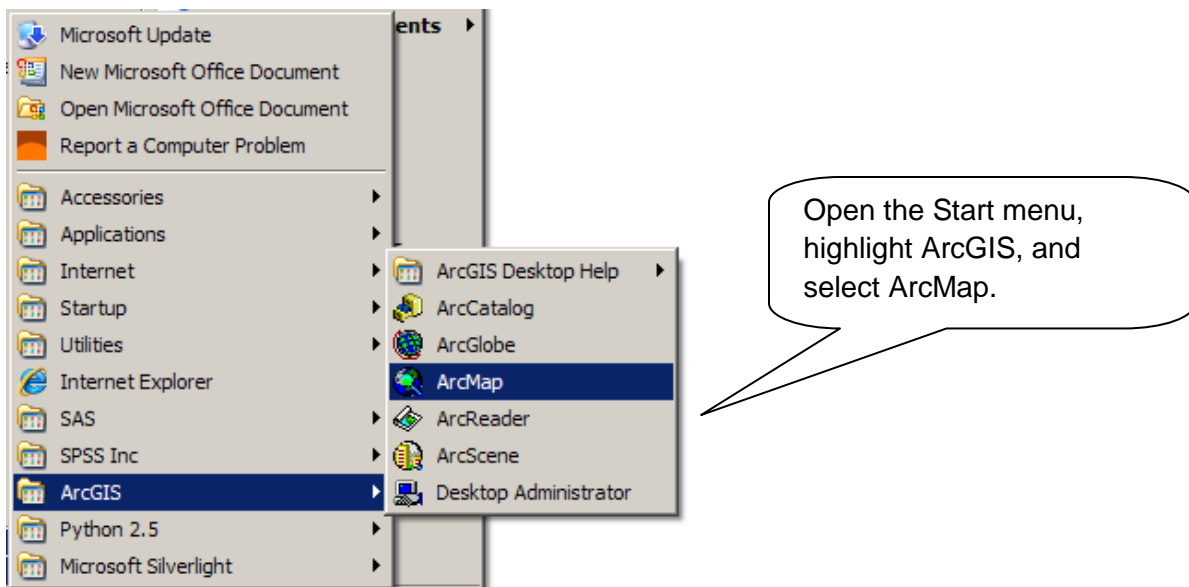


## Map Making in ArcGIS 9.3

ArcGIS is a program that allows you to create maps by combining data with a shapefile. Maps created with the program can be edited in many ways, allowing you to make maps that highlight specific information. The ArcGIS 9.3 desktop suite consists of five programs that provide different functionalities ranging from map creating to viewing and editing maps.

### Getting Started

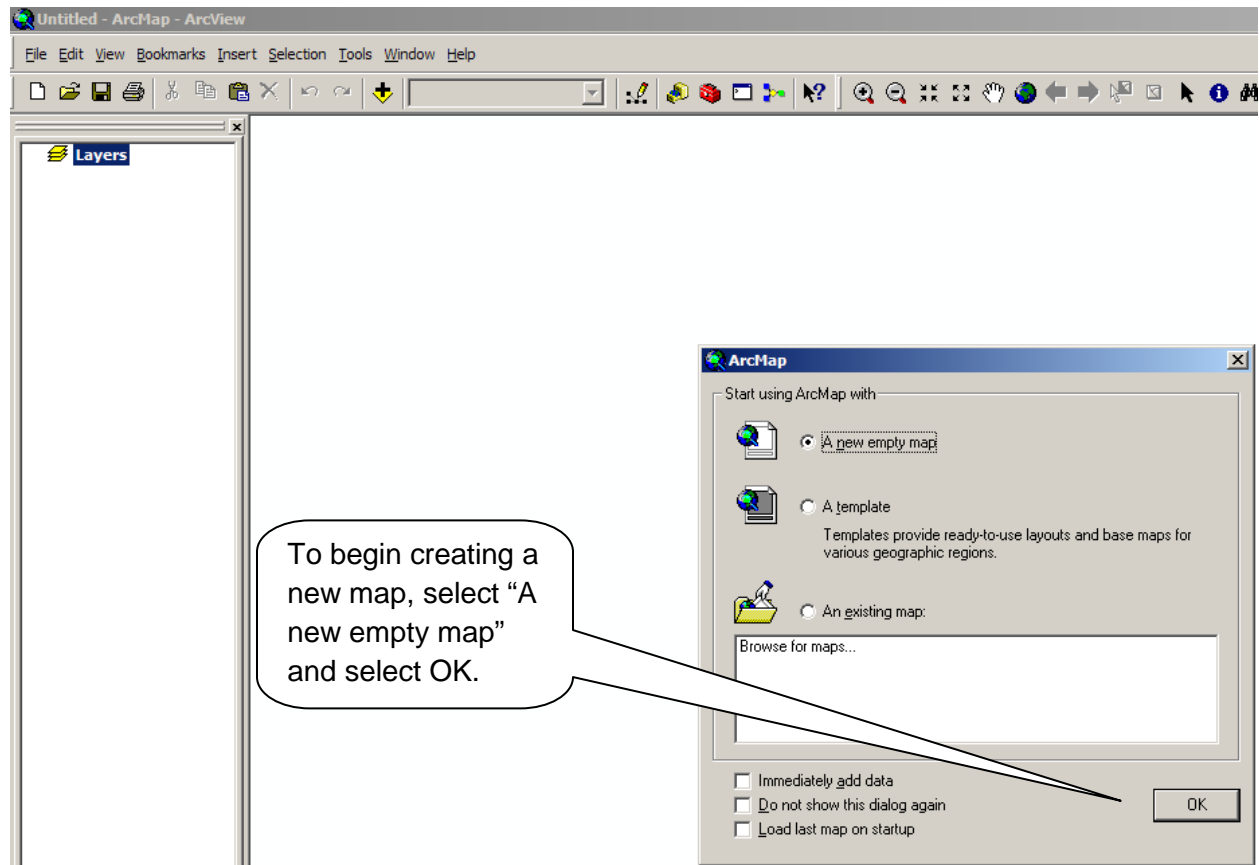
The ArcGIS suite consists of five programs – ArcCatalog, ArcGlobe, ArcMap, ArcReader, and ArcScene. ArcMap is the primary program for creating maps.



