

Introduction to GIS for Social and Environmental Analysis (CITY201)

Lab 1: Introduction to ArcGIS

Purpose of the lab:

To introduce the ArcGIS software package and its basic data management, display, and analysis components.

Before you begin:

If you are using Apporto or LabStats, log into those systems first, then continue from within the Apporto or LabStats environment. Use a web browser to go to our course Moodle page and go to the ASSIGNMENT INSTRUCTIONS section. Click on the Lab Data set 1 link to open a download window. DON'T click on the folder labeled "201_Lab-Data_Sp20_1". Instead, stretch the window large enough so that you see a button labeled "Download". Click the download button. Wait for the download to finish. Select the zipped folder (just highlight it – don't open it) and click "Extract All." Extract to where you will remember it and can work from. I recommend that you keep 1 copy of the downloaded data in a "Downloaded Data" folder, and do not work with this copy. Then duplicate the data folder into a Lab 1 folder that you will work from. If you see a folder named "_MACOSX" you can delete it – this is an artefact of how I uploaded the data to Moodle from a mac.

1. Exploring Data Management

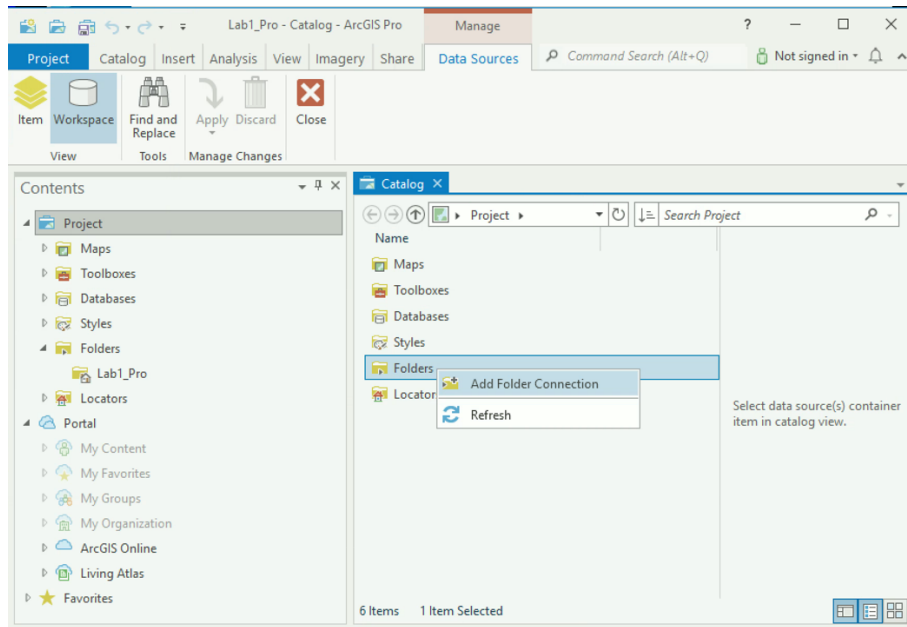
One of the most important things to remember is that you should **never ever ever** use Windows File Manager to move around data and map files. **Do ALL of your data management within the ArcGIS environment.**

ArcGIS has a data management tool within the program called Catalog. It is similar to 'My Computer' or 'File Manager' in Windows but is customized for managing geospatial data.

First, open ArcGIS Pro and select Catalog from under Blank Templates. It immediately prompts you to create a new project. Pick a name for your Project (like Lab1) and use the folder icon to navigate to the folder where you want to store this project.

