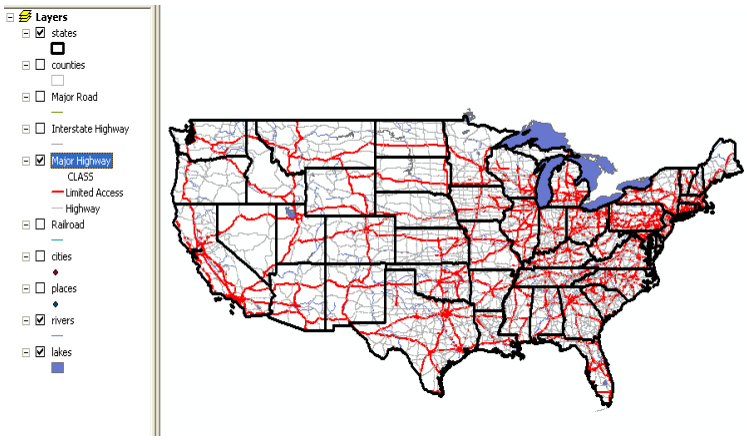
ArcGIS Basics: Mapping the US

Written by Barbara Parmenter, revised December 6, 2011



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Introduction

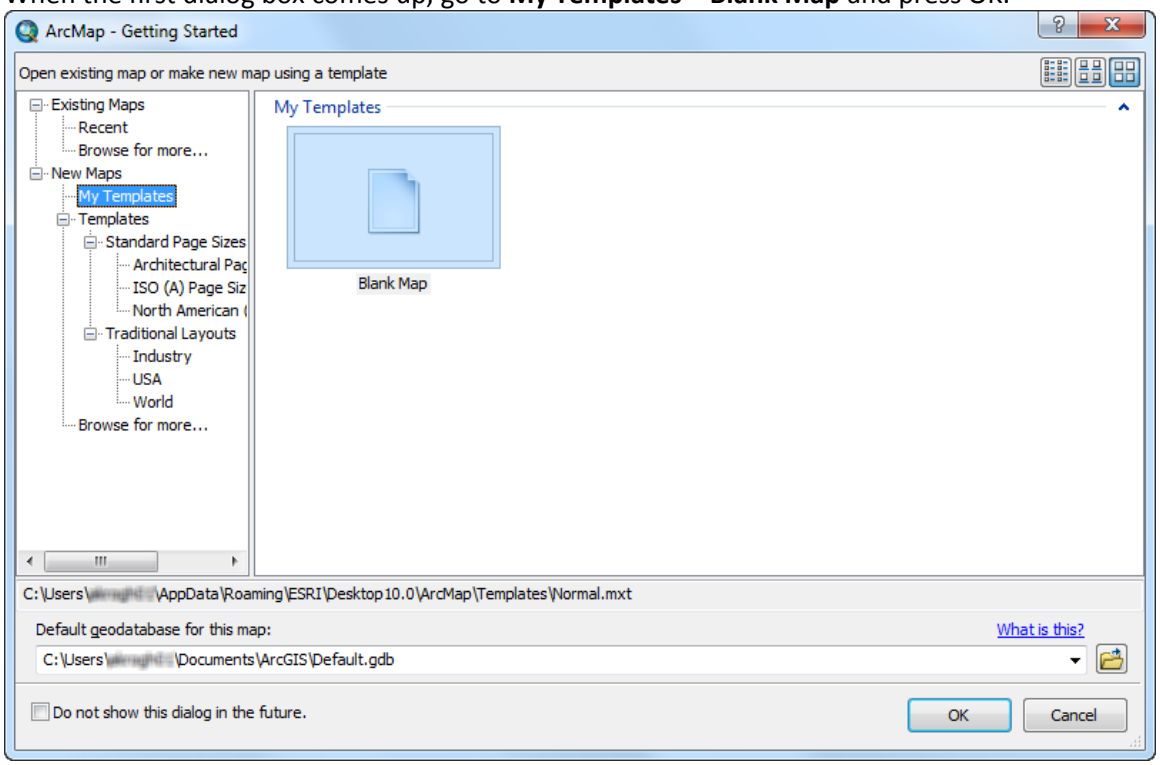
This tutorial shows you how to use the ArcMap module to create a simple map. ArcMap is one of the modules in ArcGIS Desktop. You use ArcMap to create maps, query data, perform analysis, and most of the other basic GIS operations. ArcMap is the module that you will use most frequently. The tutorial may take 3-4 hours to complete.

This tutorial only shows the most basic functioning of ArcMap. For further information, go to **Help – ArcGIS Desktop Help** and *Search* for the information you need.

Part 1 – Opening ArcMap and adding data layers

To start ArcMap, choose **Start – ArcMap 10**

1. When the first dialog box comes up, go to **My Templates – Blank Map** and press OK.



2. Choose **Customize – Toolbars**, and make sure that *Standard* and *Tools* are checked.

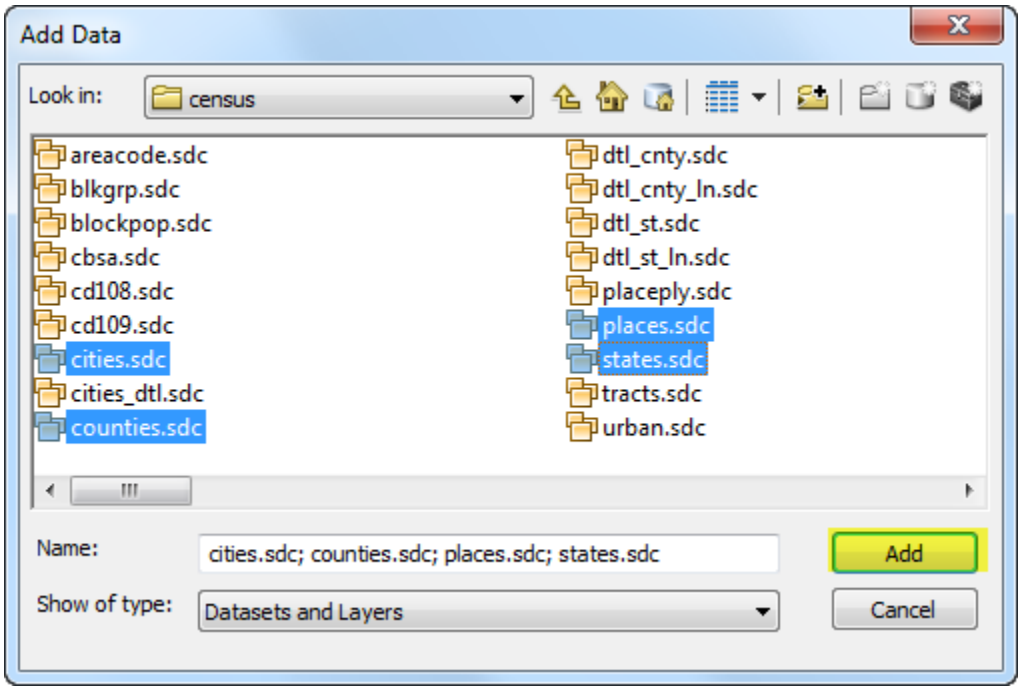
3. On the left side of the screen, you should see your *Table of Contents* area – right now it should only say "Layers". If you do not see this separate area, choose **Windows – Table of Contents**.

4. Below is the *Standard Toolbar*:

5. Click on the "plus" sign ( ) to add data.

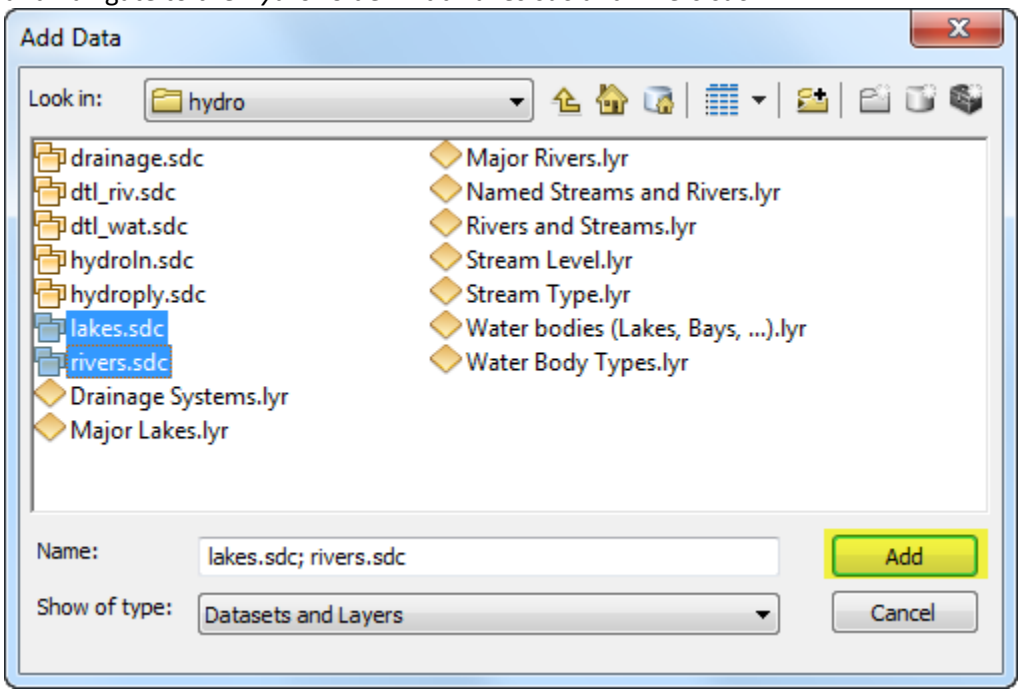
6. In the *Add Data* dialog box, navigate to M: drive – this is where the Tufts GIS Center stores data sets for university use.

7. Navigate to *M:\Country\USA\ESRIDataMaps906\census* and add the following data layers (hold down the **CTRL** key and click on each layer in turn to select multiple layers, then press **ADD**):

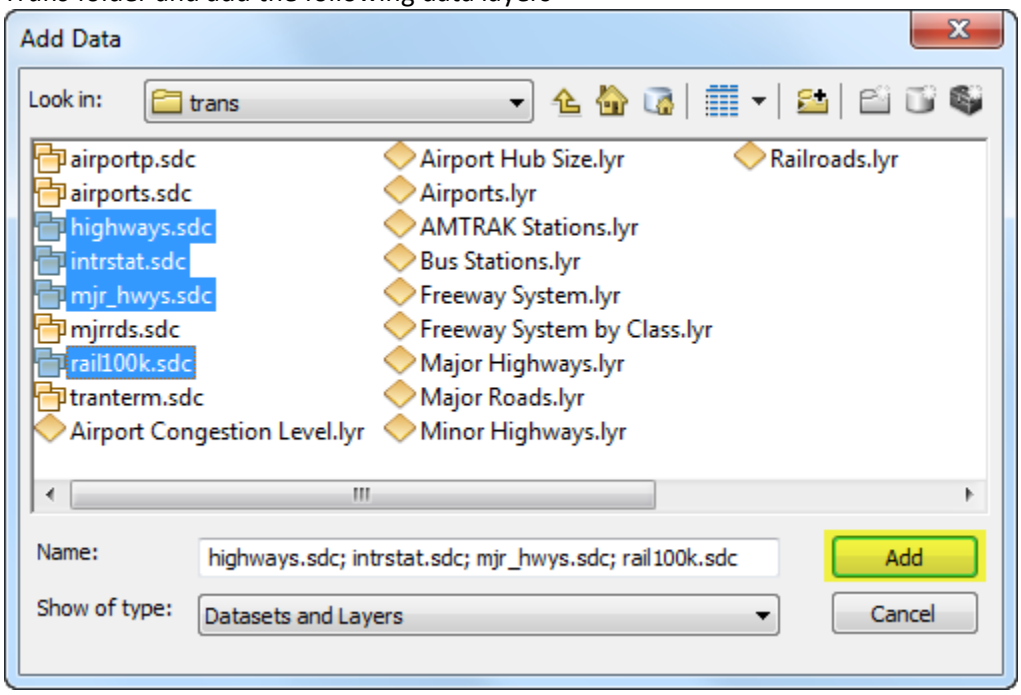


8. If you missed one of the above layers, simply click on the *Add Data* icon again and add the data set you missed.

9. Next, choose the **Add Data** icon again, but go back up the folder path one level ( ) and navigate to the *Hydro* folder. **Add** *Lakes.sdc* and *Rivers.sdc*



10. Finally, you need to add roads – go back up the folder path again and navigate to the *Trans* folder and add the following data layers

