Exercise 1: Introduction to ArcGIS Pro

Welcome! In this introductory exercise, you will start working with ArcGIS Pro, the desktop GIS software by Environmental Systems Research Institute (ESRI). This desktop software is fully integrated with other ESRI products, such as ArcGIS Online, and offers a 64-bit, tab-based interface. It is a very powerful tool for viewing spatial data, querying spatial data, making maps, conducting spatial analysis, and working with remotely sensed imagery. However, before you can make full use of this software, you have to know the basics. This is the intention of this exercise.

Topics covered in this exercise include:

1. How to open a map project file
2. How to add layers to a map
3. How to change the symbology and drawing order of data layers
4. How to explore layer properties
5. How to zoom and pan around a map
6. How to view attribute tables and query attribute information

We will start by navigating to the website and opening the map project file.

Step 1. Open a Map Project

Map project files (.aprx files) allow you to work with your spatial data. Within a project file, you can store multiple maps, scenes, and map layouts. You can also reference a variety of spatial data layers. Note that project files do not house the raw data layers. So, if you share this file with a colleague, they will be able to open it, but the data layers may not draw correctly or at all. You would need to provide the raw data also. In this course, you should never deliver a project file, as we will not be able to grade this.

First, we need to download and open the **Exercise_1.aprx** file.

- ☐ Download the **Exercise_1** data from https://www.wvview.org/. All data are available on the course webpage and linked to the exercise button. You will need to extract the compressed files and save them to your local drive.
- ☐ Open ArcGIS Pro. This can be done by navigating to All Apps followed by the ArcGIS Folder. Within the ArcGIS Folder, select ArcGIS Pro.

Note that you can also use a Task Bar or Desktop shortcut if they are available on your machine.

☐ After ArcGIS Pro launches, select "Open another project."

📁 Open another project

☐ Navigate to the directory that houses the material for this course. The project files are in the **Exercise_1** folder where it was saved on your local machine.
☐ Select **Exercise_1.aprx**. Click OK to open the project.
☐ If necessary, navigate to the WV map.

Note: **If you'd prefer, you can also just click on the Exercise_1.aprx file within the uncompressed folder directly to launch ArcGIS Pro.**

This project contains one map. This map is for West Virginia and contains a variety of data layers. Two vector point layers have been provided: **airports** and **springs**. One vector line layer has been provided: **interstates**. Two vector polygon layer has been provided: **limestone** and **counties**. Finally, three raster grids have been provided: **Land_Cover**, **elev**, and **hillshade**.
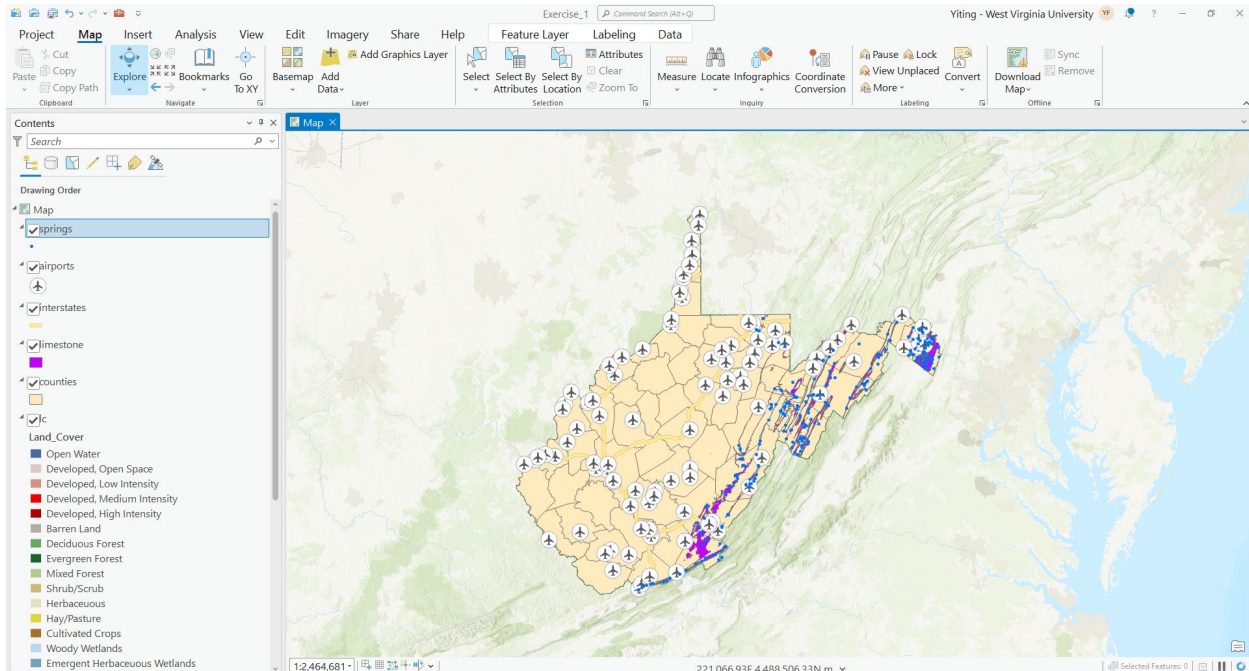
Note that it doesn't matter if the color of your map is different from the one here. ArcGIS Pro generally assigns color randomly. If you don't see any map show up and there is an exclamation mark next to each layer name in the

