W1 Exercise: Basic cartographic techniques

Dot mapping, proportional symbology, quantitative and qualitative flow mapping / 50 points (10 points per task)

This exercise will give you the opportunity to apply some basic cartographic concepts we have learned in class. You will work with data from US, Buffalo and world-wide. The datasets can be found on Canvas. Download and unzip it into on a flash drive. You will make a total of 5 maps. You will need to export all maps as picture/figures and include those in your write-up.

A. Dot mapping

1. 48 States

For this exercise, you will work with data from the 2000 US Census Bureau for the 48 states (48UScounties.shp). Choose a variable that you are interested to map….the variable should be a count. So here for instance, I have mapped the number of farmers per county using dot mapping.

- Try a few different dot sizes and dot values until you are satisfied with your result. Dots should coalesce somehow (Symbology>Dot density).

- I have put an example here below that shows the number of farmers. Here my dot value is = 200 farmers.

- Use a light color for the background.

- Once you are satisfied with your result, go under Insert>layout View>Layout view and prepare a map with a scale bar, a North arrow and a legend and the data source.
If you do not remember how to make a layout view, I suggest this video:
https://www.youtube.com/watch?v=NZ9ei4-23MM (make a layout in ArcGIS Pro)

- Export your map as a jpeg file and include it in the word document.

- In the write up, try to find explanations for the concentration of high and low values of the variable you are mapping (2-3 lines). Explain your design choice, and the difficulties you may have encountered,

B. Proportional symbol mapping

1. World cities

You will work with a 1992 data set from ESRI on the cities in the world. It also contains a certain number of variables, such as the location, population and whether or not the city is a capital. We are interested in mapping the population of capital cities greater than 750,000 habitants.