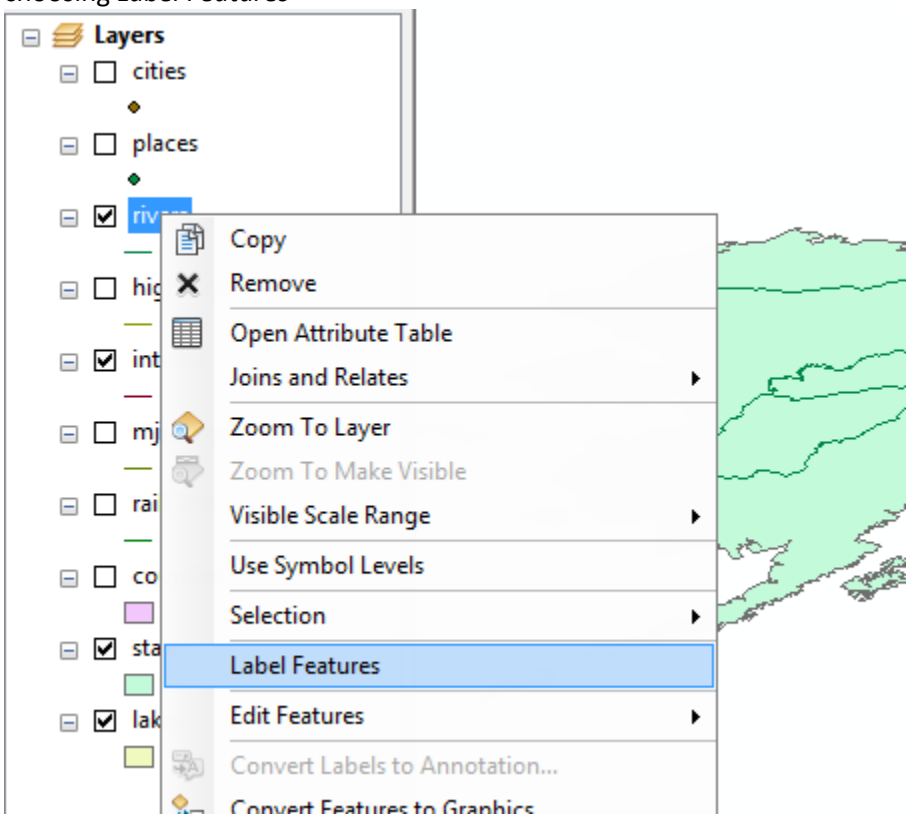


11. All the data layers added will appear in your map – a big mess!

12. Try turning off the **Places** data layer by *unchecking* it in the *Table of Contents*

13. Try turning on and off some of the other layers – for example, show a map of only states, lakes, rivers, and interstates by turning off everything else.

14. Label the rivers by **right-clicking on the Rivers layer name** in the *Table of Contents* and choosing *Label Features*



15. Try labeling some of the other layers.

16. Turn off all the labels for now by right clicking on each layer and **unchecking** *Label Features*

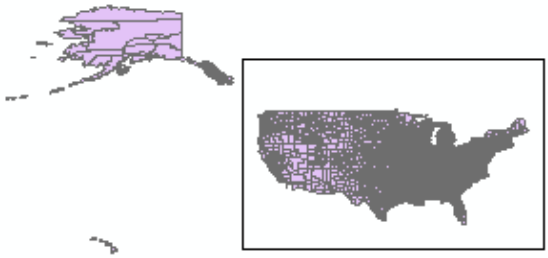
17. Now choose **File-Save**. Navigate to *your H:* drive. Name the map file *US_basemap1.mxd*. This action creates a *map file* (.mxd). A map file is a very small file that contains pointers to your data sets and remembers what you had up in your session. If you quit ArcMap at this point, the next time you start it, you can choose to start with this existing mapfile and it will automatically pop up all the data layers you added in your first session and with the view of the data just as you left it. Thus, map files are easy ways to save work.

    But beware – map files do not actually contain the data layers, they only have pointers to the data layers. If you copied your *US_basemap1.mxd* file and tried to open it on a home computer or in another lab without the GIS data layers it is referencing, an ArcMap session would start and list the data in the table of contents but nothing would appear because it would not be able to find the data it is pointing to.

Part 2 – Moving around the Map

This is the **Tools** toolbar – it contains the tools you'll use most often to work with your map:

1. Zoom into the continental US by using the *zoom-in* tool to click and drag a box around it:



2. Use the *zoom in, zoom out,* and *pan* ( ) tools to move around the map, and the *Zoom to Full Extent* tool ( ) to go back to the full extent.

3. Note that the *Go Back to Previous Extent* tool can be very useful – it will take you back a number of steps if need be

4. After you have played with these, **Zoom In** to the continental US again.

5. Turn off everything but *Interstates, Cities, Counties, Rivers, Lakes and States*

Part 3 – Renaming and defining symbology properties for a layer

In this section of the tutorial, you will learn how to organize your data layers' properties to start bringing some coherence to the map.

Assigning proper layer names

1. First, you need to give the transportation data layers better names than what they have (e.g., *Intrstat* should say "Interstate Highway")

2. Left click on the *Intrstat* layer name to select it.

3. Left click on the layer name again to rename it, and type in *Interstate Highway* instead of *Intrstat*. Hit Enter when finished.

4. Give all the other transportation layers more coherent names as best as you can (e.g.. "Railroad" instead of Rail100k, "Major Highway" instead of *mjr_hwys*) and "Major Roads" instead of *Highways* (this layer includes a lot of non-highway roads).

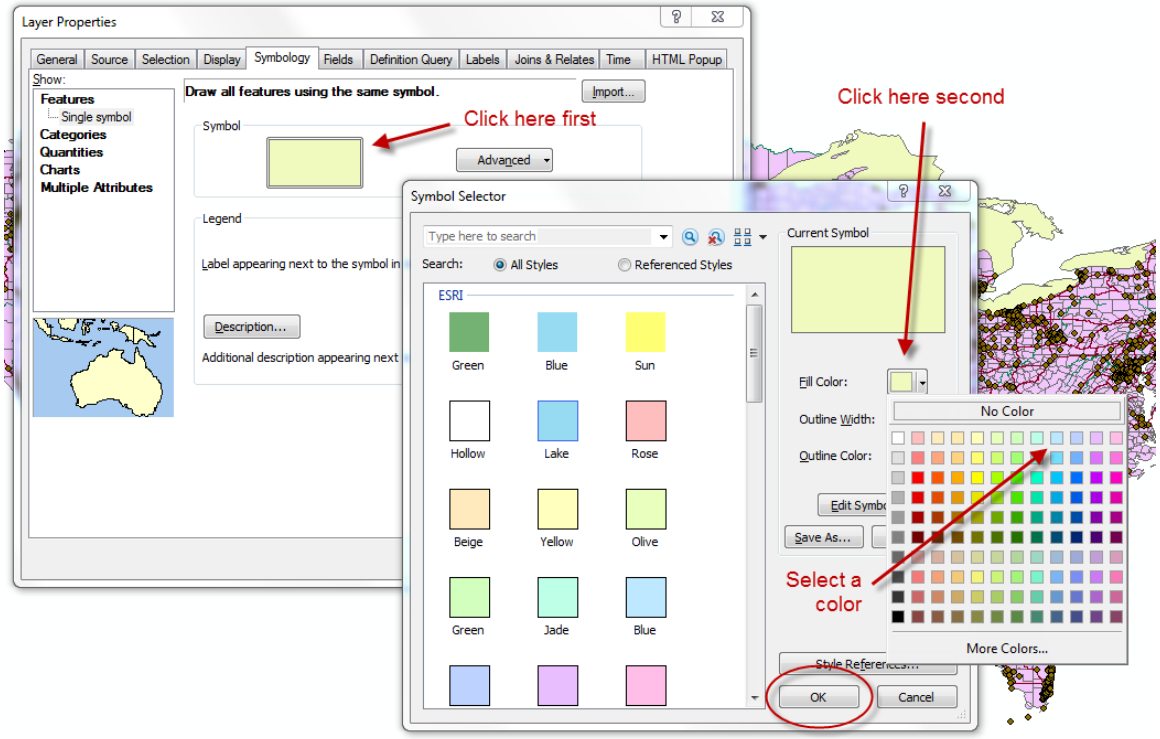
Coloring layers

Your map would be a lot better if the water were colored blue.

1. Double-click on the *Lakes* layer to bring up its *Properties* (you can also right-click and select *Properties* to do this).

2. Click on the *Symbology* tab.

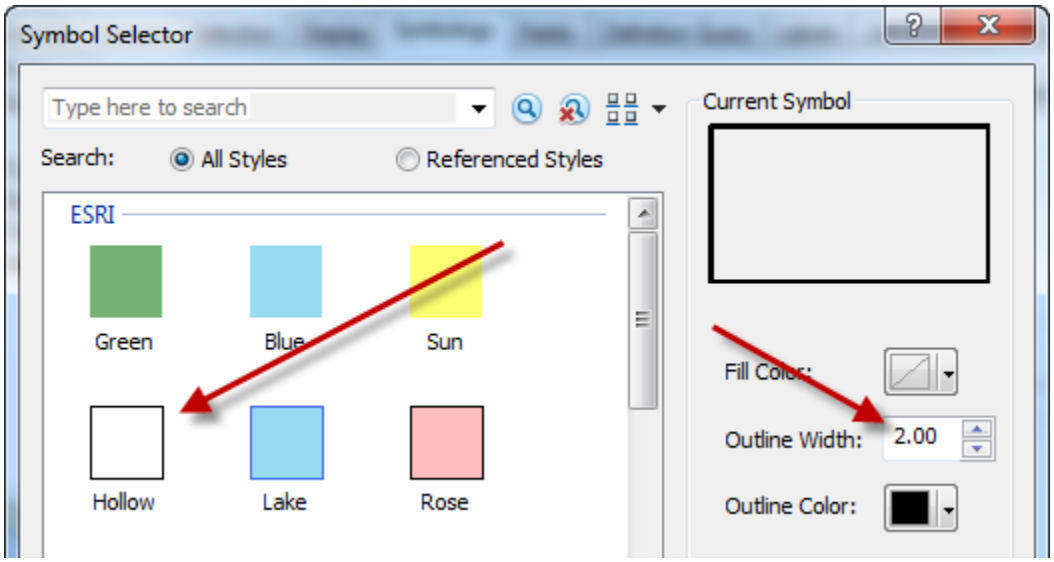
3. To change the color of the layer, follow graphic below– choose a blue color for water:



4. Press **OK** when you are finished, and **OK** again to return to your map.

5. Drag the **States** layer to the top of *the Table of Contents* by left-clicking and holding it while you drag – now it is blocking the other layers, but you can make it see-through

6. Right-click on the *States* layer and go to its symbology properties. Use the "Hollow" scheme (no fill color, with an outline), and make the outline width thicker (e.g., 2) as shown below:

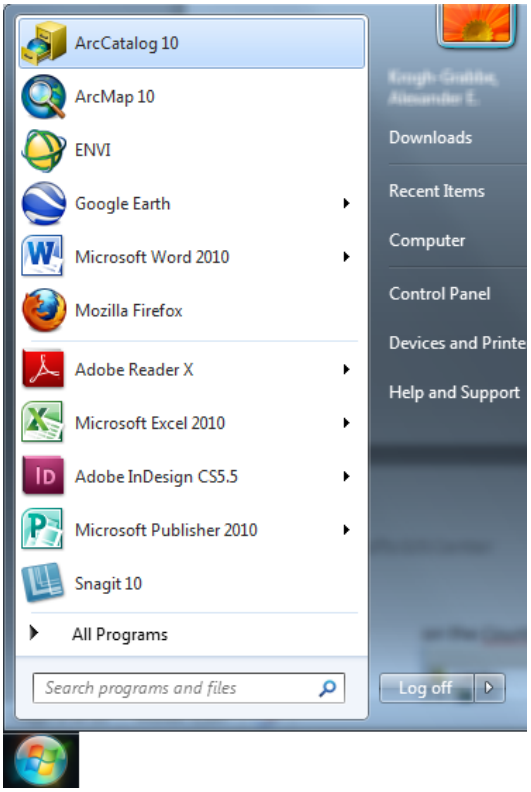


7. Drag the **Counties** layer up to just underneath the States layer and make the *counties hollow with a thin gray outline*.

8. When finished, save by hitting **Ctrl-S** or going to **File-Save**.

Part 4 – Understanding the data sets

These GIS data sets contain a lot of useful information in their attribute tables for mapping and analysis, so it's important to understand what is there.



1. **Right-click** on the *Counties* data layer in the *Table of Contents* and choose **Open Attribute Table**.

2. You'll see columns (called fields in database terminology) containing each county's name, state, FIPS code (a unique ID number identifying the county), plus information from the 2000 Census regarding population and housing.

