

MAPPING EXERCISE

Map Labeling

In this exercise, you will label a map of the state of South Carolina utilizing the cartographic conventions for the use of lettering discussed in your textbook. In general, a label is any text that names or describes a feature on the map, including proper names (Denver, Arizona, McDonough County), generic names (hospital, marsh), descriptions (hazardous, residential), or numbers (11,500 placed near a mountain to indicate its elevation).

In this exercise, you will:

- ✓ Use dynamic labeling
- ✓ Use interactive labeling
- ✓ Set a reference scale
- ✓ Adjust label properties
- ✓ Define classes of features
- ✓ Label feature classes
- ✓ Adjust the size of a label background symbol
- ✓ Remove duplicate labels
- ✓ Convert labels to annotation
- ✓ Create a map layout
- ✓ Insert a north arrow
- ✓ Insert a scale bar

Terminology and Labeling Basics

Effective use of labels on a map is an essential part of mapping. It should not be an afterthought in the mapping process. In addition to identifying features on the map, labels also help the cartographer reinforce the visual atmosphere of the map as well as reinforce the hierarchy of features on the map.

ArcMap uses the term **font** to identify typefaces. Fonts are the complete set of characters of a typeface. Fonts can be very generally divided into two categories: **serif** and **sans serif**. **Serif** typefaces have finishing strokes at the end of the strokes of the letter. **Sans serif** typefaces do not have these finishing strokes.

Serif typefaces	Sans Serif typefaces
Calisto	Arial
Courier New	Calibri
Garamond	Tahoma
Times New Roman	Verdana

Figure 1. Examples of serif and sans serif typefaces.

All letters begin on a **base line**. The height of lowercase letters is the **x-height**. Portions of letters that fall below the base line are called **descenders** and portions of letters extend above the x-height are called **ascenders**.

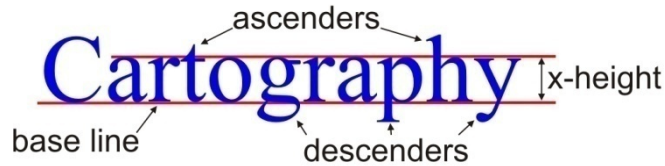


Figure 2. Key reference lines of lettering.

Considerable variation in label appearance can be achieved by modifying properties of type. Use these attributes to differentiate feature types and to reinforce a hierarchy of features on the map.

- **Size.** It should come as no surprise to you that text size adjustments are used to differentiate between features of different sizes (e.g., large cities and small cities) as well as to differentiate between features of different importance (e.g., states, counties, cities). In ArcMap text size is measured in **points**. There are 72 points in an inch.
- **Weight.** Some typefaces include light and heavy variants. In these, the characters are thinner or thicker than the normal version of the typeface.
- **Width.** Some typefaces include regular, condensed and extended variants. In this context, width refers to the width of the individual letters.
- **Form.** The two most commonly used forms are **roman** (upright) and **italics** (slanted). Hydrologic features (rivers, lakes, etc.) are often labeled using italics.
- **Case.** Prominent features are sometimes displayed in all capital letters.
- **Spacing.** You may adjust both the spacing between characters (called character spacing in ArcMap and *kerning* in printing) as well as between lines (*leading*).
- **Color.** Color is a good way to differentiate between feature types. When using color, remember that there are some natural associations between color and feature—like blue and water.

When placing **point feature labels**, the preferred position is next to the point. Have the label either begin or end at the point and shift it either up or down so that it is not horizontally aligned with the point. When point features, such as cities, are on a coast, place the label the water side of the coast. When a point is along a linear feature such as a river, place the label on the same side of the linear feature that the point is on.

When placing **line feature labels**, place the label *along* and *above* the line. If possible, place the label along a horizontal stretch. If such a stretch is not available, curve the label along the feature. Use the **New Splined Text** button on ArcMap's Draw toolbar to draw a curved label. Make the curve gentle, even for features with complex curves like a meandering river. Do not use character spacing to spread the label along a long linear feature. Instead, repeat the label along the length.

