

# GIS I: Organizing Principles Displaying Spatial Data Exercise



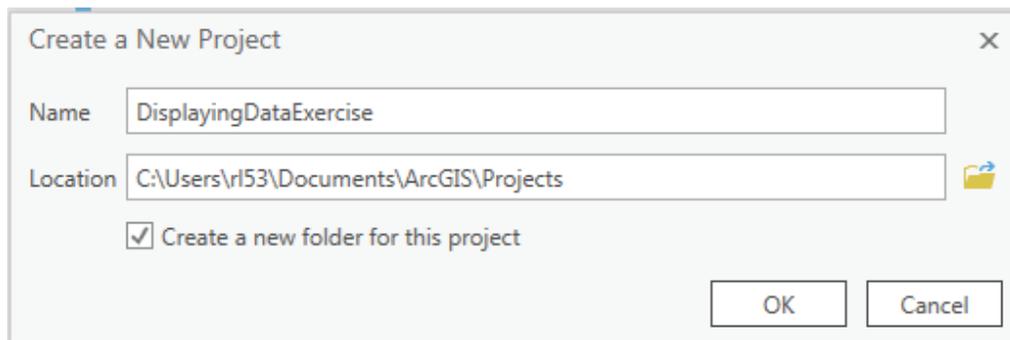
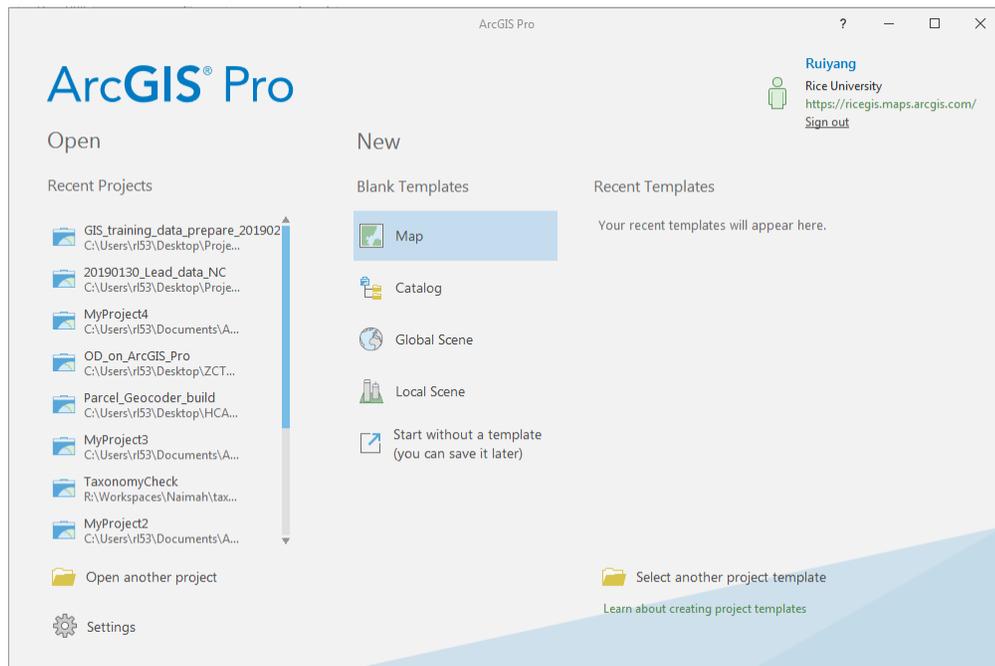
\*\*\* Files needed for exercise: *RI\_poverty\_Rate\_2017, RI\_Hospitals\_FQHCs\_201912* in *ExerciseData.gdb*

**Goals:** The goal of this exercise is to create a map with both qualitative and quantitative data of the poverty rate in the state of Rhode Island.

**Skills:** After completing this exercise, you will be able to make a flat map with ArcGIS Pro given project data. You will be familiar with adding data to ArcGIS Pro, symbolizing attributes, and creating a PDF map.

## Creating a ArcGIS Pro Project

1. In the Windows Explorer Start Menu, type ArcGIS Pro in the search and open ArcGIS Pro.
2. Click on **New > Blank Templates > Map**. In the popup, name your map project and specify your saving location to your drive and then click **OK**.

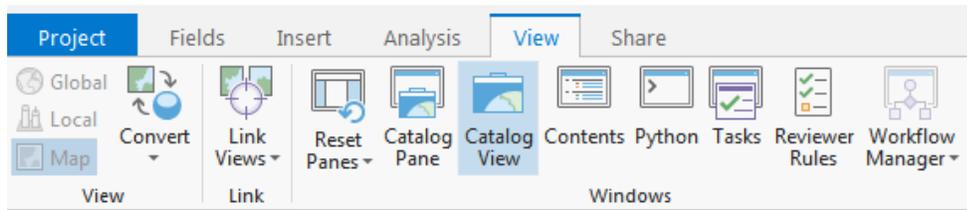


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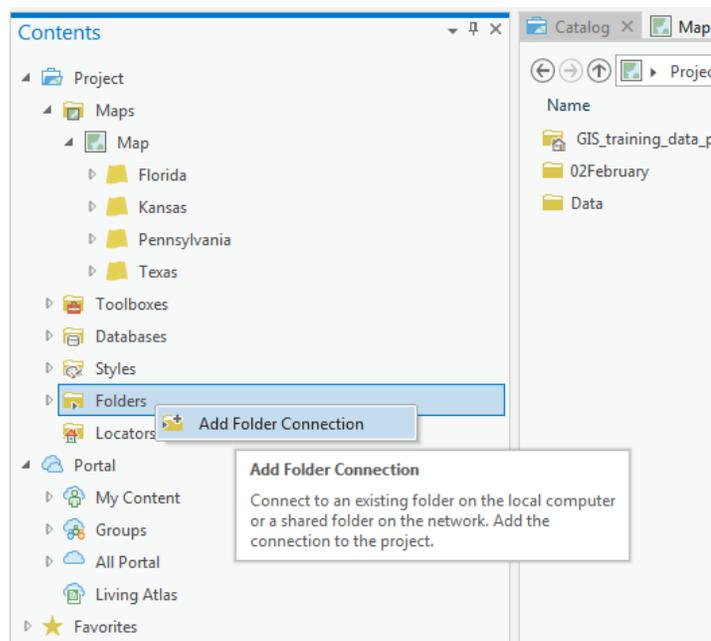