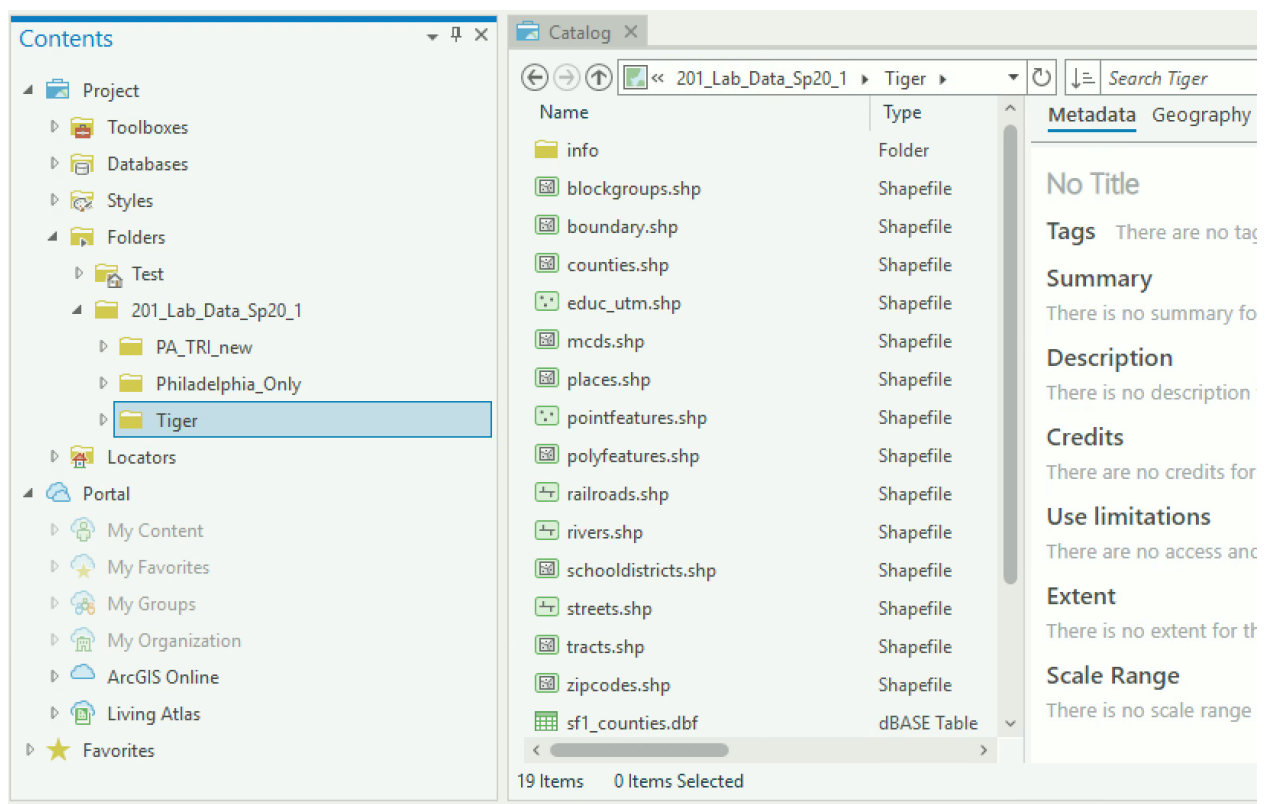
When you start with Catalog (instead of Map), then Catalog View appears in the middle of your screen (instead of a Map view). On the left side of the screen folders and data files appear. On the right side of the screen information about individual data files appear. For now, we don't need the Symbology Pane, so use the X to close that pane.

Now we're going to navigate to view some data. **Right click on Folders and Select Add Folder Connection.**

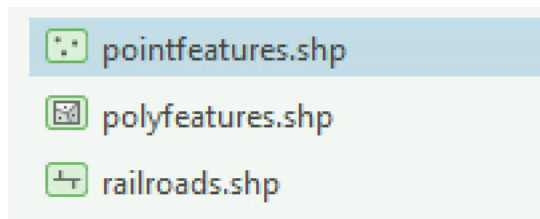


Navigate to the folder that has your data. Select that folder in the left pane (don't double click – just highlight it), then say OK. Use the tringle to expand the Folders list, and you should see your data folder.

Once you are connected, navigate to the subfolder named Tiger and expand it in the Contents Pane so that you can view all files within the folder in the Catalog Pane.

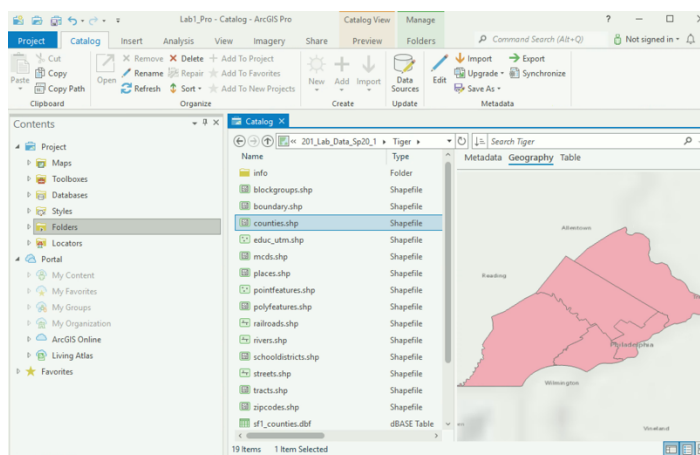


Note the different graphic symbols for different types of files. There are point, line, and polygon files in the shapefile format, as well as tabular files. As you will see, most GIS data are encoded geometrically as sets of either points, lines, or polygons. We will learn more about different file formats later.



Select the “counties” file in the Catalog Pane. Note the three tabs on the right side of the window (Metadata, Geography, Table). Click through each one to explore.

