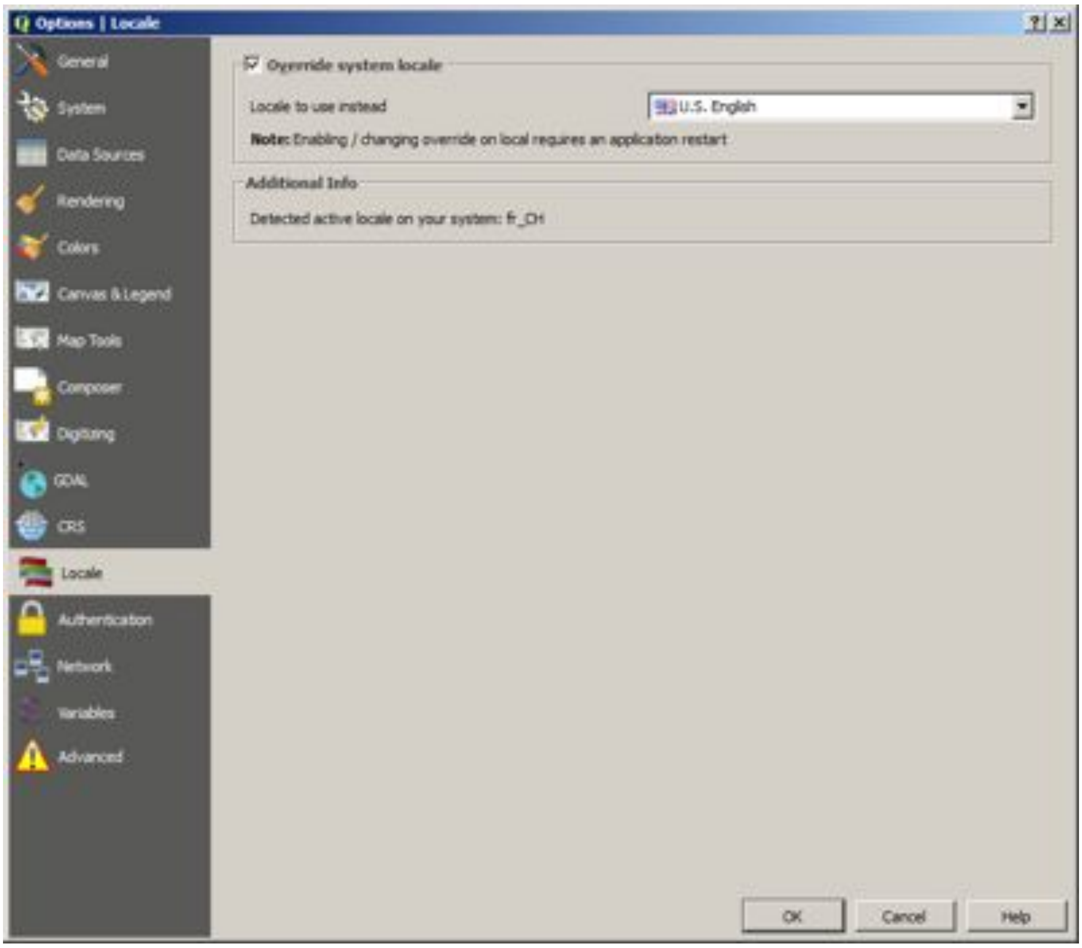
6.3 Preprocessing in QGIS

These instructions will help you to prepare each of the inputs for the InVEST Water Yield model. See module 6.2 for information on obtaining the necessary data.

A) Install QGIS

1. Download the latest version of QGIS from http://qgis.org/ and install it. This tutorial was made for QGIS 2.16.1 Nodebo.
2. Run QGIS
3. When you first open QGIS, you will see the QGIS Tips! Window, click ***OK*** to close it.

4. If desired you can change the language of QGIS by selecting ***Options*** from the ***Settings*** menu. Under ***Locale*** check the box next to ***Override system locale*** and change ***Locale to use instead*** to your preferred language. Click ***OK*** to save the change and restart QGIS to view it in the new language.

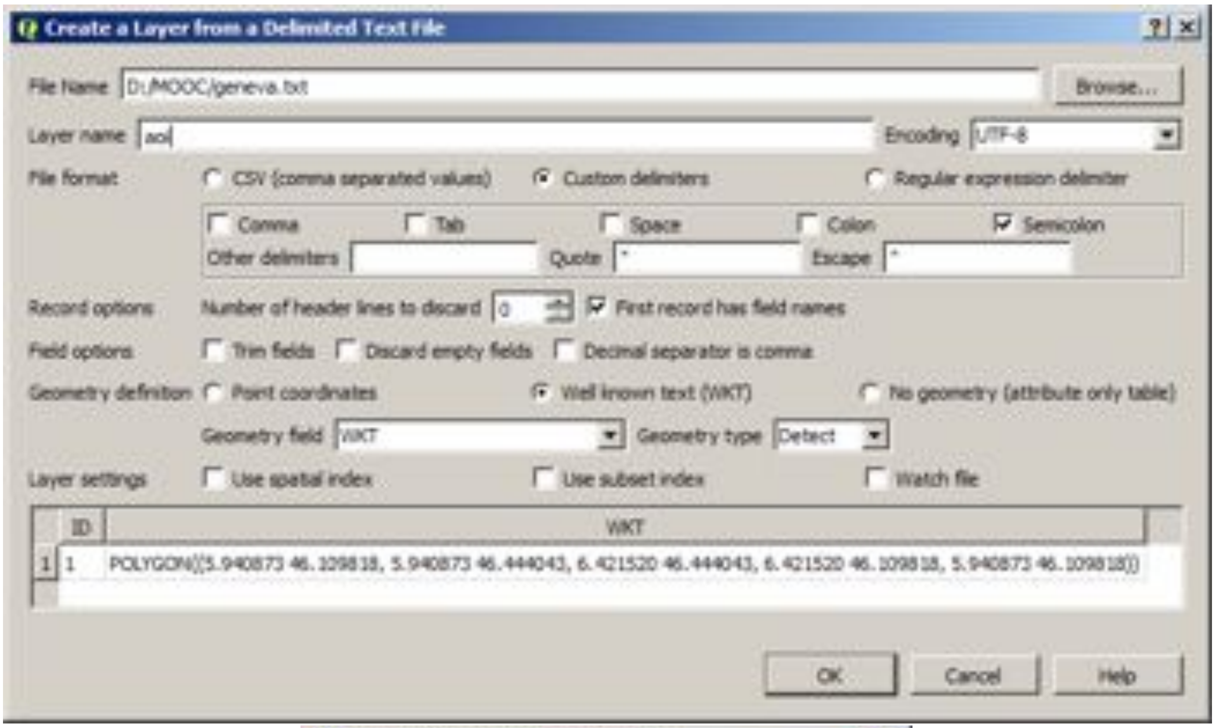


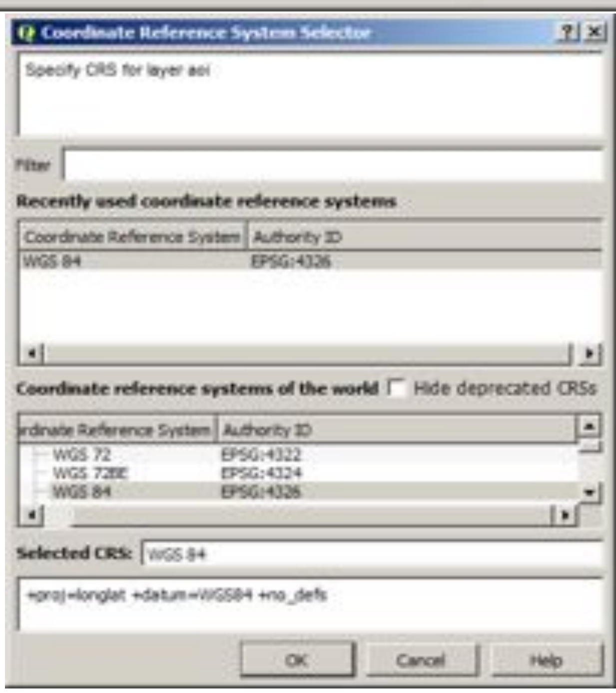
B) Create Area of Interest

The area of interest (AOI) is the focus of your analysis and having it in a Shapefile format can be useful during preprocessing by allowing you to focus on the area for which you actually need data. There are several ways to get an area of interest polygon for your analysis. If your analysis area is an official administrative unit it may be possible to obtain a Shapefile directly from the authorities responsible for this area. In other cases, you may have to create the Shapefile yourself using the coordinates for the area. For hydrological analysis it is ideal if the area of interest corresponds to watersheds or subwatersheds. Consider creating an initial area of interest with the following instructions, which you can then use to help select the final area of interest based on the watersheds as detailed in the section titled Watersheds.

1. Create a text file with the polygon defined in the WKT format. See the example file geneva.txt. Note that coordinates are a closed list, meaning the first and last point are the same, also it is conventional to list the points in clockwise order.

2. Choose Layer > Add Layer > Add Delimited Text Layer from the menu and select the options as below. When prompted select the correct projection in the Coordinate System Selector. If you are using latitude and longitude the correct projection is typically EPSG:4326.





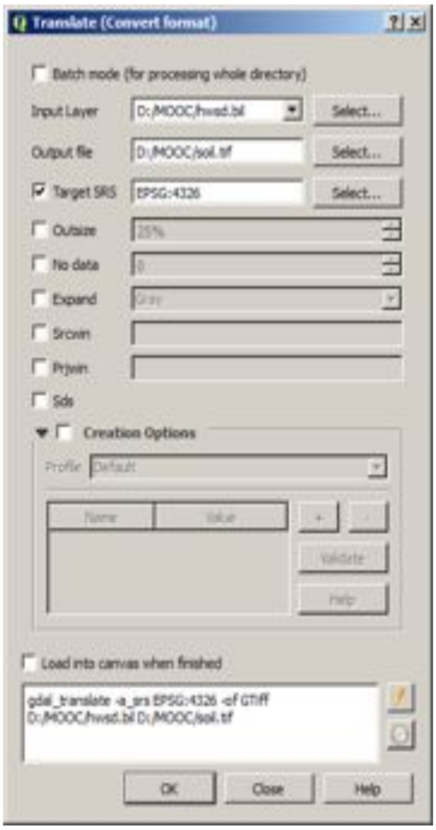
3. The area of interest is now listed in the layers panel. Right click it and select Save As to save it to the Shapefile format enter the file name aoi.shp.