## Adding Data and Connecting to Folders

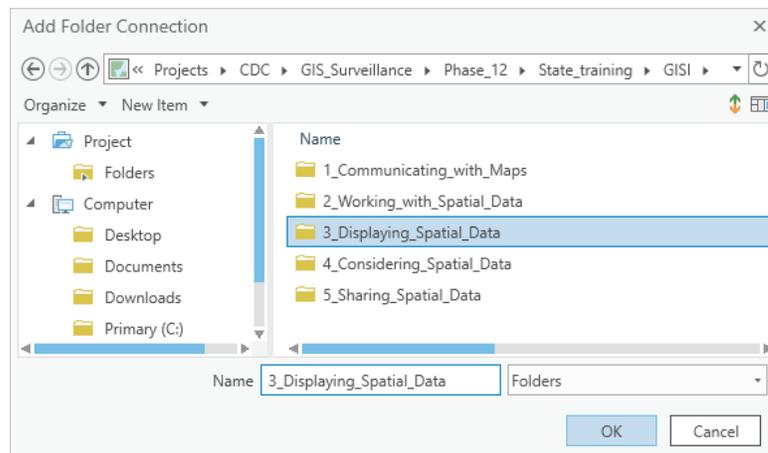
1. On the top ribbon, switch to **View** tab and click on **Catalog View**.



2. You are now in the catalog view. Right click on the **Folders** in the **Contents** pane on the right hand side, and select **Add Folder Connection**.



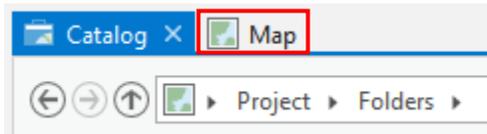
3. Navigate to this module's exercise folder, **SINGLE CLICK** on the *3\_Displaying\_Spatial\_Data* and click **OK**. You now have a connection to that folder in this project making it quicker to find and add data.



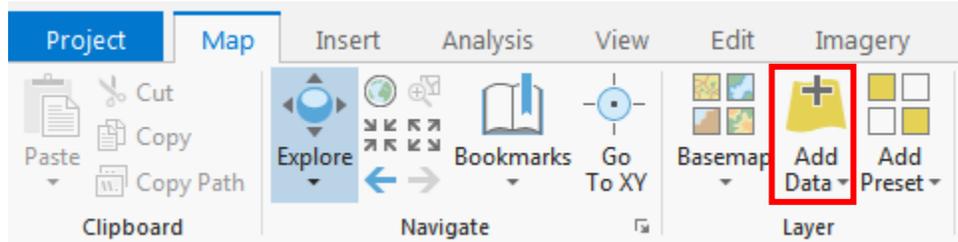
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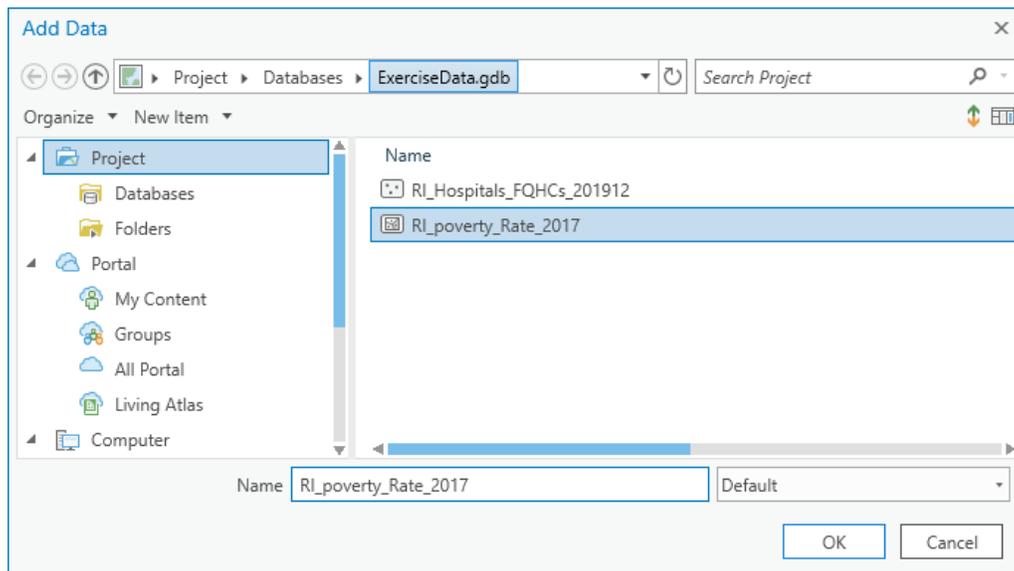
- Click on the **Map** view tab to switch to the map you were working on before.



- On the top ribbon, Click on Map and then **Add Data** icon to add new data to the map.



- Click **Folders** on the right hand side and browse to 3\_Displaying\_Spatial\_Data > *ExerciseData.gdb*.
- From the folder, click the shapefile *RI\_poverty\_Rate\_2017*. This file contains tract-level data for the poverty rate American Community Survey (ACS) 2017.
- Once you've selected the file, click **OK** and the data will appear in the **Contents** as a layer.



