
QGIS User Guide

Wydanie 2.2

QGIS Project

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Preambuła

Ten dokument to oryginalny podręcznik użytkownika programu QGIS. Większość oprogramowania i sprzętu opisanego w tym dokumencie to zarejestrowane znaki towarowe, które podlegają prawnym regulacjom. QGIS wydany jest na Powszechnej Licencji GNU. Więcej informacji znajdziesz na stronie domowej QGIS <http://www.qgis.org>.

Informacje, dane, wyniki itp. zawarte w tym dokumencie zostały podane i sprawdzone zgodnie z najlepszą wiedzą i odpowiedzialnością autorów i edytorów. Mimo tego, istnieje możliwość, że zawierają one pomyłki.

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Ten dokument został złożony za pomocą reStructuredText. Jest dostępny w postaci kodu źródłowego reST na [github](#) i online jako HTML i PDF pod adresem <http://www.qgis.org/en/docs/>. Z sekcji Dokumentacja projektu QGIS można również pobrać tłumaczenia tego dokumentu w kilku formatach. Więcej informacji na temat możliwości wniesienia własnego wkładu do dokumentacji i jej tłumaczenia znajdziesz pod adresem: <http://www.qgis.org/wiki/>.

Odnośniki w tym dokumencie

Dokument niniejszy zawiera odnośniki wewnętrzne i zewnętrzne. Kliknięcie odnośnika wewnętrznego przenosi do innej części tego dokumentu, natomiast zewnętrzne odnośniki prowadzą pod inne adresy internetowe. W PDFie oba rodzaje linków mają kolor niebieski i obsługiwane są przez przeglądarkę systemową. W przypadku HTML przeglądarka wyświetla i obsługuje oba rodzaje linków tak samo.

Autorzy i edytorzy podręczników użytkownika, instalacji i programowania:

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Internet: <http://www.qgis.org>

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Przyjęte oznaczenia

W tym rozdziale opisany jest jednolity styl oznaczeń przyjętych w tym podręczniku.

2.1 Oznaczenia GUI

Oznaczenia GUI są tak pomyślane, aby przypominały właściwy wygląd interfejsu użytkownika. Ogólna zasada jest taka, że używa się wyglądu elementów tak, jak wyglądają one bez fokusa, aby użytkownik mógł łatwo odnaleźć w interfejsie to, co opisane jest w podręczniku.

- Pozycje menu: *Warstwa* → *Dodaj warstwę rastrową* lub *Widok* → *Paski narzędzi* → *Digitalizacja*

- Narzędzia:  Dodaj warstwę rastrową

- Przycisk: [**Zapisz jako domyślne**]

- Tytuł okna *Właściwości warstwy*

- Zakładka: *Ogólne*

- Pole wyboru: *Renderuj*

- Przycisk radio: *SRID Postgis* *EPSG ID*

- Podaj liczbę:

- Wybierz tekst:

- Przeglądaj w poszukiwaniu pliku:

- Wybierz kolor:

- Suwak:

- Wprowadź tekst:

Jeśli element posiada tło (cień) oznacza, że można go kliknąć.

2.2 Oznaczenia tekstu i klawiszy

Podręcznik zawiera również oznaczenia odnoszące się do tekstu, poleceń i kodu, aby można było odróżnić różnego rodzaju obiekty, jak metody i klasy. Nie mają one żadnych odpowiedników w interfejsie użytkownika QGIS.



- Hiperlinki: <http://qgis.org>
- Kombinacje klawiszy: naciśnij `Ctrl+B`, oznacza przytrzymaj klawisz `Ctrl` i naciśnij klawisz `B`.
- Nazwa pliku: `lakes.shp`

- Nazwa klasy: **NewLayer**
- Metoda: *classFactory*
- Serwer: *myhost.de*
- Tekst wprowadzany przez użytkownika: `qgis --help`

Linie kodu wyróżnione są czcionką o stałej szerokości:

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


2.3 Uwagi szczegółowe dla platform


Ciągi poleceń i niewielkie ilości tekstu mogą być sformatowane w w linii: Kliknij   *Plik* **X** *QGIS* → *Zakończ QGIS*. Na systemach uniksowych i Windows oznacza to, że najpierw powinno się kliknąć polecenie menu Plik, a następnie Zakończ QGIS. Natomiast na platformie Macintosh OS X, powinno się najpierw kliknąć menu QGIS a następnie Zakończ QGIS.

Dłuższe fragmenty tekstu mogą być sformatowane jako lista:

-  *zrób to;*
-  *zrób to;*
- **X** *zrób tamto.*

lub jako akapity:

 **X** *Zrób to, to i to. Potem zrób to, to i to, a następnie zrób tamto i to, a potem jeszcze to.*

 *Zrób to, a potem tamto. Potem zrób to i to. Następnie zrób tamto i to, a potem jeszcze to. Na koniec zrób to, to, to i tamto.*

Zrzuty ekranowe zamieszczone w podręczniku zostały utworzone na różnych platformach, której znacznik umieszczony jest na końcu opisu obrazka.

Wstęp

Witaj we wspaniałym świecie Systemów Informacji Przestrzennej (GIS)!

QGIS jest systemem informacji przestrzennej o otwartym źródle. Projekt rozpoczął się w maju 2002 roku, a w czerwcu utworzono projekt w serwisie SourceForge. Staramy się bardzo udostępnić oprogramowanie GIS (które tradycyjnie jest kosztownym oprogramowaniem prawnie zastrzeżonym) wszystkim, którzy mają dostęp do komputera. Obecnie QGIS działa na większości platform uniksowych, na Windows i OS X. QGIS jest rozwijany przy użyciu C++ i narzędzi Qt (<http://qt.digia.com>). Oznacza to, że QGIS ma przyjemny, łatwy w użyciu interfejs (GUI) i chętnie się go używa.

W naszych zamierzeniach QGIS ma być prostym w użyciu systemem informacji przestrzennej, posiadającym popularne funkcjonalności i polecenia. Początkowo miał być przeglądarką GISową. QGIS osiągnął taki stopień rozwoju, że przez wielu użytkowników jest na co dzień używany do przeglądania danych GIS. QGIS obsługuje wiele formatów danych rastrowych i wektorowych, a dodanie kolejnych jest bardzo proste dzięki mechanizmowi wtyczek.

QGIS udostępniany jest na Powszechnej Licencji GNU (GPL). Dzięki temu, że QGIS rozwijany jest pod tą licencją możesz mieć wgląd w jego kod źródłowy, możesz go modyfikować i masz gwarancję, że jako nasz szczęśliwy użytkownik, zawsze będziesz mieć dostęp do programu GISowego wolnego od opłat i którego możesz dowolnie modyfikować. Razem z QGIS powinieneś otrzymać pełny tekst licencji GPL, którą znajdziesz też w dodatku *GNU General Public License*.

Wskazówka: Aktualna wersja dokumentacji

Aktualna wersja tego dokumentu zawsze dostępna jest w sekcji dokumentacji na stronie QGIS pod adresem <http://www.qgis.org/en/docs/>

QGIS oferuje wiele funkcjonalności GIS dostępnych jako wbudowane części programu lub jako wtyczki. Poniżej zaprezentowano sześć ogólnych kategorii narzędzi i wtyczek, a następnie dokonano krótkiego wprowadzenia do wbudowanej konsoli Pythona.

4.1 Przeglądanie danych

Można przeglądać i nakładać na siebie dane wektorowe i rastrowe zapisane w różnych formatach i w różnych układach odniesienia bez ich konwersji do jakiegoś wspólnego formatu. Obsługiwane formaty obejmują:

- Tabele i widoki z informacją przestrzenną w PostGIS, SpatiaLite, MSSQL Spatial, Oracle Spatial, formatach obsługiwanych przez zainstalowaną bibliotekę OGR, w tym ESRI shapefiles, MapInfo, SDTS, GML i wiele innych, zobacz rozdział *Working with Vector Data*.
- Rastry i zobrazowania obsługiwane przez zainstalowaną bibliotekę GDAL (Geospatial Data Abstraction Library) takie jak GeoTiff, ERDAS IMG, ArcInfo ASCII GRID, JPEG, PNG i wiele innych, zobacz rozdział *Working with Raster Data*.
- Rastry i dane wektorowe GRASS zapisane w bazach GRASS (location/mapset), zobacz rozdział *GRASS GIS Integration*.
- Dane przestrzenne udostępnione online jako OGC Web Services, w tym WMS, WMTS, WCS, WFS, WFS-T. Zobacz rozdział *Working with OGC Data*.
- OpenStreetMap data. See section *plugins_osm*.

4.2 Przeglądanie danych i tworzenie map

Możesz tworzyć mapy i interaktywnie przeglądać dane przestrzenne za pomocą przyjaznego interfejsu użytkownika. Interfejs zawiera wiele przydatnych narzędzi:

- Przeglądarka QGIS
- Przeliczanie współrzędnych w locie
- Zarządzanie bazami danych
- Wydruki map
- Panel podglądu
- Zakładki
- Narzędzia opisu
- Zaznaczanie i uzyskiwanie informacji o obiektach
- Edycja/przeglądanie/przeszukiwanie atrybutów

- Etykietowanie obiektów oparte na danych
- Style wyświetlania warstw wektorowych i rastrowych oparte na danych
- Tworzenie atlasowych kompozycji mapowych z siatkami
- Umieszczanie na mapie strzałki północy, skali i informacji o prawach autorskich
- Wsparcie dla zapisywania i przywracania projektów

4.3 Tworzenie, edycja, zarządzanie i eksport danych

Można tworzyć, edytować, zarządzać i eksportować dane rastrowe i wektorowe w różnych formatach. QGIS daje następujące możliwości.:

- Narzędzia digitalizacji dla formatów obsługiwanych przez OGR i warstw wektorowych GRASS
- Możliwość tworzenia oraz edycji plików ESRI Shapefile i warstw wektorowych GRASS
- Wtyczka Georeferencer do geokodowania obrazów
- Narzędzia GPS do importu i eksportu formatu GPX oraz konwersji innych formatów GPS do GPX i bezpośredniego ściągania/ladowania danych na urządzenia GPS (na GNU/Linuxie dodano usb: do listy urządzeń GPS)
- Wsparcie dla przeglądania i edycji danych OpenStreetMap
- Możliwość tworzenia tabel przestrzennych w bazach na podstawie plików Shapefile za pomocą wtyczki Zarządzanie bazami danych
- Poprawiona obsługa tabel w przestrzennych bazach danych
- Narzędzia do zarządzania tabelami atrybutów warstw wektorowych
- Możliwość zapisywania zrzutów ekranowych jako obrazów z georeferencją

4.4 Analiza danych

Można wykonywać przestrzenne analizy danych umieszczonych w bazach danych z rozszerzeniem przestrzennym i innych formatach obsługiwanych przez OGR. Obecnie QGIS oferuje analizę danych wektorowych, próbkowanie, geoprocesing, narzędzia zarządzania geometrią i bazami danych. Można też wykorzystać wbudowane narzędzia GRASS, dające pełną funkcjonalność GRASS, tj. ponad 400 modułów (zobacz rozdział *GRASS GIS Integration*). Można też wykorzystać wtyczkę Geoprocesing, która daje dostęp do własnych i zewnętrznych narzędzi z poziomu QGIS, obejmujących algorytmy GDAL, SAGA, GRASS, fTools i innych (zobacz rozdział *Introduction*).

4.5 Publikowanie map w Internecie

QGIS może służyć jako klient WMS, WMTS, WMS-C, WFS i WFS-T oraz jako serwer WMS, WCS lub WFS (zobacz rozdział *Working with OGC Data*). Dodatkowo można wyeksportować dane i opublikować je w Internecie przy użyciu zainstalowanych serwerów UMN MapServer lub Geoserver.

4.6 Rozszerzanie możliwości QGIS za pomocą wtyczek

QGIS można dostosować do swoich indywidualnych potrzeb za pomocą elastycznej architektury wtyczek i bibliotek, których można użyć do tworzenia wtyczek. Można nawet tworzyć własne aplikacje w C++ lub Pythonie!

4.6.1 Wtyczki instalowane razem z programem

Wtyczki instalowane razem z programem:

1. Przechwytywanie współrzędnych (Informacja o współrzędnych kursora myszy w różnych układach współrzędnych)
2. Zarządzanie bazami danych (wymiana, edycja i przeglądanie warstw i tabel, uruchamianie zapytań SQL)
3. Tworzenie diagramów (nakładanie diagramów na warstwy wektorowe)
4. Konwerter Dxf2Shp (konwertuje pliki DXF do Shapefile)
5. eVIS (wizualizacja zdarzeń)
6. fTools (analiza i zarządzanie danymi wektorowymi)
7. Narzędzia GDAL (zintegrowane z QGIS)
8. Georeferencer GDAL (dodawanie informacji przestrzennej do rastrów przy użyciu GDAL)
9. Narzędzia GPS (Ładowanie i import danych GPS)
10. GRASS (integracja GRASS)
11. Mapa termiczna (tworzenie rastrowych map termicznych na podstawie danych punktowych)
12. Wtyczka interpolacji (interpolacja rastrów na podstawie wierzchołków warstwy wektorowej)
13. Edycja offline (pozwala na edycję offline i synchronizację z bazą danych)
14. GeoRaster Oracle Spatial
15. Geoprocessing (dawniej SEXTANTE)
16. Rastrowa analiza terenu (analiza ukształtowania terenu na podstawie rastrów)
17. Wtyczka Road graph (znajdowanie najkrótszej trasy za pomocą analizy sieci)
18. Wtyczka zapytań przestrzennych
19. SPIT (importowanie plików Shapefile do bazy PostgreSQL/PostGIS)
20. Wtyczka SQL Anywhere (przechowywanie danych w bazach SQL Anywhere)
21. Kontrola topologii (znajdowanie błędów topologicznych w warstwach wektorowych)
22. Wtyczka statystyk strefowych (oblicza ilość wystąpień, sumę, średnią z rastra dla wieloboków warstwy wektorowej)

4.6.2 Wtyczki Pythona

QGIS zawiera rosnącą liczbę zewnętrznych wtyczek pythonowych, stworzonych przez społeczność. Wtyczki te można znaleźć w oficjalnym repozytorium wtyczek i łatwo zainstalować za pomocą menedżera wtyczek (zobacz rozdział *load_external_plugin*).

4.7 Konsola Pythona

Do uruchamiania skryptów można wykorzystać wbudowaną konsolę Pythona. Można ją otworzyć za pomocą menu: *Wtyczki* → *Konsola Pythona*. Konsola otwiera się jako okno niemodalne. Do interakcji ze środowiskiem QGIS służy zmienna `qgis.utils iface`, będąca instancją `QgsInterface`. Ten interfejs pozwala na dostęp do okna mapy, menu, pasków narzędzi i innych części aplikacji QGIS.

Więcej informacji o pracy z konsolą Pythona i programowaniu wtyczek QGIS i aplikacji można znaleźć na stronie http://www.qgis.org/html/en/docs/pyqgis_developer_cookbook/index.html.

4.8 Znane błędy

4.8.1 Ograniczenie ilości otwartych plików

Gdy otwiera się duży projekt QGIS i ma się pewność, że wszystkie warstwy są prawidłowe, a niektóre z nich zaznaczone są jako błędne, dotyczy to prawdopodobnie tego błędu. GNU/Linux (również inne systemy operacyjne) ma ograniczenie ilości plików otwartych przez pojedynczy proces. Ograniczenie danych źródłowych określone jest dla procesu i jest dziedziczone. Wbudowane polecenie powłoki `ulimit` zmienia to ograniczenie jedynie dla procesów bieżącej powłoki, natomiast będzie dziedziczone przez każdy proces potomny.

Można podejrzeć informacje o bieżącym `ulimit` przez wpisanie

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

Możesz zobaczyć bieżącą dopuszczalną liczbę plików otwartych przez pojedynczy proces wydając następujące polecenie w konsoli

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

Aby zmienić to ograniczenie dla **istniejącej sesji** można użyć

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

Aby naprawić to na stałe

Na większości systemów linuxowych ograniczenie źródeł ustawiane jest w czasie logowania przez moduł `pam_limits` zgodnie z ustawieniami zawartymi w `/etc/security/limits.conf` lub `/etc/security/limits.d/*.conf`. Jeśli masz uprawnienia roota (można użyć `sudo`) można edytować te pliki, ale zmiana dokona się dopiero po powtórnym zalogowaniu.

Więcej informacji:

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

What's new in 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 Application and Project Options

- **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 Data Providers

- **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 Map Composer

- **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 QGIS Server

- **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 Symbology

- **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 palletted rasters:** Rasters that use a fixed colour palette (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 User Interface

- **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`)

Pierwsze kroki

Ten rozdział zawiera ogólne informacje o instalacji QGIS, przykładowych danych zawartych na stronie internetowej QGIS i uruchomieniu pierwszej sesji z wizualizacją warstw rastrowych i wektorowych.

6.1 Instalacja

Instalacja QGIS jest bardzo prosta. Standardowe pakiety instalacyjne są dostępne dla MS Windows i dla Mac OS X. Dla wielu dystrybucji GNU/Linuksa dostępne są pakiety binarne (rpm i deb) lub repozytoria oprogramowania, które można dodać do swoich menedżerów instalacji. Najświeższe informacje o pakietach binarnych można uzyskać na stronie internetowej QGIS pod adresem <http://download.qgis.org>.

6.1.1 Instalacja z kodu źródłowego

Jeśli chcesz skompilować kod źródłowy QGIS, sięgnij do instrukcji instalacji. Instrukcje te dołączane są do kodu źródłowego QGIS w pliku o nazwie `INSTALL`. Można je również znaleźć online pod adresem <http://htmlpreview.github.io/?https://raw.githubusercontent.com/qgis/QGIS/master/doc/INSTALL.html>

6.1.2 Instalacja na nośnikach zewnętrznych


QGIS umożliwia zdefiniowanie opcji `--configpath`, która nadpisuje domyślną ścieżkę dla konfiguracji użytkownika (np. `~/qgis2` w GNU/Linuksie) i nakazuje, aby również `QSettings` korzystały z tej ścieżki. Umożliwia to użytkownikom przenoszenie instalacji QGIS na pamięci zewnętrznej razem ze wszystkimi ich ustawieniami i pluginami. Więcej informacji znajduje się w rozdziale *Zakładka System*.

6.2 Przykładowe dane

Przewodnik zawiera przykłady wykorzystujące próbny zestaw danych QGIS.

!win!Instalator windowsowy posiada opcję ściągnięcia próbnego zestawu danych !qgl. Jeśli zostanie ona zaznaczona, wówczas dane zostaną ściągnięte do twojego folderu `Moje Dokumenty` i umieszczone w folderze `:file:'GIS Database`. Możesz przenieść ten folder w inne, dogodne położenie za pomocą Exploratora Windows. Jeśli nie zaznaczysz opcji instalacji próbnego zestawu danych podczas pierwszej instalacji QGIS, możesz wybrać jedno z poniższych rozwiązań:

- użyć danych GIS, które już masz
- pobrać dane przykładowe z http://download.osgeo.org/qgis/data/qgis_sample_data.zip
- odinstalować QGIS i zainstalować go od nowa zaznaczając tym razem opcję pobierania danych (to rozwiązanie polecane jest w wypadku, gdy nie zadziała żadne z powyższych).

 **X** Dla GNU/Linuksa i Mac OS X nie są jeszcze dostępne pakiety instalacyjne rpm, deb czy dmg z przykładowymi danymi. Aby skorzystać ze zbioru danych przykładowych pobierz plik ZIP `qgis_sample_data` z http://download.osgeo.org/qgis/data/qgis_sample_data.zip a następnie odpakuj archiwum na swoim komputerze.

Zbiór danych z Alaski zawiera wszystkie dane GIS wykorzystywane jako przykłady w tym podręczniku oraz mały zestaw danych dla GRASS. Odwzorowanie zbioru danych przykładowych to Alaski Albers Equal Area z miarą długości w stopach (ang. feet). Kod EPSG tego układu to 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]]
```

Jeśli chcesz wykorzystać QGIS jako nakładkę wizualną dla GRASS, możesz pobrać zbiory danych przykładowych (np. Spearfish lub South Dakota) z oficjalnej strony GRASS GIS pod adresem <http://grass.osgeo.org/download/sample-data/>.

6.3 Przykładowa sesja






Teraz, gdy zainstalowałeś już QGIS i masz dostęp do próbnego zestawu danych, chcielibyśmy pokazać Ci prostą i krótką sesję QGIS. Wyświetlimy warstwy rastrowe i wektorowe. Wykorzystamy rastrową warstwę pokrycia terenu `qgis_sample_data/raster/landcover.img` oraz wektorową warstwę `qgis_sample_data/gml/lakes.gml`.

6.3.1 Uruchomienie QGIS

-  Uruchom QGIS wpisując w linii poleceń: "QGIS" lub korzystając z prekompilowanego pakietu binarnego z menu aplikacji.
-  Uruchom QGIS z menu Start, za pomocą skrótów na pulpicie lub dwukrotnie klikając na dowolnym pliku projektu QGIS.
- **X** Kliknij dwukrotnie ikonkę w twoim folderze Aplikacji.

6.3.2 Załaduj warstwę rastrową i wektorową z próbnego zestawu danych.




1. Kliknij na ikonkę  Dodaj warstwę rastrową.
2. Przejdź do folderu `qgis_sample_data/raster/`, wybierz plik w formacie ERDAS IMG: `file:landcover.img` i kliknij **[Otwórz]**.




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. A teraz kliknij ikonkę  Dodaj warstwę wektorową.
5. Jako typ źródła danych w nowym oknie dialogowym *Dodaj warstwę wektorową* powinien być zaznaczony  *Plik*. Kliknij [**Przełączaj**], aby wybrać warstwę wektorową.
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. Powiększ nieco widok do wybranego obszaru z jakimiś jeziorami.
8. Kliknij dwukrotnie warstwę `lakes` w legendzie mapy aby otworzyć okno dialogowe *Właściwości warstwy*.
9. Kliknij zakładkę *Styl* i ustaw niebieski jako kolor wypełnienia.
10. Kliknij zakładkę *Etykiety* i aby włączyć etykietowanie zaznacz pole wyboru checkbox *Etykietuj tę warstwę* z. Wybierz “NAMES” jako pole zawierające etykiety.
11. Można poprawić widoczność etykiet dodając do nich białą obwódkę klikając “Otoczka” w liście po lewej, zaznaczając  *Rysuj otoczkę* i wybierając jako rozmiar otoczki 3.
12. Kliknij [**Zastosuj**], sprawdź czy rezultat zmian wygląda dobrze i potem naciśnij [**OK**].

Przekonałeś się właśnie, jak łatwo można wyświetlić raster i warstwę wektorową w QGIS. Teraz przejdziemy do kolejnego rozdziału, w którym dowiemy się więcej o dostępnych funkcjonalnościach, obiektach i ich ustawieniach.


6.4 Uruchamianie i zamykanie QGIS

W rozdziale *Przykładowa sesja* dowiedziałeś się jak uruchomić QGIS. Wracamy do tego tematu, aby pokazać, że QGIS ma więcej opcji uruchamiania w linii poleceń.

-  Zakładając, że QGIS jest zainstalowany w lokalizacji zarejestrowanej w zmiennej PATH, możesz uruchomić QGIS wpisując: `qgis` w linii poleceń lub klikając dwukrotnie na ikonke aplikacji QGIS (lub skrócie) na pulpicie lub w menu aplikacji.
-  Uruchom QGIS z menu Start, za pomocą skrótu na pulpicie lub dwukrotnie klikając na dowolnym pliku projektu QGIS.
-  Kliknij dwukrotnie ikonkę w folderze aplikacji. Jeśli musisz uruchomić QGIS w powłoce, uruchom `/path-to-installation-executable/Contents/MacOS/Qgis`.

Żeby zamknąć QGIS kliknij w menu   *Projekt*  polecenie *Wyjdź z QGIS* lub użyj skrótu klawiaturowego `Ctrl+Q`.

6.5 Opcje linii poleceń

 QGIS można uruchomić z linii poleceń z szeregiem opcji. Listę dostępnych opcji można uzyskać wpisując w linii poleceń `qgis --help`. Instrukcja użycia dla QGIS jest następująca:

```
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

Wskazówka: Przykłady wykorzystania opcji linii poleceń

Możesz uruchomić QGIS podając w linii poleceń jeden lub więcej plików z danymi. Zakładając, że jesteś w katalogu `qgis_sample_data`, mógłbyś uruchomić QGIS z ładowaniem zbioru danych składającym się z warstwy wektorowej i rastrowej używając polecenia: `qgis ./raster/landcover.img ./gml/lakes.gml`

Opcja linii poleceń `--snapshot`

T opcja pozwala na utworzenie zrzutu bieżącego widoku do formatu PNG. Może się to okazać przydatne, gdy masz wiele projektów i chciałbyś utworzyć zrzutki swoich danych.

Obecnie tworzone są pliki PNG w rozdzielczości 800x600 pikseli. Można to zmienić używając w opcji linii poleceń argumentów `--width` i `--height`. Po argumentach `--snapshot` można podać nazwę pliku.

Opcja linii poleceń `--lang`

QGIS określa twoje ustawienia językowe na podstawie twojej lokalizacji. Gdybyś chciał uruchomić go w swoim języku, możesz podać kod tego języka. Na przykład `--lang=pl` uruchomi QGIS w języku polskim. Lista obsługiwanych obecnie języków, ich kodów i postępu tłumaczenia opublikowana jest pod adresem http://hub.qgis.org/wiki/quantum-gis/GUI_Translation_Progress.

Opcja linii poleceń `--project`

Można też uruchomić QGIS z istniejącym projektem. Należy wtedy dodać opcję `--project` i nazwę projektu, a QGIS otworzy wszystkie warstwy zawarte w tym pliku.

Opcja linii poleceń `--extent`

Używając tej opcji można uruchomić QGIS z określonym zakresem widoczności. Trzeba wtedy podać rozdzielane przecinkami współrzędne prostokąta opisującego żądany zakres w następującym porządku:

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

Opcja linii poleceń `--nologo`

Ta opcja ukrywa ekran powitalny w czasie uruchamiania QGIS.

Opcja linii poleceń `--noplugins`

Gdybyś miał kłopoty z wtyczkami w czasie uruchamiania QGIS, możesz wyłączyć ich ładowanie przy starcie. Będą one nadal dostępne w Menedżerze Wtyczek.

Opcja linii poleceń `--customizationfile`

Użycie tej opcji spowoduje, że w czasie uruchamiania zostanie zastosowana zapisana w pliku personalizacja interfejsu użytkownika.

Opcja linii poleceń `--nocustomization`

Użycie tej opcji spowoduje, że w czasie uruchamiania nie zostanie zastosowana istniejąca personalizacja interfejsu użytkownika.



Opcja linii poleceń `--optionspath`


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


Opcja linii poleceń `--configpath`

Ta opcja jest podobna do poprzedniej ale dodatkowo nadpisuje domyślną ścieżkę (`~/qgis2`) dla konfiguracji użytkownika i nakazuje, aby również QSettings korzystały z tej ścieżki. Umożliwia to użytkownikom np. przenoszenie instalacji QGIS na pamięci zewnętrznej razem ze wszystkimi ich ustawieniami i pluginami.

6.6 Projekty

Projekt jest zapisem stanu twojej sesji QGIS. QGIS pracuje na raz z jednym projektem. Ustawienia można zmieniać na poziomie projektu bądź uczynić je domyślnymi dla nowych projektów (zobacz rozdział *Opcje*). QGIS zapisze stan twojej przestrzeni roboczej w pliku Projektu, gdy użyjesz polecenia menu *Projekt* →  *Zapisz* lub *Projekt* →  *Zapisz jako*.

Ładowanie zapisanych Projektów do QGIS następuje za pomocą poleceń *Projekt* →  *Otwórz ...*, *Projekt* → *Nowy z szablonu* lub *Projekt* → *Otwórz ostatnie* →.

Wyczyszczenie sesji i rozpoczęcie nowej następuje za wybraniu polecenia *Projekt* →  *Nowy*. Każde z wymienionych poleceń zapyta Cię, czy zapisać bieżący projekt, jeśli nastąpiły w nim jakieś zmiany od czasu otwarcia lub ostatniego zapisu.

Informacje zapisywane w pliku projektu obejmują:

- Dodane warstwy
- Właściwości warstw, włącznie ze stylem
- Odwzorowanie widoku mapy
- Ostatni zakres widoczności



Plik projektu zapisywany jest w formacie XML, więc jeśli się na tym znasz, możesz go zmienić poza QGIS. Format pliku zmieniał się kilkakrotnie razem z kolejnymi wersjami QGIS. Pliki projektów z wcześniejszych wersji mogą nie działać teraz prawidłowo. Możesz uaktywnić ostrzeżenia o tym w zakładce *Ogólne* w *Ustawienia* → *Opcje* zaznaczając:

- *Informuj o konieczności zapisu, gdy projekt i źródło ulegną zmianie*
- *Ostrzegaj przy otwieraniu projektów zapisanych w starszych wersjach QGIS*

Za każdym razem, gdy zapiszesz projekt w QGIS 2.2 zapisywany będzie również plik zapasowy projektu.

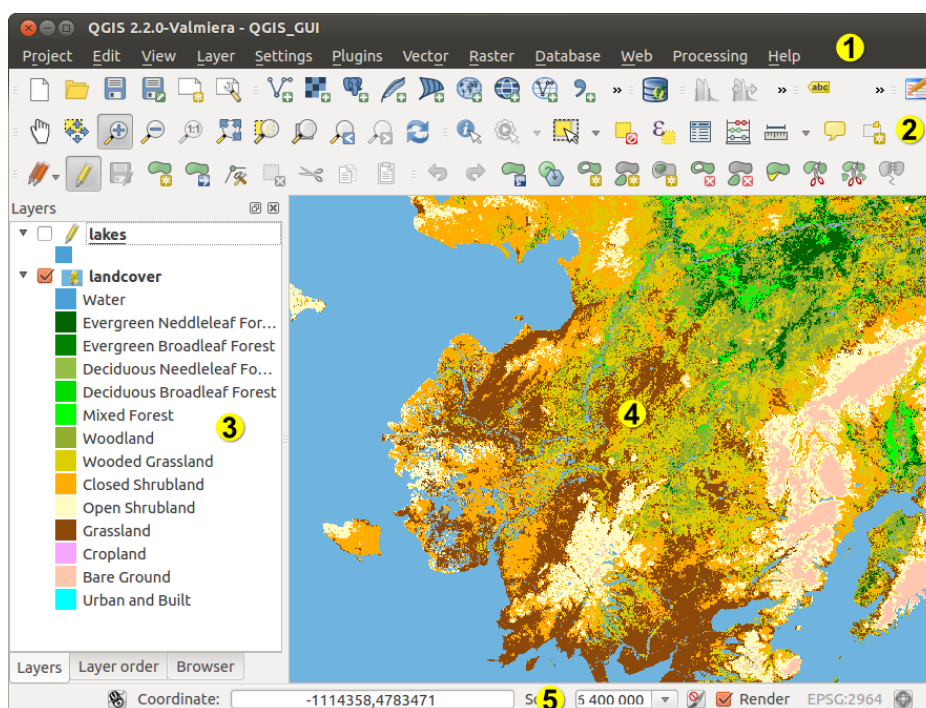
6.7 Zapisywanie


Jest kilka możliwości zapisu danych z sesji QGIS. Jedną z nich, zapisywanie jako plik projektu, omówiliśmy już w rozdziale *Projekty*. Teraz podamy inne sposoby zapisu plików:

- Polecenie menu *Projekt* →  *Zapisz jako obraz* otwiera okno dialogowe, gdzie określasz nazwę, ścieżkę i typ obrazu (format PNG lub JPG). Plik światowy z rozszerzeniem PNGW lub JPGW zapisany w tym samym katalogu zawiera informację o georeferencji obrazu.
- Polecenie menu *Projekt* → *Export DXF ...* otwiera okno, w którym można zdefiniować ‘Tryb stylów’, ‘Skalę stylów’ oraz warstwę wektorową, którą chcesz wyeksportować do DXF.
- Polecenie menu *Projekt* →  *Nowy wydruk* otwiera okno dialogowe, w którym możesz ułożyć i wydrukować bieżący widok mapy (zobacz rozdział *Print Composer*).

Interfejs graficzny użytkownika QGIS (GUI)

Po starcie QGIS zobaczysz pokazany na rysunku interfejs użytkownika (wyjaśnienie cyfr od 1 do 5 jest przedstawione poniżej).



Rysunek 7.1: QGIS Interfejs użytkownika z przykładowym zestawem danych Alaska 

Informacja: Wygląd twojego okna (paska tytułu itd.) może być nieco inny w zależności od tego, jakiego systemu operacyjnego i menadżera okien używasz.

GUI QGIS składa się z pięciu części:

1. Pasek menu
2. Pasek narzędzi
3. Legenda mapy
4. Widok mapy
5. Pasek statusu









Wymienione części interfejsu użytkownika QGIS opisane są bardziej szczegółowo poniżej w kolejnych rozdziałach. Dwa następnne rozdziały opisują skróty klawiaturowe i pomoc kontekstową.

7.1 Pasek menu
























Pasek menu umożliwia dostęp do różnych poleceń QGIS przy użyciu standardowego menu hierarchicznego. Poniżej znajdują się elementy najwyższego poziomu menu i podsumowanie niektórych jego opcji wraz z ikonkami narzędzi i skrótami klawiaturowymi. Skrót klawiaturowy mogą być ustawione ręcznie za pomocą polecenia **[Konfiguracja skrótów]** z menu *Ustawienia*.

Mimo, że wiele poleceń menu ma odpowiadające im przyciski na paskach narzędzi i na odwrót, porządek menu jest inny od układu pasków narzędziowych. Jeśli polecenie menu znajduje się również na jakimś pasku narzędzi, to obok polecenia podana jest nazwa tego paska. Niektóre z poleceń menu pojawiają się na paskach jedynie wówczas, gdy załadowana jest odpowiednia wtyczka. Więcej informacji o paskach i przyciskach narzędzi znajdziesz w rozdziale *Pasek narzędzi*.

7.1.1 Projekt




Polecenie menu	Skrót	Odnosnik	Pasek narzędzi
 <i>Nowy</i>	Ctrl+N	see <i>Projekty</i>	<i>Projekt</i>
 <i>Otwórz</i>	Ctrl+O	see <i>Projekty</i>	<i>Projekt</i>
<i>Nowy z szablonu →</i>		see <i>Projekty</i>	<i>Projekt</i>
<i>Otwórz ostatnie →</i>		see <i>Projekty</i>	
 <i>Zapisz</i>	Ctrl+S	see <i>Projekty</i>	<i>Projekt</i>
 <i>Zapisz jako...</i>	Ctrl+Shift+S	see <i>Projekty</i>	<i>Projekt</i>
 <i>Zapisz jako obraz...</i>		see <i>Zapisywanie</i>	
<i>Eksport DXF ...</i>		see <i>Zapisywanie</i>	
 <i>Nowy wydruk</i>	Ctrl+P	zobacz <i>Print Composer</i>	<i>Projekt</i>
 <i>Zarządzanie wydrukami ...</i>		zobacz <i>Print Composer</i>	<i>Projekt</i>
<i>Wydruki →</i>		zobacz <i>Print Composer</i>	
 <i>Wyjdź z QGIS</i>	Ctrl+Q		

7.1.2 Edycja
















Polecenie menu	Skrót	Odnosnik	Pasek narzędzi
 <i>Cofnij</i>	Ctrl+Z	zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Ponów</i>	Ctrl+Shift+Z	zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Wytnij obiekty</i>	Ctrl+X	zobacz <i>Digitizing an existing layer</i>	Digitalizacja
 <i>Kopiuj obiekty</i>	Ctrl+C	zobacz <i>Digitizing an existing layer</i>	Digitalizacja
 <i>Wklej obiekty</i>	Ctrl+V	zobacz <i>Digitizing an existing layer</i>	Digitalizacja
<i>Wklej obiekty jako →</i>		zob. <i>Working with the Attribute Table</i>	
 <i>Dodaj obiekt</i>	Ctrl+.	zobacz <i>Digitizing an existing layer</i>	Digitalizacja
 <i>Przesuń obiekt(y)</i>		zobacz <i>Digitizing an existing layer</i>	Digitalizacja
 <i>Usuń zaznaczone</i>		zobacz <i>Digitizing an existing layer</i>	Digitalizacja
 <i>Obróć obiekt(y)</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Uprość geometrię</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Dodaj pierścień</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Dodaj część</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Wypełnij pierścień</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Usuń pierścień</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Usuń część</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Zmień kształt obiektu</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Przesuń krzywą</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Rozdziel obiekty</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Wyodrębnij części</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Połącz zaznaczone obiekty</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Połącz atrybuty wybranych obiektów</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana digitalizacja
 <i>Edycja wierzchołków</i>		zobacz <i>Digitizing an existing layer</i>	Digitalizacja
 <i>Obróć symbol punktowy</i>		zobacz <i>Advanced digitizing</i>	Zaawansowana

Po włączeniu  Trybu edycji dla jakiegś warstwy ikonka Dodaj obiekt w menu *Edycja* będzie zależała od typu tej warstwy (punktowa, liniowa czy poligonowa).


























7.1.3 Edycja (extra)

Polecenie menu	Skrót	Odnosić	Pasek narzędzi
 Dodaj obiekt		zobacz <i>Digitizing an existing layer</i>	<i>Digitalizacja</i>
 Dodaj obiekt		zobacz <i>Digitizing an existing layer</i>	<i>Digitalizacja</i>
 Dodaj obiekt		zobacz <i>Digitizing an existing layer</i>	<i>Digitalizacja</i>






7.1.4 Widok

Polecenie menu	Skrót	Odnosić	Pasek narzędzi
 Przesuń widok			<i>Nawigacja mapy</i>
 Przesuń widok do zaznaczonych			<i>Nawigacja mapy</i>
 Powiększ	Ctrl++		<i>Nawigacja mapy</i>
 Pomniejsz	Ctrl+-		<i>Nawigacja mapy</i>
Wybierz →		zobacz <i>Zaznaczanie i odznaczanie obiektów</i>	<i>Atrybuty</i>
 Informacja o obiekcie	Ctrl+Shift+I		<i>Atrybuty</i>
Pomiar →		zobacz <i>Mierzenie</i>	<i>Atrybuty</i>
 Cały zasięg	Ctrl+Shift+F		<i>Nawigacja mapy</i>
 Powiększ do warstwy			<i>Nawigacja mapy</i>
 Powiększ do zaznaczonych	Ctrl+J		<i>Nawigacja mapy</i>
 Poprzedni widok			<i>Nawigacja mapy</i>
 Następny widok			<i>Nawigacja mapy</i>
 Powiększ do właściwego rozmiaru			<i>Nawigacja mapy</i>
Dekoracje →		zobacz <i>Dekoracje</i>	
 Podpowiedzi na mapie			<i>Atrybuty</i>
 Nowa zakładka	Ctrl+B	zobacz <i>Zakładki przestrzenne</i>	<i>Atrybuty</i>
 Pokaż zakładki	Ctrl+Shift+B	zobacz <i>Zakładki przestrzenne</i>	<i>Atrybuty</i>
 Odśwież	Ctrl+R		<i>Nawigacja mapy</i>


7.1.5 Warstwa

Polecenie menu	Skrót	Odnosnik	Pas
<i>Utwórz nową warstwę →</i>		zob. <i>Creating new Vector layers</i>	Zarz
<i>Osadź inny projekt ...</i>		zobacz <i>Zagnieżdżanie projektów</i>	
 <i>+ Dodaj warstwę wektorową</i>	Ctrl+Shift+V	zobacz <i>Working with Vector Data</i>	Zarz
 <i>+ Dodaj warstwę rastrową</i>	Ctrl+Shift+R	zob. <i>Loading raster data in QGIS</i>	Zarz
 <i>+ Dodaj warstwę PostGIS</i>	Ctrl+Shift+D	zob. <i>Warstwy PostGIS</i>	Zarz
 <i>+ Dodaj warstwę Spatialite</i>	Ctrl+Shift+L	zob. <i>Warstwy SpatiaLite</i>	Zarz
 <i>+ Dodaj warstwę MSSQL</i>	Ctrl+Shift+M	zob. <i>label_mssql</i>	Zarz
 <i>+ Ddoaj warstwę rastrową Oracle</i>		zob. <i>Oracle Spatial GeoRaster Plugin</i>	Zarz
 <i>+ Dodaj warstwę SQL Anywhere</i>		zob. <i>SQL Anywhere Plugin</i>	Zarz
 <i>+ Dodaj warswę WMS/WMTS</i>	Ctrl+Shift+W	zob. <i>WMS/WMTS Client</i>	Zarz
 <i>+ Dodaj warstwę WCS</i>		zob. <i>WCS Client</i>	Zarz
 <i>+ Dodaj warstwę WFS</i>		zob. <i>WFS and WFS-T Client</i>	Zarz
 <i>+ Dodaj warstwę tekstową CSV</i>		see <i>label_dltxt</i>	Zarz
 <i>Kopiuj styl</i>		zob. <i>Style Menu</i>	
 <i>Wklej styl</i>		zob. <i>Style Menu</i>	
 <i>Otwórz tabelę atrybutów</i>		zob. <i>Working with the Attribute Table</i>	Atry
 <i>Tryb edycji</i>		zobacz <i>Digitizing an existing layer</i>	Digi
 <i>Zapisz edycję</i>		zobacz <i>Digitizing an existing layer</i>	Digi
 <i>Bieżąca edycja →</i>		zobacz <i>Digitizing an existing layer</i>	Digi
<i>Zapisz jako...</i>			
<i>Zapisz wybrane jako plik wektorowy...</i>		Zob. <i>Working with the Attribute Table</i>	
 <i>Usuń warstwę(y)</i>	Ctrl+D		
 <i>+ Duplikuj warstwę(y)</i>			
<i>Ustaw układ współrzędnych warstw(y)</i>	Ctrl+Shift+C		
<i>:menuselection: 'Układ współrzędnych projektu z warstwy '</i>			
<i>Właściwości</i>			
<i>Zapytanie...</i>			
 <i>Etykietowanie</i>			
 <i>+ Dodaj do podglądu</i>	Ctrl+Shift+O		Zarz
 <i>+ Dodaj wszystkie do podglądu</i>			
 <i>Usuń wszystkie z podglądu</i>			
 <i>Pokaż wszystkie</i>	Ctrl+Shift+U		Zarz
 <i>Ukryj wszystkie</i>	Ctrl+Shift+H		Zarz

7.1.6 Ustawienia


Polecenie menu	Skrót	Odnośnik	Pasek narzędzi
<i>Panele</i> → <i>Paski narzędzi</i> → <i>Przełącz tryb pełnoekranowy</i>  <i>Właściwości projektu ...</i>  <i>Układ współrzędnych użytkownika ...</i> <i>Zarządzanie stylem...</i>  <i>Konfiguracja skrótów ...</i>  <i>Personalizacja ...</i>  <i>Opcje ...</i> <i>Opcje przyciągania ...</i>	 F 11 Ctrl+Shift+P	zob. <i>Panele i paski narzędziowe</i> zob. <i>Panele i paski narzędziowe</i> see <i>Projekty</i> zob. <i>Układ współrzędnych użytkownika</i> zob. <i>vector_style_manager</i> zob. <i>Personalizacja</i> zob. <i>Opcje</i>	

7.1.7 Wtyczki

Polecenie menu	Skrót	Odnośnik	Pasek narzędzi
 <i>Zarządzaj wtyczkami</i> <i>Konsola Pythona</i>		zob. <i>The Plugins Menus</i>	

Gdy uruchamiasz QGIS po raz pierwszy nie wszystkie wtyczki rdzenne wtyczki są załadowane.

7.1.8 Wektor

Polecenie menu	Skrót	Odnośnik	Pasek narzędzi
<i>Open Street Map</i> →  <i>Narzędzia analizy</i> →  <i>Narzędzia badawcze</i> →  <i>Narzędzia geoprocesingu</i> →  <i>Narzędzia geometrii</i> →  <i>Narzędzia zarządzania danymi</i> →		zob. <i>Ładowanie warstw wektorowych OpenStreetMap</i> zob. <i>fTools Plugin</i> zob. <i>fTools Plugin</i> zob. <i>fTools Plugin</i> zob. <i>fTools Plugin</i> zob. <i>fTools Plugin</i>	







Gdy uruchamiasz QGIS po raz pierwszy nie wszystkie wtyczki rdzenne wtyczki są załadowane.

7.1.9 Raster

Polecenie menu	Skrót	Odnośnik	Pasek narzędzi
<i>Kalkulator rastra ...</i>		zob. <i>Raster Calculator</i>	







Gdy uruchamiasz QGIS po raz pierwszy nie wszystkie wtyczki rdzenne wtyczki są załadowane.


7.1.10 Geoprocessing





Polecenie menu	Skrót	Odnośnik	Pasek narzędzi
 <i>Narzędzia</i>		zob. <i>The toolbox</i>	
 <i>Modelarz graficzny</i>		zob. <i>The graphical modeler</i>	
 <i>Historia i logi</i>		zob. <i>The history manager</i>	
 <i>Opcje</i>		zob. <i>Configuring the processing framework</i>	
 <i>Podgląd wyników</i>		zob. <i>Configuring external applications</i>	
 <i>Wiersz poleceń</i>	Ctrl+Alt+M	zob. <i>The SEXTANTE Commander</i>	

Gdy uruchamiasz QGIS po raz pierwszy nie wszystkie wtyczki rdzenne wtyczki są załadowane.

7.1.11 Pomoc

Polecenie menu	Skrót	Odnośnik	Pasek narzędzi
 <i>Informacje i podręczniki</i>	F1		<i>Pomoc</i>
 <i>Co to jest?</i>	Shift+F1		<i>Pomoc</i>
<i>API dla programistów</i>			
<i>Potrzebujesz wsparcia komercyjnego?</i>			
 <i>Strona projektu QGIS</i>	Ctrl+H		
 <i>Sprawdź wersję QGIS</i>			
 <i>O QGIS</i>			
 <i>Sponsorzy QGIS</i>			

Proszę zwrócić uwagę, że w GNU/Linuxie  pozycje paska menu pokazane powyżej są domyślne dla menadżera okien KDE. W GNOME menu Ustawienia ma nieco inną zawartość i pewnych pozycji trzeba szukać gdzie indziej:

 <i>Właściwości projektu</i>	<i>Projekt</i>
 <i>Opcje</i>	<i>Edycja</i>
 <i>Konfiguracja skrótów</i>	<i>Edycja</i>
<i>Zarządzanie stylem</i>	<i>Edycja</i>
 <i>Układ współrzędnych użytkownika</i>	<i>Edycja</i>
<i>Panele →</i>	<i>Widok</i>
<i>Paski narzędzi →</i>	<i>Widok</i>
<i>Przełącz tryb pełnoekranowy</i>	<i>Widok</i>
<i>Skala kafla</i>	<i>Widok</i>
<i>Śledzenie GPS</i>	<i>Widok</i>

7.2 Pasek narzędzi

Ten pasek narzędziowy umożliwia dostęp do większości funkcji obecnych w menu, a dodatkowo do narzędzi interakcji z mapą. Każda pozycja paska posiada wyskakujący opis pomocy. Gdy przytrzymasz przez chwilę kursor myszy nad przyciskiem, wyświetli się jego krótki opis jego działania.

Każdy z pasków może być przesunięty w dowolne miejsce, odpowiadające ci miejsce. Ponadto każdy z pasków może zostać wyłączony w menu kontekstowym otwieranym prawym przyciskiem myszy w obszarze pasków (zobacz również *Panele i paski narzędziowe*).

Wskazówka: Przywracanie pasków

Jeśli przez przypadek schowasz wszystkie paski narzędziowe, możesz je przywrócić korzystając z polecenia menu *Widok* → *Paski narzędzi* →. Jeśli paski znikną w Windows, co się czasem przydarza, musisz usunąć klucz rejestru `\HKEY_CURRENT_USER\Software\QGIS\qgis\UI\state`. W czasie restartu QGIS klucz ten zostanie utworzony na nowo z domyślną wartością i wszystkie paski będą znów widoczne.

7.3 Legenda mapy

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.

Warstwy można wybierać i przeciągać w dół lub górę legendy, żeby zmienić ich porządek nakładania. Warstwy umieszczone wyżej w legendzie będą rysowane ponad warstwami umieszczonymi u dołu legendy.


Informacja: Można zmienić ten układ w panelu 'Kolejność warstw'.

Warstwy w legendzie mogą być grupowane. Można to zrobić na dwa sposoby:

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. Wybierz jakies warstwy, następnie kliknij prawym przyciskiem myszy w polu legendy i wybierz *Grupuj wybrane*. Wybrane warstwy zostaną automatycznie umieszczone w nowej grupie.

Żeby wyciągnąć warstwę z grupy możesz przeciągnąć ją poza jej obszar lub kliknąć ją prawym przyciskiem i wybrać *Przenieś na główny poziom*. Grupy mogą być zagnieżdżane w innych grupach.

Pole wyboru przy grupie służy do ukrywania i pokazywania wszystkich warstw grupy za pomocą jednego kliknięcia.

Zawartość menu kontekstowego wywoływanego prawym przyciskiem myszy zależy od tego, czy wybrana jest warstwa rastrowa czy wektorowa. Dla warstw wektorowych GRASS  Tryb edycji jest niedostępny. O edycji warstw GRASS przeczytasz w *Digitizing and editing a GRASS vector layer*.

Menu kontekstowe dla warstw rastrowych

- Powiększ do zasięgu warstwy
- Powiększ do najlepszej skali (100%)
- Wzmocnij kontrast do zasięgu widoku
- Pokaż w podglądzie
- Usuń
- Duplikuj
- Ustaw układ współrzędnych warstwy
- Układ wsp. projekty z warstwy
- Zapisz jako ...
- Właściwości
- Zmień nazwę
- Kopiuj styl
- Add New Group
- Expand all
- Collapse all

- *Update Drawing Order*

Dodatkowo, w zależności od pozycji warstwy i jej wyboru

- *Przenieś na główny poziom*
- *Grupuj zaznaczone*

Menu kontekstowe dla warstw wektorowych

- *Powiększ do zasięgu warstwy*
- *Pokaż w podglądzie*
- *Usuń*
- *Duplikuj*
- *Ustaw układ współrzędnych warstwy*
- *Układ wsp. projekty z warstwy*
- *Otwórz tabelę atrybutów*
- *Tryb edycji (nie dostępne dla warstw GRASS)*
- *Zapisz jako ...*
- *Save Selection As*
- *Filtr*
- *Wyświetl liczbę obiektów*
- *Właściwości*
- *Zmień nazwę*
- *Kopiuj styl*
- *Add New Group*
- *Expand all*
- *Collapse all*
- *Update Drawing Order*

Dodatkowo, w zależności od pozycji warstwy i jej wyboru

- *Przenieś na główny poziom*
- *Grupuj zaznaczone*

Menu kontekstowe dla grup warstw

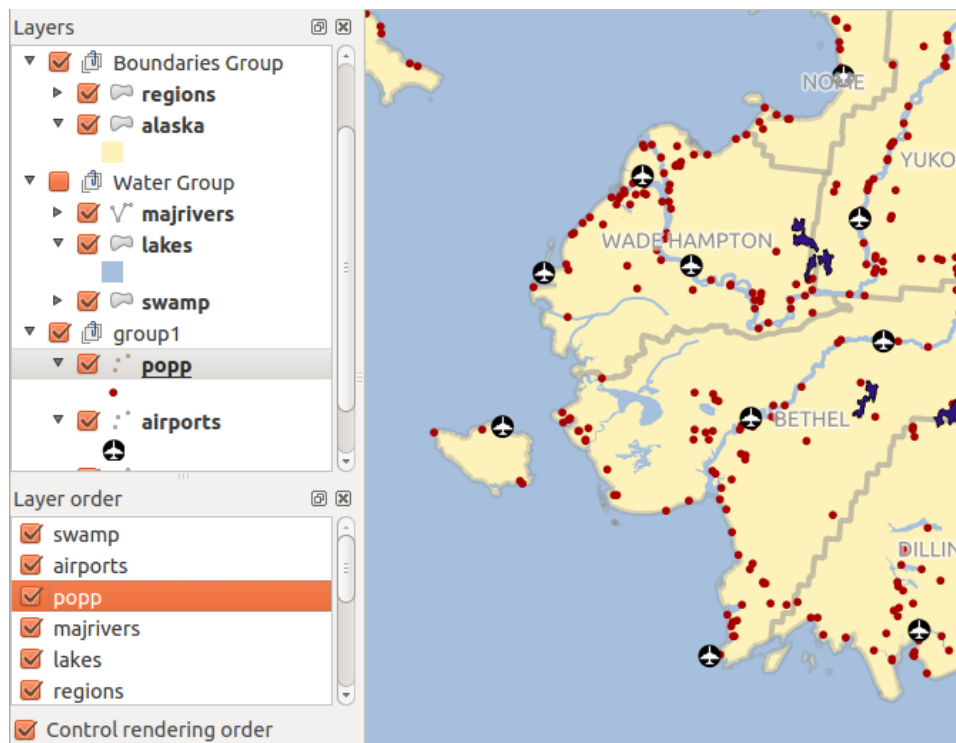
- *Powiększ do grupy*
- *Usuń*
- *Ustaw układ współrzędnych grupy*
- *Zmień nazwę*
- *Add New Group*
- *Expand all*
- *Collapse all*
- *Update Drawing Order*


Można wybrać naraz większą liczbę warstw lub grup przytrzymując klawisz `Ctrl` w czasie wybierania warstw lewym przyciskiem myszy. Wówczas można przesunąć wybrane warstwy do nowej grupy za jednym zamachem.

Możesz również usunąć naraz więcej warstw lub grup wybierając je z wciśniętym klawiszem `Ctrl`, a następnie przyciskając `Ctrl+D`. Wówczas wszystkie wybrane warstwy i grupy zostaną usunięte z listy warstw.

7.3.1 Określanie kolejności wyświetlania warstw niezależnej od legendy

Istnieje panel do określania porządku wyświetlania warstw niezależnie od legendy. Można go aktywować przez polecenie menu *Widok* → *Panele* → *Kolejność warstw*. Umożliwia to, na przykład, określenie kolejności warstw mapy wg ich istotności przy zachowaniu ich właściwego porządku wyświetlania (zob [figure_layer_order](#)). Kliknięcie pola *Kolejność warstw* pod listą spowoduje powrót do domyślnej kolejności.



Rysunek 7.2: Określ niezależny od legendy porządek wyświetlania warstw 

7.4 Widok mapy

To jest właściwe stanowisko robocze QGIS — to tu wyświetlane są mapy. Widok mapy zależy będzie od tego, jakie warstwy wektorowe i rastrowe załadujesz (zob. kolejne rozdziały, w których omówione jest ładowanie warstw). Widok mapy można przesuwać (przesunąć zakres widoczności w inne położenie), pomniejszać i powiększać. Z widokiem mapy można wykonać wiele różnych operacji, zgodnie z powyższym opisem paska narzędziowego. Widok mapy i legenda są ze sobą ściśle związane — mapa odzwierciedla zmiany, których dokonuje się w legendzie.

Wskazówka: Zmiana przybliżenia mapy za pomocą kółka myszy

Do powiększania i pomniejszania widoku można użyć kółka myszy. Należy umieścić kursor myszy w widoku mapy i przekręcić do przodu (od siebie), aby powiększyć widok lub przekręcić w tył (do siebie), aby widok pomniejszyć. Punktem centralnym przybliżenia widoku jest kursor myszy. Można dostosować zachowanie się kółka myszy w zakładce *Narzędzia mapy* menu *Ustawienia* → *Opcje*.

Wskazówka: Przesuwanie mapy za pomocą klawiszy strzałek i spacji


Można używać klawiszy strzałek do przesuwania mapy. Umieść wskaźnik myszy wewnątrz pola mapy i kliknij. Użyj strzałki w prawo, aby przesunąć się na wschód, lewej, aby przesunąć się na zachód. Strzałka w górę przesunie widok na północ, a strzałka w dół przesunie widok na południe. Mapę można również przesuwać poruszając wskaźnikiem myszy przy wciśniętym klawiszu spacji lub wciśniętym kółku myszy.

7.5 Pasek statusu

Gdy wskaźnik myszy znajduje się w polu widoku mapy, na pasku statusu widoczna jest jego bieżąca pozycja we współrzędnych mapy (tj. w metrach lub stopniach). Z lewej strony pola współrzędnych znajduje się mały przycisk przełączający widok współrzędnych wskaźnika myszy na współrzędne zakresu widoku mapy, które zmieniają się, gdy przybliżasz, oddalasz lub przesuwasz widok.


Obok pola współrzędnych znajduje się pole skali. Pokazuje ono skalę widoku mapy. Gdy powiększasz lub zmniejszasz widok QGIS podaje Ci bieżącą skalę. Możesz też wybrać zdefiniowane wcześniej skale z zakresu od 1:500 do 1:1000000.

Wskaźnik postępu na pasku statusu ilustruje postęp renderowania każdej z warstw w widoku mapy. W niektórych przypadkach, np. gdy określone są statystyki warstw rastrowych, wskaźnik postępu używany jest do pokazania statusu dłuższych operacji.

Gdy pojawi się nowa wtyczka lub aktualizacja wtyczki, po lewej stronie paska statusu pojawi się wiadomość. Po prawej stronie paska statusu znajduje się małe pole wyboru, za pomocą którego można chwilowo wstrzymać renderowanie map w widoku mapy. (zob. rozdział *Renderowanie*). Ikonka  natychmiast przerywa renderowanie mapy.

Z prawej strony funkcji renderowania znajduje się kod EPSG bieżącego projektu i ikonka odwzorowania. Jej kliknięcie powoduje otwarcie właściwości układu współrzędnych dla bieżącego projektu.

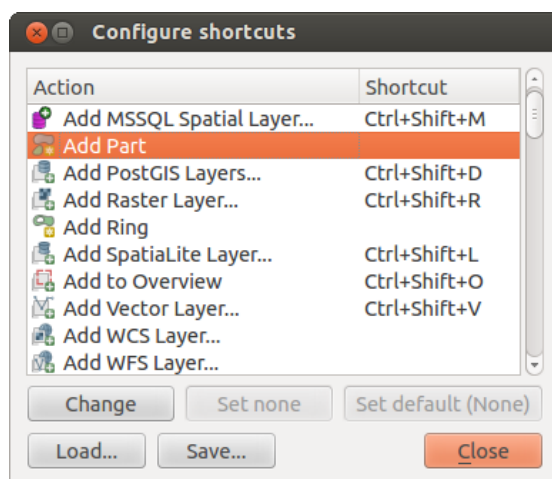
Wskazówka: Określanie poprawnej skali dla twojej mapy

Gdy uruchamiasz QGIS domyślną jednostką miary są stopnie i powoduje to, że QGIS traktuje współrzędne twoich warstw jako stopnie. Aby otrzymać właściwe wartości, możesz ręcznie zmienić jednostki miary na metry w zakładce *Ogólne* w menu *Plik* → *Właściwości projektu* lub określić odwzorowanie dla swojego projektu za pomocą przycisku z ikoną  Stan CRS. W prawym końcu paska statusu u dołu okna. W tym drugim przypadku jednostki miary są określone w definicji odwzorowania (np. '+units=m').

Podstawowe narzędzia

8.1 Skróty klawiaturowe

QGIS ma zdefiniowane domyślne skróty klawiaturowe dla wielu poleceń. Znajdziesz je w rozdziale *Pasek menu*. Dodatkowo, polecenie menu *Ustawienia* → *Konfiguracja skrótów* pozwala na zmianę tych domyślnych skrótów i dodanie do poleceń QGIS nowych skrótów.



Rysunek 8.1: Określanie opcji skrótów 🐧 (Gnome)

Konfiguracja jest bardzo prosta. Zaznacz na liście polecenie i kliknij **[Zmień]**, **[Usuń]** lub **[Dodaj domyślny]**. Gdy określisz już swoją konfigurację, możesz ją zapisać w formacie XML i załadować do innej instalacji QGIS.

8.2 Pomoc kontekstowa

Gdy potrzebna ci pomoc w pewnym temacie, możesz skorzystać z pomocy kontekstowej, dostępnej w większości okien dialogowych pod przyciskiem **[Pomoc]** — proszę zwrócić uwagę, że wtyczki mogą wskazywać na poświęcone im strony internetowe.

8.3 Renderowanie

Domyślnie QGIS renderuje wszystkie widoczne warstwy za każdym razem, gdy obszar mapy ma być odświeżony. Zdarzenia, które wywołują odświeżanie, obejmują:

- Dodawanie warstwy

- Przesuwanie widoku i przybliżanie
- Zmiana wielkości okna QGIS
- Zmiana widoczności warstwy lub warstw

QGIS pozwala na kontrolę renderowania na różne sposoby.

8.3.1 Renderowanie zależne od skali

Renderowanie zależne od skali pozwala na określenie minimalnej i maksymalnej skali, pomiędzy którymi warstwa jest widoczna. Aby wybrać renderowanie zależne od skali otwórz okno dialogowe *Właściwości* poprzez dwukrotne kliknięcie na warstwie w legendzie. W zakładce *Ogólne* zaznacz pole wyboru *Widoczność zależna od skali*, a następnie podaj minimalną i maksymalną skalę.

Możesz najpierw, poprzez przybliżenie widoku i sprawdzenie skali na pasku statusu QGIS, określić skalę, której chcesz użyć.

8.3.2 Sterowanie renderowaniem mapy

Sterowanie renderowaniem mapy może odbywać się na różne sposoby, opisane poniżej.

Zawieszanie renderowania

Aby zawiesić renderowanie kliknij pole wyboru *Renderuj* po prawej stronie paska statusu. Gdy pole wyboru *Renderuj* nie jest zaznaczone, QGIS nie przerysowuje obszaru mapy po żadnym ze zdarzeń opisanych w rozdziale *Renderowanie*. Przykłady sytuacji, kiedy można zawiesić renderowanie obejmują:

- Dodanie wielu warstw i nadanie im stylu przed ich wyświetleniem
- Dodanie jednej lub więcej dużych warstw i ustawienie wyświetlania zależnego od skali przed ich wyświetleniem
- Dodanie jednej lub więcej większych warstw i przybliżenie się do pewnego widoku przed ich wyświetleniem
- Dowolna kombinacja powyższych

Zaznaczenie pola wyboru *Renderuj* włącza renderowanie i powoduje natychmiastowe odświeżenie kanwy mapy.

Ustawienia dodawania warstw

Można ustawić opcję ładowania warstw bez ich renderowania. Oznacza to, że warstwa zostanie załadowana do mapy, ale jej pole wyboru widoczności będzie domyślnie odznaczone. Aby ustawić tę opcję wybierz polecenie menu *Ustawienia* → *Opcje* i kliknij zakładkę *Renderowanie*. Odznacz pole wyboru *Domyślnie nowo dodawane warstwy są wyświetlane*. Teraz każda nowo dodana do mapy warstwa będzie domyślnie wyłączona (niewidoczna).

Zatrzymywanie renderowania

Do zatrzymania rysowania mapy używaj klawisza `ESC`. Zatrzymuje on odświeżanie kanwy mapy i pozostawia ją częściowo przerysowaną. Zatrzymanie renderowania mapy może nastąpić po jakimś czasie od naciśnięcia klawisza `ESC`.

Informacja: W chwili obecnej nie można zatrzymać renderowania — ze względu na problemy interfejsu użytkownika (UI) zostało to zablokowane w porcie Qt4.

Aktualizacja obrazu mapy podczas renderowania

Można wybrać opcję odświeżania mapy w miarę rysowania obiektów. Domyślnie QGIS nie wyświetla żadnych obiektów aż cała warstwa zostanie zrenderowana. W celu odświeżania ekranu w czasie czytania danych ze źródła wybierz polecenie menu *Ustawienia* → *Opcje*, kliknij zakładkę *Renderowanie*. Ustaw wybraną ilość obiektów, po narysowaniu których ma nastąpić odświeżenie ekranu. Ustawienie wartości 0 wyłącza odświeżanie w czasie rysowania (to jest domyślne zachowanie). Ustawienie zbyt małej ilości spowoduje spadek wydajności, ponieważ obszar mapy będzie ciągle odświeżany w czasie czytania danych obiektów. Proponuje się, aby wartość ta nie była mniejsza niż 500.

Zmiana jakości renderowania

Aby zmienić jakość renderowania mapy mamy dwie opcje. Wybierz polecenie menu *Ustawienia* → *Opcje*, kliknij na zakładkę *Renderowanie*, a następnie zaznacz lub odznacz następujące pola wyboru.

- *Wyświetlaj linie mniej poszarpane, ale licz się ze spadkiem wydajności rysowania*
- *Napraw problemy z niewłaściwie wypełnionymi poligonami*


Przyspieszenie renderowania

Dwa ustawienia pozwalają poprawić szybkość renderowania. Otwórz okno opcji QGIS używając menu *Ustawienia* → *Opcje*, przejdź do zakładki *Renderowanie* i zaznacz lub odznacz następujące pola wyboru:


- *Szybsze wyświetlanie*. Powoduje ona szybsze wyświetlanie grafiki kosztem braku możliwości zatrzymania renderowania i stopniowego rysowania obiektów. Jeśli ta opcja jest odznaczona, można podać w polu 'Liczba obiektów koniecznych do narysowania przed odświeżeniem widoku', w przeciwnym wypadku pole liczby obiektów jest nieaktywne.
- *Użyj pamięci podręcznej aby przyspieszyć odświeżanie*.

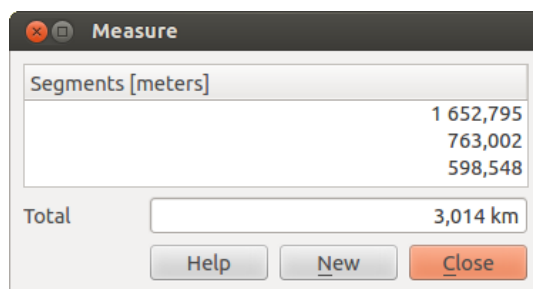
8.4 Mierzenie

Mierzenie działa zarówno w odwzorowanych układach współrzędnych (np. UTM) jak i dla danych nieodwzorowanych. Jeśli mierzenie odbywa się w układzie współrzędnych geograficznych (długość/szerokość), wówczas wyniki pomiaru długości i powierzchni będą nieprawidłowe. Aby temu zaradzić, należy zdefiniować odpowiedni układ współrzędnych mapy (zob. rozdział *Praca z układami współrzędnych*). Wszystkie narzędzia pomiarowe korzystają z ustawień przyciągania modułu digitalizacji. Jest to przydatne, gdy chcemy mierzyć wzdłuż linii lub powierzchni warstwy wektorowej.


Aby wybrać narzędzie pomiaru kliknij na ikonkę  i wskaż narzędzie, którego chcesz użyć.

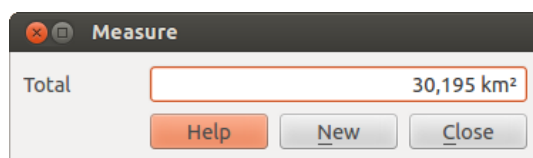
8.4.1 Pomiar długości, powierzchni i kątów

 *Pomiar odległości*. QGIS potrafi zmierzyć rzeczywistą odległość pomiędzy danymi punktami wykorzystując dane elipsoidy bieżącego układu odniesienia. Aby ją zdefiniować, wybierz polecenie *Ustawienia* → *Opcje*, Kliknij na zakładkę *Narzędzia mapy*. tutaj możesz zdefiniować kolor linijki oraz jednostki pomiaru odległości (metry lub stopy) i kątów (stopnie, radiany lub grady). Narzędzie pozwala na klikanie kolejnych punktów na mapie. W okienku pomiaru zobaczysz długości kolejnych segmentów i całkowitą długość linii. aby zakończyć pomiary kliknij na prawym przycisku myszy.




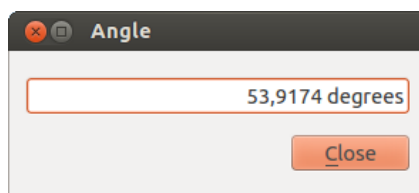
Rysunek 8.2: Pomiar odległości 🐧 (Gnome)

 **Pomiar powierzchni:** można mierzyć także powierzchnie. W okienku pomiaru pokazana jest zmierzona w danej chwili powierzchnia. Dodatkowo, jeśli bieżąca warstwa ma ustawioną tolerancję przyciągania, narzędzie pomiaru będzie przyciągane do tej warstwy. (Zobacz rozdział *Setting the Snapping Tolerance and Search Radius*). Zatem jeśli chciałbyś mierzyć wzdłuż obiektu liniowego lub wokół jakiegoś poligonu, najpierw ustaw jego tolerancję przyciągania, a następnie zaznacz odpowiednią warstwę. Wówczas podczas pomiaru każde kliknięcie będzie przyciągane do tej warstwy w granicach tolerancji przyciągania.




Rysunek 8.3: Pomiar pola powierzchni 🐧 (Gnome)






 **Pomiar kąta:** Można mierzyć również kąty. Kursor przechodzi w krzyż. Kliknij wskazując pierwsze ramię kąta, który chcesz zmierzyć, a następnie przesunij kursor tak, aby narysować mierzony kąt. Wynik pomiaru wyświetlany jest w osobnym okienku.




Rysunek 8.4: Pomiar kąta 🐧 (Gnome)


8.4.2 Zaznaczanie i odznaczanie obiektów

Pasek narzędziowy QGIS zawiera kilka narzędzi do zaznaczania obiektów na mapie. Aby wybrać jeden lub kilka obiektów kliknij na  i wybierz odpowiednie narzędzie:

-  Wybierz jeden obiekt
-  Wybierz obiekty prostokątem
-  Wybierz obiekty wielobokiem
-  Wybierz obiekty zaznaczeniem
-  Wybierz obiekty promieniem

Oznaczenie wszystkich obiektów uzyskuje się po naciśnięciu ikonki  Oznacz obiekty ze wszystkich warstw.

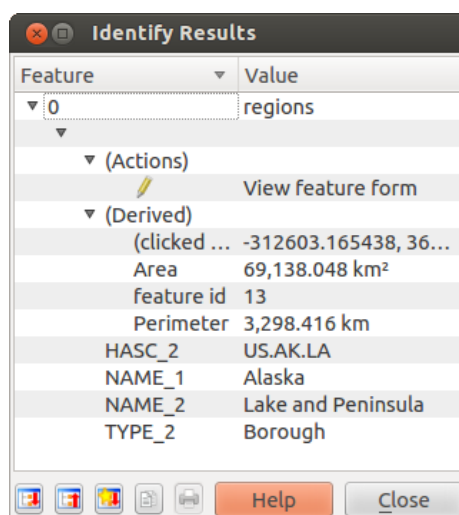
8.5 Informacje o obiekcie


Narzędzie informacji o obiekcie umożliwia interakcję z obszarem mapy i otrzymanie wartości atrybutów w oknie. Aby wyświetlić informację o obiektach skorzystaj z polecenia *Widok* → *Informacje o obiekcie*, wciśnij kombinację klawiszy `Ctrl+Shift+I`, lub kliknij ikonkę  Informacje o obiekcie, znajdującą się na pasku narzędziowym.

Jeśli klikniesz na kilku obiektach, w oknie *Wynik identyfikacji* pokazane zostaną dane atrybutów wszystkich klikniętych obiektów. Pierwsza pozycja to numer obiektu na liście z nazwą warstwy. Następnym elementem potomnym będzie nazwa i wartość jego pierwszego atrybutu. W dalszej kolejności wyświetlone są wszystkie informacje o obiekcie.






Zawartość tego okna można dostosować tak, aby wyświetlały się wybrane pola, ale domyślnie pokazuje ono trzy typy informacji:

- Akcje: do okna informacji o obiekcie mogą zostać dodane akcje. Kliknięcie nazwy akcji powoduje jej uruchomienie. Domyślnie dodana jest tylko jedna akcja wyświetlająca formularz edycji obiektu.
- Pochodne: te informacje obliczane są lub określone na bazie innych informacji. Znajdziesz tu współrzędne kliknięcia, współrzędne X i Y, pole powierzchni i obwód w jednostkach mapy dla poligonów, długość w jednostkach mapy dla obiektów liniowych oraz id obiektów.
- Dane atrybutów: lista atrybutów danych.



