Introduction to GIS: Creating a Map from Scratch

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Adding Data	• Add Data to the Map • Rearrange the Drawing Order
Navigating ArcMap	• Zoom, Pan and Bookmarks • Attribute Tables

This tutorial will enable you to use a popular and powerful GIS tool, called ArcMap, to create your own simple map. You will become oriented with the components of the ArcGIS interface, bring in several types of GIS data, add a basemap, and learn useful tools for moving around in a map and learning more about your data.

Data for this tutorial are stored in the Data subfolder of the IntroToGIS folder, which you should have saved on your local machine. The file path referenced in this tutorial is assumed to be D:\IntroToGIS\Data.

ArcMap

ArcMap is a module of ArcGIS that allows you to investigate, manipulate, analyze and create spatial data. ArcMap allows you to create maps using any number of dataset combinations. This is the application you will probably use most frequently to create new datasets, maps, and analysis for your project.

The Map Document

In ArcMap, a map document is a file containing a map and display properties. Map documents are constructed using various data but do not contain the actual datasets themselves. A map document is just a text file that contains the path to your GIS dataset.

You create, edit and analyze data in ArcMap, and the map document allows you to save the unique combination of data and symbology that you are working with. When you delete a map document, you are only deleting this combination of data and symbology, *not* the actual data records.

TIP: ArcGIS is a very context oriented program, and lots of tools, commands, options, properties, and so on can be accessed by right-clicking on part of the window. So if you can't remember quite where to go to do something, try right clicking around until you find it!

TIP: In ArcGIS, it is typical that there are several ways to do things. When possible, the tutorials will present multiple ways of doing the same task, such as adding a basemap, so you become acquainted with different ways of finding things.

Option 1. Start ArcMap by going to the Start menu > All Programs > ArcGIS > ArcMap 10.3.1.

Option 2. If continuing from the previous tutorial, click the ArcMap button on the ribbon in the ArcCatalog window to open ArcMap.

At the Getting Started window, select Blank Map and click OK to open an empty map document

Data Frames, Layers, and Basemaps

The important features of the ArcMap window are shows in Figure 1. The main workspace in ArcMap is known as the Data Frame. Once geographic features are added to the Data Frame, they are displayed as a layer. A layer is a collection of features of the same geometry type. The geometry type used to represent an object depends on the amount of detail that needs to be shown—the same object may be represented as a polygon in one layer and a point in another layer. A city, for instance, could be represented as a point with a unique location in a country or as a polygon with a boundary and an area.
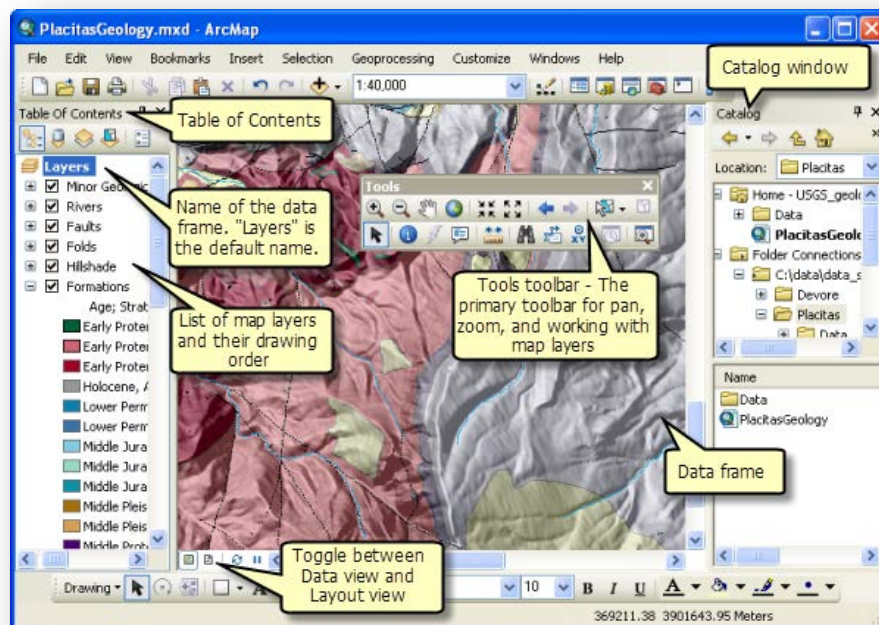

Figure 1. Basic features of the ArcMap window.