- Click the **Add Data** icon again and from the same database, select the file *RI\_Hospitals\_FQHCs\_201912*. This is a file containing point data for CMS Approved hospitals and Federally Qualified Health Centers (FQHCs) in Rhode Island and 5 miles around. This dataset extract is from the Quality Improvement Evaluation System (QIES) database which is serviced by Health Resources & Services Administration (HRSA). It includes information about provider number, name, and address and characterizes the participating institutional provider. Click **OK**. Both layers should now appear in the Contents.

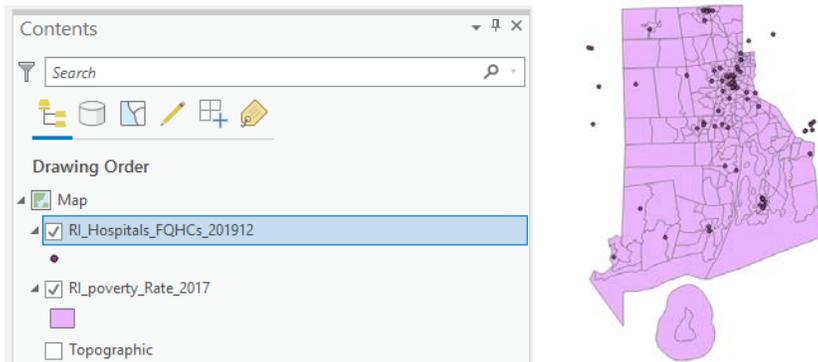
# GIS I: Organizing Principles

## Displaying Spatial Data Exercise

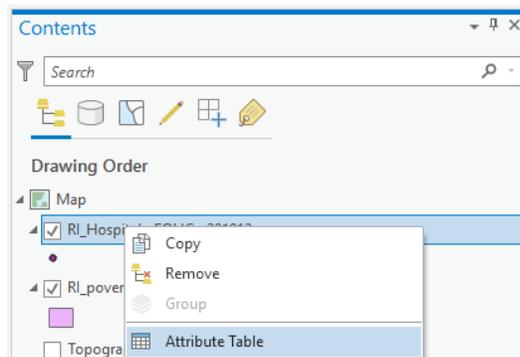


### Working with Qualitative Data

1. Take a look at the current symbolization of the census tracts of Rhode Island and all CMS approved hospitals and FQHCs. The tracts are displayed with one color corresponding to the symbol in the **Table of Contents**. The hospitals and FQHCs are also displayed with one color corresponding to one symbol. Colors may vary from the example below.



2. You can try to click and hold on *RI\_poverty\_Rate\_2017*, then drag the layer up and down to rearrange the layer. Would the layer order affect the display?



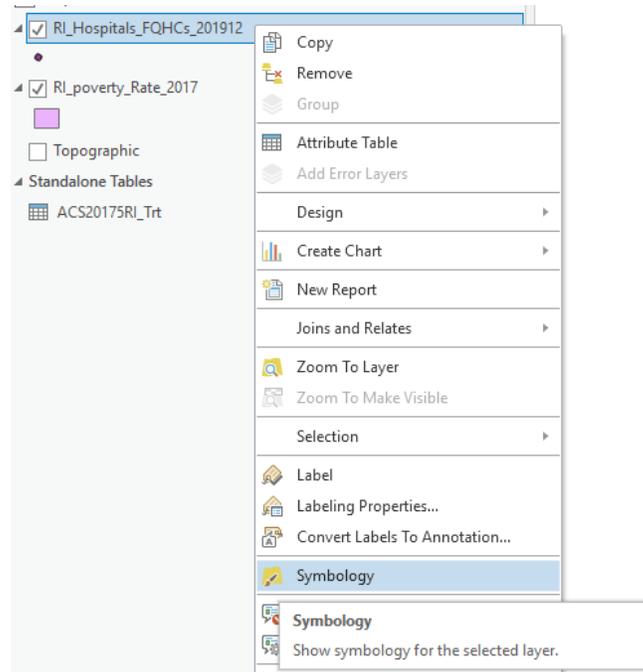
3. View the *RI\_Hospitals\_FQHCs\_201912* layer's attribute table to see what data it contains. Right click the *RI\_Hospitals\_FQHCs\_201912* in the **Contents** and select **Attribute Table**.
4. A new pane will appear with the attributes of *RI\_Hospitals\_FQHCs\_201912*. Look at the fields. The table has the address and other information about the CMS approved hospitals and FQHCs. Which fields appear qualitative? The fields that differentiate *Facility Category*: Hospital or FQHC are qualitative. Close the attribute table by clicking the 'x' in the top right corner of the tab.

| CMS_PROVIDER_ZIP_CD | CMS_PROVIDER_CAT_CD | Facility Category | CMS_PROVIDER_CAT_SUB_TYP_CD | Facility Subcategory |
|---------------------|---------------------|-------------------|-----------------------------|----------------------|
| 06260-1836          | 01                  | Hospital          | 01                          | Short Term           |
| 02703-3143          | 01                  | Hospital          | 01                          | Short Term           |
| 02721-1733          | 01                  | Hospital          | 01                          | Short Term           |
| 02720-3703          | 01                  | Hospital          | 01                          | Short Term           |
| 02703-5520          | 01                  | Hospital          | 04                          | Psychiatric          |
| 02720-5211          | 01                  | Hospital          | 04                          | Psychiatric          |
| 02908-4728          | 01                  | Hospital          | 01                          | Short Term           |

