# Exercise 3: Thematic Maps

Data for this exercise provided in the class.

## Add Data

1. Create a new **Map** project in ArcGIS Pro. Save your project as **Exercise3_CensusDivisions**.
2. Click **Add Data** button and navigate to **Exercise 3 > Data** folder. Select **States** shapefile and click **OK** to add data to the map. Also, right click on the base map layer and remove it from Contents pane.
3. Click on **Map** in the **Contents** pane and rename it as **Contiguous US**.
4. Right click on **Contiguous US** and **Properties** to access **Map Properties**. Click on **Coordinate System** tab.
5. In the search bar type **Albers Equal Area** for the data projection and hit enter key on the keyboard. Select the projection under **Projected Coordinate Systems > Continental > North America > USA Contiguous Albers Equal Area Conic.**
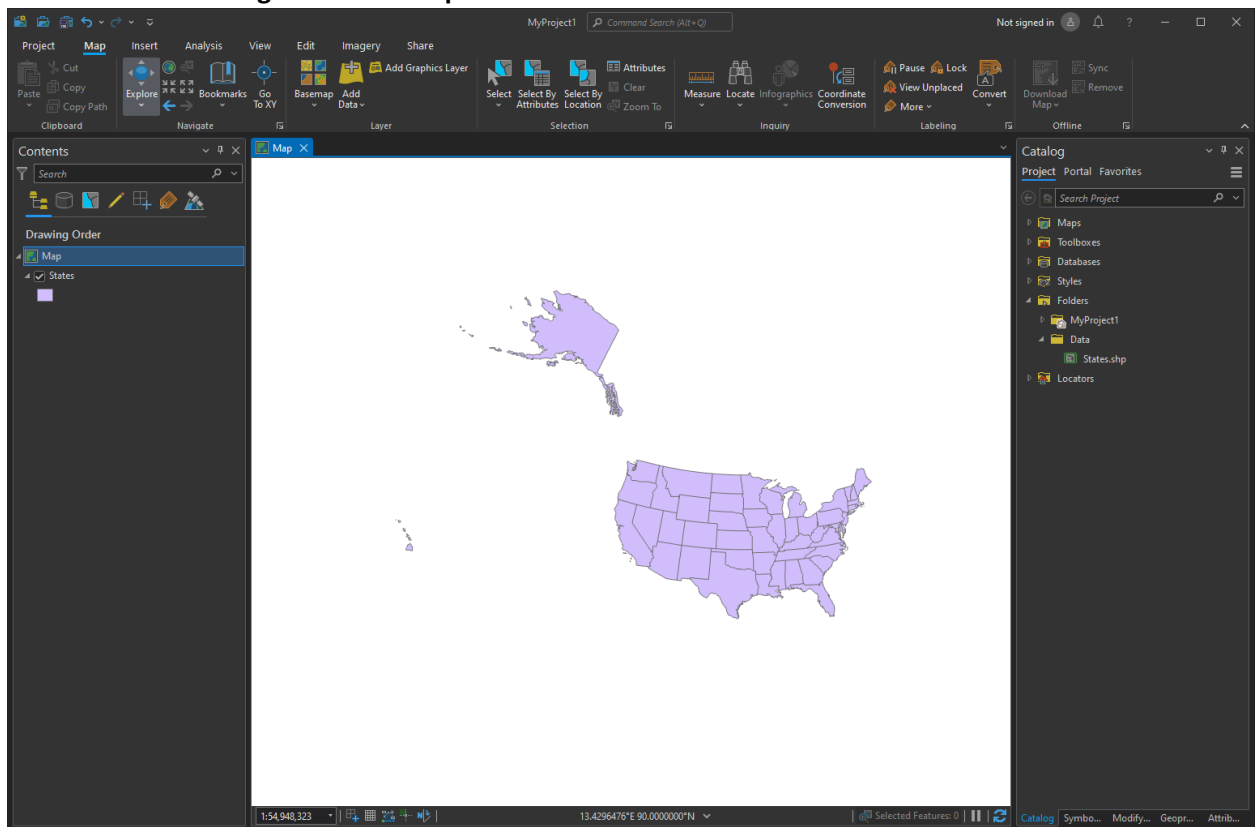


*Qualitative Thematic Map:* Create a map to show how areas differ in type.