contents pane, that means the data connection is lost. To reconnect to the data, click any exclamation mark to find the right data source. For example, you can click the exclamation mark next to layer "spring". This will bring up a window. Find the data for "spring" (which will be under the "Exercise_1.gdb" folder) and click ok. This will allow you to reconnect to all data layers.
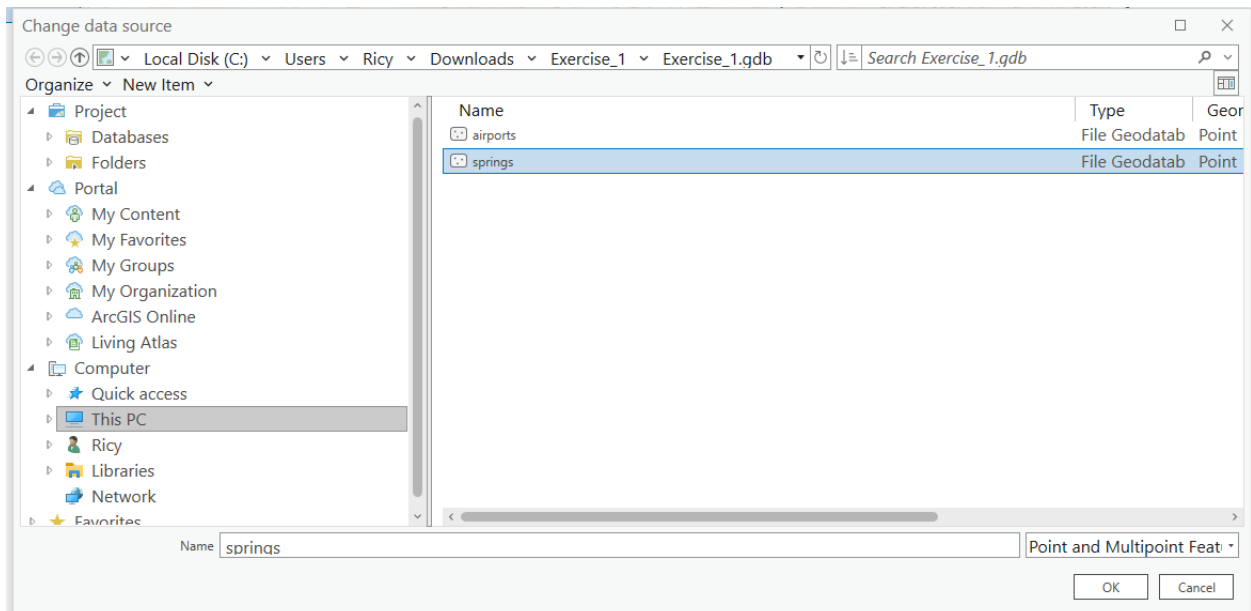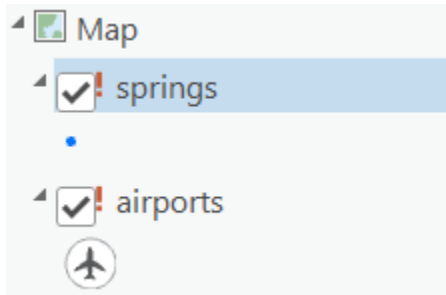
We will now further investigate ArcGIS Pro and these data layers.

Step 2. Working With the Contents Pane

The layers displayed on the map are listed in the Contents Pane on the left side of the display. Note that the map layers are organized by drawing order. Layers further up the list display above layers further down in the list. Generally, point features draw above line features which draw above polygon features. Raster layers are generally at the bottom of the list. Features

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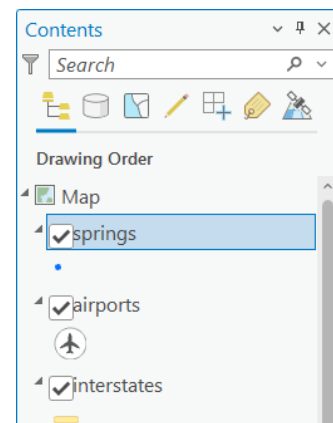
that are turned on will have a check mark in the box next to the layer name.

Question 1. How many layers are included on this map? (2 Points)

You can turn off layers by clicking in the box to remove the check mark.

- ☐ Check off the **counties** layer.

As you can see, when the layer is turned off, you can see layers below it. Layers higher up in the list of layers draw above layers that are beneath them in the Contents Pane. You can change the drawing order by moving the layers around in the Contents Pane.

- ☐ Turn the **counties** layer back on.
- ☐ Click on the **Land_Cover** layer and drag it above the **counties** layer.