Format
ESRI Shapefile
Save as
D:/MOOC/aoi.shp
Browse
CRS
Selected CRS (EPSG:4326, WGS 84)
Encoding
System
Save only selected features
Select fields to export and their export optio
Add saved file to map
Symbology export
No symbology
Scale
1:50000
Geometry
Extent (current: layer)
Layer Options
Custom Options
OK
Cancel
Help

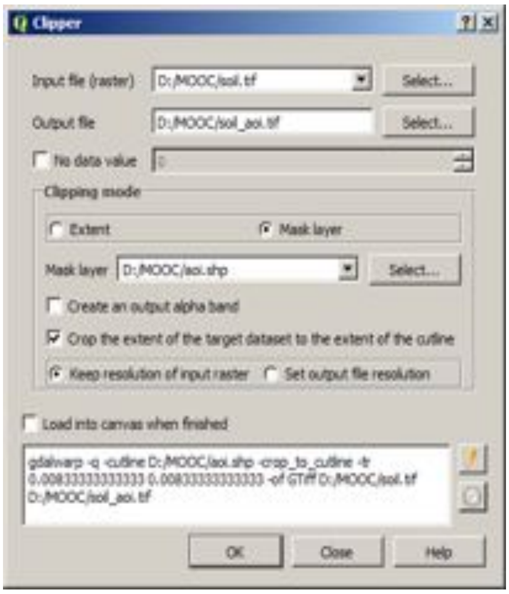
C) Root Restricting Layer Depth

The Root Restricting Layer Depth will come from the Harmonized World Soil Database.

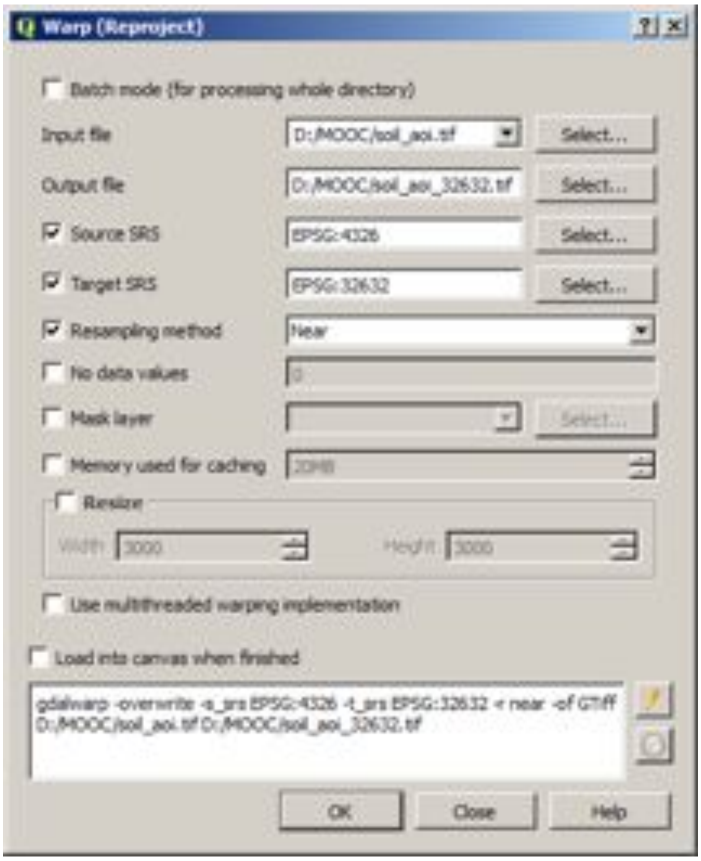
1. Choose Raster > Conversion > Translate from the menu to convert hwsd.bil to soil.tif. QGIS may not recognize the projection so specify EPSG:4326 in the Target SRS parameter.



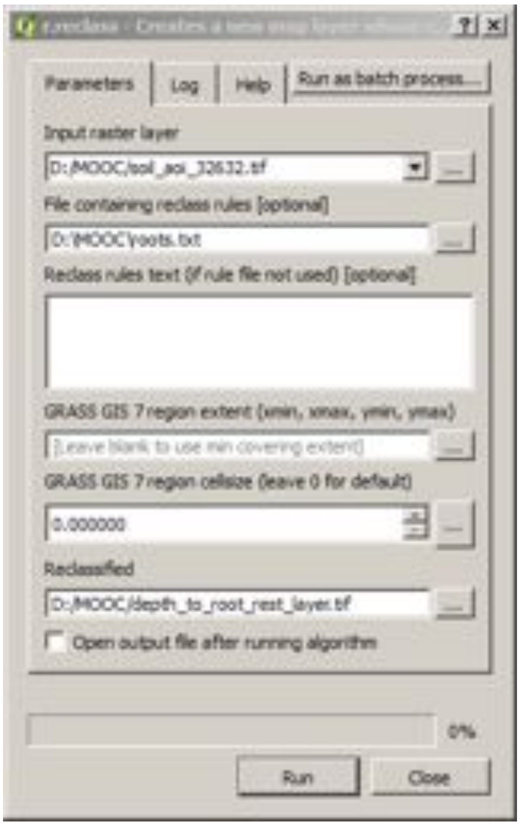
2. Use Raster > Extraction > Clipper to clip hwsd.tif with aoi.shp to create the output soil_aoi.tif. Select the options as seen in screen shot especially the Crop the extent… option.



3. Choose Raster > Projections > Warp (Reproject) from the menu to project soil_aoi.tif to the analysis projection of EPSG:32632 creating soil_aoi_32632.tif. This analysis projection corresponds to the specific UTM zone that for our analysis area and may be different from the UTM zone for your analysis area.

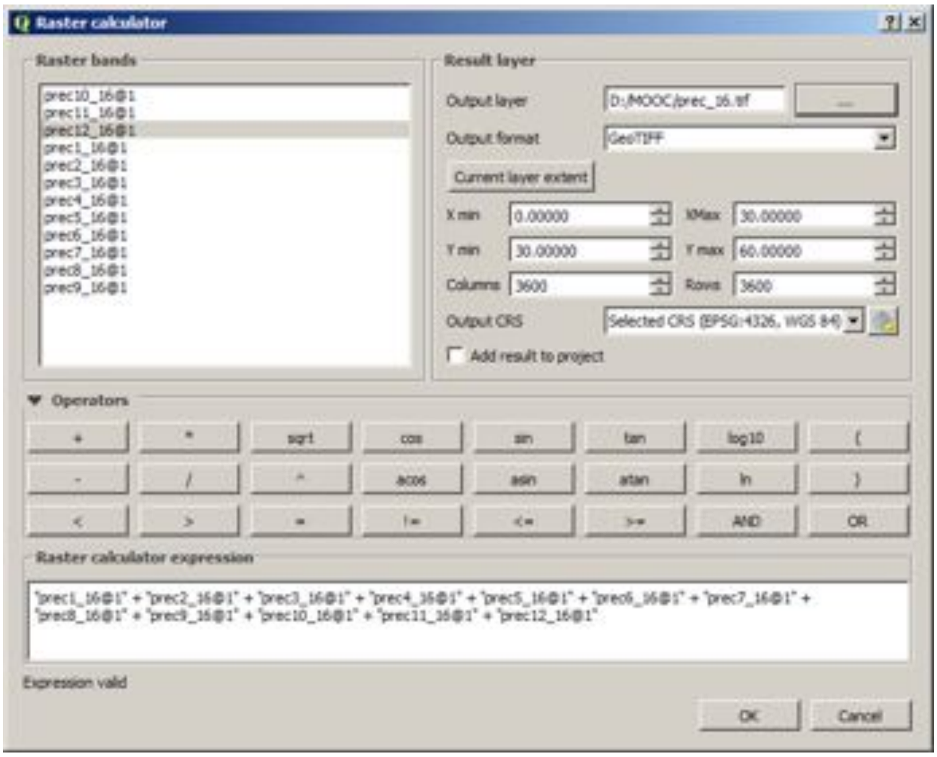


4. Choose Toolbox > GRASS GIS 7 commands > r.reclass from the processing menu to reclassify soil_aoi_32632.tif with the provided reclass rules roots.txt to create depth_to_root_rest_layer.tif.

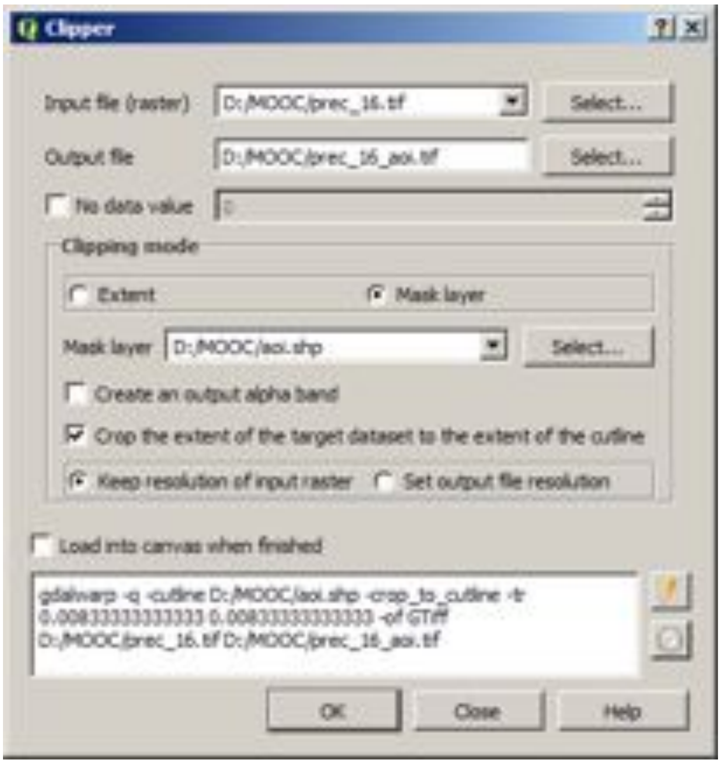


D) Precipitation

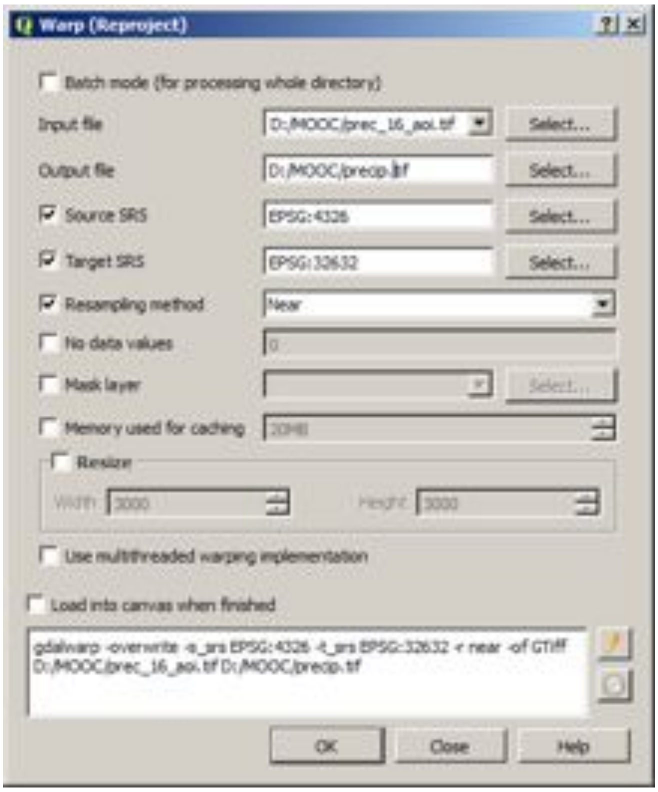
1. Add all 12 precipitation rasters to QGIS.
2. Use Raster > Raster Calculator to sum all the tiles together by using the "+" operator as seen in the screenshot and specify the Output layer as prec_16.tif.