- Open ArcGIS Pro and add CITIES.shp. Add a basemap of your choice, such as Light Gray Canvas or Ocean.
- Change the projection of your data set to an orthographic projection with center longitude on Greenwich. To do this, right-click on the map, go under properties and choose the Coordinate System tab. There, choose predefined projection systems> world, and then scroll down until you find a projection called "Vertical Perspective (sphere)". Select it, but before pressing ok, right click "Copy and Modify …" and change the longitude of center to 0 degree and the latitude to 45 degrees. Click "Save", and you will find we create a new coordinate system called "Vertical perspective (sphere) 1" under "Custom". Great! Click "OK" to quit it. Now, the data looks like it is projected on a globe centered on Europe. Good. Zoom in.
- Select the cities that are capitals and greater than 750, 000 habitants. To do so, open that attribute table of CITIES. Perform a query where the POPULATION > 750,000 and CAPITAL = Y. Once you have performed the query, close the attribute table and right-click on the layer. Create a Layer from selected. The new layer will automatically be entitled "CITIES selection".
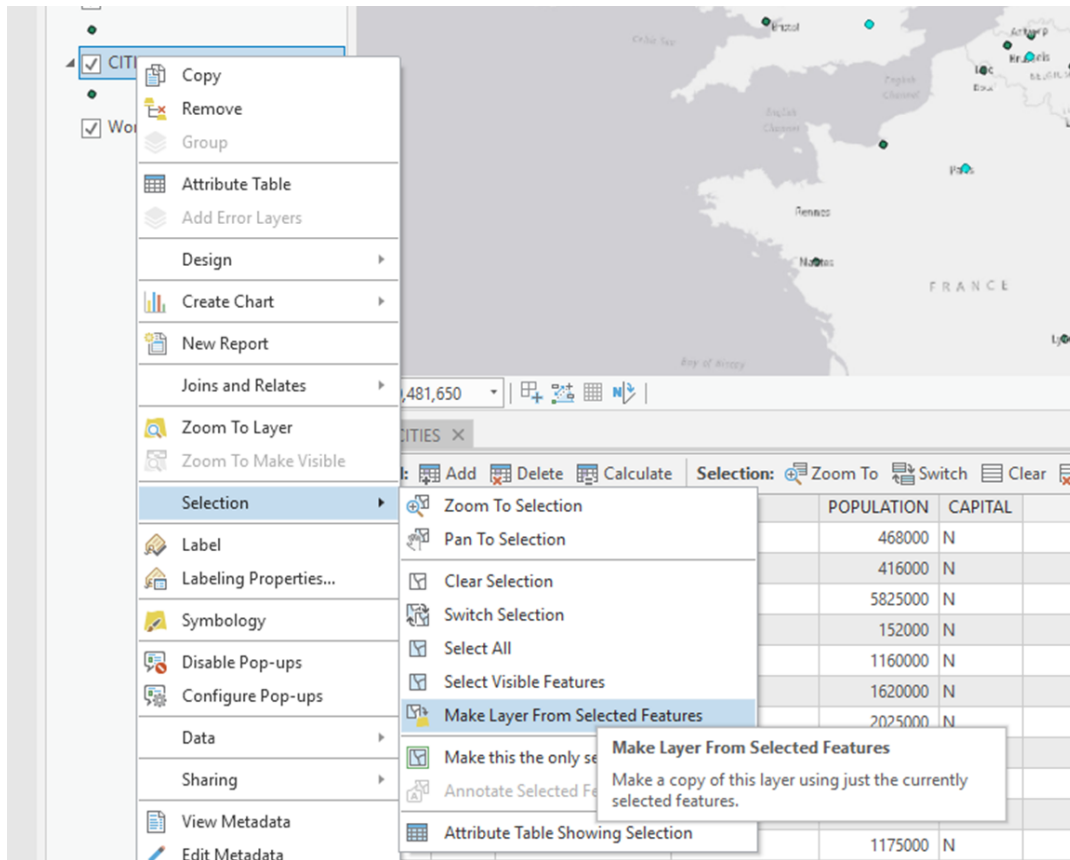
- Now, you are ready to create proportional symbol based on the population within each city. To do so, change the symbology (Appearance>Symbology) of "CITIES selection" to Quantities and graduated symbol. Select an appropriate symbol size (try different combinations) and also choose a symbol with a white border-see class notes-. Make sure that the smallest symbol is readable (min size of 4 is probably too small) and that the maximum value is great enough. Finally, change the classes, so that the numbers are easy to read. For instance, you could break it: <750,000; 1,000,000; 2,000,000, 5,000,000 ….etc
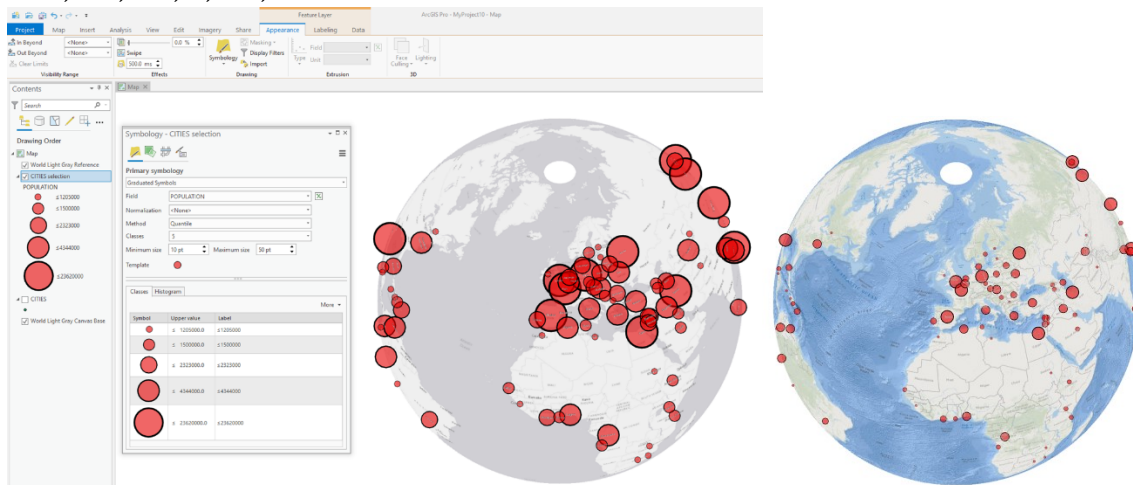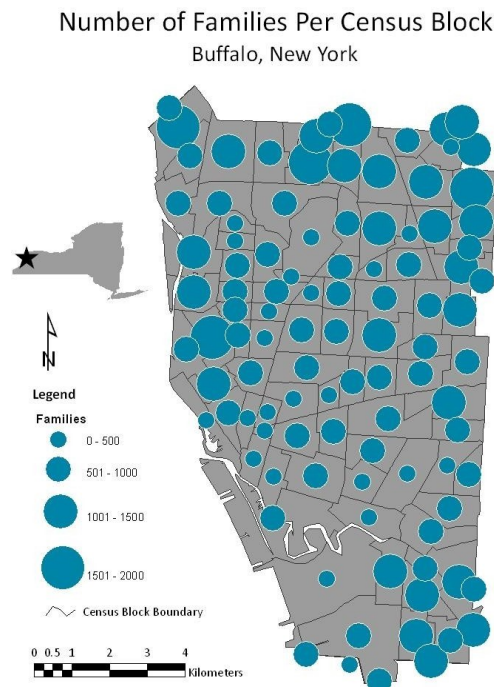
- Again, try different values of min and max values until you are happy. The map up there shows max symbol value = 50, which is probably too big.
- Once you are done, prepare a map (Insert>New Layout>Map Frame>Default Extent) and add an appropriate legend (see part I), a bar scale, title, source, etc……
- Export the map (Share>Layout Export) as a jpg and include it in your word document. Describe in 2-3 sentences the pattern that you see. Explain your design choice and the difficulties you may have encountered.

