

HW #2 - Introduction to ArcGIS Desktop

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Due: Monday, April 15th, before 5:00 pm (30points)

Goals of the Exercise

This exercise introduces you to two important parts of ArcGIS: ArcMap and ArcCatalog. You will use these applications to create a map of pan evaporation stations in Texas, and to draw a graph of monthly pan evaporation data measured at these stations. Pan evaporation data helps Civil Engineers understand how fast water will evaporate across a site as well as how long water can be expected to reside in retention ponds. You will link the spatial location of the observation sites with the time variation of the water observation data at those sites. You will use ArcCatalog to create a new personal geodatabase and import shapefiles to a feature dataset. The relationship between ArcGIS and MS Word and Excel is also demonstrated so that you can create graphs in Excel, maps in ArcGIS, and place the result in a Word file as a report for this lab.

Computer and Data Requirements

For this exercise, you will need to have a computer, which runs ArcGIS Desktop version 10.1 or higher. You will be working with the following spatial datasets during this exercise:

1. A polygon shapefile of the counties of Texas, called **Counties**
2. A point shapefile of pan evaporation stations, called **Evap**
3. A polygon shapefile of the state of Texas, called **Texas**

These shapefiles consist of several files (e.g. **evap.dbf**, **evap.shp**, **evap.shx**). You can get them from the zipped file in the public_html folder off drive W (**W:\cce\spring2019\ce202\public_html**).

You need to establish a working folder to do the exercise – create a folder – HW2 (no spaces) and copy and unzip data – **HW2Data.zip**. To unzip – right-click on file and use the 7 zip program. You should end up with a file list that looks something like the image to the right – which are Shapefiles.

Name	Date modified	Type	Size
Counties.dbf	9/5/2012 11:41 AM	DBF File	47 KB
Counties	9/5/2012 11:41 AM	PRJ File	1 KB
Counties.sbn	9/5/2012 11:41 AM	SBN File	3 KB
Counties.sbx	9/5/2012 11:41 AM	SBX File	1 KB
Counties.shp	9/5/2012 11:41 AM	SHP File	8,450 KB
Counties.shp	9/5/2012 11:41 AM	XML Document	22 KB
Counties.shx	9/5/2012 11:41 AM	SHX File	3 KB
Evap.dbf	9/5/2012 11:33 AM	DBF File	30 KB
Evap	9/5/2012 11:33 AM	PRJ File	1 KB
Evap.sbn	9/5/2012 11:33 AM	SBN File	1 KB
Evap.sbx	9/5/2012 11:33 AM	SBX File	1 KB
Evap.shp	9/5/2012 11:33 AM	SHP File	2 KB
Evap.shx	9/5/2012 11:33 AM	SHX File	1 KB
Texas.dbf	9/5/2012 11:44 AM	DBF File	1 KB
Texas	9/5/2012 11:44 AM	PRJ File	1 KB
Texas.sbn	9/5/2012 11:44 AM	SBN File	1 KB
Texas.sbx	9/5/2012 11:44 AM	SBX File	1 KB
Texas.shp	9/5/2012 11:44 AM	SHP File	1,058 KB
Texas.shp	9/5/2012 11:44 AM	XML Document	20 KB
Texas.shx	9/5/2012 11:44 AM	SHX File	1 KB

Procedure

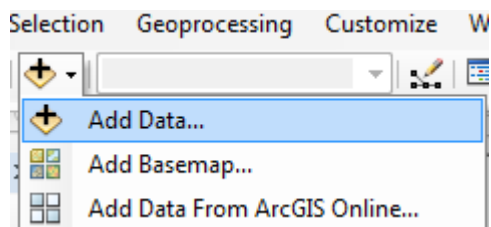
Please note that the following procedure is a general outline, which can be followed to complete this lesson. However, you are encouraged to experiment with the program and to be creative, which will enable you to learn more about GIS and have more fun! Remember to keep saving your ArcMap document as you proceed through the map making steps so that if you mess up something you can get back the work you've already done.

1. Viewing Shapefiles in ArcMap

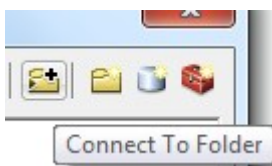
A *shapefile* is a homogenous collection of simple features that do not contain topological information. A shapefile includes geometric features and their attributes. The attributes are contained in a dBase table, which allows for the joining with a feature based on the attribute key.

Open **ArcMap** and select the **A new empty map** option.

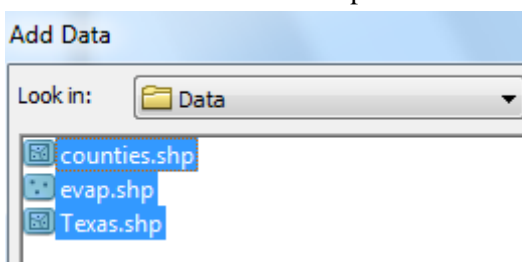
Use the **Add Data** button to add the data for this exercise to the ArcMap display.



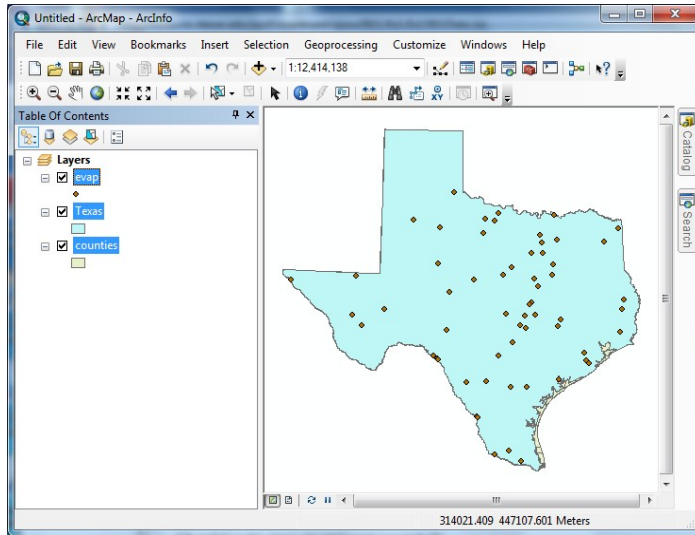
Navigate to the folder, which contains the data, and select all three files at once by using the shift key. Click the Add button to import the data. If you are using a network drive to obtain your files use the **Connect to folder** button to add the network drive to the ones that ArcMap is accessing so you can get to the files.



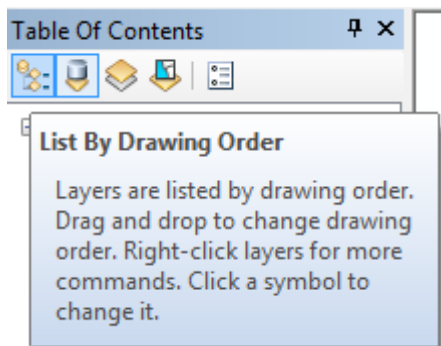
Click on each of the three shape files so that they are highlighted



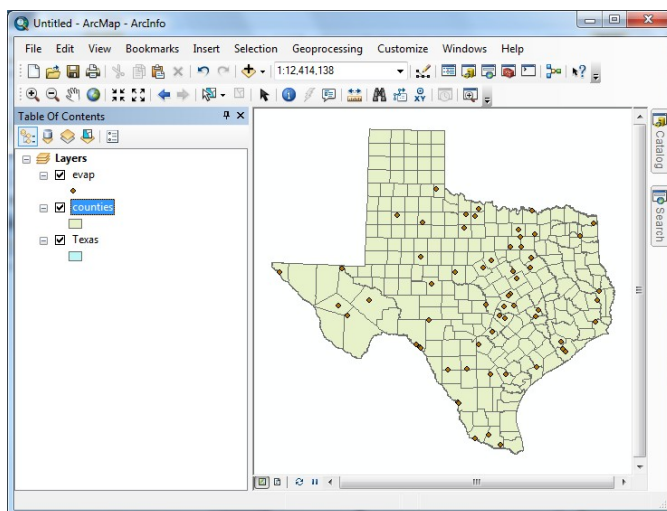
and add them to your ArcMap display. You should see the following:



All the themes are highlighted and Texas lies above counties so you cannot see the counties theme. Click on the **List by Drawing Order** button in the Table of Contents page:



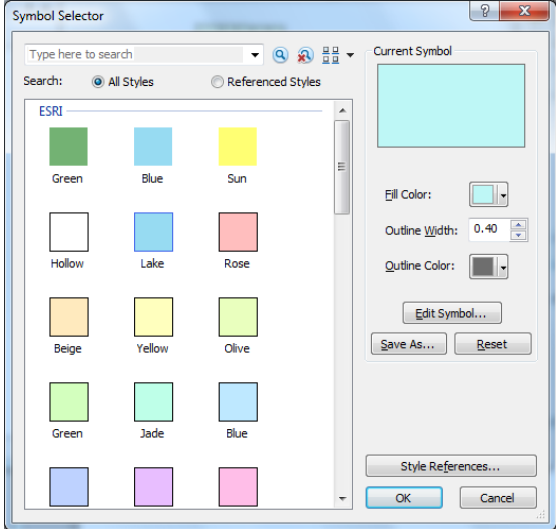
Click in the **Table of Contents** area below the feature class names so that three themes are no longer highlighted, then click on the counties theme and drag it up so that it is located above the Texas theme. You'll then get a display showing the counties.



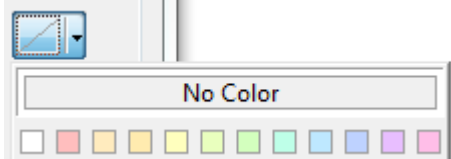
To change the appearance of a map display, you can access the **Symbology** menu just by double clicking on the Symbol (e.g., the blue box below Texas) displayed in the ArcMap Layers,



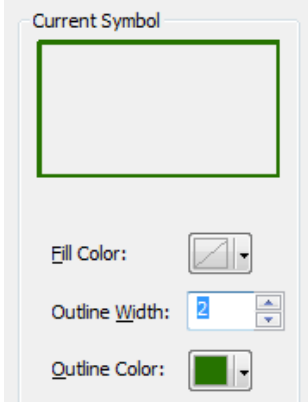
and you'll get the **Symbol Selector** window:



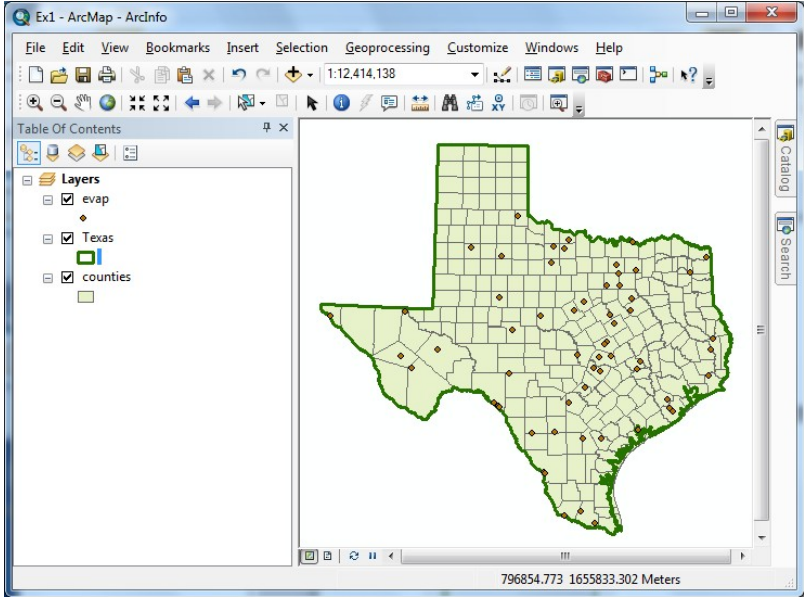
Click on the symbol color box, make your selections for the **Fill Color** and the **Outline Color**, and click OK, twice. You can show the outline of the State of Texas more distinctly by using the **No Color**



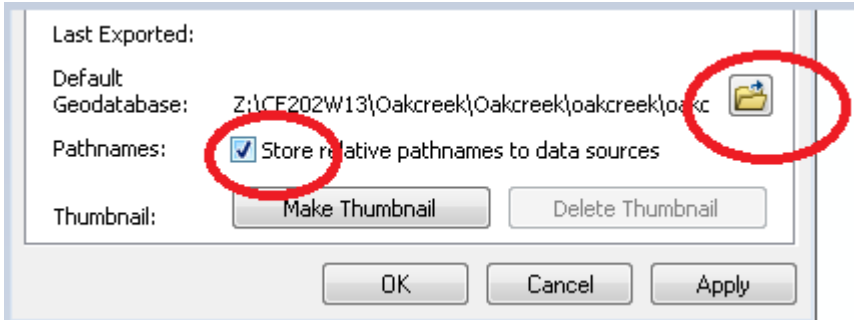
symbology for the Fill Color and then changing the Outline Color to Green and the **Outline Width** to 2.