As you can see, the **Land_Cover** layer is now being displayed above the county boundaries. So, if you need to change the drawing order of your layers, you can use this method.

Step 3. Change the Symbology of a Point Layer

You may want to change the symbology. Note that ArcGIS Pro generally will assign a symbology randomly, so it may not be optimal to show the features of interest.

- ☐ Double-click on the point symbology for the **springs** in the Contents Pane (the point feature used to show the spring locations). The Symbology Window should load.
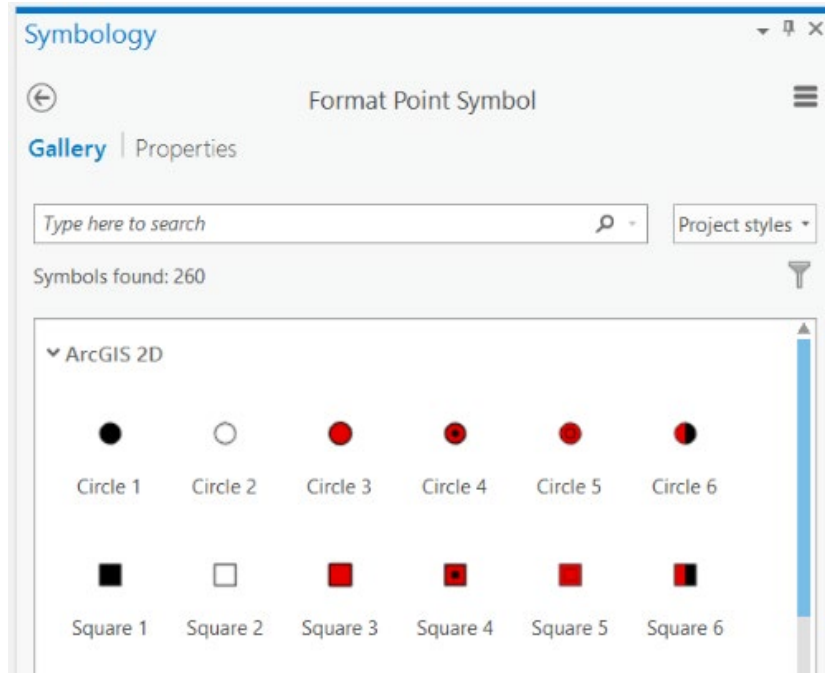
This Symbology Window allows you to change the symbology. The **Gallery** allows you to select from and search for available symbols. The **Properties** allow you to manually change the fill and outline color. A search of the available symbols in the Gallery didn't yield an appropriate symbol. So, we will change the properties manually.

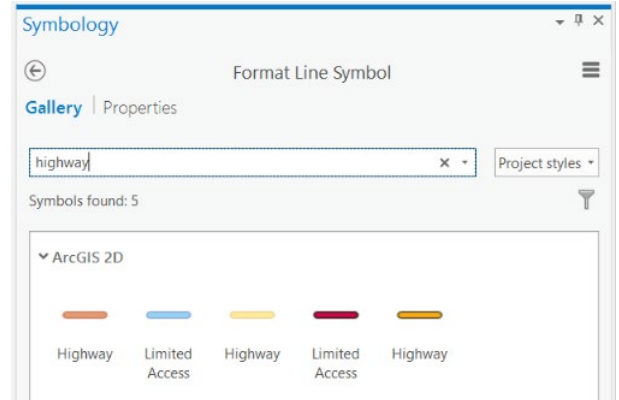☐ Click on Properties in the Symbology Window.

☐ Click on the Layers Options (looks like a grid stack).

☐ Change the Color, Outline Color, and Size to settings you feel are appropriate.

☐ Click Apply to accept the changes.
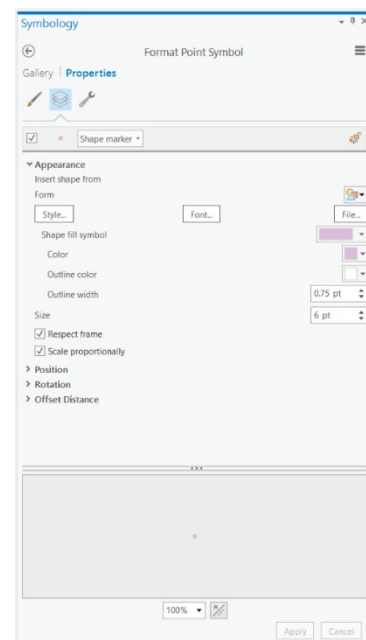
Step 4. Change the Symbology of a Line Layer

You will now change the symbology of the line layer that represents interstates. This time, we will use the Gallery.

☐ Double-click on the line symbology for **interstates** in the Contents Pane (the line feature used to show the interstate locations). The Symbology Window should now show the symbology for this feature as opposed to the springs.
☐ Navigate back to the Gallery options.
☐ Search for "highway."
☐ Select a symbology that seems appropriate.
☐ Click Apply to accept the changes.

