

Introduction to GIS

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VIP Workshop 2024 (January 29, 2024)



Outline



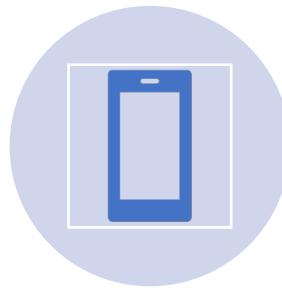
GIS Basics



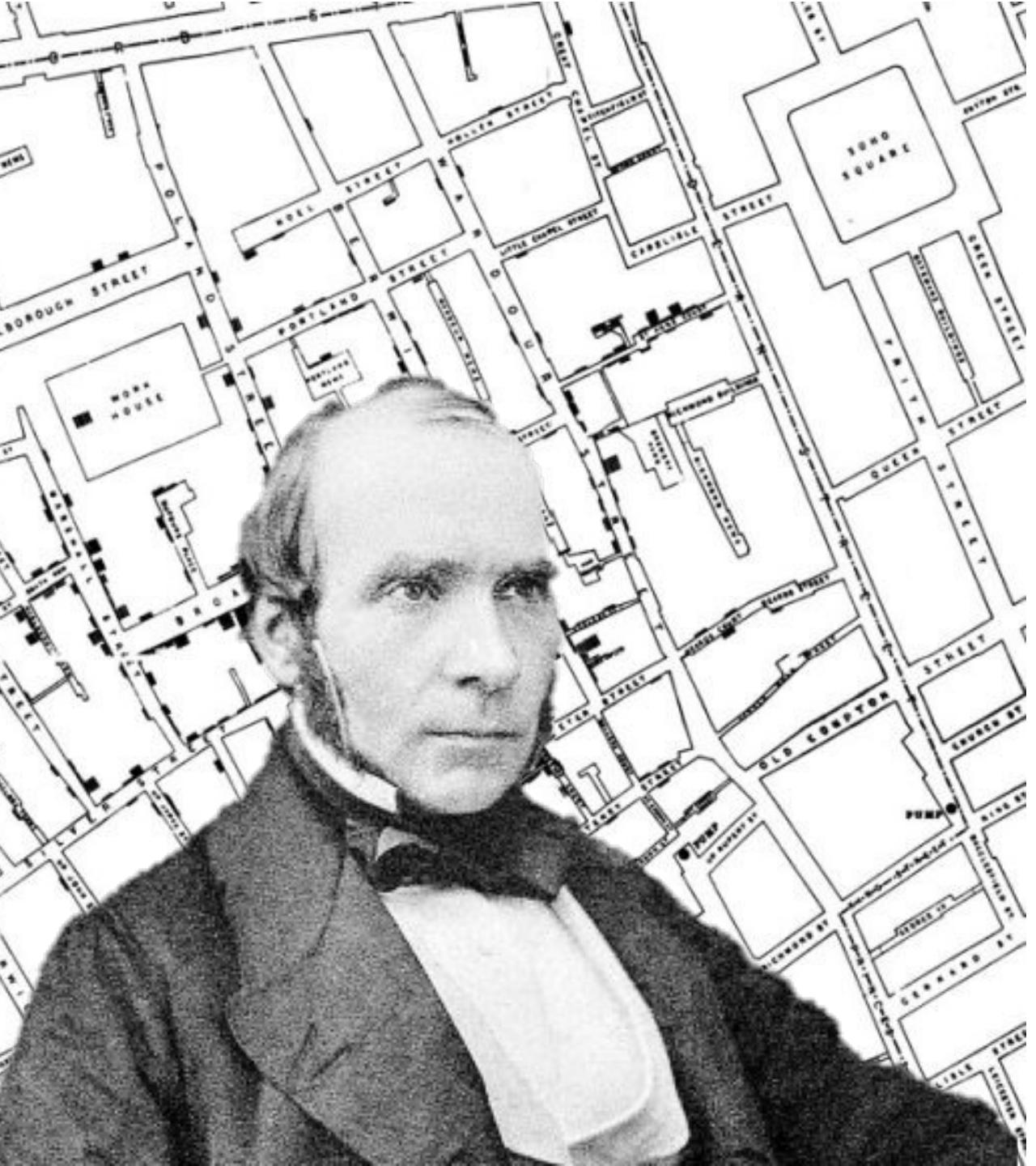
Basic Functions in GIS



Exercises



Mapping using mobile
phone app



📍 John Snow, 1854

GIS started with the mapping analysis of cholera – illustrated that cholera spreads through the water and not through the air

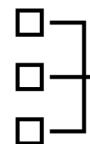


What is GIS?

Belonging to a particular
region or location on
earth



GEOGRAPHIC INFORMATION SYSTEM



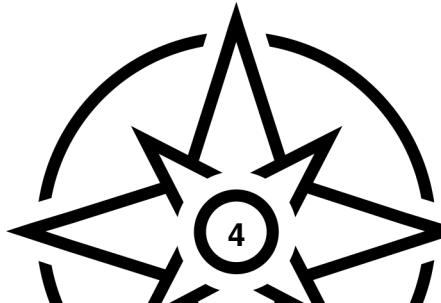
- Set of related parts that work together
 - People + Machine + Data + Procedures working together to collect, manage and distribute information



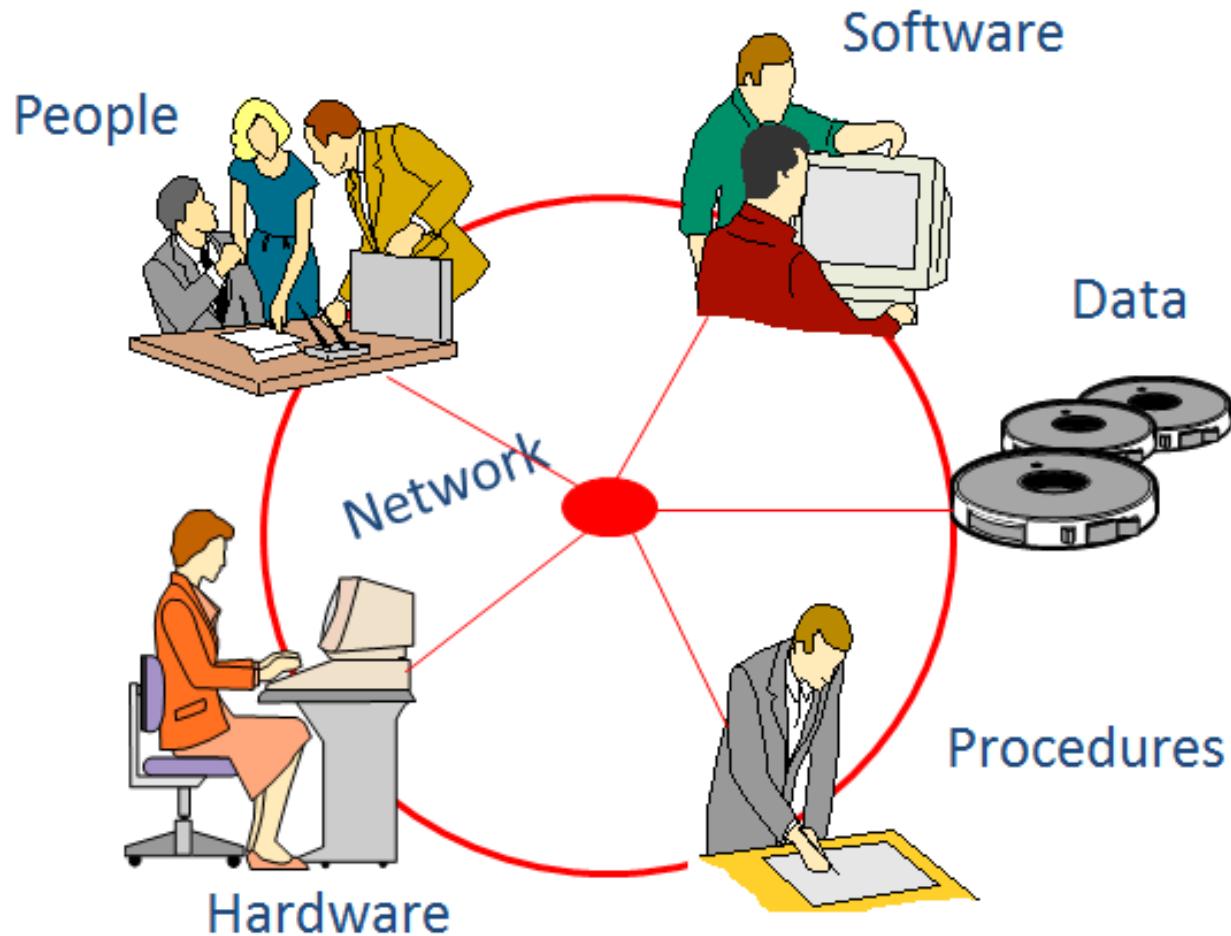
Information = data + context

Data – facts and statistics used for reference and analysis

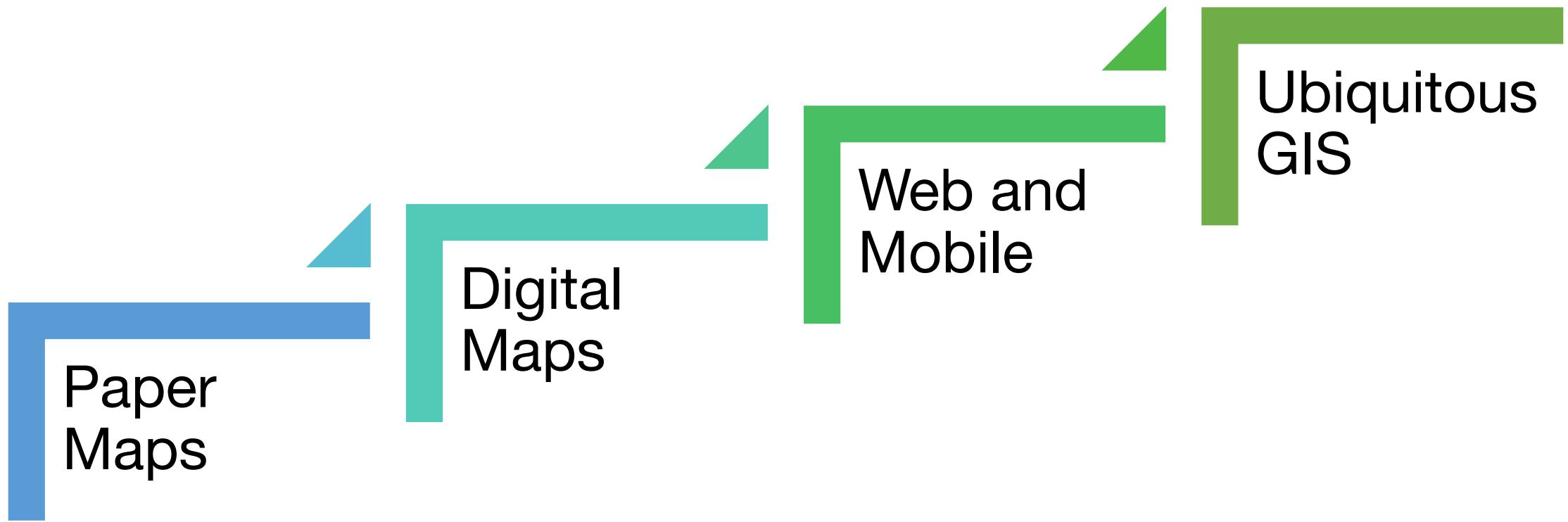
Context – circumstances that form the setting for an event, statement, or idea



