Lab 6: Digital Data and Basic Table Operations

What You'll Learn: This lab introduces some commonly available digital data sets and introduces other digital data.

Data: Unless noted, data are in UTM Zone 15, NAD83, meters, coordinates, and the data files are found in the \Lab6 subdirectory, including:

US_cities, a point layers of cities and towns, in NAD83 geographic coordinates,
cen_Stx_U83, a subset of U.S. census bureau block group data, for a small area spanning the Minnesota/Wisconsin border,
County_2010Census_DP1.zip, a compressed file of county census data for the U.S., in a .zip format,
USGS_sheds, watershed boundaries at the hydrologic unit code level 8 (HUC-8),
NED_lstx30, a National Elevation Dataset for the lower St. Croix HUC-8 watershed
NHD_LStx_high.mdb, a National Hydrologic Dataset geodatabase for the lower St. Croix HUC-8 watershed,
Stil_wetU83, wetlands data for the Stillwater, Minnesota USGS 7.5 minute quadrangle,
Citiesx010g.shp, a point shapefile layer, NAD83(86) geographic coordinates, in case you have trouble downloading the original from a national website.

What You'll Produce: five maps:
1) a Kodiak Island map using online and downloaded data
2) a population density map from a census data set, with subset cities from a US data set
3) a proportional symbol map of county population for the lower 48 U.S. states
4) a shaded relief/hydrography map
5) a map of wetlands by size class

Background: Much data is available for download from the worldwide web, as described in Chapter 7 and appendix B of the GIS Fundamentals textbook.
This exercise introduces digital data downloads with a few examples, basic selection by locations, and basic table operations. Most GIS store attribute data in tables. Each feature in a data layers is associated with a row in a table. We can select data manually from the geographic features or via the tables. We also often add or remove table columns and calculate values into columns.

<u>You'll be doing this sort of table manipulation in most of the remaining labs</u>, so we'll keep these first selections and subsequent operations rather simple. We'll manipulate data and compose maps that contain some of the wide range of data that are available for download from web sources.

National Map Cities Data **(skip to Yellow Highlight; download process changed)**
Much data is available from the U.S. Government website: nationalmap.gov

A browser search with the terms “usga national map usgs cities towns point” leads to a common data page with the URL https://nationalmap.gov/small_scale/atlasftp.html#citiesx shown in a thumbnail to the right. These websites seem to change rather frequently so the URL may have changed, or the format or look, but here we’re just illustrating the process.

Small Scale Data Download by Chapter

Land Cover · Elevation · Transportation · Governmental Units/Boundaries · Geographic Names/Map Reference · Water

Land Cover: Impervious Surface, Land Cover, Tree Canopy

Governmental Units/Boundaries: Congressional Districts, Counties, Federal lands, States...

Elevation: Contours, Elevation, Natural Earth, Satelite View, Shaded Relief...

Geographic Names/Map Reference: Cities and Towns, Coastline, Urban Areas...

Map Layer	Current Data Release	Current Documentation Release	Format and Data File Name	File Size in MB: Compressed / Decompressed
Builtup Points - Global Map	April 2014	March 2014	Shapefile : builtupp_usa.shp.tar.gz	1.1 / 4.3
			Geodatabase : builtupp_usa.gdb.tar.gz	< 1 / 2.6
Cities and Towns	August 2004	September 2006	Shapefile : citiesx020.tar.gz	1.1 / 7.5
Cities and Towns, One Million-Scale	July 2014	April 2014	Shapefile : citiesx010g.shp.tar.gz	2.4 / 15.2
			Geodatabase : citiesx010g.gdb.tar.gz	2.2 / 5.7
Coastline, One Million-Scale	March 2014	March 2014	Shapefile : coastll010g.shp.tar.gz	4.9 / 6.7
			Geodatabase : coastll010g.gdb.tar.gz	2.7 / 3.3
Combined Statistical Areas, One Million-Scale	April 2014	October 2013	Shapefile : csareap010g.shp.tar.gz	4.1 / 5.7
			Geodatabase : csareap010g.gdb.tar.gz	2.1 / 2.5
Core Based Statistical Areas, One Million-Scale	April 2014	October 2013	Shapefile : cbsareap010g.shp.tar.gz	14.9 / 20.1
			Geodatabase : cbsareap010g.gdb.tar.gz	7.5 / 8.5
Metropolitan Statistical Areas, One Million-Scale, One Million-Scale	April 2014	October 2013	Shapefile : msareap010g.shp.tar.gz	7.7 / 10.6
			Geodatabase : msareap010g.gdb.tar.gz	4 / 4.5
North American Atlas - Populated Places	July 2004	July 2004	Export : pop000x_e00.tar.gz	< 1 / < 1
			Shapefile : pop000x_shp.tar.gz	< 1 / < 1
Urban Areas	April 2015	April 2015	Shapefile : urbanap010g.shp.tar.gz	18.3 / 13.1
			Geodatabase : urbanap010g.gdb.tar.gz	7.5 / 6.8

Transportation: Airports, Parkways and Scenic Rivers, Railroads, Roads...

Water: Dams, Networked Hydrography, Gaging Stations, Streams and Waterbodies...

One of the rows was labeled “Cities and Towns, One Million-Scale.”

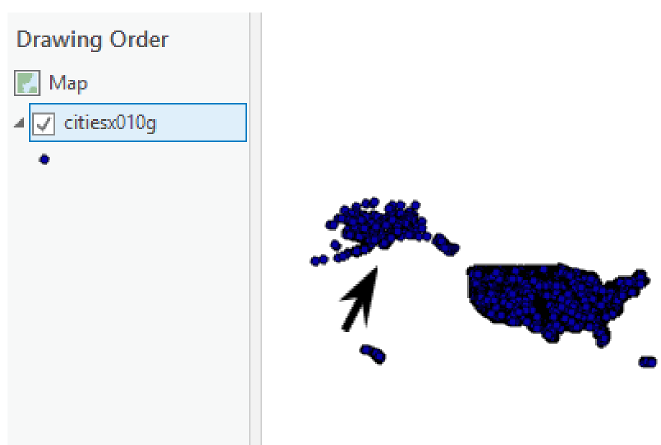
As with many of pages of publicly distributed data, there is a short description and links to more complete descriptions and a shapefile download link (arrow).

On downloading the data to a local drive, we notice it has a strange file extension: .tar.gz. This indicates a well-known compression format. Data are often compressed to save space and reduce download times. Most of unarchiving software can process the delivered formats, but there is often some trial and error the first time you access a type of archived data.

In our case the WinZip, 7zip, and other common archive utilities will decompress these data. (Note: CFANS Desktop does not have WinZip or 7Zip; if you want to see how this uncompressing process works, you will have to do that on your computer. Also .gz files must be uncompressed to a .tar and then uncompressed again to be usable; In most cases, just use the provided data as mentioned below.)

We’ve provided an unarchived version in the data set, in the Lab 6 folder: *citiesx010g_shp*.

Start ArcGIS Pro and add the cities point shapefile. It should look something like the figure to the right. The metadata states these are in geographic coordinates.



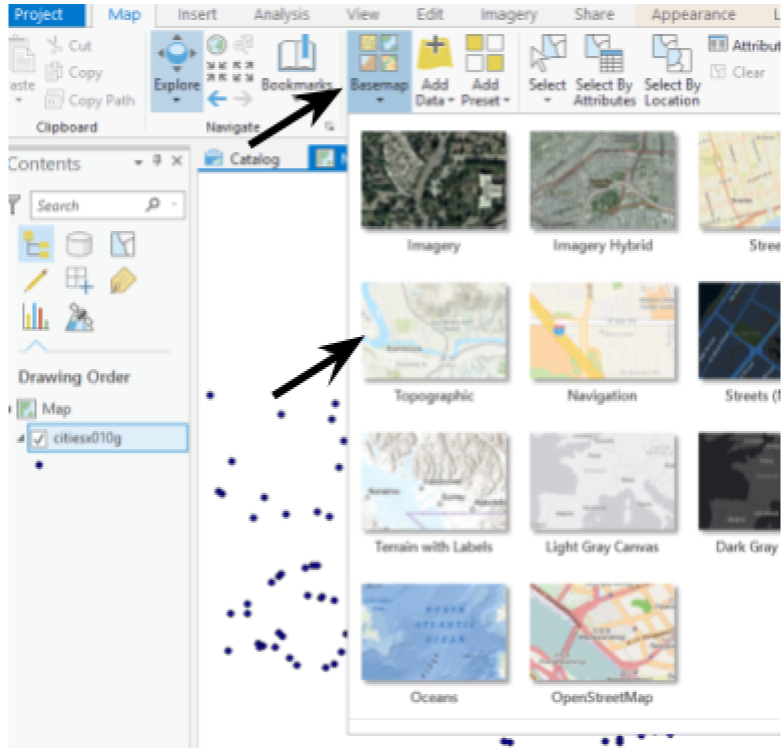
The data set includes cities in Alaska that are east and west of the international data line, so some get wrapped to the right side of the map.

We’re interested in Kodiak Island in south-central Alaska, so zoom to the area indicated by the arrow in the image at right.

Let's add a Basemap "canned" backgrounds available in ArcGIS. Click on the Add Data button, then select Basemap (figure at right).

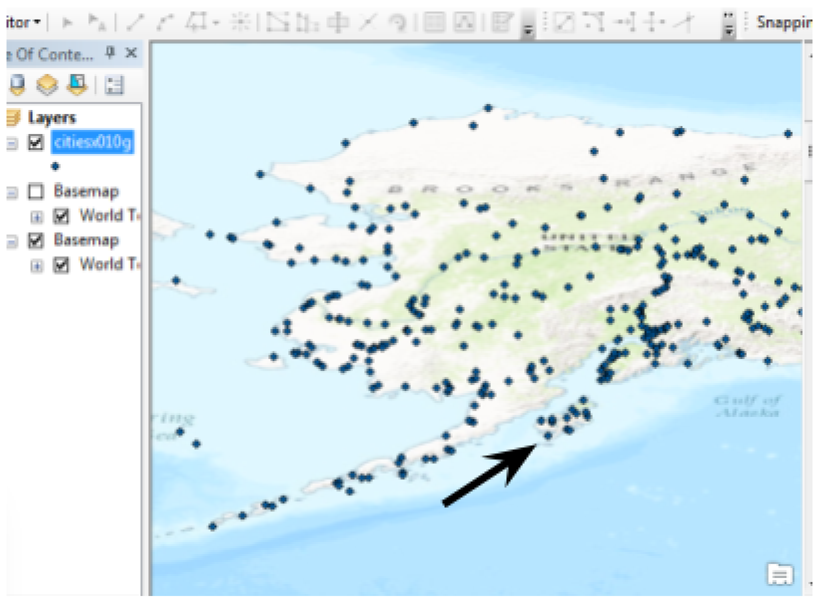
Select the Topographic tile from the options provided; usually near the left center of the choices.

Your display should approximate that shown below, right with a topographic map underlaying the cities.



Manual Feature Selection
We want to select and save only a subset of cities displayed.

Zoom to display Kodiak Island, shown by the arrow at right.



Change the Map projection to Alaska State Plane NAD 1983 (2011) State Plane zone Alaska 5 (FIPS 5005), US feet.

<u>Recall</u>: *right click on the in the Map in TOC, then Properties - Coordinate System – Projected – State Plane – NAD83(2011)(USFeet) – NAD83(2011)-StatePlane Alaska 5 Fips 5005(US Feet)*

Ignore any warnings about coordinate system incompatibility, Arc is just upset about different flavors of the NAD83 datums, but our data here are coarse resolution (why does that mean we can ignore datum differences?).

