FE 257 GIS LAB 3

Working with Attribute Data and Clipping Spatial Data
Determining Land Use and Ownership Patterns Associated with Streams

One of the primary goals of this course is to give you some hands-on experience in using ArcGIS Pro tools for forestry activities. We've now explored how to import, manipulate, and create maps of watershed areas. This lab is designed to make you more familiar with how to use ArcGIS Pro for basic GIS operations that involve topology processing.

The lab exercise uses spatial data from a coastal watershed. We will calculate some area and linear measurements of watershed features. We will also work with some of the attribute data to answer a brief set of questions. You will work with ESRI shapefiles again this week, which is a very common GIS file format.

What you will learn in this lab:
You will learn how to work with ESRI shapefiles, how to export data to a shapefile format, and how to perform some basic spatial data processing. You will perform some attribute editing and learn how to do a summary of attribute data. You will manipulate how spatial data are represented. This lab should provide you with an exposure to basic data representation and cartographic principles. These skills will assist your future GIS labs.

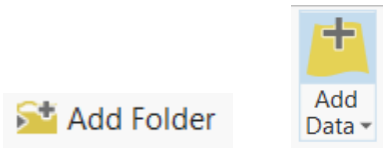
At this point, you will go through a guided exercise. We will perform our operations on the Middle Siletz River Watershed.

Open the Windows Explorer and navigate to the t:\classes\fe257\gislab3 location on the forestry network. Using the mouse, right click on this folder and choose Copy from the menu that appears. Use Windows Explorer to navigate to your workspace\fe257 folder. For most of you this will be located on the Z:\ drive and will have the same name as your user name- for me it's \nicolatk\fe257. Enter your fe257 workspace folder, right click and choose Paste from the menu that appears. This should copy the gislab3 folder and all files located in the folder to your workspace.

Guided Exercise Highlights

Copying and manipulating spatial data in the form of ESRI shapefiles.
Creating shapefiles from existing shapefiles.
Clipping spatial data.
Summarizing attribute data.
Editing and creating attribute data.

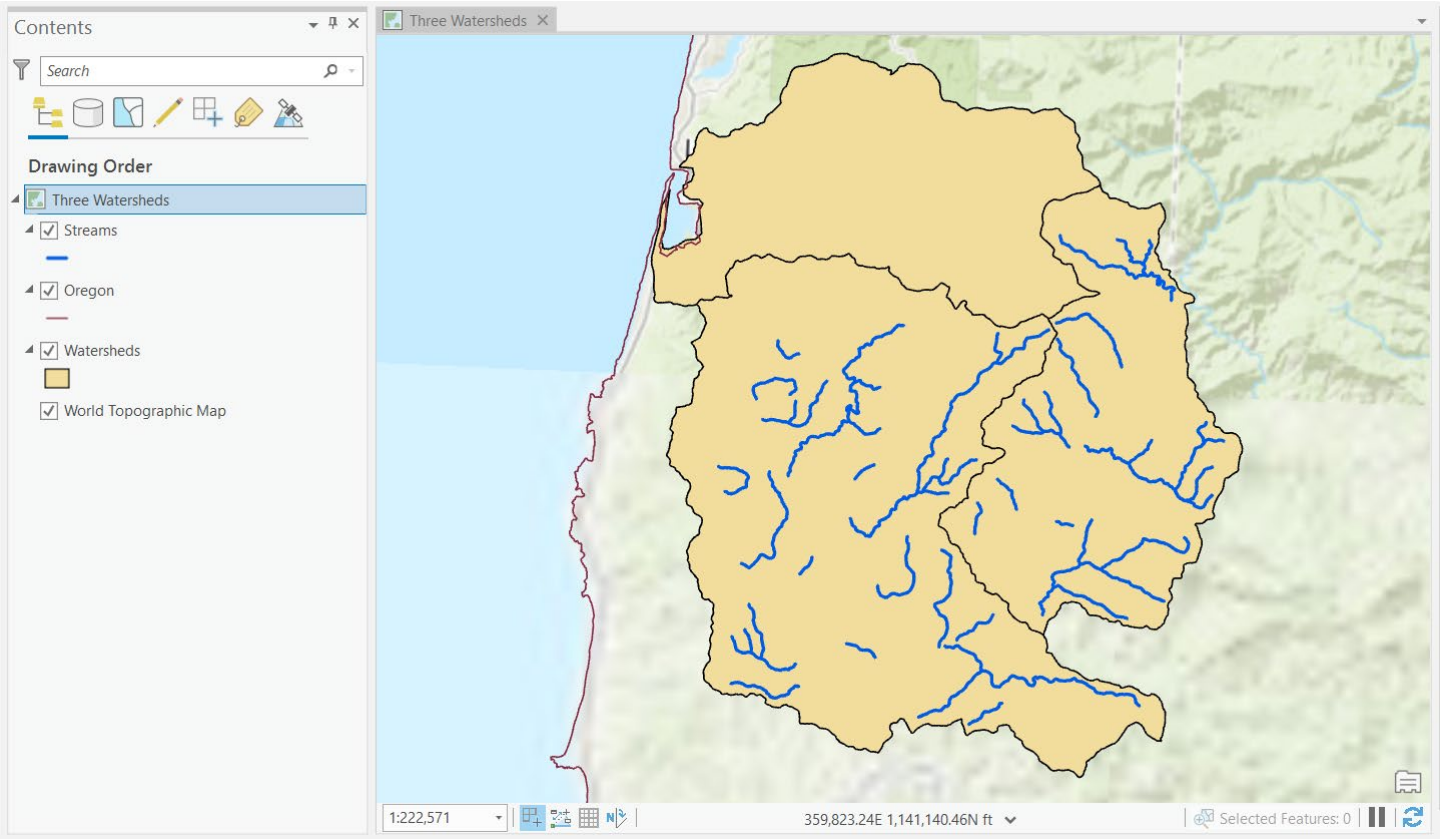
Open ArcGIS Pro and add each of the three ESRI shapefiles that should be in your gislab3 folder into a data frame by using the same method as Lab 1: connecting to the gislab3 folder and using the Add Data button.



You can select all three shapefiles by clicking on the first one and holding the control key down while you select the others. When you do this and select the Add button, you can open all three files at the same time. The shapefiles should appear on the northwest Oregon coast. Once the shapefiles have been added to your Contents, they're known as layers. Let's adjust the way the layers are displayed so that they match your preferences (right click on a layer and choose Symbology). I prefer streams that are blue and lightly shaded watersheds. Let's also change the name of the layers so that they are capitalized: "Streams", "Oregon", and "Watersheds."

Rename the data frame to "Three Watersheds" by right clicking on the data frame, accessing Properties, the General tab, and typing in the Name box.

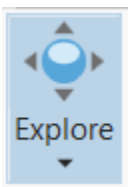
Save your map project as Lab3.aprx in your gislab3 workspace.



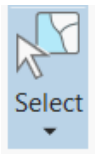
Creating Shapefiles

Zoom to the extent of the "Watersheds" layer by right clicking on it and choosing Zoom To Layer.

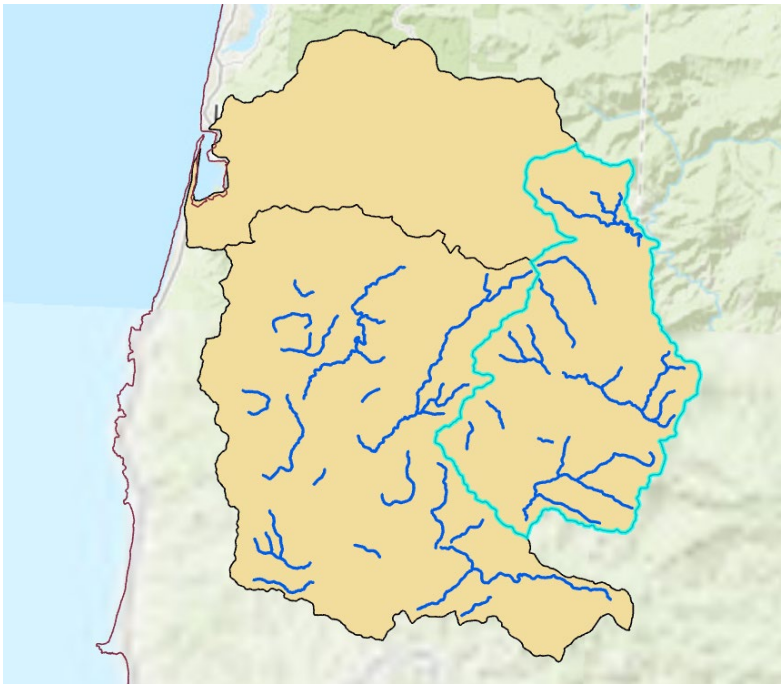
You should see that there are three watershed areas delineated in this area. Let's find out what data is connected to each of these areas by using the pop up identification tool and clicking on each of the watersheds.



