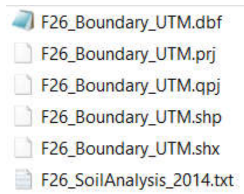
Exercise 3-1: Creating a soil property map

Mapping objectives:

- Create a soil analysis point layer from tabular data in QGIS
- Create a continuous surface soil property map using Kriging Interpolation in SAGA GIS 6.2.0
- Design a grid sampling scheme

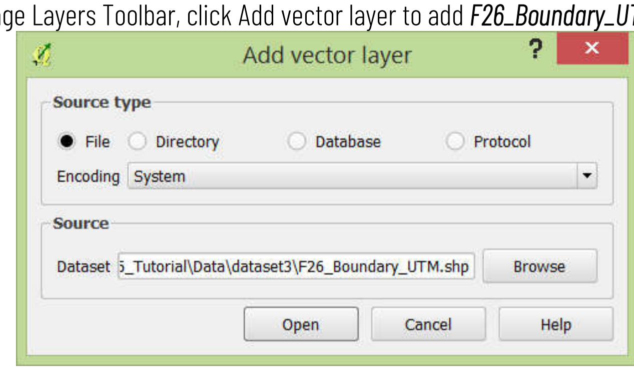
Data folder: Dataset3



Open QGIS 3.4.11 with GRASS 7.6.1

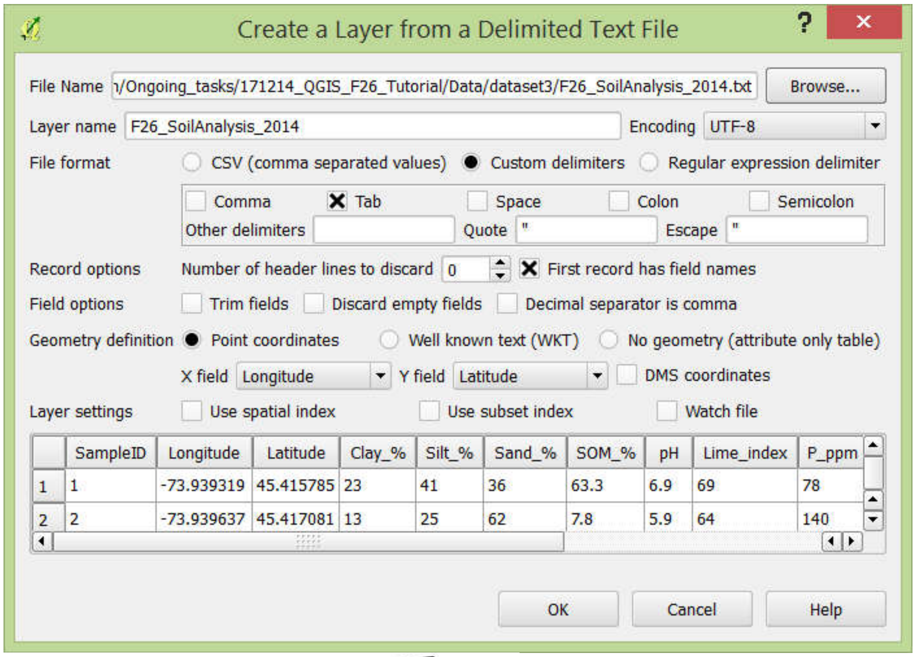
Part 1: Open a project

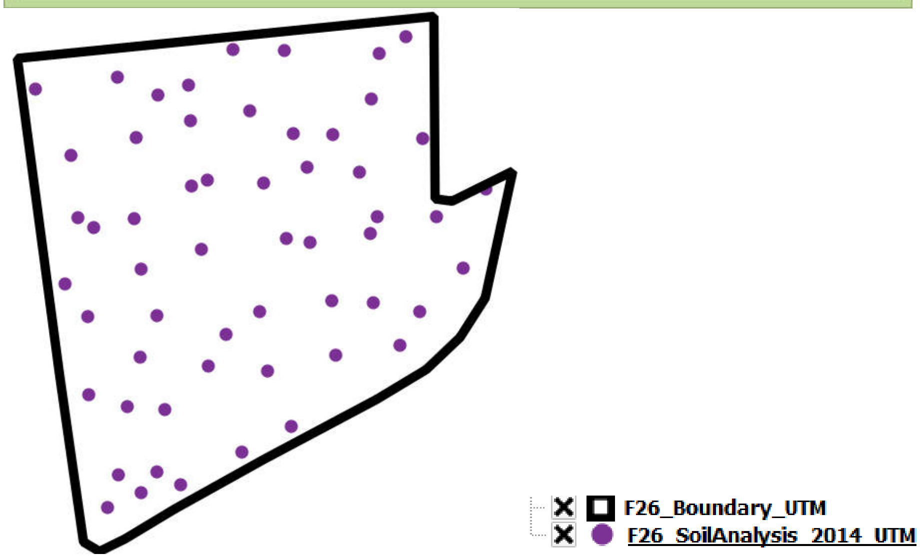
1. Create a new project in QGIS
   a. Go to Manage Layers Toolbar, click Add vector layer to add ***F26_Boundary_UTM.shp*** into the project

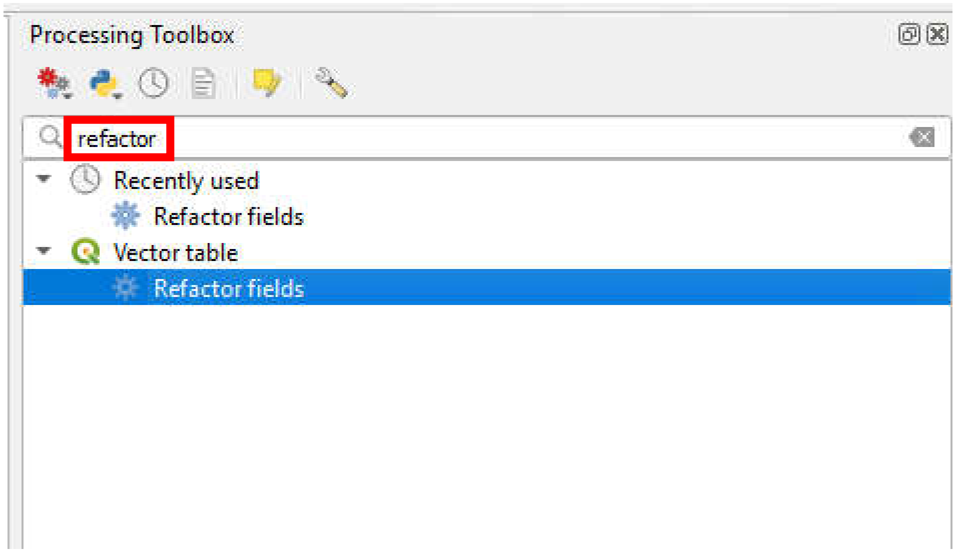


Part 2: Create a soil analysis point layer from tabular data

1. Click Add Delimited Text Layer in Manage Layers Toolbar
2. Click Browse to select ***F26_SoilAnalysis_2014.txt*** and set other parameters as follows. Then click OK


