Cartography with ArcGIS Pro

S4 GIS Institute

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May 17, 2023

https://libguides.brown.edu/gis_data_tutorials/s4arcpro

Introduction

This tutorial introduces basic elements of cartography with ArcGIS Pro: spatial reference systems (SRS) and map projections, symbolization, labeling, data classification, and map layout. We will continue where we left off with our first tutorial, *Introduction to ArcGIS Pro I*, and will use our `gis_introduction` project and the Rhode Island tutorial data downloaded previously.

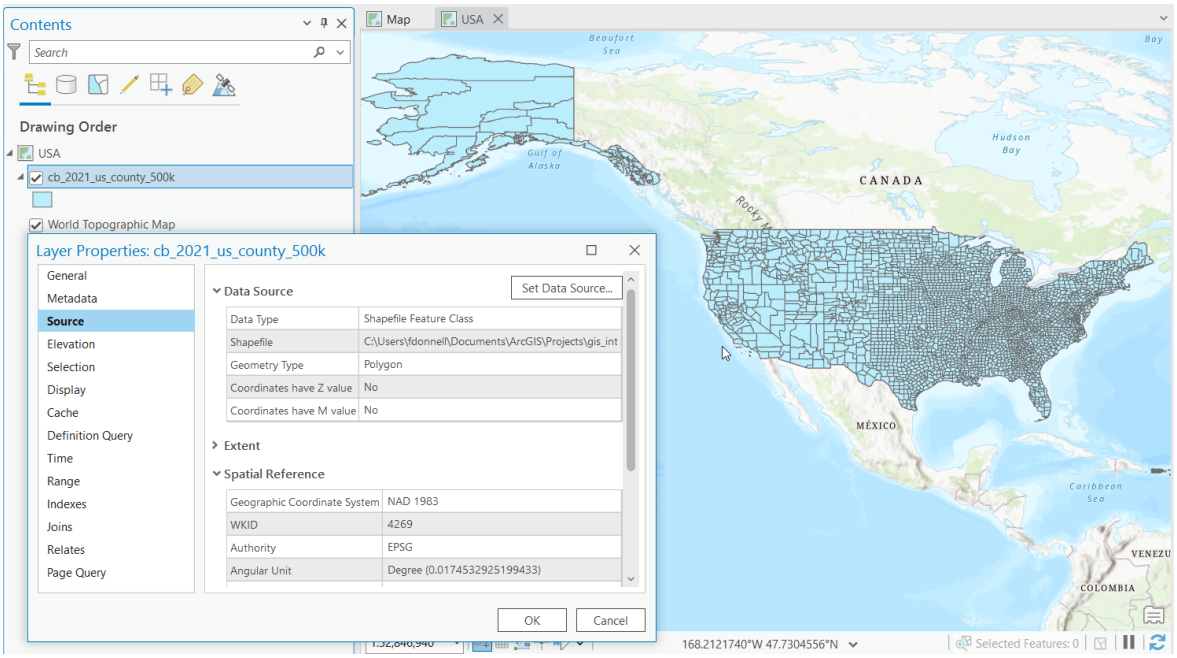
Conventions used in this tutorial:

- Summaries of steps appear in **bold face**.
- Names of windows, tabs, and tools appear in *italic face*.
- Names of files, features, and fields appear as `typewriter face`.