Click on the “Geography” tab. You should see a map of the southeastern Pennsylvania counties appear on the right side of the window, like this:

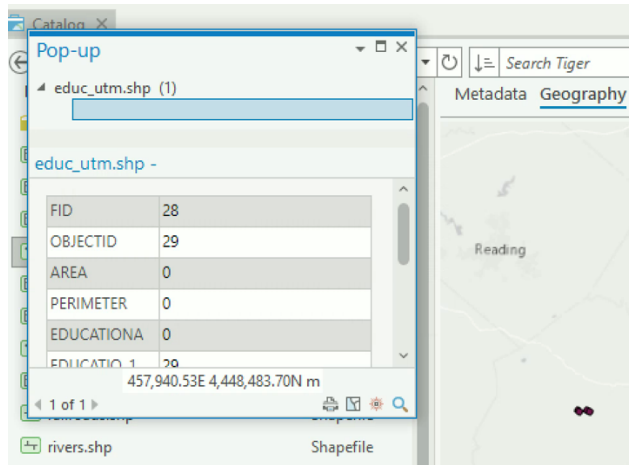


This is the spatial data part of the shapefile, displayed as a map. When you switch to the Table tab, you see the attribute data part of the shapefile, displayed as a table. Scroll to the right to see the full table. Note that each row in the table represents one county.

Now bring up the Geography Preview of the Tiger\streets shapefile. This is a line shapefile. You can use the mouse scroll button to zoom in closer and then zoom out again on the preview. You can also hold down the left click button until the hand appears and then pan around the preview..

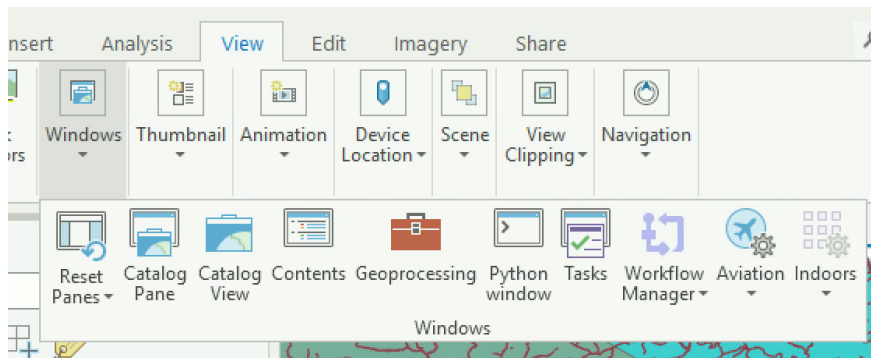
Now bring up the Geography Preview of the Tiger\educ_utm. This is a point coverage.

Use your mouse to click on one of the points. You will see information about this point in a pop-up window. This is the same information you would find in the Table for the row connected to that point.



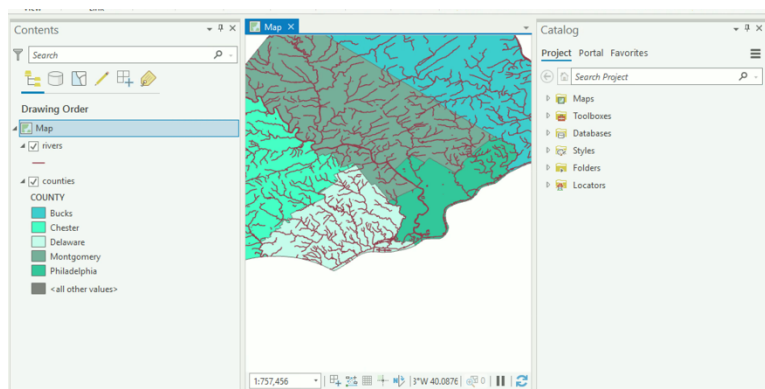
Catalog Pane versus Catalog View

ArcGIS has two different ways to view Catalog tools. If you click on the View tab at the top of the ArcGIS window, you will see a toolbar with a Windows button. When you click the arrow to open the options under the Windows button, two of the options you see are Catalog Pane and Catalog View.

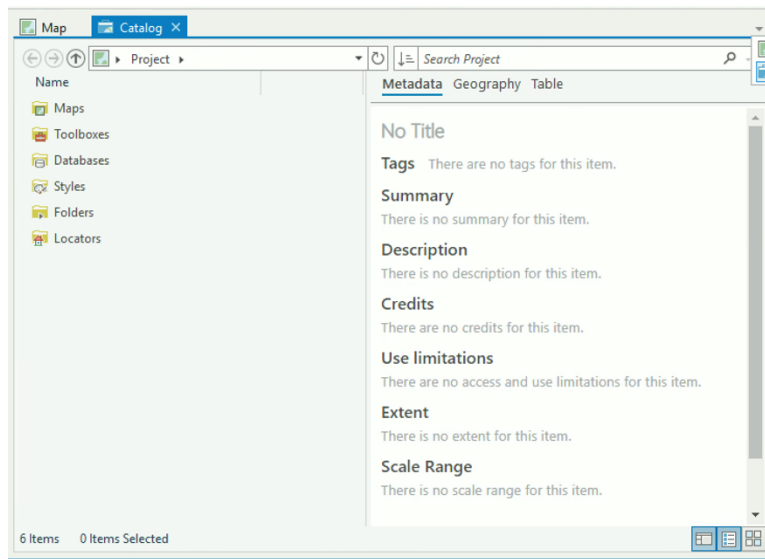


The Catalog Pane and the Catalog View are geared towards different tasks. In general, use the Catalog Pane to browse data and do some simple data management while working with a map. The Catalog View provides a rich experience for exploring and managing items without having to add them to a map or scene.