2. Buffalo census tracts.

For this exercise, you will work with the data set from Buffalo. You will work with census tracts. The data is already projected in UTM zone 17N, so the units are in meters. The shapefile contains population information from the census at the tract level. **You will prepare a proportional symbol map displaying an attribute of your choice** (could me the number of males for instance) within each tract.

- Open ArcGIS Pro and add the Buffalo-tracts.shp.
- Right-click under Buffalo_tracts, and similarly to the previous exercise, select categories, graduated symbol.
- In the value Fields, select an appropriate attribute, but do not normalize it. Change the symbol Template as shown in class, and select a neutral background.
- Change the min and max symbol size so that points begin to coalesce. Once you are happy with the outcome, create a layout (Insert>New Layout), and add it a legend, scale bar, title, source, etc…You can also add an insert map if you feel like it!
- Export the map as a jpg and include it in your word document. Describe in 2-3 sentences the pattern that you see. Explain your design choice and the difficulties you may have encountered.


Number of Families Per Census Block
Buffalo, New York

Legend
Families
○ 0 - 500
○ 501 - 1000
○ 1001 - 1500
○ 1501 - 2000
Census Block Boundary

0 0.5 1 2 3 4
Kilometers

C. Mapping linear features:

1. Qualitative mapping

For this exercise, you will work with street network data from the census bureau for Niagara and Erie County, in Western NY. Those are TIGER files. We want to create a map showing the highways, major roads and secondary roads on top of the census tracts. Specifically, we will create a qualitative map reflecting specific roads with a corresponding color and a corresponding width. An arterial street would probably be very thin and be in a light dark color. A highway on the other hand would probably have a larger width and also another color.

