Lab 03: Spatial and tabular analysis in ArcGIS Pro

Read the instructions COMPLETELY before starting the lab

This lab builds on many of the discussions and exercises from class. There are no introductory exercises or background information. Complete the tasks below and answer the questions that follow. As always, there are multiple ways accomplishing the task(s) at hand.

The following tasks use the feature classes found in the "lab03data.zip" file on in the course GitHub repository:

- nebraska_counties_census.shp: a county-level dataset from the USCensus. Contains population and income information
- nhdplus.shp: a hydrologic dataset from the National Hydrograpic Dataset at the scale of "NHDPlus Segments". The spatial extent is the Lake Champlain Basin in Vermont. Relevant fields are as follows:
    - urban_yield: total phosphorus from urban lands in NHDPlus segment in units of kg/ha/year
    - ag_yield: total phosphorus from agricultural lands in NHDPlus segment in units of kg/ha/year
    - forest_yield: total phosphorus from forested lands in NHDPlus segment in units of kg/ha/year
- lake_champlain.shp: Lake Champlain

Task 1: Analyze a hydrologic dataset

1.1. Write a Python script that finds the NHDPlus segment with the *second* largest *absolute difference* between phosphorus yield from agricultural land use and phosphorus yield from forested land use. Your script *must* use a SearchCursor.

1.2. Find the top 10 NHDPlus segments by total phosphorus yield (yield is nutrients per unit area per unit time [kg/ha/yr]). Using your analysis tool/software of choice (e.g., Excel, R), create a scatterplot (e.g., https://en.wikipedia.org/wiki/Scatter_plot) with agricultural yield on the x-axis and forested yield on the y-axis. You *must* use a SearchCursor in your script.

1.3. Make another scatterplot, this time containing data from all NHDPlus segments. Plot the distance from each NHDPlus segment to Lake Champlain on the x-axis, and plot total phosphorus yield on the y-axis.

Task 2: Nebraska counties census data

2.1 Using an UpdateCursor, delete all counties that do NOT start with the letter "L". Print the names of the remaining counties and their population of female residents under the age of 5.

2.2 The next task is to calculate an index of social vulnerability. For the sake of this exercise, we will calculate a very simple vulnerability index with only 2 components **(note, vulnerability is MUCH, MUCH more complex)**. We will use the indicators: **income** ("PerCapInc") and the **proportion vacant homes** ("Vacant" / "TotalUnits"). We will assume vulnerability is *negatively* correlated with income, and *positively* correlated with vacancy rates. This means you will need to account for different directions in the two indicators. Further, we will assume our initial analysis has shown that income is *twice as strong of a predictor* of vulnerability than the vacancy rate.

Your job: develop a metric of "vulnerability" using these two indicators. Map the result using a choropleth map. Take your time to think through what you're measuring and how. This is where a paper sketch or pseudocode can be very effective.

(Note, I am NOT concerned that you build the perfect indicator or even understand the concept of social vulnerability. I want to see that you can think through indicators of different magnitude, order, and importance.)

What to turn in:

- Task 1: your code for 1.1, 1.2, and 1.3, scatterplots from 1.2 and 1.3

- Task 2: your code for 2.1, 2.2, your map from 2.2

Answer to the following questions:

Q1. Are there any observable trends in your scatterplots in 1.2 and 1.3? If so, what are they?

Q1. For task 2.2, describe how you chose to construct your indicator. What problems did you encounter and how did you solve them? You must address: 1) how you handled the different direction of effects on vulnerability, 2) how you calculated different importance (or "weights") of the two metrics, and 3) how you handled the fact the two metrics are in different units? Again, there is no right or wrong answer (I know you're not an expert on vulnerability or indicator construction). Rather, I want you to demonstrate thoughtfulness in your design process.