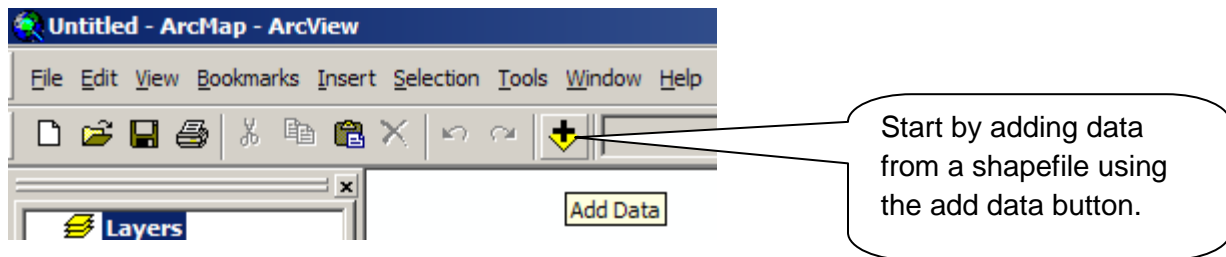
Let's say that you have a dataset containing information that you would like to be displayed in a map. By combining this dataset with map data, you can create a map displaying properties of your choosing. Maps created using ArcGIS can be edited in many ways to highlight your data in a more visually striking manner than can be achieved by using a simple table.

This guide will walk you through the basics of creating a map using ArcGIS.

The ArcMap program looks like this. From here, you are ready to begin creating maps.

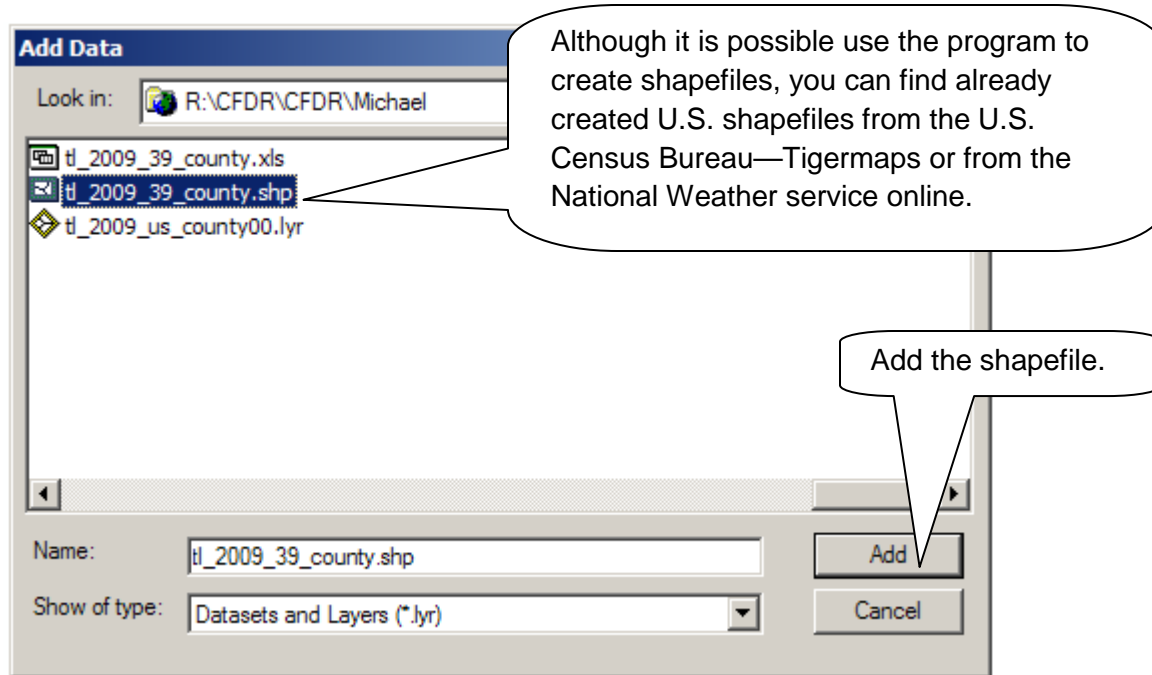
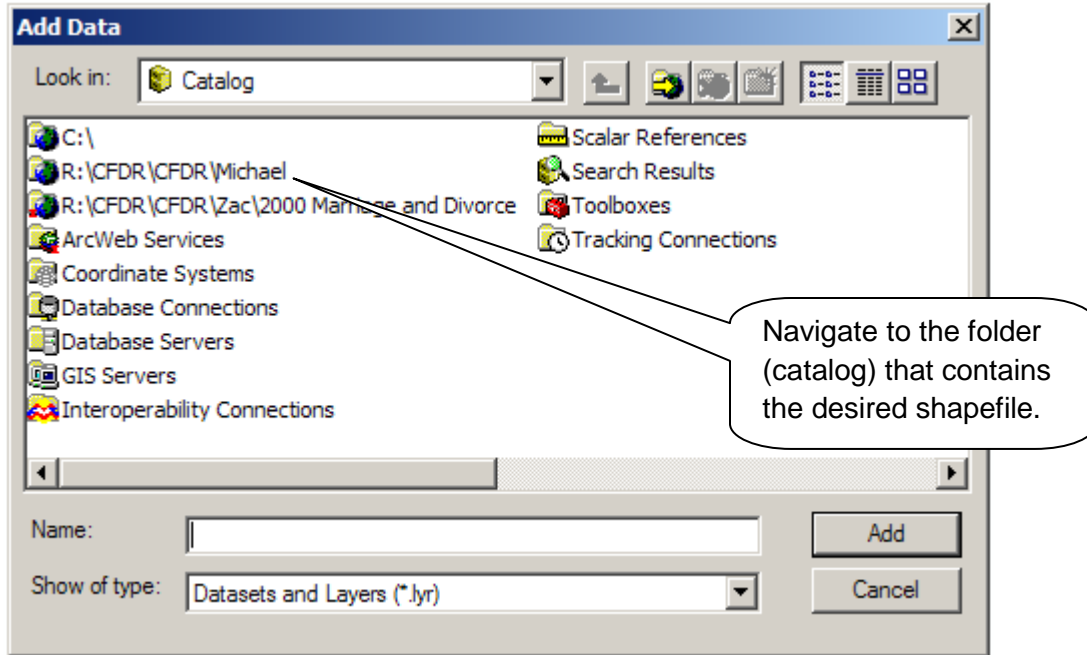


The trick to creating maps with ArcGIS is that you need two types of data that will later be combined to make the map. First, you will need data in spreadsheet form containing data that you would like to be indicated on the map. The best format for this data is an Excel spreadsheet (.xls). Second, you will need a shapefile. A shapefile contains information that tells a GIS program how to draw the map. The shapefile and the data file must contain a common variable by which the data can be combined.