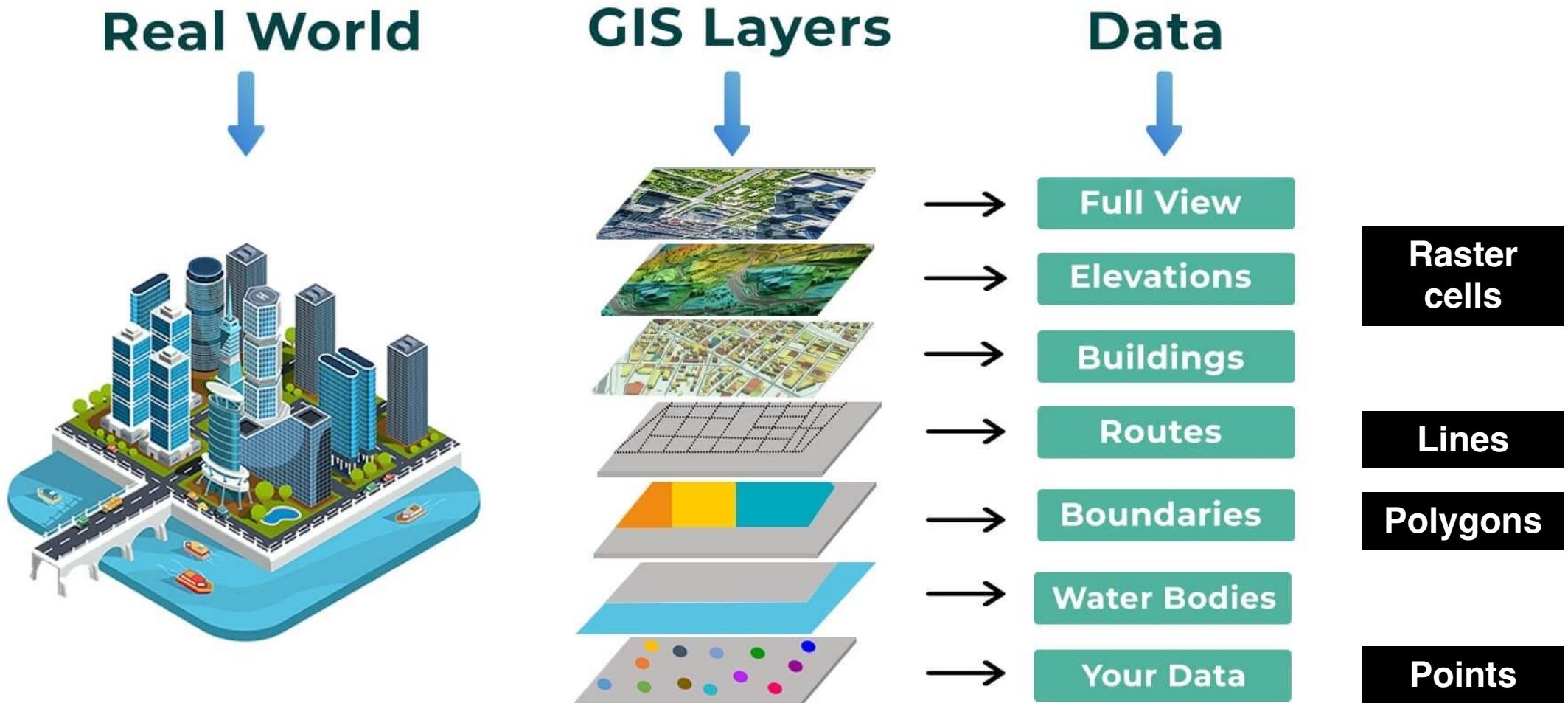
Components of GIS



Evolution of GIS



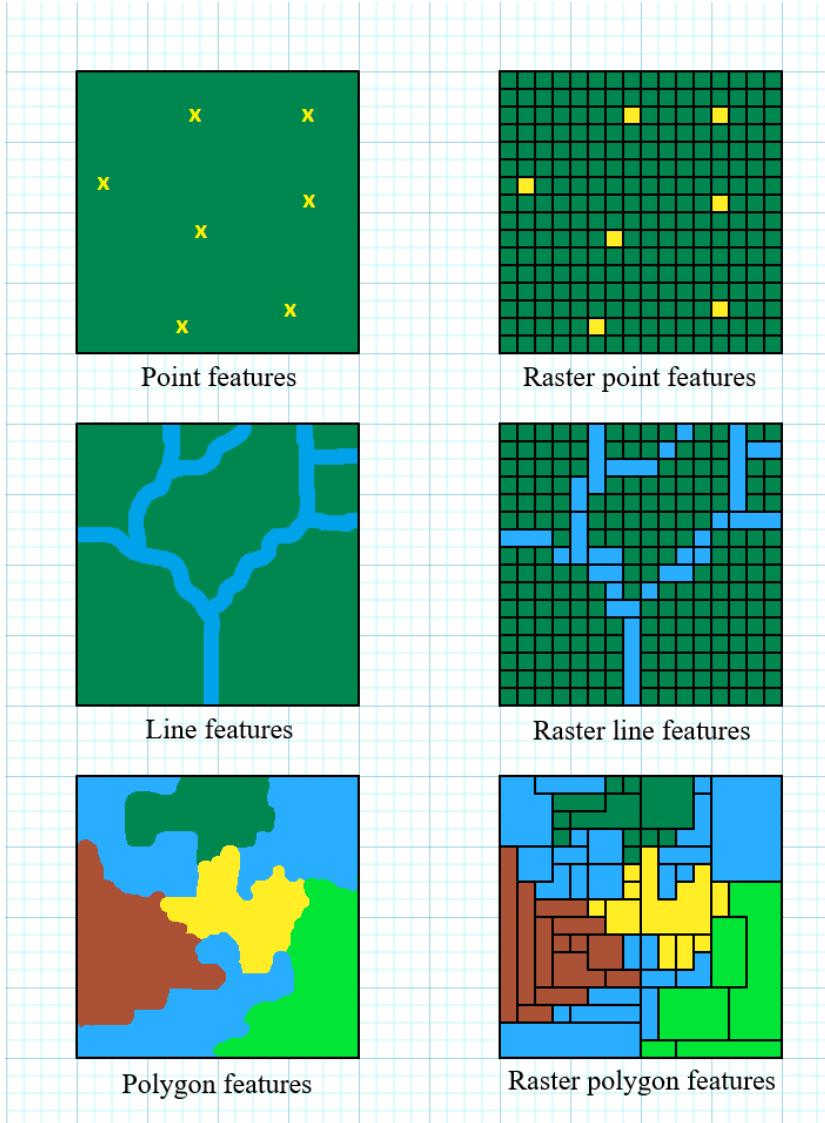
Spatial Data Models



Logical Models

VECTOR

- Used to represent objects with coordinates
- Shapefiles (SHP)

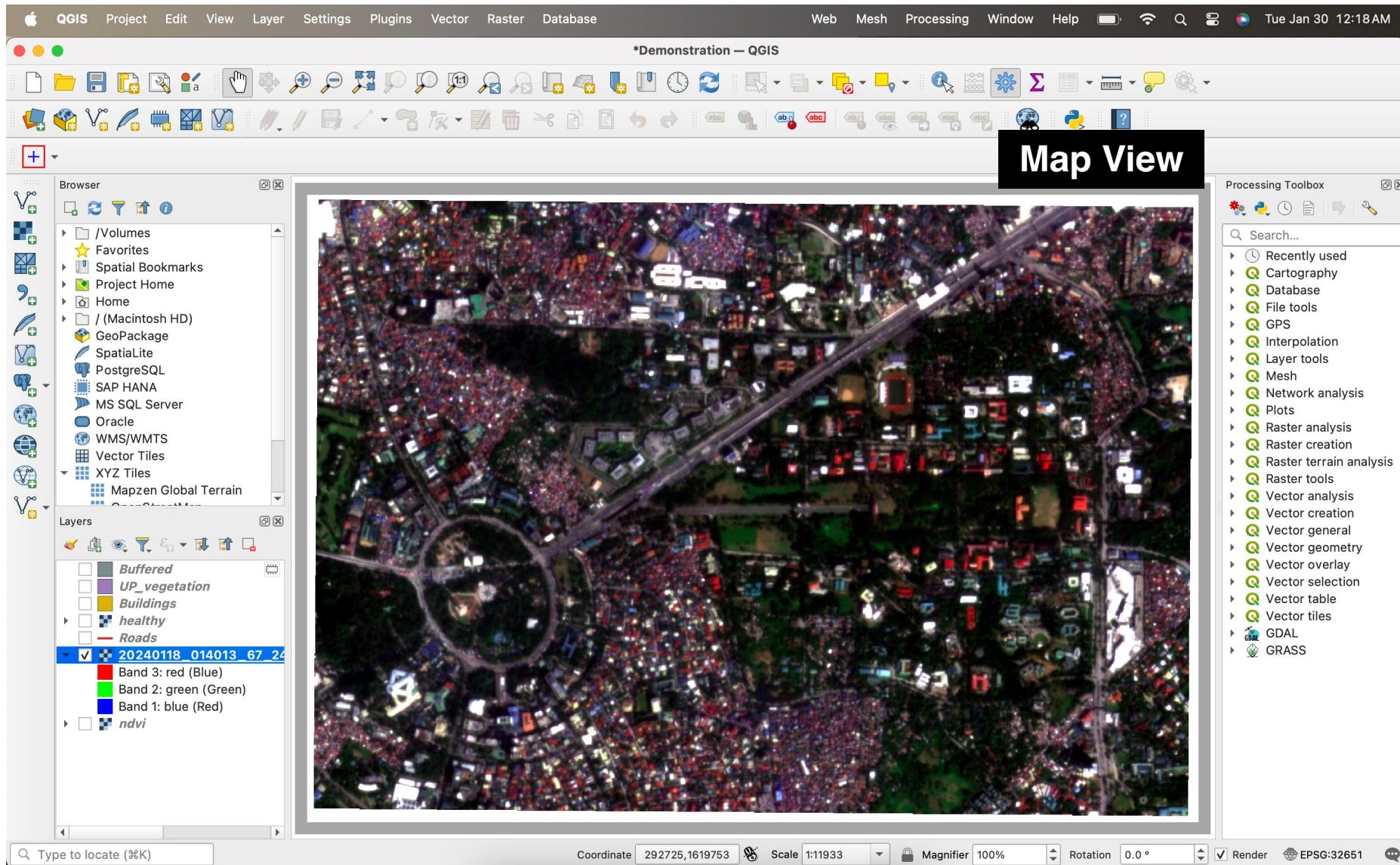


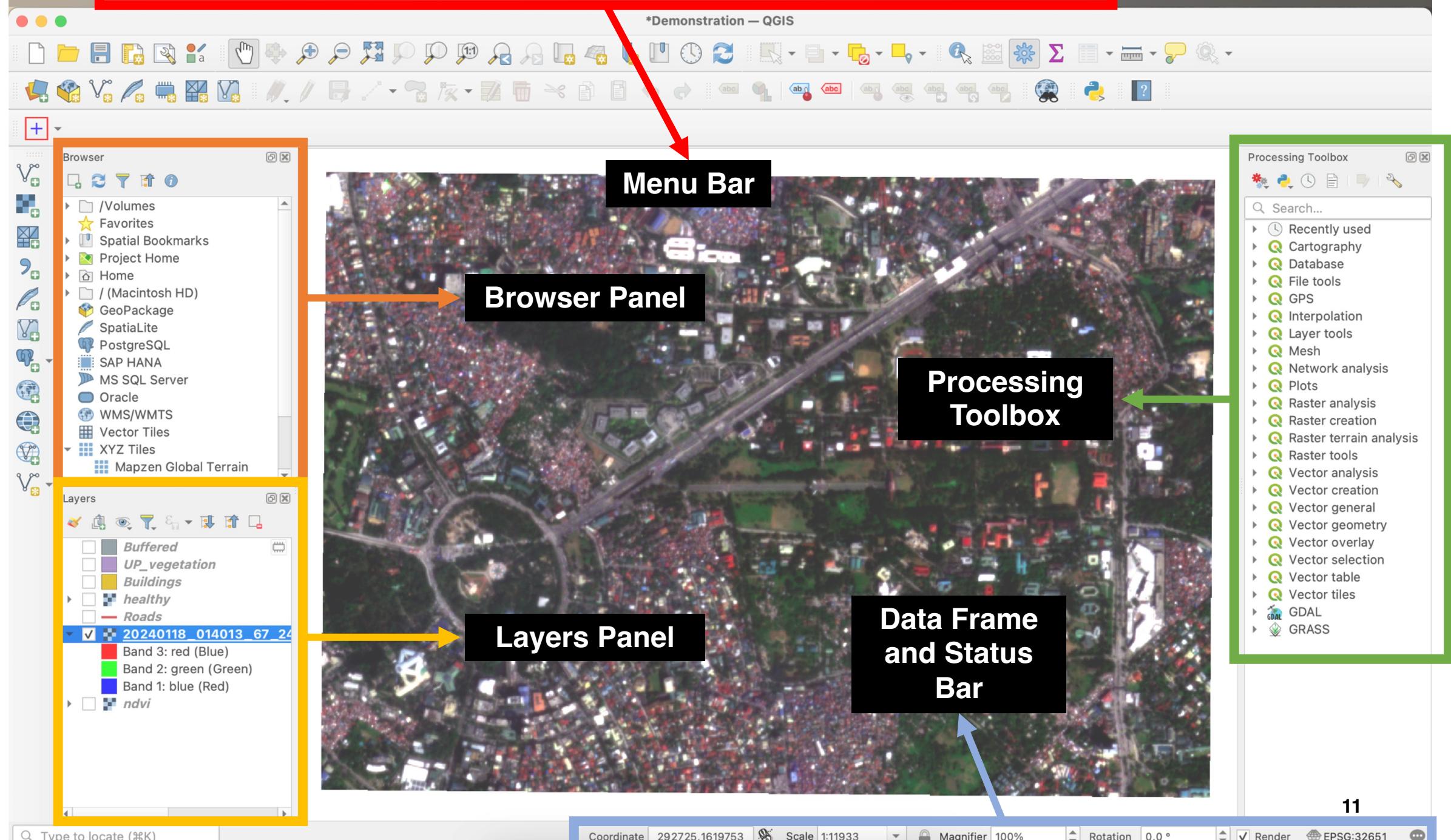
RASTER

- Study area is divided into grids/cells
- GeoTIFF (.tiff)