Now your data frame should approximate the

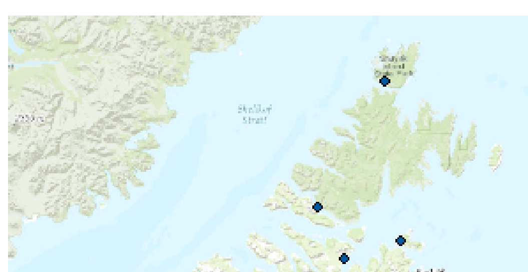
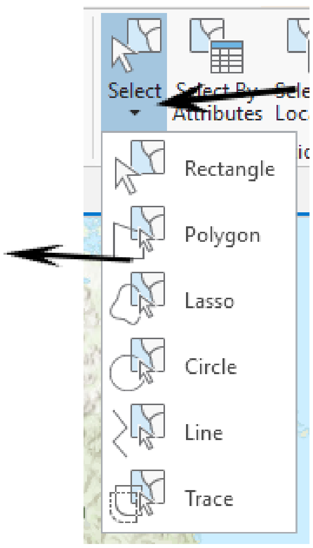


figure at right, without the vertical compression near the poles when we display geographic coordinate data.

We wish to select the cities on Kodiak Island (**Video: Manual Feature Select**).

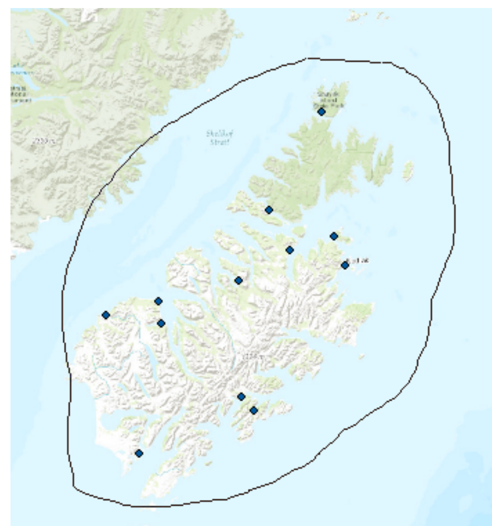
Click on the *citiesx010g* in the TOC so that is active, then Activate the select feature cursor (see figure below right).



Make sure the main Map tab is active, then click and hold on the **Select Feature** tool, it will show various options for manually selection.

For most of these you click and hold-drag to define a selection region or click multiple times to form a boundary.

Click on the 'Select by Lasso' tool.

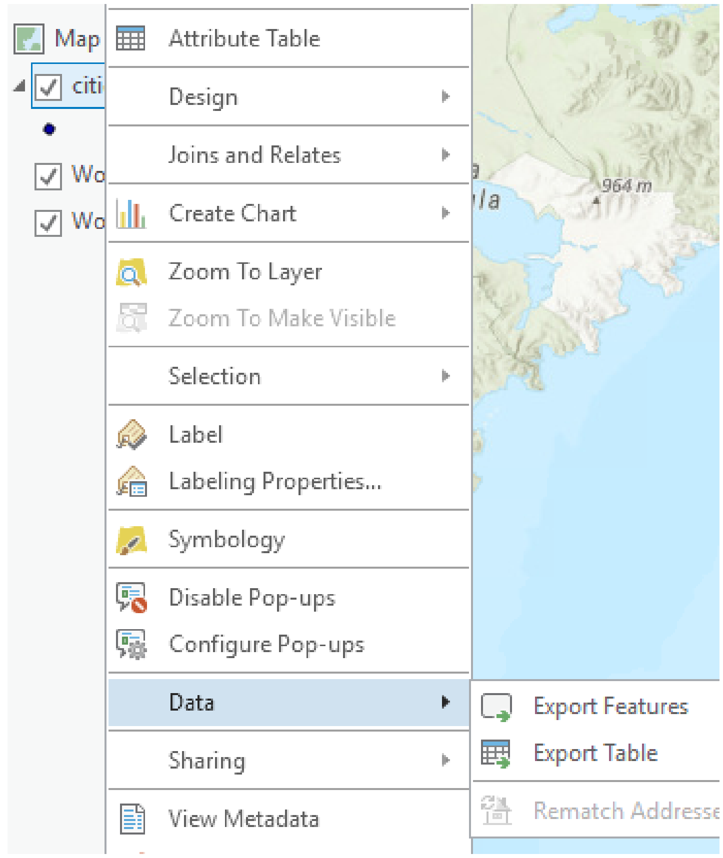


Position the cursor near the island edge, left click and hold the left mouse button as you draw a polygon that includes all the cities on Kodiak Island; then release the mouse button.

This should show a polygon as you're drawing (see at right).

On completing the polygon, release the mouse button to select the subset of cities. Only the those inside the polygon should be colored cyan (not shown).

Save the selected features by
- right clicking on the *citiesx010g* in the TOC, then
- Data – Export Features
- specify an output location for the selected features; first the geodatabase, then the name of the new layer. Here I saved them to the default geodatabase I created when starting my project, a feature class named kodiakcities.

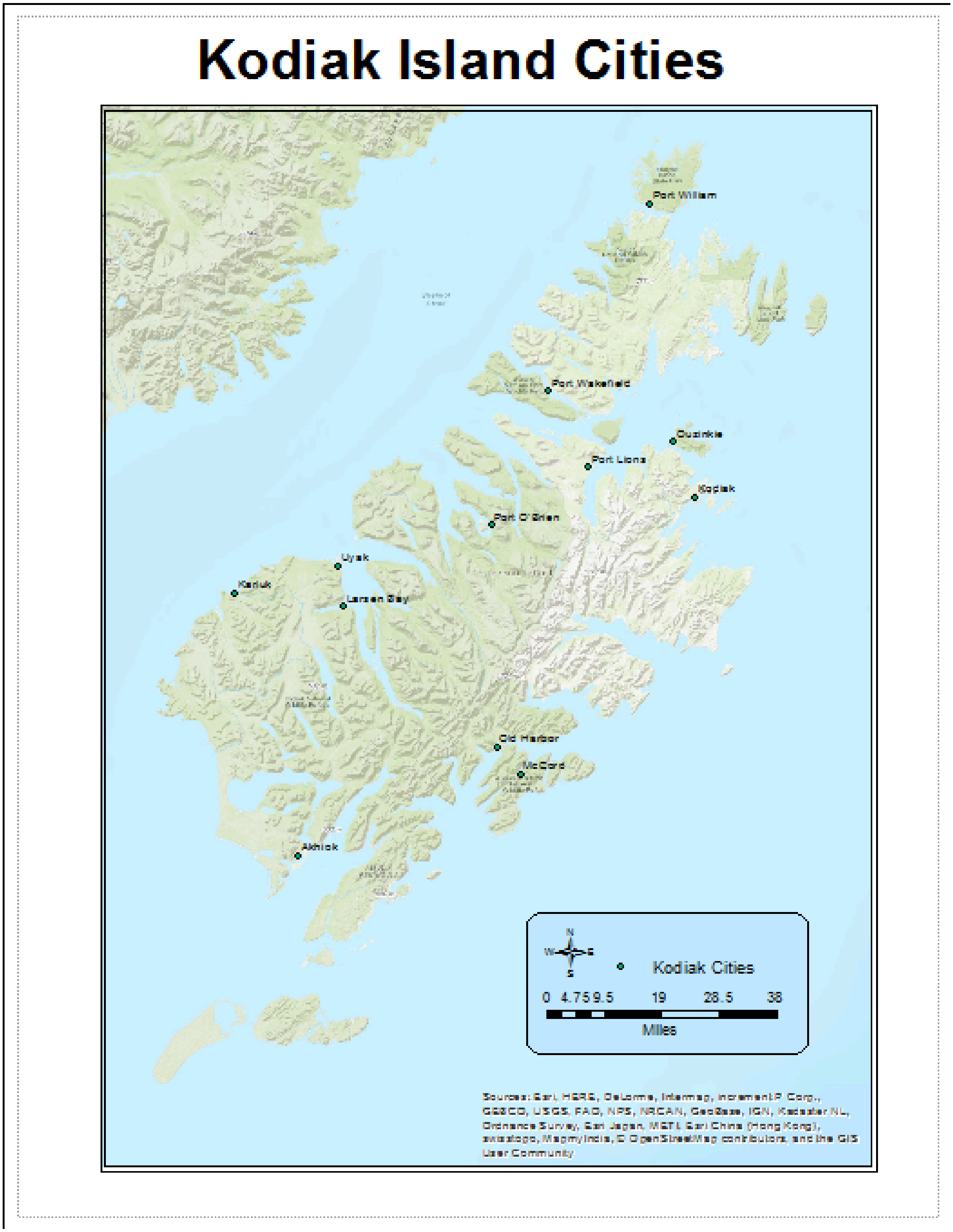


Selection greatly reduces the data set size, eases use, and speeds up redraws.

Remove the original, large data set from the data frame.

Label the cities in the view *(recall lab 2, pg.4 or lab 2 video: Labels),* then expand and use 'Text Symbol' and 'Label Placement' (under same Feature Layer tab as 'Label') to make the labels more prominent, e.g., increase the font size, perhaps add a halo, and change angle or position.

Create a map, something like the one shown below, export a pdf, and turn it in.

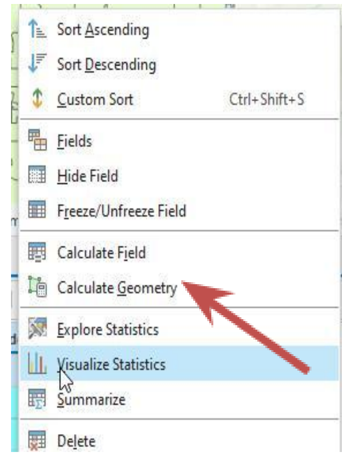

Kodiak Island Cities
Port William
Port Wakefield
Ouzinkie
Port Lions
Kodiak
Port O'Brien
Uyak
Karluk
Larsen Bay
Old Harbor
McCord
Akhiok
N
W
E
S
Kodiak Cities
0 4.75 9.5 19 28.5 38
Miles
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Census Data - 1

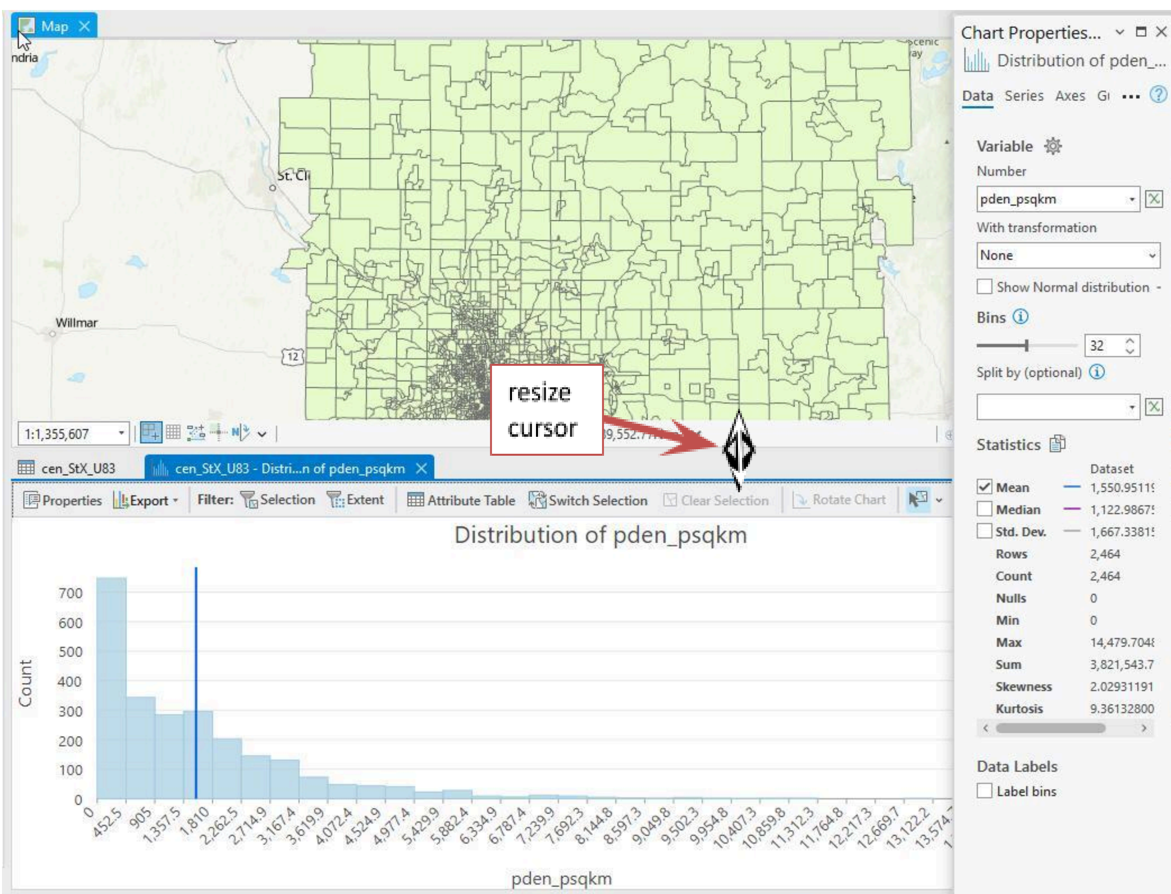
Start a new project. Add the census data, *cen_StX_U83.shp* to a new map. This is some census data for part of the Minnesota/Wisconsin border. Each polygon is a block group; an area unit for population census data.