6. Right click the **States** layer and choose **Attribute Table** to review the fields and their contents to familiarize yourself with the data. When complete, close the attribute table.
   *For information on the attribute field names and description, refer to census_variables.pdf in your Exercise_3 folder.*
7. Right Click the **States** Layer and click **Properties**. Select **Symbology** and from the drop down for **Primary Symbology** select **Unique Values**.

8. For **Field 1**, select **SUB_REGION** using the drop down menu. The map shows the states categorized into sub regions.
9. For **Color Scheme**, select a color palette of your choice or leave the default palette.
10. Right click on **<all other values>** and **Remove**.
11. Under the **Label** column, click on each label and change it to the appropriate sub region name as shown below.

| Value | Label |
|---|---|
| E N Cen | East North Central |
| E S Cen | East South Central |
| Mid Atl | Mid Atlantic |
| Mtn | Mountain |
| N Eng | New England |
| Pacific | Pacific |
| S Atl | South Atlantic |
| W N Cen | West North Central |
| W S Cen | West South Central |

12. Right Click on the **States** layer, click **Label** to add labels to the map. Similarly, click **Labeling Properties** to edit the style.
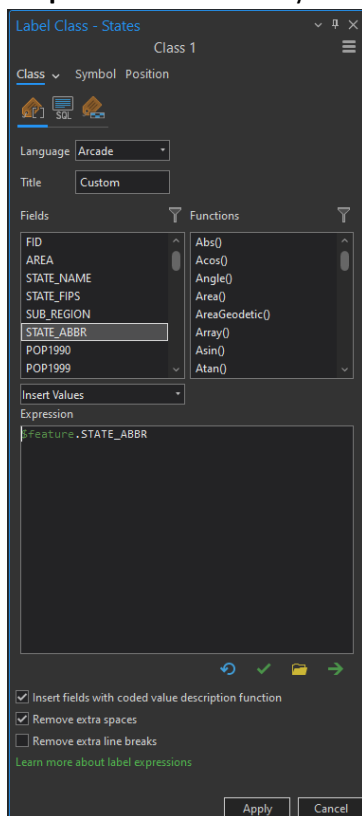


13. For **Expression**, remove any default field value and double click on **STATE_ABBR** and click **Apply**.
*Optional: Style your labels such as font style, size and color by clicking Symbol tab in the Label Class pane.*

Create a new layout and add map and elements such as: Title, Author, Legend, Scale Bar, and North Arrow.

14. Click Insert tab in the ribbon and **New Layout**. Select **ANSI Landscape Letter (8.5 x 11)**.
15. Click **Map Frame** and draw a rectangle on the layout to add map to it.
16. Using the map frame anchors, adjust the frame to fit the page.
17. Right click on the map frame and **Activate** it. Zoom map area to the **Contiguous United States**.
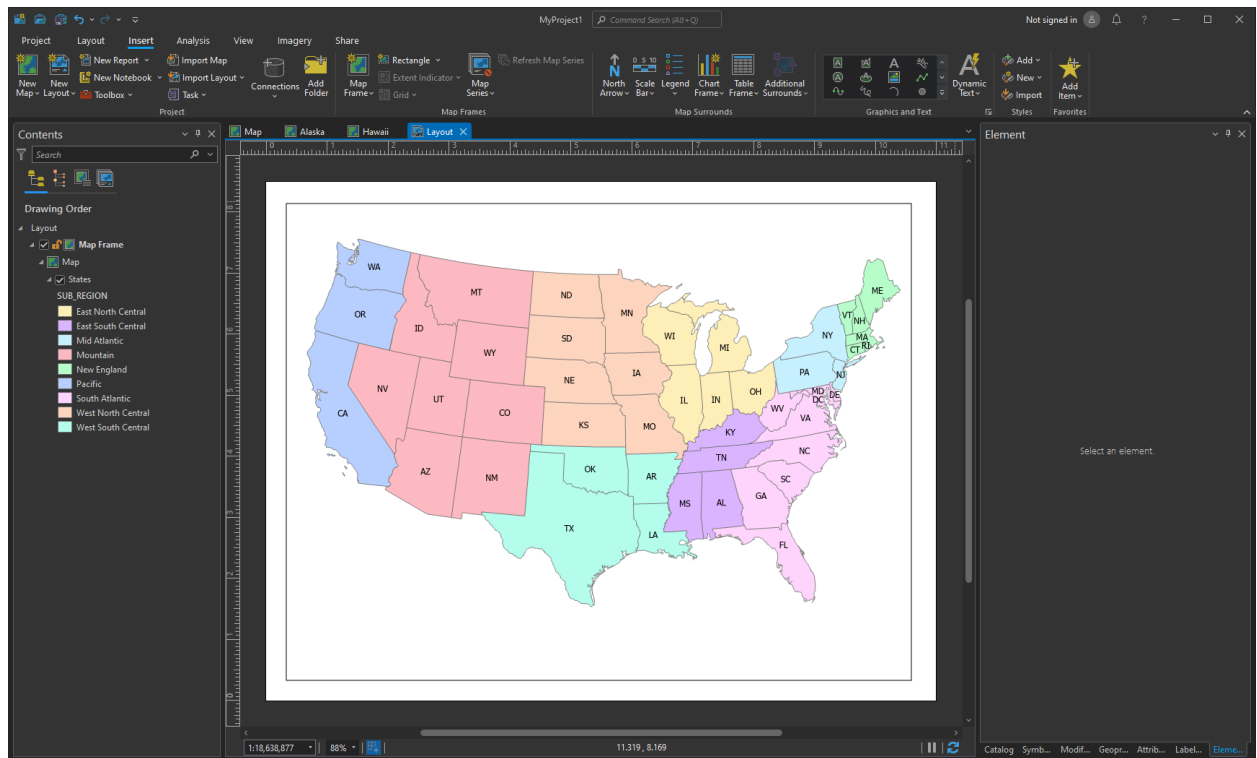


