QGIS User Guide

Rilis 2.2

QGIS Project

04 December 2014

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BAB 1

Pendahuluan

Dokumen ini merupakan buku petunjuk asli dari perangkat lunak yang dijelaskan QGIS. Perangkat lunak dan perangkat keras yang dijelaskan dalam dokumen ini dalam banyak kasus merupakan merek dagang terdaftar dan karena itu tunduk pada persyaratan hukum. QGIS menggunakan Lisensi Publik Umum GNU (GNU General Public License). Temukan informasi lebih lanjut pada QGIS alamat web http://www.qgis.org.

Detil, data, hasil dll. pada dokumen ini telah ditulis ulang dan diverifikasi dengan sebaik mungkin pengetahuan dan tanggungjawab dari penulis dan editor. Bagaimanapun juga, dimungkinkan adanya kesalahan pada isi dokumen ini.

Oleh karena itu, semua data tidak bertanggung jawab untuk setiap pekerjaan atau jaminan. Para penulis, editor dan penerbit tidak mengambil tanggung jawab atau kewajiban atas kegagalan dan konsekuensinya. Selalu terbuka bagi Anda untuk menunjukkan kemungkinan kesalahan.

Dokumen ini telah diatur dengan reStructuredText. Ini tersedia sebagai sumber kode reST di github dan dalam jaringan (online) dengan format HTML dan PDF di http://www.qgis.org/en/docs/. Versi terjemahan dari dokumen ini dapat diunduh dalam beberapa format melalui proyek dokumentasi QGIS. Informasi lebih lanjut tentang kontribusi pada dokumen ini dan tentang menerjemahkannya, silakan kunjungi: http://www.qgis.org/wiki/.

Tautan pada dokumen ini

Dokumen ini berisi tautan internal dan eksternal. Silakan klik pada tautan internal akan membuka dokumen, sedangkan klik tautan eksternal membuka alamat internet. Dalam bentuk PDF, tautan internal dan eksternal diperlihatkan dengan warna biru dan ditangani oleh sistem peramban web (browser). Dalam bentuk HTML, menampilkan peramban web (browser) dan menangani keduanya secara identik.

Pengguna, Penulis dan Editor Panduan Pemasangan dan Pemrograman (Coding):

Internet: http://www.qgis.org

Lisensi dokumen ini

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Konvensi

Bagian ini menjelaskan gaya seragam yang akan digunakan di seluruh manual ini.

2.1 Konvensi GUI

Gaya konvensi GUI dimaksudkan untuk meniru tampilan GUI. Secara umum, gaya akan mencerminkan penampilan non-hover, sehingga pengguna dapat memindai visual GUI untuk menemukan sesuatu yang tampak seperti petunjuk di manual.

- Menu Pilihan: *Lapisan* → *Tambah Lapisan Raster* atau :menuselection:'Pengaturan –> Toolbar –> Digitalisasi
- Alat: Tambah Lapisan Raster
- Tombol : **[Simpan sebagai Default]**
- Kotak Judul: *Properti Lapisan*
- Tab: *Umum*
- Kotak Centang: *Render*
- Tombol Radio: *Postgis SRID* *EPSG ID*
- Pilih Nomor: 1,00
- Pilih String: ...
- Lihat Berkas: ...
- Pilih Warna: Border color Change
- Slider:
- Masukkan Teks: Display name lakes.shp

Sebuah bayangan menunjukkan komponen GUI yang dapat diklik.

2.2 Konvensi Teks atau Papan Ketik

Panduan ini juga mencakup gaya yang berhubungan dengan teks, perintah papan ketik dan pemrograman (coding) untuk menunjukkan entitas yang berbeda, seperti kelas, atau metode. Gaya ini tidak sesuai dengan penampilan yang sebenarnya dari teks atau coding dalam QGIS.

- Pranala: http://qgis.org
- Kombinasi Keystroke: tekan `Ctrl+B`, artinya tekan dan tahan tombol Ctrl dan tekan tombol B.

- Nama Berkas: `lakes.shp`
- Nama Kelas: **LapisanBaru**
- Metode: *classFactory*
- Server: *myhost.de*
- Teks Pengguna: `qgis --help`

Baris kode ditunjukkan dengan huruf fixed-width

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

2.3 Petunjuk Spesifik Platform

Urutan GUI dan sejumlah kecil teks yang dapat diformat inline: Klik *Berkas* *QGIS → Keluar untuk menutup QGIS*. Hal ini menunjukkan bahwa di platform Linux, Unix dan Windows, pertama Anda harus mengklik menu Berkas, kemudian Keluar, sementara di platform Macintosh OS X, Anda harus mengklik QGIS menu pertama, kemudian Keluar.

Sejumlah besar teks dapat diformat sebagai daftar:

- Melakukan ini
- Melakukan itu
- Melakukan sesuatu yang lain

atau sebagai paragraf:

Lakukan ini dan ini dan ini. Kemudian melakukan ini dan ini dan ini dan ini dan ini dan ini dan ini dan ini dan ini.

Lakukan itu. Kemudian melakukan itu dan itu dan itu dan itu dan itu dan itu dan itu dan itu dan itu dan itu dan itu dan itu dan itu dan itu dan itu.

Layar yang muncul di seluruh buku panduan telah dibuat pada platform yang berbeda; platform ditunjukkan dengan ikon-platform tertentu pada akhir gambar keterangan.

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BAB 3

Kata Pengantar

Selamat datang di dunia indah dari Sistem Informasi Geografis (GIS)!

QGIS adalah Sistem Informasi Geografis Sumber Terbuka (Open Source). Proyek ini lahir di bulan Mei 2002 dan didirikan sebagai sebuah proyek di SourceForge pada bulan Juni tahun yang sama. Kami telah bekerja keras membuat perangkat lunak GIS (merupakan perangkat lunak proprietary tradisional mahal) prospek yang layak bagi siapa saja dengan akses dasar ke Personal Komputer. QGIS saat ini berjalan pada kebanyakan platform Unix, Windows, dan OS X. QGIS dikembangkan menggunakan toolkit Qt (http://qt.digia.com) dan C++. Ini berarti bahwa QGIS terasa cepat dan menyenangkan, antarmuka pengguna grafis yang mudah digunakan (GUI).

QGIS bertujuan untuk menjadi GIS yang mudah digunakan, menyediakan fungsi dan fitur-fitur umum. Tujuan awalnya adalah untuk menyediakan penampil data GIS. QGIS telah mencapai titik dalam evolusi di mana ia digunakan sehari-hari oleh banyak orang untuk kebutuhan melihat data GIS mereka. QGIS mendukung sejumlah format data raster dan vektor, dengan dukungan format baru mudah ditambahkan dengan menggunakan arsitektur plugin.

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

Tip: Pembaruan Dokumentasi

Versi terbaru dari dokumen ini selalu dapat ditemukan di website dokumentasi QGIS di http://www.qgis.org/en/docs/

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BAB 4

Fitur-fitur

QGIS menawarkan banyak fungsi GIS umum yang disediakan oleh fitur inti dan plugin. Sebuah ringkasan pendek dari enam kategori umum fitur dan plugin disajikan di bawah ini, diikuti oleh wawasan pertama ke konsol Python yang terintegrasi.

4.1 Lihat data

Anda dapat melihat dan overlay data vektor dan raster dalam format dan proyeksi yang berbeda tanpa konversi ke format internal maupun umum. Format yang didukung termasuk:

- Tabel spasial-enabled dan tampilan menggunakan PostGIS, SpatiaLite dan MSSQL Spasial, Oracle Spasial, format vektor yang didukung oleh perpustakaan OGR, termasuk ESRI shapefile, MapInfo, SDTS, GML dan banyak lagi, lihat bagian *Pekerjaan dengan Data Vektor*.
- Format raster dan citra yang didukung dengan terpasangnya GDAL (Geospatial Data Abstraction Library) perpustakaan, seperti GeoTiff, ERDAS IMG, ArcInfo ASCII GRID, JPEG, PNG dan banyak lagi, lihat bagian *Pekerjaan dengan Data Raster*.
- Data raster dan vektor GRASS dari basis data GRASS (lokasi/mapset). Lihat bagian *GRASS GIS Integration*.
- Data spasial dalam jaringan sebagai Layanan OGC Web, termasuk WMS, WMTS, WCS, WFS, dan WFS-T. Lihat bagian *Pekerjaan dengan Data OGC*.
- OpenStreetMap data. See section *plugins_osm*.

4.2 Jelajahi data dan menyusun peta

Anda dapat membuat peta interaktif dan mengeksplorasi data spasial dengan GUI yang ramah. Banyak alat yang tersedia di GUI termasuk:

- QGIS peramban web
- On-the-fly proyeksi ulang
- Pengelola DB
- Penyusun Peta
- Panel Peninjau
- Bookmark spasial
- Annotation tools
- Identifikasi/pilih fitur
- Sunting/lihat/cari atribut

- Fitur pelabelan data-ditentukan
- Alat simbologi vektor dan raster data-ditentukan
- Peta komposisi atlas dengan lapisan graticule
- Bar skala panah utara dan label hak cipta untuk peta
- Dukungan menyimpan dan mengembalikan proyek-proyek

4.3 Membuat, menyunting, mengelola dan ekspor data

Anda dapat membuat, mengedit, mengelola dan ekspor lapisan vektor dan raster dalam beberapa format. QGIS menawarkan sebagai berikut:

- Alat Digitalisasi yang didukung format OGR dan lapisan vektor GRASS
- Kemampuan untuk membuat dan mengedit lapisan shapefile dan vektor GRASS
- Plugin Georeferencer ke geocode gambar
- Alat GPS untuk mengimpor dan mengekspor format GPX, dan mengkonversi format GPS lain ke GPX atau unduh/unggah langsung ke unit GPS (di Linux, usb: telah ditambahkan ke daftar perangkat GPS.)
- Dukungan memvisualisasikan dan mengedit data OpenStreetMap
- Kemampuan membuat tabel basis data spasial dari shapefile dengan Plugin Pengelola DB
- Peningkatan penanganan tabel basis data spasial
- Peralatan untuk mengelola tabel atribut vektor
- Opsi menyimpan cuplikan layar sebagai gambar ber-georeferensi.

4.4 Analisis data

Anda dapat melakukan analisis data spasial pada basis data spasial dan format OGR lain yang didukung. QGIS saat ini menawarkan analisis vektor, sampling, geoprocessing, geometri dan aplikasi manajemen basis data. Anda juga dapat menggunakan aplikasi GRASS terintegrasi, yang meliputi fungsi GRASS lengkap lebih dari 400 modul (lihat bagian *GRASS GIS Integration*). Atau, Anda bekerja dengan Plugin Processing, yang menyediakan kerangka analisis geospasial yang kuat untuk memanggil algoritma pihak asli dan ketiga dari QGIS, seperti GDAL, SAGA, GRASS, fTools dan banyak lagi (lihat bagian *Pengantar*.)

4.5 Terbitkan peta di Internet

QGIS dapat digunakan sebagai WMS, WMTS, WMS-C atau WFS dan WFS-T client, dan sebagai WMS, WCS atau WFS server (lihat bagian *Pekerjaan dengan Data OGC*.). Selain itu Anda dapat mengekspor data, mempublikasikan mereka di internet menggunakan webserver dengan UMN MapServer atau GeoServer yang terpasang.

4.6 Memperpanjang fungsionalitas QGIS melalui plugin

QGIS dapat disesuaikan dengan kebutuhan khusus Anda dengan arsitektur plugin extensible dan perpustakaan yang dapat digunakan untuk membuat plugin. Anda dapat membuat aplikasi baru dengan C++ atau Python!

4.6.1 Inti Plugin

Plugin inti termasuk:

1. Rekaman Koordinat (Tetikus merekam koordinat di CRS yang berbeda)
2. DB Manager (Pertukaran, mengedit dan melihat lapisan dan tabel; mengeksekusi query SQL)
3. Diagram Overlay (Menempatkan diagram pada lapisan vektor)
4. Pengkonversi Dxf2Shp (Mengonversi DXF ke Shape)
5. eVIS (Visualize events)
6. fTools (Analisa dan kelola data vektor)
7. GDALTools (Integrasi alat GDAL ke dalam QGIS)
8. Georeferencer GDAL (Menambahkan informasi proyeksi ke raster menggunakan GDAL)
9. Peralatan GPS (Memuat dan impor data GPS)
10. GRASS (GRASS GIS integrasi)
11. Heatmap (Menghasilkan raster heatmap dari data titik)
12. Plugin Interpolasi (interpolasi berdasarkan simpul dari lapisan vektor)
13. Penyuntingan Luar Jaringan (Memungkinkan menyunting luar jaringan dan sinkronisasi dengan basis data)
14. Oracle Spatial GeoRaster
15. Processing (formerly SEXTANTE)
16. Analisis Terrain Raster (Analisis terrain berbasis raster)
17. Plugin Grafik Jalan (Analisis jaringan terpendek)
18. Spatial Query Plugin
19. SPIT (Impor Shapefile ke PostgreSQL/PostGIS)
20. Plugin SQL Anywhere (Menyimpan lapisan vektor dengan basis data SQL Anywhere)
21. Pemeriksa Topologi (Menemukan kesalahan topologi dalam lapisan vektor)
22. Plugin Zonal Statistik (hitung, jumlah, rata-rata raster untuk setiap poligon dari lapisan vektor)

4.6.2 Plugin Eksternal Python

QGIS menawarkan semakin banyak plugin python eksternal yang diberikan oleh masyarakat. Plugin ini berada di repositori resmi plugin, dan dapat dengan mudah dipasang menggunakan Pemasang Plugin Python. Lihat bagian *load_external_plugin*.

4.7 Python Console

Untuk membuat skrip, memungkinkan untuk mengambil keuntungan dari konsol Python terintegrasi, dimana bisa dibuka dari menu: *Plugin* → *Konsol Python*. Konsol terbuka sebagai jendela utilitas non-modal. Untuk interaksi dengan lingkungan QGIS, ada variabel `qgis.utils.iface`, yang merupakan contoh dari `QgsInterface`. Antarmuka ini memungkinkan akses ke kanvas peta, menu, toolbar dan bagian lain dari aplikasi QGIS.

Untuk informasi lebih lanjut tentang bekerja dengan plugin dan aplikasi Python Console dan Programming PyIqgl, silakan mengacu ke http://www.qgis.org/html/en/docs/pyqgis_developer_cookbook/index.html.

4.8 Isu yang Diketahui

4.8.1 Jumlah dari batas berkas yang dibuka

Jika Anda membuka sebuah proyek QGIS besar dan Anda yakin bahwa semua lapisan valid, tetapi beberapa lapisan ditandai sebagai lapisan buruk, Anda mungkin dihadapkan dengan masalah ini. Linux (dan OS lain juga) memiliki batas berkas yang dibuka. Batasan sumber daya per-proses dan diturunkan. Perintah `ulimit` merupakan termina built-in, mengubah batas hanya untuk proses terminal saat ini; batas baru akan diturunkan oleh setiap proses anak.

Anda bisa meliht semua informasi ulimit dengan mengetik

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

Anda bisa melihat jumlah yang diperbolehkan saat berkas dibuka per proses dengan perintah berikut di konsol

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

Untuk mengubah batas **sesi yang ada**, Anda mungkin dapat menggunakan sesuatu seperti

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

Untuk memperbaikinya selamanya

Pada kebanyakan sistem Linux, batasan sumber daya yang ditetapkan pada login dengan modul `pam_limits` sesuai dengan pengaturan yang terkandung dalam `/etc/security/limits.conf` atau `/etc/security/limits.d/*.conf`. Anda harus dapat mengedit berkas jika Anda memiliki hak istimewa root (juga via sudo), tetapi Anda akan perlu untuk login lagi sebelum perubahan berlaku.

Informasi tambahan:

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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BAB 5

Apa yang baru pada 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 Aplikasi dan Opsi Proyek

- **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 Penyedia Data

- **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 Penyusun Peta

- **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 Server 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 Simbologi

- **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 Antarmuka Pengguna

- **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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Memulai

Bab ini memberikan gambaran singkat cara memasang QGIS, beberapa contoh data dari QGIS halaman web dan menjalankan sesi pertama memvisualisasikan lapisan raster dan vektor sederhana.

6.1 Pemasangan (Instalasi)

Pemasangan QGIS sangat sederhana. Standar paket installer tersedia untuk MS Windows dan Mac OS X. Tersedia paket binari GNU/Linux (rpm dan deb) atau repositori perangkat lunak untuk menambah manajer instalasi. Dapatkan informasi terakhir paket binari pada website QGIS http://download.qgis.org.

6.1.1 Pemasangan dari sumber

Jika Anda perlu membangun QGIS dari sumber, silakan mengacu petunjuk instalasi. Mereka didistribusikan dengan kode sumber QGIS dalam sebuah berkas yang bernama 'INSTALL'. Anda juga bisa menemukannya di dalam jaringan (online) di http://htmlpreview.github.io/?https://raw.github.com/qgis/QGIS/master/doc/INSTALL.html

6.1.2 Pemasangan pada media eksternal

QGIS memungkinkan Anda untuk menentukan opsi `--configpath` yang menimpa path standar untuk konfigurasi pengguna (misalnya, `~/.qgis2` Linux) dan kemampuan **QSettings** menggunakan direktori ini juga. Hal ini memungkinkan Anda juga, membawa pemasang QGIS dalam pada flash drive bersama dengan semua plugin dan pengaturan. Lihat Bagian *Menu Sistem* untuk informasi tambahan.

6.2 Contoh data

Panduan pengguna berisi contoh-contoh berdasarkan contoh dataset QGIS.

installer Windows memiliki pilihan untuk mengunduh contoh dataset QGIS. Jika dicentang, data akan diunduh ke folder `My Documents` Anda dan ditempatkan dalam folder bernama `GIS database`. Anda dapat menggunakan Windows Explorer untuk memindahkan folder ini ke setiap lokasi yang nyaman. Jika Anda tidak memilih kotak centang untuk memasang contoh dataset selama instalasi QGIS, Anda dapat melakukan salah satu dari berikut:

- Gunakan data GIS yang Anda miliki
- Unduh contoh data dari http://download.osgeo.org/qgis/data/qgis_sample_data.zip
- Hapus (uninstall) QGIS dan pasang ulang dengan opsi unduh data, (hanya direkomendasikan jika solusi di atas tidak berhasil)

Untuk GNU/Linux dan Mac OS X, belum ada paket instalasi dataset yang tersedia rpm, deb atau dmg. Untuk menggunakan contoh dataset unduh berkas ZIP arsip `qgis_sample_data` dari http://download.osgeo.org/qgis/data/qgis_sample_data.zip dan unzip arsip pada sistem Anda.

Dataset Alaska mencakup semua data GIS yang digunakan sebagai contoh dan cuplikan layar di buku panduan; dan termasuk basis data kecil GRASS. Proyeksi contoh dataset QGIS adalah Alaska Albers Equal Area dengan satuan kaki. Kode EPSG 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]]
```

Jika Anda berniat untuk menggunakan QGIS sebagai grafis frontend GRASS, Anda dapat menemukan pilihan contoh lokasi (misalnya Spearfish atau South Dakota) di situs resmi GRASS GIS http://grass.osgeo.org/download/sample-data/.

6.3 Sesi Contoh

Sekarang QGIS Anda sudah terpasang dan contoh dataset tersedia, kami ingin menunjukkan sesi contoh QGIS singkat dan sederhana. Kami akan memvisualisasikan lapisan (layer) raster dan vektor. Kami akan menggunakan lapisan (layer) raster tutupan lahan `qgis_sample_data/raster/landcover.img` dan lapisan (layer) vektor danau `qgis_sample_data/gml/lakes.gml`.

6.3.1 Mulai QGIS

- Mulai QGIS dengan mengetik: "QGIS" di terminal, atau menggunakan bineri precompiled, menggunakan menu Aplikasi.
- Mulai QGIS menggunakan menu Start atau shortcut desktop, atau dobel klik di berkas proyek QGIS.
- Dobel klik ikon pada folder Aplikasi.

6.3.2 Muat lapisan (layer) raster dan vektor dari contoh dataset

1. Klik di ikon Load Raster
2. Jelejahi folder `qgis_sample_data/raster/`, pilih berkas ERDAS Img `landcover.img` dan klik **[Buka]**.
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. Sekarang klik di ikon Load Vector.
5. *Berkas* harus dipilih sebagai Jenis Sumber *Tipe Sumber* dalam dialog baru *Tambah lapisan vektor*. Sekarang klik **[Jelajah]** untuk memilih lapisan vektor.
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. Perbesar sedikit ke daerah favorit Anda dengan beberapa danau.
8. Dobel klik lapisan (layer) `lakes` di legenda peta untuk membuka dialog *Properti*.
9. Klik pada tab *Gaya* dan pilih biru sebagai warna.
10. Klik tab *Label* dan centang kotak centang *Label lapisan ini dengan* untuk mengaktifkan pelabelan. Pilih kolom "NAMES" sebagai kolom isian label.
11. Untuk memudahkan pembacaan label, Anda dapat menambahkan penyangga (buffer) putih di sekitar mereka, dengan klik "Buffer" dalam daftar sebelah kiri, periksa *Draw text buffer* dan pilih 3 sebagai ukuran penyangga (buffer).
12. Klik **[Terapkan]**. Periksa apakah hasilnya baik, dan terakhir klik **[OK]**.

Anda dapat melihat betapa mudahnya untuk memvisualisasikan lapisan (layer) raster dan vektor dalam QGIS. Mari kita lanjutkan ke bagian berikut untuk mempelajari lebih lanjut tentang fungsi, fitur dan pengaturan yang tersedia dan bagaimana menggunakannya.

6.4 Memulai dan Menghentikan QGIS

Dalam bagian *Sesi Contoh* Anda sudah belajar bagaimana memulai QGIS. Kami akan mengulanginya di sini dan Anda akan melihat QGIS juga menyediakan opsi baris perintah lebih lanjut.

- Dengan asumsi bahwa QGIS dipasang di PATH, Anda dapat memulai QGIS dengan mengetik: `qgis` pada terminal atau dengan mengklik dobel pada link aplikasi QGIS (atau shortcut) pada desktop atau dalam menu aplikasi.
- Mulai QGIS menggunakan menu Start atau shortcut desktop, atau dobel klik di berkas proyek QGIS.
- Dobel klik ikon di folder Aplikasi Anda. Jika Anda memulai QGIS di terminal, jalankan `/path-to-installation-executable/Contents/MacOS/Qgis`.

Untuk menghentikan QGIS, klik menu opsi *Berkas* *QGIS* → *Keluar*, atau menggunakan shortcut `Ctrl+Q`.

6.5 Pilihan Baris Perintah

QGIS mendukung sejumlah pilihan ketika dimulai dari baris perintah. Untuk mendapatkan daftar opsi, enter `qgis --help` pada baris perintah. Pernyataan penggunaan untuk QGIS adalah:

```
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
```

Tip: Contoh Menggunakan argumen baris perintah

Anda dapat memulai QGIS dengan menentukan satu atau lebih berkas data pada baris perintah. Misalnya, dengan asumsi Anda berada di direktori `qgis_sample_data`, Anda bisa memulai QGIS dengan berkas lapisan vektor dan raster yang diatur untuk dimuat pada startup dengan menggunakan perintah berikut: `qgis ./raster/landcover.img ./gml/lakes.gml`

Pilihan baris perintah `--snapshot`

Pilihan ini memungkinkan Anda untuk membuat cuplikan layar dalam format PNG dari tampilan saat ini. Hal ini sangat berguna ketika Anda memiliki banyak proyek dan ingin menghasilkan cuplikan layar dari data Anda.

Saat ini menghasilkan berkas PNG dengan piksel 800x600. Hal ini dapat diadaptasi dengan menggunakan argumen baris perintah `--width` dan `--height`. Nama berkas bisa ditambahkan setelah `--snapshot`.

Pilihan baris perintah `--lang`

Berdasarkan lokal QGIS Anda, pilih lokalisasi yang benar. Jika Anda ingin mengubah bahasa, Anda dapat menentukan kode bahasa. Sebagai contoh: `--lang=id` QGIS dimulai menggunakan lokal Indonesia. Daftar bahasa saat ini yang didukung dengan kode bahasa dan status disediakan di http://hub.qgis.org/wiki/quantum-gis/GUI_Translation_Progress.

Baris perintah `--project`

Memulai QGIS dengan berkas proyek yang sudah ada. Hanya tambahkan baris perintah `--project` ikuti nama berkas proyek yang akan dibuka dan QGIS akan membukanya dengan memuat semua lapisan (layer).

Baris perintah `--extent`

Untuk memulai dengan peta batas tertentu menggunakan opsi ini. Anda perlu menambahkan kotak bounding sejauh Anda dalam urutan dipisahkan oleh koma:

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

Baris perintah `--nologo`

Argumen baris perintah ini menyembunyikan layar splash ketika Anda mulai QGIS.

Baris perintah `--noplugins`

Jika Anda mengalami kesulitan pada saat startup dengan plugin, Anda dapat menghindari beban mereka pada saat startup dengan opsi ini. Mereka masih akan tersedia di Manajer Plugin after-wards.

Baris perintah `--nocustomization`

Menggunakan argumen baris perintah ini, Anda bisa menentukan penyesuaian berkas GUI, yang akan digunakan saat startup.

Baris perintah `--nocustomization`

Menggunakan argumen baris perintah ini, penyesuaian GUI yang ada tidak akan diterapkan pada saat startup.

Baris perintah `--optionspath`

You can have multiple configurations and decide which one to use when starting QGIS with this option. See *Opsi* 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.

Baris perintah `--configpath`

Pilihan ini mirip dengan yang di atas, tapi selanjutnya menimpa path default untuk konfigurasi pengguna (`~/.qgis2`) dan kemampuan **QSettings** untuk menggunakan direktori ini juga. Hal ini memungkinkan pengguna mis membawa instalasi QGIS pada flash drive bersama dengan semua plugin dan pengaturan.

6.6 Proyek

Sesi QGIS Anda dianggap sebagai sebuah proyek. QGIS bekerja pada satu proyek pada satu waktu. Pengaturan yang baik dianggap sebagai per-proyek, atau sebagai default untuk proyek-proyek baru (lihat Bagian *Opsi*). QGIS bisa menyimpan kerja Anda ke dalam sebuah berkas proyek dengan menggunakan pilihan menu *Proyek* → *Simpan* atau *Proyek* → *Simpan Sebagai*.

Memuat proyek tersimpan ke dalam sesi QGIS menggunakan *Proyek* → *Buka ...*, *Proyek* → *Baru dari template* atau *Proyek* → *Buka yang baru teradi* →.

Jika Anda ingin membersihkan sesi Anda dan memulai baru lagi, pilih *Proyek* → *Baru*. Pilihan menu ini akan meminta Anda untuk menyimpan proyek yang telah ada jika perubahan yang telah dibuat sejak dibuka atau yang terakhir disimpan.

Jenis-jenis informasi yang disimpan dalam berkas proyek meliputi:

- Lapisan (layer) yang ditambahkan
- Properti lapisan (layer), termasuk simbolisasi
- Proyeksi untuk tampilan peta
- Tampilan terkahir

Berkas proyek disimpan dalam format XML, sehingga memungkinkan untuk mengedit berkas diluar QGIS jika Anda tahu apa yang Anda lakukan. Format berkas telah diperbaharui beberapa kali dibanding versi QGIS sebelumnya. Berkas proyek dari versi QGIS yang lebih tua mungkin tidak bekerja dengan baik lagi. Harus dibuat sadar akan hal ini, di tab *Umum Pengaturan* → *Opsi* Anda dapat memilih:

- *Prompt untuk menyimpan proyek dan perubahan sumber data bila diperlukan*
- *Peringatkan ketika membuka berkas proyek QGIS yang disimpan dengan versi lama*

Setiap kali Anda menyimpan proyek dalam QGIS 2.2 sekarang berkas cadangan dari proyek dibuat.

6.7 Keluaran (Output)

Ada beberapa cara untuk menghasilkan keluaran (output) dari sesi QGIS Anda. Kita telah membahasnya pada Bagian *Proyek*, menyimpan berkas proyek. Berikut ini adalah contoh cara lain untuk menghasilkan keluaran (output) berkas:

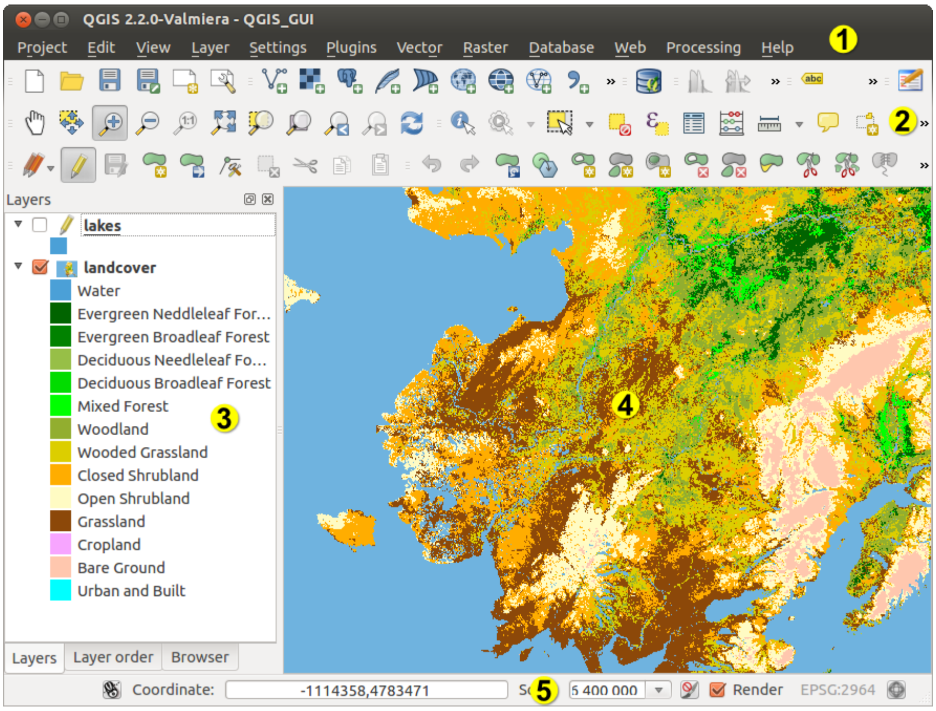
- Menu opsi *Proyek* → Simpan sebagai Gambar membuka dialog berkas di mana Anda memilih nama, path dan jenis gambar (format PNG atau JPG). Sebuah berkas dengan ekstensi PNGW atau JPGW disimpan dalam folder sama dengan gambar yang mempunyai georeferensi.

- Menu opsi *Proyek* → *Ekspor DXF ...* membuka dialog di mana Anda dapat menentukan 'Symbology mode', 'Symbology scale' dan lapisan vektor yang ingin Anda ekspor ke DXF.
- Menu opsi *Proyek* → *Penyusun Cetak Baru* membuka dialog di mana Anda dapat me-layout dan mencetak kanvas peta saat ini (lihat Bagian *Print Composer*).

.

QGIS GUI

Ketika QGIS dimulai, Anda akan disajikan tampilan GUI seperti gambar (nomer 1 sampai 5 dalam lingkaran kuning mengacu pada 5 area utama antarmuka yang dibahas dibawah ini).



Gambar 7.1: GUI QGIS dengan contoh data Alaska

Catatan: Jendela dekorasi Anda (judul bar , dll) dapat terlihat berbeda tergantung pada sistem operasi dan window manager Anda .

GUI QGIS dibagi dalam lima area:

1. Bar Menu
2. Bar Tool
3. Legenda Peta
4. Tampilan Peta
5. Status Bar

Kelima komponen antarmuka QGIS dijelaskan secara lebih rinci dalam bagian berikut. Lebih dari dua bagian dijelaskan di shortcut papan ketik dan bantuan.

7.1 Bar Menu

Menu bar memberikan akses ke berbagai fitur QGIS menggunakan standar hirarki menu. Menu-menu utama dan ringkasan dari beberapa menu pilihan yang tercantum di bawah ini, bersama-sama dengan ikon dari alat yang sesuai seperti yang ditampilkan pada toolbar, seperti shortcut papan ketik. Shortcut papan ketik juga dapat dikonfigurasi secara manual menggunakan dialog *Configure shortcuts*, dibuka dari *Pengaturan* → *Konfigurasi Shortcut...*.

Meskipun sebagian besar pilihan menu memiliki alat yang sesuai dan sebaliknya, menu tidak terorganisir seperti toolbar. Toolbar yang berisi alat ini bisa terdaftar setelah setiap pilihan menu diisi pada kotak centang. Beberapa pilihan menu hanya muncul jika plugin yang sesuai dimuat. Untuk informasi lebih lanjut tentang alat dan toolbar, lihat Bagian *Toolbar*.

7.1.1 Proyek

Pilihan Menu	Shortcut	Referensi	Toolbar
Baru	`Ctrl+N`	lihat *Proyek*	*Proyek*
Buka	`Ctrl+O`	lihat *Proyek*	*Proyek*
Baru dari template →		lihat *Proyek*	*Proyek*
Buka terkahir dikerjakan →		lihat *Proyek*	
Simpan	`Ctrl+S`	lihat *Proyek*	*Proyek*
Simpan Sebagai...	`Ctrl+Shift+S`	lihat *Proyek*	*Proyek*
Simpan sebagai gambar...		lihat *Keluaran (Output)*	
Ekspor DXF ...		lihat *Keluaran (Output)*	
Penyusun cetak baru	`Ctrl+P`	lihat *Print Composer*	*Proyek*
Manajer Penyusun ...		lihat *Print Composer*	*Proyek*
Penyusun Cetak →		lihat *Print Composer*	
Keluar QGIS	`Ctrl+Q`		

7.1.2 Edit

Pilihan Menu	Shortcut	Referensi	Toolbar
Kembali	`Ctrl+Z`	lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Ulangi	`Ctrl+Shift+Z`	lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Ambil Fitur	`Ctrl+X`	lihat *Digitizing an existing layer*	*Digitalisasi*
Salin Fitur	`Ctrl+C`	lihat *Digitizing an existing layer*	*Digitalisasi*
Tempel Fitur	`Ctrl+V`	lihat *Digitizing an existing layer*	*Digitalisasi*
Sisip fitur sebagai →		lihat *Working with the Attribute Table*	
Tambah Fitur	`Ctrl+.`	lihat *Digitizing an existing layer*	*Digitalisasi*
Pindah Fitur		lihat *Digitizing an existing layer*	*Digitalisasi*
Hapus yand dipilih		lihat *Digitizing an existing layer*	*Digitalisasi*
Rotasi Fitur		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Sederhanakan Fitur		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Tambah Ring		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Tambah Bagian		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Isi Ring		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Hapus Ring		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Hapus bagian		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Bentuk Ulang Fitur		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Offset Curves		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Pisah Fitur		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Bagian dipisah		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Gabung Fitur Terpilih		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Gabung Attr. Fitur Terpilih		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*
Node Tool		lihat *Digitizing an existing layer*	*Digitalisasi*
Rotasi Simbol Titik		lihat *Advanced digitizing*	*Digitalisasi Lanjutan*

Setelah mengaktifkan mode Toggle mengedit untuk lapisan (layer), Anda menemukan ikon `Add Feature` di menu *Edit* tergantung pada jenis lapisan (titik, garis atau poligon).

7.1.3 Edit (ekstra)

Pilihan Menu	Shortcut	Referensi	Toolbar
Tambah Fitur		lihat *Digitizing an existing layer*	*Digitalisasi*
Tambah Fitur		lihat *Digitizing an existing layer*	*Digitalisasi*
Tambah Fitur		lihat *Digitizing an existing layer*	*Digitalisasi*

7.1.4 Tampilan

Pilihan Menu	Shortcut	Referensi	Toolbar
Pan Peta			*Navigasi Peta*
Geser Peta untuk Menyeleksi			*Navigasi Peta*
Perbesar	`Ctrl++`		*Navigasi Peta*
Perkecil	`Ctrl+-`		*Navigasi Peta*
Pilih →		lihat *Pilih dan lepas fitur*	*Atribut*
Identifikasi Fitur	`Ctrl+Shift+I`		*Atribut*
Mengukur →		lihat *Mengukur*	*Atribut*
Perbesar semua	kbd:*Ctrl+Shift+F*		*Navigasi Peta*
Perbesar ke lapisan			*Navigasi Peta*
Perbesar yang diseleksi	`Ctrl+J`		*Navigasi Peta*
Perbesaran Terakhir			*Navigasi Peta*
Perbesar Selanjutnya			*Navigasi Peta*
Perbesar Ukuran Aktual			*Navigasi Peta*
Dekorasi →		lihat *Dekorasi*	
Informasi Peta			*Atribut*
Bookmark Baru	`Ctrl+B`	lihat *Bookmark Spasial*	*Atribut*
Lihat Bookmarks	`Ctrl+Shift+B`	lihat *Bookmark Spasial*	*Atribut*
Refresh	`Ctrl+R`		*Navigasi Peta*

7.1.5 Lapisan

Pilihan Menu	Shortcut	Referensi	Toolbar
Baru →		lihat *Creating new Vector layers*	*Kelola Lapisan*
Lekatkan Lapisan dan Grup ...		lihat *Proyek-proyek Nesting*	
Tambah Lapisan Vektor	kbd:*Ctrl+Shift+V*	lihat *Pekerjaan dengan Data Vektor*	*Kelola Lapisan*
Tambahkan Lapisan Raster	`Ctrl+Shift+R`	lihat *Loading raster data in QGIS*	*Kelola Lapisan*
Tambah Lapisan PostGIS	`Ctrl+Shift+D`	lihat *PostGIS Layers*	*Kelola Lapisan*
Tambahkan Lapisan SpatiaLite	`Ctrl+Shift+L`	lihat *SpatiaLite Layers*	*Kelola Lapisan*
Tambahkan Lapisan MSSQL Spasial	`Ctrl+Shift+M`	lihat *label_mssql*	*Kelola Lapisan*
Tambah Lapisan Oracle GeoRaster		lihat *Plugin Spasial Oracle GeoRaster*	*Kelola Lapisan*
Tambah Lapisan SQL Anywhere		Lihat *Plugin SQL Anywhere*	*Kelola Lapisan*
Tambah Lapisan WMS/WMTS	`Ctrl+Shift+W`	lihat *Klien WMS/WMTS*	*Kelola Lapisan*
Tambah Lapisan WCS		lihat *Klien WCS*	*Kelola Lapisan*
Tambah Lapisan WFS		lihat *Klien WFS dan WFS-T*	*Kelola Lapisan*
Tambahkan Lapisan Delimited Teks		see *label_dltext*	*Kelola Lapisan*
Gaya Salin		lihat *Style Menu*	
Gaya Tempel		lihat *Style Menu*	

Lanjut ke halaman berikutnya

Tabel 7.1 – lanjutan dari halaman sebelumnya

Pilihan Menu	Shortcut	Referensi	Toolbar
Buka Tabel Atribut		lihat *Working with the Attribute Table*	*Atribut*
Toggle Mengedit		lihat *Digitizing an existing layer*	*Digitalisasi*
Simpan Lapisan diedit		lihat *Digitizing an existing layer*	*Digitalisasi*
Diedit Sekarang →		lihat *Digitizing an existing layer*	*Digitalisasi*
Simpan Sebagai...			
Simpan terpilih sebagai berkas vektor...		Lihat *Working with the Attribute Table*	
Buang Lapisan	Ctrl+D		
Lapisan Duplikat			
Atur CRS Lapisan	Ctrl+Shift+C		
Atur CRS proyek dari Lapisan			
Properti			
Query...			
Pelabelan			
Tambahkan ke Overview	Ctrl+Shift+O		*Kelola Lapisan*
Tambahkan Semua ke Overview			
Menghapus Semua dari Overview			
Lihat Semua Lapisan	Ctrl+Shift+U		*Kelola Lapisan*
Sembunyikan Semua Lapisan	Ctrl+Shift+H		*Kelola Lapisan*

7.1.6 Pengaturan

Pilihan Menu	Shortcut	Referensi	Toolbar
Panel →		Lihat *Panel dan Toolbar*	
Toolbar →		Lihat *Panel dan Toolbar*	
Toggle Mode Layar Penuh	F 11		
Proyek Properti ...	Ctrl+Shift+P	lihat *Proyek*	
Ubah CRS ...		lihat *Custom Coordinate Reference System*	
Pengelola Gaya...		lihat *vector_style_manager*	
Konfigurasi shortcut ...			
Kustomisasi ...		lihat *Penyesuaian (Customization)*	
Opsi ...		lihat *Opsi*	
Opsi Snapping ...			

7.1.7 Plugin

Pilihan Menu	Shortcut	Referensi	Toolbar
Kelola dan Pasang Plugin		lihat *The Plugins Menus*	
Konsol Python			

Saat memulai QGIS untuk pertama kali tidak semua inti plugin dimuat.

7.1.8 Vektor

Pilihan Menu	Shortcut	Referensi	Toolbar
Open Street Map →		lihat *Loading OpenStreetMap Vectors*	
Peralatan Analisis →		lihat *Plugin fTools*	
Peralatan Riset →		lihat *Plugin fTools*	
Peralatan Geoprocessing →		lihat *Plugin fTools*	
Peralatan Geometri →		lihat *Plugin fTools*	
Peralatan Manajemen Data →		lihat *Plugin fTools*	

Saat memulai QGIS untuk pertama kali tidak semua inti plugin dimuat.

7.1.9 Raster

Pilihan Menu	Shortcut	Referensi	Toolbar
Kalkulator Raster ...		lihat *Kalkulator Raster*	

Saat memulai QGIS untuk pertama kali tidak semua inti plugin dimuat.

7.1.10 Pengolahan

Pilihan Menu	Shortcut	Referensi	Toolbar
Toolbox		lihat *The toolbox*	
Grafis Modeler		lihat *The graphical modeler*	
Sejarah dan log		lihat *Manajer riwayat*	
Opsi dan Konfigurasi		lihat *Configuring the processing framework*	
Penampil hasil		lihat *Configuring external applications*	
Perintah	`Ctrl+Alt+M`	lihat *The SEXTANTE Commander*	

Saat memulai QGIS untuk pertama kali tidak semua inti plugin dimuat.

7.1.11 Bantuan

Pilihan Menu	Shortcut	Referensi	Toolbar
Konten Bantuan	`F1`		*Bantuan*
Apakah ini?	`Shift+F1`		*Bantuan*
Dokumentasi API			
Butuh dukungan komersial?			
Beranda QGIS	`Ctrl+H`		
Periksa versi QGIS			
Tentang			
Sponsor QGIS			

Harap dicatat bahwa untuk Linux item Menu Bar yang tercantum di atas adalah yang standar di window manager KDE. Di GNOME, menu *Pengaturan* memiliki isi yang berbeda dan item bisa ditemukan di sini:

Properti Proyek	*Proyek*
Opsi	*Edit*
Konfigurasi Shortcuts	*Edit*
Pengelola Gaya	*Edit*
Modifikasi CRS	*Edit*
Panel →	*Tampilan*
Toolbar →	*Tampilan*
Toggle Mode Layar Penuh	*Tampilan*
Slider Skala Tile	*Tampilan*
Pelacakan GPS	*Tampilan*

7.2 Toolbar

Toolbar menyediakan akses ke sebagian besar fungsi yang sama seperti menu, ditambah alat tambahan untuk berinteraksi dengan peta. Setiap item toolbar memiliki popup bantuan yang tersedia. Tahan tetikus anda ke atas item dan deskripsi singkat mengenai tujuan alat itu akan ditampilkan.

Setiap menubar dipindah kesekitarnya sesuai dengan kebutuhan Anda. Selain itu setiap menubar dapat dimatikan menggunakan tombol kanan tetikus pada menu konteks Anda, arahkan tetikus ke toolbar (baca juga *Panel dan Toolbar*).

Tip: Mengembalikan toolbar

Jika Anda tidak sengaja telah menyembunyikan semua toolbar Anda, Anda dapat mengembalikannya dengan memilih menu opsi *Pengaturan* → *Toolbar* →. Jika toolbar menghilang di bawah OS Windows, tampaknya menjadi masalah di QGIS dari waktu ke waktu, Anda harus menghapus `\HKEY_CURRENT_USER\Software\QGIS\qgis\UI\state` di registry. Ketika Anda hidupkan ulang QGIS, kuncinya ditulis lagi secara standar, dan semua toolbar terlihat kembali.

7.3 Legenda Peta

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.

Suatu lapisan (layer) dapat dipilih dan digeser ke atas atau kebawah pada legenda menjadi Z-urutan. Z-urutan berarti bahwa lapisan yang terdaftar di bagian atas legenda digambar lapisan bawahnya tercantum dalam legenda.

Catatan: Perilaku ini dapat diganti dengan panel 'urutan lapisan'.

Lapisan di jendela legenda dapat dikelompokkan dalam grup. Ada dua cara untuk melakukannya:

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. Pilih beberapa lapisan (layer), klik kanan pada jendela legenda dan pilih *Grup Terpilih*. Lapisan-lapisan yang dipilih secara otomatis akan menjadi satu grup baru.

Untuk mengeluarkan lapisan dari grup, Anda bisa menggesernya keluar, atau klik kanan dan pilih *Ubah jadi tingkat teratas*. Grup dapat masuk kedalam grup lain.

Kotak centang grup akan memunculkan atau menyembunyikan lapisan dalam grup dengan satu klik.

Isi dari konteks menu tombol kanan tetikus tergantung pada item legenda yang dipilih lapisan (layer) raster atau vektor. Untuk lapisan vektor GRASS Toggle mengedit tidak tersedia. Lihat bagian *Digitizing and editing a GRASS vector layer* untuk informasi menyunting lapisan (layer) vektor GRASS.

Tombol kanan tetikus untuk lapisan raster

- *Perbesar lapisan extent*
- *Perbesar Skala Terbaik (100%)*
- *Peregangan Menggunakan Luas Terkini*
- Tampilkan di overview
- *Buang*
- *Duplikat*
- *Atur CRS Lapisan*
- *Atur CRS Proyek dari Lapisan*
- *Simpan sebagai ...*
- *Properti*
- *Ubah Nama*
- *Gaya Salin*
- *Add New Group*
- *Expand all*
- *Collapse all*
- *Update Drawing Order*

Selain itu, menurut posisi dan seleksi lapisan (layer)

- *Ubah jadi item tingkat teratas*
- *Grup dipilih*

Tombol kanan tetikus menu untuk lapisan vektor

- *Perbesar ke Lapisan Extent*
- *Tampilkan di Overview*
- *Buang*
- *Duplikat*
- *Atur CRS Lapisan*
- *Atur CRS Proyek dari Lapisan*
- *Buka Tabel Atribut*
- *Toggle Mengedit* (tidak tersedia untuk Lapisan GRASS)
- *Simpan Sebagai ...*
- *Save Selection As*
- *Saring*
- *Tampilkan Fitur Hitung*
- *Properti*
- *Ubah Nama*
- *Gaya Salin*
- *Add New Group*
- *Expand all*
- *Collapse all*
- *Update Drawing Order*

Selain itu, menurut posisi dan seleksi lapisan (layer)

- *Ubah jadi item tingkat teratas*
- *Grup dipilih*

Tombol kanan tetikus menu untuk grup lapisan

- *Perbesar ke Grup*
- *Buang*
- *Atur Grup CRS*
- *Ubah Nama*
- *Add New Group*
- *Expand all*
- *Collapse all*
- *Update Drawing Order*

Saat ini memungkinkan memilih lebih dari satu lapisan atau grup pada waktu yang sama dengan menekan tombol `Ctrl` sambil memilih lapisan dengan tombol kiri tetikus. Kemudian Anda dapat memindah semua lapisan terpilih ke dalam grup baru pada waktu yang sama.

Anda juga dapat menghapus lebih dari satu Lapisan atau Grup sekaligus dengan memilih beberapa Lapisan (layer) dengan menekan tombol `Ctrl` dan setelah itu `Ctrl+D`. Dengan cara ini semua Lapisan atau Grup terpilih akan dibuang dari daftar lapisan.

7.3.1 Bekerja dengan Legenda urutan lapisan tersendiri

Terdapat widget yang memungkinkan untuk mendefinisikan urutan legenda gambar independen. Anda dapat mengaktifkannya dari menu *Pengaturan* → *Panel* → *Urutan Lapisan*. Di sini menentukan urutan gambar dari lapisan dalam tampilan peta. Melakukan hal ini memungkinkan untuk mengurutkan lapisan Anda dalam urutan kepentingan, sebagai contoh, tapi masih menampilkan mereka dalam urutan yang benar (lihat figure_layer_order). Mengaktifkan kotak *Kontrol urutan rendering* bawah daftar lapisan akan menyebabkan kembali ke suatu perilaku standar.

7.4 Tampilan Peta

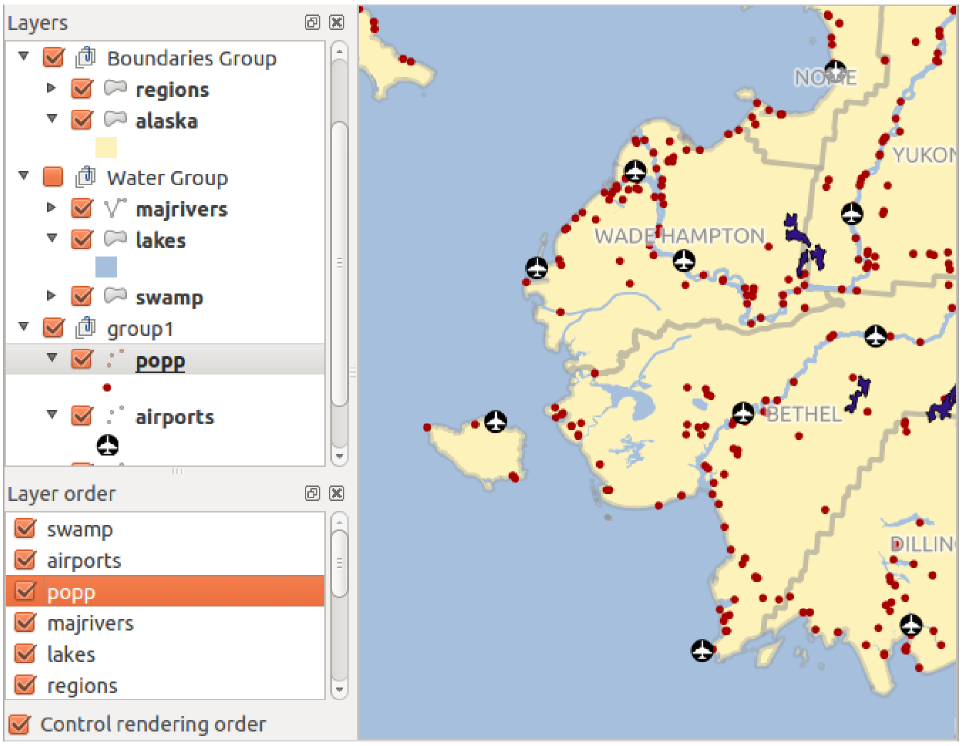
Ini "business end" dari QGIS - peta tampil di area ini! Peta yang ditampilkan dalam jendela ini tergantung pada lapisan vektor dan raster yang telah Anda pilih (lihat bagian informasi lebih lanjut tentang cara untuk memuat lapisan). Tampilan peta dapat digeser (mengalihkan fokus tampilan peta untuk daerah lain) dan memperbesar atau memperkecilnya. Berbagai operasi lainnya dapat dilakukan pada peta seperti yang dijelaskan dalam deskripsi toolbar di atas. Tampilan peta dan legenda terikat erat satu sama lain - peta dalam tampilan mencerminkan perubahan yang Anda buat di daerah legenda.

Tip: Perbesar peta dengan tetikus

Anda dapat menggunakan tetikus untuk memperbesar dan memperkecil peta. Tempatkan kursor tetikus di dalam area peta dan roll roda depan (jauh dari Anda) untuk memperbesar dan belakang (ke arah Anda) untuk memperkecil. Posisi kursor tetikus adalah pusat di mana perubahan terjadi. Anda dapat menyesuaikan perilaku pembesaran roda tetikus menggunakan menu *Alat Peta* dalam menu *Pengaturan* → *Opsi*.

Tip: Menggeser peta dengan tombol panah dan spasi bar

Anda dapat menggunakan tombol panah untuk menggeser peta. empatkan kursor tetikus dalam area peta dan klik panah kanan untuk menggeser ke Timur, panah kiri untuk menggeser ke Barat, panah atas untuk menggeser ke



Gambar 7.2: Mendefiniskan legenda urutan lapisan tersendiri

Utara dan pana bawah untuk menggeser ke Selatan. Anda juga dapat menggeser peta dengan menggunakan bar spasi atau klik pada tetikus: hanya menggerakkan tetikus bersamaan menekan bar spasi atau klik tetikus.

7.5 Status Bar

Bar status melihatkan posisi kursor Anda dalam koordinat peta (misal meter atau derajat desimal) sesuai dengan titik kursor tetikus bergerak pada tampilan peta. Di sebelah kiri tampilan koordinat di bar status adalah tombol kecil yang akan beralih antara menampilkan posisi koordinat atau menampilkan luasan peta saat Anda menggeser dan memperbesar/memperkecil tampilan peta.

Sebelah tampilan koordinat Anda menemukan tampilan skala. Itu menunjukkan skala dari tampilan peta. Jika Anda memperbesar atau memperkecil QGIS berisi skala saat ini. Ada pemilih skala yang memungkinkan Anda untuk memilih skala standar dari 1:500 sampai 1:1000000.

Suatu perkembangan (progres) bar di status bar menunjukkan kemajuan (progres) render karena setiap lapisan yang diubah di tampilan peta. Dalam beberapa kasus, seperti pengumpulan statistik di lapisan raster, progress bar akan menunjukkan status panjangnya operasi.

Jika ada plugin baru atau pembaruan plugin tersedia, Anda akan melihat pesan sebelah kiri dari bar status. Di sisi kanan status bar adalah kotak centang kecil yang dapat digunakan untuk lapisan sementara yang diberikan ke tampilan peta (lihat Bagian *Rendering*). Ikon menghentikan proses rendering peta sekarang.

Sebelah kanan dari fungsi render, Anda akan menemukan kode EPSG dari CRS proyek sekarang dan ikon proyektor. Mengklik ini akan membuka properti proyeksi untuk proyek saat ini.

Tip: Menghitung skala koreksi dari kanvas peta Anda

Saat Anda memulai QGIS, derajat merupakan unit standar, dan QGIS memberitahu bahwa setiap koordinat pada lapisan Anda dalam derajat. Untuk mengubah nilai skala, Anda juga dapat mengubahnya ke satuan meter secara manual di tab *Umum* dalam *Pengaturan* → *Proyek Properti* atau Anda bisa memilih Coordinate Reference System

(CRS) proyek dengan klik ikon CRS status di bagian kanan bawah dari status bar. Dalam kasus terakhir, unit ditetapkan untuk menentukan proyeksi proyek, (misalnya '+unit=m').

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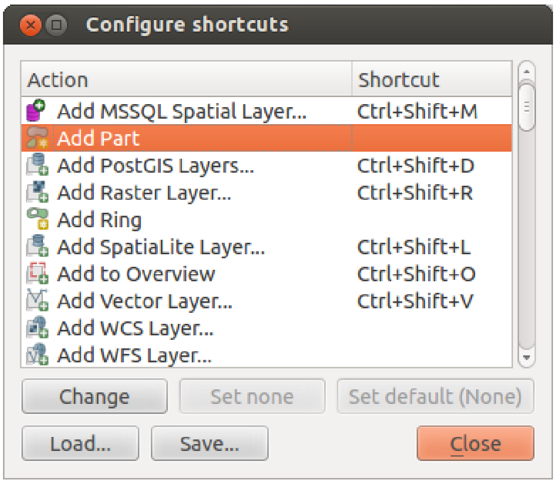
Peralatan Umum

8.1 Shortcut Papanketik

QGIS menyediakan standar shortcut papan ketik untuk banyak fitur. Anda menemukannya di Bagian *Bar Menu*. Selain itu di menu opsi *Pengaturan* → *Konfigurasi Shortcut* memungkinkan merubah standar shortcut papanketik dan menambah shortcut papanketik baru ke fitur QGIS.



Gambar 8.1: Tentukan pilihan shortcut (Gnome)

Konfigurasi sederhana. Hanya pilih fitur dari daftar dan klik pada **[Ubah]**, **[Atur none]** atau **[Atur Standar]**. Setelah Anda telah menemukan konfigurasi, Anda dapat menyimpannya sebagai berkas XML dan muat pada instalasi QGIS lain.

8.2 Konteks Bantuan

Saat Anda membutuhkan bantuan dengan topik yang spesifik, Anda dapat mengakses konteks bantuan melalui tombol **[Bantuan]** tersedia disebagian besar dialog - harap dicatat bahwa plugin pihak ketiga dapat mengarah ke halaman web khusus.

8.3 Rendering

Secara standar, QGIS membuat semua lapisan terlihat setiap kali kanvas peta di-refresh. Peristiwa yang memicu refresh kanvas peta meliputi:

- Menambahkan lapisan (layer)

- Menggeser atau memperbesar
- Mengukur jendela QGIS
- Merubah visitabilitas dari lapisan (layer)

QGIS memungkinkan Anda mengontrol proses rendering dalam beberapa cara.

8.3.1 Scale Dependent Rendering

Skala render memungkinkan Anda untuk menentukan skaa minimum dan skala maksimum di mana lapisan akan terlihat. Untuk mengatur skala render bergantung, buka dialog *Properti* dengan mengklik-dobel pada lapisan di legenda. Pada tab *Umum* klik pada kotak centang *Skala bergantung pada visibilitas* untuk mengaktifkan fitur, kemudian atur nilai maskimum dan minimum skala.

Anda dapat menentukan nilai skala dengan terlebih dahulu perbesar ke tingkat yang ingin Anda gunakan dan mencatat nilai skala pada status bar QGIS.

8.3.2 Mengontrol Rendering Peta

Me-render peta dapat dikontrol dalam berbagai cara, seperti yang dijelaskan di bawah ini.

Menunda Rendering

Untuk menunda rendering, klik kotak centang *Render* di sudut bawah kanan dari status bar. Ketika kotak centang *Render* tidak diaktifkan, QGIS tidak menggambar ulang kanvas dalam menanggapi setiap kejadian yang telah diuraikan dalam Bagian *Rendering*. Contoh ketika Anda mungkin ingin menunda render meliputi:

- Menambah banyak lapisan dan melambangkan mereka sebelum menggambar
- Menambahkan satu atau lebih lapisan besar dan mengatur ketergantungan skala sebelum menggambar
- Menambahkan satu atau lebih lapisan besar dan perbesar ke tampilan spesifik sebelum menggambar
- Kombinasi dari yang ada di atas

Aktifkan kotak centang *Render* mengaktifkan rendering dan dan menyebabkan refresh langsung dari kanvas peta.

Pengaturan Lapisan Tambah Opsi

Anda dapat mengatur pilihan untuk selalu memuat lapisan baru tanpa menggambar mereka. Ini berarti lapisan akan ditambahkan ke peta, namun visibilitas kotak centang dalam legenda akan dicentang secara default. Untuk mengatur opsi ini, pilih menu opsi *Pengaturan* → *Opsi* dan klik tab *Rendering*. Hapus centang *Secara standar lapisan baru ditambahkan ke peta selalu ditampilkan*. Setiap lapisan ditambahkan ke peta akan tidak terlihat secara standar.

Menghentikan Rendering

Untuk menghentikan penggambaran peta, tekan tombol `ESC`. Ini akan menghentikan refresh kanvas peta dan menghentikan proses penggambaran peta. Hal ini mungkin membutuhkan waktu selama menekan `ESC` dan penggambaran peta terhenti.

Catatan: Saat ini tidak memungkikan untuk menghentikan rendering - ini dinonaktifkan di port qt4 karena masalah antarmuka pengguna (UI) dan konflik (crash).

Memperbarui tampilan peta sebelum rendering

Anda dapat mengatur pilihan untuk memperbarui tampilan peta sebagai fitur. Secara standar, QGIS tidak menampilkan semua fitur untuk lapisan sampai seluruh lapisan telah dirender.Untuk memperbarui tampilan seperti fitur dibaca dari datastore, pilih opsi menu *Pengaturan* → *Opsi* klik pada menu *Rendering*. Mengatur jumlah fitur untuk nilai yang sesuai untuk memperbarui tampilan selama rendering. Menetapkan nilai 0 menonaktifkan pembaruan selama menggambar (ini adalah default). Menetapkan nilai terlalu rendah akan menghasilkan kinerja yang buruk pada kanvas peta terus diperbarui selama pembacaan fitur. Nilai yang disarankan untuk memulai adalah 500.

Mempengarui Kualitas Rendering

Untuk mempengaruhi kualitas dari peta Anda memiliki 2 opsi. Pilih opsi menu *Pengaturan* → *Opsi* klik pada tab *Rendering* dan pilih atau tidak kotak centang berikut.

- ☑ *Membuat garis tampil kurang baik dengan mengorbankan beberapa kinerja menggambar*
- ☑ *Memperbaiki masalah isi poligon*

Mempercepat rendering

Ada dua pengaturan yang memungkinkan Anda untuk meningkatkan kecepatan rendering. Buka opsi dialog QGIS menggunakan *Pengaturan* → *Opsi*, ke tab *Rendering* dan pilih atau tidak kotak centang berikut.

- ☑ *Enable back buffer*. Hal ini memberikan performa grafis yang lebih baik pada kemungkinan kehilangan biaya untuk membatalkan rendering dan secara bertahap menggambar fitur. Jika dicentang, Anda dapat mengatur *Jumlah fitur untuk menggambar sebelum memperbarui tampilan*, jika pilihan ini tidak aktif.
- ☑ *Gunakan render caching yang memungkinkan mempercepat gambar ulang*

8.4 Mengukur

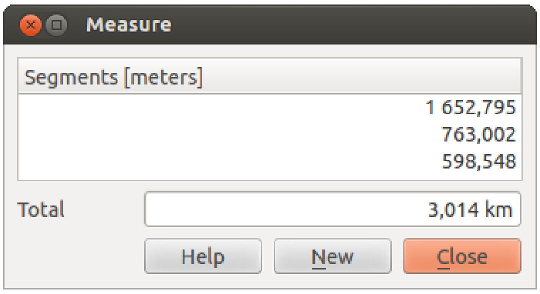
Mengukur peta dalam proyeksi sistem koordinat (misal UTM) dan data belum terproyeksi. Jika peta dimuat didefinisikan dengan sistem koordinat geografis (lintang/bujur), hasil dari garis atau daerah pengukuran akan salah. Untuk memperbaiki ini, Anda perlu mengatur peta sesuai sistem koordinat (lihat Bagian *Working with Projections*). Semua modul pengukuran juga menggunakan pengaturan snapping dari modul digitalisasi. Hal ini berguna, jika Anda ingin mengukur garis atau area di lapisan vektor.

Untuk memilih alat ukur, klik di dan pilih alat yang ingin digunakan.

8.4.1 Mengukur panjang, area dan sudut

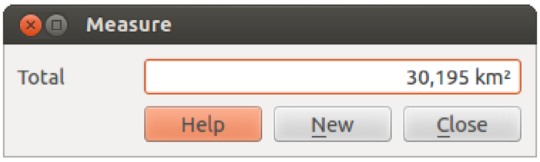
Mengukur Garis: QGIS mampu mengukur jarak nyata antar poin yang diberikan sesuai dengan ellipsoid yang didefinisikan. Untuk mengonfigurasinya, pilih menu opsi *Pengaturan* → *Opsi*, klik tab *Peralatan Peta* dan pilih ellipsoid yang tepat. Di sana Anda juga dapat mendefinisikan warna karet gelang (rubberband) dan satuan pengukuran pilihan Anda (meter atau feet) dan satuan sudut (derajat, radian dan gon). Kemudian memungkinkan Anda untuk mengklik titik pada peta. Setiap panjang-segmen serta total muncul dalam jendela-ukuran. Untuk menghentikan pengukuran klik tombol tetikus sebelah kanan.

Mengukur Area: Area juga dapat diukur. Pada jendela mengukur muncul ukuran daerah akumulasi. Selain itu, alat ukur akan mengambil (snap) ke lapisan yang sedang dipilih, asalkan lapisan yang memiliki toleransi yang ditetapkan. (Lihat Bagian *Setting the Snapping Tolerance and Search Radius*). Jadi jika Anda ingin mengukur persis sepanjang fitur garis, atau sekitar fitur poligon, pertama kali atur toleransi snap, kemudian pilih lapisan.



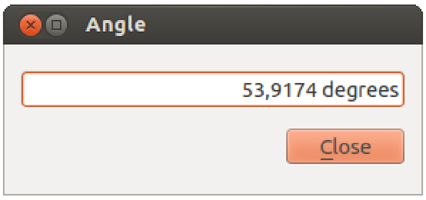
Gambar 8.2: Mengukur Panjang (Gnome)

Sekarang, ketika menggunakan alat ukur, setiap klik tetikus (dalam pengaturan toleransi) akan merekam (snap) ke lapisan itu.



Gambar 8.3: Mengukur Area (Gnome)

Mengukur Sudut: Anda juga bisa mengukur sudut. Kursor menjadi cross-shaped. Klik untuk menggambar segmen pertama dari sudut yang ingin diukur, kemudian memindahkan kursor untuk menggambar sudut yang diinginkan. Alat ukur akan ditampilkan dalam dialog pop-up.



Gambar 8.4: Mengukur Sudut (Gnome)

8.4.2 Pilih dan lepas fitur

Toolbar QGIS menyediakan beberapa alat untuk memilih fitur dalam kanvas peta. Untuk memilih satu atau beberapa fitur klik pada dan pilih perangkat Anda:

- Pilih Fitur Tunggal
- Pilih Fitur dari Rectangle
- Pilih Fitur dari Poligon
- Pilih Fitur dari Freehand
- Pilih Fitur dari Radius

Untuk melepas semua fitur yang dipilih klik di Lepas fitur dari semua lapisan.

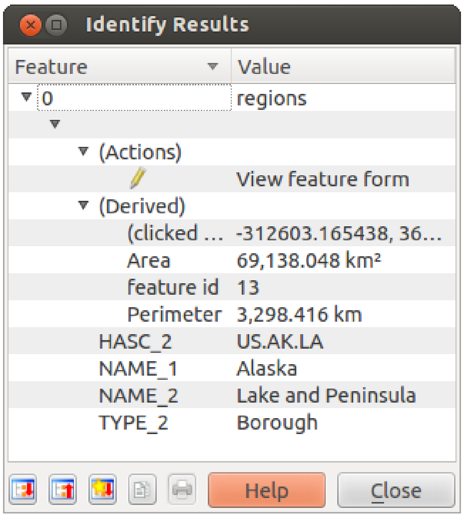
8.5 Fitur Identifikasi

Fitur identifikasi memungkinkan berinteraksi dengan kanvas peta untuk mendapatkan informasi fitur pada sebuah jendela pop-up. Identifikasi fitur menggunakan *Tampilan* → *Identifikasi fitur* atau tekan `Ctrl + Shift + I`, atau klik ikon toolbar Identifikasi fitur.

Jika Anda klik beberapa fitur, dialog *Hasil Identifikasi* akan mendaftar semua data atribut dari semua fitur. Item pertama adalah jumlah item dalam daftar hasil diikuti dengan nama lapisan. Kemudian, anak pertama akan menjadi nama sebuah kolom dengan nilainya. Akhirnya semua informasi dari fitur tersebut akan ditampilkan.

Jendela ini dapat disesuaikan untuk menampilkan kolom kustom namun secara default akan menampilkan tiga jenis informasi:

- Aksi-aksi: Aksi-aksi ditambahkan untuk mengidentifikasi fitur windows. Ketika mengklik pada aksi label, aksi akan berjalan. Secara default hanya satu tindakan ditambahkan untuk meihat form fitur untuk mengedit.
- Derived: informasi mereka dihitung atau berasal dari informasi lainnya. Anda bisa menemukan koordinat dengan diklik, koordinat X dan Y, area dalam satuan peta dan parameter peta dalam unit peta untuk poligon, panjang unit peta untuk garis dan id fitur.
- Data atribut: Daftar kolom atribut dari data



Gambar 8.5: Dialog identifikasi fitur (Gnome)

Di bagian bawah dari jendela, Anda memiliki lima ikon:

- Expand tree
- Collapse tree
- Default behaviour
- Salin atribut
- Print selected HTML response

Fungsi lain dapat ditemukan dalam menu konteks dari ditentukannya item. Sebagai contoh, dari menu konteks Anda dapat:

- Lihat form fitur
- Perbesar ke fitur
- Salin fitur: salin semua fitur geometri dan atribut
- Salin nilai atribut: hanya menyalin nilai dari atribut yang Anda klik

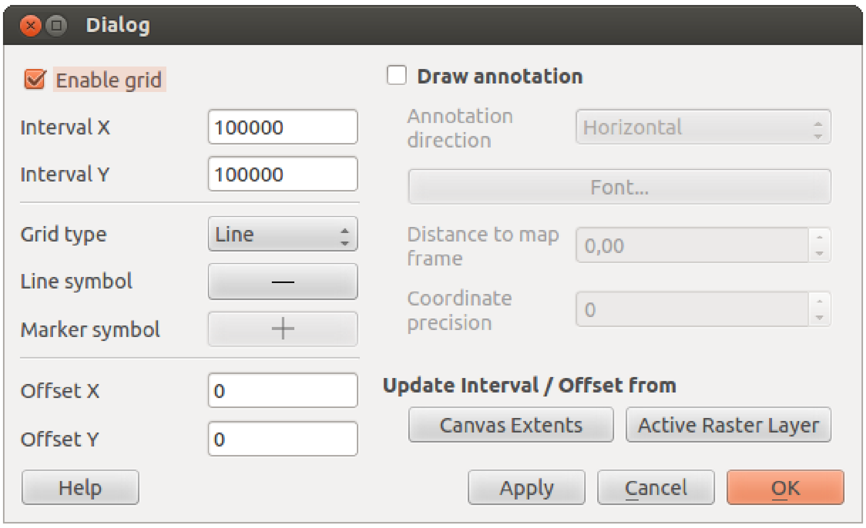
- Salin atribut fitur: hanya menyalin atribut
- Bersihkan hasilnya: Hapus hasil di jendela
- Bersihkan highlight: Hapus fitur highlight pada peta
- Highlight semua
- Highlight lapisan
- Aktifkan lapisan: Pilih lapisan yang akan diaktifkan
- Properti lapisa: buka jendel properti lapisan
- Perluas (expand) semua
- Runtuh (collapse) semua

8.6 Dekorasi

Dekorasi dari QGIS termask Grid, Label Hak Cipta, Panah Utara, dan Bar Skala. Mereka digunakan untuk ‘dekorasi’ peta dengan menambahkan elemen peta.

8.6.1 Kisi (Grid)

Grid memungkinkan untuk menambahkan koordinat kisi (grid) dan koordinat anotasi untuk kanvas peta.



Gambar 8.6: Dialog Kisi (Grid)

1. Pilih dari menu *Tampilan* → *Decorasi* → *Kisi*. Mulai dialog (lihat figure_decorations_1).
2. Aktifkan kotak centang *Aktifkan Kisi* dan menetapkan definisi kisi (grid) sesuai dengan lapisan yang dimuat dalam kanvas peta.
3. Aktifkan kotak centang *Gambar anotasi* dan menetapkan definisi anotasi sesuai dengan lapisan yang dimuat dalam kanvas peta.
4. Klik **[Terapkan]** untuk memverifikasi bahwa itu tampak seperti yang diharapkan.
5. Klik **[OK]** untuk menutup dialog.

8.6.2 Label Hak Cipta

Label Hak Cipta menambahkan label hak cipta menggunakan teks untuk peta.

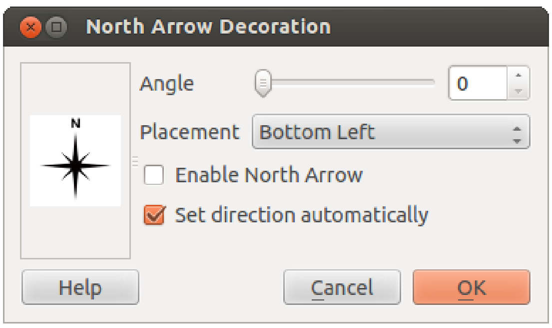
Gambar 8.7: Dialog Hak Cipta

1. Pilih dari menu *Tampilan* → *Dekorasi* → *Label hak Cipta*. (lihat figure_decorations_2).
2. Masukkan teks yang Anda ingin tempatkan di peta. Anda bisa menggunakan HTML seperti dalam contoh
3. Pilih penempatan label dari kotak kombo *Penempatan* .
4. Pastikan kotak centang telah ditandai/aktifkan *Aktifkan Label Hak Cipta*
5. Klik **[OK]**.

Dalam contoh di atas, yang merupakan default, QGIS menempatkan simbol hak cipta diikuti dengan tanggal di bagian bawah sudut kanan dari kanvas peta.

8.6.3 Panah Utara

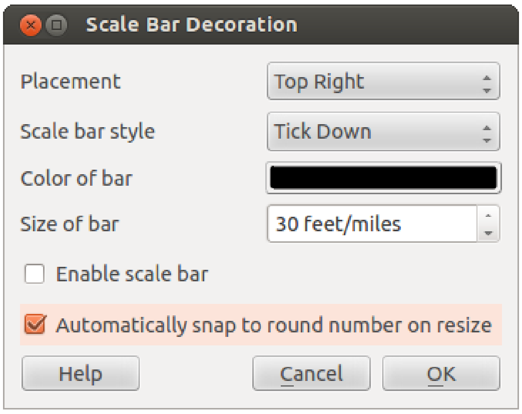
Panah Utara menempatkan panah utara sederhana di kanvas peta. Saat ini hanya ada satu gaya yang tersedia. Anda dapat mengatur sudut panah atau membiarkan QGIS mengatur arah secara otomatis. Jika Anda memilih untuk membiarkan QGIS menentukan arah, itu membuat QGIS menebak yang terbaik bagaimana panah harus berorientasi. Untuk penempatan panah, Anda memiliki empat pilihan, sesuai dengan empat penjuru kanvas peta.



Gambar 8.8: Dialog Panah Utara

8.6.4 Bar Skala

Skala Bar menambahkan bar skala sederhana untuk kanvas peta. Anda bisa mengontrol gaya dan penempatan, serta pelabelan bar.



Gambar 8.9: Dialog Bar Skala

QGIS hanya mendukung menampilkan skala dalam satuan yang sama dengan kerangka peta Anda. Jadi jika satuan lapisan Anda dalam meter, Anda tidak dapat membuat skala bar dalam kaki (feet). Demikian juga jika Anda menggunakan derajat desimal, Anda tidak dapat membuat skala bar untuk menampilkan jarak dalam meter.

Menambahkan bar skala:

1. Pilih dari menu *Tampilan* → *Dekorasi* → *Skala Bar* (lihat figure_decorations_4)
2. Pilih penempatan label dari kotak kombo *Penempatan*
3. Pilih gaya dari kotak kombo *Gaya skala bar*
4. Pilih warna bar *Warna bar* Border color Change atau gunakan hitam warna default.
5. Atur ukuran bar dan labelnya *Ukuran bar* 1,00 .
6. Pastikan kotak centang sudah aktif *Aktifkan skala bar*
7. Opsional, centang *Automatically snap to round number on resize*.
8. Klik **[OK]**.

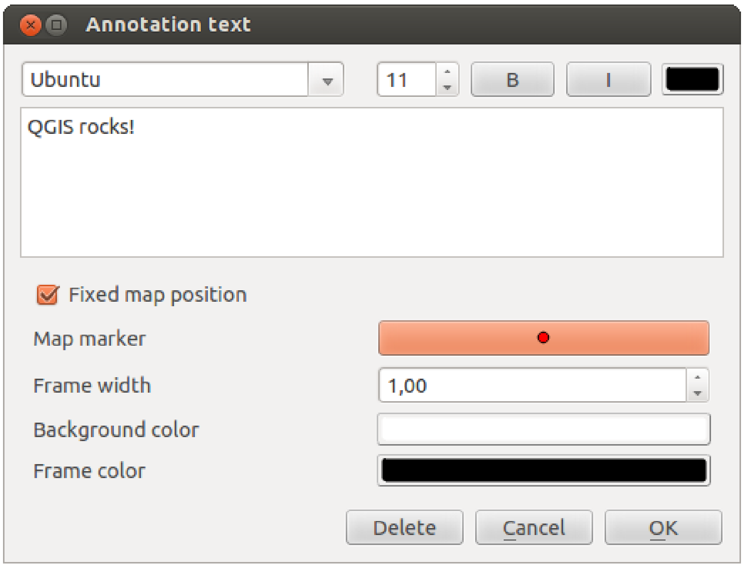
Tip: Pengaturan Dekorasi

Saat Anda menyimpan sebuah proyek `.qgs`, setiap perubahan yang Anda buat pada Kisi (Grid), Panah Utara, Skala Bar dan Hak Cipta akan disimpan dalam proyek dan dikembalikan pada saat Anda memuat proyek.

8.7 Peralatan Anotasi

Peralatan Anotasi Teks dalam toolbar atribut memberikan kemungkinan untuk menempatkan teks diformat dalam balon pada kanvas Peta QGIS. Gunakan alat *Anotasi Teks* dan klik kedalam kanvas peta.

Dobel klik pada item membuka dialog dengan berbagai pilihan. Ada editor teks untuk memasukkan teks yang diformat dan pengaturan item lain. Misalnya ada pilihan memiliki item ditempatkan pada posisi peta (ditampilkan dengan simbol penanda) atau memiliki item pada posisi layar (tidak berhubungan dengan peta). Item ini bisa



Gambar 8.10: Dialog teks anotasi

dipindahkan dengan posisi peta (geser penanda peta) atau hanya dengan memindahkan balon. Ikon adalah bagian dari tema GIS, dan digunakan secara default dalam tema-tema lain juga.

Alat Pindah Anotasi memungkinkan memindah anotasi pada kanvas peta.

8.7.1 Anotasi HTML

Alat Anotasi Html dalam toolbar atribut memberikan kemungkinan untuk menempatkan isi berkas HTML dalam balon pada kanvas Peta QGIS. Gunakan alat *Anotasi Html* dan klik kedalam kanvas peta dan menambahkan path ke berkas html ke dalam dialog.

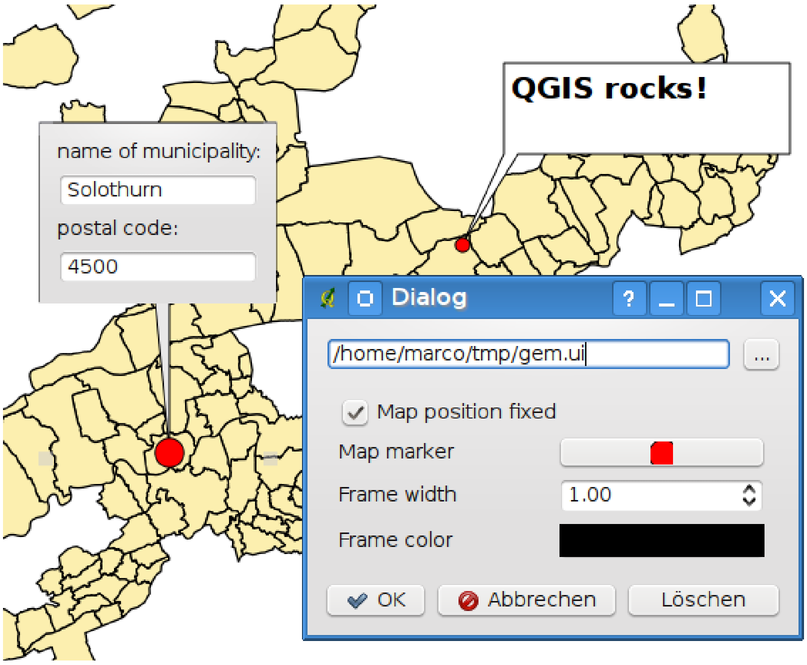
8.7.2 Anotasi SVG

Alat Anotasi SVG dalam toolbar atribut memberikan kemungkinan untuk menempatkan simbol SVG dalam balon pada kanvas Peta QGIS. Gunakan alat *Anotasi SVG* dan klik kedalam kanvas peta dan menambahkan path ke berkas SVG ke dalam dialog.

8.7.3 Form anotasi

Selain itu Anda juga dapat membuat form anotasi Anda sendiri. Alat Form Anotasi ini berguna untuk menampilkan atribut dari lapisan vektor dalam form desainer qt disesuaikan (lihat figure_custom_annotation). Hal ini mirip dengan form desainer alat *Identifikasi fitur*, tetapi ditampilkan dalam item anotasi. Lihat juga video https://www.youtube.com/watch?v=0pDBuSbQ02o dari Tim Sutton untuk informasi lebih lanjut.

Catatan: Jika Anda menekan `Ctrl+T` sementara alat *Anotasi* aktif (anotasi bergerak, anotasi teks, form anotasi), visibilitas item yang terbalik.



Gambar 8.11: Disesuaikan form anotasi bentuk desainer qt

8.8 Bookmark Spasial

Bookmark spasial memungkinkan Anda untuk "bookmark" lokasi geografis dan kembali ke spasial ini suatu saat nanti.

8.8.1 Membuat Bookmark

Membuat Bookmark

1. Perbesar atau geser ke interes area.
2. Pilih menu opsi *Tampilan* → *Bookmark Baru* atau tekan `Ctrl-B`.
3. Masukkan nama deskripsi dari bookmark (batas 255 karakter).
4. Tekan `Enter` untuk menambahkan bookmark atau **[Delete]** untuk menghapus bookmark.

Catatan Anda bisa memiliki bookmark banyak dengan satu nama.

8.8.2 Bekerja dengan Bookmark

Menggunakan atau mengelola bookmark, pilih menu opsi *Tampilan* → *Tampilkan Bookmark*. Dialog *Geospatial Bookmark* memungkinkan Anda untuk memperbesar atau menghapus bookmark. Anda tidak dapat mengedit nama bookmark atau koordinat.

8.8.3 Perbesar ke Bookmark

Dari dialog *Geospasial Bookmark*, pilih bookmark yang diinginkan dengan mengkliknya, kemudian klik **[Perbesar]**. Anda juga bisa memperbesar ke bookmark dengan dobel-klik padanya.

8.8.4 Menghapus Bookmark

Menghapus bookmark dari dialog *Geospasial Bookmark*, klik padanya dan kemudian klik **[Hapus]**. Konfirmasi Anda pilih dengan klik **[Ya]** atau batal menghapus dengan klik **[Tidak]**.

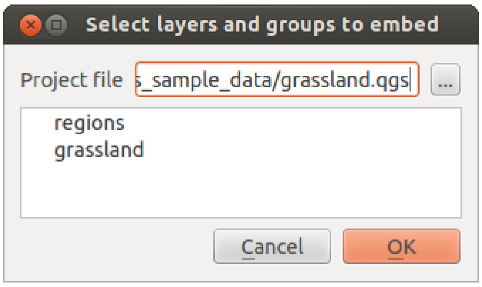
8.9 Proyek-proyek Nesting

Jika Anda ingin menanamkan (embed) isi dari berkas proyek lain kedalam proyek Anda, Anda bisa memilih *Lapisan* → *Tanam Lapisan dan Grup*.

8.9.1 Menanam (Embedding) lapisan

Dialog berikut memungkinkan Anda menanamkan lapisan dari proyek-proyek lain. Berikut ini adalah contoh kecil:

1. Tekan ... untuk mencari proyek lain dari dataset Alaska.
2. Pilih berkas proyek `grassland`. Anda bisa melihat konten dari proyek (lihat figure_embed_dialog).
3. Tekan `Ctrl` dan klik pada lapisan `grassland` dan `regions`. Tekan **[OK]**. Lapisan akan ditanam dalam legenda peta dan tampilan peta sekarang.



Gambar 8.12: Pilih lapisan-lapisan dan grup-grup untuk ditanam (embed)

Sementara lapisan tertanam dapat diedit, Anda tidak dapat mengubah properti mereka seperti gaya dan pelabelan.

8.9.2 Menghapus lapisan-lapisan ditanam (embdded)

Klik-kanan pada lapisan yang ditanam (embedded) dan pilih Hapus.

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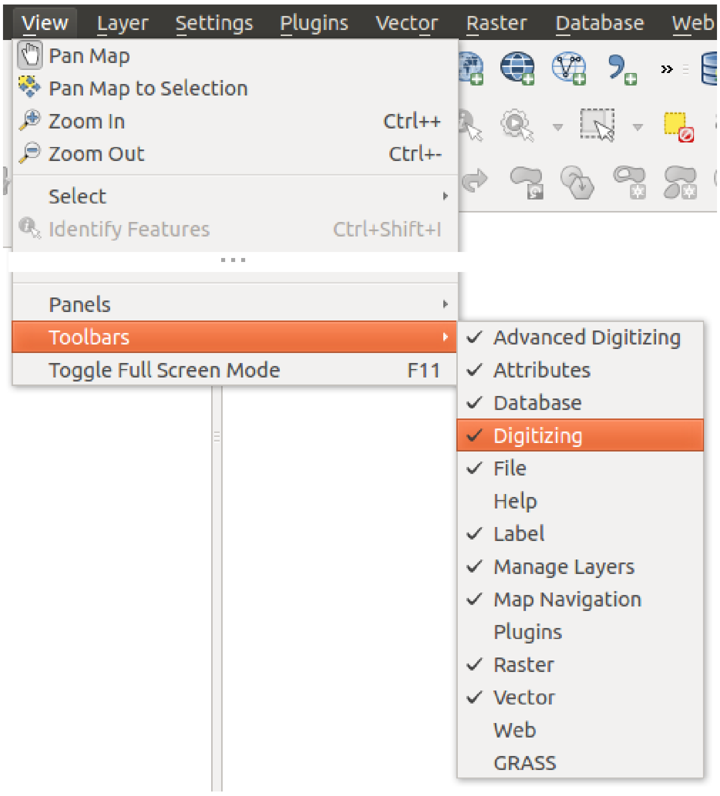
Konfigurasi QGIS

QGIS dapat dikonfigurasi melalui menu *Pengaturan*. Pilih diantara Panel, Toolbar, Properti Proyek, Opsi dan Penyesuaian.

9.1 Panel dan Toolbar

Dalam menu *Panel*→ Anda bisa mengatifkan dan menonaktfikan widget QGIS. Menu *Toolbar*→ memberikan kemungkinan mengaktfikan dan menonatifkan ikon grup di toolbar QGIS (lihat figure_panels_toolbars).



Gambar 9.1: Menu Panel dan Toolbar

Tip: Mengaktifkan Tinjauan QGIS

Di QGIS Anda dapat menggunakan panel gambaran yang menyediakan tampilan lapisan tingkat penuh yang ditambahkan ke dalamnya. Hal ini dapat dipilih di bawah menu *Tampilan* → *Panel*. Dalam pandangan persegi panjang yang menunjukkan tingkat peta saat ini. Hal ini memungkinkan Anda dengan cepat menentukan area peta yang sedang Anda lihat. Perhatikan bahwa label tidak diberikan ke gambaran peta bahkan jika lapisan dalam gambaran peta telah diatur untuk pelabelan. Jika Anda klik dan tarik persegi panjang merah dalam gambaran yang menunjukkan gambaran Anda saat ini, tampilan utama peta akan memperbarui.

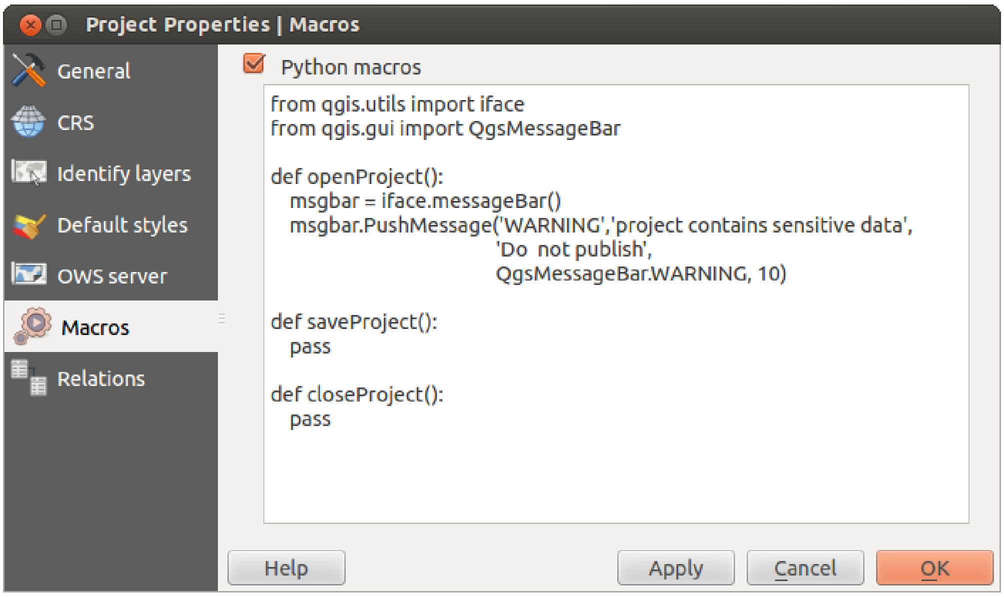
Tip: Tampilkan Pesan Log

Ini memungkinkan untuk melacak pesan QGIS. Anda bisa mengaktifkan *Log Pesan* dalam menu *Pengaturan → Panel* dan ikuti pesan yang muncul dalam tab yang berbeda selama memuat dan operasi.

9.2 Properti Proyek

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

- Di dalam menu *Umum* judul proyek, seleksi dan warna latar, satuan lapisan, presisi, dan pilihan untuk menyimpan path relatif terhadap lapisan yang dapat ditentukan. Jika transformasi CRS aktif Anda dapat memilih ellipsoid untuk perhitungan jarak. Anda dapat menentukan satuan kanvas (hanya digunakan ketika transformasi CRS dinonaktifkan) dan ketepatan desimal untuk digunakan. Anda juga dapat menentukan daftar skala proyek, yang menimpa skala yang telah ditentukan global.
- Menu *CRS* memungkinkan Anda untuk memilih Coordinat Reference System untuk proyek ini, dan memungkinkan proyeksi ulang on-the-fly lapisan raster dan lapisan vektor ketika menampilkan lapisan dari CRS yang berbeda.
- Dengan menu ketiga *Identifikasi lapisan* Anda atur (atau nonaktif) lapisan akan merespon alat mengidentifikasi (lihat paragraf "peralatan Peta" dari bagian *Opsi* untuk mengaktifkan identifikasi atau lapisan multi).
- 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.
- Tab *OWS Server* memungkinkan untuk menentukan informasi tentang Server WMS dan kapabilitas WFS QGIS, Pada Tingkat dan Pembatasan CRS.
- Menu *Macros* digunakan untuk mengedit Python macros untuk proyek. Saat ini, hanya tiga macro yang tersedia: `openProject()`, `saveProject()` dan `closeProject()`.



Gambar 9.2: Pengaturan Macro di QGIS

- Menu *Relasi* digunakan untuk menentukan relasi 1:n. Relasi ditentukan dalam dialog properti proyek. Setelah ada relasi lapisan, elemen antarmuka pengguna baru form tampilan (misalnya ketika mengidentifikasi fitur dan membuka form) akan daftar entitas terkait. Ini menyediakan cara ampuh mengekspresikan misalnya sejarah inspeksi pada panjang pipa atau segmen jalan. Anda bisa menemukan lebih jauh tentang relasi 1:n di Bagian *Creating one to many relations*.

9.3 Opsi

Beberapa pilihan dasar untuk QGIS dapat dipilih menggunakan dialog *Opsi*. Pilih menu opsi *Pengaturan* → *Opsi*. Tab di mana Anda dapat menyesuaikan pilihan Anda dijelaskan di bawah ini.

9.3.1 Menu Umum

Aplikasi

- Pilih *Gaya (QGIS diperlukan restart)* dan pilih diantara 'Oxygen','Windows','Motif','CDE', 'Plastique' dan 'Cleanlooks' ().
- Definisikan *Ikon tema* . Sekarang hanya 'default'.
- Definisikan *Ukuran Ikon* .
- Definisikan *Font*. Pilih antara *QT default* dan font user-defined.
- Ubah *Timeout for timed messages or dialogs* .
- *Sembunyikan layar splash saat startup*
- *Tampilkan Petunjuk saat startup*
- *Judul tebal kotak grup*
- *QGIS-styled kotak grup*
- *Gunakan dialog pemilih warna live-updating*

Berkas proyek

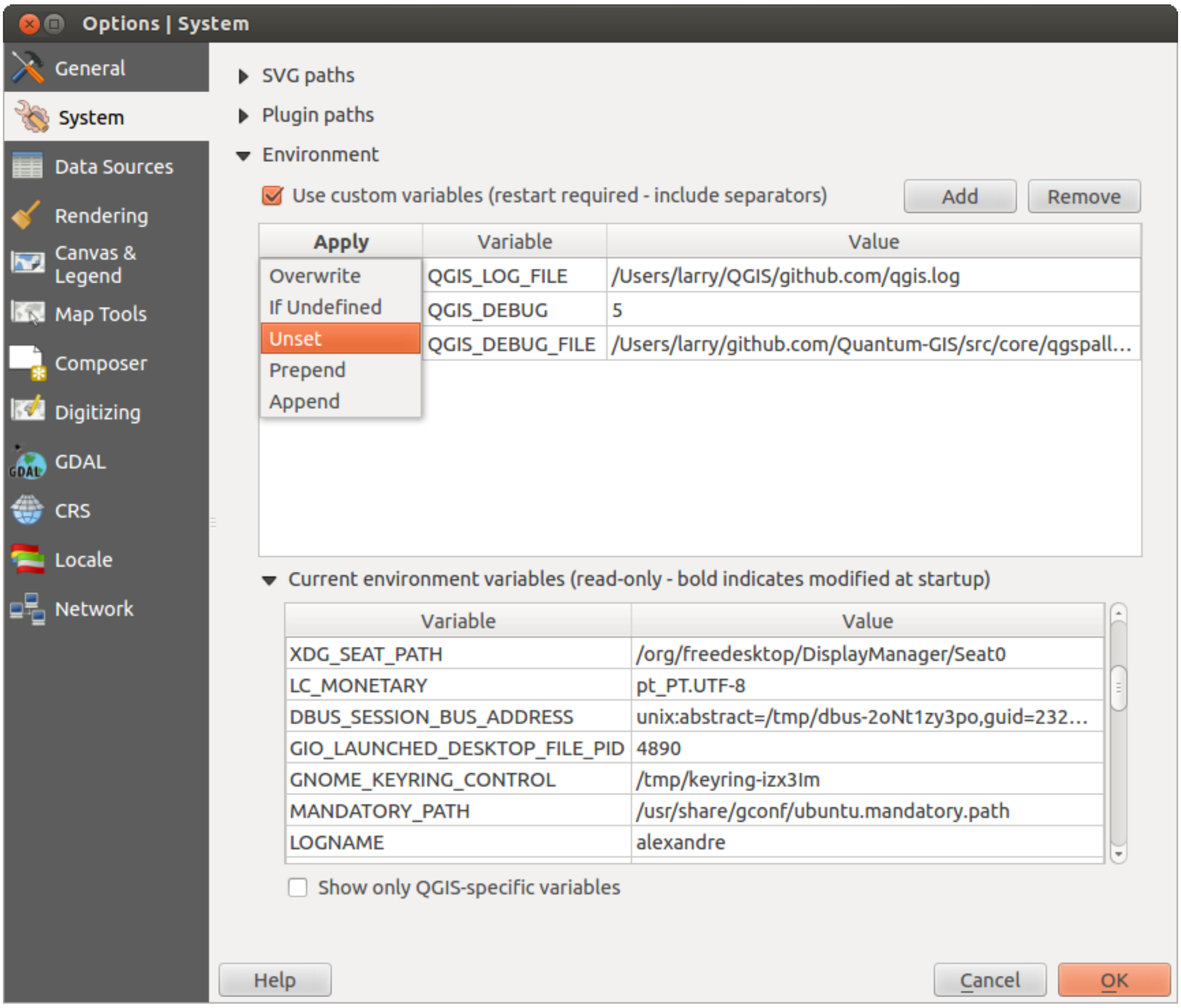
- *Buka proyek pada peluncuran* (memilih antara 'Baru'. 'Terbaru' dan 'Khusus'). Ketika memilih 'khusus' menggunakan ... untuk menentukan proyek.
- *Buat proyek baru dari proyek default*. Anda memiliki kemungkinan untuk menekan *Atur proyek sekarang sebagai default* atau pada *Reset default*. Anda dapat menelusuri melalui berkas-berkas dan menentukan direktori dimana Anda menemukan pengguna-ditetapkan proyek template Anda. Akan ada sebuah entri di *Project* → *Baru dari Template* jika Anda pertama kali mengaktifkan *Buat proyek baru dari proyek default* dan kemudian simpan proyek dalam folder proyek template.
- *Prompt untuk menyimpan proyek dan sumber data perubahan bila diperlukan*
- *Peringatkan ketika membuka berkas proyek QGIS yang disimpan dengan versi lama*
- *Aktifkan macros* . Opsi ini digunakan untuk menangani macro yang ditulis untuk melakukan tindakan pada peristiwa proyek. Anda bisa memilih diantara 'Tidak pernah', 'Bertanya', 'Hanya untuk sesi ini' dan 'Selalu (tidak direkomendasikan)'.

9.3.2 Menu Sistem

Lingkungan

Sistem lingkungan variabel saat ini dapat dilihat dan banyak dikonfigurasi dalam menu **Lingkungan** (lihat figure_environment_variables). Hal ini berguna untuk platform, seperti Mac, di mana aplikasi GUI tidak selalu mewarisi lingkungan shell pengguna. Ini juga berguna untuk pengaturan / melihat lingkungan variabel untuk mengatur alat eksternal yang dikendalikan oleh pengolahan toolbox (seperti SAGA, GRASS), dan untuk menyalakan keluaran debugging untuk bagian tertentu dari kode sumber.

- *Gunakan penyesuaian variabel (dibutuhkan restart - termasuk pemisah).* Anda bisa **[Tambah]** dan **[Hapus]** variabel. Variabel lingkungan yang sudah ditetapkan akan ditampilkan dalam:guilabel:*Variabel lingkungan sekarang*, dan hal itu memungkinkan untuk menyaring mereka dengan mengaktifkan *Tampilkan hanya variabel spesifik-QGIS*.



Gambar 9.3: Sistem lingkungan variabel dalam QGIS

Plugin path

[Tambah] atau **[Hapus]** *Path(s) untuk mencari tambahan C++ librari Plugin*

9.3.3 Menu sumber data

Atribut dan tabel fitur

- *Buka tabel atribut di dock window (dibutuhkan restart QGIS)*
- *Salin geometri di representasi WKT dari tabel atribut.* Ketika menggunakan Salin baris yang dipilih ke papan klip dari menu *Tabel atribut* kemudian ini memiliki hasil yang juga koordinat titik atau simpul disalin ke papan klip.
- *Perilaku tabel atribut* . Ada tiga kemungkinan: 'Tampilkan semua fitur', 'Tampilkan fitur dipilih' dan 'Tampilkan fitur terlihat pada peta'
- *Tabel atribut baris cache* 1,00. Baris cache ini memungkinkan untuk menyimpan baris x atribut terakhir dimuat sehingga proses tabel atribut akan lebih cepat. Cache akan dihapus ketika menutup tabel atribut.
- *Representasi untuk nilai NULL* Here you can define a value for data fields containing a NULL value. Di sini Anda dapat menentukan nilai untuk bidang data yang berisi nilai NULL.

Menangani sumber data

- *Pindai item yang valid di dock Browser* . Anda dapat memilih antara 'Periksa ekstensi' dan 'Periksa isi berkas'.
- *Pindai isi dari berkas yang dikompresi (.zip) di browser dock* . 'Tidak', 'Pindai dasar' and 'Pindai ful' memungkinkan.
- *Konfirmasi sublapisan raster saat membuka.* Beberapa raster mendukung sublapisan – mereka disebut subdataset di GDAL. Contohnya adalah berkas netCDF - jika ada banyak variabel netCDF, GDAL melihat setiap variabel sebagai sub dataset. Pilihan ini untuk mengontrol bagaimana menangani sub-lapisan ketika sebuah berkas dengan sub-lapisan dibuka. Anda memiliki pilihan berikut:
  - 'Selalu': Selalu bertanya (jika ada sub-lapisan yang ada)
  - 'Jika diperlukan': Menanyakan apakah lapisan tidak memiliki band, namun memiliki sub-lapisan
  - 'Tidak Pernah': Tidak pernah meminta, tidak akan memuat apa-apa
  - 'Muat semua': Tidak pernah meminta, tetapi memuat semua sub-lapisan
- *Abaikan deklarasi encoding shapefile.* Jika shapefile punya pengkodean informasi ini akan diabaikan oleh QGIS.
- *Tambahkan lapisan PostGIS dengan klik ganda dan pilih dalam mode diperpanjang*
- *Tambahkan lapisan Oracle with dobel klik dan pilih dalam mode diperpanjang*

9.3.4 Menu Rendering

Tindakan rendering

- *Secara default lapisan baru yang ditambahkan ke peta harus ditampilkan*
- *Enable back buffer*
- *Gunakan render caching yang memungkinkan mempercepat gambar ulang*
- *Aktifkan fitur simplication secara default untuk lapisan baru yang ditambahkan*
- *Sederhanakan di sisi penyedia jika mungkin*

Kualitas rendering

- *Membuat garis tampil kurang bagus dengan mengorbankan beberapa kinerja menggambar*
- *Fix problems with incorrectly filled polygons*

Raster-raster

- Dengan *RGB band seleksi* Anda bisa menetapkan nomor dari band Merah, Hijau dan Biru.

Contrast enhancement

- *Band abu-abu tunggal* . Sebuah band abu-abu tunggal dapat memiliki 'Tidak ada peregangan', 'Lakukan peregangan untuk MinMax', 'Peregangan dan Klip ke MinMax' dan juga 'Clip ke MinMax'
- *band multi warna (byte/band)* . Opsinya antara lain 'Tidak ada peregangan', 'Lakukan peregangan untuk MinMax', 'Peregangan dan Klip ke MinMax' dan juga 'Clip ke MinMax'.
- *band multi warna (>byte/band)* . Opsinya antara lain 'Tidak ada peregangan', 'Lakukan peregangan untuk MinMax', 'Peregangan dan Klip ke MinMax' dan juga 'Clip ke MinMax'
- *Batas (minimum/maksimum)* . Opsinya adalah 'Kumulatif jumlah potong pixel', 'Minimum/Maksimum', 'Berarti +/- standar deviasi'.
- *Kumulatif batas jumlah potong pixel*
- *Standar deviasi multiplier*

Debugging

- *Refresh kanvas peta*

9.3.5 Menu Kanvas dan Legenda

Standar penampilan peta (diganti oleh proyek properti)

- Tetapkan *Seleksi warna* dan *Warna latar*.

Legenda lapisan

- *Dobel klik pada legenda* . Anda dapat 'Buka properti lapisan' atau 'Buka atribut tabel' dengan dobel klik.
- Mengikuti *Gaya item legenda*:
  - *Nama lapisan kapital*
  - *Nama lapisan tebal*
  - *Nama grup tebal*
  - *Tampilkan klasifikasi nama atribut*
  - *Buat ikon raster (mungkin lambat)*
  - *Tambah lapisan baru ke grup sekarang atau yang dipilih*

9.3.6 Menu perangkat Peta

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 *Proyek* 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*

Alat pengukuran

- Tentukan *Warna Rubberband* untuk peralatan pengukuran
- Tentukan *Tempat desimal*
- *Perlu satuan dasar*
- *Satuan pengukuran yang dipilih* ('Meter', 'Kaki', 'Mil laut' atau 'derajat')'
- *Satuan sudut yang dipilih* ('Derajat', 'Radian' atau 'Gon')

Menggeser dan memperbesar

- Tentukan *Aksi roda tetikus* ('Perbesar', 'Perbesar dan pusat', 'Perbesar pada kursor tetikus', 'Tidak ada')
- Tentukan *Faktor pembesaran* untuk roda tetikus

Skala yang ditentukan

Di sini Anda menemukan daftar skala yang telah ditentukan. Dengan tombol **[+]** dan **[-]** Anda dapat menambahkan atau menghapus skala individu Anda.

9.3.7 Menu Penyusun

Standar Komposisi

Anda bisa menentukan font *Default* disini.

Penampilan Kotak

- Tentukan the *Gaya Kotak* ('Solid', 'Dots', 'Crosses')
- Tentukan *Warna...*

Standar kotak

- Tentukan *Spacing* 1,00
- Tentukan *Ofset kotak* 1,00 untuk x dan y
- Tentukan *Toleransi Snap* 1,00

Standar panduan

- Tentukan *Toleransi Snap* 1,00

9.3.8 Menu Digitalisasi

Membuat fitur

- *Menekan atribut jendela pop-up setelah setiap fitur dibuat*
- *Gunakan kembali nilai atribut terakhir yang dimasukkan*
- *Validasi geometris*. Mengedit garis/poligon kompleks dengan banyak node menyebabkan render sangat lambat. Hal ini karena prosedur standar validasi di QGIS dapat menghabiskan banyak waktu. Untuk mempercepat rendering itu dengan memilih validasi geometri GEOS (mulai dari GEOS 3.3) atau untuk mematikannya. Validasi geometri GEOS jauh lebih cepat, tetapi masalahnya adalah bahwa hanya geometri pertama yang akan dilaporkan.

Rubberband

- Tentukan Rubberband *Lebar garis* dan *Warna garis*

Snapping

- *Buka opsi mengambil di dock window (dibutuhkan restart QGIS)*
- Tentukan *Mode standar snap* ('Simpul', 'Segmen', 'Simpul dan Segmen', 'Mati')
- Tentukan *Default toleransi snapping* dalam satuan peta atau pixel
- Tentukan *Cari radius untuk suntingan simpul* dalam satuan peta atau pixel

Penanda simpul

- *Tampilkan penanda hanya untk fitur yang dipilih*
- Tentukan simpul *Gaya Penanda* ('Palang' (standar), 'Lingkaran semi transparan' atau 'Tidak ada')
- Tentukan simpul *Ukuran Penanda*

Alat ofset kurva

3 pilihan berikutnya mengacu pada alat Kurva Ofset dalam *Advanced digitizing*. Melalui berbagai pengaturan, ini memungkinkan untuk mempengaruhi bentuk garis ofset. Opsi-opsi ini mungkin dimulai dari GEOS 3.3.

- *Gaya Join*
- *Segmen Quadrant*
- *Batas Miter*

9.3.9 Menu GDAL

GDAL adalah data pertukaran librari untuk berkas raster. Dalam tab ini Anda dapat *Edit membuat opsi* dan *Edit Opsi Pyramid* dari format raster. Menentukan driver GDAL yang akan digunakan untuk format raster seperti dalam beberapa kasus lebih dari satu driver GDAL tersedia.

9.3.10 Menu CRS

CRS standar untuk proyek baru

- *Jangan diaktifkan proyeksi ulang 'on the fly'*
- *Aktif otomatis proyeksi ulang 'on the fly' jika lapisan memiliki CRS berbeda*
- *Mengaktifkan proyeksi ulang 'on the fly' secara default*
- Pilih sebuah CRS dan *Selalui mulai proyek baru dengan CRS ini*

CRS untuk lapisan baru

Daerah ini memungkinkan untuk menentukan tindakan ketika sebuah lapisan baru dibuat, atau ketika lapisan tanpa CRS dimuat.

- *Konfirmasi CRS*
- *Gunakan CRS proyek*
- *Gunakan standar CRS ditampilkan dibawah ini*

Transformasi datum standar

- *Mintalah transformasi datum bila tidak ada standar yang ditentukan*
- Jika Anda telah bekerja dengan transformasi CRS 'on-the-fly' Anda bisa melihat hasil dari transformasi dalam jendela di bawah. Anda bisa menemukan informasi tentang 'Sumber CRS' dan 'Destinasi CRS' maupun 'Sumber datum transform' dan 'Destinasi datum transform'.

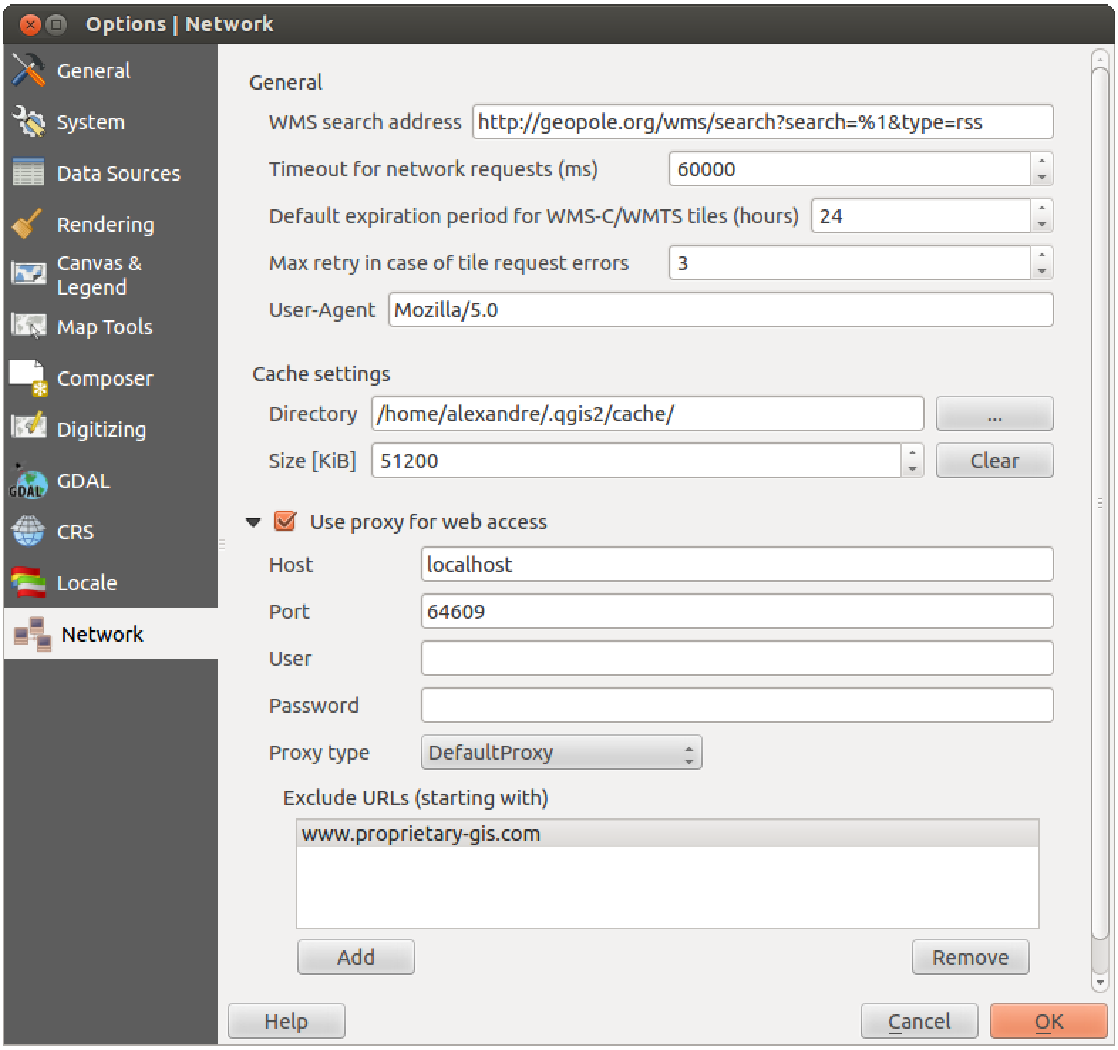
9.3.11 Menu Lokal

- *Timpah sistem lokal* dan *Lokal gunakan sebagai pengganti*
- Informasi tentang sistem lokal aktif

9.3.12 Menu Jaringan

Umum

- Tentukan *WMS cari alamat*, default `http://geopole.org/wms/search?search=\%1\&type=rss`
- Tentukan *Timeout untuk permintaan jaringan (ms)* - default 60000
- Tentukan *Standar periode ekspirasi untuk WMSC/WMTS (jam)* - default 24
- Tentukan *Mencoba kembali Maksimum jika terjadi kesalahan permintaan genteng*
- Tentukan *User-Agent*



Gambar 9.4: Pengaturan-proxy di QGIS

Pengaturan cache

Tentukan *Direktori* dan *Ukuran* untuk cache.

- *Gunakan proxy untuk akses web* dan tentukan ‘Host’, ‘Port’, ‘Pengguna’, and ‘Kata Sandi’.

- Atur *Tipe Proxy* sesuai dengan kebutuhan Anda.
  - *Proxy Standar*: Proxy ditentukan berdasarkan aplikasi pengaturan menggunakan proxy
  - *Socks5Proxy*: Proxy generik untuk setiap jenis koneksi. Mendukung TCP, UDP, mengikat ke port (koneksi masuk) dan otentikasi.
  - *HttpProxy*: Menggunakan perintah "CONNECT", mendukung hanya koneksi TCP; mendukung otentikasi.
  - *HttpCachingProxy*: Menggunakan perintah normal HTTP, itu hanya berguna dalam konteks permintaan HTTP.
  - *FtpCachingProxy*: Menggunakan proxy FTP, itu hanya berguna dalam konteks permintaan FTP.

Tidak termasuk beberapa URL dapat ditambahkan ke kotak teks di bawah pengaturan-proxy (lihat Figure_Network_Tab).

Jika Anda membutuhkan informasi lebih rinci tentang pengaturan-proxy yang berbeda, silakan lihat panduan QT-librari-dokumentasi di http://doc.trolltech.com/4.5/qnetworkproxy.html#ProxyType-enum.

Tip: Menggunakan Proxi

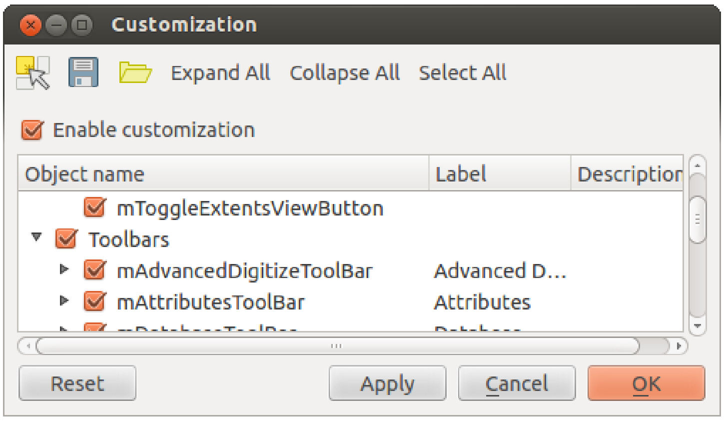
Menggunakan proxi kadang-kadang bisa rumit. Hal ini berguna 'coba dan eror' jenis proxi di atas, untuk memeriksa apakah mereka berhasil dalam kasus Anda.

Anda dapat mengubah pilihan sesuai dengan kebutuhan Anda. Beberapa perubahan mungkin memerlukan restart QGIS sebelum berjalan efektif.

- Settings are saved in a text file: `$HOME/.config/QGIS/qgis.conf`
- Anda dapat menemukan pengaturan Anda di: `$HOME/Library/Preferences/org.qgis.qgis.plist`
- pengaturan terkirim ke registri: `HKEY\CURRENT_USER\Software\QGIS\qgis`

9.4 Penyesuaian (Customization)

Alat penyesuaian memungkinkan Anda mengaktifkan (dan nonaktif) hampir setiap elemen dalam antar muka QGIS. Hal ini bisa sangat berguna jika Anda memiliki banyak plugin yang dipasang bahwa Anda tidak pernah menggunakan dan mengisi layar Anda.



Gambar 9.5: Dialog penyesuaian

Penyesuaian QGIS dibagi menjadi lima kelompok. Dalam *Menu* Anda dapat menyembunyikan entri dalam Menu bar. Dalam *Panel* Anda dapat menemukan Panel jendela. Jendela Panel adalah aplikasi yang dapat dimulai dan digunakan sebagai mengambang, jendela tingkat-atas atau tertanam ke jendela utama QGIS sebagai widget. (lihat juga *Panel dan Toolbar*). Dalam fitur *Status Bar* seperti informasi koordinat dapat dinonaktifkan. Dalam *Toolbars* Anda dapat mengaktifkan (non aktif) ikon toolbar QGIS dan *Widgets* Anda dapat mengaktifkan (non aktif) dialog serta tombol mereka.

Dengan Beralih ke penangkapan widget dalam aplikasi utama Anda dapat klik elemen dalam QGIS yang Anda ingin menyembunyikan dan menemukan entri yang sesuai dalam Penyesuaian (lihat figure_customization). Anda juga dapat menyimpan berbagai setup yang berbeda untuk kasus penggunaan yang berbeda juga. Sebelum perubahan diterapkan, Anda harus me-restart QGIS.

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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.

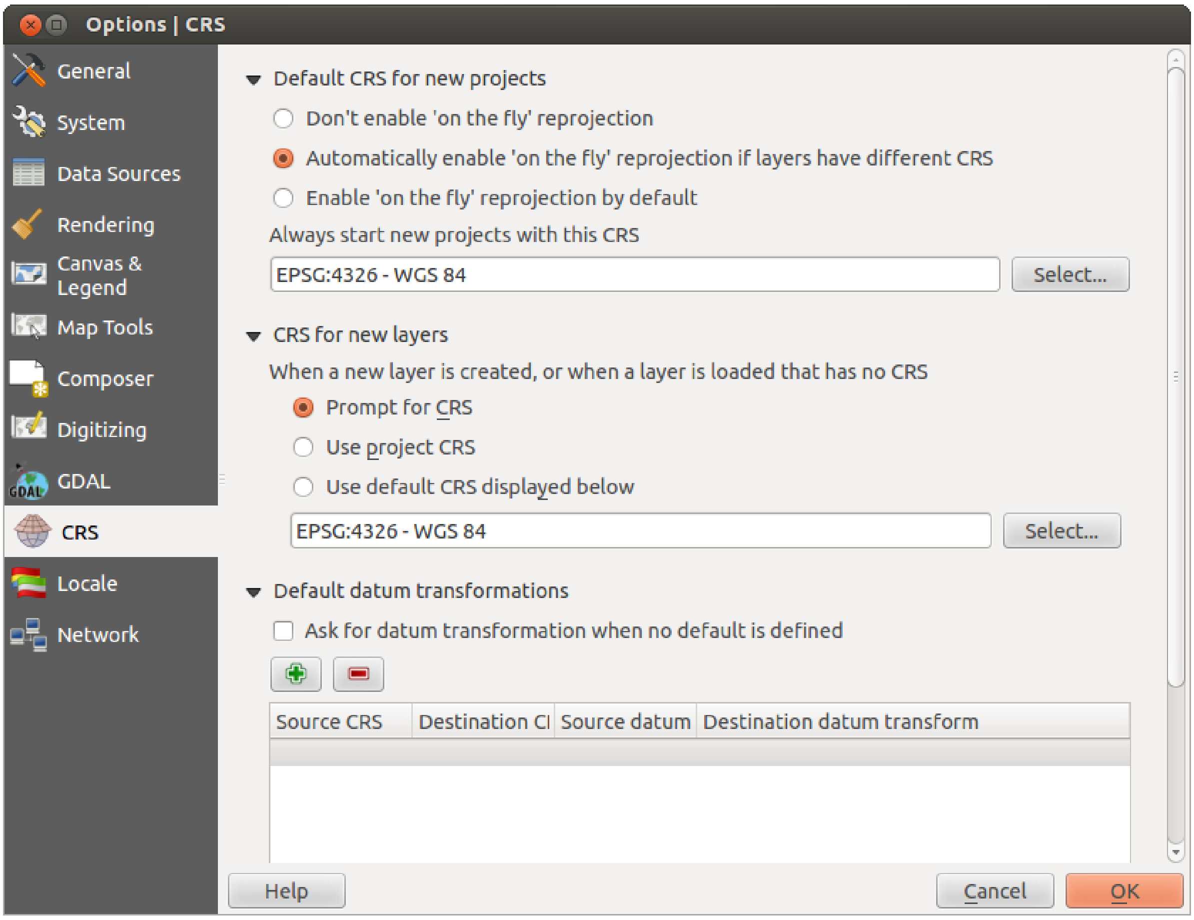
10.2 Global Projection Specification

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*



Gambar 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* .

Tip: CRS in the Map Legend

Right-clicking on a layer in the Map Legend (section *Legenda Peta*) 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*.

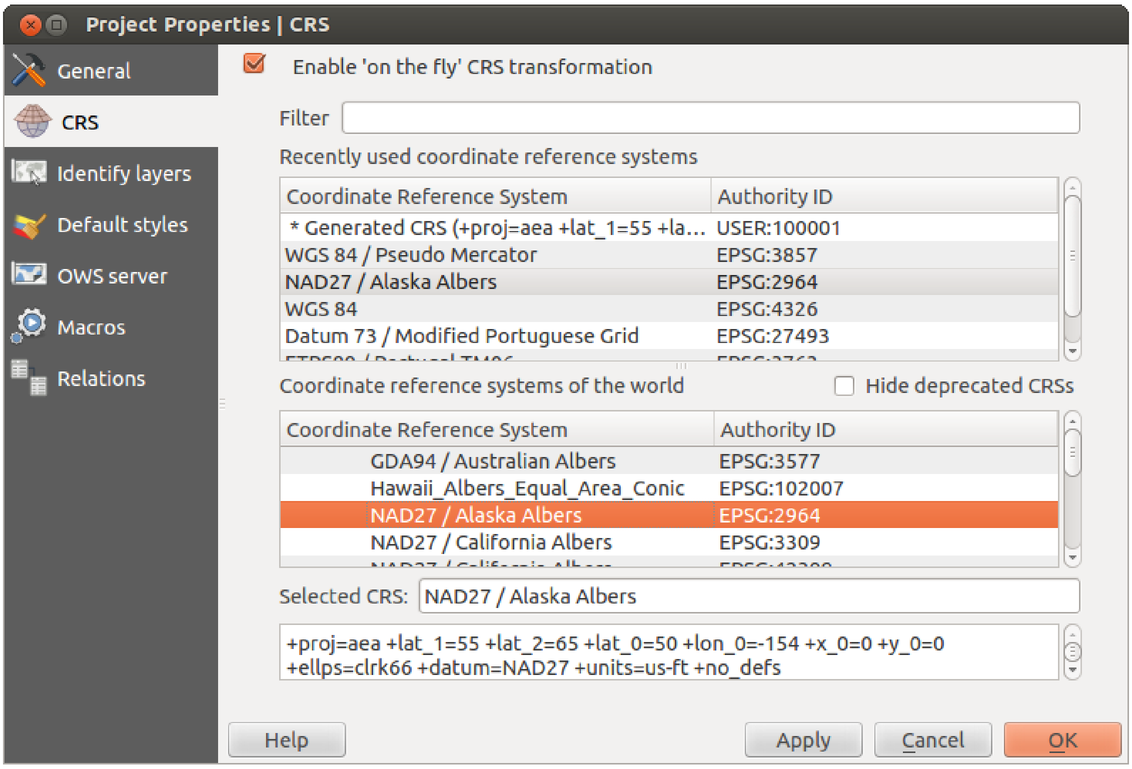
If you have already loaded a layer and you want to enable OTF projection, the best practice is to open the *CRS* tab of the *Project Properties* dialog, select a CRS, and activate the *Enable 'on the fly' CRS transformation* checkbox. The CRS status icon will no longer be greyed out, and all layers will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

Tip: 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.



Gambar 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.

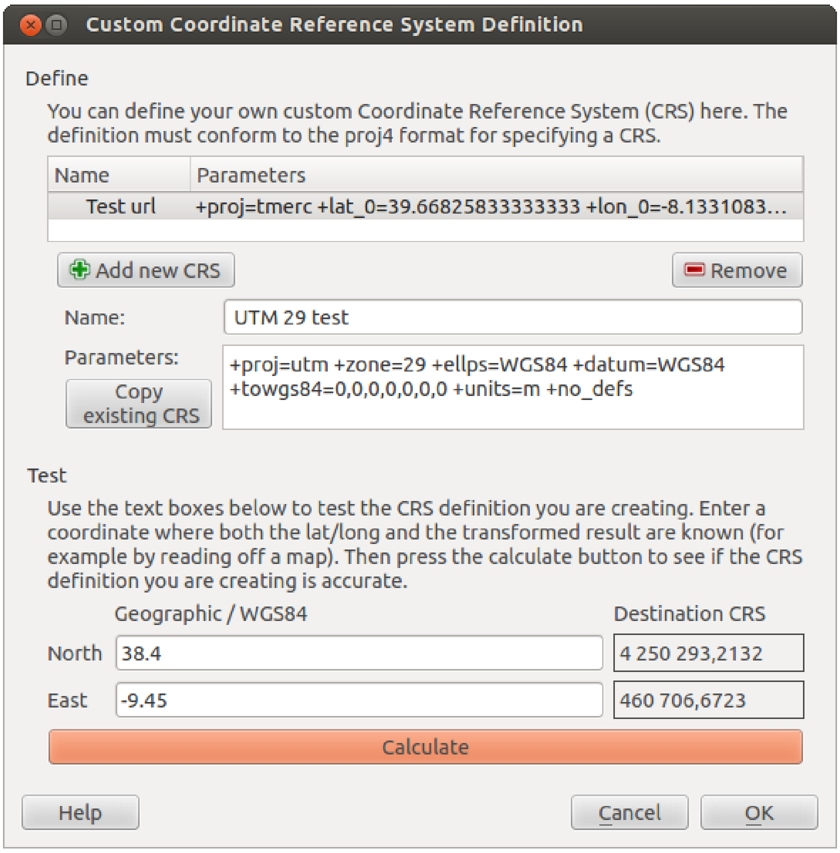
The *Custom Coordinate Reference System Definition* dialog requires only two parameters to define a user CRS:

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.



Gambar 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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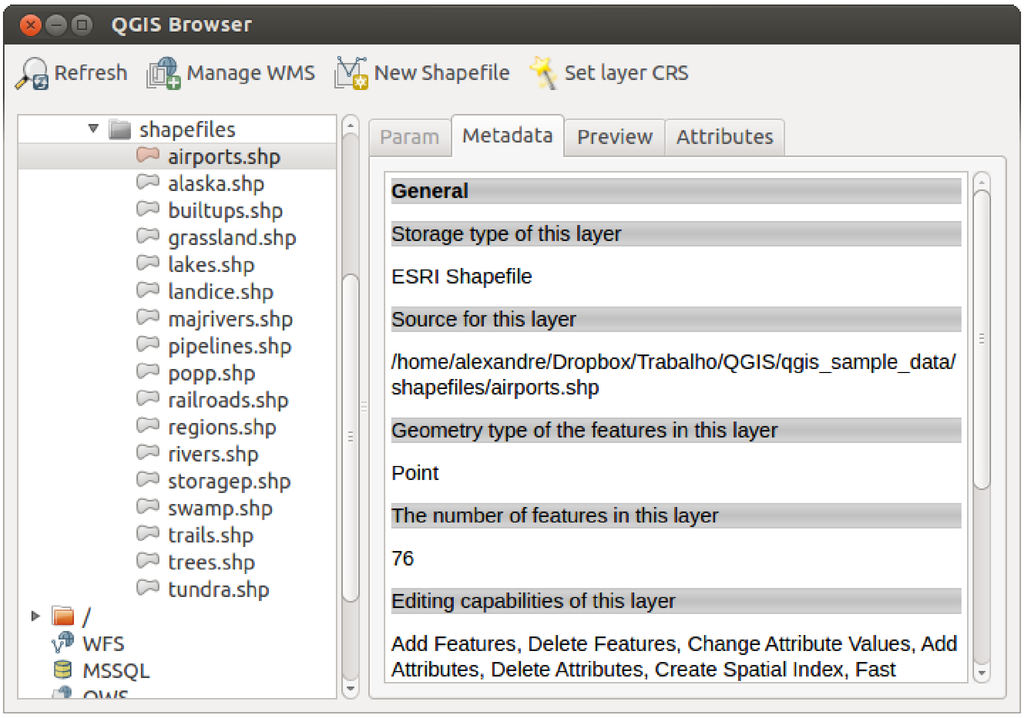
BAB 11

QGIS Peramban

Penjelajah QGIS adalah panel di QGIS yang memungkinkan Anda dengan mudah menavigasi dalam basisdata Anda. Anda memiliki akses ke berkas-berkas vektor umum (seperti berkas ESRI shapefile atau MapInfo), basisdata (seperti PostGIS, Oracle, Spatialite atau MSSQL Spatial) dan koneksi WMS/WFS. Anda juga bisa melihat data GRASS Anda (untuk mendapatkan data ke QGIS, lihat *GRASS GIS Integration*)



Gambar 11.1: Penjelajah QGIS merupakan aplikasi mandiri

Menggunakan penjelajah QGIS untuk menampilkan data Anda. Fungsi geser dan taruh membuatnya mudah untuk menempatkan data Anda ke tampilan peta dan legenda peta.

1. Mengaktifkan penjelajah QGIS. Klik-kanan pada toolbar dan centang *Peramban* atau pilih dari *Pengaturan* → *Panel*.
2. Geser panel kedalam jendela legenda dan riliskan.
3. Klik pada tab *Peramban*
4. Jelajahi dalam basisdata Anda dan pilih folder `shapefile` dari direktori `qgis_sample_data`.
5. Tekan tombol `Shift` dan pilih berkas `airports.shp` dan `alaska.shp`.
6. Tekan tombol kiri tetikus kemudian geser dan tempatkan berkas ke dalam kanvas peta.

7. Klik-kanan pada lapisan dan pilih *Atur CRS proyek dari lapisan*. Untuk informasi lebih lanjut lihat *Working with Projections*.

8. Klik pada Perbesar Full agar lapisan-lapisan terlihat.

Ada penjelajah kedua yang tersedia di *Pengaturan* → *Panel*. Hal ini berguna bila Anda perlu untuk memindahkan berkas atau lapisan antar lokasi.

1. Mengaktifkan penjelajah QGIS kedua: Klik-kanan pada toolbar dan centang *Penjelajah (2)*, atau pilih dari *Pengaturan* → *Panel*.

2. Geser panel kedalam jendela legenda

3. Arahkan ke tab *Peramban (2)* dan temukan shapefile di dalam sistem berkas Anda.

4. Pilih sebuah berkas dengan tombol kiri tetikus. Sekarang Anda bisa menggunakan ikon Tambah Lapisan Terpilih untuk menambahkannya kedalam proyek sekarang.

QGIS otomatis terlihat untuk Coordinate Reference System (CRS) dan perbesar ke batas lapisan jika Anda bekerja di sebuah proyek kosong QGIS. Jika sudah ada berkas dalam proyek Anda, berkas hanya akan ditambahkan dan dalam kasus itu memiliki tingkat yang sama dan CRS akan divisualisasikan. Jika berkas ini telah mendapat CRS lain dan lapisan Anda terlebih dahulu klik kanan pada lapisan dan pilih *Atur CRS Proyek dari Lapisan*. Kemudian pilih *Perbesar ke Batas Lapisan*.

Fungsi Saring Berkas bekerja pada level direktori. Jelajahi folder dimana Anda ingin menyaring berkas-berkas dan memberikan kata pencarian atau wildcard. Penjelajah hanya menampilkan nama berkas yang sesuai – data lain tidak akan ditampilkan.

Ini juga mungkin untuk menjalankan penjelajah QGIS sebagai aplikasi mandiri.

Mulai Penjelajah QGIS

- ketik di dalam “qbrowser” di perintah prompt.
- Mulai penjelajah QGIS menggunakan menu Start atau desktop shortcut.
- Peramban QGIS juga tersedia di fodler Aplikasi Anda.

Dalam figure_browser_standalone_metadata, Anda bisa melihat ditingkatkannya fungsi penjelajah QGIS mandiri. Tab *Param* menyediakan detail dari koneksi dataset seperti PostGIS atau MSSQL Spatial. Tab *Metadata* berisi informasi umum tentang berkas (lihat *Metadata Menu*). Dengan tab *Preview* Anda bisa melihat-lihat di berkas Anda tanpa mengimpor mereka ke proyek QGIS Anda. Ini juga mungkin untuk melihat atribut berkas Anda dalam tab *Atribut*

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BAB 12

Pekerjaan dengan Data Vektor

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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 *Literatur dan Referensi Web*). The complete list is available at http://www.gdal.org/ogr/ogr_formats.html.

Catatan: 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/).

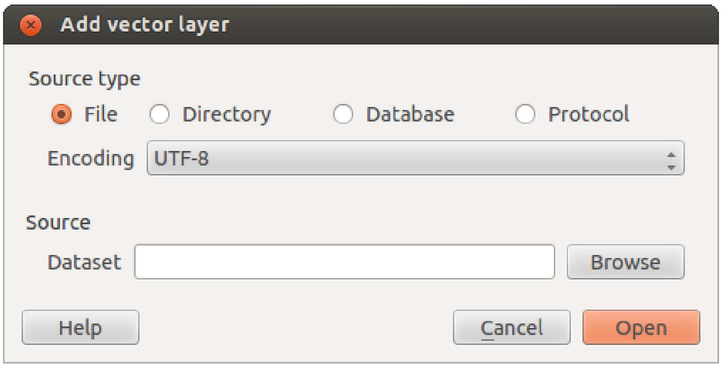
A shapefile actually consists of several files. The following three are required:

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

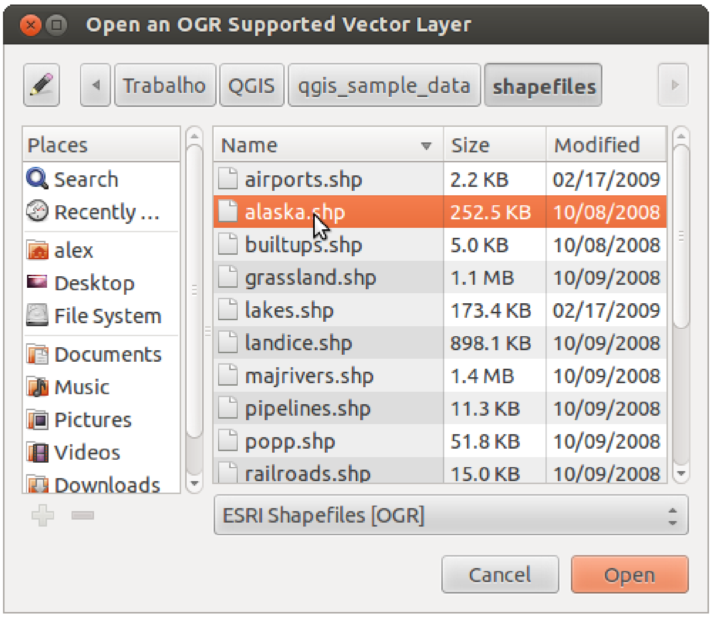
To load a shapefile, start QGIS and click on the Add Vector Layer toolbar button, or simply press `Ctrl+Shift+V`. This will bring up a new window (see figure_vector_1).



Gambar 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.



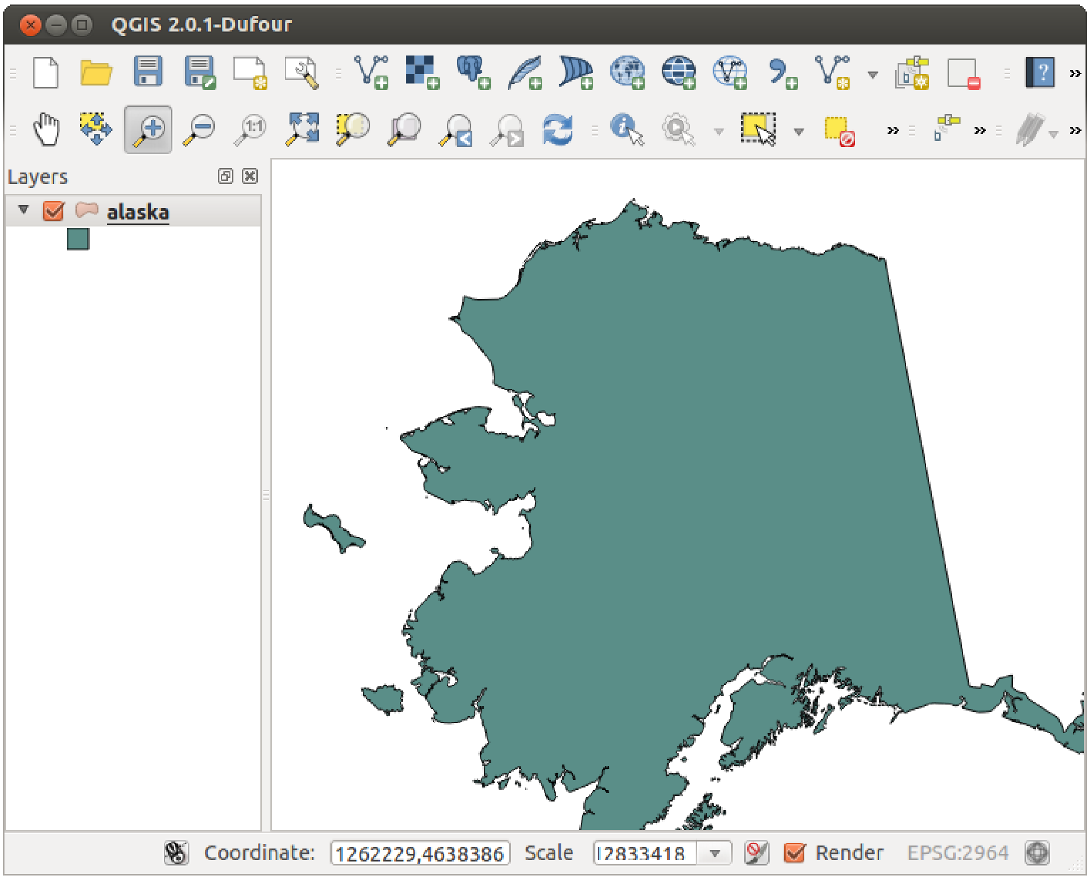
Gambar 12.2: Open an OGR Supported Vector Layer Dialog

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

Tip: 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



Gambar 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.

Tip: 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 *Contoh data*):

```
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

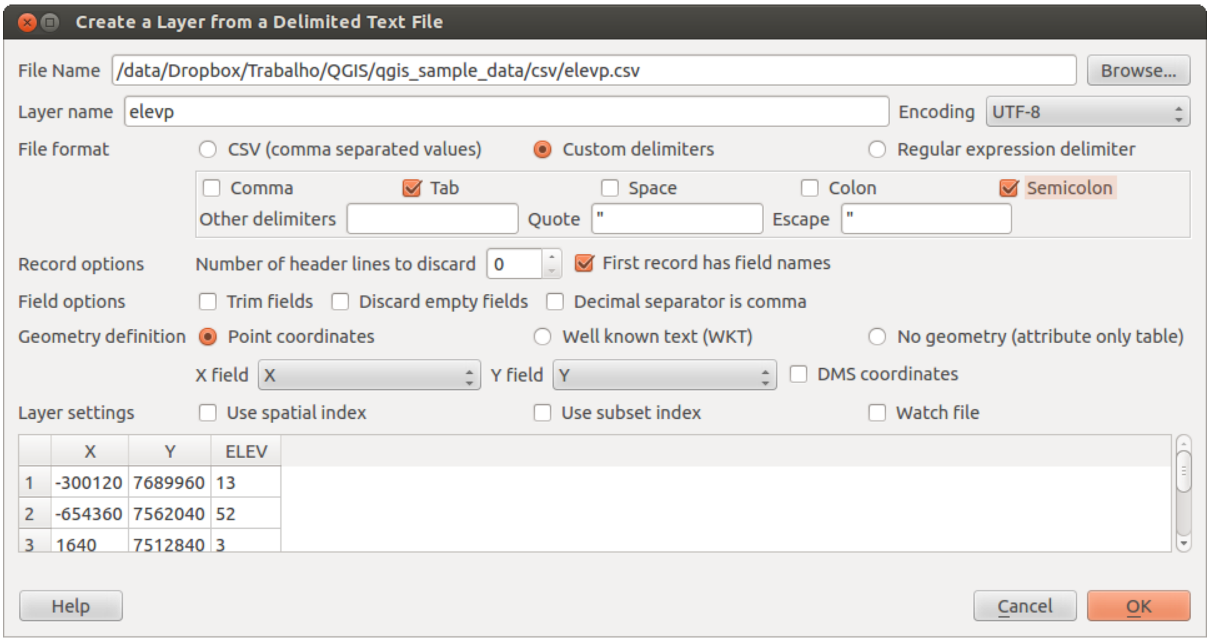
Click the toolbar icon Add Delimited Text Layer in the *Manage layers* toolbar to open the *Create a Layer from a Delimited Text File* dialog, as shown in figure_delimited_text_1.

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*.



Gambar 12.4: Delimited Text Dialog

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.

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.

Tip: 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 *Query Builder* 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.

Tip: 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 *Plugin Pengelola DB* 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.

Tip: 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 *Literatur dan Referensi Web*) for more information.

The following is an example of creating a GiST index:

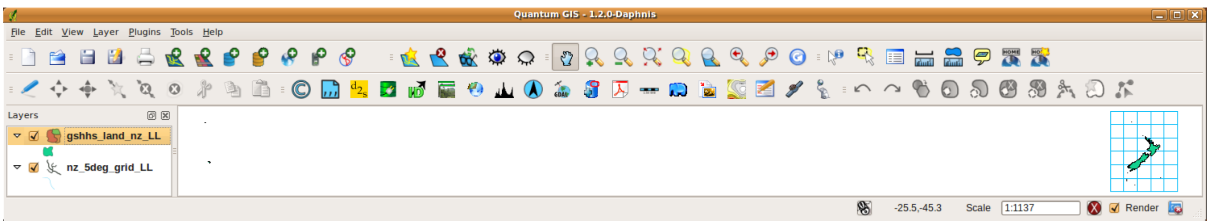
```
gsherman@madison:~/current$ psql gis_data
Welcome to psql 8.3.0, the PostgreSQL interactive terminal.

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$
```

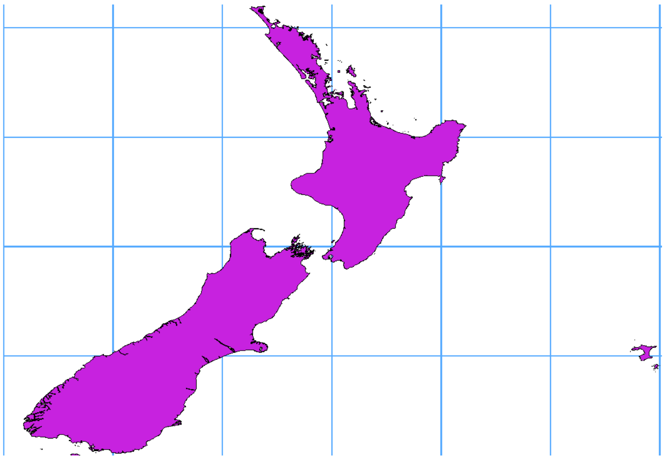
12.1.8 Vector layers crossing 180° longitude

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.



Gambar 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.



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

Usage

- Import data into PostGIS (*Importing Data into PostgreSQL*) using, for example, the DB Manager plugin.
- Use the PostGIS command line interface to issue the following command (in this example, "TABLE" is the actual name of your PostGIS table): `gis_data=# update TABLE set the_geom=ST_Shift_Longitude(the_geom);`
- If everything went well, you should receive a confirmation about the number of features that were updated. Then you'll be able to load the map and see the difference (Figure_vector_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*.

Tip: 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.

Tip: 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 *Query Builder* 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.