3. Choose Raster > Extraction > Clipper from the menu to clip prec_16.tif with aoi.shp to create the output prec_16_aoi.tif. Select the options as seen in screenshot. Pay special attention to the Crop the extent… option to limit the output to the area of interest.

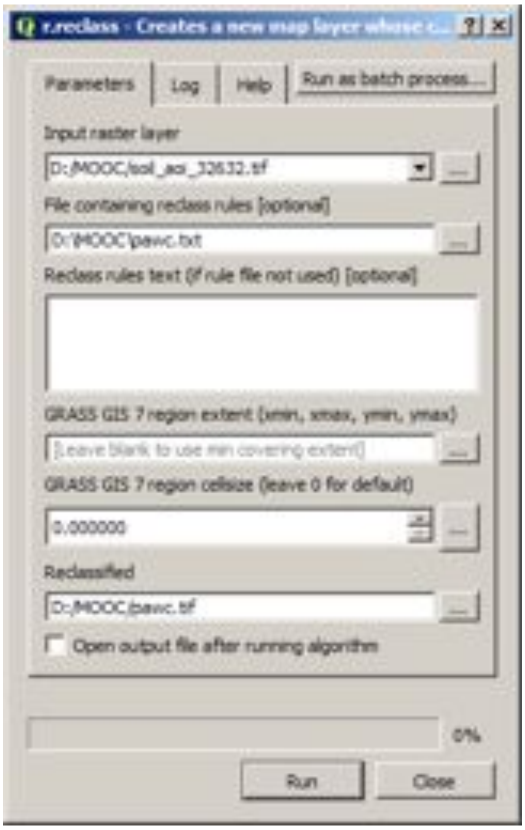


4. Choose Raster > Projections > Warp (Reproject) from the menu to project prec_16_aoi.tif to the analysis projection of EPSG:32632 creating precip.tif.



E) Plant Available Water Content

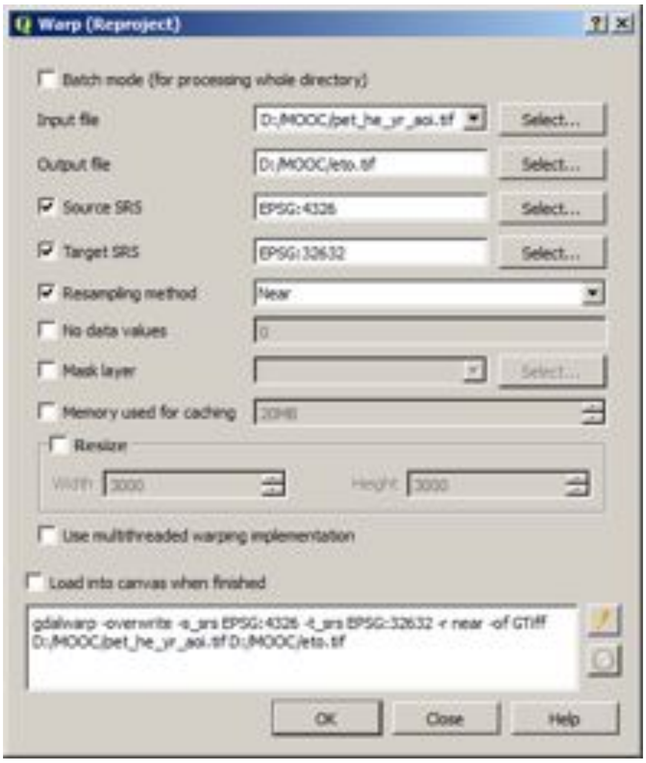
1. Choose Toolbox > GRASS GIS 7 commands > r.reclass from the processing menu to reclassify soil_aoi_32632.tif with the provided reclass rules pawc.txt to create pawc.tif.



F) Average Annual Reference Evapotranspiration

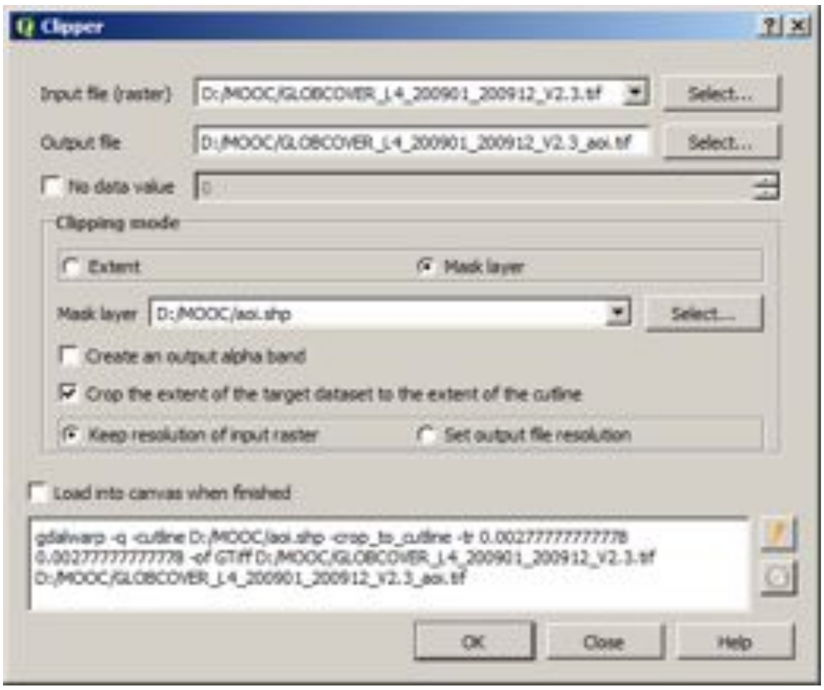
1. Use "Raster > Extraction > Clipper" to clip pet_he_yr/w001001.adf with aoi.shp to create the output pet_he_yr_aoi.tif. Select the options as seen in screen shot especially the "Crop the extent..." option.

2. Choose Raster > Projections > Warp (Reproject) from the menu to project pet_he_yr_aoi.tif to the analysis projection of EPSG:32632 creating eto.tif.

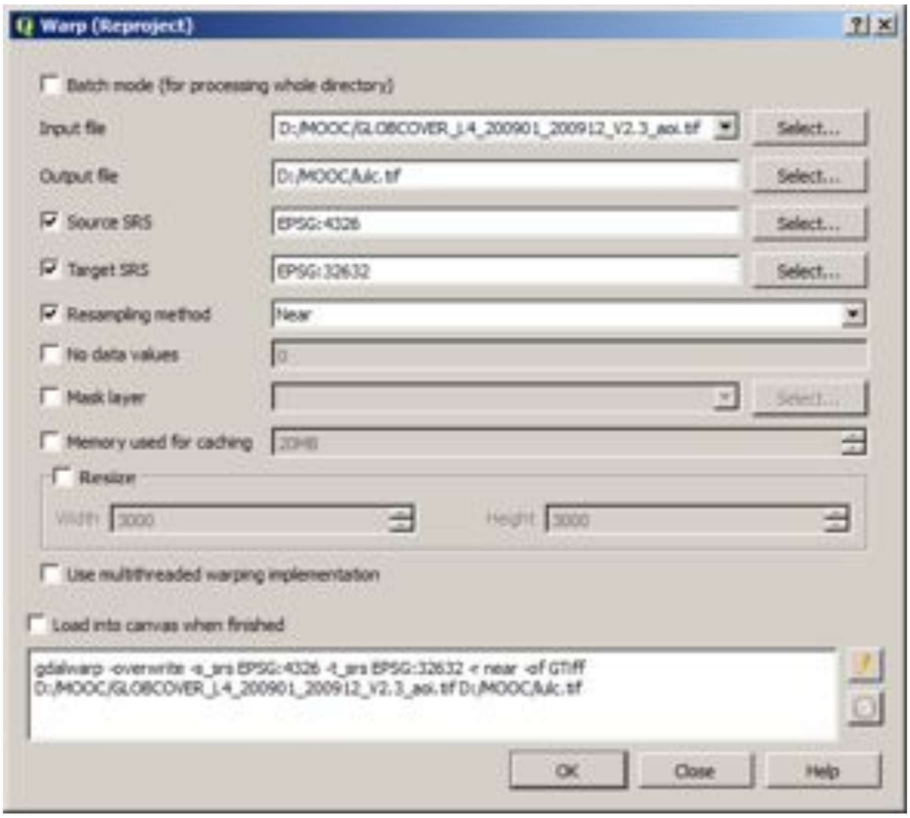


G) Land Use Land Cover

1. Use “Raster > Extraction > Clipper” to clip the GLOBCOVER raster with aoi.shp to create the output globcover_aoi.tif. Select the options as seen in screen shot especially the “Crop the extent...” option.