Rysunek 8.5: Okno dialogowe informacji o obiekcie  (Gnome)

U dołu okna znajduje się 5 ikonek:

-  Rozwiń strukturę
-  Zwiń strukturę
-  Nowe wyniki będą domyślnie rozwijane
-  Kopiuje zaznaczony obiekt do schowka
-  Drukuj wybraną odpowiedź HTML

Inne funkcje można znaleźć w menu kontekstowym rozpoznawanego obiektu. Można, na przykład, wykonać następujące zadania:


- Wyświetl formularz obiektu

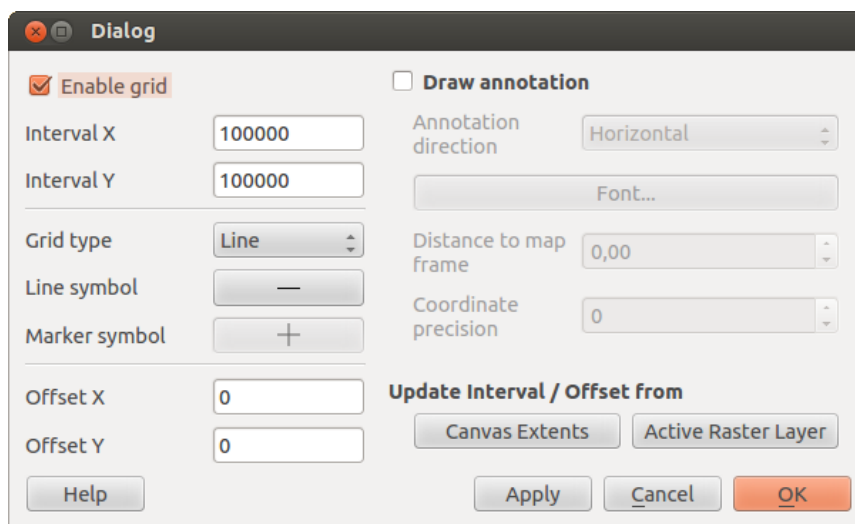
- Zbliż do obiektu
- Kopiuj obiekt: skopiuj cały obiekt, tj. jego geometrię i atrybuty;
- Kopiuj wartość atrybutu: kopiuje wartość klikniętego atrybutu
- Kopiuj atrybuty obiektu: kopiuje tylko atrybuty
- Wyczyść wyniki: usuwa wyniki z okna
- Wyczyść zaznaczenie: usuwane jest zaznaczenie obiektów na mapie
- Zaznacz wszystkie
- Zaznacz warstwę
- Aktywuj warstwę: warstwa obiektu jest aktywowana
- Właściwości warstwy: otwiera okno właściwości warstwy
- Rozwiń wszystkie
- Zwiń wszystkie


8.6 Dekoracje

Dekoracje QGIS stanowią siatki, informacje o prawach autorskich, strzałka północy i podziałka. Służą one do uzupełnienia mapy poprzez dodanie elementów kartograficznych.

8.6.1 Siatka

 Siatka pozwala na dodanie do obszaru mapy siatki współrzędnych i jej opisu.




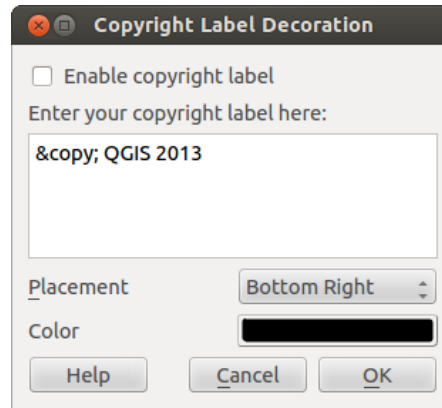
Rysunek 8.6: Okno siatki 


1. Z menu *Widok* → *Dekoracje* → *Siatka*. Wyświetli się okno (zob. [figure_decorations_1](#)).
2. Zaznacz pole wyboru *Siatka* i ustaw parametry siatki odpowiednie dla załadowanych do obszaru mapy warstw.
3. Zaznacz pole wyboru *Opisy współrzędnych* i ustaw parametry opisu odpowiednie dla załadowanych do obszaru mapy warstw.
4. Kliknij [**Zastosuj**] żeby sprawdzić, czy efekt będzie zadowalający.


5. Kliknij [OK] żeby zamknąć okno.

8.6.2 Informacja o prawach autorskich

 Informacja o prawach autorskich dodaje do mapy etykietę z podanym tekstem.




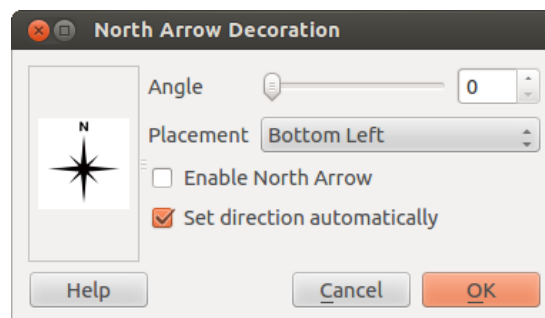
Rysunek 8.7: Okno dialogowe praw autorskich 


1. Wybierz polecenie *Wisok* → *Dekoracje* → *Informacje o prawach autorskich*. Pokaże się okno (zob. [figure_decorations_2](#)).
2. Wprowadź tekst, który chcesz zamieścić na mapie. Możesz wykorzystać HTML, jak to pokazano w przykładzie.
3. Określ położenie etykiety z listy rozwijalnej *Położenie* .
4. Upewnij się, czy pole wyboru *Włącz etykietę* jest zaznaczone.
5. Kliknij [OK].

W powyższym przykładzie, QGIS umieści symbol copyright z datą w dolnym prawym rogu obszaru mapy, co jest domyślnym położeniem informacji o prawach autorskich.


8.6.3 Strzałka północy

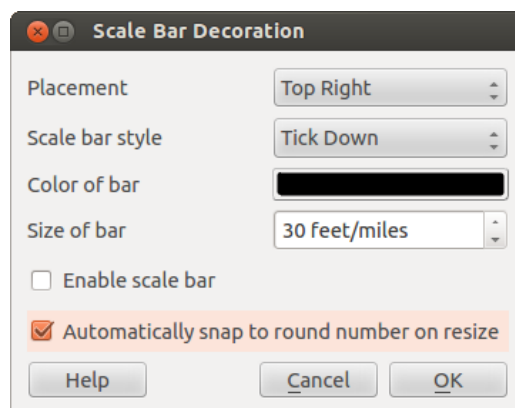
 Strzałka północy dodaje do obszaru mapy prostą strzałkę północy. Obecnie dostępny jest tylko jeden styl strzałki. Można dopasować kąt strzałki samodzielnie lub pozostawić to QGIS do automatycznego określenia. Jeśli pozostawisz wybór QGIS spróbuje on znaleźć właściwy kierunek strzałki. Strzałkę możesz umieścić w dowolnym rogu mapy.




Rysunek 8.8: Okno dialogowe strzałki północy 

8.6.4 Podziałka





 Podziałka dodaje do obszaru mapy prostą podziałkę. Położenie, styl i etykiety podziałki zależą od Ciebie.



Rysunek 8.9: Okno dialogowe podziałki 

QGIS można wyświetlić skalę jedynie w jednostkach ramki mapy. Zatem jeśli twoje warstwy są w metrach, nie możesz stworzyć podziałki w stopach. Podobnie, jeśli używasz stopni dziesiętnych, nie możesz stworzyć podziałki w metrach.


W celu dodania podziałki:

1. Wybierz polecenie *Widok* → *Dekoracje* → *Podziałka*. Pokaże się okno (zob. [figure_decorations_4](#)).
2. Określ położenie z listy rozwijalnej *Położenie* .
3. Z listy rozwijalnej *Styl podziałki*  wybierz styl.
4. Wybierz kolor podziałki z *Kolor*  lub pozostaw domyślny czarny.
5. Ustaw rozmiar podziałki i jej etykietę *Długość* .
6. Upewnij się, czy zaznaczone jest pole wyboru *Włącz*.
7. Opcjonalnie, zaznaczając pole wyboru *Automatycznie dostosuj rozmiar*, sprawisz, że rozmiar skali automatycznie się zmieniał przy przybliżaniu widoku.
8. Kliknij [OK].

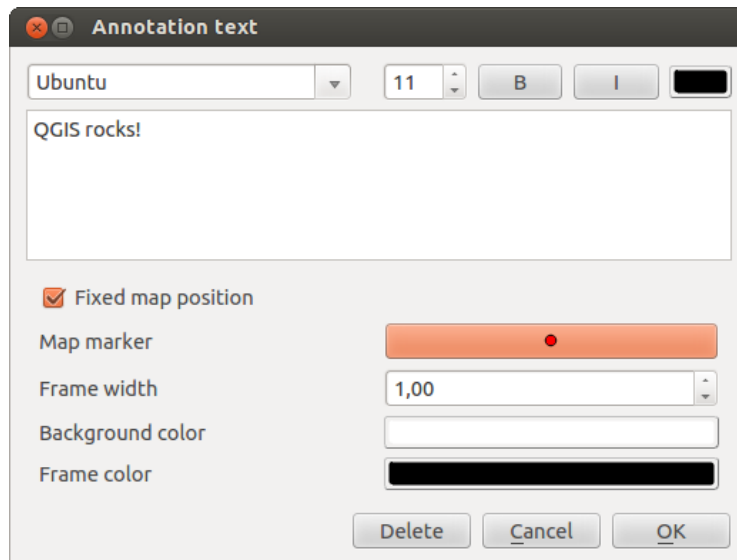
Wskazówka: Ustawienia dekoracji

W czasie zapisu projektu `.qgs` zapisywane są wszystkie zmiany, jakich dokonałeś w siatce, strzałce północy, podziałce i prawach autorskich i będą one użyte, gdy otworzysz ten projekt następnym razem.

8.7 Narzędzia opisu


Narzędzie  Opis tekstowy z paska narzędziowego atrybutów umożliwia umieszczenie w obszarze mapy chmurki ze sformatowanym tekstem. Wybierz narzędzie *Opis tekstowy* i kliknij w obszarze mapy.

Dwuklik na wybranym opisie spowoduje otwarcie okna dialogowego z różnymi opcjami. Mamy tu pole edytora tekstowego do wprowadzenia sformatowanego tekstu i inne ustawienia. Jest np. możliwość umiejscowienia opisu w określonej pozycji mapy (wyświetlany jako znacznik) lub utrzymania pozycji opisu na ekranie (niezależnie od




Rysunek 8.10: Okno dialogowe opisu tekstowego 🐧


mapy). Opis może być przesuwany przez zmianę jego pozycji na mapie (przeciagnij znacznik) lub poprzez przesunięcie samej chmurki. Ikonki są częścią szablonu GIS i są domyślnie używane również w innych szablonach.

Narzędzie  Przesuń opis umożliwia przesuwanie opisu po obszarze mapy.


8.7.1 Opis HTML

Narzędzie  Opis HTML z paska narzędziowego atrybutów umożliwia umieszczenie w obszarze mapy QGIS chmurki z zawartością opisaną kodem HTML. Wybierz narzędzie *Opis HTML*, kliknij na obszarze mapy i wskaż w oknie ścieżkę do pliku HTML.

8.7.2 Opis SVG

Narzędzie  Opisy SVG z paska narzędziowego atrybutów umożliwia umieszczenie w obszarze mapy QGIS symbolu SVG. Wybierz narzędzie *Opisy SVG*, kliknij w obszarze mapy i wskaż w oknie ścieżkę do pliku SVG.

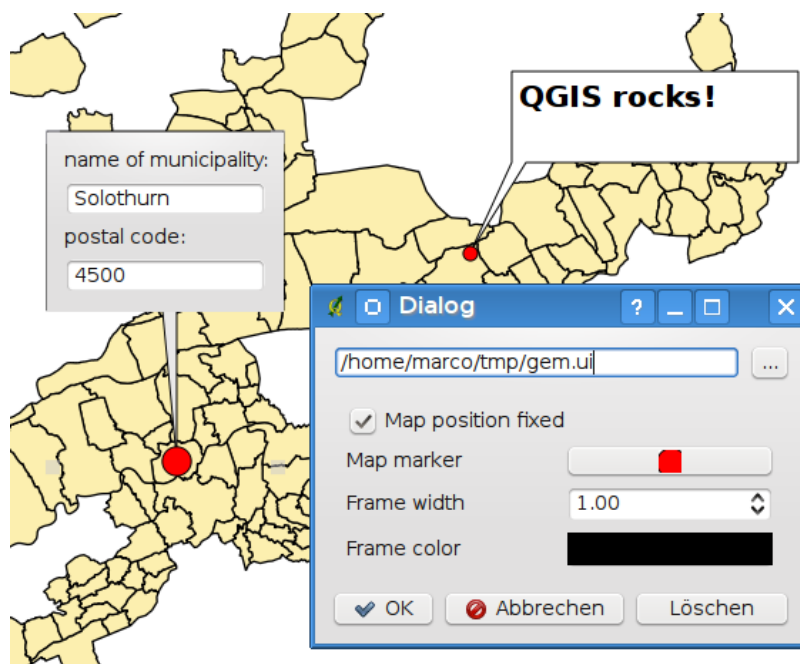
8.7.3 Opisy w formularzu

Możesz również stworzyć własne formularze opisu. Narzędzie  Opis w formularzu przydaje się, gdy chcemy wyświetlić atrybuty warstwy wektorowej w dostosowanym formularzu Qt Designera (zob. [figure_custom_annotation](#)). Jest to podobne do formularzy Designera dla narzędzia *Informacje o obiekcie*, ale wyświetlane jest w postaci opisu. Aby dowiedzieć się więcej, obejrzyj to wideo Tima Suttona <https://www.youtube.com/watch?v=0pDBuSbQ02o>

Informacja: Naciśnięcie kombinacji klawiszy `Ctrl+T` gdy aktywne jest którekolwiek narzędzie *Opisu* (przesuń opis, opis tekstowy, opis w formularzu) spowoduje zmianę stanu widoczności opisów.

8.8 Zakładki przestrzenne

Zakładki pozwalają na zapisanie pozycji geograficznej i późniejszy powrót do tego widoku.



Rysunek 8.11: Dostosowany formularz opisu Qt Designera 🐧

8.8.1 Tworzenie zakładki

Żeby utworzyć zakładkę:

1. Zbliż się lub przesuń widok do interesującego Cię obszaru.
2. Z menu górnego wybierz polecenie *Widok* → *Nowa zakładka* lub wciśnij klawisze `Ctrl-B`.
3. Wprowadź nazwę zakładki opisującą bieżącą pozycję (może zawierać do 255 znaków).
4. Naciśnij `Enter`, aby dodać zakładkę lub **[Delete]**, aby ją usunąć.

Zwróć uwagę na to, że możesz mieć wiele zakładek o takiej samej nazwie.

8.8.2 Praca z zakładkami

Aby użyć lub zmienić zakładki wybierz polecenie menu *Widok* → *Pokaż zakładki*. Okno dialogowe *Zakładki* umożliwia przejście do widoku zakładki lub jej usunięcie. Nie ma możliwości zmiany nazwy zakładki ani jej współrzędnych.

8.8.3 Przejście do widoku zakładki

W oknie dialogowym *Zakładki* zaznacz pożądaną zakładkę kliknięciem, a następnie wybierz **[Powiększ do]**. Można również wyświetlić widok zapisany w zakładce poprzez dwukrotne kliknięcie na niej.

8.8.4 Usuwanie zakładki


W celu usunięcia zakładki w oknie dialogowym :guilabel:‘Zakładki’kliknij na niej i naciśnij przycisk **[Usuń]**. Potwierdź swój wybór naciskając następnie **[Tak]** lub zrezygnuj z usuwania przyciskiem **[Nie]**.

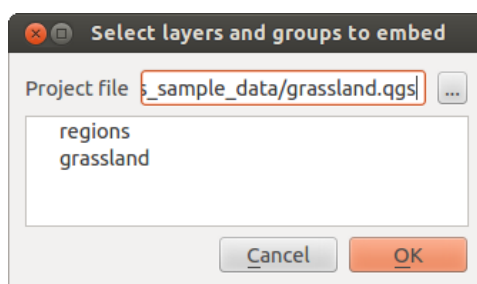
8.9 Zagnieżdżanie projektów


Jeśli w bieżącym projekcie chcesz wykorzystać zawartość innych projektów, możesz wykorzystać polecenie *Warstwa* → *Osadź inny projekt*.

8.9.1 Osadzanie warstw

Poniższe okno dialogowe umożliwia osadzenie warstw z innego projektu.

1. Naciśnij , aby wyszukać inny projekt ze zbioru danych Alaska.
2. Wybierz plik projektu `grassland`. Zobaczysz zawartość projektu (zob. [figure_embed_dialog](#)).
3. Przytrzymaj klawisz `Ctrl` i kliknij na warstwach `grassland` i `regions`. Przyciśnij **[OK]**. Wybrane warstwy zostaną osadzone w legendzie i widoku mapy.



Rysunek 8.12: Zaznaczanie warstw i grup do osadzenia 

Chociaż osadzone warstwy są edytowalne, nie można zmienić ich właściwości stylu i etykietowania.

8.9.2 Usuwanie osadzonych warstw

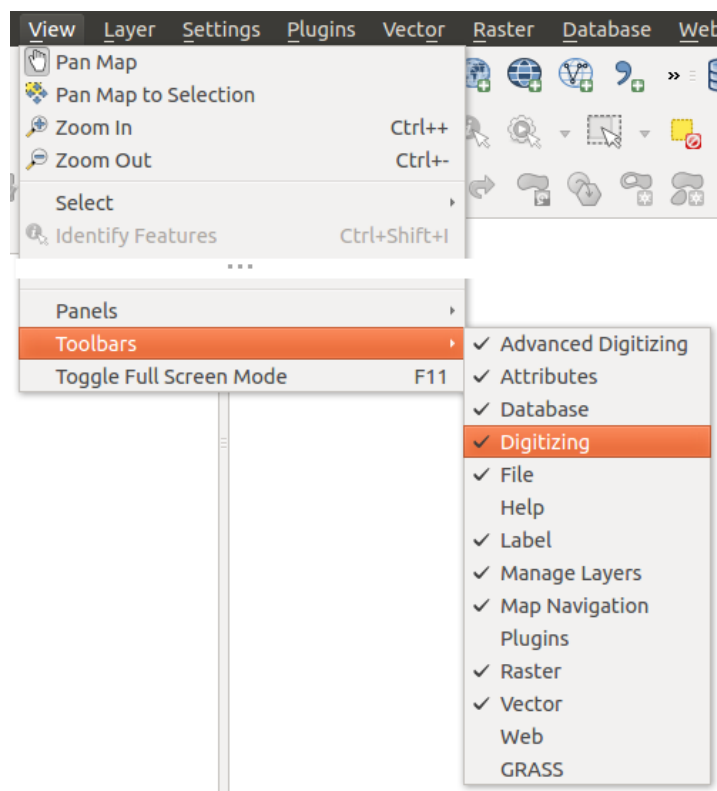
Kliknij prawym przyciskiem osadzoną warstwę i wybierz  **Usuń**.

Konfiguracja QGIS

QGIS można skonfigurować na wiele różnych sposobów za pomocą pozycji menu *Ustawienia*. Można ustawiać panele, paski narzędziowe, właściwości projektu, zmieniać opcje programu i dokonać jego personalizacji.

9.1 Panele i paski narzędziowe

W menu *Panele* → można włączać i wyłączać widżety QGIS. Menu :menuselection:‘Paski narzędzi’ → ‘umożliwia włączanie i wyłączenie grup ikon na paskach (zob. [figure_panels_toolbars](#)).



Rysunek 9.1: Menu paneli i pasków narzędziowych 🐧

Wskazówka: Włączanie podglądu QGIS



W QGIS można skorzystać z panelu podglądu, który przedstawia widok całego zakresu załadowanych warstw. Można go włączyć w menu 🐧 *Ustawienia* → *Panele* lub 🗨️ *Widok* → *Panele*. W podglądzie znajduje się prostokąt wskazujący zakres bieżącego widoku mapy. Pozwala to w prosty sposób zorientować się, jaki fragment mapy widzimy w danej chwili. Zauważ, że w podglądzie nie są wyświetlane etykiety, nawet jeśli warstwy znajdują

się w podglądzie zostały ustawione tak, aby je etykietować. Gdy przesunie się czerwony prostokąt pokazujący bieżący zakres, widok mapy zostanie odpowiednio zaktualizowany.

Wskazówka: Wgląd w teksty logów



Istnieje możliwość śledzenia komunikatów QGIS.  *Logi komunikatów* można włączyć w menu  *Ustawienia* → *Panele* lub  *Widok* → *Panele* i obserwować pojawiające się w różnych zakładkach komunikaty.

9.2 Właściwości projektu

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



- W zakładce *Ogólne* znajdziemy tytuł projektu, kolory zaznaczenia i tła, jednostki miar, dokładność i opcję zapisu względnych ścieżek do warstw. Jeśli włączone jest przeliczanie współrzędnych pomiędzy układami, można wybrać elipsoidę do pomiarów odległości. Można określić jednostki obszaru mapy (jedynie, gdy przeliczanie współrzędnych jest wyłączone) i dokładność, tj. ilość widocznych miejsc dziesiętnych po przecinku. Można również stworzyć listę skal projektu, która zastąpi skale określone globalnie.
- Menu *Układ współrzędnych* umożliwia wybór układu dla bieżącego projektu oraz włączenie przeliczania w locie współrzędnych warstw wektorowych i rastrowych w przypadku, gdy zapisane są w innym układzie współrzędnych.
- W trzeciej zakładce *Warstwy* można określić, które warstwy będą reagować na narzędzie informacji o obiekcie. (Zobacz punkt *Narzędzia mapy* w rozdziale *Opcje*, gdzie opisano, jak włączyć identyfikowanie obiektów dla wielu warstw naraz)
- 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.
- Zakładka *Serwer OWS* umożliwia podanie informacji o parametrach usług WMS i WFS QGIS Serwera, takich jak dostępne warstwy, zasięg i układy współrzędnych.
- W zakładce *Makra* tworzy się moduły Pythona dla projektu. Obecnie można zdefiniować trzy makra uruchamiane w czasie następujących zdarzeń: `openProject()`, `saveProject()` oraz `closeProject()`.
- Zakładka *Relacje* służy do definiowania relacji 1:n. Gdy określone zostaną relacje dla którejś z warstw, w interfejsie użytkownika w widoku formularza pojawiać się będzie nowy element przedstawiający połączone obiekty (np. podczas użycia narzędzia informacji o obiekcie i włączeniu jego formularza). Daje to potężne możliwości przedstawiania dodatkowych informacji o obiektach, np. historycznych wynikach pomiarów rurociągu lub długości drogi. Więcej informacji o relacjach 1:n można znaleźć w rozdziale *Creating one to many relations*.

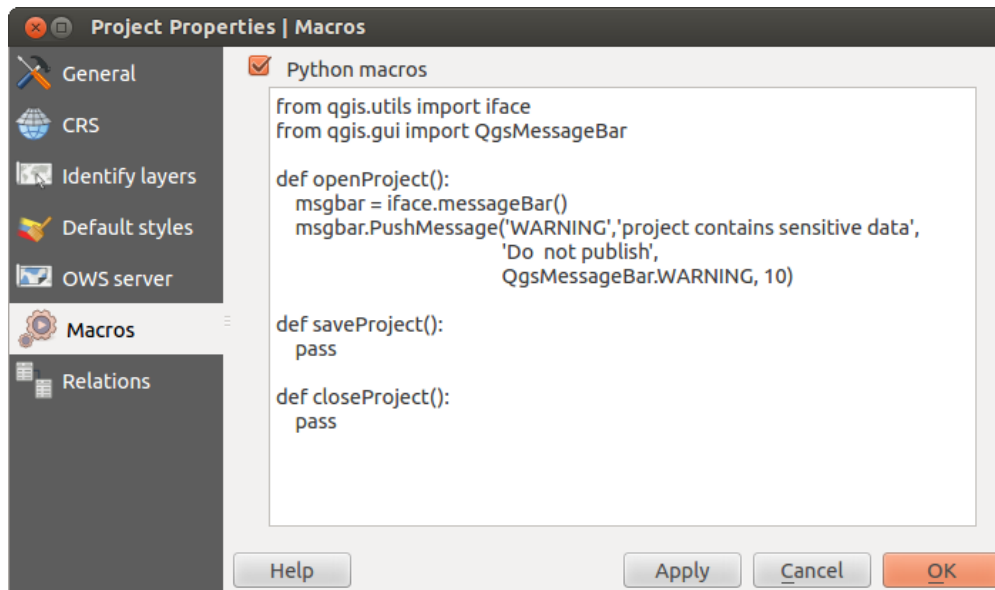
9.3 Opcje

 Niektóre podstawowe opcje QGIS określane są w oknie *Opcje*. Wybierz menu *Ustawienia* →  *Opcje*. Poniżej opisane są zakładki, w których możesz dostosowywać ustawienia.




9.3.1 Zakładka Ogólne

Program




- W pozycji *Motyw* (wymaga restartu programu)  wybierz spośród 'Oxygen', 'Windows', 'Motif', 'CDE', 'Plastique' i 'Cleanlooks' (.



Rysunek 9.2: Ustawienia makr w QGIS

- Określenie *Motywu ikon*  . Obecnie dostępny jest tylko ‘domyślny’.
- Określenie *Rozmiaru ikon*  .
- Określenie *Czcionki*. Można wybrać pomiędzy *domyślna* a dowolnie określoną przez użytkownika.
- Zmiana *Limitu czasu komunikatów*  .
- *Nie pokazuj ekranu powitalnego przy starcie*
- *Pokazuj poradę przy starcie programu*
- *Pogrubiony tytuł grupy*
- *Styl QGIS grupy*
- *Automatyczna aktualizacja okien wyboru koloru*

Pliki projektów

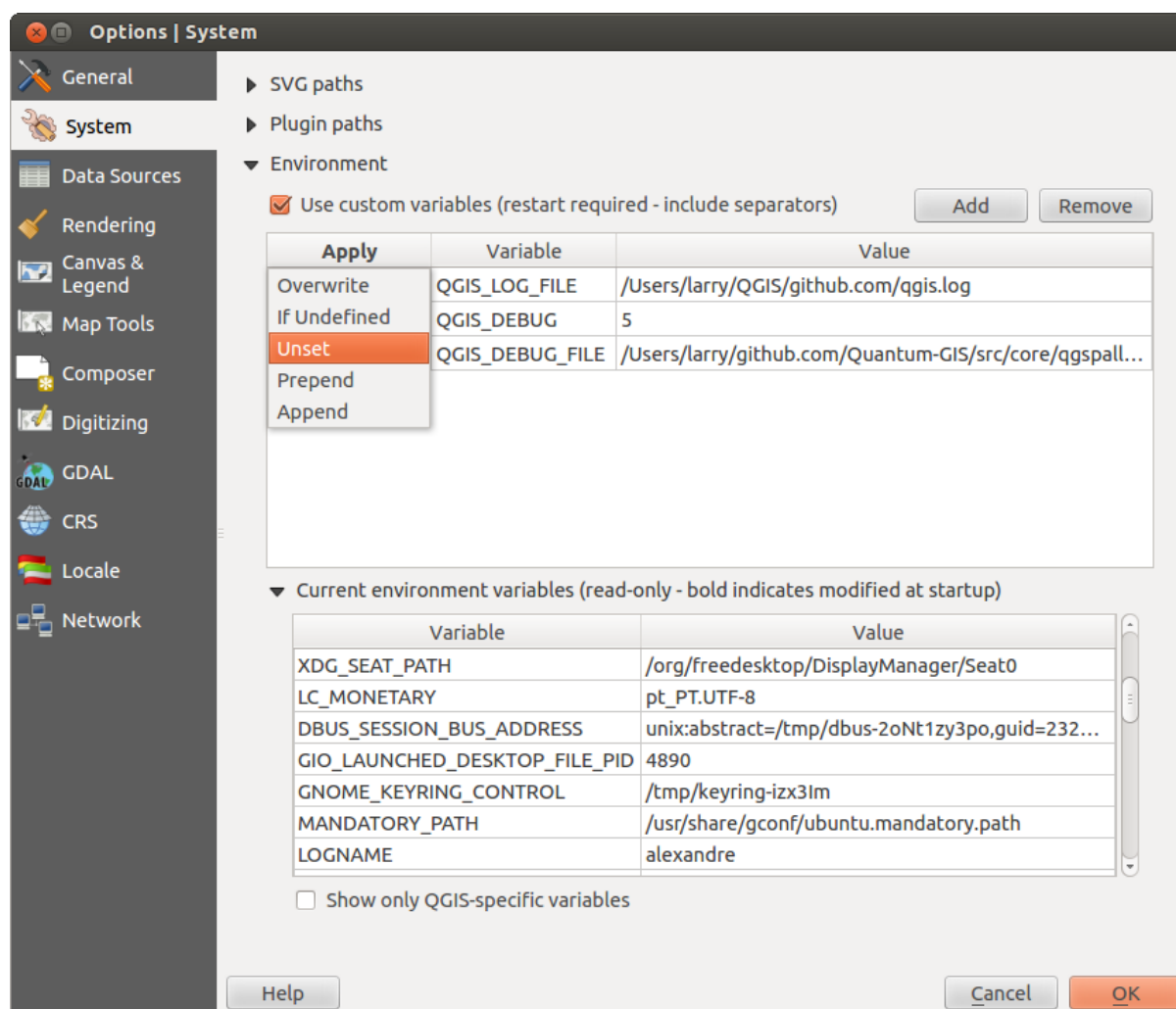
- *Przy uruchamianiu otwórz projekt*  (wybierz spośród ‘Nowy’, ‘Ostatni’ and ‘Użytkownika’. Jeśli wybierzesz ‘Użytkownika’, skorzystaj z przycisku  do określenia położenia pliku projektu).
- *Twórz nowe projekty na bazie domyślnego*. Możesz wybrać :guilabel:Bieżący projekt jako domyślny‘ or lub *Wyczyść domyślny*. Możesz wskazać katalog, w którym znajdować się będą szablony projektów zdefiniowane przez użytkownika. Gdy zapiszesz projekt w tym katalogu, pojawi się on jako pozycja w menu *Projekt* → *Nowy z szablonu*.
- *Informuj o konieczności zapisu, gdy projekt i źródło ulegną zmianie*
- *Ostrzegaj przy otwieraniu projektów zapisanych w starszych wersjach QGIS*
- *Makra Pythona*  . Opcja ta została wprowadzona, aby umożliwić obsługę makr wykonujących działania w czasie określonych zdarzeń. Można wybrać spośród ‘nigdy’, ‘pytaj’, ‘tylko w tej sesji’ i ‘zawsze (niezalecane)’.

9.3.2 Zakładka System

Środowisko

W zakładce **System** można teraz przeglądać wartości zmiennych środowiskowych, a wiele z nich można również edytować (zob. [figure_environment_variables](#)). Może się to przydać na platformach takich jak Mac, gdzie aplikacje GUI nie dziedziczą ustawień środowiskowych powłoki. Jest to również przydatne przy przeglądaniu i zmianie ustawień środowiska dla narzędzi zewnętrznych zarządzanych przez Geoprocessing (np. SAGA, GRASS) i przy włączaniu wyjścia debugowania dla określonych partii kodu źródłowego.

- Zastosuj zmienne użytkownika (wymaga ponownego uruchomienia; zawiera separatory).* Zmienne można **[Dodać]** i **[Usunąć]**. Zdefiniowane dotychczas zmienna wyświetlane są w ramce *Aktualne zmienne środowiska*, przy czym istnieje możliwość filtrowania zmiennych poprzez zaznaczenie opcji *Pokaż jedynie zmienne QGIS*.






Rysunek 9.3: Zmienne środowiska w QGIS

Ścieżki wtyczek



[Dodaj] lub **[Usuń]** *Ścieżki poszukiwań dodatkowych wtyczek C++*

9.3.3 Zakładka Źródła danych

Tabela i atrybuty obiektów

- *Otwórz tabelę atrybutów w oknie dokowalnym (wymaga restarty QGIS-a)*
- *Kopiuj geometrię w formacie WKT z tabeli atrybutów.* Powoduje to, że podczas użycia polecenia  *Kopiuj zaznaczone wiersze do schowka* w oknie *Tabeli atrybutów*, do schowka kopiowane są również współrzędne punktów lub wierzchołków.
- *Właściwości tabeli atrybutów* . Są trzy możliwości: ‘Pokaż wszystkie obiekty’, ‘Pokaż zaznaczone obiekty’ and ‘Pokaż obiekty widoczne na mapie’.
- *Cache wierszy tabeli atrybutów* . Ten cache umożliwia zapisanie N ostatnio załadowanych wierszy tabeli aby praca z tabelą była szybsza. Cache jest kasowany, gdy tabela atrybutów jest zamykana.
- *Wartość NULL jest reprezentowana przez.* Można tu określić wartość dla pól zawierających wartość NULL.

Obsługa źródeł danych

- *Szukaj poprawnych obiektów w oknie przeglądarki* . Możesz wybrać ‘Sprawdź rozszerzenie’ lub ‘Sprawdź zawartość pliku’.
- *Szukaj w plikach skompresowanych (.zip) w oknie przeglądarki* . Mamy następujące możliwości: ‘Nie’, ‘Podstawowy skan’ i ‘Pełny skan’.
- *Pytaj o podwarstwy rastrowe przy otwieraniu.* Niektóre rastry obsługują podwarstwy — w GDAL nazywane są one podzbiórami danych (subdatasets). Przykładem mogą być pliki netcdf — gdy istnieje wiele wariantów netcdf, GDAL rozpoznaje każdy z nich jako podzbiór danych. Ta opcja dotyczy sposobu, w jaki traktowane mają być podwarstwy, gdy otwierany jest plik z podwarstwami. Mamy do wyboru:
 - ‘Zawsze’: zawsze pytaj (czy istnieją podwarstwy)
 - ‘Jeśli konieczne’: pytaj, czy warstwa nie ma pasm, a posiada podwarstwy
 - ‘Nigdy’: nigdy nie pytaj i nie ładuj podwarstw.
 - ‘Wczytaj wszystkie’: nigdy nie pytaj, ale załaduj wszystkie podwarstwy
- *Ignoruj deklarację kodowania Shapefile.* Jeśli Shapefile posiada deklarację kodowania, nie będzie ona uwzględniana przez QGIS.
- *Dodaj warstwy PostGIS podwójnym kliknięciem i wybierz w trybie rozszerzonym*
- *Dodaj warstwy Oracle podwójnym kliknięciem i wybierz w trybie rozszerzonym*

9.3.4 Zakładka Renderowanie

Właściwości wyświetlania

- *Domyślnie nowo dodawane warstwy są wyświetlane*
- *Enable back buffer*
- *Użyj pamięci podręcznej aby przyspieszyć odświeżanie.*
- *Uproszczone wyświetlanie dla nowo wczytanych warstw*
- *Upraszczaj w źródle danych (jeśli to możliwe)*





Jakość wyświetlania

- *Pokaż linie jako mniej postrzępione kosztem wydajności wyświetlania*
- *Fix problems with incorrectly filled polygons*

Rastry

- W *Kanały RGB* możesz określić numery kanałów czerwonego, zielonego i niebieskiego.

Contrast enhancement

- *Jeden kanał* . Obrazy jednokanałowe można ładować z opcjami: ‘Bez rozciągania’, ‘Rozciągnij do MinMax’, ‘Rozciągnij i przytnij do MinMax’ oraz ‘Przytnij do MinMax’.
- *Kolor wielokanałowy (bajt/kanał)* . Z opcjami ‘Bez rozciągania’, ‘Rozciągnij do MinMax’, ‘Rozciągnij i przytnij do MinMax’ oraz ‘Przytnij do MinMax’.
- *Kolor wielokanałowy (>bajt/kanał)* . Z opcjami ‘Bez rozciągania’, ‘Rozciągnij do MinMax’, ‘Rozciągnij i przytnij do MinMax’ oraz ‘Przytnij do MinMax’.
- *Ogranicz do (min./max.)* . Z opcjami ‘łącznej liczby pikseli’, ‘minimum/maksimum’, ‘odchylenia standardowego’
- *Łączna liczba pikseli*
- *Wielokrotność odchylenia standardowego*

Śledzenie błędów


- *Odświeżanie obszaru mapy*

9.3.5 Zakładka Mapa i legenda

Domyślny wygląd mapy (nadpiswany przez właściwości projektu)

- Określ kolor obiektów zaznaczonych i kolor tła.

Legenda warstw

- *Dwuklik na warstwie w legendzie*  może ‘otwierać właściwości warstwy’ albo ‘otwierać tabelę atrybutów’.
- Można określić następujące opcje *Stylu legendy*:
 - *Nazwy warstw dużą literą*
 - *Nazwy warstw pogrubione*
 - *Nazwy grup pogrubione*
 - *Wyświetl atrybuty klasyfikacji*
 - *Twórz miniatury warstw rastrowych (może spowolnić program)*
 - *Nowe warstwy dodawaj do aktywnej lub zaznaczonej grupy*

9.3.6 Zakładka Narzędzia mapy

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 *Projekty* 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*

Narzędzie pomiaru

- Określenie *koloru linijki* dla narzędzi pomiarowych
- Określenie *Ilości cyfr dziesiętnych*
- *Zachowaj jednostki bazowe*
- *Preferowane jednostki długości* ('metry', 'stopy', 'mile morskie' lub 'stopnie')
- *Preferowane jednostki kątów* ('stopnie', 'radiany' lub 'grady')

Przesuwanie i powiększanie

- Określanie *działania kółka na myszce* ('Powiększ', 'Powiększ i wycentrum', 'Powiększ do kursora', 'Brak')
- Określanie *Współczynnika powiększenia* dla kółka myszy

Zdefiniowane skale

Tutaj znajdziesz listę zdefiniowanych skal. Za pomocą przycisków [+] i [-] można dodawać i usuwać własne skale.

9.3.7 Zakładka Wydruk

Domyślne ustawienia wydruku

Można określić *Domyślną czcionkę*.

Wygląd siatki

- Można określić *Styl siatki* ('linie', 'punkty', 'krzyże')
- oraz *kolor*..

Domyślne dla siatki

- Można określić *Odstęp* 1,00
- *:guiabel:'Przesunięcie* ' 1,00 w kierunku x i y
- oraz *Tolerancję przyciągania* 1,00

Domyślne dla prowadnic

- oraz *Tolerancję przyciągania* 1,00

9.3.8 Zakładka Digitalizacja


Tworzenie obiektów

- *Nie pokazuj okna z atrybutami po utworzeniu obiektu*
- *Użyj ostatnich wprowadzonych wartości atrybutu*
- *Sprawdzanie geometrii*. Podczas edycji złożonych linii i poligonów z wieloma węzłami renderowanie może być bardzo spowolnione. Jest tak ponieważ domyślna procedura sprawdzania w QGIS może zająć sporo czasu. Można przyspieszyć renderowanie poprzez zaznaczenie sprawdzania geometrii za pomocą GEOS (począwszy od GEOS 3.3) lub wyłączając sprawdzanie. Sprawdzanie geometrii za pomocą GEOS jest dużo szybsze, ale jego wadą jest to, że otrzymamy jedynie informację o pierwszym napotkanym błędzie geometrii.


Linijka

- Określenie *grubości linii i koloru linii*


Przyciąganie

- *Dokowane okno opcji (wymaga restartu QGIS-a)*
- Określenie :guiLabel:Domyślny tryb przyciągania'  ('do wierzchołka', 'do segmentu', 'do wierzchołka i segmentu', 'brak')
- *Domyślna tolerancja przyciągania* w jednostkach mapy lub pikselach
- Określ *Promień wyszukiwania przy edycji wierzchołków* w jednostkach mapy lub pikselach

Znaczniki wierzchołków

- *Wyświetl znaczniki jedynie dla wybranych obiektów*
- Określ *Styl znacznika* dla wierzchołków  ('Krzyż' (default), 'Półprzezroczyste koło' lub 'Brak')
- Określ *Rozmiar markera* wierzchołków

Przesunięcie krzywych

Następne trzy opcje dotyczą narzędzia  Przesunięcie krzywej z *Advanced digitizing*. Poprzez zmianę tych ustawień można uzyskać różne kształty przesuwanej krzywej. Opcje te dostępne są w GEOS od wersji 3.3.

- *Styl połączenia*
- *Segmentów kwadrantu*
- *Limit fazy (uciosu)*

9.3.9 Zakładka GDAL

GDAL jest biblioteką wymiany danych dla plików rastrowych. W tej zakładce można podać *Opcje generowania* i *Opcje piramid* dla rastrow. Można także określić, który ze sterowników GDAL ma być wykorzystany dla określonego formatu rastra, gdy ma to czasem miejsce, dostępnych jest kilka.

9.3.10 Zakładka Układ współrzędnych

Domyślny układ współrzędnych dla nowych projektów

- *Domyślnie wyłącz reprojekcję w locie*
- *Włącz reprojekcję w locie, jeśli warstwy mają różne układy współrzędnych*
- *Domyślnie włącz reprojekcję w locie*
- *Zawsze stosuj ten układ dla nowych projektów* i wybierz jakiś układ

Układ współrzędnych dla nowych warstw

To pole pozwala określić, co ma się zdarzyć, gdy tworzona jest nowa warstwa lub ładowana jest warstwa bez określonego układu współrzędnych.

- *pytaj o układ współrzędnych*
- *użyj układu współrzędnych projektu*
- *użyj poniższego domyślnego układu współrzędnych*

Domyślne transformacje układów odniesienia

- *Pytaj o transformację, gdy brak domyślnej*
- Jeśli korzystałeś już z reprojekcji w locie, informację o tym znajdziesz w okienku poniżej. Są tam informacje o źródłowych i docelowych układach współrzędnych płaskich i wysokościowych.

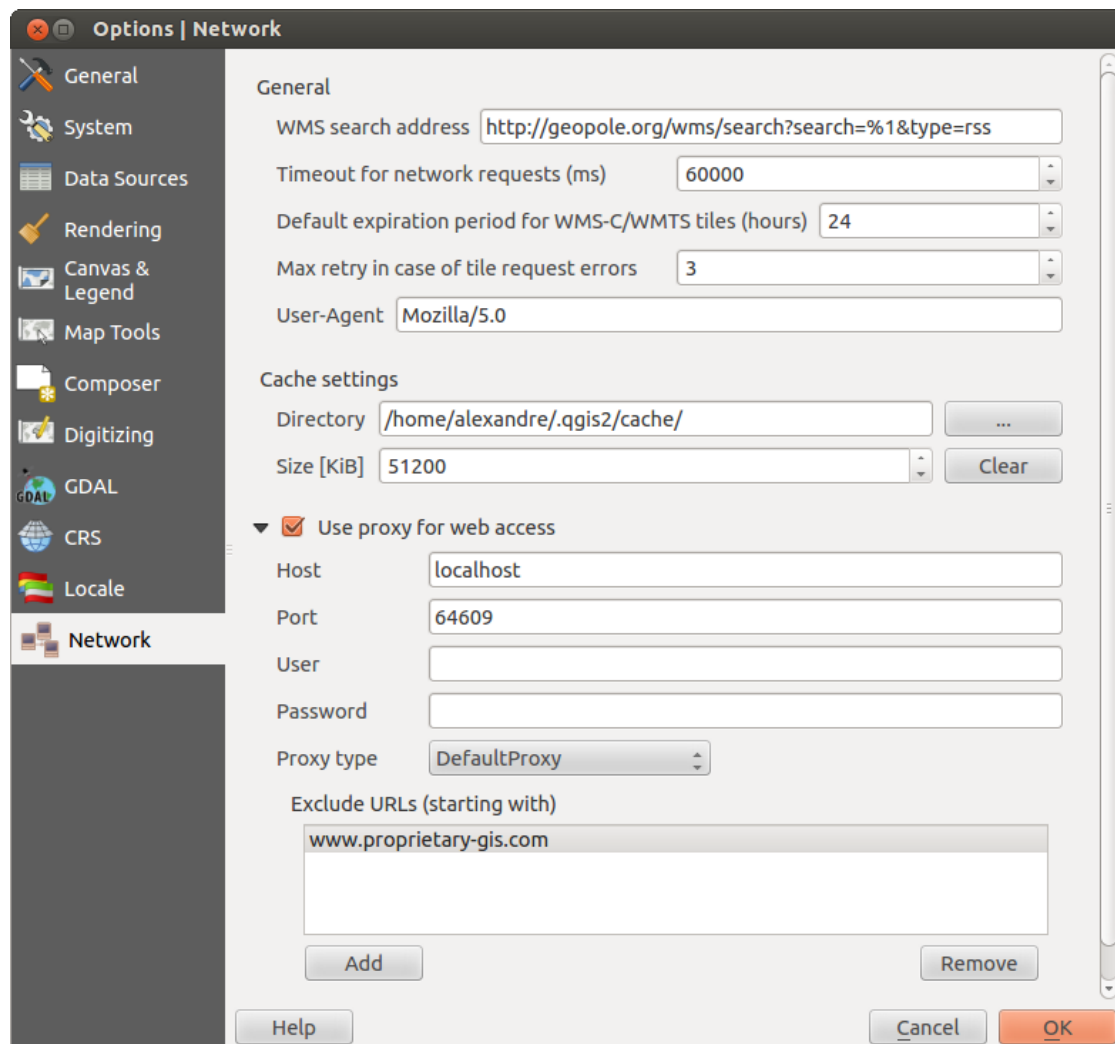
9.3.11 Zakładka Język

- *Nadpisz ustawienia lokalne i Wybierz wersję językową*
- Wykryte ustawienia lokalne w twoim systemie

9.3.12 Zakładka Sieć

Ogólne



- *Adres przeszukiwania WMS, domyślny to `http://geopole.org/wms/search?search=%1&type=rss`*
- *Limit czasu dla zapytań sieciowych (ms) - domyślny wynosi 60000*
- *Czas przedawnienia dla kafli WMSC/WMTS (h) - domyślny to 24*
- *Można określić Limit prób przy błędach pobierania kafli*
- *Klient użytkownika (User-Agent)*



Rysunek 9.4: Ustawienia serwera proxy w QGIS

Ustawienia cache

Katalog i Rozmiar dla cache.

-  Użyj serwera proxy przy dostępie do sieci wymaga podania 'Hosta' i opcjonalnie 'Portu', 'Użytkownika' oraz 'Hasła'.
- Ustaw *Typ proxy*  odpowiedni dla twojego przypadku.
 - *Default Proxy*: Proxy określany jest na podstawie ustawień aplikacji proxy
 - *Socks5Proxy*: ogólny proxy dla wszelkiego typu połączeń. Obsługuje TCP, UDP, binding do portu (dla połączeń przychodzących) oraz autoryzację.
 - *HttpProxy*: zaimplementowany z użyciem komendy "CONNECT", obsługuje jedynie połączenia wychodzące. Obsługuje autoryzację.
 - *HttpCachingProxy*: Zaimplementowany przy użyciu zwykłych poleceń HTTP, użyteczny jedynie w kontekście zapytań HTTP.
 - *FtpCachingProxy*: Zaimplementowany przy użyciu pproxy FTP, użyteczny jedynie w kontekście zapytań FTP.




Można dodać wykluczenia niektórych URL w okienku tekstowym poniżej ustawień proxy (zob. [Figure_Network_Tab](#)).

Jeśli będziesz potrzebował bardziej szczegółowych informacji o ustawieniach proxy, zajrzyj do manuala w dokumentacji biblioteki QT, która dostępna jest pod adresem <http://qt-project.org/doc/qt-4.8/qnetworkproxy.html#ProxyType-enum>.

Wskazówka: Korzystanie z proxy

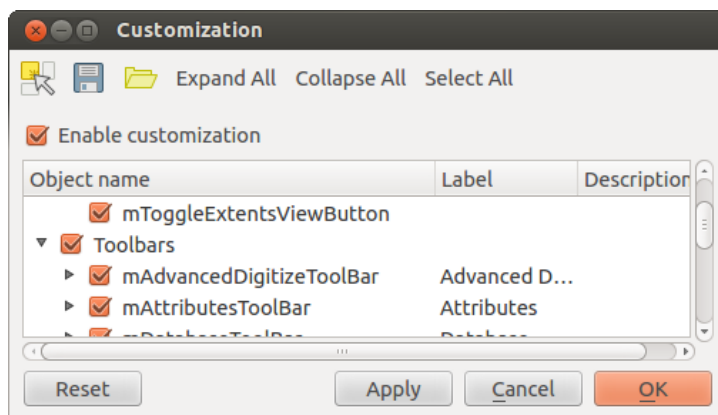
Korzystanie z proxy może być trudne. Można próbować kolejno wymienionych wyżej ustawień i sprawdzać, czy działają.


Można zmieniać te opcje stosownie do własnych potrzeb. Niektóre zmiany odnoszą skutek dopiero po restarcie QGIS.





-  Settings are saved in a text file: `$HOME/.config/QGIS/qgis.conf`
-  swoje ustawienia znajdziesz w: `$HOME/Library/Preferences/org.qgis.qgis.plist`
-  Ustawienia zapisane są w rejestrze pod: `HKEY\CURRENT_USER\Software\QGIS\qgis`


9.4 Personalizacja

Personalizacja pozwala na włączanie i wyłączanie prawie każdego elementu interfejsu użytkownika QGIS. Może to być bardzo pomocne, jeśli masz zainstalowanych wiele wtyczek, z których nie korzystasz, a które zajmują miejsce na ekranie.



Rysunek 9.5: Okno personalizacji 

Personalizacja QGIS podzielona jest na pięć części. W  *Menu* ukrywa się lub pokazuje elementy paska menu. W  *Panele* znajdują się okna paneli. Są to aplikacje, które uruchamiane są jako okna pływające, okna najwyższego rzędu lub jako okna osadzone w głównym oknie QGIS jako zadokowane widżety (zob. również *Panele i paski narzędziowe*). W  *Pasek stanu* można wyłączać elementy takie jak informacje o współrzędnych. W *checkbox* :*guilabel*:*'Paski narzędziowe*, można (dez)aktywować paski narzędziowe z ikonami poleceń QGIS, a w  *Widżety* można włączać i wyłączać różne okna dialogowe i ich przyciski.

Za pomocą  *Przełącz przechwytywanie widżetów w programie głównym* można kliknąć element QGIS, który ma zostać ukryty i w ten sposób zlokalizować go na liście Personalizacji (zob. [figure_customization](#)). Można zachować różne ustawienia personalizacji do różnych zastosowań. Załadowanie nowych ustawień personalizacji z pliku wymaga restartu QGIS.

Praca z układami współrzędnych


QGIS umożliwia zdefiniowanie globalnego układu współrzędnych i układu dla projektu, które będą stosowane dla warstw bez określonego układu. Możliwe jest także definiowanie własnych układów współrzędnych i reprojektacja współrzędnych w locie zarówno dla warstw wektorowych jak i rastrów. Umożliwia to użytkownikom poprawne wyświetlanie i nakładanie na siebie warstw utworzonych w różnych układach współrzędnych.

10.1 Ogólne wiadomości o obsłudze układów współrzędnych

QGIS obsługuje około 2 700 znanych układów współrzędnych. Definicja każdego z tych układów przechowywana jest w bazie SQLite, która instalowana jest razem z QGIS. Zwykle nie ma konieczności dokonywania zmian w tej bazie. Co istotne, zmiany takie mogłyby uniemożliwić prawidłowe przeliczanie współrzędnych. W rozdziale *Układ współrzędnych użytkownika* znajdziesz więcej informacji o zarządzaniu własnymi układami współrzędnych.


Układy dostępne w QGIS korzystają z informacji podanych przez European Petroleum Search Group (EPSG) oraz Institut Geographique National de France (IGNF) i w dużym stopniu zostały zaczerpnięte z tabel odniesień przestrzennych wykorzystanych w GDAL. Baza układów zawiera identyfikatory EPSG i w QGIS można z nich korzystać, aby określić układ współrzędnych.

Aby móc korzystać z reprojektacji w locie, dane muszą zawierać informacje o ich układach współrzędnych albo będziesz musiał sam podać układ dla tej warstwy, układ globalny lub układ projektu. W przypadku warstw PostGIS QGIS wykorzystuje identyfikator układu, który został podany w czasie tworzenia warstwy. W przypadku danych ładowanych przez OGR, QGIS sprawdza istnienie któregoś ze znanych sposobów określania układu. Dla plików shape jest to definicja układu w postaci well-known text (:index:'WKT'). Plik układu ma taką samą nazwę co shape i rozszerzenie .prj. Na przykład plik shape `alaska.shp` będzie miał definicję układu w pliku `alaska.prj`.

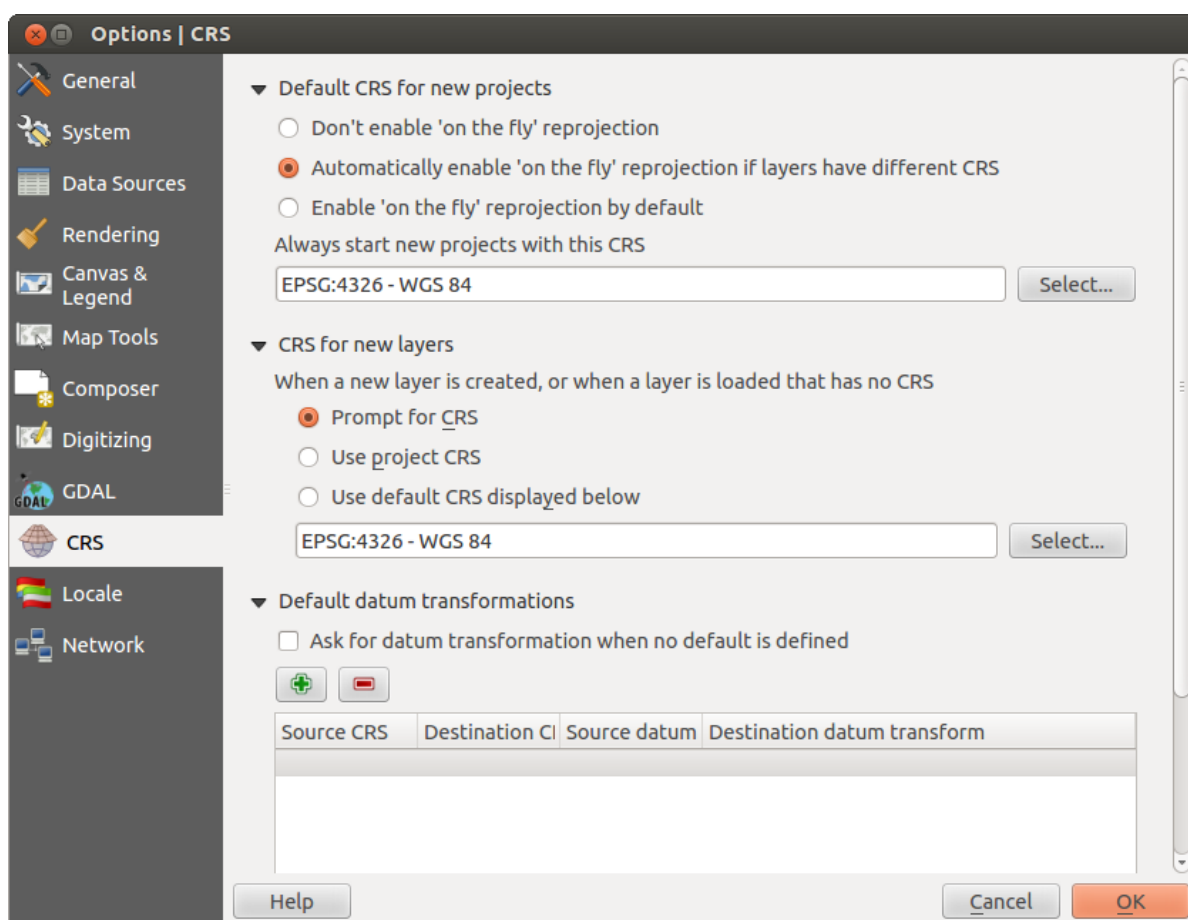
Gdy wybierasz jakiś nowy układ współrzędnych, automatycznie zmieniają się również jednostki warstwy widoczne w zakładce *Ogólne* w oknie  *Właściwości projektu* w menu *Projekt* (Windows, Gnome, OS X) lub *Ustawienia* (KDE).

10.2 Specyfikacja odwzorowań globalnych

Każdy nowy projekt QGIS wykorzystuje domyślny globalny układ współrzędnych. Domyślnym układem po zainstalowaniu QGIS jest EPSG:4326 - WGS 84 (`proj=longlat +ellps=WGS84 +datum=WGS84 +no_defs`). To domyślne ustawienie można zmienić przyciskiem **[Wybierz...]** w pierwszej sekcji, w której podajemy domyślny układ dla nowych projektów tak, jak to pokazano na rysunku [figure_projection_1](#). Wybór ten zostanie zapisany i użyty w kolejnych sesjach QGIS.

Gdy korzystasz z warstw, które nie mają określonego układu współrzędnych, musisz zdecydować w jaki sposób QGIS traktuje te warstwy. Można to określić globalnie lub dla konkretnego projektu w zakładce *Układ współrzędnych* w menu *Ustawienia* →  *Opcje*.

Opcje pokazane na [figure_projection_1](#) to:



Rysunek 10.1: Zakładka Układ współrzędnych w oknie opcji QGIS 


- *Pytaj o układ współrzędnych*
- *Użyj układu współrzędnych projektu*
- *Użyj poniższego domyślnego układu współrzędnych*

Zmiany układu współrzędnych dla konkretnej warstwy możesz dokonać również w zakładce *Ogólne* okna właściwości warstwy wektorowej i rastra (zob. *General Menu* dla rastrow i *General Menu* dla wektorów). Jeśli twoja warstwa ma już określony jakiś układ współrzędnych, zostanie on wyświetlony tak, jak to pokazano na rysunku *Vector Layer Properties Dialog*.



Wskazówka: Układy współrzędnych w legendzie mapy


Klikając prawym przyciskiem myszy na legendzie mapy (rozdz. *Legenda mapy*) uzyskujemy dostęp do dwóch skrótów do układu współrzędnych. *Ustaw układ współrzędnych warstwy* wyświetla bezpośrednio okno wyboru układu współrzędnych warstwy (zob. *figure_projection_2*). *Ustaw wsp. projektu z warstwy* powoduje, że układem projektu staje się układ warstwy.

10.3 Włączanie reprojektacji w locie

QGIS umożliwia reprojektację w locie warstw wektorowych i rastrowych. Reprojektacja nie jest jednak domyślnie włączona. Aby ją włączyć, należy zaznaczyć pole wyboru *Reprojekcja w locie* w zakładce *Układ współrzędnych* okna  *Właściwości projektu*.

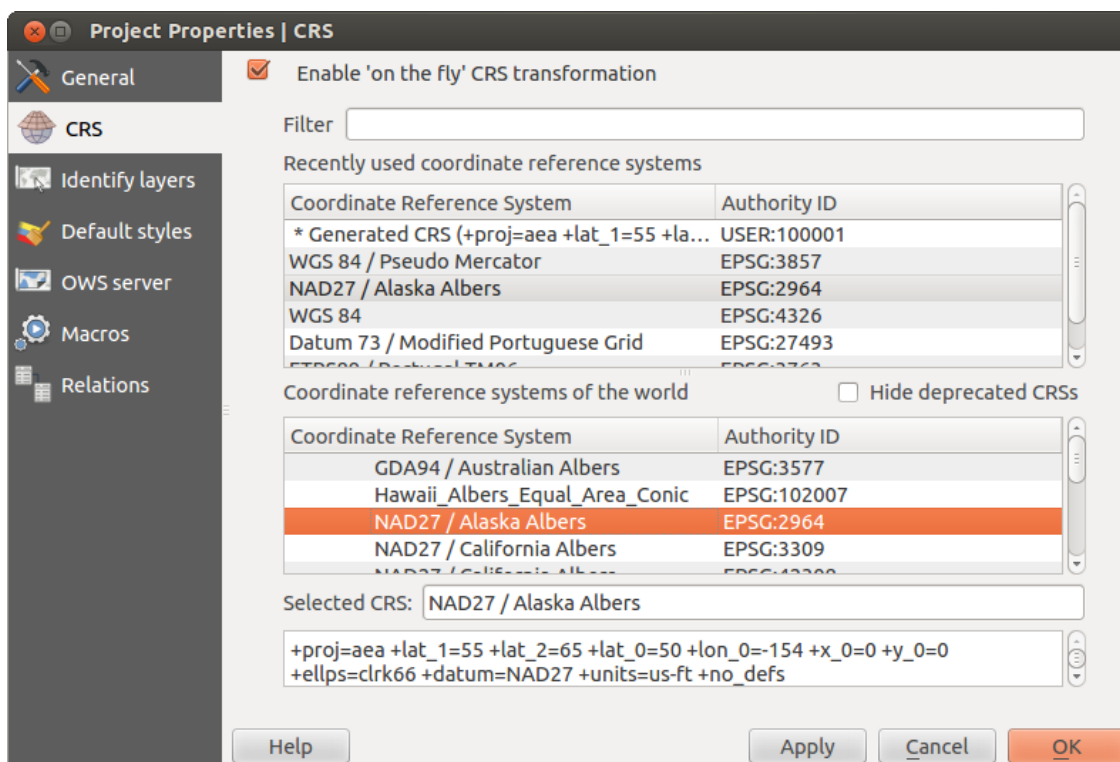
Można to zrobić na trzy sposoby:


1. Wybierz polecenie  *Właściwości projektu* z menu *Projekt* (Gnome, OSX, Windows) lub *Ustawienia* (KDE).
2. Kliknij na ikonie  *Stan CRS* z prawej strony paska stanu u dołu ekranu.
3. Włącz reprojektację w locie w zakładce *Układ współrzędnych* okna *Opcji* i zaznacz pole wyboru *Domyślnie włącz reprojektację w locie* lub *Włącz reprojektację w locie, jeśli warstwy mają różne układy współrzędnych*.

Jeśli już załadowałeś warstwę i chcesz włączyć reprojektację w locie, najlepiej będzie otworzyć zakładkę *Układ współrzędnych* w oknie *Właściwości Projektu*, wybrać jakiś układ, a następnie zaznaczyć pole *Reprojekcja w locie*. Od tej chwili ikona  *Stan CRS* nie jest już wyszarzona, a wszystkie warstwy są przeliczane do układu wskazanego obok ikony.

Zakładka *Układ współrzędnych* okna *Właściwości projektu* zawiera pięć istotnych składników, jak pokazano na rysunku *Figure_projection_2* i opisano poniżej:

1. **Reprojekcja w locie** — to pole służy do włączania reprojektacji w locie. Gdy nie jest zaznaczone, każda warstwa rysowana jest przy użyciu układu współrzędnych wczytanego razem z warstwą, a składniki opisane poniżej są nieaktywne. Gdy pole jest zaznaczone, każda warstwa jest przeliczana do układu przypisanego obszarowi mapy.
2. **Filtr** — jeśli znasz kod EPSG, identyfikator lub nazwę układu współrzędnych, możesz odnaleźć układ korzystając z wyszukiwarki. Wpisz kod EPSG, identyfikator lub nazwę.
3. **Ostatnio używane układy współrzędnych** — jeśli regularnie używasz w swojej pracy pewnych układów współrzędnych, będą one wyświetlone w tabeli. Aby wybrać jakiś układ, kliknij go.
4. **Dostępne układy współrzędnych** — jest to lista wszystkich układów obsługiwanych przez QGIS, zawierająca układy geograficzne i płaskie oraz układy zdefiniowane przez użytkownika. Aby określić układ, rozwiń właściwą gałąź drzewka i wybierz układ z listy zaznaczając go.
5. **PROJ4 text** — jest to ciąg znaków opisujący układ współrzędnych używany przez PROJ4, silnik obsługujący układy. Tekst ten jest tylko do odczytu i jest podany do informacji.




Rysunek 10.2: Okno właściwości projektu 

Wskazówka: Okno właściwości projektu

Jeśli otworzyłeś okno *Właściwości projektu* z menu *:menuselection:Projekt*, żeby zobaczyć ustawienia układu wybierz zakładkę *Układ współrzędnych*.

Otwarcie okna właściwości za pomocą przycisku  Stan CRS automatycznie wyświetli zakładkę *Układ współrzędnych*.

10.4 Układ współrzędnych użytkownika

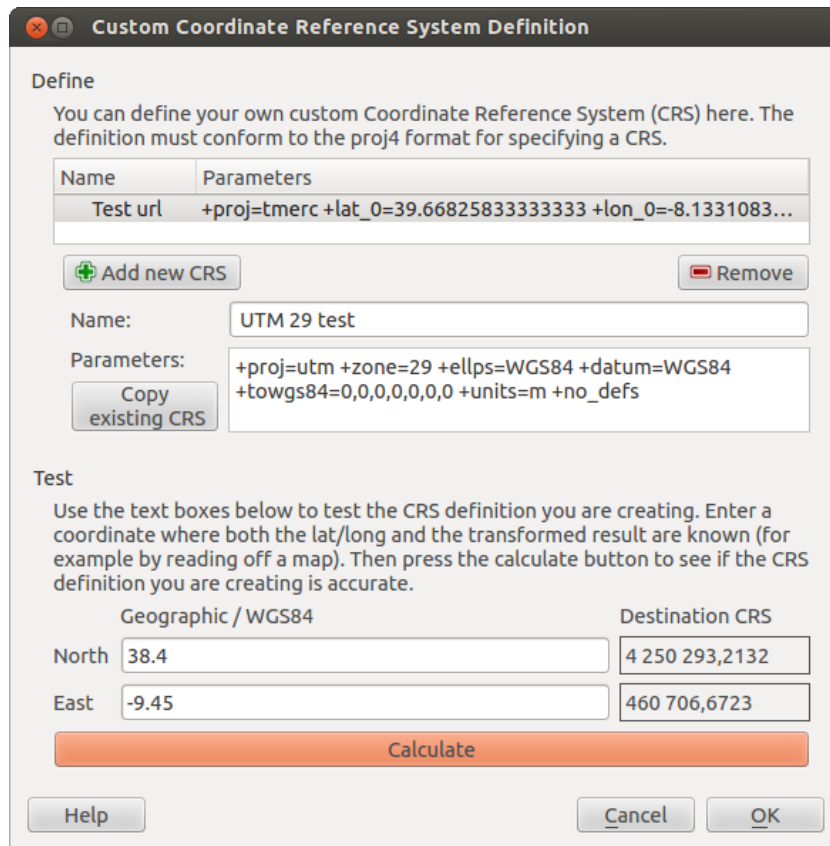
Jeśli QGIS nie obsługuje układu, którego potrzebujesz, możesz zdefiniować własny układ. W tym celu wybierz polecenie  *Układ współrzędnych użytkownika...* z menu *Ustawienia*. Układy użytkownika przechowywane są w twojej bazie danych użytkownika QGIS. Poza twoimi układami, baza ta zawiera zakładki przestrzenne i inne ustawienia osobiste.

Definiowanie własnego układu współrzędnych w QGIS wymaga od użytkownika odpowiedniej wiedzy o bibliotece odwzorowań PROJ4. Zanim zaczniesz, sprawdź “Cartographic Projection Procedures for the UNIX Environment - A User’s Manual”, Gerald I. Evenden, U.S. Geological Survey Open-File Report 90-284, 1990 (dostępne pod adresem <ftp://ftp.remotesensing.org/proj/OF90-284.pdf>).


Ten podręcznik opisuje wykorzystanie `proj.4` i podobnych narzędzi w linii poleceń. Parametry kartograficzne wykorzystane w `proj.4` opisane w tym podręczniku są takie same, jak te, używane przez QGIS.

Aby zdefiniować układ użytkownika w oknie *Definicji układu współrzędnych użytkownika* należy podać jedynie dwa parametry:

1. nazwę układu
2. parametry kartograficzne w formacie PROJ4



Rysunek 10.3: Okno układu współrzędnych użytkownika 🐧


Aby utworzyć nowy układ współrzędnych naciśnij przycisk  Dodaj nowy, podaj nazwę dobrze opisującą układ oraz jego parametry.

Zwróć uwagę na to, że aby *Parametry* właściwie opisywały nowy układ współrzędnych, powinny zaczynać się od bloku `+proj=`.

Możesz przetestować twój układ i sprawdzić, czy dają rozsądne wyniki. W tym celu wpisz jakieś znane wartości długości i szerokości geograficznej w pola *Północ* and *Wschód*. Kliknij **[Przelicz]** i sprawdź czy otrzymałeś spodziewane wyniki w swoim układzie współrzędnych.

10.5 Domyślne transformacje układów odniesienia

Reprojekcja w locie zależy od tego, czy możliwa jest transformacja współrzędnych pomiędzy układem warstwy a układem domyślnym. W przypadku pewnych układów możliwe są różne przeliczenia przy przejściu do innego układu. QGIS pozwala na określenie sposobu transformacji, a jeśli. Jeśli tego nie uczynimy, QGIS zastosuje transformację domyślną.

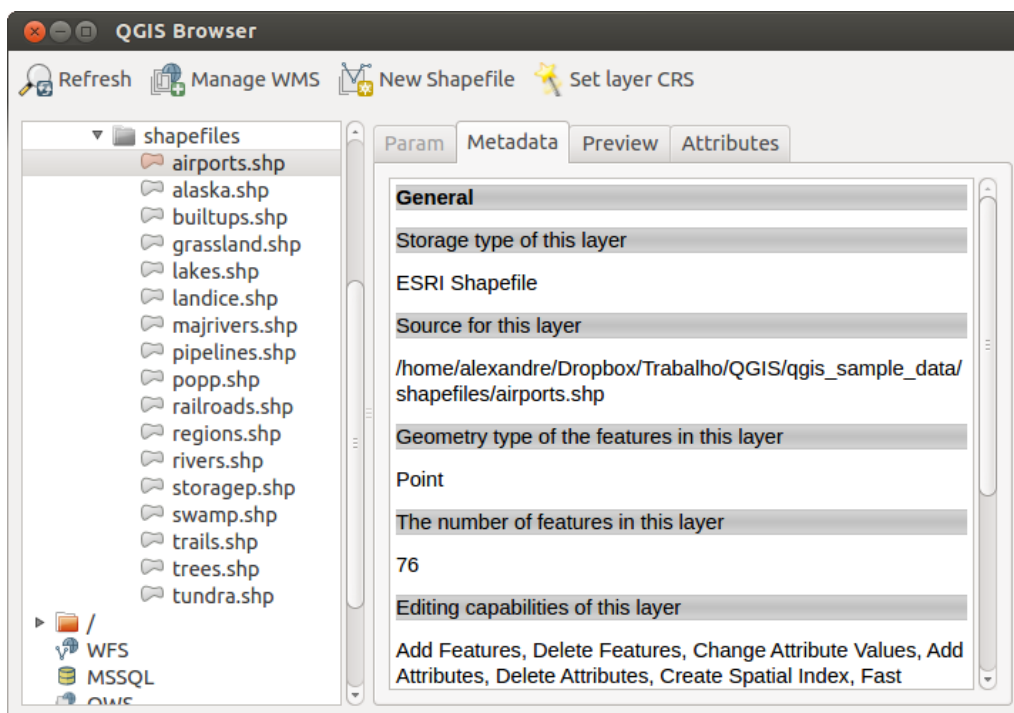
W zakładce *Układ współrzędnych* w menu *Ustawienia* →  *Opcje* można:

- ustawić QGIS, aby pytał, gdy musi określić sposób transformacji, poprzez zaznaczenie opcji *Pytaj o transformację, gdy brak domyślnej*
- zmieniać listę domyślnych transformacji

QGIS pyta, której transformacji użyć, przy czym wyświetla tekst PROJ.4 opisujący układ źródłowy i docelowy. Dalsze informacje wyświetlają się po najechaniu kursorem myszy na transformację. Ustawienia użytkownika mogą być zapisane, jeśli zaznaczone będzie pole *Zapamiętaj wybór*.

QGIS Browser


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





Rysunek 11.1: QGIS browser as a stand alone application 🐧

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


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

7. Right-click on a layer and choose *Set project CRS from layer*. For more information see *Praca z układami współrzędnych*.
8. Click on  Zoom Full to make the layers visible.

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




1. Activate a second QGIS Browser: Right-click on the toolbar and check  *Browser (2)*, or select it from *Settings* → *Panels*.
2. Drag the panel into the legend window.
3. Navigate to the *Browser (2)* tab and browse for a shapefile in your file system.
4. Select a file with the left mouse button. Now you can use the  Add Selected Layers icon to add it into the current project.