Catalog Pane (shows up to the right of the map Pane):



Catalog View (shows up in the center as a tab in the same place with the Map tab):



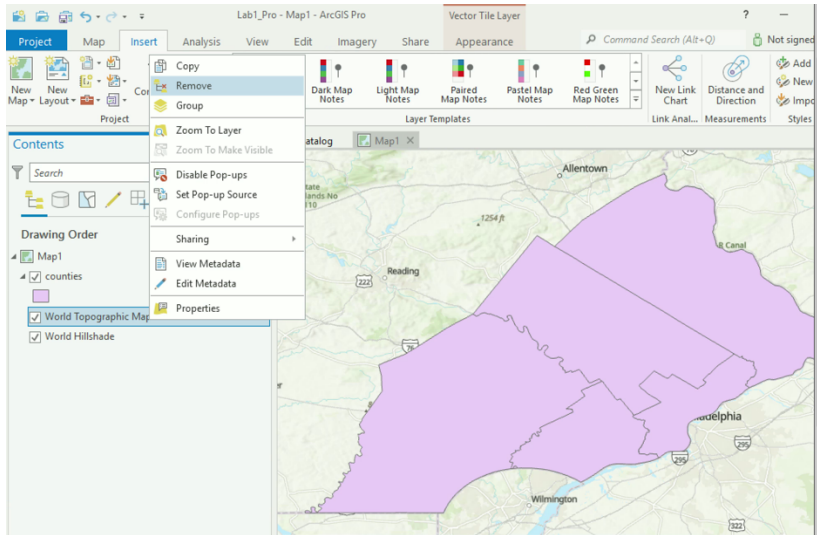
Data Dictionary

Using the **Windows File Manager** application (the folder icon you open to browse and manage files), open and browse the DataDictionary.doc file in the Cities 201_Data folder. This file lists each of the files in the Cities 201_Data folder and offers a brief explanation of its content. **You will need this file throughout the semester to figure out which data layers you need to use for different tasks.** Using the data dictionary as a guide, use ArcCatalog to explore some of the other shapefiles in the Tiger folder, or any of the other data in the Cities 201_Data folders.

2. Displaying Data in ArcMap

Now that you have a folder connection to your data folder, you can add data to your Project file.

There are multiple ways to add data to your map. We will try two of them. First, make sure you have a map pane open in the center of your screen. If you do not, go to the Insert tab and click New Map. When ArcGIS Pro opens a new map, by default it adds the World Topographic and World Hillshade layers. This is super annoying because we don't need these layers, and they chew up processing speed every time you try to do anything on the map. So let's remove them. Right click on the layer you don't want in the Contents Pane and then select Remove from the menu. Do that for both files.