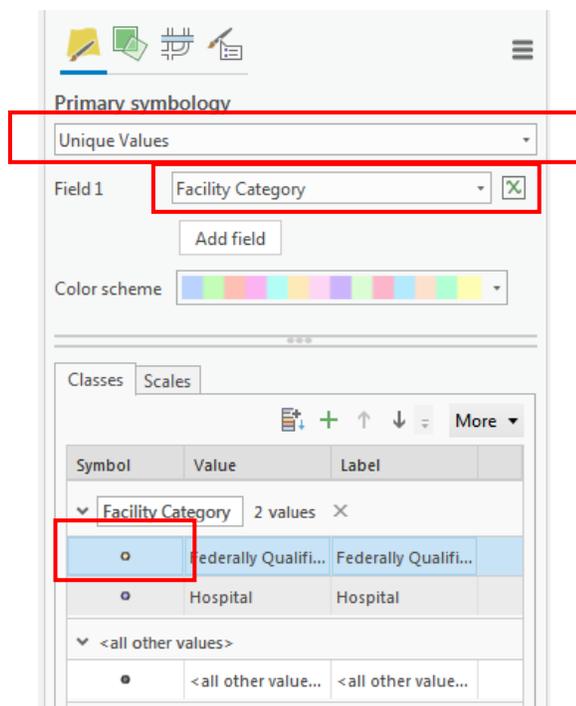
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- Now you will change the symbolization of the facilities approved by CMS. Right click the *RI\_Hospitals\_FQHCs\_201912* layer in the **Contents**, select **Symbology**.



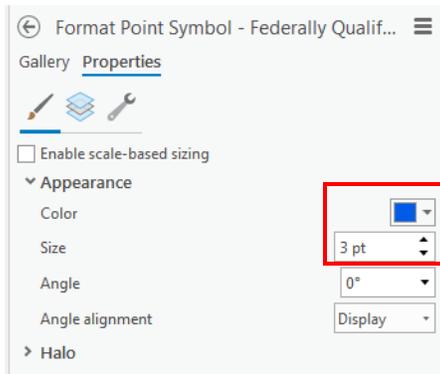
- The **Symbology** pane should appear on the right.
- You will display your qualitative data by categories. Under **Primary symbology**, select **Unique values**. In the **Field 1** drop-down menu, choose the field *Facility Category*. After a few seconds, all classes in the facilities file will be added into the window below.



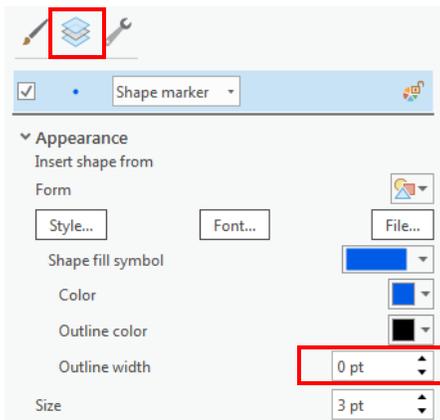
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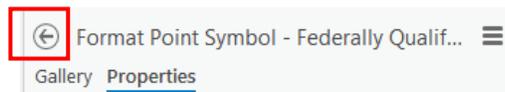
- Single click on the colored dots to change the symbols for different type of facilities. Let's first change the size of the points to 3 pt. Then pick your favorite color.



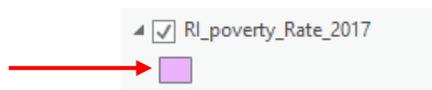
- Then, click on the **Layers** icon to switch to detail configuration tab and set the **Outline width** to 0 pt. Please remember, nothing changes unless you hit **Apply** on the bottom.



- Click on the back button on the top of this pane to go back to the primary symbology page. Similarly, change the symbol for *Hospitals*.



- Examine the map with your new symbols. Are the symbols an appropriate size and shape? Are colors easily distinguished? If not, return to the **Symbology** pane and adjust the size, shape or color. Remember, you have to click **Apply** to save your changes.
- You may want to change your tracts layer to a neutral color so the health care centers are more visible. Do this by single clicking on the color swatch for the tracts layer in the **Content** and adjusting the color.



- You now have a map of Rhode Island CMS approved facilities symbolized by their categories. This could be very useful information.

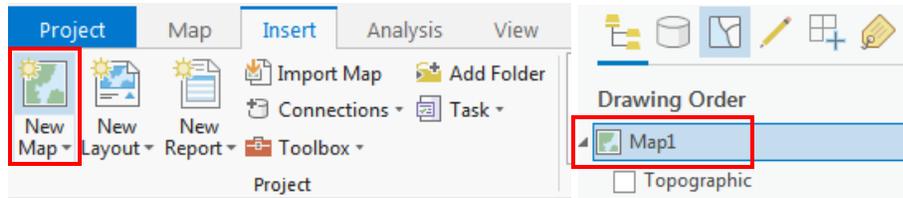
# GIS I: Organizing Principles

## Displaying Spatial Data Exercise



### Adding a New Map

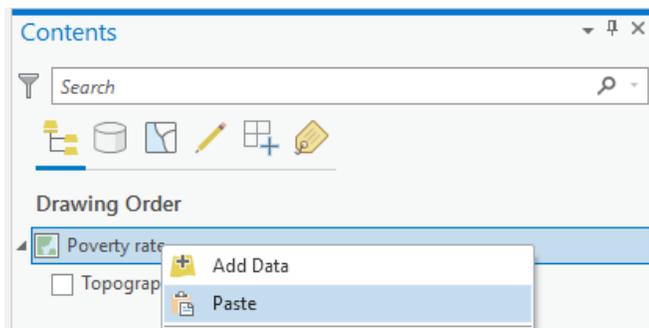
1. Next, you'll work on a second map with poverty rate data. From the **Insert** tab on the top ribbon, select **New Map** to add a new map to your project.