1 Map Projections

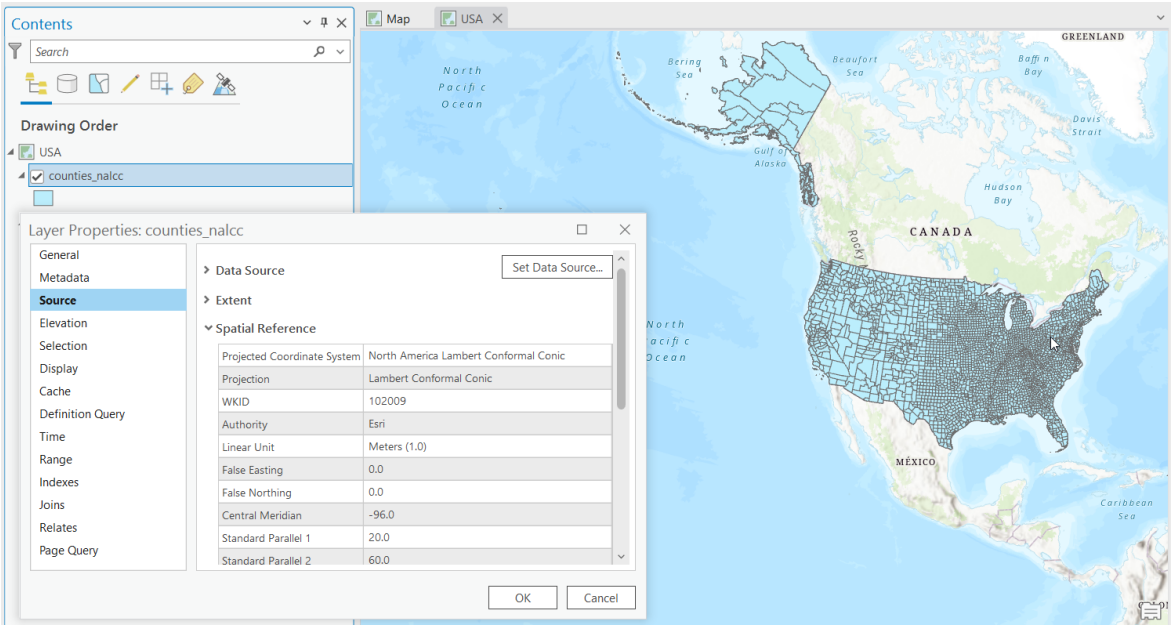
This section will illustrate spatial reference system (SRS) handling in ArcGIS Pro. These systems are the foundation for what makes GIS software work, as they are standards that allow data layers to be overlaid and treated as geographic data.

1. **Launch the software**: Open the Start Menu in Windows, select the ArcGIS folder, and select ArcGIS Pro to open the software.
2. **Open our project**: On the ArcGIS Pro Start Page, click on the `gis_introduction` project in the list to open our previous project. ArcGIS Pro will launch.
3. **View counties files**: Click on the `USA` map view tab to view the map of the `counties`. Select this layer in the *Contents* panel, right click, and choose *Properties*. Click on the *Source* option, scroll down and open the *Spatial Reference* section. You will see this layer is in NAD 1983, which is a basic longitude / latitude geographic coordinate system whose unique WKID code is 4269. Close the window.



4. **Reproject layer**: Go to the *Analysis* tab on the ribbon and open the *Tools*. In the *Geoprocessing* window, select the *Toolboxes* option. Drill down through these toolboxes: *Data Management Tools - Projections and Transformations* and choose the *Project* tool. In the *Project* window, choose `cb_2021_us_county_500k` as input. Beside the output, hit the folder icon, navigate into the `gisintro_sampledata - shapefiles` folder and in *Name* enter `counties_nalcc` and hit *Save* (we don't want to put this file into our geodatabase). Back on the *Project* window, for the *output coordinate system* hit the small globe button to open the *Coordinate System* window. Drill down through: *Projected Coordinate Systems - Continental - North America* and choose *North America Lambert Conformal Conic* and click *OK*. Back in the *Project* window, click *Run*.

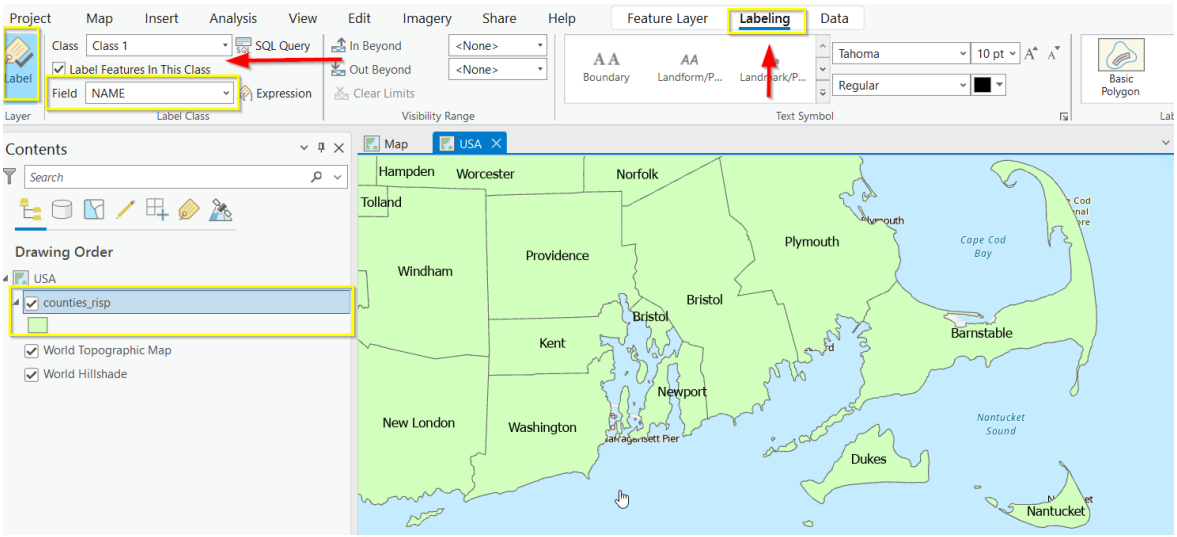
5. **Reset the map view**: It looks like nothing has happened, because ArcGIS has reprojected the new layer on the fly to match the SRS of the window, which was set to the SRS of the first layer we added. In the *Contents* pane, double click on `USA` map view. In the *Map Properties* menu select *Coordinate Systems*. In the layers list select *North America Lambert Conformal Conic* and click *OK*. Note the dramatic change in the view window. Zoom into the United States and explore the layer, and open its properties menu to view the SRS definition.