18. To close activation, click Layout in the ribbon menu and click **Close Activation**.
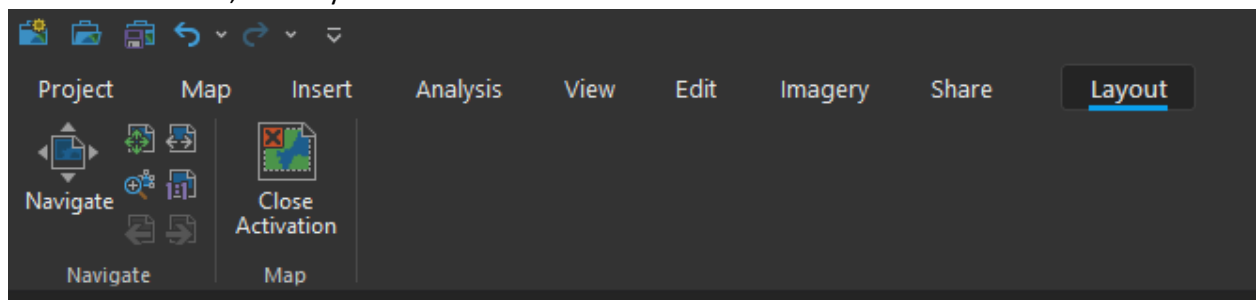