When placing **area feature labels**, place the label entirely within the feature if possible. It is common to use character spacing to spread the label across the feature. Doing so allows the label to represent the extent of the area. Note that it is easy to introduce *too much* character space and that spacing works better with uppercase letters than lowercase letters. Use good judgment when using character spacing. When adding labels for states, place the label along the state boundary (rather than extending the label across the width of the state).

Minimize use of **leader lines** and avoid using **callout boxes** in labeling. A leader line is a simple line connecting the label to the feature. In portions of the map with multiple features and labels, it may be necessary to offset a label and connect it to the feature with a leader line. Use this technique sparingly as multiple lines add clutter to the map. Callout boxes resemble “text balloons” used in comic strips. In mapping they are dominant graphic features that focus too much attention on the label.

You may use **drop shadows** and **halos** to emphasize certain labels or increase legibility. Halos are particularly useful in situations where labels are drawn on top of background map features like lines and fill that make it difficult to read the label.

For an excellent online tool to explore effective use of typography in maps, visit the TypeBrewer (<http://www.typebrewer.org>).

Getting Started

- Start ArcMap (**Start All Programs >ArcGIS >ArcMap**); if there is an icon on the computer desktop, you can start ArcMap by double-clicking it. You will be shown a window asking whether you want to open a new empty map, a template, or an existing map.
- Make sure the **An existing map:** radio button is selected and click OK. If you did not see this window, click **File >Open**.
- Browse to where you saved the **typography.mxd** project file and open it. The project will open a map of the state of South Carolina in the Data View. Note the number of layers in the table of contents. Also note that the layers have [label] and [no label] tags. When automatically labeling features on the map, you will use only the layers with the [label] tag.

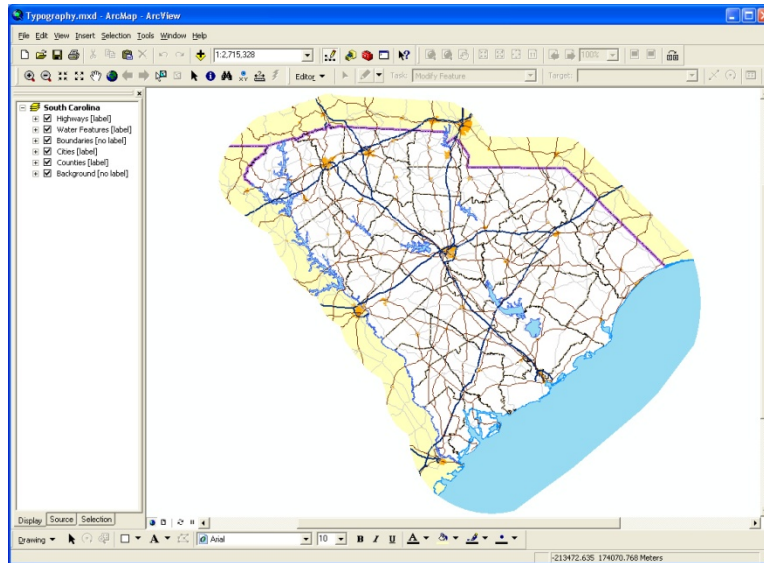


Figure 3. South Carolina.

On the map you will label states, counties, select cities, and major water features (the complete list is included at the end of the exercise). In addition, you will add a graphical scale, a north arrow, and cartographer information.

Please **do not change the attributes of any of the map layers**. This exercise is intended to deal **only** with labeling.

- Before you begin the exercise, create a bookmark of your map (**View >Bookmarks >Create**). You may accept the default name of Bookmark 1 or call it something more meaningful. You will zoom in and out of your map several times during this exercise. Having a bookmark will allow you to easily return to this display scale.

It may be useful to refer to an existing map of South Carolina when progressing through the exercise. To see examples of similar maps you may refer to an atlas, the following websites, or do an online search for additional maps:

- http://www.lib.utexas.edu/maps/south_carolina.html
- <http://www.sitesatlas.com/Flash/USCan/static/SCFH.htm>
- <http://www.sciway.net/maps/cnty/>

Labeling in ArcMap

In a general sense, a label is a text element added to a map to provide information about map features. In ArcMap, labeling has a specific meaning. Labels in ArcMap are text elements found in the attribute table that are automatically placed on the map. ArcMap labels are not individually editable nor can you select individual labels. You may edit the properties for all the labels of a layer in the Properties menu for that layer (right-click the layer name and select **Properties** from the context menu).