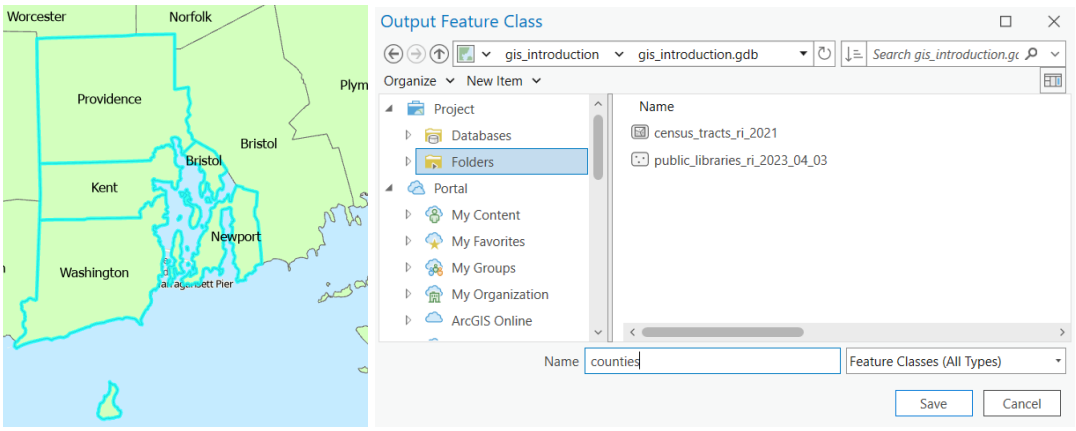
6. **Reproject layer again**: Uncheck the `cb_2021_us_county_500k` layer. Return to the *Toolbox* on the *Analysis* tab. Do a quick search for the *Project* tool. Choose `counties_nalcc` as the input layer. Name the new layer `counties_risp` and *save it in the same folder as before, as a shapefile*. For the *output coordinate system* browse through: *Projected Coordinate Systems - State Plane - NAD 1983 (US Feet) - NAD 1983 StatePlane Rhode Island*. Click *OK* then *Run*. Close the *Project* window, then repeat the previous step to reset the map view to match the new system for this file, then explore the map. This SRS is centered on Rhode Island.

7. **Remove layers we don't need**: Select the `counties_nalcc` layer in the *Contents*, right click, and choose the *Remove* option. Repeat this step and remove the initial `cb_2021_us_county_500k` layer. The only layer you should have left in this map is `counties_risp`. Save your project.

8. **Turn on labels for counties**: Zoom into the map to see Rhode Island. Select the `counties_risp` layer in the *Contents* pane to make it active. Click the context dependent *Labelling* tab at the top of the screen. On the left, make sure `Name` is selected as the *Field* and hit the *Label* button (tag with check mark) to turn labels on.



9. **Export counties for RI**: Click the *Map* tab on the ribbon and hit the *Select* features button. While holding down the Shift key, click each of the five counties of Rhode Island in the `counties_risp` layer (for guidance see the photo below). In the *Contents* pane, select `counties_risp`, right click, and choose *Data - Export Features*. Choose `counties_risp` as the input, and for the *Output Location* *store the layer in the `gis_introduction` database* (navigate up the folder tree and into the database, like it was a folder). Name the new feature class `counties`. Click *OK*.

