PRACTICAL 1

AIM: Familiarizing Quantum GIS: Installation of QGIS, datasets for both Vector and Raster data, Maps.

Step 1 for installation

- Installation of QGIS. Double click on setup file to install it. Installation window will appear like this.
- Click on "Next" button.
- Click on "I Agree".
- Set the installation path and click on "Next"
- If you want you can load other data sets by clicking on check box before them. Click on "Install".
- Click on "Finish" You will get QGIS 2.18 Folder on your desktop

Step 2 for add the vector and raster data

- Open QGIS and go to Add Layer > Add Vector Layer.
- Select the shapefile (e.g., IND_adm0.shp).
- Click Open to load the shapefile into QGIS.
- Similarly, add another shapefile (e.g., IND_rails.shp) for railway data.
- Select the layer from layer pane and open attribute table.
- Right Click on Layer and select Filter set the condition "EXS DESCRI Unexamined/Unsurveyed' and then Press "OK" button.
- The railway roads that are unexamined or unsurveyed will be displayed in different color.
- Goto Project Properties Select CRS → Select WGS 84

Calculating line lengths

- Principles of Geographic Information Systems (TYRSTI male
- Open attribute table → toggle editing Open Filed Calculator
- In attribute table the Route Len column is added with length value in KM.

PRACTICAL 2

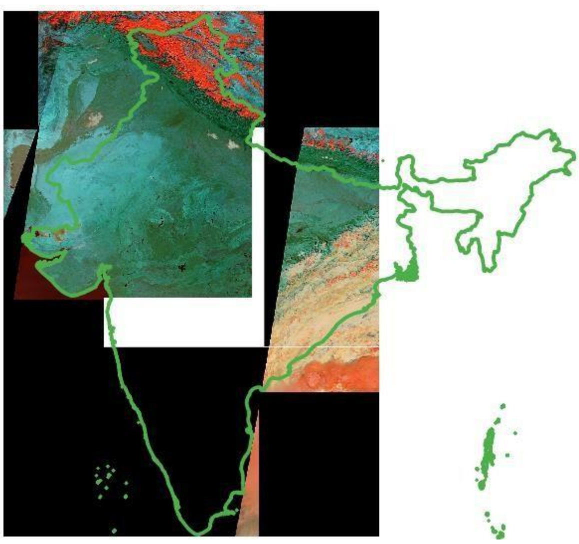
AIM: Creating and Managing Vector Data: Adding vector layers, setting properties, formatting, calculating line lengths and statistics.

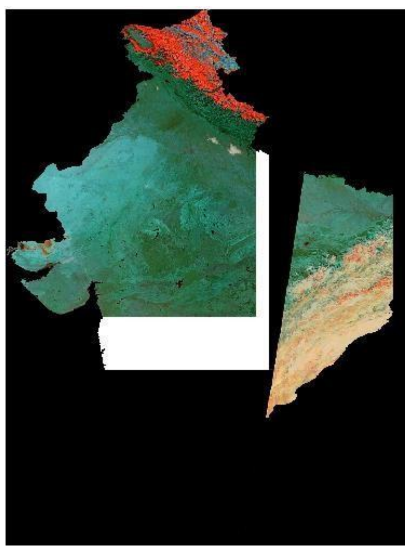
Part 1

1. Layer-create layer - new shape file layer - select point - Add name - click add attributed list – OK
2. Give your File name-Save
3. On left side-select to Toggle Editing-Select Add features - click anywhere in the screenGive ID - Click OK
4. For Line and Polygon repeat the steps and select line and polygon in step 1

Part 2

1. Layer → Add Layer → Add Vector Layer
2. From Practical 1(D) folder open → “IND_adm0.shp”
3. Layer → Add Layer → Add Vector Layer
4. From Practical 1(D) folder open → “IND_rails.shp”
5. From Layers in the left → Right click on the “IND_rails” → Click on Open Attribute Table
6. Click on Toggle editing mode (editing mode will be on)
7. Click on Open Field Calculator → Give the output Field name as “Track_len2” andchange output field type to Decimal number
8. Then write the formula $length/1000 click on OK
9. Vector → Analysis Tools → Basic Statistics
10. In the Input vector layer → select IND_rails11. In the Target field → select Track_len2 and Run and Close and values will be seen





PRACTICAL 3

AIM: Exploring and Managing Raster data: Adding raster layers, raster styling and analysis, raster mosaicking and clipping.

Part 1

1. Layer → Add Layer → Add Raster LayerFrom Practical 2(A) folder open → “glds90g60.asc”
2. From Layers in the left → Right click on the “glds90g60” → Click on Properties
3. In PropertiesChange Render type to “Singleband pseudocolor”Change Mode to “Equal Interval” Change the colorThen click on “classify” and then ok
4. Repeat step 1 and select the file “glds00g60.asc” and open in the properties of “glds00g60”
5. Change the Render typeSet the Max value to 240
6. Change the ModeClick on classify and then apply and ok
7. From Layers select both the file by clicking on the box
8. Click on Raster → Then click on “Raster Calculator”
9. In Raster CalculatorFrom the Raster Bands → Select “glds00g60@1” (By double clicking on it)
10. From the operators, select the “-” operatorThen the “glds90g60@1” from the Raster Bands
11. In the Result Layer, Click on the 3 dots of the output layer
12. Create a file named “Diff” in the “Practical 2 folder → Click on the “Save” and ok
13. Then from the layers go to the properties of “Diff” file
14. Repeat step 5, click on classify and ok

Part 2

1. Layer → Add Layer → Add Raster Layer
2. From Practical 2(C) folder → open “India” folder, select the “4 images”
3. Raster → Miscellaneous → Merge
4. In the output file → Create a file named “merged” in the “Practical 2” folder and “Save”.
5. In the input files → Select all the “4 images” which were selected previously from the “India” folder
6. Layer → Add Layer → Add Vector LayerFrom “IND_adm0.shp” file and open Raster → Extraction → ClipperIn the Input file → Select the “merged” file created previously
7. In the output file → Create a file named “Clip” and Save
8. Change the clipping mode to “Mask Layer” and ok and then close

PRACTICAL 4

AIM: Making a Map, Working with Attributes, Importing Spreadsheets or CSV files UsingPlugins, Searching and Downloading OpenStreetMap Data

PART 1 - India Map

1. Layer- add vector-select image (adm0_shp)
2. Project-new print composer-give name
3. New interface is opened
4. Layout-add map-select and drag
5. Layout-add image-select and drag-go to item-search directories-select image
6. Layout-add image-select and drag-go to item-search directories-select image
7. Layout-add label-select and drag-go to item-search directories-write any text
8. Layout-add scale bar- select and drag
9. Layout-add arrow- select and drag
10. Layout-add legend - select and drag
11. Layout-add attribute /table - select and drag
12. Left side select shapes and select and drag-go to item-search directories-change color
13. Composer-Export as Image-Give Name –save