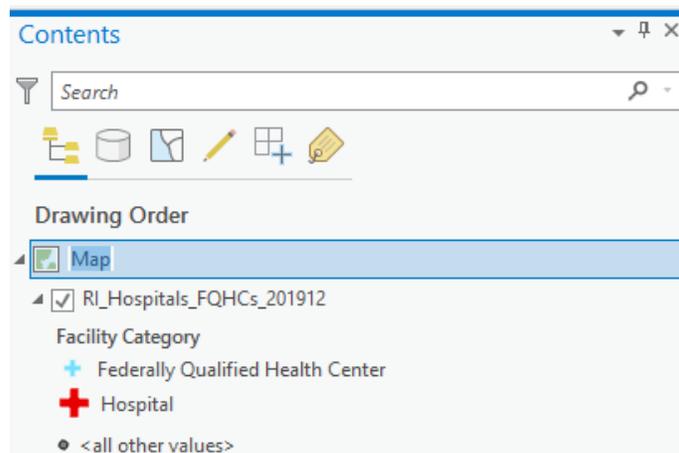
2. Rename the new map "*Poverty rate*" by clicking on the "*Map1*" and then clicking again (slow double click). Next, click on the **Map** tab to go back to your previous map and rename it "*CMS approved facilities*".



3. Right click to **Copy** the *RI\_poverty\_Rate\_2017* layer from the CMS approved facilities map. Click on the **Poverty rate** tab switch to the new map. Right click on **Poverty rate** in the **Contents**; select **Paste**.



4. Go back to **Map** tab, slowly double left click on *Map* under Contents pane to change it to *CMS Approved facilities*. Now both of your maps have names.



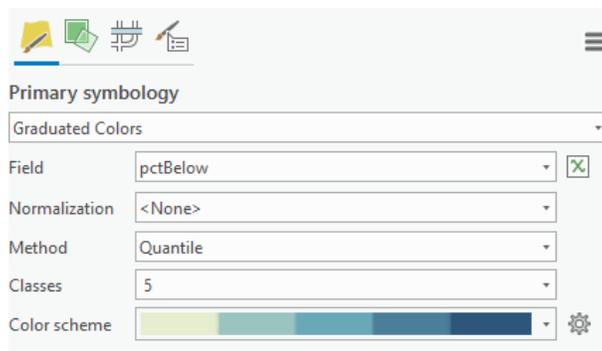
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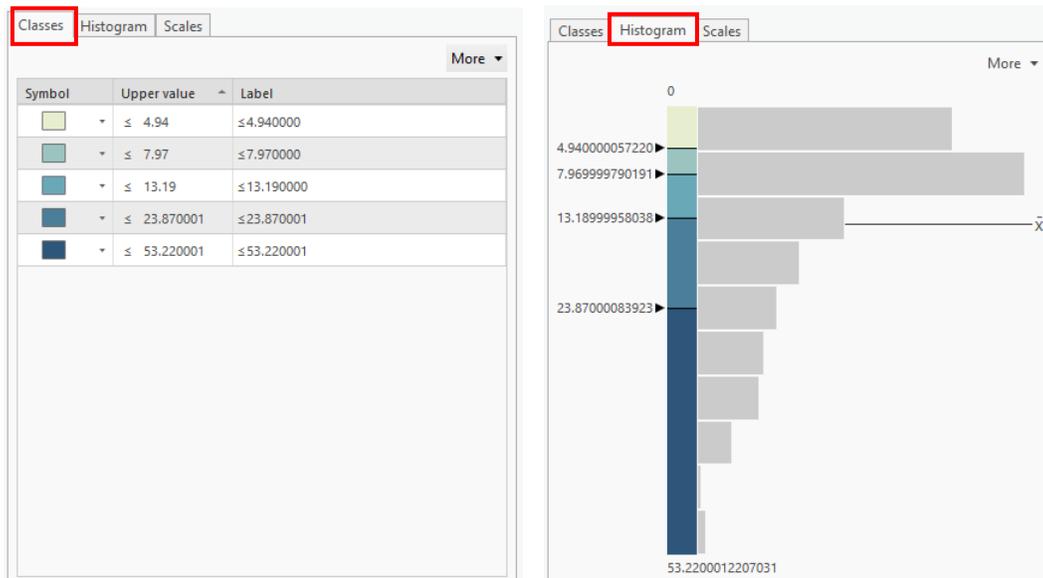


### Working with Quantitative Data

1. View the *RI\_poverty\_Rate\_2017* layer's attribute table in *Poverty rate* map to see what data it contains. Right click the layer in the **Contents** and select **Attribute Table**.
2. A new pane will appear with the attributes of *RI\_poverty\_Rate\_2017*. The *pctBelow* field is the percentage of population that below poverty line in 2017. Close the table.
3. You will symbolize tracts by poverty rate. Right click the *RI\_poverty\_Rate\_2017* layer in the **Contents**, select **Symbology**.
4. Modify the selections to show quantities using a color gradation. In the **Primary symbology** dropdown list, select **Graduated colors**. Under **Field**, select **pctBelow**.
5. To change the classification method, click the **Method** dropdown list and pick **Quantile**.



6. The class break point will be displayed on the bottom half of the pane. If you click on the **Histogram**, you will see how data distributed in those 5 categories.

