FE 257 LAB 6

Using the Projection Utility
Converting Data to Oregon's Approved Lambert Projection
Determining Stand Size, Stand Types, Road Length, and Stream Length

In this lab, you will work with ArcGIS Pro map projection tools. The intent is to learn how to change a shapefile's projection. Using the projection tools will allow you to convert spatial data from different organizations or sources into a common projection. This is extremely important if you want to do any analyses of databases containing differing projections. This lab also requires attention to file management and organization.

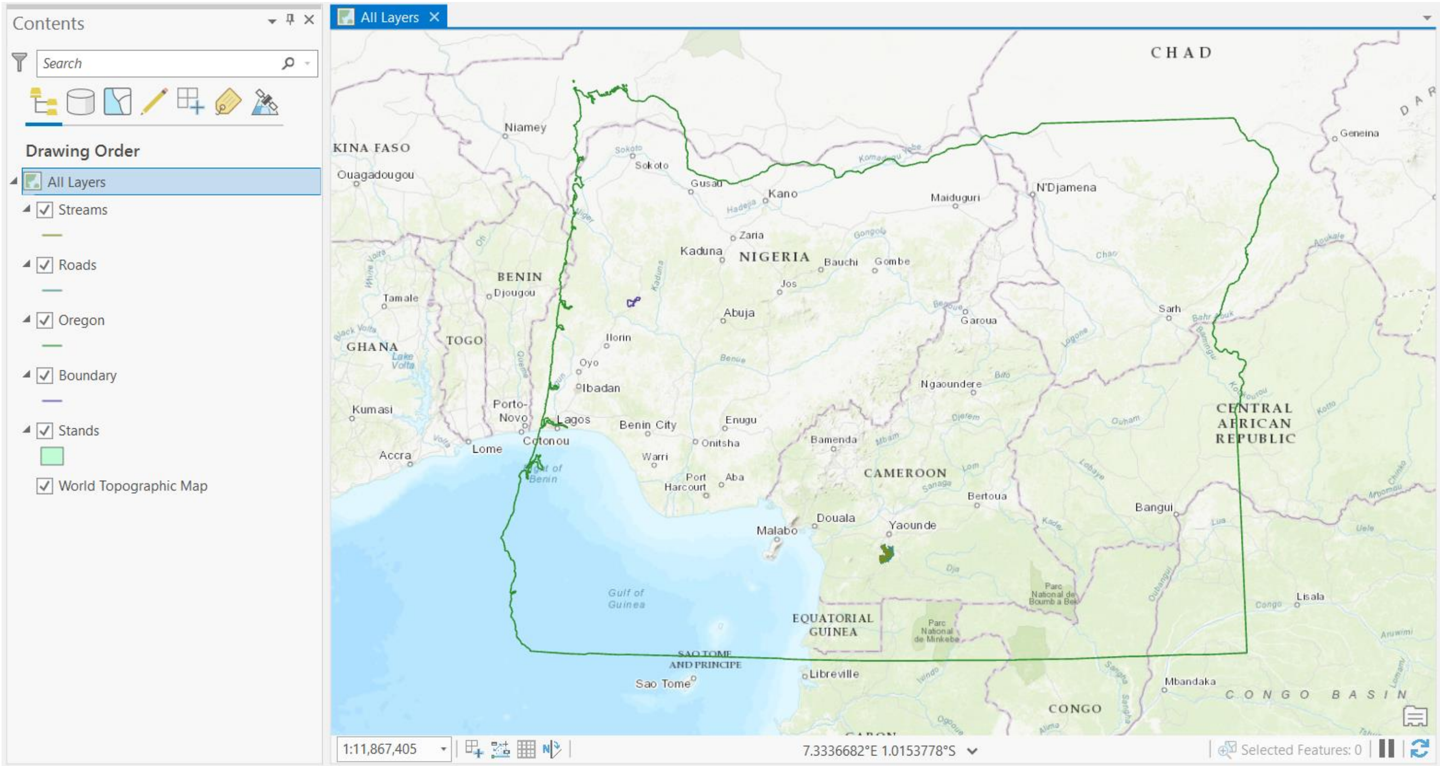
The data for this lab comes from McDonald Forest, about 10 miles northwest of Corvallis. We will be working with spatial data representing the forest boundary, streams, roads, and stands.

Open Windows Explorer and navigate to t:\teach\classes\fe257\gislab6 on the forestry network. Right click on this folder and choose Copy from the menu that appears. Use Explorer to navigate to your workspace folder. For most of you this will be located on the N:\ drive and will have the same name as your user name - for me it's \nicolatk. Right click on your workspace folder and choose Paste from the menu that appears. This should copy the gislab6 folder and all the folders and files located under it into your workspace.

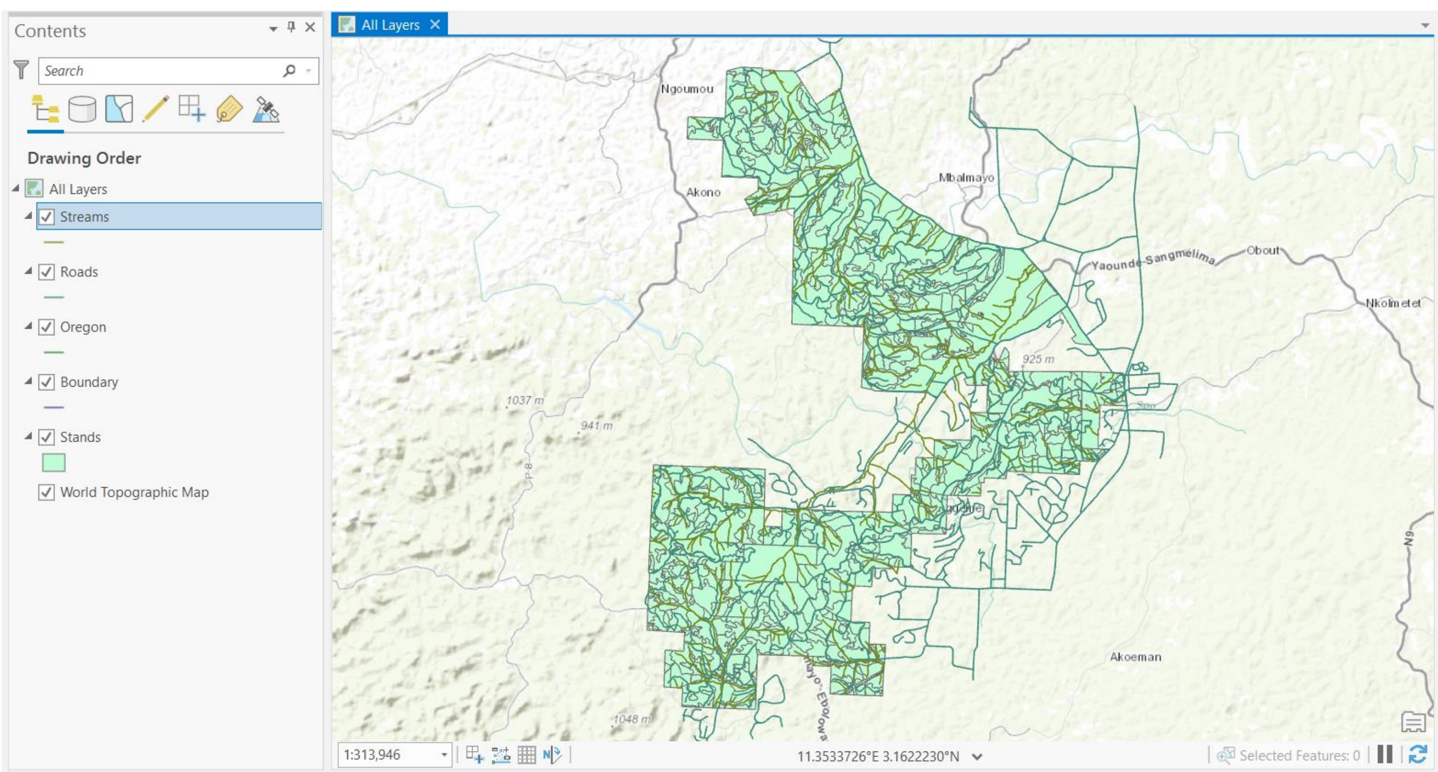
The two folders contained in the folder that you should've copied are named "mac_spn" and "mac_lamb." There are shapefiles inside of both folders, but the folders differ from one another in that different projections are used for the shapefiles located within. "Mac_spn" contains shapefiles in an Oregon State Plane Coordinate System that uses the NAD27 datum. "Mac_lamb" contains shapefiles that are in Oregon's official projection: an Oregon Centered Lambert Conformal Conic projection that uses the NAD83 datum.

Start by opening a new ArcGIS Pro session. After selecting a blank Map template, save the project as "Lab6.aprx" in the "gislab6" folder you copied into your workspace folder. Add all the shapefiles from both the mac_spn and mac_lamb folders. Use the Add Data button to navigate to your gislab6 folder and insert the shapefiles. You should find shapefiles named oregon.shp and boundary.shp in the "mac_lamb" folder and shapefiles named stands.shp, roads.shp, and streams.shp in the "mac_spn" folder. Disregard any message you might receive about missing spatial reference information. Use the Add Folder button under the Insert menu if your project doesn't automatically connect to your gislab6 folder and display the listed shapefiles.