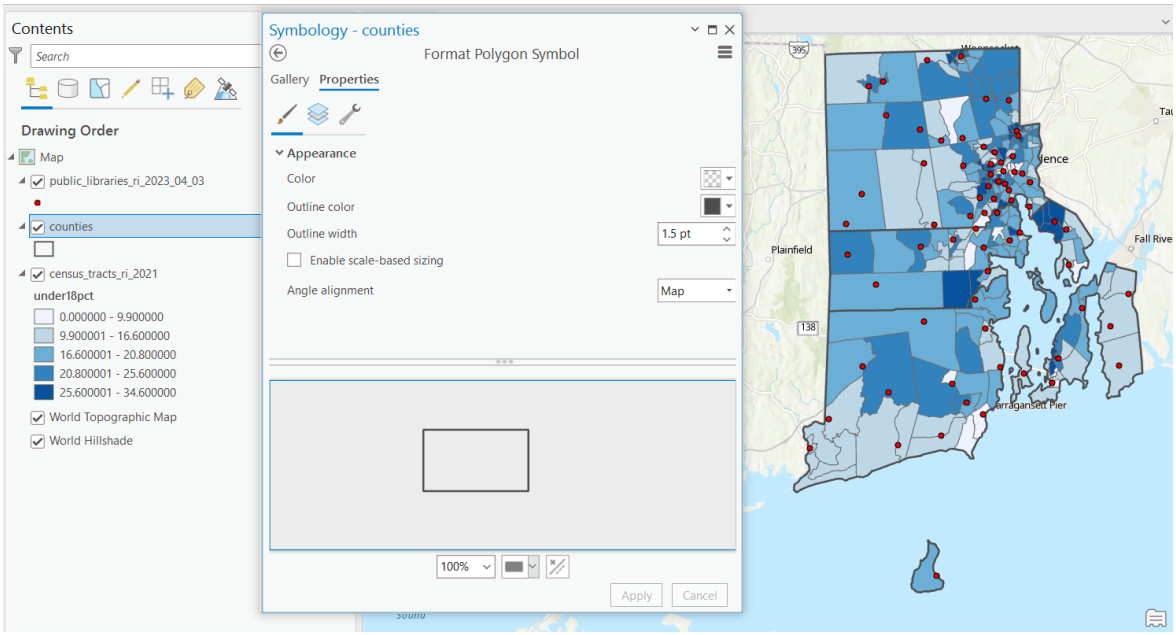


10. **Add counties to original map**: Flip back to your original map in the *Map* view that contains the layers for libraries and census tracts. Use either the yellow *Add Data* button on the *Insert* tab, or the *Catalog* pane to add the new layer of Rhode Island counties to this map. Save your project.

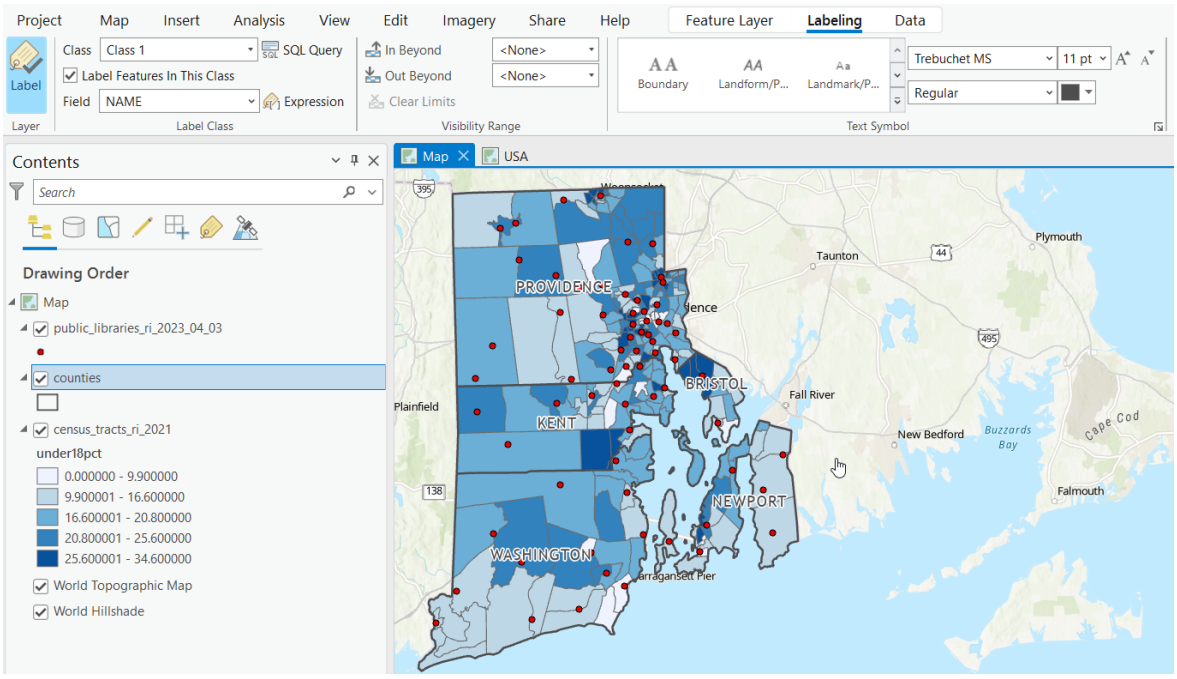
2 Symbolization and Labeling

This section demonstrates how to overlay and symbolize multiple polygon layers, and how to style feature labels.

