajustar usando los argumentos‘‘–width‘‘ y `--height` en la línea de órdenes. Se puede añadir un nombre de archivo después de `--snapshot`.

Opción de la línea de órdenes `--lang`

Basado en su configuración local, QGIS selecciona el idioma correcto. Si desea cambiar su idioma, puede especificar un código de idioma. Por ejemplo, `--lang=it` inicia QGIS en una localización italiana. En http://hub.qgis.org/wiki/quantum-gis/GUI_Translation_Progress se proporciona una lista de los idiomas actualmente soportados con el código de idioma y su estado.

Opción de la línea de órdenes `--project`

También es posible iniciar QGIS con un archivo de proyecto existente. Solamente agregue la opción `--project` a la línea de comando, seguida por el nombre de su proyecto y QGIS se abrirá con todas las capas del archivo indicado cargadas.

Opción de la línea de órdenes `--extent`

Use esta opción para iniciar con una extensión de mapa específica. Necesita añadir el cuadro delimitador de su extensión en el siguiente orden, separado por una coma:

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

Opción de la línea de órdenes `--nologo`

Este argumento de línea de órdenes oculta la pantalla de bienvenida cuando inicia QGIS.

Opción de la línea de órdenes `--noplugins`

Si tiene problemas con los complementos al iniciar, puede evitar cargarlos con ésta opción. Estarán aún disponibles después en el administrador de complementos.

Opciónde la línea de órdenes `--customizationfile`

Utilizando este argumento de línea de órdenes puede definir un archivo de personalizacion de la GUI, que se utilizará al iniciar.

Opción de la línea de órdenes `--nocustomization`

Utilizando este argumento de línea de órdenes no se aplicará la personalización existente de la GUI.

Opción de la línea de órdenes `--optionspath`

You can have multiple configurations and decide which one to use when starting QGIS with this option. See *Opciones* to confirm where the operating system saves the settings files. Presently, there is no way to specify a file to write settings to; therefore, you can create a copy of the original settings file and rename it.

Opción de la línea de órdenes `--configpath`

Esta opción es similar al anterior, pero además anula la ruta predeterminada para la configuración del usuario (`~/.qgis2`) y fuerza **QSettings** para usar también este directorio. Esto permite a los usuarios, por ejemplo, llevar la instalación de QGIS en una unidad flash junto con todos los complementos y configuraciones.

6.6 Proyectos

El estado de su sesión de QGIS es considerado un proyecto. QGIS trabaja en un proyecto cada vez. La configuración está considerada por proyecto o como predeterminada para nuevos proyectos (ver sección *Opciones*). QGIS puede guardar el estado de su espacio de trabajo dentro de un archivo de proyecto, usando las opciones de menú *Proyecto* → *Guardar* o *Proyecto* → *Guardar como...*.

Cargar los proyectos guardados en una sesión de QGIS usando *Proyecto*→ *Abrir...*, *Proyecto* → *Nuevo a partir de plantilla* o *Proyecto* → *Abrir reciente* →.

Si desea limpiar su sesión e iniciar una fresca, seleccione *Proyecto* → *Nuevo*. Cualquiera de estas opciones le pedirá que guarde el proyecto existente si se han hecho cambios desde que se abrió o se guardó por última vez.

El tipo de información guardada en el archivo de proyecto incluye:

- Las capas añadidas
- Las propiedades de las capas, incluyendo la simbolización
- Proyección de la vista del mapa
- Última extensión vista

El archivo del proyecto se guarda en formato XML, así es posible editarlo fuera de QGIS, si sabe lo que está haciendo. El formato del archivo ha sido actualizado varias veces comparado con otras versiones de QGIS. Los archivos de proyecto de versiones anteriores puede que ya no funcionen correctamente. Para estar al tanto de esto, en la pestaña *General* bajo *Configuración* → *Opciones* se puede seleccionar:

- *Preguntar si guardar cambios en el proyecto y la fuente de datos cuando sea necesario*
- *Avisar al abrir un proyecto guardado con una versión anterior de QGIS*

Siempre que guarde un proyecto en QGIS 2.2, ahora se hace una copia de seguridad del proyecto.

6.7 Salida

Hay muchas maneras de generar una salida desde su sesión QGIS. Ya hemos presentado una en la sección *Proyectos*, guardando como un archivo de proyecto. Aquí hay una muestra de otras formas de producir archivos de salida:

- La opción de menú *Proyecto* → Guardar como imagen abre un diálogo de archivo en el que seleccionar el nombre, ruta y tipo de imagen (formato PNG o JPG). Un archivo world con extensión PNGW o JPGW guardado en la misma carpeta almacenará la referencia espacial de la imagen.
- La opción de menú *Proyecto* → *Exportar a DXF...* abre un diálogo en donde puede definir el 'Modo de simbologia', la 'Escala de simbología' y las capas vectoriales que desea exportar a formato DXF.
- La opción del menú: menuselection:*Proyecto –>* *Nuevo diseñador de impresión* abre un nuevo diálogo en donde puede diseñar e imprimir el lienzo de mapa actual (vea sección *Diseñadores de impresión*).

.

QGIS GUI

When QGIS starts, you are presented with the GUI as shown in the figure (the numbers 1 through 5 in yellow circles are discussed below).

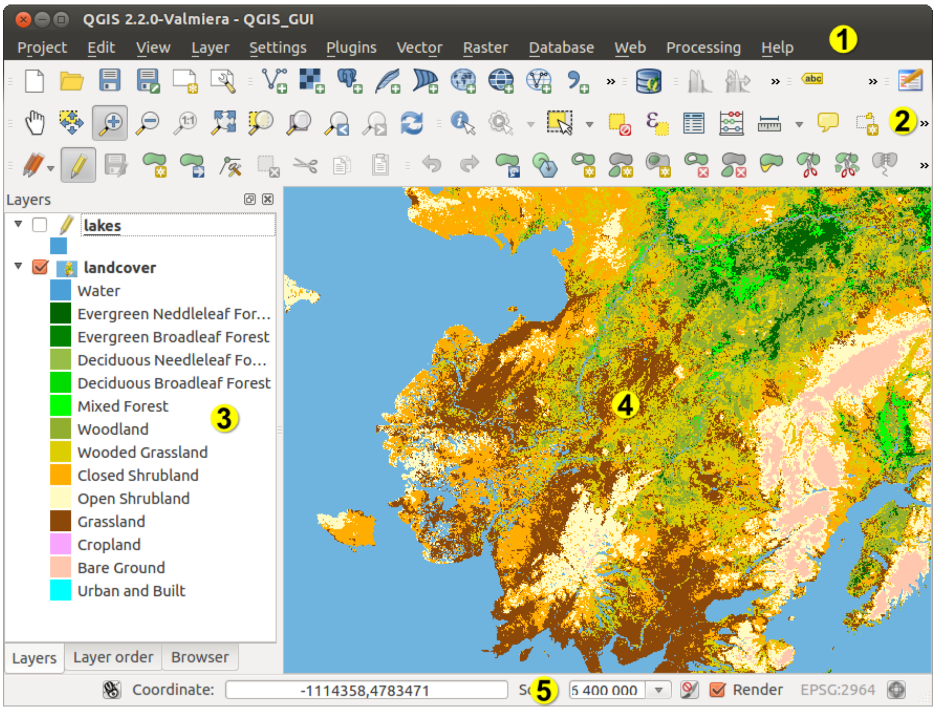

Figura 7.1: QGIS GUI con datos de ejemplo de Alaska

Nota: Las decoraciones de las ventanas (barra de título, etc.) pueden ser distintas dependiendo de su sistema operativo y su gestor de ventanas.

La GUI QGIS se divide en cinco zonas:

1. Barra de Menú
2. Barra de Herramientas
3. Leyenda del mapa
4. Vista del mapa
5. Barra de Estado

Estos cinco componentes de la interfaz de QGIS se describen con más detalle en la siguiente sección. Dos secciones más presentan atajos de teclado y ayuda contextual.

7.1 Barra de Menú

The menu bar provides access to various QGIS features using a standard hierarchical menu. The top-level menus and a summary of some of the menu options are listed below, together with the associated icons as they appear on the toolbar, and keyboard shortcuts. The shortcuts presented in this section are the defaults; however, keyboard shortcuts can also be configured manually using the *Configure shortcuts* dialog, opened from *Settings* → *Configure Shortcuts...*.

Although most menu options have a corresponding tool and vice-versa, the menus are not organized exactly like the toolbars. The toolbar containing the tool is listed after each menu option as a checkbox entry. Some menu options only appear if the corresponding plugin is loaded. For more information about tools and toolbars, see section *Barra de herramietas*.

7.1.1 Proyecto

Menú Opción	Atajos	Referencia	Barra de herramietas
Nuevo	`Ctrl+N`	see *Proyectos*	*Proyecto*
Abrir	`Ctrl+O`	see *Proyectos*	*Proyecto*
Nuevo a partir de plantilla →		see *Proyectos*	*Proyecto*
Abrir recientes →		see *Proyectos*	
Guardar	`Ctrl+S`	see *Proyectos*	*Proyecto*
Guardar como...	`Ctrl+Shift+S`	see *Proyectos*	*Proyecto*
Guardar como imagen...		ver *Salida*	
Exportar DXF ...		ver *Salida*	
Nuevo diseñador de impresión	`Ctrl+P`	ver *Diseñadores de impresión*	*Proyecto*
Administrador de diseñadores ...		ver *Diseñadores de impresión*	*Proyecto*
Diseñadores de impresión →		ver *Diseñadores de impresión*	
Salir de QGIS	`Ctrl+Q`		

7.1.2 Editar

Menú Opción	Atajos	Referencia	Barra de herramietas
Deshacer	`Ctrl+Z`	ver *Advanced digitizing*	*Digitalización Avanzada*
Rehacer	`Ctrl+Shift+Z`	ver *Advanced digitizing*	*Digitalización Avanzada*
Cortar objetos espaciales	`Ctrl+X`	ver *Digitizing an existing layer*	*Digitalización*
Copiar objetos espaciales	`Ctrl+C`	ver *Digitizing an existing layer*	*Digitalización*
Pegar objetos espaciales	`Ctrl+V`	ver *Digitizing an existing layer*	*Digitalización*
Pegar objetos espaciales como →		ver *Working with the Attribute Table*	
Añadir objetos espaciales	`Ctrl+.`	ver *Digitizing an existing layer*	*Digitalización*
Mover objeto(s) espaciales		ver *Digitizing an existing layer*	*Digitalización*
Borrar seleccionados		ver *Digitizing an existing layer*	*Digitalización*
Girar objetos espacial(es)		ver *Advanced digitizing*	*Digitalización Avanzada*
Simplificar objeto espacial		ver *Advanced digitizing*	*Digitalización Avanzada*
Añadir anillo		ver *Advanced digitizing*	*Digitalización Avanzada*
Añadir parte		ver *Advanced digitizing*	*Digitalización Avanzada*
Rellenar anillo		ver *Advanced digitizing*	*Digitalización Avanzada*
Borrar anillo		ver *Advanced digitizing*	*Digitalización Avanzada*
Borrar parte		ver *Advanced digitizing*	*Digitalización Avanzada*
Remodelar objetos espaciales		ver *Advanced digitizing*	*Digitalización Avanzada*
Desplazar curva		ver *Advanced digitizing*	*Digitalización Avanzada*
Dividir objetos espaciales		ver *Advanced digitizing*	*Digitalización Avanzada*
Dividir partes		ver *Advanced digitizing*	*Digitalización Avanzada*
Combinar objetos espaciales seleccionados		ver *Advanced digitizing*	*Digitalización Avanzada*
Combinar los atributos de los objetos espaciales seleccionados		ver *Advanced digitizing*	*Digitalización Avanzada*
Herramienta de nodos		ver *Digitizing an existing layer*	*Digitalización*

Después de activar el modo Conmutar edición de una capa, encontrará el icono `Añadir objeto espacial` en el menú *Edición* dependiendo del tipo de capa (punto, línea o polígono).

7.1.3 Edición (extra)

Menú Opción	Atajos	Referencia	Barra de herramietas
Añadir objetos espaciales		ver *Digitizing an existing layer*	*Digitalización*
Añadir objeto espacial		ver *Digitizing an existing layer*	*Digitalización*
Añadir objeto espacial		ver *Digitizing an existing layer*	*Digitalización*

7.1.4 Ver

Menú Opción	Atajos	Referencia	Barra de herramietas
Desplazar mapa			*Navegación de mapas*
Desplazar mapa a la selección			*Navegación de mapas*
Acercar zum	`Ctrl++`		*Navegación de mapas*
Alejar zum	`Ctrl+-`		*Navegación de mapas*
Seleccionar →		ver *Seleccionar y deseleccionar objetos espaciales*	*Atributos*
Identificar objetos espaciales	`Ctrl+Shift+I`		*Atributos*
Medir →		ver *Mediciones*	*Atributos*
Zum General	`Ctrl+Shift+F`		*Navegación de mapas*
Zum a la capa			*Navegación de mapas*
Zum a la selección	`Ctrl+J`		*Navegación de mapas*
Zum anterior			*Navegación de mapas*
Zum siguiente			*Navegación de mapas*
Zum al tamaño real			*Navegación de mapas*
Ilustraciones →		ver *Elementos decorativos*	
Avisos del mapa			*Atributos*
Nuevo marcador	`Ctrl+B`	ver *Marcadores espaciales*	*Atributos*
Mostrar marcadores	`Ctrl+Shift+B`	ver *Marcadores espaciales*	*Atributos*
Actualizar	`Ctrl+R`		*Navegación de mapas*

7.1.5 Capa

Menú Opción	Atajos	Referencia	Bar
Nueva→		ver *Creating new Vector layers*	*Adm*
Empotrar capas y grupos ...		ver *Anidar proyectos*	
Añadir capa vectorial	Ctrl+Shift+V	ver *Trabajar con catos vectoriales*	*Adm*
Añadir capa ráster	Ctrl+Shift+R	ver *Loading raster data in QGIS*	*Adm*
Añadir capa PostGIS	Ctrl+Shift+D	ver *PostGIS Layers*	*Adm*
Añadir capa SpatiaLite	Ctrl+Shift+L	ver *SpatiaLite Layers*	*Adm*
Añadir capa MSSQL Spatial	Ctrl+Shift+M	ver *label_mssql*	*Adm*
Añadir capa GeoRaster de Oracle GeoRaster		ver *Complemento GeoRaster espacial de Oracle*	*Adm*
Añadir capa SQL Anywhere		ver *Complemento SQL Anywhere*	*Adm*
Añadir capa WMS/WMTS	Ctrl+Shift+W	ver *Cliente WMS/WMTS*	*Adm*
Añadir capa WCS		ver *WCT Cliente*	*Adm*
Añadir capa WFS		ver *Cliente WFS y WFS-T*	*Adm*
Añadir capa de texto delimitado		see *label_dltext*	*Adm*
Copiar estilo		ver *Style Menu*	
Pegar estilo		ver *Style Menu*	
Abrir Tabla de atributos		ver *Working with the Attribute Table*	*Atri*
Conmutar edición		ver *Digitizing an existing layer*	*Dig*
Guardar cambios de la capa		ver *Digitizing an existing layer*	*Dig*
Ediciones actuales →		ver *Digitizing an existing layer*	*Dig*
Guardar como...			
Guardar selección como archivo vectorial...		Ver *Working with the Attribute Table*	
Eliminar capa(s)	Ctrl+D		
Duplicar capa(s)			
Establecer el SRC de la capa(s)	Ctrl+Shift+C		
Establecer SRC del proyecto a partir de capa			
Propiedades			
Consulta...			
Etiquetado			
Añadir a la vista general	Ctrl+Shift+O		*Adm*
Añadir todo a la vista general			
Eliminar todo de la vista general			
Mostrar todas las capas	Ctrl+Shift+U		*Adm*
Ocultar todas las capas	Ctrl+Shift+H		*Adm*

7.1.6 Configuración

Menú Opción	Atajos	Referencia	Barra de herramietas
Paneles →		ver *Paneles y Barras de Herramientas*	
Barras de herramientas→		ver *Paneles y Barras de Herramientas*	
Alternar el modo de pantalla completa	`F 11`		
Propiedades del proyecto...	`Ctrl+Shift+P`	see *Proyectos*	
SRC Personalizado ...		ver *Custom Coordinate Reference System*	
Administrador de estilos...		ver *vector_style_manager*	
Configurar atajos de teclado ...			
Personalización ...		ver *Personalización*	
Opciones ...		ver *Opciones*	
Opciones de autoensamblado ...			

7.1.7 Complementos

Menú Opción	Atajos	Referencia	Barra de herramietas
Administrar e instalar complementos		ver *The Plugins Menus*	
Consola de Python			

Cuando inicie QGIS por primera vez no se cargan todos los complementos básicos.

7.1.8 Vectorial

Menú Opción	Atajos	Referencia	Barra de herramietas
menuselection:*Open Street Map –>*		ver *Loading OpenStreetMap Vectors*	
Herramientas de análisis →		ver *Complemento fTools*	
Herramientas de investigación →		ver *Complemento fTools*	
Herramientas de Geoproceso →		ver *Complemento fTools*	
Herramientas de geometría →		ver *Complemento fTools*	
Herramientas de gestión de datos →		ver *Complemento fTools*	

Cuando inicie QGIS por primera vez no se cargan todos los complementos básicos.

7.1.9 Ráster

Menú Opción	Atajos	Referencia	Barra de herramietas
Calculadora ráster...		ver *Calculadora Ráster*	

Cuando inicie QGIS por primera vez no se cargan todos los complementos básicos.

7.1.10 Procesado

Menú Opción	Atajos	Referencia	Barra de herramietas
Caja de herramientas de procesado		ver *The toolbox*	
Modelador gráfico		ver *The graphical modeler*	
Historial y registro		ver *El administrador del historial*	
Opciones y configuración		ver *Configuring the processing framework*	
Visor de resultados		ver *Configuring external applications*	
Comandos	`Ctrl+Alt+M`	ver *The SEXTANTE Commander*	

Cuando inicie QGIS por primera vez no se cargan todos los complementos básicos.

7.1.11 Ayuda

Menú Opción	Atajos	Referencia	Barra de herramietas
Contenido de la ayuda	`F1`		*Ayuda*
¿Qué es esto?	`Shift+F1`		*Ayuda*
Documentación de la API			
¿Necesita soporte comercial?			
Página web de QGIS	`Ctrl+H`		
Comprobar versión de QGIS			
Acerca de			
Patrocinadores de QGIS			

Please note that for Linux, the menu bar items listed above are the default ones in the KDE window manager. In GNOME, the *Settings* menu has different content and its items have to be found here:

Propiedades del proyecto	*Proyecto*
Opciones	*Editar*
Configurar teclas de atajo	*Editar*
Administrador de estilos	*Editar*
SRC personalizado	*Editar*
Paneles →	*Ver*
Barras de herramientas→	*Ver*
Alternar el modo de pantalla completa	*Ver*
Escala de tesela	*Ver*
Seguimiento GPS en vivo	*Ver*

7.2 Barra de herramietas

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

Every menu bar can be moved around according to your needs. Additionally, every menu bar can be switched off using your right mouse button context menu, holding the mouse over the toolbars (read also *Paneles y Barras de Herramientas*).

Truco: Restauración de barras de herramientas

If you have accidentally hidden all your toolbars, you can get them back by choosing menu option *Settings* → *Toolbars* →. If a toolbar disappears under Windows, which seems to be a problem in QGIS from time to time, you have to remove key `\HKEY_CURRENT_USER\Software\QGIS\qgis\UI\state` in the registry. When you restart QGIS, the key is written again with the default state, and all toolbars are visible again.

7.3 Leyenda del mapa

The map legend area lists all the layers in the project. The checkbox in each legend entry can be used to show or hide the layer.

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: This behaviour can be overridden by the 'Layer order' panel.

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

1. Right click in the legend window and choose *Add 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 bring a layer out of a group, you can drag it out, or right click on it and choose *Make to toplevel item*. Groups can also be nested inside other groups.

La casilla de verificación para un grupo mostrará u ocultará todas las capas en el grupo al hacer clic.

The content of the right mouse button context menu depends on whether the selected legend item is a raster or a vector layer. For GRASS vector layers, Toggle editing is not available. See section *Digitizing and editing a GRASS vector layer* for information on editing GRASS vector layers.

El menú del boton derecho del raton para capas ráster

- *Zum a la extensión de la capa*
- *Zum a la mejor escala (100 %)*
- *Stretch Using Current Extent*
- *Mostrar en la vista general*
- *Eliminar*
- *Duplicar*
- *Establecer SRC de la capa*
- *Establecer SRC del proyecto a partir de capa*
- *Guardar como ...*
- *Propiedades*
- *Cambiar nombre*
- *Copiar estilo*
- *Add New Group*

- *Expand all*
- *Collapse all*
- *Update Drawing Order*

Además, de acuerdo con la posición y la selección de la capa

- *Subir el elemento al nivel superior*
- *Grupo seleccionado*

Menú del botón derecho del ratón para las capas vectoriales

- *Zum a la extensión de la capa*
- *Mostrar en la vista general*
- *Eliminar*
- *Duplicar*
- *Establecer SRC de la capa*
- *Establecer SRC del proyecto a partir de capa*
- *Abrir tabla de atributos*
- *Conmutar edición* (no disponible para capas GRASS)
- *Guardar como ...*
- *Save Selection As*
- *Filtrar*
- *Mostrar el conteo de objetos espaciales*
- *Propiedades*
- *Cambiar nombre*
- *Copiar estilo*
- *Add New Group*
- *Expand all*
- *Collapse all*
- *Update Drawing Order*

Además, de acuerdo con la posición y la selección de la capa

- *Subir el elemento al nivel superior*
- *Grupo seleccionado*

Menú del botón derecho del ratón para grupo de capas

- *Zum al grupo*
- *Eliminar*
- *Establecer SRC del grupo*
- *Cambiar nombre*
- *Add New Group*
- *Expand all*
- *Collapse all*
- *Update Drawing Order*

Es posible seleccionar mas de una capa o grupo al mismo tiempo manteniendo presionada la tecla `Ctrl` mientras selecciona las capas con el botón izquierdo del ratón. Después puede mover todas las capas a un nuevo grupo al mismo tiempo.

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

7.3.1 Trabajar con el orden de la leyenda de la capa independiente

There is a panel that allows you to define an independent drawing order for the map legend. You can activate it in the menu *Settings* → *Panels* → *Layer order*. This feature allows you to, for instance, order your layers in order of importance, but still display them in the correct order (see figure_layer_order). Checking the *Control rendering order* box underneath the list of layers will cause a revert to default behavior.

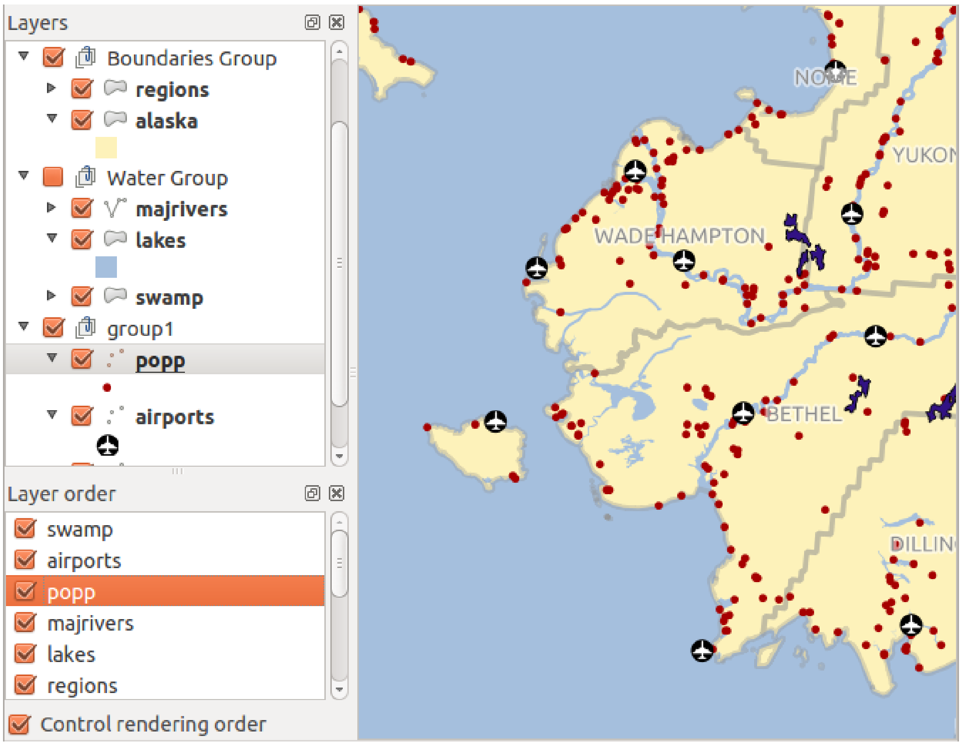

Figura 7.2: Definir el orden de la leyenda de una capa independiente

7.4 Vista del mapa

This is the "business end" of QGIS — maps are displayed in this area! The map displayed in this window will depend on the vector and raster layers you have chosen to load (see sections that follow for more information on how to load layers). The map view can be panned, shifting the focus of the map display to another region, and it can be zoomed in and out. Various other operations can be performed on the map as described in the toolbar description above. The map view and the legend are tightly bound to each other — the maps in view reflect changes you make in the legend area.

Truco: Zum al mapa con la rueda del ratón

You can use the mouse wheel to zoom in and out on the map. Place the mouse cursor inside the map area and roll the wheel forward (away from you) to zoom in and backwards (towards you) to zoom out. The zoom is centered on the mouse cursor position. You can customize the behavior of the mouse wheel zoom using the *Map tools* tab under the *Settings* → *Options* menu.

Truco: Desplazar el mapa con las teclas de dirección y barra de espaciadora

You can use the arrow keys to pan the map. Place the mouse cursor inside the map area and click on the right arrow key to pan east, left arrow key to pan west, up arrow key to pan north and down arrow key to pan south. You can also pan the map using the space bar or the click on mouse wheel: just move the mouse while holding down space bar or click on mouse wheel.

7.5 Barra de Estado

The status bar shows you your current position in map coordinates (e.g., meters or decimal degrees) as the mouse pointer is moved across the map view. To the left of the coordinate display in the status bar is a small button that will toggle between showing coordinate position or the view extents of the map view as you pan and zoom in and out.

Next to the coordinate display you will find the scale display. It shows the scale of the map view. If you zoom in or out, QGIS shows you the current scale. There is a scale selector, which allows you to choose between predefined scales from 1:500 to 1:1000000.

A progress bar in the status bar shows the progress of rendering as each layer is drawn to the map view. In some cases, such as the gathering of statistics in raster layers, the progress bar will be used to show the status of lengthy operations.

If a new plugin or a plugin update is available, you will see a message at the far left of the status bar. On the right side of the status bar, there is a small checkbox which can be used to temporarily prevent layers being rendered to the map view (see section *Renderizado* below). The icon immediately stops the current map rendering process.

To the right of the render functions, you find the EPSG code of the current project CRS and a projector icon. Clicking on this opens the projection properties for the current project.

Truco: Calculating the Correct Scale of Your Map Canvas

When you start QGIS, the default units are degrees, and this means that QGIS will interpret any coordinate in your layer as specified in degrees. To get correct scale values, you can either change this setting to meters manually in the *General* tab under *Settings* → *Project Properties*, or you can select a project CRS clicking on the CRS status icon in the lower right-hand corner of the status bar. In the last case, the units are set to what the project projection specifies (e.g., '+units=m').

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Herramientas generales

8.1 Teclas de acceso rápido

QGIS proporciona atajos de teclado predeterminados para muchas características. Puede encontrarlos en la sección *Barra de Menú*. Además, la opción de menú *Configuración* → *Configurar atajos de teclado...* permite cambiar los atajos de teclado predeterminados y agregar otros nuevos a las características de QGIS .

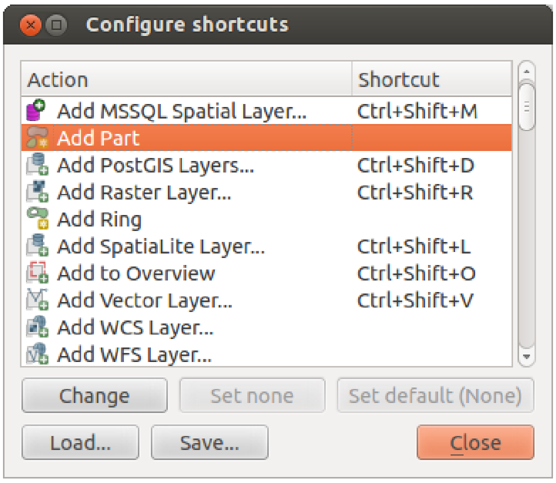

Figura 8.1: Definir opciones de atajos (Gnome)

La configuración es muy simple. Solo seleccione una entidad de la lista y haga clic en **[Cambiar]**, **[Establecer a ninguno]** o **[Establecer predeterminado]**. Una vez finalizada la configuración, se puede guardar como un archivo XML y cargarlo en otra instalación de QGIS.

8.2 Ayuda de contexto

Cuando necesite ayuda sobre un tema especifico, puede acceder a la ayuda de contexto mediante el botón **[Ayuda]** disponible en la mayoría de diálogos – tenga en cuenta que los complementos de terceros pueden apuntar a paginas web dedicadas.

8.3 Renderizado

Por omisión, QGIS representa todas las capas visibles siempre que se actualiza la vista del mapa. Los eventos que desencadena una actualización de la vista del mapa incluyen:

- Añadir una capa
- Desplazar o hacer zoom
- Redimensionar la ventana de QGIS
- Cambiar la visibilidad de una o varias capas

QGIS permite controlar el proceso de renderizado de diversas formas.

8.3.1 Renderizado dependiente de la escala

El renderizado dependiente de la escala le permite especificar las escalas mínima y máxima a las que una capa será visible. Para establecer el renderizado dependiente de la escala, abra el diálogo *Propiedades* mediante doble clic en una capa en el panel Capas. En la pestaña *General*, haga clic en la casilla ☑ *Visibilidad dependiente de la escala* para activar la característica, luego establezca los valores mínimo y máximo de escala.

Puede determinar los valores de escala haciendo zum primero al nivel que quiera usar y anotanto el valor de escala en la barra de estado de QGIS.

8.3.2 Controlar el renderizado del mapa

El renderizado del mapa se puede controlar de varias formas, como se describe a continuación.

Suspender el renderizado

Para suspender el renderizado, haga clic en la casilla ☑ *Representar* en la esquina inferior derecha de la barra de estado. Cuando la casilla ☑ *Representar* no está marcada, QGIS no redibuja el lienzo en respuesta a cualquiera de los eventos descritos en la sección *Renderizado*. Ejemplos de cuándo puede querer suspender la representación incluyen:

- Añadir muchas capas y simbolizarlas antes de dibujar
- Añadir una o más capas grandes y establecer la dependencia de escala antes de dibujar
- Añadir una o más capas grandes y hacer zoom a una vista específica antes de dibujar
- Cualquier combinación de la anteriores

Marcar la casilla ☑ *Renderizar* habilita el renderizado y origina un refresco inmediato del lienzo del mapa.

Configurar la opción de añadir una capa

Puede establecer una opción para cargar siempre las nuevas capas sin dibujarlas. Esto significa que las capas se añadirán al mapa pero su casilla de visibilidad en el panel Capas no estará marcada de forma predeterminada. Para establecer esta opción, seleccione la opción de menú *Configuración* → *Opciones* y haga clic en la pestaña *Representación*. Desmarque la casilla ☑ *Por omisión, las nuevas capas añadidas al mapa se deben visualizar*. Cualquier capa añadida posteriormente al mapa estará desactivada (invisible) por omisión.

Detener el renderizado

Para detener el dibujado del mapa, presione la tecla `ESC`. Esto detendrá el refresco del lienzo del mapa y dejará el mapa parcialmente dibujado. Puede que tarde un poco desde que se presiona la tecla `ESC` hasta que se detenga el dibujado del mapa.

Nota: Actualmente no es posible detener la representación — esto se desactivó en el paso a Qt4 debido a problemas y cuelgues de la Interfaz de Usuario (IU).

Actualizar la visualización del mapa durante el renderizado

Se puede establecer una opción para actualizar la visualización del mapa a medida que se dibujan los objetos espaciales. Por omisión, QGIS no muestra ningún objeto espacial de una capa hasta que toda la capa ha sido representada. Para actualizar la pantalla a medida que se leen los objetos espaciales desde el almacén de datos, seleccione la opción de menú *Configuración* → *Opciones* y haga clic en la pestaña *Representación*. Establezca el número de objetos espaciales a un valor apropiado para actualizar la pantalla durante la representación. Al establecer un valor de 0 desactiva la actualización durante el dibujado (este es el valor predeterminado). Establecer un valor demasiado bajo dará como resultado un bajo rendimiento, ya que la vista del mapa se actualiza continuamente durante la lectura de los objetos espaciales. Un valor sugerido para empezar es 500.

Influir en la calidad del renderizado

Para influir en la calidad de la presentación del mapa, se tienen dos opciones. Elegir la opción de menú *Configuración* → *Opciones*, hacer clic en la pestaña *Representación* y seleccionar o deseleccionar las siguientes casillas de verificación:

- *Hacer que las líneas se muestren menos quebradas a expensas del rendimiento de la representación*
- *Solucionar problemas con polígonos rellenados incorrectamente*

Acelerar renderizado

Hay dos ajustes que le permiten mejorar la velocidad de presentación. Abrir el diálogo de las opciones de QGIS usando *Configuración*→ *Opciones*, ir a la pestaña guilabel:*Representación* y seleccionar o deseleccionar las siguientes casillas de verificación:

- *Activar buffer trasero*. Esto proporciona un mejor rendimiento gráficos a costa de perder la posibilidad de cancelar la representación y dibujar objetos espaciales incrementalmente. Si no esta marcada, se puede establecer el *Número de objetos espaciales a dibujar antes de actualizar la visualización*, de lo contrario esta opción está inactiva.
- *Usar cacheado de representación cuando sea posible para acelerar redibujados*

8.4 Mediciones

Las mediciones funcionan en sistemas de coordenadas proyectadas (por ejemplo, UTM) y en datos sin proyectar. Si el mapa cargado está definido con un sistema de coordenadas geográficas (latitud/longitud), los resultados de las mediciones de lineas o áreas serán incorrectos. Para solucionar esto, se debe establecer un sistema de coordenadas del mapa apropiado (ver sección :ref:'label_projections). Todos los módulos de medición también usan la configuración de autoensamblado del módulo de digitalización. Esto es útil si se quiere medir a lo largo de lineas o áreas en una capa vectorial.

Para seleccionar una herramienta de medición, pulsar y seleccione la herramienta que se quiera usar.

8.4.1 Medir longitud, áreas y ángulos

Medir línea: En QGIS es posible medir distancias reales entre puntos dados conforme a un elipsoide definido. Para configurar esto, seleccione la opción de menú *Configuración* → *Opciones*, haga clic en la pestaña *Herramientas del mapa* y seleccione el elipsoide apropiado. Ahí también puede definir un color de la banda de medida y las unidades de medida (metros o pies) y de ángulos preferidas (grados, radianes, grados centesimales). La herramienta entonces le permite hacer clic en puntos del mapa. La longitud de cada segmento, así como el total, aparecerán en la ventana de medición. Para detener la medición, pulsar el botón derecho del ratón.

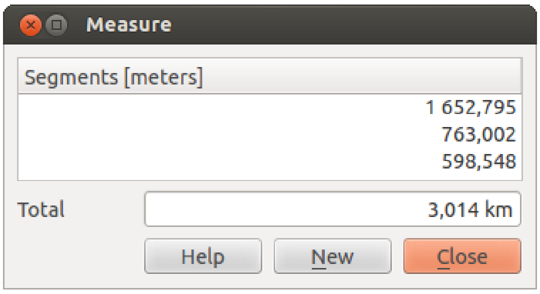

Figura 8.2: Medir distancia (Gnome)

Medir áreas: Las áreas también pueden ser medidas. En la ventana de medición, aparece el tamaño del área acumulada. Además, la herramienta de medición se autoensamblará a la capa actualmente seleccionada, siempre que la capa tenga establecida una tolerancia de autoensamblado (ver sección *Setting the Snapping Tolerance and Search Radius*). Por lo tanto, si se desea medir con exactitud a lo largo de un objeto espacial lineal, o alrededor de un objeto poligonal, primero establezca su tolerancia de autoensamblado, luego seleccione la capa. Ahora, al utilizar las herramientas de medición, cada clic del ratón (dentro de la tolerancia configurada) se ajustará a esa capa.

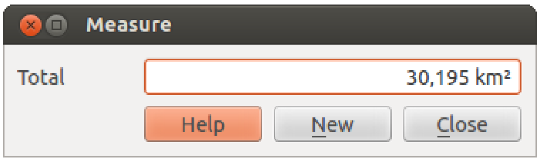

Figura 8.3: Medir área (Gnome)

Medir ángulo: Se pueden también medir ángulos. El cursor se convierte en forma de cruz. Se debe hacer clic para dibujar el primer segmento del ángulo que se desea medir y a continuación mover el cursor para dibujar el ángulo deseado. La medida se mostrará en el diálogo emergente.

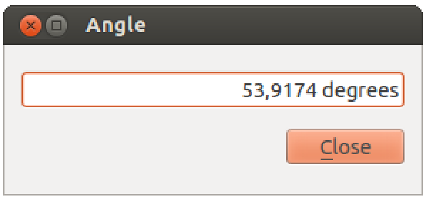

Figura 8.4: Medir ángulo (Gnome)

8.4.2 Seleccionar y deseleccionar objetos espaciales

La barra de herramientas de QGIS provee varias herramientas para seleccionar objetos espaciales en la vista del mapa. Para seleccionar una o varios objetos, basta con hacer clic en y seleccionar la herramienta:

- Seleccionar objetos espaciales individuales
- Seleccionar objetos espaciales por rectángulo
- Seleccionar objetos espaciales por polígono
- Seleccionar objetos espaciales a mano alzada
- Seleccionar objetos espaciales por radio

Para deseleccionar todos los objetos espaciales seleccionados, haga clic en Deseleccionar objetos espaciales de todas las capas.

8.5 Identificar objetos espaciales

La herramienta de identificar le permite interactuar con la vista del mapa y obtener información de los objetos espaciales en una ventana emergente. Para identificar objetos espaciales, se usa *Ver → Identificar objetos espaciales* o presionar `Ctrl + Shift + I`, o hacer clic en el icono Identificar objetos espaciales en la barra de herramientas.

Si se hace clic en varios objetos, el diálogo *Resultados de la Identificación* mostrará una lista de todos los objetos seleccionados. El primer elemento es el numero de objetos en la lista de resultados, seguido por el nombre de la capa. Luego su primer hijo será el nombre de un campo con su valor. Finalmente, toda la información de los objetos que se están mostrando.

Esta ventana puede ser personalizada para mostrar campos personalizados, pero por omisión mostrará tres tipos de información:

- Acciones: se pueden agregar acciones a la ventana para identificar objetos espaciales. Al hacer clic en la etiqueta de la acción, ésta se llevará a cabo. Por omisión, sólo se añade una acción, para ver el formulario del objeto para edición.
- Derivado: esta información se calcula o es derivada de otra información. Se puede encontrar las coordenadas pulsadas, coordendas X y Y, área y perímetro en unidades del mapa para polígonos, longitud en unidades del mapa para lineas e ID de los objetos espaciales.
- Atributos de datos: Esta es la lista de campos de atributos de los datos.

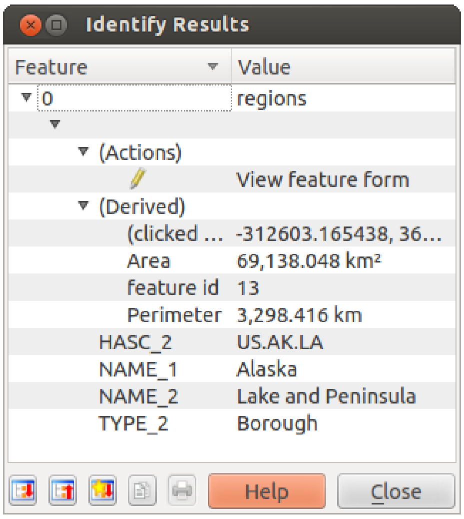

Figura 8.5: Diálogo de identificación de objetos espaciales (Gnome)

En la parte inferior de la ventana, tiene cinco iconos:

- Expandir árbol
- Comprimir árbol
- Comportamiento predeterminado
- Copiar atributos
- Imprimir respuesta del HTML seleccionado

Otras funciones se pueden encontrar en el menú contextual del elemento identificado. Por ejemplo, del menú contextual se puede:

- Ver el formulario del objeto espacial
- Zum a objeto espacial
- Copiar objeto espacial: Copiar toda la geometría y atributos del objeto espacial
- Copiar el valor del atributo: copiar solo el valor del atributo sobre el cual se hizo clic
- Copiar atributos del objeto espacial: Copiar solo atributos
- Limpiar resultados: quitar resultados de la ventana
- Limpiar resaltados: Deseleccionar los objetos espaciales en el mapa
- Resaltar todo
- Resaltar capa
- Activar capa: Elegir una capa para ser activada
- Propiedades de la capa: Abrir la ventana de propiedades de la capa.
- Expandir todo
- Colapsar todo

8.6 Elementos decorativos

Las Ilustraciones de QGIS incluyen la Cuadrícula, Etiqueta de Copyright, Flecha de Norte y Barra de Escala. Se usan para 'adornar' el mapa al agregar elementos cartográficos.

8.6.1 Cuadrícula

Cuadrícula permite agregar una rejilla de coordenadas y anotaciones a la vista del mapa.

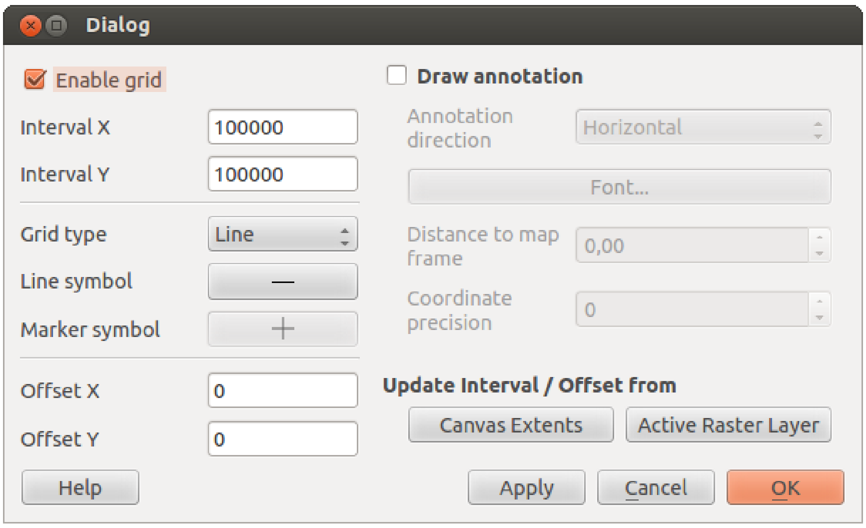

Figura 8.6: El diálogo de cuadrícula

1. Seleccione en el menú *Ver* → *Ilustraciones*→ *Cuadrícula*. Aparece el díálogo (ver figure_decorations_1).
2. Activar la casilla *Activar cuadrícula* y establecer la definición de la cuadrícula de acuerdo con las capas cargadas en la vista del mapa.

3. Activar la casilla *Dibujar anotaciones* y establecer la definición de las anotaciones de acuerdo con las capas cargadas en la vista del mapa.
4. Hacer clic en **[Aplicar]** para verificar que se vea como se esperaba.
5. Pulse **[Aceptar]** para cerrar el diálogo.

8.6.2 Etiqueta de derechos de autor

Etiqueta de copyright añade una etiqueta de copyright usando el texto que se prefiera al mapa.

Figura 8.7: Diálogo de copyright

1. Seleccione en el menú *Ver* → *Ilustraciones*→ *Etiqueta de Copyright*. Aparece el diálogo (ver figure_decorations_2).
2. Escribir el texto que se quiera colocar en el mapa. Se puede usar HTML como se muestra en el ejemplo.
3. Elegir la ubicación de la etiqueta en la lista desplegable *Ubicación*
4. Comprobar que la casilla de verificación *Activar etiqueta de copyright* este marcada.
5. Hacer clic en **[Aceptar]**

En el ejemplo anterior, que es el predeterminado, QGIS coloca un símbolo de los derechos de autor seguido de la fecha en la esquina inferior derecha de la vista del mapa.

8.6.3 Flecha del Norte

Flecha de Norte coloca una sencilla flecha de norte en la vista del mapa. En la actualidad sólo hay un estilo disponible. Se puede ajustar el ángulo de la flecha o dejar que QGIS establezca la dirección automáticamente. Si decide dejar que QGIS determine la dirección, hará su mejor conjetura en cuanto a cómo se debe orientar la flecha. Para la colocación de la flecha, se tienen cuatro opciones que corresponden a las cuatro esquinas de la vista del mapa.

8.6.4 Barra de escala

Barra de escala añade una barra de escala sencilla a la vista del mapa. Se puede controlar el estilo y la ubicación, así como el etiquetado de la barra.

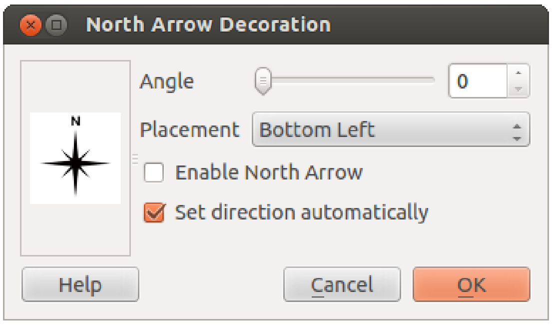

Figura 8.8: Diálogo de la flecha del Norte

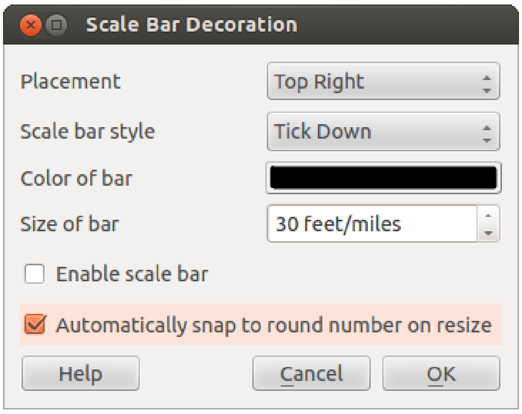

Figura 8.9: El diálogo de barra de escala

QGIS sólo es compatible con la visualización de la escala en las mismas unidades que el marco del mapa. Así que si las unidades de las capas están en metros, no se puede crear una barra de escala en pies. Del mismo modo, si está usando grados decimales, no se puede crear una barra de escala para mostrar la distancia en metros.

Para añadir una barra de escala:

1. Seleccionar del menú *Ver* → *Ilustraciones* → *Barra de escala*. Se iniciará el diálogo (ver figure_decorations_4).
2. Elegir la ubicación de la lista desplegable *Ubicación* .
3. Elegir el estilo de la caja desplegable *Estilo de la barra de escala*
4. Seleccionar el color de la barra *Color de la barra* Border color Change o usar el color negro predeterminado.
5. Establecer el tamaño de la barra y su etiqueta *Tamaño de barra* 1,00 .
6. Comprobar que la casilla de verificación *Habilitar barra de escala* esté marcada.
7. Opcionalmente, comprobar *Redondear números automáticamente al cambiar de tamaño*.
8. Hacer clic en **[Aceptar]**

Truco: Configuración de elementos decorativos

Al guardar un proyecto `.qgs`, cualquiera de los cambios que se hayan hecho a la cuadrícula, flecha de norte, barra de escala y copyright se guardarán en el proyecto y se restaurán la próxima vez que cargue el proyecto.

8.7 Herramientas de anotaciones

La herramienta Anotación de texto en la barra de herramientas de atributos provee la posibilidad de colocar texto con formato en un globo en la vista del mapa de QGIS. Usando la herramienta *Anotación de texto* haga clic en la vista del mapa.

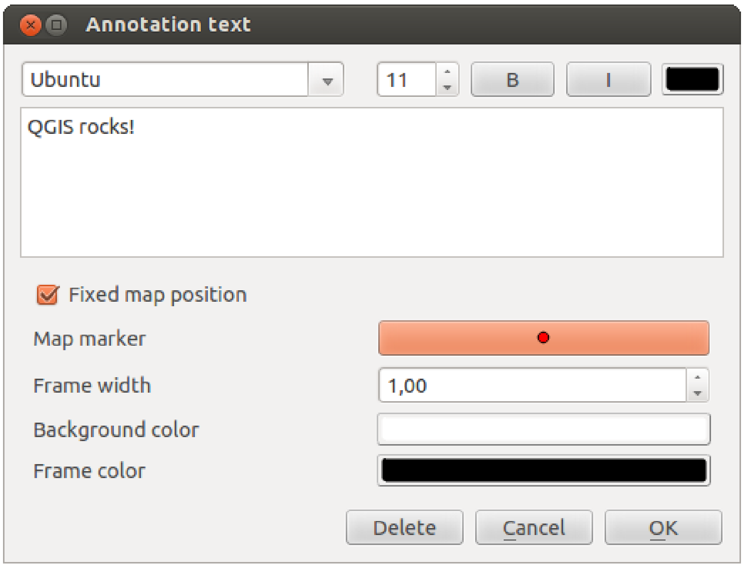

Figura 8.10: Diálogo de texto de anotación

Haciendo doble clic sobre el elemento se abre un cuadro de diálogo con varias opciones. Hay un editor de texto para escribir el texto con formato y otros ajustes de elementos. Por ejemplo, existe la opción de tener el elemento colocado en una posición del mapa (mostrado por el símbolo del marcador) o tener el elemento en una posición de la pantalla (no relacionado con el mapa). El elemento se puede mover por la posición del mapa (al arrastrar el marcador del mapa) o moviendo solo el globo. Los iconos son parte del tema de los SIG, y se utilizan de forma predeterminada en otros temas también.

La herramienta Mover anotación permite mover la anotación en la vista del mapa.

8.7.1 Anotaciones HTML

La herramienta Anotación HTML de la barra de herramientas de atributos provee la posibilidad de colocar el contenido de un archivo HTML en un globo en la vista del mapa de QGIS. Utilizando la herramienta *Anotación HTML*, haga clic en la vista del mapa y agregue la ruta de acceso al archivo HTML en el diálogo.

8.7.2 Anotaciones SVG

La herramienta Anotación SVG de la barra de herramientas de atributos provee la posibilidad para colocar un símbolo SVG en un globo en la vista del mapa de QGIS. Utilizando la herramienta *Anotación SVG*, haga clic en la vista del mapa y añada la ruta de acceso al archivo SVG en el diálogo.

8.7.3 Anotaciones de formulario

Además, puede crear sus propios formularios de anotaciones. La herramienta Formulario de anotaciones es util para mostrar los atributos de una capa vectorial en un formulario Qt Designer personalizado (ver figure_custom_annotation). Esto es similar al diseñador de formularios para la herramienta *Identificar objetos espaciales*, pero mostrado en un elemento de la anotación. Ver también el video https://www.youtube.com/watch?v=0pDBuSbQ02o de Tim Sutton para más información.

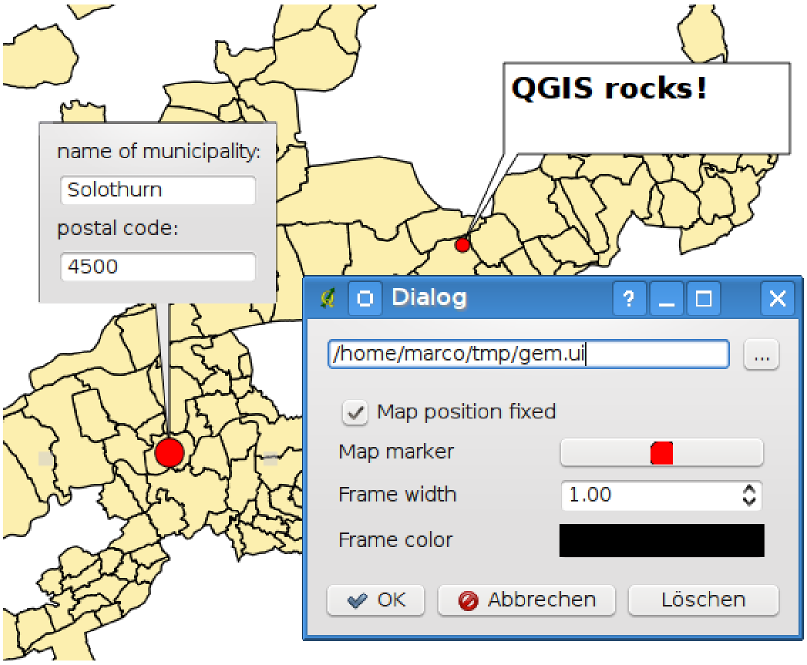

Figura 8.11: Formulario de anotación de diseñador qt personalizado

Nota: Si presiona `Ctrl+T` mientras está activa una herramienta *Anotación* (mover anotación, anotación de texto, anotación de formulario), se invierten los estados de visibilidad de los elementos.

8.8 Marcadores espaciales

Los marcadores espaciales le permiten "marcar" una localización geográfica y volver a ella más tarde.

8.8.1 Crear un marcador

Para crear un marcador:

1. Hacer zoom o desplazarse al área de interés.
2. Seleccione la opción de menú *Ver* → *Nuevo marcador* o presione `Ctrl-B`.
3. Introduzca un nombre descriptivo para el marcador (hasta 255 caracteres).
4. Presione `Añadir` para añadir el marcador o **[Borrar]** para eliminarlo.

Tenga en cuenta que puede tener múltiples marcadores con el mismo nombre.

8.8.2 Trabajar con marcadores

Para usar o administrar marcadores, seleccionar la opción de menú *Ver* → *Mostrar marcadores*. El cuadro de diálogo *Marcadores geoespaciales* permite hacer zum a un marcador o eliminarlo. No se pueden editar el nombre o las coordenadas del marcador.

8.8.3 Hacer zoom a un marcador

En el diálogo *Marcadores geoespaciales*, seleccione el marcador deseado haciendo clic en él y luego en **[Zum a]**. También puede hacer zum a un marcador haciendo doble clic en él.

8.8.4 Borrar un marcador

Para eliminar un marcador del cuadro de diálogo *Marcadores geospaciales*, hacer clic sobre él, después hacer clic en **[Eliminar]**. Confirmar la elección pulsando **[Si]**, o cancelar la eliminación pulsando **[No]**.

8.9 Anidar proyectos

Si se quiere incluir contenido de otros proyectos en un proyecto, se puede elegir *Capa* → *Empotrar capas y grupos*.

8.9.1 Empotrar capas

El siguiente cuadro de diálogo le permite incluir capas de otros proyectos. Aquí un pequeño ejemplo:

1. Presione ... para buscar otro proyecto del conjunto de datos de Alaska.
2. Seleccionar el archivo de proyecto `grassland`. Puede ver el contenido del proyecto (ver figure_embed_dialog).
3. Presionar `Ctrl` y hacer clic sobre las capas file:*grassland* y `regions`. Presionar **[OK]**. Ahora la capa seleccionada está incrustada en la leyenda del mapa y la vista del mapa.

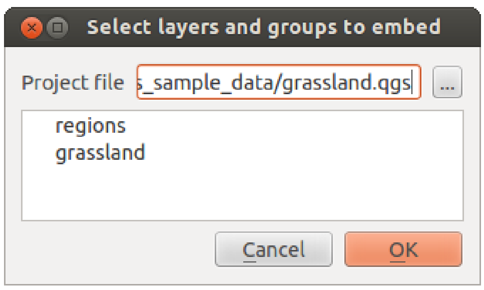

Figura 8.12: Seleccionar capas y grupos para empotrar

Si bien las capas incrustadas son editables, no se pueden cambiar sus propiedades como estilo y etiquetado.

8.9.2 Eliminar capas incrustadas

Clic derecho en la capa empotrada y elegir Eliminar.

.

CAPÍTULO 9

Configuración QGIS

QGIS es altamente configurable a través del menú *Configuración*. Elegir entre Paneles, Barras de herramientas, Propiedades del proyecto, Opciones y Personalización.

9.1 Paneles y Barras de Herramientas

En el menú *Paneles→*, puede encender o apagar los widgets de QGIS. El menú *Barra de herramientas→* proporciona la posibilidad para encender y apagar grupos de iconos en la barra de herramientas (ver figure_panels_toolbars).

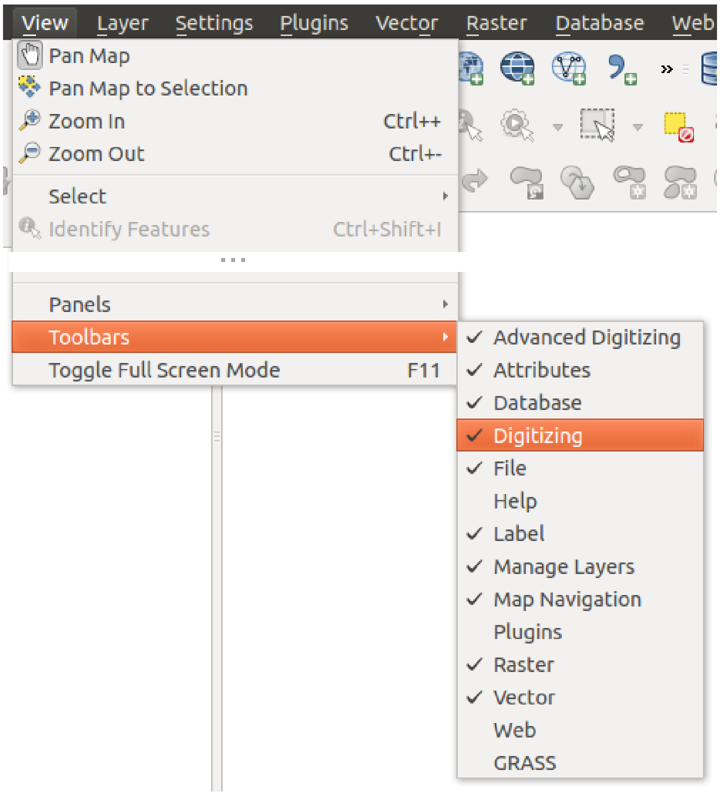

Figura 9.1: El menú de paneles y barras de herramientas

Truco: Activar la información general de QGIS

En QGIS, puede usar un panel de vista general que proporciona una vista completa de las capas añadidas. Se puede seleccionar en el menú *Configuración* → *Paneles* o *Ver* → *Paneles*. Dentro de la vista un rectangulo mostrará la vista del mapa actual. Esto le permite determinar rápidamente que área del mapa se ve actualmente.

Tenga en cuenta que las etiquetas no son representadas en la vista general del mapa incluso si las capas en la vista general del mapa se ha establecido el etiquetado. Al hacer clic y arrastrar el rectángulo rojo en la vista general se muestra la extensión actual, la vista principal del mapa se actualizará en consecuencia.

Truco: Mostrar el registro de mensajes

Es posible seguir los mensajes de QGIS. Puede activar *Registro de mensajes* en el menú *Configuración→ Paneles* o *Ver → Paneles* y seguir los mensajes que aparecen en las diferentes pestañas durante la carga y funcionamiento.

9.2 Propiedades del proyecto

In the properties window for the project under *Settings → Project Properties* or *Project → Project Properties*, you can set project-specific options. These include:

- En le menú *General*, el título del proyecto, color de selección y fondo, unidades de la capa, la precisión y la opción de guardar rutas relativas a las capas se pueden definir. Si la trasformación SRC esta activada, se puede elegir un elipsoide para cálculos de distancia. Se pueden definir las unidades del lienzo(sólo se utiliza cuando la transformación SRC está desactivada) y la precisión de decimales se utiliza. También puede definir una lista de la escala del proyecto, que anula las escalas predefinidas globales.
- El menú *SRC* habilitado para elegir el Sistema de Referencia de Coordenadas para este proyecto, y para habilitar la reproyección al vuelo de capas ráster y vector cuando se muestran capas de un diferente SRC.
- Con el tercer menú *Identificar capas*, se establece (o deshabilitar) las capas que responderán a la herramienta de identificar objetos espaciales (ver el párrafo de "Herramientas del mapa" de la sección *Opciones* para permitir la identificación de múltiples capas)
- The *Default Styles* menu lets you control how new layers will be drawn when they do not have an existing `.qml` style defined. You can also set the default transparency level for new layers and whether symbols should have random colours assigned to them.
- La pestaña de *Servidor OWS* le permite definir información acerca del QGIS servidor WMS y capacidades WFS, extensión y restricciones SRC.
- El menú *Macros* es utilizado para editar macros de Python para proyectos. Actualmente, solo tres macros están disponibles: `openProject()`, `saveProject()` and `closeProject()`.
- El menú *Relaciones* es utilizado para definir relaciones 1:n. Las relaciones están definidas en el diálogo de propiedades del proyecto. Una vez que existen las relaciones de una capa, un nuevo elemento de la interfaz de usuario en la vista del formulario (por ejemplo al identificar un elemento espacial y abrir el formulario) mostrará una lista de las entidades relacionadas. Este proporciona un poderosa forma para expresar, por ejemplo la inspección de la longitud de una tubería o el segmento de carretera. Se puede encontrar más información acerca de relaciones 1:n y soporte en la sección *Creating one to many relations*.

9.3 Opciones

Algunas opciones básicas de QGIS se pueden seleccionar utilizando el diálogo *Opciones*. Seleccione la opción del menú *Configuración →* *Opciones*. Las pestañas donde puede personalizar las opciones están descritas a continuación.

9.3.1 Menú General

Aplicación

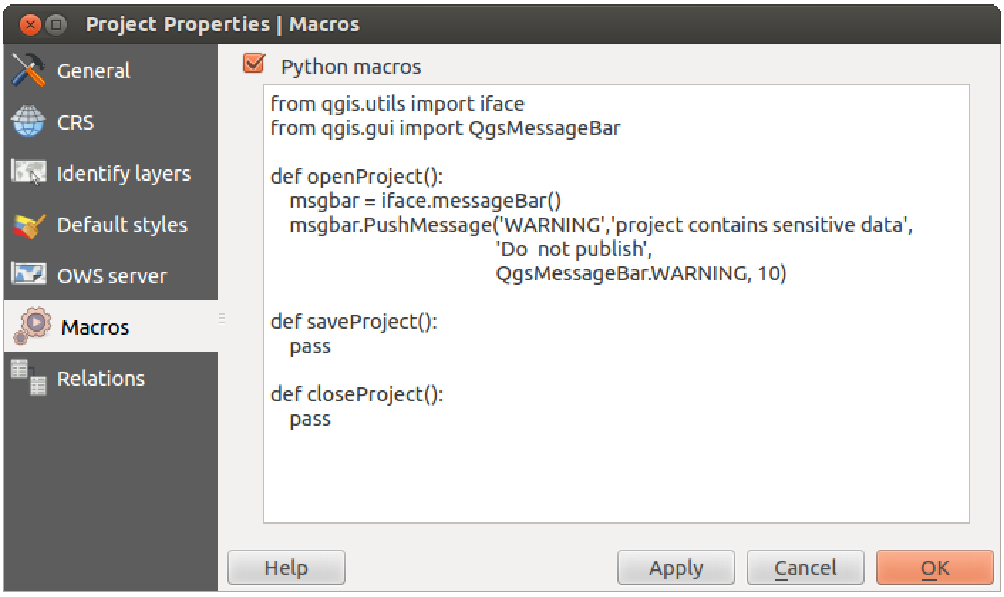

Figura 9.2: Ajustes de la Macro en QGIS

- Seleccione el *Estilo (QGIS requiere reiniciar)* y elija entre 'Oxygen','Windows','Motif','CDE', 'Plastique' and 'Cleanlooks' ().
- Definir el *Tema de icono* . Actualmente solo 'predeterminado' es posible.
- Definir el *Tamaño del icono* .
- Definir la *Fuente*. Elegir entre *Qt default* y una fuente definida por el usuario.
- Cambiar el *Límite de tiempo para mensajes o diálogos con tiempo* .
- *Ocultar la pantalla de bienvenida al iniciar la aplicación*
- *Mostrar consejos al iniciar*
- *Títulos de cajas de grupos en negrita*
- *Cajas de grupo al estilo QGIS*
- *Usar diálogos de selección de color actualizados en vivo*

Los archivos de proyecto

- *Abrir proyecto on launch* (elegir entre 'Nuevo', Más reciente' y 'Específico'). Al elegir 'Específico' utilice el ... para definir un proyecto.
- *Crear nuevo proyecto desde el proyecto predeterminado*. Tiene la posibilidad de presionar *Establecer el actual proyecto como predeterminado* o sobre *Restablecer el predeterminado*. Puede navegar a través de sus archivos y definir un directorio donde se encuentra las plantillas definidas por el usuario. Esto se añadirá a *Proyecto → Nueva plantilla de formulario*. Si activa primero *Crear nuevo proyecto desde proyecto predeterminado* y entonces guarde un proyecto en l la carpeta de las plantillas de proyecto.
- *Solicitar guardar proyectos y fuentes de datos modificadas cuando sea necesario*
- *Avisar cuando se abra un proyecto guardado con una versión anterior de QGIS*
- *Habilitar macros* . Esta opción fue creada para manejar macros que estén escritos para llevar una acción en los eventos del proyecto. Puede elegir entre 'Nunca', 'Preguntar', 'Sólo para esta sesión' y 'Siempre

(no recomendado)’.

9.3.2 Menú Sistema

Entorno

Variables de entorno del sistema ahora se puede ver, y muchos lo configuran en el grupo **Entorno** (ver figure_environment_variables). Esto es útil para las plataformas, como Mac, donde una aplicación GUI no heredan necesariamente entorno del casco del usuario. También es útil para configurar y visualizar las variables de entorno para los conjuntos de herramientas externas controladas por la caja de herramientas de procesamiento (por ejemplo, SAGA, GRASS), y para activar la salida de depuración para secciones específicas del código fuente.

- *Utilizar variables personalizadas (requiere reiniciar - incluir separadores)*. Puede **[Añadir]** y **[Borrar]** variables. Las variables de entorno ya definidas se muestran en *Variables de entorno actuales*, y es posible filtrarlos activando *Mostrar sólo variables de QGIS específicas*.

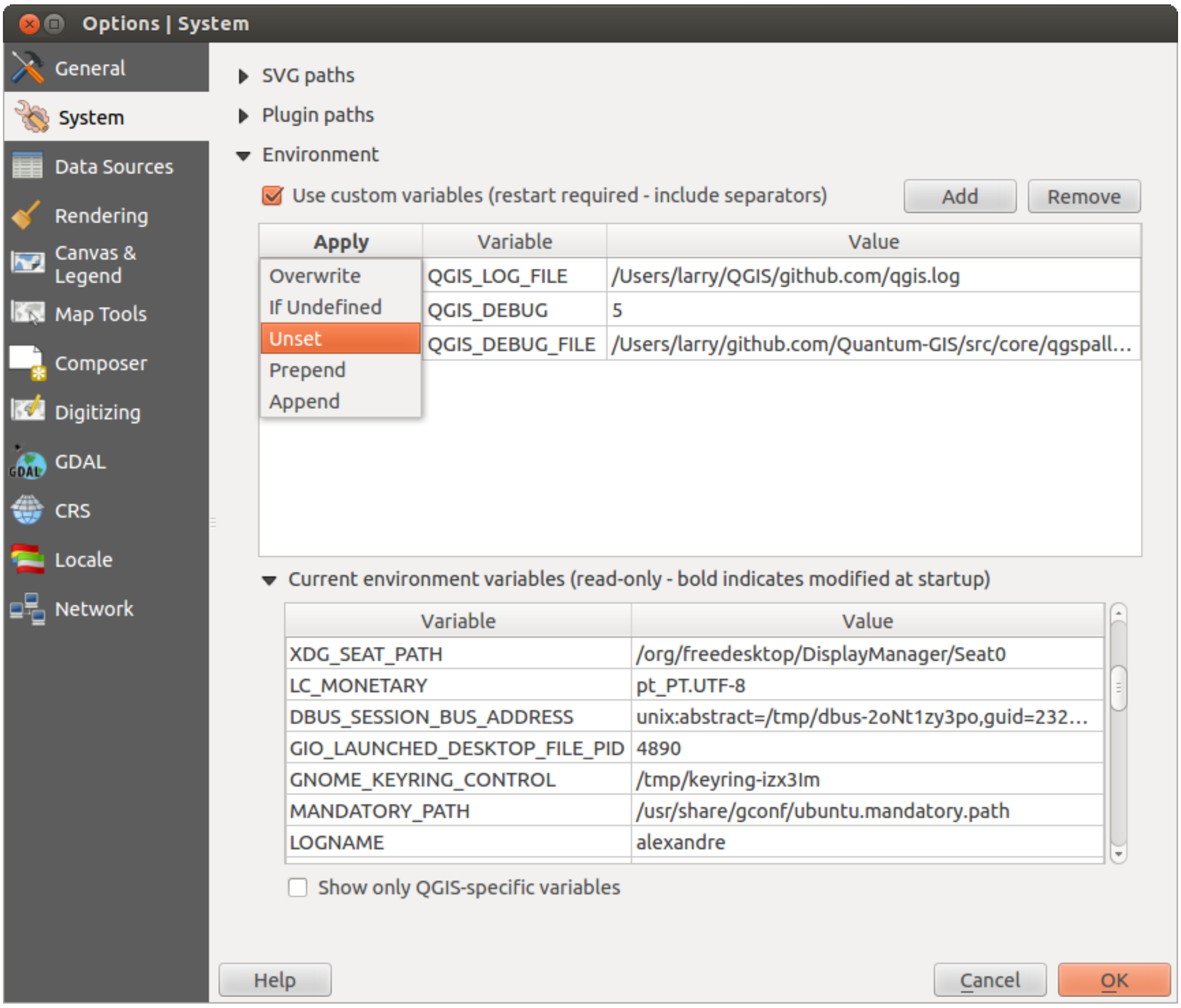

Figura 9.3: Variables de entorno del sistema en QGIS

Rutas de complemento

[Añadir] o **[Borrar]** *Ruta(s) para buscar librerías de componentes en C++ adicionales*

9.3.3 Menú Fuente de datos

Atributos de entidades espaciales y tabla

- *Abrir tabla de atributos en la ventana adosada (requiere reiniciar QGIS)*
- *Copiar geometría en WKT representación de la tabla de atributos*. Al utilizar :sup:‘ Copiar las filas seleccionadas al portapapeles‘ desde el diálogo *Tabla de atributos*, este tiene el resultado que las coordenadas de los puntos o vértices también se copian en el portapapeles.
- *Funcionamiento de la tabla de atributos* . Hay tres posibilidades: ‘Mostrar todos los objetos espaciales’, ‘Mostrar objetos seleccionados’ y ‘Mostrar objetos espaciales visibles en el mapa’.
- *Caché de registro de tabla de atributos* 1,00. Esta fila en caché hace posible guardar la última carga de N filas de atributos de modo que el trabajo con la tabla de atributos será más rápido. El caché se borrará cuando cierre la tabla de atributos.
- *Representación de valores NULOS*. Aquí, puede definir un valor para los datos de campos que tienen un valor NULO.

Manejo de fuente de datos

- *Buscar elementos válidos en el dock del explorador* . Puede elegir entre ‘Comprobar extensión’ y ‘Comprobar contenido de archivo’.
- *Analizar en busca de contenido de archivos comprimidos (zip) en navegador base* . ‘No’, ‘Exploración básica’ y ‘Exploración completa’ son posibles.
- *Solicitar subcapas raster al abrir*. Algunas subcapas raster soportadas — se les llama subdataset en GDAL. Un ejemplo son los archivos netCDF — si hay muchos variables netCDF, GDAL ve cada variable como un subconjunto de datos. La opción le permite controlar cómo lidiar con subcapas cuando se abre un archivo con subcapas. Dispone de las siguientes opciones:
  - ‘Siempre’: Siempre preguntar (Si hay subcapas existentes)
  - ‘Si es necesario’: Preguntar si la capa no tiene bandas, pero tiene subcapas
  - ‘Nunca’: Nunca preguntar, no se cargará nada
  - ‘Cargar todo’: Nunca preguntar, pero cargar todas las subcapas
- *Ignorar la declaración de codificación del archivo shape*. Si el archivo shape tiene información de codificación, Este será ignorado por QGIS.
- *Añadir capas PostGIS con doble clic y seleccionar en modo extendido*
- *Añadir capas de Oracle con doble clic y seleccionar en modo extendido*

9.3.4 Menú representación

Comportamiento de presentación

- *Por defecto las nuevas capas añadidas al mapa se deben mostrar*
- *Enable back buffer*
- *Utilizar el cacheo de presentación en lo posible a la velocidad de regeneración*
- *Habilitar simplificación de objetos espaciales por defecto a las nuevas capas añadidas*
- *Simplifique el lado del proveedor si es posible*

Calidad de representación

- *Hacer que las líneas se muestren menos quebradas a expensas del rendimiento de la representación*
- *Fix problems with incorrectly filled polygons*

Rásters

- Con *Selección de la banda RGB*, puede definir el numero para la banda Roja, Verde y Azul.

Contrast enhancement

- *Unibanda gris* . Una sola banda de gris puede tener 'Sin realce', 'Estirar a MinMax', 'Estirar y cortar a MinMax' y también 'Cortar a MinMax'.
- *Color de multibanda (byte/band)* . Las opciones son 'Sin realce', 'Estirar a MinMax', 'Estirar y cortar a MinMax' y 'Cortar a MinMax'.
- *Color de multibanda (>byte/band)* . Las opciones son 'No realce', 'Estirar a MinMax', 'Estirar y cortar a MinMax' y 'Cortar a MinMax'.
- *Límites (mínimo/máximo)* . Las opciones son 'Corte del conteo acumulativo', 'Min/Máx', 'Media +/- desviación estándar'.
- *Límite para corte del conteo acumulativo de píxeles*
- *Multiplicador de la desviación estándar*

Depuración

- *Refrescar lienzo de mapa*

9.3.5 Menú Vista del mapa y leyenda

Apariencia del mapa predeterminado (anulado por las propiedades del proyecto)

- Definir un *Color de selección* y un *Color de fondo*.

Leyenda de capa

- *Acción doble clic en la leyenda* . Puede 'Abrir las propiedades de la capa' o 'Abrir la tabla de atributos' con el doble clic.
- Lo siguiente es posible *Estilos de elementos de la leyenda*:
  - *Comenzar el nombre de las capas con mayúsculas*
  - *Poner en negrita los nombres de la capa*
  - *Poner en negrita los nombres de grupo*
  - *Mostrar nombres de atributos de clasificación*
  - *Crear iconos de ráster (puede ser lento)*
  - *Añadir nuevas capas al grupo seleccionado o al actual*

9.3.6 Menú Herramientas de mapa

Identify

- *Open identify results in a dock window (QGIS restart required)*

- The *Mode* setting determines which layers will be shown by the Identify tool. By switching to 'Top down' or 'Top down, stop at first' instead of 'Current layer', attributes for all identifiable layers will be shown with the Identify tool. In QGIS 2.2. you can now use a 'Layer selection' option so that you can choose with the left-mouse menu which layer you want to identify (see the "Project properties" section under *Proyectos* to set which layers are identifiable).
- *Open feature form, if a single feature is identified*
- Define *Search radius for identifying and displaying map tips as a percentage of the map width*

Herramienta de medición

- Definir *Color de la banda de medida* para herramienta de medida
- Definir *Lugares decimales*
- *Mantener unidad base*
- *Unidades de medida preferidas* ('Metros', 'Pies', 'Millas náuticas' o 'Grados')'
- *Unidades de ángulos preferidas* ('Grados', 'Radianes' o 'Grados centecimales')

Mover y zum

- Definir *Acción de la rueda del ratón* ('Zum', 'Zum y centrar', 'Zoom al cursor del ratón', 'Nada')
- Definir *Factor de zum* para la rueda del ratón

Escalas predefinidas

Aquí, encontrará una liste de escalas predefinidas. Con los botones **[+]** y **[-]** puede añadir o eliminar las escalas individuales.

9.3.7 Menú Diseñador

Predeterminados de la composición

Puede definir la fuente *Predeterminado* aquí.

Apariencia de la cuadrícula

- Definir el *Estilo de cuadrícula* ('Sólido, 'Puntos', 'Cruces')
- Definir el *Color...*

Cuadrícula predeterminada

- Definir la *Separación* 1,00
- Definir el *Desplazamiento de cuadrícula* 1,00 para x y y
- Definir la *Tolerancia de Ajuste* 1,00

Guía predeterminada

- Definir la *Tolerancia de Ajuste* 1,00

9.3.8 Menú Digitalización

Creación de entidades espaciales

- *Suprimir formulario emergente de atributos después de crear objetos espaciales*
- *Reutilizar últimos valores de atributos introducidos*

- *Validar geometrías*. Editar lineas y polígonos complejos con muchos nodos puede resultar a una representación muy lenta. Esto se debe a los procesos de validación por defecto en QGIS puede tomar mucho tiempo. Para acelerar la representación, es posible seleccionar la validación de geometría GEOS (a partir de GEOS 3.3) o a pagarlo. La validación de geometría GEOS es mucho más rápido, pero la desventaja es que sólo el primer problema de geometría será reportado.

Banda de medición

- Definir banda elástica *Ancho de línea* y *Color de línea*

Autoensamblado

- *Abrir opciones de autoensamblado en una ventana adosada(requiere reiniciar QGIS)*
- Definir *Modo de autoensamblado por omisión* (‘A vértice’, ‘A segmento’, ‘A vértice y segmento’, ‘Desconectado’)
- Definir *Tolerancia de autoensamblado predeterminado* en unidades de mapa o píxeles
- Definir el *Radio de búsqueda para edición de vértices* en unidades de mapa o píxeles

Marcar vértices

- *Mostrar marcadores sólo para los objetos espaciales seleccionados*
- Definir vértice *Estilo de marcador* (‘Cruz’ (predeterminado), ‘Círculo semitransparente’ o ‘Nada’)
- Definir vértice *Tamaño de marcador*

Herramienta de desplazamiento de curva

Las siguientes 3 opciones se refieren a la herramienta Desplazar curva en *Advanced digitizing*. A través de las diversas configuraciones, es posible influir en la forma del desplazamiento de la línea. Estas opciones son posibles a partir de GEOS 3.3.

- *Estilo de la unión*
- *Segmentos del cuadrante*
- *Límite Miter*

9.3.9 Menú GDAL

GDAL es una biblioteca de intercambio de datos para archivos ráster. Es esta pestaña, puede *Editar opciones de creación* y *Editar opciones de pirámides* de los formatos ráster. Definir que controlador GDAL se va a utilizar para un formato ráster, como en algunos casos más de un controlador está disponible.

9.3.10 Menú SRC

SRC predeterminado para nuevos proyectos

- *No habilitar la reproyección ‘al vuelo’*
- *Habilitar automáticamente la reproyección al vuelo si las capas tienen un SRC diferente*
- *Activar reproyección al vuelo por defecto*
- Seleccionar un SRC y *Empezar siempre nuevos proyectos con este SRC*

SRC para nuevas capas

Esta área permite definir la acción a realizar cuando una nueva capa es creada, o cuando una capa sin SRC es cargada.

- *Solicitar SRC*

- *Usar SRC del proyecto*
- *Usar SRC por omisión mostrado abajo*

Por defecto transformación de datum

- *Preguntar por la trasformación del datum cuando el predeterminado no este definido*
- Si ha trabajado con la trasformación de SRC 'al vuelo' puede ver el resultado de la transformación en la ventana de abajo. Puede encontrar información acerca de 'Origen SRC' y 'Destino SRC' así como también 'Transformación de datum de origen' y 'Trasformación de datum destino'.

9.3.11 Menú Idioma

- *Ignorar el idioma del sistema* y *Idioma a usar en su lugar*
- Información acerca del idioma del sistema

9.3.12 Menú Red

General

- Definir *Dirección de búsqueda de WMS*, por omisión es `http://geopole.org/wms/search?search=\%1\&type=`
- Definir *Expiró el tiempo para solicitudes de red* - por omisión 60000
- Definir *Periodo de expiración predeterminada para teselas WMS-C/WMTS (en horas)* - por omisión 24
- Definir *Reintentar al máximo en caso de errores en la solicitud de tile*
- Definir *Agente- Usuario*

Configuración de caché

Definir la configuración del caché *Directorio* y un *Tamaño*.

- *Usar proxy para acceso web* y definir 'Servidor', 'Puerto', 'Usuario', y 'Contraseña'.
- Establecer el *Tipo de proxy* de acuerdo a sus necesidades.
  - *Default Proxy*: Proxy se determina con base en el proxy de aplicación que establece el uso
  - *Socks5Proxy*: Proxy genérico para cualquier tipo de conexión. Soporta TCP, UDP, unión a un puerto (conexiones entrantes) y autenticación.
  - *HttpProxy*: Implementado con el comando "CONNECT", sólo admite conexiones TCP salientes; admite la autenticación.
  - *HttpCachingProxy*: Implementando el uso de comandos HTTP normales, es útil sólo en el contexto de peticiones HTTP.
  - *FtpCachingProxy*: Implementar el uso de un proxy FTP, es útil sólo en el contexto de las peticiones FTP.

Excluir algunas URLs se puede agregar a la caja de texto debajo los valores del proxy (ver Figure_Network_Tab).

Si necesita más información detallada acerca de las diferentes configuraciones de proxy, consulte el manual de documentación de la biblioteca QT en http://doc.trolltech.com/4.5/qnetworkproxy.html#ProxyType-enum.

Truco: Utilizar proxies

El uso de proxies a veces puede ser complicado. Es útil para proceder por 'prueba y error' con los tipos de proxies anteriores, comprobar para ver si en su caso tiene éxito.

Puede modificar las opciones de acuerdo a sus necesidades. Alguno de los cambios puede requerir un reinicio de QGIS antes de hacerse efectivos.

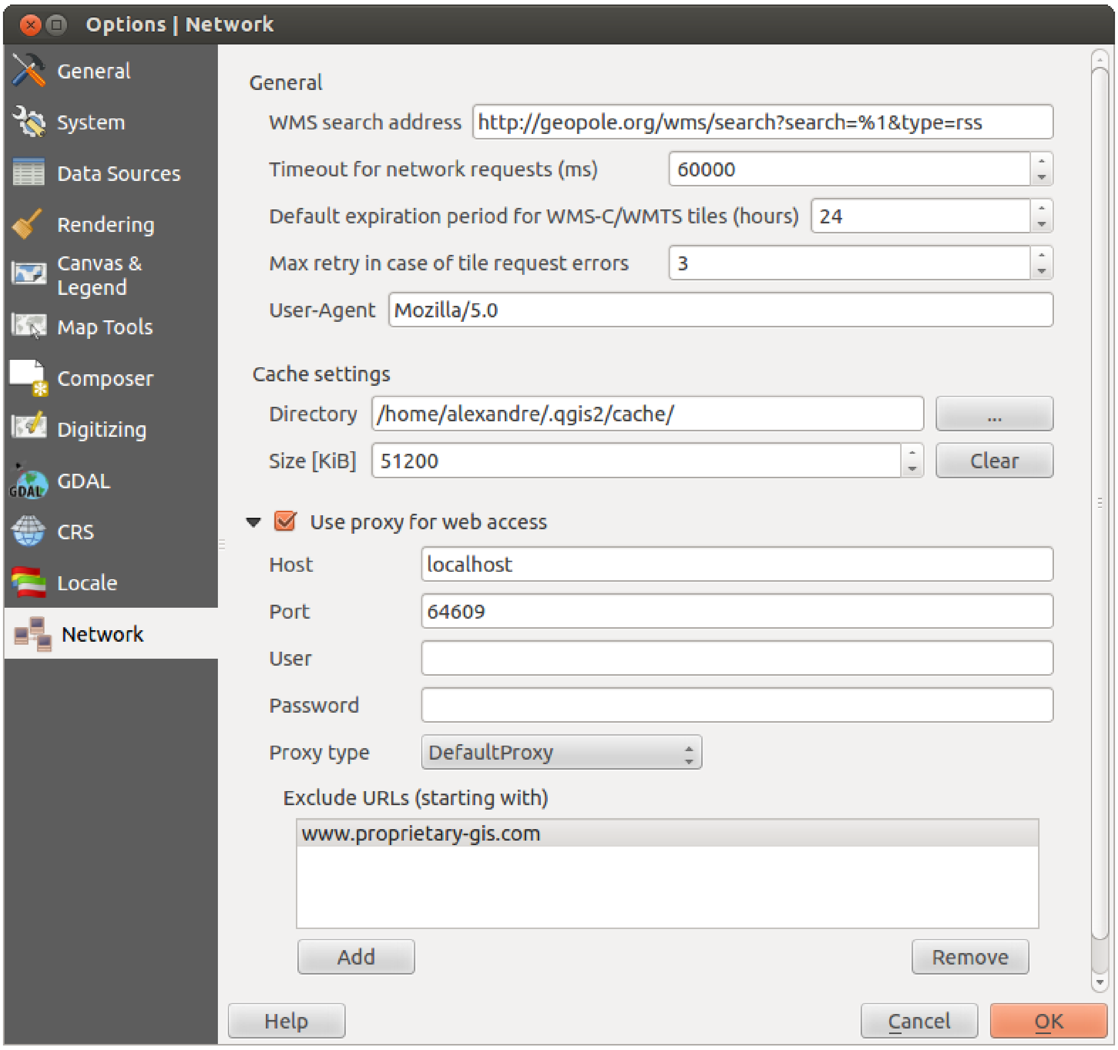

Figura 9.4: Configurar proxy en QGIS

- Settings are saved in a text file: `$HOME/.config/QGIS/qgis.conf`
- Puede encontrar sus ajustes en: `$HOME/Library/Preferences/org.qgis.qgis.plist`
- Los ajustes se almacenan bajo el registro: `HKEY\CURRENT_USER\Software\QGIS\qgis`

9.4 Personalización

Las herramientas personalizadas permite que (des)active casi todos los elementos en la interfaz de usuario de QGIS. Esto puede ser muy útil si se tienen muchos complementos instalados que nunca se utilizan y que esta llenando su pantalla.

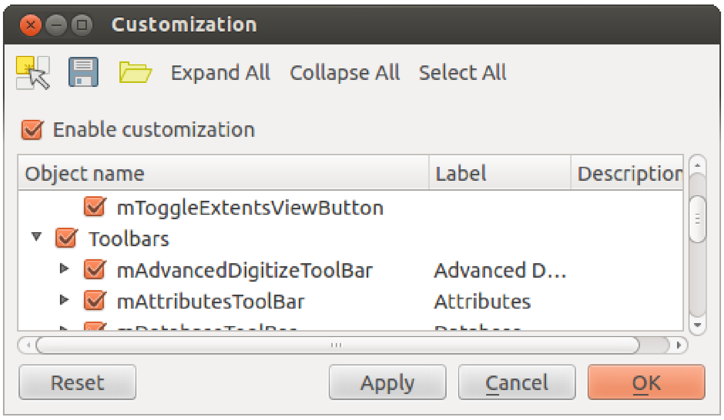

Figura 9.5: El diálogo de Personalización

La personalización de QGIS se divide en cinco grupos. En los *Menús*, puede ocultar las entradas en la barra de menú. En *Panel*, encontrar el panel de ventanas. Ventanas del panel son aplicaciones que se pueden iniciar y usar como una ventana flotante, de nivel superior o incrustados a la ventana principal de QGIS como se acopló el widget (ver también *Paneles y Barras de Herramientas*). En el *Barra de Estado*, las funciones como la información de coordenadas se puede desactivar. En *Barra de Herramientas*, puede (des)activar los iconos de la barra de QGIS, y en *Widgets*, puede (des)activar diálogos, así como sus botones.

Con Cambiar a la captura de widgets en la aplicación principal, puede hacer clic en los elementos en QGIS que desee que se oculte y busque las entradas correspondientes en la personalización (ver figure_customization). También puede guardar sus diferentes configuraciones para diferentes casos de uso. Antes de aplicar los cambios es necesario reiniciar QGIS.

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CAPÍTULO 10

Working with Projections

QGIS allows users to define a global and project-wide CRS (coordinate reference system) for layers without a pre-defined CRS. It also allows the user to define custom coordinate reference systems and supports on-the-fly (OTF) projection of vector and raster layers. All of these features allow the user to display layers with different CRSs and have them overlay properly.

10.1 Overview of Projection Support

QGIS has support for approximately 2,700 known CRSs. Definitions for each CRS are stored in a SQLite database that is installed with QGIS. Normally, you do not need to manipulate the database directly. In fact, doing so may cause projection support to fail. Custom CRSs are stored in a user database. See section *Custom Coordinate Reference System* for information on managing your custom coordinate reference systems.

The CRSs available in QGIS are based on those defined by the European Petroleum Search Group (EPSG) and the Institut Geographique National de France (IGNF) and are largely abstracted from the spatial reference tables used in GDAL. EPSG identifiers are present in the database and can be used to specify a CRS in QGIS.

In order to use OTF projection, either your data must contain information about its coordinate reference system or you will need to define a global, layer or project-wide CRS. For PostGIS layers, QGIS uses the spatial reference identifier that was specified when the layer was created. For data supported by OGR, QGIS relies on the presence of a recognized means of specifying the CRS. In the case of shapefiles, this means a file containing the well-known text (WKT) specification of the CRS. This projection file has the same base name as the shapefile and a `.prj` extension. For example, a shapefile named `alaska.shp` would have a corresponding projection file named `alaska.prj`.

Whenever you select a new CRS, the layer units will automatically be changed in the *General* tab of the *Project Properties* dialog under the *Project* (Gnome, OS X) or *Settings* (KDE, Windows) menu.

10.2 Global Projection Specification

QGIS starts each new project using the global default projection. The global default CRS is EPSG:4326 - WGS 84 (`proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs`), and it comes predefined in QGIS. This default can be changed via the **[Select...]** button in the first section, which is used to define the default coordinate reference system for new projects, as shown in figure_projection_1. This choice will be saved for use in subsequent QGIS sessions.

When you use layers that do not have a CRS, you need to define how QGIS responds to these layers. This can be done globally or project-wide in the *CRS* tab under *Settings* → *Options*.

