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Center for Spatially Integrated Social Science

GIS Cookbook: Introduction

The GIS Cookbook is a collection of simple descriptions and illustrations of GIS methods written with minimal GIS jargon. Recipes cover two GIS software platforms, ArcView 3.x and ArcGIS 8/9.x. The target users are social scientists with an interest in introducing spatial thinking into their current research and also having some experience with computers but little to no exposure to GIS. The GIS Cookbook was prepared in 2002-2005 to serve the expanding community of social scientists wanting to apply GIS for research and teaching.

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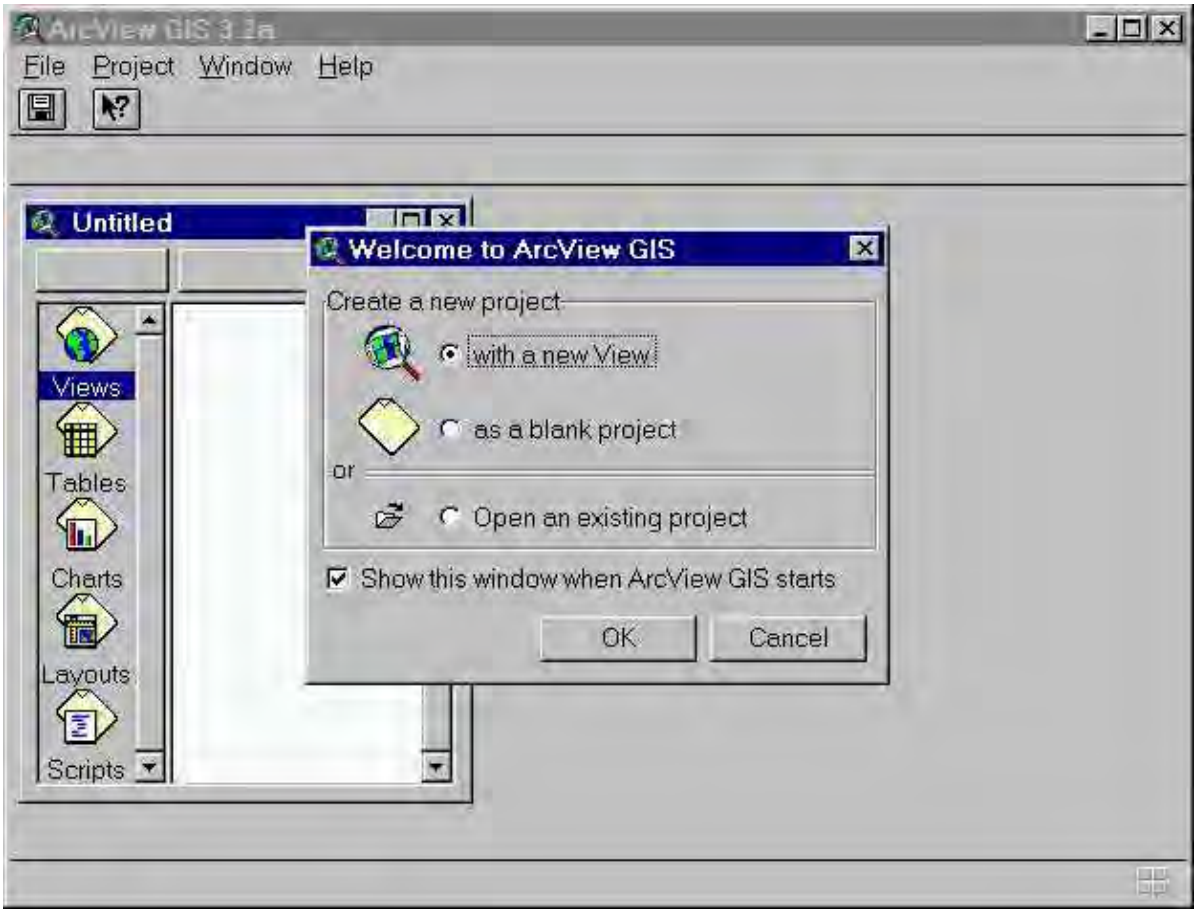
GIS Cookbook: Getting Started - How to Open a New Project, New View, or Existing Project, then Add Data

Keywords: New View, ArcView, project, open project
Category: Starters
Software: ArcView 3.2

Problem: Most recipes require me to open a new view or project and then add data. How do I do these tasks?

Description: At the start of many recipes, the first line of instruction will be to "open a new view." The following recipe will show you how to execute this step.

Methodology:
1) Click on the **Start** button, go to **Programs**, go to **ESRI**, select ArcView 3.2. The following windows will appear on your screen. If you are not able to find the program this way, See Pitfall 1.

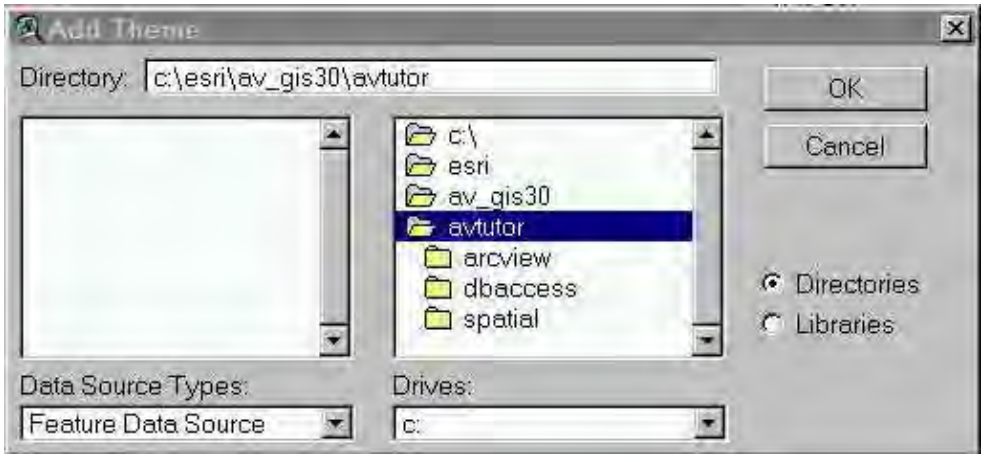


2a) To open a New Project with a New View, select the bullet next to **"with a new view"** and then select **OK**.

2b) To open an existing project, select the **"open existing project"** bullet. Then select **OK**.

3) After selecting **OK** to opening a New View, the program will ask if you would like to add data. The following window will appear on your screen.

To add data, select **Yes**. The following window will appear, with which you can navigate to upload the data files you would like to add to your view.



4) After selecting the data file, select **OK**.
Pitfalls:

- If you cannot find ArcView within your Start Menu, go to **Start** and search for the application using the **Find** tool. Your programs will be in different locations depending on where they were placed during program installation.

Authored by: Sam Ying **Modified:** 9/11/03

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GIS Cookbook: Getting Started - How to Open a Map Document, then Add Data

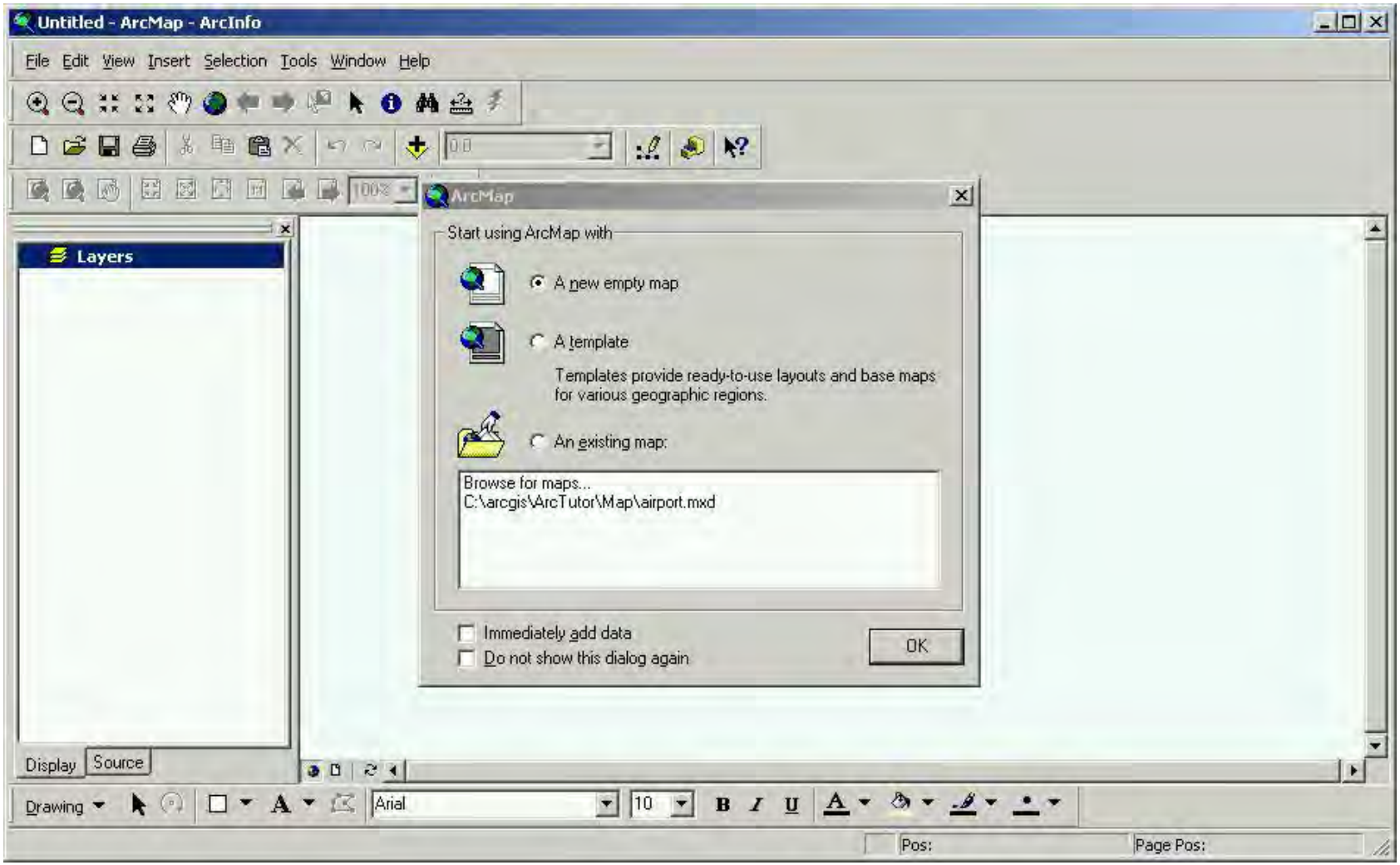
Keywords: ArcMap, project, open project, add data, map document, open map document
Category: Starters
Software: ArcGIS 8/9.x

Problem: Most recipes require me to open a new map document (project) and then add data. How do I do these tasks?

Description: At the start of many recipes included in the CSISS Cookbook, the first lines of instruction will be to "open a new map document" and then to "add data." The following recipe will show you how to execute these steps.

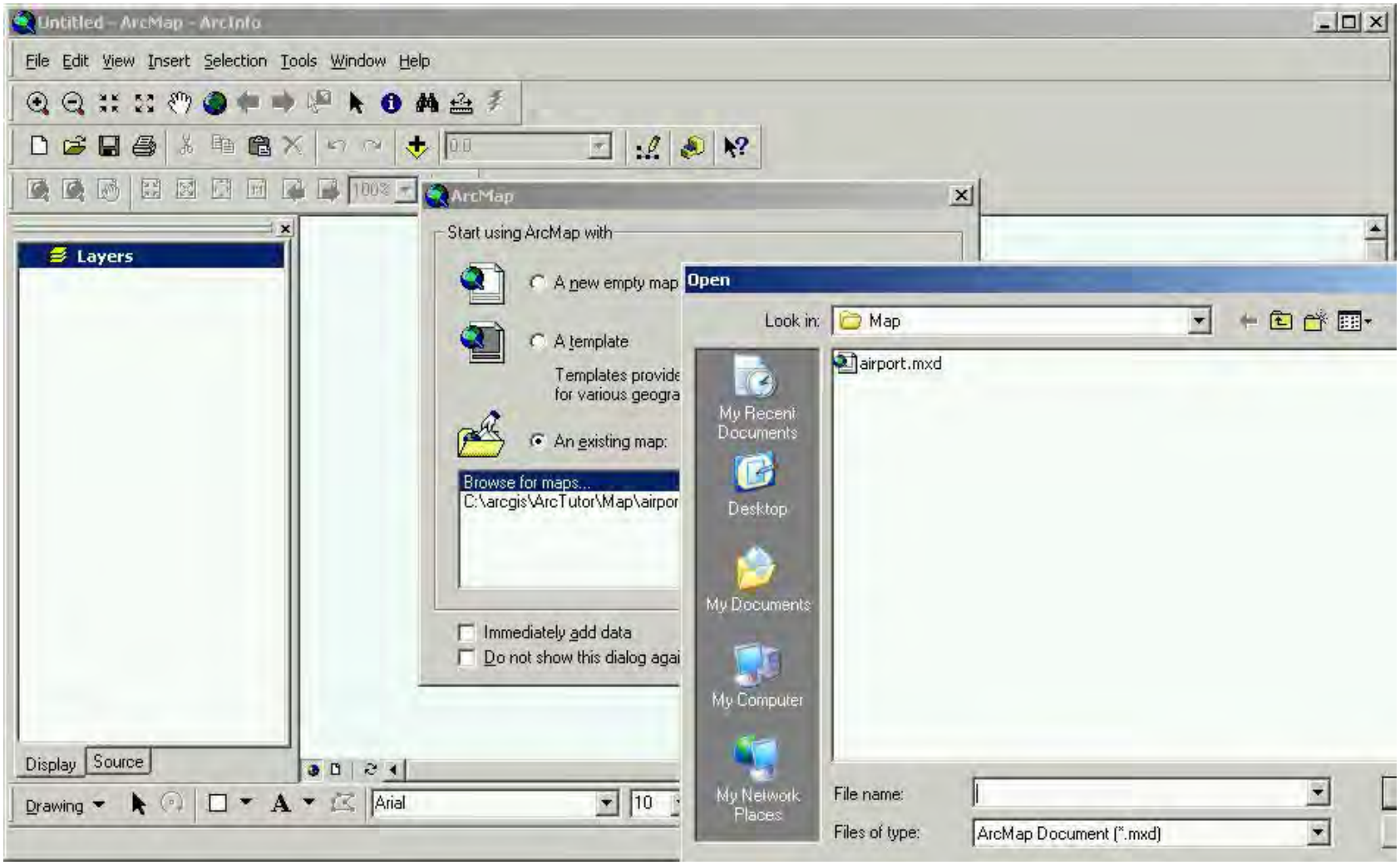
Methodology:
1) Click on the **Start** button, go to **Programs**, go to **ArcGIS**, select ArcMap. The following windows will appear on your screen. If you are not able to find the program this way, please See Pitfall 1.

2a) To open a new map document with an empty data frame, select the bullet next to **A new empty map** and then select **OK**.



Starting a new map document

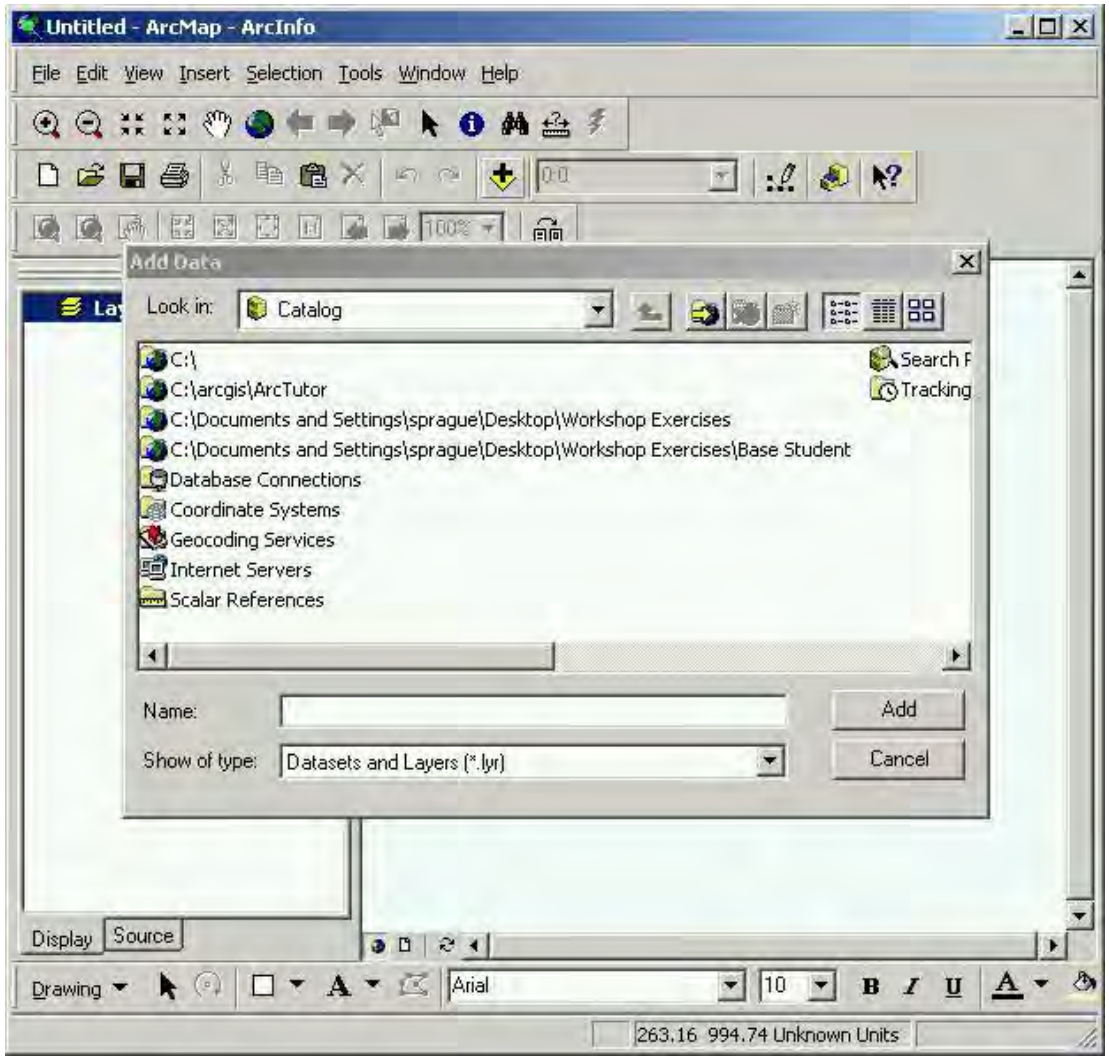
2b) To open an existing project, select the **An existing map** bullet. Then select **OK**.



Open an already existing map document

3) After selecting a map document, you can now add data.
To add data, click the **Add Data** Button.

Note: You can also go to **File -> Add Data** .
The following window will appear

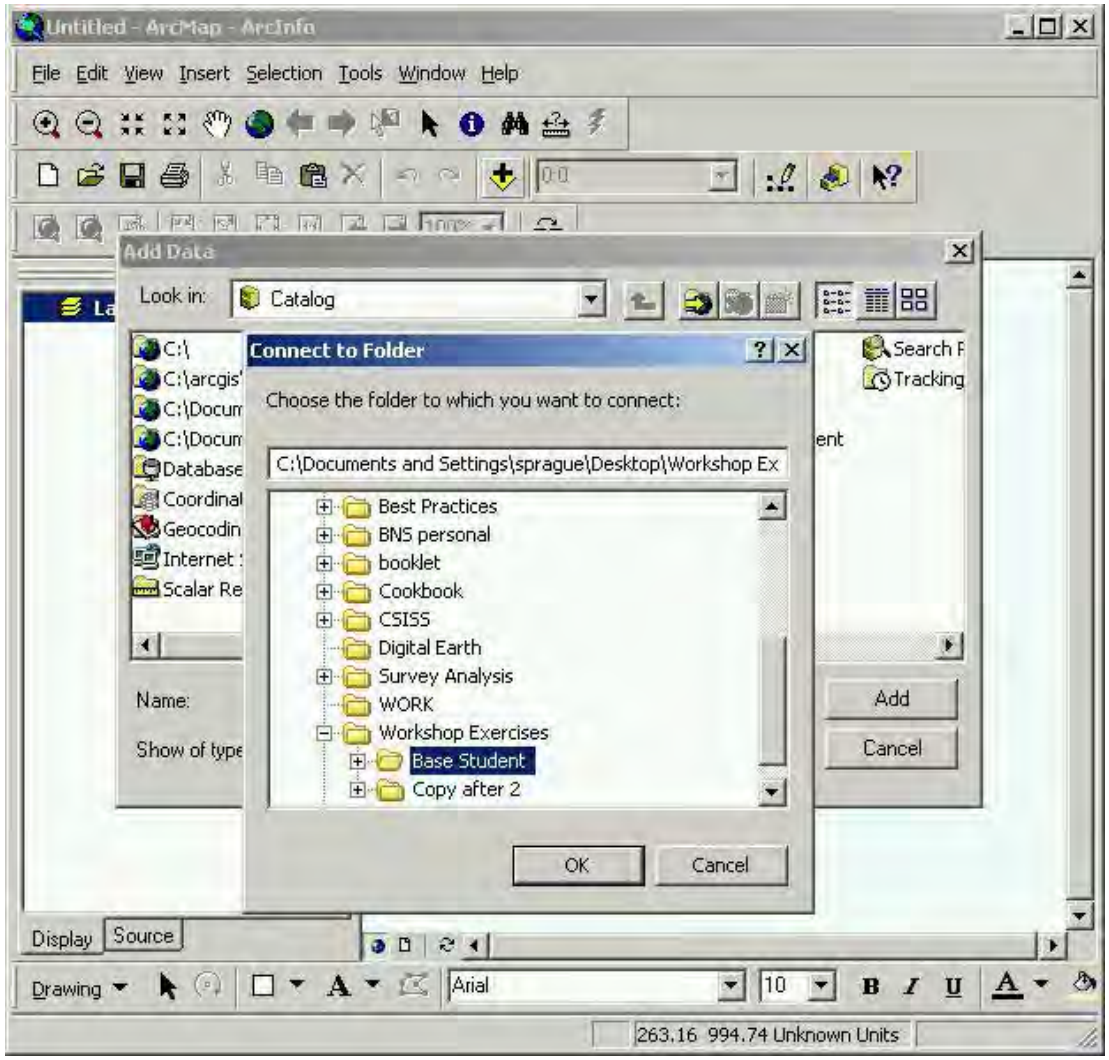


Adding data

4) First, you will map your data drive. This allows you to select the directory and folder within which your data layers are stored, so you do not have to search for the folder every time you upload data. This way, you only need to direct the program to that folder once.

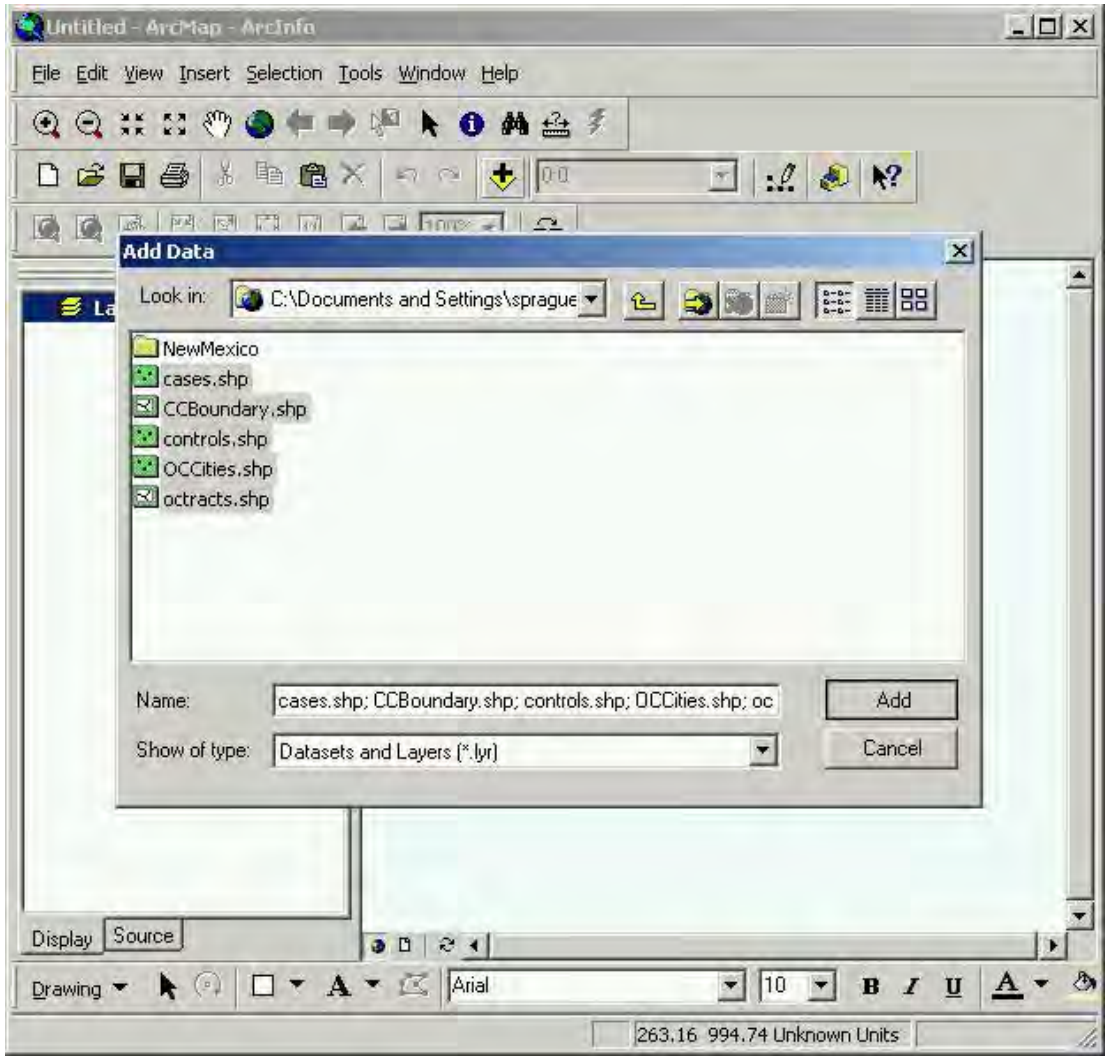
Click on the **Connect to Folder** button in the Add Data window.

The Connect to Folder window will appear. Use it to navigate to the folder where the data files you would like to add to your map are located.



Connect to the folder where your data is located

5) After connecting to the folder, navigate to the data file or files you would like to add and select the data files by clicking on them (use the Shift or Ctrl keys to select multiple files), and then click **Add**.



6) Your data will appear in your map window. You can repeat the Add Data process as many times as necessary. However, once you have connected to your folder one time you do not have to do it again, unless you would like to retrieve data from another folder or directory.

Pitfalls:

- If you cannot find ArcMap within your Start Menu, go to **Start** and search for the application using the **Find** tool. At the find prompt (it will look different depending on your operating system), type "Arcmap.exe" without the quotes. Your programs will be in different locations depending on where they were placed during program installation.

Authored by: Benjamin N. Sprague **Modified:** 2/4/05

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GIS Cookbook: Getting Started - How to Add Data after Opening a New View

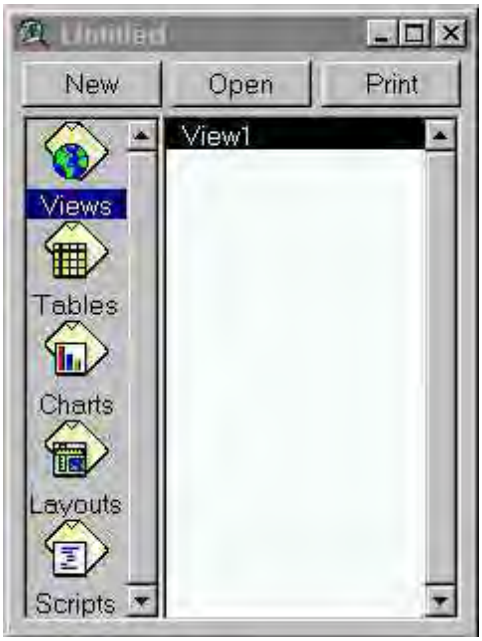
Keywords: Add data, new view, existing data
Category: Starters
Software: ArcView 3.2

Problem: How do I add data to my view or my project?

Description: After opening a new View or existing data, you will often need to add data to your view. The following recipe will show you how to execute this step. To see how to open a new View or existing project, refer to recipe ***How to open ArcView and a New View or Existing Project***.