The layers are drawn onto the map according to their order in the Table of Contents, which shows up on the left side of the ArcMap window. Layers at the top of the list will draw on top of layers beneath it, as Figure 2 illustrates. In the Table of Contents (TOC) for your empty map, you will see a data frame icon 🥞 with the default name, Layers. There is nothing in the data frame yet, so nothing else is shown.
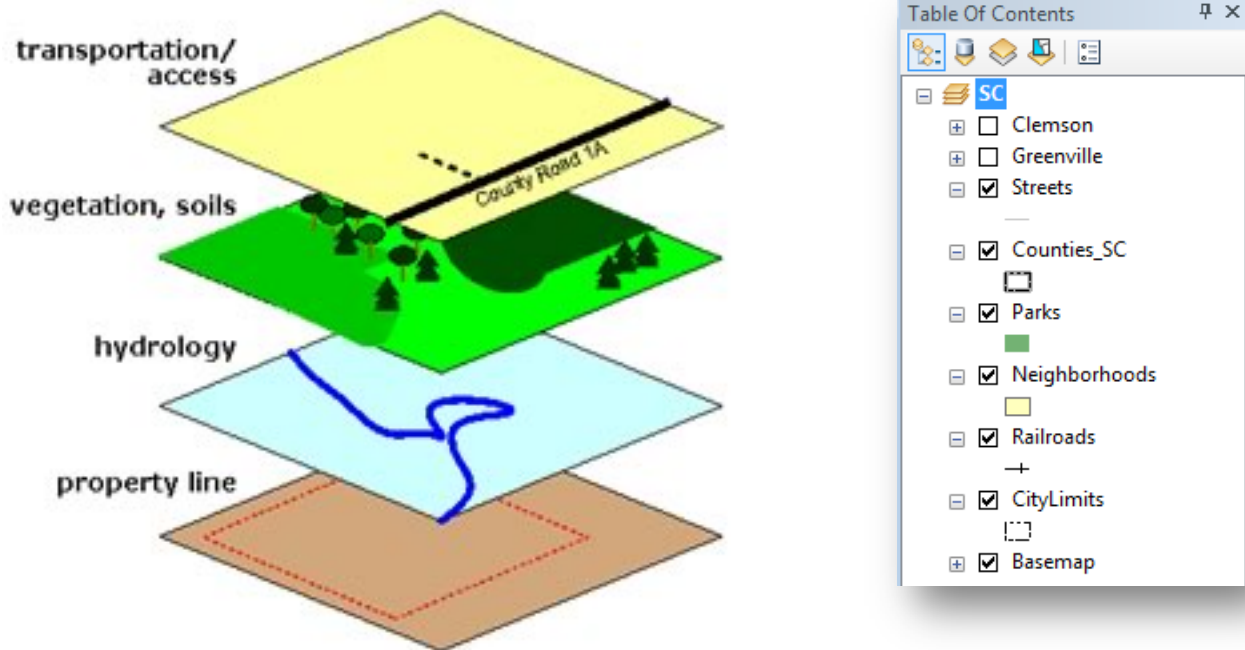

Figure 2: Conceptual diagram of map layers; Table of contents from a sample map.

Let's begin by adding a basemap to the document. A basemap is the bottom-most layer in the map, and all other datasets are drawn on top of the basemap. In ArcMap, several built-in basemap styles are available for your use. Note that the basemap is accessed from the web, and may slow down the drawing of your map as you change the zoom or pan around.