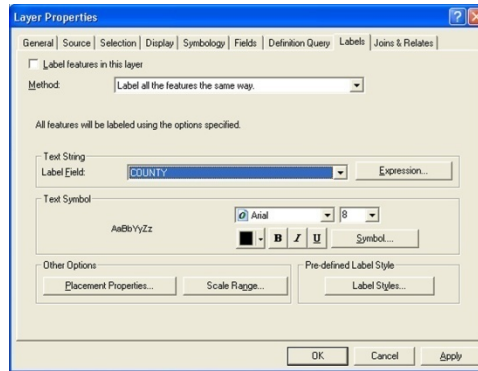


Figure 4. The Labels tab of the Properties window.

In addition to defining the font, size, weight and color properties of your labels, you can also adjust more properties of your labels by clicking the **Symbol** button. In the Symbol Selector window, click the **Properties** button to open the **Editor** window. Click the Formatted Text tab to adjust the character and word spacing, the character width, leading, text position and case. Click the Mask tab to create a halo around your text.

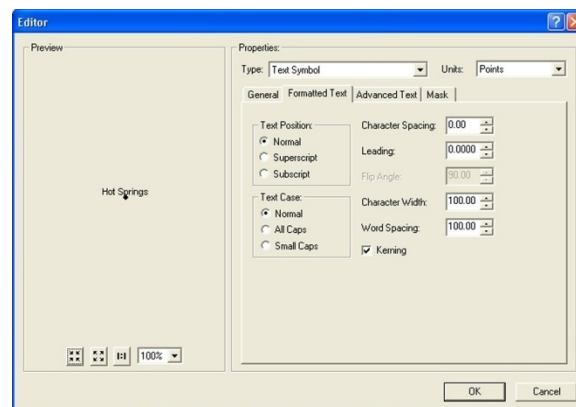


Figure 5. Formatted text properties.

Labels are automatically added to the map in one of two ways: **dynamic labeling** or **interactive labeling**. In dynamic labeling, all feature labels in a layer are added at once. ArcMap will automatically adjust the placement of the labels so that no labels overlap. To dynamically label a feature, right-click the layer name in the Table of Contents and select Label from the context menu.

In interactive labeling, you label features one at a time in positions that you choose. Select the **Label** button from the Drawing toolbar. You may need to press the menu arrow next to the New Text button (Figure 6) to display the Label button. Please be aware that interactive labels are not automatically adjusted to prevent overlaps.

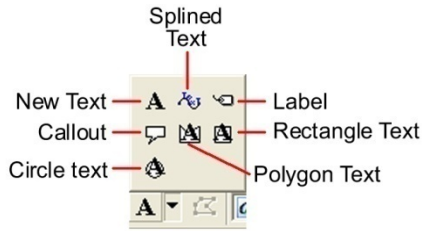


Figure 6. The various text tools.

Not all the labels that need to go on your map can be added by dynamic or interactive labeling. You will need to manually enter some of the labels on the map. To manually enter text, use **Insert >Text** from the menu or the **New Text** button on the drawing toolbar (Figure 6). To place text along curved path (e.g., along a river or arcing road), use the **New Splined Text** tool. When using this tool, you first digitize the path that the text will follow and then you enter the text.

i When adding text and symbolizing features in ArcMap, you specify size attributes of features these items. For example, you may choose to have a particular text element be 10 points tall. A reference scale simply is the map scale at which this text element will be the size you specify. When the reference scale is set, text items will be larger if you zoom in and smaller if you zoom out. If you do not set a reference scale, the item will always appear the same size regardless of whether you are zoomed in or out.

Before you begin labeling, you should set the reference scale for the map.

If you zoomed in or out on the map, you need to return to the original display scale. Click **View >Bookmarks >[your bookmark]** to return to the original display scale.