Open the attribute table (right click on *cen_StX_U83* in TOC, then click Open Attribute Table), and inspect the values for the column labeled pden_psqkm; this is the population density for block groups.

Next, right click on the column name and select **Visualize Statistics** (see right).



This should display a histogram below the map and a column summary in a tab named Chart Properties in the rightmost pane. You may have to hover the cursor over the window boundary between the chart and Map windows to display the resize cursor (see below). Click and hold-drag to resize.

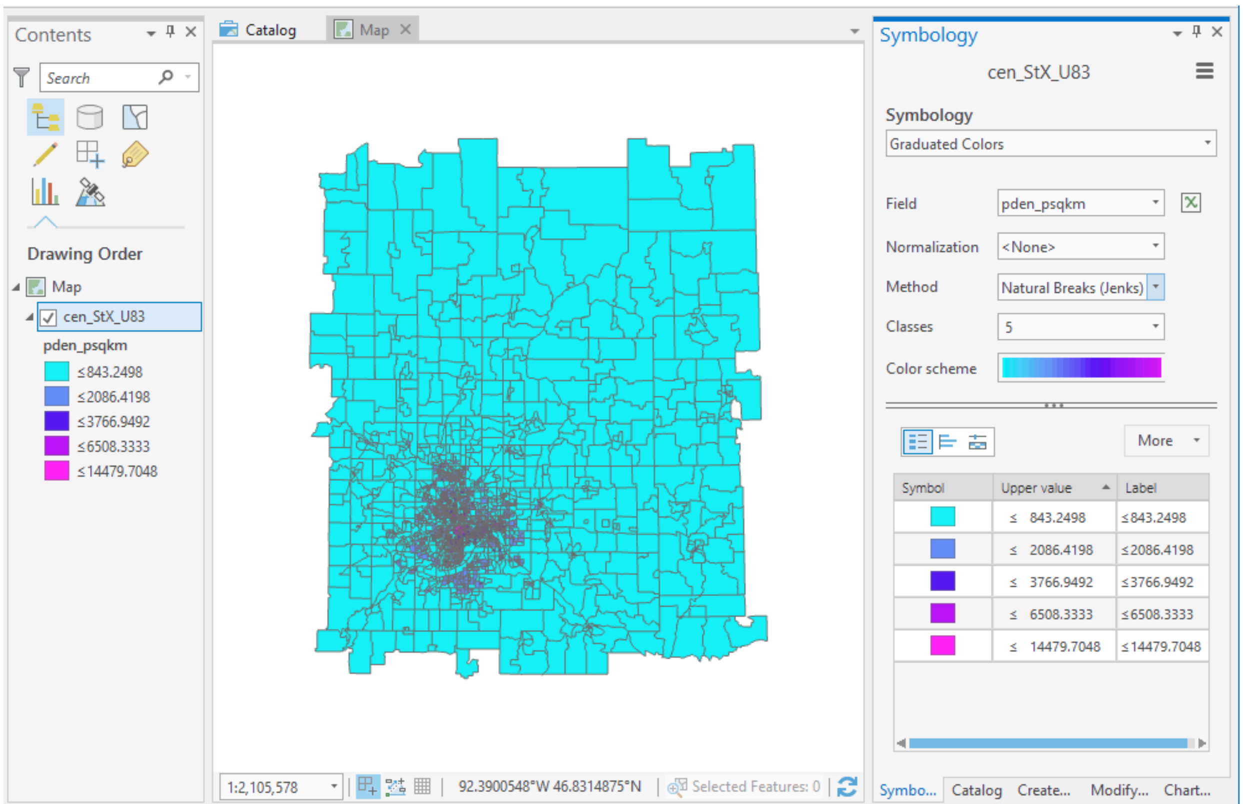


Note that the data has quite a few small values and a few very large values. This "long-tailed" distribution is common in some types of data and often displays better with a non-uniform spacing of symbol ranges. We’ll demonstrate.

Close the table and open the **Symbology Properties** menu for the census data layer.

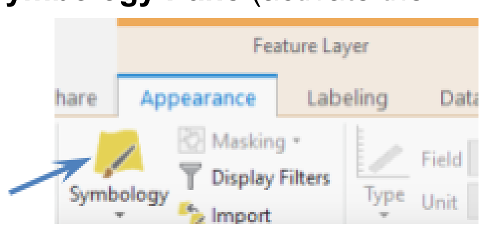
Symbolize this as **Graduated Colors** and display the population density data (pden_psqkm) in the **Field**, with no normalization, and the default Natural Breaks Method.

Keep the default number of classes and select a gradient color ramp. In the example below I selected the cyan-blue-magenta color ramp. (***Video: Color ramp***)



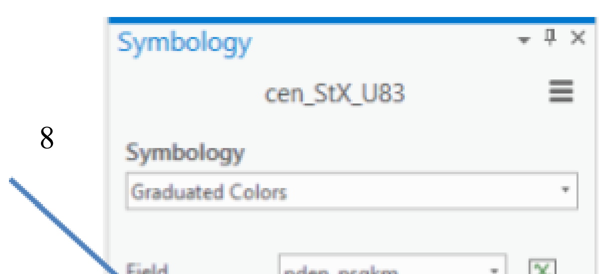
Notice the rather sub-optimal symbology, in that the lines obscure the colors for the small polygons and there is little range.

We can get a more useful symbology through the **Symbology Pane** (activate the Symbology Tab by right clicking on the layer name in the TOC, then Symbology).



Specify None for Normalization, a Method of **Geometric Interval**, with 20 **Classes**, and Apply.

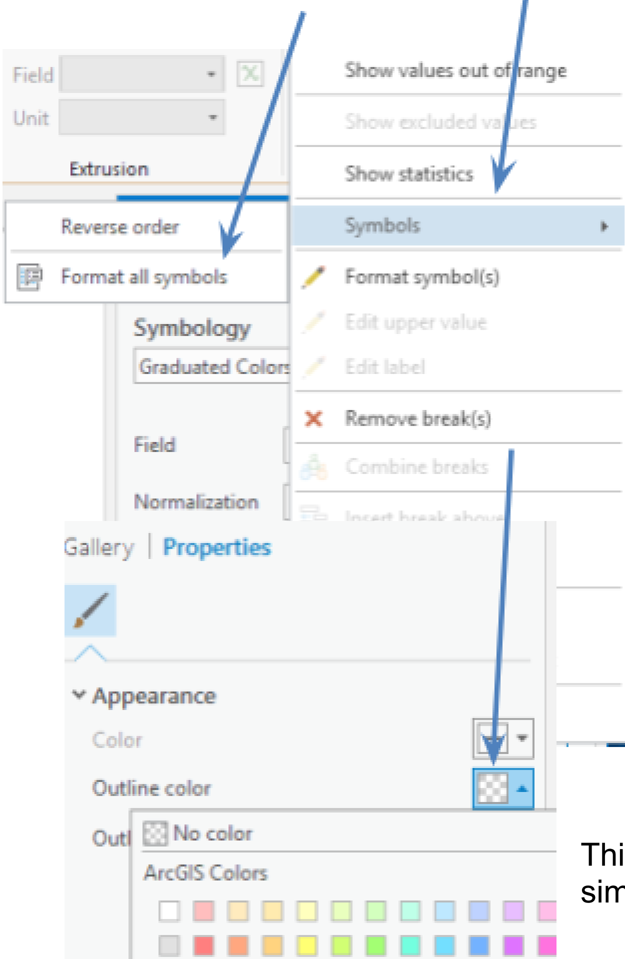
Notice this improves the colors somewhat, but the lines still obscure the small polygons.



To remove the lines, click on More in the main Symbology Pane

Then Symbols in the menu that pops up

Then Format all symbols



This should display symbol properties menu, then under Appearance set the Outline color to No color:

This should display the layer in a manner similar to that shown below.

This symbology provides a clearer view of the

variation in the data due both to removal of the border lines and placing a geometric spacing of symbol ranges.

Note that there are many other options that appear in the menu that contains the Properties for All Symbols.

You may group, flip, ramp, or otherwise change a set of selected symbols, or all symbols.

Experiment with these to see their effects.

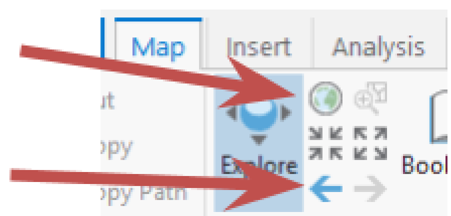
Selection by Location

Add the *US_cities.shp* point layer to the data frame.

These are data on cities for the entire U.S. and territories.

Use the **Zoom to Full Extent** button to view the entire dataset, and then

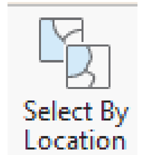
Zoom to Previous Extent button to return to the area of the *cen_StX_U83* area.



It is burdensome to work with a large data set when we only wish for a small portion or subset. Select just the cities data that correspond with our census data set.
(***Video: Select by Location)***

Do this by:

Opening the **Select by Location** tool under the Feature Layer group along the top of the main window (the Map tab should be active)

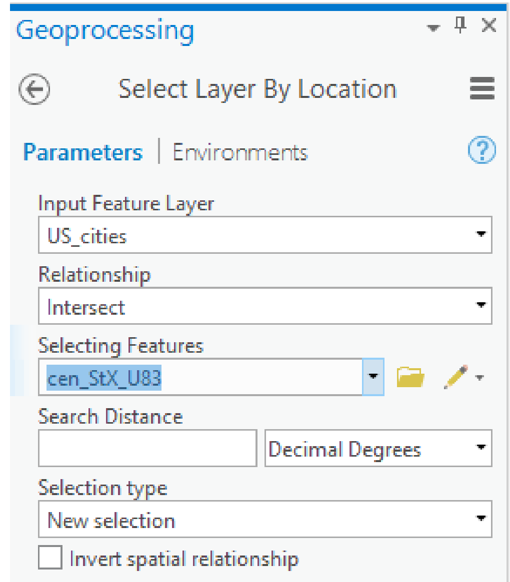


Specify the US_cities as the Input Feature Layer,

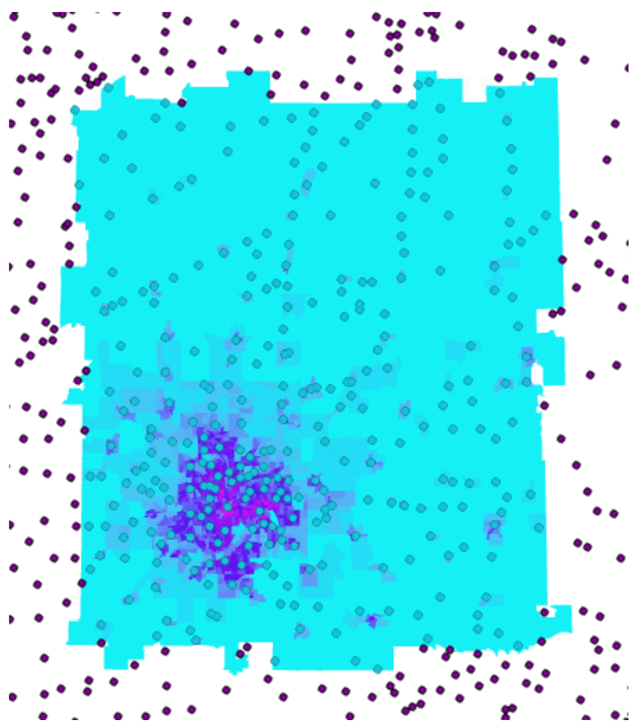
and

cen_StX_83 as the Selecting Features

then click Run

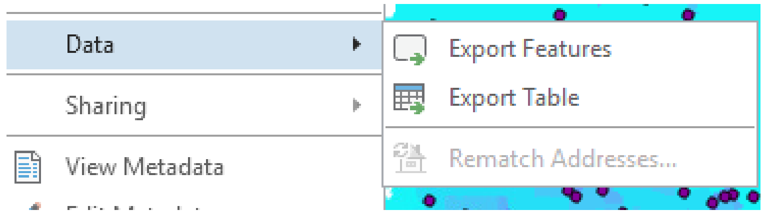


This should display a view similar to the one at right. The selected cities show up in the current selection color, in this case, cyan.



