Introduction to Geographic Information Systems (GIS)

Week 03

In this week’s exercise, we will look at demographic, economic, and social data for New York State. The assignment involves using existing maps and data that are available on the Internet. There is one video this week.

This week will also have a quiz. It has 10 objective style questions. The quiz is open book, but when you start it you must finish it. There are four quizzes throughout the semester. Quizzes are 30% of the course grade.

***Creating this week’s folder***

As indicated in assignment one, you should make sure your maps/projects are in a folder for the week with the correct folder path from the “root”.

1. Add to the directory structure described in the assignment for week02 for week03. Be sure to use the naming convention illustrated below:

For example, for me: c*: \farkas\week03*

1. When building your weekly exercise, place all data files in the folder for the current week

**IMPORTANT: The files must be in the directory structure above for me to see them when I copy them to my computer to look at your GIS models. The named folder must be your last name (instead of “farkas”).**

**Data Sources**

Many of the data sources we will use are in the public domain and free (most provided by government agencies. When we are interested in geographic features (e.g. roads, towns) which form the backdrop of other data we will place on the map the layers are called basemaps.

Some data has no geography associated with it, for example, average household income. However, if the data is presented as a table by state or county we can combine the data from a demographic (or other) table with a map that has geography. The process is called a “Join”.

In this week’s assignment, we use data from the American Community Service (demographic), And the U. S. Census Bureau Tigerline data. The video goes into more detail about basemaps, demographic data and data sources.

For this exercise, I’ve downloaded the data, cleaned it up, and posted it in Blackboard.

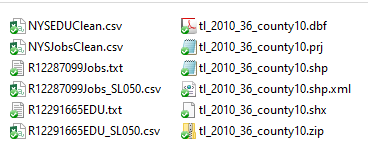
**Using layers and building basemaps**

1. I have downloaded statewide data for New York. There are 2 files:
   1. NYSJobsClean.csv – a file of job counts for different industries by county
   2. NYS
   3. tl\_2010\_36\_county10.zip – a New York State by county shapefile

NOTE. The Names come from the Census Bureau:

* tl – Tigerline
* 2010 – Year 2010
* 36 – New York State

1. Download from blackboard and unzip these files in your “week03” folder. You will see your zip files and some other files as well. Note the folder path as well.



1. Start ArcMap and create a new map
2. Using “Add Data” (from the file menu or toolbar icon “+”) add the statewide polygon shapefile (tl\_2010\_36\_county10.shp). You will get a message about spatial referencing. Just click ok (we’ll discuss this later). You should see a map of New York State.
3. Turn on the labels and you will see the county names: right click the layer name (tl\_2010\_36\_county10) and select “Label Features”. Turn them off since for now they “clutter” the map.
4. Rename the Layer “NYSCounties”

**Using data that isn’t in the map and is not georeferenced**

1. Using “Add Data” (or the yellow plus sign icon), add the Jobs data (*NYSJobsClean.csv:*
2. In ArcView 10.x, select the second icon at the top of the Table of Contents (List by Source).
3. Look at the attributes of the map (*right click the tl\_2010\_36\_county10 layer -> open attribute table*) and you will see a feature (row) for each county polygon and a field called *namelsad10.* This is the county name. Note it includes the word “county”.
4. Notice also in the attribute data there is very little data. We would need a “Data Dictionary” to interpret the attribute names.
5. For this exercise, you will have to use the Data Dictionary at the end of this document.
6. Close this attribute table.
7. Look at the attributes of the NYSJobsClean table (*right click -> open*) and you will also see a feature for each county and a field called *Geo\_Name.*
8. Looking at the Data Dictionary at the end of this document, note that the attributes are the Jobs data associated with different industries and that the table data has no geometry (or location) associated with it. We are going to “join” it to the NYS county map. Close the attribute table.
   1. right mouse click on the map county layer and choose “joins and relates”
   2. select join
   3. Fill in the dialog box:
      1. *namelsad10*
      2. NYSJobsClean.csv
      3. *Geo\_Name*
   4. Note we are using a database operation and joining the two attribute tables around a name field. Their entries must be identical although the attribute name can be different.
   5. Select ok (if it asks to create an index click ok/yes).
   6. Check that the tables have been joined by right clicking the county map layer and looking at the attribute table. You should see all the attributes from both the county and data files.
9. Save the map in your week03 folder (File->Save) and give it the name *yourlastnameNYSAllCounties.mxd*.