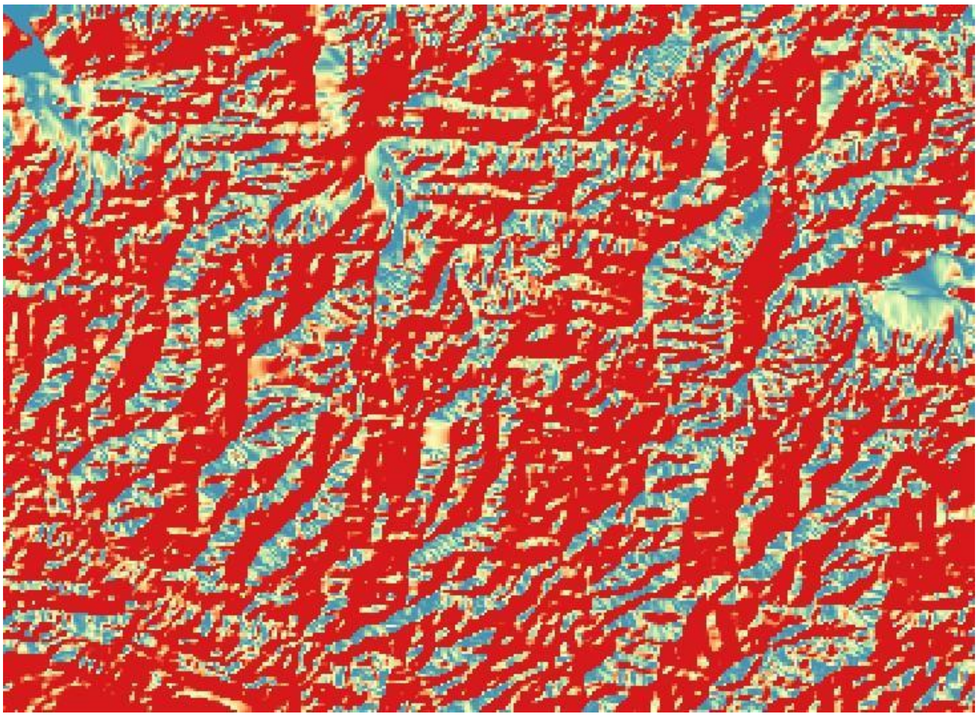
Part 2 - Mumbai Map

1. Layer-add-Raster-Select Image-(mumbai-map.jpg)
2. Project-new print composer-give name
3. New interface is opened
4. Layout-add map-select and drag
5. Layout-add image-select and drag-go to item-search directories-select-image
6. Layout-add image-select and drag-go to item-search directories-select image 7. Layout-add label-select and drag-go to item-search directories-write any text
7. Layout-add scale bar - select and drag
8. Layout-add arrow- select and drag
9. Layout-add legend-select and drag
10. Layout-add attribute table select and drag
11. Left side select shapes and select and drag-go to stem-search directories-change
12. Composer-Export as Image-Give Name-save

Part 3- Sample File

1. Select layer-Add layer-Add delimated text layer
2. File Name-Select sample xis
3. Select custom delimiters-Select all the checkboxes

4. In geometry definition-x field (select LATITUDE Feld LONGITUDE)
5. Click OK-Close-Cancel



PRACTICAL 5

AIM: Working with attributes, Terrain Data

Part 1:

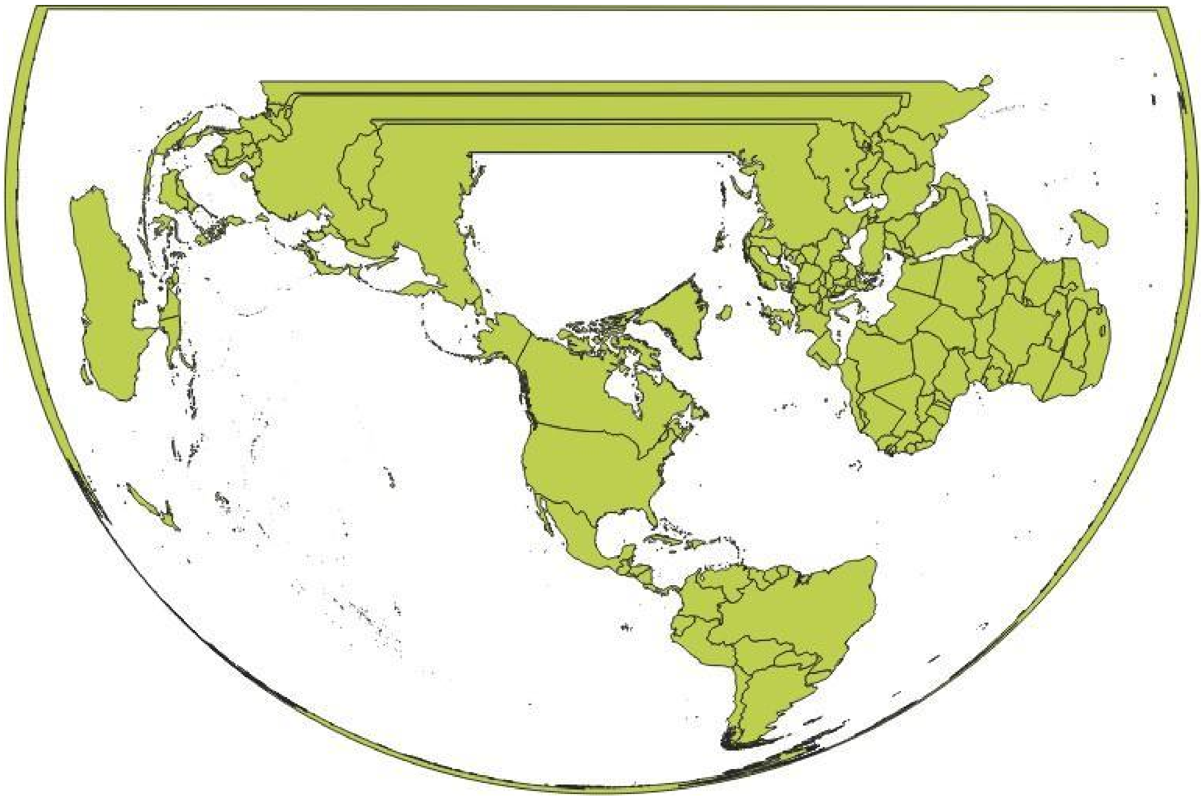
1. Open New Project
2. Click on Layer New Layer Add Vector Layer
3. Browse "Practical 4" dataset and click "open" Select the zip file "ne_10m_populated_places_simple"
4. Right click on that file Click on "open attribute table"
5. From above tools Click on "Select feature using an expression"
6. Put this formula in textbox

   pop_max > 10000 and sov0name = 'India'
7. Click on select and close

Part 2:

1. Layer-Add layer-Add raster layer select image with end (mea300 rif extension file)- tif layer is displayed on screen
2. Select raster-Extraction-Select Clipper
3. Check input file whether that is the same filename as you selected prior
4. In output file-select-give any name to your file-Save
5. Drag and Select the displayed image and click OK-OK-OK and close
6. On the left side untick the filename mea300 if which you have selected prior then your clipped layer will be duplayed.
7. Select raster-Extraction-Select Contour
8. Check input file and drop and select the clipped file
9. In output file-Select-gave any name to your file-Save
10. Change interval between contour line into 100 and check the Atribute name-Elev
11. Click OK-OK-OK and close
12. Right click on the contour file from the layers section on the left bonam side
13. Open Attribute table and new window will be duplayed-click ELEV and select downward triangle to get highest value
14. Select first row then select the Zoom map to the selected row icon and close that window you will get the output
15. Again repeat step 12
16. Right on the contour file and go to properties-select label-select checkbox in label this layer and select ELEV from dropdown
17. Click Apply and select OK