- Set the reference scale by **right-clicking** the data frame (South Carolina) in the Table of Contents. Select **Reference Scale** and **Set Reference Scale**.

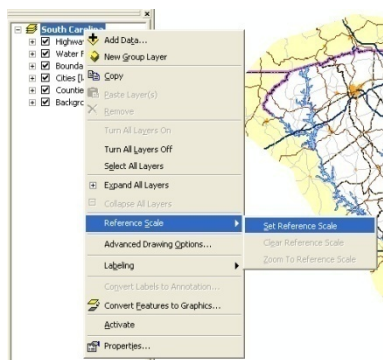


Figure 7. Setting the Reference Scale.

Zoom in and out of your map. Note how the line widths get proportionately larger or smaller.

Return to the original display scale by selecting returning to your bookmark. Now you are ready to label the map features.

Although a list of features to be labeled is included at the end of this lab, you do have the ability to easily label most of the map features within ArcMap itself.

- The first layer in the Table of Contents is Highways. There are three highway types on the map: Interstate highways (blue lines), U.S. highways (brown lines), and State highways (gray lines). You will label only the Interstate and U.S. highways. **Right-click** the layer and select **Label Features**.

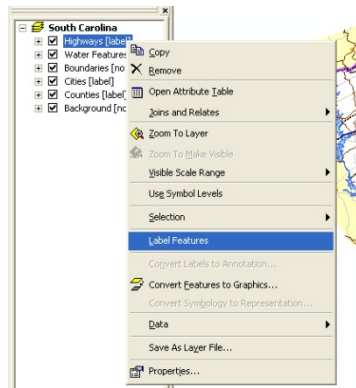


Figure 8. Use "Label Features" to toggle the labels on and off.

When you added the labels, you may have noticed several things about the labels that are not ideal for your map. First, highways in the United States are typically labeled using specific shield designs (Figure 9). Second, several highways have multiple labels, sometimes very close to one another. Finally, some labels at the edge of the mapped area appear to be cut off (Figure 10). The latter situation occurs because the mapped area is *clipped* to one of the map layers. When clipping is done, features—or portions of features—extending beyond the edge will not be displayed.



Figure 9. Interstate, U.S., and State highway shields (state highway marker designs vary by state).

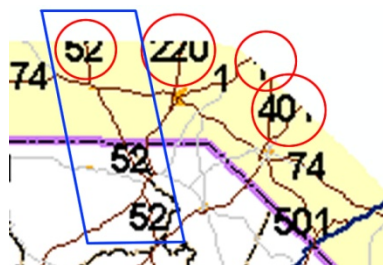


Figure 10. Multiple labels and labels cut off by clipping.

Let's deal with the shield symbols first.

- Right-click the Highways label and select **Properties**. When the Layer Properties window opens, select the **Labels** tab.
- Note that the Method is **Label all the features the same way**. The Label field should be Hwy.
- The Text Symbol area allows you to change the text properties (color, weight, font, etc.). To change the background of the label to a highway shield, click the **Symbol** button.

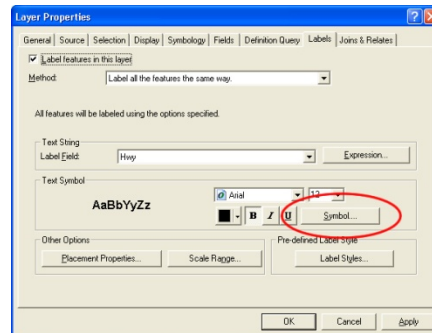


Figure 11. Use the Symbol button to select symbol types and/or edit symbol styles.

- Scroll down until you see the **U.S. Route HWY** symbol. Select it and press **OK**.

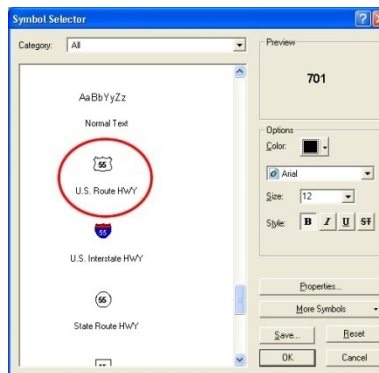


Figure 12. U.S. Highway shield symbol.