**Creating Color-Coded Maps (Choropleth)**

1. Let’s change the *symbology* to display jobs counts in the information industry for counties:
   1. Right mouse click on the county map layer, click on *Properties*, and go to the *Symbology* tab.
   2. In the Show pane on the left select Quantities->Graduated Colors
   3. In the Value Fields pane (in the center) select the Information Industries attribute:
   4. Look up the attribute name for Information in the Data Dictionary at the end of this write -up. We see it is B001\_007).
   5. In the Normalization pull-down menu select the total number of jobs (B007\_001) which is the total number of jobs.. This way we get a percentage which is a better representation of the distribution.
   6. The “classes” field should be 5.
   7. Select “OK”
   8. Save the map
   9. Can you tell from the color coded map which counties have the highest percentatage employees in the information industries? Look at the legend in the Table of Contents panel on the left.
   10. In the table of contents, change the Attribute description to something more meaningful: “Information Industries”

**Preparing the map for presentation/publishing**.

1. Choose the “Layout View” from the View menu item at the top.
2. Change the layout to Landscape:
   1. Find the “Change Layout” icon at the top. You can move your mouse over the different icons and it will identify itself.
   2. Click the icon, select the“North American (ANSI) page sizes” tab and select a template, “ISO A4 Landscape mxd” (in earlier versions the selection is ““Letter (ANSI A) Landscape.mxd”
   3. Select Finish
   4. You may want to use the Zoom tool to enlarge the map.
3. From the “Insert” menu add a title, legend and North Arrow and scale bar (we did this in a previous exerciswe). Note that after the item is entered, you may have to move it (left mouse click down, move, mouse click up)
   1. Important. Your title should include your name and date. For example:

*Information Industry Employees*

*Author: Daniel Farkas*

*September, 2019*

1. Export the map as a “jpeg” (yourlastname*NYSInformationJobs.jpeg)*
2. Save the map (File->Save). Third icon from in the top is also save.

**Creating another layer with different values**

1. Go back to the “Data” view (View->Data View)
2. Right click on the layer and select copy.
3. Right click on the “Layers” heading and click paste. You will have another identical layer.
4. Turn off the original layer.
5. Decide on a different attribute to display using the Data Dictionary at the end of this write-up.
6. In the new (copied) layer choose select the new attribute to display using Properties->Symbology->*graduated color* symbology. Normalization should still be with the total jobs for that sector (B007\_001).
7. Rename this layer from “Information…” to the new attribute you are displaying e.g. Retail, Management – it’s ok to abbreviate).
8. Make this layer the current one (turn off the previous layer), create a map (with title, north arrow, legend and scale bar) as above and export as a “jpeg” (yourlastname*NYSjobtype.jpeg*.
9. NOTE: You have to change the title and add a new Legend to reflect the different attribute you are using.
10. File->Save the map.

**Creating a layered PDF**

1. For your new layer, turn on the layer of your map with new Attribute (turn off other layers). Export the map, but instead of exporting as a “jpeg”, select export as a PDF. Give the name of the pdf: *yourlastnameNYSInformationJobs.pdf*

**Gathering existing data and creating the maps on your own**

1. Create a new map (File -> New).
2. Switch to “Data View”
3. Create maps which show
   1. The distribution in the different New York State counties of highest degree achieved for Bachelor, Master, and Doctorate degrees in the over 25 population
   2. You will have layers and export 3 maps.
4. Each will be a different map layer (NYSBach, NYSMast, NYSDoc).
   * 1. Reload the NYS County map (tl\_2010\_36\_county10)
     2. Add the Education table (NYSEDUClean.csv)
     3. Join the Education table to the NYS Counties layer. The join field are the same as in the Jobs map.
     4. Copy the joined table layer and paste twice (you now have 3 identical, joined layers)
     5. It would be a good time, right after the copies to rename the layers (Total Bachelors, Total Masters, Total Doctoral.
     6. Look up the attribute names for Bachelor, Master and Doctorate in the Data Dictionary at the end of the assignment.
     7. Use symbology (Properties->Symbology->Graduate to display the bachelor, master, doctoral distributions in each separate layer. For example, for Total Bachelors:
        1. Turn off Masters and Doctoral layers
        2. Set the symbology. Properties->Symbology Tab ->Quantities->Graduated Colors->Field Value-> A12002\_005; Set classes to 5.
        3. Set Normalization to the total population: “A12002\_001
        4. In Layout mode:
           1. Change to Landscape mode if not already set (see above)
           2. Add a Title, Legend, and North Arrow, Scale Bar.
        5. Save the map
        6. Export as jpeg (NYSBach.jpeg)
        7. Save the map.
     8. Repeat the steps for Masters and Doctoral making sure you modify the layer names and the title when exporting as jpegs.
     9. In total, you will create and export maps as JPEGs 3 times with each different layer turned on and the others turned off with titles, legend, scalebar and north arrow.
     10. AGAIN NOTE: before each export you have to change the Title and the Legend