Methodology:
1) To open a new view in an existing project select the Views icon

within the project manager window, then select **New**.



2) To add data, select the **Add Data** button

The **Add Data** button can be found near the top of the ArcView 3.x window next to the **Save** button marked as a floppy disk icon. This will lead you to a directory where you can navigate to your data files to be uploaded onto the view.

3) After you have selected the title of the file on the directory, select **OK**.

Authored by: Sam Ying **Modified:** 9/9/03

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GIS Cookbook: Getting Started - Performing an Attribute Query

Keywords: query, attribute, select, tabular, SQL
Category: Starters
Software: ArcGIS 8/9.x

Problem: You want to select map features that have certain tabular attributes.

Description: One of the most common functions in a GIS is the ability to ask the software to display all of the geographic features that meet some criteria. These criteria may be based on information stored in a layer's attribute table (an attribute query) or they may involve desired spatial relationships between features in different geographic data layers (a spatial query). This recipe will focus on building an attribute query.

Methodology:
Assuming you have ArcMap open and have added all of the desired data layers, you can build an attribute query as follows:

1. Click on **Selection > Select By Attributes**.

2. In the **Select By Attributes** dialog, be sure to select the **Layer** whose attribute table you'd like to query. Upon selecting a layer, you should see a list of its **Fields** (or columns) appear on the left side of the dialog.

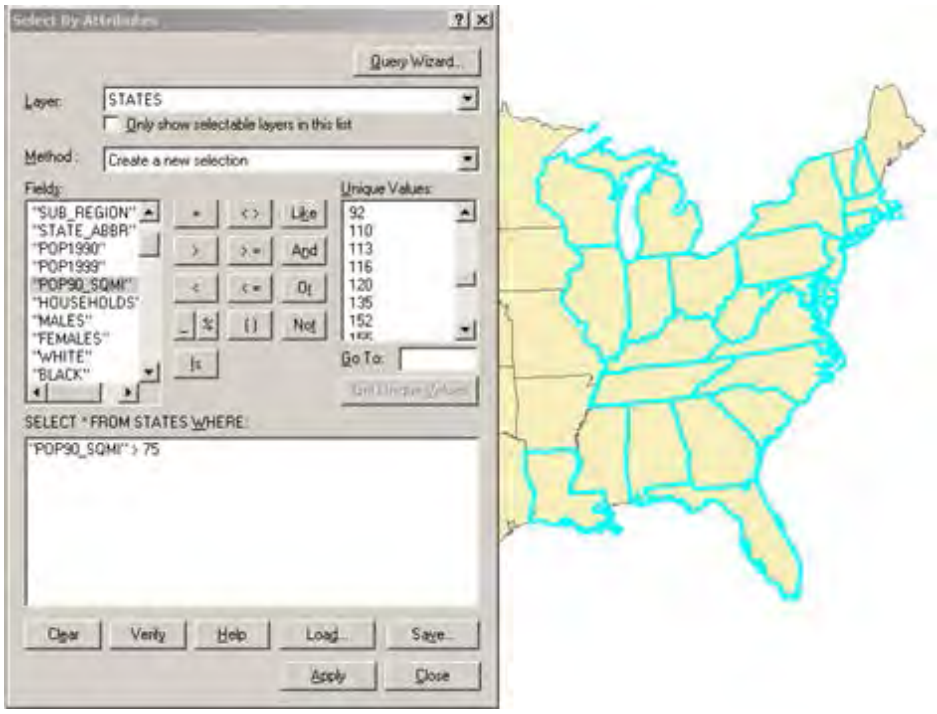
3. In the **Fields** list, double-click on the desired field. Note that the name of the field is added to the large text box in the bottom half of the window.

4. Next, click on one of the logical operators in the middle of the dialog (such as **=**, **>**, **≥**, etc.).

5. The last step in building the query expression is to enter a value that is appropriate for the field and that defines your selection criteria when combined with the chosen logical operator. You may place the cursor at the end of the expression and manually type the desired value, or you may click the **Get Unique Values** button to see a list of the unique values within the chosen field and then double-click on one of the values listed to insert it at the end of the expression.

6. When you've finished building the query expression, click the **Apply** button. ArcMap will highlight the features that meet your criteria in the selection color (cyan, by default).

See Pitfall 1



Using the Select By Attributes dialog to select U.S. states with a population density greater than 75.

Notes:

1. One of the options in the Select By Attributes dialog is **Method**. This defaults to **Create a new selection**, which means that if there are already some features selected, that selection set will be wiped out. Other choices include: **Add to current selection**, **Remove from current selection**, and **Select from current selection**. These other selection methods may be used to evaluate multiple attribute criteria one at a time.

2. Another way to evaluate multiple selection criteria is to use the logical operators **And** and **Or**. For example, if you wanted to select states with a population density over 75 and at least 50000 farms, after entering the value 75 you could click the **And** operator, then begin the three-step process (field-operator-value) again to enter the second part of the compound expression.

3. If you open the layer's attribute table, note that the tabular records associated with the selected map features are also shown in the selection color. In fact, it is possible to invoke this same Select By Attibutes dialog by clicking on the **Options** button in the lower right of an open attribute table window.

4. Besides simply seeing which map features meet some criteria, creating a selection set is an important step in performing a number of other GIS functions. These include:

- Using the selection set for further analysis (such as buffering the selected features)
- Using the selection set to select features in another layer
- Editing the selection set (either the geometries of the features or their attributes)
- Creating a new layer from the subset
- Calculating summary statistics for the selected features

- and more...

5. Using the **Save** and **Load** buttons in the Select By Attributes dialog, it is possible to store query expressions on disk and re-load them at a later time.

Pitfalls:

- New users frequently encounter syntax errors when using the Select By Attributes dialog. Remember to double-click on the items in the **Fields** and **Unique Values** list boxes and single-click on the logical operator buttons. If you're unable to pinpoint the error in your expression, it may be easiest to click the **Clear** button and start again.

Authored by: Jim Detwiler **Modified:** 3/6/05

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GIS Cookbook: Getting Started - Performing a Spatial Query

Keywords: query, spatial, topological, select by location
Category: Starters
Software: ArcGIS 8/9.x

Problem: You want to select map features based on their spatial relationship with other map features.

Description: One capability that distinguishes GIS software from simple drawing packages is the ability to explore the spatial relationships between map features in different layers. These relationships (often referred to as topological relationships after the branch of geometry called topology) include connectivity, adjacency, and containment. GIS software enables researchers to ask questions like:

- Which roads are connected to Interstate 80?
- Which census tracts are adjacent to this industrial park?
- How far is the nearest bus stop from each of my study subjects?
- Which schools are contained within this Metropolitan Statistical Area?
- Etc.

Methodology:
Many of these types of questions can be answered by building a spatial query using the **Select By Location** dialog. Assuming you have ArcMap open and have added all of the desired data layers, you can build a spatial query as follows:

1. Click on **Selection > Select By Location**.

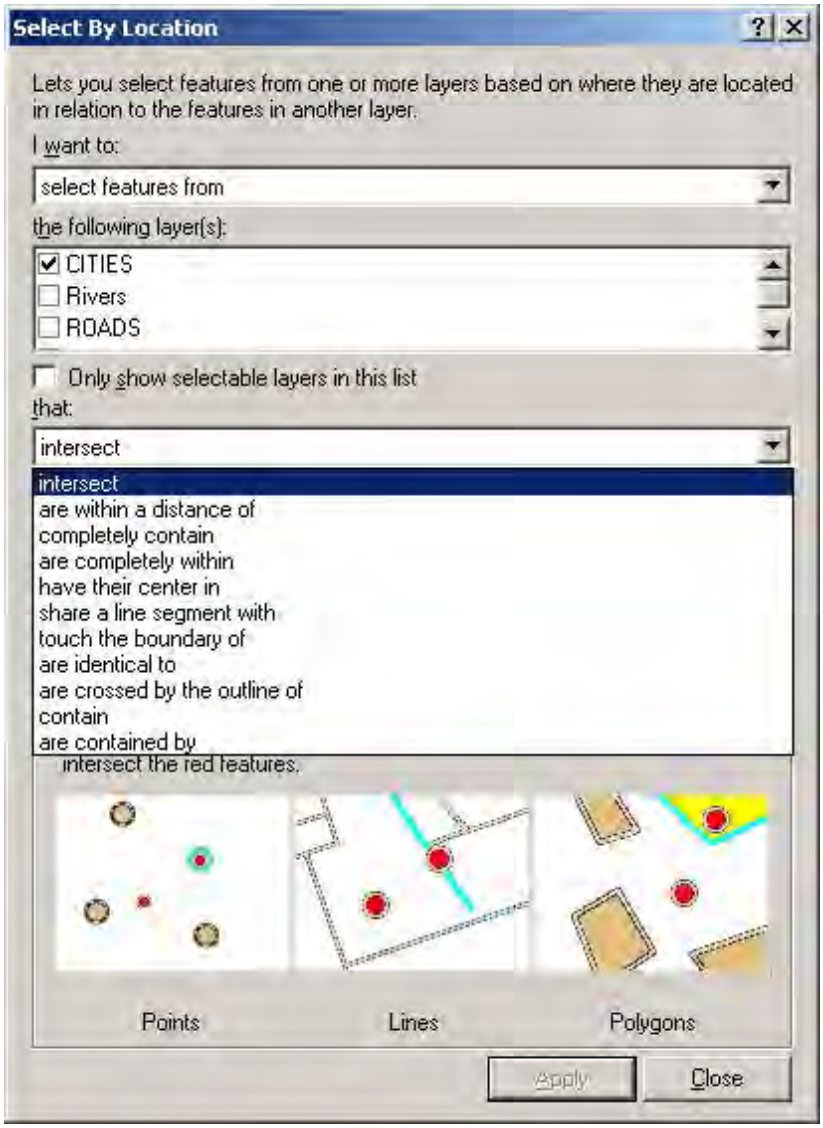
Setting the options in the Select By Location dialog can be approached by constructing a sentence that describes the query, beginning at the top with the words, **I want to:**.

2. The first option is the selection method. In most instances, the default option of **select features from** is the most appropriate. See Note #1 for more information on selection methods.

3. The next step is to specify which layer(s) contain the features you'd like to select by choosing from the list under the words **the following layer(s)**.

4. Next comes the choice of an appropriate spatial relationship from the drop-down list under the word

that:. See Figure 1 for a list of available relationships.



Spatial relationships available in the Select By Location dialog

5. To complete the sentence, you must choose the other layer participating in the relationship by selecting from the list under the words **the features in this layer:**.

6. Click **Apply** to execute the query. Figure 2 shows an example of a point-in-polygon selection.

Selecting CITIES features that intersect features in the Western States layer

7. Optionally, you may want to specify that only the selected features in the query layer (**Western States** in this example) be used to find matching features in the target layer. This can be done by clicking the **Use selected features** checkbox as shown in Figure 3.

Selecting CITIES features that intersect just the selected features in the Western States layer

8. Buffering the features in the query layer is another optional setting. When the **are within a distance of** relationship is selected, this checkbox is automatically checked. Upon selecting this option, the next step is to enter the desired buffer distance. Figure 4 shows an example of selecting cities within 100 miles of the Nevada border.

Selecting CITIES features within a distance of 100 miles from the selected Western States features

Notes:

1. The first drop-down list in the Select By Location dialog provides a list of selection methods. It defaults to **Select features from**, which means that if there are already some features selected, that selection set will be wiped out. Other choices include: **Add to the currently selected features in**, **Remove from the currently selected features in**, and **Select from the currently selected features in**. These other selection methods may be used to evaluate multiple spatial queries one at a time.

2. If you open the layer's attribute table, note that the tabular records associated with the selected map features are also shown in the selection color.

3. Besides simply seeing which map features meet some criteria, creating a selection set is an important step in performing a number of other GIS functions. These include:

- Using the selection set for further analysis (such as buffering the selected features)
- Using the selection set to select features in another layer
- Editing the selection set (either the geometries of the features or their attributes)
- Creating a new layer from the subset
- Calculating summary statistics for the selected features
- and more...

Authored by: Jim Detwiler **Modified:** 3/6/05

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GIS Cookbook: Recipe - Importing an Excel table to your GIS project

Keywords: Tables, Excel, linking, joining, data management
Category: Data Analysis
Software: ArcView 3.2

Problem: I have data in an Excel format, how do I use it within my ArcView project?

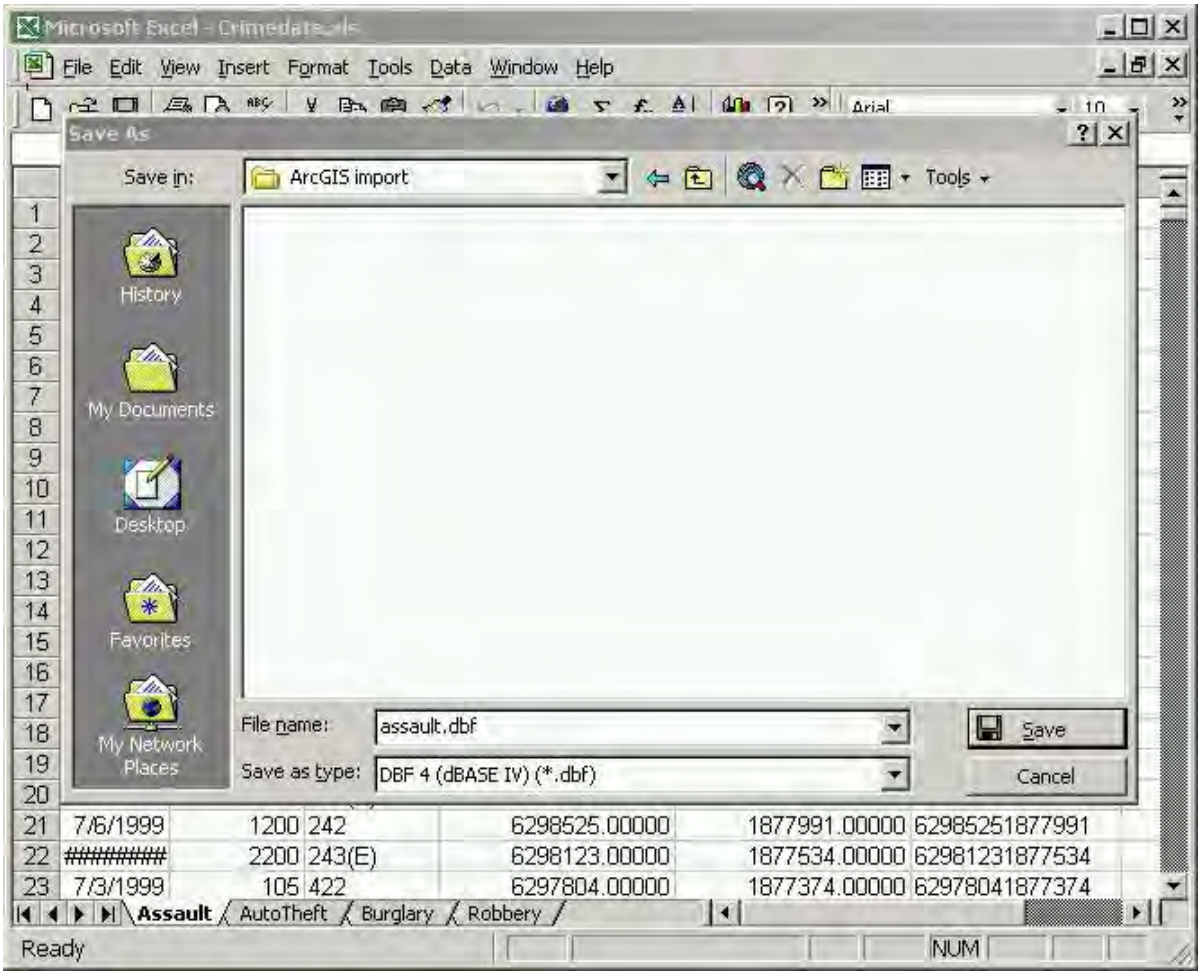
Description: Often the data we work with does not come nicely packaged in a GIS data file. Instead we work with a variety of different data sources. In this recipe we will convert data from an Excel database into GIS friendly formats and then import them so that they can be used within your ArcView project.

Methodology:
1) Open Excel, and the data file that you want to use in ArcView. Bring up the exact data spreadsheet you would like to import.

2) Go to the **File -> Save As** menu option

3) Set the *Save in:* folder to a familiar directory and remember where you saved it.

4)Set the *Save as type:* to DBASE IV.



the **Save As** window

5) Set your file name appropriately and click **Save**.

6) A message while appear about multiple worksheets, Click **OK** to the verification message about multiple worksheets. (Note: If you have multiple work sheets in your excel workbook, you will need to repeat steps 1-6 for each that you would like to import to ArcView)

7) Then Click **Yes** to the informational message regarding formats. The Data you selected is then written to disk as a DBase file.

8) Close excel.

9) Open ArcView 3.x. You can either import it to a new project, or to a existing project.

10) Use the Add Data button to add the DBase files to the map. If you do not know how to do this yet see the recipe *How to Open a New Project and View or Existing Project, then Add Data (ArcView 3.2)*.

11) Navigate to the folder where you saved the .dbf files. Select the file or files you would like to add, and click the **Add** button. If you receive an error message See Pitfall 1, or See Pitfall 2.

12) The DBase tables are displayed in your view.

Pitfalls:

- If your error message says that the file is busy or already in use, it means that you have left the .dbf file you are trying to import open in excel. Makes sure the file you are importing and preferably excel are closed before you import the data. Link
- If your error message says that the format is not accepted or ArcMap cannot read the format, there is an error either with your file type (eg. wrong format) or there is an error within your data that prevents it from being imported (this may include extra spaces within columns, empty cells, and many other consistancy issues) Try to make your data as neat as possible and try again.

Authored by: Benjamin N. Sprague **Modified:** 9/9/03

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GIS Cookbook: Recipe - Importing an Excel table to your GIS project

Keywords: Tables, Excel, linking, joining, data management
Category: Data Analysis
Software: ArcGIS 8/9.x

Problem: I have data in Excel format, how do I use it within my ArcGIS project?

Description: Often the data we work with does not come nicely packaged in a GIS data file. Instead we work with a variety of different data sources. In this recipe we will convert data from an Excel spreadsheet into a GIS-friendly format and then import them so that they can be used within your ArcMap map document.

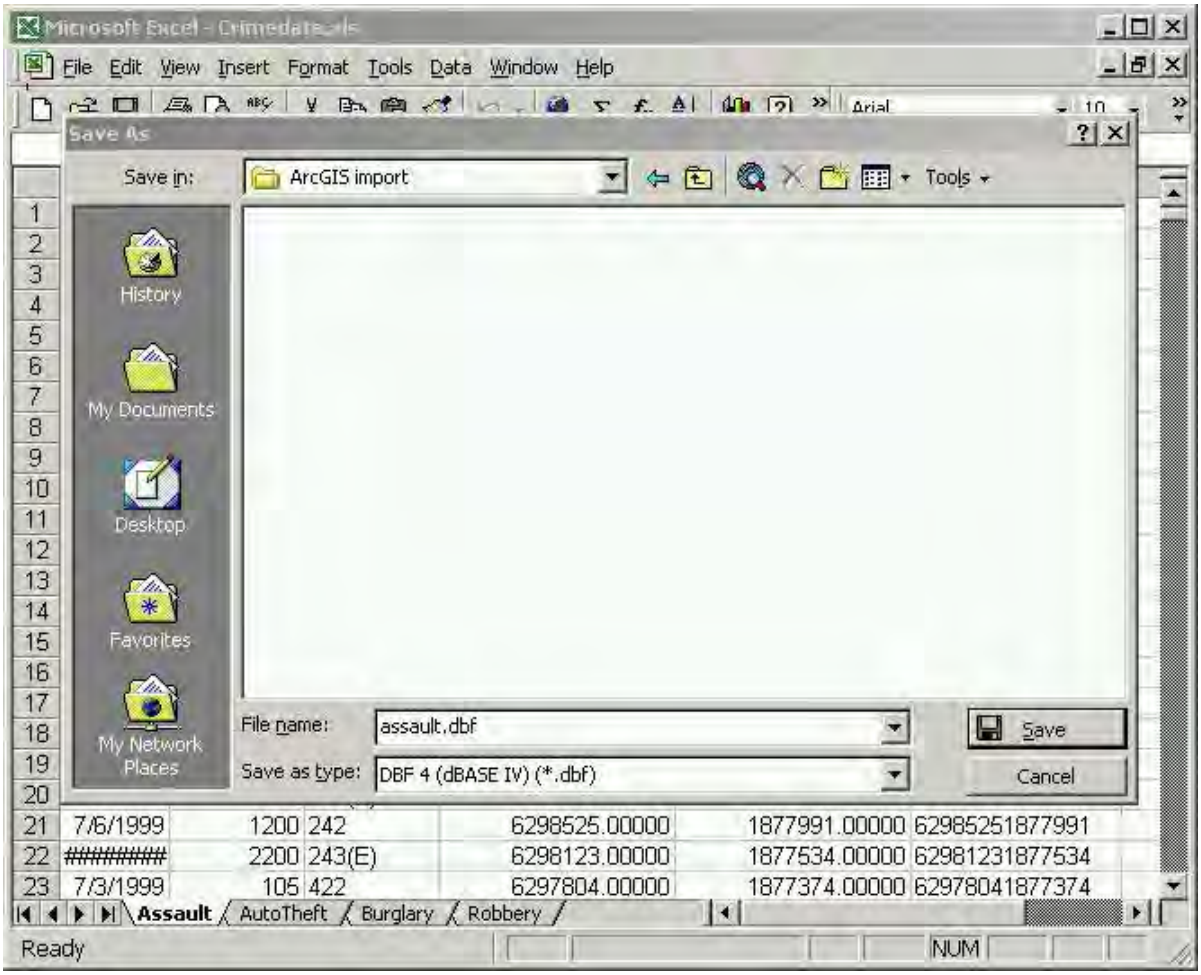
Methodology:

1) Open Excel to the data file that you want to use in ArcMap. Bring up the exact data spreadsheet you would like to import.

2) Go to the **File -> Save As** menu option

3) Set the *Save in:* folder to a familiar directory and remember where you saved it.

4)Set the *Save as type:* to DBASE IV.



The **Save As** window

5) Set your file name appropriately and click **Save**.

6) A message will appear about multiple worksheets. If your data are in a worksheet other than Sheet1, be sure to select that sheet here. Otherwise, just accept the default Sheet1. (Note: If you have multiple worksheets in your Excel workbook, you will need to repeat steps 1-6 for each that you would like to import to ArcMap.)

7) Then Click **Yes** to the message regarding formats. The Data you selected is then written to disk as a dBase file.

8) Close Excel.

9) Open ArcMap. You can either import it to a new map document, or to a existing map document.

10) Use the **Add Data** button to add the dBase files to the map. If you do not know how to do this yet see the recipe *How to Open a Map Document, then Add Data (ArcGIS 8.x/9.x)*.

11) Navigate to the folder where you saved the .dbf files. Select the file or files you would like to add, and click the **Add Data** button. If you receive an error message See Pitfall 1, or See Pitfall 2.

12) The DBase tables are displayed in your active data frame.

Pitfalls:

- If your error message says that the file is busy or already in use, it means that you have left the .dbf file you

are trying to import open in Excel. Make sure the file you are importing and preferably Excel are closed before you import the data.

- If your error message says that the format is not accepted or ArcMap cannot read the format, there is an error either with your file type (e.g., wrong format) or there is an error within your data that prevents it from being imported (this may include extra spaces within columns, empty cells, and many other consistency issues) Try to make your data as neat as possible and try again.

Authored by: Benjamin N. Sprague **Modified:** 2/4/05

GIS Cookbook: Recipe - Joining a table

Keywords: Data, joining, relates, sorting, data analysis
Category: Data Analysis
Software: ArcView 3.2

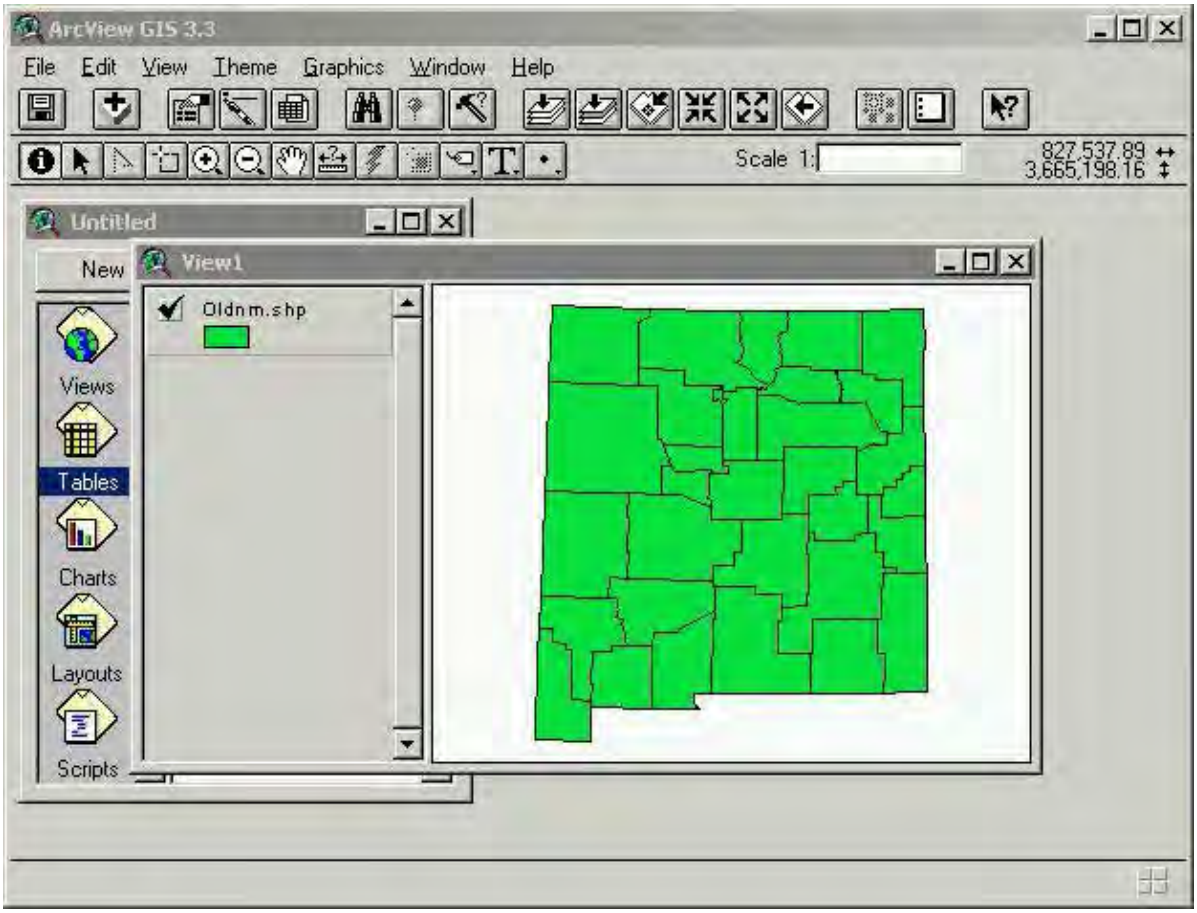
Problem: I have information in a table that I would like to join to a point, polygon or line feature.

Description: Often times, the information you want to display or analyse within GIS is in two different places or formats. Often you will have a map of a standard area, like the counties in a state or the states of a country, and you will want to add external data to them so you can look at your data in a spatial context. In this recipe we will look at how to join data to a shapefile.

Scenario:
Ever since the work of John Snow and his mapping of Cholera cases, mapping cases and frequencies of diseases can help to find sources and cures. One of the major research topics of the 20th century is the search for an understanding of cancer. It helps researchers in the subject to know where the cases of cancer are the highest. In this scenerio, we are going to look at the state of New Mexico and join the the cancer statistics for each county to the counties within the state.