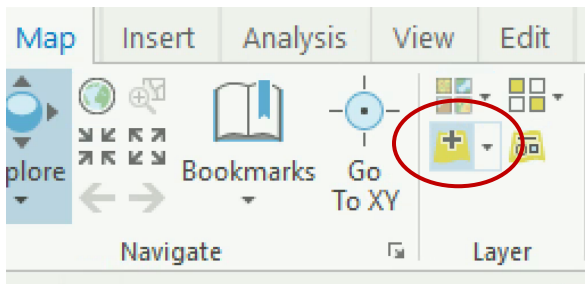


Add Data via Drag & Drop

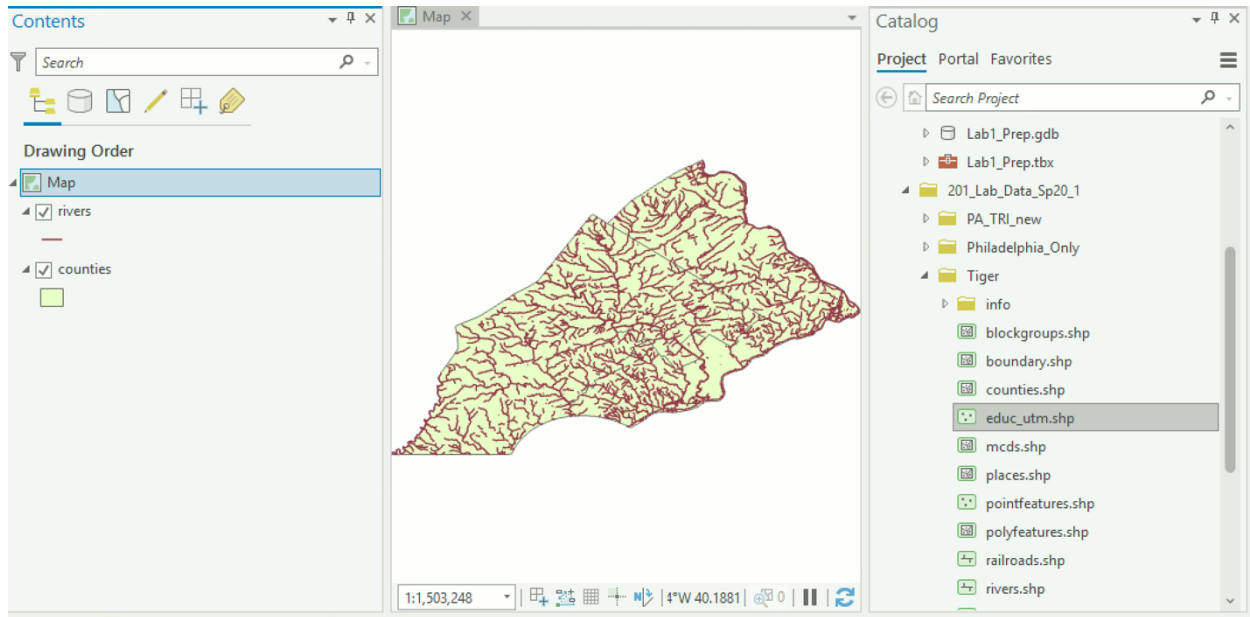
Next, make sure the Catalog Pane is open on the right side of your screen. Navigate until the Tiger folder is open and you can see individual data layers. Drag and drop \Tiger\counties from the Catalog Pane into the Map Pane. The data layer is now displayed on the Map and in the Contents Pane.

Add Data via Add Data Button

Another way to add data to your map is to use the Add Data button in the Layer collection on the Map tab toolbar. Use this button to add the rivers shapefile. If a warning appears when you drop the rivers file, ignore it and click ok.



Your screen should look something like this (your colors might be different):



Turn the rivers layer off and on by clicking on the check mark in the Table of Contents. The order of the shapefiles in the Table of Contents determines the order in which they are layered in the view window. Click the List by Drawing Order button at the top left of the Table of Contents. With both shapefiles turned on, drag the counties shapefile above the rivers in the Table of Contents. See how the rivers shapefile is visually obscured in the view window by the counties.

3. Selection in ArcMap

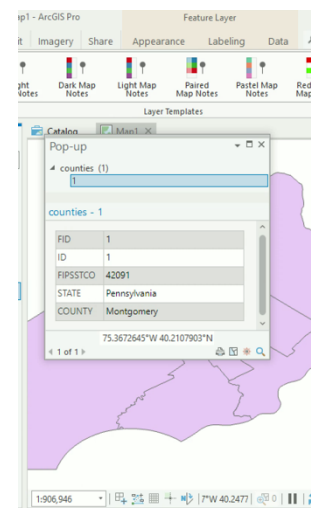
You can retrieve attribute data for any feature in a spatial data layer by using the “Identify” function. Hover over any county and then click on any county shape to retrieve information on that county. You may need to turn off your rivers layer so that the click will reach the counties layer.

Open the attribute table for the counties shapefile by right clicking counties in the Table of Contents and choosing “Attribute Table.”

The ***spatial data and attribute data are linked together***. Arrange your windows so you can see the counties map and attribute table at the same time.

Select with Select Features Button

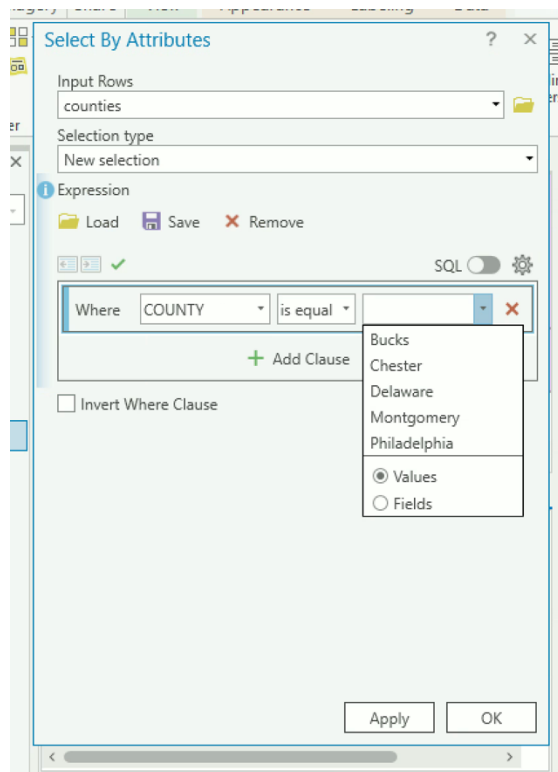
Choose the “Select Features” button with the arrow and the half blue square from the toolbar and click on a county in the view window. The county’s outline should turn blue, indicating it has been selected, and the appropriate row in the attribute table should also turn blue. Select multiple counties in the view window by clicking and



dragging a box with the “Select Features” button. Likewise, you can select a row in the table by clicking on the far left of that row, and the appropriate county in the map will also be selected.