Create a Layer from a Delimited Text File
File Name
\/Ongoing_tasks/171214_QGIS_F26_Tutorial/Data/dataset3/F26_SoilAnalysis_2014.txt
Browse...
Layer name
F26_SoilAnalysis_2014
Encoding
UTF-8
File format
CSV (comma separated values)
Custom delimiters
Regular expression delimiter
Comma
Tab
Space
Colon
Semicolon
Other delimiters
Quote
Escape
Record options
Number of header lines to discard
0
First record has field names
Field options
Trim fields
Discard empty fields
Decimal separator is comma
Geometry definition
Point coordinates
Well known text (WKT)
No geometry (attribute only table)
X field
Longitude
Y field
Latitude
DMS coordinates
Layer settings
Use spatial index
Use subset index
Watch file
SampleID Longitude Latitude Clay_% Silt_% Sand_% SOM_% pH Lime_index P_ppm
1 1 -73.939319 45.415785 23 41 36 63.3 6.9 69 78
2 2 -73.939637 45.417081 13 25 62 7.8 5.9 64 140
OK
Cancel
Help


F26_Boundary_UTM
F26_SoilAnalysis_2014_UTM



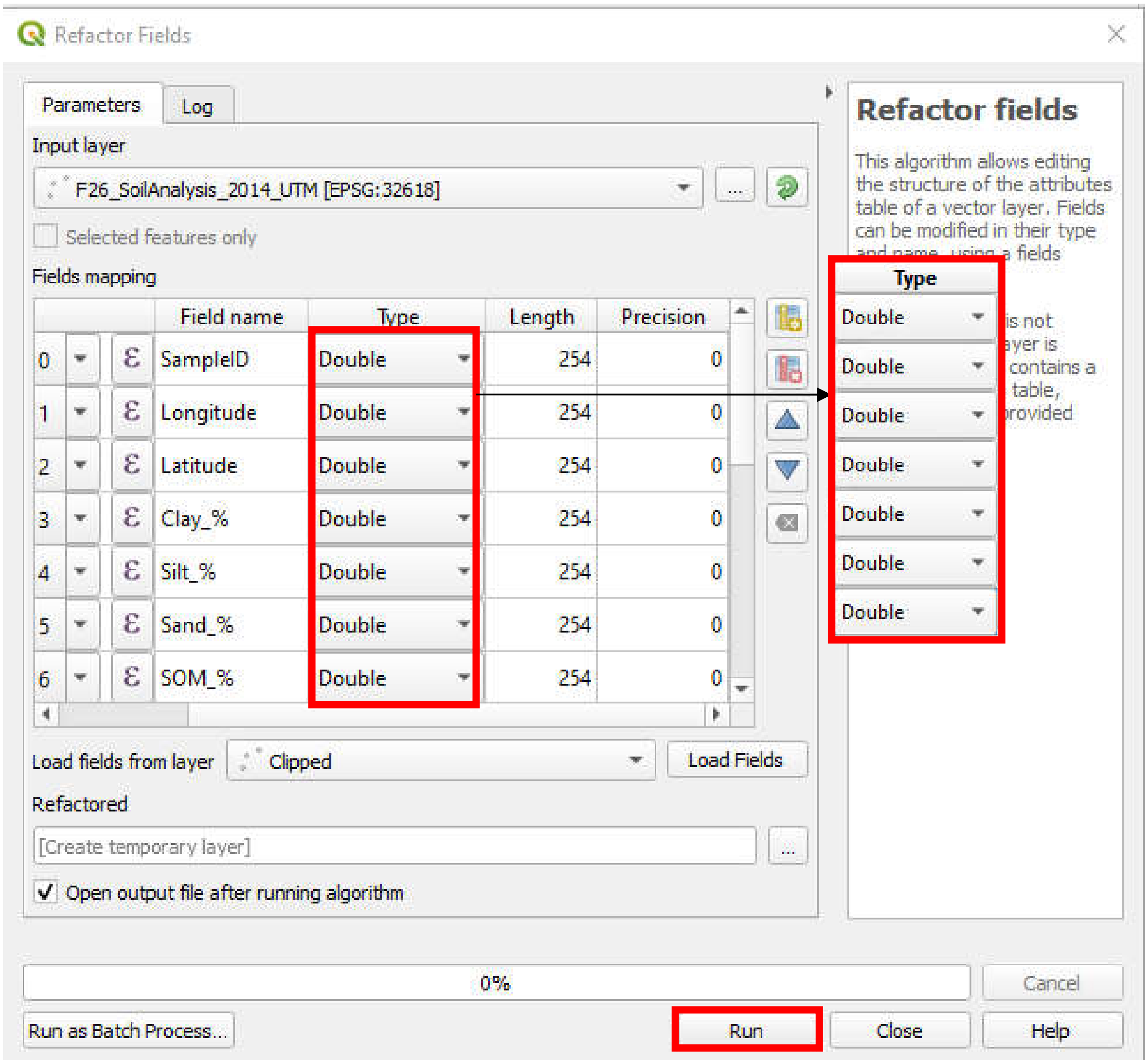
6. Change the type of field:

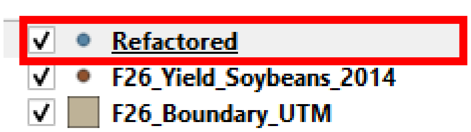
a. Type "refactor" in processing Toolbox and open "**Refactor fields**".

b. Select "*F26_SoilAnalysis_2014*" shapefile.

c. change all string type to "Double".

d. click "Run"

