GIS Tutorial for Atmospheric Sciences

J. Greg Dobson, University of North Carolina at Asheville

Jennifer Boehnert, National Center for Atmospheric Research

© 2015 UCAR and UNC-Asheville. This is an open access article under the terms of the Creative Commons Attribution-NonCommercial 3.0 Unported License, which permits all non-commercial use, distribution and reproduction in any medium, provided the original work is properly cited.

Exercise 4

Cartographic Mapping

Use Case: Superstorm (Blizzard) of 1993

In this exercise you will plan, design, and create a weather post event map. Post event maps are commonly used by NOAA and the weather and climate industry as a way to display and highlight storm impacts. From an emergency management and response perspective, they are critical for responding to a storm in an efficient and timely manner by knowing where storm impacts occurred. They are also useful from a climatological and planning perspective.

GIS is not just about map making. Maps themselves are often the byproducts of spatial analysis. The process of creating effective and visually appealing maps requires choosing the right layers to be included in the map, symbolizing those layers in a meaningful fashion, proper map design, and using appropriate map elements for your map to tell its story. It also involves effective dissemination and sharing strategies to reach its audience.

In this example, you will be working with data from the March 12-15, 1993 blizzard, more commonly referred to as the Superstorm of 93', which impacted the eastern two thirds of the U.S.

Sub-Sections in Exercise 4:

1. Preparing the ArcMap Document Data Frame and Layers to Create a Final Map
2. *Using Layout View to Design the Appearance of the Final Map*
3. *Adding Elements to the Map*
4. *Disseminating and Sharing Your Map*

© 2015 UCAR and UNC Asheville

Preparing the ArcMap Document Data Frame and Layers to Create a Final Map

<u>Step 1</u> Adding the necessary layers and arranging them properly

When preparing to create a map, one of the first steps is to assemble all of the data layers in ArcMap required for the final map.

- Open a blank ArcMap document.
- Click the **Add Data** button.
- Click the **Connect to Folder** button.
- Navigate to ***C:\Exercise4\ (***or wherever you stored the data for this exercise) and click **OK.**
- Click the **Add Data** button and navigate to ***C:\Exercise4\data\Exercise4.gdb***.
- Add the following layers to the map.
    - ***CONUS_States***
    - ***GSP_CWA_Counties***
    - ***Snowfall***
    - ***Snowfall_Grid***
    - ***Southeast_Counties***

In Exercise 1, Step 6 you learned how to reorder the layers in the Table of Contents.

- Arrange the layers such that ***Snowfall*** is on top, followed by ***CONUS_States***, ***GSP_CWA_Counties, Southeast_Counties,*** and ***Snowfall_Grid***.

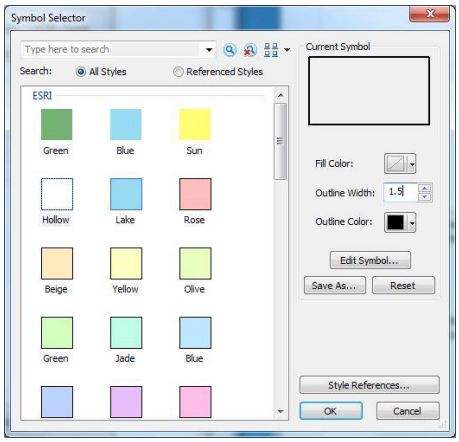
TIP: If you are unable to rearrange the layers, make sure the datasets in the Table of Contents are *displayed by Drawing Order*. Also, when add multiple layers at one time, they all are selected in the Table of Contents. You must un-select them all before you can move one. To un-select them all, simply click in some blank white space.

- Turn off the ***Snowfall*** and ***Snowfall_Grid*** layers.
- Right-click on the layer ***Southeast_Counties*** and select **Zoom to Layer.**

Step 2 Symbolize the boundary layers

In this step you will symbolize the boundary layers you just added to the map. Refer back to Exercise 3, Step 1 if necessary, as a reminder for symbolizing these qualitative layers.

- Double-click on ***GSP_CWA_Counties*** layer in the Table of Contents to open the Layer Properties window.
- Click the **Symbology** tab.
- Change the Symbol to Hollow with an Outline Width of 1.50 and an **Outline Color** of Black.

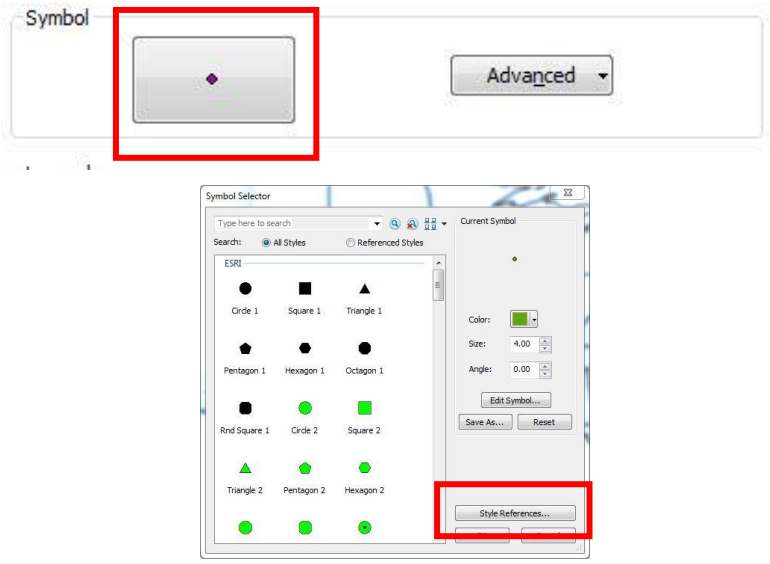


- Click **OK** twice to apply your changes and close the windows.
- Double-click on ***CONUS_States*** layer to open the **Layer Property** window.
- In the **Symbology** tab change the symbol to be Hollow with an Outline Width of 2.00 and an Outline Color of Black.
- Click **OK** twice to close the Layer Properties window.
- Open the Layer Property window for the ***Southeast_Counties*** layer and in the **Symbology** tab change the symbol to be Hollow with an Outline Width of 0.50 and an Outline Color of Gray 30%.
- Click the **OK** button twice to close the Layer Property window.

Step 3 Symbolize the Snowfall vector layer using a style reference

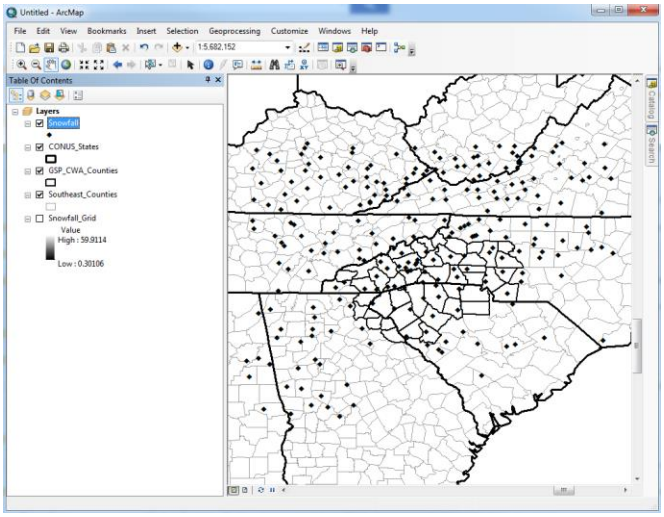
In Exercise 3, Step 1 and Step 2, you learned how to access the Symbol Selector and how to expand the choices of symbols by using a *Style Reference*.