Basic Functions in QGIS

QGIS Interface





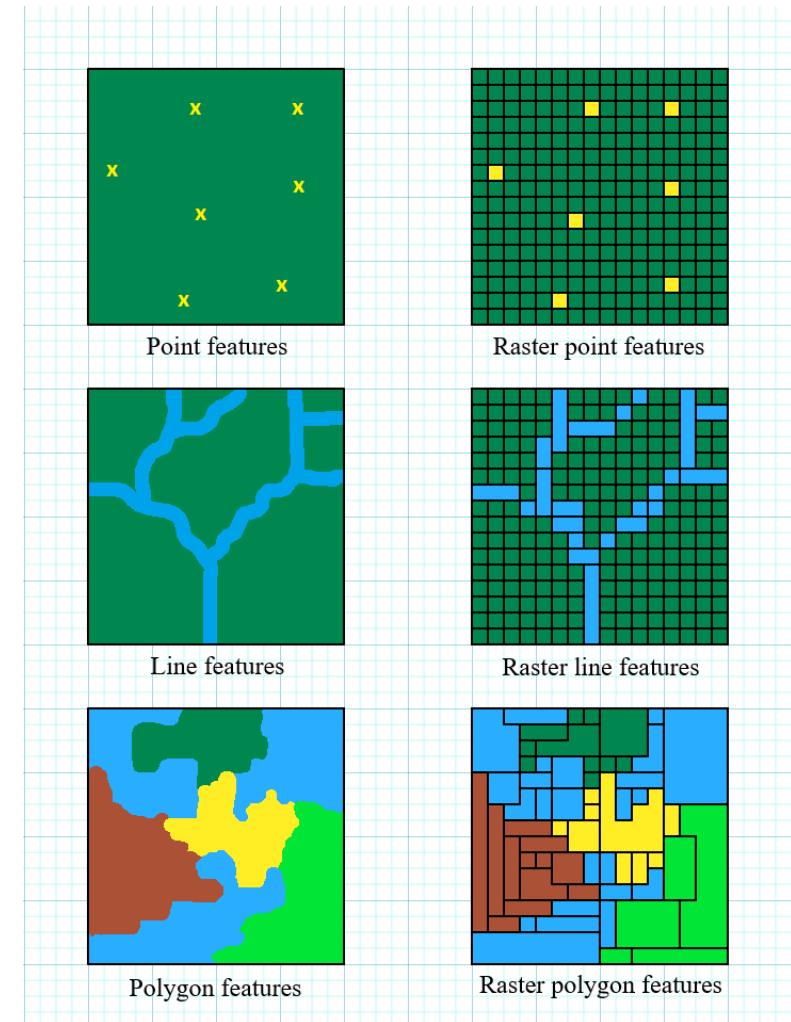
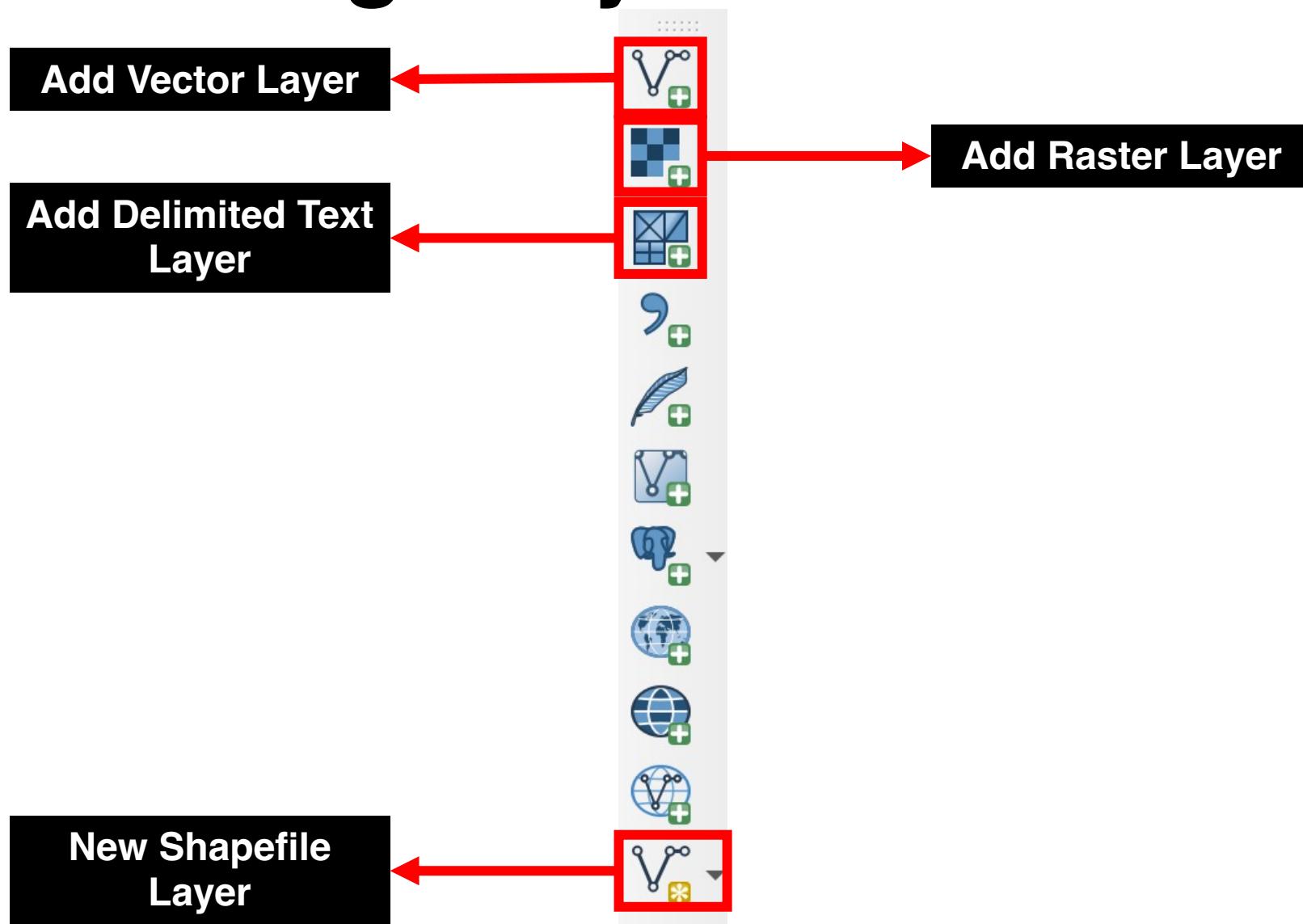
*Demonstration — QGIS

Manage Layers Toolbar

Different Toolbars

The screenshot displays the QGIS application window titled "Demonstration — QGIS". The interface includes a top menu bar with options like Project, Edit, View, Layer, Settings, Plugins, Vector, Raster, Database, Web, Mesh, Processing, Window, Help, and a date/time stamp. Below the menu is a toolbar with various icons for file operations, selection, measurement, and analysis. A large green arrow points from the "Manage Layers Toolbar" callout to the left side of the interface, where the "Layers" panel is located. This panel contains a tree view of layers and a list of selected layers, including "20240118_014013_67_24" which is checked. To the right of the map canvas is the "Processing Toolbox" containing a list of geoprocessing tools. The main map canvas shows a satellite image of a densely built urban area with roads and green spaces.