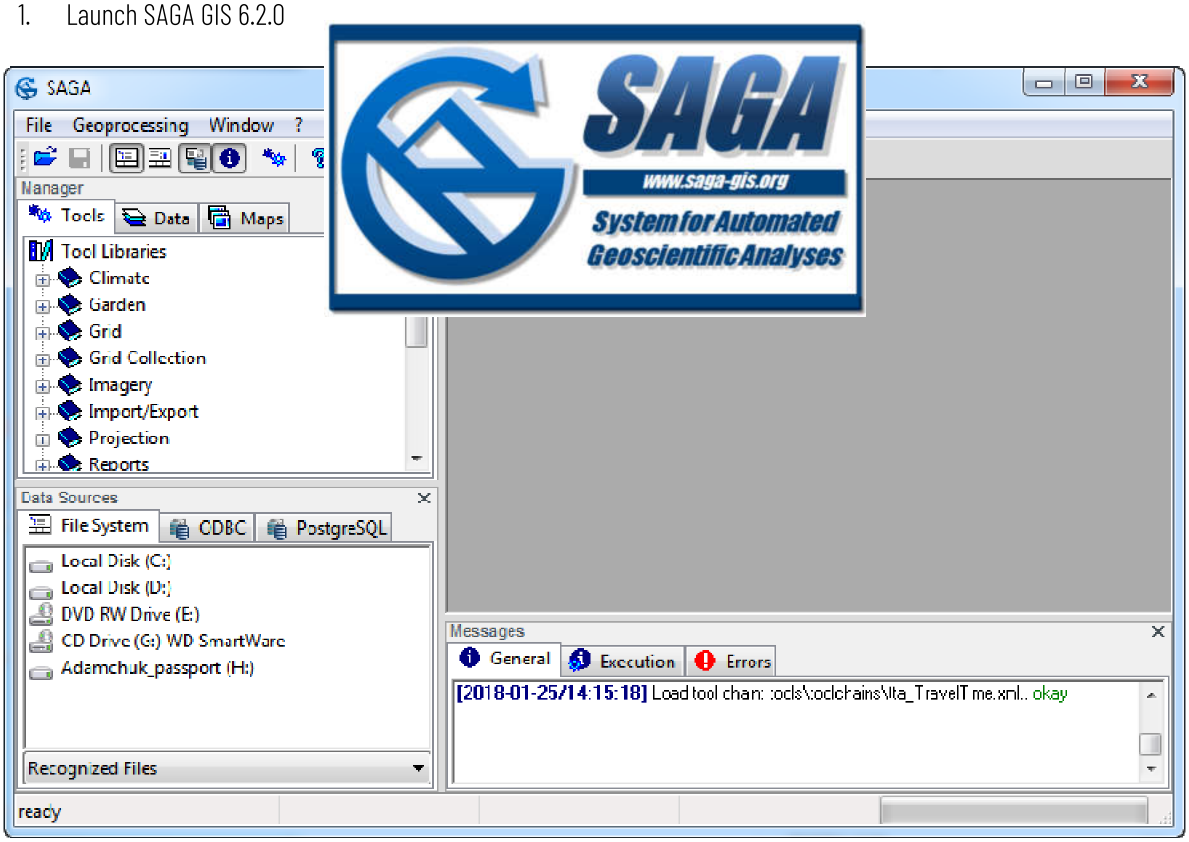

Refactor Fields
Parameters
Log
Input layer
F26_SoilAnalysis_2014_UTM [EPSG:32618]
Selected features only
Fields mapping
Field name
Type
Length
Precision
SampleID
Longitude
Latitude
Clay_%
Silt_%
Sand_%
SOM_%
Double
254
0
Load fields from layer
Clipped
Load Fields
Refactored
[Create temporary layer]
Open output file after running algorithm
Refactor fields
This algorithm allows editing the structure of the attributes table of a vector layer. Fields can be modified in their type
Type
0%
Cancel
Run as Batch Process...
Run
Close
Help


Refactored
F26_Yield_Soybeans_2014
F26_Boundary_UTM

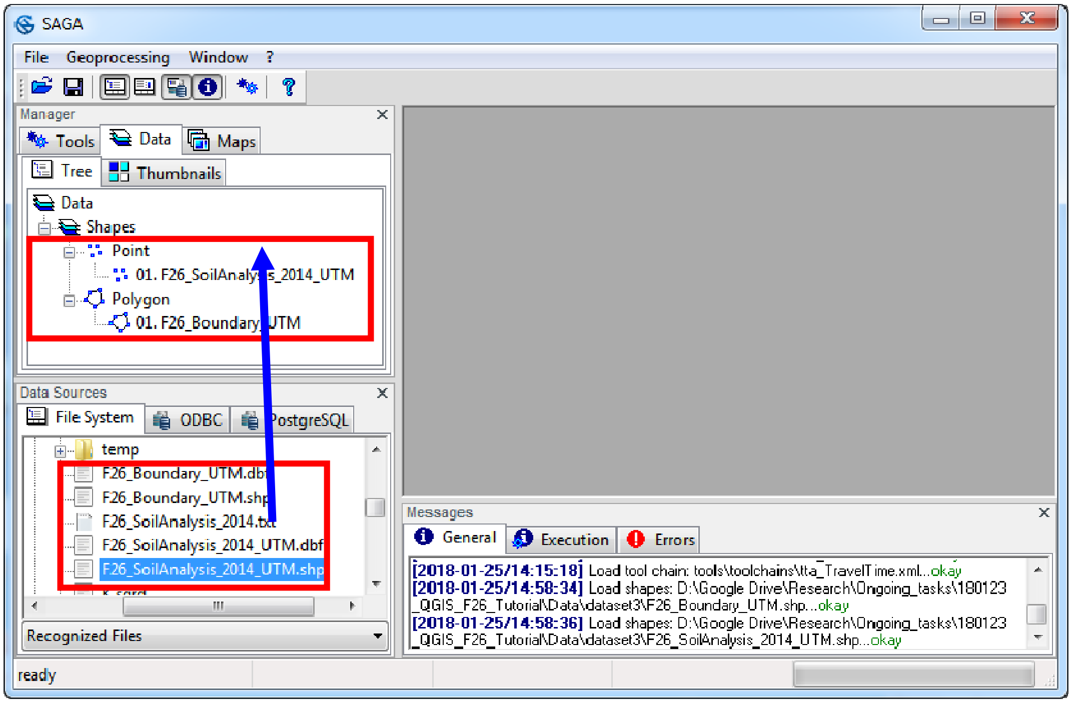
3. In Layer Panel, right click *Refactoraed*, then click Save As
4. In Save vector layer
    a. Format = ESRI Shapefile
    b. File name = *F26_SoilAnalysis_2014_UTM.shp*
    c. CRS = Project CRS (EPSG:32618 – WGS 84 / UTM zone 18 N) Click OK
5. Right click *F26_SoilAnalysis_2014* and *Refactoraed* then click Remove