1. **Change the fill for counties**: In your original *Map* view drag the `counties` layer in the *Contents* pane so that it sits below the `public libraries` but above the `census tracts`. Right click on the `counties` and choose *Symbology*. Under the *Primary Symbology* window click on the rectangle for the symbol. In the *Format Polygon Symbol* menu switch from the *Gallery* to the *Properties*. Drag the window open a little to expand it. Change the dropdown for color to *No Color*. Change the outline to a darker grey and increase the thickness to 1.5pt. Click *Apply*. Close the *Symbology* window.



2. **Label counties**: With the `counties` layer selected in the *Contents* pane, click on the *Labeling* tab on the ribbon. On the far left side of the ribbon click the large *Label* button, and make sure *Field* dropdown is set to `NAME`, which is the attribute column that holds the county name. In the center of the ribbon experiment with the different label options by selecting different ones in turn. Note that when you select a label you can alter the font type, face, capitalization, and size on the right. For example: select the *Populated Place (Capital)* scheme, change the font type to *Trebuchet MS*, the font size to 11 and the font face to regular. Also note if you hit the call out box arrow you can access a full range of label options. Save your project.

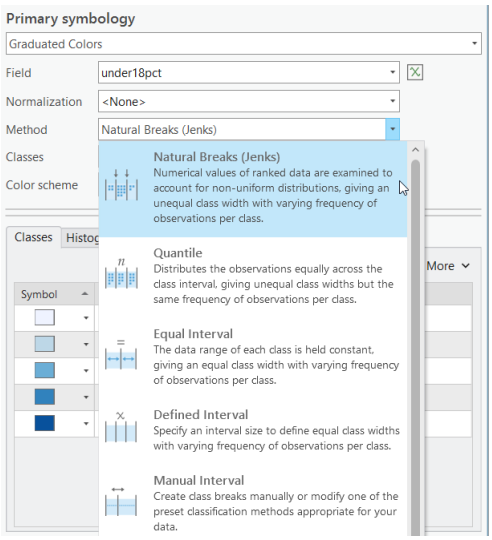


3. **Reset library symbols**: *If* you tried the experiments at the end of the previous tutorial, change the symbolization of the `public_libraries` layer back to being displayed as basic single symbols.

3 Data Classification and Multiple Maps

In this section you will experiment with different quantitative data classification methods, and will learn how to duplicate existing maps to create multiple series in the same project.

1. **Experiment with data classification**: Select the `census_tracts` layer, right click, and choose *Symbology*. Make sure the dropdown is set to *Graduated Colors*, the field is set to `under18pct`, you have 5 classes, and the color scheme is set to display different tones of the same color from light to dark. Begin with *Natural Breaks (Jenks)* as the method, and observe the map and the scheme displayed in the *Contents* pane. Cycle through the *quantile, equal interval, defined interval, and manual methods*; note the descriptions of each and notice how the map changes with each method.



2. **Set to natural breaks**: When you are finished experimenting, set the method to *Natural Breaks* and close the symbology window.

3. **Make a copy of this map**: In the *Contents* pane, double click on your *Map* to open the *Properties* menu. In the *General* menu change the name from `Map` to `Population Under 18`, and click *OK*. Next, go over to the *Catalog* pane (if you don't have one open, go to *View - Catalog Pane*). Hit the down arrow beside *Maps* to see your different maps. Select the `Population Under 18` map, right click and choose *Copy*.Then select *Maps* on the top, right click, and choose *Paste*. A copy called `Population Over 181` is created. Select it, right click, and choose *Rename*. Name it `Population Over 64`. Then select this new map, right click, and hit the *Open* button. This opens this newly copied map in the view window of your project.

4. **Alter the second map**: In the `Population Over 64` map, go into the `census tracts` *Symbology* and change the field being mapped to `over64pct`. Save your project.