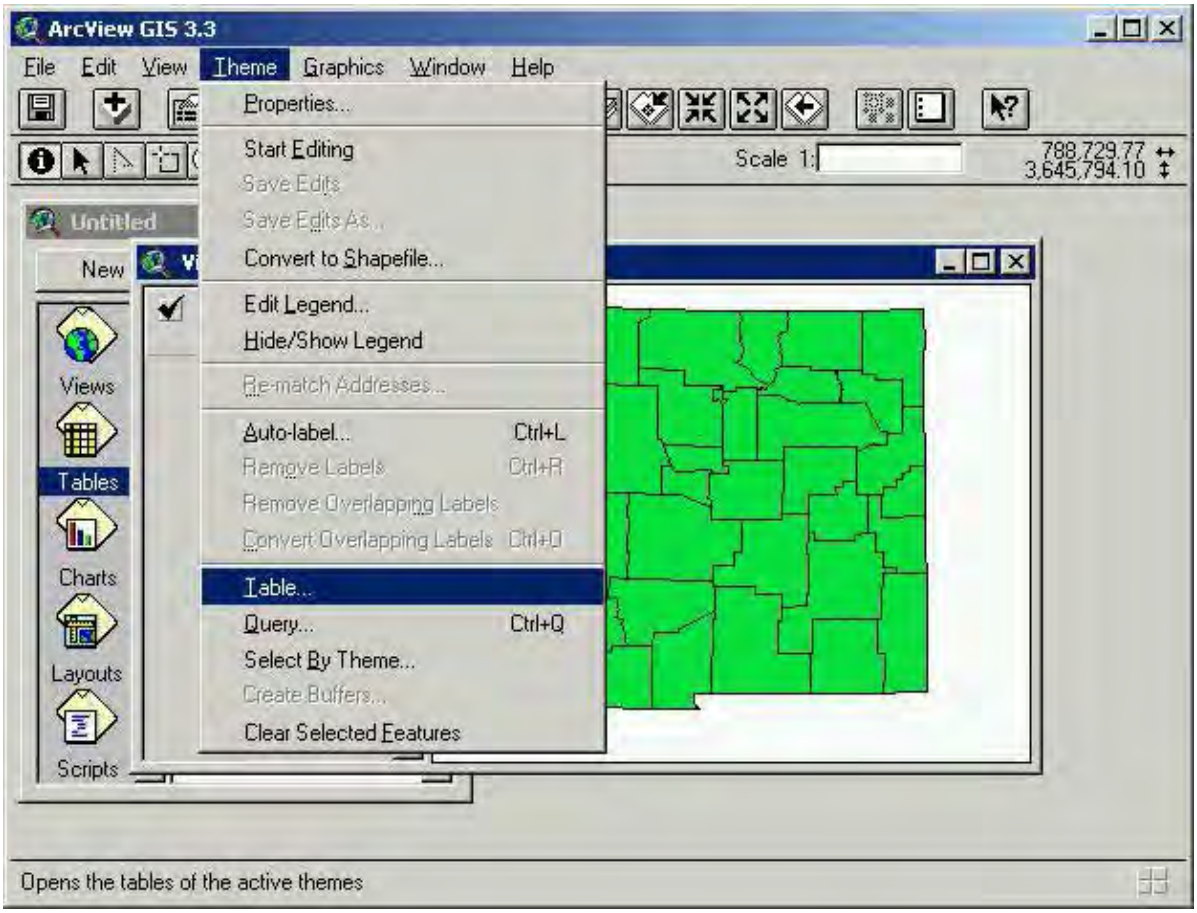
Methodology:
1) Open ArcView

2) Add the shapefile you wish to attach your data too.

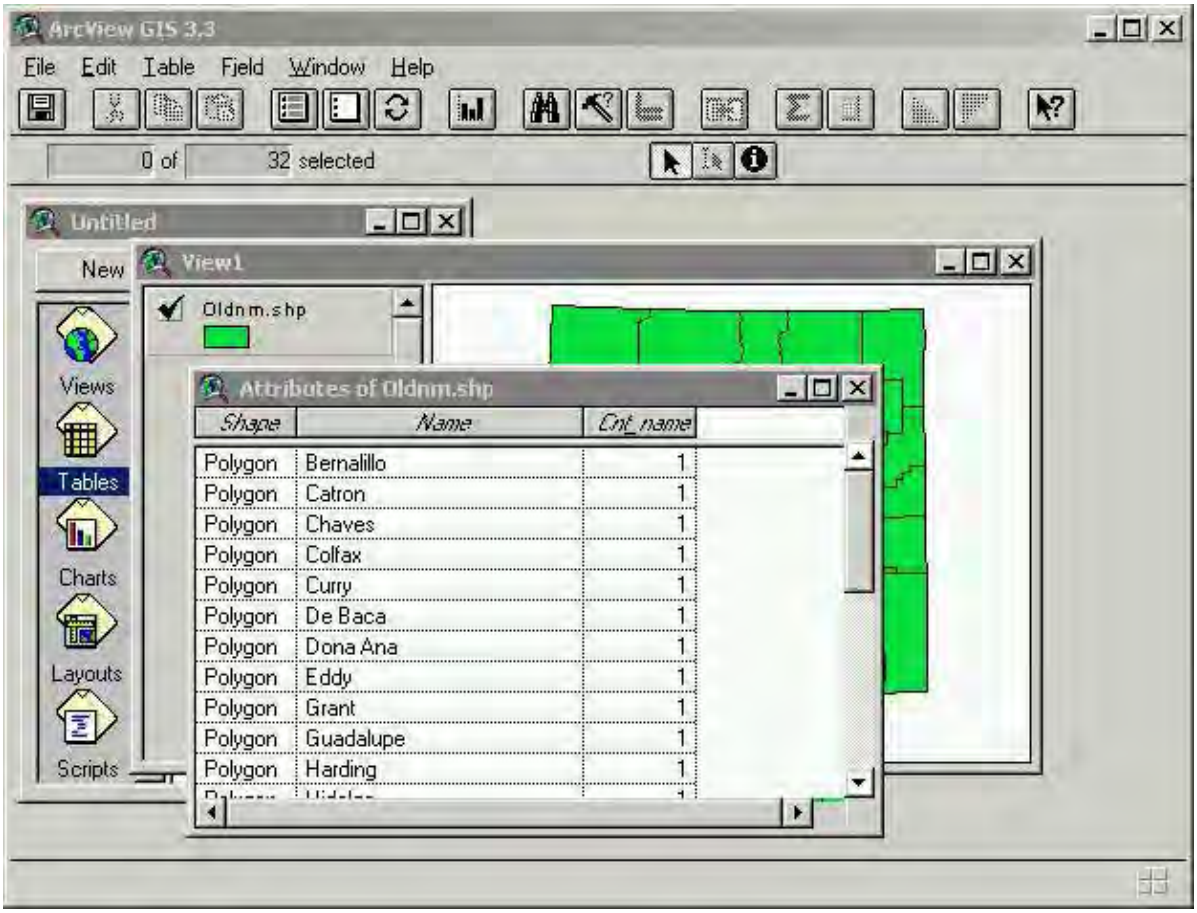


Your starting theme

3) Click on the shapefile in the table of contents, making it active, and then select **Theme ->Table** This will display the attribute information currently within the shapefile.



To get your shapefiles attribute table



Your shapefiles attribute table

There is usually only basic information. You will need to identify one of these attribute columns to match up your external data too. In this scenerio, we will be joining to counties.

3) Navigate to and open your external data source. Open to the data you would like to add or join to the shapefile open in ArcView. Your external data will need to be in the correct form to bring it into ArcView, either (txt or .dbf) If you are working in excel see the recipe *Importing an Excel table to your GIS project (3.x)* This recipe may work for other platforms as well.

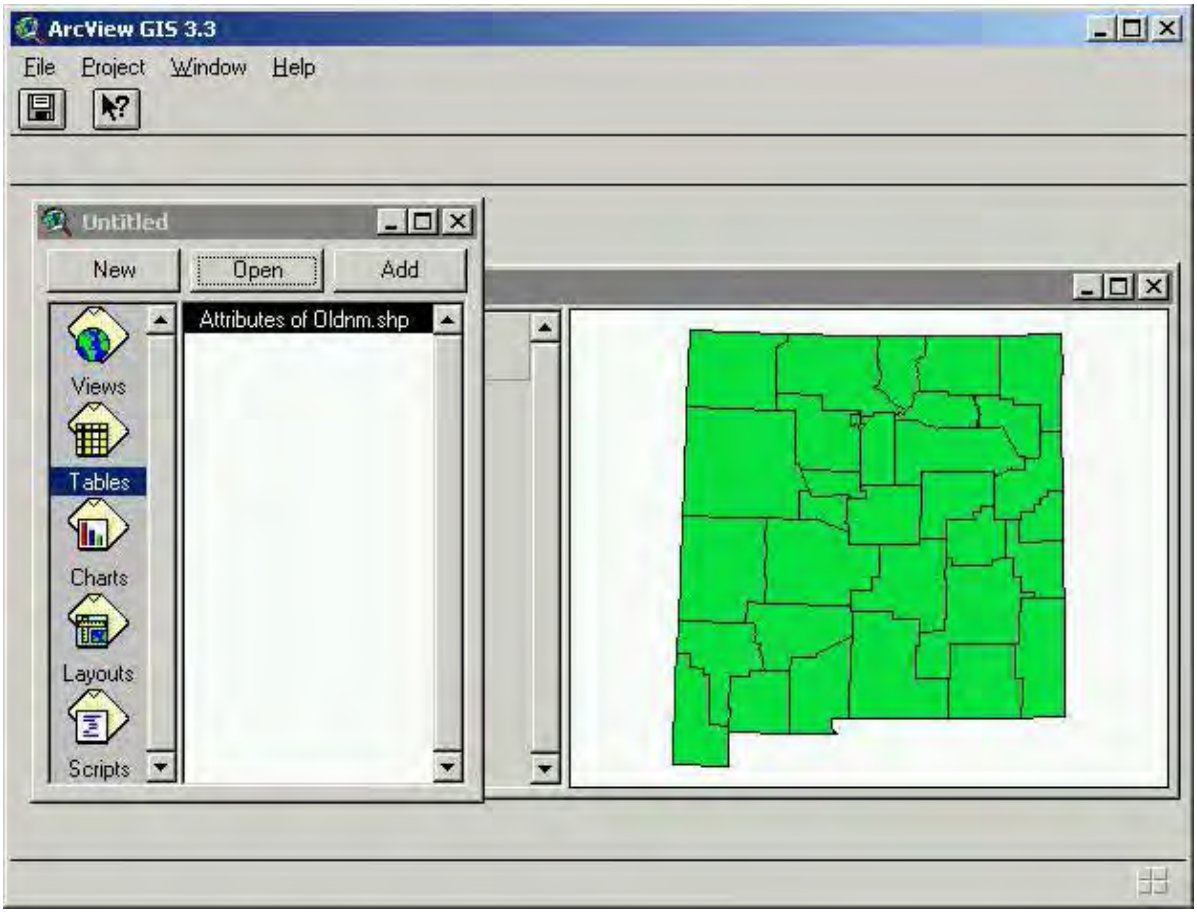
4) In your external data, Make sure that there is a one to one match so that each data entry matches with one shapefile attrubute. This will allow you to join the two together. This may require you to do some editing of your external data source. You may have to combine or expand your data to fit the one to one relationship.

(For Example, if you wanted to join your external data to counties , but your external data was organized in census tracts or cities with county information within them, you would need to combine the information within the datasource so that there was only one county entry. You would add up all the cities or cesus tracts to make one county entry.)

5) When you are finished editing your data there should be the same number of data entries in your external data as there are in row attributes (polygons, or ID numbers) in your shapefile attribute table. Make sure you SAVE and CLOSE the external Data file you have been working on.

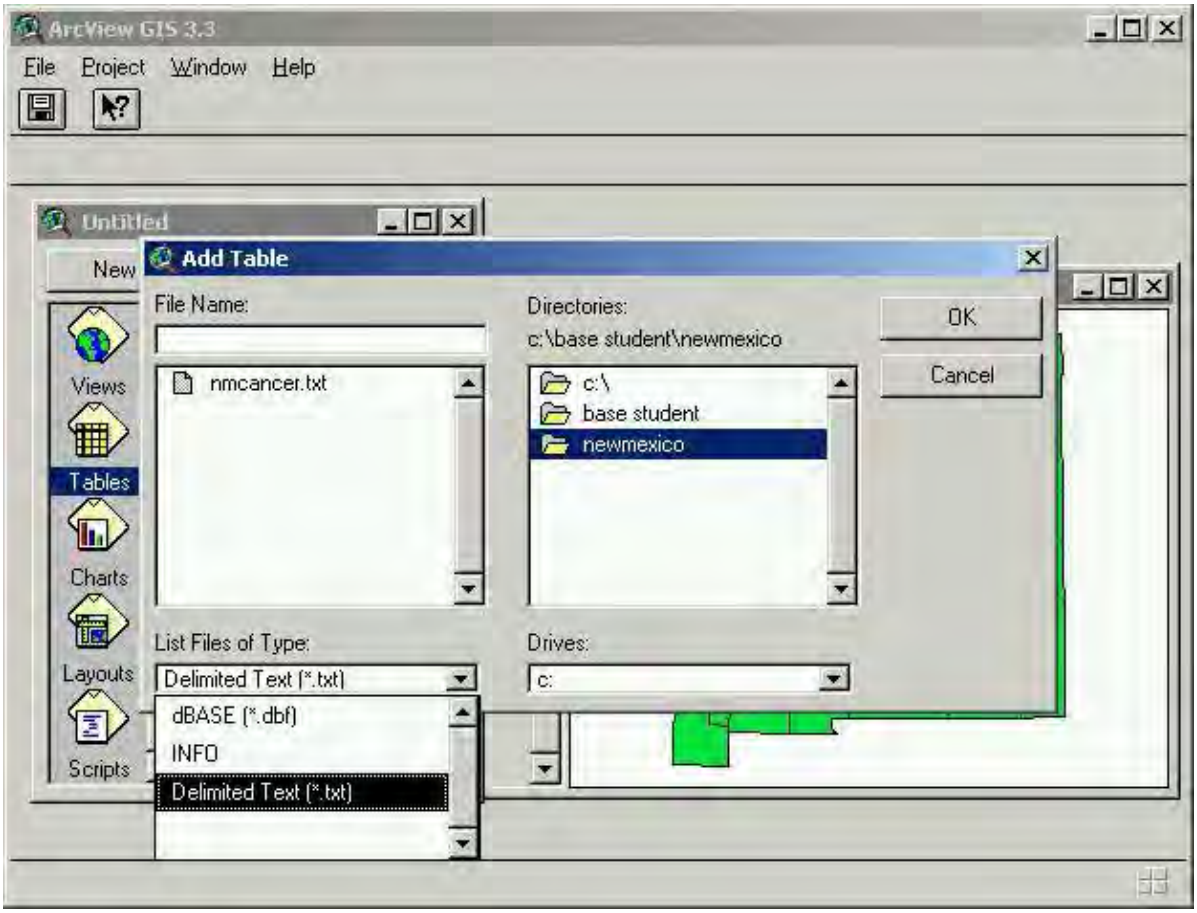
6) Now we will bring your external data into ArcView.

7) Go to the project manager window. Then click on the table icon, and in the upper right corner, click **Add**



The Project Manager window

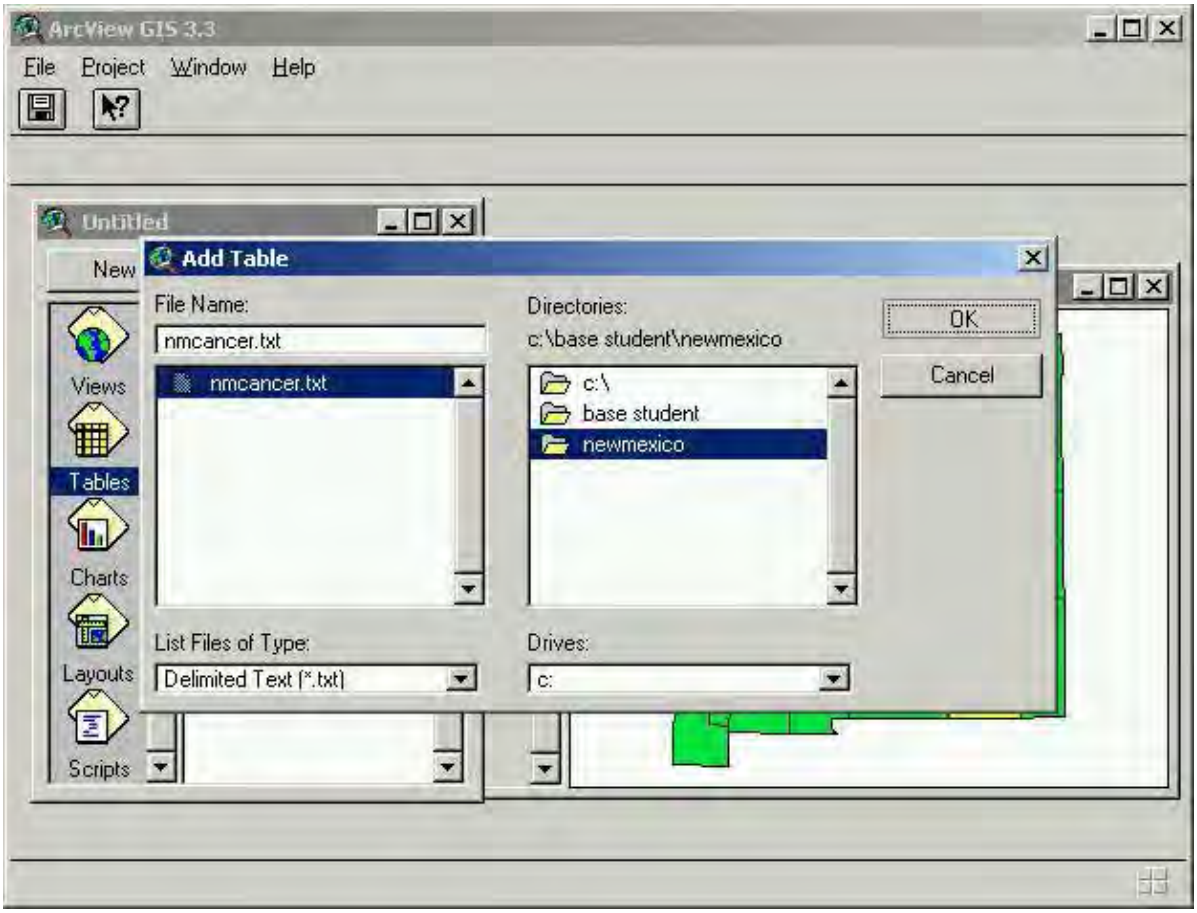
8) The *Add Table* window will appear.



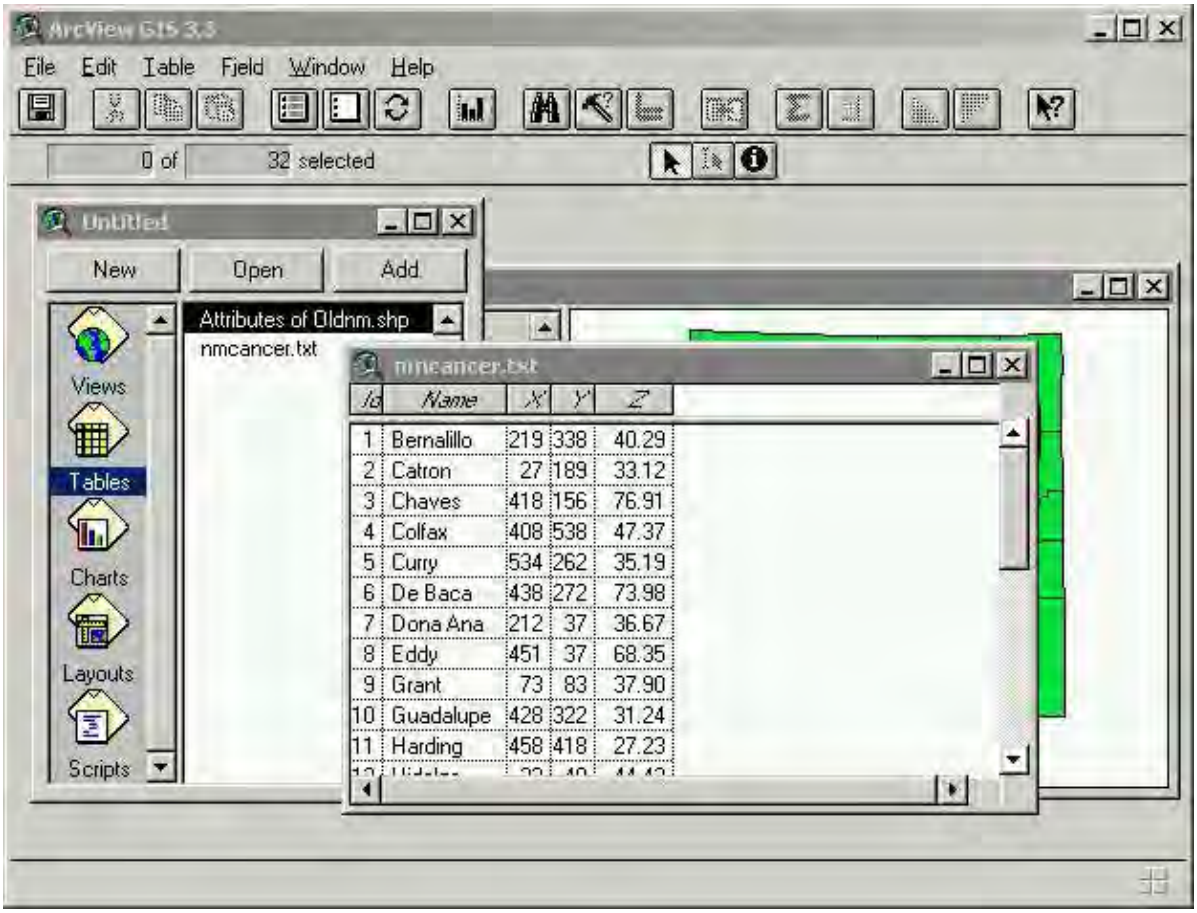
Load your external Data

Navigate to the directory with your external data in it. Make sure that on the lower left of the *Add Table* window, that the *List of File Type* matches the type of your external data, either .dbf, .txt, or INFO. When you have selected your external data on the right side of the window, click **Ok**

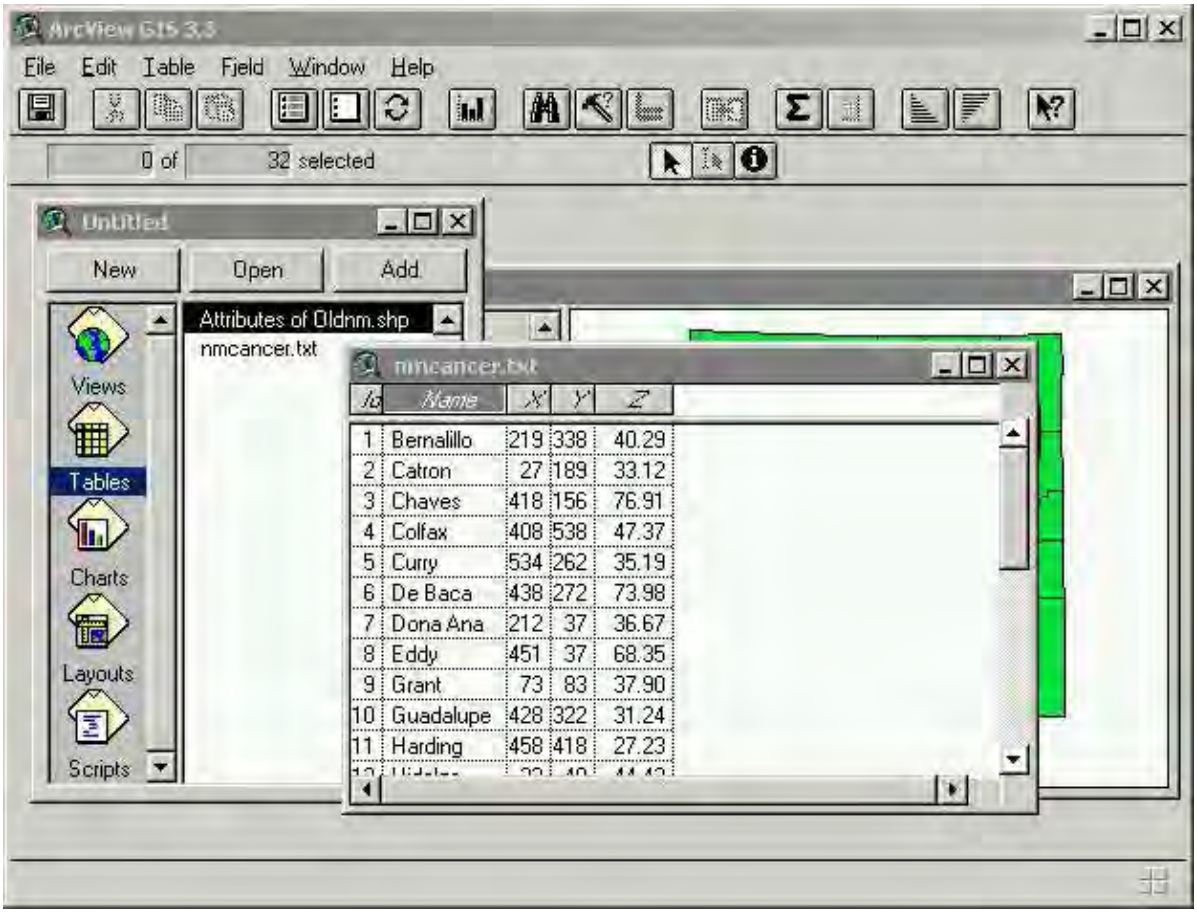
If your error message says that the file is busy or already in use See Pitfall 1



9) Your external data will appear in a table window in ArcView. Click on the column attribute that you plan to join with your shapefile attribute.