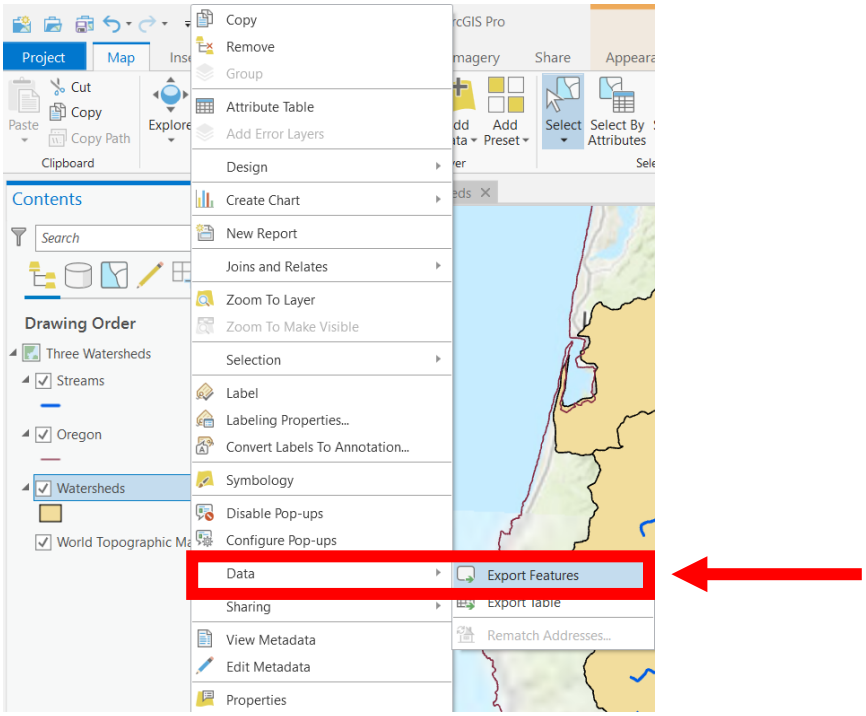
Let's select the Middle Siletz watershed by clicking on the Select tool in the Map toolbar and clicking on part of the watershed polygon while being careful not to click on a stream or the Oregon border.



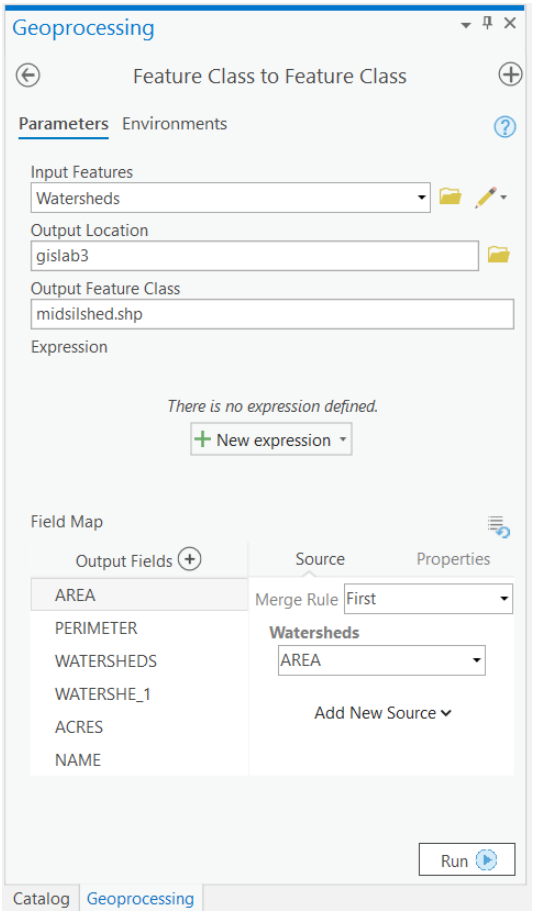
Notice that the border surrounding the polygon changes to bright blue when selected; your map should look similar to the figure below.



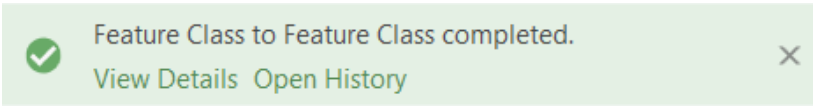
Let's create a shapefile from the selected polygon so that we can focus our analysis on this area. With the polygon of interest selected, right click on the Watersheds layer in the Contents, choose Data, then Export Features from the pop up menu.



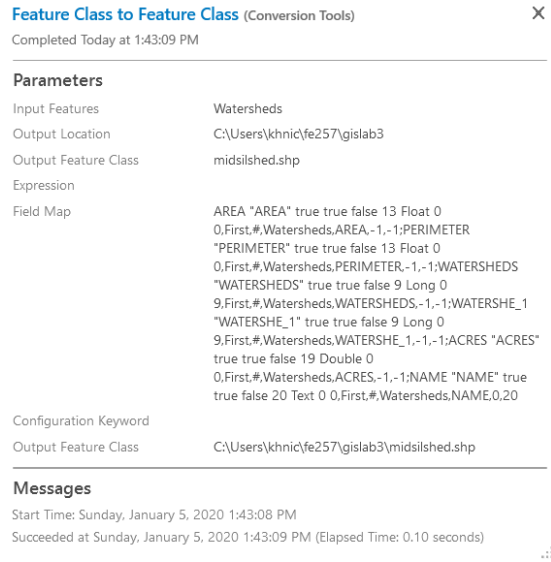
The Geoprocessing window will appear and display the Feature Class to Feature Class tool. This is because we are exporting data from a polygon feature class (All Watersheds) to another polygon feature class (Middle Siletz Watershed). Specify a name for the new shapefile (midsilshed.shp) and browse to direct it to your gislab3 folder. Leave all other default settings and click Run.



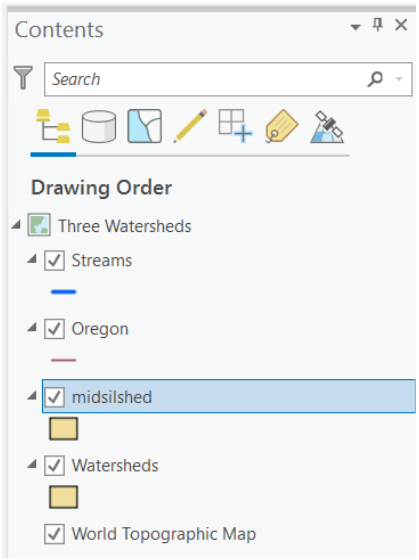
If successful a number of things will happen. You will see a message at the bottom of your geoprocessing window:



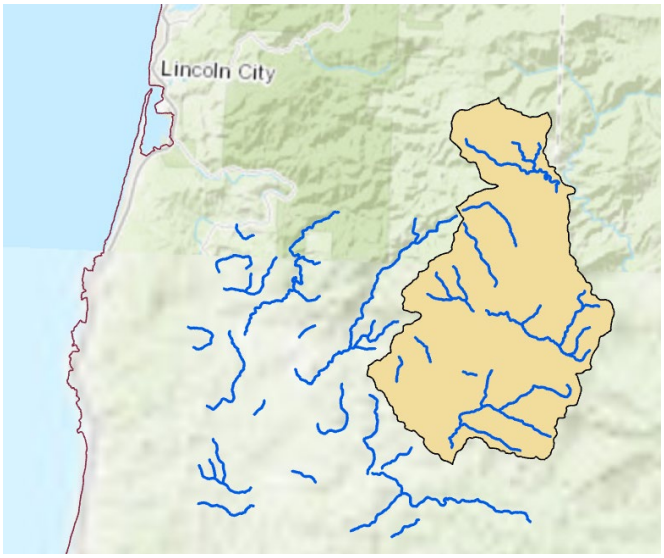
A geoprocessing history pop up should appear showing task completion:



And the newly created midsilshed layer should appear in your Contents and Map windows:



Rename the new layer to “Middle Siletz Watershed” by right clicking on it and accessing its Properties. Move this layer to the bottom of the Contents and turn the Watersheds layer off from view. Your map should now look like this:

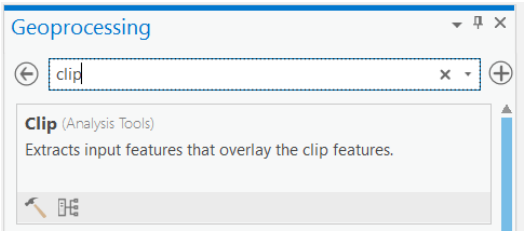


Save your map project.