19. Click **Insert** menu and select **New Map**, this adds a **Map1** (new map frame) to the Project. Click on the Map1 in the Contents Pane and rename as **Alaska**.
20. Click Add Data and add States layer to the Alaska map and follow steps 6 - 13. OR simply right click and copy the States layer in the main map and paste it in Alaska Map. Which preserves style options.
21. Follow steps 3 and 4, and Select the projection under **Projected Coordinate Systems > Continental > North America > Alaska Albers Equal Area Conic.**
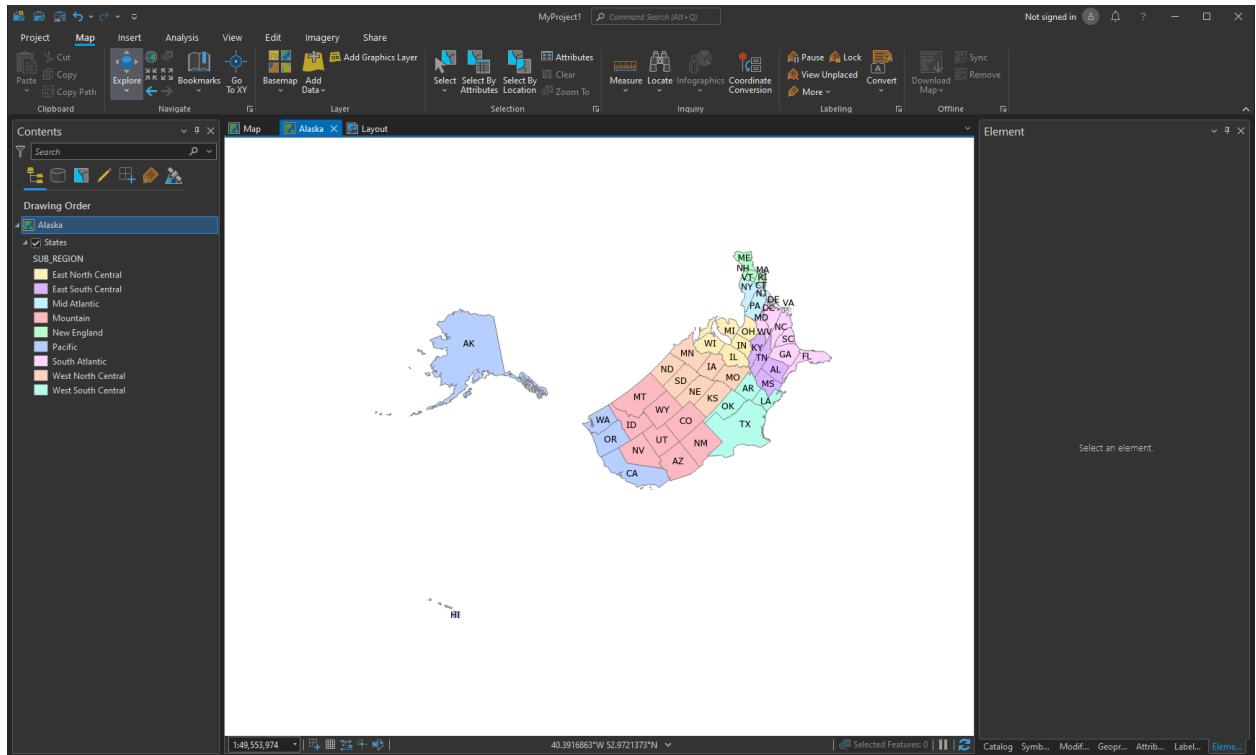