The options shown in figure_projection_1 are:

- *Prompt for CRS*
- *Use project CRS*

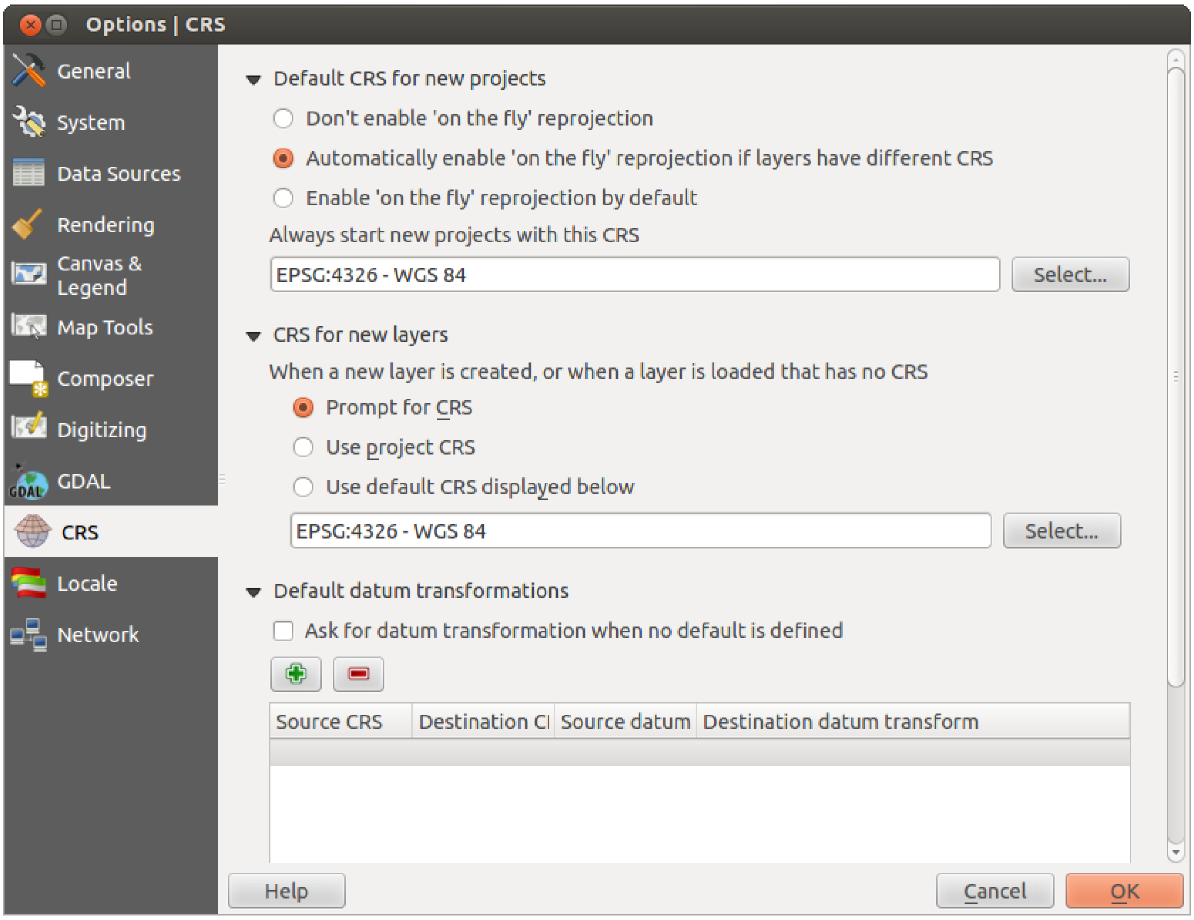

Figura 10.1: CRS tab in the QGIS Options Dialog

- *Use default CRS displayed below*

If you want to define the coordinate reference system for a certain layer without CRS information, you can also do that in the *General* tab of the raster and vector properties dialog (see *General Menu* for rasters and *General Menu* for vectors). If your layer already has a CRS defined, it will be displayed as shown in *Vector Layer Properties Dialog* .

Truco: CRS in the Map Legend

Right-clicking on a layer in the Map Legend (section *Leyenda del mapa*) provides two CRS shortcuts. *Set layer CRS* takes you directly to the Coordinate Reference System Selector dialog (see figure_projection_2). *Set project CRS from Layer* redefines the project CRS using the layer's CRS.

10.3 Define On The Fly (OTF) Reprojection

QGIS supports OTF reprojection for both raster and vector data. However, OTF is not activated by default. To use OTF projection, you must activate the *Enable on the fly CRS transformation* checkbox in the *CRS* tab of the *Project Properties* dialog.

There are three ways to do this:

1. Select *Project Properties* from the *Project* (Gnome, OSX) or *Settings* (KDE, Windows) menu.
2. Click on the CRS status icon in the lower right-hand corner of the status bar.
3. Turn OTF on by default in the *CRS* tab of the *Options* dialog by selecting *Enable 'on the fly' reprojection by default* or *Automatically enable 'on the fly' reprojection if layers have different CRS*.

If you have already loaded a layer and you want to enable OTF projection, the best practice is to open the *CRS* tab of the *Project Properties* dialog, select a CRS, and activate the *Enable 'on the fly' CRS transformation* checkbox. The CRS status icon will no longer be greyed out, and all layers will be OTF projected to the CRS shown next to the icon.

The *CRS* tab of the *Project Properties* dialog contains five important components, as shown in Figure_projection_2 and described below:

1. **Enable 'on the fly' CRS transformation** — This checkbox is used to enable or disable OTF projection. When off, each layer is drawn using the coordinates as read from the data source, and the components described below are inactive. When on, the coordinates in each layer are projected to the coordinate reference system defined for the map canvas.
2. **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.
3. **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.
4. **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.
5. **PROJ.4 text** — This is the CRS string used by the PROJ.4 projection engine. This text is read-only and provided for informational purposes.

Truco: Project Properties Dialog

If you open the *Project Properties* dialog from the *Project* menu, you must click on the *CRS* tab to view the CRS settings.

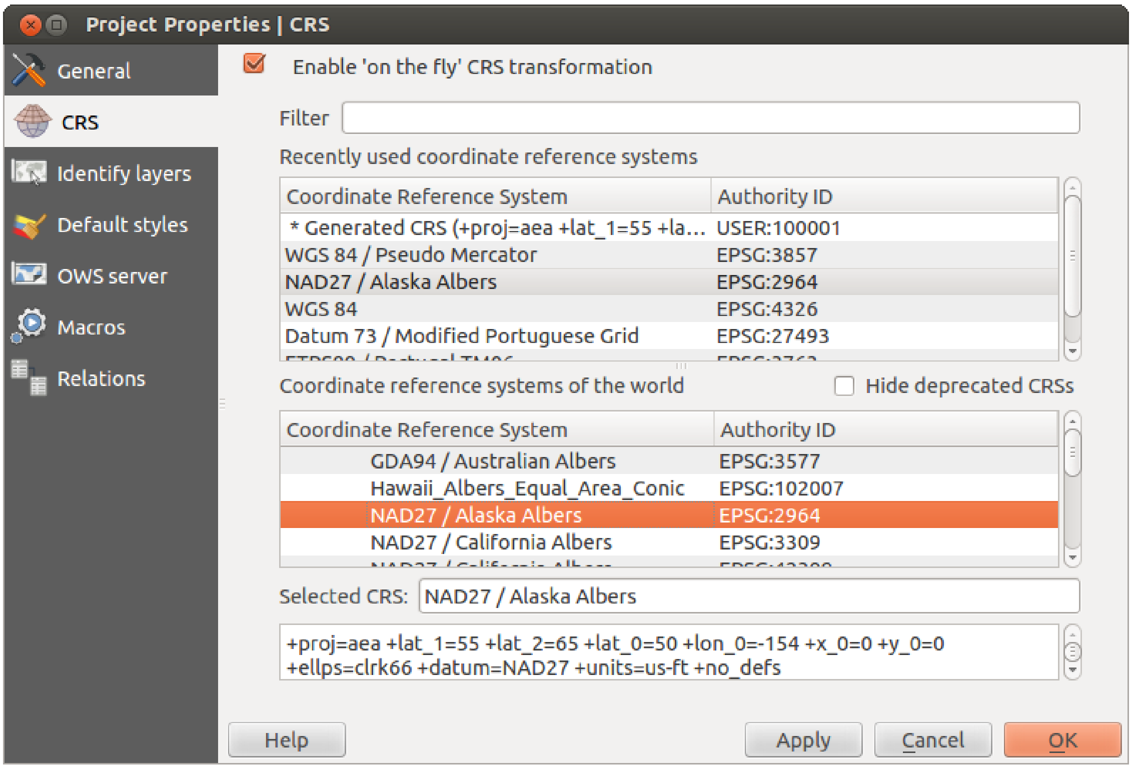

Figura 10.2: Project Properties Dialog

Opening the dialog from the CRS status icon will automatically bring the *CRS* tab to the front.

10.4 Custom Coordinate Reference System

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.4 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 ftp://ftp.remotesensing.org/proj/OF90-284.pdf).

This manual describes the use of the `proj.4` and related command line utilities. The cartographic parameters used with `proj.4` are described in the user manual and are the same as those used by QGIS.

The *Custom Coordinate Reference System Definition* dialog requires only two parameters to define a user CRS:

1. A descriptive name
2. The cartographic parameters in PROJ.4 format

To create a new CRS, click the Add new CRS button and enter a descriptive name and the CRS parameters.

Note that the *Parameters* must begin with a `+proj=` block, to represent the new coordinate reference system.

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.

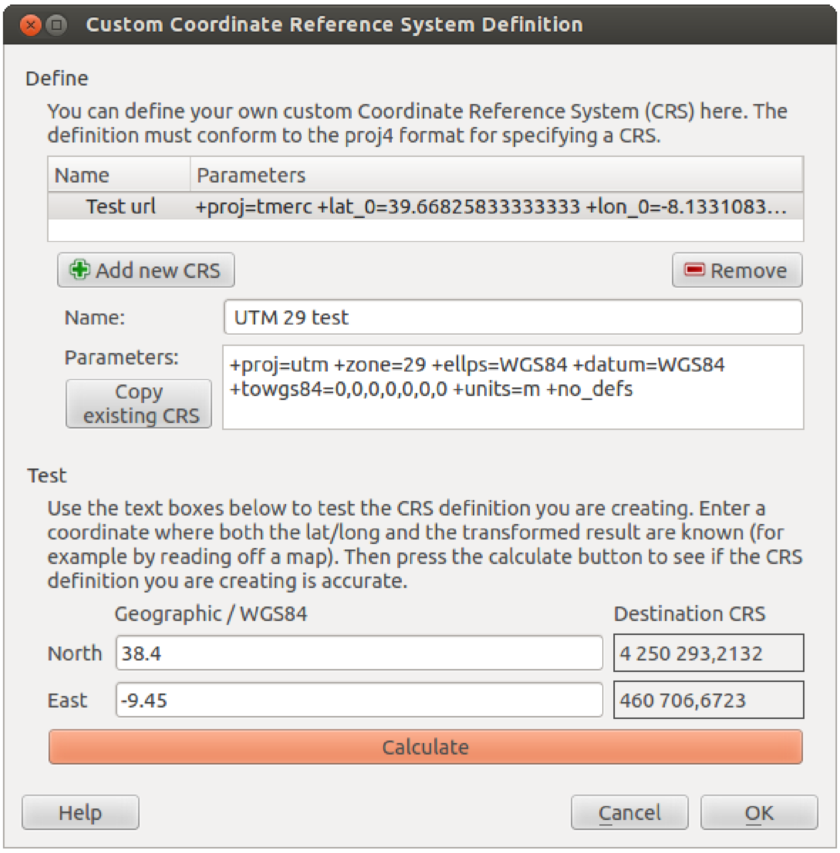

Figura 10.3: Custom CRS Dialog

10.5 Default datum transformations

OTF depends on being able to transform data into a 'default CRS', and QGIS uses WGS84. For some CRS there are a number of transforms available. QGIS allows you to define the transformation used otherwise QGIS uses a default transformation.

In the *CRS* tab under *Settings* → *Options* you can:

- set QGIS to ask you when it needs define a transformation using *Ask for datum transformation when no default is defined*
- edit a list of user defaults for transformations.

QGIS asks which transformation to use by opening a dialogue box displaying PROJ.4 text describing the source and destination transforms. Further information may be found by hovering over a transform. User defaults can be saved by selecting *Remember selection*.

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QGIS Browser

The QGIS Browser is a panel in QGIS that lets you easily navigate in your filesystem and manage geodata. You can have access to common vector files (e.g., ESRI shapefiles or MapInfo files), databases (e.g., PostGIS, Oracle, SpatiaLite or MS SQL Spatial) and WMS/WFS connections. You can also view your GRASS data (to get the data into QGIS, see *GRASS GIS Integration*).

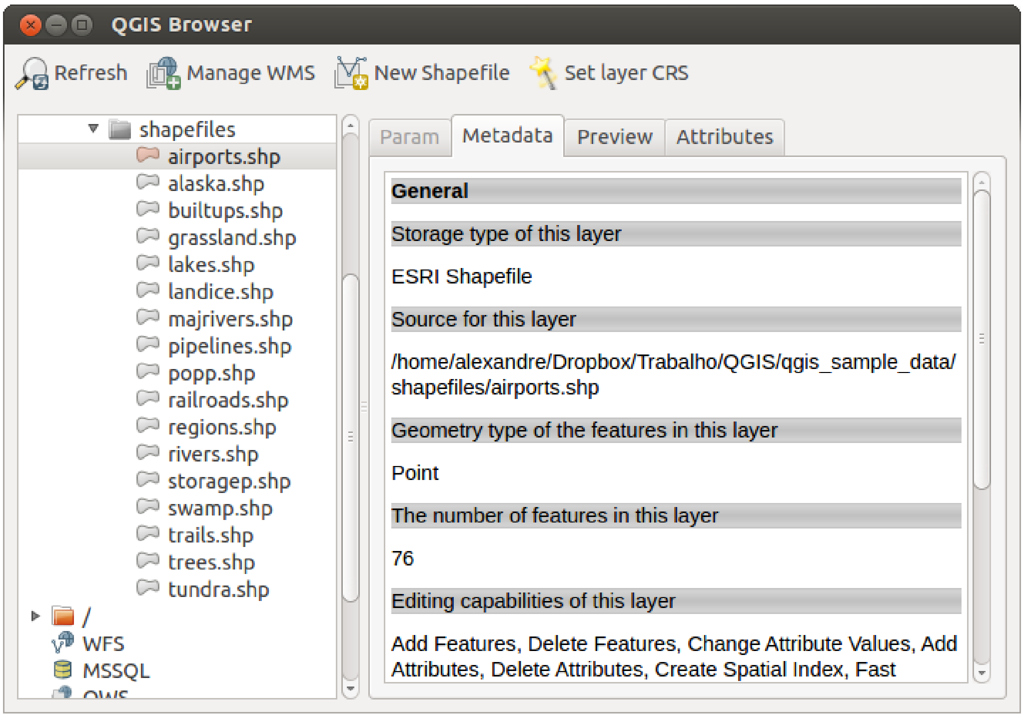

Figura 11.1: QGIS browser as a stand alone application

Use the QGIS Browser to preview your data. The drag-and-drop function makes it easy to get your data into the map view and the map legend.

1. Activate the QGIS Browser: Right-click on the toolbar and check *Browser* or select it from *Settings* → *Panels*.
2. Drag the panel into the legend window and release it.
3. Click on the *Browser* tab.
4. Browse in your filesystem and choose the `shapefile` folder from `qgis_sample_data` directory.
5. Press the `Shift` key and select the `airports.shp` and `alaska.shp` files.
6. Press the left mouse button, then drag and drop the files into the map canvas.

7. Right-click on a layer and choose *Set project CRS from layer*. For more information see *Working with Projections*.

8. Click on Zoom Full to make the layers visible.

There is a second browser available under *Settings* → *Panels*. This is handy when you need to move files or layers between locations.

1. Activate a second QGIS Browser: Right-click on the toolbar and check *Browser (2)*, or select it from *Settings* → *Panels*.

2. Drag the panel into the legend window.

3. Navigate to the *Browser (2)* tab and browse for a shapefile in your file system.

4. Select a file with the left mouse button. Now you can use the Add Selected Layers icon to add it into the current project.

QGIS automatically looks for the coordinate reference system (CRS) and zooms to the layer extent if you work in a blank QGIS project. If there are already files in your project, the file will just be added, and in the case that it has the same extent and CRS, it will be visualized. If the file has another CRS and layer extent, you must first right-click on the layer and choose *Set Project CRS from Layer*. Then choose *Zoom to Layer Extent*.

The Filter files function works on a directory level. Browse to the folder where you want to filter files and enter a search word or wildcard. The Browser will show only matching filenames – other data won't be displayed.

It's also possible to run the QGIS Browser as a stand-alone application.

Start the QGIS browser

- Type in "qbrowser" at a command prompt.
- Start the QGIS Browser using the Start menu or desktop shortcut.
- The QGIS Browser is available from your Applications folder.

In figure_browser_standalone_metadata, you can see the enhanced functionality of the stand-alone QGIS Browser. The *Param* tab provides the details of your connection-based datasets, like PostGIS or MSSQL Spatial. The *Metadata* tab contains general information about the file (see *Metadata Menu*). With the *Preview* tab, you can have a look at your files without importing them into your QGIS project. It's also possible to preview the attributes of your files in the *Attributes* tab.

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CAPÍTULO 12

Trabajar con catos vectoriales

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12.1 Supported Data Formats

QGIS uses the OGR library to read and write vector data formats, including ESRI shapefiles, MapInfo and MicroStation file formats, AutoCAD DXF, PostGIS, SpatiaLite, Oracle Spatial and MSSQL Spatial databases, and many more. GRASS vector and PostgreSQL support is supplied by native QGIS data provider plugins. Vector data can also be loaded in read mode from zip and gzip archives into QGIS. As of the date of this document, 69 vector formats are supported by the OGR library (see OGR-SOFTWARE-SUITE in *Referencias bibliográficas y web*). The complete list is available at http://www.gdal.org/ogr/ogr_formats.html.

Nota: Not all of the listed formats may work in QGIS for various reasons. For example, some require external commercial libraries, or the GDAL/OGR installation of your OS may not have been built to support the format you want to use. Only those formats that have been well tested will appear in the list of file types when loading a vector into QGIS. Other untested formats can be loaded by selecting `*.*`.

Working with GRASS vector data is described in Section *GRASS GIS Integration*.

This section describes how to work with several common formats: ESRI shapefiles, PostGIS layers, SpatiaLite layers, OpenStreetMap vectors, and Comma Separated data (CSV). Many of the features available in QGIS work the same, regardless of the vector data source. This is by design, and it includes the identify, select, labeling and attributes functions.

12.1.1 ESRI Shapefiles

The standard vector file format used in QGIS is the ESRI shapefile. Support is provided by the OGR Simple Feature Library (http://www.gdal.org/ogr/).

A shapefile actually consists of several files. The following three are required:

1. `.shp` file containing the feature geometries
2. `.dbf` file containing the attributes in dBase format
3. `.shx` index file

Shapefiles also can include a file with a `.prj` suffix, which contains the projection information. While it is very useful to have a projection file, it is not mandatory. A shapefile dataset can contain additional files. For further details, see the ESRI technical specification at http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf.

Loading a Shapefile

To load a shapefile, start QGIS and click on the Add Vector Layer toolbar button, or simply press `Ctrl+Shift+V`. This will bring up a new window (see figure_vector_1).

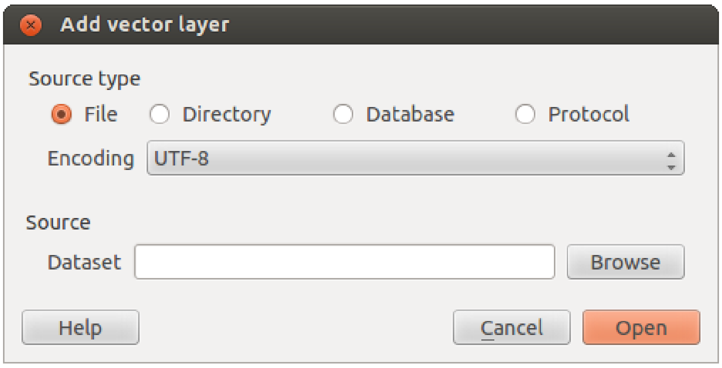

Figura 12.1: Add Vector Layer Dialog

From the available options check *File*. Click on **[Browse]**. That will bring up a standard open file dialog (see figure_vector_2), which allows you to navigate the file system and load a shapefile or other supported data source. The selection box *Filter* allows you to preselect some OGR-supported file formats.

You can also select the encoding for the shapefile if desired.

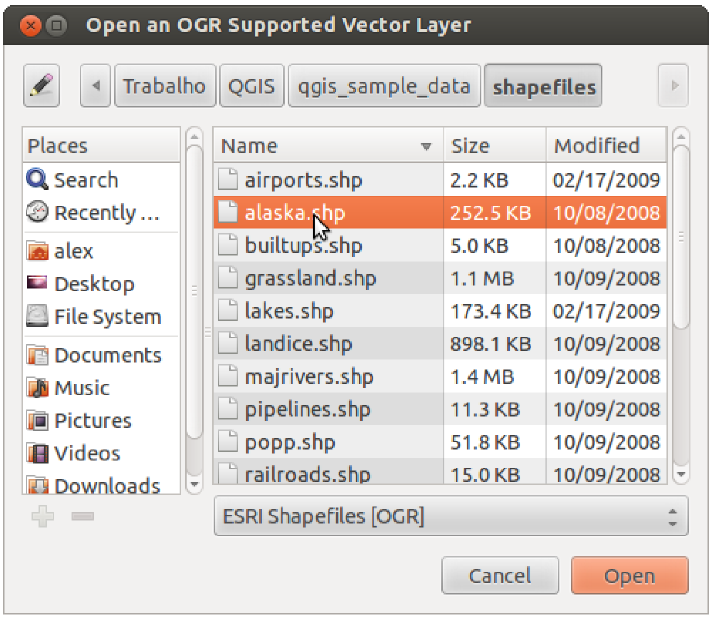

Figura 12.2: Open an OGR Supported Vector Layer Dialog

Selecting a shapefile from the list and clicking **[Open]** loads it into QGIS. Figure_vector_3 shows QGIS after loading the `alaska.shp` file.

Truco: Layer Colors

When you add a layer to the map, it is assigned a random color. When adding more than one layer at a time, different colors are assigned to each layer.

Once a shapefile is loaded, you can zoom around it using the map navigation tools. To change the style of a layer, open the *Layer Properties* dialog by double clicking on the layer name or by right-clicking on the name in the

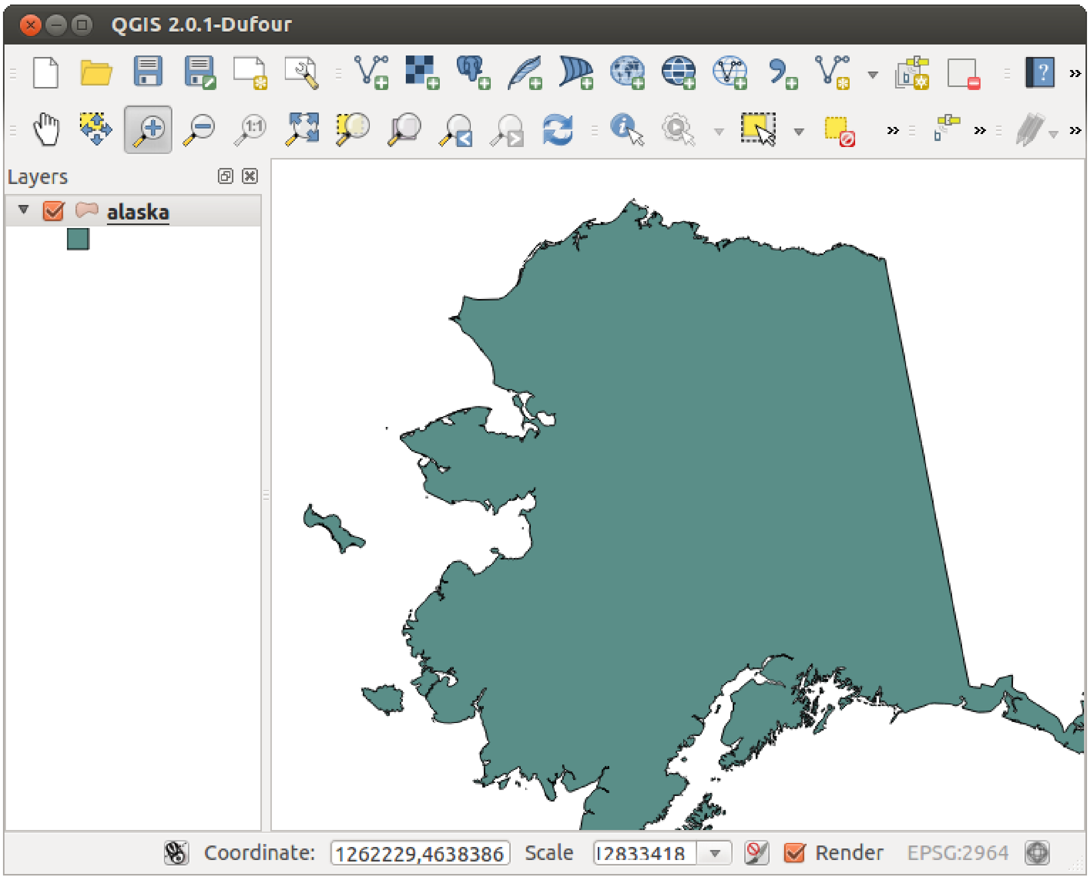

Figura 12.3: QGIS with Shapefile of Alaska loaded

legend and choosing *Properties* from the context menu. See section *Style Menu* for more information on setting symbology of vector layers.

Truco: Load layer and project from mounted external drives on OS X

On OS X, portable drives that are mounted beside the primary hard drive do not show up as expected under *File → Open Project*. We are working on a more OSX-native open/save dialog to fix this. As a workaround, you can type `/Volumes` in the *File name* box and press `Enter`. Then you can navigate to external drives and network mounts.

Improving Performance for Shapefiles

To improve the performance of drawing a shapefile, 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:

- Load a shapefile by clicking on the Add Vector Layer toolbar button or pressing `Ctrl+Shift+V`.
- Open the *Layer Properties* dialog by double-clicking on the shapefile name in the legend or by right-clicking and choosing *Properties* from the context menu.
- In the *General* tab, click the **[Create Spatial Index]** button.

Problem loading a shape .prj file

If you load a shapefile 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 within the *General* tab of the *Layer Properties* dialog of the layer by clicking the **[Specify...]** 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 shapefile with QGIS, two different projection files are created: a `.prj` file with limited projection parameters, compatible with ESRI software, and a `.qpj` file, providing the complete parameters of the used CRS. Whenever QGIS finds a `.qpj` file, it will be used instead of the `.prj`.

12.1.2 Loading a MapInfo Layer

To load a MapInfo layer, click on the Add Vector Layer toolbar button; or type `Ctrl+Shift+V`, change the file type filter *Files of type* : to 'Mapinfo File [OGR] (*.mif *.tab *.MIF *.TAB)' and select the MapInfo layer you want to load.

12.1.3 Loading an ArcInfo Binary Coverage

To load an ArcInfo Binary Coverage, click on the Add Vector Layer toolbar button or press `Ctrl+Shift+V` to open the *Add Vector Layer* dialog. Select *Directory* as *Source type*. Change the file type filter *Files of type* to 'Arc/Info Binary Coverage'. Navigate to the directory that contains the coverage file, and select it.

Similarly, you can load directory-based vector files in the UK National Transfer Format, as well as the raw TIGER Format of the US Census Bureau.

12.1.4 Delimited Text Files

Tabular data is a very common and widely used format because of its simplicity and readability – data can be viewed and edited even in a plain text editor. A delimited text file is an attribute table with each column separated by a defined character and each row separated by a line break. The first row usually contains the column names. A common type of delimited text file is a CSV (Comma Separated Values), with each column separated by a comma.

Such data files can also contain positional information in two main forms:

- As point coordinates in separate columns
- As well-known text (WKT) representation of geometry

QGIS allows you to load a delimited text file as a layer or ordinal table. But 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 in the text file.
2. The header row must contain field(s) with geometry definition. These field(s) can have any name.
3. The X and Y coordinates (if geometry is defined by coordinates) must be specified as numbers. The coordinate system is not important.

As an example of a valid text file, we import the elevation point data file `elevp.csv` that comes with the QGIS sample dataset (see section *Datos de ejemplo*):

```
X;Y;ELEV
-300120;7689960;13
-654360;7562040;52
1640;7512840;3
[...]
```

Some items 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.

Loading a delimited text file

Click the toolbar icon Add Delimited Text Layer in the *Manage layers* toolbar to open the *Create a Layer from a Delimited Text File* dialog, as shown in figure_delimited_text_1.

First, select the file to import (e.g., `qgis_sample_data/csv/elevp.csv`) by clicking on the **[Browse]** button. Once the file is selected, QGIS attempts to parse the file with the most recently used delimiter. To enable QGIS to properly parse the file, it is important to select the correct delimiter. You can specify a delimiter by activating *Custom delimiters*, or by activating *Regular expression delimiter* and entering text into the *Expression* field. For example, to change the delimiter to tab, use `\t` (this is a regular expression for the tab character).

Once the file is parsed, set *Geometry definition* to *Point coordinates* and choose the `X` and `Y` fields from the dropdown lists. If the coordinates are defined as degrees/minutes/seconds, activate the *DMS coordinates* checkbox.

Finally, enter a layer name (e.g., `elevp`), as shown in figure_delimited_text_1. To add the layer to the map, click **[OK]**. The delimited text file now behaves as any other map layer in QGIS.

There is also a helper option that allows you to trim leading and trailing spaces from fields — *Trim fields*. Also, it is possible to *Discard empty fields*. If necessary, you can force a comma to be the decimal separator by activating *Decimal separator is comma*.

If spatial information is represented by WKT, activate the *Well Known Text* option and select the field with the WKT definition for point, line or polygon objects. If the file contains non-spatial data, activate *No geometry (attribute only table)* and it will be loaded as an ordinal table.

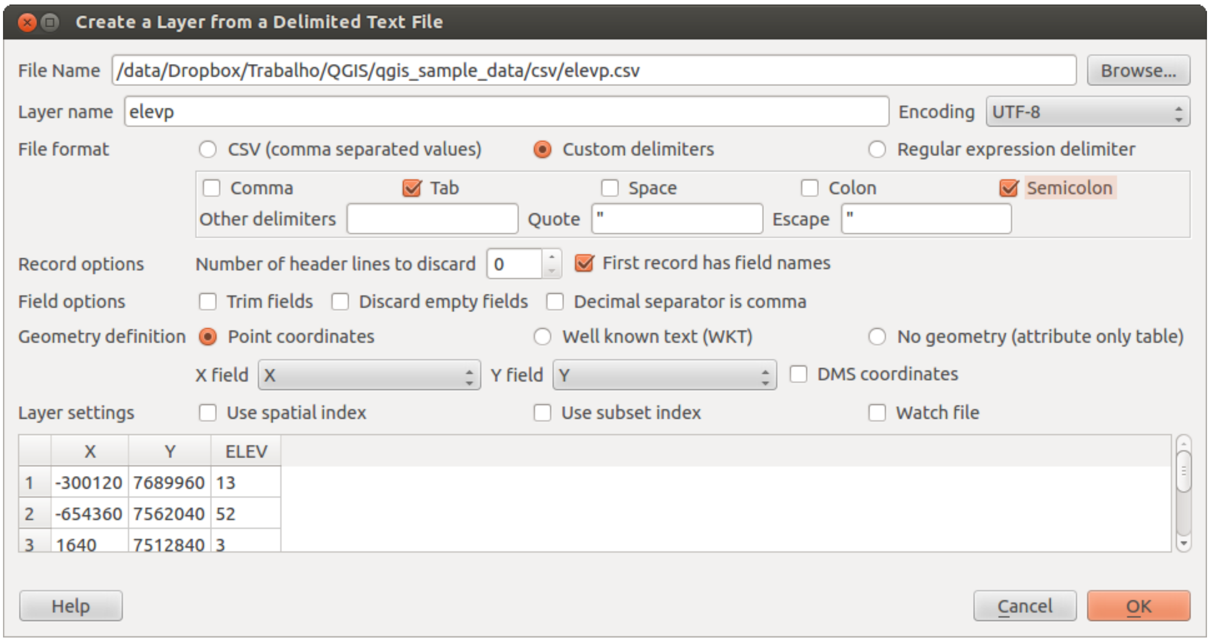

Figura 12.4: Delimited Text Dialog

Additionaly, you can enable:

- *Use spatial index* to improve the performance of displaying and spatially selecting features.
- *Use subset index*.
- *Watch file* to watch for changes to the file by other applications while QGIS is running.

12.1.5 OpenStreetMap data

In recent years, the OpenStreetMap project has gained popularity 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 or local knowledge. To support this objective, QGIS provides suppport for OSM data.

Loading OpenStreetMap Vectors

QGIS integrates OpenStreetMap import as a core functionality.

- To connect to the OSM server and download data, open the menu *Vector* → *Openstreetmap* → *Load data*. You can skip this step if you already obtained an `.osm` XML file using JOSM, Overpass API or any other source.
- The menu *Vector* → *Openstreetmap* → *Import topology from an XML file* will convert your `.osm` file into a SpatiaLite database and create a corresponding database connection.
- The menu *Vector* → *Openstreetmap* → *Export topology to SpatiaLite* then allows you to open the database connection, select the type of data you want (points, lines, or polygons) and choose tags to import. This creates a SpatiaLite geometry layer that you can add to your project by clicking on the Add SpatiaLite Layer toolbar button or by selecting the *Add SpatiaLite Layer...* option from the *Layer* menu (see section *SpatiaLite Layers*).

12.1.6 PostGIS Layers

PostGIS layers are stored in a PostgreSQL database. The advantages of PostGIS are the spatial indexing, filtering and query capabilities it provides. Using PostGIS, vector functions such as select and identify work more accurately than they do with OGR layers in QGIS.

Creating a stored Connection

The first time you use a PostGIS data source, you must create a connection to the PostgreSQL database that contains the data. Begin by clicking on the Add PostGIS Layer toolbar button, selecting the *Add PostGIS Layer...* option from the *Layer* menu, or typing `Ctrl+Shift+D`. You can also open the *Add Vector Layer* dialog and select *Database*. The *Add PostGIS Table(s)* dialog will be displayed. To access the connection manager, click on the **[New]** button to display the *Create a New PostGIS Connection* dialog. The parameters required for a connection are:

- **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`.
- **Host**: Name of the database host. This must be a resolvable host name such as would be used to open a telnet 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 is 5432.
- **Database**: Name of the database.
- **SSL mode**: How the SSL connection will be negotiated with the server. Note that massive speedups in PostGIS layer rendering can be achieved by disabling SSL in the connection editor. The following options are available:
  - Disable: Only try an unencrypted SSL connection.
  - Allow: Try a non-SSL connection. If that fails, try an SSL connection.
  - Prefer (the default): Try an SSL connection. If that fails, try a non-SSL connection.
  - Require: Only try an SSL connection.
- **Username**: User name used to log in to the database.
- **Password**: Password used with *Username* to connect to the database.

Optionally, you can activate the following checkboxes:

- *Save Username*
- *Save Password*
- *Only look in the geometry_columns table*
- *Don't resolve type of unrestricted columns (GEOMETRY)*
- *Only look in the 'public' schema*
- *Also list tables with no geometry*
- *Use estimated table metadata*

Once all parameters and options are set, you can test the connection by clicking on the **[Test Connect]** button.

Truco: QGIS User Settings and Security

Depending on your computing environment, storing passwords in your QGIS settings may be a security risk. Your customized settings for QGIS are stored based on the operating system:

- The settings are stored in your home directory in `~/.qgis2`.
- The settings are stored in the registry.

Loading a PostGIS Layer

Once you have one or more connections defined, you can load layers from the PostgreSQL database. Of course, this requires having data in PostgreSQL. See section *Importing Data into PostgreSQL* for a discussion on importing data into the database.

To load a layer from PostGIS, perform the following steps:

- If the *Add PostGIS layers* dialog is not already open, selecting the *Add PostGIS Layer...* option from the *Layer* menu or typing `Ctrl+Shift+D` opens the dialog.
- Choose the connection from the drop-down list and click **[Connect]**.
- Select or unselect *Also list tables with no geometry*.
- Optionally, use some *Search Options* to define which features to load from the layer, or use the **[Build query]** button to start the *Query builder* dialog.
- Find the layer(s) you wish to add in the list of available layers.
- Select it by clicking on it. You can select multiple layers by holding down the `Shift` key while clicking. See section *Constructor de consultas* for information on using the PostgreSQL Query Builder to further define the layer.
- Click on the **[Add]** button to add the layer to the map.

Truco: PostGIS Layers

Normally, a PostGIS layer is defined by an entry in the geometry_columns table. From version 0.9.0 on, QGIS can load layers that do not have an entry in the geometry_columns table. This includes both tables and views. Defining a spatial view provides a powerful means to visualize your data. Refer to your PostgreSQL manual for information on creating views.

Some details about PostgreSQL layers

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 any QGIS messages and give you direction on changing the PostgreSQL table or view definition to allow QGIS to load it.

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).

If the PostgreSQL layer is a view, the same requirement exists, but views do not have primary keys or columns with unique constraints on them. You have to define a primary key field (has to be integer) in the QGIS dialog before you can load the view. If a suitable column does not exist in the view, QGIS will not load the layer. If this occurs, the solution is to alter the view so that it does include a suitable column (a type of integer and either a primary key or with a unique constraint, preferably indexed).

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. It can make sense to disable this option when you use expensive views.

12.1.7 Importing Data into PostgreSQL

Data can be imported into PostgreSQL/PostGIS using several tools, including the SPIT plugin and the command line tools shp2pgsql and ogr2ogr.

DB Manager

QGIS comes with a core plugin named DB Manager. It can be used to load shapefiles and other data formats, and it includes support for schemas. See section *Complemento administrador de BBDD* for more information.

shp2pgsql

PostGIS includes an utility called **shp2pgsql** that can be used to import shapefiles into a PostGIS-enabled database. For example, to import a shapefile 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 *Working with Projections* for more information on spatial reference systems and projections.

Truco: Exporting datasets from PostGIS

Like the import tool **shp2pgsql**, there is also a tool to export PostGIS datasets as shapefiles: **pgsql2shp**. This is shipped within your PostGIS distribution.

ogr2ogr

Besides **shp2pgsql** and **DB Manager**, there is another tool for feeding geodata in PostGIS: **ogr2ogr**. This is part of your GDAL installation.

To import a shapefile 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 `alaska.shp` into the PostGIS database *postgis* using the user *postgres* with the password *topsecret* on 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 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 searches of the data (GiST index information is taken from the PostGIS documentation available at http://postgis.refractions.net).

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 *Referencias bibliográficas y web*) for more information.

The following is an example of creating 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$
```

12.1.8 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 will see two far, distinct locations, that should appear near each other. In Figure_vector_4, 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.

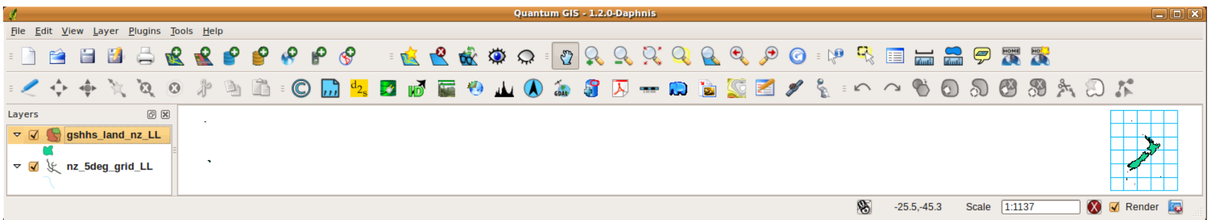

Figura 12.5: Map in lat/lon crossing the 180° longitude line

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.

Usage

- Import data into PostGIS (*Importing Data into PostgreSQL*) using, for example, the DB Manager plugin.

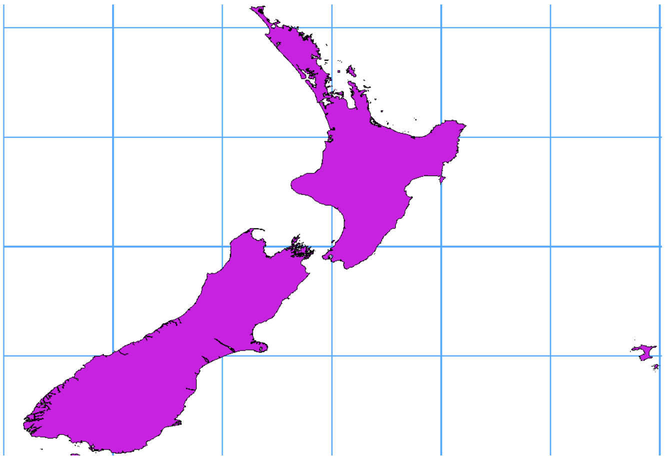

Figura 12.6: Crossing 180° longitude applying the **ST_Shift_Longitude** function

- 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_5).

12.1.9 SpatiaLite Layers

The first time you load data from a SpatiaLite database, begin by clicking on the Add SpatiaLite Layer toolbar button, or by selecting the *Add SpatiaLite Layer...* option from the *Layer* menu, or by typing `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 can 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.

If you want to save a vector layer to SpatiaLite format, you can do this by right clicking the layer in the legend. Then, click on *Save as..*, define the name of the output file, and select 'SpatiaLite' as format and the CRS. Also, you can select 'SQLite' as format and then add `SPATIALITE=YES` in the OGR data source creation option field. This tells OGR to create a SpatiaLite database. See also http://www.gdal.org/ogr/drv_sqlite.html.

QGIS also supports editable views in SpatiaLite.

Creating a new SpatiaLite layer

If you want to create a new SpatiaLite layer, please refer to section *Creating a new SpatiaLite layer*.

Truco: SpatiaLite data management Plugins

For SpatiaLite data management, you can also use several Python plugins: QSpatiaLite, SpatiaLite Manager or DB Manager (core plugin, recommended). If necessary, they can be downloaded and installed with the Plugin Installer.

12.1.10 MSSQL Spatial Layers

QGIS also provides native MS SQL 2008 support. The first time you load MSSQL Spatial data, begin by clicking on the Add MSSQL Spatial Layer toolbar button or by selecting the *Add MSSQL Spatial Layer...* option from the *Layer* menu, or by typing `Ctrl+Shift+M`.

12.1.11 Oracle Spatial Layers

The spatial features in Oracle Spatial aid users in managing geographic and location data in a native type within an Oracle database. QGIS now has support for such layers.

Creating a stored Connection

The first time you use an Oracle Spatial data source, you must create a connection to the database that contains the data. Begin by clicking on the Add Orcale Spatial Layer toolbar button, selecting the *Add Orcale Spatial Layer...* option from the *Layer* menu, or typing `Ctrl+Shift+O`. To access the connection manager, click on the **[New]** button to display the *Create a New Oracle Spatial Connection* dialog. The parameters required for a connection are:

- **Name**: A name for this connection. It can be the same as *Database*
- **Database**: SID or SERVICE_NAME of the Oracle instance.
- **Host**: Name of the database host. This must be a resolvable host name such as would be used to open a telnet 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 is 1521.
- **Username**: Username used to login to the database.
- **Password**: Password used with *Username* to connect to the database.

Optionally, you can activate following checkboxes:

- *Save Username* Indicates whether to save the database username in the connection configuration.
- *Save Password* Indicates whether to save the database password in the connection settings.
- *Only look in meta data 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, restrict 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 estimated table statistics for the layer metadata* When the layer is set up, various metadata are required for the Oracle table. This includes information such as the table row count, geometry type and spatial extents of the data in the geometry column. If the table contains a large number of rows, determining this metadata can be time-consuming. By activating this option, the following fast table metadata operations are done: Row count is determined from `all_tables.num_rows`. Table extents are always determined with the SDO_TUNE.EXTENTS_OF function, even if a layer filter is applied. Table geometry is determined from the first 100 non-null geometry rows in the table.
- *Only existing geometry types* Only list the existing geometry types and don't offer to add others.

Once all parameters and options are set, you can test the connection by clicking on the **[Test Connect]** button.

Truco: QGIS User Settings and Security

Depending on your computing environment, storing passwords in your QGIS settings may be a security risk. Passwords are saved in clear text in the system configuration and in the project files! Your customized settings for QGIS are stored based on the operating system:

- The settings are stored in your home directory in `.config/QGIS/QGIS2.conf`.

- The settings are stored in the registry.

Loading an Oracle Spatial Layer

Once you have one or more connections defined, you can load layers from the Oracle database. Of course, this requires having data in Oracle.

To load a layer from Oracle Spatial, perform the following steps:

- If the *Add Oracle Spatial layers* dialog is not already open, click on the Add Oracle Spatial Layer toolbar button.
- Choose the connection from the drop-down list and click **[Connect]**.
- Select or unselect *Also list tables with no geometry*.
- Optionally, use some *Search Options* to define which features to load from the layer or use the **[Build query]** button to start the *Query builder* dialog.
- Find the layer(s) you wish to add in the list of available layers.
- Select it by clicking on it. You can select multiple layers by holding down the `Shift` key while clicking. See section *Constructor de consultas* for information on using the Oracle Query Builder to further define the layer.
- Click on the **[Add]** button to add the layer to the map.

Truco: Oracle Spatial Layers

Normally, an Oracle Spatial layer is defined by an entry in the **USER_SDO_METADATA** table.

.

12.2 The Vector Properties Dialog

The *Layer Properties* dialog for a vector layer provides information about the layer, symbology settings and labeling options. If your vector layer has been loaded from a PostgreSQL/PostGIS datastore, you can also alter the underlying SQL for the layer by invoking the *Query Builder* dialog on the *General* tab. To access the *Layer Properties* dialog, double-click on a layer in the legend or right-click on the layer and select *Properties* from the pop-up menu.

12.2.1 Style Menu

The Style menu provides you with a comprehensive tool for rendering and symbolizing your vector data. You can use *Layer rendering* → tools that are common to all vector data, as well as special symbolizing tools that were designed for the different kinds of vector data.

Layer rendering

- *Layer transparency* : 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 the menu beside the slider.
- *Layer blending mode* and *Feature blending mode*: You can achieve special rendering effects with these tools that you may previously only know from graphics programs. The pixels of your overlaying and underlaying layers are mixed through the settings described below.

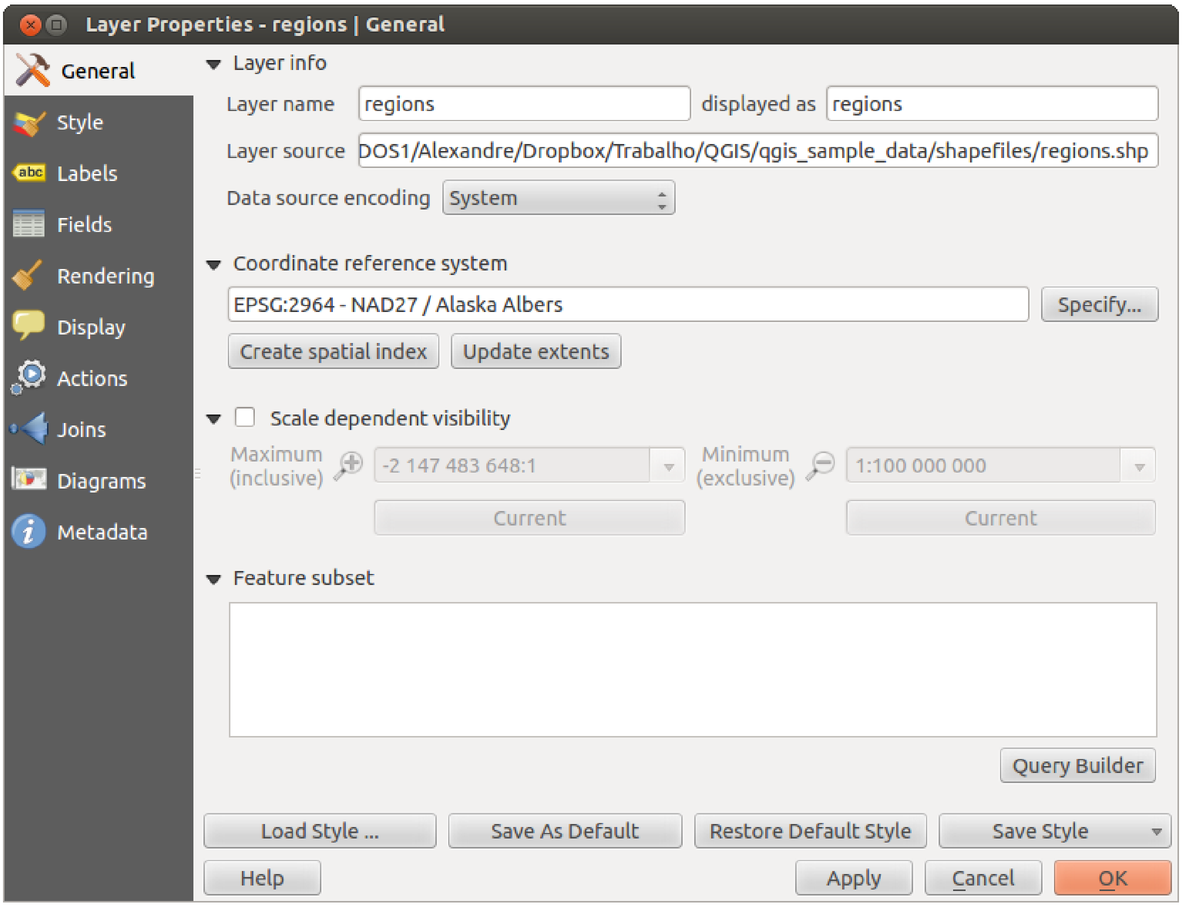

Figura 12.7: Vector Layer Properties Dialog

- Normal: This is the standard blend mode, which uses the alpha channel of the top pixel to blend with the pixel beneath it. The colors aren't mixed.
- 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 layer with another layer (e.g., you can use a hillshade to texture another layer).
- Dodge: Dodge will brighten and saturate underlying pixels based on the lightness of the top pixel. So, 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: This blend mode simply adds pixel values of one layer with the other. In case of values above one (in the case of RGB), white is displayed. This mode is suitable for highlighting features.
- Darken: This creates a resultant pixel that retains the smallest components of the foreground and background pixels. Like lighten, the results tend to be jagged and harsh.
- Multiply: Here, the numbers for each pixel of the top layer are multiplied with the corresponding pixels for the bottom layer. The results are darker pictures.
- Burn: Darker colors in the top layer cause the underlying layers to darken. Burn can be used to tweak and colorise underlying layers.
- Overlay: This mode combines the multiply and screen blending modes. In the resulting picture, light parts become lighter and dark parts become darker.
- Soft light: This is 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: Difference subtracts the top pixel from the bottom pixel, or the other way around, to always get a positive value. Blending with black produces no change, as the difference with all colors is zero.
- Subtract: This blend mode simply subtracts pixel values of one layer from the other. In case of negative values, black is displayed.

Renderers

The renderer is responsible for drawing a feature together with the correct symbol. There are four types of renderers: single symbol, categorized, graduated and rule-based. There is no continuous color renderer, because it is in fact only a special case of the graduated renderer. The categorized and graduated renderers can be created by specifying a symbol and a color ramp - they will set the colors for symbols appropriately. For point layers, there is a point displacement renderer available. For each data type (points, lines and polygons), vector symbol layer types are available. Depending on the chosen renderer, the *Style* menu provides different additional sections. On the bottom right of the symbology dialog, there is a **[Symbol]** button, which gives access to the Style Manager (see section vector_style_manager). The Style Manager allows you to edit and remove existing symbols and add new ones.

Truco: Select and change multiple symbols

The Symbology allows you to select multiple symbols and right click to change color, transparency, size, or width of selected entries.

Single Symbol Renderer

The Single Symbol Renderer is used to render all features of the layer using a single user-defined symbol. The properties, which can be adjusted in the *Style* menu, depend partially on the type of layer, but all types share the following dialog structure. In the top-left part of the menu, there is a preview of the current symbol to be rendered. On the right part of the menu, there is a list of symbols already defined for the current style, prepared to be used by selecting them from the list. The current symbol can be modified using the menu on the right side. If you click on the first level in the *Symbol layers* dialog on the left side, it's possible to define basic parameters like *Size*, *Transparency*, *Color* and *Rotation*. Here, the layers are joined together.

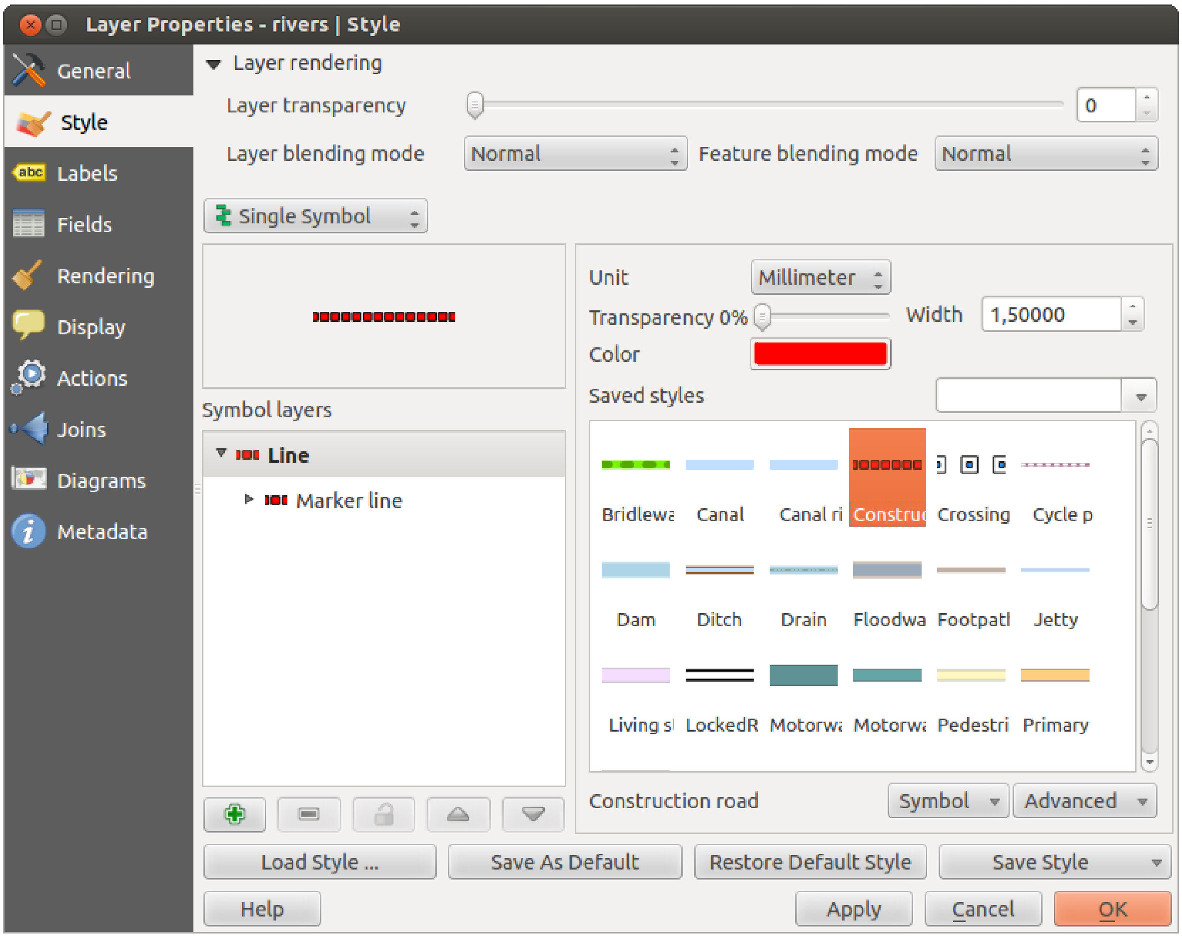

Figura 12.8: Single symbol line properties

More detailed settings can be made when clicking on the second level in the *Symbol layers* dialog. You can define *Symbol layers* that are combined afterwards. A symbol can consist of several *Symbol layers*. The following settings are possible:

- Point layers:
- *Symbol layer type*: You have the option to use Ellipse markers, Font markers, Simple markers, SVG markers and Vector Field markers.
- *Colors*
- *Size*
- *Outline style*
- *Outline width*
- *Angle*
- *Offset X,Y*: You can shift the symbol in the x- or y-direction.
- *Anchor point*
- *Data defined properties ...*
- Line layers:
- *Symbol layer type*: Here you can use Simple Lines and Marker Lines.

- *Color*
- *Pen width*
- *Offset*
- *Pen style*
- *Join style*
- *Cap style*
- *Use custom dash pattern*
- *Dash pattern unit*
- *Data defined properties ...*
- Polygon Layers:
- *Symbol layer type*: It's possible to use Centroid Fill, Gradient Fill, Line Pattern Fill, Point Pattern Fill, SVG Fill, Simple Fill and two Outlines (Marker line and Simple line).
- *Colors*
- *Fill style*
- *Border style*
- *Border width*
- *Offset X,Y*
- *Data defined properties ...*

'Gradient Fill' *Symbol layer type* allows you to select between a *Two color* and *Color ramp* setting. You can use the *Feature centroid* as *Referencepoint*. All fills 'Gradient Fill' *Symbol layer type* is also available through the *Symbol* menu of the Categorized and Graduated Renderer and through the *Rule properties* menu of the Rule-based renderer.

It is possible to only draw polygon borders inside the polygon. Using 'Outline: Simple line' select *Draw line only inside polygon*.

Note that once you have set the size in the lower levels of the *Symbol layers* dialog, the size of the whole symbol can be changed with the *Size* menu in the first level again. The size of the lower levels changes accordingly, while the size ratio is maintained. After having made any needed changes, the symbol can be added to the list of current style symbols (using **[Symbol]** *Save in symbol library*), and then it can easily be used in the future. Furthermore, you can use the **[Save Style]** button to save the symbol as a QGIS layer style file (.qml) or SLD file (.sld). 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. That means that categorized or graduated styles are converted to rule-based. If you want to preserve those renderers, you have to stick to the QML format. On the other hand, it can be very handy sometimes to have this easy way of converting styles to rule-based. With the *Style manager* from the **[Symbol]** menu you can administer your symbols. You can add item, edit item, remove item and share item. 'Marker' symbols, 'Line' symbols, 'Fill' patterns and 'Color ramps' can be used to create the symbols (see defining_symbols). The symbols are then assigned to 'All Symbols', 'Groups' or 'Smart groups'.

Categorized Renderer

The Categorized Renderer is used to render all features from a layer, using a single user-defined symbol whose color reflects the value of a selected feature's attribute. The *Style* menu allows you to select:

- The attribute (using the Column listbox or the *Set column expression* function)
- The symbol (using the Symbol dialog)
- The colors (using the Color Ramp listbox)

The **[Advanced]** button in the lower-right corner of the dialog allows you to set the fields containing rotation and size scale information. For convenience, the center of the menu lists the values of all currently selected attributes together, including the symbols that will be rendered.

The example in figure_symbology_2 shows the category rendering dialog used for the rivers layer of the QGIS sample dataset.

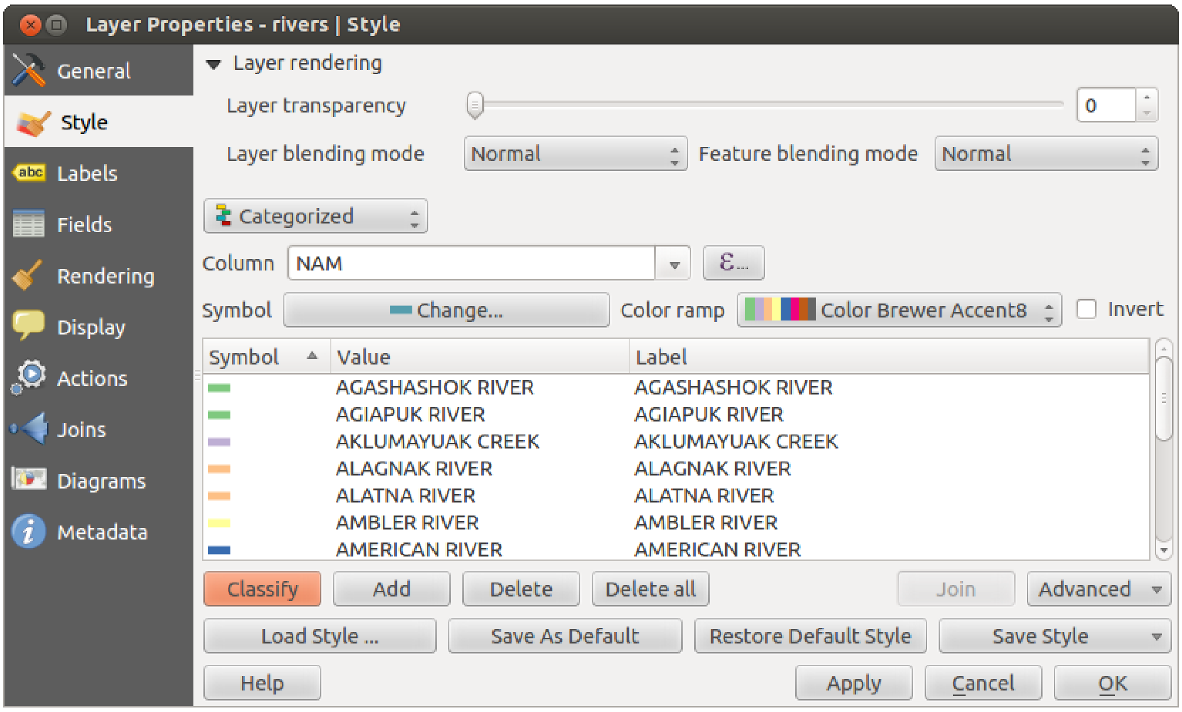

Figura 12.9: Categorized Symbolizing options

You can create a custom color ramp choosing *New color ramp...* from the *Color ramp* drop-down menu. A dialog will prompt for the ramp type: Gradient, Random, ColorBrewer, or cpt-city. The first three have options for number of steps and/or multiple stops in the color ramp. You can use the *Invert* option while classifying the data with a color ramp. See figure_symbology_3 for an example of custom color ramp and figure_symbology_3a for the cpt-city dialog.

The cpt-city option opens a new dialog with hundreds of themes included 'out of the box'.

Graduated Renderer

The Graduated Renderer is used to render all the features from a layer, using a single user-defined symbol whose color reflects the assignment of a selected feature's attribute to a class.

Like the Categorized Renderer, the Graduated Renderer allows you to define rotation and size scale from specified columns.

Also, analogous to the Categorized Renderer, the *Style* tab allows you to select:

- The attribute (using the Column listbox or the ε... *Set column expression* function)
- The symbol (using the Symbol Properties button)
- The colors (using the Color Ramp list)

Additionally, you can specify the number of classes and also the mode for classifying features within the classes (using the Mode list). The available modes are:

- Equal Interval
- Quantile
- Natural Breaks (Jenks)

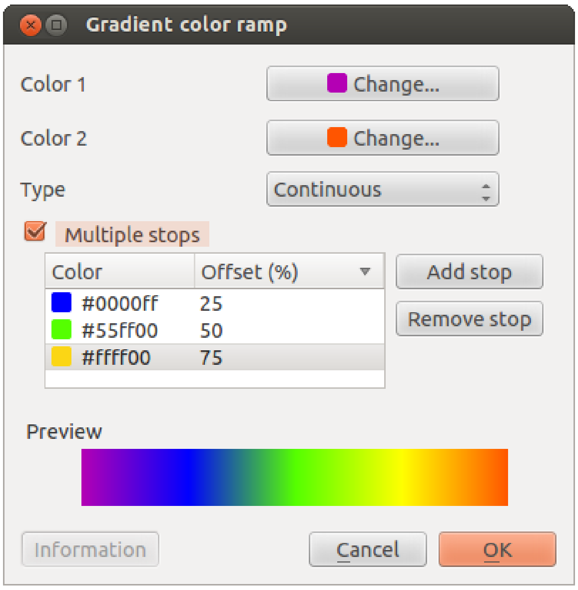

Figura 12.10: Example of custom gradient color ramp with multiple stops

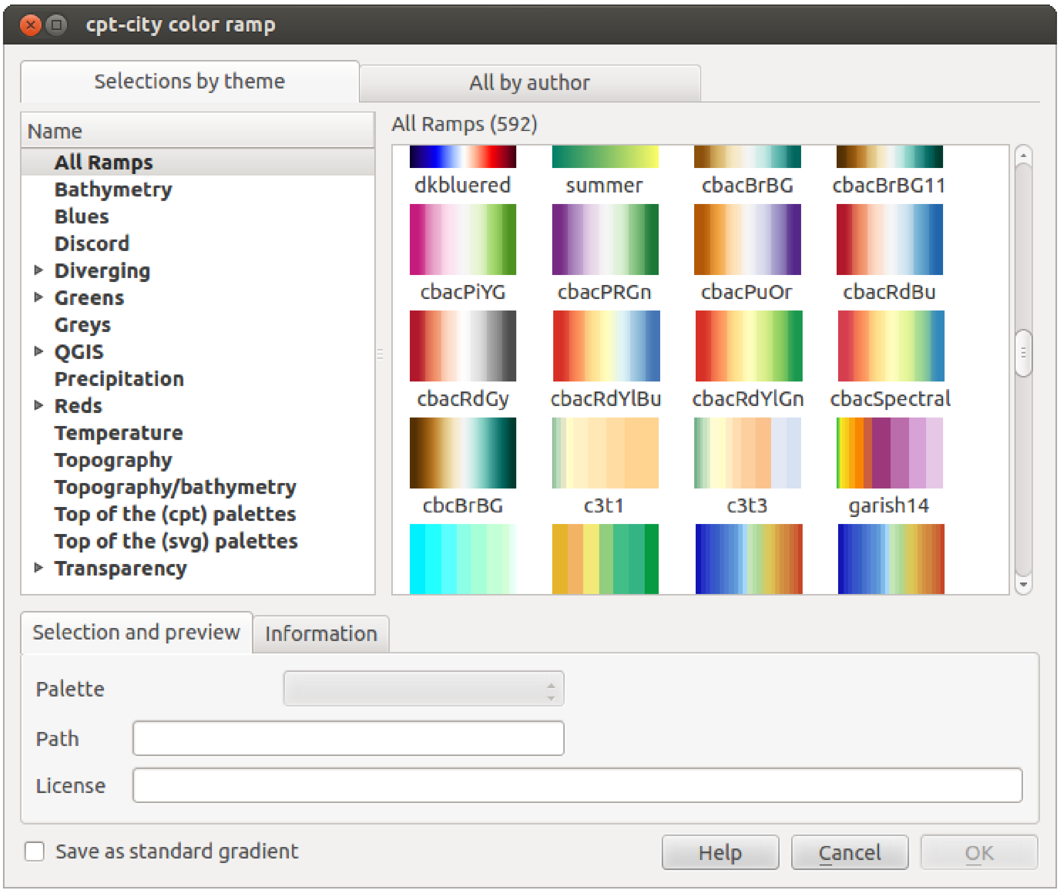

Figura 12.11: cpt-city dialog with hundreds of color ramps

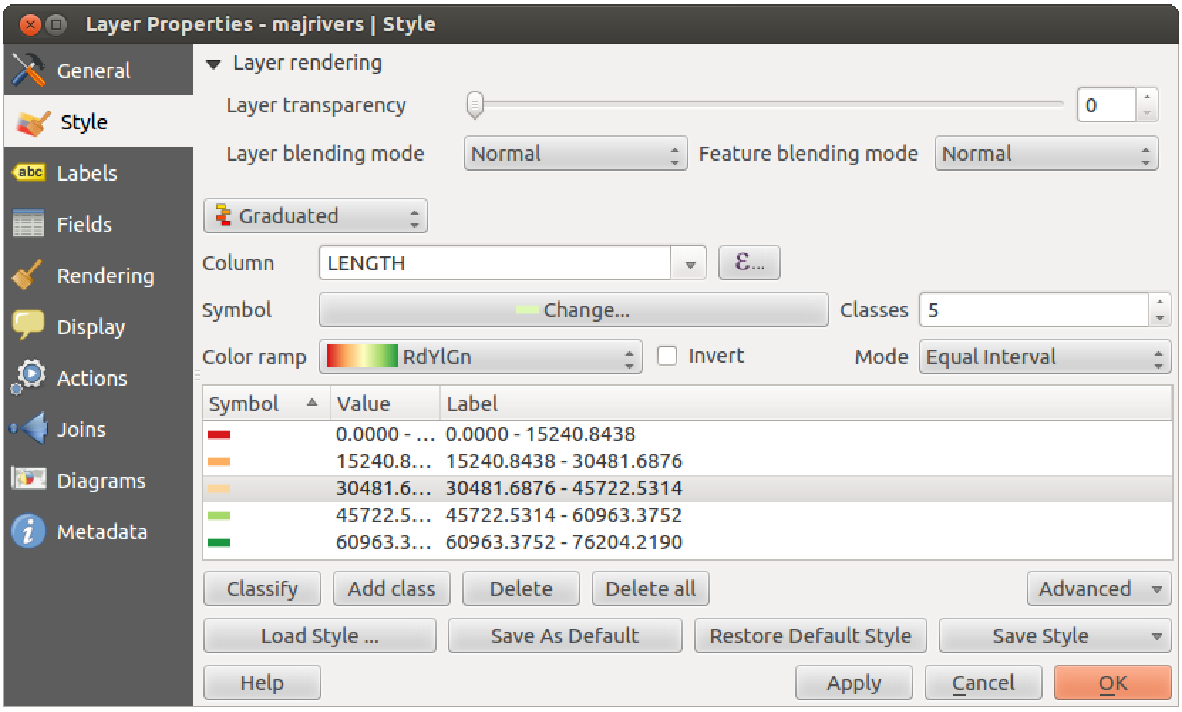

Figura 12.12: Graduated Symbolizing options

- Standard Deviation
- Pretty Breaks

The listbox in the center part of the *Style* menu lists the classes together with their ranges, labels and symbols that will be rendered.

The example in figure_symbology_4 shows the graduated rendering dialog for the rivers layer of the QGIS sample dataset.

Truco: Thematic maps using an expression

Categorized and graduated thematic maps can now be created using the result of an expression. In the properties dialog for vector layers, the attribute chooser has been augmented with a *Set column expression* function. So now you no longer need to write the classification attribute to a new column in your attribute table if you want the classification attribute to be a composite of multiple fields, or a formula of some sort.

Rule-based rendering

The Rule-based Renderer is used to render all the features from a layer, using rule based symbols whose color reflects the assignment of a selected feature's attribute to a class. The rules are based on SQL statements. The dialog allows rule grouping by filter or scale, and you can decide if you want to enable symbol levels or use only the first-matched rule.

The example in figure_symbology_5 shows the rule-based rendering dialog for the rivers layer of the QGIS sample dataset.

To create a rule, activate an existing row by double-clicking on it, or click on '+' and click on the new rule. In the *Rule properties* dialog, you can define a label for the rule. Press the ... button to open the expression string builder. In the **Function List**, click on *Fields and Values* to view all attributes of the attribute table to be searched. To add an attribute to the field calculator **Expression** field, double click its name in the *Fields and Values* list. Generally, you can use the various fields, values and functions to construct the calculation expression, or you can just type it into the box (see *Field Calculator*). Since QGIS 2.2, you can create a new rule by copying and pasting an existing rule with the right mouse button. Also since QGIS 2.2, you can use the 'ELSE' rule that will be run if none of the other rules on that level match.

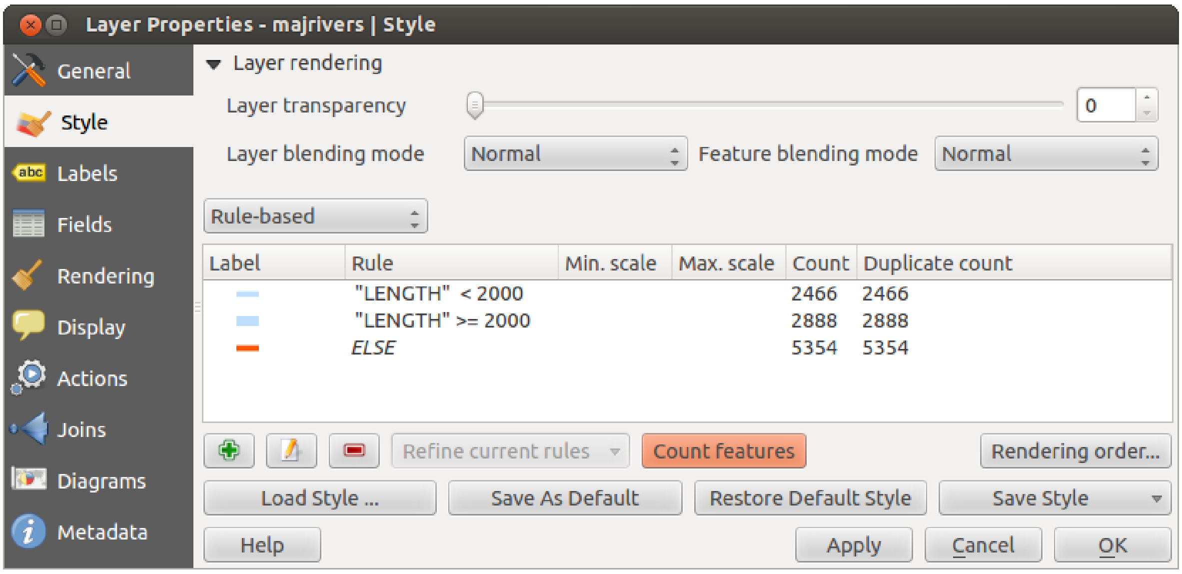

Figura 12.13: Rule-based Symbolizing options

Point displacement

The Point Displacement Renderer works to visualize all features of a point layer, even if they have the same location. To do this, the symbols of the points are placed on a displacement circle around a center symbol.

Truco: Export vector symbology

You have the option to export vector symbology from QGIS into Google *.kml, *.dxf and MapInfo *.tab files. Just open the right mouse menu of the layer and click on *Save selection as* → to specify the name of the output file and its format. In the dialog, use the *Symbology export* menu to save the symbology either as *Feature symbology* → or as *Symbol layer symbology* →. If you have used symbol layers, it is recommended to use the second setting.

12.2.2 Labels Menu

The Labels core application provides smart labeling for vector point, line and polygon layers, and it only requires a few parameters. This new application also supports on-the-fly transformed layers. The core functions of the application have been redesigned. In QGIS, there are a number of other features that improve the labeling. The following menus have been created for labeling the vector layers:

- Text
- Formatting
- Buffer
- Background
- Shadow
- Placement
- Rendering

Let us see how the new menus can be used for various vector layers. **Labeling point layers**

Start QGIS and load a vector point layer. Activate the layer in the legend and click on the Layer Labeling Options icon in the QGIS toolbar menu.

The first step is to activate the *Label this layer with* checkbox and select an attribute column to use for labeling. Click ε... if you want to define labels based on expressions - See labeling_with_expressions.

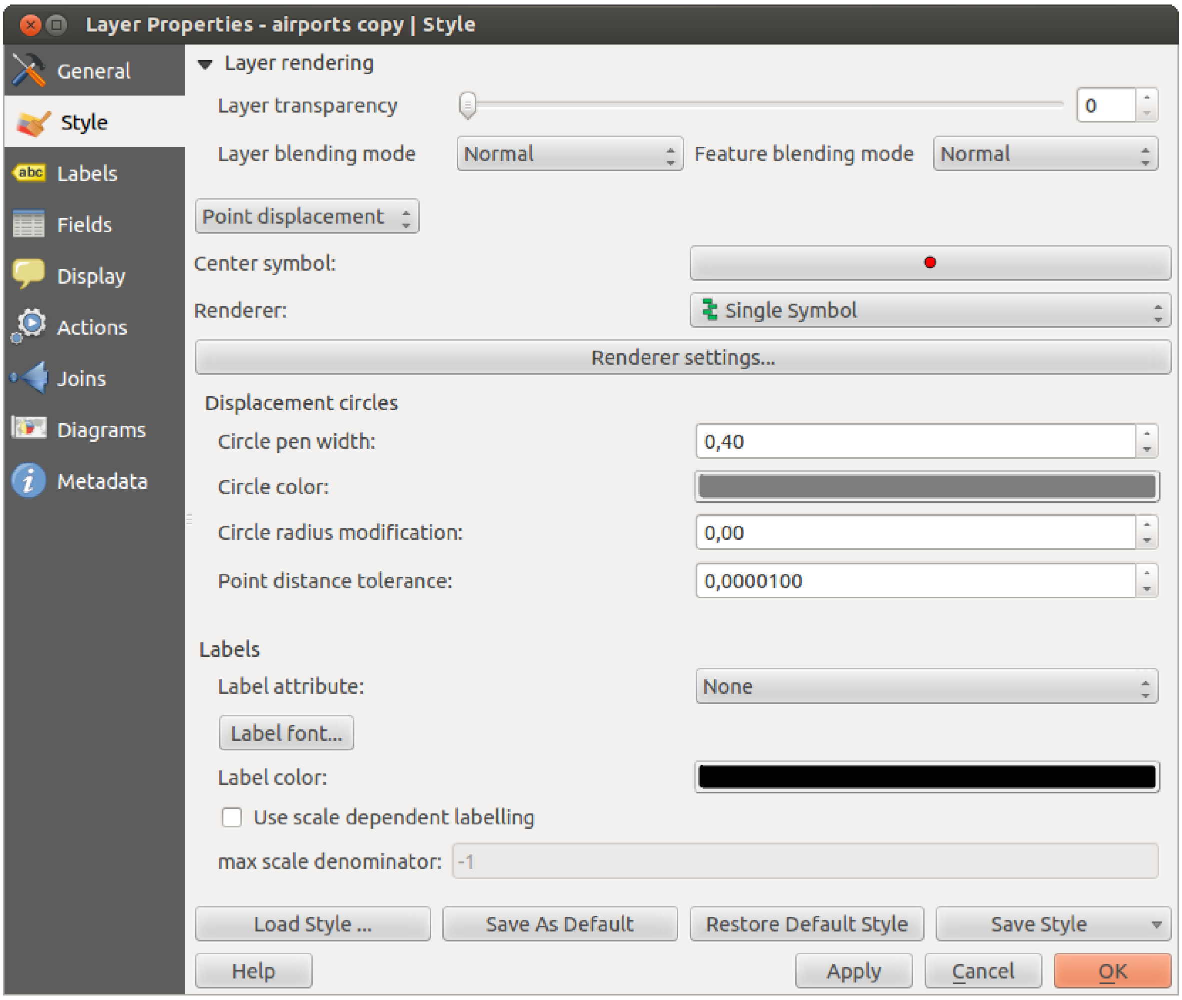

Figura 12.14: Point displacement dialog

The following steps describe a simple labeling without using the *Data defined override* functions, which are situated next to the drop-down menus.

You can define the text style in the *Text* menu (see Figure_labels_1). Use the *Type case* option to influence the text rendering. You have the possibility to render the text 'All uppercase', 'All lowercase' or 'Capitalize first letter'. Use the blend modes to create effects known from graphics programs (see blend_modes).

In the *Formatting* menu, you can define a character for a line break in the labels with the 'Wrap on character' function. Use the *Formatted numbers* option to format the numbers in an attribute table. Here, decimal places may be inserted. If you enable this option, three decimal places are initially set by default.

To create a buffer, just activate the *Draw text buffer* checkbox in the *Buffer* menu. The buffer color is variable. Here, you can also use blend modes (see blend_modes).

If the *Color buffer's fill* checkbox is activated, it will interact with partially transparent text and give mixed color transparency results. Turning off the buffer fill fixes that issue (except where the interior aspect of the buffer's stroke intersects with the text's fill) and also allows you to make outlined text.

In the *Background* menu, you can define with *Size X* and *Size Y* the shape of your background. Use *Size type* to insert an additional 'Buffer' into your background. The buffer size is set by default here. The background then consists of the buffer plus the background in *Size X* and *Size Y*. You can set a *Rotation* where you can choose between 'Sync with label', 'Offset of label' and 'Fixed'. Using 'Offset of label' and 'Fixed', you can rotate the background. Define an *Offset X,Y* with X and Y values, and the background will be shifted. When applying *Radius X,Y*, the background gets rounded corners. Again, it is possible to mix the background with the underlying layers in the map canvas using the *Blend mode* (see blend_modes).

Use the *Shadow* menu for a user-defined *Drop shadow*. The drawing of the background is very variable. Choose between 'Lowest label component', 'Text', 'Buffer' and 'Background'. The *Offset* angle depends on the orientation of the label. If you choose 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. You can influence the appearance of the shadow with the *Blur radius*. The higher the number, the softer the shadows. The appearance of the drop shadow can also be altered by choosing a blend mode (see blend_modes).

Choose the *Placement* menu for the label placement and the labeling priority. Using the *Offset from point* setting, you now have the option to use *Quadrants* to place your label. Additionally, you can alter the angle of the label placement with the *Rotation* setting. Thus, a placement in a certain quadrant with a certain rotation is possible.

In the *Rendering* menu, you can define label and feature options. Under *Label options*, you find the scale-based visibility setting now. You can prevent QGIS from rendering only selected labels with the *Show all labels for this layer (including colliding labels)* checkbox. Under *Feature options*, you can define whether every part of a multipart feature is to be labeled. It's possible to define whether the number of features to be labeled is limited and to *Discourage labels from covering features*.

Labeling line layers

The first step is to activate the *Label this layer* checkbox in the *Label settings* tab and select an attribute column to use for labeling. Click if you want to define labels based on expressions - See labeling_with_expressions.

After that, you can define the text style in the *Text* menu. Here, you can use the same settings as for point layers.

Also, in the *Formatting* menu, the same settings as for point layers are possible.

The *Buffer* menu has the same functions as described in section labeling_point_layers.

The *Background* menu has the same entries as described in section labeling_point_layers.

Also, the *Shadow* menu has the same entries as described in section labeling_point_layers.

In the *Placement* menu, you find special settings for line layers. The label can be placed *Parallel*, *Curved* or *Horizontal*. With the *Parallel* and *Curved* option, you can define the position *Above line*, *On line* and *Below line*. It's possible to select several options at once. In that case, QGIS will look for the

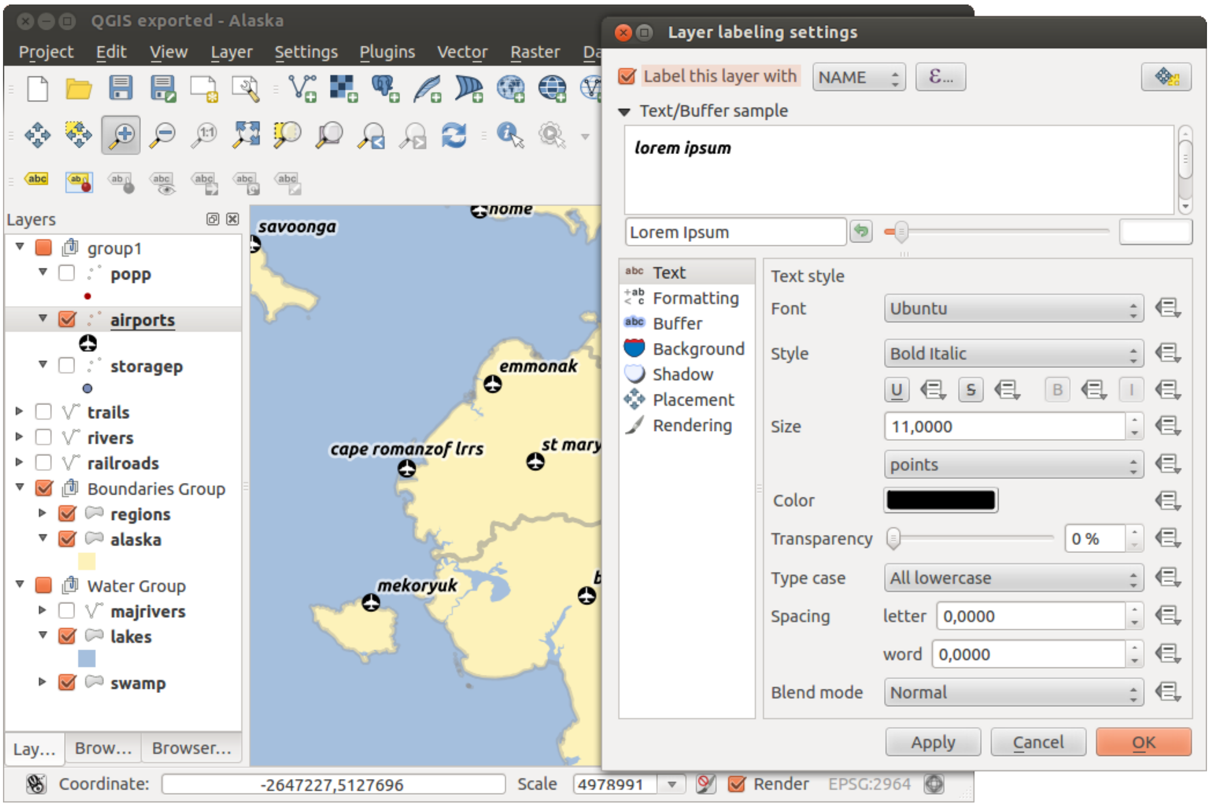

Figura 12.15: Smart labeling of vector point layers

optimal position of the label. Remember that here you can also use the line orientation for the position of the label. Additionally, you can define a *Maximum angle between curved characters* when selecting the *Curved* option (see Figure_labels_2).

The *Rendering* menu has nearly the same entries as for point layers. In the *Feature options*, you can now *Suppress labeling of features smaller than*.

Labeling polygon layers

The first step is to activate the *Label this layer* checkbox and select an attribute column to use for labeling. Click ε... if you want to define labels based on expressions - See labeling_with_expressions.

In the *Text* menu, define the text style. The entries are the same as for point and line layers.

The *Formatting* menu allows you to format multiple lines, also similar to the cases of point and line layers.

As with point and line layers, you can create a text buffer in the *Buffer* menu.

Use the *Background* menu to create a complex user-defined background for the polygon layer. You can use the menu also as with the point and line layers.

The entries in the *Shadow* menu are the same as for point and line layers.

In the *Placement* menu, you find special settings for polygon layers (see Figure_labels_3). *Offset from centroid*, *Horizontal (slow)*, *Around centroid*, *Free* and *Using perimeter* are possible.

In the *Offset from centroid* settings, you can specify if the centroid is of the *visible polygon* or *whole polygon*. That means that either the centroid is used for the polygon you can see on the map or the centroid is determined for the whole polygon, no matter if you can see the whole feature on the map. You can place your label with the quadrants here, and define offset and rotation. The *Around centroid* setting makes it possible to place the label around the centroid with a certain distance. Again, you can define *visible polygon* or *whole polygon* for the centroid. With the *Using perimeter* settings, you can define a position and a distance for the

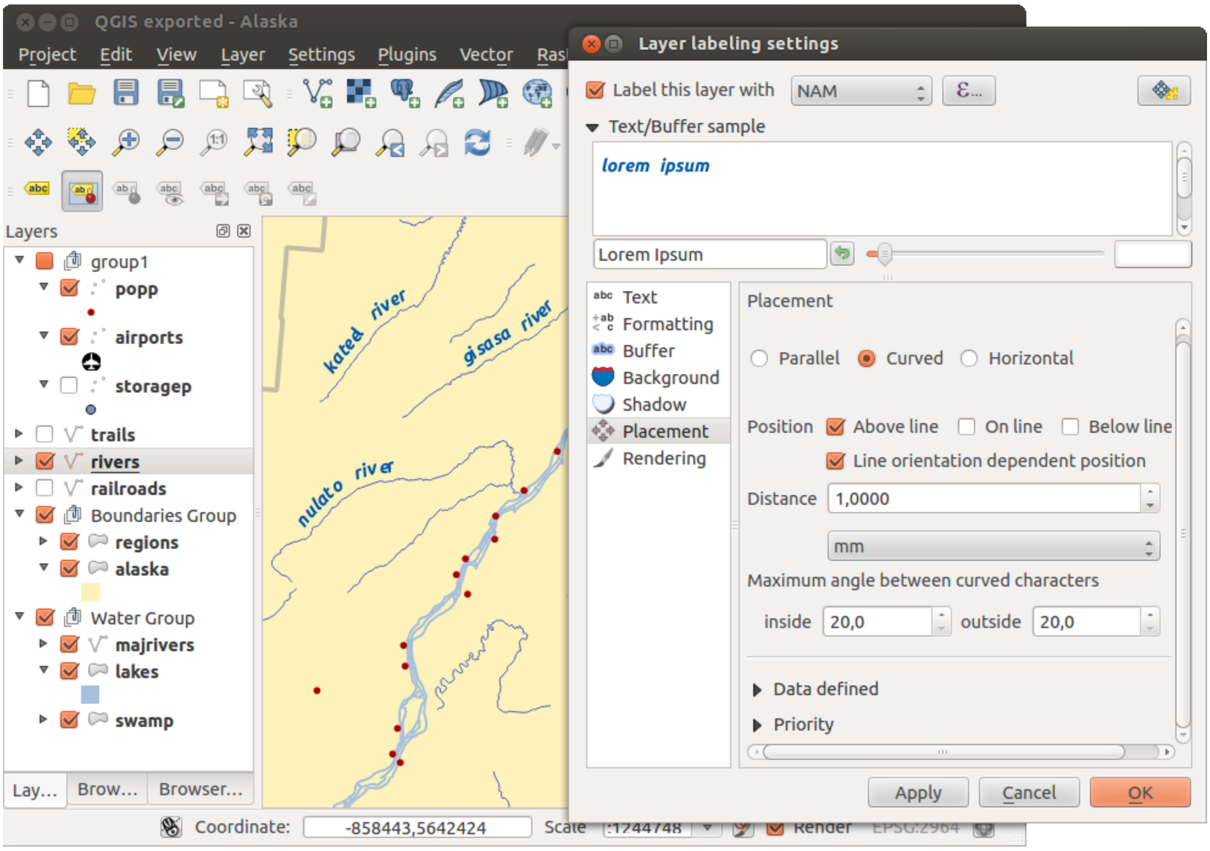

Figura 12.16: Smart labeling of vector line layers

label. For the position, *Above line*, *On line*, *Below line* and *Line orientation dependent position* are possible.

The entries in the *Rendering* menu are the same as for line layers. You can also use *Suppress labeling of features smaller than* in the *Feature options*. **Define labels based on expressions**

QGIS allows to use expressions to label features. Just click the icon in the Labels menu of the properties dialog. In figure_labels_4 you see a sample expression to label the alaska regions with name and area size, based on the field 'NAME_2', some descriptive text and the function '$area()' in combination with 'format_number()' to make it look nicer.

Expression based labeling is easy to work with. All you have to take care of is, that you need to combine all elements (strings, fields and functions) with a string concatenation sign '||' and that fields a written in "double quotes" and strings in 'single quotes'. Let's have a look at some examples:

```
# label based on two fields 'name' and 'place' with a
"name" || ', ' || "place"

-> John Smith, Paris

# label based on two fields 'name' and 'place' with a descriptive text
'My name is ' || "name" || 'and I live in ' || "place"

-> My name is John Smith and I live in Paris

# label based on two fields 'name' and 'place' with a descriptive text
# and a line break (\n)
'My name is ' || "name" || '\nI live in ' || "place"

