

**Introduction to Cartographic Processes**

Geography (GEOG 3305)

**Lab 5A: Thematic Mapping – Dot Density**

**Dot Density Map**

The dot density map is a popular form of thematic mapping used by cartographers. The technique is simple and straightforward: a dot is used to represent a specific number of items (e.g., one dot representing 500 persons), and the symbol is repeated until the total number of items in an area is accounted for (e.g., 100 dots representing 50,000 persons). The strength of this technique is that it allows the reader to visually infer density without using derived tabulated data.

When employing this technique, consider the following guidelines:

* Employ an equal-area projection constructed at small or intermediate scales. For situations where dots are randomly placed in statistical areas (as in this exercise), try to keep these areas small. A good rule of thumb for mapping the United States: use counties (or smaller units) when mapping the country; use census tracts (or smaller units) when mapping at the state level. The larger the map scale you use, the more locational error is introduced with respect to dot placement.
* Choose a *dot value* that allows you to have two or three dots in the statistical area with the smallest value and coalescence of the dots in the statistical area with the highest value. You can achieve coalescence when using small dot values by increasing the *dot size*.
* Use a dot value that is easily understood (e.g., 10, 50, 1,000).
* If possible, avoid mapping phenomena with extremely large ranges. A small dot value, chosen to allow statistical areas with small values to have two or three dots, will create symbol overload at the high end of the range. A large dot value, chosen to allow coalescence at the high end of the data range, will result in statistical areas at the low end having no dots (as their values are smaller than the dot value).

In this part of the lab exercise, each student will learn how to:

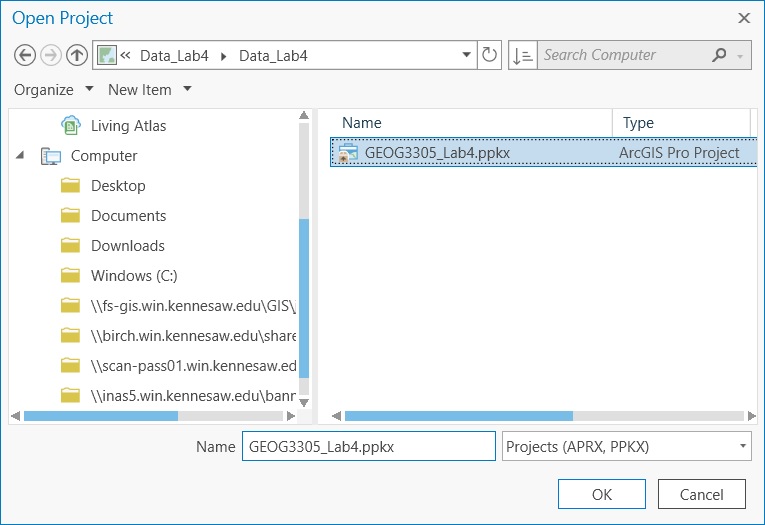
* Browse an attribute table
* Select fields to display using the dot technique
* Adjust dot size and dot value
* Change the background properties of the dot map layer
* Create a map layout

**Step 1**: **Getting Started in ArcGIS Pro**

1. Start ArcGIS Pro (***Start* *Menu* > *ArcGIS* > *ArcGIS Pro***) or if there is an icon on the computer desktop, you can start ArcGIS Pro by double-clicking it.
2. Next, if prompted, sign in using your licensed ArcGIS account. Use your username and password associated with your KSU GIS Account.
3. To open the files downloaded from D2L, click on “***Open another project***”.