22. Similarly follow steps 19 – 21 to create a data frame for the **state of Hawaii**.
    a.  **Map name = Hawaii**
    b.  **Projection = Hawaii Albers Equal Area Conic**
23. Switch to Layout and click Map Frame to add Alaska and Hawaii Maps to the layout. Activate each of those frames and Zoom in to fit the State boundary within the frame.
24. Add map elements learned in the class: title, legend, north arrow, scale bar, date, description and other necessary information.
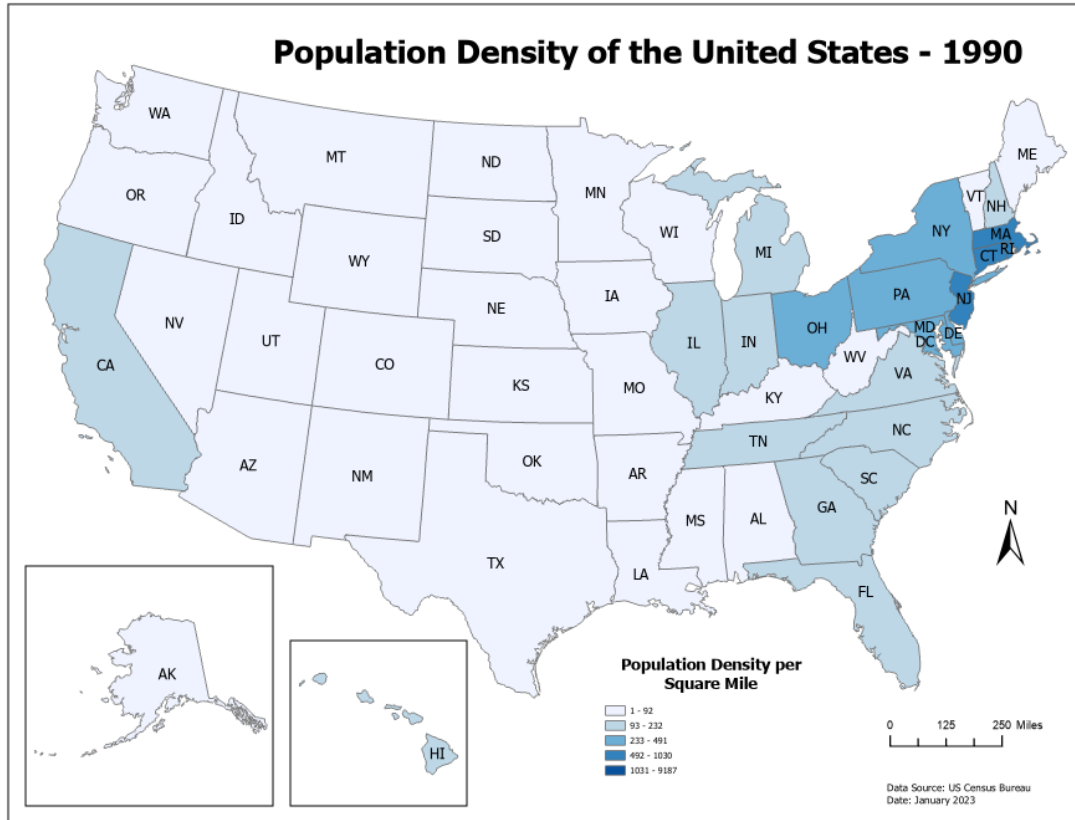    **Title: Census Divisions of the United States**.
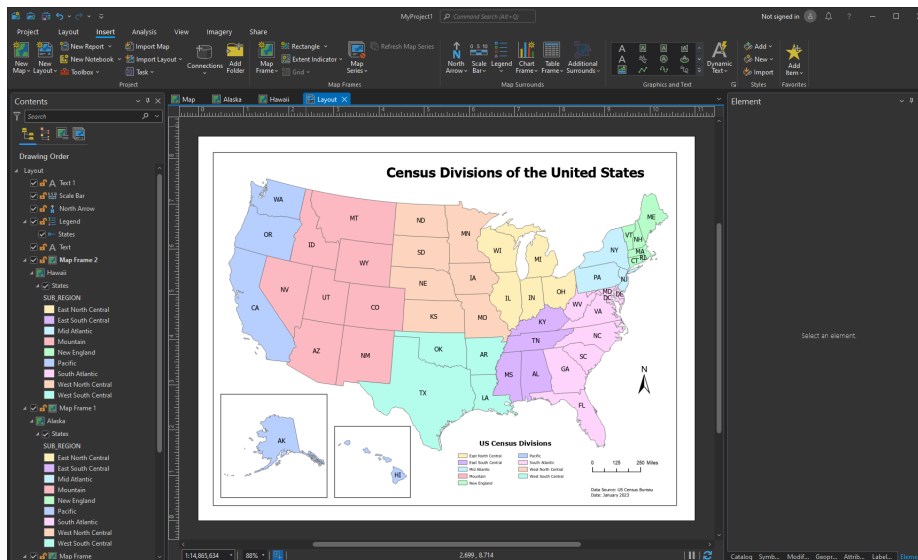


