CEEN 114

Edited 1/2018

Lab 4- Introduction to GIS/ArcMap

Summary

In previous labs, you collected spatial data and performed computations manually. The surveying and computation techniques you practiced are the original method for mapping and spatial analysis. As technology improved, including the expansion of computing power and GPS, engineers developed methods for performing these calculations automatically. While more advanced, the computer performs computations similar to these.

You will submit your work for this lab by creating a pdf that contains only the requested deliverables information. It should be well organized and easy to understand. If you need help saving a PDF, see a TA. You will also need to submit screenshots of the data you capture. It is preferable that you use the snipping tool, an application built-in to Windows. If you are uncomfortable taking screenshots, ask a TA.

The skills learned in this lab are fundamental to the rest of the class. You may want to save this lab and the answers for reference later in the semester.

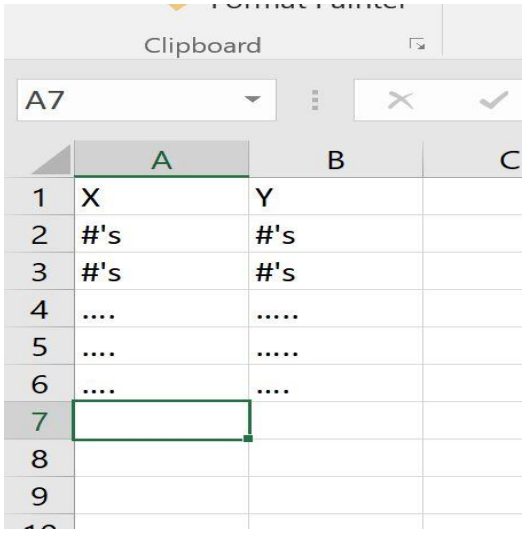
Goals for lab

1. Visualize your traverse coordinates in ArcMap
2. View various spatial datasets in different formats
3. Learn the layout of ArcMap.
4. Use some of the tools in ArcMap

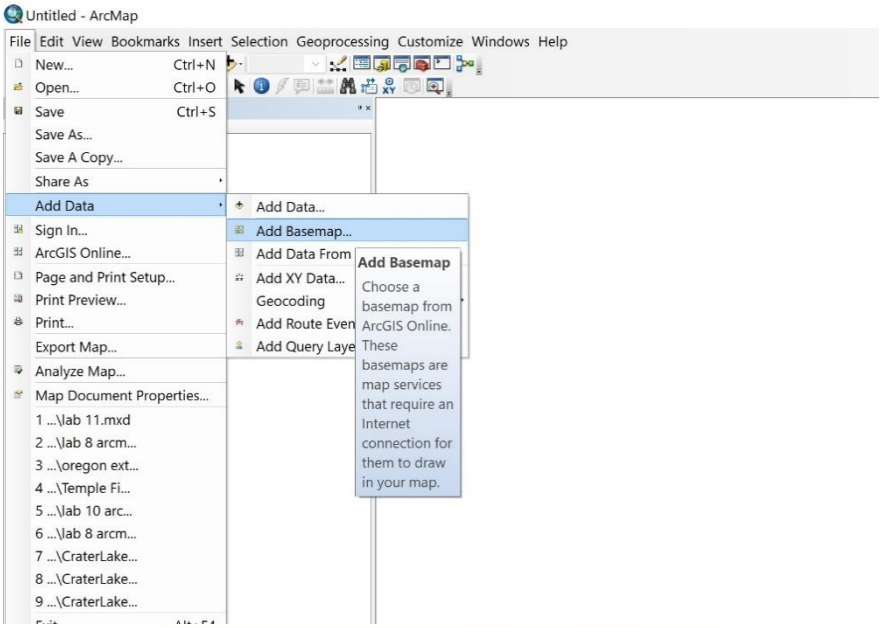
Create and Visualize a Dataset for your Traverse (XY data)