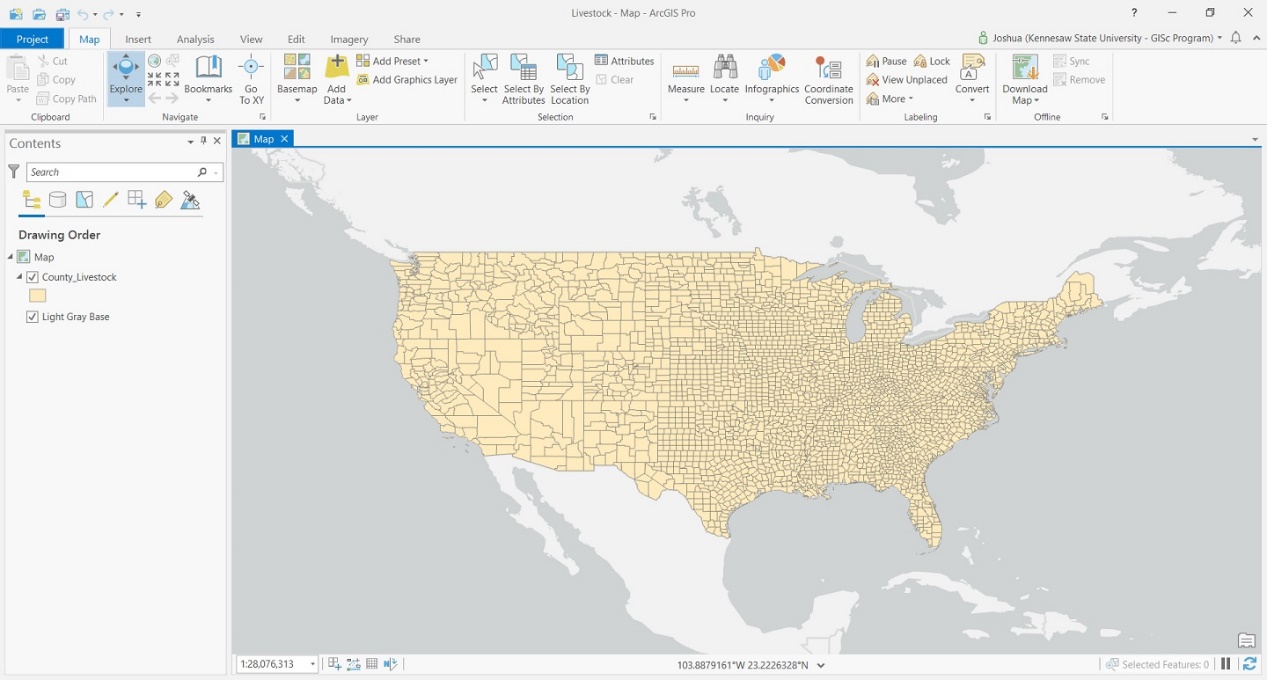


1. Then navigate to the location or directory of where you saved the files. The file name that you are looking for is named “***GEOG3305\_Lab5A.ppkx***”. After you selected the file, click **OK**.



**Note**: You will need to extract the files from the zipped folder (Data\_Lab5A.zip) to access the file. If not, you cannot open the file correctly on ArcGIS Pro.

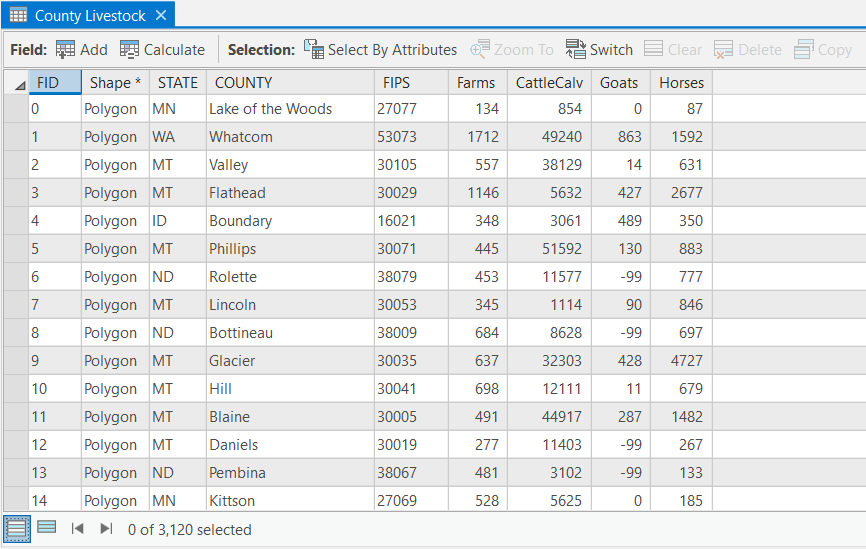
1. After you have opened the file, two map layers are displayed in the *Table of Contents*: **County Livestock** and **Light Gray Base**. Because the County Livestock layer is above the Light Gray Base in the Table of Contents, you can see the counties layer in the data view.



**Step 2: View the Attribute Table**

Now that you have opened the file onto your computer, you will next look at the data associated with each state at the county/parish level.

1. Open the “***Attribute Table****”*for the **County Livestock** layer (right-click the layer name and select Open Attribute Table). Notice that the fields in the attribute table are enumerated at the *county/parish level*.



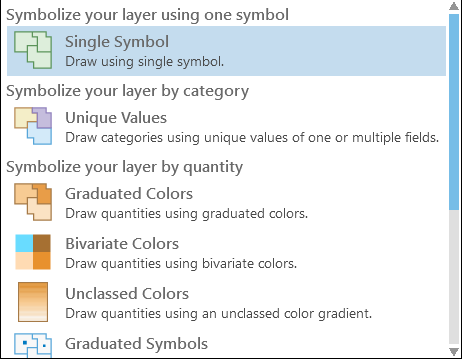
The attributes for each county are displayed above. Note that the four fields at on the right-hand side of the table are data from the 2017 U.S. Agricultural Census: (1) the total number farms, (2) cattle and calves, (3) goats, (4) horses by county/parish. The data comes from the 2017 Agricultural Census. Note: Values of -99 are for counties/parishes where totals were withheld to avoid disclosing data for individual farms.

1. After you have examined the attribute table, “***Close***” out of the table by clicking on the “**X**” next to County Livestock icon.

**Step 3: Create a Dot Density Map**

For the next step, you will learn how to create a dot density map with the agriculture livestock data provided to you in the lab exercise.

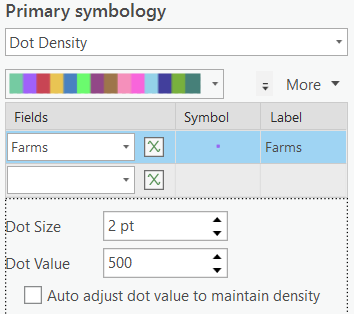
1. In the Contents pane, right-click the **County Livestock** layer and choose “***Symbology***”. The Symbology pane opens, with the primary symbology set to the default of Single Symbol.



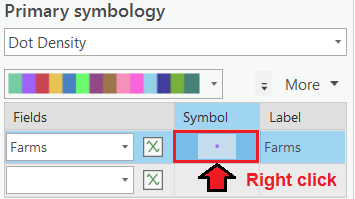
1. In the Symbology pane, you need to change the default setting of the primary symbology from “***Single Symbol***” to “***Dot Density***”. After you change the symbology, you will see your data window or view update. The symbology pane (on the right side of window) also updates as part of the process.