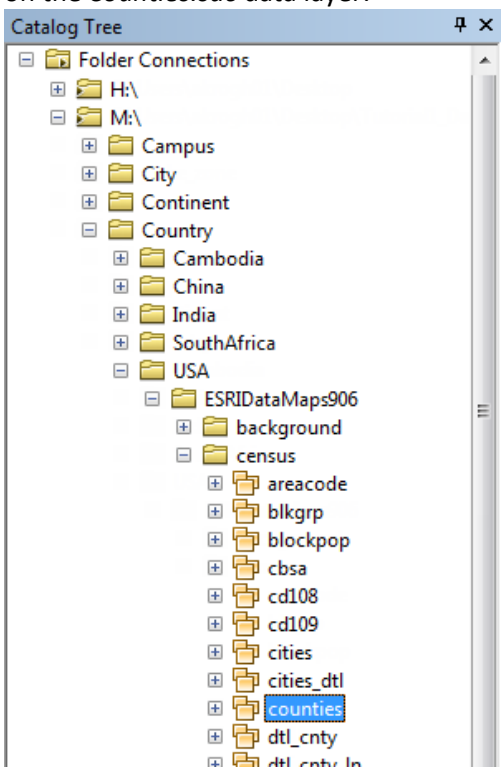
3. Close the attribute table.

To understand what these values are, you need data documentation (also called Metadata). There is another module of ArcGIS called ArcCatalog that allows you to read metadata.

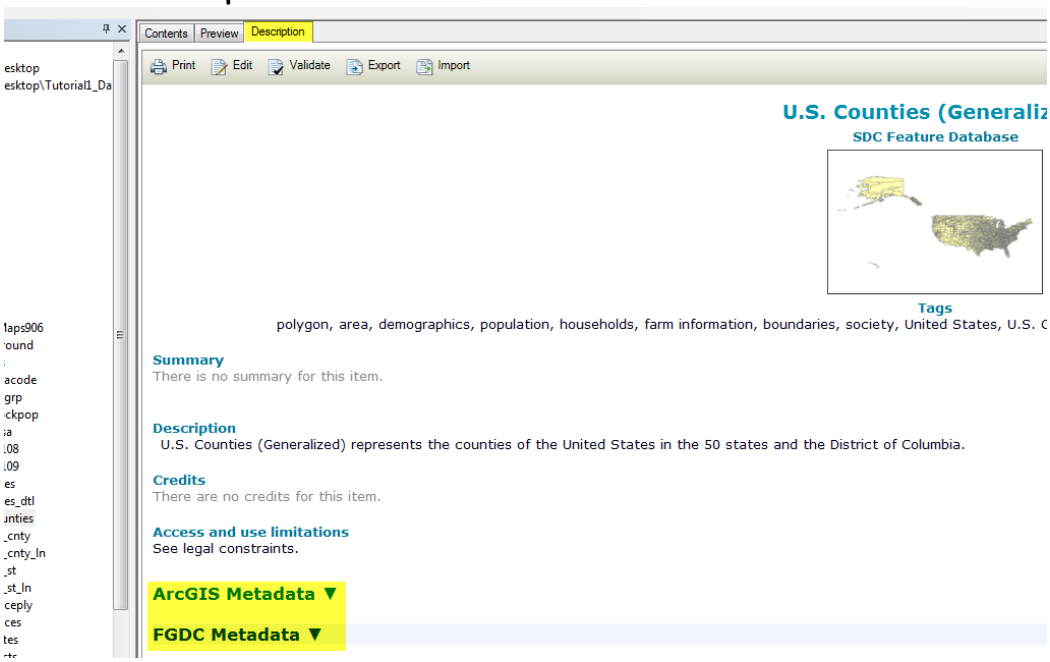
1. Start ArcCatalog by going to **Start – ArcCatalog 10**

The catalog tree on the left of the ArcCatalog window looks similar to a standard Windows Explorer view, but the ArcCatalog tree only shows data that can be read by ArcGIS.

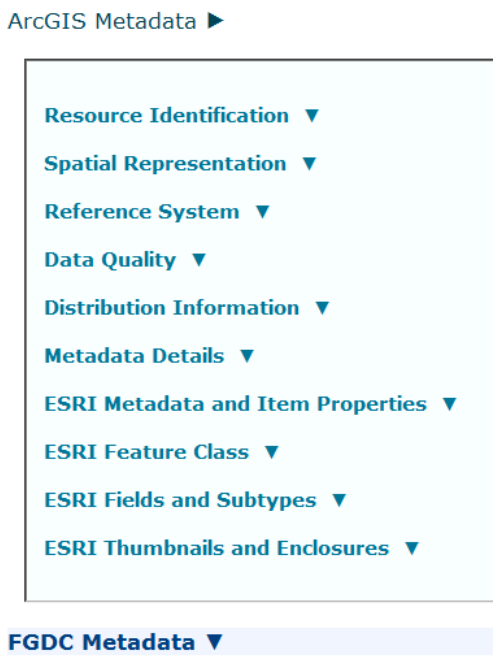
2. In ArcCatalog, navigate to the M: drive, then to *M:\Country\USA\ESRIDataMaps906\census*, then on **the left side** of the window, click on the *Counties.sdc* data layer:



3. Click on the **Description** tab for the *counties.sdc* file.



4. At the bottom of the Description window are two headings that say “Metadata”. Click on the one that says “ArcGIS Metadata”.



5. Explore the different dropdowns. You will find information about the coordinate system (in “Reference System”), the production of the metadata, and more information about all of the different fields in the attribute table (in “ESRI Fields and Subtypes”).

6. Next, click on the next heading, “FGDC Metadata”.

7. Explore these dropdowns as well. This is a different format for the same data set.

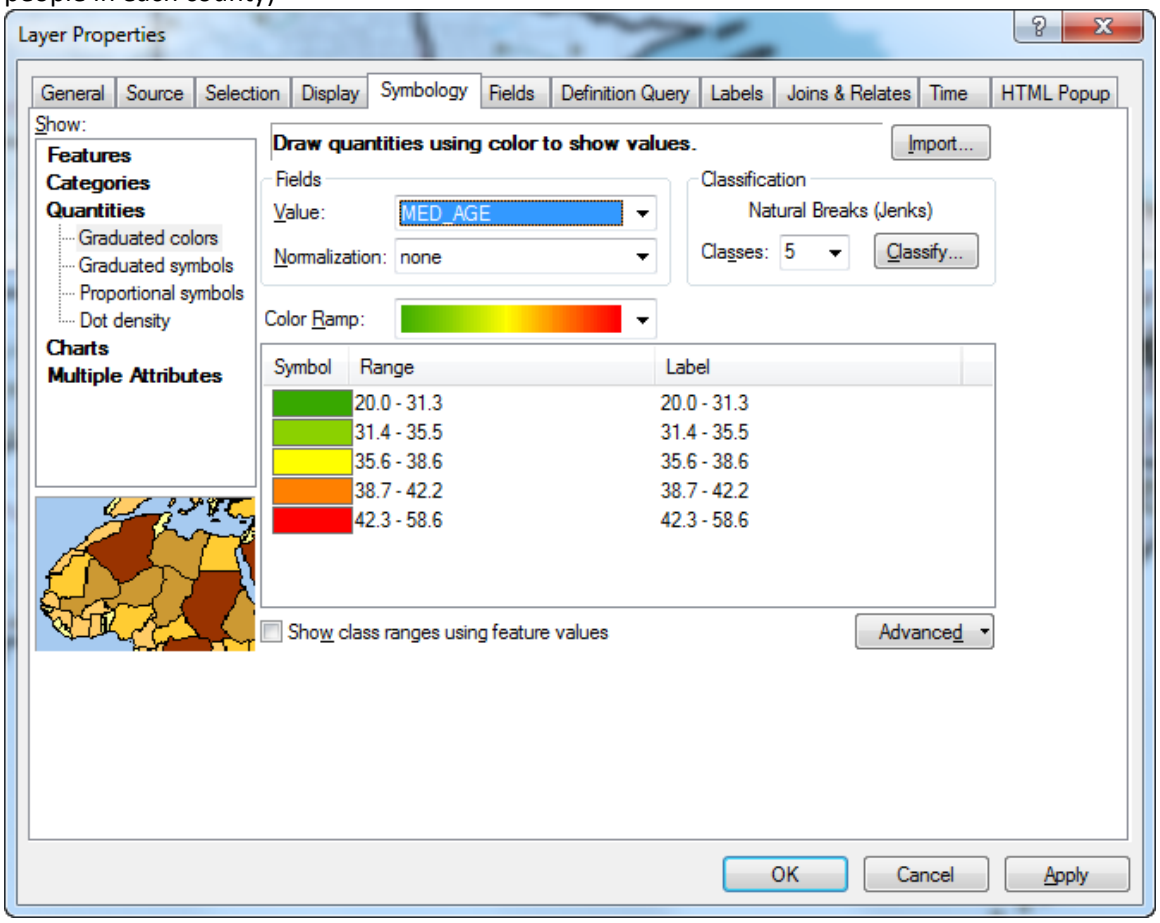
Now we’re going to draw a map based on the census information

Part 5 – Mapping Median Age by County (map by quantities)

We’re going to create a map of median age by county.

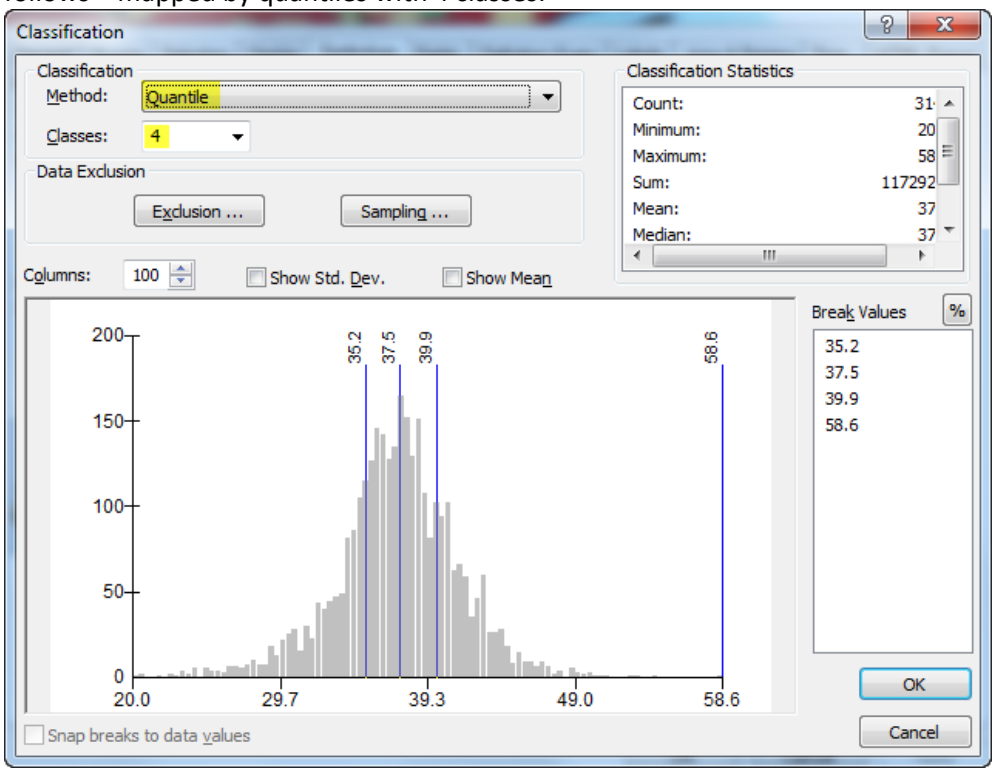
1. Return to ArcMap and checkmark *Counties* if it isn’t visible.
2. **Double-click on Counties** to bring up *Properties.*
3. Click on the *Symbology* tab
4. On the left side of the dialog box under *Show*: click on *Quantities – Graduated Colors*

5. Click on the box by value (as shown below) and then find MED_AGE (median age of people in each county)



6. Click **OK**
7. What kinds of patterns do you see? Where is the age of the population higher and where it lower?
8. Go back to the **Symbology Properties** for *Counties*
9. Click on the button for **Classify**
10. This shows you lots of information about the median age value, including the distribution of values, maximum, minimum, and mean values. You can also choose a different mapping method and set a different number of classes. Set up your map as

follows – mapped by quantiles with 4 classes:



11. Press **OK**
12. What you're seeing now is US counties divided into four classes (quartiles) with the same number of counties in each class – this is a good way to get quick look at percentiles.
13. Save your *US_basemap1.mxd* mapfile again.

Part 6 – Mapping Major Highways by class (map by categories)

Now we want to map our major highways by what kind of highway or road they are.

1. Return to **ArcCatalog**
2. Navigate to the TRANS folder and look at the metadata for *the MJR_HWYS* data set, and again click on "FGDC Metadata" and then "Entities and Attributes".