- Open ArcGIS Pro and add two layers: "wnyroads_projected" and "wnytracts_projected". The second layer (census tracts) will serve as a background layer.
- Open the attribute table of wnyroads_projected and look into the different headings. One column is called CFCC, and you can look up the description of this code here: https://support.esri.com/en/technical-article/000001496
  All entries start with A, where the A classcode refers to a road type. B refers to railroad, etc… but we do not have this data here. For instance now, codes A11 to A18 denote highways. Codes A21 to A28 are primary roads. Secondary roads are from A31 till A38. And so on. We are mainly interested in the first three types. Indeed there may be local, neighborhood, rural roads and vehicular trails and those would add useless information to the map. They would overload the map if we would add those.
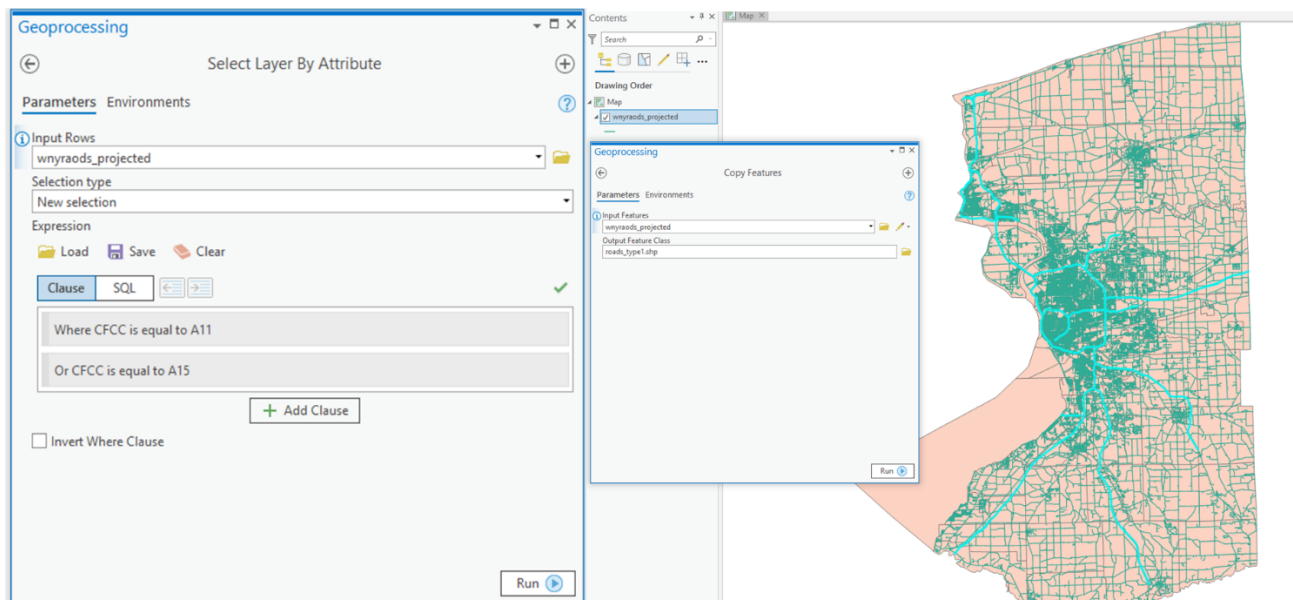
- Open the attribute table of wnyroads and select all the roads that are primary highways. Close the table. Then, right click on the layer, and go and click Data>Export Features. Cope selected feature into a new shapefile, (Copy Features tool copy

selected features by default and make sure the selected features are highlighted on top) -call it"roads_type1"- and save it within your working directory. Add it to the map.

- Now we will repeat the same operation two more times. Go back to the initial layer wnyroads.shp. Open the attribute table and clear the selection. Create a new selection where you select all the CFCC codes from A21 to A28. Close the table. Then, right click on the layer, and go under Data. Create a new shape file, -call it "roads_type2"- and save it within your working directory (make sure it is not temporary). Add it to the map.

- Go back to the initial layer wnyroads.shp. Open the attribute table and clear the selection.

- Finally, create a new selection where you select all the CFCC codes from A31 to A38. Close the table. Then, right click on the layer, and go under Data. Create a new shape file, -call it "roads_type3"- and save it within your working directory (make sure it is not temporary). Add it to the map.

- Go back to the initial layer wnyroads.shp. Open the attribute table and clear the selection.

- Now, you have 5 layers in total: wnyroads, wnytracts, roads_type1, roads_type2 and roads_type3. Deactivate wnyroads, and give an appropriate color scheme for all the three last layers (roads_type1, roads_type2 and roads_type3).

- Remember that there needs to be a visual hierarchy: important roads should have the layer on top, and so on. All the way at the bottom should be the census tracts layer.

- Prepare a map (Insert>New Layout), add a legend, a scale bar, title, etc…

- Export your map as a jpg file and include it in your write up. Briefly discuss the pattern that you see. Explain your design choice and the difficulties you may have encountered.
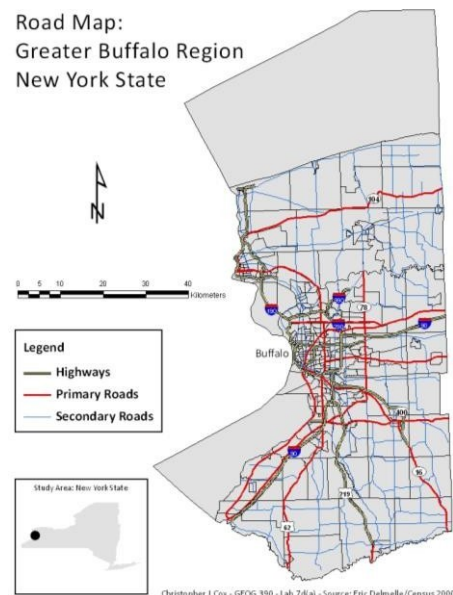
2.   Quantitative – flow mapping

For this exercise, you will work with street data from Erie County and Niagara County in Western NY. This data contains counts of **traffic** during a single – I do not recall on top of my head when the data was collected, so you don't have to worry about this at this point. The data is projected in UTM zone 17, NAD1983, with meter units.