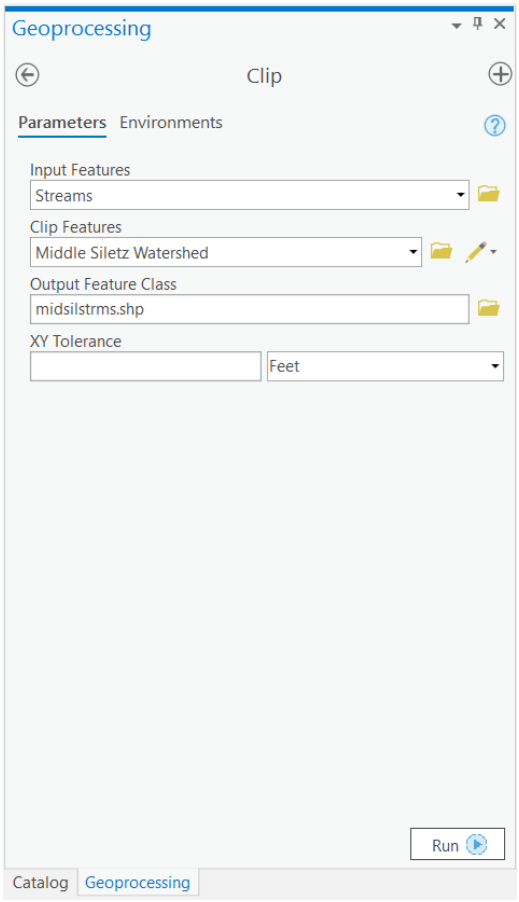
Clipping Spatial Data

For our lab exercise we want to also make a layer that contains only those streams in the Middle Siletz Watershed. We’ll use a clip operation to pare down the Streams layer to meet our objectives. Make the Geoprocessing window available by clicking on the tab in the lower right-hand corner next to Catalog.

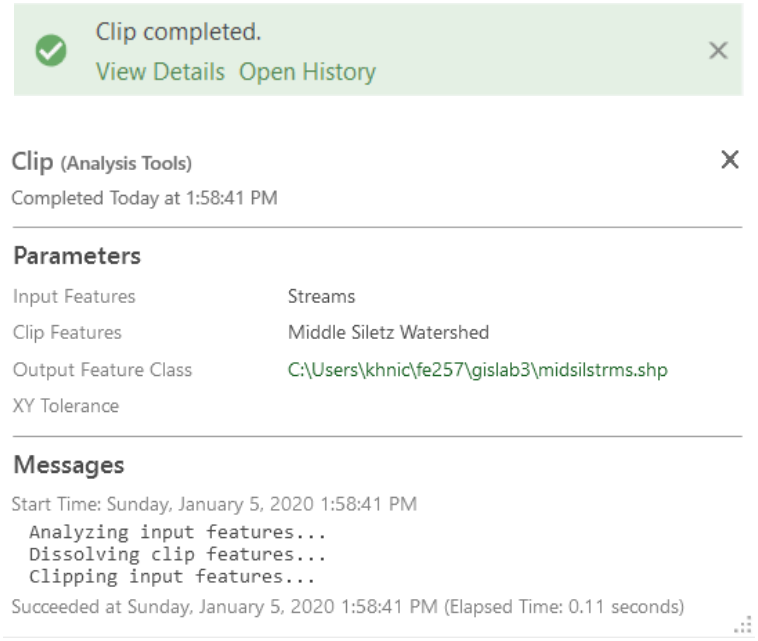
Within Geoprocessing, search for Clip and click on the first result “Clip (Analysis Tools).”



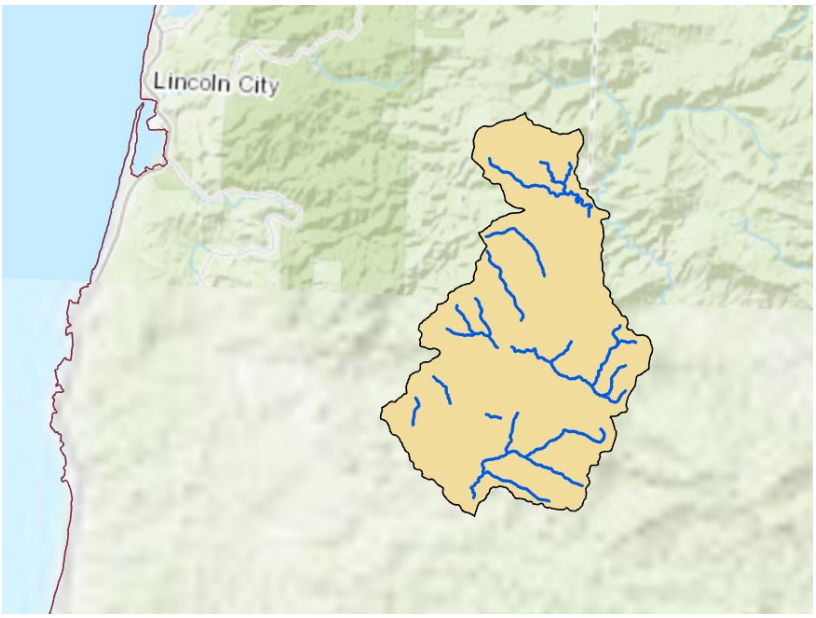
Clip the Streams layer to Middle Siletz Watershed and write the output to your gislab3 workspace with the name midsilstrms.shp. See the graphic below of the Clip dialog box:



Click Run. Some processing should take place. If successful you should receive these messages:



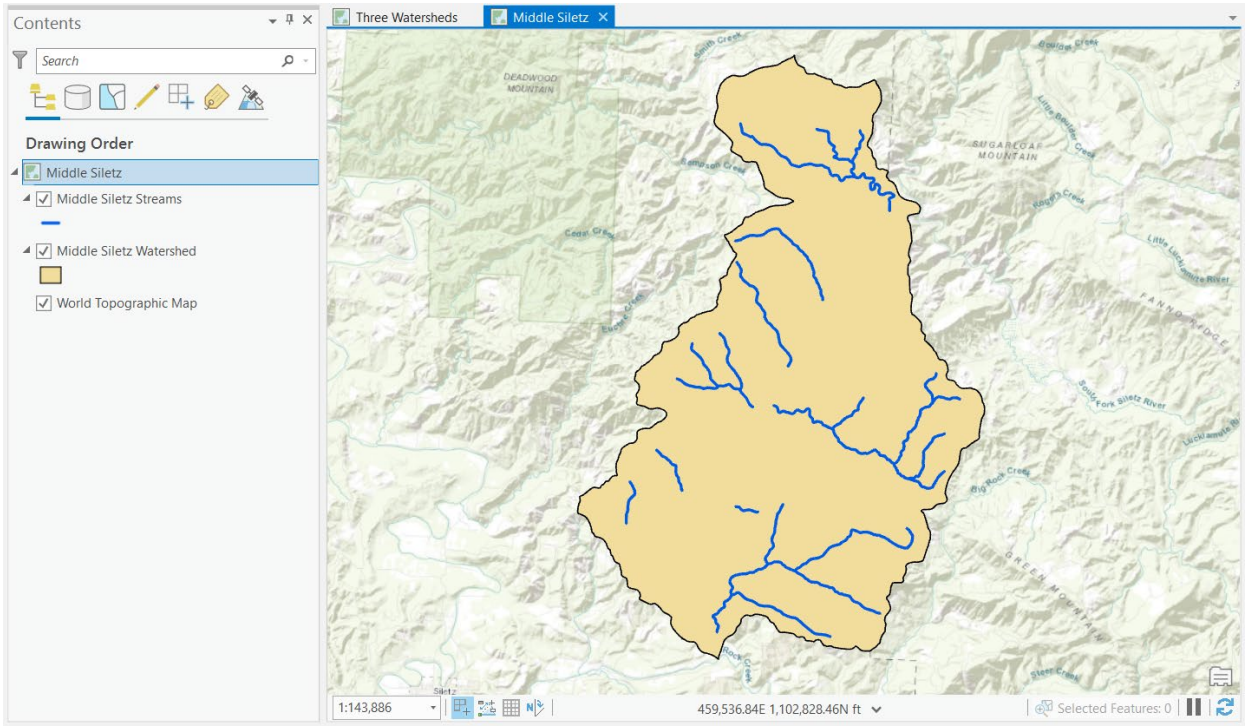
The new layer should be added to your Contents and Map. Access its properties and rename it to “Middle Siletz Streams.” Turn off the Streams layer. Your map should now look like this.



Create a new data frame so that we can move our two new layers into their own space. You can add a data frame by choosing Insert > New Map. Once the new data frame is inserted, rename it to Middle Siletz by right clicking on it, accessing Properties, and typing into the Name input box under the General tab.

Move Middle Siletz Watershed and Middle Siletz Streams into the new data frame by copy-pasting them from the Three Watersheds Contents window into the Middle Siletz Contents window. Once you’ve copied both layers to the new data frame, you can delete them from the old data frame by right clicking on them and choosing Remove.

Toggle to your new data frame if it isn’t already active, make sure that the Middle Siletz Watershed layer is at the bottom of the Contents stack (if not, click on it and drag it), and adjust the Symbology to your liking. Your map should look similar to the graphic below.