Drag the Texas layer above the Counties layer, and you'll see that the Counties are not obscured as they were before and the State of Texas is highlighted with a nice Green outline! They are green in Texas!



To save this map display, use **File/Save As** in ArcMap and save the resulting file as **HW2.mxd**. It is always a good idea to setup the map document properties, so let's do this now—**File—Map Document Properties**—select **Store Relative Path Names**—and select the path to your folder—to do this select the icon folder—



Connect to your folder on FARM where you have stored the datasets.



Navigate to your HW2 folder—select new geodatabase – rename the new geodatabase to HW2 and make sure this name is in the path.

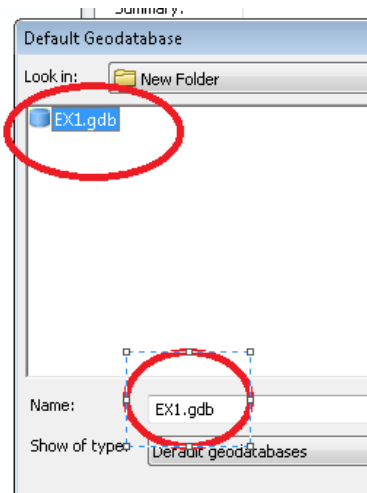
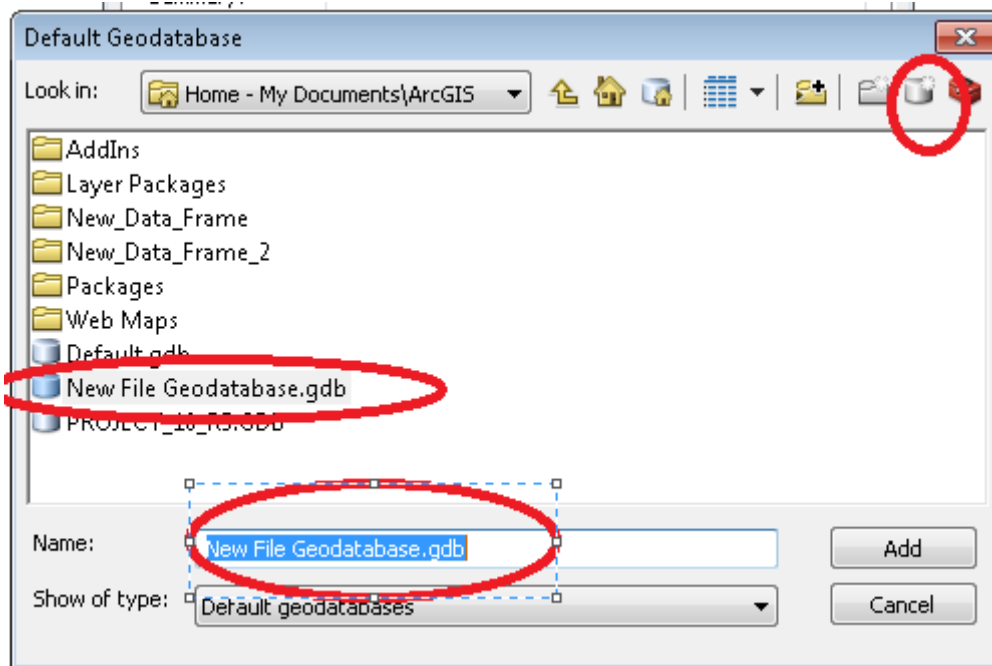
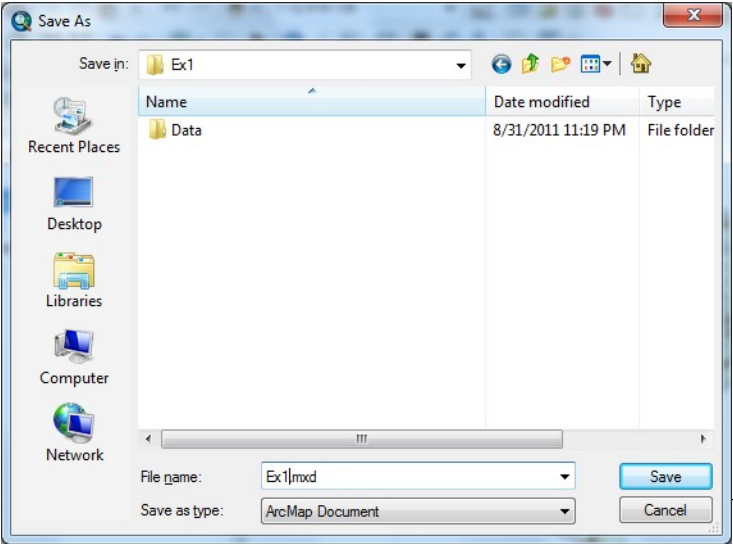


Figure 1. Shows Ex1 but we are naming it HW2



Save your work in ArcMap by choosing **File/Save** and, after navigating to your working directory, naming the file **HW2** (the file will be assigned the extension mxd). When you do this, the **HW2.mxd** file contains the file location of the geodatabase and the symbology you've chosen for the map display. You can shut down Arc Map and then invoke Arc Map again and reload the same map display by clicking on HW2.mxd. Note, however, that if in the mean time you've relocated your data, ArcMap will go back to where you had it at the time the map file was saved. The data is not being stored in your MXD file. Rather, the mxd file just tells ArcMap where to find the data.

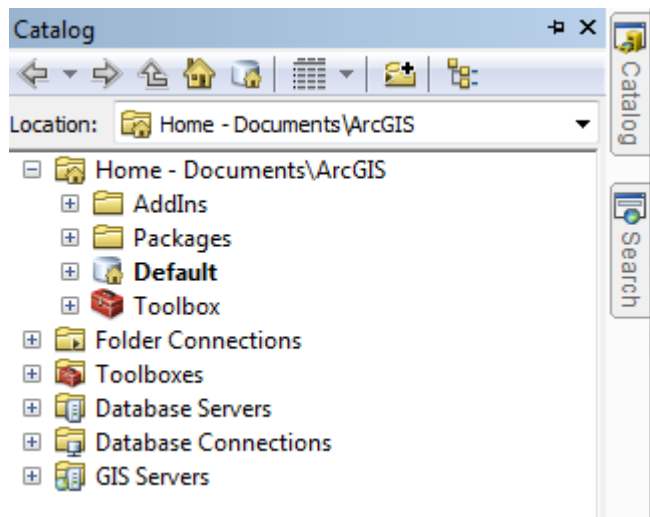


Helpful Tip:

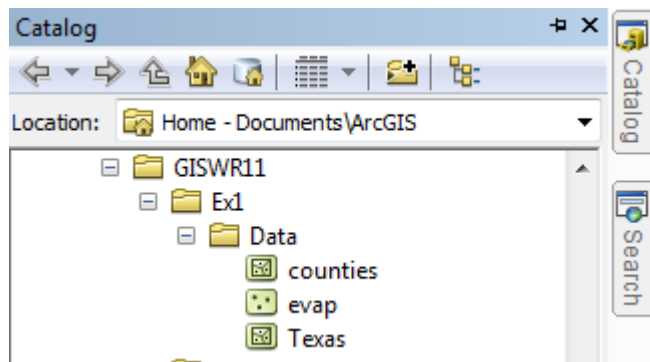
If you open your ArcMap HW2.mxd file later from another location in your file system, you may see a red exclamation points beside your feature classes. If this happens, in ArcMap, right click on the feature class use **Data/RepairData Sources** to relocate the file location where the corresponding data are now stored and your map will display correctly again.

2. Viewing Shapefiles in ArcCatalog

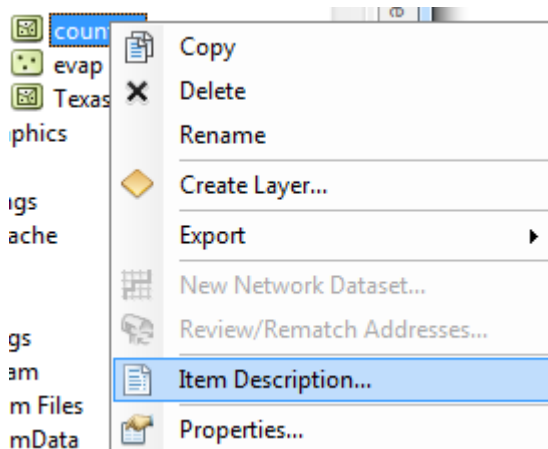
Open **ArcCatalog** by clicking on the Catalog tab on the right hand side of the map display



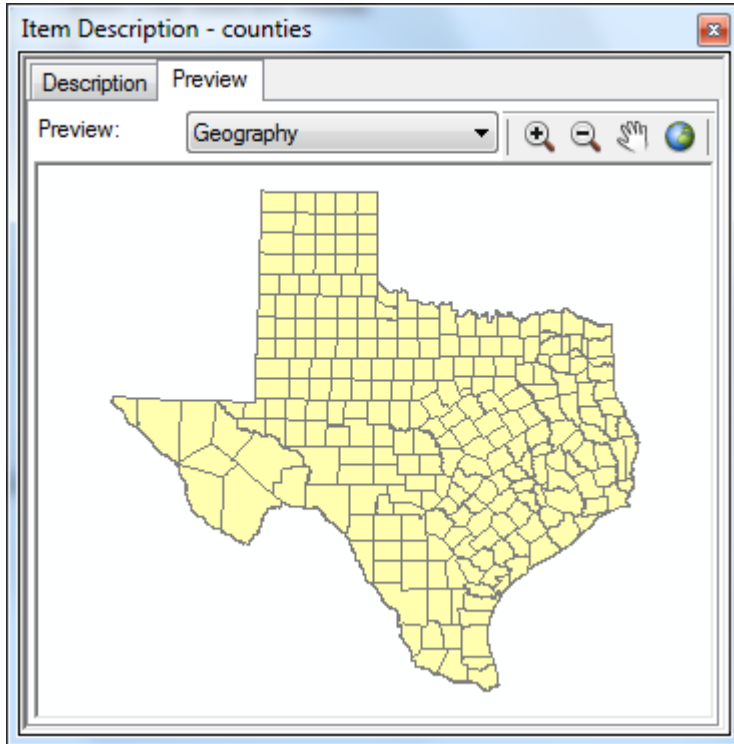
Click on the “**Folder Connections**” button and navigate to where your data are stored.



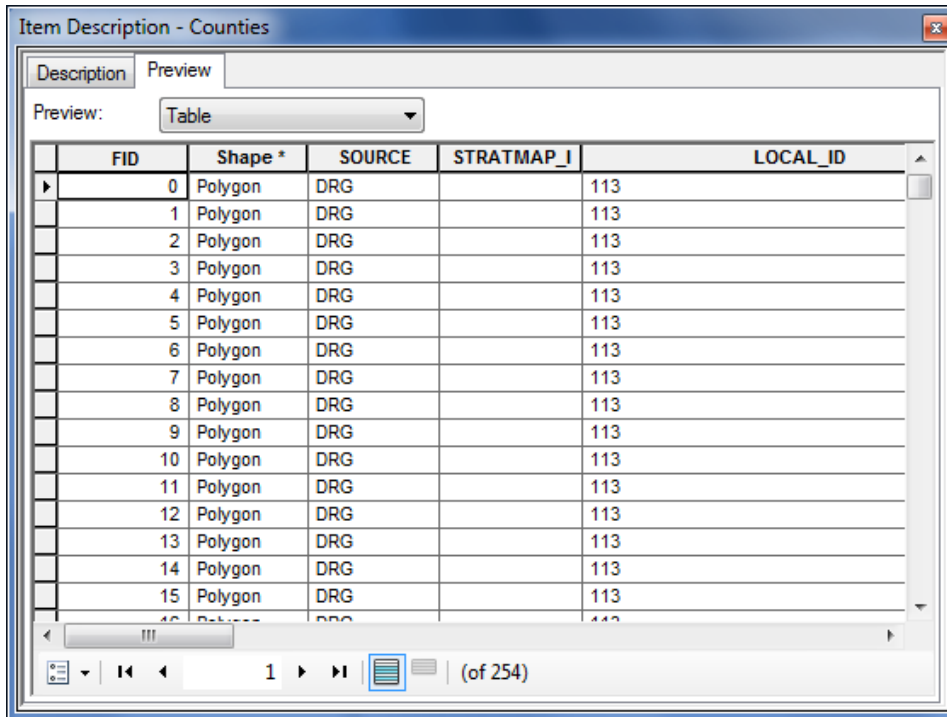
If you right click on a data layer, you can obtain an Item Description



Select the **Preview** tab and then **Geography** to see a map of the feature class

