

## Lab 6: Introduction to Cartography (Map Design)

Maps are the primary tool for communicating spatial information in GIS. Choosing how to display all of that information on a map is called Cartography. A map can be used to tell stories. When designing a map, you choose what information to include or exclude and how it gets presented. If you make good design decisions, the maps you create will be clear, easy to understand, accurate and professionally presented. If you make poor design choices, your map could be incomplete, unclear, or otherwise misleading. You should be careful to always create high quality maps that are well suited to communicate the information you want to convey.

In this lab you will: Download spatial data, Put that data in a map document in ArcMAP, Learn about map components and design choices, Apply cartographic principles to make design choices for your map, Print a map to show your work. By the end of the lab, you should be comfortable with the following concepts and tools

- Layout View vs Data View
- Different ways to export a map
- Adding Labels
- Changing Symbology
- Using custom symbols
- Various basemaps
- Visual Weight
- Names and purpose of cartographic elements

### Collect sample data

If you don't have it, download the folder of lab data from LearningSuite. You're going to be using the data organized into the lab 6 folder. This is a geodatabase that contains all the data you will need to complete this lab assignment.

### Create a new Project in ArcMAP

Open ArcMAP. In the ArcCatalog menu on the right, (if not visible, click the customize button then click ArcCatalog) create a folder connection to the folder on the D:/ drive that contains all your data. Click and Drag each shapefile from ArcCatalog to the Table of Contents column found on the left. Add a basemap. For more help on this section, refer to the lab "Introduction to ArcGIS and Spatial Data."

### Components of Maps and Visual Weight

Cartography is the practice of designing maps. The visual design of maps has unlimited possibilities. Depending on the purpose of the map, certain elements are more important than others and stylistic choices can be made as a result. All design decisions should be made after considering questions such as: Will this make the map easier to read and understand? Will this make the map more accurate? What message do I want this map to convey? With a clear purpose in mind, design decisions

become easier. For example, A map with the purpose of showing only the locations of Wal-Marts in Utah doesn't need as large or detailed of a legend as a map showing the locations of all stores in the city of Provo.

Position, size, shape, and color of elements determine their *Visual Weight* on the map. Elements that are most important to the message of the map should have a larger visual weight than less important items. For example: Maps showing boundaries in property lines might provide a larger, or even multiple, scale bars and be concerned about the style of projection used in the map. That map probably shouldn't spend as much space on a large legend. Remember to evaluate the visual weight of items in the context of the map's purpose.

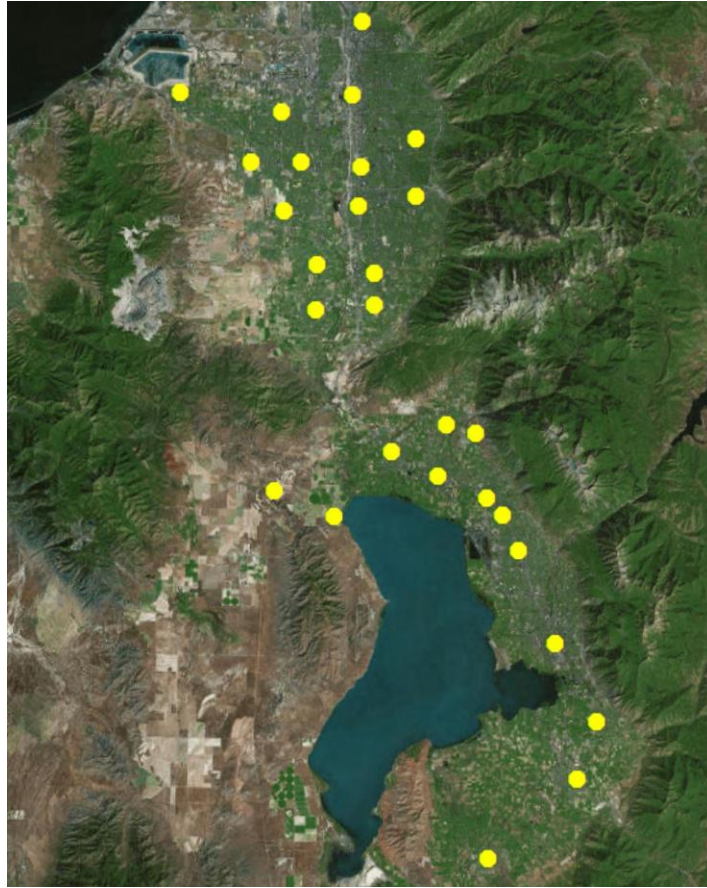
Not all map components are required for every map or in every situation. Personal preferences and the purposes of the map drive design choices. In this class we will learn to add labels and create additional map views or inset maps. These items may not be on every map you work with. However, all the maps you create for labs in this class should contain all the following:

- Neatline- a thin line that surrounds all of the elements of your map. Not filled in.
- North Arrow- Any style is acceptable if it is professional and readable
- Scale Bar- Be sure to use distance units appropriate for the zoom level of the map
- Title- The title should convey the purpose of the map and/or describe the contents
- Projection information- In Utah, this will always be NAD 1983 UTM Zone 12N
- Coordinate System Information- Every projection has a corresponding coordinate system
- Author- Include the name of all group members when applicable
- Legend- Should always be exhaustive (show all symbols used)
- Basemap- background imagery and/or labels to supplement the GIS data
- Date- When the map was created
- Inset Map- An additional view of a map usually included for context. Occasionally not required.

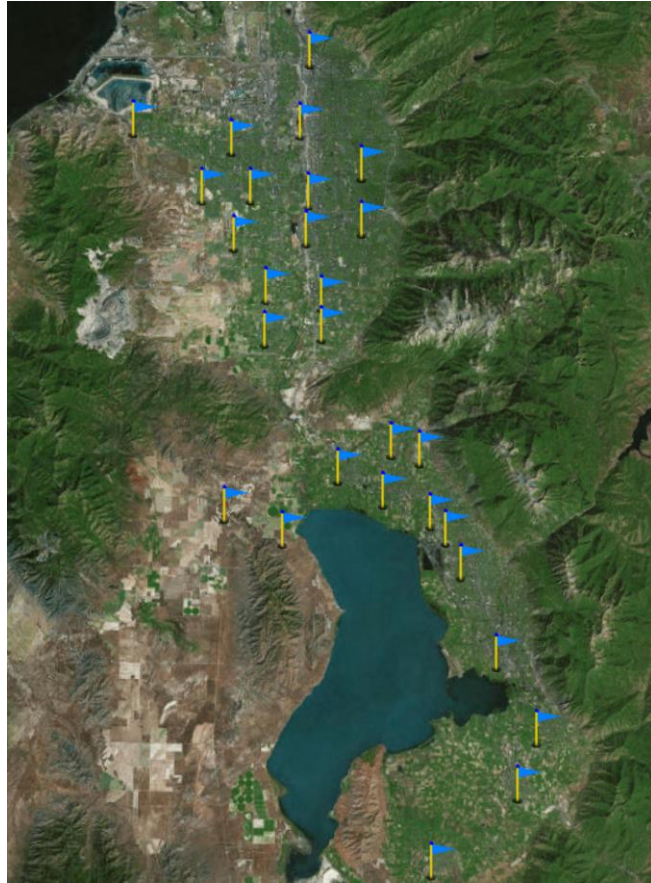
## Changing Symbols

Add the cities shapefile to a new ArcMap project. The default symbology is usually unclear and should be changed.

1. To change the symbol, right click on the layer and choose Properties -> Symbology tab -> Double click on the symbol.  
Or: double click on the symbol beneath the layer in the table of contents.
2. Change the symbol to be a yellow octagon, size 12. It should look something like the following.



