

Getting Started with ArcGIS

Background and Introduction

BACKGROUND ON ArcGIS SOFTWARE

ArcGIS is a set of tools for collecting, storing, managing, analyzing, and representing geographic information. ArcGIS exists at three levels, **ArcView**, **ArcEditor**, and **ArcInfo**. They all appear the same and work in similar ways – the only difference is the tools available. ArcEditor offers more tools than ArcView and ArcInfo offers more tools than ArcEditor. At Brown we have access to ArcInfo level ArcGIS, faculty can also access this level of ArcGIS from home using VPN; while students cannot access ArcGIS from home they can contact S4 and receive a 1 year single user license of ArcGIS at the ArcView level. In addition there are extensions associated with **spatial analysis**, **3D analysis**, and **Geostatistics** can be used for working with specific types of data and specific types of problems.

ArcGIS is made up of three components: **ArcMap**, **ArcCatalog**, and **ArcToolbox**, each performs a distinct set of tasks.

ArcMap lets you make maps from multiple layers of geographic data. The ArcMap interface presents a Table of Contents (TOC) with currently available data layers as well as the current map and symbology. Users can change between a publication view of the map (called *Layout View*), to which legends and other map elements can be added and a working view in which you can manipulate your data (called *Data View*).

ArcCatalog supports your connection to and browsing of spatial data. Through the tools associated with ArcCatalog you can access data on your computer and other systems to which your computer is connected and add it to your map. When using ArcGIS it is important to remember that a *connection* must be made to the location of your data (even your computer's main storage system) before you can add data from that location to your map; this is done using ArcCatalog. ArcCatalog is also the subsystem that provides access to metadata and allows you to update and edit information associated with the spatial data you are using.

ArcToolbox contains an extensive menu of tools for manipulating your spatial data, at the ArcInfo level you will access to advanced spatial analytic tools as well.

Within ArcGIS there is a great deal of interdependence among the three aforementioned components. From ArcMap, the subsystem in which you are likely to be spending most of your time, you can start both ArcCatalog and ArcToolbox; in fact, starting ArcToolbox from ArcMap will add the ArcToolbox menu to the ArcMap view providing a seamless view of both of these important components. In addition, if you are adding data in ArcMap the window that opens in order for you to navigate to your data source includes a couple of ArcCatalog tools (specifically associated with creating a *connection* to a location on your computer where data exists) so you don't have to exit and open a separate ArcCatalog window in order to then add data through ArcMap from a currently


unconnected location. These are just two examples of the interactions among the ArcGIS components which increase the software's user friendliness; however, it is important to keep in mind that each component contains extensive tools for the set of tasks it is intended to accomplish and it is often useful to work with them in a somewhat independent fashion to accomplish your larger GIS related goals.

INTRODUCTION TO ARCGIS: Adding Data

Before adding data to a map and using it you have to download some data from the S4 website and create a connection to a location on your computer. Navigate to <http://www.s4.brown.edu/S4/about.htm>, select "teaching and training" from the menu bar on the left. This page consists of several learning models and component lessons for each Module as well as data necessary for completing each lesson. Under the Getting Started with ArcGIS1 tutorial you should see a zipped data file called Cntry00.zip, download it to a location on your computer (it can be a network or local location). Unzip the data; the data is in shapefile format, a data format that was created by same company that makes ArcGIS and also a standard format for other spatial analysis software. If you complete the Getting Data tutorial you will learn more about data formats and where to find data.

Start ArcCatalog from the Start Menu at the lower left corner of your computer screen; you'll have to navigate to All Programs, and then ArcGIS, and then select ArcCatalog.

ArcCatalog. *Start → All Programs → ArcGIS → ArcCatalog.*

Within ArcCatalog you can select "File" on the menu bar and see "connect folder" as an option, you'll also recognize the icon just below the menu on the toolbar, you can use either button . Selecting "connect folder" will bring up a window that will show the various locations to which you computer is connected, you can select any of these as "connection folders," you should probably select a location as high up the hierarchy as possible (like the C: drive) rather than a specific subfolder within a drive. This way you can navigate to any folder below that "connected" location and find data, rather than having to connect to a new location later. You should connect to the drive on which you stored and unzipped the data from the S4 drive. The drive to which you connected should now appear in the left hand side of the ArcCatalog window.