Manage Layers Toolbar



Map Navigation Toolbar

Pan

- move around the map

Zoom full

- zoom to extent

Zoom to Layer

- zoom to selected layer



Zoom in

- zoom into image

Zoom out

- zoom out of image

Zoom to Selection

- zoom to selected features

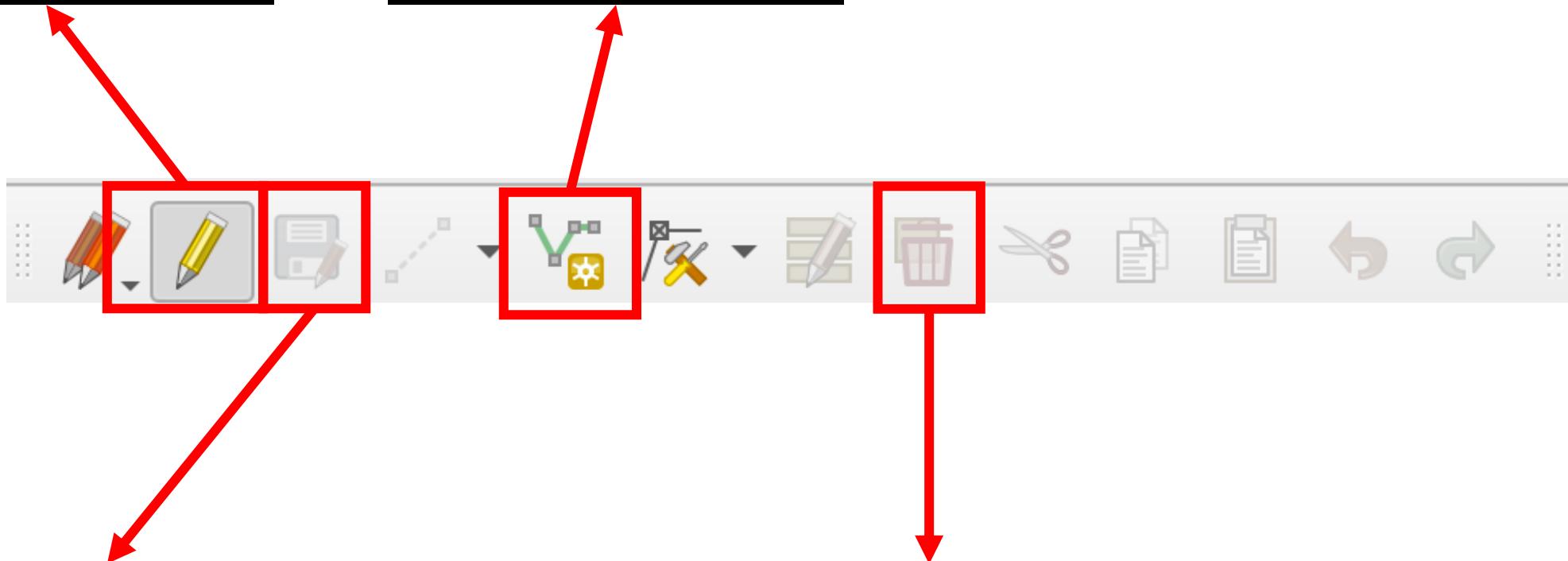
Digitizing Toolbar

Toggle Editing

- turn on to edit shapefile

Add Feature

- create features



Save Layer Edits
- save edits made to
shapefile

Delete Features

- delete selected features

Attributes Toolbar

Select Features by area or single click
- select features

Select Features by Location

Show Statistical Summary

Measure
- measure geometry of feature

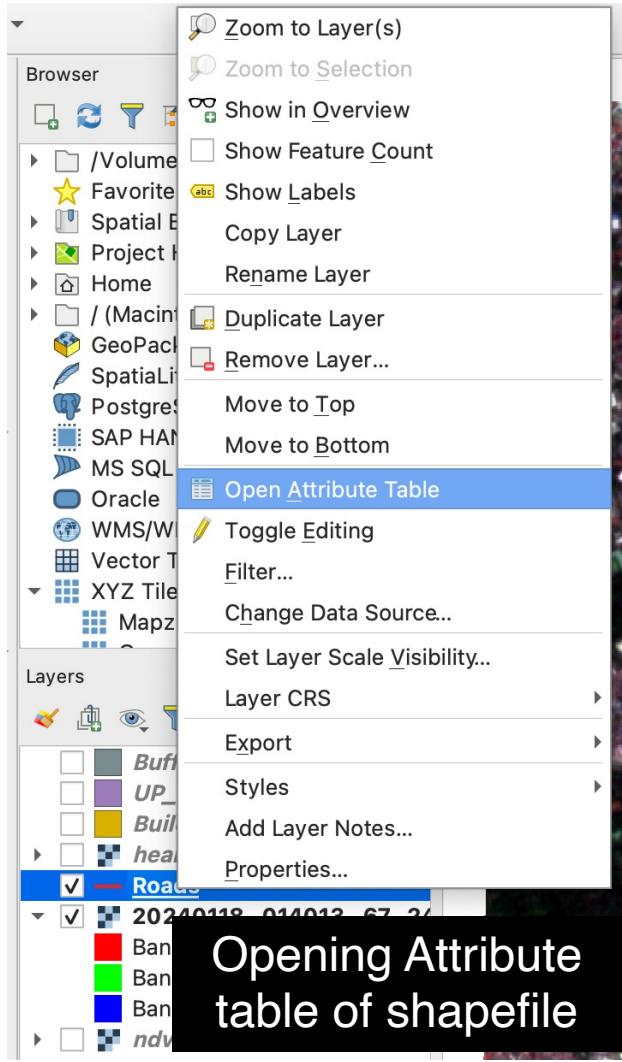


Deselect Features from All Layers
- deselect features in a shapefile layer

Identify features
- shows information about the feature selected

Open Attribute Table
- opens attribute table of shapefile

Attribute table



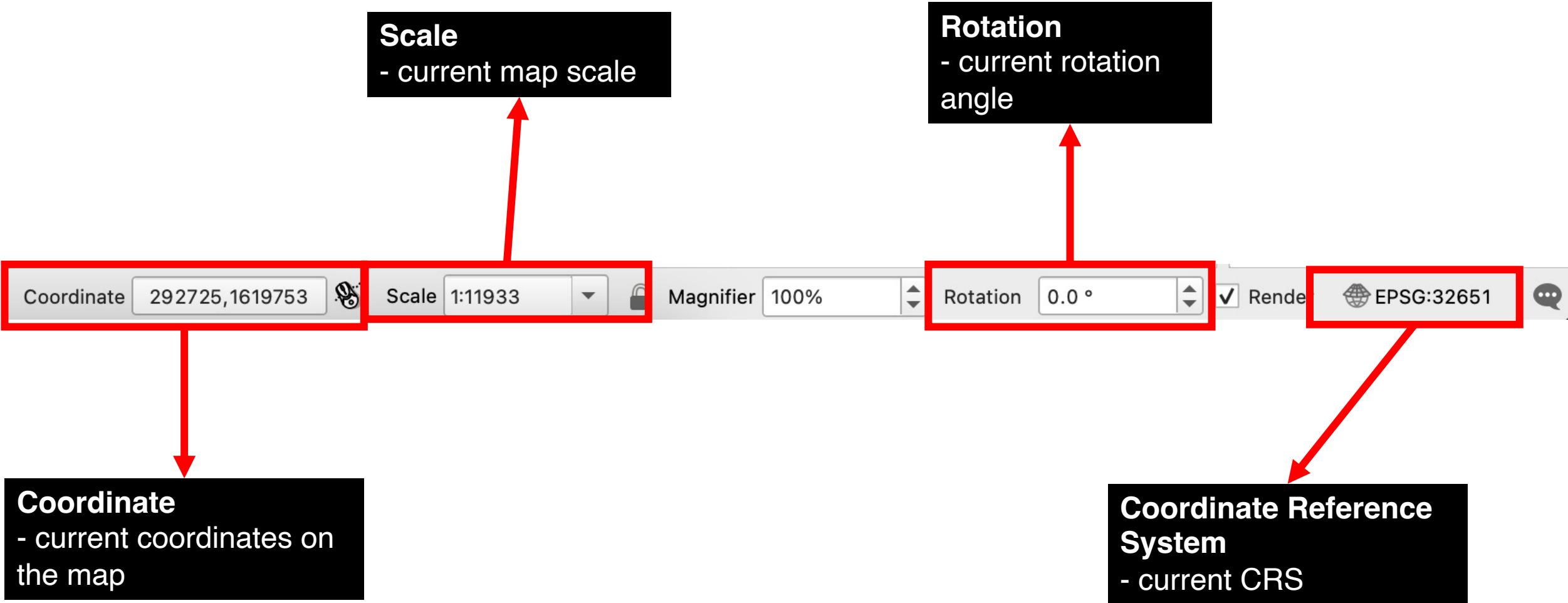
A screenshot of the attribute table for the 'Roads.shp' layer. The table has two columns: 'id' and 'BufferSize'. The data is as follows:

	id	BufferSize
1	1	25.000
2	2	6.000
3	3	15.000

Attribute table of Roads.shp

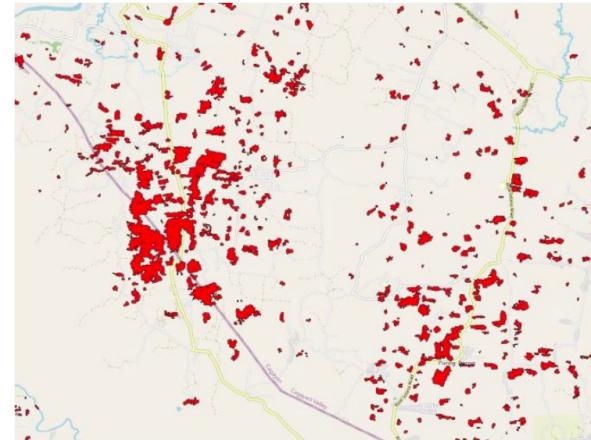
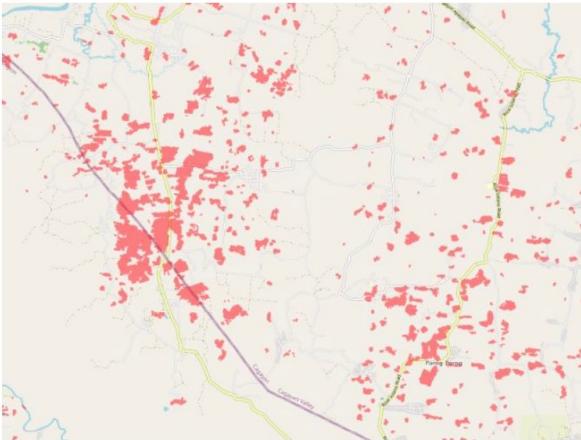
This table shows relevant information about the features.

Status Bar



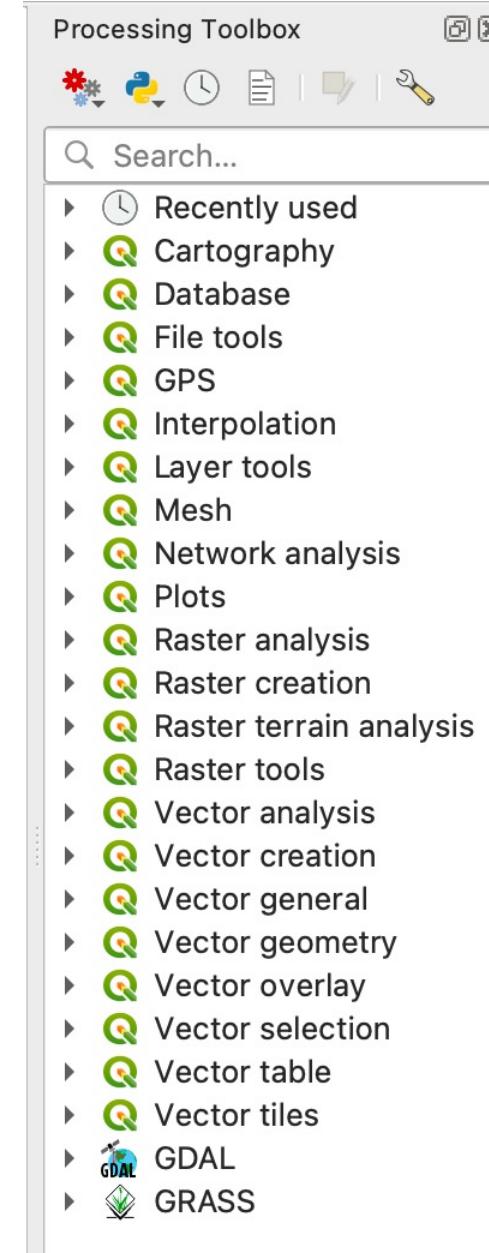
Layer Visualization

- Visualization for layers can be modified for better data analysis.
- Change band order number, minimum and maximum values, color rendering, color fill, color outline, transparency, etc.



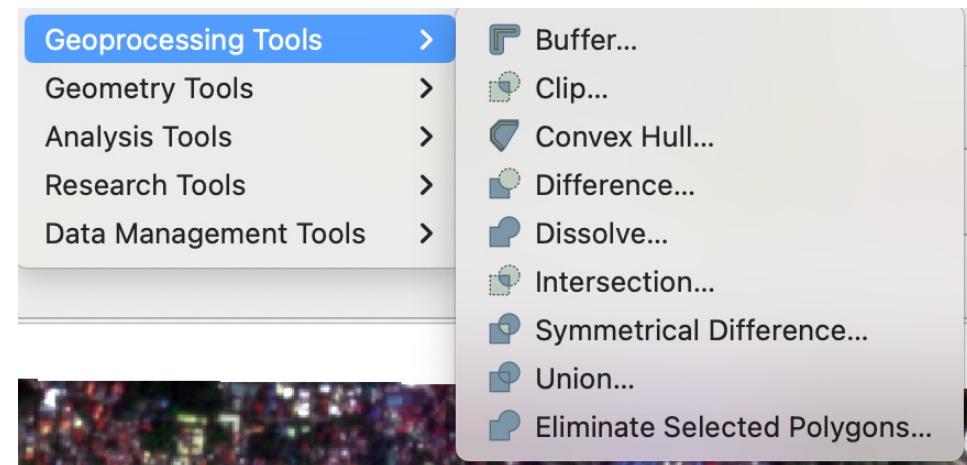
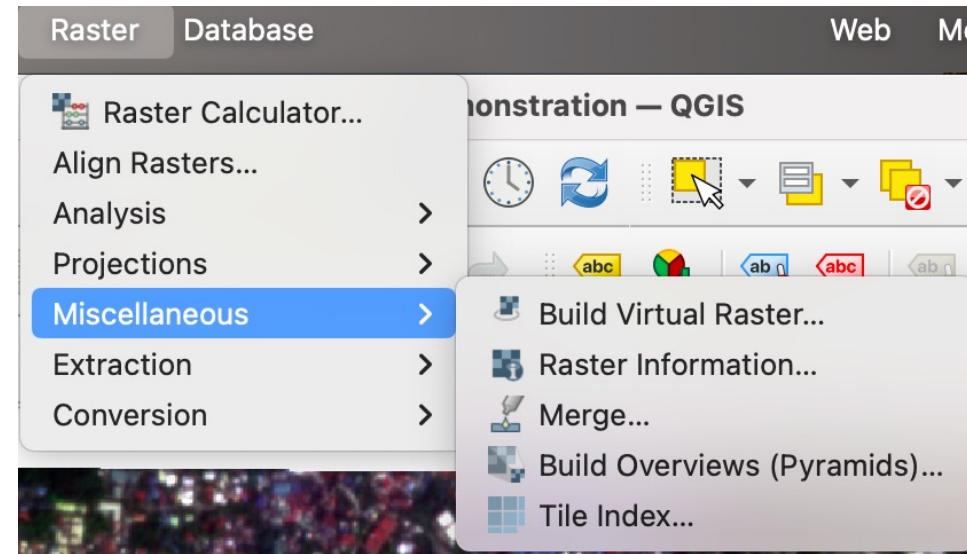
Processing Toolbox