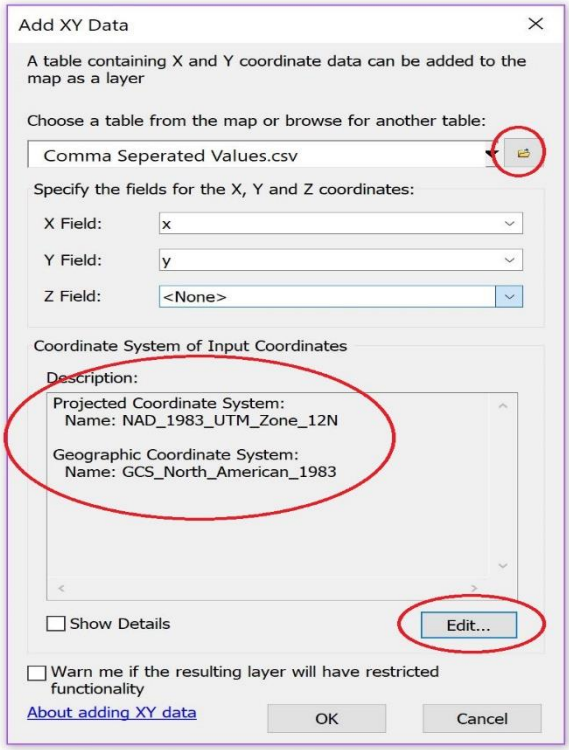
Data Points may be entered as x,y coordinates into ArcMap. A spreadsheet program, such as Excel, can save these coordinate pairs in a csv file (comma separated values).

1. Open Microsoft Excel. Create a table using the following format. In the place of the number symbols, enter the northing and easting coordinates that you got out of your last steps in the previous lab.



2. Save the file as a "comma separated values" file. Do this by clicking file -> save as -> change the file type to comma separated values .csv. You should name the file traverse coordinates. You should save this file in a folder on the D:/ drive of your computer if you are in a CAEDM lab. If you are on a personal computer, you should save this file in a folder named lab 4 in your My Documents folder.
3. Open ArcMap and start a new map project.
4. Save your new project in the same folder with your CSV file. The ArcMap project file will have the extension ".mxd".
5. ArcMap doesn't search through all of your files to find GIS data. You need to specify where to look. On the right hand pane of ArcMap is a navigation pane labeled ArcCatalog (if the catalog pane is not visible on your screen, go to the "window" tab of the top bar then select "catalog"). The icon 3rd from the right is called "Connect to Folder." Click "Connect to Folder" and select the folder containing csv file you just created and press the blue OK button.
6. Navigate to File -> Add Data -> Add Basemap. Choose the top-left map labeled Imagery.
7. Navigate to File -> Add Data -> Add XY Data. Where it asks you to choose a table, use the drop down menu or file browser to choose the file labeled "comma separated values.csv" from the Lab 4 Data folder you downloaded. It should be visible under the "Folder Connections" category. Next press the edit button and choose Projected Coordinate Systems -> UTM -> NAD 1983-> Zone 12N. Press OK.





8. Your traverse should now be visible on the screen. If you do not see your points, find the entry called "traverse coordinates.csv" on the left side of your screen under the table of contents. Right click on the layer and click zoom to layer. If your points are in the wrong location, you either made a math mistake last lab or else you entered them incorrectly into the csv file. You can repeat the previous steps to correct the mistakes.

9. On LearningSuite, download the zipped folder of data called "Intro to GIS/ArcMap Data." It is located with this lab document. Unzip the data and store it in the same folder you stored your csv file in.
10. Repeat step 6 except use the csv file called "mystery points.csv"

Inspecting GIS data

You should now have two sets of coordinates visible on your ArcMap project. Now that your data has been digitized, you can repeat some of the measurements you made with the total station.