**What to submit this week (Due 9/24/2019, 1 day grace period).**

1. Create a **single** word file with images of your maps. Put each image on a separate page and label or title the page with which map it is. If you have correctly created the title for the map, that will be sufficient (Title, your name, Date).

Basic assignment

* + 1. yourlastname*NYSInformationJobs.jpeg*
    2. yourlastnameNYS*YourAttributeSelection*.jpeg

Education assignment

* + 1. NYSBach.jpeg
    2. NYSMast.jpeg
    3. NYSDoc.jpeg

1. **Important**. Place your word documents in the Assignment link in this week’s folder. Use our standard name for files. For example: *Yourlastname*-Week03-NYSImages.doc

*NOTE: don’t put the “jpegs” by themselves. Place them in the word document.*

Add the jobs PDF to the Assignment link.

1. Take the quiz. (The quiz link will not be available after Wednesday, 9/24)

Data Dictionary: NYS Jobs by Sector

1. B007\_001: Total Number of Jobs
2. B007\_002: Total Number of Jobs: NAICS Sector 11 (Agriculture, Forestry, Fishing and Hunting)
3. B007\_003: Total Number of Jobs: NAICS Sector 21 (Mining, Quarrying, and Oil and Gas Extraction)
4. B007\_004: Total Number of Jobs: NAICS Sector 22 (Utilities)
5. B007\_005: Total Number of Jobs: NAICS Sector 23 (Construction)
6. B007\_006: Total Number of Jobs: NAICS Sector 31-33 (Manufacturing)
7. B007\_007: Total Number of Jobs: NAICS Sector 42 (Wholesale Trade)
8. B007\_008: Total Number of Jobs: NAICS Sector 44-45 (Retail Trade)
9. B007\_009: Total Number of Jobs: NAICS Sector 48-49 (Transportation and Warehousing)
10. B007\_010: Total Number of Jobs: NAICS Sector 51 (Information)
11. B007\_011: Total Number of Jobs: NAICS Sector 52 (Finance and Insurance)
12. B007\_012: Total Number of Jobs: NAICS Sector 53 (Real Estate and Rental and Leasing)
13. B007\_013: Total Number of Jobs: NAICS Sector 54 (Professional, Scientific, and Technical Services)
14. B007\_014: Total Number of Jobs: NAICS Sector 55 (Management of Companies and Enterprises)
15. B007\_015: Total Number of Jobs: NAICS Sector 56 (Administrative and Support and Waste Management and Remediation Services)
16. B007\_016: Total Number of Jobs: NAICS Sector 61 (Educational Services)
17. B007\_017: Total Number of Jobs: NAICS Sector 62 (Health Care and Social Assistance)
18. B007\_018: Total Number of Jobs: NAICS Sector 71 (Arts, Entertainment, and Recreation)
19. B007\_019: Total Number of Jobs: NAICS Sector 72 (Accommodation and Food Services)
20. B007\_020: Total Number of Jobs: NAICS Sector 81 (Other Services [Except Public Administration])
21. B007\_021: Total Number of Jobs: NAICS Sector 92 (Public Administration)

Data Dictionary: Highest Educational Attainment for Population 25 Years and Over

1. Highest Educational Attainment for Population 25 Years and Over

Universe: Population 25 Years and Over

Name: A12002

Variables:

A12002\_001: Population 25 Years and Over:

A12002\_002: Less than High School

A12002\_003: High School Graduate or More (Includes Equivalency)

A12002\_004: Some College or More

A12002\_005: Bachelor's Degree or More

A12002\_006: Master's Degree or More

A12002\_007: Professional School Degree or More

A12002\_008: Doctorate Degree