Part 3: Create an interpolated soil property raster layer using SAGA GIS software

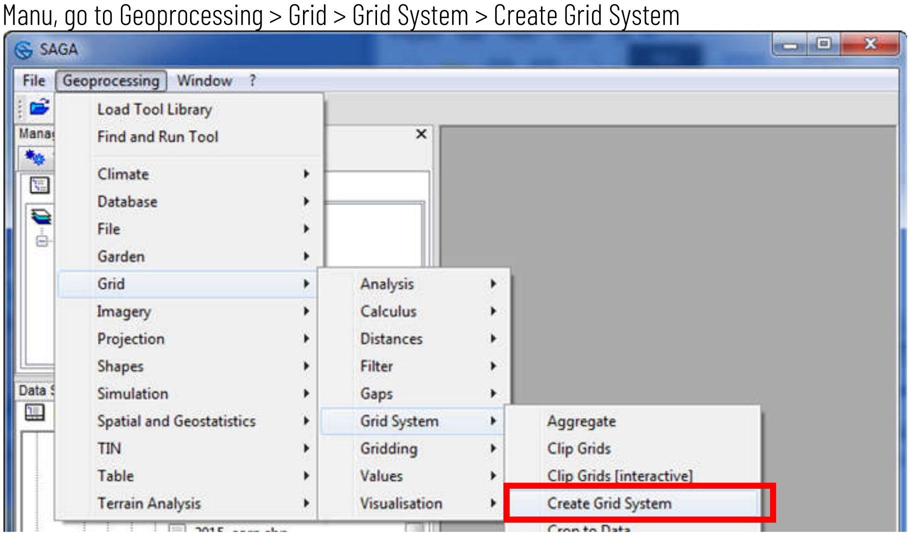
1. Launch SAGA GIS 6.2.0



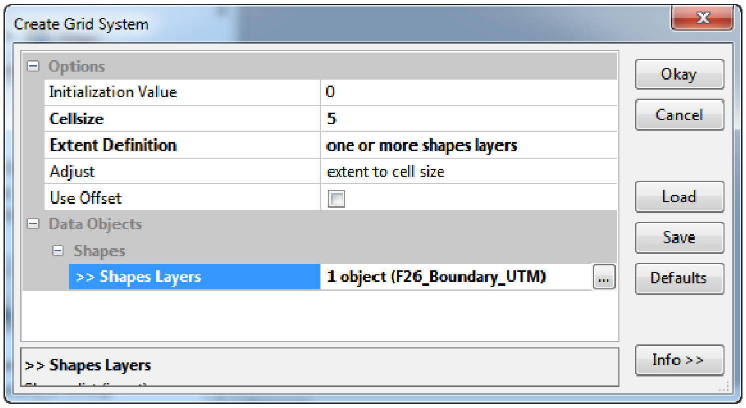
2. Import *F26_Boundary_UTM.shp* and *F26_SoilAnalysis_2014_UTM.shp* into SAGA
    a. In Data Source > File system, navigate to the project folder and double click on *F26_Boundary_UTM.shp* and *F26_SoilAnalysis_2014_UTM.shp* to add these two layers to Data > Tree

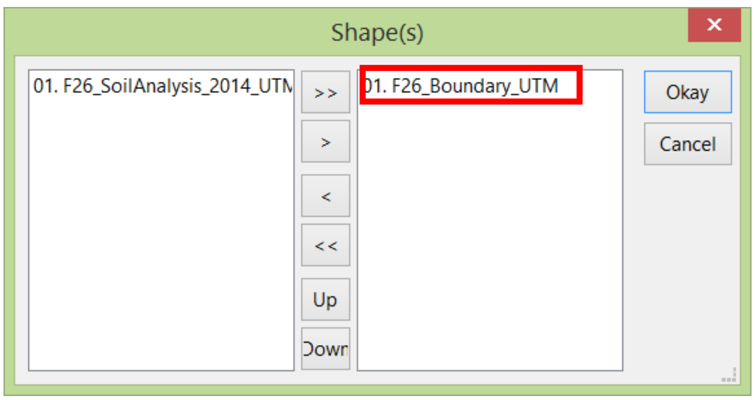


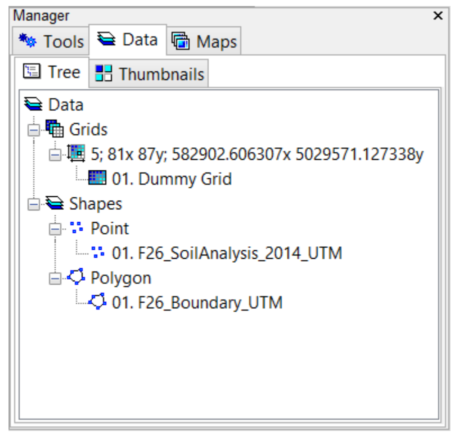
3. In Main Manu, go to Geoprocessing > Grid > Grid System > Create Grid System



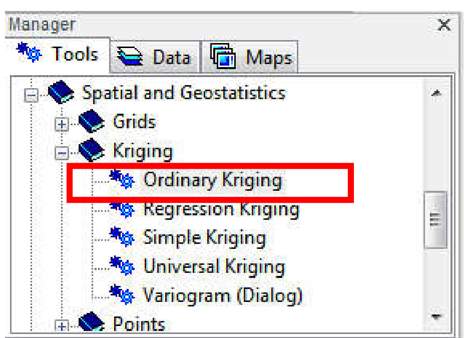
4. In Create Grid System:
Use default values, with the following exceptions:
   a. Cellsize = 5
   b. Extent Definition = one or more shapes layers
   c. Adjust = extent to cell size
   d. Data Objects > Shapes > Sahpes Layers = 1 object (***F26_Boundary_UTM***), click Okay