3. Scroll down – you'll see an attribute listing for **CLASS** – we're going to draw our major highways based on the codes below.
4. Leave ArcCatalog up with this table in view.

```
ATTRIBUTE
  ATTRIBUTE LABEL   CLASS
  ATTRIBUTE DEFINITION
  The highway class.
  ATTRIBUTE DEFINITION SOURCE   ESRI
  ATTRIBUTE DOMAIN VALUES
    ENUMERATED DOMAIN
      ENUMERATED DOMAIN VALUE   1
      ENUMERATED DOMAIN VALUE DEFINITION
      Limited Access.
      ENUMERATED DOMAIN VALUE DEFINITION SOURCE
      ESRI
    ENUMERATED DOMAIN
      ENUMERATED DOMAIN VALUE   2
      ENUMERATED DOMAIN VALUE DEFINITION
      Highway.
      ENUMERATED DOMAIN VALUE DEFINITION SOURCE
      ESRI
    ENUMERATED DOMAIN
      ENUMERATED DOMAIN VALUE   3
      ENUMERATED DOMAIN VALUE DEFINITION
      Major Road.
      ENUMERATED DOMAIN VALUE DEFINITION SOURCE
      ESRI
    ENUMERATED DOMAIN
      ENUMERATED DOMAIN VALUE   4
      ENUMERATED DOMAIN VALUE DEFINITION
      Local Road.
      ENUMERATED DOMAIN VALUE DEFINITION SOURCE
      ESRI
    ENUMERATED DOMAIN
      ENUMERATED DOMAIN VALUE   5
      ENUMERATED DOMAIN VALUE DEFINITION
      Minor Road.
      ENUMERATED DOMAIN VALUE DEFINITION SOURCE
      ESRI
    ENUMERATED DOMAIN
      ENUMERATED DOMAIN VALUE   6
      ENUMERATED DOMAIN VALUE DEFINITION
      Other Road.
      ENUMERATED DOMAIN VALUE DEFINITION SOURCE
      ESRI
    ENUMERATED DOMAIN
      ENUMERATED DOMAIN VALUE   7
      ENUMERATED DOMAIN VALUE DEFINITION
      Ramp.
      ENUMERATED DOMAIN VALUE DEFINITION SOURCE
      ESRI
    ENUMERATED DOMAIN
      ENUMERATED DOMAIN VALUE   8
      ENUMERATED DOMAIN VALUE DEFINITION
      Ferry.
      ENUMERATED DOMAIN VALUE DEFINITION SOURCE
      ESRI
    ENUMERATED DOMAIN
      ENUMERATED DOMAIN VALUE   9
      ENUMERATED DOMAIN VALUE DEFINITION
      Pedestrian Way.
      ENUMERATED DOMAIN VALUE DEFINITION SOURCE
      ESRI
```

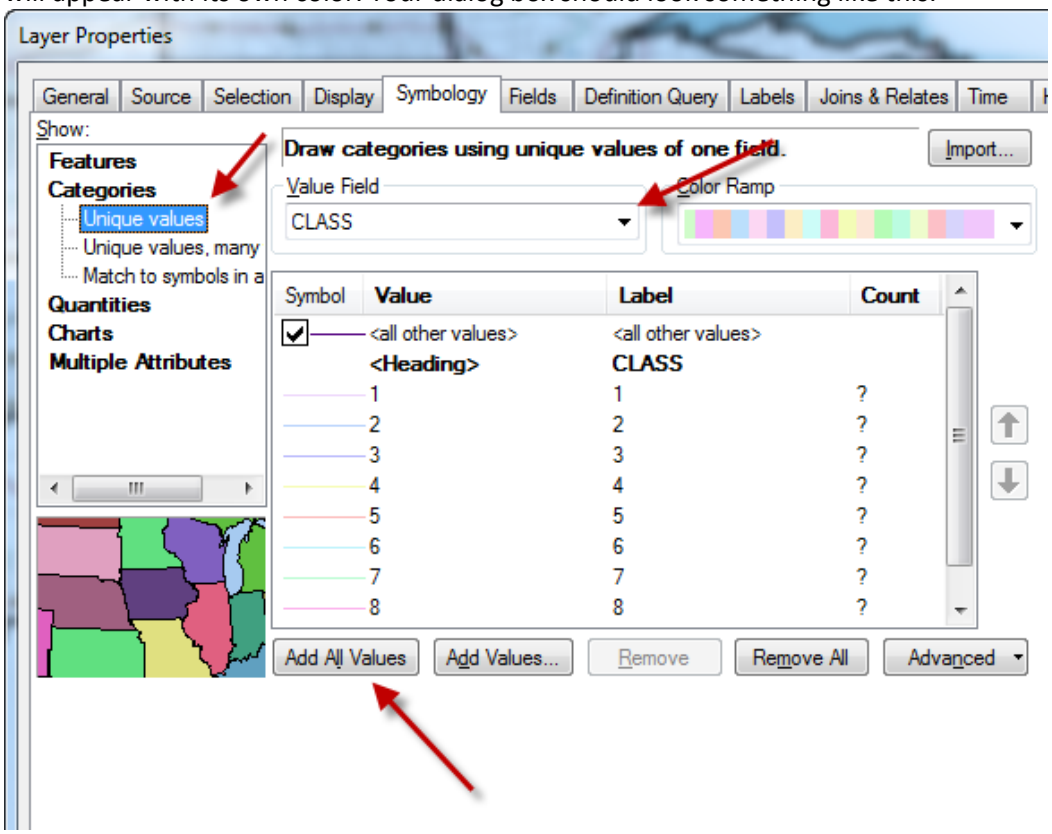
Note: metadata is not always found in ArcCatalog. It may come as a text file (e.g., called README.txt) or it may be explained on the web site of the agency from which the data set comes.

Suppose we want to color limited access highways red, other highways gray, and not see non-highway roads at all on your map. You've seen that the MRJ_HWYS (now called Major Highways in your map) has a CLASS column that describes the class of road.

To do this

1. Return to **ArcMap**
2. **Turn on** (checkmark) your *Major Highways* and the *States* data layer
3. **Turn off** the all the other layers
4. Double-click on *Major Highways* and go to the *Symbology* tab
5. On the left side of the Symbology dialog box, click on *Categories*, and then *Unique Values*.
6. From the pull-down menu under "Value Field," select *Class*.

7. Next, click on *Add All Values* – each unique value in the *Class* field of the attribute table will appear with its own color. Your dialog box should look something like this:

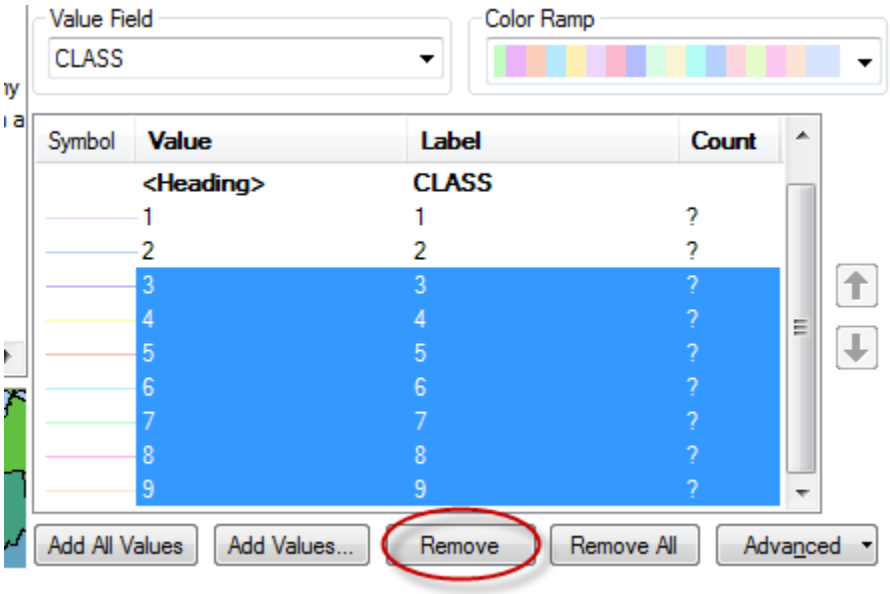


8. Press OK to return to your map. It's still not what we want – we want ONLY classes 1 and 2, with 1 as red and 2 as gray.

9. Double-click on the *Major Highways* and return to its symbology properties

10. Click on the value for 3, then hold down shift and click on the value for 9. This will highlight all the values we don't want.

11. Click on **Remove**



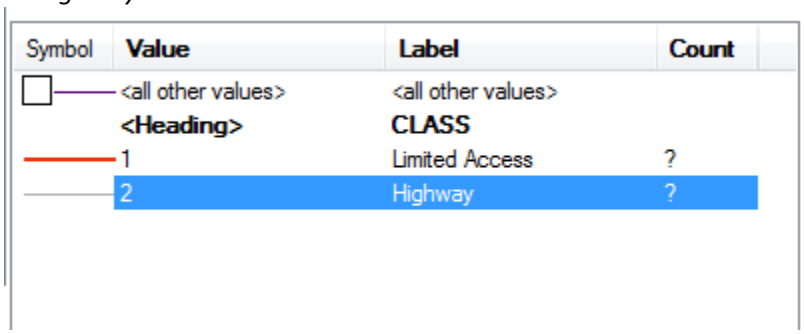
12. Uncheck *<all other values>*

13. Now double click on the line to the left of 1 to bring up its color properties.

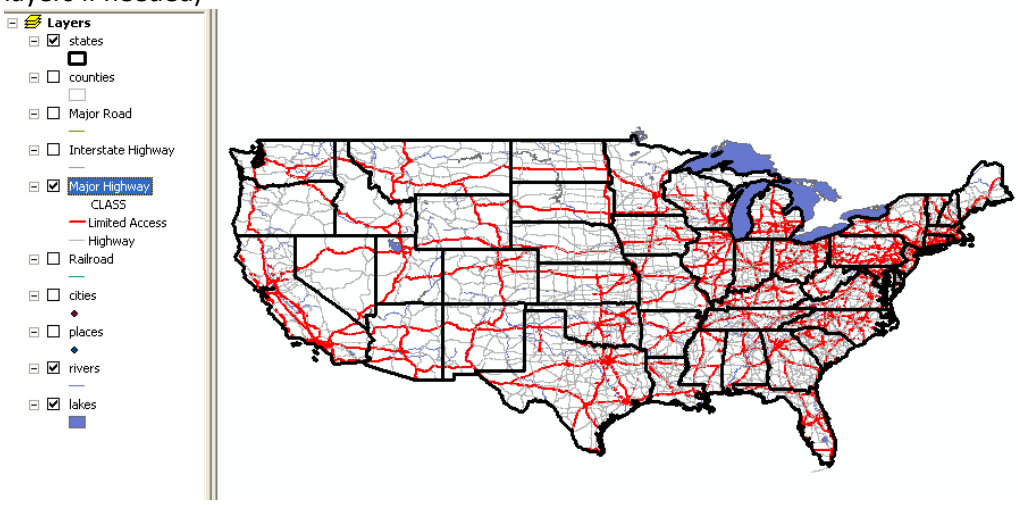
14. Make it RED with a line width of 1.5 and press OK

15. Make the line for *Class 2* roads GRAY with a line width of 0.4

16. In the *Label* column, click on 1 to replace the road class 1 code number with its definition as defined in the metadata – 1=*Limited Access.* Do the same for road class 2=*Highway*:



17. Press **OK** when finished. Your map should look like this (turn off Counties and other layers if needed)



Save your *US_basemap1.mxd* mapfile again.

Part 7 – Downloading Data from GIS Data Web Sites

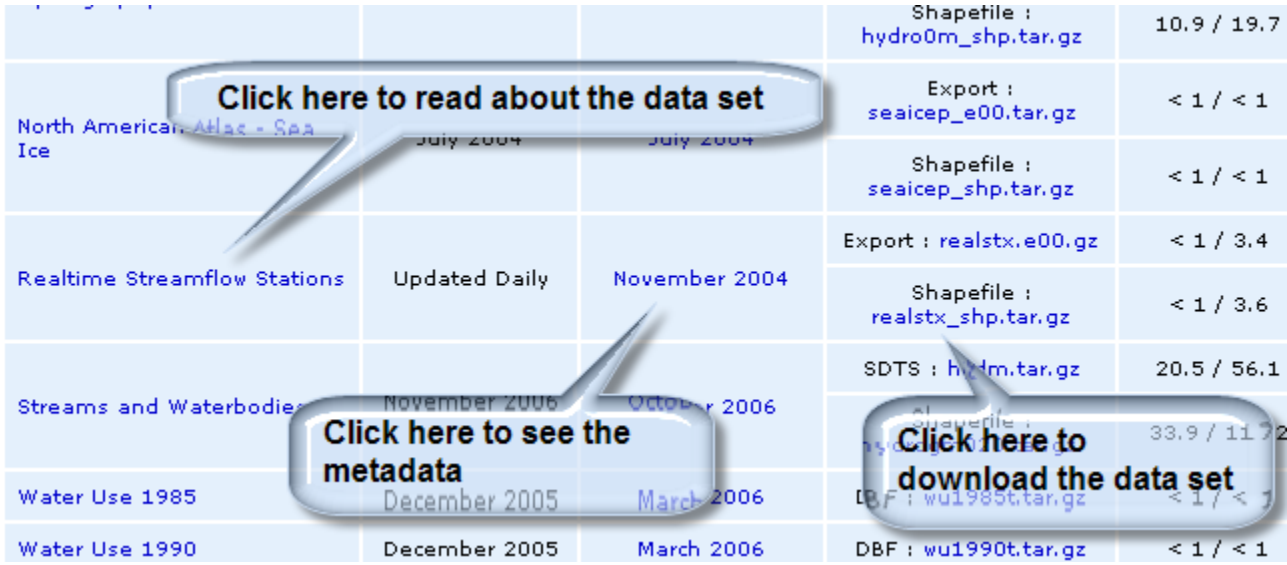
In this section we're going to download data from two different web sites to illustrate how that works

Downloading and Displaying Data from the National Atlas

The National Atlas (http://nationalatlas.gov) is an online mapping site for looking at data from the Federal Government. You can also download GIS data from this site. We're going to download real time stream gauge information for the US.