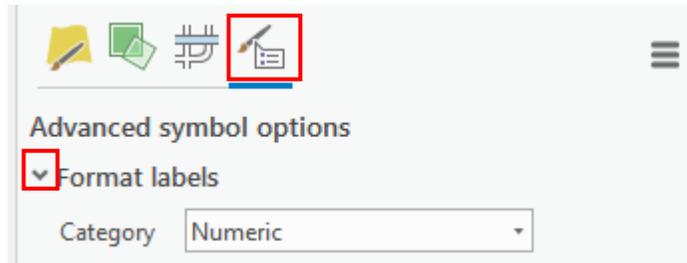


7. Switch back to **Classes** tab instead of **Histogram**, change the **Color scheme** to the color of your choice. For legibility, it is best practice to use a monochromatic (single hue) color ramp for data that is increasing or decreasing in value.

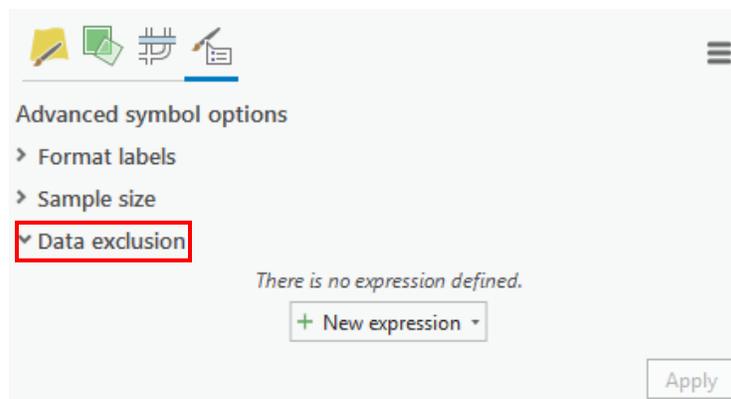
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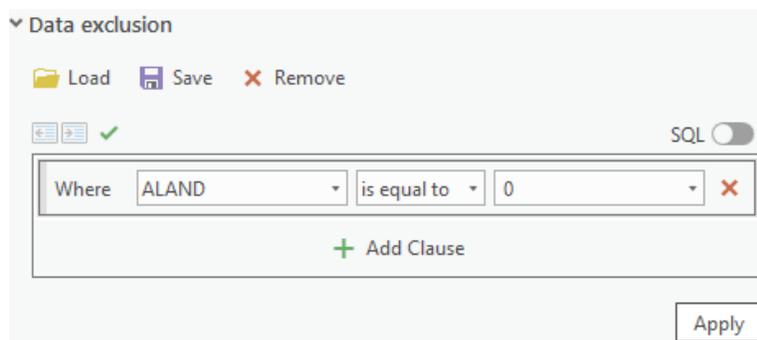
8. Change the **Label** format. Click on the **Advanced symbol options** button on the very top and then expand **Format labels**. There are many different format categories depending on what type of data you are displaying. Change the number of decimal places to 1.



9. You may notice that in the Rhode Island census tract file, we have a few census tracts that are water tracts, and there is no population living in those census tracts. Keeping those census tracts in the file will affect the classification method. We will need to exclude them for better classification by using the *ALAND* field in the layer *RI\_poverty\_Rate\_2017*. On the same panel, expand the **Data exclusion** tab.



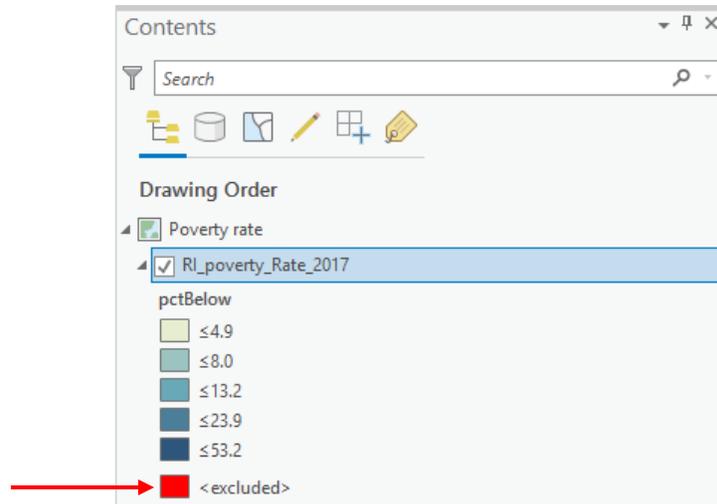
10. Click on **+ New expression** to add a new expression to define the shapes that you wanted to exclude.
11. In the combo box that appears below, select the drop down lists to make the sentence – *Where ALAND is equal to 0*. This means we are going to exclude all census tracts with 0 land area. Then click **Apply**.



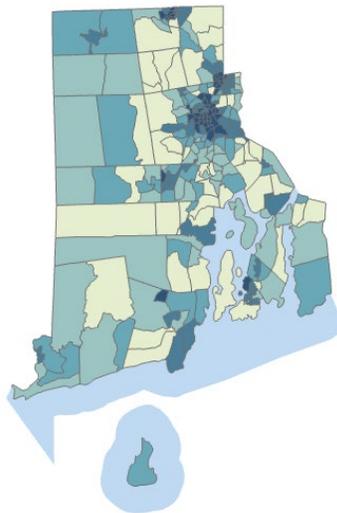
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12. Now all your symbols and labels setting should be done. Your **Contents** pane should look like the screenshot displayed below.



13. Single click on the swatch for <excluded> to change the color to Water (area). Then your map will look like this.



14. Right click on *RI\_poverty\_Rate\_2017*, go back to **Symbology**. Change the Method from **Quantile** to any other category, then change back to **Quantile**. You will see the upper value changed because you excluded the water bodies. You can double click to change the label of the <excluded> to *water body*.
15. Take some time to look at the map display. Use **Explore tools** under **Map** tab on ribbon to see which areas of the state have higher and lower rates. You can mouse over the tool to see all options available.