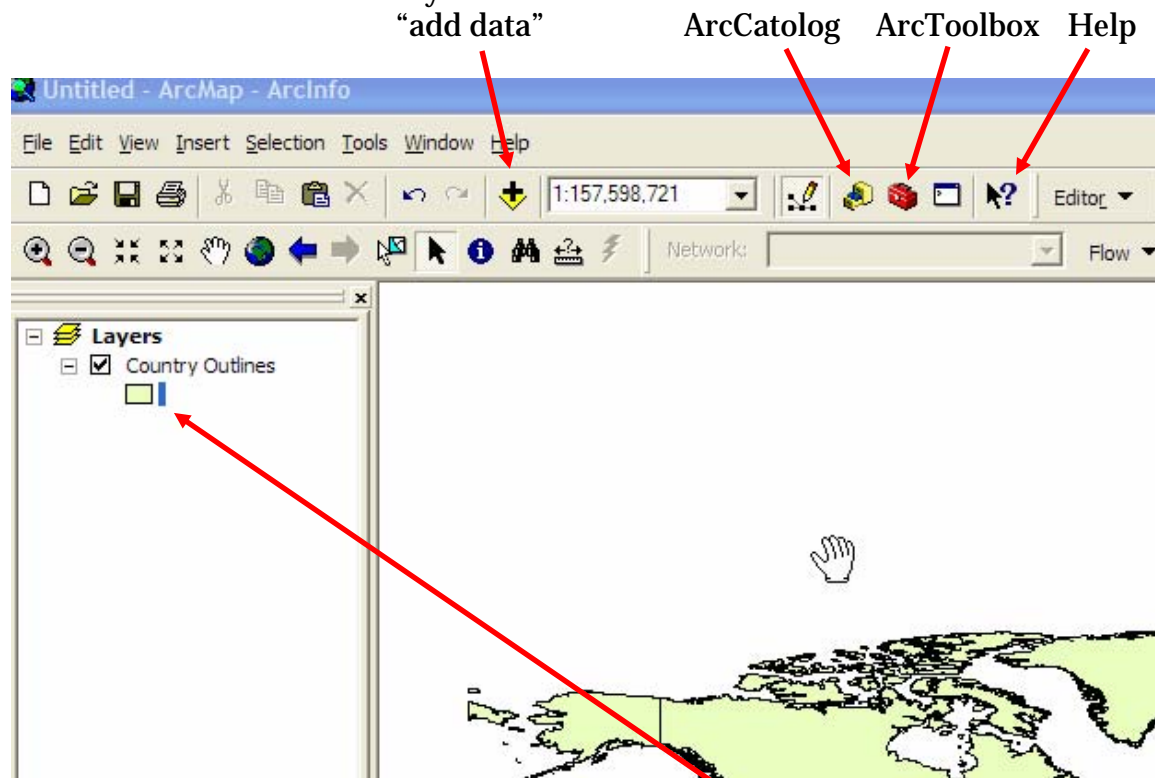
There are a variety of ways to open spatial data in ArcGIS:

- You can open ArcMap (either from the Windows start menu or from the toolbar in ArcCatalog (the small Earth with magnifying glass icon) and add data using the add data icon (see below)
- if both programs are open (ArcCatalog and ArcMap) you can drag the data file from ArcCatalog to the display window of ArcMap



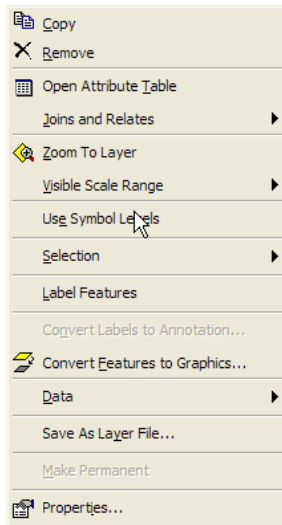
Add the world countries layer to ArcMap, you can click ok to any windows that come up regarding spatial extent, projection, or coordinate systems. Maintaining consistency with respect to frames of reference is critically important, however, for now we are only working with one layer of data.