1. Open Firefox and go to the http://nationalatlas.gov
2. Click on the link for *Mapping Professionals* (that's you!)
3. Click on the link for *Raw Data*
4. Click on the link for Water
5. Scroll down to see the *Realtime Streamflow Stations*

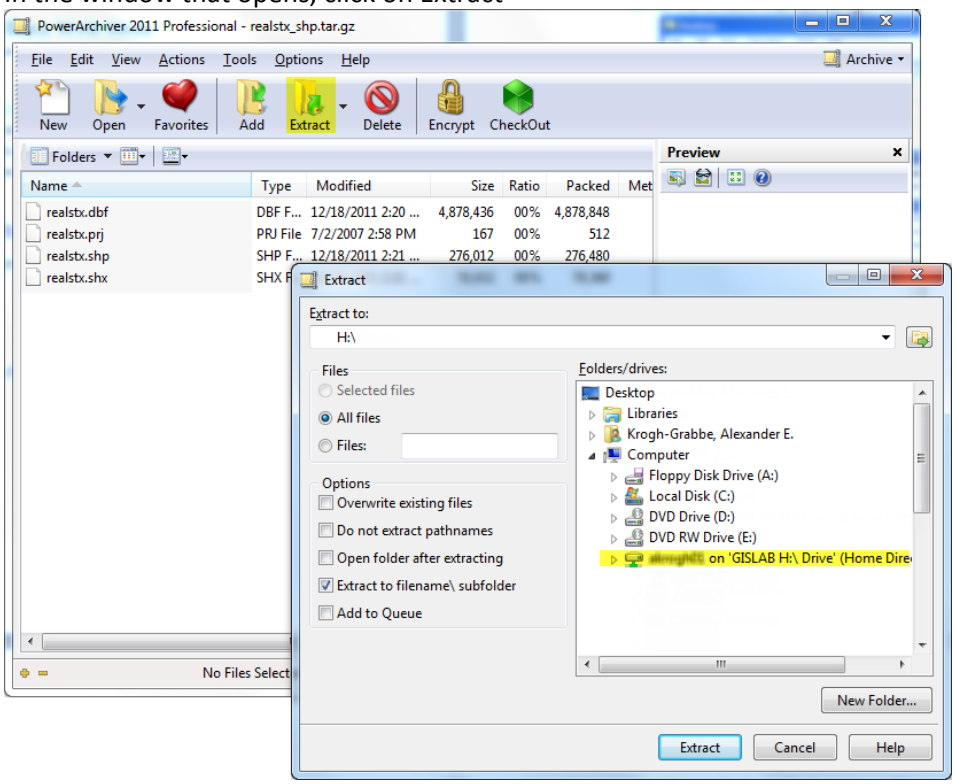
6. Read about the data set and take a look at its metadata:



7. **Download** the shapefile version by clicking where indicated above and choosing *Open with* PowerArchiver. This should be the default.

8. When it asks you if you want to remove the read-only attribute, say **Yes**.

9. In the window that opens, click on Extract

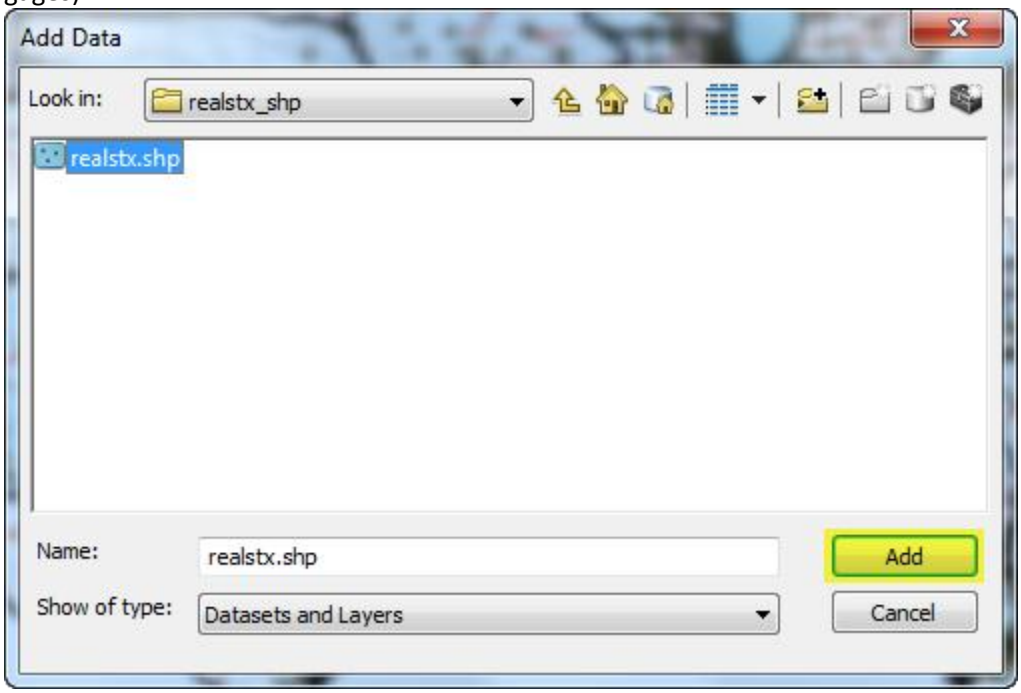


10. Navigate to your *H: drive* and click **Extract**

11. Return to **ArcMap**

12. Click on the **Add Data** button

13. Navigate to your H: drive and add the realstx.shp file (this is the realtime streamflow gages)



14. You should see points appear on the map

15. In the *Table of Contents*, re-name this data layer to **Streamflow**

16. Right-click on the data layer and choose *Open Attribute Table*

17. Take a look at the attributes included there. **Stage** is the height of the water in a river, while **flow** is a computed value estimating the quantity of water passing by the gage.

18. Close the attribute table.

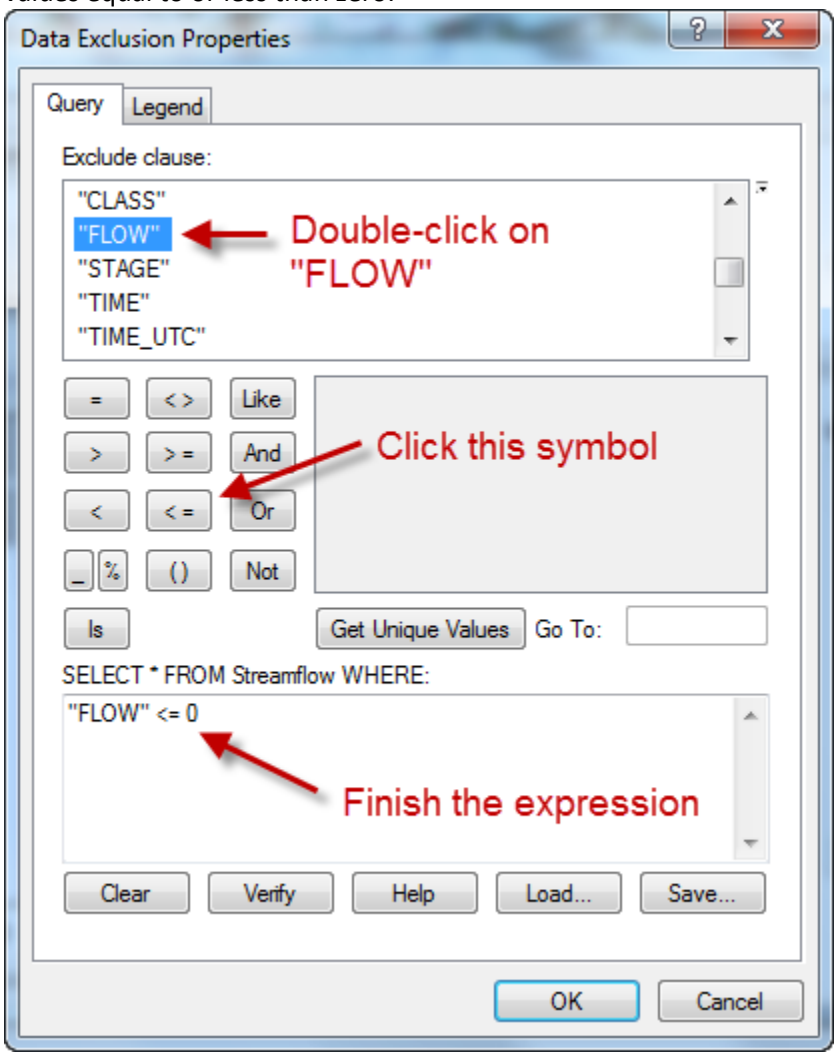
19. Try making a map (by quantities) of the stage at each stream gage (stage is the height of the river).

20. Try making a map (by quantities) of the flow at each gage.

21. Note there are some negative values in *Flow*. Go back to the **Symbology Properties** for *Streamflow*

22. Click on **Classify**

23. Click on the **Exclusion** button and fill out the form as you see below to exclude flow values equal to or less than zero:



24. Click OK and OK again to get back to your map.

Where is there higher flow of streams today?

Downloading and Mapping Power Plants using the EPA's eGRID data

The EPA has a database of power plants that includes emissions for carbon dioxide and other pollutants and greenhouse gases. We're going to map these.

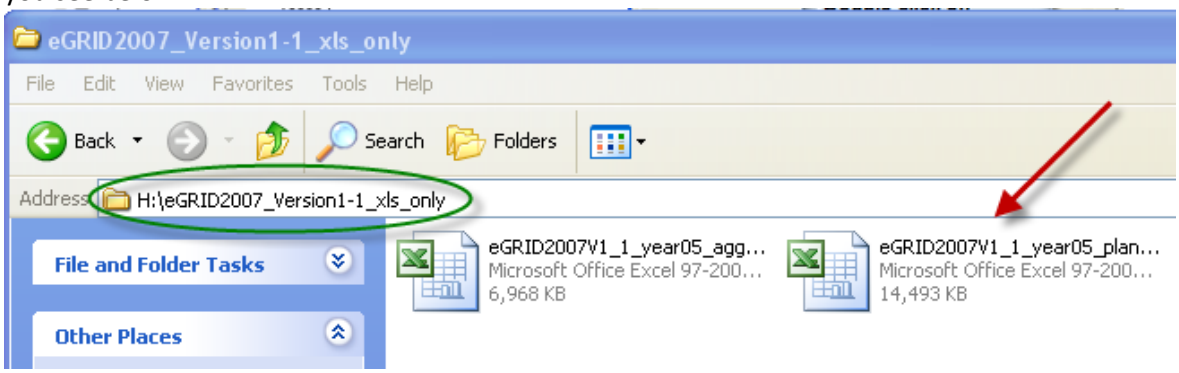
1. Go to the EPA eGRID 2007 web site – http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

2. Read about the data set

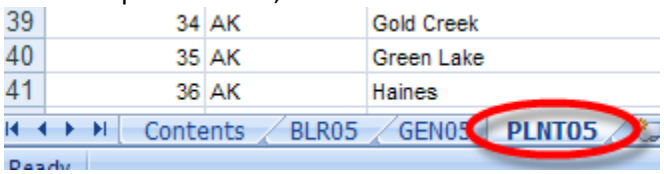
3. Click on the link for "eGRID2007 year 2005 plant and aggregation files (ZIP) (5.9 MB)" – http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2007_Version1-1_xls_only.zip – and choose *Open with* PowerArchiver.