- Open the Layer Properties window for the layer ***Snowfall***.
- Click the **Symbology** tab and open the **Symbol Selector** window by clicking the **Symbol** patch.



- Click the **Style References…** button.
- Scroll to the bottom and place a checkmark next to **Weather**.
- Click **OK**.
- In the **Search Box** at the top of the Symbol Selector, type "*Weather Station*."
- Hit the Enter key.
- Click the second choice from the left – ***Weather Station Complete***.
- Change the Size to 14.
- Click **OK** twice to close the Symbol Selector and the Layer Properties window.
- Turn on the layer ***Snowfall*** in the Table of Contents.
- Right-click on the layer ***Snowfall*** and select **Zoom to Layer.**
- Click **File > Save.**
- Save your map as ***C:\Exercise4\maps\exercise4.mxd.***

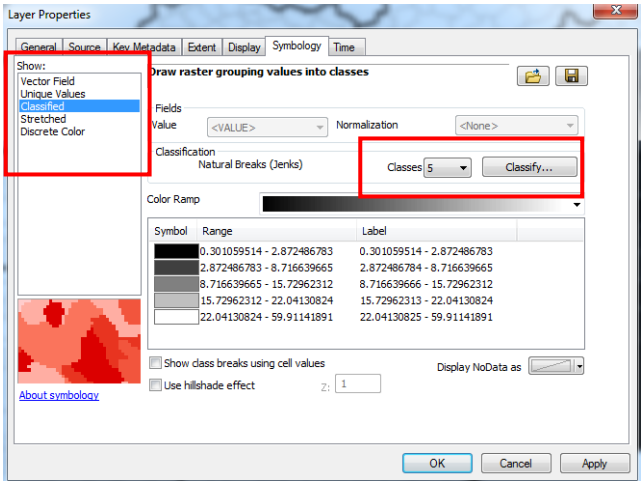
Your map display area should now look like the one below.



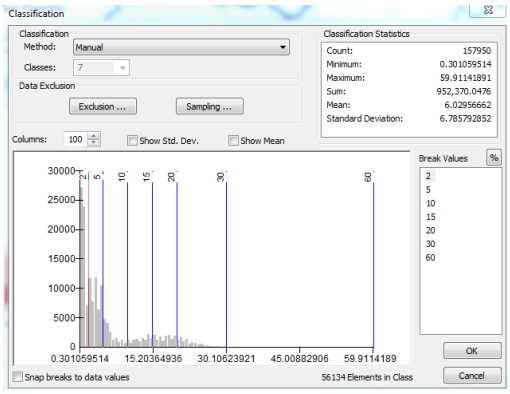
<u>Step 4</u> Symbolize the Snowfall raster layer using a classification method

Symbolize the Snowfall_Grid layer such that there are clearly identifiable ranges of values instead of the default stretched color ramp showing the total range of values currently displayed.

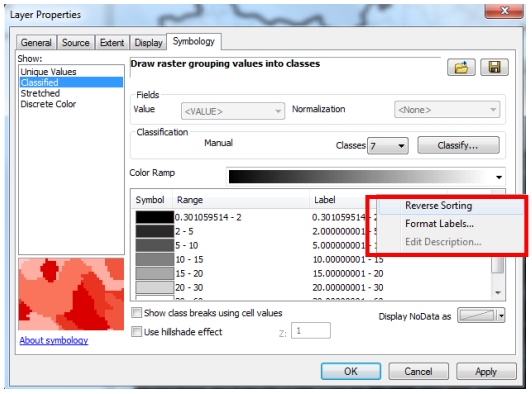
- Turn on the ***Snowfall_Grid*** layer.
- Open the Layer Properties for the ***Snowfall_Grid*** layer and click the **Symbology** tab.
- Under **Show**, click **Classified**.
- Set the number of Classes to 7.
- Click **Classify**.



- Change the **Classification Method** to **Manual**.
- In the **Break Values** box, set the values to be the following intervals. Start with the last break value of 60 and work your way to the smallest number.
    - 2
    - 5
    - 10
    - 15
    - 20
    - 30
    - 60



- Click **OK**.
- Click on the **Label** column heading (click the actual word “Label”) and then click Format Labels.

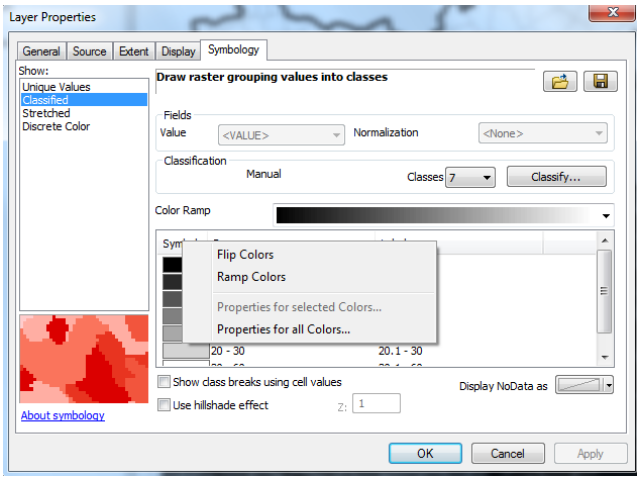


- Under **Rounding**, make sure the "**Number of decimal places**" is checked.
- Set this to 1.
- Click **OK** to close the Number Format window.
- Click **Appl**y.

TIP: In Layer Properties and other windows within ArcMap, clicking Apply and OK are essentially the same. To save yourself a "click," you could just click OK and not click Apply and the changes would still be applied. However, if you wanted to view the changes without closing the window, you could click Apply, position the box so you can see the changes, and decide whether you want to keep them before closing the box.

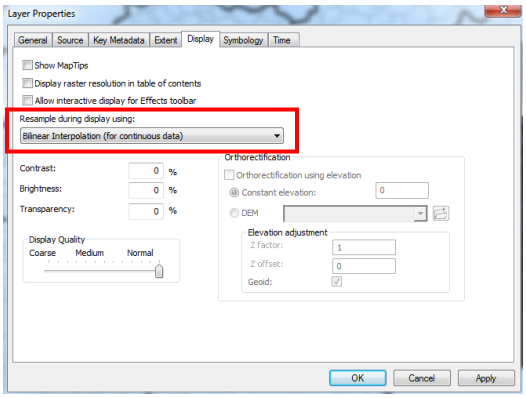
Sometimes the raster data color ramp is reversed where the darkest colors represent the smaller values and vice versa. In this case, the darkest colors should correspond to the highest values.

- Click on the column labeled ***Symbol*** (or Sym…) and then click **Flip Colors**.



Raster data are gridded, thus, by default, the data appear “blocky” in the map. This can be changed in the map itself to smooth this appearance. The data do not change, just the way it is displayed.

- Click the ***Display*** tab.
- Under “**Resample during display using**:” choose **Bilinear Interpolation** (for continuous data).



- Click **OK** to apply your changes and close the Layer Properties window.