Select by Attribute Query

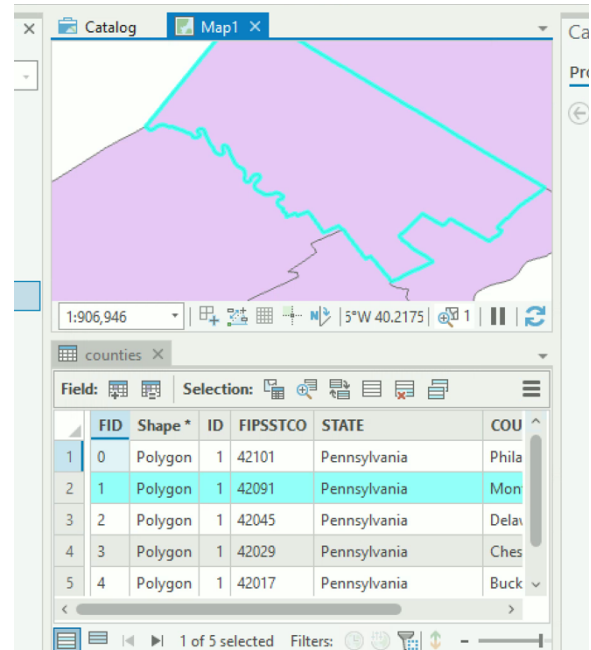
Selection can also be by an attribute query. Click the “Select by Attributes” button at the top of the Table window to open a dialog box. By double clicking the words and buttons in the calculator-like interface enter the expression "COUNTY" = 'Delaware'. Your screen should look something like this:

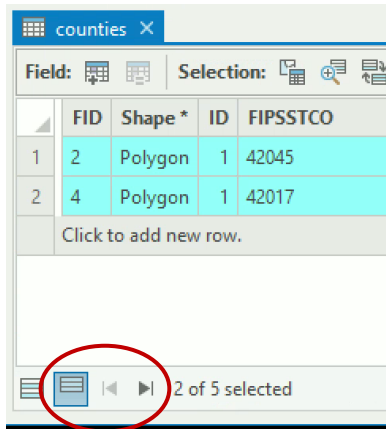


Press the “Apply” button. Now, Delaware County is selected. If you press “OK,” it does the “Apply” action and closes the dialog box window.

You can also create a compound query by using ‘or’ or ‘and’. Click the ‘Add Clause’ button and try the expression "COUNTY" = 'Delaware' OR "COUNTY" = 'Bucks' to select those two counties.

To show only those counties that are selected in the attribute table, press the Show Selected button at the bottom of the attribute table window.



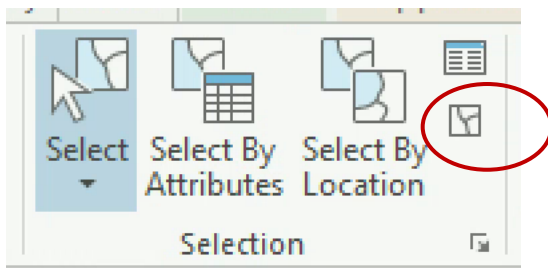


	FID	Shape *	ID	FIPSSTCO
1	2	Polygon	1	42045
2	4	Polygon	1	42017

Click to add new row.

2 of 5 selected

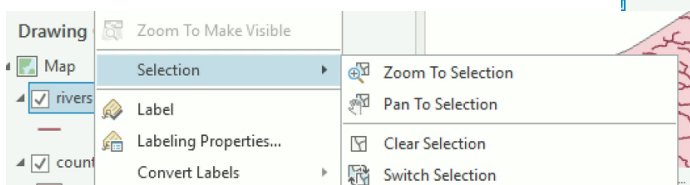
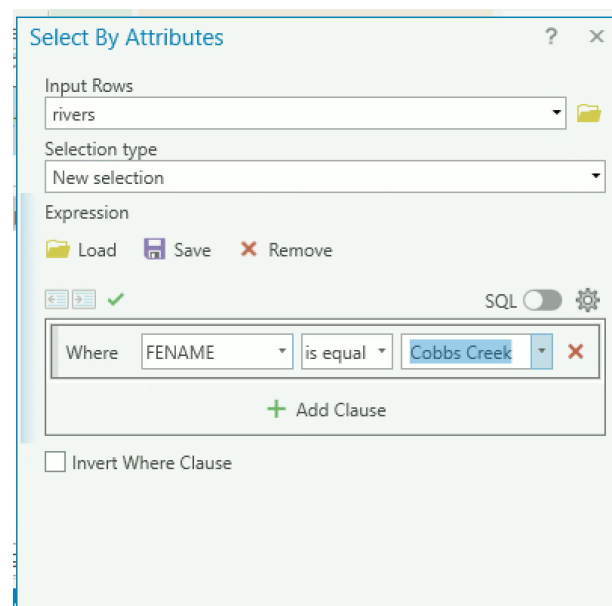
Close the “Select by Attribute” and the Table windows. Clear your selection by going to the “Selection” menu item in the main ArcMap window and choosing “Clear Selected Features” from the drop down menu.