- Shows available algorithms QGIS can perform
 - GDAL, GRASS GIS, SAGA GIS, QGIS geoalgorithms
 - Scripts and models created by user



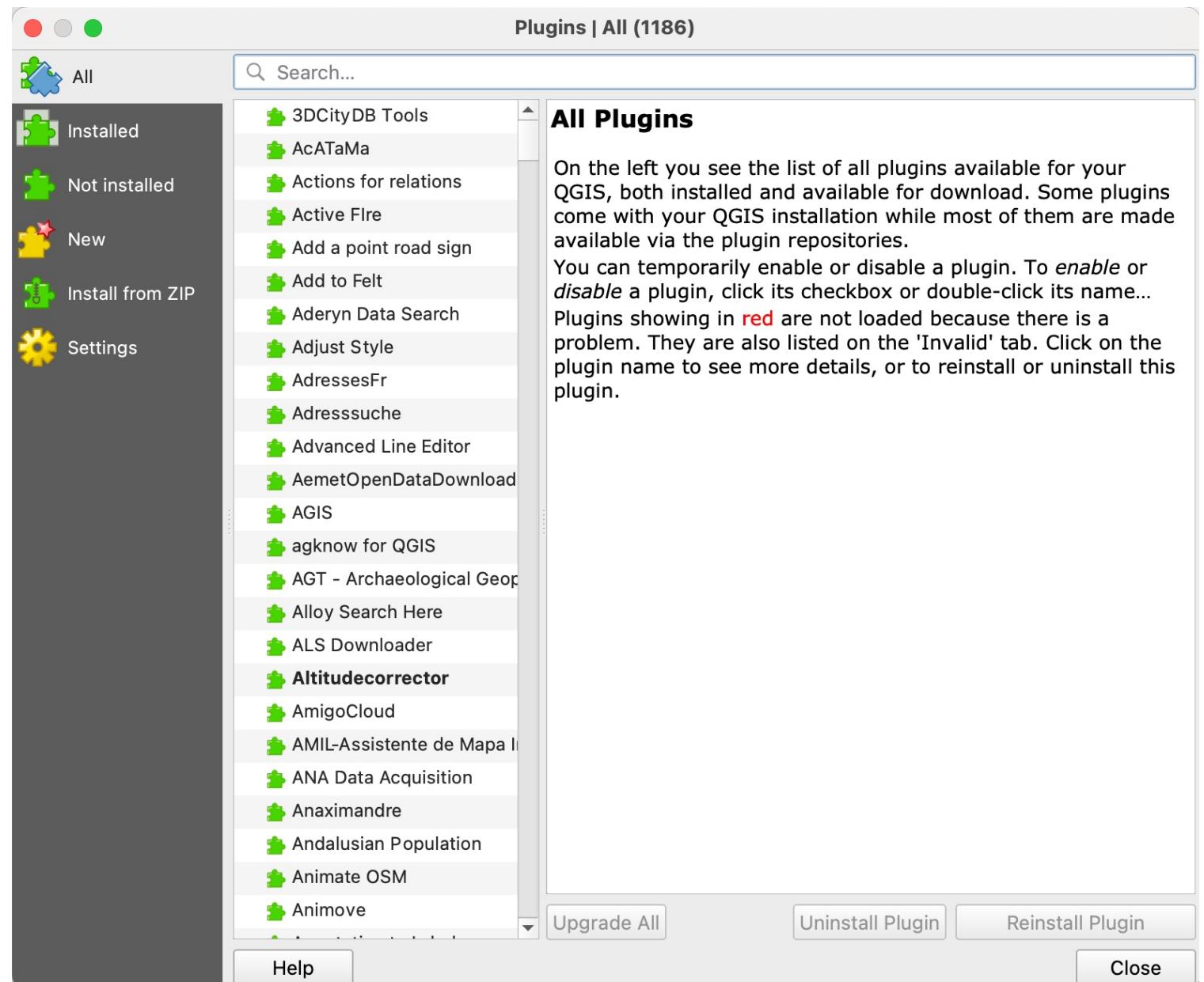
Other Functions

- Raster Processing
 - Band Math
 - Georeferencing
 - Conversion to Polygon
 - Merging
 - Clipping
- Vector Processing
 - Geoprocessing
 - Geometry tools



Plugins

- Useful plugins
 - Quickmap services
 - Freehand editing
 - Rectangles Ovals
Digitizing
 - GEarthView

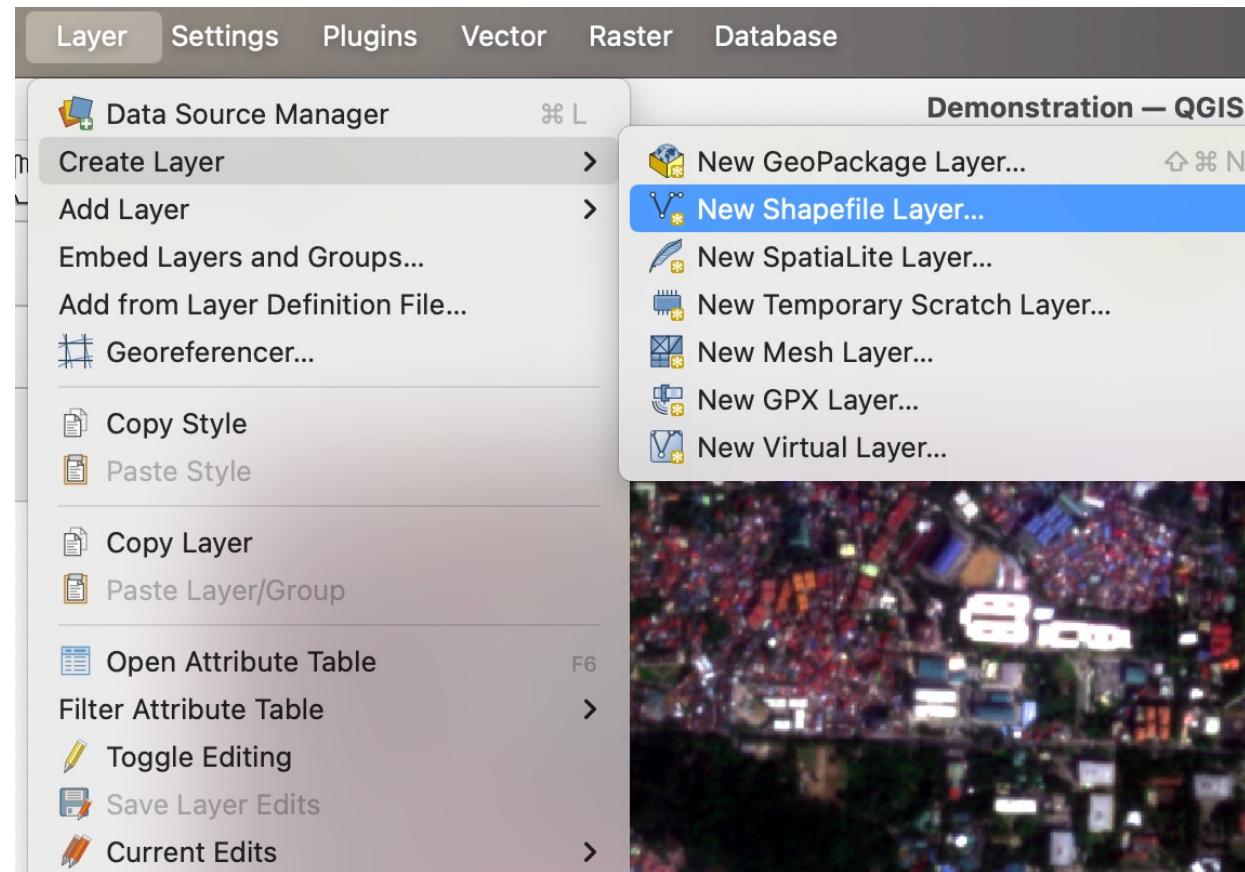


Exercise 1: Digitizing

Digitizing Roads and Buildings (Interest Areas)