TIP: If you see the globe in the lower right corner of the window spinning, don't click anything in the program, or the program may freeze completely and crash!

1. Click File > Add Data >Add Basemap. A window opens where you can select the basemap style. Click the cancel button to close the window.

2. Click the inverted triangle next to the Add Data button (the plus sign over a diamond), and choose the Add Basemap option.
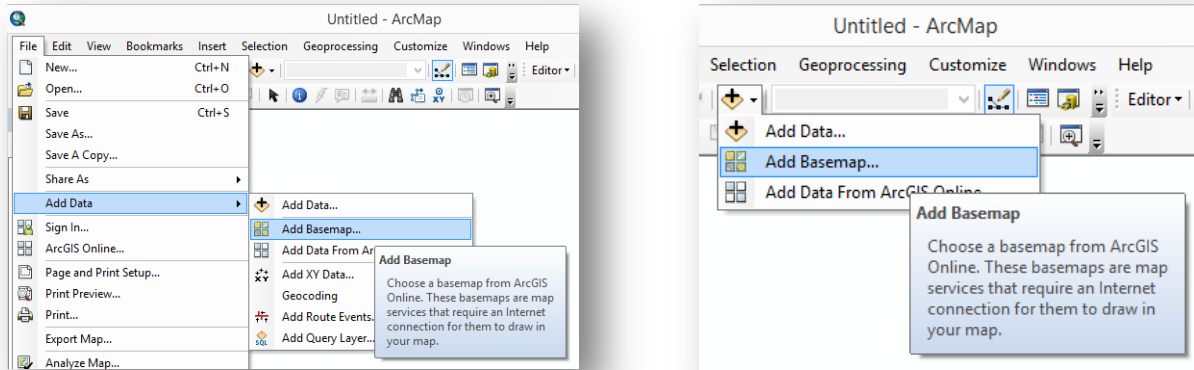
Figure 3. It's common in ArcMap to be able to perform tasks in multiple ways, such as adding a basemap.

3. Examine the options for basemaps. Several styles are probably familiar, such as Streets and Imagery, which are similar to those used in Google Maps. Click the Streets style to select it and click Add.

4. The Streets basemap will display in the data frame zoomed out to show the full extent of the map. Notice that the TOC now shows a layer called Basemap with a sublayer called World Street Map.

A map document can have multiple data frames, which may be useful for creating maps of different cities or at different scales which you want to display next to one another in the final product. For practice, let's rename the data frame to something more meaningful than Layers.

5. Right click on the name of the data frame (Layers) to see the available options. Select Properties.

6. Select the General tab, if not already selected. Change the Name of the data frame to South Carolina. Click OK to accept the changes.

Navigating Through the Map

There are several tools we can use to navigate around the map document. (Note that they function exactly the same way as in ArcCatalog!) Now you will use them to take a look at the basemap in more detail.

1. Click the Zoom In button (🔍) on the main toolbar. Click anywhere on the map and you will incrementally zoom in toward where you clicked.

2. Click and drag in the data frame to draw a box. The map document will zoom in to that area.

3. Click the Zoom Out button (🔍). Click once to incrementally zoom out, then try drawing a box and see the result.

4. The Pan tool allows you to move around the map without change the scale. Click the Pan button, ( ), then click on the map and while holding down the mouse button, drag the map to move it.

5. The mouse wheel can also be used to zoom in and out. Push the mouse wheel away from you to zoom out. Then roll the wheel toward you to zoom in. Notice that the zoom will use your cursor select the area of zoom.

6. Click the Full Extent ( ) button. This will zoom out to the largest extent of any data in the data frame, so you should see the entire world once again.

Bookmarks save a snapshot of the map location and scale. These are useful if you often zoom or pan in your map but want to return to a particular location frequently.