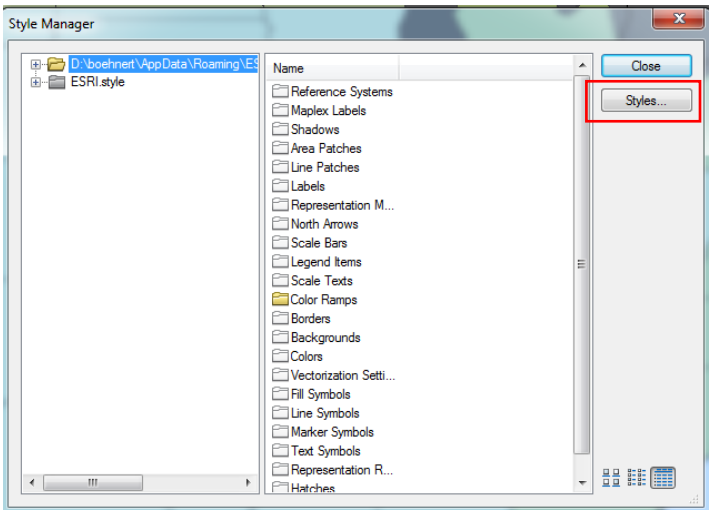
Resampling data will change the way the data are displayed. For discrete data such as land use or soil data, the nearest-neighbor resampling technique is most appropriate. However, with continuous data such as elevation, temperature and snowfall, the Bilinear Interpolation technique will give a smoother result.

Now that you have classified the data, you need to choose an appropriate color ramp to display the snowfall amounts. Snowfall is typically displayed using lighter shades, often greys, blues, and magentas.

- As you did in Step 3 of Exercise 4, make sure that the **ColorBrewer** style set is added to your ArcMap document.

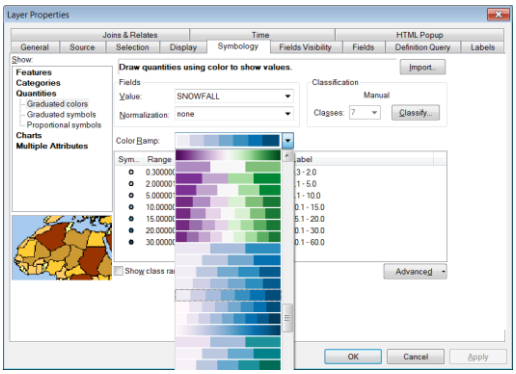
If ColorBrewer is not a style set in your map then complete the following steps. If it is already set then skip to page 10.

- Click the **Customize** menu and select **Style Manager**.



- Click the **Styles….** Button.
- Click **Add Style to List….**
- Navigate to ***C:\Exercise4\data\ColorBrewer*** and select ***ColorBrewer.style,*** click **Open**.

- Open the Layer Properties window for the ***Snowfall_Grid,*** and click the **Symbology** tab.
- Choose a 7-phase color ramp for blues. (Choose the ramp that goes from light purple to dark blue). Make sure that the order is correct, you might have to flip the colors.

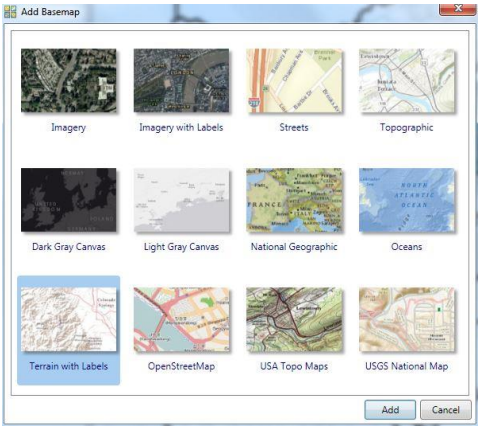


- Click **OK**.

Step 5 Adding a Basemap

Basemaps provide context to maps in the form of general reference, terrain, imagery, and other useful information. For weather and climate-related-maps, it can be helpful to understand the underlying terrain influences and how they may impact a local weather event.

- Click the down arrow beside the **Add Data…** button then choose **Add Basemap…**
- Select the "**Terrain with Labels**" and click **Add**.



Esri and other Basemap services are often served in such a way that the vector and raster data they are representing are separated into multiple layers. In the Table of Contents, you see that a Reference layer and a Basemap layer were both added to the Data Frame. However, you can't see the Basemap layer because it is underneath the other map layers.

- Turn off all layers except for ***Reference*** and ***Basemap***.
- Save your map.

Now you can see the terrain context of the Basemap. However, you want to see this terrain data in conjunction with the snowfall data. To do this, you need to adjust the transparency and layer order of the Basemap.

Step 6 Adjusting layer transparency

Recall that layer transparency allows you to see through a vector polygon or raster layer to see other layers in the background. This can be especially useful with thematic maps such as this when you need to show multiple pieces of information on the same map. In this example, you want to see variable terrain and how it might influence snowfall accumulations.

- Open the ***Basemap*** Layer Properties and click the **Display** tab.
- Set the **Transparency** to 60%.
- Click **OK**.
- Turn on the ***Snowfall_Grid*** layer.
- In the Table of Contents, drag the ***Basemap*** layer right above the ***Snowfall_Grid*** layer.

Now you can see both the snowfall and terrain layers at once. Notice how the higher snowfall amounts strongly correlate with the areas of greater terrain.

TIP: You could have adjusted the transparency of the Snowfall_Grid layer to see through to the Basemap layer. However, this would have greatly muted the colors of the snowfall ranges thereby mismatching them to the colors in the Table Of Contents.

- Turn on all of the remaining layers and turn off ***Reference***.
- **Save** your map.

Using Layout View to Design the Appearance of the Final Map

Previously we discussed the difference between Data View and Layout View. Now that you have chosen the layers you want to include in your final map and symbolized them appropriately, you will design the final map and add map elements.

Step 7 Switch from Data View to Layout View and re-size the map

- From the **View** Menu, click **Layout View.**

The default layout view is portrait. The scale and orientation of your data will determine whether or not you should select a portrait or landscape orientation. In this case, the orientation of the GSP_CWA_Counties layer is stretched from west to east, suggesting that a landscape orientation would be better suited for this map.

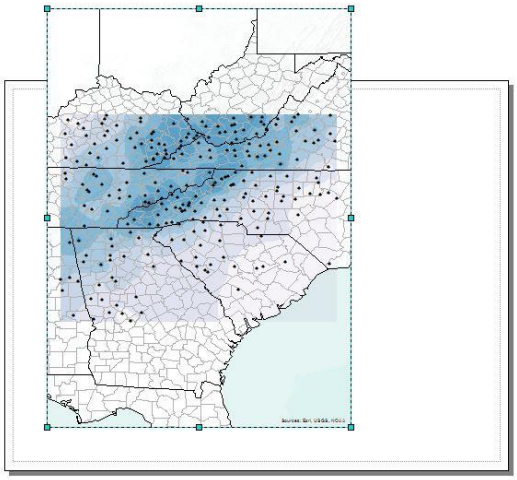
- From the **File** menu, choose **Page and Print Setup.**
- Under **Paper**, change the **Orientation** to **Landscape**.
- Click **OK**.