25. Click **Project** menu in the ribbon and **Save** to save edits.

*Choropleth Map*: Create a population density map for the United States.

26. In the **Contiguous US** map, right click and make a copy of the **States** layer. Right click the Contiguous US map item and click Paste.
27. Rename the layer to **Population Density – Choropleth**. And turn off the previous layer.
28. Right click on the **States** layer and select **Symbology**.
29. In the **Symbology** pane, select **Graduated colors** from the drop down menu.
30. For **Field**, select **POP90_SQMI**. Leave the default values for rest of the options and pick a **Color Scheme** of choice, to see the population density for the United States per square mile as of the year 1990.
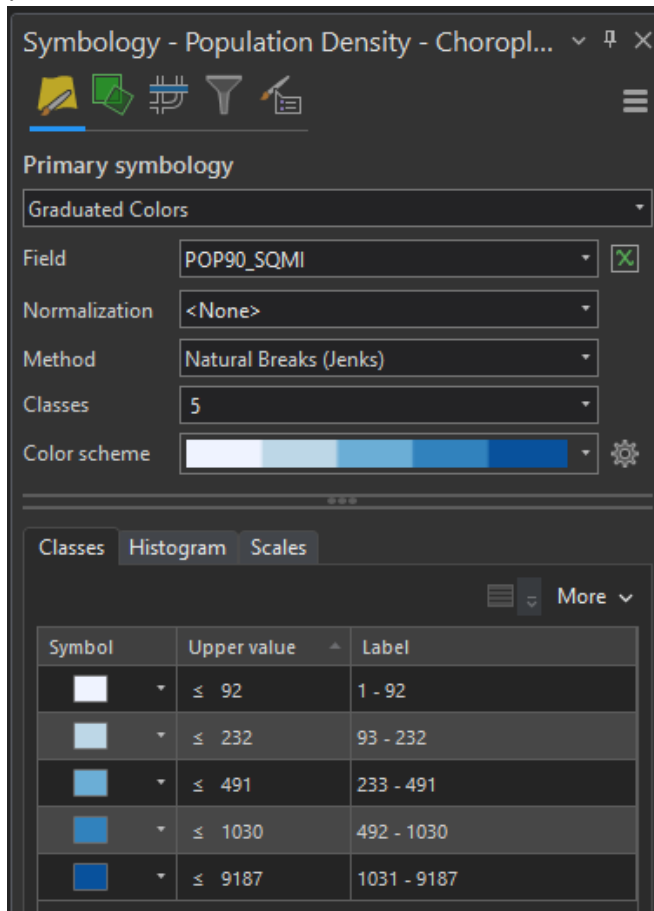


31. Rename the **States** layer to **Population Density – choropleth**.
    *Optional: Change the population density ranges, classification methods, and experiment with colors and view changes in the map*.
32. Similarly, perform steps 26 – 30 for remaining two map frames to apply classification to Alaska and Hawaii.
33. Change title to **Population Density of United States – 1990**. Configure legend and text as appropriate.

**Population Density of the United States - 1990**

**Population Density per
Square Mile**

- 1 - 92
- 93 - 232
- 233 - 491
- 492 - 1030
- 1031 - 9187

0   125   250 Miles

Data Source: US Census Bureau
Date: January 2023

*Proportional Symbol Map*: Create a map showing number of household units per state