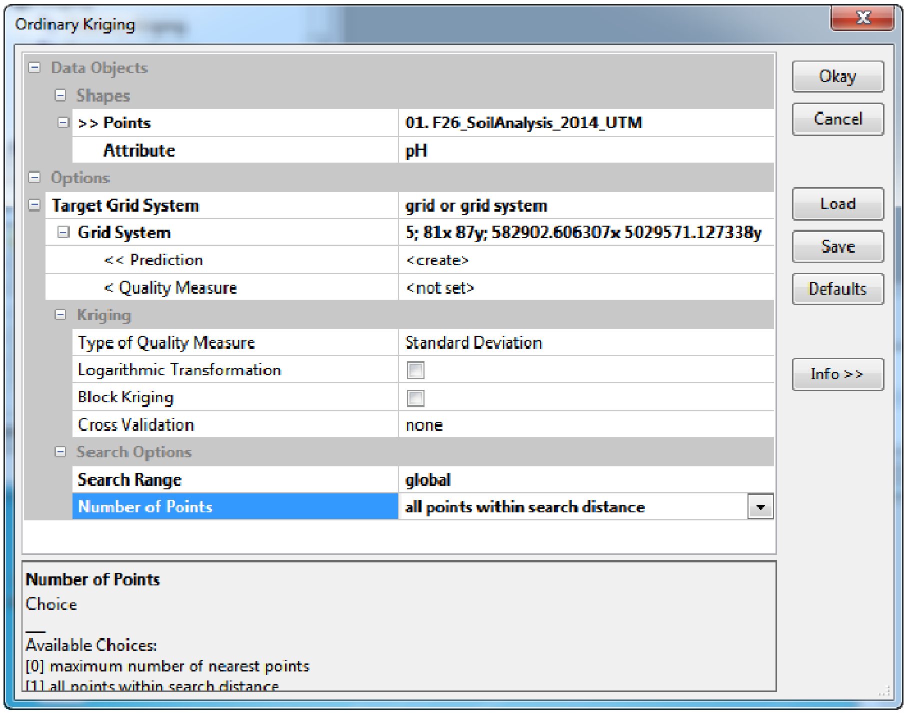


5. Go to Manager > Tools > Spatial and Geostatistics - Kriging > Ordinary Kriging. Double click on this tool to open the dialog window



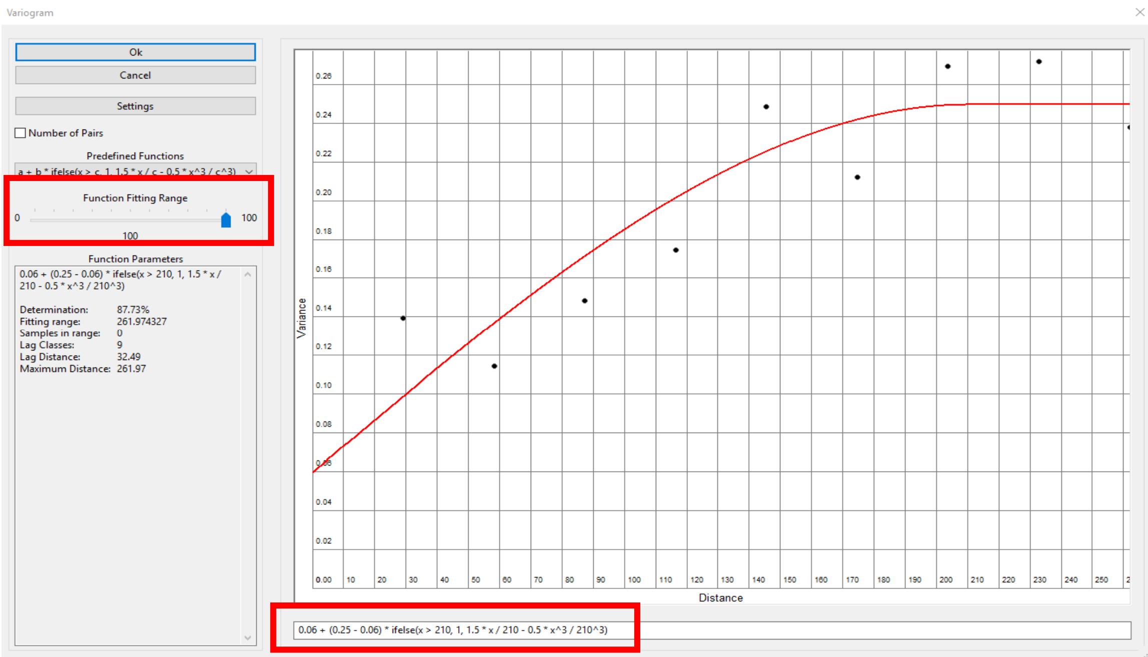
6. In Ordinary Kriging:
   Use the default values, except for the following:
   a. Data Objects
      Shapes >> Points = *01. F26_SoilAnalysis_2014_UTM*
      Attribute = pH
   b. Options > Target Grid system = grid or grid system
      Grid system= 5; 81x87y; 582902.606307x5029571.127338y
      << Prediction = <create>
   c. Search Options
      Search Range = global
      Number of Points = all points within search distance