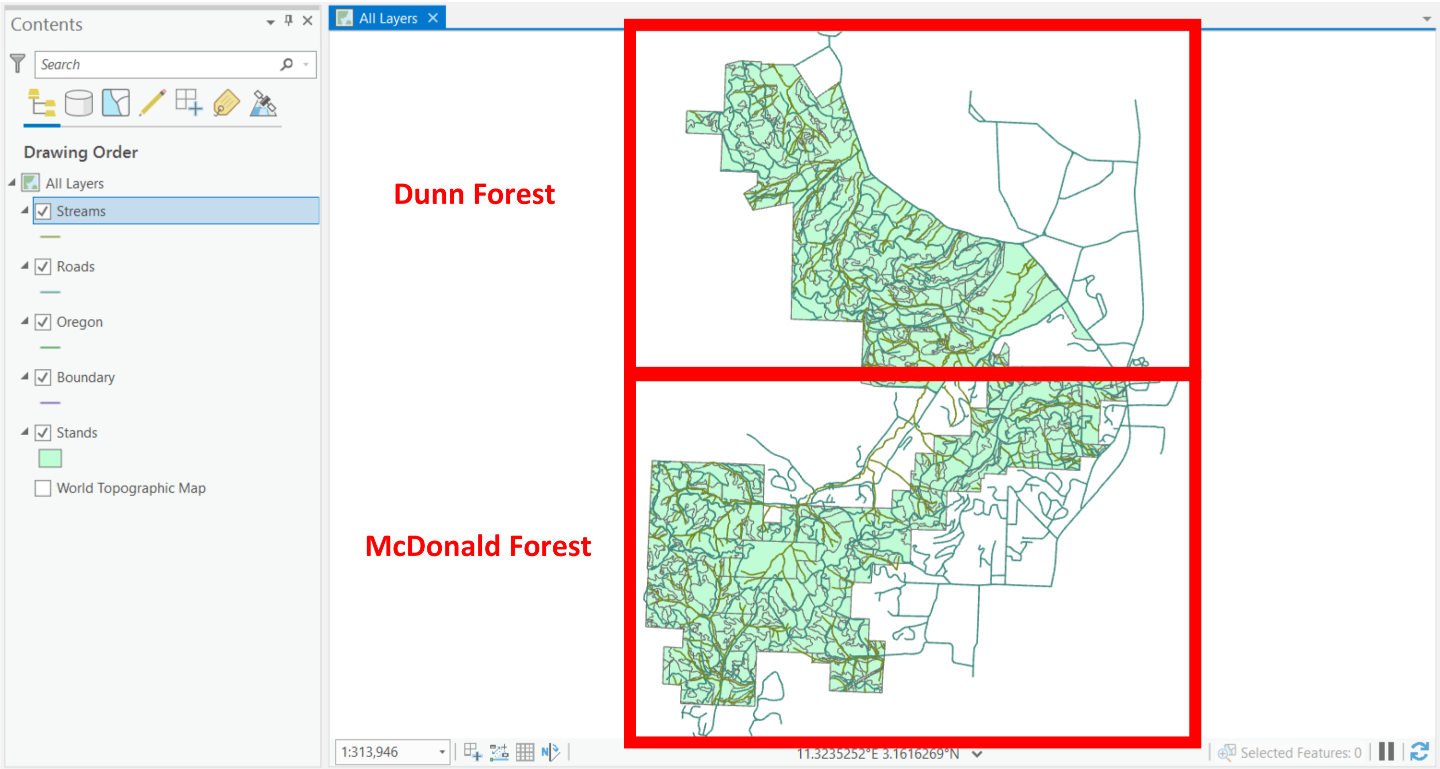
Rename the data frame "All Layers" and capitalize the layer names. Your map should look similar to the graphic below. Notice the most apparent issue – the layers don't have any spatial reference information, so they are projected in Africa. At the full map extent, you should see the Oregon boundary and small shapes in the northwest and south-central parts of the state displaying polygon and line layers of the McDonald and Dunn forests.



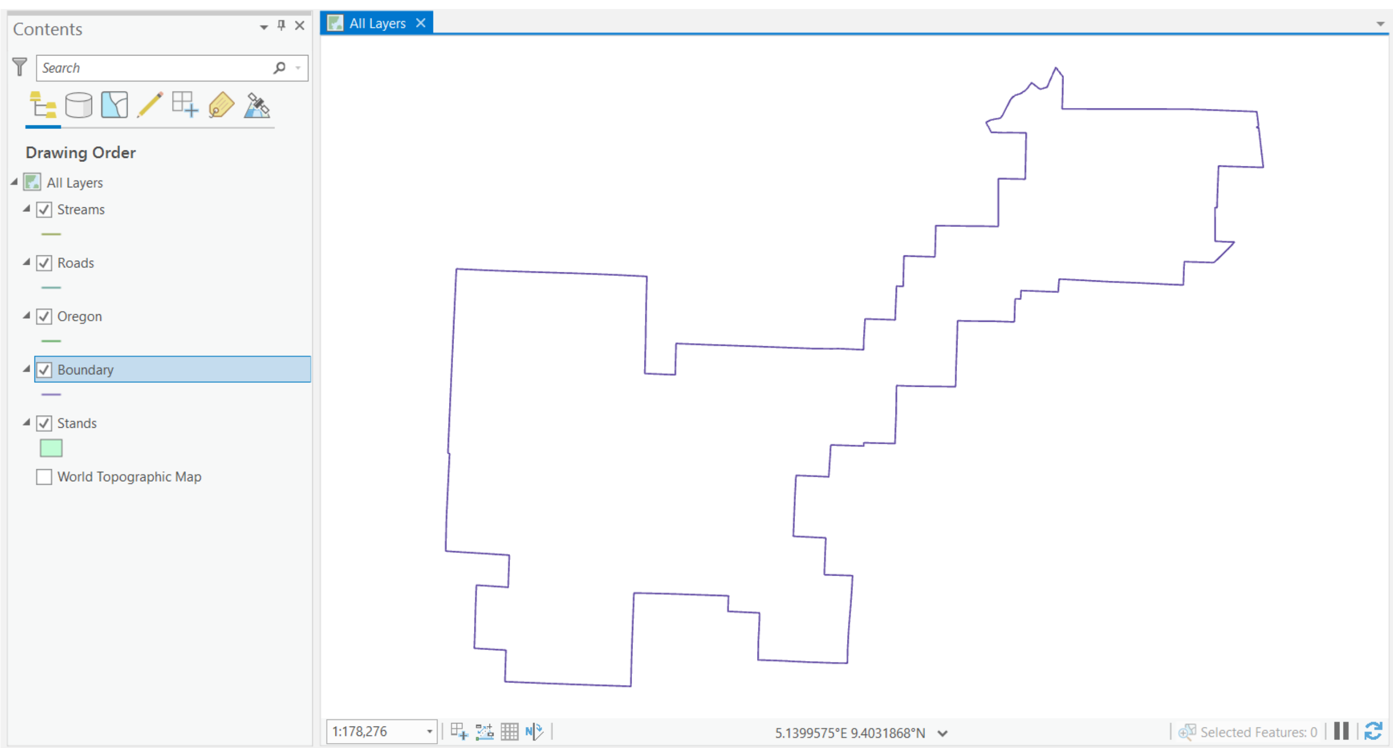
In many cases when layers in different projections are opened in the same data frame, they may appear as tiny spots on opposite sides of the screen and you may not be able to see them unless you zoom in. In this case however, the coordinates for all of the layers were close enough to at least view the outlines of all layers at the same time. Right click on the Streams layer and choose Zoom to Layer to get a closer look. This is one of the layers that appeared in Oregon's south-central region. You should see something similar to the map below.



This shows us that the Streams, Roads, and Stands layers for McDonald Forest are currently located in the south of Oregon, nearly 200 miles from where we'd expect to find them (McDonald Forest is located about 10 miles northwest of Corvallis). In addition, it looks like the Stands layer includes Dunn Forest, and that the Streams and Roads layers contain information from not only both McDonald and Dunn Forests, but for areas in the immediate vicinity as well.



Right click on the Boundary layer and choose Zoom to Layer. You should see something similar to the graphic below.



This is the McDonald Forest boundary, the shape we could originally see in the northwest part of Oregon where we would expect to find the McDonald Forest in our original view of all the layers. We will use this boundary to clip the Dunn Forest and surrounding areas out of the other McDonald Forest layers to answer some questions. Before we can do the clip however, we need to project the Stands, Roads, and Streams layers so that they match the projection of the Boundary layer.