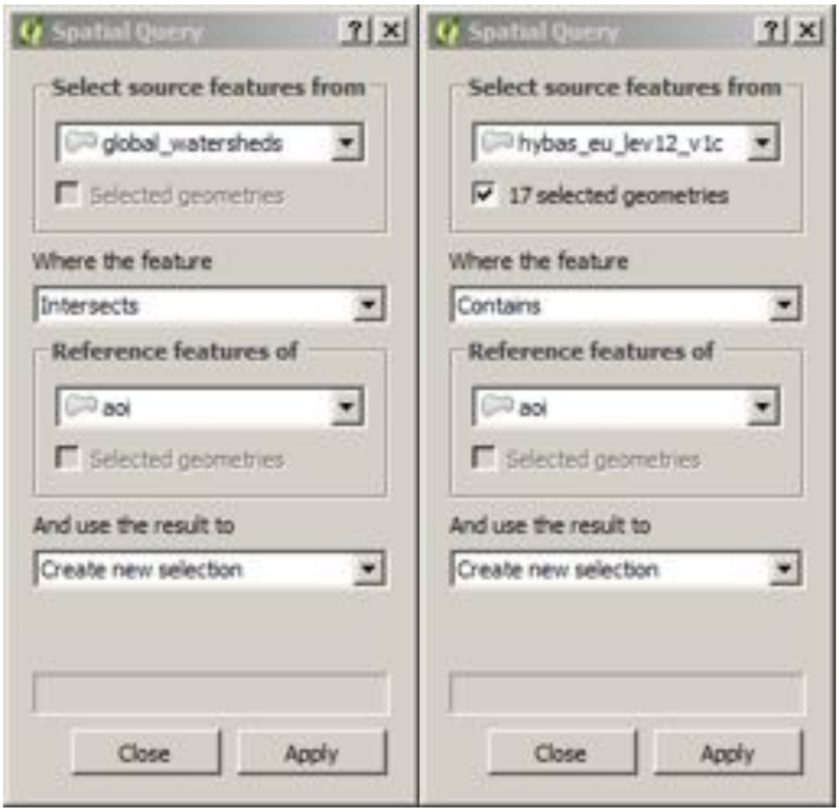
2. Choose Raster > Projections > Warp (Reproject) from the menu to project globcover_aoi.tif to the analysis projection of EPSG:32632 creating lulc.tif.

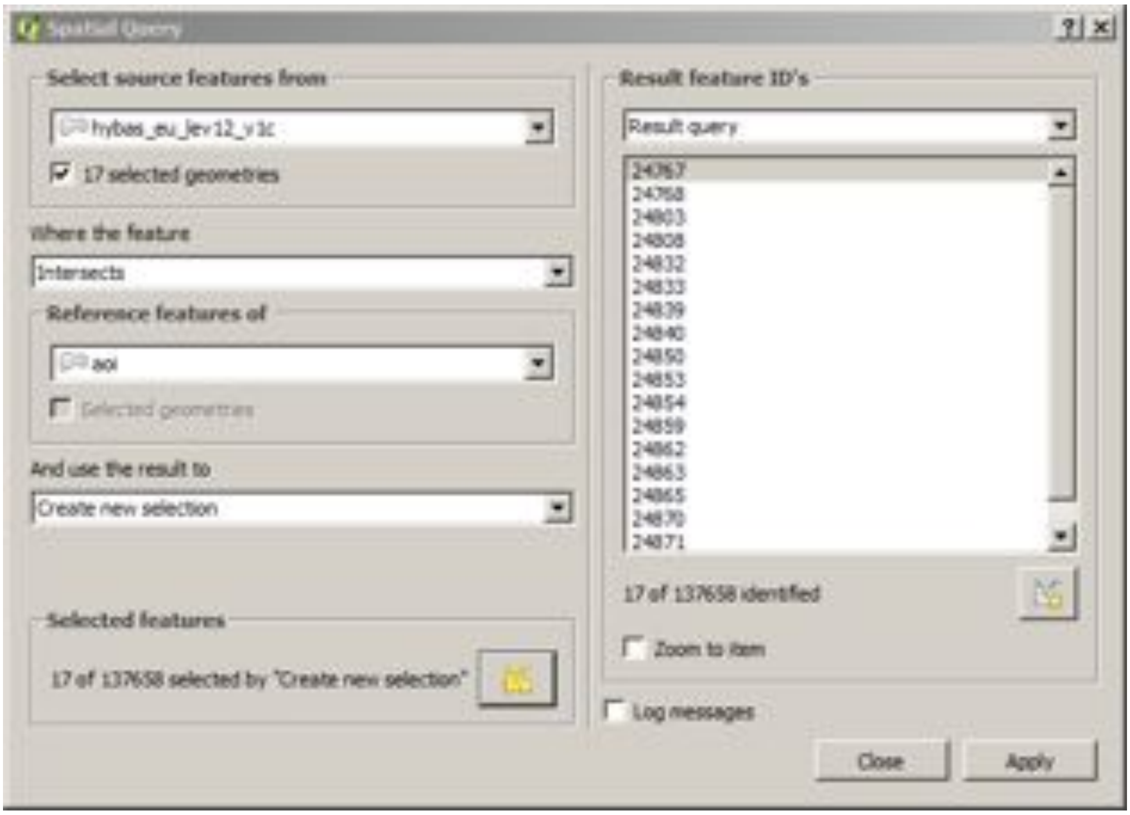


H) Watersheds

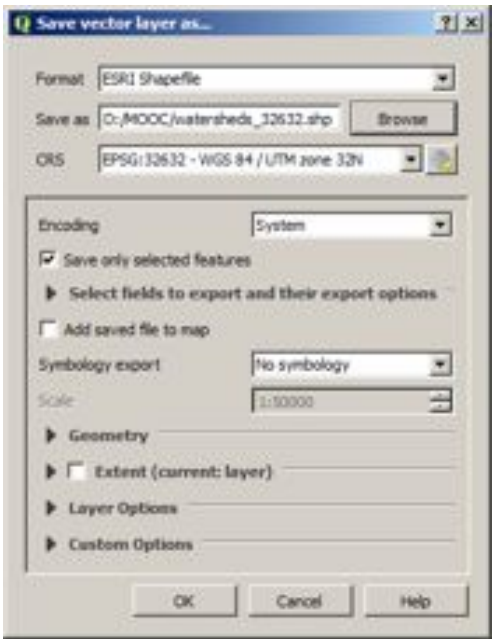
Creating the watershed input can be done in a variety of ways, either by manually selecting the watersheds or by using aoi.shp with a spatial query on a watershed layer as the following instructions describe.

1. Add the aoi.shp and watershed layers
2. Choose Vector > Spatial Query > Spatial Query and specify the parameters as in the screenshot. Click Apply and then Close when the Spatial Query completes.

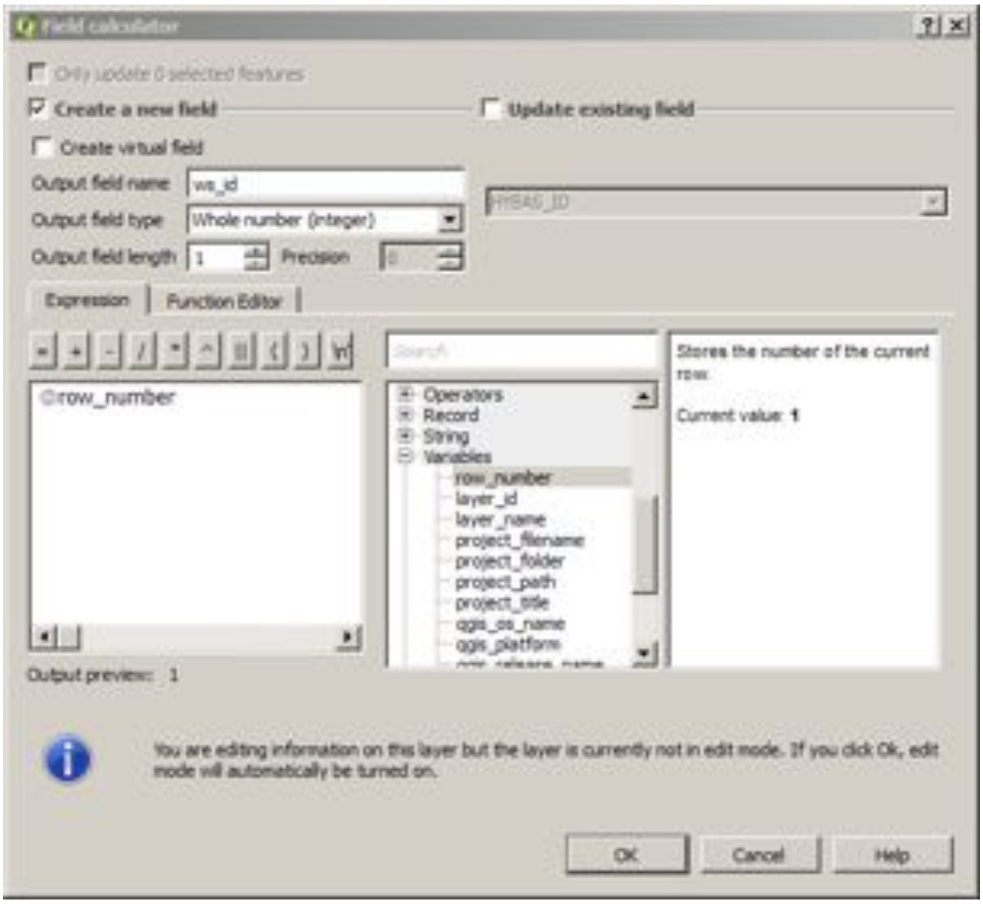

Spatial Query
Select source features from
global_watersheds
Selected geometries
Where the feature
Intersects
Reference features of
aoi
Selected geometries
And use the result to
Create new selection
Close
Apply
Spatial Query
Select source features from
hybas_eu_lev12_v1c
17 selected geometries
Where the feature
Contains
Reference features of
aoi
Selected geometries
And use the result to
Create new selection
Close
Apply


Spatial Query
Select source features from
hybas_eu_lev12_v1c
17 selected geometries
Where the feature
Intersects
Reference features of
aoi
Selected geometries
And use the result to
Create new selection
Selected features
17 of 137658 selected by "Create new selection"
Result feature ID's
Result query
24767
24768
24803
24808
24832
24833
24839
24840
24850
24853
24854
24859
24862
24863
24865
24870
24871
17 of 137658 identified
Zoom to item
Log messages
Close
Apply

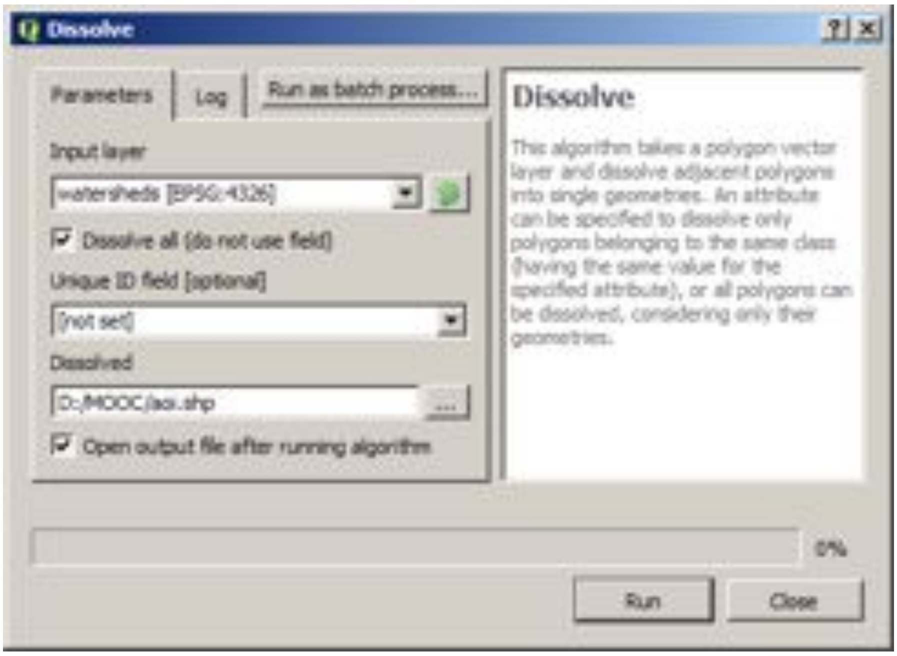
3. Save the selected watersheds by right clicking the watershed layer in the Layers Panel, specifying the projection EPSG:32632, and selecting Save only selected features.