-> My name is John Smith
```

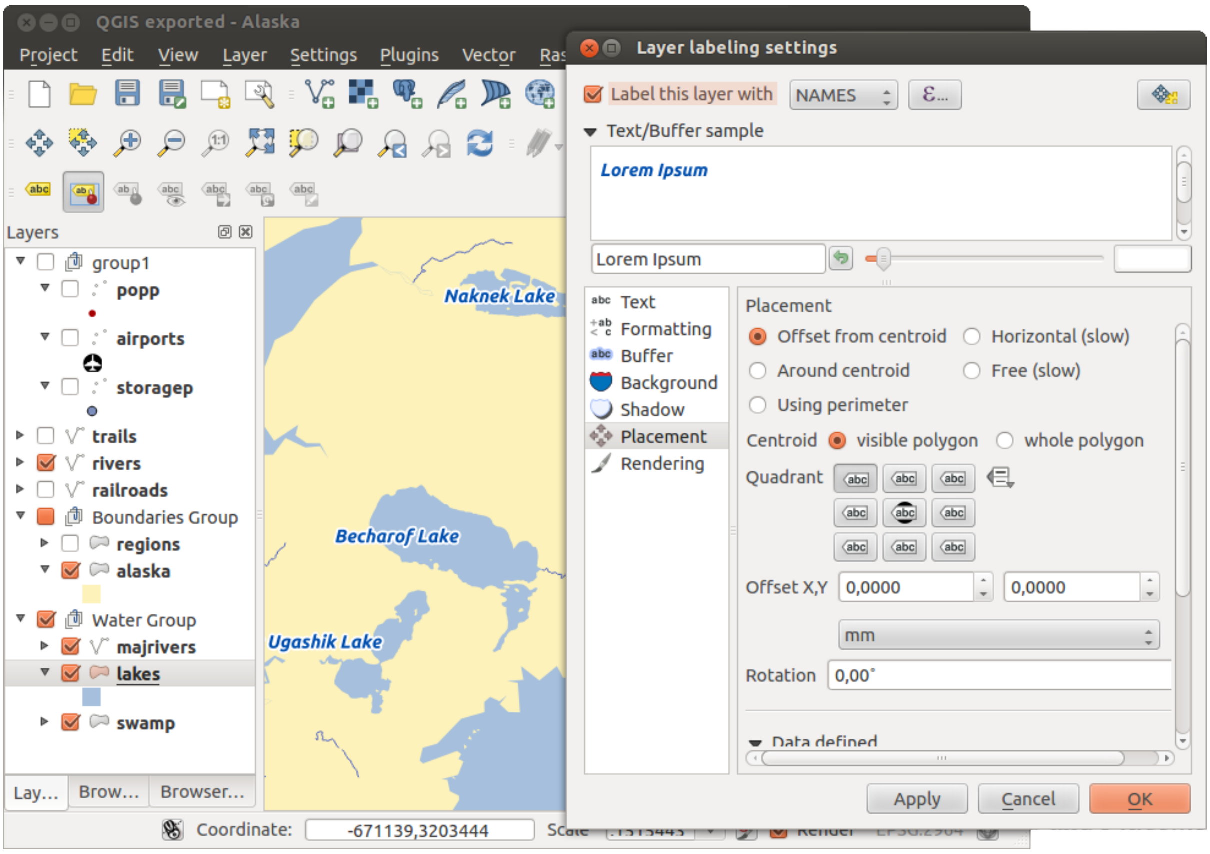

Figura 12.17: Smart labeling of vector polygon layers

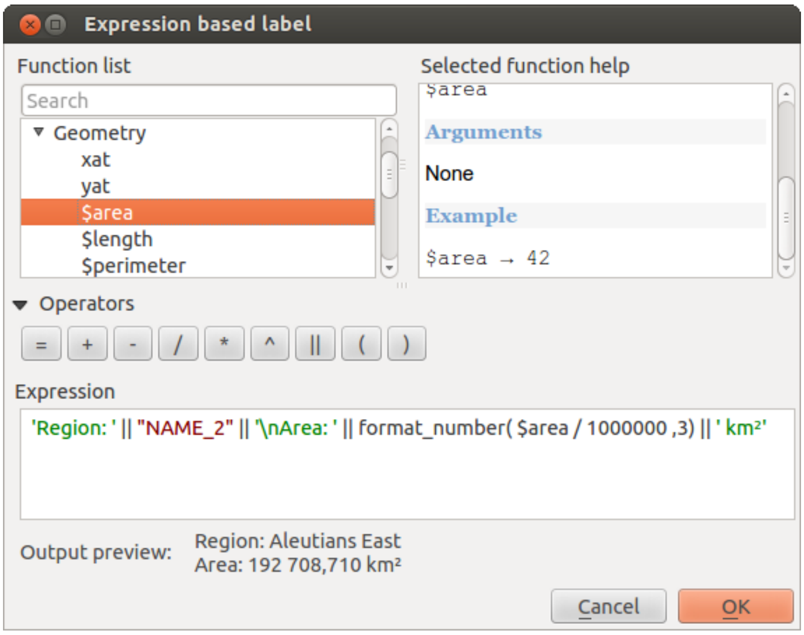

Figura 12.18: Using expressions for labeling

```
   I live in Paris

 # create a multi-line label based on a field and the $area function
 # to show the place name and its area size based on unit meter.
 'The area of ' || "place" || 'has a size of ' || $area || 'm²'

 -> The area of Paris has a size of 105000000 m²

 # create a CASE ELSE condition. If the population value in field
 # population is <= 50000 it is a town, otherwise a city.
 'This place is a ' || CASE WHEN "population <= 50000" THEN 'town' ELSE 'city' END

-> This place is a town
```

As you can see in the expression builder, you have hundreds if functions available to create simple and very complex expressions to label your data in QGIS.

Using data-defined override for labeling

With the data-defined override functions, the settings for the labeling are overridden by entries in the attribute table. You can activate and deactivate the function with the right-mouse button. Hover over the symbol and you see the information about the data-defined override, including the current definition field. We now describe an example using the data-defined override function for the Move label function (see figure_labels_5).

1. Import `lakes.shp` from the QGIS sample dataset.
2. Double-click the layer to open the Layer Properties. Click on *Labels* and *Placement*. Select *Offset from centroid*.
3. Look for the *Data defined* entries. Click the icon to define the field type for the *Coordinate*. Choose 'xlabel' for X and 'ylabel' for Y. The icons are now highlighted in yellow.
4. Zoom into a lake.
5. Go to the Label toolbar and click the icon. Now you can shift the label manually to another position (see figure_labels_6). The new position of the label is saved in the 'xlabel' and 'ylabel' columns of the attribute table.

12.2.3 Fields Menu

Within the *Fields* menu, the field attributes of the selected dataset can be manipulated. The buttons New Column and Delete Column can be used when the dataset is in Editing mode.

Edit Widget

Within the *Fields* menu, you also find an **edit widget** column. This column can be used to define values or a range of values that are allowed to be added to the specific attribute table column. If you click on the **[edit widget]** button, a dialog opens, where you can define different widgets. These widgets are:

- **Line edit**: An edit field that allows you to enter simple text (or restrict to numbers for numeric attributes).
- **Classification**: Displays a combo box with the values used for classification, if you have chosen 'unique value' as legend type in the *Style* menu of the properties dialog.
- **Range**: Allows you to set numeric values from a specific range. The edit widget can be either a slider or a spin box.
- **Unique values**: You can select one of the values already used in the attribute table. If 'Editable' is activated, a line edit is shown with autocompletion support, otherwise a combo box is used.
- **File name**: Simplifies the selection by adding a file chooser dialog.

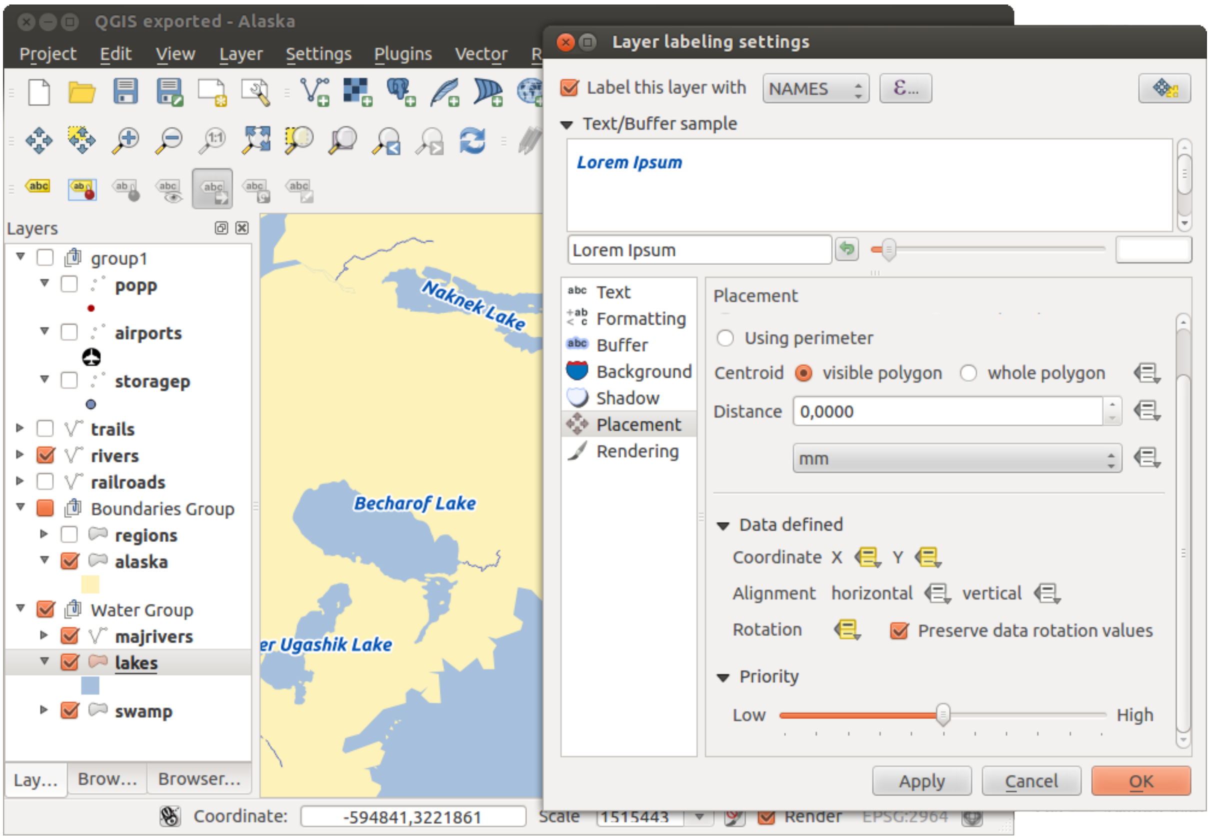

Figura 12.19: Labeling of vector polygon layers with data-defined override

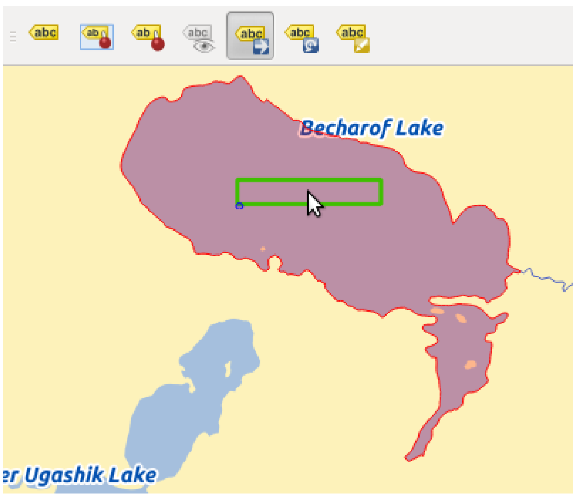

Figura 12.20: Move labels

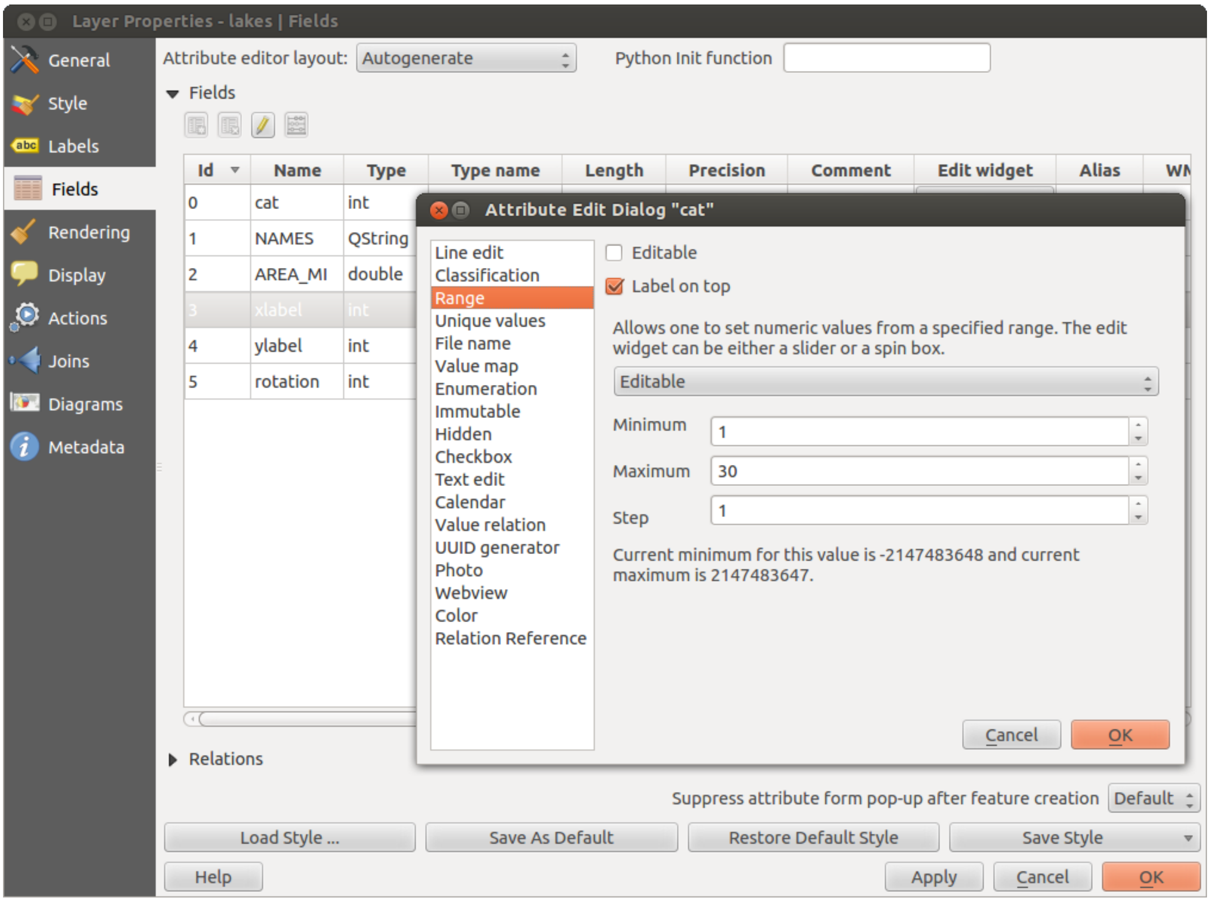

Figura 12.21: Dialog to select an edit widget for an attribute column

- **Value map**: A combo box with predefined items. The value is stored in the attribute, the description is shown in the combo box. You can define values manually or load them from a layer or a CSV file.
- **Enumeration**: Opens a combo box with values that can be used within the columns type. This is currently only supported by the PostgreSQL provider.
- **Immutable**: The immutable attribute column is read-only. The user is not able to modify the content.
- **Hidden**: A hidden attribute column is invisible. The user is not able to see its contents.
- **Checkbox**: Displays a checkbox, and you can define what attribute is added to the column when the checkbox is activated or not.
- **Text edit**: This opens a text edit field that allows multiple lines to be used.
- **Calendar**: Opens a calendar widget to enter a date. Column type must be text.
- **Value Relation**: Offers values from a related table in a combobox. You can select layer, key column and value column.
- **UUID Generator**: Generates a read-only UUID (Universally Unique Identifiers) field, if empty.
- **Photo**: Field contains a filename for a picture. The width and height of the field can be defined.
- **Webview**: Field contains a URL. The width and height of the field is variable.
- **Color**: A field that allows you to enter color codes. During data entry, the color is visible through a color bar included in the field.
- **Relation Reference**: This widged lets you embed the feature form of the referenced layer on the feature form of the actual layer. See *Creating one to many relations*.

With the **Attribute editor layout**, you can now define built-in forms for data entry jobs (see figure_fields_2). Choose 'Drag and drop designer' and an attribute column. Use the icon to create a category that will then be shown during the digitizing session (see figure_fields_3). The next step will be to assign the relevant fields to the category with the icon. You can create more categories and use the same fields again. When creating a new category, QGIS will insert a new tab for the category in the built-in form.

Other options in the dialog are 'Autogenerate' and 'Provide ui-file'. 'Autogenerate' just creates editors for all fields and tabulates them. The 'Provide ui-file' option allows you to use complex dialogs made with the Qt-Designer. Using a UI-file allows a great deal of freedom in creating a dialog. For detailed information, see http://nathanw.net/2011/09/05/qgis-tips-custom-feature-forms-with-python-logic/.

QGIS dialogs can have a Python function that is called when the dialog is opened. Use this function to add extra logic to your dialogs. An example is (in module MyForms.py):

```
def open(dialog,layer,feature):
geom = feature.geometry()
control = dialog.findChild(QWidged,"My line edit")
```

Reference in Python Init Function like so: MyForms.open

MyForms.py must live on PYTHONPATH, in .qgis2/python, or inside the project folder.

12.2.4 General Menu

Use this menu to make general settings for the vector layer. There are several options available:

Layer Info

- Change the display name of the layer in *displayed as*
- Define the *Layer source* of the vector layer
- Define the *Data source encoding* to define provider-specific options and to be able to read the file

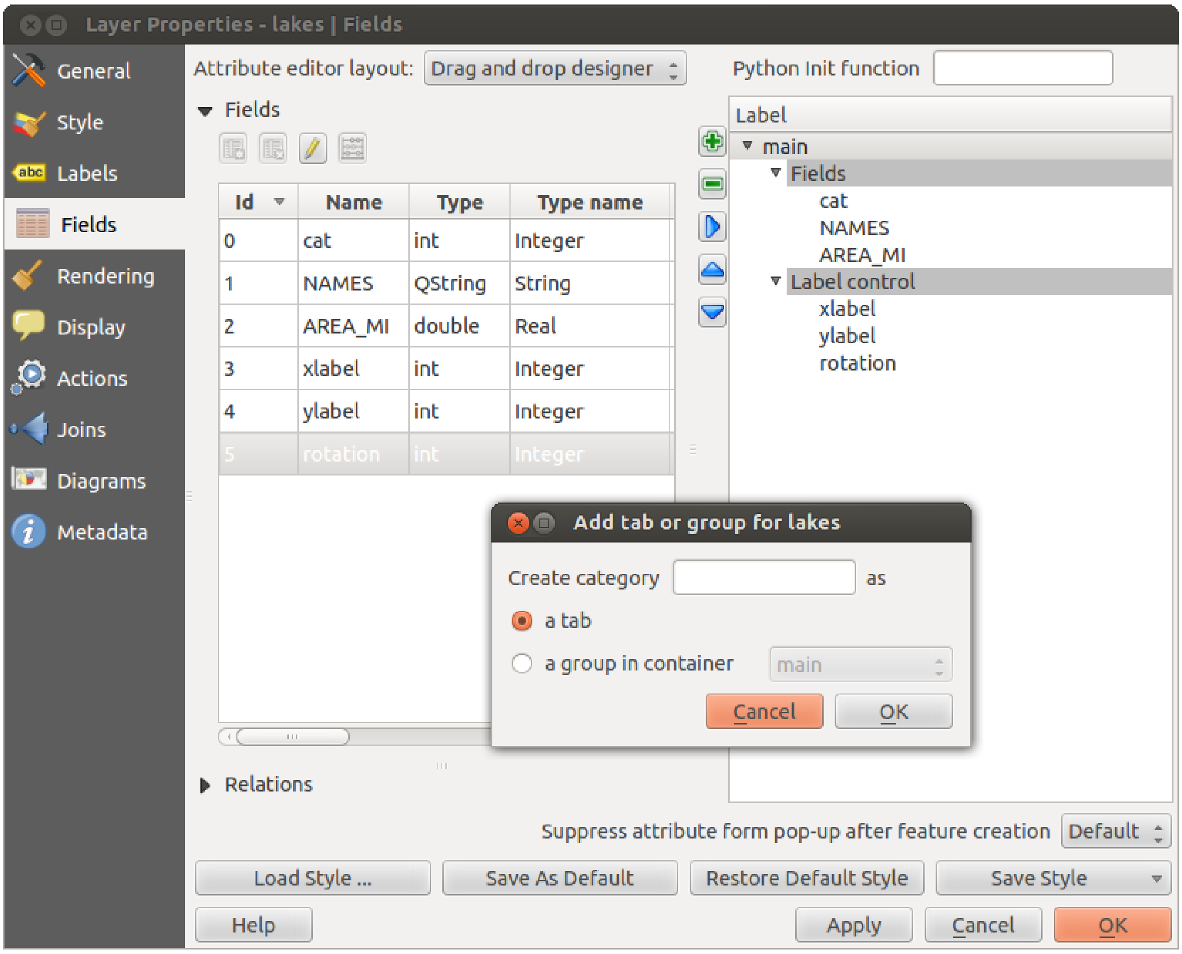

Figura 12.22: Dialog to create categories with the **Attribute editor layout**

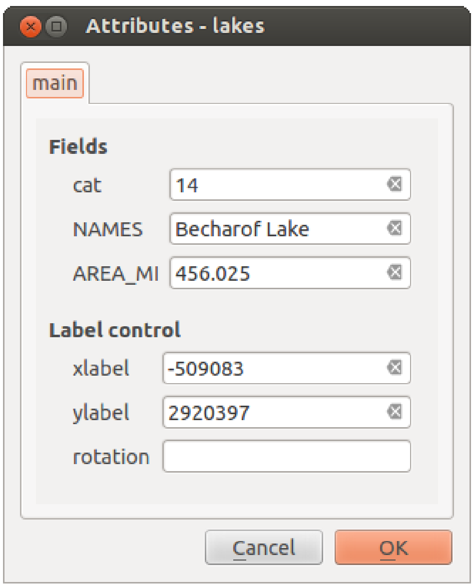

Figura 12.23: Resulting built-in form in a data entry session

Coordinate Reference System

- *Specify* the coordinate reference system. Here, you can view or change the projection of the specific vector layer.
- Create a *Spatial Index* (only for OGR-supported formats)
- *Update Extents* information for a layer
- View or change the projection of the specific vector layer, clicking on *Specify* ...

Scale dependent visibility

- You can set the *Maximum (inclusive)* and *Minimum (exclusive)* scale. The scale can also be set by the **[Current]** buttons.

Feature subset

- With the **[Query Builder]** button, you can create a subset of the features in the layer that will be visualized (also refer to section *Save selected features as new layer*).

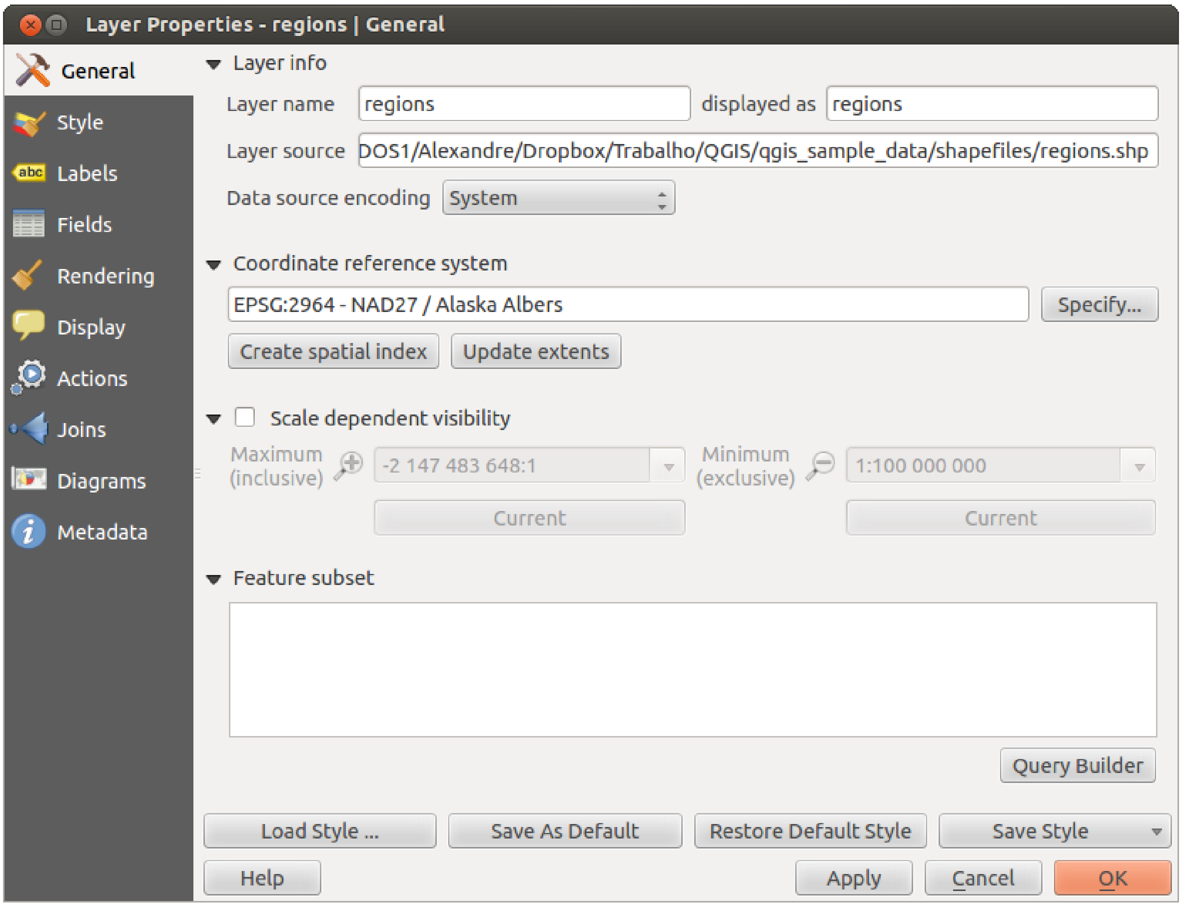

Figura 12.24: General menu in vector layers properties dialog

12.2.5 Rendering Menu

QGIS 2.2 introduces 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 new global setting that enables generalisation by default for newly added layers (see section *Opciones*). **Note**: 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.

12.2.6 Display Menu

This menu is specifically created for Map Tips. It includes a new feature: Map Tip display text in HTML. While you can still choose a *Field* to be displayed when hovering over a feature on the map, it is now possible to insert HTML code that creates a complex display when hovering over a feature. To activate Map Tips, select the menu option *View* → *MapTips*. Figure Display 1 shows an example of HTML code.

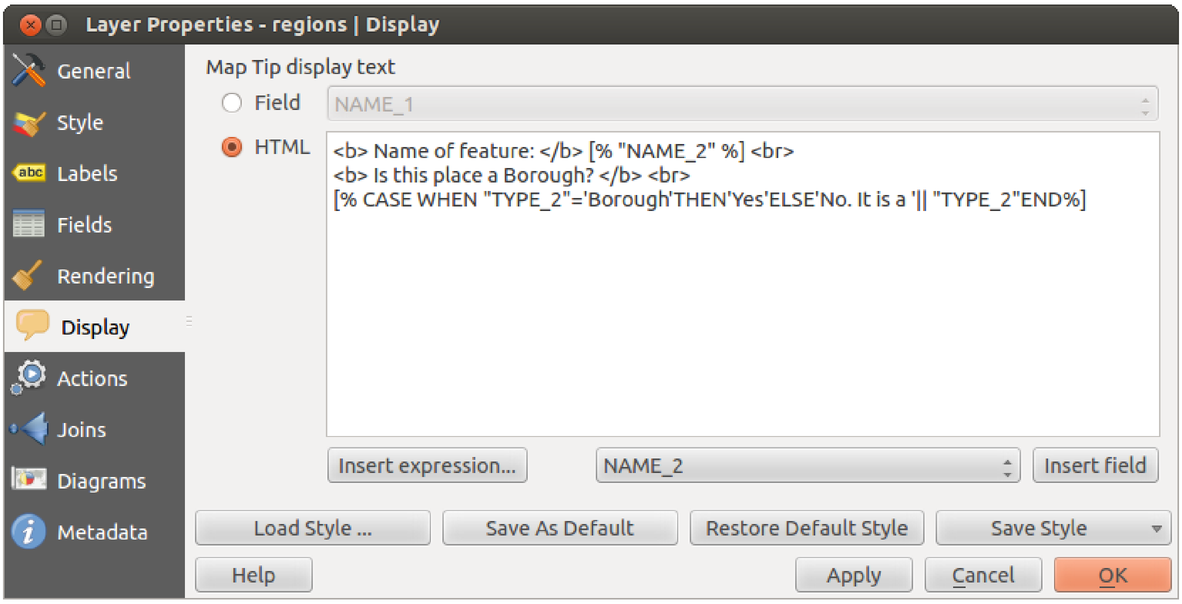

Figura 12.25: HTML code for map tip

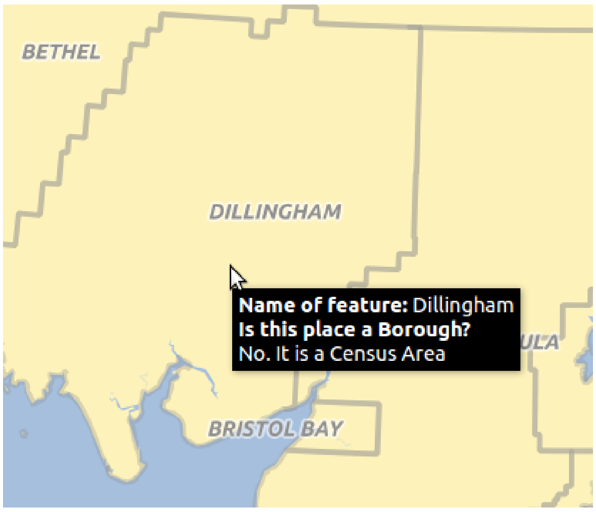

Figura 12.26: Map tip made with HTML code

12.2.7 Actions Menu

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.

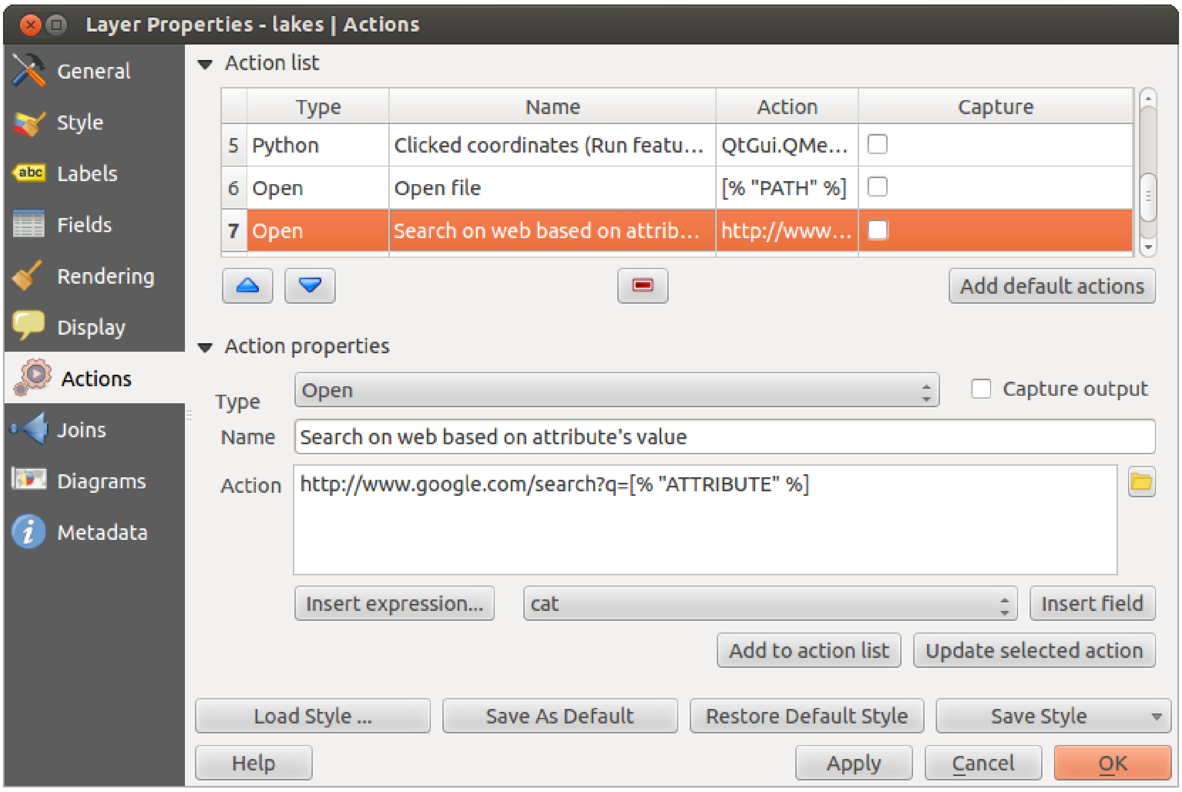

Figura 12.27: Overview action dialog with some sample actions

Actions are useful when you frequently want to run an external application or view a web page based on one or more values in your vector layer. They are divided into six types and can be used like this:

- Generic, Mac, Windows and Unix actions start an external process.
- Python actions execute a Python expression.
- Generic and Python actions are visible everywhere.
- Mac, Windows and Unix actions are visible only on the respective platform (i.e., you can define three 'Edit' actions to open an editor and the users can only see and execute the one 'Edit' action for their platform to run the editor).

There are several examples included in the dialog. You can load them by clicking on **[Add default actions]**. One example is performing a search based on an attribute value. This concept is used in the following discussion.

Defining Actions

Attribute actions are defined from the vector *Layer Properties* dialog. To define an action, open the vector *Layer Properties* dialog and click on the *Actions* menu. Go to the *Action properties*. Select 'Generic' as 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.

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 preceeding 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 http://www.google.com/search?q=%nam`
- `konqueror http://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 http://www.google.com/search?q=%nam`. This will ensure that the konqueror application will be executed when the action is invoked.

The second example uses the %% notation, which does not rely on a particular field for its value. When the action is invoked, the %% will be replaced by the value of the selected field in the identify results or attribute table.
Using Actions

Actions can be invoked from either the *Identify Results* dialog, an *Attribute Table* dialog or from *Run Feature Action* (recall that these dialogs can be opened by clicking Identify Features or Open Attribute Table or Run Feature Action). To invoke an action, right click on the record and choose the action from the pop-up menu. Actions are listed in the popup menu by the name you assigned when defining the action. Click on the action you wish to invoke.

If you are invoking an action that uses the `%%` notation, right-click on the field value in the *Identify Results* dialog or the *Attribute Table* dialog that you wish to pass to the application or 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"
```

After selecting a few localities and running the action on each one, opening the output file will show something like this:

```
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 http://google.com/search?q=qgis, where `QGIS` is the search term. Armed with this information, we can proceed:

1. Make sure the `lakes` layer is loaded.
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* menu.
4. Enter a name for the action, for example `Google Search`.
5. For the action, we need to provide the name of the external program to run. In this case, we can use Firefox. If the program is not in your path, you need to provide the full path.
6. Following the name of the external application, add the URL used for doing a Google search, up to but not including the search term: `http://google.com/search?q=`

7. The text in the *Action* field should now look like this: `firefox http://google.com/search?q=`
8. Click on the drop-down box containing the field names for the `lakes` layer. It's located just to the left of the **[Insert Field]** button.
9. From the drop-down box, select 'NAMES' and click **[Insert Field]**.
10. Your action text now looks like this:

    `firefox http://google.com/search?q=%NAMES`

11. To finalize the action, click the **[Add to action list]** button.

This completes the action, and it is ready to use. The final text of the action should look like this:

```
firefox http://google.com/search?q=%NAMES
```

We can now use the action. Close the *Layer Properties* dialog and zoom in to an area of interest. Make sure the `lakes` layer is active and identify a lake. In the result box you'll now see that our action is visible:

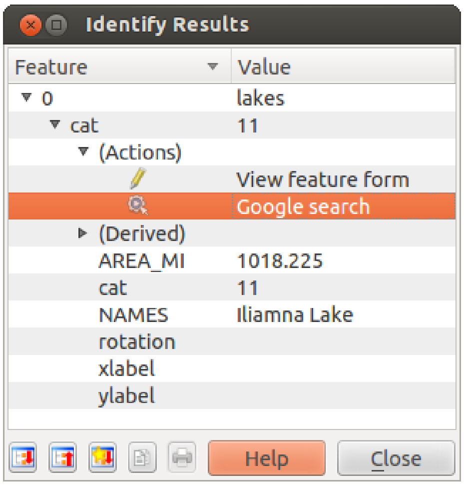

Figura 12.28: Select feature and choose action

When we click on the action, it brings up Firefox and navigates to the URL http://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.

You can define multiple actions for a layer, and each will show up in the *Identify Results* dialog.

There are all kinds of uses for actions. For example, if you have a point layer containing locations of images or photos along with a file name, you could create an action to launch a viewer to display the image. You could also use actions to launch web-based reports for an attribute field or combination of fields, specifying them in the same way we did in our Google search example.

We can also make more complex examples, for instance, using **Python** actions.

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 a 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 ] );
```

We just have to remember that the action is one of type *Python* and the *command* and *imagerelpath* variables must be changed to fit our needs.

But what about if the relative path needs to be relative to the (saved) project file? The code of the Python action would be:

```
command="firefox";
imagerelpath="images/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 ] );
```

Another Python action example is the one that allows us to add new layers to the project. For instance, the following examples will add to the project respectively a vector and a raster. The names of the files to be added to the project and the names to be given to the layers are data driven (*filename* and *layername* are column names of the table of attributes of the vector where the action was created):

```
qgis.utils.iface.addVectorLayer('/yourpath/[% "filename" %].shp','[% "layername" %]',
  'ogr')
```

To add a raster (a TIF image in this example), it becomes:

```
qgis.utils.iface.addRasterLayer('/yourpath/[% "filename" %].tif','[% "layername" %]
')
```

12.2.8 Joins Menu

The *Joins* menu allows you to join a loaded attribute table to a loaded vector layer. After clicking , the *Add vector join* dialog appears. As key columns, you have to define a join layer you want to connect with the target vector layer. Then, you have to specify the join field that is common to both the join layer and the target layer. As a result of the join, all information from the join layer and the target layer are displayed in the attribute table of the target layer as joined information.

QGIS currently has support for joining non-spatial table formats supported by OGR (e.g., CSV, DBF and Excel), delimited text and the PostgreSQL provider (see figure_joins_1).

Additionally, the add vector join dialog allows you to:

- *Cache join layer in virtual memory*
- *Create attribute index on the join field*

12.2.9 Diagrams Menu

The *Diagrams* menu allows you to add a graphic overlay to a vector layer (see figure_diagrams_1).

The current core implementation of diagrams provides support for pie charts, text diagrams and histograms.

The menu is divided into four tabs: *Appearance*, *Size*, *Postion* and *Options*.

In the cases of the text diagram and pie chart, text values of different data columns are displayed one below the other with a circle or a box and dividers. In the *Size* tab, diagram size is based on a fixed size or on linear scaling according to a classification attribute. The placement of the diagrams, which is done in the *Position* tab, interacts

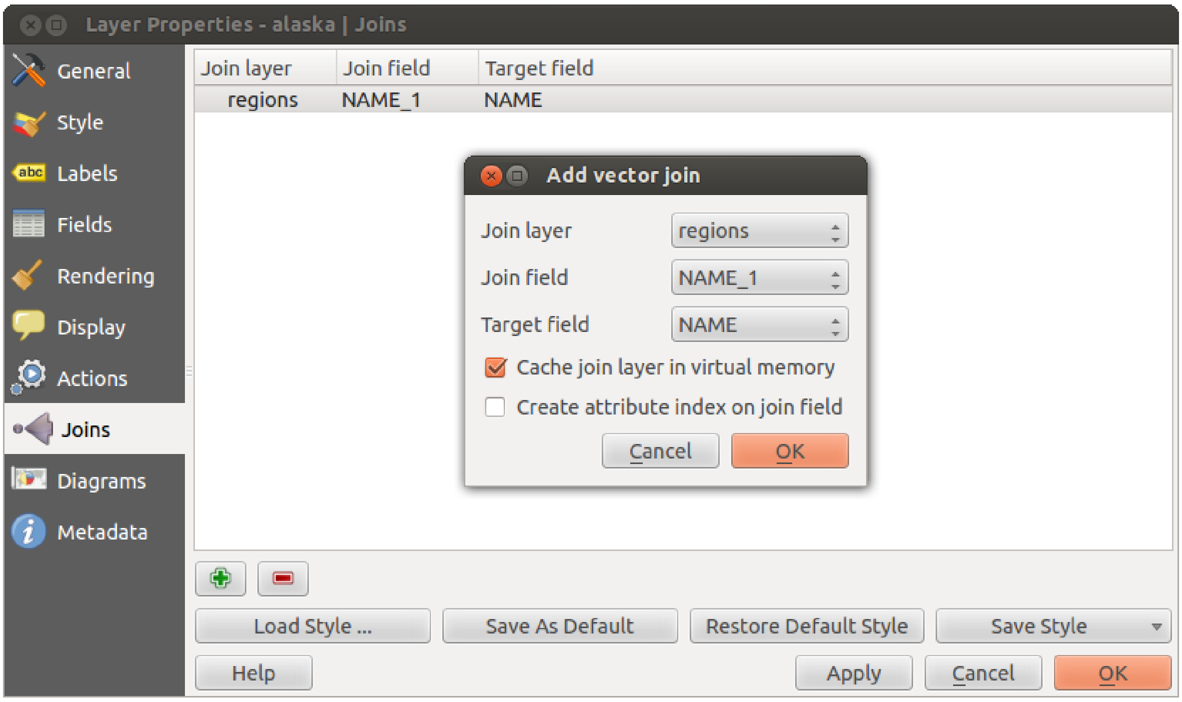

Figura 12.29: Join an attribute table to an existing vector layer

with the new labeling, so position conflicts between diagrams and labels are detected and solved. In addition, chart positions can be fixed manually.

We will demonstrate an example and overlay on the Alaska boundary layer a text diagram showing temperature data from a climate vector layer. Both vector layers are part of the QGIS sample dataset (see section *Datos de ejemplo*).

1. First, click on the Load Vector icon, browse to the QGIS sample dataset folder, and load the two vector shape layers `alaska.shp` and `climate.shp`.
2. Double click the `climate` layer in the map legend to open the *Layer Properties* dialog.
3. Click on the *Diagrams* menu, activate *Display diagrams*, and from the *Diagram type* combo box, select 'Text diagram'.
4. In the *Appearance* tab, we choose a light blue as background color, and in the *Size* tab, we set a fixed size to 18 mm.
5. In the *Position* tab, placement could be set to 'Around Point'.
6. In the diagram, we want to display the values of the three columns `T_F_JAN`, `T_F_JUL` and `T_F_MEAN`. First select `T_F_JAN` as *Attributes* and click the button, then `T_F_JUL`, and finally `T_F_MEAN`.
7. Now click **[Apply]** to display the diagram in the QGIS main window.
8. You can adapt the chart size in the *Size* tab. Deactivate the *Fixed size* and set the size of the diagrams on the basis of an attribute with the **[Find maximum value]** button and the *Size* menu. If the diagrams appear too small on the screen, you can activate the *Increase size of small diagrams* checkbox and define the minimum size of the diagrams.
9. Change the attribute colors by double clicking on the color values in the *Assigned attributes* field. Figure_diagrams_2 gives an idea of the result.
10. Finally, click **[Ok]**.

Remember that in the *Position* tab, a *Data defined position* of the diagrams is possible. Here, you can use

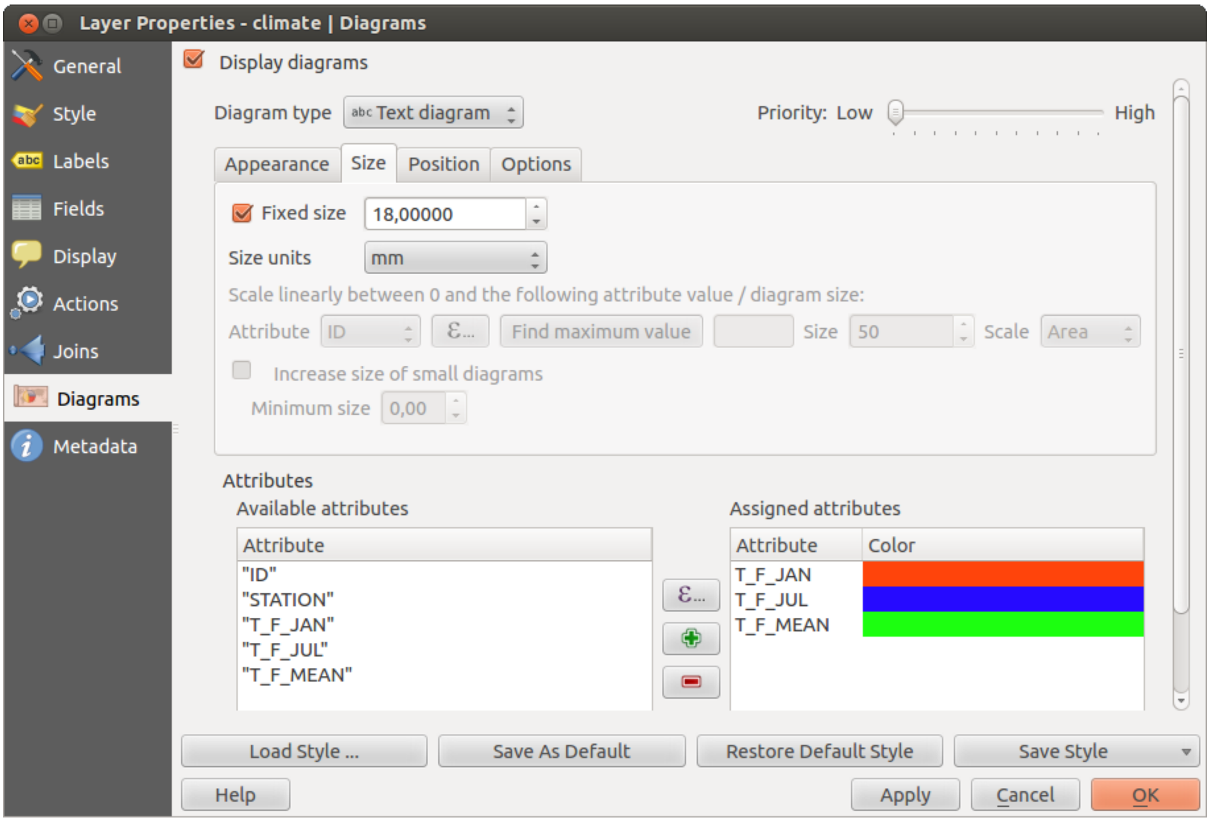

Figura 12.30: Vector properties dialog with diagram menu

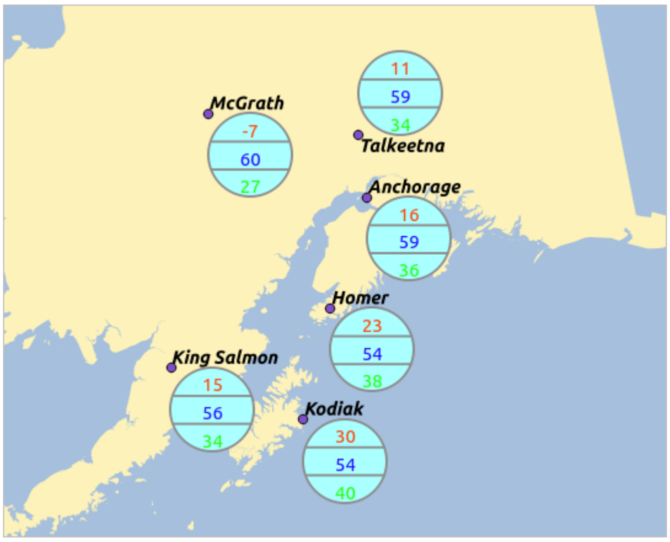

Figura 12.31: Diagram from temperature data overlayed on a map

attributes to define the position of the diagram. You can also set a scale-dependent visibility in the *Appearance* tab.

The size and the attributes can also be an expression. Use the button to add an expression.

12.2.10 Metadata Menu

The *Metadata* menu consists of *Description*, *Attribution*, *MetadataURL* and *Properties* sections.

In the *Properties* section, you get general information about the layer, including specifics about the type and location, number of features, feature type, and editing capabilities. The *Extents* table provides you with layer extent information and the *Layer Spatial Reference System*, which is information about the CRS of the layer. This is a quick way to get information about the layer.

Additionally, you can add or edit a title and abstract for the layer in the *Description* section. It's also possible to define a *Keyword list* here. These keyword lists can be used in a metadata catalogue. 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 catalogue. In *MetadataUrl*, you can define the general path to the XML metadata catalogue. This information will be saved in the QGIS project file for subsequent sessions and will be used for QGIS server.

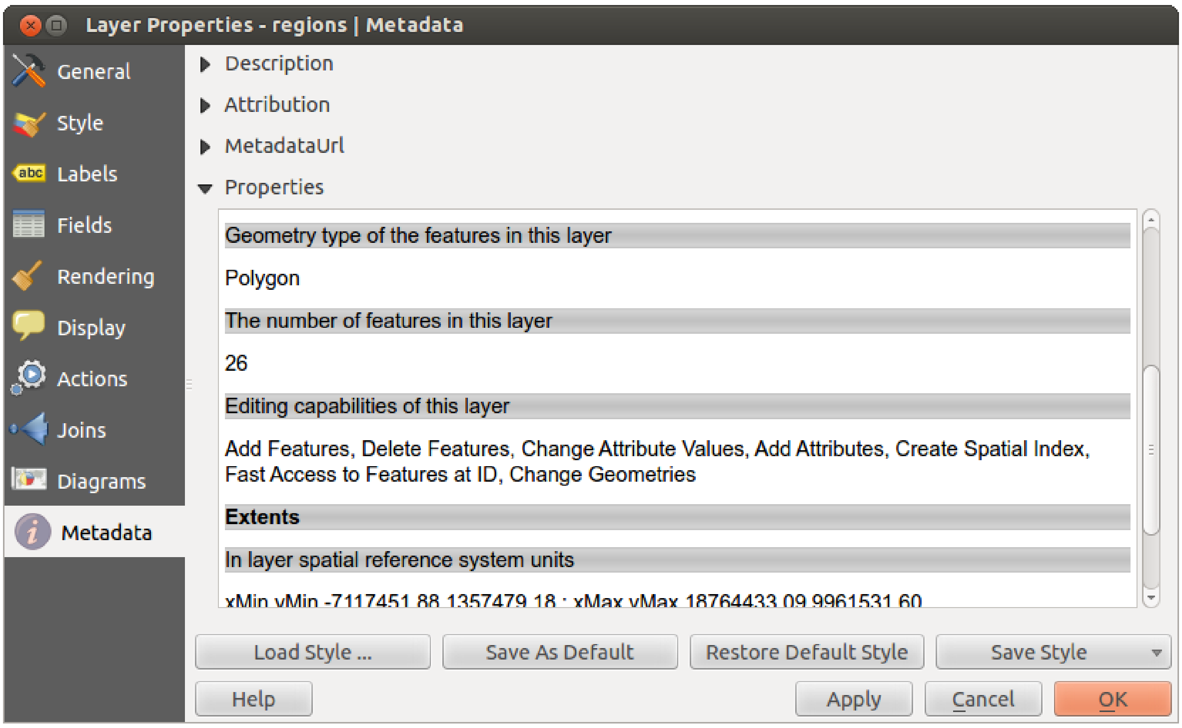

Figura 12.32: Metadata menu in vector layers properties dialog

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12.3 Editing

QGIS supports various capabilities for editing OGR, SpatiaLite, PostGIS, MSSQL Spatial and Oracle Spatial vector layers and tables.

Nota: The procedure for editing GRASS layers is different - see section *Digitizing and editing a GRASS vector layer* for details.

Truco: Concurrent Edits

This version of QGIS does not track if somebody else is editing a feature at the same time as you are. The last person to save their edits wins.

12.3.1 Setting the Snapping Tolerance and Search Radius

Before we can edit vertices, we must set the snapping tolerance and search radius to a value that allows us an optimal editing of the vector layer geometries.

Snapping tolerance

Snapping tolerance is the distance QGIS uses to `search` for the closest vertex and/or segment you are trying to connect to when you set a new vertex or move an existing vertex. If you aren't within the snapping tolerance, QGIS will leave the vertex where you release the mouse button, instead of snapping it to an existing vertex and/or segment. The snapping tolerance setting affects all tools that work with tolerance.

1. A general, project-wide snapping tolerance can be defined by choosing *Settings* → *Options*. On Mac, go to *QIS* → *Preferences...*. On Linux: *Edit* → *Options*. In the *Digitizing* tab, you can select between 'to vertex', 'to segment' or 'to vertex and segment' as default snap mode. You can also define a default snapping tolerance and a search radius for vertex edits. The tolerance can be set either in map units or in pixels. The advantage of choosing pixels is that the snapping tolerance doesn't have to be changed after zoom operations. In our small digitizing project (working with the Alaska dataset), we define the snapping units in feet. Your results may vary, but something on the order of 300 ft at a scale of 1:10000 should be a reasonable setting.
2. A layer-based snapping tolerance can be defined by choosing *Settings* → (or *File* →) *Snapping options...* to enable and adjust snapping mode and tolerance on a layer basis (see figure_edit_1).

Note that this layer-based snapping overrides the global snapping option set in the Digitizing tab. So, if you need to edit one layer and snap its vertices to another layer, then enable snapping only on the `snap to` layer, then decrease the global snapping tolerance to a smaller value. Furthermore, snapping will never occur to a layer that is not checked in the snapping options dialog, regardless of the global snapping tolerance. So be sure to mark the checkbox for those layers that you need to snap to.

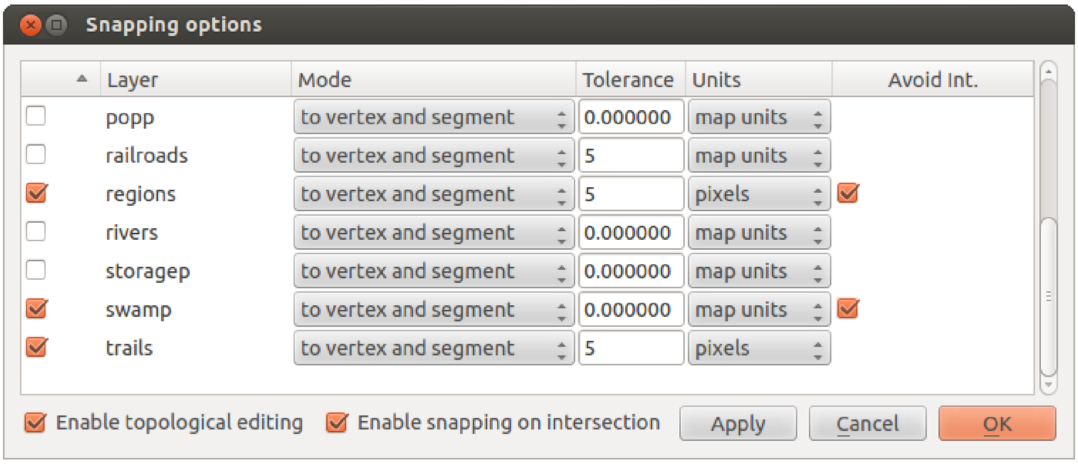

Figura 12.33: Edit snapping options on a layer basis

Search radius

Search radius is the distance QGIS uses to `search` for the closest vertex you are trying to move when you click on the map. If you aren't within the search radius, QGIS won't find and select any vertex for editing, and it will pop up an annoying warning to that effect. Snap tolerance and search radius are set in map units or pixels, so you may find you need to experiment to get them set right. If you specify too big of a tolerance, QGIS may snap to the wrong vertex, especially if you are dealing with a large number of vertices in close proximity. Set search radius too small, and it won't find anything to move.

The search radius for vertex edits in layer units can be defined in the *Digitizing* tab under *Settings* → *Options*. This is the same place where you define the general, project- wide snapping tolerance.

12.3.2 Zooming and Panning

Before editing a layer, you should zoom in to your area of interest. This avoids waiting while all the vertex markers are rendered across the entire layer.

Apart from using the pan and zoom-in / zoom-out icons on the toolbar with the mouse, navigating can also be done with the mouse wheel, spacebar and the arrow keys.

Zooming and panning with the mouse wheel

While digitizing, you can press the mouse wheel to pan inside of the main window, and you can roll the mouse wheel to zoom in and out on the map. For zooming, place the mouse cursor inside the map area and roll it forward (away from you) to zoom in and backwards (towards you) to zoom out. The mouse cursor position will be the center of the zoomed area of interest. You can customize the behavior of the mouse wheel zoom using the *Map tools* tab under the *Settings* → *Options* menu.

Panning with the arrow keys

Panning the map during digitizing is possible with the arrow keys. Place the mouse cursor inside the map area, and click on the right arrow key to pan east, left arrow key to pan west, up arrow key to pan north, and down arrow key to pan south.

You can also use the space bar to temporarily cause mouse movements to pan the map. The `PgUp` and `PgDown` keys on your keyboard will cause the map display to zoom in or out without interrupting your digitizing session.

12.3.3 Topological editing

Besides layer-based snapping options, you can also define topological functionalities in the *Snapping options...* dialog in the *Settings* (or *File*) menu. Here, you can define *Enable topological editing*, and/or for polygon layers, you can activate the column *Avoid Int.*, which avoids intersection of new polygons.

Enable topological editing

The option *Enable topological editing* is for editing and maintaining common boundaries in polygon mosaics. QGIS 'detects' a shared boundary in a polygon mosaic, so you only have to move the vertex once, and QGIS will take care of updating the other boundary.

Avoid intersections of new polygons

The second topological option in the *Avoid Int.* column, called *Avoid intersections of new polygons*, avoids overlaps in polygon mosaics. It is for quicker digitizing of adjacent polygons. If you already have one polygon, it is possible with this option to digitize the second one such that both intersect, and QGIS then cuts the second polygon to the common boundary. The advantage is that you don't have to digitize all vertices of the common boundary.

Enable snapping on intersections

Another option is to use *Enable snapping on intersection*. It allows you to snap on an intersection of background layers, even if there's no vertex on the intersection.

12.3.4 Digitizing an existing layer

By default, QGIS loads layers read-only. This is a safeguard to avoid accidentally editing a layer if there is a slip of the mouse. However, you can choose to edit any layer as long as the data provider supports it, and the underlying data source is writable (i.e., its files are not read-only).

In general, tools for editing vector layers are divided into a digitizing and an advanced digitizing toolbar, described in section *Advanced digitizing*. You can select and unselect both under *Settings → Toolbars →*. Using the basic digitizing tools, you can perform the following functions:

Icon	Purpose	Icon	Purpose
	Current edits		Toggle editing
	Adding Features: Capture Point		Adding Features: Capture Line
	Adding Features: Capture Polygon		Move Feature
	Node Tool		Delete Selected
	Cut Features		Copy Features
	Paste Features		Save layer edits

Table Editing: Vector layer basic editing toolbar

All editing sessions start by choosing the Toggle editing option. This can be found in the context menu after right clicking on the legend entry for a given layer.

Alternatively, you can use the Toggle Editing Toggle editing button from the digitizing toolbar to start or stop the editing mode. Once the layer is in edit mode, markers will appear at the vertices, and additional tool buttons on the editing toolbar will become available.

Truco: Save Regularly

Remember to Save Layer Edits regularly. This will also check that your data source can accept all the changes.

Adding Features

You can use the Add Feature, Add Feature or Add Feature icons on the toolbar to put the QGIS cursor into digitizing mode.

For each feature, you first digitize the geometry, then enter its attributes. To digitize the geometry, left-click on the map area to create the first point of your new feature.

For lines and polygons, keep on left-clicking for each additional point you wish to capture. When you have finished adding points, right-click anywhere on the map area to confirm you have finished entering the geometry of that feature.

The attribute window will appear, allowing you to enter the information for the new feature. Figure_edit_2 shows setting attributes for a fictitious new river in Alaska. In the *Digitizing* menu under the *Settings* → *Options* menu, you can also activate *Suppress attributes pop-up windows after each created feature* and *Reuse last entered attribute values*.

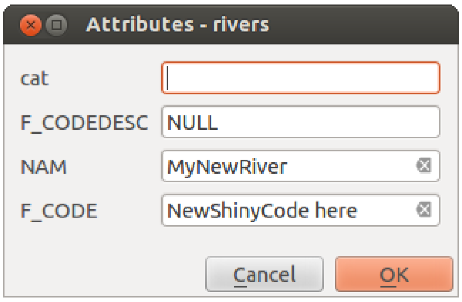

Figura 12.34: Enter Attribute Values Dialog after digitizing a new vector feature

With the Move Feature(s) icon on the toolbar, you can move existing features.

Truco: Attribute Value Types

For editing, the attribute types are validated during entry. Because of this, it is not possible to enter a number into a text column in the dialog *Enter Attribute Values* or vice versa. If you need to do so, you should edit the attributes in a second step within the *Attribute table* dialog.

Current Edits

This new feature allows the digitization of multiple layers. Choose *Save for Selected Layers* to save all changes you made in multiple layers. You also have the opportunity to *Rollback for Selected Layers*, so that the digitization may be withdrawn for all selected layers. If you want to stop editing the selected layers, *Cancel for Selected Layer(s)* is an easy way.

The same functions are available for editing all layers of the project.

Node Tool

For shapefile-based layers as well as SpatialLite, PostgreSQL/PostGIS, MSSQL Spatial, and Oracle Spatial tables, the Node Tool 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 node tool also works with 'on the fly' projection turned on, and it supports the topological editing feature. This tool is, unlike other tools in QGIS, persistent, so when some operation is done, selection stays active for this feature and tool. If the node tool is unable to find any features, a warning will be displayed.

It is important to set the property *Settings* → *Options* → *Digitizing* → *Search Radius:* 1,00 to a number greater than zero (i.e., 10). Otherwise, QGIS will not be able to tell which vertex is being edited.

Truco: Vertex Markers

The current version of QGIS supports three kinds of vertex markers: 'Semi-transparent circle', 'Cross' and 'None'. To change the marker style, choose *Options* from the *Settings* menu, click on the *Digitizing* tab and select the appropriate entry.

Basic operations

Start by activating the Node Tool and selecting a feature by clicking on it. Red boxes will appear at each vertex of this feature.

- **Selecting vertices**: You can select vertices by clicking on them one at a time, by clicking on an edge to select the vertices at both ends, 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 `Ctrl` key while clicking. Hold down `Ctrl` or `Shift` when clicking to toggle the selection state of vertices (vertices that are currently unselected will be selected as usual, but also vertices that are already selected will become unselected).
- **Adding vertices**: To add a vertex, simply double click near an edge and a new vertex will appear on the edge near to the cursor. Note that the vertex will appear on the edge, not at the cursor position; therefore, it should be moved if necessary.
- **Deleting vertices**: After selecting vertices for deletion, click the `Delete` key. Note that you cannot use the Node Tool to delete a complete feature; QGIS will ensure it retains the minimum number of vertices for the feature type you are working on. To delete a complete feature use the Delete Selected tool.
- **Moving vertices**: Select all the vertices you want to move. Click on a selected vertex or edge and drag in the direction you wish to move. All the selected vertices will move together. If snapping is enabled, the whole selection can jump to the nearest vertex or line.

Each change made with the node tool 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 node tool provides tooltips to identify a vertex by hovering the pointer over it.

Cutting, Copying and Pasting Features

Selected features can be cut, copied and pasted between layers in the same QGIS project, as long as destination layers are set to Toggle editing beforehand.

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.

However, in this version of QGIS, text features from outside QGIS cannot 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.

As an example, we will copy some lakes to a new layer:

1. Load the layer you want to copy from (source layer)
2. Load or create the layer you want to copy to (target layer)
3. Start editing for target layer
4. Make the source layer active by clicking on it in the legend
5. Use the Select Single Feature tool to select the feature(s) on the source layer
6. Click on the Copy Features tool
7. Make the destination layer active by clicking on it in the legend
8. Click on the Paste Features tool

9. Stop editing and save the changes

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.

Truco: Congruency of Pasted Features

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.

Deleting Selected Features

If we want to delete an entire polygon, we can do that by first selecting the polygon using the regular Select Single Feature tool. You can select multiple features for deletion. Once you have the selection set, use the Delete Selected tool to delete the features.

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.

Saving Edited Layers

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.

If the changes cannot be saved (e.g., disk full, or the attributes have values that are out of range), the QGIS in-memory state is preserved. This allows you to adjust your edits and try again.

Truco: Data Integrity

It is always a good idea to back up your data source before you start editing. While the authors of QGIS have made every effort to preserve the integrity of your data, we offer no warranty in this regard.

12.3.5 Advanced digitizing

Icon	Purpose	Icon	Purpose
	Undo		Redo
	Rotate Feature(s)		Simplify Feature
	Add Ring		Add Part
	Fill Ring		Delete Ring
	Delete Part		Reshape Features
	Offset Curve		Split Features
	Split Parts		Merge Selected Features
	Merge Attributes of Selected Features		Rotate Point Symbols

Table Advanced Editing: Vector layer advanced editing toolbar

Undo and Redo

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 Figure_edit_3). This widget is not displayed by default; it can be displayed by right clicking on the toolbar and activating the Undo/Redo checkbox. Undo/Redo is however active, even if the widget is not displayed.

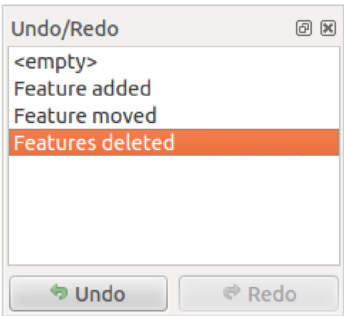

Figura 12.35: Redo and Undo digitizing steps

When Undo is hit, 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.

To use the undo/redo history widget, simply click to select an operation in the history list. All features will be reverted to the state they were in after the selected operation.

Rotate Feature(s)

Use Rotate Feature(s) to rotate one or multiple selected features in the map canvas. You first need to select the features and then press the Rotate Feature(s) icon. The centroid of the feature(s) appears and will be the rotation anchor point. If you selected multiple features, the rotation anchor point will be the common center of the features. Press and drag the left mouse button in the desired direction to rotate the selected features.

It's also possible to create a user-defined rotation anchor point around which the selected feature will rotate. Select the features to rotate and activate the Rotate Feature(s) tool. Press and hold the `Ctrl` button and move the mouse pointer (without pressing the mouse button) to the place where you want the rotation anchor to be moved. Release the `Ctrl` button when the desired rotation anchor point is reached. Now, press and drag the left mouse button in the desired direction to rotate the selected feature(s).

Simplify Feature

The Simplify Feature tool allows you to reduce the number of vertices of a feature, as long as the geometry doesn't change. First, select a feature. It will be highlighted by a red rubber band and a slider will appear. Moving the slider, the red rubber band will change its shape to show how the feature is being simplified. Click **[OK]** to store the new, simplified geometry. If a feature cannot be simplified (e.g. multi-polygons), a message will appear.

Add Ring

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.

Add Part

You can add part polygons to a selected multipolygon. The new part polygon must be digitized outside the selected multi-polygon.

Fill Ring

You can use the Fill Ring function to add a ring to a polygon and add a new feature to the layer at the same time. Thus you need not first use the Add Ring icon and then the Add feature function anymore.

Delete Ring

The Delete Ring tool allows you to delete ring polygons inside an existing area. This tool only works with polygon layers. It doesn't change anything when it is used on the outer ring of the polygon. This tool can be used on polygon and multi-polygon features. Before you select the vertices of a ring, adjust the vertex edit tolerance.

Delete Part

The Delete Part tool allows you to delete parts from multifeatures (e.g., to delete polygons from a multi-polygon feature). It won't delete the last part of the feature; this last part will stay untouched. This tool works with all multi-part geometries: point, line and polygon. Before you select the vertices of a part, adjust the vertex edit tolerance.

Reshape Features

You can reshape line and polygon features using the Reshape Features icon on the toolbar. It replaces the line or polygon part from the first to the last intersection with the original line. With polygons, this 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.

For example, you can edit the boundary of a polygon with this tool. First, click in the inner area of the polygon next to the point where you want to add a new vertex. Then, cross the boundary and add the vertices outside the polygon. To finish, right-click in the inner area of the polygon. The tool will automatically add a node where the new line crosses the border. It is also possible to remove part of the area from the polygon, starting the new line outside the polygon, adding vertices inside, and ending the line outside the polygon with a right click.

Nota: The reshape tool may alter the starting position of a polygon ring or a closed line. So, the point that is represented 'twice' will not be the same any more. This may not be a problem for most applications, but it is something to consider.

Offset Curves

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 the edited layer). It is thus ideally suited for the creation of distance line layers. The displacement is shown at the bottom left of the taskbar. To create a shift of a line layer, you must first go into editing mode and then select the feature. You can make the Offset Curve tool active and drag the cross to the desired distance. Your changes may then be saved with the Save Layer Edits tool.

Split Features

You can split features using the Split Features icon on the toolbar. Just draw a line across the feature you want to split.

Split parts

In QGIS 2.0 it is now possible to split the parts of a multi part feature so that the number of parts is increased. Just draw a line across the part you want to split using the Split Parts icon.

Merge selected features

The Merge Selected Features tool allows you to merge features that have common boundaries and the same attributes.

Merge attributes of selected features

The Merge Attributes of Selected Features tool allows you to merge attributes of features with common boundaries and attributes without merging their boundaries. First, select several features at once. Then press the Merge Attributes of Selected Features button. Now QGIS asks you which attributes are to be applied to all selected objects. As a result, all selected objects have the same attribute entries.

Rotate Point Symbols

Rotate Point Symbols allows you to change the rotation of point symbols in the map canvas. You must first define a rotation column from the attribute table of the point layer in the *Advanced* menu of the *Style* menu of the *Layer Properties*. Also, you will need to go into the 'SVG marker' and choose *Data defined properties ...*. Activate *Angle* and choose 'rotation' as field. Without these settings, the tool is inactive.

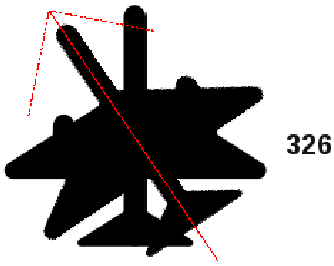

Figura 12.36: Rotate Point Symbols

To change the rotation, select a point feature in the map canvas and rotate it, holding the left mouse button pressed. A red arrow with the rotation value will be visualized (see Figure_edit_4). When you release the left mouse button again, the value will be updated in the attribute table.

Nota: If you hold the `Ctrl` key pressed, the rotation will be done in 15 degree steps.

12.3.6 Creating new Vector layers

QGIS allows you to create new shapefile layers, new SpatiaLite layers, and new GPX layers. Creation of a new GRASS layer is supported within the GRASS plugin. Please refer to section *Creating a new GRASS vector layer* for more information on creating GRASS vector layers.

Creating a new Shapefile layer

To create a new shape layer for editing, choose *New* → *New Shapefile Layer...* from the *Layer* menu. The *New Vector Layer* dialog will be displayed as shown in Figure_edit_5. Choose the type of layer (point, line or polygon) and the CRS (coordinate reference system).

Note that QGIS does not yet support creation of 2.5D features (i.e., features with X,Y,Z coordinates).

To complete the creation of the new shapefile layer, add the desired attributes by clicking on the **[Add to attributes list]** button and specifying a name and type for the attribute. A first 'id' column is added as default but can be removed, if not wanted. Only *Type: real* , *Type: integer* , *Type: string* and *Type:date* attributes are supported. Additionally and according to the attribute type, you can also define the width and precision of the new attribute column. Once you are happy with the attributes, click **[OK]** and provide a name for the shapefile. QGIS will automatically add a `.shp` extension to the name you specify. Once the layer has been created, it will be added to the map, and you can edit it in the same way as described in section *Digitizing an existing layer* above.

Creating a new SpatiaLite layer

To create a new SpatiaLite layer for editing, choose *New* → *New SpatiaLite Layer...* from the *Layer* menu. The *New SpatiaLite Layer* dialog will be displayed as shown in Figure_edit_6.

The first step is to select an existing SpatiaLite database or to create a new SpatiaLite database. This can be done with the browse button to the right of the database field. Then, add a name for the new layer, define the layer type, and specify the coordinate reference system with **[Specify CRS]**. If desired, you can select *Create an autoincrementing primary key*.

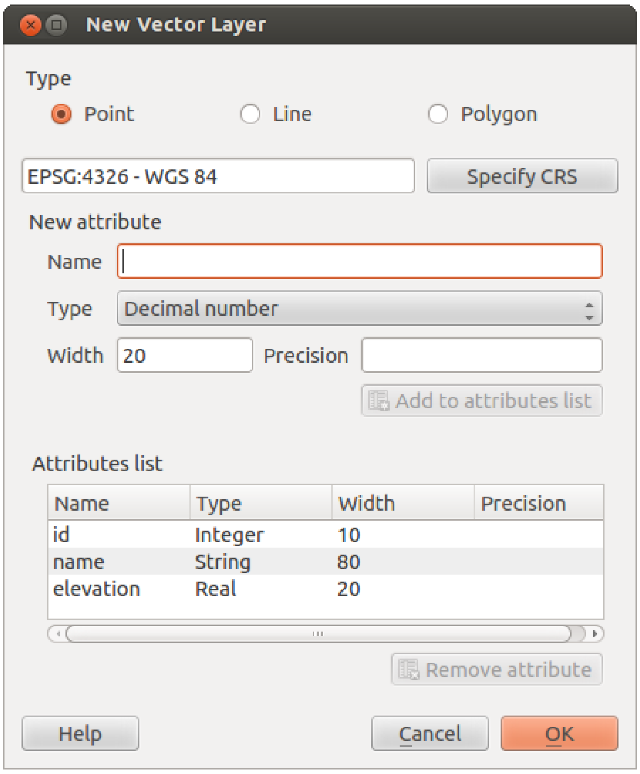

Figura 12.37: Creating a new Shapefile layer Dialog

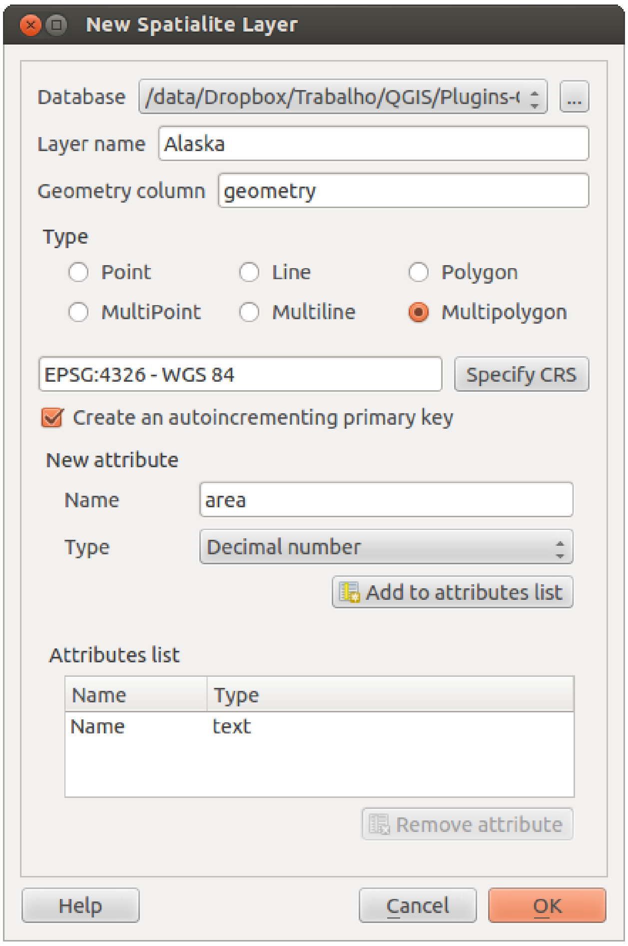

Figura 12.38: Creating a New SpatiaLite layer Dialog

To define an attribute table for the new SpatiaLite layer, add the names of the attribute columns you want to create with the corresponding column type, and click on the **[Add to attribute list]** button. Once you are happy with the attributes, click **[OK]**. QGIS will automatically add the new layer to the legend, and you can edit it in the same way as described in section *Digitizing an existing layer* above.

Further management of SpatiaLite layers can be done with the DB Manager. See *Complemento administrador de BBDD*.

Creating a new GPX layer

To create a new GPX file, you need to load the GPS plugin first. *Plugins* → *Plugin Manager...* opens the Plugin Manager Dialog. Activate the *GPS Tools* checkbox.

When this plugin is loaded, choose *New* → *Create new GPX Layer...* from the *Layer* menu. In the *Save new GPX file as* dialog, you can choose where to save the new GPX layer.

12.3.7 Working with the Attribute Table

The attribute table displays features of a selected layer. Each row in the table represents one map feature, and each column contains a particular piece of information about the feature. Features in the table can be searched, selected, moved or even edited.

To open the attribute table for a vector layer, make the layer active by clicking on it in the map legend area. Then, from the main *Layer* menu, choose *Open Attribute Table*. It is also possible to right click on the layer and choose *Open Attribute Table* from the drop-down menu, and to click on the *Open Attribute Table* button in the Attributes toolbar.

This will open a new window that displays the feature attributes for the layer (figure_attributes_1). The number of features and the number of selected features are shown in the attribute table title.

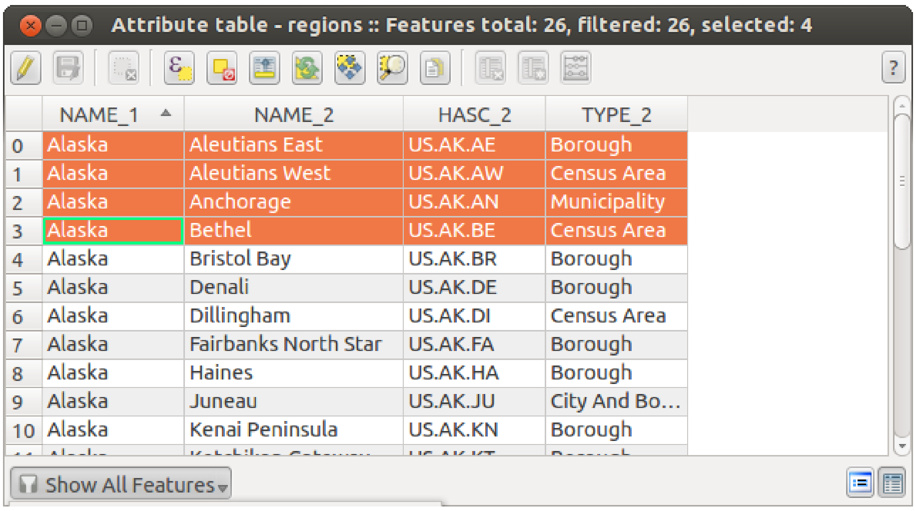

Figura 12.39: Attribute Table for regions layer

Selecting features in an attribute table

Each selected row in the attribute table displays the attributes of a selected feature in the layer. If the set of features selected in the main window is changed, the selection is also updated in the attribute table. Likewise, if the set of rows selected in the attribute table is changed, the set of features selected in the main window will be updated.

Rows can be selected by clicking on the row number on the left side of the row. **Multiple rows** can be marked by holding the `Ctrl` key. A **continuous selection** can be made by holding the `Shift` key and clicking on several row headers on the left side of the rows. All rows between the current cursor position and the clicked row are selected. Moving the cursor position in the attribute table, by clicking a cell in the table, does not change the row selection. Changing the selection in the main canvas does not move the cursor position in the attribute table.

The table can be sorted by any column, by clicking on the column header. A small arrow indicates the sort order (downward pointing means descending values from the top row down, upward pointing means ascending values from the top row down).

For a **simple search by attributes** on only one column, choose the *Column filter* → from the menu in the bottom left corner. Select the field (column) on which the search should be performed from the drop-down menu, and hit the **[Apply]** button. Then, only the matching features are shown in the attribute table.

To make a selection, you have to use the Select features using an Expression icon on top of the attribute table. Select features using an Expression allows you to define a subset of a table using a *Function List* like in the Field Calculator (see *Field Calculator*). The query result can then be saved as a new vector layer. For example, if you want to find regions that are boroughs from `regions.shp` of the QGIS sample data, you have to open the *Fields and Values* menu and choose the field that you want to query. Double-click the field 'TYPE_2' and also **[Load all unique values]** . From the list, choose and double-click 'Borough'. In the *Expression* field, the following query appears:

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

Here you can also use the *Function list* → *Recent (Selection)* to make a selection that you used before. The expression builder remembers the last 20 used expressions.

The matching rows will be selected, and the total number of matching rows will appear in the title bar of the attribute table, as well as in the status bar of the main window. For searches that display only selected features on the map, use the Query Builder described in section *Constructor de consultas*.

To show selected records only, use *Show Selected Features* from the menu at the bottom left.

The other buttons at the top of the attribute table window provide the following functionality:

- Toggle editing mode to edit single values and to enable functionalities described below (also with `Ctrl+E`)
- Save Edits (also with `Ctrl+S`)
- Unselect all (also with `Ctrl+U`)
- Move selected to top (also with `Ctrl+T`)
- Invert selection (also with `Ctrl+R`)
- Copy selected rows to clipboard (also with `Ctrl+C`)
- Zoom map to the selected rows (also with `Ctrl+J`)
- Pan map to the selected rows (also with `Ctrl+P`)
- Delete selected features (also with `Ctrl+D`)
- New Column for PostGIS layers and for OGR layers with GDAL version >= 1.6 (also with `Ctrl+W`)
- Delete Column for PostGIS layers and for OGR layers with GDAL version >= 1.9 (also with `Ctrl+L`)
- Open field calculator (also with `Ctrl+I`)

Truco: Skip WKT geometry

If you want to use attribute data in external programs (such as Excel), use the Copy selected rows to clipboard button. You can copy the information without vector geometries if you deactivate *Settings* → *Options* → Data sources menu *Copy geometry in WKT representation from attribute table*.

Save selected features as new layer

The selected features can be saved as any OGR-supported vector format and also transformed into another coordinate reference system (CRS). Just open the right mouse menu of the layer and click on *Save selection as* → to define the name of the output file, its format and CRS (see section *Leyenda del mapa*). It is also possible to specify OGR creation options within the dialog.

Paste into new layer

Features that are on the clipboard may be pasted into a new layer. To do this, first make a layer editable. Select some features, copy them to the clipboard, and then paste them into a new layer using *Edit* → *Paste Features as* and choosing *New vector layer* or *New memory layer*.

This applies to features selected and copied within QGIS and also to features from another source defined using well-known text (WKT).

Working with non spatial attribute tables

QGIS allows you also to load non-spatial tables. This currently includes tables supported by OGR and delimited text, as well as the PostgreSQL, MSSQL and Oracle provider. The tables can be used for field lookups or just generally browsed and edited using the table view. When you load the table, you will see it in the legend field. It can be opened with the Open Attribute Table tool and is then editable like any other layer attribute table.

As an example, you can use columns of the non-spatial table to define attribute values, or a range of values that are allowed, to be added to a specific vector layer during digitizing. Have a closer look at the edit widget in section *Fields Menu* to find out more.

12.3.8 Creating one 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.

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).

Foreign keys

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 region layer, you need to create a one to many relation using foreign keys, because there are several airports in most regions.

In addition to the already existing attributes in the airports attribute table 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 the editing and QGIS takes care about 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.

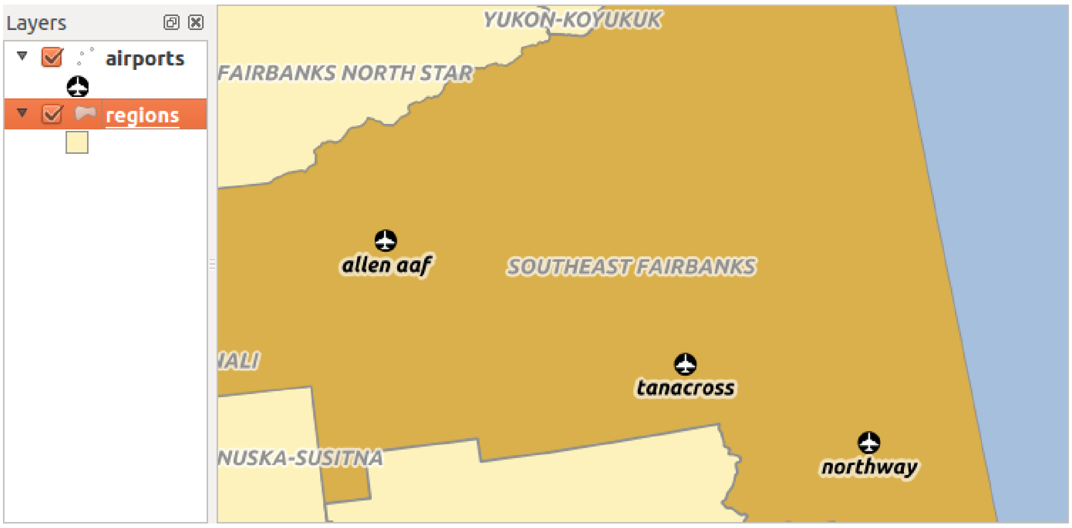

Figura 12.40: Alaska region with airports

Layers

QGIS makes no difference between a table and a vector layer. Basically, a vector layer is a table with a geometry. So can add your table as a vector layer. To demostrate you can load the 'region' shapefile (with geometries) and the 'airport' csv table (without geometries) and a foreign key (fk_region) to the layer region. 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).

Definition (Relation Manager)

The first thing we are going to do is to let QGIS know about the relations between the layer. This is done in *Settings* → *Project Properties*. Open the *Relations* menu and click on *Add*.

- **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 "Airports" in this case.
- **referencing layer** is the one with the foreign key field on it. In our case this is the airports layer
- **referencing field** will say, which field points to the other layer so this is fk_region in this case
- **referenced layer** is the one with the primary key, pointed to, so here it is the regions layer
- **referenced field** is the primary key of the referenced layer so it is ID
- **id** will be used for internal purposes and has to be unique. You may need it to build custom forms once this is supported. 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.

Forms

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.

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

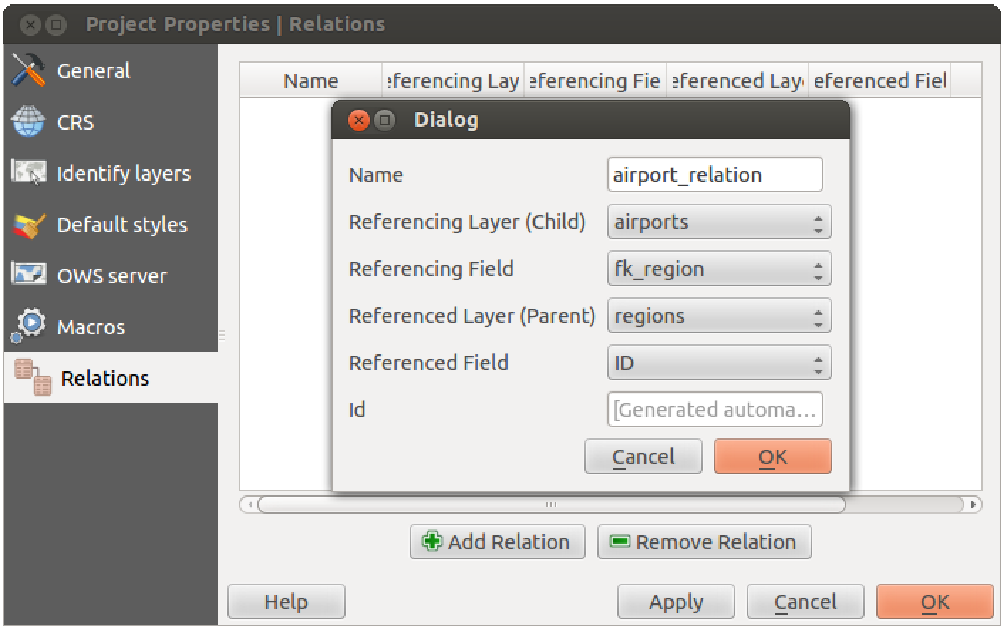

Figura 12.41: Relation Manager

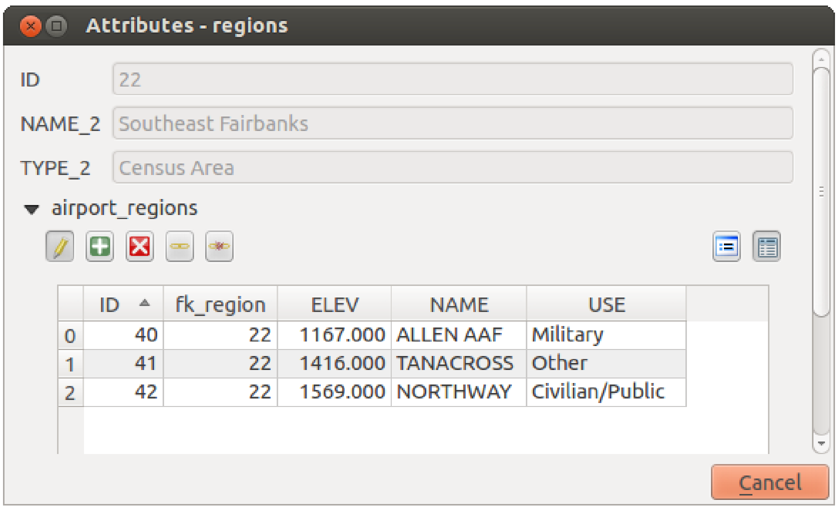

Figura 12.42: Identification dialog regions with relation to airports

- 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 will add a new feature to the airport layer. And it will assign the new airport to the current region by default.
- 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.
- The two buttons to the right switch between table view and form view where the later let's you view all the airports in their respective form.

If you work on the airport table, a new widget type is available which lets you embed the feature form of the referenced region on the feature form of the airports. It can be used when you open the layer properties of the airports table, switch to the *Fields* menu and change the widget type of the foreign key field 'fk_region' to Relation Reference.

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.

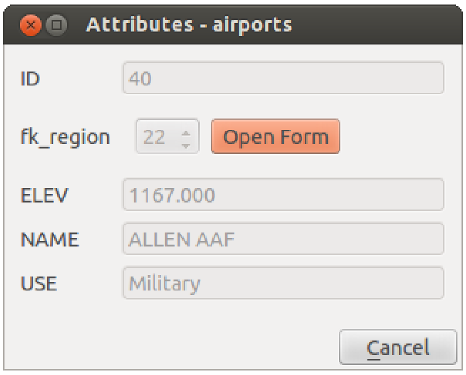

Figura 12.43: Identification dialog airport with relation to regions

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12.4 Constructor de consultas

El Constructor de consultas permite definir un sub conjunto de una tabla utilizando SQL- como clausulas WHERE y visualizar los resultados en la ventana principal. El resultado de la consulta se puede guardar como una nueva capa vectorial.

12.4.1 Consulta

Abra el **Constructor de consultas** al abrir las Propiedades de la capa y vaya al menú *General*. Bajo *Subconjunto de datos espaciales*, haga clic en el botón **[Constructor de consultas]** para abrir el *Constructor de consultas*. Por ejemplo, si tiene una capa de `regiones` con un campo `TYPE_2`, podría seleccionar sólo regiones que estén en `municipio` y la caja *Expresión de filtrado específica por el proveedor* del Constructor de consultas. Figure_attributes_2 muestra un ejemplo de Constructor de consultas poblada con la capa `regions.shp` de los datos de ejemplo de QGIS. Las secciones de campos, valores y operadores ayudan a construir el SQL- como consulta.

