EPPS/GISC 4317/6317: GeoComputation/Computer Programming For GIS

**Instructor: Dr. Bryan Chastain**

**Lab08: Open Source GIS in Python**

This lab may be completed either in ArcGIS Notebooks or in a Python IDE (i.e. Spyder). If using an IDE, you will need to open Anaconda Prompt and run the following command first to make sure you have the necessary libraries installed:

conda install fiona shapely geopandas

If using ArcGIS Notebooks, be sure to upload all required files to your Notebook. If using an IDE, just make sure the files are in the same directory as your script.

**Part 1 – Fiona**

**Step 1: Describe a Shapefile**

In this exercise, we will use the open source fiona library to access metadata about a shapefile

* Create a new script and save it to your lab08 folder. Use script to describe the *Railroads.shp* shapefile from eLearning.
* Print the extent and geometry type (point/line/polygon/etc).
* If it is a *Point* feature class, print that it is a point. If it is a *Polyline* feature class, print that it is a line. If it is a *Polygon* feature class, print that it is a polygon. Otherwise print that you do not know the type.

**Step 2: Access Field Values**

In this step you will need to print the name and population of each country in the Country.shp shapefile.

* Print the name and population for each country in the Country.shp shapefile.
* Format the output as follows:

Uganda has a population of 18144360.0

United Kingdom has a population of 56420180.0

Ukraine has a population of 53164920.0

etc.

**Part 2: Rasterio**

GDAL - the Geospatial Data Abstraction Library is a software library for reading and writing raster and vector geospatial data formats and forms the basis of most software for processing geospatial data.

There are many formats for using GDAL ranging from graphical tools like ArcGIS or QGIS to command line GDAL tools but here we're using the fantastic rasterio python package which provides a pythonic wrapping around GDAL.

**Step 1: Working with Landsat imagery**

* Use rasterio to open LE70220492002106EDC00\_stack.gtif
* Print the number of bands as well as the number of rows and columns.
* What coordinate system does this image use?
* Plot just the near-infraread band of the image (the fourth band) using rasterio.plot.show (gray color map)

**Step 2: Map Algebra**

* Open the Digital Elevation Model of the US (usdem10k.tiff)
* This currently represents the elevation in the US in feet. Use Map Algebra to convert this to meters (\*0.3048)
* Plot this modified DEM and include a legend to show the new units (fig.colorbar())

**HOMEWORK**

**Undergraduate:**

**a: Working with shapefiles**

* Download the Michigan Airports shapefile (mi\_airports\_shp.zip) and either upload to Notebooks or extract to your lab 8 folder if working in an IDE/Jupyter.
* How many features are stored in this shapefile and what geometry type are they?
* How many airports are in Ingham county?
* Which airport has the highest elevation?

Deliverables: Submit either .ipynb from ArcGIS Notebooks OR Python script as .py file to eLearning.

**Graduate:**

**Do (a) above, as well as:**

**b. Calculate NDVI**

In this step you will use rasterio to calculate the Normalized Difference Vegetation Index (NDVI) which is a way of using the relationship of brightness in the red and near-infrared parts of the spectrum to determine the amount of live green vegetation present. The calculation is simply (Near Infrared – Red)/(Near Infrared + Red). Use the

* Open the LE70220492002106EDC00\_stack.gtif from earlier
* Calculate NDVI, using band 3 as Red and band 4 as Near Infrared.
* Display a plot and colorbar legend of the NDVI raster.

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