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

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

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

Start the QGIS browser

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

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

Working with Vector Data

12.1 Obsługiwane formaty danych

Do odczytu i zapisu danych wektorowych, w tym ESRI Shapefile, plików w formatach MapInfo i MicroStation, AutoCAD DXF, baz danych PostGIS, SpatiaLite, Oracle Spatial i MSSQL Spatial i wielu innych, QGIS wykorzystuje bibliotekę OGR. Obsługa danych wektorowych GRASS i baz PostgreSQL odbywa się za pomocą natywnych wtyczek QGIS. Można też załadować do odczytu dane wektorowe znajdujące się w archiwach zip lub gzip. Obecnie, gdy tworzona jest ta dokumentacja, za pomocą biblioteki OGR obsługiwanych jest 69 różnych formatów wektorowych (zob. OGR-SOFTWARE-SUITE in *Literature and Web References*). Kompletna lista formatów dostępna jest pod adresem http://www.gdal.org/ogr/ogr_formats.html.

Informacja: Może się zdarzyć, że nie wszystkie z przedstawionych formatów będą działać w QGIS. Niektóre z nich mogą, na przykład, wymagać zewnętrznych komercyjnych bibliotek lub GDAL/OGR dla twojego systemu został skompilowany bez obsługi formatu, którego chcesz użyć. Na liście typów plików podczas ładowania warstwy wektorowej do QGIS będą się pojawiały tylko te formaty, które zostały dobrze przetestowane. Inne, nieprzetestowane formaty, mogą być załadowane po wybraniu *.*.

Praca z danymi wektorowymi GRASS została opisana w rozdziale *GRASS GIS Integration*.

Bieżący rozdział poświęcony jest sposobom pracy z kilkoma popularnymi formatami: ESRI shapefile, warstwami PostGIS i SpatiaLite, danymi wektorowymi OpenStreetMap oraz danych w formacie tekstowym (CSV).

12.1.1 ESRI Shapefiles

Standardowym formatem danych wektorowych wykorzystywanym w QGIS jest ESRI shapefile. Jest on obsługiwany za pomocą biblioteki OGR Simple Feature Library (<http://www.gdal.org/ogr/>).

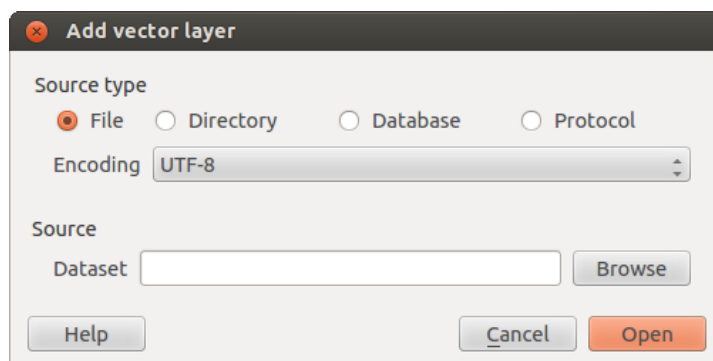
Shapefile składa się właściwie z kilku plików. Wymagane są trzy poniższe:

1. `.shp` zawierający geometrię obiektów
2. `.dbf` zawierający atrybuty w formacie dBase
3. `.shx` plik indeksu



Shapefile mogą również zawierać plik z rozszerzeniem `.prj` z informacją o układzie współrzędnych. Plik z układem jest bardzo przydatny, ale nie jest obowiązkowy. Zbiór danych Shapefile może zawierać jeszcze inne dodatkowe pliki. Więcej informacji o specyfikacji technicznej ESRI znajduje się pod adresem: <http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf>.

Ładowanie Shapefile

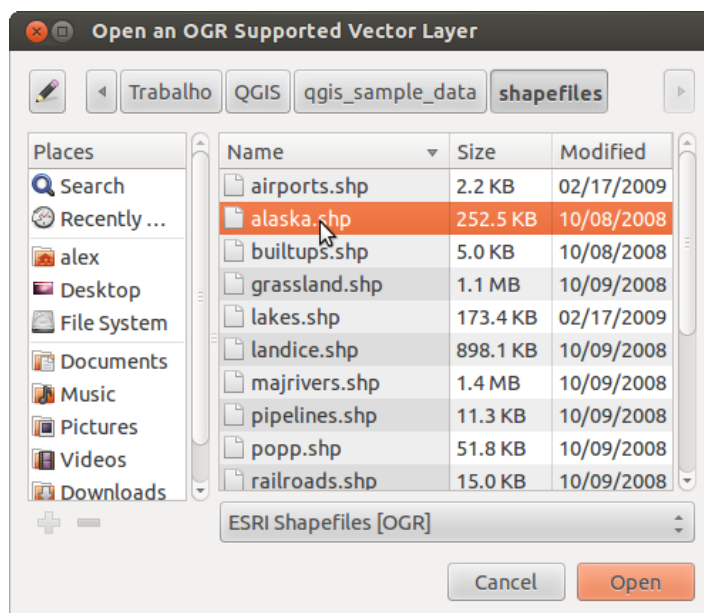
Ładowanie shapefile odbywa się za pomocą polecenia  Dodaj warstwę wektorową z paska narzędziowego lub za pomocą kombinacji klawiszy `Ctrl+Shift+V`. Spowoduje to otwarcie nowego okna (zob. [figure_vector_1](#)).




Rysunek 12.1: Okno dodawania warstwy wektorowej 

Wybierz opcję  *Plik*. Naciśnij przycisk **[Przeglądaj]**. Otworzy się standardowe okno otwierania pliku (zob. [figure_vector_2](#)), w którym można przeglądać system plików i załadować Shapefile lub dane w innym obsługiwanej formacie. Pasek wyboru *Filtr*  umożliwia wyświetlanie plików o określonym formacie, obsługiwanych przez OGR.

Jeśli zachodzi taka potrzeba, można również wybrać typ kodowania dla otwieranego shapefile.

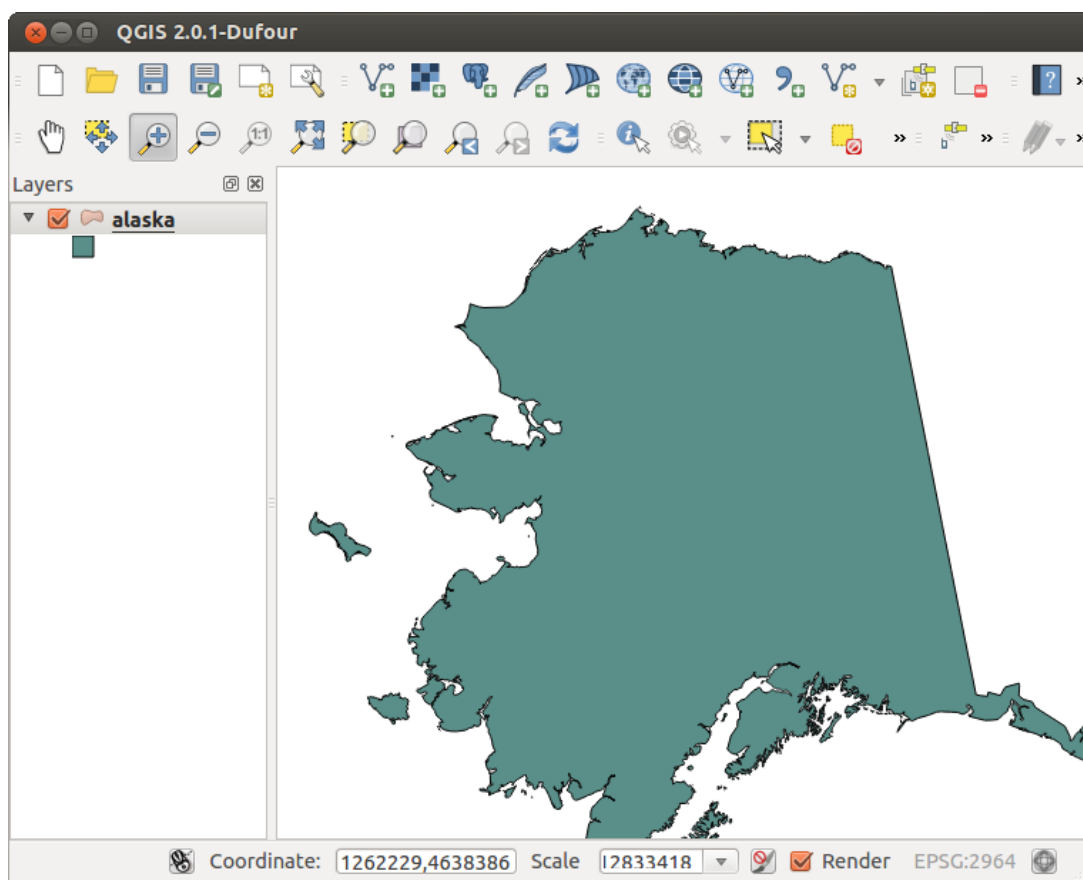


Rysunek 12.2: Okno otwierania warstwy wektorowej obsługiwanej przez OGR 

Zaznaczenie któregoś Shapefile z listy i naciśnięcie **[Otwórz]** załaduje go do QGIS. Obrazek [Figure_vector_3](#) pokazuje jak wygląda QGIS po załadowaniu pliku `alaska.shp`.

Wskazówka: Kolory warstwy

Gdy ładujesz warstwę do mapy, zostaje jej przypisany losowy kolor. Jeśli ładujesz naraz wiele warstw, wówczas każdej z nich przypisany zostaje inny kolor.



Rysunek 12.3: QGIS załadowanym plikiem Shapefile z Alaską 🐧

Po załadowaniu shapefile możesz go przeglądać w dowolnym powiększeniu korzystając z narzędzi nawigacji mapy. Jeśli chcesz zmienić styl wyświetlania warstwy, otwórz okno *Właściwości warstwy* dwukrotnie klikając lub klikając prawym przyciskiem myszy na nazwie warstwy w legendzie i wybierając z menu kontekstowego polecenie *Properties*. Zobacz rozdział *Style Menu* poświęcony nadawaniu stylu warstwom.


Wskazówka: Ładowanie warstwy i projektu z zewnętrznego źródła danych w OS X

W OS X zewnętrzne nośniki danych montowane poza głównym dyskiem nie są widoczne w menu *Plik* → *Otwórz projekt*, chociaż tego właśnie byśmy oczekiwali. Pracujemy nad stworzeniem okna otwierania/zapisywania plików o naturze bliższej OS X, co powinno rozwiązać ten problem. Można obejść ten problem wpisując `/Volumes` w polu nazwy pliku i naciskając `Enter`. Możesz potem przeglądać dyski zewnętrzne i sieciowe.

Zwiększanie wydajności pracy z Shapefile

Można polepszyć wydajność wyświetlania Shapefile poprzez utworzenie przestrzennego indeksu. Indeks ten poprawi szybkość powiększania i przeciągania widoku. Indeksy przestrzenne, z których korzysta QGIS mają rozszerzenie `.qix`.

Indeks przestrzenny tworzy się w następujący sposób:




- Załaduj shapefile klikając ikonkę paska narzędziowego  Dodaj warstwę wektorową lub naciskając klawisze `Ctrl+Shift+V`.
- Otwórz okno *Właściwości warstwy* dwukrotnie klikając na nazwie Shapefile lub klikając prawym przyciskiem myszy i wybierając z menu podręcznego *Właściwości*.
- W zakładce *Ogólne* kliknij przycisk [**Twórz indeks przestrzenny**].

Problemy z ładowaniem pliku `.prj` z Shapefile




Gdy QGIS w czasie ładowania shapefile nie jest w stanie określić układu współrzędnych na podstawie pliku `.prj`, będziesz musiał samodzielnie określić układ w zakładce *Ogólne* okna *Właściwości warstwy* klikając przycisk [**Podaj...**]. Problem ten wynika z tego, że pliki `.prj` często nie zawierają kompletnej informacji o układzie współrzędnych w rozumieniu QGIS, jak to widać w zakładce *Układ współrzędnych*.

Z tego względu, gdy tworzysz nowy Shapefile w QGIS, tworzone są dwa różne pliki z układem współrzędnych. Plik `.prj` z ograniczoną ilością parametrów, kompatybilny z oprogramowaniem ESRI, oraz plik `.qpj`, zawierający komplet parametrów układu współrzędnych. Gdy QGIS napotka na plik `.qpj`, użyj go zamiast pliku `.prj`.

12.1.2 Ładowanie warstwy MapInfo

 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 Ładowanie ArcInfo Binary Coverage

 Aby załadować ArcInfo Binary Coverage, naciśnij przycisk  Dodaj warstwę wektorową z paska narzędzi lub naciśnij kombinację klawiszy `Ctrl+Shift+V`. Otworzy się okno *Dodaj warstwę wektorową*. Wybierz pole radio *Katalog* w polu: `guiabel:Typ źródła danych`. Zmień filtr typów na *Pliki typu*  na 'Arc/Info Binary Coverage'. Przejdź do katalogu, który zawiera plik coverage i wybierz go.

W podobny sposób można załadować warstwy zapisane w strukturze katalogu w formacie UK National Transfer Format oraz TIGER opracowany w US Census Bureau.

12.1.4 Pliki tekstowe z danymi rozdzielanymi separatorami

Dane rozdzielane tabulatorem są bardzo popularnym i chętnie używanym formatem ze względu na jego prostotę i możliwości odczytu – dane mogą być przeglądane i edytowane nawet w prostym edytorze tekstu. Tekst rozdzielany separatorami może stanowić tabelę atrybutów, której kolumny rozdzielone są pewnym umownym znakiem, a wiersze rozdziela znak złamania wiersza. Pierwszy wiersz zawiera zwykle nazwy kolumn. Popularnym typem tekstu rozdzielanego separatorem jest CSV (Comma Separated Values), w którym kolumny rozdzielone są przecinkiem.

Takie pliki danych mogą również zawierać informację przestrzenną w postaci:

- współrzędnych punktów w oddzielnych kolumnach
- jako geometria w postaci WKT (well-known text)

QGIS umożliwia załadowanie tekstu rozdzielanego separatorami jak warstwy lub zwykłej tabeli. Najpierw jednak upewnij się, że plik spełnia poniższe warunki:

1. Plik musi posiadać nagłówek z nazwami pól rozdzielonymi separatorem. Musi to być pierwsza linia pliku tekstowego.
2. Wiersz nagłówkowy musi zawierać pole lub pola definiujące geometrię. Pola te mogą mieć dowolną nazwę.
3. Współrzędne X i Y (jeśli geometria opisana jest współrzędnymi) muszą być podane jako liczby. Układ współrzędnych nie ma znaczenia.


Jako przykład poprawnego pliku importujemy punktowe dane wysokościowe z pliku `elevp.csv` zawartego w przykładowym zestawie danych QGIS (zob. rozdział *Przykładowe dane*):

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

Uwagi dotyczące pliku tekstowego:

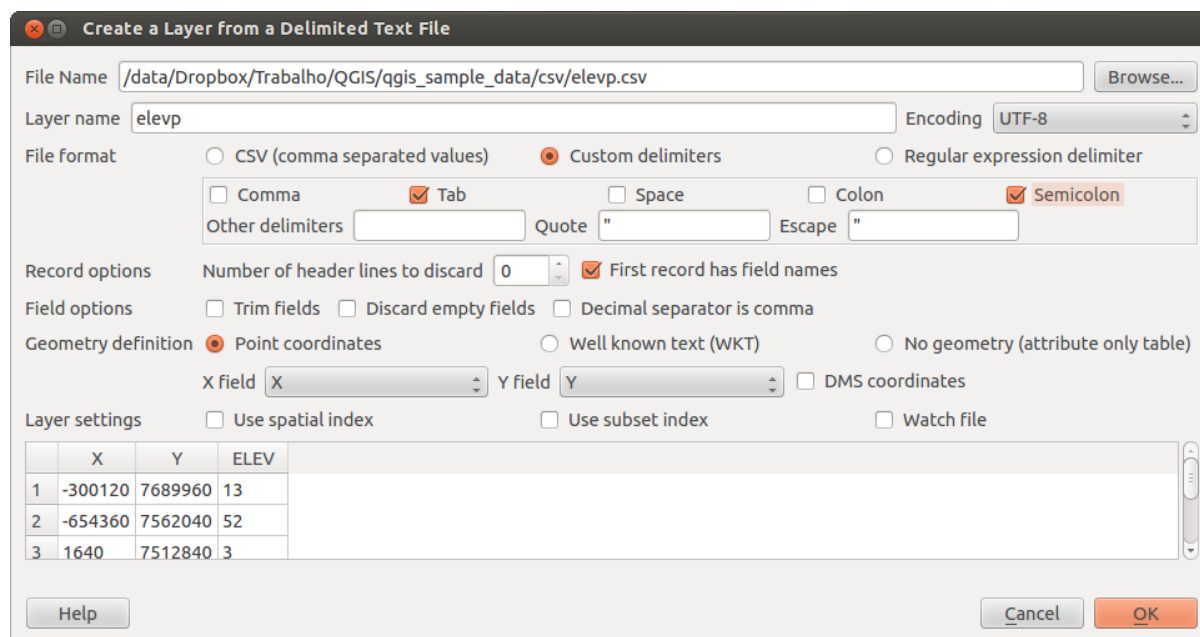
1. W przykładowym pliku znakiem rozdzielającym jest ; (średnik). Można użyć dowolnego innego znaku do rozdzielenia pól.
2. Pierwszy wiersz to nagłówki. Zawiera on pola X, Y oraz ELEV.
3. Nie używa się cudzysłowu (") dla pól typu tekstowego.
4. Współrzędne x podane są w polu X.
5. Współrzędne y zawarte są w polu Y.

Ładowanie pliku tekstowego z separatorami

W celu otwarcia okna dialogowego *Utwórz warstwę na podstawie pliku rozdzielanego separatorem*, pokazanego na rysunku `figure_delimited_text_1`, kliknij ikonkę  Dodaj warstwę tekstową CSV na pasku narzędziowym *Zarządzaj warstwami*.

Najpierw zaznacz plik do importu (np. `qgis_sample_data/csv/elevp.csv`) klikając na przycisk **[Przełóżaj]**. Po wybraniu pliku QGIS próbuje go sparsować używając ostatnio wykorzystanego separatora, w tym przypadku średnika (;). Aby umożliwić QGIS właściwe sparsowanie pliku, istotne jest, aby dobrać prawidłowy separator. Możesz go dobrać włączając *Rozdzielone innym znakiem* lub *Wyrażenie regularne* i wpisując odpowiedni tekst w pole *Wyrażenie*. Na przykład w celu zmiany separatora na tabulację, wpisz `\t` (jest to wyrażenie regularne dla znaku tabulacji).

Gdy ładowany plik zostanie sparsowany, określ *Geometrię* jako *Współrzędne punktowe* i wybierz atrybuty X i Y z list rozwijalnych. Jeśli współrzędne podane są w stopniach/minutach/sekundach, zaznacz pole wyboru *Współrzędne SMS*.



Rysunek 12.4: Okno dialogowe pliku tekstowego z separatorem 🐧

Na koniec podaj nazwę dla tworzonej warstwy (np. `elevp`) jak pokazano na rys. [figure_delimited_text_1](#). Aby dodać warstwę do mapy kliknij **[OK]**. Od tej chwili plik z danymi rozdzielanymi separatorem można traktować jak normalną warstwę QGIS.

Istnieje również możliwość obcinania spacji poprzedzających i następujących po tekście poprzez zaznaczenie pola wyboru *Usuń spacje przed/po*. W każdym rekordzie można też *Pomiąć puste kolumny*. Można też, jeśli zachodzi taka konieczność, określić *Przecinek jako separator dziesiętny*.

Jeśli informacja przestrzenna ma postać WKT, zaznacz pole *WKT (well known text)* i wybierz pole, zawierające definicję WKT obiektów punktowych, liniowych lub poligonowych. Jeśli plik nie zawiera informacji przestrzennych, zaznacz pole *bez geometrii (tylko tabela atrybutów)*, co spowoduje załadowanie pliku jako zwykłej tabeli.

Możesz też dodatkowo włączyć:



- *Indeks przestrzenny* aby poprawić wydajność wyświetlania i zapytań przestrzennych
- *Indeks filtrowania*.
- *:guilabel:Śledź plik* w celu obserwowania zmian w pliku dokonanych przez inne aplikacje, podczas gdy QGIS jest uruchomiony.

12.1.5 Dane OpenStreetMap

W ostatnich latach projekt OpenStreetMap zyskał popularność ponieważ w wielu krajach nie są dostępne dane przestrzenne dotyczące dróg. Celem projektu OSM jest stworzenie wolnej edytowalnej mapy świata sporządzonej na podstawie danych GPS, zdjęć lotniczych i wiadomościach lokalnych. QGIS obsługuje dane OSM, aby wspierać realizację tego celu.

Ładowanie warstw wektorowych OpenStreetMap





Import danych OpenStreetMap jest jednym z podstawowych narzędzi QGIS.

- Aby połączyć się z serwerem OSM i ściągnąć dane otwórz menu *Wektor* → *Openstreetmap* → *Pobierz dane*. Możesz pominąć ten krok, jeśli już ściągnąłeś plik XML .osm za pośrednictwem JOSM, Overpass API lub z innego źródła.
- Polecenie *Wektor* → *OpenStreetMap* → *Wczytaj topologię z XML...* przetworzy plik .osm do bazy Spatialite i utworzy stosowne połączenie z tą bazą.
- Polecenie *Wektor* → *OpenStreetMap* → *Eksportuj topologię do Spatialite...* umożliwi otwarcie połączenia z bazą, wybór typu danych (punkty, linie lub poligony) oraz tagów do importu. Spowoduje to utworzenie warstwy Spatialite, którą można załadować poleceniem  *Dodaj warstwę Spatialite* z paska narzędzi lub  *Dodaj warstwę Spatialite...* z menu *Warstwa* (zob. rozdz. *Warstwy Spatialite*).

12.1.6 Warstwy PostGIS

Warstwy PostGIS umieszczone są w bazie danych PostgreSQL. Plusem korzystania z PostGIS są oferowane przez niego możliwości przestrzennego indeksowania warstw, filtrowania i tworzenia zapytań. Użycie PostGIS sprawia, że mechanizmy zaznaczania i uzyskiwania informacji o obiektach warstw wektorowych działają w QGIS lepiej niż z warstwami OGR.







Tworzenie połączenia z bazą danych

 Zanim skorzystasz z danych PostGIS, musisz utworzyć połączenie z bazą danych, w której zapisane są te dane. Można zacząć od kliknięcia przycisku na pasku narzędziowym  *Dodaj warstwę PostGIS*, od polecenia  *Dodaj warstwę PostGIS...* z menu *Warstwa* lub wciśnięcia kombinacji klawiszy `Ctrl+Shift+D`. Można też skorzystać z polecenia *Dodaj warstwę wektorową* i w oknie zmienić typ źródła danych na  *Baza danych*. Przycisk **[Nowe]** uruchamia menedżera połączeń w oknie *Utwórz nowe połączenie PostGIS*. Wymagane do połączenia parametry to:

- **Nazwa:** nazwa połączenia. Może być taka sama jak *Baza danych*
- **Usługa:** parametr usługi, który może być używany zamiennie z host/port (i potencjalnie również z bazą danych). Można to zdefiniować w `pg_service.conf`.
- **Host:** nazwa hosta, na którym znajduje się baza danych. Musi to być rozpoznawalna nazwa hosta, taka sama, jaka mogłaby zostać użyta do otwarcia połączenia telnet lub pingowania hosta. Jeśli baza znajduje się na tym samym komputerze, co QGIS, wpisz po prostu `'localhost'`.
- **Port:** numer portu, na którym nasłuchuje serwer bazy danych PostgreSQL. Domyślnym portem jest 5432.
- **Baza danych:** nazwa bazy danych.
- **Tryb SSL:** określa, jak będzie nawiązywane połączenie SSL z serwerem. Zauważ, że można uzyskać znaczne przyspieszenie wyświetlania warstw PostGIS, gdy wyłączysz SSL. Możliwe są tutaj następujące opcje:
 - Wyłącz: nawiązane będzie połączenie nieszyfrowane.
 - Zezwól: spróbuj nawiązać połączenie bez SSL, a gdy będzie to niemożliwe, spróbuj nawiązać połączenie SSL.
 - Preferuj (domyślne): spróbuj nawiązać połączenie SSL, a gdy jest to niemożliwe, spróbuj nawiązać połączenie bez SSL.
 - Wymagaj: próbuj nawiązać jedynie połączenie SSL.
- **Użytkownik:** nazwa użytkownika logującego się do bazy danych.
- **Hasło:** hasło *Użytkownika* logującego się do bazy danych.

Można też zaznaczyć następujące pola wyboru:



-  *Zapisz nazwę użytkownika*

-  *Zapisz hasło*
-  *Wyświetlaj tylko zarejestrowane warstwy*
-  *Nie sprawdzaj typu dla kolumn GEOMETRY*
-  *Sprawdź tylko schemat 'public'*
-  *Pokaż także tabele bez geometrii*
-  *Użyj szacunkowych metadanych tabeli*


Po podaniu parametrów i opcji połączenia można przetestować połączenie klikając na przycisk **[Test połączenia]**.

Wskazówka: Ustawienia użytkownika QGIS a bezpieczeństwo




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:

-  Ustawienia przechowywane są w twoim katalogu domowym w `~/.qgis2`.
-  Ustawienia przechowywane są w rejestrze.

Ładowanie warstwy PostGIS

 Po zdefiniowaniu połączenia możesz ładować dane z bazy PostgreSQL. Oczywiście wymaga to posiadania danych w PostgreSQL. Zobacz rozdział *Importowane danych do PostgreSQL* poświęcony importowi danych do bazy.

W celu załadowania warstwy PostGIS wykonaj następujące czynności:

- Jeśli okno *Dodaj tabele PostGIS* jeszcze otwarte, użyj polecenia  *Dodaj warstwę PostGIS...* z menu *Warstwa* lub skorzystaj ze skrótu klawiaturowego `Ctrl+Shift+D` aby je otworzyć.
- Wybierz połączenie z bazą z listy rozijalnej i naciśnij **[Połącz]**.
- Wybierz lub odznacz  *Pokaż także tabele bez geometrii*.
- Możesz również skorzystać z  *Opcji wyszukiwania* aby określić, które obiekty z zaznaczonej warstwy załadować lub wykorzystać przycisk **[Ustaw filtr]**, żeby otworzyć okno *kreatora zapytań*.
- Na liście dostępnych warstw szukaj warstwę(y), które chcesz dodać.
- Zaznacz ją poprzez kliknięcie. Można zaznaczać więcej warstw przytrzymując w czasie klikania klawisz `Shift`. Zobacz *Query Builder*, gdzie opisano wykorzystanie kreatora zapytań PostgreSQL do jeszcze dokładniejszego określania warstw.
- Naciśnij przycisk **[Dodaj]** aby dodać warstwę do mapy.

Wskazówka: Warstwy PostGIS

Zwykle warstwa PostGIS zdefiniowana jest przez wpis w tabeli `geometry_columns`. Począwszy od wersji 0.9 QGIS może ładować warstwy, które nie mają wpisu w tabeli `geometry_columns`. Dotyczy to zarówno tabel jak i widoków. Definiowanie widoków daje potężne możliwości wizualizacji danych. Informacje o tworzeniu widoków znajdziesz w podręczniku PostgreSQL.

Kilka szczegółów o warstwach PostgreSQL

Ten rozdział zawiera kilka szczegółów o dostępie QGIS do warstw PostgreSQL. W większości przypadków QGIS powinien zwyczajnie pokazać listę tabel bazy danych, które mogą być załadowane i, jeśli sobie tego życzysz, załadować je. Jeśli jednak okaże się, że masz kłopot z załadowaniem tabeli PostgreSQL do QGIS, to poniższe informacje mogą okazać się pomocne w zrozumieniu komunikatów QGIS i zawiera wskazówki, jak zmodyfikować tę tabelę lub zdefiniować widok, aby QGIS mógł ją załadować.

QGIS wymaga, aby warstwy PostgreSQL zawierały kolumnę, która może być jej unikatowym kluczem. W przypadku tabel oznacza to, że tabela musi posiadać klucz główny lub kolumnę z wymogiem niepowtarzalności. Kolumna ta musi mieć w QGIS typ `int4` (4-bajtowa liczba całkowita). Można też użyć kolumny `ctid` jako klucza głównego. Jeśli kolumna ich nie posiada, wówczas używana jest do tego kolumna `oid`. Wydajność będzie większa, jeśli kolumna ta jest zindeksowana (zauważ, że klucze główne są w PostgreSQL indeksowane automatycznie).


Jeśli warstwa PostgreSQL jest widokiem, obowiązują te same wymagania, ale widoki nie posiadają kluczy głównych czy kolumn z ograniczeniem niepowtarzalności. Musisz zdefiniować klucz główny (musi to być typu `integer`) w oknie QGIS zanim będziesz mógł załadować widok. Jeśli widok nie posiada odpowiedniej kolumny, QGIS go nie załaduje. Sposobem na rozwiązanie może być wówczas przededefiniowanie widoku tak, aby zawierał odpowiednią kolumnę (typu `integer`, z ograniczeniem niepowtarzalności, najlepiej zindeksowaną).

W QGIS istnieje opcja **Wybierz poprzez id**, która domyślnie jest aktywna. Oznacza to, że pobierane jest jedynie pole `id`, co zwykle pozwala przyspieszyć pracę. W przypadku podłączania widoków, które długo się generują, warto rozważyć odznaczenie tej opcji.

12.1.7 Importowane danych do PostgreSQL

Import danych do bazy PostgreSQL/PostGIS może się odbyć przy pomocy kilku narzędzi, takich jak wtyczka SPIT lub narzędzia linii poleceń `shp2pgsql` i `ogr2ogr`.

Zarządzanie bazami

QGIS posiada wbudowaną wtyczkę  **DB Menadżer**. Można jej użyć do załadowania do bazy plików `shp` i danych w innych formatach. Narzędzie to obsługuje schematy bazy. Więcej informacji znajduje się w rozdziale *DB Manager Plugin*.

shp2pgsql

PostGIS zawiera narzędziezwane **shp2pgsql**, które może być wykorzystane do importu shapefile do bazy PostGIS. Na przykład, aby zaimportować shapefile o nazwie `lakes.shp` do bazy PostgreSQL o nazwie `gis_data`, skorzystaj z następującego polecenia:

```
shp2pgsql -s 2964 lakes.shp lakes_new | psql gis_data
```

Spowoduje to utworzenie nowej warstwy o nazwie `lakes_new` w bazie danych `gis_data`. Warstwa będzie miała nadany układ współrzędnych o identyfikatorze (SRID) 2964. Więcej informacji o układach odniesienia i odwzorowaniach znajdziesz w rozdziale *Praca z układami współrzędnych*.

Wskazówka: Eksportowanie zbiorów danych z PostGIS

Podobnie do narzędzia importu **shp2pgsql** istnieje również narzędzie do eksportowania zbiorów danych z PostGIS jako shapefile: **pgsql2shp**. Jest ono dołączone do twojej dystrybucji PostGIS.


ogr2ogr

Oprócz **shp2pgsql** i **DB Menadżera** jest jeszcze jedno narzędzie, które może posłużyć do wsadzania danych do bazy PostGIS: **ogr2ogr**. Jest ono częścią instalacji GDAL.


Importowanie shapefile do PostGIS odbywa się w następujący sposób:

```
ogr2ogr -f "PostgreSQL" PG:"dbname=postgis host=myhost.de user=postgres
password=topsecret" alaska.shp
```

Spowoduje to wgranie shapefile `alaska.shp` do bazy danych PostGIS `postgis` przy użyciu użytkownika `postgres` z hasłem `topsecret` na hoście `myhost.de`.

Zwróć uwagę, że OGR musi być skompilowany z PostgreSQL, aby obsługiwać PostGIS. Można to sprawdzić wpisując (w )

```
ogrinfo --formats | grep -i post
```

Jeśli chciałbyś wykorzystać polecenie PostgreSQL **COPY** zamiast domyślnej metody **INSERT INTO** możesz określić następującą zmienną środowiskową (przynajmniej na  i **X**):

```
export PG_USE_COPY=YES
```

ogr2ogr nie tworzy indeksów przestrzennych, tak jak **shp2pgsql**. Musisz utworzyć go ręcznie osobnym poleceniem SQLa **CREATE INDEX** (opis znajdziesz w następnym rozdziale *Zwiększanie wydajności*).

Zwiększanie wydajności

Wczytywanie obiektów z bazy danych PostgreSQL może zajmować dużo czasu, zwłaszcza po sieci. Można poprawić wydajność wyświetlania warstw PostgreSQL sprawdzając, czy każda z warstw w bazie posiada indeks przestrzenny PostGIS. PostGIS pozwala na tworzenie indeksów GiST (Generalized Search Tree) w celu przyspieszenia przestrzennego wyszukiwania danych (informacje o indeksie GIST zaczerpnięte są z dokumentacji PostGIS dostępnej pod adresem <http://postgis.refractions.net>).

Składnia tworzenia indeksu GIST jest następująca:

```
CREATE INDEX [indexname] ON [tablename]
  USING GIST ( [geometryfield] GIST_GEOMETRY_OPS );
```

Zwróć uwagę, że dla większych tabel tworzenie indeksu może trwać długo. Po utworzeniu indeksu należy przeprowadzić `VACUUM ANALYZE`. Więcej informacji znajdziesz w dokumentacji PostGIS (POSTGIS-PROJECT *Literature and Web References*).

Poniżej znajduje się przykład tworzenia indeksu GIST:

```
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 Warstwy wektorowe przechodzące przez południk 180

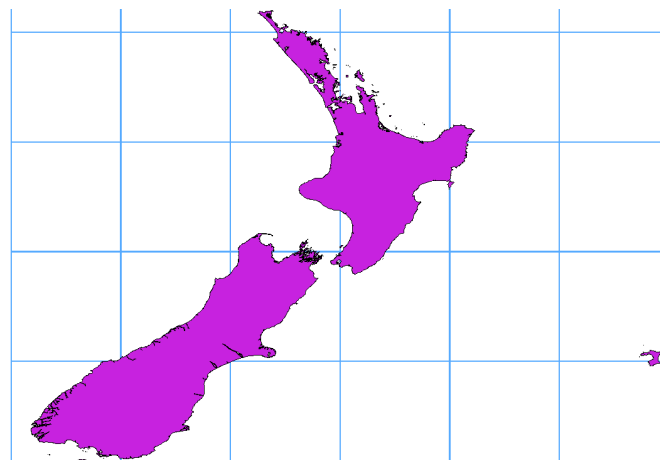
Wiele pakietów GIS nie zawija map wektorowych w geograficznym układzie odniesienia (długość/szerokość) przechodzących przez południk 180 (http://postgis.refractions.net/documentation/manual-2.0/ST_Shift_Longitude.html). W rezultacie, gdy otworzymy taką mapę w QGIS, zobaczymy dwie oddalone od

siebie lokalizacje, które powinny przecież znajdować się blisko siebie. Na rysunku [Figure_vector_4](#) mały punkt z lewej strony obszaru mapy (Wyspy Chatham) powinien znajdować się w siatce, z prawej strony Nowej Zelandii.



Rysunek 12.5: Mapa w układzie geograficznym przechodząca przez południk 180° 

Można to obejść korzystając z funkcji PostGIS o nazwie **ST_Shift_Longitude**. Czyta ona każdy punkt/wierzchołek wszystkich części każdego obiektu w geometrii warstwy i, jeśli długość geogr. < 0°, dodaje do niej 360°. W wyniku tego otrzymujemy wersję danych w przedziale 0° - 360° wycentrowaną na południku 180°.





Rysunek 12.6: Przejście przez południk 180° z zastosowaniem funkcji **ST_Shift_Longitude**

Sposób użycia

- Zaimportuj dane do PostGIS (*Importowane danych do PostgreSQL*) korzystając np. z wtyczki DB Menadżer.
- Skorzystaj z linii poleceń PostGIS i wydaj następujące polecenie (jest to przykład, w którym "TABLE" jest właściwą nazwą tabeli PostGIS): `gis_data=# update TABLE set the_geom=ST_Shift_Longitude(the_geom);`
- Jeśli wszystko pójdzie dobrze, otrzymasz potwierdzenie z liczbą obiektów, które zostały zaktualizowane i będziesz mógł załadować mapę i zobaczyć różnicę ([Figure_vector_5](#))

12.1.9 Warstwy SpatiaLite

Gdy ładujesz warstwy z bazy SpatiaLite po raz pierwszy, zacznij od kliknięcia na przycisk  Dodaj warstwę SpatiaLite z paska narzędziowego lub wybierz polecenie  Dodaj warstwę SpatiaLite... z menu Warstwa lub naciśnij skrót `Ctrl+Shift+L`. Spowoduje to otwarcie okna, w którym będzie można nawiązać połączenie z jakąś bazą zarejestrowaną już w QGIS, którą można wybrać z listy rozwijalnej lub zdefiniować nowe połączenie do nowej bazy. Nowe połączenie definiuje się za pomocą przycisku **[Nowe]** i wskazanie położenia nowej bazy SpatiaLite, która jest plikiem z rozszerzeniem `.sqlite`.

Jeśli chcesz zapisać warstwę wektorową w formacie SpatiaLite, możesz to zrobić klikając prawym przyciskiem warstwę w legendzie i wybierając polecenie *Zapisz jako...* ‘Następnie podaj nazwę pliku, jako format zapisu wybierz SpatiaLite i określ docelowy układ współrzędnych. Można również wybrać jako format zapisu ‘SQLite’, a następnie, w okienku opcji danych wpisać ‘SPATIALITE=YES’. W ten sposób OGR utworzy bazę SpatiaLite. Zobacz również http://www.gdal.org/ogr/drv_sqlite.html.

QGIS obsługuje edytowalne widoki SpatiaLite.




Tworzenie nowej warstwy SpatiaLite

Jeśli chcesz utworzyć nową warstwę SpatiaLite, zajrzyj do rozdziału *Creating a new SpatiaLite layer*.

Wskazówka: Wtyczki do zarządzania danymi SpatiaLite

Do zarządzania danymi w bazach SpatiaLite można użyć również kilku wtyczek: QSpatialite, SpatiaLite Manager lub Zarządzanie bazami (ta ostatnia jest wtyczką domyślnie instalowaną z programem i jest polecana). Można je pobrać i zainstalować za pomocą Menadżera Wtyczek.




12.1.10 Warstwy MSSQL Spatial

 QGIS posiada także wbudowaną obsługę MS SQL 2008. Zanim skorzystasz z danych MSSQL Spatial, kliknij przycisk z paska narzędziowego  Dodaj warstwę MSSQL Spatial, lub wybierz polecenie  Dodaj warstwę MSSQL Spatial... z menu *Warstwa* lub wciśnij kombinację klawiszy `Ctrl+Shift+M`.

12.1.11 Warstwy Oracle Spatial

Narzędzia przestrzenne Oracle Spatial umożliwiają użytkownikom natywną obsługę danych geograficznych w bazie Oracle. QGIS obsługuje te warstwy.






Tworzenie połączenia z bazą danych

 Zanim skorzystasz z danych Oracle Spatial, musisz utworzyć połączenie z bazą danych, w której zapisane są te dane. Można zacząć od kliknięcia przycisku na pasku narzędziowym  Dodaj warstwę Oracle Spatial, od polecenia  Dodaj warstwę Oracle Spatial... z menu *Warstwa* lub wciśnięcia kombinacji klawiszy `Ctrl+Shift+O`. Przycisk [Nowe] uruchamia menedżera połączeń w oknie *Utwórz nowe połączenie Oracle*. Wymagane do połączenia parametry to:

- **Nazwa:** nazwa połączenia. Może być taka sama jak *Baza danych*
- **Database:** SID lub SERVICE_NAME instancji Oracle.
- **Host:** nazwa hosta, na którym znajduje się baza danych. Musi to być rozpoznawalna nazwa hosta, taka sama, jaka mogłaby zostać użyta do otwarcia połączenia telnet lub pingowania hosta. Jeśli baza znajduje się na tym samym komputerze, co QGIS, wpisz po prostu *localhost*.
- **Port:** numer portu, na którym nasłuchuje serwer bazy danych Oracle. Domyślnym portem jest 1521.
- **Użytkownik:** nazwa użytkownika logującego się do bazy danych.
- **Hasło:** hasło *Użytkownika* logującego się do bazy danych.

Można też zaznaczyć następujące pola wyboru:



- *Zapisz użytkownika* Wskazuje, czy w danych konfiguracyjnych połączenia zapisać również nazwę użytkownika.
- *Zapisz hasło* Wskazuje, czy w konfiguracji połączenia zapisać hasło użytkownika bazy.

-  *Przeszukaj tylko meta data table* Ogranicza wyświetlane tabele tylko do zapisanych w widoku all_sdo_geom_metadata. Może to znacząco przyspieszyć pierwsze wyświetlenie tabel przestrzennych.
-  *Szukaj tylko tabel użytkownika* Ogranicz poszukiwanie tabel przestrzennych do będących własnością użytkownika.
-  *Pokaż także tabele bez geometrii.* Wskazuje, czy wyszczególnione mają zostać również tabele bez geometrii.
-  *Użyj szacunkowych metadanych tabeli* Oracle przechowuje liczne metadane o tabelach, takie jak liczba rekordów, typ geometrii, zasięg przestrzenny danych geometrycznych. Jeśli tabela ma wiele rekordów, uzyskanie tych informacji może być czasochłonne. Włączenie tych opcji spowoduje przyspieszenie tych operacji poprzez: oszacowanie liczby rekordów z all_tables.num_rows. Zasięg tabeli będzie zawsze określany funkcją SDO_TUNE.EXTENTS_OF, nawet jeśli użyto filtra warstwy. Tabela geometrii jest określana z pierwszych 100 niepustych (NOT NULL) rekordów geometrii.
-  *Tylko istniejące typy geometrii.* Wyszczególniaj tylko istniejące typy geometrii i nie oferuj dodawania nowych.


Po podaniu parametrów i opcji połączenia można przetestować połączenie klikając na przycisk [**Test połączenia**].

Wskazówka: Ustawienia użytkownika QGIS a bezpieczeństwo




W zależności od tego, w jakim środowisku pracujesz, przechowywanie haseł w twoich ustawieniach QGIS może narazić twoje bezpieczeństwo. Hasła zapisywane są otwartym tekstem w ustawieniach systemowych i plikach projektu! Twoje ustawienia QGIS są, w zależności od systemu operacyjnego, przechowywane w:

-  The settings are stored in your home directory in `.config/QGIS/QGIS2.conf`.
 -  Ustawienia przechowywane są w rejestrze.
-

Ładowanie warstwy Oracle Spatial

 Po zdefiniowaniu połączenia możesz ładować dane z bazy Oracle. Oczywiście wymaga to posiadania danych w Oracle.

W celu załadowania warstwy z Oracle Spatial wykonaj następujące kroki/l

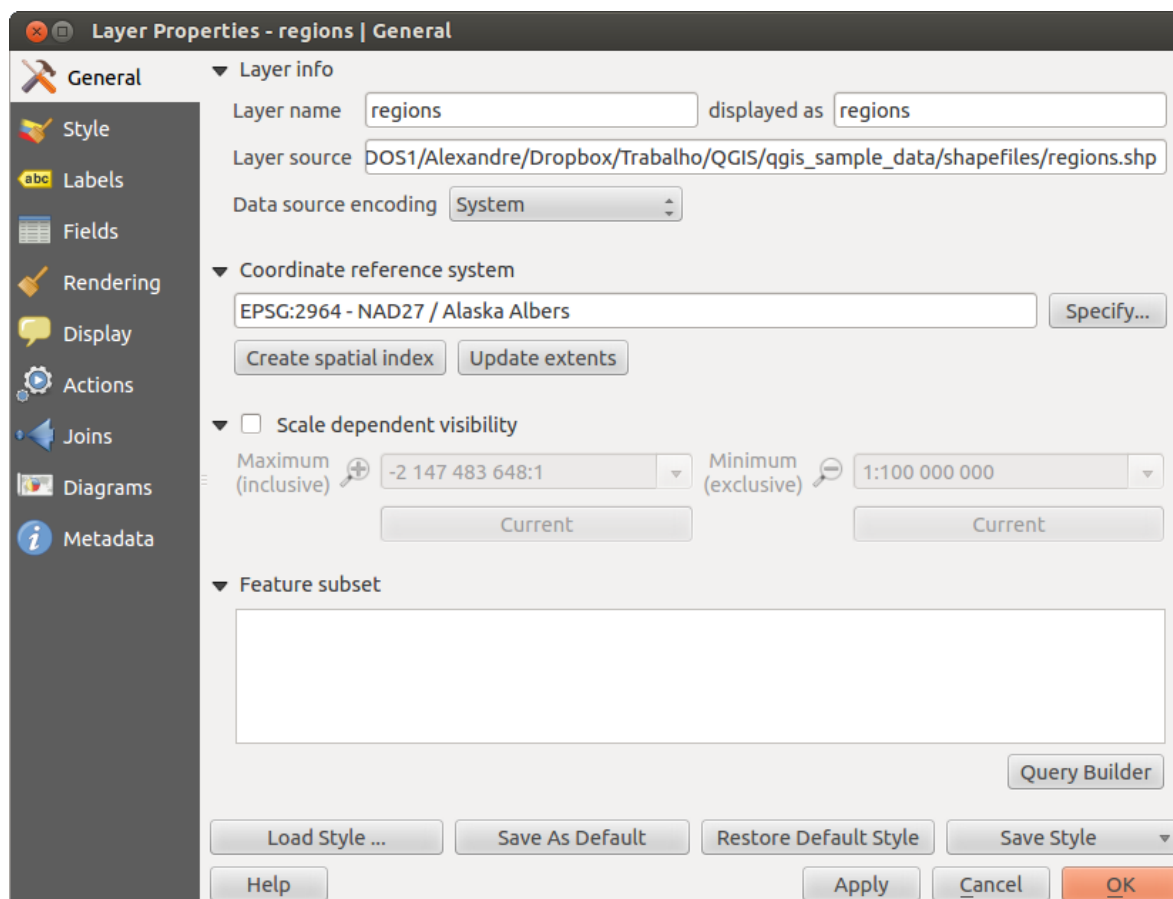
- Jeśli okno *Dodaj tabele Oracle* nie jest otwarte, kliknij  Dodaj warstwę Oracle Spatial z paska narzędzi.
- Wybierz połączenie z bazą z listy rozijalnej i naciśnij [**Połącz**].
- Wybierz lub odznacz  *Pokaż także tabele bez geometrii.*
- Możesz również skorzystać z  *Opcji wyszukiwania* aby określić, które obiekty z zaznaczonej warstwy załadować lub wykorzystać przycisk [**Ustaw filtr**], żeby otworzyć okno *kreatora zapytań*.
- Na liście dostępnych warstw zyskaj warstwę(y), które chcesz dodać.
- Zaznacz ją poprzez kliknięcie. Można zaznaczać więcej warstw przytrzymując w czasie klikania klawisz Shift. Zobacz *Query Builder*, gdzie opisano wykorzystanie kreatora zapytań Oracle do jeszcze dokładniejszego określania warstw.
- Naciśnij przycisk [**Dodaj**] aby dodać warstwę do mapy.

Wskazówka: Warstwy Oracle Spatial

Zwykle warstwa Oracle Spatial zdefiniowana jest poprzez wpis w tabeli **USER_SDO_METADATA**.

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.




Rysunek 12.7: Vector Layer Properties Dialog 

12.2.1 Style Menu

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

Layer rendering

- *Layer transparency* : You can make the underlying layer in the map canvas visible with this tool. Use the slider to adapt the visibility of your vector layer to your needs. You can also make a precise definition of the percentage of visibility in the the menu beside the slider.
- *Layer blending mode* and *Feature blending mode*: You can achieve special rendering effects with these tools that you may previously only know from graphics programs. The pixels of your overlaying and underlying 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.

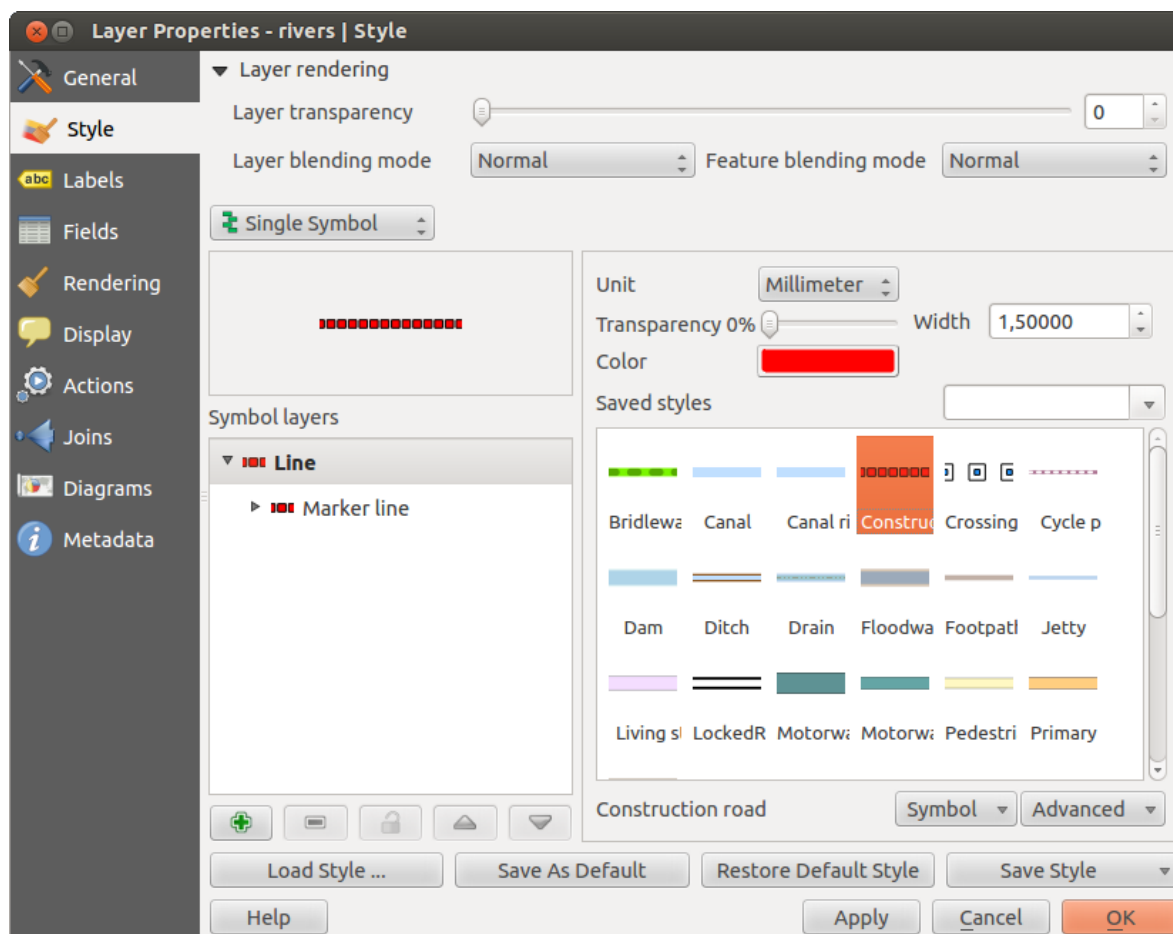
Wskazówka: Select and change multiple symbols

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.



Rysunek 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

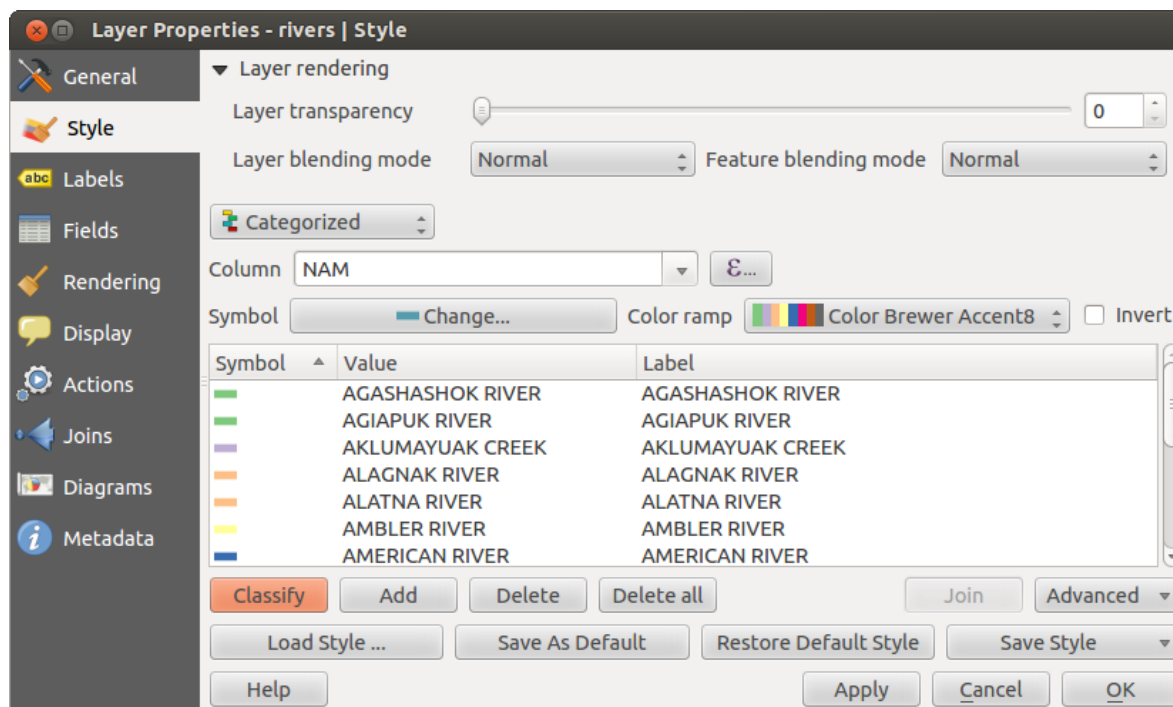
The Categorized Renderer is used to render all features from a layer, using a single user-defined symbol whose color reflects the value of a selected feature's attribute. The *Style* menu allows you to select:

- The attribute (using the Column listbox or the \mathcal{E} ... *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.



Rysunek 12.9: Categorized Symbolizing options

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

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

Graduated Renderer

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

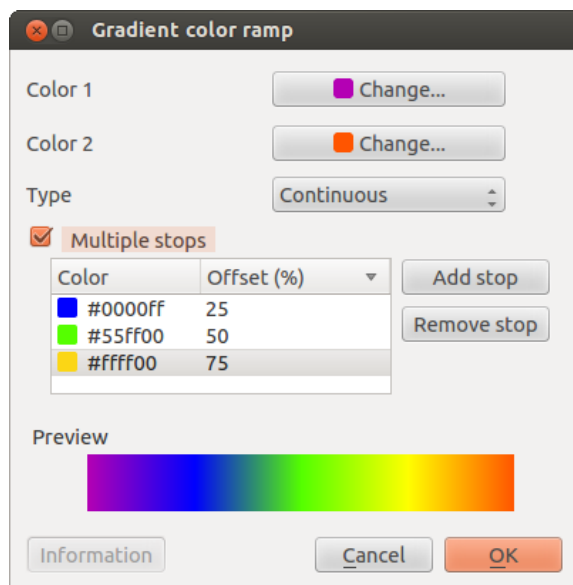
Like the Categorized Renderer, the Graduated Renderer allows you to define rotation and size scale from specified columns.

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

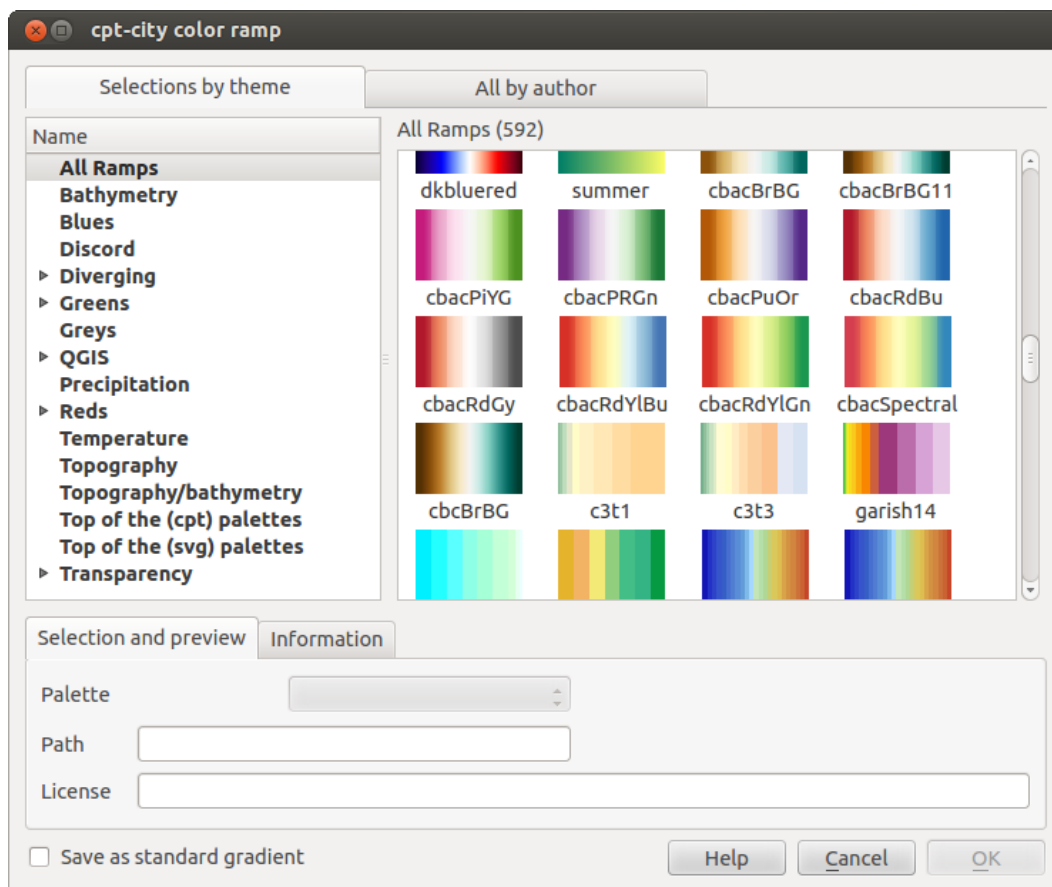
- The attribute (using the Column listbox or the ϵ ... *Set column expression* function)
- The symbol (using the Symbol Properties button)
- The colors (using the Color Ramp list)

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

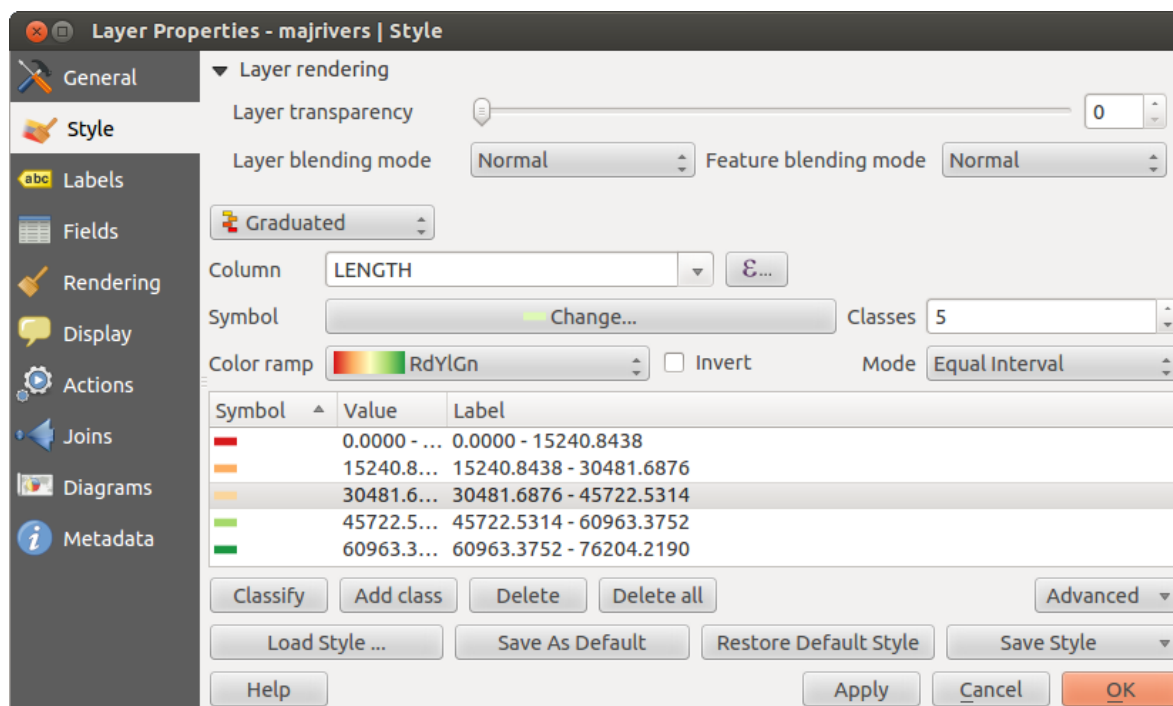
- Equal Interval
- Quantile



Rysunek 12.10: Example of custom gradient color ramp with multiple stops 🐧



Rysunek 12.11: cpt-city dialog with hundreds of color ramps 🐧




Rysunek 12.12: Graduated Symbolizing options 

- 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.


Wskazówka: 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.

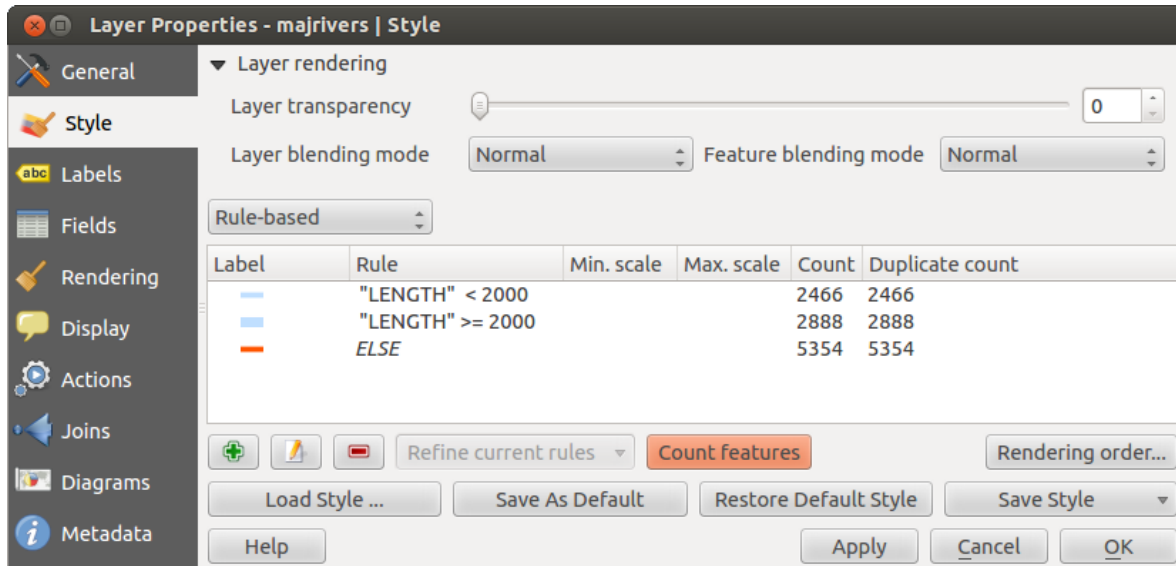
Rule-based rendering


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.



Rysunek 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.

Wskazówka: Export vector symbology


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

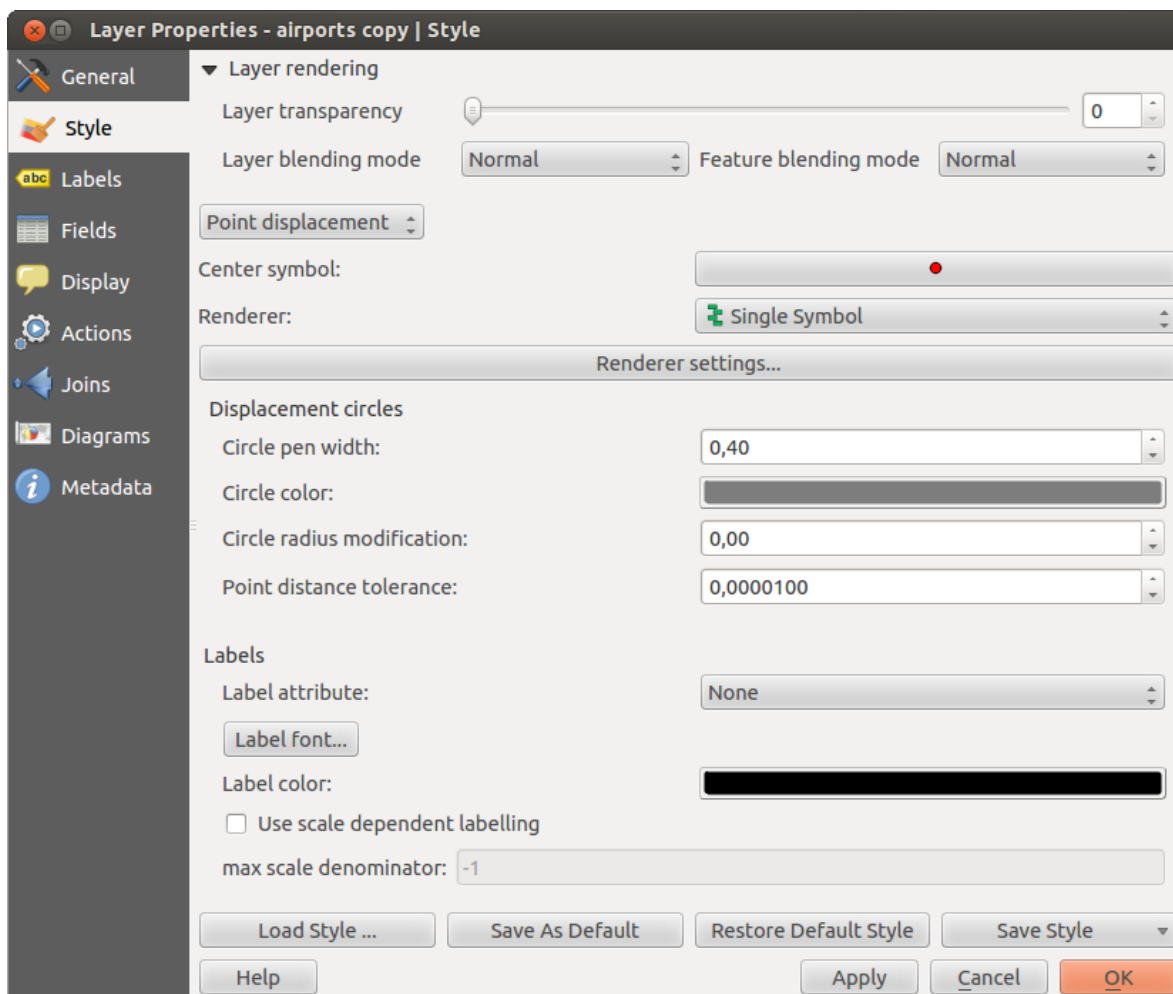
12.2.2 Labels Menu


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


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

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

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



Rysunek 12.14: Point displacement dialog 

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](#).

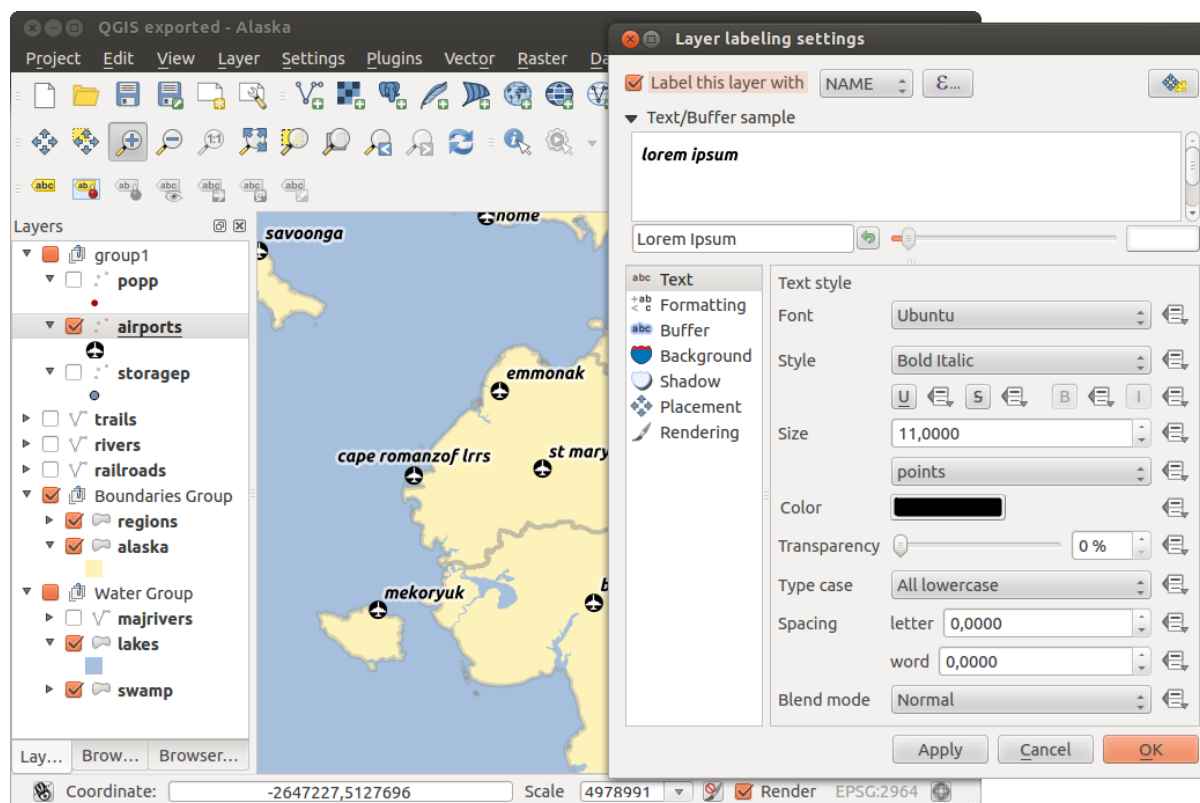
After that, you can define the text style in the *Text* menu. Here, you can use the same settings as for point layers.

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](#).



Rysunek 12.15: Smart labeling of vector 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 **E...** if you want to define labels based on expressions - See [labeling_with_expressions](#).

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

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

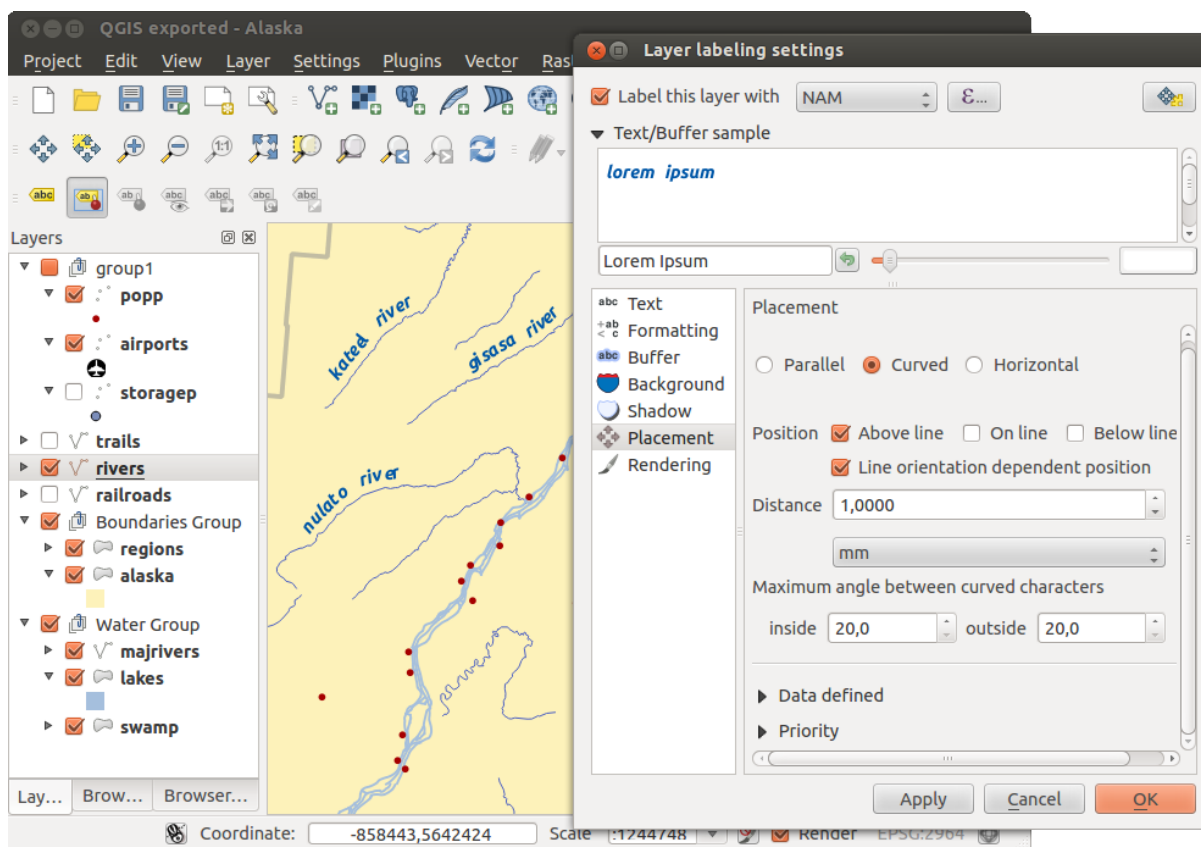
As with point and line layers, you can create a text buffer in the *Buffer* menu.

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

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

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



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



Rysunek 12.16: Smart labeling of vector line layers 

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:

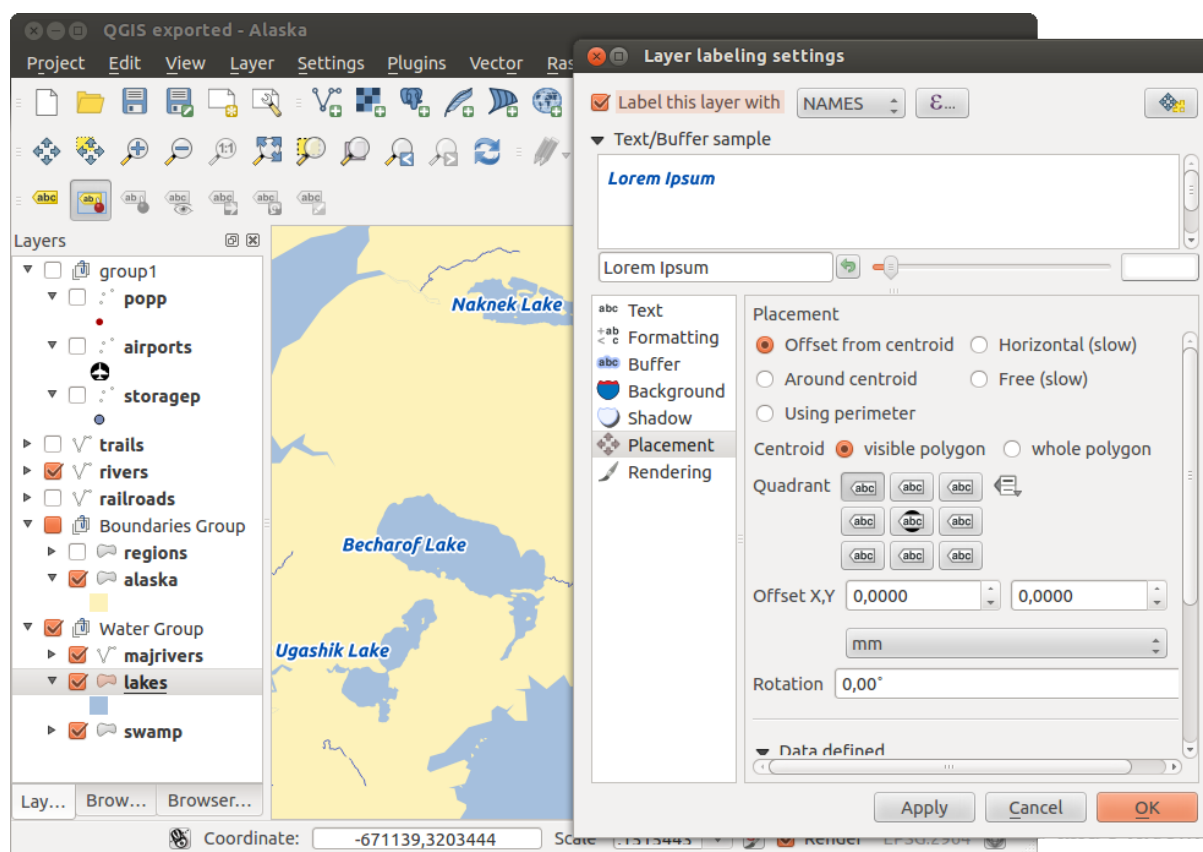
```
# label based on two fields 'name' and 'place' with a
"name" || ', ' || "place"
```

-> John Smith, Paris

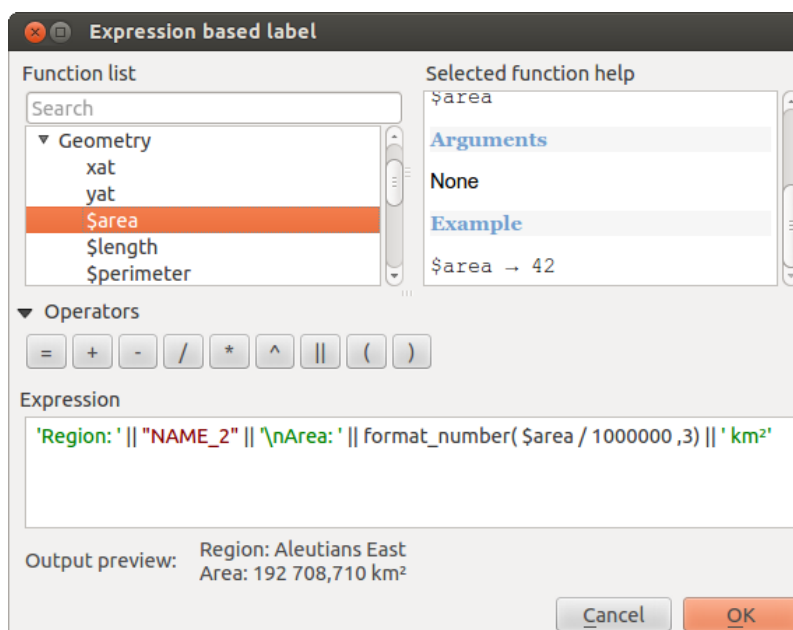
```
# label based on two fields 'name' and 'place' with a descriptive text
'My name is ' || "name" || 'and I live in ' || "place"
```

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

```
# label based on two fields 'name' and 'place' with a descriptive text
```



Rysunek 12.17: Smart labeling of vector polygon layers 🐧



Rysunek 12.18: Using expressions for labeling 🐧

```
# 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 of 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.