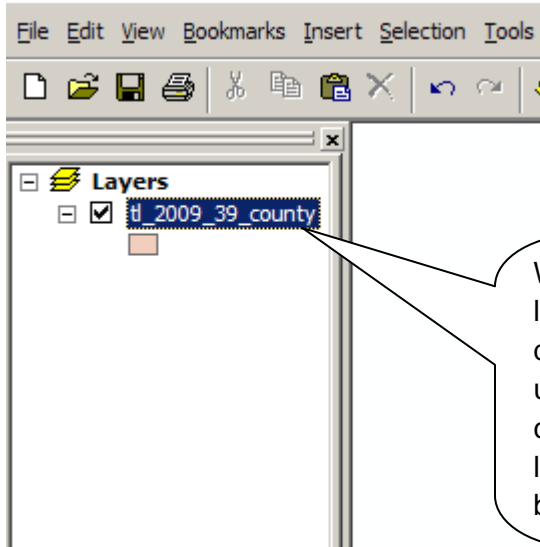


You can also begin adding data by right-clicking the Layers tab on the left.

The following window will be opened. Begin by selecting the desired shapefile. The ArcGIS program is capable of creating shapefiles that will suit your needs. However, it may be easier and less time-consuming to find already created shapefiles online.

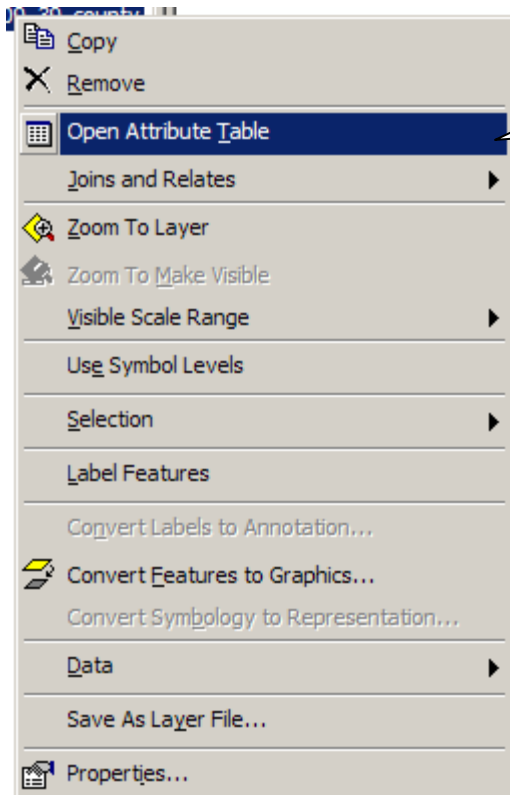


Adding shapefiles will cause “layers” to be added to the map. Multiple layers can be added to give additional dimensions to your map.



Whenever a shapefile, table, or layer file is opened, it will be displayed in the left hand column under "layers." Removing the check from the box beside each layer will prevent that layer from being displayed.

Shapefiles are graphical files, but the data contained in shapefiles are contained in spreadsheet form. This data is called an "attribute table."



To explore this data, right click on the name of the shapefile and open the attribute table.

Attributes of tl\_2009\_39\_county

FID	Shape	STATEFP	COUNTYFP	COUNTYNS	CNTYIDFP	NAME	NAMESAD	LSAD	CLASSFP
0	Polygon	39	143	01074084	39143	Sandusky	Sandusky County	06	H1
1	Polygon	39	153	01074088	39153	Summit	Summit County	06	H1
2	Polygon	39	113	01074069	39113	Montgomery	Montgomery County	06	H1
3	Polygon	39	001	01074014	39001	Adams	Adams County	06	H1
4	Polygon	39	025	01074025	39025	Clermont			H1
5	Polygon	39	003	01074015	39003	Allen			H1
6	Polygon	39	007	01074017	39007	Ashtabula			H1
7	Polygon	39	111	01074068	39111	Monroe			H1
8	Polygon	39	015	01074020	39015	Brown			H1
9	Polygon	39	023	01074024	39023	Clark			H1
10	Polygon	39	019	01074022	39019	Carroll			H1
11	Polygon	39	145	01074085	39145	Scioto	Scioto County	06	H1
12	Polygon	39	017	01074021	39017	Butler	Butler County	06	H1
13	Polygon	39	005	01074016	39005	Ashland	Ashland County	06	H1
14	Polygon	39	013	01065575	39013	Belmont	Belmont County	06	H1
15	Polygon	39	033	01074029	39033	Crawford	Crawford County	06	H1
16	Polygon	39	031	01074028	39031	Coshocton	Coshocton County	06	H1
17	Polygon	39	131	01074078	39131	Pike	Pike County	06	H1
18	Polygon	39	021	01074023	39021	Champaign	Champaign County	06	H1
19	Polygon	39	011	01074019	39011	Auglaize	Auglaize County	06	H1

Record: 1 Show: All Selected Records (0 out of 88 Selected) Options

The data is displayed in a standard spreadsheet.