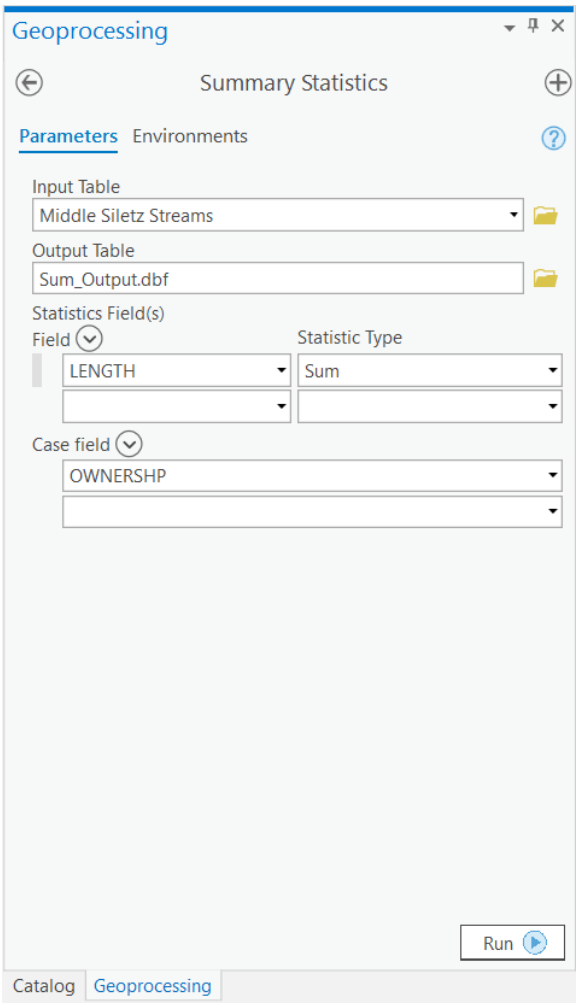
Save your map document!

Summarizing, Editing, and Joining Spatial Attribute Data

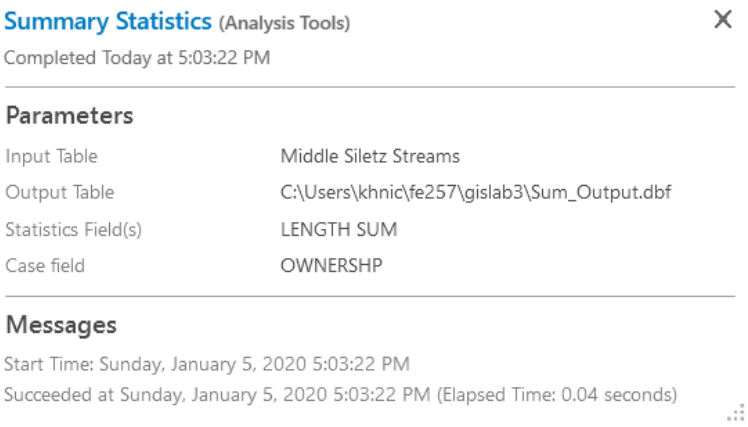
Let's take a look at the data that are attached to our Middle Siletz layers. Right click on the Middle Siletz Watershed layer and choose Attribute Table. There is only one polygon so only one record is present in the attribute table- not much to see here.

Right click on the "Middle Siletz Streams" layer and open its attribute table. Find the variable named "Ownership" by scrolling to the right. Let's create an output file from this table that will show us a summary of stream length by ownership category. Right click the heading of the Ownership column and select Summarize.

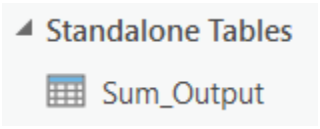
In the Summary Statistics window, the input table is Middle Siletz Streams. Browse to your gislab3 workspace and save the output table as Sum_Output.dbf. In the Field drop down select Length and Sum for Statistic Type. Make sure the Case field shows Ownership. Click Run.



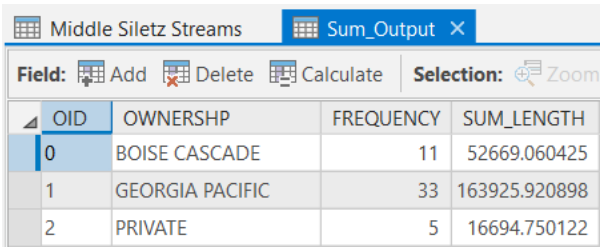
If successful, these messages will appear:



The newly created table appear in your Contents window:



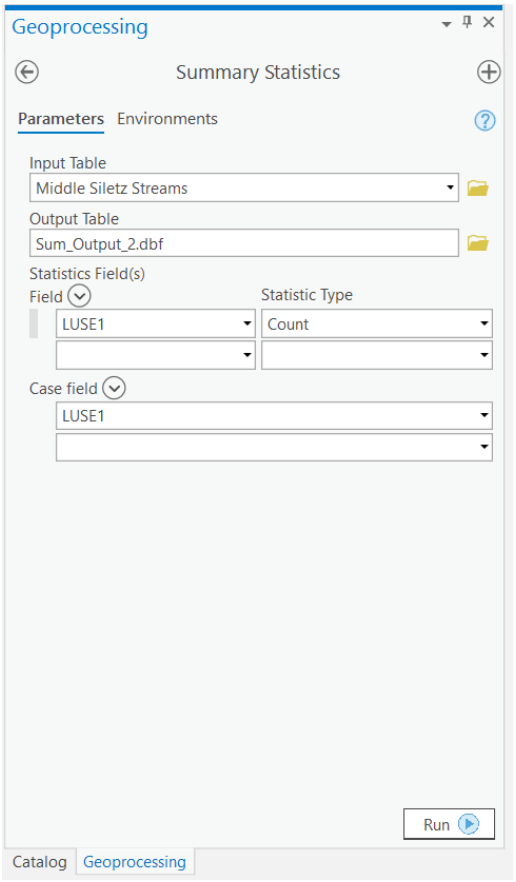
Right click on the table name and choose Open. The output file lists stream length sums by ownership category.



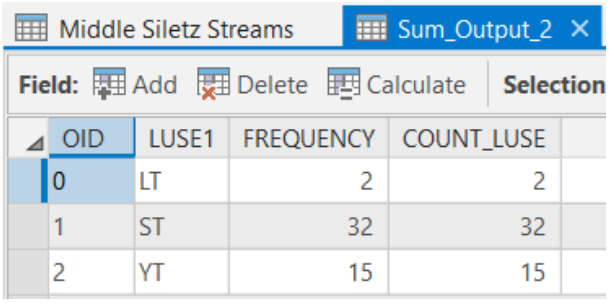
OID	OWNERSHP	FREQUENCY	SUM_LENGTH
0	BOISE CASCADE	11	52669.060425
1	GEORGIA PACIFIC	33	163925.920898
2	PRIVATE	5	16694.750122

Close this summary table.

Let's look at a variable that represents land use and land cover data for the streams. Return to the attribute table for "Middle Siletz Streams." Find the field "Luse1" and perform a summary on this field by right clicking on the column header and choosing Summarize. In the Summary Statistics window, the input table is Middle Siletz Streams. Browse to your gislab3 workspace and save the output table as Sum_Output_2.dbf. Change Field to LUSE1 and Statistic Type to Count. Click Run.



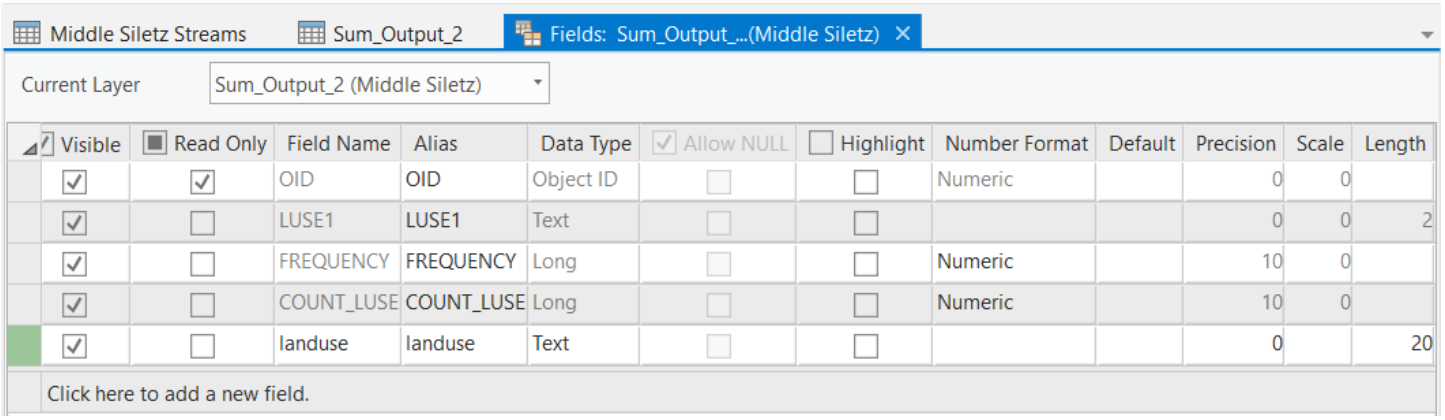
Just like the last table, geoprocessing messages will notify you of your success and the new table will appear in the Contents. Open Sum_Output_2.dbf and note the three categories representing land use types listed in the output table.