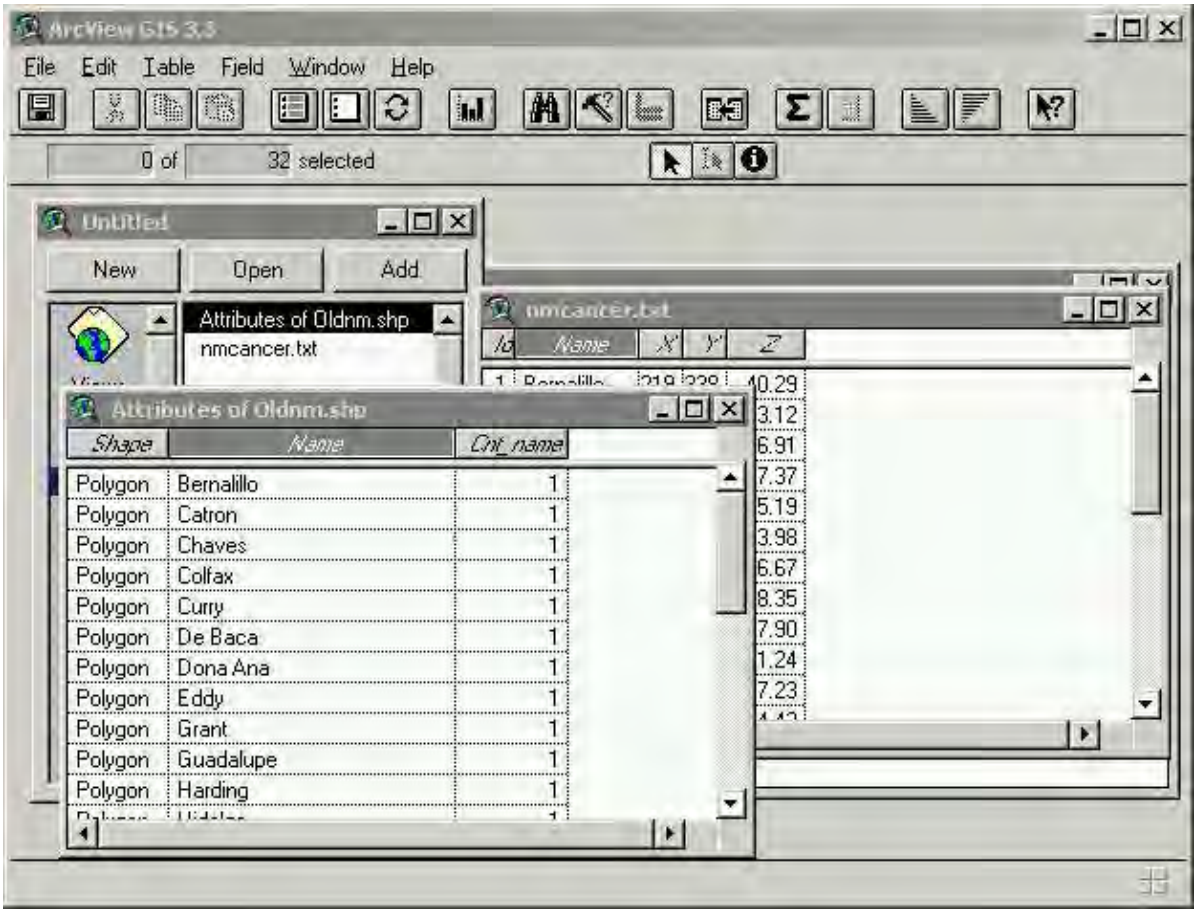


Your external data



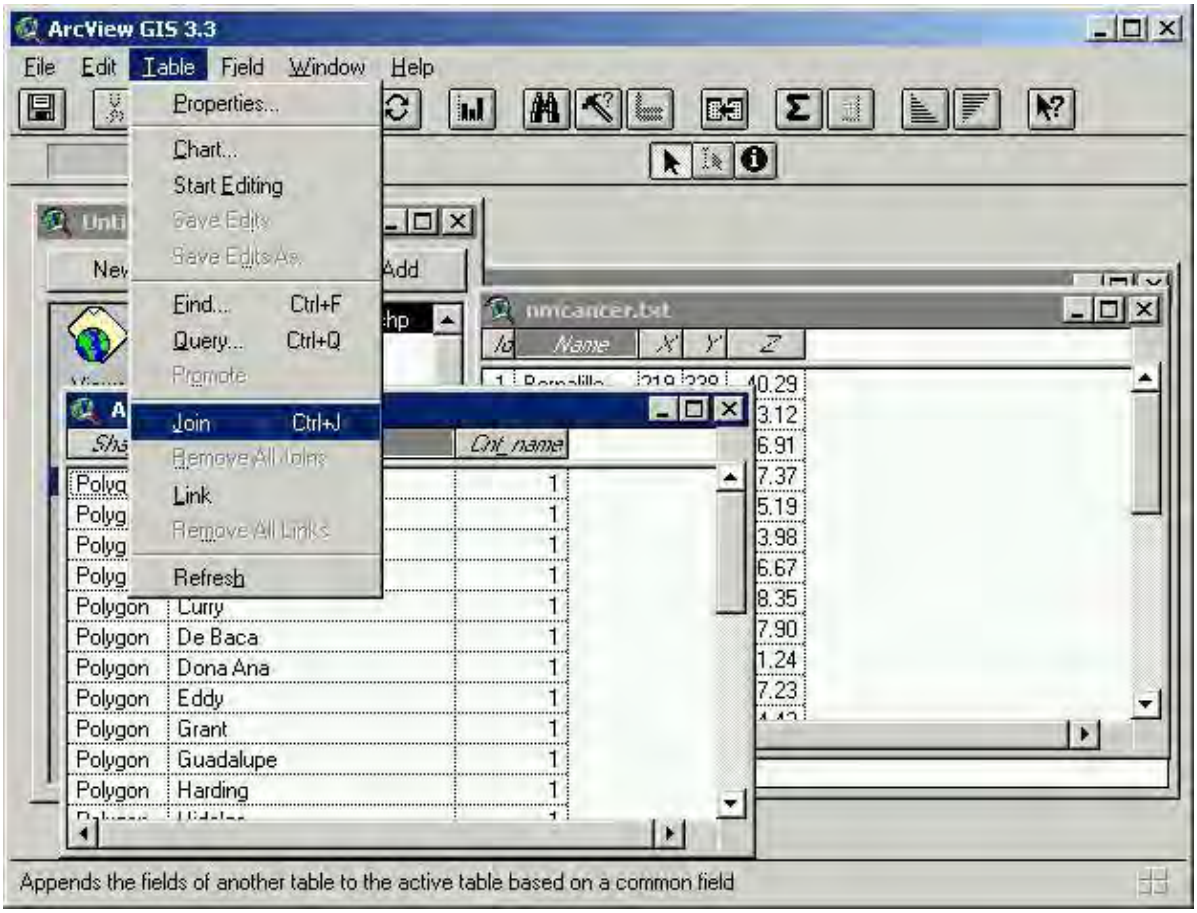
Select the attribute you will use to join the two

10) Now open the attribute table for the shapefile you are joining too and click on the matching column attribute (the one field in two have in common)



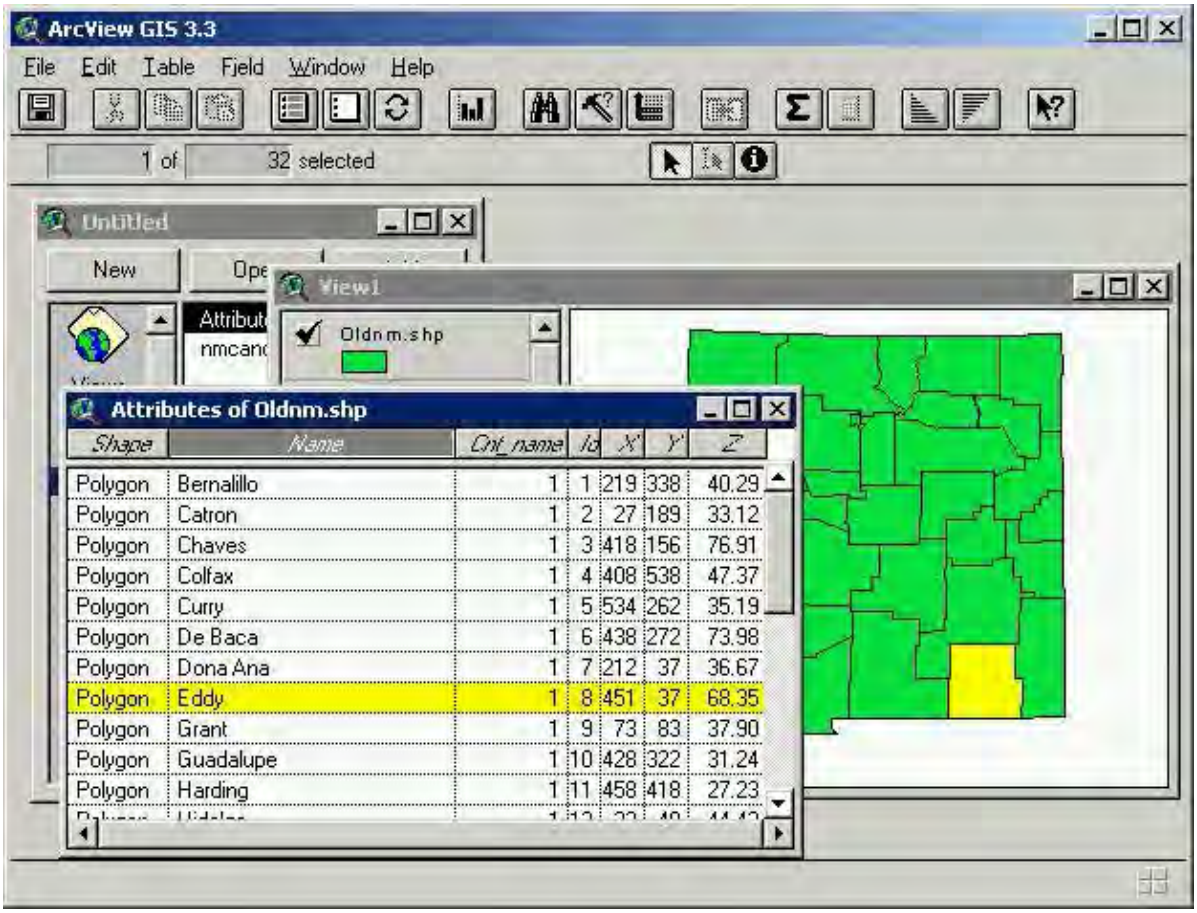
Select the matching attribute to join

11) With both column headings selected select **Table -> Join**



Join the two

12) Your external data table will disappear. It is now joined to your shapefile. Now in the attribute table of your shapefile you can scroll right and see your external table embedded within it. If you don't see it See Pitfall 2or See Pitfall 3.



Shape	Name	Ori_name	Id	X	Y	Z
Polygon	Bernalillo	1	1	219	338	40.29
Polygon	Catron	1	2	27	189	33.12
Polygon	Chaves	1	3	418	156	76.91
Polygon	Colfax	1	4	408	538	47.37
Polygon	Curry	1	5	534	262	35.19
Polygon	De Baca	1	6	438	272	73.98
Polygon	Dona Ana	1	7	212	37	36.67
Polygon	Eddy	1	8	451	37	68.35
Polygon	Grant	1	9	73	83	37.90
Polygon	Guadalupe	1	10	428	322	31.24
Polygon	Harding	1	11	458	418	27.23

Your final joined data, ready for analysis and so much more

13) It is now spatially referenced and can be used for spatial analysis. For example, See Recipe *Making a choropleth map (3.x)*

Pitfalls:

- This means that you have left the external data file you are trying to import open in another window. Makes sure the file you are importing and preferably its host program are closed before you import the data. Link
- There are many possibilities for error when joining two features. The synatx of the two columns you are joining have to be exactly the same
- If the join is successful, but there are some blank rows in the join, there maybe some errors in your external data source, you need to go back through your external data source and compare it to the attribute table of the shapefile until they match up exactly

Authored by: Benjamin N. Sprague **Modified:** 9/11/03

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GIS Cookbook: Recipe - Joining a table

Keywords: Tables, joining, relates, sorting, data analysis
Category: Data Analysis
Software: ArcGIS 8/9.x

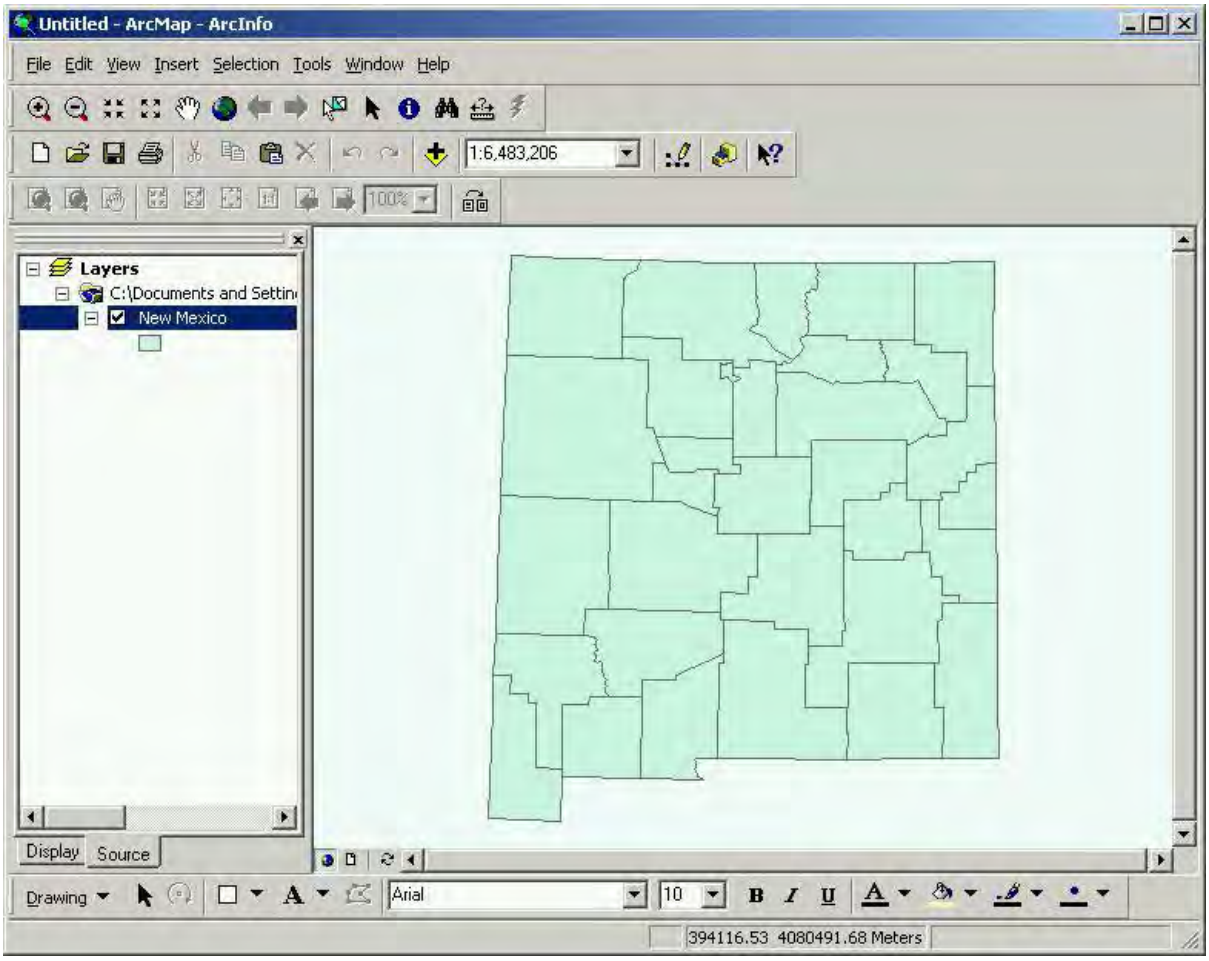
Problem: I have information in a table that I would like to join to a point, polygon or line layer.

Description: Often times, the information you want to display or analyze within GIS is in two different places or formats. Often you will have a map of a standard area, like the counties in a state or the states of a country, and you will want to add external data to them so you can look at that external data in a spatial context. In this recipe we will look at how to join data to a shapefile.

Scenario:
Ever since the work of John Snow and his mapping of Cholera cases, mapping cases and frequencies of diseases can help to find sources and cures. One of the major research topics of the 20th century is the search for an understanding of cancer. It helps researchers in the subject to know where the cases of cancer are the highest. In this scenario, we are going to look at the state of New Mexico and join the cancer statistics for each county to the counties within the state.

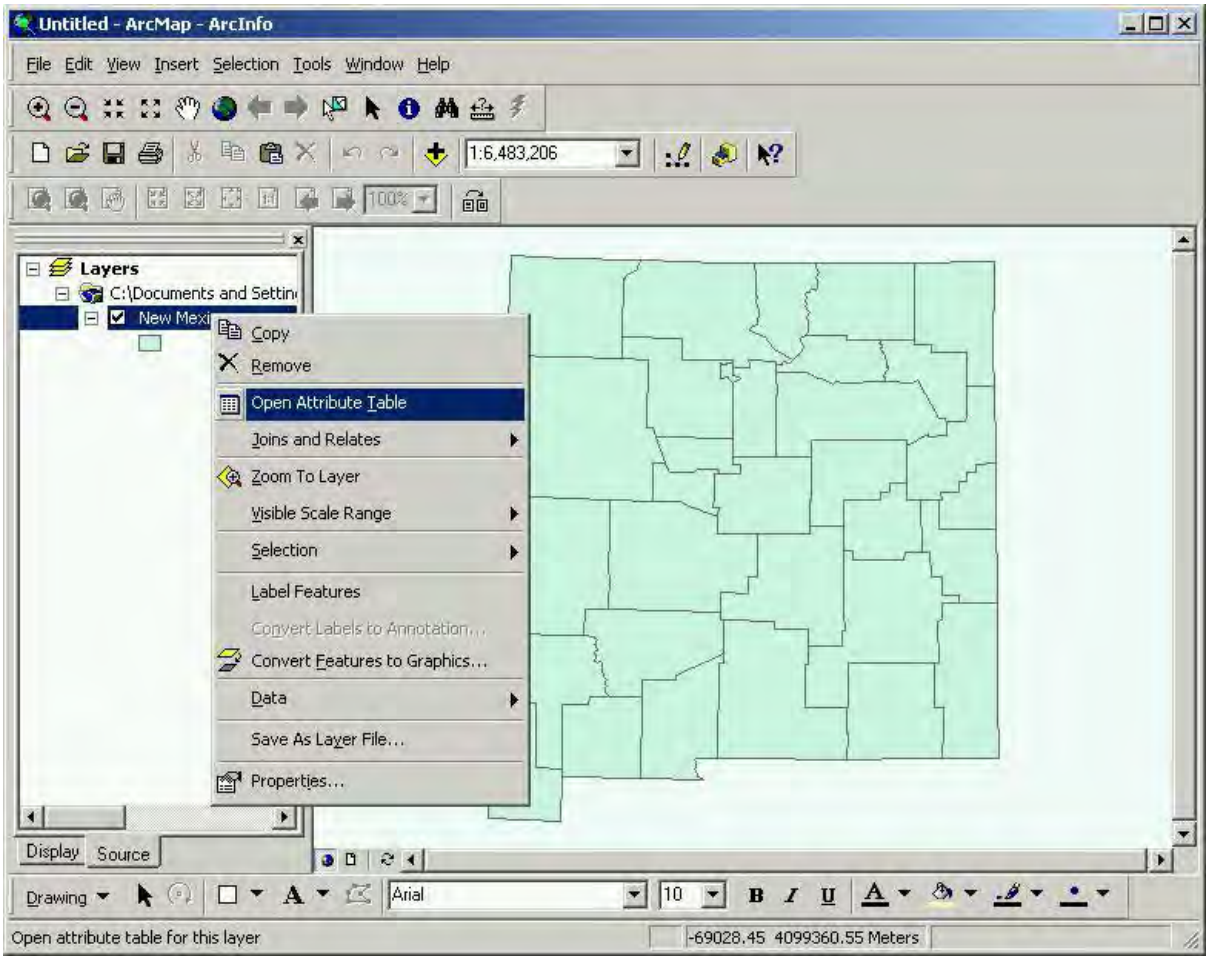
Methodology:
1) Open ArcMap.

2) Add the shapefile you wish to attach your data to.

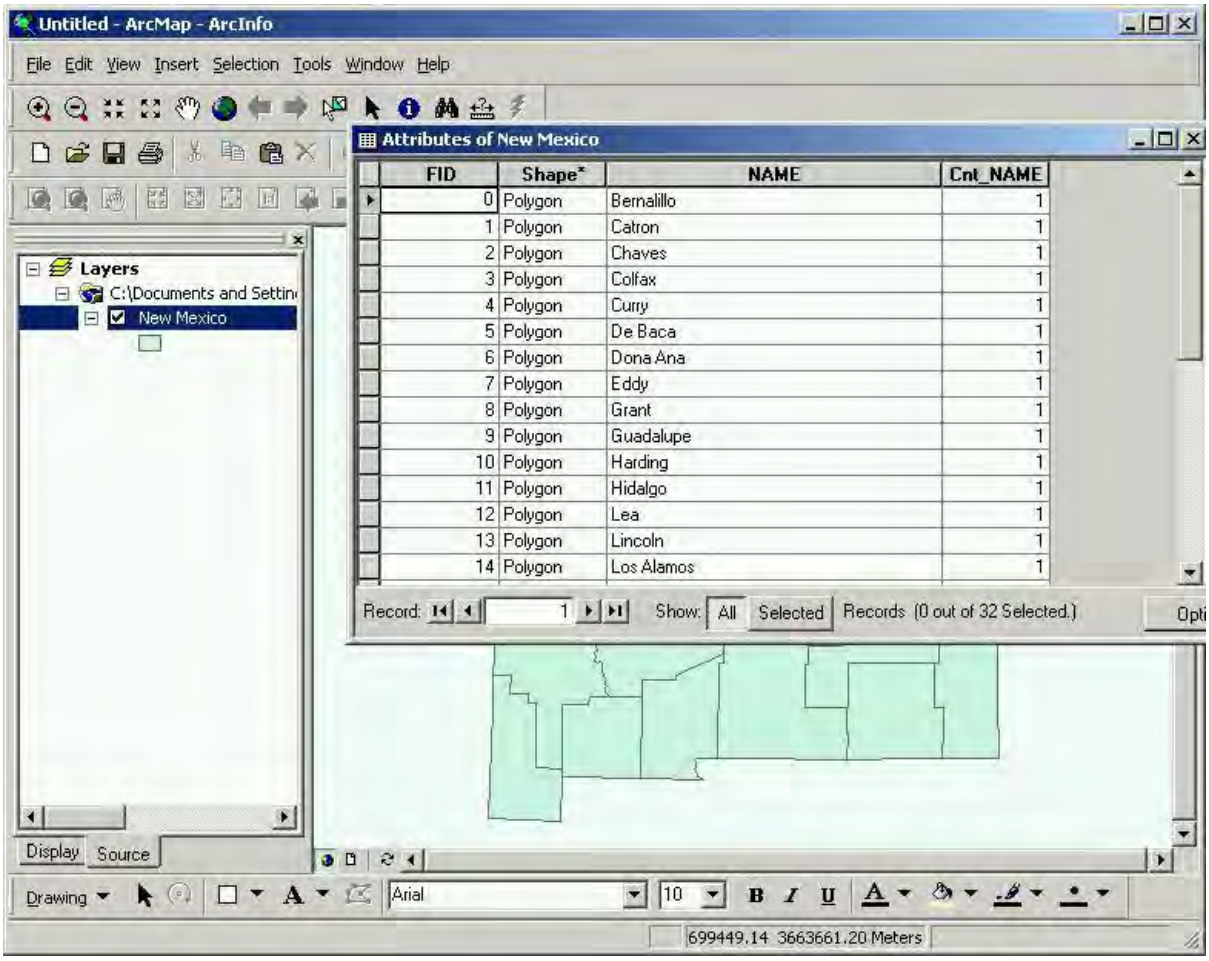


The Shapefile you are going to work with

3) Right-click on the shapefile and select **Open Attribute Table** This will display the tabular information currently within the shapefile.



Opening the attribute table of the shapefile we are working with



The New Mexico layer's attribute table

You will need to identify one of these attribute columns to match up your external data too. In this scenario, we will be joining based on the NAME field.

4) Ensure that your external data is in a form that is compatible with ArcMap, either delimited text or .dbf. If you are working in Excel see the recipe *Importing an Excel table to your GIS project (ArcGIS 8.x/9.x)*.

Also, make sure that there is a one-to-one match between the records in the external data source and the shapefile attribute table. This will allow you to join the two tables together. This may require you to do some editing of your external data source. You may have to combine or expand your data to fit the one-to-one relationship.

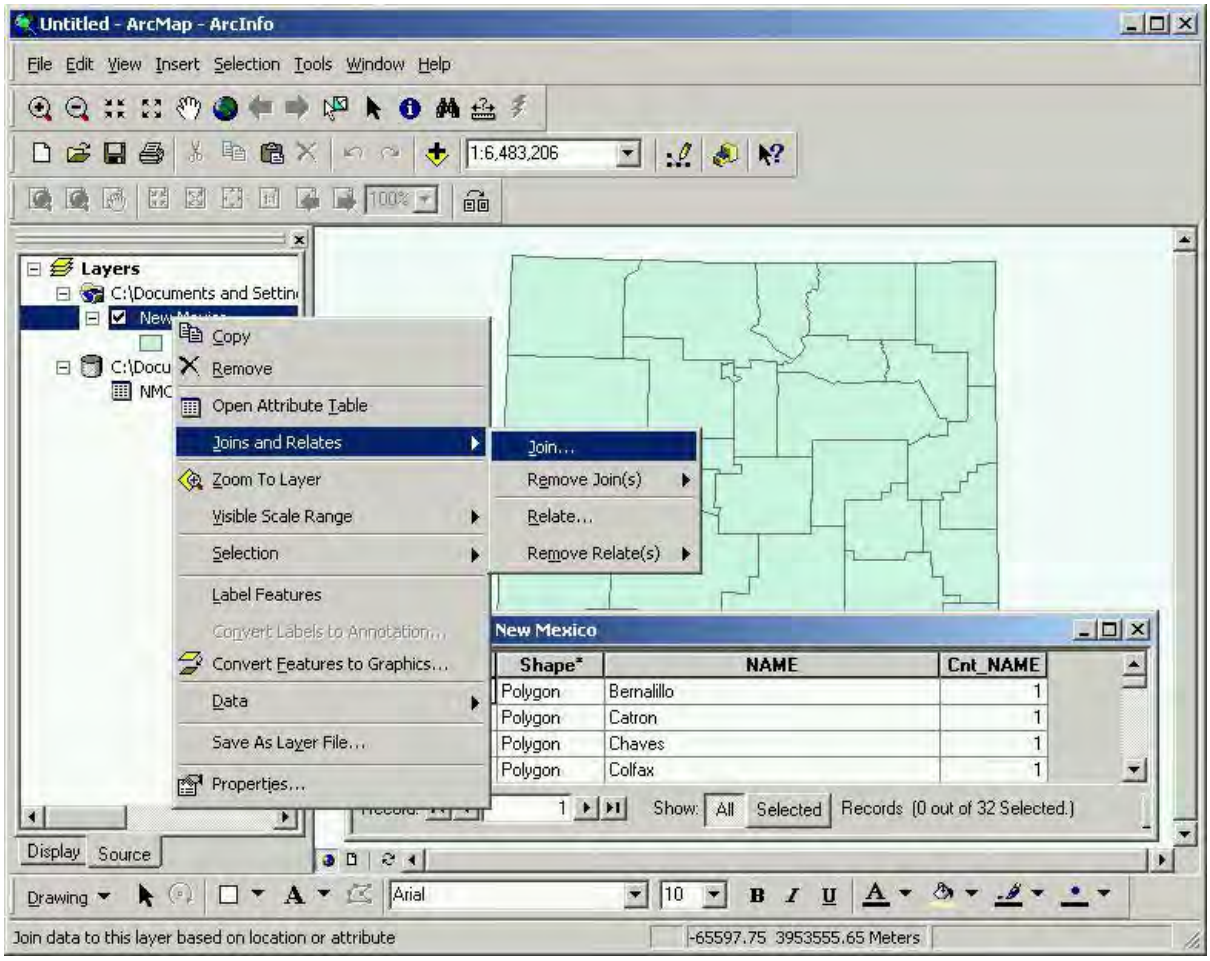
(For example, if you wanted to join your external data to counties, but your external data was organized in census tracts or cities with county information within them, you would need to combine the information within the data source so that there was only one county entry. You would add up all the cities or census tracts to make one county entry.)

When you are finished editing your data there should be the same number of data entries in your external data as there are in your shapefile attribute table. Make sure you SAVE and CLOSE the external data file you have been working on.

5) In ArcMap, go to the **Add Data** button. Navigate to your external dataset in either .txt or .dbf form. Select it and click **Add**

6) Your external data set will appear in the Table of Contents beneath your shapefile. **Note:** You can view external data tables like this one by clicking on the Source tab at the bottom of the Table of Contents. The Display tab shows only the map layers in the map document.

7) Right-click on your shapefile within the Table of Contents and select **Joins and Relates -> Join** . **Note:** This step is always performed on the layer you want to join data TO.



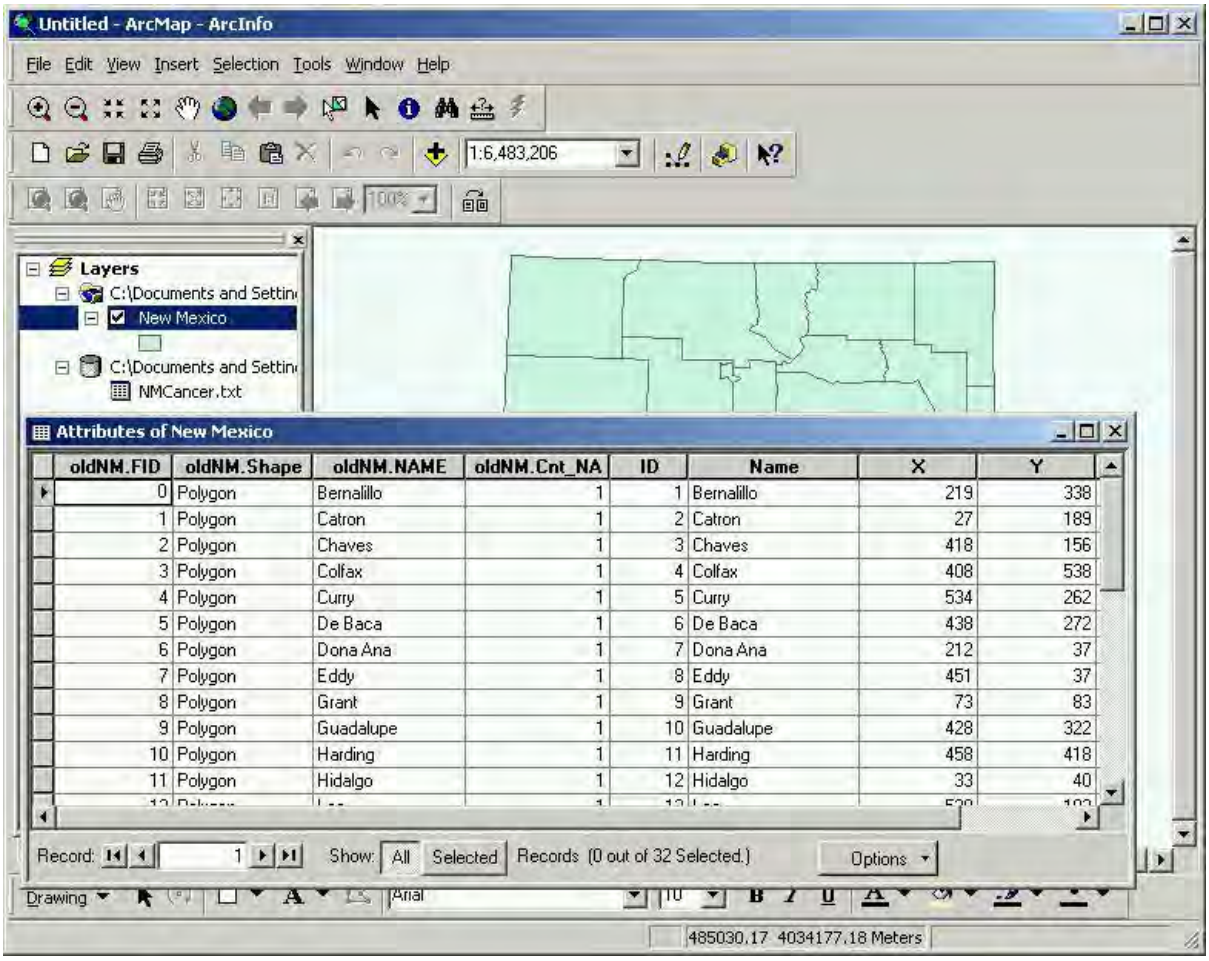
Joining

8) The **Join Data** window will appear. In Step 1, choose the name of the field in the shapefile you will use to join the data. In Step 2, select your external data source. In Step 3, select the name of the field in your external data source that you are going to join by. Then click **OK** .