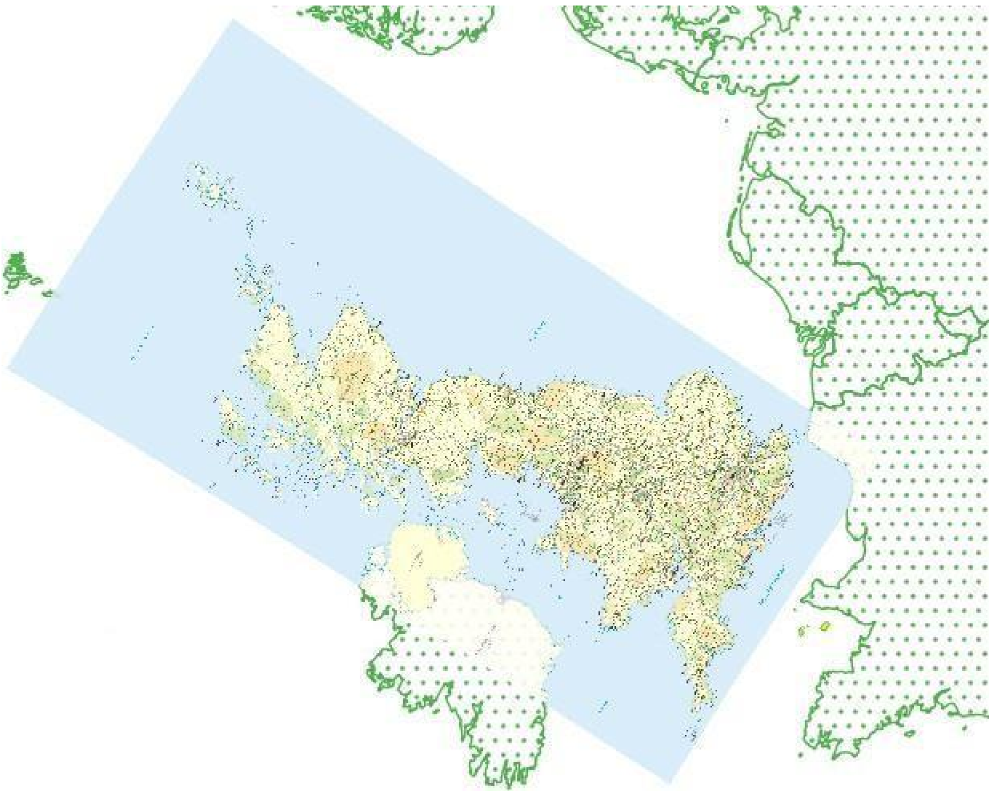
18. Click raster-Analysis-select DEM(Terrain models)
19. Give your filename in OUTPUT file using SELECT
20. Check your mode should be Hillshade and the click OK OK OK and close
21. You will get your output in sometime



PRACTICAL 6

AIM: Working with Projections and WMS Data

1. Extract-Practical 5 data
2. Layer Add Layer Add Vector Layer
3. From the Practical 5 dataset Select the file "ne_10m_admin_0_countries" and Open Layer
4. Save As Click on Browse and give it any names and Save in CRS-Click on Symbol(Select CRS) (to the right side of the dropdown)
5. In Filter-give the value as 102008 and below from Coordinate Reference System- Select "North_America_Albers_Equal_Area_Conic and click on OK-OK
6. Layer Add Layer - Add Raster Layer
7. In Practical 5 folder In the search bar search for "tif and select MiniScale (standard) R17 click on Open and ON
8. In Project Project Properties-CRS-In Filter give the value 102008 and below from Coordinate Reference System- Select

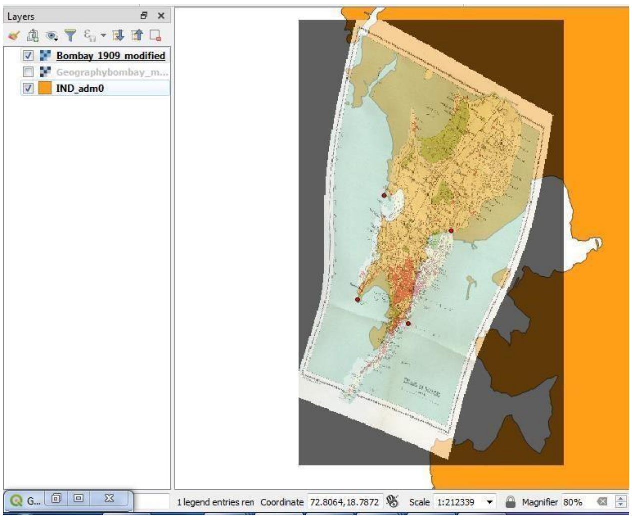


PRACTICAL 7

AIM: Georeferencing Topo Sheets and Scanned Maps, Georeferencing Aerial Imagery

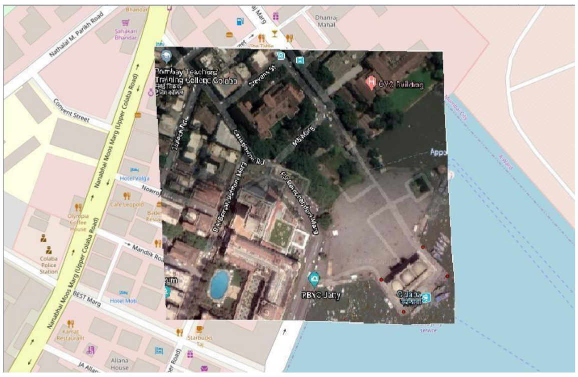
A. Georeferencing Topo Sheets and Scanned Maps

1. Start a new project
2. Go to Layers → Add Layer → Add vector Layer
3. Select GIS_Workshop\Manual\Prac06\IND_adm0.shp
4. Zoom in to Mumbai region in the layer
5. Go to Plugins→ Manage and Install Plugins
6. Ensure that is checked, if not install Georeferencer GDAL plugin.
7. Go to Raster → Georefrencer
8. A new Georeferencer window will open
9. File → Open Raster
10. Select file "1870_southern-india_3975_3071_600.jpg" from project data folder
11. Go to Settings →Transformation Settings
12. In the Transformation Settings window
13. In Georeferencer window Go to Edit → Add Points
14. Select the set of control points.
15. Go to, Setting → transformation settings.
16. Press "RUN"
17. In Georeferencing window go to → File → Start Georeferencing
18. The progress indicator will appear
19. The canvas area will now have the scanned map of Mumbai referenced with control points.
20. Select the newly added layer in Layer Panel Right click and go to property.
21. Set Transparency level of raster layer to appropriate level.
22. The Scanned Image map coincides with the existing map



B. Georeferencing Aerial Imagery

1. Install plugin OpenStreetMap
2. Go to Project → Properties → Set CRS to EPSG 3857
3. Go to View → Panels → select OSM Place search
4. The Gateway of India, Mumbai is located at 18.92°N 72.83°E
5. Search Gateway of India in OSM Search Panel
6. Zoom in to appropriate level.
7. The map will appear like thisGo to Raster → Georefrencer
8. A new Georeferencer window will open
9. File → Open Raster
10. Select file "Gateway_Imagery.tif" from project data folder
11. Go to Edit → Add Point
12. Select control points from map (Indicated in red color).
13. Go to Setting → Transformation Setting
14. Go to File → Start Georeferencing or Press the button in Georegerencing Window.
15. The progress indicator will appear
16. Observe that the aerial image of the Gateway of India is georeferenced on OSM in the map canvas.