Tip: Oracle Spatial Layers

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

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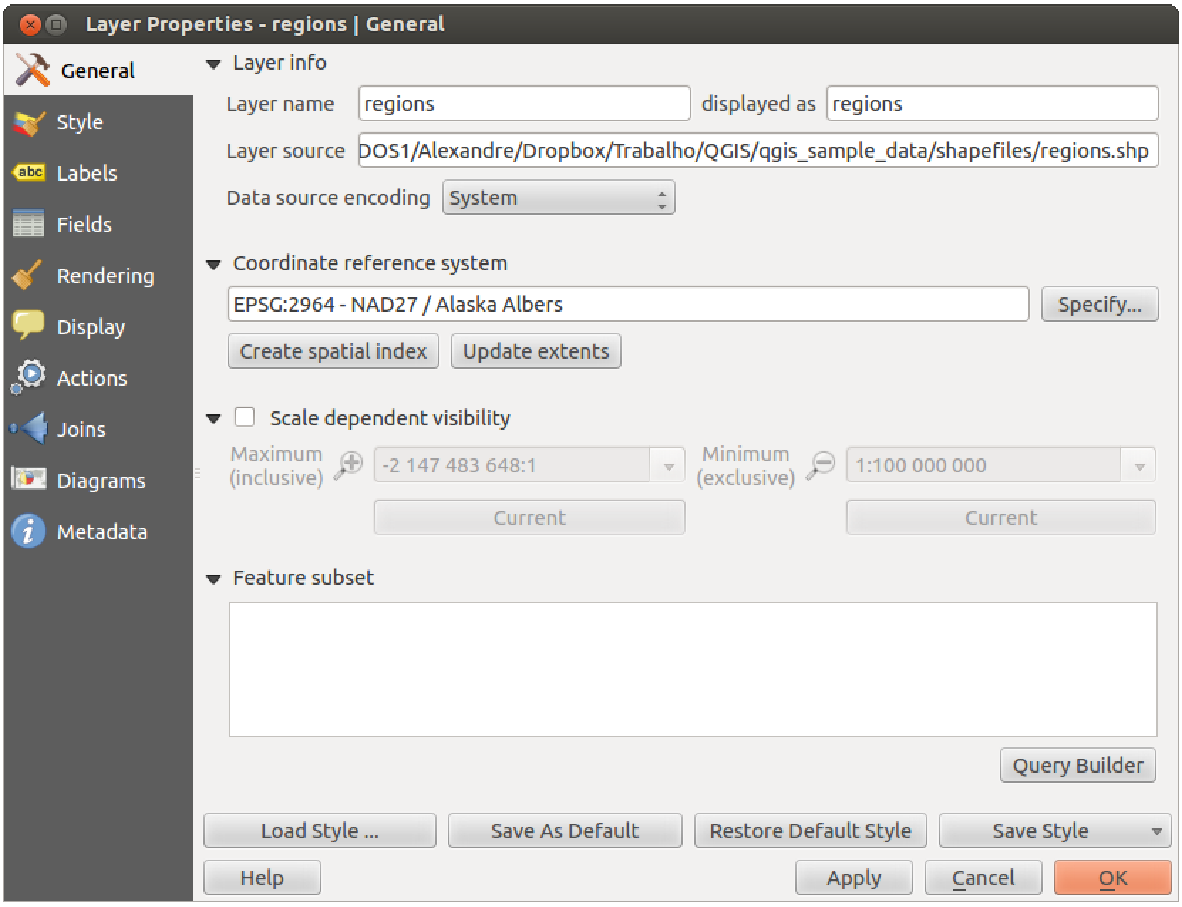
12.2 The Vector Properties Dialog

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.



Gambar 12.7: Vector Layer Properties Dialog

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.
  - 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

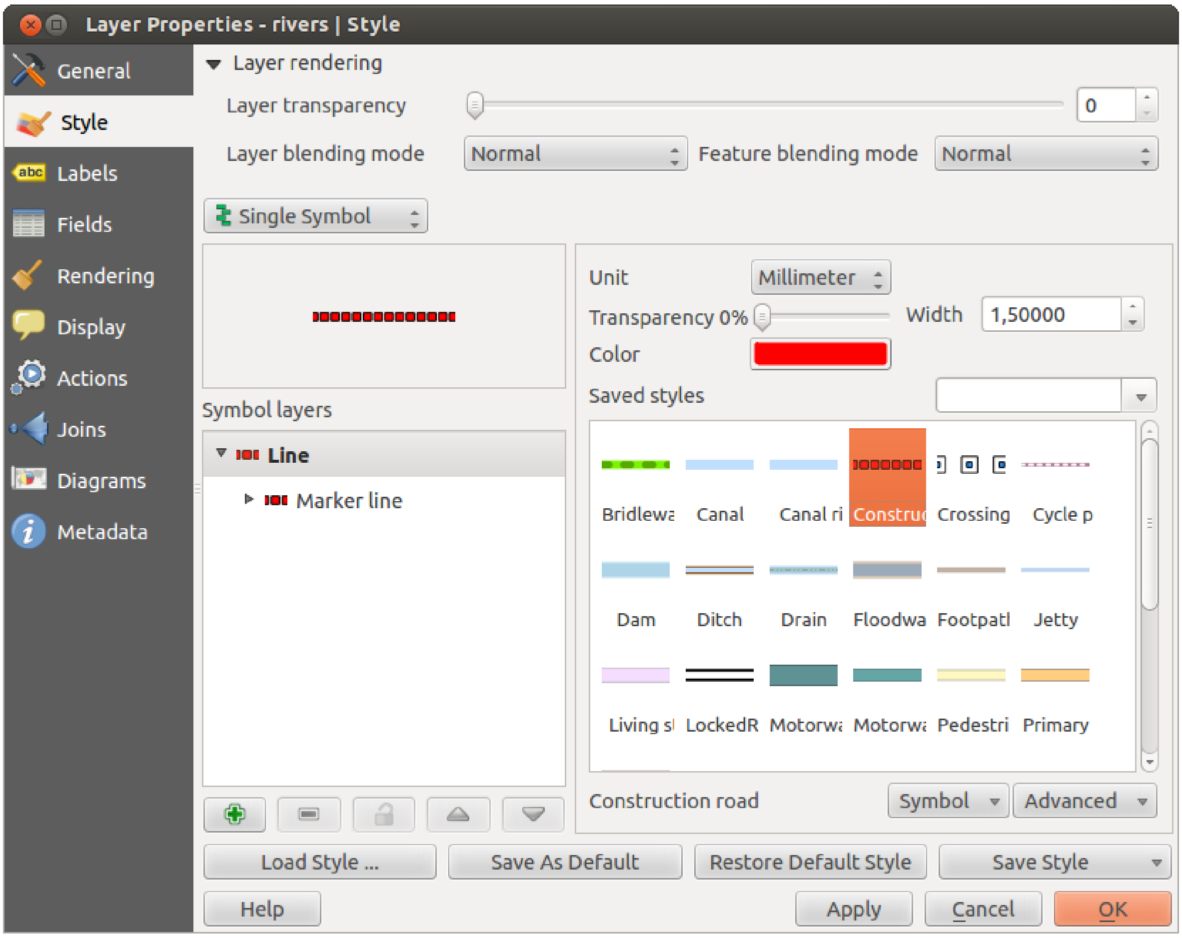
The renderer is responsible for drawing a feature together with the correct symbol. There are four types of renderers: single symbol, categorized, graduated and rule-based. There is no continuous color renderer, because it is in fact only a special case of the graduated renderer. The categorized and 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.

Tip: 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.



Gambar 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'.

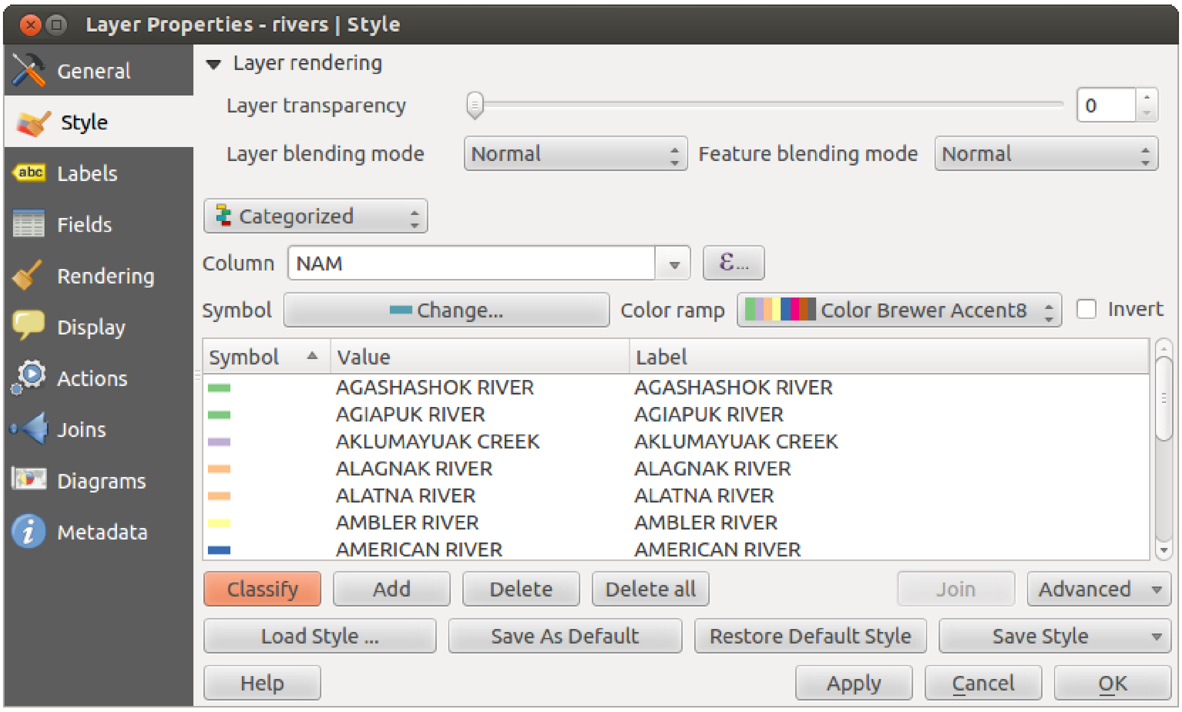
Categorized Renderer

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 ε... *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.



Gambar 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.

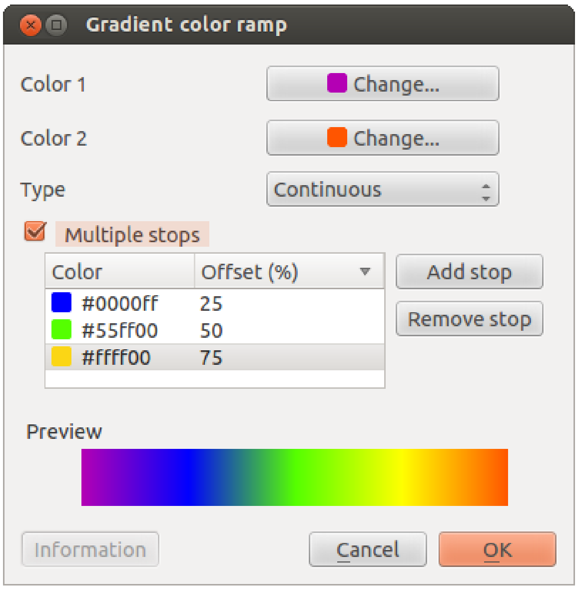
The cpt-city option opens a new dialog with hundreds of themes included 'out of the box'.

Graduated Renderer

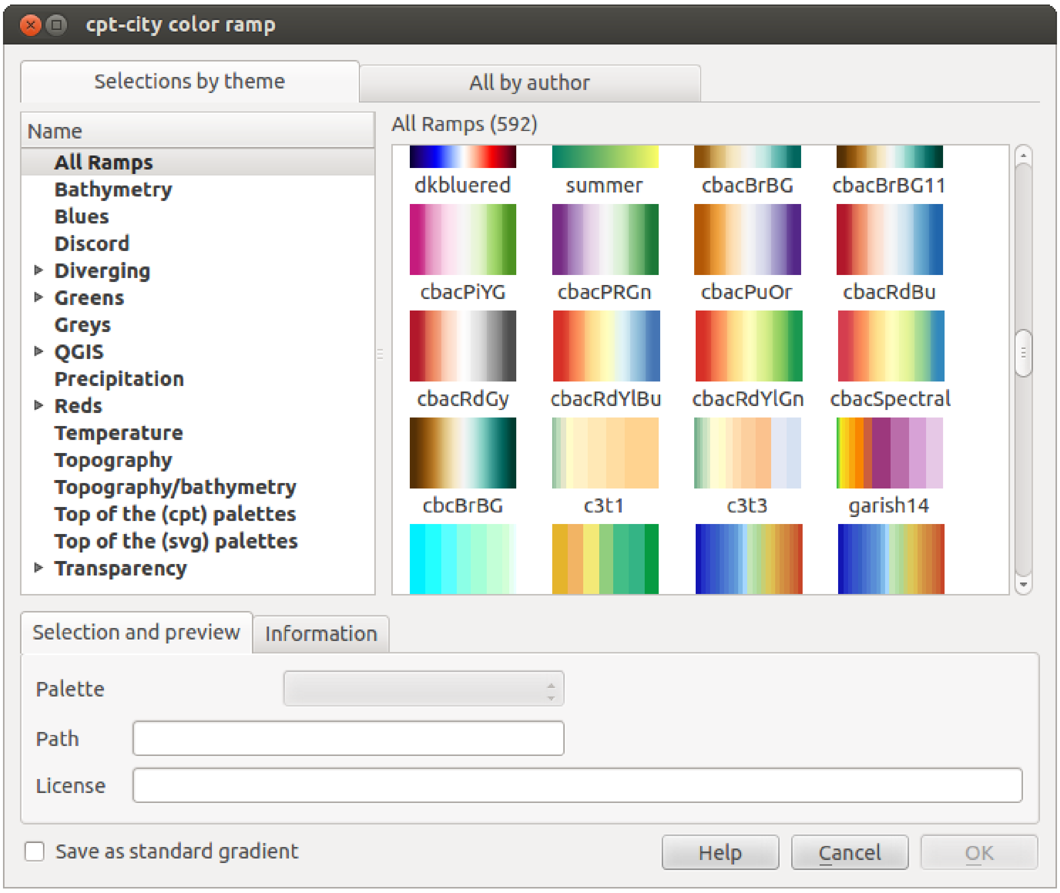
The Graduated Renderer is used to render all the features from a layer, using a single user-defined symbol whose color reflects the assignment of a selected feature's attribute to a class.

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

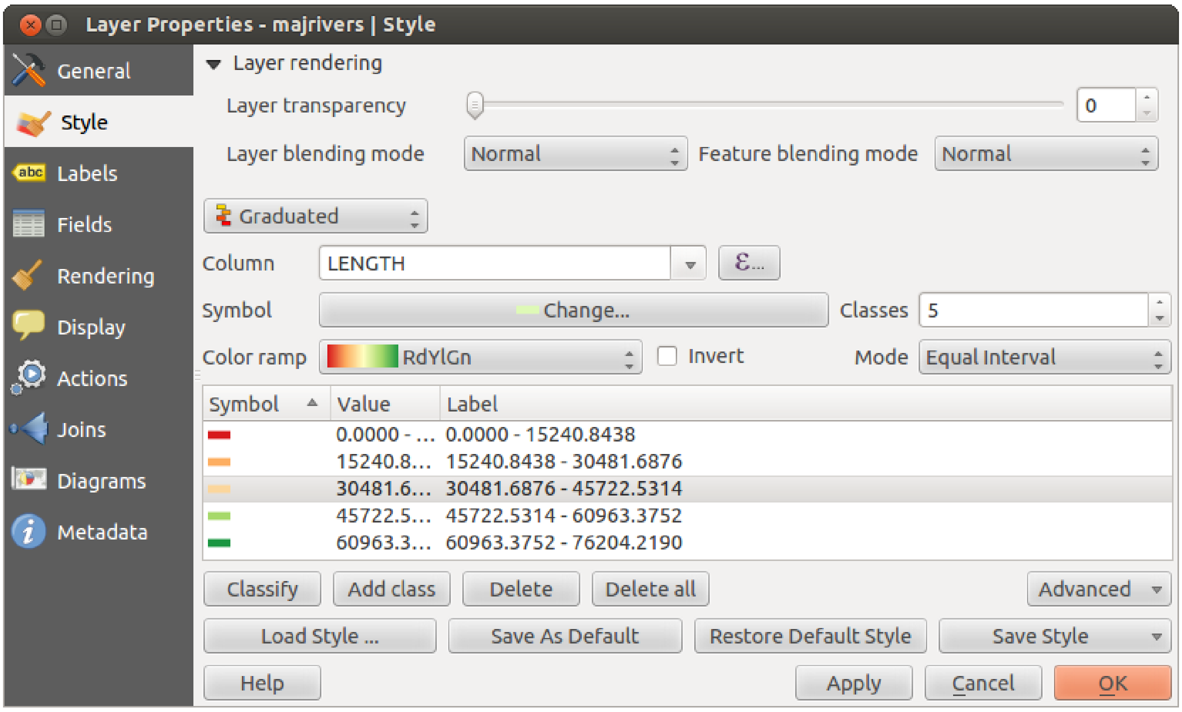
Also, analogous to the Categorized Renderer, the *Style* tab allows you to select:



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



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



Gambar 12.12: Graduated Symbolizing options

- The attribute (using the Column listbox or the *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)
- 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.

Tip: Thematic maps using an expression

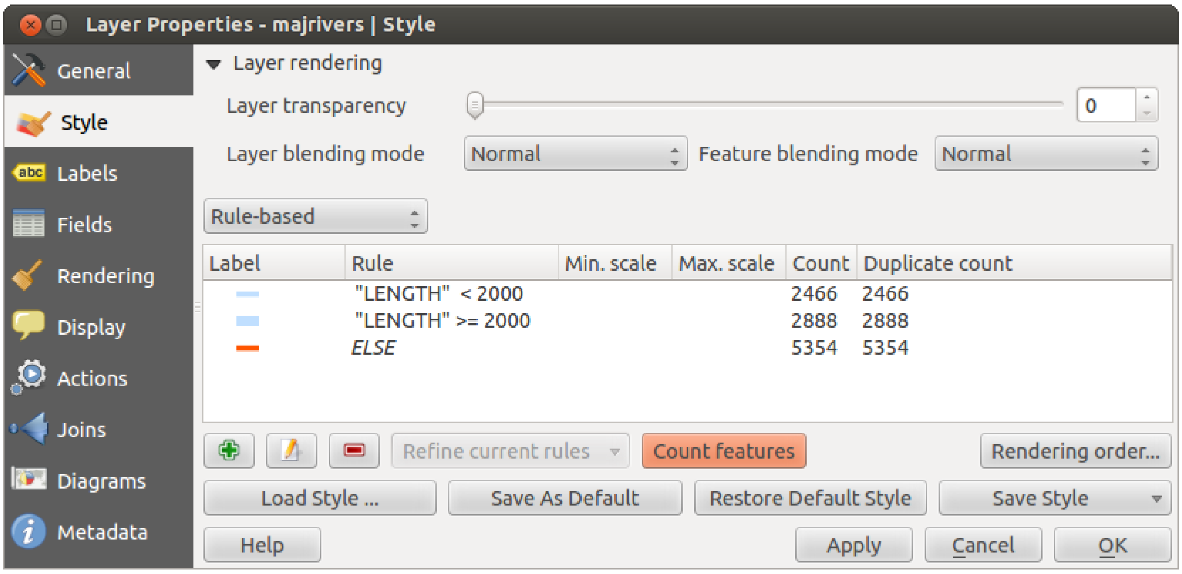
Categorized and graduated thematic maps can now be created using the result of an expression. In the properties dialog for vector layers, the attribute chooser has been augmented with a *Set column expression* function. So now you no longer need to write the classification attribute to a new column in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



Gambar 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.

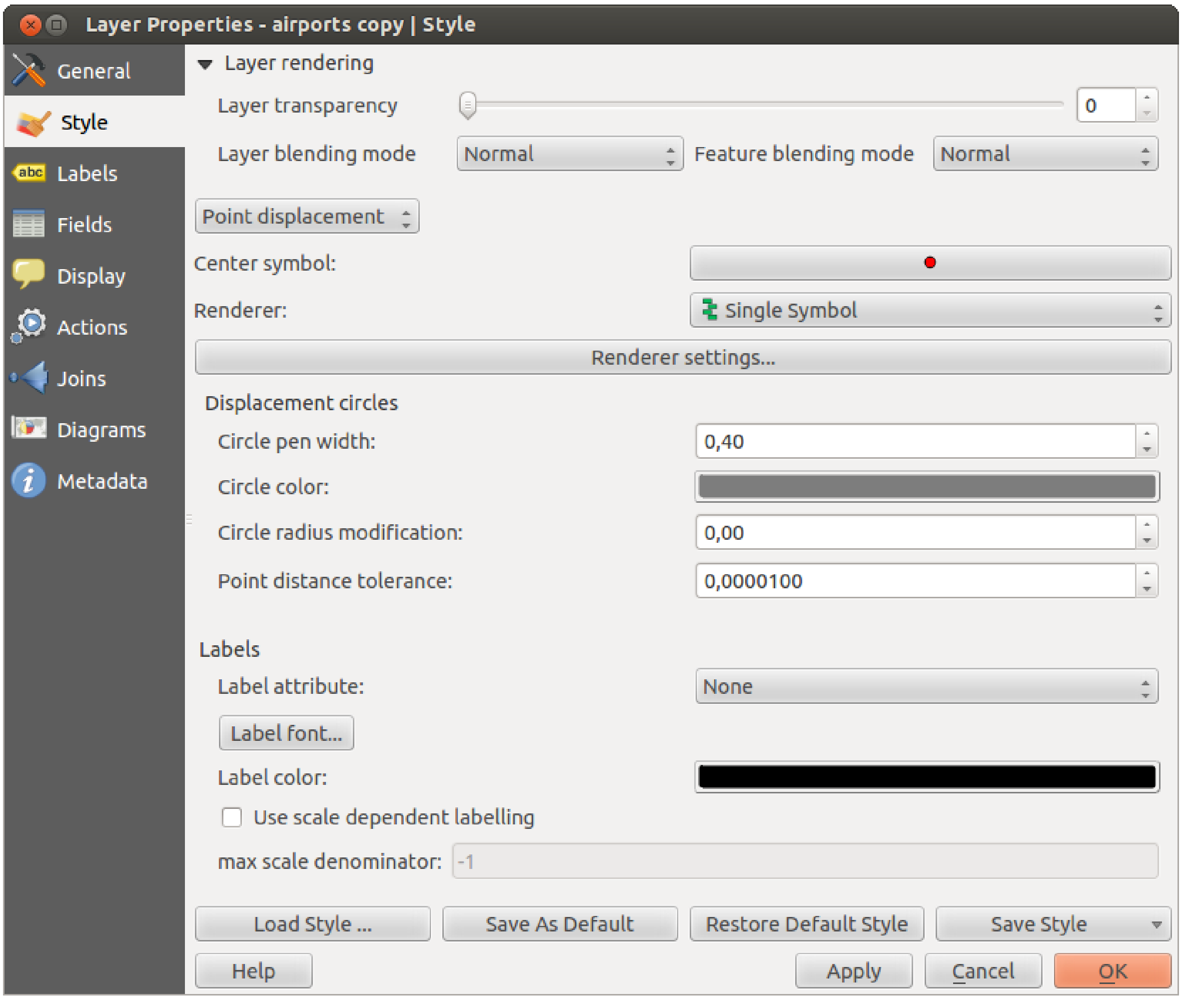
Tip: Export vector symbology

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 abc 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



Gambar 12.14: Point displacement dialog

- 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 if you want to define labels based on expressions - See labeling_with_expressions.

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).

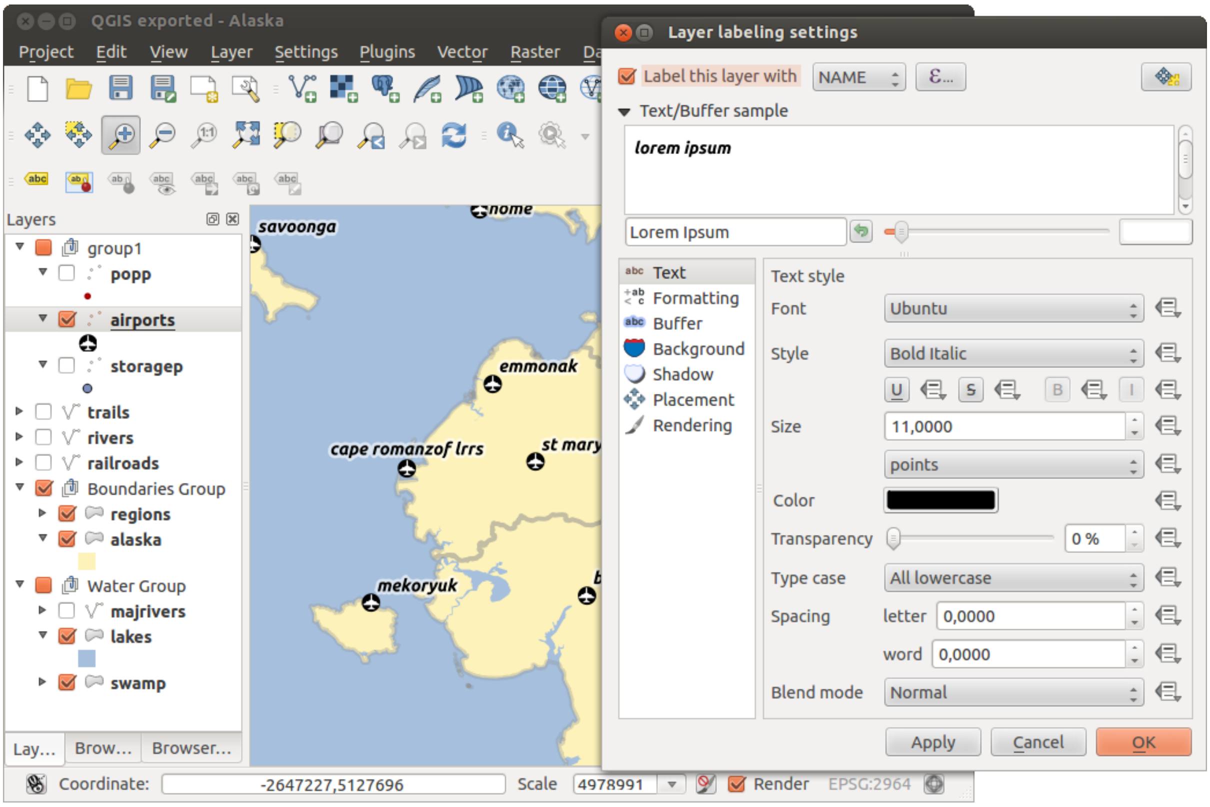
Use the *Shadow* menu for a user-defined *Drop shadow*. The drawing of the background is very variable. Choose between 'Lowest label component', 'Text', 'Buffer' and 'Background'. The *Offset* angle depends on the orientation of the label. If you choose the *Use global shadow* checkbox, then the zero 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.



Gambar 12.15: Smart labeling of vector point layers

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 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

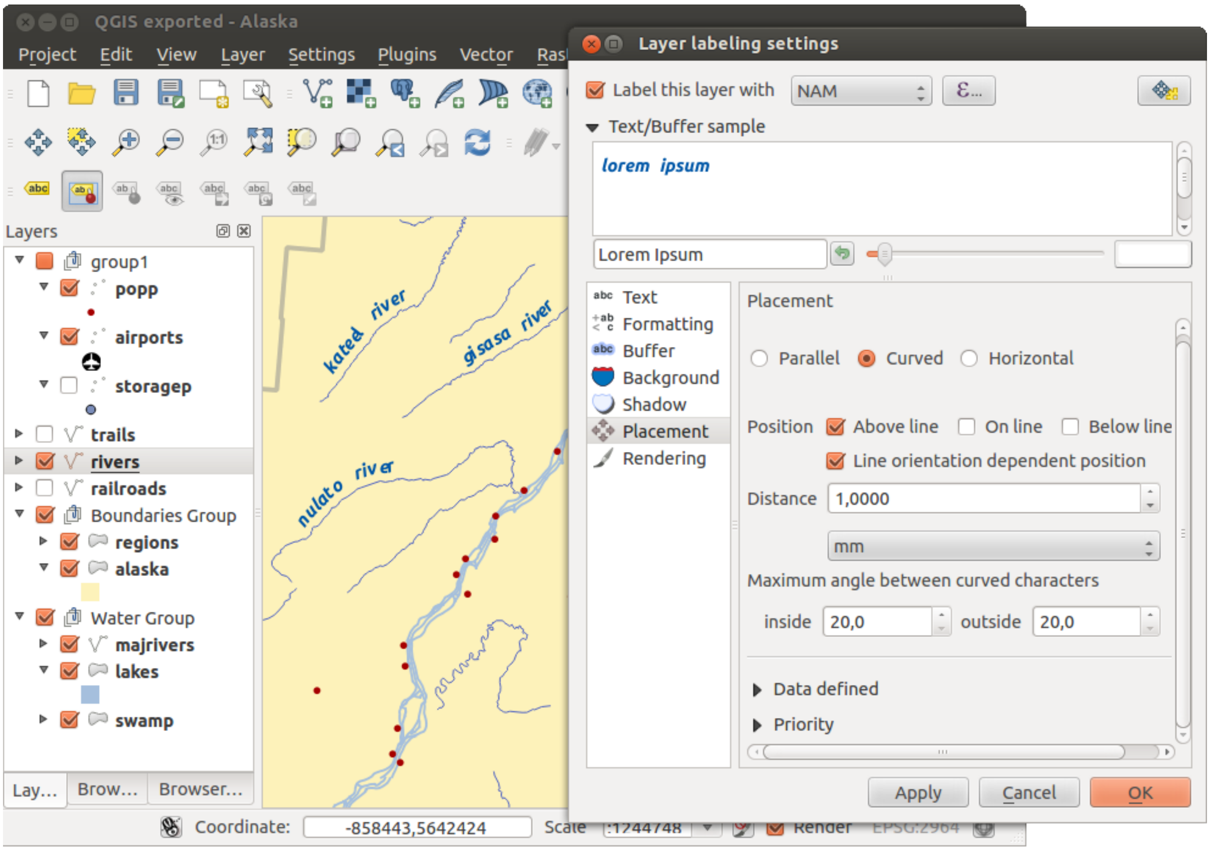
The first step is to activate the *Label this layer* checkbox and select an attribute column to use for labeling. Click ε... if you want to define labels based on expressions - See labeling_with_expressions.

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.



Gambar 12.16: Smart labeling of vector 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.

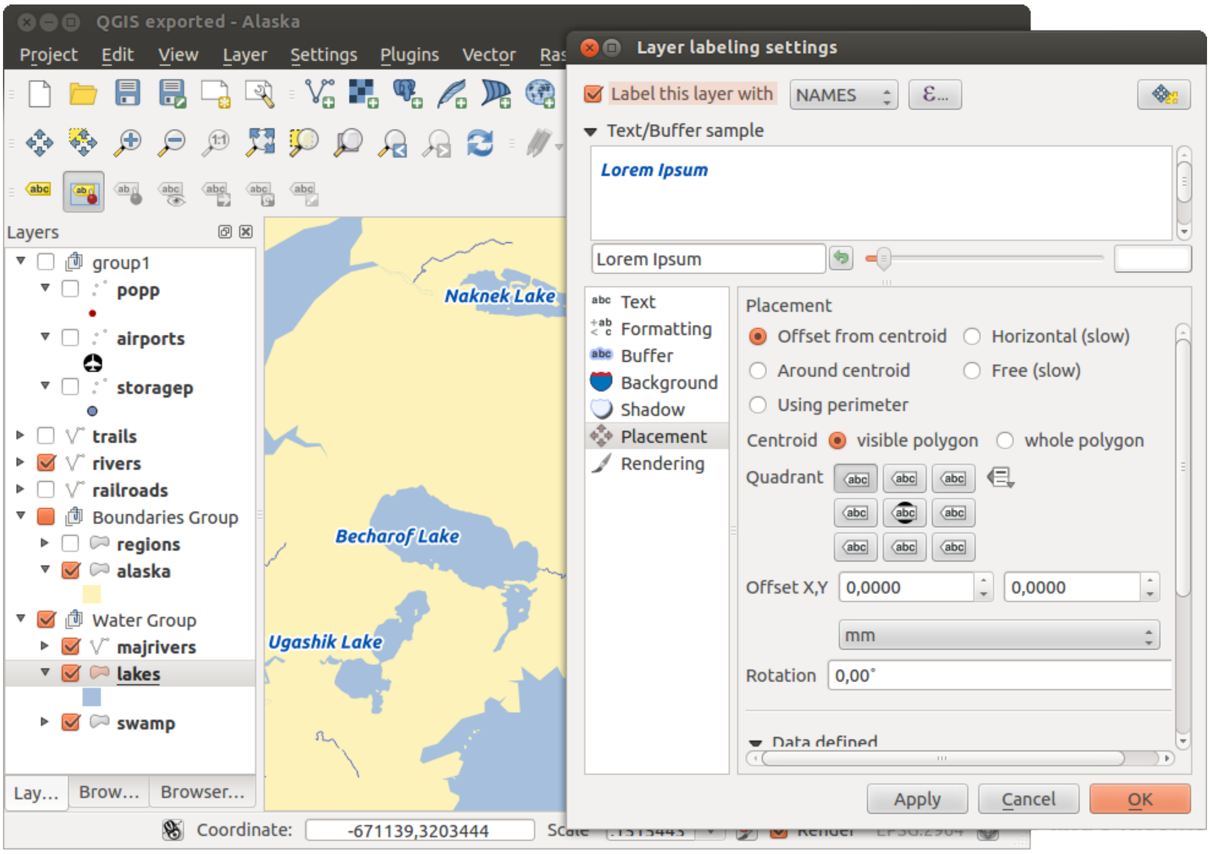
In the *Offset from centroid* settings, you can specify if the centroid is of the *visible polygon* or *whole polygon*. That means that either the centroid is used for the polygon you can see on the map or the centroid is determined for the whole polygon, no matter if you can see the whole feature on 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 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**

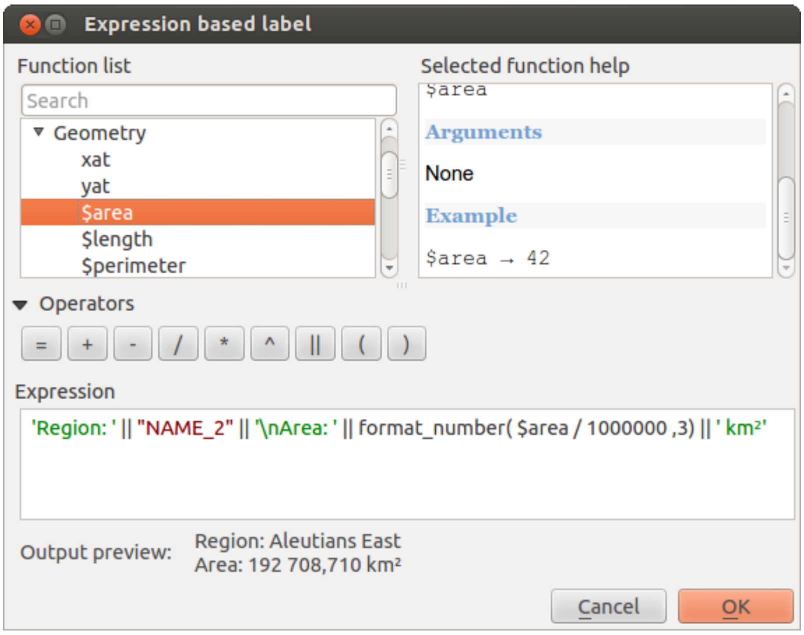
QGIS allows to use expressions to label features. Just click the icon in the Labels menu of the properties dialog. In figure_labels_4 you see a sample expression to label the alaska regions with name and area size, based on the field 'NAME_2', some descriptive text and the function '$area()' in combination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



Gambar 12.17: Smart labeling of vector polygon layers



Gambar 12.18: Using expressions for labeling

```
-> 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
   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).

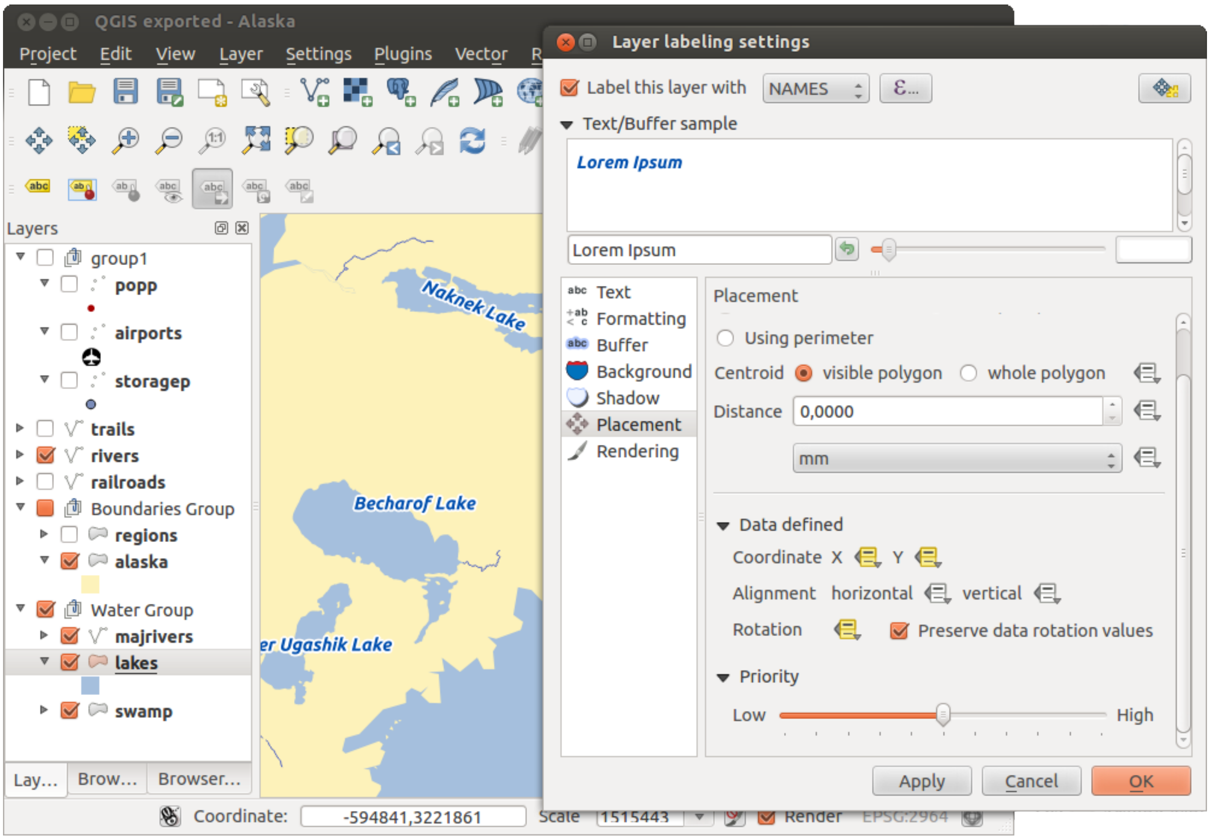
1. Import `lakes.shp` from the QGIS sample dataset.
2. Double-click the layer to open the Layer Properties. Click on *Labels* and *Placement*. Select *Offset from centroid*.
3. Look for the *Data defined* entries. Click the icon to define the field type for the *Coordinate*. Choose 'xlabel' for X and '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

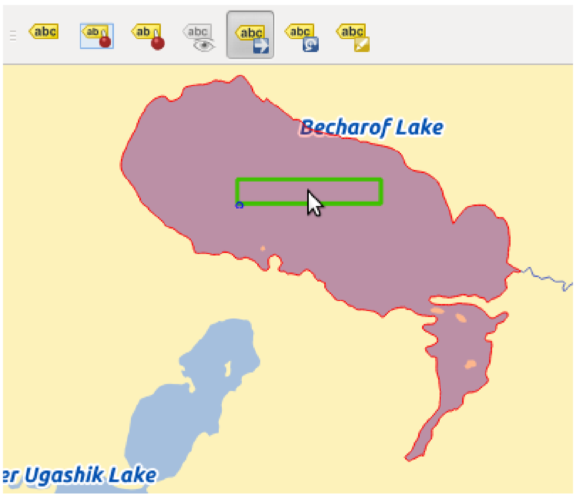
Within the *Fields* menu, the field attributes of the selected dataset can be manipulated. The buttons New Column and Delete Column can be used when the dataset is in Editing mode.

Edit Widget

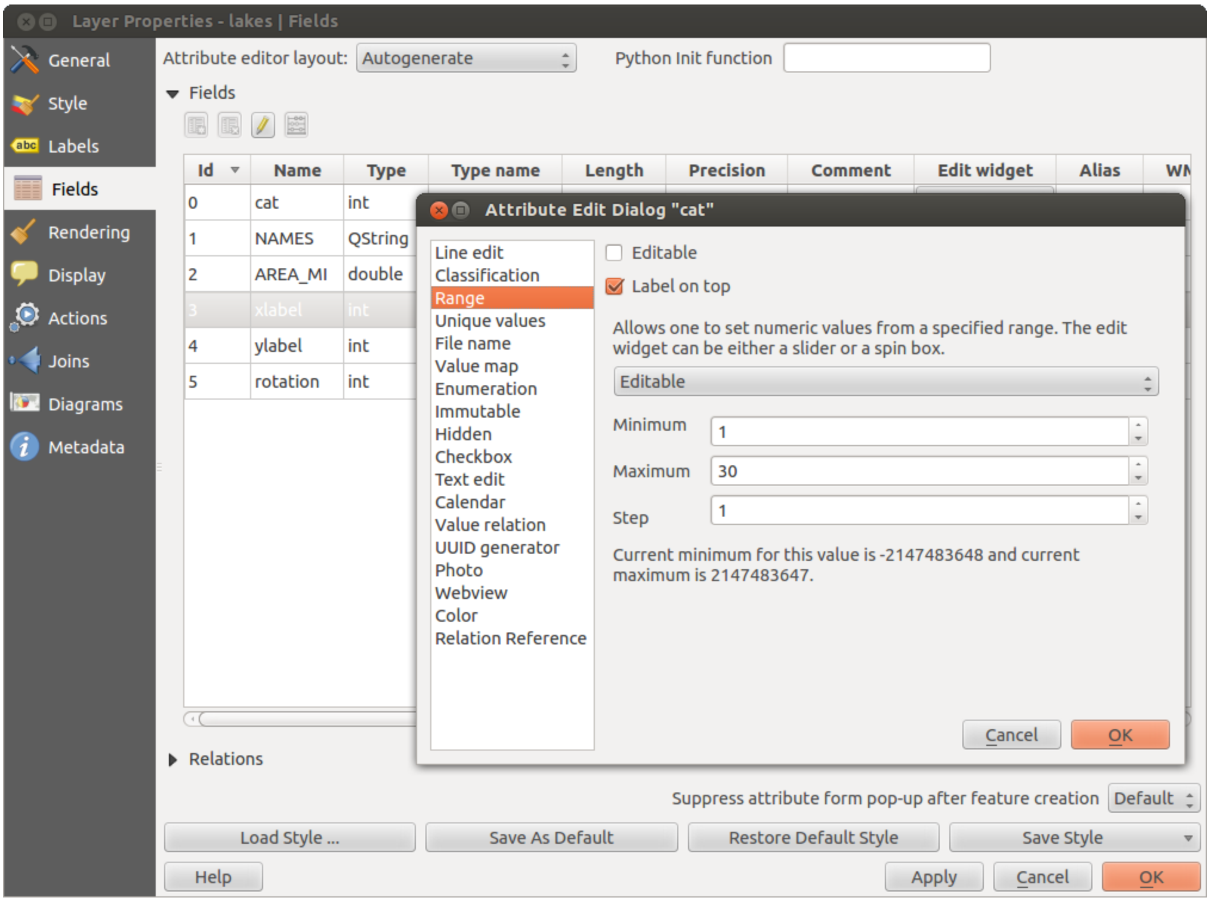
Within the *Fields* menu, you also find an **edit widget** column. This column can be used to define values or a range of values that are allowed to be added to the specific attribute table column. If you click on the **[edit widget]** button, a dialog opens, where you can define different widgets. These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



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



Gambar 12.20: Move labels



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

- **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.
- **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.

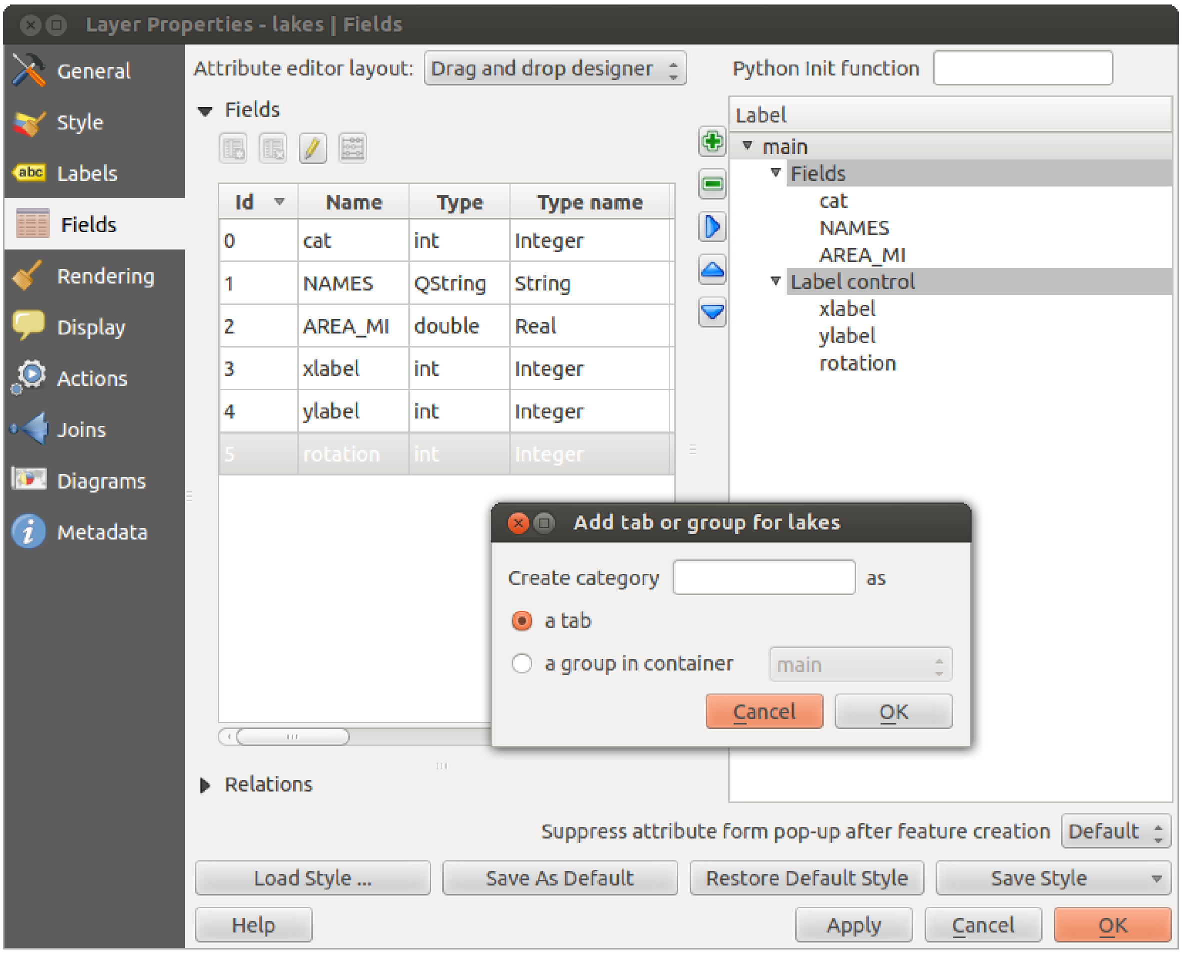
Other options in the dialog are 'Autogenerate' and 'Provide ui-file'. 'Autogenerate' just creates editors for all fields and tabulates them. The 'Provide ui-file' option allows you to use complex dialogs made with the Qt-Designer. Using a UI-file allows a great deal of freedom in creating a dialog. For 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):

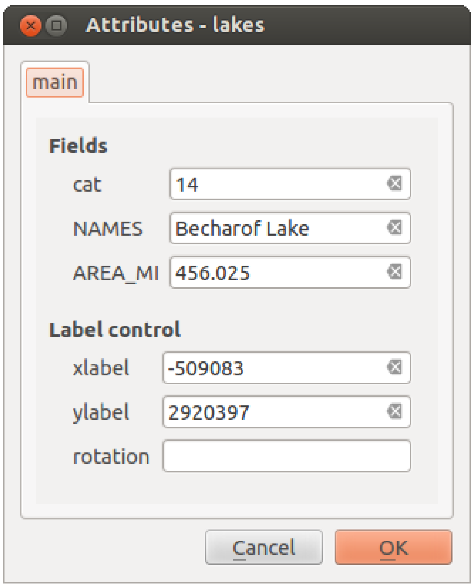
```
def open(dialog,layer,feature):
geom = feature.geometry()
control = dialog.findChild(QWidged,"My line edit")
```

Reference in Python Init Function like so: MyForms.open

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



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



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

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

Coordinate Reference System

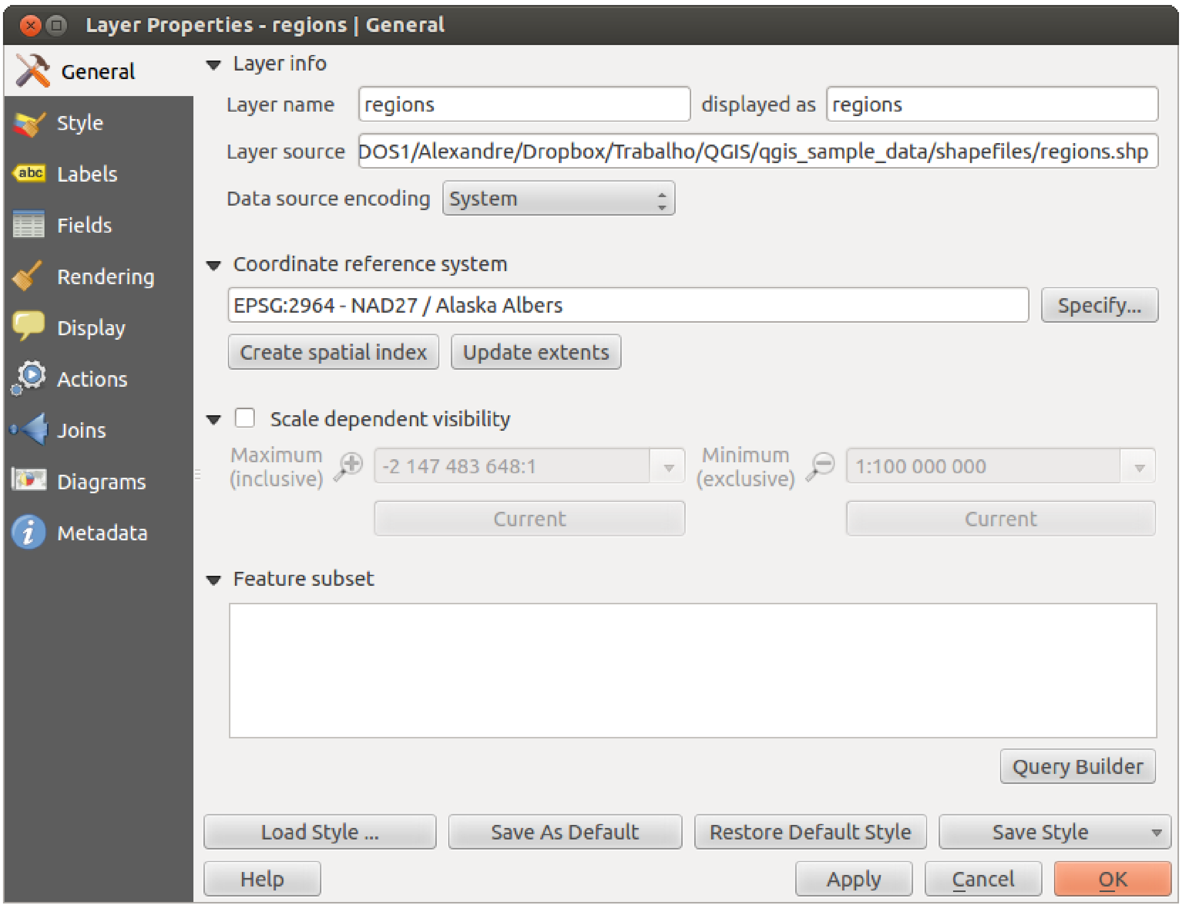
- *Specify* the coordinate reference system. Here, you can view or change the projection of the specific vector layer.
- Create a *Spatial Index* (only for OGR-supported formats)
- *Update Extents* information for a layer
- View or change the projection of the specific vector layer, clicking on *Specify*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

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*).



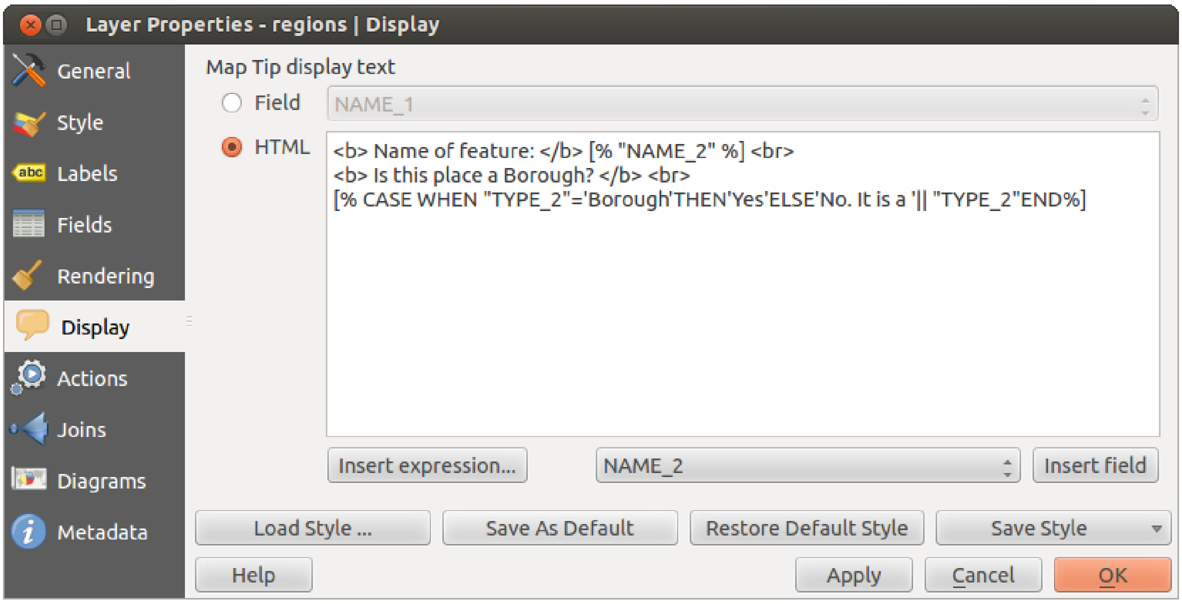
Gambar 12.24: General menu in vector layers properties dialog

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 *Opsi*). **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.



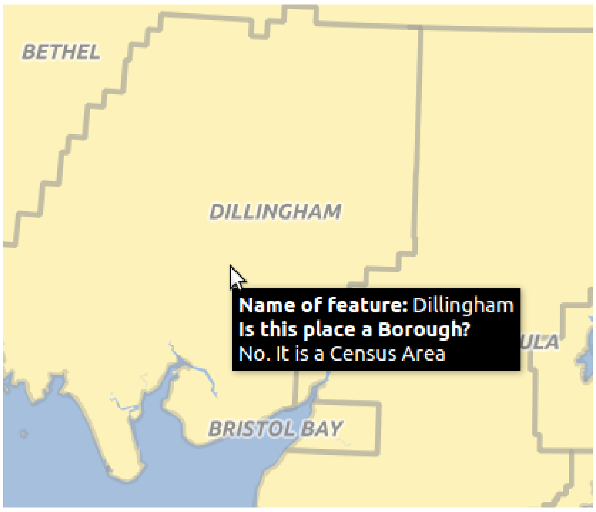
Gambar 12.25: HTML code for map tip

12.2.7 Actions Menu

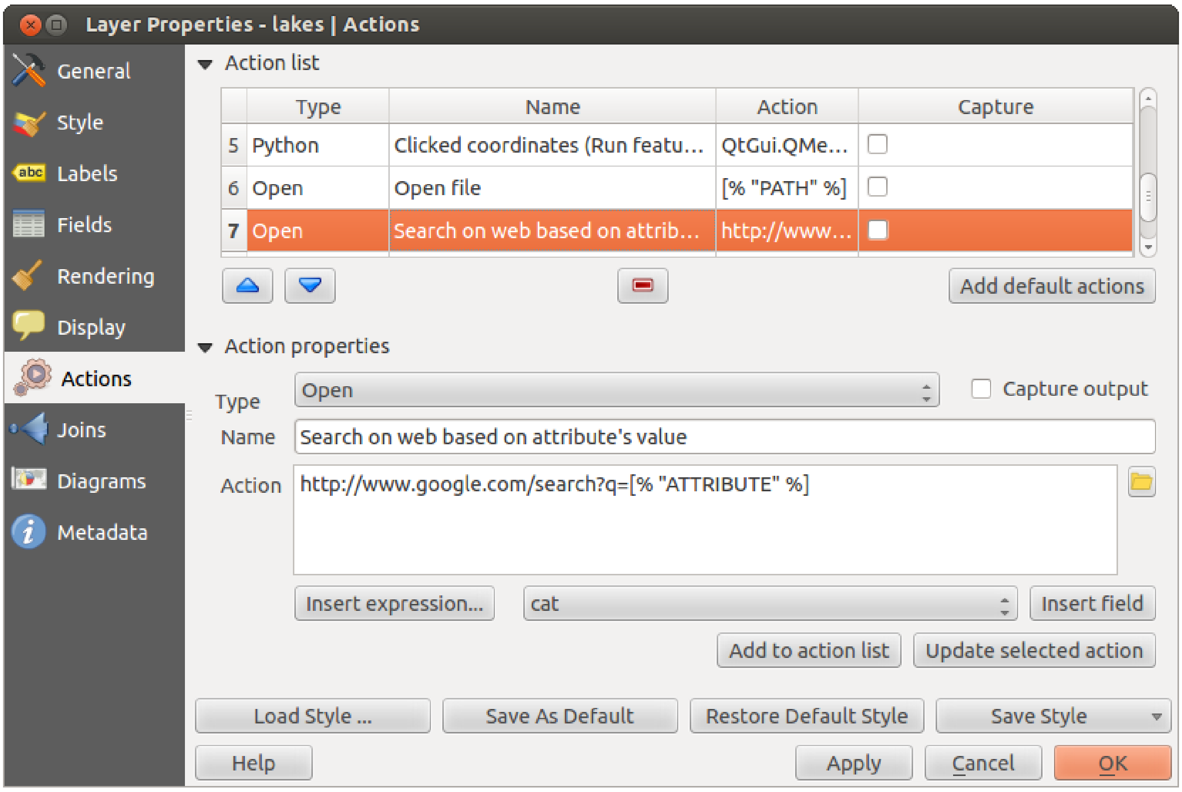
QGIS provides the ability to perform an action based on the attributes of a feature. This can be used to perform any number of actions, for example, running a program with arguments built from the attributes of a feature or passing parameters to a web reporting tool.

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).



Gambar 12.26: Map tip made with HTML code



Gambar 12.27: Overview action dialog with some sample actions

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:

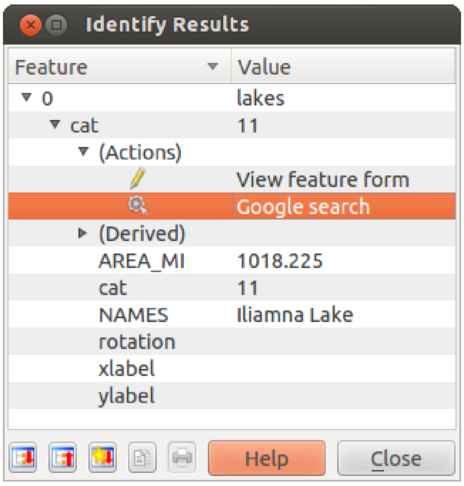
1. Make sure the `lakes` layer is loaded.
2. Open the *Layer Properties* dialog by double-clicking on the layer in the legend, or right-click and choose *Properties* from the pop-up menu.
3. Click on the *Actions* menu.
4. Enter a name for the action, for example `Google Search`.
5. For the action, we 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:



Gambar 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’)
```