The Join Data Window

If your error message says that the file is busy or already in use, See Pitfall 1

9) Right-click on the shapefile in the Table of Contents and select **Open Attribute Table**. Scroll to the right and confirm that the data from the external table have been appended onto the original data. If not, See Pitfall 2.



External Data is displayed in the attribute table of your original shapefile

10) Your external information is now spatially referenced and can be used for spatial analysis. For example, See Recipe *Making a choropleth map (8.x)*

Pitfalls:

- This means that you have left the external data file you are trying to import open in another application. Make sure the file you are importing and preferably its host program is closed before you import the data.
- If the tables joined successfully, but there are empty cells where you expect valid values, it means the value in the join field for that record did not have a match in the external data. You should double-check to make sure you've selected the correct fields to perform the join.
-

Authored by: Benjamin N. Sprague **Modified:** 2/4/05

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GIS Cookbook: Recipe - Classifying Data

Keywords: Census tract, census data, classification, reclassification, nominal data, interval data, null value
Category: Census Data
Software: ArcView 3.2

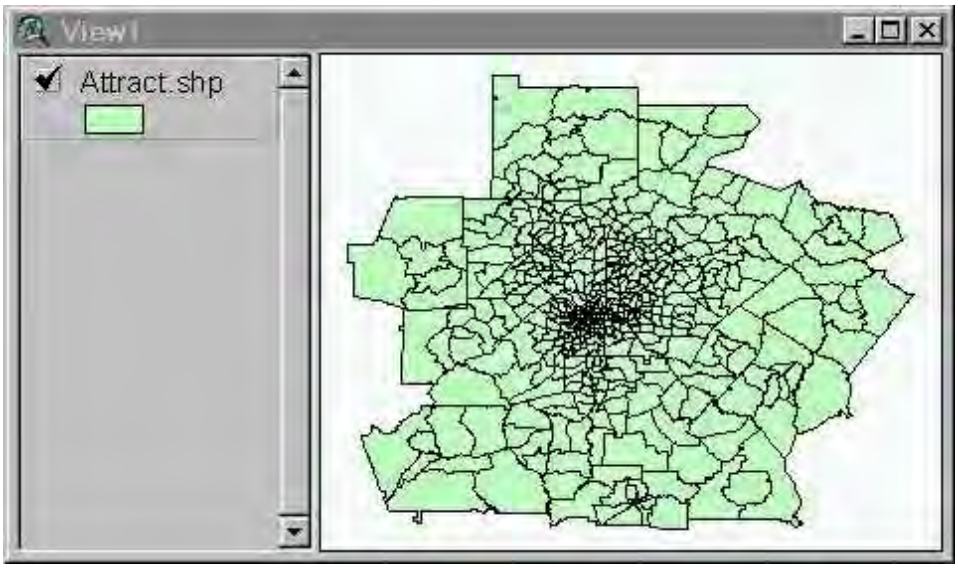
Problem: I have a shapefile of census tracts with attributes, how do I classify the data?

Description: When a shapefile is being displayed on your view, it is usually shown in a single color. This is because the information has not been classified into categories. When information has been classified by a given variable, the shapefile will display different colors representing different values for that variable in its attribute table. For example, if a census tract were to be displayed according to age, it may result in an image where red would stand for a tract with an average age above 60, orange for the 50 to 60 range, yellow for 40 to 49, and so on. When classifying data, you can choose the ranges in which your data will be divided. You are also able to select the colors that will be associated with each range, although it is important to keep your color scheme intuitive and easy to follow.

Scenario:
In this recipe, you will learn how to classify and display census tracts according to average age within each tract.

Methodology:
1) Create a new view and add your census tract shapefile to your view by using the **Add Data** button

.



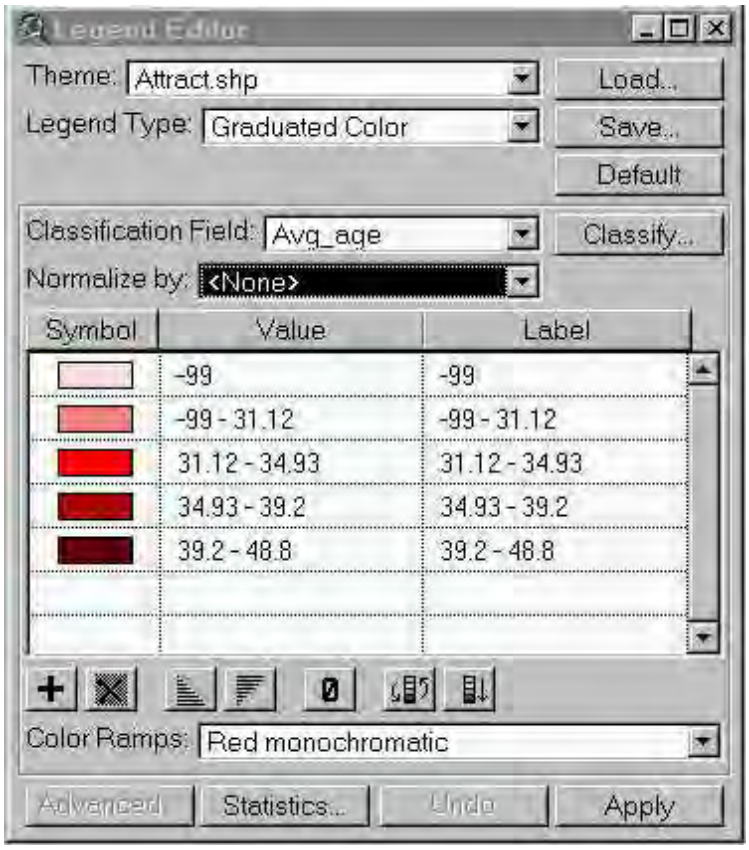
2) Make the census tract theme active by clicking on it in your view window. Now select the **Edit Legend**

button. A window similar to the following should pop-up on your screen.

3) In the space next to Theme should be the name of the census tract layer. For Legend Type we will choose "Graduated Color." If you were to choose "Unique Color" a different and unrelated color would be assigned to each category. "Unique color" should be used if you are classifying nominal data (i.e. data that does not have an inherent order to it that would require an ordered color scheme to accompany it). "Graduated Color" is being used here because we want to display the average age within each tract. Age is interval data, so we want a color scheme that shows this order.

4) For Classification Field, select the category you would like to display. In this example we are using *Avg_age*.

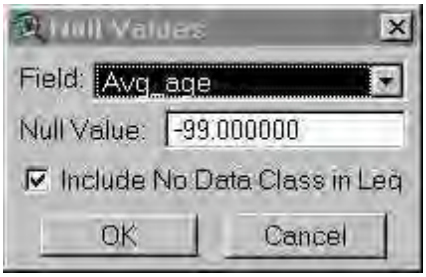
5) We do not need to normalize the data by any other category because we are only displaying one attribute, therefore leave it as *None*. Your Legend Editor should look similar to the following picture.



6) Notice in the above picture, instead of beginning with *0*, the first interval begins with *-99*. *-99* is the *null value* used in the database to stand for a missing value. These values should be excluded to avoid skewing the image's color scale. To exclude the null value, press the **null value** button

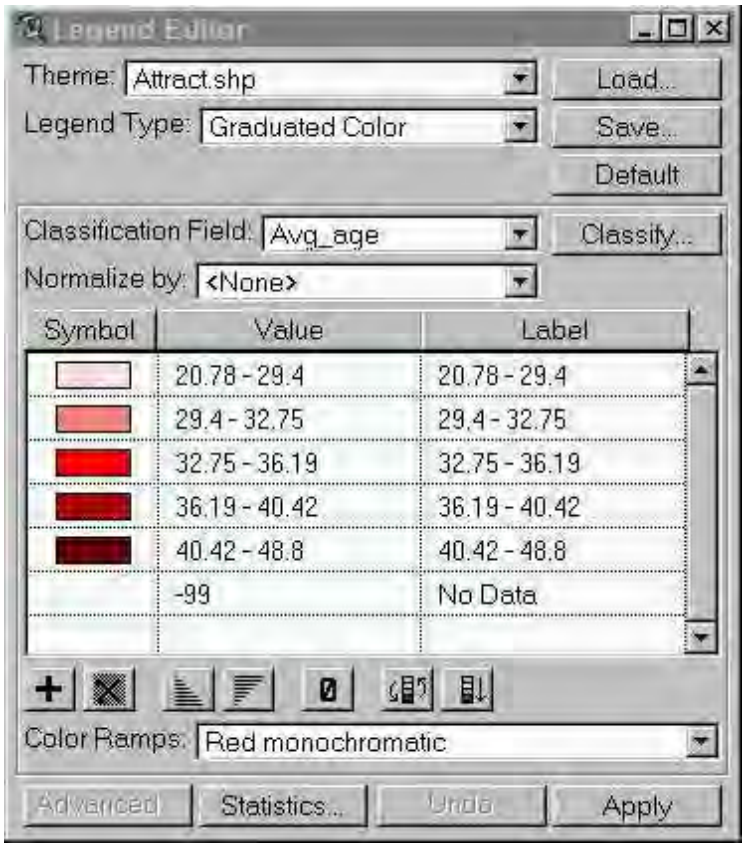
within the Legend Editor window.

7) Under Field choose the name of the category from which you would like to exclude the *null value*, then type in the value in the following space below.

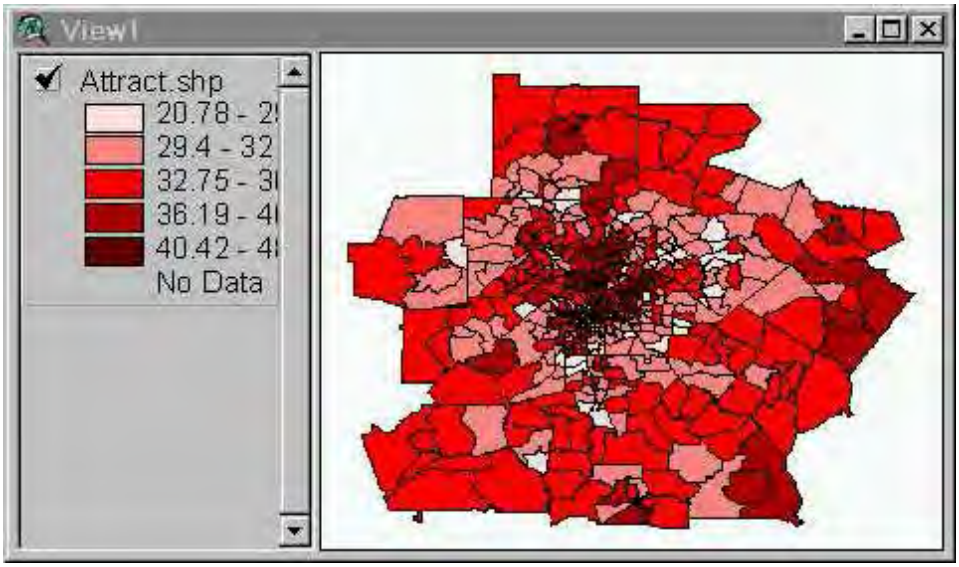


Note: if you choose the "Include No Data Class in Legend" box, it will display the null value on your legend and label it as "no data."

Select the **OK** button. Your legend editor should now exclude the null value from its first interval.



8) Select **Apply** at the bottom of the Legend Editor window. Notice if you do not like the color scheme or the way it displays in the view window, select **Undo** and make the necessary changes. To change the color scheme scroll down the **Color Ramps** option. Your View should now be classified.



Pitfalls:

- There should be no pitfalls, if any are found please contact us or refer to the links below

Links:

ESRI Canada (K-12) Tutorial - This is an ESRI tutorial page that talks about reclassifying census tracts within a geocoding tutorial. This recipe references this page.

Authored by: Sam Ying **Modified:** 9/10/03

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GIS Cookbook: Recipe - Making a Choropleth map

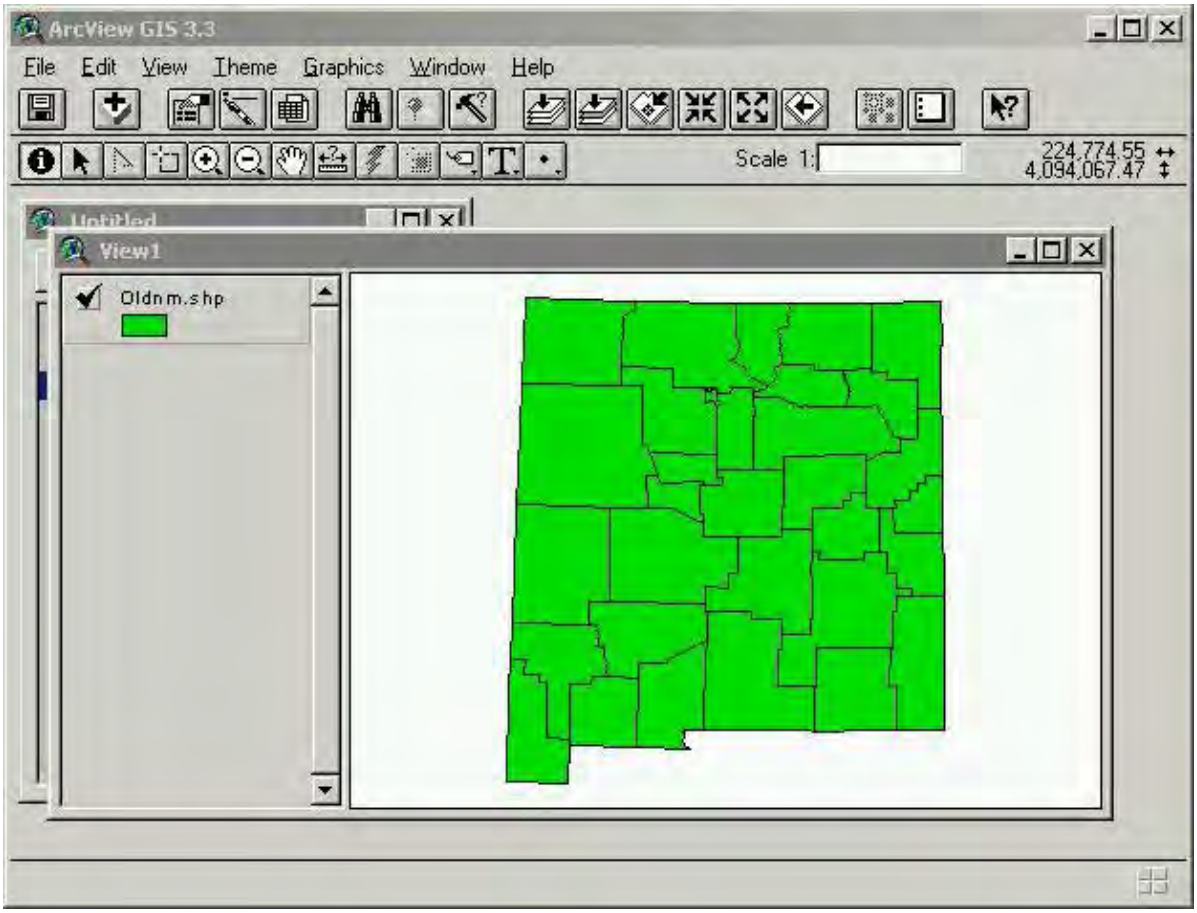
Keywords: Spatial analyisis, choropleth map, color symbology
Category: Data Analysis
Software: ArcView 3.2

Problem: How do I make a choropleth map, so I can see pattterns and analyze them.

Description: A choropleth map is a map that uses different colors to show different values over space. This is very helpful to look at different values displayed over space.

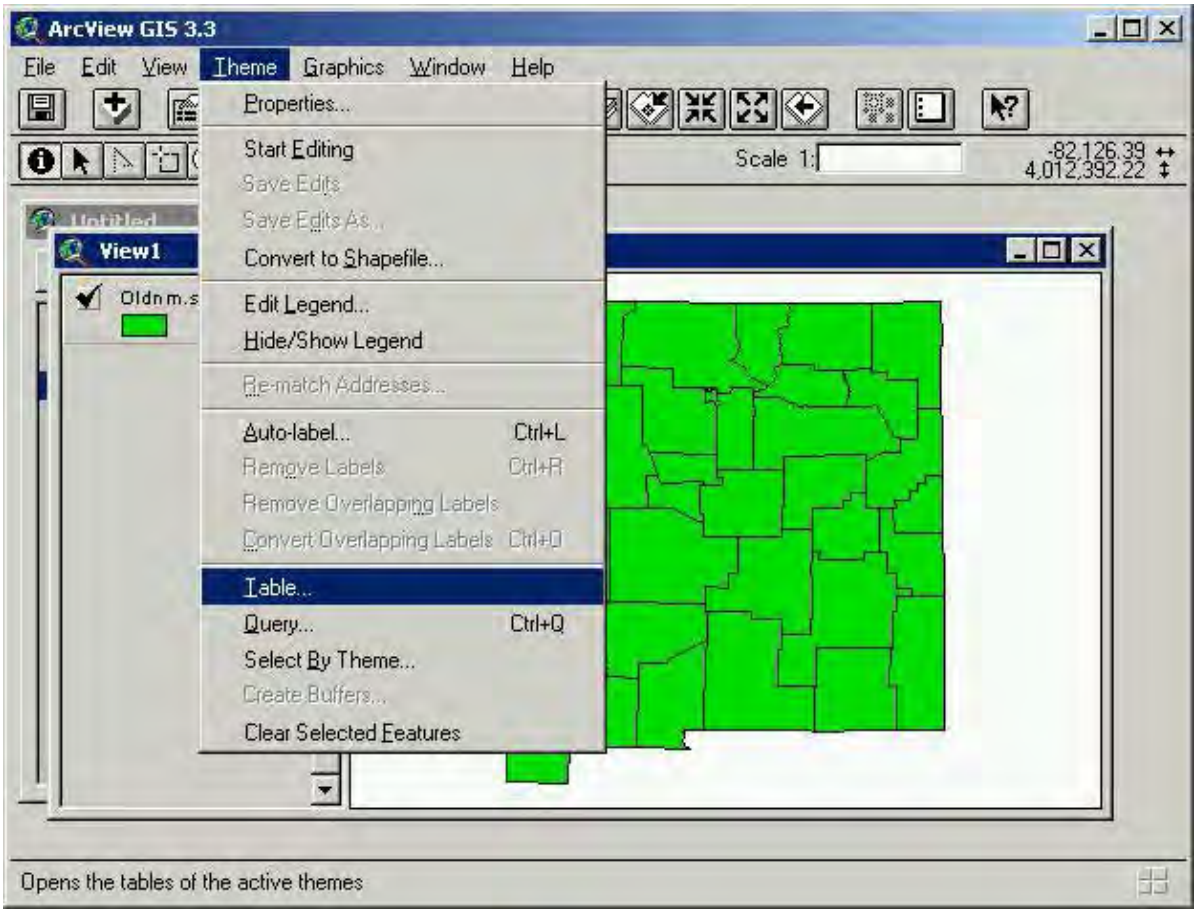
Scenario:
Ever since the work of John Snow and his mapping of Cholera cases, mapping cases and frequencies of diseases can help to find sources and cures. One of the major research topics of the 20th century is the search for an understanding of cancer. It helps researchers in the subject to know where the cases of cancer are the highest. In this scenerio, we are going to look at the state of New Mexico the cancer statistics for each county. Once finish we can look at and analyse the information and compare it to other choropleth maps.

Methodology:
1) Open ArcView and add the layer/shapefile you want to work with.

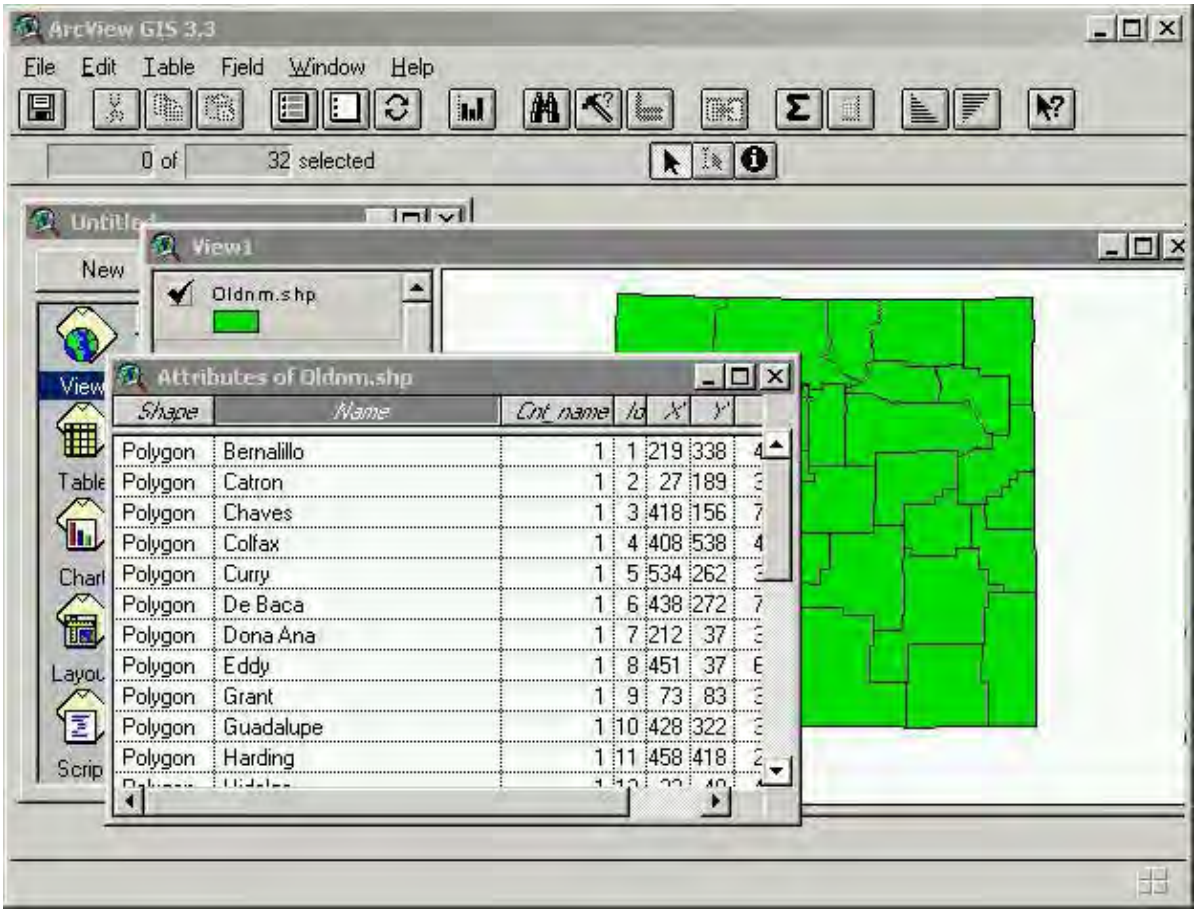


Your starting attribute

2) Click on the shapefile in the table of contents, making it active, and then select **Theme ->Table** This will display the . If it is not, and you need to add it from an external source, see the recipe *Joining a table (3.x)* Make sure to note the name of the column you are going to display.