The dots you are seeing on the map are the total number of farms in each county/parish across the lower 48 states. The default setting selects the first attribute of the table, in this case, Farms. In addition, your default settings also set the **dot size** to 2 with a **dot value** of 500 (because the dot value is automatically calculated, you may have a different value). The dot value of 500 means that one dot on the map represents 500 farms in a given county/parish.

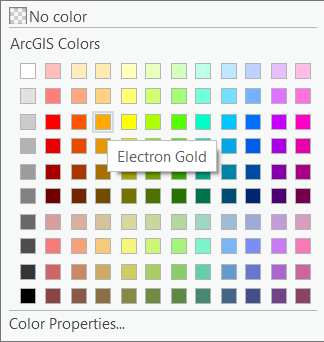
To change the color, size, and/or value of a dot on the map, you will need to modify the settings within the symbology pane.



1. First, you will change the dot color. To adjust the dot color, you must **right click** on the dot found under the “***Symbol***” field and to the right of the “***Fields***” drop-down icon.

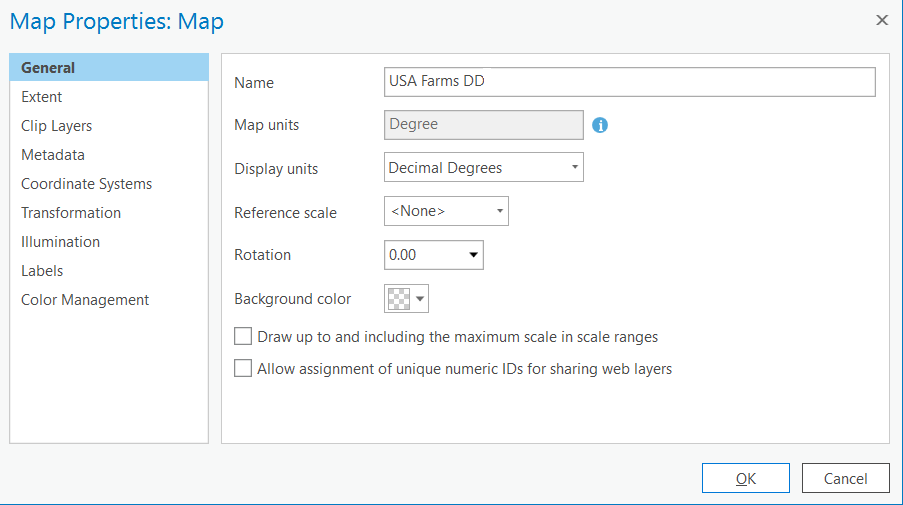


1. Change the dot color to “***Electron Gold***”.



After you have selected the new color, your dots will update on your data view map.

1. Next, you will now change the dot size and dot value. In the symbology pan (right side of your screen), keep the ***Dot Size*** at “***2***” but change the ***Dot Value*** to “***100***”. Your data map will update to reflect this change in the dot value. Note, how the density of the map changes across the United States. Where do you see the highest and lowest density of farms in the United States?
2. For your final task, please go to the Contents pane (left-side panel), under ***Drawing Order***, right-click ***Layout*** and click ***Properties***.
3. On the Layout Properties dialog box, click the **General tab**, if necessary. Change the name from “***Map***” to “***USA Farms DD***” and then click ***OK***.

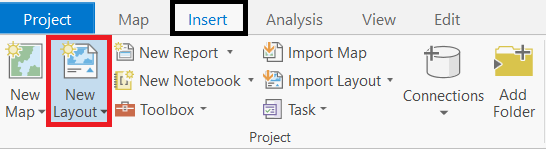


The name change is reflected in the Contents pane and on the view tab.

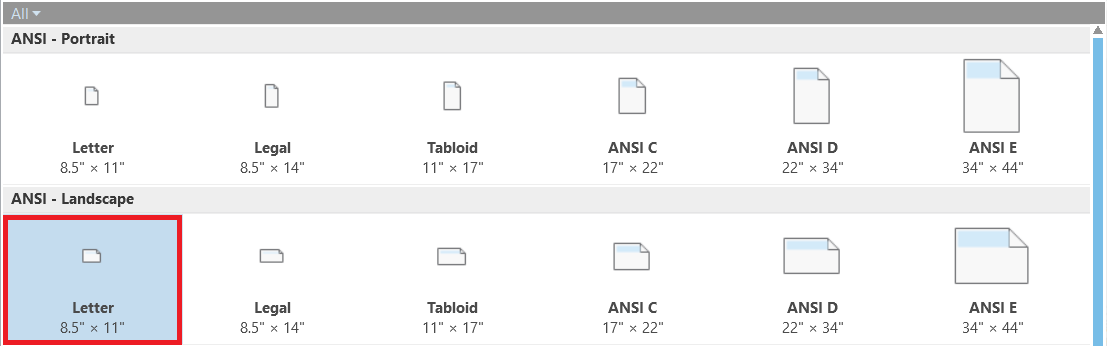
**Step 4: Insert a layout or create an exportable map**

After you have adjusted the dot value and color of your map, the next step in making a page layout is to insert a blank layout. This is where you will learn how to export your results as an actual map with a legend, title, north arrow, etc. I will show you the basic instructions of how to perform such a task.

1. On the ribbon, click the ***Insert tab***, if necessary. In the ***Project*** group, click ***New Layout*** New Layout to show page size and orientation options.