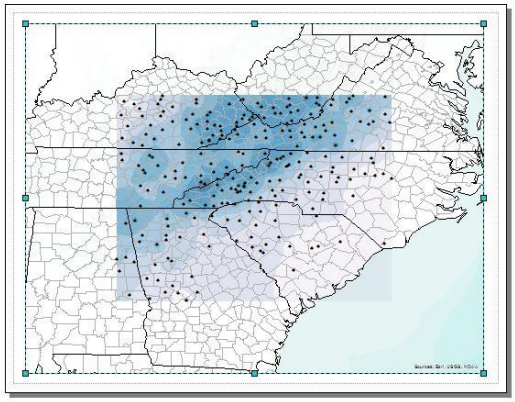
Resize the Data Frame to fit within the black border of the map. When the map is printed or saved as digital picture file, anything within the border in the Layout View will be visible.

- Make sure the **Select Element** tool is selected.

- Click anywhere on the map to activate the “handles” that are found at any of the corners or along the middle edges of the map.

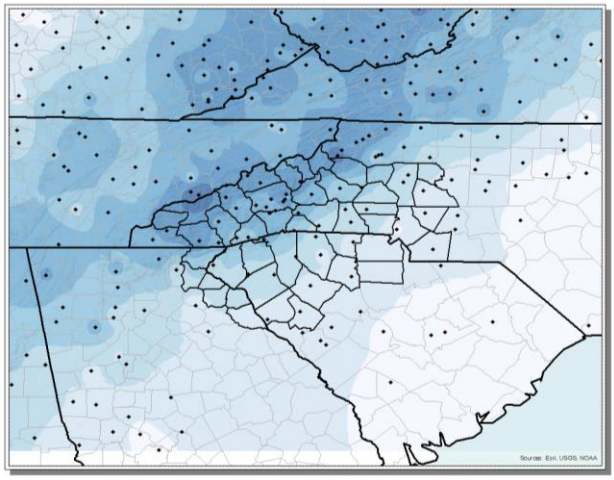
- Click on one or more handles to stretch and pull the map to fit within the border of the map.
- Click and hold on the map itself to drag the map down so that you can see the handles along the top edge of the map.
- Adjust the size of the map until all four corner fit neatly and evenly within the border of the map.





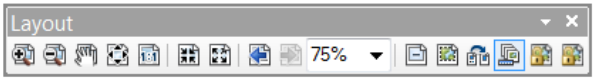
During the process of resizing the map, the scale became much smaller.

- Right-click the ***GSP_CWA_Counties*** layer and choose **Zoom To Layer**.
- Save your map.



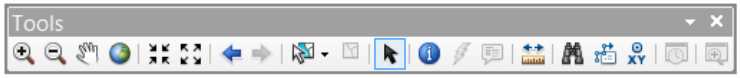
Step 8 Navigating in Layout View vs. Data View

You probably noticed that when you switched to Layout View, an additional Toolbar became active. This is called the Layout Toolbar.



- If you do not see the Layout Toolbar, then from the **Customize** menu, choose **Toolbars** and then click **Layout**.
- Reposition the toolbar so that it does not interfere with the map. Alternatively, you could "dock" the toolbar along with your other toolbars.

The Layout Toolbar contains very similar buttons as compared to the Tools toolbar you have previously been using to navigate the map in Data View.



However, the Layout Toolbar is used only for navigating the "map" itself, not the data. This means that as you use its tools to zoom and pan, you will only be zooming in and out on the map itself. The scale of the data will remain the same. If you wanted to physically zoom in on some of the data or to a particular area, thus changing the scale of the data, you would need to use the Tools toolbar.

- Click the **Zoom In** button on the **Layout** toolbar.
- While making note of the scale of the map, zoom into an area of your choice on the map by clicking on the map, hold, drag a box inside the map, then let go.

Notice that the scale did not change. Also notice that the map now fills the entire window and that the map border is no longer visible. This would be similar to zooming into an area of a digital picture or PDF document on your computer. However, if you were to print the map now, you would see the entire map, not just this area you have zoomed to.

- Click the **Go Back to Extent** button on the **Layout** Toolbar to return to the previous extent.

- Click the **Zoom Out** button on the **Layout** Toolbar.
- Click, hold, and drag a box inside the map, then let go.

Notice the map itself becomes much smaller. However, the scale remained the same.

- Click the **Zoom Whole Page** button.

Now you will use the Zoom functions on the Tools Toolbar to navigate the map.

- Click the **Zoom In** button on the **Tools** Toolbar.
- Zoom into an area of your choice.

Notice that the scale has now changed, and that you still see the border of the map. This indicates that you have physically zoomed in on your data and that if you were to print the map now, this is all you would see, not the entire map region.

- Click the **Go Back To Previous Extent** button on the Tools toolbar to return to the full region of the map.
- **Save** your map.

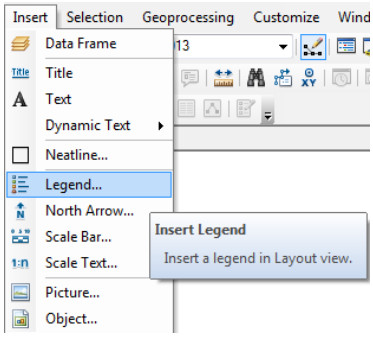
TIP: The zoom functions on the Layout and Tools Toolbars can be very confusing. It is important that you use the correct navigational tools when you are in Layout View.

Adding Map Elements

When designing a map, there are certain elements all maps should comprise to ensure good use and interpretation of the map. If your map readers do not understand the map or how to interpret it, then your map will be ineffective. Some key map elements include a title, scale bar, north arrow, and legend.

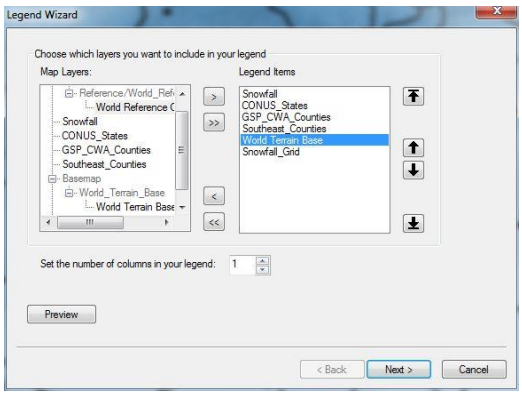
<u>Step 9</u> Insert a map legend

- Click the **Insert** menu and select **Legend**.



The Legend Wizard window appears. The first step is to choose which layers you want included in the legend. For this map, you want all layers except World Terrain Base to be included in the legend.

- Click on the World Terrain Base layer and then click the **<** button to remove it from the selection.
- Click **Next**.

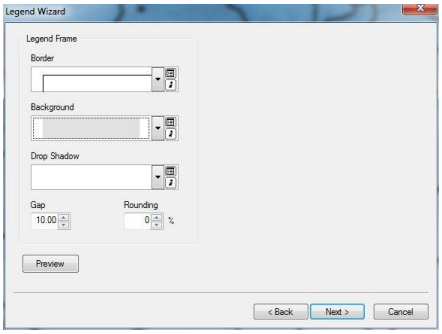


The word Legend already appears as the Legend Title. You can change that here, or leave blank if you don't want to have a legend title.