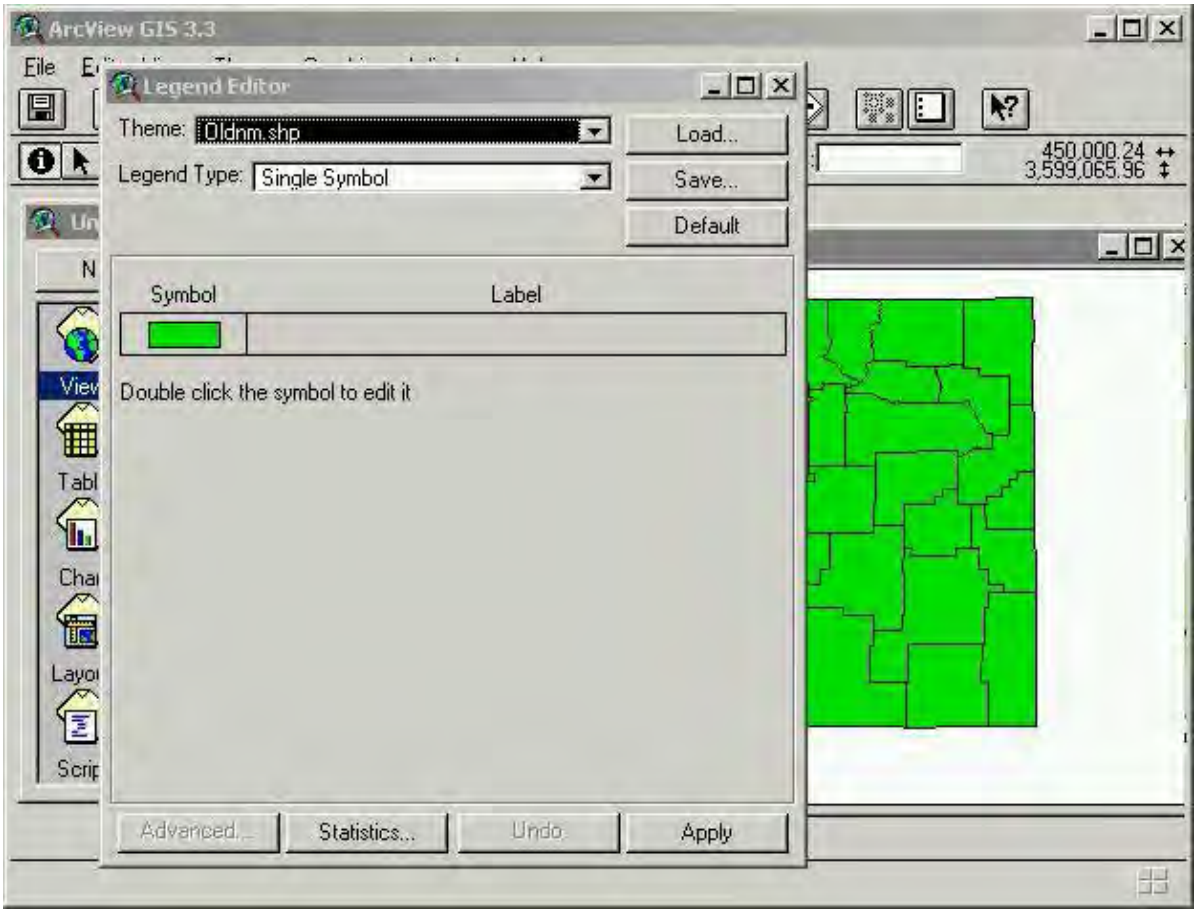


Open your attribute table



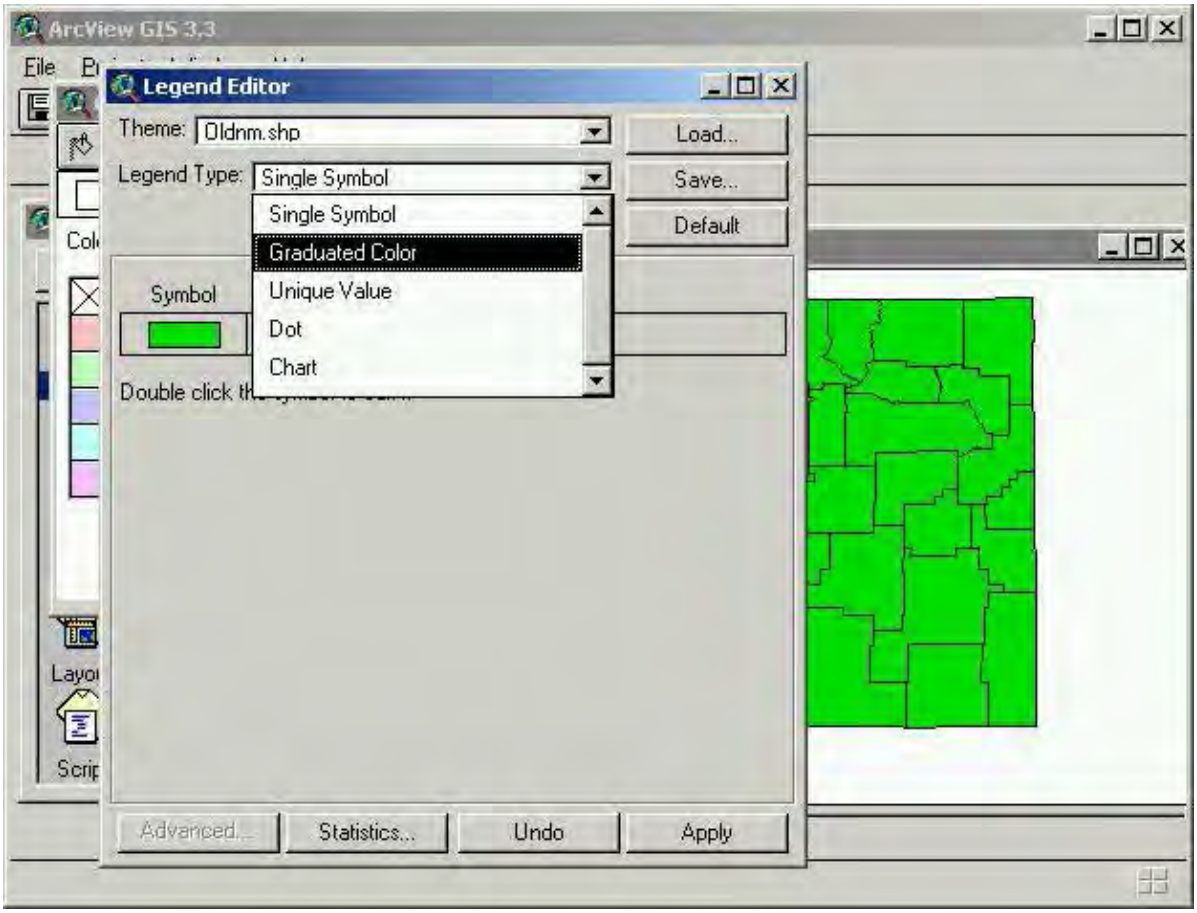
Your shapefiles attribute table

3) Double click on the shapefile in the table of contents and your will appear

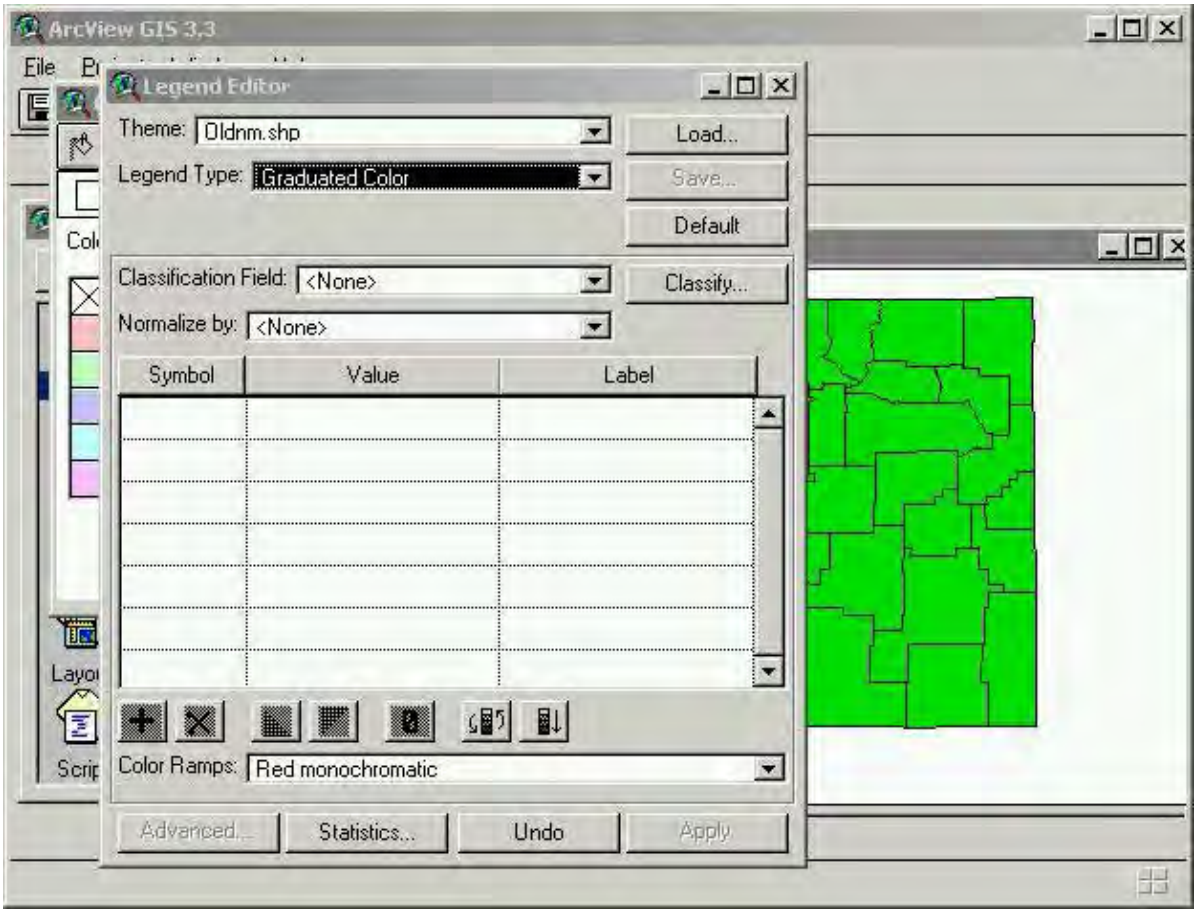


Double click on your theme/shapefile to bring up the Legend Editor

4) In the second dialogue box in your legend editor, change the *Legend Type:* from *Single Symbol* to

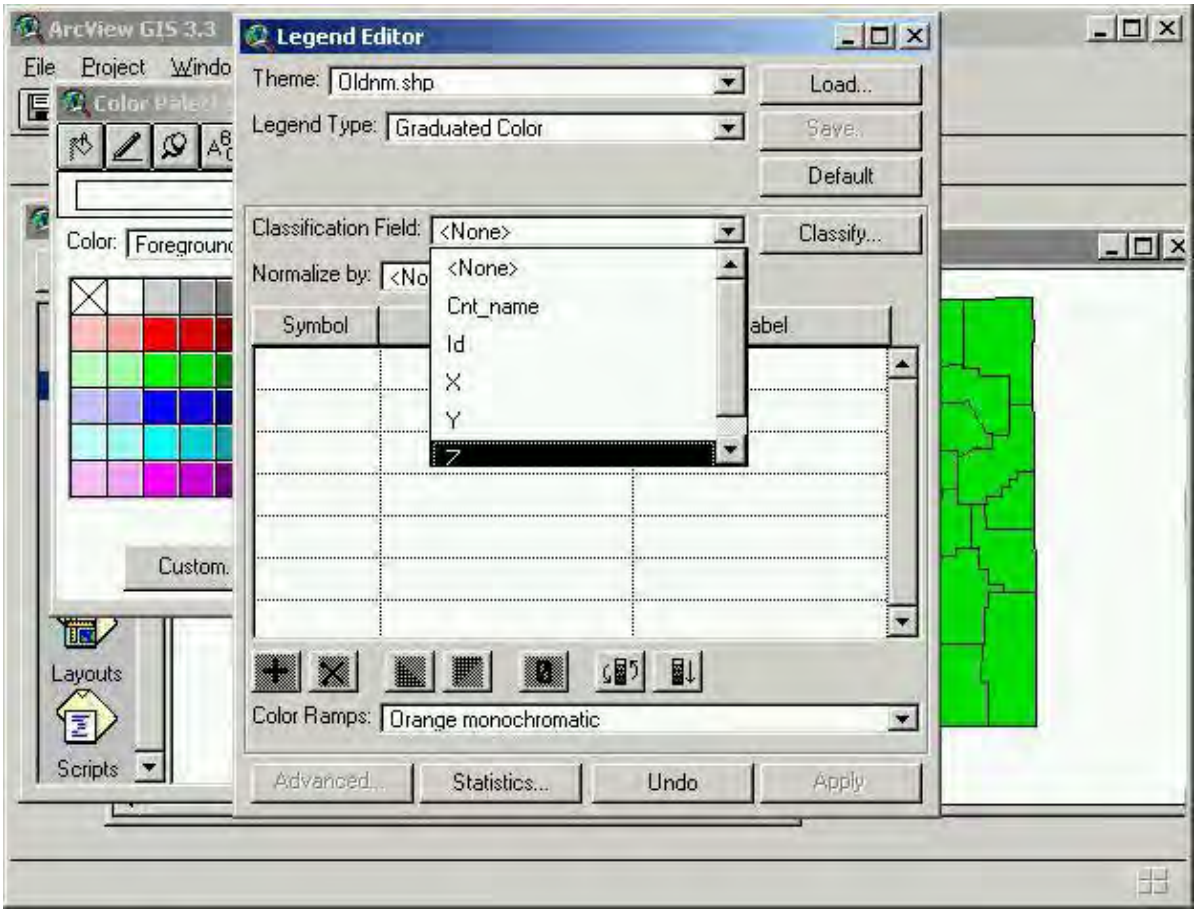


Select graduated color



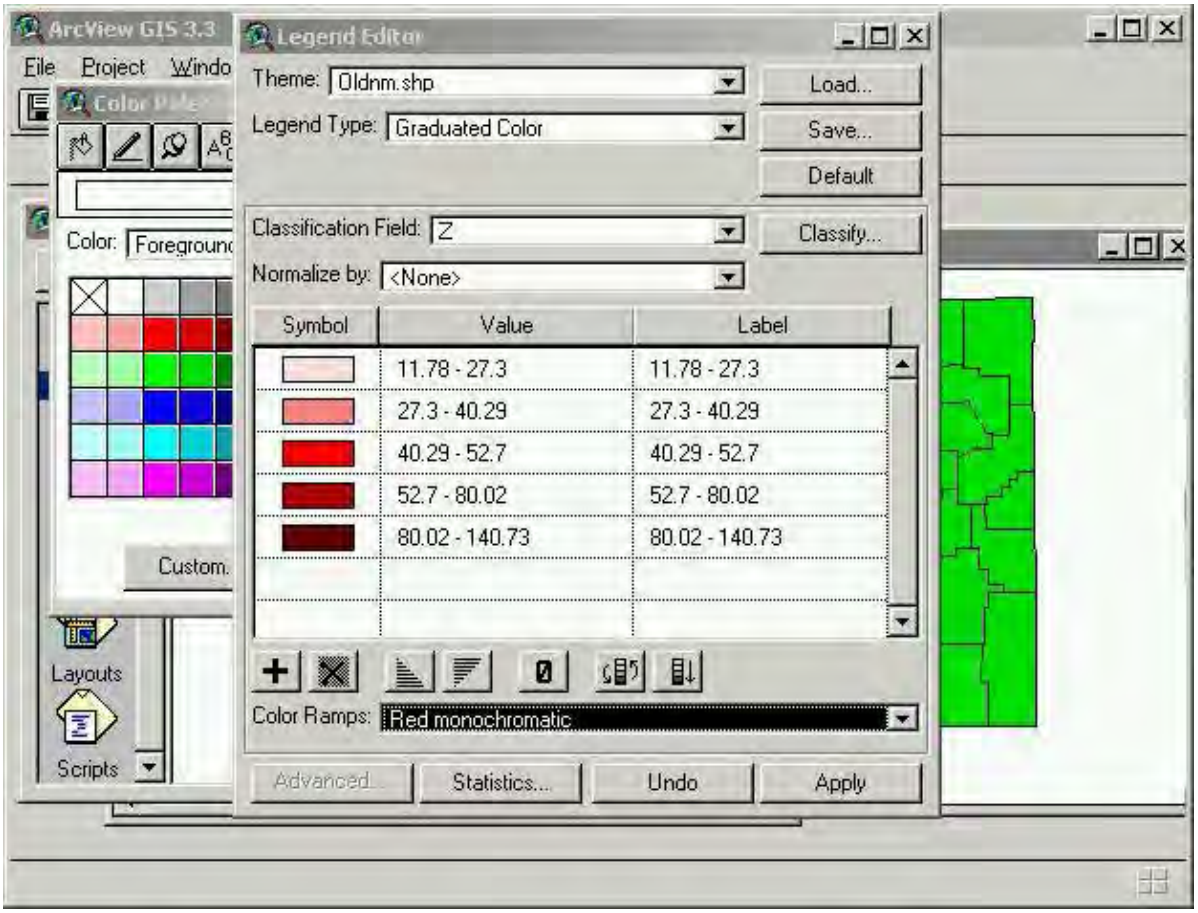
Graduated color selected

5) Now, in the third dialogue box *Classification Field:* select the Attribute column from your shapefile that you wish do display in different categories, by highlighting it.



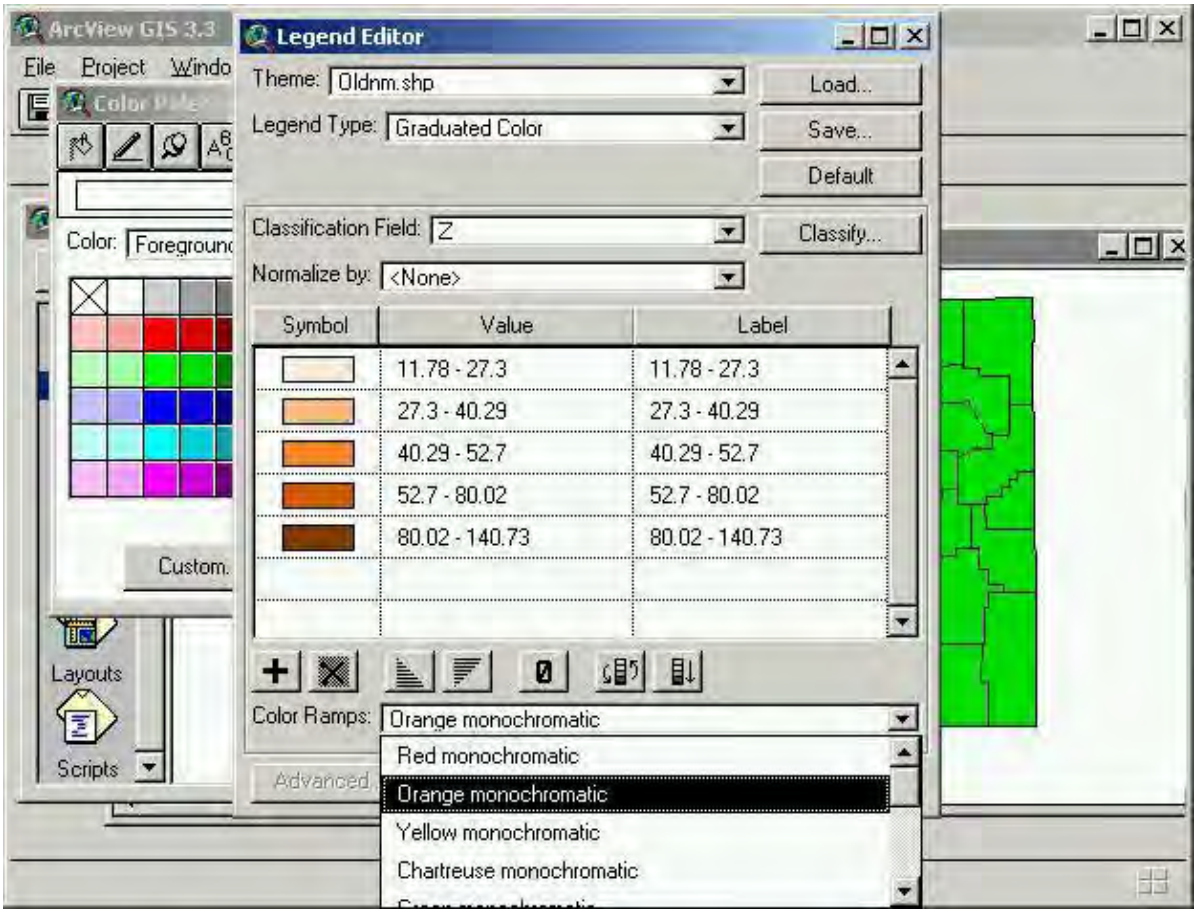
Change to the attribute you want to map by

6) The preorganized classes for your choropleth map will appear.



Your prearranged classes will appear

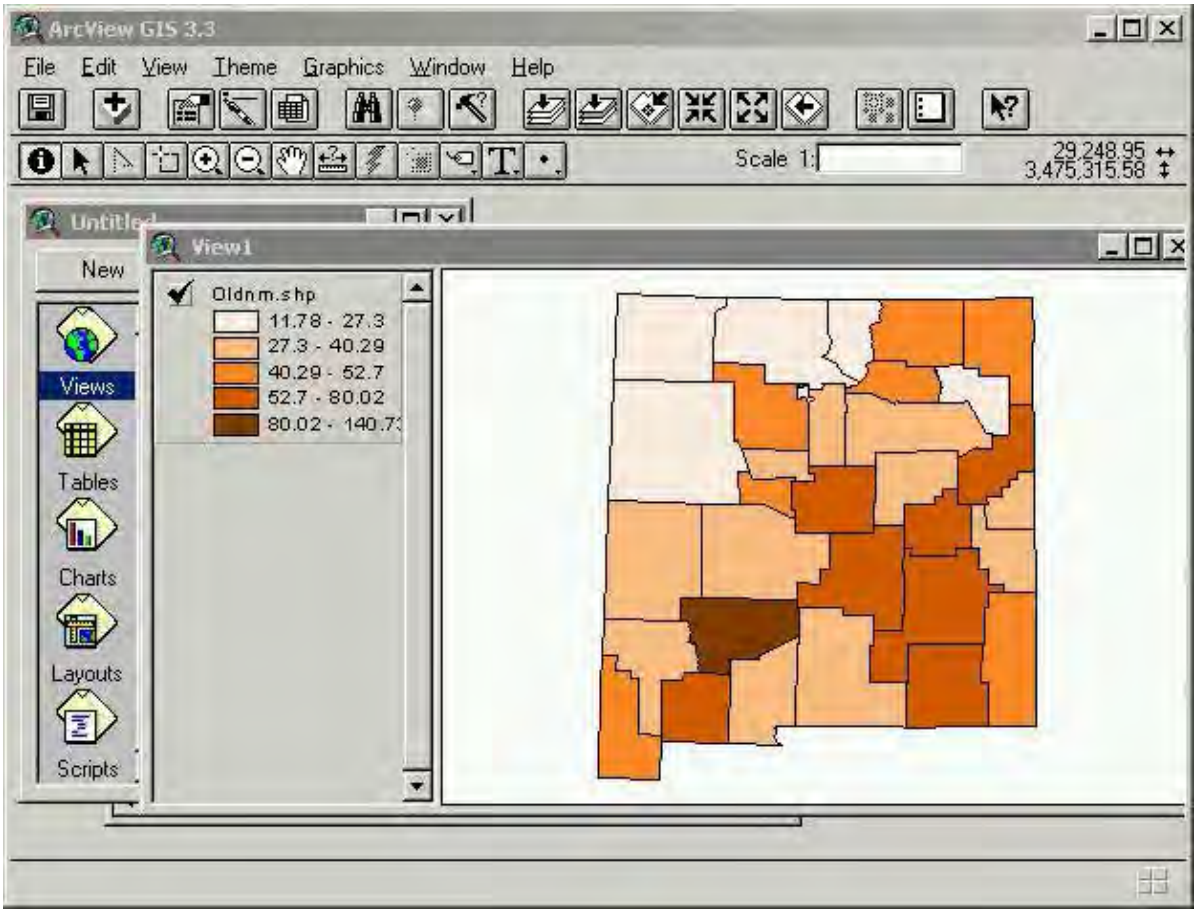
7) Now, within the window you can edit the colors (color ramps), number of classes (Classify button), your class intervals (double click on the numbers themselves) and even the types of classifications(advanced, classify button) you can use to display your map. To obtain the best results, it is best to use trial and error when it comes to these details.



You can easily change your color scheme

9) When the settings are tuned to your liking click **Apply** and then **Ok**

10) Your choropleth map will appear on your map window.



Your Choropleth map the higher the number or darker the color the higher rate of cancer in that county

Authored by: Benjamin N. Sprague **Modified:** 9/11/03

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GIS Cookbook: Recipe - Making a Choropleth Map

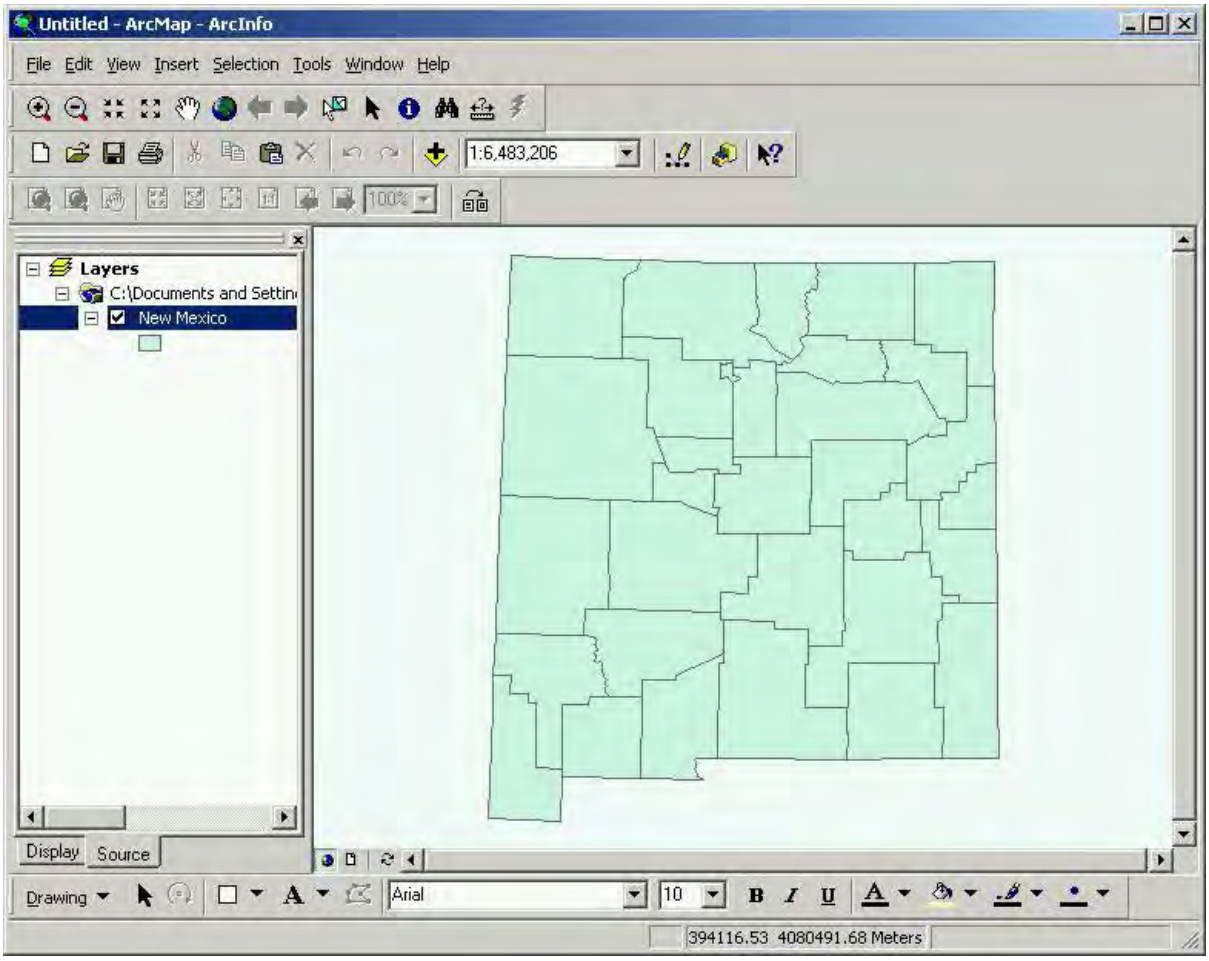
Keywords: Spatial analysis, choropleth map, color symbology
Category: Data Analysis
Software: ArcGIS 8/9.x

Problem: How do I make a choropleth map, so I can see spatial patterns and analyze them?

Description: A choropleth map is a map that uses different colors to show how some phenomenon varies across space. For example, a choropleth map of U.S. states colored according to their population density (with light hues representing states with low population density and dark hues representing states with high population density) makes it easier to identify spatial patterns in the population data.

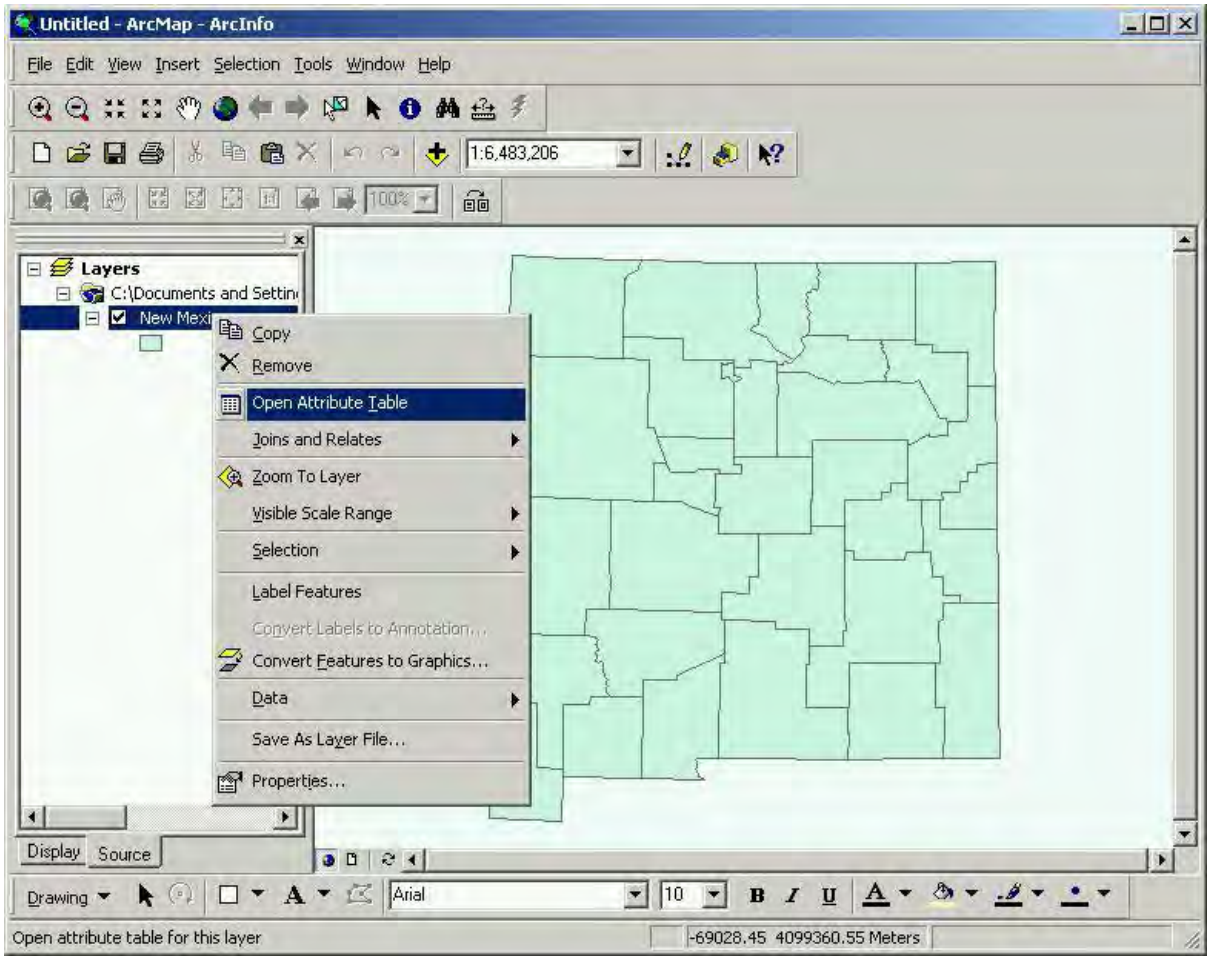
Scenario:
Ever since the work of John Snow and his mapping of Cholera cases, mapping cases and frequencies of diseases can help to find sources and cures. One of the major research topics of the 20th century is the search for an understanding of cancer. It helps researchers in the subject to know where the cases of cancer are the highest. In this scenario, we are going to look at cancer statistics for each county in the state of New Mexico. Once finished we can look at and analyze the information and compare it to other choropleth maps.