In the image below you see a file called “countries outline” (if you added cntry00 you should see it in the version of ArcMap you are running) layer added as well as some of the tools and elements already mentioned.



As in almost all Windows programs the right mouse click is a useful tool in ArcGIS.

Right click on the box showing the color of the layer in the TOC and you can quickly change the color of the layer. Right click on the layer name (“Country Outlines” in this case) and you are given access to several very powerful tools:



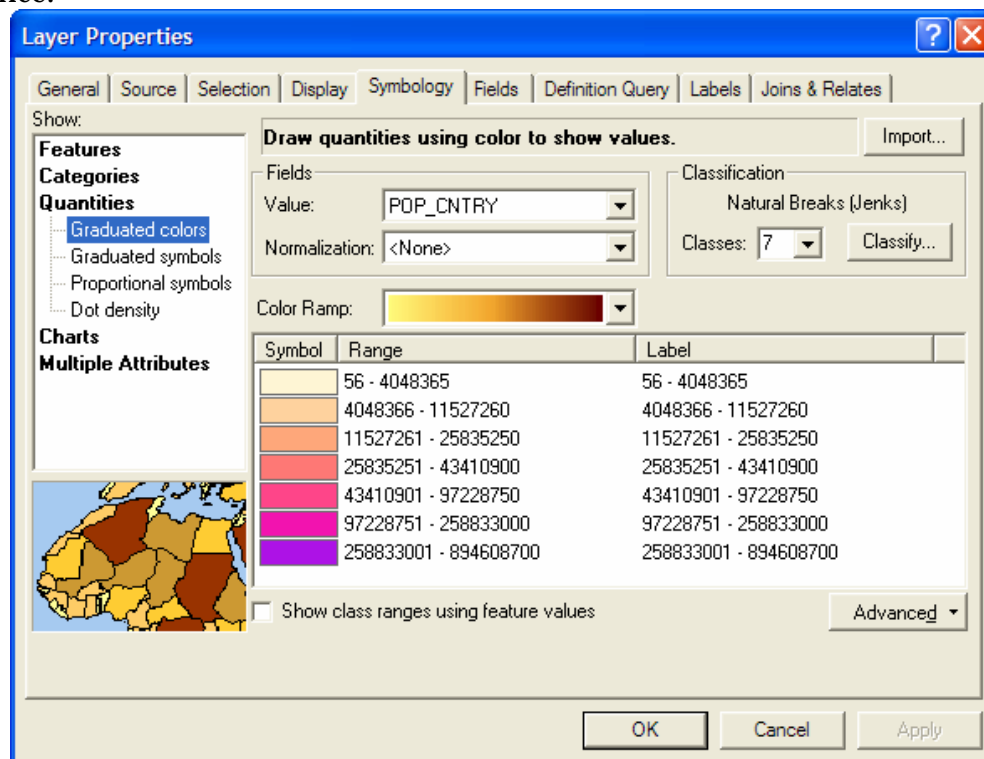
“Open Attribute Table” allows you to see the data associated with the layer, once open you can edit the table, add data, and perform other data related tasks.

“Joins and Relates” allows you to link external data to your map data. Databases in text format, dbf, access, and some other formats can be “joined” to this data’s attribute table. Once joined the data will appear as columns in the attribute table; it is important to remember that in order to be joined both the attribute table of your map data and the external data you want to join must have a variable (column, attribute) in common.

The final option in the pull down window is the “Properties” tool.