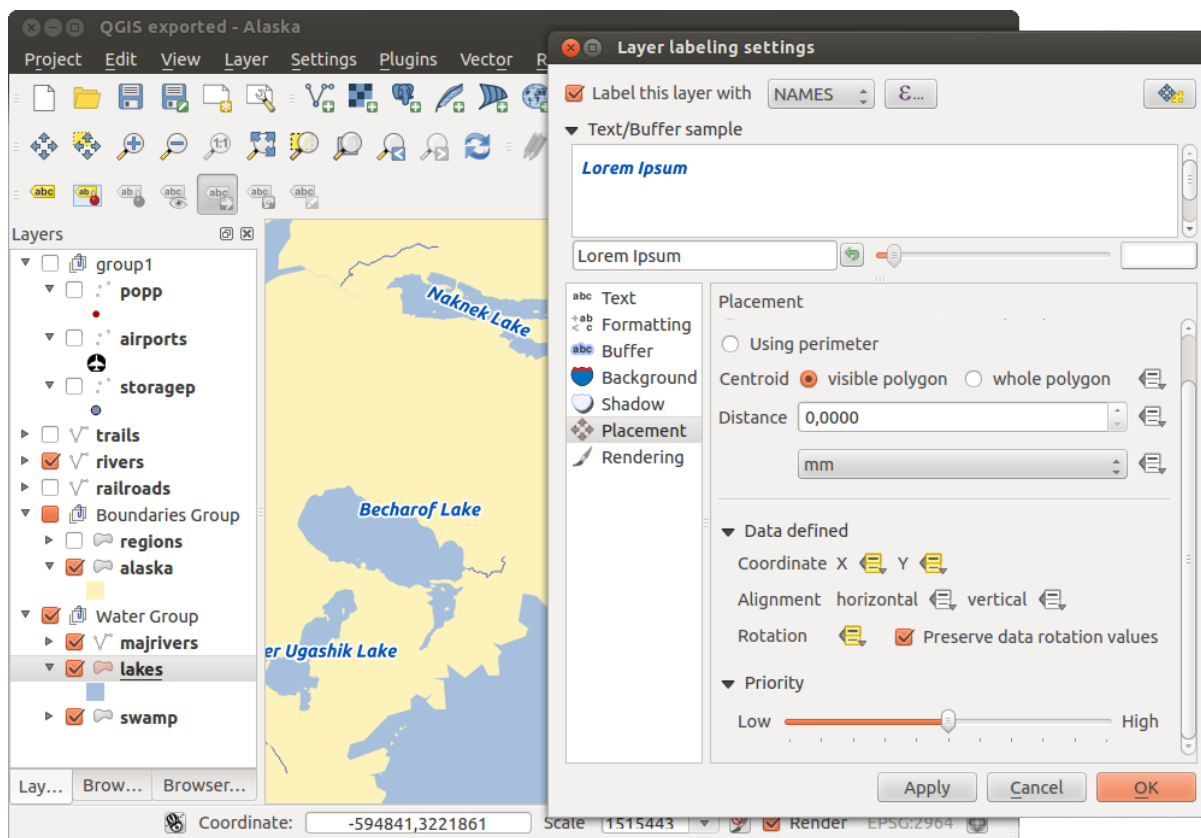
12.2.3 Fields Menu

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

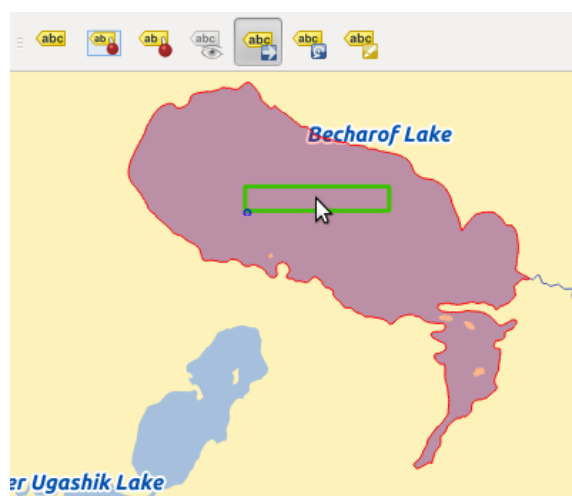
Edit Widget

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

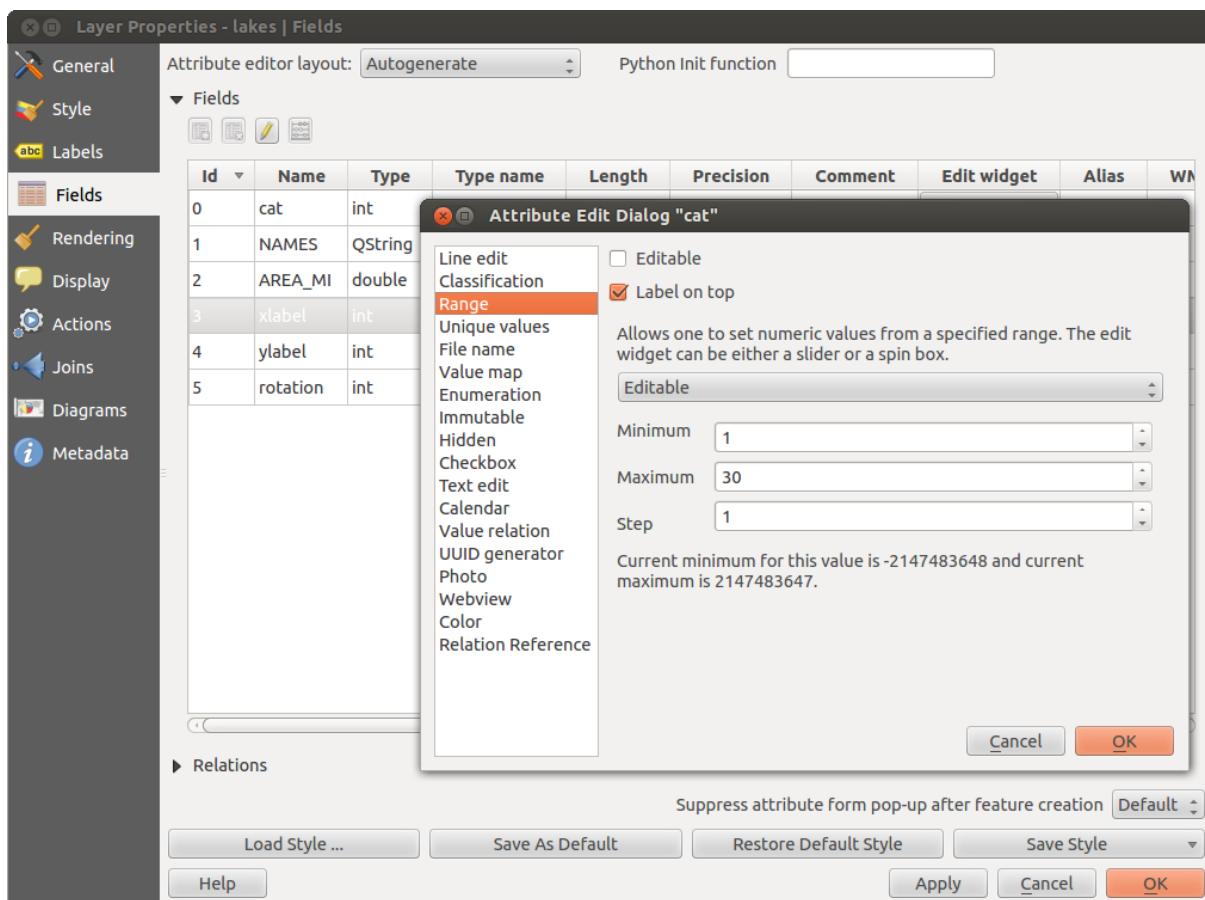
- **Line edit:** An edit field that allows you to enter simple text (or restrict to numbers for numeric attributes).
- **Classification:** Displays a combo box with the values used for classification, if you have chosen 'unique value' as legend type in the *Style* menu of the properties dialog.
- **Range:** Allows you to set numeric values from a specific range. The edit widget can be either a slider or a spin box.




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





Rysunek 12.20: Move labels 🐧



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

- **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 widget 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(QWidget, "My line edit")
```

Reference in Python Init Function like so: MyForms.open

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

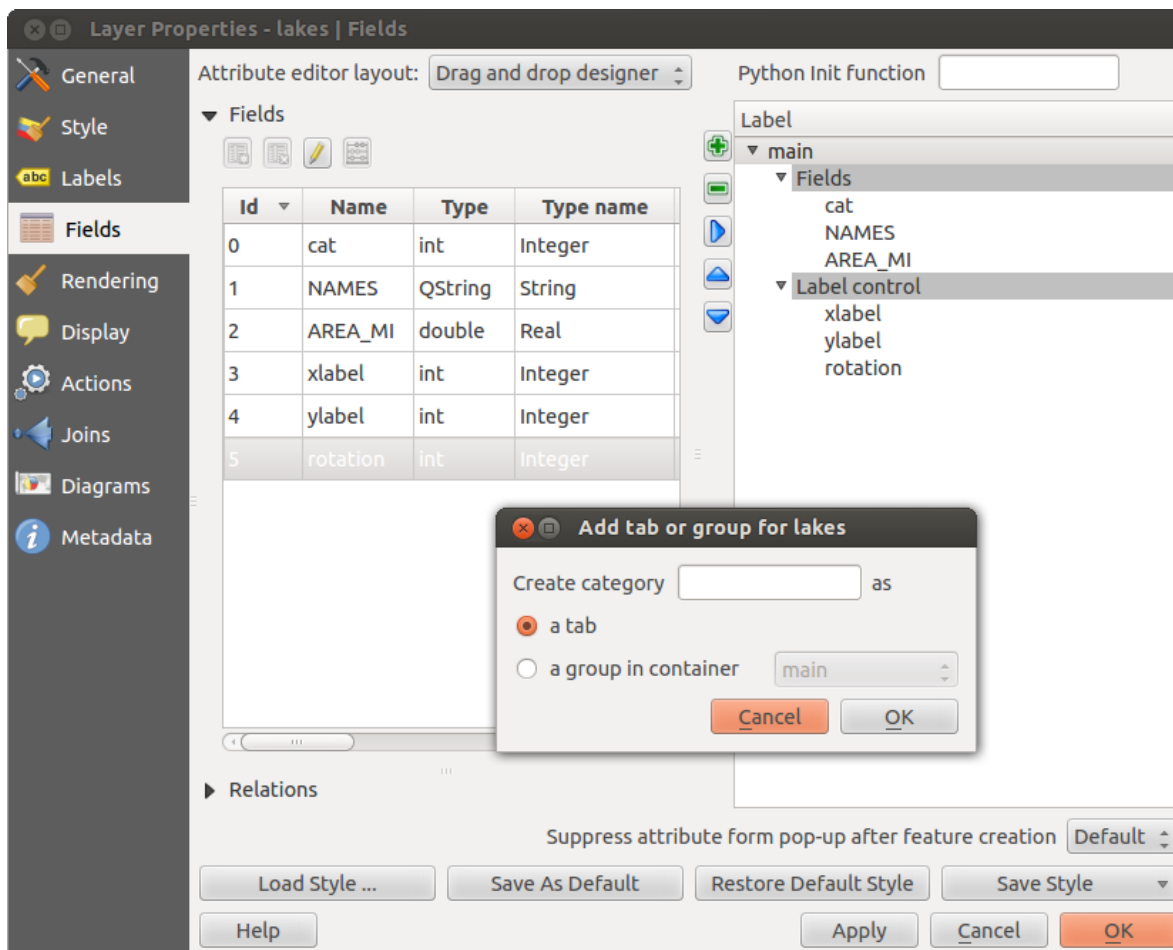
12.2.4 General Menu



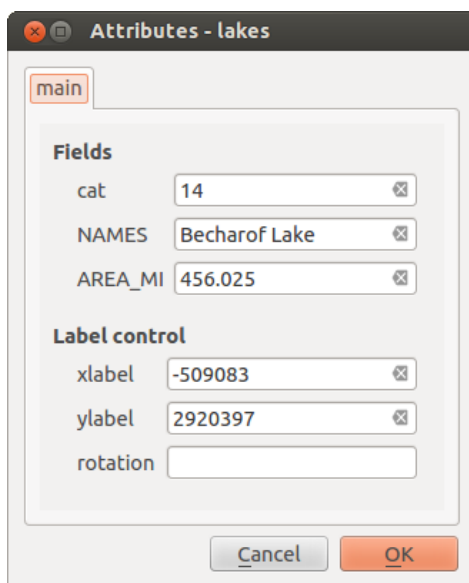
Use this menu to make general settings for the vector layer. There are several options available:

Layer Info

- Change the display name of the layer in *displayed as*



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



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

- 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

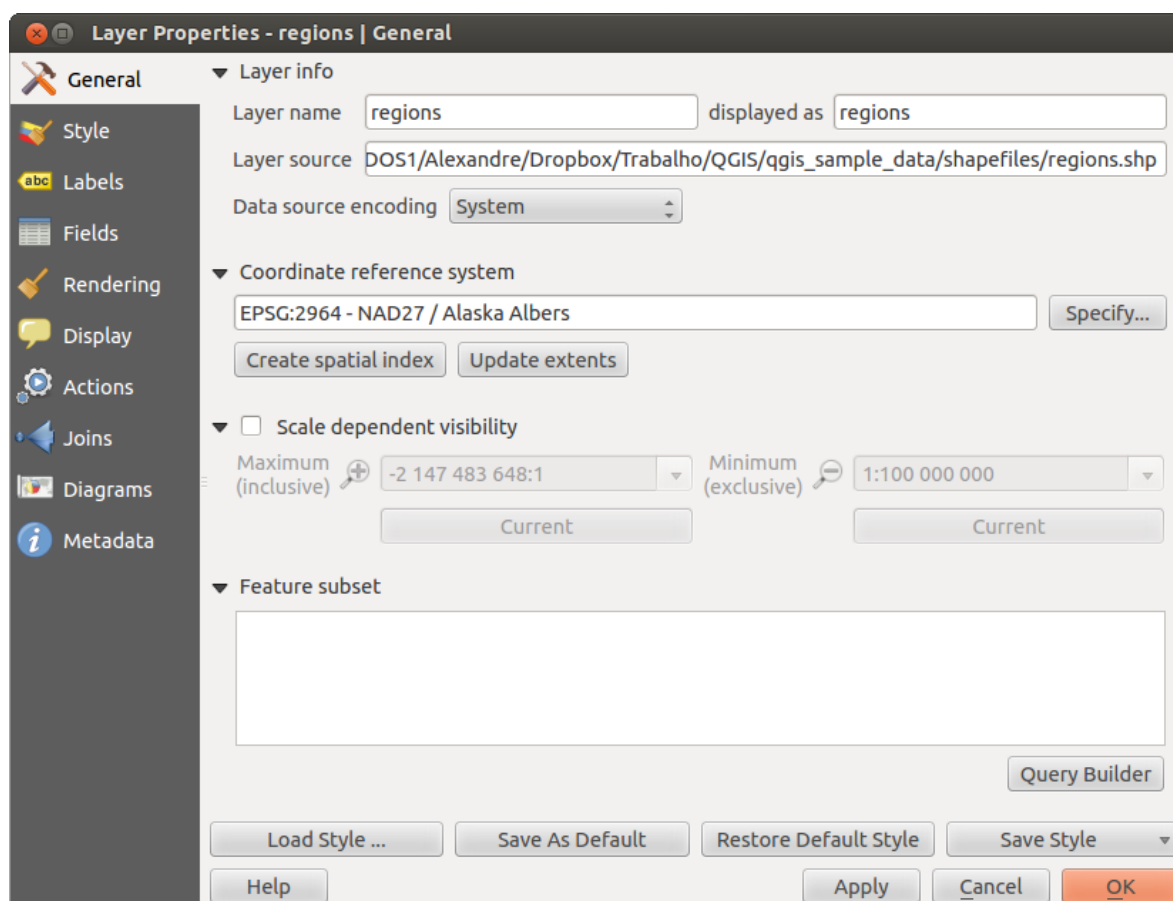
- *Specify* the coordinate reference system. Here, you can view or change the projection of the specific vector layer.
- Create a *Spatial Index* (only for OGR-supported formats)
- *Update Extents* information for a layer
- View or change the projection of the specific vector layer, clicking on *Specify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


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*).




Rysunek 12.24: General menu in vector layers properties dialog 

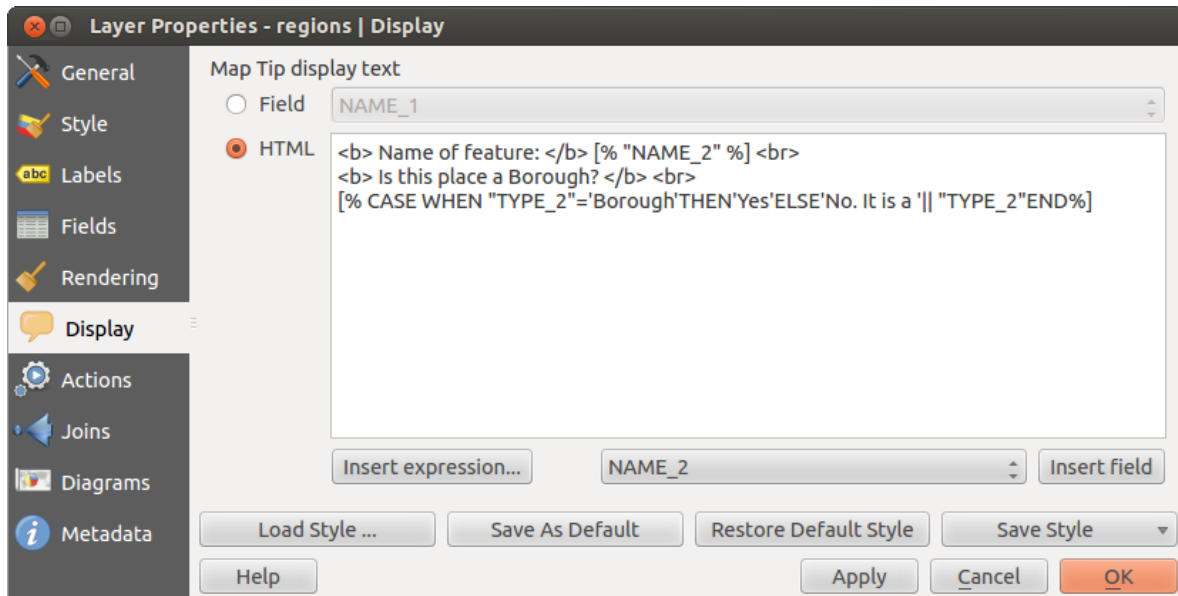
12.2.5 Rendering Menu

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

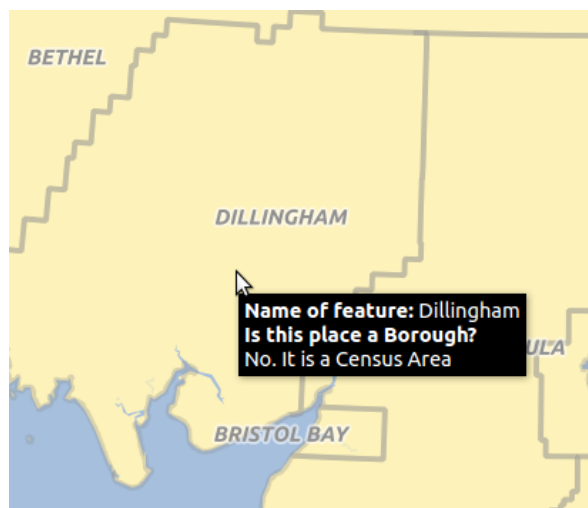
added layers (see section *Opcje*). **Note:** Feature generalisation may introduce artefacts into your rendered output in some cases. These may include slivers between polygons and inaccurate rendering when using offset-based symbol layers.


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.



Rysunek 12.25: HTML code for map tip 

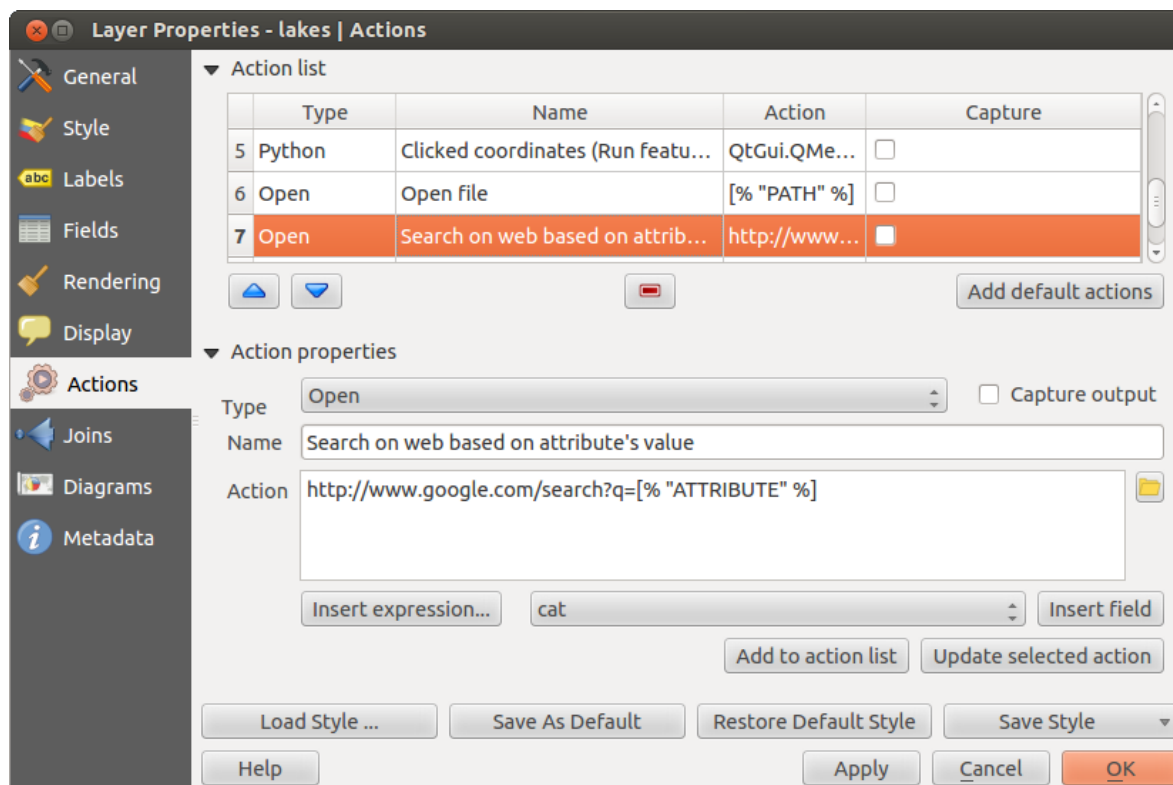


Rysunek 12.26: Map tip made with HTML code 

12.2.7 Actions Menu



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



Rysunek 12.27: Overview action dialog with some sample actions 

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

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

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

Defining Actions

Attribute actions are defined from the vector *Layer Properties* dialog. To define an action, open the vector *Layer Properties* dialog and click on the *Actions* menu. Go to the *Action properties*. Select 'Generic' as type and provide a descriptive name for the action. The action itself must contain the name of the application that will be executed when the action is invoked. You can add one or more attribute field values as arguments to the application. When the action is invoked, any set of characters that start with a % followed by the name of a field will be replaced by the value of that field. The special characters %% will be replaced by the value of the field that was selected from the identify results or attribute table (see [using_actions](#) below). Double quote marks can be used to group text into a single argument to the program, script or command. Double quotes will be ignored if preceded by a backslash.

If you have field names that are substrings of other field names (e.g., `coll` and `coll0`), you should indicate that by surrounding the field name (and the `%` character) with square brackets (e.g., `[%coll0]`). This will prevent the `%coll0` field name from being mistaken for the `%coll` 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: `[[%coll0]]`.

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 preceding 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.

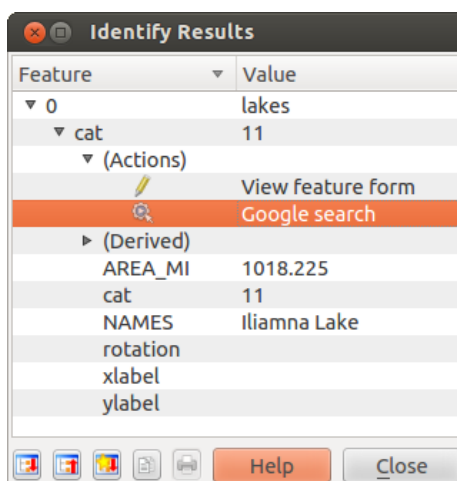
4. Enter a name for the action, for example `Google Search`.
5. For the action, we need to provide the name of the external program to run. In this case, we can use `Firefox`. If the program is not in your path, you need to provide the full path.
6. Following the name of the external application, add 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:



Rysunek 12.28: Select feature and choose action 

When we click on the action, it brings up Firefox and navigates to the URL <http://www.google.com/search?q=Tustumena>. It is also possible to add further attribute fields to the action. Therefore, you can add a + to the end of the action text, select another field and click on **[Insert Field]**. In this example, there is just no other field available that would make sense to search for.

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

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

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

Usually, when we create an action to open a file with an external application, we can use absolute paths, or eventually relative paths. In the second case, the path is relative to the location of the external program executable file. But what about if we need to use relative paths, relative to the selected layer (a file-based one, like a shapefile or SpatiaLite)? The following code will do the trick:

```
command = "firefox";
imagerelpath = "images_test/test_image.jpg";
layer = qgis.utils iface.activeLayer();
import os.path;
layerpath = layer.source() if layer.providerType() == 'ogr'
    else (qgis.core.QgsDataSourceURI(layer.source()).database()
    if layer.providerType() == 'spatialite' else None);
path = os.path.dirname(str(layerpath));
image = os.path.join(path, imagerelpath);
import subprocess;
subprocess.Popen( [command, image ] );
```

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

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

```
command="firefox";
imagerelpath="images/test_image.jpg";
projectpath=qgis.core.QgsProject.instance().fileName();
import os.path; path=os.path.dirname(str(projectpath)) if projectpath != '' else None;
image=os.path.join(path, imagerelpath);
import subprocess;
subprocess.Popen( [command, image ] );
```

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


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

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

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

12.2.8 Joins Menu



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

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

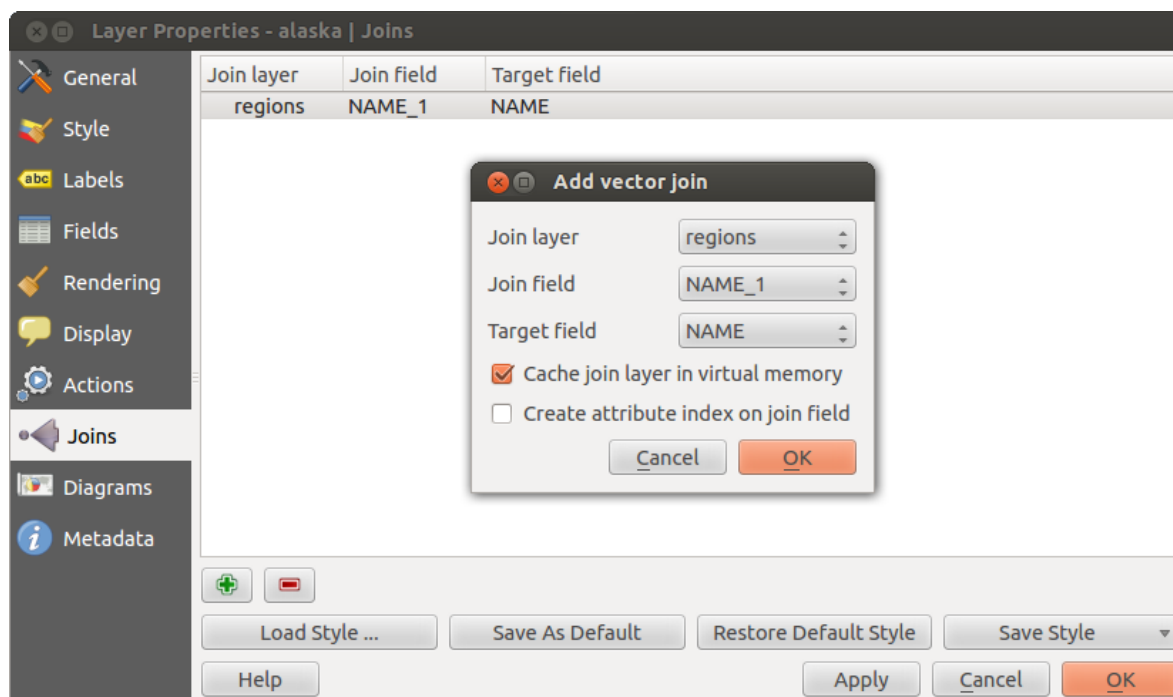
Additionally, the add vector join dialog allows you to:


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

12.2.9 Diagrams Menu



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






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

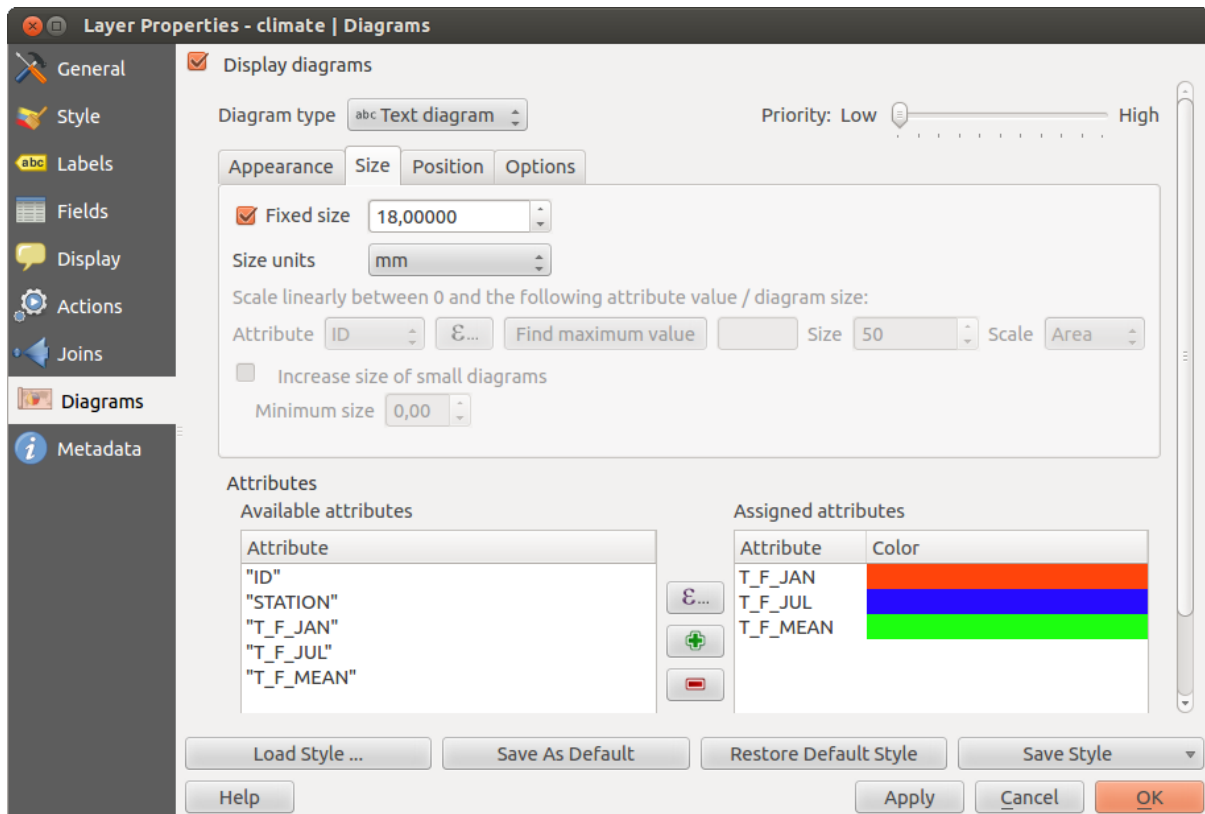
The current core implementation of diagrams provides support for pie charts, text diagrams and histograms.

The menu is divided into four tabs: *Appearance*, *Size*, *Position* 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 *Przykładowe dane*).

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



Rysunek 12.30: Vector properties dialog with diagram menu 

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  button to add an expression.

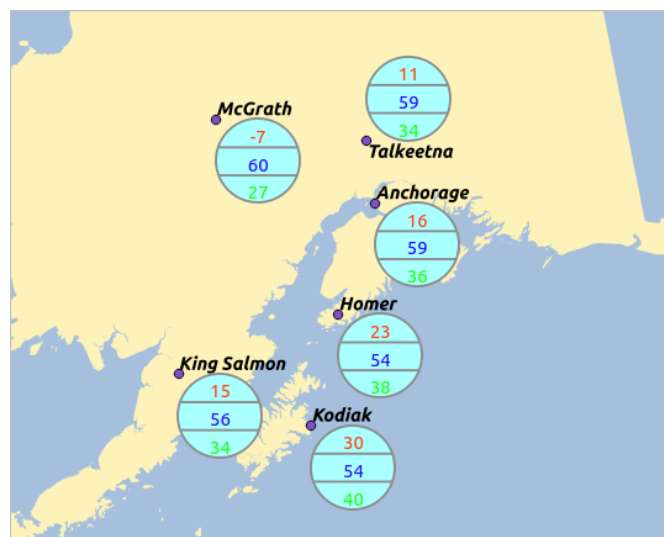
12.2.10 Metadata Menu



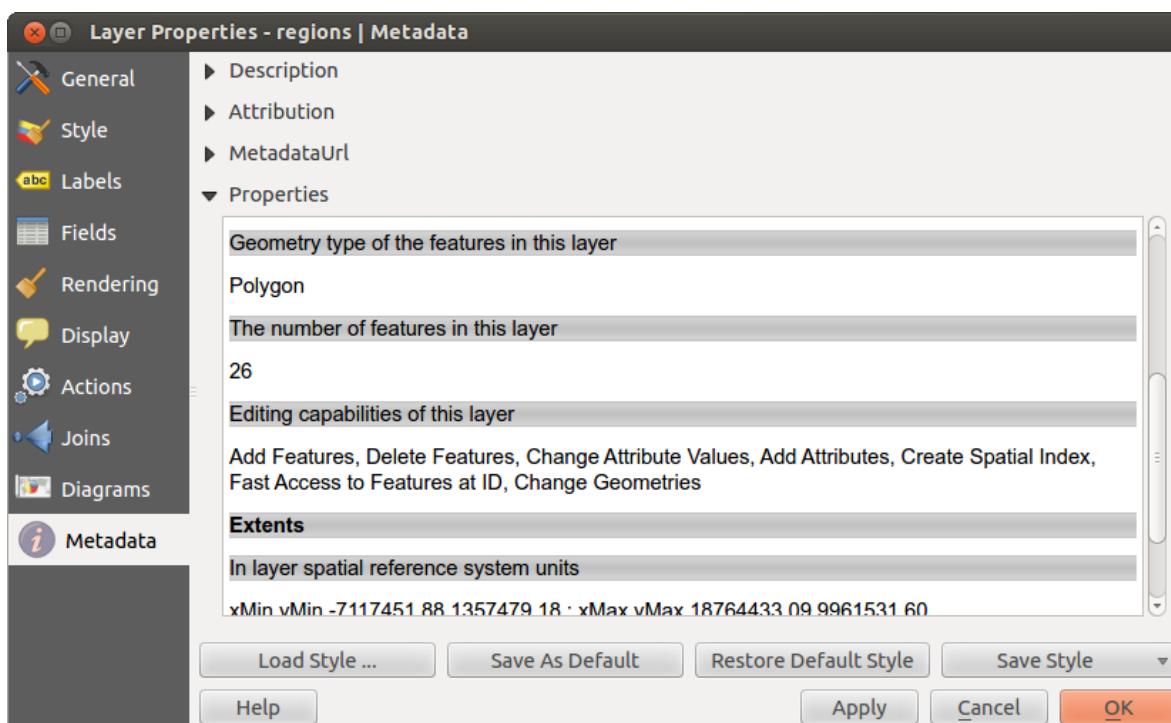
The *Metadata* menu consists of *Description*, *Attribution*, *MetadataURL* and *Properties* sections.

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

Additionally, you can add or edit a title and abstract for the layer in the *Description* section. It's also possible to define a *Keyword list* here. These keyword lists can be used in a metadata catalogue. If you want to use a title from an XML metadata file, you have to fill in a link in the *DataUrl* field. Use *Attribution* to get attribute data from an XML metadata catalogue. In *MetadataUrl*, you can define the general path to the XML metadata catalogue. This information will be saved in the QGIS project file for subsequent sessions and will be used for QGIS server.



Rysunek 12.31: Diagram from temperature data overlaid on a map 🐧



Rysunek 12.32: Metadata menu in vector layers properties dialog 🐧

12.3 Editing

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

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

Wskazówka: Concurrent Edits




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

12.3.1 Setting the Snapping Tolerance and Search Radius

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

Snapping tolerance


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

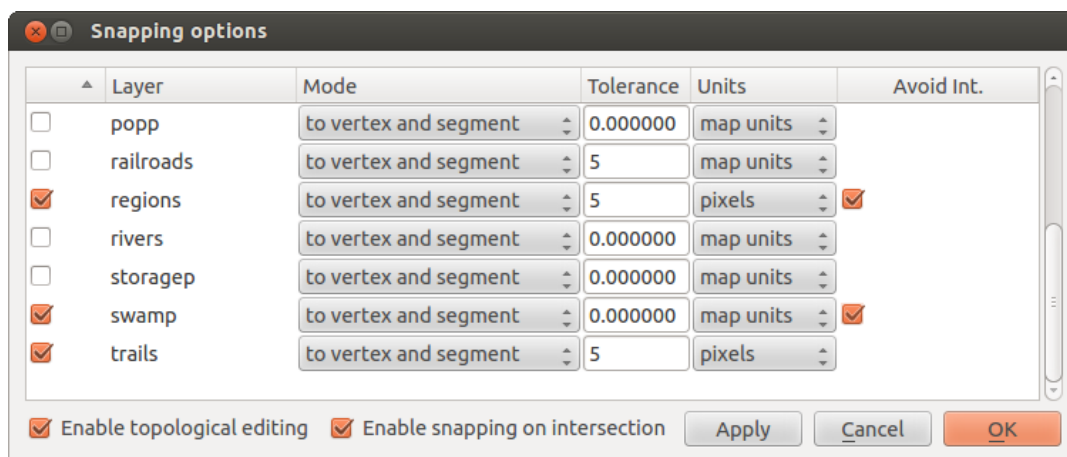
1. A general, project-wide snapping tolerance can be defined by choosing *Settings* →  *Options*. On Mac, go to *QIS* →  *Preferences...*. On Linux: *Edit* →  *Options*. In the *Digitizing* tab, you can select between 'to vertex', 'to segment' or 'to vertex and segment' as default snap mode. You can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


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

Search radius

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




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




Rysunek 12.33: Edit snapping options on a layer basis 

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.

Wskazówka: Save Regularly

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

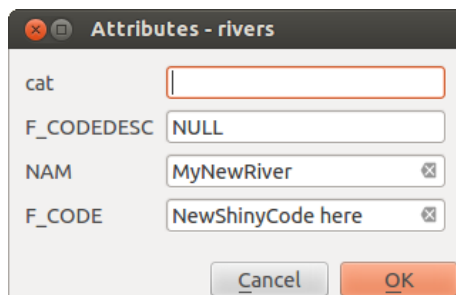
Adding Features

You can use the ,  *Add Feature*, 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*.






Rysunek 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.

Wskazówka: 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*: to a number greater than zero (i.e., 10). Otherwise, QGIS will not be able to tell which vertex is being edited.

Wskazówka: 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.

Wskazówka: 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.

Wskazówka: 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.

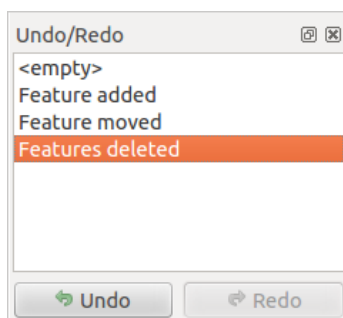
12.3.5 Advanced digitizing

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.



Rysunek 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.

Informacja: 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

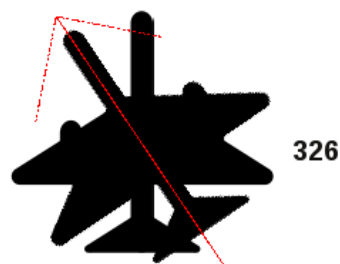
The  Merge Selected Features tool allows you to merge features that have common boundaries and the same attributes.

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.



Rysunek 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.

Informacja: 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 SpatialLite 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).

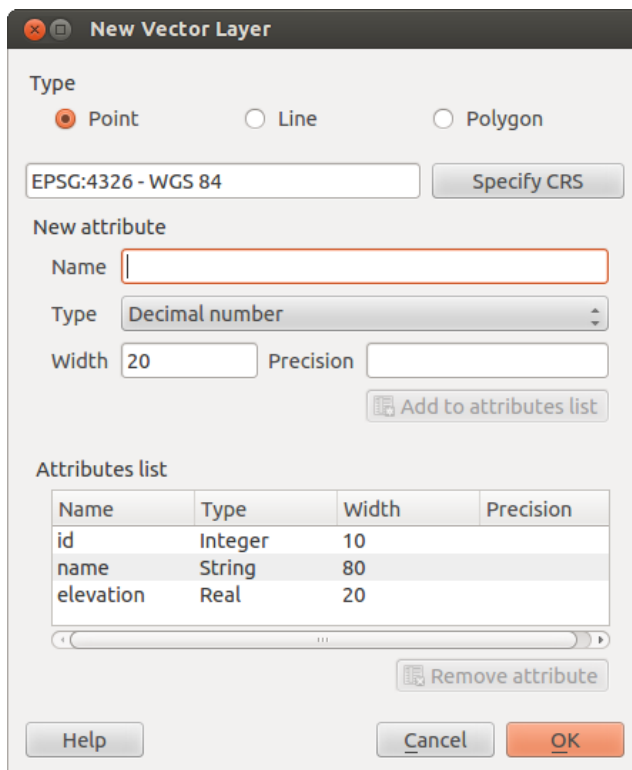
Note that QGIS does not yet support creation of 2.5D features (i.e., features with X,Y,Z coordinates).


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.

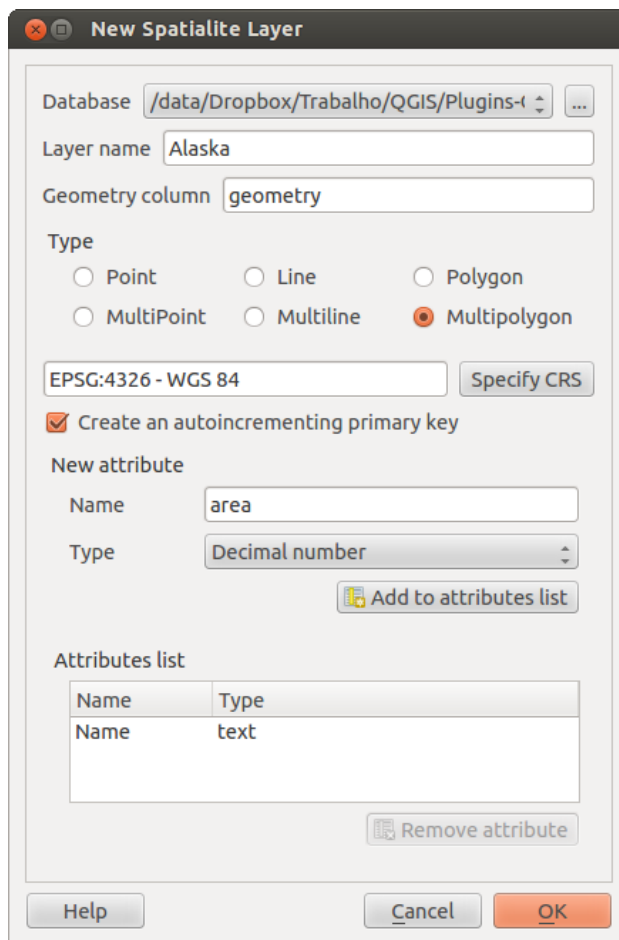
Creating a new SpatialLite layer

To create a new SpatialLite layer for editing, choose *New* →  *New SpatialLite Layer...* from the *Layer* menu. The *New SpatialLite Layer* dialog will be displayed as shown in [Figure_edit_6](#).

The first step is to select an existing SpatialLite database or to create a new SpatialLite 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*.



Rysunek 12.37: Creating a new Shapefile layer Dialog 






Rysunek 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 *DB Manager Plugin*.




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.

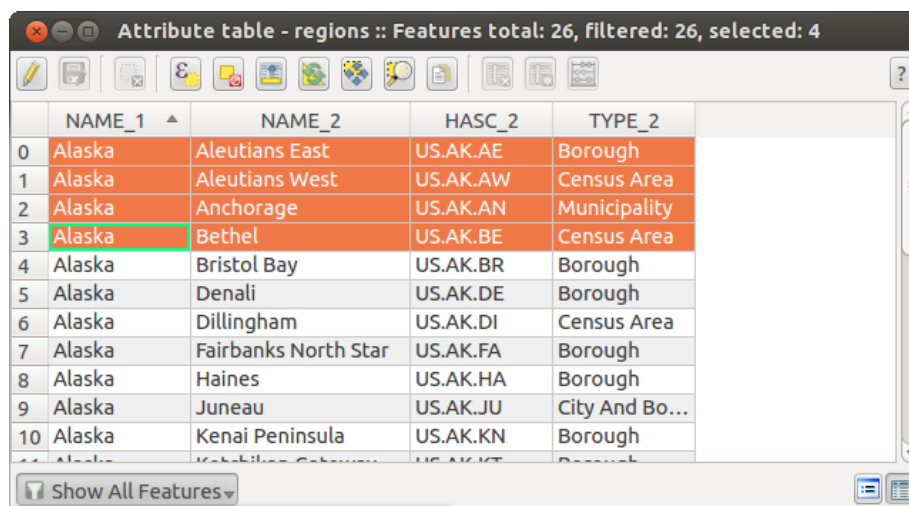
When this plugin is loaded, choose *New* →  *Create new GPX Layer...* from the *Layer* menu. In the *Save new GPX file as* dialog, you can choose where to save the new GPX layer.

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.



Rysunek 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`)

Wskazówka: 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 mapy*). 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.



Rysunek 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 demonstrate 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)

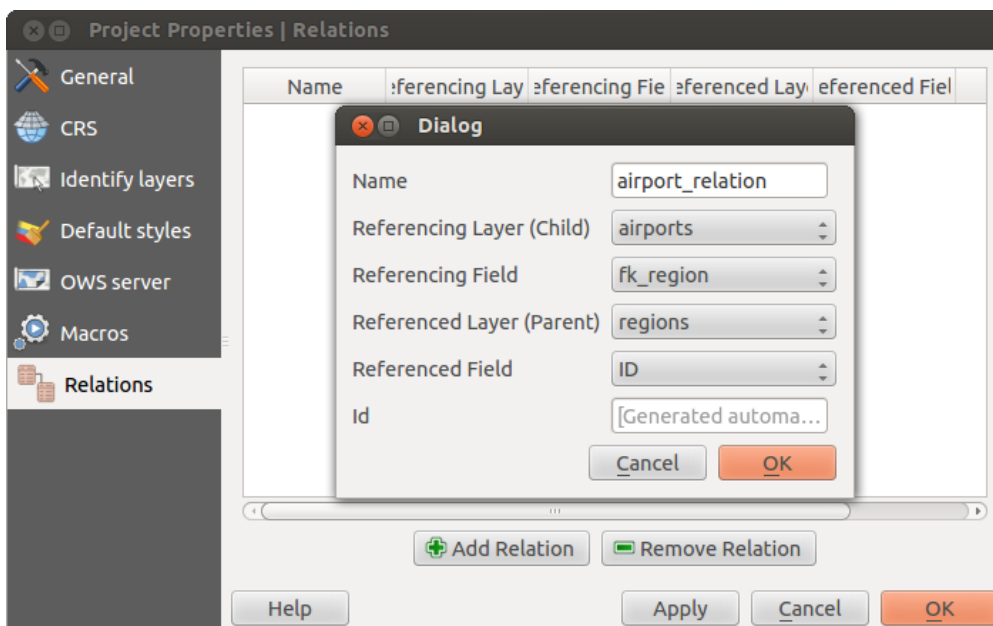
The first thing we are going to do is to let QGIS know about the relations between the layer. This is done in *Settings* → *Project Properties*. Open the *Relations* menu and click on *Add*.

- **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.

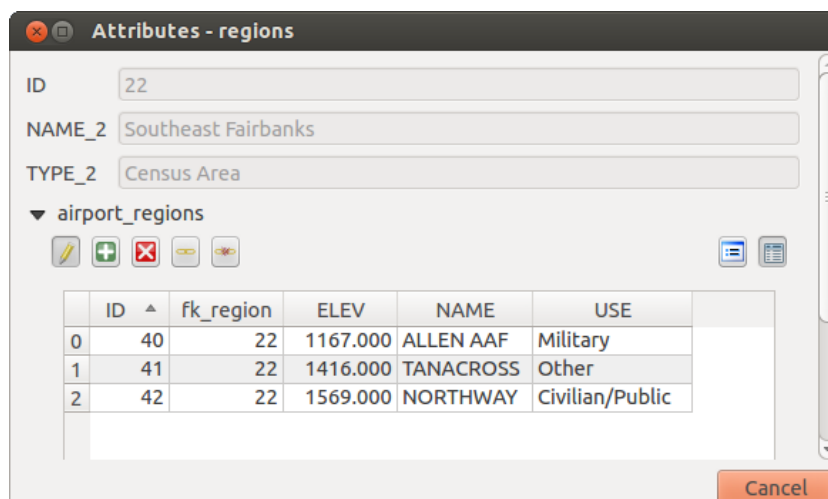
Forms


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



Rysunek 12.41: Relation Manager 

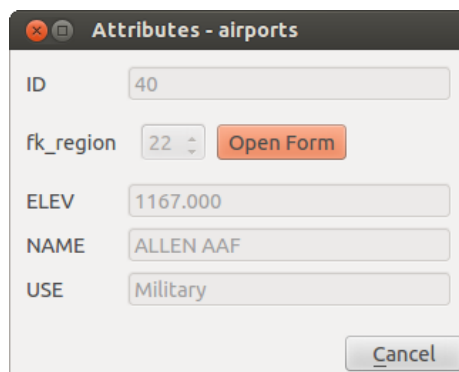


Rysunek 12.42: Identification dialog regions with relation to airports 

- 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.



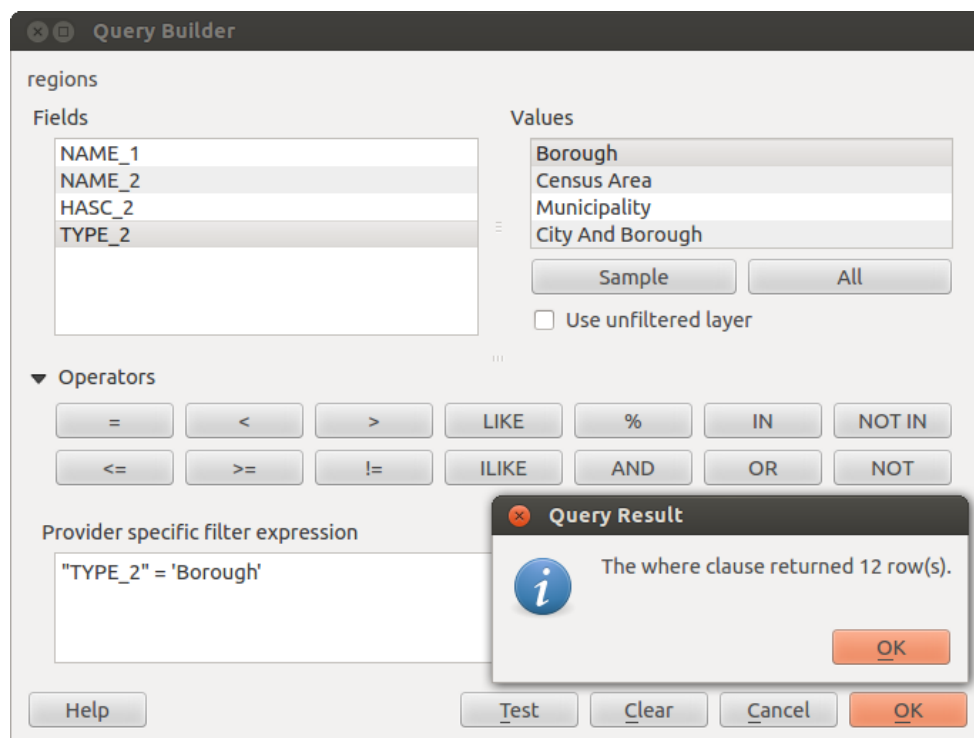
Rysunek 12.43: Identification dialog airport with relation to regions 


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.



Rysunek 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.

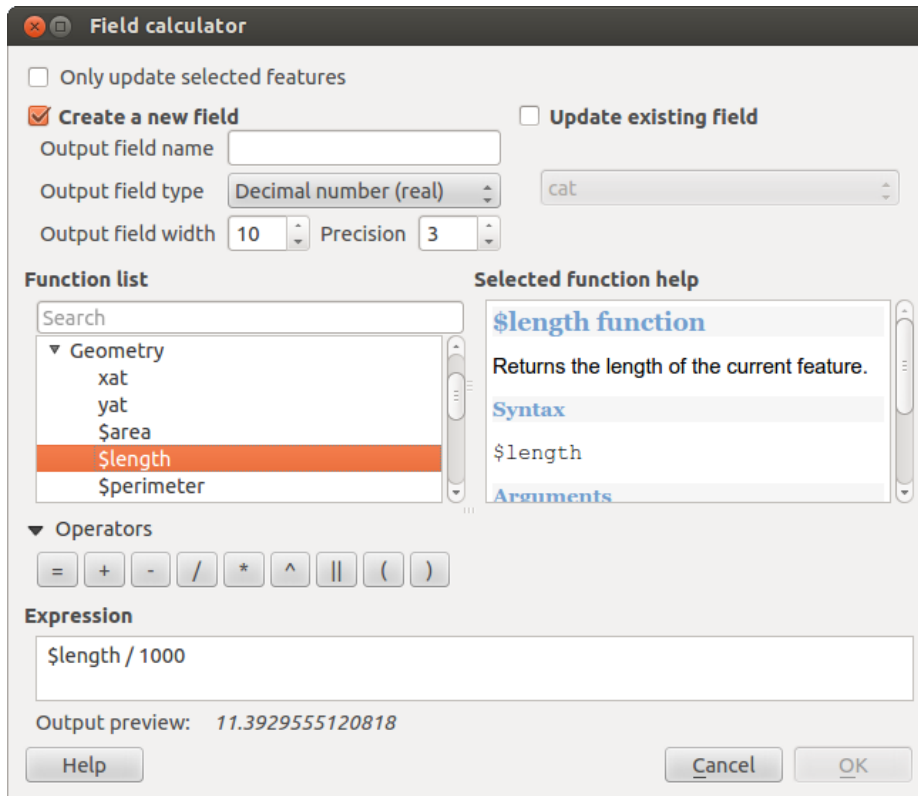
12.4.2 Save selected features as new layer

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

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.



Rysunek 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., +, -, *).

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

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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Working with Raster Data

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 *Literature and Web References*). A complete list is available at http://www.gdal.org/formats_list.html.

Informacja: 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 Extent*
- *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*

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](#)).

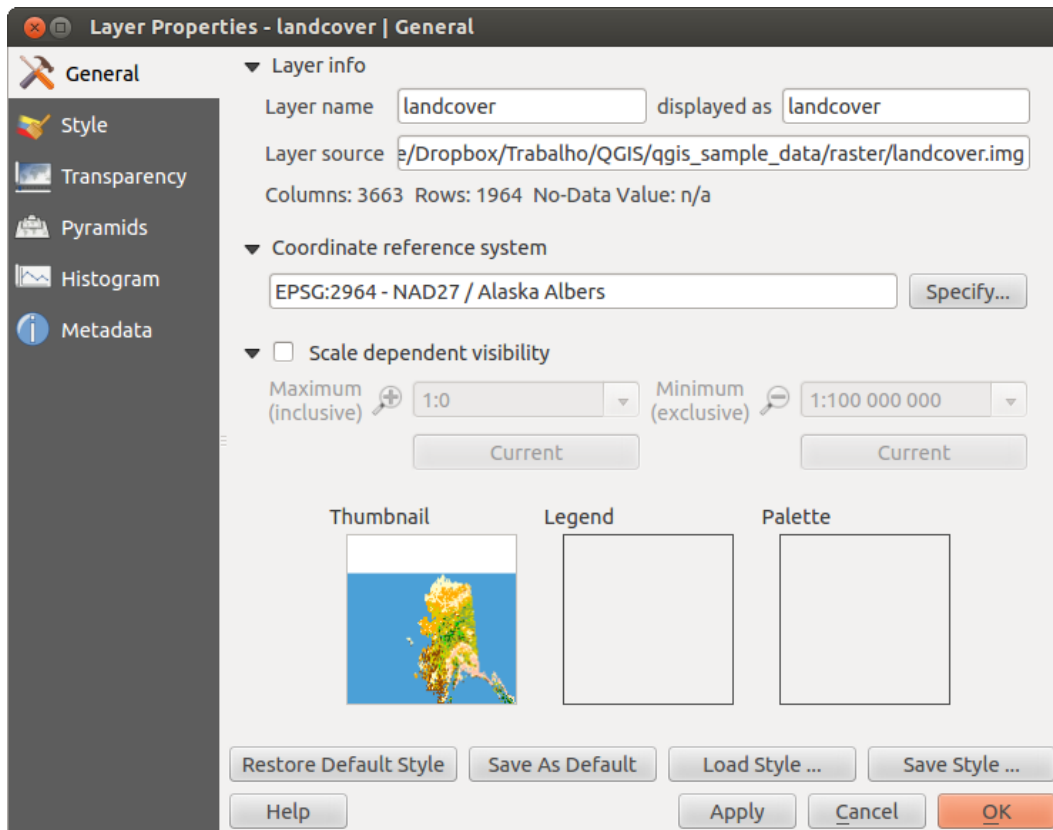
There are several menus in the dialog:

- *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.



Rysunek 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

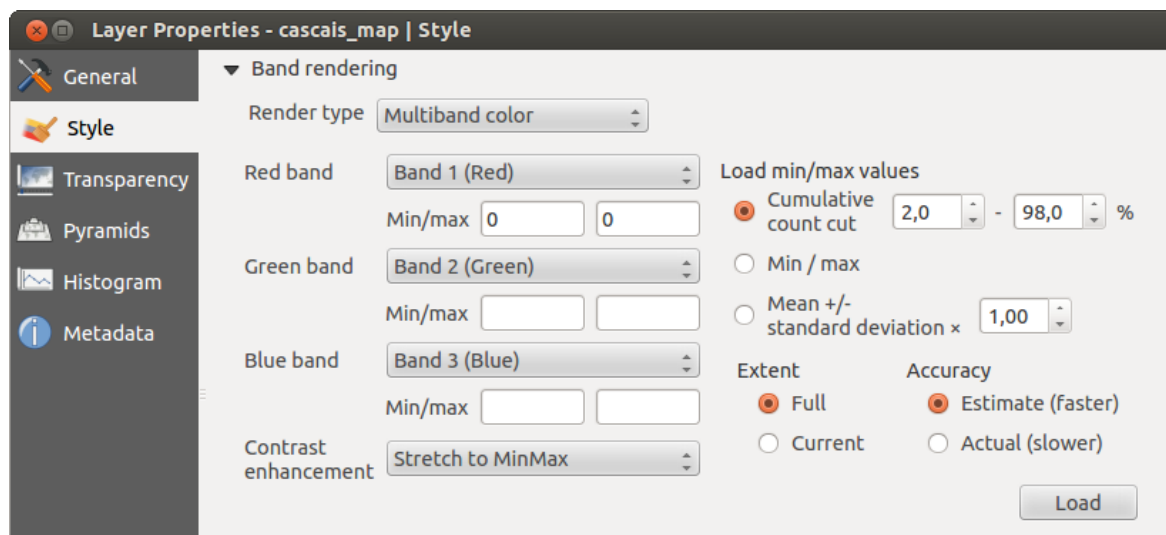
Band rendering

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 continuous 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'.



Rysunek 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* . 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.

Wskazówka: Viewing a Single Band of a Multiband Raster

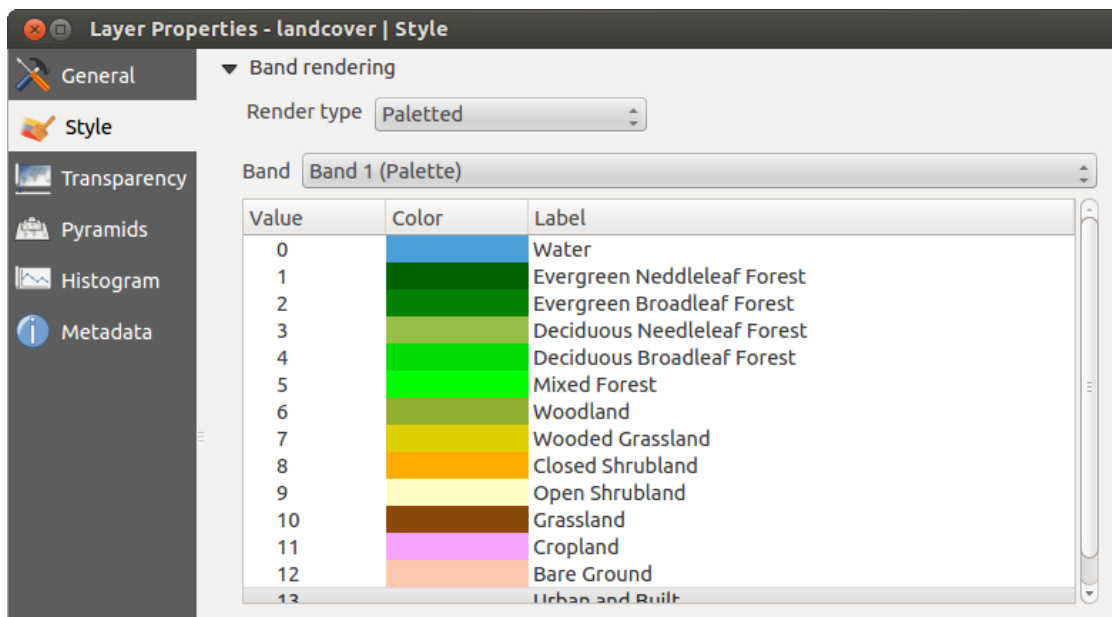
If you want to view a single band of a multiband image (for example, Red), you might think you would set the Green and Blue bands to "Not Set". But this is not the correct way. To display the Red band, set the image type to 'Singleband gray', then select Red as the band to use for Gray.

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

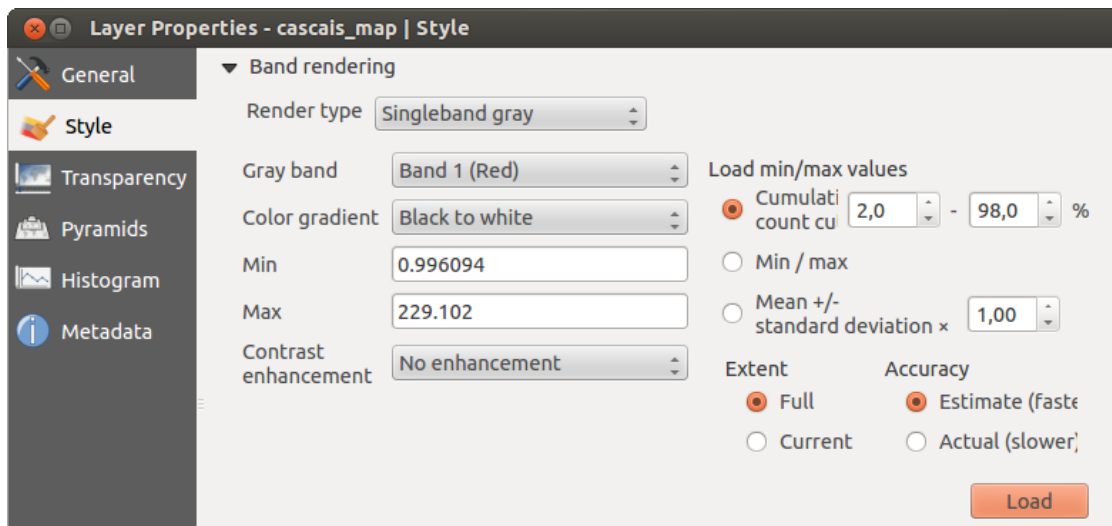
Informacja: When adding GRASS rasters, the option *Contrast enhancement* will always be set automatically to *stretch to min max*, regardless of if this is set to another value in the QGIS general options.



Rysunek 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.

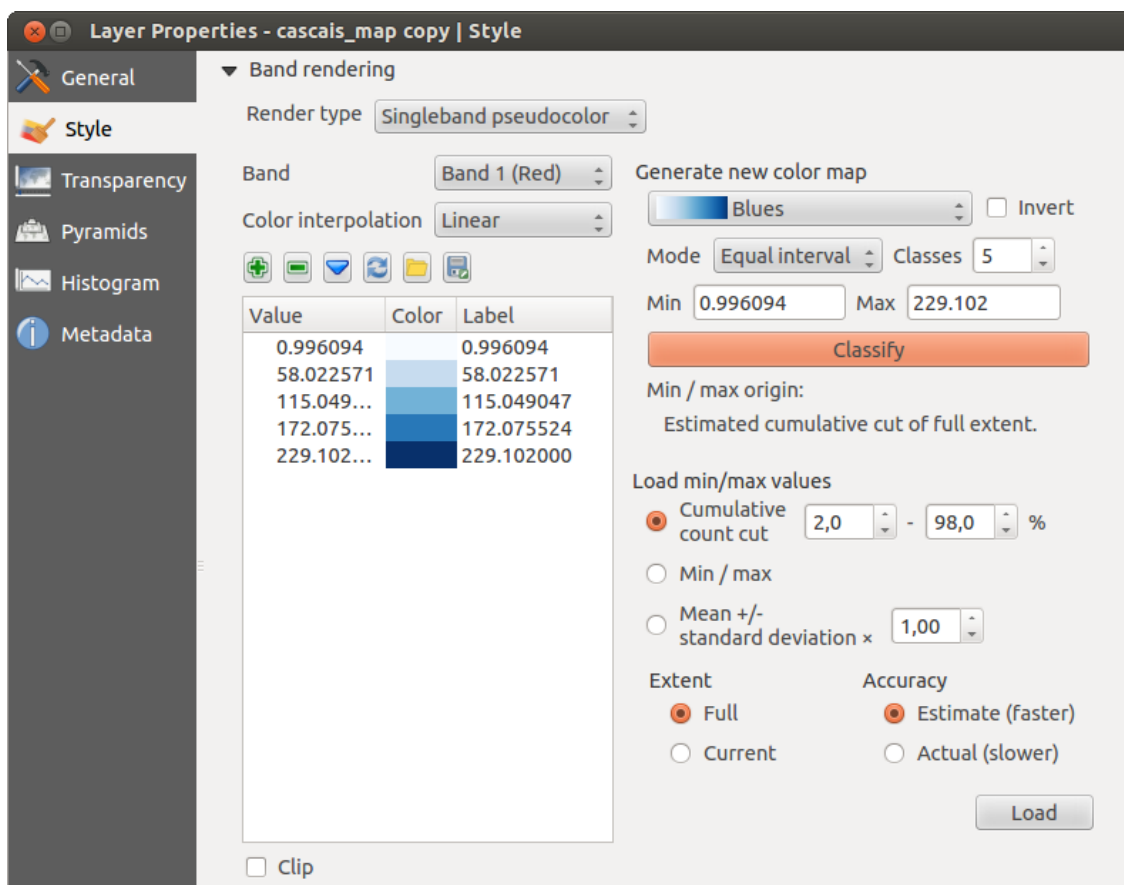


Rysunek 13.4: Raster Renderer - Singleband gray 🐧

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* . 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 continuous palette. You can also create individual color maps for the single bands here. Three types of color interpolation are available:



Rysunek 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*  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*  'Continuous', 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* \times . Then, only the values within the standard deviation or within multiple standard deviations are considered for the color table.

Color rendering

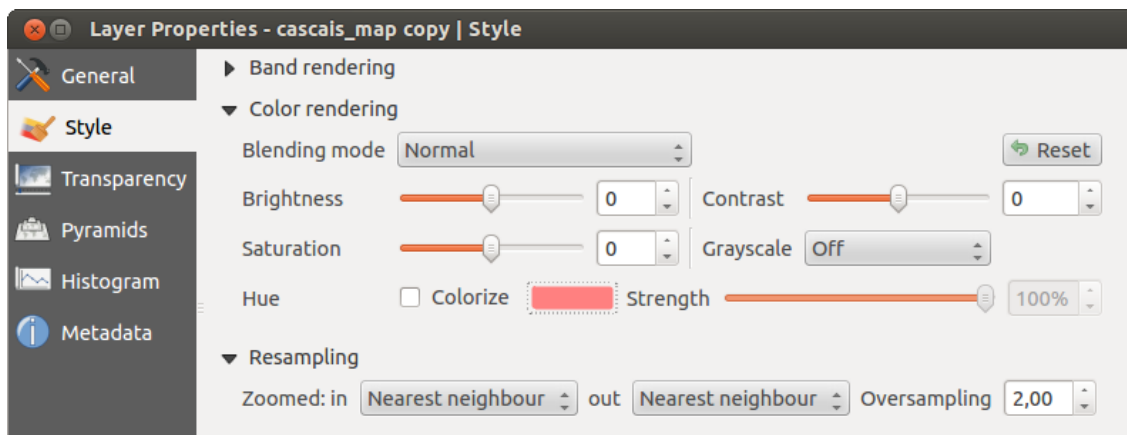
For every *Band rendering*, a *Color rendering* is possible.

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 modifying 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.



Rysunek 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 overlaid 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 necessary:

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)'.

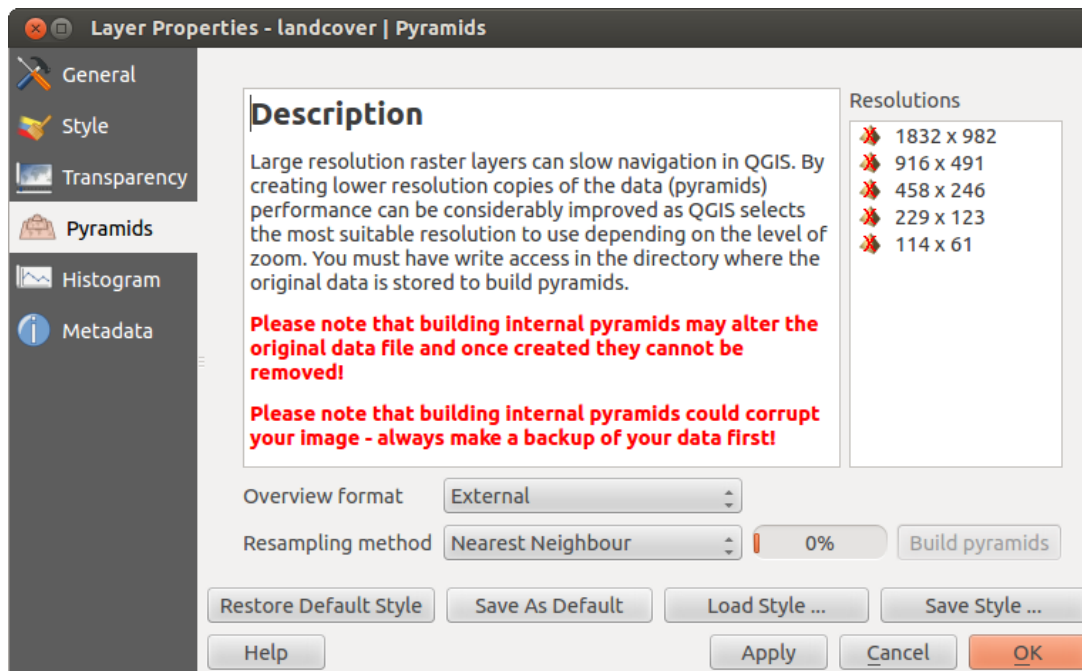
Please note that building pyramids may alter the original data file, and once created they cannot be removed. If you wish to preserve a 'non-pyramided' version of your raster, make a backup copy prior to building pyramids.

13.2.5 Histogram Menu

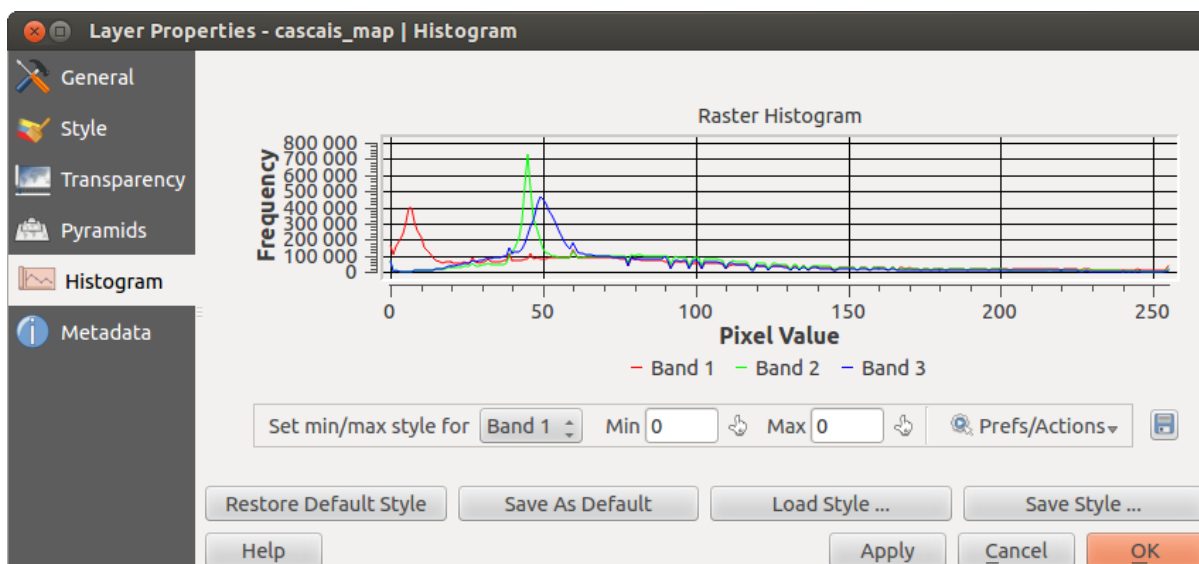
The *Histogram* menu allows you to view the distribution of the bands or colors in your raster. The histogram is generated automatically when you open the *Histogram* menu. All existing bands will be displayed together. You can save the histogram as an image with the  button. With the *Visibility* option 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

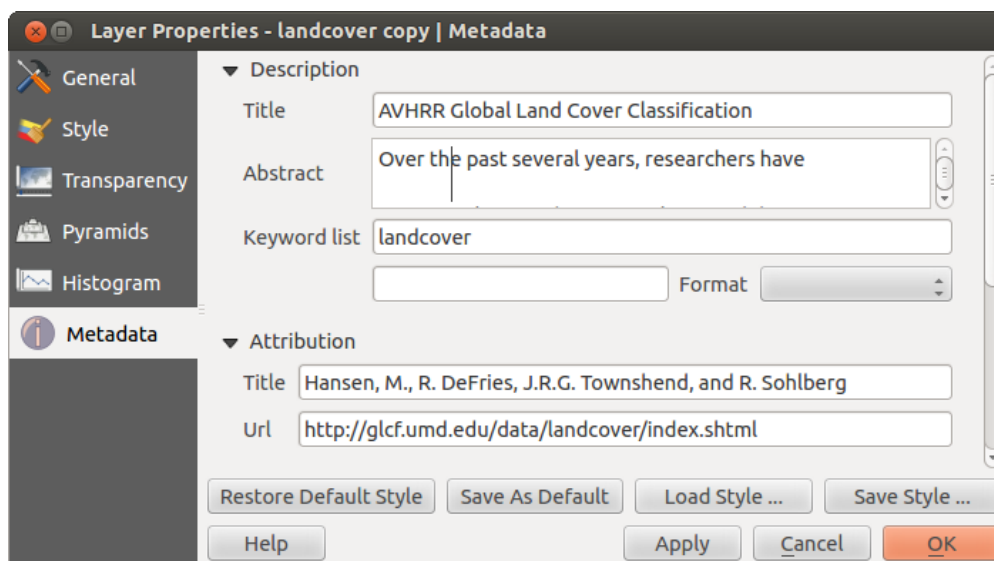


Rysunek 13.7: The Pyramids Menu 🐧



Rysunek 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.



Rysunek 13.9: Raster Metadata 

13.3 Raster Calculator

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.

The **Raster bands** list contains all loaded raster layers that can be used. To add a raster to the raster calculator expression field, double click its name in the Fields list. You can then use the operators to construct calculation expressions, or you can just type them into the box.

In the **Result layer** section, you will need to define an output layer. You can then define the extent of the calculation area based on an input raster layer, or based on X,Y coordinates and on columns and rows, to set the resolution of the output layer. If the input layer has a different resolution, the values will be resampled with the nearest neighbor algorithm.

The **Operators** section contains all available operators. To add an operator to the raster calculator expression box, click the appropriate button. Mathematical calculations (+, -, *, ...) and trigonometric functions (sin, cos, tan, ...) are available. Stay tuned for more operators to come!

With the *Add result to project* checkbox, the result layer will automatically be added to the legend area and can be visualized.

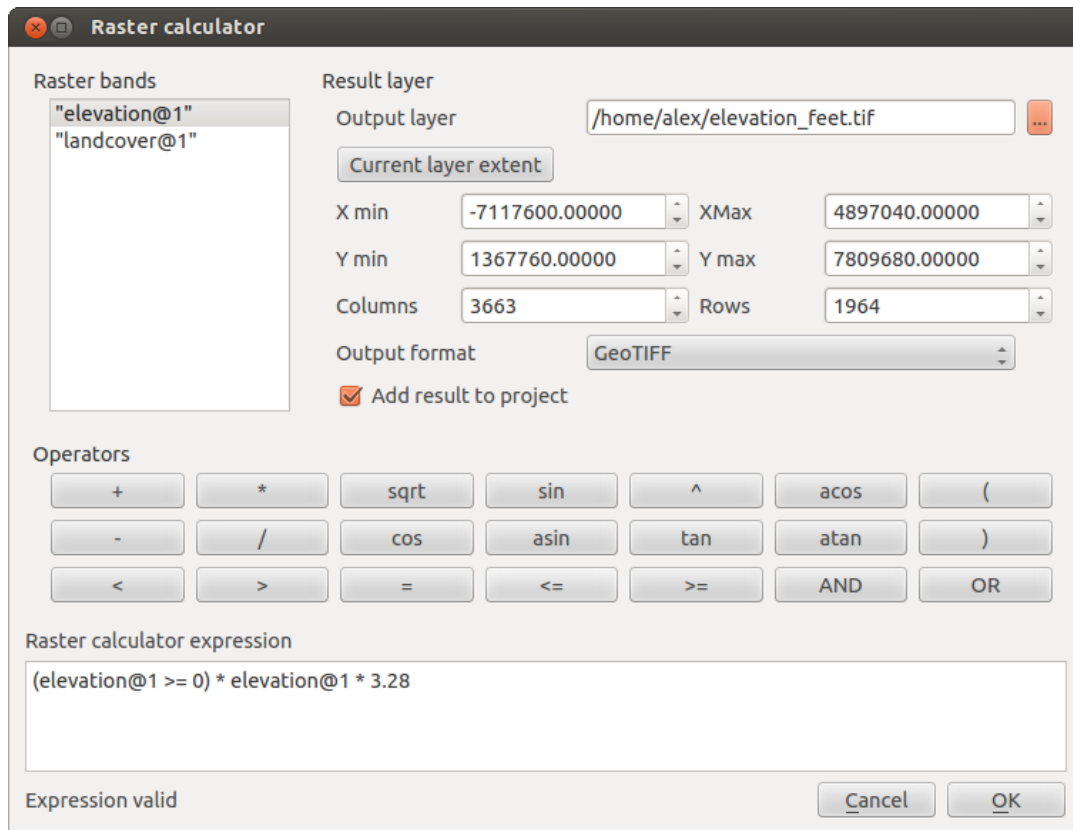
13.3.1 Examples

Convert elevation values from meters to feet

Creating an elevation raster in feet from a raster in meters, you need to use the conversion factor for meters to feet: 3.28. The expression is:

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

Using a mask



Rysunek 13.10: Raster Calculator 

If you want to mask out parts of a raster – say, for instance, because you are only interested in elevations above 0 meters – you can use the following expression to create a mask and apply the result to a raster in one step.

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

In other words, for every cell greater than or equal to 0, set its value to 1. Otherwise set it to 0. This creates the mask on the fly.

Working with OGC Data

14.1 QGIS as OGC Data Client

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/>.

Important OGC specifications supported by QGIS are:

- **WMS** — Web Map Service (*WMS/WMTS Client*)
- **WMTS** — Web Map Tile Service (*WMS/WMTS Client*)
- **WFS** — Web Feature Service (*WFS and WFS-T Client*)
- **WFS-T** — Web Feature Service - Transactional (*WFS and WFS-T Client*)
- **WCS** — Web Coverage Service (*WCS Client*)
- **SFS** — Simple Features for SQL (*Warstwy PostGIS*)
- **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 *Warstwy PostGIS*).

14.1.1 WMS/WMTS Client

Overview of WMS Support

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.

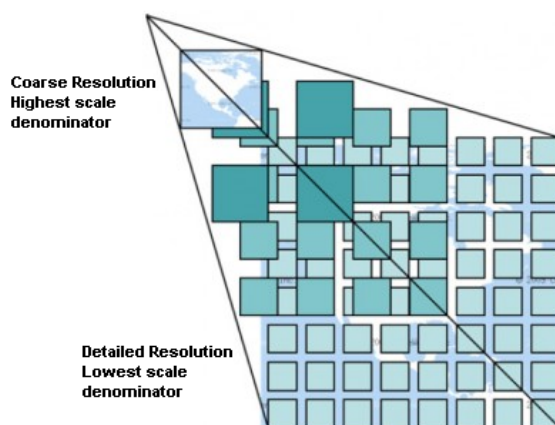
WMS layers can be added quite simply, as long as you know the URL to access the WMS server, you have a serviceable connection to that server, and the server understands HTTP as the data transport mechanism.

Overview of WMTS Support

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.

In order to display the data at a variety of scales close to what the user might want, the WMTS tile sets are produced at several different scale levels and are made available for the GIS client to request them.

This diagram illustrates the concept of tile sets:



Rysunek 14.1: Concept of 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>.

Informacja: 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.

Selecting WMS/WMTS Servers


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](#):

Name	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.
Username	Username to access a secured WMS server. This parameter is optional.
Password	Password for a basic authenticated WMS server. This parameter is optional.
Ignore GetMap URI	<input checked="" type="checkbox"/> <i>Ignore GetMap URI reported in capabilities. Use given URI from URL field above.</i>
Ignore GetFeatureInfo URI	<input checked="" type="checkbox"/> <i>Ignore GetFeatureInfo URI reported in capabilities. Use given URI from URL field above.</i>

Table OGC 1: WMS Connection Parameters

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.

Wskazówka: On WMS Server URLs

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.

Loading WMS/WMTS Layers

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.

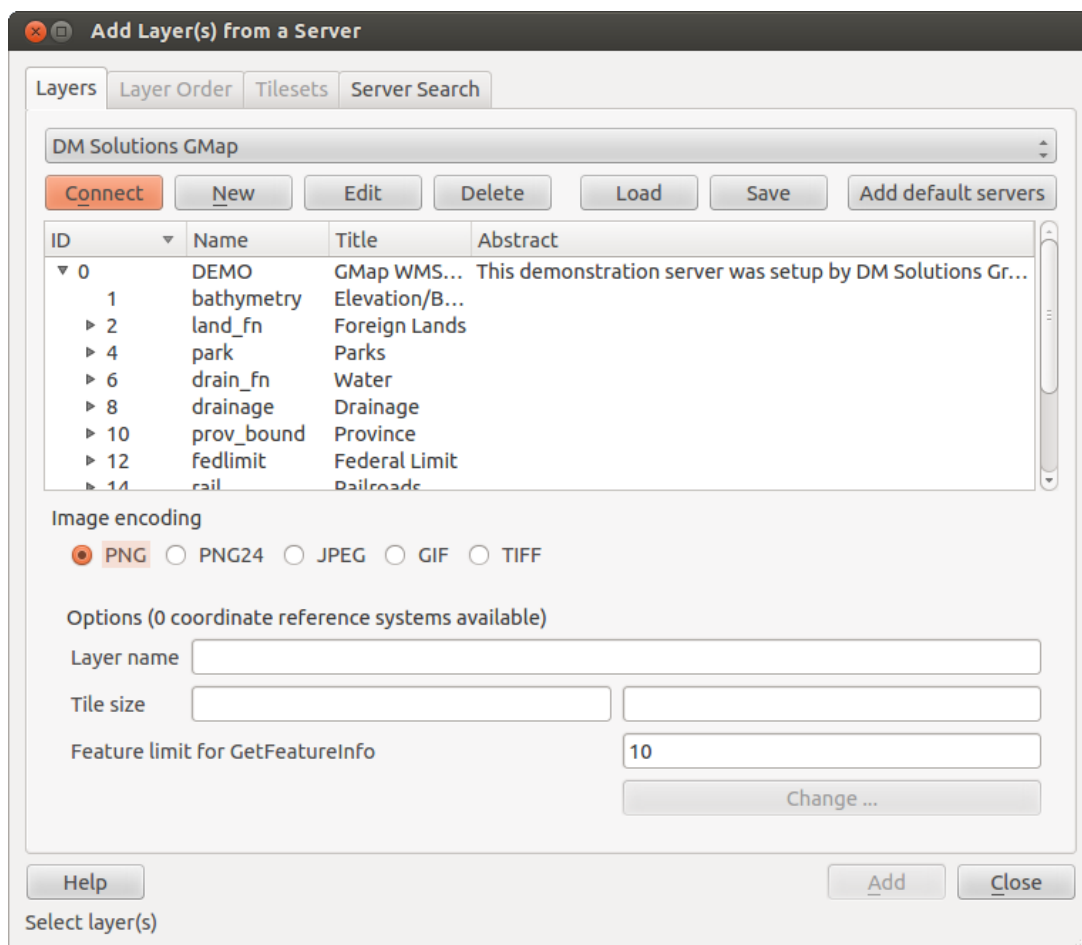
Your screen should now look a bit like [figure_OGR_1](#), which shows the response provided by the DM Solutions Group WMS server.

Image Encoding

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

Wskazówka: Image Encoding

You will typically find that a WMS server offers you the choice of JPEG or PNG image encoding. JPEG is a lossy compression format, whereas PNG faithfully reproduces the raw raster data.



Rysunek 14.2: Dialog for adding a WMS server, showing its available layers 🐧

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.

Options

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.

The *Feature limit for GetFeatureInfo* defines what features from the server to 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.

Layer Order

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.

Wskazówka: WMS Layer Ordering

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.

Transparency

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

Wskazówka: WMS Layer Transparency

The availability of WMS image transparency depends on the image encoding used: PNG and GIF support transparency, whilst JPEG leaves it unsupported.

Coordinate Reference System

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

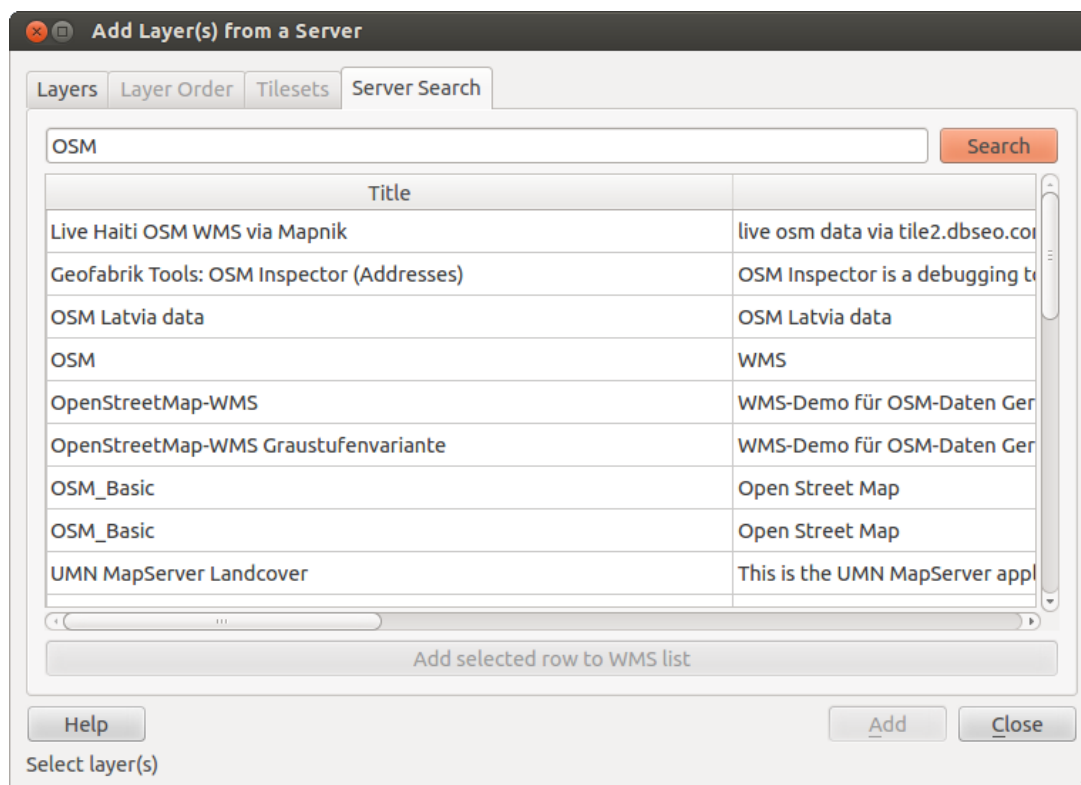
Each WMS layer can be presented in multiple CRSs, depending on the capability of the WMS server.


To choose a CRS, select **[Change...]** and a dialog similar to Figure Projection 3 in *Praca z układami współrzędnych* 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.

Server search

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



Rysunek 14.3: Dialog for searching WMS servers after some keywords 

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>.


Tilesets

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.

Using the Identify Tool

Once you have added a WMS server, and if any layer from a WMS server is queryable, you can then use the  Identify tool to select a pixel on the map canvas. A query is made to the WMS server for each selection made. The results of the query are returned in plain text. The formatting of this text is dependent on the particular WMS server used. **Format selection**

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. **GML format support**

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"
```