Step 5. Change the Symbology of a Polygon Layer

You will now change the symbology of the **limestone** layer. This layer shows the extent of limestone geology in the state.

☐ Double-click on the polygon symbology for **limestone** in the Contents Pane (the polygon feature used to show the limestone extents). The Symbology Window should now show the symbology for this feature as opposed to the previously selected layer.
☐ Click on Properties in the Symbology Window.
☐ Click on the Symbol Options (looks like a brush).
☐ Change the Color, Outline Color, and Outline Width to settings you feel are appropriate.
☐ Click Apply to accept the changes.
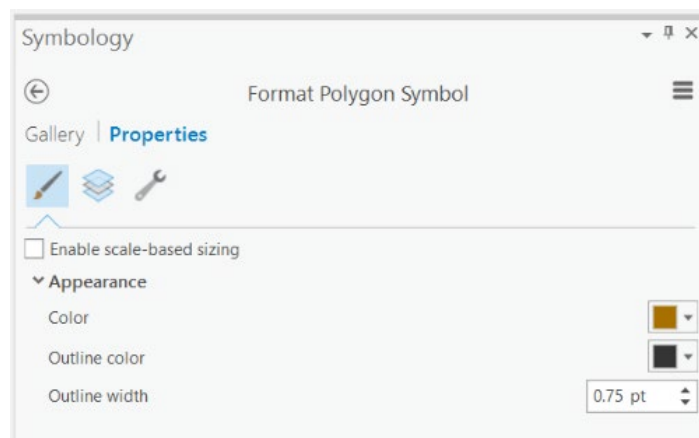
Step 6. Change the Symbology of a Raster Layer

All of the above examples demonstrated how to change the symbology of
vector layers: points, lines, and polygons. Now, you will investigate changing
the symbology of a raster layer. Specifically, we will change the colors used
to symbolize the elevation data.

☐ Right-click on the **elev** layer then select
   Symbology.
☐ In the Symbology Window, leave the
   Symbology as Stretch.
☐ Under Color Ramp, change the Color
   Scheme to a color scheme of your
   choosing.

Note: You may have to turn off some layers
to see the elevation surface.
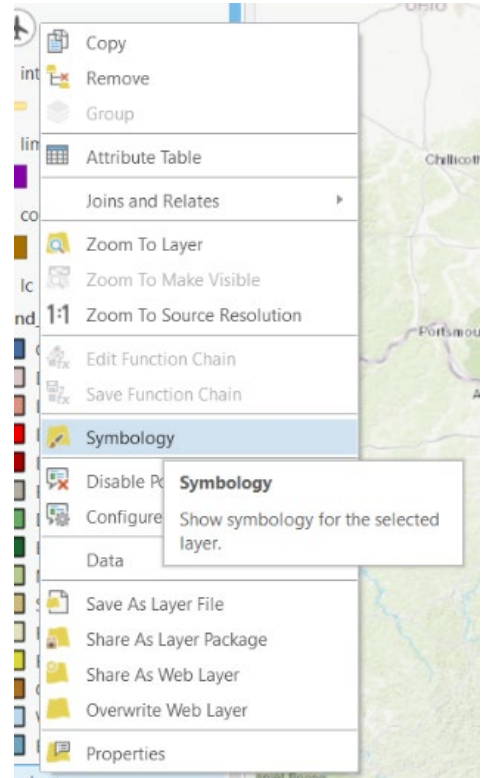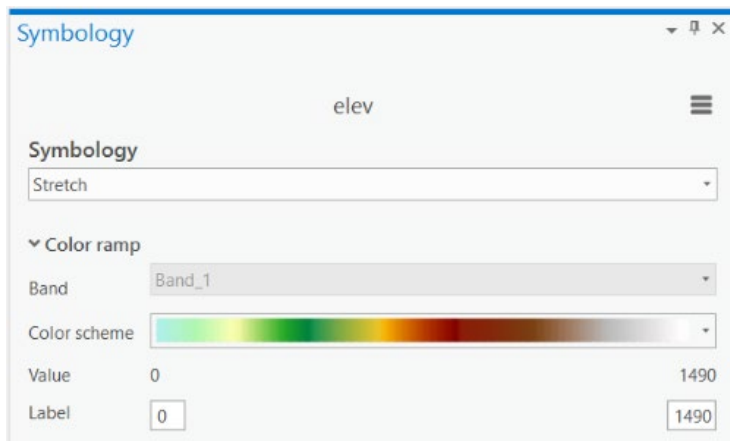
Step 7. Change a Layer Name in the Contents Pane

Other than changing the symbology of a layer, you can also change the
name of the layer in the Contents Pane. Note that this does not change the
name of the file. It is only changing how the name is displayed in the
Contents Pane.