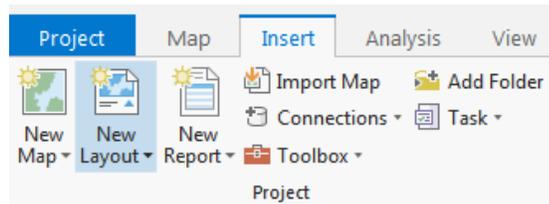
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## Displaying Spatial Data Exercise

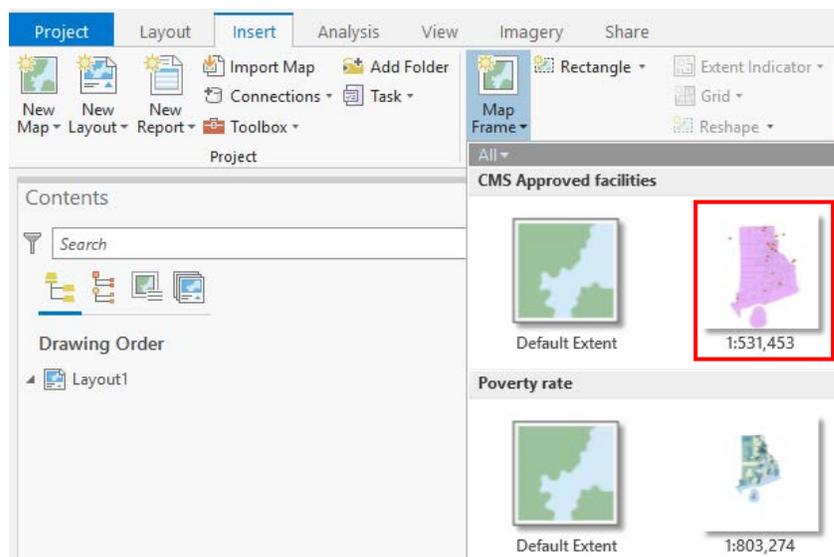


### Make a flat map for printing

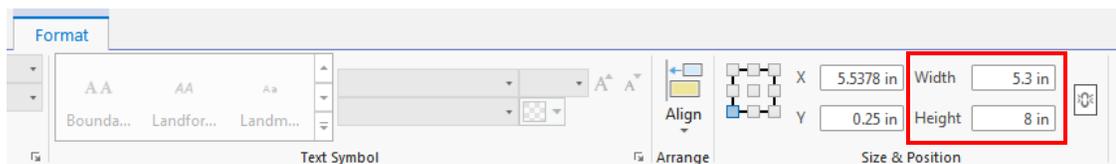
1. To make a flat map, you need a layout to help organize your map. Under **Insert** tab on the top ribbon, click **New Layout** then select your ideal size and paper orientation to insert a new layout into your project. We picked a landscape letter paper to work with.



2. Now you are in the layout view. In the **Insert** tab from the top ribbon, click **Map Frame** and then pick the second map from *CMS Approved facilities* section. Your mouse will turn in to a black plus. Drag on your layout view to put this map down on the paper.



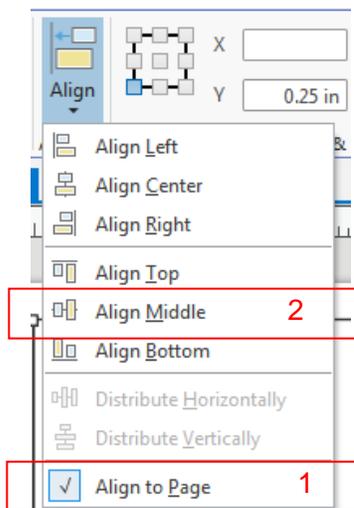
3. Similarly, insert a map frame with the map of *Poverty rate*.
4. Click on one of the maps and click on the **Format** tab on the top ribbon. Change the **Width** to 5.3 in and **Height** to 8 in. Repeat this step to change the other map to 5.3 inches by 8 inches.



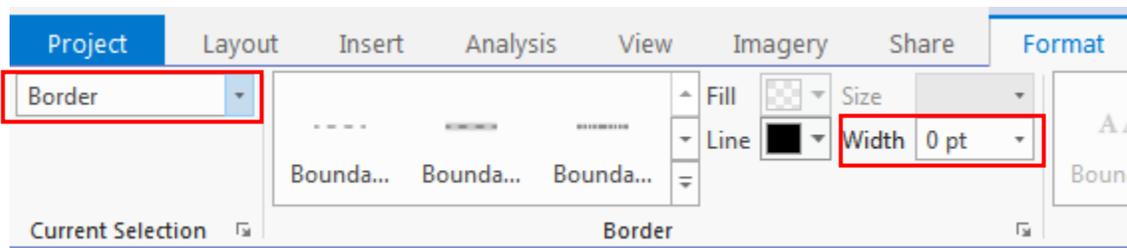
5. Hold shift key on your keyboard and select both maps in the layout view. Under **Format** tab, click **Align** and check **Align to Page**. Then click **Align** again and click on **Align Middle**. Then both of maps will be placed on the middle of the page. Use your mouse to move the map left and right to make use of the space well.