34. In the **Contiguous US** map, right click and make a copy of the **States** layer. Right click the Contiguous US map item and click Paste.
35. Rename the layer as **Household Units – Proportional Symbol** and turn off other map layers.
36. In the **Symbology** pane, select **Proportional Symbols** for Primary Symbology selection.
37. For **Field**, select **HSE_UNITS**, Leave default values for rest of the options.
38. Click on **Template** to choose color/style; and **Background** to change the symbolize the background layer (States).
39. Adjust the symbol size by selecting Minimum and Maximum size.
40. Right click on the Household units layer and choose **Properties**. From Display tab, check Scale Symbols box. This maintains the relative symbol sizes as you zoom in and out of the map.
41. In the **Feature Layer** menu on the ribbon, set **Transparency** to **50%** under **Effects** section.
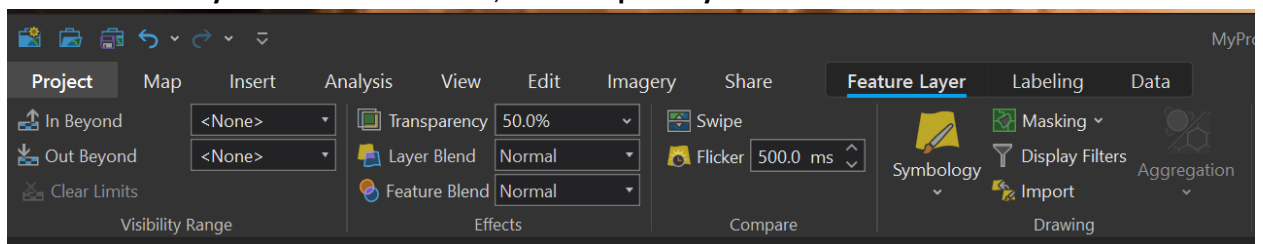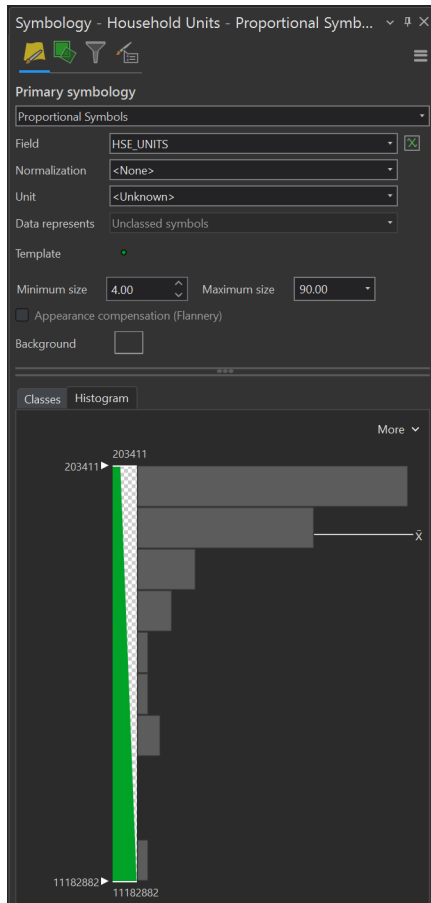
42. Also, adjust the top slider in the Classes pane to scale the symbols as desired.
43. To view both variables population density and no. of household units (Choropleth and Proportional Symbol) overlaid on top of each other, turn ON both layers in **Contents** Pane. Change the **Background** symbology for proportional symbols, and set **Outline color** to **No Color**. Click **Apply**.
    *Note: Graduated symbols – quantitative values are grouped into classes. Within a class, all features are drawn with the same symbol. Can't discern the value of individual features. Whereas Proportional symbols represent data values more precisely. The size of a proportional symbol reflects the actual data value.*
    *Check box next to Appearance Compensation (Flannery) to change the symbol scaling method. This technique increases the symbol size to avoid underestimating symbol values.*
44. Similarly, perform steps 34 – 43 on remaining two map frames to apply classification to Alaska and Hawaii.
45. Select appropriate title to the map. Add legend, text and other map elements as appropriate.
46. To create Multivariate Proportional Symbols

**Household Unit Count and Population Density of the United States - 1990**
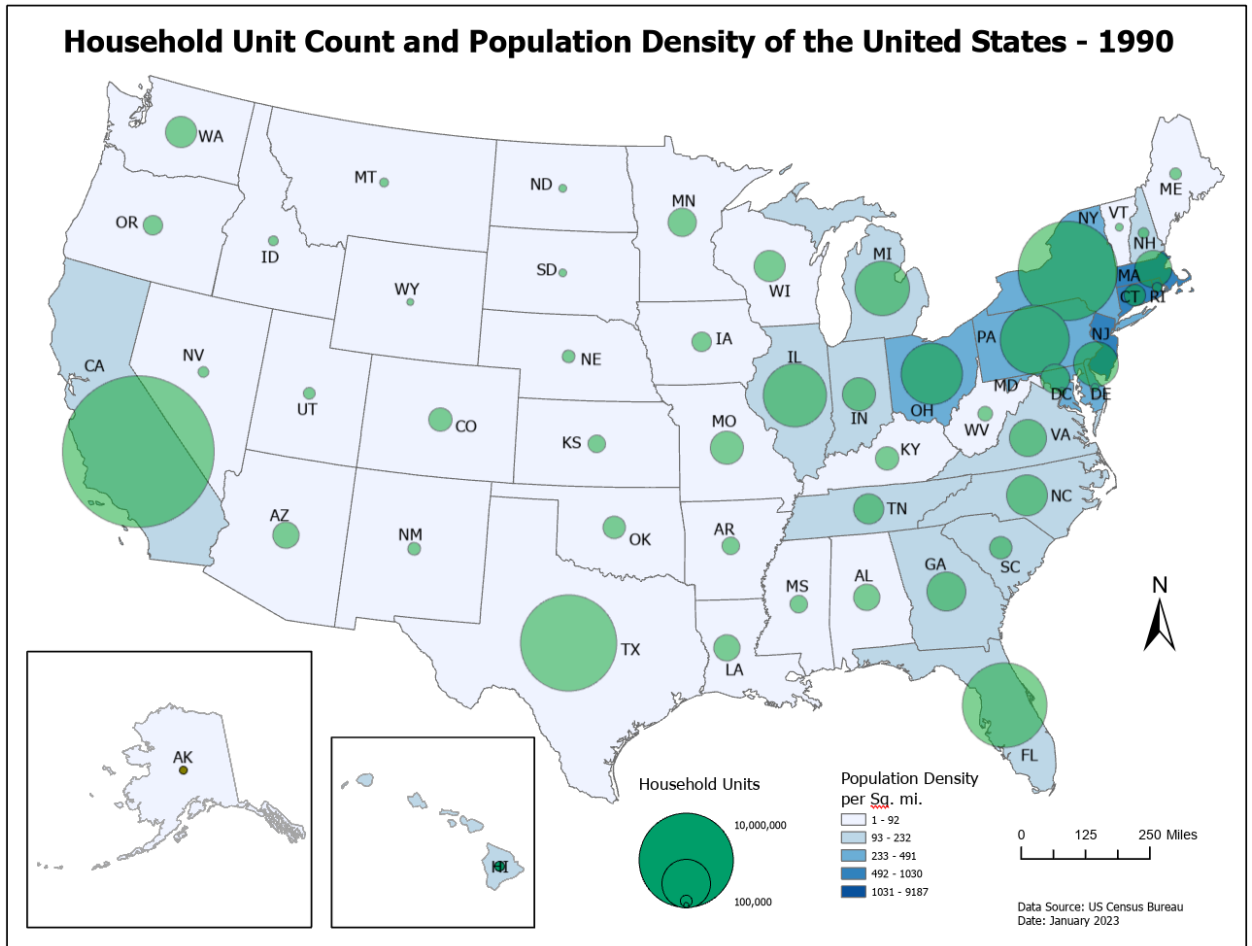
*Dot Density Map:* Create a map to show crop acreage in the United States.