☐ Right-click on the **elev** layer then select Properties.
☐ Under General options, change the Name to "elevation."
☐ Click OK to accept the change.
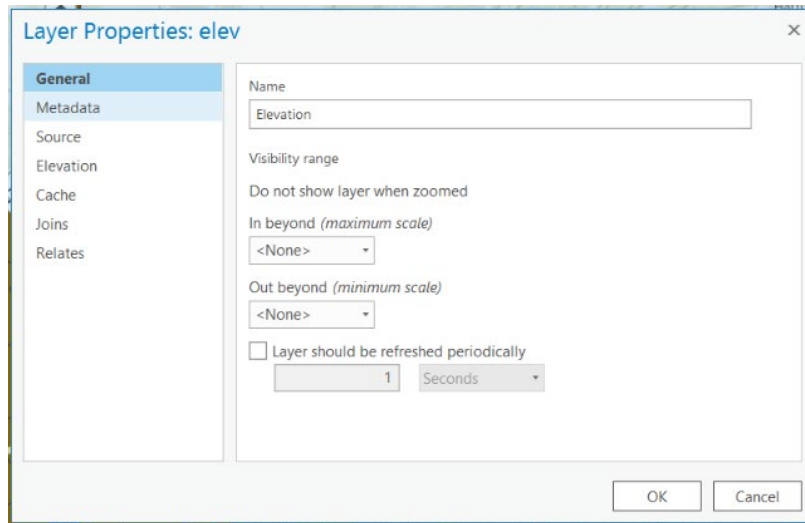
Step 8. Viewing Feature Attributes

When you click in the map space and over a map feature, a dialog box appears that provides attribute information. This allows for an interactive means to explore attribute information.

- ☐ Make sure the **counties** layer is turned on.
- ☐ Click on Monongalia County. A dialog box should open that provides information about this county.

Note: If you're not sure which county is Monongalia County, please see the map below.
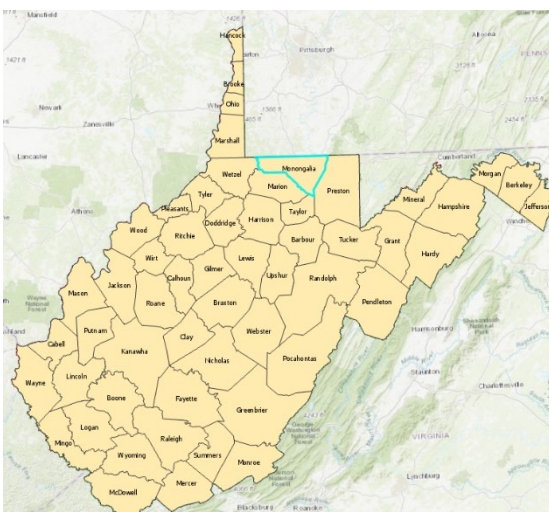
Use the information provided to answer the following questions.

Question 2. What was the population of Monongalia County in 1995? (2 Points)

Question 3. What was the population of Monongalia County in 2005? (2 Points)

Question 4. What is the area of Monongalia County in square miles? (2 Points)

Question 5. Using your answers from above, calculate the population density of Monongalia County in 2005 as people per square mile. (2 Points)

- ☐ Click on the airport that is furthest north (at the top of the northern panhandle).

Use the provided information to answer the following questions.

Question 6. What is the name of the airport? (2 Points)
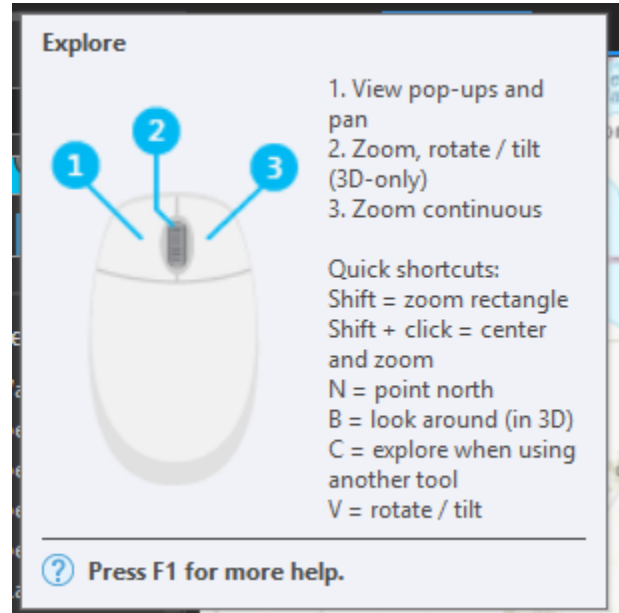
Question 7. What is the elevation of the airport in feet? (2 Points)

Step 9. Moving Around the Map

Under the Map Tab and in the Navigation Section, a variety of tools are available for navigating around the map.

The Explore Tool allows you to navigate around the map space. Here are some pointers.

1. Hovering over the Explore Tool brings up a dialog box that provides navigation information (shown here to the right).
2. Clicking and holding allows you to pan around the map space.
3. You can also pan by using the keyboard arrow keys.
4. Using the mouse roller allows you to zoom in and out.
5. Clicking then selecting shift allows you to draw a box to zoom in.
6. Holding down the right mouse button and moving the mouse allows for continuous zooming.
7. Holding down V while moving the mouse allows you to rotate the map. The map is north oriented by default.