Notice that all the labels on the map are now symbolized with the shield. Remember, however, that you are labeling Interstate, U.S., and State highways. ArcMap allows you to select different symbol types within a layer. The process is a bit more complicated but it can be very effective.

- Before you change the symbol types, **open the attribute table for the Highways layer** (right-click Highways and select Open Attribute Table). Note the rightmost field, **Type**. This field categorizes the highway types: Int (for interstates), US, and State.
- Close the Attribute table and reopen the Layer Properties window, Labels tab.
- Change the **Method**: to **Define classes of features and label each class differently**.

The window changes to reveal options for defining the classes.

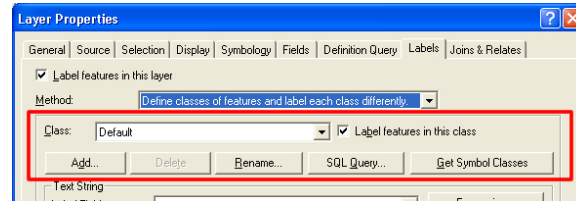


Figure 13. The Label Class tools.

You will create a label class for each of the highway types.

- Click the **Add** button and enter the class name of **Interstates**. Click **OK**.
- Repeat this procedure once more, creating the **US** class.

In the drop-down menu for Class, you will now see three classes: Default, Interstates, and US.

- Select Interstates.

You now need to specify which records will have the Interstate Highway Shield symbol. To do this, you will do a query.

- Click the **SQL Query** button. A new window appears.
- Double-click “Type” to place it in the query box in the lower half of the window.
- Next, click the = button.
- Next, click the **Get Unique Values** button. A list appears above the button showing all three highway types.
- Double-click ‘Int’ to place it in the query box. Your window should look like the following:

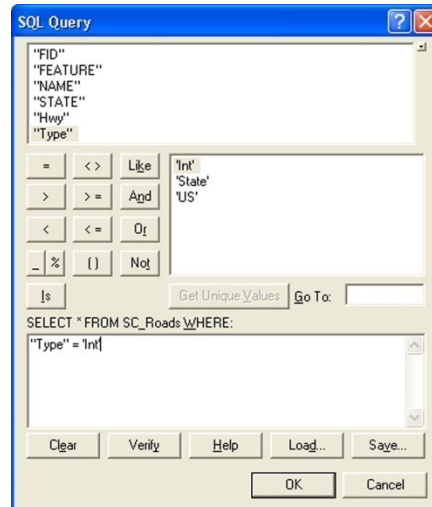


Figure 14. The SQL Query window.

You can also type the query in the window without clicking on the field names or buttons.

- Click **OK**. You now return to the Layer Properties window.
- Making sure the Label Field is Hwy, click the **Symbol** button.
- Scroll down until you find the **U.S. Interstate HWY** shield, select it and press **OK**.
- Before moving to the next label class, make sure the **Label features in this class** box is checked.
- Repeat the process for the **US** class, making sure the **Label features in this class** box is checked.
- Before displaying the new symbol classes on the map, switch to the **Default** class and **uncheck** the **Label features in this class** box. Doing so will ensure that any feature not in the Interstates or US class will not be labeled.
- Click **Apply** to register your changes.

You may have noticed that they symbols are a bit too large for the map. Ordinarily changing the symbol size is easy to do: simply change the label size in the Text Symbol portion of the Labels tab. The problem with doing this is that changing the size changes *only* the font size, *not* the shield size. If you want to change the shield size, you need to do the following steps:

- With the appropriate label class selected (Interstates, US, State), click the **Symbol** button.
- In the Symbol Selector window, click **Properties**. The **Editor** window appears.
- Select the **Advanced Text** tab.