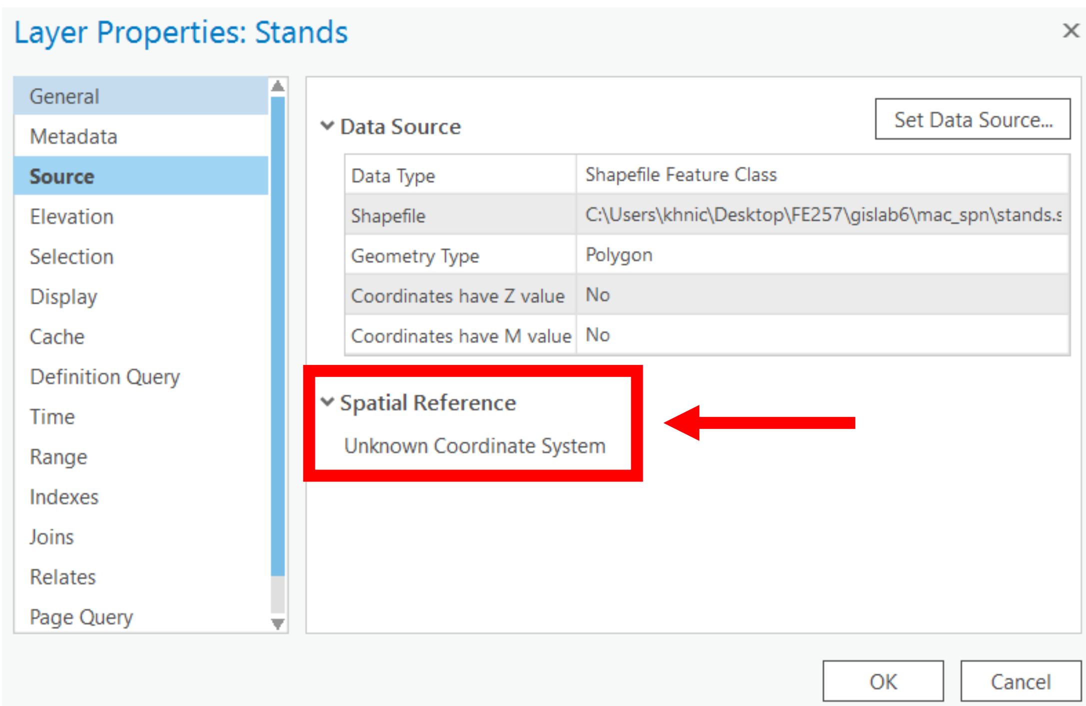
Using Geoprocessing to Define and Create Spatial Projections

As we move through this example, it's important to follow instructions carefully.

When we alter the projection of a spatial database, we almost always create a new database containing the new projection; the original is often left alone and still exists in its workspace. For that reason, it's often a good idea to name the new database to reflect the new projection information (eg. Stands_lambert, Stands_UTM, etc).

Also, when ArcGIS Pro does not recognize the spatial database projection, you must first *establish* the database projection before creating a new database with a different projection. ArcGIS Pro calls this "Defining the Projection."

In this lab, none of the spatial databases in the two subfolders mac_lamb and mac_spn have existing projection information. You can verify this by accessing a layer's Properties, choosing the Source tab, and clicking on Spatial Reference. Here you will see the Coordinate System listed as Unknown.

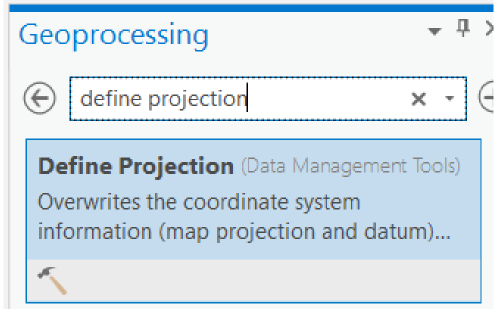


This means that our database creation process will involve two steps:

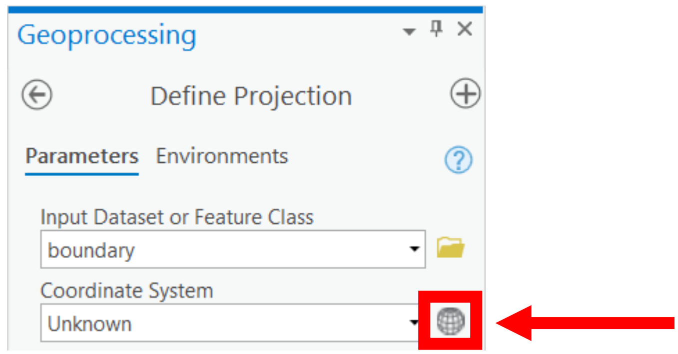
1. Defining the spatial projection of our original databases
2. Specifying a different projection for a new output databases

Defining the Spatial Projection of an Existing GIS Database

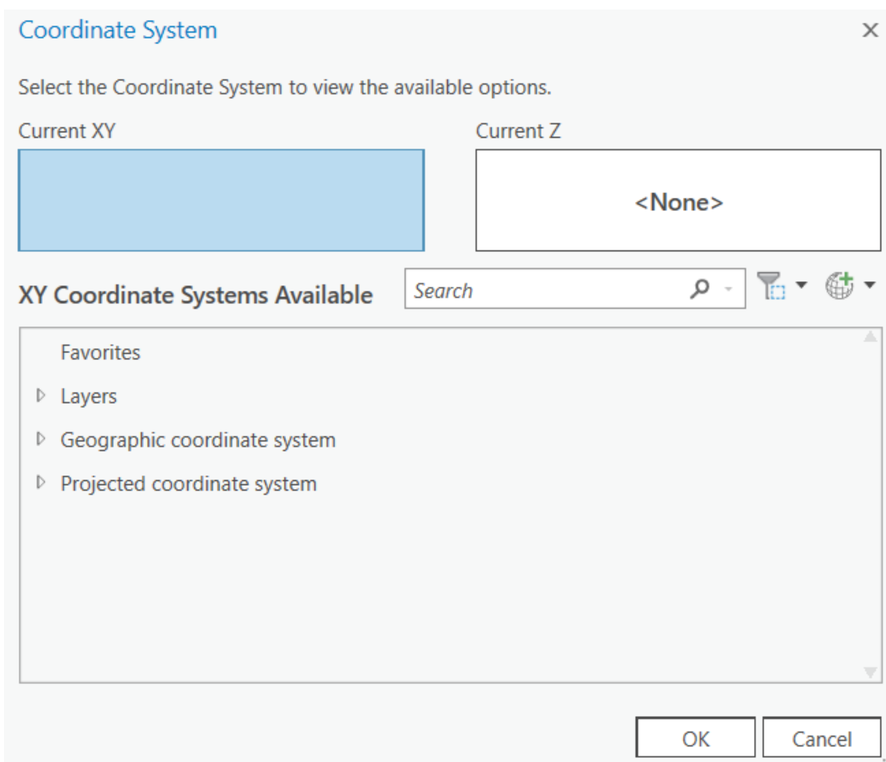
Open the Geoprocessing window and search for Define Projection.



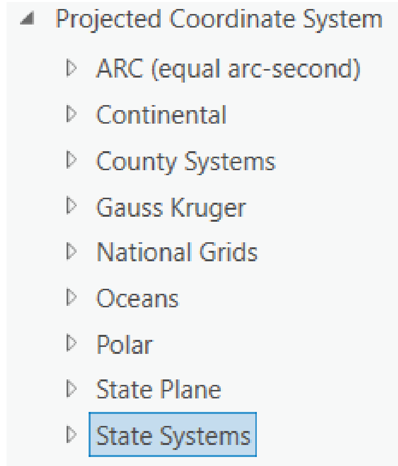
Choose Boundary as the Input Database and note that the Coordinate System is reported as unknown.



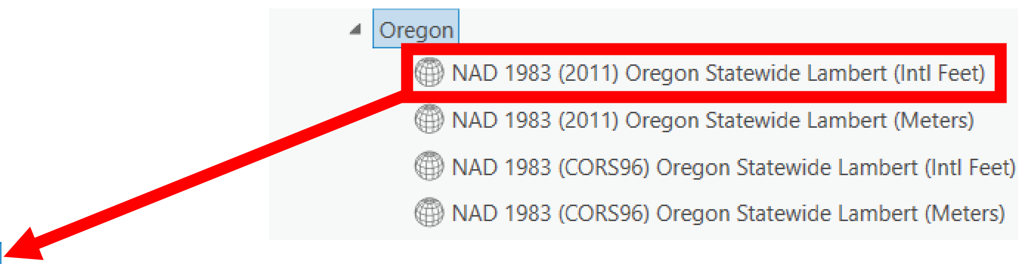
Click on the Browse icon next to the Coordinate System input to open the Coordinate System dialog box.

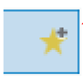


Expand the Projected Coordinate System group and find State Systems.

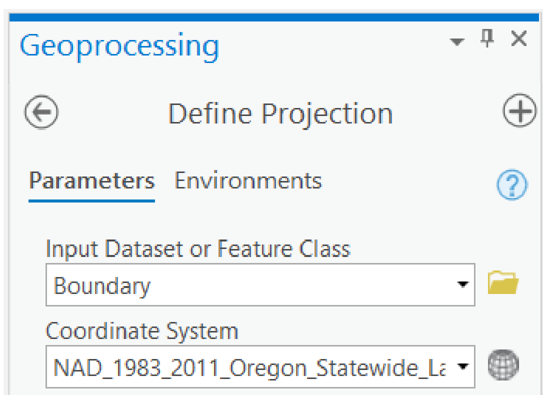


Expand the State Systems group and scroll down to Oregon. Expand Oregon and select **NAD 1983 (2011) Oregon Statewide Lambert (Intl Feet).**



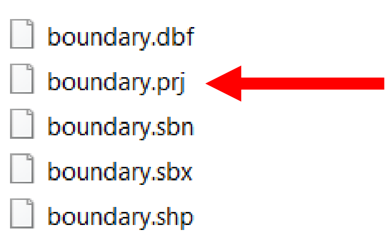
 Click this star option to add the projection to your Favorites so you can find it easily later in the lab.