Explore

1. View pop-ups and pan
2. Zoom, rotate / tilt (3D-only)
3. Zoom continuous

Quick shortcuts:
Shift = zoom rectangle
Shift + click = center and zoom
N = point north
B = look around (in 3D)
C = explore when using another tool
V = rotate / tilt

(?) **Press F1 for more help.**

The Bookmark Tool allows you to bookmark a map position so that you can return to it later.

Generally in ArcGIS Pro, if you hover over a tool, a helpful dialog box will load.

Hover over the tools referenced below to answer the questions posed.
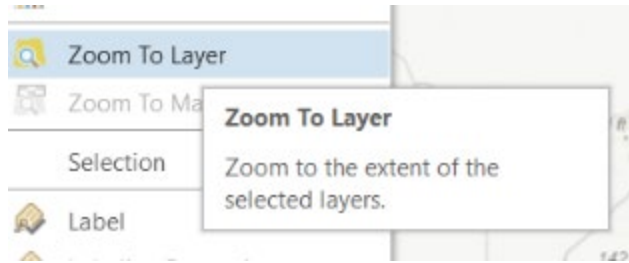
Question 8

Question 9

Explore | Bookmarks
Navigate
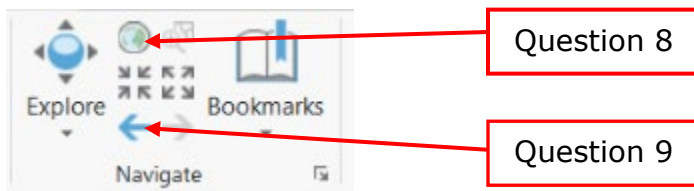
Question 8. What is the purpose of the tool labelled above? (2 Points)

Question 9. What is the purpose of the tool labelled above? (2 Points)

Another zoom/panning option is to zoom to the extent of a certain layer.

☐ Right-click on the **limestone** layer in the Contents Pane.
☐ Select Zoom to Layer.

Question 10. Why did zooming to the full extent of the limestone layer not incorporate the full state? (2 Points)

Step 10. Working with Attribute Tables

One of the benefits of a GIS is the ability to link spatial and aspatial or tabulated data. For example, the **counties** layer available in this project does not just provide the county boundaries; it also provides tabulated or aspatial data about the counties. You can view this information using the attribute table.

☐ Right-click on the **counties** layer and select Attribute Table.
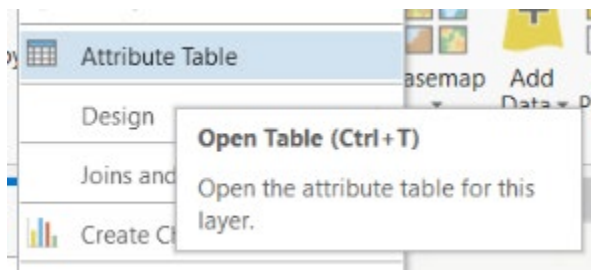
The attribute table should open.

OBJECTID	Shape	AREA	PERIMETER	NAME	STATE	FIPS	STATE_ABBR	SQUARE_MIL ▾	POP2000	POP00SQMIL	MALE2000	FEMALE2000	MAL2FEM	UNDER18	AIAN	ASI
25	Polygon	2691753634.8	324281.73498	Randolph	54	-1145	WV	1039.725	28262	27.2	14222	14040	101	22.3	0.2	0
43	Polygon	2651376091.35	291021.258067	Greenbrier	54	-1151	WV	1021.258	34453	33.7	16556	17897	93	21.6	0.3	0
34	Polygon	2437515275.93	269650.535179	Pocahontas	54	-1146	WV	940.288	9131	9.7	4703	4428	106	20.9	0.1	0
38	Polygon	2357253576.21	309273.651659	Kanawha	54	-1149	WV	903.098	200073	221.5	95178	104895	91	21.3	0.2	0
31	Polygon	1807519120.32	197019.787819	Pendleton	54	-1146	WV	697.871	8196	11.7	4125	4071	101	21.8	0.3	0
44	Polygon	1730626352.73	228118.380177	Fayette	54	-1151	WV	663.929	47579	71.7	23569	24010	98	21.7	0.3	0
40	Polygon	1693557008.91	237475.777916	Nicholas	54	-1146	WV	648.632	26562	40.9	12983	13579	96	23.3	0.2	0
3	Polygon	1686168096.7	179373.536795	Preston	54	-1145	WV	648.324	29334	45.2	14535	14799	98	23.7	0.1	0
11	Polygon	1669946274.63	187873.321722	Hampshire	54	-1150	WV	641.721	20203	31.5	10087	10116	100	25.1	0.2	0
47	Polygon	1576113050.32	237882.242823	Raleigh	54	-1145	WV	606.935	79220	130.5	38975	40245	97	21.5	0.2	0
22	Polygon	1513690918.56	207396.438169	Hardy	54	-1150	WV	583.393	12669	21.7	6255	6414	98	23.3	0.2	0
35	Polygon	1439510921	167601.512884	Webster	54	-1143	WV	555.968	9719	17.5	4783	4936	97	23	0.1	0

☐ Locate the "SQUARE_MIL" field in the table.
☐ Right-click on the field name and select Sort Descending. This will reorder the counties in descending order based on area.