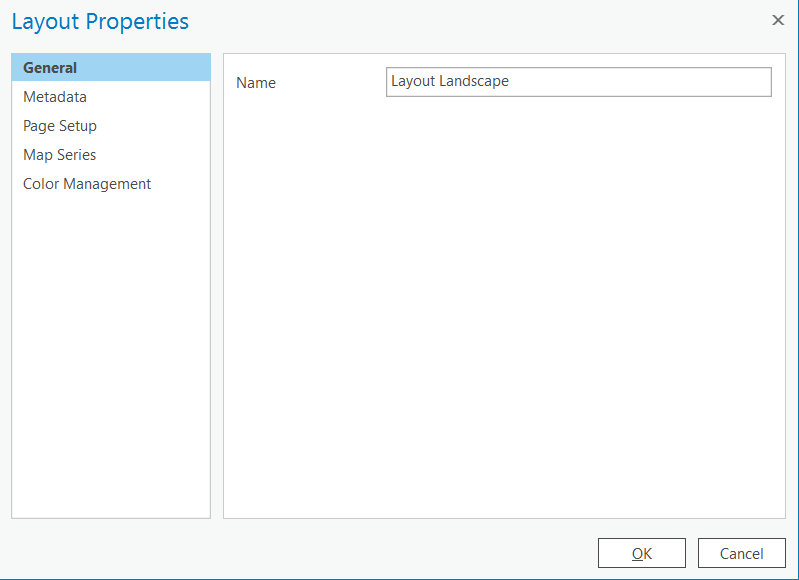


1. Under ***ANSI - Landscape***, click ***Letter 8.5” x 11”***.

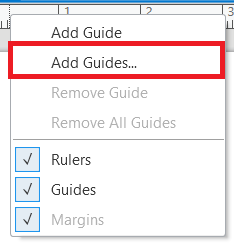


A new, blank layout view opens.

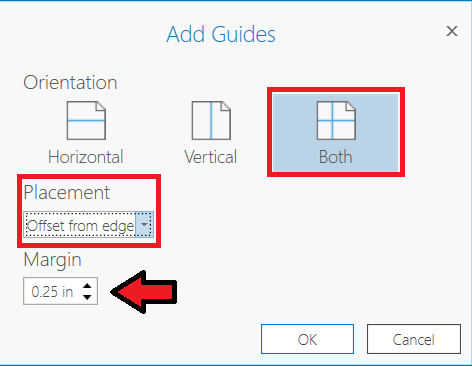
1. In the ***Contents*** pane, under ***Drawing Order***, right-click ***Layout*** and click ***Properties***.
2. On the Layout Properties dialog box, click the ***General tab***, if necessary. Change the name from “***Layout***” to “***Layout Landscape***” and click **OK**. The name change is reflected in the Contents pane and on the view tab above the ruler.



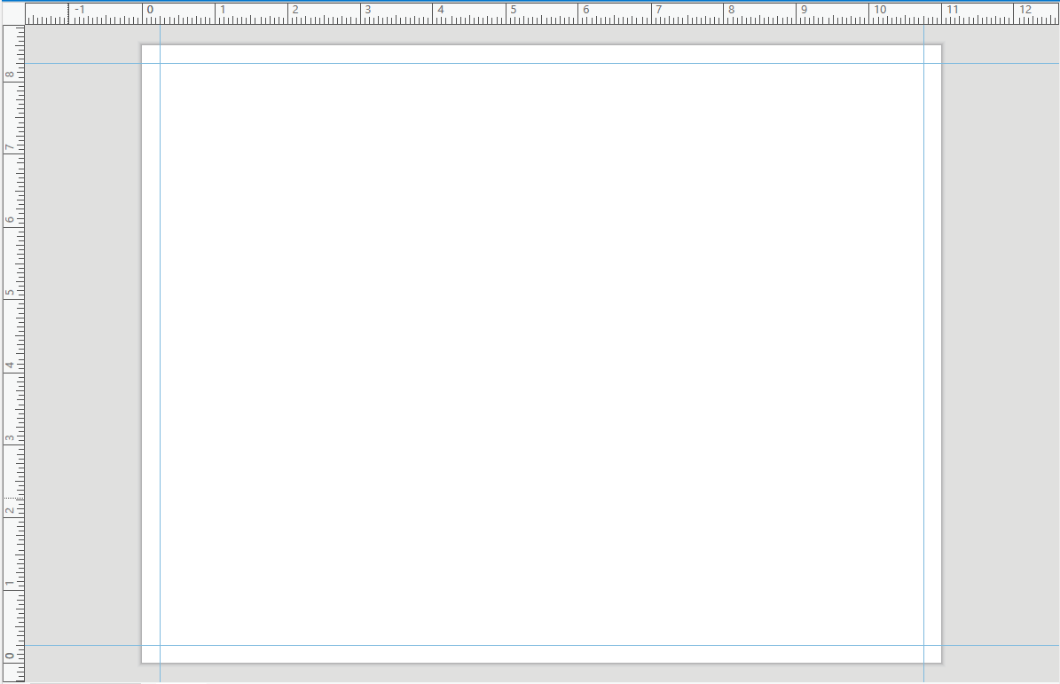
1. Right-click the top ruler and click ***Add Guides***. Guides are nonprinting lines that help you align elements on the layout.



1. On the ***Add Guides*** dialog box, under ***Orientation***, click “***Both***”.
2. Next, click the ***Placement*** drop-down menu and click “***Offset from edge***”.
3. Finally, replace the value in the ***Margin box*** with “***0.25 in***”.
4. Click ***OK*** after performing these three tasks.