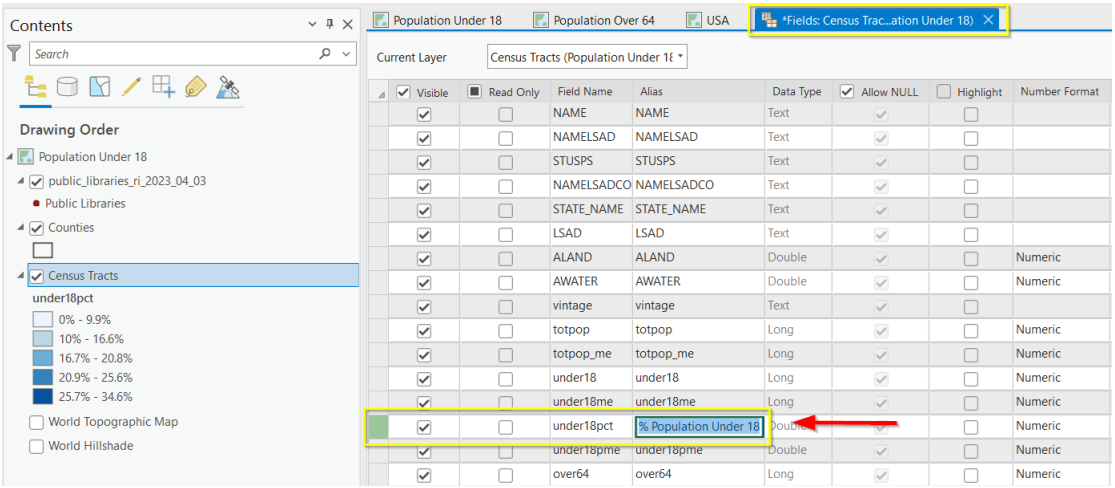
4 Map Layout

This section briefly demonstrates map layout capabilities, and the preliminary steps you need to take to ensure that the labels of your layers and field are appropriate for making finished maps.

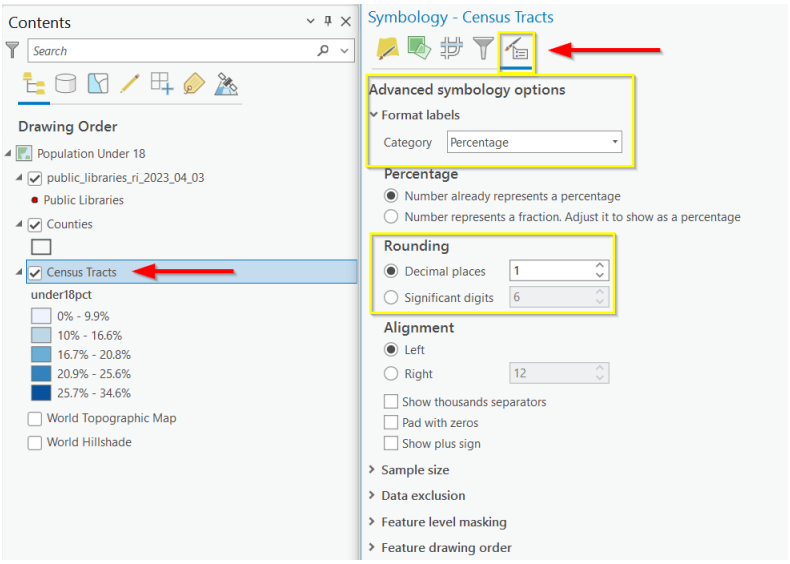
1. **Prepare to map**: In both sets of Rhode Island maps, make sure the `Topographic` and `Hillshade` layers are turned off. On each map, zoom in and pan so that Rhode Island is perfectly centered in your map view.

2. **Format layer titles**: We need to modify the names and descriptions of our layers in our map so they will appear correctly in our legend. Double click on the `counties` layer, open its *Properties* menu, and change the name in the *General* tab to capitalize it to `Counties`. Repeat this step for the `census_tracts`, naming them `Census Tracts`, and for the `public_libraries`, naming them `Public Libraries`.

3. **Modify field or column names**: We need to modify some of our attribute information to clearly illustrate the tract data we are mapping. Right click the `Census Tracts`, choose *Data Design - Fields*. This opens a new tab in the view pane. Next to each field name is an alias, which is currently identical to the field name. In the alias beside the `under18pct` field, type in: `% Population Under 18`. Close the fields tab and save the changes. Go into the symbology and reclassify the data so the change is reflected in the *Contents* pane (choose a different column to classify, and then change it back to `% Population Under 18`).



