

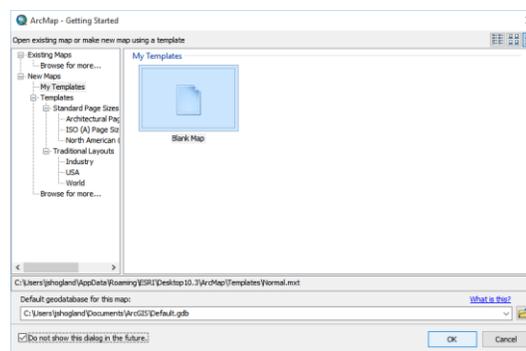
STUDENT PAGES

Instructions for Analyzing GIS Data

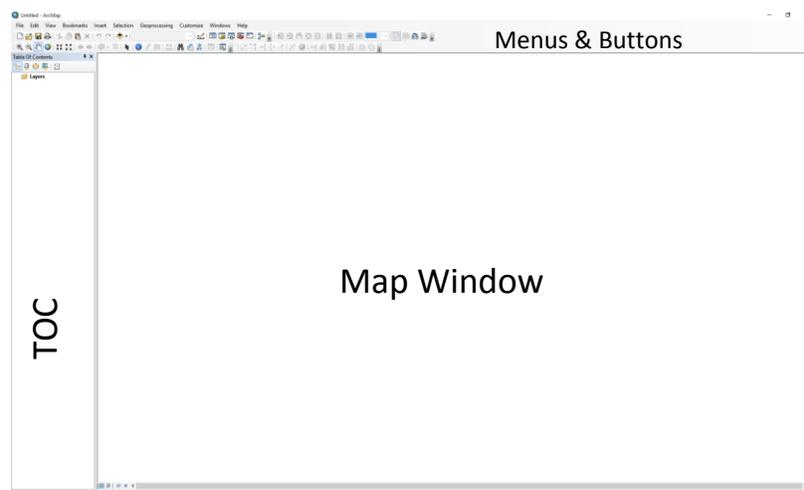
For this GIS exercise, you will learn about the geographical range of gray wolves in the Northern Rocky Mountains. You will also learn how to make a map showing the distribution of gray wolf packs. To do this, you will need spatial data. You can download the GIS data for this wolf exercise from Bear Trust International: www.beartrust.org/wolves-in-na. Here's what you need to do with these data:

1. Open ArcMap

Your teacher will provide instructions on how to access the software called ArcMap, which we will use to create maps and analyze spatial data. When ArcMap is finished loading you will be asked what type of template you want to use to begin building your map. Templates allow users to customize how maps are created. For now check the "do not show this dialog in the future" checkbox and left click the OK button.



This will bring up ESRI ArcMap Graphical Users Interface (aka: ArcMap):



On the left side of ArcMap is a Table of Contents (TOC) window that displays all the layers within a given map. Above the TOC is a number of menus, toolbars, and buttons. To the right of the TOC there is the Map Window which will display all the layers you load into the TOC.



The "Standard" toolbar has buttons that can be used to create a new map, open an existing map, save a map, print a map, cut, copy, past, delete, undo, redo, add geographic layers to a map, and load additional windows to ArcMap.



The "Tools" toolbar has button to move around a map, zoom in and out, search for information, select features, and find out information about any object located within a map.

2. Make a Map

Let's make a map of the wolf packs in the Northern Rocky Mountains. The layers you will be adding to the map window are called shapefiles (.shp) layers.

A. Add Data

Click **Add Data**  in the toolbar. All of the map layers are pre-loaded in the folder called "**GIS Data_Wolves**". This folder is available for free download through Bear Trust International; your teacher will give you instructions on how to access this folder. When you have the folder "**GIS Data_Wolves**" downloaded on your computer, click on the following files to load them into your map:

1. **UnitedStates.shp**
2. **Boundary_NRMGWDP.shp**

Boundary_NRMGWDP is a map layer showing the boundary of the Northern Rocky Mountain Gray Wolf Distinct Population

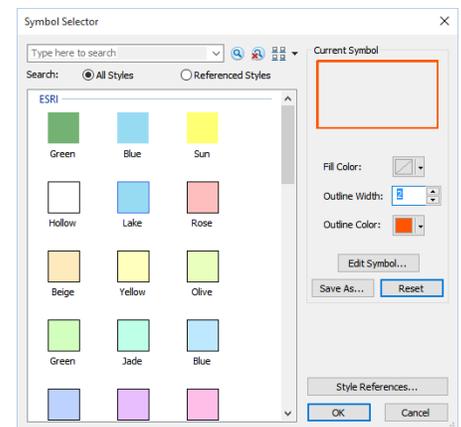
Examine the Table of Contents (TOC) that now has two layers for your map. Notice that each of the layers has a button to expand or minimize its data symbology and a box to uncheck/check to make the layers invisible/visible.