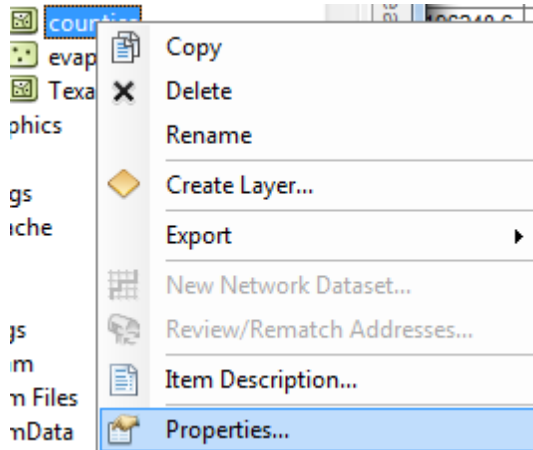


And then select the **Table** view

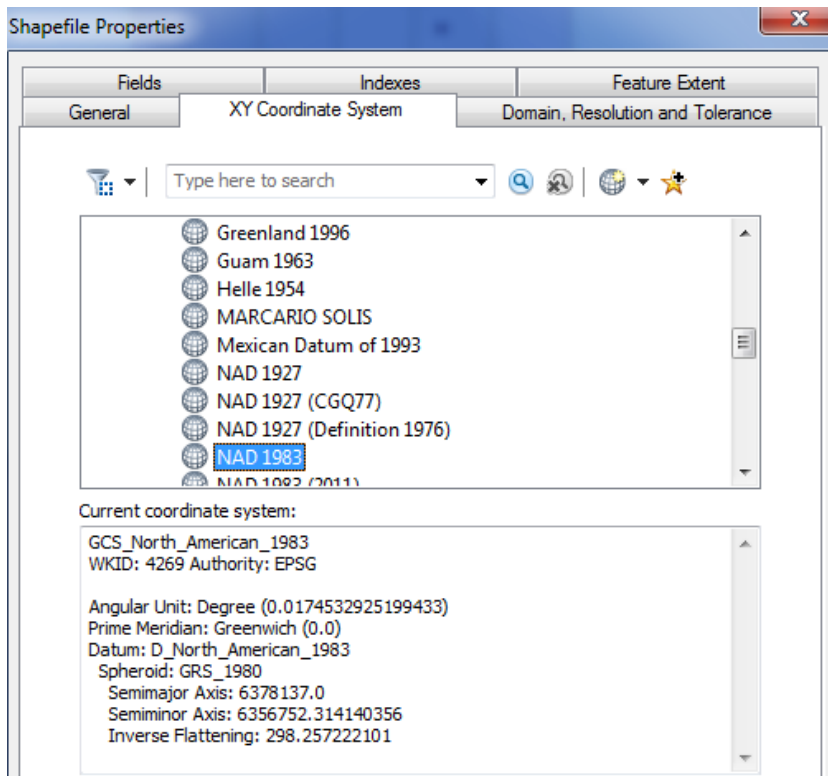


The attributes *FID*, *Shape*, *Area* and *Perimeter* are standard attributes for ArcGIS feature classes. The units of the area and perimeter are defined from the map units of the feature class.

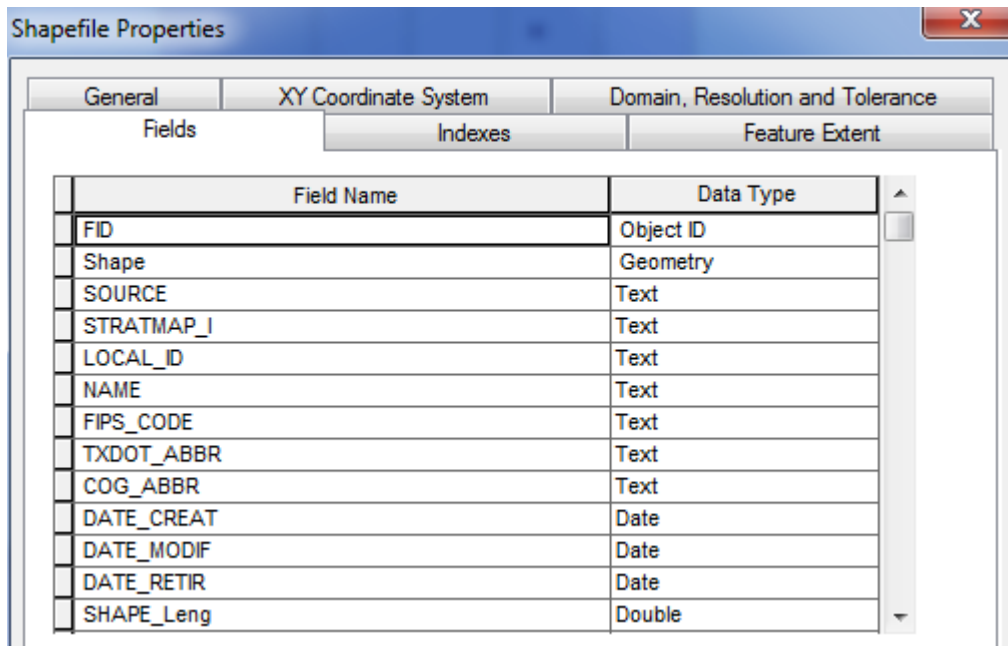
If you right click on a feature class and then select **Properties**



And select **XY Coordinate System**, which shows you the parameters of the coordinate system of these data. The coordinate system provides a rather complicated set of parameters that we will explore next week. **NAD83** is the North American Datum of 1983, which is just one of the pieces of information that are important to define a coordinate system.



If you click on the **Fields** tab, you'll see a formal definition of each attribute field with its **Field Name** and **Data Type**. In this case, **ObjectID** means a special data type that indexes each feature as an object in the GIS, **Geometry** means that the Shape field has geographical coordinates stored in it, and **Float** and **Double** mean decimal numbers in single or double precision, respectively. There are some other data types such as Short and Long integers, Text and Date types, which we'll encounter later in the course.



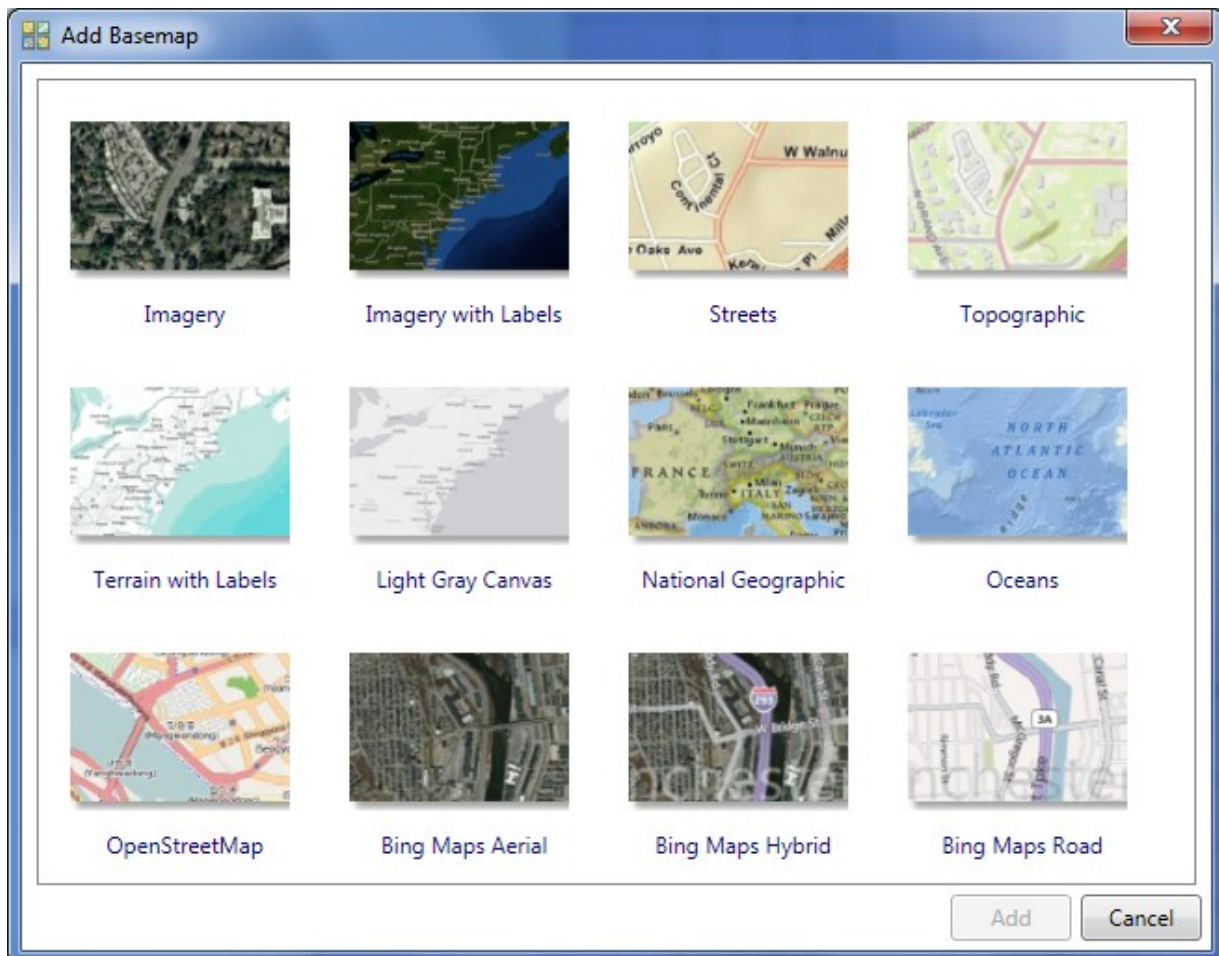
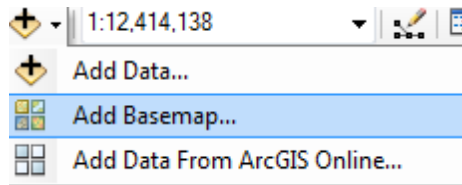
The screenshot shows the 'Shapefile Properties' dialog box with the 'Fields' tab selected. The table below lists the fields and their data types.

Field Name	Data Type
FID	Object ID
Shape	Geometry
SOURCE	Text
STRATMAP_I	Text
LOCAL_ID	Text
NAME	Text
FIPS_CODE	Text
TXDOT_ABBR	Text
COG_ABBR	Text
DATE_CREAT	Date
DATE_MODIF	Date
DATE_RETIR	Date
SHAPE_Leng	Double

Click on the other two data layers, **Evap** and **Texas** to preview them also.

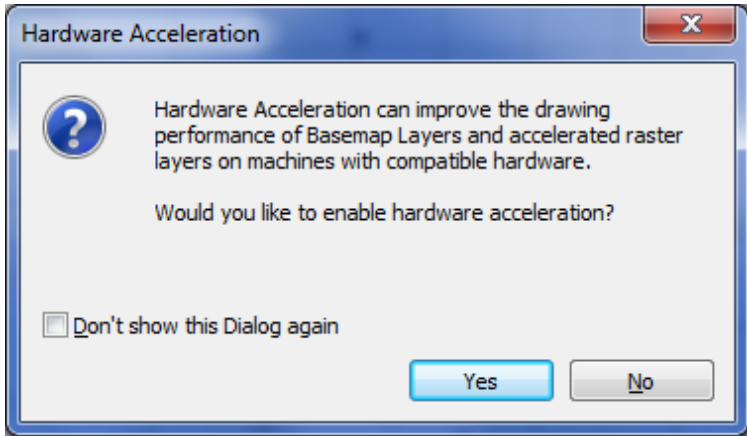
3. Using Base Maps from ArcGIS Online

Up to this point we have just used local GIS data in our display. Let's use base maps from the ArcGIS Online. Click **Add Basemap**:



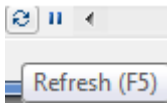
Click on **“Streets”**, in the bottom row of maps. You'll see a background map appear behind your Texas display. Pretty cool!

If you get a message asking about Hardware Acceleration, say **Yes** to it.



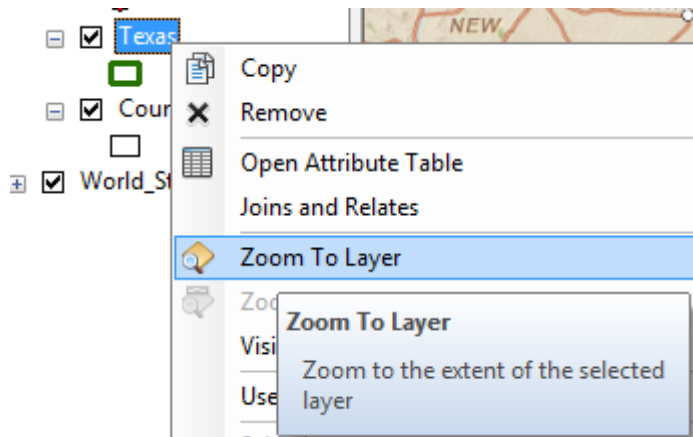
You may also get a warning that it is in a different coordinate system. Click OK to that. (We will talk more about this important feature of GIS next week).