The data is called **traffic** and contains traffic counts for all the streets. Since there are so many streets, we are only interested in plotting the important streets, namely interstates, expressways, principal arterials.

- Click "Select By Attributes" and perform the following query.
  "CODE" = 'RURAL INTERSTATE' OR "CODE" = 'EXPRESSWAY' OR "CODE" = 'INTERSTATE' OR "CODE" = 'PRINCIPAL ARTERIAL' OR "CODE" = 'RURAL PRINCIPAL ARTERIAL'
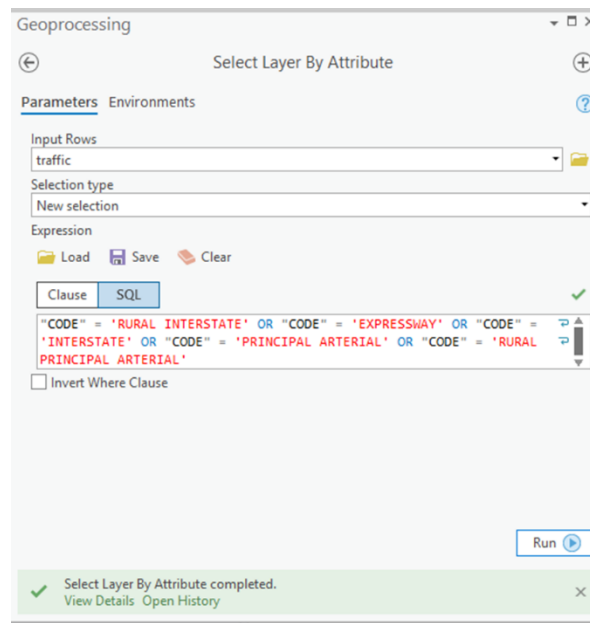
- Right click on the layer, and go under export features. Create a new shape file, - call it "extracted-roads.shp"- and save it within your working directory (make sure it is not temporary). Add it to the map.
- Next, under the symbology tab, go under categories and go under graduated symbol. Select an appropriate color scheme (red?), but also select an appropriate classification method. Additionally, select an appropriate min and max symbol size…you don't want to overload the map.
- Go under the initial layer called traffic.shp. Open the attribute table and clear the selection. Change the symbology to unique value, and select a very thin (.2) light-gray colored symbol for the background.
- Look at the map. The street network is in the back and the important roads, depicted by varying widths are displayed on top. Does the width of the road reflect what you found out in the previous exercise? Is there a correlation between traffic counts and road type…Are the highways getting the highest traffic counts?
- Explain your design choice and the difficulties you may have encountered.
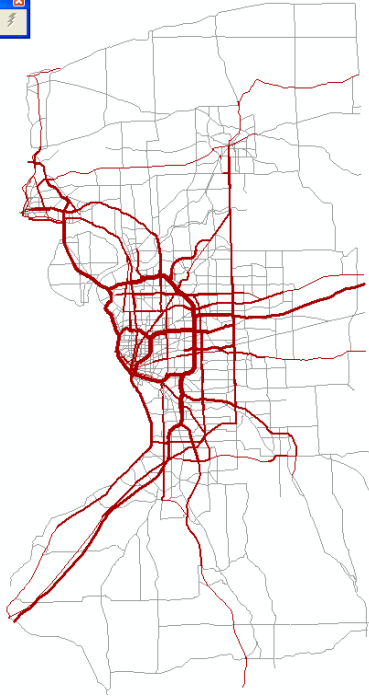
- Prepare a map (Insert>New Layout) and add a legend containing the traffic counts, but also the underlying street network.
- Be creative on the legend (see what types of legend we have seen in class). Add a scale bar, title; North arrow, etc…
- Export your map as a jpeg and include it into your word document. Explain the pattern that you see, your design choice and the difficulties you may have encountered.

How you will be graded:

You will be graded based on whether or not you follow all the instructions. Additionally, for each map you prepared, you include a small write-up on the pattern (no more than 2-3 lines for each section). Please also explaining your design decisions, the difficulties you may have encountered, etc…