4. Right click the watersheds_32632.shp layer and click on “Open Attribute Table” then click on the second icon (an abbacus) from the right. Set the parameters as defined below, be sure that the Output file length will have enough digits for the number of watersheds.



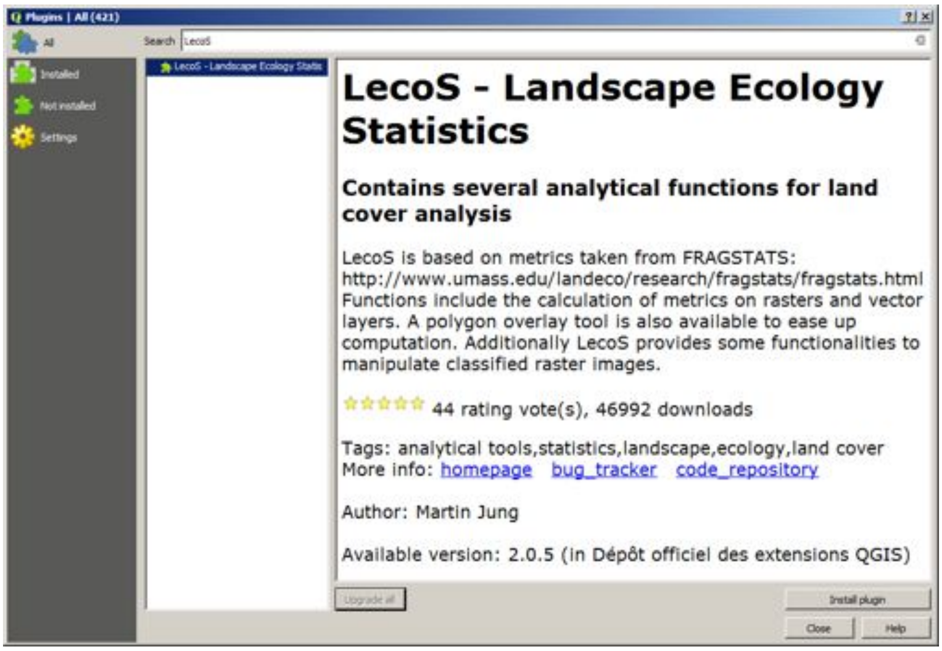
5. Choose “Vector > Geoprocessing > Dissolve” to dissolve the select watersheds and create the final area of interest.



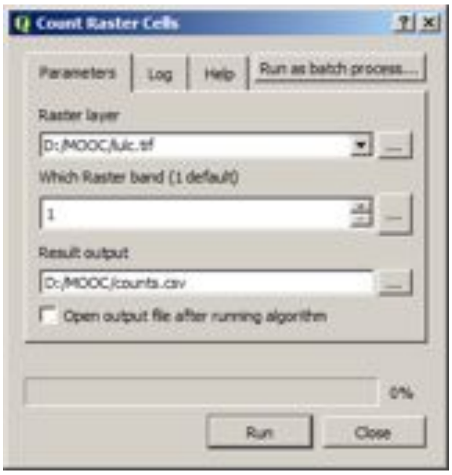
I) Biophysical Table

We recommend that you install the LecoS plugin and use the Count Raster Cells tool to generate a list of the LULC codes in the raster. This can then be used to ensure that each LULC code has the required biophysical values.

1. Choose “Plugins > Manage and Install Plugins” from the toolbar. In the search box type “LecoS” and install the plugin.



2. Choose “Processing > Toolbox” from the menu and type “Count Raster Cells” and double click the tool to run it. Alternatively, you can browse to find the tool under “LecoS > Count Raster Cells”



3. Use counts.csv as a template to create the biophysical table and fill in the remaining data with the methods highlighted in module 6.2.

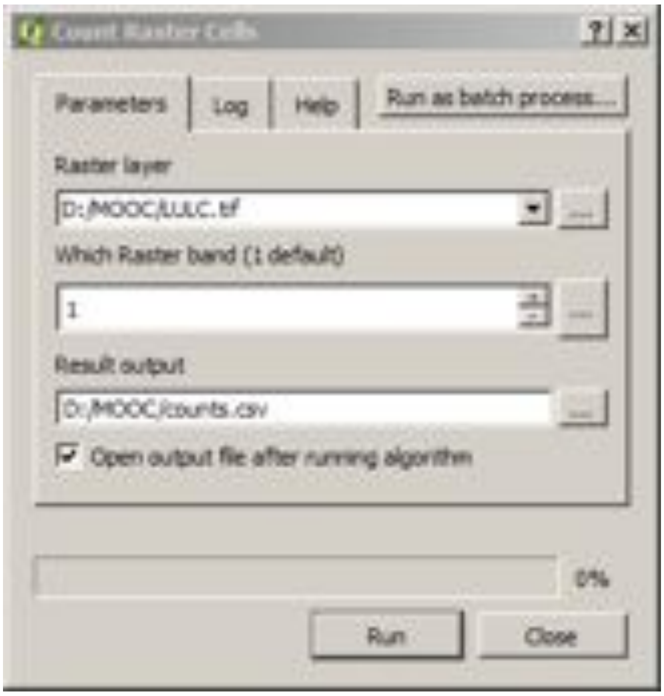
J) Z parameter

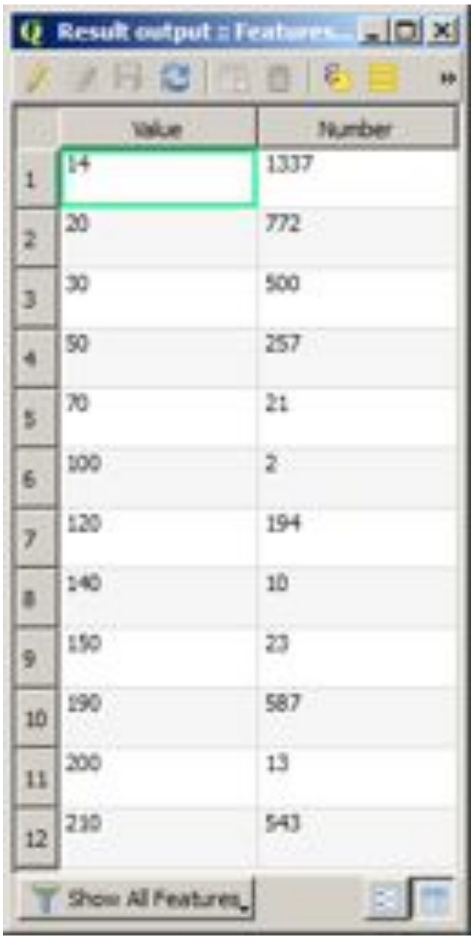
“Floating point value on the order of 1 to 30 corresponding to the seasonal distribution of precipitation.”

K) Appendix

Reclassifying a Raster

We recommend that you install the LecoS and use the Count Raster Cells tool to generate a list of the LULC codes in the raster.



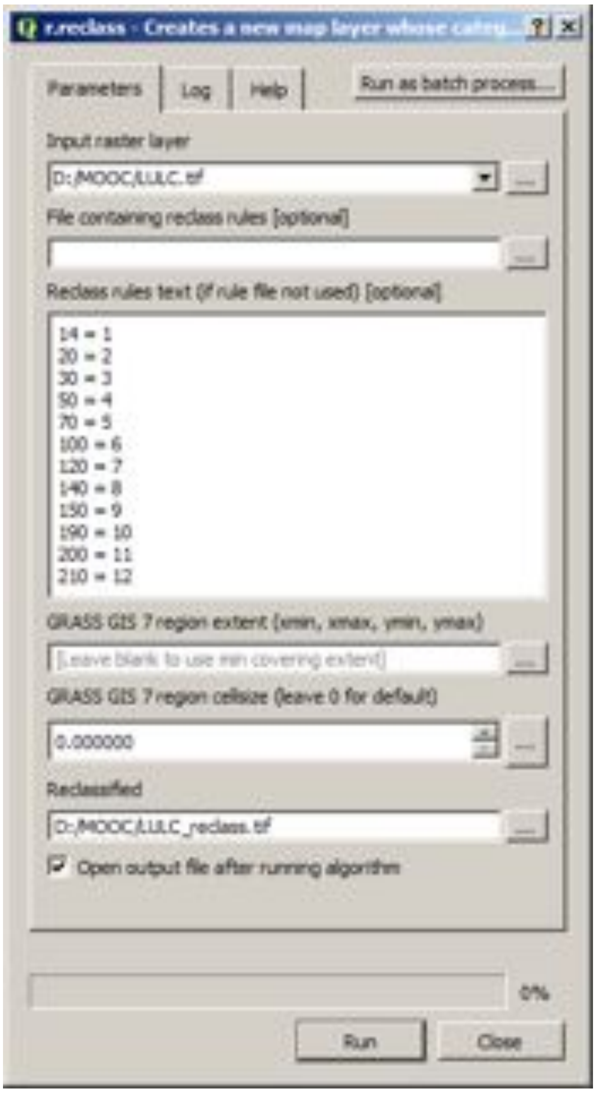


https://grass.osgeo.org/grass70/manuals/r.reclass.html

Next construct the reclass rule text. Rule can use the following templates:

10 = 1
12 13 = 2
14 thru 20 = 3
* = NULL

From the processing toolbox select r.reclass.