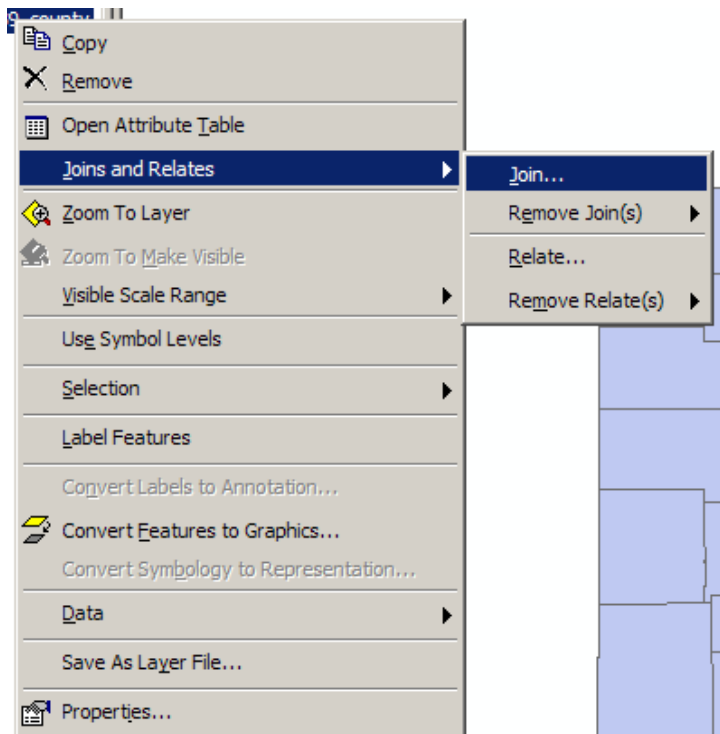
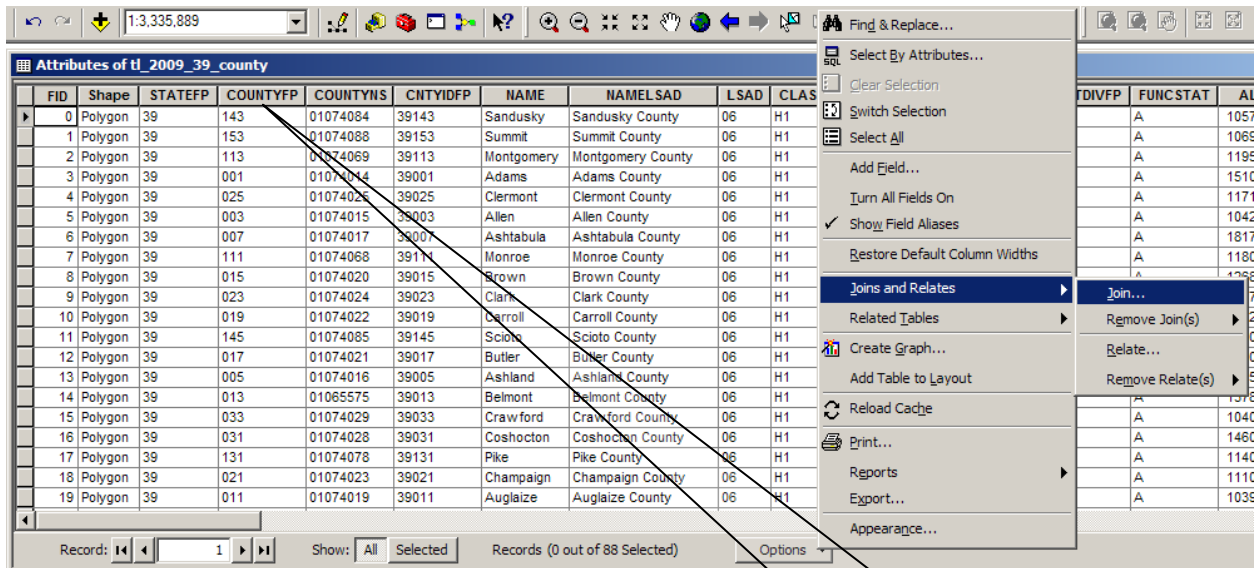
Foreign Born	% Foreign Born
<Null>	<Null>
14252	
10143	
<Null>	<Null>
1543	
1706	
958	
<Null>	<Null>
<Null>	<Null>
3632	
<Null>	<Null>
3165	
7860	
<Null>	<Null>
8150	
<Null>	<Null>
<Null>	<Null>
<Null>	<Null>
<Null>	<Null>
<Null>	<Null>

- Sort Ascending
- Sort Descending
- Advanced Sorting...
- Summarize...
- Statistics...
- Field Calculator...
- Calculate Geometry...
- Turn Field Off
- Freeze/Unfreeze Column
- Delete Field
- Properties...

By right-clicking on the variable names in the attribute table, you can access the properties of each variable. From here, the properties of variables can be adjusted, particularly if they affect how the information is displayed in the maps.

Notice the “Options” button at the bottom of the attribute table. This button allows you to choose from a number of options allowing you to alter the properties of the attribute table or to add features to the map.

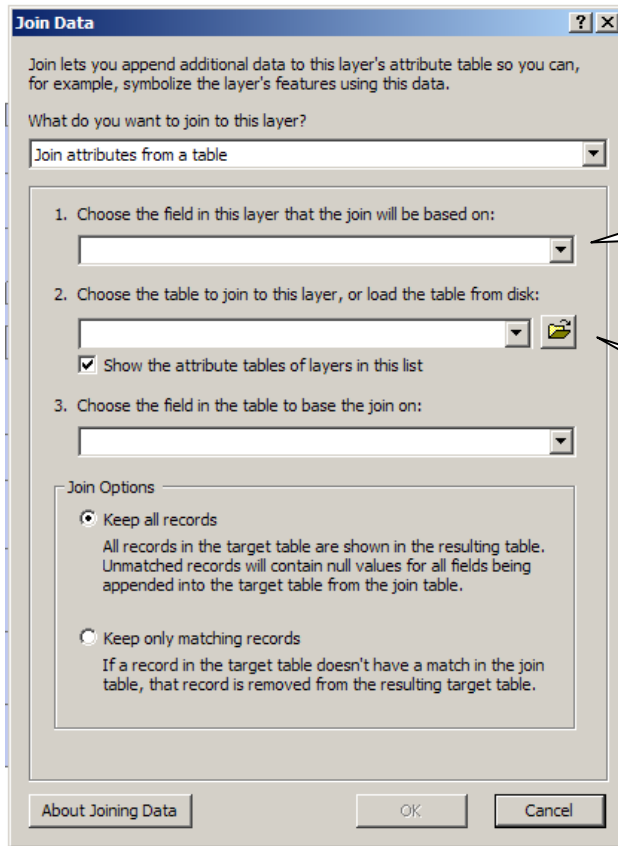
The “Joins and Relates” option allows you to add variables to the attribute table. You must use this option to create your map, because a shapefile alone does not contain all the variables you need. In order to do this, you will need to add a data file containing a variable common to both that data file and the shapefile.



In this example, the county code variable is the common variable. The program will match observations from both tables based on this variable.