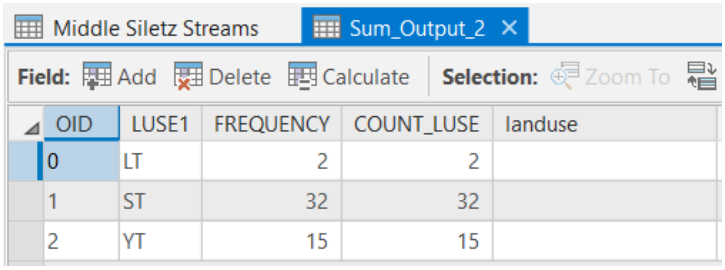
OID	LUSE1	FREQUENCY	COUNT_LUSE
0	LT	2	2
1	ST	32	32
2	YT	15	15

We're going to add a variable to this table that's more descriptive of land use and we will join the resulting file to the original attribute table.

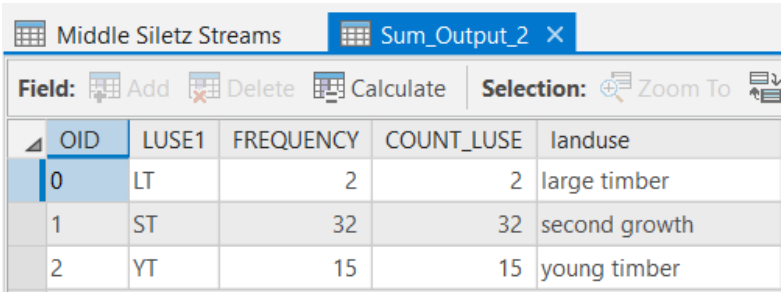
1. Select "Add" from the Field toolbar at the top of the attribute table.
2. Enter the name "landuse" in the Field Name box, use the drop down list to select "Text" in the Data Type box, and set the Length to 20. We selected "Text" because we're going to work with a character variable and not a numeric variable. Click Save in the "Standalone Table, Data" toolbar, and the rest of the row will auto populate.



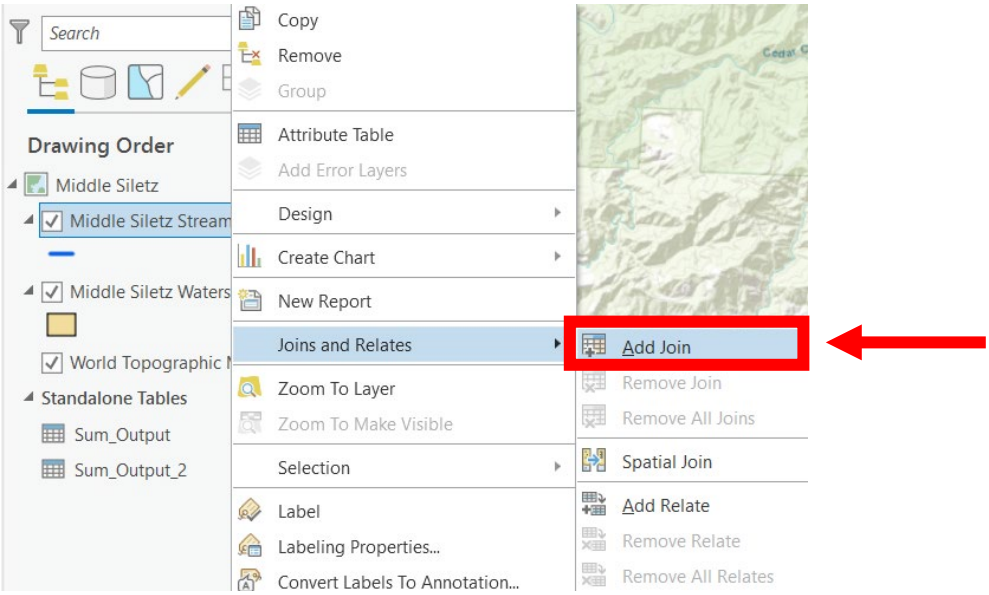
3. This should add the new field to your Sum_Output_2 table.



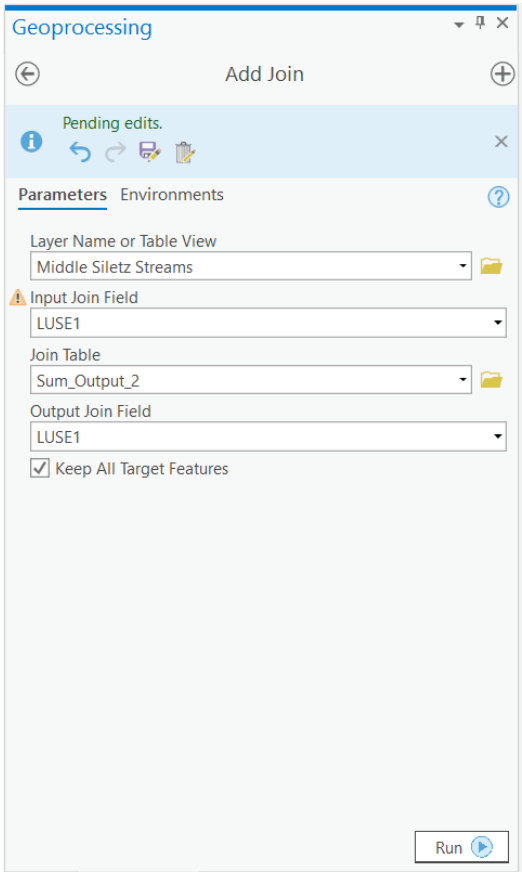
We want to be able to type some descriptions that better clarify the land use and land cover types symbolized by the LUSE1 abbreviations. Double click in the first empty cell under landuse (this should in the same row as the LT record) and type “large timber”, click the second empty cell and type “second growth,” select the next and type “young timber.” Your table should look like the figure below.



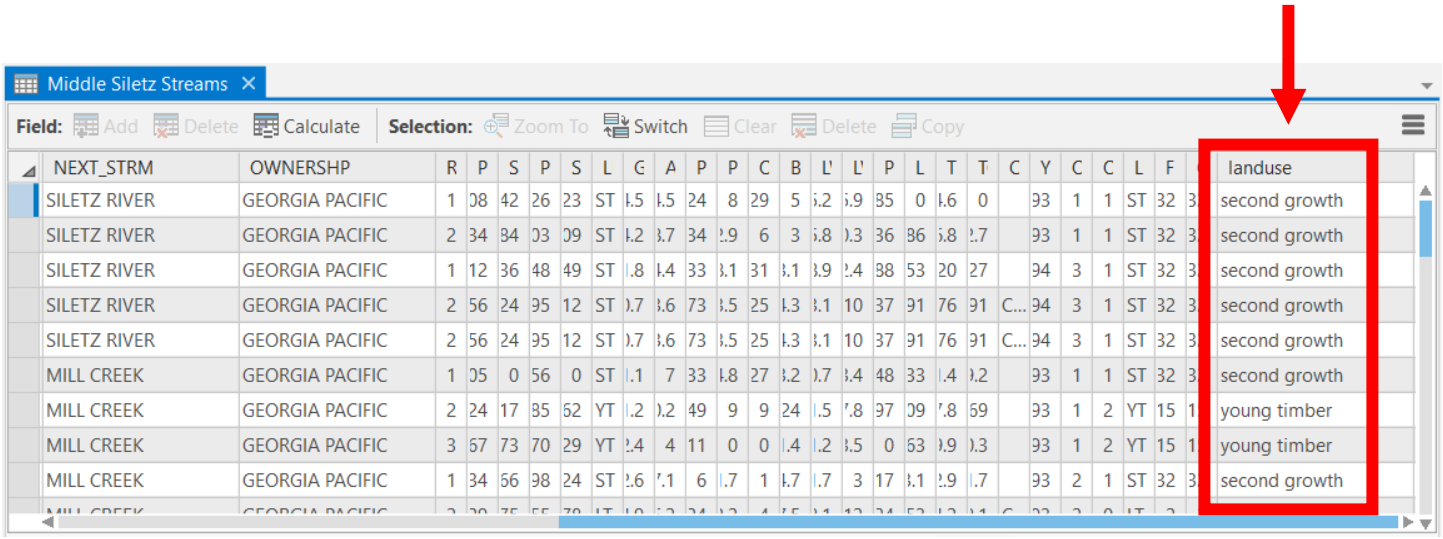
We’re going to join this summary data table to the attributes from Middle Siletz Streams. The joined data should give a land use/land cover description for every stream in the database. Go to your Contents and locate Middle Siletz Streams. Right click on this layer, chose Joins and Relates, then choose Add Join.



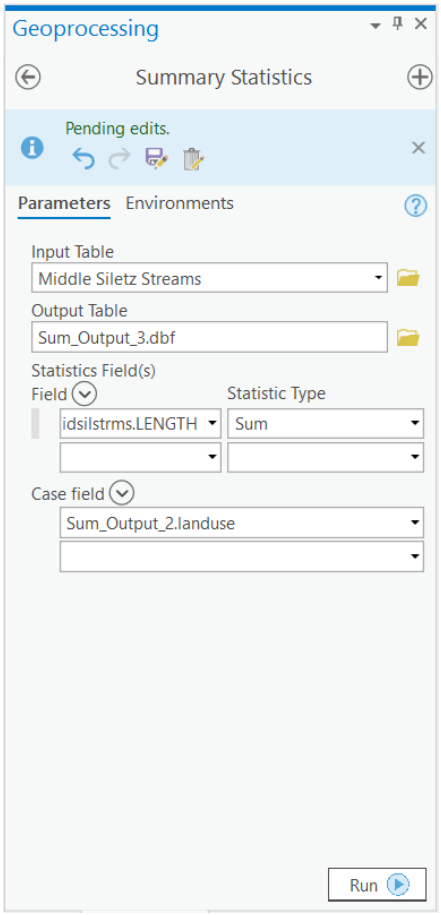
The way this join will work is that the attribute shared between Middle Siletz Streams and Sum_Output_2, which is LUSE1, will serve as the join item or common ID for the join. We'll need to make some choices in the Add Join dialog box that appears. The Layer Name is Middle Siletz Streams, both Input and Output Join Fields are LUSE1, and the Join Table is Sum_Output_2. Select Keep All Target Features and click Run.