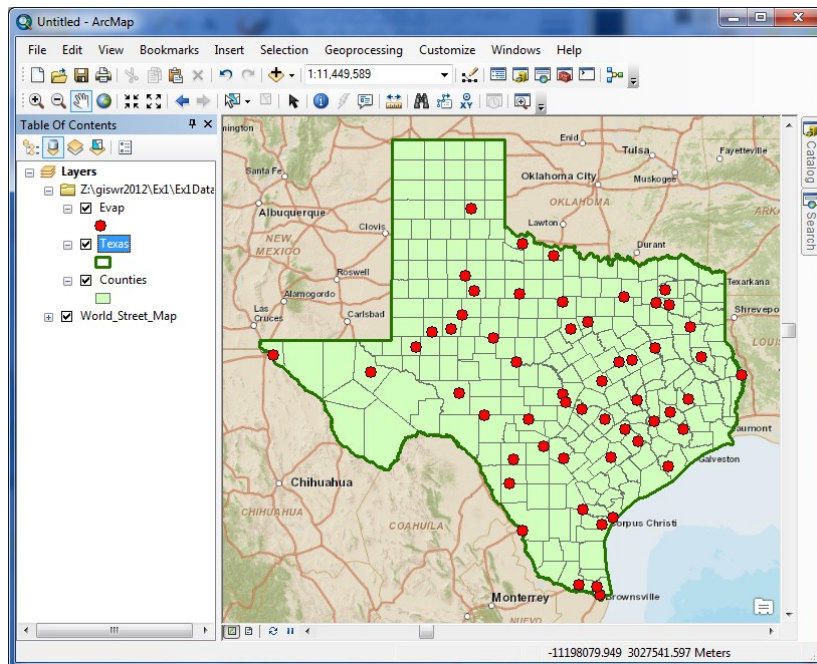
You should see a result like that shown below. If your BaseMap does not show up, use the **Refresh** tool



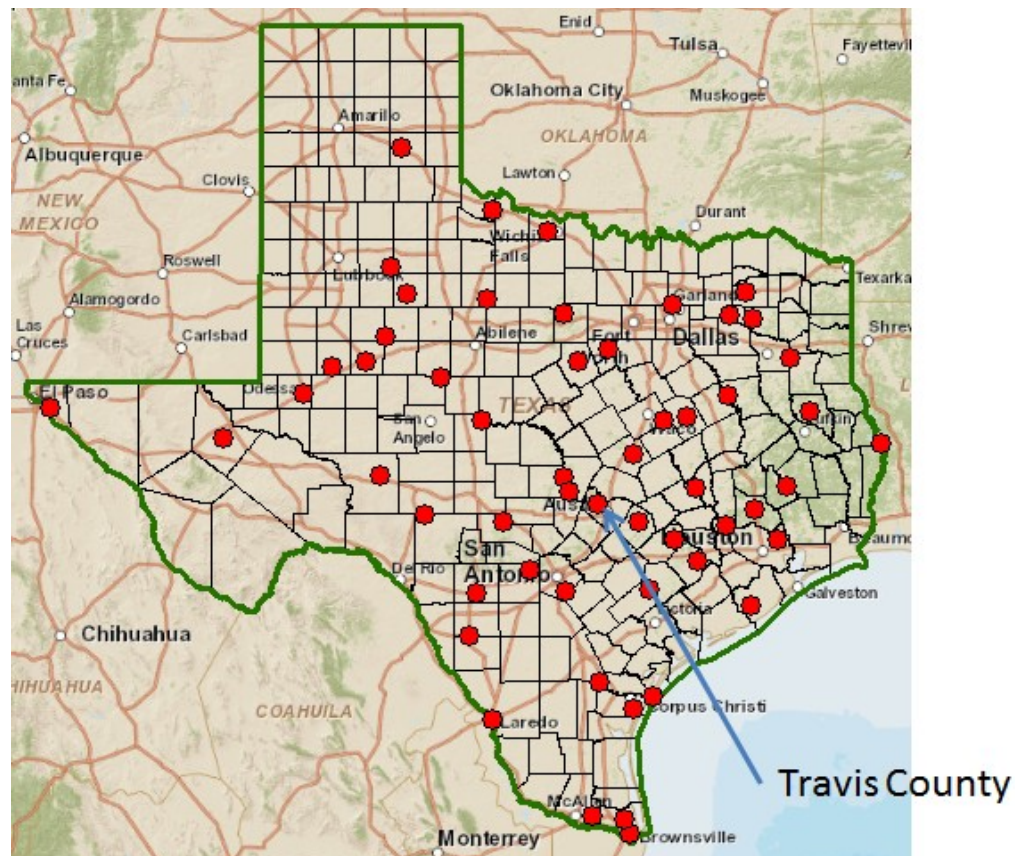
in the bottom left hand corner of the ArcMap display to redraw the map and the BaseMap should then show up.

To quickly get the map to center on Texas, right click on the Texas layer and select **Zoom to Layer**





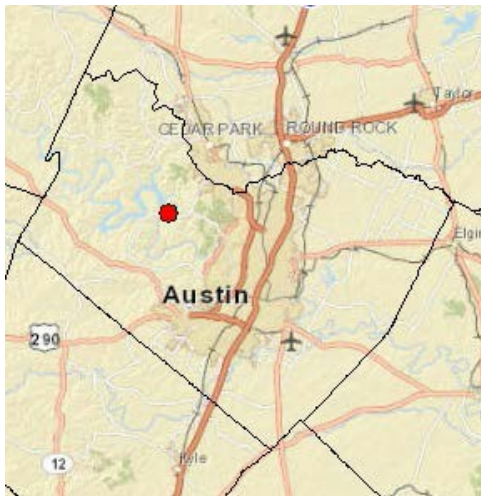
Click on the Counties theme and use the Symbol Selector to change the Fill Color to “No Color” so we can see through it to the background map, and the new display appears. Let’s examine Travis County.



Use the Zoom in button to select a box around Travis County



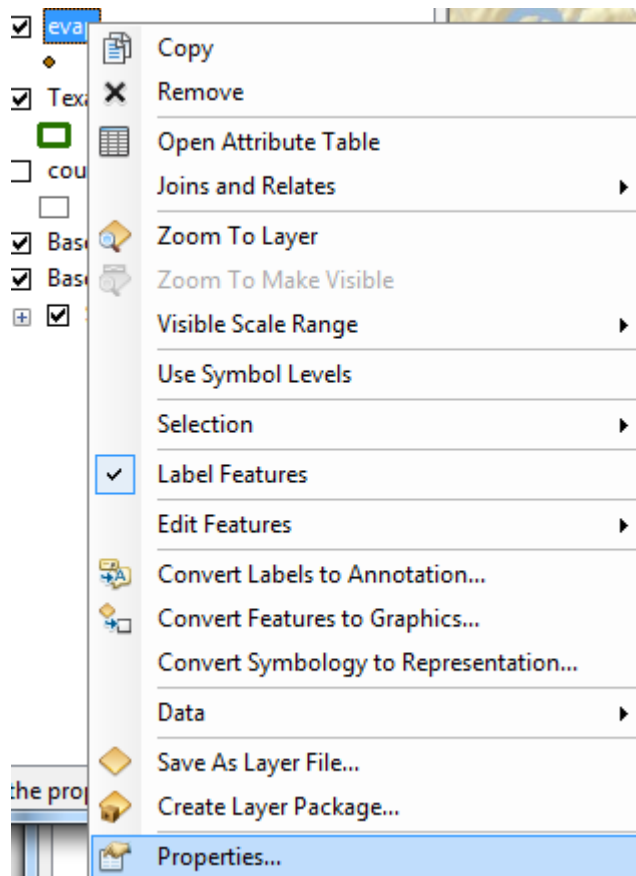
Click the counties layer to turn off the county boundaries since the background map already shows the county boundaries



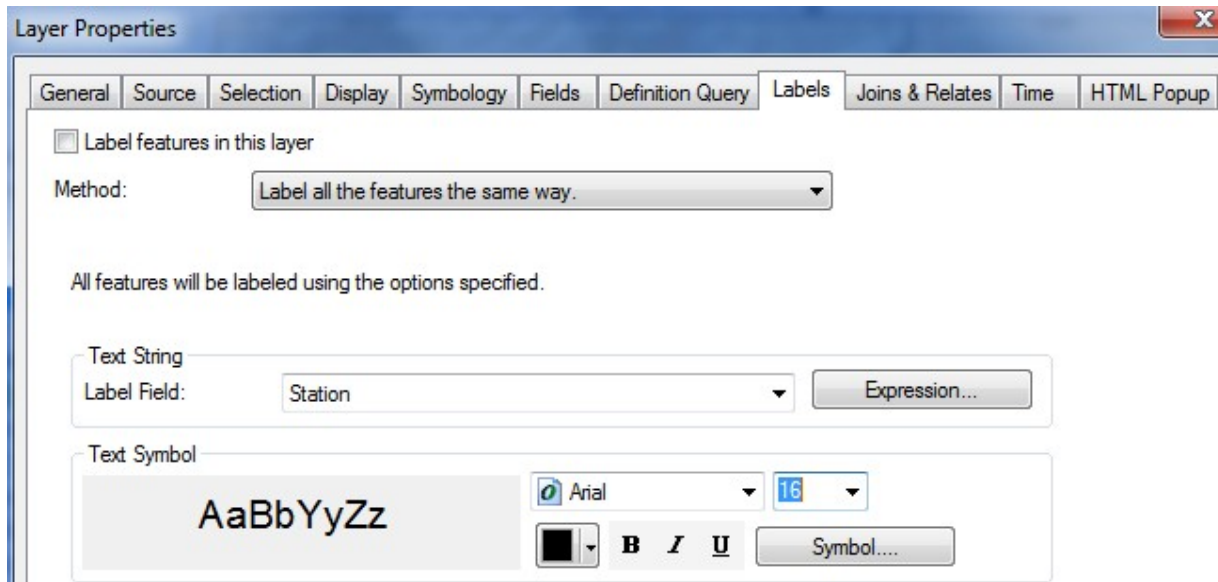
Zoom in to Travis County by Austin in the center of Texas, and let's examine the evaporation site by Lake Travis to the Northwest of the city. Notice how more detailed information appears as you zoom in closer.



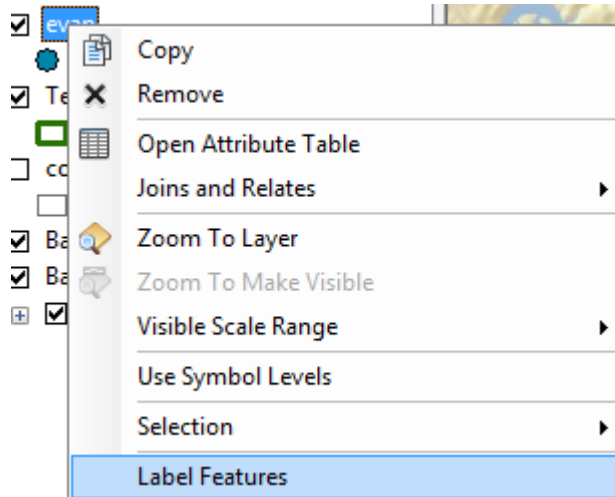
Let's label the sites with their names. Right click on the **Evap** theme and select **Properties** at the bottom of the display that appears.



Labels tab and for the **Label Field**, select **Station**, and **16** point as the type size. Hit **Apply** and then **Ok**, to close this window.



Now, right click on the Evap theme again and select **Label Features**, and you'll see a nice label **Mansfield Dam** appear by the site next to Lake Travis.



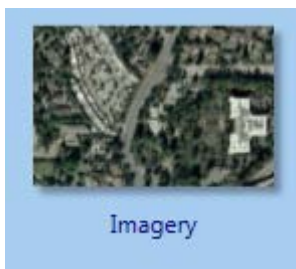
Click on the symbol for the Evap points and use the Symbol Selector to change the size of the points to 8 and the color to Red. Now we've got a nice map that shows the location of our observation site labeled with its name.



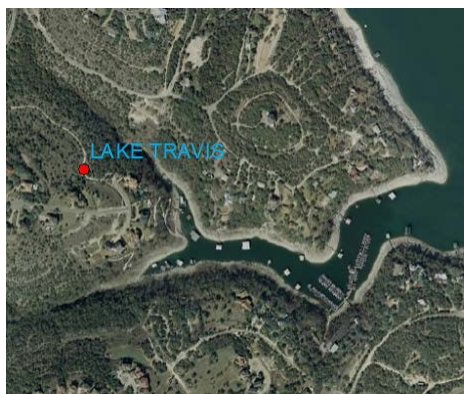
If you zoom in a bit closer, you can see just where the site is located near Lake Travis. Mansfield Dam is the dam that is at the downstream end of Lake Travis. You can even see the access roads you'd use to go to this site. After you are done reviewing the base map turn the layer off by unchecking the layer in the table of contents. On-line base maps and imagery slow the computer down.