Viewing Properties

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

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 *Literature and Web References*), but here are a few handy definitions:

- **Server Properties**

- **WMS Version** — The WMS version supported by the 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.

- **Layer Properties**

- **Selected** — Whether or not this layer was selected when its server was added to this project.
- **Visible** — Whether or not this layer is selected as visible in the legend (not yet used in this version of QGIS).
- **Can Identify** — Whether or not this layer will return any results when the Identify tool is used on it.
- **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 (downloaded) 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.

WMS Client Limitations

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

Editing WMS Layer Settings

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.

WMS Servers Requiring Authentication

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 *Selecting WMS/WMTS Servers* for details.

Wskazówka: Accessing secured OGC-layers

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>.

Wskazówka: 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 as OGC Data Server*.

14.1.2 WCS Client



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 WFS and WFS-T Client

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.

Loading a WFS Layer

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. Click on **[New]**.
3. Enter 'DM Solutions' as name.
4. Enter the URL (see above).
5. Click **[OK]**.
6. Choose 'DM Solutions' from the *Server Connections*  drop-down list.
7. Click **[Connect]**.
8. Wait for the list of layers to be populated.
9. Select the *Parks* layer in the list.
10. Click **[Apply]** to add the layer to the map.

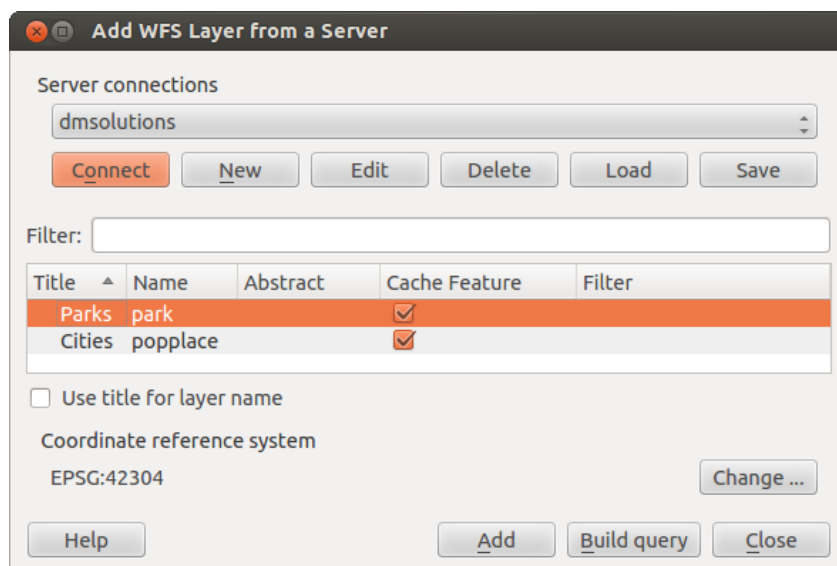
Note that any proxy settings you may have set in your preferences are also recognized.

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 *Pomoc i wsparcie* for further information about the mailing lists.

Wskazówka: Finding WFS Servers

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.



Rysunek 14.4: Adding a WFS layer 

14.2 QGIS as OGC Data Server

QGIS Server is an open source WMS 1.3, WFS 1.0.0 and WCS 1.1.1 implementation that, in addition, implements advanced cartographic features for thematic mapping. The QGIS Server is a FastCGI/CGI (Common Gateway Interface) application written in C++ that works together with a web server (e.g., Apache, Lighttpd). It is funded by the EU projects Orchestra, Sany and the city of Uster in Switzerland.

QGIS Server uses QGIS as back end for the GIS logic and for map rendering. Furthermore, the Qt library is used for graphics and for platform-independent C++ programming. In contrast to other WMS software, the QGIS Server uses cartographic rules as a configuration language, both for the server configuration and for the user-defined cartographic rules.

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.

In one of the following manuals, we will provide a sample configuration to set up a QGIS Server. For now, we recommend to read one of the following URLs to get more information:

- 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/>

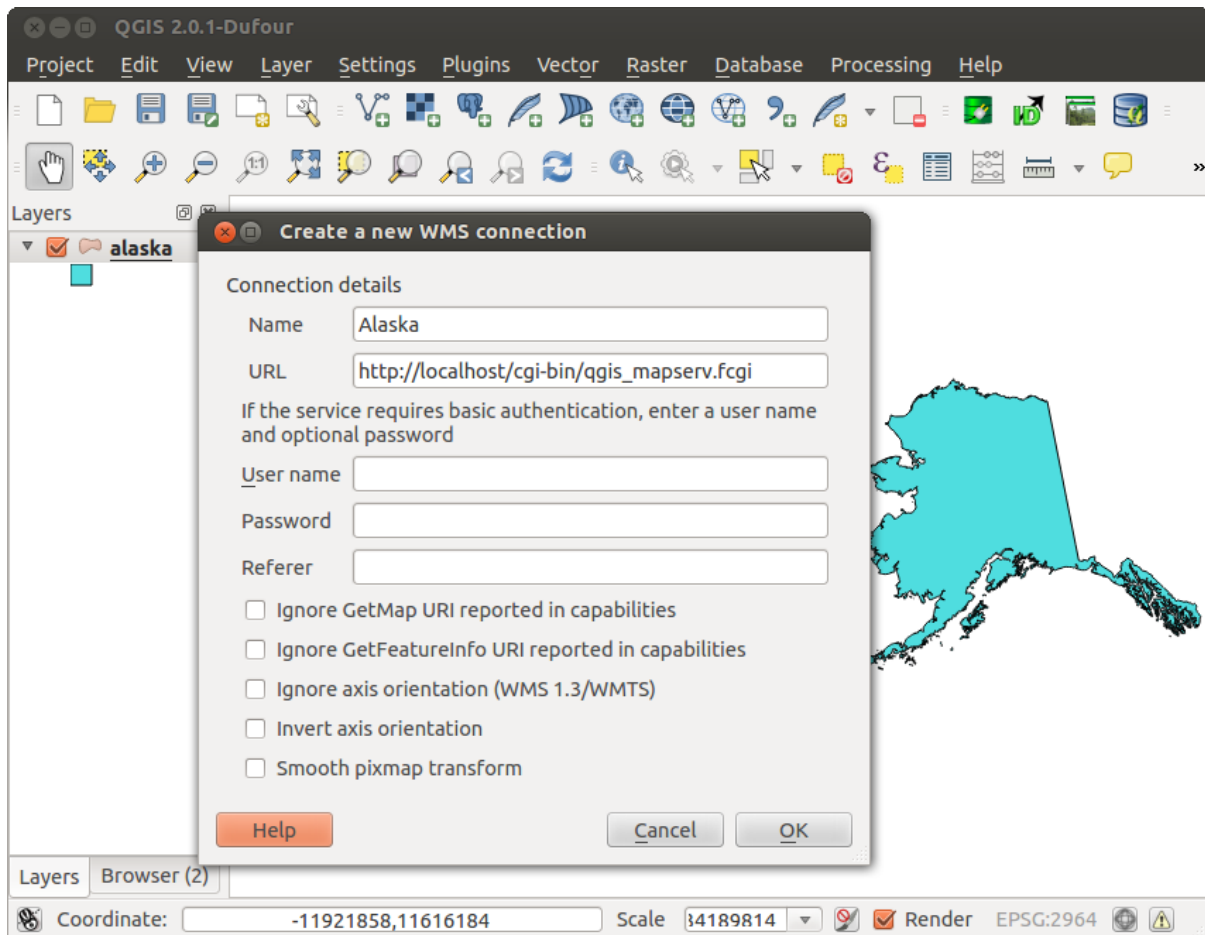
14.2.1 Sample installation on Debian Squeeze

At this point, we will give a short and simple sample installation how-to for Debian Squeeze. Many other OSs provide packages for QGIS Server, too. If you have to build it all from source, please refer to the URLs above.

Apart from QGIS and QGIS Server, you need a web server, in our case apache2. You can install all packages with `aptitude` or `apt-get` install together with other necessary dependency packages. After installation, you should test to confirm that the web server and QGIS Server work as expected. Make sure the apache server is

running with `/etc/init.d/apache2 start`. Open a web browser and type URL: `http://localhost`. If apache is up, you should see the message 'It works!'.

Now we test the QGIS Server installation. The `qgis_mapserv.fcgi` is available at `/usr/lib/cgi-bin/qgis_mapserv.fcgi` and provides a standard WMS that shows the state boundaries of Alaska. Add the WMS with the URL `http://localhost/cgi-bin/qgis_mapserv.fcgi` as described in *Selecting WMS/WMTS Servers*.



Rysunek 14.5: Standard WMS with USA boundaries included in the QGIS Server (KDE) 

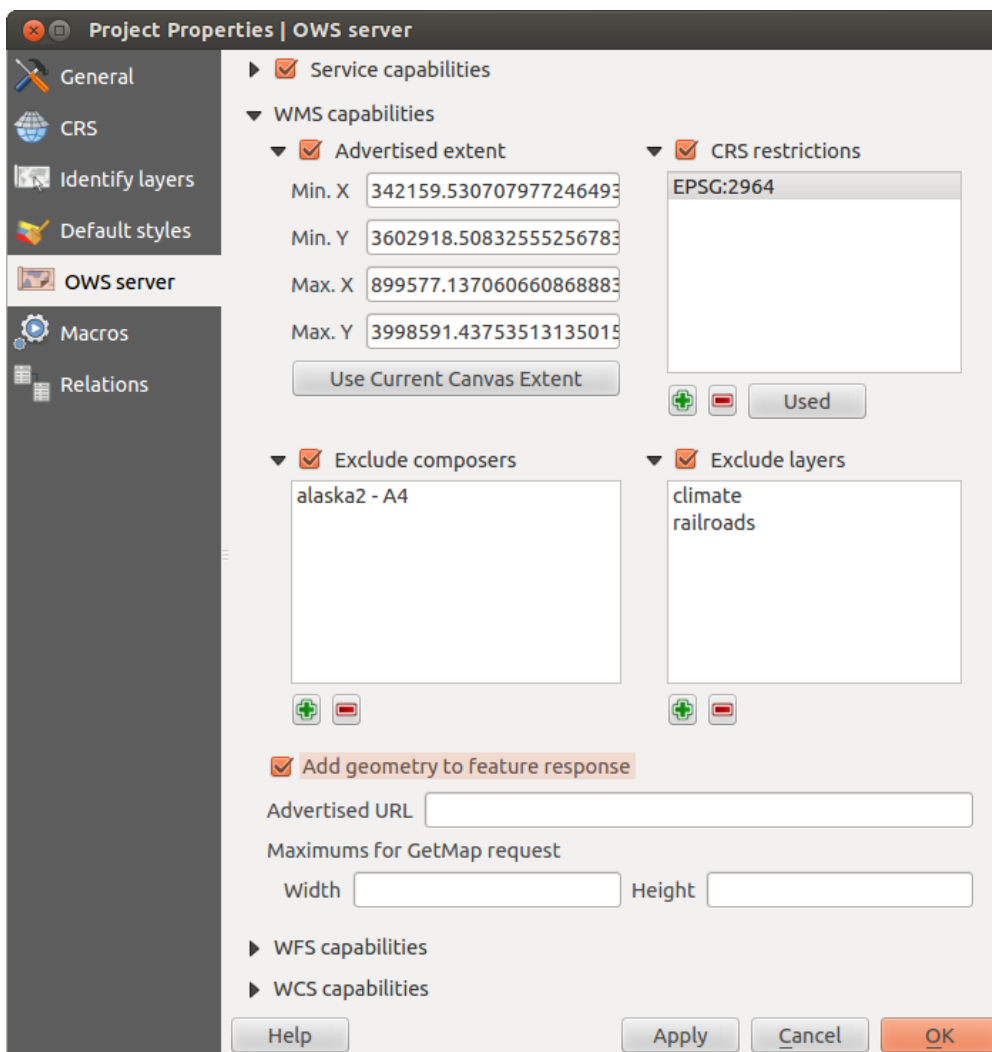
14.2.2 Creating a WMS/WFS/WCS from a QGIS project

To provide a new QGIS Server WMS, WFS or WCS, we have to create a QGIS project file with some data. Here, we use the 'Alaska' shapefile from the QGIS sample dataset. Define the colors and styles of the layers in QGIS and the project CRS, if not already defined.


Then, go to the *OWS Server* menu of the *Project* → *Project Properties* dialog and provide some information about the OWS in the fields under *Service Capabilities*. This will appear in the *GetCapabilities* response of the WMS, WFS or WCS. If you don't check *Service capabilities*, QGIS Server will use the information given in the `wms_metadata.xml` file located in the `cgi-bin` folder.


WMS capabilities


In the *WMS capabilities* section, you can define the extent advertised in the WMS *GetCapabilities* response by entering the minimum and maximum X and Y values in the fields under *Advertised extent*. Clicking *Use Current Canvas Extent* sets these values to the extent currently displayed in the QGIS map canvas. By checking *CRS restrictions*, you can restrict in which coordinate reference systems (CRS) QGIS Server will offer to render maps.



Rysunek 14.6: Definitions for a QGIS Server WMS/WFS/WCS project (KDE)

Use the  button below to select those CRS from the Coordinate Reference System Selector, or click *Used* to add the CRS used in the QGIS project to the list.

If you have print composers defined in your project, they will be listed in the GetCapabilities response, and they can be used by the GetPrint request to create prints, using one of the print composer layouts as a template. This is a QGIS-specific extension to the WMS 1.3.0 specification. If you want to exclude any print composer from being published by the WMS, check *Exclude composers* and click the  button below. Then, select a print composer from the *Select print composer* dialog in order to add it to the excluded composers list.

If you want to exclude any layer or layer group from being published by the WMS, check *Exclude Layers* and click the  button below. This opens the *Select restricted layers and groups* dialog, which allows you to choose the layers and groups that you don't want to be published. Use the *Shift* or *Ctrl* key if you want to select multiple entries at once.

You can receive requested GetFeatureInfo as plain text, XML and GML. Default is XML, text or GML format depends the output format chosen for the GetFeatureInfo request.

If you wish, you can check *Add geometry to feature response*. This will include in the GetFeatureInfo response the geometries of the features in a text format. If you want QGIS Server to advertise specific request URLs in the WMS GetCapabilities response, enter the corresponding URL in the *Advertised URL* field. Furthermore, you can restrict the maximum size of the maps returned by the GetMap request by entering the maximum width and height into the respective fields under *Maximums for GetMap request*.

WFS capabilities

In the *WFS capabilities* area, you can select the layers that you want to publish as WFS, and specify if they will allow the update, insert and delete operations. If you enter a URL in the *Advertised URL* field of the *WFS capabilities* section, QGIS Server will advertise this specific URL in the WFS GetCapabilities response.

WCS capabilities

In the *WCS capabilities* area, you can select the layers that you want to publish as WCS. If you enter a URL in the *Advertised URL* field of the *WCS capabilities* section, QGIS Server will advertise this specific URL in the WCS GetCapabilities response.

Now, save the session in a project file `alaska.qgs`. To provide the project as a WMS/WFS, we create a new folder `/usr/lib/cgi-bin/project` with admin privileges and add the project file `alaska.qgs` and a copy of the `qgis_mapserv.fcgi` file - that's all.

Now we test our project WMS, WFS and WCS. Add the WMS, WFS and WCS as described in [Loading WMS/WMTS Layers](#), [WFS and WFS-T Client](#) and [WCS Client](#) to QGIS and load the data. The URL is:

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

Fine tuning your OWS

For vector layers, the *Fields* menu of the *Layer → Properties* dialog allows you to define for each attribute if it will be published or not. By default, all the attributes are published by your WMS and WFS. If you want a specific attribute not to be published, uncheck the corresponding checkbox in the *WMS* or *WFS* column.

You can overlay watermarks over the maps produced by your WMS by adding text annotations or SVG annotations to the project file. See section Annotation Tools in [Podstawowe narzędzia](#) for instructions on creating annotations. For annotations to be displayed as watermarks on the WMS output, the *Fixed map position* check box in the *Annotation text* dialog must be unchecked. This can be accessed by double clicking the annotation while one of the annotation tools is active. For SVG annotations, you will need either to set the project to save absolute paths (in the *General* menu of the *Project → Project Properties* dialog) or to manually modify the path to the SVG image in a way that it represents a valid relative path.

Extra parameters supported by the WMS GetMap request

In the WMS GetMap request, QGIS Server accepts a couple of extra parameters in addition to the standard parameters according to the OGC WMS 1.3.0 specification:

- **MAP** parameter: Similar to MapServer, the MAP parameter can be used to specify the path to the QGIS project file. You can specify an absolute path or a path relative to the location of the server executable (`qgis_mapserv.fcgi`). If not specified, QGIS Server searches for `.qgs` files in the directory where the server executable is located.

Example:

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

- **DPI** parameter: The DPI parameter can be used to specify the requested output resolution.

Example:

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

- **OPACITIES** parameter: Opacity can be set on layer or group level. Allowed values range from 0 (fully transparent) to 255 (fully opaque).

Example:

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

Working with GPS Data


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.

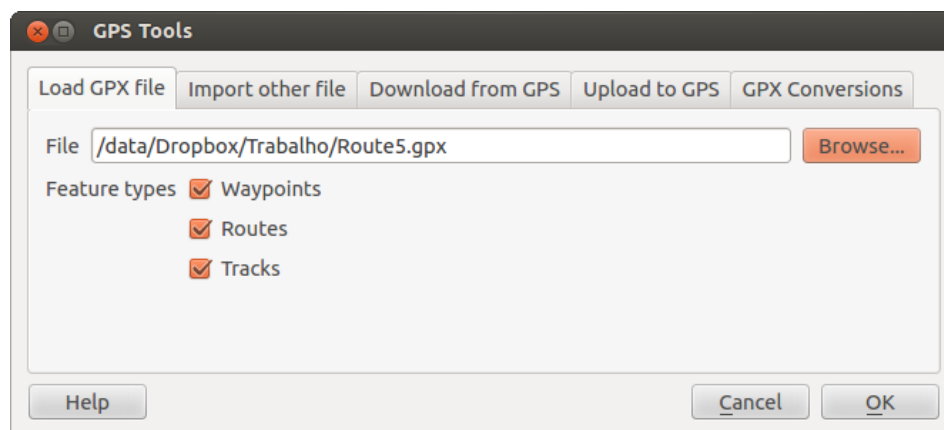
To load a GPX file, you first need to load the plugin. *Plugins* →  *Plugin Manager...* opens the Plugin Manager Dialog. Activate the *GPS Tools* checkbox. When this plugin is loaded, two buttons with a small handheld GPS device will show up in the toolbar:

-  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 *Przykładowe dane* 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.



Rysunek 15.1: The *GPS Tools* dialog window 

Informacja: 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 GPSTools

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 GPSTools, which is available at <http://www.gpsbabel.org>. This program can also transfer GPS data between your computer and a GPS device. QGIS uses GPSTools 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 GPSTools 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.

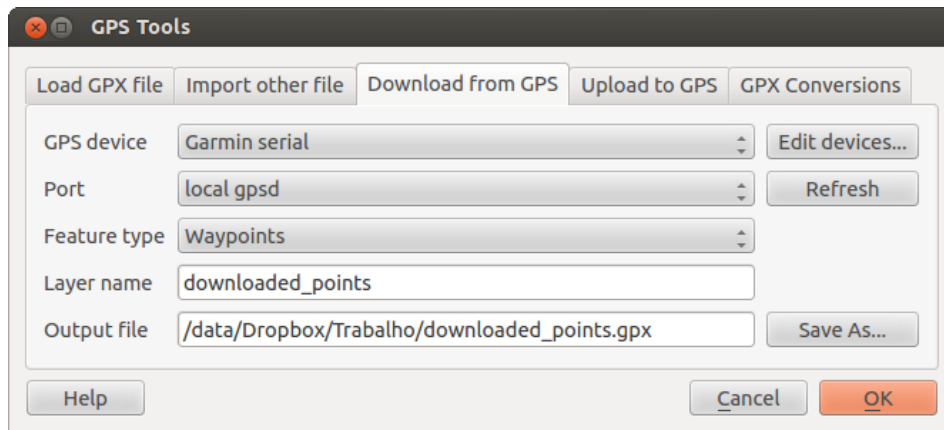
15.1.5 Downloading GPS data from a device

QGIS can use GPSTools 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 GPSTools 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.



Rysunek 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 GPSTools 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 GPSTools 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 GPSTools 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

Informacja: 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 unsuccessfully 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 `GPSTabel` 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 `GPSTabel`

```
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.

Ostrzeżenie: 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

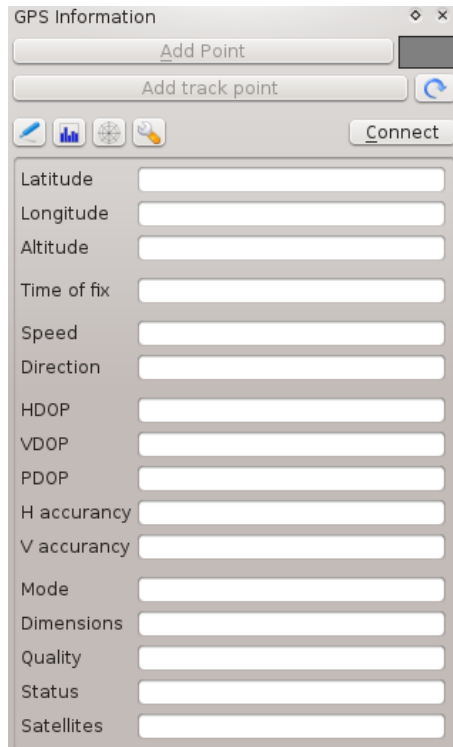
 If the GPS is receiving signals from satellites, you will see your position in latitude, longitude and altitude together with additional attributes.

15.2.2 GPS signal strength

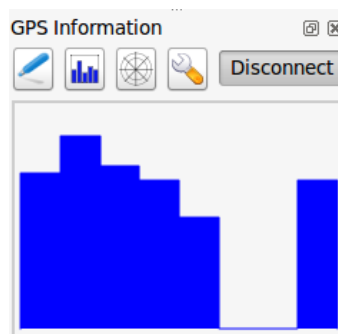
 Here, you can see the signal strength of the satellites you are receiving signals from.

15.2.3 GPS polar window

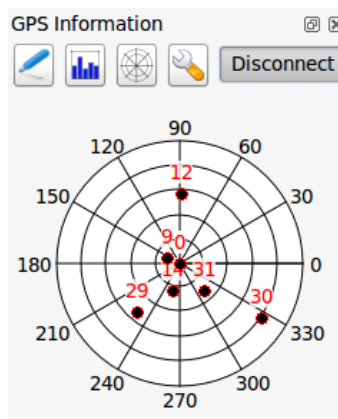
 If you want to know where in the sky all the connected satellites are, you have to switch to the polar screen. You can also see the ID numbers of the satellites you are receiving signals from.



Rysunek 15.3: GPS tracking position and additional attributes 🐧




Rysunek 15.4: GPS tracking signal strength 🐧



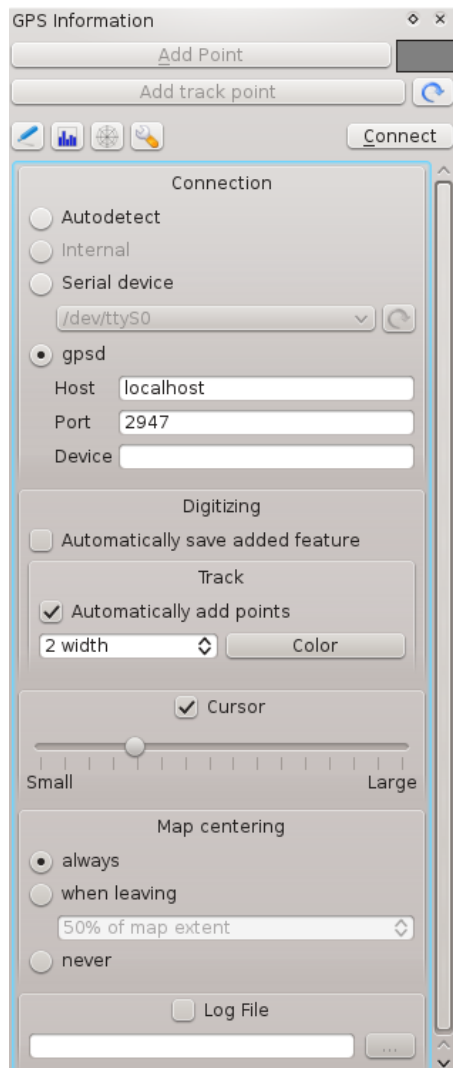
Rysunek 15.5: GPS tracking polar window 🐧

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.





Rysunek 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 authorization 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 [GPSTGate](#).

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 GPST, 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 by 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 GPST (under Linux) or GPSTGate (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 GPSTool 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 GPSTool