Saving a Selected Set to a New File

To save this selected set into a new file:



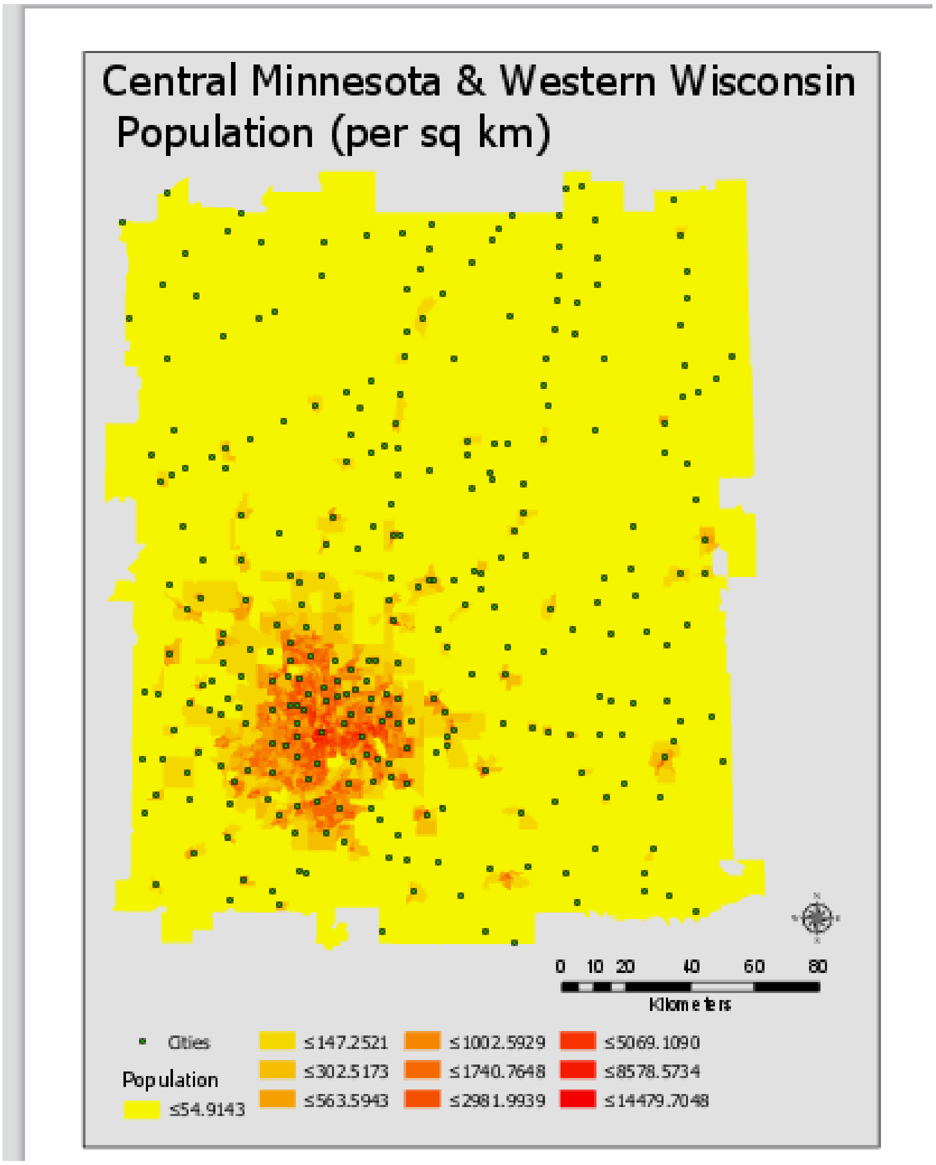
Right click on the *US_cities* file name in the Table of Contents, Left click on **Data > Export Features**.

Navigate to your data directory (e.g. Lab6, not the GeoDatabase) in the menu that appears and name the new output file with the ".shp" extension, e.g., "subcities.shp" (but don't include the quotes). *This saves the data as a "shapefile" an older simpler structure which does not need (or can't be included) in a Geodata base.*

You can add the subset layer to the Map and remove the original *US_cities* layer.

Map 2
Create a layout view that includes both the selected population density and cities data layers, a suitable legend, North arrow, scale bar, description, and produce a pdf.

Note we have a different color scheme in the examples above and the map below, you don't need to match either, but you do need to have the range of classes visible by applying the geometric interval over enough classes, and you do need to remove the polygon lines.



Census Data - 2

This is to practice what you've already learned in this and previous labs, but without much specific instruction, and to teach you a tool that helps winnow columns, something often done after downloading data.

Examine the file County_2010Census_DP1 file in the Country_C2010Census_DP1 folder. It contains summary population data for all counties in the U.S. and territories, and was downloaded from the site:
https://www.census.gov/geo/maps-data/data/tiger-data.html

Note that there is a set of shapefiles and an Excel file describing the variables in the shapefiles. You often get ancillary files, usually text but sometimes other formats, that describe downloaded spatial data.

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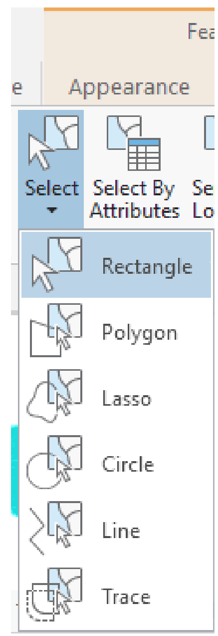
Open the Excel file. Notice that there are tens of variable names (rows) which describe the contents of the columns in the County_2010Census_DP1 layer. If we're not interested in all of them then they just take up space, reduce performance, and clutter our view. This often happens, so we need to subset the table.

We're primarily interested in total population. Verify in the Excel file that this variable is in the column labeled DP0010001.

We also want to keep the FID (a.k.a., ObjectID), Shape, and NAMELSAD10 variables.

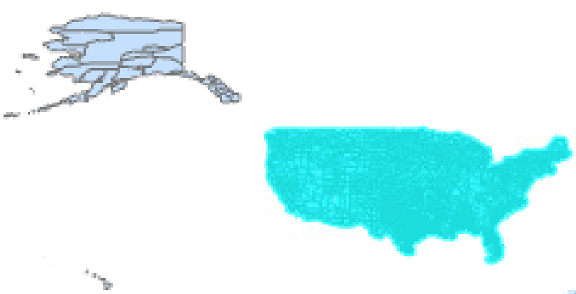
<u>Create a new Map</u> and add the shapefile County_2010Cencus_DPI.shp.

Notice that there are data for all the U.S., including Alaska, Hawaii, and Puerto Rico. We wish to save the data for only the lower 48 U.S. states.



We'll subset the data for the lower 48 states only, using a manual method.
Activate the manual selection tool, 'Select', and expand the options (like at right).

Select the Rectangle tool, then click-drag a box containing just the lower 48 states:



They should appear selected, as on the left.

Save the lower 48 states to a new file named, something like Lower48.

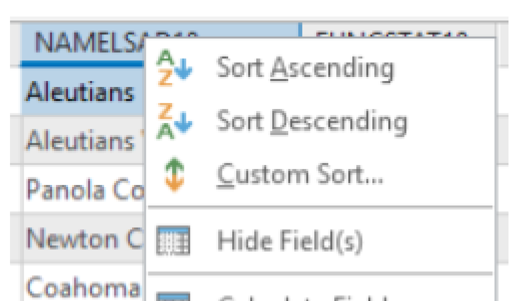
Add the Lower48 layer to your data frame and remove the original County_2010Census_DP1 layer.

Open the attribute table and inspect the columns. Notice there are many, most starting with a DP, and then various strings of numbers.

It would be helpful to delete most of the columns, keeping only FID (a.k.a., ObjectID), shape, NAMELSAD10, and DP0010001.

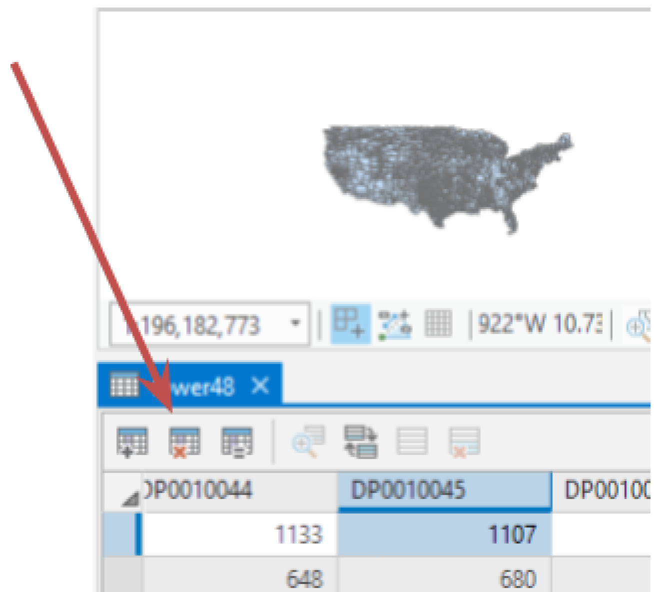
(***Video: Field Delete***)

We can delete a single column by right clicking on the column name, and



then clicking on **Delete Field** in the dropdown menu.

Or by clicking on the name of a column, then clicking on the delete column shortcut:

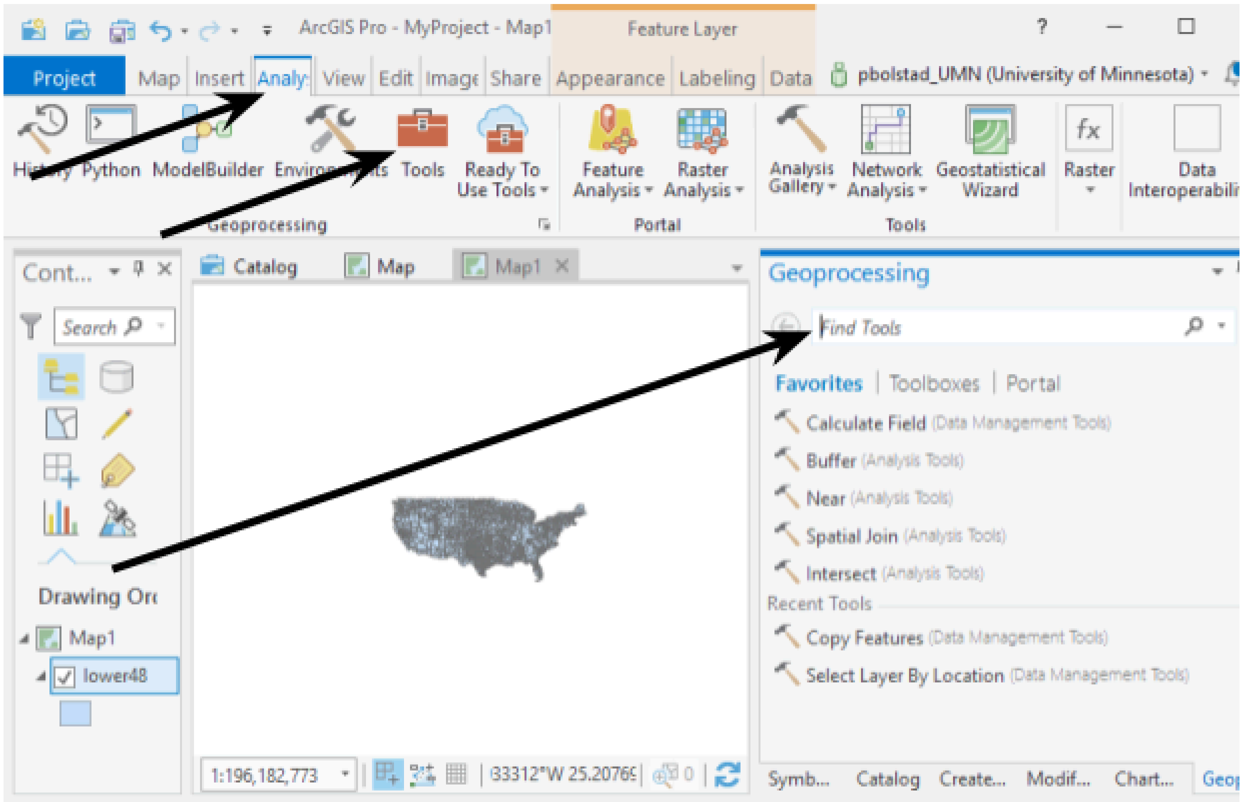


This would get rather tedious for the tens of extra fields in this table; we'd like a batch delete tool.