- Click **Next**.

Legends can have their own borders, background of various colors, and drop shadows.

- Click the dropdown next to the **Border** box and choose 1.0 Point.
- Click the dropdown next to **Background** and choose Grey 10%.
- Click **Next**.

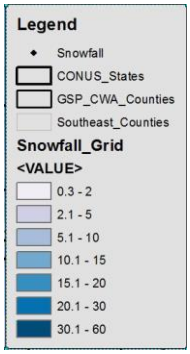


Symbol patches can be used to mimic the type of line or polygon vector data you are displaying. They are not applicable to point vector data or to raster data. For now, we will not use any symbol patches.

- Click **Next**.

Finally, you can choose to adjust the spacing between the individual parts of the legend. For now, you will just accept the defaults.

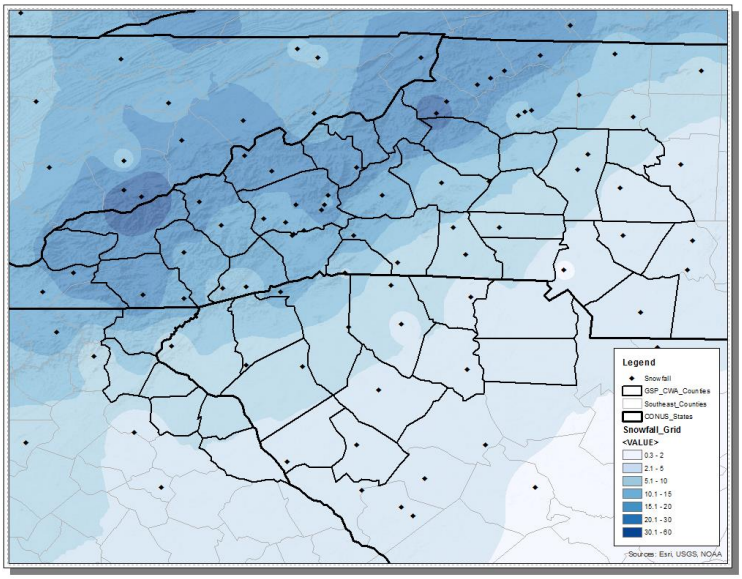
- Click **Finish**.



The legend map element is added to the map. You can interact with

map elements similar to how you would elements inside a Microsoft Word or PowerPoint file in that you can click on them to move them around, re-size them, and right-click on them to view and edit their properties, as well as copy or delete them.

- With the **Select Element** tool selected on the **Tools** toolbar, position the legend so that it fits neatly in the lower right-hand corner of the map.
- Resize the legend so that the top border of the legend does not extend above the South Carolina border, but the bottom border does not cover up the Sources text.



By default, if a Basemap is used, the source information of the Basemap automatically appears in the lower right corner when you are in Layout View.

Step 10 Editing the layer names

By default, layer names in the Table of Contents are the actual file names. This carries over to the legend. However, you can change layer names in the Table of Contents so that they display a different name. This will only affect the map document and not the actual name of the file. When you change the layer name in the Table of Contents, the name in the legend will automatically update.

- Open the Layer Properties for ***Snowfall_Grid.***
- Click the **General** Tab.
- In the **Layer Name** box, change the name to *Interpolated Snowfall*.

- Click **OK**.

Notice that the name in the legend has updated to reflect the name of the layer.

- Change the name of the ***Snowfall*** layer to ***Weather Stations***.
- Rename all the other layers to names that make sense. (remove underscores, etc.)
- Under the **Interpolated Snowfall** layer, single click on the word "**VALUE**".
- Now click the word "**VALUE**" one more time.
- You should now be able to change the name from "**VALUE**" to "**Inches**".
- Save your map.

Step 11 Changing the order of layers in the legend

When a legend is first created, the order of the layers in the legend is exactly the same as the order in the Table of Contents. However, sometimes you may want to change this order, to bring more prominent layers to the top, without changing the drawing order in the Table of Contents. This is often the case when you want raster layers shown above other vector layers, or vector point layers shown below polygon layers. All map elements can be edited and customized by adjusting their properties.

- Right-click on the map legend and choose **Properties**.
- Click the **General** tab.
- Under **Legend Items**, Click on ***Interpolate Snowfall***, then click the top arrow to the right of the box.

This will move the legend item to the top of the list.

- Repeat this process for ***Weather Station***.
- Click on ***CONUS States*** and click the bottom arrow to the right of the box.

This will move the legend item to the bottom of the list.

- Click **OK**.

Step 12 Insert a north arrow

- From the **Insert** menu, click **North Arrow**.

The North Arrow Selector window opens. There are several north arrow styles to choose from.

- Click the **ESRI North 1** north arrow.
- Click **OK**.

Similar to the legend, you can move and resize the north arrow.

- Position the north arrow so that it is in the upper right-hand corner of the map.

Because the map contains data that encompass the entire map layout, thus not leaving any extra white space, the north arrow is not very visible. Again, all map elements can be further customized.

- Right-click on the **north arrow** and choose **Properties**.
- Click the **Frame** tab.
- Under **Background**, click the drop-down arrow and choose **White**.
- Click **OK**.

TIP: When working with map elements, right-clicking on the element or double-clicking the element will bring up the Properties of that map element.

Greater changes to the properties of map elements can be made as well. If you did not like the north arrow you chose, you could select a different option.

- Double-click the **north arrow** to open the **North Arrow Properties** window.
- Click the **North Arrow** tab.
- At the bottom of the **Preview** window, click the **Style** button.
- Select the **ESRI North 8** north arrow.

- Click **OK**, and then **OK** again.
- If needed, re-position the north arrow so that it is still neatly within the border of the map.

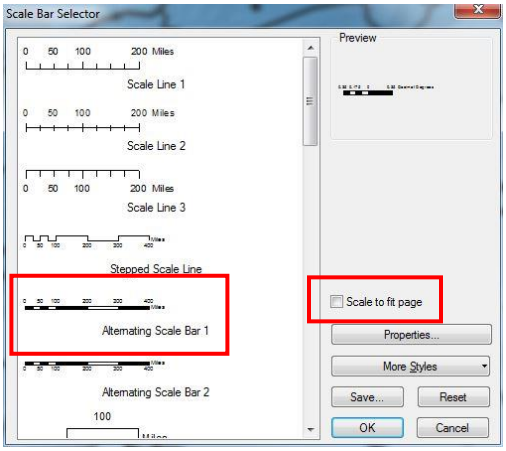
Step 13 Insert a scale bar

Scale bars are useful for measuring distances on your map. They are most common on general reference and other navigational maps, but often they are included on thematic maps such as this as well.

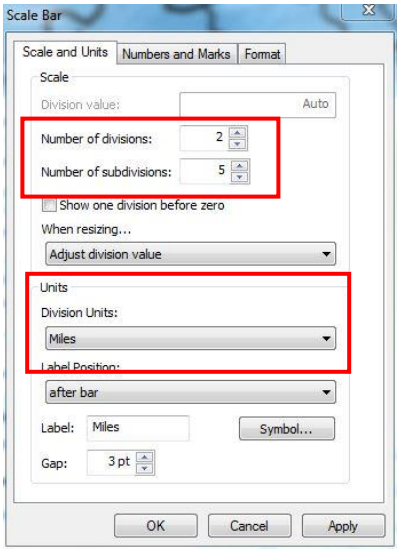
- From the **Insert** Menu, choose **Scale Bar.**

Similar to the north arrow, the **Scale Bar Selector** window provides several styles of scale bars to choose from.