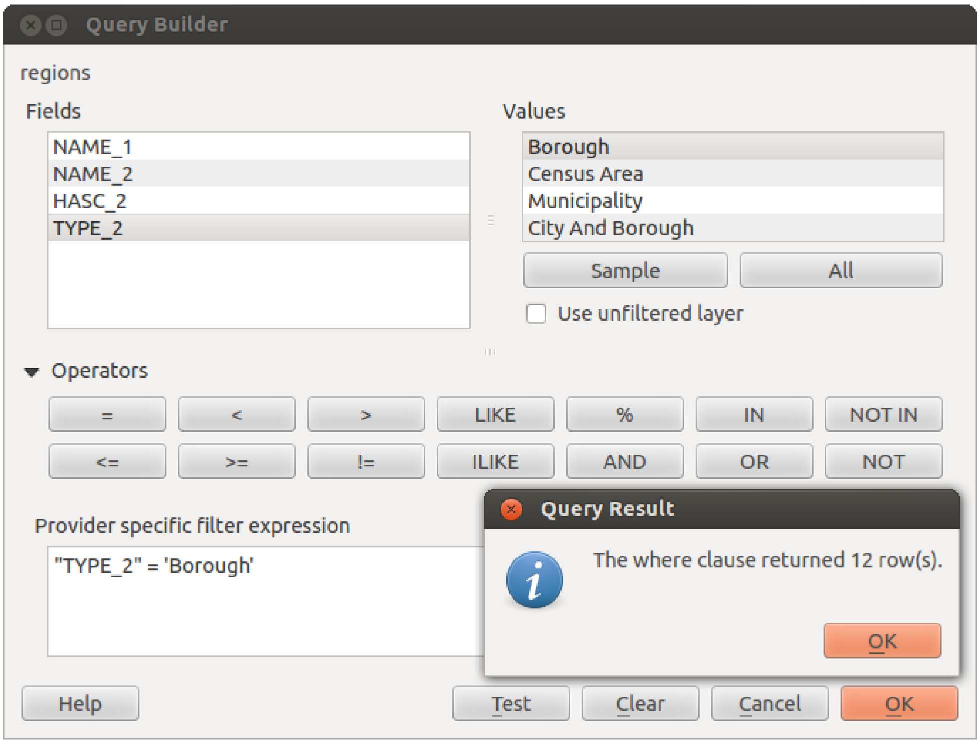

Figura 12.44: Constructor de consultas

La **Lista de campos** contiene todos las columnas de atributos de la tabla de atributos a ser buscados. Para agregar una columna de atributos al campo de la clausula SQL WHERE, haga doble clic en el nombre de la lista de campos. En general puede usar varios campos, valores y operadores para construir la consulta, o simplemente puede escribirlo en la caja SQL.

La **Lista de valores** lista los valores de una tabla de atributos. Para listar todos los valores posibles de un atributo, seleccione el atributo en la lista de campos y haga clic en el botón **[Todos]**. Para listar los primeros 25 valores únicos de una columna de atributos, seleccione la columna de atributos en la lista de campos y haga clic en el botón **[Muestra]**. Para añadir un valor al campo de la clausula WHERE de SQL, haga doble clic en el nombre en la lista de valores.

La **Sección de Operadores** contiene todos los operadores utilizables. Para añadir un operador al campo de la clausula WHERE, haga clic en el botón correspondiente. Los operadores relacionales (= , > , ...), operador de comparación de cadenas (`COMO`), y los operadores lógicos (`Y`, `O`, ...) están disponibles.

El botón **[Probar]** muestra un cuadro de mensaje con el numero de objetos espaciales que satisfacen la consulta actual, que es útil en el proceso de construcción de consultas. El botón **[Limpiar]** limpia el texto en el campo de texto de la clausula WHERE de SQL. El botón **[Aceptar]** cierra la ventana y selecciona los objetos espaciales que satisfacen la consulta. El botón **[Cancelar]** cierra la ventana sin cambiar la selección actual.

12.4.2 Save selected features as new layer

The selected features can be saved as any OGR-supported vector format and also transformed into another coordinate reference system (CRS). Just open the right mouse menu of the layer and click on *Save selection as* → to define the name of the output file, its format and CRS (see section *Leyenda del mapa*). It is also possible to specify OGR creation options within the dialog.

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12.5 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 written to a new attribute column, or they can be used to update values in an existing column.

You will need to bring the vector layer into editing mode, before you can click on the field calculator icon to open the dialog (see figure_attributes_3). In the dialog, you first must select whether you want to only update selected features, create a new attribute field where the results of the calculation will be added or update an existing field.

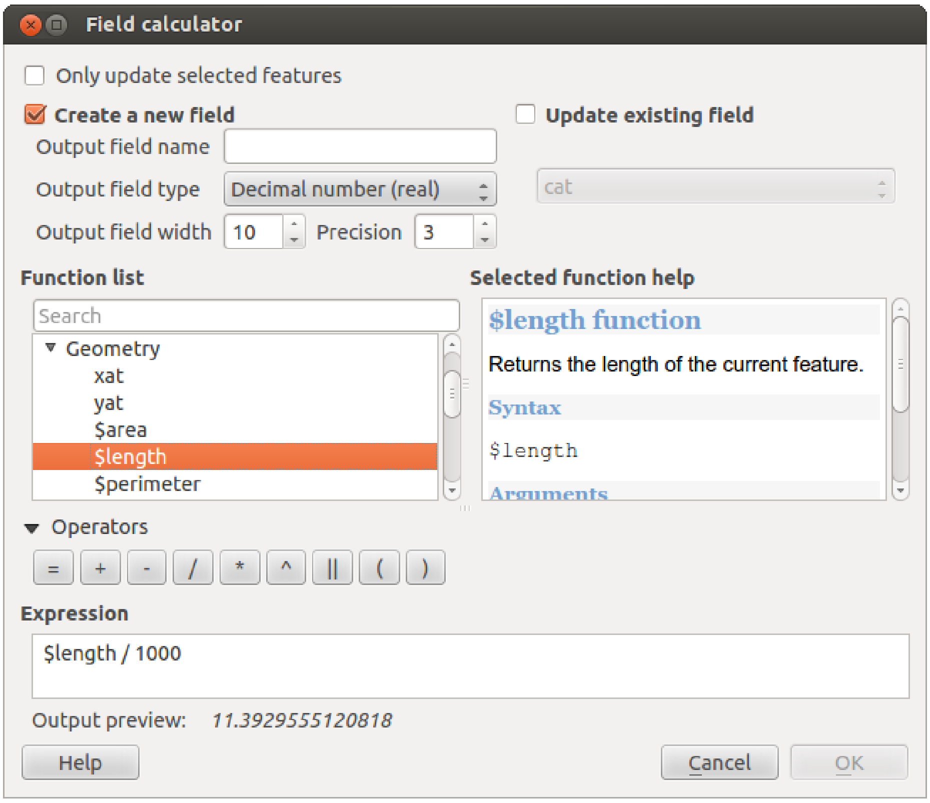

Figura 12.45: Field Calculator

If you choose to add a new field, you need to enter a field name, a field type (integer, real or string), the total field width, and the field precision (see figure_attributes_3). For example, if you choose a field width of 10 and a field precision of 3, it means you have 6 digits before the dot, then the dot and another 3 digits for the precision.

The **Function List** contains functions as well as fields and values. View the help function in the **Selected Function Help**. In **Expression** you see the calculation expressions you create with the **Function List**. For the most commonly used operators, see **Operators**.

In the **Function List**, click on *Fields and Values* to view all attributes of the attribute table to be searched. To add an attribute to the Field calculator **Expression** field, double click its name in the *Fields and Values* list. Generally, you can use the various fields, values and functions to construct the calculation expression, or you can just type it into the box. To display the values of a field, you just right click on the appropriate field. You can choose between *Load top 10 unique values* and *Load all unique values*. On the right side, the **Field Values** list opens with the unique values. To add a value to the Field calculator **Expression** box, double click its name in the **Field Values** list.

The *Operators*, *Math*, *Conversions*, *String*, *Geometry* and *Record* groups provide several functions. In *Operators*, you find mathematical operators. Look in *Math* for mathematical functions. The *Conversions* group contains functions that convert one data type to another. The *String* group provides functions for data strings. In the *Geometry* group, you find functions for geometry objects. With *Record* group functions, you can add a numeration to your data set. To add a function to the Field calculator **Expression** box, click on the > and then double click the function.

A short example illustrates how the field calculator works. 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. Add `length` as Output field name and `real` as Output field type, and define Output field width to be 10 and Precision, 3.
5. Now double click on function `$length` in the *Geometry* group to add it into the Field calculator expression box.
6. Complete the expression by typing "/ 1000" in the Field calculator expression box and click **[Ok]**.
7. You can now find a new column `length` in the attribute table.

The available functions are listed below.

The field calculator **Function list** with the **Selected Function Help** , **Operators** and **Expression** menu are also available through the rule-based rendering in the Style menu of the Layer properties, and the expression-based labeling ... in the Labeling core application.

Operators

This group contains operators (e.g., +, -, *).

```
a + b      a plus b
a - b      a minus b
a * b      a multiplied by b
a / b      a divided by b
a % b     a modulo b (for example, 7 % 2 = 1, or 2 fits into 7 three times with remainder 1)
a ^ b      a power b (for example, 2^2=4 or 2^3=8)
a = b      a and b are equal
a > b      a is larger than b
a < b      a is smaller than b
a <> b     a and b are not equal
a != b     a and b are not equal
a <= b     a is less than or equal to b
a >= b     a is larger than or equal to b
a ~ b      a matches the regular expression b
+ a        positive sign
- a        negative value of a
||         joins two values together into a string 'Hello' || ' world'
LIKE       returns 1 if the string matches the supplied pattern
ILIKE      returns 1 if the string matches case-insensitive the supplied
           pattern (ILIKE can be used instead of LIKE to make the match case-insensitive)
IS         returns 1 if a is the same as b
OR         returns 1 when condition a or b is true
AND        returns 1 when condition a and b are true
NOT        returns 1 if a is not the same as b
column name "column name"     value of the field column name
'string'                      a string value
NULL                          null value
a IS NULL                     a has no value
a IS NOT NULL                 a has a value
a IN (value[,value])          a is below the values listed
a NOT IN (value[,value])      a is not below the values listed
```

Conditionals

This group contains functions to handle conditional checks in expressions.

```
CASE                          evaluates multiple expressions and returns a result
CASE ELSE                     evaluates multiple expressions and returns a result
coalesce                      returns the first non-NULL value from the expression list
regexp_match                  returns true if any part of a string matches
                              the supplied regular expression
```

Mathematical Functions

This group contains math functions (e.g., square root, sin and cos).

```
sqrt(a)                       square root of a
abs                           returns the absolute value of a number
sin(a)                        sine of a
cos(a)                        cosine of a
tan(a)                        tangent of a
asin(a)                       arcsin of a
acos(a)                       arccos of a
atan(a)                       arctan of a
atan2(y,x)                    arctan of y/x using the signs of the two arguments
                              to determine the quadrant of the result
exp                           exponential of a value
ln                            value of the natural logarithm of the passed expression
log10                         value of the base 10 logarithm of the passed expression
log                           value of the logarithm of the passed value and base
round                         round to number of decimal places
rand                          random integer within the range specified by the minimum
                              and maximum argument (inclusive)
randf                         random float within the range specified by the minimum
                              and maximum argument (inclusive)
max                           largest value in a set of values
min                           smallest value in a set of values
clamp                         restricts an input value to a specified range
scale_linear                  transforms a given value from an input domain to an output
                              range using linear interpolation
scale_exp                     transforms a given value from an input domain to an output
                              range using an exponential curve
floor                         rounds a number downwards
ceil                          rounds a number upwards
$pi                           pi as value for calculations
```

Conversions

This group contains functions to convert one data type to another (e.g., string to integer, integer to string).

```
toint                        converts a string to integer number
toreal                       converts a string to real number
tostring                     converts number to string
todatetime                   converts a string into Qt data time type
todate                       converts a string into Qt data type
totime                       converts a string into Qt time type
tointerval                   converts a string to an interval type (can be used to take days,
                             hours, months, etc. off a date)
```

Date and Time Functions

This group contains functions for handling date and time data.

```
$now       current date and time
age        difference between two dates
year       extract the year part from a date, or the number of years from an interval
month      extract the month part from a date, or the number of months from an interval
week       extract the week number from a date, or the number of weeks from an interval
day        extract the day from a date, or the number of days from an interval
```

```
hour        extract the hour from a datetime or time, or the number
            of hours from an interval
minute      extract the minute from a datetime or time, or the number
            of minutes from an interval
second      extract the second from a datetime or time, or the number
            of minutes from an interval
```

String Functions

This group contains functions that operate on strings (e.g., that replace, convert to upper case).

```
lower          convert string a to lower case
upper          convert string a to upper case
title          converts all words of a string to title case (all words lower case
               with leading capital letter)
trim           removes all leading and trailing white space (spaces, tabs, etc.) from a string
length         length of string a
replace        returns a string with the supplied string replaced
regexp_replace(a,this,that)  returns a string with the supplied regular expression replaced
regexp_substr    returns the portion of a string which matches a supplied regular expression
substr(*a*,from,len)         returns a part of a string
concat         concatenates several strings to one
strpos         returns the index of a regular expression in a string
left           returns a substring that contains the n leftmost characters of the string
right          returns a substring that contains the n rightmost characters of the string
rpad           returns a string with supplied width padded using the fill character
lpad           returns a string with supplied width padded using the fill character
format         formats a string using supplied arguments
format_number    returns a number formatted with the locale separator for thousands
                 (also truncates the number to the number of supplied places)
format_date    formats a date type or string into a custom string format
```

Color Functions

This group contains functions for manipulating colors.

```
color_rgb        returns a string representation of a color based on its red, green,
                 and blue components
color_rgba       returns a string representation of a color based on its red, green,
                 blue, and alpha (transparency) components
ramp_color       returns a string representing a color from a color ramp
color_hsl        returns a string representation of a color based on its hue,
                 saturation, and lightness attributes
color_hsla       returns a string representation of a color based on its hue, saturation,
                 lightness and alpha (transparency) attributes
color_hsv        returns a string representation of a color based on its hue,
                 saturation, and value attributes
color_hsva       returns a string representation of a color based on its hue, saturation,
                 value and alpha (transparency) attributes
color_cmyk       returns a string representation of a color based on its cyan, magenta,
                 yellow and black components
color_cmyka      returns a string representation of a color based on its cyan, magenta,
                 yellow, black and alpha (transparency) components
```

Geometry Functions

This group contains functions that operate on geometry objects (e.g., length, area).

```
xat               retrieves an x coordinate of the current feature
yat               retrieves a y coordinate of the current feature
$area             returns the area size of the current feature
$length           returns the length size of the current feature
$perimeter        returns the perimeter length of the current feature
$x                returns the x coordinate of the current feature
$y                returns the y coordinate of the current feature
```

```
$geometry         returns the geometry of the current feature (can be used
                  for processing with other functions)
geomFromWKT       returns a geometry created from a well-known text (WKT) representation
geomFromGML       returns a geometry from a GML representation of geometry
bbox
disjoint          returns 1 if the geometries do not share any space together
intersects        returns 1 if the geometries spatially intersect
                  (share any portion of space) and 0 if they don't
touches           returns 1 if the geometries have at least one point in common,
                  but their interiors do not intersect
crosses           returns 1 if the supplied geometries have some, but not all,
                  interior points in common
contains          returns true if and only if no points of b lie in the exterior of a,
                  and at least one point of the interior of b lies in the interior of a
overlaps          returns 1 if the geometries share space, are of the same dimension,
                  but are not completely contained by each other
within            returns 1 if geometry a is completely inside geometry b
buffer            returns a geometry that represents all points whose distance
                  from this geometry is less than or equal to distance
centroid          returns the geometric center of a geometry
convexHull        returns the convex hull of a geometry (this represents the
                  minimum convex geometry that encloses all geometries within the set)
difference        returns a geometry that represents that part of geometry a that
                  does not intersect with geometry b
distance          returns the minimum distance (based on spatial ref) between
                  two geometries in projected units
intersection      returns a geometry that represents the shared portion
                  of geometry a and geometry b
symDifference     returns a geometry that represents the portions of a and b
                  that do not intersect
combine           returns the combination of geometry a and geometry b
union             returns a geometry that represents the point set union of the geometries
geomToWKT         returns the well-known text (WKT) representation of the
                  geometry without SRID metadata
```

Record Functions

This group contains functions that operate on record identifiers.

```
$rownum                 returns the number of the current row
$id                     returns the feature id of the current row
$scale                  returns the current scale of the map canvas
```

Fields and Values

Contains a list of fields from the layer. Sample values can also be accessed via right-click.

Select the field name from the list, then right-click to access a context menu with options to load sample values from the selected field.

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CAPÍTULO 13

Trabajar con catos raster

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13.1 Working with Raster Data

This section describes how to visualize and set raster layer properties. QGIS uses the GDAL library to read and write raster data formats, including ArcInfo Binary Grid, ArcInfo ASCII Grid, GeoTIFF, ERDAS IMAGINE, and many more. GRASS raster support is supplied by a native QGIS data provider plugin. The raster data can also be loaded in read mode from zip and gzip archives into QGIS.

As of the date of this document, more than 100 raster formats are supported by the GDAL library (see GDAL-SOFTWARE-SUITE in *Referencias bibliográficas y web*). A complete list is available at http://www.gdal.org/formats_list.html.

Nota: Not all of the listed formats may work in QGIS for various reasons. For example, some require external commercial libraries, or the GDAL installation of your OS may not have been built to support the format you want to use. Only those formats that have been well tested will appear in the list of file types when loading a raster into QGIS. Other untested formats can be loaded by selecting the `[GDAL] All files (*)` filter.

Working with GRASS raster data is described in section *GRASS GIS Integration*.

13.1.1 What is raster data?

Raster data in GIS are matrices of discrete cells that represent features on, above or below the earth's surface. Each cell in the raster grid is 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 an elevation matrix.

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 in the map canvas.

QGIS makes use of georeference information inside the raster layer (e.g., GeoTiff) or in an appropriate world file to properly display the data.

13.1.2 Loading raster data in QGIS

Raster layers are loaded either by clicking on the Add Raster Layer icon or by selecting the *Layer* → *Add Raster Layer* menu option. More than one layer can be loaded at the same time by holding down the `Ctrl` or `Shift` key and clicking on multiple items in the *Open a GDAL Supported Raster Data Source* dialog.

Once a raster layer is loaded in the map legend, you can click on the layer name with the right mouse button to select and activate layer-specific features or to open a dialog to set raster properties for the layer.

Right mouse button menu for raster layers

- *Zoom to Layer Extent*
- *Zoom to Best Scale (100 %)*
- *Stretch Using Current Extend*
- *Show in Overview*
- *Remove*
- *Duplicate*
- *Set Layer CRS*
- *Set Project CRS from Layer*
- *Save as ...*
- *Properties*
- *Rename*
- *Copy Style*
- *Add New Group*
- *Expand all*
- *Collapse all*
- *Update Drawing Order*

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13.2 Raster Properties Dialog

To view and set the properties for a raster layer, double click on the layer name in the map legend, or right click on the layer name and choose *Properties* from the context menu. This will open the *Raster Layer Properties* dialog (see figure_raster_1).

There are several menus in the dialog:

- *General*
- *Style*
- *Transparency*
- *Pyramids*
- *Histogram*
- *Metadata*

13.2.1 General Menu

Layer Info

The *General* menu displays basic information about the selected raster, including the layer source path, the display name in the legend (which can be modified), and the number of columns, rows and no-data values of the raster.

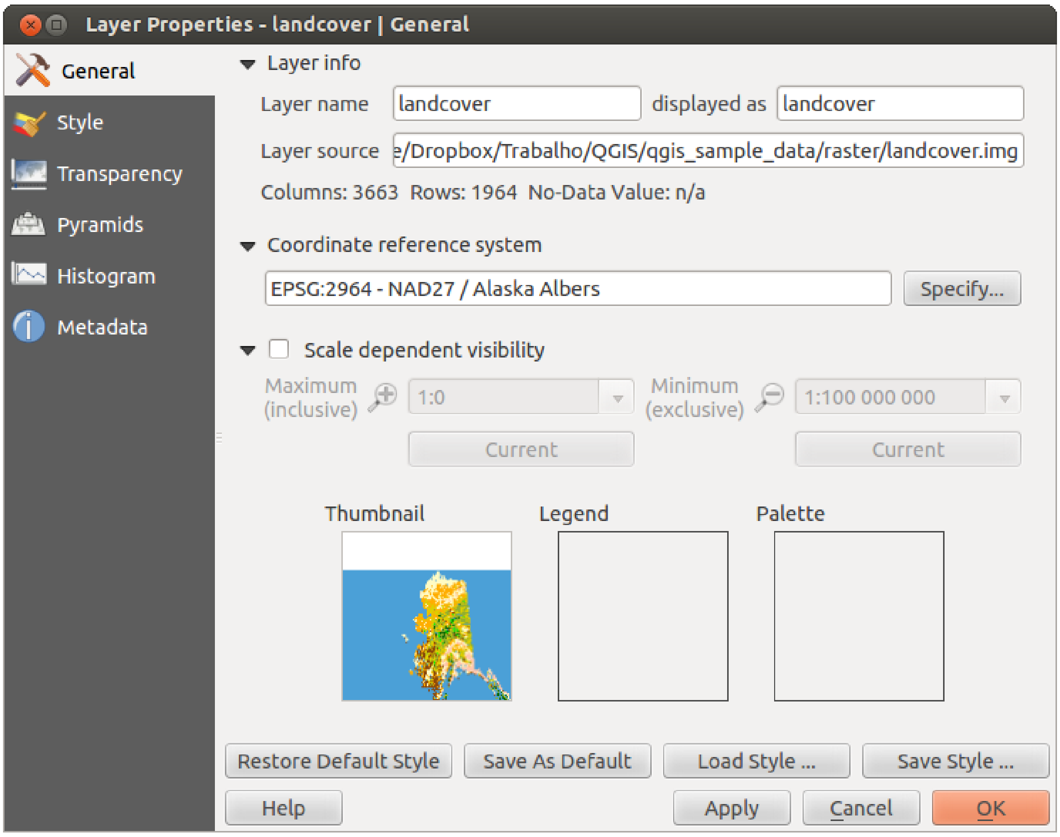

Figura 13.1: Raster Layers Properties Dialog

Coordinate reference system

Here, you find the coordinate reference system (CRS) information printed as a PROJ.4 string. If this setting is not correct, it can be modified by clicking the **[Specify]** button.

Scale Dependent visibility

Additionally scale-dependent visibility can be set in this tab. You will need to check the checkbox and set an appropriate scale where your data will be displayed in the map canvas.

At the bottom, you can see a thumbnail of the layer, its legend symbol, and the palette.

13.2.2 Style Menu

Band rendering

QGIS offers four different *Render types*. The renderer chosen is dependent on the data type.

1. Multiband color - if the file comes as a multiband with several bands (e.g., used with a satellite image with several bands)
2. Paletted - if a single band file comes with an indexed palette (e.g., used with a digital topographic map)
3. Singleband gray - (one band of) the image will be rendered as gray; QGIS will choose this renderer if the file has neither multibands nor an indexed palette nor a continous palette (e.g., used with a shaded relief map)
4. Singleband pseudocolor - this renderer is possible for files with a continuous palette, or color map (e.g., used with an elevation map)

Multiband color

With the multiband color renderer, three selected bands from the image will be rendered, each band representing the red, green or blue component that will be used to create a color image. You can choose several *Contrast enhancement* methods: 'No enhancement', 'Stretch to MinMax', 'Stretch and clip to MinMax' and 'Clip to min max'.

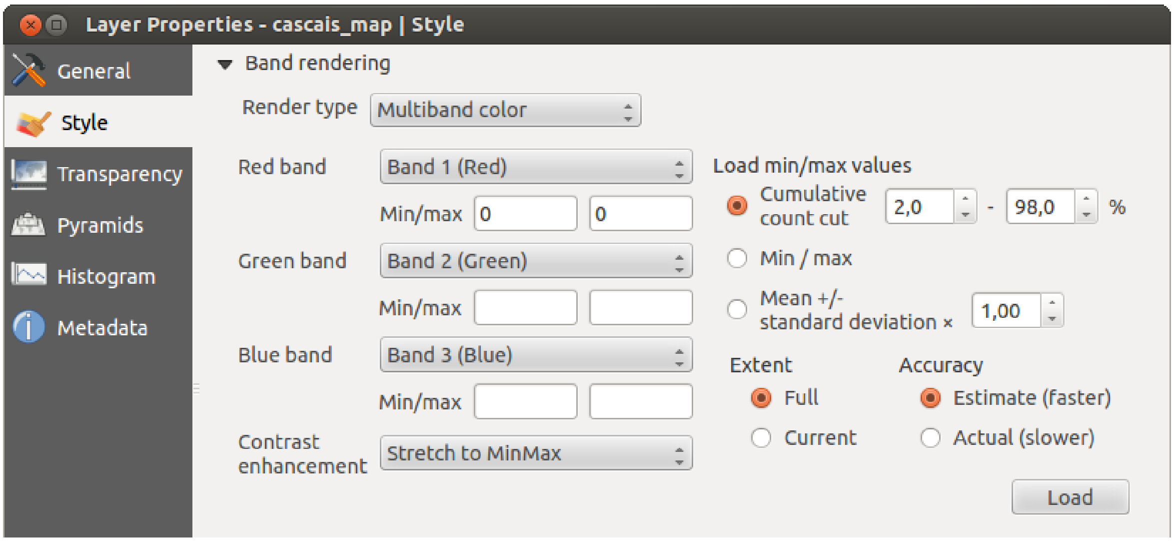

Figura 13.2: Raster Renderer - Multiband color

This selection offers you a wide range of options to modify the appearance of your raster layer. First of all, you have to get the data range from your image. This can be done by choosing the *Extent* and pressing **[Load]**. QGIS can *Estimate (faster)* the *Min* and *Max* values of the bands or use the *Actual (slower) Accuracy*.

Now you can scale the colors with the help of the *Load min/max values* section. A lot of images have a few very low and high data. These outliers can be eliminated using the *Cumulative count cut* setting. The standard data range is set from 2 % to 98 % of the data values and can be adapted manually. With this setting, the gray character of the image can disappear. With the scaling option *Min/max*, QGIS creates a color table with all of the data included in the original image (e.g., QGIS creates a color table with 256 values, given the fact that you have 8 bit bands). You can also calculate your color table using the *Mean +/- standard deviation x* 1,00. Then, only the values within the standard deviation or within multiple standard deviations are considered for the color table. This is useful when you have one or two cells with abnormally high values in a raster grid that are having a negative impact on the rendering of the raster.

All calculations can also be made for the *Current* extent.

Truco: Viewing a Single Band of a Multiband Raster

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 this is not the correct way. To display the Red band, set the image type to 'Singleband gray', then select Red as the band to use for Gray.

Paletted

This is the standard render option for singleband files that already include a color table, where each pixel value is assigned to a certain color. In that case, the palette is rendered automatically. If you want to change colors assigned to certain values, just double-click on the color and the *Select color* dialog appears. Also, in QGIS 2.2. it's now possible to assign a label to the color values. The label appears in the legend of the raster layer then.

Contrast enhancement

Nota: When adding GRASS rasters, the option *Contrast enhancement* will always be set automatically to *stretch to min max*, regardless of if this is set to another value in the QGIS general options.

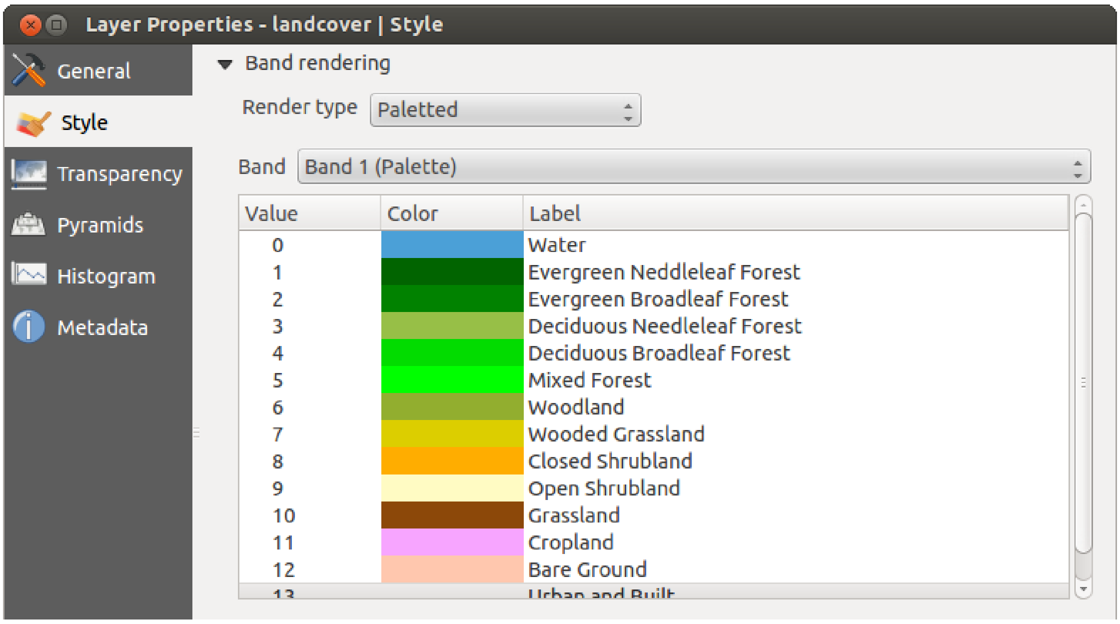

Figura 13.3: Raster Renderer - Paletted

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 define a *Min* and a *Max* value by choosing the *Extent* first and then pressing **[Load]**. QGIS can *Estimate (faster)* the *Min* and *Max* values of the bands or use the *Actual (slower) Accuracy*.

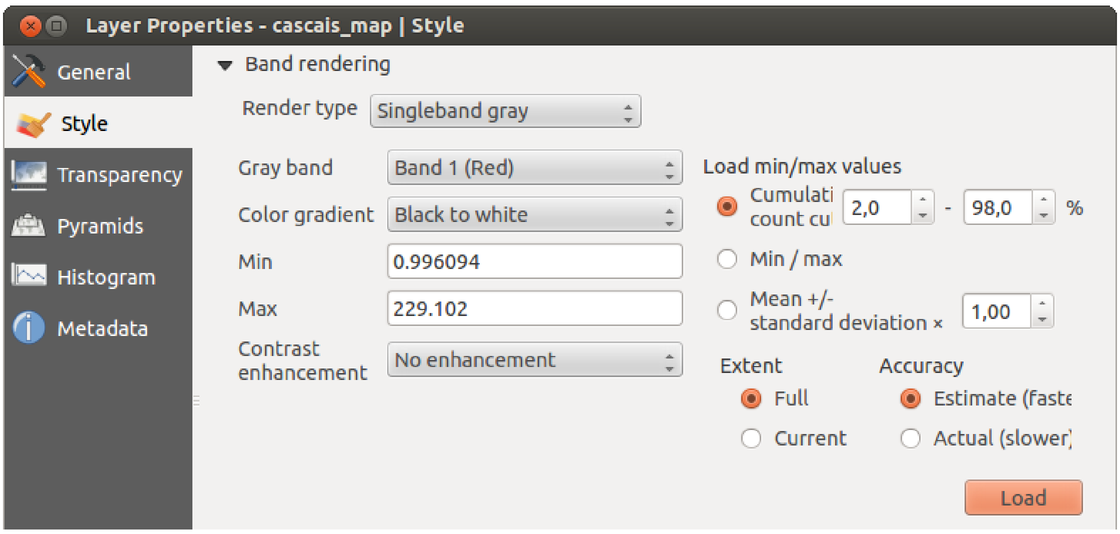

Figura 13.4: Raster Renderer - Singleband gray

With the *Load min/max values* section, scaling of the color table is possible. Outliers can be eliminated using the *Cumulative count cut* setting. The standard data range is set from 2 % to 98 % of the data values and can be adapted manually. With this setting, the gray character of the image can disappear. Further settings can be made with *Min/max* and *Mean +/- standard deviation x* 1,00. While the first one creates a color table with all of the data included in the original image, the second 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 grid that are having a negative impact on the rendering of the raster.

Singleband pseudocolor

This is a render option for single-band files, including a continous palette. You can also create individual color maps for the single bands here. Three types of color interpolation are available:

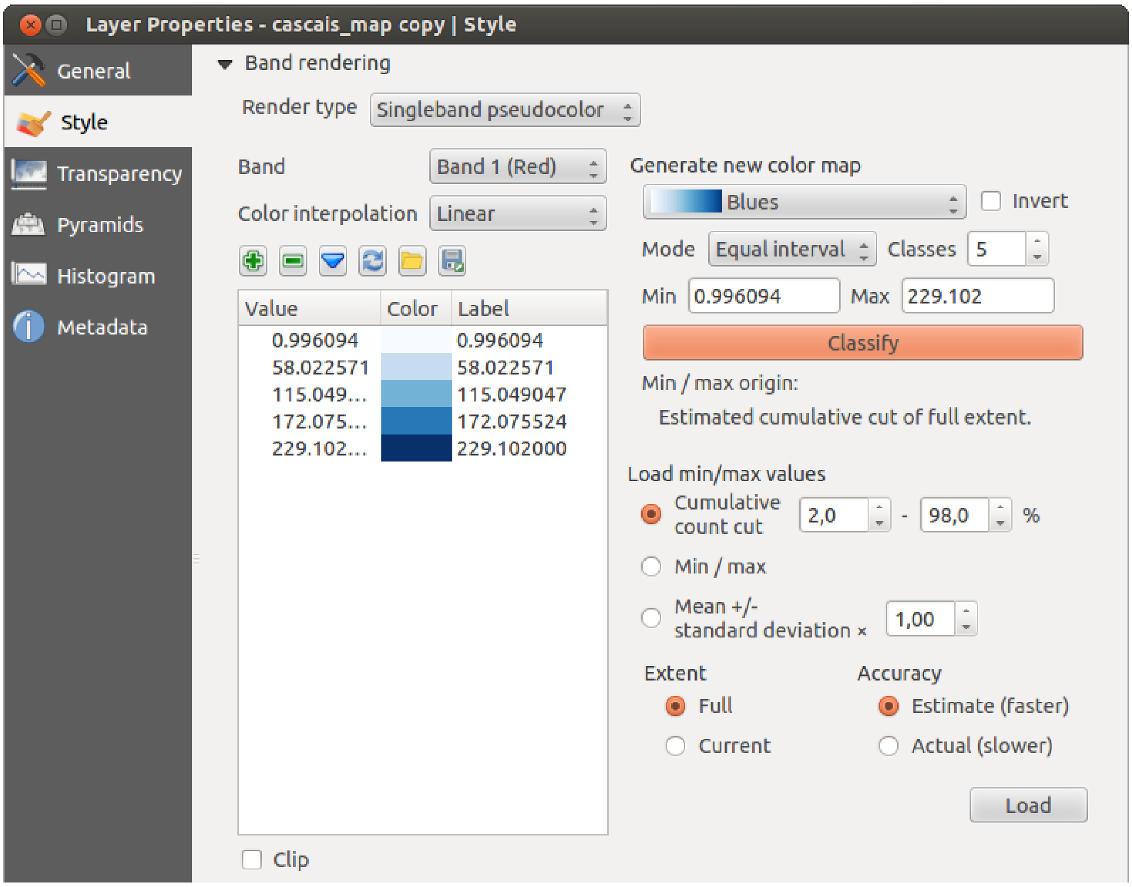

Figura 13.5: Raster Renderer - Singleband pseudocolor

1. Discrete
2. Linear
3. Exact

In the left block, 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, and the Sort colormap items button sorts the color table according to the pixel values in the value column. 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. Further, you can also add labels for each color, but this value won't be displayed when you use the identify feature tool. You can also click on the button Load color map from band, which tries to load the table from the band (if it has any). And 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 defined color table for other sessions.

In the right block, *Generate new color map* allows you to create newly categorized color maps. For the *Classification mode* 'Equal interval', you only need to select the *number of classes* 1,00 and press the button *Classify*. You can invert the colors of the color map by clicking the *Invert* checkbox. In the case of the *Mode* 'Continous', QGIS creates classes automatically depending on the *Min* and *Max*. Defining *Min/Max* values can be done with the help of the *Load min/max values* section. A lot of images have a few very low and high data. These outliers can be eliminated using the *Cumulative count cut* setting. The standard data range is set from 2 % to 98 % of the data values and can be adapted manually. With this setting, the gray character of the image can disappear. With the scaling option *Min/max*, QGIS creates a color table with all of the data included in the original image (e.g., QGIS creates a color table with 256 values, given the fact that you have 8 bit bands). You can also calculate your color table using the *Mean +/- standard deviation x* 1,00. Then, only the values within the standard deviation or within multiple standard deviations are considered for the color table.

Color rendering

For every *Band rendering*, a *Color rendering* is possible.

You can also achieve special rendering effects for your raster file(s) using one of the blending modes (see *The Vector Properties Dialog*).

Further settings can be made in modifiying the *Brightness*, the *Saturation* and the *Contrast*. You can also use a *Grayscale* option, where you can choose between 'By lightness', 'By luminosity' and 'By average'. For one hue in the color table, you can modify the 'Strength'.

Resampling

The *Resampling* option makes its appearance 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.

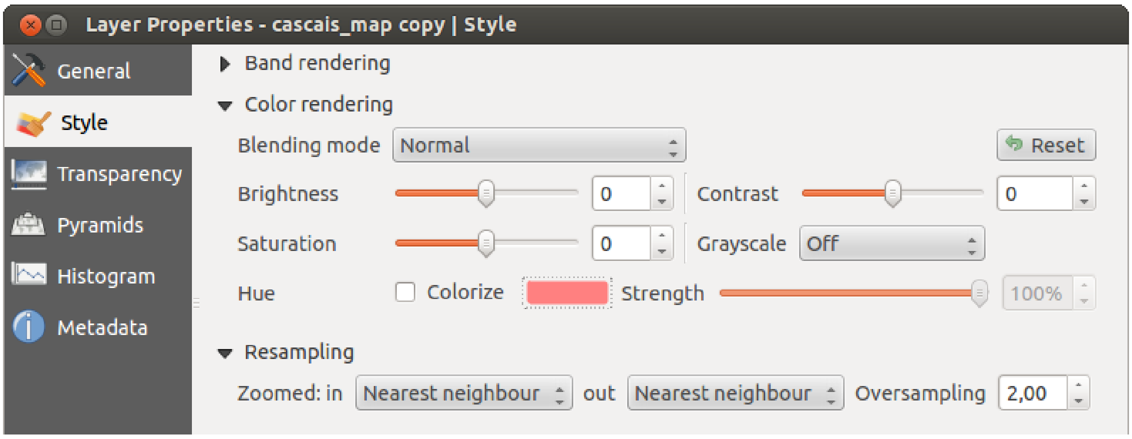

Figura 13.6: Raster Rendering - Resampling

When applying the 'Nearest neighbour' method, the map can have a pixelated structure when zooming in. This appearance can be improved by using the 'Bilinear' or 'Cubic' method, which cause sharp features to be blurred. The effect is a smoother image. This method can be applied, for instance, to digital topographic raster maps.

13.2.3 Transparency Menu

QGIS has the ability to display each raster layer at a different transparency level. Use the transparency slider to indicate to what extent the underlying layers (if any) should be visible though the current raster layer. This is very useful if you like to overlay more than one raster layer (e.g., a shaded relief map overlayed by a classified raster map). This will make the look of the map more three dimensional.

Additionally, you can enter a raster value that should be treated as *NODATA* in the *Additional no data value* menu.

An even more flexible way to customize the transparency can be done in the *Custom transparency options* section. The transparency of every pixel can be set here.

As an example, we want to set the water of our example raster file `landcover.tif` to a transparency of 20 %. The following steps are neccessary:

1. Load the raster file `landcover.tif`.

2. Open the *Properties* dialog by double-clicking on the raster name in the legend, or by right-clicking and choosing *Properties* from the pop-up menu.
3. Select the *Transparency* menu.
4. From the *Transparency band* menu, choose 'None'.
5. Click the Add values manually button. A new row will appear in the pixel list.
6. Enter the raster value in the 'From' and 'To' column (we use 0 here), and adjust the transparency to 20 %.
7. Press the **[Apply]** button and have a look at the map.

You can repeat steps 5 and 6 to adjust more values with custom transparency.

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.

13.2.4 Pyramids Menu

Large 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 level of zoom.

You must have write access in the directory where the original data is stored to build pyramids.

Several resampling methods can be used to calculate the pyramids:

- Nearest Neighbour
- Average
- Gauss
- Cubic
- Mode
- None

If you choose 'Internal (if possible)' from the *Overview format* menu, QGIS tries to build pyramids internally. You can also choose 'External' and 'External (Erdas Imagine)'.

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 building pyramids.

13.2.5 Histogram Menu

The *Histogram* menu allows you to view the distribution of the bands or colors in your raster. The histogram is generated automatically when you open the *Histogram* menu. All existing bands will be displayed together. You can save the histogram as an image with the button. With the *Visibility* option in the *Prefs/Actions* menu, you can display histograms of the 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'. With the *Actions* option, you can 'Reset' and 'Recompute histogram' after you have chosen the *Min/max options*.

13.2.6 Metadata Menu

The *Metadata* menu displays a wealth of information about the raster layer, including statistics about each band in the current raster layer. From this menu, entries may be made for the *Description*, *Attribution*, *MetadataUrl* and

Figura 13.7: The Pyramids Menu

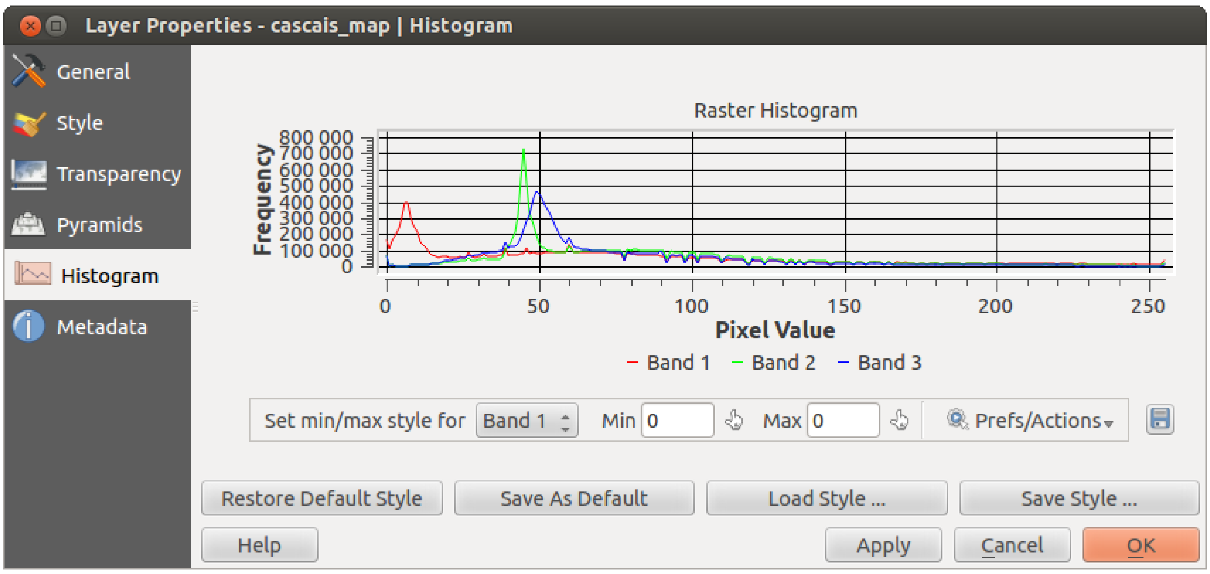

Figura 13.8: Raster Histogram

Properties. In *Properties*, statistics are gathered on a 'need to know' basis, so it may well be that a given layer's statistics have not yet been collected.

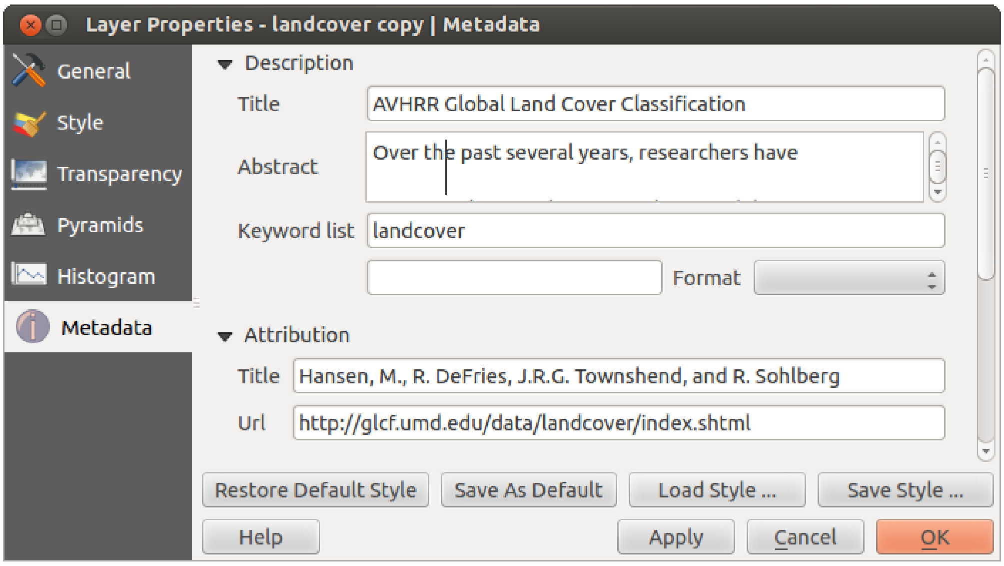

Figura 13.9: Raster Metadata

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13.3 Calculadora Ráster

The *Raster Calculator* in the *Raster* menu allows you to perform calculations on the basis of existing raster pixel values (see figure_raster_2_). The results are written to a new raster layer with a GDAL-supported format.

La lista **Bandas ráster** contiene todas las capas ráster cargadas que pueden ser utilizadas. Para añadir un ráster a la expresión de la calculadora de campos, haga doble clic en el nombre en la lista de campos. Puede después utilizar los operadores para construir expresiones de cálculo o simplemente puede escribirlas en el cuadro.

En la sección **Capa de resultado**, tendrá que definir una capa de salida. A continuación puede definir la extensión de la zona de cálculo basado en una capa ráster de entrada, o sobre la base de coordenadas X,Y y sobre columnas y filas, para establecer la resolución de la capa de salida. Si la capa de entrada tiene diferente resolución, los valores serán remuestreados con el algoritmo del vecino más cercano.

La sección de **Operadores** contiene todos los operadores disponibles. Para añadir un operador a la caja de expresiones de la calculadora ráster, haga clic en el botón apropiado. Cálculos matemáticos (`+`, `-`, `*`, ...) y funciones trigonométricas (`sin`, `cos`, `tan`, ...) están disponibles. ¡Estén atentos a más operadores por venir!

Con la casilla de verificación *Añadir resultado al proyecto*, La capa de resultado se añadirá automaticamente a la zona de la leyenda y puede ser visualizado.

13.3.1 Ejemplos

Convertir valores de elevación de metros a pies

Crear un ráster de elevación en pies de un ráster en metros, es necesario utilizar el factor de conversión de metros a pies: 3.28. La expresión es:

```
"elevation@1" * 3.28
```

El uso de una máscara

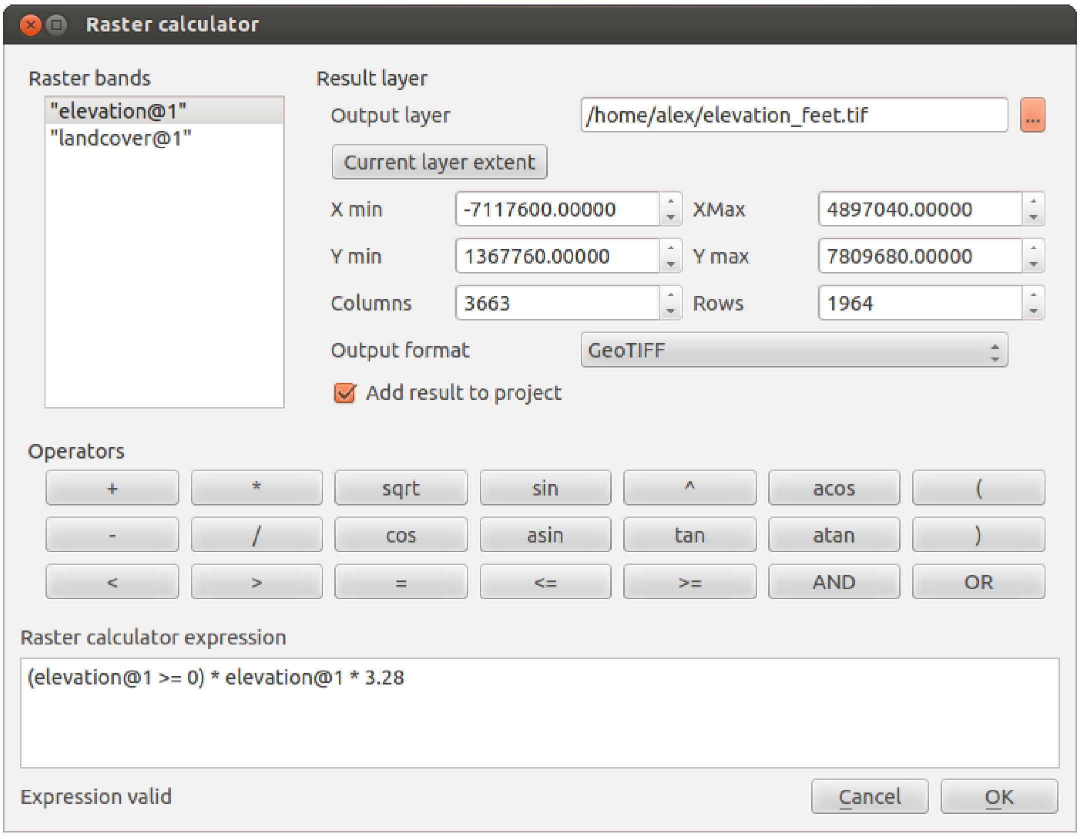

Figura 13.10: Calculadora Ráster

Si desea enmascarar partes de una ráster- digamos , por ejemplo , porque sólo está interesado en elevaciones por encima de 0 metros – se puede utilizar la siguiente expresión para crear una máscara y aplicar el resultado a un ráster en un solo paso.

```
("elevation@1" >= 0) * "elevation@1"
```

En otras palabras, por cada celda superior o igual a 0 , establezca su valor en 1. De lo contrario, establecer a 0. Esto crea la máscara al vuelo.

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CAPÍTULO 14

Trabajar con datos OGC

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14.1 QGIS como cliente de datos OGC

The Open Geospatial Consortium (OGC) is an international organization with membership of more than 300 commercial, governmental, nonprofit and research organizations worldwide. Its members develop and implement standards for geospatial content and services, GIS data processing and exchange.

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 http://www.opengeospatial.org/.

Importantes especificaciones OGC implementadas por QGIS son:

- **WMS** — Web Map Service (*Cliente WMS/WMTS*)
- **WMTS** — Web Map Tile Service (*Cliente WMS/WMTS*)
- **WFS** — Web Feature Service (*Cliente WFS y WFS-T*)
- **WFS-T** — Web Feature Service - Transactional (*Cliente WFS y WFS-T*)
- **WCS** — Web Coverage Service (*WCT Cliente*)
- **SFS** — Simple Features for SQL (*PostGIS Layers*)
- **GML** — Lenguaje de Marcado Generalizado

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 *PostGIS Layers*).

14.1.1 Cliente WMS/WMTS

Información general de la implementación 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.

Las capas WMS se pueden añadir sencillamente, siempre que conozca la URL para acceder al servidor WMS, si tiene una conexión útil a ese servidor, y el servidor entiende HTTP como mecanismo de transporte de datos.

Información general de la implementación 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.

Para mostrar los datos en una variedad de escalas cercanas a lo que el usuario podría querer, los conjuntos de teselas WMTS se producen en varios niveles de escala diferentes y están disponibles para el cliente SIG para pedirlos.

Este diagrama ejemplifica el concepto de conjunto de teselas:

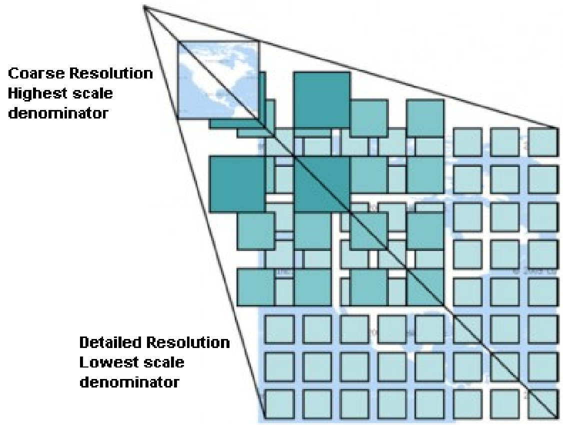

Figura 14.1: Concepto de conjunto de teselas WMTS

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"
```

Un ejemplo de este tipo de dirección es

```
http://opencache.statkart.no/gatekeeper/gk/gk.open_wmts?\
  service=WMTS&request=GetCapabilities
```

For testing the topo2 layer in this WMTS works nicely. Adding this string indicates that a WMTS web service is to be used instead of a WMS service.

2. The **RESTful WMTS** service takes a different form, a straightforward URL. The format recommended by the OGC is:

```
{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 http://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 http://wiki.osgeo.org/wiki/Tile_Map_Service_Specification for more information about this specification.

When you read WMTS, you can often think WMS-C also.

Seleccionar servidor WMS/WMTS

The first time you use the WMS feature in QGIS, there are no servers defined.

Begin by clicking the Add WMS layer button on the toolbar, or selecting *Layer → Add WMS Layer...*.

The dialog *Add Layer(s) from a Server* for adding layers from the WMS server appears. You can add some servers to play with by clicking the **[Add default servers]** button. This will add two WMS demo servers for you to use: the WMS servers of the DM Solutions Group and Lizardtech. To define a new WMS server in the *Layers* tab, select the **[New]** button. Then enter the parameters to connect to your desired WMS server, as listed in table_OGC_1:

Nombre	A name for this 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.
Nombre de usuario	Username to access a secured WMS server. This parameter is optional.
Contraseña	Password for a basic authenticated WMS server. This parameter is optional.
Ignorar URI GetMap	*Ignore GetMap URI reported in capabilities*. Use given URI from URL field above.
Ignorar la URI GetFeatureInfo	*Ignore GetFeatureInfo URI reported in capabilities*. Use given URI from URL field above.

Tabla OGC 1: Parámetros de conexión WMS

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 & Proxy* 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.

Once the new WMS server connection has been created, it will be preserved for future QGIS sessions.

Truco: En las direcciones URL del servidor WMS

Be sure, when entering the WMS server URL, that you have the base URL only. For example, you shouldn't have fragments such as `request=GetCapabilities` or `version=1.0.0` in your URL.

Cargando capas 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 of the WMS dialog.

La pantalla ahora debe lucir un poco como figure_OGR_1, que muestra la respuesta proporcionada por el servidor WMS de DM Solutions Group.

Codificación de la Imagen

The *Image encoding* section lists the formats that are supported by both the client and server. Choose one depending on your image accuracy requirements.

Truco: Codificación de la Imagen

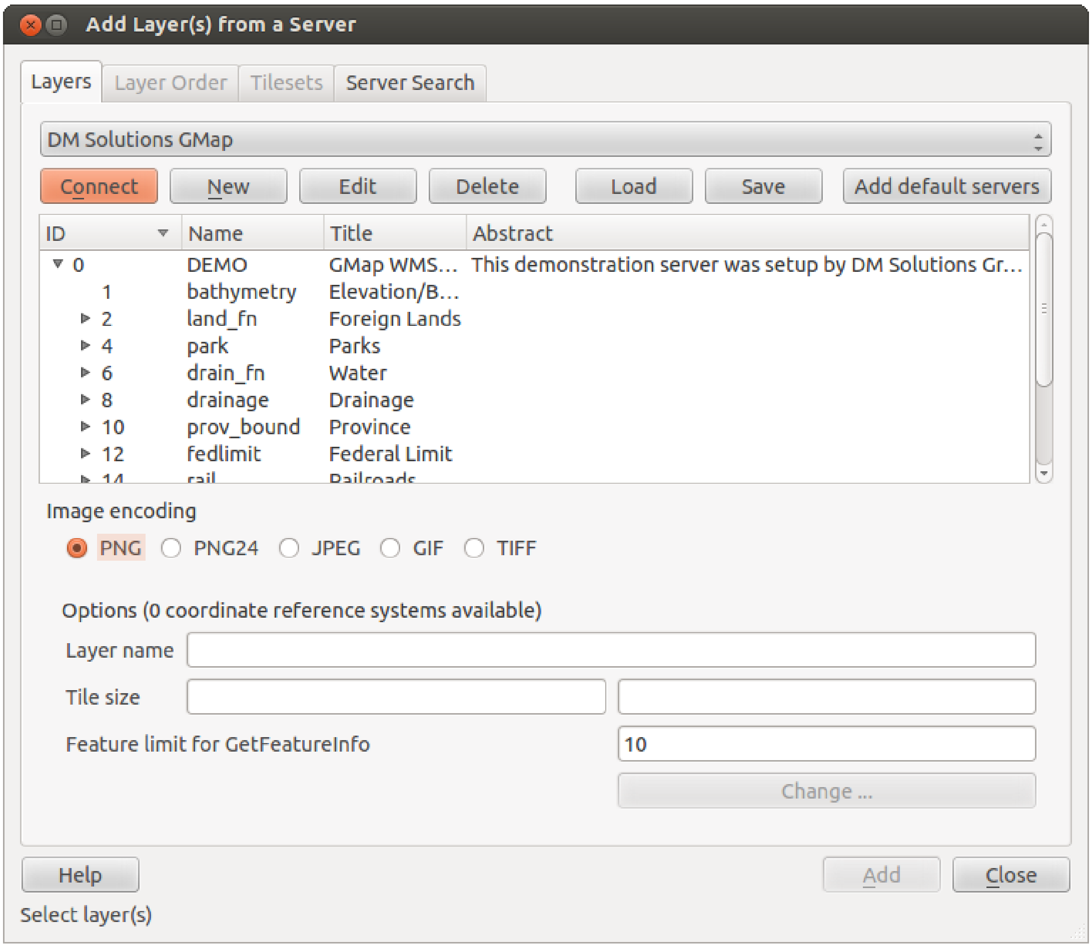

Figura 14.2: El diálogo para añadir un servidor WMs, mostrará las capas disponibles

Normalmente, encontrará que un servidor WMS le ofrece la opción de codificación de la imagen en JPEG o PNG. JPEG es un formato de compresión con pérdida, mientras que PNG reproduce fielmente los datos crudos raster.

Use JPEG if you expect the WMS data to be photographic in nature and/or you don't mind some loss in picture quality. This trade-off typically reduces by five times the data transfer requirement compared with PNG.

Use PNG if you want precise representations of the original data and you don't mind the increased data transfer requirements.

Opciones

The Options area of the dialog provides a text field where you can add a *Layer name* for the WMS layer. This name will appear in the legend after loading the layer.

Below the layer name, you can define *Tile size* if you want to set tile sizes (e.g., 256x256) to split up the WMS request into multiple requests.

El *Límite del objeto espacial para GetFeatureInfo* define los objetos espaciales del servidor a consultar.

If you select a WMS from the list, a field with the default projection provided by the mapserver appears. If the **[Change...]** button is active, you can click on it and change the default projection of the WMS to another CRS provided by the WMS server.

Orden de la capa

The *Layer Order* tab lists the selected layers available from the current connected WMS server. You may notice that some layers are expandable; this means that the layer can be displayed in a choice of image styles.

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.

Truco: Ordenar capas WMS

WMS layers rendered by a server are overlaid in the order listed in the Layers section, from top to bottom of the list. If you want to change the overlay order, you can use the *Layer Order* tab.

Transparencia

In this version of QGIS, the *Global transparency* setting from the *Layer Properties* is hard coded to be always on, where available.

Truco: Transparencia de capa WMS

La disponibilidad de imagen WMS transparente depende de la codificación de la imagen utilizada: PNG y GIF reconoce la transparencia, mientras JPEG deja sin reconocerlo.

Sistema de referencia de coordenadas

A coordinate reference system (CRS) is the OGC terminology for a QGIS projection.

Each WMS layer can be presented in multiple CRSs, depending on the capability of the WMS server.

To choose a CRS, select **[Change...]** and a dialog similar to Figure Projection 3 in *Working with Projections* 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.

Busqueda del servidor

Within QGIS, you can search for WMS servers. Figure_OGC_2 shows the *Server Search* tab with the *Add Layer(s) from a Server* dialog.

As you can see, it is possible to enter a search string in the text field and hit the **[Search]** button. After a short while, the search result will be populated into the list below the text field. Browse the result list and inspect your search results within the table. To visualize the results, select a table entry, press the **[Add selected row to WMS list]** button and change back to the *Layers* tab. QGIS has automatically updated your server list, and the selected

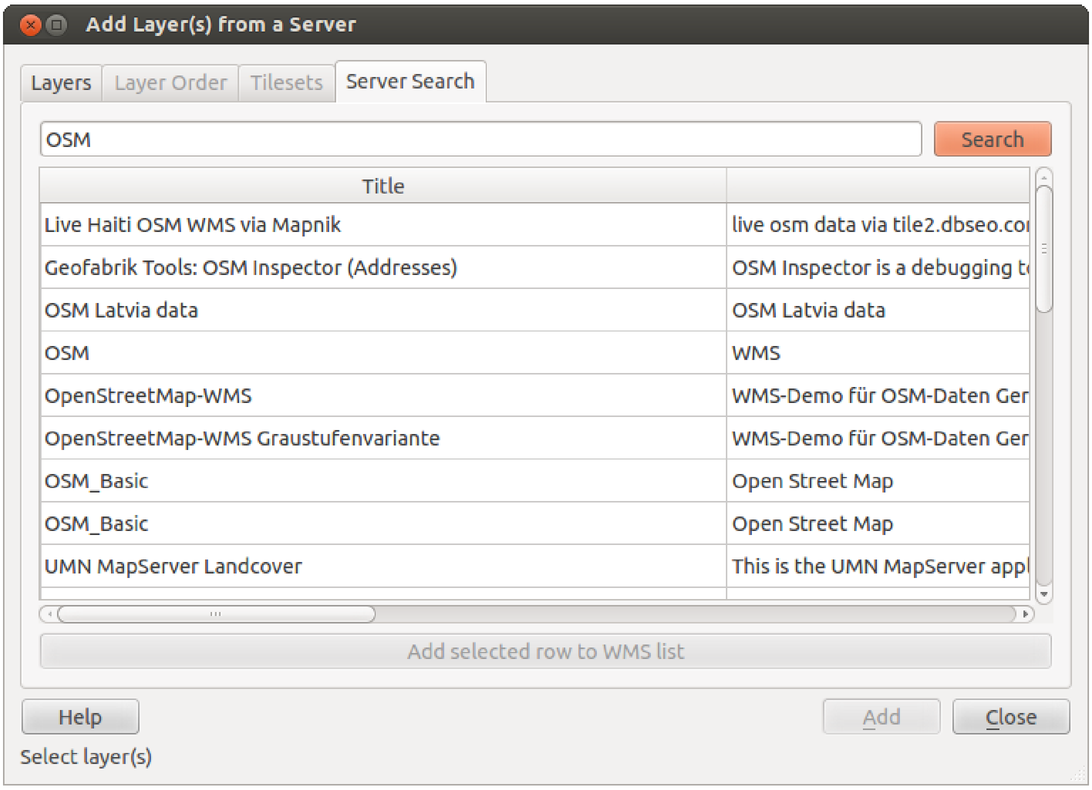

Figura 14.3: Diálogo para buscar servidores WMS después de algunas palabras clave

search result is already enabled in the list of saved WMS servers in the *Layers* tab. You only need to request the list of layers by clicking the **[Connect]** button. This option is quite handy when you want to search maps by specific keywords.

Basically, this option is a front end to the API of http://geopole.org.

Conjunto de teselas

When using WMTS (Cached WMS) services like

```
http://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 *Settings* → *Panels* (KDE and Windows) or *View* → *Panels* (Gnome and MacOSX), then choosing *Tile scale*. This gives you the available scales from the tile server with a nice slider docked in.

Utilizar la herramienta de Identificar objetos espaciales

Una vez que haya añadido un servidor WMS, y si alguna capa de un servidor WMS es consultable, puede entonces utilizar la herramienta Identificar objetos espaciales para seleccionar un píxel del lienzo del mapa. Una consulta se hace al servidor WMS por cada selección realizada. El resultado de la consulta se regresara en texto plano. El formato de este texto es dependiente del servidor WMS particular utilizado. **Selección de Formato**

If multiple output formats are supported by the server, a combo box with supported formats is automatically added to the identify results dialog and the selected format may be stored in the project for the layer. **Usar 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
    NAME "OGRGML"
    MIMETYPE "ogr/gml"
    DRIVER "OGR/GML"
    FORMATOPTION "FORM=multipart"
END

# in WEB METADATA define formats (example):
"wms_getfeatureinfo_formatlist" "OGRGML,text/html"
```

Ver propiedades

Once you have added a WMS server, you can view its properties by right-clicking on it in the legend and selecting *Properties*. **Pestaña de Metadatos**

The tab *Metadata* displays a wealth of information about the WMS server, generally collected from the capabilities statement returned from that server. Many definitions can be gleaned by reading the WMS standards (see OPEN-GEOSPATIAL-CONSORTIUM in *Referencias bibliográficas y web*), but here are a few handy definitions:

- **Propiedades del servidor**
  - **Versión WMS** — La versión WMS implementada por el servidor.
  - **Formatos de Imagen** — La lista de MIME-types que el servidor puede responder con la hora de elaboración del mapa. QGIS reconoce cualquier formato las bibliotecas Qt subyacentes con que fueron construidas, que es típicamente al menos `image/png` y `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.
- **Propiedades de la capa**
  - **Seleccionar** — Sea o no esta capa seleccionada cuando su servidor fue añadido a este proyecto.
  - **Visible** — Whether or not this layer is selected as visible in the legend (not yet used in this version of QGIS).
  - **Poder Identificar** — Sea o no esta capa regresará algunos resultados cuando la herramienta de identificar se utilice en él.
  - **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.
  - **Conteo en Cascada** — Los servidores WMS pueden actuar como proxy para otros servidores WMS para obtener datos ráster de una capa. Esta entrada muestra el número de veces que se remitió la solicitud de esta capa para ver a los servidores WMS para obtener un 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`.
- **Disponible en SRC** — Las proyecciones que esta capa puede representar por el servidor WMS. Éstos se enumeran en el formato nativo de WMS.
- **Disponible en estilo** — Los estilos de imagen que esta capa puede representar por el servidor WMS.

Mostrar leyenda gráfica WMS en la tabla de contenido y diseñador de impresión

The QGIS WMS data provider is able to display a legend graphic in the table of contents' layer list and in the map composer. 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.

If a legendGraphic is available, it is shown below the layer. It is little and you have to click on it to open it in real dimension (due to QgsLegendInterface architectural limitation). Clicking on the layer's legend will open a frame with the legend at full resolution.

In the print composer, the legend will be integrated at it's original (dowloaded) dimension. Resolution of the legend graphic can be set in the item properties under Legend -> WMS LegendGraphic to match your printing requirements

The legend will display contextual information based on your current scale. The WMS legend will be shown only if the WMS server has GetLegendGraphic capability and the layer has getCapability url specified, so you have to select a styling.

Limitaciones del cliente WMS

Not all possible WMS client functionality had been included in this version of QGIS. Some of the more noteworthy exceptions follow.

Editar la configuración de la capa 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.

**Autentificación necesaria en servidores WMS **

Currently, publicly accessible and secured WMS services are supported. The secured WMS servers can be accessed by public authentication. You can add the (optional) credentials when you add a WMS server. See section *Seleccionar servidor WMS/WMTS* for details.

Truco: Acceso garantizado a capas 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 http://inteproxy.wald.intevation.org.

Truco: 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 chapter *QGIS como Servidor de Datos OGC*.

14.1.2 WCT Cliente

A Web Coverage Service (WCS) provides access to raster data in forms that are useful for client-side rendering, as input into scientific models, and for other clients. The WCS may be compared to the WFS and the WMS. As WMS and WFS service instances, a WCS allows clients to choose portions of a server's information holdings based on spatial constraints and other query criteria.

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.

14.1.3 Cliente WFS y WFS-T

In QGIS, a WFS layer behaves pretty much like any other vector layer. You can identify and select features, and view the attribute table. Since QGIS 1.6, editing WFS-T is also supported.

In general, adding a WFS layer is very similar to the procedure used with WMS. The difference is that there are no default servers defined, so we have to add our own.

Cargar una capa WFS

As an example, we use the DM Solutions WFS server and display a layer. The URL is: http://www2.dmsolutions.ca/cgi-bin/mswfs_gmap

1. Click on the Add WFS Layer tool on the Layers toolbar. The *Add WFS Layer from a Server* dialog appears.
2. Haga clic en **[Nuevo]**.
3. Ingrese 'DS Solutions' como nombre.
4. Introducir la URL (véase más arriba).
5. Haga clic en **[Aceptar]**.
6. Seleccione 'DM Solutions' de la lista desplegable *Conexiones de servidor* .
7. Haga clic en **[Conectar]**
8. Espere a que la capa de capas este poblada.
9. Seleccione la capa *Parks* en la lista.
10. Haga clic en **[Aplicar]** para añadir la capa al mapa.

Tenga en cuenta que cualquier configuración de proxy que pueda haber establecido en sus preferencias también son reconocidos.

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 province or two and view the attribute table.

Only WFS 1.0.0 is supported. At this time, there have not been many tests against WFS versions implemented in other WFS servers. If you encounter problems with any other WFS server, please do not hesitate to contact the development team. Please refer to section *Help and Support* for further information about the mailing lists.

Truco: Encontrar servidores WFS

Puede encontrar servidores WFS adicionales al utilizar Google o su buscador favorito. Hay un número de listas con URLs publicas, algunos de ellos son mantenidos y otro no.

.

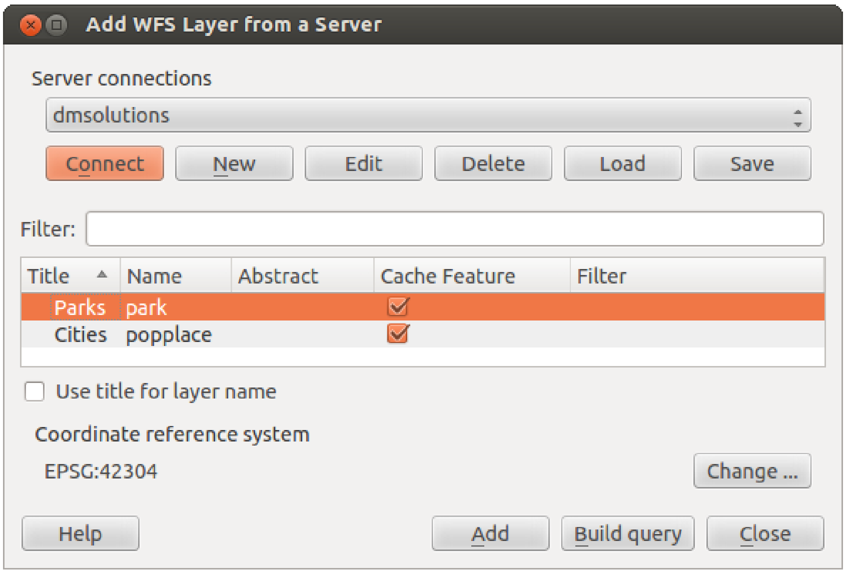

Figura 14.4: Añadir una capa WFS

14.2 QGIS como Servidor de Datos OGC

El servidor QGIS es una aplicación de código abierto WMS 1.3, WFS 1.0.0 y WCS 1 1.1.1 que además implementa características cartográficas avanzadas para la cartografía temática. El servidor QGIS es una aplicación FastCGI/CGI (Common Gateway Interface) escrita en C++ que trabaja en conjunto con el servidor web (por ejemplo, Apache, Lighttpd). Es financiado por los proyectos de EU Orchestra, Sany y la ciudad de Uster en Suiza.

El servidor QGIS utiliza QGIS como back-end para la lógica de los SIG y de mapa de representación. Además, la biblioteca Qt se utiliza para gráficos y para la plataforma independiente la programación en C++. En contraste con otro software de WMS, el servidor de QGIS utiliza reglas cartográficos como un lenguaje de configuración, tanto para la configuración del servidor y de las reglas cartográficas definidas por el usuario.

Moreover, the QGIS Server project provides the 'Publish to Web' plugin, a plugin for QGIS desktop that exports the current layers and symbology as a web project for QGIS Server (containing cartographic visualization rules expressed in SLD).

As QGIS desktop and QGIS Server use the same visualization libraries, the maps that are published on the web look the same as in desktop GIS. The 'Publish to Web' plugin currently supports basic symbolization, with the option to introduce more complex cartographic visualization rules manually. As the configuration is performed with the SLD standard and its documented extensions, there is only one standardised language to learn, which greatly simplifies the complexity of creating maps for the Web.

En uno de los siguientes manuales, proporcionaremos un ejemplo de configuración para configurar un servidor QGIS. Por ahora, recomendamos leer una de las siguientes direcciones URLs para obtener más información:

- http://karlinapp.ethz.ch/qgis_wms/
- http://hub.qgis.org/projects/quantum-gis/wiki/QGIS_Server_Tutorial
- http://linfiniti.com/2010/08/qgis-mapserver-a-wms-server-for-the-masses/

14.2.1 Ejemplo de instalación en Debian Squeeze

En este punto, daremos un ejemplo de instalación corto y simple cómo hacerlo para Debian Squeeze. Muchos otros sistemas operativos proporcionan paquetes para servidor QGIS, también. Si tienen que construir todo desde las fuentes, consulte las URLs anteriores.

Aparte de QGIS y Servidor QGIS, necesita un servidor web, en nuestro caso apache2. Puede instalar todos los paquetes con `aptitude` o `apt-get install` junto con otros paquetes de dependencias necesarias. Después de la instalación, debe probar para confirmar que el servidor web y el servidor QGIS funcionan como esperaban. Asegúrese de que el servidor Apache se está ejecutando con `/etc/init.d/apache2 start`. Abra un navegador web y escriba la URL‘‘http://localhost‘‘. Si Apache está arriba, debería ver el mensaje ‘It works!’.

Ahora probamos la instalación del servidor QGIS. El `qgis_mapserv.fcgi` esta disponible en `/usr/lib/cgi-bin/qgis_mapserv.fcgi` y proporciona un WMS estándar que muestra los limites estatales de Alaska. Añadir el WMS con la URL `http://localhost/cgi-bin/qgis_mapserv.fcgi` como se describe en *Seleccionar servidor WMS/WMTS*.

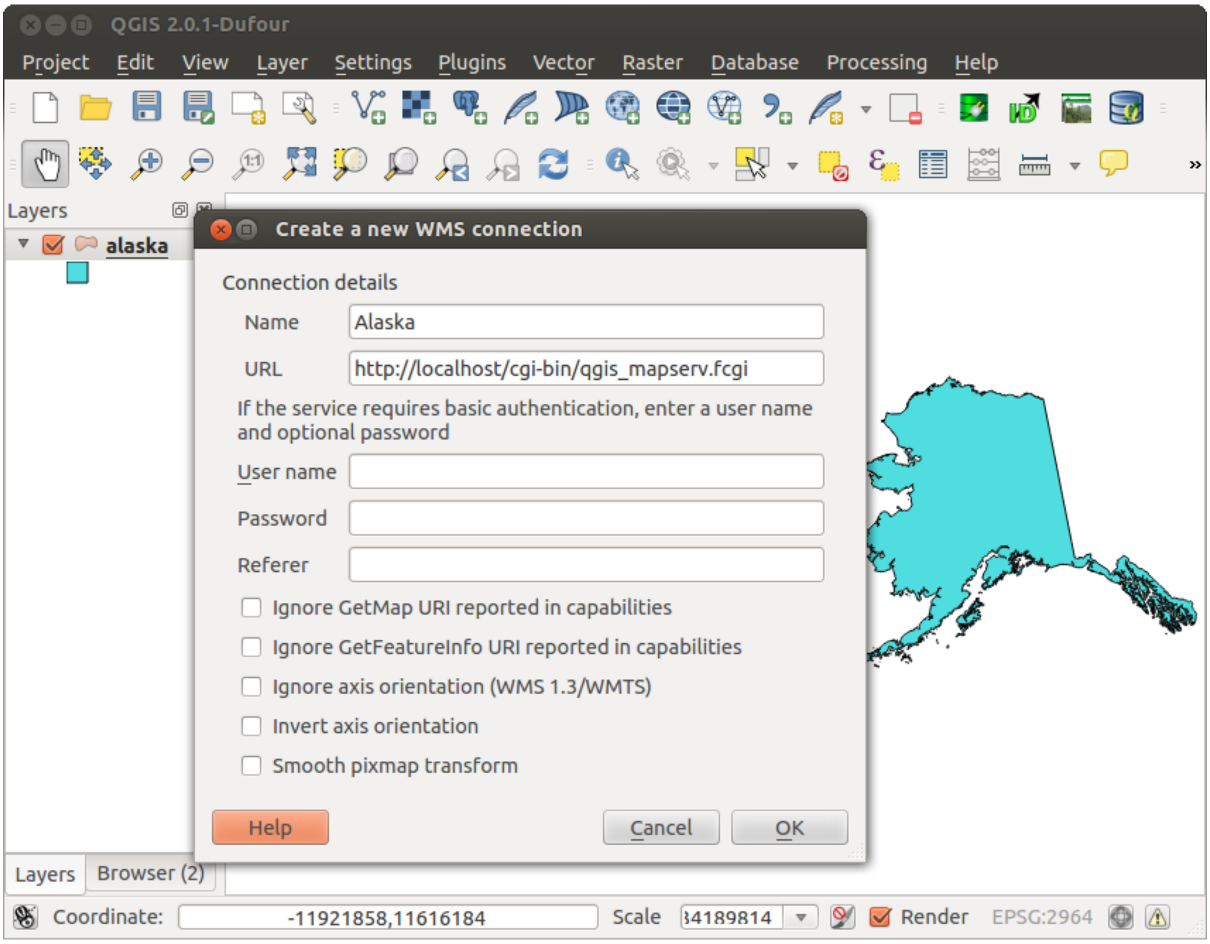

Figura 14.5: El estándar WMS con límites de EUA incluidas en el Servidor QGIS (KDE)

14.2.2 Crear un WMS/WFS/WCS desde un proyecto QGIS

Para proveer un nuevo servidor QGIS WMS, WFS o WCS, tenemos que crear un archivo de proyecto QGIS con algunos datos. Aquí, utilizamos el archivo shape ‘Alaska’ del conjunto de datos de ejemplo de QGIS. Definir los colores y estilos de las capas en QGIS y el SRC del proyecto, si aun no se ha definido.

Luego, vaya al menú *OWS Server* del diálogo *Proyecto* → *Propiedades del Proyecto* y proporciona información acerca del OWS en los campos de abajo *Capacidades del Servicio*. Esto aparecera en la respuesta de GetCapabilities del WMS, WFS o WCS. Si no marca *Capacidades del servicio*, el servidor QGIS utilizará la información dada en el archivo `wms_metadata.xml` ubicado en la carpeta `cgi-bin`.

WMS capacidades

En la sección *Capacidades WMS*, puede definir la extensión anunciada en la respuesta del GetCapabilities del WMS mediante el ingreso de los valores mínimo y máximo de X y Y en los campos en *extensión anunciada*. Al hacer clic en *Usar la extensión de la vista del mapa actual* establece estos valores de la extensión actual

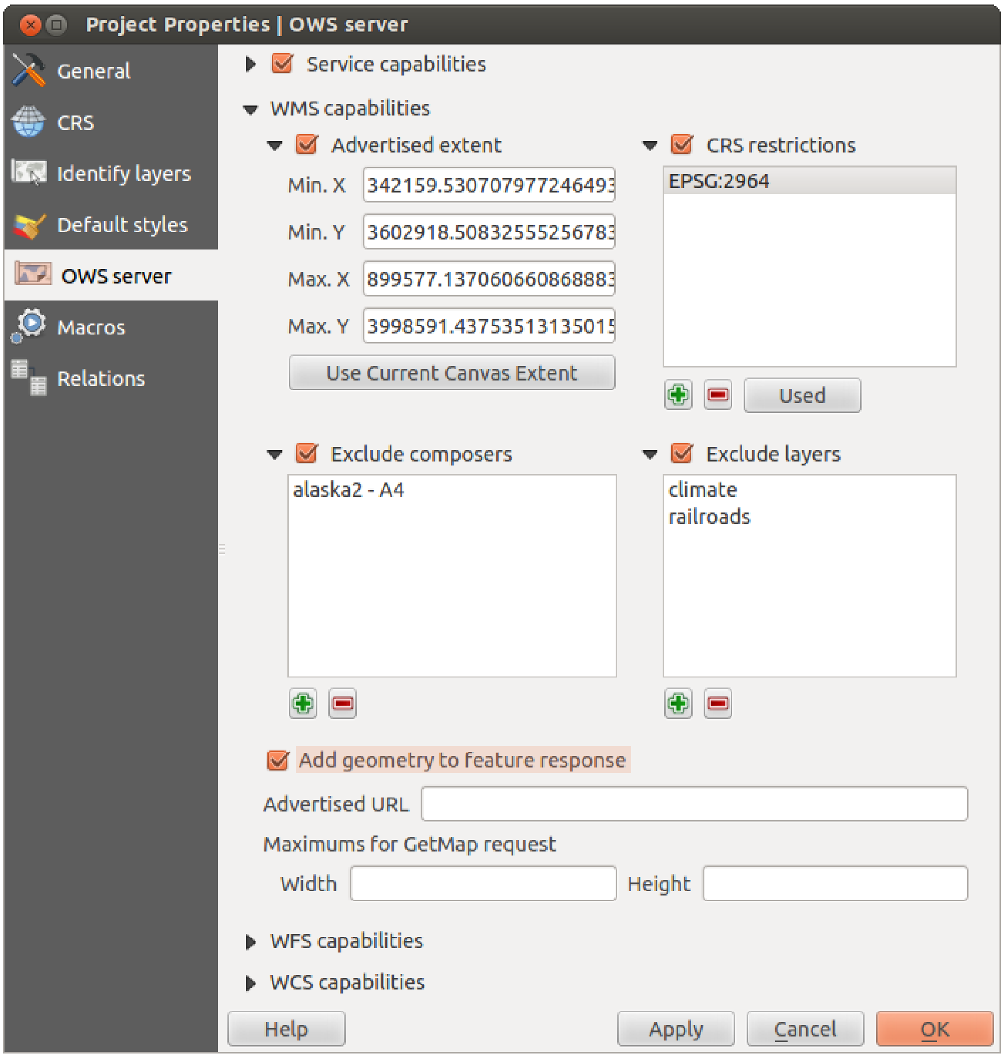

Figura 14.6: Definiciones para un proyecto QGIS de Servidor WMS/WFS/WCS (KDE)

mostrada en la vista del mapa de QGIS. Al marcar *Restricciones SRC*, puede restringir en que los sistemas de coordenadas de referencia (SRC) del servidor QGIS ofrecerá representar mapas. Utilice el botón de abajo para seleccionar aquellos SRC del selector de Sistemas de Referencia de Coordenadas, o haga clic en *Usado* y añada los SRC utilizados en el proyecto QGIS a la lista.

Si usted tiene un diseños de impresión definidas en el proyecto, se enumerarán en la respuesta GetCapabilities, y pueden ser utilizados por la solicitud GetPrint para crear impresiones, utilizando uno de los diseños de impresión como una plantilla. Esta es una extensión especifica de QGIS de la especificación WMS 1.3.0. Si desea excluir cualquier diseñador de impresión de ser publicado por el WMS, marque *Excluir diseñadores* y haga clic en el botón de abajo . A continuación, seleccione un diseñador de impresión desde el diálogo *Seleccionar diseñador de impresión* para añadirlo a la lista de diseñadores excluidos.

Si desea excluir alguna capa o grupo de capas de ser publicadas por el WMS, marque *Excluir capas* y haga clic en el botón de abajo . Esto abre el diálogo *Seleccionar capas y grupos restringidos*, que le permite elegir las capas y grupos que no desea que sean publicados. Utilice la tecla `Shift` o la tecla `Ctrl` si desea seleccionar múltiples entradas a la vez.

Puede recibir la solicitud de GetFeatureInfo como texto plano, XML y GML. Por omisión el formato es XML, texto o GML depende del formato de salida seleccionado para la petición GetFeatureInfo.

Si desea, puede marcar *Añadir geometría a la repuesta del objeto*. Este incluirá en la respuesta GetFeatureInfo las geometrías de las características en un formato de texto. Si quiere el servidor QGIS para anunciar URLs de peticiones especificas en la respuesta WMS GetCapabilities, introduzca la URL correspondiente en el campo *URL anunciada*. Por otra parte, puede restringir el tamaño máximo de los mapas devueltos en la solicitud GetMap al introducir el ancho y altura máxima en los campos correspondientes en *Máximos para la solicitud GetMap*.

WFS capacidades

En el área *Capacidades WFS*, puede seleccionar las capas que desee publicar como WFS, y especificar si permitirá la actualización, inserción y eliminación de operaciones. Si introduce una URL en el campo *URL anunciada* de la sección *Capacidades WFS*, el Servidor QGIS anunciará esta URL especifica en la respuesta de WFS GetCapabilities.

WCS capacidades

En el área *Capacidades WCS*, puede seleccionar las capas que desee publicar como WCS. Si introduce una URL en el campo *URL anunciada* de la sección *Capacidades WCS*, el Servidor QGIS anunciará la URL especifica en la respuesta de WCS GetCapabilities.

Ahora, guardarmos la sesión en un archivo de proyecto `alaska.qgs`. Para proveer el proyecto como WMS/WFS, creamos una nueva carpeta `/usr/lib/cgi-bin/project` con privilegios de administrados y añadimos el archivo del proyecto `alaska.qgs` y copiamos del archivo `qgis_mapserv.fcgi` - eso es todo.

Ahora probaremos nuestro proyecto WMS, WFS y WCS. Añadir el WMS, WFS y WCS como se describe en *Cargando capas WMS/WMTS*, *Cliente WFS y WFS-T* y *WCT Cliente* a QGIS y cargar los datos. La URL es:

```
http://localhost/cgi-bin/project/qgis_mapserv.fcgi
```

Ajuste fino de OWS

Para capas vectoriales, el menú *Campos* del diálogo *Capa→ Propiedades* permitirá definir cada atributo si será publicado o no. Por omisión, todos los atributos están publicados por WMS y WFS. Si desea especificar que un atributo no sea publicado, demarque la casilla de verificación correspondiente en la columna *WMS* o *WFS*.

Puede superponer una marca de agua sobre el mapa producido por WMS al añadir anotaciones de texto o anotaciones SVG para el archivo del proyecto. Vea la sección Herramientas de Anotación en *Herramientas generales* para obtener instrucciones en la creación de anotaciones. Para que las anotaciones sean desplegadas como marca de agua en el WMS de salida, al marcar la caja *Fijar posición del mapa* en el diálogo *Anotaciones de texto* debe ser desmarcada. Esto se puede acceder al hacer doble clic en la anotación mientras una de las herramientas de anotación esta activa. Para anotaciones SVG, necesitará configurar el proyecto para guardar rutas absolutas (en el menú *General* del diálogo *Proyecto→ Propiedades del proyecto*) o para modificar manualmente la ruta de la imagen SVG de una manera que representa una ruta relativa válida.

Parámetros extra soportados por la petición GetMap del WMS

En la petición GetMap del WMS, el servidor QGIS acepta un par de parámetros adicionales ademas de los parámetros estándar de acuerdo a la especificación OGC WMS 1.3.0:

- Parámetro **MAP**: Similar a MapServer, el parámetro `MAP` se puede utilizar para especificar la ruta al archivo del proyecto QGIS. Puede especificar una ruta absoluta o una ruta relativa a la ubicación del ejecutable del servidor (`qgis_mapserv.fcgi`). Si no especifica, el Servidor QGIS busca archivos .qgs en el directorio donde se encuentra el ejecutable del servidor.

  Ejemplo:

  ```
  http://localhost/cgi-bin/qgis_mapserv.fcgi?\
    REQUEST=GetMap&MAP=/home/qgis/mymap.qgs&...
  ```

- Parámetro **DPI**: El parámetro `DPI` se puede utilizar para especificar la resolución de la solicitud de salida.

  Ejemplo:

  ```
  http://localhost/cgi-bin/qgis_mapserv.fcgi?REQUEST=GetMap&DPI=300&...
  ```

- Parámetro **OPACITIES**: La opacidad se puede establecer en una capa o nivel de grupo. Los valores permitidos van de 0 (completamente transparente) a 255 (totalmente opaco).

  Ejemplo:

  ```
  http://localhost/cgi-bin/qgis_mapserv.fcgi?\
    REQUEST=GetMap&LAYERS=mylayer1,mylayer2&OPACITIES=125,200&...
  ```

.

Trabajar con datos GPS

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15.1 GPS Plugin

15.1.1 What is 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.

15.1.2 Loading GPS data from a file

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, two buttons with a small handheld GPS device will show up in the toolbar:

- Create new GPX Layer
- GPS Tools

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 *Datos de ejemplo* for more information about the sample data.

1. Select *Vector* → *GPS* → *GPS Tools* or click the GPS Tools icon in the toolbar and open the *Load GPX file* tab (see figure_GPS_1).
2. Browse to the folder `qgis_sample_data/gps/`, select the GPX file `national_monuments.gpx` and click **[Open]**.

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.

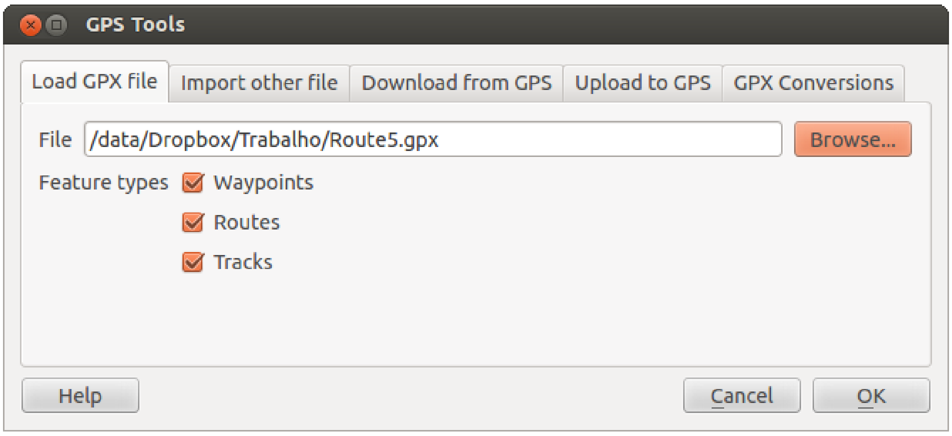

Figura 15.1: The *GPS Tools* dialog window

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 http://www.topografix.com/GPX/1/1/.

15.1.3 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 http://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.

15.1.4 Importing GPS data

To import GPS data from a file that is not a GPX file, you use the tool *Import other file* in the GPS Tools dialog. Here, you select the file that you want to import (and the file type), which feature type you want to import from it, where you want to store the converted GPX file and what the name of the new layer should be. Note that not all GPS data formats will support all three feature types, so for many formats you will only be able to choose between one or two types.

15.1.5 Downloading GPS data from a device

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 Figure_GPS_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.

The device type you select in the GPS device menu determines how GPSBabel tries to communicate with your GPS device. If none of the available types work with your GPS device, you can create a new type (see section *Defining new device types*).

The port may be a file name or some other name that your operating system uses as a reference to the physical port in your computer that the GPS device is connected to. It may also be simply USB, for USB-enabled GPS units.

- On Linux, this is something like `/dev/ttyS0` or `/dev/ttyS1`.
- On Windows, it is `COM1` or `COM2`.