Luckily, one exists.

Close the attribute table.

We can delete several columns at once with the **Delete Field** command. It isn't on any toolbar, but we'll show you how to search for tools, including those on toolbars that you know exist and remember a fragment of their name, but have trouble finding.



Open the **Tool Search** utility **(**found in the Geoprocessing Pane activated from the Analysis Tab, Tools icon):

You may type in the name or partial name of a command and click on the magnifying glass to display a list of related tools.

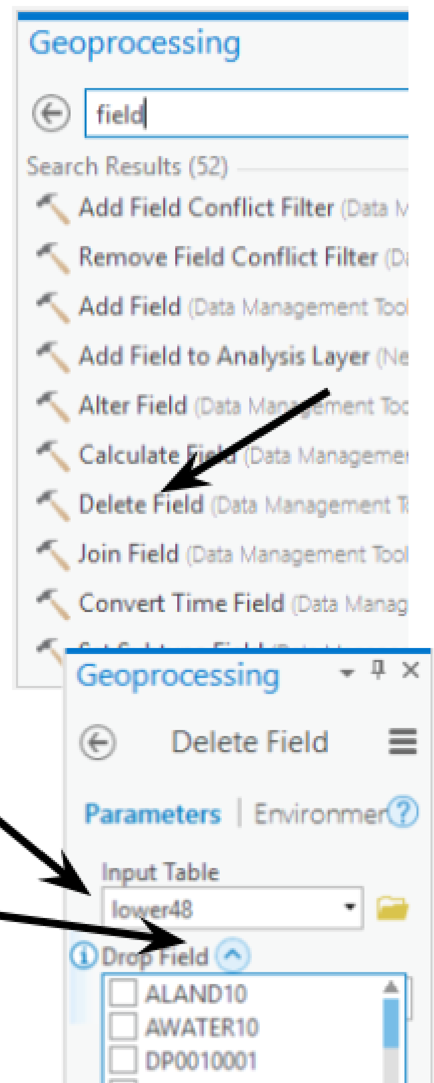
If I type “Field” (without the quotes) in the search window and click on the magnifying glass, it lists commands that have ‘Field’ in their name (see left figure).

You’ll notice that several commands down there is one named **Delete Field**.

This helps us rapidly delete many fields.

Left click on the Delete Field hammer displayed in the list.

In the resulting input pane enter your layer you exported for the lower 48 states.



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Left click on the caret at the right edge of the Drop Field

it should list the items in the Input Table:

We check the boxes next to fields we wish to delete, then on hitting Run, they are removed from the table.

We wish to keep the NAMELSAD10 and DP0010001. We don't have the ability to delete the FID and Shape items, as these are key for maintaining the table. and not in the list.

It is perhaps easiest to click on the ***Toggles all checkboxes*** button and then uncheck the few items we want to keep.

However, you decide to do it, check variables to delete the un-needed columns, then click **Add,** then **Run** to remove the unwanted items.

Once the tool completes, open the table and verify it worked as expected, that is, that you have four columns in your table: the FID (a.k.a.,ObjectID), Shape, NAMELSAD10 and DP0010001 items.

Now we'll introduce a new way to symbolize data.

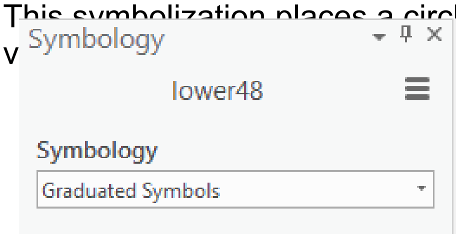
First, change the Data Frame coordinate system to the NAD83 Contiguous USA Albers (Projected – Continental – North America – NAD83 Contiguous USA Albers)

Set the Lower48 symbology to **Quantities – Graduated symbols**, as shown in the figure on the next page.

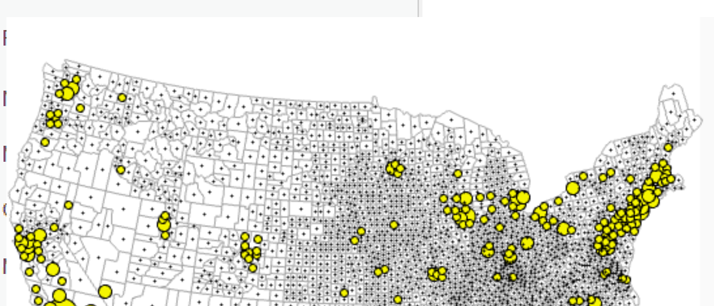
You'll need to

- set the value field to DP0010001
- set the number of classes to 5 and specify a Natural Breaks classification
- change the symbol size range to 1 - 18.

This symbolization places a circle in each polygon with the circle size proportional to a v wing relative size.



These settings should result in an image similar to that below:



Here we want to show population differences for counties.

While this approximately reflects the magnitude of differences between counties, the circle sizes are a bit off. The smallest population county has 82 residents, the largest almost 10 million.

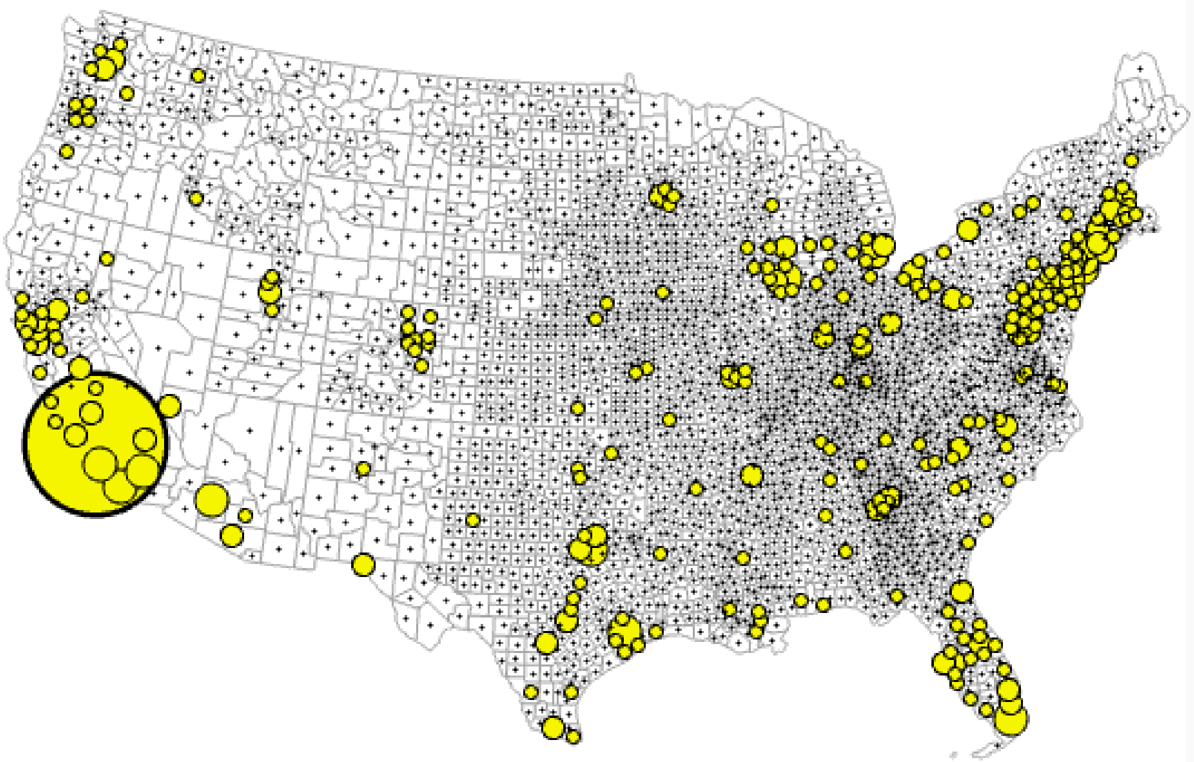
This symbology is a bit mis-leading because the midpoint of the smallest class is 20,000, while the midpoint of the largest class is 7.5 million, a ratio of 375:1, while the relative area of the symbols only has a ratio of 81:1.

This makes small population counties appear to have more people than they do relative to densely populated counties. We should fix this.

We can modify the individual symbol size by left clicking on the symbol in the table of contents.

Click on the circle in the TOC, then change the size in the Symbology-Properties Pane to the right to be 48 pt, then click on Apply at the bottom. This modifies the largest class to have a size of 48, to better reflect the relative county populations.
(Note: this might take a long time repainting the data, it is a big file, for a big country)

You should have a Map pane that looks something like the figure below:



Create a landscape layout that includes the Map pane, descriptive title, north arrow, legend, and your name. (Note: this might take a long time repainting the data, it is a big file, for a big country); EXTRA NOTE: Select Image Quality “Fastest” when exporting the PDF as you don’t need to create a huge high quality PDF.

Export it as a pdf and **turn it in as your third map.**

Digital Elevation and NHD Data

We'll now explore digital elevation and related hydrologic data a bit. We'll hold off an in-depth treatment of DEMs until Chapter 11 in the GIS Fundamentals textbook and a later lesson. Right now, we'll just introduce the data and show you how to make an interesting shaded-relief map, one suitable for backgrounds and many illustrations.

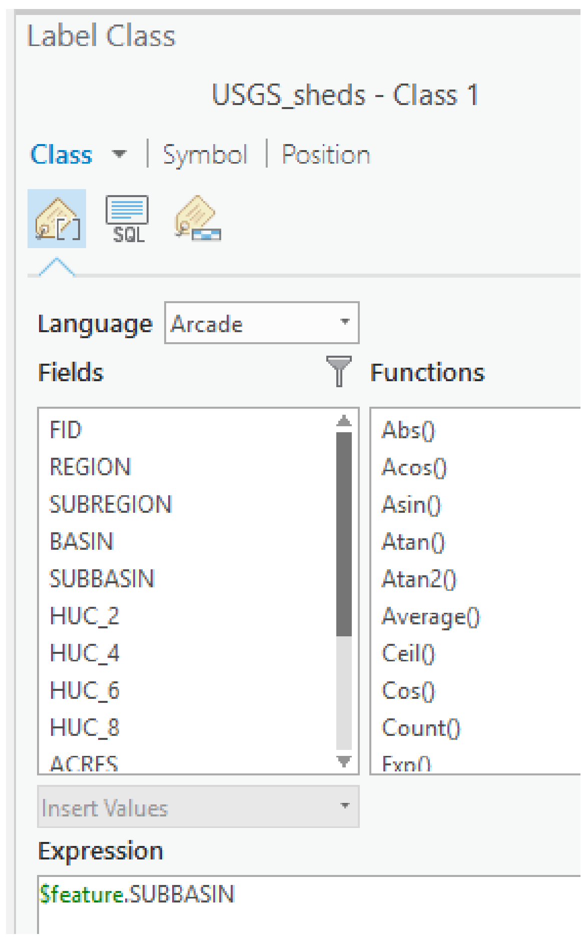
Create a new Project, add a Map, and set the data frame coordinate system to the UTM Zone 15N, NAD83 projection.