Choose OK.

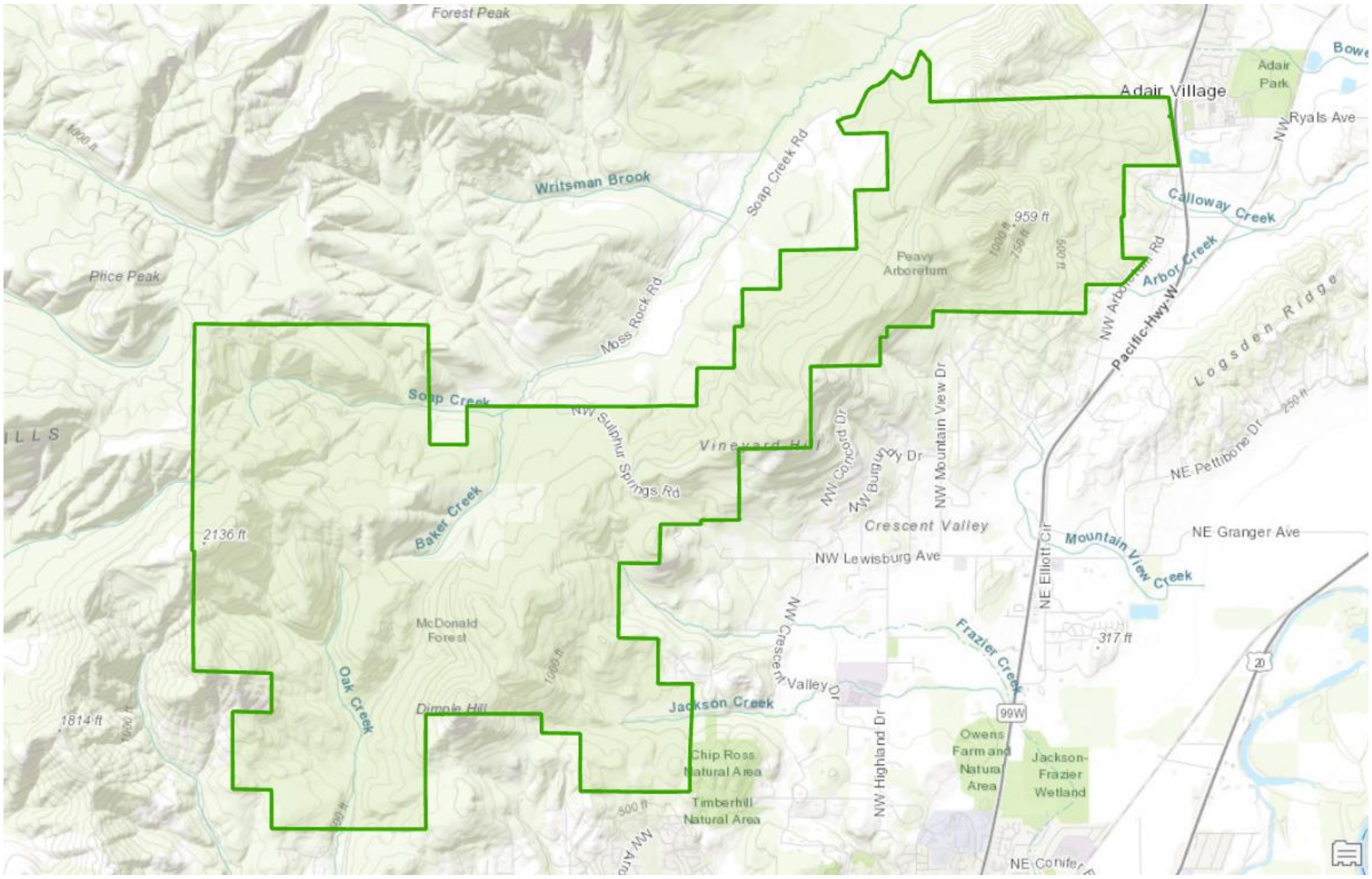


Click Run to establish the projection.

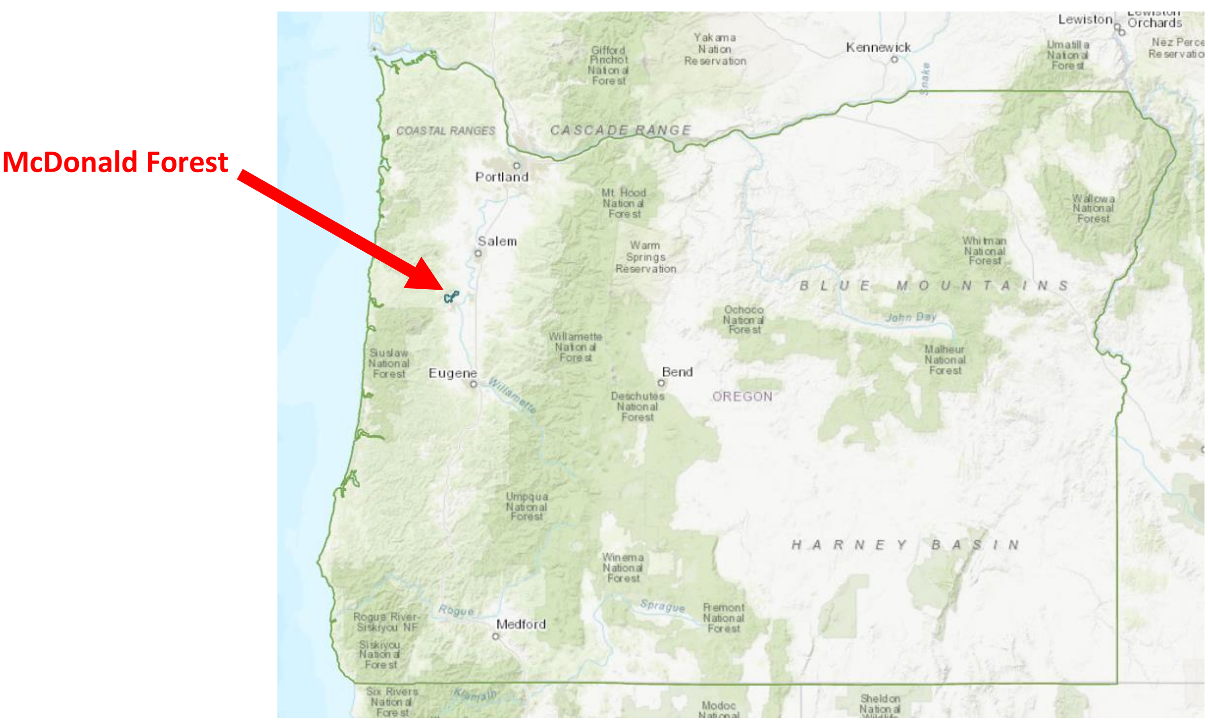
At this point, the spatial projection of the Boundary layer should be established. If you look at the mac_lamb subfolder in your workspace in Windows Explorer, you'll notice the Boundary shapefile now has a .prj, or projection, file.



The Boundary shapefile now appears in the correct location on the base map.



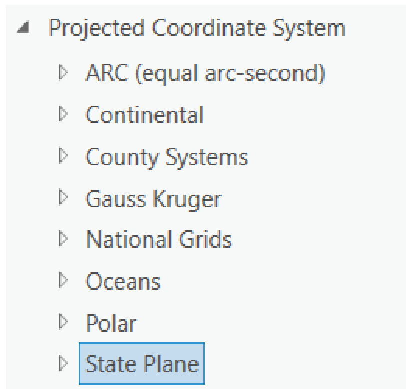
Repeat the same Define Projection steps on pages 5-6 using the Oregon layer and the NAD 1983 (2011) Oregon Statewide Lambert (Intl Feet) coordinate system. When finished the Oregon and McDonald Forest boundaries should appear in the correct location.

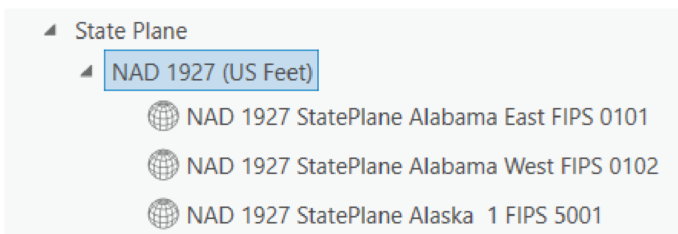


Repeat the same Define Projection steps on pages 5-6 using the Streams layer and the NAD 1927 State Plane Oregon North FIPS 3601 coordinate system. This is a different coordinate system than Boundary and Oregon, though we will eventually transform the Stands, Streams, and Roads layers into the same coordinate system as Boundary and Oregon.