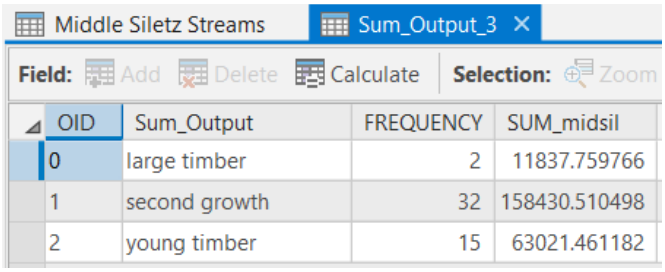
Scroll to the end of the Middle Siletz Streams attribute table and notice that fields have different titles and that there are also some new variables. These have been joined in a "one to many" relationship. Most importantly, the landuse field you created is now part of the Middle Siletz Streams attribute table.



Now perform a summary of stream length by land use type. In Middle Siletz Streams, right click on the landuse field (should be the last field) and click Summarize. In the Summary Statistics dialogue box, the Input Table is Middle Siletz Streams. Browse to your gislab3 workspace and save the output table as Sum_Output_3.dbf. Under Field, scroll to midsilstrms.LENGTH and choose Sum for Statistic Type. Case field will be Sum_Output_2.landuse. Click Run.



Open Sum_Output_3.dbf from the Contents window. Your output should look like the table below.

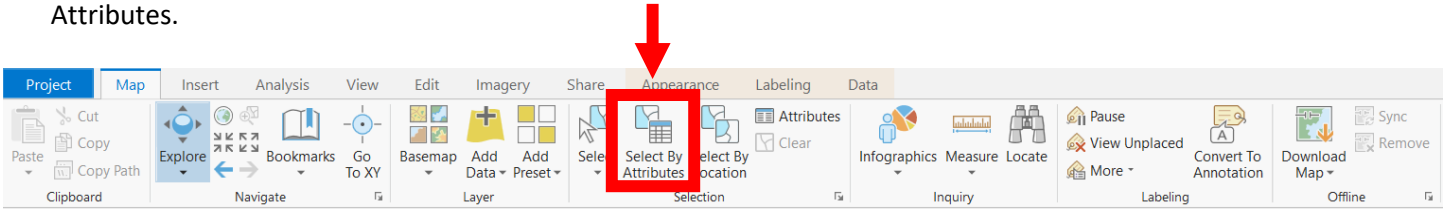


OID	Sum_Output	FREQUENCY	SUM_midsil
0	large timber	2	11837.759766
1	second growth	32	158430.510498
2	young timber	15	63021.461182

Close this table.

Let's experiment a bit with our Streams layer and learn to use another ArcGIS Pro tool. Suppose that we wanted to see what portion of a layer's contents contained attribute data that matched a request that we had in mind. In the Middle Siletz Streams layer, a field exists that describes the number of conifers within the riparian area. Let's see which of the streams have conifer counts greater than 200.

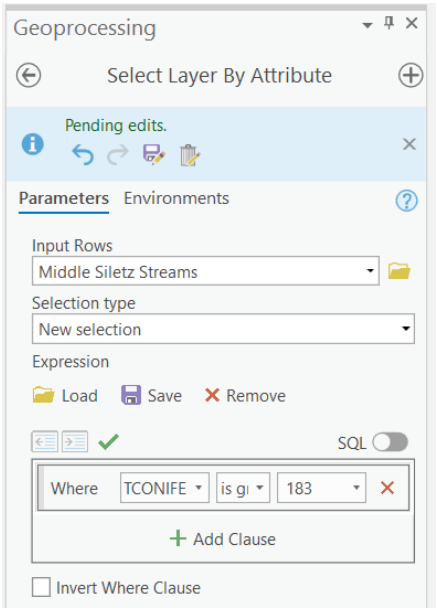
1. Click on the Middle Siletz Streams layer in the Contents so it is highlighted. Go to the Map toolbar and click Select By Attributes.



   In the Select Layer By Attribute dialogue box that appears, make sure Middle Siletz Streams is in the Input Rows box. Pick New Selection for Selection Type, then click New Expression to start building a new query. The Select By Attributes tool takes a user query and searches the layer of interest for all the values contained within that query's parameters, then returns those values to the user. In this case, we want to select all the streams in the Middle Siletz Streams layer that have conifer counts greater than 200 within their riparian areas. TCONIFER is the field in the Middle Siletz Streams attribute table stating how many trees are contained within a stream's riparian area. Therefore, in word form, our expression will look something like this:

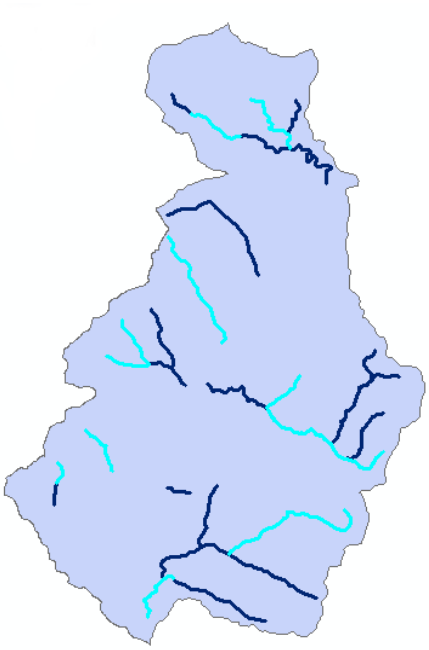
      Select all streams from the Middle Siletz Streams layer where TCONIFER is greater than 200 trees.

2. In the "Where" drop downs, select "TCONIFERS," "is greater than," and "183." We cannot enter 200 directly because this drop down draws from unique values in the attribute table; notice that the values closest to 200 in the attribute table is 183 and the next highest is 244. Therefore, to capture streams with greater than 200 trees, we must make 183 trees our threshold.