Add the *USGS_sheds.shp* dataset to the data frame. These are watershed boundaries derived from elevation data and downloaded from the US Geological Survey.

Label these features:
Right click on *USGS_sheds* in the **TOC -> Labels** to toggle the labels on. Unfortunately, it chooses Region, the first text variable it finds to label each polygon, and this isn't very informative.

So, right click on *USGS_sheds* in the **TOC** then left click on **Label Properties**

This should display a pane on the right:



Select and delete the *$feature.REGION* displayed in the 'Expression' window located about mid-pane, but here shown at the bottom of the image.

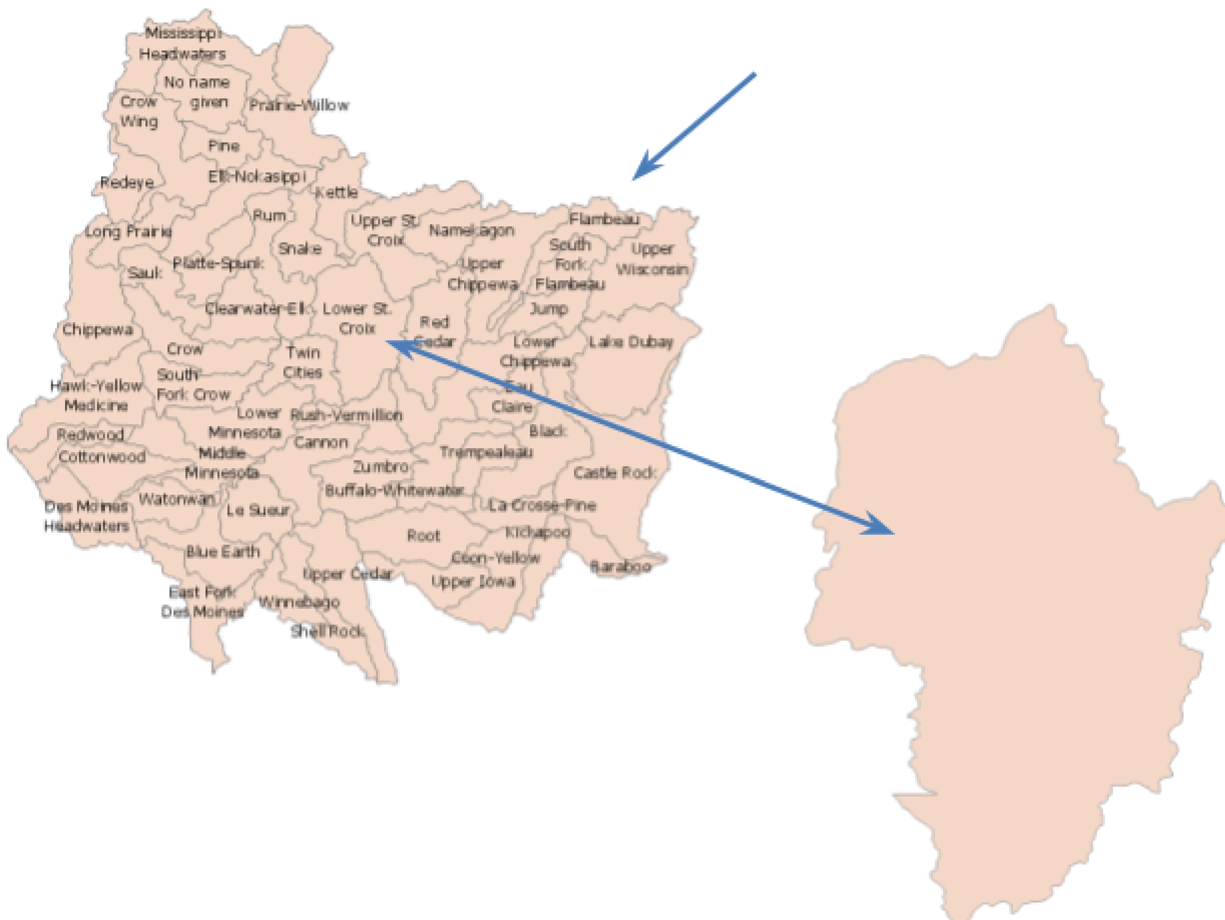
Then double click on the SUBBASIN variable in the 'Fields' list.

You should now have *$feature.SUBBASIN* displayed in the Expression window, as shown in the figure at right

Click Apply

This should place the name of each of the sub-basin within a polygon, something like the figure below.

Select/export a data set that consists of the outline of <u>only</u> the Lower St. Croix watershed, near the center of the data set, by using the methods shown earlier in this lab or ones shown in earlier labs. *(Recall you can use the 'Select' option under the 'Map' tab, then you can simply click on the polygon you want selected – it will display with a cyan outline - then you can* *export that data).*



All the watersheds.

Lower St Croix sub basin

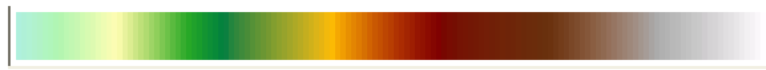
Remove the USGS_sheds data from your Map. Leave the StCroix Subbasin data but click it off in the TOC so that it isn't displayed.

Create a Shaded-relief Elevation Map

Add the *ned_lstx30* DEM to your data frame. If this file will not load from your Desktop use the same layer found in S:\FNRM3131\Lab6 or 5131.

Use **Properties** > **Symbology** to display the Layer Properties menu and set a stretched color ramp.

Use a Stretch Type of Standard Deviations, set n: 2, and use the elevation color ramp:

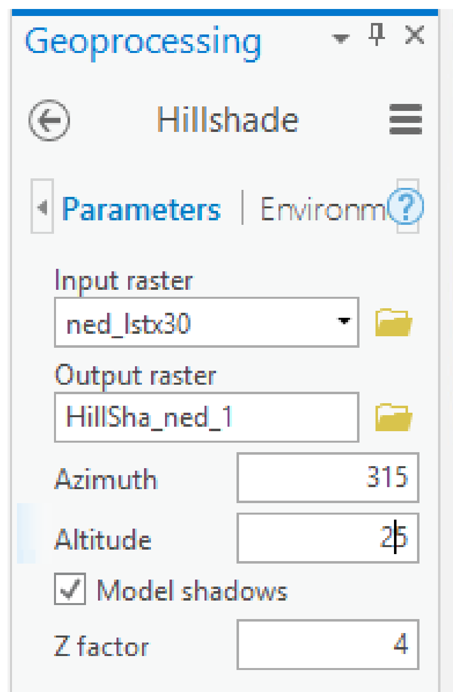


Now, calculate a hillshade surface:

Select **Analysis** □ **Tools** □ **Spatial Analysis**□ **Surface**□ **Hillshade**.

(***Video: Shaded Relief & More Symbology***)

Set the options as shown on the right. You may experiment with various changes in the options; the 'z factor' and 'Altitude' affect how much the terrain is expressed, and 'Model shadows' adds depth.

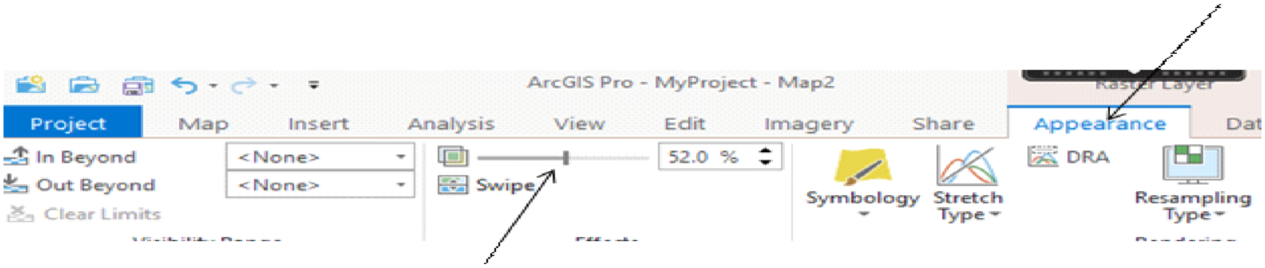


Run should eventually display something like the figure below:

We would like to see both the hillshade and elevation shading, so we need to make the hillshade semi-transparent.

Select the hillshade layer in the TOC, click on the Appearance tab in Raster Layer group along the top menu bar (see below).

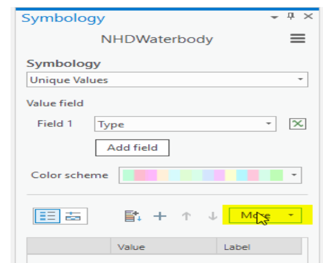
Various new controls will be displayed. Under the effects, use the transparency slider to adjust the hillshade layer to something between 40 and 60% works well.



You should now see the DEM with the hillshading "painted" on top (see the figure, below, shown with additional data added).

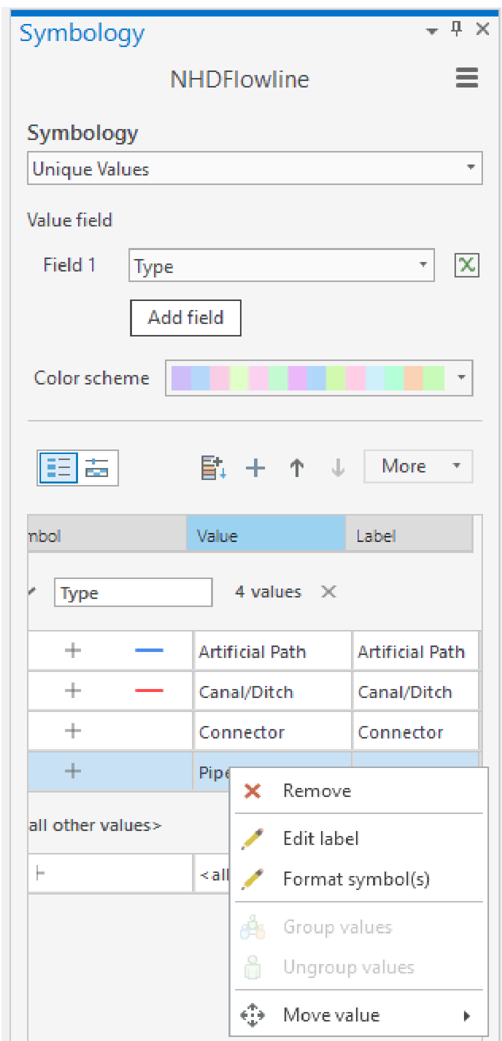
Let's add some hydrologic data from the National Hydrologic Dataset (NHD). These are lakes, streams, and other water features derived from DEMS and other sources and integrated into a consistent hydrologic network:

Add the *NHDWaterbody.shp* file, which contains Lake/Ponds and Reservoirs. Use Symbology □Unique Values with the Value field set to **'Type'.**



Remove the labels for "all other values" by clicking on More and uncheck the "show all other values".
Symbolize the two water types blue and with no border.

Finally, add the data layer *NHDFlowline.shp* layer and use the same symbology (Unique values with the Value field set to 'Type').



Symbolize the StreamRiver and Artificial Paths in blue, and CanalDitch in red.