Now, let's look at some imagery for this location. Proceeding as you did before to get the Street map, use **Add BaseMap**, to add data for **Imagery** Turn off the Street Map so you can see the imagery.



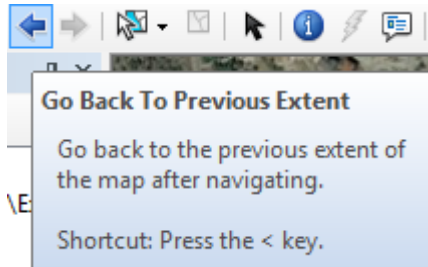
And now you'll see the same information displayed against a background map of orthoimagery, and let's zoom in a bit to see more detail. For the **Evap** theme, I have used the **Properties/Label** to change the color of my site labels from black to blue to make them easier to see against the image background. This is really cool stuff! You can really get a sense of context about where this observation site is located. This is much more helpful in analysis and drawing conclusions than just looking at a series of numbers in a table and trying to make sense of it!



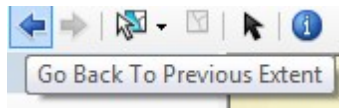
Turn the images off (uncheck layer). Use **File/Save As** to save this new map display as **HW2.mxd** so that you can get it back later if you need it.

4. Accessing and Querying Attribute Data

Let's go back to the view we had earlier of Travis County. Use the Go Back to Previous Extent arrow

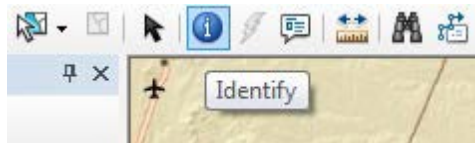


to step back through the views we have just been working on, and turn off the Image basemap so that you can see the Streets basemap again. Change the Label color for the evap sites back to Black.

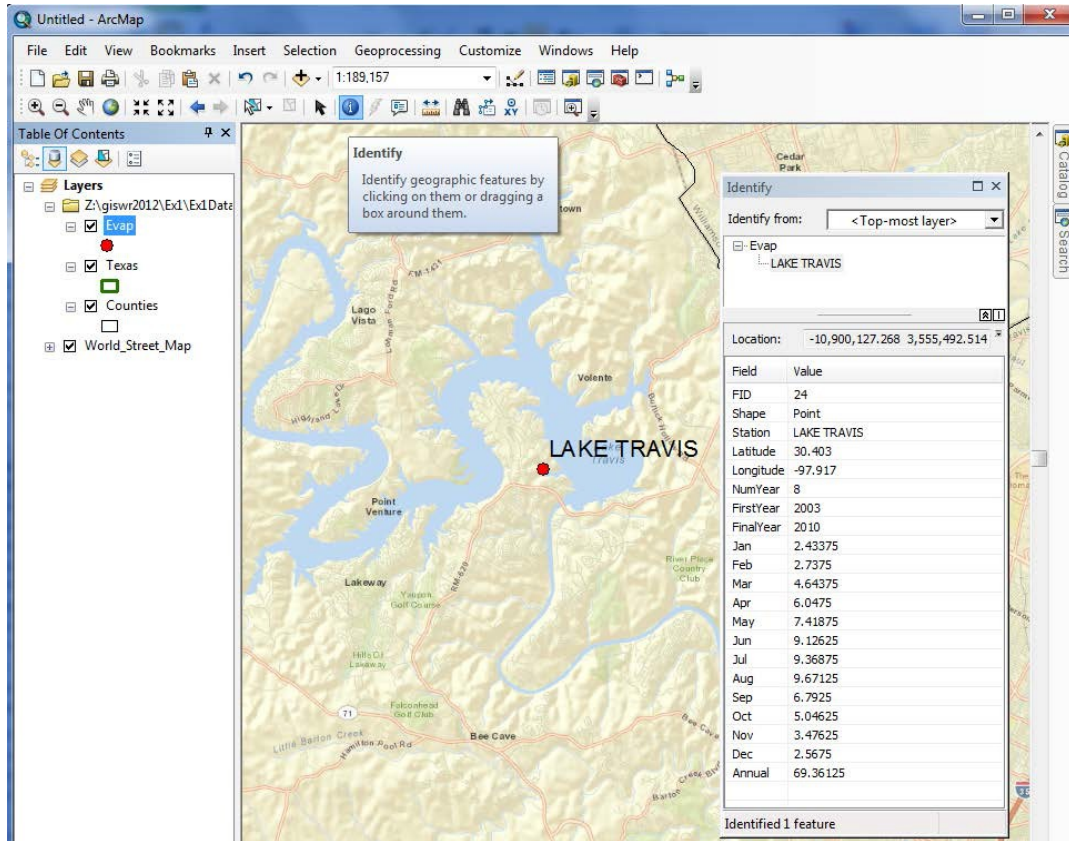


Numerical and text information stored in the fields of the geodatabase tables are called **attributes**. To access attribute data of the feature classes at a specific location:

Click on the **Identify** tool



Highlight the feature class you are interested in the Table of Contents (Evap), and then click on the feature on the map you are interested in. In the **Identify** window that pops up you'll see the attributes of that particular feature. In this instance, what you see is that the data for Lake, cover the range from 2003 to 2010, the latitude and longitude are 30.403 and -97.917, and the values from Jan through Dec are the mean monthly evaporation recorded at this location, in inches, whose annual total (Annual) is 69.36 inches.

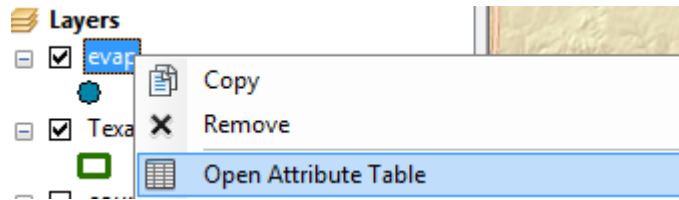


These are pan evaporation data recorded using an instrument like that shown below. The evaporation data were obtained from the Texas Water Development Board. Only data from 2001 onwards is used because the TWDB has only quality control checked that information since 2001. Monthly evaporation is found by averaging the daily values of evaporation read from the pan, and multiplying by the number of days in the month. If a month has fewer than 20 daily values recorded, it is excluded from the dataset. Only years with valid monthly data for all 12 months are used in computing the mean monthly and mean annual pan evaporation data shown in the attribute table.

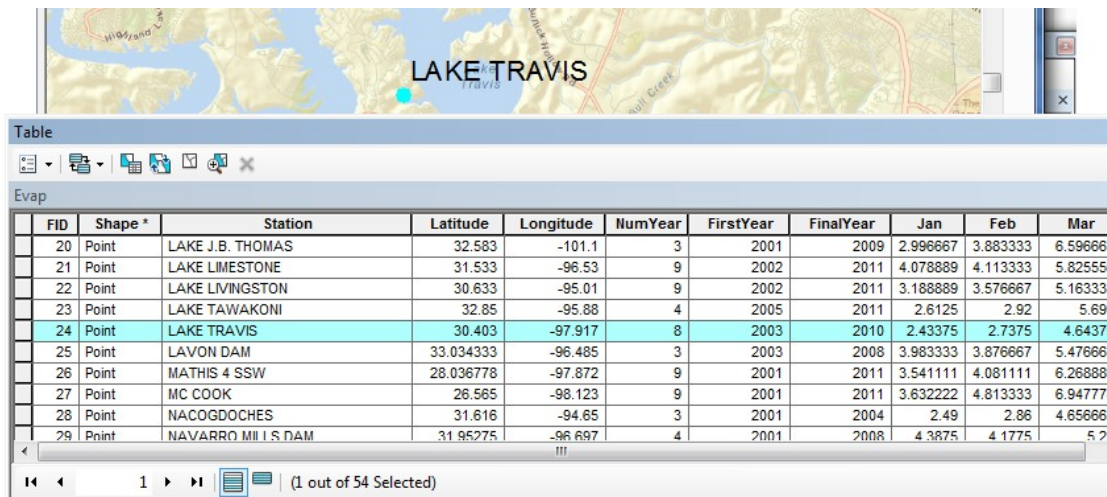


5. Viewing an Attribute Table

To access attribute data of an entire layer, in **ArcMap**: right click on the **Evap** layer name in the table of contents, and select **Open Attribute Table**:



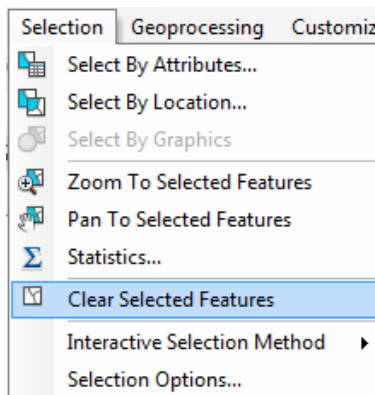
And if you scroll down the resulting **Table** and click on **FID 24** you'll see the record that contains the attributes of the Lake Travis station that you identified earlier. Click on this to select it, and you'll see the corresponding point selected in the map – this is a key idea of GIS – map features are described by records in attribute tables.



The screenshot shows a map of Lake Travis with a cyan point selected. Below the map is the 'Table' window for the 'Evap' layer. The table has the following columns: FID, Shape *, Station, Latitude, Longitude, NumYear, FirstYear, FinalYear, Jan, Feb, and Mar. The row for FID 24 is highlighted in cyan.

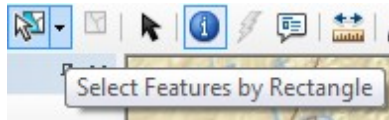
FID	Shape *	Station	Latitude	Longitude	NumYear	FirstYear	FinalYear	Jan	Feb	Mar
20	Point	LAKE J.B. THOMAS	32.583	-101.1	3	2001	2009	2.996667	3.883333	6.596667
21	Point	LAKE LIMESTONE	31.533	-96.53	9	2002	2011	4.078889	4.113333	5.825556
22	Point	LAKE LIVINGSTON	30.633	-95.01	9	2002	2011	3.188889	3.576667	5.163333
23	Point	LAKE TAWAKONI	32.85	-95.88	4	2005	2011	2.6125	2.92	5.695
24	Point	LAKE TRAVIS	30.403	-97.917	8	2003	2010	2.43375	2.7375	4.64375
25	Point	LAVON DAM	33.034333	-96.485	3	2003	2008	3.983333	3.876667	5.476667
26	Point	MATHIS 4 SSW	28.036778	-97.872	9	2001	2011	3.541111	4.081111	6.268889
27	Point	MC COOK	26.565	-98.123	9	2001	2011	3.632222	4.813333	6.947778
28	Point	NACOGDOCHES	31.616	-94.65	3	2001	2004	2.49	2.86	4.656667
29	Point	NAVARRO MILL S DAM	31.95275	-96.697	4	2001	2008	4.3875	4.1775	5.22

To Clear a Selected feature and select a new one, use: **Selection/Clear Selected Features** in the ArcMap toolbar:

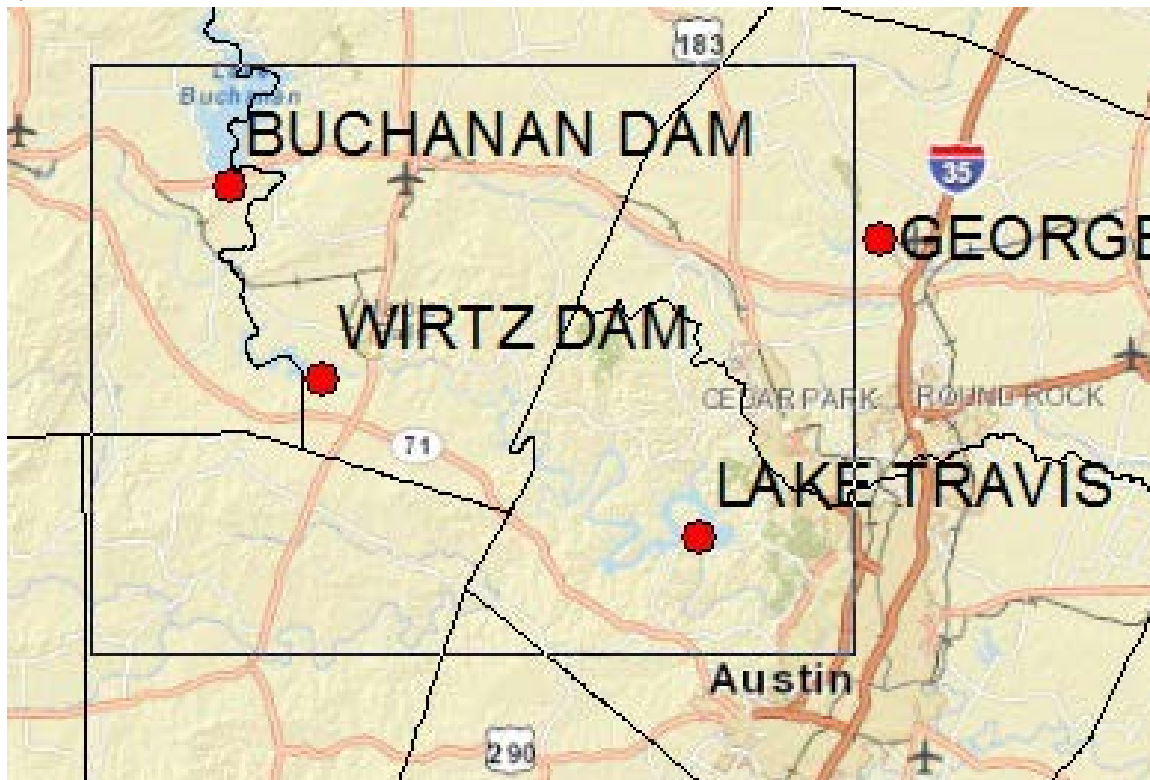


6. Selecting features from a feature class

Selecting features from a feature class involves choosing a subset of all the features in the class for a specific purpose. Feature selection can be made from a map by identifying the geometric shape or from an attribute table by identifying the record. Regardless of how you select an object, both the shape in the map and the record in the attribute table will be selected. Make sure that the Evap theme is highlighted in the Table of Contents and then Click on the **Select Features by Rectangle** tool



If zoom back a little bit and drag a box over the three evaporation sites in the Highland Lakes reservoir system,



you'll see both records highlighted on the map and in the attribute table. I've turned off the Counties layer and used **Show selected records** at the bottom of the Attribute Table to just show the three highlighted stations.

Map

Table

Evap

FID	Shape *	Station	Latitude	Longitude	NumYear	FirstYear	FinalYear
5	Point	BUCHANAN DAM	30.733	-98.43	5	2007	20
24	Point	LAKE TRAVIS	30.403	-97.917	8	2003	20
52	Point	WIRTZ DAM	30.55	-98.33	4	2002	20

(3 out of 54 Selected)

Evap Show selected records

To clear your selection, choose **Selection/Clear Selected Features**.

Selection Geoprocessing Customize

- Select By Attributes...
- Select By Location...
- Select By Graphics
- Zoom To Selected Features
- Pan To Selected Features
- Statistics...
- Clear Selected Features**

Interactive Selection Method

Sele Clear Selected Features

Unselect the currently selected features in all layers.

Clicking on Show all records, then displays all the records in the attribute table again.

Table

Evap

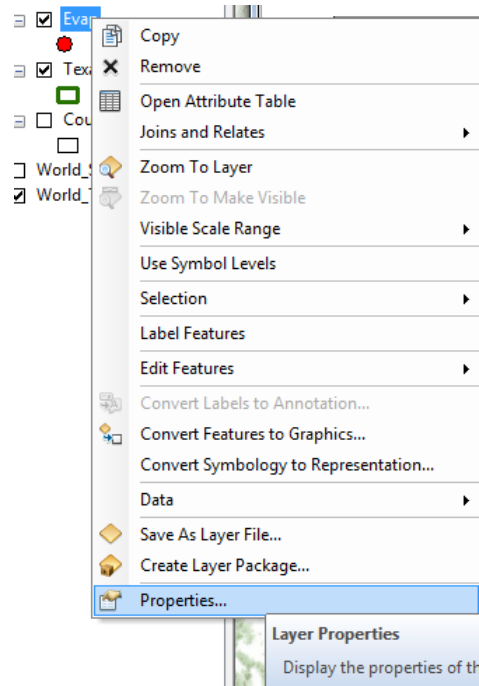
FID	Shape *	Station	Latitude	Longitude	NumYear	FirstYear
20	Point	LAKE J.B. THOMAS	32.583	-101.1	3	20
21	Point	LAKE LIMESTONE	31.533	-96.53	9	20
22	Point	LAKE LIVINGSTON	30.633	-95.01	9	20
23	Point	LAKE TAWAKONI	32.85	-95.88	4	20

(0 out of 54 Selected)

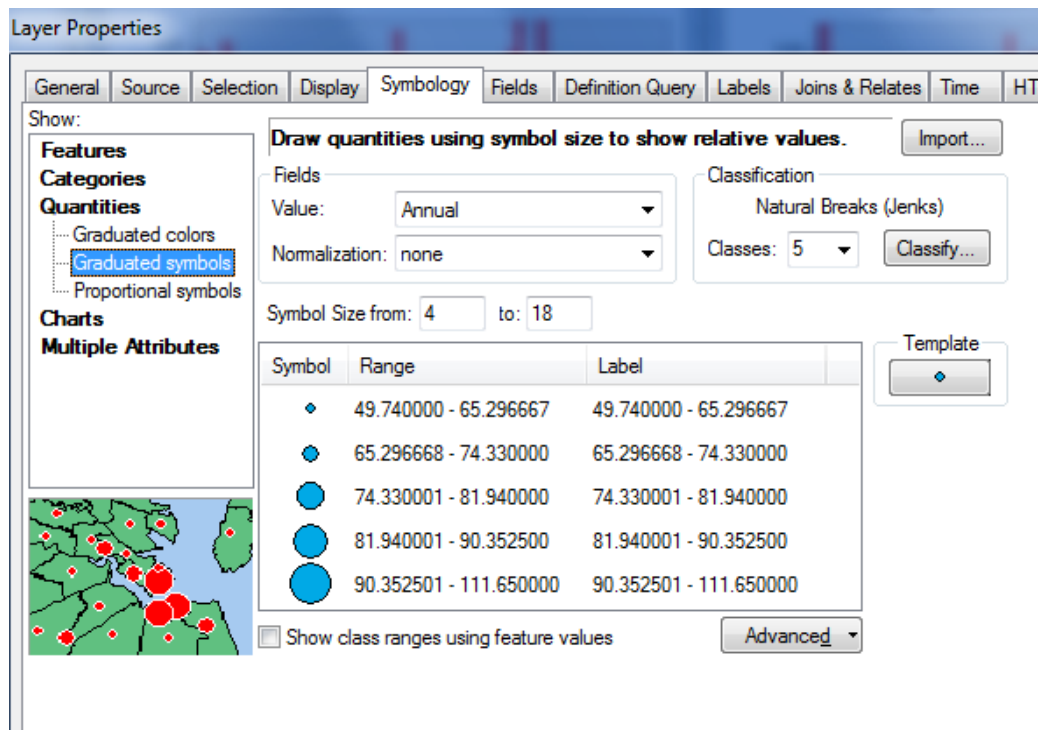
Evap Show all records

7. Mapping Annual Evaporation

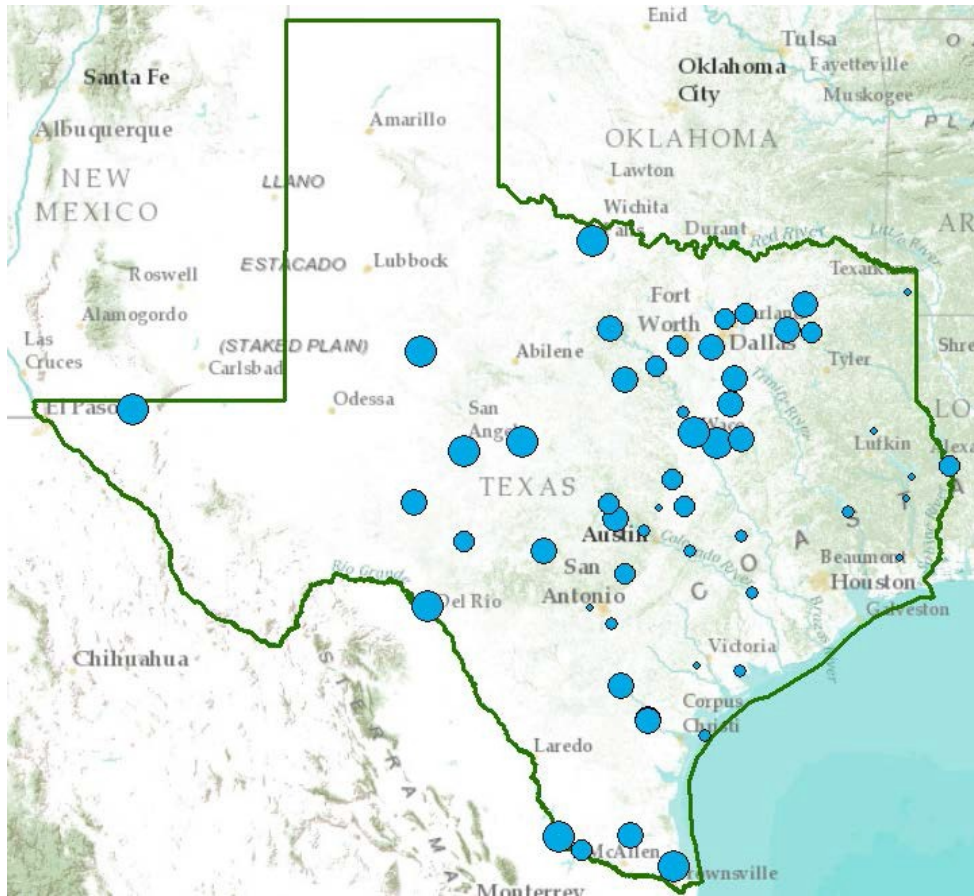
Let's suppose we want to map the values of annual evaporation recorded at the stations, rather than just symbolizing them by their location. Right click on the **Evap** layer and select **Properties/Symbology**.



Show **Quantities/Graduated Symbols** with the **Value** field of **Annual** and make the **Template** color blue.

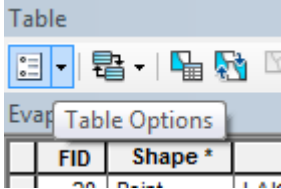


I have turned off all the other layers and added the **Topographic** base map to get the image below. Very cool!

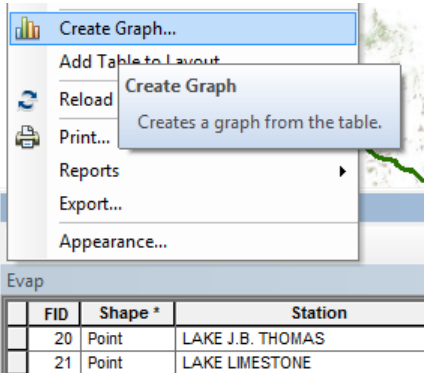


8. Making a Chart

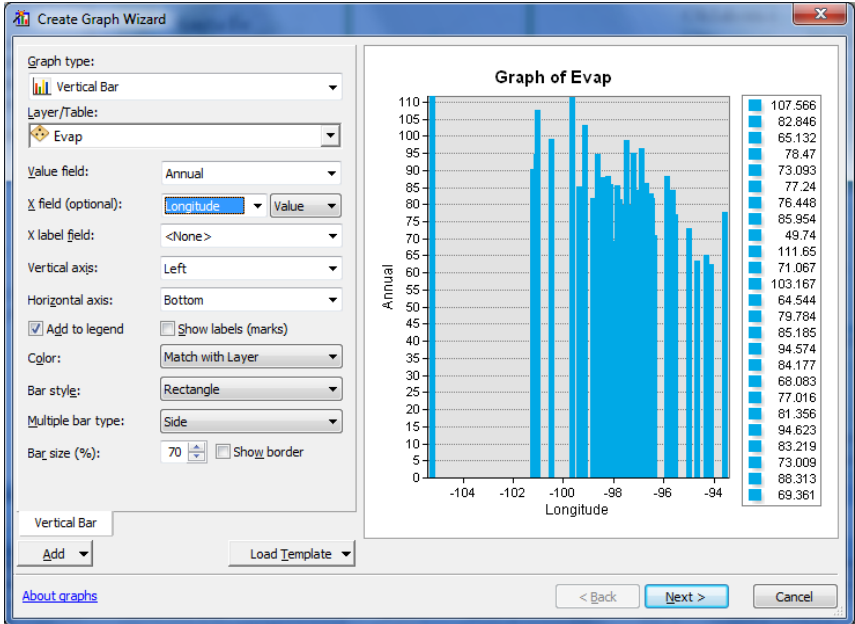
You can see from the map that there is some tendency for lower evaporation values near the coast and to the East and higher values to the West. Charts are useful because they allow you to visualize trends in data. Click on **Table Options**



at the top left of the Table and select **Create Graph**.