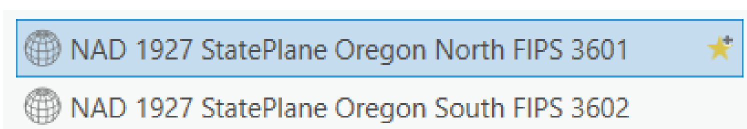
Below is an example of how to define the projection for Streams. Open the Define Projection geoprocessing window. Make Streams the Input Dataset and click the icon next to Coordinate System to open the Coordinate System dialog box.

Under Projected Coordinate System, expand State Plane, then expand NAD 1927.

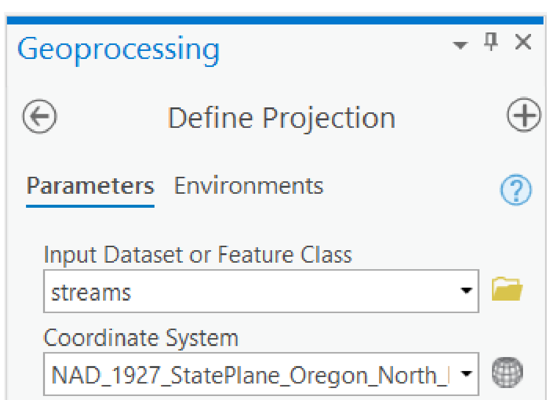




Scroll down to select NAD 1927 State Plane Oregon North FIPS 3601 as the coordinate system.



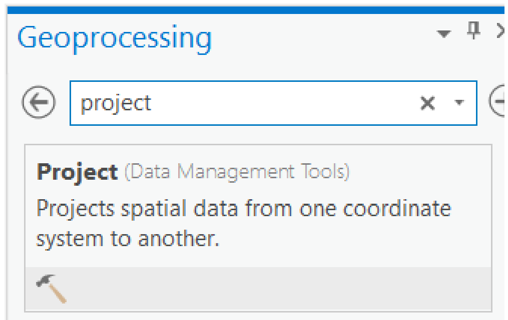
Your Define Projection dialogue box should look like the graphic below. Click run to complete the process.



Now repeat the Define Projection steps on page 8 using the Stands and Roads layers and the NAD 1927 State Plane Oregon North FIPS 3601 coordinate system. When finished, your Boundary and Oregon layers should contain the NAD 1983 (2011) Oregon Statewide Lambert (Intl Feet) projection, and your Streams, Stands, and Roads should contain the NAD 1927 State Plane Oregon North FIPS 3601.

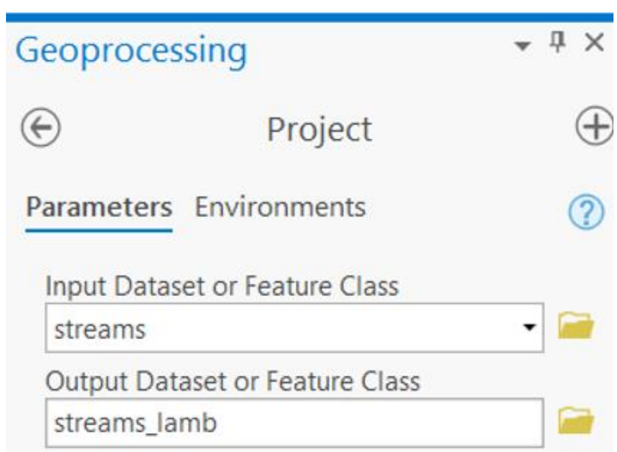
Creating a New GIS Database in a Different Projection

Now create a new GIS database for the Streams layer in a different projection to match Boundary and Oregon. Return to the Geoprocessing window and search for Project.

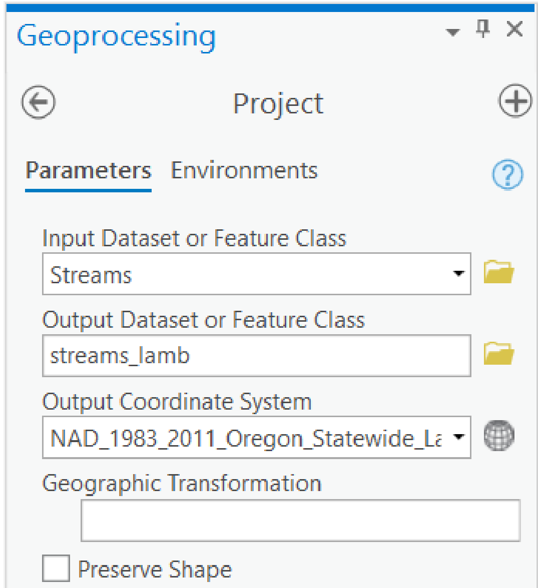


Select Streams as the Input Dataset. Save the Output Dataset to your mac_lamb folder by clicking the Browse option to navigate to the folder. Name the output file streams_lamb and use the drop-down menu to select Feature Classes (All Types) as the file type. Notice how you do not include ".shp" at the end of the file name; instead you establish the file type in the browse menu. **If you skip this step and try to save the file with a .shp extension instead, the Project function will fail.**

You should now see the following graphic.



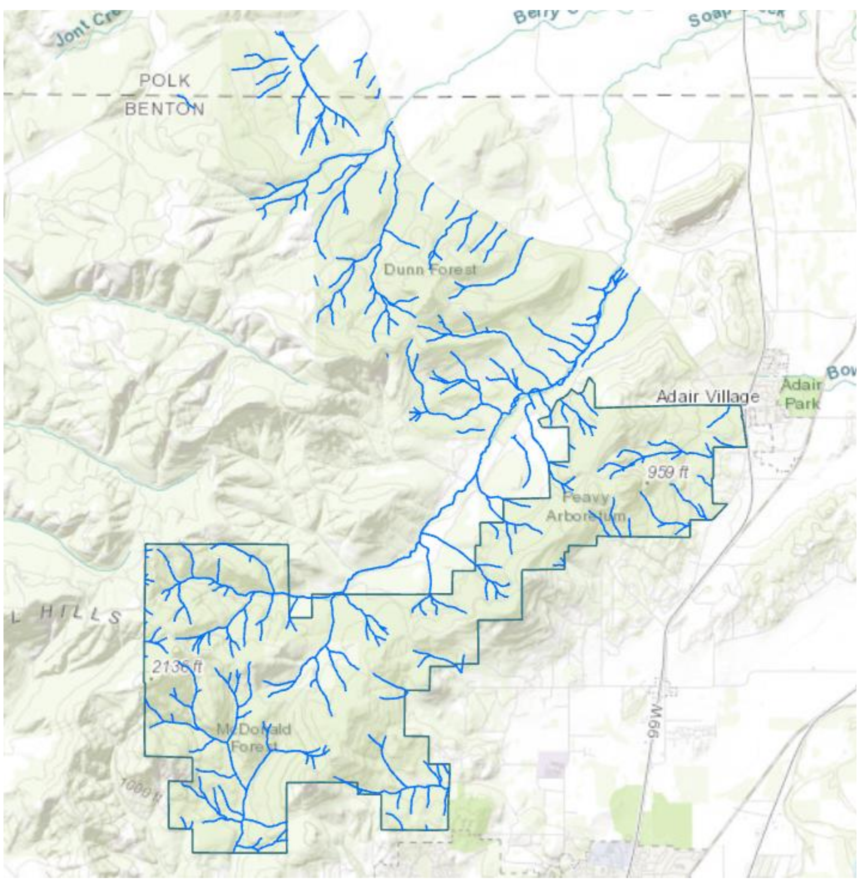
In the Output Coordinate System drop down, select Boundary. This will ensure that the output file streams_lamb shares the same coordinate system as Boundary and Oregon: NAD 1983 (2011) Oregon Statewide Lambert (Intl Feet).



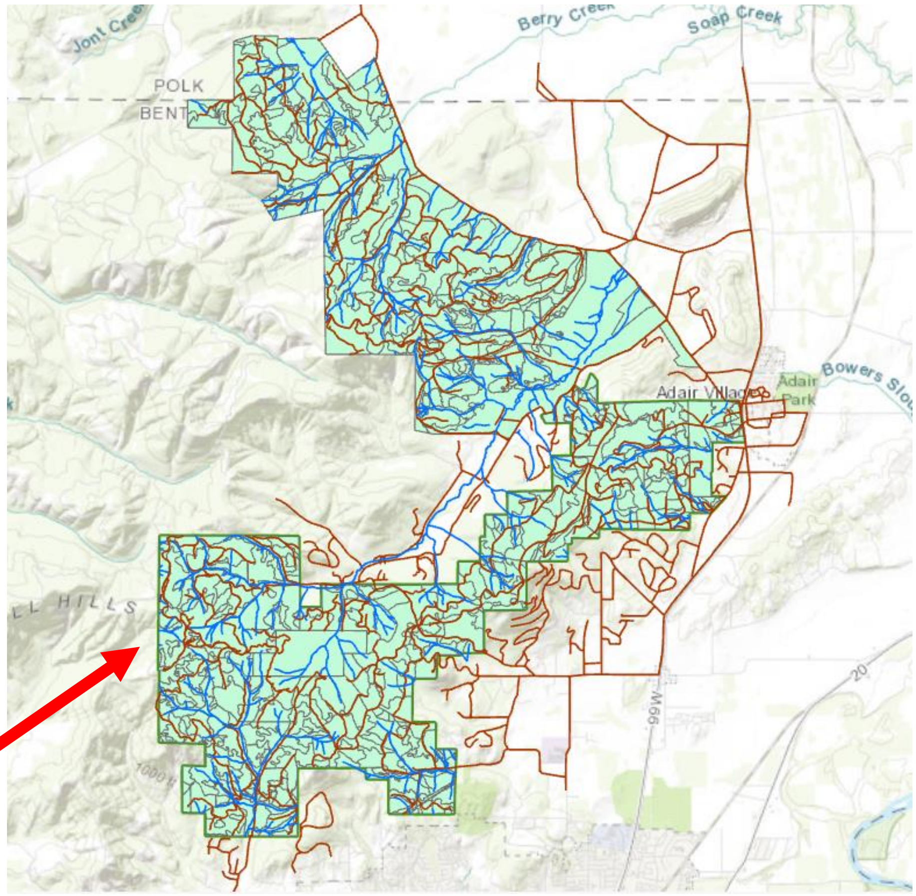
Click Run to complete the Project function.