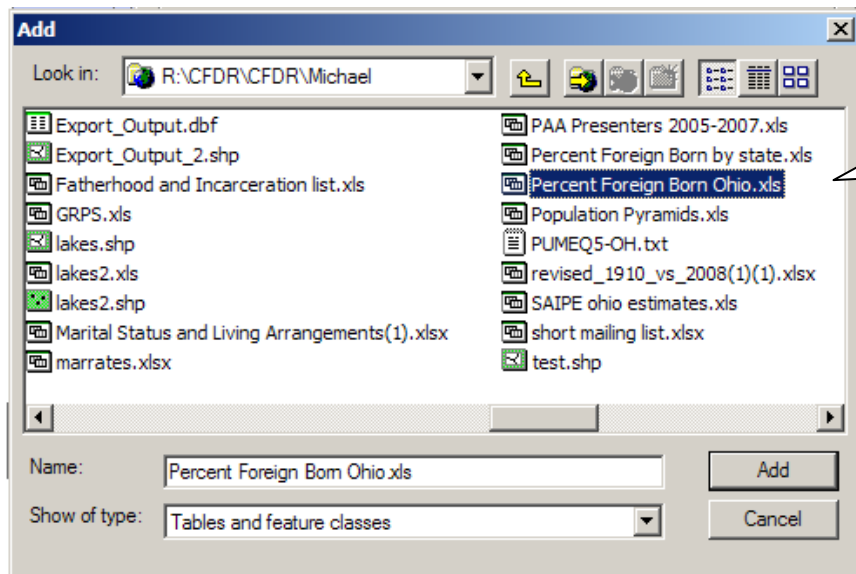
Right click on the shapefile name to open this menu, highlight Joins and Relates, and select Join.

The Join Data window is opened. Now you are ready to join the data with the shapefile.

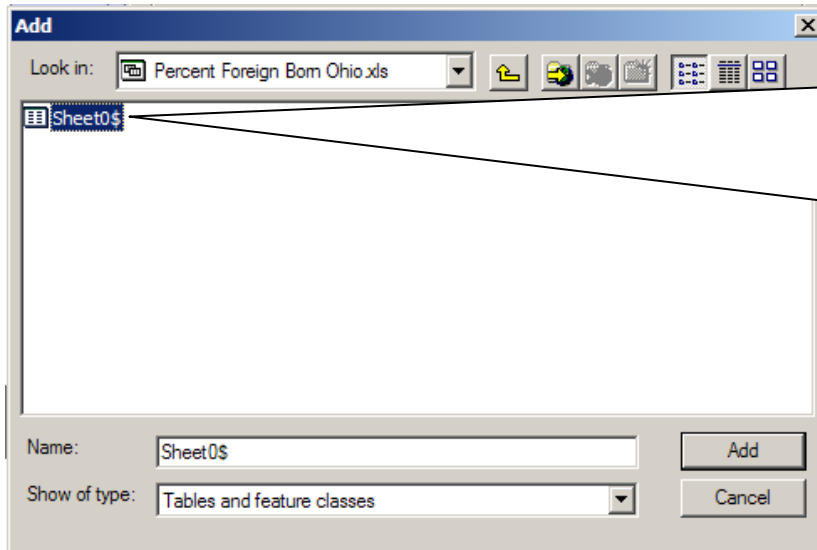


Start by selecting the common variable from the attribute table associated with the shapefile from the drop down list.

Then, select this button to browse for the data that is being joined with the shapefile.

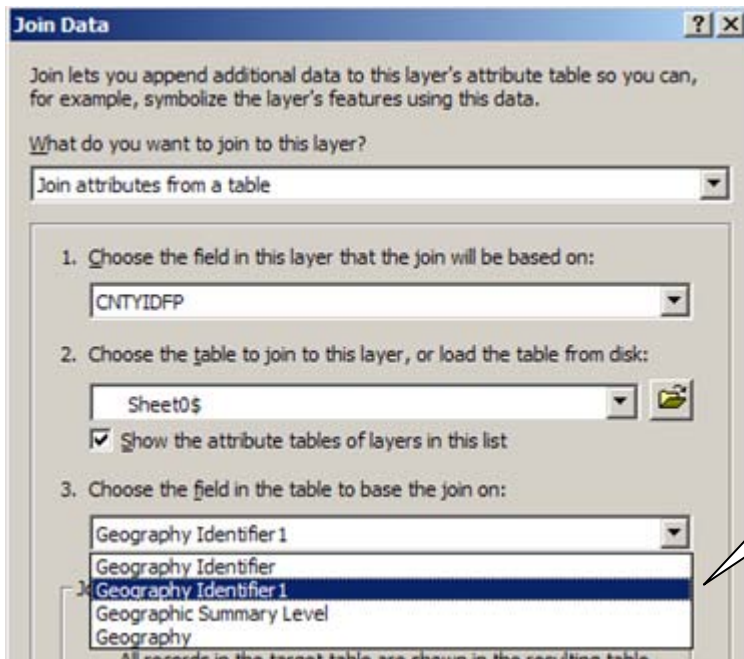


Find the data, select it, and click "Add."



If the data is in Excel format, you will need to select the sheet number that contains the data you will use. The Excel file in this example only contains one sheet, but if yours contains more, be sure to keep track of exactly which sheet you need to use.

Now, select the variable that is common both to the data file and the shapefile. Although the variables may have different names, the join will work as long as the information contained in the variables is identical.

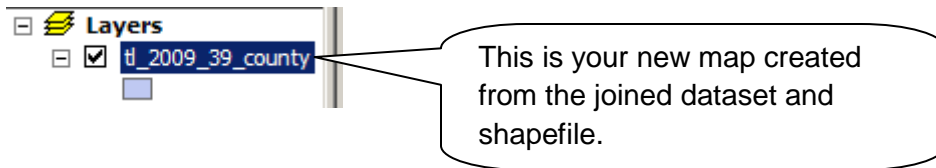


Here, select the variable in the dataset that will be joined with the common variable from the shapefile.