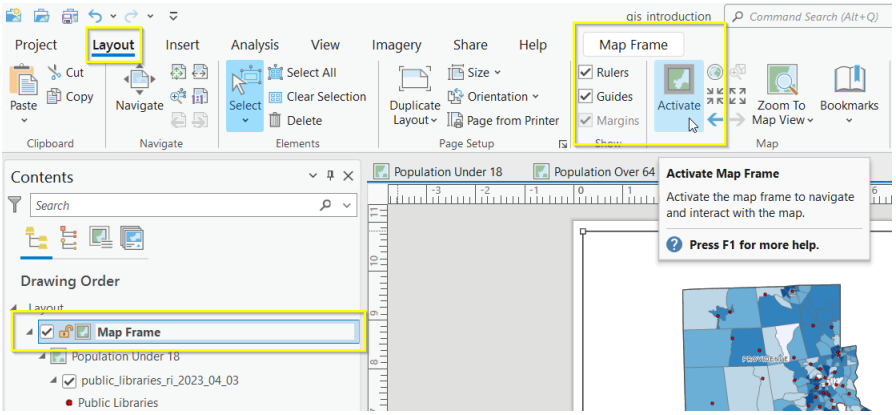
4. **Round census tract values**: Open the *Symbology* for the tracts, and click on the last *Advanced Symbology Options* button at the top of the window. Under *Format Labels* change the *Category* option from numeric to percentage, then under *Rounding* change the decimal places from 6 to 1. Close the window.



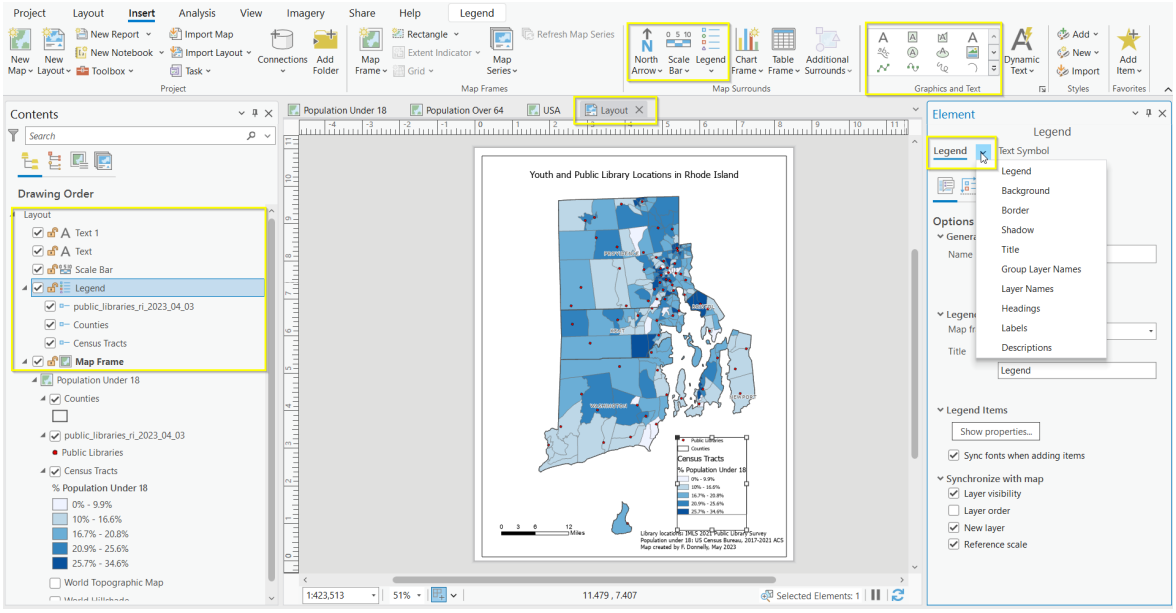
5. **Add a layout**: Select the *Population Under 18* map in your view, so that it is your active map. On the *Insert* tab on the ribbon, click the *New Layout* button on the far left. Choose *ANSI Portrait - Letter* paper for the page size. A new layout tab will appear in your view window.

6. **Add a map**: On the *Insert* tab on the ribbon click the *Map Frame* button. Choose the `Population Under 18 scale` option (not the *Default* option). Then click in the upper left hand corner of the page, leaving a little space for a margin, drag a box that covers the page (leaving a little space for a margin) and release. This adds the map to the page. You can resize the box by clicking the corners and moving it around.