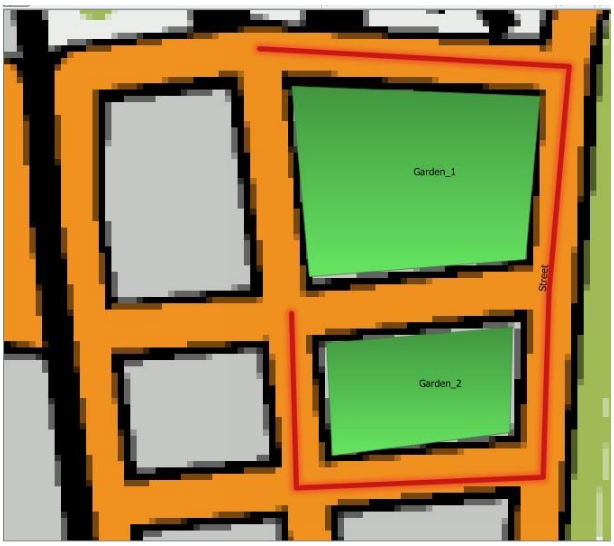


C. Digitizing Map Data Spatialite is an open database format similar to ESRI's geodatabase format. Spatialite database is contained within a single file on your hard drive and can contain diferent types of spatial (point, line, polygon) as well as non-spatial layers. This makes is much easier to move it around instead of a bunch of shapefiles.

<u>Digitizing Map Data</u>

1. Go to Layer ‣ Add Raster→ Select "Christchurch Topo50 map.tif" from project Folder.
2. QGIS offers a simple solution to make raster load much faster by using Image Pyramids. Right-click the Christchurch Topo50 map.tif layer and select Properties.

3. Choose the Pyramids tab. Hold the Ctrl key and select all the resolutions offered in the Resolutions panel
4. Click Build pyramids. Then click OK.
5. Go to Settings →Options.... Select the Digitizing tab in the Options dialog.
6. Set the Default snap mode to vertex and segment.
7. Press OK.
8. Go to Layer → Add Layer → Add Spatialite Layer.
9. Select the name and location for Spatial database
   eg: "GIS_Workshop\Practicals\Practical_06\C\MySpatialDataBase.sqlite".
10. Name the Layer as "Digitized_Road
11. Set Geometry type as "Line"
12. Set CRS EPSG:4167 – NZGD2000
13. Add "Name" and "Class" fields using "Add to Fields List".
14. Once the layer is loaded, click the Toggle Editing button to put the layer in editing mode. Click the Add feature button. Click on the map canvas to add a new vertex. Add new vertices along the road feature. Once you have digitized a road segment, right-click to end the feature.
15. On Layer Panel Right Click on Digitze_Road, Select the Style tab in the Layer Properties dialog.
16. Select appropriate style to see the digitized road feature clearly.
17. After creating a new Spatialite layer
18. Select Digitized_Garden layer in Layer Panel and click on Toggle Editing button and then Add Polygon Feature button on Tool bar.
19. Add two gardens to the region by adding polygon.
20. The Layer will appear on map canvas
21. Using the above procedure a point feature can also be digitized.
22. The digitizing task is now complete. You can play with the styling and labeling options in layer properties to create a nice looking map from the data you created.



PRACTICAL 8

<u>AIM:</u> Managing Data Tables and Saptial data Sets: Table joins, spatial joins, points in polygon analysis, performing spatial queries

a) Table joins

1.Start a new project

2.“I:\GIS_Workshop\Practicals\Practical_07\A\Data\tl_2013 _06_tract.zip”

3. We could import this csv file without any further action and it would be imported. But, the default type of each column would be a String (text). That is ok except for the D001 field which contains numbers for the population. Having those imported as text would not allow us to run any mathematical operations on this column. To tell QGIS to import the field as a number, we need to create a sidecar file with a .csvt extension.

4. This file will have only 1 row specifying data types for each column. Save this file as ca_tracts_pop.csvt in the same directory as the original .csv file.

5. Go to Layer Add Layer Add Delimited Text Layer And add I:\GIS_Workshop\Practicals\Practical_07\A\Data\ca_tacts_pop.csv”

6. the layer panel, Right click on “tl_2013_06_tract”, layer and select Properties

7. Select the option in Properties, and click on button to add new table join.

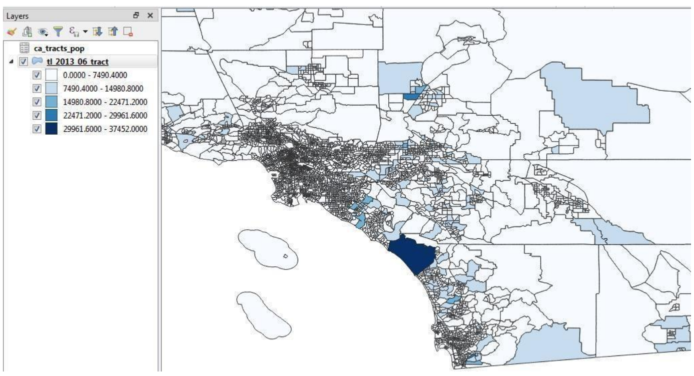
8. In the Add Vector Join window set the following properties and click OK.

9. After performing join

10. For more clear output, select “tl_2013_06_tact” from Layer Panel, right click and select properties. Go to Symbology and set the following properties.

11.A detailed and accurate population map of California can be seen as the result.

Same technique can be used to create maps based on variety of census data.



b.shp” and

“I:\GIS_Workshop\Practicals\Practical_07\B\Data\OEM_NursingHomes_001\O

EM_NursingHo mes_001.shp”, from data folder.

1. Go to attribute table and observe the data.

2. Table before performing Join

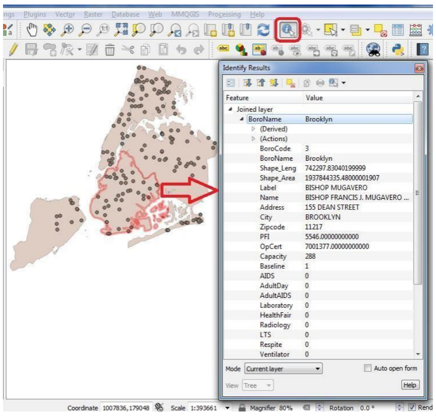
3. Go to Vector

➢ Data Management Tools

➢ Join Attributes by Location

4. Attribute table after join

5. Use the Identify Feature Button to select a region to view join data on map Layer.



c) Points in polygon analysis

• Go to Layer-> Add Layer-> Add Delimited Text Layer Select "EarthQuakeDatabase.txt"

• to Layer ->Add Layer -> Add Delimited Text Layer "I:\GIS_Workshop\Practicals\Practical_07\C\Data\ne_10m_admin_ 0_countries.zip"

• Use the select Feature button to check country wise counting of Earthquakes.