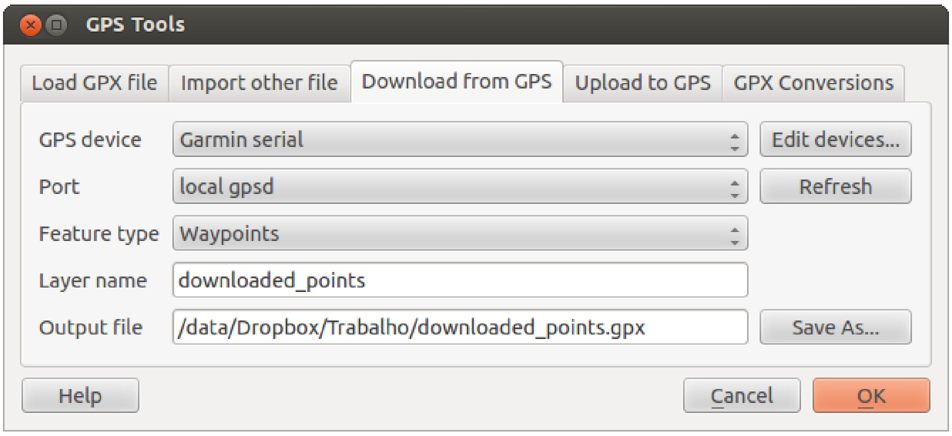

Figura 15.2: The download tool

When you click **[OK]**, the data will be downloaded from the device and appear as a layer in QGIS.

15.1.6 Uploading GPS data to a device

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.

15.1.7 Defining new device types

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` will be replaced by `-w` if you are downloading waypoints, `-r` if you are downloading routes and `-t` if you are downloading tracks. These are command-line options that tell GPSBabel which feature type to 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`.

The upload command is the command that is used to upload data to the device. The same keywords are used, but `%in` is now replaced by the name of the GPX file for the layer that is being uploaded, and `%out` is replaced by the port name.

You can learn more about GPSBabel and its available command line options at http://www.gpsbabel.org.

Once you have created a new device type, it will appear in the device lists for the download and upload tools.

15.1.8 Download of points/tracks from GPS units

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 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 http://www8.garmin.com/support/download_details.jsp?id=591

Connect the unit. Open GPS Tools and use `type=garmin serial` and `port=usb`: Fill the fields *Layer name* and *Output file*. Sometimes it seems to have problems saving in a certain folder, using something like `c:\temp` usually works.

Ubuntu/Mint GNU/Linux

It is first needed an issue about the permissions of the device, as described at https://wiki.openstreetmap.org/wiki/USB_Garmin_on_GNU/Linux. You can try to create a file `/etc/udev/rules.d/51-garmin.rules` containing this rule

```
ATTRS{idVendor}=="091e", ATTRS{idProduct}=="0003", MODE="666"
```

After that is necessary to be sure that the `garmin_gps` kernel module is not loaded

```
rmmod garmin_gps
```

and then you can use the GPS Tools. Unfortunately there seems to be a bug and usually QGIS freezes several times before the operation work fine.

BTGP-38KM datalogger (only Bluetooth)

MS Windows

The already referred bug does not allow to download the data from within QGIS, so it is needed to use GPSBabel from the command line or using its interface. The working command is

```
gpsbabel -t -i skytraq,baud=9600,initbaud=9600 -f COM9 -o gpx -F C:/GPX/aaa.gpx
```

Ubuntu/Mint GNU/Linux

Use same command (or settings if you use GPSBabel GUI) as in Windows. On Linux it maybe somehow common to get a message like

```
skytraq: Too many read errors on serial port
```

it is just a matter to turn off and on the datalogger and try again.

BlueMax GPS-4044 datalogger (both BT and USB)

MS Windows

Nota: It needs to install its drivers before using it on Windows 7. See in the manufacturer site for the proper download.

Downloading with GPSBabel, both with USB and BT returns always an error like

```
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 unsucessfully with code 1
```

Ubuntu/Mint GNU/Linux

With USB

After having connected the cable use the `dmesg` command to understand what port is being used, for example `/dev/ttyACM3`. Then as usual use GPSBabel from the CLI or GUI

```
gpsbabel -t -i mtk -f /dev/ttyACM3 -o gpx -F /home/user/bluemax.gpx
```

With Bluetooth

Use Blueman Device Manager to pair the device and make it available through a system port, then run GPSBabel

```
gpsbabel -t -i mtk -f /dev/rfcomm0 -o gpx -F /home/user/bluemax_bt.gpx
```

.

15.2 Live GPS tracking

To activate live GPS tracking in QGIS, you need to select *Settings* → *Panels* *GPS information*. You will get a new docked window on the left side of the canvas.

There are four possible screens in this GPS tracking window:

- GPS position coordinates and an interface for manually entering vertices and features
- GPS signal strength of satellite connections
- GPS polar screen showing number and polar position of satellites
- GPS options screen (see figure_gps_options)

With a plugged-in GPS receiver (has to be supported by your operating system), a simple click on **[Connect]** connects the GPS to QGIS. A second click (now on **[Disconnect]**) disconnects the GPS receiver from your computer. For GNU/Linux, gpsd support is integrated to support connection to most GPS receivers. Therefore, you first have to configure gpsd properly to connect QGIS to it.

> **Advertencia:** If you want to record your position to the canvas, you have to create a new vector layer first and switch it to editable status to be able to record your track.

15.2.1 Position and additional attributes

If the GPS is receiving signals from satellites, you will see your position in latitude, longitude and altitude together with additional attributes.

15.2.2 GPS signal strength

Here, you can see the signal strength of the satellites you are receiving signals from.

15.2.3 GPS polar window

If you want to know where in the sky all the connected satellites are, you have to switch to the polar screen. You can also see the ID numbers of the satellites you are receiving signals from.

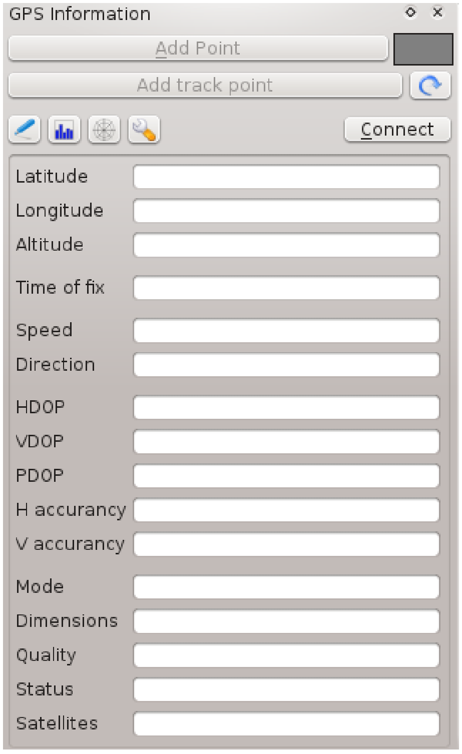

Figura 15.3: GPS tracking position and additional attributes

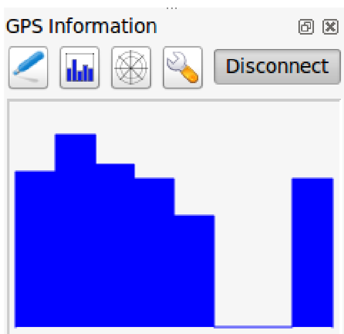

Figura 15.4: GPS tracking signal strength

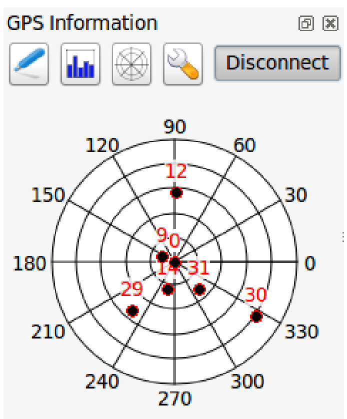

Figura 15.5: GPS tracking polar window

15.2.4 GPS options

In case of connection problems, you can switch between:

- *Autodetect*
- *Internal*
- *Serial device*
- *gpsd* (selecting the Host, Port and Device your GPS is connected to)

A click on **[Connect]** again initiates the connection to the GPS receiver.

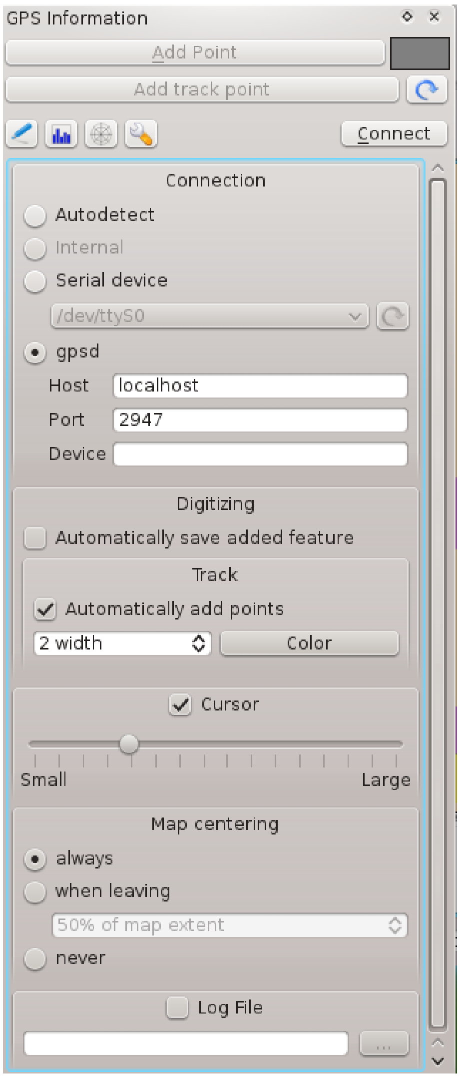

Figura 15.6: GPS tracking options window

You can activate *Automatically save added features* when you are in editing mode. Or you can activate *Automatically add points* to the map canvas with a certain width and color.

Activating *Cursor*, you can use a slider to shrink and grow the position cursor on the canvas.

Activating *Map centering* allows you to decide in which way the canvas will be updated. This includes 'always', 'when leaving', if your recorded coordinates start to move out of the canvas, or 'never', to keep map extent.

Finally, you can activate *Log file* and define a path and a file where log messages about the GPS tracking are logged.

If you want to set a feature manually, you have to go back to Position and click on **[Add Point]** or **[Add track point]**.

15.2.5 Connect to a Bluetooth GPS for live tracking

With QGIS you can connect a Bluetooth GPS for field data collection. To perform this task you need a GPS Bluetooth device and a Bluetooth receiver on your computer.

At first you must let your GPS device be recognized and paired to the computer. Turn on the GPS, go to the Bluetooth icon on your notification area and search for a New Device.

On the right side of the Device selection mask make sure that all devices are selected so your GPS unit will probably appear among those available. In the next step a serial connection service should be available, select it and click on **[Configure]** button.

Remember the number of the COM port assigned to the GPS connection as resulting by the Bluetooth properties.

After the GPS has been recognized, make the pairing for the connection. Usually the autorization code is `0000`.

Now open :guilabel:'GPS information'panel and switch to GPS options screen. Select the COM port assigned to the GPS connection and click the **[Connect]**. After a while a cursor indicating your position should appear.

If QGIS can't receive GPS data, then you should restart your GPS device, wait 5-10 seconds then try to connect again. Usually this solution work. If you receive again a connection error make sure you don't have another Bluetooth receiver near you, paired with the same GPS unit.

15.2.6 Using GPSMAP 60cs

MS Windows

Easiest way to make it work is to use a middleware (freeware, not open) called GPSGate.

Launch the program, make it scan for GPS devices (works for both USB and BT ones) and then in QGIS just click **[Connect]** in the Live tracking panel using the *Autodetect* mode.

Ubuntu/Mint GNU/Linux

As for Windows the easiest way is to use a server in the middle, in this case GPSD, so

```
sudo apt-get install gpsd
```

Then load the `garmin_gps` kernel module

```
sudo modprobe garmin_gps
```

And then connect the unit. Then check with `dmesg` the actual device being used bu the unit, for example `/dev/ttyUSB0`. Now you can launch gpsd

```
gpsd /dev/ttyUSB0
```

And finally connect with the QGIS live tracking tool.

15.2.7 Using BTGP-38KM datalogger (only Bluetooth)

Using GPSD (under Linux) or GPSGate (under Windows) is effortless.

15.2.8 Using BlueMax GPS-4044 datalogger (both BT and USB)

MS Windows

The live tracking works for both USB and BT modes, by using GPSGate or even without it, just use the  *Autodetect* mode, or point the tool the right port.

Ubuntu/Mint GNU/Linux

For USB

The live tracking works both with GPSD

```
gpsd /dev/ttyACM3
```

or without it, by connecting the QGIS live tracking tool directly to the device (for example `/dev/ttyACM3`).

For Bluetooth

The live tracking works both with GPSD

```
gpsd /dev/rfcomm0
```

or without it, by connecting the QGIS live tracking tool directly to the device (for example `/dev/rfcomm0`).

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CAPÍTULO 16

GRASS GIS Integration

The GRASS plugin provides access to GRASS GIS databases and functionalities (see GRASS-PROJECT in *Referencias bibliográficas y web*). This includes visualizing GRASS raster and vector layers, digitizing vector layers, editing vector attributes, creating new vector layers and analysing GRASS 2-D and 3-D data with more than 400 GRASS modules.

In this section, we'll introduce the plugin functionalities and give some examples of managing and working with GRASS data. The following main features are provided with the toolbar menu when you start the GRASS plugin, as described in section sec_starting_grass:

- Open mapset
- New mapset
- Close mapset
- Add GRASS vector layer
- Add GRASS raster layer
- Create new GRASS vector
- Edit GRASS vector layer
- Open GRASS tools
- Display current GRASS region
- Edit current GRASS region

16.1 Starting the GRASS plugin

To use GRASS functionalities and/or visualize GRASS vector and raster layers in QGIS, you must select and load the GRASS plugin with the Plugin Manager. Therefore, go to the menu *Plugins* → *Manage Plugins*, select *GRASS* and click **[OK]**.

You can now start loading raster and vector layers from an existing GRASS `LOCATION` (see section sec_load_grassdata). Or, you can create a new GRASS `LOCATION` with QGIS (see section *Creating a new GRASS LOCATION*) and import some raster and vector data (see section *Importing data into a GRASS LOCATION*) for further analysis with the GRASS Toolbox (see section *The GRASS Toolbox*).

16.2 Loading GRASS raster and vector layers

With the GRASS plugin, you can load vector or raster layers using the appropriate button on the toolbar menu. As an example, we will use the QGIS Alaska dataset (see section *Datos de ejemplo*). It includes a small sample GRASS `LOCATION` with three vector layers and one raster elevation map.

1. Create a new folder called `grassdata`, download the QGIS 'Alaska' dataset `qgis_sample_data.zip` from http://download.osgeo.org/qgis/data/ and unzip the file into `grassdata`.
2. Start QGIS.
3. If not already done in a previous QGIS session, load the GRASS plugin clicking on *Plugins* → *Manage Plugins* and activate *GRASS*. The GRASS toolbar appears in the QGIS main window.
4. In the GRASS toolbar, click the Open mapset icon to bring up the *MAPSET* wizard.
5. For `Gisdbase`, browse and select or enter the path to the newly created folder `grassdata`.
6. You should now be able to select the *LOCATION* `alaska` and the *MAPSET* `demo`.
7. Click **[OK]**. Notice that some previously disabled tools in the GRASS toolbar are now enabled.
8. Click on Add GRASS raster layer, choose the map name `gtopo30` and click **[OK]**. The elevation layer will be visualized.
9. Click on Add GRASS vector layer, choose the map name `alaska` and click **[OK]**. The Alaska boundary vector layer will be overlayed on top of the `gtopo30` map. You can now adapt the layer properties as described in chapter *The Vector Properties Dialog* (e.g., change opacity, fill and outline color).
10. Also load the other two vector layers, `rivers` and `airports`, and adapt their properties.

As you see, it is very simple to load GRASS raster and vector layers in QGIS. See the following sections for editing GRASS data and creating a new `LOCATION`. More sample GRASS `LOCATIONs` are available at the GRASS website at http://grass.osgeo.org/download/sample-data/.

Truco: GRASS Data Loading

If you have problems loading data or QGIS terminates abnormally, check to make sure you have loaded the GRASS plugin properly as described in section *sec_starting_grass*.

16.3 GRASS LOCATION and MAPSET

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 *Referencias bibliográficas y web*). In order to analyze vector and raster layers with GRASS modules, you must 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. But because this is not the usual way for beginners to work with GRASS, this functionality will not be described here.)

16.3.1 Creating a new GRASS LOCATION

As an example, here is how the sample GRASS `LOCATION alaska`, which is projected in Albers Equal Area projection with unit feet was created for the QGIS sample dataset. This sample GRASS `LOCATION alaska`

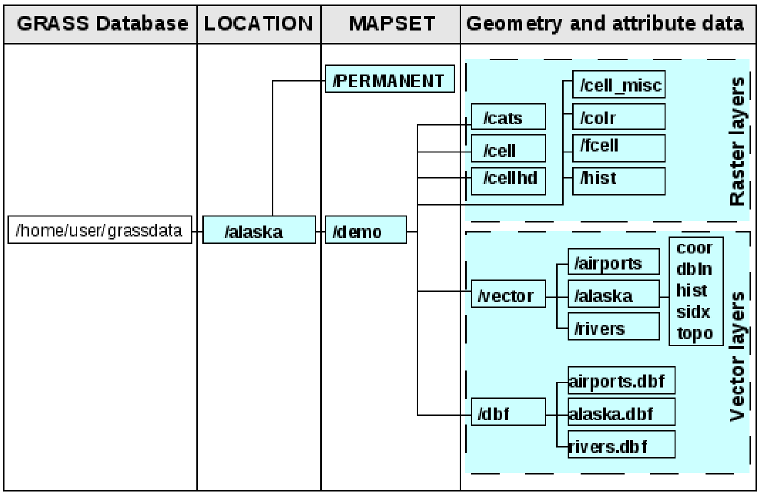

Figura 16.1: GRASS data in the alaska LOCATION

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 *Datos de ejemplo*).

1. Start QGIS and make sure the GRASS plugin is loaded.
2. Visualize the `alaska.shp` shapefile (see section *vector_load_shapefile*) from the QGIS Alaska dataset (see *Datos de ejemplo*).
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 *Adding a new MAPSET*) or to create a new `LOCATION` altogether. Select *Create new location* (see figure_grass_location_2).
6. Enter a name for the `LOCATION` – we used 'alaska' – and click **[Next]**.
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 *Working with Projections*)).
9. In *Filter*, insert 2964 to select the projection.
10. Click **[Next]**.
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 |qg| extent]**, to apply the extent of the loaded layer `alaska.shp` as the GRASS default region extent.
12. Click **[Next]**.
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 *Referencias bibliográficas y web*).
14. Check out the summary to make sure it's correct and click **[Finish]**.
15. The new `LOCATION`, 'alaska', and two `MAPSETs`, 'demo' and 'PERMANENT', are created. The currently opened working set is 'demo', as you defined.

16. Notice that some of the tools in the GRASS toolbar that were disabled are now enabled.

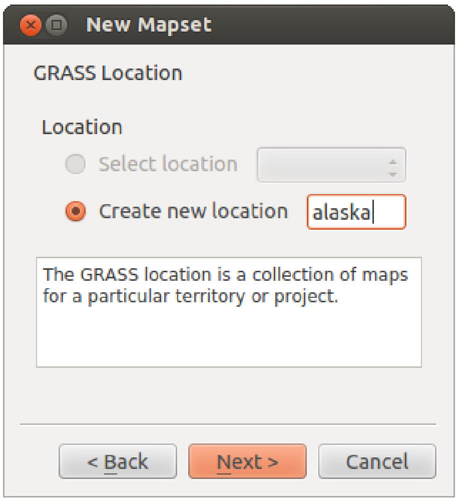

Figura 16.2: Creating a new GRASS LOCATION or a new MAPSET in QGIS

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 *Importing data into a GRASS LOCATION*). You can also use the already-existing vector and raster data in the sample GRASS `LOCATION` 'alaska', included in the QGIS 'Alaska' dataset *Datos de ejemplo*, and move on to section *The GRASS vector data model*.

16.3.2 Adding a new MAPSET

A user has write access only to a GRASS `MAPSET` 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`.

All `MAPSETs` include a `WIND` file that stores the current boundary coordinate values and the currently selected raster resolution (see Neteler & Mitasova 2008 in *Referencias bibliográficas y web*, and section *The GRASS region tool*).

1. Start QGIS and make sure the GRASS plugin is loaded.
2. In the GRASS toolbar, click on the New mapset icon to bring up the *MAPSET* wizard.
3. Select the GRASS database (GISDBASE) folder `grassdata` with the `LOCATION` 'alaska', where we want to add a further `MAPSET` called 'test'.
4. Click **[Next]**.
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 figure_grass_location_2) and click **[Next]**.
6. Enter the name `text` 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]**.

16.4 Importing data into a GRASS LOCATION

This section gives an example of how to import raster and vector data into the 'alaska' GRASS `LOCATION` provided by the QGIS 'Alaska' dataset. Therefore, we use the landcover raster map `landcover.img` and the vector GML file `lakes.gml` from the QGIS 'Alaska' dataset (see *Datos de ejemplo*).

1. Start QGIS and make sure the GRASS plugin is loaded.
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 *The GRASS Toolbox*) dialog appears.
5. To import the raster map `landcover.img`, click the module `r.in.gdal` in the *Modules Tree* tab. This GRASS module allows you to import GDAL-supported raster files into a GRASS `LOCATION`. The module dialog for `r.in.gdal` appears.
6. Browse to the folder `raster` in the QGIS 'Alaska' dataset and select the file `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 **Succesfully finished**, click **[View output]**. The `landcover_grass` raster layer is now imported into GRASS and will be visualized in the QGIS canvas.
9. To import the vector GML file `lakes.gml`, click the module `v.in.ogr` in the *Modules Tree* tab. This GRASS module allows you to import OGR-supported vector files into a GRASS `LOCATION`. The module dialog for `v.in.ogr` appears.
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.

16.5 The GRASS vector data model

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 labeled) by the **centroid** of the area.

Besides boundaries and centroids, a vector map can also contain points and lines. All these geometry elements can be mixed in one vector and will be represented in different so-called 'layers' inside one GRASS vector map. So in GRASS, a layer is not a vector or raster map but a level inside a vector layer. This is important to distinguish carefully. (Although it is possible to mix geometry elements, it is unusual and, even in GRASS, only used in special cases such as vector network analysis. Normally, you should prefer to store different geometry elements in different layers.)

It is possible to store several 'layers' in one vector dataset. For example, fields, forests and lakes can be stored in one vector. An adjacent forest and lake can share the same boundary, but they have separate attribute tables. It is also possible to attach attributes to boundaries. An example might be the case where the boundary between a lake and a forest is a road, so it can have a different attribute table.

The 'layer' of the feature is defined by the 'layer' inside GRASS. 'Layer' is the number which defines if there is more than one layer inside the dataset (e.g., if the geometry is forest or lake). For now, it can be only a number. In the future, GRASS will also support names as fields in the user interface.

Attributes can be stored inside the GRASS `LOCATION` as dBase or SQLite3 or in external database tables, for example, PostgreSQL, MySQL, Oracle, etc.

Attributes in database tables are linked to geometry elements using a 'category' value.

'Category' (key, ID) is an integer attached to geometry primitives, and it is used as the link to one key column in the database table.

Truco: Learning the GRASS Vector Model

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 http://grass.osgeo.org/documentation/manuals/ for more information, books and tutorials in several languages.

16.6 Creating a new GRASS vector layer

To create a new GRASS vector layer with the GRASS plugin, click the Create new GRASS vector toolbar icon. Enter a name in the text box, and you can start digitizing point, line or polygon geometries following the procedure described in section *Digitizing and editing a GRASS vector layer*.

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*).

Truco: Creating an attribute table for a new GRASS vector layer

If you want to assign attributes to your digitized geometry features, make sure to create an attribute table with columns before you start digitizing (see figure_grass_digitizing_5).

16.7 Digitizing and editing a GRASS vector layer

The digitizing tools for GRASS vector layers are accessed using the Edit GRASS vector layer icon on the toolbar. Make sure you have loaded a GRASS vector and it is the selected layer in the legend before clicking on the edit tool. Figure figure_grass_digitizing_2 shows the GRASS edit dialog that is displayed when you click on the edit tool. The tools and settings are discussed in the following sections.

Truco: Digitizing polygons in GRASS

If you want to create a polygon in GRASS, you first digitize the boundary of the polygon, setting the mode to 'No category'. Then you add a centroid (label point) into the closed boundary, setting the mode to 'Next not used'. 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.

Toolbar

In figure_grass_digitizing_1, you see the GRASS digitizing toolbar icons provided by the GRASS plugin. Table table_grass_digitizing_1 explains the available functionalities.

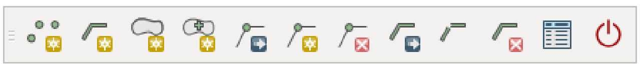

Figura 16.3: GRASS Digitizing Toolbar

Icon	Tool	Purpose
	New Point	Digitize new point
	New Line	Digitize new line
	New Boundary	Digitize new boundary (finish by selecting new tool)
	New Centroid	Digitize new centroid (label existing area)
	Move vertex	Move one vertex of existing line or boundary and identify new position
	Add vertex	Add a new vertex to existing line
	Delete vertex	Delete vertex from existing line (confirm selected vertex by another click)
	Move element	Move selected boundary, line, point or centroid and click on new position
	Split line	Split an existing line into two parts
	Delete element	Delete existing boundary, line, point or centroid (confirm selected element by another click)
	Edit attributes	Edit attributes of selected element (note that one element can represent more features, see above)
	Close	Close session and save current status (rebuilds topology afterwards)

Table GRASS Digitizing 1: GRASS Digitizing Tools

Category Tab

The *Category* tab allows you to define the way in which the category values will be assigned to a new geometry element.

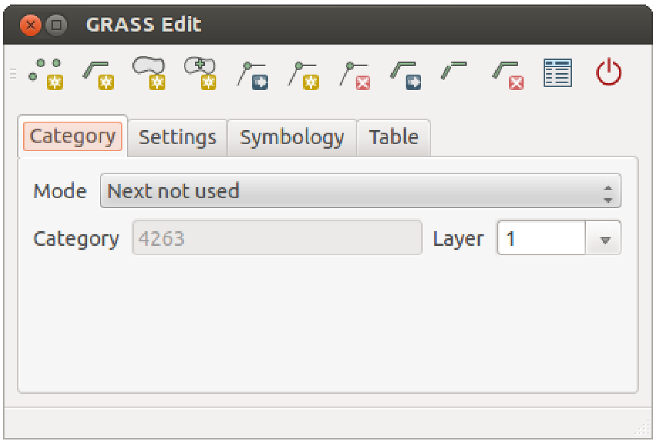

Figura 16.4: GRASS Digitizing Category Tab

- **Mode**: The category value that will be applied to new geometry elements.
  - Next not used - Apply next not yet used category value to geometry element.
  - Manual entry - Manually define the category value for the geometry element in the 'Category' entry field.
  - No category - Do not apply a category value to the geometry element. This is used, for instance, for area boundaries, because the category values are connected via the centroid.
- **Category** - The number (ID) that is attached to each digitized geometry element. It is used to connect each geometry element with its attributes.

- **Field (layer)** - Each geometry element can be connected with several attribute tables using different GRASS geometry layers. The default layer number is 1.

Truco: Creating an additional GRASS 'layer' with |qg|

If you would like to add more layers to your dataset, just add a new number in the 'Field (layer)' entry box and press return. In the Table tab, you can create your new table connected to your new layer.

Settings Tab

The *Settings* tab allows you to set the snapping in screen pixels. The threshold defines at what distance new points or line ends are snapped to existing nodes. This helps to prevent gaps or dangles between boundaries. The default is set to 10 pixels.

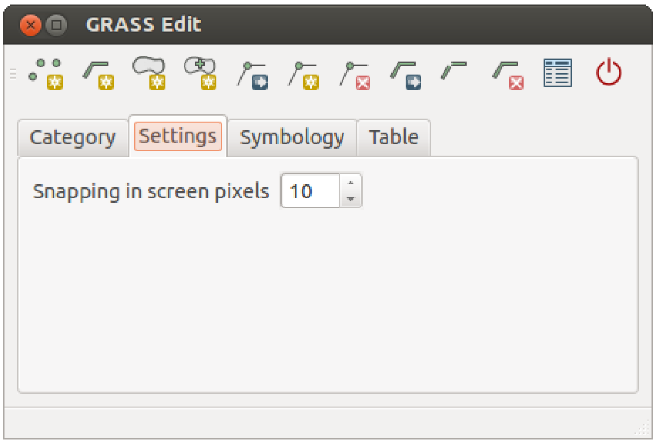

Figura 16.5: GRASS Digitizing Settings Tab

Symbology Tab

The *Symbology* tab allows you to view and set symbology and color settings for various geometry types and their topological status (e.g., closed / opened boundary).

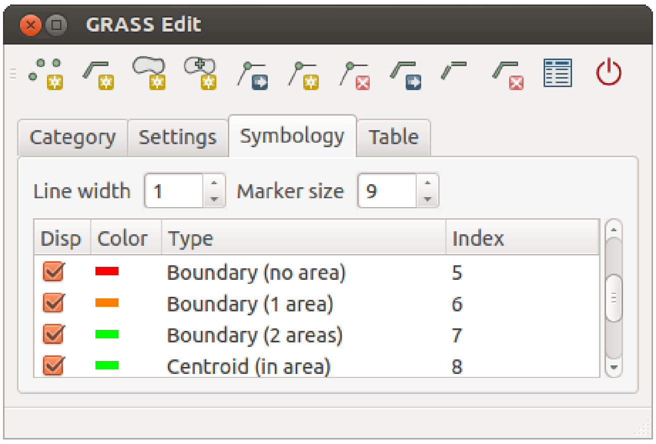

Figura 16.6: GRASS Digitizing Symbology Tab

Table Tab

The *Table* tab provides information about the database table for a given 'layer'. Here, you can add new columns to an existing attribute table, or create a new database table for a new GRASS vector layer (see section *Creating a new GRASS vector layer*).

Truco: GRASS Edit Permissions

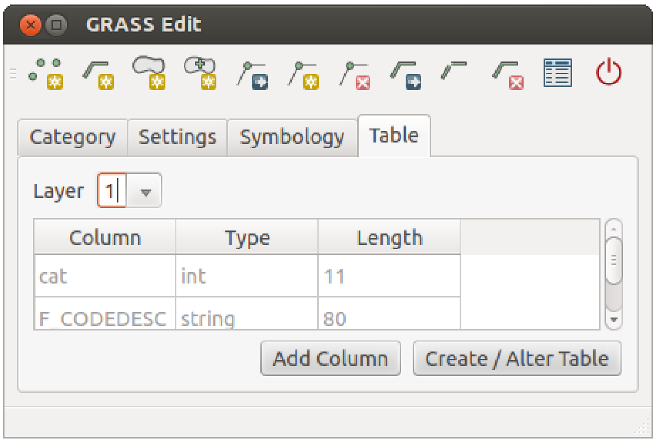

Figura 16.7: GRASS Digitizing Table Tab

You must be the owner of the GRASS `MAPSET` you want to edit. It is impossible to edit data layers in a `MAPSET` that is not yours, even if you have write permission.

16.8 The GRASS region tool

The region definition (setting a spatial working window) in GRASS is important for working with raster layers. Vector analysis is by default not limited to any defined region definitions. But all newly created rasters will have the spatial extension and resolution of the currently defined GRASS region, regardless of their original extension and resolution. The current GRASS region is stored in the `$LOCATION/$MAPSET/WIND` file, and it defines north, south, east and west bounds, number of columns and rows, horizontal and vertical spatial resolution.

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.

With the Edit current GRASS region icon, you can open a dialog to change the current region and the symbology of the GRASS region rectangle in the QGIS canvas. Type in the new region bounds and resolution, and click **[OK]**. The dialog also allows you to select a new region interactively with your mouse on the QGIS canvas. Therefore, click with the left mouse button in the QGIS canvas, open a rectangle, close it using the left mouse button again and click **[OK]**.

The GRASS module `g.region` provides a lot more parameters to define an appropriate region extent and resolution for your raster analysis. You can use these parameters with the GRASS Toolbox, described in section *The GRASS Toolbox*.

16.9 The GRASS Toolbox

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`.

16.9.1 Working with GRASS modules

The GRASS shell inside the GRASS Toolbox provides access to almost all (more than 300) GRASS modules in a command line interface. To offer a more user-friendly working environment, about 200 of the available GRASS modules and functionalities are also provided by graphical dialogs within the GRASS plugin Toolbox.

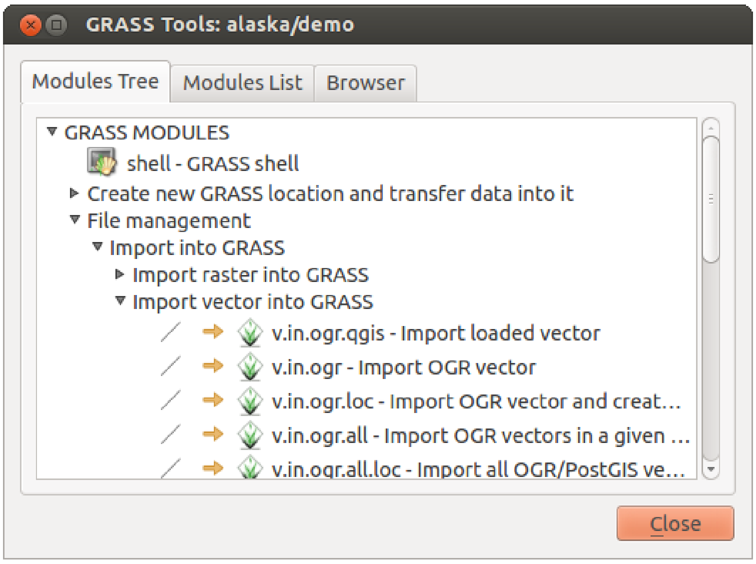

Figura 16.8: GRASS Toolbox and Module Tree

A complete list of GRASS modules available in the graphical Toolbox in QGIS version 2.2 is available in the GRASS wiki at http://grass.osgeo.org/wiki/GRASS-QGIS_relevant_module_list.

It is also possible to customize the GRASS Toolbox content. This procedure is described in section *Customizing the GRASS Toolbox*.

As shown in figure_grass_toolbox_1, you can look for the appropriate GRASS module using the thematically grouped *Modules Tree* or the searchable *Modules List* tab.

By clicking on a graphical module icon, a new tab will be added to the Toolbox dialog, providing three new sub-tabs: *Options*, *Output* and *Manual*.

Options

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.

The provided module parameters are often not complete to keep the dialog clear. If you want to use further module parameters and flags, you need to start the GRASS shell and run the module in the command line.

A new feature since QGIS 1.8 is the support for a *Show Advanced Options* button below the simplified module dialog in the *Options* tab. At the moment, it is only added to the module `v.in.ascii` as an example of use, but it will probably be part of more or all modules in the GRASS Toolbox in future versions of QGIS. This allows you to use the complete GRASS module options without the need to switch to the GRASS shell.

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

The *Manual* tab shows the HTML help page of the GRASS module. You can use it to check further module parameters and flags or to get a deeper knowledge about the purpose of the module. At the end of each module manual page, you see further links to the `Main Help index`, the `Thematic index` and the `Full index`. These links provide the same information as the module `g.manual`.

Truco: Display results immediately

If you want to display your calculation results immediately in your map canvas, you can use the 'View Output' button at the bottom of the module tab.

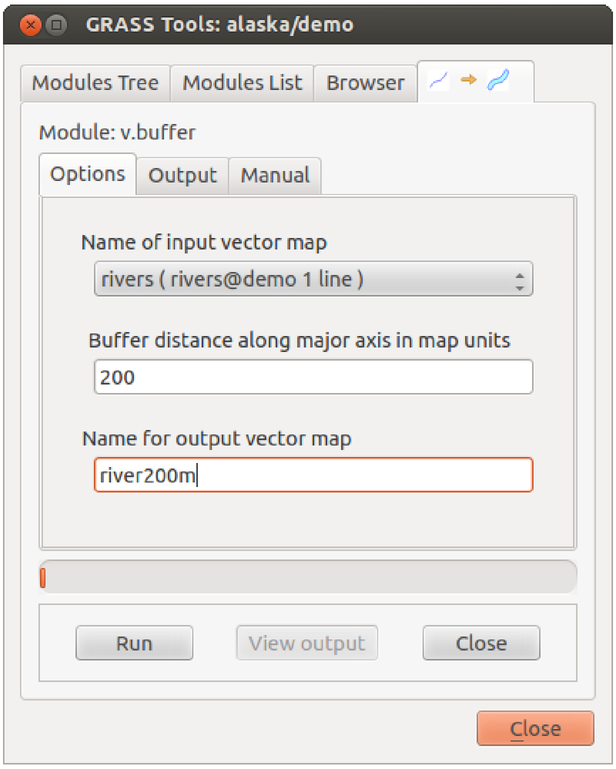

Figura 16.9: GRASS Toolbox Module Options

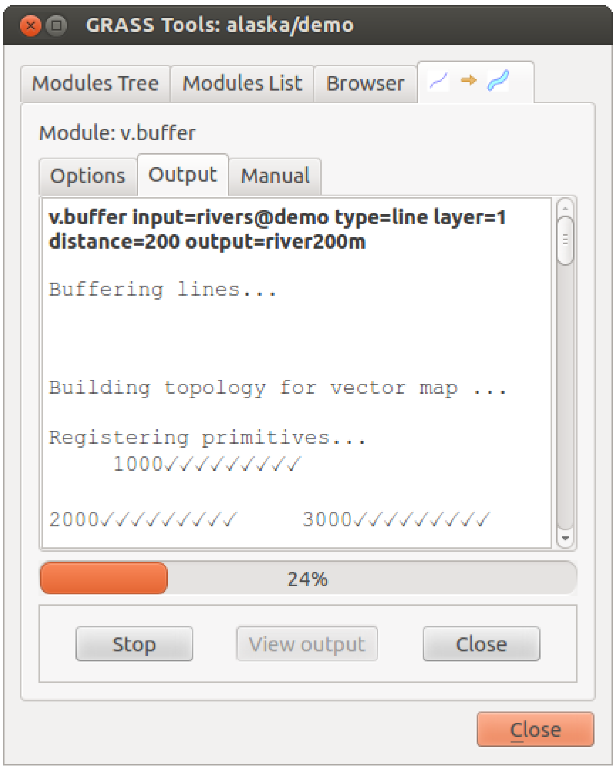

Figura 16.10: GRASS Toolbox Module Output

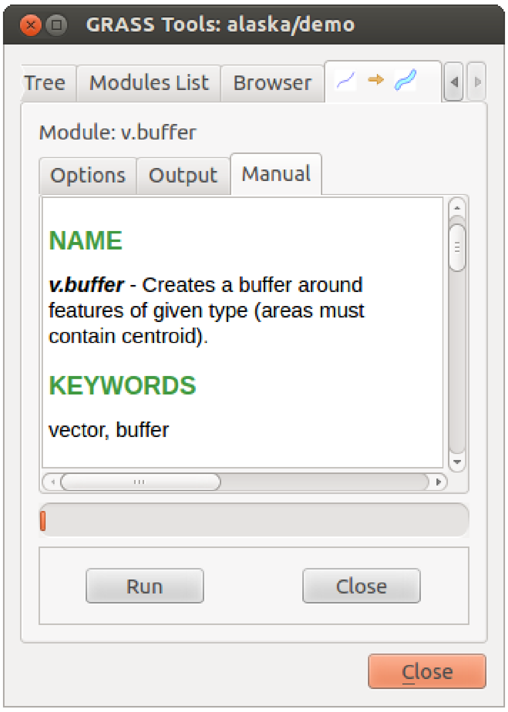

Figura 16.11: GRASS Toolbox Module Manual

16.9.2 GRASS module examples

The following examples will demonstrate the power of some of the GRASS modules.

Creating contour lines

The first example creates a vector contour map from an elevation raster (DEM). Here, it is assumed that you have the Alaska `LOCATION` set up as explained in section *Importing data into a GRASS LOCATION*.

- First, open the location by clicking the Open mapset button and choosing the Alaska location.
- Now load the `gtopo30` elevation raster by clicking Add GRASS raster layer and selecting the `gtopo30` raster from the demo location.
- Now open the Toolbox with the Open GRASS tools button.
- In the list of tool categories, double-click *Raster* → *Surface Management* → *Generate vector contour lines*.
- Now a single click on the tool **r.contour** will open the tool dialog as explained above (see *Working with GRASS modules*). The `gtopo30` raster should appear as the *Name of input raster*.
- Type into the *Increment between Contour levels* 1,00 the value 100. (This will create contour lines at intervals of 100 meters.)
- Type into the *Name for output vector map* the name `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]**.

Since this is a large region, it will take a while to display. After it finishes rendering, you can open the layer properties window to change the line color so that the contours appear clearly over the elevation raster, as in *The Vector Properties Dialog*.

Next, zoom in to a small, mountainous area in the center of Alaska. Zooming in close, you will notice that the contours have sharp corners. GRASS offers the **v.generalize** tool to slightly alter vector maps while keeping their overall shape. The tool uses several different algorithms with different purposes. Some of the algorithms (i.e., Douglas Peuker and Vertex Reduction) simplify the line by removing some of the vertices. The resulting vector will load faster. This process is useful when you have a highly detailed vector, but you are creating a very small-scale map, so the detail is unnecessary.

Truco: The simplify tool

Note that the QGIS fTools plugin has a *Simplify geometries →* tool that works just like the GRASS **v.generalize** Douglas-Peuker algorithm.

However, the purpose of this example is different. The contour lines created by `r.contour` have sharp angles that should be smoothed. Among the **v.generalize** algorithms, there is Chaiken's, which does just that (also Hermite splines). Be aware that these algorithms can **add** additional vertices to the vector, causing it to load even more slowly.

- Open the GRASS Toolbox and double-click the categories *Vector → Develop map → Generalization*, then click on the **v.generalize** module to open its options window.
- Check that the 'ctour_100' vector appears as the *Name of input vector*.
- 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]**.
- You may change the color of the vector to display it clearly on the raster background and to contrast with the original contour lines. You will notice that the new contour lines have smoother corners than the original while staying faithful to the original overall shape.

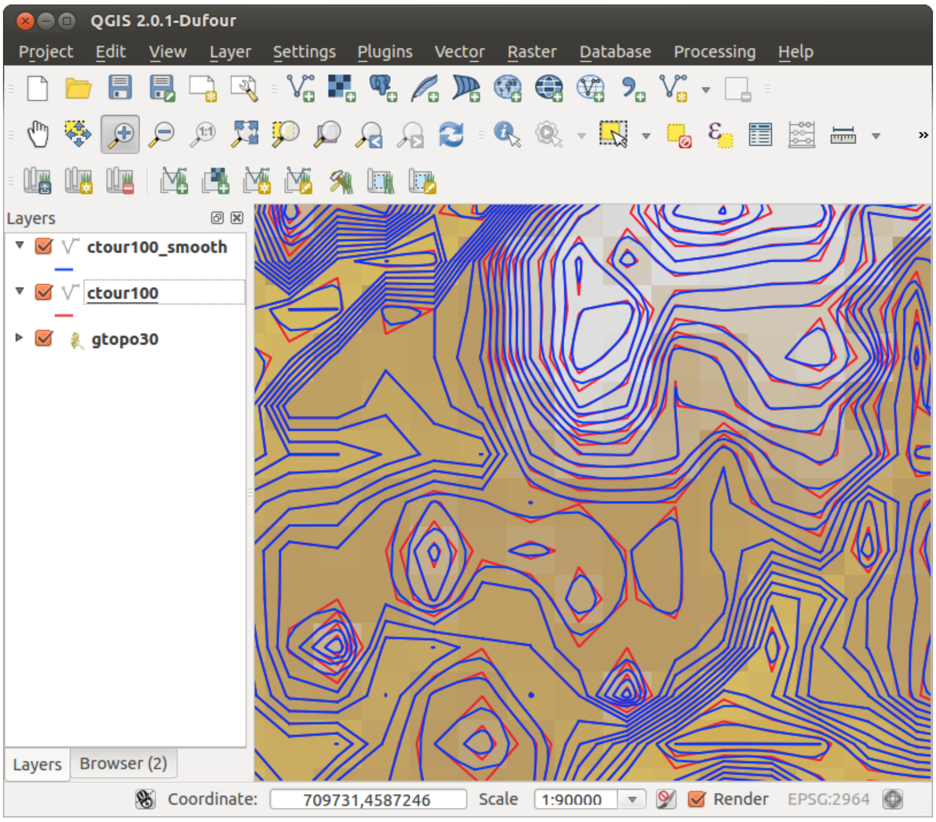

Figura 16.12: GRASS module v.generalize to smooth a vector map

Truco: Other uses for r.contour

The procedure described above can be used in other equivalent situations. If you have a raster map of precipitation data, for example, then the same method will be used to create a vector map of isohyetal (constant rainfall) lines.

Creating a Hillshade 3-D effect

Several methods are used to display elevation layers and give a 3-D effect to maps. The use of contour lines, as shown above, is one popular method often chosen to produce topographic maps. Another way to display a 3-D effect is by hillshading. The hillshade effect is created from a DEM (elevation) raster by first calculating the slope and aspect of each cell, then simulating the sun's position in the sky and giving a reflectance value to each cell. Thus, you get sun-facing slopes lighted; the slopes facing away from the sun (in shadow) are darkened.

- Begin this example by loading the `gtopo30` elevation raster. Start the GRASS Toolbox, and under the Raster category, double-click to open *Spatial analysis* → *Terrain analysis*.
- Then click **r.shaded.relief** to open the module.
- Change the *azimuth angle* 1,00 270 to 315.
- Enter `gtopo30_shade` for the new hillshade raster, and click **[Run]**.
- When the process completes, add the hillshade raster to the map. You should see it displayed in grayscale.
- To view both the hillshading and the colors of the `gtopo30` together, move the hillshade map below the `gtopo30` map in the table of contents, then open the *Properties* window of `gtopo30`, switch to the *Transparency* tab and set its transparency level to about 25 %.

You should now have the `gtopo30` elevation with its colormap and transparency setting displayed **above** the grayscale hillshade map. In order to see the visual effects of the hillshading, turn off the `gtopo30_shade` map, then turn it back on.

Using the GRASS shell

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.

The module **r.shaded.relief** can take a parameter `zmult`, which multiplies the elevation values relative to the X-Y coordinate units so that the hillshade effect is even more pronounced.

- Load the `gtopo30` elevation raster as above, then start the GRASS Toolbox and click on the GRASS shell. In the shell window, type the command `r.shaded.relief map=gtopo30 shade=gtopo30_shade2 azimuth=315 zmult=3` and press **[Enter]**.
- After the process finishes, shift to the *Browse* tab and double-click on the new `gtopo30_shade2` raster to display it in QGIS.
- As explained above, move the shaded relief raster below the `gtopo30` raster in the table of contents, then check the transparency of the colored `gtopo30` layer. You should see that the 3-D effect stands out more strongly compared with the first shaded relief map.

Raster statistics in a vector map

The next example shows how a GRASS module can aggregate raster data and add columns of statistics for each polygon in a vector map.

- Again using the Alaska data, refer to *Importing data into a GRASS LOCATION* to import the trees shapefile from the `shapefiles` directory into GRASS.
- Now an intermediate step is required: centroids must be added to the imported trees map to make it a complete GRASS area vector (including both boundaries and centroids).

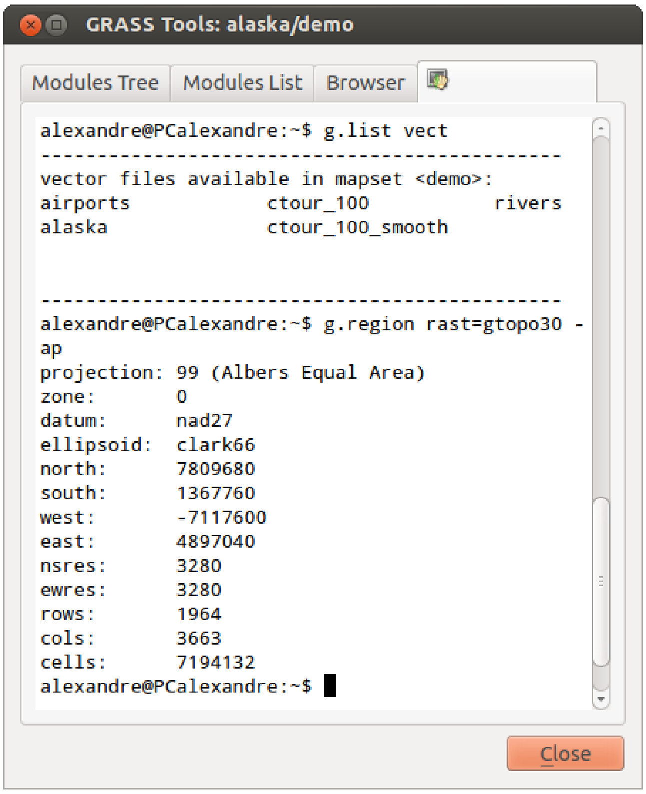

Figura 16.13: The GRASS shell, r.shaded.relief module

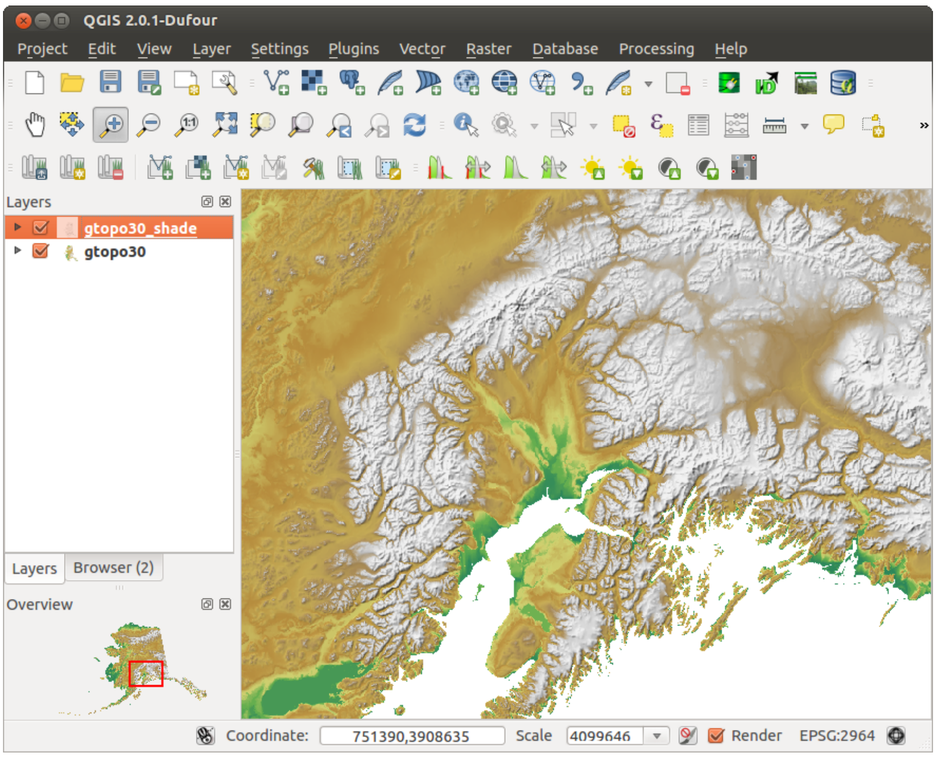

Figura 16.14: Displaying shaded relief created with the GRASS module r.shaded.relief

- From the Toolbox, choose *Vector* → *Manage features*, and open the module **v.centroids**.
- Enter as the *output vector map* 'forest_areas' and run the module.
- 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 *sec_symbology* of the vector section.)
- Next, reopen the GRASS Toolbox and open *Vector* → *Vector update* by other maps.
- Click on the **v.rast.stats** module. Enter `gtopo30` and `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).
- Finally, open the `forest_areas` attribute table, and verify that several new columns have been added, including `elev_min`, `elev_max`, `elev_mean`, etc., for each forest polygon.

16.9.3 Working with the GRASS LOCATION browser

Another useful feature inside the GRASS Toolbox is the GRASS `LOCATION` browser. In figure_grass_module_7, you can see the current working `LOCATION` with its `MAPSETs`.

In the left browser windows, you can browse through all `MAPSETs` inside the current `LOCATION`. The right browser window shows some meta-information for selected raster or vector layers (e.g., resolution, bounding box, data source, connected attribute table for vector data, and a command history).

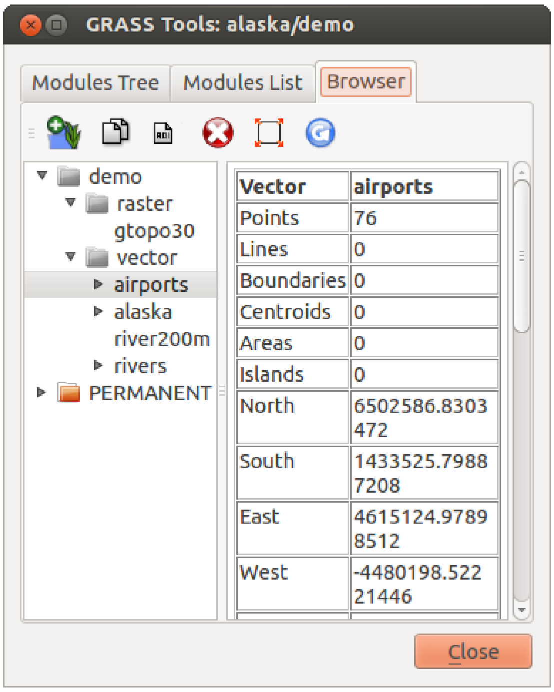

Figura 16.15: GRASS LOCATION browser

The toolbar inside the *Browser* tab offers the following tools to manage the selected `LOCATION`:

-  *Add selected map to canvas*
-  *Copy selected map*
-  *Rename selected map*

- *Delete selected map*
- *Set current region to selected map*
- *Refresh browser window*

The *Rename selected map* and *Delete selected map* only work with maps inside your currently selected `MAPSET`. All other tools also work with raster and vector layers in another `MAPSET`.

16.9.4 Customizing the GRASS Toolbox

Nearly all GRASS modules can be added to the GRASS Toolbox. An XML interface is provided to parse the pretty simple XML files that configure the modules' appearance and parameters inside the Toolbox.

A sample XML file for generating the module `v.buffer` (v.buffer.qgm) looks like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE qgisgrassmodule SYSTEM "http://mrcc.com/qgisgrassmodule.dtd">

<qgisgrassmodule label="Vector buffer" module="v.buffer">
        <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 on the QGIS wiki at http://hub.qgis.org/projects/quantum-gis/wiki/Adding_New_Tools_to_the_GRASS_Toolbox.

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Entorno de trabajo de procesamiento de QGIS

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17.1 Introducción

Este capítulo introduce al marco de procesamiento de QGIS, un entorno de geoprosesamiento que se puede utilizar para llamar algoritmos nativos o de terceros de QGIS, haciendo su tarea de análisis espacial más productivo y fácil de lograr.

En las siguientes secciones, revisaremos cómo usar los elementos gráficos de este sistema y sacar el máximo provecho de cada uno de ellos.

Hay cuatro elementos básicos en el marco IUG, que se usa para ejecutar algoritmos para diferentes propósitos. Elegir una u otra herramienta dependerá del tipo de análisis que se va a realizar y de las características particulares que cada usuario y proyecto. Todos ellos (a excepción de la interfaz de procesamiento por lotes, lo que se llama desde la caja de herramientas, como veremos más delante) se puede acceder desde el menú *Procesado*. (Verpa más de cuatro entradas. Los restantes no se utilizan para ejecutar los algoritmos y se explicarán más adelante en este capítulo.)

- La caja de herramientas. El elemento principal de la IUG, se usa para ejecutar un solo algoritmo o grupo de procesos sobre la base de ese algoritmo.

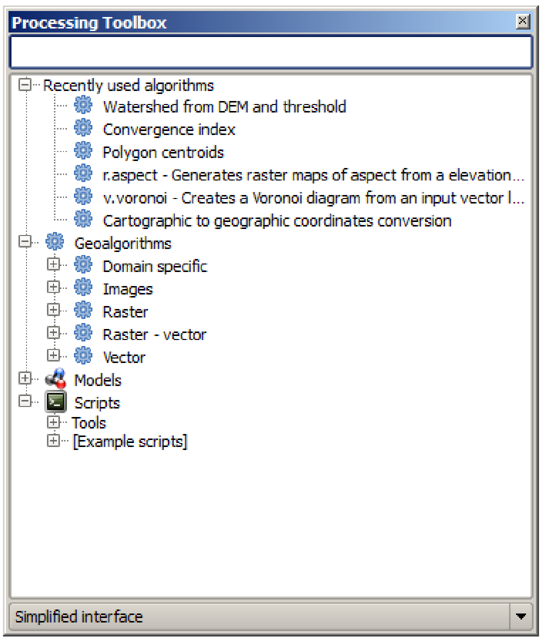

Figura 17.1: Caja de herramientas de procesado

- El modelador gráfico. Varios algoritmos se pueden combinar graficamente usando el modelador para definir un flujo de trabajo, creando un proceso individual que involucre varios subprocesos.

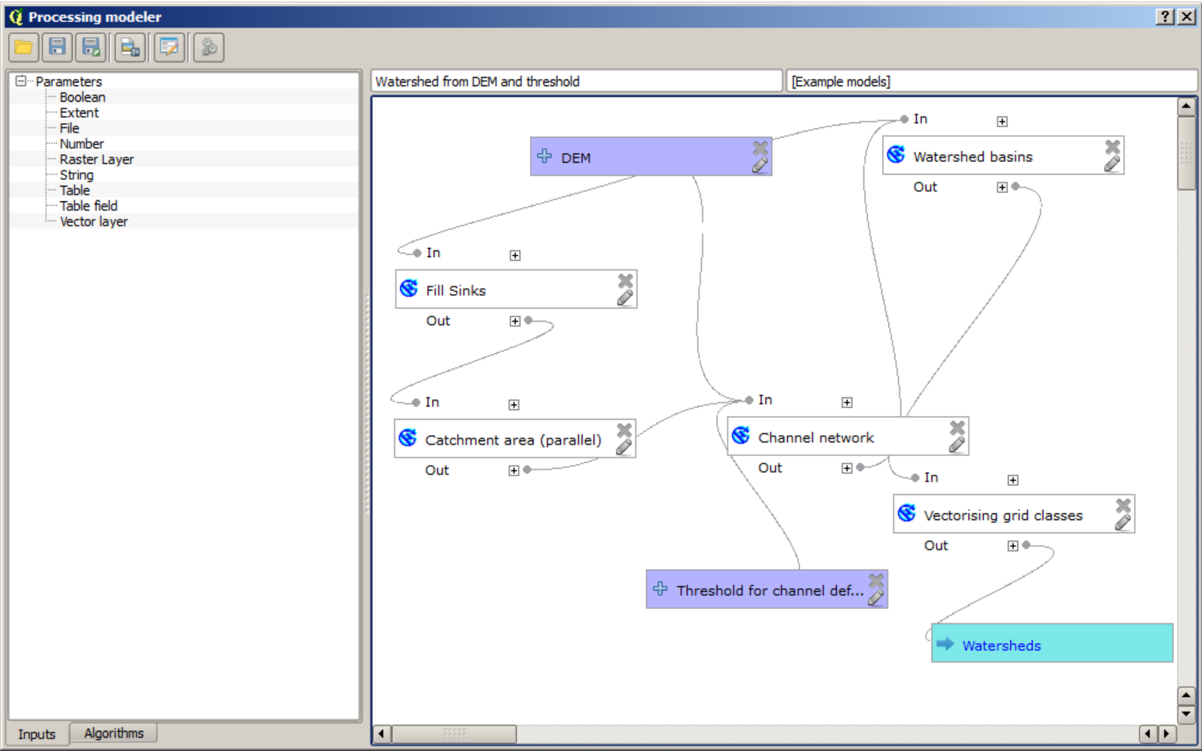

Figura 17.2: Procesamiento del modelador

- El administrador del historial. Todas las acciones que se llevan acabo mediante cualquiera de los elementos mencionados se almacenan en un archivo de la historia y puede ser posteriormente producido usando el administrador del historial.
- La interfaz de procesamiento por lote. Esta interfaz permite que ejecute procesos por lote y automatizar la ejecución de un solo algoritmo a múltiples conjuntos de datos.

En las siguientes secciones, revisaremos cada uno de los elementos a detalle.

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17.2 The toolbox

The *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, and it 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.

The toolbox contains all the available algorithms, divided into predefined groups. All these groups are found under a single tree entry named *Geoalgorithms*.

Additionally, two more entries are found, namely *Models* and *Scripts*. These include user-created algorithms, and they allow you to define your own workflows and processing tasks. We will devote a full section to them a bit later.

In the upper part of the toolbox, you will find a text box. To reduce the number of algorithms shown in the toolbox and make it easier to find the one you need, you can enter any word or phrase on the text box. Notice that, as you type, the number of algorithms in the toolbox is reduced to just those that contain the text you have entered in their names.

In the lower part, you will find a box that allows you to switch between the simplified algorithm list (the one explained above) and the advanced list. If you change to the advanced mode, the toolbox will look like this:

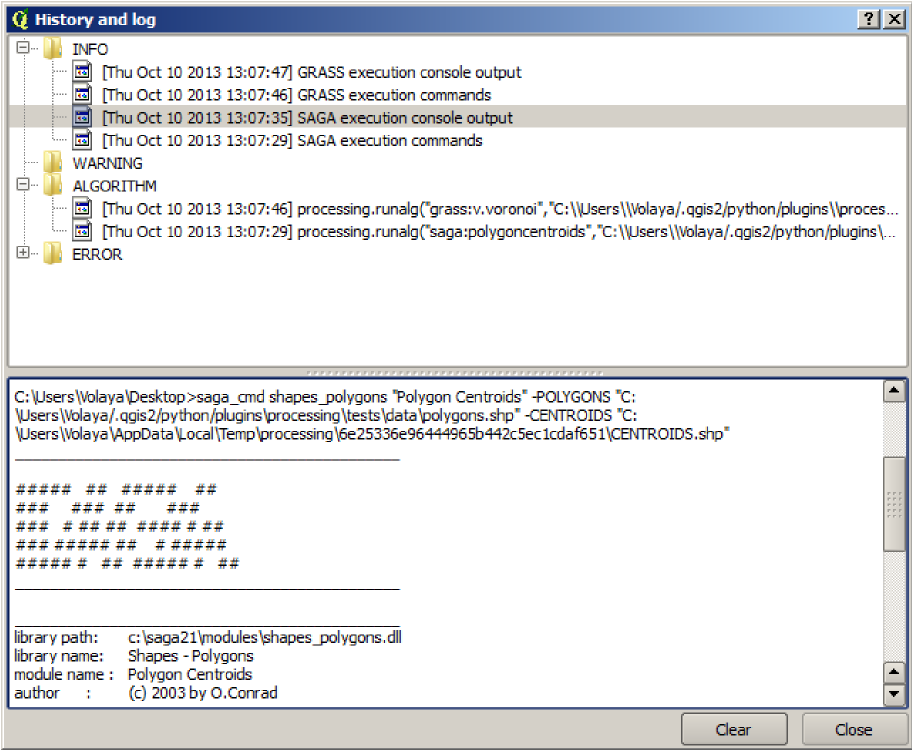

Figura 17.3: Procesamiento de Historial

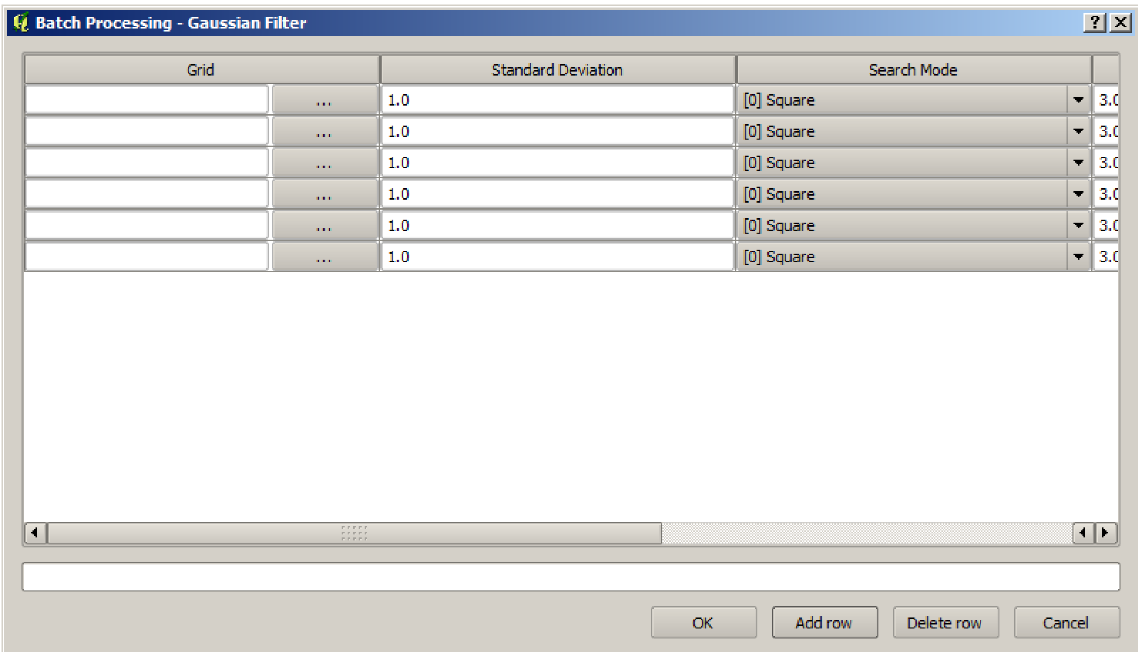

Figura 17.4: Interfaz de procesamiento por lote

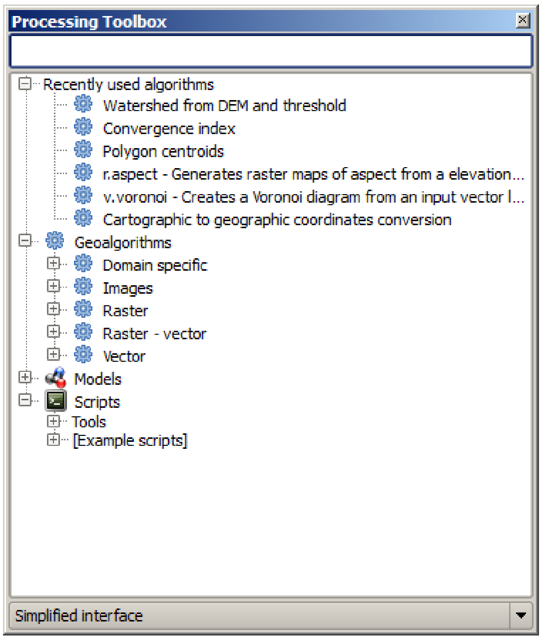

Figura 17.5: Processing Toolbox

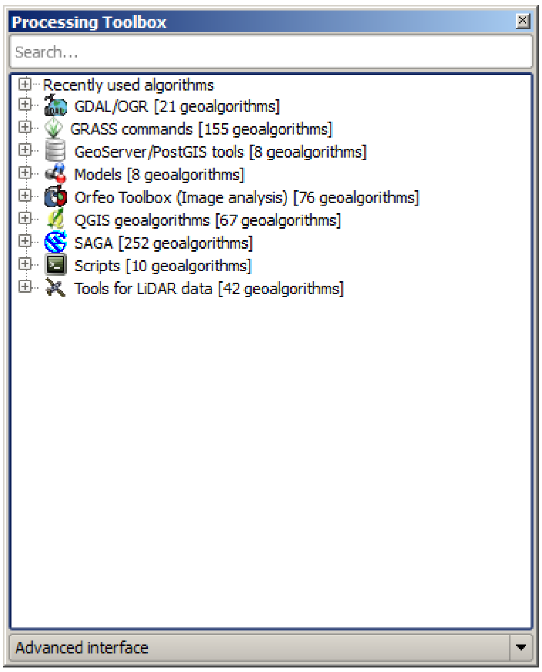

Figura 17.6: Processing Toolbox (advanced mode)

In the advanced view, each group represents a so-called 'algorithm provider', which is a set of algorithms coming from the same source, for instance, from a third-party application with geoprocessing capabilities. Some of these groups represent algorithms from third-party applications like SAGA, GRASS or R, while others contain algorithms directly coded as part of the processing plugin, not relying on any additional software.

This view is recommended to those users who have a certain knowledge of the applications that are backing the algorithms, since they will be shown with their original names and groups.

Also, some additional algorithms are available only in the advanced view, such as LiDAR tools and scripts based on the R statistical computing software, among others. Independent QGIS plugins that add new algorithms to the toolbox will only be shown in the advanced view.

In particular, the simplified view contains algorithms from the following providers:

- GRASS
- SAGA
- OTB
- Native QGIS algorithms

In the case of running QGIS under Windows, these algorithms are fully-functional in a fresh installation of QGIS, and they can be run without requiring any additional installation. Also, running them requires no prior knowledge of the external applications they use, making them more accesible for first-time users.

If you want to use an algorithm not provided by any of the above providers, switch to the advanced mode by selecting the corresponding option at the bottom of the toolbox.

To execute an algorithm, just double-click on its name in the toolbox.

17.2.1 The algorithm dialog

Once you double-click on the name of the algorithm that you want to execute, a dialog similar to that in the figure below is shown (in this case, the dialog corresponds to the SAGA 'Convergence index' algorithm).

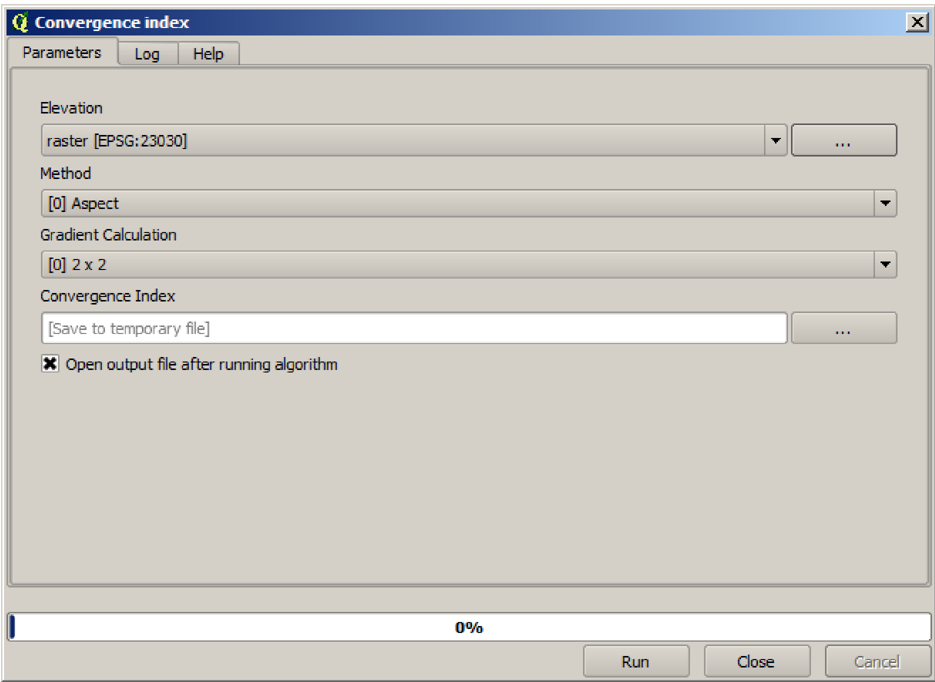

Figura 17.7: Parameters Dialog

This dialog is used to set the input values that the algorithm needs to be executed. It shows a table where input values and configuration parameters are 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. On the left side, the name of the parameter is shown. On the right side, the value of the parameter can be set.

Although the number and type of parameters depend on the characteristics of the algorithm, the structure is similar for all of them. The parameters found in the table can be of one of the following types.

- 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 a button by each vector layer selector, as shown in the figure below.

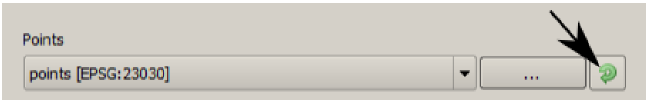

Figura 17.8: Vector iterator button

If the algorithm contains several of them, you will be able to toggle just one of them. If the button corresponding to a vector input is toggled, the algorithm will be executed iteratively on each one of its features, instead of just once for the whole layer, producing as many outputs as times the algorithm is executed. This allows for automating the process when all features in a layer have to be processed separately.

- 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 text box. You will find a button by its side. Clicking on it, you will see a dialog that allows you to enter a mathematical expression, so you can use it as a handy calculator. 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.

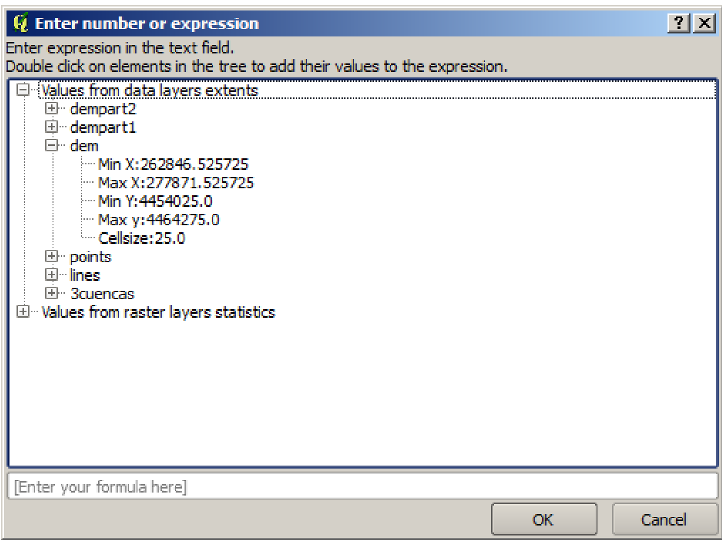

Figura 17.9: Number Selector

- 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 type the EPSG code directly in the text box, or select it from the CRS selection dialog that appears when you click on the button on the right-hand side.
- An extent, to be entered by four numbers representing its `xmin`, `xmax`, `ymin`, `ymax` limits. Clicking on the button on the right-hand side of the value selector, a pop-up menu will appear, giving you two options: to select the value from a layer or the current canvas extent, or to define it by dragging directly onto the map canvas.

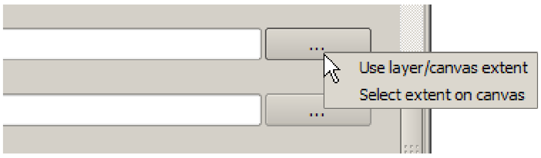

Figura 17.10: Extent selector

If you select the first option, you will see a window like the next one.

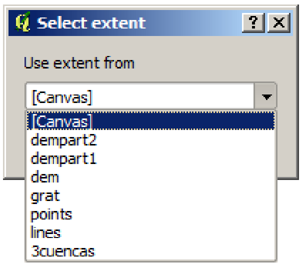

Figura 17.11: Extent List

If you select the second one, the parameters window will hide itself, so you can click and drag onto the canvas. Once you have defined the selected rectangle, the dialog will reappear, containing the values in the extent text box.

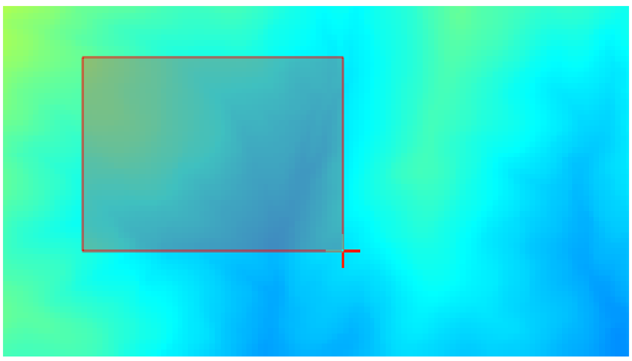

Figura 17.12: Extent Drag

- A list of elements (whether raster layers, vector layers or tables), to select from the list of such layers available in QGIS. To make the selection, click on the small button on the left side of the corresponding row to see a dialog like the following one.
- A small table to be edited by the user. These are used to define parameters like lookup tables or convolution kernels, among others.

  Click on the button on the right side to see the table and edit its values.

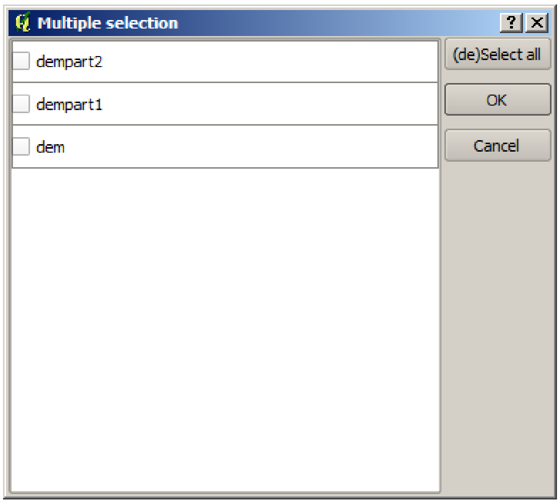

Figura 17.13: Multiple Selection

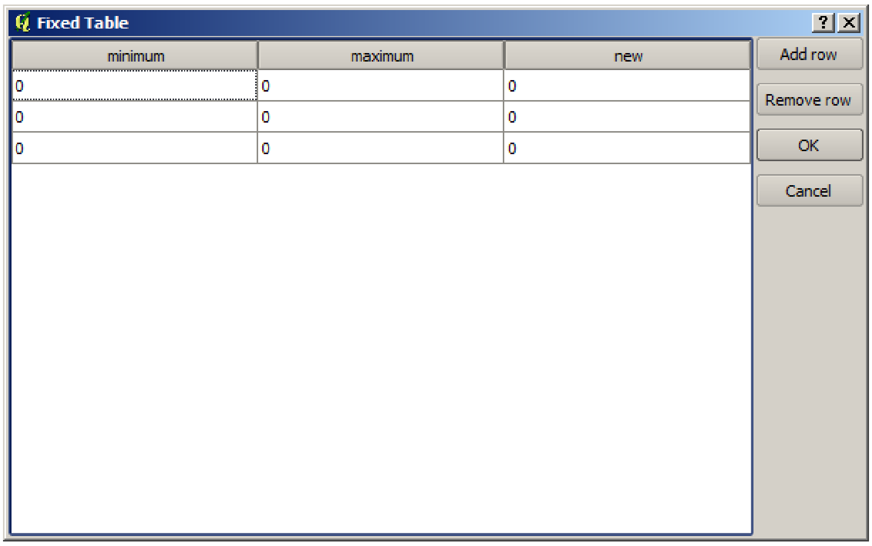

Figura 17.14: Fixed Table

Depending on the algorithm, the number of rows can be modified or not by using the buttons on the right side of the window.

You will find a **[Help]** tab in the the parameters dialog. If a help file is available, it will be shown, giving you more information about the algorithm and detailed descriptions of what each parameter does. Unfortunately, most algorithms lack good documentation, but if you feel like contributing to the project, this would be a good place to start.

A note on projections

Algorithms run from the processing framework — this is also true of most of the external applications whose algorithms are exposed through it. Do not perform any reprojection on input layers and assume that all of them are already in a common coordinate system and ready to be analized. Whenever you use more than one layer as input to an algorithm, whether vector or raster, it is up to you to make sure that they are all in the same coordinate system.

Note that, 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. That reprojection should be done manually, and then the resulting files should be used as input to the algorithm. Also, note that the reprojection process can be performed with the algorithms that are available in the processing framework itself.

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 configuration dialog, unchecking the *Show CRS* option.

If you try to execute an algorithm using as input two or more layers with unmatching CRSs, a warning dialog will be shown.

You still can execute the algorithm, but be aware that in most cases that will produce wrong results, such as empty layers due to input layers not overlapping.

17.2.2 Data objects generated by algorithms

Data objects generated by an algorithm can be of any of the following types:

- A raster layer
- A vector layer
- A table
- An HTML file (used for text and graphical outputs)

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 the architecture allows for any other way of storing it. For instance, a vector layer can be stored in a database or even uploaded to a remote server using a WFS-T service. Although solutions like these are not yet implemented, the processing framework is prepared to handle them, and we expect to add new kinds of output channels in a near feature.

To select an output channel, just click on the button on the right side of the text box. That will open 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 (usually `.dbf`' for tables, `.tif` for raster layers and `.shp` for vector layers) will be appended to the file path, and the file format corresponding to that extension will be used to save the layer or table.

If you do not enter any filename, 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 configuration dialog (you can open it from the *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.

When running an algorithm that uses a vector layer in iterative mode, the entered file path is used as the base path for all generated files, which are named using the base name and appending a number representing the index of the iteration. The file extension (and format) is used for all such generated files.

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.

For all the other types of output, you will find a checkbox that you can use to tell the algorithm whether to load the file once it is generated by the algorithm or not. By default, all files are opened.

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).

17.2.3 Configuring the processing framework

As has been mentioned, the configuration menu gives access to a new dialog where you can configure how algorithms work. Configuration parameters are structured in separate blocks that you can select on the left-hand side of the dialog.

Along with the aforementioned *Output folder* entry, the *General* block contains parameters for setting the default rendering style for output layers (that is, layers generated by using algorithms from any of the framework GUI components). 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 SEXTANTE 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*. You will see a dialog like the one shown next.

Select the style file (`.qml`) that you want for each output and press **[OK]**.

Other configuration parameters in the *General* group are listed below:

- *Use filename as layer name*. 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.
- *Use only selected features*. If this option is selected, whenever a vector layer is used as input for an algorithm, only its selected features will be used. If the layer has no selected features, all features will be used.

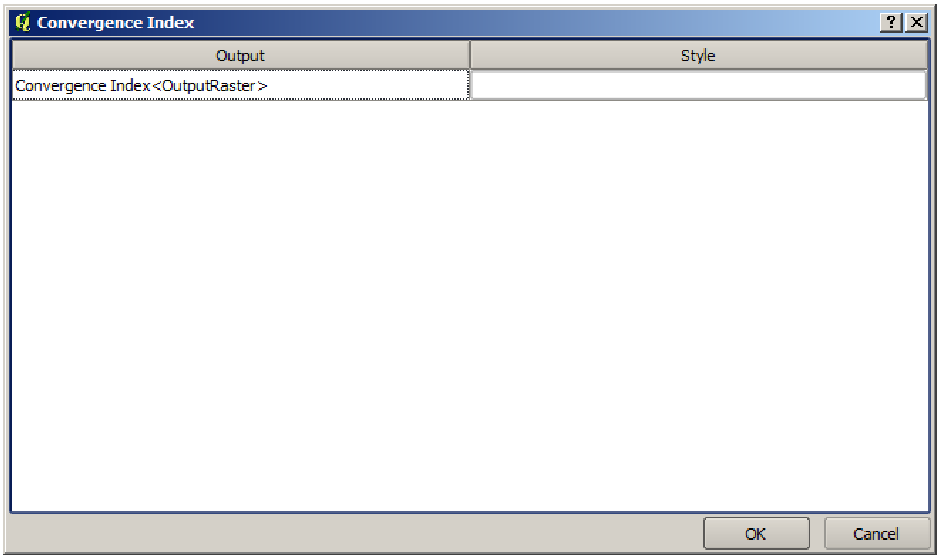

Figura 17.15: Rendering Styles

- *Pre-execution script file* and *Post-execution script file*. These parameters refer to scripts written using the processing scripting functionality, and are explained in the section covering scripting and the console.

Apart from the *General* block in the settings dialog, 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. Also, some algorithm providers have their own configuration items, which we will explain later when covering particular algorithm providers.

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17.3 The graphical modeler

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, but rather part of a chain of operations instead. Using the graphical modeler, that chain of processes can be wrapped into a single process, so it is as easy and convenient to execute as a single process later on a different set of inputs. No matter how many steps and different algorithms it involves, a model is executed as a single algorithm, thus saving time and effort, especially for larger models.

The modeler can be opened from the processing menu.

The modeler has a working canvas where the structure of the model and the workflow it represents are shown. On the left part of the window, a panel with two tabs can be used to add new elements to the model.

Creating a model involves two 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 it happens with all the 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 those inputs or the outputs generated by other algorithms already in the model.

17.3.1 Definition of inputs

The first step to create a model is to define the inputs it needs. The following elements are found in the *Inputs* tab on the left side of the modeler window:

- Raster layer

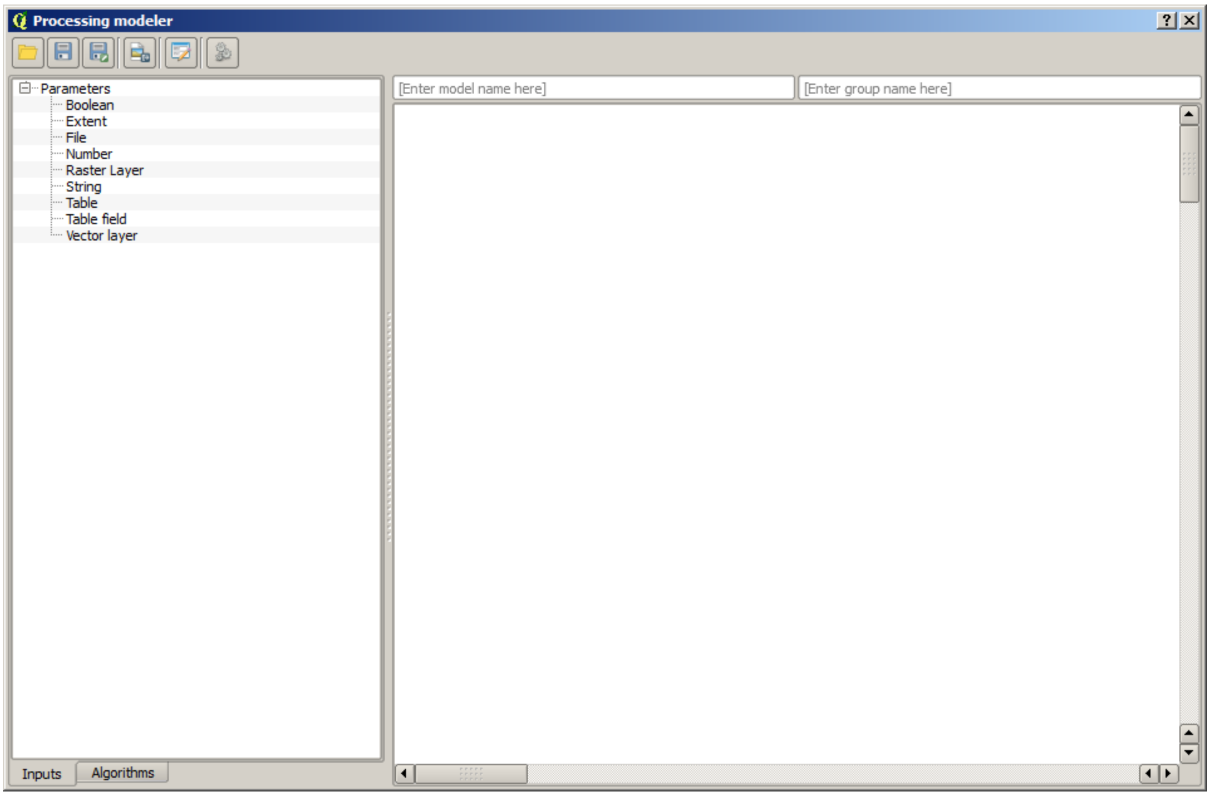

Figura 17.16: Modeler

- Vector layer
- String
- Table field
- Table
- Extent
- Number
- Boolean
- File

Double-clicking on any of these elements, a dialog is shown to define its characteristics. Depending on the parameter itself, the dialog may contain just one basic element (the description, which is what the user will see when executing the model) or more of them. For instance, when adding a numerical value, as can be seen in the next figure, apart from the description of the parameter, you have to set a default value and a range of valid values.

For each added input, a new element is added to the modeler canvas.

17.3.2 Definition of the workflow

Once the inputs have been defined, it is time to define the algorithms to apply on them. Algorithms can be found in the *Algorithms* tab, grouped much in the same way as they are in the toolbox.

The appearance of the toolbox has two modes here as well: simplified and advanced. However, there is no element to switch between views in the modeler, so you have to do it in the toolbox. The mode that is selected in the toolbox is the one that will be used for the list of algorithms in the modeler.

To add an algorithm to a model, double-click on its name. 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 one

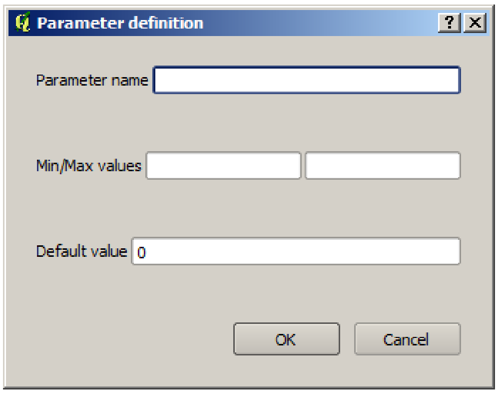

Figura 17.17: Model Parameters

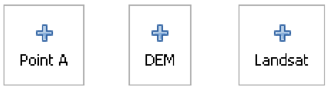

Figura 17.18: Model Parameters

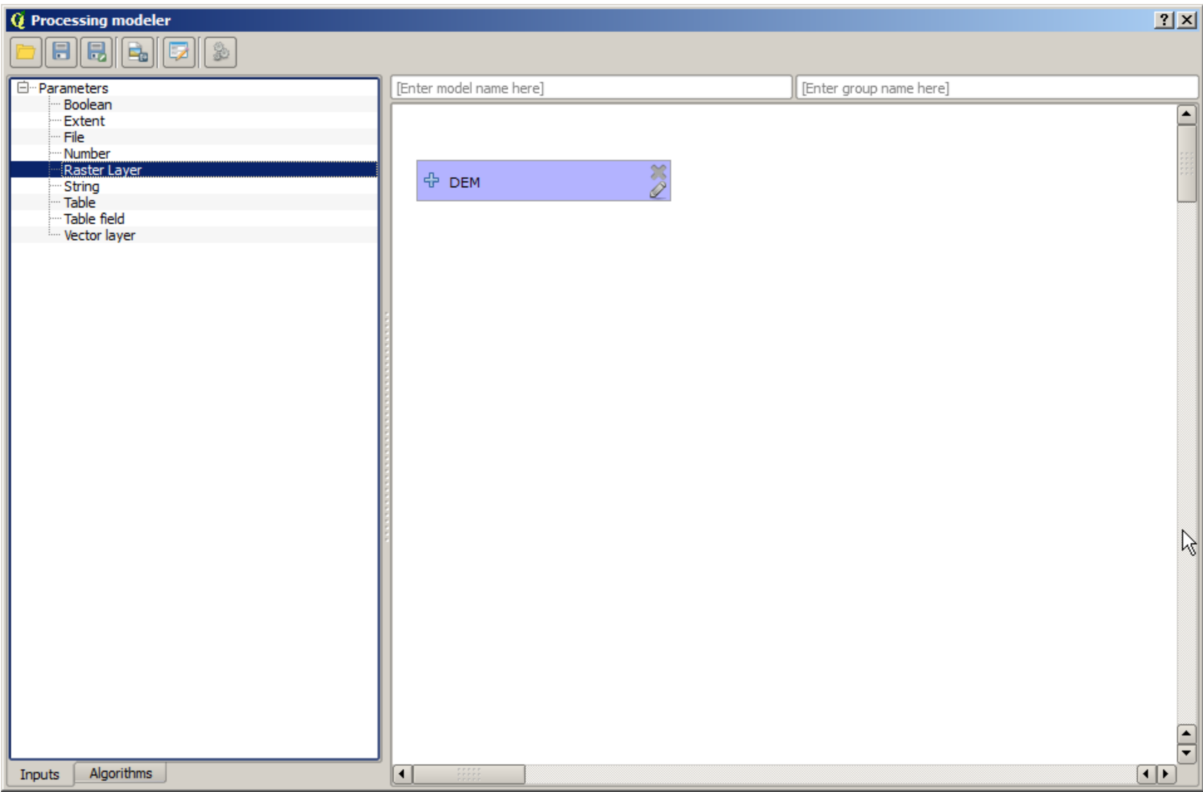

Figura 17.19: Model Parameters

shown next corresponds to the SAGA 'Convergence index' algorithm, the same example we saw in the section dedicated to the toolbox.