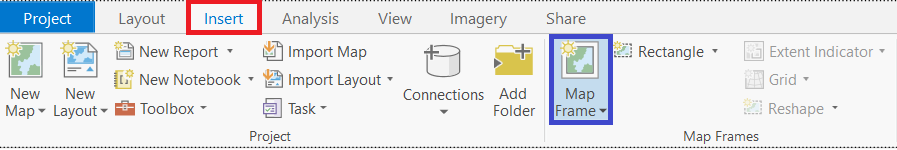
Guides are added to the layout at one-quarter inch from each margin.



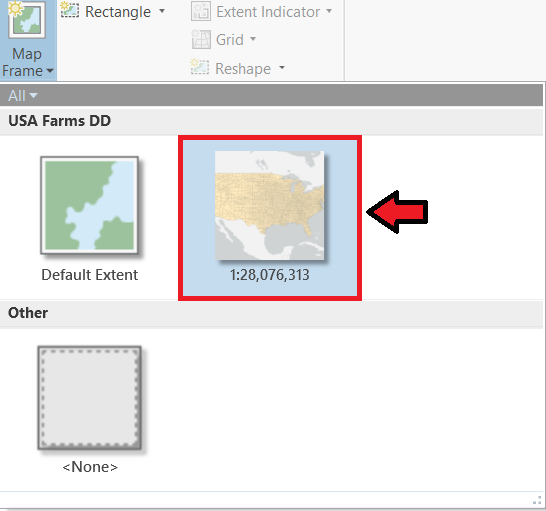
**Step 5: Insert a map frame**

Now you will add the United States Farm dot density data to the layout.

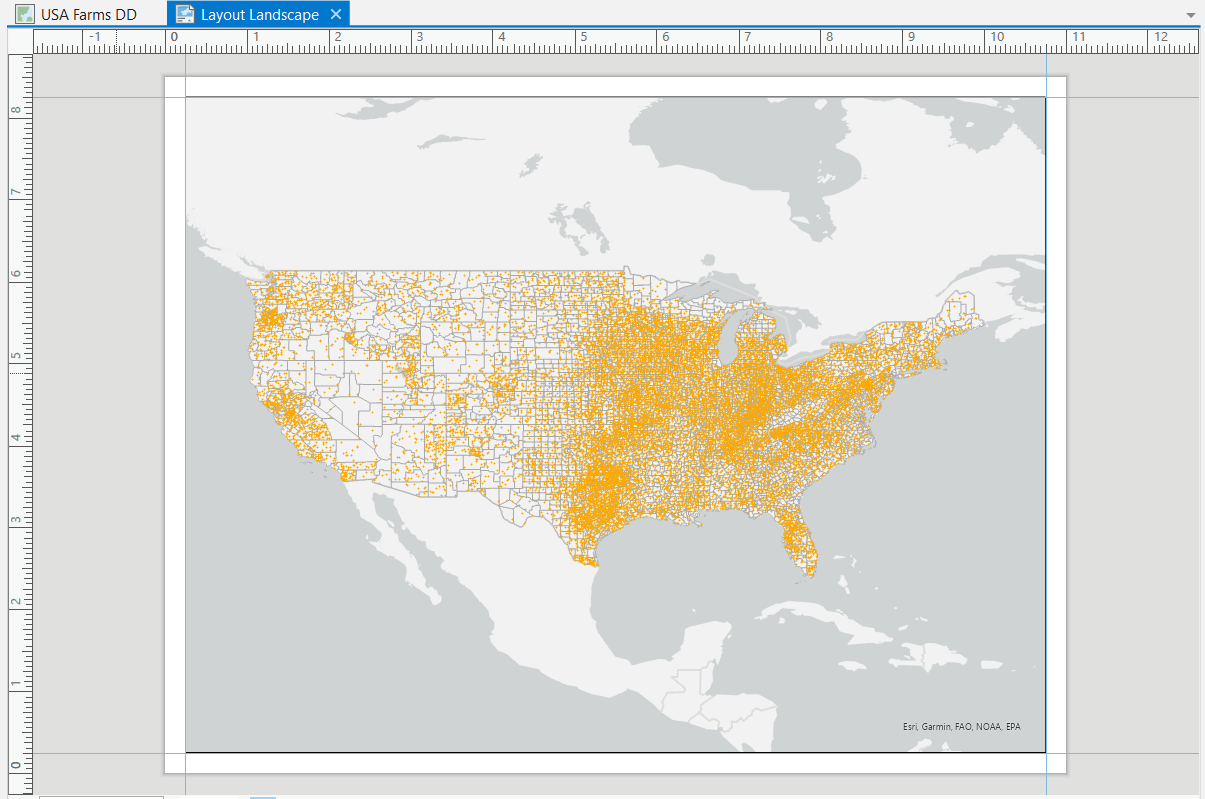
1. On the ribbon, on the ***Insert tab***, in the Map Frames group, click the ***Map Frame*** drop-down menu.



1. Under ***USA Farms DD***, click the thumbnail image of the dot density layer (second image), you created earlier in the exercise.



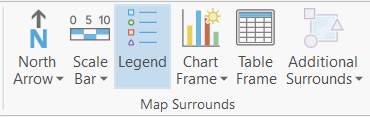
1. Use your mouse to draw a large rectangle on the layout. Use the guidelines as your boundary as you draw your rectangle. If you over stretch or do not fit the map frame exactly to the border of the guidelines, it is okay. You can adjust the size of the map frame, by clicking on the map frame and then you can expand or shrink the frame in whatever direction you like. If you fit the frame to the guidelines, your data frame map will look like the below image.