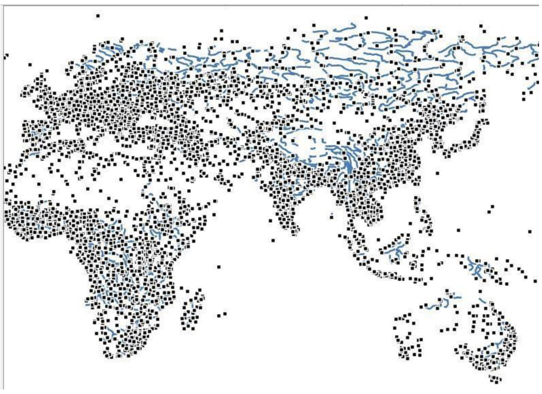
• Also a new column is added to attribute table "NumPoints" indicating number of earth quake points in each country

d) Performing spatial queries

• Go to Layer

➢ Add Layer

➢ Add Vector Layer and Load "\GIS_Workshop\Practicals\Practical_07\D\Data\ne_10m_populated_places_simple \ne_10m_populated_places_simple.shp"and "I:\GIS_Workshop\Practicals\Practical_07\D\Data\ne_10m_rivers_lake_centerlines\ ne_10m_rivers o _lake_centerlines.shp” from project data folder.

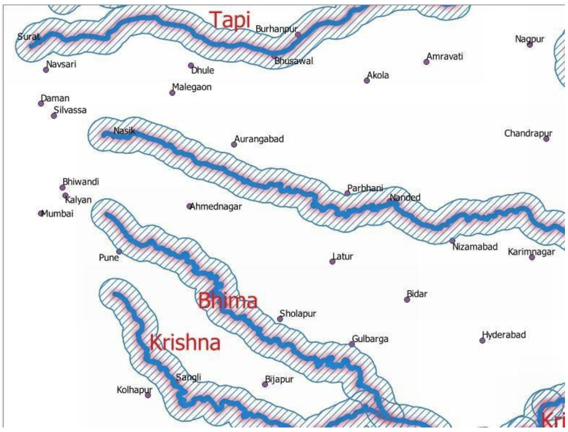


Go To Vector

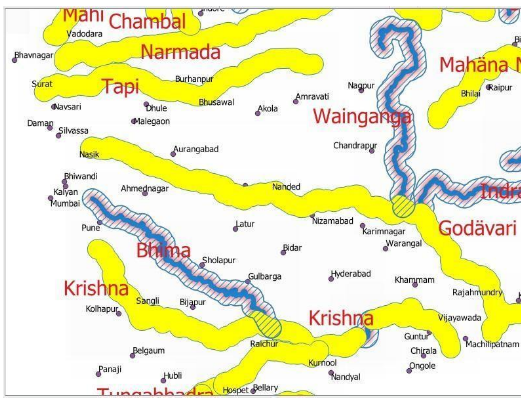
- ➢ Geoprocessing Tool
- ➢ Buffer

Repeat the step to create River Buffer

Create a buffer for River



- Go to Vector
  - ➢ Research Tool
  - ➢ Select By Location
- This will highlight only those rivers containing a populated place within 2 KM



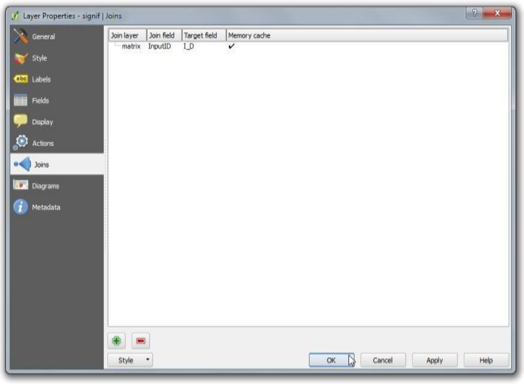
PRACTICAL 9

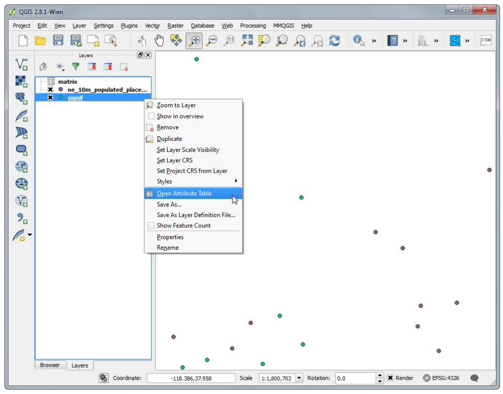
AIM: Advanced GIS Operations 1: Nearest Neighbor Analysis, Sampling Raster Data using Points or Polygons, Interpolating Point Data

(A) Nearest Neighbor Analysis

- Go to Layer
  - Add Layer
  - Add Delimited Text Layer and load “signif.txt” from data file.
- Go to Layer
  - Add Layer
  - Add vector Layer and from data folder “\GIS_Workshop\Practicals\Practical_08\A\DATA\ne_10m_populated_places_simple.zip” load the layer to the project and remove all rows from attribute table other than India.
- Calculate the Distance matrix and perform Nearest Neighbor Analysis
- Now you will be able to see the content of our results. The InputID field contains the field name from the Earthquake layer. The TargetID field contains the name of the feature from the Populated Places layer that was the closest to the earthquake point. The Distance field is the distance between the 2 points.
- Here select the earthquake layer signif as the Input point layer and the populated places ne_10m_populated_places_simpleas the target layer. You also need to select a unique field from each of these layers which is how your results will be displayed. In this analysis, we are looking to get only 1 nearest point, so check the Use only the nearest(k) target points, and enter 1. Name your output file matrix.csv, and click OK. Once the processing finishes, click Close.

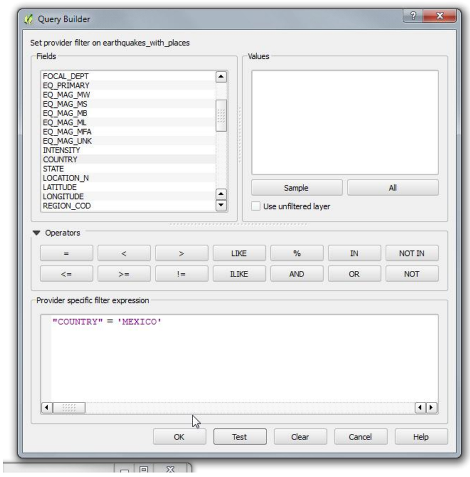
- You will see the CSV file loaded as a table. Right-click on the table layer and select Open Attribute Table
- This is very close to the result we were looking for. For some users, this table would be sufficient. However, we can also integrate this results in our original Earthquake layer using a Table Join. Right-click on the Earthquake layer, and select Properties.
- Go to the Joins tab and click on the + button.