Question 11. What is the largest county in West Virginia? (2 Points)

The smallest county should appear at the bottom of the list. Alternatively, you can resort the data using Sort Ascending.

Question 12. What is the smallest county in West Virginia? (2 Points)

Use similar methods to answer the following questions.

Question 13. What county had the highest population in the year 2000 (Use the "POP2000" field)? (2 Points)

Question 14. What county had the lowest population in the year 2000 (Use the "POP2000" field)? (2 Points)

Question 15. What county had the highest percentage of the population under 18 (Use the "UNDER18" field)? (2 Points)

It is also possible to create a new field in an attribute table. You will now create a new field in which to calculate population change.

- ☐ In the **counties** attribute table, click the Add button.
- ☐ Name the new field "change" (without the quotes).
- ☐ Define the field as Long.
- ☐ In the Fields Tab at the top of the screen, select Save.

If you navigate to the end of the attribute table, you will see that a new field has been added. The field is called "change". In this field, you will now calculate the population change between 1996 and 2006.

- ☐ Right-click on the change field and select Calculate Field. A Calculate Field window should open.
- ☐ Provide the expression to calculate change. Here, we will subtract the 1996 population from the 2006 population. Instead of typing the syntax, select (double click) the 1996 and 2006 fields from the list of available fields.
- ☐ Once you have generated the syntax, click Run to execute the calculation.
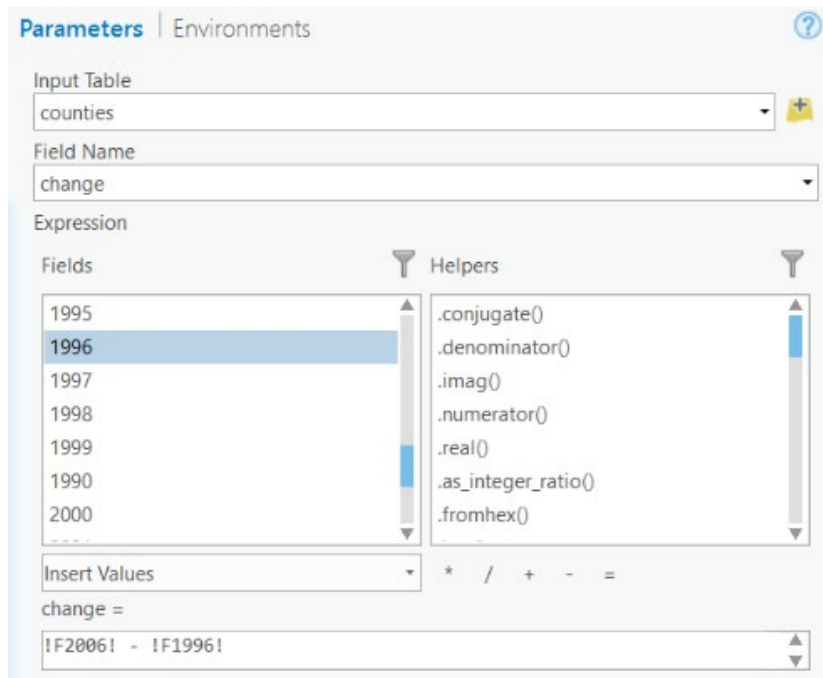
Back in the attribute table, you should now have numbers in the new "change" field. Negative values would indicate decrease in population whereas positive value would indicate increase in population. Use this new field to answer the following questions.

Question 16. Which county experienced the greatest population increase between these years? (2 Points)

Question 17. Which county experienced the greatest population decrease between these years? (2 Points)

You can also calculate geometric measures into an attribute column. This can be done using the **Calculate Geometry Attributes** Tool. You will work with a variety of tools in this course, so this will serve as an introduction to setting up and running a tool.