Methodology:
1) Open ArcMap and add the shapefile that covers the desired study area in the desired areal units.

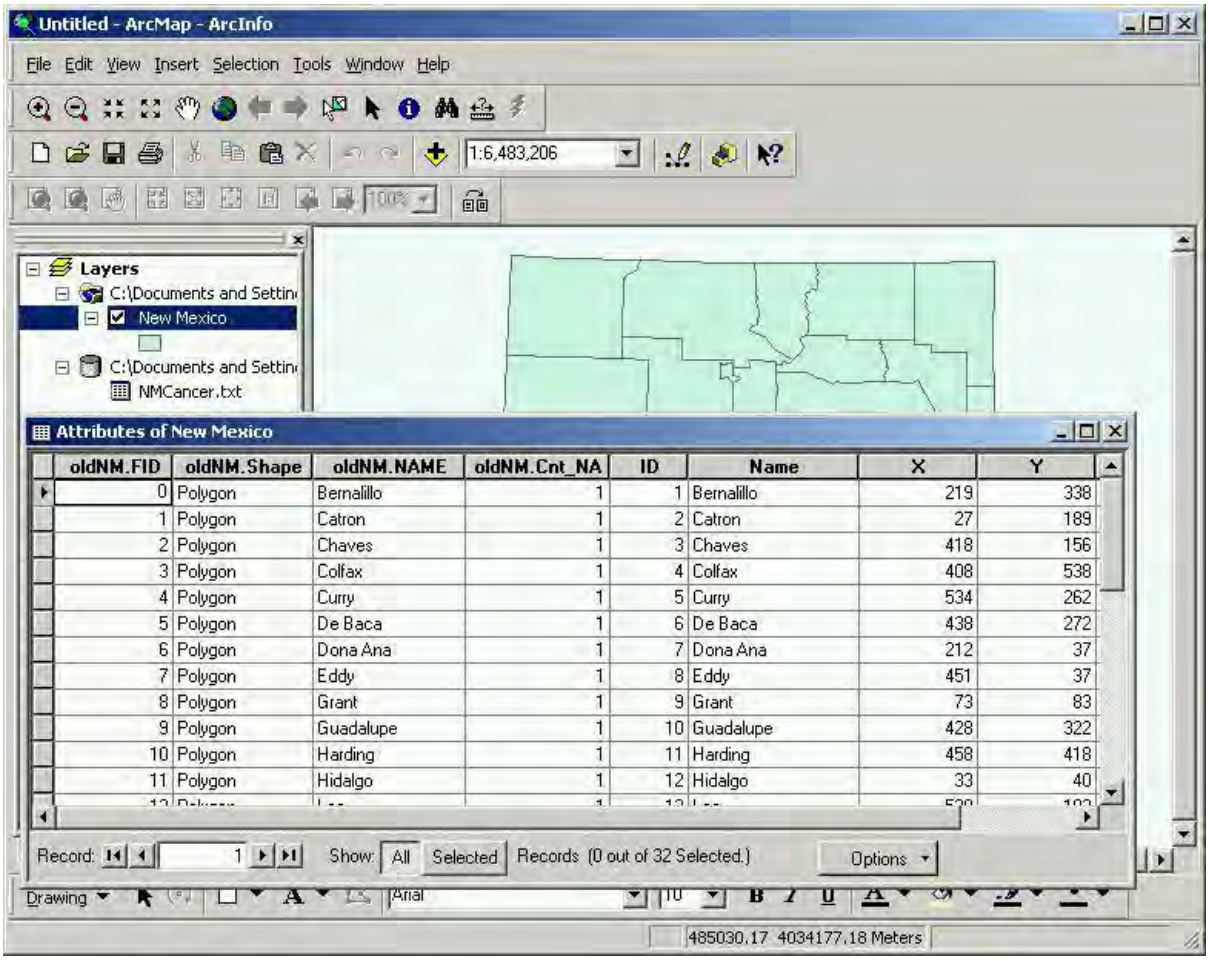


Your starting shapefile/layer

2) Right-click on the layer/shapefile and select **Open Attribute Table** . This will display the tabular information currently within the shapefile. Make sure the information you want to see is displayed within the attribute table. If it is not, and you need to add it from an external source, see the recipe *Joining a table* . Make sure to note the name of the column you are going to display.

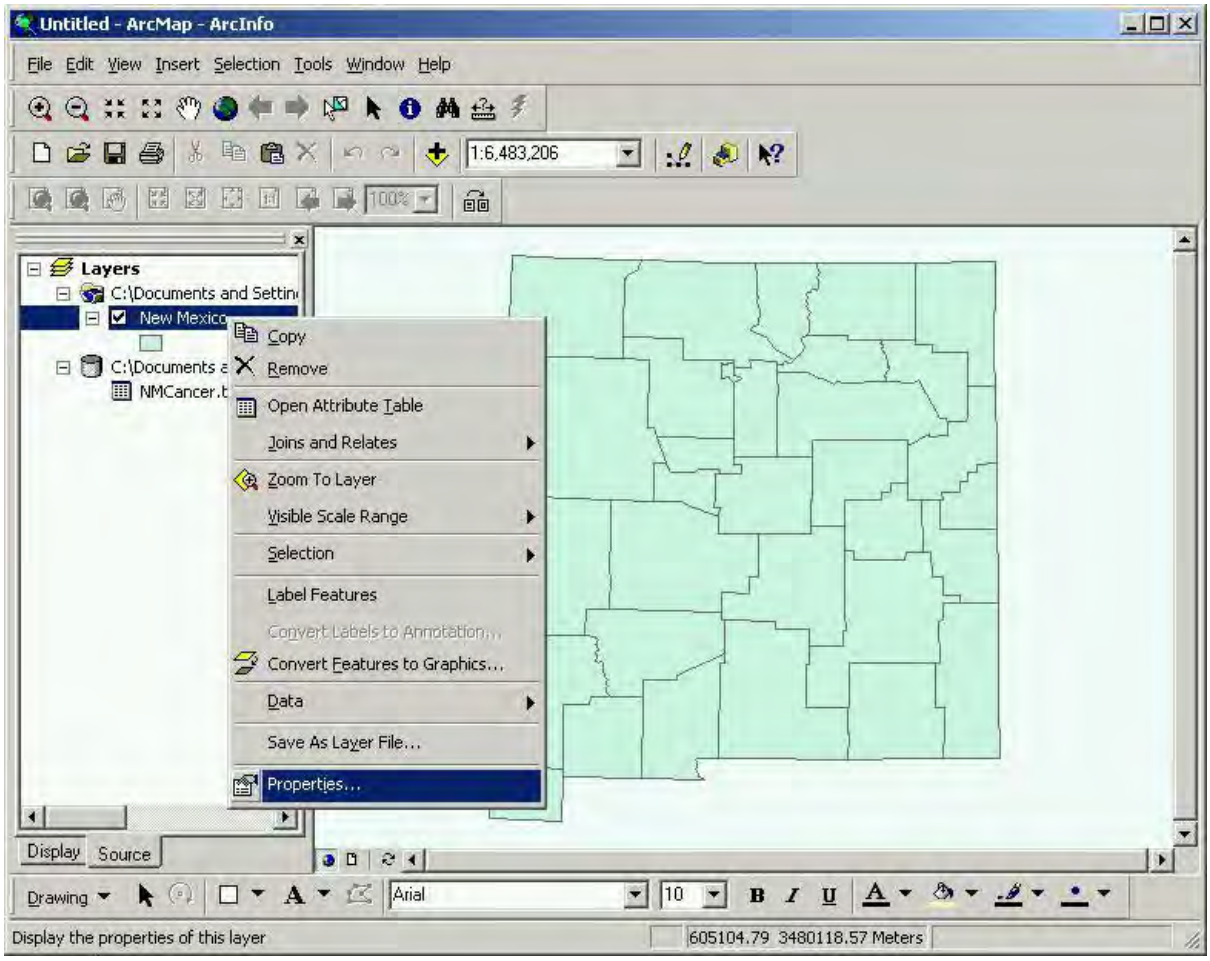


Vew attribute table



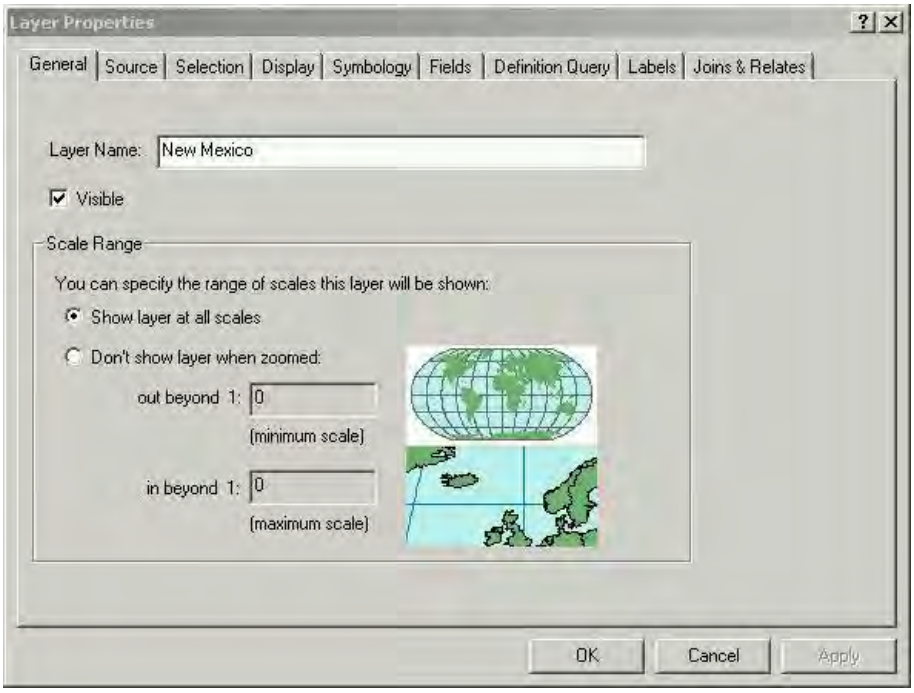
Your attribute table

3) Right-click on the shapefile and select **Properties**



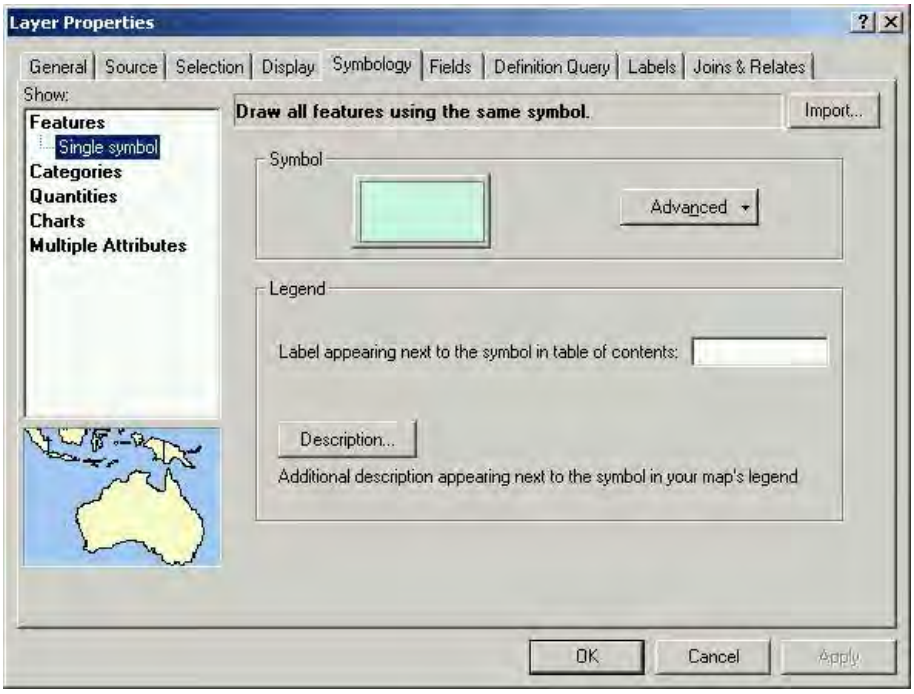
Layer properties

4) The Layer Properties window will appear. (If you have opened the properties for this shapefile before it will open to whichever properties window you had opened last.)



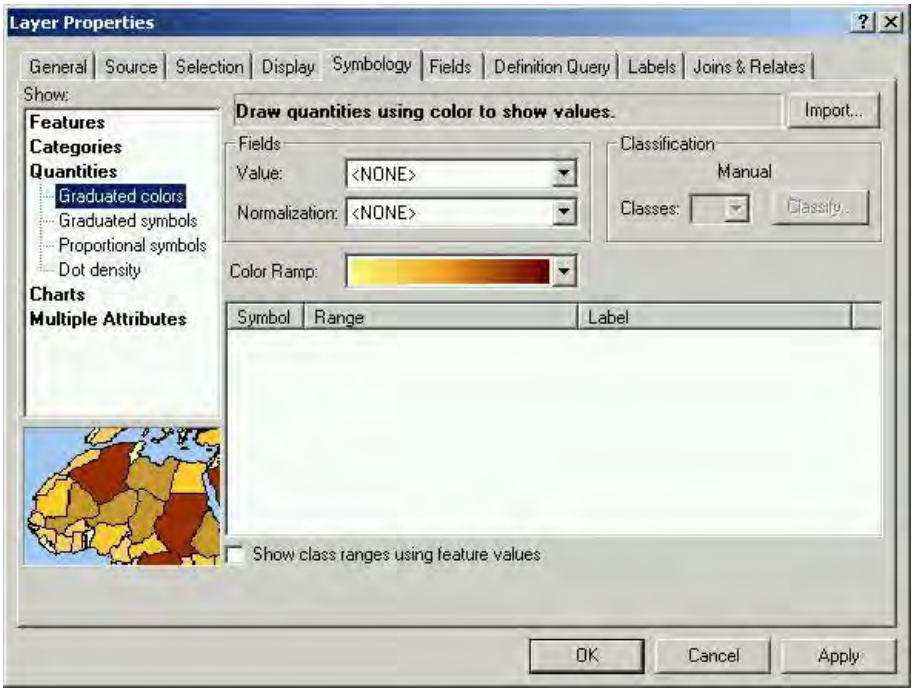
Layer Properties opened

5) On the top of the window click on the **Symbology** tab.



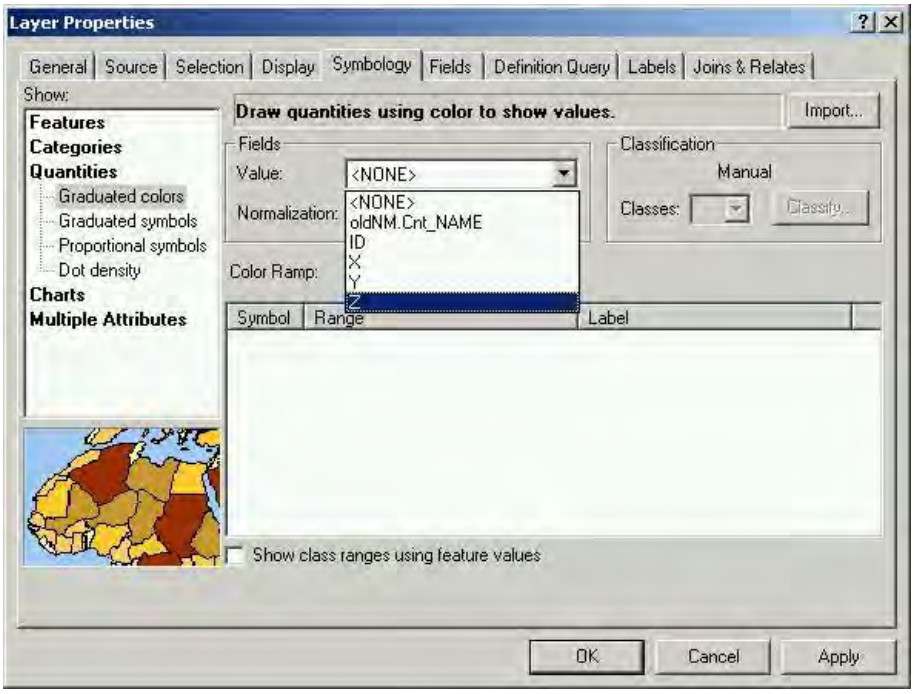
Symbology tab

6) On the left side of the dialog box under the *Show:* heading, select **Quantities** , then **Graduated colors**.



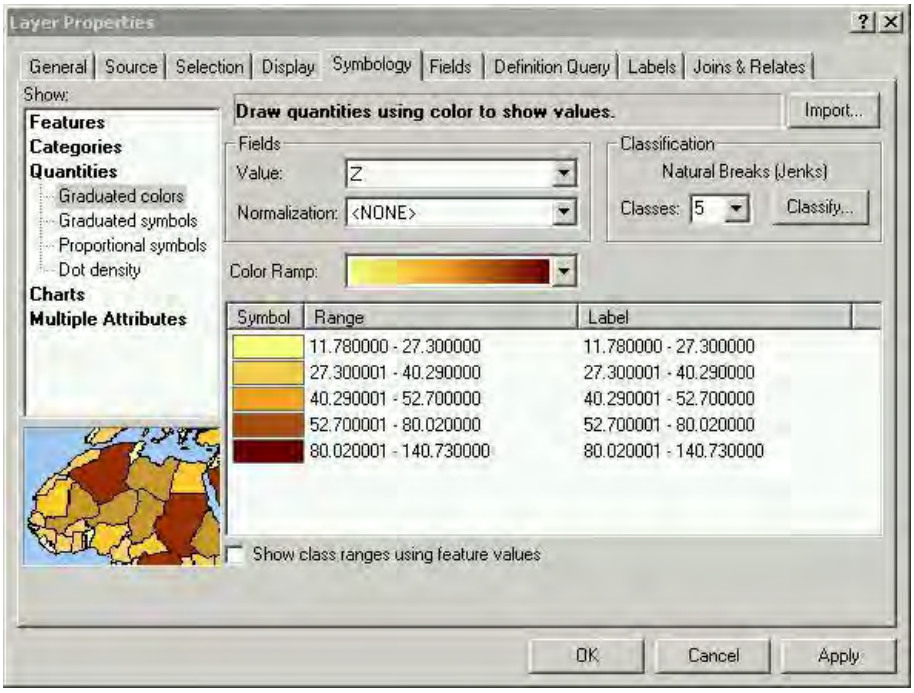
Quantities selected

7) In the *Fields* section of the window , find the drop-down list labeled *Value:* . Select the attribute field from your shapefile that contains the data you wish to use to construct the choropleth map.



Select your attribute

8) ArcMap will break your data up into five classes using the default Natural Breaks classification method and will assign a random light-to-dark color ramp.

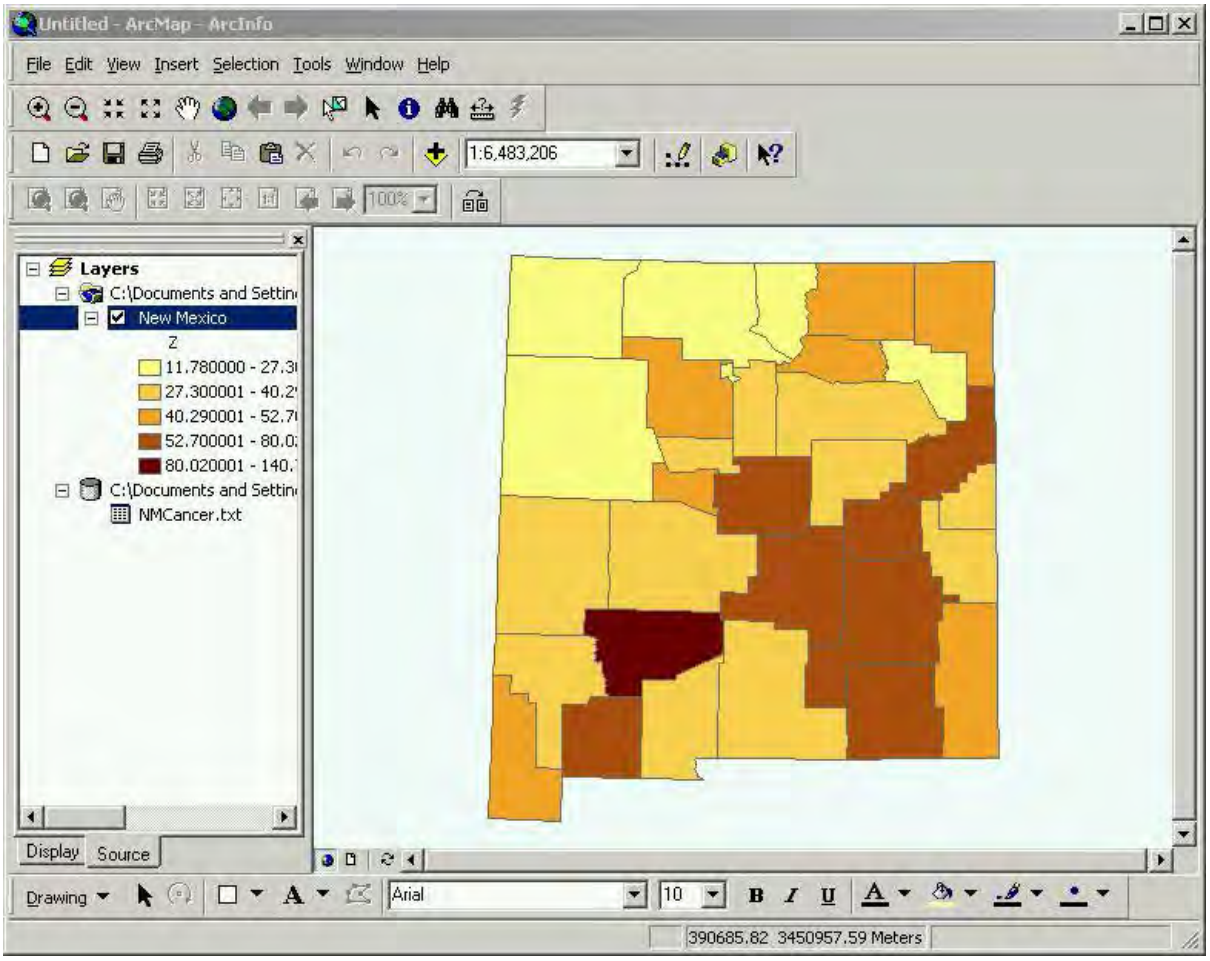


What your choropleth classes will look like

9) Within the Layer Properties window you can now edit the colors (color ramp), number of classes, class intervals (click the **Classify** button) and even the type of classification (also accessed through the Classify button).

10) When the settings are tuned to your liking click **Apply** and then **OK**

11) Your choropleth map will appear on your map window.



Your choropleth map. Higher cases of cancer are darker, lower are lighter.

Authored by: Benjamin N. Sprague **Modified:** 2/4/05

GIS Cookbook: Recipe - Define Projection for a Shapefile or Geodatabase

Keywords: Projection, datum, coordinate, system, define, spheroid, shapefile, geodatabase, transform, ArcToolbox, wizard, unknown,
Category: Projections
Software: ArcGIS 8.x

Problem: When I open my geographic data file, I get a warning message that the file does not have a coordinate system defined.

Description: Features on a three-dimensional spherical surface like the Earth are depicted on two-dimensional surfaces like a paper map or computer screen using mathematical conversions known as map projections. All map projections distort real-world features in some way. A mnemonic that's often used to remember the four properties that could be distorted by a map projection is, "Projections make geographers SADD." (**S**hape, **A**rea, **D**istance, **D**irection.)

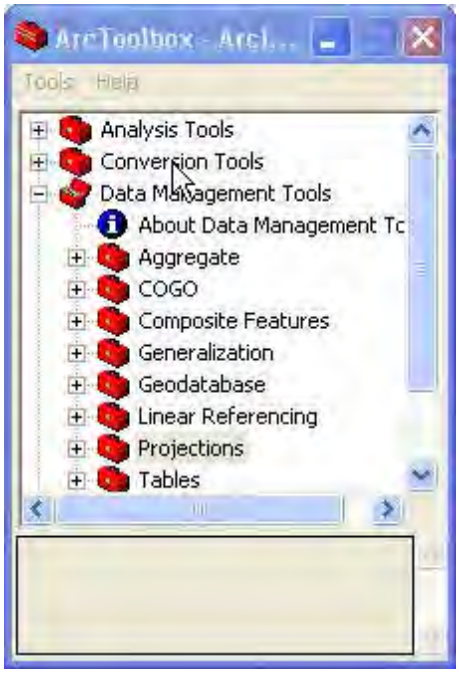
A valuable feature of ArcMap is something called “on-the-fly re-projection”, which means that the user can add datasets that are in different projections and ArcMap will make them line up in the same coordinate space. A critical element of this on-the-fly re-projection process is that each of the layers has its projection defined (i.e., that you, the user, tell the software how each layer is projected). Some of the datasets you come across will already have their projection defined. However, if when adding a dataset to ArcMap you receive a warning message or the layer does not line up with other layers, the dataset’s projection is either undefined or defined incorrectly. The solution is to properly define the projection using ArcToolbox (i.e., to tell the software how your data are projected).

Note: The terms projection, coordinate system, and spatial reference are often used to refer to the same thing in the various ArcGIS dialog boxes. While there are slight differences between these terms, you can treat them as synonymous.

Methodology:
1) Start ArcToolbox from its location in your Start Menu hierarchy.

The ArcToolbox window

2) There are four primary options in the toolbox: Analysis Tools, Conversion Tools, Data Management Tools, and My Tools. Navigate to the Projections option underneath the Data Management Tools.



The various Data Management Tools, including projection tools

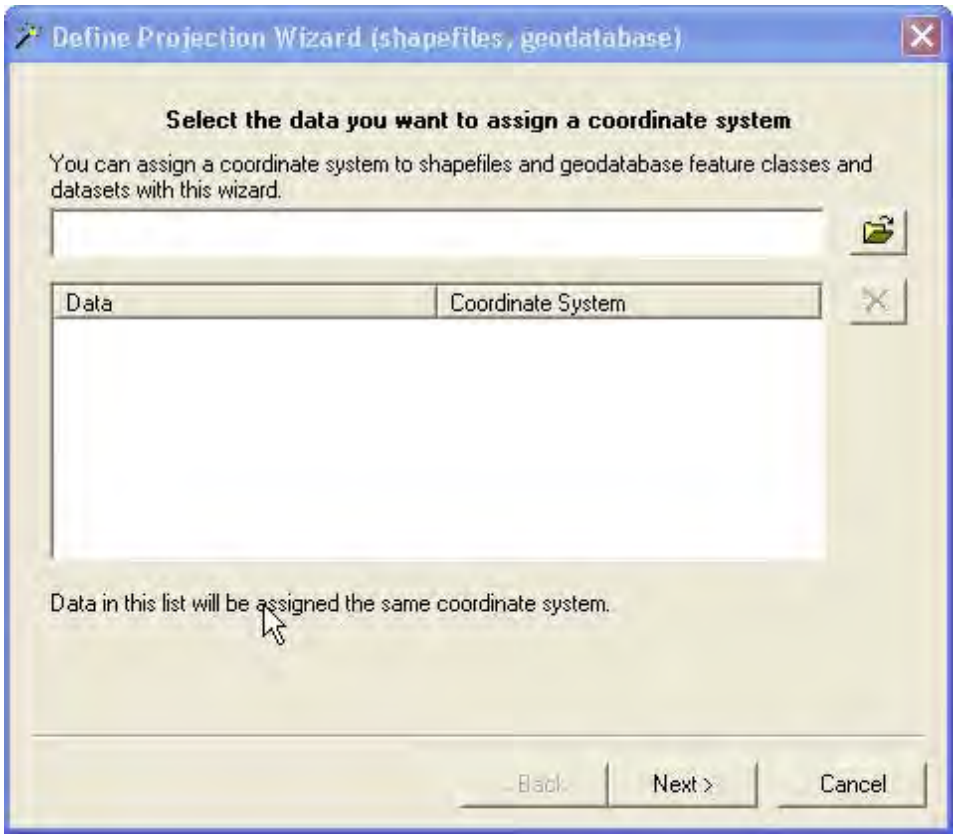
3) There are two Define Projection Wizards, one for coverages/grids/TINs and one for shapefiles/geodatabases.