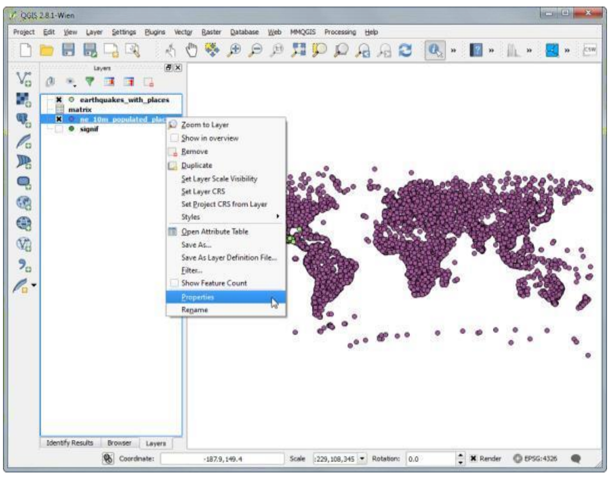


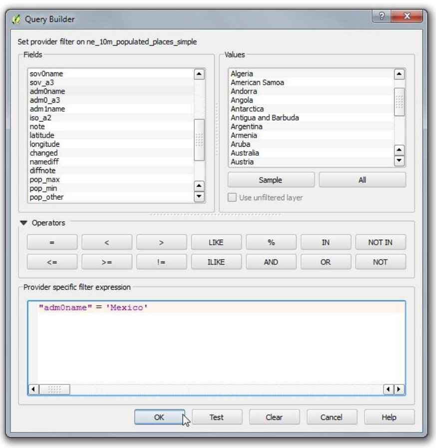


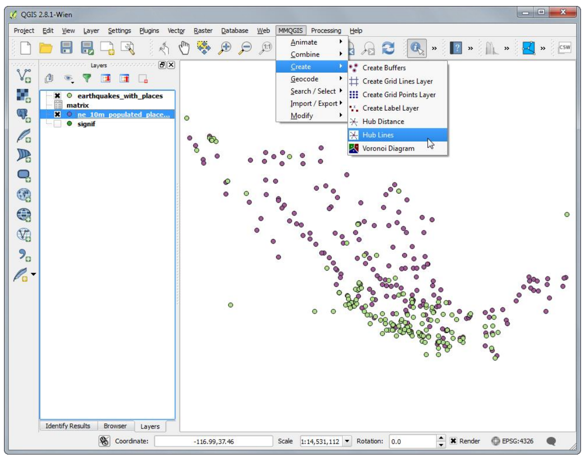
- You will see that for every Earthquake feature, we now have an attribute which is the nearest neighbor (closest populated place) and the distance to the nearest neighbor.
- Click the Browse button next to Save as label and name the output layer as earthquake_with_places.shp. Make sure the Add saved file to map box is checked and click OK.
- Once the new layer is loaded, you can turn off the visibility of the signif layer. As our dataset is quite large, we can run our visualization analysis on a subset of the data. QGIS has a neat feature where you can load a subset of features from a layer without having to export it to a new layer. Right-click the earthquake_with_places layer and select Properties

In the General tab, scroll down to the Feature subset section. Click Query Builder.









(B) Sampling Raster Data Using Points and Polygons

Many scientific and environmental datasets come as gridded rasters. Elevation data (DEM) is also distributed as raster files. In these raster files, the parameter that is being represented is encoded as the pixel values of the raster. Often, one needs to extract the pixel values at certain locations or aggregate them over some area. This functionality is available in QGIS via two plugins - Point SamplingTool and Zonal Statistics plugin.

Procedure

1. Go to Layer ‣ Add Raster Layer and browse to the downloaded us.tmax_nohads_ll_{YYYYMMDD}_float.tif file and click Open.
2. Once the layer is loaded, select the Identify tool and click anywhere on the layer. You will see the temperature value in celsius as the value or Band 1 at that location.
3. Now unzip the downloaded 2013_Gaz_ua_national.zip file and extract the 2013_Gaz_ua_national.txt file on your disk. Go to Layer ‣Add Delimited Text Layer.
4. In the Create a Layer from Delimited Text File dialog, click Browse and open 2013_Gaz_ua_national.txt. Choose Tab under Custom delimiters. The point coordinates are in Latitude and Longitude, so select INTPTLONG as X field and INTPTLAT as Y field. Check the Use spatial index box and click OK.
5. Now we are ready to extract the temperature values from the raster layer. Install the Point Sampling Tool plugin. See Using Plugins for details on how to install plugins.
6. Open the plugin dialog from Plugins ‣Analyses ‣Point sampling tool.
7. In the Point Sampling Tool dialog, select 2013_Gaz_ua_national as the Layer containing sampling points. We must explicitely pick the fields from the input layer that we want in the output layer. Choose GEOID and NAME fields from the2013_Gaz_ua_national layer. We can sample values from multiple raster band at once, but since our raster has only 1 band, choose the us.tmax_nohads_ll_{YYYYMMDD}_float: Band 1. Name the output vector layer as max_temparature_at_urban_locations.shp. Click the OK to start the sampling process. Click Close once the process finishes.
8. You will see a new layer max_temparature_at_urban_locations loaded in QGIS. Use the Identify tool to click on any point to see the attributes. You will see the us.tmax_no field - which contains the raster pixel value at the location of the point.
9. First part of our analysis is over. Let’s remove the unnecessary layers. Hold the Shift key and select max_temparature_at_urban_locations and 2013_Gaz_ua_national layers. Right-click and select Remove to remove them from QGIS TOC.
10. Go to Layer ‣ Add Vector Layer. Browse to the downloaded tl_2013_us_county.zip file and click Open. Select thetl_2013_us_county.shp as the layer and click OK.
11. The tl_2013_us_county will be added to QGIS. This layer is in EPSG:4269 NAD83 projection. This doesn’t match the projection of the raster layer. We will reproject this layer to EPSG:4326 WGS84 projection.

12. Right-click the tl_2013_us_county layer and select Save As...
13. In the Save Vector layer as.. dialog, click Browse and name the output file as
counties.shp. Choose Selected CRS from the CRS dropdown menu. Click Browse and select WGS 84 as the CRS. Check the Add saved file to map and click OK.
14. A new layer named counties will be add to QGIS.
15. Enable the Zonal Statistics Plugins. This is a core plugin so it is already installed. See Using Plugins to know to how enable core plugins.
16. Go to Raster ‣Zonal statistics ‣Zonal statistics.
17. Select us.tmax_nohads_ll_{YYYYMMDD}_float as the Raster layer and counties as the Polygon layer containing the zones. Enter ZS_ as the Output column prefix. Click OK.
18. The analysis may take some time depending on the size of the dataset.
19. Once the processing finishes, select the counties layer. Use the Identify tool and click on any county polygon. You will see three new attributes added to the layer: ZS_count, ZS_mean and ZS_sum. These attributes contain the count of raster pixels, mean of raster pixel values and sum of raster pixel values respectively. Since we are interested in average temperature, the ZS_meanfield will be the one to use.
20. Let's style this layer to create a temperature map. Right-click the counties layer and select Properties.
21. Switch to the Style tab. Choose Graduated style and select ZS_mean as the Column. Choose a Color Ramp and Mode of your chose. Click Classify to create the classes. Click OK.
22. You will see the county polygons styled using average maximum temperature
extracted from the raster grid

(C) ***Interpolating Point Data***

Procedure

1. Open QGIS. Go to Layer ‣ Add Layer ‣Add Vector Layer..
2. Browse to the downloaded Shapefiles.zip file and select it. Click Open.
3. In the Select layers to add... dialog, hold the Shift key and select Arlington_Soundings_2007_stpl83.shp andBoundary2004_550_stpl83.shp layers. Click OK.
5. This will reveal the data from the second layer Arlington_Soundings_2007_stpl83. Though the data looks like lines, it is a series of points that are very closel
6. Click the Zoom icon and select a small area on the screen. As you zoom closer, you will see the points. Each point represents a reading taken by a Depth Sounder at the location recorded by a DGPS equipment.
7. Select the Identify tool and click on a point. You will see the Identify Results panel show up on the left with the attribute value of the point. In this case, the ELEVATION attribute contains the

depth of the lake at the location. As our task is to create a depth profile and elevation contours, we will use this values as input for the interpolation.