- Click **Alternating Scale Bar 1.**



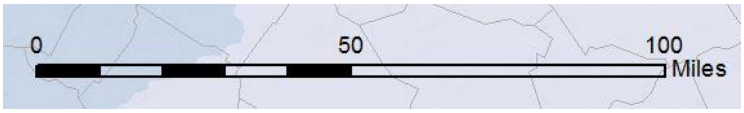
- Check the box next to **Scale to fit page**.
- Click **Properties** button.
- Click the **Scale and Units** tab.
- Under ***Scale***, make the Number of divisions **2** and the Number of subdivisions **5**.
- Under ***Units***, make the *Division Units* be Miles.



- Click the **Numbers** and **Marks** tab at the top.
- Under **Numbers**, make the **Frequency** be “divisions.”
- Click **OK** and **OK**.

The scale bar defaults to a range of 0 – 80 miles and includes two main divisional breaks, one at 40 miles and the other and 80 miles. However, it might look better to adjust this to be 50 miles and 100 miles.

- Click the **scale bar** to activate its handles.
- Click on the middle handle on the right-hand side of the scale bar and drag it to the right until the maximum scale changes to 100 miles.
- Position the scale bar in the lower left corner of the map.
- Save your Map



Step 14 Insert a title

Perhaps one of the most important map elements that your map should contain is a title. If the map reader does not know what the map is displaying, it is not going to be effective.

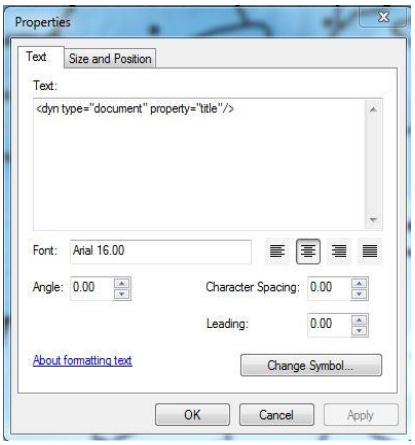
- From the **Insert** Menu, choose **Title**.
- In the Insert Title window, type “Total Snowfall – Superstorm of 93’”.
- Click **OK**.

The title is added to the map. However, similar to the issue with the north arrow, the map color makes the title hard to read. Changing the Properties will improve the legibility of the title.

- Open the Properties of the title by double-clicking on the title.

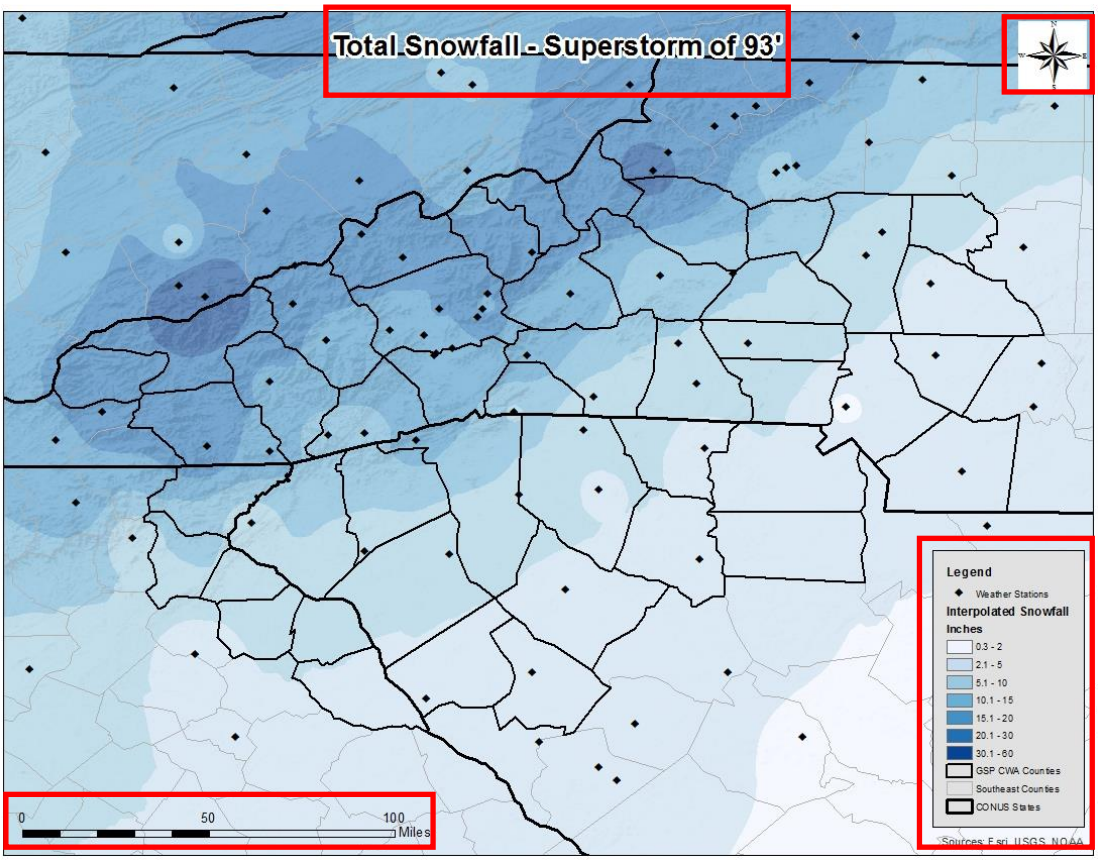
Instead of the title you entered in the previous step, you see this: <dyn type="document" property="title"/>. This is because the title is dynamic text. This title now stored in the Map Documents Properties.

- Click **Change Symbol**.
- In the **Symbol Selector** window, change the font **Size** to 20.
- Make the **Style** Bold. B
- Click **Edit Symbol**.
- In the **Editor** window, click the **Mask** tab.
- Set the **Style** to **Halo**.
- Accept the default Size of 2.0.
- Click **OK** in each of the three open windows.
- Position the title in the upper center of the map.



The title now is more legible and visible on the map.

Your map now contains the four main map elements that will make your map more meaningful to your map audience. Notice too that the map is visually balanced. You should always ensure that your map is not too cluttered and that map elements have enough space around them so that they are clearly visible.