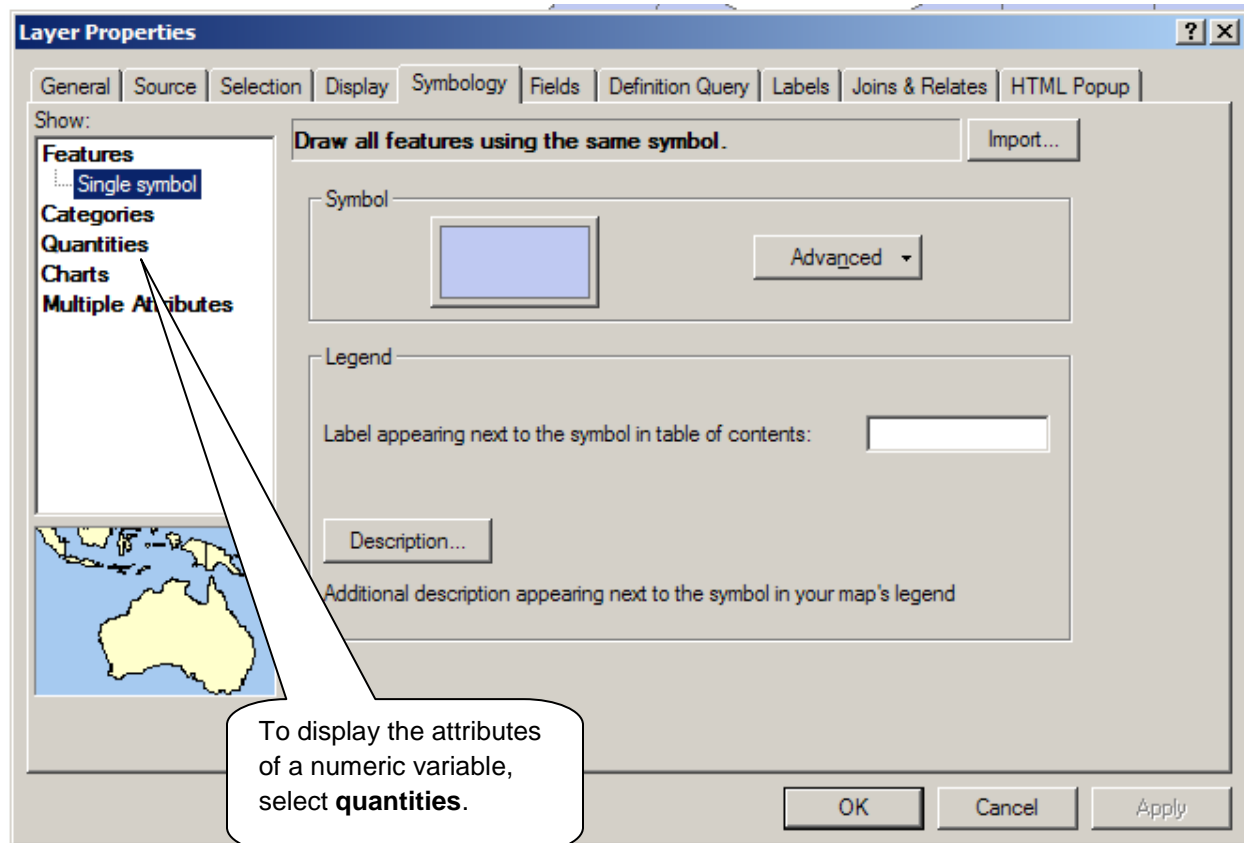
To check that the variables were joined successfully, reopen the shapefile attribute table. Look to make sure that the joined dataset contains variables from both the original data set and the shapefile, and check to see whether the observations match up.



After you have joined the data, double click on the layer name to open the layer properties window.



The layer properties window will automatically be opened to the “symbology” tab.



From here, you can begin editing the map to highlight whatever attributes you want.

In this example, we are creating a map highlighting the percentage of the population in the state of Ohio which is foreign-born by county. We will create categories in which to place a county depending on its percentage of foreign-born population, choose a color scheme for the map, and label each county.

Keep in mind that there are many other options that are not covered in this guide. Do some exploring and you will find many ways to make your maps stand out!

Begin by selecting the variable containing the attribute to be displayed in the “fields” box.

**Layer Properties**

General | Source | Selection | Display | Symbology | Fields | Definition Query | Labels | Joins & Relates | HTML Popup

Show:

**Features**

**Categories**

**Quantities**

- Graduated colors
- Graduated symbols
- Proportional symbols
- Dot density

**Charts**

**Multiple Attributes**

**Draw quantities using color to show values.** Import...

Fields

Value: none

Classification: Manual

Normalization: none

Color Ramp:

- none
- ALAND
- AWATER
- Universe: TOTAL POPULATION IN THE UNITED STATES: Total (Estimat
- Universe: TOTAL POPULATION IN THE UNITED STATES: U#S# citizen,
- Universe: TOTAL POPULATION IN THE UNITED STATES: U#S# citizen,1
- Universe: TOTAL POPULATION IN THE UNITED STATES: U#S# citizen b
- Universe: TOTAL POPULATION IN THE UNITED STATES: Not a U#S# cit
- Foreign Bom
- % Foreign Bom
- % Foreign Bom Naturalized
- % Foreign Bom not U#S# Citizen

Show class ranges using feature values

Advanced

OK Cancel Apply

Select graduated colors to create categories that will correspond with different colors on your map.

**Layer Properties**

General | Source | Selection | Display | Symbology | Fields | Definition Query | Labels | Joins & Relates | HTML Popup

Show:

**Features**

**Categories**

**Quantities**

- Graduated colors
- Graduated symbols
- Proportional symbols
- Dot density

**Charts**

**Multiple Attributes**

**Draw quantities using color to show values.** Import...

Fields

Value: % Foreign Bom

Classification: Natural Breaks (Jenks)

Normalization: none

Color Ramp:

Symbol	Range	Label
[Light Yellow]	0.704152 - 1.297098	0.704152 - 1.297098
[Yellow]	1.297099 - 2.011653	1.297099 - 2.011653
[Orange]	2.011654 - 3.455392	2.011654 - 3.455392
[Dark Orange]	3.455393 - 4.759319	3.455393 - 4.759319
[Dark Red]	4.759320 - 8.444290	4.759320 - 8.444290

Show class ranges using feature values

Advanced

OK Cancel Apply

The program automatically produces a graduated scale based on natural breaks in the data. This becomes the legend for the map. To change the range for each category, click the “classify” button.

You can click under “labels” to change what is displayed in the map legend.

There are many ways in which you can break up the categories by which the attribute will be displayed. ArcGIS has several preset options you can use, or you can manually adjust the range for each category. You may want to try several options to see how it affects the appearance of the map. Select the option that will best illustrate your data.