Use the Add Data button to add streams_lamb to your map project. The file should be in the mac_lamb folder and contain your new projection results.

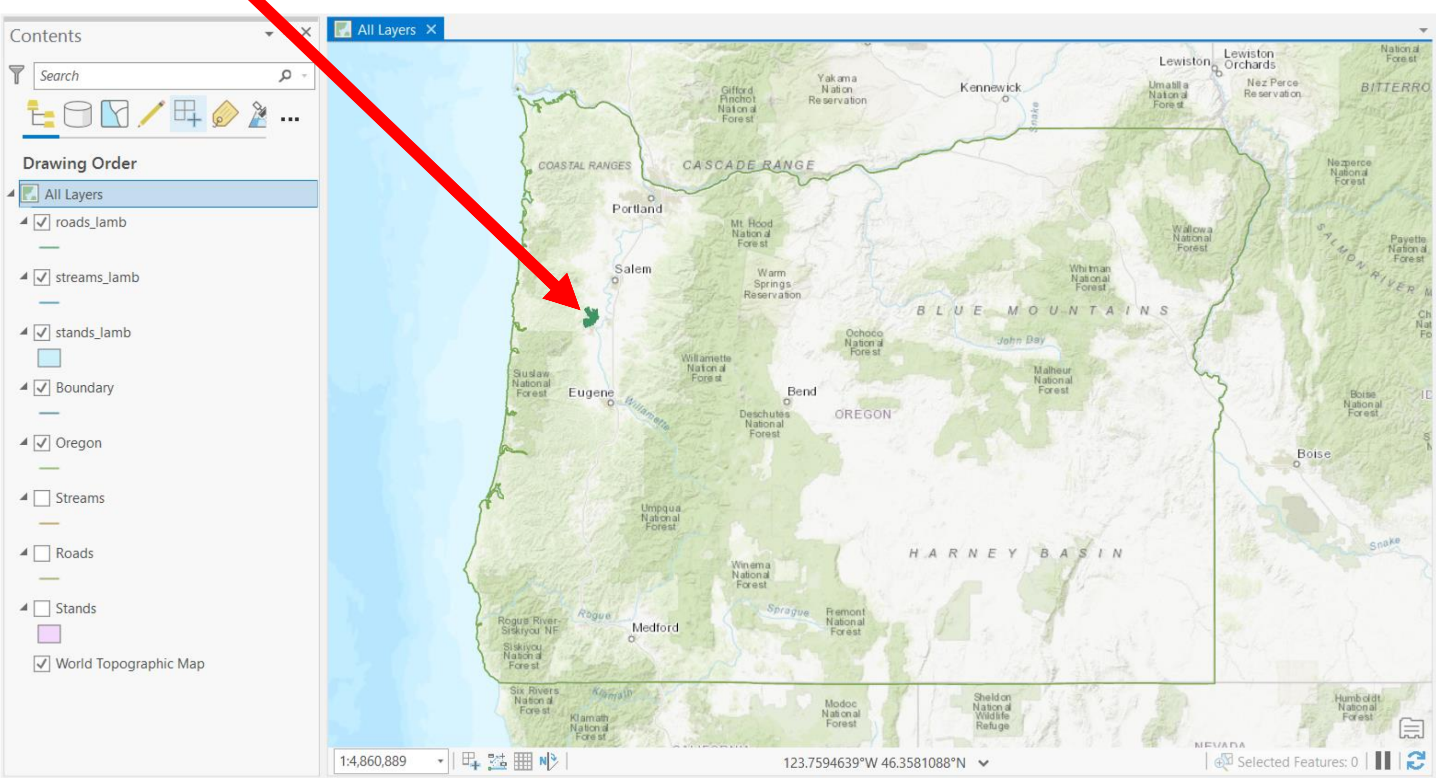
Zoom to the spatial extent of the new streams_lamb layer and toggle the layer on and off to see that the layer, if you've entered the correct projection parameters, matches up to the areas within and around McDonald Forest.



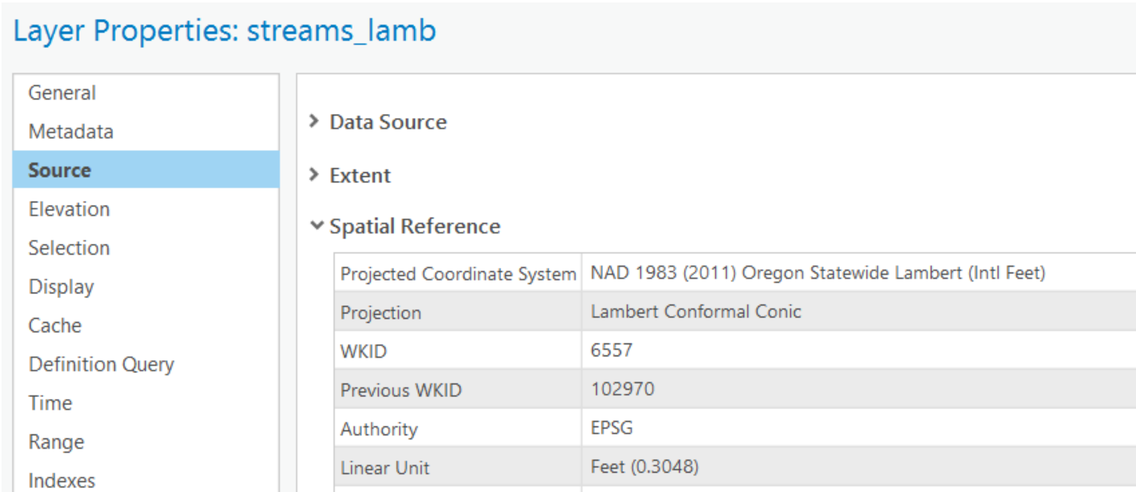
Repeat the Project steps on pages 9-10 using the Stands and Roads layers. When finished, you should have three new shapefiles called roads_lamb, streams_lamb, and stands_lamb, alongside the two original shapefiles Boundary and Oregon, all in the NAD 1983 (2011) Oregon Statewide Lambert (Intl Feet) coordinate system.