4. Extract the file to your H: drive as you did in the last section

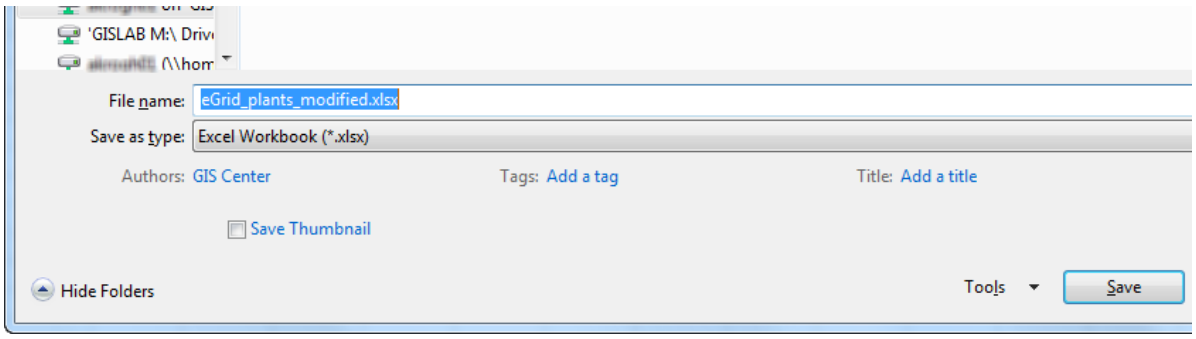
5. Go to My Computer and navigate to your H: drive and open the *eGRID…plant* data set you see below:



6. When it opens in Excel, click on the **PLNT05 tab** at the bottom



7. Now choose **File – Save** as and save the file as *eGrid_plants_modified.xlsx*

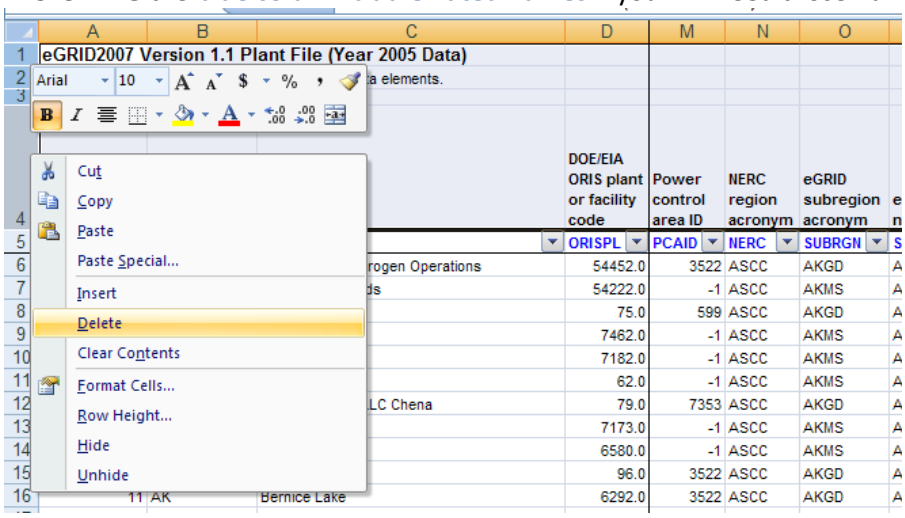


8. Look through the Plant information and see what attribute columns it has – note that in addition to emissions information, it has *Plant latitude* (LAT) and *Plant longitude* (LON). We'll use this information to map this table.

You have to modify the Excel table before using it in ArcMap. For a table to be usable in ArcMap, it can only contain the column names and the data rows, not table titles or other text above the table. Also, the column names can only be 11 characters long with no spaces or special characters. The blue column headings in the Plant05 worksheet already meet

these criteria. But we need to delete the rows above them before we bring this table into ArcMap.

9. In your modified Excel file, delete the top rows of information down to but **NOT INCLUDING** the **blue column abbreviated names** – you will need those names!



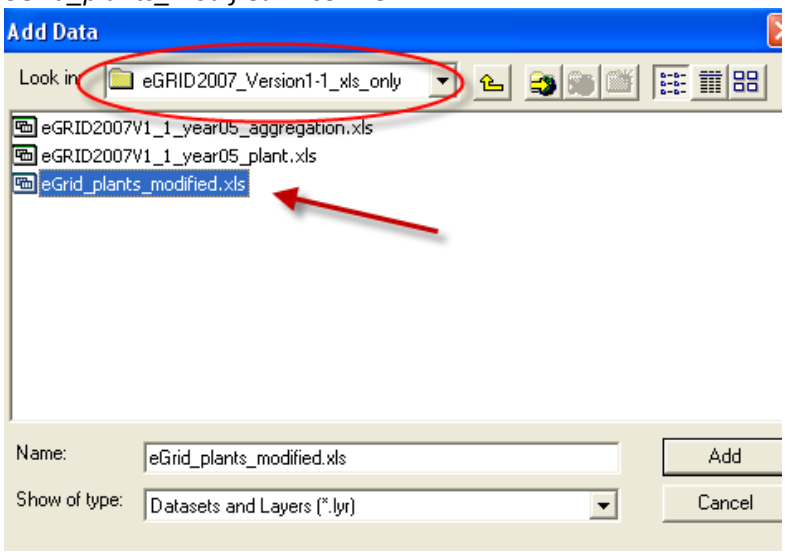
10. Choose **File – Save**

11. **Close Excel**

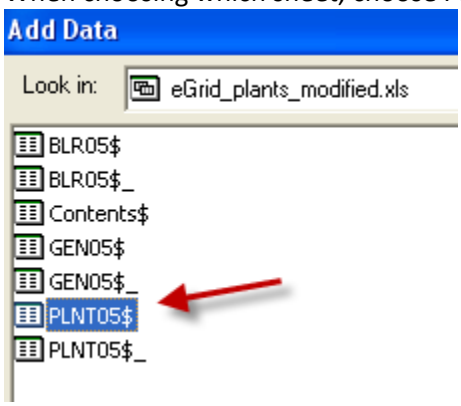
Mapping the eGRID data set in ArcMap

1. Return to **ArcMap**

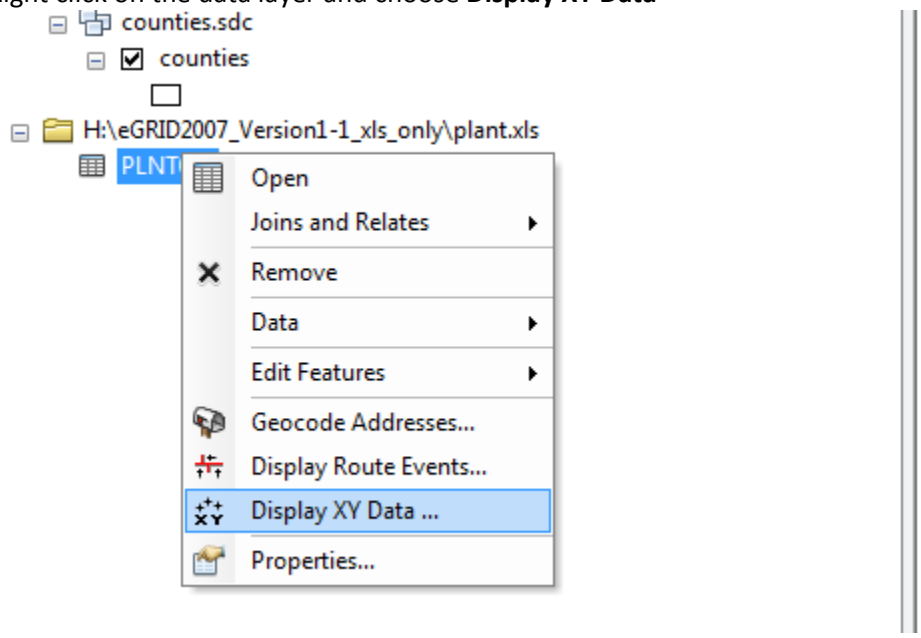
2. Click on the **Add Data** icon and navigate to your H: drive to add the *eGrid_plants_modified* Excel file:



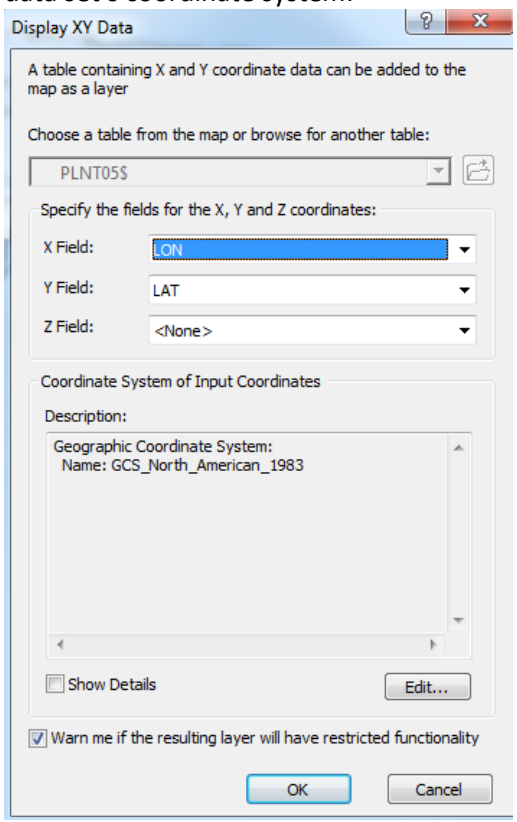
3. When choosing which sheet, choose PLNT05$:



4. Right click on the data layer and choose **Display XY Data**



5. Make sure the dialog box is filled out as follows and then click **EDIT** to define the eGrid data set's coordinate system:



6. Choose **SELECT** in the next dialog box

7. Double-click *Geographic Coordinate System*

8. Double-click *World*

9. Double-click *WGS 1984.prj*

10. Click OK and OK again.

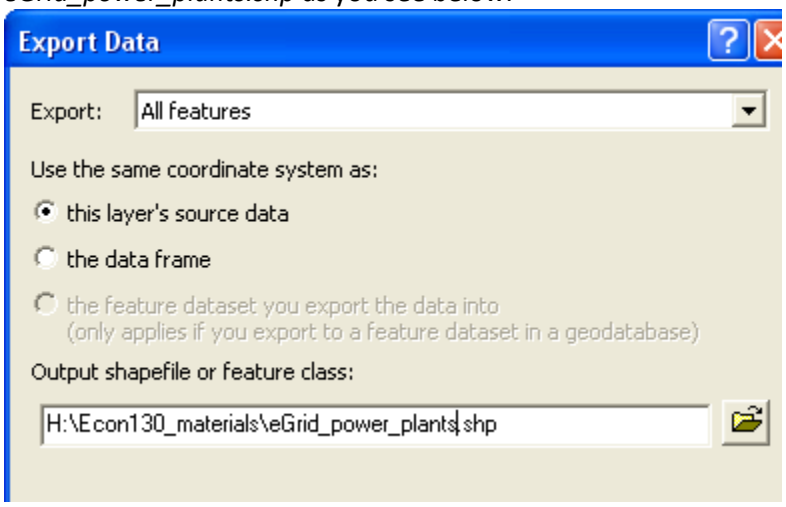
11. Click OK when you get the warning message

12. The power plants appear as points.

13. The warning message was saying that this is not a true GIS data set. To make it a permanent GIS data set, **right click** on the *PLNT05$ Events* data layer

14. choose **Data – Export Data**

15. This will create a new GIS data layer – make sure it is on your H: drive and name it *eGrid_power_plants.shp* as you see below:

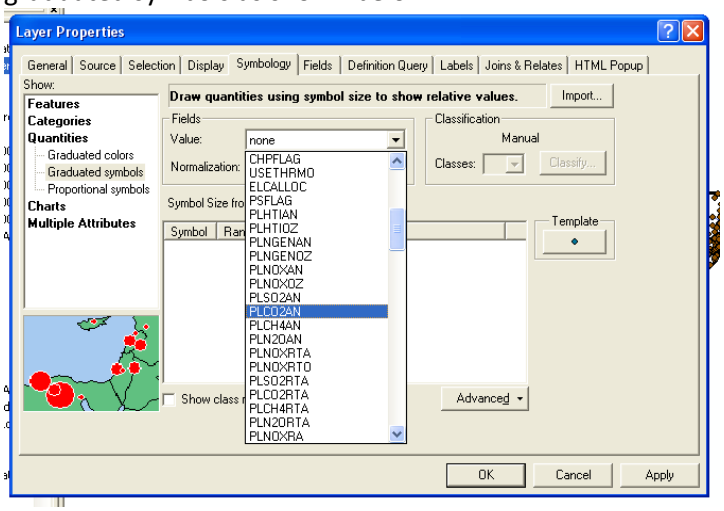


16. Click OK

17. Click Yes to add it to the map

18. Remove the original *PLNT05$ Events* data set by right-clicking on it and choosing REMOVE.

19. Try mapping some of the attribute information, e.g., annual CO2 emissions using graduated symbols as shown below:



20. Play around with this data set

21. Save your *US_basemap1.mxd* when finished

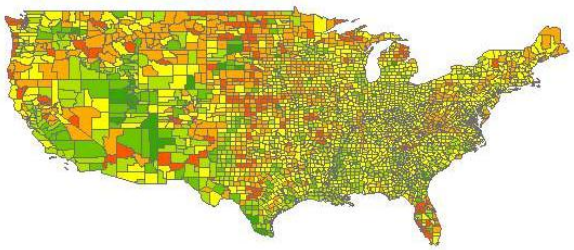
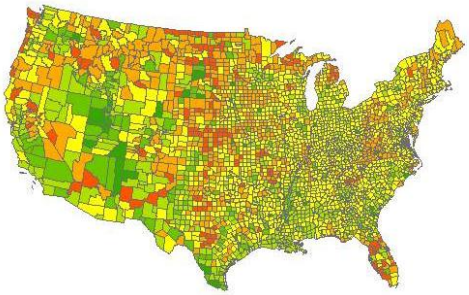
There are thousands of GIS data sets that you can download from web sites. See the Tufts GIS Center (http://gis.tufts.edu) and its links to *Online Resources* for a good guide. If you have a

specific topic interest, try going to the link for GISTA Data by Topic link (https://wikis.uit.tufts.edu/confluence/x/5QOH)