8. Make sure you have the Interpolation plugin enabled. See Using Plugins for how to enable plugins. Once enabled, go toRaster‣Interpolation ‣Interpolation.

9. In the Interpolation dialog, select Arlington_Soundings_2007_stpl83 as the Vector layers in the Input panel. Select ELEVATION as the Interpolation attribute. Click Add. Change the Cellsize X and Cellsize Y values to 5. This value is the size of each pixel in the output grid. Since our source data is in a projected CRS with Feet-US as units, based on our selection, the grid size will

be 5 feet. Click on the ... button next to Output file and name the output file as elevation_tin.tif. CLick OK

10. You will see the new later elevation_tin loaded in QGIS. Right-click the layer and select Zoom to layer.

11. Now you will see the full extent of the created surface. Interpolation does not give accurate results outside the collection area. Let's clip the resulting surface with the lake boundary. Go to Raster ‣ Extraction ‣Clipper.

12. Name the Output file as elevation_tin_clipped.tif. Select the Cliiped mode as Mask layer. Select Boundary2004_550_stpl83 as the Mask layer`. Click OK.

13. A new raster elevation_tin_clipped will be loaded in QGIS. We will now style this layer to show the difference in elevations. Note the min and max elevation values from the elevation_tin layer. Right-click the elevation_tin_clipped layer and select Properties.

14. Go to the Style tab. Select Render type as Singleband pseudocolor. In the Generate new color map panel, select Spectralcolor ramp. As we want to create a depth-map as opposed to a height map, check the Invert box. This will assign blues to deep areas and reds to shallow areas. Click Classify.

15. Switch to the Tranparency tab. We want to remove the black-pixels from our output. Enter 0 as the Additional no data value. Click OK.

16. Now you have a elevation relief map for the lake generated from the individual depth readings. Let's generate contours now. Go to Raster ‣Extraction ‣Contours.

17. In the Contour dialog, enter contours as the Output file for contour lines. We will generate contour lines at 5ft intervals, so enter 5.00 as the Interval between contour lines. Check the Attribute name box. Click OK.

18. The contour lines will be loaded as contours layer once the processing is finished. Right-click the layer and select Properties.

19. Go to the Labels tab. Check the Label this layer with box and select ELEV as the field. Select Curved as the Placement type and click OK.

20. You will see that each contour line will be appropriately labeled with the elevation along the line

PRACTICAL 10

AIM: Advance GIS Operations 2: Batch Processing using Processing Framework, Automating Complex Workflows using Processing Modeler, Automating Map Creation with Print Composer Atlas, Validating Map data

(A) Batch Processing using Processing Framework

1. Go to Layer ‣ Add Vector Layer.

2. Browse to the downloaded Admin 0 Countries shapefile ne_10m_admin_0_countries.shp and click Open.

3. As our task is to clip the global layers to the boundary of Africa, we need to first prepare a layer containg a polygon for the entire continent. The countries layer has an attribute called CONTINENT. We can use a geoprocessing concept called Dissolve to merge all countries that have the same continent value and merge them to a single polygon.

4. Open the Dissolve tool from Vector ‣ Geoprocessing Tools ‣ Dissolve.

5. Select ne_10m_admin_0_countries as the Input vector layer. The Dissolve field would be CONTINENT. Name the output file as continents.shp and check the box next to Add result to convas. Note If you want to merge ALL polygons regardless of their attributes, you can select – Dissolve All – as the Dissolve field. This will combine all polygons in the layer and give you a single aggregate polygon.

6. The dissolve processing may take a while. Once the process finishes, you will see the new continent layer added to QGIS. Use the Select Single Feature tool from the toolbar and click on Africa to select the polygon representing the continent

7. Right-click the continents layer and select Save Selection As....

8. Name the output file as africa.shp. Since we are only interested in the shape of the continent and not any attributes, you may check the Skip attribute creation. Make sure the Add saved file to map box is checked and click OK.

9. Now you will have the africa layer loaded in QGIS containing a single polygon for the entire continent. Now, it’s time to start our batch clip process. Open Processing ‣ Toolbox. 10. Browse all available algorithms and find the Clip tool from QGIS geo algorithms ‣ Vector overlay tools ‣ Clip. You may also use the Search box to easily find the algorithm as well

11. Right-click the Clip algorithm and select Execure as batch process.

12. In the Batch Processing dialog, the first tab is Parameters where we define out inputs. Click the ... next to the first row in the Input layer column.

13. Browse to the directory containing the global transportation layers that you had downloaded. Hold the Ctrl key and select all the layers that you want to clip. You may also use Shift or Ctrl A to make multiple selection. Click Open.

14. You will notice that the Input layer columns will be auto-populated with all layers
you had selected. You may use Add row button to add more rows and define more inputs. Next, we need to select the layer containing the boundary to clip our input layers. Click the ... button for the first row and add the africa.shp Clip layer. Since the clip layer is the same for all our inputs, you can double-click the column header Clip layer and the same layer will be auto-filled for all the rows. Next, we need to define our outputs. Click the ... buton next to the first row in the Clipped column

15. Browse the the directory where you want your output layers. Type the filename as clipped_ and click Save.

16. You will see a new Autofill settings dialog pop up. Select Fill with parameter values as the Autofill mode. Select Parameter to useas Input layer. This setting will add the input file name to the output along with the specified output_ filename. This is important to ensure all the output files have unique names and they do not overwrite each other

17. Now we are ready to start the batch procesing. Click Run.

18. The clip algorithm will run for each of the inputs and create output files are we have specified. Once the batch process finishes, you will see the layers added to QGIS canvas. As you will notice, all the global layers are properly clipped to the continent boundary that we had specified.

(B) Automating Complex Workflows using Processing Modeler

- Apply a Majority Filter algorithm to the input landcover raster. This will reduce noise in our output by eliminating isolated pixels.
- Convert the resulting raster to a polygon layer.
- Query for a class value from the attribute table of the polygon layer and create a vector layer for that class. The following steps outline the process to code the above process into a model and run it on the downloaded datasets.

1. Launch QGIS and go to Processing ‣ Graphical Modeler....

2. The Processing modeler dialog contains a left-hand panel and a main canvas. Select the Inputs tab in the left-hand panel and drag the + Raster layer to the canvas.

3. A Parameter definition dialog will pop-up. Enter Input as the Parameter name and mark Yes to Required. Click OK.

4. You will see a box with the name Input appear in the canvas. This represents the landcover raster that we will use as input. Next step is to apply a Majority filter algorithm. Switch to the Algorithm tab from the bottom-left corner. Search for the algorithm and you will find it listed under SAGA provider. Drag it to the canvas. Note If you do not see this algorithm or any of the subsequent algorithms mentioned in the tutorial, you may be using the Simplified Interface of the Processing Toolbox. Switch to the Advanced Interface by using the dropdown at the bottom of the Processing Toolbox in the main QGIS window.

5. A configuration dialog for Majority Filter will be presented. Leave the values to their default and click OK.

6. You will note that there is now a new box named Majority Filter in the canvas and it is connected to the Input box. This is because the Majority Filter algorithm uses the Input raster as its input. The next step in our workflow is to convert the output of majority filter to vector. Find the Polygonize (raster to vector) algorithm and drag it to the canvas. Note The boxes can be moved and arranged by clicking on it and dragging it while holding the left mouse button. You can also use the scroll-wheel to zoom in and out in the model canvas.