Click Okay
In Grids > Grid System, use the drop down arrow to select

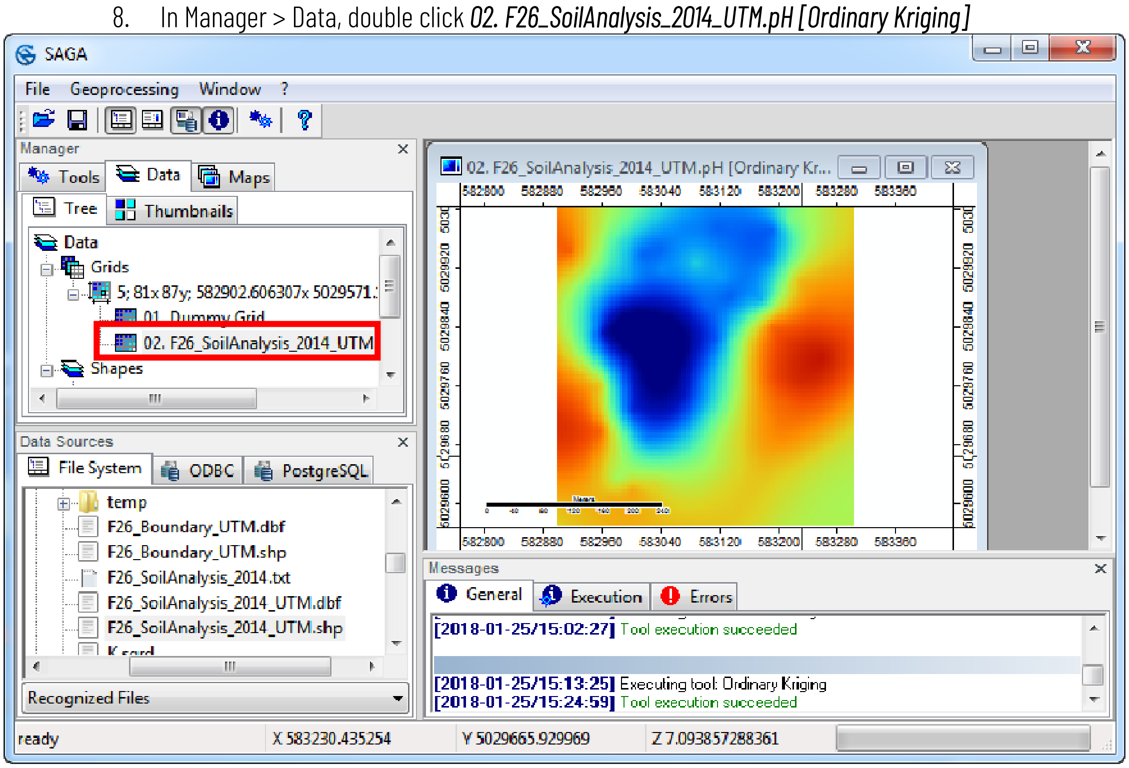


7. In Variogram:
   Use default values, except …

   Under the variogram plot, replace the variables with values:
   n (nugget) = 0.06; s (sill) = 0.25; r (range) = 210
   So, the spherical model of pH =
   0.06 + (0.25 - 0.06) * ifelse(x > 210, 1, 1.5 * x / 210 - 0.5 * x^3 / 210^3) [Press Enter key]
   Click Ok



8. In Manager > Data, double click *02. F26_SoilAnalysis_2014_UTM.pH [Ordinary Kriging]*

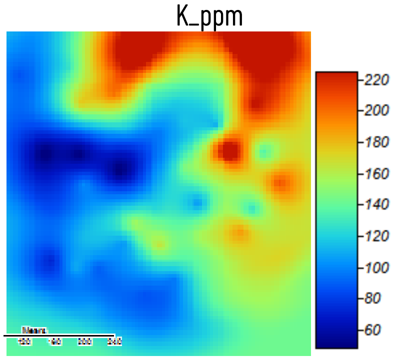


9. Right click *02. F26_SoilAnalysis_2014_UTM.pH [Ordinary Kriging]* to save the file as *pH.sgrd*

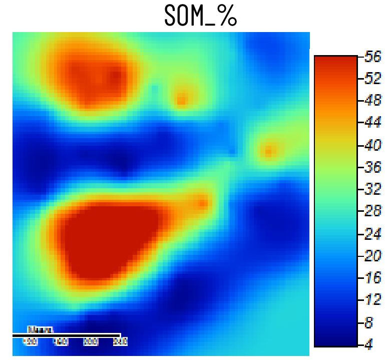
10. Repeat steps 5 – 8 to interpolate soil property of K_ppm, P/Al_ratio, SOM_%, and Lime_index, and then save them as *K_sgrd*, *P_Al.sgrd*,, *SOM.sgrd* and *lime_index.sgrd* respectively

Attribute	Spherical model	Function Fitting Range
K_ppm	0 + (2600 - 0) * ifelse(x > 150, 1, 1.5 * x / 150 - 0.5 * x^3 / 150^3)	60
P/Al	0 + (340 - 0) * ifelse(x > 160, 1, 1.5 * x / 160 - 0.5 * x^3 / 160^3)	80
Lime_index	2.5 + (6.8 – 2.5) * ifelse(x > 200, 1, 1.5 * x / 200 - 0.5 * x^3 / 200^3)	100
SOM_%	0 + (520 – 0) * ifelse(x > 150, 1, 1.5 * x / 150 - 0.5 * x^3 / 150^3)	100