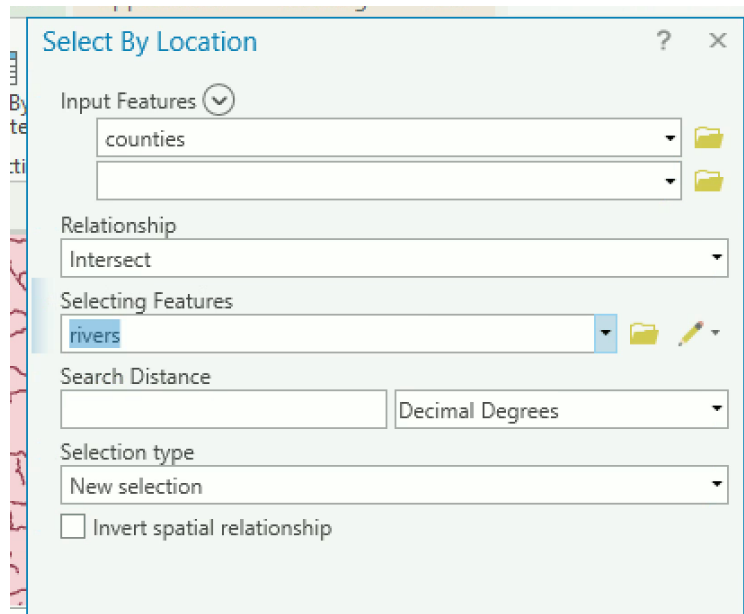
Select by Location Query (Spatial Query)

Selection can also be performed using a spatial query. First we start with an attribute query to select those rivers where "FENAME" = 'Cobbs Creek'.

Once the query has run, right click on the rivers layer in the Contents Pane and choose Selection → Zoom to Selection. Now you have a close-up view of the selected creek.



Now go to the “Selection” drop down menu and choose “Select by Location”. Choose the drop down list options as follows:



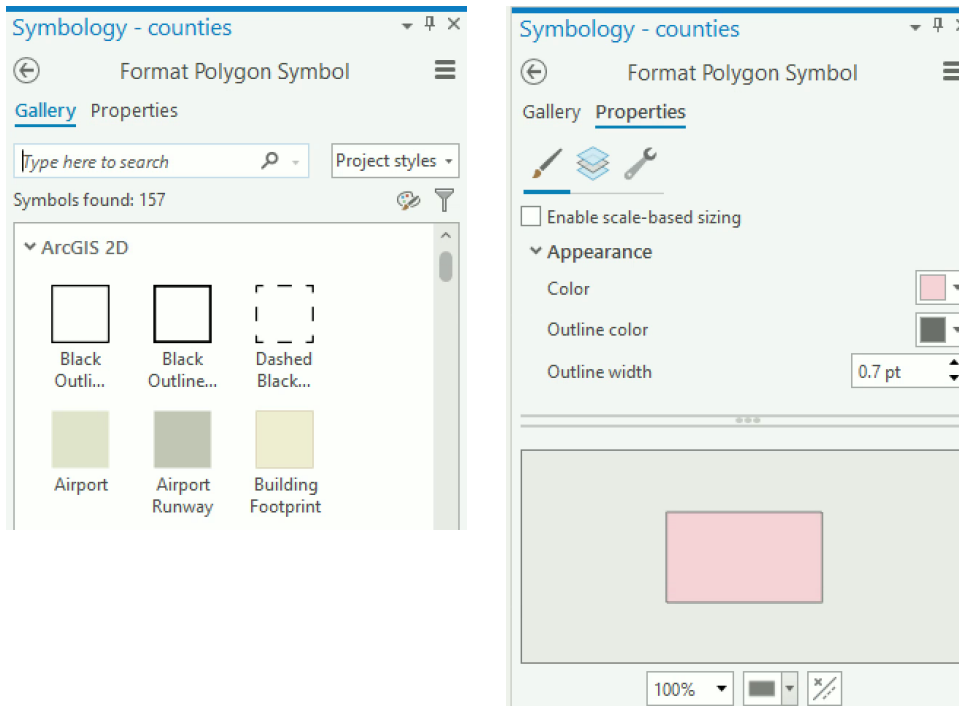
Press the “OK” button. Only those counties that are spatially coincident with, or spatially intersect, Cobbs Creek, are now selected.