McDonald-Dunn
Forest

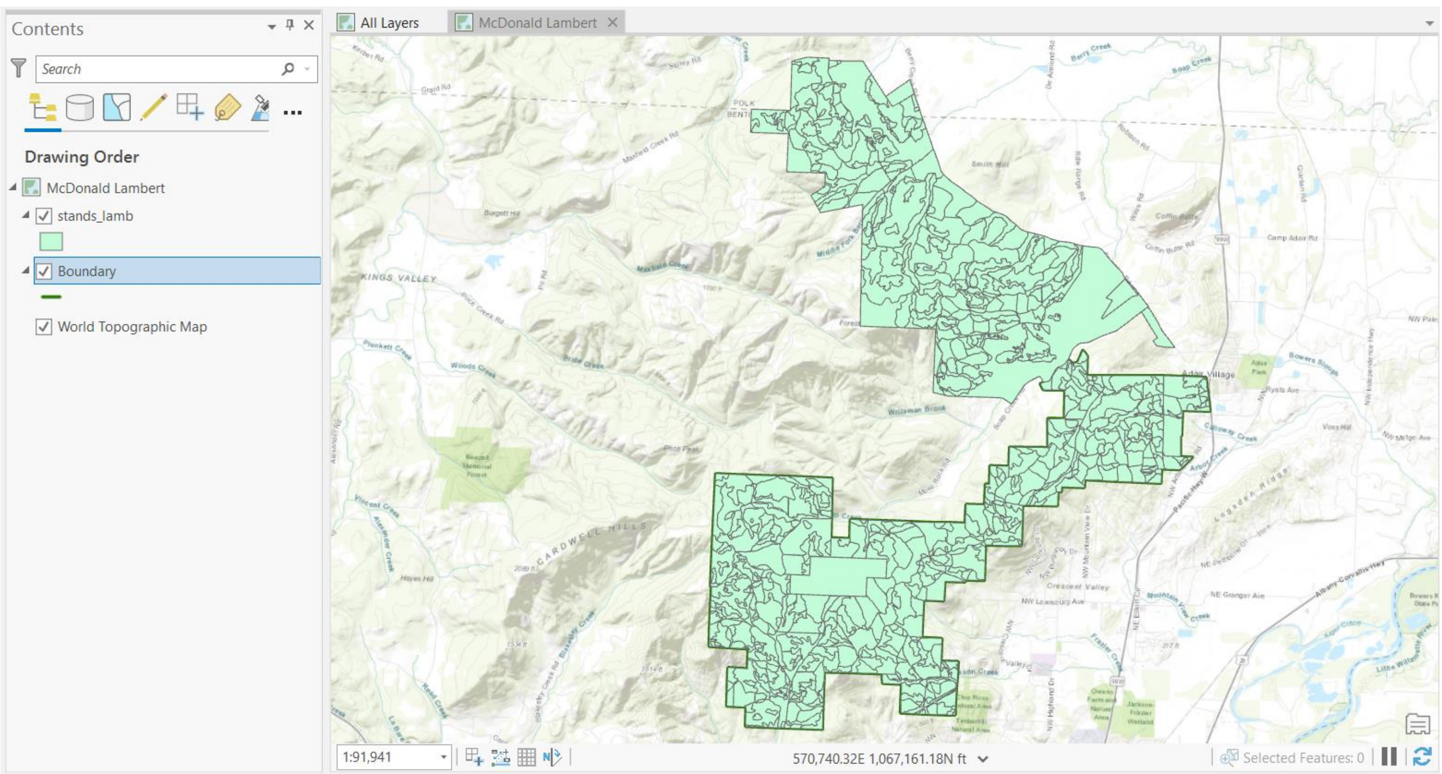


Check each layer's Properties > Source > Spatial Reference tabs to ensure they contain the same coordinate system, NAD 1983 (2011) Oregon Statewide Lambert (Intl Feet).



Let's do some organizing before proceeding.

Create a new data frame by choosing Insert > New Map from the Insert menu. Rename the new data frame "McDonald Lambert." Copy the stands_lamb shapefile and the Boundary shapefile to the new McDonald Lambert data frame. Remove these files from the original All Layers data frame once they are copied.



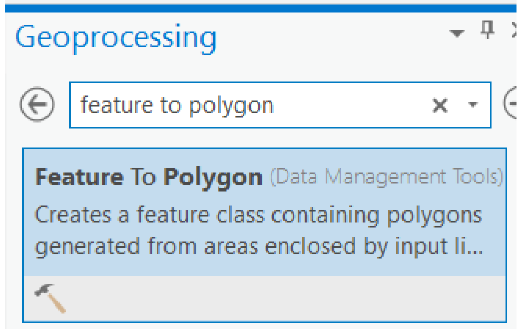
Clipping Layers

In order to limit our analysis to areas within McDonald Forest and not include those in Dunn Forest, we need to clip the stands_lamb layer so that only stands within McDonald Forest are included in the output layer. Notice that oundary is a line file. **This is a problem because we need a polygon in order to perform a clip.**

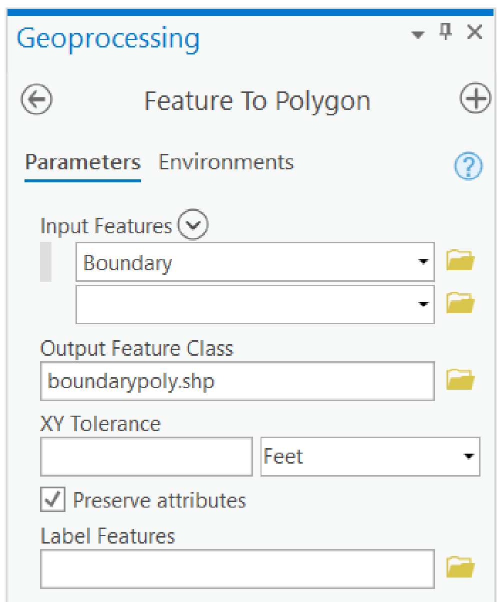
Let's use Geoprocessing to transform the Boundary line feature shapefile to a Boundary polygon feature shapefile.

Feature Class Conversion

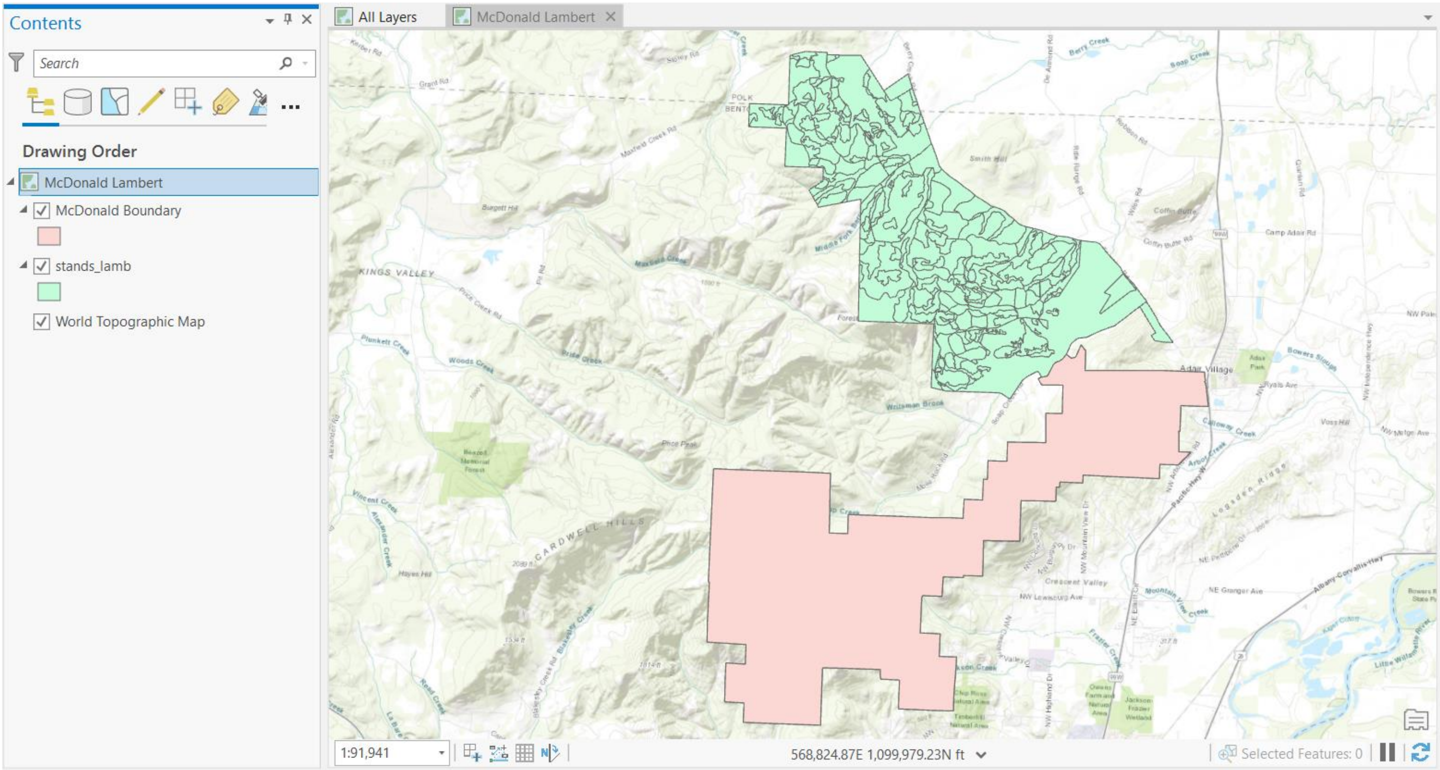
Search for Feature to Polygon in the Geoprocessing window.



Choose Boundary as the Input Features and write the Output Feature Class boundarypoly.shp to your mac_lamb folder. Click Run.

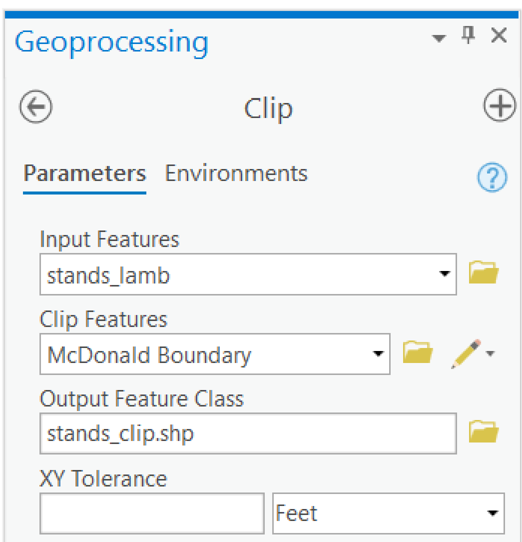


If the new shapefile doesn't automatically appear, used the Add Data button to import boundarypoly.shp from your mac_lamb folder. Delete the line feature Boundary file and name the new polygon Boundary shapefile "McDonald Boundary."