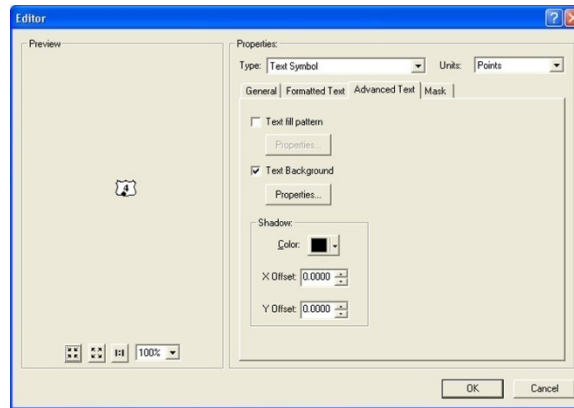


Figure 15. The Symbol Editor window.

- Beneath Text Background, click the **Properties** button. You will now see a **Marker Text Background** tab.

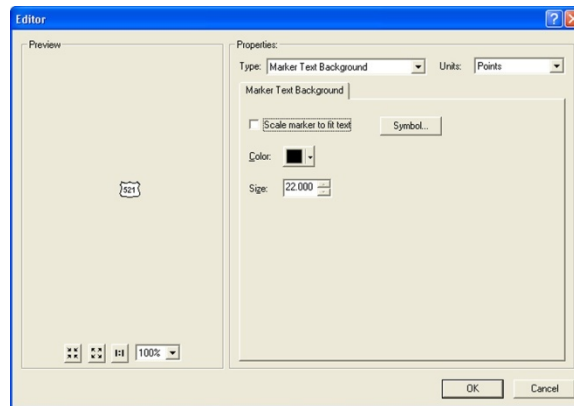


Figure 16. Marker Text Background properties.

- Use the **Size** property to change the symbol size. Note how the symbol changes in the preview pane. You may need to go adjust this symbol size several times as you make changes to the text size in the symbol. Always check the symbols *on the map* before deciding on a final size.

i The **scale marker to fit text** command is very useful in certain situations. When selected, the background symbol will increase or decrease in size as you make changes to the symbol text (e.g., making the text larger or smaller). You will not use it here as the highway designations vary in width from one digit to three. Three-digit highway designations will end up with noticeably larger shields than single-digit designations. You should have all shields be the same size in your map, so use the size command instead of scaling.

- Next, add the labels for the **water features**, **cities** and **counties**. Right-click each layer in the Table of Contents and select **Add Labels**.

- Adjust the label properties for so that the labels for each layer are distinguishable from those for all other layers.

When your map contains features with multiple parts, ArcMap allows you to control how you wish the software to handle labeling these features.

You may have notice that when you labeled the Counties layer, several Beaufort labels appeared (Beaufort County is in the southern part of the state along the coast). This county polygon is comprised of seven different polygons. You need only one label for this county.

- Go to the Labels tab of the Layer Properties window for the **Counties** layer. Click the **Placement Properties** button. The Placement Properties dialog opens.
- Change the Duplicate Labels option from Place one label per feature part to **Remove duplicate labels**.

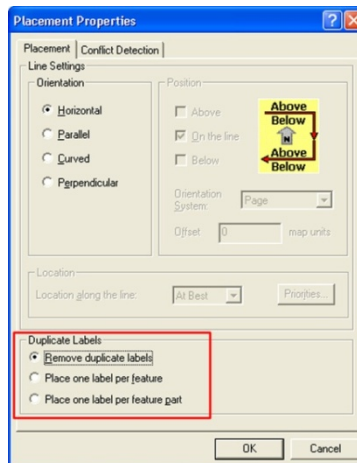


Figure 17. Placement Properties. Here you can control orientation, duplication and placement for overlapping labels.

So far you have used dynamic labeling to add the text elements. When using dynamic labeling in ArcMap, there are important things you need to keep in mind:

- Label positions are generated automatically
- Labels are not selectable
- You cannot edit the display properties of individual labels



In addition to the recommendations found on pp. 2-3, consider the following additional guidelines:

- Use no more than two font families in the map. Use differences in size, weight, width, form, case, spacing and color to provide variation among labels.
- Varying size, weight, and case of labels helps to establish a visual hierarchy among features. Larger and/or more important features should have labels that reflect this importance.
- Cultural features (political units, transportation, etc.) commonly are labeled with sans serif fonts.
- Physical features (water features, mountains, etc.) commonly are labeled with serif fonts. It is common to use blue, italics, serif fonts for water features.
- Avoid having lines pass through labels whenever possible. If it is not possible to prevent a line and label from overlapping, avoid having vertical letters (or letter parts) overlap the line. Variations in label color help to provide distinction between label and line.