The Properties option contains many pieces of information about the layer and offers several useful tools to the mapmaker, an example from the countries outline data is shown below

Notice all the tabs across the top of this window; each contains important information and options related to the layer. The currently selected tab is the “Symbology” tab which can be used to map data from the attribute table. The world countries data has a population variable which can be used to create a map of the world with categories associated with ranges of country population. You can map any variable for which you have data for each country in the world (you could add the variable directly into the attribute table and then enter values or you could join an external data file). An example is an assessment of whether a country is “less developed,” “developing,” or “developed” for instance.



It is important to note that an extensive body of research exists regarding the classification of data for mapping and the selection and assignment of color schemes for such maps. On the S4 training page listed with this tutorial are three articles and one link. The articles summarize some of the research on selecting appropriate classification schemes for your data as well as providing a checklist of mapmaking; the link is to an excellent resource for selecting numbers of classes and assigning colors to those classes. Many of the default ArcGIS color schemes and classification techniques are easy to apply but you might find them less than appealing visually or they might not communicate your desired message.

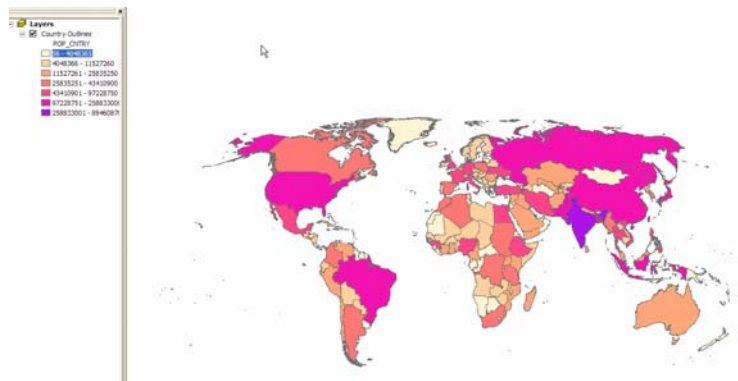
Fortunately there are lots of options in the properties window to customize your map symbolization. The window on the left lets you designate the type of variable you are going to map, in some cases you won't be able to map a variable in all possible ways, but be careful, ArcGIS give you lots of flexibility to map your data, sometimes this flexibility results in inappropriate decisions. For instance under the categories option you can select "unique values;" if you apply this to population each different population value (one for every country) will get a different color (not very useful). Additionally you can symbolize your countries in several different ways; you can fill the country outlines with color ("graduated color"), you can assign each country a symbol that is colored ("graduated symbol"), or you can use proportional symbols or dot density (if your data logically supports that type of symbology).

There are lots of other options in this window as well. You need to select the variable you're going to map (in the middle under "Fields" you select a "Value"). You can select a pre-determined color ramp (just below "Fields"), or customize it (more on this below), you need to select a classification scheme (under "Classification" to the right of "Fields"), which includes both the number of classes and a classification scheme.

A note on classification:

In order to select a classification scheme you need to click on the "Classify..." button, which will bring up a window that offers several automatic classifications (natural breaks, equal interval, user-defined interval, quantile, quartile, and standard deviation) as well as a manual classification option that lets you set the class break points yourself. This window will also let you move break points and determine what range of your data will be mapped (for instance, how new so many places had negative populations, check the attribute table, right-click on `cntry00.POP_COUNTRY` and sort the data and you'll see several places with a population of -99999). Once you've selected a classification scheme you can work on your class colors, this where you will find www.colorbrewer.org helpful, it provides lots of good default color schemes and offers explanations for various color selection decisions. You can edit individual colors in your classification scheme from the "symbolization" tab of the "layer properties" (the window you're probably still in) or directly from the TOC by right clicking individual color boxes (in either case).

In the next tutorial (Getting Started with ArcGIS2) you will learn how to move from symbolizing and mapping data to creating a finished map, so what you have might look something like this:



You will learn how to turn it into something like this:
 (The following map was done very quickly, in the next lesson we move more slowly through the layout process and create something much better looking.)