B. Save your Map

Before you do anything else, let's name your map and save it in a place you can find again later. Save your map using the Save button in the Standard toolbar (📁). Navigate to the "**GIS Data_Wolves**" folder and locate the folder called "**My Wolf GIS Project**". Save the Map (.mxd) with the name **WolfGISMap**.

C. Let's make the names of the states visible. In the TOC, right click on the layer **UnitedStates** and then select "Label Features".

D. It would be nice if we could easily view the boundary of the Northern Rocky Mountain Gray Wolf region. Let's change the symbology of that layer and make the boundary transparent. Look in the TOC and find the layer called **Boundary_NRMGWDP**. Find the square underneath this shapefile and double click on the square. This will bring up a box called "Symbol Selector". Chose "Hollow", make the outline color "red" and increase the "outline width" to 3. Click OK.



E. Let's zoom in and get a better look at the Northern Rocky Mountains. In the TOC, right click on the layer called **Boundary_NRMGWDP** and select "Zoom to Layer".

F. Pan and Zoom: Want to move the map around and zoom in and out more? To do this, you can use three buttons from the "Tools" toolbar; the pan (**the hand**), zoom in (**the plus magnifying glass**), and fixed zoom out (**four arrows pointing towards the corner**) buttons. The hand button allows you to left click and drag the map in any direction. The plus magnifying button allows you to zoom into an area of interest by left clicking, dragging a square around an area and releasing the button. Practice using these buttons to zoom in and out and move around the map.



Don't worry if you move the map to a location with no data or zoom too far out or in. To center your map back on the Boundary of the Northern Rocky Mountain Gray Wolf Distinct Population and zoom to that layer's extent, right click on the **Boundary_NRMGWDP** layer and left click on the "Zoom to Layer" button.

G. Let's bring in the data for the location of the wolf packs. Click **Add Data**  in the toolbar and add these shapefile layers:

1. **Wolfpacks_ID.shp**
2. **Wolfpacks_MT.shp**
3. **Wolfpacks_OR.shp**
4. **Wolfpacks_WA.shp**
5. **Wolfpacks_WY.shp**
6. **Wolfpacks_YNP.shp**
7. **Boundary_YNP_and_GNP.shp**

H. Change the Order of Maps in the TOC: Change the order in which map layers are drawn in your map window by first clicking on the "List by Drawing Order" button (located directly underneath the words "Table of Contents"). Then, left click on a map layer you want to move in the TOC, and drag the map layer to the new spot in the TOC.

Boundary_YNP and GNP shows the boundaries for Yellowstone National Park and Glacier National Park.

I. Let's make the wolf packs in each state different colors. In the TOC, right click on **Wolfpacks_ID** and select "Properties". Click on "Symbology" and double click on the symbol. Select "Circle 1", Size 12, color BLUE.

Repeat this process for all of the different shapefiles for wolf packs. For each state, select "Circle1", Size 12, but use a different color for each state. For example, in the TOC click on the layer **Wolfpacks_MT** and select "Properties".

Click on "Symbology" and double click on the symbol. Select "Circle 1", Size 12, color GREEN.

J. Let's make the Boundary for Yellowstone National Park and Glacier National Park translucent. Look in the TOC and find the shapefile called **Boundary_YNP_and_GNP**. Find the square underneath this shapefile and double click on the square. This will bring up a box called "Symbol Selector". Chose "Hollow", make the outline color "black" and increase the "outline width" to 3. Click OK.

K. Let's change the name of the 2 boundary layers so it's easy to understand what they mean. In the TOC, right click on **Boundary_YNP_and_GNP** and select "Properties". In the General tab, change the "layer name" to: **Yellowstone and Glacier National Park Boundaries**.

Use the same steps above to change the name of **Boundary_NRMGWDP** to: **Northern Rocky Mountain Gray Wolf Distinct Population Boundary**

L. Data: Now let's look at some of the data associated with each wolf pack layer. The data are stored as attributes in an attributes table. You can get to the information associated with each wolf pack in a number of ways but one of the easiest ways is to use the identification button () within the "Tools" toolbar. Left click the identification button, selecting the tool, and then left click on one of the wolf pack points. These actions will open the "Identity" window which will show all the information associated with any given point in the map.

M. Attribute Tables: To look at wolf pack attributes for a given state all at once, right click on one of the wolf pack layers in the TOC and left click on the "Open Attribute Table" button. This will open the "Table" window which shows all the information associated with wolf pack location. Each row or record in the table corresponds to one of the wolf pack locations displayed on the map.

Let's open the attribute table for the layer **Wolfpacks_MT**. Scroll through the table to see what type of information is associated with each wolf pack. You can see that there is a column for the Year in which these data were collected. There's also a column for the pack name. There's an easy way to determine how

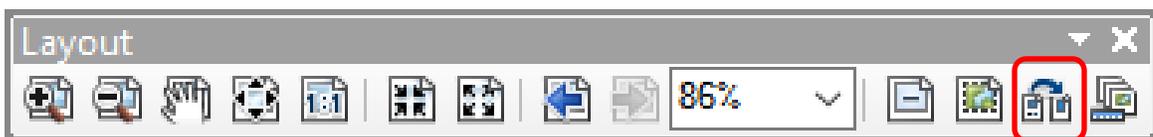
many packs there are in each state by looking at the attribute table. Can you figure it out?