```
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 GPSTool

```
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 *Literature and Web References*). 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 *Przykładowe dane*). 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 overlaid 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/>.

Wskazówka: GRASS Data Loading

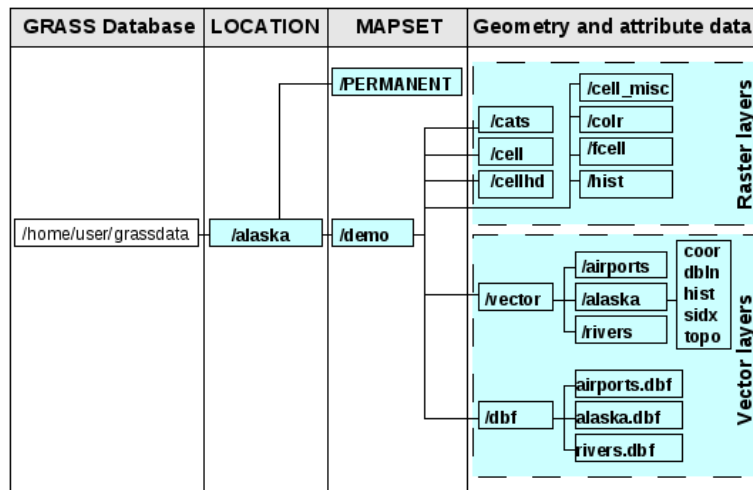
If you have problems loading data or QGIS terminates abnormally, check to make sure you have loaded the GRASS plugin properly as described in section *sec_starting_grass*.

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 *Literature and Web References*). 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`

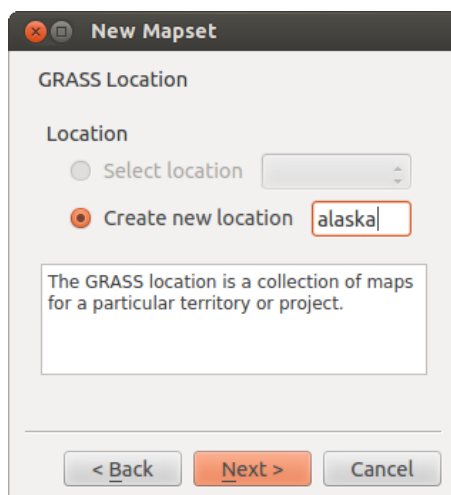


Rysunek 16.1: GRASS data in the alaska LOCATION

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 *Przykładowe dane*).

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 *Przykładowe dane*).
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 *Praca z układami współrzędnych*)).
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 lqgl 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 *Literature and Web References*).
14. Check out the summary to make sure it’s correct and click **[Finish]**.
15. The new *LOCATION*, ‘alaska’, and two *MAPSET*s, ‘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.




Rysunek 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 *Przykładowe dane*, 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 *Literature and Web References*, 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 `test` for the new MAPSET. Below in the wizard, you see a list of existing MAPSETs and corresponding owners.
7. Click [Next], check out the summary to make sure it's all correct and click [Finish].

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 *Przykładowe dane*).

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 **Successfully 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 dsname=/path/to/lakes.gml output=lakes_grass`.
12. When it says **Successfully 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.

Wskazówka: 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*).

Wskazówka: 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.

Wskazówka: 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.



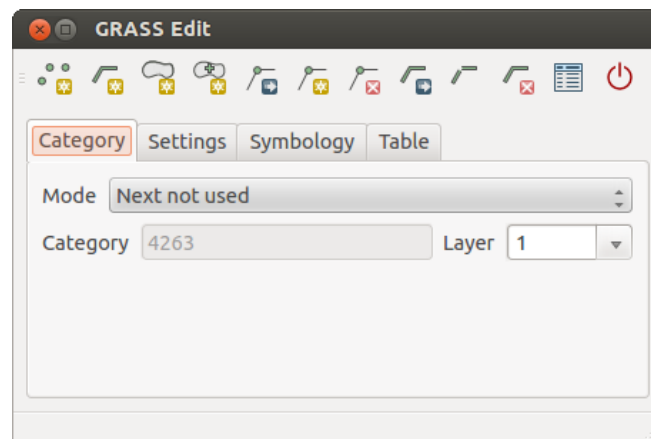
Rysunek 16.3: GRASS Digitizing Toolbar

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.



Rysunek 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.

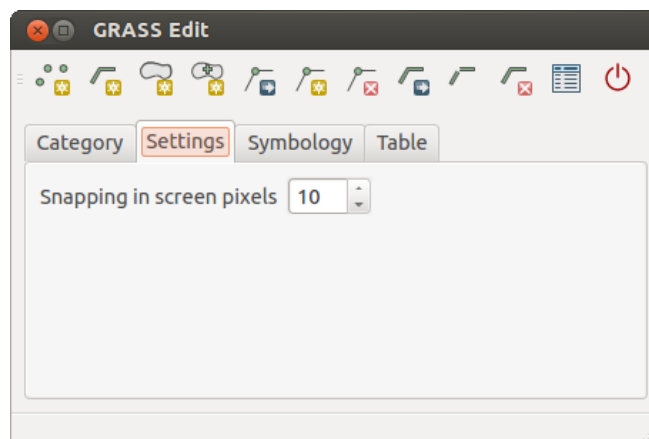
- **Field (layer)** - Each geometry element can be connected with several attribute tables using different GRASS geometry layers. The default layer number is 1.

Wskazówka: Creating an additional GRASS ‘layer’ with lqgl

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

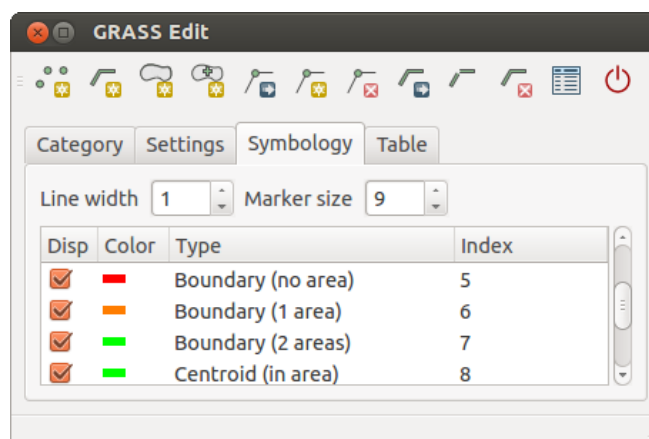
The *Settings* tab allows you to set the snapping in screen pixels. The threshold defines at what distance new points or line ends are snapped to existing nodes. This helps to prevent gaps or dangles between boundaries. The default is set to 10 pixels.



Rysunek 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).

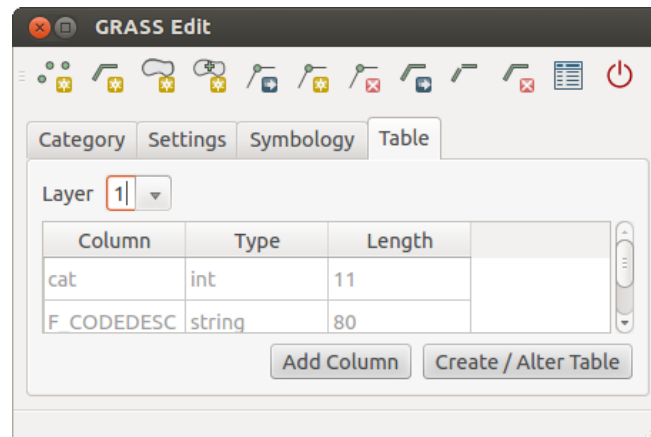


Rysunek 16.6: GRASS Digitizing Symbology Tab

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*).

Wskazówka: GRASS Edit Permissions





Rysunek 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].

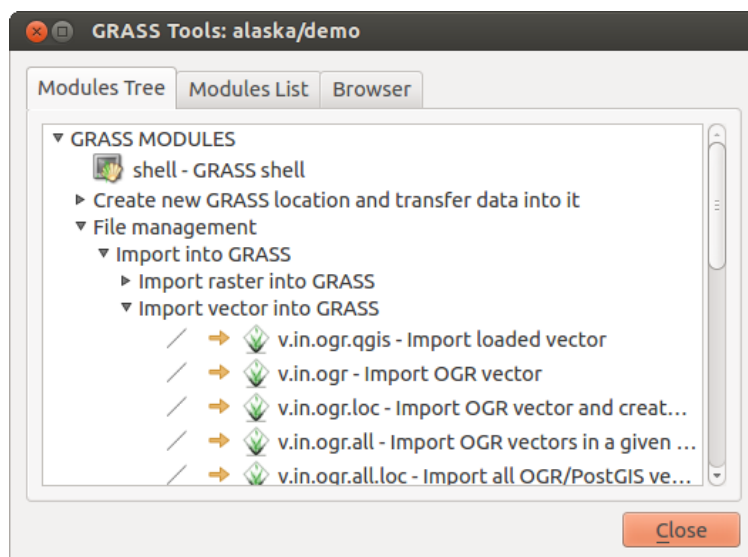
The GRASS module `g.region` provides a lot more parameters to define an appropriate region extent and resolution for your raster analysis. You can use these parameters with the GRASS Toolbox, described in section [The GRASS Toolbox](#).

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.



Rysunek 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

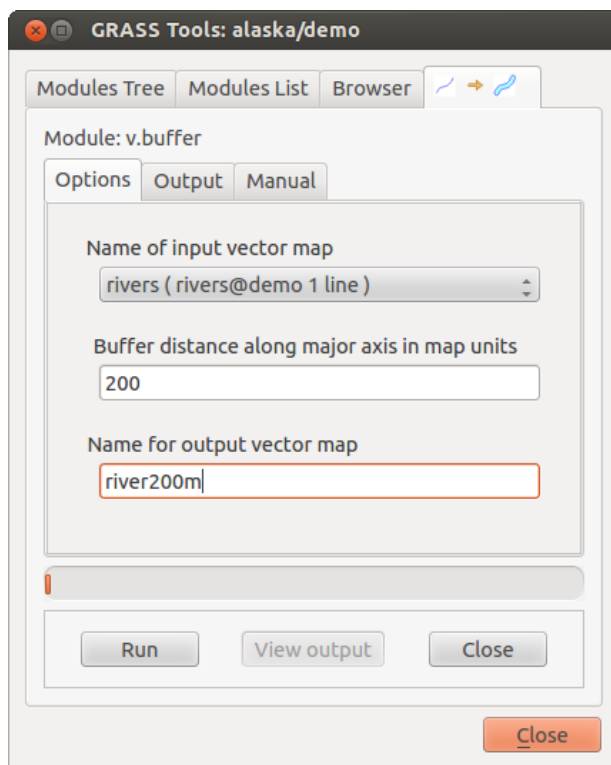
The *Output* tab provides information about the output status of the module. When you click the **[Run]** button, the module switches to the *Output* tab and you see information about the analysis process. If all works well, you will finally see a `Successfully finished` message.

Manual

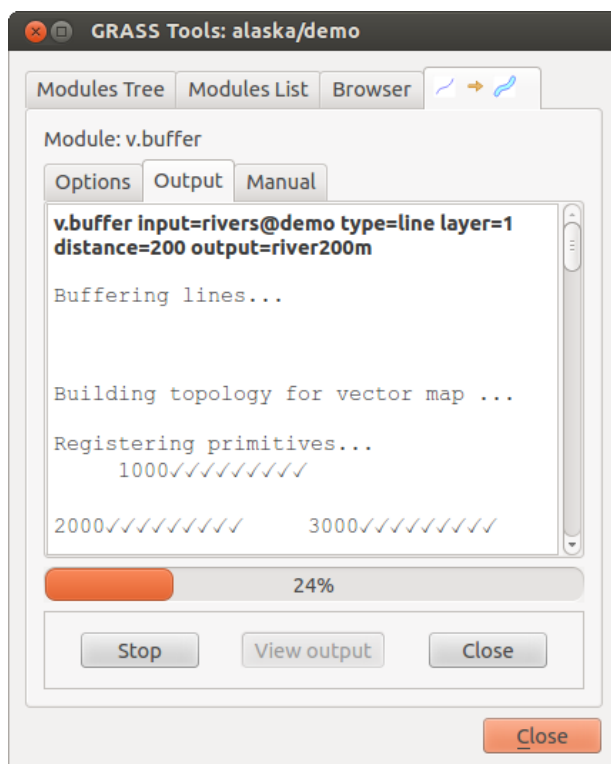
The *Manual* tab shows the HTML help page of the GRASS module. You can use it to check further module parameters and flags or to get a deeper knowledge about the purpose of the module. At the end of each module manual page, you see further links to the `Main Help index`, the `Thematic index` and the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

Wskazówka: Display results immediately

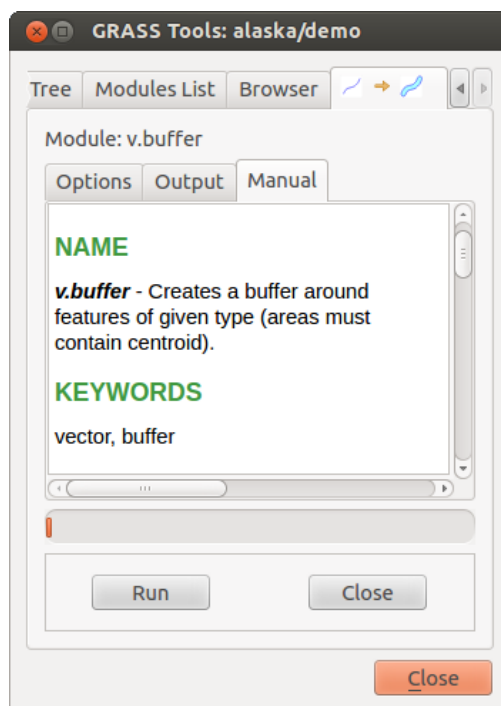
If you want to display your calculation results immediately in your map canvas, you can use the ‘View Output’ button at the bottom of the module tab.



Rysunek 16.9: GRASS Toolbox Module Options 



Rysunek 16.10: GRASS Toolbox Module Output 






Rysunek 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* 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

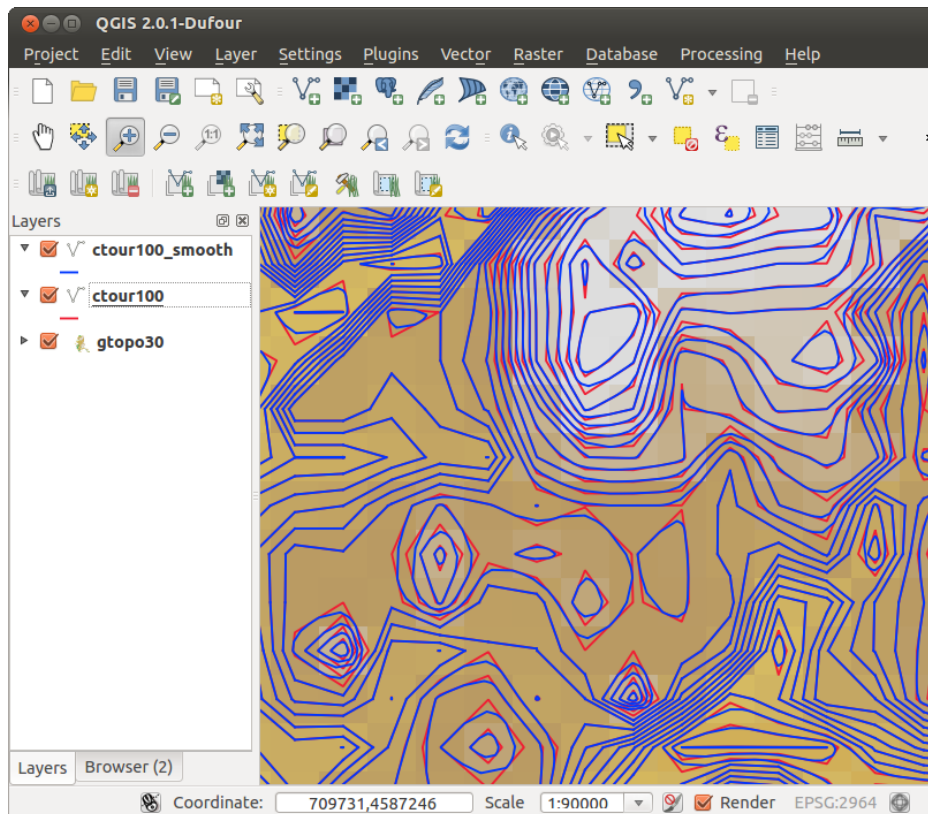
their overall shape. The tool uses several different algorithms with different purposes. Some of the algorithms (i.e., Douglas Peucker and Vertex Reduction) simplify the line by removing some of the vertices. The resulting vector will load faster. This process is useful when you have a highly detailed vector, but you are creating a very small-scale map, so the detail is unnecessary.

Wskazówka: The simplify tool

Note that the QGIS fTools plugin has a *Simplify geometries* → tool that works just like the GRASS **v.generalize** Douglas-Peucker 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.



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

Wskazówka: 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* 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.

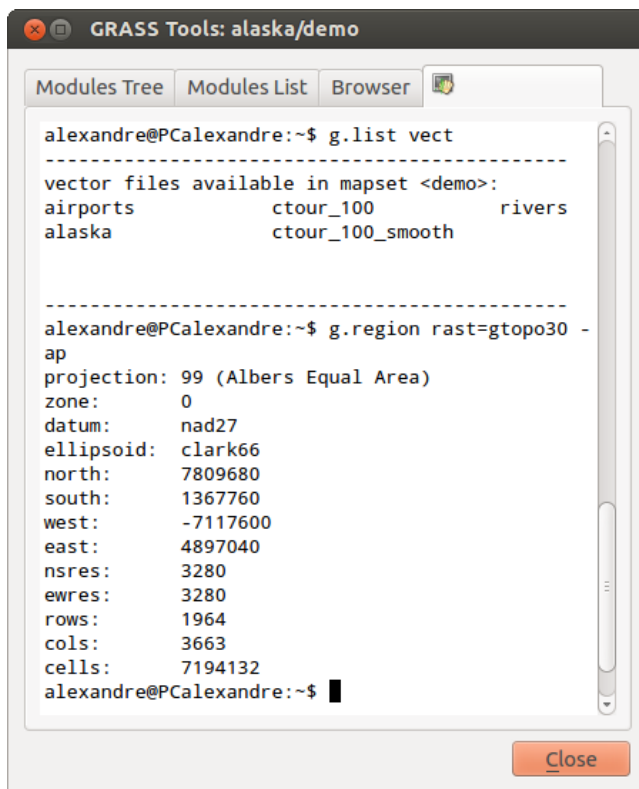
The module **r.shaded.relief** can take a parameter `zmult`, which multiplies the elevation values relative to the X-Y coordinate units so that the hillshade effect is even more pronounced.

- 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.

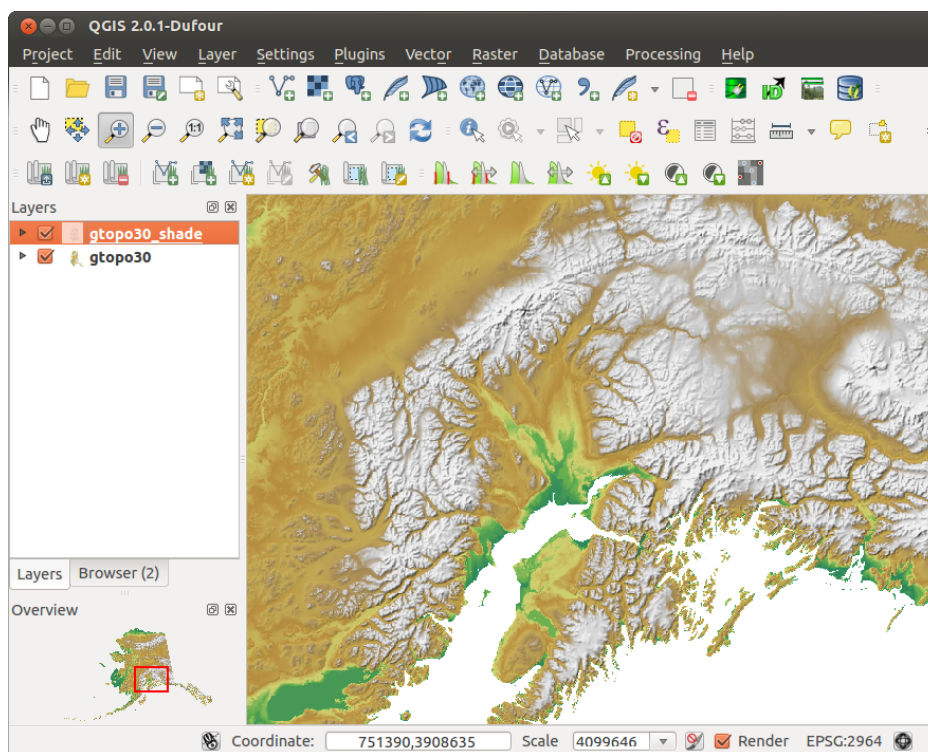
Raster statistics in a vector map

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).



Rysunek 16.13: The GRASS shell, r.shaded.relief module 🐧



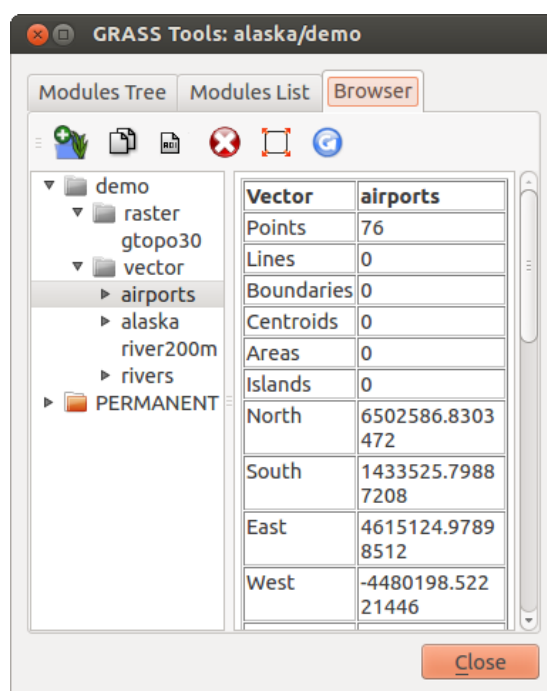
Rysunek 16.14: Displaying shaded relief created with the GRASS module r.shaded.relief 🐧

- 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).





Rysunek 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.

QGIS processing framework

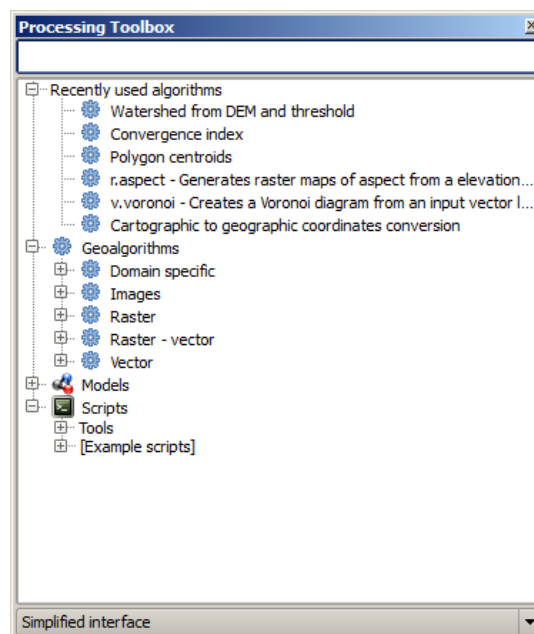
17.1 Introduction

This chapter introduces the QGIS processing framework, a geoprocessing environment that can be used to call native and third-party algorithms from QGIS, making your spatial analysis tasks more productive and easy to accomplish.

In the following sections, we will review how to use the graphical elements of this framework and make the most out of each one of them.

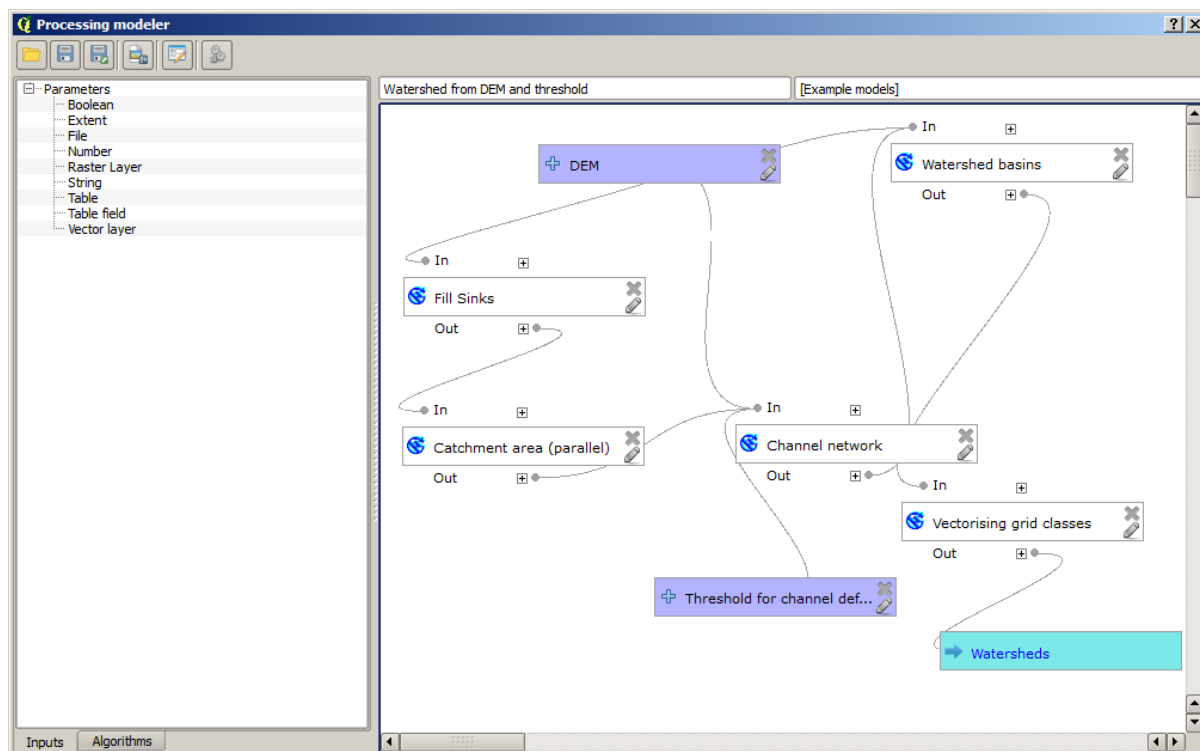
There are four basic elements in the framework GUI, which are used to run algorithms for different purposes. Choosing one tool or another will depend on the kind of analysis that is to be performed and the particular characteristics of each user and project. All of them (except for the batch processing interface, which is called from the toolbox, as we will see) can be accessed from the *Processing* menu item. (You will see more than four entries. The remaining ones are not used to execute algorithms and will be explained later in this chapter.)

- The toolbox. The main element of the GUI, it is used to execute a single algorithm or run a batch process based on that algorithm.



Rysunek 17.1: Processing Toolbox 

- The graphical modeler. Several algorithms can be combined graphically using the modeler to define a workflow, creating a single process that involves several subprocesses.



Rysunek 17.2: Processing Modeler

- The history manager. All actions performed using any of the aforementioned elements are stored in a history file and can be later easily reproduced using the history manager.
- The batch processing interface. This interface allows you to execute batch processes and automate the execution of a single algorithm on multiple datasets.

In the following sections, we will review each one of these elements in detail.

17.2 The toolbox

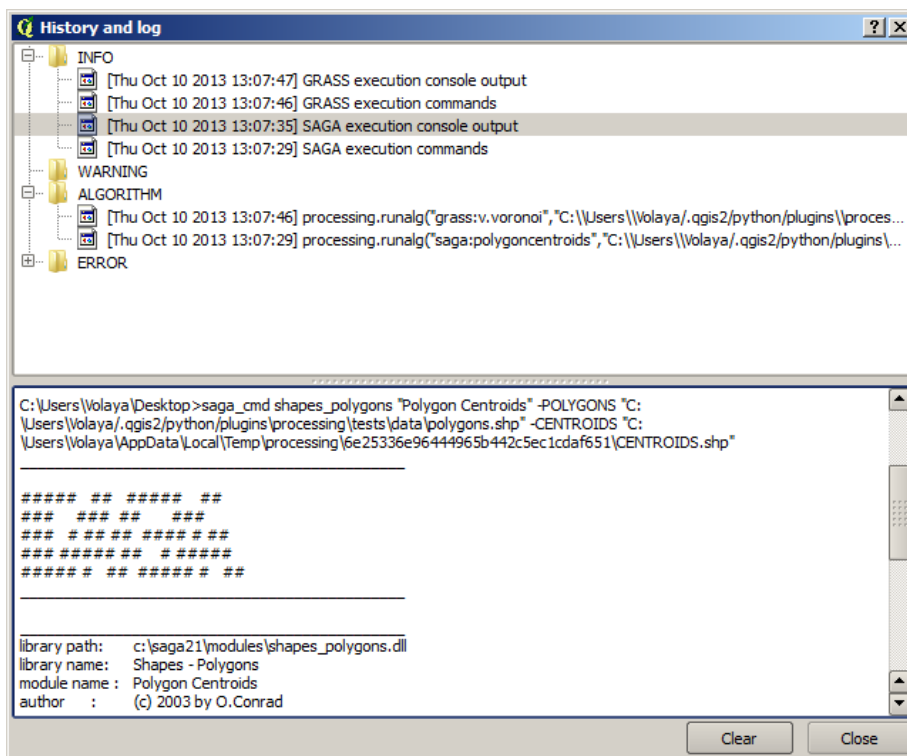
The *Toolbox* is the main element of the processing GUI, and the one that you are more likely to use in your daily work. It shows the list of all available algorithms grouped in different blocks, and it is the access point to run them, whether as a single process or as a batch process involving several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

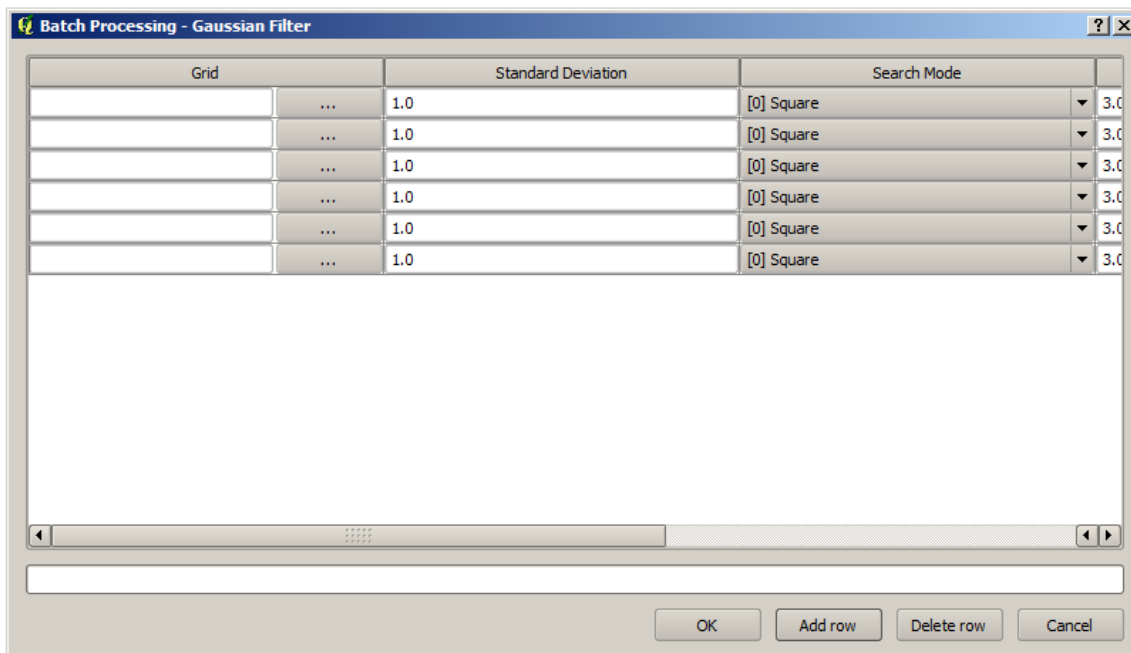
Additionally, two more entries are found, namely *Models* and *Scripts*. These include user-created algorithms, and they allow you to define your own workflows and processing tasks. We will devote a full section to them a bit later.

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.

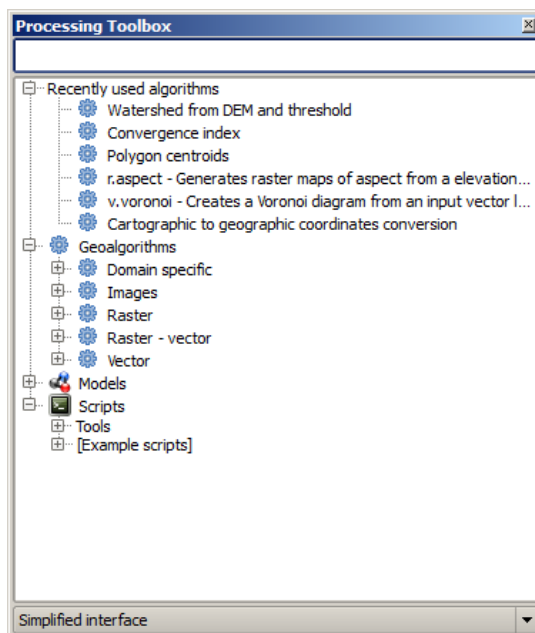
In the lower part, you will find a box that allows you to switch between the simplified algorithm list (the one explained above) and the advanced list. If you change to the advanced mode, the toolbox will look like this:



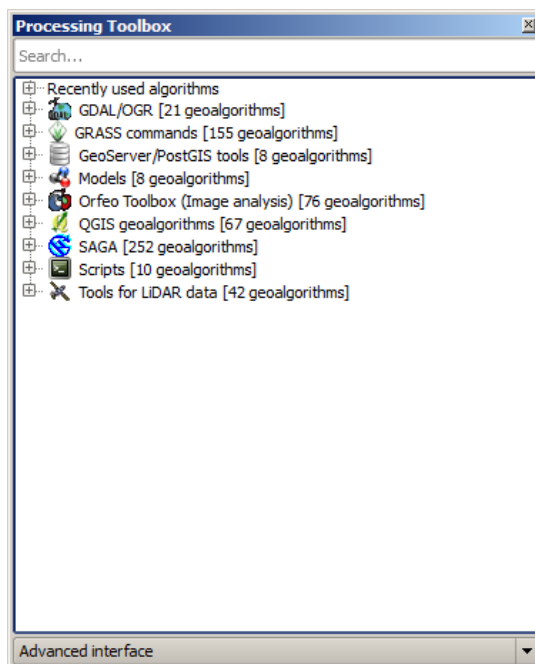
Rysunek 17.3: Processing History



Rysunek 17.4: Batch Processing interface



Rysunek 17.5: Processing Toolbox



Rysunek 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

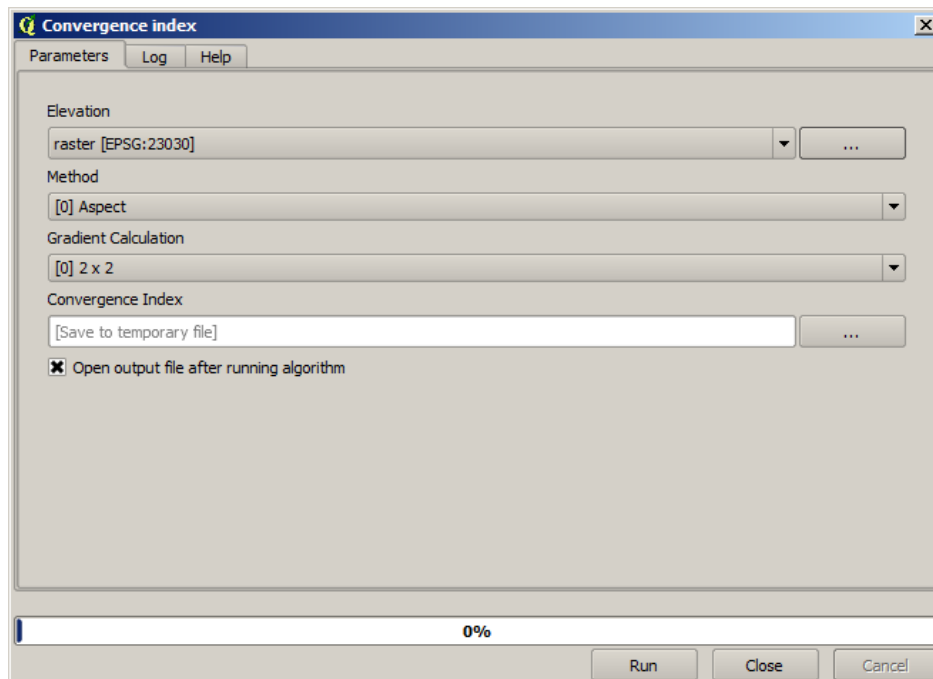
In the case of running QGIS under Windows, these algorithms are fully-functional in a fresh installation of QGIS, and they can be run without requiring any additional installation. Also, running them requires no prior knowledge of the external applications they use, making them more accessible for first-time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



Rysunek 17.7: Parameters Dialog

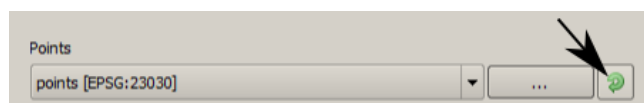
This dialog is used to set the input values that the algorithm needs to be executed. It shows a table where input values and configuration parameters are to be set. It of course has a different content, depending on the require-

ments 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.

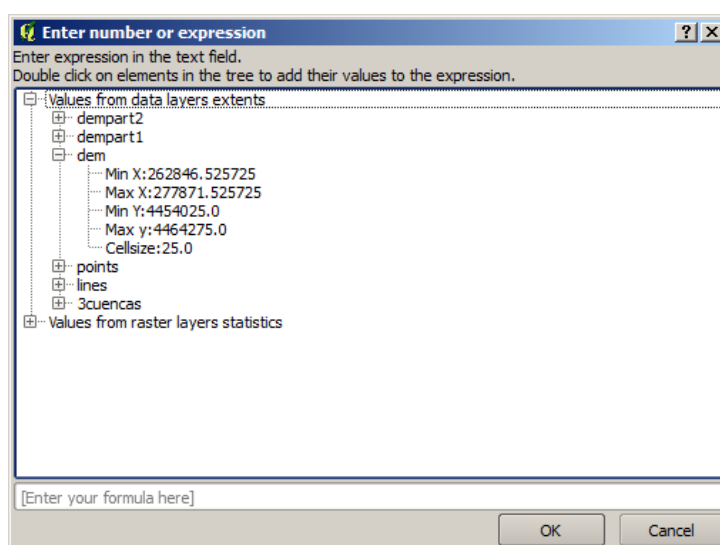
You will see a button by each vector layer selector, as shown in the figure below.



Rysunek 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.




Rysunek 17.9: Number Selector

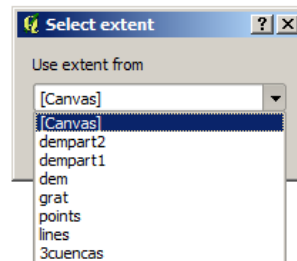
- A range, with min and max values to be introduced in two text boxes.


- 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 x_{min} , x_{max} , y_{min} , y_{max} 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.



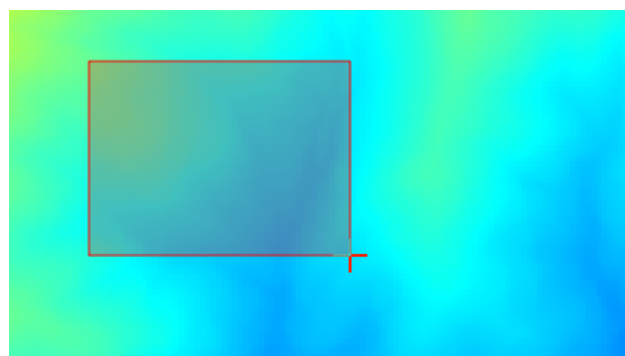
Rysunek 17.10: Extent selector 


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



Rysunek 17.11: Extent List 

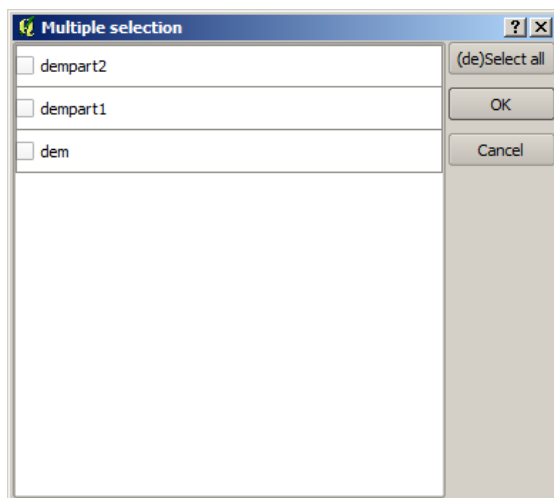
If you select the second one, the parameters window will hide itself, so you can click and drag onto the canvas. Once you have defined the selected rectangle, the dialog will reappear, containing the values in the extent text box.



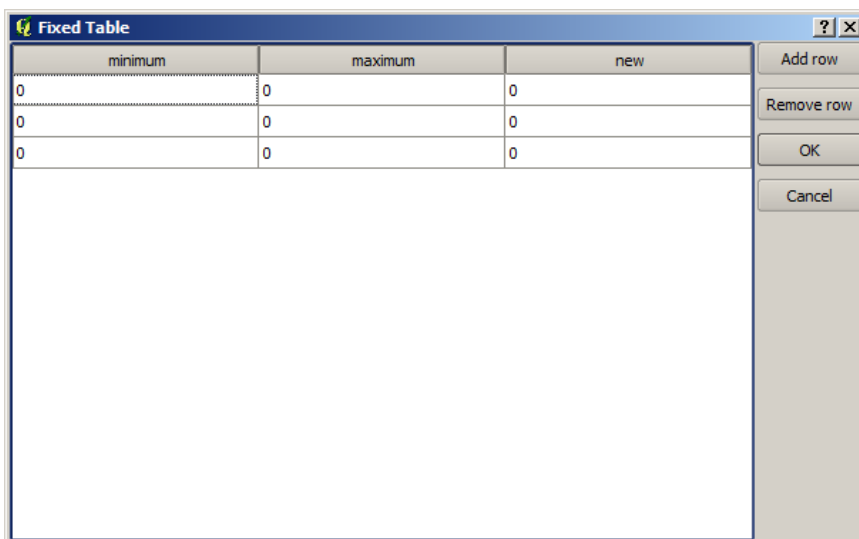
Rysunek 17.12: Extent Drag 

- 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.



Rysunek 17.13: Multiple Selection



Rysunek 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 analyzed. 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 future.

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.

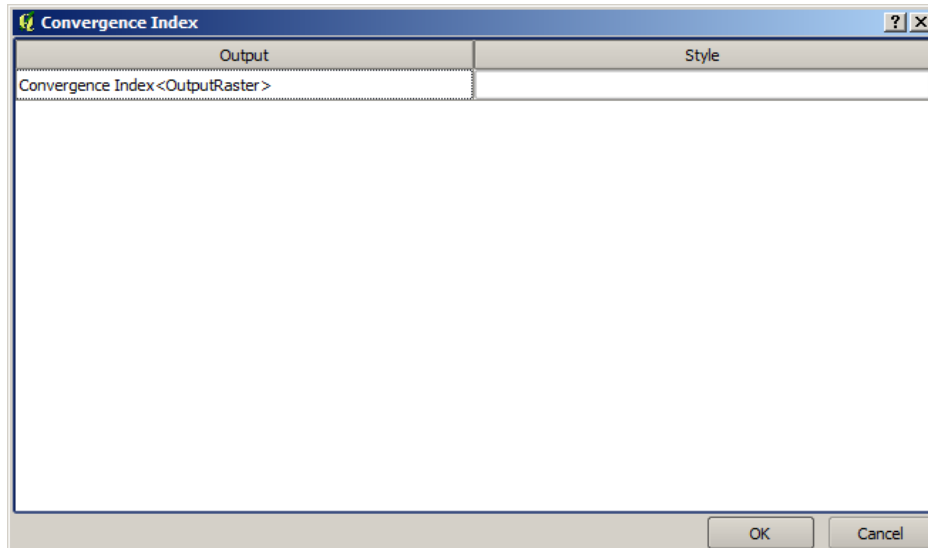
Along with the aforementioned *Output folder* entry, the *General* block contains parameters for setting the default rendering style for output layers (that is, layers generated by using algorithms from any of the framework GUI components). Just create the style you want using QGIS, save it to a file,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



Rysunek 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.

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.

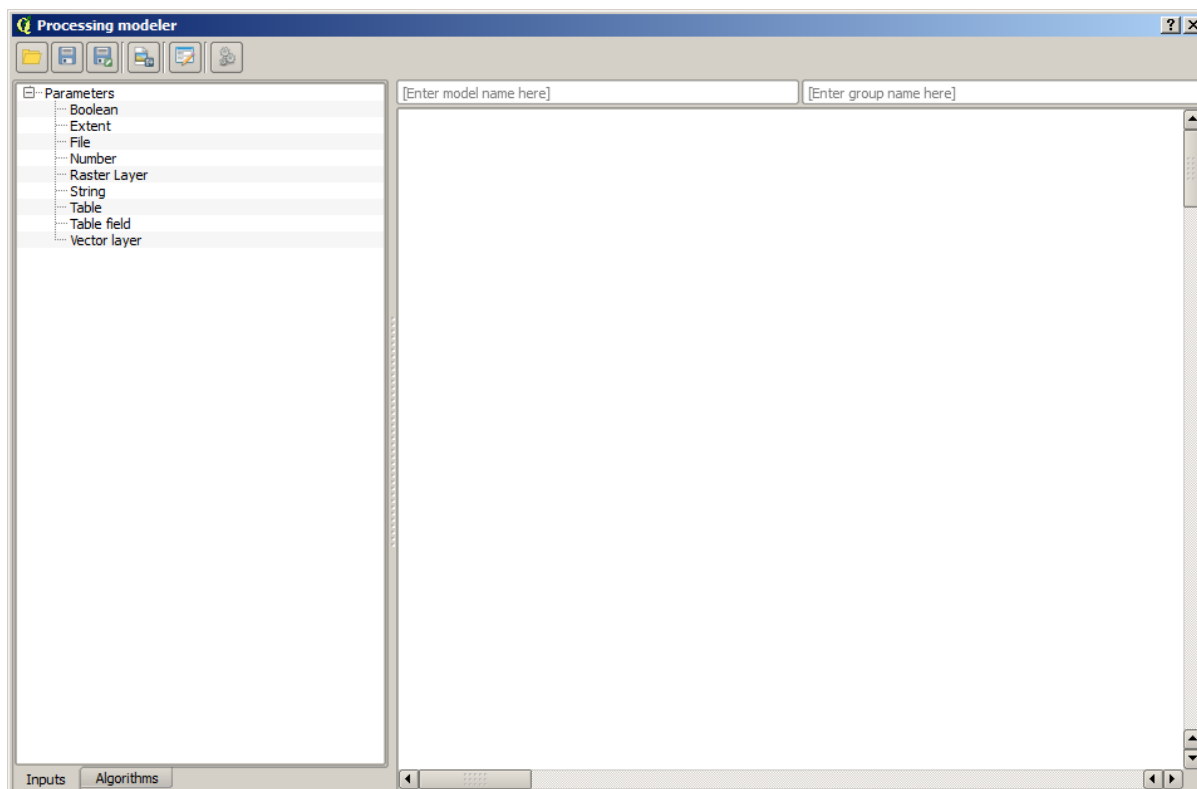
Creating a model involves two steps:


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



Rysunek 17.16: Modeler 

- Vector layer
- String
- Table field
- Table
- Extent
- Number
- Boolean
- File

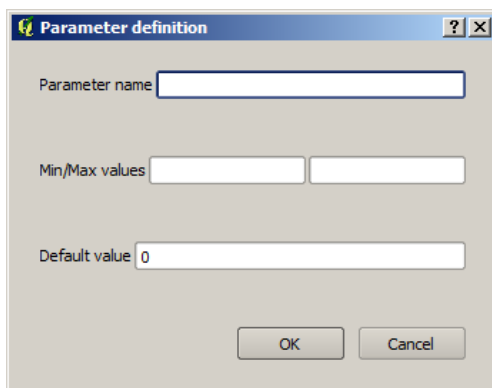
Double-clicking on any of these elements, a dialog is shown to define its characteristics. Depending on the parameter itself, the dialog may contain just one basic element (the description, which is what the user will see when executing the model) or more of them. For instance, when adding a numerical 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.

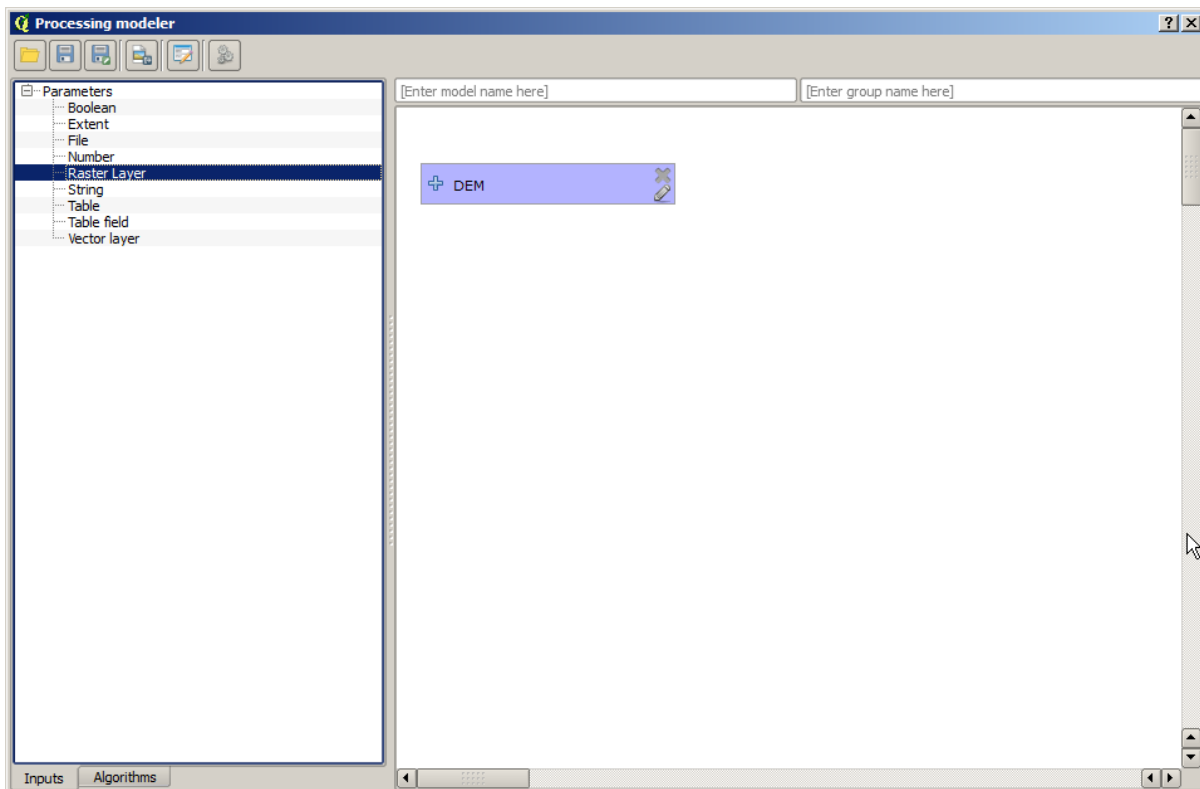
The appearance of the toolbox has two modes here as well: simplified and advanced. However, there is no element to switch between views in the modeler, so you have to do it in the toolbox. The mode that is selected in the toolbox is the one that will be used for the list of algorithms in the modeler.



Rysunek 17.17: Model Parameters

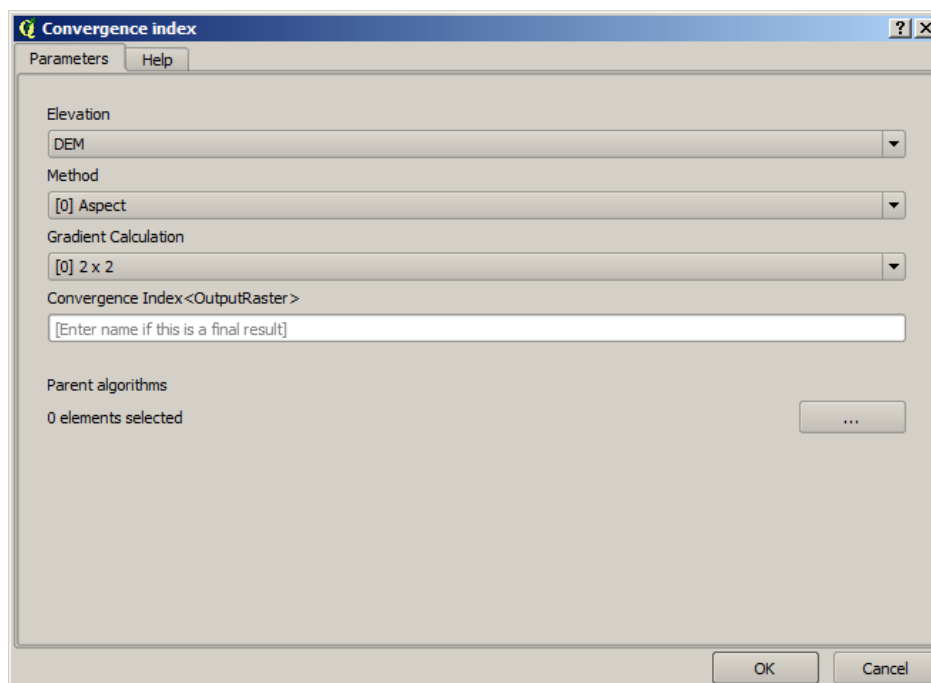


Rysunek 17.18: Model Parameters



Rysunek 17.19: Model Parameters

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 shown next corresponds to the SAGA ‘Convergence index’ algorithm, the same example we saw in the section dedicated to the toolbox.



Rysunek 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.

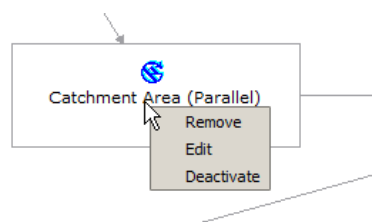
Models loaded from the `models` folder appear not only in the toolbox, but also in the algorithms tree in the *Algorithms* tab of the modeler window. That means that you can incorporate a model as a part of a bigger model, just as you add any other algorithm.

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.

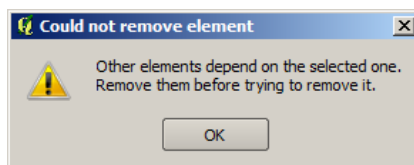
If you right-click on an algorithm in the canvas representing the model, you will see a context menu like the one shown next:




Rysunek 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:



Rysunek 17.22: Cannot Delete Algorithm 

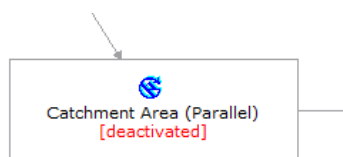
Selecting the *Edit* option or simply double-clicking on the algorithm icon will show the parameters dialog of the algorithm, so you can change the inputs and parameter values. Not all input elements available in the model will appear in this case as available inputs. Layers or values generated at a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



Rysunek 17.23: Deactivate 

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

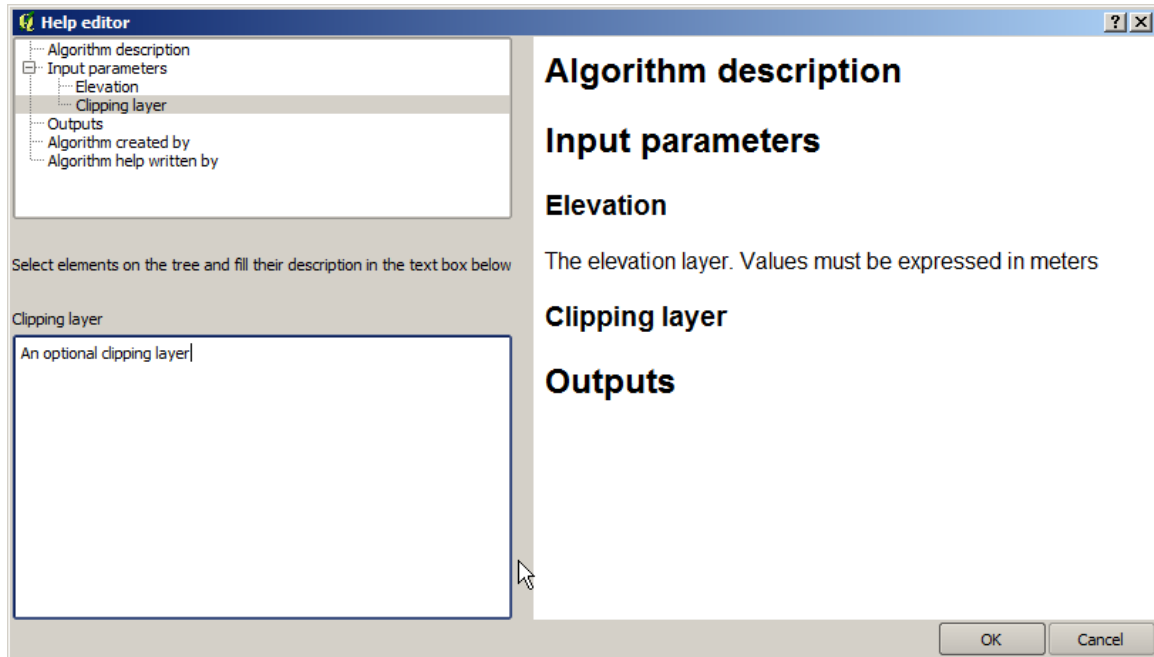
To activate an algorithm, just right-click on its icon and select the *Activate* option.


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.



Rysunek 17.24: Help Edition 

17.3.7 About available algorithms

You might notice that some algorithms that can be executed from the toolbox do not appear in the list of available algorithms when you are designing a model. To be included in a model, an algorithm must have 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.

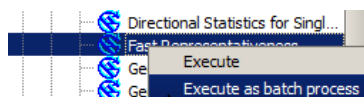
Save your model in the `models` folder and go to the toolbox, where it should appear now, ready to be run. Right-click on the model name and select *Save as Python script* in the context menu that will pop up. A dialog will prompt you to introduce the file where you want to save the script.

17.4 The batch processing interface

17.4.1 Introduction

All algorithms (including models) can be executed as a batch process. That is, they can be executed using not just a single set of inputs, but several of them, executing the algorithm as many times as needed. This is useful when processing large amounts of data, since it is not necessary to launch the algorithm many times from the toolbox.

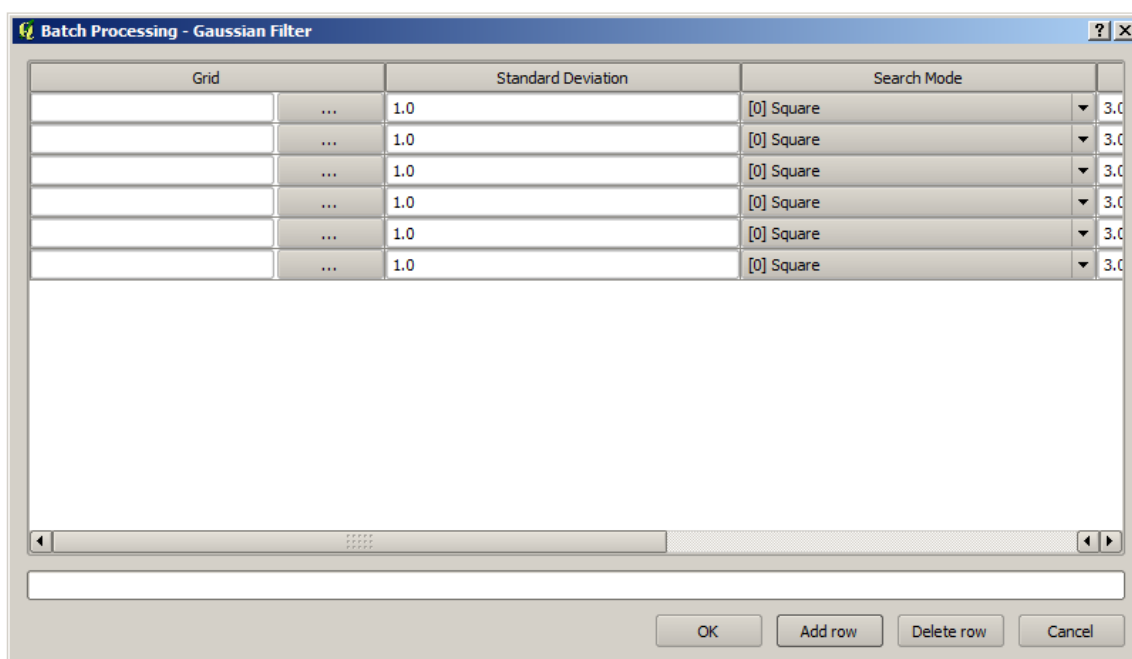
To execute an algorithm as a batch process, right-click on its name in the toolbox and select the *Execute as batch process* option in the pop-up menu that will appear.



Rysunek 17.25: Batch Processing Right Click

17.4.2 The parameters table

Executing a batch process is similar to performing a single execution of an algorithm. Parameter values have to be defined, but in this case we need not just a single value for each parameter, but a set of them instead, one for each time the algorithm has to be executed. Values are introduced using a table like the one shown next.



Rysunek 17.26: Batch Processing

Each line of this table represents a single execution of the algorithm, and each cell contains the value of one of the parameters. It is similar to the parameters dialog that you see when executing an algorithm from the toolbox, but with a different arrangement.


By default, the table contains just two rows. You can add or remove rows using the buttons on the lower part of the window.

Once the size of the table has been set, it has to be filled with the desired values.

17.4.3 Filling the parameters table

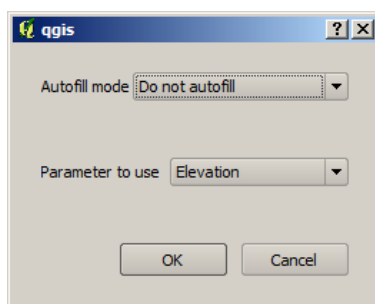
For most parameters, setting the value is trivial. Just type the value or select it from the list of available options, depending on the parameter type.

The main differences are found for parameters representing layers or tables, and for output file paths. Regarding input layers and tables, when an algorithm is executed as part of a batch process, those input data objects are taken directly from files, and not from the set of them already opened in QGIS. For this reason, any algorithm can be executed as a batch process, even if no data objects at all are opened and the algorithm cannot be run from the toolbox.

Filenames for input data objects are introduced directly typing or, more conveniently, clicking on the  button on the right hand of the cell, which shows a typical file chooser dialog. Multiple files can be selected at once. If the input parameter represents a single data object and several files are selected, each one of them will be put in a separate row, adding new ones if needed. If the parameter represents a multiple input, all the selected files will be added to a single cell, separated by semicolons (;).

Output data objects are always saved to a file and, unlike when executing an algorithm from the toolbox, saving to a temporary file is not permitted. You can type the name directly or use the file chooser dialog that appears when clicking on the accompanying button.

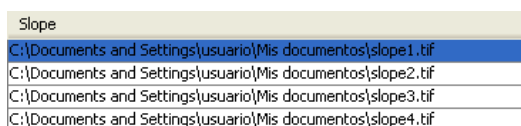
Once you select the file, a new dialog is shown to allow for autocompletion of other cells in the same column (same parameter).



Rysunek 17.27: Batch Processing Save

If the default value ('Do not autocomplete') is selected, it will just put the selected filename in the selected cell from the parameters table. If any of the other options is selected, all the cells below the selected one will be automatically filled based on a defined criteria. This way, it is much easier to fill the table, and the batch process can be defined with less effort.

Automatic filling can be done by simply adding correlative numbers to the selected file path, or by appending the value of another field at the same row. This is particularly useful for naming output data objects according to input ones.



Rysunek 17.28: Batch Processing File Path 

17.4.4 Executing the batch process

To execute the batch process once you have introduced all the necessary values, just click on [OK]. Progress of the global batch task will be shown in the progress bar in the lower part of the dialog.

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 processing console in QGIS, but all processing commands are available instead from the QGIS built-in Python console. That means that you can incorporate those commands into your console work and connect processing algorithms to all the other features (including methods from the QGIS API) available from there.

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.algslist()
```

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 Threshold 1----->saga:averagewiththreshold1
Average With Threshold 2----->saga:averagewiththreshold2
Average With Threshold 3----->saga:averagewiththreshold3
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 `algslist("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:sloplength
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 `algorithms()` command, as shown in the following example:

```
>>> processing.algorithms("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.

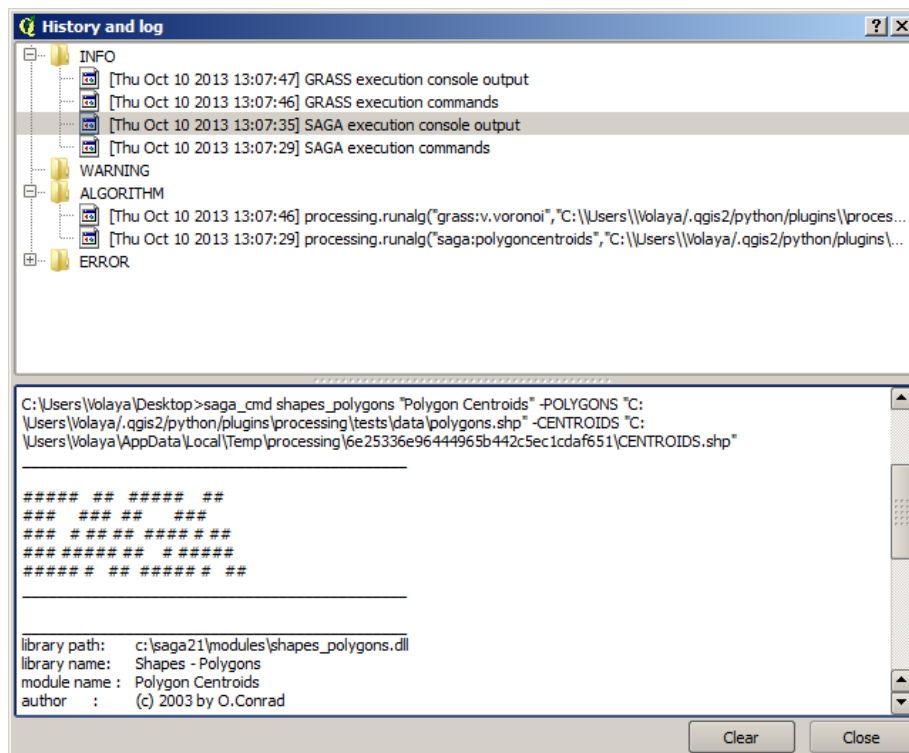
17.6 The history manager


17.6.1 The processing history

Every time you execute an algorithm, information about the process is stored in the history manager. Along with the parameters used, the date and time of the execution are also saved.

This way, it is easy to track and control all the work that has been developed using the processing framework, and easily reproduce it.

The history manager is a set of registry entries grouped according to their date of execution, making it easier to find information about an algorithm executed at any particular moment.



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Process information is kept as a command-line expression, even if the algorithm was launched from the toolbox. This makes it also useful for those learning how to use the command-line interface, since they can call an algorithm using the toolbox and then check the history manager to see how that same algorithm could be called from the command line.

Apart from browsing the entries in the registry, you can also re-execute processes by simply double-clicking on the corresponding entry.

Along with recording algorithm executions, the processing framework communicates with the user by means of the other groups of the registry, namely *Errors*, *Warnings* and *Information*. In case something is not working properly, having a look at the *Errors* might help you to see what is happening. If you get in contact with a

developer to report a bug or error, the information in that group will be very useful for her or him to find out what is going wrong.

Third-party algorithms are usually executed by calling their command-line interfaces, which communicate with the user via the console. Although that console is not shown, a full dump of it is stored in the *Information* group each time you run one of those algorithms. If, for instance, you are having problems executing a SAGA algorithm, look for an entry named 'SAGA execution console output' to check all the messages generated by SAGA and try to find out where the problem is.

Some algorithms, even if they can produce a result with the given input data, might add comments or additional information to the *Warning* block if they detect potential problems with the data, in order to warn you. Make sure you check those messages if you are having unexpected results.

.

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 application 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 accessing 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 `##userreadgdal`.

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 `polyg` 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. If you have used it, layers are saved using the `writeGDAL()` method. If not, the `writeRaster()` method from the `raster` package will be used.

If you have used the `#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.

Informacja: `rgdal` and `mapproj` 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. Additionally, 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 running 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
```