To (a) select, (b) move and/or (c) edit properties of individual labels **you must convert them to annotation** (i.e., individual text elements).

- Prior to converting the labels, return to the bookmark you created at the beginning of the exercise (**View >Bookmarks >[your bookmark]**).

You may convert the labels to annotation one layer at a time or for the entire map. You will convert all of the labels at once.

- **Right-click the data frame** (South Carolina) in the Table of Contents and select **Convert Labels to Annotation** (be careful not to click the Convert Features to Graphics item). A context window appears. You will need to change the following two items:
- Have “Store Annotation” set to **In the map**. This feature keeps the newly-created annotation stored within the map. Using the “In a database” stores the text in a separate file.
- Have “Create Annotation For” set to **Features in current extent**

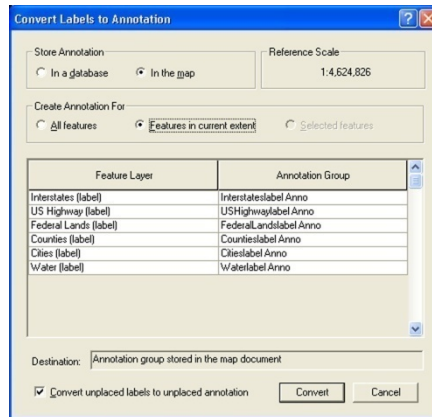


Figure 18. Converting your labels to annotation.

Be forewarned that converting the labels to annotation severs the control over the labels that you have using the layer's properties window. Your labels will become individual text elements. If you wish to do so individually or you must delete the labels and go through the process of adding them again as you did previously.

- Press the **Convert** button to create the annotation.

You now have annotation on your map. You may select, move, and edit the properties of these items individually.



A word of warning: when you placed all of your labels on the map, some may have disappeared because multiple labels were being drawn in the same space. As a result, you will need to double-check your map to see if all of the labels are present and re-add a label if necessary.

If you need to add an individual label, use the **Label** button on the Draw toolbar to re-add a label (see Figure 5), **turn off** the layers in the Table of Contents **except** the layer you wish to label and click on the feature. Select the **Place label at position clicked** button and make sure **Use properties set for the feature layer** is selected. When you put your mouse over a feature, a small preview box will appear showing you the label value that you are about to add. Remember to turn all your layers back on when you are finished.

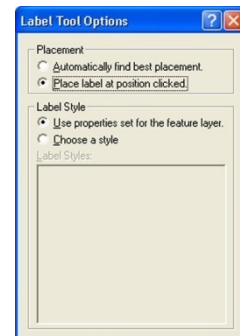


Figure 19. Label Tool Options.

- Refer to the list at the end of this document. As stated previously, there are a handful of labels you will need to add to the map manually. These items were not part of any map layer.
- Continue to adjust your labels as necessary until you are satisfied with their properties and placement. **Be sure to adjust the placement of any labels that extend beyond the clipped area.**

Creating the layout

Once you have all of the labels in their final format and location, you create a layout of your map to export.

- **Switch to the layout view.**
- Using the **Page and Print Setup** menu item (right-click outside the page in the layout view to get the context menu where this is located), make sure the layout is oriented as **Landscape** rather than portrait. Also make sure the **Use Printer Paper Settings** and **Show Printer Margins on Layout** boxes are checked.
- By default, the data frame has a border around it. **Turn off this border.** Right-click the data frame and select **Properties**. Next, select the **Frame** tab and switch the **Border** to **<None>**.
- Next, reposition the map so the right edge of the mapped are (not the entire data frame) is near, but inside, the right margin. Doing this has freed up space in the lower left-hand portion of the layout.
- **Insert a neatline (Insert >Neatline)** with the following properties: Gap: **5**; **Place Inside Margins**; Roundness: **0%**; Thickness: **2 points**.
- Add the **map title (Insert >Title)**. Given the subject, **South Carolina** is sufficient. Choose a font size and weight that is appropriate. Place the title in the empty space to the **left** of the mapped area.
- Below the map title:
 - Add a **north arrow (Insert >North Arrow)**
 - Add a **scale bar (Insert >Scale Bar)**. Select **Alternating Scale Bar 1** and assign the following properties:
 - Division units: **miles**
 - Label position: **below bar**
 - When resizing: **adjust width**
 - Division value: **50 miles**
 - Number of divisions: **3**
 - Number of subdivisions: **0**
- In the bottom right-hand corner, inside the neatline, add the cartographer's information (two lines, right-aligned):