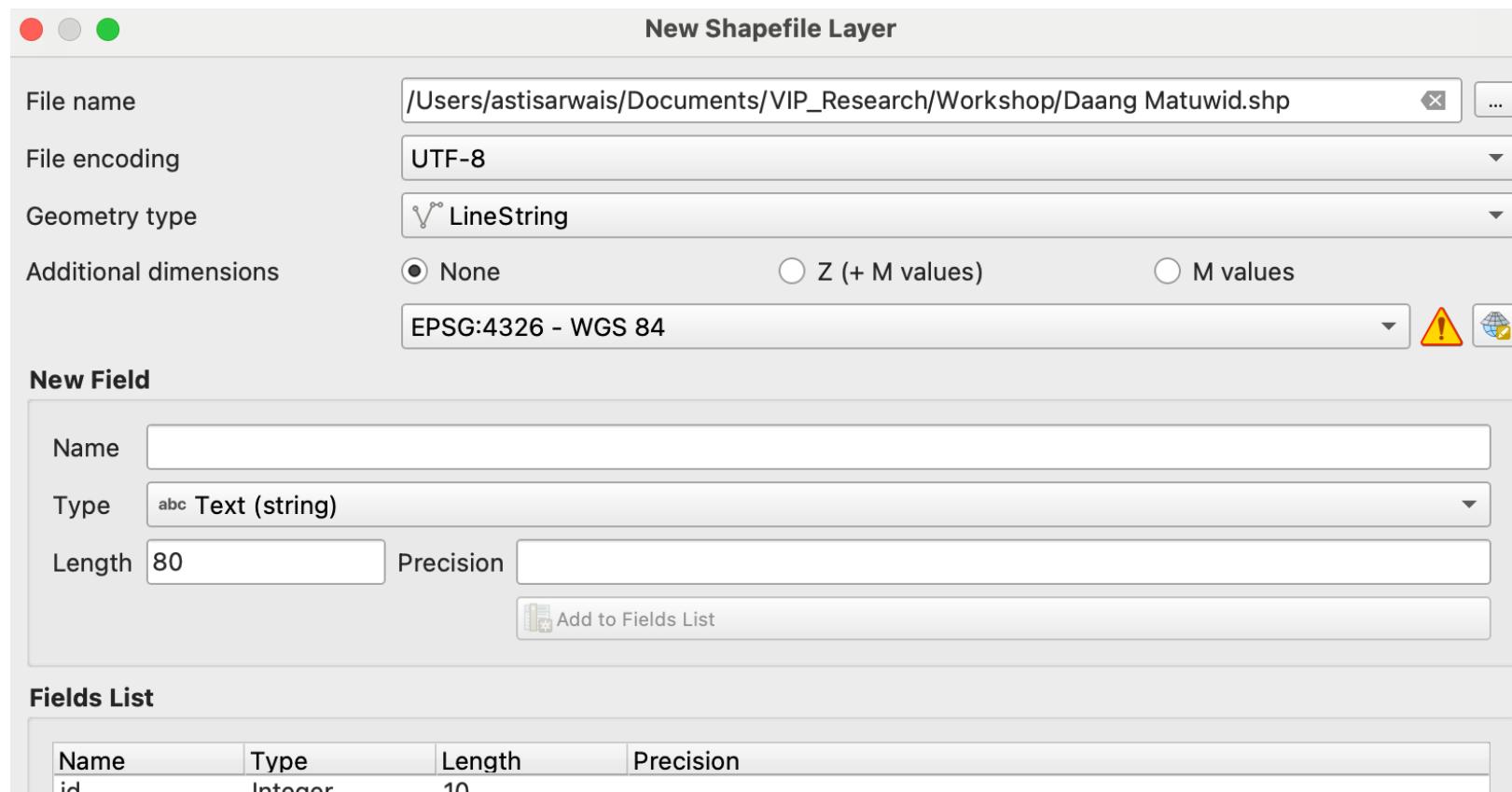
Digitizing Roads

1. Create a new shapefile layer.



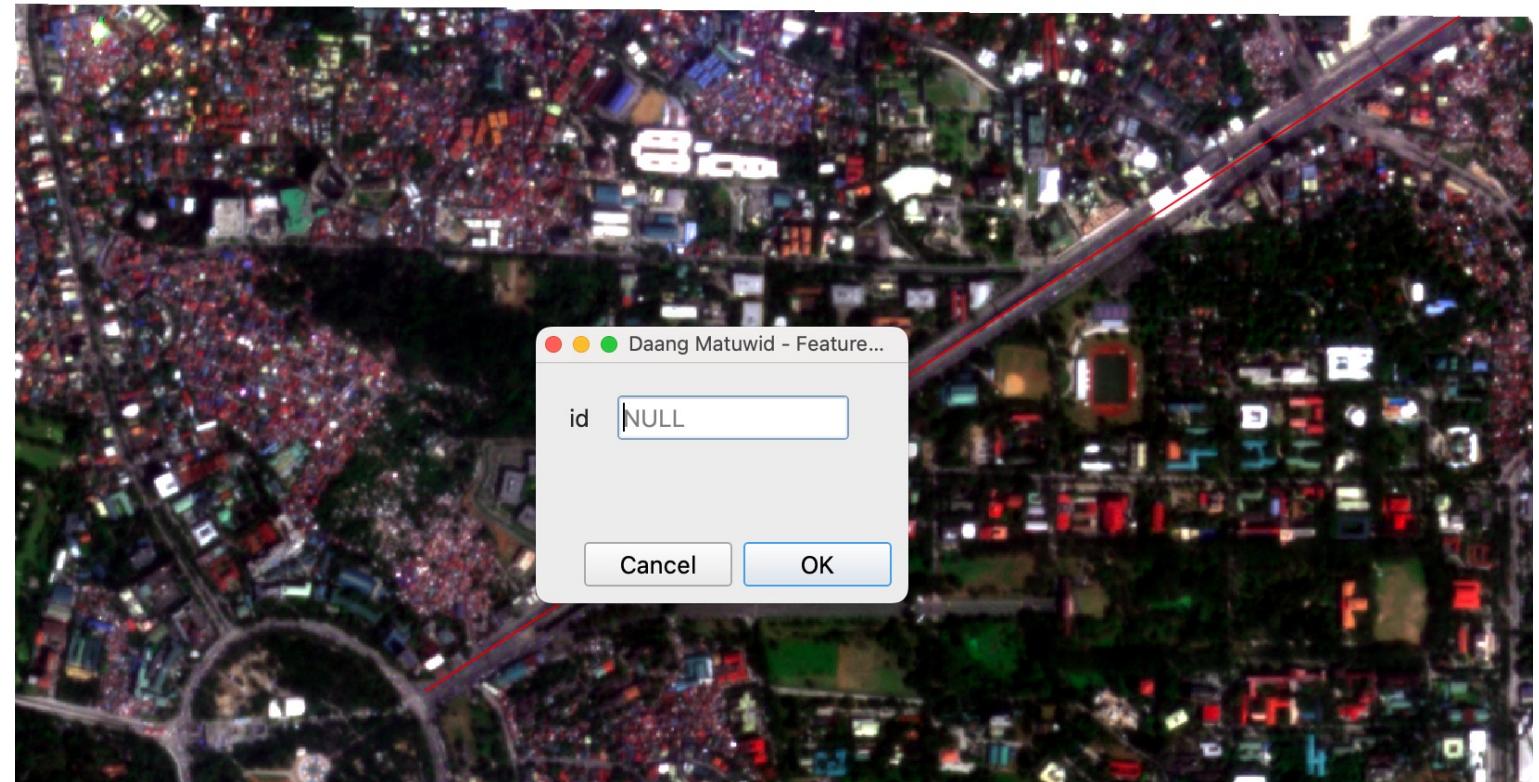
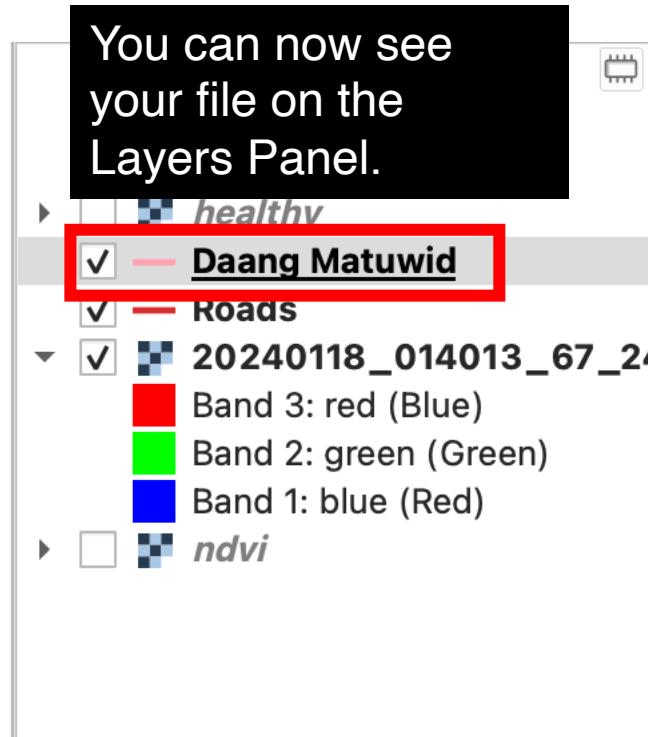
Digitizing Roads

2. Set a file name to your shapefile and set the Geometry type to Line String.



Digitizing Roads

3. Toggle editing and add line feature. Start digitizing and ID per feature.

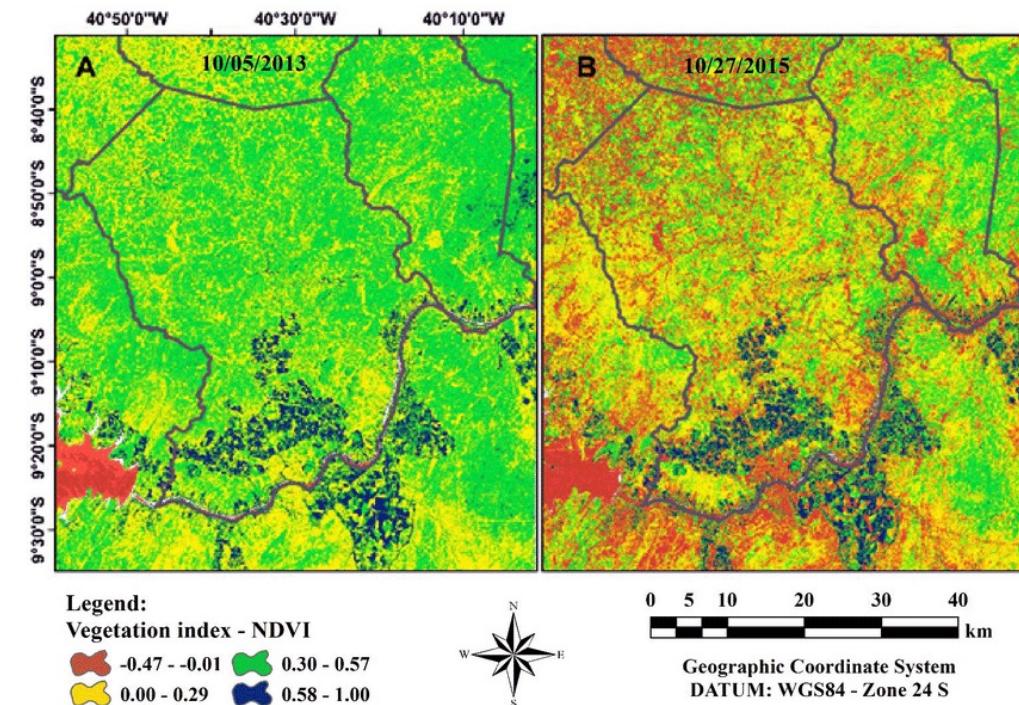


Exercise 2: Raster Operations

Creating Indices from Rasters

What are indices?

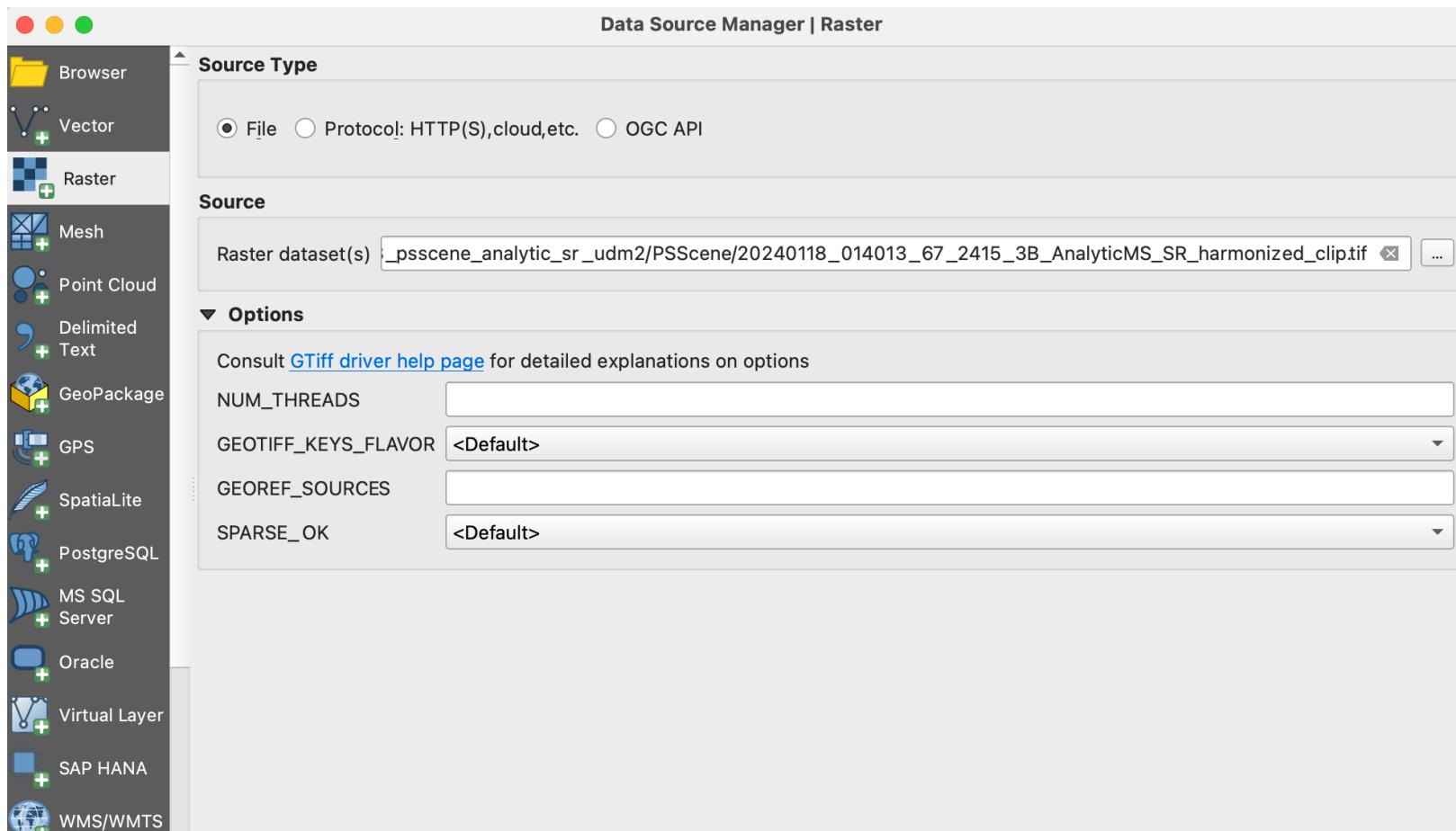
- Indices are values derived from band value of rasters used to enhance certain features and improve separability between classes.
- More indices at <https://www.indexdatabase.de>