3. There is a large library of symbols built in to ArcMap. You can download additional symbols from ESRI or import custom graphics. To upload custom graphics, you need to get to the advanced symbol changing menu. While in the symbol selector menu, click on edit symbol, found on the right side of the menu.
4. You should be in the Symbol Property Editor menu. Towards the top left of the menu is a drop-down box. It should currently say Character Marker Symbol. Change that to Picture Marker Symbol.
5. A file explorer window will open prompting you to choose the location of the picture. In the same folder that contains the city shapefile you have open, there is also a graphic. Choose that file as your graphic. Usually you will need to make the symbols very large. Choose a size between 20 and 30 pt for this graphic.
6. If you choose a graphic that is difficult to see, you can add a background or halo to the image so that it becomes easier to view. Those options will be discussed further in the next section.



### Adding and Customizing Labels

Now that your points are clearly visible, you want to label the many cities so that you can see their names. To label features, right click on the layer in the table of contents. Choose Properties then the Labels tab on the top of the menu. You are now in the labels menu.

1. On the top the menu, check the box that says “label features in this layer.”
2. Do not change the method for labeling features.
3. Change the label field box to be Name. This box chooses which column of the attribute table for the file contains the information you want to be visible. In this case, we’re using the name of the city. You might also choose, county, population, etc.
4. There are many more options for labels than are listed in this screen. In the text symbol section, click on “Symbol...” the “Edit Symbol...”
5. The four tabs of this menu show all the choices for editing labels. On the first page, pick a font and size of about 15.
6. Add either a background or a halo to your text label. Those options are found under the “Advanced Text” and “Mask” tabs respectively. There are similar menus for changing colors and sizes using the “Symbol...” button on each screen. A halo is like a background that is fitted to the shapes of the letter rather than a generic square or circle shape. These are examples of Backgrounds and Halos. (halo on left, background on right).



**COTTONWOOD HEIGHTS**

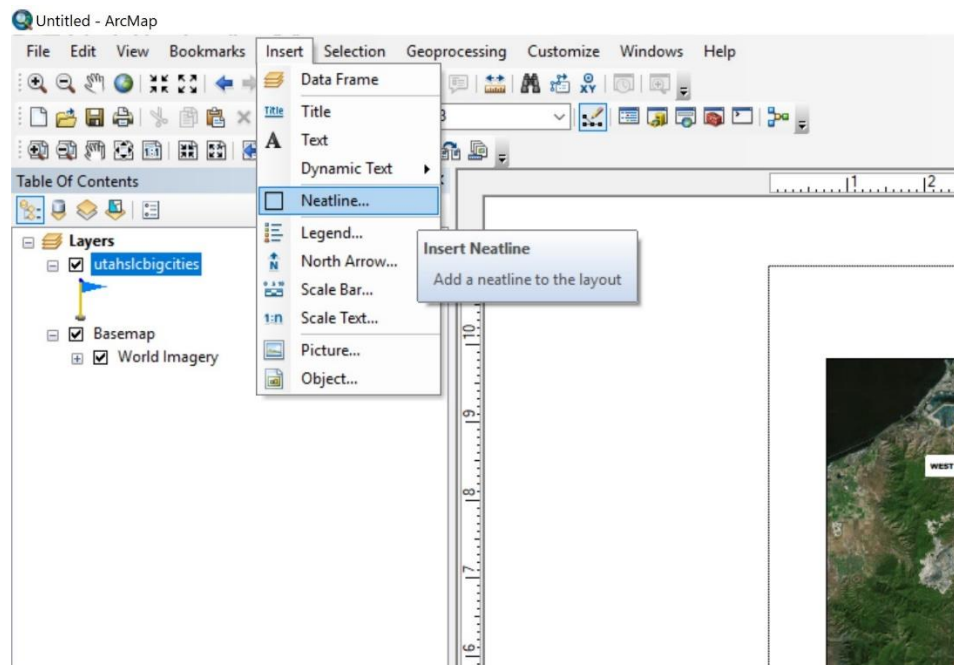
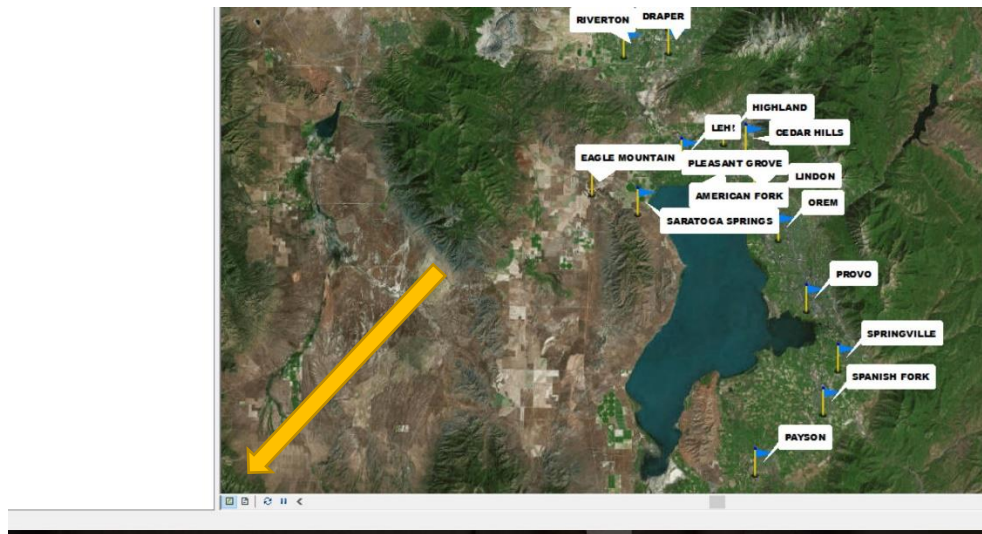
**COTTONWOOD HEIGHTS**

