Lab 1: Introduction to QGIS and python

This lab will serve to give you an introduction to the tools we will be using for the rest of the class. If you have already taken my GIS class or Remote Sensing class, you have already covered similar material and can skim through this to refresh your memory. If you have not, you will want to complete the whole thing.

Part 1: QGIS and introduction to GIS

Go to this website for background information on GIS concepts: https://docs.qgis.org/3.16/en/docs/gentle_gis_introduction/index.html

Read through the documentation to answer the following questions:

- What is a vector?

Vector is a GIS data storage/representation format using geometrical objects (points, polylines, and polygons). The corresponding object information are stored in an attribute table.

- What is a raster?

Raster is a GIS data storage/representation format where we use an array of pixels to represent real-world objects. A raster image can have multiple bands stacked on top of each other wherein each band is a matrix of pixel values.

- What is a coordinate reference system?

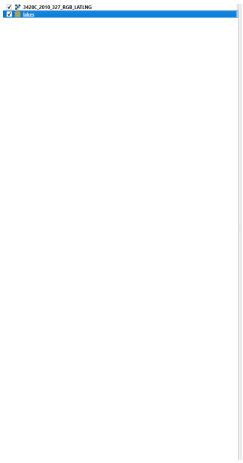
A coordinate reference system mathematically relates the projected 2D space of a map to the real world.

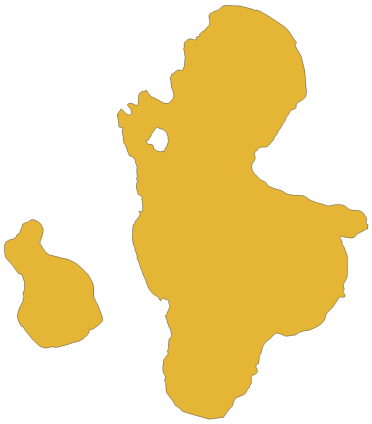
- If you have a gridded dataset, what data type is that (vector or raster)? What are some key pieces of information you would need to use it with other geographic data in a GIS system?
- Ans: Raster. We need the raster metadata and coordinate reference system having the affine transformation parameters.

Now download the data for the QGIS exercises: https://github.com/qgis/QGIS-Training-Data/archive/release_3.16.zip

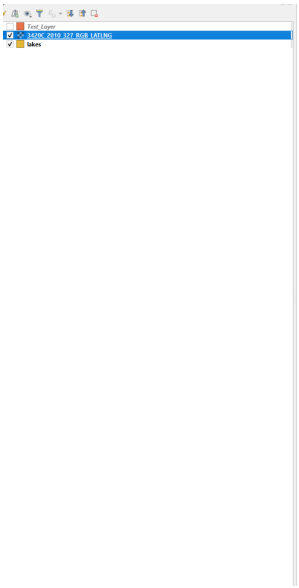
If you have not had GIS before: do modules 2, 5, 6, and 7. Take a screenshot at the end of each module. If you have had GIS before: use the dataset you downloaded to load in some vector and raster data. Create your own vector dataset in a reasonable coordinate reference system. Take a screenshot and paste below. Describe briefly what you did.

lakes.shp (UTM 35N)

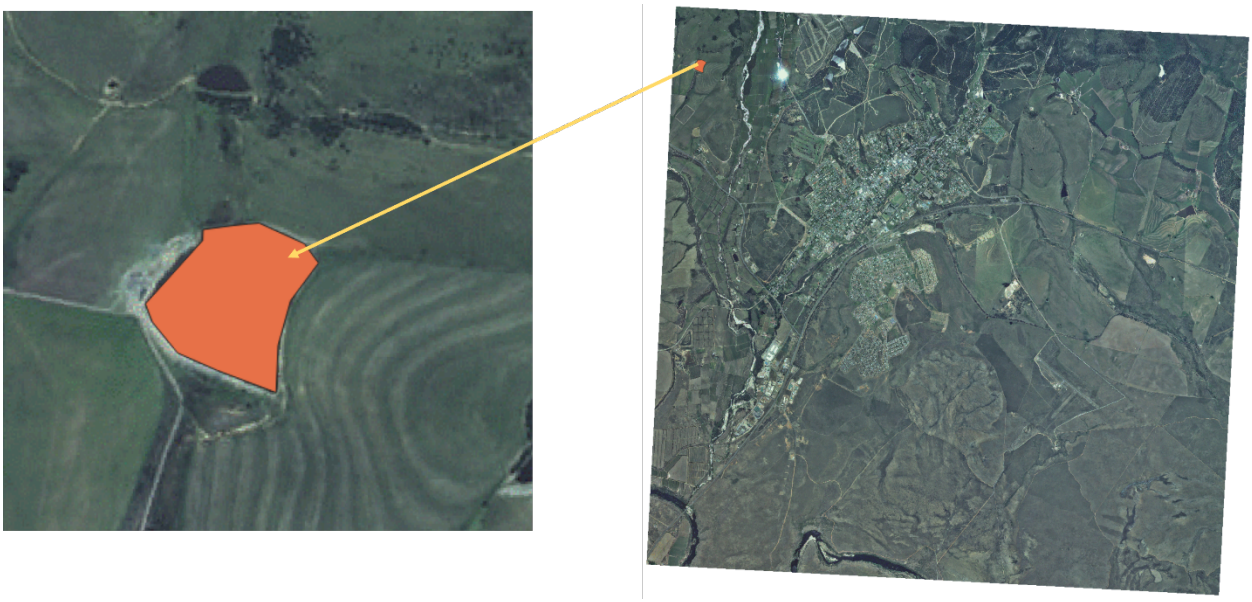




3420C_2010_327_RGB_LATLNG.tif (WGS 84)



Test_Layer.shp



In the above screenshot, I created a polygon over a water body and saved it in an ESRI shapefile format. Both the raster and vector data are in WGS 84 geographic coordinate system. This is a supervised labeling approach which could be useful to map water bodies in multiple raster images.

PS: I have been using GIS since 2017, so, I skipped modules 2, 5, 6, and 7.

Part 2: Introduction to Python

If you do not have a background in python, please complete the assignment below. If you do, please briefly describe your background in python and paste some sample code that you have written.

1. Complete part 1 of the introduction to python modules on github: https://github.com/rg-smith/remote-sensing-hydro/blob/main/labs/lab1/intro-python-part1.ipynb

2. Complete part 2 of the introduction to python modules on github: https://github.com/rg-smith/remote-sensing-hydro/blob/main/labs/lab1/intro-python-part2.ipynb

I have been extensively using Python since 2017. Some of my projects involving Python include snow depth and snow water equivalent estimation (master's thesis), groundwater withdrawal estimation using integrated remote sensing products and machine learning (ongoing doctoral research), global inland surface water monitoring using PlanetScope data and deep learning (summer internship at Planet Labs). Here are some of my public Github repositories showcasing my experience in Python:

[1] https://github.com/montimaj/HydroMST [Majumdar, S., Smith, R., Butler, J. J., & Lakshmi, V. (2020). Groundwater withdrawal prediction using integrated multitemporal remote sensing data sets and machine learning. Water Resources Research, 56, e2020WR028059. https://doi.org/10.1029/2020WR028059]

[2] https://github.com/montimaj/PolInSnow [Majumdar, S. (2019). Snow depth and SWE Estimation using spaceborne polarimetric and interferometric synthetic aperture radar (MSc Thesis). University of Twente. Available at https://library.itc.utwente.nl/papers_2019/msc/gfm/majumdar.pdf]