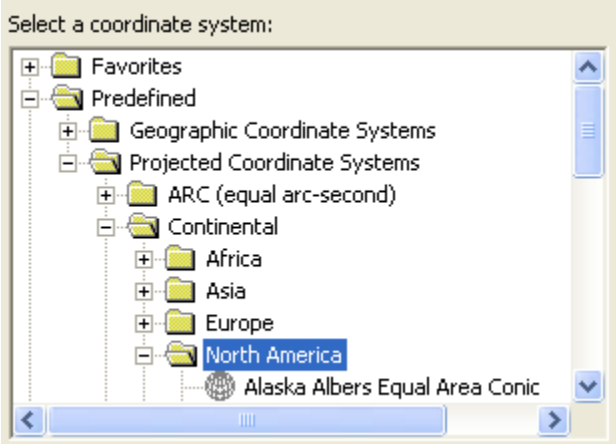
Part 8 – Setting the Data Frame's Coordinate System

If the data you are using is already projected (e.g., data from MassGIS is already projected into the Massachusetts State Plane NAD 83 coordinate system), you most likely will NOT want to change the coordinate system of your data frame. However, if the data is unprojected (in a geographic coordinate system – GCS), then you should project it for better map results. There are many national data sets that are unprojected, including the US data we have from ESRI. The example below shows how to project a map US data into an appropriate coordinate system.

To change the coordinate system of your map, e.g., from what you see on the left to what you see on the right (a much better way to show the US in a choropleth map):

US Counties – Geographic Coordinate System, NAD 83	US Counties – US Contiguous Albers Equal Area
	

1. Right-click on **Layers** in the *Table of Contents* (this is the *data frame*) and go to *Properties* (or choose **View – Properties**)
2. Click on the *Coordinate System tab*
3. Select *Predefined – Projected Coordinate System* and the type of the coordinate system you want. In the case above we went to *Continental – North America – Contiguous Albers Equal Area Conic USGS*.
4. Click *OK* when done.

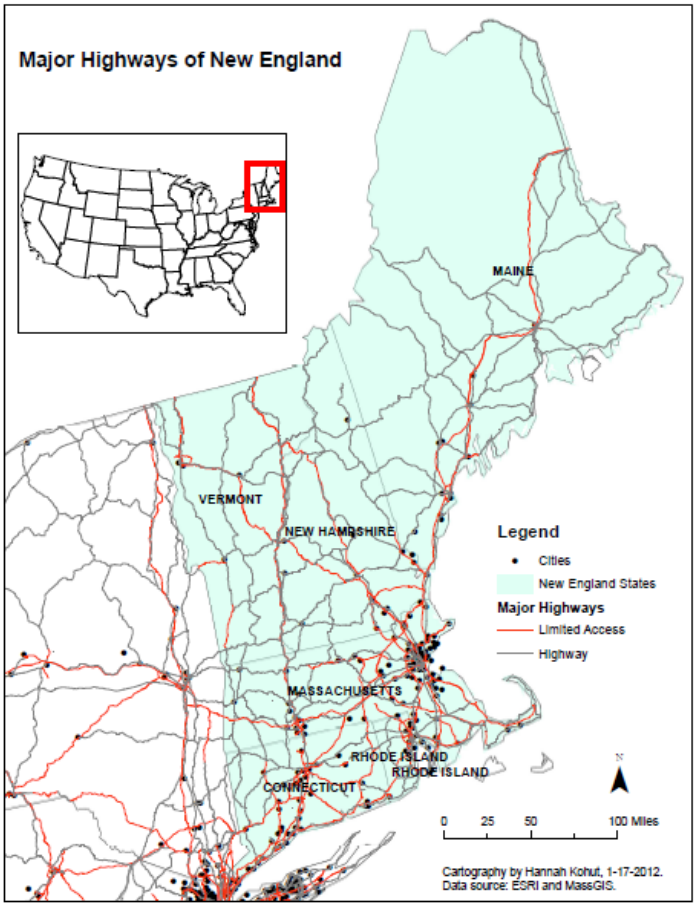


Note: this may result in problems when you are trying to add a GIS data set that does not have a defined spatial reference. A data set you expect to see on the map may not appear after you add it. If this happens, ask a lab assistant for help and take a look at our Tufts GIS tip sheet for "defining a projection/coordinate system" (https://wikis.uit.tufts.edu/confluence/download/attachments/47448223/Projections+-+defining+a+projection.pdf?version=2&modificationDate=1324312496000)

Part 9 – Creating a layout for printing or graphic export

Now you're ready to create a well-designed map. But please read the following first….

When you create a map, you should include the map itself, plus a title, a legend, a scale, and a north arrow. You should also provide the name of the cartographer (you), a date, and acknowledgements about data sources. Here is an example of a complete map:



It is important in a map not to include too much information. You would not want a map that includes all the data layers you have in your ArcMap session from this tutorial. It would be much better to do several maps, e.g., one showing the general layout of New England and its states,

another showing land use, possibly one showing counties of a specific state or certain cities labeled.

You may also include other elements on your map, for example, more explanatory text, charts, tables, photos, or other images.

Note that you can also have more than one data frame on a layout – for example, you can have a small locational reference map (as in the map above) or an inset map to show an area in more detail. See the next section (*Adding a data frame to show two or more maps on a layout*) for instructions about how to do this.

To do all this, you will move into *Layout View*. *Layout View* is much like viewing the page layout when you are working in a word processing software. You should do all the preliminary work and analysis in the *data frame view* (where you have been up to now in this tutorial), then move into *Layout View* only when you are ready to create a map

For detailed information about layouts, see *Help – ArcGIS Desktop Help – Professional Library – Mapping and Visualization – Page Layouts*

If you don't already have it open, start ArcMap and bring up your map file from the earlier part of this tutorial.

Setting up a map layout

1. In preparation for this section of the tutorial you'll need to add one additional layer to your map.
2. Click on the **Add Data** button
3. Navigate to *M:\State\MA\MassGIS\Political_Boundaries,* and add *NEWENGLAND_POLY.shp* to your map.
4. Before you start a map layout, it is important to think through what you want to do and how you want your map to look. What do you want to show? How large do you want your final map to be? Portrait or landscape orientation? Do you need space for additional text or graphics? This tutorial example will assume a paper size (8x11 inch) map but often you are making map for publications where they must be smaller, or for Powerpoint where they need to be a certain size (e.g., 7.5x10 inches), or for posters where they may be much larger than 8x11.
5. In ArcMap, choose **View – Layout View** from the main menu.
6. The view changes to show your data frame on a page layout and a new toolbar appears – the *Layout* toolbar
7. The first thing you should do is to set up your Page properties. Choose **File – Page and Print Setup**
8. In the *Page Setup* dialog box, make sure that the page size is set to *Letter*. Also check either *Portrait* or *Landscape* (which would be better for the map you want to create? The example map is in *Portrait* orientation). Press OK to return to the map.

Moving around in the page and data frame

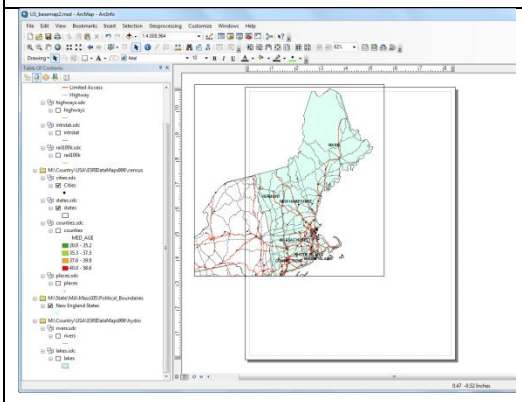
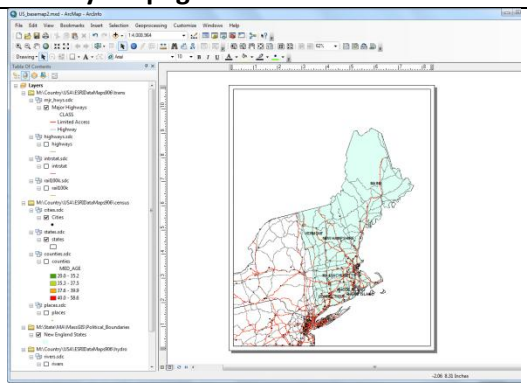
It is very important to understand the difference between the **Layout** toolbar and the regular (data frame) **Tools** toolbar. They share similar tools (zoom in and out, pan) but the **layout tools** work on the layout as if you were zooming in and out of the *paper itself*, while the same tools on

the **Tools** toolbar work on the data inside the data frame (e.g., zoom into New England). You will get confused occasionally, but once you get the hang of the two toolbars, you will be off and running. For now experiment with both to see what happens.

The Tools Toolbar	**The Layout Toolbar**
Use these to navigate within the *data frame* on your map (e.g., you want the data frame to be slightly more zoomed into New England, or you need to pan the data frame to the north).	The 1:1 tool is particularly useful to see what the map features and text looks like at actual print size. The Zoom to Whole Page tool will take you back to the entire page view. Remember, the layout tools have a layout under the tool on the icons.

Resizing and moving the data frame

You will always need to re-size things in your map, especially the data frame itself which contains the map image. On the left below is something you might see when you first start a layout. In this case we are moving and resizing our data frame so that it fills the upper 4/5ths of our page. We'll then put a title, legend, and other map requirements in the blank space along the bottom of the page:

Data frame and layout page not adjusted	**Data frame after resizing and moving to fit the layout page**
	

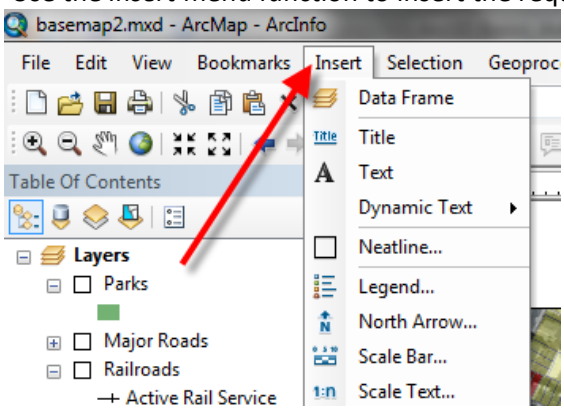
Moving and re-sizing in ArcMap works similarly to most other programs where you use graphics. The key is selecting the element first.

1. To resize and move the data frame, use the **Select Elements** pointer to select the frame first.
2. Use the small grab points on the corners and sides to resize
3. Place the cursor anywhere over the data frame to move it.

Inserting a title, north arrow, and legend

These are all usually required elements on a map. You access them by going to the **Insert** item on the *main menu* bar. You can read more about these by going to *Help - ArcGIS Desktop Help – Professional Library – Mapping and Visualization – Page Layouts*, but here are a few tips:

Use the *Insert* menu function to insert the required map elements



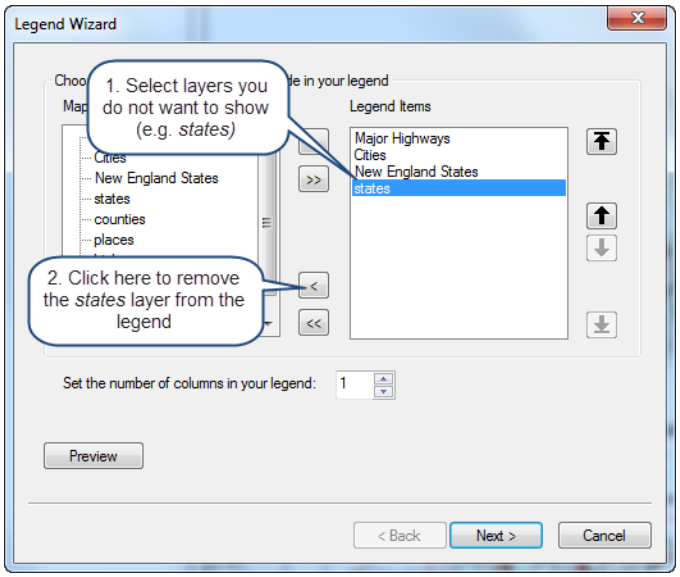
Insert Scale Bar

The scale bar you select will be in the *Display* units of your data frame (e.g., feet). If you want a different unit, double-click on the scale bar. In the *Scale Line Properties* dialog box, select a different *Division Unit*.