7. Close the menus for the labeling backgrounds. The last option on the Layer Properties menu is Placement. You can use the options on this screen to choose the position of labels and what to do when labels overlap (conflict detection). Because there are so many cities close together, your labels will overlap no matter what you do. Choose placement settings to suite your preference.
8. When you have finished. Click OK in the properties menu. The box will disappear and your labels will appear on the map.
9. Adjust the visual weight of the symbols on screen (size, position, color, font, etc) to optimize visibility. After finishing this step, you should have a map that looks like this:



### Adding Cartographic Elements

You now need to add all of the cartographic elements listed earlier in the lab. When you first open ArcMap, you are in Data View. This view is meant for viewing, manipulating, positioning, creating, etc for all the spatial data you use. In the bottom left corner of the map window, there is a button to switch between data view and layout view. Switch to layout view to begin adding elements and change the presentation of the map.



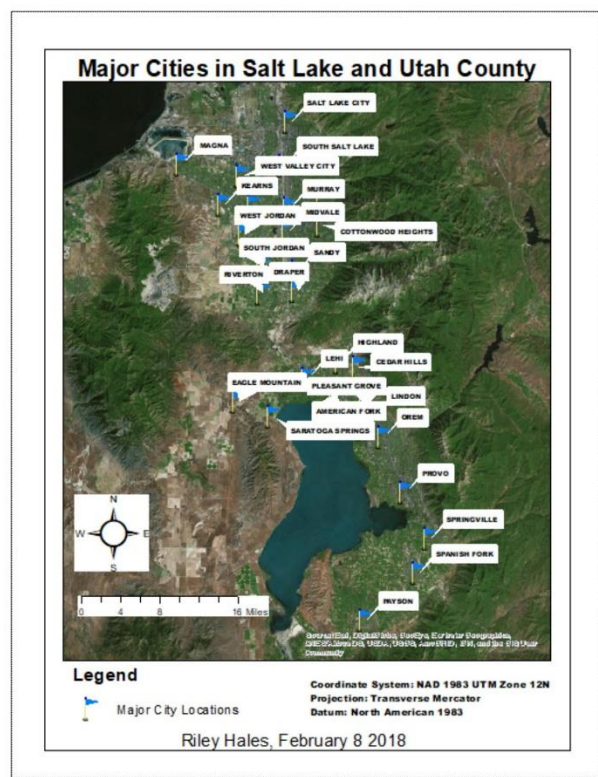
In layout view, go to the Insert Menu on the top left of the ArcMap window. In this menu, you will find buttons to help you add all of the cartographic elements you need for the map. To make this process easiest, add all of them except for the neatline. Change the positioning and size of all the elements. Try to keep them centered in the page (you can right click on each element and use the options to snap the object to certain positions). Once you have all those items, add the neatline. Choose the option in the neatline menu to surround all elements on the page. The background is optional but using no background color is professional.