47. In the **Contiguous US** map, right click and make a copy of the **States** layer. Right click the Contiguous US map item and click Paste.
48. Rename the layer as **Cropland – Dot Density**.
49. In the **Symbology** pane, select **Dot density** for Primary Symbology.
50. For **Field**, select **CROP_ACR87.** Edit **Symbol** properties and Label Crop Acreage.
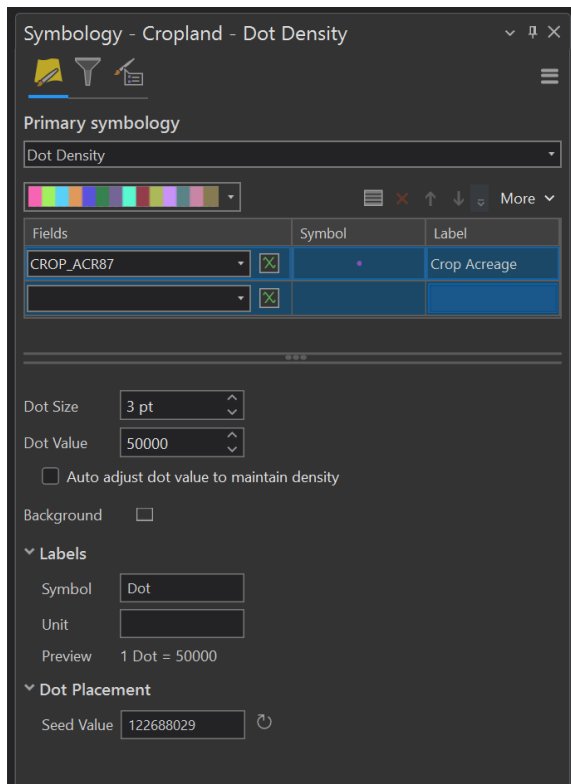
51. Set **Dot Size = 3** and **Dot Value = 50,000**. **Uncheck** box next to **Auto adjust dot value to maintain density**. This allows to keep the dot value static and will not change as you zoom in and zoom out.

52. **Background** options allows to change the background color and line style for the state boundaries.

53. Similarly, perform steps 47 – 52 on remaining two data frames to apply classification to Alaska and Hawaii.

54. Select appropriate title to the map. Add legend, text and other map elements as appropriate

*Multivariate Dot Density Map*: Create a dot density map to show male and female population in the US

55. Follow similar steps as the Dot Density Map and select variables under Fields