At this point, it would be good to answer questions in your "Student Pages: Questions About the GIS Data".

3. Make a Map Layout

You will be making a map layout showing the location of wolf packs throughout the Northern Rocky Mountain Gray Wolf Distinct Population Area.

- Close any attribute tables that are open
- In the TOC, make the following layers visible: **Wolfpacks_MT, Wolfpacks_ID, Wolfpacks_WA, Wolfpacks_WY, Wolfpacks_OR, Wolfpacks_YNP, Northern Rocky Mountain Gray Wolf Distinct Population Boundary, Yellowstone and Glacier National Parks Boundaries, United States.**
- Make sure that **Boundary_YNP and GNP** is first in the draw order
- Right click **Northern Rocky Mountain Gray Wolf Distinct Population Boundary**, in the table of contents, and click "zoom to layer"
- Go to the **View** tab at the top of the program and click **Layout View**. A skinny layout window will pop up. Click the **Change Layout** button (inside red box below).

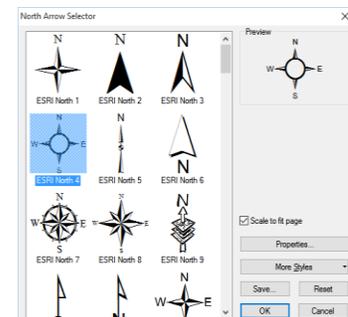


The Layout View within the Map Window allows you to prepare map data for printing and for saving.

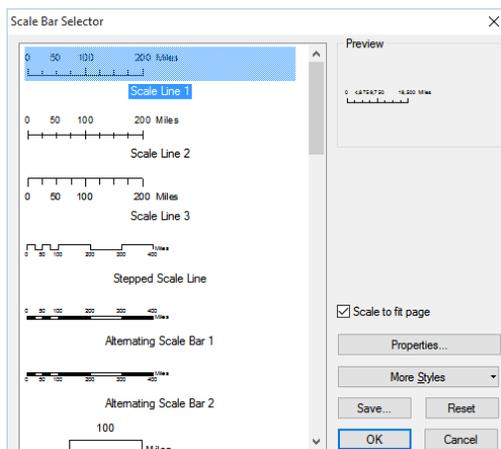
- Under the **Architectural Page Sizes** tab choose **ARCH A landscape.mxd.(8x12in)** Click **Finish**.
- Let's change the names of a few layers so that they are easy to read in the map layout you are about to create. In the TOC, right click on **Wolfpacks_ID** and click "Properties". Click the "General" tab and rename this map **Wolf Packs in Idaho**.

- Using the same method, rename all of the wolf pack layers (example: rename the **Wolfpacks_MT** to: **Wolf packs in Montana**)
- Go to the "Insert" tab at the top of the program and click "Legend". Set the number of columns to "2". Click "Next". Set the font size to "12". Click "Next". Make the legend border "1.5 point", background "light blue", and click "Next". Click "Next" again and then click "Finish". Move the legend to the bottom left of the map but not on the white border. You don't really need to include **United States** in the legend, so let's get rid of it. How? Double click on the legend. In the window that lists "Legend Items", click on **UnitedStates** and then click the "back arrow" to send the **UnitedStates** to the "Map Layers" window.
- Under the "Insert" tab click "Title" and name your map " Figure 7: Gray Wolf Packs in the Northern Rocky Mountains." Click "OK" when done.

- Insert a North arrow by left clicking on the Insert menu and left clicking on North Arrow button. Pick any North Arrow you wish, left click the OK button. Drag the compass rose to your layout.



- Insert a Scale bar by left click on the Insert menu and left clicking on the Insert Scale Bar button. This will open the Scale bar selector dialog. Select the top scale bar and left click the OK button.



- One last step. Let's clip out the entire map so it shows just the Northern Rocky Mountain Gray Wolf Distinct Population Area. How do we do that? In the TOC,

right click on the word "Layers" at the very top. Select "Properties". Go to the "Data Frame" tab. Under "Clip Options" select "Click to Shape". Click the "Specify Shape" button. Select the "Outline of Features" and scroll until you find the layer **Northern Rocky Mountain Gray Wolf Distinct Population** and click on it. Click "OK" and then "OK" again. Cool, right?

- Now your map is complete! Save your work and then go to File: Export Map. Name it "Figure 7: Gray Wolf Packs in the Northern Rocky Mountains" and keep it as a PDF. Save it to a folder you can find again. You'll need to also paste this layout in your "Student Pages: Questions for Individual Activity", so keep it handy.
- To go back to the data view with the table of contents and all your layers, go to the "View" tab and click "Data View". Make another map of your choosing!