QGIS Basics: Library Workshop Series.

Goals:
- To introduce basic platform of QGIS 3.X (plug-ins functions and connect to cloud sources)
- Learn basic functions to create a map including spatial analysis using vector and raster data

QGIS is free and open source GIS software. Advantages of this software are: free, transportable data from different sources, comprehensive analysis functions available (many comparable to ArcGIS) and working on Window, Mac, Linux and Unix. You have to set up a CRS (Coordinate Reference System) for the layer before you start your project. For running multi-Layers, make sure they have the same CRS to overlay. Layout and sharing part are clumsy. You also need to know which modules needed to plug in before you start your project.

> Download Data for exercise: Create your working folder on your Lab computer (L Drive) and copy and paste the data: **MD_tract10** ("Dropbox>Workshop Files>GIS workshop files>QGIS>Spatial_Join>MC_tract10) and **the N_arrow (.jpg)** to your folder.
> **Note:** Open QGIS Desktop 2.18 and Go to "Plug-Ins" and check whether <u>GDAL, HeatMap, and OpenLayers are marked.</u>

Add Data: Vector a delimited data (CSV) for creating a locator map
- <u>First import you CSV file and make it as a layer file</u>
1) Go to Layer>Data Source Manager>choose <u></u>"Delimited Text" option. Then, choose a CSV file from the MD_tract10 folder, then Geometry Definition> my data is lat- long (NAD 31) so that your data come with a projected CRS. Click on "Apply" and "OK"
2) It will display the points on the canvas
3) Save this as a layer: Click on your newly create point layer>Export>Save Feature As>choose, "ESRI Shapefile" as format and give a name and folder to save the shape file to edit or manipulate this point layer.
4) Add your MD Census Tract Layer: Navigate "Browser" and locate a directory and folder containing MD_Tract10 and choose "t1_2010_24_tract1.shp".
5) Right Click on the tl_2010_24_tract10 and click on "Set a CRS" as NAD 32 (EPSG 4269) and rename it (Right Click the layer>Rename Layer).
   Note: Explore how the layer looks change with different coordinate reference system (CRS) projections. QGIS does not automatically define a CRS like ArcGIS. You should set a CRS for your project (Project>Project Properties, check "Enable "on the fly" CRS transformation and choose a CRS for layers for your project.
6) Change the order of the layers if you don't see the points or change the color of MD Census Tract Layer and change the size of the dots.

Overly Analysis–Spatial Join (how many points are falling inside a polygon?)
1) Go to Vector>Analysis Tools>Count Points in Polygon and pick up the polygon layer (MD_Tract10) and the point layer (Traffic Accidents)
2) Click on "Run." with a field name as NUMPOINTS and
3) A new layer, "Count" with a field name, NUMPOINTS will be created.
4) Change the name of that layer as Accidents_Tract

Visualize the data based on this new created column (NUMPOINTS) as a thematic map.

1) Click the TrafficAccdidents_Tract layer and select Properties>Symbology

2) Change "Single symbol to Graduated", Pick up a color, Mode>Equal Interval or Natural Break, Click on "Classify" then Apply and OK.

Select a subset data from an existing layer—Query Builder

1) Right Click the Accident_Tract and choose, Properties>Source

2) Find "Query Builder" button in the bottom on right; select NUMPOINTS (double click on that field name) and make the Query as NUMPOINTS>="1" (also "NUMPOINTS" !=0 expression anything but (!=0)) and Apply>Ok to save this as a new layer.

3) You will get a new layer based on this criteria and save it as a new shape file (or a csv file) if you want. Explore other ways to select data including ascending/descending and create a new field.

Create a Heat Map from a point layer

1) Click on "TrafficAccident" layer> Properties>Symbology>Heat Map

2) Give a name for your output raster in your folder and set up Radius (20000 as layer units, which is default) as shown below.

Get Centroids of Polygons

1) Go to Vector>Geometry Tools>Polygon Centroids

2) Select your MD_Tract10 layer as Input Layer and give an output name ("centroid") in your folder. You will see each tract has a point in the center (to label locations for labeling and generate a distance matrix, etc.)

Label text or numbers on centroid locations

1) Click the "centroid" layer and select Properties>Style to make the centroid symbol to be transparent (80% transparency level and pick up a light color to be invisible)

2) Click the "centroid" layer and select "Properties>Label" and choose a column with " Label with" (i.e. Tract10), then Apply and OK.

3) The labels are located in the center of each polygon. Adjust text size if possible (Single Labels>text>size option)

Save your project

1) Go to Project>Save As and give a project name. It will be saved in xxxx.QQZ file in you folder.

2) If you want to open this project next time, go Project>Open>locate the xxxx.QGS to work on the project continually.

How to Print (Publishing maps)

1) Go to Project>New Print Composer, give your composer a name.
2) Specify things like page size and orientation on the right under the Composition tab.

3) Click this sign ☐ (Add new map sign) on the left side tool bar and drag and drop to bring your map on the canvas; use this sign ⬆ to adjust your map position on the canvas.

4) Add Title (click on "Item Properties" on the right to change the title of the map and font size, etc), Legend, Scale Bar, and North Arrow (Click on the Add Image Button and drag and drop to set a location in the map (there's a button in the right hand Item properties panel next to "Load another" to search for any image file on your computer) and pick up add North_ arrow from your folder to the map.

5) Composer> Export in PDF (or various image formats).

Adding WFS (World Feature Service**) and WMS (**World Mapping Service**) layers** (similar to adding publically available layers from Web Servers).

1) Go to "Browser" and click on WFS (there are layers available to bring in your project)

Adding Base Maps (Browser>XYZ files>Drag, "Open Street Map" to Drop in Layers to bring this on canvas. To use Google Maps as base map: see https://geogeek.xyz/how-to-add-google-maps-layers-in-qgis-3.html

Other Tips ▬▬ ▬ ▬▬ ▬▬ ▬ ▬ ▬ ▬▬ ▬ ▬ ▬ ▬▬ ▬▬ ▬

-Map Units (for meters—UTM, 1 map unit = 1 meter) and Layer Units (Decimal Degrees): Project>Project
-EPSG(European Petroleum Survey Group) that uniquely identify a specific CRS.

-Properties>General Tab to find out the canvas unit are set to "Meters" or not.
-QGIS Geocoding—free 2500 rows for geocoding (Need to Plugin GEOCODING)
-Other common spatial analysis procedure such as Join, Clip etc. for QGIS (see-https://guides.library.duke.edu/QGIS/CommonProcedures)

-GeoSearch—find address or place>make it as a point map.
-PlugIns info: Go to PlugIns Menu>Manage & Install Plugins—type in the search box for what you are looking for (e.g. Spatial Query). It will show you what module you need to plug in for that function. http://docs.qgis.org/2.14/en/docs/training_manual/qgis_plugins/index.html

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