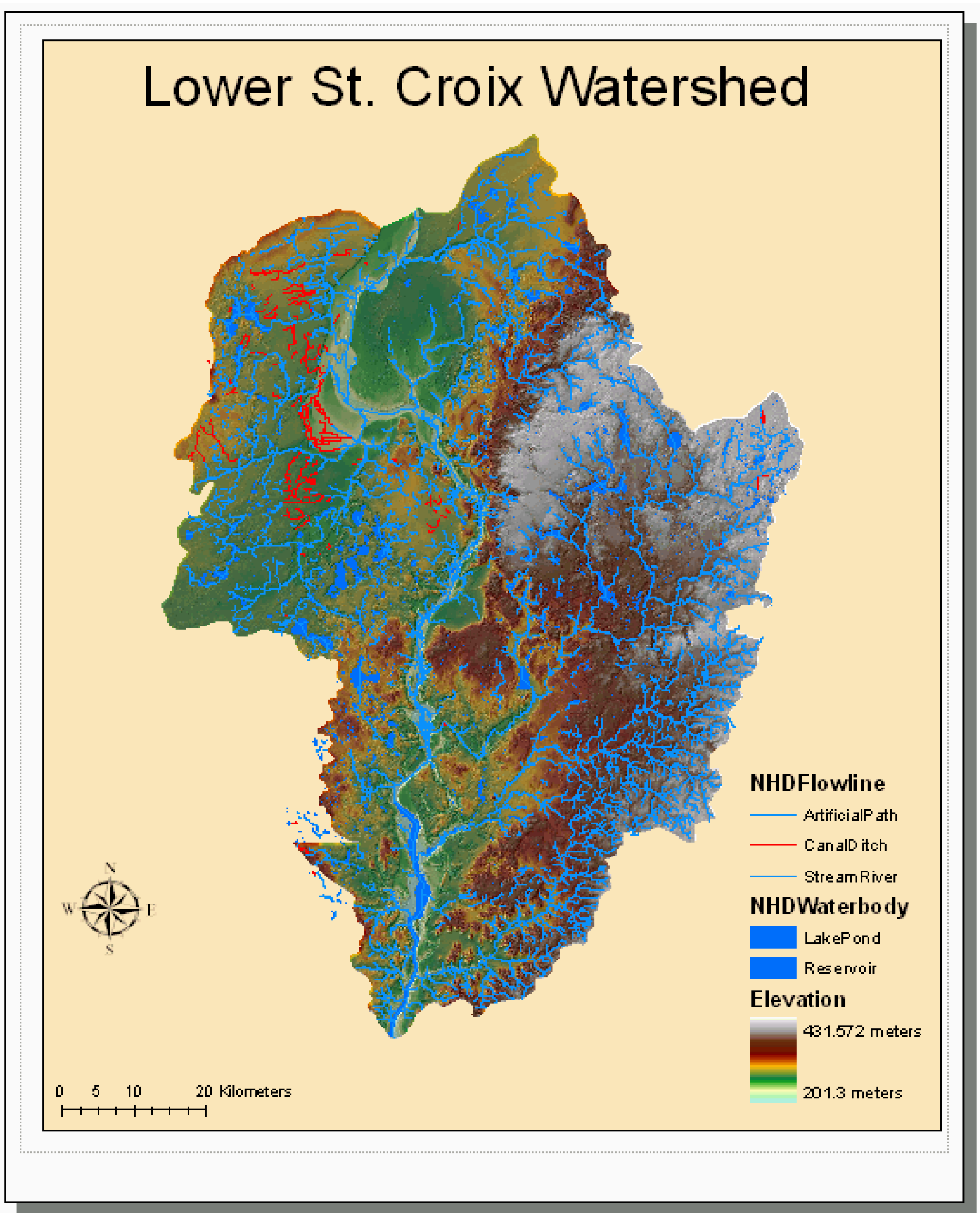
Remove the other line types from the legend by right clicking on an entry in the Symbology Pane, then selecting Remove from the dropdown menu (as shown in image at left).

Do this successively for all the entries except StreamRiver, Artificial Path, and CanalDitch.

As with the waterbodies layer, uncheck the display for "all other values."

Your data view should appear approximately as the figure below.

Map 4: Create a layout with the usual map elements, output a pdf, and save your project.

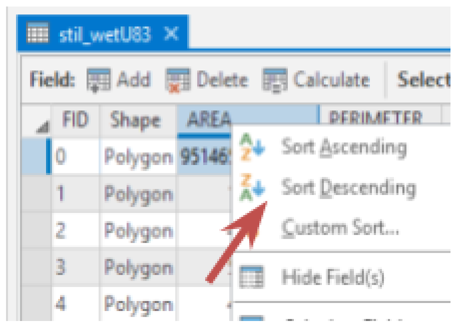


NWI Data and Basic Table Manipulations
Open a new ArcGIS Pro project and add *Stil_wetU83.shp* to a new Map.

We wish to assign three classes of wetlands: Small, Medium, and Large. We also want to label Upland polygons, and a Wisconsin polygon outside our mapped area.

Right click on the *Stil_wetU83* layer in the table of contents, then left click on Attribute Table in the dropdown menu.

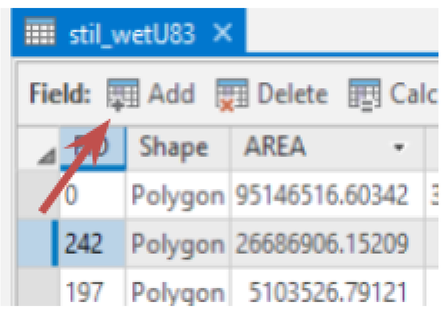
You will see the attributes of the wetlands layer. The Field called “Area” displays the area of the polygon in square meters (m^2). The “Wet_type” field displays the type of wetland.



Right click over the heading of the “Area” column and select **Sort Descending** (as shown right).
(Video: Basic Tables)

This brings the largest polygons to the top of the table. Note the Wet_type for the largest areas are coded “U” for uplands, and “Out”, in Wisconsin, are outside the mapping jurisdiction for these data.

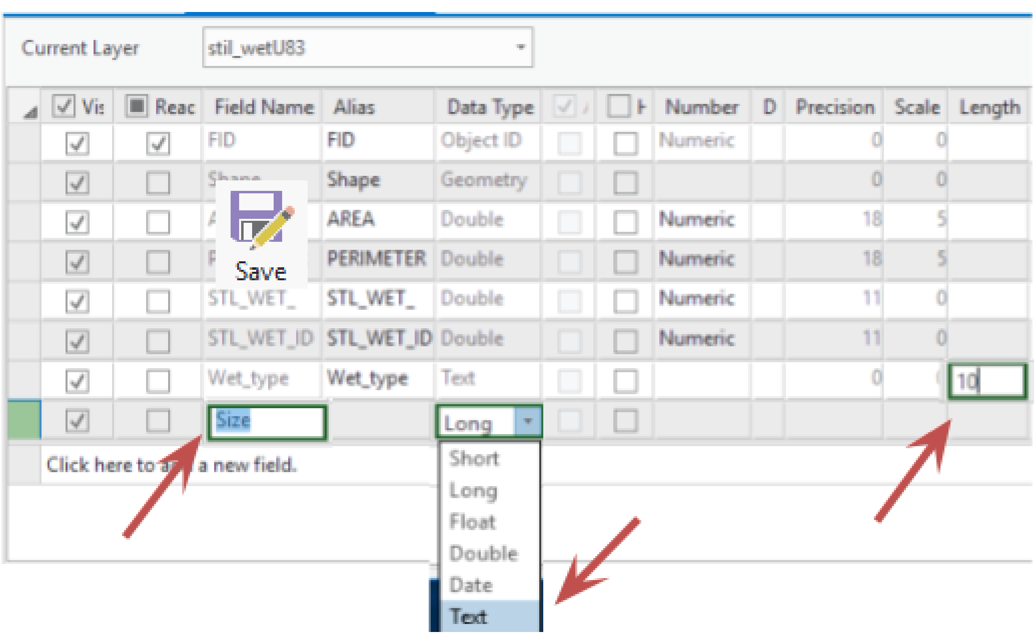
We will add a new variable and manually classify the polygons by their area.



Left click on the Table Options.

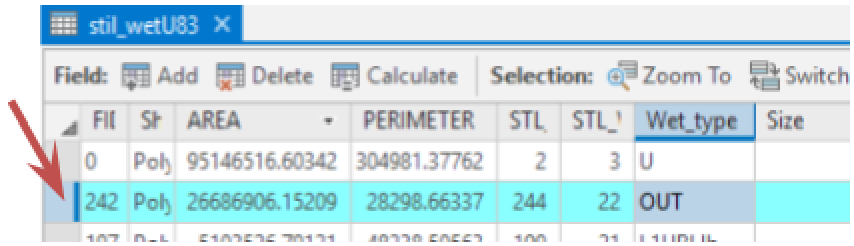
Left click on the “Add” tool in the table display, this should open a window to specify a new field.

Name the field “Size”, select the Type as “Text”, and change the Length to 10:



Click on the Save icon near the top center of the main window.

Click on the ‘x’ at the right side of the add field tab to close that window.

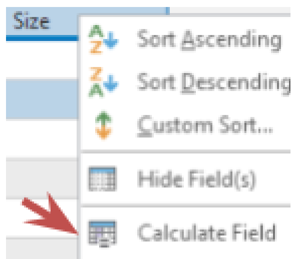


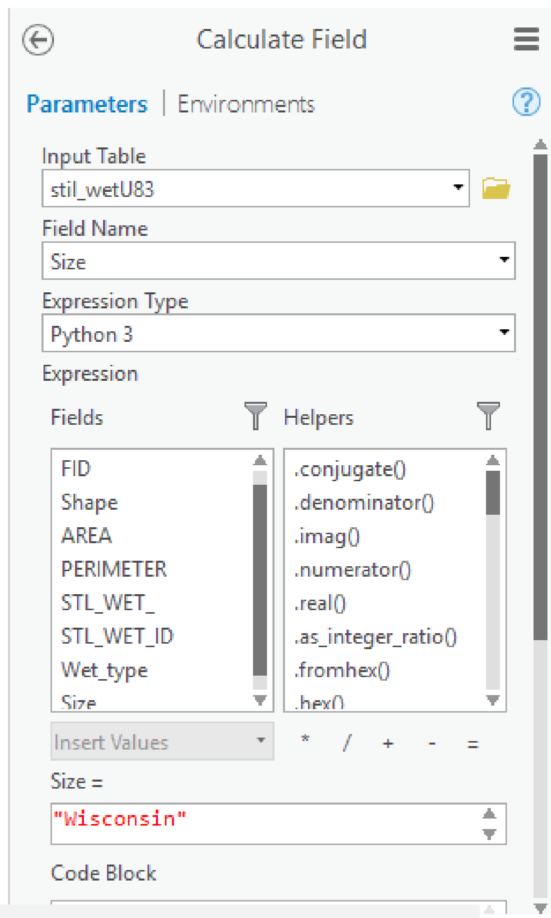
Left click on the selection patch for the table row with a Wet_type of "OUT" (see figure at right).

The selection patch is a small gray square for each row at the left edge of the table.

This should highlight the row in the default selection color.
(Video: Calculate Fields)

While the "OUT" row is selected, right-click on the "Size" field and click on the 'Calculate Field' icon to activate 'Calculate Field' pane at the right of the main window:



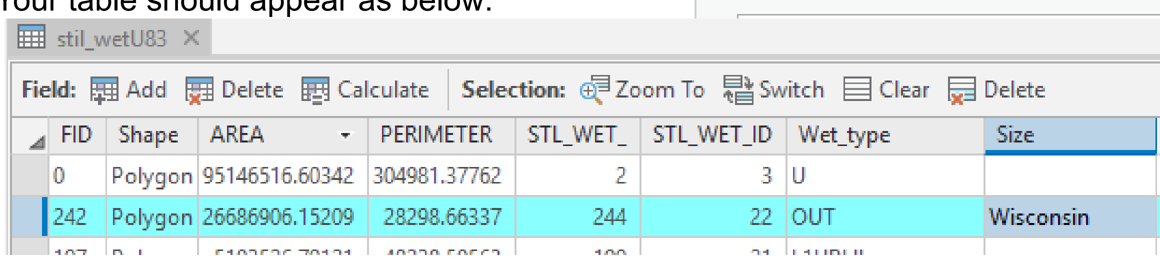


This lists the input table, target field for change, and various settings to help you create a formula window located just below the "Size =" label in the figure at the far right.

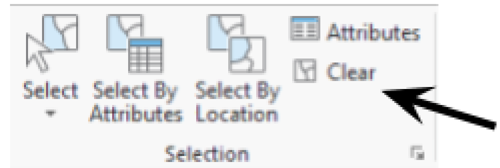
You build an expression in this formula window, and when you hit run this formula is applied <u>for only the selected rows, if some are selected, and for all rows if no rows are selected</u> (I know, it seems a bit counter-intuitive).

Type "Wisconsin" in the formula window, as shown at right, and include the quotes. Although Wisconsin isn't a size, we'll put the name in the size column to avoid using two columns.