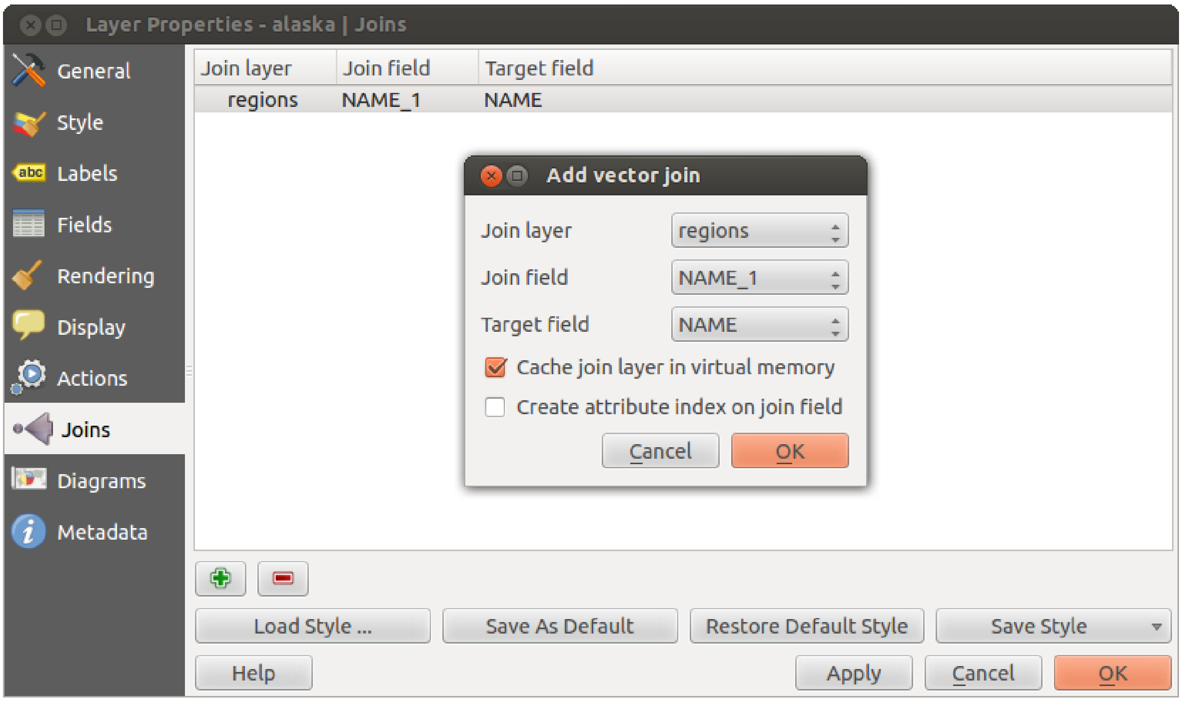
To add a raster (a TIF image in this example), it becomes:

```
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).



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

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).

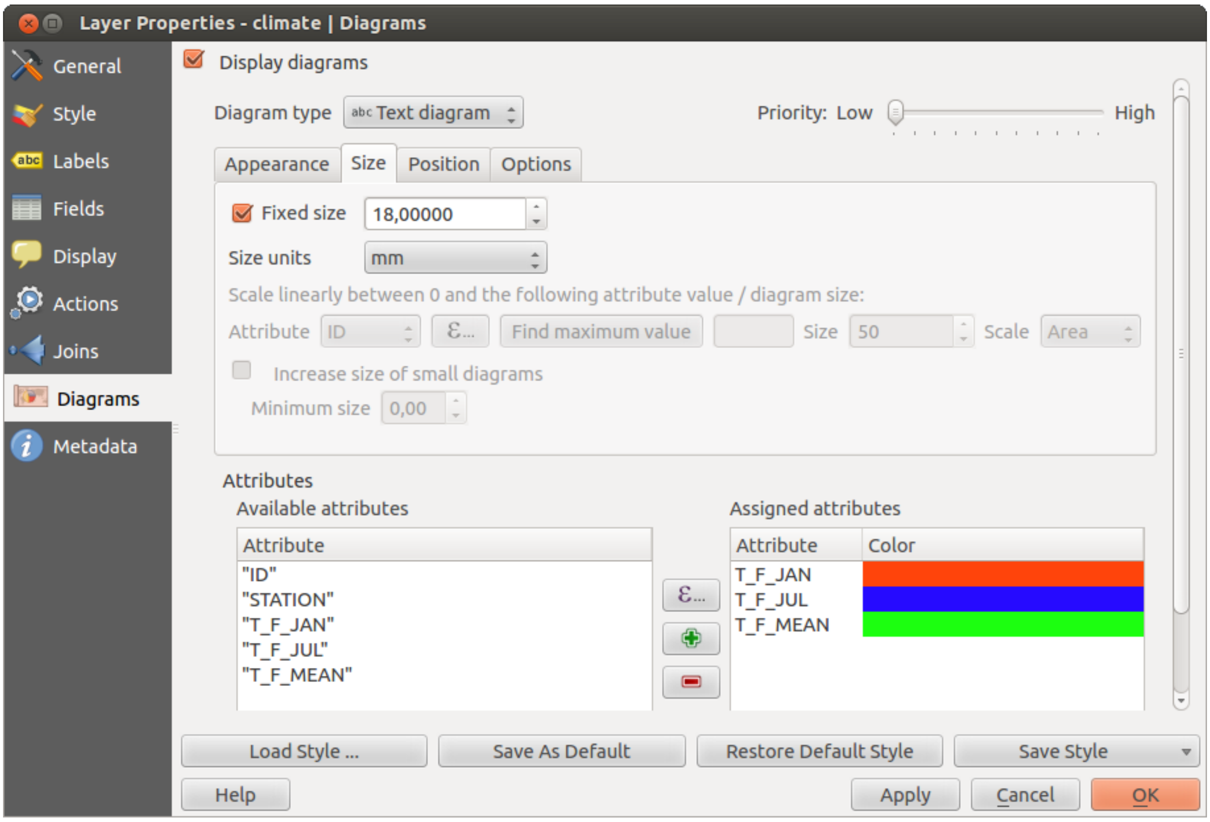
The current core implementation of diagrams provides support for pie charts, text diagrams and histograms.

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 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 *Contoh data*).

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.

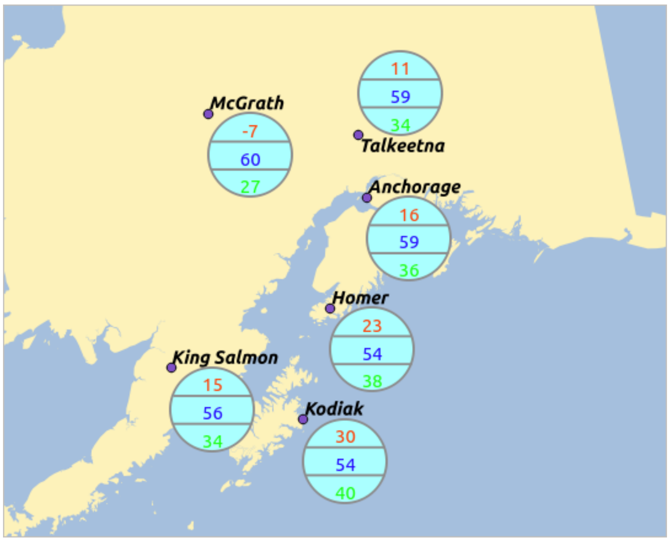


Gambar 12.30: Vector properties dialog with diagram menu

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 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 ε... button to add an expression.



Gambar 12.31: Diagram from temperature data overlayed on a map

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.

.

12.3 Editing

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

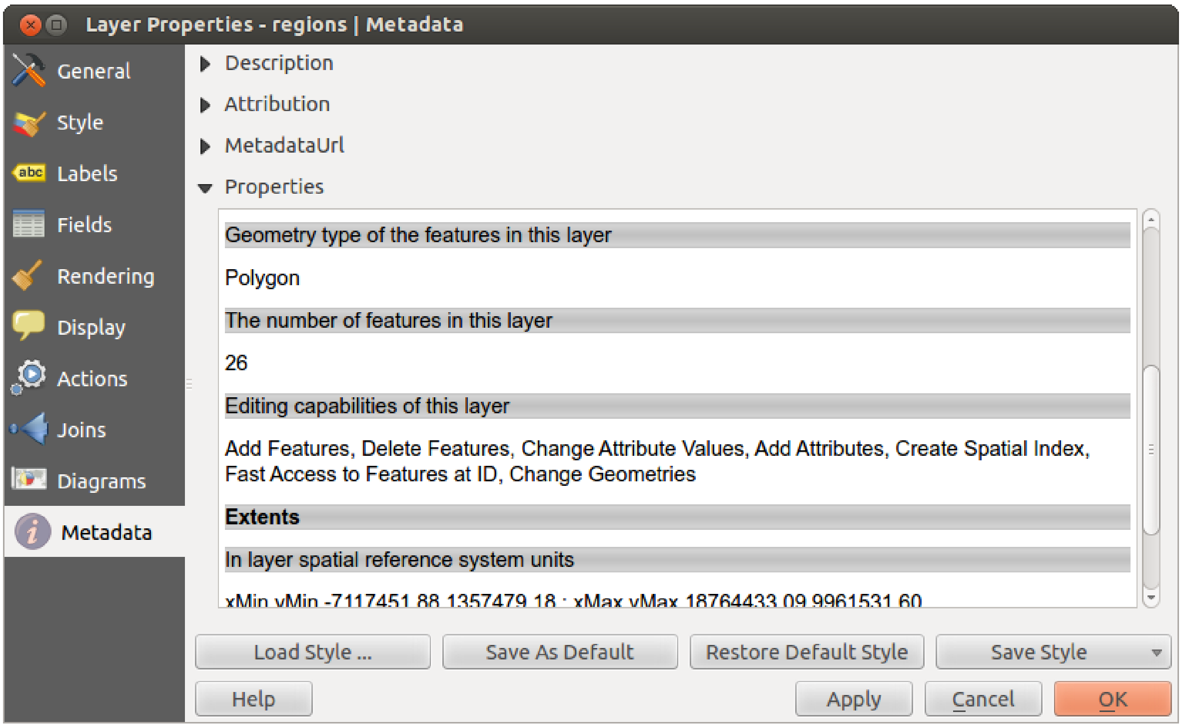
Catatan: The procedure for editing GRASS layers is different - see section *Digitizing and editing a GRASS vector layer* for details.

Tip: 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.



Gambar 12.32: Metadata menu in vector layers properties dialog

Snapping tolerance

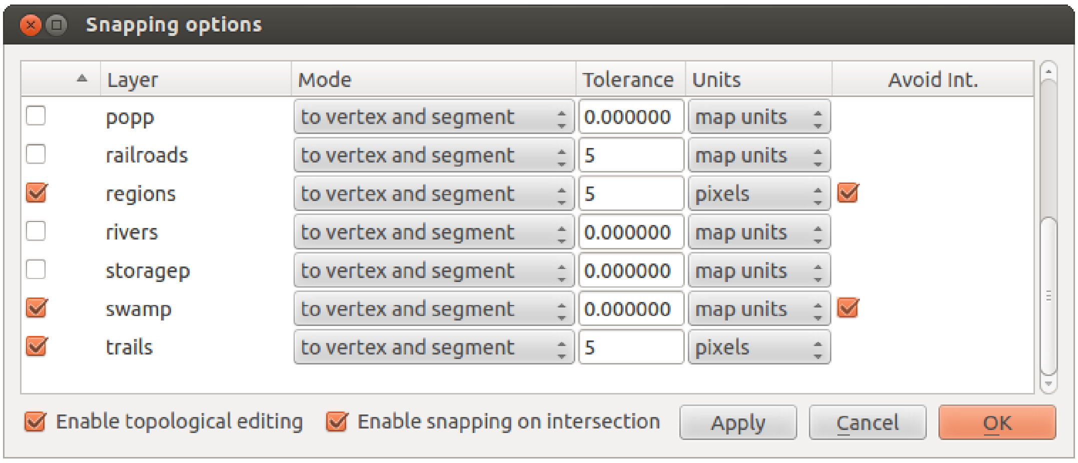
Snapping tolerance is the distance QGIS uses to `search` for the closest vertex and/or segment you are trying to connect to when you set a new vertex or move an existing vertex. If you aren't within the snapping tolerance, QGIS will leave the vertex where you release the mouse button, instead of snapping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

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



Gambar 12.33: Edit snapping options on a layer basis

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.

Tip: Save Regularly

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

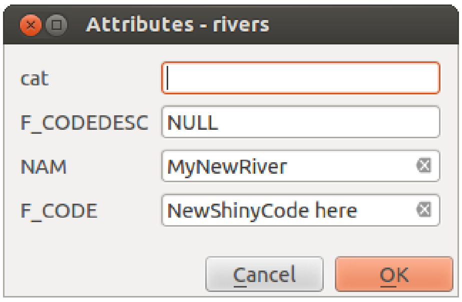
Adding Features

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*.



Gambar 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.

Tip: 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.

Tip: 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.

Tip: 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.

Tip: 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.

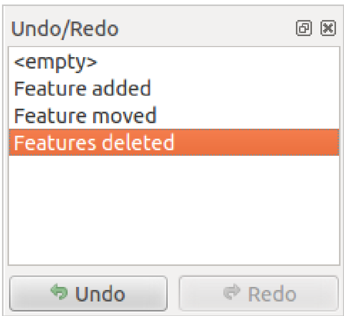
12.3.5 Advanced digitizing

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.



Gambar 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.

Catatan: 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

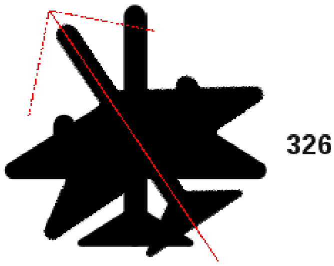
The Merge Selected Features tool allows you to merge features that have common boundaries and the same attributes.

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.



Gambar 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.

Catatan: 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).

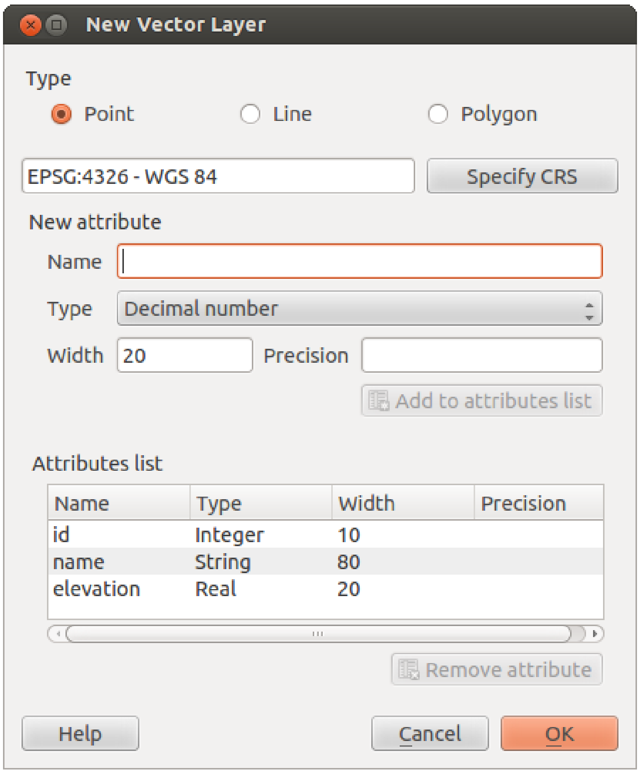
Note that QGIS does not yet support creation of 2.5D features (i.e., features with X,Y,Z coordinates).

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.

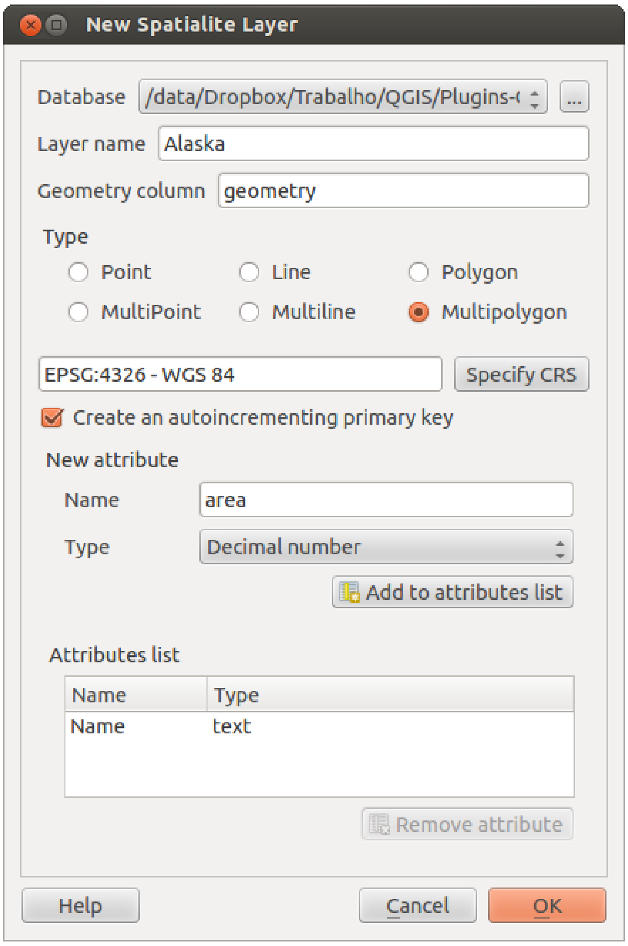
Creating a new SpatiaLite layer

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*.



Gambar 12.37: Creating a new Shapefile layer Dialog



Gambar 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 *Plugin Pengelola DB*.

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.

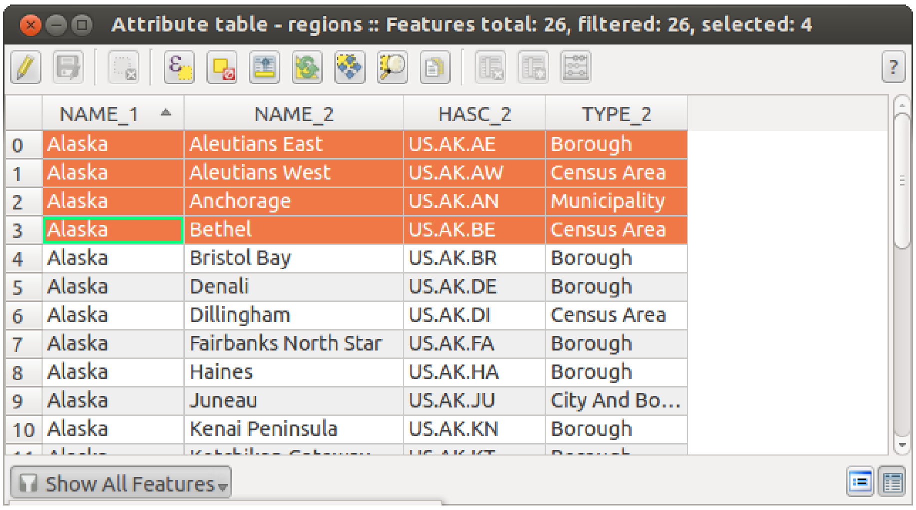
When this plugin is loaded, choose *New* → *Create new GPX Layer...* from the *Layer* menu. In the *Save new GPX file as* dialog, you can choose where to save the new GPX layer.

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.



Gambar 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 *Query Builder*.

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`)

Tip: 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 *Legenda Peta*). 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.

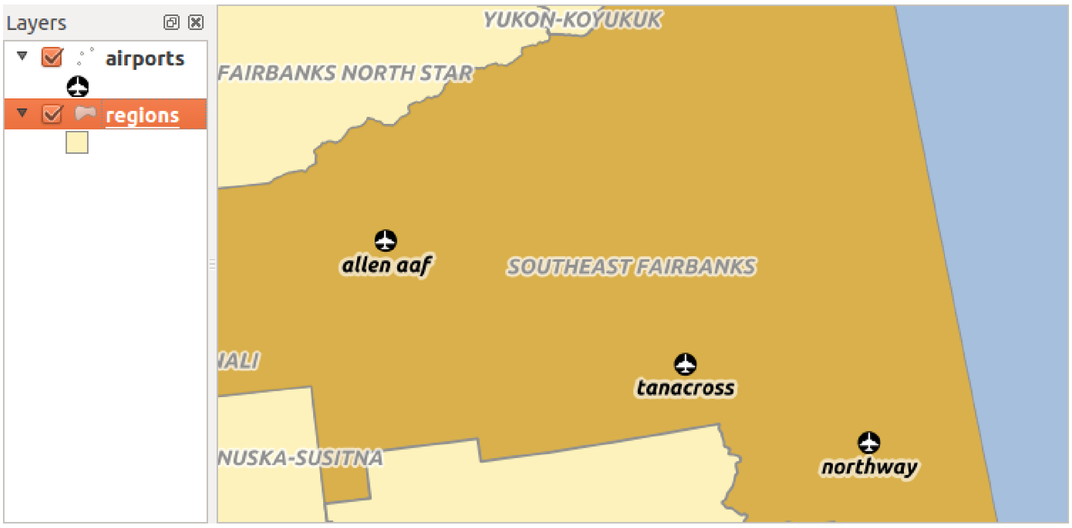
As an example you have a layer with all regions of alaska (polygon) which provides some attributes about its name and region type and a unique id (which acts as primary key).

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.



Gambar 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)

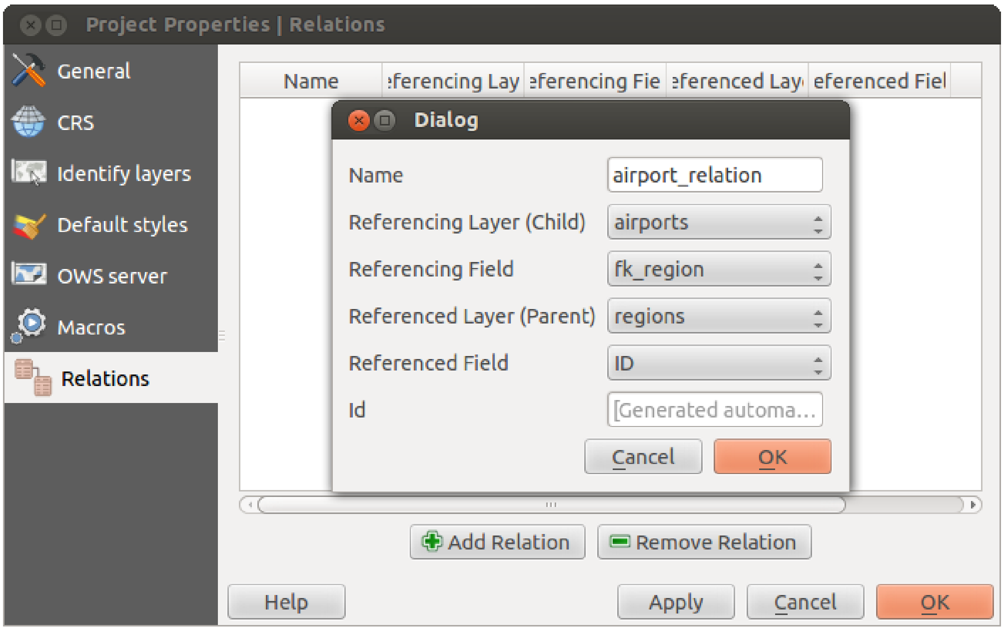
The first thing we are going to do is to let QGIS know about the relations between the layer. This is done in *Settings* → *Project Properties*. Open the *Relations* menu and click on *Add*.

- **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.

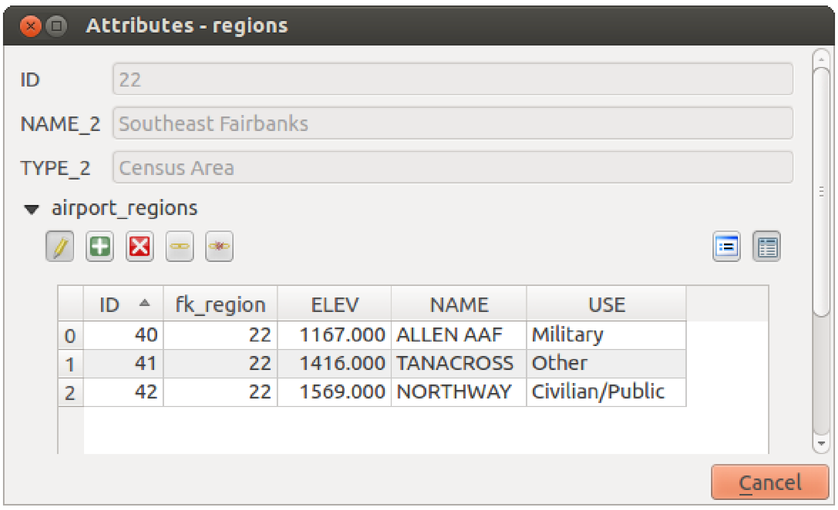
Forms

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



Gambar 12.41: Relation Manager

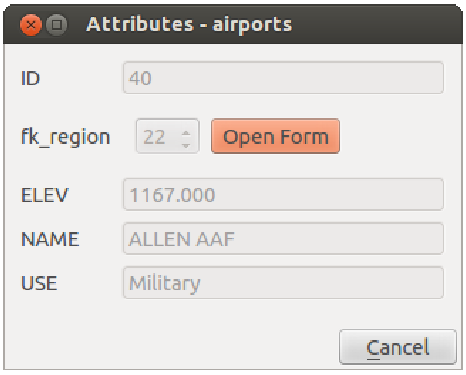


Gambar 12.42: Identification dialog regions with relation to airports

- 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.



Gambar 12.43: Identification dialog airport with relation to regions

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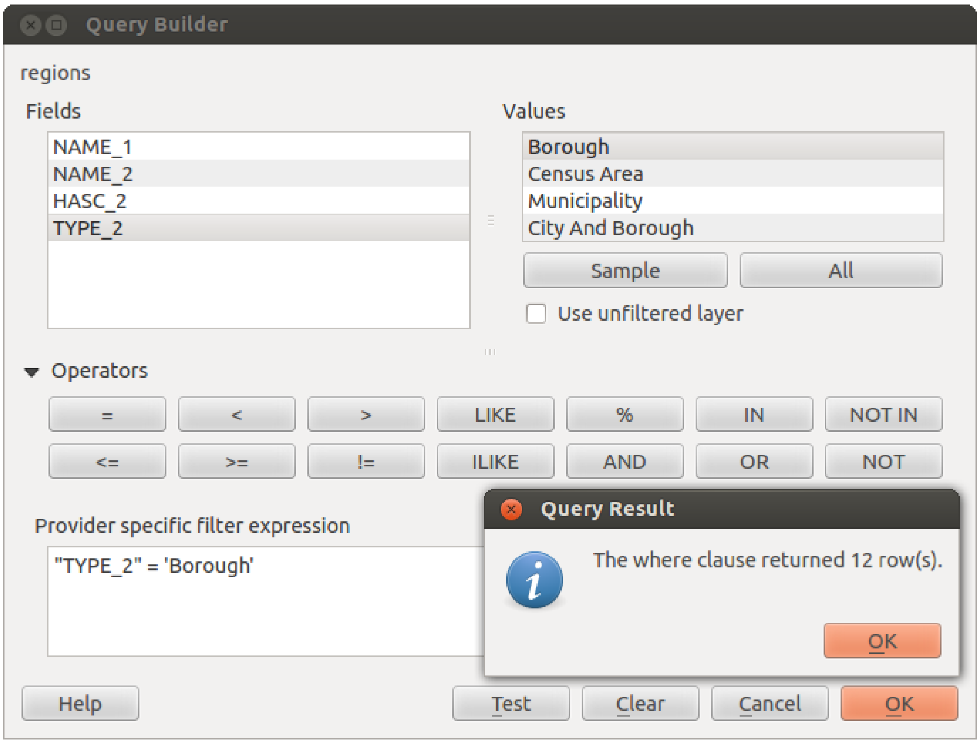
12.4 Query Builder

The Query Builder allows you to define a subset of a table using a SQL-like WHERE clause and to display the result in the main window. The query result can then be saved as a new vector layer.

12.4.1 Query

Open the **Query Builder** by opening the Layer Properties and going to the *General* menu. Under *Feature subset*, click on the **[Query Builder]** button to open the *Query builder*. For example, if you have a `regions` layer with a `TYPE_2` field, you could select only regions that are `borough` in the *Provider specific filter expression* box of the Query Builder. Figure_attributes_2 shows an example of the Query Builder populated with the `regions.shp` layer from the QGIS sample data. The Fields, Values and Operators sections help you to construct the SQL-like query.



Gambar 12.44: Query Builder

The **Fields list** contains all attribute columns of the attribute table to be searched. To add an attribute column to the SQL WHERE clause field, double click its name in the Fields list. Generally, you can use the various fields, values and operators to construct the query, or you can just type it into the SQL box.

The **Values list** lists the values of an attribute table. To list all possible values of an attribute, select the attribute in the Fields list and click the **[all]** button. To list the first 25 unique values of an attribute column, select the attribute column in the Fields list and click the **[Sample]** button. To add a value to the SQL WHERE clause field, double click its name in the Values list.

The **Operators section** contains all usable operators. To add an operator to the SQL WHERE clause field, click the appropriate button. Relational operators (= , > , ...), string comparison operator (`LIKE`), and logical operators (`AND`, `OR`, ...) are available.

The **[Test]** button shows a message box with the number of features satisfying the current query, which is useful in the process of query construction. The **[Clear]** button clears the text in the SQL WHERE clause text field. The **[OK]** button closes the window and selects the features satisfying the query. The **[Cancel]** button closes the window without changing the current selection.

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 *Legenda Peta*). It is also possible to specify OGR creation options within the dialog.

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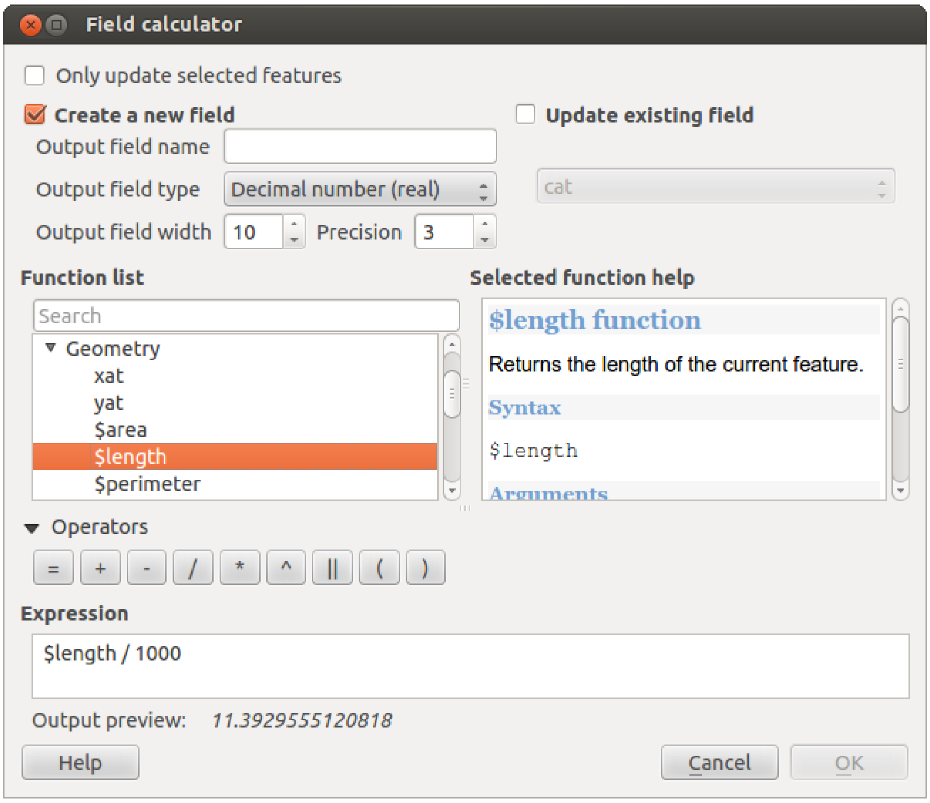
12.5 Field Calculator

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.



Gambar 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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Pekerjaan dengan Data 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 *Literatur dan Referensi Web*). A complete list is available at http://www.gdal.org/formats_list.html.

Catatan: 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).

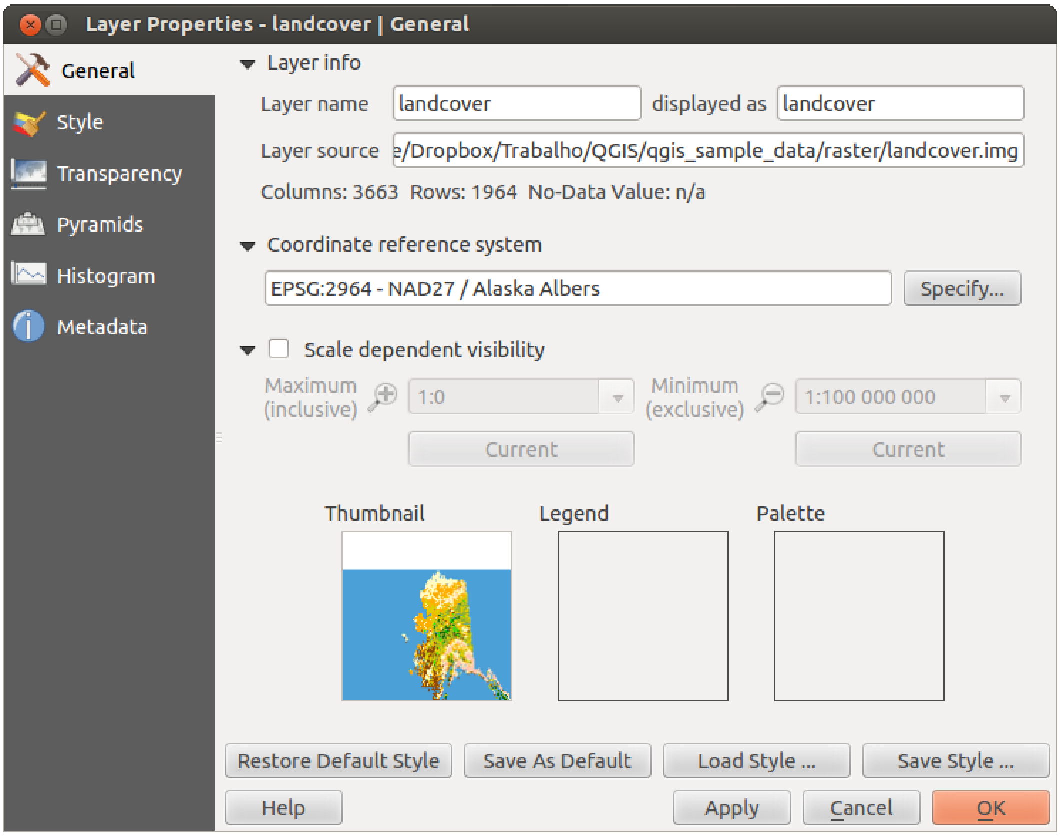
There are several menus in the dialog:

- *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.



Gambar 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

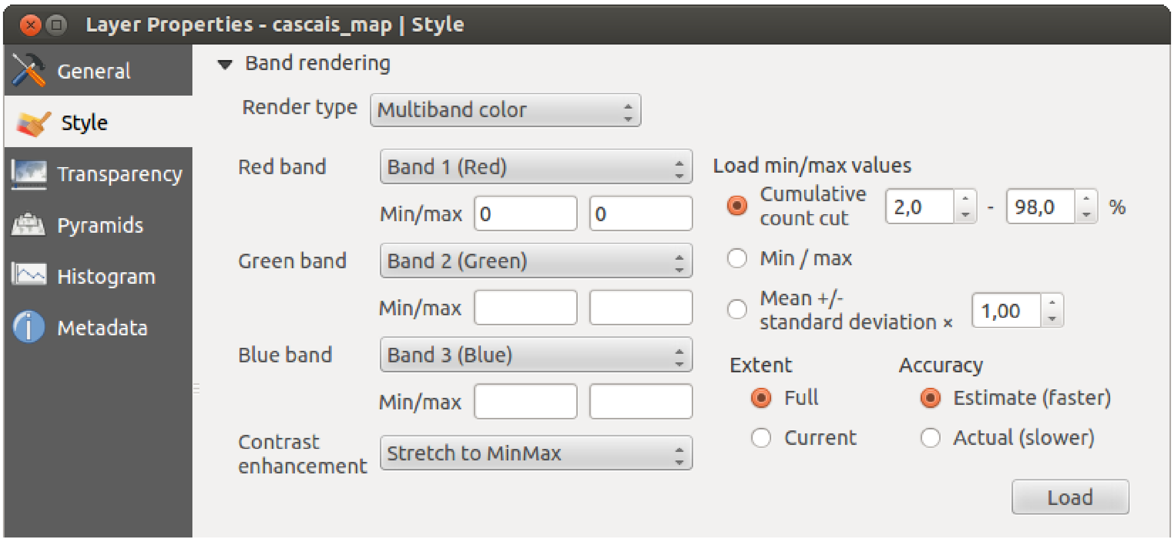
Band rendering

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'.



Gambar 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.

Tip: Viewing a Single Band of a Multiband Raster

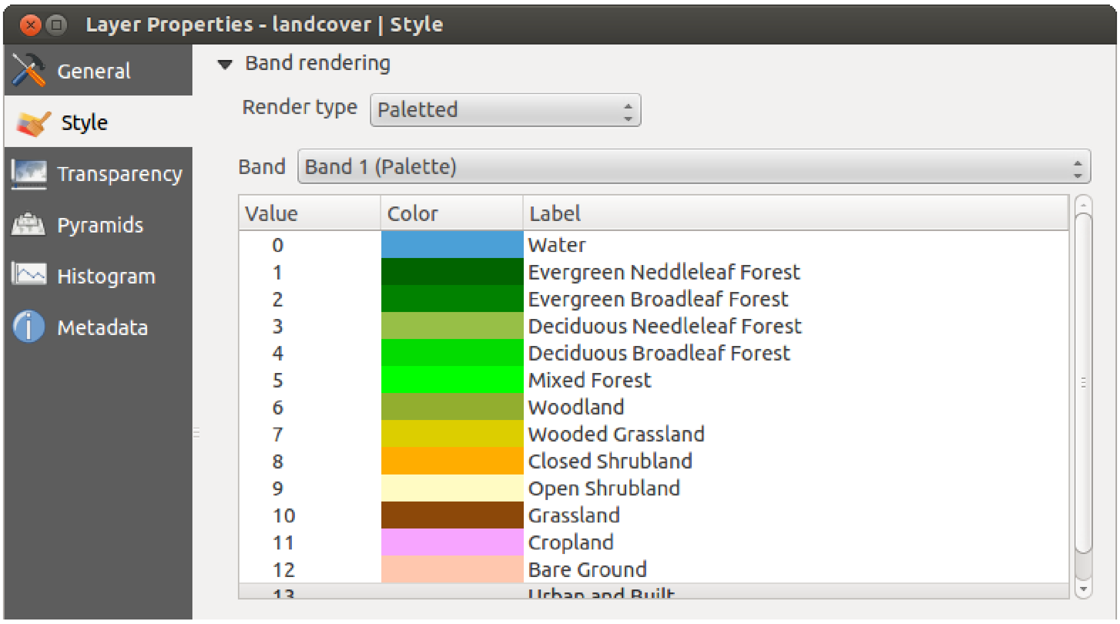
If you want to view a single band of a multiband image (for example, Red), you might think you would set the Green and Blue bands to "Not Set". But this is not the correct way. To display the Red band, set the image type to 'Singleband gray', then select Red as the band to use for Gray.

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

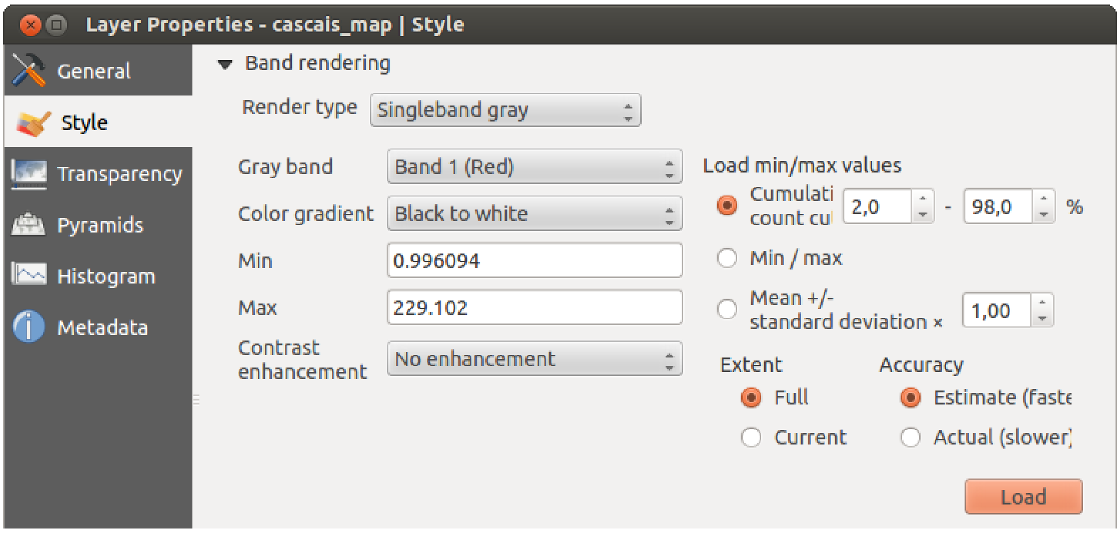
Catatan: When adding GRASS rasters, the option *Contrast enhancement* will always be set automatically to *stretch to min max*, regardless of if this is set to another value in the QGIS general options.



Gambar 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*.

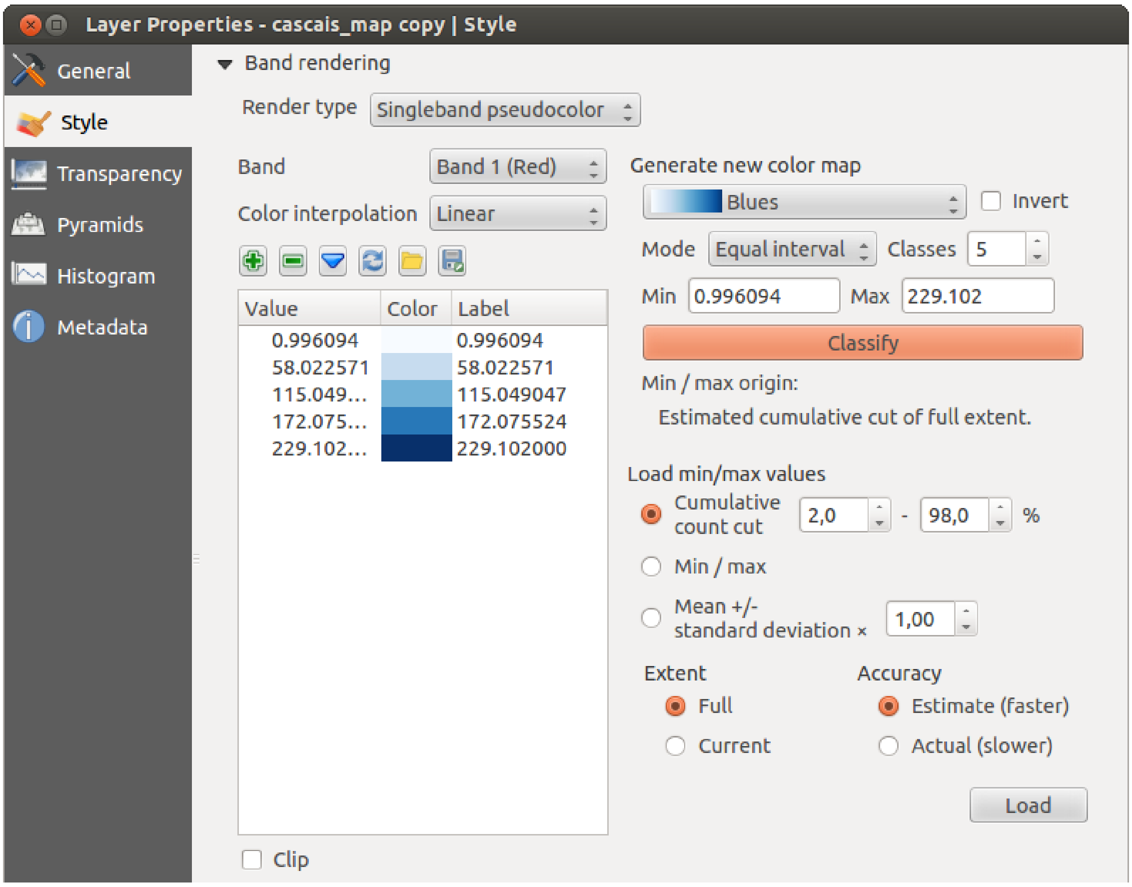


Gambar 13.4: Raster Renderer - Singleband gray

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:



Gambar 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

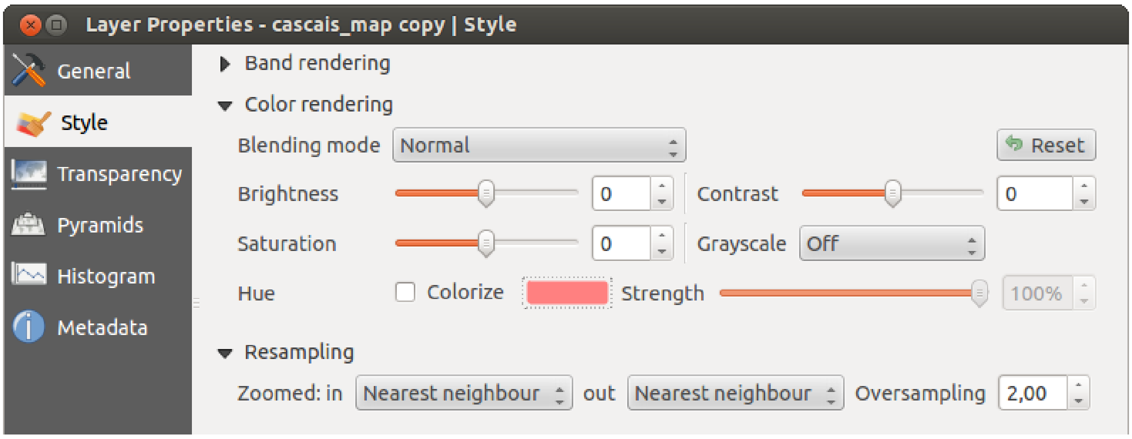
For every *Band rendering*, a *Color rendering* is possible.

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.



Gambar 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.

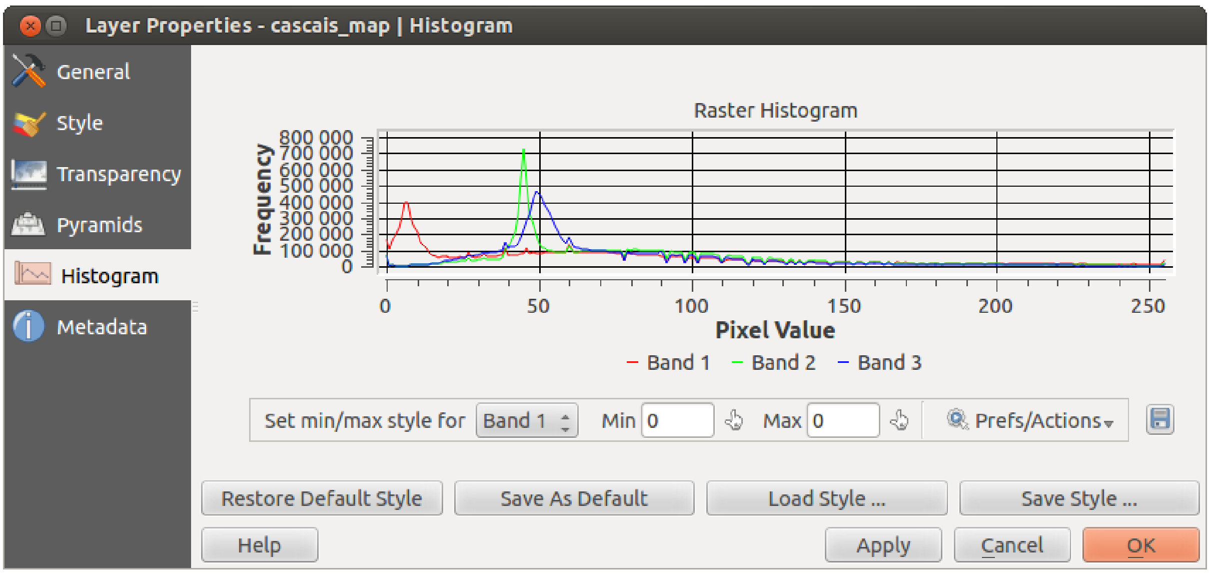
13.2.5 Histogram Menu

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

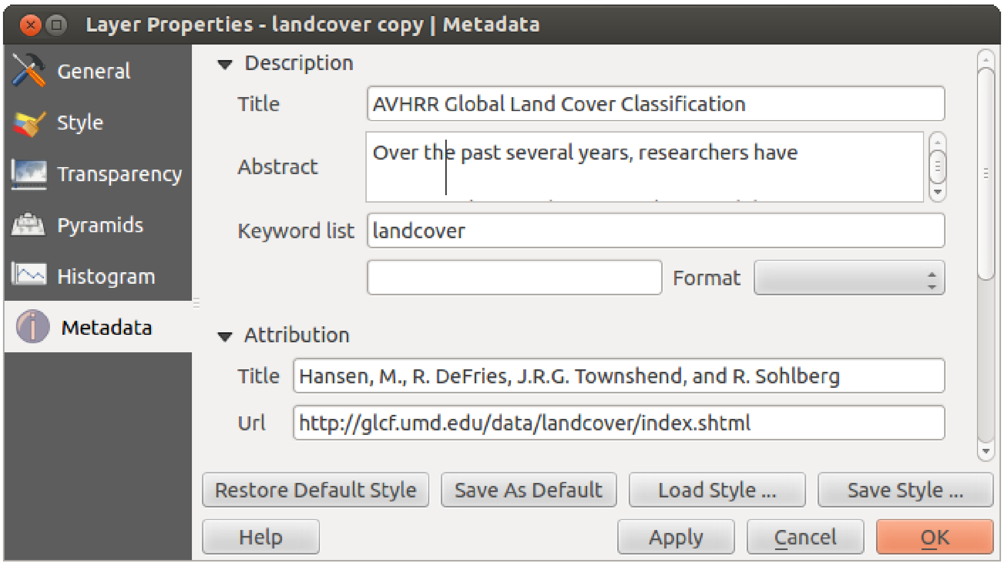
The *Metadata* menu displays a wealth of information about the raster layer, including statistics about each band in the current raster layer. From this menu, entries may be made for the *Description*, *Attribution*, *MetadataUrl* and

Gambar 13.7: The Pyramids Menu



Gambar 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.



Gambar 13.9: Raster Metadata

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13.3 Kalkulator Raster

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.

Daftar **Pita Raster** berisi semua lapisan raster yang dapat digunakan. Untuk menambahkan raster ke kalkulator raster kolom ekspresi, klik dua kali namanya dalam daftar kolom. Anda kemudian dapat menggunakan operator untuk membangun perhitungan ekspresi, atau Anda hanya dapat mengetik mereka ke dalam kotak.

Dalam bagian **Hasil lapisan**, Anda akan perlu mendefinisikan keluaran lapisan. Anda kemudian dapat menentukan luasnya daerah perhitungan berdasarkan masukan lapisan raster, atau berdasarkan koordinat X, Y dan pada kolom dan baris, untuk mengatur resolusi dari keluaran lapisan. Jika lapisan masukan memiliki resolusi yang berbeda, nilai-nilai akan resampled dengan algoritma tetangga terdekat.

Bagian **Operator** berisi semua operator yang tersedia. Untuk menambahkan operator ke kotak ekspresi kalkulator raster, klik tombol yang sesuai. Perhitungan matematika tersedia (+, −, *, ...) dan fungsi trigonometri (`sin`, `cos`, `tan`, ...). Nantikan operator lainnya yang akan datang!

Dengan kotak centang *Tambahkan hasil ke proyek*, lapisan hasil secara otomatis akan ditambahkan ke area legenda dan dapat divisualisasikan.

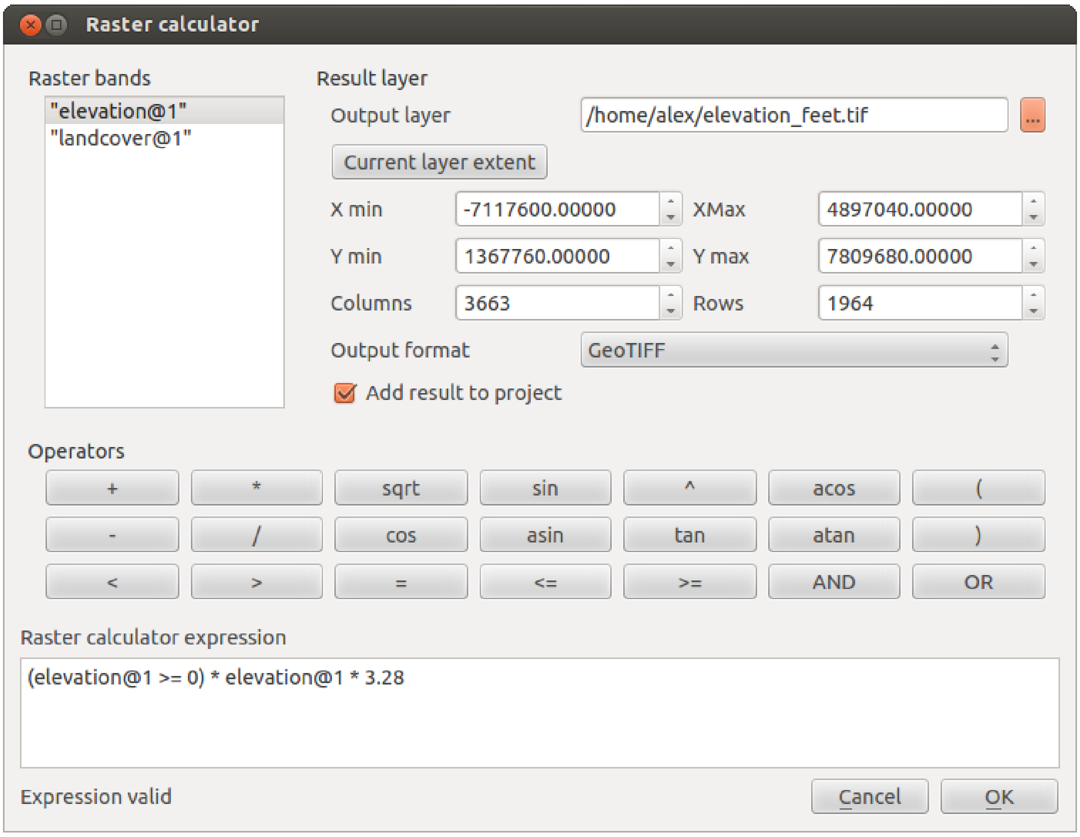
13.3.1 Contoh-contoh

Konversi nilai elevasi dari meter ke kaki

Membuat elevasi raster dalam kaki dari raster dalam meter, Anda perlu menggunakan faktor konversi meter ke kaki: 3.28. Ekspresinya adalah:

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

Menggunakan masker



Gambar 13.10: Kalkulator Raster

Jika Anda ingin untuk menutupi bagian-bagian dari suatu raster - kata, misalnya, karena Anda hanya tertarik pada ketinggian di atas 0 meter – Anda dapat menggunakan ekspresi berikut untuk membuat masker dan menerapkan hasil untuk raster dalam satu langkah.

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

Dengan kata lain, untuk setiap sel yang lebih besar dari atau sama dengan 0, atur nilainya ke 1. Jika nilai ke 0. Ini menciptakan masker on the fly.

.

BAB 14

Pekerjaan dengan Data OGC

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14.1 QGIS sebagai OGC Klien Data

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/.

Spesifikasi penting OGC yang didukung oleh QGIS adalah:

- **WMS** — Web Map Service (*Klien WMS/WMTS*)
- **WMTS** — Web Map Tile Service (*Klien WMS/WMTS*)
- **WFS** — Web Feature Service (*Klien WFS dan WFS-T*)
- **WFS-T** — Web Feature Service - Transactional (*Klien WFS dan WFS-T*)
- **WCS** — Web Coverage Service (*Klien WCS*)
- **SFS** — Simple Features for SQL (*PostGIS Layers*)
- **GML** — Geography Markup Language

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 Klien WMS/WMTS

Sekilas Dukungan 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.

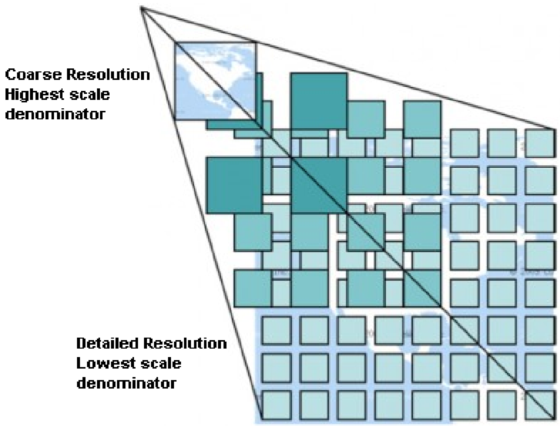
Lapis WMS dapat ditambahkan dengan sederhana, asalkan Anda tahu mengakses URL server WMS, Anda memiliki sambungan ke server, dan server memahami HTTP sebagai mekanisme transportasi data.

Sekilas Dukungan 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.

Dalam rangka untuk menampilkan data pada berbagai skala dengan apa yang pengguna inginkan, WMTS tile sets diproduksi pada beberapa tingkat skala yang berbeda dan dibuat tersedia untuk klien GIS untuk meminta mereka.

Diagram ini menggambarkan konsep tile sets:



Gambar 14.1: Konsep WMTS tile sets

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"`

An example of this type of address is

```
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.

Catatan: 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.

Memilih Server 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:

Nama	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.
Nama pengguna	Username to access a secured WMS server. This parameter is optional.
Kata Sandi	Password for a basic authenticated WMS server. This parameter is optional.
Abaikan GetMap URI	*Ignore GetMap URI reported in capabilities*. Use given URI from URL field above.
Abaikan GetFeatureInfo URI	*Ignore GetFeatureInfo URI reported in capabilities*. Use given URI from URL field above.

Tabel OGC 1: Parameter Sambungan 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.

Tip: Di URL Server 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.

Memuat Lapis 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.

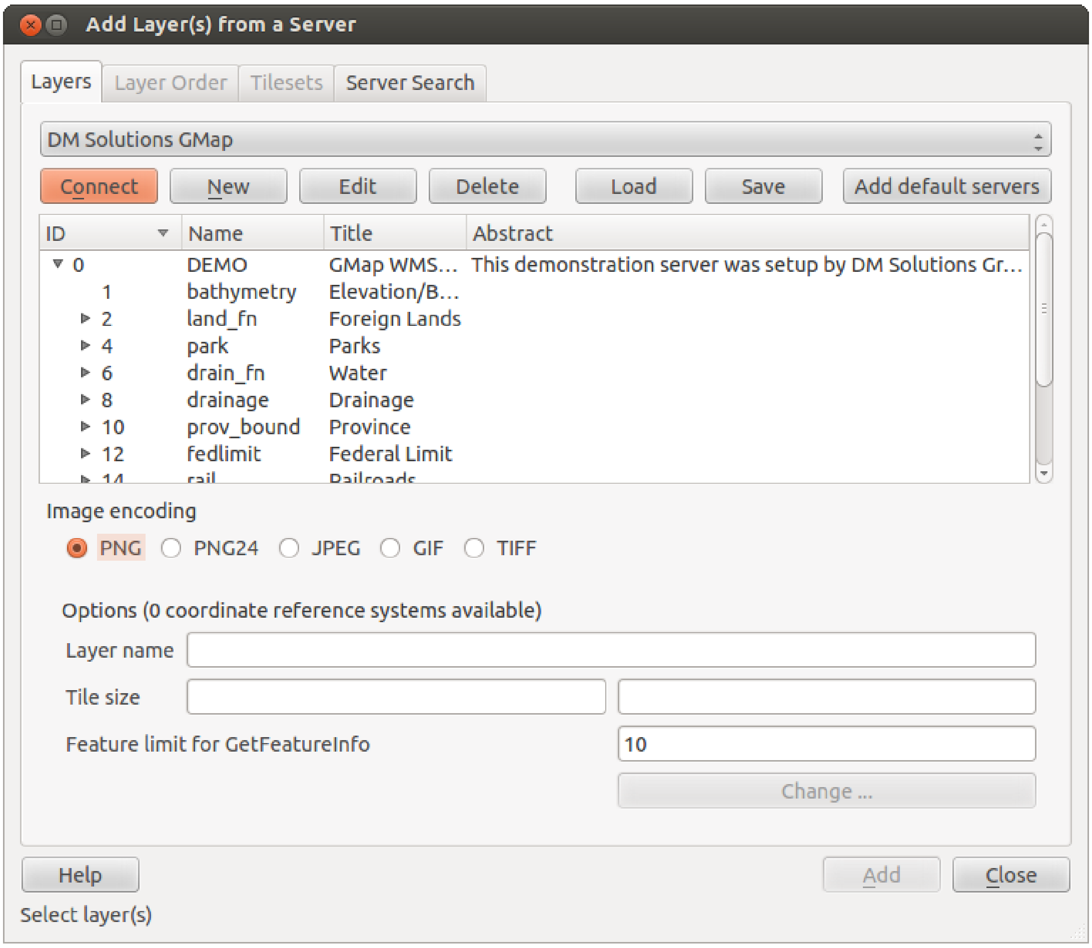
Layar Anda sekarang terlihat seperti figure_OGR_1, yang menunjukkan respon yang diberikan oleh server DM Solutions Group WMS.

Pengkodean Gambar

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

Tip: Pengkodean Gambar

Anda biasanya akan menemukan bahwa server WMS menawarkan pilihan pengkodean JPEG atau PNG. JPEG adalah format kompresi lossy, sedangkan PNG mereproduksi data raster mentah.



Gambar 14.2: Dialog menambahkan server WMS, menunjukkan lapis yang tersedia

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.

Opsi-Opsi

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.

Feature limit for GetFeatureInfo mendefinisikan fitur apa dari server untuk query.

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.

Urutan Lapis

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.

Tip: Mengurutkan Lapis 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.

Transparansi

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

Tip: Transparansi Lapis WMS

Ketersediaan gambar WMS transparansi tergantung pada pengkodean gambar yang digunakan: PNG dan GIF didukung transparansi, JPEG sementara tidak didukung.

Sistem Referensi Koordinat

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

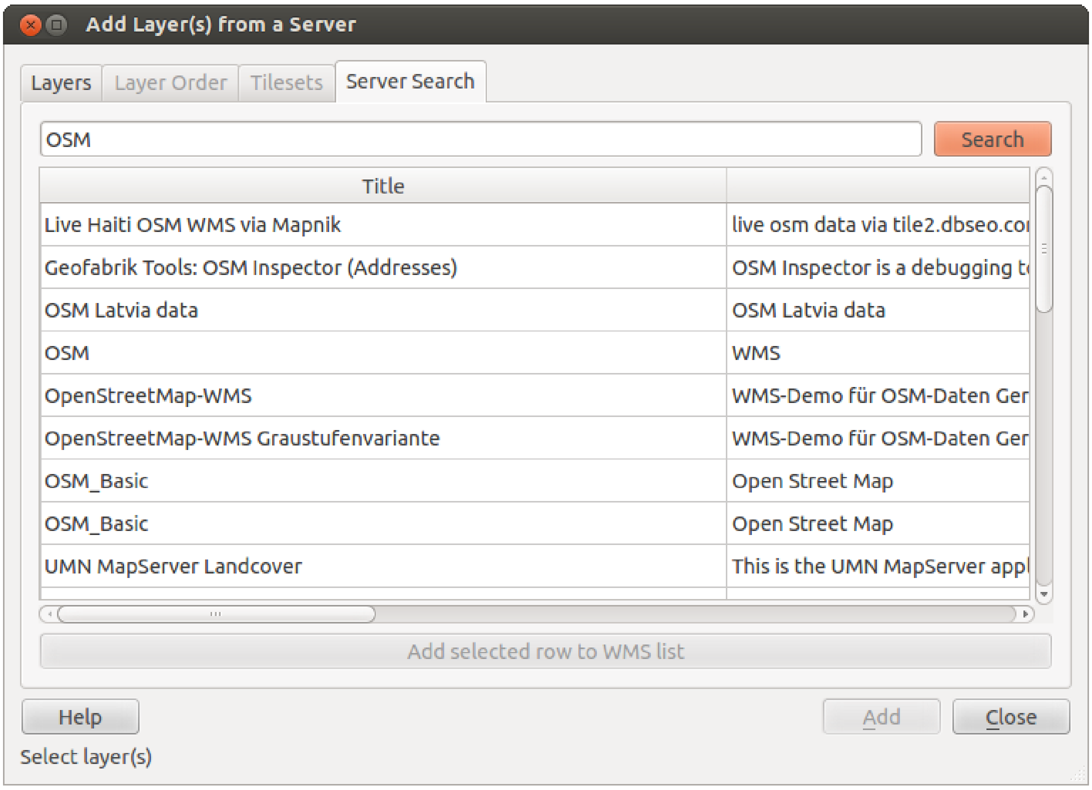
Each WMS layer can be presented in multiple CRSs, depending on the capability of the WMS server.

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.

Mencari server

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 search result is already enabled in the list of saved WMS servers in the *Layers* tab. You only need to request the list



Gambar 14.3: Dialog untuk mencari server WMS dengan beberapa kata kunci

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.

Tileset

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.

Menggunakan Alat Identifikasi

Setelah Anda telah menambahkan server WMS, dan jika ada lapis dari server WMS adalah queryable, Anda kemudian dapat menggunakan alat Identify untuk memilih pixel di peta kanvas. Sebuah query dibuat untuk server WMS untuk setiap pilihan yang dibuat. Hasil dari query dikembalikan dalam teks biasa. Format teks ini tergantung pada server WMS tertentu yang digunakan. **Pemilihan Format**

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. **Dukungan format 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"
```

Menampilkan Properti

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

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 *Literatur dan Referensi Web*), but here are a few handy definitions:

- **Properti Server**
  - **Versi WMS** — Versi WMS yang didukung oleh server.
  - **Image Formats** — The list of MIME-types the server can respond with when drawing the map. QGIS supports whatever formats the underlying Qt libraries were built with, which is typically at least `image/png` and `image/jpeg`.
  - **Identity Formats** — The list of MIME-types the server can respond with when you use the Identify tool. Currently, QGIS supports the `text-plain` type.
- **Properti Lapis**
  - **Dipilih** — Apakah ada atau tidak lapis ini dipilih ketika server telah ditambahkan ke dalam proyek ini.
  - **Visible** — Whether or not this layer is selected as visible in the legend (not yet used in this version of QGIS).
  - **Bisa Diidentifikasi** — Apakah ada atau tidak lapis ini akan menghasilkan apa-apa ketika Mengidentifikasi alat yang digunakan di atasnya.
  - **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.
  - **Cascade Count** — WMS servers can act as a proxy to other WMS servers to get the raster data for a layer. This entry shows how many times the request for this layer is forwarded to peer WMS servers

for a result.

- **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`.
- **Available in CRS** — The projections that this layer can be rendered in by the WMS server. These are listed in the WMS-native format.
- **Available in style** — The image styles that this layer can be rendered in by the WMS server.

Show WMS legend graphic in table of contents and composer

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.

Batasan Klien WMS

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

Pengaturan Mengedit Lapis 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.

Server WMS Membutuhkan Otentikasi

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 *Memilih Server WMS/WMTS* for details.

Tip: Mengakses OGC-lapis dengan aman

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.

Tip: 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 sebagai OGC Data Server*.

14.1.2 Klien WCS

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 Klien WFS dan 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.

Memuat Lapis 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. Klik **[Baru]**.
3. Masukkan 'DM Solutions' sebagai nama.
4. Masukkan URL (lihat di atas).
5. Klik **[OK]**.
6. Pilh 'DM Solutions' dari daftar drop-down *Sambungan Server* .
7. Klik **[Sambung]**.
8. Wait for the list of layers to be populated.
9. Select the *Parks* layer in the list.
10. Klik **[Terapkan]** untuk menambahkan lapis ke peta.

Note that any proxy settings you may have set in your preferences are also recognized.

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 *Bantuan dan Dukungan* for further information about the mailing lists.

Tip: Mencari Server WFS

You can find additional WFS servers by using Google or your favorite search engine. There are a number of lists with public URLs, some of them maintained and some not.

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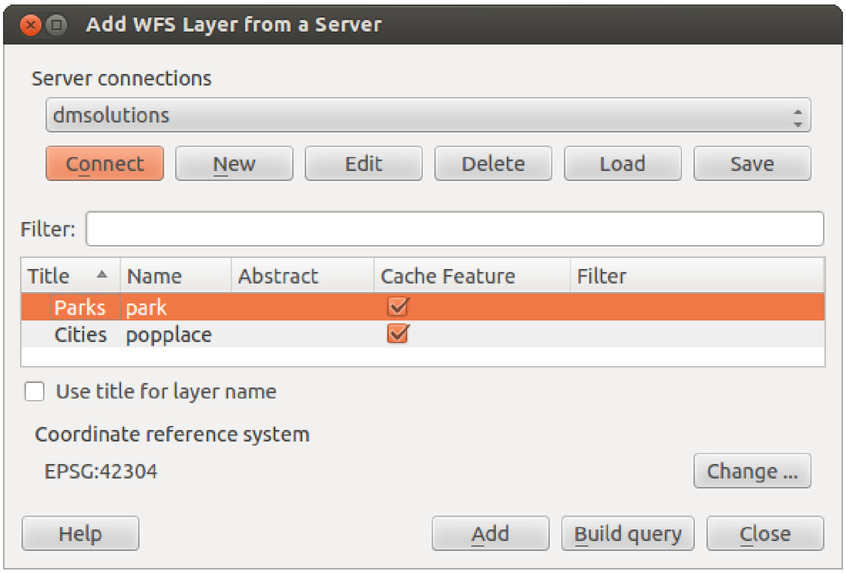


Gambar 14.4: Menambahkan lapis WFS

14.2 QGIS sebagai OGC Data Server

Server QGIS merupakan open source WMS 1.3, WFS 1.0.0 dan WCS 1 1.1.1 implementasi yang, di samping itu, mengimplementasikan fitur kartografi canggih untuk pemetaan tematik. Server QGIS adalah aplikasi FastCGI/CGI (Common Gateway Interface) ditulis dalam C++ yang bekerja sama dengan web server (misalnya Apache, Lighttpd). Hal ini didanai oleh proyek Uni Eropa Orchestra, Sany dan kota Uster di Swiss.

Server QGIS digunakan QGIS sebagai back end untuk logika GIS dan peta rendering. Selain itu, perpustakaan Qt digunakan untuk grafis dan pemrograman C++ platform-independen. Berbeda dengan perangkat lunak WMS lain, Server QGIS menggunakan aturan kartografi sebagai bahasa konfigurasi, baik untuk konfigurasi server dan aturan kartografi yang ditetapkan pengguna.

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.

Dalam salah satu buku pedoman berikut, kami akan memberikan contoh konfigurasi untuk membangun sebuah Server QGIS. Untuk saat ini, kami sarankan untuk membaca salah satu URL berikut ini untuk mendapatkan informasi lebih lanjut:

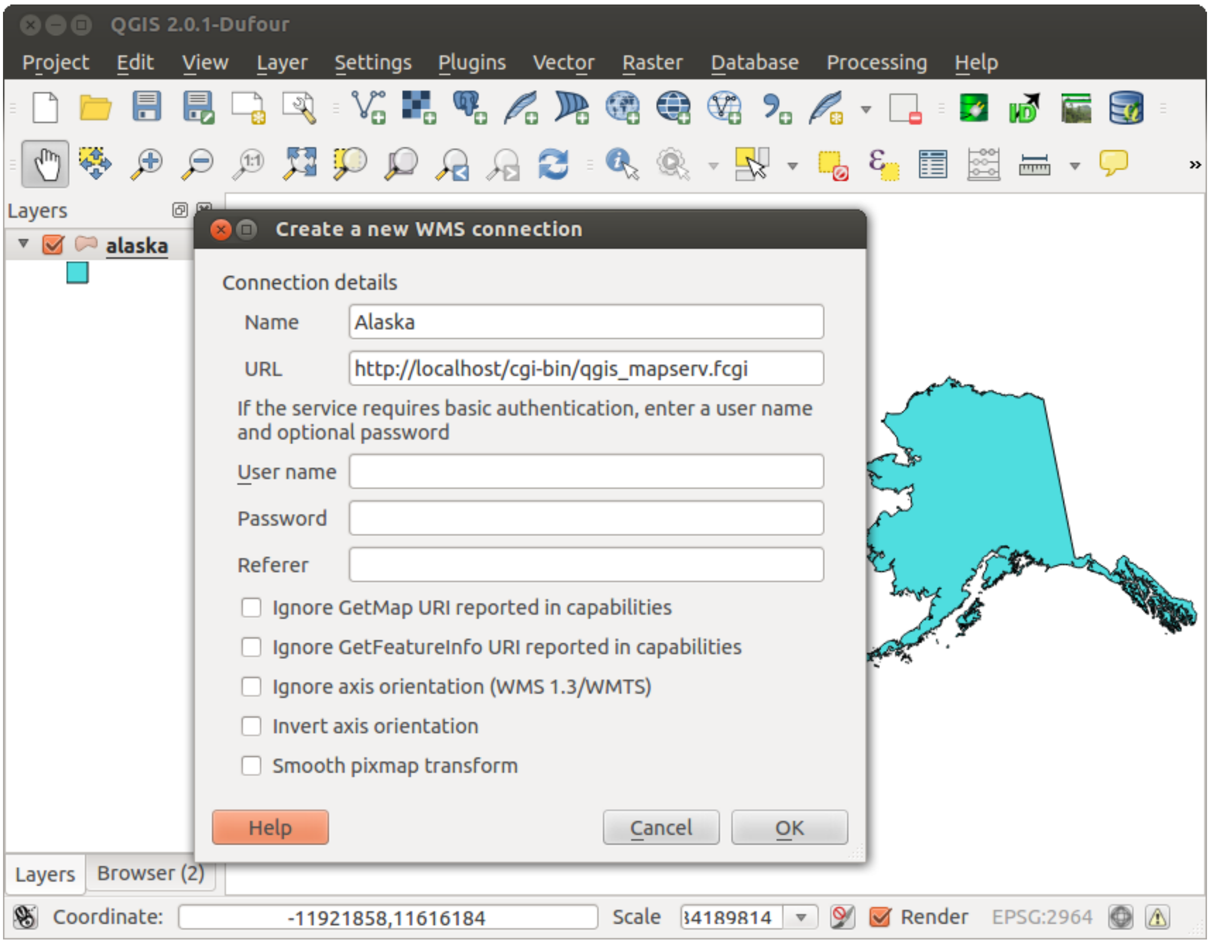
- http://karlinapp.ethz.ch/qgis_wms/
- http://hub.qgis.org/projects/quantum-gis/wiki/QGIS_Server_Tutorial
- http://linfiniti.com/2010/08/qgis-mapserver-a-wms-server-for-the-masses/

14.2.1 Contoh Pemasangan pada Debian Squeeze

Pada titik ini, kami akan memberikan contoh instalasi singkat dan sederhana bagaimana caranya untuk Debian Squeeze. Banyak OS lain menyediakan paket untuk Server QGIS, juga. Jika Anda harus membangun semuanya dari sumber, silakan lihat URL di atas.

Terlepas dari QGIS dan Server QGIS, Anda memerlukan server web, dalam kasus apache2 kami. Anda dapat menginstal semua paket dengan `aptitude` atau `apt-get install` bersama-sama dengan paket ketergantungan yang diperlukan lainnya. Setelah instalasi, Anda harus menguji mengkonfirmasi bahwa server web dan Server QGIS bekerja seperti yang diharapkan. Pastikan server apache berjalan dengan `/ etc/init.d/apache2 start`. Buka peramban web dan ketik URL: `http://localhost`. Jika apache sudah habis, Anda akan melihat pesan 'It works!'.

Sekarang coba pemasangan Server QGIS. `qgis_mapserv.fcgi` tersedia di `/usr/lib/cgi-bin/qgis_mapserv.fcgi` dan mendukung standar WMS yang menunjukkan batas-batas negara bagian Alaska. Tambahkan WMS dengan URL `http://localhost/cgi-bin/qgis_mapserv.fcgi` seperti yang dijelaskan dalam *Memilih Server WMS/WMTS*.



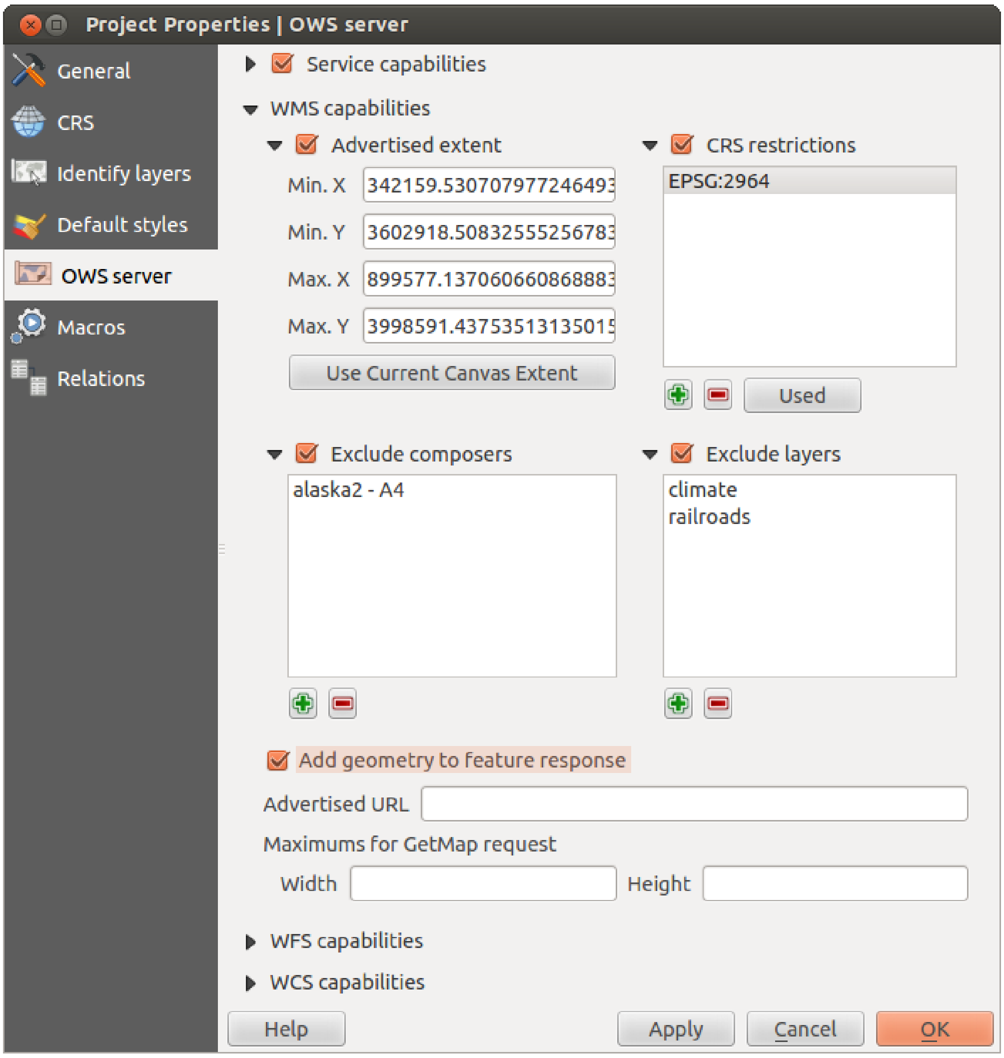
Gambar 14.5: WMS standar dengan batas-batas Amerika Serikat termasuk dalam QGIS Server (KDE)

14.2.2 Membuat WMS/WFS/WCS dari proyek QGIS

Untuk memberikan Server QGIS baru WMS, WFS atau WCS, kita harus membuat berkas proyek QGIS dengan beberapa data. Di sini, kita menggunakan 'Alaska' shapefile dari contoh dataset QGIS. Tentukan warna dan gaya dari lapis dalam QGIS dan proyek CRS, jika belum ditetapkan.

Kemudian, ke menu *Server OWS* dialog *Proyek* → *Proyek Properti* dan memberikan beberapa informasi tentang OWS di kolom di bawah *Kemapuan Layanan*. Ini akan muncul di GetCapabilities respon dari WMS, WFS atau WCS. Jika Anda tidak mencentang *Kemampuan Layanan*, Server QGIS akan menggunakan informasi yang diberikan dalam berkas `wms_metadata.xml` yang terletak di folder `cgi-bin`.

Kemampuan WMS



Gambar 14.6: Definisi QGIS Server WMS/WFS/WCS proyek (KDE)

Di bagian *Kemampuan WMS*, Anda dapat menentukan tingkat diiklankan di respon WMS GetCapabilities dengan memasukkan nilai minimum dan maksimum X dan Y dalam kolom di bawah *Batas diiklankan*. Klik *Gunakan Batas Kanvas Sekarang* menetapkan nilai-nilai ini sejauh yang sedang ditampilkan dalam kanvas peta QGIS. Dengan mencentang *Pembatasan CRS*, Anda dapat membatasi di mana sistem koordinat referensi (CRS) Server QGIS akan menawarkan untuk membuat peta. Gunakan tombol di bawah untuk memilih CRS dari Coordinate Reference System Selector, atau klik *Digunakan* untuk menambahkan CRS digunakan proyek QGIS ke dalam daftar.

Jika Anda memiliki penyusun cetak didefinisikan dalam proyek Anda, mereka akan tercantum dalam GetCapabilities respon, dan mereka dapat digunakan oleh permintaan GetPrint untuk membuat cetakan, menggunakan salah satu tata letak penyusun cetak sebagai template. Ini adalah ekstensi-khusus QGIS untuk spesifikasi WMS 1.3.0. Jika Anda ingin mengecualikan penyusun cetak dari yang diterbitkan oleh WMS, centang *Kecuali Penyusun* dan klik tombol dibawah . Kemudian, pilih penyusun cetak dari dialog *Pilih penyusun cetak* untuk menambahkannya ke daftar penyusun yang dikecualikan.

Jika Anda ingin mengecualikan setiap lapis atau grup lapis dari yang diterbitkan oleh WMS, centang *Kecuali Lapis* dan klik menu di bawah . Akan membuka dialog *Pilih lapis dan grup dibatasi*, yang memungkinkan Anda untuk memilih lapis dan grup yang tidak ingin dipublikasikan. Gunakan tombol `Shift` atau `Ctrl` jika Anda ingin memilih beberapa entri sekaligus.

Anda dapat menerima diminta GetFeatureInfo sebagai teks biasa, XML dan GML. Default adalah XML, teks atau format GML tergantung format keluaran dipilih untuk permintaan GetFeatureInfo.

Jika Anda ingin, Anda dapat mencentang *Tambahkan geometri untuk fitur respon*. Ini akan mencakup dalam respon GetFeatureInfo fitur geometri dalam format teks. Jika Anda ingin QGIS Server QGIS mengiklankan URL permintaan khusus dalam respon WMS GetCapabilities, masukkan URL yang sesuai dalam kolom *Iklankan URL*. Selanjutnya, Anda dapat membatasi ukuran maksimum peta dikembalikan oleh permintaan GetMap dengan memasukkan lebar, tinggi dalam kolom masing-masing di bawah *Maksimal untuk permintaan GetMap*.

Kemampuan WFS

dalam area *Kemampuan WFS*, Anda dapat memilih lapis yang ingin Anda publikasikan sebagai WFS, dan menentukan apakah mereka akan memungkinkan memperbarui, memasukkan dan menghapus operasi. Jika Anda memasukkan URL di kolom *Iklankan URL* dari bagian *Kemampuan WFS*, Server QGIS akan mengiklankan URL tertentu dalam respon WFS GetCapabilities.

Kemampuan WCS

dalam area *Kemampuan WCS*, Anda dapat memilih lapis yang ingin Anda publikasikan sebagai WCS. Jika Anda memasukkan URL di kolom *Iklankan URL* dari bagian *Kemampuan WCS*, Server QGIS akan mengiklankan URL tertentu dalam respon WCS GetCapabilities.

Sekarang, simpan sesi ke dalam berkas proyek `alaska.qgs`. Untuk memberikan proyek sebagai WMS / WFS, kita membuat folder baru `/usr/lib/cgi-bin/project` dengan hak istimewa admin dan menambahkan berkas proyek `alaska.qgs` dan salinan berkas `qgis_mapserv.fcgi` - itu saja.

Sekarang coba proyek kita WMS, WFS dan WCS. Tambahkan WMS, WFS dan WCS seperti yang dijelaskan dalam *Memuat Lapis WMS/WMTS*, *Klien WFS dan WFS-T* dan *Klien WCS* ke QGIS dan muat data. URLnya adalah:

```
http://localhost/cgi-bin/project/qgis_mapserv.fcgi
```

Menyetel baik OWS Anda

Untuk lapis vektor, menu *Kolom* dari dialog *Lapis* → *Properti* memungkinkan Anda untuk menentukan setiap atribut jika akan diterbitkan atau tidak. Secara default, semua atribut yang diterbitkan oleh WMS dan WFS. Jika Anda ingin atribut tertentu tidak akan diterbitkan, hapus centang pada kotak centang yang sesuai dalam kolom *WMS* atau *WFS*.

Anda dapat melapisi tanda air pada peta yang diproduksi oleh WMS Anda dengan menambahkan penjelasan teks atau anotasi SVG ke berkas proyek. Lihat bagian Alat Anotasi di *Peralatan Umum* untuk petunjuk membuat anotasi. Untuk anotasi yang akan ditampilkan sebagai tanda air pada keluaran WMS, kotak centang *Posisi peta ditetapkan* dalam dialog *Anotasi teks* harus dilepas centangnya. Hal ini dapat diakses dengan mengklik ganda anotasi sementara salah satu alat anotasi aktif. Untuk anotasi SVG, Anda akan membutuhkan mengatur proyek menyimpan path absolut (dalam menu *Umum* dari dialog *Proyek* → *Proyek Properti*) atau secara manual mengubah path ke gambar SVG dengan cara itu, path relatif valid.

Parameter tambahan yang didukung oleh permintaan WMS GetMap

Dalam permintaan WMS GetMap, Server QGIS menerima beberapa parameter tambahan di samping parameter standar sesuai dengan spesifikasi OCG WMS 1.3.0:

- Parameter **MAP**: Mirip dengan MapServer, *parameter 'MAP'* dapat digunakan untuk menentukan path ke berkas proyek QGIS. Anda dapat menentukan path absolut atau path relatif ke lokasi server executable (`qgis_mapserv.fcgi`). Jika tidak ditentukan, pencarian server QGIS untuk berkas .qgs dalam direktori di mana server executable berada.

  Contoh:

  ```
  http://localhost/cgi-bin/qgis_mapserv.fcgi?\
    REQUEST=GetMap&MAP=/home/qgis/mymap.qgs&...
  ```

- Parameter **DPI**: Parameter `DPI` dapat digunakan untuk menentukan resolusi keluaran yang diminta.

  Contoh:

  ```
  http://localhost/cgi-bin/qgis_mapserv.fcgi?REQUEST=GetMap&DPI=300&...
  ```

- Parameter **Kekeruhan**: Opacity dapat diatur pada lapis atau tingkat grup. Nilai diperbolehkan berkisar dari 0 (sepenuhnya transparan) sampai 255 (sepenuhnya keruh).

  Contoh:

  ```
  http://localhost/cgi-bin/qgis_mapserv.fcgi?\
    REQUEST=GetMap&LAYERS=mylayer1,mylayer2&OPACITIES=125,200&...
  ```

.

Pekerjaan dengan Data 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.

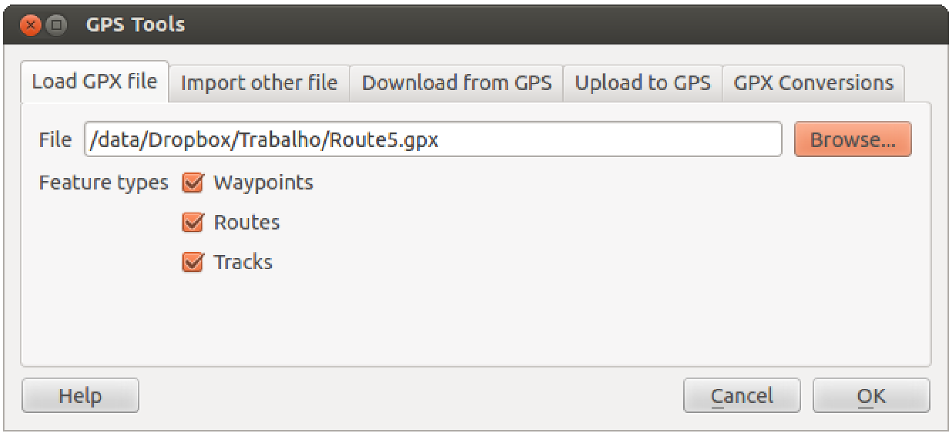
To load a GPX file, you first need to load the plugin. *Plugins* → *Plugin Manager...* opens the Plugin Manager Dialog. Activate the *GPS Tools* checkbox. When this plugin is loaded, two buttons with a small handheld GPS device will show up in the toolbar:

- 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 *Contoh data* 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.



Gambar 15.1: The *GPS Tools* dialog window

Catatan: 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.

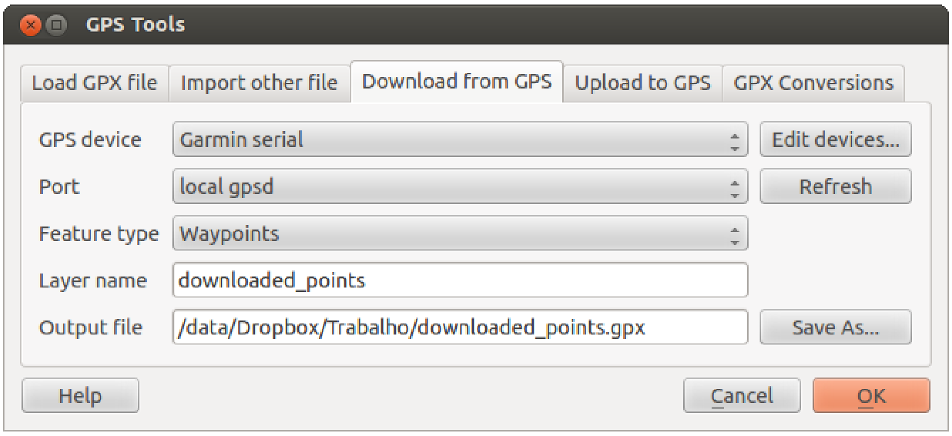
15.1.5 Downloading GPS data from a device

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`.



Gambar 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

Catatan: 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.

> **Peringatan:** 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

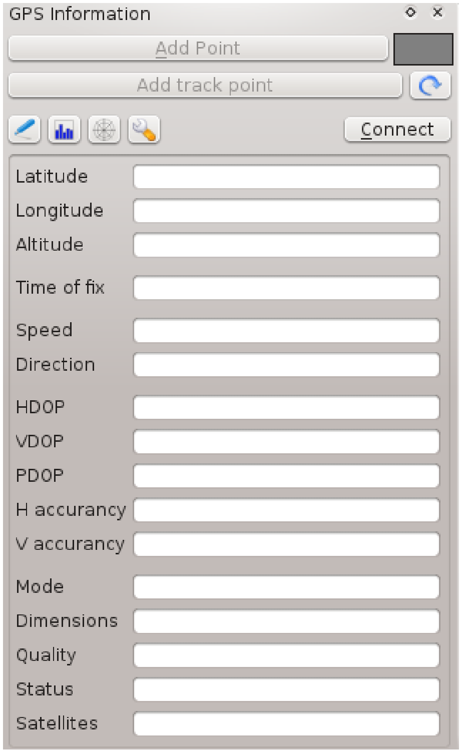
If the GPS is receiving signals from satellites, you will see your position in latitude, longitude and altitude together with additional attributes.

15.2.2 GPS signal strength

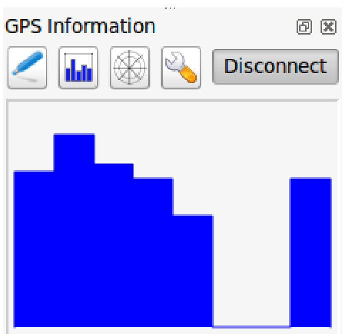
Here, you can see the signal strength of the satellites you are receiving signals from.

15.2.3 GPS polar window

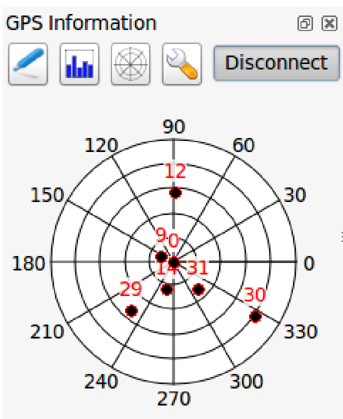
If you want to know where in the sky all the connected satellites are, you have to switch to the polar screen. You can also see the ID numbers of the satellites you are receiving signals from.



Gambar 15.3: GPS tracking position and additional attributes



Gambar 15.4: GPS tracking signal strength



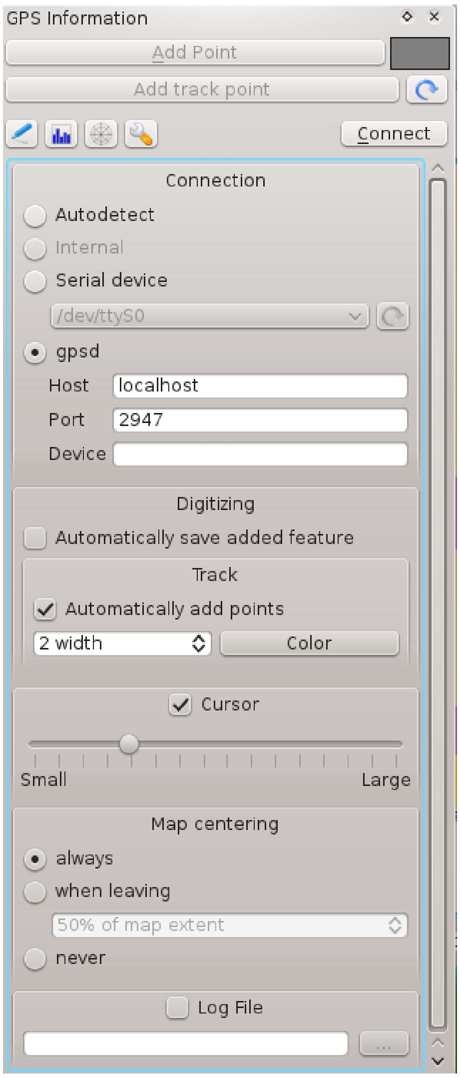
Gambar 15.5: GPS tracking polar window

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.



Gambar 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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GRASS GIS Integration

The GRASS plugin provides access to GRASS GIS databases and functionalities (see GRASS-PROJECT in *Literatur dan Referensi 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 *Contoh data*). 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/.

Tip: GRASS Data Loading

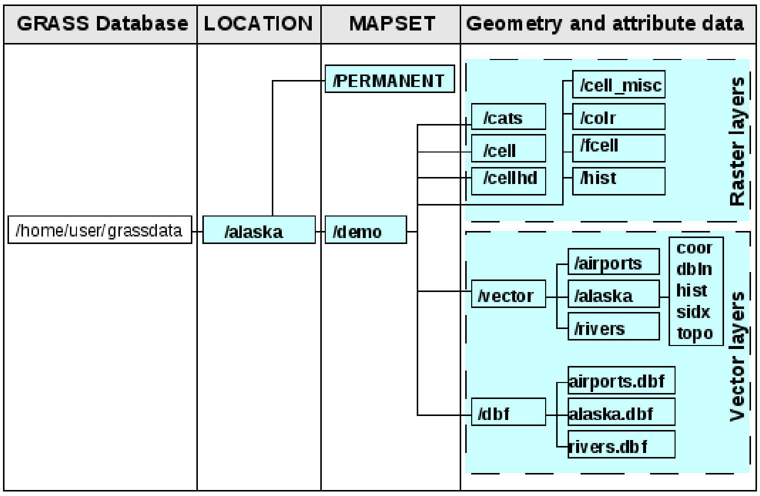
If you have problems loading data or QGIS terminates abnormally, check to make sure you have loaded the GRASS plugin properly as described in section *sec_starting_grass*.

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 *Literatur dan Referensi 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`

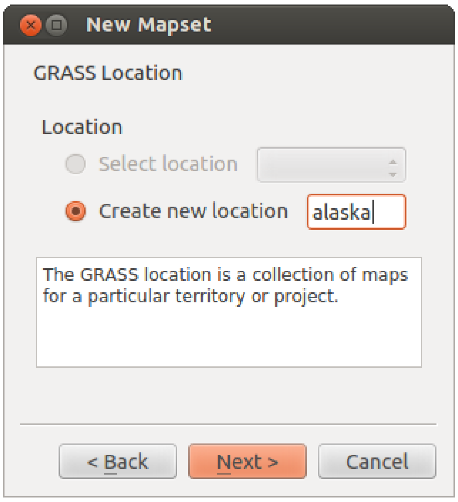


Gambar 16.1: GRASS data in the alaska LOCATION

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 *Contoh data*).

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 *Contoh data*).
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 *Literatur dan Referensi 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.



Gambar 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 *Contoh data*, 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 *Literatur dan Referensi 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 *Contoh data*).

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.

Tip: 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*).

Tip: 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.

Tip: 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.

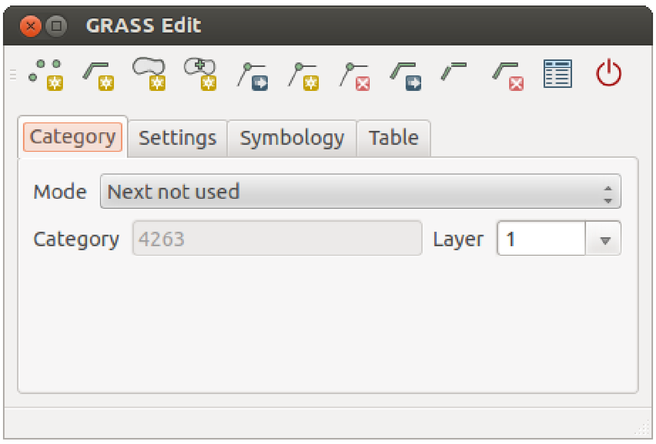
Gambar 16.3: GRASS Digitizing Toolbar

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.



Gambar 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.

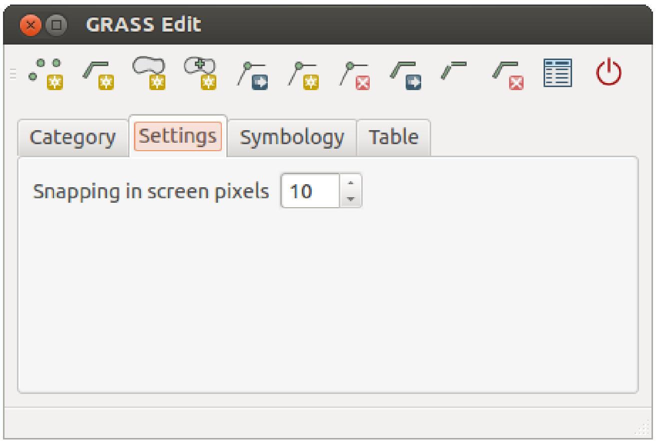
- **Field (layer)** - Each geometry element can be connected with several attribute tables using different GRASS geometry layers. The default layer number is 1.

Tip: 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

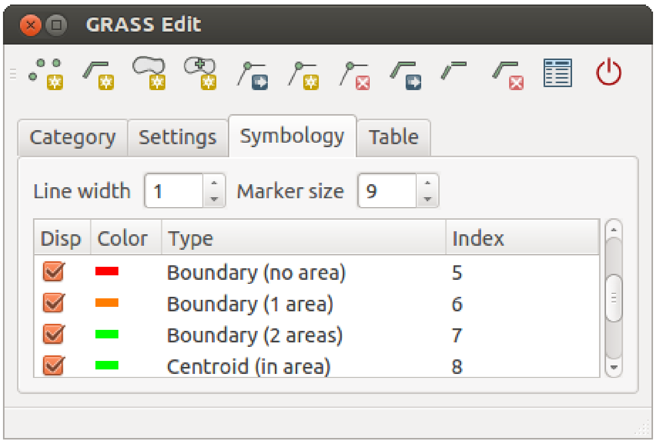
The *Settings* tab allows you to set the snapping in screen pixels. The threshold defines at what distance new points or line ends are snapped to existing nodes. This helps to prevent gaps or dangles between boundaries. The default is set to 10 pixels.



Gambar 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).

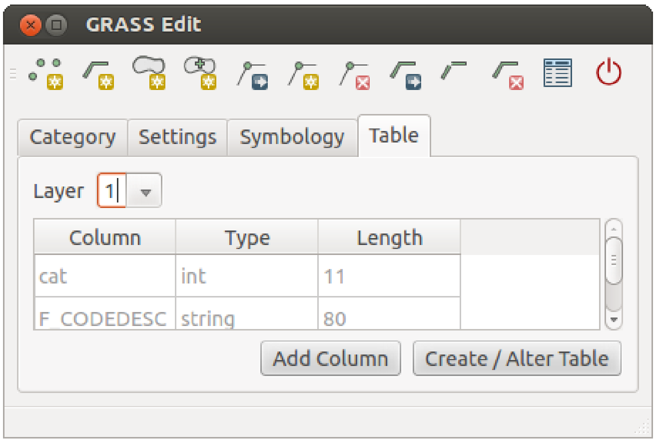


Gambar 16.6: GRASS Digitizing Symbology Tab

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*).

Tip: GRASS Edit Permissions



Gambar 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]**.

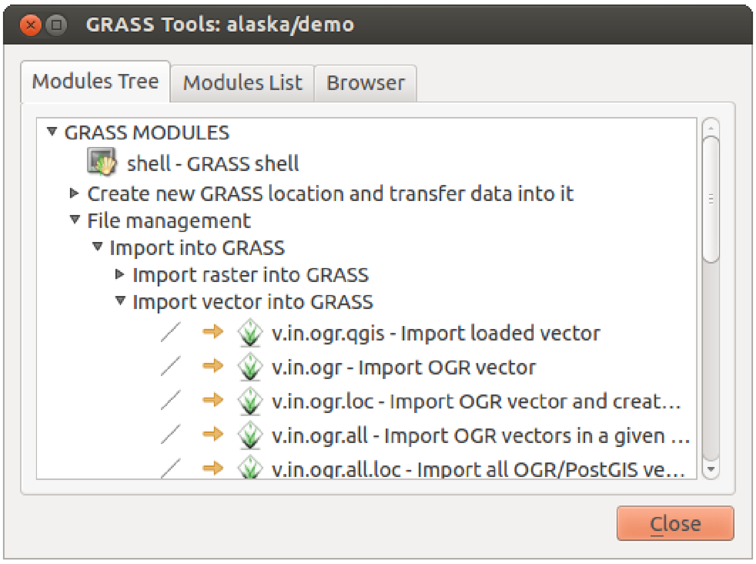
The GRASS module `g.region` provides a lot more parameters to define an appropriate region extent and resolution for your raster analysis. You can use these parameters with the GRASS Toolbox, described in section *The GRASS Toolbox*.

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.



Gambar 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

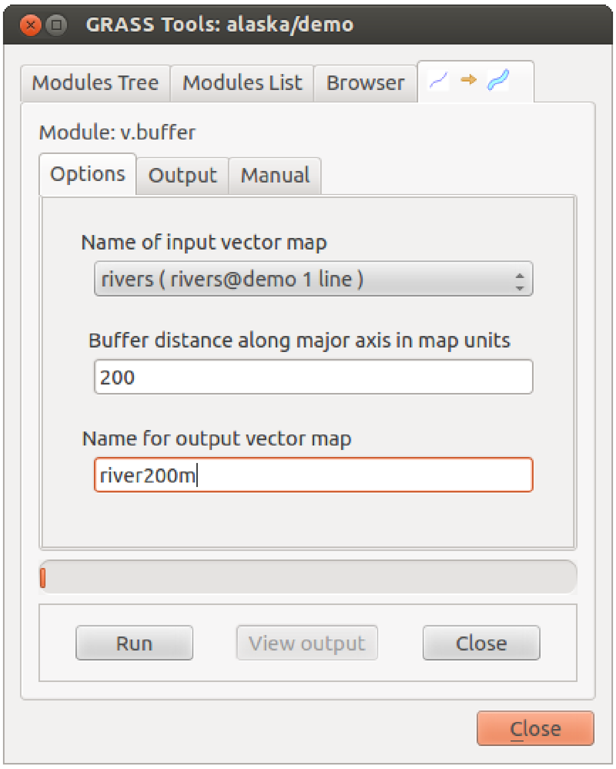
The *Output* tab provides information about the output status of the module. When you click the **[Run]** button, the module switches to the *Output* tab and you see information about the analysis process. If all works well, you will finally see a `Successfully finished` message.

Manual

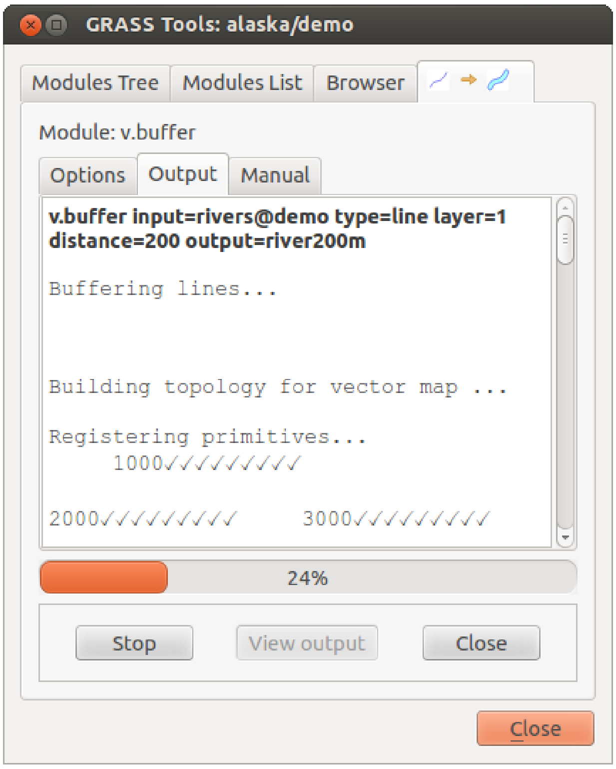
The *Manual* tab shows the HTML help page of the GRASS module. You can use it to check further module parameters and flags or to get a deeper knowledge about the purpose of the module. At the end of each module manual page, you see further links to the `Main Help index`, the `Thematic index` and the `Full index`. These links provide the same information as the module `g.manual`.

Tip: Display results immediately

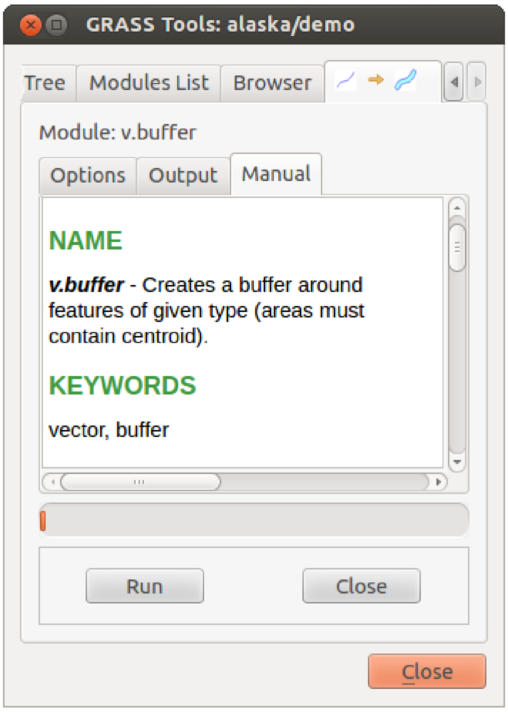
If you want to display your calculation results immediately in your map canvas, you can use the 'View Output' button at the bottom of the module tab.



Gambar 16.9: GRASS Toolbox Module Options



Gambar 16.10: GRASS Toolbox Module Output



Gambar 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*.

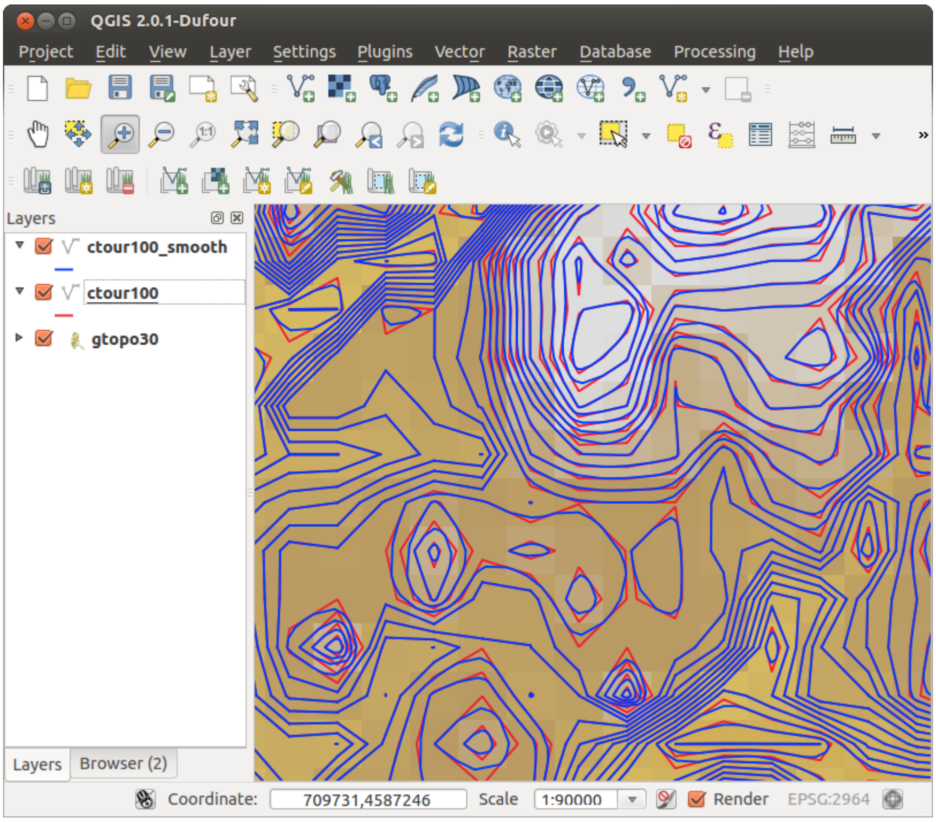
Next, zoom in to a small, mountainous area in the center of Alaska. Zooming in close, you will notice that the contours have sharp corners. GRASS offers the **v.generalize** tool to slightly alter vector maps while keeping their overall shape. The tool uses several different algorithms with different 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.

Tip: 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.



Gambar 16.12: GRASS module v.generalize to smooth a vector map

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Tip: 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.

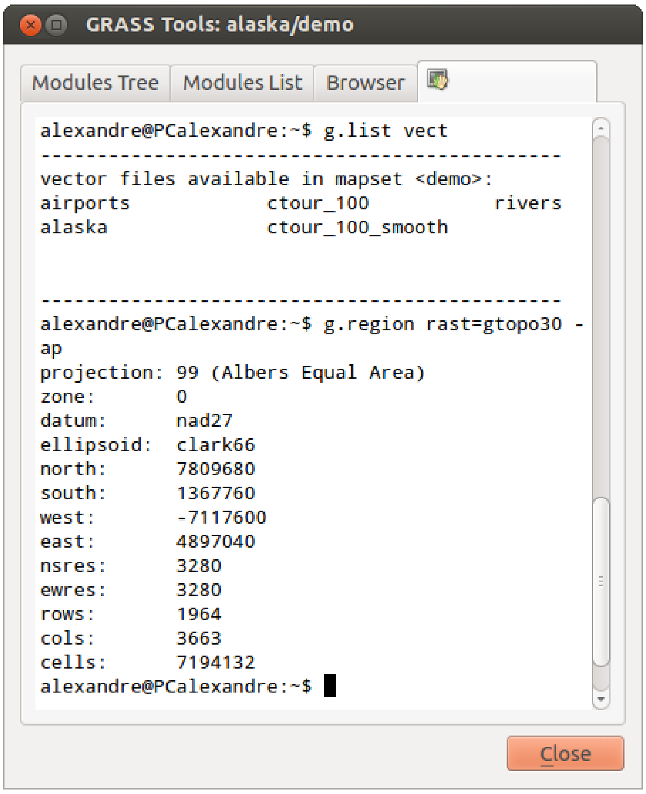
The module **r.shaded.relief** can take a parameter `zmult`, which multiplies the elevation values relative to the X-Y coordinate units so that the hillshade effect is even more pronounced.

- 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.

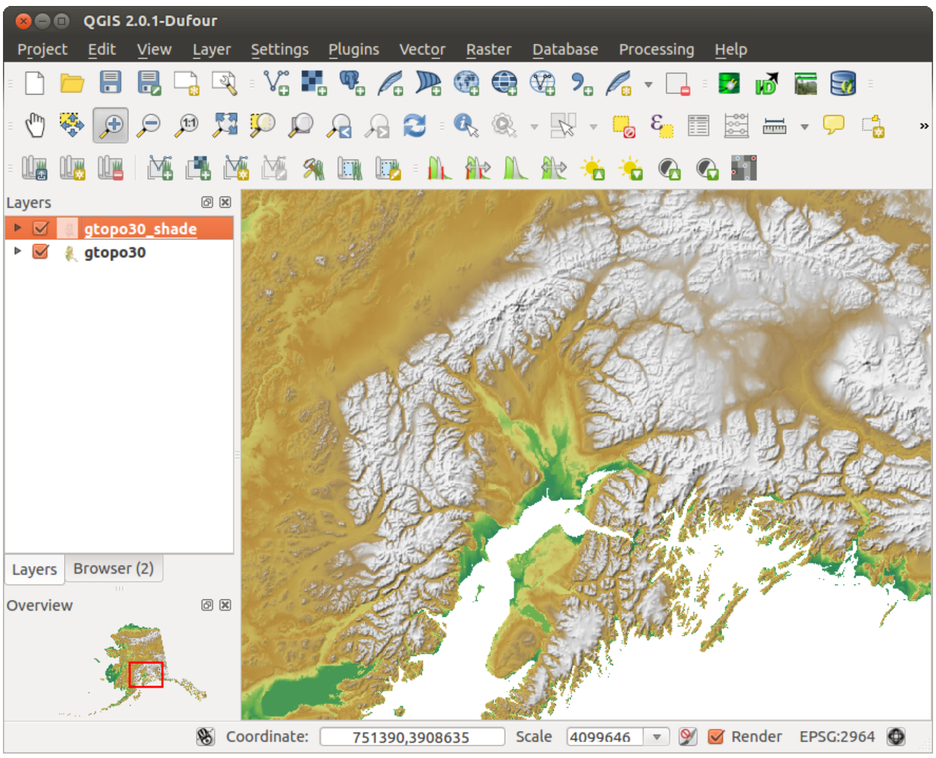
Raster statistics in a vector map

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).



Gambar 16.13: The GRASS shell, r.shaded.relief module



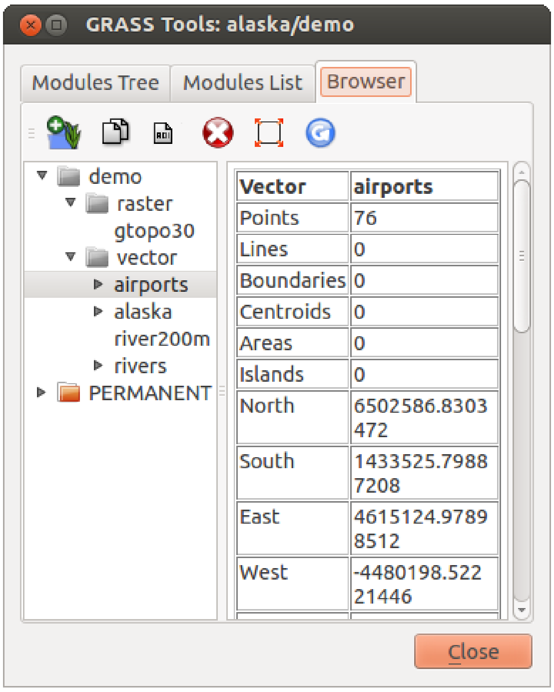
Gambar 16.14: Displaying shaded relief created with the GRASS module r.shaded.relief

- 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).



Gambar 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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QGIS kerangka pengolahan

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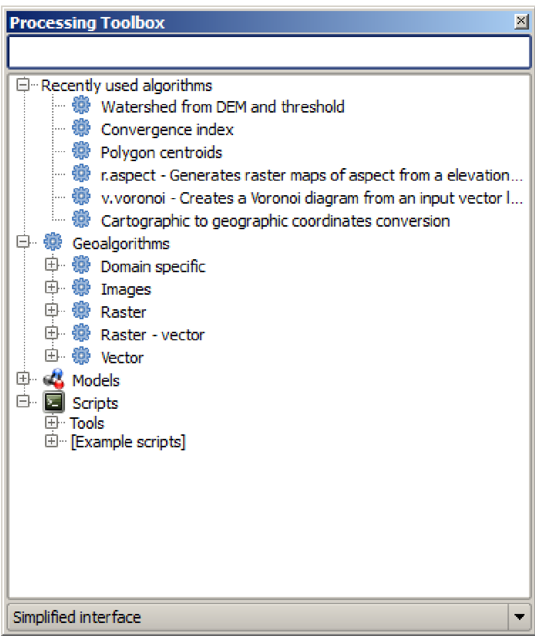
17.1 Pengantar

Bab ini memperkenalkan kerangka pengolahan QGIS, lingkungan geoprocessing yang dapat digunakan untuk memanggil algoritma asli dan pihak ketiga dari QGIS, membuat tugas analisis spasial Anda lebih produktif dan mudah untuk melakukannya.

Pada bagian berikut kita akan meninjau bagaimana menggunakan unsur-unsur grafis dari kerangka kerja ini dan mengambil yang terbaik masing-masing dari mereka.

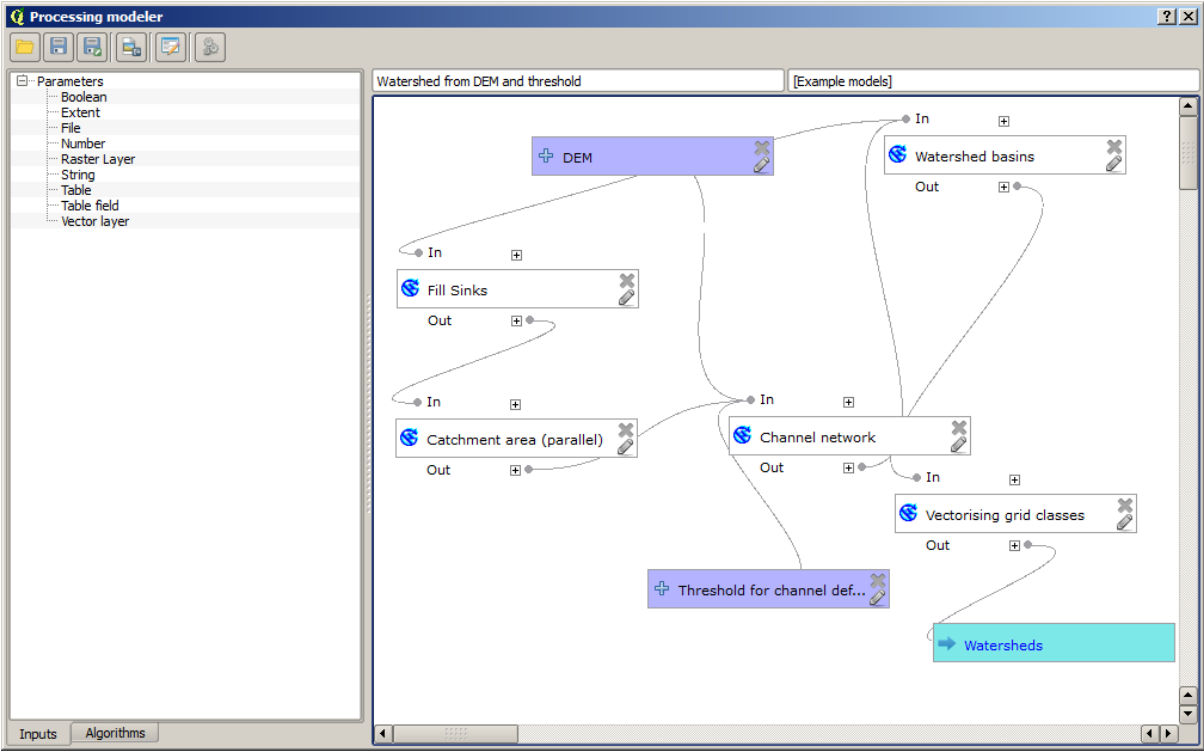
Ada empat elemen dasar dalam kerangka GUI, yang digunakan untuk menjalankan algoritma untuk tujuan yang berbeda. Memilih salah satu alat atau lain akan tergantung pada jenis analisis yang akan dilakukan dan karakteristik tertentu dari masing-masing pengguna dan proyek. Semuanya (kecuali untuk antarmuka batch processing, yang disebut dari toolbox, seperti akan kita lihat) bisa diakses dari menu *Pengolahan* (Anda akan melihat lebih dari empat entri. Yang tersisa tidak digunakan untuk mengeksekusi algoritma dan akan dijelaskan nanti dalam bab ini).

- Toolbox. Unsur utama dari GUI, digunakan untuk menjalankan algoritma tunggal atau menjalankan proses batch berdasarkan algoritma tersebut.



Gambar 17.1: Toolbox Pengolahan

- Modeler grafis. Beberapa algoritma dapat dikombinasikan secara grafis dengan menggunakan modeler untuk mendefinisikan alur kerja, menciptakan satu proses yang melibatkan beberapa sub-proses



Gambar 17.2: Modeler Pengolahan

- Sejarah pengelola. Semua tindakan dilakukan dengan menggunakan salah satu elemen tersebut disimpan dalam berkas sejarah dan dapat kemudian dengan mudah direproduksi menggunakan manajer sejarah
- Antarmuka pengolahan batch. Antarmuka ini memungkinkan Anda untuk menjalankan proses batch dan mengotomatisasi eksekusi algoritma tunggal pada beberapa dataset.

Dalam bagian berikut ini, kita akan meninjau masing-masing elemen ini secara rinci.

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17.2 The toolbox

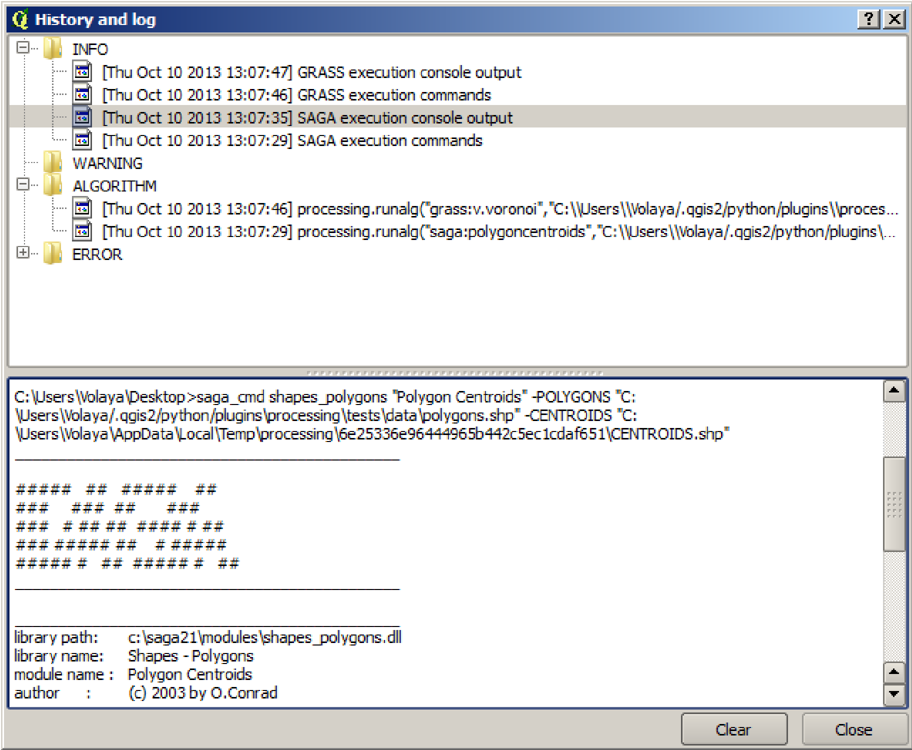
The *Toolbox* is the main element of the processing GUI, and the one that you are more likely to use in your daily work. It shows the list of all available algorithms grouped in different blocks, and it is the access point to run them, whether as a single process or as a batch process involving several 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*.

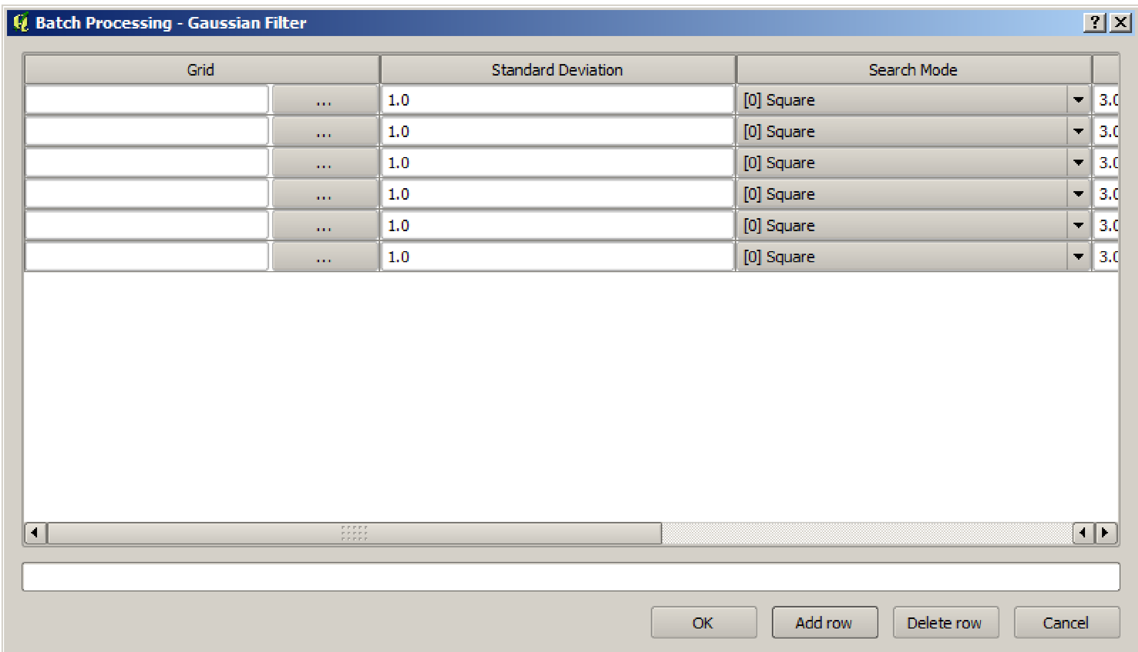
Additionally, two more entries are found, namely *Models* and *Scripts*. These include user-created algorithms, and they allow you to define your own workflows and processing tasks. We will devote a full section to them a bit later.

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.

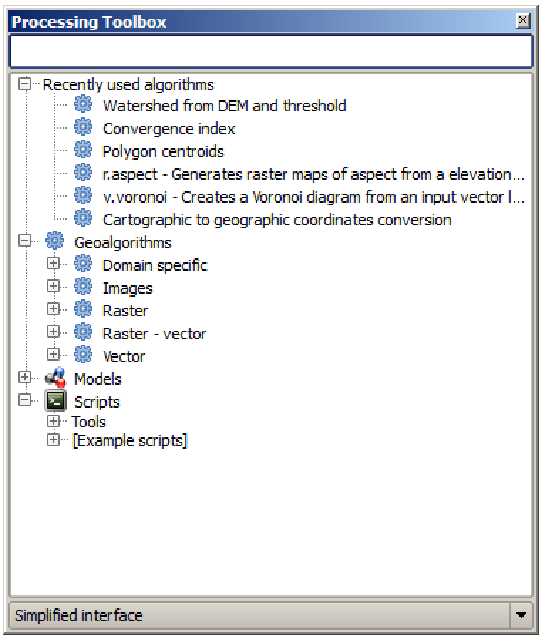
In the lower part, you will find a box that allows you to switch between the simplified algorithm list (the one explained above) and the advanced list. If you change to the advanced mode, the toolbox will look like this:



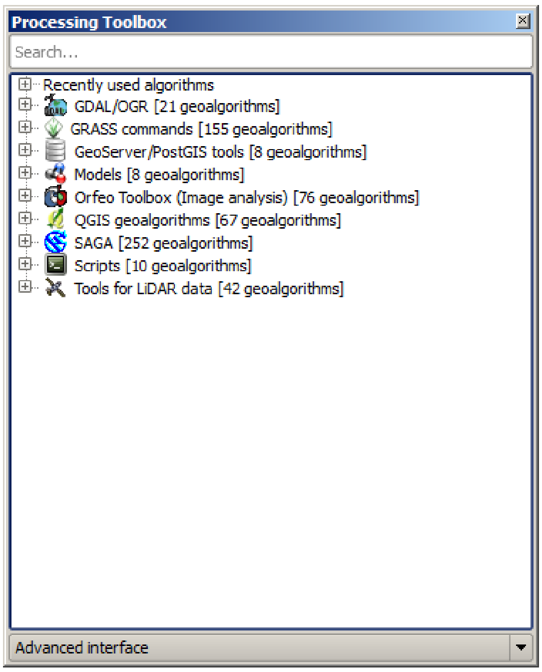
Gambar 17.3: Pengolahan Sejarah



Gambar 17.4: Antarmuka proses batch



Gambar 17.5: Processing Toolbox



Gambar 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

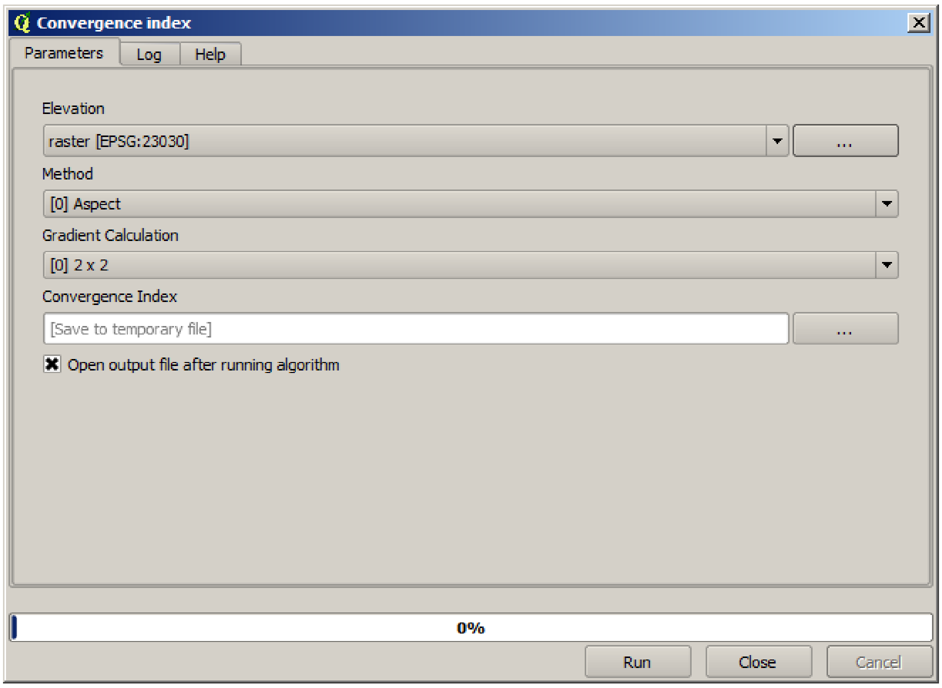
In the case of running QGIS under Windows, these algorithms are fully-functional in a fresh installation of QGIS, and they can be run without requiring any additional installation. Also, running them requires no prior knowledge of the external applications they use, making them more accesible for first-time 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).



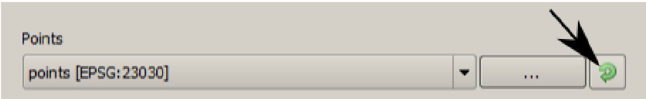
Gambar 17.7: Parameters Dialog

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.

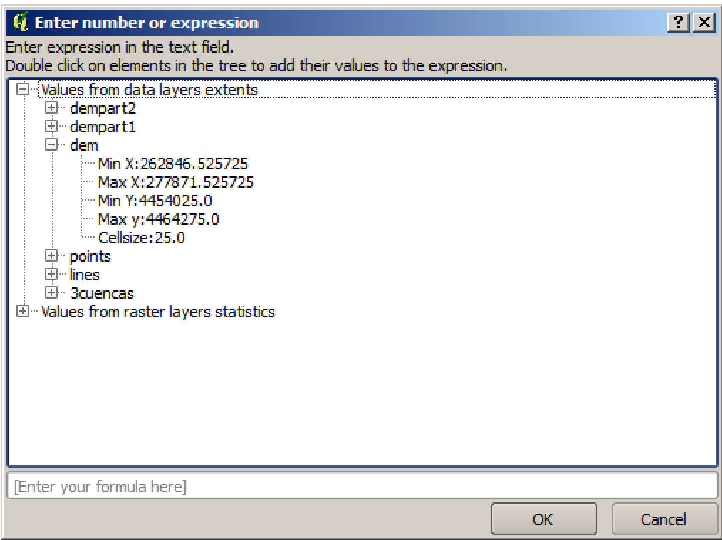
  You will see a button by each vector layer selector, as shown in the figure below.



Gambar 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.

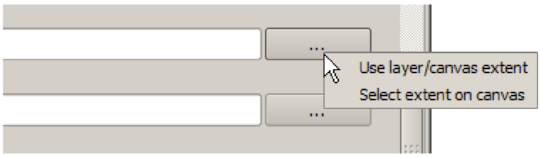
- A table, to select from a list of all available in QGIS. Non-spatial tables are loaded into QGIS like vector layers, and in fact they are treated as such by the program. Currently, the list of available tables that you will see when executing an algorithm that needs one of them is restricted to tables 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.



Gambar 17.9: Number Selector

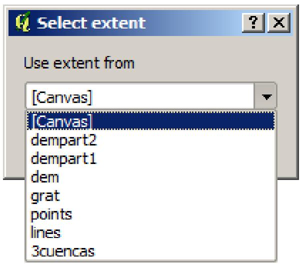
- A range, with min and max values to be introduced in two text boxes.

- 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.



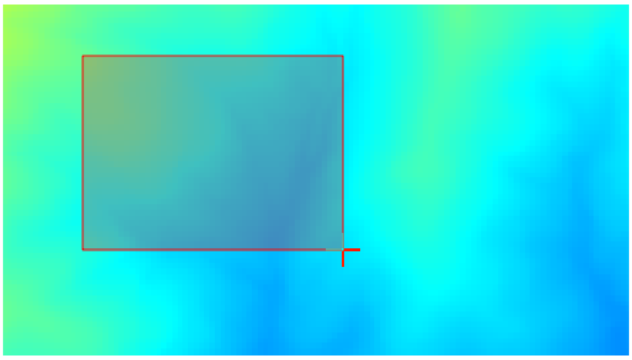
Gambar 17.10: Extent selector

If you select the first option, you will see a window like the next one.



Gambar 17.11: Extent List

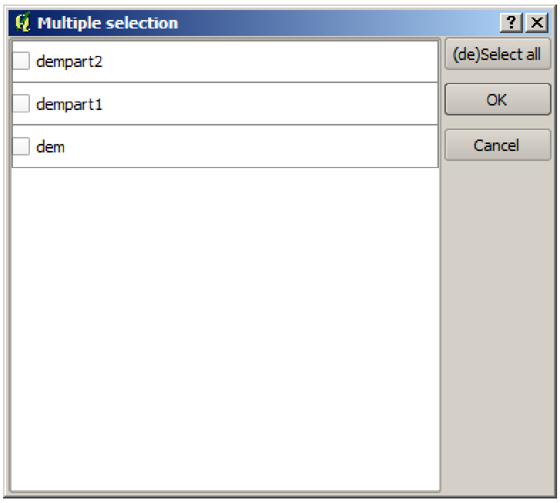
If you select the second one, the parameters window will hide itself, so you can click and drag onto the canvas. Once you have defined the selected rectangle, the dialog will reappear, containing the values in the extent text box.



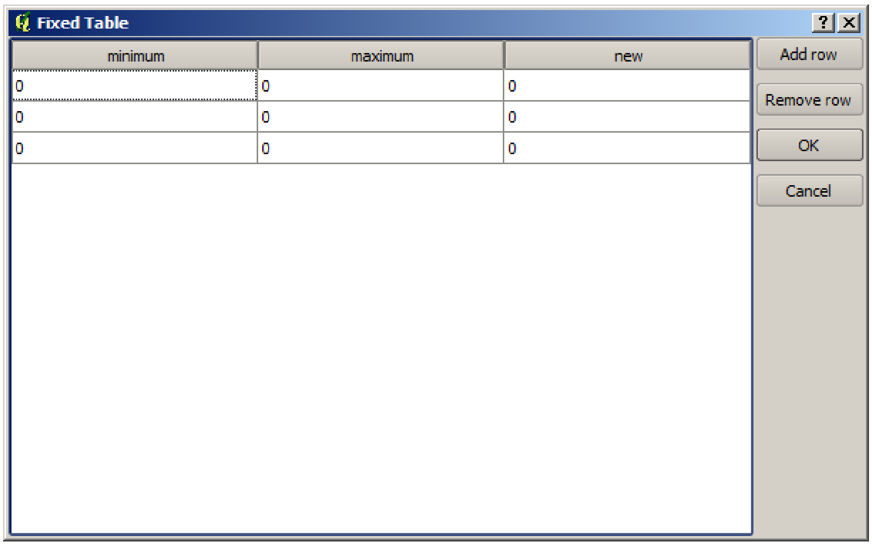
Gambar 17.12: Extent Drag

- 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.



Gambar 17.13: Multiple Selection



Gambar 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.

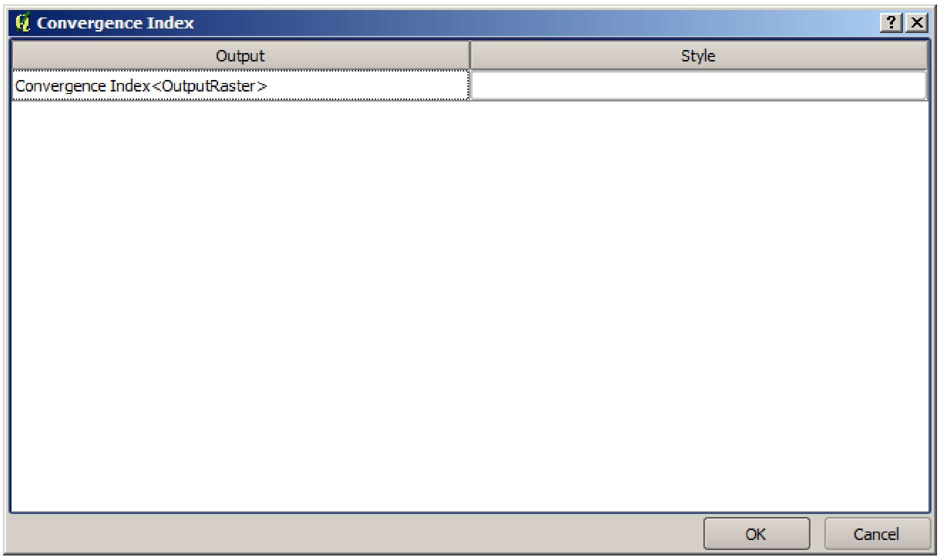
Along with the aforementioned *Output folder* entry, the *General* block contains parameters for setting the default rendering style for output layers (that is, layers generated by using algorithms from any of the framework GUI components). Just create the style you want using QGIS, save it to a file, 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.



Gambar 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.

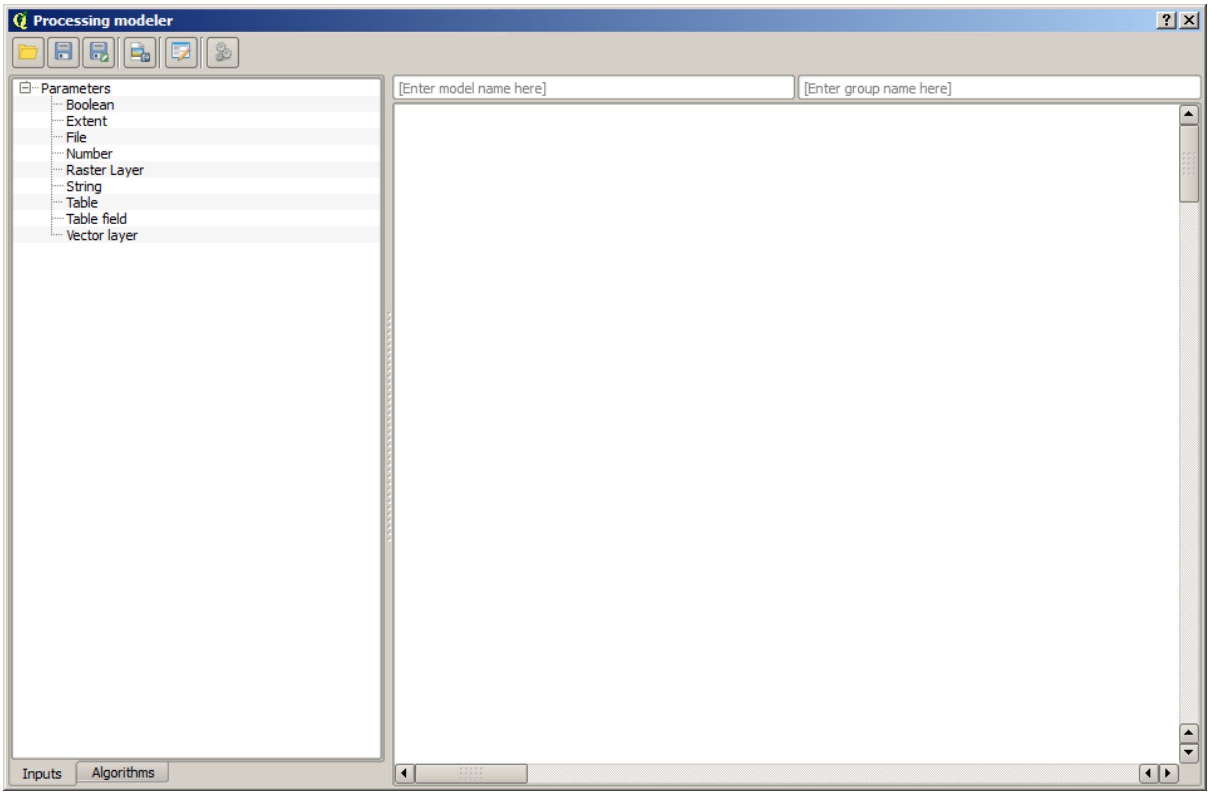
Creating a model involves two steps:

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



Gambar 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.

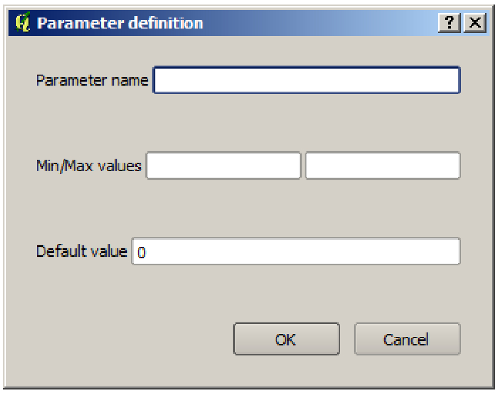
For each added input, a new element is added to the modeler canvas.

17.3.2 Definition of the workflow

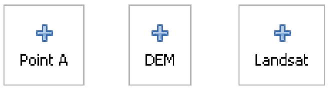
Once the inputs have been defined, it is time to define the algorithms to apply on them. Algorithms can be found in the *Algorithms* tab, grouped much in the same way as they are in the toolbox.

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.

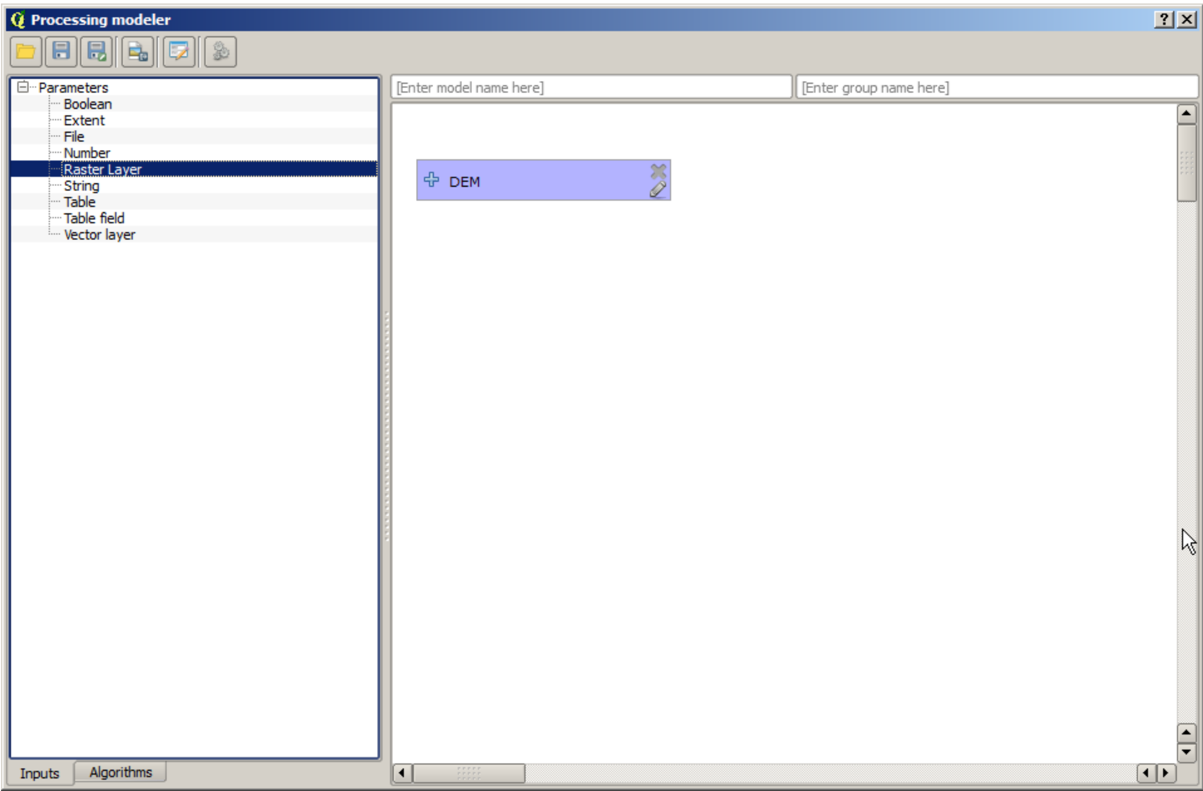
To add an algorithm to a model, double-click on its name. An execution dialog will appear, with a content similar to the one found in the execution panel that is shown when executing the algorithm from the toolbox. The one



Gambar 17.17: Model Parameters

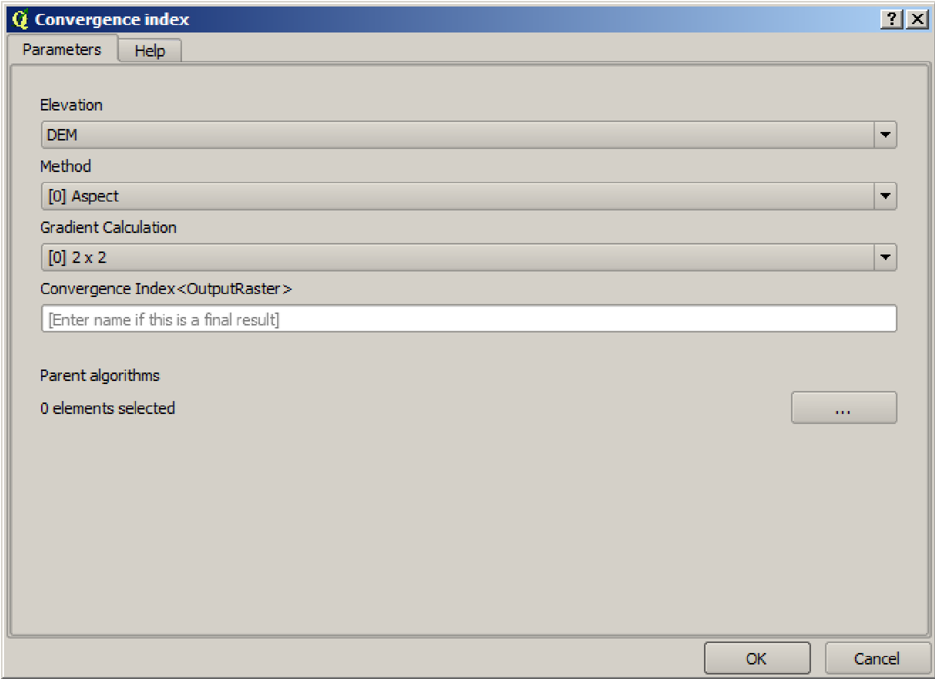


Gambar 17.18: Model Parameters



Gambar 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.



Gambar 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.

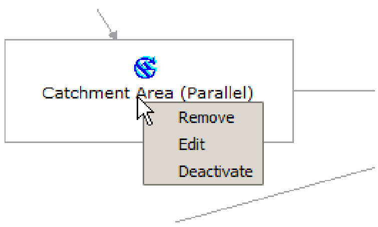
Models loaded from the `models` folder appear not only in the toolbox, but also in the algorithms tree in the *Algorithms* tab of the modeler window. That means that you can incorporate a model as a part of a bigger model, just as you add any other algorithm.

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

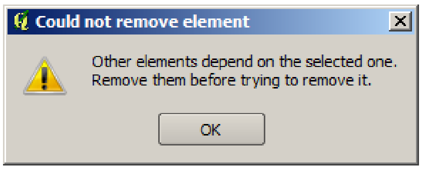
You can edit the model you are currently creating, redefining the workflow and the relationships between the algorithms and inputs that define the model itself.

If you right-click on an algorithm in the canvas representing the model, you will see a context menu like the one shown next:



Gambar 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:



Gambar 17.22: Cannot Delete Algorithm

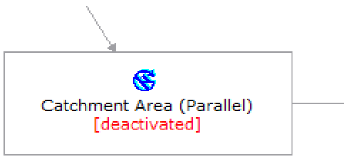
Selecting the *Edit* option or simply double-clicking on the algorithm icon will show the parameters dialog of the algorithm, so you can change the inputs and parameter values. Not all input elements available in the model will appear in this case as available inputs. Layers or values generated at a 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.



Gambar 17.23: Deactivate

All algorithms depending (directly or indirectly) on that algorithm will also appear as inactive, since they cannot be executed now.

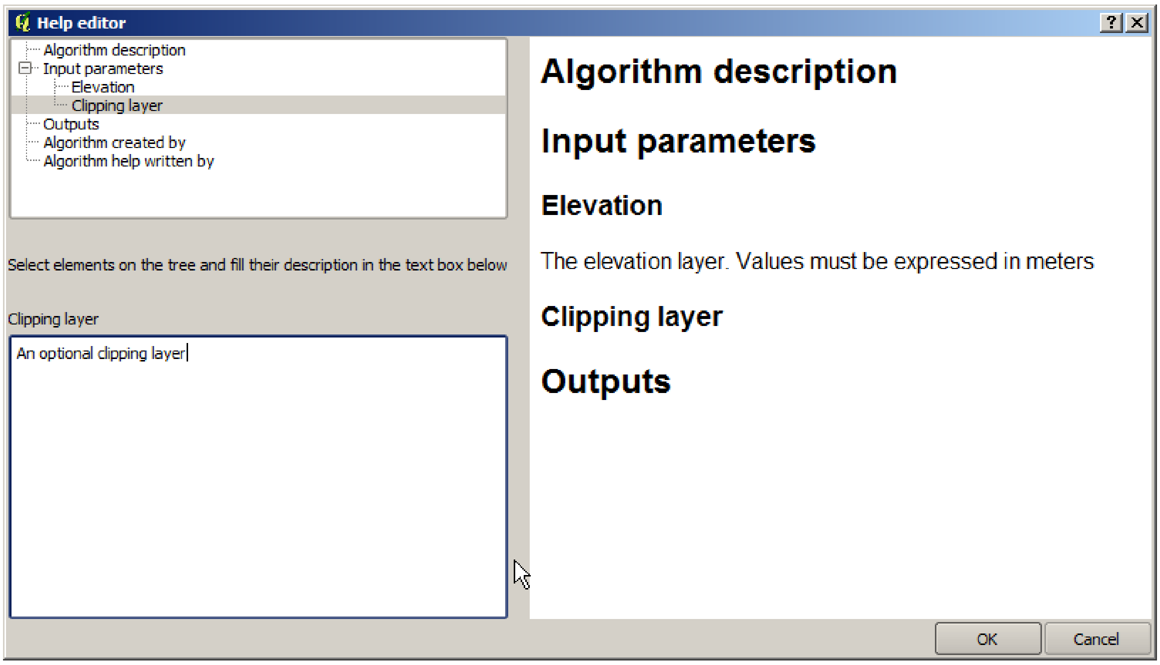
To activate an algorithm, just right-click on its icon and select the *Activate* option.

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.



Gambar 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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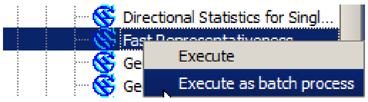
17.4 Antarmuka memproses batch

17.4.1 Pengantar

Semua algoritma (termasuk model) dapat dijalankan sebagai proses batch. Artinya, mereka dapat dijalankan menggunakan tidak hanya satu set masukan, namun beberapa dari mereka, melaksanakan algoritma sebanyak yang diperlukan. Hal ini berguna saat memproses data dalam jumlah besar, karena tidak perlu meluncurkan algoritma berkali-kali dari toolbox.

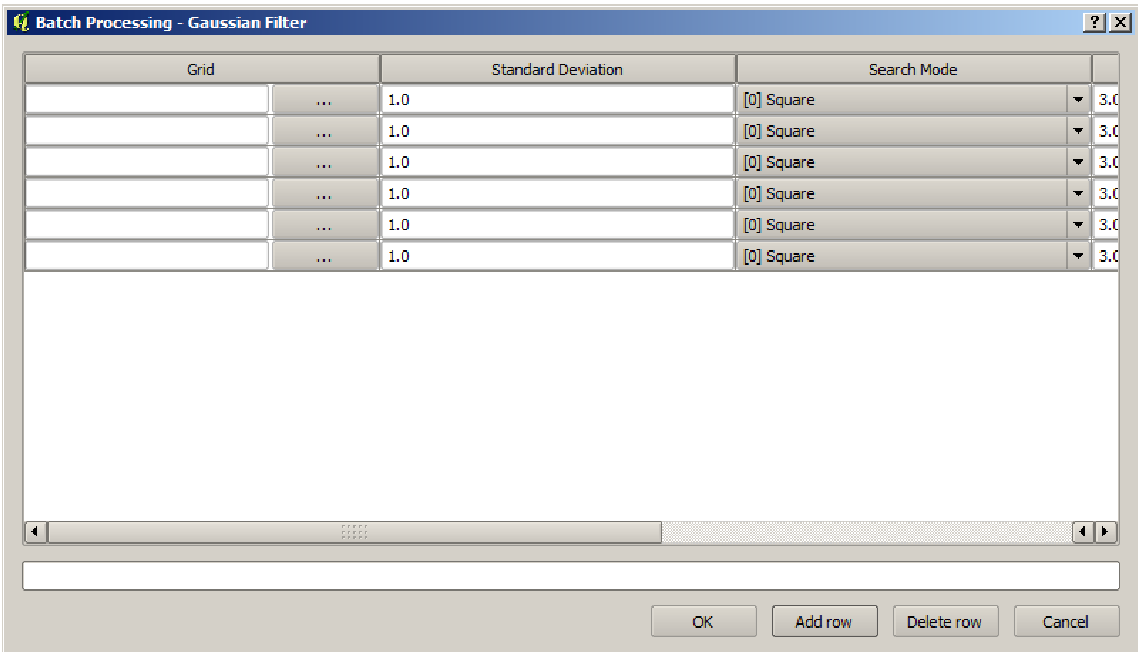
Untuk menjalankan algoritma sebagai proses batch, klik kanan pada namanya dalam kotak alat dan pilih opsi *Eksekusi sebagai proses batch* di menu pop-up yang akan muncul.



Gambar 17.25: Klik Kanan Memproses Batch

17.4.2 Tabel parameter

Pelaksana proses batch mirip dengan melakukan eksekusi tunggal dari suatu algoritma. Nilai parameter harus didefinisikan, tetapi dalam kasus ini kita tidak perlu hanya nilai tunggal untuk masing-masing parameter, tapi satu set mereka sebagai gantinya, satu untuk setiap kali algoritma harus dieksekusi. Nilai akan diperkenalkan menggunakan tabel seperti yang ditunjukkan berikutnya.



Gambar 17.26: Memproses Batch

Setiap baris dari tabel ini merupakan eksekusi tunggal algoritma, dan setiap sel berisi nilai salah satu parameter. Hal ini mirip dengan dialog parameter yang Anda lihat ketika menjalankan sebuah algoritma dari toolbox, tapi dengan pengaturan yang berbeda.

Secara default, tabel berisi hanya dua baris. Anda dapat menambahkan atau menghapus baris menggunakan tombol pada bagian bawah jendela.

Setelah ukuran tabel telah ditetapkan, harus diisi dengan nilai-nilai yang diinginkan.

17.4.3 Mengarsipkan tabel parameter

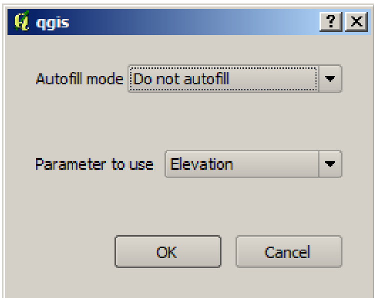
Bagi kebanyakan parameter, menetapkan nilai sepele. Cukup ketik nilai atau pilih dari daftar pilihan yang tersedia, tergantung pada jenis parameter.

Perbedaan utama yang ditemukan untuk parameter yang mewakili lapis atau tabel, dan untuk path berkas keluaran. Mengenai masukan lapis dan tabel, ketika sebuah algoritma dijalankan sebagai bagian dari proses batch, obyek masukan data yang diambil langsung dari berkas, dan bukan dari aturan mereka yang sudah dibuka di QGIS. Untuk alasan ini, algoritma dapat dijalankan sebagai proses batch, bahkan jika tidak ada obyek data sama sekali yang dibuka dan algoritma tidak dapat dijalankan dari toolbox.

Nama berkas untuk obyek masukan data diperkenalkan langsung dengan mengetik atau, lebih nyaman, mengklik tombol ... di sebelah kanan dari sel, yang menunjukkan dialog pemilih berkas. Beberapa berkas dapat dipilih sekaligus. Jika parameter masukan mewakili obyek data tunggal dan beberapa berkas yang dipilih, masing-masing dari mereka akan dimasukkan ke dalam baris yang terpisah, menambahkan yang baru jika diperlukan. Jika parameter mewakili banyak masukan, semua berkas yang dipilih akan ditambahkan ke satu sel, dipisahkan oleh titik koma (`;`).

Obyek data keluaran akan selalu disimpan ke berkas dan, tidak seperti ketika menjalankan algoritma dari toolbox, menyimpan ke berkas sementara tidak diizinkan. Anda dapat mengetik nama secara langsung atau menggunakan dialog pemilih berkas yang muncul saat mengklik tombol yang menyertainya.

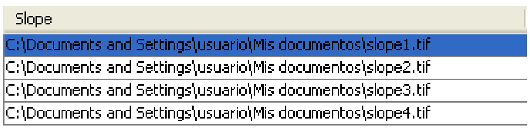
Setelah Anda memilih berkas, dialog baru ditampilkan untuk memungkinkan autocompletion dari sel-sel lain dalam kolom yang sama (parameter yang sama).



Gambar 17.27: Simpan Memproses Batch

Jika nilai default ('Jangan AutoComplete') yang dipilih, itu hanya akan menempatkan nama berkas yang dipilih dalam sel yang dipilih dari tabel parameter. Jika salah satu opsi lain yang dipilih, semua sel di bawah satu yang dipilih otomatis akan diisi berdasarkan kriteria yang ditetapkan. Dengan cara ini, jauh lebih mudah untuk mengisi tabel, dan proses batch dapat didefinisikan dengan sedikit usaha.

Mengisi otomatis dapat dilakukan dengan hanya menambahkan angka korelatif untuk path berkas yang dipilih, atau dengan menambahkan nilai dari bidang lain pada baris yang sama. Hal ini sangat berguna untuk penamaan obyek data keluaran sesuai dengan yang masukan.



Gambar 17.28: Path Berkas Memproses Batch

17.4.4 Mengeksekusi proses batch

Untuk melaksanakan proses batch setelah Anda memperkenalkan semua nilai yang diperlukan, klik **[OK]**. Kemajuan tugas bets global akan ditampilkan dalam bar kemajuan di bagian bawah 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.

.

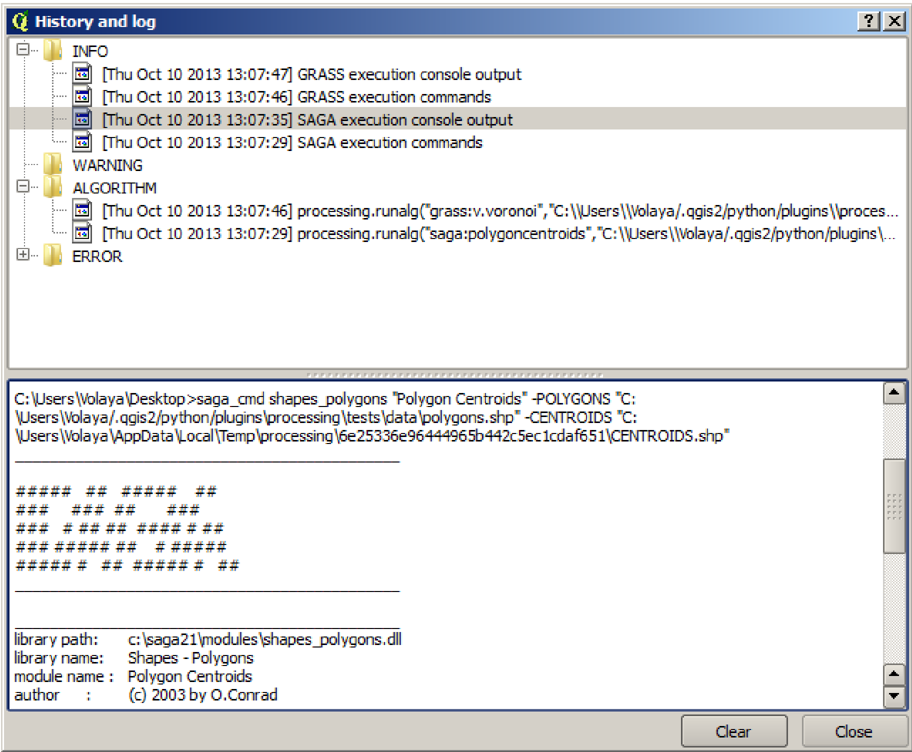
17.6 Manajer riwayat

17.6.1 Pemrosesan riwayat

Setiap kali Anda mengeksekusi sebuah algoritma, informasi tentang proses disimpan dalam manajer riwayat. Seiring dengan parameter yang digunakan, tanggal dan waktu eksekusi juga disimpan.

Dengan cara ini, mudah untuk melacak dan mengendalikan semua pekerjaan yang telah dikembangkan dengan menggunakan kerangka pengolahan, dan mudah mereproduksi itu.

Manajer riwayat adalah satu set entri registri dikelompokkan berdasarkan tanggal eksekusi mereka, sehingga lebih mudah untuk menemukan informasi tentang algoritma yang dijalankan pada saat tertentu.



Gambar 17.29: Riwayat

Informasi proses disimpan sebagai ekspresi baris-perintah, bahkan jika algoritma diluncurkan dari kotakalat. Hal ini juga berguna bagi mereka belajar bagaimana menggunakan antarmuka baris perintah, karena mereka dapat memanggil algoritma menggunakan kotak alat dan kemudian memeriksa manajer riwayat melihat bagaimana algoritma yang sama bisa dipanggil dari baris perintah.

Selain menjelajah entri dalam registri, Anda juga dapat jalankan kembali proses dengan hanya mengklik dua kali pada entri yang sesuai.

Seiring dengan rekaman algoritma eksekusi, kerangka pengolahan berkomunikasi dengan pengguna melalui kelompok lain dari registri, yaitu *Eror*, *Peringatan* dan *Informasi*. Dalam hal sesuatu yang tidak bekerja dengan baik, akan melihat *Eror* dapat membantu Anda untuk melihat apa yang terjadi. Jika Anda mendapatkan kontak dengan pengembang melaporkan bug atau kesalahan, informasi dalam kelompok akan sangat berguna baginya atau untuk mencari tahu apa yang salah.

Algoritma pihak ketiga biasanya dilakukan dengan memanggil antarmuka baris perintah mereka, yang berkomunikasi dengan pengguna melalui konsol. Meskipun konsol yang tidak ditampilkan, dump penuh disimpan dalam grup *Informasi* setiap kali Anda menjalankan salah satu algoritma. Jika, misalnya, Anda mengalami masalah mengeksekusi algoritma SAGA, mencari entri bernama 'keluaran konsol eksekusi SAGA' untuk memeriksa semua pesan yang dihasilkan oleh SAGA dan coba mencari tahu di mana masalahnya.

Beberapa algoritma, bahkan jika mereka dapat menghasilkan hasil dengan masukan data yang diberikan, bisa menambahkan komentar atau informasi tambahan ke blok *Peringatan* jika mereka mendeteksi potensi masalah dengan data, dalam rangka untuk memperingatkan Anda. Pastikan Anda memeriksa pesan tersebut jika Anda mengalami hasil yang tidak diharapkan.

.

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.

Catatan: `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

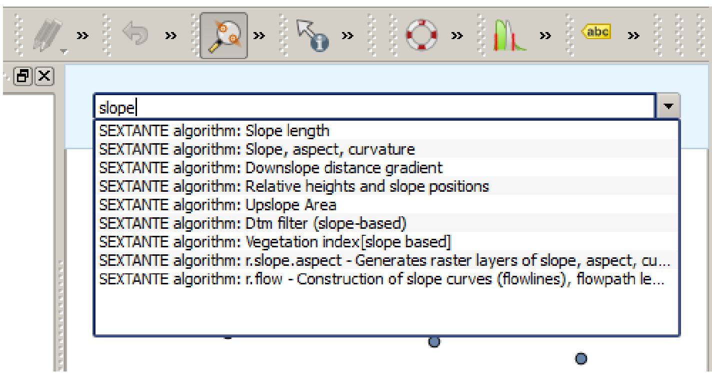
```
sudo make install
```

.

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.



Gambar 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.

Moreover, the Commander is configurable, so you can add your custom commands and have them just a few keystrokes away, making it a powerful tool to help you become more productive in your daily work with QGIS.

17.8.1 Available commands

The commands available in the Commander fall in the following categories:

- SEXTANTE algorithms. These are shown as `SEXTANTE algorithm: <name of the algorithm>`.
- Menu items. These are shown as `Menu item: <menu entry text>`. All menus items available from the QGIS interface are available, even if they are included in a submenu.
- Python functions. You can create short Python functions that will be then included in the list of available commands. They are shown as `Function: <function name>`.

To run any of the above, just start typing and then select the corresponding element from the list of available commands that appears after filtering the whole list of commands with the text you have entered.

In the case of calling a Python function, you can select the entry in the list, which is prefixed by `Function:` (for instance, `Function: removeall), or just directly type the function name (``removeall` in the previous example). There is no need to add brackets after the function name.

17.8.2 Creating custom functions

Custom functions are added by entering the corresponding Python code in the `commands.py` file that is found in the `.qgis/sextante/commander directory` in your user folder. It is just a simple Python file where you can add the functions that you need.

The file is created with a few example functions the first time you open the Commander. If you haven't launched the Commander yet, you can create the file yourself. To edit the commands file, use your favorite text editor. You can also use a built-in editor by calling the `edit` command from the Commander. It will open the editor with the commands file, and you can edit it directly and then save your changes.

For instance, you can add the following function, which removes all layers:

```
from qgis.gui import *

def removeall():
    mapreg = QgsMapLayerRegistry.instance()
    mapreg.removeAllMapLayers()
```

Once you have added the function, it will be available in the Commander, and you can invoke it by typing `removeall`. There is no need to do anything apart from writing the function itself.

Functions can receive parameters. Add `*args` to your function definition to receive arguments. When calling the function from the Commander, parameters have to be passed separated by spaces.

Here is an example of a function that loads a layer and takes a parameter with the filename of the layer to load.

```
import sextante

def load(*args):
  sextante.load(args[0])
```

If you want to load the layer in `/home/myuser/points.shp`, type `load /home/myuser/points.shp` in the Commander text box.

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Print Composer

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:

Icon	Purpose	Icon	Purpose
	Save Project		New Composer
	Duplicate Composer		Composer Manager
	Load from template		Save as template
	Print or export as PostScript		Export to an image format
	Export print composition to SVG		Export as PDF
	Revert last change		Restore last change
	Zoom to full extent		Zoom to 100%
	Zoom in		Zoom out
	Refresh View		
	Pan		Zoom to specific region
	Select/Move item in print composition		Move content within an item
	Add new map from QGIS map canvas		Add image to print composition
	Add label to print composition		Add new legend to print composition
	Add scale bar to print composition		Add basic shape to print composition
	Add arrow to print composition		Add attribute table to print composition
	Add an HTML frame		
	Group items of print composition Lock Selected Items		Ungroup items of print composition Unlock All items
	Raise selected items		Lower selected items
	Move selected items to top		Move selected items to bottom
	Align selected items left		Align selected items right
	Align selected items center		Align selected items center vertical
	Align selected items top		Align selected items bottom
	Preview Atlas		First Feature
	Previous Feature		Next Feature
	Last feature		Print Atlas
	Export Atlas as Image		Atlas Settings

Table Composer 1: Print Composer Tools

All Print Composer tools are available in menus and as icons in a toolbar. The toolbar can be switched off and on using the right mouse button over the toolbar.

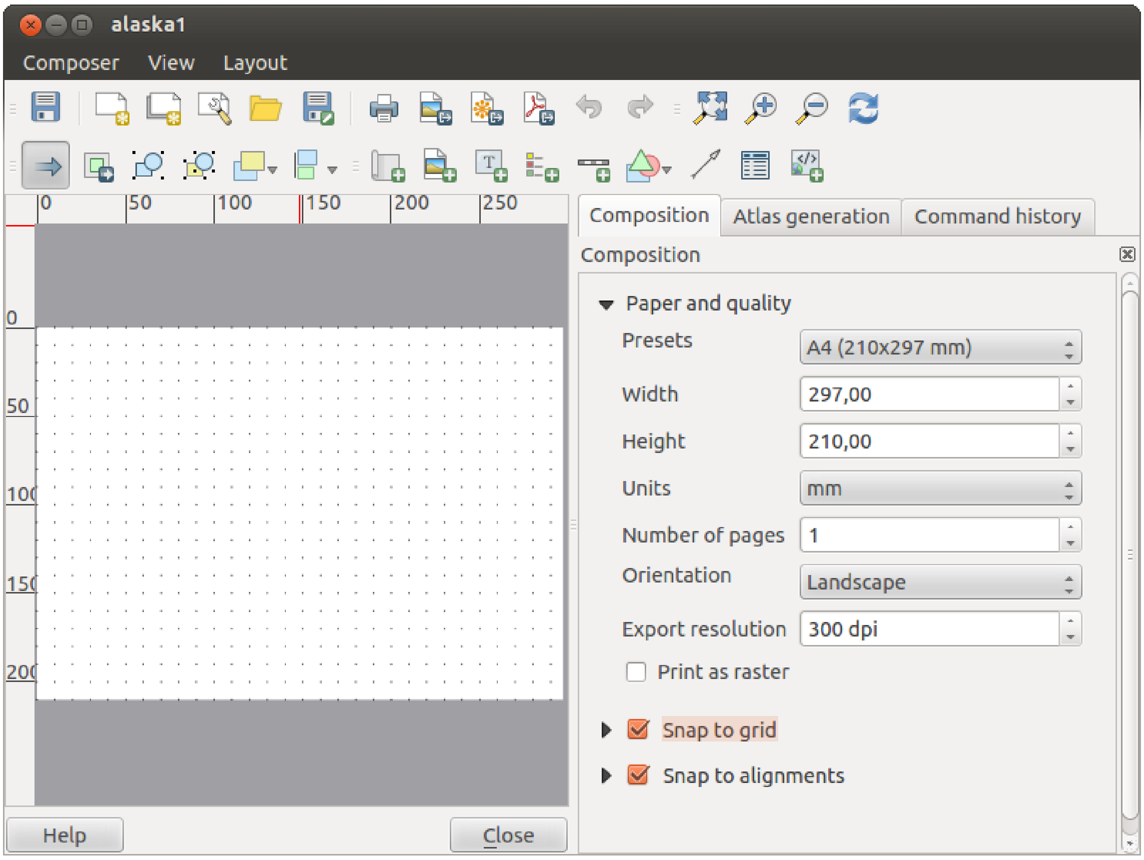
18.1 First steps

18.1.1 Open a new Print Composer Template

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.



Gambar 18.1: Print Composer

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.

Navigation tools

To navigate in the canvas layout, the Print Composer provides some general tools:

- Zoom in
- Zoom out
- Zoom to full extent
- Zoom to 100%
- Refresh the view (if you find the view in an inconsistent state)
- 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 Composition tab — General composition setup

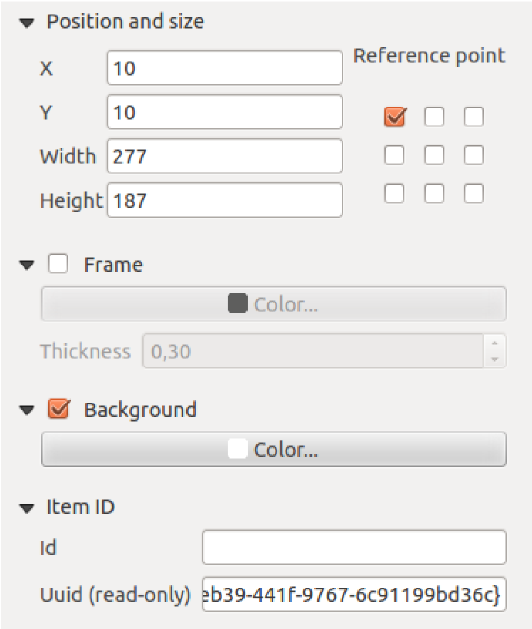
In the *Composition* tab, you can define the global settings of your composition.

- 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).

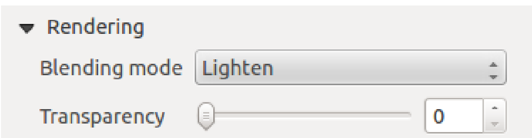


Gambar 18.2: Common Item properties Dialogs

- The *Position and size* dialog lets you define size and position of the frame that contains the item. You can also choose which *Reference point* will be set at the **X** and **Y** coordinates previously defined.
- The *Rotation* sets the rotation of the element (in degrees).
- The *Frame* shows or hides the frame around the label. Click on the **[Color]** and **[Thickness]** buttons to adjust those properties.
- 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 Rendering mode

QGIS now allows advanced rendering for Composer items just like vector and raster layers.



Gambar 18.3: Rendering mode

- *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.
  - Hard light: Hard light is 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 with pixel values of the other. In case of negative values, black is displayed.

18.3 Composer Items

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:

- **Rectangle** is the default setting. It only displays an empty box with a message 'Map will be printed here'.
- **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.

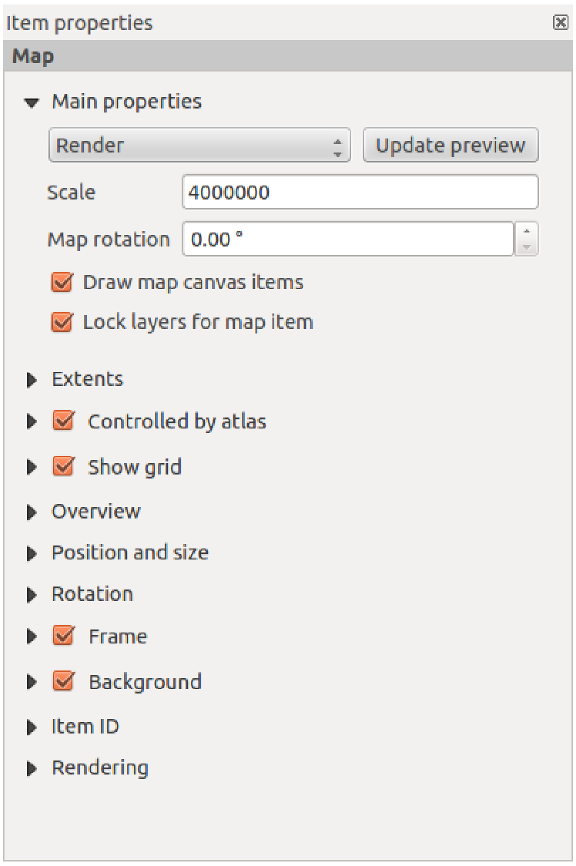
Cache is the default preview mode for newly added Print Composer maps.

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):



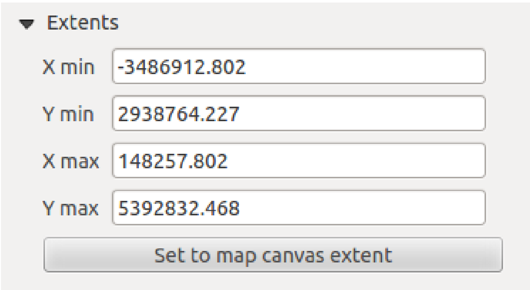
Gambar 18.4: Map Item properties Tab

- 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):



Gambar 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).

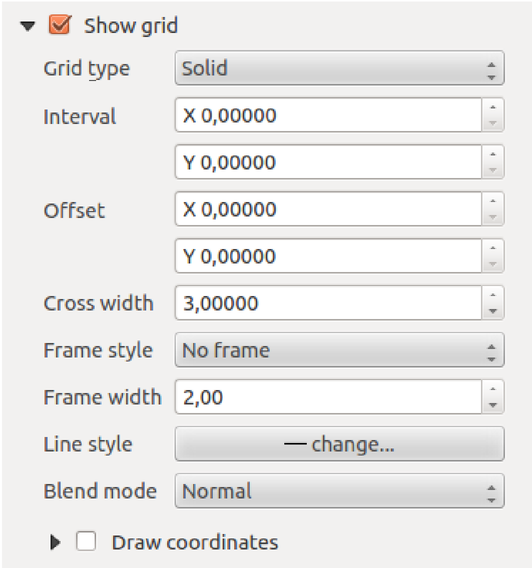
Grid

The *Grid* dialog of the map *Item Properties* tab provides the following functionalities (see Figure_composer_6):

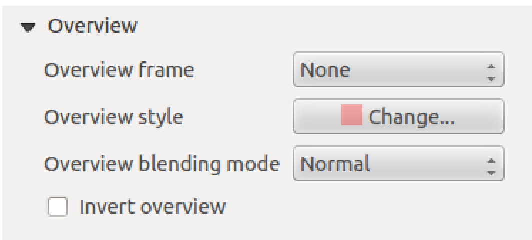
- The *Show grid* checkbox allows you to overlay a grid onto the map element. As grid type, you can specify to use a solid line or cross. Symbology of the grid can be chosen. See section Rendering_Mode. Furthermore, you can define an interval in the X and Y directions, an X and Y offset, and the width 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):



Gambar 18.6: Map Grid Dialog



Gambar 18.7: Map Overview Dialog

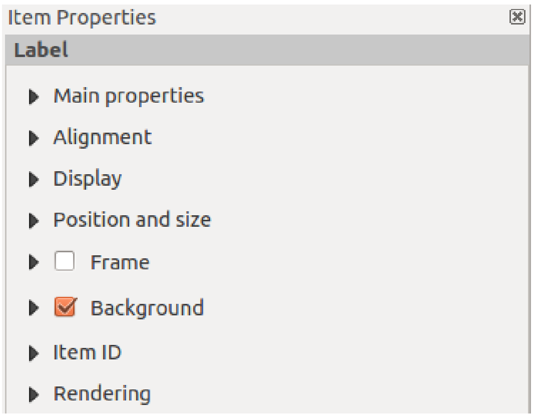
If the Composer has more than one map, you can choose to use a first map to show the extents of a second map. The *Overview* dialog of the map *Item Properties* tab allows you to customize the appearance of that feature.

- 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 .
- 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:

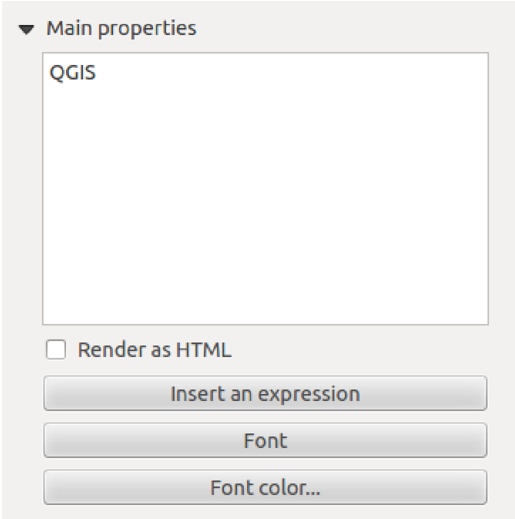


Gambar 18.8: Label Item properties Tab

Main properties

The *Main properties* dialog of the label *Item Properties* tab provides the following functionalities (see Figure_composer_9):

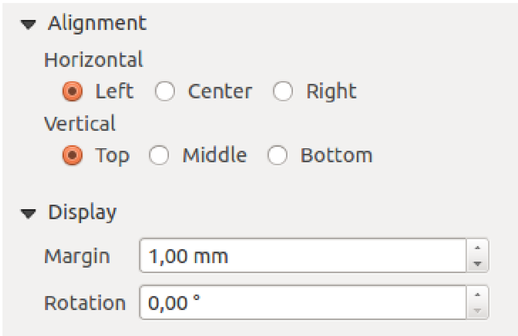
- The main properties dialog is where the text (HTML or not) or the expression needed to fill the label is added to the Composer canvas.
- Labels can be interpreted as HTML code: check *Render as HTML*. You can now insert a URL, a clickable image that links to a web page or something more complex.
- 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.
- Define font and font color by clicking on the **[Font]** and **[Font color...]** buttons.



Gambar 18.9: Label Main properties Dialog

Alignment and Display

The *Alignment* and *Display* dialogs of the label *Item Properties* tab provide the following functionalities (see Figure_composer_10):



Gambar 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

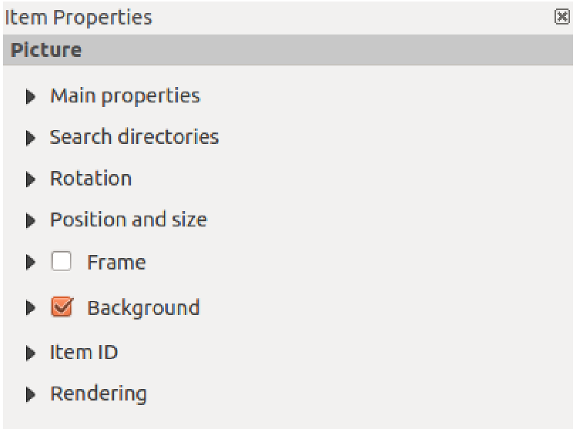
To add an image, click the Add image icon, place the element with the left mouse button on the Print Composer canvas and position and customize its appearance in the image *Item Properties* tab.

The image *Item Properties* tab provides the following functionalities (see figure_composer_11):

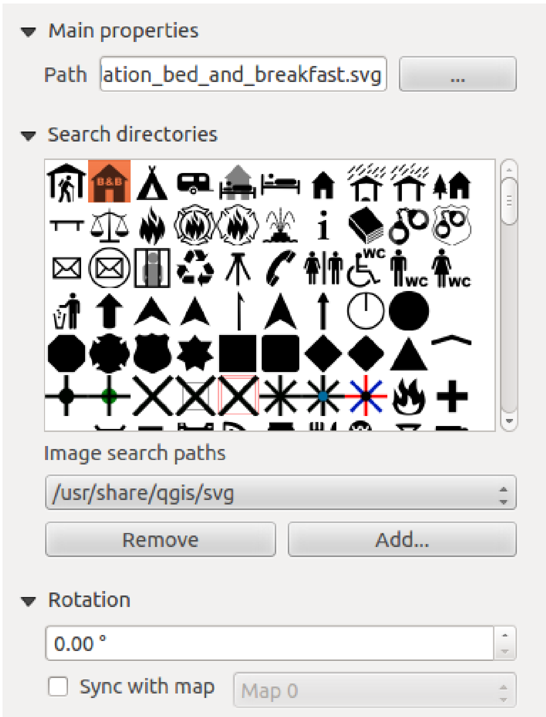
Main properties, Search directories and Rotation

The *Main properties* and *Search directories* dialogs of the image *Item Properties* tab provide the following functionalities (see Figure_composer_12):

- 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.



Gambar 18.11: Image Item properties Tab



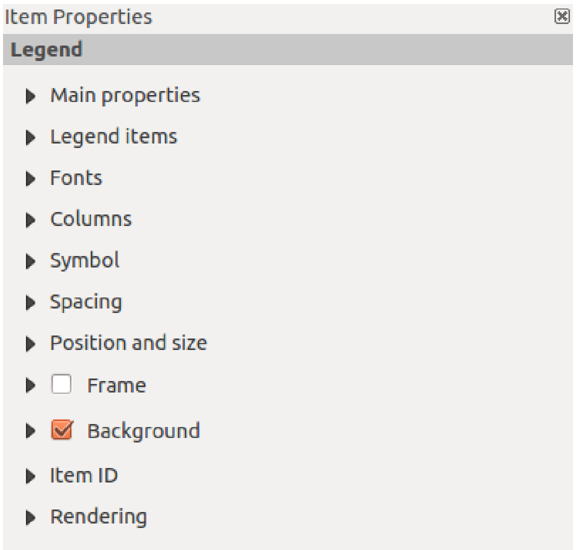
Gambar 18.12: Image Main properties, Search directories and Rotation Dialogs

- 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.

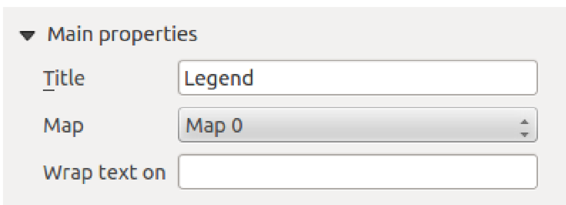
The *Item properties* of a legend item tab provides the following functionalities (see figure_composer_14):



Gambar 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):

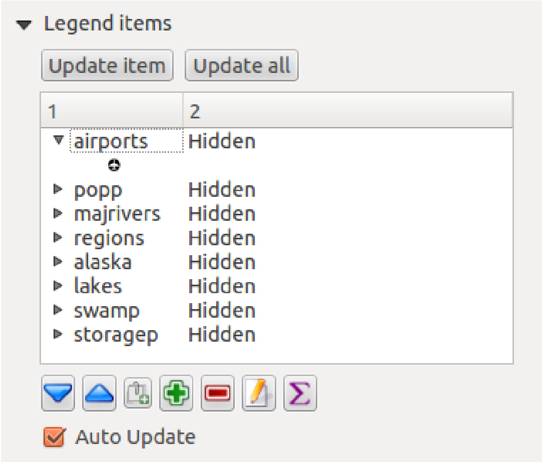


Gambar 18.14: Legend Main properties Dialog

- 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):



Gambar 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

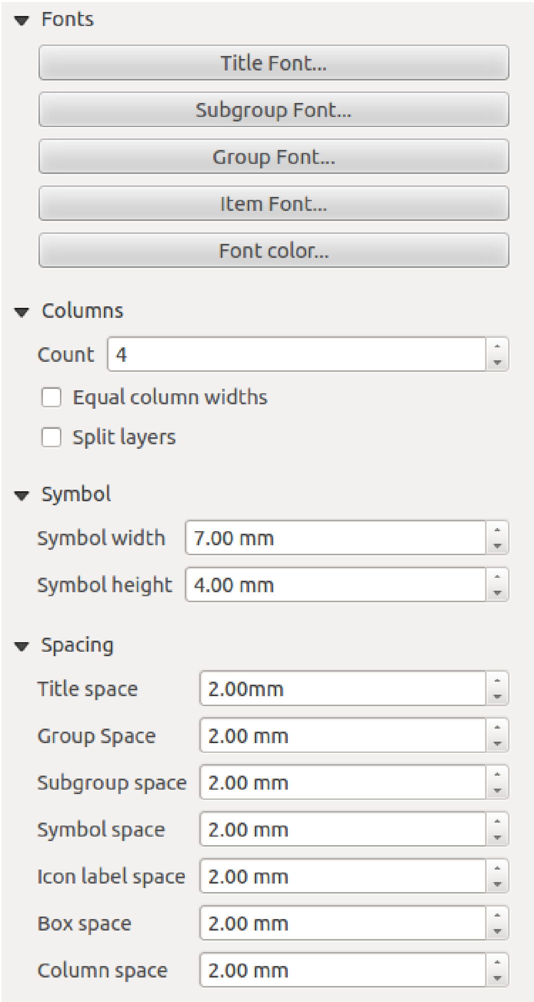
The *Fonts*, *Columns*, *Symbol* and *Spacing* dialogs of the legend *Item Properties* tab provide the following functionalities (see figure_composer_16):

- 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.

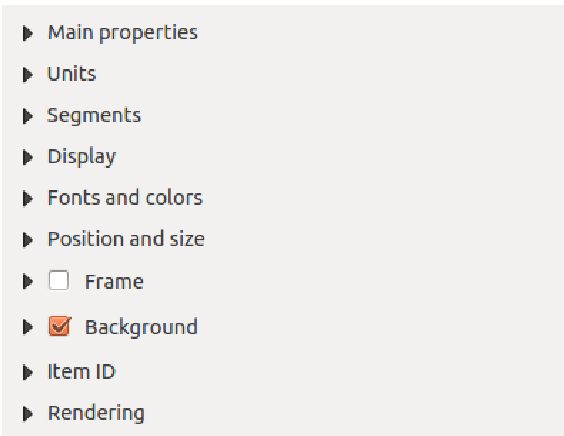
18.3.5 Adding a Scale Bar item to the Print Composer

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.

The *Item properties* of a scale bar item tab provides the following functionalities (see figure_composer_17):



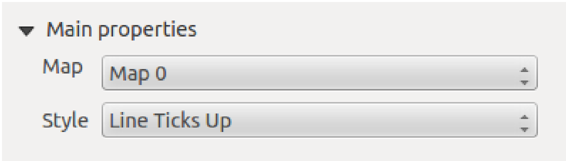
Gambar 18.16: Legend Fonts, Columns, Symbol and Spacing Dialogs



Gambar 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):

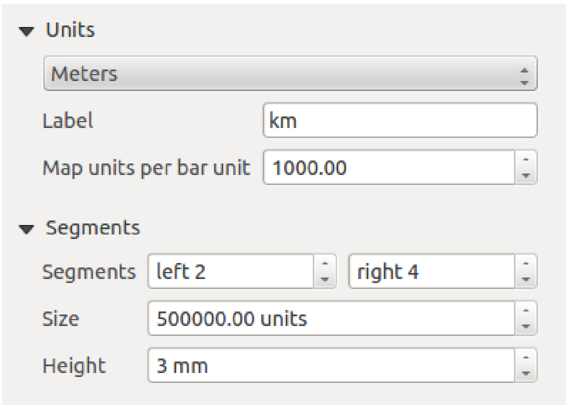


Gambar 18.18: Scale Bar Main properties Dialog

- 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):



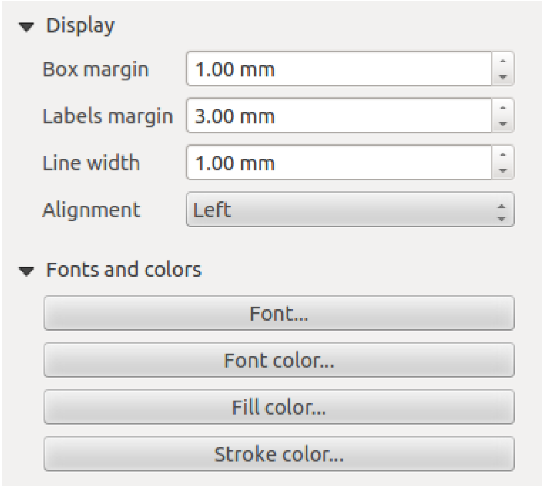
Gambar 18.19: Scale Bar Units and Segments Dialogs

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.

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):



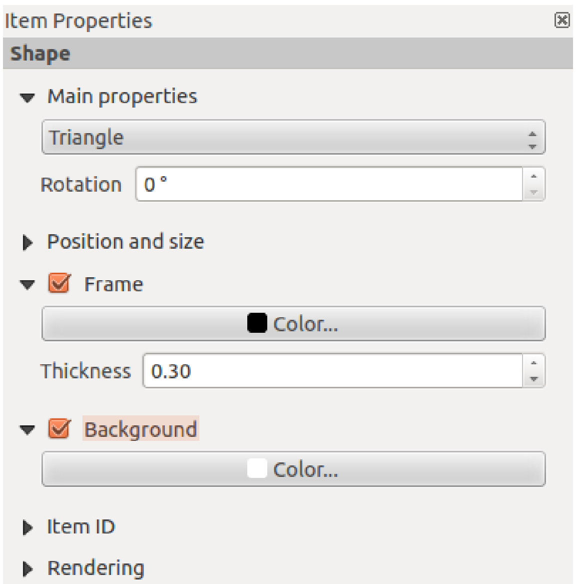
Gambar 18.20: Scale Bar Display, Fonts and colors Dialogs

- 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

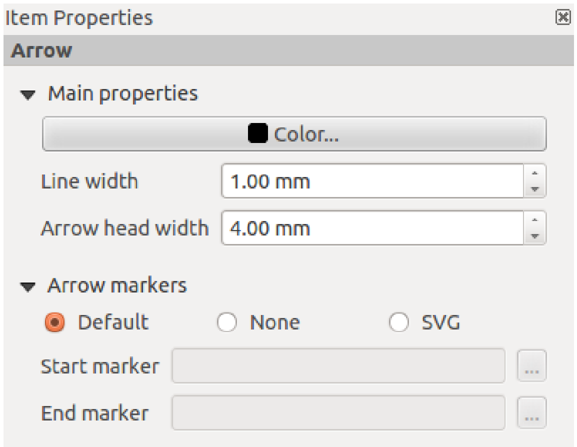
It is possible to add basic shapes (ellipse, rectangle, triangle) and arrows to the Print Composer canvas: Click the Add basic shape icon or the Add Arrow icon, place the element with the left mouse button on the Print Composer canvas and position and customize the appearance in the *Item Properties* 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.



Gambar 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.



Gambar 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.

Catatan: 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

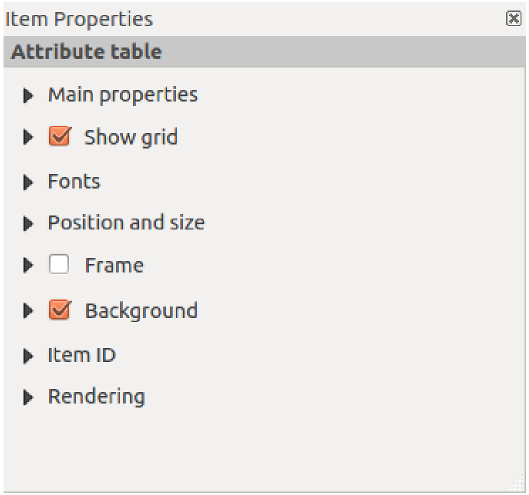
It is possible to add parts of a vector attribute table to the Print Composer canvas: Click the Add attribute table icon, place the element with the left mouse button on the Print Composer canvas, and position and customize the appearance in the *Item Properties* tab.

The *Item properties* of an attribute table item tab provides the following functionalities (see figure_composer_23):

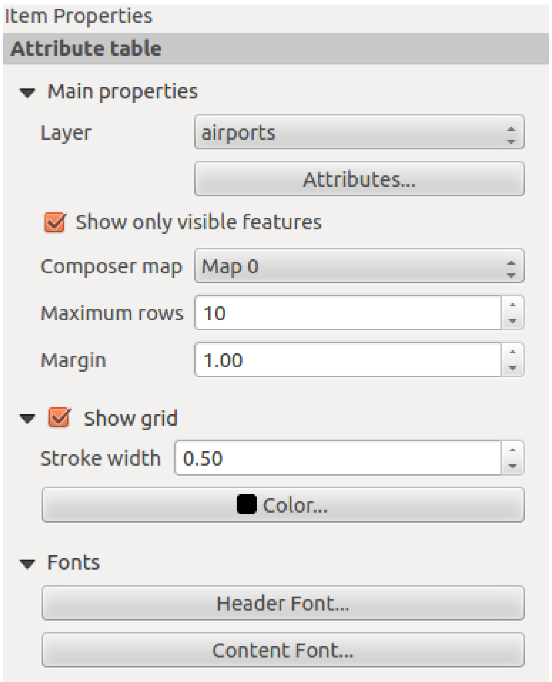
Main properties, Show grid and Fonts

The *Main properties*, *Show grid* and *Fonts* dialogs of the attribute table *Item Properties* tab provide the following functionalities (see figure_composer_24):

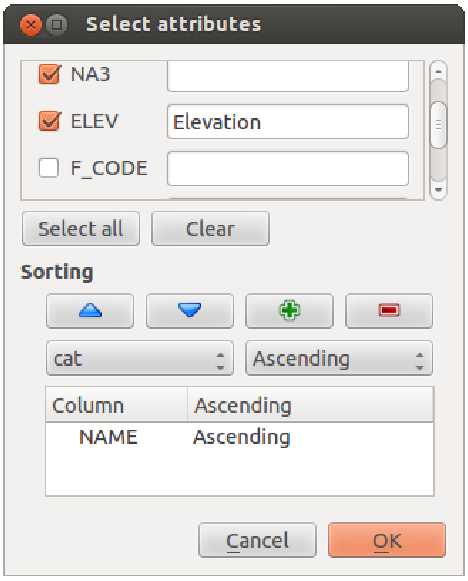
- The *Table* dialog allows you to select the vector layer and columns of the attribute table. Attribute columns can be sorted, and you can specify whether to show values in ascending or descending order (see figure_composer_25).
- You can choose to display the attributes of only features visible on a map. Check *Show only visible features* and select the corresponding *Composer map* to filter.



Gambar 18.23: Scale Bar Item properties Tab



Gambar 18.24: Attribute table Main properties, Show grid and Fonts Dialog



Gambar 18.25: Attribute table Select attributes Dialog

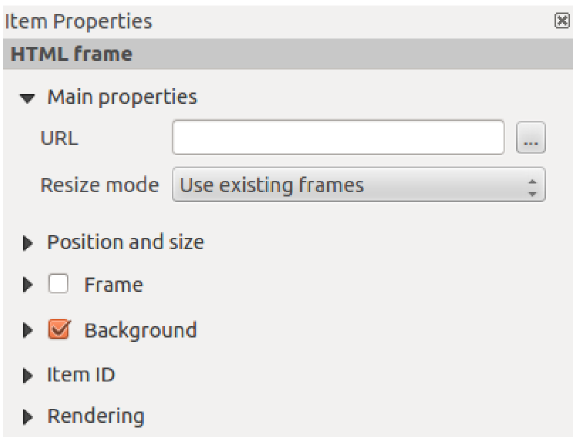
- You can define the *Maximum number of rows* to be displayed and the *margin* around text.
- Additionally, you can define the grid characteristics of the table (*Stroke width* and *Color* of the grid) and the header and content font.

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):



Gambar 18.26: HTML frame Item properties Tab

- 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.

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.

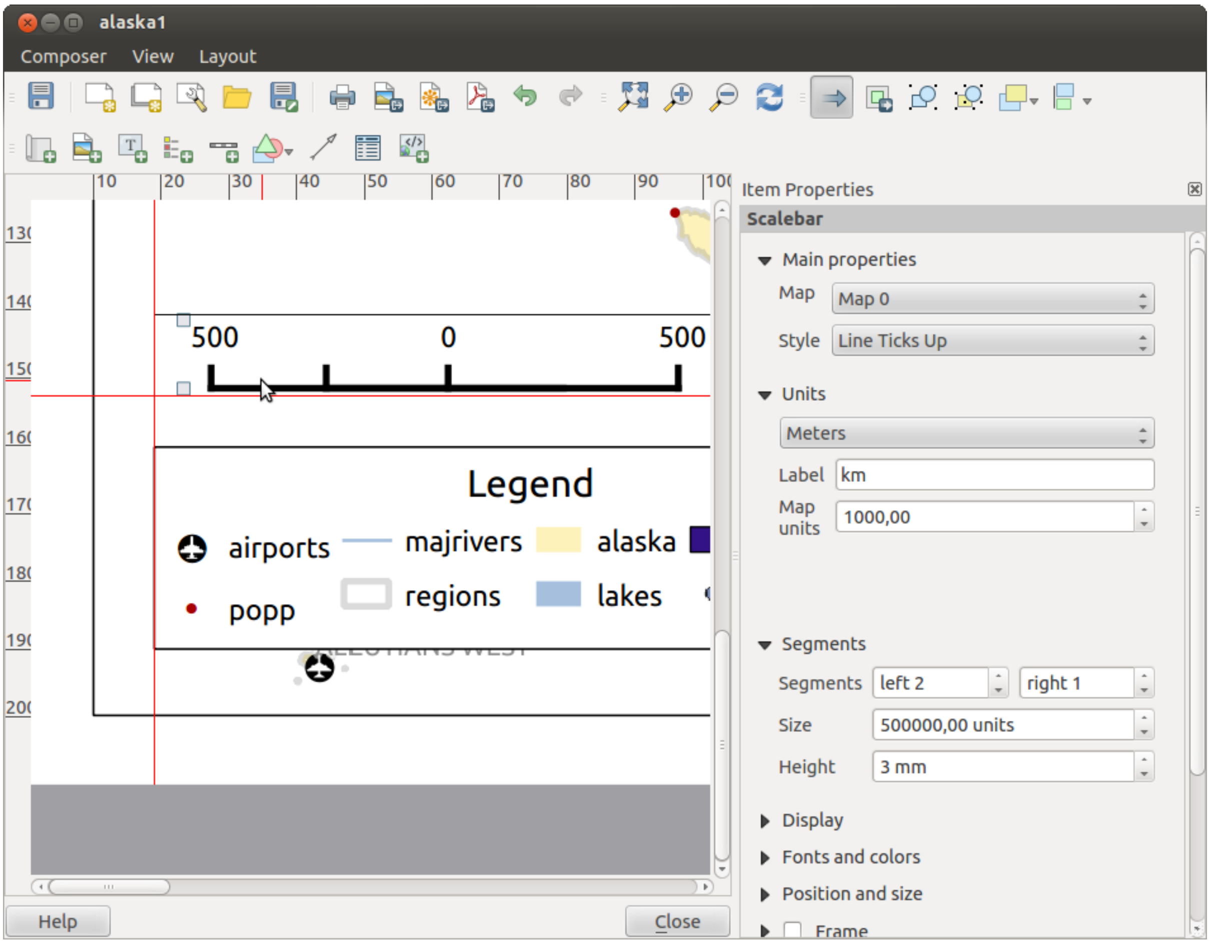
18.4.2 Alignment

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.

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.



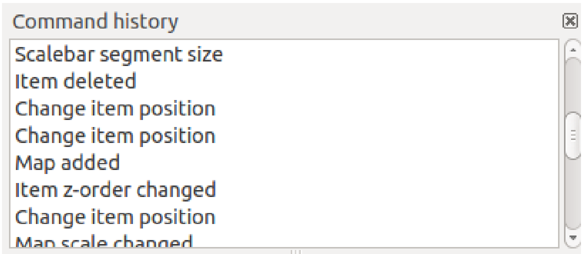
Gambar 18.27: Alignment helper lines in the Print Composer

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).



Gambar 18.28: Command history in the Print Composer

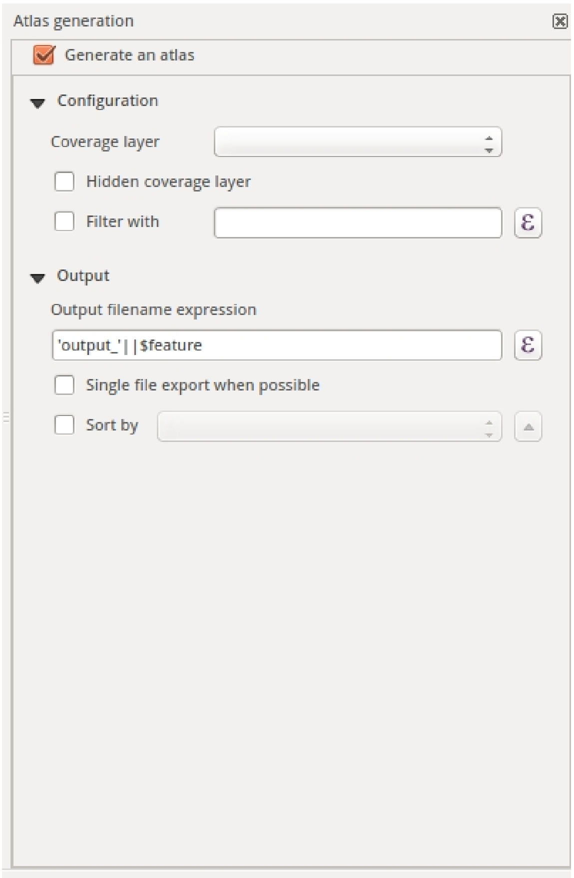
18.6 Atlas generation

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.
- 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:



Gambar 18.29: Atlas generation tab

- 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

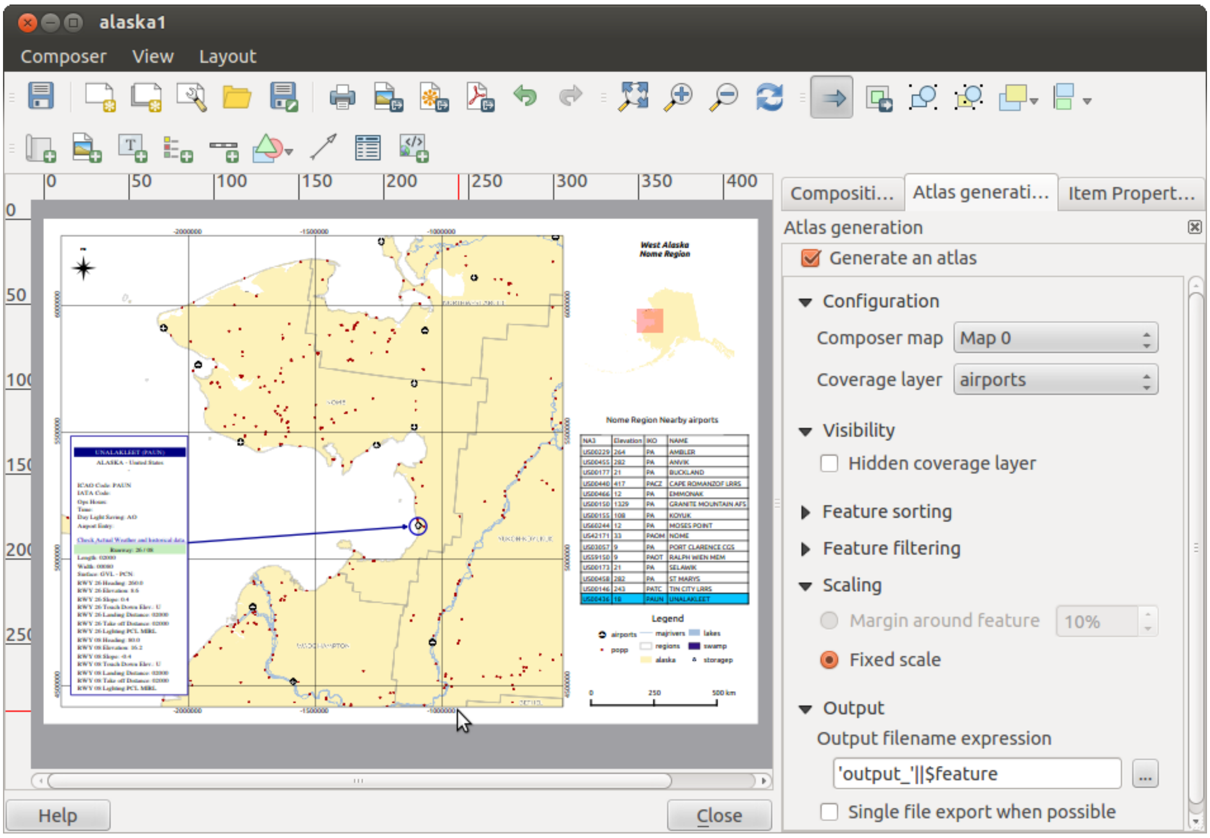
Figure_composer_30 shows the Print Composer with an example print layout, including each type of map element described in the sections above.

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.
- 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.

Catatan: Currently, the SVG output is very basic. This is not a QGIS problem, but a problem with the underlying



Gambar 18.30: Print Composer with map view, legend, image, scale bar, coordinates, text and HTML frame added

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.

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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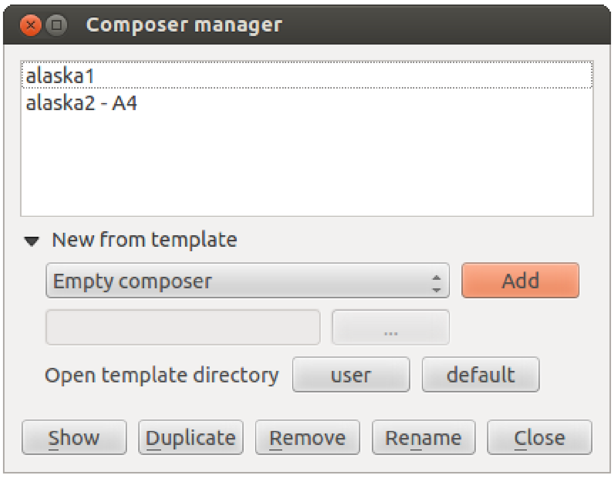

Gambar 18.31: The Print Composer Manager

BAB 19

Plugin

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19.1 Plugin-plugin QGIS

QGIS telah dirancang dengan arsitektur plugin. Hal ini memungkinkan banyak fitur baru / fungsi dapat dengan mudah ditambahkan ke aplikasi. Banyak fitur di QGIS benar-benar diterapkan sebagai plugin.

19.1.1 The Plugins Menus

The menus in the Plugins dialog allow the user to install, uninstall and upgrade plugins in different ways.

Semua

Di sini, semua plugin yang tersedia terdaftar, termasuk plugin inti dan eksternal. Gunakan **[Upgrade semua]** untuk mencari versi baru dari plugin. Selanjutnya, Anda dapat menggunakan **[pasang plugin]**, jika plugin tercantum dalam daftar namun tidak dipasang, dan **[Uninstall plugin]** maupun **[Reinstall plugin]**, jika plugin telah terpasang. Jika sebuah plugin terpasang, dapat diaktifkan/dinonaktifkan menggunakan kotak centang.

Terpasang

Dalam menu ini, Anda hanya dapat menemukan plugin terpasang. Plugin eksternal dapat dihapus dan diinstal ulang dengan menggunakan tombol **[Uninstall plugin]** and **[Reinstall plugin]**. Anda bisa **[Upgrade semua]**.

Tidak terpasang

Menu ini berisi semua plugin yang tidak dipasang. Anda dapat menggunakan tombol **[Pasang plugin]** untuk mengimplementasikan plugin dalam QGIS.

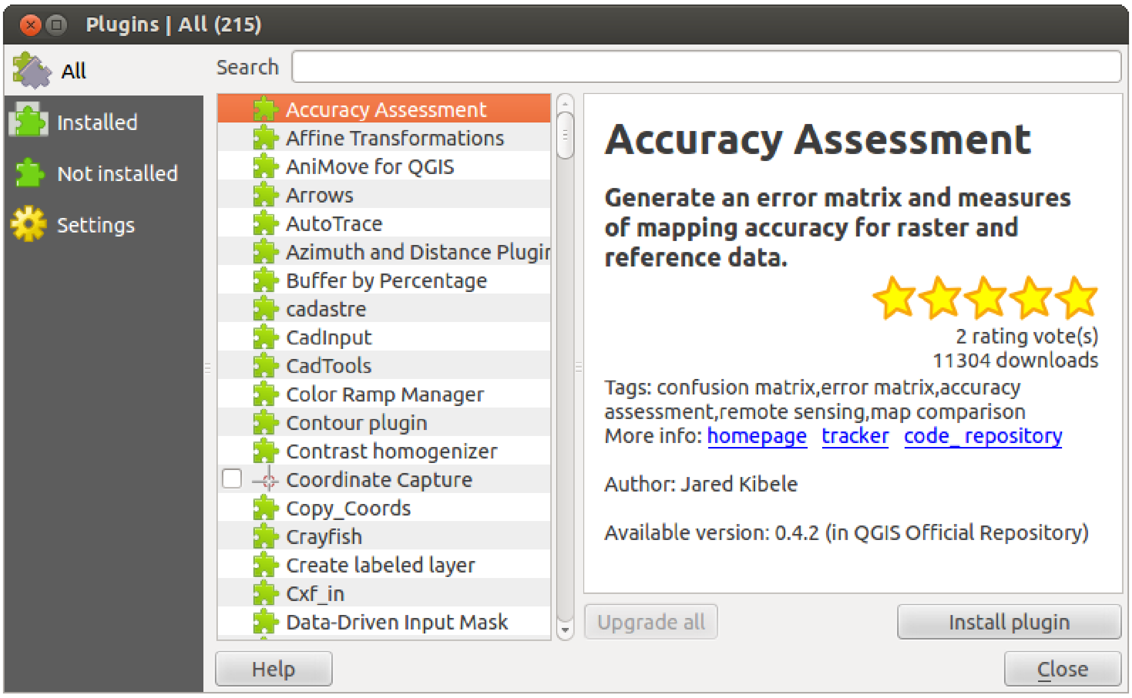
Upgradeable

Jika Anda mengaktifkan *Tampilkan juga plugin eksperimental* dalam menu *Pengaturan*, Anda bisa menggunakan menu ini untuk mencari versi Plugin yang lebih baru. Bisa dilakukan dengan tombol **[Upgrade plugin]** atau **[Upgrade semua]**.

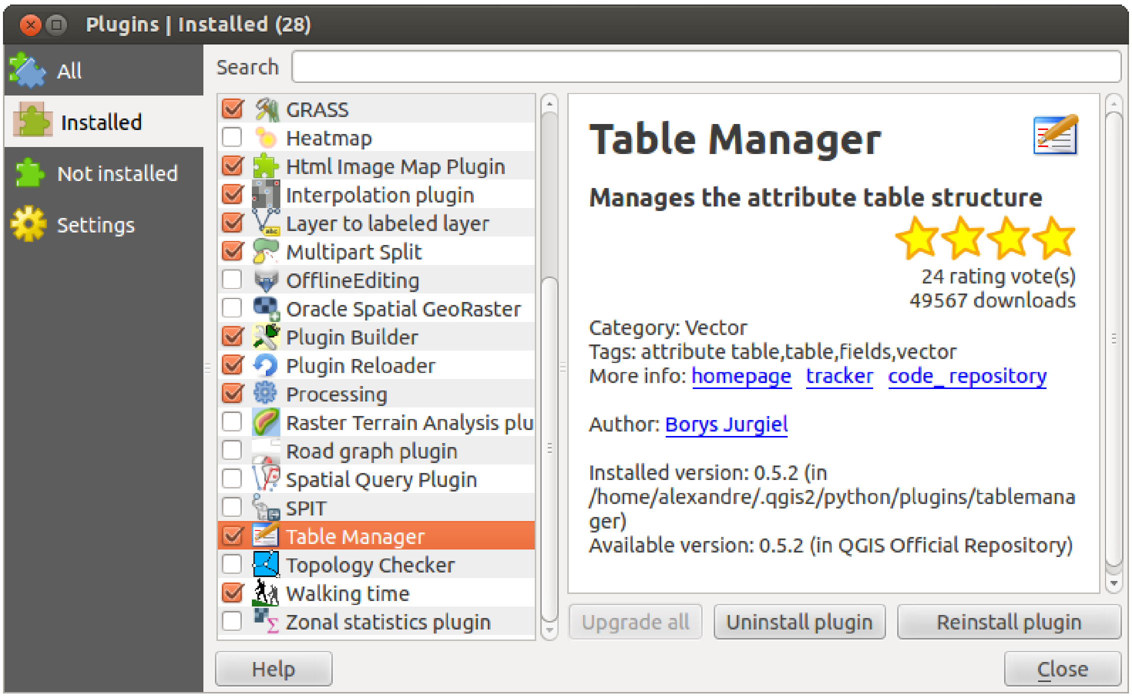
Pengaturan

Dalam menu ini, Anda dapat menggunakan pilihan berikut:

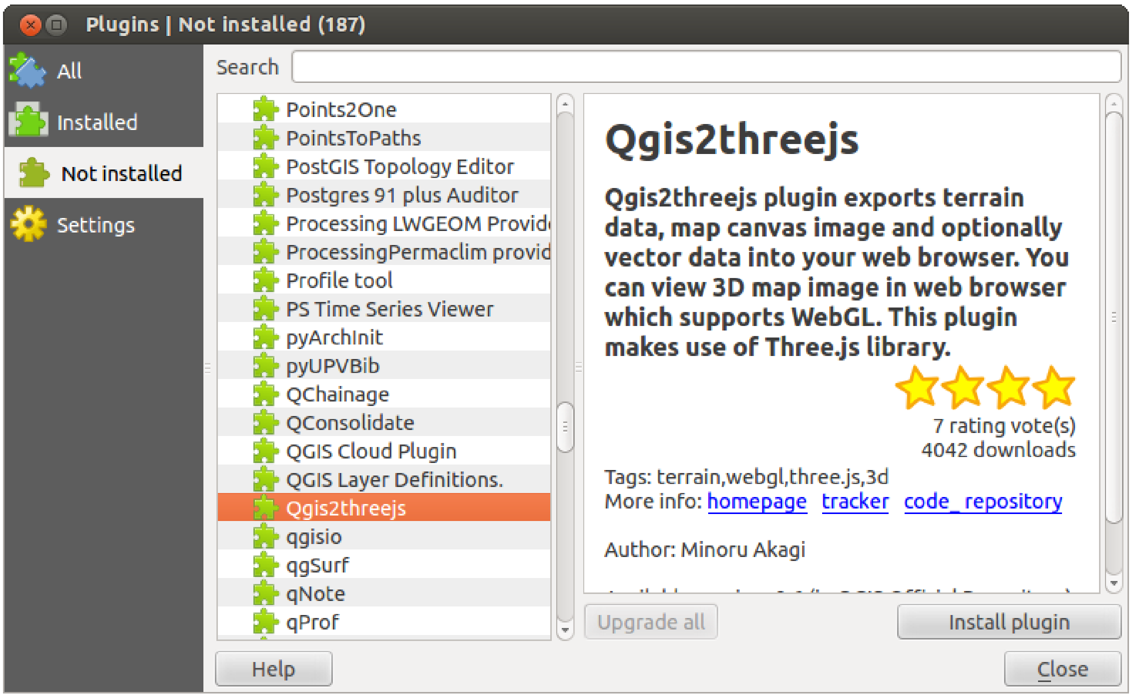
- *Periksa pembaruan saat startup*. Setiap kali sebuah plugin baru atau update plugin tersedia, QGIS akan memberitahu Anda 'every time QGIS starts', 'once a day', 'every 3 days', 'every week', 'every 2 weeks' or 'every month'.



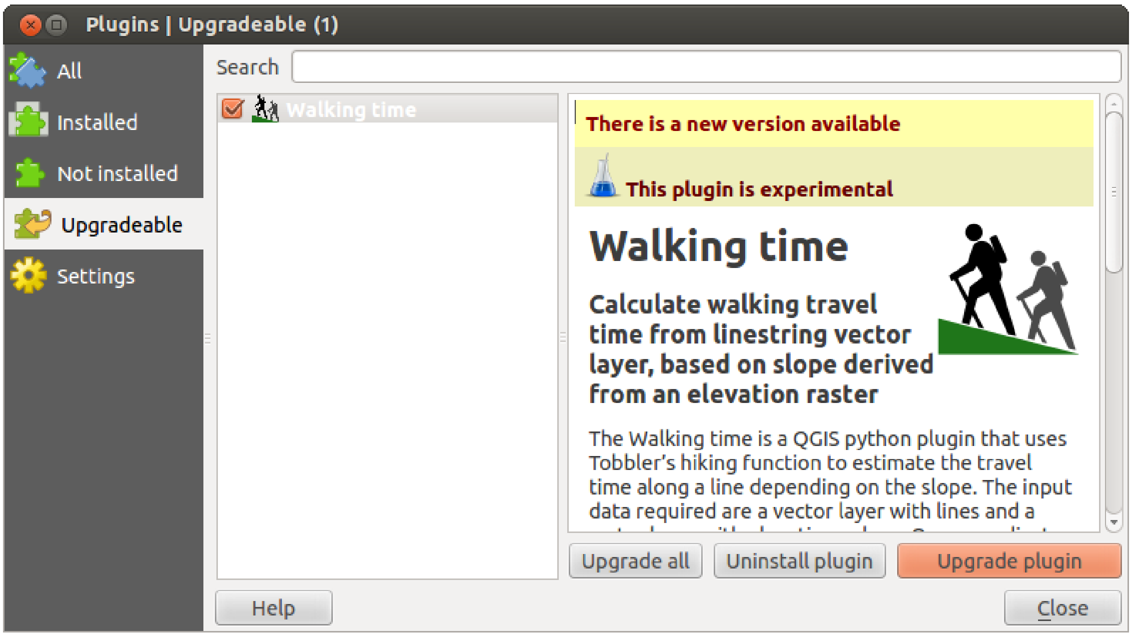
Gambar 19.1: Menu *Semua*



Gambar 19.2: Menu *Terpasang*



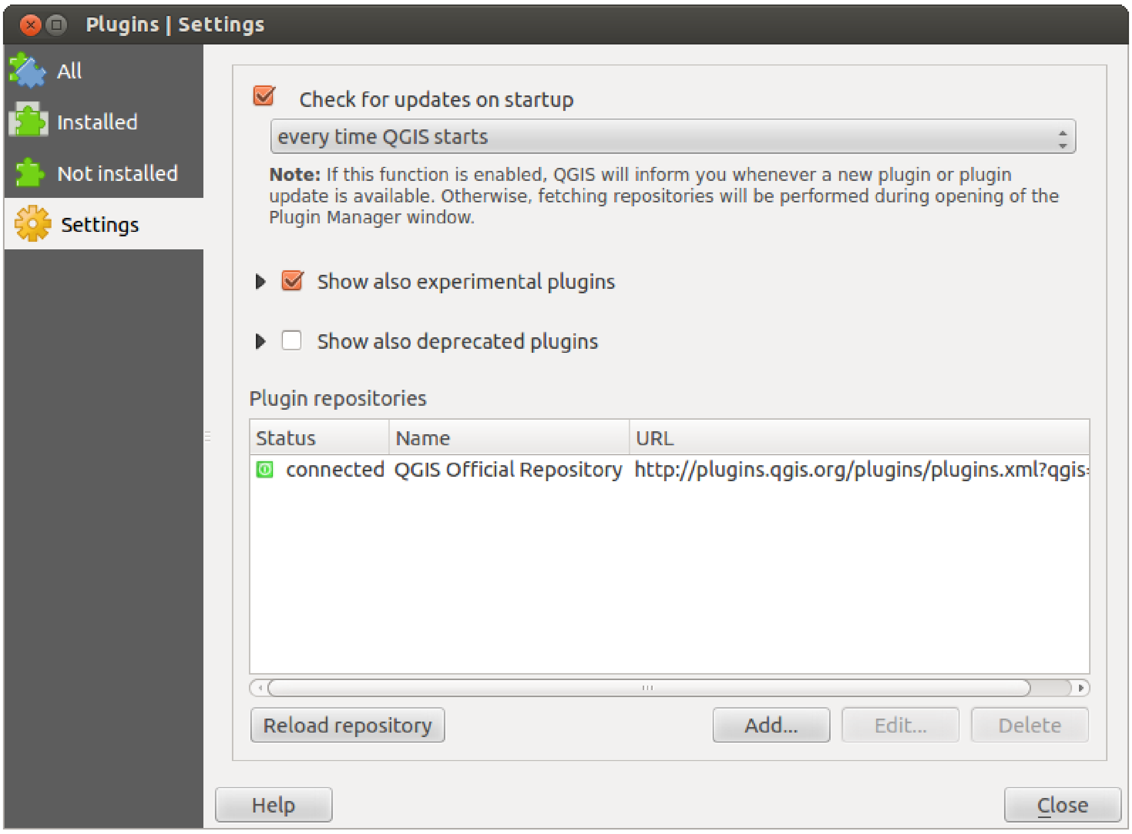
Gambar 19.3: Menu *Tidak terpasang*



Gambar 19.4: Menu *Upgradeable*

- *Tampikan juga plugin eksperimental*. QGIS akan menunjukkan plugin di tahap awal pengembangan, yang umumnya tidak cocok untuk penggunaan produksi.
- *Tampilkan juga plugin usang*. Plugin ini usang dan umumnya tidak cocok untuk penggunaan produksi.

Untuk menambah repositori penulis eksternal, klik **[Tambah...]** dalam bagian *Plugin repositori*. Jika Anda tidak ingin salah satu atau lebih dari repositori ditambahkan, mereka dapat dinonaktifkan melalui tombol **[Edit...]**, atau benar-benar dihapus dengan tombol **[Hapus]**.



Gambar 19.5: Menu *Settings*

Fungsi *Cari* tersedia di hampir setiap menu (kecuali *Pengaturan*). Di sini, Anda dapat mencari plugin tertentu.

Tip: Plugin inti dan eksternal

Plugin QGIS diimplementasikan dengan baik sebagai **Plugin Inti** atau **Plugin Eksternal**. **Plugin Inti** dipelihara oleh Tim Pengembangan QGIS dan secara otomatis bagian dari setiap distribusi QGIS. Mereka ditulis dalam salah satu dari dua bahasa: C++ atau Python. **Plugin Eksternal** saat ini ditulis menggunakan Python. Mereka disimpan dalam repositori eksternal dan dipelihara oleh penulis individu.

Dokumentasi rinci tentang penggunaan, minimum versi QGIS, homepage, penulis, dan informasi penting lainnya yang disediakan untuk Repositori 'Resmi' QGIS di http://plugins.qgis.org/plugins/. Untuk repositori eksternal lainnya, mungkin tersedia dengan plugin eksternal sendiri. Secara umum tidak termasuk dalam panduan ini.

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19.2 Menggunakan QGIS Plugin Inti

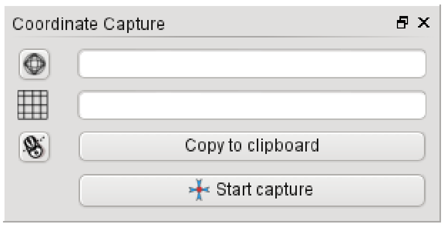
Ikon	Plugin	Deskripsi	Referensi Panduan
	Tangkapan Koordinat	Tetikus menangkap koordinat di CRS yang berbeda	:ref:'coordcapt
	Pengelola DB	Mengelola basis data Anda dengan QGIS	*Plugin Pengelola DB*
	Pengubah DXF2Shape	Mengubah berkas format dari DXF ke SHP	*Plugin Pengonversi Dxf2Shp*
	eVis	Alat Visualisasi	*Plugin eVis*
	fTools	Perangkat alat vektor	*Plugin fTools*
	Perangkat GPS	Alat untuk bongkar impor data GPS	*GPS Plugin*
	GRASS	Fungsionalitas GRASS	*GRASS GIS Integration*
	Alat GDAL	Fungsionalitas raster GDAL	*Plugin Peralatan GDAL*
	Pemberi Georeferensi GDAL	Georeferensi Raster dengan GDAL	*Plugin Georeferencer*
	Heatmap	Membuat heatmap raster dari memasukkan titik vektor	*Plugin Heatmap*
	Plugin Interpolasi	Interpolasi pada dasar simpul dari lapisan vektor	*Plugin Interpolasi*
	Menyunting di luar jaringan	Penyuntingan di luar jaringan dan sinkronisasi dengan basis data	*Plugin Mengedit Diluar Jaringan (Offline)*
	Oracle Spasial Georaster	Akses Oracle Spasial GeoRaster	*Plugin Spasial Oracle GeoRaster*
	Pengelola Plugin	Mengelola inti dan plugin eksternal	*The Plugins Menus*
	Analisis Raster Terrain	Fitur menghitung geomorfologi dari DEM	*Plugin Raster Analisis Terrain*
	Plugin Grafik Jalan	Analisis jalur terpendek	*Plugin Grafik Jalan*
	Plugin SQL Anywhere	Akses SQL dimanapun DB	*Plugin SQL Anywhere*
	Query Spasial	Query spasial pada vektor	*Plugin Spasial Query*
	SPIT	Alat Impor Shapefile ke PostgreSQL/PostGIS	*Plugin SPIT*
	Statistik Zonal	Hitung statistik raster untuk poligon vektor	*Plugin Statistik Zonal*

.

19.3 Plugin Mengambil Koordinat

Plugin Mengambil Koordinat mudah digunakan dan memberikan kemampuan menampilkan koordinat di kanvas peta untuk dua Sistem Koordinat Referensi (CRS) dipilih.

1. Mulai QGIS, pilih *Proyek Properti* dari menu *Pengaturan* (KDE, Windows) atau *Berkas* (Gnome, OSX) dan klik tab *Proyeksi*. Sebagai alternatif, Anda juga bisa klik ikon CRS status di sudut kanan bawah status bar.



Gambar 19.6: Plugin Mengambil Koordinat

2. Klik pada kotak centang *Aktifkan proyeksi on the fly* dan pilih proyeksi sistem koordinat dari yang Anda pilih (lihat juga *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. Klik pada ikon Klik pilih CRS untuk menampilkan koordinat dan memilih CRS berbeda dari yang Anda pilih di atas.
5. Untuk mulai mengambil koordinat, klik pada **[Mulai ambil]**. Sekarang Anda dapat mengklik di mana saja di kanvas peta dan plugin akan menampilkan koordinat untuk kedua CRS yang Anda pilih.
6. Untuk mengaktifkan tetikus pelacak koordinat, klik ikon pelacak tetikus.
7. Anda juga bisa menyalin koordinat yang dipilih ke papanklip.

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19.4 Plugin Pengelola DB

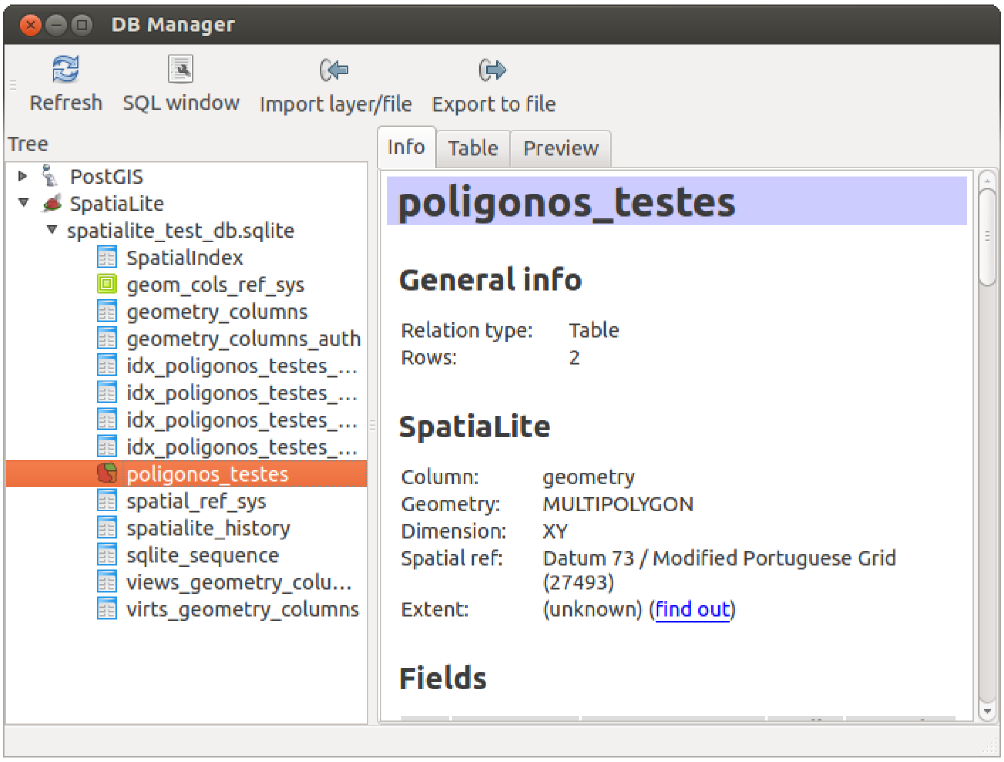
Plugin Pengelola DB resmi bagian dari inti QGIS dan bermaksud untuk menggantikan Plugin SPIT dan tambahan untuk mengintegrasikan semua format basisdata lain yang didukung oleh QGIS dalam satu antarmuka pengguna. Plugin Manajer DB menyediakan beberapa fitur. Anda dapat menggeser lapisan dari Penjelajah QGIS ke Pengelola DB dan akan mengimpor lapisan Anda ke dalam basisdata spasial Anda. Anda dapat menggeser dan menempatkan tabel antar basisdata spasial dan mereka akan diimpor. Anda juga dapat menggunakan Pengelola DB untuk mengeksekusi query SQL terhadap basisdata spasial Anda dan kemudian melihat keluaran spasial untuk queries dengan menambahkan hasilnya ke QGIS sebagai lapisan query.

Menu *Basisdata* memungkinkan untuk terhubung ke basisdata yang sudah ada, untuk memulai SQL-Window dan untuk keluar dari Plugin Pengeloa DB. Satu Anda terhubung ke basisdata yang sudah ada, menu *Skema* dan *Tabel* tambahan muncul.

Menu *Skema* termasuk alat untuk membuat dan menghapus (kosong) skema dan, jika topologi tersedia (seperti PostGIS 2) untuk memulai *TopoViewer*.

Menu *Tabel* memungkinkan untuk membuat dan mengedit tabel dan menghapus tabel dan tampilan. Hal ini juga memungkinkan untuk mengosongkan tabel dan untuk memindahkan tabel dari skema satu ke skema lain. Seperti fungsionalitas lebih lanjut Anda dapat melakukan VACUUM dan kemudian ANALYZE untuk setiap tabel yang dipilih. VACUUM sederhana mengambil kembali ruang dan membuatnya tersedia untuk digunakan kembali dan ANALYZE update statistik untuk menentukan cara yang paling efisien untuk mengeksekusi query. Akhirnya Anda dapat mengimpor lapisan/berkas, jika mereka dimuat dalam QGIS atau ada dalam sistem berkas. Dan Anda dapat mengekspor tabel basisdata untuk Shape dengan fitur Ekspor berkas.

Jendela *Tree* daftar semua database yang ada didukung oleh QGIS. Dengan doble-klik Anda bisa koneksi ke basisdata. Dengan tombol tetikus-kanan Anda bisa mengubah nama dan menghapus skema dan tabel yang ada. Tabel juga dapat ditambahkan ke kanvas QGIS dengan menu konteks.



Gambar 19.7: Dialog Pengelola DB

Jika terkoneksi ke sebuah basisdata, jendela **utama** dari Pengelola DB menyediakan tiga tab. Tab *Info* memberikan informasi tentang tabel dan geometri serta tentang kolom yang ada, Kendala dan Indeks. Hal ini juga memungkinkan untuk menjalankan Vacuum Analis dan untuk membuat indeks spasial pada tabel yang dipilih, jika belum melakukannya. Tab *Tabel* menampilkan semua atribut dan tab *Pratinjau* render geometri sebagai pratinjau.

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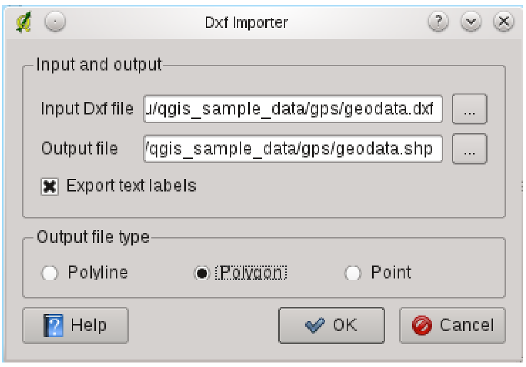
19.5 Plugin Pengonversi Dxf2Shp

Plugin pengonversi dxf2shape dapat digunakan untuk mengkonversi data vektor dari DXF ke format Shapefile. Hal ini membutuhkan parameter berikut harus ditentukan sebelum menjalankan:



Gambar 19.8: Plugin Pengonversi Dxf2Shp

- **Masukan berkas DXF**: Masukkan path ke berkas DXF yang akan dikonversi.
- **Keluaran berkas SHP**: Masukkan nama yang diinginkan dari Shapefile yang akan dibuat.

- **Keluaran tipe berkas**: Tentukan jenis geometri keluaran Shapefile. Saat ini jenis yang didukung adalah polyline, polygon, dan titik.
- **Ekspor label teks**: Ketika kotak centang ini diaktifkan, lapisan titik Shapefile tambahan akan dibuat, dan tabel DBF terkait akan berisi informasi tentang kolom "TEXT" yang ditemukan dalam berkas DXF, dan teks string mereka sendiri.

19.5.1 Menggunakan Plugin

1. Mulai QGIS, muat plugin Dxf2Shape di Manajer Plugin (lihat Bagian *The Plugins Menus*) dan klik pada ikon Pengonversi Dxf2Shape yang muncul di menu toolbar QGIS. Dialog plugin Dxf2Shape akan muncul seperti Figure_dxf2shape_1.
2. Masukkan berkas DXF, nama untuk keluaran Shapefile dan jenis Shapefile.
3. Aktifkan kotak centang *Ekspor teks label* jika Anda ingin membuat lapisan titi ekstra dengan label.
4. Klik **[OK]**.

.

19.6 Plugin eVis

(Bagian ini berasal dari Horning, N., K. Koy, P. Ersts. 2009. eVis (v1.1.0) User's Guide. American Museum of Natural History, Center for Biodiversity and Conservation. Tersedia di http://biodiversityinformatics.amnh.org/, dan dirilis di bawah GNU FDL.)

The Biodiversity Informatics Facility at the American Museum of Natural History's (AMNH) Center for Biodiversity and Conservation (CBC) has developed the Event Visualization Tool (eVis), another software tool to add to the suite of conservation monitoring and decision support tools for guiding protected area and landscape planning. This plugin enables users to easily link geocoded (i.e., referenced with latitude and longitude or X and Y coordinates) photographs, and other supporting documents, to vector data in QGIS.

Sekarang eVis secara otomatis terpasang dan diaktifkan pada QGIS versi baru, dan seperti semua plugin, dapat dinonaktifkan dan diaktifkan menggunakan Manajer Plugin (lihat *The Plugins Menus*).

Plugin Evis terdiri dari tiga modul: 'Alat sambungan basisdata', 'Alat ID Event', dan 'Navigasi Event'. Bekerja sama untuk melihat foto geocoded dan dokumen lain yang terkait dengan fitur disimpan dalam berkas vektor, database, atau spreadsheet.

19.6.1 Navigasi Event

Modul 'Event Browser' menyediakan fungsi tampilan foto geo kode yang memiliki tautan pada fitur vektor yang tampil dalam jendela peta lqgl. Data titik, sebagai contoh, dapat terbentuk dari berkas vektor yang dapat diinput menggunakan lqgl atau dapat juga dengan menggunakan hasil 'query' basis data. Fitur vektor wajib memiliki atribut informasi yang berhubungan dengannya sehubungan dengan lokasi dan nama berkas yang berisi foto dan, opsional, arah mata angin sudut pengambilan gambar. Lapisan vektor wajib dimuat dalam lqgl sebelum menjalankan 'Event Browser'.

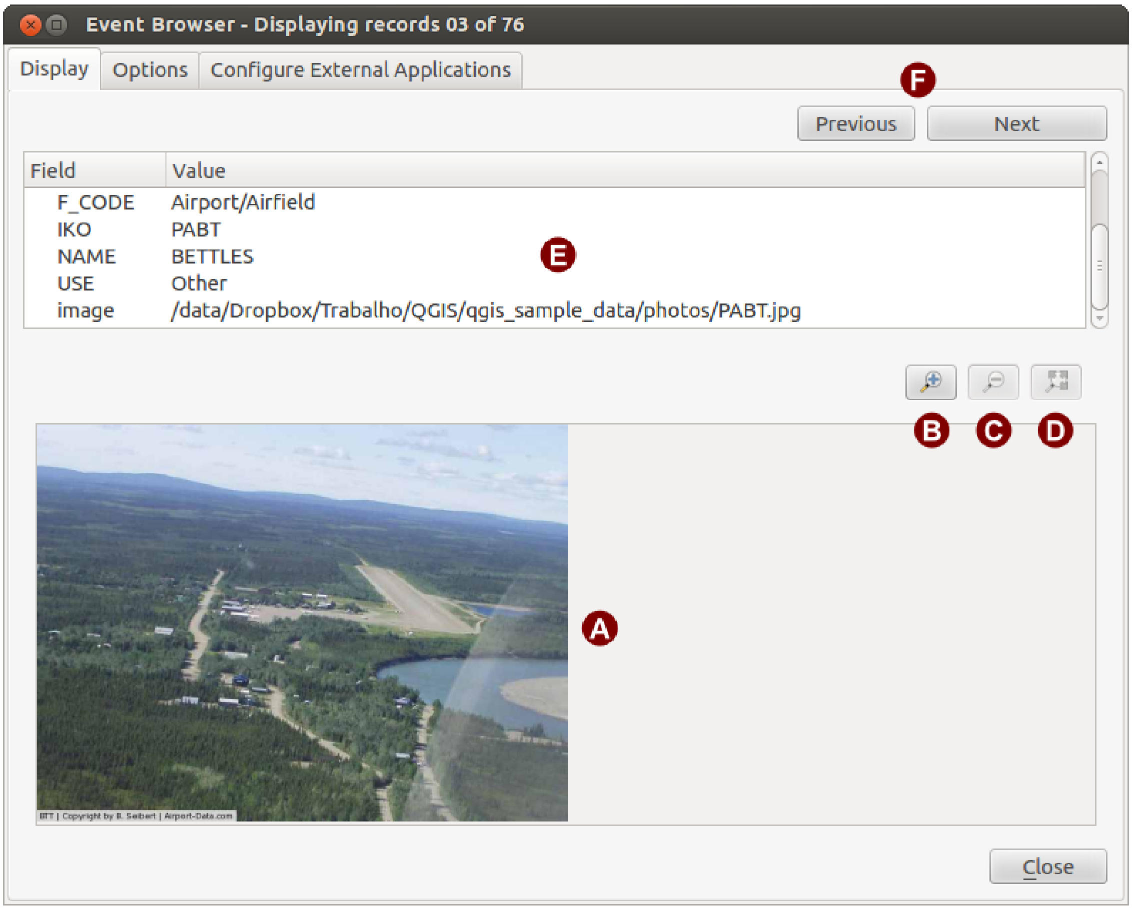
Peluncuran modul Navigasi Event

Meluncurkan Modul Navigasi Kegiatan, klik *Basisdata* → *eVis* → *eVis Navigasi Kegiatan*. Akan membuka jendela *Navigasi Kegiatan Umum*.

The *Event Browser* window has three tabs displayed at the top of the window. The *Display* tab is used to view the photograph and its associated attribute data. The *Options* tab provides a number of settings that can be adjusted to control the behavior of the eVis plugin. Lastly, the *Configure External Applications* tab is used to maintain a table of file extensions and their associated application to allow eVis to display documents other than images.

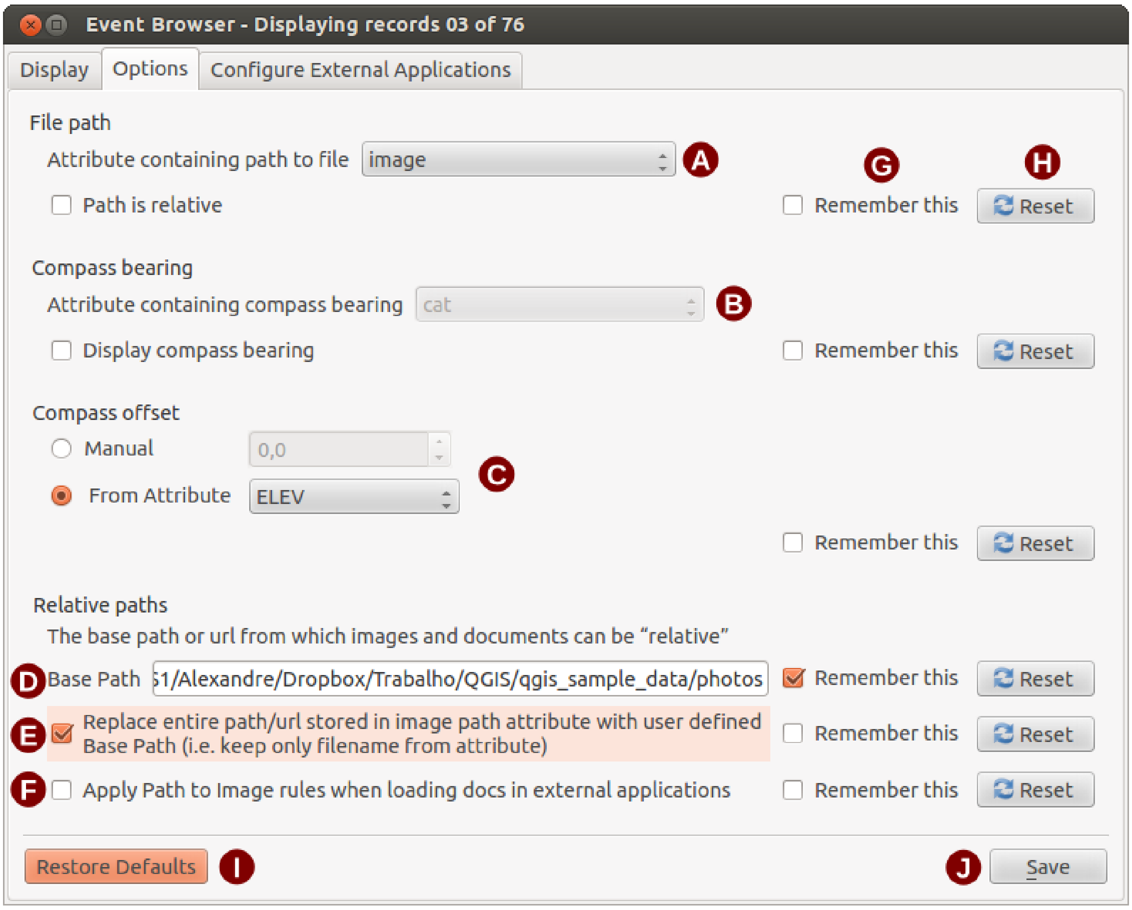
Memahami jendela Tampilan

Melihat jendela *Tampilan*, klik tab *Tampilan* di jendela *Navigasi Kegiatan*. Jendela *Tampilan* digunakan untuk melihat foto-foto geocoded dan data atribut yang terkait.



Gambar 19.9: Tampilan jendela *eVis*

1. **Jendela Tampilan**: Sebuah jendela di mana foto itu akan muncul.
2. **Tombol memperbesar**: Memperbesar untuk melihat lebih detil. Jika seluruh gambar tidak dapat ditampilkan di jendela layar, scroll bar akan muncul di sisi kiri dan bawah jendela untuk memungkinkan Anda untuk menjelajah gambar.
3. **Tombol memperkecil**: Memperkecil untuk melihat lebih banyak daerah.
4. **Perbesar ke seluruh area**: Menampilkan secara penuh dari foto.
5. **Attribute information window**: All of the attribute information for the point associated with the photograph being viewed is displayed here. If the file type being referenced in the displayed record is not an image but is of a file type defined in the *Configure External Applications* tab, then when you double-click on the value of the field containing the path to the file, the application to open the file will be launched to view or hear the contents of the file. If the file extension is recognized, the attribute data will be displayed in green.
6. **Tombol navigasi**: Gunakan tombol Sebelumnya dan Berikutnya untuk memuat fitur sebelumnya atau berikutnya ketika lebih dari satu fitur yang dipilih.

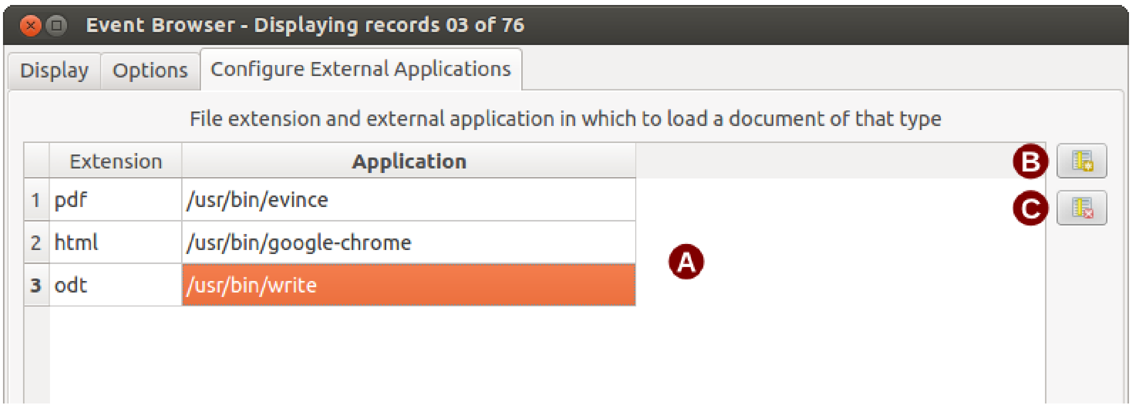


Gambar 19.10: Jendela Opsi *eVis*

Memahami jendela Opsi

1. **File path**: A drop-down list to specify the attribute field that contains the directory path or URL for the photographs or other documents being displayed. If the location is a relative path, then the checkbox must be clicked. The base path for a relative path can be entered in the *Base Path* text box below. Information about the different options for specifying the file location are noted in the section *Menentukan lokasi dan nama dari sebuah foto* below.
2. **Compass bearing**: A drop-down list to specify the attribute field that contains the compass bearing associated with the photograph being displayed. If compass bearing information is available, it is necessary to click the checkbox below the drop-down menu title.
3. **Compass offset**: Compass offsets can be used to compensate for declination (to adjust bearings collected using magnetic bearings to true north bearings). Click the *Manual* radio button to enter the offset in the text box or click the *From Attribute* radio button to select the attribute field containing the offsets. For both of these options, east declinations should be entered using positive values, and west declinations should use negative values.
4. **Path direktori dasar**: Path dasar ke mana path relatif didefinisikan dalam Figure_eVis_2 (A) akan ditambahkan.
5. **Ganti path**: Jika kotak centang ini diperiksa, hanya nama berkas dari A akan ditambahkan ke basis path.
6. **Apply rule to all documents**: If checked, the same path rules that are defined for photographs will be used for non-image documents such as movies, text documents, and sound files. If not checked, the path rules will only apply to photographs, and other documents will ignore the base path parameter.
7. **Ingat pengaturan**: Jika kotak centang dicentang, nilai-nilai untuk parameter terkait akan disimpan untuk sesi berikutnya ketika jendela ditutup atau bila tombol ** [Simpan] ** di bawah ditekan.
8. **Atur ulang nilai**: Mengatur ulang nilai pada baris ini ke pengaturan default.
9. **Kembali ke default**: Ini akan mengatur ulang semua kolom ke pengaturan default. Memiliki efek yang sama seperti mengklik tombol **[Atur Ulang]**.
10. **Simpan**: Akan menyimpan pengaturan tanpa menutup panel *Opsi*.

Memahami jendela Konfigurasi Aplikasi Eksternal



Gambar 19.11: Jendela Aplikasi Eksternal *eVis*

1. **Tabel referensi berkas**: Sebuah tabel yang berisi jenis berkas yang dapat dibuka dengan menggunakan eVis. Setiap jenis berkas membutuhkan ekstensi berkas dan path ke aplikasi yang dapat membuka jenis berkas. Hal ini memberikan kemampuan membuka berbagai berkas seperti film, rekaman suara, dan dokumen teks, bukan hanya gambar.
2. **Tambah jenis berkas baru**: Tambahkan jenis berkas baru dengan ekstensi yang unik dan path untuk aplikasi yang dapat membuka berkas.

3. **Hapus baris saat ini**: Menghapus jenis berkas yang disorot dalam tabel dan didefinisikan oleh ekstensi berkas dan path ke sebuah aplikasi terkait.

19.6.2 Menentukan lokasi dan nama dari sebuah foto

The location and name of the photograph can be stored using an absolute or relative path, or a URL if the photograph is available on a web server. Examples of the different approaches are listed in Table 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 Menentukan lokasi dan nama dokumen pendukung lainnya

Supporting documents such as text documents, videos, and sound clips can also be displayed or played by eVis. To do this, it is necessary to add an entry in the file reference table that can be accessed from the *Configure External Applications* window in the *Generic Event Browser* that matches the file extension to an application that can be used to open the file. It is also necessary to have the path or URL to the file in the attribute table for the vector layer. One additional rule that can be used for URLs that don't contain a file extension for the document you want to open is to specify the file extension before the URL. The format is — `file extension:URL`. The URL is preceded by the file extension and a colon; this is particularly useful for accessing documents from wikis and other web sites that use a database to manage the web pages (see Table evis_examples).

19.6.4 Menggunakan Navigasi Event

When the *Event Browser* window opens, a photograph will appear in the display window if the document referenced in the vector file attribute table is an image and if the file location information in the *Options* window is properly set. If a photograph is expected and it does not appear, it will be necessary to adjust the parameters in the *Options* window.

If a supporting document (or an image that does not have a file extension recognized by eVis) is referenced in the attribute table, the field containing the file path will be highlighted in green in the attribute information window if that file extension is defined in the file reference table located in the *Configure External Applications* window. To open the document, double-click on the green-highlighted line in the attribute information window. If a supporting document is referenced in the attribute information window and the file path is not highlighted in green, then it will be necessary to add an entry for the file's filename extension in the *Configure External Applications* window. If the file path is highlighted in green but does not open when double-clicked, it will be necessary to adjust the parameters in the *Options* window so the file can be located by eVis.

If no compass bearing is provided in the *Options* window, a red asterisk will be displayed on top of the vector feature that is associated with the photograph being displayed. If a compass bearing is provided, then an arrow will appear pointing in the direction indicated by the value in the compass bearing display field in the *Event Browser* window. The arrow will be centered over the point that is associated with the photograph or other document.

Menutup jendela *Navigasi kegiatan*, klik tombol **[Tutup]** dari jendela *Tampilan*.

19.6.5 Alat ID Event

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.

Peluncuran modul ID Event

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.

To view the photographs linked to vector features in the active vector layer displayed in the QGIS map window, move the Event ID cursor over the feature and then click the mouse. After clicking on the feature, the *Event Browser* window is opened and the photographs on or near the clicked locality are available for display in the browser. If more than one photograph is available, you can cycle through the different features using the **[Previous]** and **[Next]** buttons. The other controls are described in the ref:*evis_browser* section of this guide.

19.6.6 Sambungan Basisdata

Modul 'Sambungan Basisdata' menyediakan alat untuk menghubungkan dan query basisdata atau sumber daya ODBC lainnya, seperti spreadsheet.

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.

Peluncuran modul Sambungan Basisdata

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.

Menyambung ke basisdata

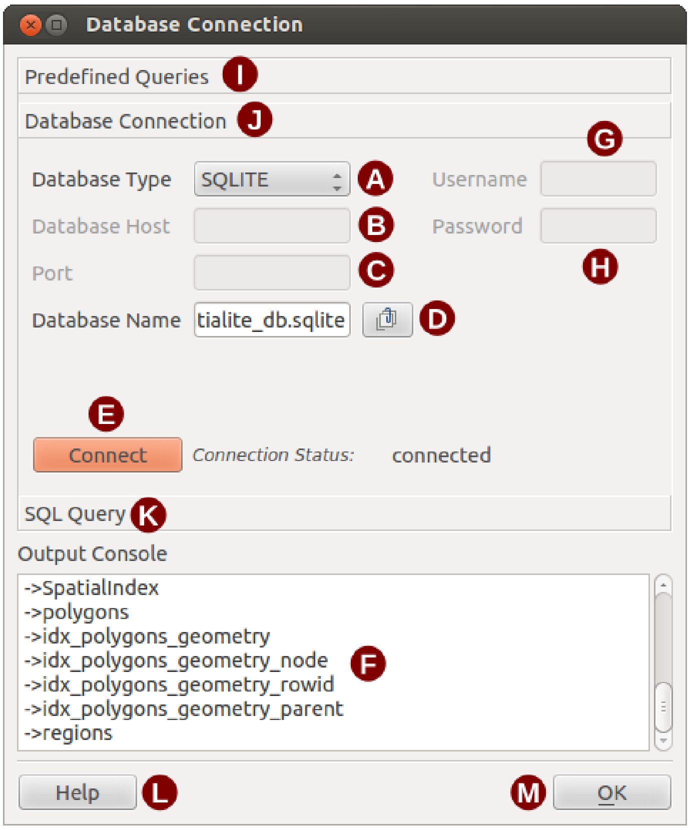
Click on the *Database Connection* tab to open the database connection interface. Next, use the *Database Type* combo box to select the type of database that you want to connect to. If a password or username is required, that information can be entered in the *Username* and *Password* textboxes.

Enter the database host in the *Database Host* textbox. This option is not available if you selected 'MS Access' as the database type. If the database resides on your desktop, you should enter "localhost".

Masukkan nama basisdata di kotak teks *Nama Basisdata*. Jika Anda memilih 'ODBC' sebagai tipe basisdata, Anda harus memasukkan nama sumber data.

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. **Tipe database**: Sebuah daftar drop-down untuk menentukan jenis basisdata yang akan digunakan.
2. **Host Basisdata**: Nama host basisdata.
3. **Port**: Nomor port jika MySQL atau PostgreSQL tipe database yang dipilih.
4. **Nama Basisdata**: Nama dari basisdata.
5. **Sambung**: Sebuah tombol untuk menghubungkan ke basisdata menggunakan parameter yang didefinisikan di atas.
6. **Keluaran Konsol**: Jendela konsol di mana pesan yang terkait dengan pengolahan akan ditampilkan.
7. **Namapengguna**: Namapengguna/Username untuk digunakan ketika basisdata dilindungi kata sandi/password.
8. **Kata sandi**: Kata sandi/Password digunakan ketika basisdata dilindungi kata sandi.



Gambar 19.12: Jendela Sambungan Basisdata *eVis*

9. **Query yang ditentukan**: Tab untuk membuka jendela "Query yang ditentukan".
10. **Sambungan Basisdata**: Tab membuka jendela "Sambungan Basisdata".
11. **Query SQL**: Tab membuka jendela "Query SQL".
12. **Bantuan**: Tampilan bantuan dalam jaringan.
13. **OK**: Tutup jendela utama "Sambungan Basisdata".

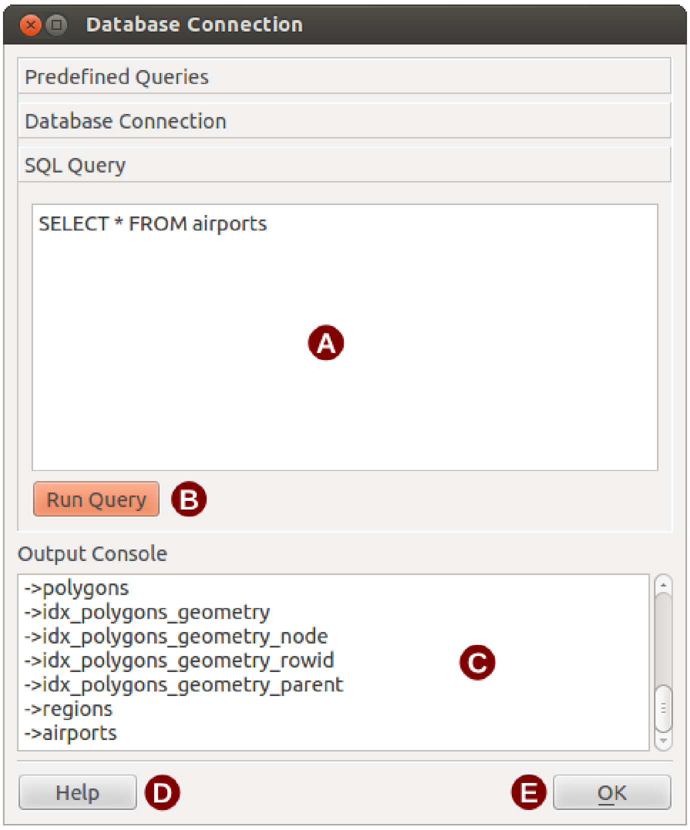
Menjalankan query SQL

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.

Di jendela *Pilih Berkas Basisdata*, masukkan nama lapisan yang akan dibuat dari hasil query dalam kotak teks *Nama Lapisan Baru*.

1. **Jendela Teks Query SQL**: Sebuah layar untuk mengetik query-query SQL.
2. **Jalankan Query**: Tombol untuk mengeksekusi query dimasukkan dalam *Jendela Query SQL*.
3. **Jendela Konsol**: Jendela konsol di mana pesan yang terkait dengan pengolahan akan ditampilkan.
4. **Bantuan**: Tampilan bantuan dalam jaringan.



Gambar 19.13: Tab query SQL eVis

5. **OK**: Menutup jendela *Sambungan Basisdata*.

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.

To save this vector file for future use, you can use the QGIS 'Save as...' command that is accessed by right-clicking on the layer name in the QGIS map legend and then selecting 'Save as...'

Tip: Membuat lapisan vektor dari Microsoft Excel Worksheet

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.

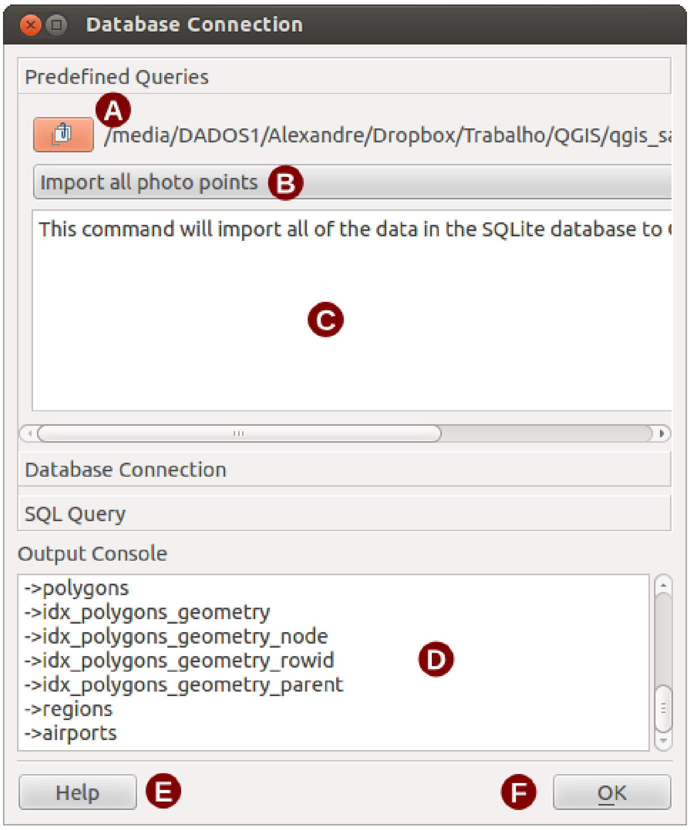
Menjalankan query-query yang ditentukan

With predefined queries, you can select previously written queries stored in XML format in a file. This is particularly helpful if you are not familiar with SQL commands. Click on the *Predefined Queries* tab to display the predefined query interface.

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.

Select the query you want to run from the drop-down menu and then click on the *SQL Query* tab to see that the query has been loaded into the query window. If it is the first time you are running a predefined query or are switching databases, you need to be sure to connect to the database.

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.



Gambar 19.14: Tab *eVis* Queri Ditentukan

1. **Buka Berkas**: Meluncurkan “Buka Berkas” navigasi berkas untuk mencari berkas XML memegang query yang telah ditetapkan.
2. **Query Ditentukan**: Sebuah daftar drop-down dengan semua query yang didefinisikan oleh query berkas XML yang telah ditetapkan.
3. **Deskripsi Query**: Sebuah deskripsi singkat dari query. Deskripsi ini adalah dari query yang telah ditentukan berkas XML.
4. **Jendela Konsol**: Jendela konsol di mana pesan yang terkait dengan pengolahan akan ditampilkan.
5. **Bantuan**: Tampilan bantuan dalam jaringan.
6. **OK**: Tutup jendela utama “Sambungan Basisdata”.

Format XML untuk eVis query yang ditentukan

Tag XML dibaca oleh eVis

Tag	Deskripsi
query	Mendefinisikan awal dan akhir dari pernyataan query.
deskripsi singkat	Sebuah deskripsi singkat dari query yang muncul dalam menu drop-down eVis.
deskripsi	Penjelasan lebih rinci dari query ditampilkan dalam jendela teks Query yang Ditentukan.
tipebasis-data	Tipe basisdata, yang didefinisikan dalam menu drop-down Tipe Basisdata dalam tab Sambungan Basisdata.
portbasis-data	Port sebagaimana didefinisikan dalam kotak teks Port di tab Sambungan Basisdata.
namaba-sisdata	Nama basisdata sebagaimana dimaksud dalam Nama Basisdata kotak teks dalam tab Sambungan Basisdata.
uername-baisdata	Nama pengguna basisdata sebagai didefinisikan dalam kotak teks Nama pengguna dalam tab Sambungan Basisdata.
katasandiba-sisdata	Kata sandi basisdata seperti yang didefinisikan dalam kotak teks Kata sandi di tab Sambungan Basisdata.
sqlstate-ment	Perintah SQL.
sambun-gotomatis	Sebuah bendera (“true” “atau” false ”) untuk menentukan apakah tag di atas harus digunakan secara otomatis terhubung ke basisdata tanpa menjalankan sambungan basisdata rutin dalam tab Sambungan Basisdata.

Contoh berkas XML lengkap dengan tiga query ditampilkan di bawah ini:

```
<?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>
```

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19.7 Plugin fTools

Tujuan dari plugin fTools Python adalah menyediakan one-stop sumber daya untuk banyak tugas GIS umum berbasis vektor, tanpa perlu software tambahan, perpustakaan, atau kompleks solusinya. Menyediakan paket pengelolaan data spasial dan fungsi analisis yang baik cepat dan fungsional.

fTools sekarang otomatis terpasang dan aktif dalam QGIS versi terbaru, dan seperti semua plugin, bisa dinonaktifkan dan diaktifkan menggunakan Pengelola Plugin (Lihat Bagian *load_core_plugin*). Ketika diaktifkan, plugin fTools menambahkan menu *Vektor* ke QGIS, menyediakan fungsi mulai dari Peralatan Analisis dan Riset ke Peralatan Geometri dan Geoprocessing, serta beberapa Peralatan Tata Kelola Data yang berguna.

19.7.1 Alat Analisis

Ikon	Alat	Kegunaan
	Jarak Matriks	Ukur jarak antara dua lapisan titik, dan hasil keluarannya a) Matriks jarak Square, b) Matriks jarak Linear, atau c) Ringkasan dari jarak. Dapat membatasi jarak ke k fitur terdekat.
	Sum panjang garis	Hitung jumlah total garis panjang untuk setiap poligon dari lapisan vektor poligon.
	Poin di poligon	Hitung jumlah poin yang terjadi pada setiap poligon dari masukan lapisan vektor poligon.
	Daftar nilai unik	Daftar semua nilai unik di dalam masukan kolom lapisan vektor
	Dasar statistik	Hitung statistik dasar (rata-rata, std dev, N, sum, CV) pada koom masukan.
	Analisis tetangga terdekat	Menghitung Statistik tetangga terdekat, menilai tingkat pengelompokan dalam lapisan titik vektor
	Koordinat Mean	Hitung pusat rata-rata normal atau tertimbang dari seluruh lapisan vektor, atau beberapa fitur berdasarkan kolom ID unik.
	Persimpangan garis	Cari persimpangan antara garis, dan hasil keluaran sebagai titik shapefile. Berguna untuk mencari persimpangan jalan atau sungai, mengabaikan persimpangan garis dengan panjang > 0.

Tabel Ftools 1: fTools Analysis tools

19.7.2 Peralatan Riset

Ikon	Alat	Kegunaan
	Seleksi Random	Secara acak memilih nomor n dari fitur, atau persentase n dari fitur.
	Seleksi acak dalam subset	Secara acak memilih fitur dalam subset berdasarkan kolom ID unik.
	Poin Acak	Menghasilkan poin pseudo-acak atas masukan lapisan yang diberikan.
	Poin reguler	Menghasilkan kotak biasa dari poin atas wilayah tertentu dan ekspor mereka sebagai titik shapefile.
	Kotak vektor	Menghasilkan kotak garis atau poligon yang didasarkan pada pengguna jaringan jarak tertentu.
	Pilih dari lokasi	Pilih fitur berdasarkan lokasi relatif mereka terhadap lapisan lain untuk membentuk pilihan baru, atau menambah atau mengurangi dari pilihan saat ini.
	Poligon dari lapisan batas	Buat layer poligon persegi panjang tunggal dari luasnya sebuah masukan lapisan raster atau lapisan vektor.

Tabel Ftools 2: fTools Research tools

19.7.3 Peralatan Geoprocessing

Ikon	Alat	Kegunaan
	Convex hull(s)	Buat convex hull minimum untuk masukan lapisan, atau berdasarkan kolom ID.
	Penyangga	Buat penyangga sekitar fitur berdasarkan jarak, atau kolom jarak.
	Memotong	Tampilan lapisan-lapisan seperti keluaran berisi daerah di mana kedua lapisan berpotongan.
	Penggabungan	Tampilan lapisan-lapisan seperti keluaran berisi daerah berpotongan dan non-berpotongan.
	Perbedaan simetrik	Tampilan lapisan seperti keluaran berisi daerah-daerah dari masukan dan perbedaan lapisan yang tidak berpotongan.
	Klip	Tampilan lapisan seperti keluaran berisi daerah yang bersinggungan lapisan klip.
	Perbedaan	Tampilan lapisan seperti keluaran yang berisi daerah yang tidak memotong lapisan klip.
	Larut	Menggabungkan fitur berdasarkan masukan bidang. Semua fitur dengan nilai masukan yang identik digabungkan untuk membentuk satu fitur tunggal.
	Menghilangkan poligon sepotong	Menggabungkan fitur yang dipilih dengan poligon tetangga dengan daerah terbesar atau batas umum terbesar.

Tabel Ftools 3: fTools Peralatan Geoprocessing

19.7.4 Peralatan Geometri

Ikon	Alat	Kegunaan
	Periksa validitas geometri	Periksa poligon untuk persimpangan, ditutup-lubang, dan memperbaiki pengurutan node.
	Ekspor/Tambah kolom geometri	Tambah lapisan vektor geometri ke lapisan poin (XCOORD, YCOORD), garis (LENGTH), atau poligon (AREA, PERIMETER).
	Polygon centroids	Menghitung centroid berlaku untuk setiap poligon dalam masukan lapisan poligon.
	Triangulasi Delaunay	Menghitung dan keluaran (sebagai poligon) triangulasi Delaunay dari masukan lapisan vektor titik.
	Poligon Voronoi	Menghitung poligon voronoi dari masukan lapisan vektor.
	Sederhanakan geometri	Generalisasi garis atau poligon dengan algoritma Douglas-Peucker dimodifikasi.
	Geometri densify	Densify garis atau poligon dengan menambahkan simpul.
	Multipart ke singgelpart	Mengkonversi fitur multipart ke beberapa fitur singgelpart. Membuat poligon dan garis sederhana.
	Singgelpart ke multipart	Merge beberapa fitur ke fitur tunggal berdasarkan kolom ID unik.
	Poligon ke garis	Mengkonversi poligon ke garis, poligon multipart untuk beberapa garis singgelpart.
	Garis ke poligon	Mengkonversi garis ke poligon, garis multi ke beberapa bagian poligon tunggal.
	Ekstrak simpul	Ekstrak simpul dari lapisan garis dan poligon dan keluaran mereka sebagai poin.

Tabel Ftools 4: fTools Peralatan Geometri

Catatan: Alat *Menyederhanakan geometri* dapat digunakan untuk menghapus simpul duplikat di garis dan poligon geometri, hanya mengatur parameter *Menyederhanakan toleransi* ke 0 dan ini akan melakukan trik.

19.7.5 Peralatan Tata Kelola Data

Ikon	Alat	Kegunaan
	Tentukan proyeksi sekarang	Tentukan CRS untuk shapefile yang CRS belum ditetapkan.
	Menggabung atribut sesuai lokasi	Menggabung dengan atribut tambahan ke lapisan vektor didasarkan pada hubungan spasial. Atribut dari satu lapisan vektor yang ditambahkan ke tabel atribut dari lapisan lain dan diekspor sebagai shapefile.
	Membagi lapisan vektor	Membagi lapisan masukan ke beberapa lapisan terpisah berdasarkan masukan kolom.
	Menggabung shapefile menjadi satu	Menggabungkan beberapa shapefile dalam folder ke dalam shapefile baru berdasarkan jenis lapisan (titik, garis, area).
	Membuat indeks spasial	Buat indeks spasial untuk yang didukung format OGR.

Tabel Ftools 5: fTools Peralatan Tata Kelola Data

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19.8 Plugin Peralatan GDAL

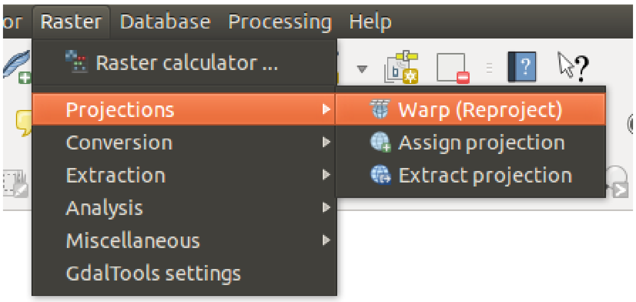
19.8.1 Apakah Peralatan GDAL itu?

Plugin Alat GDAL menawarkan GUI untuk koleksi alat dalam Geospatial Data Abstraction Library, http://gdal.osgeo.org. Ini adalah alat manajemen raster untuk query, re-proyek, warp dan menggabungkan berbagai format raster. Juga termasuk adalah alat untuk membuat lapisan kontur (vektor), atau relief shaded dari DEM raster, dan untuk membuat vrt (Virtual Raster Tile dalam format XML) dari koleksi satu atau lebih berkas raster. Alat ini tersedia bila plugin terpasang dan diaktifkan.

Perpustakaan GDAL

Perpustakaan GDAL terdiri dari satu set program baris perintah, masing-masing dengan daftar besar pilihan. Pengguna nyaman dengan menjalankan perintah dari terminal dapat memilih baris perintah, dengan akses pilihan set lengkap. Plugin alat GDAL menawarkan antarmuka yang mudah ke alat-alat, memperlihatkan hanya pilihan yang paling populer.

19.8.2 Daftar dari alat-alat GDAL



Gambar 19.15: Daftar menu *Alat-alat GDAL*

Proyeksi

Warp (Reproject)	Utilitas ini merupakan mosaicing gambar, proyeksi ulang dan warping utilitas. Program ini dapat proek ulang untuk setiap proyeksi yang didukung, dan juga dapat menerapkan GCPs disimpan dengan gambar jika gambar "raw" dengan informasi kontrol. Untuk informasi lebih lanjut Anda dapat membaca di situs GDAL http://www.gdal.org/gdalwarp.html
Menetapkan proyeksi	Alat ini memungkinkan menetapkan proyeksi untuk raster yang sudah bergeoreferensi tetapi informasi proyeksi keliru. Juga dengan membantu mengubah definisi proyeksi yang ada. Kedua berkas tunggal dan mode batch didukung. Untuk informasi lebih lanjut silakan kunjungi halaman utilitas di situs GDAL http://www.gdal.org/gdalwarp.html
Ekstrak proyeksi	Utilitas ini membantu Anda untuk mengekstrak informasi proyeksi dari berkas masukan. Jika Anda ingin mengambil proyeksi dari seluruh direktori Anda dapat menggunakan mode Batch. Ini menciptakan kedua berkas `.prj` dan `.wld`.

Konversi

Rasterize	Program ini membakar vektor geometri (titik, garis dan poligon) ke pita raster dari gambar raster. Vektor dibaca dari OGR yang didukung format vektor. Perhatikan bahwa data vektor harus sama sistem koordinat dengan data raster; pada proyeksi ulang fly tidak disediakan. Untuk informasi lebih lanjut lihat http://www.gdal.org/gdal_rasterize.html
Polygonize	Utilitas ini menciptakan vektor poligon untuk semua daerah piksel terhubung di raster berbagi nilai umum pixel. Setiap poligon dibuat dengan atribut yang menunjukkan nilai pixel poligon itu. Utilitas akan menciptakan keluaran sumber data vektor jika tidak sudah ada, default ke format shapefile ESRI. Lihat juga http://www.gdal.org/gdal_polygonize.html
Terjemahan	Utilitas ini dapat digunakan untuk mengkonversi data raster antar format yang berbeda, berpotensi melakukan beberapa operasi seperti subsettings, resampling, dan rescaling piksel dalam proses. Untuk informasi Anda bisa membaca di http://www.gdal.org/gdal_translate.html
RGB ke PCT	Utilitas ini akan menghitung tabel warna-pseudo yang optimal untuk citra RGB yang diberikan dengan menggunakan algoritma cut median pada RGB histogram downsampled. Kemudian mengubah gambar menjadi gambar berwarna-pseudo menggunakan tabel warna. Konversi ini menggunakan Floyd-Steinberg dithering (difusi error) untuk memaksimalkan keluaran visual gambar kualitas. Utilitas ini juga dijelaskan pada http://www.gdal.org/rgb2pct.html
PCT ke RGB	Utilitas ini akan mengkonversi sebuah pita pseudocolor pada berkas masukan ke berkas keluaran RGB dari format yang diinginkan. Untuk informasi lebih lanjut lihat http://www.gdal.org/pct2rgb.html

Ekstraksi

Kontur	Program ini menghasilkan berkas kontur vektor dari masukan data elevasi raster (DEM). Pada http://www.gdal.org/gdal_contour.html Anda bisa menemukan banyak informasi.
Clipper	Utilitas ini memungkinkan untuk klip (ekstrak bagian) raster menggunakan batas yang dipilih atau berdasarkan masker lapisan batas. Informasi lebih lanjut dapat ditemukan di http://www.gdal.org/gdal_translate.html.

Analisis

Sieve	Utilitas ini menghilangkan raster poligon lebih kecil dari ukuran ambang batas yang disediakan (dalam piksel) dan menggantikan mereka dengan nilai piksel dari tetangga poligon terbesar. Hasilnya dapat ditulis kembali ke pita raster yang sudah ada, atau disalin ke dalam sebuah berkas baru. Untuk informasi lebih lanjut, lihat http://www.gdal.org/gdal_sieve.html .
Hampir Hitam	Utilitas ini akan memindai gambar dan mencoba untuk mengatur semua piksel yang hampir hitam (atau hampir putih) di sekitar tepi persis hitam (atau putih). Hal ini sering digunakan untuk "fix up" berkurangnya kompresi foto udara sehingga warna piksel dapat diperlakukan sebagai transparan ketika mosaicing. Lihat juga http://www.gdal.org/nearblack.html .
Isi tidak ada data	Utilitas ini mengisi seleksi raster area (biasanya tidak ada data area) dengan interpolasi dari piksel yang valid di sekitar tepi area. Lihat juga http://www.gdal.org/gdal_fillnodata.html .
Kedekatan	Utilitas ini menghasilkan peta raster kedekatan menunjukkan jarak dari pusat setiap piksel ke pusat piksel terdekat diidentifikasi sebagai piksel sasaran. Target piksel adalah pada raster sumber yang nilai raster piksel di set dari nilai target piksel. Untuk informasi lebih lanjut, lihat http://www.gdal.org/gdal_proximity.html .
Kisi (Interpolasi)	Utilitas ini menciptakan kisi biasa (raster) dari data yang tersebar dibaca dari sumber data OGR. Masukan data akan diinterpolasi untuk mengisi node kisi dengan nilai-nilai, Anda dapat memilih dari berbagai metode interpolasi. Utilitas ini juga dijelaskan di situs GDAL http://www.gdal.org/gdal_grid.html .
DEM (Terrain model)	Alat untuk menganalisis dan memvisualisasikan DEM. Hal ini dapat membuat relief shaded, lereng, aspek, warna relief, Indeks Terrain Ketidakrataan, Indeks Posisi Topografi dan kekasaran peta dari setiap GDAL didukung elevasi raster. Untuk informasi lebih lanjut Anda dapat membaca pada http://www.gdal.org/gdaldem.html .

Bermacam-macam

Build Virtual Raster (Katalog)	Program ini membangun VRT (Virtual Dataset) yang merupakan mosaik dari daftar masukan dataset GDAL. Lihat juga http://www.gdal.org/gdalbuildvrt.html .
Gabung	Utilitas ini secara otomatis akan mosaik serangkaian gambar. Semua gambar harus dalam sistem koordinat yang sama dan memiliki sejumlah pencocokan pita, tetapi mereka mungkin tumpang tindih, dan pada resolusi yang berbeda. Di daerah-daerah tumpang tindih, gambar terakhir akan disalin lebih dari yang sebelumnya. Utilitas ini juga dijelaskan pada http://www.gdal.org/gdal_merge.html .
Informasi	Utilitas ini berisi berbagai informasi tentang GDAL didukung dataset raster. Lihat juga http://www.gdal.org/gdalinfo.html .
Gambaran Build	Utilitas gdaladdo dapat digunakan untuk membangun atau membangun kembali gambar ikhtisar untuk format berkas yang paling didukung dengan salah satu dari beberapa algoritma downsampling. Untuk informasi lebih lanjut, lihat http://www.gdal.org/gdaladdo.html .
Indeks Tile	Utilitas ini membangun shapefile dengan catatan untuk setiap berkas masukan raster, atribut yang berisi nama berkas, dan geometri poligon menguraikan raster. Lihat juga http://www.gdal.org/gdaltindex.html .

Pengaturan Peralatan GDAL

Gunakan dialog ini untuk menempelkan variabel GDAL Anda.

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19.9 Plugin Georeferencer

Plugin Georeferencer adalah alat untuk menghasilkan berkas-berkas dunia untuk raster-raster. Hal ini memungkinkan Anda untuk membuat referensi raster dengan sistem koordinat geografis atau diproyeksikan dengan menciptakan GeoTiff baru atau dengan menambahkan sebuah berkas dunia dengan gambar yang ada. Pendekatan dasar Georeferensi raster adalah untuk menemukan titik-titik pada raster Anda secara akurat dan dapat menentukan koordinat mereka.

Fitur-fitur

Ikon	Tujuan	Ikon	Tujuan
	Buka raster		Memulai georeferensi
	Menghasilkan Skrip GDAL		Muat Poin-Poin GCP
	Simpan Poin GCP Sebagai		Pengaturan Transformasi
	Tambah Poin		Hapus Poin
	Pindahkan Poin GCP		Pan
	Perbesar		Perkecil
	Perbesar Ke Lapisan		Perbesaran Terakhir
	Perbesar Selanjutnya		Tautan Georeferencer ke QGIS
	Tautan QGIS ke Georeferencer		Peregangan histogram penuh
	Peregangan histogram lokal		

Tabel Georeferensi 1: Alat-Alat Georeferensi

19.9.1 Prosedur biasa

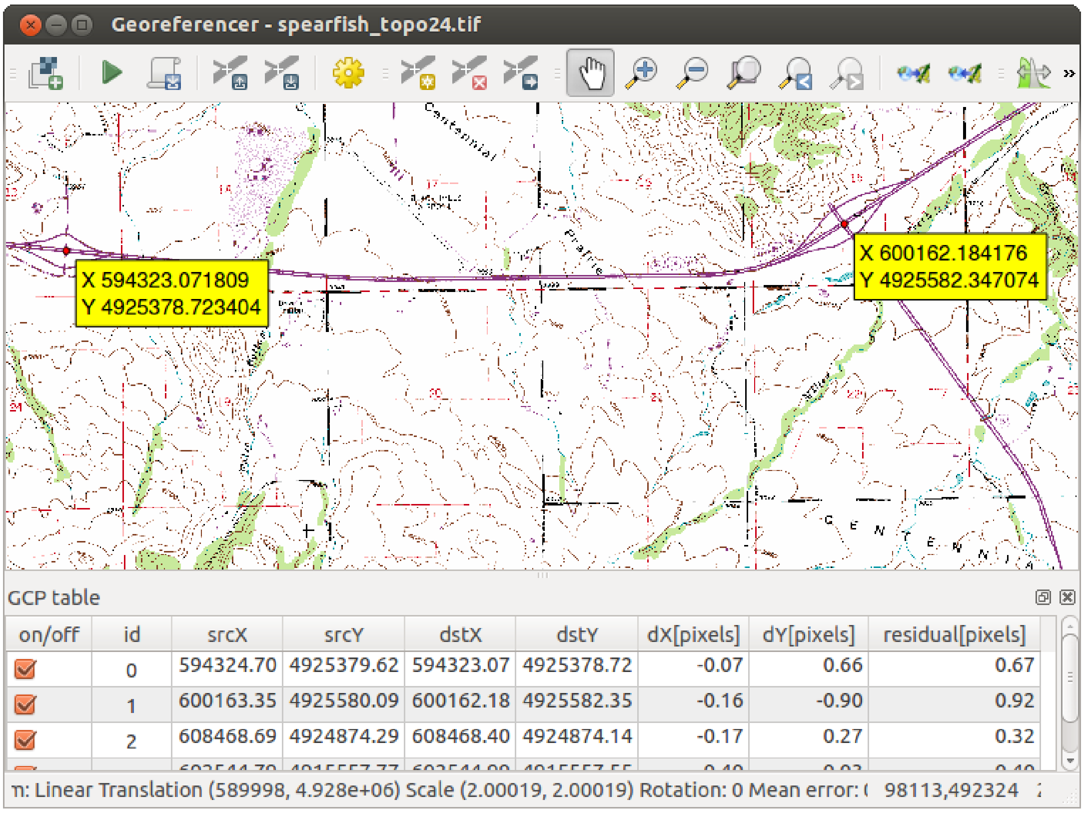
Sebagai koordinat X dan Y (DMS (dd mm ss.ss), DD (dd.dd) atau koordinat diproyeksikan (mmmm.mm)), yang sesuai dengan titik yang dipilih pada gambar, dua alternatif prosedur dapat digunakan:

- Raster itu sendiri kadang-kadang memberikan salib dengan koordinat "written" pada gambar. Dalam hal ini Anda dapat memasukkan koordinat secara manual.
- Menggunakan lapisan sudah bergeoreferensi, hal ini dapat berupa data vektor atau raster yang berisi benda-benda yang sama/fitur yang Anda miliki pada gambar yang ingin Anda Georeferensi dan proyeksi. Dalam hal ini Anda dapat memasukkan koordinat dengan mengklik pada dataset referensi dimuat dalam kanvas peta QGIS.

Prosedur yang biasa untuk Georeferensi gambar memilih beberapa poin pada raster, menentukan koordinat mereka, dan memilih jenis transformasi yang relevan. Berdasarkan parameter masukan dan data, plugin akan menghitung parameter berkas dunia. Semakin banyak titik koordinat Anda berikan, akan semakin baik hasilnya.

Langkah pertama jalankan QGIS, muat Plugin Georeferencer (lihat *The Plugins Menus*) dan klik *Raster → Georeferencer* , yang muncul di menu bar QGIS. Dialog Plugin Georeferencer akan tampil seperti figure_georeferencer_1.

Untuk contoh ini, kita menggunakan toposheet South Dakota dari SDGS. Hal ini nantinya dapat divisualisasikan bersama dengan data dari lokasi GRASS `spearfish60`. Anda dapat menngunduh toposheet di sini: http://grass.osgeo.org/sampledata/spearfish_toposheet.tar.gz.

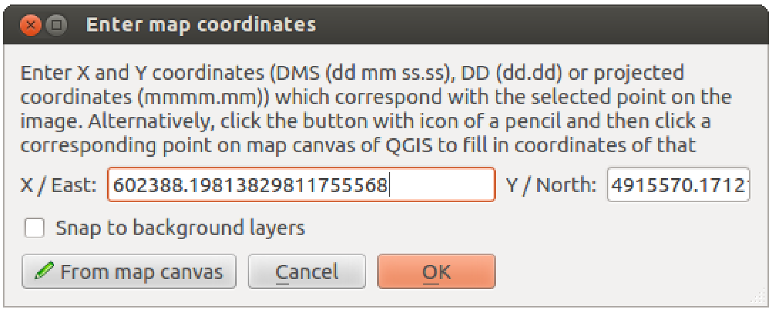


Gambar 19.16: Dialog Plugin Georeferencer

Memasukkan titik-titik kontrol lapangan (GCPs)

1. Untuk memulai georeferensi sebuah raster rintisan, kita harus memuat dengan menggunakan tombol . Raster akan muncul di wilayah kerja utama dialog. Setelah raster dimuat, kita bisa mulai untuk memasukkan titik-titik acuan.
2. Menggunakan tombol Tambah Poin, menambahkan poin-poin untuk wilayah kerja utama dan memasukkan koordinat mereka (lihat Gambar figure_georeferencer_2). Untuk prosedur ini, Anda memiliki tiga pilihan:
   - Klik pada poin di gambar raster dan masukkan koordinat X dan Y secara manual.
   - Klik pada poin gambar raster dan pilih tombol Dari kanvas peta untuk menambahkan koordinat X dan Y coordinates dengan bantuan peta georeferensi sudah dimuat dalam kanvas peta QGIS.
   - Dengan tombol , Anda bisa menggeser GCP di dalam jendela, jika mereka berada di tempat yang salah.
3. Lanjutkan memasukkan titik-titik. Anda harus memiliki setidaknya 4 titik, dan semakin banyak koordinat yang dapat Anda berikan, akan semakin baik hasilnya. Ada alat tambahan pada dialog plugin untuk memperbesar dan menggeser wilayah kerja dalam rangka untuk mencari satu set titik GCP relevan.

Poin-poin yang ditambahkan ke peta akan disimpan dalam sebuah berkas teks yang terpisah (`[filename].points`) biasanya bersama-sama dengan gambar raster. Hal ini memungkinkan kita untuk membuka kembali plugin Georeferencer di kemudian hari dan menambah poin baru atau menghapus yang sudah ada untuk mengoptimalkan hasilnya. Berkas poin berisi nilai-nilai dalam bentuk: `mapX, mapY,`

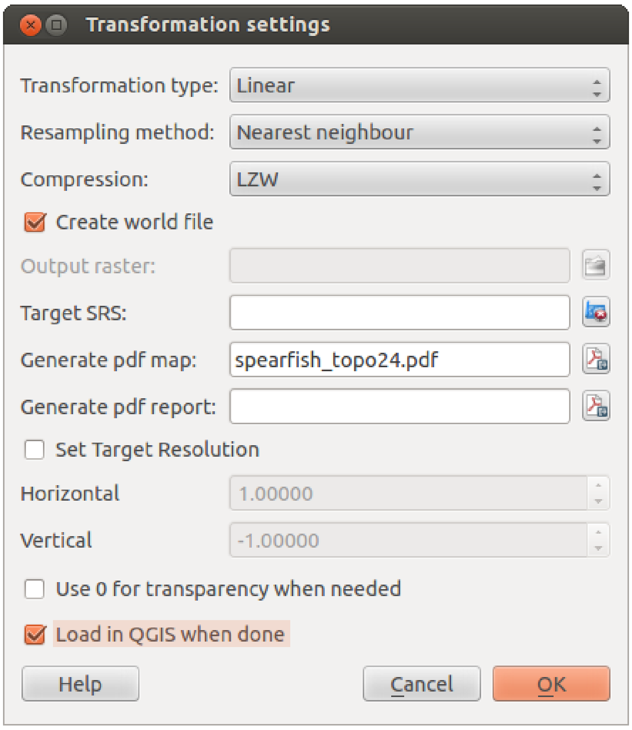


Gambar 19.17: Tambahkan titik-titik ke gambar raster

pixelX, pixelY. Anda bisa menggunakan tombol-tombol Muat poin-poin GCP dan Simpan poin GCP sebagai untuk mengelola berkas.

Pengaturan mendefinisikan transformasi

Setelah Anda telah menambahkan GCPs Anda ke gambar raster, Anda harus menentukan pengaturan transformasi untuk proses georeferensi.



Gambar 19.18: Pengaturan mendefinisikan transformasi

Algoritma Transformasi Tersedia

Tergantung pada berapa banyak titik kontrol lapangan yang telah direkam, Anda mungkin ingin menggunakan algoritma transformasi yang berbeda. Pilihan algoritma transformasi juga tergantung pada jenis dan kualitas masukan data dan jumlah distorsi geometris Anda bersedia untuk memasukkan kepada hasil akhir.

Saat ini, tersedia *Tipe Transformasi* :

- Algoritma **Linear** adalah digunakan untuk membuat berkas-dunia, dan berbeda dari algoritma yang lain, karena tidak benar-benar mengubah raster. Algoritma ini kemungkinan besar tidak akan cukup jika Anda berurusan dengan bahan yang dipindai.
- Transformasi **Helmert** melakukan scaling dan rotasi transformasi sederhana.
- Algoritma 1-3 **Polynomial** yang paling banyak digunakan algoritma yang diperkenalkan untuk mencocokkan sumber dan tujuan poin kontrol lapangan. Paling banyak digunakan algoritma polinomial adalah urutan kedua transformasi polinomial, yang memungkinkan beberapa kelengkungan. Urutan pertama transformasi polinomial (affine) mempertahankan collinearity dan memungkinkan scaling, terjemahan dan rotasi saja.
- Algoritma **Thin Plate Spline** (TPS) adalah adalah metode georeferencing yang lebih modern, yang mampu memperkenalkan deformasi lokal dalam data. Algoritma ini berguna ketika kualitas asli sangat rendah sebagai rujukan geografis.
- Transformasi **Proyektif** rotasi linear dan terjemahan koordinat.

Tentukan metode Sampel ulang

Jenis resampling Anda memilih kemungkinan akan tergantung pada data masukan Anda dan tujuan akhir dari latihan. Jika Anda tidak ingin mengubah statistik dari gambar, Anda mungkin ingin memilih 'Nearest neighbour', sedangkan 'resampling Cubic' kemungkinan akan memberikan hasil yang lebih rapi.

Hal ini dimungkinkan untuk memilih lima metode resampling yang berbeda:

1. Nearest neighbour
2. Linear
3. Cubic
4. Cubic Spline
5. Lanczos

Tentukan pengaturan transformasi

Ada beberapa opsi yang perlu didefinisikan untuk keluaran raster georeferensi.

- Kotak centang *Buat berkas dunia* hanya tersedia jika Anda memutuskan untuk menggunakan jenis transformasi linear, karena ini berarti bahwa gambar raster sebenarnya tidak akan berubah. Dalam hal ini, kolom *Keluaran raster* tidak aktif, karena hanya berkas dunia baru yang akan dibuat.
- Untuk semua jenis transformasi lain Anda harus menentukan *Keluaran raster*. Sebagai default berkas baru ([filename]_modified) akan dibuat dalam folder yang sama bersama-sama dengan gambar raster asli.
- Sebagai langkah berikutnya Anda harus menentukan *Target SRS* (Spatial Reference System) untuk georeferensi raster (lihat bagian *label_projections*').
- Jika Anda ingin, Anda bisa **menghasilkan peta pdf** dan juga **laporan pdf**. Laporan ini mencakup informasi tentang parameter transformasi yang digunakan. Sebuah gambar dari residual dan daftar dengan semua GCP dan eror RMS.
- Selanjutnya Anda dapat mengaktifkan kotak centang *Set Target Resolusi* dan tentukan pixel resolusi dari keluaran raster. Resolusi horisontal dan vertikal default adalah 1.
- *Gunakan 0 untuk transparan jika dibutuhkan* bisa diaktifkan, jika pixel dengan nilai 0 akan divisualisasikan transparan. Dalam contoh toposheet kami semua bidang putih akan jadi transparan.
- Akhirnya *muat di QGIS saat selesai* muat keluaran raster secara otomatis ke dalam kanvas Peta QGIS ketika transformasi sudah dilakukan.

Tampilkan dan menyesuaikan properti raster

Mengklik ada dialog *Raster properti* didalam menu *Pengaturan* membuka properti raster dari lapisan yang ingin Anda Georeferensi.

Konfigurasi georeferensi

- Anda dapat menentukan apakah Anda ingin menunjukkan koordinat GCP dan/atau ID.
- Sebagai unit sisa piksel dan unit peta dapat dipilih.
- Untuk laporan PDF margin kiri dan kanan dapat ditentukan dan Anda juga dapat mengatur ukuran kertas untuk peta PDF.
- Akhirnya Anda bisa mengaktifkan *show georeferencer window docked*.

Menjalankan transformasi

Setelah semua GCPs telah dikumpulkan dan semua pengaturan transformasi ditentukan, tekan tombol Mulai georeferencing untuk membuat raster baru bergeoreferensi.

.

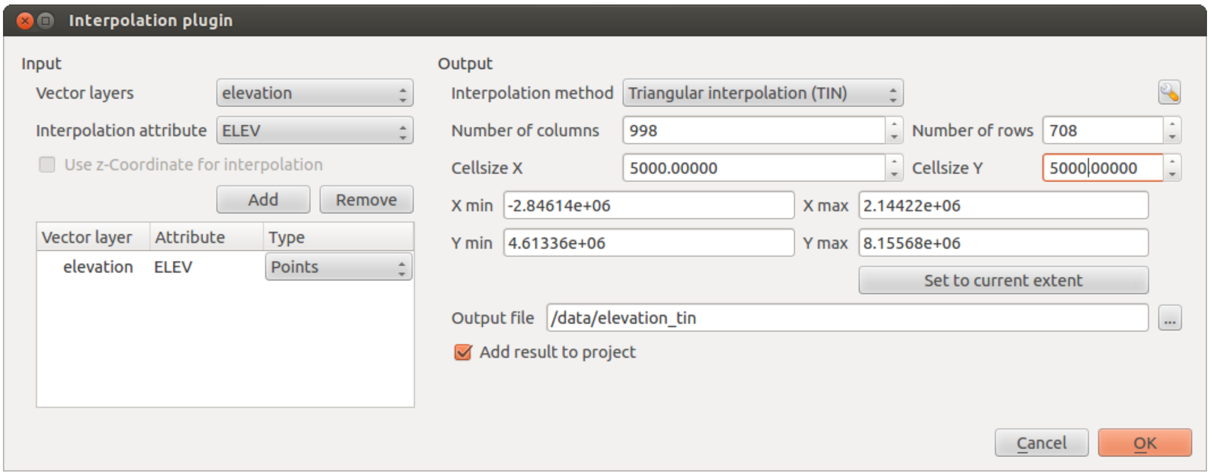
19.10 Plugin Interpolasi

Plugin Interpolasi dapat digunakan untuk membuat interpolasi TIN atau IDW dari suatu layer vektor titik. Plugin ini sangat sederhana serta menyediakan tampilan antarmuka yang intuitif untuk membuat layer raster terinterpolasi (lihat Figure_interpolation_1). Plugin ini memerlukan parameter-parameter berikut sebelum dapat dijalankan:

- Masukan **Lapisan-lapisan Vektor**: Tentukan masukan lapisan vektor titik dari daftar lapisan titik yang dimuat. Jika beberapa lapisan ditentukan, maka data dari semua lapisan yang digunakan untuk interpolasi. Catatan: Hal ini dimungkinkan untuk menyisipkan baris atau poligon untuk triangulasi, dengan menentukan “titik”, “garis struktur” atau “baris break” dalam combobox *Tipe* .
- **Atribut interpolasi**: Pilih kolom atribut untuk digunakan dalam interpolasi atau aktifkan checkbox *Gunakan koordinat-Z* untuk menggunakan nilai Z yang tersimpan pada layer.
- **Metode Interpolasi**: Pilih metode interpolasi. Pilihannya antara lain ‘Triangulated Irregular Network (TIN)’ atau ‘Inverse Distance Weighted (IDW)’.
- **Jumlah kolom/baris**:Tentukan jumlah baris dan kolom untuk keluaran berkas raster.
- **File keluaran**: Masukkan nama untuk file raster yang dihasilkan.
- *Tambah hasil ke proyek* untuk memuat hasil kedalam kanvas peta.

19.10.1 Menggunakan plugin interpolasi

1. Mulai QGIS dan muat lapisan vektor titik (seperti `elevp.csv`).
2. Muat plugin interpolasi di Pengelola Plugin (lihat Bagian *managing_plugins) dan klik :menuselection:‘Raster –> Interpolasi –> Interpolasi* , yang muncul dalam menu toolbar QGIS. Dialog plugin Interploasi ditunjukkan dalam Figure_interpolation_1.
3. Pilih layer masukan (seperti *elevp*) dan kolom (seperti `ELEV`) untuk interpolasi.
4. Pilih metode interpolasi (seperti ‘Triangulated Irregular Network (TIN)’), dan masukkan ukuran sel 5000 sebagaimana juga nama file keluaran (seperti, `elevation_tin`).



Gambar 19.19: Plugin Interpolasi

5. Klik **[OK]**.

.

19.11 Plugin Mengedit Diluar Jaringan (Offline)

Untuk pengumpulan data merupakan situasi umum bekerja dengan laptop atau ponsel di luar jaringan (offline) di lapangan. Setelah kembali ke jaringan, perubahan perlu disinkronkan dengan sumber data master, misalnya basisdata PostGIS. Jika beberapa orang bekerja secara bersamaan pada dataset yang sama, sulit untuk menggabungkan hasil edit dengan tangan, bahkan jika orang tidak mengubah fitur yang sama.

Plugin Mengedit Offline Plugin secara otomatis melakukan sinkronisasi dengan menyalin isi dari sumber data (biasanya PostGIS atau WFS-T) ke basisdata SpatiaLite dan menyimpan suntingan luar jaringan (offline) ke tabel khusus. Setelah terhubung ke jaringan lagi, memungkinkan untuk menerapkan secara suntingan luar jaringan (offline) ke dataset induk.

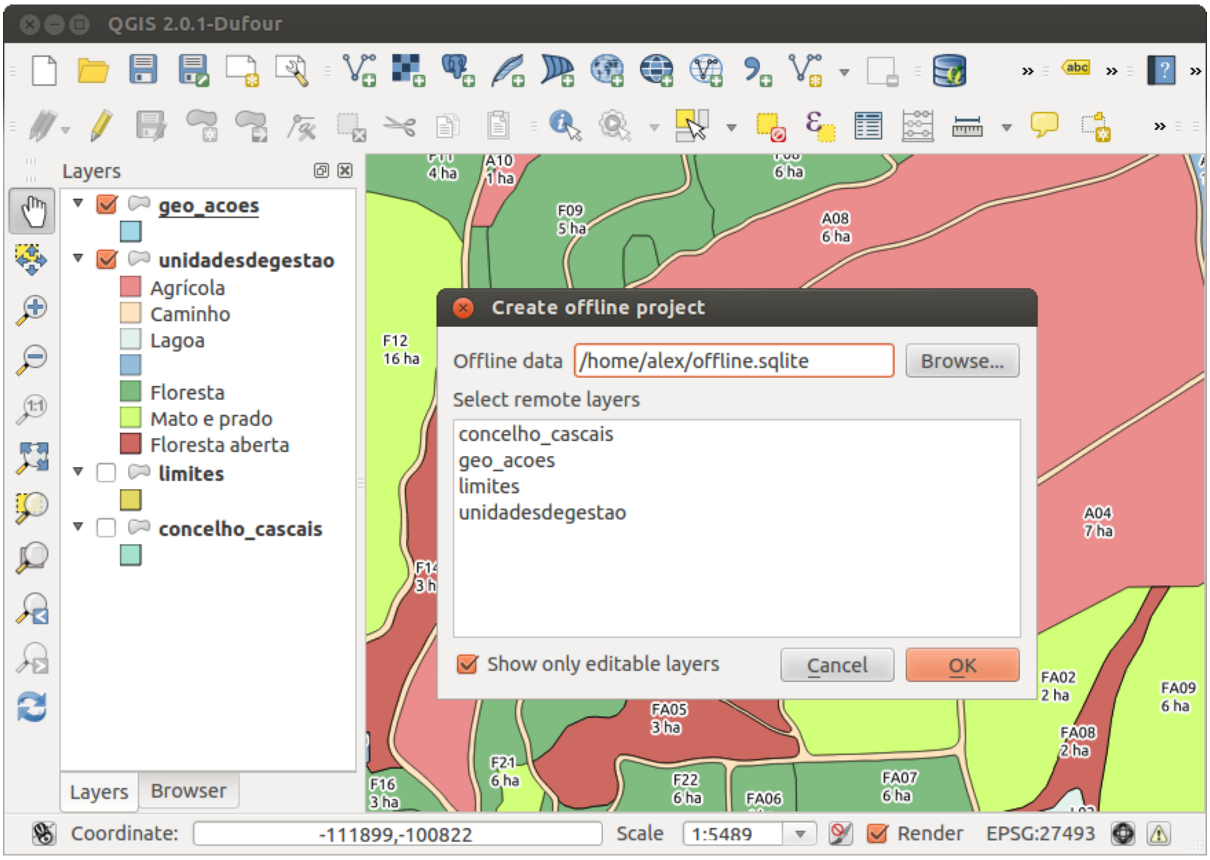
19.11.1 Menggunakan plugin

- Buka beberapa lapisan vektor, (misal dari sumber data PostGIS atau WFS-T).
- Menyimpannya sebagai proyek.
- Pergi ke *Basisdata* → *Mengedit Luring* → *Konversikan ke proyek luring* dan pilih lapisan untuk menyimpan. Isi dari lapisan disimpan ke tabel SpatiaLite.
- Edit lapisan luar jaringan.
- Setelah terhubung lagi, mengunggah perubahan menggunakan *Basisdata* → *Mengedit luring* → *Sinkronisasi*.

.

19.12 Plugin Spasial Oracle GeoRaster

Dalam basisdata Oracle, data raster dapat disimpan dalam obyek SDO_GEORASTER tersedia ekstensi Oracle Spasial. Dalam QGIS, plugin Spasial Oracle GeoRaster ini didukung oleh GDAL dan tergantung pada produk basisdata Oracle yang sedang dipasang dan bekerja pada mesin Anda. Sementara Oracle adalah perangkat lunak



Gambar 19.20: Membuat proyek luar jaringan dari lapisan PostGIS atau WFS

proprietary, mereka menyediakan perangkat lunak bebas untuk tujuan pengembangan dan pengujian. Berikut adalah salah satu contoh sederhana bagaimana untuk memuat gambar raster ke GeoRaster:

```
$ gdal_translate -of georaster input_file.tif geor:scott/tiger@orcl
```

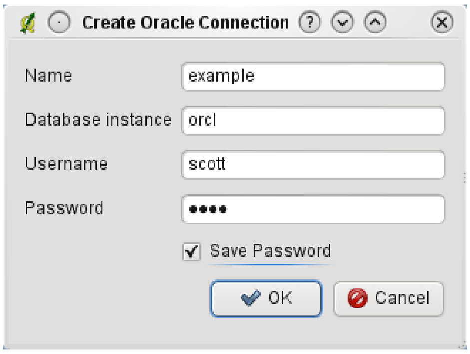
Hal ini akan memuat raster ke default tabel GDAL_IMPORT, sebagai kolom bernama `RASTER`.

19.12.1 Mengelola koneksi-koneksi

Pertama, Plugin Oracle GeoRaster harus diaktifkan menggunakan Pengelola Plugin (lihat *The Plugins Menus*). Pertama kali Anda memuat GeoRaster dalam QGIS, Anda harus membuat koneksi/sambungan ke basisdata Oracle yang berisi data. Untuk melakukan hal ini, mulai dengan klik tombol toolbar Tambah lapisan Oracle GeoRaster – ini akan membuka jendea dialog *Pilih Spasial Oracle GeoRaster*. Klik pada **[Baru]** membuka jendela dialog, dan menentukan parameter sambungan (Lihat Figure_oracle_raster_1):

- **Nama**: Masukkan nama dari sambungan basisdata.
- **Contoh basisdata**: Masukkan nama dari basisdata yang ingin Anda sambungkan.
- **Namapengguna**: Tentukan nama pengguna/username Anda sendiri yang akan Anda gunakan untuk mengakses basisdata.
- **Kata sandi**: Memasukkan kata sandi/password yang terkait dengan nama pengguna yang diperlukan untuk mengakses basisdata.

Sekarang, kembali jendela utama dialog *Spasial Oracle GeoRaster* (lihat Figure_oracle_raster_2), gunakan daftar drop-down untuk memilih satu sambungan, dan gunakan tombol **[Sambung]** untuk sambungan tersebut. Anda mungkin juga **[Edit]** koneksi dengan membuka dialog sebelumnya dan membuat perubahan pada informasi koneksi, atau gunakan tombol **[Hapus]** untuk menghapus sambungan dari daftar drop-down.



Gambar 19.21: Buat dialog koneksi Oracle

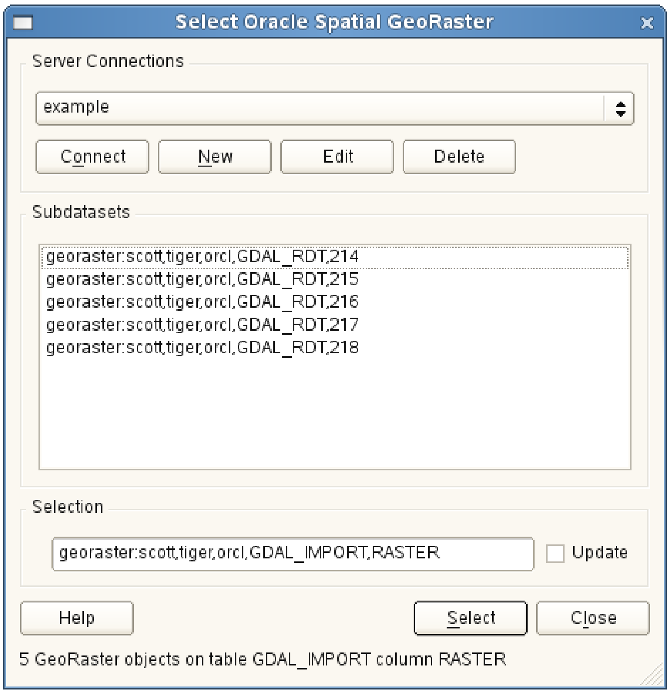
19.12.2 Memilih sebuah GeoRaster

Setelah sambungan telah ditetapkan, jendela subdatasets akan menampilkan nama-nama semua tabel yang berisi kolom GeoRaster dalam basisdata dalam format nama GDAL subdataset.

Klik pada salah satu subdatasets terdaftar dan kemudian klik pada **[Pilih]** memilih nama tabel. Sekarang daftar subdatasets lain akan menunjukkan nama-nama kolom GeoRaster di tabel itu. Biasanya sebuah daftar singkat, karena sebagian besar pengguna tidak akan memiliki lebih dari satu atau dua kolom GeoRaster di tabel yang sama.

Klik pada salah satu subdatasets terdaftar dan kemudian klik pada **[Pilih]** memilih salah satu kombinasi tabel/kolom. Dialog sekarang akan menampilkan semua baris yang berisi obyek-obyek GeoRaster. Perhatikan bahwa daftar subdataset sekarang akan menampilkan Tabel Data Raster dan pasangan Id Raster.

Setiap saat, masukan seleksi dapat diedit untuk bisa langsung ke GeoRaster yang diketahui atau kembali ke awal dan pilih nama tabel lain.



Gambar 19.22: Pilih dialog Oracle GeoRaster

Masukan data seleksi juga dapat digunakan untuk memasukkan `WHERE` klausul pada akhir identifikasi string (misal, `geor:scott/tiger@orcl,gdal_import,raster,geoid=`). Lihat http://www.gdal.org/frmt_georaster.html untuk informasi lebih lanjut.

19.12.3 Menampilkan GeoRaster

Akhirnya, dengan memilih GeoRaster dari daftar Tabel Data Raster dan Id Raster, gambar raster akan dimuat ke QGIS.

Dialog *Pilih Spasial Oracle GeoRaster* dapat ditutup sekarang dan waktu berikutnya terbuka, akan menjaga sambungan yang sama dan akan menampilkan daftar sama subdatasets sebelumnya, sehingga sangat mudah untuk membuka gambar lain dari konteks yang sama.

Catatan: GeoRasters yang berisi piramida akan ditampilkan lebih cepat, tapi piramida harus dihasilkan di luar QGIS menggunakan Oracle PL/SQL atau gdaladdo.

Berikut ini adalah contoh menggunakan `gdaladdo`:

```
gdaladdo georaster:scott/tiger@orcl,georaster\_table,georaster,georid=6 -r
nearest 2 4 6 8 16 32
```

Ini contoh menggunakan 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 Plugin Raster Analisis Terrain

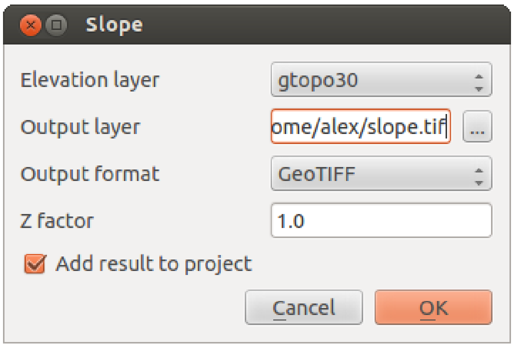
Plugin Raster Analisis Terrain dapat digunakan untuk menghitung kemiringan, aspek, bayangan bukit, indeks kekasaran dan relief untuk model elevasi digital (DEM). Sangat sederhana menangani dan menyediakan grafis antarmuka pengguna intuitif untuk membuat lapisan raster baru (Lihat Figure_raster_terrain_1).

Deskripsi dari analisis:

- **Lereng**: Menghitung sudut kemiringan untuk setiap sel dalam derajat (berdasarkan urutan pertama estimasi derivatif).
- **Aspek**: Eksposisi (dimulai dengan 0 untuk arah utara, dalam derajat berlawanan jarum jam).
- **Bukitbayangan**: Buat peta berbayang menggunakan cahaya dan bayangan untuk memberikan penampilan lebih tiga dimensi untuk peta relief berbayang.
- **Indeks Ketidakrataan**: Sebuah pengukuran kuantitatif dari medan heterogenitas seperti yang dijelaskan oleh Riley et al. (1999). Hal ini dihitung untuk setiap lokasi, dengan meringkas perubahan elevasi dalam kisi 3x3 piksel.
- **Relief**: Membuat peta relief berbayang dari data elevasi digital. Diimplementasikan metode memilih warna elevasi dari menganalisis frekuensi distribusi.

19.13.1 Menggunakan plugin

1. Mulai QGIS dan muat layer raster `gtopo30` dari contoh lokasi GRASS.
2. Muat plugin Raster Analisis Terrain plugin di Pengelola Plugin (lihat Bagian *The Plugins Menus*).



Gambar 19.23: Plugin Raster Pemodelan Terrain (perhitungan kemiringan)

3. Pilih metode analisis dari menu (misalnya *Raster* → *Analisis Terrain* → *Kemiringan*). Dialog *Kemiringan* seperti dalam gambar Figure_raster_terrain_1.
4. Spesifikasi keluaran berkas path dan keluaran tipe berkas:
5. Klik **[OK]**.

.

19.14 Plugin Heatmap

Plugin *Heatmap* menggunakan Kernel Density Estimation untuk menciptakan kepadatan (heatmap) raster dari titik masukan lapisan vektor. Kepadatan tersebut dihitung berdasarkan jumlah poin di lokasi, dengan jumlah poin berkerumun yang lebih besar menghasilkan nilai yang lebih besar. Heatmaps memudahkan identifikasi "hotspot" dan pengelompokan poin.

19.14.1 Mengaktfikan plugin Heatmap

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.

Pilih menu *Tampilan* → *Toolbar* → *Raster* untuk memunculkan Toolbar Raster jika tidak terlihat.

19.14.2 Menggunakan plugin Heatmap

Klik alat tombol *Heatmap* membuka dialog Plugin Heatmap (lihat figure_heatmap_2).

Dialog memiliki opsi-opsi berikut:

- **Masukan poin lapisan**: Daftar semua titik lapisan vektor dalam proyek saat ini dan digunakan untuk memilih lapisan yang akan dianalisis.
- **Raster keluaran**: Memungkinkan Anda menggunakan tombol ... untuk memilih nama folder dan berkas keluaran raster plugin Heatmap yang dihasilkan. Sebuah ekstensi berkas tidak diperlukan.
- **Format keluaran**: Memilih format keluaran. Meskipun semua format didukung oleh GDAL dapat dipilih, dalam banyak kasus GeoTIFF adalah format terbaik.
- **Radius**: Digunakan untuk menentukan radius pencarian heatmap (atau lebar pita kernel) dalam meter atau unit peta. Jari-jari menentukan jarak sekitar titik di mana pengaruh titik akan terasa. Nilai yang lebih besar menghasilkan kehalusan yang lebih besar, tetapi nilai-nilai yang lebih kecil mungkin menunjukkan rincian halus dan variasi dalam kepadatan titik.

Saat kotak centang *Lanjutan* dicentang, opsi tambahan akan tersedia:

- **Baris** dan **Kolom**: Digunakan untuk mengubah dimensi keluaran raster. Nilai-nilai ini juga terkait dengan **Ukuran sel X** dan **Ukuran sel Y**. Peningkatan jumlah baris atau kolom akan mengurangi ukuran sel dan meningkatkan ukuran berkas keluaran. Nilai-nilai dalam Baris dan Kolom juga terkait, sehingga menggandakan jumlah baris secara otomatis akan menggandakan jumlah kolom dan ukuran sel juga akan dibagi dua. Wilayah geografis raster keluaran akan tetap sama!
- **Ukuran sel X** dan **Ukuran sel Y**: Mengontrol ukuran geografis masing-masing piksel dalam keluaran raster. Mengubah nilai-nilai ini juga akan mengubah jumlah Baris dan Kolom dalam keluaran raster.
- **Bentuk Kernel**: Bentuk kernel mengontrol tingkat di mana pengaruh titik menurun sebagai jarak dari titik meningkat. Kernel yang berbeda peluruhan pada tingkat yang berbeda, sehingga kernel triweight memberikan fitur bobot yang lebih besar untuk jarak yang lebih dekat ke titik maka kernel Epanechnikov tidak. Akibatnya, triweight hasil dalam hotspot "tajam", dan hasil Epanechnikov dalam hotspot "halus". Sejumlah fungsi kernel standar yang tersedia di QGIS, dijelaskan dan diilustrasikan pada Wikipedia.
- **Rasio Decay**: Dapat digunakan dengan kernel Segitiga untuk lebih mengontrol bagaimana panas/heat dari fitur menurun dengan jarak dari fitur tersebut.
  - Nilai 0 (= minimum) menunjukkan bahwa panas akan terkonsentrasi di pusat radius tertentu dan benar-benar padam di tepi.
  - Nilai 0,5 mengindikasikan bahwa piksel di tepi jari-jari akan diberikan setengah panas/heat sebagai piksel di pusat radius pencarian.
  - Nilai 1 berarti panas/heat tersebar secara merata di seluruh radius pencarian lingkaran. (Ini sama dengan 'Uniform' kernel.)
  - Sebuah nilai yang lebih besar dari 1 menunjukkan bahwa panas lebih tinggi menuju tepi radius pencarian daripada di pusat.

Masukan poin lapisan juga dapat memiliki bidang atribut yang dapat mempengaruhi bagaimana mereka mempengaruhi heatmap ini:

- **Gunakan radius dari bidang**: Mengatur radius pencarian untuk setiap fitur dari kolom atribut dalam masukan lapisan.
- **Gunakan bobot dari bidang**: Memungkinkan fitur masukan untuk dilakukan pembobotan dengan bidang atribut. Hal ini dapat digunakan untuk meningkatkan pengaruh fitur tertentu pada heatmap yang dihasilkan.

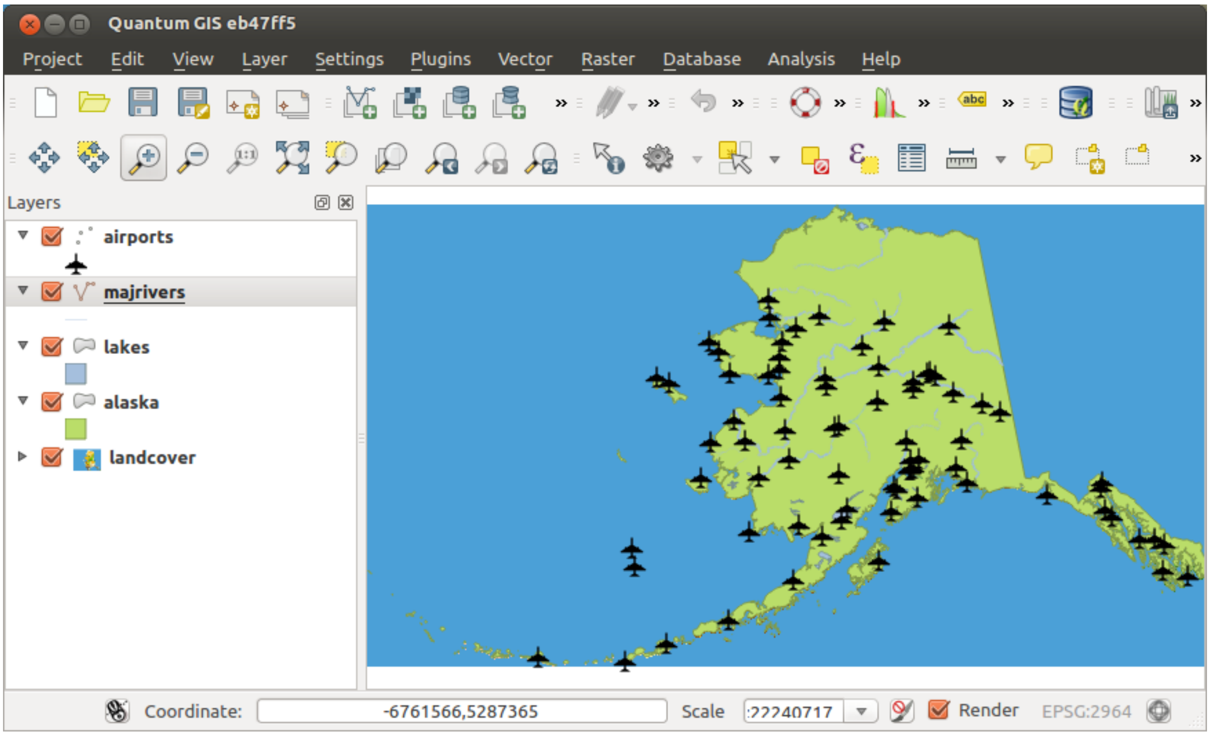
Ketika sebuah nama berkas keluaran raster yang ditentukan, tombol **[OK]** dapat digunakan untuk membuat heatmap tersebut.

19.14.3 Tutorial: Membuat Heatmap

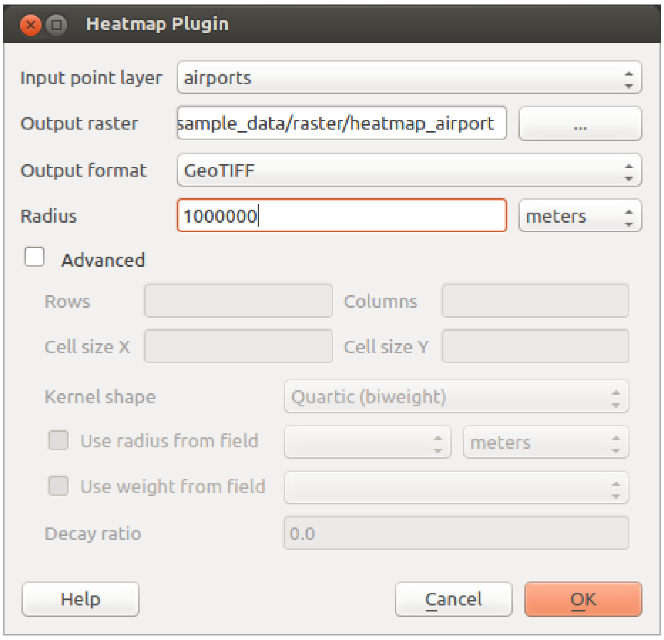
Sebagai contoh berikut, kita akan menggunakan lapisan vektor poin `airports` dari contoh dataset QGIS (lihat *Contoh data*). Tutorial QGIS sangat baik yang lain untuk membuat peta panas/heat dapat ditemukan di http://qgis.spatialthoughts.com.

Dalam Figure_Heatmap_1, bandara Alaska ditunjukkan.

1. Pilih tombol *Heatmap* membuka dialog Heatmap (lihat Figure_Heatmap_2).
2. Dalam kolom *Masukan lapisan poin* , pilih `airports` dari daftar lapisan titik yang dimuat dalam proyek saat ini.
3. Tentukan nama berkas keluaran dengan mengklik tombol ... selanjutnya ke *Raster keluaran*. Masukkan nama berkas `heatmap_airports` (tidak ada ekstensi berkas yang diperlukan).
4. Tinggalkan *Format keluaran* sebagai format default, `GeoTIFF`.
5. Ubah *Radius* ke `1000000` meter.
6. Klik **[OK]** membuat dan memuat bandara heatmap (lihat Figure_Heatmap_3).

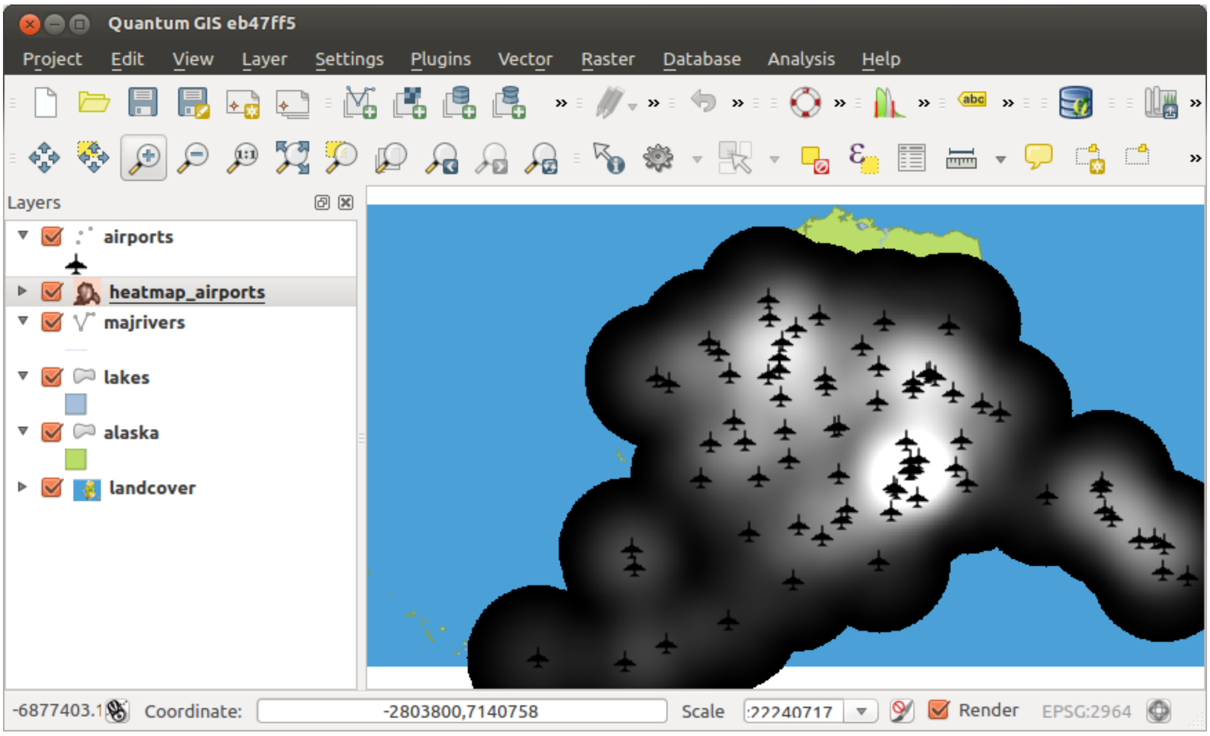


Gambar 19.24: Bandara Alaska



Gambar 19.25: Dialog Heatmap

QGIS akan menghasilkan heatmap dan menambahkan hasilnya ke jendela peta Anda. Secara default, heatmap yang diarsir pada Skala abu-abu, dengan area yang lebih terang menunjukkan konsentrasi yang lebih tinggi dari bandara. Heatmap sekarang dapat ditata dalam QGIS untuk memperbaiki penampilan.



Gambar 19.26: Heatmap setelah pemuatan tampak seperti permukaan abu-abu

1. Buka dialog properti dialog dari lapisan `heatmap_airports` (pilih lapisan `heatmap_airports`, buka menu kontek dengan tombol kanan tetikus dan pilih *Properti*).
2. Pilih tab *Style*.
3. Ubah *Tipe Render* ke 'Singleband pseudocolor'.
4. Pilih yang sesuai *Warna peta* , misalnya `YlOrRed`.
5. Klik tombol **[Muat]** untuk mengambil nilai minimum dan maksimum dari raster, kemudian klik tombol **[Klasifikasi]**.
6. Klik **[OK]** untuk memperbarui lapisan.

Hasil akhir akan ditampilkan dalam Figure_Heatmap_4.

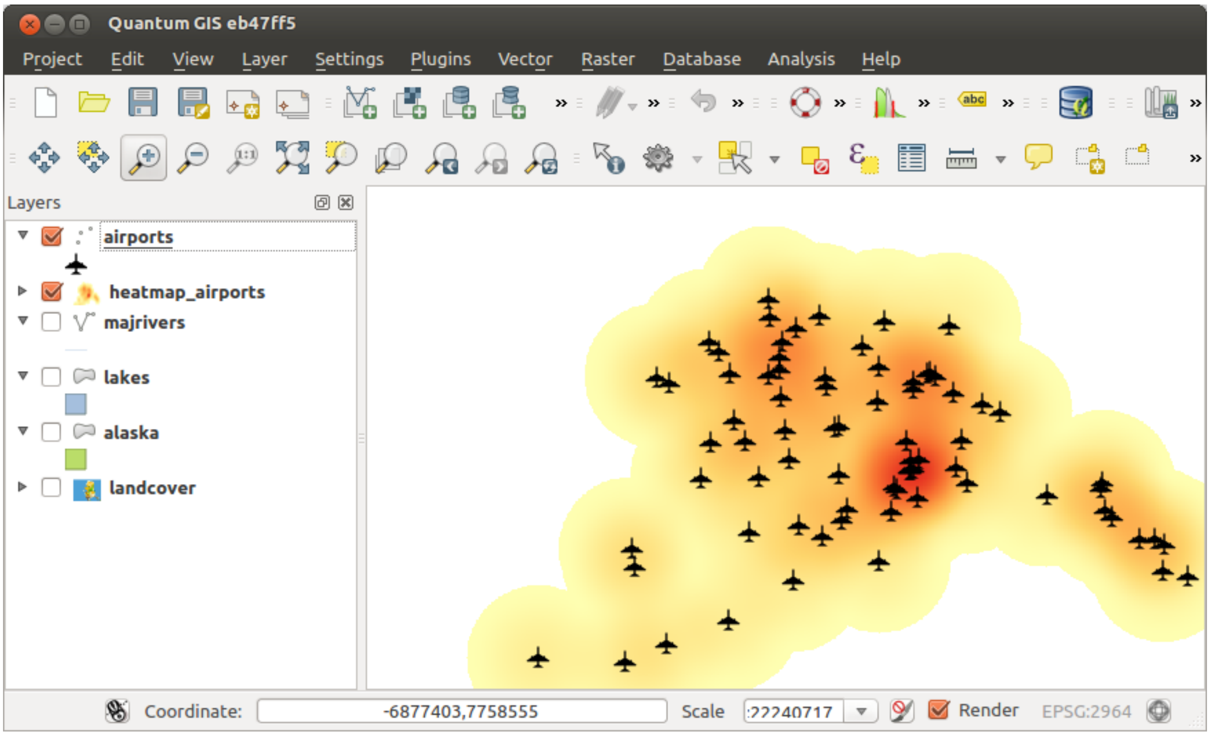
.

19.15 Plugin Grafik Jalan

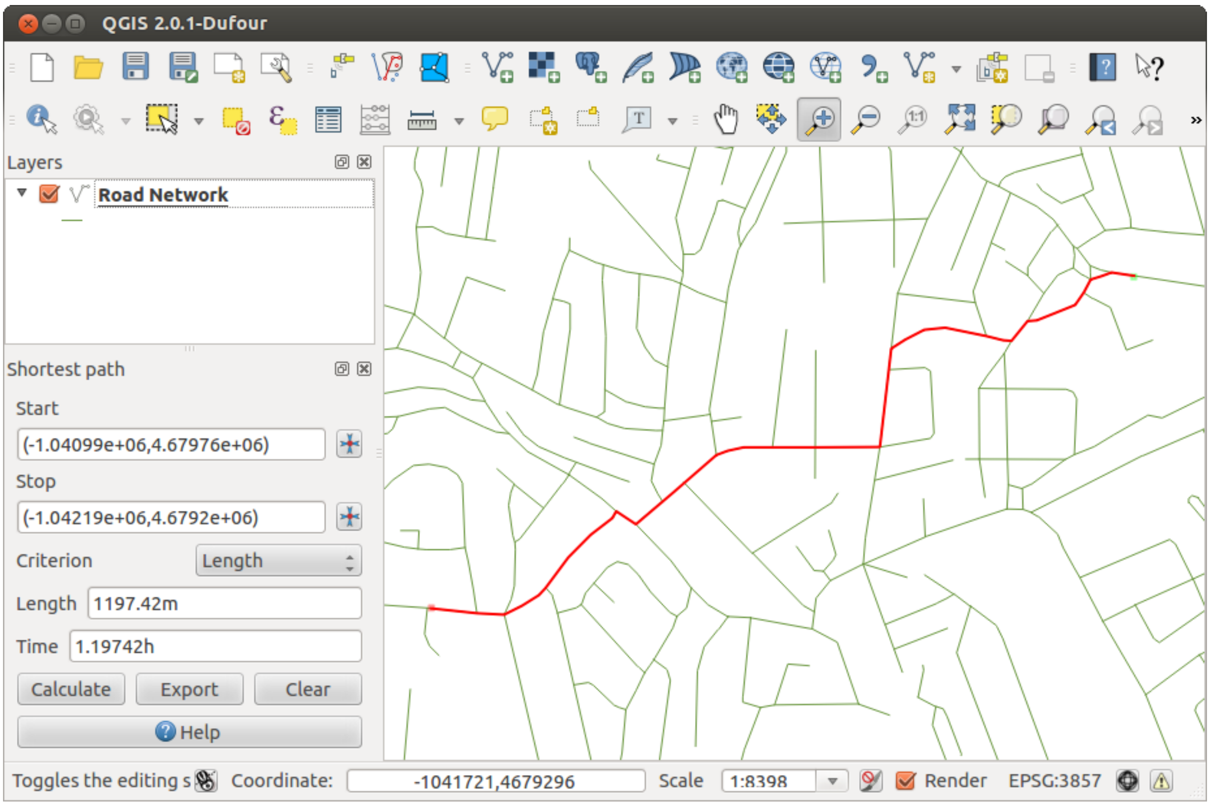
Plugin Grafik Jalan merupakan plugin C++ untuk QGIS, yang menghitung jalur terpendek antara dua titik pada setiap lapisan polyline dan plot jalan ini melalui jaringan jalan.

Fitur Utama:

- Menghitung path, maupun panjang dan waktu travel.
- Mengoptimalkan dari panjang atau dari waktu travel.
- Ekspor path ke lapisan vektor.



Gambar 19.27: Gaya heatmap dari bandara Alaska



Gambar 19.28: Plugin Grafik Jalan

- Arah jalan highlight (ini lambat dan digunakan terutama untuk tujuan debug dan untuk pengujian pengaturan).

Seperti lapisan jalan Anda bisa menggunakan setiap lapisan vektor polyline dalam format yang didukung QGIS. Dua garis dengan titik umum dianggap terhubung. Harap dicatat, ini diperlukan untuk menggunakan CRS lapisan sebagai CRS proyek ketika mengedit lapisan jalan. Hal ini disebabkan fakta bahwa perhitungan koordinat antara CRS yang berbeda memperkenalkan beberapa kesalahan yang dapat mengakibatkan diskontinuitas, bahkan ketika 'snapping' digunakan.

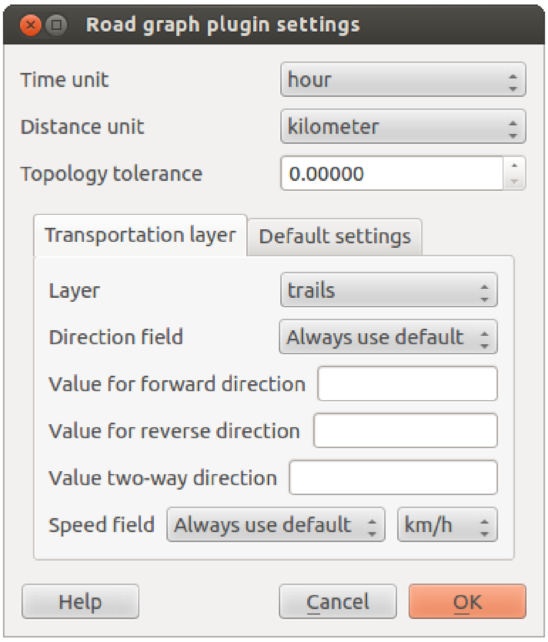
Dalam tabel lapisan atribut kolom berikut dapat digunakan:

- Kecepatan pada bagian jalan (kolom numerik).
- Arah (jenis, yang dapat dicor ke string). Arah maju dan mundur yang sesuai dengan jalan satu arah, dua arah mengindikasikan dua arah jalan.

Jika beberapa bidang tidak memiliki nilai apapun atau tidak ada — nilai standar yang digunakan. Anda dapat mengubah default dan beberapa pengaturan plugin di dialog pengaturan plugin.

19.15.1 Menggunakan plugin

Setelah Plugin aktif Anda akan melihat sebuah panel tambahan di sisi kiri dari jendela utama QGIS. Sekarang membuat beberapa definisi dialog *Pengaturan plugin grafik jalan* di menu *Vektor* → *Grafik Jalan* (lihat fig-ure_road_graph_2).



Gambar 19.29: Pengaturan plugin grafik jalan

Setlah mengatur *Satuan waktu*, *Satuan Jarak* dan *Toleransi topologi* Anda bisa memilih lapisan vektor di tab *Lapisan transportasi*. Disini Anda juga bisa memilih *Kolom Arah* dan *Kolom Kecepatan*. Dalam tab *Pengaturan standar* Anda bisa mengatur *Arah* untuk menghitung.

Akhirnya pada panel *Shortest Path* pilih mulai dan titik Berhenti di lapisan jaringan jalan dan klik **[Hitung]**.

.

19.16 Plugin Spasial Query

Plugin Spasial Query memungkinkan untuk membuat query spasial (pilih fitur) di lapisan sasaran dengan mengacu pada lapisan lain. Fungsi ini didasarkan pada perpustakaan GEOS dan tergantung pada sumber fitur lapisan yang dipilih.

Operator yang mungkin adalah:

- Isi
- Sama
- Tumpang tindih
- Persilangan
- Berpotongan
- Memisah
- Bersinggungan
- Di dalam

19.16.1 Menggunakan plugin

Sebagai contoh, kita ingin mencari daerah dalam dataset Alaska yang mengandung bandara. Langkah-langkah berikut diperlukan:

1. Mulai QGIS dan muat lapisan vektor `regions.shp` dan `airports.shp`.
2. Muat Plugin Spasial Query dari Pengelola Plugin (Lihat Bagian *The Plugins Menus*) dan klik ikon Spasial Query yang muncul di menu toolbar QGIS. Dialog plugin muncul.
3. Pilih lapisan `regions` sebagai sumber lapisan dan `airports` sebagai lapisan fitur referensi.
4. Pilih 'Isi' sebagai operator dan klik **[Terapkan]**.

Sekarang Anda mendapatkan daftar ID fitur dari query dan Anda memiliki beberapa pilihan seperti yang ditunjukkan pada figure_spatial_query_1.

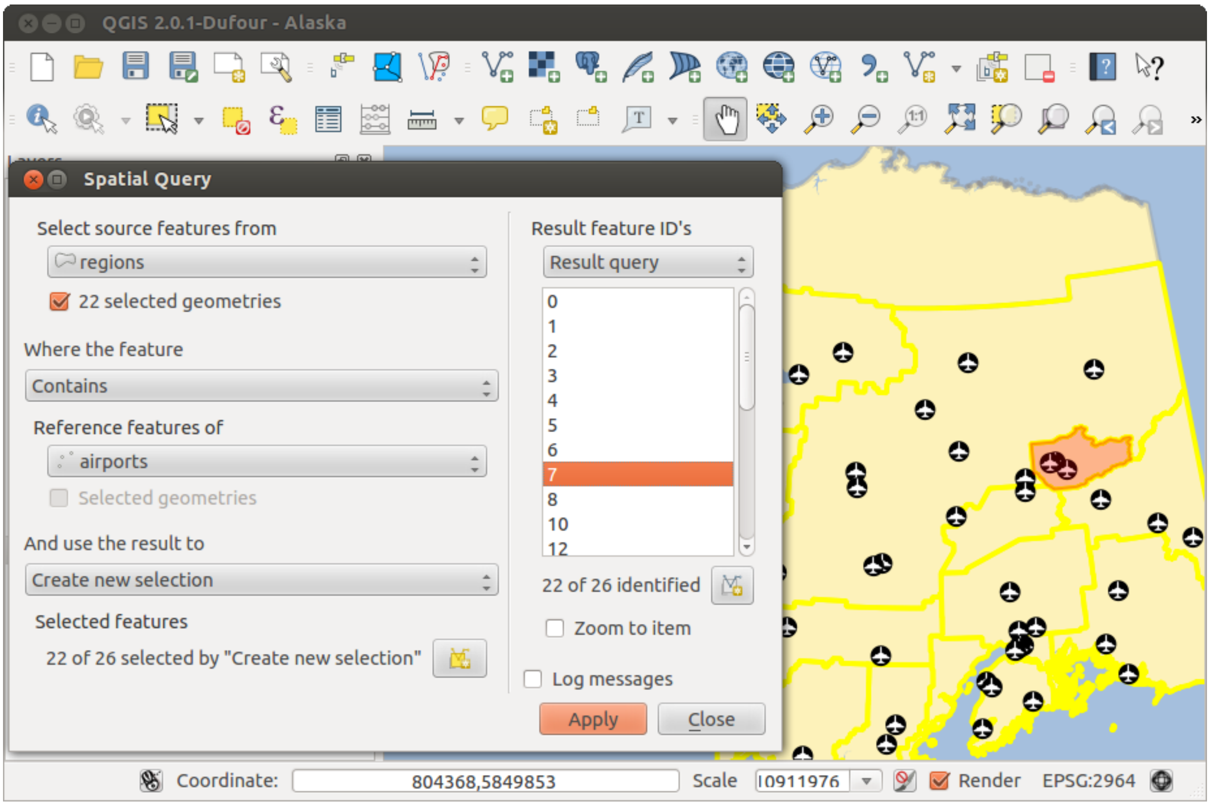
- Klik pada Buat lapisan dengan daftar item.
- Pilih ID dari daftar dan klik Buat lapisan yang dipilih
- Pilih 'Hapus dari seleksi sekarang' dalam kolom *Dan gunakan hasilnya* .
- Selain itu ANda juga bisa *Perbesar ke item* atau tampilkan *Pesan Log*.

.

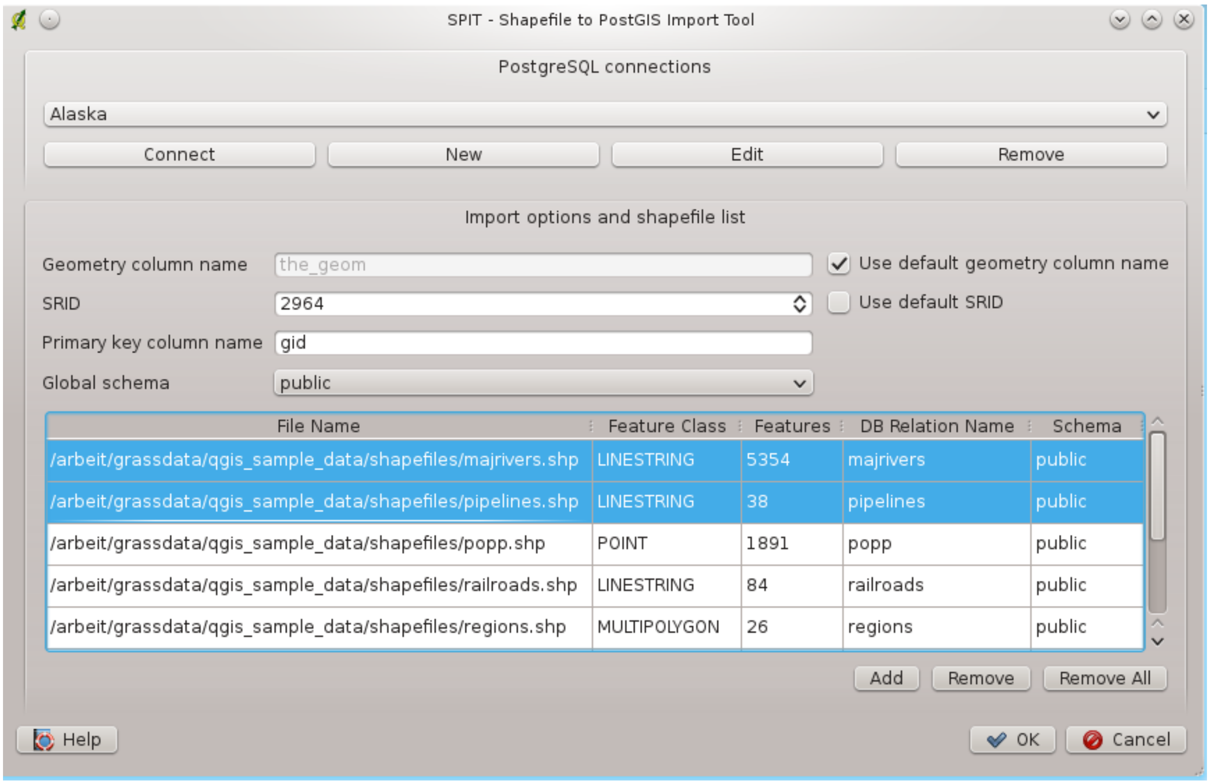
19.17 Plugin SPIT

QGIS datang dengan nama plugin SPIT (Shapefile to PostGIS Import Tool). SPIT dapat digunakan untuk memuat beberapa shapefile pada satu waktu dan termasuk dukungan untuk skema. Menggunakan SPIT, buka Manajer Plugin dari menu *Plugin*, di menu *Installed* centang kotaknya *SPIT* dan klik **[OK]**.

Mengimpor shapefile, gunakan *Basisdata → Spit → Impor Shapefiles ke PostgreSQL* dari menu bar membuka dialog *SPIT - Alat Impor Shapefile ke PostGIS*. Pilih basisdata PostGIS yang ingin Anda koneksikan dan klik **[Koneksi]**. Jika Anda ingin, Anda dapat menentukan atau mengubah beberapa opsi impor. Sekarang Anda dapat menambahkan satu atau lebih berkas ke antrian dengan mengklik tombol **[Tambah]**. Untuk memroses berkas, klik tombol **[OK]**. Proses impor serta kesalahan / peringatan akan ditampilkan setiap shapefile yang diproses. .



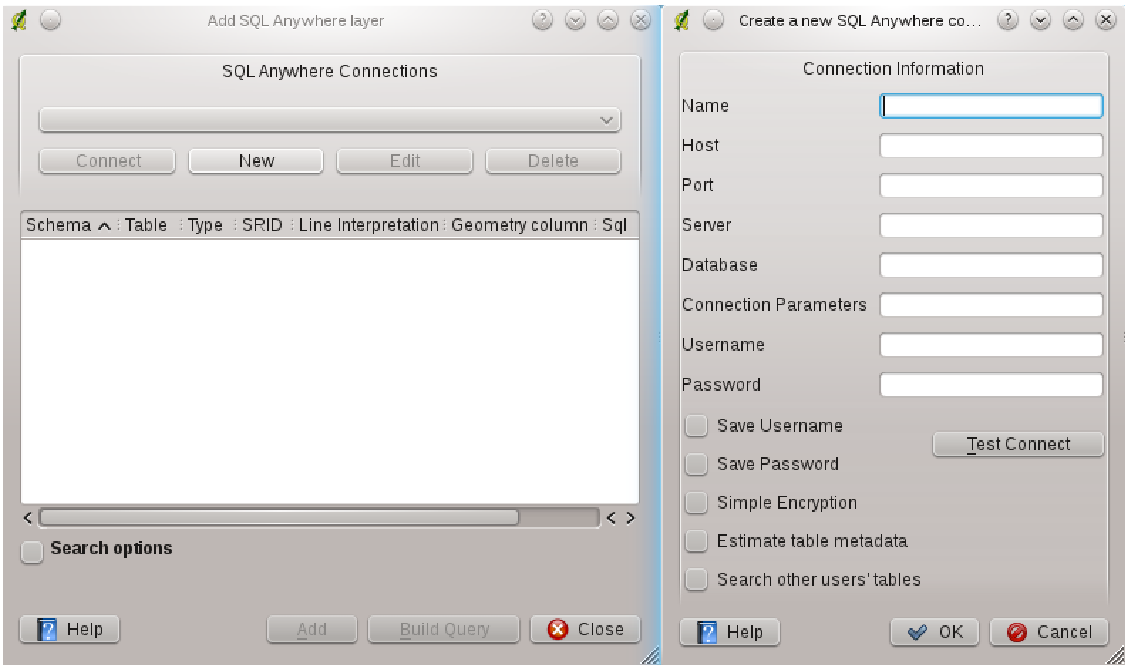
Gambar 19.30: Analisis Spasial Query - regions contain airports



Gambar 19.31: Menggunakan Plugin SPIT untuk mengimpor berkas Shape ke PostGIS

19.18 Plugin SQL Anywhere

SQL Anywhere adalah relational database management system (RDBMS) proprietary dari Sybase. SQL Anywhere termasuk dukungan spasial antara lain OGC, shapefile dan dibangun dalam fungsi untuk ekspor ke KML, GML dan format SVG.



Gambar 19.32: Dialog SQL Anywhere (KDE)

SQL Anywhere memungkinkan untuk terhubung ke spasial basisdata SQL Anywhere aktif. Dialog *Add SQL Anywhere layer* mirip dalam dialog dengan fungsi untuk PostGIS dan SpatiaLite.

.

19.19 Plugin Pemeriksa Topologi

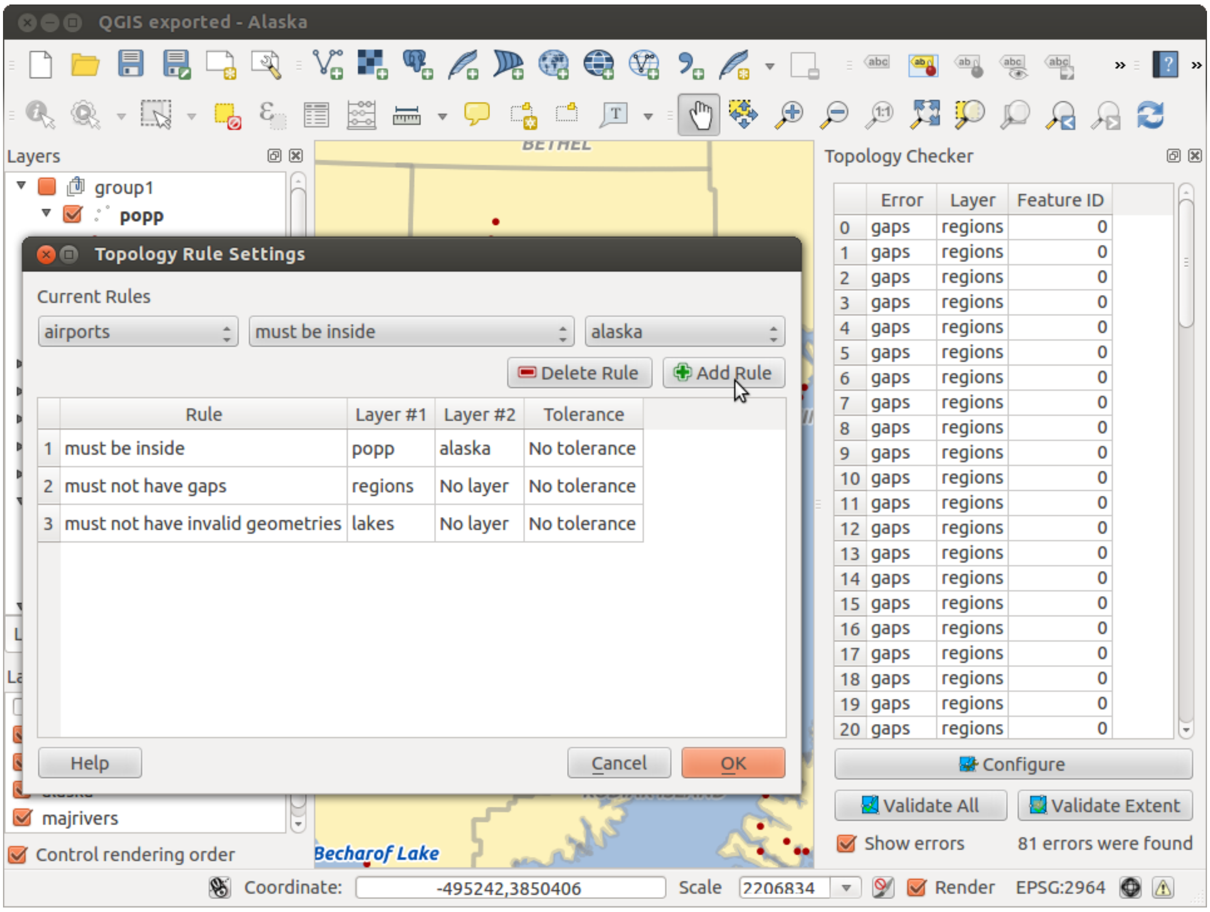
Topologi menggambarkan hubungan antara titik, garis dan poligon yang mewakili fitur dari wilayah geografis. Dengan plugin Pemeriksa Topologi Anda dapat melihat lebih berkas vektor dan memeriksa topologi dengan beberapa aturan topologi. Aturan-aturan ini memeriksa hubungan spasial apakah fitur Anda 'Equal', 'Contain', 'Cover', 'CoveredBy', 'Cross', 'Disjoint', 'Intersect', 'Overlap', 'Touches' dan 'Within' satu sama lain. Hal ini tergantung pada pertanyaan individu aturan topologi yang Anda terapkan pada data vektor. Misalnya biasanya Anda tidak akan menerima overshoot dalam lapisan baris tetapi jika mereka menggambarkan jalan buntu Anda tidak akan menghapusnya dari lapisan vektor Anda.

QGIS telah terintegrasi dengan fitur editing topologi yang besar untuk menciptakan fitur baru tanpa kesalahan. Tapi kesalahan data yang ada dan diinduksi kesalahan pengguna sulit untuk mencari tahu. Plugin ini membantu Anda mengetahui kesalahan tersebut melalui daftar aturan.

Hal ini sangat sederhana untuk membuat aturan topologi dengan plugin pemeriksa topologi

Pada **lapisan poin** aturan berikut ini tersedia:

- **Harus ditutupi oleh**: Disini Anda bisa memilih lapisan vektor dari proyek Anda. Poin yang tidak tercakup oleh lapisan vektor yang diberikan, terjadi 'Galat' di bidang.
- **Harus ditutupi oleh titik akhir dari**: Disini Anda bisa memilih lapisan garis dari proyek Anda.



Gambar 19.33: Plugin Pemeriksa Topologi

- **Harus berada di dalam**: Disini Anda bisa memilih lapisan poligon dari proyek Anda. Poin harus berada di dalam poligon. Jika tidak, QGIS menulis sebuah 'Galat' untuk titik.
- **Harus tidak duplikat**: Setiap poin diwakili dua kali atau lebih, akan terjadi 'Galat' di bidang.
- **Harus tidak memiliki geometri yang tidak valid**: Periksa apakah geometri berlaku.
- **Harus tidak banyak-bagian-geometri**: Semua bagian poin yang ditulis kedalam bidang 'Galat'.

Pada **lapisan garis** aturan berikut ini tersedia:

- **Titik akhir harus ditutupi oleh**: Disini Anda bisa memilih lapisan poin dari proyek Anda.
- **Harus tidak teruntai**: Ini akan menunjukkan dalam lapisan garis.
- **Harus tidak duplikat**: Setiap kali fitur garis diwakili dua kali atau lebih, ini akan terjadi 'Galat' di bidang.
- **Harus tidak memiliki geometri yang tidak valid**: Periksa apakah geometri berlaku.
- **Harus tidak multi-bagian geometri**: Kadang-kadang, geometri sebenarnya merupakan kumpulan sederhana (singgel-bagian) geometri. Geometri seperti ini disebut multi-bagian geometri. Jika berisi hanya satu jenis geometri sederhana, kita menyebutnya multi-point, multi-linestring atau multi-poligon. Semua multi-bagian garis ditulis kedalam bidang 'Galat'.
- **Harus tidak memiliki pseudos**: Poin akhir sebuah garis geometri yang harus dihubungkan ke titik akhir dari dua geometri lainnya. Jika poin akhir terhubung ke satu poin akhir geometri lain, poin akhir disebut titik pseudo.

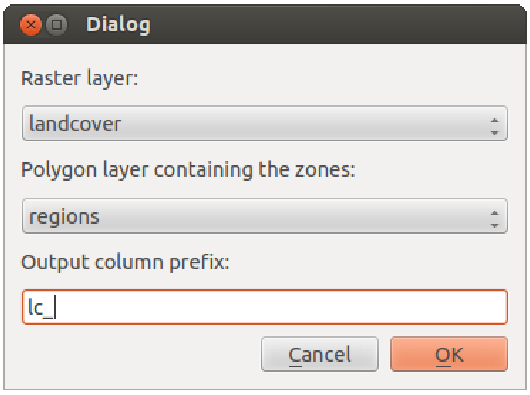
Pada **lapisan poligon** aturan berikut ini tersedia:

- **Harus berisi**: Lapisan poligon harus mengandung setidaknya satu poin/titik geometri dari lapisan kedua.
- **Harus tidak duplikat**: Poligon dari lapisan yang sama tidak harus memiliki geometri identik. Setiap kali fitur poligon diwakili dua kali atau lebih akan terjadi 'Galat' di bidang.
- **Harus tidak memiliki gap**: Poligon yang berdekatan seharusnya tidak membentuk gap/celah di antara mereka. Batas administratif bisa disebutkan sebagai contoh (poligon negara bagian AS tidak memiliki gap/celah antara mereka ...).
- **Harus tidak memiliki geometri yang tidak valid**: Periksa apakah geometri valid. Beberapa aturan yang mendefinisikan geometri yang valid:
  - Ring poligon harus tertutup.
  - Ring yang mendefinisikan lubang harus berada di dalam ring yang menentukan batas-batas eksterior.
  - Cincin tidak mungkin berpotongan (mereka mungkin tidak menyentuh atau silang satu sama lain).
  - Cincin mungkin tidak menyentuh cincin lain, kecuali pada suatu titik.
- **Harus tidak multi-bagian geometri**: Kadang-kadang, geometri sebenarnya merupakan kumpulan sederhana (singgel-bagian) geometri. Geometri seperti ini disebut multi-bagian geometri. Jika berisi hanya satu jenis geometri sederhana, kita menyebutnya multi-point, multi-linestring atau multi-poligon. Sebagai contoh, sebuah negara yang terdiri dari beberapa pulau dapat direpresentasikan sebagai multi-poligon.
- **Tidak tumpang tindih**: Poligon yang berdekatan harus tidak berbagi area umum.
- **Tidak boleh tumpang tindih dengan**: Poligon yang berdekatan dari satu lapisan tidak harus berbagi area umum dengan poligon dari lapisan lain.

.

19.20 Plugin Statistik Zonal

Dengan Plugin Statistik Zonal Anda dapat menganalisis hasil klasifikasi tematik. Hal ini memungkinkan untuk menghitung beberapa nilai-nilai piksel dari lapisan raster dengan bantuan lapisan vektor poligonal (lihat figure_zonal_statistics). Anda dapat menghitung jumlah, nilai rata-rata dan jumlah total piksel yang berada di dalam poligon. Plugin menghasilkan kolom keluaran dalam lapisan vektor dengan awalan user-defined.



Gambar 19.34: Dialog Statistik Zonal (KDE)

.

BAB 20

Bantuan dan Dukungan

20.1 Milis

QGIS masih aktif dikembangkan dan karena itu tidak akan selalu bekerja seperti yang Anda harapkan. Cara yang lebih disukai untuk mendapatkan bantuan adalah dengan bergabung di milis qgis-pengguna. Pertanyaan Anda akan menjangkau khalayak yang lebih luas dan jawabannya juga akan menguntungkan orang lain.

20.1.1 qgis-pengguna

Milis ini digunakan untuk membahas QGIS secara umum, serta pertanyaan-pertanyaan spesifik mengenai instalasi dan penggunaan. Anda dapat berlangganan milis qgis-pengguna dengan mengunjungi tautan URL: http://lists.osgeo.org/mailman/listinfo/qgis-user

20.1.2 fossgis-talk-liste

Untuk audien berbahasa Jerman, FOSSGIS e.V. menyediakan milis fossgis-talk-liste. Milis ini digunakan untuk diskusi GIS open source secara umum termasuk QGIS. Anda dapat berlangganan dengan mengunjungi URL: https://lists.fossgis.de/mailman/listinfo/fossgis-talk-liste

20.1.3 qgis-pengembang

Jika Anda seorang pengembang menghadapi masalah yang bersifat teknis, Anda mungkin ingin bergabung dengan milis qgis-pengembang di sini: http://lists.osgeo.org/mailman/listinfo/qgis-developer

20.1.4 qgis-commit

Setiap kali komit dibuat untuk kode repositori QGIS surel dikirim ke daftar ini. Jika Anda ingin mendapatkan informasi terbaru setiap perubahan basis kode saat ini, Anda bisa berlangganan di: http://lists.osgeo.org/mailman/listinfo/qgis-commit

20.1.5 qgis-trac

Daftar ini memberikan notifikasi surel yang terkait dengan manajemen proyek, termasuk laporan bug, tugas, dan permintaan fitur. Anda dapat berlangganan di: http://lists.osgeo.org/mailman/listinfo/qgis-trac

20.1.6 qgis-komunitas-tim

Daftar ini berkaitan dengan topik seperti dokumentasi, konteks bantuan, panduan-pengguna, pengalaman online termasuk situs web, blog, milis, forum, dan upaya penerjemahan. Jika Anda ingin bekerja pada panduan-pengguna juga, dalam daftar ini adalah titik awal yang baik untuk mengajukan pertanyaan Anda. Anda dapat berlangganan di: http://lists.osgeo.org/mailman/listinfo/qgis-community-team

20.1.7 qgis-rilis-tim

Daftar ini berkaitan dengan topik seperti proses rilis, pemaketan binari untuk berbagai OS dan mengumumkan rilis baru ke dunia pada umumnya. Anda dapat berlangganan di: http://lists.osgeo.org/mailman/listinfo/qgis-release-team

20.1.8 qgis-tr

Daftar ini berkaitan dengan upaya penerjemahan. Jika Anda ingin bekerja pada penerjemahan panduan atau grafis antarmuka pengguna (GUI), dalam daftar ini adalah titik awal yang baik untuk mengajukan pertanyaan Anda. Anda bisa berlangganan di: http://lists.osgeo.org/mailman/listinfo/qgis-tr

20.1.9 qgis-edu

Daftar ini berkaitan dengan upaya pendidikan QGIS. Jika Anda ingin bekerja pada bahan pendidikan QGIS, daftar ini adalah awal yang baik untuk mengajukan pertanyaan Anda. Anda bisa berlangganan di: http://lists.osgeo.org/mailman/listinfo/qgis-edu

20.1.10 qgis-psc

Daftar ini digunakan untuk membahas isu-isu Komite Pengarah yang berkaitan dengan arah dan manajemen secara keseluruhan QGIS. Anda dapat berlangganan di: http://lists.osgeo.org/mailman/listinfo/qgis-psc

Anda dipersilakan untuk berlangganan ke salah satu daftar. Harap ingat untuk berkontribusi ke dalam daftar dengan menjawab pertanyaan dan berbagi pengalaman Anda. Perhatikan bahwa qgis-commit dan qgis-trac dirancang hanya untuk pemberitahuan saja dan tidak dimaksudkan untuk mengirim surel.

20.2 IRC

Kami juga mengunakan IRC - kunjungi kami dengan bergabung dalam kanal #qgis di irc.freenode.net. Butuh waktu untuk menanggapi pertanyaan Anda karena banyak orang-orang di saluran ini melakukan hal-hal lain dan mungkin diperlukan waktu beberapa saat bagi mereka untuk melihat pertanyaan Anda. Jika Anda melewatkan sebuah diskusi di IRC, tidak masalah! Kami log semua diskusi, sehingga Anda dapat dengan mudah mengejar ketinggalan. Hanya pergi ke http://qgis.org/irclogs dan baca IRC-logs.

Dukungan komersial untuk QGIS juga tersedia. Periksa website http://qgis.org/en/commercial-support.html untuk informasi selengkapnya.

20.3 BugTracker

Sementara milis qgis-pengguna berguna untuk jenis pertanyaan umum 'bagaimana cara melakukan XYZ di QGIS', Anda mungkin ingin memberitahu kami tentang bug di QGIS. Anda bisa mengirimkan laporan bug menggunakan pelacak bug QGIS di http://hub.qgis.org/projects/quantum-gis/issues. Saat membuat tiket bug baru, mohon diinformasikan alamat surel dimana kami bisa meminta informasi tambahan.

Harap diingat bahwa bug Anda mungkin tidak selalu sesuai dengan prioritas Anda seperti harapan Anda (tergantung pada tingkat kesulitannya). Beberapa bug mungkin memerlukan upaya pengembang yang signifikan untuk memperbaiki dan tenaga kerja tidak selalu tersedia.

Permintaan fitur dapat disampaikan juga menggunakan sistem tiket yang sama untuk bug. Pastikan untuk memilih jenis `Feature`.

Jika Anda telah menemukan bug dan memperbaikinya sendiri Anda bisa mengirimkan patchnya juga. Sekali lagi, kirim ke sistem tiket redmine di http://hub.qgis.org/wiki/quantum-gis/issues. Periksa kotak centang `Patch supplied` dan melampirkan patch Anda sebelum mengirimkan bug. Seseorang pengembang akan meninjau dan menerapkannya ke QGIS. Harap jangan khawatir jika patch Anda tidak diterapkan langsung — pengembang terikat dengan komitmen-komitmen lainnya.

20.4 Blog

Komunitas juga menjalankan weblog di http://planet.qgis.org/planet/ yang memiliki beberapa artikel menarik bagi pengguna dan pengembang juga disediakan oleh masyarakat dalam blog lain. Anda diundang berkontribusi pada blog QGIS Anda sendiri!

20.5 Plugin

Situs web http://plugins.qgis.org menyediakan web resmi Portal plugin QGIS. Di sini Anda menemukan daftar semua plugin QGIS stabil dan eksperimental tersedia melalui 'Repositori Plugin QGIS Resmi'.

20.6 Wiki

Akhirnya, kami memelihara situs web WIKI di http://hub.qgis.org/projects/quantum-gis/wiki di mana Anda dapat menemukan berbagai informasi berguna yang berhubungan dengan pengembangan QGIS, rencana rilis, tautan untuk mengunduh, pesan petunjuk-terjemahan dan sebagainya. Silakan dikunjungi, ada banyak informasi bagus didalamnya!

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Appendix

21.1 GNU General Public License

Version 2, June 1991

Preamble

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