Clear your selections and close the spatial query window.

4. Controlling Symbolology in ArcMap

Changing the Color – Single Symbol

Right click the counties shapefile and choose “Symbology” from the drop down menu. A new Pane opens on the right side of your window. Change the color of all of the counties by clicking on the large colored button. You can choose from pre-selected options on the Gallery tab or you can click the Properties tab to get even more options. Note that you can change the fill color, outline color, and outline line weights.



Changing to Unique Values

Now click the back arrow at the top of the Symbology pane to get back to the main screen. This time, click on the drop down arrow to the right of “Single Symbol” and select “Unique Values.” Under the Field 1 drop down, choose COUNTY. The map should now show a unique color for each county. Explore the options under the drop down arrow for Color scheme.

5. Screen capture

For all labs this semester, you will need to use screen capture or ArcGIS export functions to capture image records of your maps or tables to put into your lab report. For this lab, we will use screen capture.

ON WINDOWS MACHINES:

1. Snipping Tool – lets you select the area of the screen to capture

The Snipping Tool has been delisted from the list of apps from the Start menu, but it's easily accessible via the search bar. Click the **New** button to begin the screenshot process. The default snip type is a rectangular snip, but you can also take free-form, full-screen and window snips. The Snipping Tool does not automatically save your screenshots -- you will need to manually save them in the tool before you exit -- and it does automatically copy your captures to the clipboard.

2. Print Screen – captures your whole screen

To capture your entire screen and automatically save the screenshot, hold down 3 keys at the same time: Fn + Windows + Print Screen. Your screen will briefly go dim to indicate that you've just taken a

screenshot, and the screenshot will be saved to the Pictures > Screenshots folder. You will need to use the Crop tool in Word to cut the image to just the area you want to show.

ON MAC MACHINES:

1. Keyboard shortcut for snipping – lets you select the area of the screen to capture

Shift-Command-4: Use this keyboard combo to turn your cursor into a crosshair, which you can drag to select a portion of your screen to capture. Release the mouse button or trackpad to take the shot.

2. Keyboard shortcut for screenshot – captures your whole screen

Command-Shift-3: This keyboard shortcut captures a screenshot of your entire screen. You will need to manually save them in the tool before you exit -- and it does automatically copy your captures to the clipboard.

Try out these tools to capture an image of your map.

ASSIGNMENT

Objective

For this assignment, assume you are concerned about potential flooding of streets from certain creeks in different neighborhoods in the city of Philadelphia (not all of southeast Pennsylvania – just Philadelphia). ***The objective of this assignment is to identify neighborhoods in Philadelphia that have streets that cross either Pennypack Creek, Tacony Creek, Cobbs Creek, or Wissahickon Creek.***

Deliverables

REFER TO THE LAB REPORT INSTRUCTIONS PDF that is at the top of the ASSIGNMENT INSTRUCTIONS section of our course Moodle page for general instructions about the requirements for all Lab Reports.

Your report should provide information that meets the above objective. **The report should provide a separate list, for each creek, of the names of those neighborhoods that have streets that cross that creek. It should also include a map distinguishing those neighborhoods in Philadelphia that have streets that cross these creeks from those that do not.**

Getting Started

I suggest you first consider the kinds of data layers you will need to complete this assignment (i.e. neighborhoods of Philadelphia, streets, and rivers), then browse the data dictionary and available course data to find the appropriate information.

You should perform this analysis by using the GIS operations you used in the exercise portion of the lab above (e.g. selection). Do not simply ‘guess’ the answer by graphically displaying the rivers and neighborhoods on the screen without performing any GIS operations. Based on the lab exercise instructions, think about what operations you will need to perform to meet the objective of the assignment (hint: consider ‘Select by Attribute’ and ‘Select by Location’ operations; you do not need to use tools we have not learned for this assignment). **Before you start your selections, explore the data in the attributes you will use – what do you notice about these attributes?**

For this lab, your Summary of Operations table should include the following operations. I have provided the “answer” for the first operation to give you a model to follow.

Lab 1 Summary of Operations

Operation	Briefly describe what this operation does	List the steps to complete this operation
Select by Attribute	Selects features based on values in the attribute table	Select by Attributes button→Fill in options in the selection dialogue box to create a formula for the query→Apply or OK
Select by Location		
Symbology: Unique Values		

Lab 1 will be graded with the following criteria (see General Lab Report instructions for more detail):

	Pass	Good	Excellent
Objective			
Clear statement of GIS analysis objective			
Analysis Steps			
Correct steps & understanding of GIS operations			
Results			
Clear summary of results that describes the patterns seen			
Discussion			
Limitations			
Extensions			
Decisionmaker applications			
Tables & Figures			
Map makes it clear which neighborhoods were selected			
Tables are provided with the required data			
GIS Operations Summary			
Steps are correct			
Other Notes			
Notes			