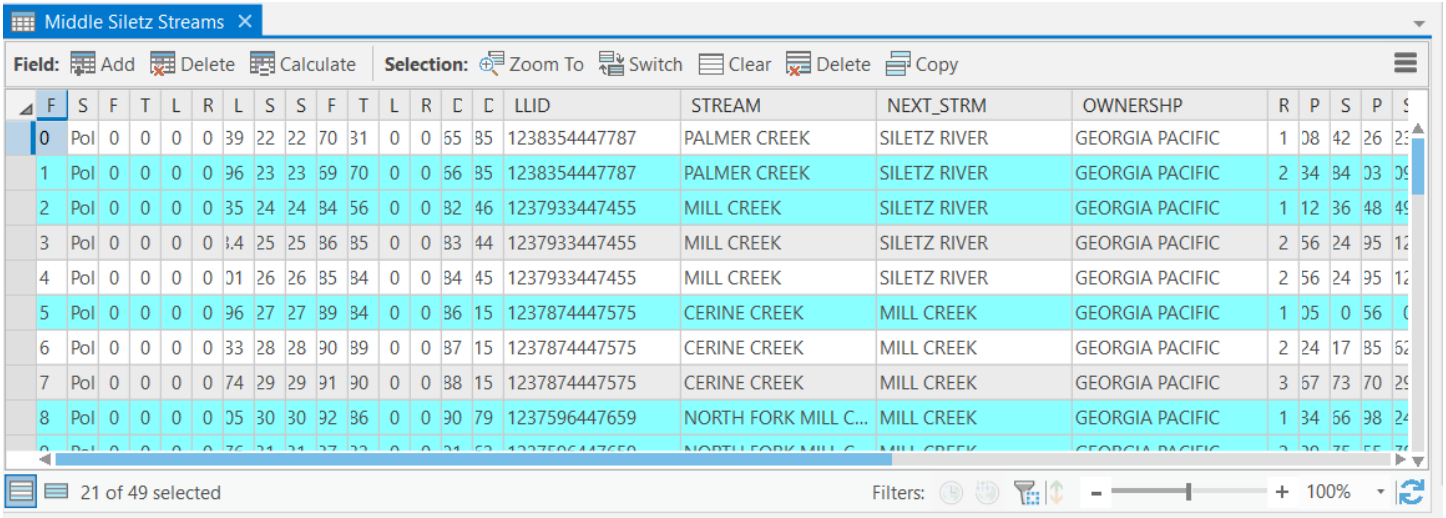


3. Click Run.

4. The corresponding records should be selected. Look at your map to see the set of streams that match this criterion.

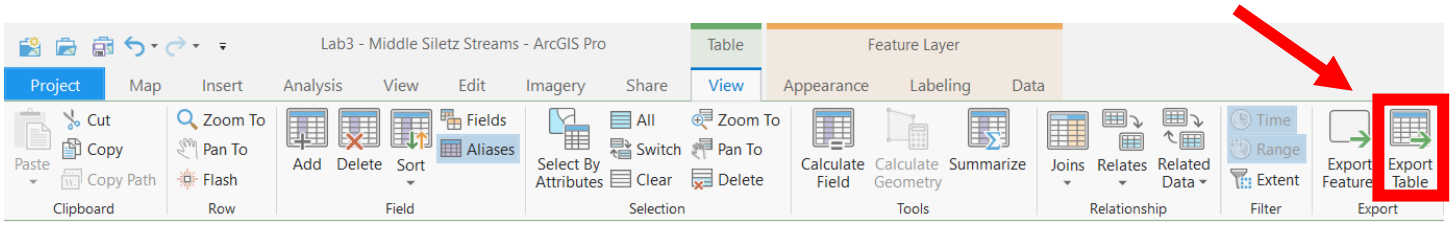


5. You might also notice that the records for these streams have been highlighted in the attribute table. If you've closed the table, open the attribute table for "Middle Siletz Streams" and look. There should be 21 records selected.

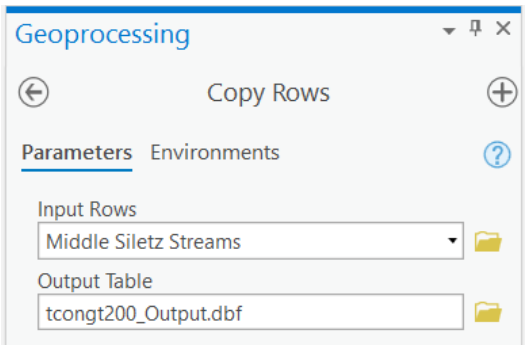


6. Let's get a list of the streams that match our criterion.

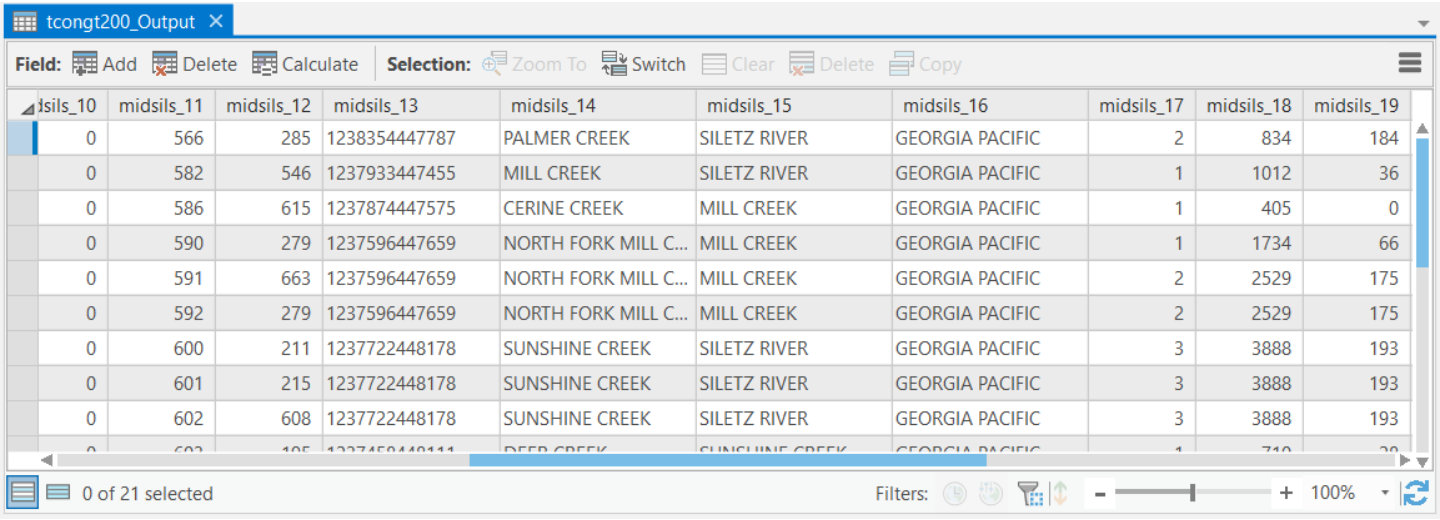
7. With the 21 records selected, a "Table, View" toolbar should appear at the top of your screen. Click Export Table.



8. In the Copy Rows window that appears, make sure Input Rows are Middle Siletz Streams. Let's send the output to your gislab3 folder and name it "tcongt200_Output.dbf." Click Run.

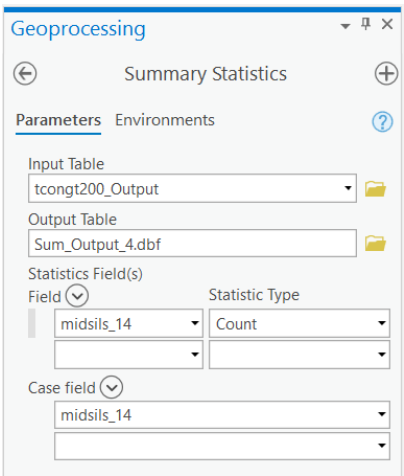


The output table with 21 records should now appear in your Contents window. Unfortunately the field headers are not retained in the new table, so you'll have to do a bit of sleuthing to retrieve information.



midsils_10	midsils_11	midsils_12	midsils_13	midsils_14	midsils_15	midsils_16	midsils_17	midsils_18	midsils_19
0	566	285	1238354447787	PALMER CREEK	SILETZ RIVER	GEORGIA PACIFIC	2	834	184
0	582	546	1237933447455	MILL CREEK	SILETZ RIVER	GEORGIA PACIFIC	1	1012	36
0	586	615	1237874447575	CERINE CREEK	MILL CREEK	GEORGIA PACIFIC	1	405	0
0	590	279	1237596447659	NORTH FORK MILL C...	MILL CREEK	GEORGIA PACIFIC	1	1734	66
0	591	663	1237596447659	NORTH FORK MILL C...	MILL CREEK	GEORGIA PACIFIC	2	2529	175
0	592	279	1237596447659	NORTH FORK MILL C...	MILL CREEK	GEORGIA PACIFIC	2	2529	175
0	600	211	1237722448178	SUNSHINE CREEK	SILETZ RIVER	GEORGIA PACIFIC	3	3888	193
0	601	215	1237722448178	SUNSHINE CREEK	SILETZ RIVER	GEORGIA PACIFIC	3	3888	193
0	602	608	1237722448178	SUNSHINE CREEK	SILETZ RIVER	GEORGIA PACIFIC	3	3888	193

9. Do a summary of the variable "Stream," represented in the new table as "midsils_14" in the new output table to see a list of which streams were selected as part of the 21 records with TCONIFERS > 200. You can do this by right clicking on the midsils_14 field and choosing Summarize. The input table is tcongt200_Output, the Field is midsils_14 and the Statistic Type is Count. Leave the default Case Field. Direct your output table Sum_Output_4.dbf to your gislab3 folder and click Run. As usual, the output table will appear in your Contents and you must open it to view it.



Sum_Output_4

Field: Add Delete Calculate Selection: Zoom

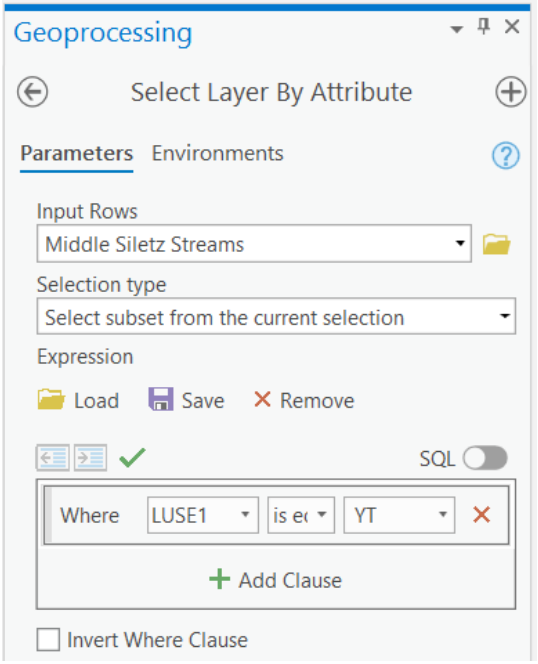
OID	midsils_14	FREQUENCY	COUNT_mids
0	CERINE CREEK	1	1
1	DEER CREEK	2	2
2	GRAVEL CREEK	1	1
3	HOLMAN CREEK	1	1
4	MILL CREEK	1	1
5	NORTH FORK GRAVE...	3	3
6	NORTH FORK MILL C...	1	1
7	NORTH FORK MILL C...	3	3
8	PALMER CREEK	1	1
9	S FK BUCK CREEK	1	1
10	SUNSHINE CREEK	3	3
11	W. FK. BUCK CREEK	1	1
12	WILDCAT CREEK	2	2

You should see a list of 13 streams. Be careful in your use of the OID field- it always starts at 0. Let's close this output.