7. Select ‘Filtered Grid’ from algorithm ‘Majority Filter’ as the value for Input layer. Click OK.

8. The final step in the workflow is to query for a class value and create a new layer from the matching features. Search for the Extract by attribute algorithm and drag it the canvas.

9. Select ‘Vectorized’ from algorithm ‘Polygonize (raster to vector) as the Input Layer. We want to extract the pixels that represent Croplands. The corresponding pixel value for this class will be 12. (see Code Values). Enter DN as the Selection attribute and 12as the value. As the output of this operation will be the final result, we need to name the output. Enter vectorized class as the Output.

10. Enter the Model name as vectorize and Group name as raster. Click the button

11. Name the model vectorize and click Save.

12. Now it is time to test our model. Close the modeler and switch to the main QGIS window. Go to Layer ‣ Add Layer ‣ Add Raster Layer....

13. Browse to the downloaded LC_hd_global_2001.tif.gz file and click Open. Once the raster is loaded, go to Processing ‣ Toolbox.

14. Find the newly created model under Models ‣ raster ‣ vectorize. Double-click to launch the model.

15. Select LC_hd_global_2001 as the Input and click Run.

16. You will see all the steps being executed without any user input. Once the processing finishes, a new layer vectorized_classwill be added to QGIS. Let’s improve the model a little bit. Right click on the vectorize model and select Edit model.

17. In Step 12, we hard-coded the value 12 as the class value. Instead, we can specify it as a input parameter which the user can change. To add this, switch to the Inputs tab and drag the + String to the model

18. Enter the Parameter Name as Class. Enter 12 as the Default value.

19. We will now change the Extract by attribute algorithm to use this input instead of the hard coded value. Click the Edit button next to the Extract by attribute box.

20. Click the dropdown arrow for Value and select Class. Click OK.

21. You will see from the model diagram that the Extract by attribute algorithm now uses 2 inputs. The modeler has a shortcut to launch the model and test it. Click the Run button from the toolbar.

22. Notice that the model dialog has a new editable field called Class. Enter 16 as the Class value and click Run.
23. Once the processing finishes, you will see that with just a click of a button we were able to run a complex workflow and extract the area for class 16.
24. Now that our model is ready, we can run it just as easily on a new raster layer. Load the LC_hd_global_2012.tif.gz file by going to Layer ‣ Add Layer ‣ Add Raster Layer.... Click the vectorize` model from the Processing Toolbox panel.
25. Pick the LC_hd_global_2012 layer as the Input and click Run.
26. Once the new output is loaded, you can compare the changes in the Croplands from 2001 to 2012
27. It is always a good idea to add documentation to your model. The modeler has a built-in Help editor that allows you to embed help directly in the model. Rightclick the vectorize model and select Edit model.
28. Click the Edit model help button from the toolbar.
29. In the Help editor dialog, select any item from the Select element to edit panel and enter the help text in Element description. Click OK. This help will be available in the Help tab when you launch the model to run.

(C) Automating Map Creation with Print Composer Atlas

Procedure

1. Launch QGIS and go to Layer ‣ Add Layer ‣ Add Vector Layer.
2. owse to the HI_Wetlands.shp.zip file and click Open.
3. Select the HI_Wetlands_Poly layer and click OK.
4. You will see the polygons representing the wetlands in the entire state of Hawaii. Since we want to make separate wetlands map for each county in the state, we will need the county boundaries layer. Go to Layer ‣ Add Layer ‣ Add Vector Layer and browse to the county10.shp.zip file. Click Open
5. Go to Project ‣ New Print Composer
6. Leave the composer title field empty and click OK.
7. Go to Layout ‣ Add Map.
8. Drag a rectangle while holding the left mouse button where you would like to insert the map
9. Scroll down in the Item Properties tab and check the Controlled by atlas box. This will indicate the composer that the extent of the map displayed in this item will be determined by the Atlas tool.
10. Switch to the Atlas generation tab. Check the Generate an atlas box. Select the county10 as the Coverage layer. This will indicate that we want to create 1 map each for every polygon feature in the county10 layer. You can also check the Hidden coverage layer so that the features themselves will not appear on the map.
11. You will notice that the map image does not change after configuring the Atlas settings. Go to Atlas ‣ Preview Atlas.

12. Now you will see the map refresh and show how individual map will look like. Notice that it shows the current feature number from the coverage layer at the bottom right.
13. You can preview how the map will look for each of the county polygons. Go to Atlas ‣ Next Feature.
14. Atlas will render the map to the extent of the next feature in the coverage layer.
15. Let’s add a label to the map. Go to Layout ‣ Add Label.
16. Under the Item properties tab, click Insert an expression... button.
17. The label of the map can use the attributes from the coverage layer.he concat function is used to join multiple text items into a single text item. In this case we will join the value the NAME10 attribute of the county10 layer with the text County of. Add an expression like below and click OK.
concat('County of ', "NAME10")
18. Adjust the font size to your liking.
19. Add another label and enter Wetlands Map under the Main properties. Since there is no expression here, this text will remain the same on all
20. Go to Atlas ‣ Last Feature and verify that the map labels do work as intended. You will notice that the wetland map has polygons extending out in the ocean that looks ugly. We can change the style to that areas outside the county boundaries are hidden.
21. Switch to the main QGIS window. Right-click the county10 layer and select Properties.
22. In the Style tab, select the Inverted polygons renderer. This renderer styles the outside of the polygon - not inside. Select white as the fill color and click OK.
23. Switch to the Print Composer window. If we want the effect of the inverted polygons to show, we need to uncheck the Hidden coverage layer box under Atlas generation. You will now see that the rendered image is clean and areas outside the coverage polygon is not visible.
24. There is one problem though. You can see areas of the map that are outside the coverage layer boundary but still visible. This is because Atlas doesn’t automatically hide other features. can be useful in some cases, but for our purpose, we only want to show wetlands of the county whose map is being generated. To fix this, switch back to the main QGIS window and right click the county10 layer and select Properties.
25. In the Style tab, select Rule-based renderer as the Sub renderer. Double-click the area under Rule.
26. Click the ... button next to Filter
27. In the Expression string builder, expand the Atlas group of functions. The $atlasfeatureid function will return the currently selected feature. We will construct an expression that will select only the currently selected Atlas feature. Enter the expression as : $id=$
28. Back in the Print Composer window, click the Update preview button under Item properties tab to see the changes. Notice that now only the area covering the county boundary is shown.
29. We will now add another dynamic label to show the current date . Go to Layout ‣ Add Label and select the area on the map. ClickInsert an expression button.

30. Expand the Date and Time functions group and you will find the $now function. This holds the current system time. The function todate() will convert this to a date string. Enter the expression as below: concat('Created on: ', todate($now))

31. Add another label citing the data source. You may also add other map elements such as a north arrow, scalebar etc. as described in Making a Map tutorial.

32. Once you are satisfied with the map layout, go to Atlas ‣ Export Atlas as Images.

33. Select a directory on your computer and click Choose.

34. The Atlas tool will now iterate through each feature in the coverage layer and create a separate map image based on the template we created. You can see the images in the directory once the process completes.

35. Here are the map images for reference.