There are several preset options for breaking up categories, and there is also a manual option.

Count:	38
Minimum:	0.704152
Maximum:	8.444290
Sum:	102.377982
Mean:	2.694157
Median:	2.266074
Standard Deviation:	1.708073

Break Values	%
1.297098	
2.011653	
3.455392	
4.759319	
8.444290	

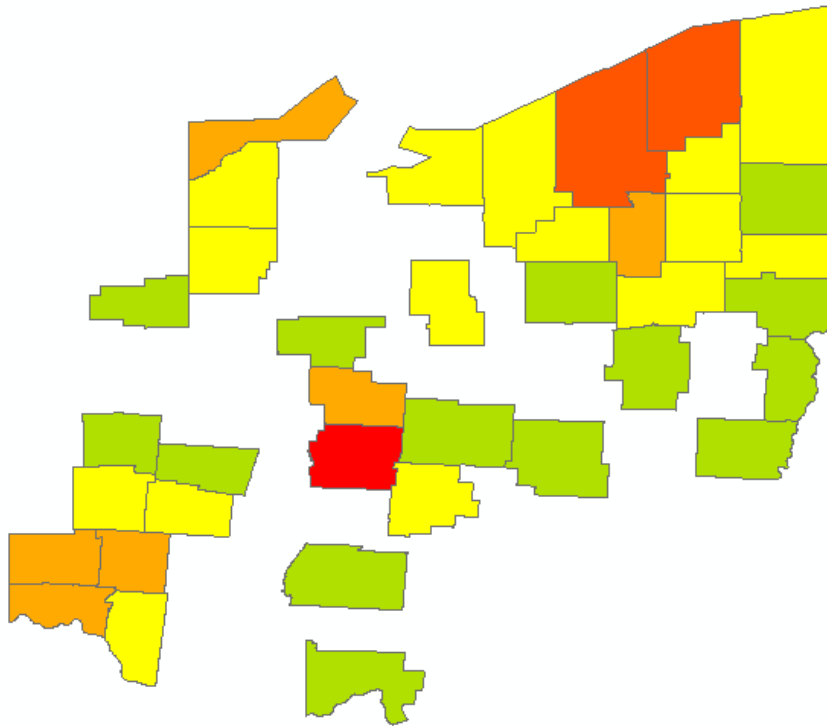
If you choose to set break values manually, the number of decimal places must be set in the attribute table. This must be done before the graduated scale is created.

To change the display colors, use the Color Ramp. Different color schemes can be selected from here.

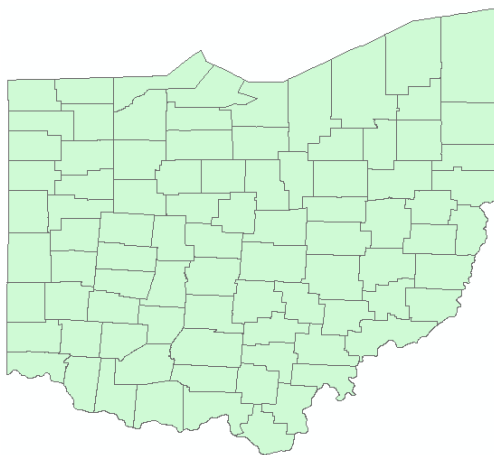
Symbol	Range	Label
[Yellow]	0.704152 - 1.297098	0.704152 - 1.297098
[Light Orange]	1.297099 - 2.011653	1.297099 - 2.011653
[Orange]	2.011654 - 3.455392	2.011654 - 3.455392
[Dark Orange]	3.455393 - 4.759319	3.455393 - 4.759319
[Dark Red]	4.759320 - 8.444290	4.759320 - 8.444290

If you want to use custom colors, double click on the corresponding color under “Symbol.” Colors can be changed using RGB, HSV, or CMYK color scales. This option is useful if you are creating a map for a website or presentation that follows a set color scheme.

After selecting breakpoints for attribute categories and a color scheme, the map is starting to take shape. However, there is a problem with this map – several counties are missing. In this case, counties are missing because there are missing observations for the display variable. These are counties with a very low percentage of foreign-born population.

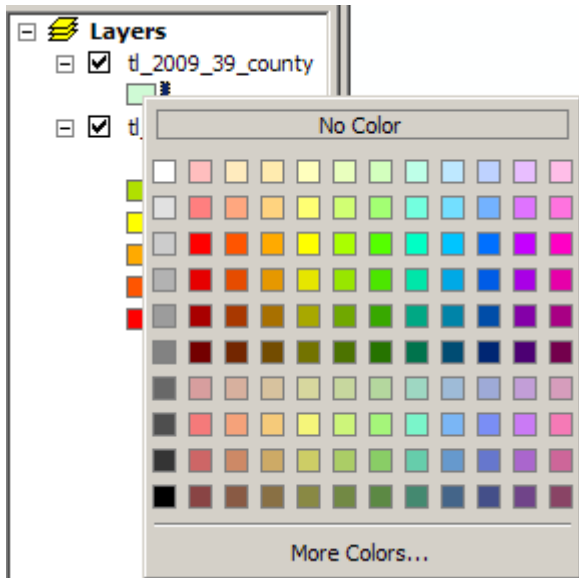


There is a simple method of fixing issues with missing portions of a map. You can add another layer to the map and place it over the first layer. To do this, go back to “Add data” and reselect the original shapefile. ArcGIS will open a new map layer over the first.