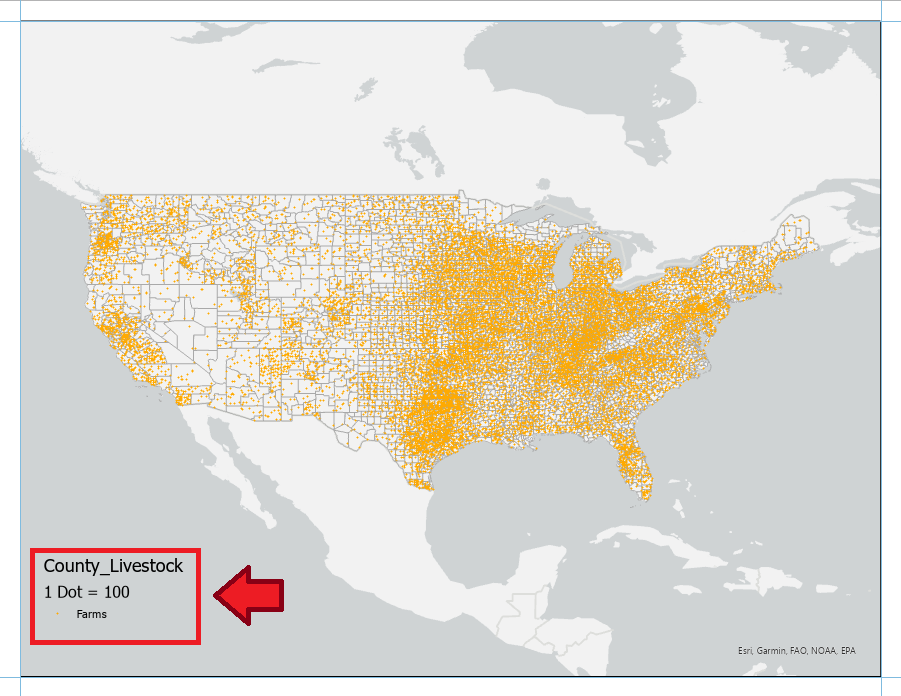


**Step 6: Insert map surrounds**

At this point you will learn how to add a legend, north arrow, and scale bar to the layout. The legend explains the map's symbology. The north arrow and scale bar provide geographic context.

1. On the ribbon, click the ***Insert*** tab. In the ***Map Surrounds*** group, click ***Legend*** Legend. Draw a rectangle in the bottom left hand corner of your layout map to display the legend of your dot density data related to the total farms in the United States by county/parish.

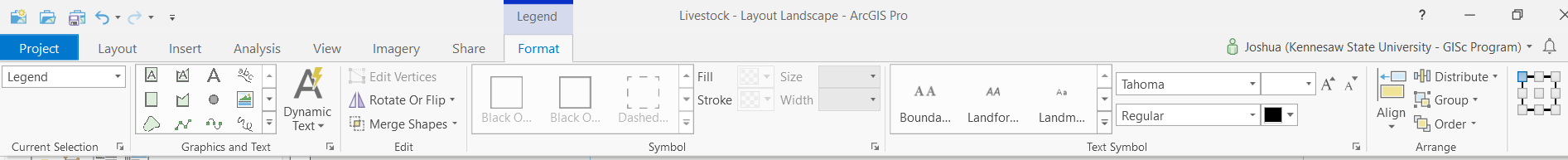




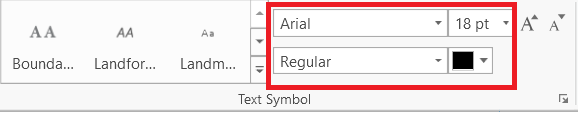
**Note**: At the bottom of the legend, the dot symbol is not clearly distinguished in the legend.

To updates the font for all text in the legend, makes only legend item headings bold, and adds a border with an offset follow the steps below.

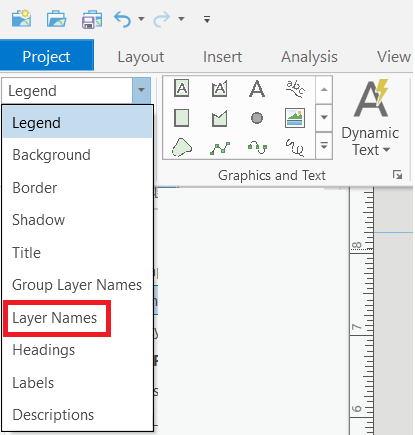
1. Select the ***Legend*** in the ***Contents*** pane.
2. Under the ***Legend*** tab, on the ***Format*** tab, in the Current Selection group, verify that Legend is selected.



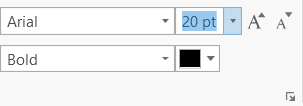
1. In the ***Text Symbol*** group, choose a new ***font***.



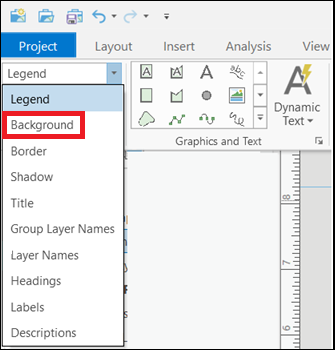
1. In the ***Current Selection*** group, expand the selection drop-down menu, and choose ***Layer Names***.



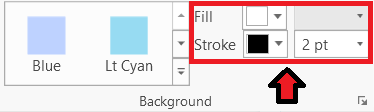
1. In the ***Text Symbol*** group, choose a new ***font size***.