# GIS I: Organizing Principles

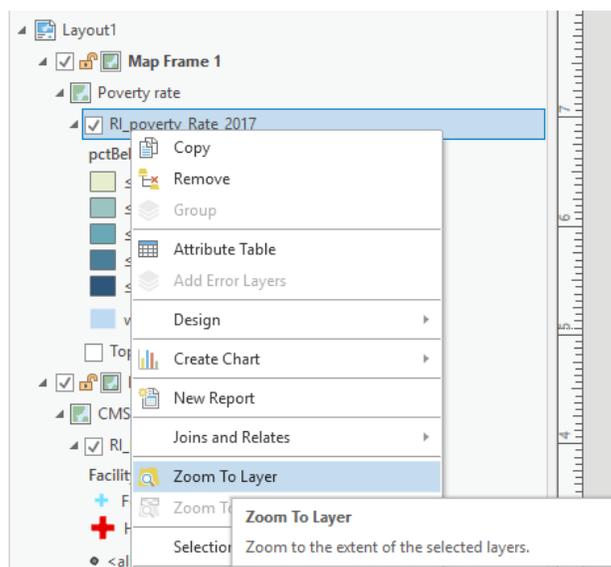
## Displaying Spatial Data Exercise



6. Select one of the maps again, and under the **Format** tab, change the current selection from **Map Frame** to **Border**, and then change the **Line Width** to 0 pt. Repeat the same step for the other map. Now you've removed the outline of your map frames.



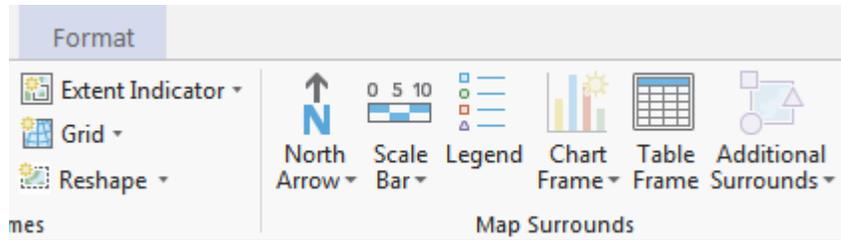
7. In the Contents pane, fully expand both the **Map Frame 1** and **Map Frame** contents so that the individual layers can be selected. Right click on the *RI\_poverty\_Rate\_2017* layer under *Poverty Rate* and click **Zoom To Layer**. Do the same thing for CMS approved facilities. Now both maps have been zoomed to the same scale.



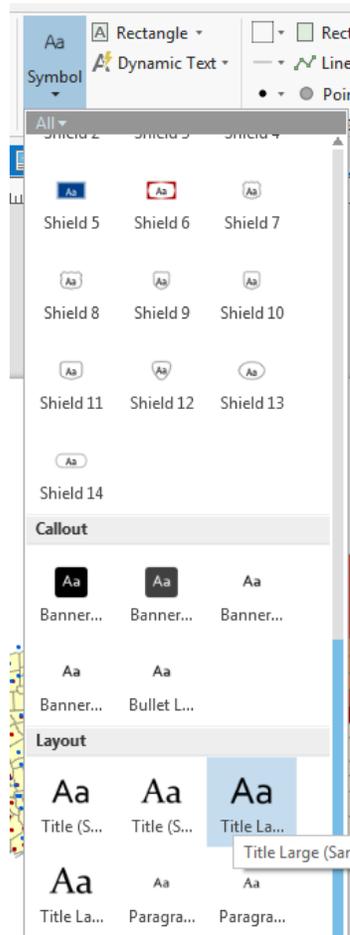
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8. Insert map elements to your project. Under **Insert** tab, to add a **North Arrow**, **Scale Bar**, and **Legend** with a simple click on the **Map Surrounds** section in the **Format** tab. Make sure you select one of the maps before inserting a legend.



9. To modify the legend, right click on a legend and then click on Properties. Then the **Format Legend** pane will appear on the right hand side. Feel free to explore the options in this pane.
10. To insert a title, click on **Symbol** button under the **Insert** tab in the top ribbon. Scroll all the way down to the bottom of the dropdown list and click on **Title Large**.

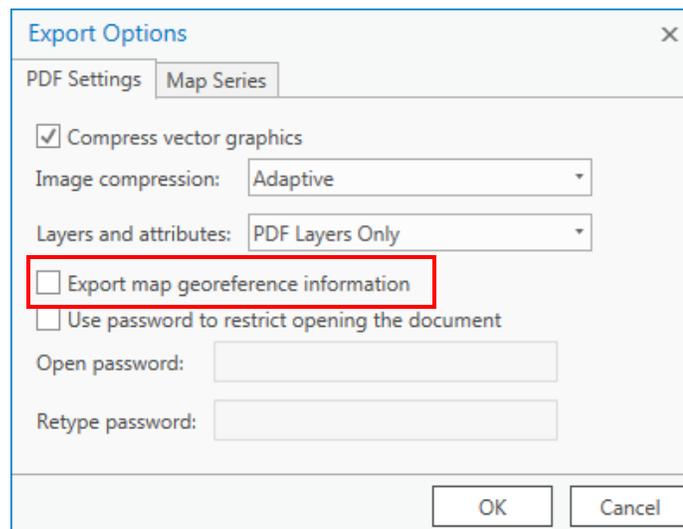


11. Click anywhere on the layout where you want to place. Type in the title.
12. Please also include a small paragraph on the bottom of the map to document the date, author, data source, and other relevant metadata.

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13. After adding all desired map elements, export the map as a PDF (for printing later, for emailing, adding to a document). Click the **Share** tab on the top ribbon, select **Layout**. In the Export Layout window, navigate to where you would like to save the file and use the **Save as type** drop-down menu to select **PDF (\*.pdf)**. Keep all other options default and click **Export**.
14. **\*Note:** By default, ArcMap will export georeference information – this means that someone can open your PDF, and without much trouble, retrieve X/Y coordinate information for all the data in your map. This can be a data security issue. To disable this, uncheck the box “**Export map georeference information**” in the **Export Options window** when exporting.



15. **Reflect:** What insights might be gained by overlaying these two data types on one map?  
For further reference see CDC's Cartographic Guidelines for Public Health (on the Box site under Resources).