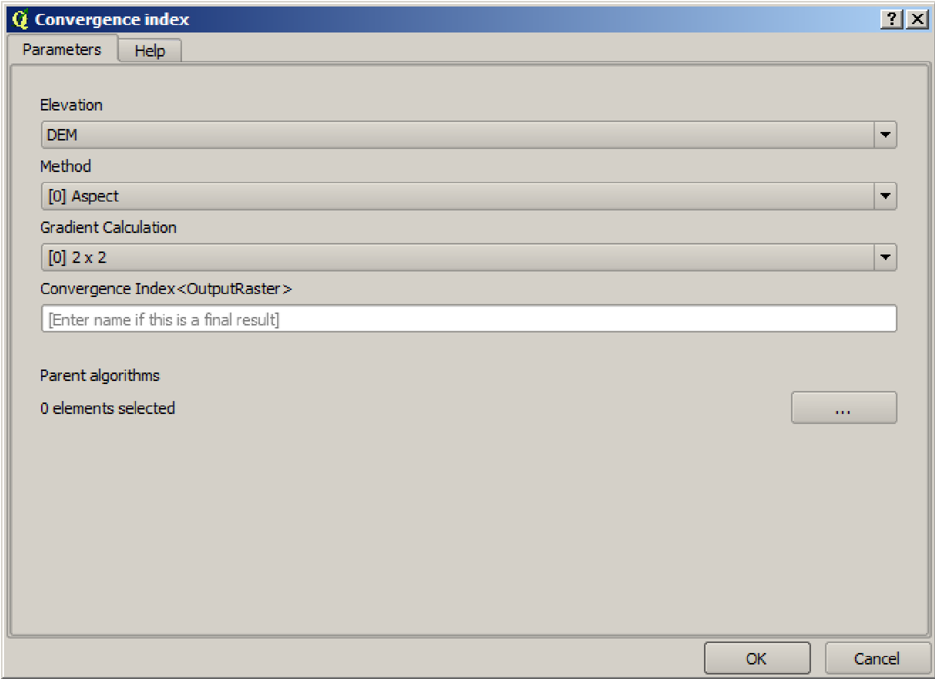

Figura 17.20: Model Parameters

As you can see, some differences exist. Instead of the file output box that was used to set the file path for output layers and tables, a simple text box is used here. If the layer generated by the algorithm is just a temporary result that will be used as the input of another algorithm and should not be kept as a final result, just do not edit that text box. Typing anything in it means that the result is final and the text that you supply will be the description for the output, which will be the output the user will see when executing the model.

Selecting the value of each parameter is also a bit different, since there are important differences between the context of the modeler and that of the toolbox. Let's see how to introduce the values for each type of parameter.

- Layers (raster and vector) and tables. These are selected from a list, but in this case, the possible values are not the layers or tables currently loaded in QGIS, but the list of model inputs of the corresponding type, or other layers or tables generated by algorithms already added to the model.
- Numerical values. Literal values can be introduced directly in the text box. But this text box is also a list that can be used to select any of the numerical value inputs of the model. In this case, the parameter will take the value introduced by the user when executing the model.
- String. As in the case of numerical values, literal strings can be typed, or an input string can be selected.
- Table field. The fields of the parent table or layer cannot be known at design time, since they depend on the selection of the user each time the model is executed. To set the value for this parameter, type the name of a field directly in the text box, or use the list to select a table field input already added to the model. The validity of the selected field will be checked at run time.

In all cases, you will find an additional parameter named *Parent algorithms* 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, which 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 an 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 *Parent algorithms* parameter and the two steps 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 all the other elements in the canvas, whether algorithms or inputs, that provide objects that are used as inputs for that algorithm.

Elements can be dragged to a different position within the canvas, to change the way the module structure is displayed and make it more clear and intuitive. Links between elements are updated automatically.

You can run your algorithm anytime by clicking on the **[Run]** button. However, 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.

17.3.3 Saving and loading models

Use the **[Save]** button to save the current model and the **[Open]** button to open any model previously saved. Models are saved with the `.model` extension. If the model has been previously saved from the modeler window, you will not be prompted for a filename. Since there is already a file associated with that model, the same file will be used for any subsequent saves.

Before saving a model, you have to enter a name and a group for it, using the text boxes in the upper part of the window.

Models saved on 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 `.model` 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.

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 as you add any other algorithm.

In some cases, a model might not be loaded because not all the algorithms included in its workflow are available. If you have used a given algorithm as part of your model, it should be available (that is, it should appear in the toolbox) in order to load that model. Deactivating an algorithm provider in the processing configuration window renders all the algorithms in that provider unusable by the modeler, which might cause problems when loading models. Keep that in mind when you have trouble loading or executing models.

17.3.4 Editing a model

You can edit the model you are currently creating, redefining the workflow and the relationships between the algorithms and inputs that define the model itself.

If you right-click on an algorithm in the canvas representing the model, you will see a context menu like the one shown next:

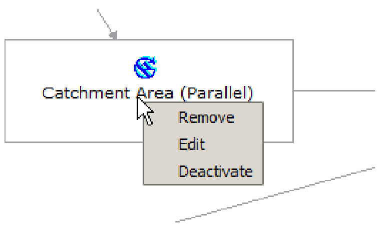

Figura 17.21: Modeler Right Click

Selecting the *Remove* option will cause the selected algorithm to be removed. An algorithm can be removed only if there are no other algorithms depending on it. That is, if no output from the algorithm is used in a different one as input. If you try to remove an algorithm that has others depending on it, a warning message like the one you can see below will be shown:

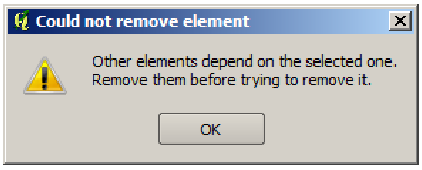

Figura 17.22: Cannot Delete Algorithm

Selecting the *Edit* option or simply double-clicking on the algorithm icon will show the parameters dialog of the algorithm, so you can change the inputs and parameter values. Not all input elements available in the model will appear in this case 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 then click on the **[OK]** button as usual. The connections between the model elements will change accordingly in the modeler canvas.

17.3.5 Activating and deactivating algorithms

Algorithms can be deactivated in the modeler, so they will not be executed once the model is run. This can be used to test just a given part of the model, or when you do not need all the outputs it generates.

To deactivate an algorithm, right-click on its icon in the model canvas and select the *Deactivate* option. You will see that the algorithm is represented now with a red label under its name indicating that it is not active.

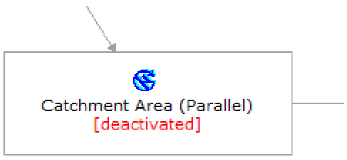

Figura 17.23: Deactivate

All algorithms depending (directly or indirectly) on that algorithm will also appear as inactive, since they cannot be executed now.

To activate an algorithm, just right-click on its icon and select the *Activate* option.

17.3.6 Editing model help files and meta-information

You can document your models from the modeler itself. Just click on the **[Edit model help]** button and a dialog like the one shown next will appear.

On the right-hand side, you will see a simple HTML page, created using the description of the input parameters and outputs of the algorithm, along with some additional items like a general description of the model or its author. The first time you open the help editor, all these descriptions are empty, but you can edit them using the elements on the left-hand side of the dialog. Select an element on the upper part and then write its description in the text box below.

Model help is saved in a file in the same folder as the model itself. You do not have to worry about saving it, since it is done automatically.

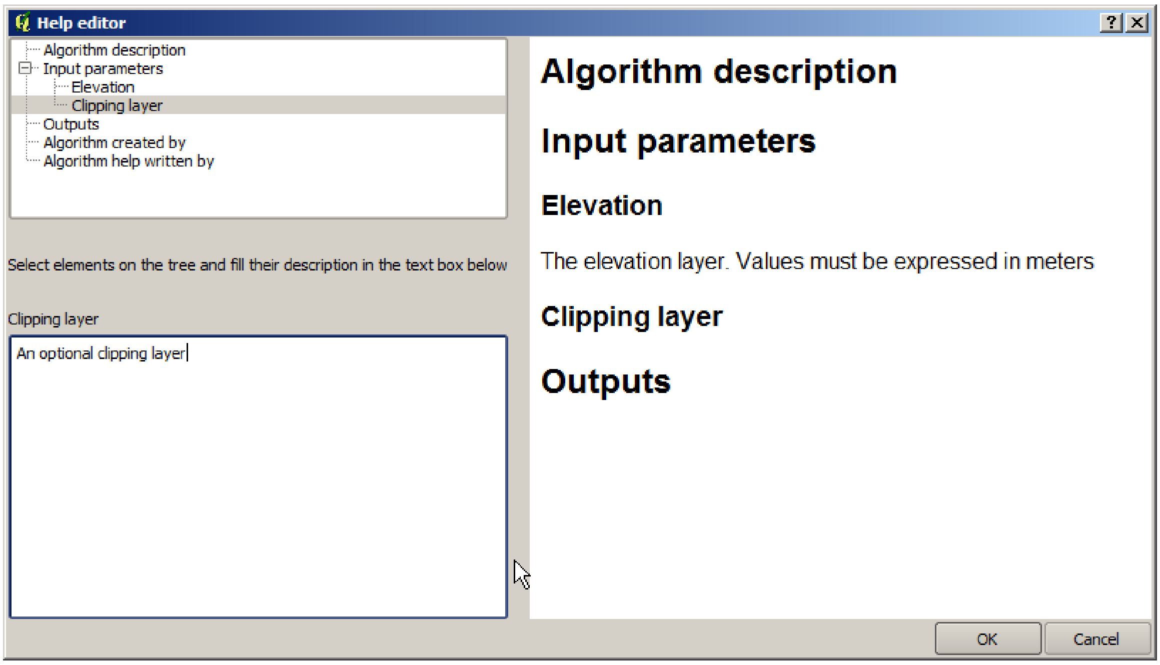

Figura 17.24: Help Edition

17.3.7 About available algorithms

You might notice that some algorithms that can be 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 a correct semantic, so as to be properly linked to others in the workflow. 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 thus, it does not appear in the list of algorithms that you can find in the modeler dialog.

Additionally, you will see some algorithms in the modeler that are not found in the toolbox. These algorithms are meant to be used exclusively as part of a model, and they are of no interest in a different context. The 'Calculator' algorithm is an example of that. It is just a simple arithmetic calculator that you can use to modify numerical values (entered by the user or generated by some other algorithm). This tool is really useful within a model, but outside of that context, it doesn't make too much sense.

17.3.8 Saving models as Python code

Given a model, it is possible to automatically create Python code that performs the same task as the model itself. This code is used to create a console script (we will explain scripts later in this manual) and you can modify that script to incorporate actions and methods not available in the graphical modeler, such as loops or conditional sentences.

This feature is also a very practical way of learning how to use processing algorithms from the console and how to create new algorithms using Python code, so you can use it as a learning tool when you start creating your own scripts.

Save your model in the `models` folder and go to the toolbox, where it should appear now, ready to be run. Right-click on the model name and select *Save as Python script* in the context menu that will pop up. A dialog will prompt you to introduce the file where you want to save the script.

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17.4 La interfaz de procesamiento por lotes

17.4.1 Introducción

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.

To execute an algorithm as a batch process, right-click on its name in the toolbox and select the *Execute as batch process* option in the pop-up menu that will appear.

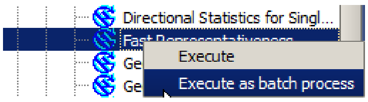


Figura 17.25: Haga clic derecho en Procesamiento por lotes

17.4.2 La tabla de parámetros

Executing a batch process is similar to performing a single execution of an algorithm. Parameter values have to be defined, but in this case we need not just a single value for each parameter, but a set of them instead, one for each time the algorithm has to be executed. Values are introduced using a table like the one shown next.

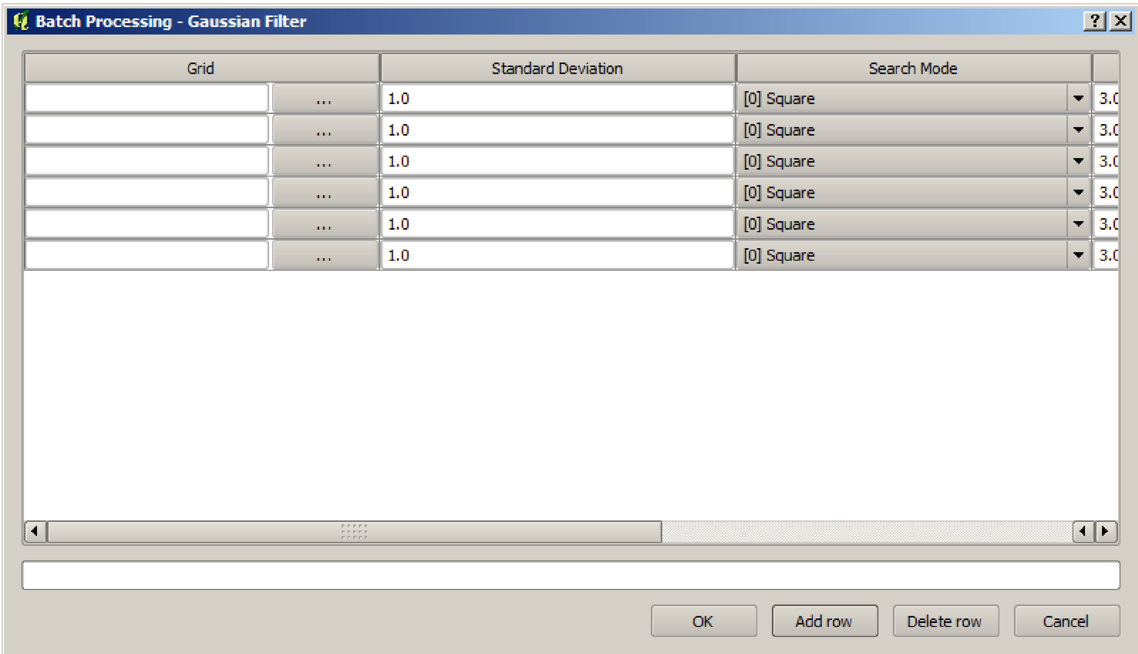


Figura 17.26: Procesamiento por lotes

Each line of this table represents a single execution of the algorithm, and each cell contains the value of one of the parameters. It is similar to the parameters dialog that you see when executing an algorithm from the toolbox, but with a different arrangement.

By default, the table contains just two rows. You can add or remove rows using the buttons on the lower part of the window.

Once the size of the table has been set, it has to be filled with the desired values.

17.4.3 Llenado de la tabla de parámetros

For most parameters, setting the value is trivial. Just type the value or select it from the list of available options, depending on the parameter type.

The main differences are found for parameters representing layers or tables, and for output file paths. Regarding input layers and tables, when an algorithm is executed as part of a batch process, those input data objects are taken directly from files, and not from the set of them already opened in QGIS. For this reason, any algorithm can be executed as a batch process, even if no data objects at all are opened and the algorithm cannot be run from the toolbox.

Filenames for input data objects are introduced directly typing or, more conveniently, clicking on the  button on the right hand of the cell, which 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 (`;`).

Output data objects are always saved to a file and, unlike when executing an algorithm from the toolbox, saving to a temporary file is not permitted. You can type the name directly or use the file chooser dialog that appears when clicking on the accompanying button.

Once you select the file, a new dialog is shown to allow for autocompletion of other cells in the same column (same parameter).

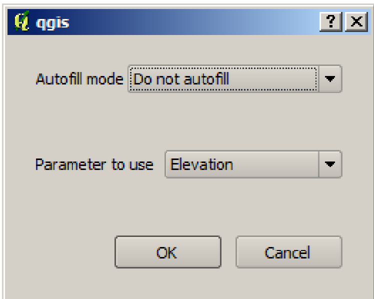
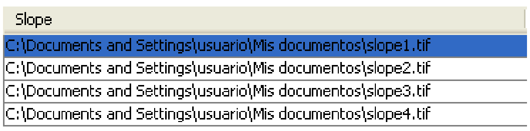


Figura 17.27: Guardar Procesamiento por lotes

If the default value ('Do not autocomplete') is selected, it will just put the selected filename in the selected cell from the parameters table. If any of the other options is selected, all the cells below the selected one will be automatically filled based on a defined criteria. This way, it is much easier to fill the table, and the batch process can be defined with less effort.

Automatic filling can be done by simply adding correlative numbers to the selected file path, or by appending the value of another field at the same row. This is particularly useful for naming output data objects according to input ones.



Slope
C:\Documents and Settings\usuario\Mis documentos\slope1.tif
C:\Documents and Settings\usuario\Mis documentos\slope2.tif
C:\Documents and Settings\usuario\Mis documentos\slope3.tif
C:\Documents and Settings\usuario\Mis documentos\slope4.tif

Figura 17.28: Ruta de archivo de procesamiento por lotes

17.4.4 Ejecutar el proceso por lotes

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.

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17.5 Using processing algorithms from the console

The console allows advanced users to increase their productivity and perform complex operations that cannot be performed using any of the other GUI elements of the processing framework. Models involving several algorithms can be defined using the command-line interface, and additional operations such as loops and conditional sentences can be added to create more flexible and powerful workflows.

There is not a proccesing 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.

The code that you can execute from the Python console, even if it does not call any specific processing method, can be converted into a new algorithm that you can later call from the toolbox, the graphical modeler or any other component, just like you do with any other algorithm. In fact, some algorithms that you can find in the toolbox are simple scripts.

In this section, we will see how to use processing algorithms from the QGIS Python console, and also how to write algorithms using Python.

17.5.1 Calling algorithms from the Python console

The first thing you have to do is to import the processing functions with the following line:

```
>>> 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 `runalg()` 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 `algslist()` method. Type the following line in your console:

```
>>> processing.alglist()
```

You will see something like this.

```
Accumulated Cost (Anisotropic)---------------->saga:accumulatedcost(anisotropic)
Accumulated Cost (Isotropic)------------------>saga:accumulatedcost(isotropic)
Add Coordinates to points--------------------->saga:addcoordinatestopoints
Add Grid Values to Points--------------------->saga:addgridvaluestopoints
Add Grid Values to Shapes--------------------->saga:addgridvaluestoshapes
Add Polygon Attributes to Points-------------->saga:addpolygonattributestopoints
Aggregate------------------------------------->saga:aggregate
Aggregate Point Observations------------------>saga:aggregatepointobservations
Aggregation Index----------------------------->saga:aggregationindex
Analytical Hierarchy Process------------------>saga:analyticalhierarchyprocess
Analytical Hillshading------------------------>saga:analyticalhillshading
Average With Mask 1--------------------------->saga:averagewithmask1
Average With Mask 2--------------------------->saga:averagewithmask2
Average With Thereshold 1--------------------->saga:averagewiththereshold1
Average With Thereshold 2--------------------->saga:averagewiththereshold2
Average With Thereshold 3--------------------->saga:averagewiththereshold3
B-Spline Approximation------------------------>saga:b-splineapproximation
...
```

That’s a list of all the available algorithms, alphabetically ordered, along with their corresponding command-line names.

You can use a string as a parameter for this method. Instead of returning the full list of algorithms, it will only display those that include that string. If, for instance, you are looking for an algorithm to calculate slope from a DEM, type `alglist("slope")` to get the following result:

```
DTM Filter (slope-based)----------------------->saga:dtmfilter(slope-based)
Downslope Distance Gradient-------------------->saga:downslopedistancegradient
Relative Heights and Slope Positions----------->saga:relativeheightsandslopepositions
Slope Length----------------------------------->saga:slopelength
Slope, Aspect, Curvature----------------------->saga:slopeaspectcurvature
Upslope Area----------------------------------->saga:upslopearea
Vegetation Index[slope based]------------------>saga:vegetationindex[slopebased]
```

This result might change depending on the algorithms you have available.

It is easier now to find the algorithm you are looking for and its command-line name, in this case `saga:slopeaspectcurvature`.

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 and the order in which they have to be passed when calling the `runalg()` 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 `alghelp(name_of_the_algorithm)` method. Use the command-line name of the algorithm, not the full descriptive name.

Calling the method with `saga:slopeaspectcurvature` as parameter, you get the following description:

```
>>> processing.alghelp("saga:slopeaspectcurvature")
ALGORITHM: Slope, Aspect, Curvature
   ELEVATION <ParameterRaster>
   METHOD <ParameterSelection>
   SLOPE <OutputRaster>
   ASPECT <OutputRaster>
   CURV <OutputRaster>
   HCURV <OutputRaster>
   VCURV <OutputRaster>
```

Now you have everything you need to run any algorithm. As we have already mentioned, there is only one single command to execute algorithms: `runalg()`. Its syntax is as follows:

```
>>> processing.runalg(name_of_the_algorithm, param1, param2, ..., paramN,
         Output1, Output2, ..., OutputN)
```

The list of parameters and outputs to add depends on the algorithm you want to run, and is exactly the list that the `alghelp()` method gives you, in the same order as shown.

Depending on the type of parameter, values are introduced differently. The next list gives a quick review of how to introduce values for each type of input parameter:

- 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. If the input is optional and you do not want to use any data object, use `None`.
- Selection. If an algorithm has a selection parameter, the value of that parameter should be entered using an integer value. To know the available options, you can use the `algoptions()` command, as shown in the following example:

  ```
  >>> processing.algoptions("saga:slopeaspectcurvature")
  METHOD(Method)
      0 - [0] Maximum Slope (Travis et al. 1975)
      1 - [1] Maximum Triangle Slope (Tarboton 1997)
      2 - [2] Least Squares Fitted Plane (Horn 1981, Costa-Cabral & Burgess 1996)
      3 - [3] Fit 2.Degree Polynom (Bauer, Rohdenburg, Bork 1985)
      4 - [4] Fit 2.Degree Polynom (Heerdegen & Beran 1982)
      5 - [5] Fit 2.Degree Polynom (Zevenbergen & Thorne 1987)
      6 - [6] Fit 3.Degree Polynom (Haralick 1983)
  ```

  In this case, the algorithm has one such parameter, with seven options. Notice that ordering is zero-based.

- Multiple input. The value is a string with input descriptors separated by semicolons (`;`). As in the case of single layers or tables, each input descriptor can be the data object name, or its file path.
- Table Field from XXX. Use a string with the name of the field to use. This parameter is case-sensitive.
- Fixed Table. Type the list of all table values separated by commas (`,`) and enclosed between quotes (`"`). Values start on the upper row and go from left to right. You can also use a 2-D array of values representing the table.
- CRS. Enter the EPSG code number of the desired CRS.
- Extent. You must use a string with `xmin`, `xmax`, `ymin` and `ymax` values separated by commas (`,`).

Boolean, file, string and numerical parameters do not need any additional explanations.

Input parameters such as strings, booleans, or numerical values have default values. To use them, specify `None` for the corresponding parameter entry.

For output data objects, type the file path to be used to save it, just as it is done from the toolbox. If you want to save the result to a temporary file, use `None`. 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. If you want to add an output to the map canvas, you have to do it yourself after running the algorithm. To do so, you can use QGIS API commands, or, even easier, use one of the handy methods provided for such tasks.

The `runalg` method returns a dictionary with the output names (the ones shown in the algorithm description) as keys and the file paths of those outputs as values. You can load those layers by passing the corresponding file paths to the `load()` method.

17.5.2 Additional functions for handling data

Apart from the functions used to call algorithms, importing the `processing` package will also import some additional functions that make it easier to work with data, particularly vector data. They are just convenience functions that wrap some functionality from the QGIS API, usually with a less complex syntax. These functions should be used when developing new algorithms, as they make it easier to operate with input data.

Below is a list of some of these commands. More information can be found in the classes under the `processing/tools` package, and also in the example scripts provided with QGIS.

- `getobject(obj)`: Returns a QGIS object (a layer or table) from the passed object, which can be a filename or the name of the object in the QGIS Table of Contents.
- `values(layer, fields)`: Returns the values in the attributes table of a vector layer, for the passed fields. Fields can be passed as field names or as zero-based field indices. Returns a dict of lists, with the passed field identifiers as keys. It considers the existing selection.
- `getfeatures(layer)`: Returns an iterator over the features of a vector layer, considering the existing selection.
- `uniquelabels(layer, field)`: Returns a list of unique values for a given attribute. Attributes can be passed as a field name or a zero-based field index. It considers the existing selection.

17.5.3 Creating scripts and running them from the toolbox

You can create your own algorithms by writing the corresponding Python code and adding a few extra lines to supply additional information needed to define the semantics of the algorithm. You can find a *Create new script* menu under the *Tools* group in the *Script* algorithms block of the toolbox. Double-click on it to open the script editing dialog. 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 `.py` extension will automatically create the corresponding algorithm.

The name of the algorithm (the one you will see in the toolbox) is created from the filename, removing its extension and replacing low hyphens with blank spaces.

Let's have a look at the following code, which calculates the Topographic Wetness Index (TWI) directly from a DEM.

```
##dem=raster
##twi=output
ret_slope = processing.runalg("saga:slopeaspectcurvature", dem, 0, None,
                None, None, None, None)
ret_area = processing.runalg("saga:catchmentarea(mass-fluxmethod)", dem,
                0, False, False, False, False, None, None, None, None, None)
processing.runalg("saga:topographicwetnessindex(twi), ret_slope['SLOPE'],
                ret_area['AREA'], None, 1, 0, twi)
```

As you can see, the calculation involves three algorithms, all of them coming from SAGA. The last one calculates the TWI, but it needs a slope layer and a flow accumulation layer. We do not have these layers, but since we have the DEM, we can calculate them by calling the corresponding SAGA algorithms.

The part of the code where this processing takes place is not difficult to understand if you have read the previous sections in this 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 start with a double Python comment symbol (`##`) and have the following structure:

```
[parameter_name]=[parameter_type] [optional_values]
```

Here is a list of all the parameter types that are supported in processing scripts, their syntax and some examples.

- `raster`. A raster layer.
- `vector`. A vector layer.
- `table`. A table.
- `number`. A numerical value. A default value must be provided. For instance, `depth=number 2.4`.
- `string`. A text string. As in the case of numerical values, a default value must be added. For instance, `name=string Victor`.
- `boolean`. A boolean value. Add `True` or `False` after it to set the default value. For example, `verbose=boolean True`.
- `multiple raster`. A set of input raster layers.
- `multiple vector`. A set of input vector layers.
- `field`. A field in the attributes table of a vector layer. The name of the layer has to be added after the `field` tag. For instance, if you have declared a vector input with `mylayer=vector`, you could use `myfield=field mylayer` to add a field from that layer as parameter.
- `folder`. A folder.
- `file`. A filename.

The parameter name is the name that will be shown to the user when executing the algorithm, and also the variable name to use in the script code. The value entered by the user for that parameter will be assigned to a variable with that name.

When showing the name of the parameter to the user, the name will be edited to improve its appearance, replacing low hyphens with spaces. So, for instance, if you want the user to see a parameter named `A numerical value`, you can use the variable name `A_numerical_value`.

Layers and table values are strings containing the file path of the corresponding object. To turn them into a QGIS object, you can use the `processing.getObjectFromUri()` function. Multiple inputs also have a string value, which contains the file paths to all selected object, separated by semicolons (`;`).

Outputs are defined in a similar manner, using the following tags:

- `output raster`
- `output vector`
- `output table`
- `output html`
- `output file`
- `output number`
- `output string`

The value assigned to the output variables is always a string with a file path. It will correspond to a temporary file path in case the user has not entered any output filename.

When you declare an output, the algorithm will try to add it to QGIS once it is finished. That is why, although the `runalg()` method does not load the layers it produces, the final TWI layer will be loaded (using the case of our previous example), since it is saved to the file entered by the user, which is the value of the corresponding output.

Do not use the `load()` method in your script algorithms, just when working with the console line. 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 its syntax (as defined by the tags explained above) will not match what the algorithm really creates.

Hidden outputs (numbers and strings) do not have a value. Instead, you have to assign a value to them. To do so, just set the value of a variable with the name you used to declare that output. For instance, if you have used this declaration,

```
##average=output number
```

the following line will set the value of the output to 5:

```
average = 5
```

In addition to the tags for parameters and outputs, you can also define the group under which the algorithm will be shown, using the `group` tag.

If your algorithm takes a long time to process, it is a good idea to inform the user. You have a global named `progress` available, with two possible methods: `setText(text)` and `setPercentage(percent)` to modify the progress text and the progress bar.

Several examples are provided. Please check them to see real examples of how to create algorithms using the processing framework classes. You can right-click on any script algorithm and select *Edit script* to edit its code or just to see it.

17.5.4 Documenting your 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. In the script editing dialog, you will find an **[Edit script help]** button. Click on it and it will take you to the help editing dialog. Check the section about the graphical modeler to know more about this dialog and how to use it.

Help files are saved in the same folder as the script itself, adding the `.help` extension to the filename. Notice that you can edit your script's help before saving the script for the first time. If you later close the script editing dialog without saving the script (i.e., you discard it), the help content you wrote will be lost. If your script was already saved and is associated to a filename, saving the help content is done automatically.

17.5.5 Pre- and post-execution script hooks

Scripts can also be used to set pre- and post-execution hooks that are run before and after an algorithm is run. This can be used to automate tasks that should be performed whenever an algorithm is executed.

The syntax is identical to the syntax explained above, but an additional global variable named `alg` is available, representing the algorithm that has just been (or is about to be) executed.

In the *General* group of the processing configuration dialog, you will find two entries named *Pre-execution script file* and *Post-execution script file* where the filename of the scripts to be run in each case can be entered.

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17.6 El administrador del historial

17.6.1 El historial del procesamiento

Cada vez que ejecutas un algoritmo, la información acerca del proceso es almacenado en el administrador de la historia. Junto con los parámetros usados, la fecha y hora de la ejecución también se guardan.

De esta manera, es fácil rastrear y controlar todo el trabajo que se ha desarrollado usando la caja de herramientas de procesado, y fácil reproducirlo.

El administrador del historial es un conjunto de entradas de registros agrupados de acuerdo a su fecha de ejecución, por lo que es más fácil encontrar información sobre un algoritmo ejecutado en cualquier momento en particular.

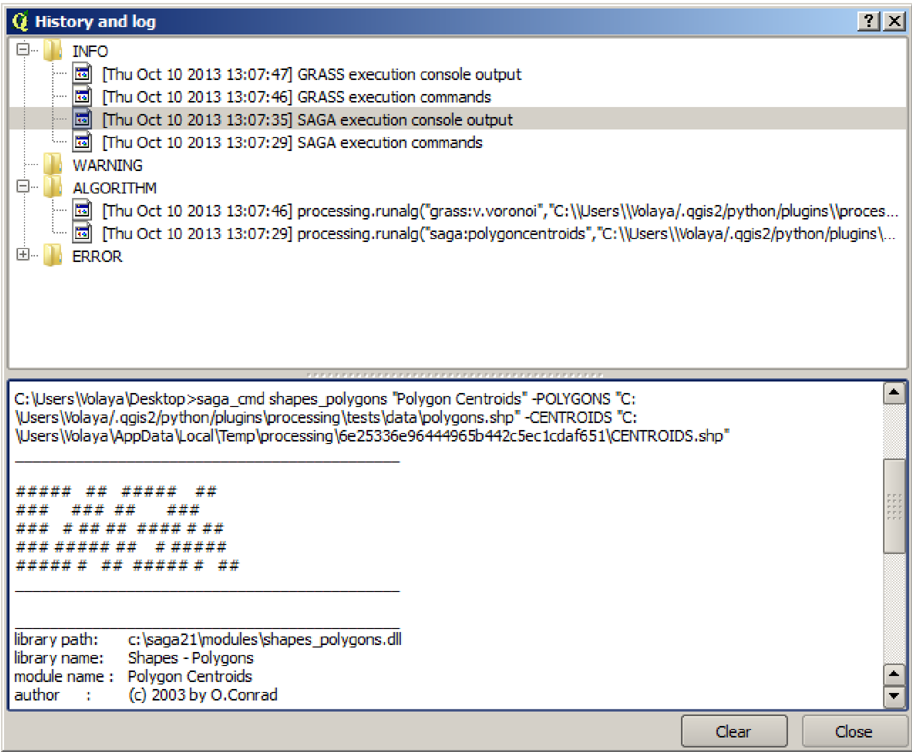

Figura 17.29: Historial

Información del proceso se mantiene como una expresión de línea de comandos, incluso si el algoritmo fue lanzado desde la caja de herramientas. Esto hace que sea también útil para aquellos que están aprendiendo cómo utilizar la interfaz de línea de comandos, ya que se pueden llamar un algoritmo usando la caja de herramientas y compruebe el administrados del historial para ver cómo ese mismo algoritmo podría ser llamado desde la línea de comandos.

Parte de la navegación por las entradas en el registro, también puede volver a ejecutar los procesos al hacer doble clic en la entrada correspondiente.

Junto con el registro de algoritmos ejecutados, la caja de herramientas de procesado se comunica con el usuario por medio de los otros grupos del registro, a saber *Errors*, *WARNING* y *INFO*. En caso de que algo no este funcionando adecuadamente, echar un vistazo a *ERROR* que pueden ayudarle a ver lo que está sucediendo. Si se pone en contacto con un desarrollador para informar de un bug o error, la información en ese grupo va a ser muy útil para él o ella para averiguar lo que está mal.

Los algoritmos de terceros se ejecutan normalmente llamando su interfaz de linea de comandos, que se comunica con el usuario vía consola. Aunque la consola no se muestra, una copia completa de la misma se almacena en el grupo *INFO* cada vez que se ejecuta uno de estos algoritmos. Si, por ejemplo, se tienen problemas al ejecutar el algoritmo de SAGA, busque una entrada denominada 'SAGA execution console output' para comprobar todos los mensajes generados por SAGA y tratar de localizar donde esta el problema.

Algunos algoritmos, incluso pueden producir un resultado con los datos de entrada dados , puede añadir comentarios o información adicional para el bloque *WARNING* si detectan problemas potenciales con los datos, con el fin de advertirle. Asegúrese de revisar esos mensajes si se esta teniendo resultados inesperados.

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17.7 Configuring external applications

The processing framework can be extended using additional applications. Currently, SAGA, GRASS, OTB (Orfeo Toolbox) and R are supported, along with some other command-line applications that provide spatial data analysis functionalities. Algorithms relying on an external application are managed by their own algorithm provider.

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 geoalgorithm.

By default, all algorithms that rely on an external appplication not shipped with QGIS are not enabled. You can enable them in the configuration dialog. Make sure that the corresponding application is already installed in your system. Enabling an algorithm provider without installing the application it needs will cause the algorithms to appear in the toolbox, but an error will be thrown when you try to execute them.

This is because the algorithm descriptions (needed to create the parameters dialog and provide the information needed about the algorithm) are not included with each application, but with QGIS instead. That is, they are part of QGIS, so you have them in your installation even if you have not installed any other software. Running the algorithm, however, needs the application binaries to be installed in your system.

17.7.1 A note for Windows users

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 OSGeo4W application. That will automatically install SAGA, GRASS and OTB in your system and configure them so they can be run from QGIS. All the algorithms in the simplified view of the toolbox will be ready to be run without needing any further configuration.

If you want to know more about how these providers work, or if you want to use some algorithms not included in the simplified toolbox (such as R scripts), keep on reading.

17.7.2 A note on file formats

When using an external software, opening a file in QGIS does not mean that it can be opened and processed as well 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 history and log dialog) to know more about what is going wrong.

Using GRASS raster layers is, for instance, one case in which you might have trouble and not be able to complete your work if you call an external algorithm using such a layer as input. For this reason, these layers will not appear as available to algorithms.

You should, however, find no problems at all 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 if the layer has a large size, so do not be surprised if it takes more time to process a layer from a DB connection than it does to process one of a similar size stored in a shapefile.

Providers not using external applications can process any layer that you can open in QGIS, since they open it for analysis through QGIS.

Regarding output formats, all formats supported by QGIS as output can be used, both for raster and vector layers. Some providers do not support certain formats, but all can export to common raster layer formats that can later be transformed by QGIS automatically. As in the case of input layers, if this conversion is needed, that might increase the processing time.

If the extension of the filename specified when calling an algorithm does not match the extension of any of the formats supported by QGIS, then a suffix will be added to set a default format. In the case of raster layers, the `.tif` extension is used, while `.shp` is used for vector layers.

17.7.3 A note on vector layer selections

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 execution times to be longer.

SAGA

SAGA algorithms can be run from QGIS if you have SAGA installed in your system and you configure the processing framework properly so it can find SAGA executables. In particular, the SAGA command-line executable is needed to run SAGA algorithms.

If you are running Windows, both the stand-alone installer and the OSGeo4W installer include SAGA along with QGIS, and the path is automatically configured, so there is no need to do anything else.

If you have installed SAGA yourself (remember, you need version 2.1), the path to the SAGA executable must be configured. To do this, open the configuration dialog. In the *SAGA* block, you will find a setting named *SAGA Folder*. Enter the path to the folder where SAGA is installed. Close the configuration dialog, and now you are ready to run SAGA algorithms from QGIS.

If you are running Linux, SAGA binaries are not included with SEXTANTE, so you have to download and install the software yourself. Please check the SAGA website for more information. SAGA 2.1 is needed.

In this case, there is no need to configure the path to the SAGA executable, and you will not see those folders. Instead, you must make sure that SAGA is properly installed and its folder is added to the PATH environment variable. Just open a console and type `saga_cmd` to check that the system can find where the SAGA binaries are located.

17.7.4 About SAGA grid system limitations

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).

The definition of that common grid system is controlled by the user, and you will find several parameters in the SAGA group of the settings window to do so. There are two ways of setting the target grid system:

- Setting it manually. You define the extent by setting the values of the following parameters:

- *Resampling min X*
- *Resampling max X*
- *Resampling min Y*
- *Resampling max Y*
- *Resampling cellsize*

Notice that QGIS will resample input layers to that extent, even if they do not overlap with it.

- Setting it automatically from input layers. To select this option, just check the *Use min covering grid system for resampling* option. All the other settings will be ignored and the minimum extent that covers all the input layers will be used. The cell size of the target layer is the maximum of all cell sizes of the input layers.

For algorithms that do not use multiple raster layers, or for those that do not need a unique input grid system, no resampling is performed before calling SAGA, and those parameters are not used.

17.7.5 Limitations for multi-band layers

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).

17.7.6 Limitations in cell size

SAGA assumes that raster layers have the same cell size in the X and Y axis. If you are working with a layer with different values for horizontal and vertical cell size, you might get unexpected results. In this case, a warning will be added to the processing log, indicating that an input layer might not be suitable to be processed by SAGA.

17.7.7 Logging

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 in detail 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 an external application and call it through the command-line have similar options, so you will find them as well in other places in the processing settings list.

R. Creating R scripts

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 a few examples). Instead, you should write your scripts and call R commands, much like you would do from R, and in a very similar manner to what we saw in the section dedicated to processing scripts. This section shows you the syntax to use to call those R commands from QGIS and how to use QGIS objects (layers, tables) in them.

The first thing you have to do, as we saw in the case of SAGA, is to tell QGIS where your R binaries are located. You can do this using the *R folder* entry in the processing configuration dialog. Once you have set that parameter, you can start creating and executing your own R scripts.

Once again, this is different in Linux, and you just have to make sure that the R folder is included in the PATH environment variable. If you can start R just typing `R` in a console, then you are ready to go.

To add a new 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 tells the processing framework how to perform that operation and the corresponding R commands to do so.

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 set this folder in the *R* settings group (available from the processing settings dialog), just like you do with the folder for regular processing scripts.

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, especially, `sp`, is mandatory.

```
##polyg=vector
##numpoints=number 10
##output=output vector
##sp=group
pts=spsample(polyg,numpoints,type="random")
output=SpatialPointsDataFrame(pts, as.data.frame(pts))
```

The first lines, which start with a double Python comment sign (`##`), tell QGIS the inputs of the algorithm described in the file and the outputs that it will generate. They work with exactly the same syntax as the SEXTANTE scripts that we have already seen, so they will not be described here again. Check the *processing_scripts* section for more information.

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 later be used as input for R commands.

In the above example, we are declaring an input of type `vector` named `polyg`. When executing the algorithm, QGIS will open in R the layer selected by the user and store it in a variable also named `polyg`. So, the name of a parameter is also the name of the variable that we can use in R for accesing the value of that parameter (thus, you should avoid using reserved R words as parameter names).

Spatial elements such as vector and raster layers are read using the `readOGR()` and `brick()` commands (you do not have to worry about adding those commands to your description file – QGIS will do it), and they are stored as `Spatial*DataFrame` objects. Table fields are stored as strings containing the name of the selected field.

Tables are opened using the `read.csv()` command. If a table entered by the user is not in CSV format, it will be converted prior to importing it into R.

Additionally, raster files can be read using the `readGDAL()` command instead of `brick()` by using the `##usereadgdal`.

If you are an advanced user and do not want QGIS to create the object representing the layer, you can use the `##passfilename` tag to indicate that you prefer a string with the filename instead. 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, we can now understand the first line of our first example script (the first line not starting with a Python comment).

```
pts=spsample(polyg,numpoints,type="random")
```

The variable `polygon` already contains a `SpatialPolygonsDataFrame` object, so it can be used to call the `spsample` method, just like the `numpoints` one, which indicates the number of points to add to the created sample grid.

Since we have declared an output of type vector named `out`, we have to create a variable named `out` and store a `Spatial*DataFrame` object in it (in this case, a `SpatialPointsDataFrame`). You can use any name for your intermediate variables. Just make sure that the variable storing your final result has the same name that you used to declare it, and that it contains a suitable value.

In this case, the result obtained from the `spsample` method has to be converted explicitly into a `SpatialPointsDataFrame` object, since it is itself an object of class `ppp`, which is not a suitable class to 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. In 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 `#passfilename` option, outputs are generated using the `raster` package (with `writeRaster()`), even though it is not used for the inputs.

If your algorithm does not generate any layer, but rather 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') sign. The output of all other lines will not be 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:

```
##showplots
```

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 shown in the processing results manager.

For more information, please check the script files provided with SEXTANTE. Most of them are rather simple and will greatly help you understand how to create your own scripts.

Nota: `rgdal` and `maptools` libraries are loaded by default, so you do not have to add the corresponding `library()` commands (you just have to make sure that those two packages are installed in your R distribution). However, other additional libraries that you might need have to be explicitly loaded. Just add the necessary commands at the beginning of your script. You also have to make sure that the corresponding packages are installed in the R distribution used by QGIS. The processing framework will not take care of any package installation. If you run a script that requires a package that is not installed, the execution will fail, and SEXTANTE will try to detect which packages are missing. You must install those missing libraries manually before you can run the algorithm.

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. Additionaly, a shell interpreter (usually `msys.exe`, which can be found in most GRASS for Windows distributions) has to be defined and its path set up as well.

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 in 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 that setting and point to the folder where the other version is installed. GRASS 6.4 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 console.

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 behaviour you prefer, just check the *Use min covering region* option in the GRASS configuration parameters.

The last parameter that has to be configured is related to the mapset. A mapset is needed to run GRASS, and the processing framework creates a temporary one for each execution. You have to specify if the data you are working with uses geographical (lat/lon) coordinates or projected ones.

GDAL

No additional configuration is needed to run GDAL algorithms. Since they are already incorporated into QGIS, the algorithms can infer their configuration from it.

Orfeo Toolbox

Orfeo Toolbox (OTB) algorithms can be run from QGIS if you have OTB installed in your system and you have configured QGIS properly, so it can find all necessary files (command-line tools and libraries).

As in the case of SAGA, OTB binaries are included in the stand-alone installer for Windows, but they are not included if you are runing Linux, so you have to download and install the software yourself. Please check the OTB website for more information.

Once OTB is installed, start QGIS, open the processing configuration dialog and configure the OTB algorithm provider. In the *Orfeo Toolbox (image analysis)* block, you will find all settings related to OTB. First, ensure that algorithms are enabled.

Then, configure the path to the folder where OTB command-line tools and libraries are installed:

- Usually *OTB applications folder* points to `/usr/lib/otb/applications` and *OTB command line tools folder* is `/usr/bin`.
- If you use the OSGeo4W installer, then install `otb-bin` package and enter `C:\OSGeo4W\apps\orfeotoolbox\applications` as *OTB applications folder* and `C:\OSGeo4W\bin` as *OTB command line tools folder*. These values should be configured by default, but if you have a different OTB installation, configure them to the corresponding values in your system.

TauDEM

To use this provider, you need to install TauDEM command line tools.

17.7.8 Windows

Please visit the TauDEM homepage for installation instructions and precompiled binaries for 32-bit and 64-bit systems. **IMPORTANT**: You need TauDEM 5.0.6 executables. Version 5.2 is currently not supported.

17.7.9 Linux

There are no packages for most Linux distributions, so you should compile TauDEM by yourself. As TauDEM uses MPICH2, first install it using your favorite package manager. Alternatively, TauDEM works fine with Open MPI, so you can use it instead of MPICH2.

Download TauDEM 5.0.6 source code and extract the files in some folder.

Open the `linearpart.h` file, and after line

```
#include "mpi.h"
```

add a new line with

```
#include <stdint.h>
```

so you'll get

```
#include "mpi.h"
#include <stdint.h>
```

Save the changes and close the file. Now open `tiffIO.h`, find line `#include "stdint.h"` and replace quotes (`""`) with `<>`, so you'll get

```
#include <stdint.h>
```

Save the changes and close the file. Create a build directory and cd into it

```
mkdir build
cd build
```

Configure your build with the command

```
CXX=mpicxx cmake -DCMAKE_INSTALL_PREFIX=/usr/local ..
```

and then compile

```
make
```

Finally, to install TauDEM into `/usr/local/bin`, run

```
sudo make install
```

.

17.8 The SEXTANTE Commander

SEXTANTE includes a practical tool that allows you to run algorithms without having to use the toolbox, but just by typing the name of the algorithm you want to run.

This tool is known as the *SEXTANTE Commander*, and it is just a simple text box with autocompletion where you type the command you want to run.

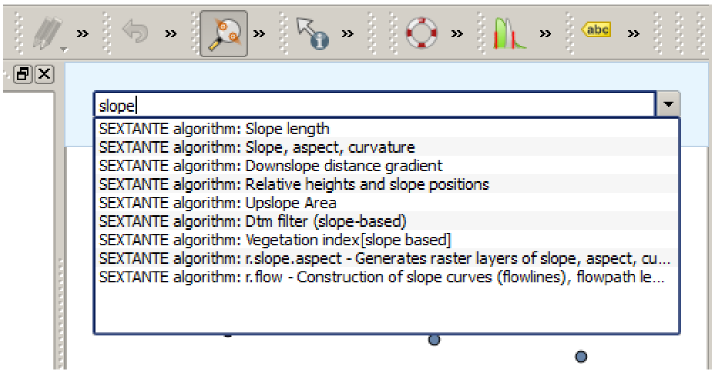

Figura 17.30: The SEXTANTE Commander

The Commander is started from the *Analysis* menu or, more practically, by pressing `Shift + Ctrl + M` (you can change that default keyboard shortcut in the QGIS configuration, if you prefer a different one). Apart from executing SEXTANTE algorithms, the Commander gives you access to most of the functionality in QGIS, which means that it gives you a practical and efficient way of running QGIS tasks and allows you to control QGIS with reduced usage of buttons and menus.

Además, el comandante es configurable, así que puede agregar sus comandos personalizados y ellos tienen sólo unas pocas teclas de distancia, por lo que es una herramienta de gran alcance para ayudarle a ser más productivo en su trabajo diario con QGIS.

17.8.1 Comandos disponibles

Los comandos disponibles en el Comandante caen en la siguiente categoría:

- SEXTANTE algorithms. These are shown as SEXTANTE algorithm: <name of the algorithm>.
- Los elementos del menú. Estos se muestran como Menu item: <Texto de entrada del menú>. Todos los elementos de los menús disponibles desde la interfaz QGIS están disponibles, incluso si se incluyen en un submenú.
- Funciones Python. Puede crear funciones cortas en Python que serán entonces incluidas en la lista de comandos disponibles. Ellos se muestran como Function: <nombre de la función>.

Para ejecutar cualquiera de los anteriores, inicie escribiendo y a continuación, seleccione el elemento de la lista de comandos disponibles que aparecen después de filtrar toda la lista de comandos con el texto que ha introducido.

En caso de llamar a una función de Python, puede seleccionar la entrada en la lista, que tiene el prefijo Function: (por ejemplo, Command: removeall), o simplemente escribir directamente el nombre de la función (‘‘removeall en el ejemplo anterior). No hay necesidad de añadir espacios después del nombre de la función.

17.8.2 Crear funciones personalizadas

Las funciones personalizadas se añaden al introducir el código correspondiente de Python en el archivo commands.py que se encuentra en el directorio .qgis/sextante/commander en su carpeta de usuario. Es solo un archivo Python simple donde puede añadir las funciones que necesite.

Se crea el archivo con unas pocas funciones de ejemplo la primera vez que se abre Comandos. Si no ha lanzado Comandos, puedes crear el archivo usted mismo. Para editar el archivo de comandos, utilice su editor de texto favorito. También se puede utilizar un editor incorporado llamando al comando edit de Comandos. Se abrirá el editor con el archivo de comandos, y se puede editar directamente y luego guardar los cambios.

Por ejemplo, puede añadir la siguiente función, la cual borre todas las capa:

```
from qgis.gui import *

def removeall():
    mapreg = QgsMapLayerRegistry.instance()
    mapreg.removeAllMapLayers()
```

Una vez que se haya añadido la función, estará disponible en Comandos, y puede invocarlo escribiendo removeall. No hay necesidad de hacer algo más aparte de escribir la función en sí.

Las funciones pueden recibir parámetros. Añadir *args a la definición de su función para recibir argumentos. Cuando llame a la función desde Comandos, los parámetros tienen que ser pasados separados por espacios.

Aquí esta un ejemplo de una función que carga una capa y toma un parámetro con el nombre del archivo de la capa cargada.