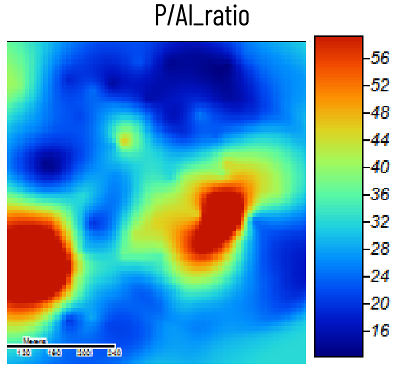
K_ppm



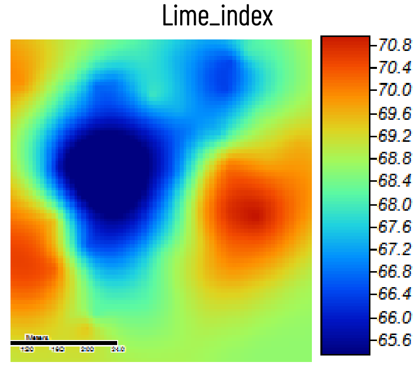
SOM_%



P/Al_ratio

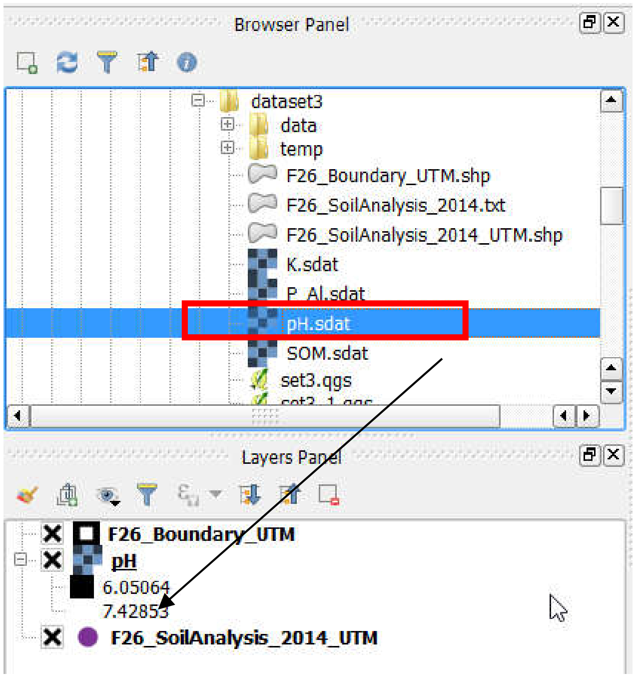


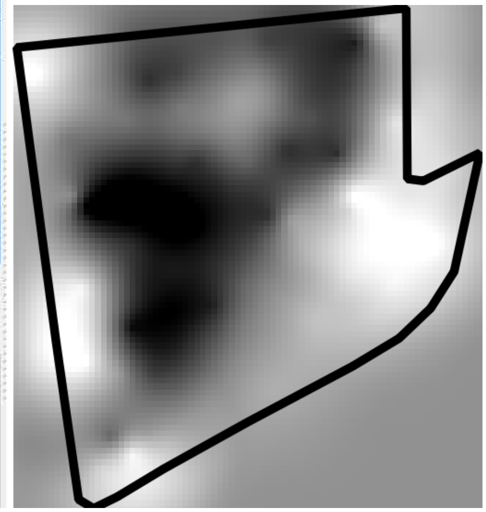
Lime_index



Part 4: View the interpolated soil property maps in QGIS

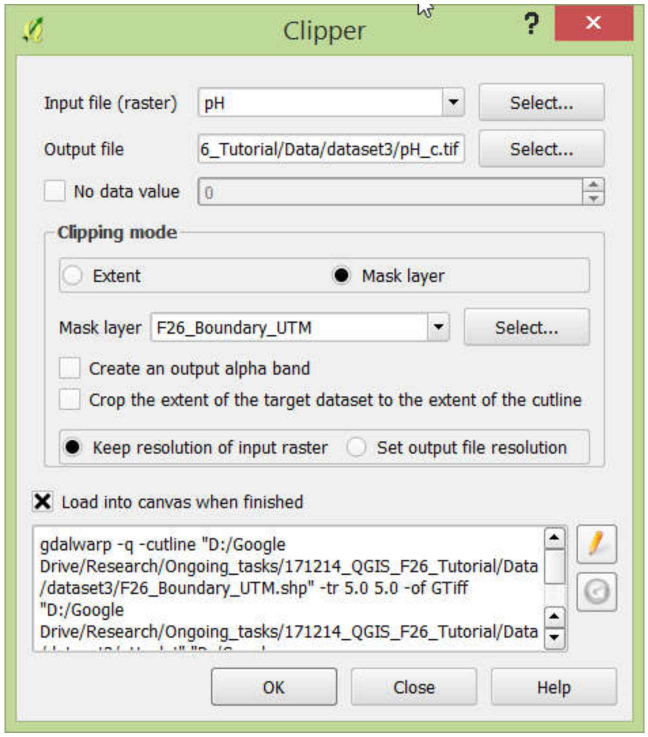
1. Back to QGIS interface, double click ***pH.sdat*** in Browser Panel to add this layer into Layers Panel



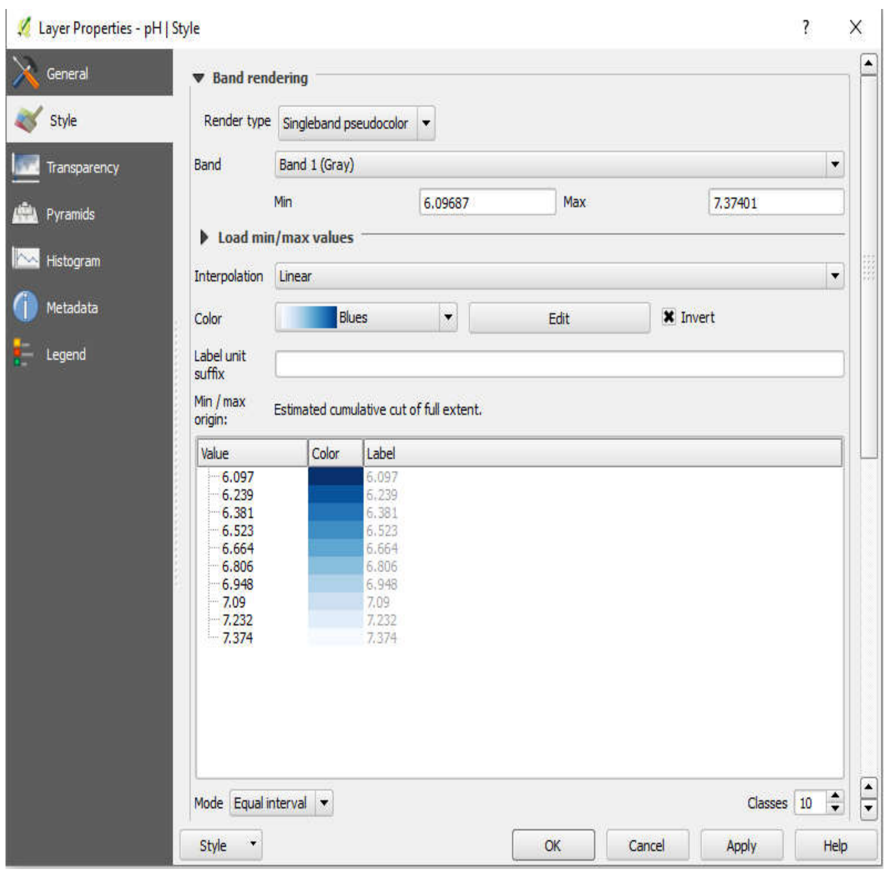


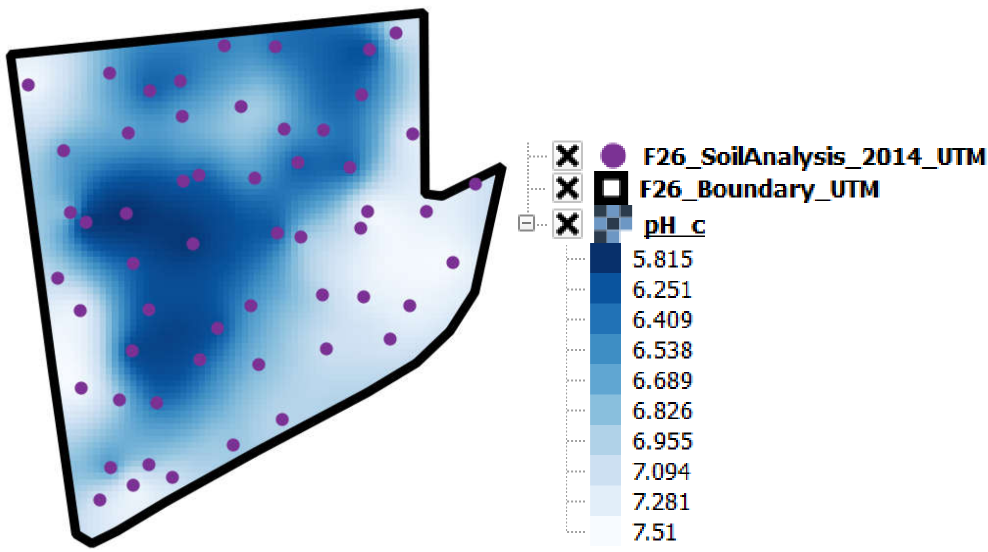
2. In Menu Bar, go to Raster > Extraction > Clipper ...
   a. Input file (rater) = *pH*
   b. Output file = *pH_c*
   c. Clipping mode = Mask layer
      Mask layer = *F26_Boundary_UTM*
      Keep resolution of input raster
   a. Load into canvas when finished