Your name
Today's date

To print a hard-copy of the map:

- Click on the **print button** or select **File >Print** (you may also print preview using **File >Print Preview**)

To create a PDF document (for digital submissions):

- Export the map by selecting **File >Export Map...**
- Change the **Save as type:** to **PDF (*.pdf)**.
- Change the file name to include your name. The Resolution should be **300** dpi and the **Output Image Quality** should be **best**. Keep these settings unless directed otherwise.

Features to Label

States. These are not labels—you must manually add them. Place the label *along the boundaries*, not across the entire area of the state.

South Carolina

North Carolina

Georgia

Counties

Abbeville	Chesterfield	Hampton	Oconee
Aiken	Clarendon	Horry	Orangeburg
Allendale	Colleton	Jasper	Pickens
Anderson	Darlington	Kershaw	Richland
Bamberg	Dillon	Lancaster	Saluda
Barnwell	Dorchester	Laurens	Spartanburg
Beaufort	Edgefield	Lee	Sumter
Berkeley	Fairfield	Lexington	Union
Calhoun	Florence	McCormick	Williamsburg
Charleston	Georgetown	Marion	York
Cherokee	Greenville	Marlboro	
Chester	Greenwood	Newberry	

Cities (Major cities are in bold)

In South Carolina:

Abbeville	Edgefield	Newberry
Aiken	Florence	North Augusta
Allendale	Gaffney	Orangeburg
Anderson	Georgetown	Pickens
Bamberg	Greenville	Ridgeland
Barnwell	Greenwood	Rock Hill
Beaufort	Greer	Saint George
Bennettsville	Hampton	Saint Matthews
Bishopville	Kingstree	Saluda
Camden	Lancaster	Spartanburg
Charleston	Laurens	Summerville
Chester	Lexington	Sumter
Chesterfield	Manning	Union
Clemson	Marion	Walhalla
Columbia	Mauldin	Walterboro
Conway	McCormick	Whitmire
Darlington	Moncks Corner	Winnsboro
Dillon	Mount Pleasant	York
Easley	Myrtle Beach	

*In North Carolina: **Charlotte***

*In Georgia: **Augusta, Savanna***

Highways*Interstate Highways*

16	77	185
20	85	385
26	95	

U.S. Highways

1	64	220	401
15	74	221	441
17	76	276	501
21	78	278	521
23	80	280	601
25	123	301	701
29	176	321	
52	178	378	

Water Bodies

Atlantic Ocean (not a label, must be typed).	Lake Keowee
Savannah River (along the Georgia-South Carolina boundary)	Lake Marion
Hartwell Lake	Lake Moultrie
J. Strom Thurmond Lake	Lake Murray
Lake Greenwood	Lake Wylie
Lake Jocassee	Richard B. Russell Lake
	Wateree Lake

Exercise Questions

1. What is the difference between *serif* and *sans serif* typefaces.
2. How many points are in an inch?
3. How do you adjust the character spacing and leading?
4. How do you place a halo around your text?
5. What does the *splined text* tool do?
6. How do you ensure that labels will increase with size as you zoom in (or decrease in size as you zoom out)?
7. How do you convert automatic labels to annotation for a map layer?
8. How do you create two different label types from the *same field* of a layer?
9. How do you change the size of the *background* of a label (e.g., the shield of a highway symbol)?
10. How do you label a feature with multiple parts (e.g., island countries or highways with multiple segments) so that the feature has only one label?