Also note, you only include the quotes when assigning text variables.
Your table should appear as below:



Deselect the row by clicking on the ‘Clear Selection’ tool in the selection group along the top-mid of the main window:

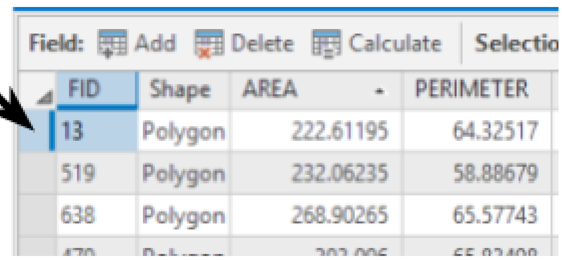


This should un-select all the current rows, removing the cyan shading.

Now, sort the table in ascending order by the ‘Area’ field, again, by right clicking on the column heading and selecting sort ascending from the dropdown menu.

Manually select the rows with areas between 222.61195 and 2993.85555, inclusive (this is the largest below our definition of small, 3000 square meters).

Do this by first left clicking on the selection patch - the small gray square on the left edge of the record - for the first record you want to select.

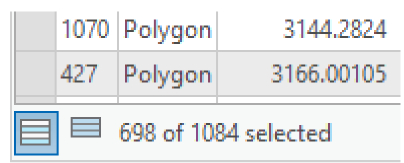


FID	Shape	AREA	PERIMETER
13	Polygon	222.61195	64.32517
519	Polygon	232.06235	58.88679
638	Polygon	268.90265	65.57743

Then scrolling down the table to display the last record you want to select.

Then, hold the shift key and left click on the selection patch for the last record you wish to select.

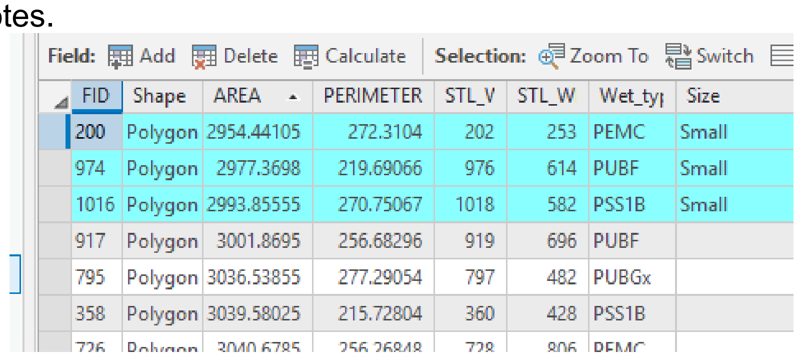
All the intervening records should appear in the cyan selection color, and if you look in the lower left corner of the attribute table it should show 698 of 1084 records selected (see figure at right).



1070	Polygon	3144.2824
427	Polygon	3166.00105

Use the **Calculate Field** tool as before and assign a “Size” values for the selected records to “Small”. Don’t forget the quotes.

A portion of the result is shown to the right.



FID	Shape	AREA	PERIMETER	STL_V	STL_W	Wet_typ	Size
200	Polygon	2954.44105	272.3104	202	253	PEMC	Small
974	Polygon	2977.3698	219.69066	976	614	PUBF	Small
1016	Polygon	2993.85555	270.75067	1018	582	PSS1B	Small
917	Polygon	3001.8695	256.68296	919	696	PUBF	
795	Polygon	3036.53855	277.29054	797	482	PUBGx	
358	Polygon	3039.58025	215.72804	360	428	PSS1B	

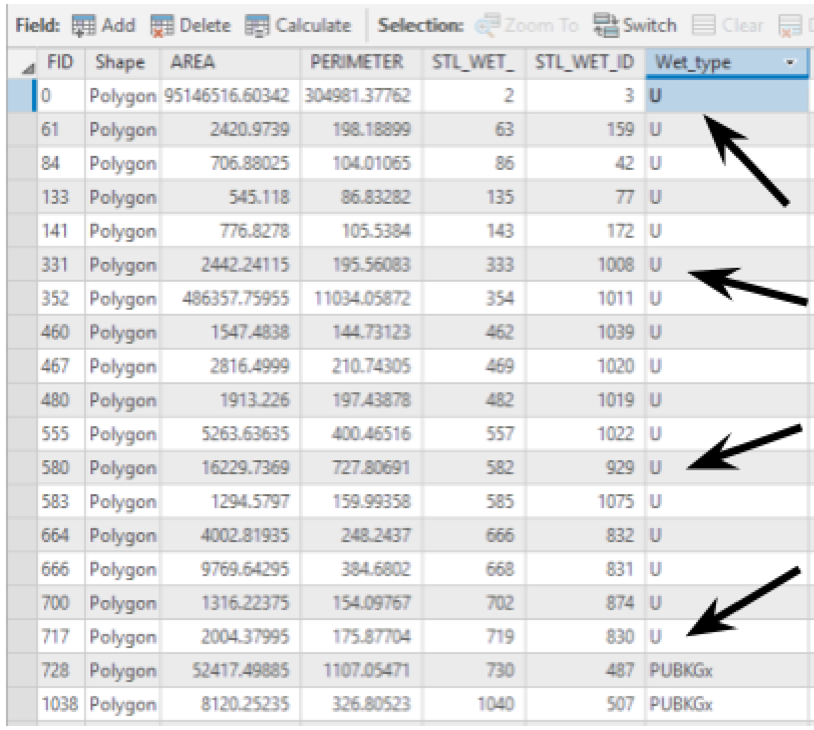
Notice that the assignment has been applied only to the selected rows.

Follow similar steps as above to assign a value of “Medium” for the "AREA" >= 3001.8695 AND "AREA" <= 9969.29615 (wetlands from 3,000 to 10,000 sq m).

Repeat the process for **"**AREA" >= 10076.1794 AND "AREA" <= 5103526.79121. Assign a value of “Large” to the Size field.

Now sort the field in <u>descending</u> order by Wet_type.

It should appear as the figure at right, with all the U Wet_types listed at the top:



Field: Add Delete Calculate Selection: Zoom To Switch Clear D

FID	Shape	AREA	PERIMETER	STL_WET_	STL_WET_ID	Wet_type
0	Polygon	95146516.60342	304981.37762	2	3	U
61	Polygon	2420.9739	198.18899	63	159	U
84	Polygon	706.88025	104.01065	86	42	U
133	Polygon	545.118	86.83282	135	77	U
141	Polygon	776.8278	105.5384	143	172	U
331	Polygon	2442.24115	195.56083	333	1008	U
352	Polygon	486357.75955	11034.05872	354	1011	U
460	Polygon	1547.4838	144.73123	462	1039	U
467	Polygon	2816.4999	210.74305	469	1020	U
480	Polygon	1913.226	197.43878	482	1019	U
555	Polygon	5263.63635	400.46516	557	1022	U
580	Polygon	16229.7369	727.80691	582	929	U
583	Polygon	1294.5797	159.99358	585	1075	U
664	Polygon	4002.81935	248.2437	666	832	U
666	Polygon	9769.64295	384.6802	668	831	U
700	Polygon	1316.22375	154.09767	702	874	U
717	Polygon	2004.37995	175.87704	719	830	U
728	Polygon	52417.49885	1107.05471	730	487	PUBKGx
1038	Polygon	8120.25235	326.80523	1040	507	PUBKGx

Left click on the selection button for the first row with a U (for Upland) Wet_type.

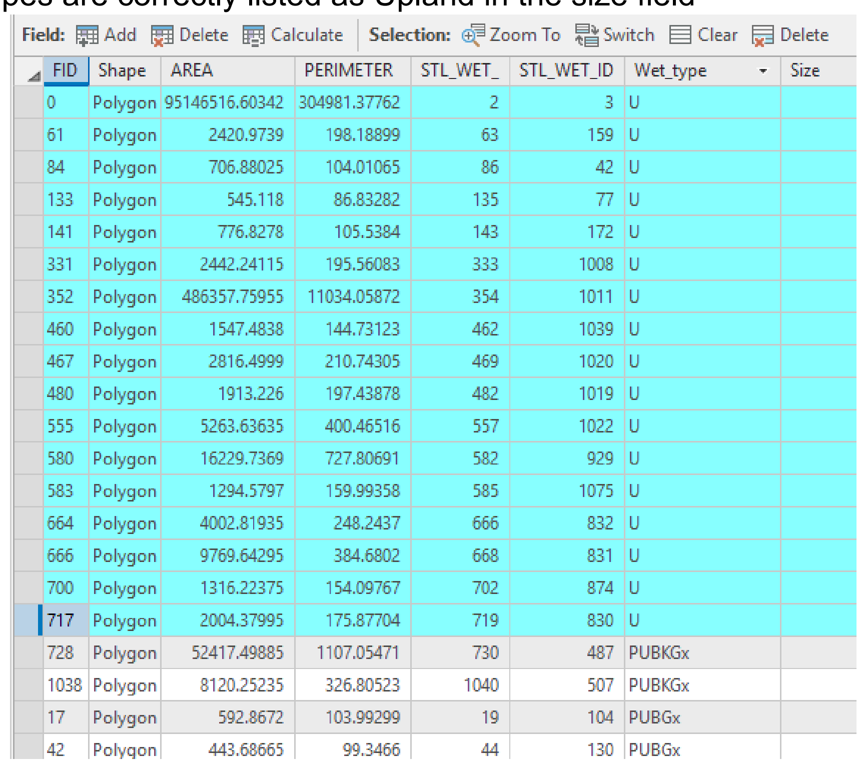
It should show colored in cyan.

Hold down the keyboard shift key and left-click on the LAST row with a U in Wet_type.

This should select all the upland polygons in the data set (see figure below).

Use the Field Calculator as before to assign the selected polygons a value of “Upland” for the Size column.

After you apply the calculation, review the columns to ensure that you applied it correctly and that all the U Wet_types are correctly listed as Upland in the size field (not shown in our figures here).



Field: Add Delete Calculate Selection: Zoom To Switch Clear Delete

FID	Shape	AREA	PERIMETER	STL_WET_	STL_WET_ID	Wet_type	Size
0	Polygon	95146516.60342	304981.37762	2	3	U	
61	Polygon	2420.9739	198.18899	63	159	U	
84	Polygon	706.88025	104.01065	86	42	U	
133	Polygon	545.118	86.83282	135	77	U	
141	Polygon	776.8278	105.5384	143	172	U	
331	Polygon	2442.24115	195.56083	333	1008	U	
352	Polygon	486357.75955	11034.05872	354	1011	U	
460	Polygon	1547.4838	144.73123	462	1039	U	
467	Polygon	2816.4999	210.74305	469	1020	U	
480	Polygon	1913.226	197.43878	482	1019	U	
555	Polygon	5263.63635	400.46516	557	1022	U	
580	Polygon	16229.7369	727.80691	582	929	U	
583	Polygon	1294.5797	159.99358	585	1075	U	
664	Polygon	4002.81935	248.2437	666	832	U	
666	Polygon	9769.64295	384.6802	668	831	U	
700	Polygon	1316.22375	154.09767	702	874	U	
717	Polygon	2004.37995	175.87704	719	830	U	
728	Polygon	52417.49885	1107.05471	730	487	PUBKGx	
1038	Polygon	8120.25235	326.80523	1040	507	PUBKGx	
17	Polygon	592.8672	103.99299	19	104	PUBGx	
42	Polygon	443.68665	99.3466	44	130	PUBGx	

Now…

First, de-select the currently selected rows, as shown above, by clicking on the clear selection button along the top of the table.

Check to make sure you didn’t overwrite the “Wisconsin” value for size we added near the start of this section. This is one of the dis-advantages of manual selection, and we’ll show you a way to avoid this problem in next week’s lab.

For now, re-do the selection for the ‘OUT’ Wet_type if you need to, and assign them a value of “Wisconsin”

Finally**,** Clear Selected Features and close the Table.

Change the symbology for the stil_wetU83 layer so that you show unique values for the ‘Size’ variable.

You should have five categories displayed: Small, Medium, Large, Upland, and Wisconsin.

Map 5
Create a layout like that found below, add appropriate title, legend, scale bar and north arrow; export as pdf.

To Turn In

Five pdf maps total:

1) Kodiak Island map
2) population cities
3) the county graduated symbol map
4) St Croix shaded relief
5) wetlands by size