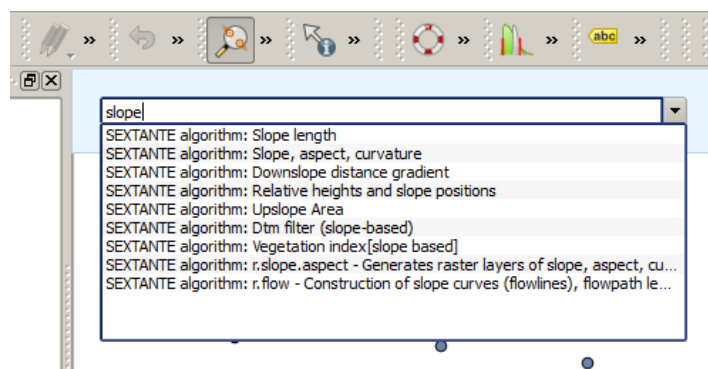
Finally, to install TauDEM into `/usr/local/bin`, run

```
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.



Rysunek 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.

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		Zoom to specific region
	Pan		Move content within an item
	Select/Move item in print composition		Add image to print composition
	Add new map from QGIS map canvas		Add new legend to print composition
	Add label to print composition		Add basic shape to print composition
	Add scale bar to print composition		Add attribute table to print composition
	Add arrow to print composition		Ungroup items of print composition
	Add an HTML frame		Unlock All items
	Group items of print composition		Lower selected items
	Lock Selected Items		Move selected items to bottom
	Raise selected items		Align selected items right
	Move selected items to top		Align selected items center vertical
	Align selected items left		Align selected items bottom
	Align selected items center		First Feature
	Align selected items top		Next Feature
	Preview Atlas		Print Atlas
	Previous Feature		Atlas Settings
	Last feature		
	Export Atlas as Image		

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

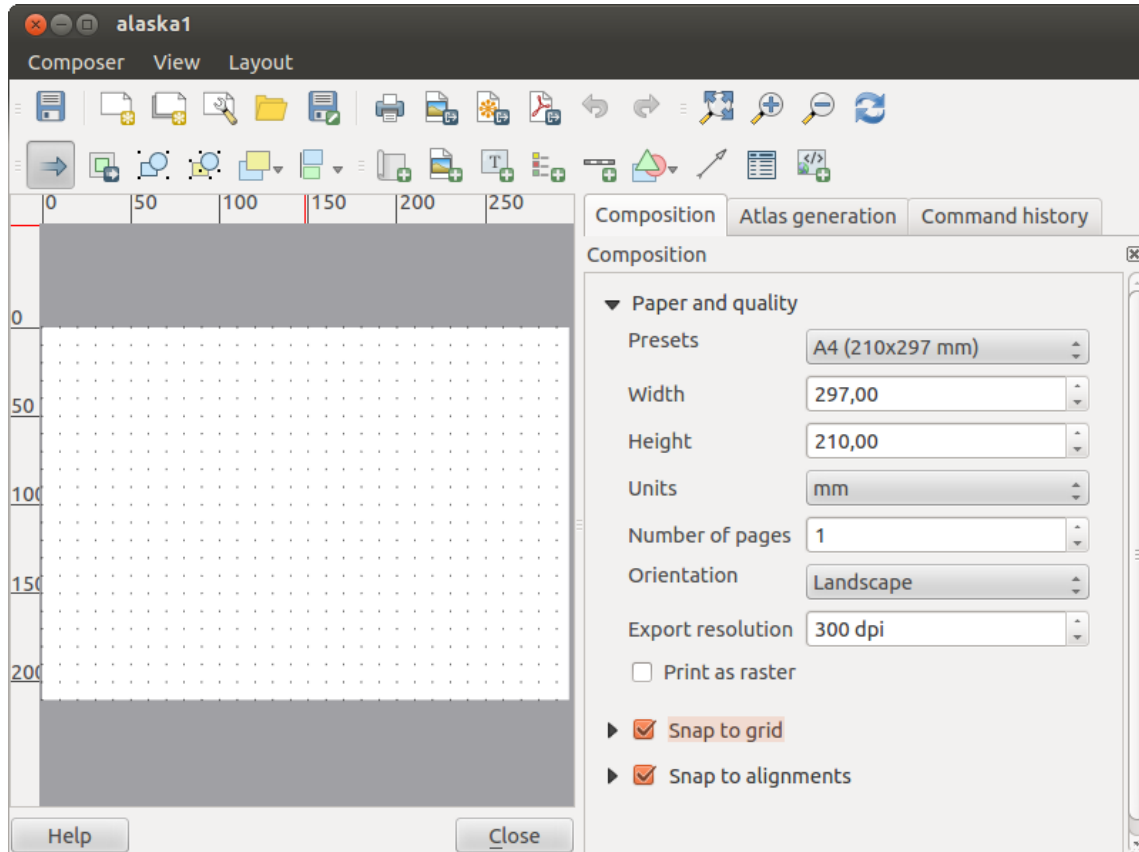
18.1.1 Open a new Print Composer Template


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.



Rysunek 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 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

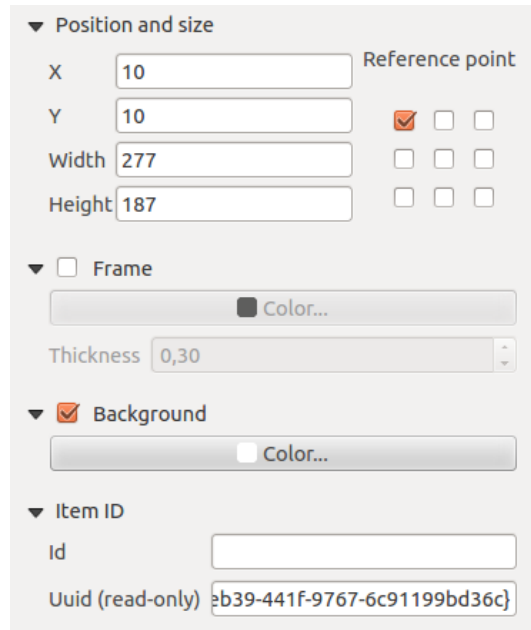
In the *Composition* tab, you can define the global settings of your composition.


- 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](#)).

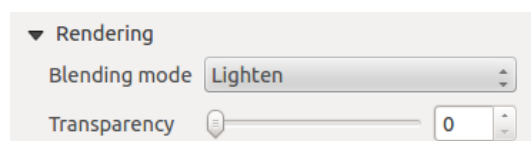


Rysunek 18.2: Common Item properties Dialogs 


- 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 through 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.




Rysunek 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.

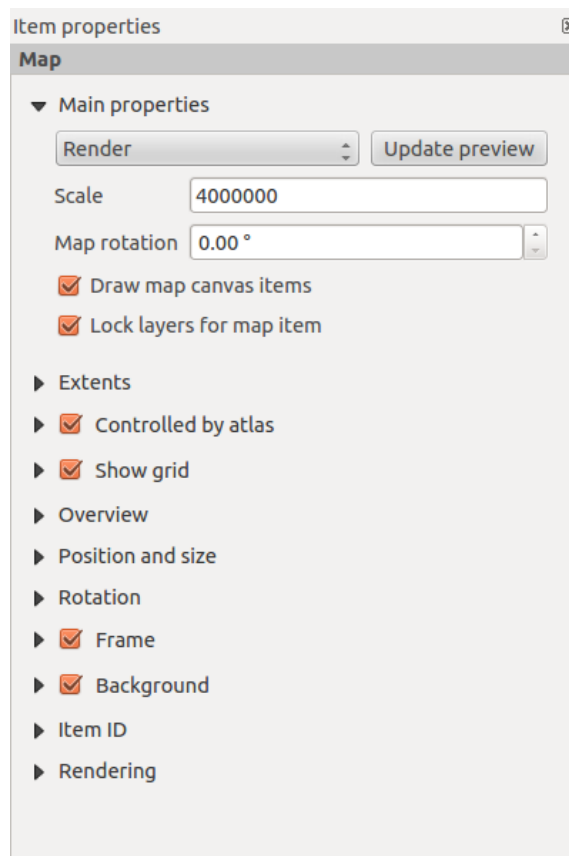
Cache is the default preview mode for newly added Print Composer maps.

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 Properties* tab provides the following functionalities (see [figure_composer_4](#)):



Rysunek 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* sets a manual scale.

- The field *Rotation* 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](#)):

Rysunek 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](#)).

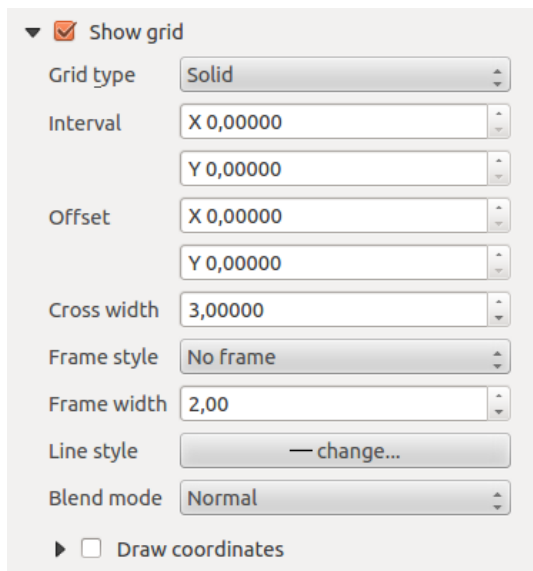
Grid

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

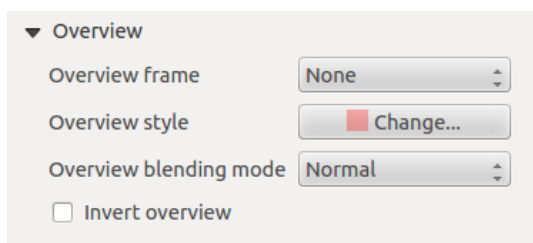
- The *Show grid* checkbox allows you to overlay a grid onto the map element. As grid type, you can specify to use a solid line or cross. Symbology of the grid can be chosen. See section [Rendering_Mode](#). Furthermore, you can define an interval in the X and Y directions, an X and Y offset, and the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



Rysunek 18.6: Map Grid Dialog 




Rysunek 18.7: Map Overview Dialog 

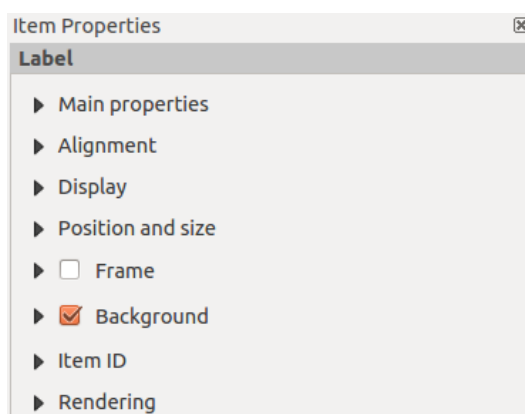
If the Composer has more than one map, you can choose to use a first map to show the extents of a second map. The *Overview* dialog of the map *Item Properties* tab allows you to customize the appearance of that feature.

- 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:

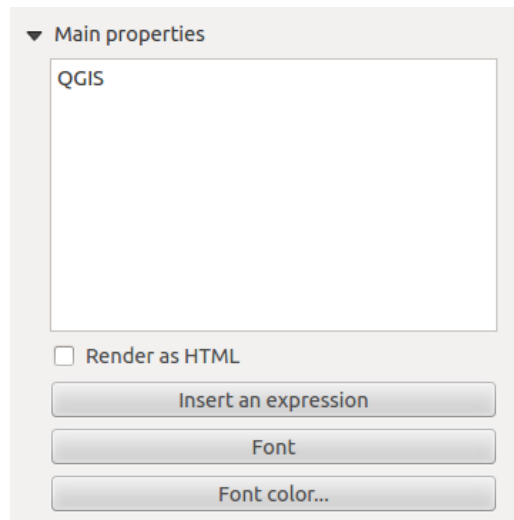


Rysunek 18.8: Label Item properties Tab 

Main properties

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

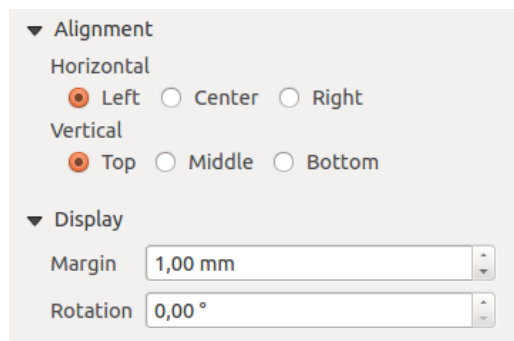
- The main properties dialog is where the text (HTML or not) or the expression needed to fill the label is added to the Composer canvas.
- Labels can be interpreted as HTML code: check *Render as HTML*. You can now insert a URL, a clickable image that links to a web page or something more complex.
-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




Rysunek 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](#)):



Rysunek 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

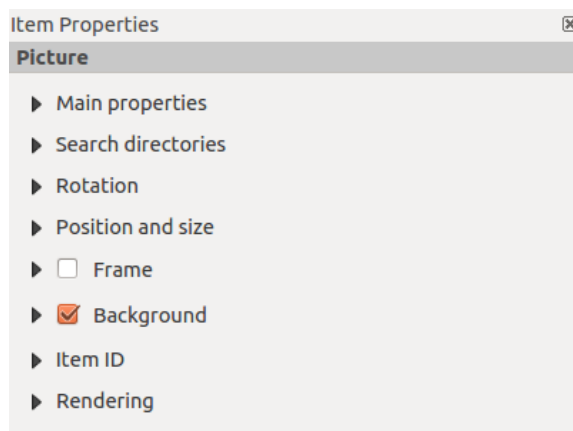
To add an image, click the  Add image icon, place the element with the left mouse button on the Print Composer canvas and position and customize its appearance in the image *Item Properties* tab.


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

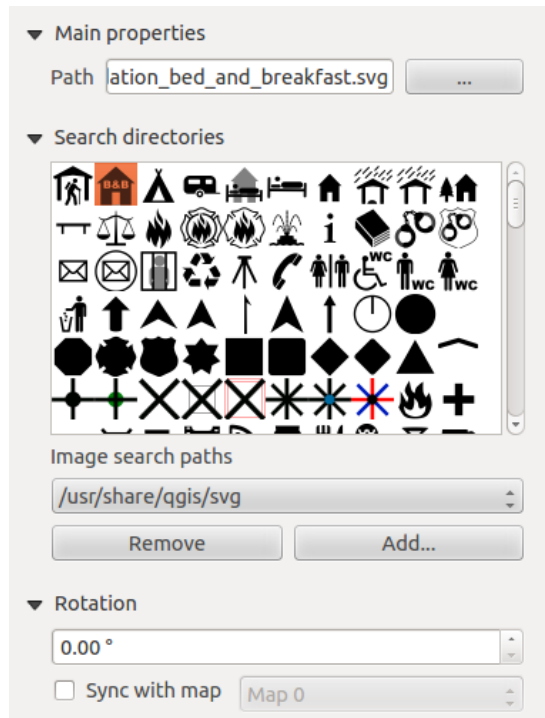
Main properties, Search directories and Rotation


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.




Rysunek 18.11: Image Item properties Tab 



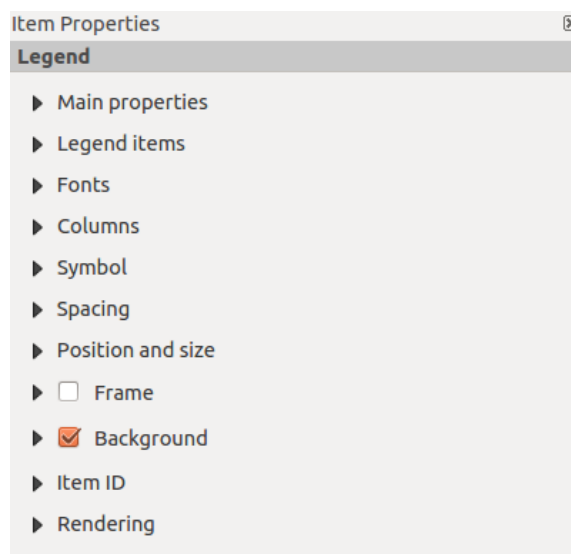
Rysunek 18.12: Image Main properties, Search directories and Rotation Dialogs 

- 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* 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.

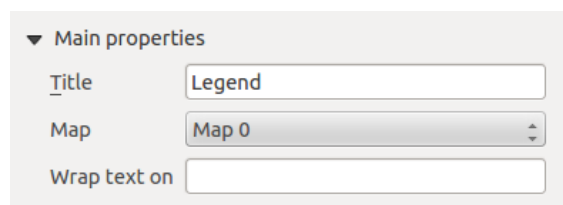
The *Item properties* of a legend item tab provides the following functionalities (see [figure_composer_14](#)):



Rysunek 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](#)):

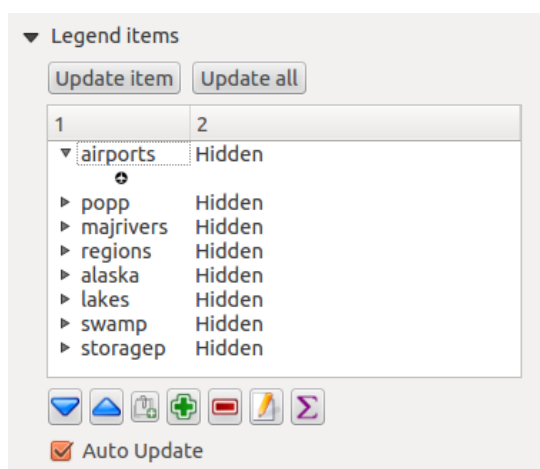


Rysunek 18.14: Legend Main properties Dialog 

- 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](#)):



Rysunek 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

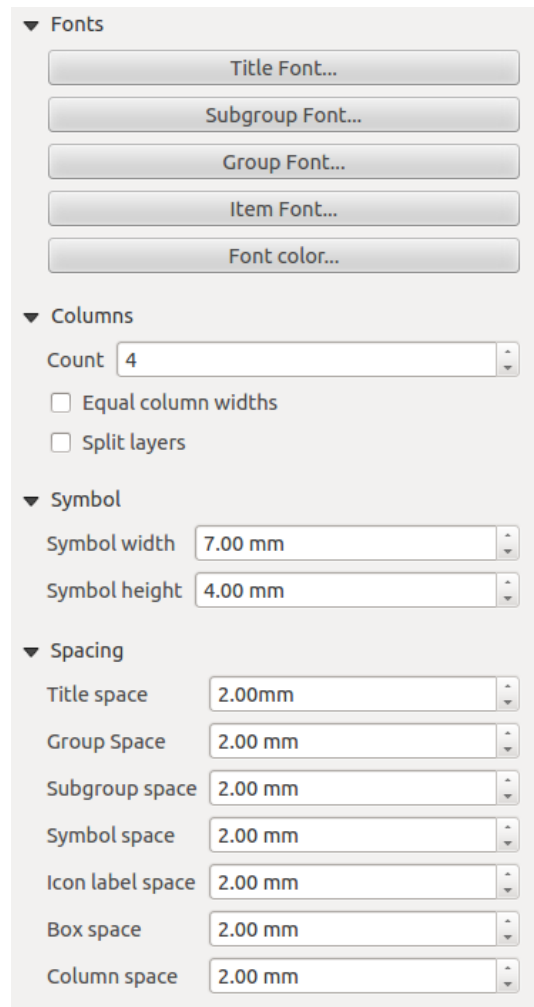
The *Fonts*, *Columns*, *Symbol* and *Spacing* dialogs of the legend *Item Properties* tab provide the following functionalities (see [figure_composer_16](#)):


- 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* 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 around title, group, subgroup, symbol, icon label, box space or column space can be customized through this dialog.

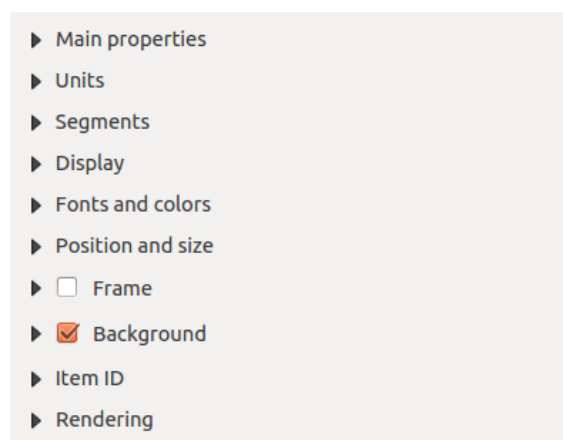
18.3.5 Adding a Scale Bar item to the Print Composer

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](#)):



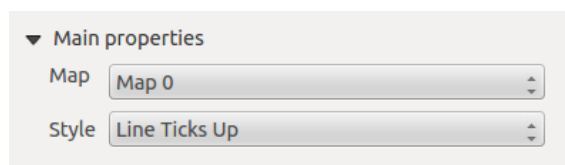
Rysunek 18.16: Legend Fonts, Columns, Symbol and Spacing Dialogs 



Rysunek 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](#)):

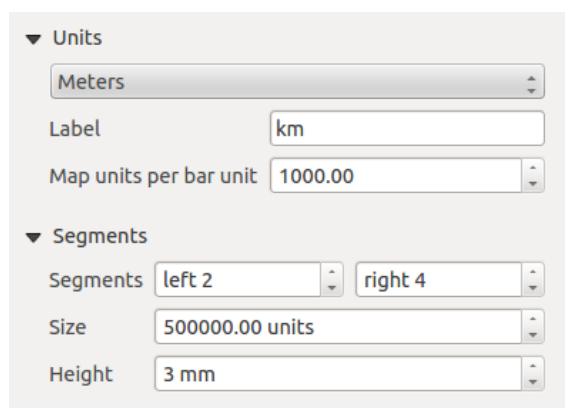


Rysunek 18.18: Scale Bar Main properties Dialog 

- 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](#)):



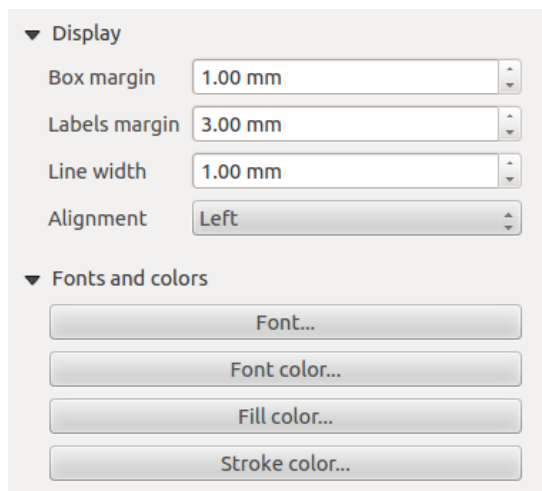
Rysunek 18.19: Scale Bar Units and Segments Dialogs 

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](#)):



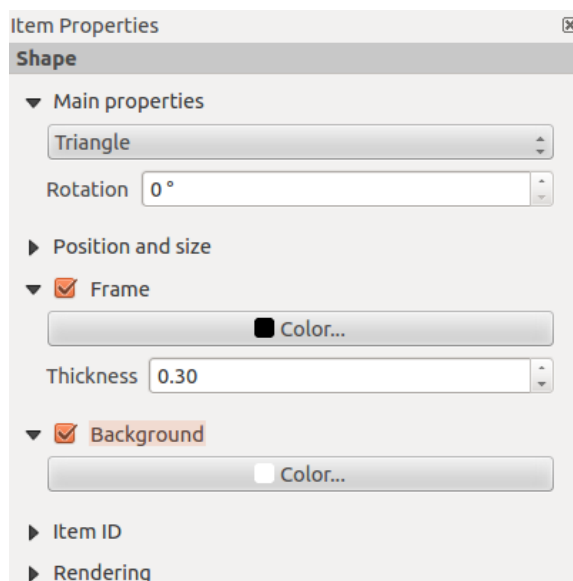
Rysunek 18.20: Scale Bar Display, Fonts and colors Dialogs 

- 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

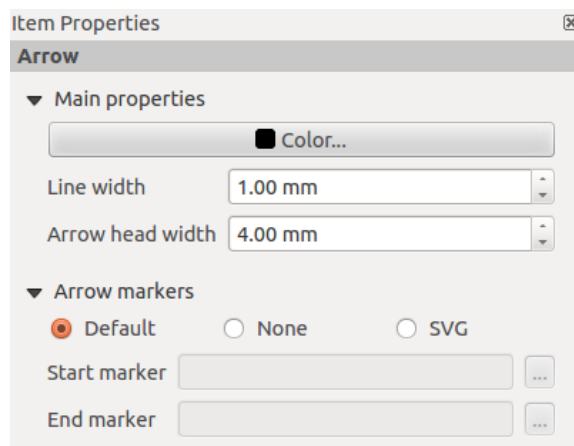
It is possible to add basic shapes (ellipse, rectangle, triangle) and arrows to the Print Composer canvas: Click the  Add basic shape icon or the  Add Arrow icon, place the element with the left mouse button on the Print Composer canvas and position and customize the appearance in the *Item Properties*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



Rysunek 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.




Rysunek 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.

Informacja: 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

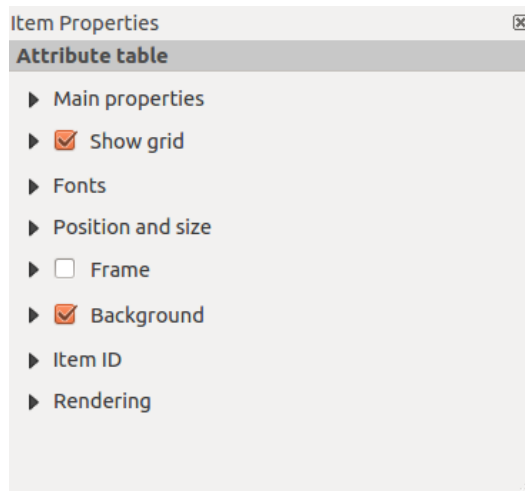
It is possible to add parts of a vector attribute table to the Print Composer canvas: Click the  Add attribute table icon, place the element with the left mouse button on the Print Composer canvas, and position and customize the appearance in the *Item Properties* tab.

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

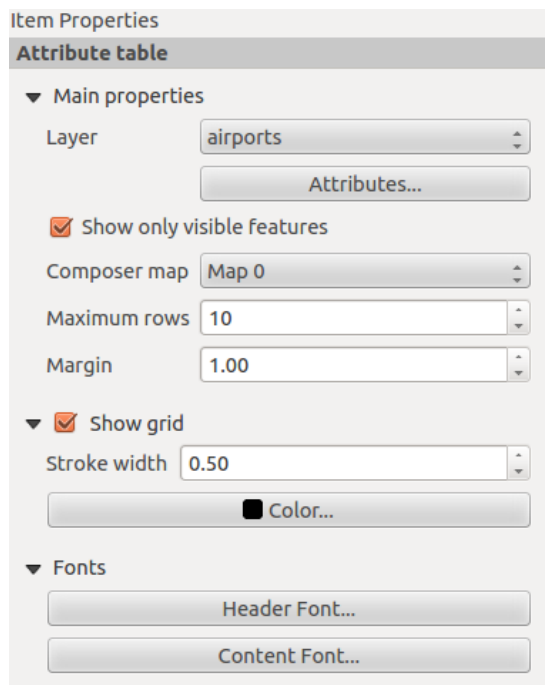
Main properties, Show grid and Fonts

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

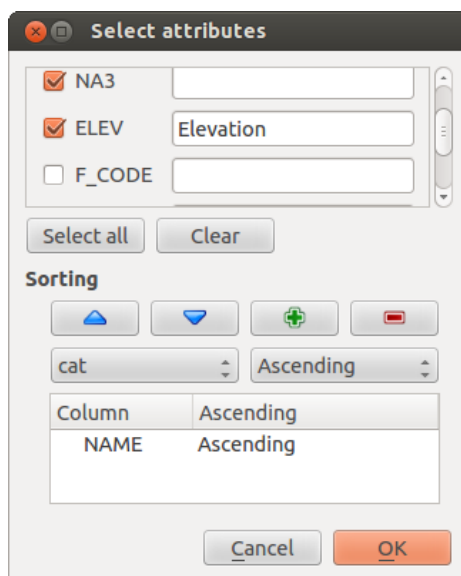
- The *Table* dialog allows you to select the vector layer and columns of the attribute table. Attribute columns can be sorted, and you can specify whether to show values in ascending or descending order (see [figure_composer_25](#)).
- You can choose to display the attributes of only features visible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



Rysunek 18.23: Scale Bar Item properties Tab 




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



Rysunek 18.25: Attribute table Select attributes Dialog 

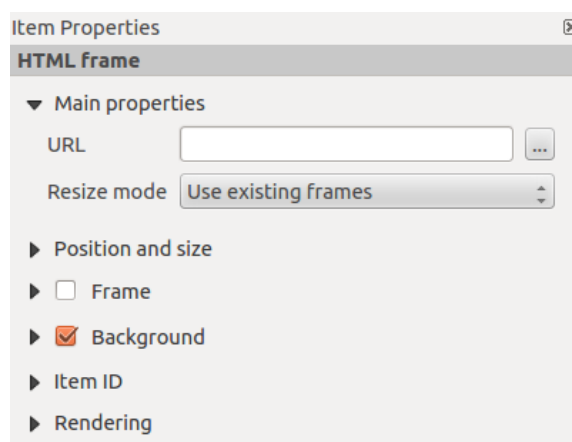
- You can define the *Maximum number of rows* to be displayed and the *margin* around text.
- Additionally, you can define the grid characteristics of the table (*Stroke width* and *Color* of the grid) and the header and content font.

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](#)):




Rysunek 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.

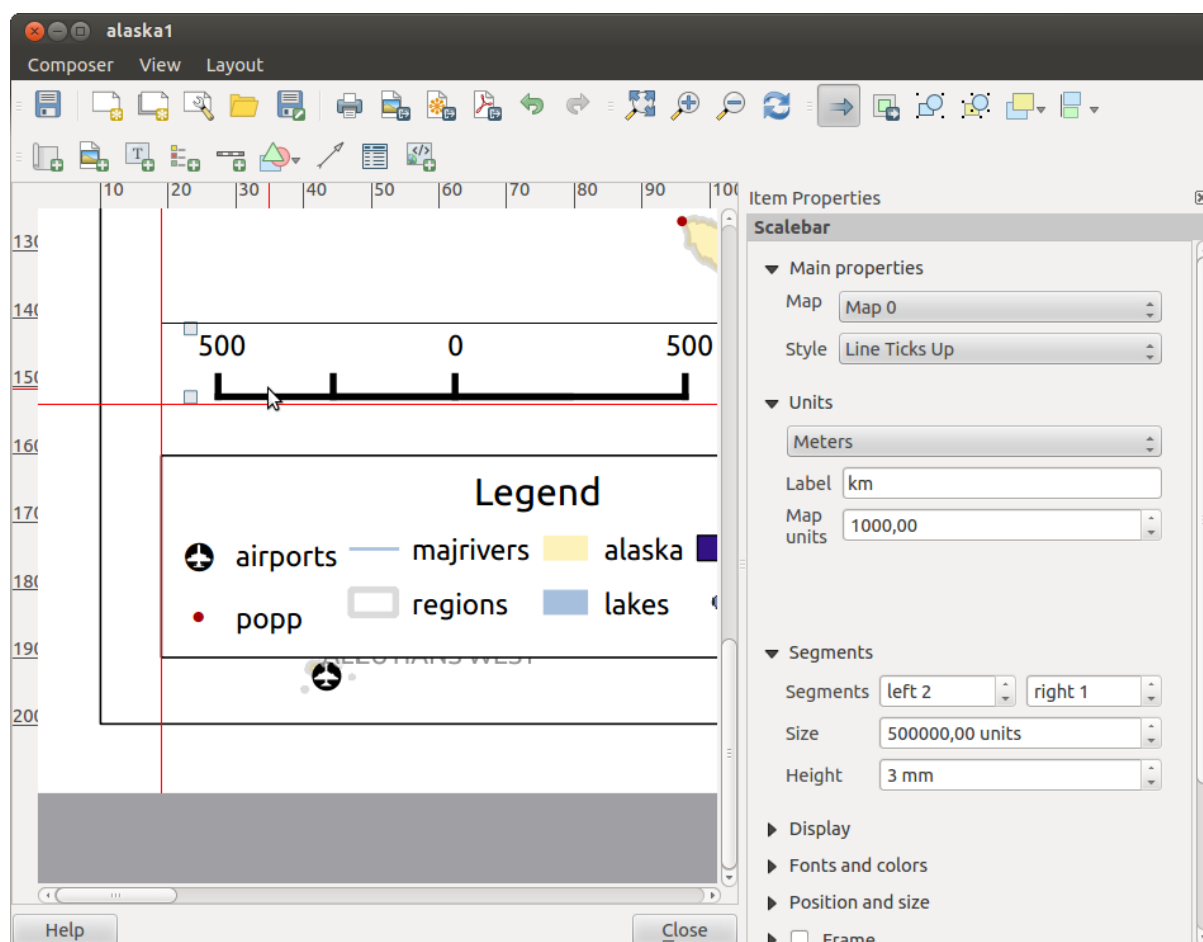
18.4.2 Alignment

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.



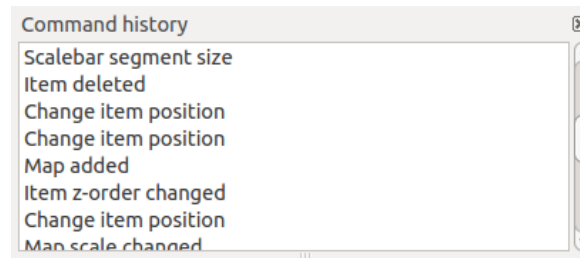
Rysunek 18.27: Alignment helper lines in the Print Composer 🐧

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](#)).




Rysunek 18.28: Command history in the Print Composer 

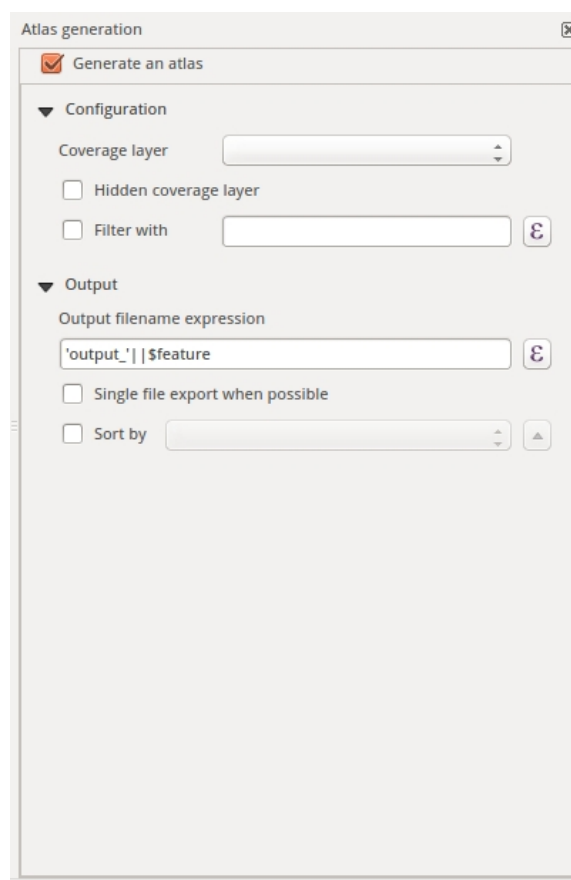
18.6 Atlas generation

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:



Rysunek 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

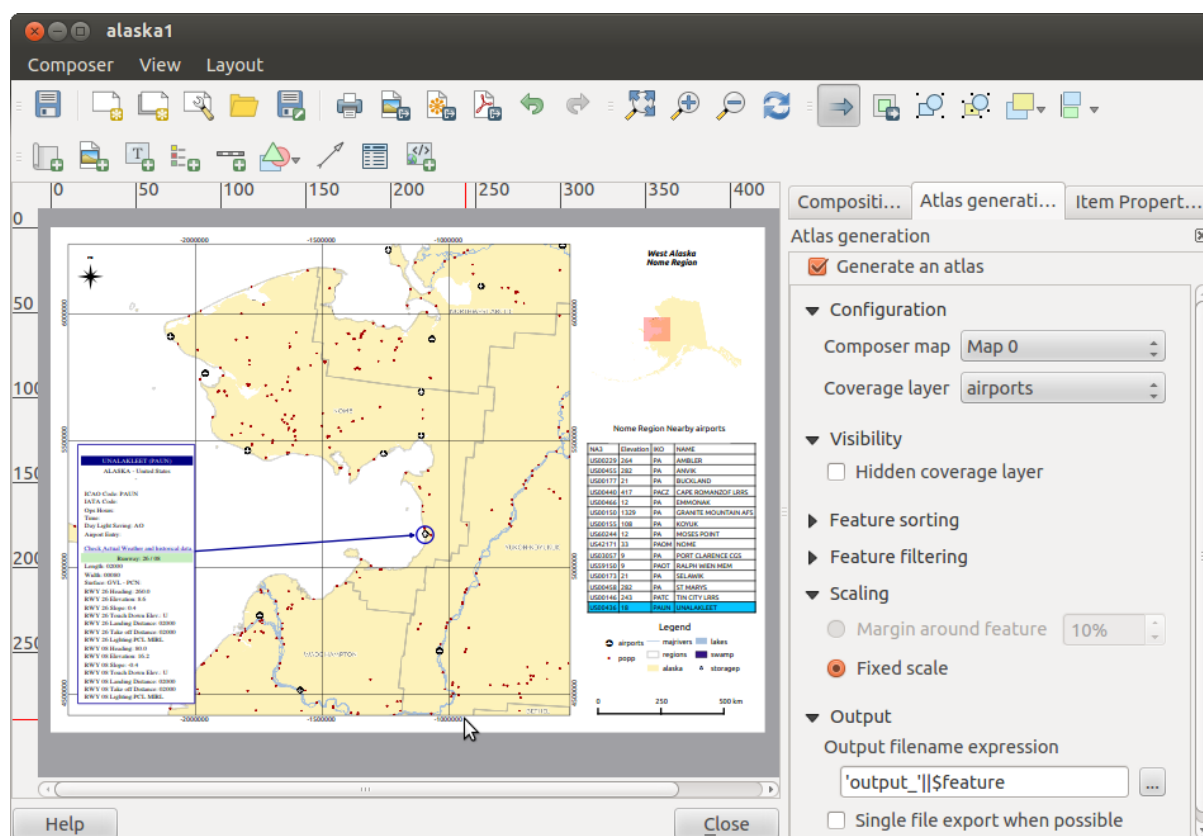
Figure_composer_30 shows the Print Composer with an example print layout, including each type of map element described in the sections above.

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,...
- The  *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.

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



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

underlying Qt library. This will hopefully be sorted out in future versions. Exporting big rasters can sometimes fail, even if there seems to be enough memory. This is also a problem with the underlying Qt management of rasters.

18.8 Manage the Composer

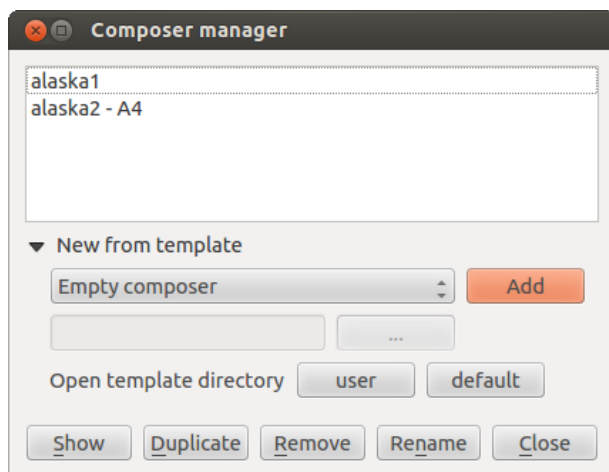
With the Save as template and Load from template icons, you can save the current state of a Print Composer session as a .qpt template and load the template again in another session.

The Composer Manager button in the QGIS toolbar and in *Composer* → *Composer Manager* allows you to add a new Composer template, create a new composition based on a previously saved template or to manage already existing templates.

By default, the Composer manager searches for user templates in `~/qgis2/composer_template`.

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.



Rysunek 18.31: The Print Composer Manager 

19.1 QGIS Plugins

QGIS has been designed with a plugin architecture. This allows many new features and functions to be easily added to the application. Many of the features in QGIS are actually implemented as plugins.

19.1.1 The Plugins Menus

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



All

Here, all the available plugins are listed, including both core and external plugins. Use **[Upgrade all]** to look for new versions of the plugins. Furthermore, you can use **[Install plugin]**, if a plugin is listed but not installed, and **[Uninstall plugin]** as well as **[Reinstall plugin]**, if a plugin is installed. If a plugin is installed, it can be de/activated using the checkbox.



Installed

In this menu, you can find only the installed plugins. The external plugins can be uninstalled and reinstalled using the **[Uninstall plugin]** and **[Reinstall plugin]** buttons. You can **[Upgrade all]** here as well.




Not installed

This menu lists all plugins available that are not installed. You can use the **[Install plugin]** button to implement a plugin into QGIS.



Upgradeable

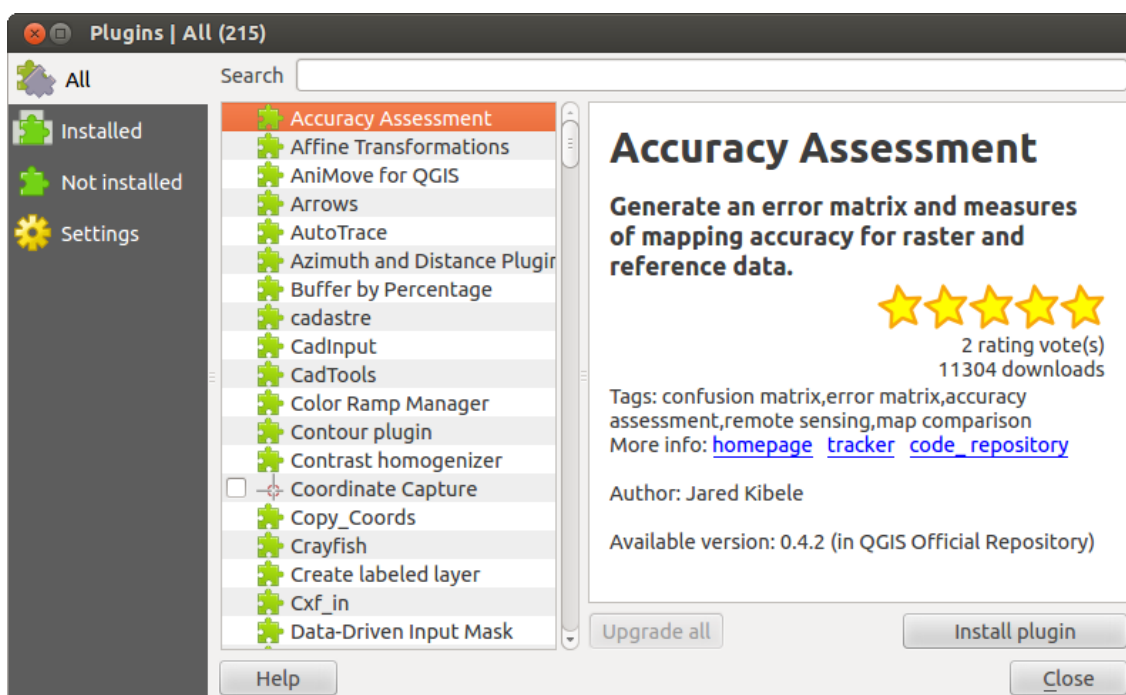
If you activated *Show also experimental plugins* in the  *Settings* menu, you can use this menu to look for more recent plugin versions. This can be done with the **[Upgrade plugin]** or **[Upgrade all]** buttons.



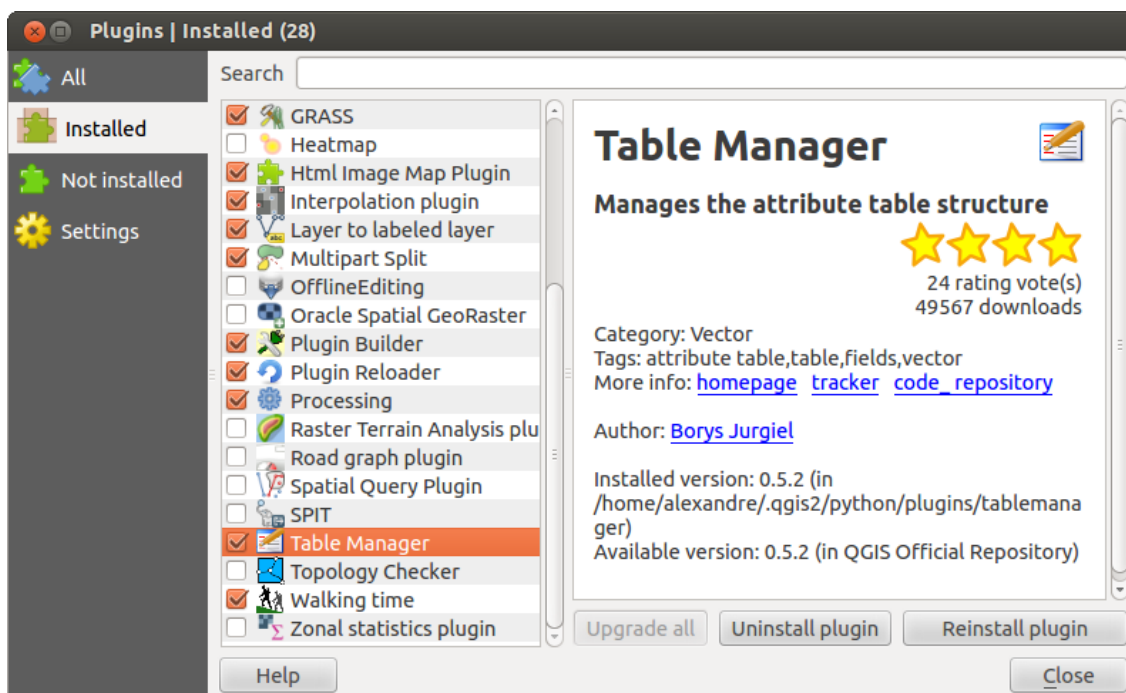
Settings

In this menu, you can use the following options:

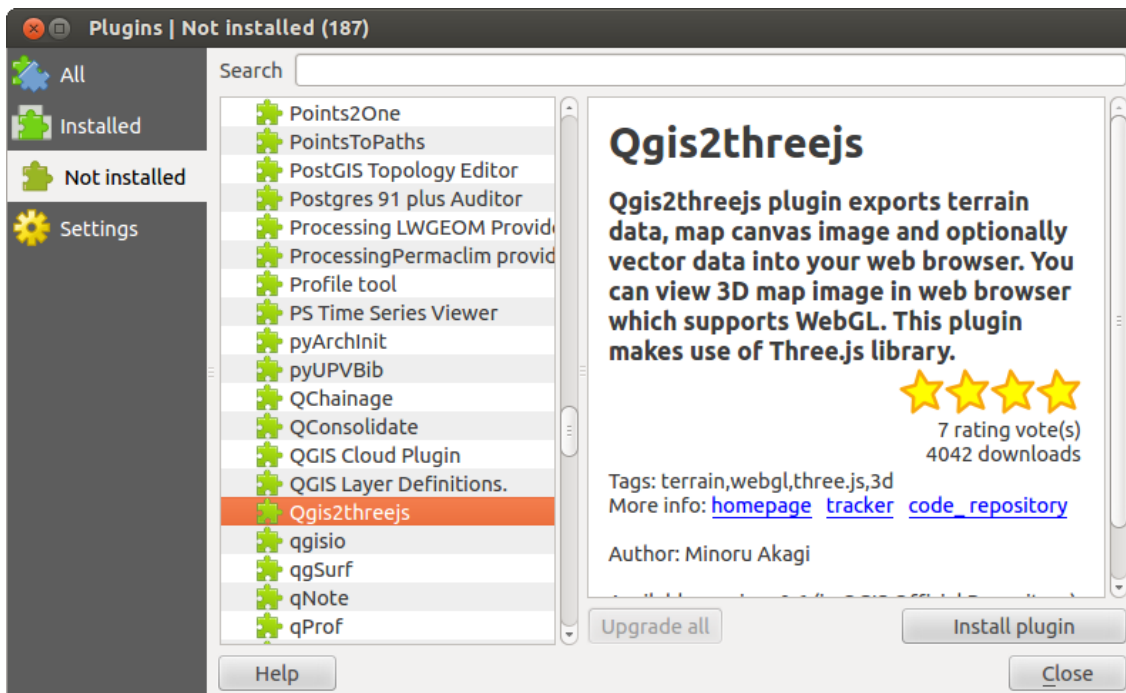
- *Check for updates on startup*. Whenever a new plugin or a plugin update is available, QGIS will inform you 'every time QGIS starts', 'once a day', 'every 3 days', 'every week', 'every 2 weeks' or 'every month'.
- *Show also experimental plugins*. QGIS will show you plugins in early stages of development, which are generally unsuitable for production use.



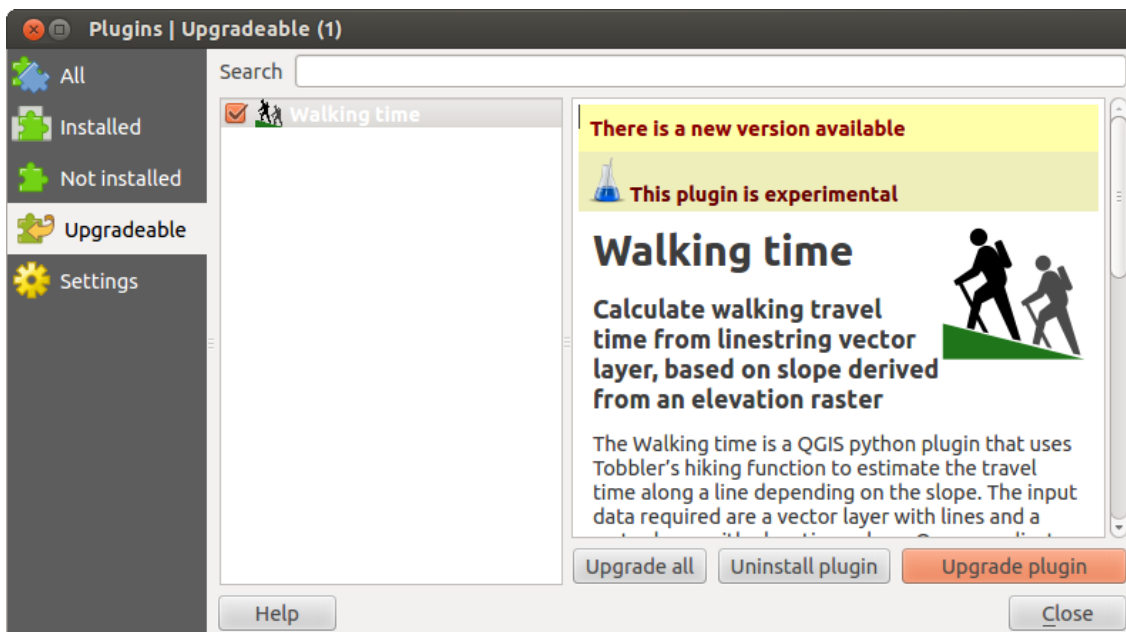
Rysunek 19.1: The  All menu 



Rysunek 19.2: The  Installed menu 



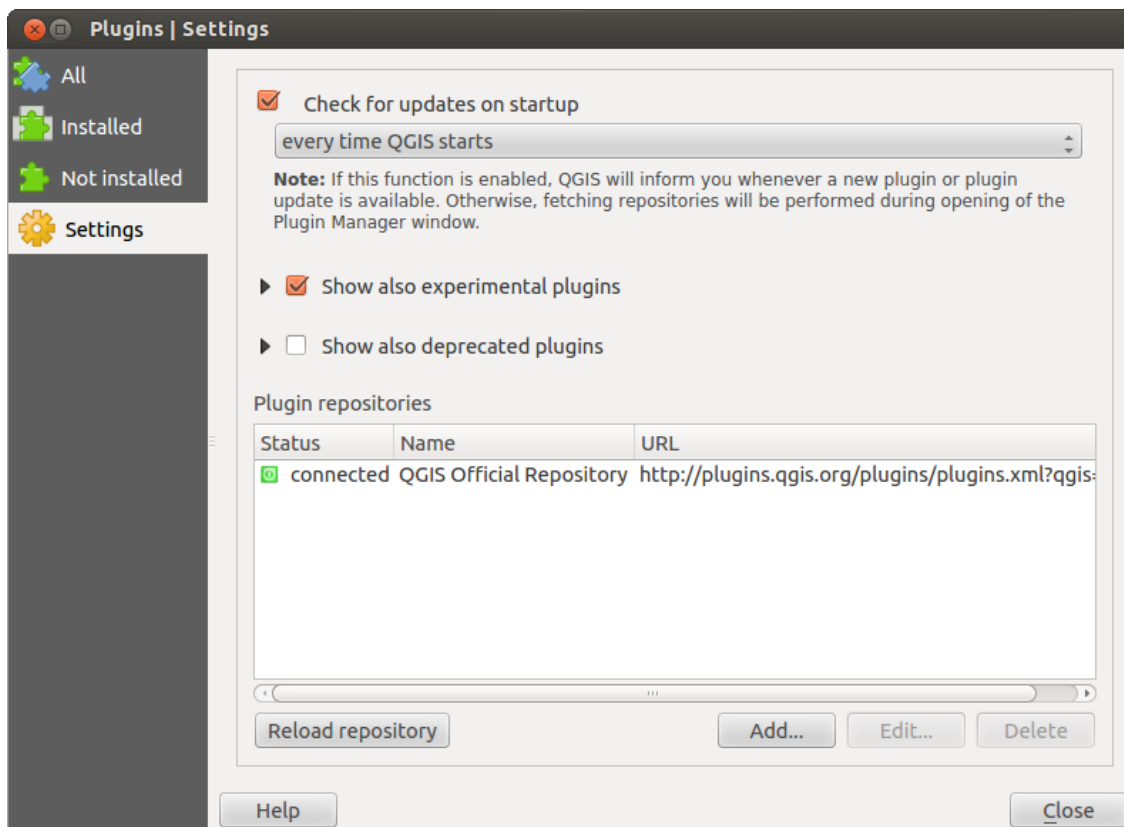
Rysunek 19.3: The  *Not installed* menu 




Rysunek 19.4: The  *Upgradeable* menu 

- *Show also deprecated plugins.* These plugins are deprecated and generally unsuitable for production use.

To add external author repositories, click **[Add...]** in the *Plugin repositories* section. If you do not want one or more of the added repositories, they can be disabled via the **[Edit...]** button, or completely removed with the **[Delete]** button.



Rysunek 19.5: The  *Settings* menu 





















The *Search* function is available in nearly every menu (except  *Settings*). Here, you can look for specific plugins.

Wskazówka: Core and external plugins

QGIS plugins are implemented either as **Core Plugins** or **External Plugins**. **Core Plugins** are maintained by the QGIS Development Team and are automatically part of every QGIS distribution. They are written in one of two languages: C++ or Python. **External Plugins** are currently all written in Python. They are stored in external repositories and are maintained by the individual authors.

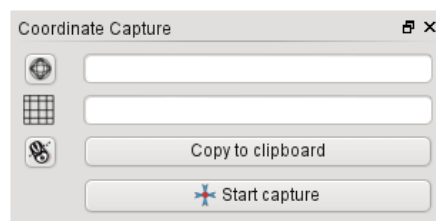
Detailed documentation about the usage, minimum QGIS version, home page, authors, and other important information are provided for the ‘Official’ QGIS Repository at <http://plugins.qgis.org/plugins/>. For other external repositories, documentation might be available with the external plugins themselves. In general, it is not included in this manual.

19.2 Using QGIS Core Plugins



Icon	Plugin	Description	Manual Reference
	Coordinate Capture	Capture mouse coordinate in different CRS	<i>Coordinate Capture Plugin</i>
	DB Manager	Manage your databases within QGIS	<i>DB Manager Plugin</i>
	DXF2Shape Converter	Converts from DXF to SHP file format	<i>Dxf2Shp Converter Plugin</i>
	eVis	Event Visualization Tool	<i>eVis Plugin</i>
	fTools	A suite of vector tools	<i>fTools Plugin</i>
	GPS Tools	Tools for loading and importing GPS data	<i>GPS Plugin</i>
	GRASS	GRASS functionality	<i>GRASS GIS Integration</i>
	GDAL Tools	GDAL raster functionality	<i>GDAL Tools Plugin</i>
	Georeferencer GDAL	Georeference rasters with GDAL	<i>Georeferencer Plugin</i>
	Heatmap	Create heatmap rasters from input vector points	<i>Heatmap Plugin</i>
	Interpolation plugin	Interpolation on base of vertices of a vector layer	<i>Interpolation Plugin</i>
	Offline Editing	Offline editing and synchronizing with database	<i>Offline Editing Plugin</i>
	Oracle Spatial Georaster	Access Oracle Spatial GeoRasters	<i>Oracle Spatial GeoRaster Plugin</i>
	Plugin Manager	Manage core and external plugins	<i>The Plugins Menus</i>
	Raster Terrain Analysis	Compute geomorphological features from DEMs	<i>Raster Terrain Analysis Plugin</i>
	Road Graph plugin	Shortest path analysis	<i>Road Graph Plugin</i>
	SQL Anywhere plugin	Access SQL anywhere DB	<i>SQL Anywhere Plugin</i>
	Spatial Query	Spatial queries on vectors	<i>Spatial Query Plugin</i>
	SPIT	Shapefile to PostgreSQL/PostGIS Import Tool	<i>SPIT Plugin</i>
	Zonal Statistics	Calculate raster statistics for vector polygons	<i>Zonal Statistics Plugin</i>






19.3 Coordinate Capture Plugin

The coordinate capture plugin is easy to use and provides the ability to display coordinates on the map canvas for two selected coordinate reference systems (CRS).




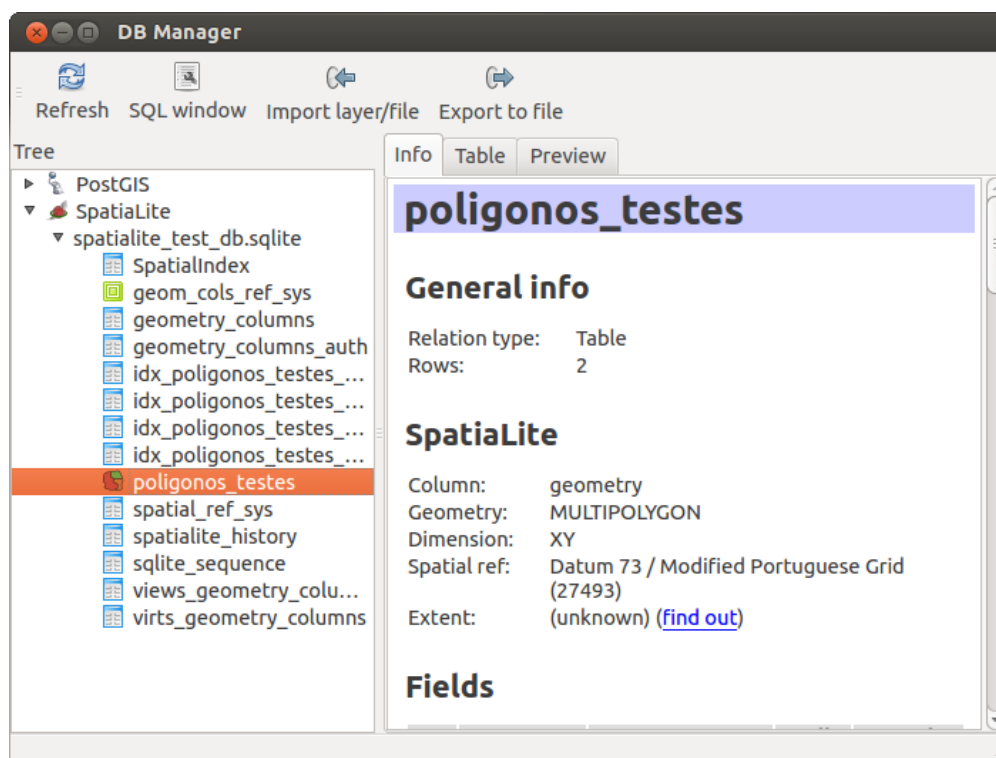
Rysunek 19.6: Coordinate Capture Plugin 

1. Start QGIS, select  *Project Properties* from the *Settings* (KDE, Windows) or *File* (Gnome, OSX) menu and click on the *Projection* tab. As an alternative, you can also click on the  CRS status icon in the lower right-hand corner of the status bar.

2. Click on the  *Enable on the fly projection* checkbox and select a projected coordinate system of your choice (see also *Praca z układami współrzędnych*).
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. Click on the  Click to the select the CRS to use for coordinate display icon and select a different CRS from the one you selected above.
5. To start capturing coordinates, click on **[Start capture]**. You can now click anywhere on the map canvas and the plugin will show the coordinates for both of your selected CRS.
6. To enable mouse coordinate tracking, click the  mouse tracking icon.
7. You can also copy selected coordinates to the clipboard.

19.4 DB Manager Plugin

The DB Manager Plugin is officially part of the QGIS core and is intended to replace the SPIT Plugin and, additionally, to integrate all other database formats supported by QGIS in one user interface. The  DB Manager Plugin provides several features. You can drag layers from the QGIS Browser into the DB Manager, and it will import your layer into your spatial database. You can drag and drop tables between spatial databases and they will get imported. You can also use the DB Manager to execute SQL queries against your spatial database and then view the spatial output for queries by adding the results to QGIS as a query layer.



Rysunek 19.7: DB Manager dialog 

The *Database* menu allows you to connect to an existing database, to start the SQL window and to exit the DB

Manager Plugin. Once you are connected to an existing database, the menus *Schema* and *Table* additionally appear.

The *Schema* menu includes tools to create and delete (empty) schemas and, if topology is available (e.g., PostGIS 2), to start a *TopoViewer*.

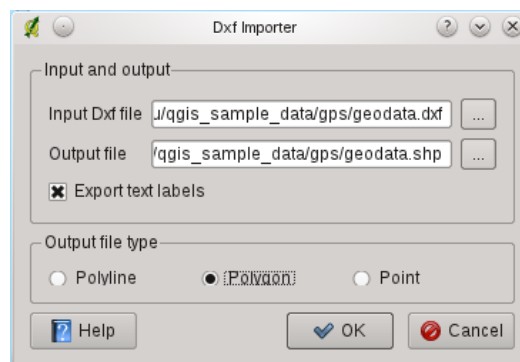
The *Table* menu allows you to create and edit tables and to delete tables and views. It is also possible to empty tables and to move tables from one schema to another. As further functionality, you can perform a VACUUM and then an ANALYZE for each selected table. Plain VACUUM simply reclaims space and makes it available for reuse. ANALYZE updates statistics to determine the most efficient way to execute a query. Finally, you can import layers/files, if they are loaded in QGIS or exist in the file system. And you can export database tables to shape with the Export File feature.

The *Tree* window lists all existing databases supported by QGIS. With a double-click, you can connect to the database. With the right mouse button, you can rename and delete existing schemas and tables. Tables can also be added to the QGIS canvas with the context menu.

If connected to a database, the **main** window of the DB Manager offers three tabs. The *Info* tab provides information about the table and its geometry, as well as about existing fields, constraints and indexes. It also allows you to run Vacuum Analyze and to create a spatial index on a selected table, if not already done. The *Table* tab shows all attributes, and the *Preview* tab renders the geometries as preview.

19.5 Dxf2Shp Converter Plugin


The dxf2shape converter plugin can be used to convert vector data from DXF to shapefile format. It requires the following parameters to be specified before running:



Rysunek 19.8: Dxf2Shape Converter Plugin

- **Input DXF file:** Enter the path to the DXF file to be converted.
- **Output Shp file:** Enter desired name of the shapefile to be created.
- **Output file type:** Specify the geometry type of the output shapefile. Currently supported types are polyline, polygon, and point.
- **Export text labels:** When this checkbox is enabled, an additional shapefile point layer will be created, and the associated DBF table will contain information about the “TEXT” fields found in the DXF file, and the text strings themselves.

19.5.1 Using the Plugin

1. Start QGIS, load the Dxf2Shape plugin in the Plugin Manager (see *The Plugins Menus*) and click on the  icon, which appears in the QGIS toolbar menu. The Dxf2Shape plugin dialog appears, as shown in [Figure_dxf2shape_1](#).

2. Enter the input DXF file, a name for the output shapefile and the shapefile type.
3. Enable the *Export text labels* checkbox if you want to create an extra point layer with labels.
4. Click [OK].

19.6 eVis Plugin

(This section is derived from Horning, N., K. Koy, P. Ersts. 2009. eVis (v1.1.0) User's Guide. American Museum of Natural History, Center for Biodiversity and Conservation. Available from <http://biodiversityinformatics.amnh.org/>, and released under the 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.

eVis is now automatically installed and enabled in new versions of QGIS, and as with all plugins, it can be disabled and enabled using the Plugin Manager (see *The Plugins Menus*).

The eVis plugin is made up of three modules: the 'Database Connection tool', 'Event ID tool', and the 'Event Browser'. These work together to allow viewing of geocoded photographs and other documents that are linked to features stored in vector files, databases, or spreadsheets.

19.6.1 Event Browser

The Event Browser module provides the functionality to display geocoded photographs that are linked to vector features displayed in the QGIS map window. Point data, for example, can be from a vector file that can be input using QGIS or it can be from the result of a database query. 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. Your vector layer must be loaded into QGIS before running the Event Browser.

Launch the Event Browser module

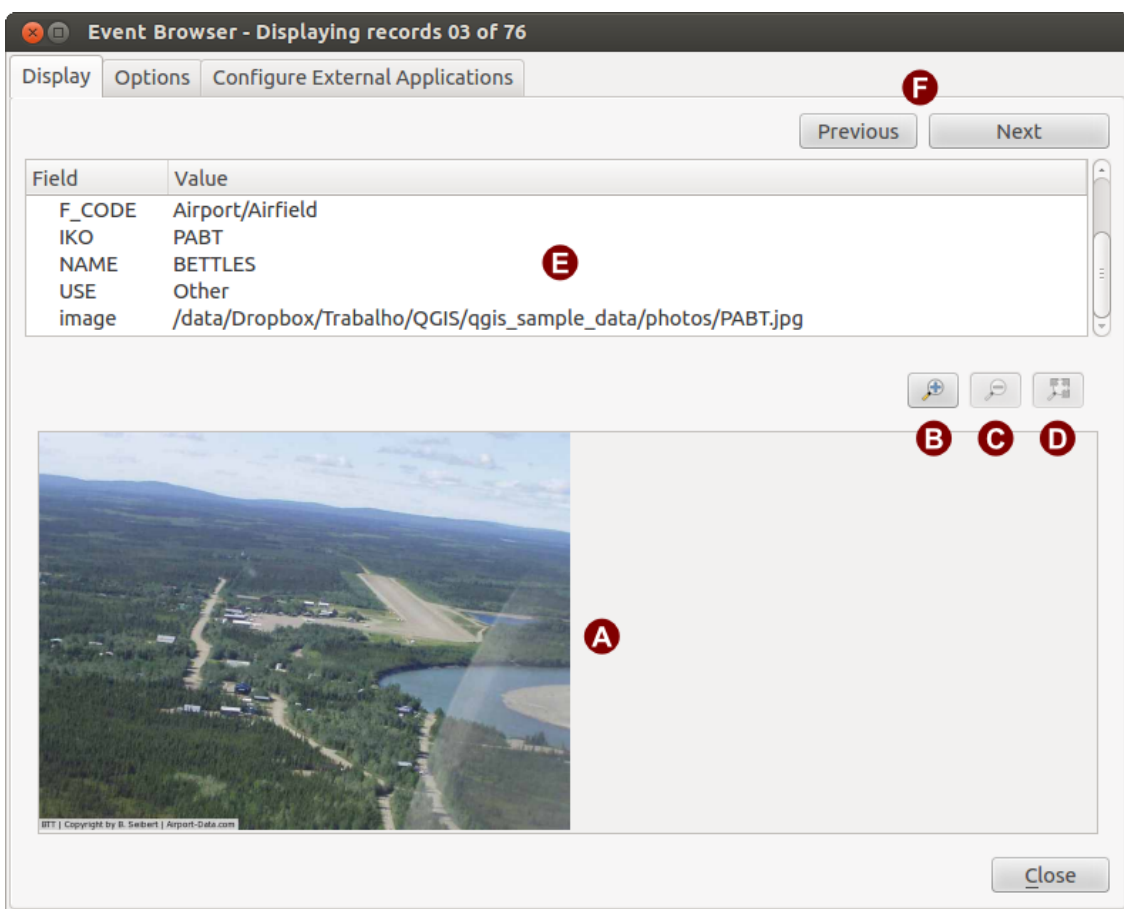
To launch the Event Browser module, click on *Database* → *eVis* → *eVis Event Browser*. This will open the *Generic Event Browser* window.

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.

Understanding the Display window

To see the *Display* window, click on the *Display* tab in the *Event Browser* window. The *Display* window is used to view geocoded photographs and their associated attribute data.

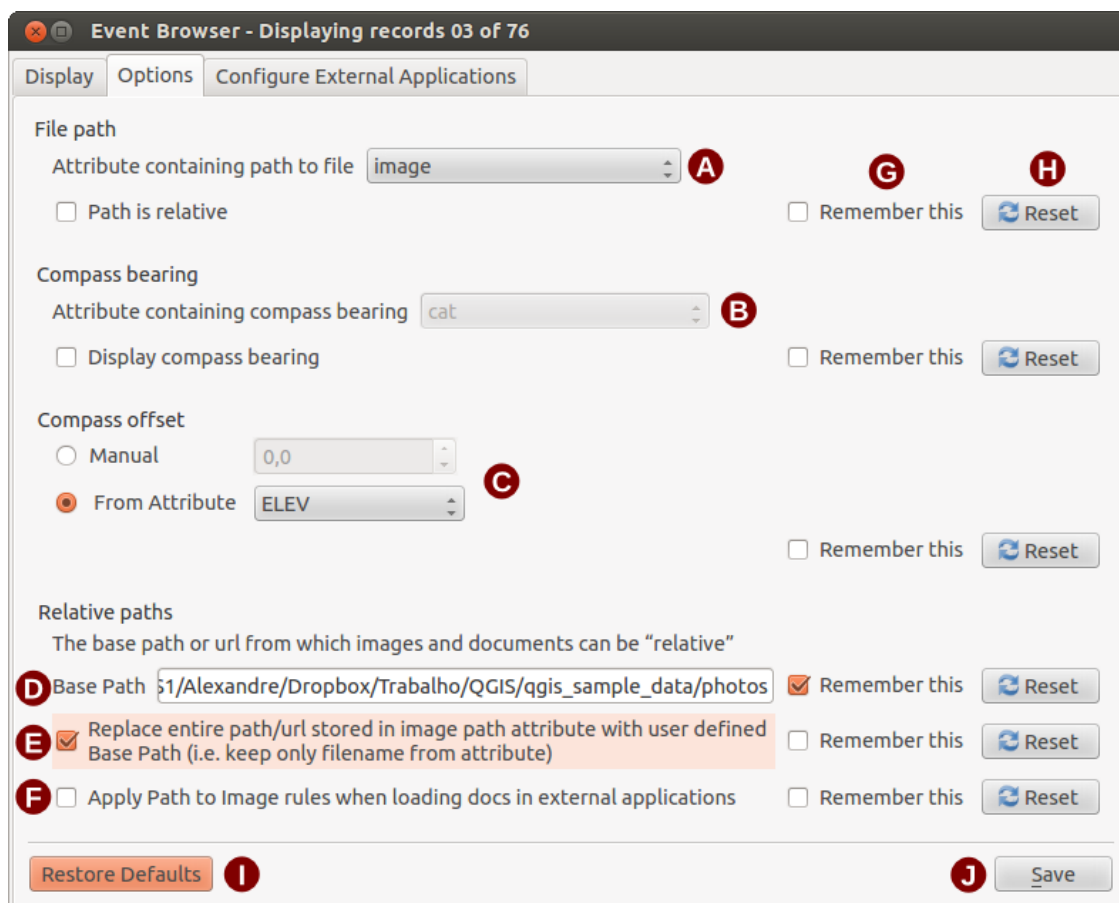
1. **Display window:** A window where the photograph will appear.
2. **Zoom in button:** Zoom in to see more detail. If the entire image cannot be displayed in the display window, scroll bars will appear on the left and bottom sides of the window to allow you to pan around the image.
3. **Zoom out button:** Zoom out to see more area.
4. **Zoom to full extent button:** Displays the full extent of the photograph.



Rysunek 19.9: The *eVis* display window

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. **Navigation buttons:** Use the Previous and Next buttons to load the previous or next feature when more than one feature is selected.

Understanding the Options window

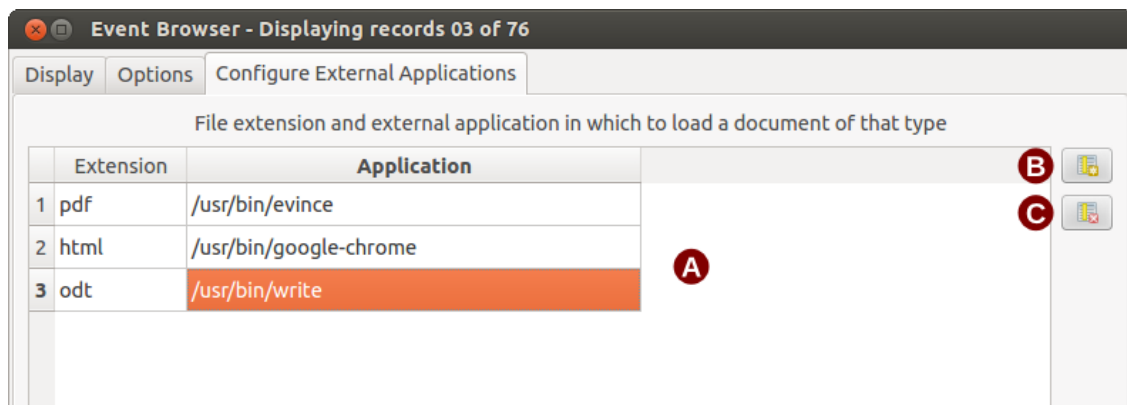


Rysunek 19.10: The *eVis* Options window

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 *Specifying the location and name of a photograph* 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. **Directory base path:** The base path onto which the relative path defined in [Figure_eVis_2](#) (A) will be appended.
5. **Replace path:** If this checkbox is checked, only the file name from A will be appended to the base 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. **Remember settings:** If the checkbox is checked, the values for the associated parameters will be saved for the next session when the window is closed or when the **[Save]** button below is pressed.
8. **Reset values:** Resets the values on this line to the default setting.
9. **Restore defaults:** This will reset all of the fields to their default settings. It has the same effect as clicking all of the **[Reset]** buttons.
10. **Save:** This will save the settings without closing the *Options* pane.

Understanding the Configure External Applications window



Rysunek 19.11: The *eVis* External Applications window

1. **File reference table:** A table containing file types that can be opened using *eVis*. Each file type needs a file extension and the path to an application that can open that type of file. This provides the capability of opening a broad range of files such as movies, sound recordings, and text documents instead of only images.
2. **Add new file type:** Add a new file type with a unique extension and the path for the application that can open the file.
3. **Delete current row:** Delete the file type highlighted in the table and defined by a file extension and a path to an associated application.

19.6.2 Specifying the location and name of a photograph

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 Specifying the location and name of other supporting documents

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 Using the Event Browser

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.

To close the *Event Browser* window, click on the **[Close]** button from the *Display* window.

19.6.5 Event ID Tool

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.

Launch the Event ID module

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 Database connection


The 'Database Connection' module provides tools to connect to and query a database or other ODBC resource, such as a 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.

Launch the Database Connection module

To launch the 'Database Connection' module, either click on the appropriate icon  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.

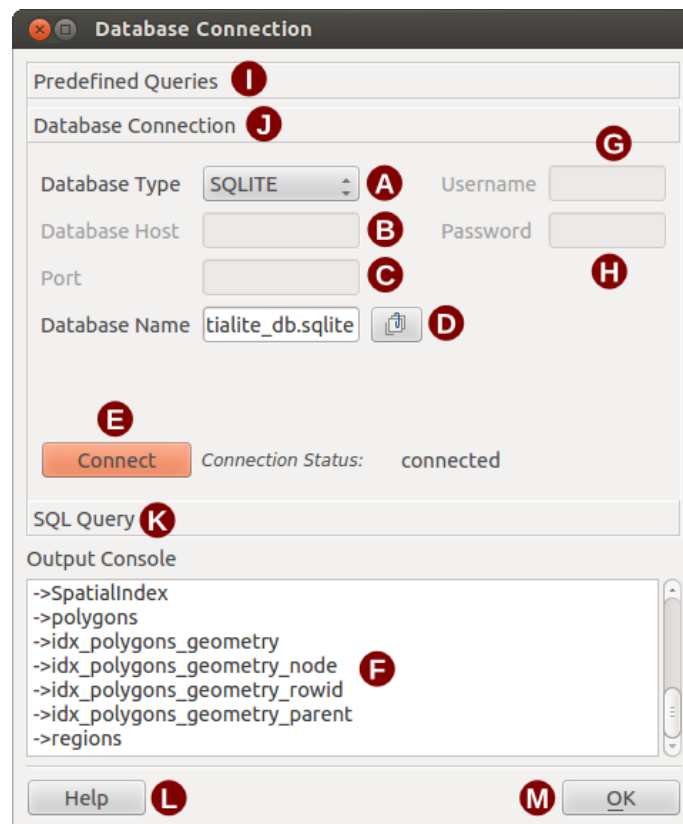
Connect to a database

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".

Enter the name of the database in the *Database Name* textbox. If you selected 'ODBC' as the database type, you need to enter the data source name.

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.



Rysunek 19.12: The eVis Database connection window

1. **Database Type:** A drop-down list to specify the type of database that will be used.

2. **Database Host:** The name of the database host.
3. **Port:** The port number if a MySQL or PostgreSQL database type is selected.
4. **Database Name:** The name of the database.
5. **Connect:** A button to connect to the database using the parameters defined above.
6. **Output Console:** The console window where messages related to processing are displayed.
7. **Username:** Username for use when a database is password protected.
8. **Password:** Password for use when a database is password protected.
9. **Predefined Queries:** Tab to open the “Predefined Queries” window.
10. **Database Connection:** Tab to open the “Database Connection” window.
11. **SQL Query:** Tab to open the “SQL Query” window.
12. **Help:** Displays the online help.
13. **OK:** Closes the main “Database Connection” window.



Running SQL queries

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.

In the *Database File Selection* window, enter the name of the layer that will be created from the results of the query in the *Name of New Layer* textbox.

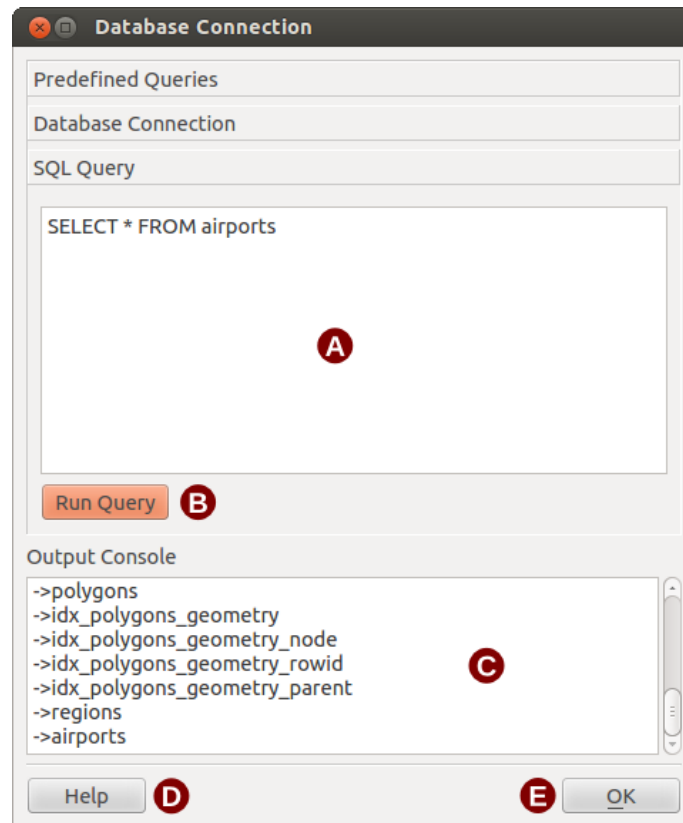
1. **SQL Query Text Window:** A screen to type SQL queries.
2. **Run Query:** Button to execute the query entered in the *SQL Query Window*.
3. **Console Window:** The console window where messages related to processing are displayed.
4. **Help:** Displays the online help.
5. **OK:** Closes the main *Database Connection* window.

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...’

Wskazówka: Creating a vector layer from a 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.



Rysunek 19.13: The eVis SQL query tab

Running predefined queries

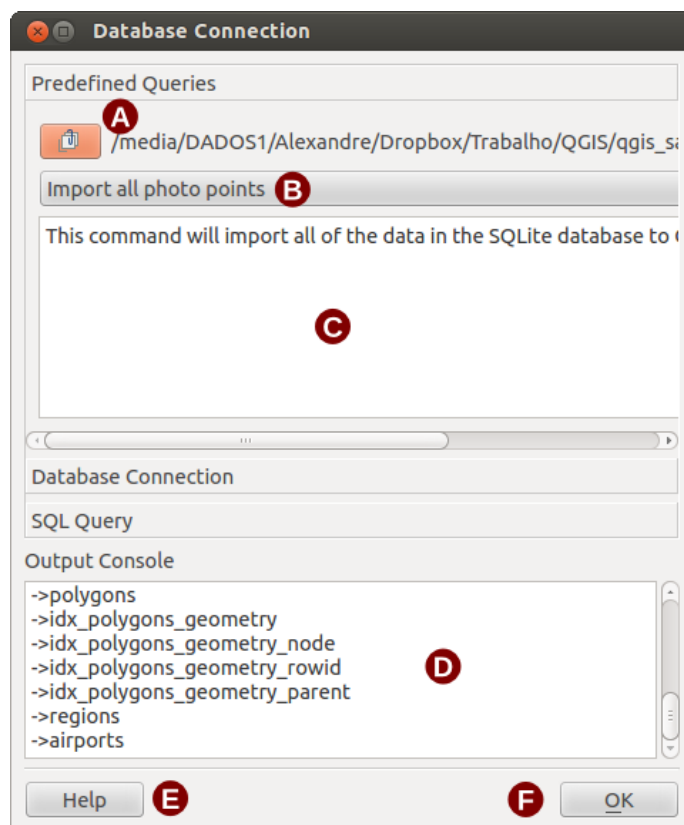
With predefined queries, you can select previously written queries stored in XML format in a file. This is particularly helpful if you are not familiar with SQL commands. Click on the *Predefined Queries* tab to display the predefined query interface.

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.

1. **Open File:** Launches the “Open File” file browser to search for the XML file holding the predefined queries.
2. **Predefined Queries:** A drop-down list with all of the queries defined by the predefined queries XML file.
3. **Query description:** A short description of the query. This description is from the predefined queries XML file.
4. **Console Window:** The console window where messages related to processing are displayed.
5. **Help:** Displays the online help.
6. **OK:** Closes the main “Database Connection” window.



Rysunek 19.14: The *eVis* Predefined Queries tab

XML format for *eVis* predefined queries

The XML tags read by *eVis*

Tag	Description
query	Defines the beginning and end of a query statement.
shortdescription	A short description of the query that appears in the <i>eVis</i> drop-down menu.
description	A more detailed description of the query displayed in the Predefined Query text window.
database-type	The database type, defined in the Database Type drop-down menu in the Database Connection tab.
database-port	The port as defined in the Port text box in the Database Connection tab.
database-name	The database name as defined in the Database Name text box in the Database Connection tab.
databaseusername	The database username as defined in the Username text box in the Database Connection tab.
databasepassword	The database password as defined in the Password text box in the Database Connection tab.
sqlstatement	The SQL command.
autoconnect	A flag (“true” or “false”) to specify if the above tags should be used to automatically connect to the database without running the database connection routine in the Database Connection tab.

A complete sample XML file with three queries is displayed below:

```
<?xml version="1.0"?>
<doc>
  <query>
```

```

<shortdescription>Import all photograph points</shortdescription>
<description>This command will import all of the data in the SQLite database to QGIS
  </description>
<databasetype>SQLITE</databasetype>
<databasehost />
<databaseport />
<databasename>C:\textbackslash Workshop\textbackslash
eVis\_Data\textbackslash PhotoPoints.db</databasename>
<databaseusername />
<databasepassword />
<sqlstatement>SELECT Attributes.*, Points.x, Points.y FROM Attributes LEFT JOIN
  Points ON Points.rec_id=Attributes.point_ID</sqlstatement>
<autoconnect>>false</autoconnect>
</query>
<query>
<shortdescription>Import photograph points "looking across Valley"</shortdescription>
<description>This command will import only points that have photographs "looking across
  a valley" to QGIS</description>
<databasetype>SQLITE</databasetype>
<databasehost />
<databaseport />
<databasename>C:\Workshop\eVis_Data\PhotoPoints.db</databasename>
<databaseusername />
<databasepassword />
<sqlstatement>SELECT Attributes.*, Points.x, Points.y FROM Attributes LEFT JOIN
  Points ON Points.rec_id=Attributes.point_ID where COMMENTS='Looking across
  valley'</sqlstatement>
<autoconnect>>false</autoconnect>
</query>
<query>
<shortdescription>Import photograph points that mention "limestone"</shortdescription>
<description>This command will import only points that have photographs that mention
  "limestone" to QGIS</description>
<databasetype>SQLITE</databasetype>
<databasehost />
<databaseport />
<databasename>C:\Workshop\eVis_Data\PhotoPoints.db</databasename>
<databaseusername />
<databasepassword />
<sqlstatement>SELECT Attributes.*, Points.x, Points.y FROM Attributes LEFT JOIN
  Points ON Points.rec_id=Attributes.point_ID where COMMENTS like '%limestone%'
</sqlstatement>
<autoconnect>>false</autoconnect>
</query>
</doc>

```

19.7 fTools Plugin

The goal of the fTools Python plugin is to provide a one-stop resource for many common vector-based GIS tasks, without the need for additional software, libraries, or complex work-arounds. It provides a growing suite of spatial data management and analysis functions that are both fast and functional.

fTools is now automatically installed and enabled in new versions of QGIS, and as with all plugins, it can be disabled and enabled using the Plugin Manager (see *The Plugins Menus*). When enabled, the fTools plugin adds a *Vector* menu to QGIS, providing functions ranging from Analysis and Research Tools to Geometry and Geoprocessing Tools, as well as several useful Data Management Tools.

19.7.1 Analysis tools









Icon	Tool	Purpose
	Distance matrix	Measure distances between two point layers, and output results as a) Square distance matrix, b) Linear distance matrix, or c) Summary of distances. Can limit distances to the k nearest features.
	Sum line length	Calculate the total sum of line lengths for each polygon of a polygon vector layer.
	Points in polygon	Count the number of points that occur in each polygon of an input polygon vector layer.
	List unique values	List all unique values in an input vector layer field.
	Basic statistics	Compute basic statistics (mean, std dev, N, sum, CV) on an input field.
	Nearest neighbor analysis	Compute nearest neighbor statistics to assess the level of clustering in a point vector layer.
	Mean coordinate(s)	Compute either the normal or weighted mean center of an entire vector layer, or multiple features based on a unique ID field.
	Line intersections	Locate intersections between lines, and output results as a point shapefile. Useful for locating road or stream intersections, ignores line intersections with length > 0.

Table Ftools 1: fTools Analysis tools

19.7.2 Research tools








Icon	Tool	Purpose
	Random selection	Randomly select n number of features, or n percentage of features.
	Random selection within subsets	Randomly select features within subsets based on a unique ID field.
	Random points	Generate pseudo-random points over a given input layer.
	Regular points	Generate a regular grid of points over a specified region and export them as a point shapefile.
	Vector grid	Generate a line or polygon grid based on user-specified grid spacing.
	Select by location	Select features based on their location relative to another layer to form a new selection, or add or subtract from the current selection.
	Polygon from layer extent	Create a single rectangular polygon layer from the extent of an input raster or vector layer.

Table Ftools 2: fTools Research tools

19.7.3 Geoprocessing tools










Icon	Tool	Purpose
	Convex hull(s)	Create minimum convex hull(s) for an input layer, or based on an ID field.
	Buffer(s)	Create buffer(s) around features based on distance, or distance field.
	Intersect	Overlay layers such that output contains areas where both layers intersect.
	Union	Overlay layers such that output contains intersecting and non-intersecting areas.
	Symmetrical difference	Overlay layers such that output contains those areas of the input and difference layers that do not intersect.
	Clip	Overlay layers such that output contains areas that intersect the clip layer.
	Difference	Overlay layers such that output contains areas not intersecting the clip layer.
	Dissolve	Merge features based on input field. All features with identical input values are combined to form one single feature.
	Eliminate sliver polygons	Merges selected features with the neighbouring polygon with the largest area or largest common boundary.

Table Ftools 3: fTools Geoprocessing tools

19.7.4 Geometry tools













Icon	Tool	Purpose
	Check geometry validity	Check polygons for intersections, closed holes, and fix node ordering.
	Export/Add geometry columns	Add vector layer geometry info to point (XCOORD, YCOORD), line (LENGTH), or polygon (AREA, PERIMETER) layer.
	Polygon centroids	Calculate the true centroids for each polygon in an input polygon layer.
	Delaunay triangulation	Calculate and output (as polygons) the Delaunay triangulation of an input point vector layer.
	Voronoi polygons	Calculate Voronoi polygons of an input point vector layer.
	Simplify geometry	Generalize lines or polygons with a modified Douglas-Peucker algorithm.
	Densify geometry	Densify lines or polygons by adding vertices.
	Multipart to singleparts	Convert multipart features to multiple singlepart features. Creates simple polygons and lines.
	Singleparts to multipart	Merge multiple features to a single multipart feature based on a unique ID field.
	Polygons to lines	Convert polygons to lines, multipart polygons to multiple singlepart lines.
	Lines to polygons	Convert lines to polygons, multipart lines to multiple singlepart polygons.
	Extract nodes	Extract nodes from line and polygon layers and output them as points.

Table Ftools 4: fTools Geometry tools

Informacja: The *Simplify geometry* tool can be used to remove duplicate nodes in line and polygon geometries. Just set the *Simplify tolerance* parameter to 0 and this will do the trick.

19.7.5 Data management tools






Icon	Tool	Purpose
	Define current projection	Specify the CRS for shapefiles whose CRS has not been defined.
	Join attributes by location	Join additional attributes to vector layer based on spatial relationship. Attributes from one vector layer are appended to the attribute table of another layer and exported as a shapefile.
	Split vector layer	Split input layer into multiple separate layers based on input field.
	Merge shapefiles to one	Merge several shapefiles within a folder into a new shapefile based on the layer type (point, line, area).
	Create spatial index	Create a spatial index for OGR- supported formats.

Table Ftools 5: fTools Data management tools

19.8 GDAL Tools Plugin

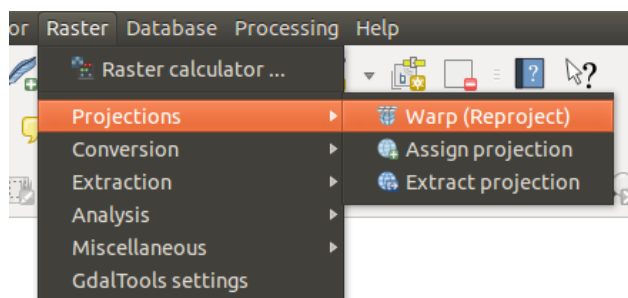
19.8.1 What is GDAL Tools?

The GDAL Tools plugin offers a GUI to the collection of tools in the Geospatial Data Abstraction Library, <http://gdal.osgeo.org> . These are raster management tools to query, re-project, warp and merge a wide variety of raster formats. Also included are tools to create a contour (vector) layer, or a shaded relief from a raster DEM, and to make a VRT (Virtual Raster Tile in XML format) from a collection of one or more raster files. These tools are available when the plugin is installed and activated.

The GDAL Library




The GDAL library consists of a set of command line programs, each with a large list of options. Users comfortable with running commands from a terminal may prefer the command line, with access to the full set of options. The GDALTools plugin offers an easy interface to the tools, exposing only the most popular options.

19.8.2 List of GDAL tools








Rysunek 19.15: The *GDALTools* menu list



Projections

 <p><i>Warp (Reproject)</i></p>	<p>This utility is an image mosaicing, reprojection and warping utility. The program can reproject to any supported projection, and can also apply GCPs stored with the image if the image is “raw” with control information. For more information, you can read on the GDAL website http://www.gdal.org/gdalwarp.html.</p>
 <p><i>Assign projection</i></p>	<p>This tool allows you to assign projection to rasters that are already georeferenced but miss projection information. Also with its help, it is possible to alter existing projection definitions. Both single file and batch mode are supported. For more information, please visit the utility page at the GDAL site, http://www.gdal.org/gdalwarp.html.</p>
 <p><i>Extract projection</i></p>	<p>This utility helps you to extract projection information from an input file. If you want to extract projection information from a whole directory, you can use the batch mode. It creates both <code>.prj</code> and <code>.wld</code> files.</p>







Conversion

 <p><i>Rasterize</i></p>	<p>This program burns vector geometries (points, lines and polygons) into the raster band(s) of a raster image. Vectors are read from OGR-supported vector formats. Note that the vector data must in the same coordinate system as the raster data; on the fly reprojection is not provided. For more information see http://www.gdal.org/gdal_rasterize.html.</p>
 <p><i>Polygonize</i></p>	<p>This utility creates vector polygons for all connected regions of pixels in the raster sharing a common pixel value. Each polygon is created with an attribute indicating the pixel value of that polygon. The utility will create the output vector datasource if it does not already exist, defaulting to ESRI shapefile format. See also http://www.gdal.org/gdal_polygonize.html.</p>
 <p><i>Translate</i></p>	<p>This utility can be used to convert raster data between different formats, potentially performing some operations like subsetting, resampling, and rescaling pixels in the process. For more information you can read on http://www.gdal.org/gdal_translate.html.</p>
 <p><i>RGB to PCT</i></p>	<p>This utility will compute an optimal pseudocolor table for a given RGB image using a median cut algorithm on a downsampled RGB histogram. Then it converts the image into a pseudocolored image using the color table. This conversion utilizes Floyd-Steinberg dithering (error diffusion) to maximize output image visual quality. The utility is also described at http://www.gdal.org/rgb2pct.html.</p>
 <p><i>PCT to RGB</i></p>	<p>This utility will convert a pseudocolor band on the input file into an output RGB file of the desired format. For more information, see http://www.gdal.org/pct2rgb.html.</p>






Extraction

 <p><i>Con- tour</i></p>	<p>This program generates a vector contour file from the input raster elevation model (DEM). On http://www.gdal.org/gdal_contour.html, you can find more information.</p>
 <p><i>Clip- per</i></p>	<p>This utility allows you to clip (extract subset) rasters using selected extent or based on mask layer bounds. More information can be found at http://www.gdal.org/gdal_translate.html.</p>

Analysis

 <i>Sieve</i>	<p>This utility removes raster polygons smaller than a provided threshold size (in pixels) and replaces them with the pixel value of the largest neighbor polygon. The result can be written back to the existing raster band, or copied into a new file. For more information, see http://www.gdal.org/gdal_sieve.html.</p>
 <i>Near Black</i>	<p>This utility will scan an image and try to set all pixels that are nearly black (or nearly white) around the edge to exactly black (or white). This is often used to “fix up” lossy compressed aerial photos so that color pixels can be treated as transparent when mosaicing. See also http://www.gdal.org/nearblack.html.</p>
 <i>Fill nodata</i>	<p>This utility fills selected raster regions (usually nodata areas) by interpolation from valid pixels around the edges of the areas. On http://www.gdal.org/gdal_fillnodata.html, you can find more information.</p>
 <i>Proximity</i>	<p>This utility generates a raster proximity map indicating the distance from the center of each pixel to the center of the nearest pixel identified as a target pixel. Target pixels are those in the source raster for which the raster pixel value is in the set of target pixel values. For more information see http://www.gdal.org/gdal_proximity.html.</p>
 <i>Grid (Interpolation)</i>	<p>This utility creates a regular grid (raster) from the scattered data read from the OGR datasource. Input data will be interpolated to fill grid nodes with values, and you can choose from various interpolation methods. The utility is also described on the GDAL website, http://www.gdal.org/gdal_grid.html.</p>
 <i>DEM (Terrain models)</i>	<p>Tools to analyze and visualize DEMs. It can create a shaded relief, a slope, an aspect, a color relief, a Terrain Ruggedness Index, a Topographic Position Index and a roughness map from any GDAL-supported elevation raster. For more information, see http://www.gdal.org/gdaldem.html.</p>

Miscellaneous

 <i>Build Virtual Raster (Catalog)</i>	<p>This program builds a VRT (Virtual Dataset) that is a mosaic of the list of input GDAL datasets. See also http://www.gdal.org/gdalbuildvrt.html.</p>
 <i>Merge</i>	<p>This utility will automatically mosaic a set of images. All the images must be in the same coordinate system and have a matching number of bands, but they may be overlapping, and at different resolutions. In areas of overlap, the last image will be copied over earlier ones. The utility is also described at http://www.gdal.org/gdal_merge.html.</p>
 <i>Information</i>	<p>This utility lists various information about a GDAL-supported raster dataset. On http://www.gdal.org/gdalinfo.html, you can find more information.</p>
 <i>Build Overviews</i>	<p>The <code>gdaladdo</code> utility can be used to build or rebuild overview images for most supported file formats with one of several downsampling algorithms. For more information, see http://www.gdal.org/gdaladdo.html.</p>
 <i>Tile Index</i>	<p>This utility builds a shapefile with a record for each input raster file, an attribute containing the filename, and a polygon geometry outlining the raster. See also http://www.gdal.org/gdaltindex.html.</p>

GDAL Tools Settings

Use this dialog to embed your GDAL variables.

19.9 Georeferencer Plugin

The Georeferencer Plugin is a tool for generating world files for rasters. It allows you to reference rasters to geographic or projected coordinate systems by creating a new GeoTiff or by adding a world file to the existing image. The basic approach to georeferencing a raster is to locate points on the raster for which you can accurately determine coordinates.

Features




















Icon	Purpose	Icon	Purpose
	Open raster		Start georeferencing
	Generate GDAL Script		Load GCP Points
	Save GCP Points As		Transformation settings
	Add Point		Delete Point
	Move GCP Point		Pan
	Zoom In		Zoom Out
	Zoom To Layer		Zoom Last
	Zoom Next		Link Georeferencer to QGIS
	Link QGIS to Georeferencer		Full histogram stretch
	Local histogram stretch		

Table Georeferencer 1: Georeferencer Tools

19.9.1 Usual procedure

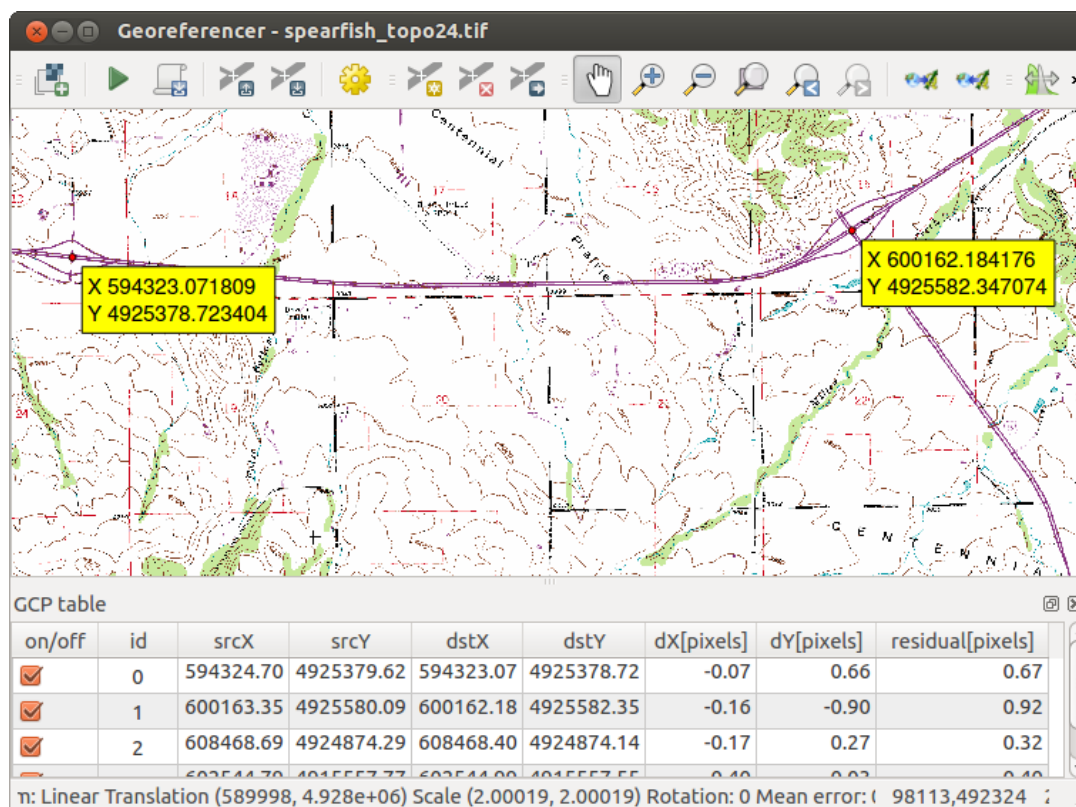
As X and Y coordinates (DMS (dd mm ss.ss), DD (dd.dd) or projected coordinates (mmmm.mm)), which correspond with the selected point on the image, two alternative procedures can be used:

- The raster itself sometimes provides crosses with coordinates “written” on the image. In this case, you can enter the coordinates manually.
- Using already georeferenced layers. This can be either vector or raster data that contain the same objects/features that you have on the image that you want to georeference and with the projection that you want for your image. In this case, you can enter the coordinates by clicking on the reference dataset loaded in the QGIS map canvas.

The usual procedure for georeferencing an image involves selecting multiple points on the raster, specifying their coordinates, and choosing a relevant transformation type. Based on the input parameters and data, the plugin will compute the world file parameters. The more coordinates you provide, the better the result will be.





The first step is to start QGIS, load the Georeferencer Plugin (see *The Plugins Menus*) and click on *Raster* → *Georeferencer*, which appears in the QGIS menu bar. The Georeferencer Plugin dialog appears as shown in [figure_georeferencer_1](#).



For this example, we are using a topo sheet of South Dakota from SDGS. It can later be visualized together with the data from the GRASS `spearfish60` location. You can download the topo sheet here: http://grass.osgeo.org/sampled/spearfish_toposheet.tar.gz.



Rysunek 19.16: Georeferencer Plugin Dialog 

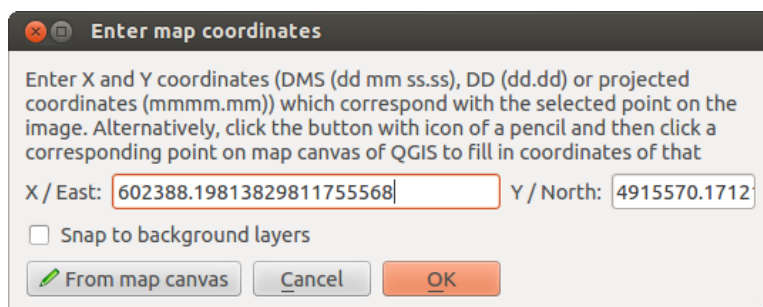
Entering ground control points (GCPs)

1. To start georeferencing an unreferenced raster, we must load it using the  button. The raster will show up in the main working area of the dialog. Once the raster is loaded, we can start to enter reference points.
2. Using the  Add Point button, add points to the main working area and enter their coordinates (see Figure [figure_georeferencer_2](#)). For this procedure you have three options:
 - Click on a point in the raster image and enter the X and Y coordinates manually.
 - Click on a point in the raster image and choose the  From map canvas button to add the X and Y coordinates with the help of a georeferenced map already loaded in the QGIS map canvas.
 - With the  button, you can move the GCPs in both windows, if they are at the wrong place.
3. Continue entering points. You should have at least four points, and the more coordinates you can provide, the better the result will be. There are additional tools on the plugin dialog to zoom and pan the working area in order to locate a relevant set of GCP points.

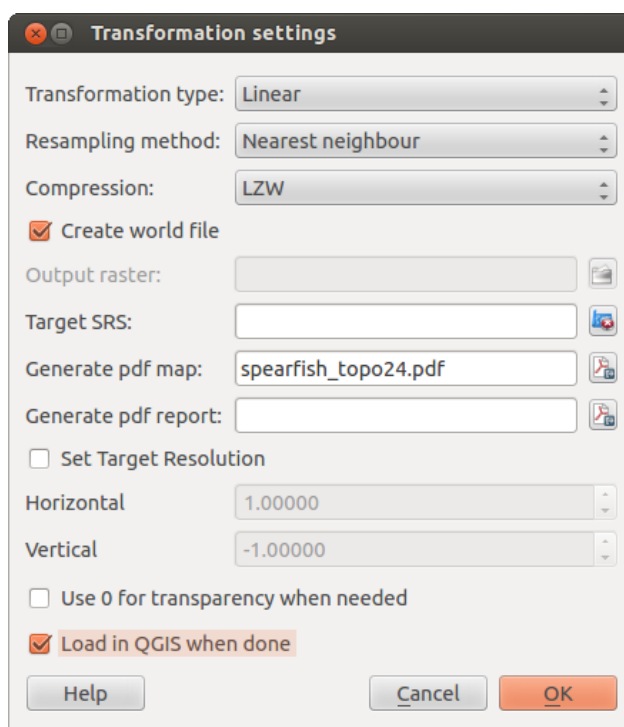
The points that are added to the map will be stored in a separate text file (`[filename].points`) usually together with the raster image. This allows us to reopen the Georeferencer plugin at a later date and add new points or delete existing ones to optimize the result. The points file contains values of the form: `mapX, mapY, pixelX, pixelY`. You can use the  Load GCP points and  Save GCP points as buttons to manage the files.

Defining the transformation settings

After you have added your GCPs to the raster image, you need to define the transformation settings for the georeferencing process.



Rysunek 19.17: Add points to the raster image 🐧



Rysunek 19.18: Defining the georeferencer transformation settings 🐧

Available Transformation algorithms

Depending on how many ground control points you have captured, you may want to use different transformation algorithms. Choice of transformation algorithm is also dependent on the type and quality of input data and the amount of geometric distortion that you are willing to introduce to the final result.

Currently, the following *Transformation types* are available:

- The **Linear** algorithm is used to create a world file and is different from the other algorithms, as it does not actually transform the raster. This algorithm likely won't be sufficient if you are dealing with scanned material.
- The **Helmert** transformation performs simple scaling and rotation transformations.
- The **Polynomial** algorithms 1-3 are among the most widely used algorithms introduced to match source and destination ground control points. The most widely used polynomial algorithm is the second-order polynomial transformation, which allows some curvature. First-order polynomial transformation (affine) preserves collinearity and allows scaling, translation and rotation only.
- The **Thin Plate Spline** (TPS) algorithm is a more modern georeferencing method, which is able to introduce local deformations in the data. This algorithm is useful when very low quality originals are being georeferenced.
- The **Projective** transformation is a linear rotation and translation of coordinates.

Define the Resampling method

The type of resampling you choose will likely depending on your input data and the ultimate objective of the exercise. If you don't want to change statistics of the image, you might want to choose 'Nearest neighbour', whereas a 'Cubic resampling' will likely provide a more smoothed result.

It is possible to choose between five different resampling methods:

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

Define the transformation settings

There are several options that need to be defined for the georeferenced output raster.

- The *Create world file* checkbox is only available if you decide to use the linear transformation type, because this means that the raster image actually won't be transformed. In this case, the *Output raster* field is not activated, because only a new world file will be created.
- For all other transformation types, you have to define an *Output raster*. As default, a new file ([file-name]_modified) will be created in the same folder together with the original raster image.
- As a next step, you have to define the *Target SRS* (Spatial Reference System) for the georeferenced raster (see *Praca z układami współrzędnych*).
- If you like, you can **generate a pdf map** and also **a pdf report**. The report includes information about the used transformation parameters, an image of the residuals and a list with all GCPs and their RMS errors.
- Furthermore, you can activate the *Set Target Resolution* checkbox and define the pixel resolution of the output raster. Default horizontal and vertical resolution is 1.
- The *Use 0 for transparency when needed* can be activated, if pixels with the value 0 shall be visualized transparent. In our example toposheet, all white areas would be transparent.

- Finally, *Load in QGIS when done* loads the output raster automatically into the QGIS map canvas when the transformation is done.


Show and adapt raster properties

Clicking on the *Raster properties* dialog in the *Settings* menu opens the raster properties of the layer that you want to georeference.

Configure the georeferencer


- You can define whether you want to show GCP coordinates and/or IDs.
- As residual units, pixels and map units can be chosen.
- For the PDF report, a left and right margin can be defined and you can also set the paper size for the PDF map.
- Finally, you can activate to *Show Georeferencer window docked*.

Running the transformation


After all GCPs have been collected and all transformation settings are defined, just press the  Start georeferencing button to create the new georeferenced raster.

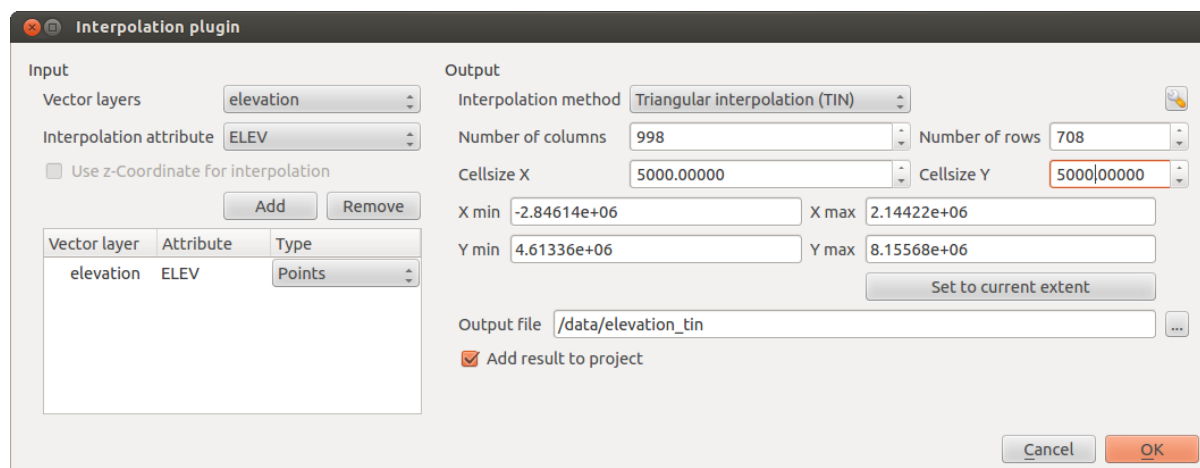
19.10 Interpolation Plugin

The Interpolation plugin can be used to generate a TIN or IDW interpolation of a point vector layer. It is very simple to handle and provides an intuitive graphical user interface for creating interpolated raster layers (see [Figure_interpolation_1](#)). The plugin requires the following parameters to be specified before running:


- **Input **Vector layers**:** Specify the input point vector layer(s) from a list of loaded point layers. If several layers are specified, then data from all layers is used for interpolation. Note: It is possible to insert lines or polygons as constraints for the triangulation, by specifying either “points”, “structure lines” or “break lines” in the *Type*  combo box.
- **Interpolation attribute:** Select the attribute column to be used for interpolation or enable the *Use Z-Coordinate* checkbox to use the layer’s stored Z values.
- **Interpolation Method:** Select the interpolation method. This can be either ‘Triangulated Irregular Network (TIN)’ or ‘Inverse Distance Weighted (IDW)’.
- **Number of columns/rows:** Specify the number of rows and columns for the output raster file.
- **Output file:** Specify a name for the output raster file.
- *Add result to project* to load the result into the map canvas.

19.10.1 Using the plugin

1. Start QGIS and load a point vector layer (e.g., `elevp.csv`).
2. Load the Interpolation plugin in the Plugin Manager (see *The Plugins Menus*) and click on the *Raster* → *Interpolation* →  *Interpolation*, which appears in the QGIS menu bar. The Interpolation plugin dialog appears as shown in [Figure_interpolation_1](#).




Rysunek 19.19: Interpolation Plugin 



3. Select an input layer (e.g., *elevp* ) and column (e.g., *ELEV*) for interpolation.
4. Select an interpolation method (e.g., ‘Triangulated Irregular Network (TIN)’), and specify a cell size of 5000 as well as the raster output filename (e.g., *elevation_tin*).
5. Click [OK].

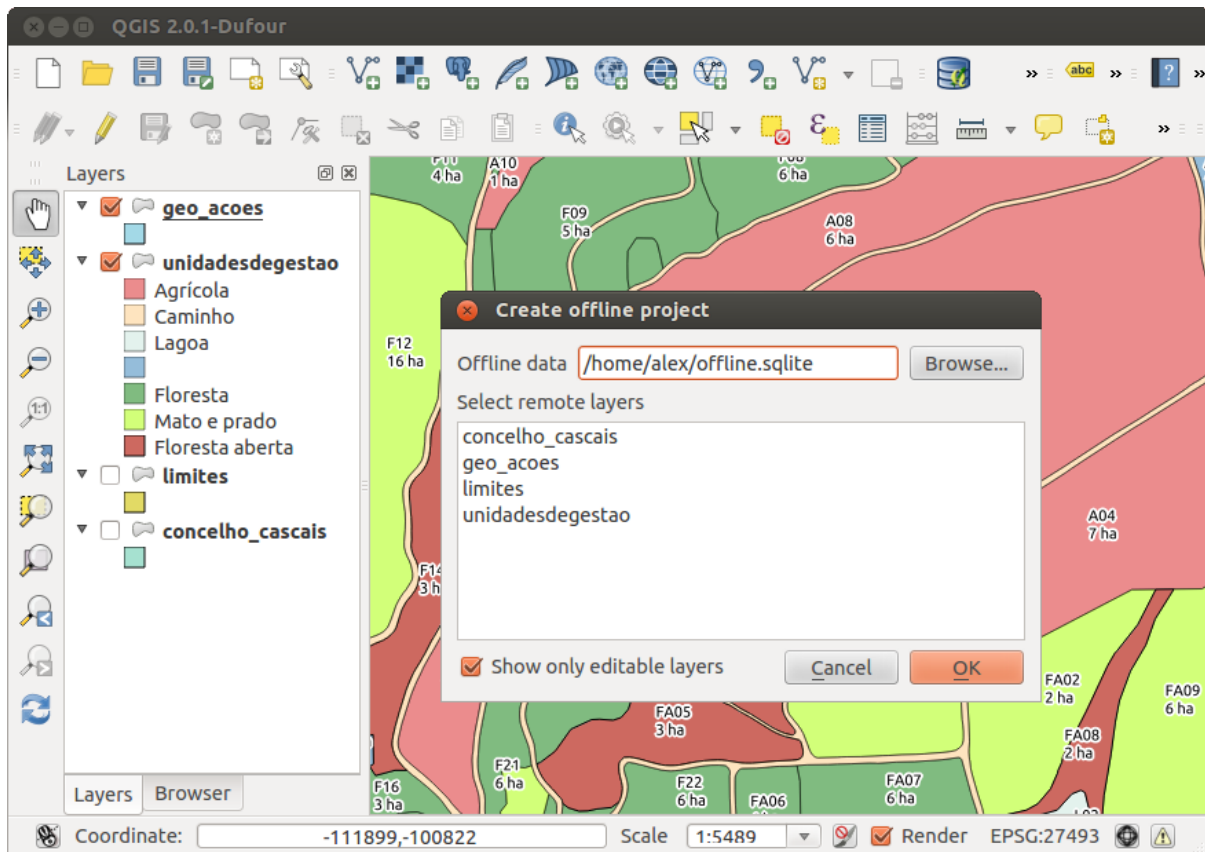
19.11 Offline Editing Plugin

For data collection, it is a common situation to work with a laptop or a cell phone offline in the field. Upon returning to the network, the changes need to be synchronized with the master datasource (e.g., a PostGIS database). If several persons are working simultaneously on the same datasets, it is difficult to merge the edits by hand, even if people don’t change the same features.

The  Offline Editing Plugin automates the synchronisation by copying the content of a datasource (usually PostGIS or WFS-T) to a SpatiaLite database and storing the offline edits to dedicated tables. After being connected to the network again, it is possible to apply the offline edits to the master dataset.


19.11.1 Using the plugin

- Open some vector layers (e.g., from a PostGIS or WFS-T datasource).
- Save it as a project.
- Go to *Database* → *Offline Editing* →  *Convert to offline project* and select the layers to save. The content of the layers is saved to SpatiaLite tables.
- Edit the layers offline.
- After being connected again, upload the changes using *Database* → *Offline Editing* →  *Synchronize*.



Rysunek 19.20: Create an offline project from PostGIS or WFS layers


19.12 Oracle Spatial GeoRaster Plugin

In Oracle databases, raster data can be stored in SDO_GEORASTER objects available with the Oracle Spatial extension. In QGIS, the  Oracle Spatial GeoRaster plugin is supported by GDAL and depends on Oracle's database product being installed and working on your machine. While Oracle is proprietary software, they provide their software free for development and testing purposes. Here is one simple example of how to load raster images to GeoRaster:

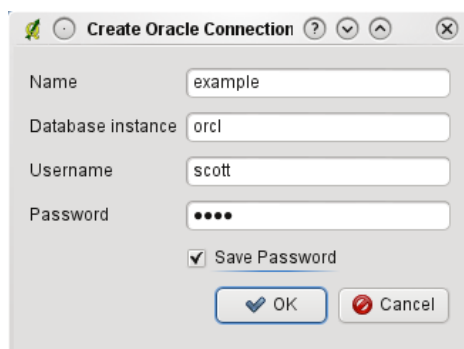
```
$ gdal_translate -of georaster input_file.tif geor:scott/tiger@orcl
```

This will load the raster into the default GDAL_IMPORT table, as a column named RASTER.

19.12.1 Managing connections

Firstly, the Oracle GeoRaster Plugin must be enabled using the Plugin Manager (see *The Plugins Menus*). The first time you load a GeoRaster in QGIS, you must create a connection to the Oracle database that contains the data. To do this, begin by clicking on the  Add Oracle GeoRaster Layer toolbar button – this will open the *Select Oracle Spatial GeoRaster* dialog window. Click on **[New]** to open the dialog window, and specify the connection parameters (See *Figure_oracle_raster_1*):

- **Name:** Enter a name for the database connection.
- **Database instance:** Enter the name of the database that you will connect to.
- **Username:** Specify your own username that you will use to access the database.
- **Password:** Provide the password associated with your username that is required to access the database.



Rysunek 19.21: Create Oracle connection dialog

Now, back on the main *Oracle Spatial GeoRaster* dialog window (see [Figure_oracle_raster_2](#)), use the drop-down list to choose one connection, and use the **[Connect]** button to establish a connection. You may also **[Edit]** the connection by opening the previous dialog and making changes to the connection information, or use the **[Delete]** button to remove the connection from the drop-down list.

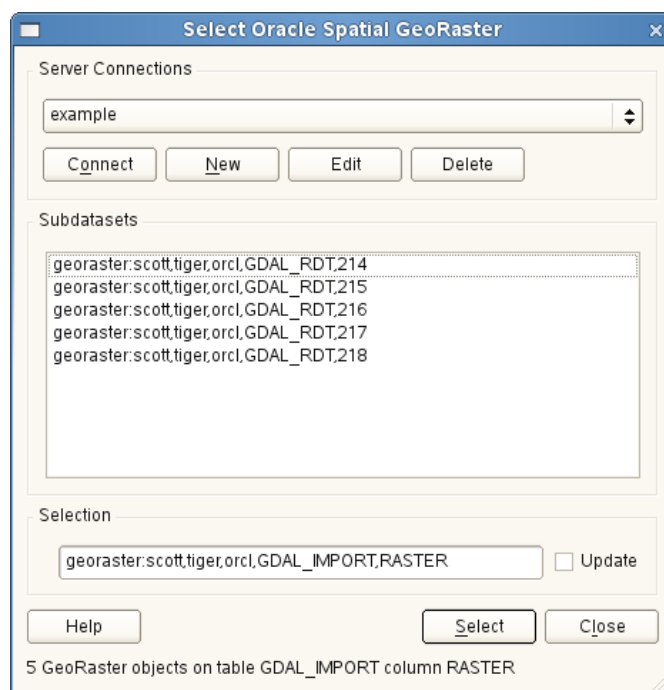
19.12.2 Selecting a GeoRaster

Once a connection has been established, the subdatasets window will show the names of all the tables that contain GeoRaster columns in that database in the format of a GDAL subdataset name.

Click on one of the listed subdatasets and then click on **[Select]** to choose the table name. Now another list of subdatasets will show with the names of GeoRaster columns on that table. This is usually a short list, since most users will not have more than one or two GeoRaster columns on the same table.

Click on one of the listed subdatasets and then click on **[Select]** to choose one of the table/column combinations. The dialog will now show all the rows that contain GeoRaster objects. Note that the subdataset list will now show the Raster Data Table and Raster Id pairs.

At any time, the selection entry can be edited in order to go directly to a known GeoRaster or to go back to the beginning and select another table name.



Rysunek 19.22: Select Oracle GeoRaster dialog

The selection data entry can also be used to enter a WHERE clause at the end of the identification string (e.g., `geor:scott/tiger@orcl,gdal_import,raster,geoid=`). See http://www.gdal.org/frmt_georaster.html for more information.

19.12.3 Displaying GeoRaster

Finally, by selecting a GeoRaster from the list of Raster Data Tables and Raster Ids, the raster image will be loaded into QGIS.

The *Select Oracle Spatial GeoRaster* dialog can be closed now and the next time it opens, it will keep the same connection and will show the same previous list of subdatasets, making it very easy to open up another image from the same context.

Informacja: GeoRasters that contain pyramids will display much faster, but the pyramids need to be generated outside of QGIS using Oracle PL/SQL or `gdaladdo`.

The following is an example using `gdaladdo`:

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

This is an example using 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 Raster Terrain Analysis Plugin



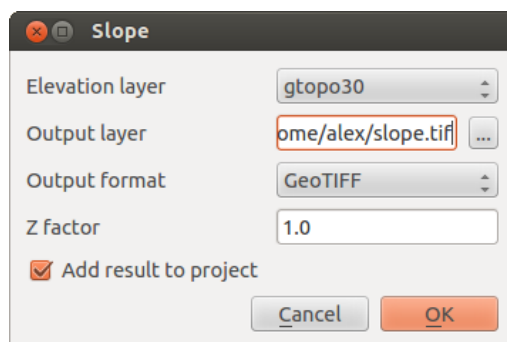
The Raster Terrain Analysis Plugin can be used to calculate the slope, aspect, hillshade, ruggedness index and relief for digital elevation models (DEM). It is very simple to handle and provides an intuitive graphical user interface for creating new raster layers (see [Figure_raster_terrain_1](#)).

Description of the analysis:

- **Slope:** Calculates the slope angle for each cell in degrees (based on first-order derivative estimation).
- **Aspect:** Exposition (starting with 0 for north direction, in degrees counterclockwise).
- **Hillshade:** Creates a shaded map using light and shadow to provide a more three-dimensional appearance for a shaded relief map.
- **Ruggedness Index:** A quantitative measurement of terrain heterogeneity as described by Riley et al. (1999). It is calculated for every location by summarizing the change in elevation within the 3x3 pixel grid.
- **Relief:** Creates a shaded relief map from digital elevation data. Implemented is a method to choose the elevation colors by analysing the frequency distribution.

19.13.1 Using the plugin

1. Start QGIS and load the `gtopo30` raster layer from the GRASS sample location.




Rysunek 19.23: Raster Terrain Modelling Plugin (slope calculation)

2. Load the Raster Terrain Analysis plugin in the Plugin Manager (see *The Plugins Menus*).
3. Select an analysis method from the menu (e.g., *Raster* → *Terrain Analysis* → *Slope*). The *Slope* dialog appears as shown in [Figure_raster_terrain_1](#).
4. Specify an output file path, and an output file type.
5. Click [OK].

19.14 Heatmap Plugin

The *Heatmap* plugin uses Kernel Density Estimation to create a density (heatmap) raster of an input point vector layer. The density is calculated based on the number of points in a location, with larger numbers of clustered points resulting in larger values. Heatmaps allow easy identification of “hotspots” and clustering of points.

19.14.1 Activate the Heatmap plugin


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.

Select the menu *View* → *Toolbars* → *Raster* to show the Raster Toolbar if it is not visible.

19.14.2 Using the Heatmap plugin

Clicking the  *Heatmap* tool button opens the Heatmap plugin dialog (see [figure_heatmap_2](#)).

The dialog has the following options:

- **Input point layer:** Lists all the vector point layers in the current project and is used to select the layer to be analysed.
- **Output raster:** Allows you to use the  button to select the folder and filename for the output raster the Heatmap plugin generates. A file extension is not required.
- **Output format:** Selects the output format. Although all formats supported by GDAL can be chosen, in most cases GeoTIFF is the best format to choose.
- **Radius:** Is used to specify the heatmap search radius (or kernel bandwidth) in meters or map units. The radius specifies the distance around a point at which the influence of the point will be felt. Larger values result in greater smoothing, but smaller values may show finer details and variation in point density.

When the  *Advanced* checkbox is checked, additional options will be available:

- **Rows and Columns:** Used to change the dimensions of the output raster. These values are also linked to the **Cell size X** and **Cell size Y** values. Increasing the number of rows or columns will decrease the cell size and increase the file size of the output file. The values in Rows and Columns are also linked, so doubling the number of rows will automatically double the number of columns and the cell sizes will also be halved. The geographical area of the output raster will remain the same!
- **Cell size X and Cell size Y:** Control the geographic size of each pixel in the output raster. Changing these values will also change the number of Rows and Columns in the output raster.
- **Kernel shape:** The kernel shape controls the rate at which the influence of a point decreases as the distance from the point increases. Different kernels decay at different rates, so a triweight kernel gives features greater weight for distances closer to the point than the Epanechnikov kernel does. Consequently, triweight results in “sharper” hotspots, and Epanechnikov results in “smoother” hotspots. A number of standard kernel functions are available in QGIS, which are described and illustrated on [Wikipedia](#).
- **Decay ratio:** Can be used with Triangular kernels to further control how heat from a feature decreases with distance from the feature.
 - A value of 0 (=minimum) indicates that the heat will be concentrated in the centre of the given radius and completely extinguished at the edge.
 - A value of 0.5 indicates that pixels at the edge of the radius will be given half the heat as pixels at the centre of the search radius.
 - A value of 1 means the heat is spread evenly over the whole search radius circle. (This is equivalent to the ‘Uniform’ kernel.)
 - A value greater than 1 indicates that the heat is higher towards the edge of the search radius than at the centre.

The input point layer may also have attribute fields which can affect how they influence the heatmap:




- **Use radius from field:** Sets the search radius for each feature from an attribute field in the input layer.
- **Use weight from field:** Allows input features to be weighted by an attribute field. This can be used to increase the influence certain features have on the resultant heatmap.

When an output raster file name is specified, the **[OK]** button can be used to create the heatmap.

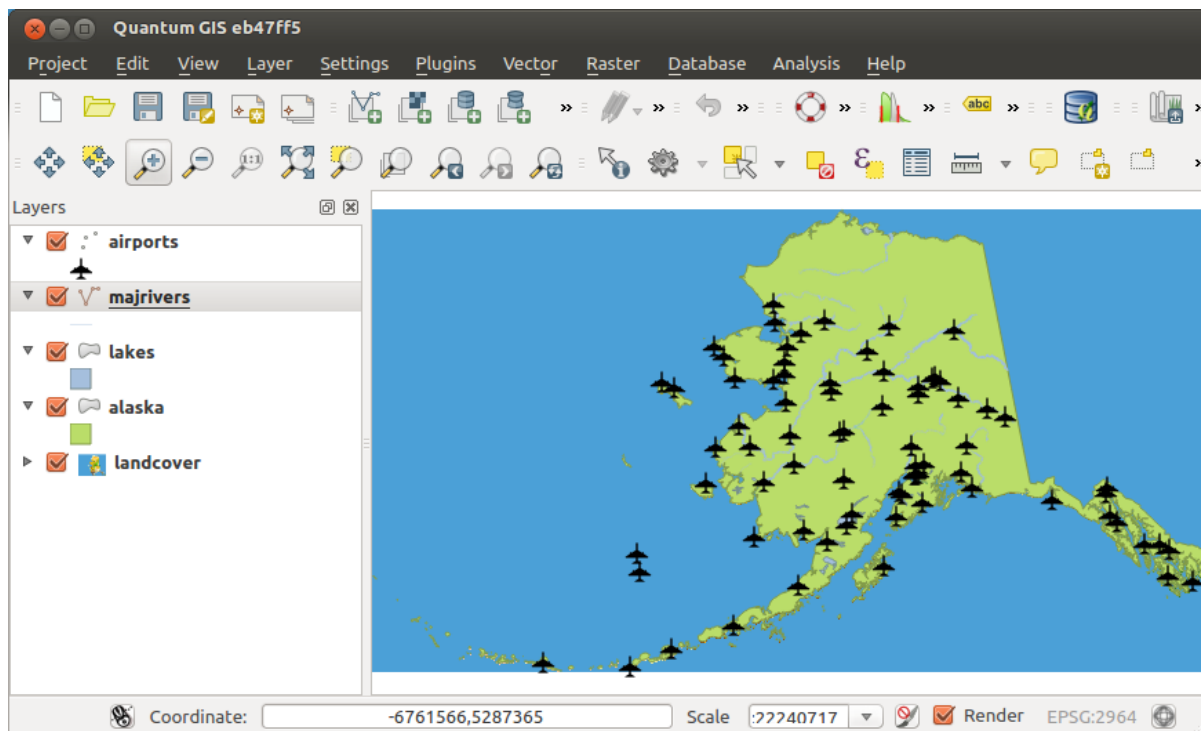
19.14.3 Tutorial: Creating a Heatmap

For the following example, we will use the `airports` vector point layer from the QGIS sample dataset (see *Przykładowe dane*). Another excellent QGIS tutorial on making heatmaps can be found at <http://qgis.spatialthoughts.com>.

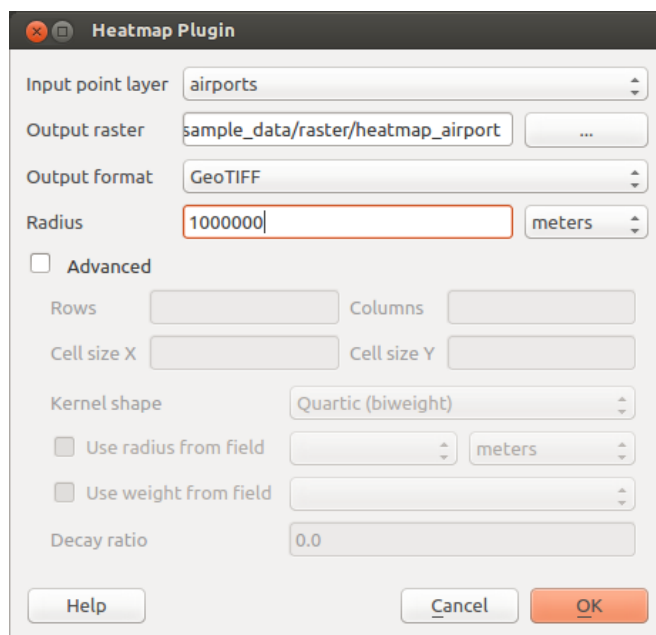
In *Figure_Heatmap_1*, the airports of Alaska are shown.

1. Select the  *Heatmap* tool button to open the Heatmap dialog (see *Figure_Heatmap_2*).
2. In the *Input point layer*  field, select `airports` from the list of point layers loaded in the current project.
3. Specify an output filename by clicking the  button next to the *Output raster* field. Enter the filename `heatmap_airports` (no file extension is necessary).
4. Leave the *Output format* as the default format, GeoTIFF.
5. Change the *Radius* to 1000000 meters.
6. Click on **[OK]** to create and load the airports heatmap (see *Figure_Heatmap_3*).

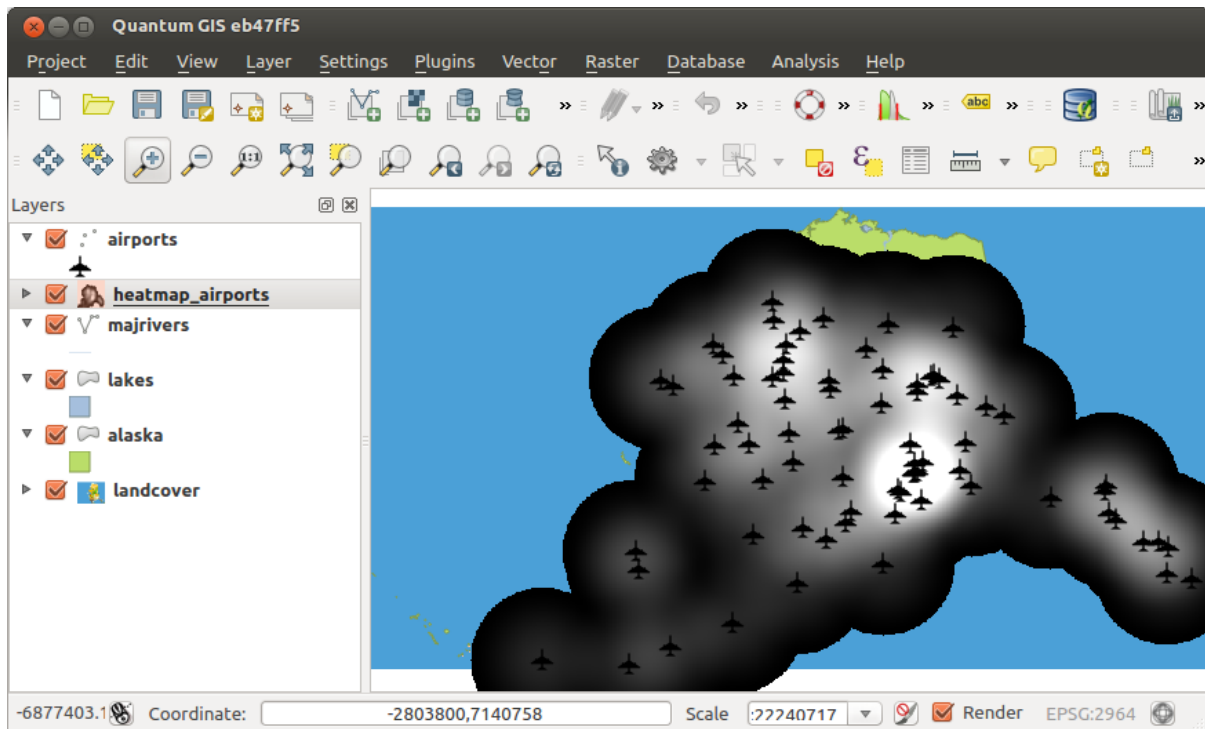
QGIS will generate the heatmap and add the results to your map window. By default, the heatmap is shaded in greyscale, with lighter areas showing higher concentrations of airports. The heatmap can now be styled in QGIS to improve its appearance.



Rysunek 19.24: Airports of Alaska 



Rysunek 19.25: The Heatmap Dialog 



Rysunek 19.26: The heatmap after loading looks like a grey surface 🐧

1. Open the properties dialog of the `heatmap_airports` layer (select the layer `heatmap_airports`, open the context menu with the right mouse button and select *Properties*).
2. Select the *Style* tab.
3. Change the *Render type* to 'Singleband pseudocolor'.
4. Select a suitable *Color map* , for instance `YlOrRed`.
5. Click the **[Load]** button to fetch the minimum and maximum values from the raster, then click the **[Classify]** button.
6. Press **[OK]** to update the layer.

The final result is shown in [Figure_Heatmap_4](#).

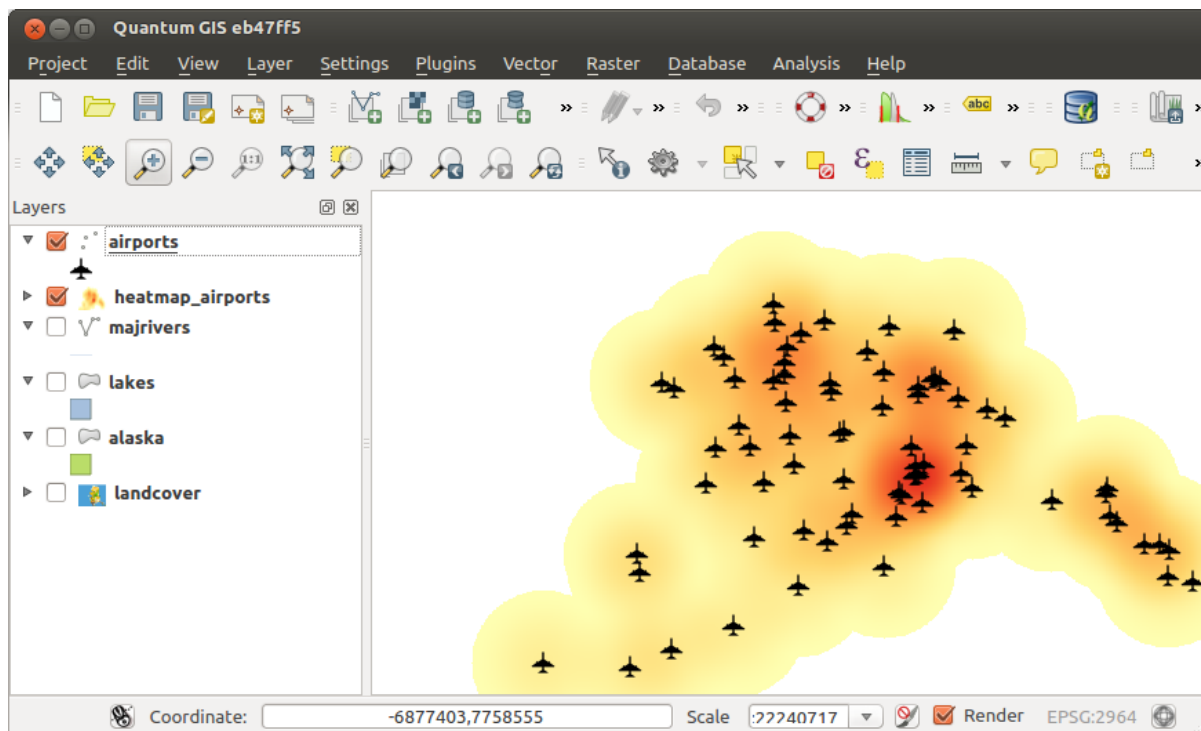
19.15 Road Graph Plugin

The Road Graph Plugin is a C++ plugin for QGIS that calculates the shortest path between two points on any polyline layer and plots this path over the road network.

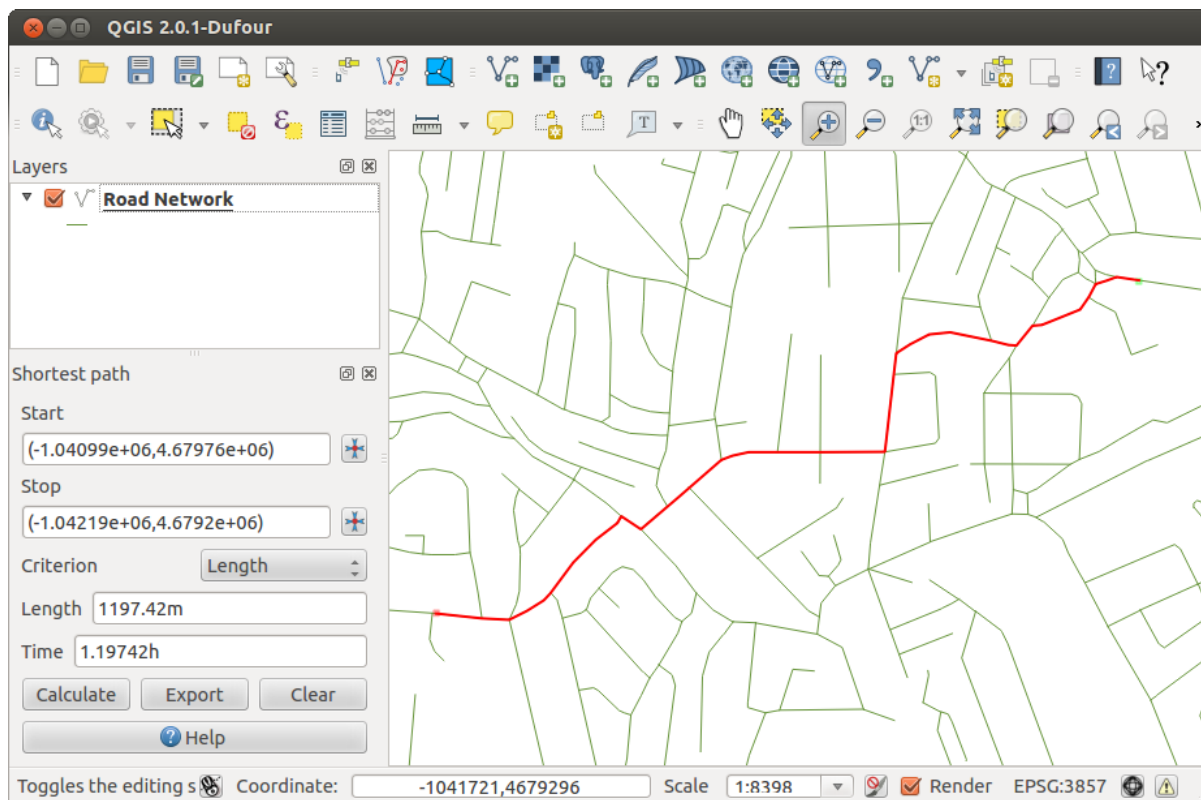
Main features:

- Calculates path, as well as length and travel time.
- Optimizes by length or by travel time.
- Exports path to a vector layer.
- Highlights roads directions (this is slow and used mainly for debug purposes and for the settings testing).

As a roads layer, you can use any polyline vector layer in any QGIS-supported format. Two lines with a common point are considered connected. Please note, it is required to use layer CRS as project CRS while editing a roads



Rysunek 19.27: Styled heatmap of airports of Alaska 🐧



Rysunek 19.28: Road Graph Plugin 🐧

layer. This is due to the fact that recalculation of the coordinates between different CRSs introduces some errors that can result in discontinuities, even when ‘snapping’ is used.

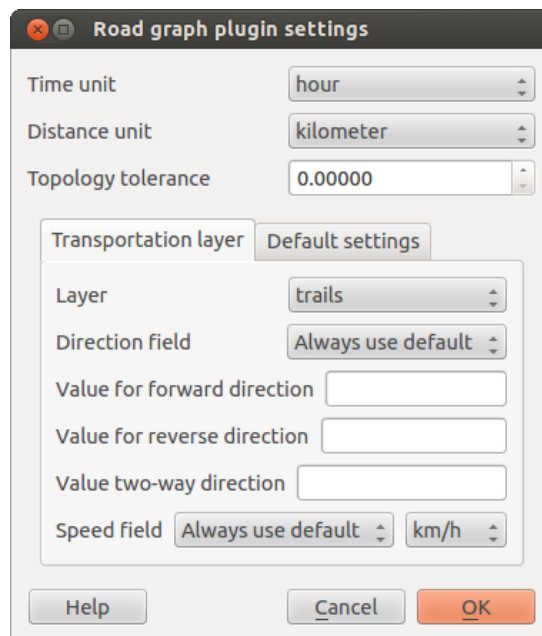
In the layer attribute table, the following fields can be used:


- Speed on road section (numeric field).
- Direction (any type that can be cast to string). Forward and reverse directions correspond to a one-way road, both directions indicate a two-way road.

If some fields don’t have any value or do not exist, default values are used. You can change defaults and some plugin settings in the plugin settings dialog.

19.15.1 Using the plugin

After plugin activation, you will see an additional panel on the left side of the main QGIS window. Now, enter some parameters into the *Road graph plugin settings* dialog in the *Vector* → *Road Graph* menu (see [figure_road_graph_2](#)).




Rysunek 19.29: Road graph plugin settings 

After setting the *Time unit*, *Distance unit* and *Topology tolerance*, you can choose the vector layer in the *Transportation layer* tab. Here you can also choose the *Direction field* and *Speed field*. In the *Default settings* tab, you can set the *Direction* for the calculation.

Finally, in the *Shortest Path* panel, select a Start and a Stop point in the road network layer and click on [**Calculate**].

19.16 Spatial Query Plugin

The  Spatial Query Plugin allows you to make a spatial query (i.e., select features) in a target layer with reference to another layer. The functionality is based on the GEOS library and depends on the selected source feature layer.


Possible operators are:

- Contains




- Equals
- Overlap
- Crosses
- Intersects
- Is disjoint
- Touches
- Within

19.16.1 Using the plugin


As an example, we want to find regions in the Alaska dataset that contain airports. The following steps are necessary:

1. Start QGIS and load the vector layers `regions.shp` and `airports.shp`.
2. Load the Spatial Query plugin in the Plugin Manager (see *The Plugins Menus*) and click on the  Spatial Query icon, which appears in the QGIS toolbar menu. The plugin dialog appears.
3. Select the layer `regions` as the source layer and `airports` as the reference feature layer.
4. Select 'Contains' as the operator and click **[Apply]**.

Now you get a list of feature IDs from the query and you have several options, as shown in `figure_spatial_query_1`.

- Click on  Create layer with list of items .
- Select an ID from the list and click on  Create layer with selected .
- Select 'Remove from current selection' in the field *And use the result to*  .
- Additionally, you can *Zoom to item* or display *Log messages*.

19.17 SPIT Plugin

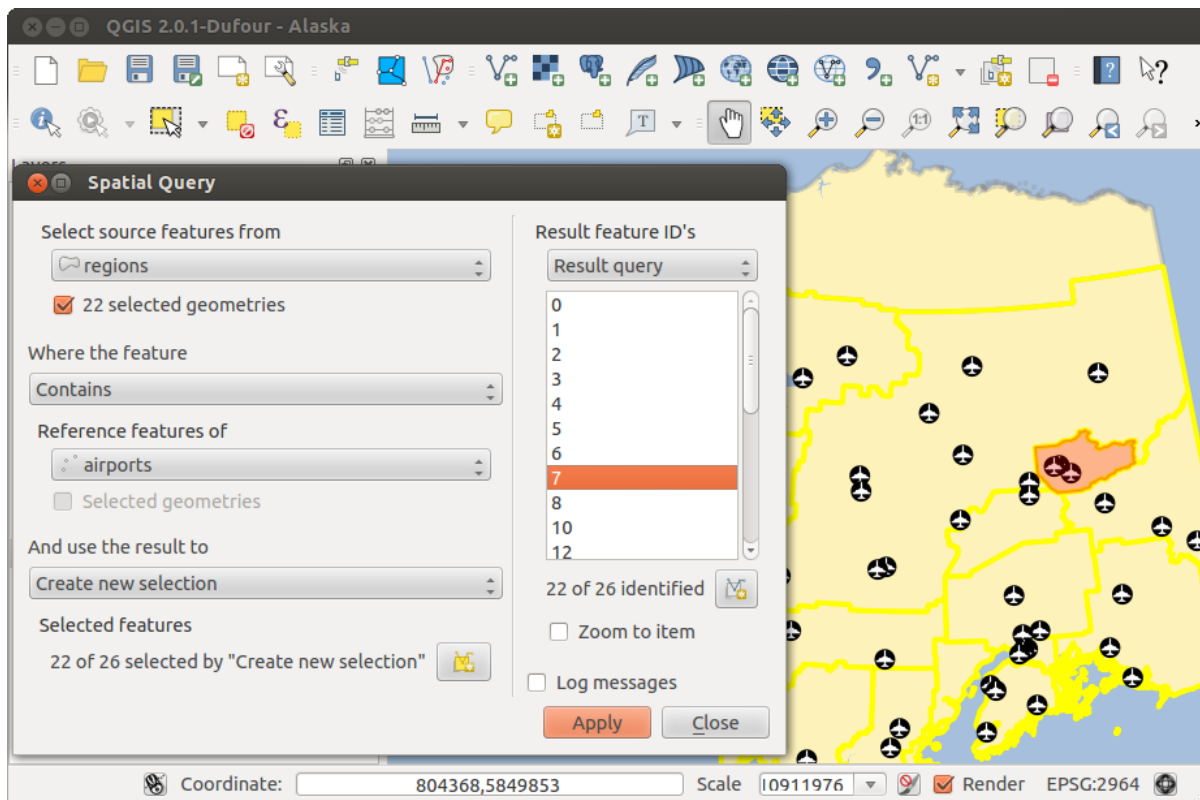
QGIS comes with a plugin named SPIT (Shapefile to PostGIS Import Tool). SPIT can be used to load multiple shapefiles at one time and includes support for schemas. To use SPIT, open the Plugin Manager from the *Plugins* menu, in the  *Installed* menu check the box next to the *SPIT* and click **[OK]**.

To import a shapefile, use *Database* → *Spit* → *Import Shapefiles to PostgreSQL* from the menu bar to open the *SPIT - Shapefile to PostGIS Import Tool* dialog. Select the PostGIS database you want to connect to and click on **[Connect]**. If you want, you can define or change some import options. Now you can add one or more files to the queue by clicking on the **[Add]** button. To process the files, click on the **[OK]** button. The progress of the import as well as any errors/warnings will be displayed as each shapefile is processed.

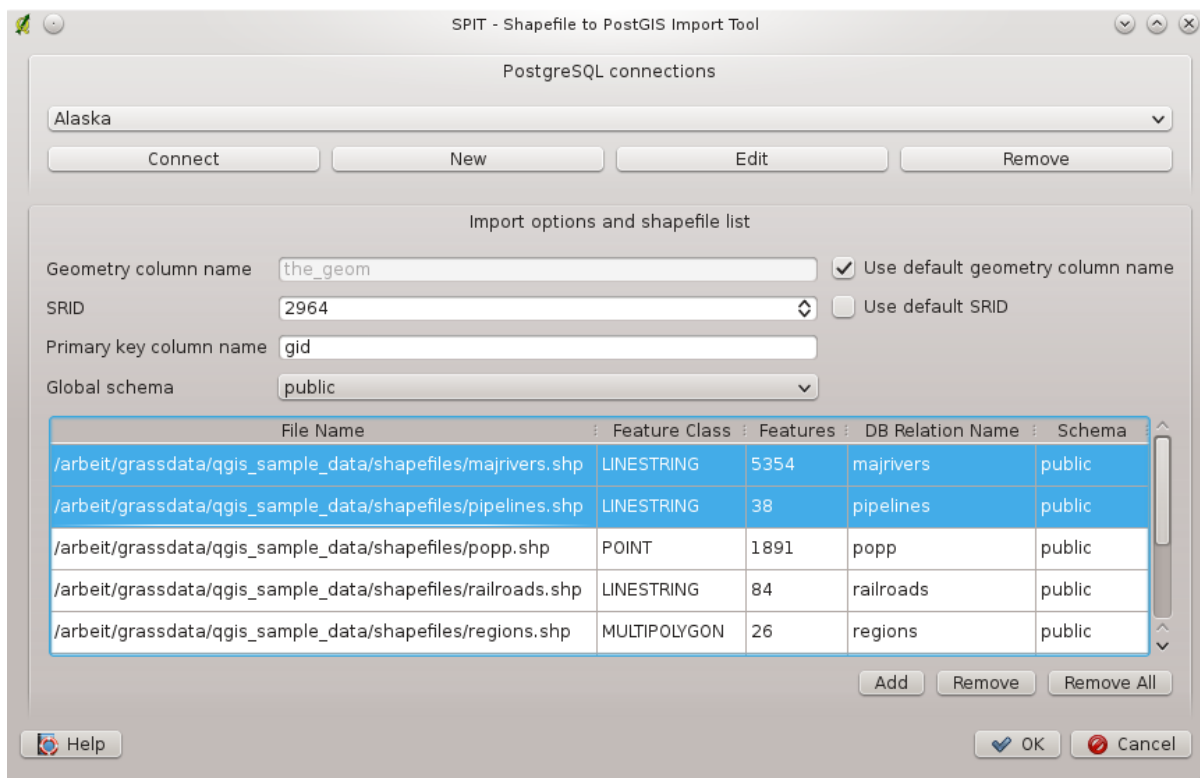
19.18 SQL Anywhere Plugin

SQL Anywhere is a proprietary relational database management system (RDBMS) from Sybase. SQL Anywhere provides spatial support, including OGC, shapefiles and built-in functions to export to KML, GML and SVG formats.

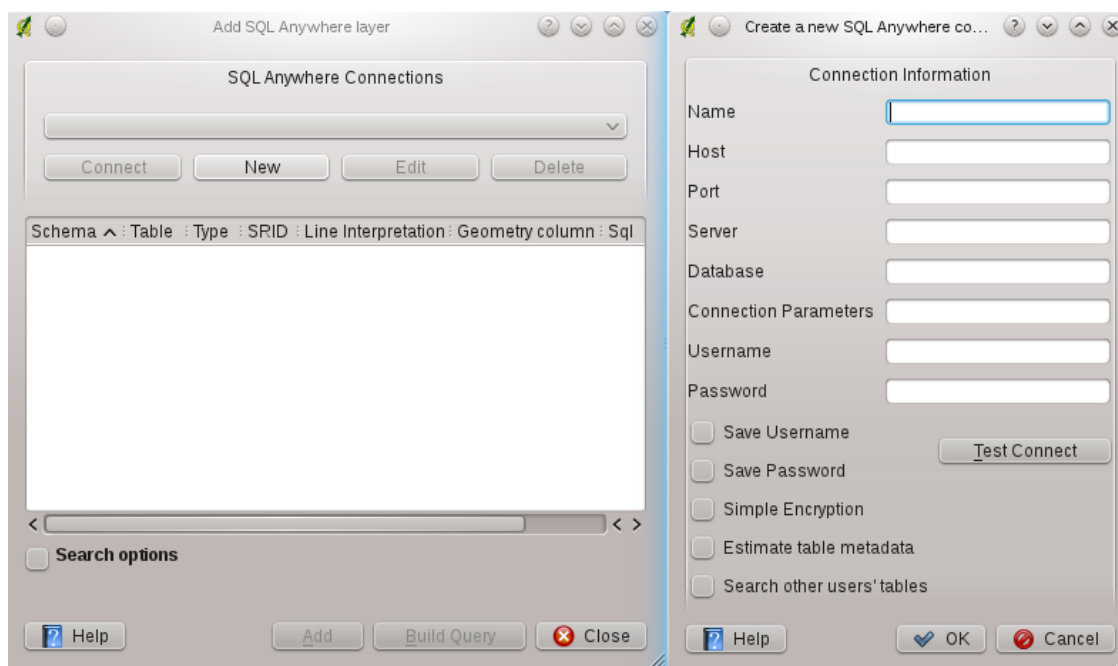
 SQL Anywhere allows you to connect to spatially enabled SQL Anywhere databases. The *Add SQL Anywhere layer* dialog is similar in functionality to the dialogs for PostGIS and SpatialLite.



Rysunek 19.30: Spatial Query analysis - regions contain airports 🐧



Rysunek 19.31: Using SPIT Plugin to import Shape files to PostGIS 🐧



Rysunek 19.32: SQL Anywhere dialog (KDE) 

19.19 Topology Checker Plugin

Topology describes the relationships between points, lines and polygons that represent the features of a geographic region. With the Topology Checker plugin, you can look over your vector files and check the topology with several topology rules. These rules check with spatial relations whether your features ‘Equal’, ‘Contain’, ‘Cover’, are ‘CoveredBy’, ‘Cross’, are ‘Disjoint’, ‘Intersect’, ‘Overlap’, ‘Touch’ or are ‘Within’ each other. It depends on your individual questions which topology rules you apply to your vector data (e.g., normally you won’t accept overshoots in line layers, but if they depict dead-end streets you won’t remove them from your vector layer).

QGIS has a built-in topological editing feature, which is great for creating new features without errors. But existing data errors and user-induced errors are hard to find. This plugin helps you find such errors through a list of rules.

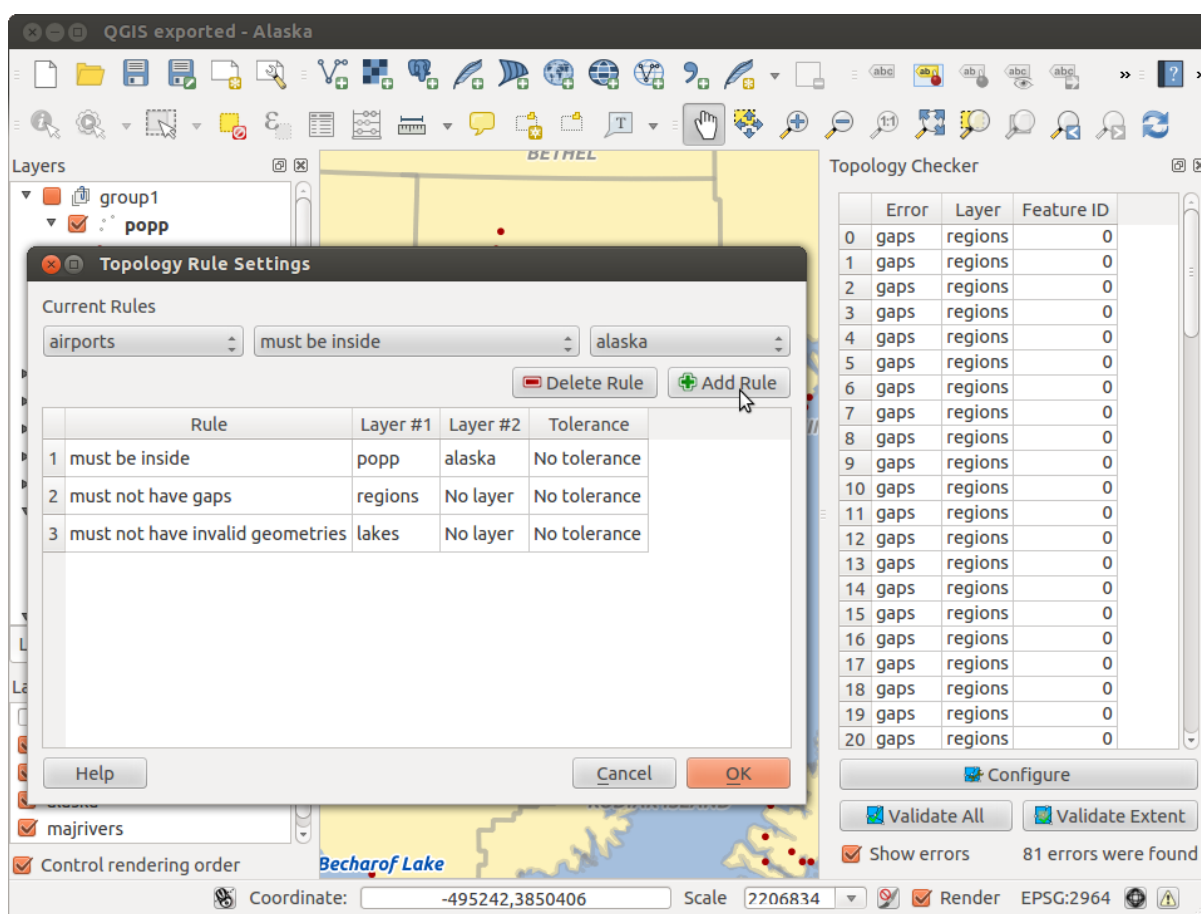
It is very simple to create topology rules with the Topology Checker plugin.

On **point layers** the following rules are available:

- **Must be covered by:** Here you can choose a vector layer from your project. Points that aren’t covered by the given vector layer occur in the ‘Error’ field.
- **Must be covered by endpoints of:** Here you can choose a line layer from your project.
- **Must be inside:** Here you can choose a polygon layer from your project. The points must be inside a polygon. Otherwise, QGIS writes an ‘Error’ for the point.
- **Must not have duplicates:** Whenever a point is represented twice or more, it will occur in the ‘Error’ field.
- **Must not have invalid geometries:** Checks whether the geometries are valid.
- **Must not have multi-part-geometries:** All multi-part points are written into the ‘Error’ field.

On **line layers**, the following rules are available:

- **End points must be covered by:** Here you can select a point layer from your project.
- **Must not have dangles:** This will show the overshoots in the line layer.




Rysunek 19.33: The Topology Checker Plugin

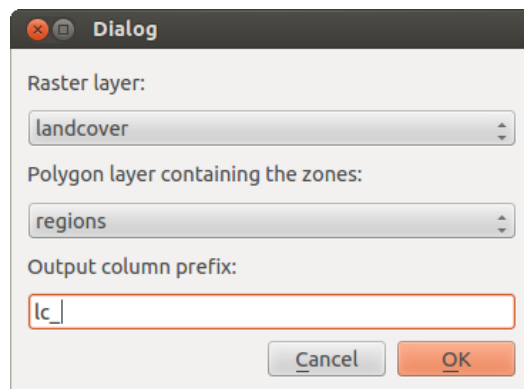
- **Must not have duplicates:** Whenever a line feature is represented twice or more, it will occur in the 'Error' field.
- **Must not have invalid geometries:** Checks whether the geometries are valid.
- **Must not have multi-part geometries:** Sometimes, a geometry is actually a collection of simple (single-part) geometries. Such a geometry is called multi-part geometry. If it contains just one type of simple geometry, we call it multi-point, multi-linestring or multi-polygon. All multi-part lines are written into the 'Error' field.
- **Must not have pseudos:** A line geometry's endpoint should be connected to the endpoints of two other geometries. If the endpoint is connected to only one other geometry's endpoint, the endpoint is called a pseudo node.


On **polygon layers**, the following rules are available:

- **Must contain:** Polygon layer must contain at least one point geometry from the second layer.
- **Must not have duplicates:** Polygons from the same layer must not have identical geometries. Whenever a polygon feature is represented twice or more it will occur in the 'Error' field.
- **Must not have gaps:** Adjacent polygons should not form gaps between them. Administrative boundaries could be mentioned as an example (US state polygons do not have any gaps between them...).
- **Must not have invalid geometries:** Checks whether the geometries are valid. Some of the rules that define a valid geometry are:
 - Polygon rings must close.
 - Rings that define holes should be inside rings that define exterior boundaries.
 - Rings may not self-intersect (they may neither touch nor cross one another).
 - Rings may not touch other rings, except at a point.
- **Must not have multi-part geometries:** Sometimes, a geometry is actually a collection of simple (single-part) geometries. Such a geometry is called multi-part geometry. If it contains just one type of simple geometry, we call it multi-point, multi-linestring or multi-polygon. For example, a country consisting of multiple islands can be represented as a multi-polygon.
- **Must not overlap:** Adjacent polygons should not share common area.
- **Must not overlap with:** Adjacent polygons from one layer should not share common area with polygons from another layer.

19.20 Zonal Statistics Plugin

With the  *Zonal statistics* plugin, you can analyze the results of a thematic classification. It allows you to calculate several values of the pixels of a raster layer with the help of a polygonal vector layer (see [figure_zonal_statistics](#)). You can calculate the sum, the mean value and the total count of the pixels that are within a polygon. The plugin generates output columns in the vector layer with a user-defined prefix.



Rysunek 19.34: Zonal statistics dialog (KDE) 

Pomoc i wsparcie

20.1 Lista mailingowa

QGIS jest ciągle rozwijany i może w związku z tym nie zawsze zachowywać się tak, jakbyś tego oczekiwał. Najlepszym sposobem uzyskania pomocy jest skorzystanie z listy `qgis-users`. W ten sposób twoje pytanie zobaczy większa ilość osób, a z odpowiedzi będą mogli skorzystać również inni.

20.1.1 `qgis-users`

Ta lista służy do ogólnych dyskusji o QGIS oraz do bardziej szczegółowych kwestii dotyczących jego instalacji i używania. Do listy `qgis-users` możesz zapisać się pod adresem: <http://lists.osgeo.org/mailman/listinfo/qgis-user>

20.1.2 `fossGIS-talk-liste`

Dla użytkowników niemieckojęzycznych FOSSGIS e.V. prowadzi listę `fossGIS-talk-liste`. Lista ta służy do rozmów o oprogramowaniu GIS o otwartym źródle, włączając w to QGIS. Możesz się zapisać do listy `fossGIS-talk-liste` pod adresem: <https://lists.fossGIS.de/mailman/listinfo/fossGIS-talk-liste>

20.1.3 `qgis-developer`

Jeśli jesteś programistą i napotkałeś na problemy natury technicznej, dołącz do listy mailingowej `qgis-developer` pod adresem : <http://lists.osgeo.org/mailman/listinfo/qgis-developer>

20.1.4 `qgis-commit`

Za każdym razem, gdy ktoś dodaje coś do repozytorium kodu źródłowego QGIS, na tę listę wysyłany jest email. Jeśli chcesz być na bieżąco z kodem źródłowym, możesz zapisać się na tę listę pod adresem: <http://lists.osgeo.org/mailman/listinfo/qgis-commit>

20.1.5 `qgis-trac`

Na tę listę wysyłane są mailowe powiadomienia związane z zarządzaniem projektem, w tym zawierające zgłoszenia błędów, zadania i zapotrzebowanie na danego typu narzędzia. Możesz zapisać się do tej listy pod adresem: <http://lists.osgeo.org/mailman/listinfo/qgis-trac>

20.1.6 qgis-community-team

Ta lista obejmuje temtykę dokumentacji, pomocy kontekstowej, podręcznika, i materiałów online, takich jak strony projektu, blog, listy mailingowe, forum i tłumaczenia. Gdybyś chciał popracować nad podręcznikiem, ta lista jest dobrym miejscem do zadawania pytań. Możesz do niej dołączyć pod adresem: <http://lists.osgeo.org/mailman/listinfo/qgis-community-team>

20.1.7 qgis-release-team

Ta lista dotyczy tematów związanych z tworzeniem kolejnych wersji programu, tworzeniem paczek binarnych dla różnych systemów operacyjnych i ogłaszania nowych wersji. możesz do niej dołączyć pod adresem: <http://lists.osgeo.org/mailman/listinfo/qgis-release-team>

20.1.8 qgis-tr

Ta lista dotyczy tłumaczeń. Jeśli chciałbyś przetłumaczyć podręcznik lub graficzny interfejs użytkownika (GUI), to jest właściwe miejsce do zadawania pytań. Możesz się do niej zapisać pod adresem: <http://lists.osgeo.org/mailman/listinfo/qgis-tr>

20.1.9 qgis-edu

Lista ta dotyczy działań edukacyjnych związanych z QGIS. Gdybyś chciał opracować jakieś materiały edukacyjne, to jest to właściwe miejsce do zadawania związanych z tym pytań. Możesz się zapisać na tę listę pod adresem: <http://lists.osgeo.org/mailman/listinfo/qgis-edu>

20.1.10 qgis-psc

Lista ta używana jest to dyskusji nad sprawami Komitetu Sterującego, dotyczącymi ogólnego zarządzania i kierunku rozwoju QGIS. Można się do niej zapisać pod adresem: <http://lists.osgeo.org/mailman/listinfo/qgis-psc>

Zapraszamy do zapisania się do dowolnych list. Prosimy o wnoszenie własnego wkładu poprzez udzielanie odpowiedzi na pytania i dzielenie się własnym doświadczeniem. Prosimy zwrócić uwagę na to, że qgis-commit i qgis-trac utworzone zostały wyłącznie w celu powiadamiania użytkowników, a nie przyjmowania postów użytkowników.

20.2 IRC

Jesteśmy również obecnie na IRC - możesz się z nami spotkać na kanale #qgis na irc.freenode.net. Prosimy o danie nam chwili na odpowiedź na wasze pytania, bo użytkownicy kanału mogą być czymś zajęci i zajmuje to zwykle jakiś czas, zanim zobaczą nowe pytanie. Jeśli ominęła cię jakaś dyskusja na IRC, nie ma problemu! Wszystkie dyskusje są zapisywane, więc możesz do nich łatwo powrócić. Po prostu odwiedź stronę <http://qgis.org/irclogs>.

Możliwe jest również uzyskanie komercyjnego wsparcia dla QGIS. Więcej informacji znajdziesz na stronie <http://qgis.org/en/commercial-support.html>.

20.3 BugTracker

Lista qgis-users świetnie nadaje się do zadawania pytań 'jak w QGIS zrobić ABC', ale możesz przecież chcieć powiadomić nas o jakimś błędzie QGISa. Do przesłania raportu o błędzie QGIS możesz wykorzystać tzw. bug tracker pod adresem <http://hub.qgis.org/projects/quantum-gis/issues>. Gdy przesyłasz zgłoszenie o błędzie, prosimy o podanie adresu email, abyśmy mogli zapytać Cię o szczegóły.

Prosimy zwrócić uwagę na to, że zgłoszenia błędów mogą nie mieć tak wysokiego priorytetu, na jaki liczysz (zależy to od tego, jak poważne są to błędy). Naprawa niektórych błędów wymaga sporego nakładu pracy, a nie zawsze dysponujemy wolnymi zasobami.

Za pomocą systemu zgłaszania błędów można również zgłaszać zapotrzebowania na funkcjonalności. Nie zapomnij o zaznaczeniu typu zgłoszenia jako `Feature`.

Jeśli znalazłeś jakiś błąd i samodzielnie go naprawiłeś, możesz przesłać nam swoją łatkę. Tutaj również możesz wykorzystać nasz kochany system ticketów redmine, znajdujący się pod adresem <http://hub.qgis.org/wiki/quantum-gis/issues>. Zaznacz opcję `Patch supplied` i załącz swoją łatkę przed wysłaniem raportu o błędzie. Któryś z deweloperów przejrzy ją i włączy do QGIS. Prosimy się nie niepokoić, jeśli twoja łatka od razu nie zostanie zastosowana — deweloperzy mogą być zajęci innymi zgłoszeniami.

20.4 Blog

Spółeczność QGIS prowadzi również bloga pod adresem <http://planet.qgis.org/planet/>. Znajdziesz tam interesujące teksty członków społeczności zarówno dla użytkowników, jak i deweloperów. Zapraszamy do tworzenia własnego bloga!

20.5 Wtyczki

Na stronie <http://plugins.qgis.org> znajduje się oficjalny portal wtyczek QGIS. Możesz tu znaleźć listę wszystkich wtyczek, stabilnych i eksperymentalnych, dostępnych w 'oficjalnym repozytorium wtyczek QGIS'.

20.6 Wiki

I na koniec mamy jeszcze stronę WIKI, znajdującą się pod adresem <http://hub.qgis.org/projects/quantum-gis/wiki>, gdzie można znaleźć różne przydatne informacje dotyczące rozwoju QGISa, planów kolejnych wydań, linków do stron pobierania, wskazówek tłumaczeniowych itd. Sprawdź ją, bo jest tam sporo dobra!

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Version 2, June 1991

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