```
import sextante

def load(*args):
  sextante.load(args[0])
```

Si desea cargar la capa en /home/myuser/points.shp, tipo load /home/myuser/points.shp en la caja de texto de Comandos.

.

CAPÍTULO 18

Diseñadores de impresión

The Print Composer provides growing layout and printing capabilities. It allows you to add elements such as the QGIS map canvas, text labels, images, legends, scale bars, basic shapes, arrows, attribute tables and HTML frames. You can size, group, align and position each element and adjust the properties to create your layout. The layout can be printed or exported to image formats, PostScript, PDF or to SVG (export to SVG is not working properly with some recent Qt4 versions; you should try and check individually on your system). You can save the layout as a template and load it again in another session. Finally, generating several maps based on a template can be done through the atlas generator. See a list of tools in table_composer_1:

Icono	Propósito	Icono	Propósito
	Save Project		New Composer
	Duplicate Composer		Composer Manager
	Cargar de plantilla		Guardar como plantilla
	Print or export as PostScript		Exportar a un formato de imagen
	Exportar como SVG		Exportar como PDF
	Revertir el último cambio		Restaurar el último cambio
	Zum general		Zoom to 100 %
	Acercar Zum		Alejar Zum
	Refresh View		
	Pan		Zoom to specific region
	Seleccionar/Mover elementos		Mover contenido dentro de un elemento
	Add new map from QGIS map canvas		Añadir imagen a diseño de impresión
	Añadir etiqueta al diseño de impresión		Añadir nueva leyenda a diseño de impresión
	Add scale bar to print composition		Añadir figura básica al diseño de impresión
	Añadir flecha		Añadir tabla de atributos
	Add an HTML frame		
	Agrupar elementos Lock Selected Items		Desagrupar elementos Unlock All items
	Subir los elementos seleccionados		Bajar elementos seleccionados
	Mover elementos seleccionados arriba		Mover elementos seleccionados abajo
	Alinear a la izquierda elementos seleccionados		Alinear a la derecha elementos seleccionados
	Alinear al centro elementos seleccionados		Alinear al centro vertical los elementos seleccionados
	Alinear arriba los elementos seleccionados		Alinear abajo los elementos seleccionados
	Preview Atlas		First Feature
	Previous Feature		Next Feature
	Last feature		Print Atlas
	Export Atlas as Image		Atlas Settings

Tabla Diseñador 1: Herramientas del Diseñador de Impresión

Todas las herramientas del diseñador de impresión estan disponibles en los menús y como iconos en la barra de herramientas. La barra de herramientas se puede prender y apagar utilizando el botón derecho del ratón sobre la barra de herramientas.

18.1 Primeros pasos

18.1.1 Abrir una plantilla del diseñador de impresión

Before you start to work with the Print Composer, you need to load some raster and 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 Composer icon in the toolbar or choose *File* → *New Print Composer*. You will be prompted to choose a title for the new Composer.

18.1.2 Using Print Composer

Opening the Print Composer provides you with a blank canvas to which you can add the current QGIS map canvas, text labels, images, legends, scale bars, basic shapes, arrows, attribute tables and HTML frames. Figure_composer_1 shows the initial view of the Print Composer before any elements are added.

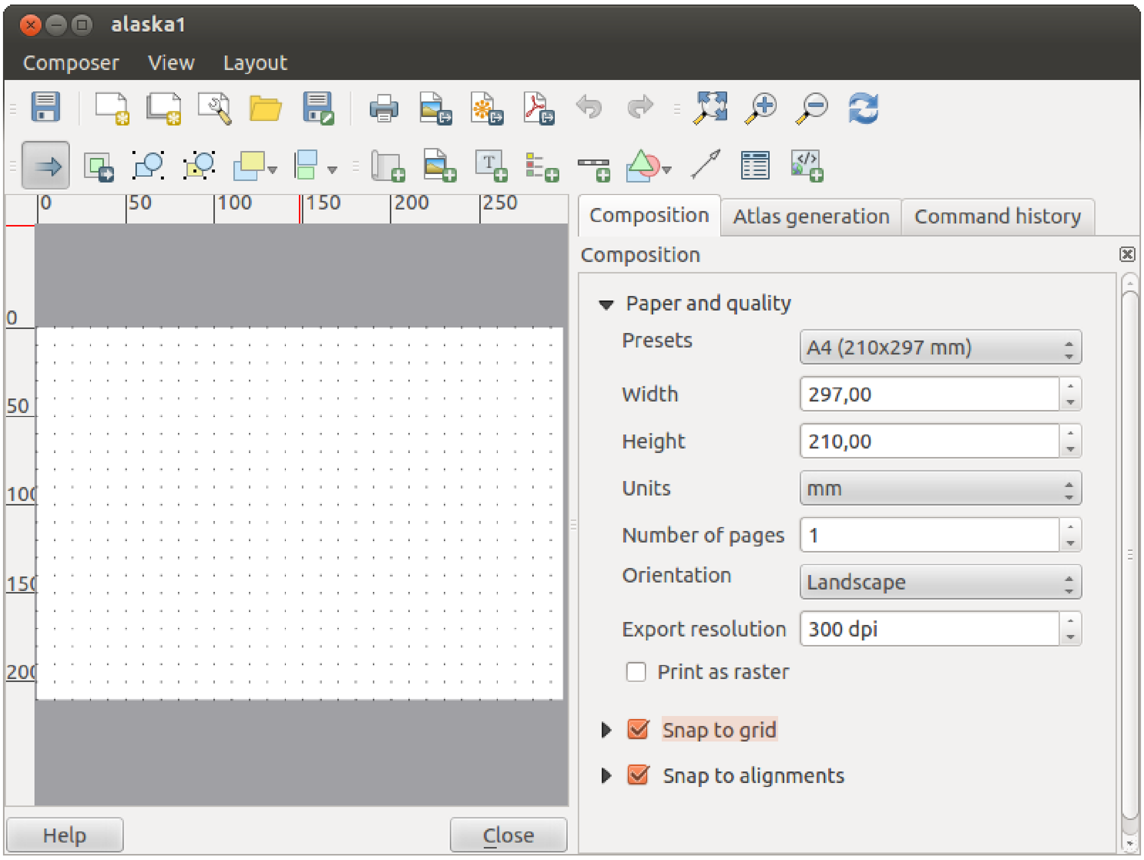

Figura 18.1: Diseñador de impresión

The Print Composer provides four tabs:

- The *Composition* tab allows you to set paper size, orientation, the page background, number of pages and print quality for the output file in dpi. Furthermore, you can also activate the *Print as raster* checkbox. This means all elements will be rastered before printing or saving as PostScript or PDF. In this tab, you can also customize settings for grid and smart guides.
- The *Item Properties* tab displays the properties for the selected item element. Click the Select/Move item icon to select an element (e.g., legend, scale bar or label) on the canvas. Then click the *Item Properties* tab and customize the settings for the selected element.

- The *Command history* tab (hidden by default) displays a history of all changes applied to the Print Composer layout. With a mouse click, it is possible to undo and redo layout steps back and forth to a certain status.
- The *Atlas generation* tab allows you to enable the generation of an atlas for the current Composer and gives access to its parameters.

In the bottom part of the Print Composer window, you can find a status bar with mouse position, current page number and a combo box to set the zoom level.

You can add multiple elements to the Composer. It is also possible to have more than one map view or legend or scale bar in the Print Composer 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 Composer canvas you can do that with the `Delete` or the `Backspace` key.

Herramientas de navegación

To navigate in the canvas layout, the Print Composer provides some general tools:

- Acercar zum
- Alejar zum
- Zoom to full extent
- Zoom to 100 %
- Actualizar la vista (Si encuentra la vista en un estado inconsistente)
- Pan composer
- Marquee zoom mode (zoom to a specific region of the Composer)

You can change the zoom level also using the mouse wheel or the combo box in the status bar. If you need to switch to pan mode while working in the Composer area, you can hold the `Spacebar` or the the mouse wheel. With `Ctrl+Spacebar`, you can temporarily switch to marquee zoom mode, and with `Ctrl+Shift+Spacebar`, to zoom out mode.

18.1.3 Print Composer Options

From *Settings* → *Composer Options* you can set some options that will be used as default during your work.

- *Compositions defaults* let you specify the default font to use.
- With *Grid appearance*, you can set the grid style and its color.
- *Grid defaults* defines spacing, offset and tolerance of the grid. There are three types of grid: **Dots**, **Solid** lines and **Crosses**.
- *Guide defaults* defines the tolerance for the guides.

18.1.4 Pestaña de Diseño — Configuración general de diseño

En la pestaña *Diseño*, puede definir la configuración global de su diseño.

- You can choose one of the *Presets* for your paper sheet, or enter your custom *width* and *height*.
- Composition can now be divided into 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. Set the *Number of pages* to the desired value. You can choose the page *Orientation* and its *Exported resolution*. When checked, *print as raster* means all elements will be rasterized before printing or saving as PostScript or PDF.

- *Grid* lets you customize grid settings like *spacings*, *offsets* and *tolerance* to your need.
- In *Snap to alignments*, you can change the *Tolerance*, which is the maximum distance below which an item is snapped to smart guides.

Snap to grid and/or to smart guides can be enabled from the *View* menu. In this menu, you can also hide or show the grid and smart guides.

18.1.5 Composer items general options

Composer items have a set of common properties you will find on the bottom of the *Item Properties* tab: Position and size, Frame, Background, Item ID and Rendering (See figure_composer_2).

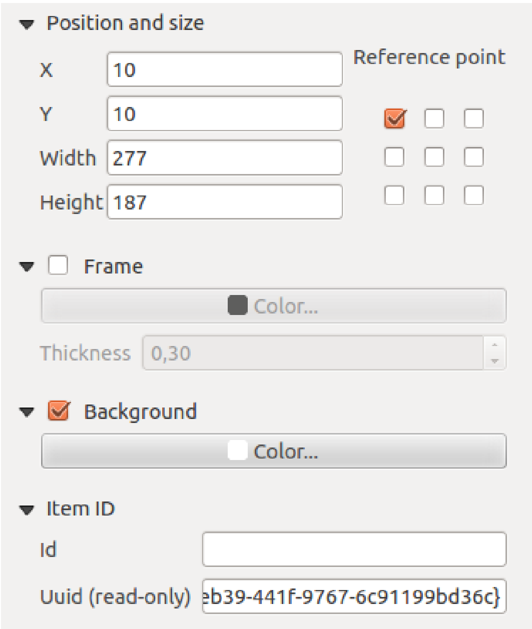

Figura 18.2: Diálogo de propiedades de elementos comunes

- El diálogo *Posición y tamaño* le permite definir tamaño y posición del marco que contiene los elementos. También puede optar por *Punto de referencia* para establecer las coordenadas **X** y **Y** previamente definidas.
- The *Rotation* sets the rotation of the element (in degrees).
- El *Marco* muestra u oculta el marco alrededor de la etiqueta. Haga clic en los botones **[Color]** y **[Delgadez]** para ajustar esas propiedades.
- The *Background* enables or disables 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 also be adjusted throught the **alpha** field.
- Use the *Item ID* to create a relationship to other Print Composer items. This is used with QGIS server and any potential web client. You can set an ID on an item (e.g., a map and 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 what items and which IDs are available in a layout.
- *Rendering* mode can be selected in the option field. See Rendering_Mode.

18.2 Modo de representación

QGIS now allows advanced rendering for Composer items just like vector and raster layers.

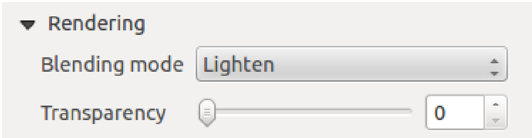

Figura 18.3: Modo de representación

- *Transparency* : You can make the underlying item in the Composer 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 the menu beside the slider.
- *Blending mode*: You can achieve special rendering effects with these tools that you previously only may know from graphics programs. The pixels of your overlaying and underlaying items are mixed through the settings described below.
  - Normal: This is the standard blend mode, which uses the alpha channel of the top pixel to blend with the pixel beneath it; the colors aren't mixed.
  - 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 layer with another layer (e.g., you can use a hillshade to texture another layer).
  - Dodge: Dodge will brighten and saturate underlying pixels based on the lightness of the top pixel. So, 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: This blend mode simply adds pixel values of one layer with pixel values of the other. In case of values above 1 (as in the case of RGB), white is displayed. This mode is suitable for highlighting features.
  - Darken: This creates a resultant pixel that retains the smallest components of the foreground and background pixels. Like lighten, the results tend to be jagged and harsh.
  - Multiply: Here, the numbers for each pixel of the top layer are multiplied with the numbers for the corresponding pixel of the bottom layer. The results are darker pictures.
  - Burn: Darker colors in the top layer cause the underlying layers to darken. Burn can be used to tweak and colorise underlying layers.
  - Overlay: This mode combines the multiply and screen blending modes. In the resulting picture, light parts become lighter and dark parts become darker.
  - Soft light: This is very similar to overlay, but instead of using multiply/screen it uses color burn/dodge. This mode is supposed to emulate shining a soft light onto an image.
  - Iluminar fuerte: Ilumina fuerte es muy similar a la del modo de superposición. Se supone que es emular a la proyección de una luz muy intensa en una imagen.
  - Difference: Difference subtracts the top pixel from the bottom pixel, or the other way around, to always get a positive value. Blending with black produces no change, as the difference with all colors is zero.
  - Subtract: This blend mode simply subtracts pixel values of one layer with pixel values of the other. In case of negative values, black is displayed.

18.3 Elementos de diseño

18.3.1 Adding a current QGIS map canvas to the Print Composer

Click on the Add new map toolbar button in the Print Composer toolbar to add the QGIS map canvas. Now, drag a rectangle onto the Composer canvas with the left mouse button to add the map. To display the current map, you can choose between three different modes in the map *Item Properties* tab:

- **Rectángulo** es la configuración predeterminada. Solo muestra una caja vacía con un mensaje 'El mapa será impreso aquí'.
- **Cache** renders the map in the current screen resolution. If you zoom the Composer window in or out, the map is not rendered again but the image will be scaled.
- **Render** means that if you zoom the Composer window in or out, the map will be rendered again, but for space reasons, only up to a maximum resolution.

Cache is the default preview mode for newly added Print Composer maps.

You can resize the map element by clicking on the Select/Move item button, selecting the element, and dragging one of the blue handles in the corner of the map. With the map selected, you can now adapt more properties in the map *Item Properties* tab.

To move layers within the map element, select the map element, click the Move item content icon and move the layers within the map element frame with the left mouse button. After you have found the right place for an element, you can lock the element position within the Print Composer canvas. Select the map element and click on the right mouse button to Lock the element position and again to unlock the element. You can also lock the map element by activating the *Lock layers for map item* checkbox in the *Map* dialog of the *Item Properties* tab.

Main properties

The *Main properties* dialog of the map *Item Properies* tab provides the following functionalities (see figure_composer_4):

- The **Preview** area allows you to define the preview modes 'Rectangle', 'Cache' and 'Render', as described above. If you change the view on the QGIS map canvas by changing vector or raster properties, you can update the Print Composer view by selecting the map element in the Print Composer and clicking the **[Update preview]** button.
- The field *Scale* 1,00 sets a manual scale.
- The field *Rotation* 1,00 allows you to rotate the map element content clockwise in degrees. Note that a coordinate frame can only be added with the default value 0.
- *Draw map canvas items* lets you show annotations that may be placed on the map canvas in the main QGIS window.
- You can choose to lock the layers shown on a map item. Check *Lock layers for map item*. After this is checked, any layer that would be displayed or hidden in the main QGIS window won't appear or be hidden in the map item of the Composer. But style and labels of a locked layer are still refreshed according to the main QGIS interface.

Extents

The *Extents* dialog of the map item tab provides the following functionalities (see figure_composer_5):

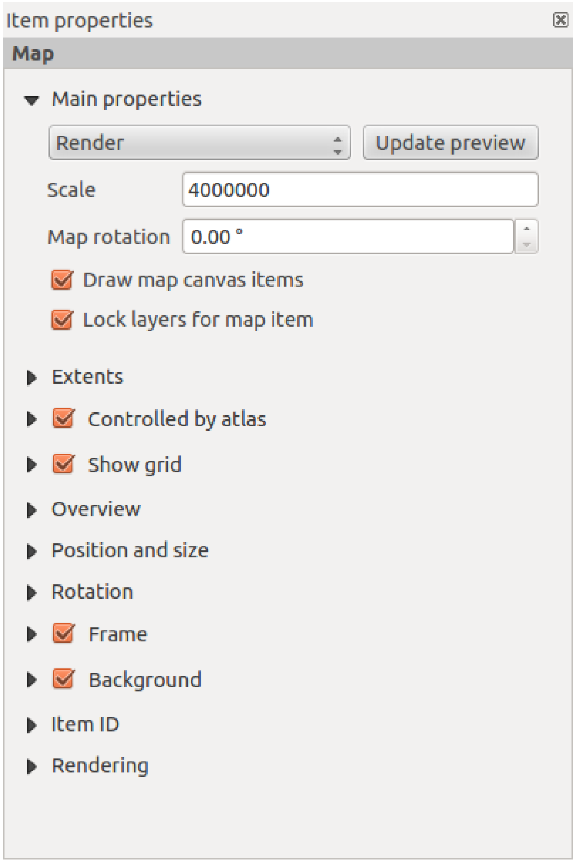

Figura 18.4: Map Item properties Tab

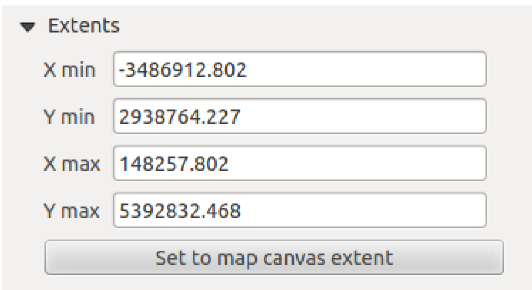

Figura 18.5: Map Extents Dialog

- The **Map extent** area allows you to specify the map extent using Y and X min/max values or by clicking the **[Set to map canvas extent]** button.

If you change the view on the QGIS map canvas by changing vector or raster properties, you can update the Print Composer view by selecting the map element in the Print Composer and clicking the **[Update preview]** button in the map *Item Properties* tab (see figure_composer_2).

Grid

The *Grid* dialog of the map *Item Properties* tab provides the following functionalities (see Figure_composer_6):

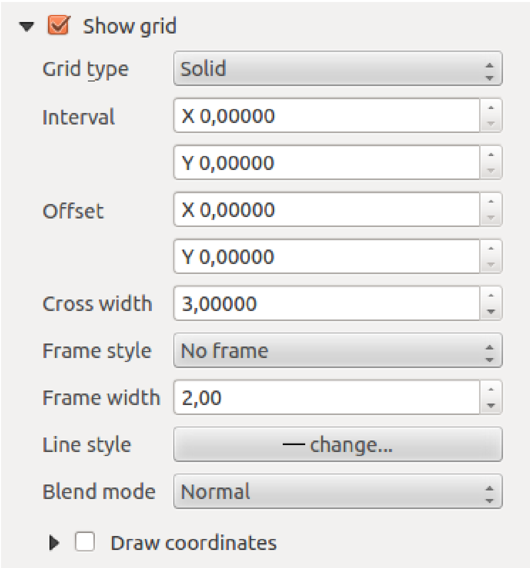

Figura 18.6: Map Grid Dialog

- The *Show grid* checkbox allows you to overlay a grid onto the map element. As grid type, you can specify to use a solid line or cross. Symbology of the grid can be chosen. See section Rendering_Mode. Furthermore, you can define an interval in the X and Y directions, an X and Y offset, and the width used for the cross or line grid type.
- You can choose to paint the frame with a zebra style. If not selected, the general frame option is used (see section Frame_dialog). Advanced rendering mode is also available for grids (see section Rendering_mode).
- The *Draw coordinates* checkbox allows you to add coordinates to the map frame. The annotation can be drawn inside or outside the map frame. The annotation direction can be defined as horizontal, vertical, horizontal and vertical, or boundary direction, for each border individually. Units can be in meters or in degrees. Finally, you can define the grid color, the annotation font, the annotation distance from the map frame and the precision of the drawn coordinates.

Overview

The *Overview* dialog of the map *Item Properties* tab provides the following functionalities (see Figure_composer_7):

If the Composer has more than one map, you can choose to use a first map to show the extents of a second map. The *Overview* dialog of the map *Item Properties* tab allows you to customize the appearance of that feature.

- The *Overview frame* combo list references the map item whose extents will be drawn on the present map item.
- The *Overview Style* allows you to change the frame color. See section vector_style_manager .

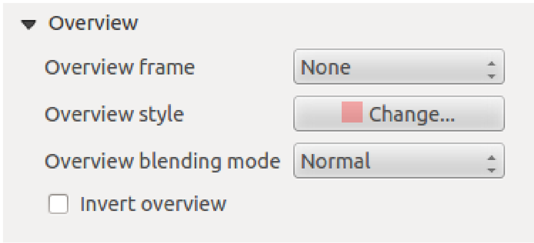

Figura 18.7: Map Overview Dialog

- The *Overview Blend mode* allows you to set different transparency blend modes, to enhance visibility of the frame. See Rendering_Mode.
- If checked, *Invert overview* creates a mask around the extents: the referenced map extents are shown clearly, whereas everything else is blended with the frame color.

18.3.2 Adding a Label item to the Print Composer

To add a label, click the Add label icon, place the element with the left mouse button on the Print Composer canvas and position and customize its appearance in the label *Item Properties* tab.

The *Item Properties* tab of a label item provides the following functionalities:

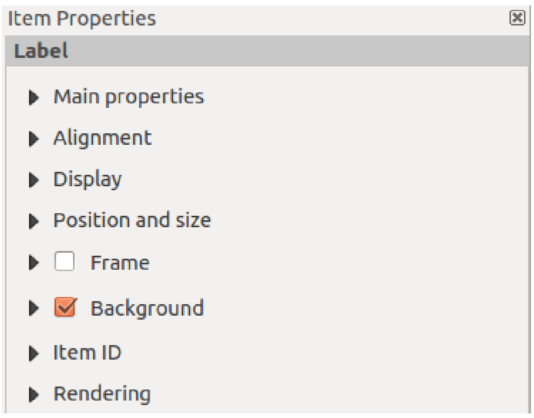

Figura 18.8: Label Item properties Tab

Main properties

The *Main properties* dialog of the label *Item Properties* tab provides the following functionalities (see Figure_composer_9):

- The main properties dialog is where the text (HTML or not) or the expression needed to fill the label is added to the Composer canvas.
- Labels can be interpreted as HTML code: check *Render as HTML*. You can now insert a URL, a clickable image that links to a web page or something more complex.
- You can also insert an expression. Click on **[Insert an expression]** to open a new dialog. Build an expression by clicking the functions available in the left side of the panel. On the right side of the *Insert an expression* dialog, the help file associated with the function selected is displayed. Two special categories can be useful, particularly associated with the atlas functionality: geometry functions and records functions. At the bottom, a preview of the expression is shown.

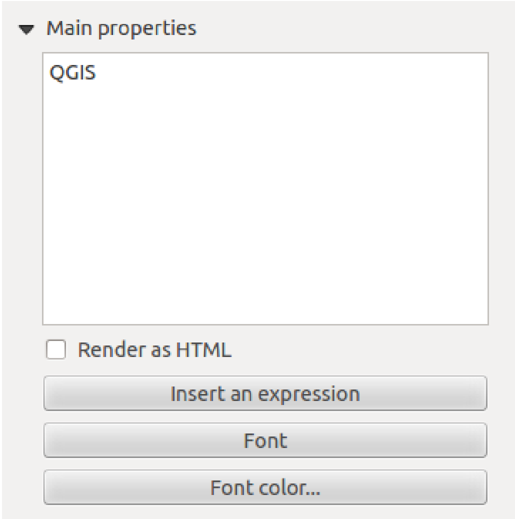

Figura 18.9: Label Main properties Dialog

- Define font and font color by clicking on the **[Font]** and **[Font color...]** buttons.

Alignment and Display

The *Alignment* and *Display* dialogs of the label *Item Properties* tab provide the following functionalities (see Figure_composer_10):

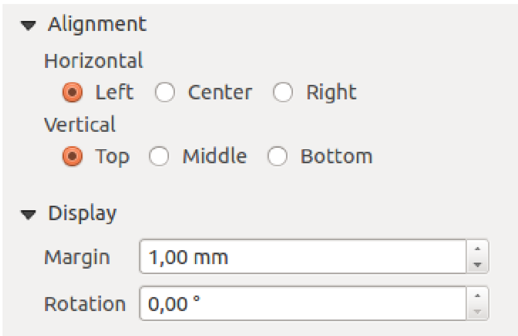

Figura 18.10: Label Alignment and Display Dialogs

- You can define the horizontal and vertical alignment in the *Alignment* zone.
- In the **Display** tag, you can define a margin in mm and/or a rotation angle in degrees for the text.

18.3.3 Adding an Image item to the Print Composer

To add an image, click the Add image icon, place the element with the left mouse button on the Print Composer canvas and position and customize its appearance in the image *Item Properties* tab.

The image *Item Properties* tab provides the following functionalities (see figure_composer_11):

Main properties, Search directories and Rotation

The *Main properties* and *Search directories* dialogs of the image *Item Properties* tab provide the following functionalities (see Figure_composer_12):

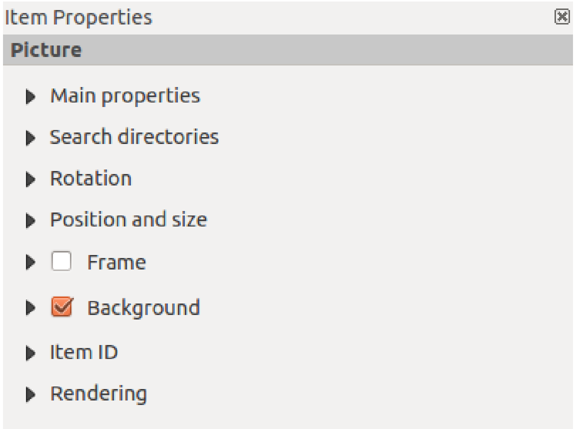

Figura 18.11: Image Item properties Tab

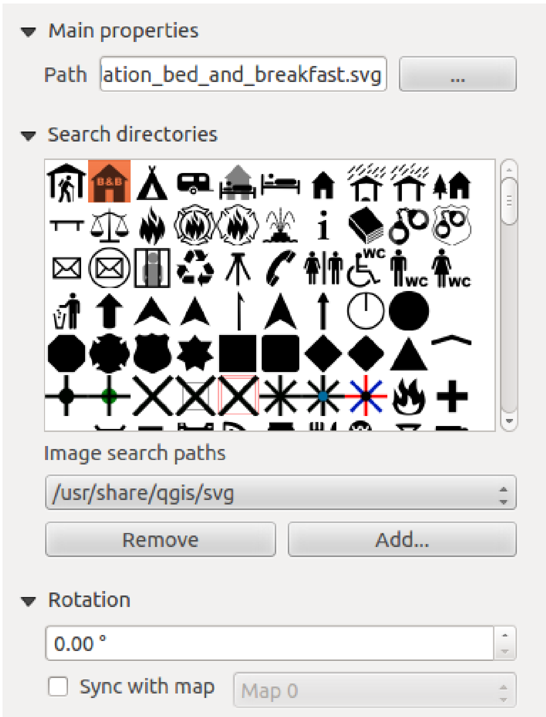

Figura 18.12: Image Main properties, Search directories and Rotation Dialogs

- The **Main properties** dialog shows the current image that is displayed in the image item. Click on the **[...]** button to select a file on your computer.
- This dialog shows all pictures stored in the selected directories.
- The **Search directories** area allows you to add and remove directories with images in SVG format to the picture database.
- Images can be rotated with the *Rotation* 1,00 field.
- Activating the *Sync with map* checkbox synchronizes the rotation of a picture in the QGIS map canvas (i.e., a rotated north arrow) with the appropriate Print Composer image.

18.3.4 Adding a Legend item to the Print Composer

To add a map legend, click the Add new legend icon, place the element with the left mouse button on the Print Composer canvas and position and customize the appearance in the legend *Item Properties* tab.

The *Item properties* of a legend item tab provides the following functionalities (see figure_composer_14):

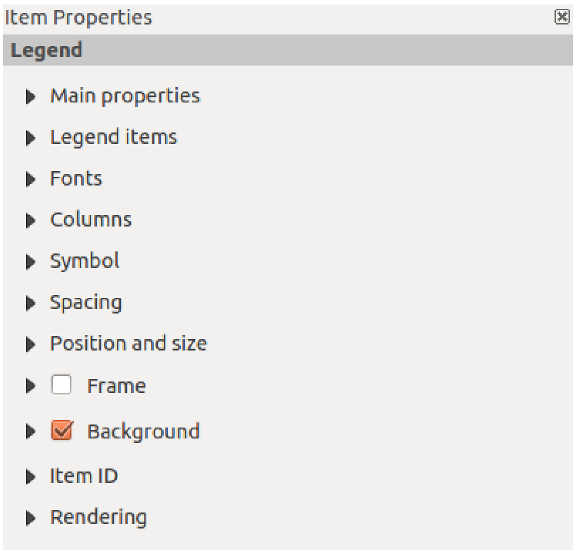

Figura 18.13: Legend Item properties Tab

Main properties

The *Main properties* dialog of the legend *Item Properties* tab provides the following functionalities (see figure_composer_14):

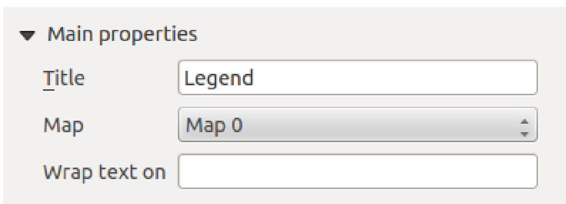

Figura 18.14: Legend Main properties Dialog

- Here, you can adapt the legend title.
- You can also choose which *Map* item the current legend will refer to in the select list.

- Since QGIS 1.8, you can wrap the text of the legend title on a given character.

Legend items

The *Legend items* dialog of the legend *Item Properties* tab provides the following functionalities (see figure_composer_15):

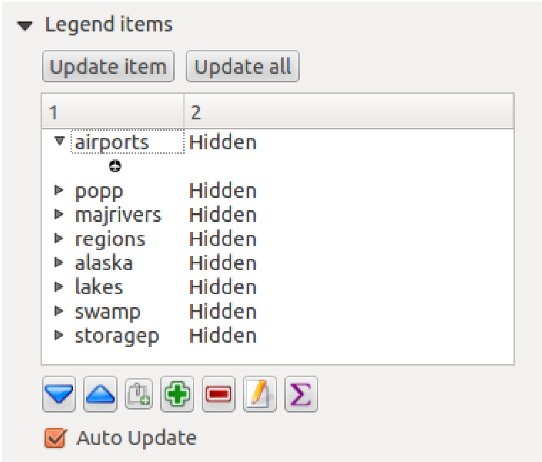

Figura 18.15: Legend Legend Items Dialog

- The legend items window lists all legend items and allows you to change item order, group layers, remove and restore items in the list, and edit layer names. After changing the symbology in the QGIS main window, you can click on **[Update]** to adapt the changes in the legend element of the Print Composer. The item order can be changed using the **[Up]** and **[Down]** buttons or with 'drag-and-drop' functionality.
- The feature count for each vector layer can be shown by enabling the **[Sigma]** button.
- The legend will be updated automatically if *Auto-update* is checked.

Fonts, Columns, Symbol and Spacing

The *Fonts*, *Columns*, *Symbol* and *Spacing* dialogs of the legend *Item Properties* tab provide the following functionalities (see figure_composer_16):

- You can change the font of the legend title, group, subgroup and item (layer) in the legend item. Click on a category button to open a **Select font** dialog.
- All these items will get the same **Color**.
- Legend items can be arranged in several columns. Select the correct value in the *Count* 1,00 field.
- *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.
- You can change the width and height of the legend symbol in this dialog.
- Spacing aroung title, group, subgroup, symbol, icon label, box space or column space can be customized through this dialog.

18.3.5 Adding a Scale Bar item to the Print Composer

To add a scale bar, click the Add new scalebar icon, place the element with the left mouse button on the Print Composer canvas and position and customize the appearance in the scale bar *Item Properties* tab.

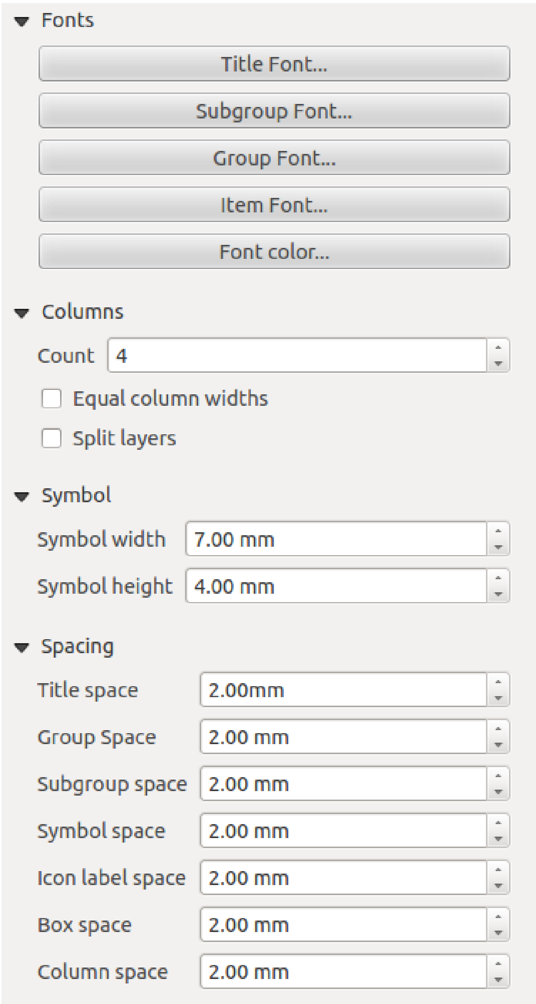

Figura 18.16: Legend Fonts, Columns, Symbol and Spacing Dialogs

The *Item properties* of a scale bar item tab provides the following functionalities (see figure_composer_17):

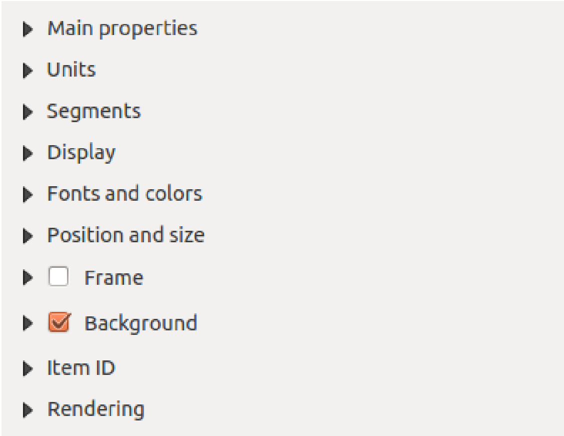

Figura 18.17: Scale Bar Item properties Tab

Main properties

The *Main properties* dialog of the scale bar *Item Properties* tab provides the following functionalities (see figure_composer_18):

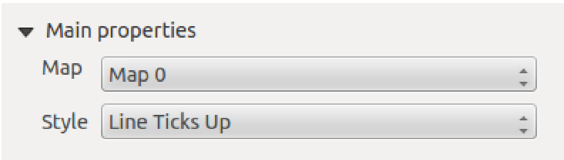

Figura 18.18: Scale Bar Main properties Dialog

- First, choose the map the scale bar will be attached to.
- Then, choose the style of the scale bar. Six styles are available:
  - **Single box** and **Double box** styles, which contain one or two lines of boxes alternating colors.
  - **Middle**, **Up** or **Down** line ticks.
  - **Numeric**, where the scale ratio is printed (i.e., 1:50000).

Units and Segments

The *Units* and *Segments* dialogs of the scale bar *Item Properties* tab provide the following functionalities (see figure_composer_19):

In these two dialogs, you can set how the scale bar will be represented.

- Select the map units used. There are three possible choices: **Map Units** is the automated unit selection; **Meters** or **Feet** force unit conversions.
- The *Label* field defines the text used to describe the units of the scale bar.
- The *Map units per bar unit* allows you to fix the ratio between a map unit and its representation in the scale bar.
- You can define how many *Segments* will be drawn on the left and on the right side of the scale bar, and how long each segment will be (*Size* field). *Height* can also be defined.

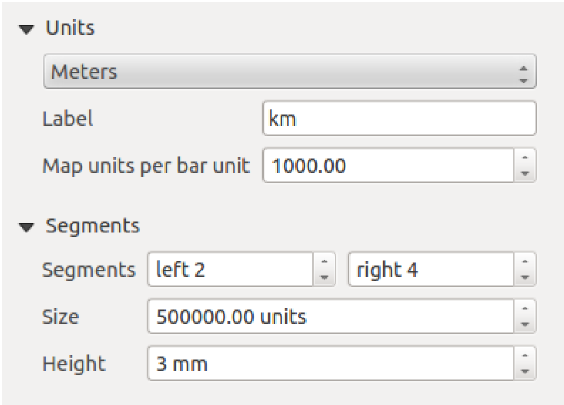

Figura 18.19: Scale Bar Units and Segments Dialogs

Display, Fonts and colors

The *Display* and *Fonts and colors* dialogs of the scale bar *Item Properties* tab provide the following functionalities (see figure_composer_20):

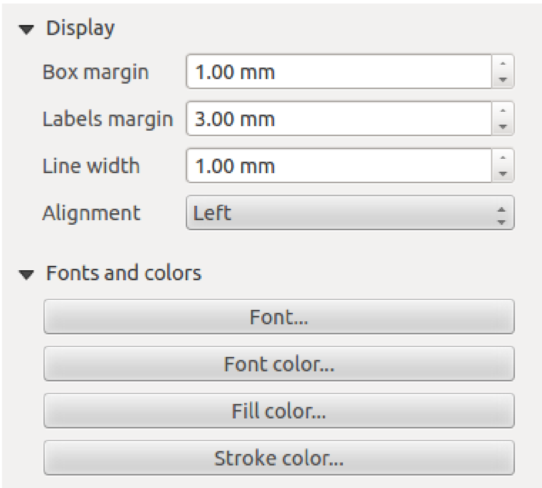

Figura 18.20: Scale Bar Display, Fonts and colors Dialogs

- You can define how the scale bar will be displayed in its frame. Adjust the *Box margin* between text and frame borders, *Labels margin* between text and scale bar drawing and the *Line width* of the scale bar drawing.
- The *Alignment* in the *Display* dialog only applies to *Numeric* styled scale bars and puts text on the left, middle or right side of the frame.

18.3.6 Adding a Basic shape or Arrow item to the Print Composer

It is possible to add basic shapes (ellipse, rectangle, triangle) and arrows to the Print Composer canvas: Click the Add basic shape icon or the Add Arrow icon, place the element with the left mouse button on the Print Composer canvas and position and customize the appearance in the *Item Properties* tab.

The *Shape* item properties tab allows you to draw an ellipse, rectangle, or triangle in the Print Composer canvas. You can define its outline and fill color, the outline width and a clockwise rotation. For the rectangle shape, you can change the value of the corner radius.

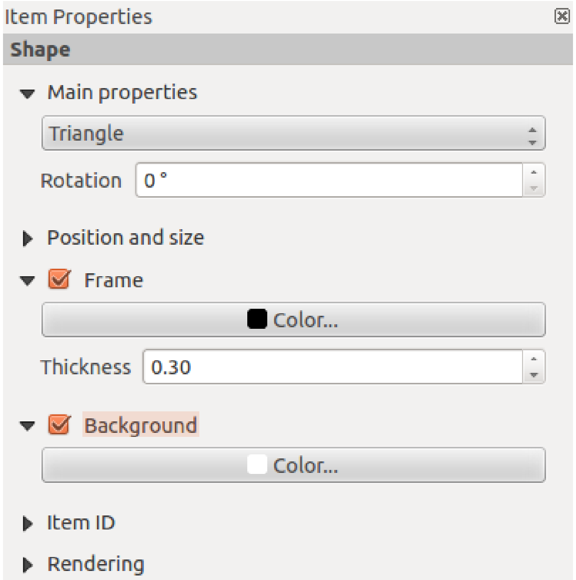

Figura 18.21: Shape Item properties Tab

The *Arrow* item properties tab allows you to draw an arrow in the Print Composer canvas. You can define color, outline and arrow width, and it is possible to use a default marker, no marker, or an SVG marker. For the SVG marker, you can additionally add an SVG start and end marker from a directory on your computer.

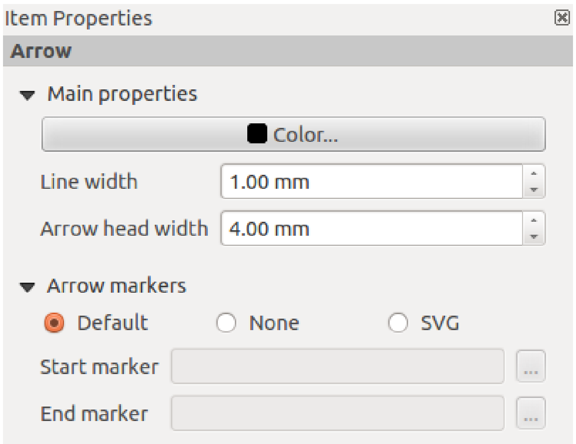

Figura 18.22: Arrow Item properties Tab

Main properties

- For basic shapes, this dialog allows you to choose an **Ellipse**, **Rectangle** or **Triangle** shape and its rotation.
- Unlike the other items, line style, line color and background color of a basic shape are adjusted with the Frame and Background dialog. No frame is drawn.
- For arrows, you can define here the line style: *Color*, *Line width* and *Arrow head width*.
- *Arrows markers* can be adjusted. If you want to set an SVG *Start marker* and/or *End marker*, browse to your SVG file by clicking on the **[...]** button after selecting the *SVG* radio button.

Nota: Unlike other items, the background color for a basic shape is the shape background and not the frame background.

18.3.7 Add attribute table values to the Print Composer

It is possible to add parts of a vector attribute table to the Print Composer canvas: Click the Add attribute table icon, place the element with the left mouse button on the Print Composer canvas, and position and customize the appearance in the *Item Properties* tab.

The *Item properties* of an attribute table item tab provides the following functionalities (see figure_composer_23):

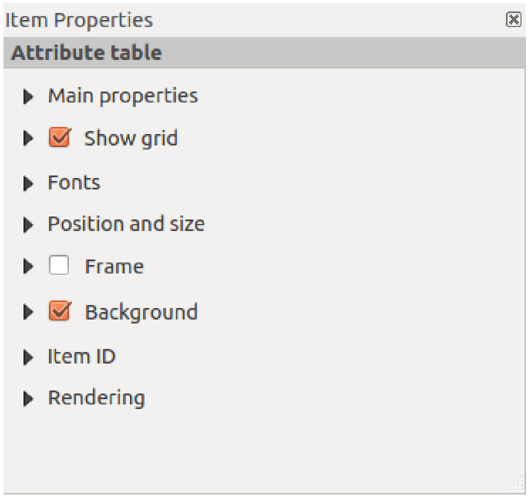

Figura 18.23: Scale Bar Item properties Tab

Main properties, Show grid and Fonts

The *Main properties*, *Show grid* and *Fonts* dialogs of the attribute table *Item Properties* tab provide the following functionalities (see figure_composer_24):

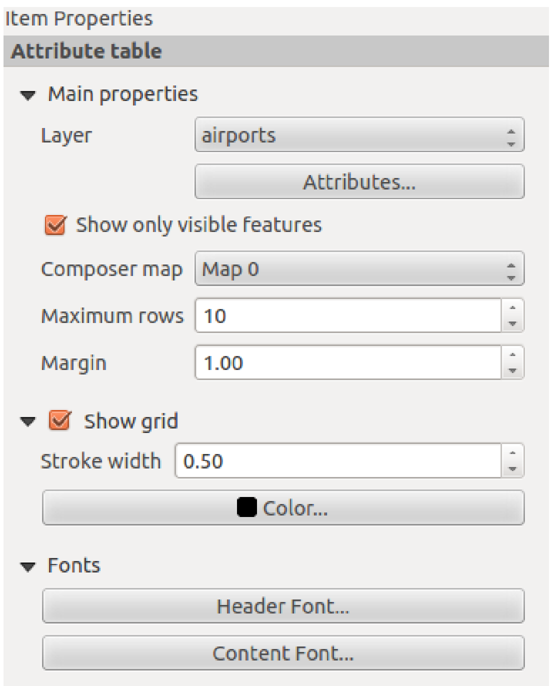

Figura 18.24: Attribute table Main properties, Show grid and Fonts Dialog

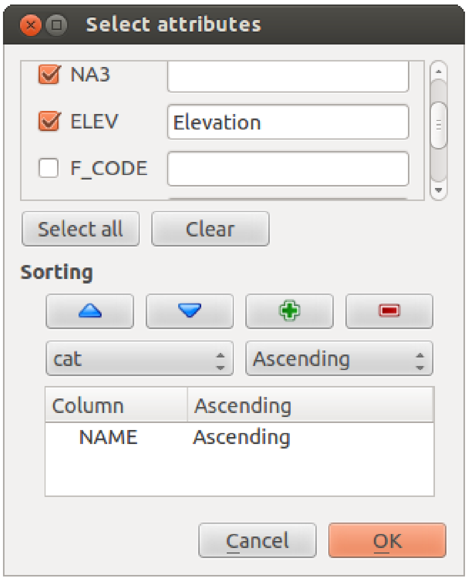

Figura 18.25: Attribute table Select attributes Dialog

- The *Table* dialog allows you to select the vector layer and columns of the attribute table. Attribute columns can be sorted, and you can specify whether to show values in ascending or descending order (see figure_composer_25).
- You can choose to display the attributes of only features visible on a map. Check *Show only visible features* and select the corresponding *Composer map* to filter.
- You can define the *Maximum number of rows* to be displayed and the *margin* around text.
- Additionally, you can define the grid characteristics of the table (*Stroke width* and *Color* of the grid) and the header and content font.

18.3.8 Add an HTML frame to the Print Composer

It is possible to add a clickable frame linked to a URL: Click the Add HTML frame icon, place the element with the left mouse button on the Print Composer canvas and position and customize the appearance in the *Item Properties* tab.

Main properties

The *Main properties* dialog of the HTML frame *Item Properties* tab provides the following functionalities (see figure_composer_26):

- Point the *URL* field to the URL or the HTML file you want to insert in the Composer.
- You can adjust the rendering of the page with the *Resize mode*.
- **Use existing frames** constrains the page inside its first frame or in the frame created with the next settings.
- **Extent 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.

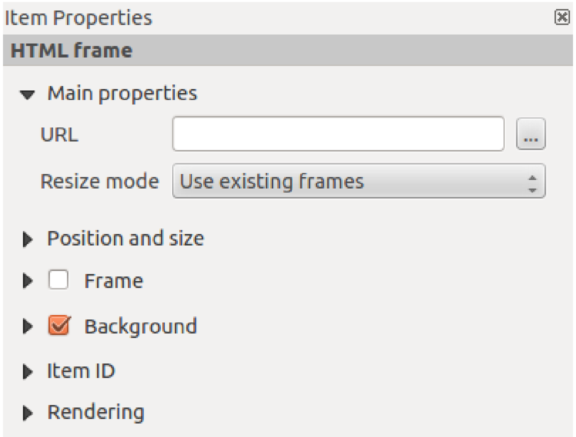

Figura 18.26: HTML frame Item properties Tab

18.4 Manage items

18.4.1 Size and position

Each item inside the Composer can be moved/resized to create a perfect layout. For both operations the first step is to activate the Select/Move item tool and to click on the item; you can then move it using the mouse while holding the left button. If you need to constrain the movements to the horizontal or the vertical axis, just hold the `Shift` while moving the mouse. If you need a better precision, you can move a selected item using the `Arrow keys` on the keyboard; if the movement is too slow, you can speed up it by holding `Shift`.

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 `Ctrl` will resize from the item center.

The correct position for an item can be obtained using snapping to grid or smart guides. If you need to disable the snap on the fly just hold `Ctrl` while moving the mouse.

You can choose multiple items with the Select/Move item button. Just hold the `Shift` button and click on all the items you need. You can then resize/move this group just like a single item.

Once you have found the correct position for an item, you can lock it by clicking with the right mouse button. Press the same button another time to unlock it. You can also lock/unlock items using the icons on the toolbar.

To unselect an item, just click on it holding the `Shift` button.

Inside the *Edit* menu, you can find actions to select all the items, to clear all selections or to invert the current selection.

18.4.2 Alignment

Raising or lowering functionalities for elements are inside the Raise selected items pull-down menu. Choose an element on the Print Composer canvas and select the matching functionality to raise or lower the selected element compared to the other elements (see table_composer_1).

There are several alignment functionalities available within the Align selected items pull-down menu (see table_composer_1). To use an alignment functionality, you first select some elements and then click on the matching alignment icon. All selected elements will then be aligned within to their common bounding box. When moving items on the Composer canvas, alignment helper lines appear when borders, centers or corners are aligned.

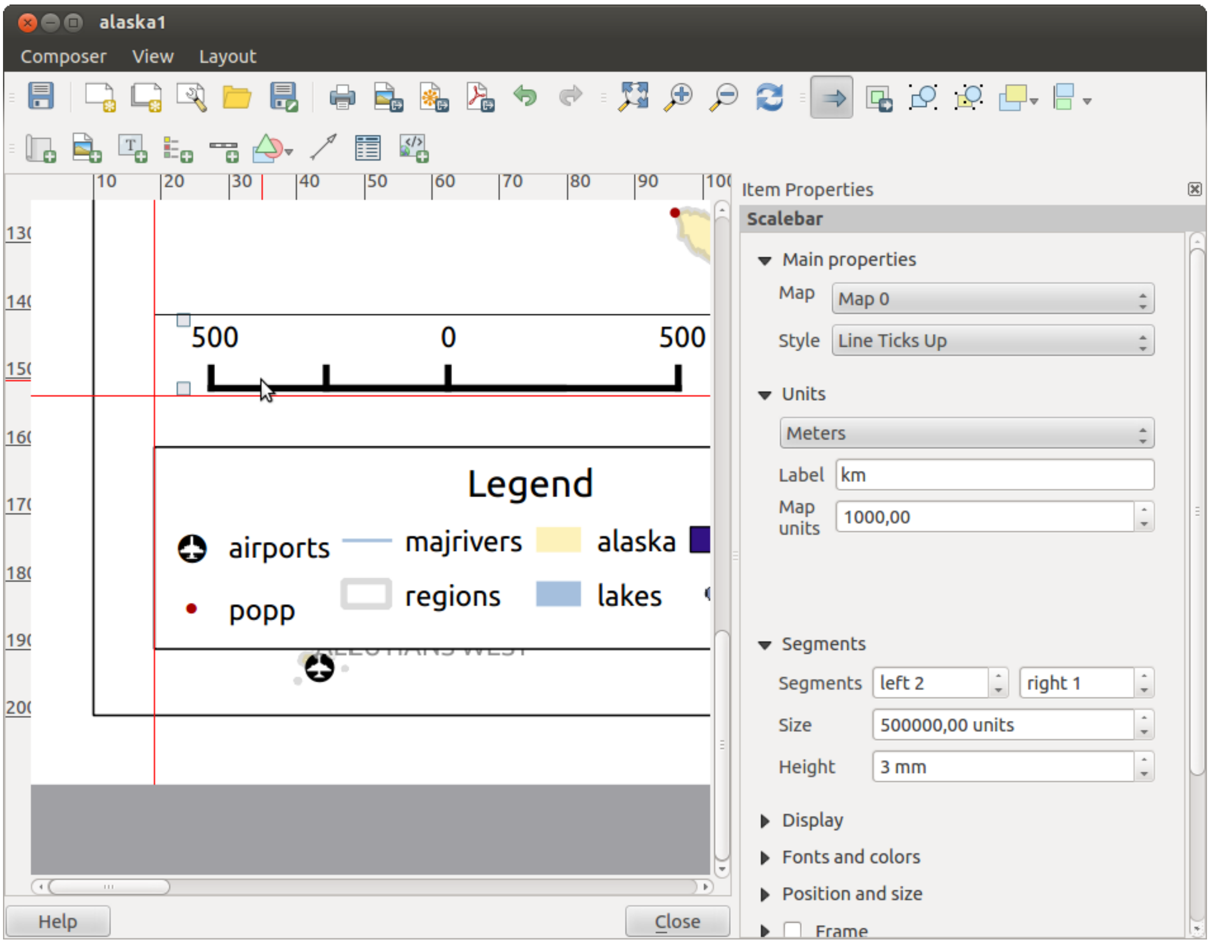

Figura 18.27: Alignment helper lines in the Print Composer

18.4.3 Copy/Cut and Paste items

The print composer includes actions to use the common Copy/Cut/Paste functionality for the items in the layout. As usual first you need to select the items using one of the options seen above; at this point the actions can be found in the *Edit* menu. When using the Paste action, the elements will be pasted according to the current mouse position.

18.5 Revert and Restore tools

During the layout process, it is possible to revert and restore changes. This can be done with the revert and restore tools:

- Revert last changes
- Restore last changes

This can also be done by mouse click within the *Command history* tab (see figure_composer_28).

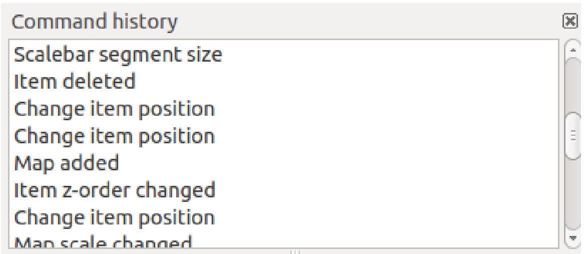

Figura 18.28: Command history in the Print Composer

18.6 Atlas generation

The Print Composer includes generation functions that allow you to create map books in an automated way. The concept is to use a coverage layer, which contains geometries and fields. For each geometry in the coverage layer, a new output will be generated where the content of some canvas maps will be moved to highlight the current geometry. Fields associated with this geometry can be used within text labels.

Every page will be generated with each feature. To enable the generation of an atlas and access generation parameters, refer to the *Atlas generation* tab. This tab contains the following widgets (see Figure_composer_29):

- *Generate an atlas*, which enables or disables the atlas generation.
- A *Coverage layer* combo box that allows you to choose the (vector) layer containing the geometries on which to iterate over.
- An optional *Hidden coverage layer* that, if checked, will hide the coverage layer (but not the other ones) during the generation.
- 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 selected. The button on the right allows you to display the expression builder.
- An *Output filename expression* textbox that is used to generate a filename for each geometry if needed. It is based on expressions. This field is meaningful only for rendering to multiple files.

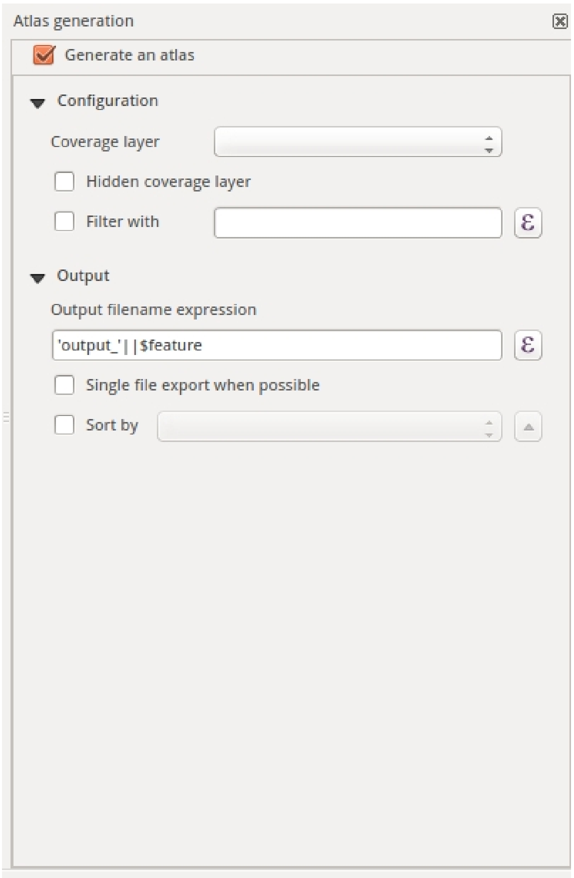

Figura 18.29: Atlas generation tab

- 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.
- An optional *Sort by* that, if checked, allows you to sort features of the coverage layer. The associated combo box allows you to choose which column will be used as the sorting key. Sort order (either ascending or descending) is set by a two-state button that displays an up or a down arrow.

You can use multiple map items with the atlas generation; each map will be rendered according to the coverage features. To enable atlas generation for a specific map item, you need to check *Controlled by Atlas* under the item properties of the map item. Once checked, you can set:

- An input box *Margin around feature* that allows you to select the amount of space added around each geometry within the allocated map. Its value is meaningful only when using the auto-scaling mode.
- A *Fixed scale* that allows you to toggle between auto-scale and fixed-scale mode. In fixed-scale mode, the map will only be translated for each geometry to be centered. In auto-scale mode, the map's extents are computed in such a way that each geometry will appear in its entirety.

18.6.1 Labels

In order to adapt labels to the feature the atlas plugin iterates over, use a label with this special notation *[%expression using field_name %]*. For example, for a city layer with fields CITY_NAME and ZIPCODE, you could insert this:

"*[% 'The area of ' || upper(CITY_NAME) || ',' || ZIPCODE || ' is ' format_number($area/1000000,2) || ' km2' %]*"

That would result in the generated atlas as

"*The area of PARIS,75001 is 1.94 km2*".

18.6.2 Preview

Once the atlas settings have been configured and map items selected, you can create a preview of all the pages by clicking on *Atlas* → *Preview Atlas* and using the arrows, in the same menu, to navigate through all the features.

18.6.3 Generation

The atlas generation can be done in different ways. For example, with *Atlas* → *Print Atlas*, you can directly print it. You can also create a PDF using *Atlas* → *Export Atlas as PDF*: The user will be asked for a directory for saving all the generated PDF files (except if the *Single file export when possible* has been selected). If you need to print just a page of the atlas, simply start the preview function, select the page you need and click on *Composer* → *Print* (or create a PDF).

18.7 Creating Output

Figure_composer_30 shows the Print Composer with an example print layout, including each type of map element described in the sections above.

The Print Composer allows you to create several output formats, and it is possible to define 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 installed printer drivers.

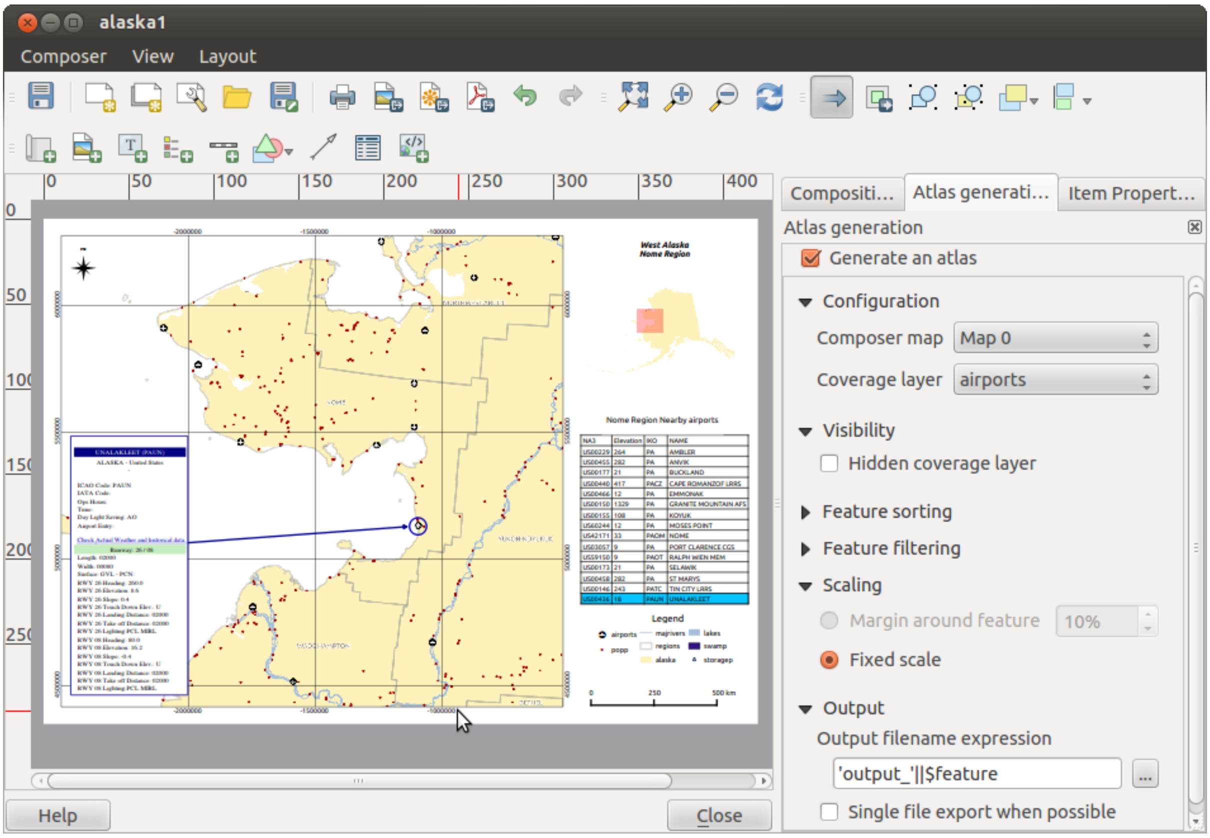

Figura 18.30: Print Composer with map view, legend, image, scale bar, coordinates, text and HTML frame added

- The Export as image icon exports the Composer canvas in several image formats, such as PNG, BPM, TIF, JPG,...
- Export as PDF saves the defined Print Composer canvas directly as a PDF.
- The Export as SVG icon saves the Print Composer canvas as an SVG (Scalable Vector Graphic).

If you need to export your layout as a **georeferenced image** (i.e., to load back inside QGIS), you need to enable this feature under the Composition tab. Check *World file on* and choose the map item to use. With this option, the 'Export as image' action will create also a world file.

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. Exporting big rasters can sometimes fail, even if there seems to be enough memory. This is also a problem with the underlying Qt management of rasters.

18.8 Manage the Composer

With the Save as template and Load from template icons, you can save the current state of a Print Composer session as a `.qpt` template and load the template again in another session.

The Composer Manager button in the QGIS toolbar and in *Composer* → *Composer Manager* allows you to add a new Composer template, create a new composition based on a previously saved template or to manage already existing templates.

By default, the Composer manager searches for user templates in ~/.qgis2/composer_template.

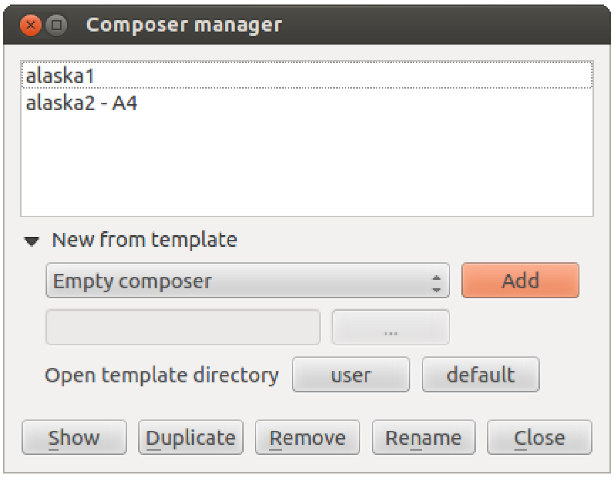

Figura 18.31: The Print Composer Manager

The New Composer and Duplicate Composer buttons in the QGIS toolbar and in *Composer* → *New Composer* and *Composer* → *Duplicate Composer* allow you to open a new Composer dialog, or to duplicate an existing composition from a previously created one.

Finally, you can save your print composition with the Save Project button. This is the same feature as in the QGIS main window. All changes will be saved in a QGIS project file.

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Complementos

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19.1 QGIS Complementos

QGIS ha sido diseñado con la arquitectura de un complemento. Esto permite que muchas nuevas características y funciones sean fácil de añadir a la aplicación. Muchas de las características en QGIS están actualmente implementadas como complementos.

19.1.1 The Plugins Menus

The menus in the Plugins dialog allow the user to install, uninstall and upgrade plugins in different ways.

Todos

Aquí, todos los complementos disponibles están listados, incluyendo los complementos base y externos. Use **[Actualizar todo]** para buscar nuevas versiones de los complementos. Además, puede usar **[Instalar complemento]**, si un complemento esta listado pero no instalado, y **[Desinstalar complemento]** así como **[Reinstalar complemento]**, si un complemento esta instalado. Si uno esta instalado, puede ser desactivado o activado utilizando la casilla de verificación.

Instalado

En este menú, se pueden encontrar solo los complementos instalados. Los complementos instalados pueden ser desinstalados y reinstalados usando los botones **[Desinstalar complemento]** y **[Reinstalar complemento]**. Se puede **[Actualizar todo]** aquí también.

No instalado

Este menú lista todos los complementos disponibles que no están instalados. Se puede usar el botón **[Instalar complemento]** para ejecutar un complemento en QGIS.

Actualizable

Si se activa *Mostrar también los complementos experimentales* en el menú *Configuración*, se puede usar el menú para buscar versiones de complementos más recientes. Esto se puede hacer con los botones **[Actualizar complementos]** o **[Actualizar todos]**.

Configuración

Este menú, puede utilizar las siguientes opciones:

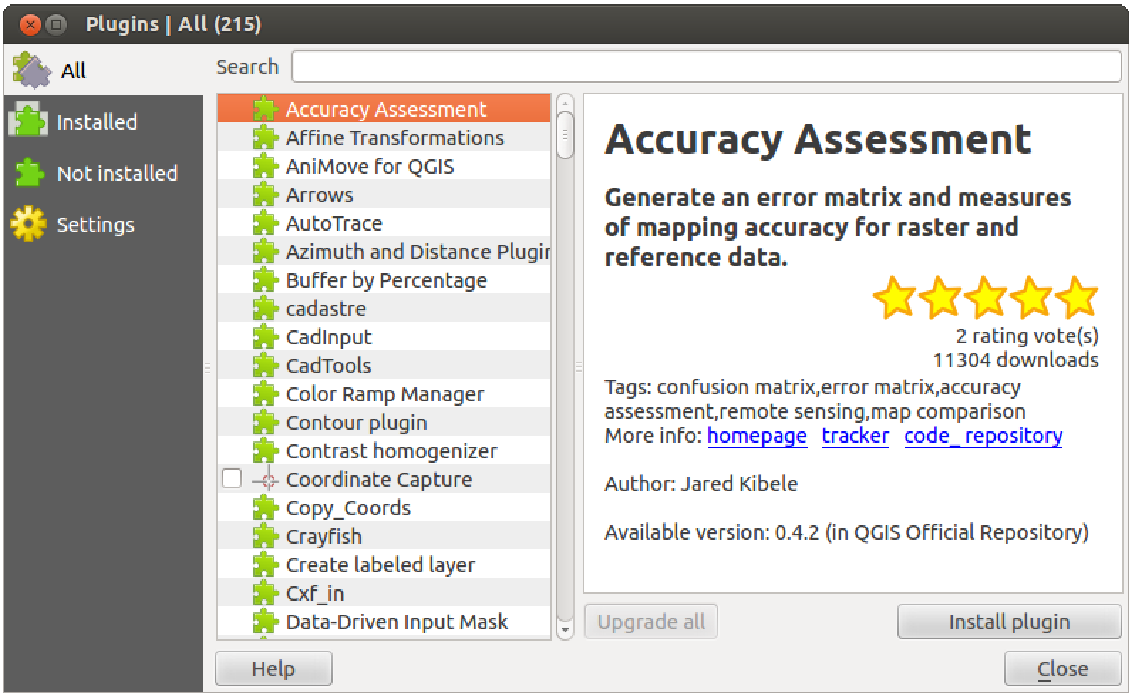

Figura 19.1: El menú *Todos*

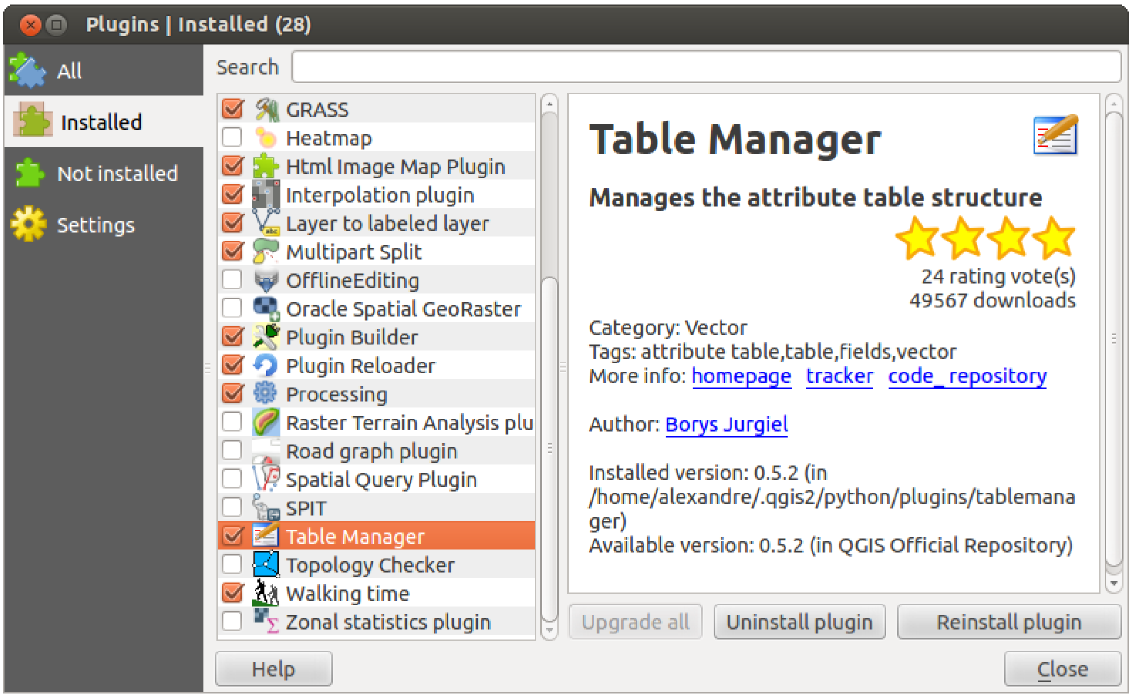

Figura 19.2: El menú *Instalado*

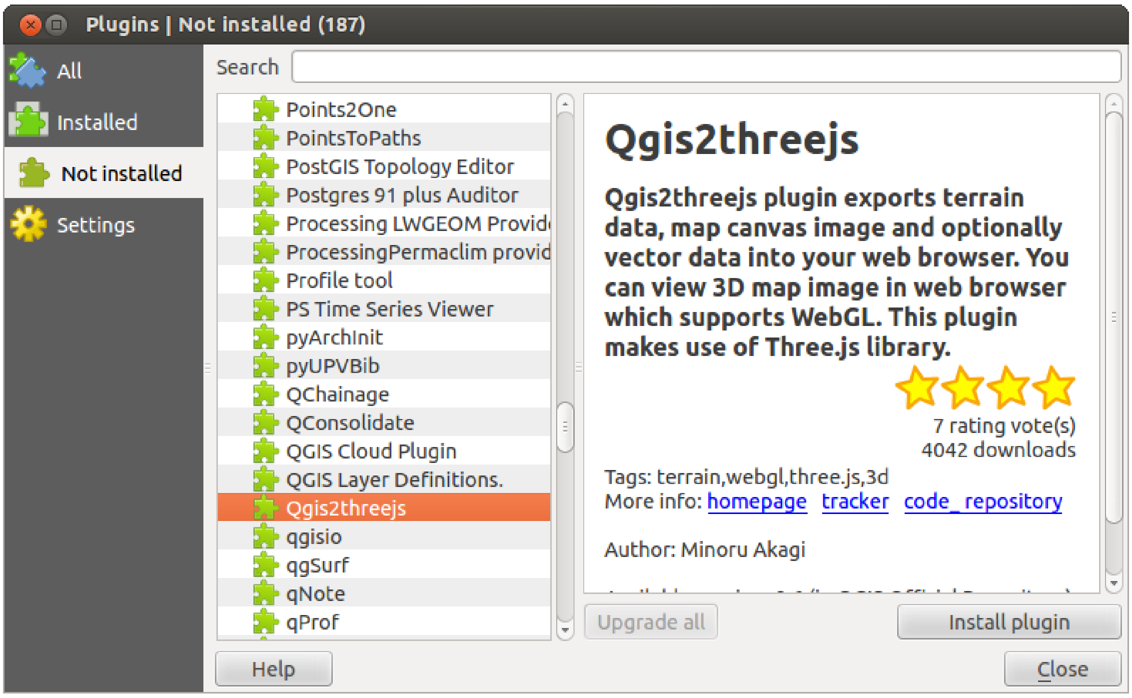

Figura 19.3: El menú *No instalado*

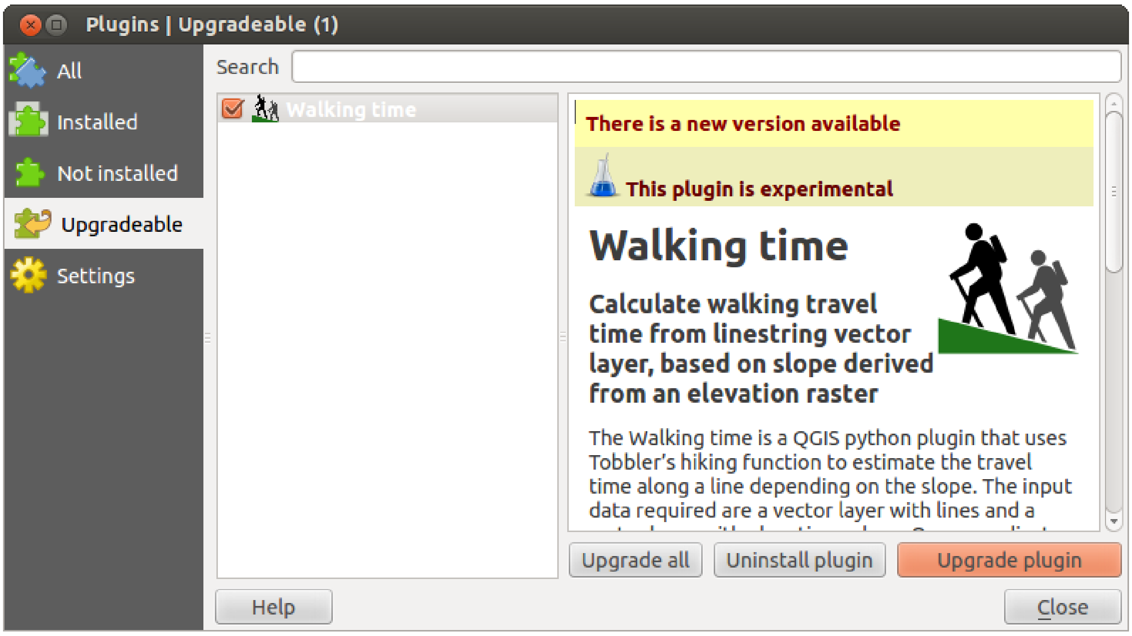

Figura 19.4: El menú *Actualizable*

- *Comprobar actualizaciones al inicio*. Siempre que un nuevo complemento o actualización de complemento esta disponible, QGIS informará 'cada vez que se inicia QGIS', 'una vez al día', 'cada 3 días', 'cada semana', 'cada 2 semanas' o 'cada mes'.
- *Mostrar también los complementos experimentales*. QGIS mostrará complementos en etapas tempranas de desarrollo, que son generalmente inadecuados para su uso en producción.
- *Mostrar también complementos obsoletos*. Estos complementos están en desuso y generalmente no aptos para uso en producción.

Para añadir un repositorio de un autor externo, haga clic **[Añadir...]** en la sección *Repositorios de complementos*. Si no desea uno o más de los repositorios añadidos, se pueden deshabilitar con el botón **[Editar...]**, o eliminar completamente con el botón **[Borrar]**

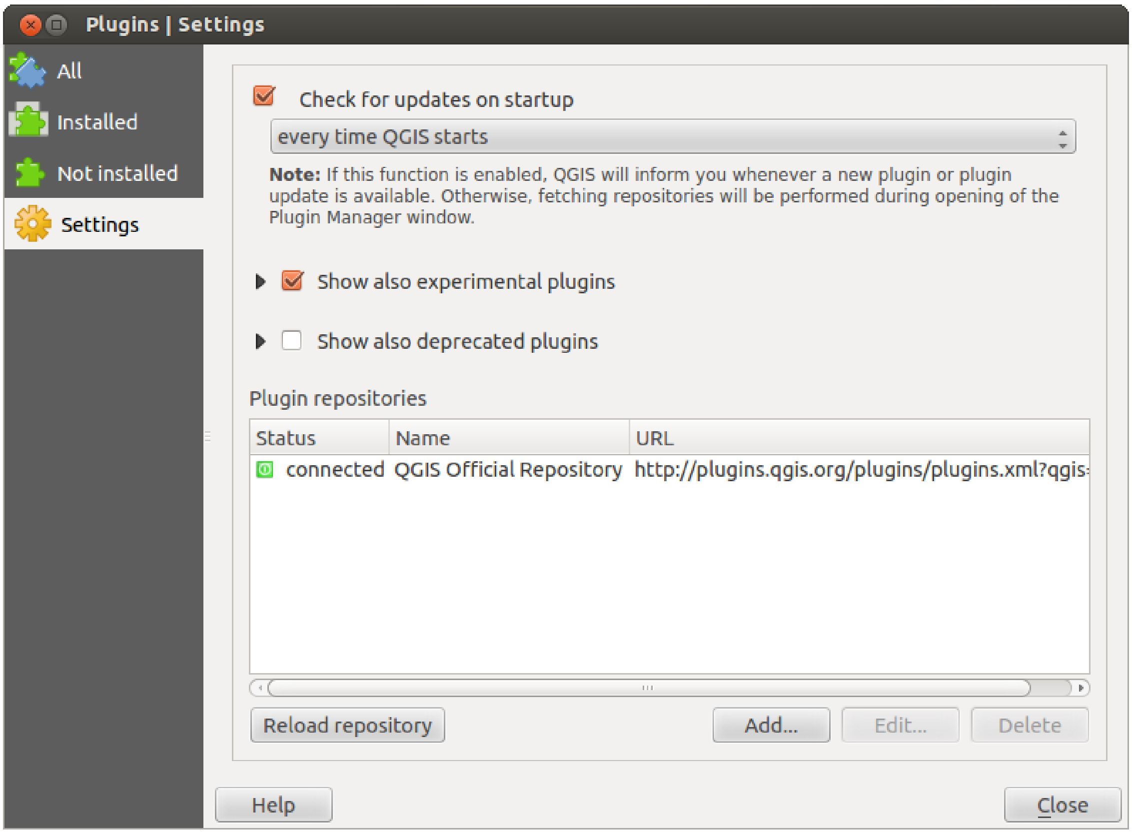

Figura 19.5: El menú *Configuración*

La función *Buscar* esta disponible en casi cada menú (excepto *Configuración*). Aquí, se pueden buscar complemento específicos.

Truco: Complementos base y externos

Los complementos de QGIS se ejecutan, ya sea como **Complementos base** o **Complementos Externos**. Los **Complementos Base** son mantenidos por el equipo de desarrollo QGIS y son automáticamente parte de cada distribución de QGIS. Están escritas en uno de los dos lenguajes: C++ o Python. Los **Complementos Externos** actualmente todo esta escrito en Python. Se almacenan en repositorios externos y son mantenidos por autores individuales.

La documentación detallada sobre el uso, mínimo de la versión de QGIS, página de inicio, autores, y otra información importante se proporcionan para el repositorio 'Oficial' de QGIS en http://plugins.qgis.org/plugins/. Para otros repositorios externos, puede haber documentación en los propios complementos externos. En general, no se incluye en este manual.

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19.2 Usar complementos núcleo de QGIS

Icono	Complemento	Descripción	Manual de referencia
	Captura de coordenadas	Captura de coordenadas del ratón en diferentes SRC	*Complemento Captura de coordenadas*
	DB Manager	Administrar la base de datos dentro de QGIS	*Complemento administrador de BBDD*
	Conversor DXF2Shp	Convertir de archivo DXF a formato SHP	*Complemento Conversor DxfaShp*
	eVis	Herramienta de visualización de eventos	*Complemento Visualización de Eventos*
	fTools	Un conjunto de herramientas vectoriales	*Complemento fTools*
	Herramientas de GPS	Herramientas para cargar e importar datos GPS	*GPS Plugin*
	GRASS	Funcionalidad GRASS	*GRASS GIS Integration*
	Herramientas GDAL	Funcionalidad ráster GDAL	*Complemento Herramientas de GDAL*
	Georreferenciador GDAL	Georeferenciación de rásteres con GDAL	*Complemento Georreferenciador*
	Mapa de calor	Crear mapa de calor de un capa de puntos de entrada.	*Complemento Mapa de calor*
	Complemento de interpolación	Interpolación en base a vétices de una capa vectorial	*Complemento de interpolación*
	Edición fuera de línea	Edición fuera de línea y sincronización con la base de datos	*Complemento Edición fuera de linea*
	Georaster Espacial de Oracle	Acceso a Georasters Espaciales de Oracle	*Complemento GeoRaster espacial de Oracle*
	Administrar complementos	Administrar complementos núcleo y externos	*The Plugins Menus*
	Análisis del terreno ráster	Calcular entidades geomorfológica de un DEMs	*Complemento Análisis de Terreno*
	Complemento Grafo de rutas	Análisis de la ruta más corta	*Complemento Grafo de rutas*
	Complemento SQL Anywhere	Acceso a BD SQL anywhere	*Complemento SQL Anywhere*
	Consulta espacial	Consulta espacial en vectores	*Complemento Consulta espacial*
	SPIT	Herramienta para importar archivo shape a PostGIS	*Complemento SPIT*
	Estadísticas de zona	Calcular estadísticas de ráster para polígonos.	*Complemento de Estadísticas de zona*

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19.3 Complemento Captura de coordenadas

El complemento de captura de coordenadas es fácil de usar y proporciona la capacidad de mostrar coordenadas en la vista del mapa para dos sistemas de referencia de coordenadas (SRC).

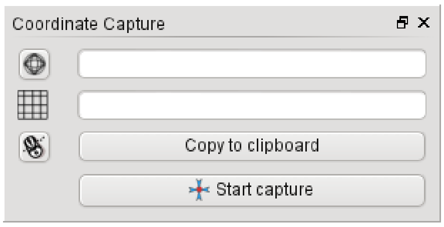

Figura 19.6: Complemento Captura de coordenadas

1. Inicie QGIS, seleccione *Propiedades del proyecto* del menú *Configuración* (KDE, Windows) o *Archivo* (Gnome, OSX) y pulse la pestaña *Proyección*. Como alternativa, también puede pulsar el icono Estado del SRC en la esquina inferior derecha de la barra de estado.
2. Pulse en la casilla de verificación *Activar transformación de SRC al vuelo* y seleccione un sistema de coordenadas proyectadas de su elección (vea también *Working with Projections*)
3. Load the coordinate capture plugin in the Plugin Manager (see *load_core_plugin*) and ensure that the dialog is visible by going to *View* → *Panels* and ensuring that *Coordinate Capture* is enabled. The coordinate capture dialog appears as shown in Figure figure_coordinate_capture_1. Alternatively, you can also go to *Vector* → *Coordinate Capture* and see if *Coordinate Capture* is enabled.
4. Haga clic en el icono Pulse para seleccionar el SRC a usar para la visualización de coordenadas y elija un SRC diferente al que seleccionó anteriormente.
5. Para empezar a capturar coordenadas, pulse **[Comenzar captura]**. Ahora puede hacer clic en cualquier lugar de la vista del mapa y el complemento mostrará las coordenadas en ambos SRC seleccionados.
6. Para habilitar el seguimiento de coordenadas del ratón, pulse el icono Seguimiento del ratón.
7. También se pueden copiar las coordenadas seleccionadas al portapapeles.

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19.4 Complemento administrador de BBDD

El complemento administrador de BBDD es oficialmente parte del núcleo de QGIS y tiene por objeto sustituir el complemento SPIT y además, para integrar otros formatos de base de datos soportados por QGIS en una interfaz de usuario. El complemento Administrador de BBDD proporciona varias características. Se pueden arrastrar capas desde el navegador de QGIS al Administrador de BBDD y se importarán a la base de datos espacial. Se puede arrastrar y soltar capas entre base de datos espacial y se importarán. Se puede usar también el Administrador de BBDD para ejecutar consultas SQL contra su base de datos espacial y luego ver la salida espacial de las consultas al agregar el resultado a QGIS como una capa de consulta.

El menú *Base de datos* permite conectar a una base de datos existente, para iniciar la ventana de SQL y para finalizar el componente de Administrador de BBDD. Una vez que este conectado a la base de datos existente, los menús *Esquema* y *Tabla* aparecerá de forma adicional.

EL menú *Esquema* incluye herramientas para crear y eliminar (vaciar) esquemas y, si la topología esta disponible (e.j., PostGIS 2), iniciar un *TopoViewer*.

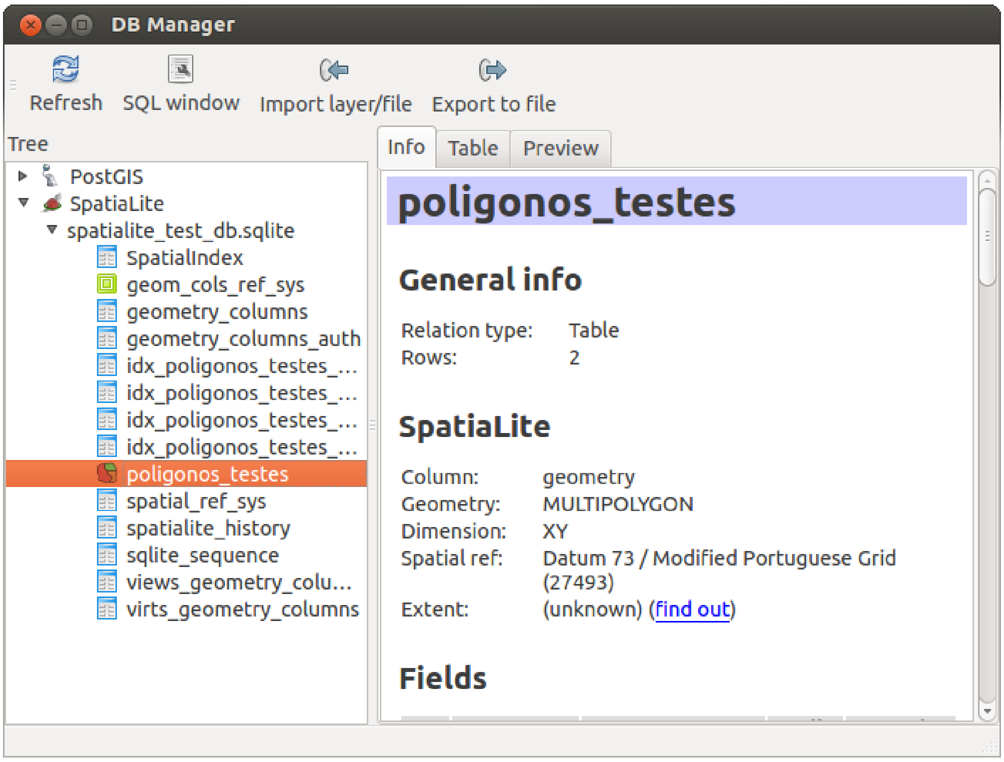

Figura 19.7: Diálogo del complemento administrador de BBDD

El menú *Tabla* permite crear y editar tablas y eliminar tablas y vistas. También es posible vaciar tablas y moverlas de un esquema a otro. Como función adicional, se puede realizar un VACUUM y luego un ANALYZE para cada tabla seleccionada. VACUUM simplemente recupera espacio y hace que este disponible para reusarlo. ANALYZE actualiza las estadisticas para determinar la forma más eficiente de ejecutar una consulta. Finalmente, se pueden importar capas/archivos, si estan cargados en QGIS o existen en el sistema de archivos. Y se puede exportar tablas de la base de datos a archivo vectorial con la función "Exportar archivo".

La ventana *Árbol* muestra todas las bases de datos soportadas por QGIS. Con un doble-clic, se puede conectar a la base de datos. Con el botón derecho del ratón, se puede cambiar el nombre y eliminar las tablas y esquemas existentes. Las tablas también se pueden agregar al lienzo de QGIS con el menú contextual.

Si se está conectado a una base de datos, la ventana **principal** del Administrador de BBDD ofrece tres pestañas. La pestaña *Info* proporciona información acerca de la tabla y su geometría, así como de los campos existentes, limitaciones e índices. También permite que ejecute Vacuum Analyze y crear índices espaciales en una tabla seleccionada, si no está ya hecho. La pestaña de *Tabla* muestra todos los atributos y la pestaña *Vista preliminar* representa las geometrías como vista previa.

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19.5 Complemento Conversor DxfaShp

El complemento Conversor DxfaShp se puede usar para convertir datos vectoriales del formato DXF a archivo shape. Requiere que se especifiquen los siguientes parámetros antes de ejecutarlo:

- **Archivo DXF de entrada**: Introduzca la ruta al archivo DXF a convertir.
- **Archivo shp de salida**: Introduzca el nombre deseado para el archivo shape a crear.
- **Tipo de archivo de salida**: Especificar el tipo de geometría del archivo de salida. Actualmente los tipos soportados son polilíneas, polígonos y puntos.
- **Exportar etiquetas de texto**: Cuando esta casilla de verificación esta habilitada, se creará una capa de puntos adicional, y la tabla DBF asociada contendrá información sobre los campos "texto" que se encuentran

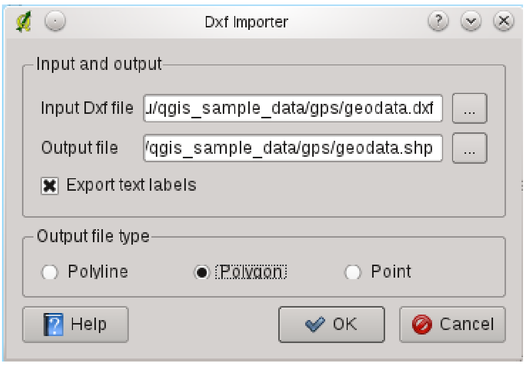

Figura 19.8: Complemento Conversor DxfaShp

en el archivo DXF y las cadenas de texto en sí.

19.5.1 Usar el complemento

1. Iniciar QGIS, cargar el complemento DxfaShape en el Administrador de complementos (vea *The Plugins Menus*) y hacer clic en el icono Conversor DxfaShp, que aparece en el menú de barras de herramientas de QGIS. El diálogo del complemento Dxf2Shape aparece, como se muestra en Figure_dxf2shape_1.
2. Introduzca el archivo DXF de entrada, un nombre para el archivo shape de salida y el tipo de archivo shape.
3. Habilitar la casilla de verificación *Exportar etiquetas de texto* si desea crear una capa extra de puntos con etiquetas.
4. Hacer clic en **[Aceptar]**

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19.6 Complemento Visualización de Eventos

(En esta sección se deriva de Horning, N., K, Koy, P. Ersts. 2009. eVis (v1.1.0) Guía de Usuario. Museo Americano de Historia Natural, Centro para la Biodiversidad y Conservación. Disponible de http://biodiversityinformatics.amnh.org/, y realizado bajo GNU FDL.)

El mecanismo de información sobre biodiversidad en el Museo Americano de Historia Natural(AMNH) Centro para la Biodiversidad y la Conservación (CBC) ha desarrollado la herramienta de visualización de eventos (eVis), otra herramienta de software para añadir al suite de monitoreo de conservación y herramienta de apoyo a las decisiones para guiar un área protegida y la planificación del paisaje. Este complemento permite a los usuarios enlazar fácilmente la geocodificación (es decir., se hacer referencia con latitud y longitud o coordenadas X y Y) de fotografías, y otros documentos de apoyo, a los datos vectoriales en QGIS.

eVis ahora esta automáticamente instalado y habilitado en nuevas versiones de QGIS, y como todos los demás complementos, se puede habilitar y deshabilitar utilizando el Administrador de Complementos (ver *The Plugins Menus*).

El complemento de visualización de eventos se compone de tres módulos: la 'Herramienta para conexión a la base de datos', 'Herramienta de ID evento', y el 'Eventos del navegador'. Estos trabajan juntos para permitir la visualización de fotografías geocodificadas y otros documentos que están vinculados a objetos espaciales almacenados en archivo de vectores, base de datos o hojas de cálculo.

19.6.1 Explorador de Eventos

El módulo de Explorador de eventos proporciona la funcionalidad de desplegar fotografías geocodificadas que están vinculadas con un objetos espacial vectorial desplegado en la ventana de mapa de QGIS. Datos específicos, por ejemplo, puede ser desde un archivo vectorial que se puede ingresar mediante QGIS o puede ser a partir del resultado de una consulta de base de datos. El vector del objeto espacial debe tener información del atributo asociado con él para describir la ubicación y el nombre del archivo que contiene la fotografía y, opcionalmente, la dirección de la brújula de la cámara fue indicado cuando fue adquirida la imagen. Su capa vectorial se debe cargar en QGIS antes de ejecutar el explorador de eventos.

Iniciar el módulo de Explorador de eventos

Para poner en marcha el modulo Explorador de Eventos, haga clic en *Base de datos→ eVis → Explorador de Eventos eVis*. Esto abrirá la ventana *Explorador de Eventos Genérico*.

La ventana *Explorador de eventos* tiene tres pestañas desplegadas en la parte superior de la ventana. La pestaña *Visualizar* se utiliza para ver las fotografías y los datos de sus atributos asociados. La pestaña *Opciones* proporciona un número de ajustes para controlar el funcionamiento del complemento eVis. Por último, la pestaña *Configuración de aplicaciones externas* se utiliza para mantener una tabla de extensiones de archivos y su aplicación asociada para permitir a eVis desplegar documentos que no sean imágenes.

Comprender la ventana Visualizar

Para ver la ventana *Visualizar*, haga clic en la pestaña *Visualizar* en la ventana *Explorador de Eventos*. La ventana *Visualizar* se utiliza para visualizar las fotografías geocodificadas y los atributos asociados a ellas.

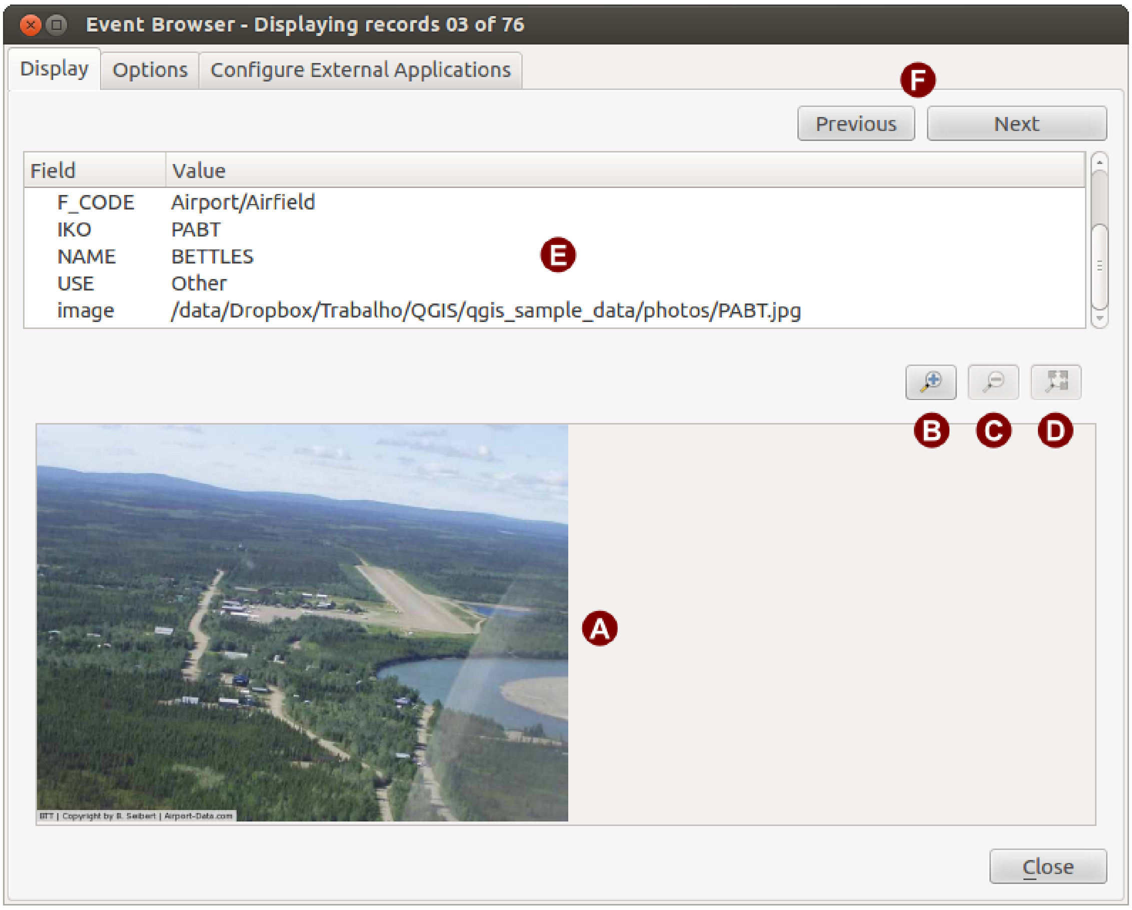

Figura 19.9: La ventana de *eVis* visualizar

1. **Ventana de Visualizar**: Una ventana donde la fotografía aparece.
2. **Botón de Acercar zoom**: Acercar zoom para ver más detalle. Si la imagen completa no puede ser visualizada en la ventana de visualizar, las barras de desplazamiento aparecerán en del lado izquierdo e inferior

de la ventana para permitirle desplazarse por la imagen.

3. **Botón de Alejar zoom**: Alejar zoom para ver más área.
4. Botón **Zum general**: Despliega la fotografía completa.
5. **Ventana de información de atributos**: Toda la información de atributos del punto asociado con la foto que se está viendo se muestra aquí. Si el tipo de archivo al que hace referencia del registro mostrado no es una imagen sino un tipo de archivo definido en la pestaña *Configurar aplicaciones externas* cuando haga doble clic en el valor del campo que contiene la ruta al archivo se abrirá la aplicación para ver u oír el contenido del archivo. Si se reconoce la extensión del archivo los datos de los atributos se mostrarán en verde.
6. **Botones de Navegación**: Utiliza el botón anterior y siguiente para cargar el objeto anterior o siguiente cuando mas de un objeto espacial esta seleccionado.

Comprender la ventana de Opciones

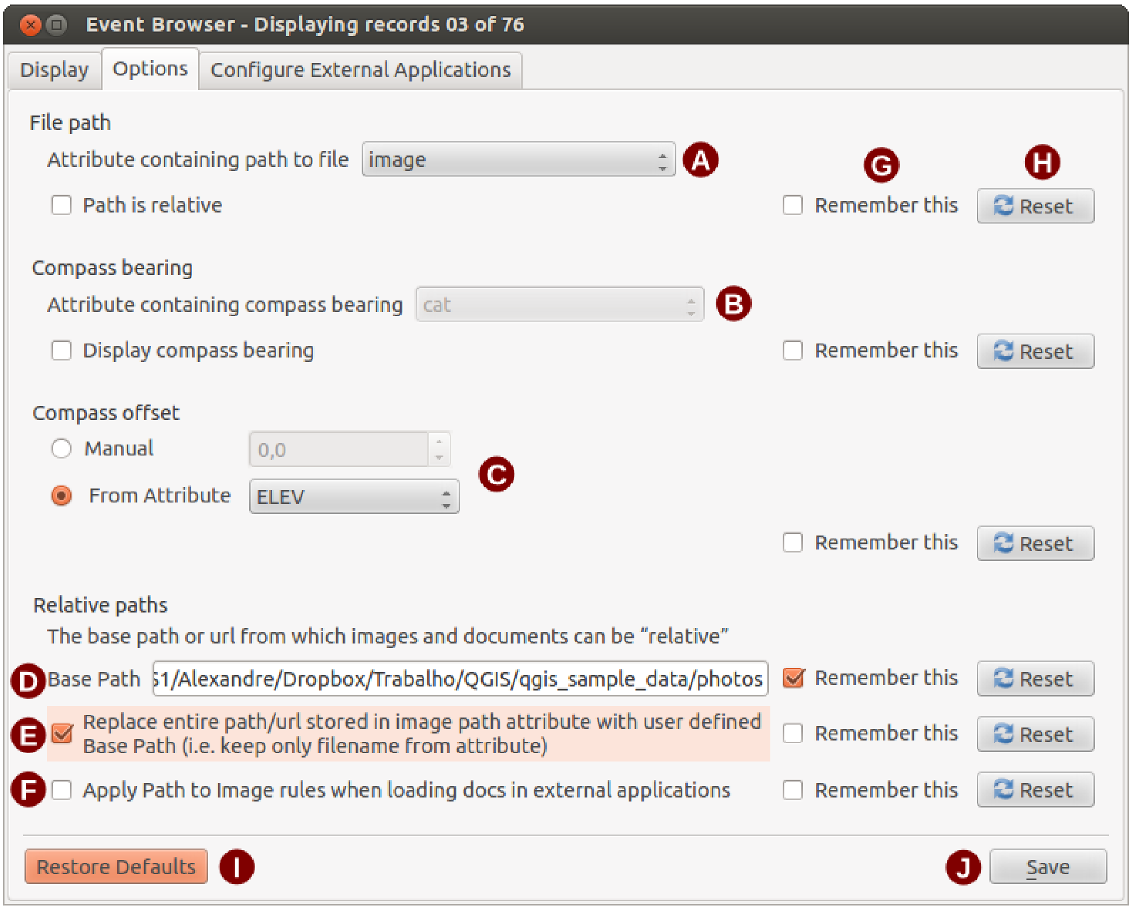

Figura 19.10: La ventana de *eVis* Opciones

1. **Ruta del archivo**: Una lista desplegable para especificar el campo de atributo que contiene la ruta del directorio o URL para las fotografías u otros documentos que se muestran. Si la ubicación es una ruta relativa, entonces la casilla de verificacion debe hacer clic. LA ruta base para una ruta relativa puede ser introducida en la caja de texto *Ruta Base* a continuación. La información sobre las diferentes opciones para especificar la ubicación del archivo se indica en la sección *Especificar la ubicación y nombre de la fotografía* a continuación.
2. **Rumbo de la brújula**: Una lista desplegable para especificar el campo de atributo que contiene el rumbo de la brújula asociado con las fotografías que se muestran. Si la información del rumbo de la brújula esta disponible, es necesario hacer clic en casilla de verificación a continuación el título del menú desplegable.

3. **Desplazamiento de la brújula**: El desplazamiento de la brújula se puede utilizar para compensar la declinación (para ajustar los rodamientos recolectados usando cojinetes magnéticos para el rumbo del norte verdadero). Haga clic en el botón de radio *Manual* para ingresar el desplazamiento en la caja de texto o haga clic en el botón de radio *De atributo* para seleccionar el campo del atributo que contiene los desplazamientos. Para ambas opciones, declinaciones del este deben introducirse utilizando valores positivos, y declinaciones al oeste deben utilizar valores negativos.
4. **Ruta del archivo**: La ruta de la base sobre la que se añadirá la ruta relativa se define en Figure_eVis_2 (A).
5. **Sustituir la ruta**: Si esta casilla de verificación esta marcada, solo el nombre del archivo de A se anexará a la ruta base.
6. **Aplicar regla a todos los documentos**: Si se marco, las mismas reglas de ruta que están definidas para las fotografías se utilizarán para los documentos sin imagen, tales como películas, documentos de texto y archivos de sonido. Si no se marca, las reglas de ruta sólo se aplicarán a las fotografías, y los otros documentos ignorarán el parámetro de la ruta base.
7. **Recordar ajustes**: Si la casilla de verificación es marcada, los valores de los parámetros asociados se guardarán para la siguiente sesión cuando la ventana se cierra o cuando el botón **[Guardar]** de abajo sea presionado.
8. **Restablecer**: Restablecer los valores en esta línea a la configuración predeterminada.
9. **Restaurar los valores predeterminados**: Esto restablecerá todos los campos a su configuración predeterminada. Tiene el mismo efecto hacer clic en todos los botones de **[Restablecer]**.
10. **Guardar**: Esto guardará los ajustes sin cerrar el panel *Opciones*.

Comprender la ventana de Configurar aplicaciones externas

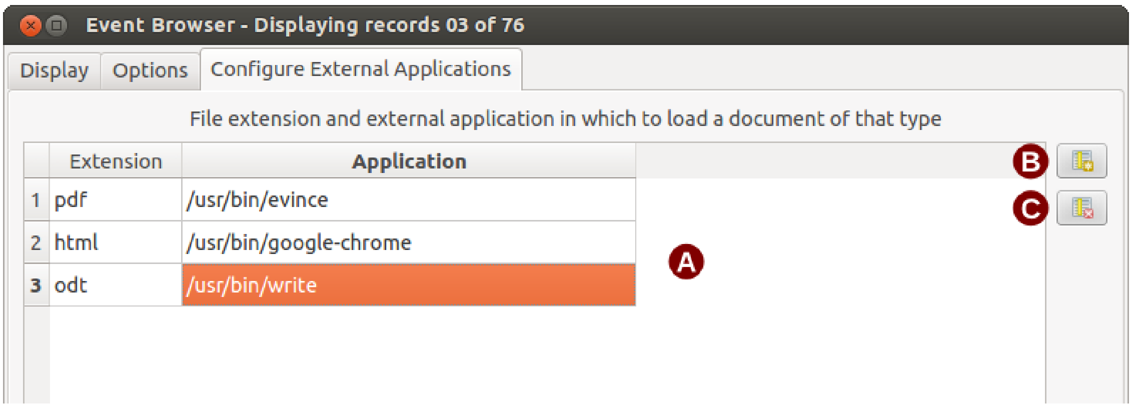

Figura 19.11: La ventana de *eVis* Aplicaciones externas

1. **Tabla de referencia de archivo**: Una tabla contiene los tipos de archivo que se pueden abrir utilizando eVis. Cada tipo de archivo necesita una extensión de archivo y la ruta de una aplicación que pueda abrir ese tipo de archivo. Esto proporciona la capacidad de abrir una amplia gama de archivos tales como películas, grabaciones sonoras y documentos de texto en lugar de solo imágenes.
2. **Añadir nuevo tipo de archivo**: Añadir un nuevo tipo de archivo con una única extensión y la ruta para la aplicación que puede abrirlo.
3. **Borrar la fila actual**: Borrar el tipo de archivo destacado en la tabla y definido por una extensión de archivo y una ruta a una aplicación asociada.

19.6.2 Especificar la ubicación y nombre de la fotografía

La ubicación y nombre de la fotografía se pueda almacenar utilizando una ruta relativa o absoluta, o una URL, si la fotografía esta disponible en el servidor web. Ejemplos de los diferentes enfoques están listados en la tabla evis_examples.

```
X         Y         FILE                                               BEARING
780596    1784017   C:\Workshop\eVis_Data\groundphotos\DSC_0168.JPG    275
780596    1784017   /groundphotos/DSC_0169.JPG                         80
780819    1784015   http://biodiversityinformatics.amnh.org/\
                    evis_testdata/DSC_0170.JPG                         10
780596    1784017   pdf:http://www.testsite.com/attachments.php?\
                    attachment_id-12                                   76
```

19.6.3 Especificar la ubicación y nombre de otros documentos soportados

Los documentos de apoyo tales como documentos de texto, videos, y clips de sonido también se pueden visualizar o reproducir por eVis. Para ello, es necesario añadir una entrada en el archivo de tabla de referencia que se puede acceder desde la ventana *Configurar Aplicaciones Externas ' en el :guilabel:'Generic Event Browser* que coincide con la extensión de archivo a una aplicación que se puede utilizar para abrir el archivo. También es necesario disponer de la ruta o URL para el archivo en la tabla de atributos de la capa vectorial. Una regla adicional que puede ser utilizada para las direcciones URL que no contienen una extensión de archivo para el documento que desea abrir es especificar la extensión del archivo antes de la URL. El formato es — `file extension:URL`. La URL es precedida por la extensión de archivo y dos puntos; esto es particularmente útil para el acceso a los mismos a partir de los wikis y otros sitios web que utilizan una base de datos para gestionar las páginas web (véase Table evis_examples).

19.6.4 Utilizar el Explorador de eventos

Cuando la ventana :guilabel: *Navegador de Eventos* se abre, una fotografía aparecerá en la pantalla si el documento se hace referencia en la tabla de atributos de archivo vectorial es una imagen y si la información de la ubicación del archivo en la ventana *Opciones* es correctamente establecida. Si se espera una fotografía y no aparece, será necesario ajustar los parámetros en la ventana :guilabel: *Opciones*.

Si un documento de apoyo (o una imagen que no tiene una extensión de archivo reconocido por eVis) se hace referencia en la tabla de atributos, el campo que contiene la ruta del archivo se resaltará en verde en la ventana de información de atributos si esa extensión de archivo se define en el archivo de la tabla de referencia se encuentra en la ventana *Configurar Aplicaciones Externas*. Para abrir el documento, haga doble clic en la línea verde resaltado en la ventana de información de atributos. Si un documento de apoyo se hace referencia en la ventana de información de atributos y la ruta del archivo no está resaltado en verde, entonces será necesario añadir una entrada para la extensión de nombre de archivo del archivo en la ventana *Configurar Aplicaciones Externas*. Si la ruta del archivo se resalta en verde, pero no se abre al hacer doble clic, será necesario ajustar los parámetros en la ventana :guilabel: *Opciones* por lo que el archivo puede ser localizado por eVis.

Si no se proporciona una brújula en la ventana :guilabel: *Opciones*, un asterisco rojo se mostrará en la parte superior de la característica de vector que se asocia con la fotografía que se muestra. Si se proporciona una brújula, a continuación, aparecerá una flecha apuntando en la dirección indicada por el valor en el campo de visualización de brújula en la ventana :guilabel: *Navegador de Eventos*. La flecha estará centrado sobre el punto que se asocia con la fotografía u otro documento.

Para cerrar la ventana *Explorador de eventos*, haga clic en el botón **[Cerrar]** de la ventana *Visualizar*.

19.6.5 Herramienta ID evento

The 'Event ID' module allows you to display a photograph by clicking on a feature displayed in the QGIS map window. The vector feature must have attribute information associated with it to describe the location and name of the file containing the photograph and, optionally, the compass direction the camera was pointed when the image was acquired. This layer must be loaded into QGIS before running the 'Event ID' tool.

Iniciar el módulo ID evento

To launch the 'Event ID' module, either click on the Event ID icon or click on *Database* → *eVis* → *Event ID Tool*. This will cause the cursor to change to an arrow with an 'i' on top of it signifying that the ID tool is active.

Para ver las fotografías vinculadas con entidades vectoriales en la capa vectorial activa se muestra en la ventana de mapa de QGIS, mova el cursor del Evento ID sobre el objeto espacial y hacer clic en el ratón. Después de hacer clic en el objeto, la ventana *Explorador de eventos* se abrirá y las fotografías sobre o cerca de la ubicación donde se ha hecho clic están disponibles para su visualización en el navegador. Si más de una fotografía está disponible, se puede rotar entre las distintas entidades utilizando los botones ** [Anterior] ** y ** [Siguiente] **. Los otros controles se describen en la sección ref:*evis_browser* de esta guía.

19.6.6 Conexión a base de datos

El módulo 'Conexión a base de datos' proporciona herramientas para conectar a y consultar una base de datos u otros recursos ODBC, tales como una hoja de cálculo.

eVis can directly connect to the following types of databases: PostgreSQL, MySQL, and SQLite; it can also read from ODBC connections (e.g., MS Access). When reading from an ODBC database (such as an Excel spreadsheet), it is necessary to configure your ODBC driver for the operating system you are using.

Iniciar el módulo de Conexión a base de datos

To launch the 'Database Connection' module, either click on the appropriate icon eVis Database Connection or click on *Database* → *eVis* → *Database Connection*. This will launch the *Database Connection* window. The window has three tabs: *Predefined Queries*, *Database Connection*, and *SQL Query*. The *Output Console* window at the bottom of the window displays the status of actions initiated by the different sections of this module.

Conectar a una base de datos

Click on the *Database Connection* tab to open the database connection interface. Next, use the *Database Type* combo box to select the type of database that you want to connect to. If a password or username is required, that information can be entered in the *Username* and *Password* textboxes.

Introduzca el host de base de datos en el cuadro de texto :guilabel: *Host de Base de Datos*. Esta opción no está disponible si ha seleccionado 'MS Access' como el tipo de base de datos. Si la base de datos reside en su equipo, usted debe seleccionar "localhost".

Introducir el nombre de la base de datos en la caja de texto *Nombre de la base de datos*. Si seleccionó 'ODBC' como el tipo de base de datos, es necesario introducir el nombre de la fuente de datos.

When all of the parameters are filled in, click on the **[Connect]** button. If the connection is successful, a message will be written in the *Output Console* window stating that the connection was established. If a connection was not established, you will need to check that the correct parameters were entered above.

1. **Tipo de base de datos**: Una lista desplegable para especificar el tipo de base de datos que se utilizará.
2. **Host de la base de datos**: El nombre del host de la base de datos.
3. **Puerto**: El numero de puerto si una un tipo de base de datos MySQL o PostgreSQL es seleccionado.
4. **Nombre de la base de datos**: EL nombre de la base de datos.
5. **Conectar**: Un botón para conectar a la base de datos utilizando los parámetros definidos anteriormente.
6. **Salidas a la Consola**: La ventana de consola donde los mensajes relacionados a procesos son mostrados.
7. **Nombre del Usuario**: Nombre del usuario para utilizar cuando una base de datos este protegida con contraseña.
8. **Contraseña**: Para usar cuando la base de datos esta protegida con contraseña.

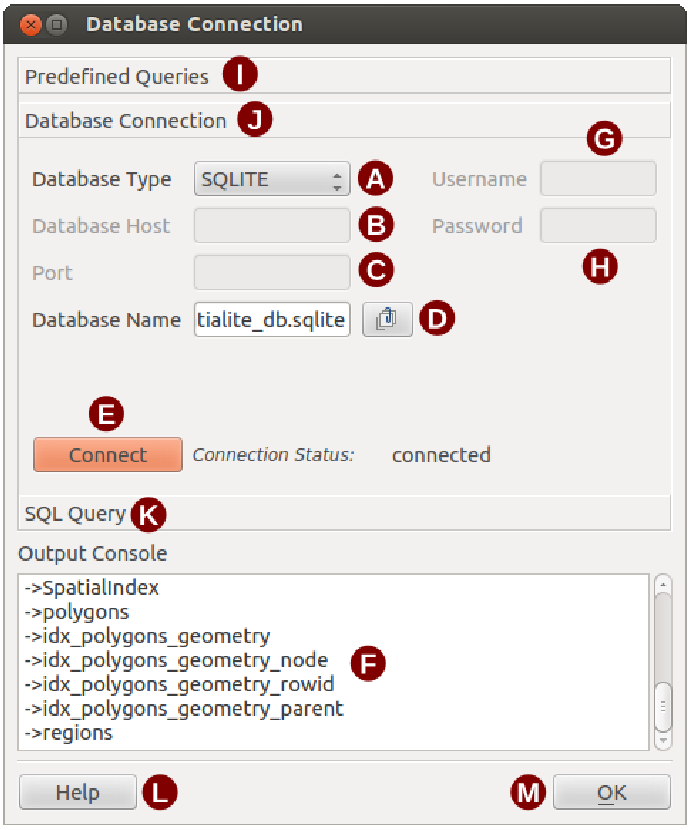

Figura 19.12: La ventana de conexión a base de datos *eVis*

9. **Consultas predefinidas**: Pestaña para abrir la ventana "Consultas Predefinidas".
10. **Conexión a base de datos**: Pestaña para abrir la ventana "Conexión a base de datos".
11. **Consulta SQL**: Pestaña para abrir la ventana "Consulta SQL".
12. **Ayuda**: Muestra la ayuda en línea.
13. **Aceptar**: Cierra la ventana principal "Conexión a Base de datos"

Ejecutar consultas SQL

SQL queries are used to extract information from a database or ODBC resource. In eVis, the output from these queries is a vector layer added to the QGIS map window. Click on the *SQL Query* tab to display the SQL query interface. SQL commands can be entered in this text window. A helpful tutorial on SQL commands is available at http://www.w3schools.com/sql. For example, to extract all of the data from a worksheet in an Excel file, `select * from [sheet1$]` where `sheet1` is the name of the worksheet.

Click on the **[Run Query]** button to execute the command. If the query is successful, a *Database File Selection* window will be displayed. If the query is not successful, an error message will appear in the *Output Console* window.

En la ventana *Selección de archivo de base de datos*, introduzca el nombre de la capa que será creada de los resultados de la consulta en la caja de texto *Nombre de la nueva capa*

1. **Ventana de texto de consulta SQL**: Una pantalla para consultas tipo SQL.
2. **Ejecutar consulta**: El botón para ejecutar la consulta introducida en la *Consulta SQL*.
3. **Consola de salida**: La consola de salida donde se muestran los mensajes relacionados con el procesamiento.
4. **Ayuda**: Muestra la ayuda en línea.

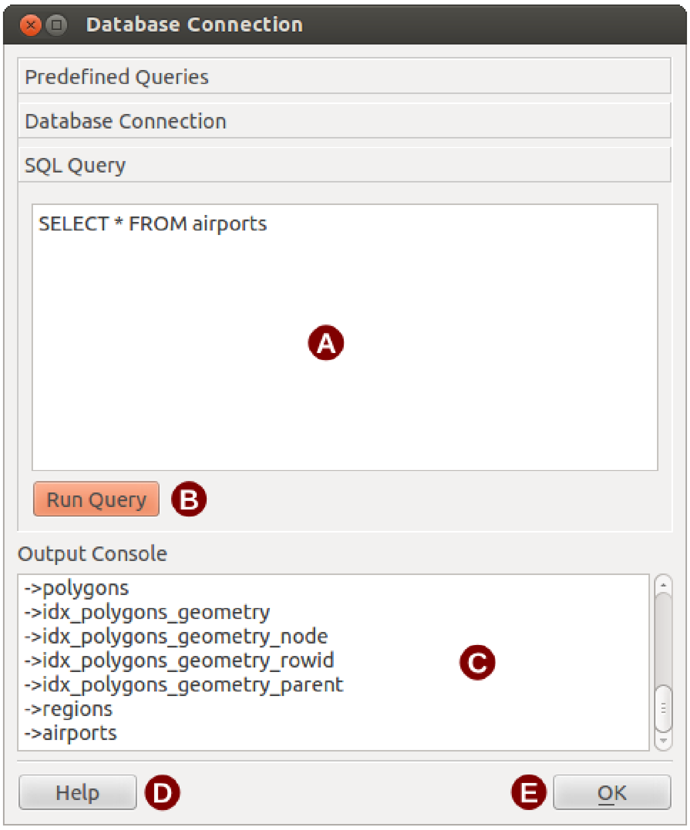

Figura 19.13: La pestaña Consulta SQL de eVis

5. **Aceptar**: Cierra la ventana principal *Conexión a base de datos*.

Use the *X Coordinate* and *Y Coordinate* combo boxes to select the fields from the database that stores the `X` (or longitude) and `Y` (or latitude) coordinates. Clicking on the **[OK]** button causes the vector layer created from the SQL query to be displayed in the QGIS map window.

Para guardar este archivo vectorial para usarlo en el futuro, se puede utilizar el comando de QGIS 'Guardar como...' que se accede al hacer clic derecho sobre el nombre de la capa en la leyenda del mapa de QGIS y después seleccione 'Guardar como...'

Truco: Crear una capa vectorial de una Hoja de cálculo de Microsoft Excel

When creating a vector layer from a Microsoft Excel Worksheet, you might see that unwanted zeros ("0") have been inserted in the attribute table rows beneath valid data. This can be caused by deleting the values for these cells in Excel using the `Backspace` key. To correct this problem, you need to open the Excel file (you'll need to close QGIS if you are connected to the file, to allow you to edit the file) and then use *Edit* → *Delete* to remove the blank rows from the file. To avoid this problem, you can simply delete several rows in the Excel Worksheet using *Edit* → *Delete* before saving the file.

Ejecutar consultas predefinidas

Con las consultas predefinidas, se pueden seleccionar consultas escritas previamente almacenadas en un archivo de formato XML. Esto es particularmente útil, si no esta familiarizado con comandos SQL. Haga clic en la pestaña *Consultas predefinidas* para visualizar la interfaz de consultas predefinidas.

To load a set of predefined queries, click on the Open File icon. This opens the *Open File* window, which is used to locate the file containing the SQL queries. When the queries are loaded, their titles as defined in the XML file will appear in the drop-down menu located just below the Open File icon. The full description of the query is displayed in the text window under the drop-down menu.

Seleccione la consulta que desee ejecutar del menú desplegable y después haga clic en la pestaña *Consulta SQL* para ver las consultas que se han estado cargando en la ventana de consultas. Si es la primera vez puede ejecutar una consulta predefinida o esta cambiando a base de datos, necesita estar seguro para conectarse a la base de datos.

Click on the **[Run Query]** button in the *SQL Query* tab to execute the command. If the query is successful, a *Database File Selection* window will be displayed. If the query is not successful, an error message will appear in the *Output Console* window.

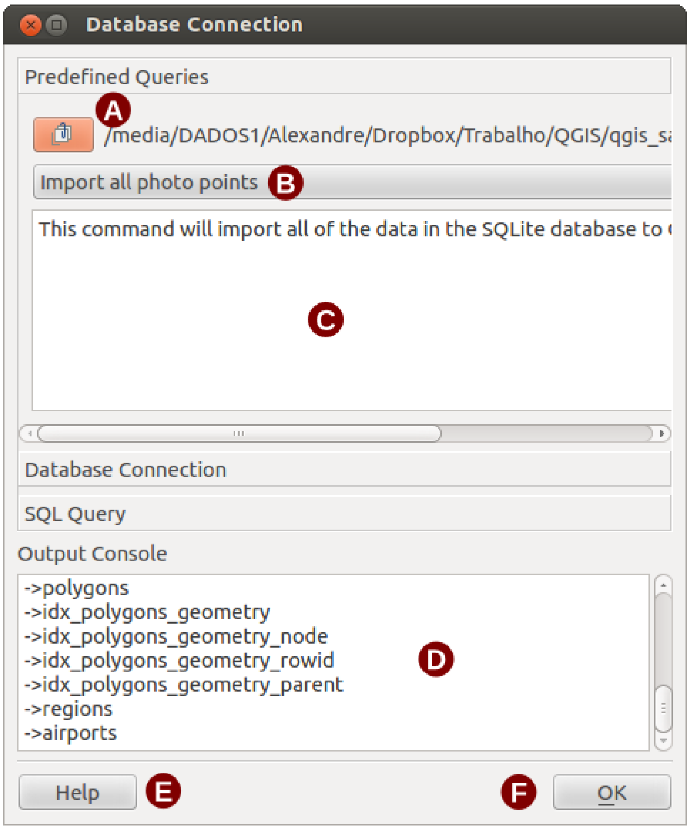

Figura 19.14: La pestaña de *eVis* Consultas predefinidas

1. **Abrir Archivo**: Iniciar el archivo "Abrir Archivo" navegar para buscar el archivo XML manteniendo las consultas predefinidas.
2. **Consultas predefinidas**: Una lista desplegable con todas las consultas definidas por el archivo XML de consultas predefinidas.
3. **Descripción de consulta**: Una descripción corta de la consulta. Esta descripción es del archivo XML de consultas predefinidas.
4. **Consola de salida**: La consola de salida donde se muestran los mensajes relacionados con el procesamiento.
5. **Ayuda**: Muestra la ayuda en línea.
6. **Aceptar**: Cierra la ventana principal "Conexión a Base de datos"

El formato XML para consultas predefinidas eVis

Las etiquetas XML leídas por eVis

Etiquetas	Descripción
Consulta	Definir el inicio y fin de una sentencia de consulta.
Descripción corta	Una descripción corta de la consulta que aparece en el menú desplegable de eVis.
Descripción	Una descripción más detallada de la consulta desplegada en la ventana de texto de consulta predefinida.
Tipo de base de datos	El tipo de la base de datos, definido en el menú desplegable de Tipo de base de datos en la pestaña de Conexión a base de datos.
Puerto	El puerto como se define en el cuadro de texto Puerto en la pestaña de Conexión a base de datos.
Nombre de la base de datos	El nombre de la base de datos como se define en el cuadro de texto en la pestaña de Conexión a base de datos.
Nombre de usuario	El nombre de usuario de la base de datos como se define en el cuadro de texto Nombre de usuario en la pestaña de Conexión a base de datos.
databasepass- word	La contraseña de la base de datos como se define en el cuadro de texto Contraseña en la pestaña Conexión a base de datos.
Sentencia sql	El comando SQL
autoconectar	Una bandera ("verdadero" o "falso") para especificar si las etiquetas anteriores deben utilizarse para conectarse automáticamente a la base de datos sin ejecutar la rutina de conexión de base de datos en la solapa Conexión de Base de Datos.

Se muestra un archivo XML de ejemplo completo con tres preguntas a continuación:

```
<?xml version="1.0"?>
<doc>
 <query>
   <shortdescription>Import all photograph points</shortdescription>
   <description>This command will import all of the data in the SQLite database to QGIS
      </description>
   <databasetype>SQLITE</databasetype>
   <databasehost />
   <databaseport />
   <databasename>C:\textbackslash Workshop/textbackslash
eVis\_Data\textbackslash PhotoPoints.db</databasename>
   <databaseusername />
   <databasepassword />
   <sqlstatement>SELECT Attributes.*, Points.x, Points.y FROM Attributes LEFT JOIN
      Points ON Points.rec_id=Attributes.point_ID</sqlstatement>
   <autoconnect>false</autoconnect>
 </query>
  <query>
   <shortdescription>Import photograph points "looking across Valley"</shortdescription>
   <description>This command will import only points that have photographs "looking across
      a valley" to QGIS</description>
   <databasetype>SQLITE</databasetype>
   <databasehost />
   <databaseport />
   <databasename>C:\Workshop\eVis_Data\PhotoPoints.db</databasename>
   <databaseusername />
   <databasepassword />
   <sqlstatement>SELECT Attributes.*, Points.x, Points.y FROM Attributes LEFT JOIN
      Points ON Points.rec_id=Attributes.point_ID where COMMENTS='Looking across
      valley'</sqlstatement>
   <autoconnect>false</autoconnect>
 </query>
 <query>
   <shortdescription>Import photograph points that mention "limestone"</shortdescription>
   <description>This command will import only points that have photographs that mention
      "limestone" to QGIS</description>
   <databasetype>SQLITE</databasetype>
   <databasehost />
   <databaseport />
```