7. Using a combination of zoom tools, zoom in to the Clemson University area.

8. On the Ribbon, click Bookmarks > Create Bookmark. Call it Clemson.

9. Click the Full Extent button, then click Bookmarks > Clemson to go back to the previous view.

Adding Data to the Map as Layers

Now that you are familiar with the parts of the ArcMap window, can navigate comfortably, and have a basemap, let's add some data!

1. First, we will drag data from the ArcCatalog window directly into the map. Position the ArcCatalog and ArcMap windows so they are both visible on the screen.

2. From the D:\IntroToGIS\Data folder in ArcCatalog, click on the Bridges_SC.shp dataset and drag it over into the ArcMap frame. (If you get Geographic Coordinate Systems Warning, click Close to close it). The Bridges_SC layer now shows up in the TOC of the South Carolina data frame above the Basemap.

Q: What kind of data are these (vector or raster)? If vector, are they points, lines, or polygons?

3. Click the ArcCatalog button on the top of the ArcMap window. The ArcCatalog panel opens up on the right side of the window. Click the Pin along the top of the panel to pin the ArcCatalog panel open.
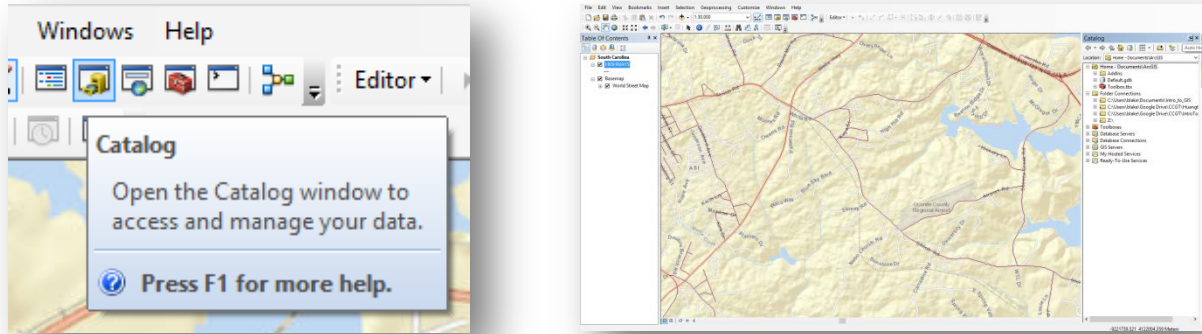
Figure 4. Just as we opened ArcMap from ArcCatalog, we can access ArcCatalog from ArcMap and use it to add data to the map.

4. In the ArcCatalog panel, navigate to the D:\IntroToGIS\Data folder. Click Highways_SC.shp and drag it to the map.

Q: What kind of data are these (vector or raster)? If vector, are they points, lines, or polygons?

5. Repeat the process to add Counties_SC.shp. (Close any Geographic Coordinate Systems warnings).

Q: What kind of data are these (vector or raster)? If vector, are they points, lines, or polygons?

We are zoomed in too far to see much detail in the data we added, so let's use another great shortcut.

6. In the TOC, right-click the Counties_SC layer and select Zoom to Layer. This will automatically zoom to the extent of the dataset.

7. Create a bookmark called South Carolina extent.

Things are a bit messy, and we can't see the county lines very well. Let's rearrange the order of layers in our TOC.

8. Click on the Counties_SC layer and drag it to be above Bridges_SC - a black bar will appear between Bridges_SC and the South Carolina data frame name.

Now, notice the checkboxes next to each layer name in the TOC. When checked, the layer is drawn in the data frame.