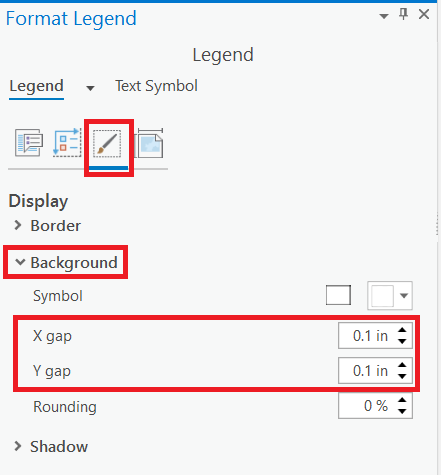
1. Next, in the ***Current Selection*** group, expand the selection drop-down menu, and choose ***Background***.



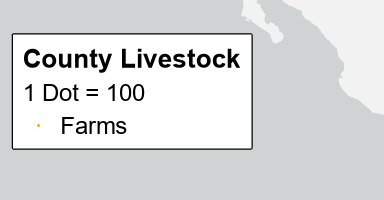
1. In the ***Background*** group, choose a new ***Fill*** color to Arctic White and set the ***Stroke*** width to 2 pt.



1. Finally, right-click the ***Legend*** in the Contents pane and click ***Properties***. In the Format Legend pane, click the Display tab Display. Under ***Background*** set the ***X-gap*** and ***Y-gap*** to “***0.1 in***”.



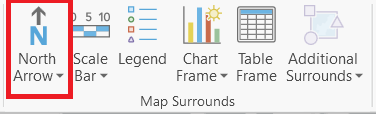
After performing these tasks to the legend, it should like similar to the image below. It will take you some time to perfect any legend or layout style of a map. So, do not be freak out if your first map is not the best. Practice makes perfect over time!



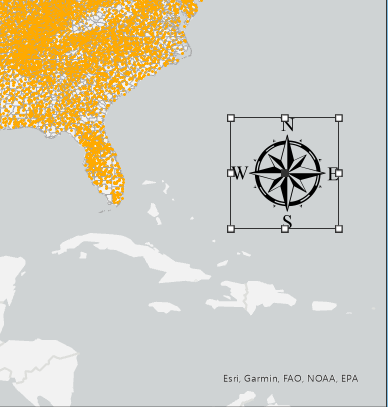
**Note**: The dot looks very small on the legend because we are only use a 2 pt size. If we decided to make the dot bigger, it would make it very difficult to read it on the layout map.

## Step 7: Insert a north arrow

## On the *Insert* tab, in the *Map Surrounds* group, click *North Arrow* New North Arrow.

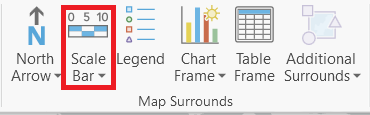


1. Select any of the north arrows to display on your map, after choosing a north arrow, place the arrow on the right side of the layout map. After you place it on your map, click on it and you can adjust the size of your north arrow to your desired size.

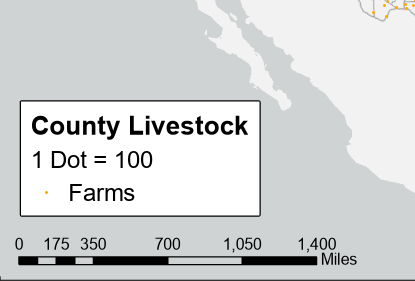


## Step 8: Insert a scale bar

1. On the ***Insert*** tab, in the ***Map Surrounds*** group, click the ***Scale Bar*** button New Scale Bar. Choose a style, and on the layout view, click and drag to create the scale bar.



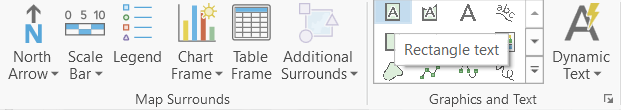
1. After selecting a scale bar, please it underneath or below your legend. You may need to slide up your legend to fit the scale bar underneath it.



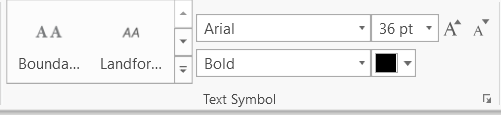
**Note**: We will spend more time about addressing appropriate units and divisions in later lab exercises.

**Step 9: Insert a map title**

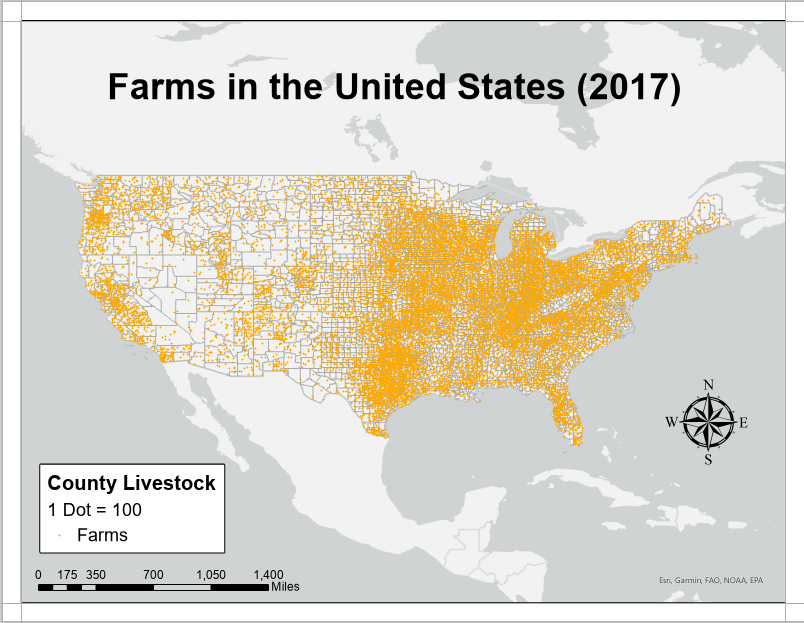
1. On the ***Insert*** tab, in the ***Graphics and Text*** group, in the tool gallery, click the ***Rectangle text*** tool Rectangle text. On the layout, in the top middle of the map frame, draw a rectangle for your map title.