```
    <databasename>C:\Workshop\eVis_Data\PhotoPoints.db</databasename>
    <databaseusername />
    <databasepassword />
    <sqlstatement>SELECT Attributes.*, Points.x, Points.y FROM Attributes LEFT JOIN
       Points ON Points.rec_id=Attributes.point_ID where COMMENTS like '%limestone%'
       </sqlstatement>
    <autoconnect>false</autoconnect>
  </query>
</doc>
```

.

19.7 Complemento fTools

El objetivo del complemento fTools Python es proporcionar un recurso integral para muchas tareas comunes de SIG basados en vectores, sin necesidad de software adicional, bibliotecas, o complejas soluciones temporales. Proporciona un conjunto cada vez mayor de las funciones de gestión y análisis de datos espaciales que son a la vez rápidos y funcionales.

fTools esta instalado automáticamente y habilitado en nuevas versiones de QGIS, y como con todos los complementos, se puede deshabilitar y habilitar utilizando el Administrador de complementos (vea *The Plugins Menus*). Cuando está activado, el complemento de fTools agrega un *Vectorial* a QGIS, proporcionando funciones que van desde Herramientas de Análisis, de Investigación, de Geometría y herramientas de geoprocesamiento, así como varias útiles herramientas de gestión de datos.

19.7.1 Herramientas de Análisis

Icono	Herramienta	Propósito
	Matriz de distancia	Medida de distancias entre dos puntos en la capa, y el resultado de salida como a) Matriz de distancia cuadrada, b) Matriz de distancia lineal, o c) Matriz de distancia resumen. Puede limitar las distancias de las entidades k más cercanas.
	Sumar longitud de líneas	Calcular la suma total de la longitudes de linea para cada polígono de una capa vectorial de poligonos.
	Puntos en polígonos	Contar el número de puntos que se encuentran en cada polígono de una capa vectorial de polígonos de entrada.
	Listar valores únicos	Lista de todos los valores únicos en un campo de la capa vectorial de entrada.
	Estadísticas básicas	Estadísticas básicas (media, desviación estándar, N, suma, CV)en un campo de entrada.
	Análisis del vecino más próximo	Calcular estadísticas del vecino más cercano para evaluar el nivel de agregación en una capa vectorial de puntos.
	Coordenada(s) media	Calcular el centro medio normal o ponderado de una capa vectorial completa, o múltiples entidades basadas en un campo ID único.
	Intersecciones de líneas	Localizar intersecciones entre líneas, y los resultados de salida como un archivo shape de puntos. Útil para localizar calles o intersecciones de corrientes, ignora intersecciones de línea con longitud > 0.

Tabla Ftools 1: Herramientas de Análisis fTools

19.7.2 Herramientas de investigación

Icono	Herramienta	Propósito
	Selección aleatoria	Selección aleatoria de un número n de entidades, o n porcentaje de entidades.
	Selección aleatoria dentro de subconjutos	Selección aleatoria de entidades dentro de subconjuntos basado en un campo ID único
	Puntos aleatorios	Generar puntos pseudo-aleatorios más de una capa de entrada.
	Puntos regulares	Generar una cuadrícula regular de puntos sobre una región específica y exportarlos como un archivo shape de puntos.
	Cuadrícula vectorial	Generar una cuadrícula de línea o polígono en base aun espaciado de cuadrícula especificada.
	Seleccionar por localización	Seleccionar entidades en función de su ubicación con respecto a otra capa para formar una nueva selección, o sumar o restar de la selección actual.
	Polígono de la extensión de la capa	Crear un rectángulo sencillo en la capa de polígono de extensión de una capa de entrada ráster o vectorial.

Tabla Ftools 2: Herramientas de investigación fTools

19.7.3 Herramientas de geoproceso

Icono	Herramienta	Propósito
	Envolvente(s) convexa(s)	Crear un envolvente convexo para una capa de entrada, o en función de un campo ID.
	Buffer(s)	Crear buffer(s) en torno a las entidades basado en la distancia, o un campo de distancia.
	Intersección	Sobrepone capas de manera que la salida contenga áreas donde ambas capas se cruzan.
	Unión	sobreponer capas de manera que la salida contenga las áreas intersectadas y las no intersectadas.
inter-sec-tadas	Diferencia Simétrica	Sobreponer capas de manera que la salida contenga esas zonas de las capas de entrada y diferencia que no se intersectan.
	Cortar	Sobreponer capas de tal manera que la salida contenga zonas que cruzo la capa de corte.
	Deferencia	Sobreponer capas de tal manera que la salida contenga las zonas que no intersectó la capa de corte.
	Disolver	Combinar entidades basadas en el campo de entrada. Todas los rasgos con valores de entrada idénticos se combinan para formar una solo rasgo.
	Eliminar polígonos <<astilla>>	Combinar las entidades seleccionadas con el polígono vecino con el área más grande o el límite mas grande en común.

Tabla Ftools3: Herramientas de geoproceso fTools

19.7.4 Herramientas de geometría

Icono	Herramienta	Propósito
	Comprobar validez de geometría	Comprar los polígonos para intersecciones, cerrar los agujeros y fijar el nodo de ordenamiento.
	Exportar/Añadir columnas de geometría	Añadir a capa vectorial información de geometría de la capa de punto (XCOORD, YCOORD), línea(LONGITUD), o polígono (ÁREA, PERÍMETRO) .
	Centroides de polígonos	Calcular los verdaderos centroides de cada polígono en una capa de polígonos de entrada.
	Triangulación de Delaunay	Calcular y salida (como polígonos) de la triangulación Delaunay de una capa vectorial de puntos de entrada.
	Polígonos Voronoi	Calcular polígonos Voronoi de una capa vectorial de puntos de entrada.
	Simplificar geometrías	Generalizar líneas o polígonos con un algoritmo Douglas-Peucker modificado.
	Densificar geometrías	Densificar líneas o polígonos al añadir vértices.
	Multipartes a partes sencillas	Convertir entidad multiparte a entidades múltiples de partes sencillas. Crear polígonos y líneas sencillas
	Partes sencillas a multiparte	Unir múltiples entidades a una sencilla multiparte en base a un campo ID único.
	Polígonos a líneas	Convertir polígonos a líneas, polígonos multiparte a líneas multiple de parte sencilla
	Líneas a polígonos	Convertir líneas a polígonos, líneas multiparte a polígonos de múltiple parte sencilla.
	Extraer nodos	Extraer nodos de las capas de líneas y polígonos y la salida de ellos como puntos.

Tabla Ftools 4: Herramientas de geometría fTools

Nota: La herramienta de **Simplificar geometría** se puede utilizar para borrar nodos duplicados en geometrías de líneas y polígonos. Solo tiene que establecer el parámetro de **Tolerancia de simplificado** a 0 y esto hará el truco.

19.7.5 Herramientas de gestión de datos

Icono	Herramienta	Propósito
	Definir la proyección actual	Especificar el SRC para archivos shape cuyo SRC no ha sido definido.
	Unir atributos por localización	Unir atributos adicionales a la capa de vectorial en función de su relación espacial. Los atributos de una capa vectorial se adjunta a la tabla de atributo de otra capa y se exporta como un archivo shape.
	Dividir capa vectorial	Dividir la capa de entrada en varias capas separadas basadas en el campo de entrada.
	Combinar archivos shape en uno	Combinar varios archivos shape dentro de una carpeta en un nuevo archivo shape basándose en el tipo de capa (punto, linea, polígono)
	Crear índice espacial	Crear un índice espacial para formatos OGR soportados.

Tabla Ftools 5: Herramientas de gestión de datos

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19.8 Complemento Herramientas de GDAL

19.8.1 ¿Qué son las herramientas GDAL?

El complemento de herramientas GDAL ofrece una GUI para la colección de herramientas en Geospatial Data Abstraction Library, http://gdal.osgeo.org. Estas son las herramientas de gestión ráster para consultar, re-proyecto, urdimbre y combinar una amplia variedad de formatos ráster. También se incluyen herramientas para crear una capa (vector) del contorno, o un relieve sombreado de un ráster MDT, y para hacer una VRT (Virtual Raster Tile en formato XML) a partir de una colección de uno o más archivos ráster. Estas herramientas están disponibles cuando se instala el complemento y es activado.

La biblioteca GDAL

La librería GDAL consiste en un conjunto de programas de línea de comandos, cada uno con una larga lista de opciones. Los usuarios cómodos con la ejecución de comandos desde la terminal pueden preferir la línea de comandos, con acceso a todo el conjunto de opciones. El complemento de Herramientas GDAL ofrece una interfaz fácil de las herramientas, exponiendo las opciones más populares.

19.8.2 Lista de Herramientas GDAL

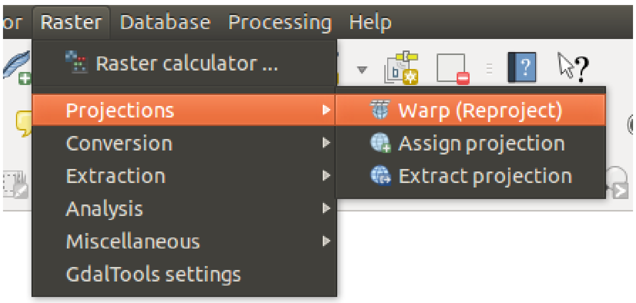

Figura 19.15: La lista del menú *Herramientas GDAL*

Projecciones

Warp (Reproject)	Esta utilidad es una imagen de mosaicos, reproyección y utilidad deformación. El programa puede reproyectar a cualquier proyección apoyada, y también se puede aplicar GCPs almacenados con la imagen si la imagen es "crudo" con información de control. Para obtener más información, se puede leer en el sitio web GDAL http://www.gdal.org/gdalwarp.html
Asignación de proyección	Esta herramienta le permite asignar proyección a rásters que ya tengan una referencia geográfica, que le falte la información de la proyección. También con su ayuda, es posible alterar las definiciones de proyección existentes. Ambos archivos simples y el modo por lotes son compatibles. Para obtener más información, por favor visite la página de utilidad en el sitio GDAL http://www.gdal.org/gdalwarp.html.
Extraer proyección	Esta utilidad te ayuda a extraer información de la proyección de un archivo de entrada. Si desea extraer información de un directorio completo, puede usar el modo por lotes. Este crea ambos archivos `.prj` and `.wld`

Conversión

Rasterizar	Este programa fusiona geometrías vectoriales (puntos, líneas y polígonos) en la banda(s) ráster de una imagen raster. Los vectores se leen de formatos vectoriales reconocidos por OGR. Tenga en cuenta que los datos vectoriales debe estar en el mismo sistema de coordenadas como los datos ráster; en la reproyección al vuelo no se proporciona. Para obtener más información, consulte http://www.gdal.org/gdal_rasterize.html.
Poligonizar	Esta utilidad crea polígonos vectoriales para todas las regiones conectadas de píxeles del ráster que comparte un valor de píxel en común. Cada polígono se crea con un atributo que indica el valor de píxel de dicho polígono. La utilidad crea el vector de salida de origen de datos si no existe ya, predeterminado a el formato de archivo shape de ESRI. Ver también http://www.gdal.org/gdal_polygonize.html.
Traducir	Esta utilidad se puede utilizar para convertir los datos ráster entre diferentes formatos, lo que podría llevar a cabo algunas operaciones como subconjuntos, remuestreo, y reescalar píxeles en el proceso. Para obtener más información se puede leer en http://www.gdal.org/gdal_translate.html.
RGB a PCT	Esta utilidad calculará una tabla de pseudocolor óptima para una imagen RGB determinada, utilizando un algoritmo de corte medio de un histograma RGB downsampled. Luego se convierte la imagen en una imagen pseudocoloreada usando la tabla de colores. Esta conversión utiliza Floyd-Steinberg (difusión de errores) para maximizar la imagen de salida de calidad visual. La utilidad también se describe en http://www.gdal.org/rgb2pct.html.
PCT a RGB	Esta utilidad convertirá una banda pseudocolor en el archivo de entrada en un archivo RGB de salida del formato deseado. Para mayor información, vea http://www.gdal.org/pct2rgb.html.

Extracción

Curvas de nivel	Este programa genera un archivo vectorial de curvas de nivel del modelo del terreno ráster (MDT). En http://www.gdal.org/gdal_contour.html, se puede encontrar más información.
Clipper	Esta utilidad le permite que acorte rásteres (extraer un subconjunto) utilizando una extensión seleccionada o en base a límites de la capa de máscara.. Más información se puede encontrar en http://www.gdal.org/gdal_translate.html.

Análisis

Filtrado	Esta utilidad elimina polígonos ráster más pequeños que un tamaño umbral previsto (en píxeles) y los reemplaza con el valor del píxel del polígono vecino más grande. El resultado se puede escribir de nuevo a la banda del ráster existente, o copiado en un nuevo archivo. Para mayor información, vea http://www.gdal.org/gdal_sieve.html.
Casi Negro	Esta utilidad escaneará una imagen y tratar de establecer todos los píxeles que son casi negros (o casi blancos) alrededor del borde para exactamente negro (o blanco). Esto se utiliza a menudo para "arreglar" comprimir pérdidas de fotos aéreas de modo que los píxeles de color se pueden tratar como transparentes cuando se hace el mosaico. También vea http://www.gdal.org/nearblack.html.
Rellenar sin datos	Esta utilidad rellena regiones de ráster seleccionadas (generalmente áreas sin datos) por interpolación de píxeles válidos alrededor de los bordes de las áreas. En http://www.gdal.org/gdal_fillnodata.html, se puede encontrar más información.
Proximidad	Esta utilidad genera un mapa ráster de proximidad que indica la distancia desde el centro de cada píxel al centro del píxel más cercano identificado como un píxel objetivo. Los pixeles objetivo son los del ráster fuente para la cual el valor de píxel del ráster está en el conjunto de valores de píxel objetivo. Para obtener más información, consulte http://www.gdal.org/gdal_proximity.html.
Cuadrícula (Interpolación)	Esta utilidad crea una cuadrícula regular (ráster) a partir de los datos dispersos leídos desde la fuente de datos OGR. Los datos de entrada serán interpolados para rellenar nodos de la cuadrícula con los valores, y puede elegir entre varios métodos de interpolación. La utilidad también se describe en el el sitio web GDAL, http://www.gdal.org/gdal_grid.html.
MDT(Modelos de Terreno)	Herramientas para analizar y visualizar DEMs. Esto puede crear un relieve sombreado, pendiente, orientación, color de relieve y un indice de irregularidad del terreno, un indice de posición topográfica y un mapa de irregularidad de algún ráster de elevación reconocido GDAL. Para mayor información , vea http://www.gdal.org/gdaldem.html.

Miscelánea

Construir ráster virtual (Catálogo)	Este programa crea un VRT (Conjunto de datos virtual) que es un mosaico de la lista de conjunto de datos GDAL de entrada. Vea también http://www.gdal.org/gdalbuildvrt.html.
Combinar	Esta utilidad automáticamente hará el mosaico un conjunto de imágenes. Todas las imágenes deben estar en el mismo sistema de coordenadas y tener un número correspondiente de bandas, pero pueden ser superpuestas, y en diferentes resoluciones. En áreas de superposición, la última imagen se copiará en las anteriores. La utilidad también se describe en http://www.gdal.org/gdal_merge.html.
Información	Esta utilidad muestra diversa información acerca de un conjunto de datos ráster GDAL-implementado. En http://www.gdal.org/gdalinfo.html, puede encontrar más información.
Generar vistas generales	La utilidad gdaladdo se puede utilizar para construir o reconstruir las vistas generales para los formatos más compatibles con un de varios algoritmos de disminución de resolución. Para obtener más información, vea http://www.gdal.org/gdaladdo.html.
Tile Index	Esta utilidad crea un archivo shape con un registro para cada archivo de entrada ráster, un atributo contiene el nombre del archivo y una geometría de polígono delineando el ráster. Vea también http://www.gdal.org/gdaltindex.html.

Configuración de herramientas GDAL

Utilice este diálogo para integrar las variables GDAL.

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19.9 Complemento Georreferenciador

El complemento Georreferenciador es una herramienta para generar archivos de referencia de ráster. Permite referenciar los ráster a sistemas de coordenadas geográficas o proyectadas mediante la creación de un nuevo GeoTiff o añadiendo un archivo de referencia a la imagen existente. El enfoque básico para georreferenciar un ráster es localizar puntos del ráster para los que se puedan determinar con precisión las coordenadas.

Características

Icono	Propósito	Icono	Propósito
	Abrir ráster		Comenzar georreferenciado
	Generar script de GDAL		Cargar puntos PCT
	Guardar puntos PCT como		Configuración de la transformación
	Añadir punto		Borrar punto
	Mover punto PCT		Desplazar
	Acercar zum		Alejar zum
	Zum a la capa		Zum anterior
	Zum siguiente		Enlazar Georreferenciador a QGIS
	Enlazar QGIS a Georreferenciador		Estiramiento total del histograma
	Estiramiento local del histograma		

Tabla Georreferenciador 1: Herramientas de Georreferenciador

19.9.1 Procedimiento habitual

Como coordenadas X e Y (GMS (gg mm ss.ss), GG (gg.gg) o coordenadas proyectadas (mmmm.mm)), que correspondan al punto seleccionado en la imagen, se pueden usar dos procedimientos alternativos:

- El propio ráster a veces proporciona cruces con coordenadas "escritas" sobre la imagen. En este caso se pueden introducir las coordenadas manualmente.
- Usando capas ya georreferenciadas. Esto pueden ser datos vectoriales o ráster que contengan los mismos objetos/entidades que tenga en la imagen que desea georreferenciar y con la proyección que desee para su imagen. En este caso puede introducir las coordenadas haciendo clic en el conjunto de datos de referencia cargado en el lienzo del mapa de QGIS.

El procedimiento habitual para georreferenciar una imagen consiste en seleccionar múltiples puntos en el ráster, especificando sus coordenadas, y elegir un tipo de transformación adecuado. Sobre la base de los parámetros y datos de entrada, el complemento calculará los parámetros del archivo de referencia. Cuantas más coordenadas suministre, mejor será el resultado.

El primer paso es iniciar QGIS, cargar el complemento Georreferenciador (vea *The Plugins Menus*) y hacer clic en *Ráster* → *Georeferenciador*, el cual aparece en la barra de menú de QGIS. El diálogo del complemento Georreferenciador aparece como se muestra en figure_georeferencer_1.

Para este ejemplo usaremos una hoja topográfica de Dakota del Sur del SDGS. Más tarde se puede visualizar junto con los datos de la localización `spearfish60` de GRASS. Puede descargar la hoja topográfica aquí: http://grass.osgeo.org/sampledata/spearfish_toposheet.tar.gz.

Introducir puntos de control sobre el terreno (PCT)

1. Para empezar a georreferenciar un ráster no referenciado, debemos cargarlo utilizando el botón . El ráster aparecerá en la zona de trabajo principal del diálogo. Una vez que el ráster esté cargado, podemos empezar a introducir los puntos de referencia.
2. Añada puntos a la zona principal de trabajo usando el botón Añadir punto e introduzca sus coordenadas (vea la Figura figure_georeferencer_2). Para este procedimiento tiene tres opciones:
   - Hacer clic en un punto de la imagen ráster e introducir las coordenadas X e Y manualmente.
   - Haga clic en un punto de la imagen ráster y elija el botón Desde lienzo del mapa para añadir las coordenadas X e Y con la ayuda de un mapa ya georreferenciado cargado en el lienzo del mapa de QGIS.

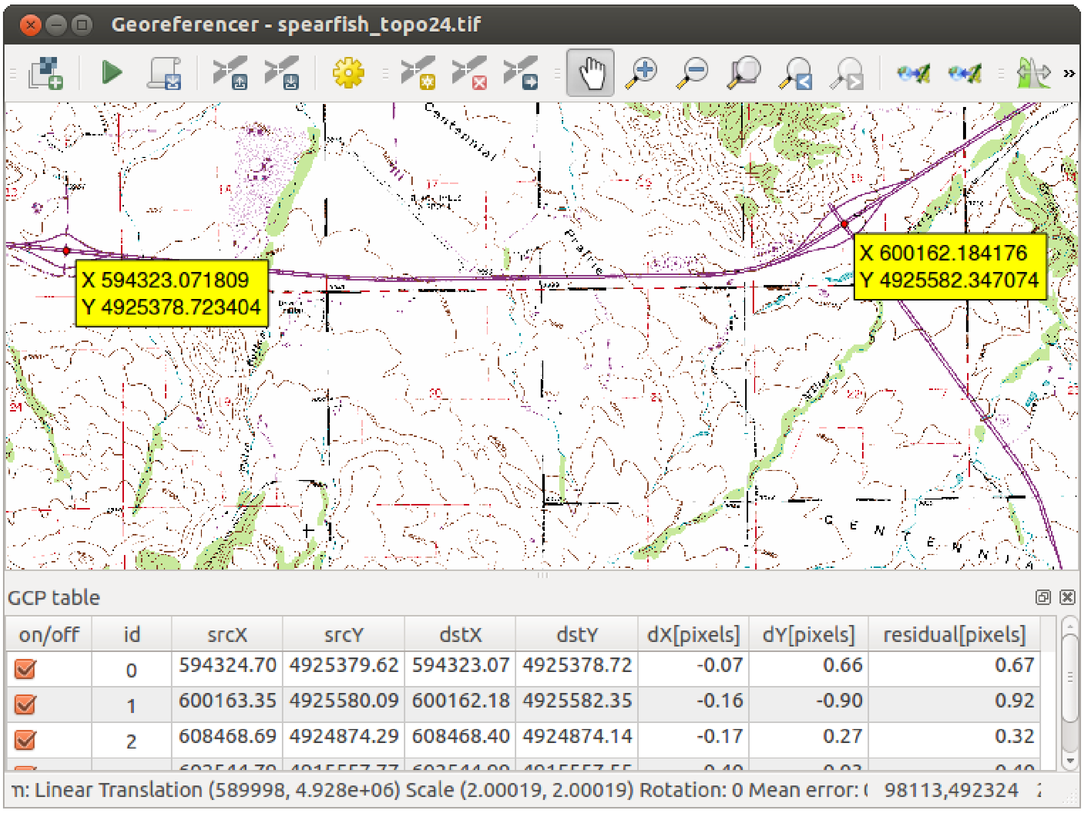

Figura 19.16: Diálogo del complemento Georreferenciador

- Con el botón puede mover los PCT en ambas ventanas, si están en un lugar incorrecto.

3. Continuar introduciendo puntos. Debe tener por lo menos cuatro puntos y cuantas más coordenadas pueda proporcionar mejor será el resultado. Existen herramientas adicionales en el cuadro de diálogo del complemento para hacer zum o desplazar la zona de trabajo con el fin de localizar un conjunto relevante de puntos PCT.

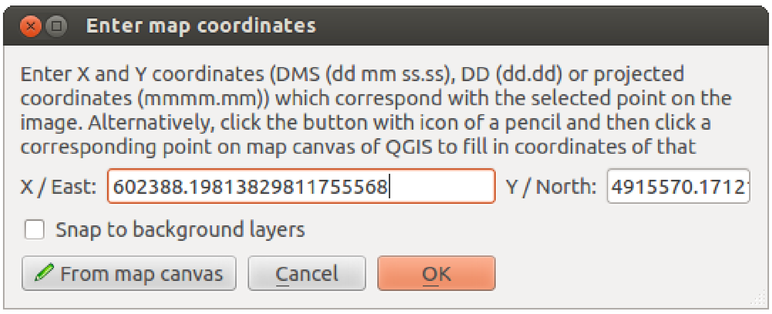

Figura 19.17: Añadir puntos a la imagen ráster

Los puntos que se agregan al mapa se almacenarán en un archivo de texto separado (`[nombre de archivo].points`) generalmente junto con la imagen ráster. Esto nos permite reabrir el complemento Georeferenciador en una fecha posterior y añadir nuevos puntos o eliminar los ya existentes para optimizar el resultado. El archivo contiene los valores de los puntos de la forma: `mapX, mapY, pixelX, pixelY`. Puede utilizar los botones Cargar puntos PCT y Guardar puntos PCT como para gestionar los archivos.

Definir la configuración de la transformación

Después de añadir los PCT a la imagen ráster, debe definir la configuración de la transformación para el proceso de georreferenciación.

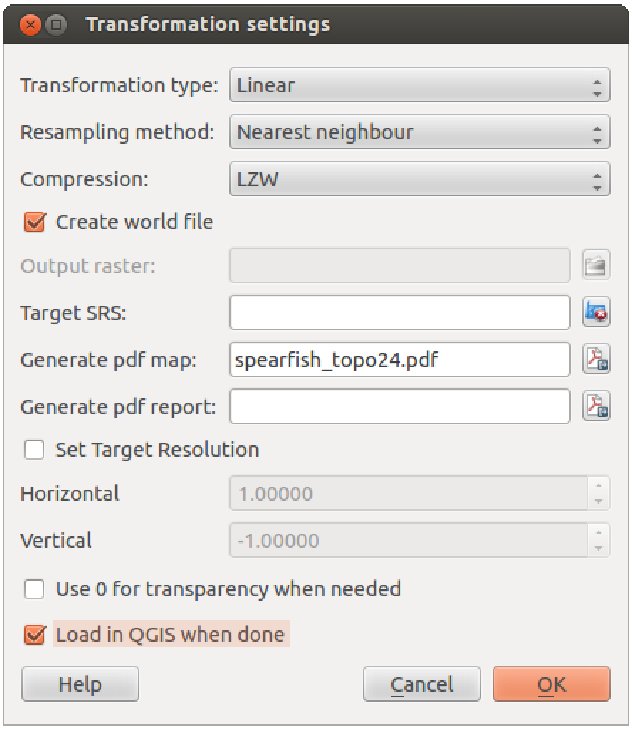

Figura 19.18: Definir la configuración de la transformación del georreferenciador

Algoritmos de transformación disponibles

Dependiendo del número de puntos de control sobre el terreno que haya capturado, es posible que desee utilizar diferentes algoritmos de transformación. La elección del algoritmo de transformación también depende del tipo y la calidad de los datos de entrada y la cantidad de distorsión geométrica que está dispuesto a introducir en el resultado final.

Actualmente están disponibles los siguientes *Tipos de transformación*:

- El algoritmo **Lineal** se utiliza para crear un archivo de referencia y es diferente de los otros algoritmos, ya que realmente no trasforma el ráster. Este algoritmo probablemente no será suficiente si se trata de material escaneado.
- La trasformación **Helmert** realiza un escalado sencillo y trasformaciones de rotación.
- Los algoritmos **Polinomial** 1-3 son algunos de los algoritmos más utilizados introducidas para que coincidan los puntos de control sobre el terreno de origen y destino. El algoritmo polinomial más ampliamente usado es la transformación polinomial de segundo orden, que permite cierta curvatura. La transformación polinomial de primer orden (afín) preserva la colinealidad y permite escalado, traslación y rotación solamente.
- El algoritmo **Thin Plate Spline** (TPS) es un método de georreferenciación más moderno, que es capaz de introducir deformaciones locales en los datos. Este algoritmo es útil cuando se georreferencian originales de muy baja calidad.
- La trasformación **Proyectiva** es una rotación lineal y traducción de coordenadas.

Definir el método de remuestreo

El tipo de remuestreo que elija probablemente dependerá de los datos de entrada y el objetivo último del ejercicio. Si no se desea cambiar las estadísticas de la imagen, es posible que desee elegir "Vecino más próximo", mientras que un 'Remuestreo cúbico' probablemente proporcionará un resultado más suavizado.

Es posible elegir entre cinco diferentes métodos de remuestreo:

1. Vecino más próximo
2. Lineal
3. Cúbica
4. Spline cúbica
5. Lanczos

Definir la configuración de la trasformación

Hay varias opciones que deben definirse para el ráster de salida georreferenciado.

- La casilla de verificación checkbox| *Crear archivo de referencia* esta disponible solo si se decide utilizar la transformación lineal, porque esto quiere decir que la imagen ráster no será transformada realmente. En este caso, el campo *Ráster de salida* no se activa, porque solo se creará el nuevo archivo de referencia.
- Para todos los otros tipos de transformación hay que definir un *Ráster de salida*. Por omisión se creará un nuevo archivo ([nombre de archivo] _modificado) en la misma carpeta junto con la imagen ráster original.
- Como siguiente paso, tiene que definir el *SRE de destino* (Sistema de Referencia Espacial) para la imagen georeferenciada (vea *Working with Projections*).
- Si lo desea, puede **generar un mapa en pdf** y también **un informe en pdf**. El informe incluye información acerca de los parámetros de trasformación utilizados, una imagen de los residuos y una lista con todos los PCT y sus errores RMS.
- Además, puede activar la casilla de verificación *Establecer resolución de destino* y definir la resolución del píxel del archivo de salida. Por omisión la resolución horizontal y vertical es 1.
- Se puede activar la casilla *Usar 0 para transparencia cuando sea necesario*, si los píxeles con valor 0 deben visualizarse trasparentes. En nuestra hoja topográfica de ejemplo todas las áreas blancas serían transparentes.
- Finalmente, la casilla *Cargar en QGIS cuando esté hecho* carga el ráster de salida automáticamente en el lienzo del mapa de QGIS cuando la transformación está hecha.

Mostrar y adaptar las propiedades del ráster

Al hacer clic en el diálogo *Propiedades del ráster* en el menú *Configuración* se abren las propiedades del ráster de la capa que desea georreferenciar.

Configurar el georreferenciador

- Puede definir si quiere mostrar las coordenadas y/o las ID de los PCT.
- Como unidades residuales se pueden elegir píxeles y unidades del mapa.
- Para el informe PDF puede definir un margen izquierdo y derecho y también puede establecer el tamaño del papel para el mapa PDF.
- Finalmente, puede activar *Mostrar la ventana del Georeferenciador adosada*.

Ejecutar la transformación

Una vez se hayan recopilado todos los PCT y se hayan definido todos los ajustes de transformación, basta con pulsar el botón Comenzar gerreferenciado para crear el nuevo ráster georreferenciado.

.

19.10 Complemento de interpolación

El complemento de interpolación se puede utilizar para generar una interpolación TIN o IDW de una capa vectorial de puntos. Es muy fácil de usar y proporciona una interfaz gráfica de usuario intuitiva para crear capas ráster interpoladas (ver Figure_interpolation_1). El complemento requiere que se especifiquen los siguientes parámetros antes de ejecutarlo:

- **Capas vectoriales** de entrada: Especificar la(s) capa(s) vectorial(es) de puntos de entrada a partir de una lista de capas de puntos cargadas. Si se especifican varias capas, entonces se usarán los datos de todas ellas para la interpolación. Nota: es posible insertar lineas o polígonos como restricción para la triangulación, especificando "puntos", "líneas de estructura" o "líneas de ruptura" en el cuadro combinado *Tipo*
- **Atributo de interpolación**: Seleccionar la columna de atributos a usar para la interpolación o habilitar la casilla *Usar coordenada-Z* para usar los valores Z almacenados en la capa.
- **Método de interpolación**: Seleccionar el método de interpolación. Este puede ser 'Red Irregular Triangulada (Triangulated Irregular Network-TIN)' o 'Distancia Inversa Ponderada (Inverse Distance Weighted-IDW)'.
- **Número de columnas/filas**: Especificar el número de filasy columnas para el archivo ráster de salida.
- **Archivo de salida**: Especifica un nombre para el fichero ráster de salida.
- *Añadir el resultado al proyecto* para cargar el resultado en la vista del mapa.

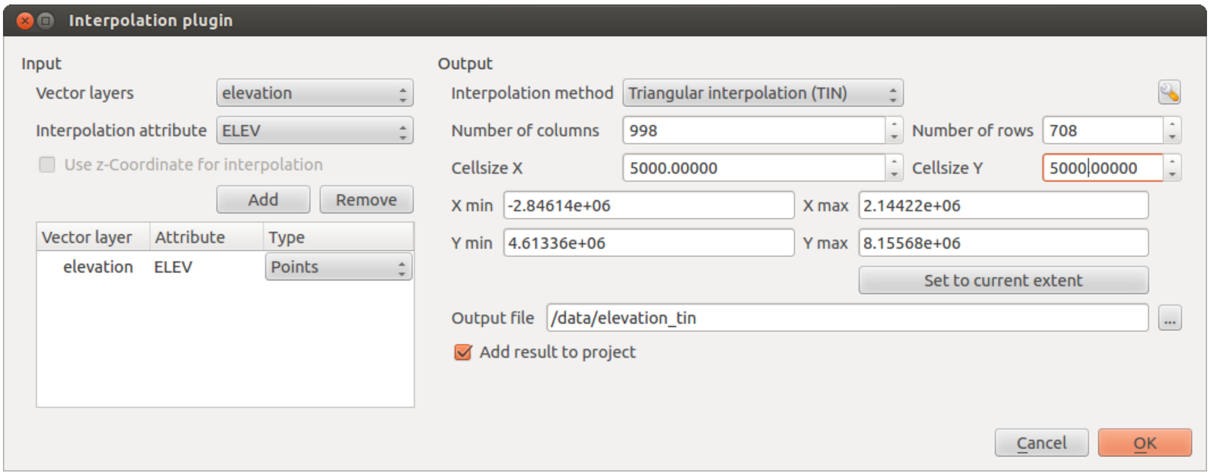

Figura 19.19: Complemento de Interpolación

19.10.1 Usar el complemento

1. Comenzar QGIS y cargar una capa vectorial de puntos (ej. `elevp.csv`).
2. Cargar el Complemento de interpolación en el Administrador de complementos (ver *The Plugins Menus*) y dar clic sobre *Ráster* → *Interpolación* → *Interpolación*, que aparece en la barra de menú de QGIS. La ventana de diálogo del complemento de interpolación aparece como se muestra en la Figure_interpolation_1.

3. Seleccione una capa de entrada (ej. *elevp*) y una columna (ej. `ELEV`) para interpolación.
4. Seleccionar un método de interpolación(ej. 'Red Irregular Triangulada (Triangulated Irregular Network-TIN)') y especificar un tamaño de celda de 5000 así como el nombre del archivo ráster de salida (ej.:file:*elevation_tin*).
5. Pulse **[Aceptar]**.

.

19.11 Complemento Edición fuera de linea

Para la recolección de datos, es una situación común para trabajar con un ordenador portátil o una línea de teléfono celular en el campo. A su regreso a la red, los cambios tienen que ser sincronizados con el origen de datos principal (ej., una base de datos PostGIS). Si varias personas están trabajando simultáneamente en los mismos conjuntos de datos, es difícil fusionar los cambios a mano, incluso si la gente no cambia los mismo elementos.

El complemento Edición fuera de linea automatiza la sincronización al copiar el contenido de una fuente de datos (en general PostGIS o WFS-T) a una base de datos SpatialLite y almacena la edición fuera de linea en tablas dedicadas, Después ser conectado a la red de nuevo, es posible aplicar la edición fuera de linea al conjunto de datos maestro.

19.11.1 Usar el complemento

- Abrir algunas capas vectoriales (e.j. de una fuente de datos PostGIS o WFS-T).
- Guardarlo como un proyecto.
- Ir a *Base de datos* → *Edición fuera de linea* → *Convertir en proyecto fuera de linea* y seleccionar las capas a guardar. El contenido de las capas se guarda en tablas SpatiaLite.
- Editar las capas fuera de linea.
- Después de ser conectado de nuevo, cargar los cambios usando *Base de datos* → *Edición fuera de linea*→ *Sincronizar*.

.

19.12 Complemento GeoRaster espacial de Oracle

En las bases de datos de Oracle, los datos raster se pueden almacenar como objetos SDO_GEORASTER disponibles con la extensión de Oracle Spatial. En QGIS, el complemento GeoRaster espacial de Oracle Spatial es admitido por GDAL y depende de que tenga instalado y funcionando en su equipo el producto de bases de datos de Oracle. Aunque Oracle es software propietario, proporciona de forma gratuita su software con fines de desarrollo y prueba. Aquí hay un ejemplo de cómo cargar imágenes raster a GeoRaster:

```
$ gdal_translate -of georaster input_file.tif geor:scott/tiger@orcl
```

Esto cargará el raster en la tabla predeterminada GDAL_IMPORT, como una columna llamada "RASTER"

19.12.1 Administrar conexiones

En primer lugar, se debe habilitar el complemento GeoRaster de Oracle, usando el Administrador de complementos (ver *The Plugins Menus*). La primera vez que cargue un GeoRaster in QGIS, debe crear una conexión a la base de datos de Oracle que contiene los datos. Para hacer esto, inicie con clic sobre el botón de la barra

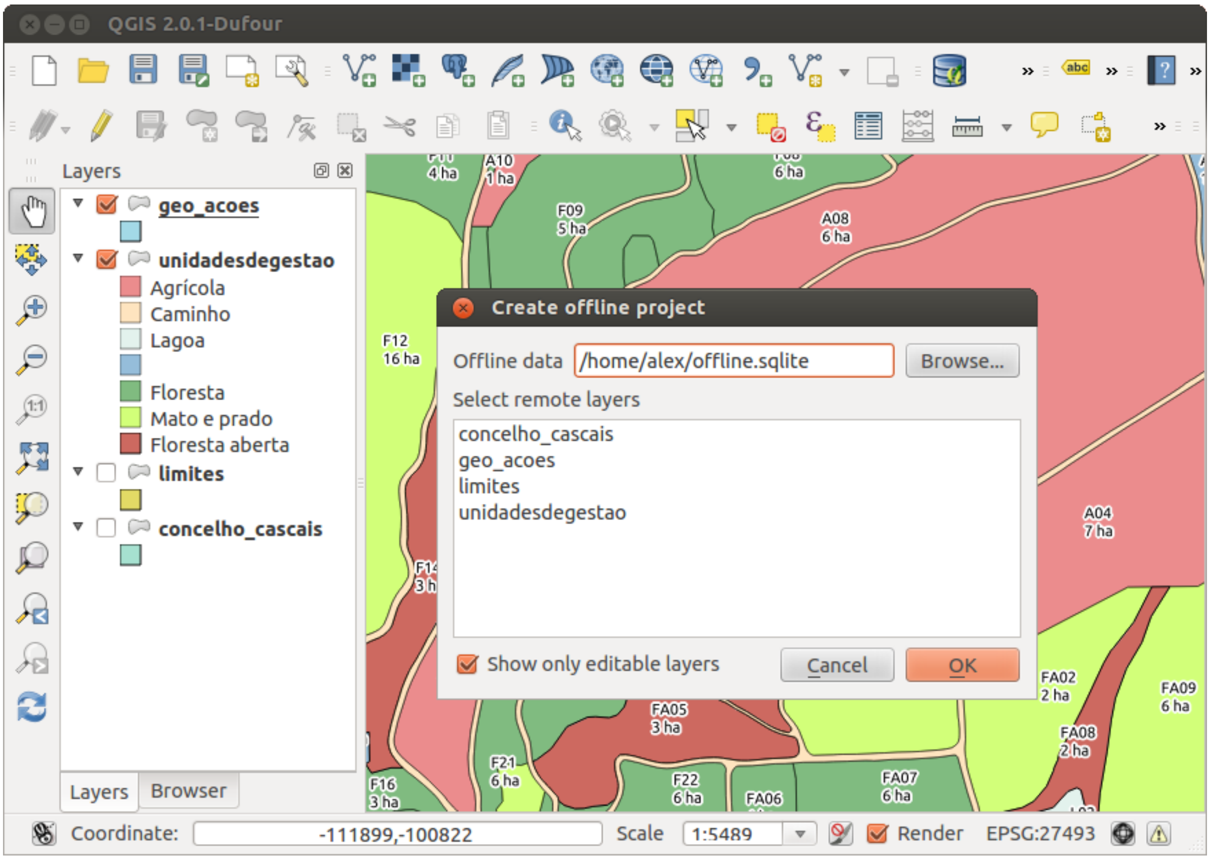

Figura 19.20: Crear un proyecto fuera de linea de capas PostGIS o WFS

de herramientas Añadir capa GeoRaster de Oracle –esto abrirá la ventana de diálogo *Seleccionar GeoRaster espacial de Oracle*. Clic sobre **[Nuevo]** para abrir la ventana de dialogo y especificar los parámetros de conexión (Ver Figure_oracle_raster_1_1):

- **Nombre**: Introduzca un nombre para al conexión a la base de datos.
- **Instancia de la base de datos**: Introduzca el nombre de la base de datos a la que desea conectarse.
- **Nombre de usuario**: Especificar su nombre de usuario que usará para acceder a la base de datos.
- **Contraseña**: Proporcionar la contraseña asociada con su usuario que es requerida para el acceso a la base de datos.

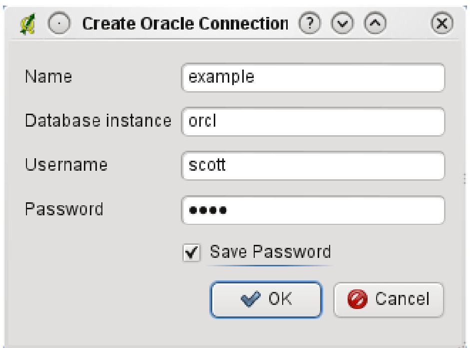

Figura 19.21: Crear dialogo de conexión de Oracle

Ahora, de vuelta en la ventana principal de *GeoRaster espacial de Oracle* (vea la Figure_oracle_raster_2), utilice la lista desplegable para elegir una conexión y utilice el botón **[Conectar]** para establecer la conexión. También puede **[Editar]** la conexión abriendo el dialogo previo y haciendo cambios en la información de la conexión, o usar el botón **[Borrar]** para eliminar la conexión desde la lista desplegable.

19.12.2 Seleccionar un GeoRaster

Una vez que la conexión se ha establecido, la ventana de subconjuntos de datos mostrará los nombres de todas las tablas que contengan columnas GeoRaster en esa base de datos en el formato de un nombre del subconjunto de datos GDAL.

Haga clic en uno de los subconjuntos de datos listados y después haga en **[Seleccionar]** para elegir el nombre de la tabla. Ahora se mostrará otra lista de subconjuntos de datos con los nombres de las columnas del GeoRaster en la tabla. Normalmente es una lista corta, ya que la mayoría de los usuarios no tendrán mas de una o dos columnas de GeoRaster en la misma tabla.

Clic sobre uno de los subconjuntos de datos en listados y después sobre **[Seleccionar]** para elegir una de las combinaciones tabla/columna. El dialogo mostrará ahora todos los registros que contengan objetos GeoRaster. Note que la lista de subconjunto de datos mostrará ahora las parejas de tablas de datos raster e Id de raster.

En cualquier momento, la entrada seleccionada se puede ser editar para ir directamente a un GeoRaster conocido o para regresar al inicio y seleccionar otro nombre de tabla.

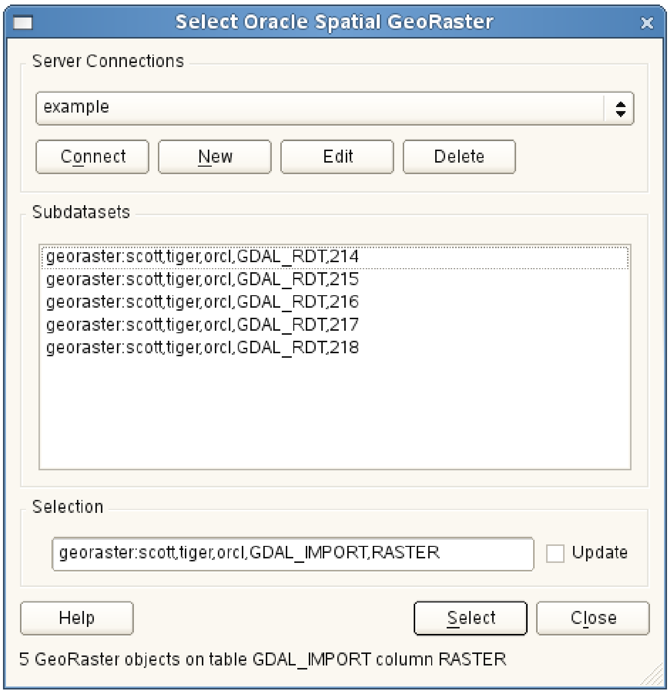

Figura 19.22: Diálogo de selección de GeoRaster de Oracle

La entrada de datos seleccionados también puede usarse para introducir una cláusula `WHERE` al final de la cadena de identificación (ej. `geor:scott/tiger@orcl,gdal_import,raster,geoid=`). Vea http://www.gdal.org/frmt_georaster.html para mayor información.

19.12.3 Mostrar GeoRaster

Finalmente, al seleccionar un GeoRaster de la lista de tablas de datos raster e Id raster, la imagen raster se cargará en QGIS.

El dialogo *Seleccionar GeoRaster espacial de Oracle* puede cerrarse ahora y la siguiente ocasión en que se abra mantendrá la misma conexión y mostrará la misma lista previa de subconjuntos de datos, haciendo muy fácil abrir otra imagen del mismo contexto.

Nota: Los GeoRaster que contienen pirámides se mostrarán mucho más rápido, pero las pirámides se deben generar fuera de QGIS usando PL/SQL o gdaladdo.

Lo siguiente es un ejemplo usando `gdaladdo`:

```
gdaladdo georaster:scott/tiger@orcl,georaster\_table,georaster,georid=6 -r
nearest 2 4 6 8 16 32
```

Este es un ejemplo usando PL/SQL:

```
$ sqlplus scott/tiger
SQL> DECLARE
 gr sdo_georaster;
BEGIN
    SELECT image INTO gr FROM cities WHERE id = 1 FOR UPDATE;
    sdo_geor.generatePyramid(gr, 'rLevel=5, resampling=NN');
    UPDATE cities SET image = gr WHERE id = 1;
    COMMIT;
END;
```

.

19.13 Complemento Análisis de Terreno

El complemento de Análisis de Terreno se puede utilizar para calcular la pendiente, orientación, mapa de sombras, índice de irregularidad y relieve para un modelo digital de elevación (DEM). Es muy sencillo el manejo y proporciona una interfaz de usuario gráfica intuitiva para crear nuevas capas ráster (vea Figure_raster_terrain_1).

Descripción del análisis:

- **Pendiente**: Calcula el ángulo de la pendiente de cada celda en grados (basado en primer orden estimación derivada).
- **Orientación**: Exposición (iniciar con 0 para la dirección norte, en grados antihorario).
- **Mapa de sombras**: Crea un mapa de sombra utilizando la luz y sombra que proporciona un aspecto más tridimensional para u mapa de relieve sombreado.
- **Índice de irregularidad**: Una medición cuantitativa de la heterogeneidad del terreno tal como se describe por Riley et al. (1999). Se calcula para cada lugar con un resumen de los cambios en la elevación dentro de la cuadrícula de 3x3 píxeles.
- **Relieve**: Crea un mapa de relieve sombreado de los datos digitales de elevación. Implementado es un método para elegir los colores de elevación mediante el análisis de la distribución de frecuencias.

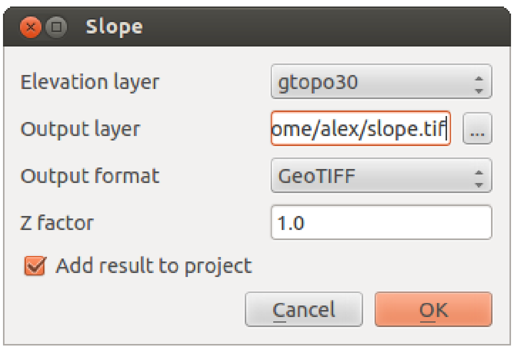

Figura 19.23: Complemento de Modelado de Terreno (Cálculo de la pendiente)

19.13.1 Usar el complemento

1. Inicie QGIS y cargue las capas raster `gtopo30` de la ubicación de ejemplo de GRASS.
2. Cargar el complemento de Análisis de Terreno en el Administrador de Complementos (vea *The Plugins Menus*).
3. Seleccione un método de análisis del menú (e.j., *Ráster* → *Análisis de Terreno* → *Pendiente*). El diálogo *Pendiente* aparece como se muestra en Figure_raster_terrain_1.
4. Especificar una ruta , y un tipo de archivo de salida
5. Haga clic en **[Aceptar]**.

.

19.14 Complemento Mapa de calor

El complemento *Mapa de calor* usa Estimación de Densidad de Kernel para crear un ráster de densidad (mapa de calor) de una capa de puntos de entrada. La densidad se calcula en base al número de puntos en una ubicación, de forma que un mayor número de puntos agrupados resulta en valores mayores. Los mapas de calor permiten una fácil identificación de los "puntos calientes" y la agrupación de los puntos.

19.14.1 Activar el complemento Mapa de calor

First this core plugin needs to be activated using the Plugin Manager (see *load_core_plugin*). After activation, the heatmap icon can be found in the Raster Toolbar, and under the *Raster* → *Heatmap* menu.

Seleccione el menú *Ver* → *Barras de herramientas* → *Ráster* para mostrar la barra de herramientas Ráster, si no está visible.

19.14.2 Usar el complemento de Mapa de calor

Haga clic en el botón de la herramienta *Mapa de calor* para abrir el diálogo del complemento Mapa de calor (vea figure_heatmap_2).

El diálogo tiene las siguientes opciones:

- **Capa de puntos de entrada**: Lista todas las capas vectoriales de puntos del proyecto actual y se usa para seleccionar la capa a analizar.
- **Ráster de salida**: Permite usar el botón ... para seleccionar la carpeta y el nombre de archivo del ráster de salida que genera el complemento Mapa de calor. La extensión del archivo no es necesaria.
- **Formato de salida**: Selecciona el formato de salida. Aunque se pueden elegir todos los formatos soportados por GDAL, en la mayoría de los casos GeoTIFF es el mejor formato para elegir.
- **Radio**: Se usa para especificar el radio de búsqueda del mapa de calor (o ancho de banda del kernel) en metros o unidades del mapa. El radio especifica la distancia alrededor de un punto a la que se notará la influencia del punto. Los valores más altos dan lugar a un mayor suavizado, mientras que los valores más pequeños pueden mostrar detalles y variación más finos en la densidad de puntos.

Cuando la casilla de verificación *Avanzado* está marcada, hay disponibles opciones adicionales:

- **Filas** y **Columnas**: Utilizado para cambiar las dimensiones del ráster de salida. Estos valores también están ligados a los valores de **Tamaño X de celda** y **Tamaño Y de celda**. Incrementar el número de filas y columnas disminuirá el tamaño de la celda e incrementará el tamaño del archivo de salida. Los valores en Filas y Columnas también están vinculados, por lo que duplicar el número de filas duplicará automáticamente el número de columnas y el tamaño de las celdas también se reducirá a la mitad. ¡El área geográfica del ráster de salida seguirá siendo el mismo!

- **Tamaño X de celda** y **Tamaño Y de celda**: Controlan el tamaño geográfico de cada píxel en el ráster de salida. Cambiar estos valores también cambiará el número de filas y columnas en el ráster de salida.
- **Forma del kernel**: La forma del kernel controla la proporción en la que la influencia de un punto disminuye a medida que aumenta la distancia desde el punto. Los diferentes kernels disminuyen en distintas proporciones, por lo que un kernel triweight da mayor peso a las entidades más próximas al punto de lo que hace el kernel Epanechnikov. En consecuencia, triweight de como resultado puntos calientes "más afilados" y Epanechnikov da puntos calientes "más suaves". Hay disponible una serie de funciones estándar del kernel en QGIS, que se describen e ilustran en Wikipedia.
- **Relación de decadencia**: Se puede utilizar con kernel Triangulares para un mayor control de cómo disminuye el calor de una entidad con la distancia a la misma.
  - Un valor de 0 (= mínimo) indica que el calor estará concentrado en el centro del radio dado y se extinguirá por completo en el borde.
  - Un valor de 0.5 indica que a los píxeles del borde del radio se les dará la mitad del calor que a los píxeles del centro del radio de búsqueda.
  - Un valor de 1 significa que el calor se distribuye uniformemente por todo el círculo del radio de búsqueda. (Esto es equivalente al kernel 'Uniforme'.)
  - Un valor mayor que 1 indica que el calor es mayor hacia el borde del radio de búsqueda que en el centro.

La capa de puntos de entrada también puede tener campos de atributos que pueden afectar la forma en que influyen en el mapa de calor:

- **Usar radio a partir de campo**: Establece el radio de búsqueda para cada entidad a partir de un campo de atributos de la capa de entrada.
- **Usar peso a partir de campo**: Permite ponderar las entidades de entrada por un campo de atributos. Esto se puede utilizar para aumentar la influencia que ciertas entidades tienen en el mapa de calor resultante.

Cuando se especifica un nombre para el archivo ráster de salida se puede utilizar el botón **[Aceptar]** para crear el mapa de calor.

19.14.3 Tutorial: crear un mapa de calor

Para el siguiente ejemplo usaremos la capa vectorial de puntos `airports` del conjunto de datos de ejemplo de QGIS (vea *Datos de ejemplo*). Otro excelente tutorial de QGIS sobre hacer mapas de calor se puede encontrar en http://qgis.spatialthoughts.com.

En Figure_Heatmap_1, se muestran los aeropuertos de Alaska.

1. Seleccione el botón de la herramienta *Mapa de calor* para abrir el diálogo de Mapa de calor (vea Figure_Heatmap_2).
2. En el campo *Capa de puntos de entrada* , seleccione `airports` de la lista de capas de puntos cargadas en el proyecto actual.
3. Especifique un nombre para el archivo de salida haciendo clic en el botón ... próximo al campo *Ráster de salida*. Escriba el nombre del archivo `heatmap_airports` (no es necesaria extensión de archivo).
4. Deje el *Formato de salida* como el formato predeterminado, `GeoTIFF`.
5. Cambie el *Radio* a `1000000` metros.
6. Haga clic en **[Aceptar]** para crear y cargar el mapa de calor de aeropuertos (vea Figure_Heatmap_3).

QGIS generará el mapa de calor y añadirá el resultado a la ventana del mapa. Por omisión, el mapa de calor está sombreado en escala de grises, con las zonas más claras mostrando una mayor concentración de aeropuertos. Al mapa de calor se le puede aplicar ahora un estilo en QGIS para mejorar su apariencia.

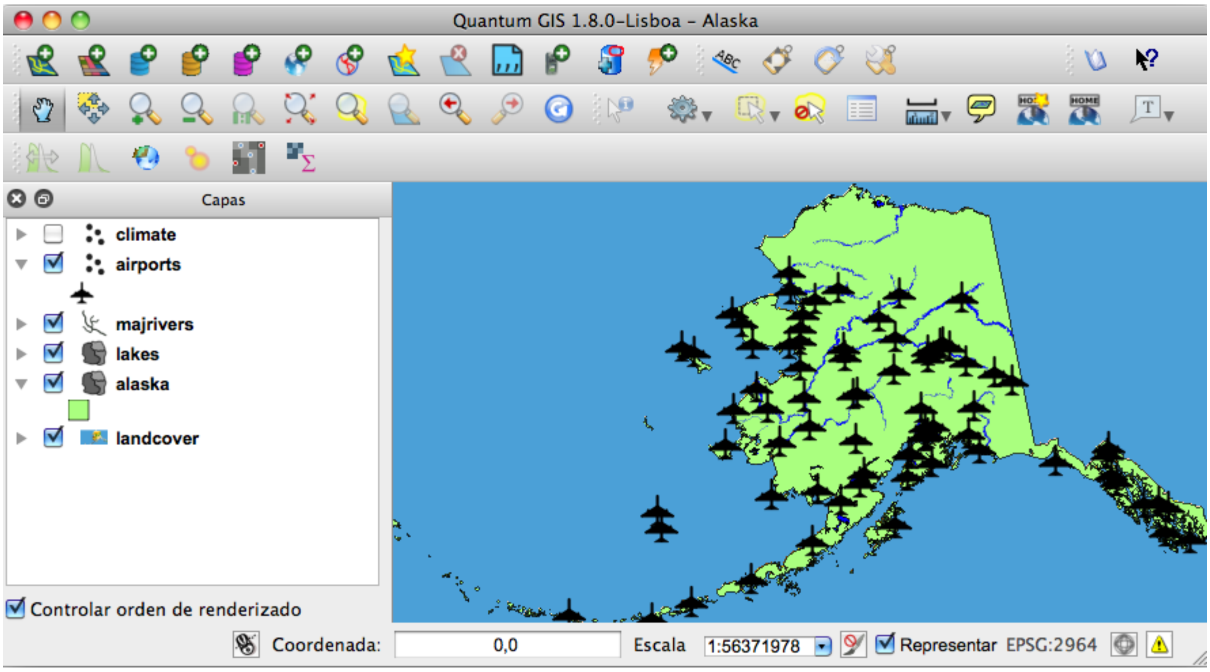

Figura 19.24: Aeropuertos de Alaska

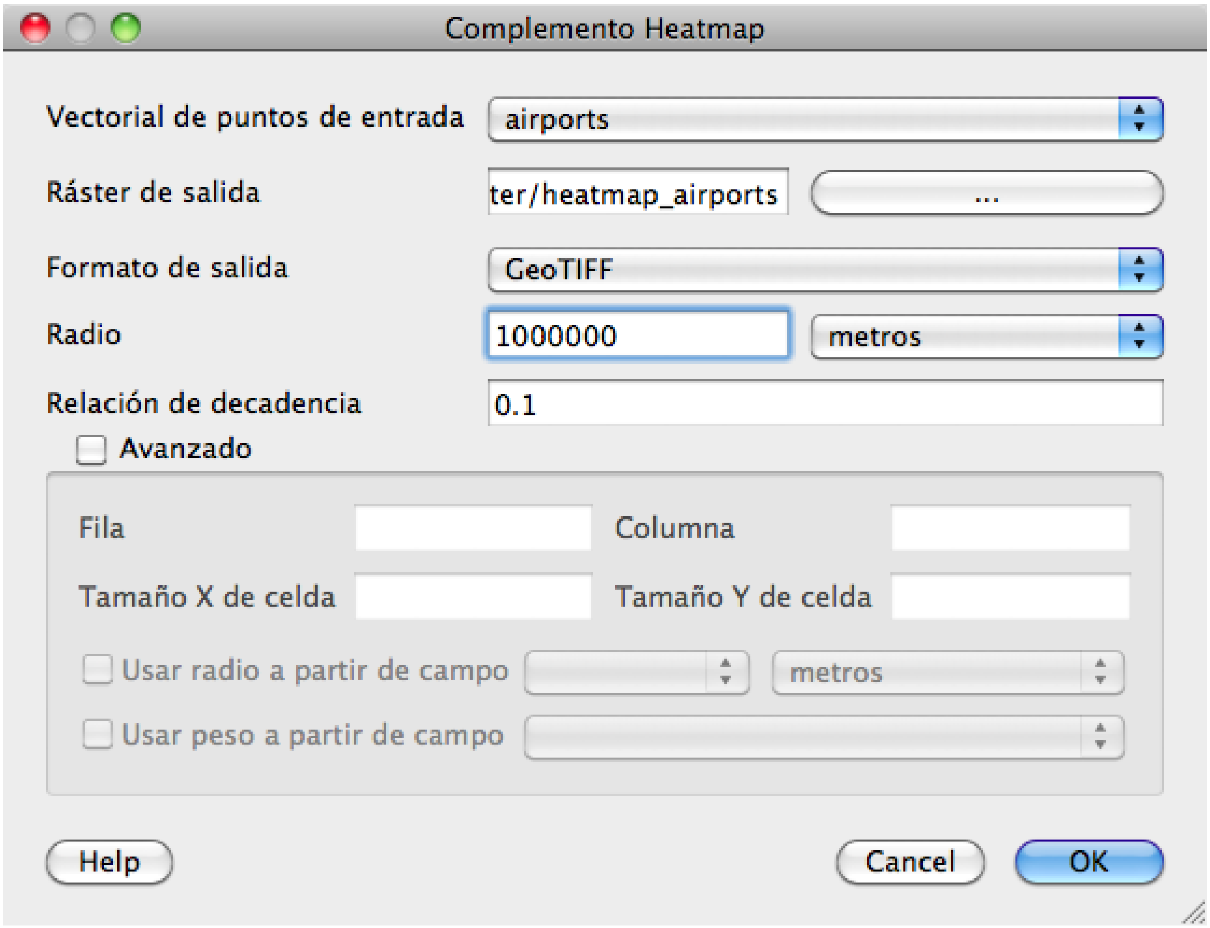

Figura 19.25: El diálogo de Mapa de calor

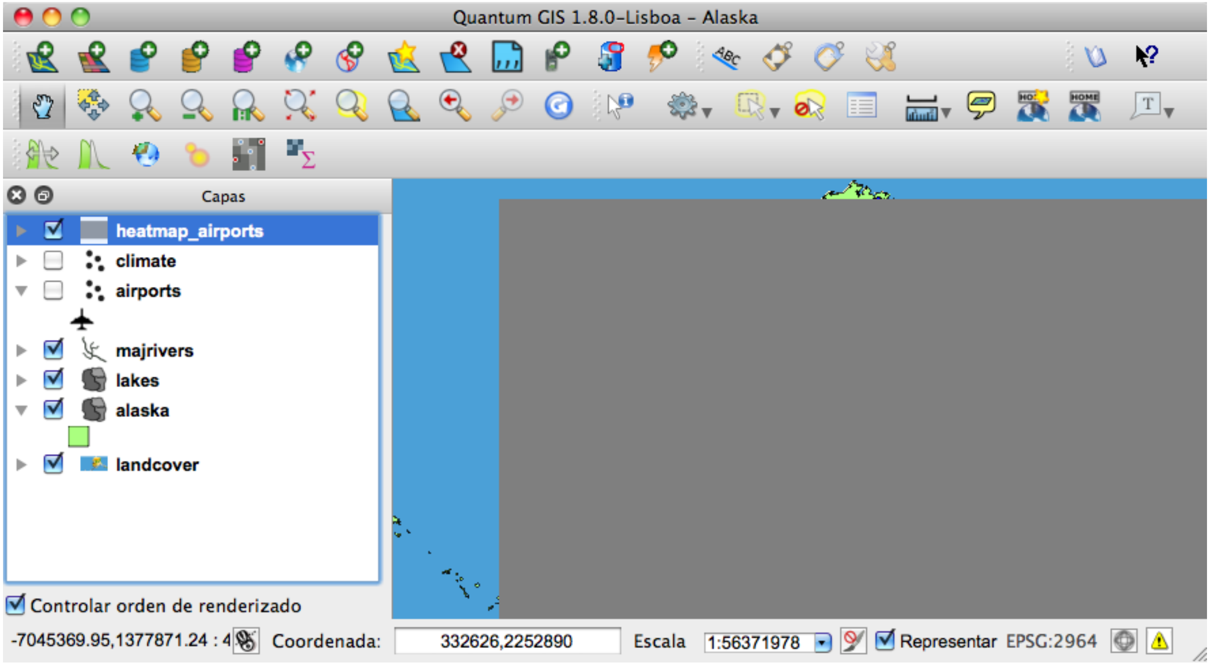

Figura 19.26: Después de cargar el mapa de calor se ve como una superficie gris

1. Abra el diálogo de propiedades de la capa `heatmap_airports` (seleccione la capa `heatmap_airports`, abra el menú contextual con el botón derecho del ratón y seleccione *Propiedades*).
2. Seleccione la pestaña *Estilo*.
3. Cambie el *Tipo de representación* a 'Pseudocolor de una sola banda'.
4. Seleccione un *Mapa de color* adecuado, por ejemplo `YlOrRed`.
5. Haga clic en el botón **[Cargar]** para recabar los valores mínimo y máximo del ráster, después pulse el botón **[Clasificar]**.
6. Pulse **[Aceptar]** para actualizar la capa.

El resultado final se muestra en Figure_Heatmap_4.

.

19.15 Complemento Grafo de rutas

Grafo de rutas es un complemento en C++ para QGIS que calcula la ruta más corta entre dos puntos de una capa de polilíneas y traza esta ruta sobre la red de carreteras.

Características principales:

- Calcula la ruta, así como la longitud y el tiempo de viaje.
- Optimiza la longitud o el tiempo de viaje.
- Exporta la ruta a una capa vectorial.
- Resalta la dirección de las carreteras (esto es lento y se utiliza principalmente para fines de depuración y para pruebas de configuración)

Como una capa de carreteras, se puede usar cualquier capa vectorial de polilíneas en cualquier formato admitido por QGIS. Dos líneas con un punto en común se consideran conectadas. Tenga en cuenta que es necesario usar el SRC de la capa como SRC del proyecto mientras edita una capa de carreteras. Esto es debido al hecho de que

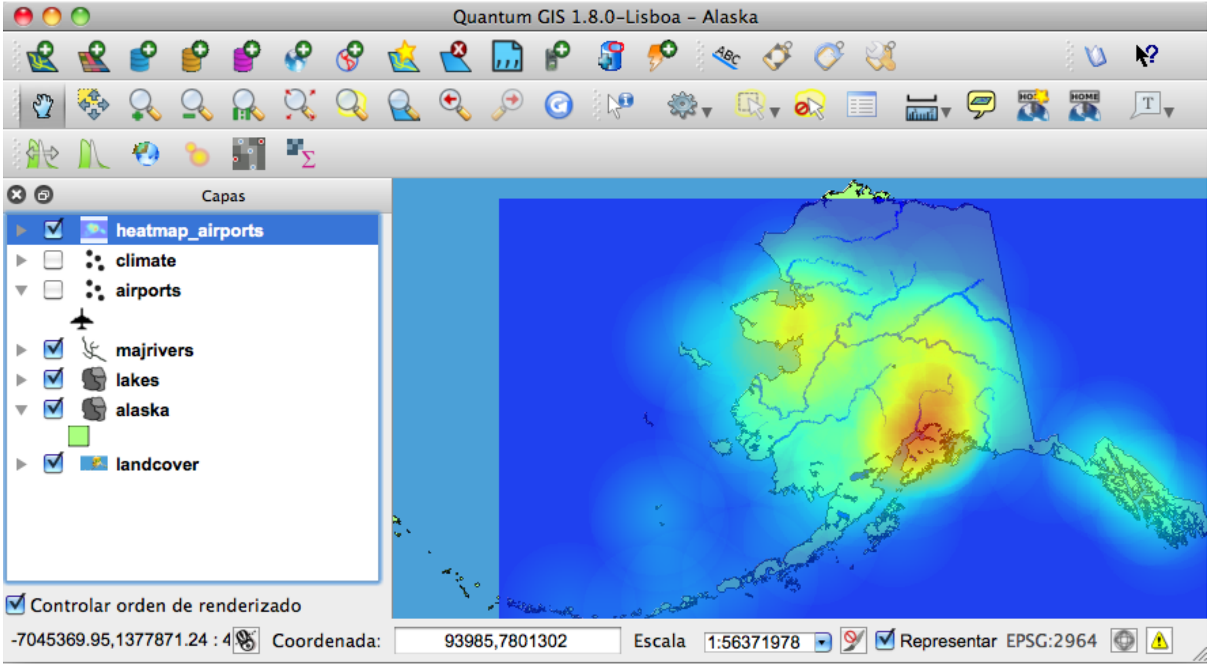

Figura 19.27: Mapa de calor de los aeropuertos de Alaska con estilo aplicado

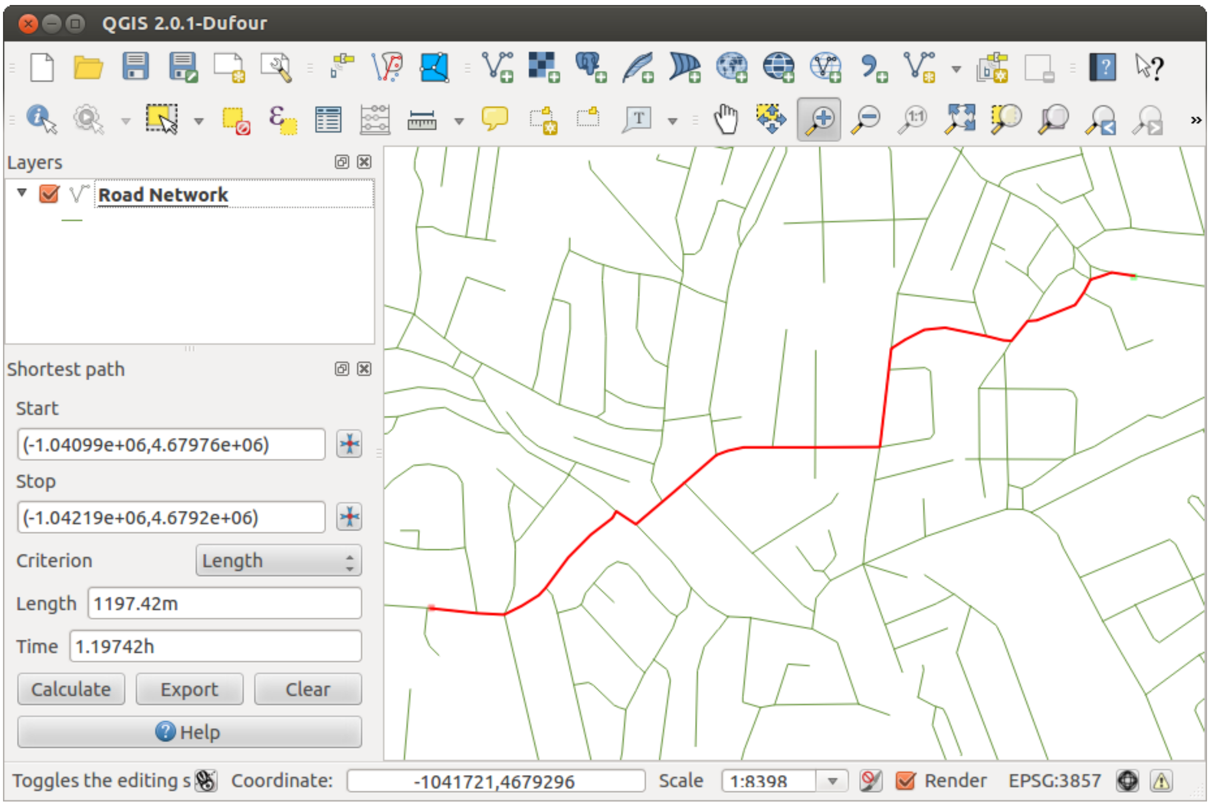

Figura 19.28: Complemento Grafo de rutas

recalcular las coordenadas entre diferentes SRC introduce algunos errores que pueden resultar en discontinuidades, incluso cuando se utiliza el 'autoensamblado'.

En la tabla de atributos de la capa, se pueden usar los siguientes campos:

- Velocidad en una sección de la carretera (campo numérico).
- Dirección (cualquier tipo que se pueda convertir en texto). Las direcciones de avance y retroceso corresponden a una carretera de un solo sentido, ambas direcciones indican una carretera de doble sentidos.

Si algunos campos no tienen ningún valor o no existen, se usan los valores predeterminados. Puede cambiar lo predeterminado y algunas configuraciones del complemento en el diálogo de configuración del complemento.

19.15.1 Usar el componente

Después de activar el complemento verá un panel adicional en el lado izquierdo de la ventana principal de QGIS. Ahora, escriba algunos parámetros en el diálogo *Configuración del complemento Grafos de rutas* en el menú *Vectorial* → *Grafo de rutas* (vea figure_road_graph_2).

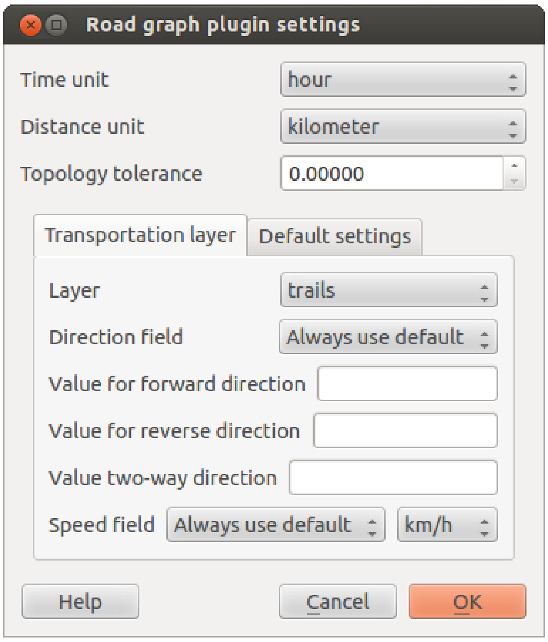

Figura 19.29: Configuración del complemento Grafo de rutas

Después de configurar *Unidad de tiempo*, *Unidad de distancia* y *Tolerancia de topología*, puede seleccionar la capa vectorial en la pestaña *Capa de transporte*. Aquí también puede seleccionar el *Campo de sentido* y el *Campo de velocidad*. En la pestaña *Configuración predeterminada*, puede establecer el *Sentido* para el calculo.

Finalmente, en el panel *Ruta más corta*, seleccione un punto de Inicio y un punto Final en la capa de red de carreteras y pulse **[Calcular]**.

.

19.16 Complemento Consulta espacial

El Complemento Consulta espacial permite hacer una consulta espacial (ej., seleccionar rasgos) en una capa de destino con referencia a otra capa. La funcionalidad se basa en la librería de GEOS y depende de la capa de rasgos de origen seleccionado.

Operadores posibles son:

- Contiene
- Igual
- Solapa
- Cruzar
- Intersecta
- Está inconexo
- Toca
- Dentro

19.16.1 Usar el complemento

Como un ejemplo, queremos encontrar regiones en el conjunto de datos de Alaska que contenga aeropuertos. Los siguientes pasos son necesarios:

1. Iniciar QGIS y cargar las capas vectoriales `regions.shp` y `airports.shp`.
2. Cargue el complemento de Consulta espacial en el Administrador de Complementos (vea *The Plugins Menus*) y haga clic en el icono Consulta espacial, que aparecerá en el menú de la barra de herramientas de QGIS. El diálogo de complemento aparece.
3. Seleccione la capa `regions` como la capa origen y `airports` como la capa de entidades de referencia.
4. Seleccione 'Contiene' como operador y haga clic en **[Aplicar]**.

Ahora obtiene una lista de IDs de entidades de la consulta y tiene varias opciones, como se muestra en figure_spatial_query_1.

- Haga clic sobre Crear capa con lista de elementos.
- Seleccione un ID de la lista y haga clic sobre Crear capa selección.
- Seleccione 'Eliminar de la selección actual' en el campo *Y utilizar el resultado para* .
- Además, se puede *Zum a los elementos* o checkbox| *Mensajes de registro*.

.

19.17 Complemento SPIT

QGIS viene con un complemento llamado SPIT (Herramienta para importar archivos shape a PostGIS). SPIT se puede usar para cargar multiples archivos shape en una sola vez e incluye soporte para esquemas. Para usar SPIT, abra el Administrador de complementos desde el menú *Complementos*, en el menú *Instalado* marque la casilla junto a *SPIT* y pulse **[Aceptar]**.

Para importar un archivo shape, use de la barra de menú *Base de datos* → *Importar (SPIT)* → *Importar archivos shape a PostgreSQL* para abrir el diálogo *SPIT - Herramienta para importar archivos shape a PostGIS*. Seleccione la base de datos PostGIS a la que quiera conectar y haga clic en **[Conectar]**. Si desea puede definir o cambiar algunas opciones de importación. Ahora puede agregar uno o más archivos a la cola haciendo clic en el botón **[Añadir]**. Para procesar los archivos, haga clic en el botón **[Aceptar]**. El proceso de importación, así como cualquier error/advertencia, se mostrará a medida que se procesa cada archivo shape. .

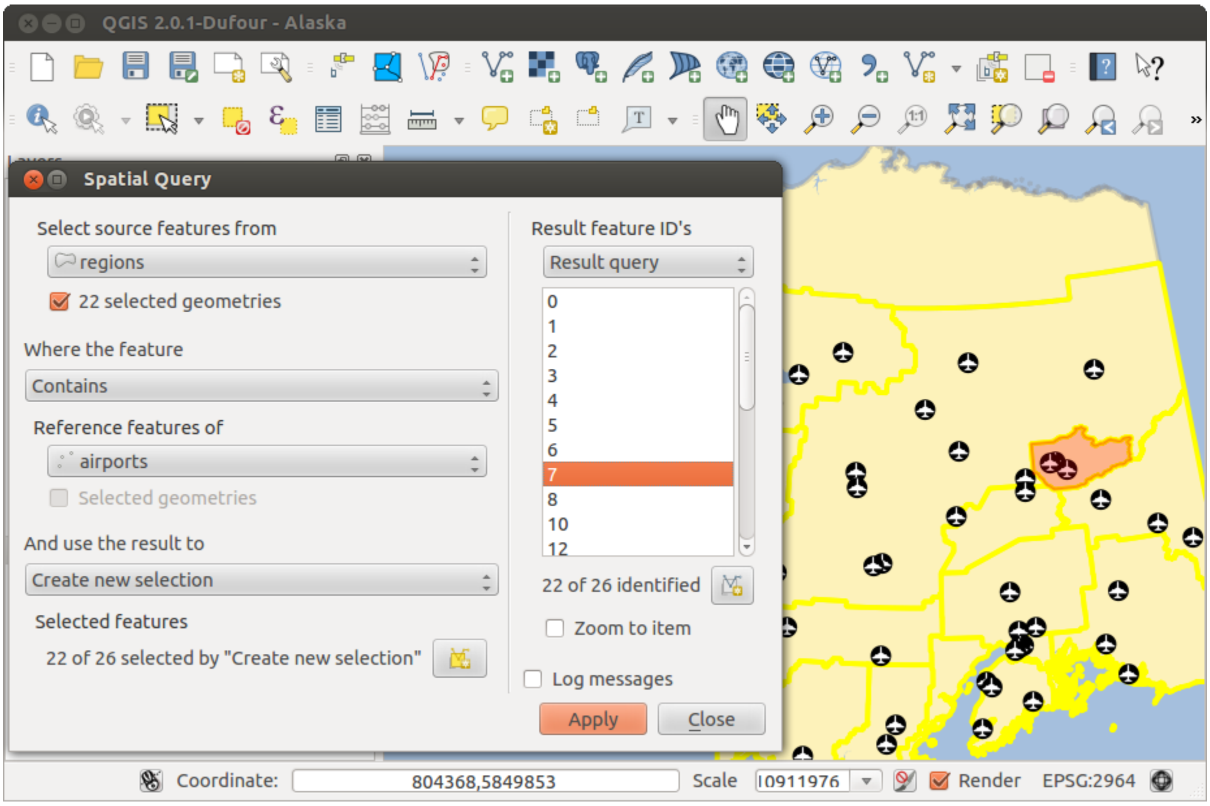

Figura 19.30: Análisis de consulta espacial - las regiones contienen aeropuertos QGIS

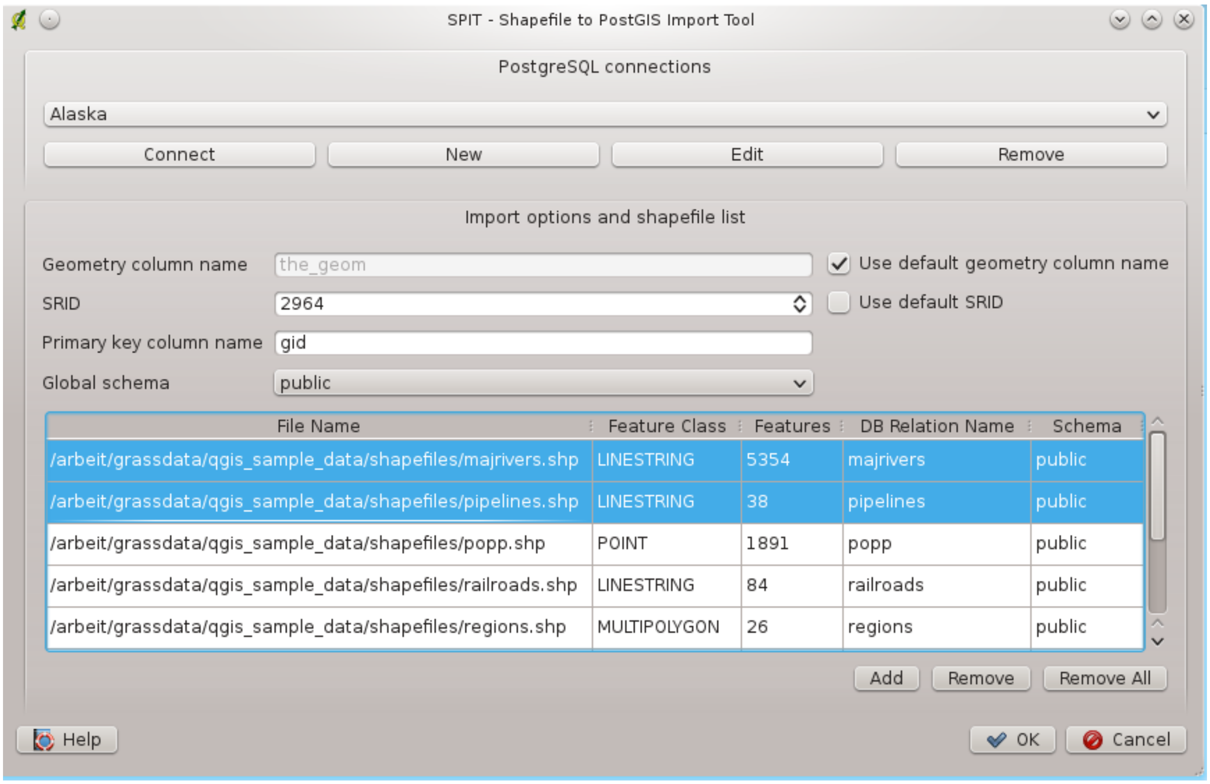

Figura 19.31: Usar el complemento SPIT para importar archivos shape a PostGIS

19.18 Complemento SQL Anywhere

SQL Anywhere es un sistema administrador de base de datos relacional (RDBMS) propietario de Sybase. SQL Anywhere proporciona soporte espacial, incluyendo OGC, archivos shape y funciones incorporadas para exportar a formatos KML, GML y SVG.

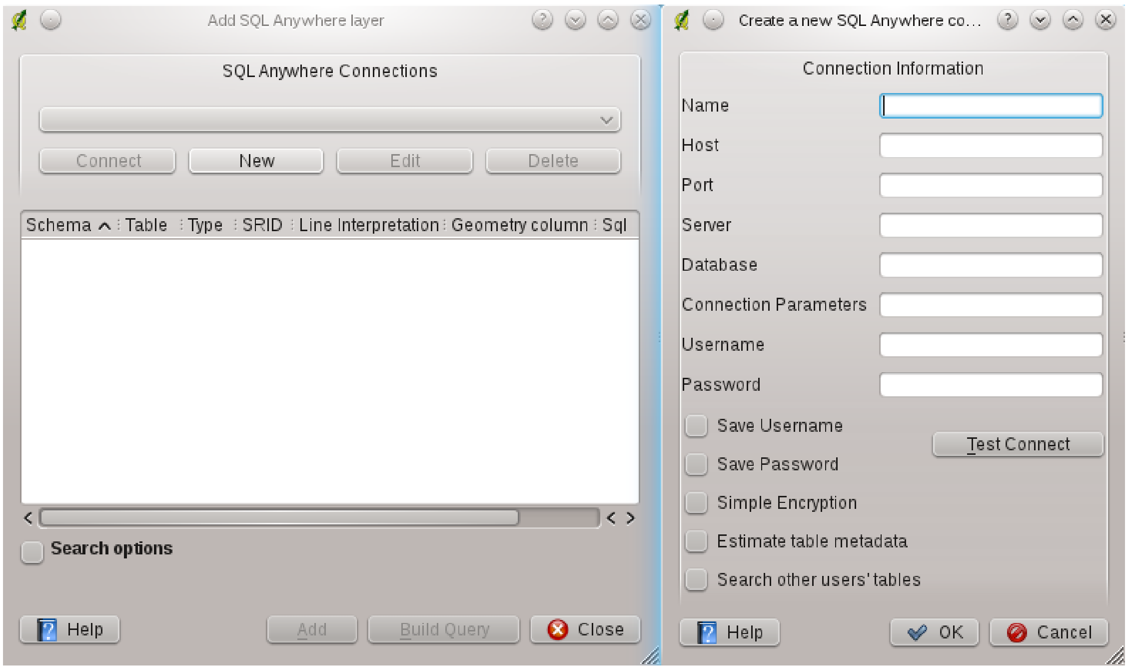

Figura 19.32: Cuadro de diálogo de SQL Anywhere (KDE)

SQL Anywhere permite conectarte a base de datos espaciales de SQL Anywhere. La ventana de diálogo :guilabel:'Añadir capa de SQL Anywhere ' es similar en funcionalidad a las de PostGIS y SpatialLite.

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19.19 Complemento Comprobador de topología.

La topología describe las relaciones entre puntos, líneas y polígonos que representa los objetos espaciales de una región geográfica. Con el complemento de Comprobador de Topología, puede revisar sus archivos vectoriales y verificar la topología con varias reglas topológicas. Estas reglas comprueban con relaciones espaciales si su objeto espacial es 'Equal', 'Contain', 'Cover', 'CoveredBy', 'Cross', o son 'Disjoint', 'Intersect', 'Overlap', 'Touch' o 'Within' el uno al otro. Depende de sus preguntas individuales que reglas topológicas que se aplican a los datos vectoriales (por ejemplo, normalmente no aceptará overshoots en capas de líneas, pero si ellos representan callejones sin salida que no eliminará de su capa vectorial).

QGIS tiene una característica integrada de edición topológica, que es ideal para la creación de nuevas funciones sin errores. Pero los errores de datos existentes y los errores inducidos por el usuario son difíciles de encontrar. Este complemento te ayuda a encontrar este tipo de errores a través de una lista de reglas.

Es muy simple crear reglas topológicas con el complemento Comprobador de topología.

En **capa de puntos** las siguientes reglas están disponibles:

- **Must be covered by**: Aquí puede elegir una capa vectorial de su proyecto. Los puntos que no están cubiertos por la capa vectorial dada se produce en el campo 'Error'.
- **Must be covered by endpoints of**: Aquí puede elegir una capa de líneas de su proyecto.

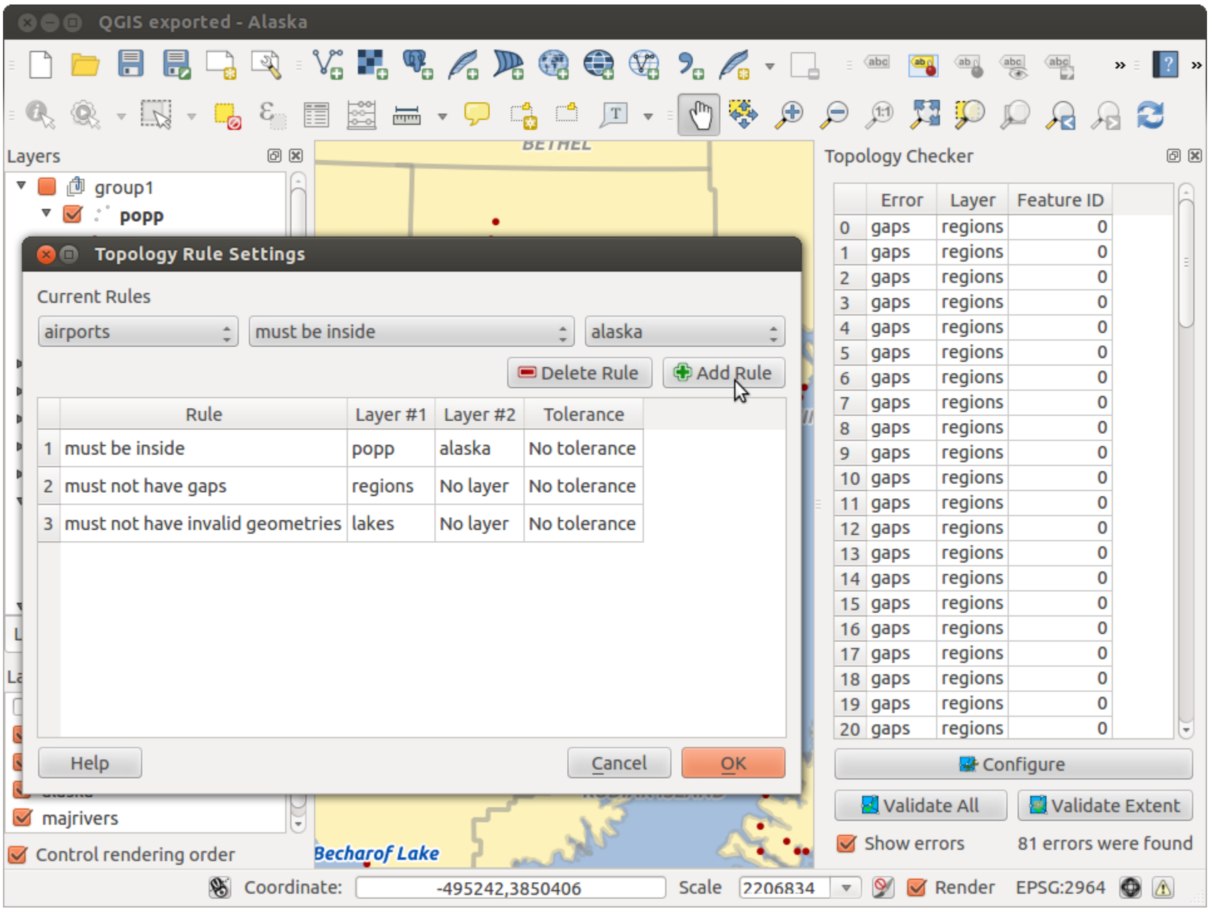

Figura 19.33: El complemento de Comprobador de Topología

- **Must be inside**: Aquí puede elegir una capa de polígonos de su proyecto. Los puntos deben estar dentro del polígono. De lo contrario, QGIS escribe un 'Error' del punto.
- **Must not have duplicates**: Siempre que un punto se representa dos o más veces, se producirá el campo 'Error'.
- **Must not have invalid geometries**: Comprobar si las geometrías son validas.
- **Must not have multi-part-geometries**: Todos los puntos multi-parte se escriben en el campo 'Error'.

En **Capas de líneas**, las siguientes reglas están disponibles:

- **End points must be covered by**: Aquí se puede seleccionar una capa de puntos de su proyecto.
- **Must not have dangles**: Este mostrará los overshoots en la capa de líneas.
- **Must not have duplicates**: Siempre que un objeto línea es representado una o dos veces, se producirá en el campo 'Error'.
- **Must not have invalid geometries**: Comprobar si las geometrías son validas.
- **Must not have multi-part geometries**: A veces, una geometría es en realidad una colección de simples (una sola pieza) geometrías. Una geometría de este tipo se denomina de geometría multiparte. Si contiene sólo un tipo de geometría simple, lo llamamos multi-punto, multi-línea o multi-polígono. Todas las líneas de multi-partes se escriben en el campo 'Error'.
- **Must not have pseudos**: Un punto final de geometría de línea debe estar conectado a los extremos de otras dos geometrías. Si el punto final está conectado al punto final de otra geometría, el punto final se denomina un nodo psuedo.

En **capas de polígonos**, las siguientes reglas están disponibles:

- **Must contain**: La capa de polígonos debe contener al menos un punto de la geometría de la segunda capa.
- **Must not have duplicates**: Los polígonos de la misma capa no deben tener geometrías idénticas. Cada vez que una entidad de polígono se represente dos veces o más se producirá en el campo 'Error'.
- **Must not have gaps**: Los polígonos adyacentes no deben formar espacios entre ellos. Los límites administrativos podrían mencionarse como ejemplo (polígonos de los estados de Estados Unidos no tienen espacios entre ellos ...).
- **Must not have invalid geometries**: Comprobar si las geometrías con validas. Algunas de las reglas que definen si una geometría es valida son:
  - Anillos de polígonos deben cerrarse.
  - Los anillos que definen agujeros deben estar dentro de los anillos que definen los límites exteriores.
  - Los anillos no deben intersectarse (Ni pueden tocarse o cruzarse entre si)
  - Los anillos no puede tocar otros anillos, excepto en un punto.
- **Must not have multi-part geometries**: A veces, una geometría es en realidad una colección geometrías sencillas (parte sencilla). Una geometría de este tipo se denomina de geometría multi-parte. Si contiene sólo un tipo de geometría simple, lo llamamos multi-punto, multi-líneas o multi-polígono. Por ejemplo, un país que consta de múltiples islas se puede representar como un multi-polígono.
- **Must not overlap**: Los polígonos adyacentes no deben de compartir un área en común.
- **Must not overlap with**: Los polígonos adyacentes de una capa no deben compartir un área con los polígonos de otra.

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19.20 Complemento de Estadísticas de zona

Con el complemento *Estadísticas de zona*, se pueden analizar los resultados de una clasificación temática. Esto permite calcular varios valores de los píxeles de una capa ráster con la ayuda de una capa vectorial de polígonos (vea figure_zonal_statistics). Puede calcular la suma, el valor medio y el total de los píxeles que están dentro de un polígono. El complemento genera columnas de salida en la capa vectorial con un prefijo definido por el usuario.

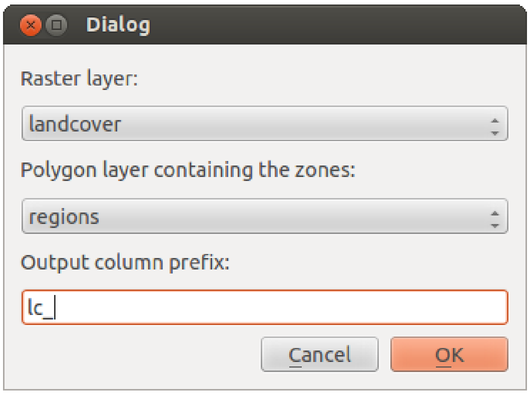

Figura 19.34: Diálogo de Estadísticas de zona (KDE)

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Help and Support

20.1 Mailing lists

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.

20.1.1 qgis-users

This mailing list is used for discussion of 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: http://lists.osgeo.org/mailman/listinfo/qgis-user

20.1.2 fossgis-talk-liste

For the German-speaking audience, the German FOSSGIS e.V. provides the fossgis-talk-liste mailing list. This mailing list is used for discussion of open-source GIS in general, including QGIS. You can subscribe to the fossgis-talk-liste mailing list by visiting the following URL: https://lists.fossgis.de/mailman/listinfo/fossgis-talk-liste

20.1.3 qgis-developer

If you are a developer facing problems of a more technical nature, you may want to join the qgis-developer mailing list here: http://lists.osgeo.org/mailman/listinfo/qgis-developer

20.1.4 qgis-commit

Each time a commit is made to the QGIS code repository, an email is posted to this list. If you want to be up-to-date with every change to the current code base, you can subscribe to this list at: http://lists.osgeo.org/mailman/listinfo/qgis-commit

20.1.5 qgis-trac

This list provides email notification related to project management, including bug reports, tasks, and feature requests. You can subscribe to this list at: http://lists.osgeo.org/mailman/listinfo/qgis-trac

20.1.6 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: http://lists.osgeo.org/mailman/listinfo/qgis-community-team

20.1.7 qgis-release-team

This list deals with topics like the release process, packaging binaries for various OSs and announcing new releases to the world at large. You can subscribe to this list at: http://lists.osgeo.org/mailman/listinfo/qgis-release-team

20.1.8 qgis-tr

This list deals with the translation efforts. If you like to work on the translation of the 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: http://lists.osgeo.org/mailman/listinfo/qgis-tr

20.1.9 qgis-edu

This list deals with QGIS education efforts. If you would like to work on QGIS education materials, this list is a good starting point to ask your questions. You can subscribe to this list at: http://lists.osgeo.org/mailman/listinfo/qgis-edu

20.1.10 qgis-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: http://lists.osgeo.org/mailman/listinfo/qgis-psc

You are welcome to subscribe to any of the lists. Please remember to contribute to the list by answering questions and sharing your experiences. Note that the qgis-commit and qgis-trac lists are designed for notification only and are not meant for user postings.

20.2 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://qgis.org/irclogs and read the IRC-logs.

Commercial support for QGIS is also available. Check the website http://qgis.org/en/commercial-support.html for more information.

20.3 BugTracker

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 at http://hub.qgis.org/projects/quantum-gis/issues. When creating a new ticket for a bug, please provide an email address where we can contact you for additional information.

Please bear in mind that your bug may not always enjoy the priority you might hope for (depending on its severity). Some bugs may require significant developer effort to remedy, and the manpower is not always available for this.

Feature requests can be submitted as well using the same ticket system as for bugs. Please make sure to select the type `Feature`.

If you have found a bug and fixed it yourself, you can submit this patch also. Again, the lovely redmine ticketsystem at http://hub.qgis.org/wiki/quantum-gis/issues has this type as well. Check the `Patch supplied` checkbox and attach your patch before submitting your bug. One of the developers will review it and apply it to QGIS. Please don't be alarmed if your patch is not applied straight away – developers may be tied up with other commitments.

20.4 Blog

The QGIS community also runs a weblog at http://planet.qgis.org/planet/, which has some interesting articles for users and developers as well provided by other blogs in the community. You are invited to contribute your own QGIS blog!

20.5 Plugins

The website http://plugins.qgis.org provides 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'.

20.6 Wiki

Lastly, we maintain a WIKI web site at http://hub.qgis.org/projects/quantum-gis/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!

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Appendix

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Preamble

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