1. Toward the top left of your screen is a button named geoprocessing. Under that is a tool called measure. It looks like a ruler and an arrow. Click on the symbol to open the tool. A dialog box should open on your screen. Change the settings using that box to change the distance units to feet. You can choose plane rather than geodesic distance.
2. You can click between various points to collect distances.
3. Measure the distance between the two mystery points provided to you.
4. Measure the distance between the points of your traverse. Compare them to the measurements you made with your total station.
5. Make other measurements and explore this tool such as: distance between the Clyde and your apartment, between the Wilk and LaVell Edwards stadium. Distance from your apartment to your home town, etc.

Adding Data Layers

GIS programs divide the data you add into different 'layers' to be organized. A data layer could contain a point, a polyline, or a polygon. One of the most important features of GIS is its ability to take different 'layers' of data and compare their spatial and attribute properties with others. Sometimes, you create the layers yourself by means of GPS or surveying as you did in the XY data section. Most often, you will use data from curated catalogs from online sources. This data is saved as a SHP (or 'shape' file), a LYR (or 'layer' file) or a GDB (geodatabase).

1. In the catalog menu on the right of your screen, navigate to the lab 4 folder containing all your data.
2. Find the shape file called "nps_boundary.shp". Click and drag that file from the Catalog to the Table of Contents. Be sure you do not drop the file underneath the layer that says basemap.
3. This is a larger data file so it may take a moment to process all the data.

Inspecting Attribute Tables

Data in a GIS program is either a Point, Polyline, or Polygon. These are geographical locations whose position is recorded and presented in ArcMap. There is much more to know about a place than simply its location. If you are surveying a mountain or valley, you are probably also interested in the elevation at all of the points you record. If you are in a desert, yearly rainfall at a variety of locations might influence where you build a town. This is information that can be added to you file in addition to the spatial location. That information is visible in what is known as an attribute table.

1. Right click on the layer "nps_boundary.shp" Select View Attribute Table. You can see several columns representing data for each park.
2. You can toggle which column to sort the data with by clicking on the top of the column. Try to find all the parks in California just by sorting the column and scrolling through the data.

Searching the Attribute table

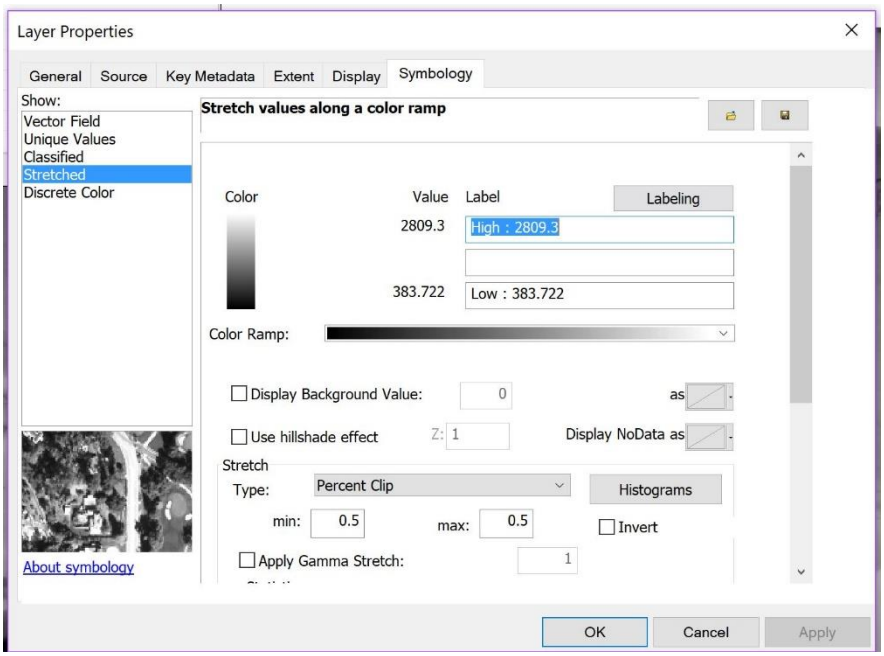
Suppose you wanted to perform more complicated searches of data. If you wanted to search through this data set, you would have to look through hundreds of rows of data, each with over a dozen columns of values. That means you might have search thousands of cells to find the attributes you need. There are a few ways to search this table that is faster.