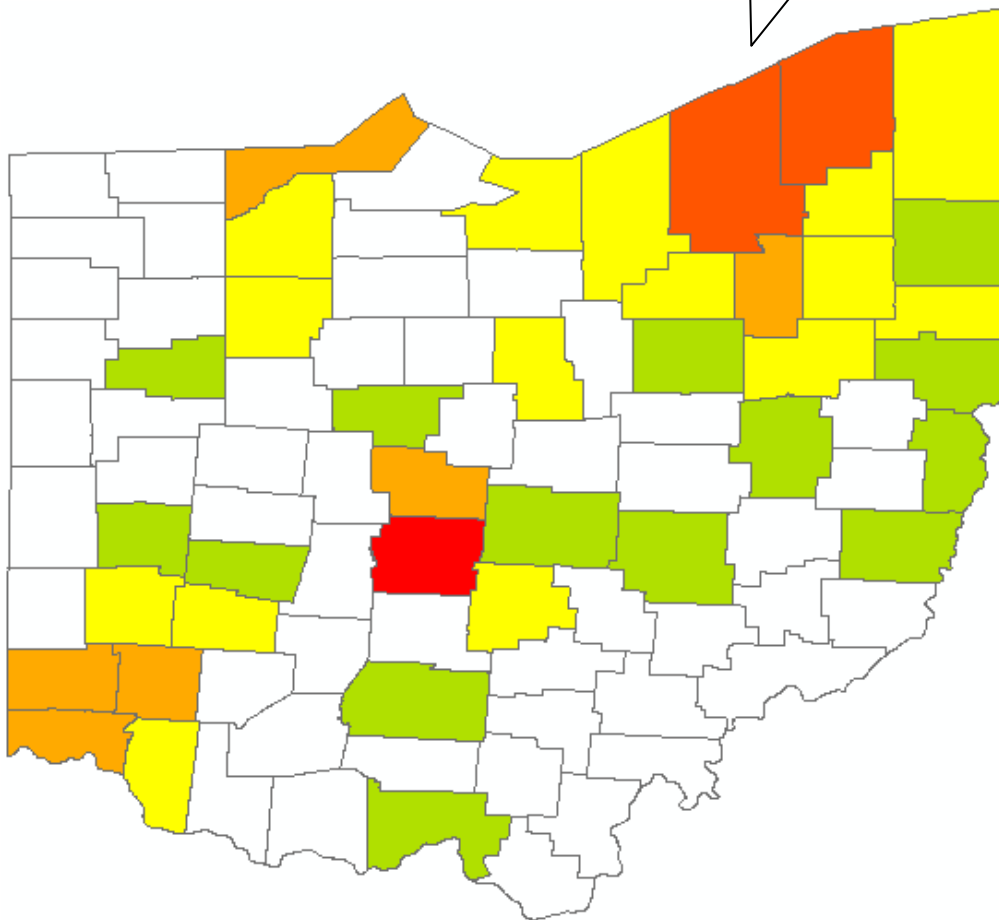


After adding the new layer, you will appear to have a plain map again. The map you have been working on is still there, but it is hidden under the layer you have just added.

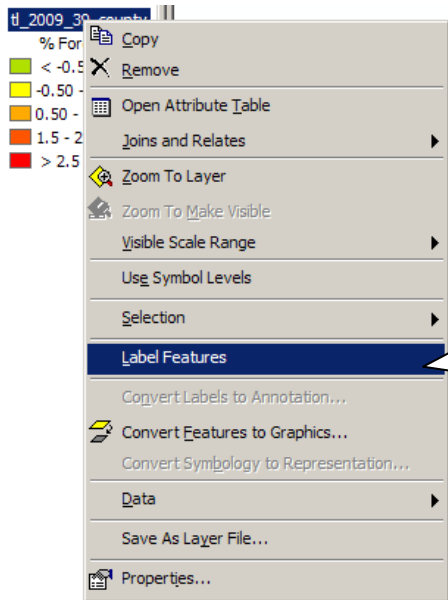
To bring out the original map, right-click on the colored box under the new layer name, and select “No Color.”



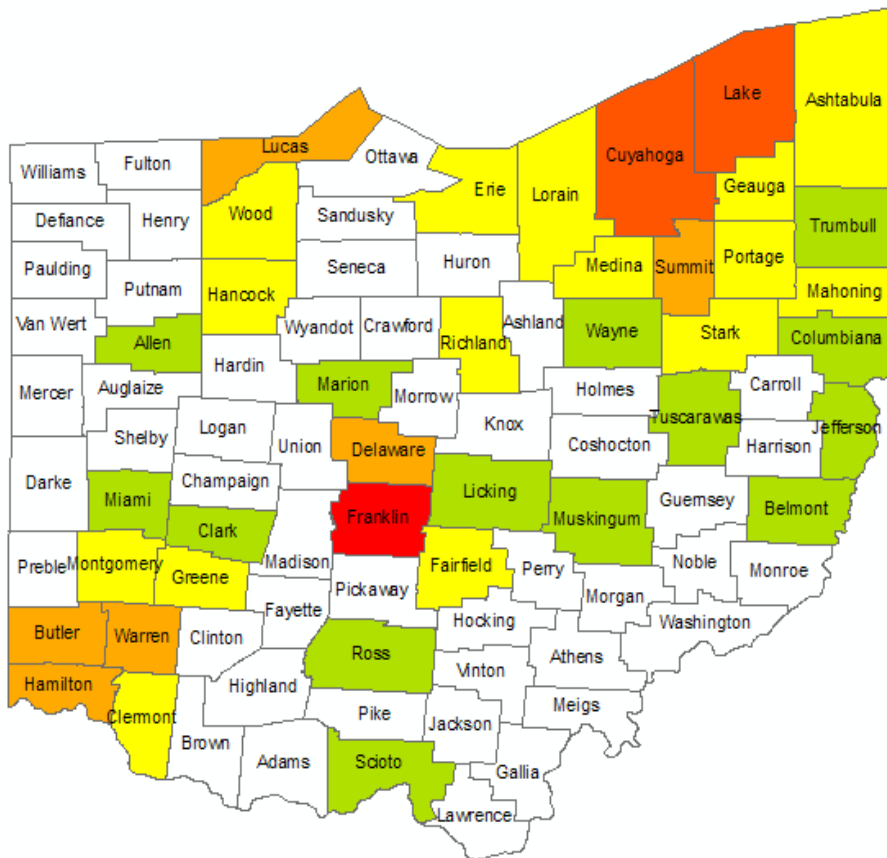
Now, the missing counties appear. The colorless map layer on top allows the colors of the original to be shown, but the county boundaries are kept. Both layers together give you a full map.



Finally, we will label the counties on the map. The dataset we are working with contains a variable with the county names, so this variable will be used to label the map.



To label the map, right-click on the name of the first layer and select "Label Features." From there, use "Label Field" and select the variable you want to use to label the map.



The map is now finished. Ohio counties are labeled and color-coded by percentage of foreign-born population.

This guide has covered the basics of combining a shapefile with another data file by using a common variable and creating a simple map. ArcGIS has many functions to explore that will allow you to create many kinds of maps. Experiment with the program's features and find creative ways to present your data!