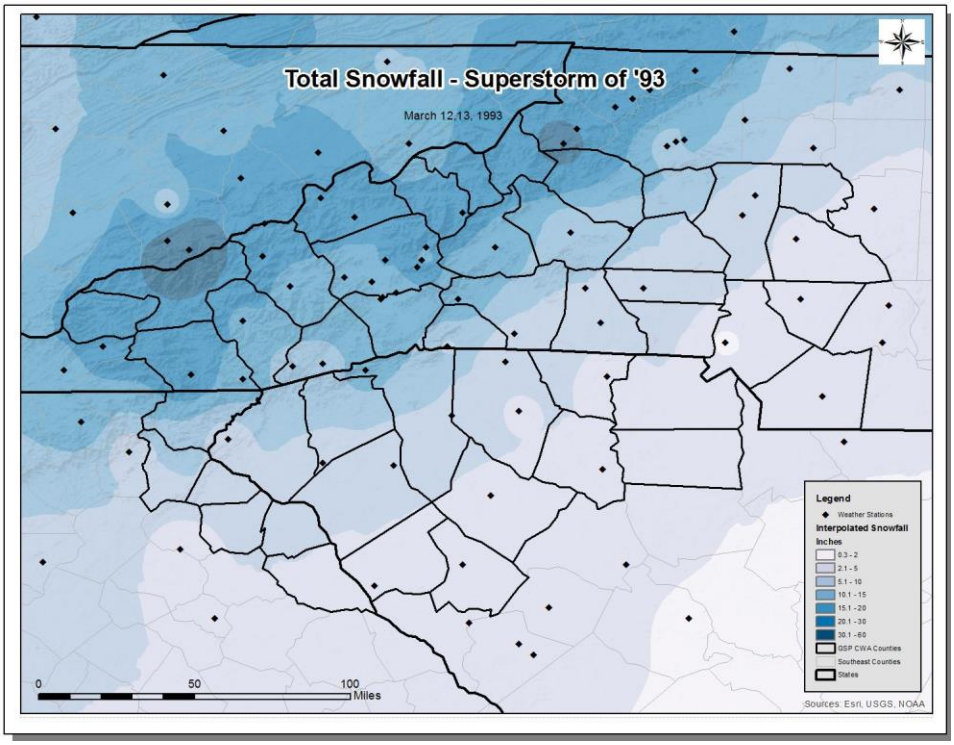
In addition to the main map elements that you just added to your map, there are other map elements that can be useful and add further context and details to your map to increase its effectiveness, such as text, pictures, inset maps, and labels.

Though we have already added a map title, there might be other text-based information that you want to include on your map, such as the map creator or cartographer, the date the map was created, the organization, among others.

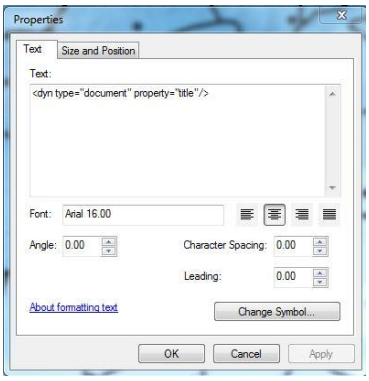
Step 15 Insert basic text

In this step you will add some text as well as some dynamic text to your map.

- Select **Insert > Text.**
- The text will appear in the center of your map.
- Type in "*March 12,13, 1993*" and hit Enter.
- Position the subtitle under the title in the upper center of the map.



- Double-click on the text to open the Properties window.
- Click **Change Symbol**.
- In the **Symbol Selector** window, change the font **Size** to 16.
- Make the **Style** Bold. **B**
- Click **Edit Symbol**.
- In the **Editor** window, click the **Mask** tab.
- Set the **Style** to **Halo**.
- Accept the default **Size** of 2.0.
- Click **OK** in each of the three open windows.



TIP: Another option to using a Halo around the text would be to use a solid white box around the entire title and placing the text on top of the box. The Draw Toolbar contains many of the same tools that you would find in a Microsoft Office program, such as "draw a rectangle". You could then edit the Properties of the box to be white or another color of your choice.

Step 16 Insert dynamic text

- From the **Insert** Menu, choose **Dynamic Text,** and choose **Author**.

When Text is first added to a map, its default location is the center of the map with a word-holder of "Author:" Depending on the size of your map, this could get lost.

- Click on the Text to make it active and drag towards the bottom of your map beside the legend.
- Double-click on the text to open the Properties window.
- After "Author:" replace *<dyn type="document" property="author"/>* with your name.

TIP: Be very careful when clicking on or selecting your map elements. You may think you have selected a particular map element, such as text, when in fact you might select the entire Data Frame. Before you realize it, you might move or delete the wrong map element. Fortunately, you can click the Undo button on the Standard Toolbar.

- Click **Insert**, choose **Dynamic Text,** and choose **Current Date**.
- Position the text to be located above your Author text.

Step 17 Insert an organization logo

A variety of graphical elements can be added to a map, including pictures, logos, charts, graphs, and other objects.

- From the **Insert** menu, choose **Picture**.
- Browse to your ***Exercise4*** folder and click on the ***NWS_Logo.jpg*** file, then click **Open**.
- Resize the logo to make it a similar size to the north arrow.
- Position the logo above the left side of your scale bar, in line with your map design and date text.

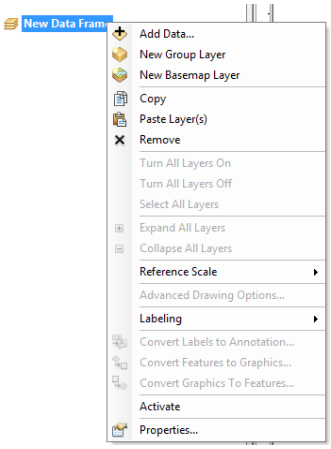
Step 18 Insert an inset map

Inset maps, also referred to as location maps, can be useful for showing the location of your map area in relation to a larger region

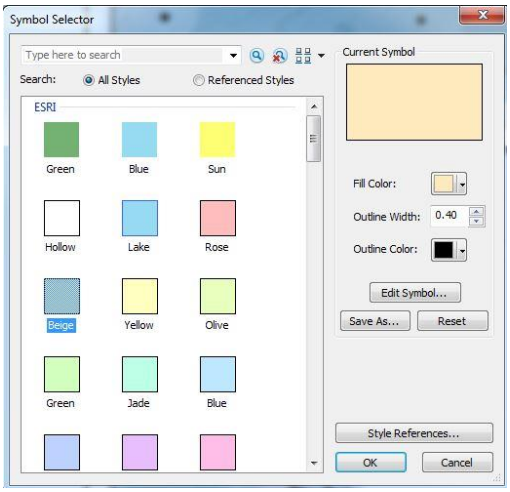
- From the **Insert** menu, choose **Data Frame.**

An empty Data Frame is added to the center of your map. It is now the "active" Data Frame. Notice that the title "New Data Frame" is bolded in the Table of Contents. The title of your other Data Frame, "*Layers*," is not bold, indicating that it is no longer active. An active Data Frame indicates that certain ArcMap functions, such as Add Data, will be applied to that Data Frame only.