1. Type the following text: “***Farms in the United States (2017)***”. When you are finished, click an empty area on the layout.
2. On the ribbon, under ***Text***, click the ***Format*** tab. In the ***Text Symbol*** group, change the font type to “***Arial***”, the font size to “***36 pt***”, and symbol font style to “***Bold***”.



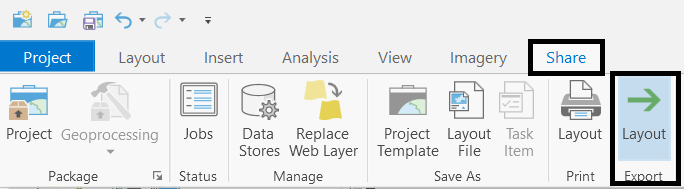
1. After adjusting the font type, size, and style, your title showed like similar to the one below. **Note**: If necessary, you may need to widen the text element to see the full title on your layout map.



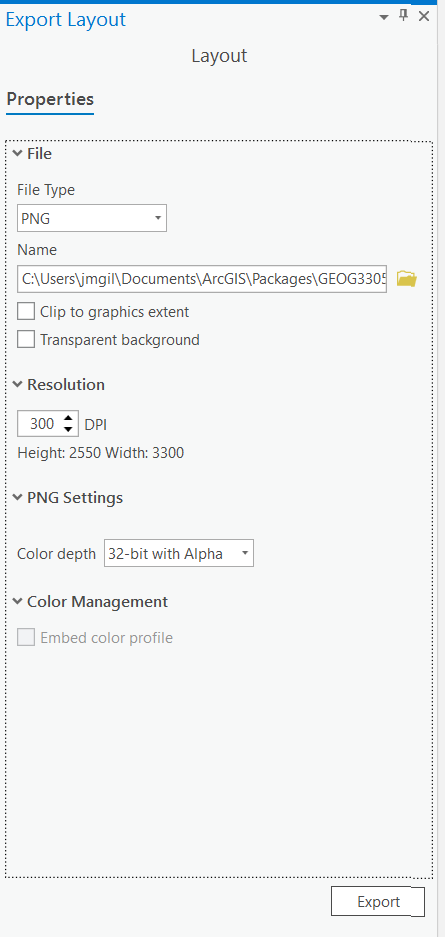
**Step 10: Export a layout (Your final map)**

Now that your layout is finished, you can print it or export it to a file that can be easily shared. You will learn how to export the layout of your map as a ***PNG*** file.

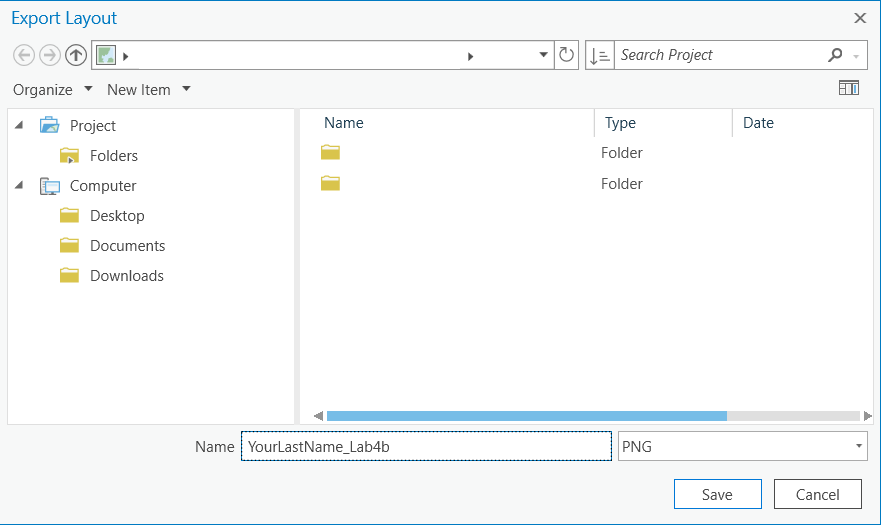
1. On the ribbon, click the ***Share*** tab. In the ***Export*** group, click ***Layout*** Export Layout.



1. The Export Layout pane appears. On the ***Properties*** tab, change ***File Type*** to ***PNG***, if necessary. Also make sure the ***Resolution*** is set to ***300 DPI***. This is the most common resolution used to export a map file from any GIS software.



1. In the ***Name box***, name your map as “***YourLastName\_Lab5A.*** Then, click the ***Browse*** button Browse and browse to the location (working direction – e.g., GIS Fileshare) where you want to save the file.



1. After accepting the other default PNG settings, click on the bottom of the pane, ***Export***.
2. When the export is completed, click ***View*** exported file at the bottom of the pane.

The file opens in your default image viewing application. If you want to print the layout, on the Share tab, in the Print group, click Layout Print Layout. You may need to change some printer settings, such as the page orientation, before you send the layout to the printer.

After you have finished this step, you have completed this portion of the lab exercise. Please make sure to upload the PNG file to D2L to receive credit for your work. For the second part of lab 5, you will create a flow map.