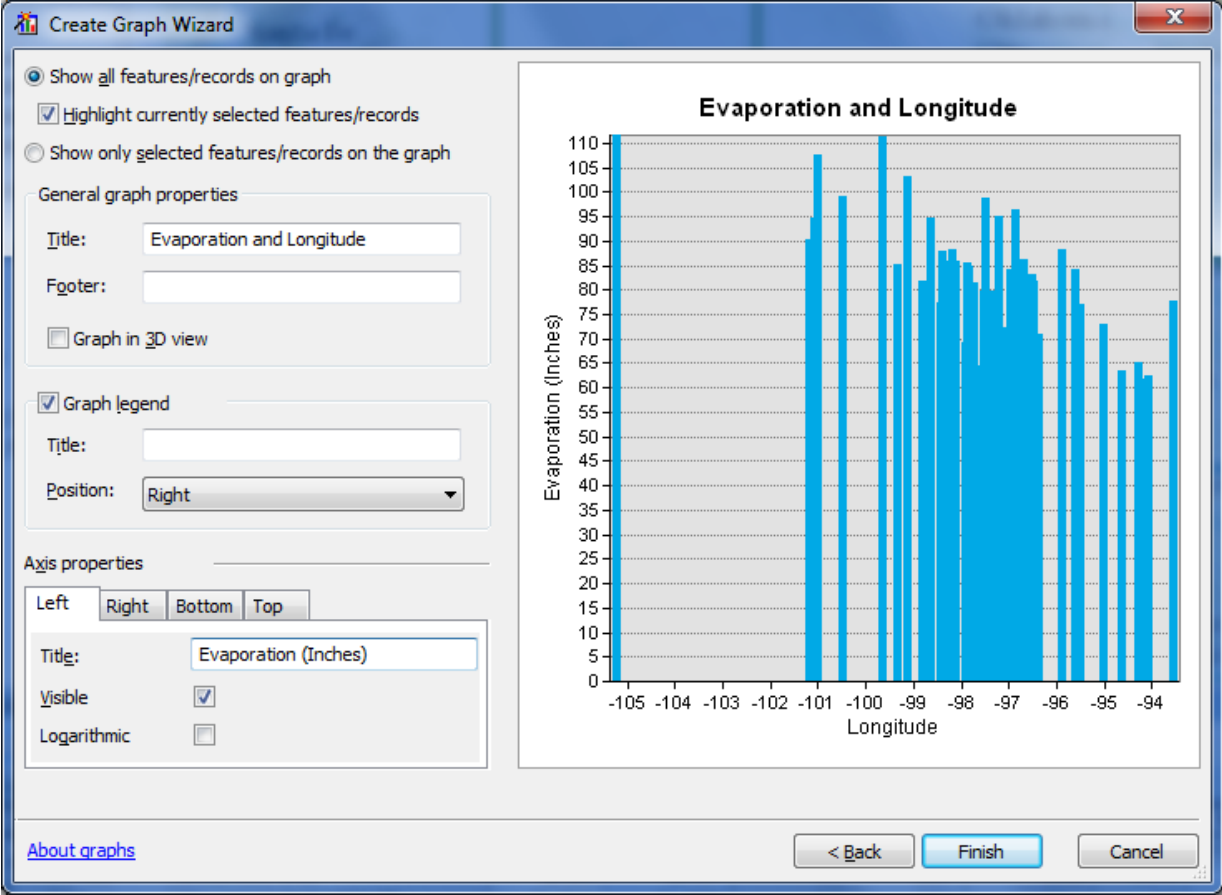


You will be making a Vertical bar chart (the default option). The next screen will allow you to indicate the data to be used in the graph. Here is a graph of the Annual Evaporation (**Annual**) of all the stations plotted against the Longitude of the station. You can see that there is a general trend of the evaporation increasing as you go from East to West in Texas. The color of the chart bars is blue, the same as the map points.

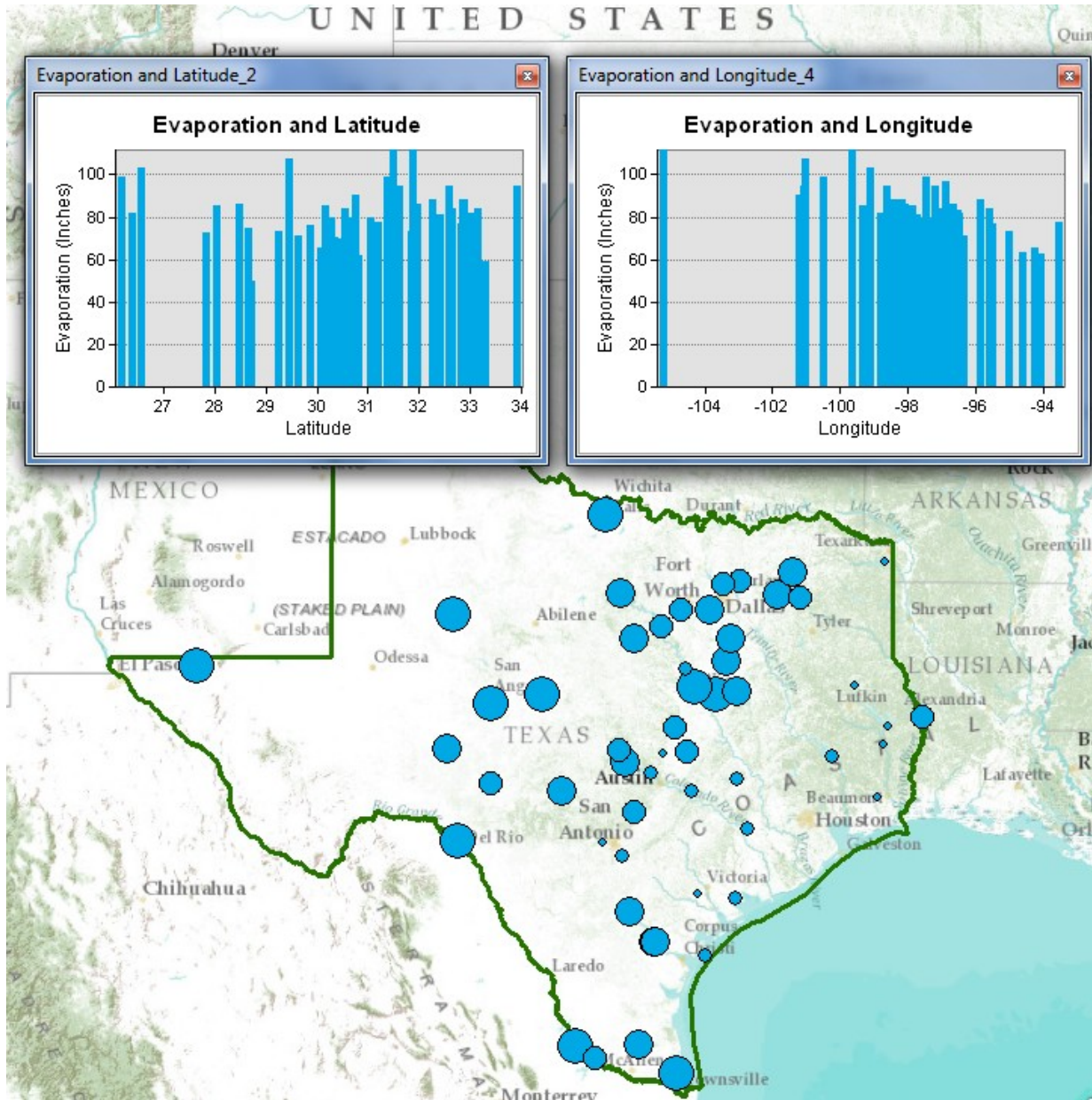


Click off “Add to Legend” to remove the legend on the right hand side.

Hit **Next** and edit the graph properties to make them nicer. Add a title **Evaporation and Longitude** and re-label the vertical axis **Evaporation (Inches)**



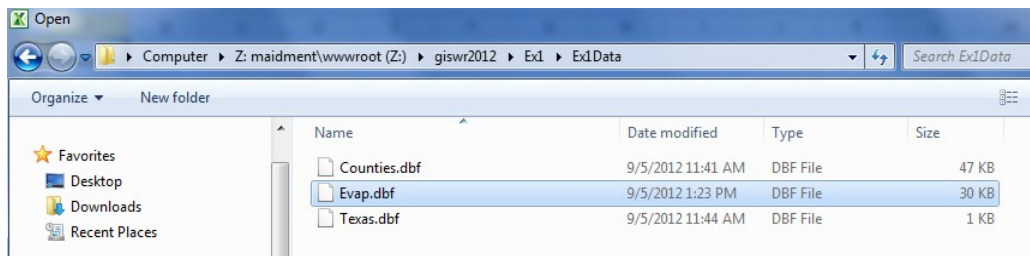
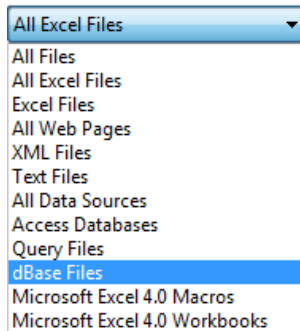
Click **Finish**, and you’ve created a graph linked to mapped features in ArcMap. If you create the same kind of graph for Evaporation and Latitude, you can see that there isn’t a tendency for evaporation to vary with latitude in Texas, as there is for variation of evaporation with longitude.



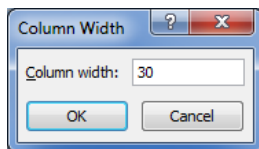
Save your ArcMap document **HW2.mxd** so that you can retain this display.

9. Graphing in Excel

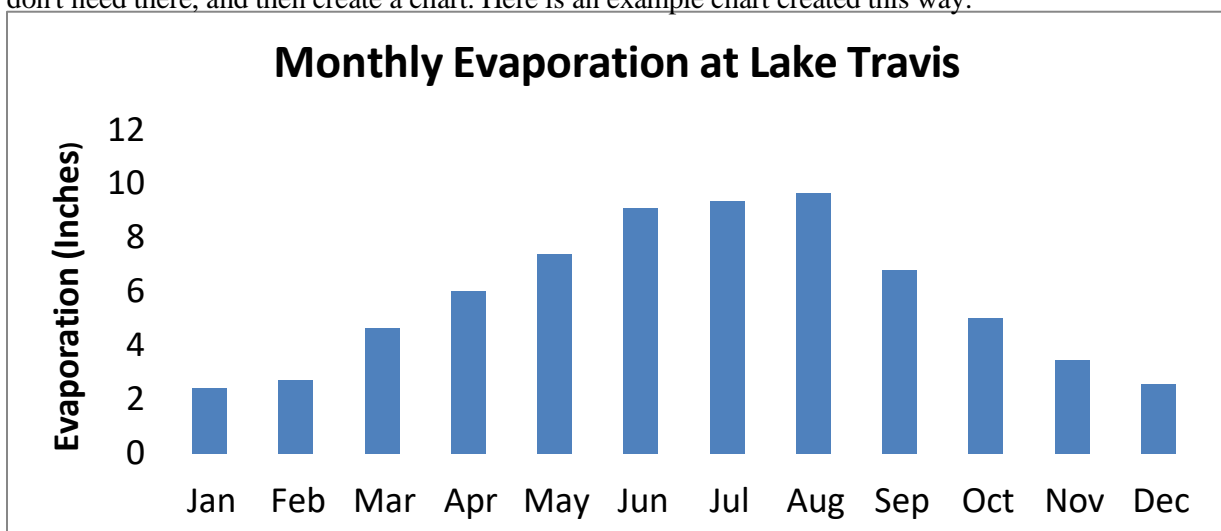
Another graphing option is to make a chart in Excel using the dBase tables given by the evaporation shapefile. Open the evaporation attributes table **Evap.dbf** as a table in **Excel**. Use **Files of Type: dBase files** in Excel to focus only on .dbf tables when you open the table.



When you open the file, you'll see that the Station name is very wide (254 characters). Right click on this column in Excel and select **Column width** of 30 characters to correct this.



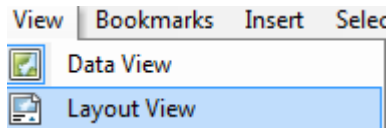
Select the stations you want to plot, copy their records to a new worksheet, delete the columns you don't need there, and then create a chart. Here is an example chart created this way:




10. Creating a Map Layout

Now we are going to create a formal map of evaporation in Texas that includes the charts that we've created.