- Right-click on the ***CONUS States*** layer in the Table of Contents and select **Copy**.
- Right-click on the **Data Frame** called 'New Data Frame' in the Table of Contents and select **Paste Layer(s).**

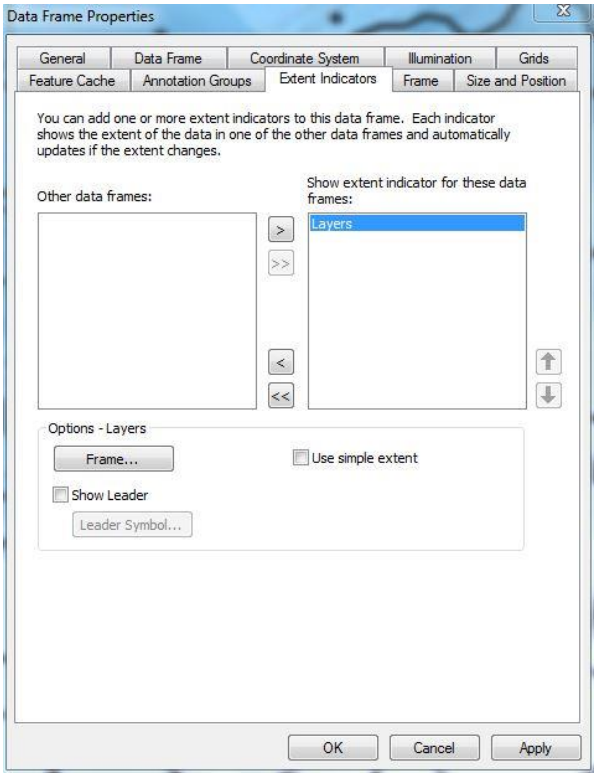


- Open the **Layer Properties** window for **CONUS States** and change the symbology to the predefined option of Beige.



- Click **OK** twice to apply the changes.
- Using the **Zoom In** tool and the **Pan** tool zoom in to the Eastern states.
- Double-click on the **New Data Frame** to open the **Data Frame Properties** window.
- Click the **Extent Indicators** tab.
- Click on the word ***Layers*** in the "Other data frames:" box and click the button.

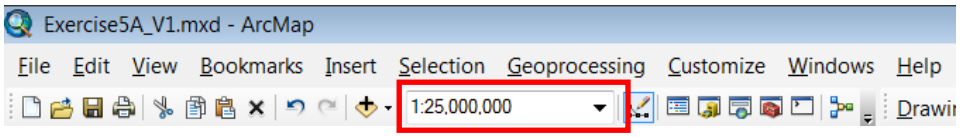
The name *Layers* should now be in the Show extent indicator for these data frames.



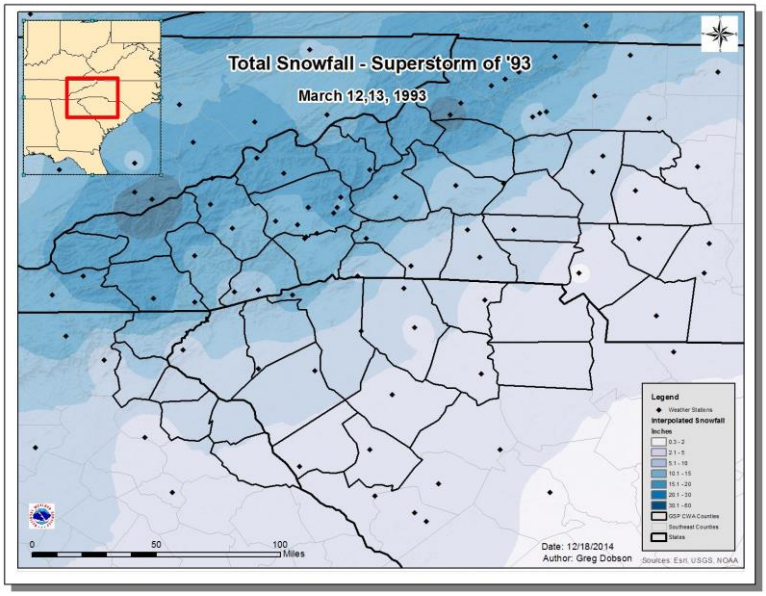
- Click **OK**.

This added a red box to your inset map of the extent of your main map.

- Choose the scale of the **New Data Frame** of 1:25,000,000 by typing this value into the **Scale** box on the **Standard Toolbar**.



- Position the New Data Frame so that it fits neatly in the upper left corner of the map.



Inset maps can have their own map elements such as legends, scale bars, north arrows, among others. For this example, we will not add map elements to the inset map.

- Save your map.

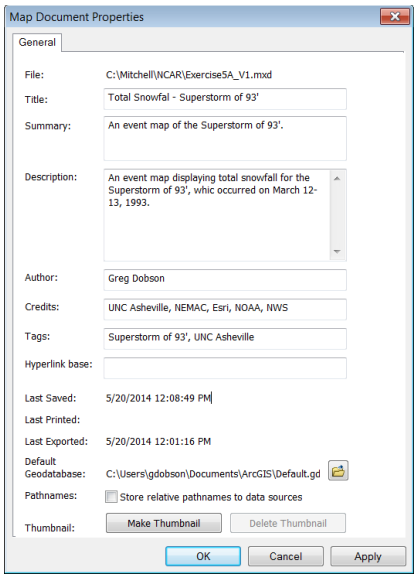
Step 19 Add map document properties

- From the **File** Menu, click **Map Document Properties**.

The Map Document Properties manages several pieces of information pertaining to the map document. This information is stored as *Dynamic Text*. Dynamic Text is text stored in the properties of the map.

- Type a brief Summary of the map.
- Type a brief Description of the map.
- Use your name as the Author.
- List any Credits, such as the NWS, NOAA, or Esri, as well as your organization.
- Provide Tags that could be used to search for your map online.

The Hyperlink base is the only map property that does not have to be populated. Your Map Document Properties should closely match the following, though you could customize this for your own organization:



- Click **Apply** and **OK** to close the Map Document Properties.

Disseminating and Sharing Your Map

Now that you have completed your map, there are several options for sharing your maps with others. The simplest option would be to print a hardcopy of your map directly from within ArcMap. However, in this digital age, hardcopy maps are not commonly distributed.

Step 20 Exporting your map as a digital map file

When you have completed a map, you may want to share it digitally, either by posting to a website, sharing across social media platforms, or perhaps as an e-mail attachment.

- From the main **File** Menu, choose **Export Map**.
- In the Export Map window, browse to your working directory to save the map.
- Enter the **File** name of ***"<your name>_Exercise4_EventMap".***
- Set the **Save** as type to **JPEG**.
- Set the **Resolution** to 100 dpi.
- Click **Save**.

Notice there are several options for exporting your map, including file type and resolution. Additionally, you can choose to export the map as an Adobe Illustrator (AI) file for further enhancement in an Adobe graphical editing program.

Step 21 Sharing your map as a Map Package

In addition to disseminating and sharing the map itself, it may be necessary to share the ArcMap map document file and all its contents, including the actual GIS data used to create the final map. This enables another user to make edits to the map in ArcMap, change the symbology, or add additional data. Traditionally this was accomplished by placing each GIS layer into zip files along with the ArcMap map document file. However, Esri has developed a new way of doing this called *sharing a Map Package.*

Now you are now ready to create the actual Map Package.

- From the **File** Menu, choose **Share As** and then **Map Package**.
- Under **Map Package**, choose **Save** package to file and browse ***C:\exerciese4*** directory to save the file.
- Check the box for **Include Enterprise Geodatabase** data instead of referencing the data.

This last option ensures that the actual data will be included with the map document file.

- In the upper-right of the Map Package window, click **Share**.

Depending on the size of the GIS data and the map document file, this could take a few minutes.

- When the Map Package process has completed, click **OK**.

You now have a file than contains everything anyone would need to open and edit your ArcMap document in their own ArcMap. To do so, a user would simply open a blank ArcMap document file and from Windows Explorer, drag this map package file into the Table of Contents.