Adding Fields to a Shapefile

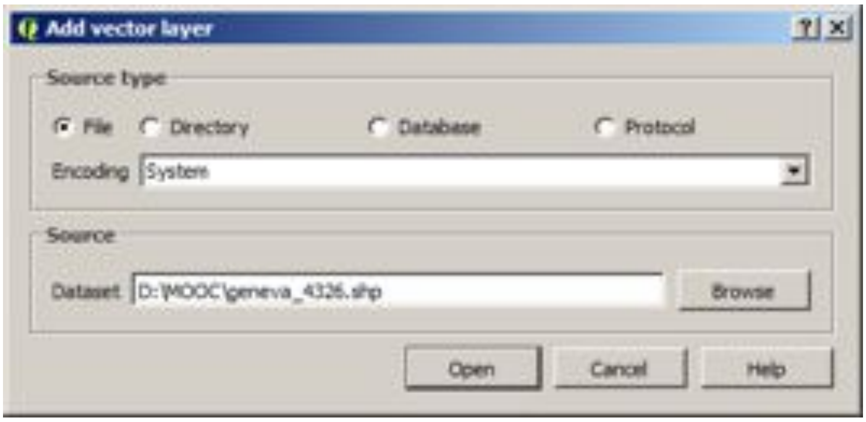
Layer > Add Layer > Add Vector Layer

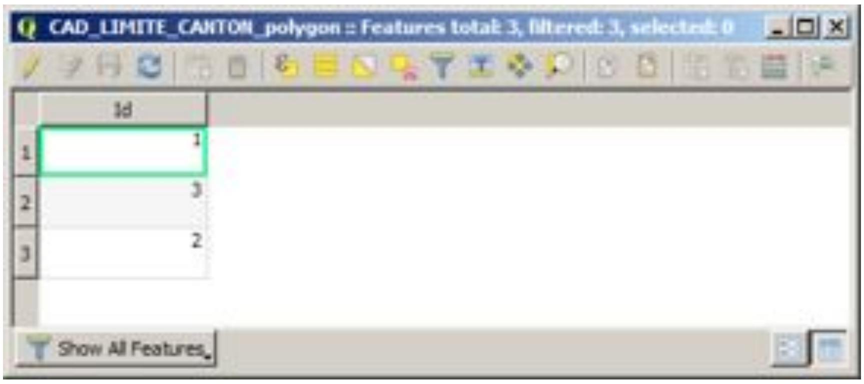
Right click > Open Attribute Table

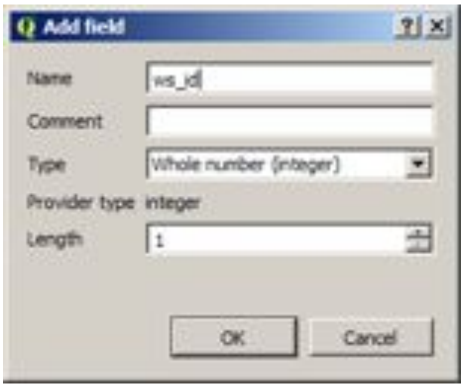
Toggle Editing Mode (Pencil)

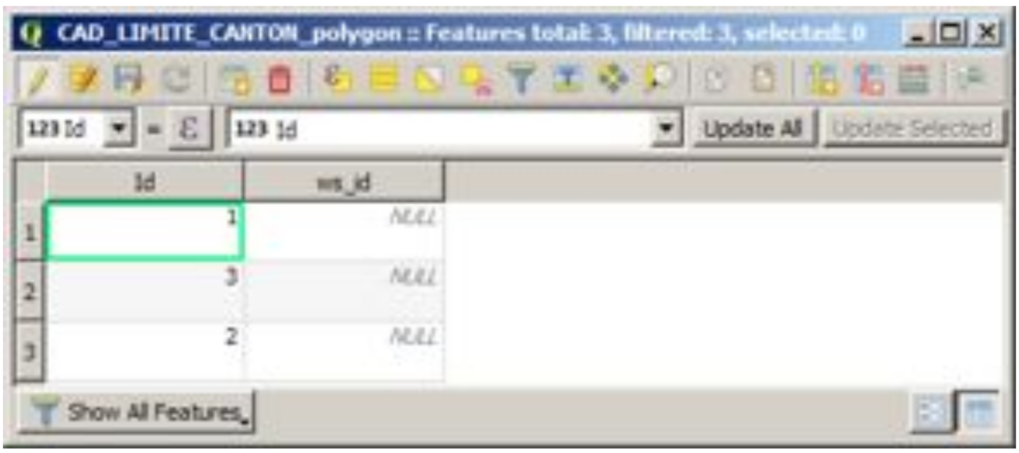
Add a new field using the add field icon.

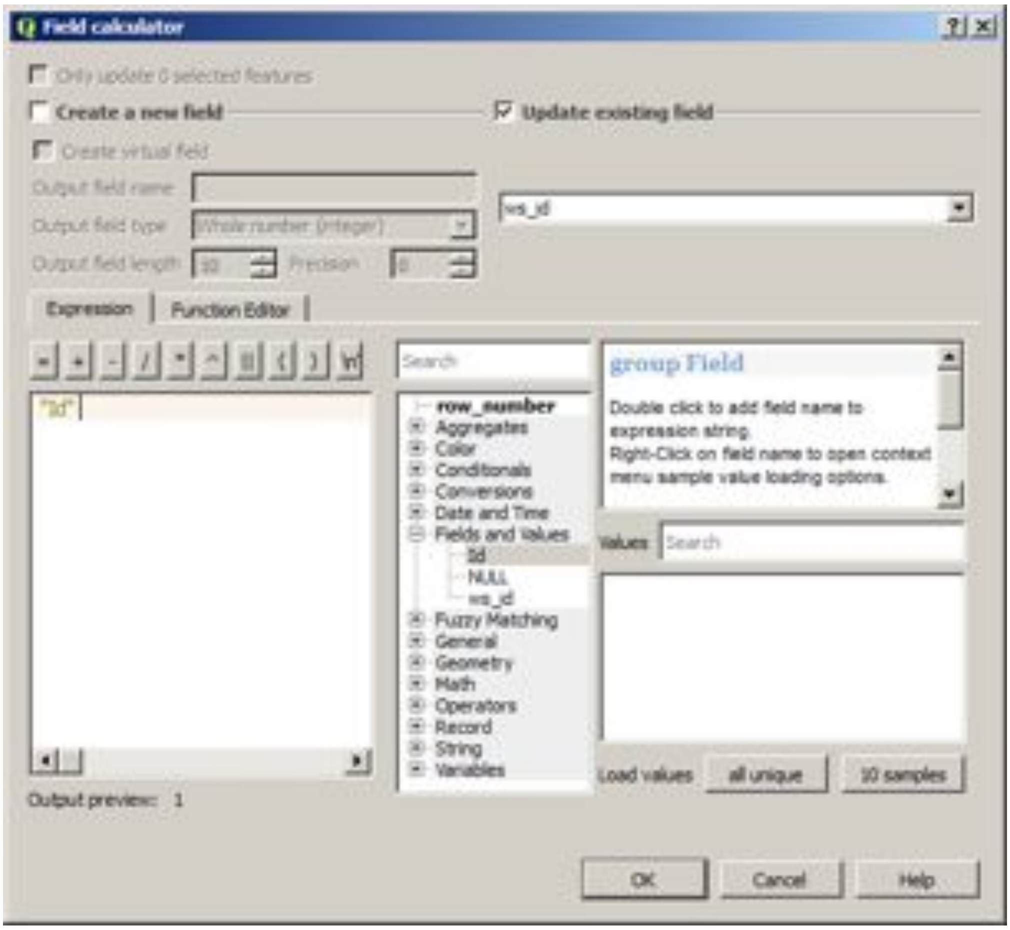
Manually enter the values or copy values from another column using the calculator. Alternatively the calculator can also create a new field.

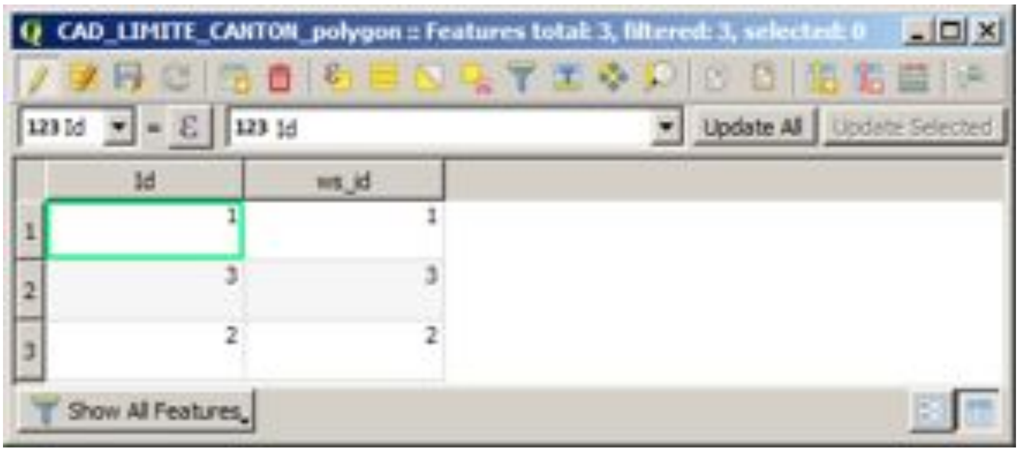

Add vector layer
Source type
File
Directory
Database
Protocol
Encoding
System
Source
Dataset
D:\MOOC\geneva_4326.shp
Browse
Open
Cancel
Help


CAD_LIMITE_CANTON_polygon :: Features total: 3, filtered: 3, selected: 0
Id
1
3
2
Show All Features


Add field
Name
ws_id
Comment
Type
Whole number (integer)
Provider type
integer
Length
1
OK
Cancel


CAD_LIMITE_CANTON_polygon :: Features total: 3, filtered: 3, selected: 0
123 Id
123 Id
Update All
Update Selected
Id
ws_id
NULL
Show All Features