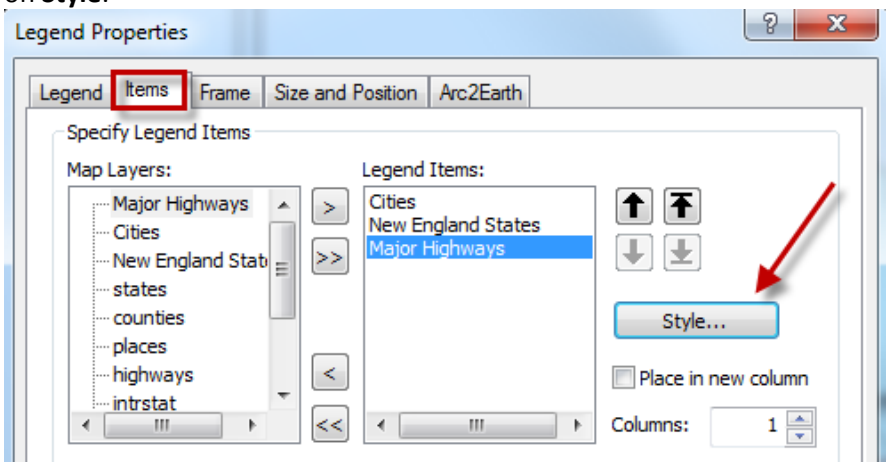
Insert Legend

There are lots of ways to improve your legend. For starters, let's say we're creating a land use map. We want the legend and map to focus on land use. We have imagery in the background as in the example map, but everyone knows what that is, it doesn't have to be identified in the legend. To control what goes on the legend:

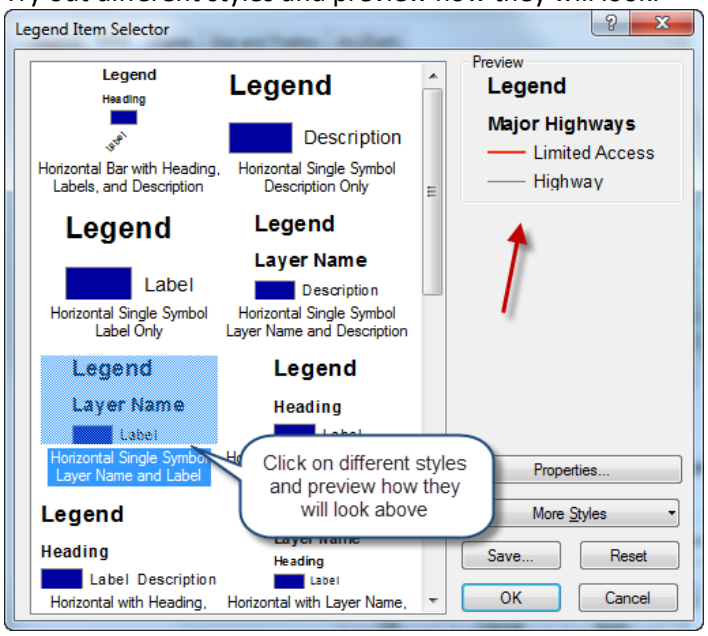
1. Choose **Insert – Legend** from the main menu
2. Adjust the legend to include *Major Highways, Cities*, and *New England States*:



3. You can modify a legend by double-clicking on it to bring up the legend properties. For example in the Legend Properties, you can tell it NOT to show the word "Legend" or you can change that word to something else.
4. Still in the *Legend Wizard* box, click on the **Items** tab, highlight *Land Use*, and then click on **Style**:



5. Try out different styles and preview how they will look:



6. Press OK, and OK again. If the map goes back to one column and you want two, double-click on the *Legend* again and under the *Items* tab, type in 2 for *columns*

Selecting Elements

Remember, you always have to select an element before you can move, resize, or change its properties. Use the select pointer icon on the *Tools* Toolbars.
You can select more than one element by holding down the CTRL key as you click on each element.

Modifying an element after insertion

You can usually modify an element after you have inserted it by selecting it and then double-clicking on it. The relevant dialog box will appear for that element (e.g., title, legend, scale bar).

Inserting text

To put in your name as the cartographer, and any other information, use the **Insert -Text function**. Remember also to include a date. You should also have a data source note that the data comes from ESRI and MassGIS.

Add more text for any more descriptions or explanation.

You can change font properties on selected text by right-clicking on the selected text and choosing Properties

Inserting a Picture

Note that you can also insert images into the data frame.

Deleting and trying again

If modifying an existing element doesn't work, remember that you can always select an item and delete it if you don't like it. Select it using the select pointer, and press *delete*. Especially useful if your legend gets messed up - just delete and insert a new legend again to start fresh.

Saving map files under different names

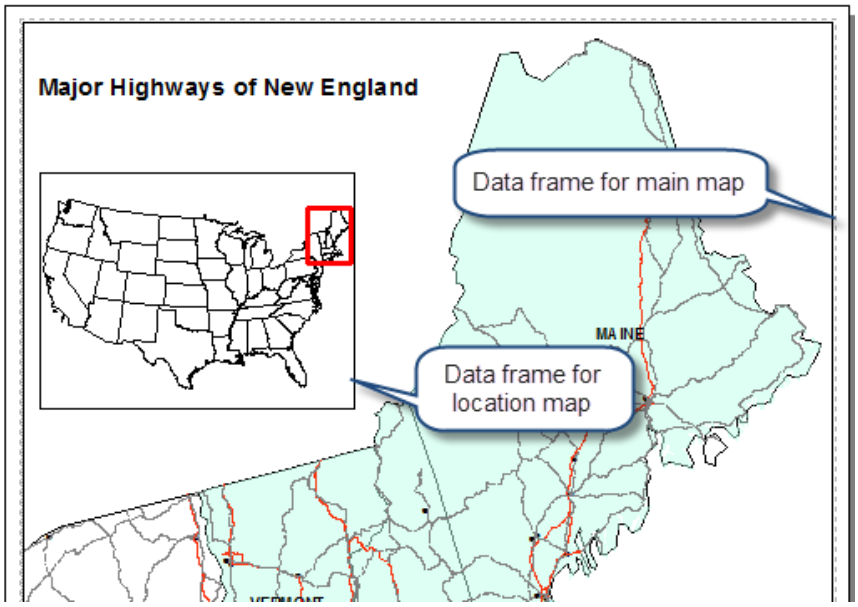
Once you have created one map in a layout you like, you can save your map file (File – Save As) to be the name of that map (e.g., Major Highways of New England). You can then use the same layout but change some of the visible features and save as a new map name (e.g., New England Counties).

This allows you to make maps fast once you have a good layout, and it allows you to make maps of the same area at the same scale, but showing different layers of information.

Choose **File-Save As** now and save the map file to an appropriate new name.

Adding a second data frame to show an inset map

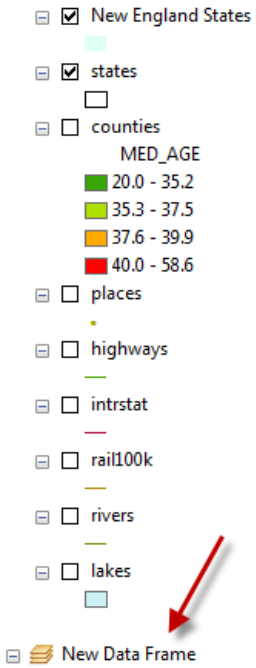
You can add a second (or more) data frames to your ArcMap session. Only one data frame will appear at a time in the data frame view (right-click on the data frame name and choose Activate to see the data frame you want). But in the layout, all the data frames will appear. This can be handy for putting in a small "locator" map as in the *Major Highways of New England* example:



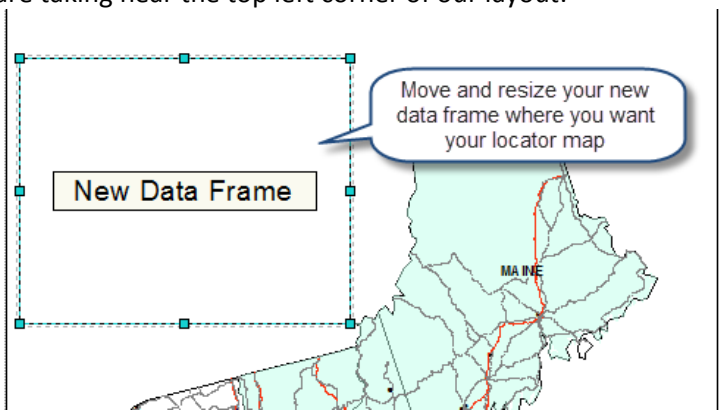
Adding a second data frame for a locator map

Multiple data frames can get a little tricky, and will take some practice. Play with them some, and remember to save map files frequently under different names in case you mess up and want to return to a previous view. In this example, we'll use a new data frame to insert a locator map.

1. In *Layout View*, choose **Insert - Data Frame** from the main menu – a *new data frame* box appears in your layout. You'll see *the New Data Frame* listed in the table of contents:



2. Move and resize the *new data frame* box so it is in the location you want it – here we are taking near the top left corner of our layout:



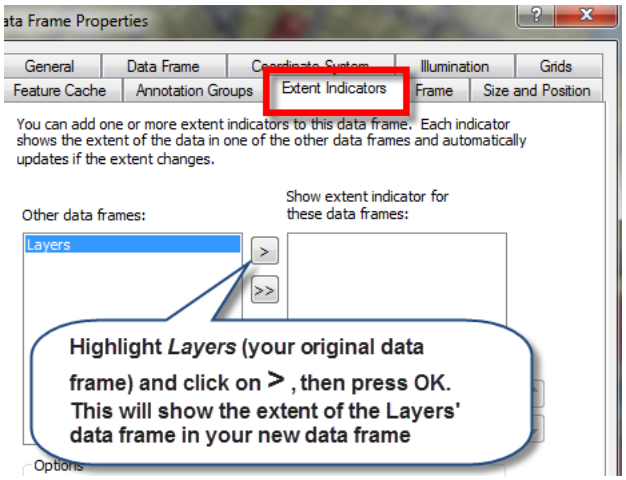
3. You can add data to this data frame just as you did to the first one, or in the *Table of Contents*, you can drag a layer from the first frame to the second. Try dragging the *states* layer from the original data frame (called *Layers*) down to the *New Data Frame* and turn it on

4. Save your map file!

Setting up locator map boundary box

Finally, we're going to show a boundary box on our *Locator Map*.

1. Right-click on the *new data frame* to get its *Properties* dialog box back.
2. Click on *Extent Indicators* tab and follow the instructions below, then press OK:



3. If all this was successful, save your mapfile! Otherwise delete and try again.

Part 10 – Printing or exporting layouts

You can print directly from ArcMap or you can export to a digital graphic format like .pdf. Printing works just like any other Windows program.

The ability to export to a digital format is very useful. If exporting to an image, remember to set your page size to the appropriate dimensions – this may mean custom dimensions, e.g., a small image to fit on a computer screen, a powerpoint presentation, a web site, or word document. When creating a layout for digital export, you should think ahead about what size you want your final image and lay out the map accordingly.

1. When you have your layout the way you want it, choose **File – Export**

2. In the *Export* dialog box that appears, navigate to your personal folder and give the image a name.

3. For *Save as Type*:, choose a format – we recommend **.pdf format** because they come out well (often better than jpg's), they print easily, and are readable across a variety of platforms. The only problem with PDF formats is that they do not recognize all text fonts, so stay simple with your font types – e.g., Arial or Times New Roman.

4. **Before you export,** press the **Options** button to adjust resolution. Digital images meant to be seen on a computer screen do not need high resolution. 96 or 150 should be fine depending on image size, 300 should be the maximum.

5. For .jpg formats, set the *quality* scroll bar to somewhere in the middle. The higher the quality the larger the file size and the longer it will take to load on a viewer's screen or to print/plot.
6. Press **Export** when you are ready to go – the process will take a few minutes.
7. Check your results – if not pleased, experiment with different resolutions and compare file sizes.

That's the basics. Now practice what you have learned by creating several maps showing different aspects of the US.

For tips on making good maps, see our **GIS Online Tips and Tutorials** – https://wikis.uit.tufts.edu/confluence/display/GISatTufts/Tufts+GIS+Tip+Sheets+ArcGIS10 – go to the *Mapping and Presentation* section and read through the following tip sheets:

- *Cartography Tips*
- *Creating and Editing a Scale Bar and Legend*

There are lots of other tip sheets there as well.