7. **Change zoom on map**: To modify the extent and zoom of the actual map (as opposed to just zooming in and out of the page layout), select the *Map Frame* in the *Contents* pane. In the *Layout* tab on the ribbon, click the *Activate* button towards the right of the ribbon. Now, on the *Map* tab on the ribbon, you should be able to pan and zoom to get Rhode Island more centered in your layout view. Make sure to leave some space in the layout for a title and legend. When finished, click the *Layout: Map Frame* link that appears next to a backward arrow in the upper left-hand corner of the view to return to the layout mode.



8. **Add legend**: With the *Map Frame* selected in the *Contents* pane, on the *Insert* tab on the ribbon click the *Legend* button, and draw a box to insert a legend on your map. Select the *Legend* in the *Contents* pane, right click, and choose *Properties*. A *Format Legend* pane opens on the right that allows you to customize every conceivable option about the legend. For example, hit the dropdown arrow beside the small *Legend* heading and choose *Border*. Turn the border from no fill to a dark grey line and hit *Apply*. Then hit the middle *Layers* button on this window and add a text offset of 4 or 5 points and hit *Apply*. On the left in the *Contents* pane you will see each item that is active in the legend. You can check or uncheck layers to remove them from the legend (they stay on the map) or drag to change the drawing order.



9. **Add scalebar**: On the *Insert* tab on the ribbon click the dropdown arrow beside the *Scale Bar* button, and choose a scalebar. Then click on the map to add a scalebar. With the bar selected, you can modify its properties in the same way, right clicking, open *Properties*, and use the *Format Scale Bar* pane on the right. On the *Properties* in the *Fitting Strategy* dropdown, you can *Adjust divisions and values*, and then drag the edge of the scalebar with the mouse to create one of suitable size that doesn't contain tick marks with long decimal numbers like 3.175.

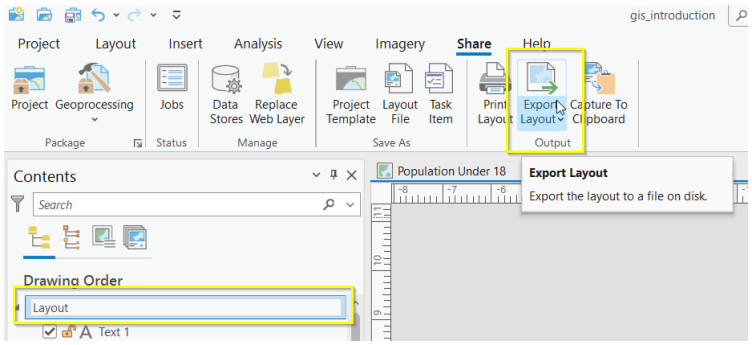
10. **Add a title and text**: On the *Graphics and Text* section on the *Insert* tab of the ribbon, click on the small, plain letter "A" in the menu box of icons to add *Straight Text*, and then click near the top of the map to add text. With the text selected, in the *Format Text* pane on the right change the value from `Text` to `Youth and Public Library Locations in Rhode Island`. Then click on the *Text Symbol* option, and increase the font size to 18. You can also change the font face if you wish. When you're finished, repeat this step and add text in a smaller font size towards the bottom of the map to provide source information like:

    Library locations: IMLS 2021 Public Library Survey
    Population under 18: US Census Bureau, 2017-2021 ACS
    Map created by YOUR NAME, May 2023

    You can modify how text is aligned in a box (left, center, right) under *Text Symbol - Position*.

11. **Align elements and export**. Now that you have all the elements in place, experiment with aligning them on the page to achieve some balance. When you are satisfied, select the layout in the *Contents* pane, and on the *Share* tab on the ribbon hit the *Export Layout* button. In the *Export* properties menu, you could change the file type (default is PDF, can also choose image types like PNG and TIF), the destination and file name, and can modify other elements. Keep the defaults and under *Name* scroll to the end of the path and change the file name to `ri_libraries_under18`. Hit the *Export* button at the bottom. When the export is finished,

click on the *View Exported File* link at the bottom of the menu. Congrats on creating your first map! Save your project. To exit the *Layout* view, simply select a *Map* tab to open its view.



5 Experiment on Your Own

1. In the `USA` map view, experiment with additional map projections such as North America Albers Equal Area for all the counties in the US and NAD 83 UTM Zone 19N for the Rhode Island counties.

2. Experiment additional, different layout options and modifying the properties of legends and scalebars.

3. Repeat the map layout steps, and create a stand-alone map for the population over 64 relative to public library locations, entitled "Seniors and Public Library Locations in Rhode Island".

4. Create a third layout where you add two maps - the under 18 and 64 and over pop - to the same layout side by side. In doing this, you will also want to adjust the classification schemes of each map so that they match. Experiment with different possibilities for doing this.