   Click OK

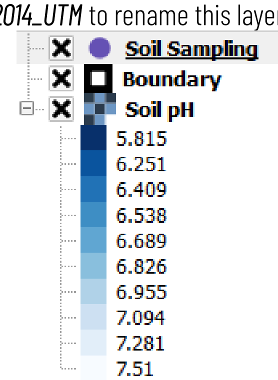


3. In Layers Panel, right click *pH* layer and click Remove
4. In Layers Panel, right click *pH_c* layer and click Properties
    a. In Style:
       Render type = Singleband pseudocolor
    b. Load min/max values
       Interpolation = Liner
       Color = Blues;
       Check Invert
       Mode = Equal interval;
       Classes = 10
       Click Classify
       Click OK



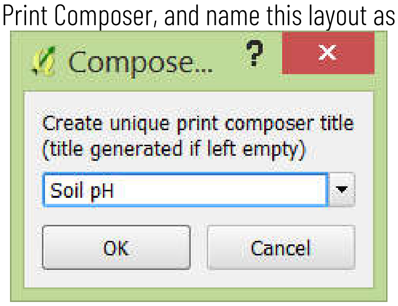


5. Rename each layer for a better layout
    a. Right click *pH_c* to rename this layer as *Soil pH*
    b. Right click *F26_Boundary_UTM* to rename this layer as *Boundary*
    c. Right click *F26_SoilAnalysis_2014_UTM* to rename this layer as *Soil Sampling*

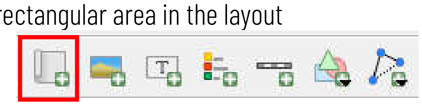


Part 5: Create a soil pH layout map

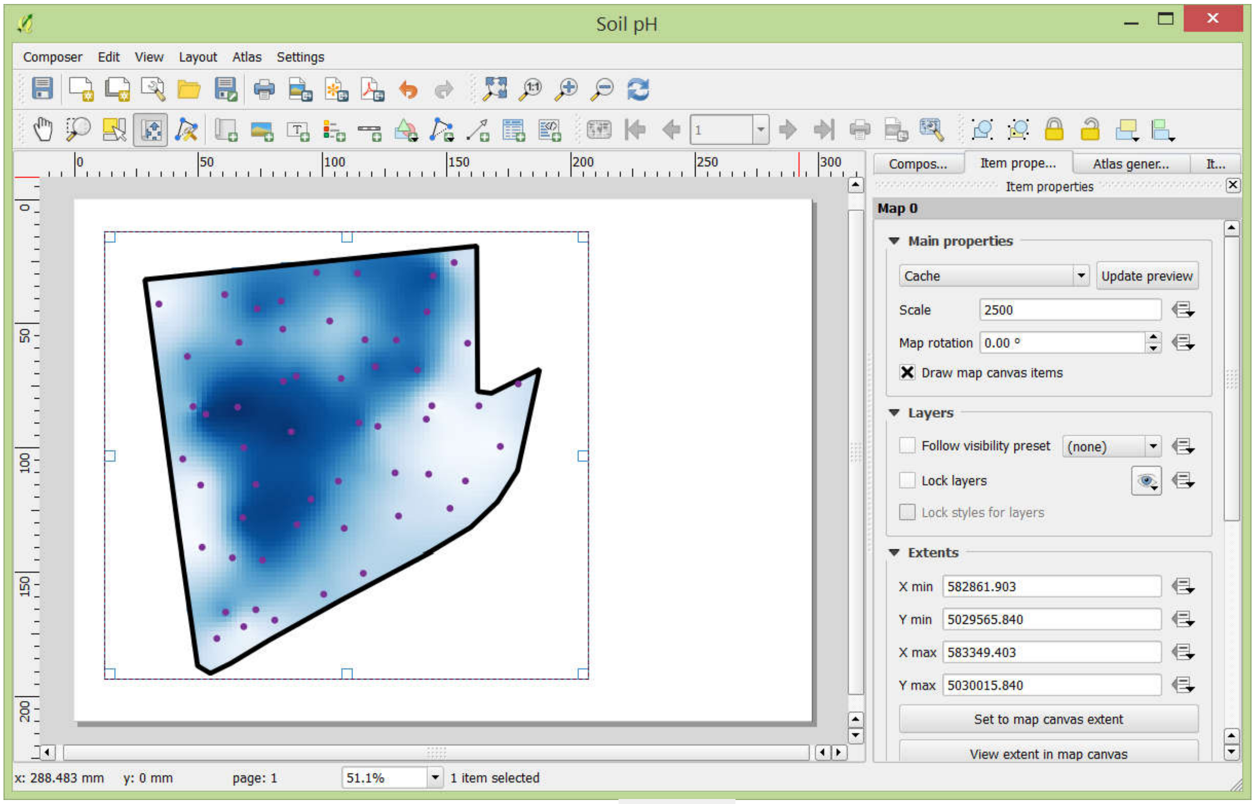
1. In Main Menu, click Project > New Print Composer, and name this layout as Soil pH. Click OK

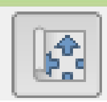


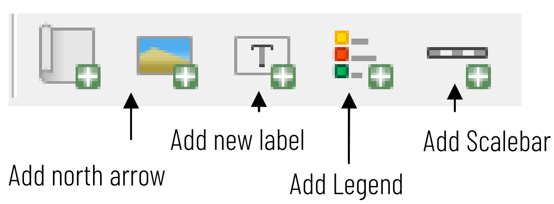
2. Click Add new map and draw a rectangular area in the layout



Scale = 2500



3. Use move item content to adjust the view of map 
4. Add legend, title, and scalebar to the map using:



6. Go to Composer > Export as Image...
    a. File name = *soil_pH_map.png*
7. Save the project as *set3.qgs*