Let's build another condition into the query that we created. Return to the Middle Siletz Streams attribute table, which should still have the 21 records selected where TCONIFERS > 183. If these records are not selected, you will need to repeat the query expression you built previously to select the 21 records. Go to the Map toolbar and click Select By Attributes again to bring up the Select Layer By Attribute geoprocessing window.

1. In the Select Layer By Attribute window, the Input Rows should still read Middle Siletz Streams, but in the Selection type drop down, choose "Select subset from the current selection."

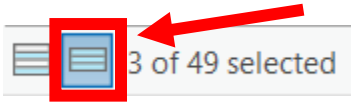
2. Our second criterion will ask that only streams that are affiliated with young timber land use/land cover types be considered. Click the New Expression button and use the drop down menus to build an expression that reads "Where LUSE1 is equal to YT." This will select from the 21 records where the land cover type is young timber.



3. Click Run when your input box matches the graphic above.

4. Look at your map to see the set of streams that match these criteria.

Examine the attribute table for Middle Siletz Streams. If you change the “Show” option in the bottom left corner of the attribute window from All to Selected you will see only those records that fit our query.

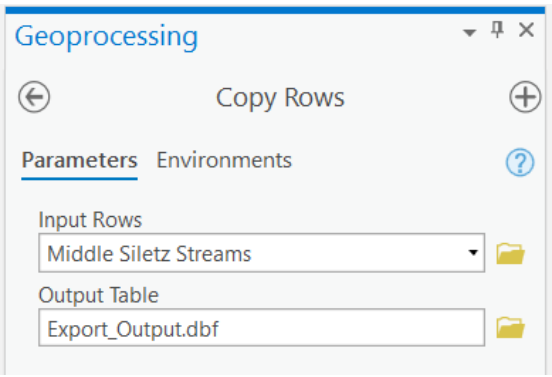


Middle Siletz Streams

Field: Selection: Highlighted:

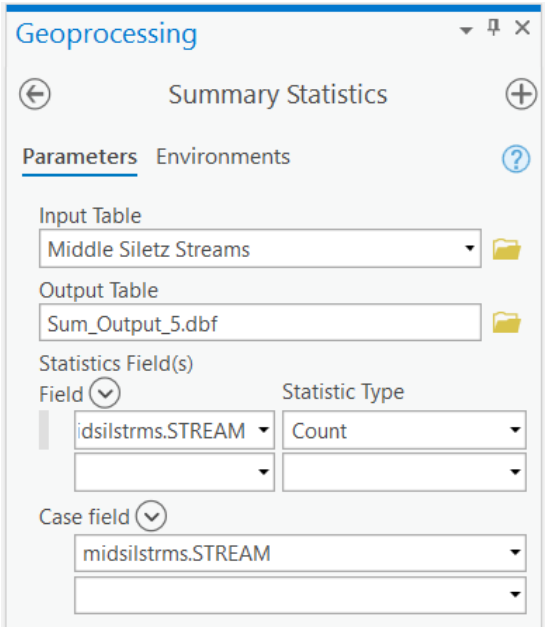
F	S	F	T	L	R	L	S	S	F	T	L	R	C	C	LLID	STREAM	NEXT_STRM	OWNERSHP	R	P	S	P	S
28	Pol	0	0	0	0	96	50	50	39	04	0	0	11	29	1237241448806	GRAVEL CREEK	SILETZ RIVER	BOISE CASCADE	3	56	58	73	50
29	Pol	0	0	0	0	16	51	51	05	03	0	0	12	27	1237403448909	NORTH FORK GRAVE...	GRAVEL CREEK	PRIVATE	1	05	27	53	29
30	Pol	0	0	0	0	99	52	52	08	05	0	0	14	24	1237403448909	NORTH FORK GRAVE...	GRAVEL CREEK	PRIVATE	1	05	27	53	29

Let’s find out the names of these streams. Similar to your previous steps, with the 3 records selected, access the Table, View toolbar and select Export Table. In the Copy Rows geoprocessing window, Input Rows will be Middle Siletz Streams. Direct the output to your gislab3 folder and name the Output Table “Export_Output.dbf.”

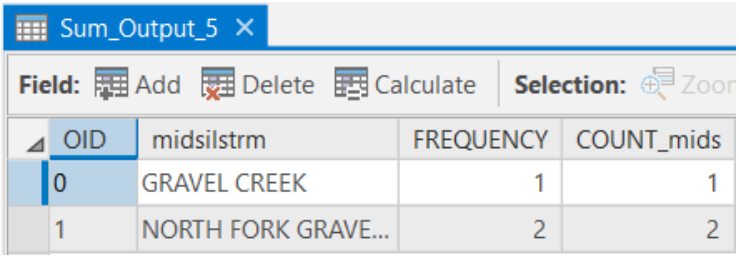


You should now have a table named Export_Output containing only the 3 selected records. Open the table to view it.

Do a summary of the variable “Stream” in the new output table to see a list of which streams were selected. You can do this by right clicking on the Stream field header and choosing Summarize. In the Summary Statistics window, the Input Table is Middle Siletz Streams, the Field is midsilstrms.STREAM, and the Statistic Type is Count. Leave the default Case Field. Direct the output table to your gislab3 folder and name it “Sum_Output_5.dbf.” Click Run.



Open your Sum_Output_5 table to view the results. Summarizing should result in the two entries named North Fork Gravel Creek being combined into one row with the count listed as 2.



OID	midsilstrm	FREQUENCY	COUNT_mids
0	GRAVEL CREEK	1	1
1	NORTH FORK GRAVE...	2	2

Save your map document.

GIS Lab 3 Application: Determining Land Use and Ownership Patterns associated with Streams.

This is the portion of the lab where we repeat some of the steps we just learned using a different watershed area. We'll do some basic processing and answer some questions. Hopefully by now, you will have been exposed to the operations necessary for you to complete a project.

You are to perform all operations on data located within the **Lower Siletz River Watershed.**

The Parameters:
Return to the "Three Watersheds" data frame. From the Watershed layer, select the Lower Siletz River Watershed polygon and convert it into a shapefile (make sure you save this into your workspace\gislab3 folder and name it losilshed.shp). Use this new watershed to clip the streams from the streams layer that are within the watershed. Save the output file to your workspace\gislab3 folder and name it losilstrms.shp. Create a new data frame and copy both of the new layers into the new data frame. Rename the new data frame to "Lower Siletz" and rename the Streams layer to "Lower Siletz Streams" and the Watershed layer to "Lower Siletz Watershed."

Using tables and the attribute file from the new streams cover, do a summary based on counts of luse1. Create a new text field called landuse in the summary files and code it based on the following values for Luse1*****:

AG	Agriculture
LT	Large Timber
MT	Mature Timber
ST	Second Growth
TH	Timber Harvest
YT	Young Timber

Join this summary file, after you've saved it, to the attribute table for streams. Use the luse1 variable as the join item or common ID.

Assignment 3A. This is an individual assignment. Type your answers and turn in at the beginning of your next lab meeting. Be sure to include your name, course number (FE 257), assignment number, and lab day and time (please include both so we can keep track of your assignments) in the upper left-hand corner of the first page. All units in the GIS databases are in international feet or feet^2 unless indicated otherwise. **Report all measurements to the nearest whole unit (no decimal places)**. **Please create a table with column headings and not a long sentence** when there is more than one response for a question. 12 points.

Questions (All questions refer to the Lower Siletz Watershed area)- do not report decimals

1. What is the size in sq ft of the Lower Siletz Watershed? (statistics of area)

2. What is the maximum length, in feet, among the stream records in the Lower Siletz Watershed? (statistics of length)

3. What ownership category has the second shortest combined stream length and what is the length? (summary of ownershp by length)

4. What landuse category has the second shortest combined stream length and what is the length? (summary of landuse by length)

5. Of all stream records that have a CC01 value for the culvert field, which one is the most northern?

6. Which streams contain LWD volumes greater than 45 m^3? (select all streams that have a value greater than 45 in lwdvol1). List the streams in alphabetical order. Wood volumes are expressed in m^3 in the GIS database.

7. Which streams contain more than 25 large boulders? (select all streams that have a value greater than 25 in lrgbldr1). List the streams in alphabetical order.

8. Which streams feature both LWD volumes greater than 45 m^3 and more than 25 large boulders? (select all streams that have a value greater than 45 in lwdvol1 and that have a value lwdvol1 greater than 25 in lrgbldr1). List the streams in alphabetical order.

Assignment 3B. Please answer the following questions. 5 points total.

1. Answer question 1.11 on page 25 of your text (3 points). Give one relative strength and one relative weakness for each technique. Use no more than one sentence for each of the strengths and weaknesses that you list.

2. Answer question 1.13 on page 25 of your text (2 points). Use no more than one paragraph (3-5 sentences) and include an accuracy estimate expressed in meters for working under canopy.