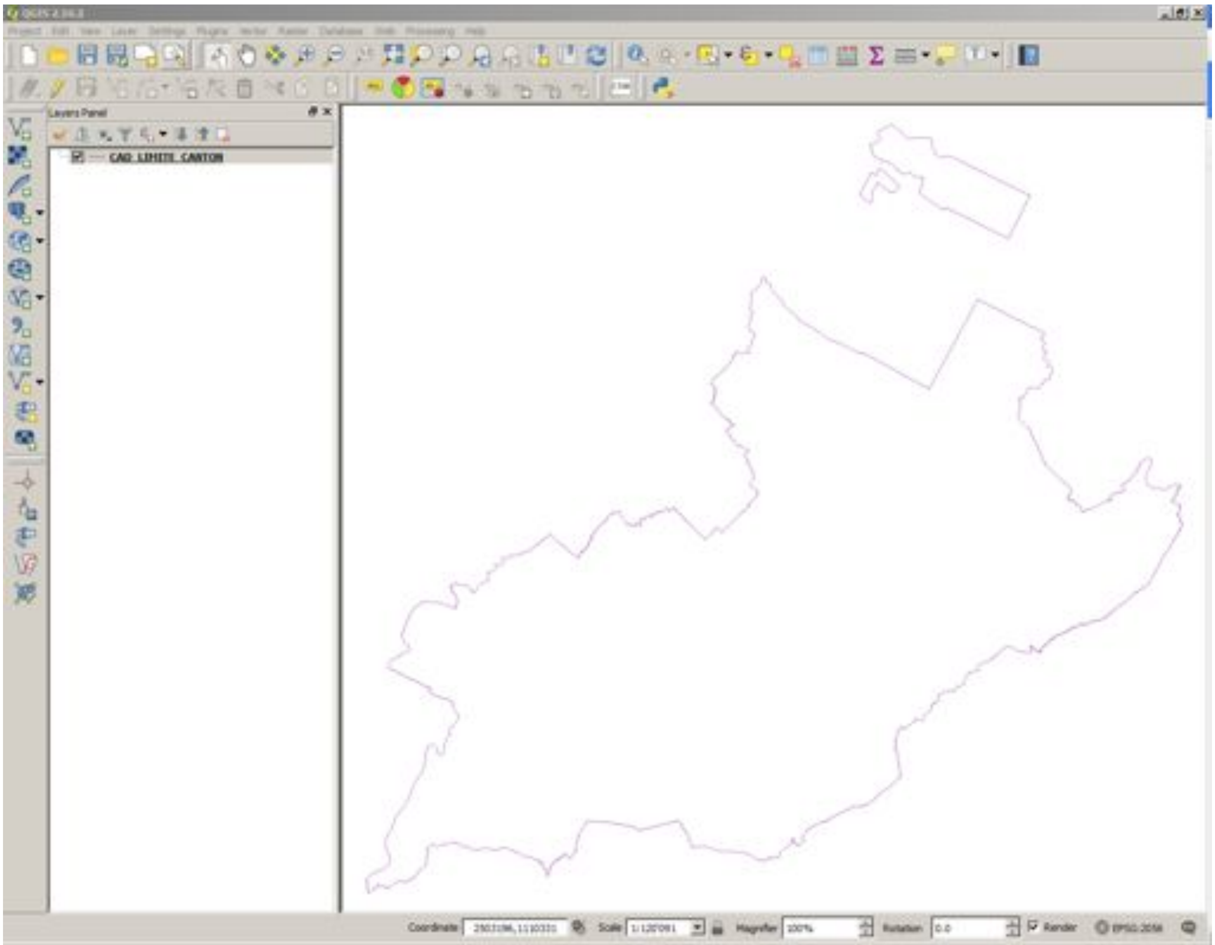


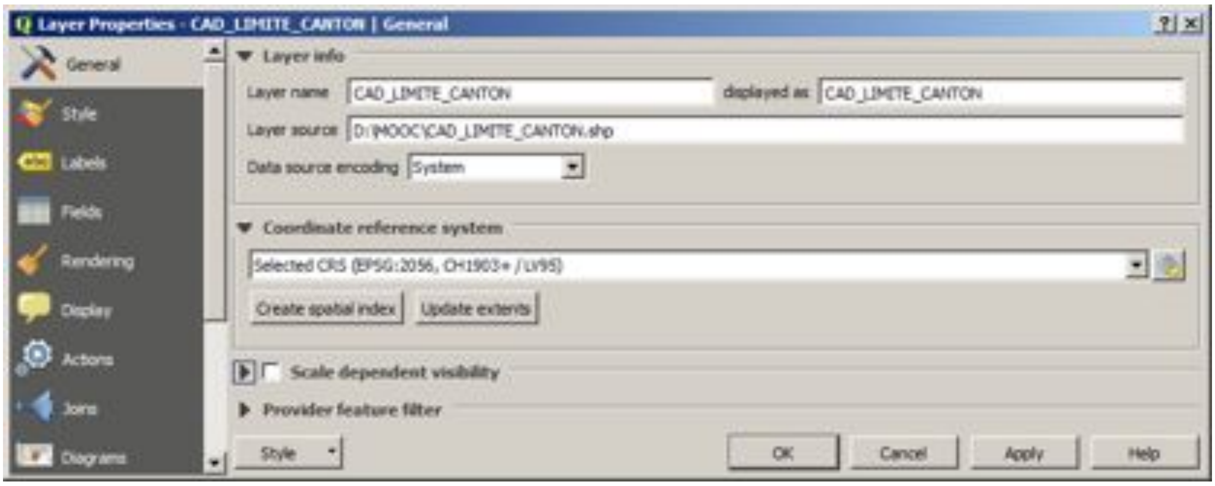


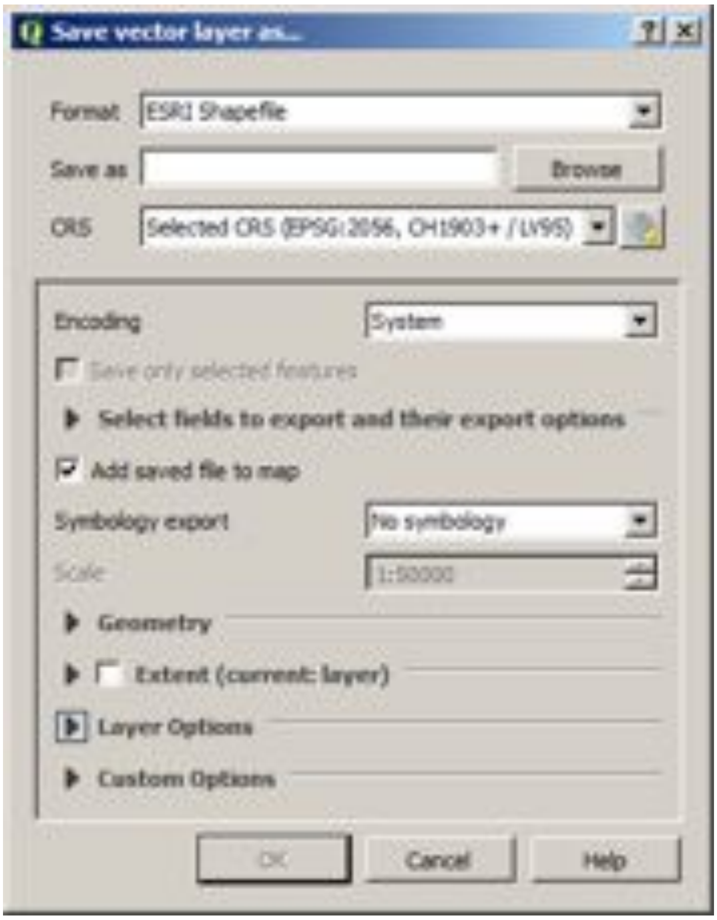
Reprojecting Data

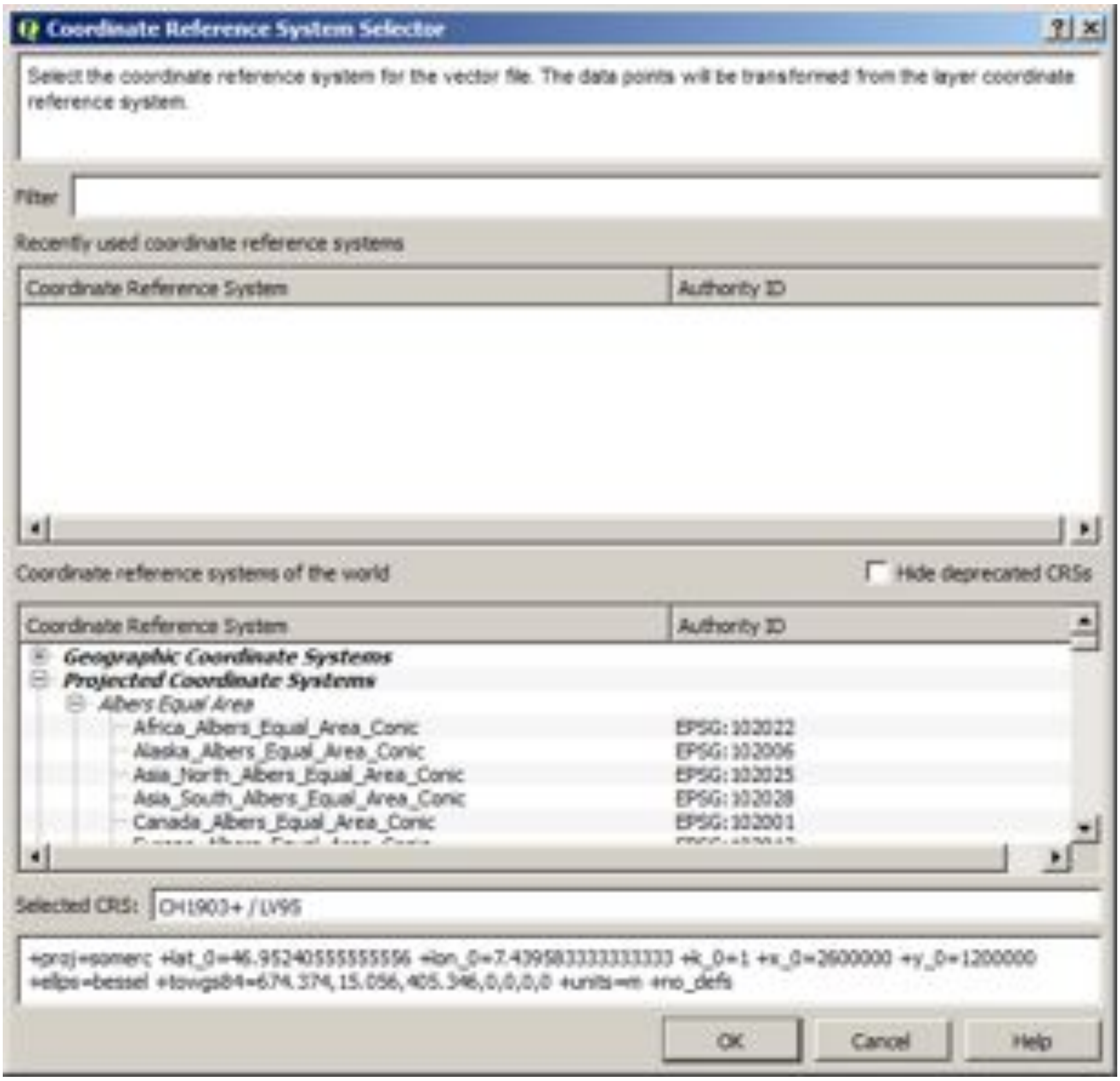
Geography is literally the study of Earth and a coordinate system describes how to divide it into pieces. Coordinate systems include a formal description of the shape of Earth, the area where the coordinate system can be used, and the unit of measure. The unit of measure is either angular or linear. Angular units are those like degrees that measure parts of a rotation. Linear units are those like meters that measure distances. There are thousands of commonly used coordinate systems each with their own advantages. Projecting data means to change the coordinate system of the data, although it should be noted that colloquially "projected data" is sometimes used to refer to data with a coordinate system that uses linear units. For convenience, QGIS will display data with different coordinate systems together, however data must be in the same coordinate system for it to interact such as with the clip described above. For this reason you will learn how to identify the coordinate system of data and project data into another coordinate system.