9. Click to uncheck Counties_SC in the TOC to turn the layer off.

10. One by one, uncheck all the layers, including the basemap.

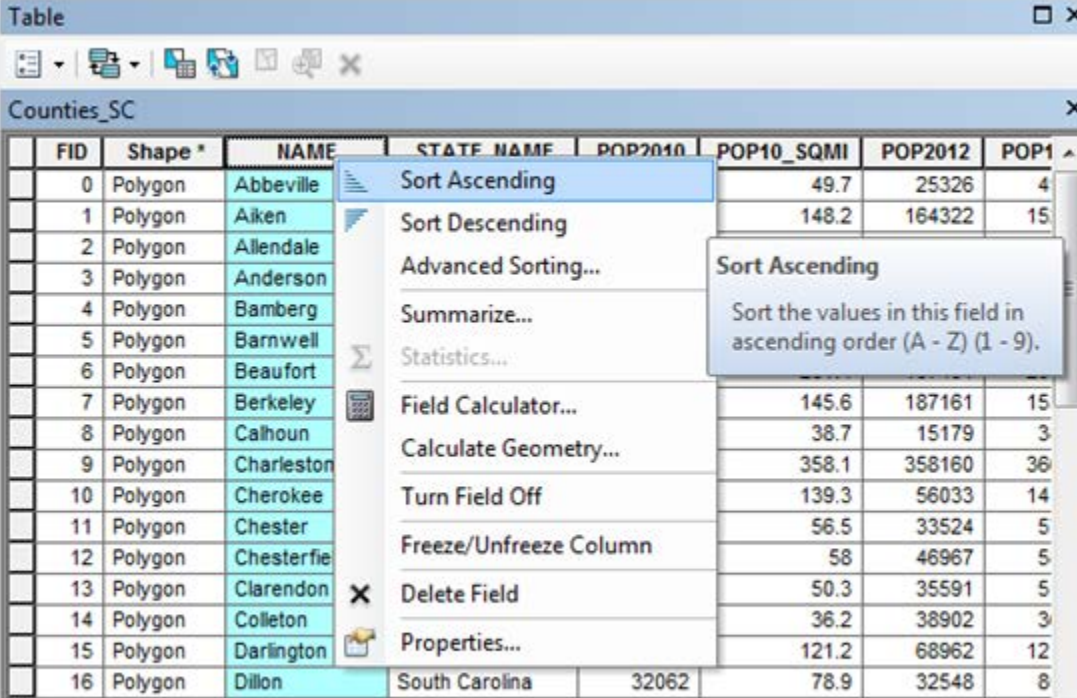11. One by one, turn the layers back on.

Q: How can I put Counties_SC back in its original place in the TOC so I can see the Bridges and Highways layers?

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12. Use your answer to do so.

Opening the Attribute Table of a Feature

In the Previewing Data tutorial, you looked at the attribute table for a dataset. You can also open the attributes for any layer in ArcMap by right clicking on its name in the TOC.

1. Right-click **Counties_SC** in the TOC and select **Open Attribute Table**. Notice the many fields in this attribute table. You can scroll to the right and/or resize the attribute table window in order to view more fields.

2. There are a few ways to sort the information in this table. Right-click on the NAME field heading and note the options provided in this menu. Selecting **Sort Ascending** will sort the field alphabetically, A-Z. You also have the option to Sort Descending, from Z-A.

Figure 5. The attribute table for Counties_SC. Fields (columns) can be sorted by value, just like a spreadsheet.

You can also freeze a column to ease the reading of the table. Freezing a column in the Attribute table is similar to freezing or locking a column in an Excel spreadsheet: it keeps specific columns visible while you scroll in the table or worksheet.

1. Right-click on the field name at the top of the column and select **Freeze/Unfreeze Column**. Now that this column is fixed, find the size of Anderson in square miles (Hint: scroll to the right until the attribute field SQMI fits right next to the field NAME and scroll down until you find Anderson).

Q. How does this value compare to the sizes for Beaufort and Charleston?

2. Close the Attribute Table.

3. We will save the map for use in the next tutorial. Click File, Save, and in the D:\IntroToGIS folder, save the map as IntrotoGIS_Map1_**.mxd, replacing the stars with your initials.