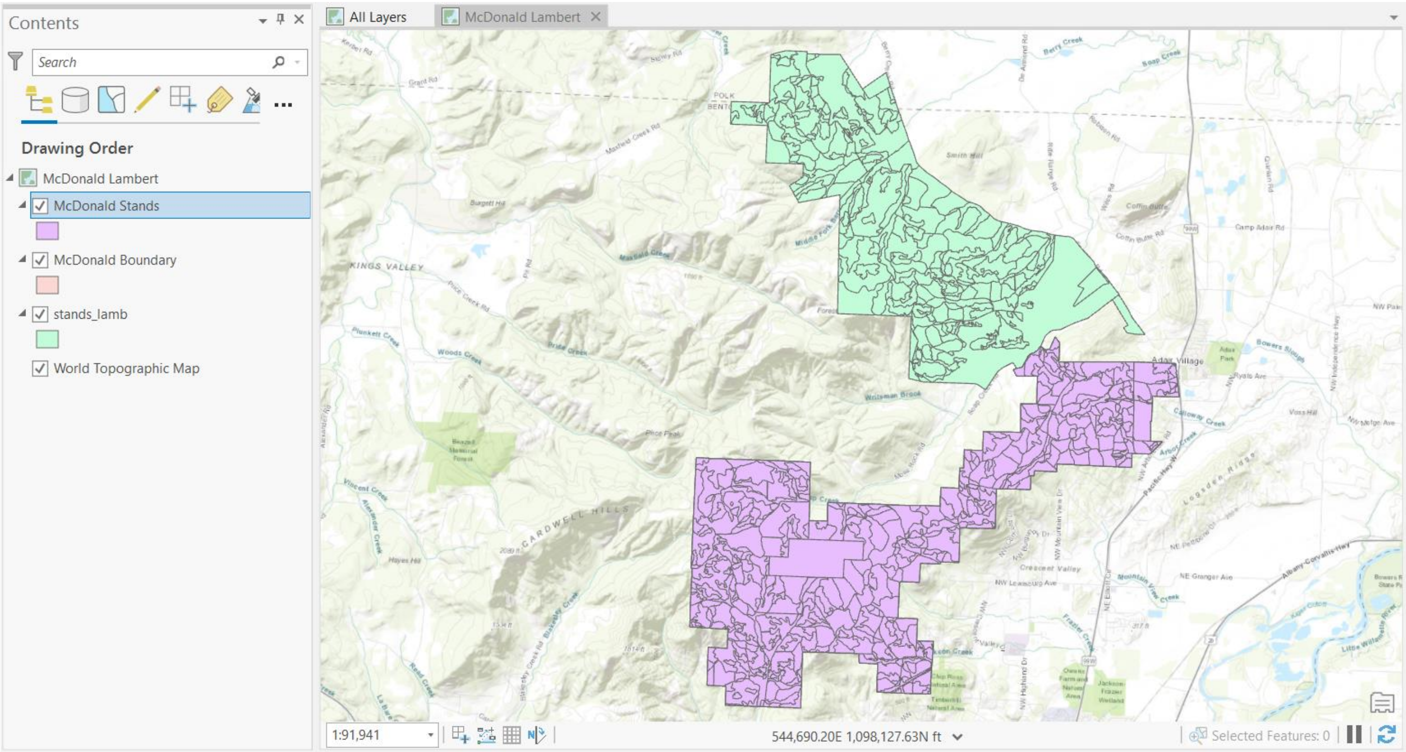


Use the new McDonald Boundary polygon layer to clip the stands_lamb layer we just projected. Search for Clip in the geoprocessing window.

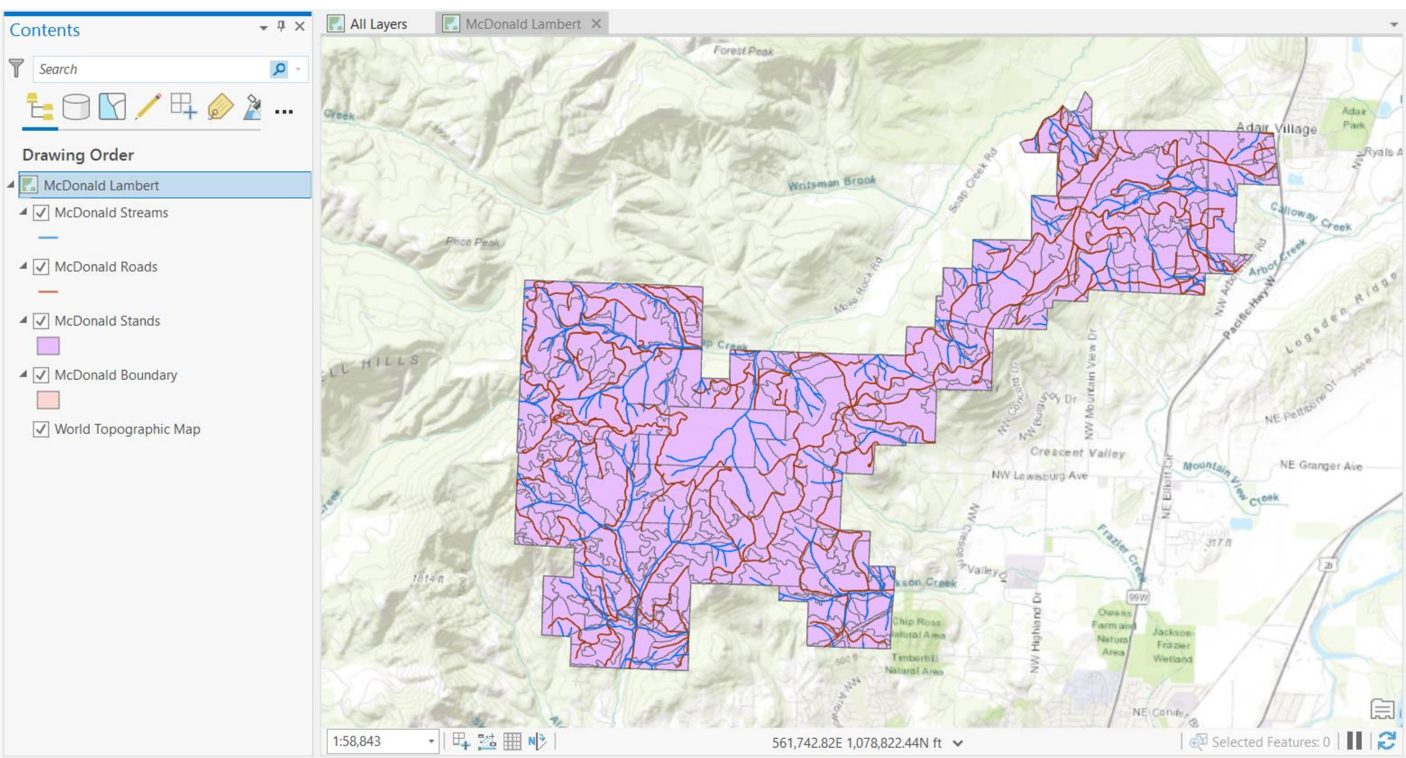
Select stands_lamb as the Input Features, the McDonald Boundary as the Clip Features, and write the Output Feature Class to your mac_lamb folder as stands_clip.shp.



View the new stands_clip layer on your map and rename it to McDonald Stands. You should notice that it only contains stands from within the McDonald Forest boundary.



Copy-paste the streams_lamb and roads_lamb layers from the All Layers data frame into the McDonald Lambert data frame. **Repeat the Clip process on page 14 to clip streams_lamb and roads_lamb to the McDonald Boundary.** Save all outputs to your mac_lamb folder. Your map should look like the graphic below when finished:



The area measurement for the clipped stands layer will need to be updated. The length measurements for your clipped roads and streams layers will also need to be updated. See the Lab 5 exercise for a reminder on how to do this; you can use Calculate Geometry on preexisting AREA and LENGTH fields.

LAB 6 Application: Converting Data to Oregon's Approved Lambert Projection.
Determining stand size, stand types, road length, and stream length.

Assignment 6A. Please answer the following questions. This is a team assignment. Present your typed document at the beginning of the next lab. Be sure to include your names, lab day (e.g. Tuesday 10 AM), assignment number, and course title with your answers. **All questions refer only to those areas within the borders of McDonald Forest. It will be necessary for you to clip roads and streams before you can answer these questions. Report all measurements to the nearest whole units (no decimals).** Create a table when a question has more than one answer. 7 points total.

1. What stand has the fourth largest area? Report the STANDID and acreage in your response.

2. The stands layer for McDonald Forest contains a variable called "Landalloc" that denotes land allocation. There are categories in this variable that refer to "Research" and "Irregular Shelterwood." What is the size, in acres, of each of these allocations (list both separately)?

3. The stands layer for McDonald Forest contains a variable called "Stantype" that denotes stand types. In terms of hectares, what are the sizes of the "ag. pasture" and "pure hardwood (<15%)" categories of this variable (list both separately)?

4. What is the total length, in feet, of road types NOT specified as "rock" or "dirt" by the field "TYPE" in the roads layer?

5. What is the total length, in feet, of Woods Creek in the streams layer?

Assignment 6B. Please answer question 2.2 on page 52 of your text book with reference to McDonald Forest (do not include Dunn Forest). Your answers to parts a and b should be expressed in miles, with units rounded to the nearest half-mile (report no more than one decimal in your response). 4 points total.

a) What is the largest north–south dimension of McDonald Forest in miles?
b) What is the largest west–east dimension of McDonald Forest in miles?
c) Which of the two projections would you choose?
d) Defend your projection choice.