1. Reopen the attribute table for "nps_boundary.shp."
2. On the top toolbar, open the selection menu then 'select by attributes'
3. Make sure the proper layer is chosen in the top of the box.
4. To ensure you use the correct language for the query, use the buttons available in the interface. You can type your queries manually using SQL but you can save lots of time by using the shortcuts.
5. To use this tool, double click one of the attributes from the box, select the = box, press get unique values. Pick the unique value. Press apply. Scroll through the attribute table, notice that all the features that met your qualifications were highlighted. Ex: query might look be 'state = NY' and all the parks in NY would be highlighted.
6. Make 5 queries using this format. To see them on the table, you can scroll through to find the highlighted ones. To see them on the map, right click on the nps_boundaries layer and click selection -> zoom to selected features. Use the identify tool and the basemap imagery to help you identify the places outlined.

Raster Data Sets

In your readings, you learned that a Raster is a grid of information. Each cell of the grid holds a single piece of information about the geographical space represented by the cell. Some of the most common uses of raster data sets are showing elevation and rainfall. We will visualize some elevation data for the Grand Canyon park boundaries we just found.

1. In the lab 4 data file, add the file labeled "Grand Canyon elevation raster" to your project by clicking and dragging the file onto the table of contents column.
2. You may need to right click on the layer and press "zoom to layer." You may need to turn of the imagery basemap layer and/or the nps_boundary layer to see the elevation data.
3. In the table of contents, right click on the layer and select properties. Choose the symbology tab. Here, you can change the color scheme the program uses to interpret the data by changing the drop down menu labeled "color ramp."
4. For ease in this example, choose the color scheme that goes between black and white.



The Identify Tool

Raster Data sets do not show their attributes in a table the same way as vector data. A raster is a large grid of information. Each cell of the grid contains a single value. You can assign a color gradient, like the black to white scale your just chose, to visually inspect the data. Another way you can inspect this data is to use the identify tool.

1. On the tool bar on the top of the screen, choose the Identify tool (blue circle with a white i).
2. Click anywhere on the raster data set (resize the box that shows up so the map is still visible). In the window that appears, a number will show up under the name of the layer that tells the elevation in feet.
3. Click several places around the raster and the window will automatically update.

Deliverables and Rubric:

Submit the screenshots, the questions, and your answers using a separate document. Do not include any portion of this lab document or the rubric. Submit the screenshots in the order they are listed and numbered as indicated. Copy the questions and type your answers beneath each question.

Screenshots

1. Screenshot of the XY data points of your traverse AND the mystery points, in the correct place on the map, with a basemap beneath them.
2. Screenshot of the Grand Canyon Boundaries highlighted (from the nps_boundary layer).
3. Screenshot with both the Raster data set and the identify tool information visible.
4. Screenshot of all the parks in Utah highlighted using the select by attribute tool.

Questions:

1. Using the Identify tool, give a range of possible elevation values for a) the lower right and b) the upper left corner of the raster. (2 points)
2. Give the names of the first 4 columns in the attribute table of the nps_boundary.shp layer. (2 points)
3. According to this data layer, how many National Parks are in Georgia? Name their FID numbers (all entries in this data file are considered national parks) (2 points)
4. What is the name of the window that shows you the layers being used on your current map project? What is the name of the window you use to organize data files and add them to a map document? (2 points)
5. How many parks are in the nps_boundary.shp layer? (compare the smallest and largest FID #) (1 point)
6. What is the distance between the two mystery points in the csv file provided? (1 point)
7. Measure the distance between the points of your traverse. Do the numbers from the computer match the numbers from your measurements last week? Why or why not? (2 points)
8. What 5 queries did you make? Copy the queries and list how many results came out of the query. (2 points)

Item	**Value**
Screenshots	4/screenshot
Questions	14 total
	Total/30