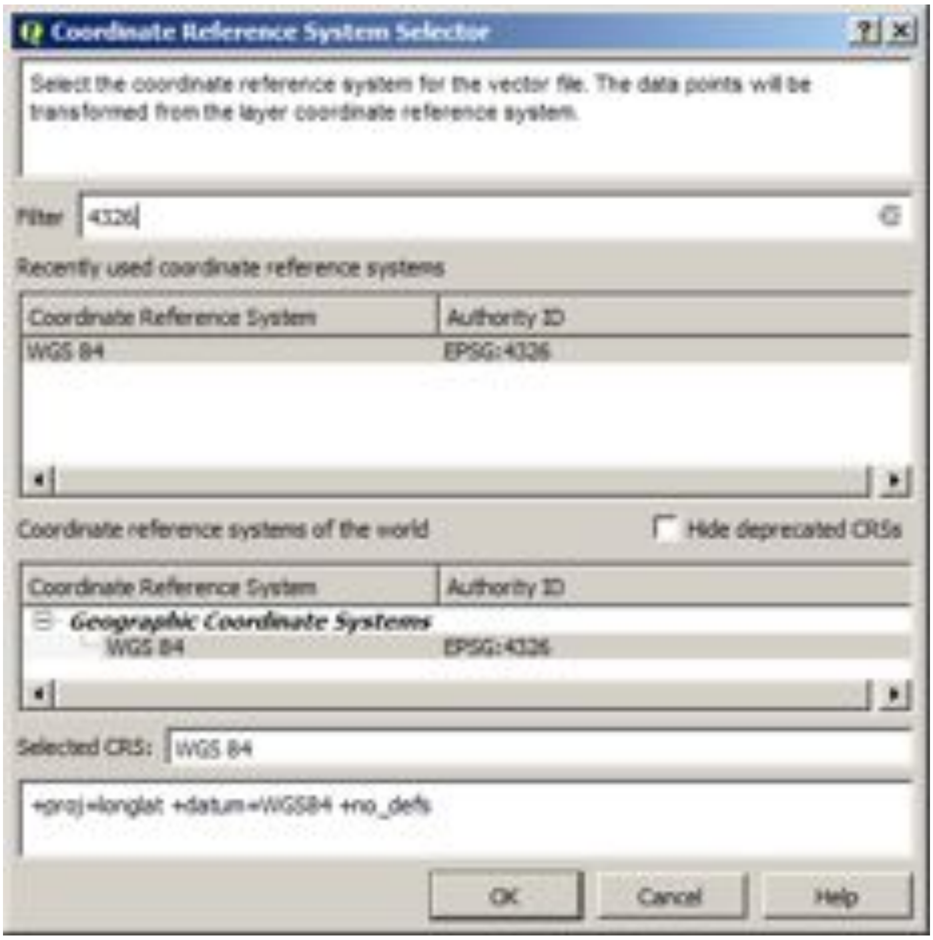
Start by first adding the shapefile for your study area to QGIS. See above for details. After you add your shapefile to QGIS you will see it listed in the “Layers Panel” on the left. If you cannot see the layers panel you can enable it by selecting View > Panels > Layers Panel. Right click on your layer and select properties. Under the “General” tab you will see a section named “Coordinate reference system” where the coordinate system is identified. In the case of Geneva, you will see “Selected CRS (EPSG:2056, CH1903+ /LV95)” which is a projection specifically designed for Switzerland. We will create a new copy of our study area in the projection “CRS (EPSG:4326, WGS 84)” so that it can be used with GLOBCOVER. Right click on your layer and select “Save As.” Click on the icon to the right of the box labeled “CRS” that contains the description of the coordinate system of your study area. This will open the “Coordinate Reference System Selector.” You can browse the available coordinate systems or type in the filter to find the one you want. Type 4326 into the filter and select the coordinate system with the “Authority ID” of “EPSG:4326” before clicking “OK.” The selected coordinate system has now changed. Click on browse to set the filename and click “OK” to save a copy of the data in the new projection.

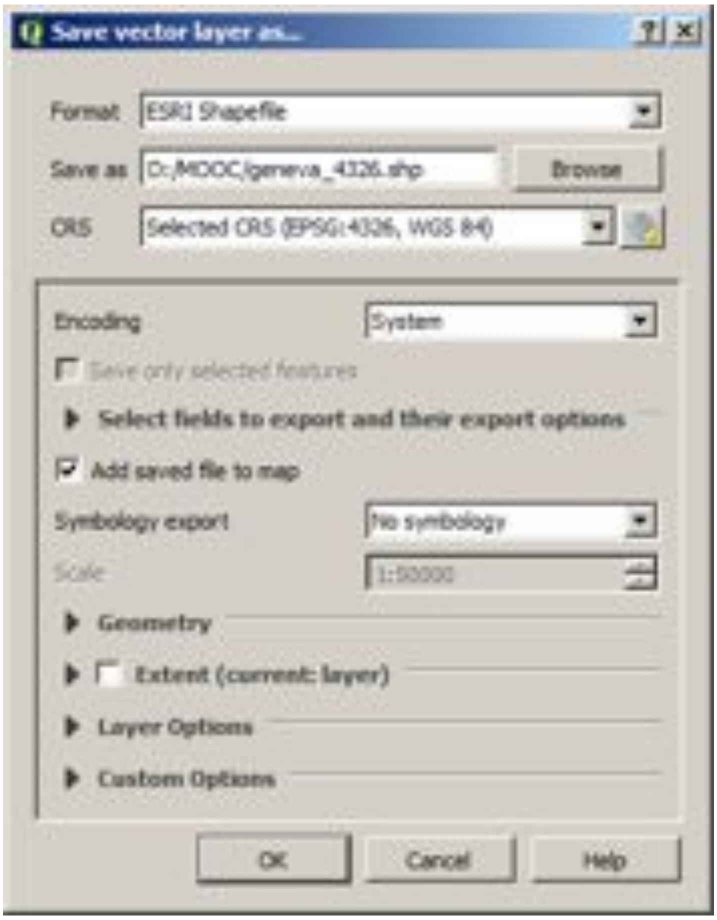



Layer Properties - CAD_LIMITE_CANTON | General
General
Style
Labels
Fields
Rendering
Display
Actions
Joins
Diagrams
Layer info
Layer name
CAD_LIMITE_CANTON
displayed as
CAD_LIMITE_CANTON
Layer source
D:\MOOC\CAD_LIMITE_CANTON.shp
Data source encoding
System
Coordinate reference system
Selected CRS (EPSG:2056, CH1903+ / LV95)
Create spatial index
Update extents
Scale dependent visibility
Provider feature filter
Style
OK
Cancel
Apply
Help


Save vector layer as...
Format
ESRI Shapefile
Save as
Browse
CRS
Selected CRS (EPSG:2056, CH1903+ / LV95)
Encoding
System
Save only selected features
Select fields to export and their export options
Add saved file to map
Symbology export
No symbology
Scale
1:50000
Geometry
Extent (current: layer)
Layer Options
Custom Options
OK
Cancel
Help


Coordinate Reference System Selector
Select the coordinate reference system for the vector file. The data points will be transformed from the layer coordinate reference system.
Filter
Recently used coordinate reference systems
Coordinate Reference System
Authority ID
Coordinate reference systems of the world
Hide deprecated CRSs
Coordinate Reference System
Authority ID
Geographic Coordinate Systems
Projected Coordinate Systems
Albers Equal Area
Africa_Albers_Equal_Area_Conic
EPSG:102022
Alaska_Albers_Equal_Area_Conic
EPSG:102006
Asia_North_Albers_Equal_Area_Conic
EPSG:102025
Asia_South_Albers_Equal_Area_Conic
EPSG:102028
Canada_Albers_Equal_Area_Conic
EPSG:102001
Selected CRS:
CH1903+ / LV95
+proj=somerc +lat_0=46.95240555555556 +lon_0=7.439583333333333 +k_0=1 +x_0=2600000 +y_0=1200000 +ellps=bessel +towgs84=674.374,15.056,405.346,0,0,0,0 +units=m +no_defs
OK
Cancel
Help


Coordinate Reference System Selector
Select the coordinate reference system for the vector file. The data points will be transformed from the layer coordinate reference system.
Filter
4326
Recently used coordinate reference systems
Coordinate Reference System
Authority ID
WGS 84
EPSG:4326
Coordinate reference systems of the world
Hide deprecated CRSs
Coordinate Reference System
Authority ID
Geographic Coordinate Systems
WGS 84
EPSG:4326
Selected CRS:
WGS 84
+proj=longlat +datum=WGS84 +no_defs
OK
Cancel
Help


Save vector layer as...
Format
ESRI Shapefile
Save as
D:/MOOC/geneva_4326.shp
Browse
CRS
Selected CRS (EPSG:4326, WGS 84)
Encoding
System
Save only selected features
Select fields to export and their export options
Add saved file to map
Symbology export
No symbology
Scale
1:50000
Geometry
Extent (current: layer)
Layer Options
Custom Options
OK
Cancel
Help