We have not discussed adding additional map views (inset maps) so you do not need to include one in this map. This will be discussed in future labs.

Other notes/suggestions about adding cartographic elements.

1. For best readability, you generally shouldn't overlap items on the map. The north arrow and scale bar are the exceptions. To improve their readability, you may add backgrounds/halos to them and position them over the map in less important positions.
2. To edit a cartographic element after it has been placed, double click on it.
3. Lab 6 is not a good choice of title for a map. Pick something that describes the content such as Selected Cities in Utah, or Cities with Population over 10 Thousand, etc.
4. Legends should show all the layers used on the map, regardless of if they are labeled. This is called an exhaustive legend. You can't do much editing to the legend after it has been created. You may have to delete it and reset to make some changes.
5. Items in the legend are named the same way they are in the Table of Contents. You will need to change the name in the table of contents to change the name in the legend so that it is helpful.
6. DO NOT include the 5 items in the legend for imagery and citations.
7. Typically, Imagery is the standard basemap choice. Depending on the purpose, different basemaps may be acceptable if it enhances the visual presentation and clarity of a map.
8. Rather than type all the projection/coordinate system information yourself, there is a dynamic text box option that will fill it in for you. However, only include the projection and coordinate system information out of everything included in that box.
9. You may design your map any way you wish if it contains the proper data sets, is professional in presentation, and uses the necessary cartographic elements.

**Your finished map should look something like this**



## Exporting your finished map

Screenshots are obviously not a professional method to present your work. You can export a finished map in ArcMap using 2 methods.

1. Press file -> export map. Choose pdf as the type and a resolution at least 1000 dpi (default).
2. Press file -> Print. Choose print to pdf as the printer type. Press print and choose a save location.

## Exercise 2

Use the lakes and roads dataset in the geodatabase you downloaded. Following the pattern for the previous example, you should:

1. Make the colors of the lakes blue.
2. Use the 'highway ramp' default color scheme for the roads. Change the color to yellow.
3. Make the outline on the polygons at least 1 pt thick.
4. Add labels to the lakes. Use the GNIS\_Name field to label the features. Use a white halo.
5. Label the roads. Use the RT\_Name field to label the features. Do not add a background/halo.
6. Use the Light Grey Canvas basemap.
7. Add all the cartographic elements.



## Deliverables

You should submit both the maps that you created for the examples in this lab; both the cities map and the lakes/roads map. They should be full size (8.5x11) in the format that came out of ArcMap after exporting. Don't shrink them to fit into a page in word, take screenshots. Combine both the exported maps into 1 pdf using the adobe software on the CAEDM computers or using a web service.

Submit only 1 pdf that contains both of the exported maps.

## Rubric

Each map is worth 15 points as follows

### 1 Point Per Cartographic Element-

- Neatline
- North Arrow
- Author and Date
- Projection and Coordinate System
- Title
- Scale bar
- Legend
- Symbols used
- Basemap

### 3 Points For Formatting-

- 8.5x11 size exported map from ArcMap, legible, organized, professional, etc

### 3 Points For Correct Data and Symbolology-

- Correct colors and symbols
- Appropriate sizes
- All necessary data visible