Name of the indice	Formula	Author
Normalised difference Vegetation Index (NDVI)	$\frac{(NIR - VIS)}{(NIR + VIS)}$	Rouse et al (1973)
Simple Ratio Index (SR)	VIS/NIR	Jordan (1969)
Soil Adjusted Vegetation Index (SAVI)	$(1+L) \frac{(NIR-VIS)}{(NIR-VIS + L)}$	Huete (1988)
Pasture Index (PI)	$\frac{(NIR - RED_1)^2}{\sqrt{(RED_1 - RED_2)}}$	
Normalised Difference Water Index (NDWI)	$\frac{NIR_{860} + NIR_{1240}}{NIR_{860} - NIR_{81240}}$	Gao et al (1996)
RDVI	$\frac{(NIR - RED)}{\sqrt{NIR + RED}}$	Rougean and Breon (1995)

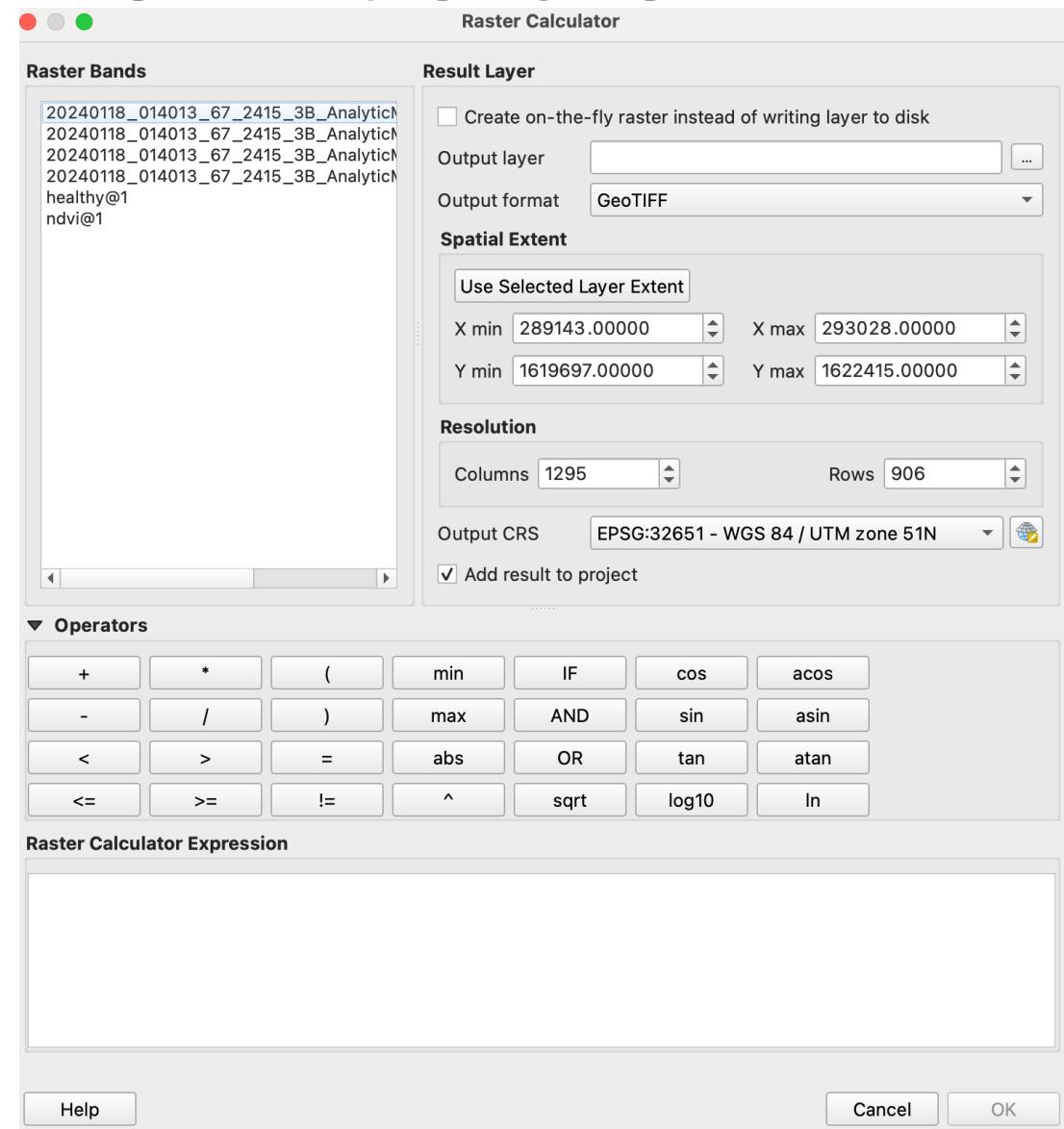
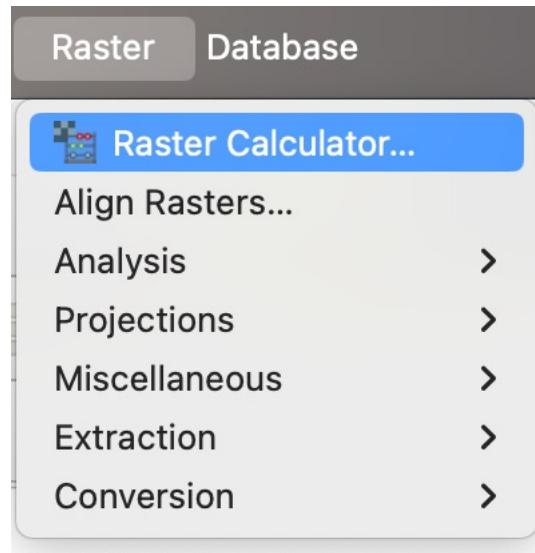
Creating indices from rasters

1. Load raster/dataset to QGIS.



Creating indices from rasters

2. Open raster calculator.

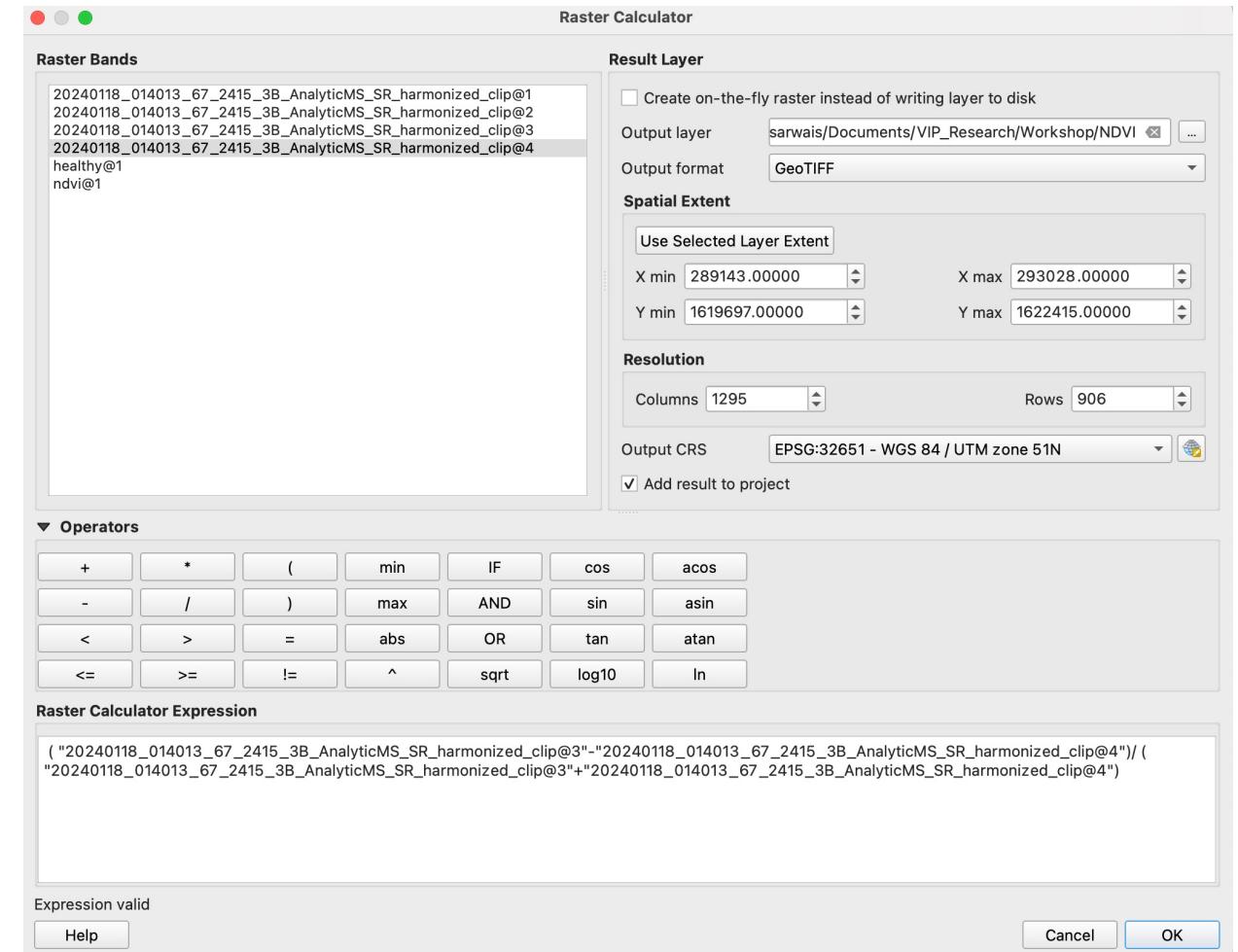


Creating indices from rasters

3. Set the output name and type.

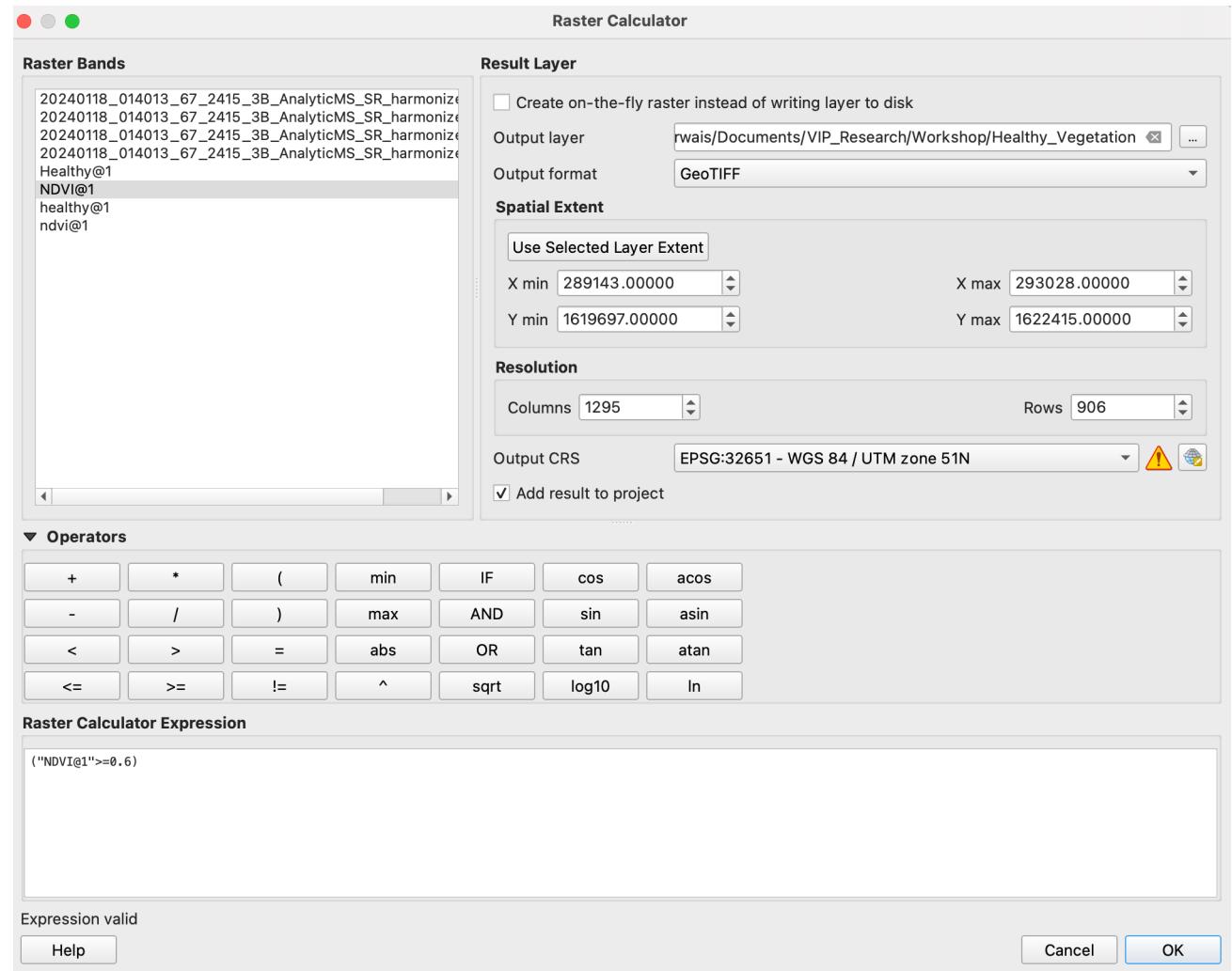
4. Type the expression of your desired index. Choose the appropriate bands.