Change the format of the display window from **Data View** to **Layout View** by clicking on **View/Layout View**,



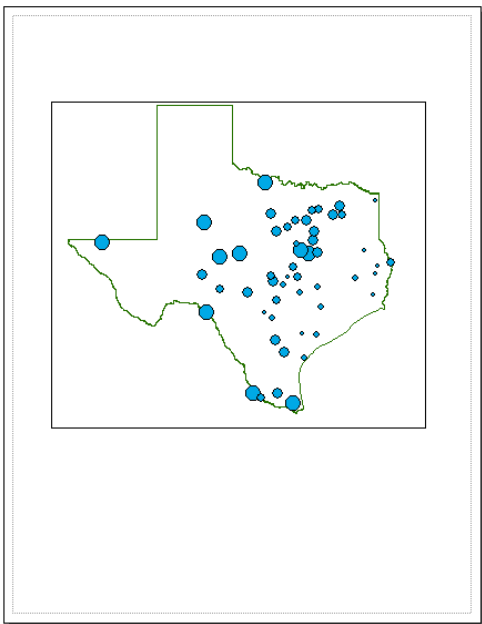
If your Layout doesn't display properly in ArcMap, hit  at the bottom of the map display to refresh it.

Reduce the size of the data frame in the layout (i.e., rectangle where the spatial data is contained) -- to make room for the graph -- by clicking on the graph and moving its handlers. If you have a zoomed in view in Arc Map, you'll get the same image in in the Layout. To move the location of your map, go back to the **Data View** and use the **Pan** tool



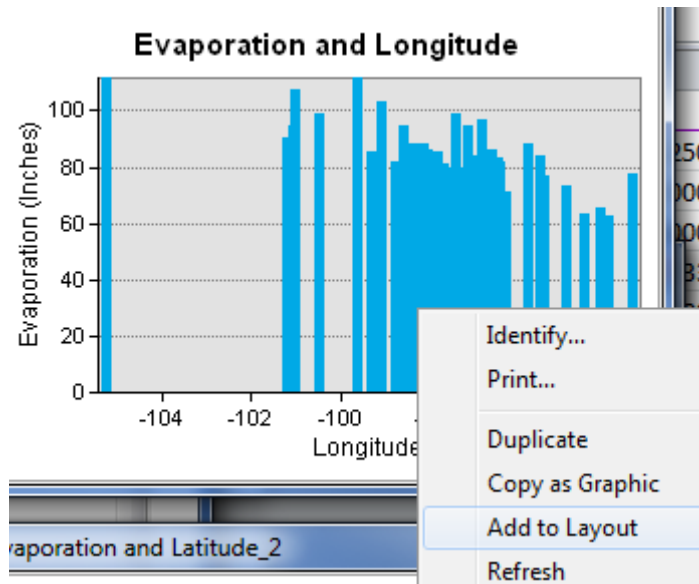
to move your map around. When you switch back to the Layout View the new map location will be displayed.

I have temporarily turned off the Basemap to make the map easier to interpret.

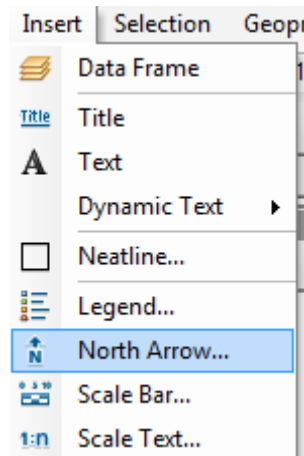


Remember to keep saving your ArcMap document as you proceed through the map making steps so that if you mess up something you can get back the work you've already done.


To insert the ArcMap Chart into the Layout, right-click on the upper blue bar at the top of the Chart and select **Add to Layout**. Move and resize the graph as necessary. If you want to copy your graph from Excel, highlight the graph, and click on **Copy** in Excel, then **Paste** in ArcMap and your graph should appear in the map layout.



You can also insert a **North Arrow** and a **Scale Bar** by using the **Insert** menu in ArcMap.

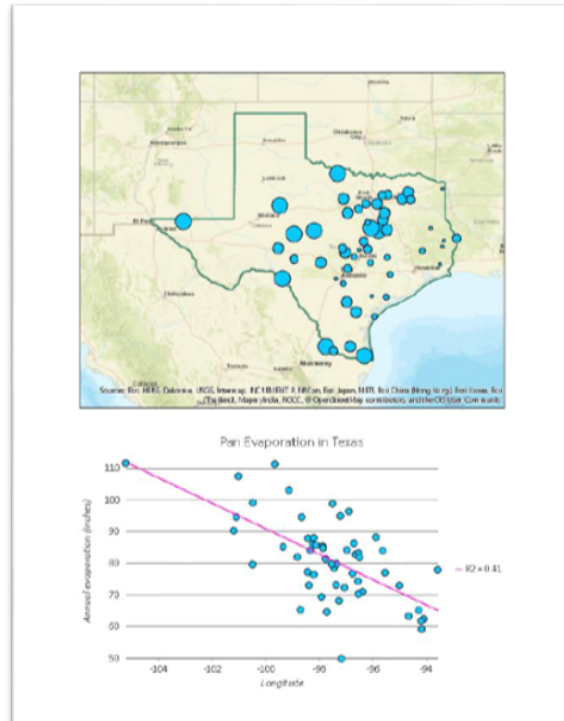
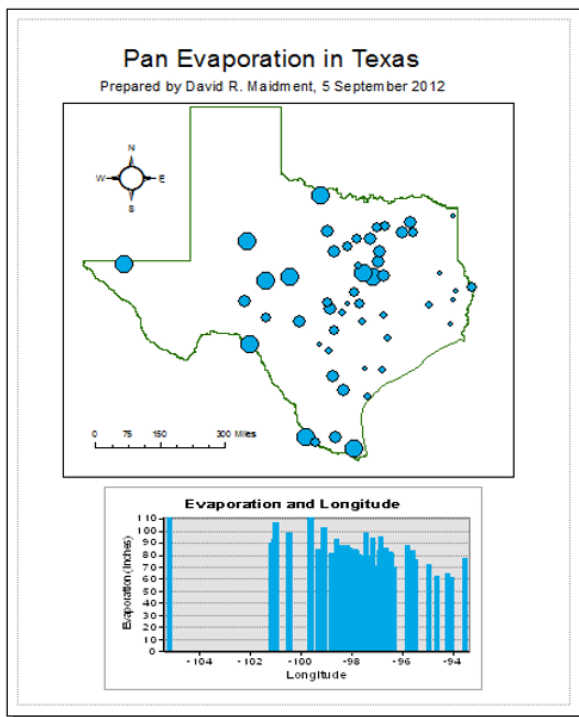


When you put up the scale bar you can select the distance units to be displayed. I have used miles.

You can add a **Title** or **Text** with the text tool  shown next to the line draw tool. The text displays in very small font sizes. Select and click on them, and use **Properties** to resize them.

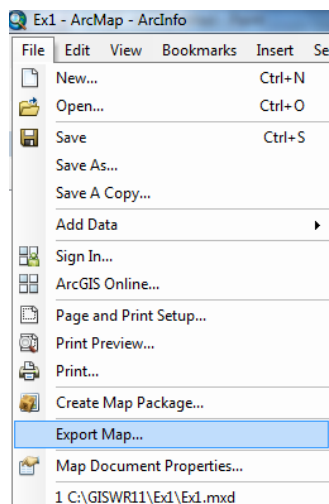
You can also change the scale bar, north arrow, etc, by right-clicking on the object and going to the **Properties** menu.

Your map might look like this:



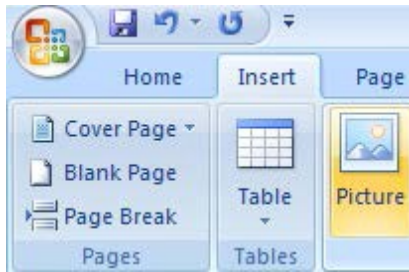
Save your document.

You can export your map from ArcGIS using **File/Export Map** from the ArcMap menu, and you can store this as **HW2.emf** in your data folder. Then you can add it to a Word document using **Insert/Picture/From File** and load this emf file, as shown below. Pretty cool!



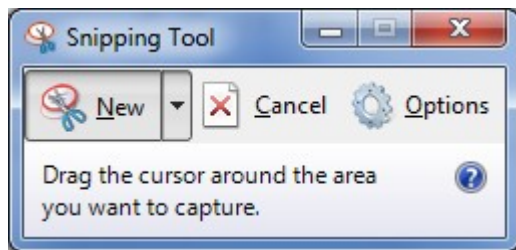
Then you can add it to a Word document using **Insert/Picture/From File** and load this emf file (watch

resolution, should be 300 or 350 dpi. If it drops to 95 it will be very poor resolution.), as shown below. You can also export map as PDF as well as a wide variety of other formats, depending on how you plan on using it.



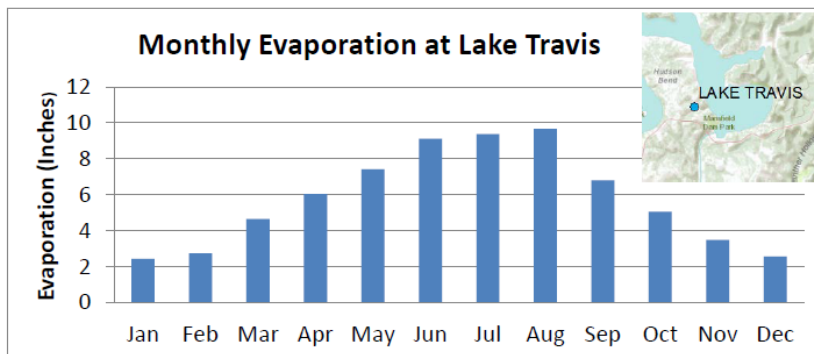
Helpful Tip:

A more general procedure is to simply use the SNIPPING tool and select the part that you want, copy and paste it to a file for later use. That is how all the images in this exercise were prepared. **All Programs/Accessories** on your Windows Desktop interface



Drag the cursor around the area that you want to capture and you'll see it copied into a new display, then use **Paste** to insert this snippet into a specific location in your document. If you only want to capture the active frame, press **Alt + Print Screen** and then Paste it to the new document.

This approach can also be used to add a map to a chart in Excel:



The manipulations just described transfer objects from one application to another.

HOWEVER, NOTE THAT THE SNIPPING TOOL DOES NOT COPY AT AS HIGH OF RESOLUTION AS THE EXPORT MAP OPTION CAN. ALSO, NOTE THAT THE SNIPPING TOOL WILL ALSO PIXELIZE TEXT, WHICH CAN BE PRESERVED IN FORMATS SUCH AS EMF. SO USE WITH CAUTION!!!!

11. Summary of Items to be Turned In: (30pts)

- (1) An ArcMap map layout in it showing a map of the state of Texas with gages, coupled with a graph showing evaporation data plotted from one gage of your choice. In the presentation of information on maps and charts it is important to include sufficient labeling detail so that the information can be clearly and unambiguously interpreted. You should include a scale bar to indicate distance, a north arrow to indicate direction and labels or legends with units wherever they are needed to interpret map or quantitative values. Let's see some nice cartography and don't just copy example! Do NOT use the example shown (longitude) as your table on your map. Be creative. Chart something else (7pts).

Note: Part of your grade will be based on the overall professionalism of the map. Suggest exporting map as PDF and not using a snipping tool for a more professional map product. Also, review the documents on Canvas about making maps. Be cautious about legends - do not show legends with excessive numeric precision (14 digits); round up to 2 decimal places. To do this – right click on layer – properties-symbolology-click on Label- format – 2 places.

- (2) Research pan evaporation via the internet. Describe what pan evaporation is, how it works and what it measures.(4 points)
- (3) Answer the following questions using the provided datasets (19pts):
- How many counties are there in Texas? (1pt)
 - What is the largest county (by area)? Smallest? (2 pts)
 - What are the units for area for this dataset? Hint: right click on layer- properties-select Source tab-and in second paragraph what are the units? How useful are these units for measuring or area? (1pt)
 - How many evaporation stations are there? Which is the eastern-most station, most southern? Hint: open attribute table and look at bottom of table. (2pts)
 - Which station had the highest annual evaporation rate and which county does it reside? Lowest and county? (2pts)
 - Given the geographic locations of these sites, does it make sense that they would be the stations with the highest and lowest values? Why or why not? (3pts)
 - How many stations were still operational until the end of 2009? (1pt)
 - Change the symbology so that the stations operational until the end of 2010 are colored in blue and the stations after 2011 and beyond that are colored in red. Use a snippet to show results. Hint: select your records in the attribute database (with mouse select small square on left side in table) – right click on data layer—selection – create a layer from selection. (3pts)
 - What coordinate system is being used to display the evaporation data? Hint: See Q3c's hint. (1pt)
 - Comment on the overall spatial distribution of the evaporation sites. What do the sites tend to be close to? Why are there no pan evaporation sites in the

northern region of state? (Hint, look at your streets basemap and compare to the location of the points). (3pts)

Submit your PDF document through CANVAS (if you have more than one document – use Bluebeam to staple documents together to create one single document). Hint: at start menu type: Revu – select Bluebeam Stapler or Revu – use Wizard tool – add pdf files, move up or down to have correct order then fill out new file name and location to save to.