☐ Navigate to the Analysis Tab then select Tools. This will open the Geoprocessing Window.
☐ Search for Calculate Geometry Attributes.
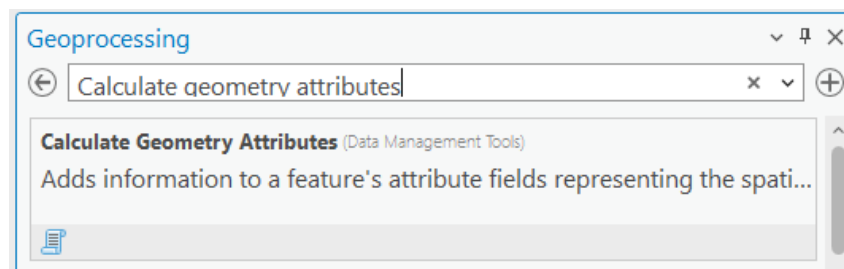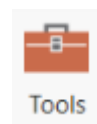
- ☐ Click on the tool to open it.
- ☐ Set the Input Feature to **counties**.
- ☐ Input POLY_AREA to the Geometry Field list.
- ☐ Add Area to the Geometry Properties list.
- ☐ Set the Area Unit to Square kilometers.
- ☐ Set the Coordinate System to Current Map [Map].
- ☐ Click Run to execute the tool.
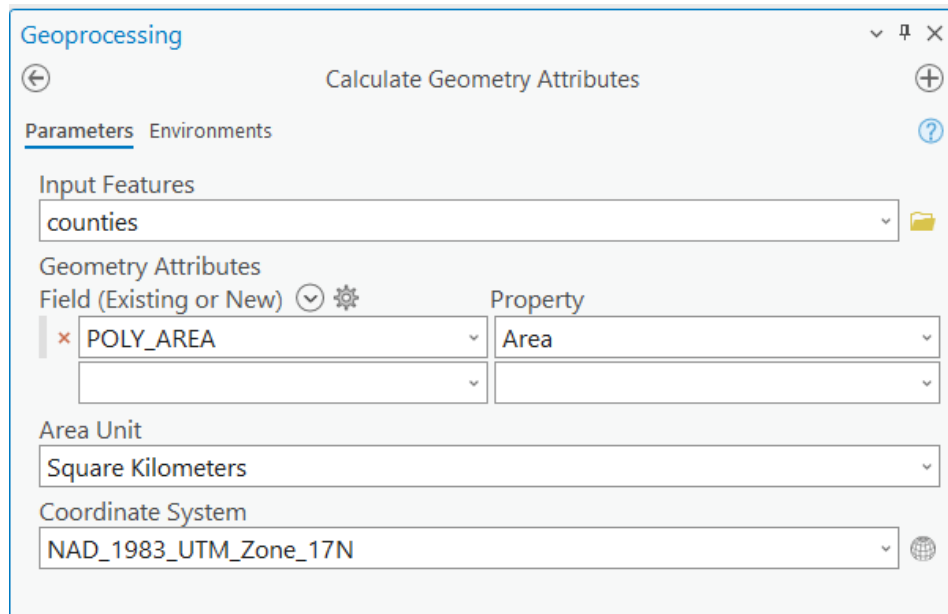
Back in the counties layer attribute table, you should see that a new field named "POLY_AREA" was added to the end of the table. This field now contains the area of the county in square kilometers. Use this field to answer the following question.

**Question 18.** What is the area of Pocahontas County in square kilometers? (2 Points)

Step 11. Saving the Project

You can save your work by navigating to the Project Tab then selecting Save. If you want to save a new copy you can use Save As. Remember to save often as you work through the lab exercises.

Step 12. Creating a New Layout

To finish this exercise, you will add a new Map Layout to your project. Map projects can house multiple 2D and 3D maps along with multiple map layouts.

- ☐ Navigate to the Insert Tab and Select New Layout.
- ☐ From the list, select ANSI Portrait Letter 8.5" x 11" (this should be the first option). A new blank layout should be added.
- ☐ To add the map to the layout, click on Map Frame under the Insert Tab. Choose the map you need to add and draw on the layout.
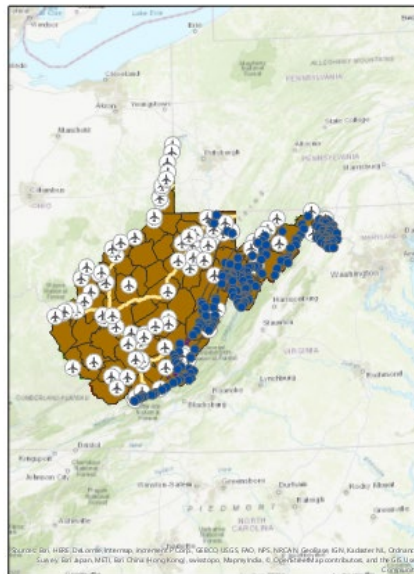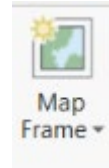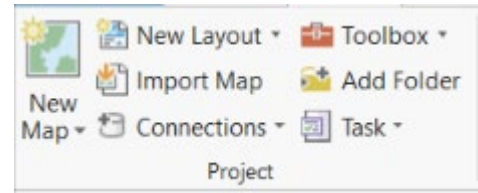
In later exercises, you will learn how to create effective map layouts. Here, we simply want to show you how to save the map as a graphic file.

- ☐ Navigate to the Share Tab and select Export Layout.
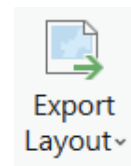
This will allow you to save a map layout as a graphic file, such as PDF or JPEG. When we ask you to turn in a map layout in this class, you will need to export it to a graphic file using this method as opposed to providing the project file.

END OF EXERCISE