$$NDVI = \frac{NIR - Red}{NIR + Red}$$
$$NDVI = \frac{Band\ 4 - Band\ 3}{Band\ 4 + Band\ 3}$$

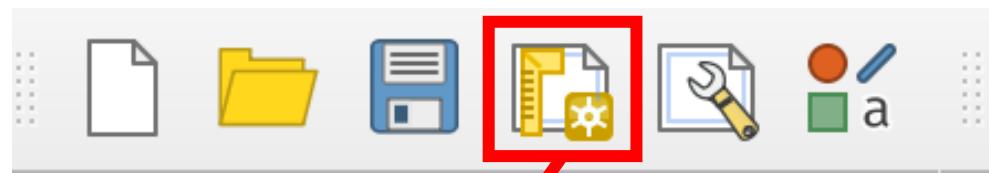


Creating indices from rasters

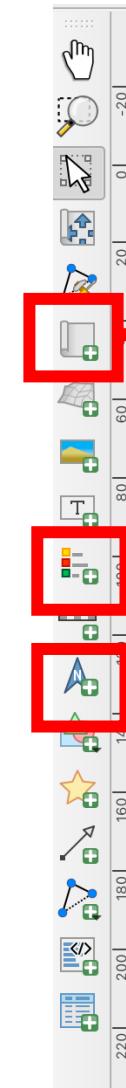
5. Filter out the high values of the index and save your output.



Optional: Map Layout



New Print Layout
- creates new map layout



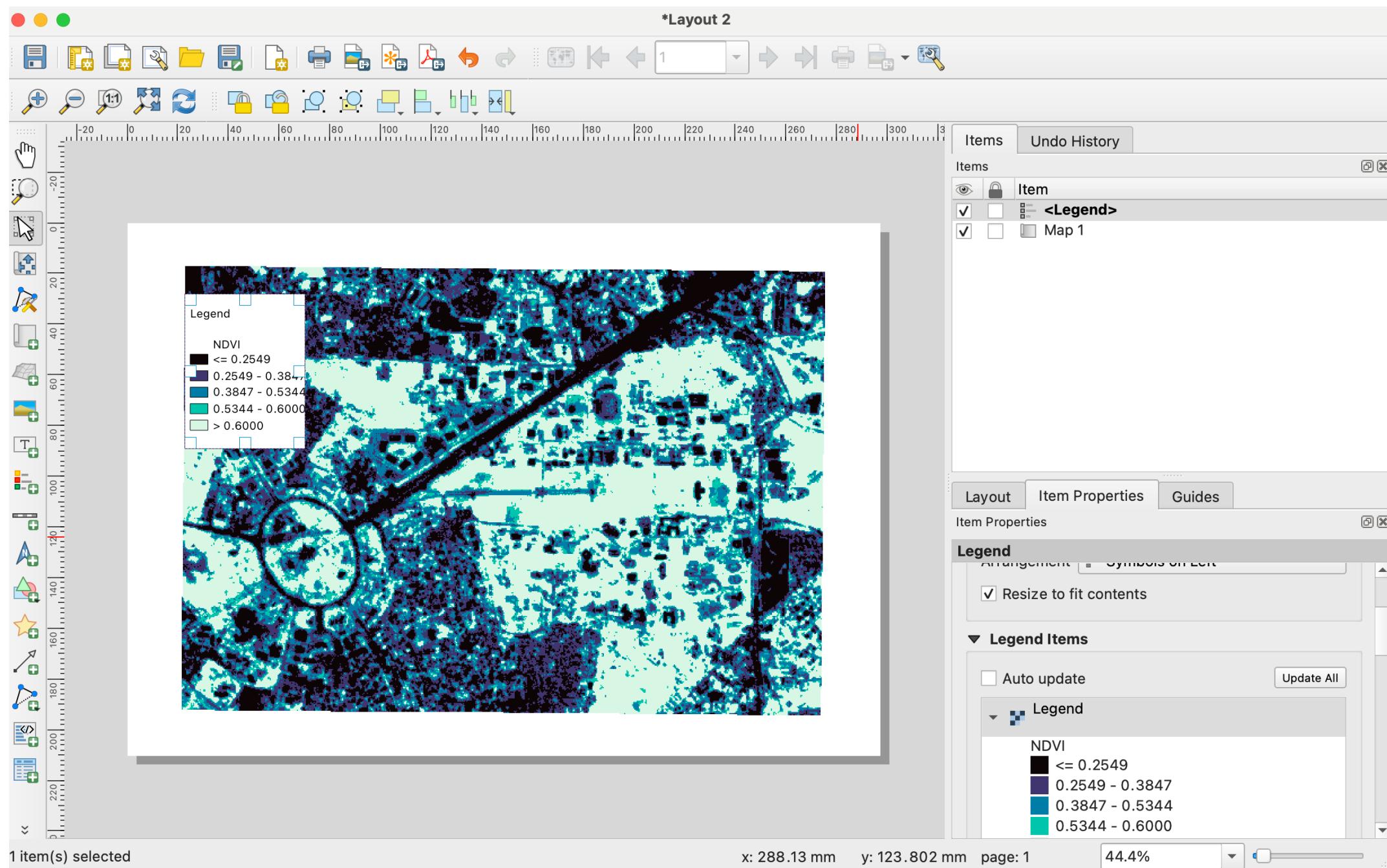
Add Map
- creates a map pane



Add Legend
- creates legend on the map



Add North Arrow

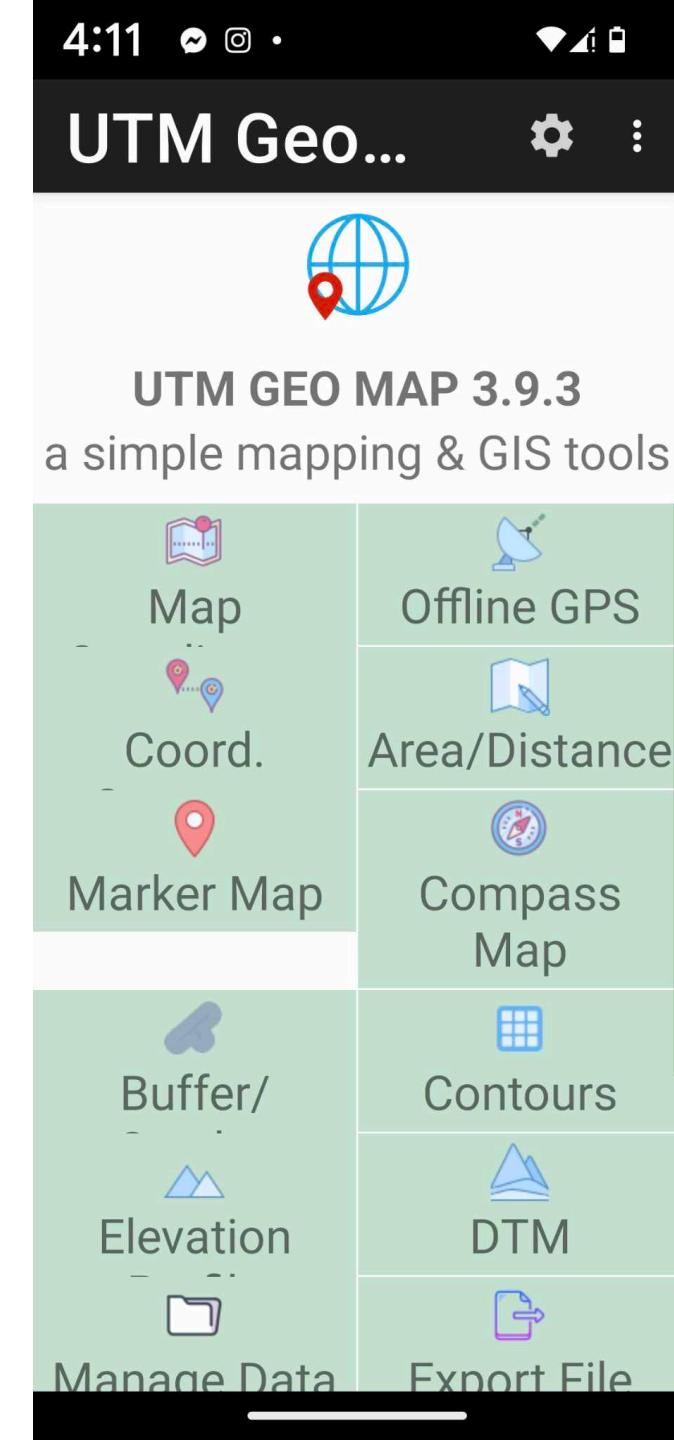


Mapping using UTM Geo Map

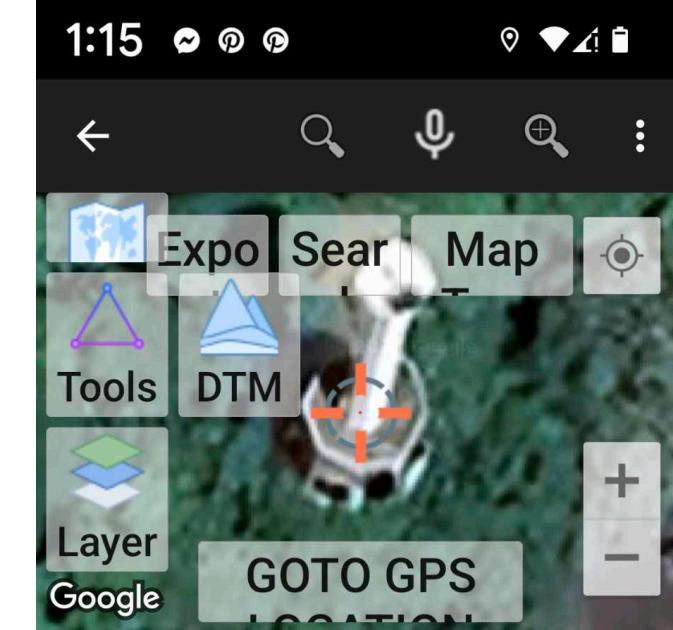
Mapping using mobile phone and using Story Maps

UTM Geo Map

- [UTM Geo Map](#)
- [\(16\) UTM Geo Map App - YouTube](#)
- [UTM Geo Map APP Quick Start](#)



Calibrating your GPS



Monuments and Landmarks in UP for GPS Calibration

- Acad Oval markers
- UP Oblation
- Quezon Hall
- Academic Buildings
- Carillon Tower
- UP Baseline: [11v02pmxj8](#)

<https://arcg.is/1eGaLv2>
Story Maps in ArcGIS

Resources

- Datasets
 - Planet (Optical data)
 - Sentinel via <https://dataspace.copernicus.eu/> (SAR, Optical data ++)
 - Landsat
 - ALOS2 (SAR, JAXA)
- Shapefiles
 - National boundaries (Humanitarian Data Exchange) via
https://data.humdata.org/dataset?q=philippines&sort=last_modified%20desc&ext_page_size=25
 - Geoportal via <https://www.geoportal.gov.ph/>