The Projection tools

See Pitfall 1

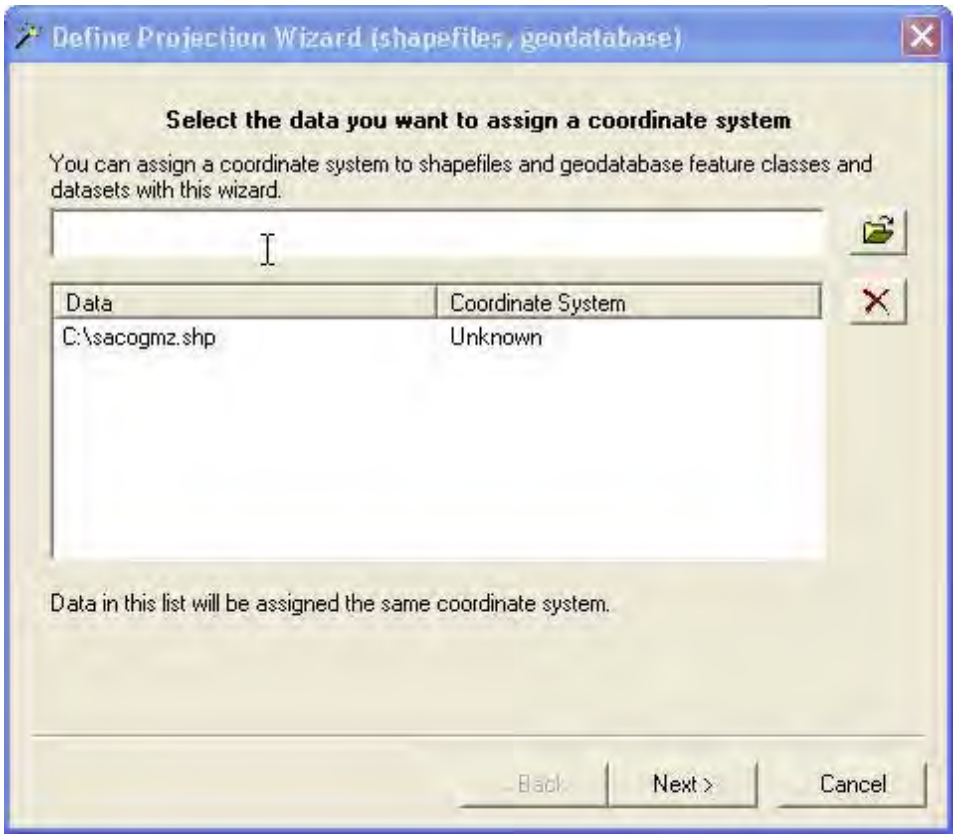
Double-click the **Define Projection Wizard (shapefiles, geodatabases)** option.

In this example, we will use a traffic analysis zones file for the Sacramento Council of Governments planning area.



The Define Projection Window

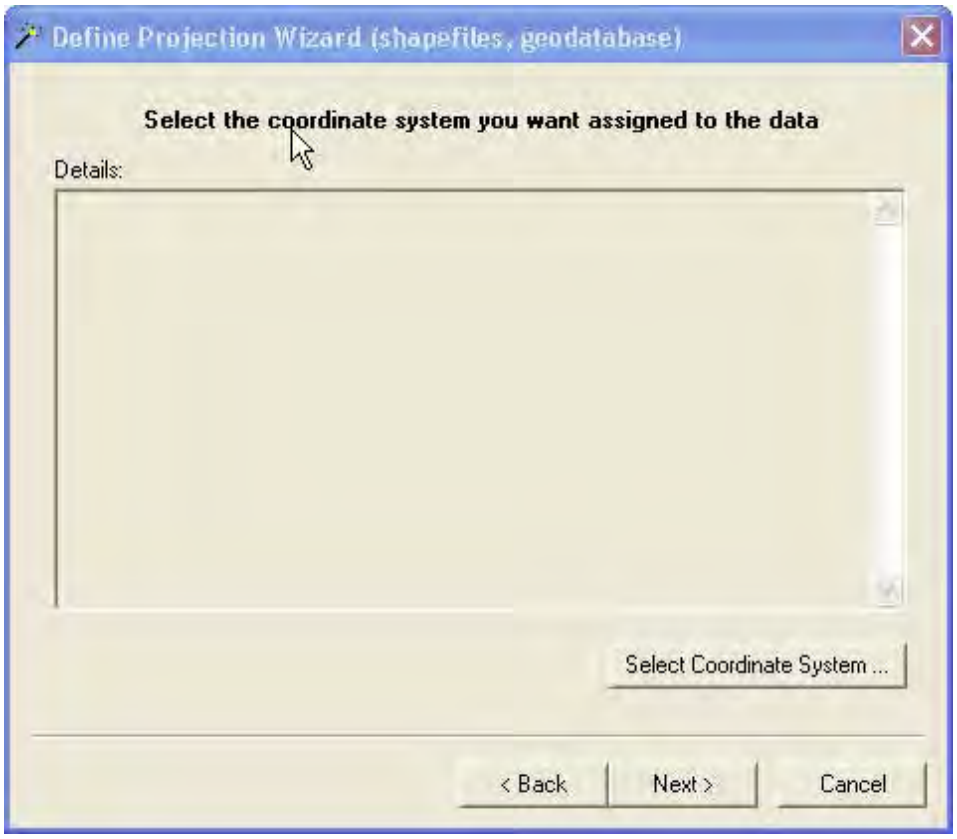
4) You are asked to select the data set for which you want to perform this operation. Using the **Browse** button (or type the path and file) to the right of the select window, navigate to your data set. In this case, the traffic analysis zones were selected.



The Define Projection Window with the selcted file displayed

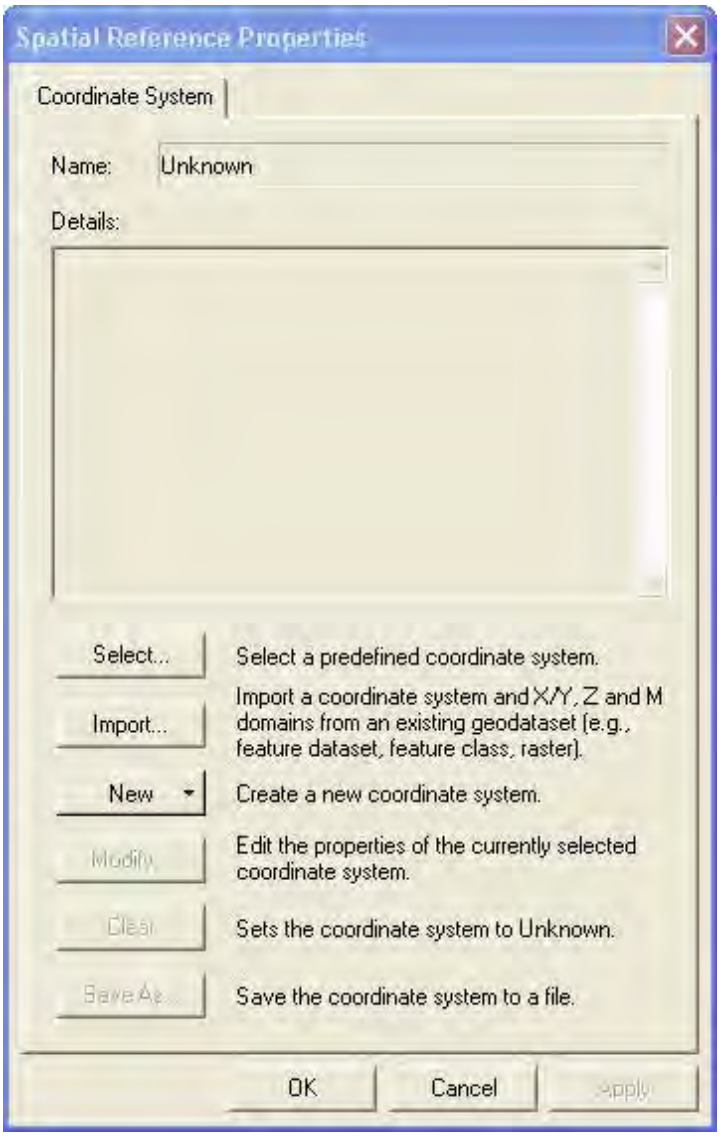
Once selected, your data set should appear in the bottom half of the pop-up window. The right-hand side column displays the Coordinate System that has been defined for your data. If there is a coordinate system already defined, you're done. However, if you have not used this data set yet, it is likely that it says "Unknown". It is also possible that the GIS has assumed a coordinate system. If either you're coordinate system is unknown or assumed, you should proceed through the process of explicitly defining your coordinate system.

5) Select your data set in the window and click **Next->**.



There is no coordinate system assigned yet

6) The next window shows the details of the coordinate system for your data. If no coordinate system has been defined, it will be gray and blank. Click the button **Select Coordinate System**.



Select the method of coordinate system assignment

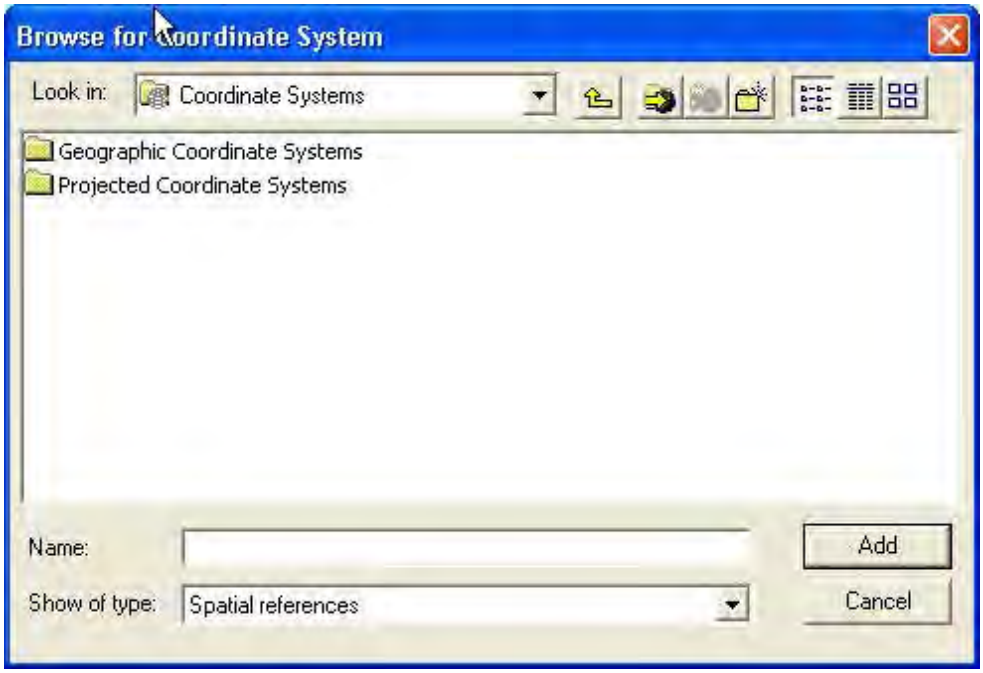
You are presented with several options on the Spatial Reference Properties window.

1. **Select** Select a pre-defined coordinate system. This is the most likely course of action. Your data is probably in a common coordinate system that ESRI has included for you as pre-defined.
2. **Import** Import a coordinate system and X/Y/Z and M domains from an existing geodataset (e.g., feature dataset, feature class, raster). If you have another data set that you know has the same projection, you can simply import that coordinate system here.
3. **New** Create a new coordinate system. In rare occasions, your data may have been projected in a proprietary or uncommon coordinate system. This option allows you complete reign over the components of the coordinate system definition.

See Pitfall 2

In our example, a *.txt* file was included in the publicly available download from **www.sacog.org** that described the projection of the data (State Plane CA Zone II units feet Datum NAD83).

7) So, we click **Select**

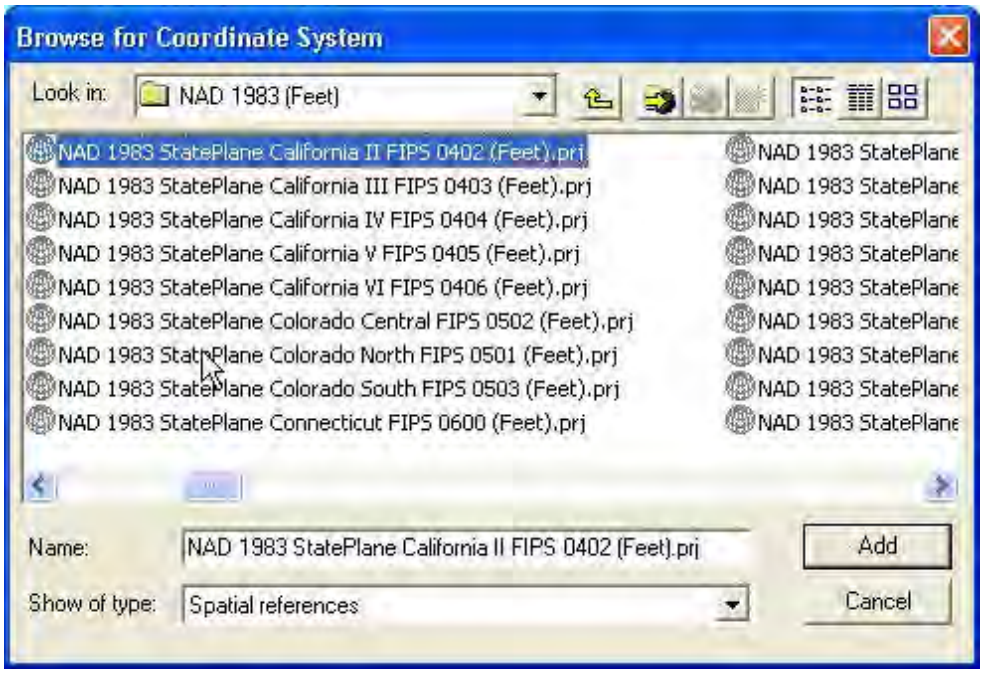


Starting the navigation to the proper coordinate system

This takes us to a browse screen with two folders to browse: Projected Coordinate Systems and Geographic Coordinate Systems. Our coordinate system for the traffic zone data is a projected coordinate system.

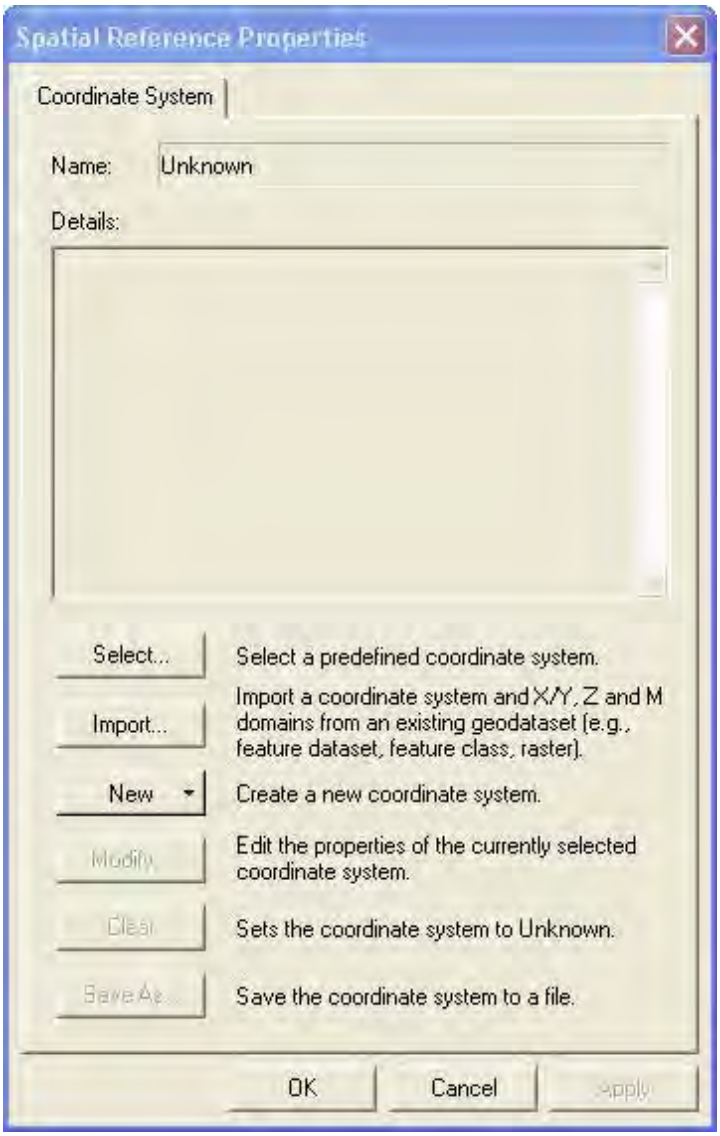
8) Double-click the **Projected Coordinate Systems** or **Geographic Coordinate Systems** folder.

Several options are available. Navigate through the folders until the desired coordinate system is located. For the example file, the **State Plane** folder is opened and then the **NAD 1983 (Feet)** folder, until a list of state plane projection options appears. For this example, we choose **NAD 1983 StatePlane California II FIPS 0402 (Feet).prj**, since that is the projection identified in the *.txt* file that accompanied the data download.



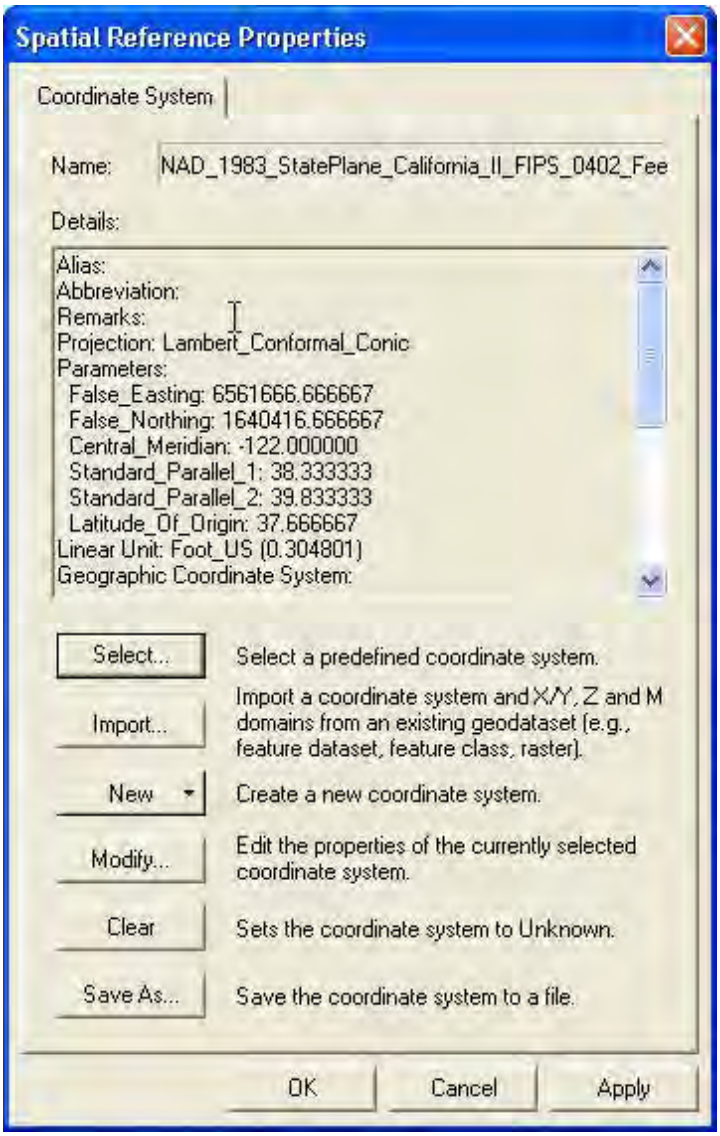
The proper coordinate system for our traffic zones data

9) Single-click the proper coordinate system and then click **Add**. You are returned to the previous screen showing the chosen coordinate system and its details. Click **OK**.



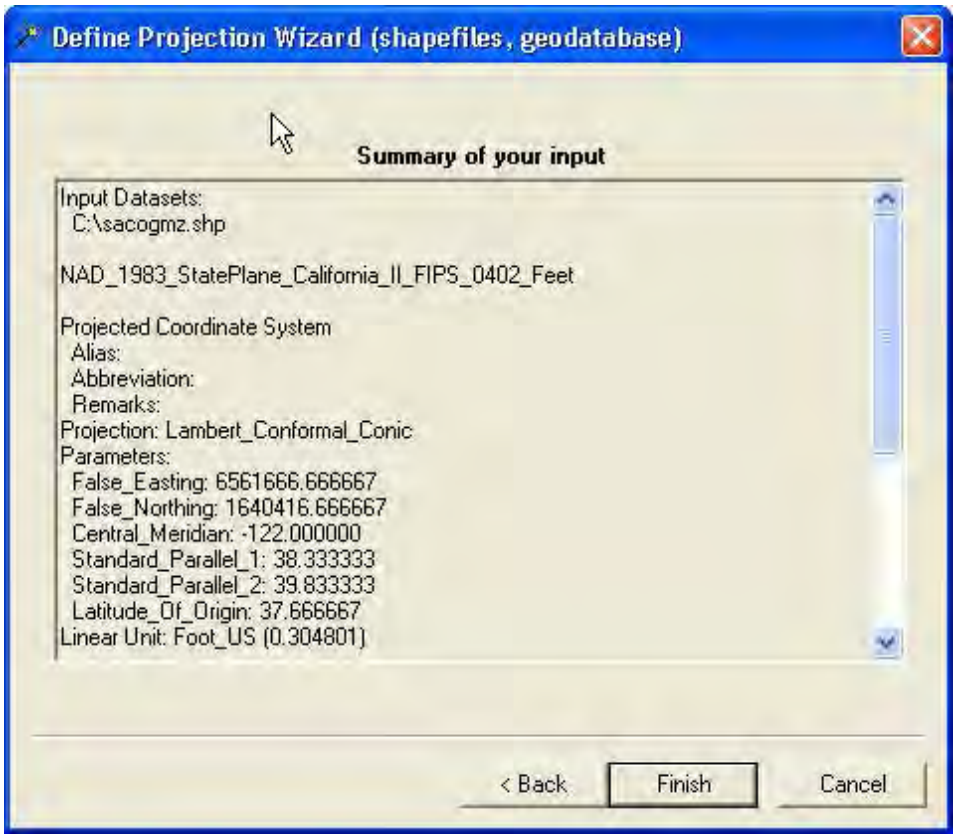
The Spatial Reference Properties window has been populated

10) Now the coordinate system details are waiting to be attached to your data set. Click **Next**.



The Coordinate System has been attached

11) You are shown a final summary. Click **Finish** if you're satisfied.



The final summary window

Pitfalls:

- Don't know type of file.
- Don't know the coordinate system for your data.

Sacramento Council of Governments data used in the example.

Authored by: Rob Farrell **Modified:** 2/26/05

GIS Cookbook: Recipe - Define Projection for a Shapefile or Geodatabase

Keywords: Projection, datum, coordinate system, define, spheroid, shapefile, geodatabase, ArcToolbox
Category: Projections
Software: ArcGIS 9.x

Problem: One of the layers in my map document is not lining up with the others OR When I add a dataset to ArcMap, I get a warning message that the data does not have a coordinate system defined.

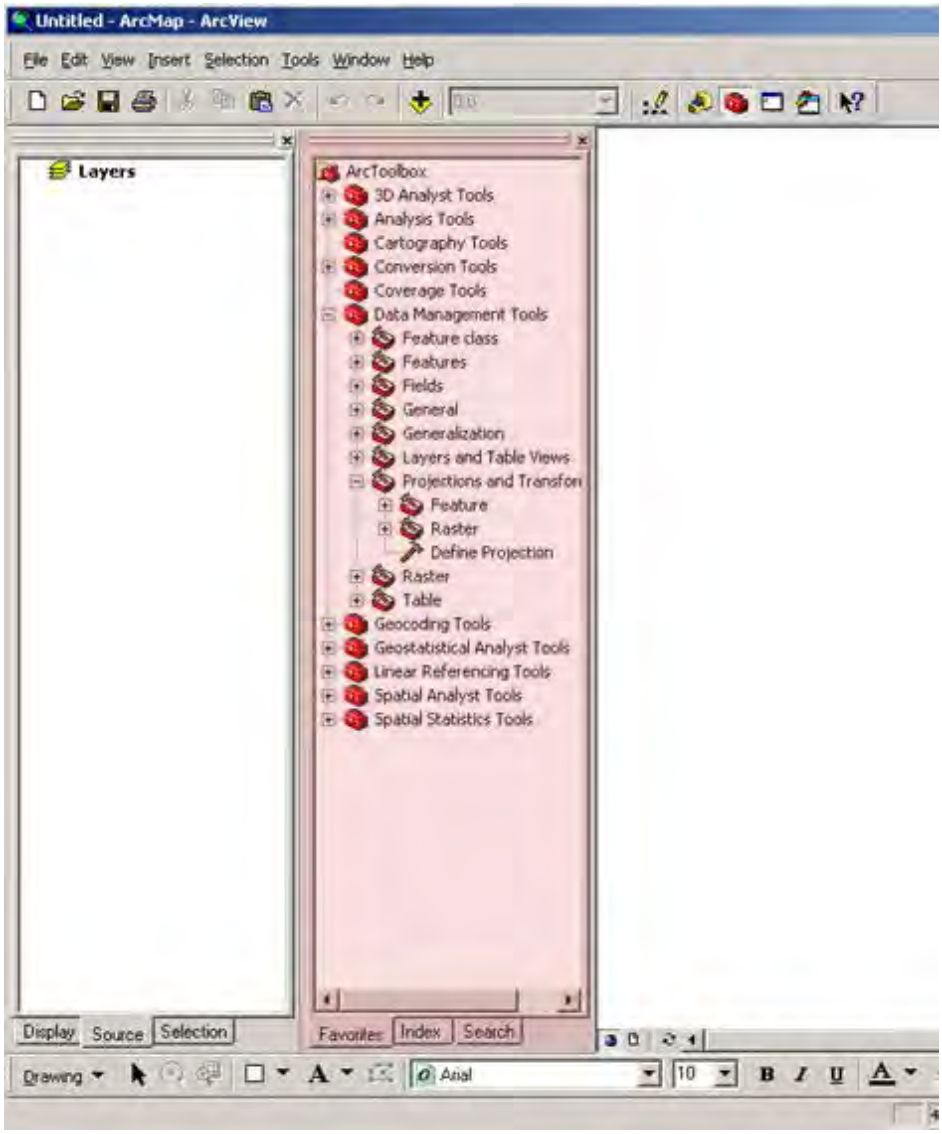
Description: Features on a three-dimensional spherical surface like the Earth are depicted on two-dimensional surfaces like a paper map or computer screen using mathematical conversions known as map projections. All map projections distort real-world features in some way. A mnemonic that's often used to remember the four properties that could be distorted by a map projection is, "Projections make geographers SADD." (**S**hape, **A**rea, **D**istance, **D**irection.)

A valuable feature of ArcMap is something called “on-the-fly re-projection”, which means that the user can add datasets that are in different projections and ArcMap will make them line up in the same coordinate space. A critical element of this on-the-fly re-projection process is that each of the layers has its projection defined (i.e., that you, the user, tell the software how each layer is projected). Some of the datasets you come across will already have their projection defined. However, if when adding a dataset to ArcMap you receive a warning message or the layer does not line up with other layers, the dataset’s projection is either undefined or defined incorrectly. The solution is to properly define the projection using ArcToolbox (i.e., to tell the software how your data are projected).

Note: The terms projection, coordinate system, and spatial reference are often used to refer to the same thing in the various ArcGIS dialog boxes. While there are slight differences between these terms, you can treat them as synonymous.

Methodology:
The biggest difference in defining a dataset's projection between ArcGIS 8.x and 9.x is that ArcToolbox is a stand-alone application in 8.x and is integrated into the ArcMap and ArcCatalog applications in 9.x.

1) With either ArcMap or ArcCatalog open, click on the red toolbox icon on the Standard toolbar to open ArcToolbox. Within the ArcMap application window, a pane that contains the ArcToolbox tools will be added between the Table of Contents and map display area as shown below. The ArcToolbox window will contain different toolboxes depending on which ArcGIS extensions are loaded on the computer.



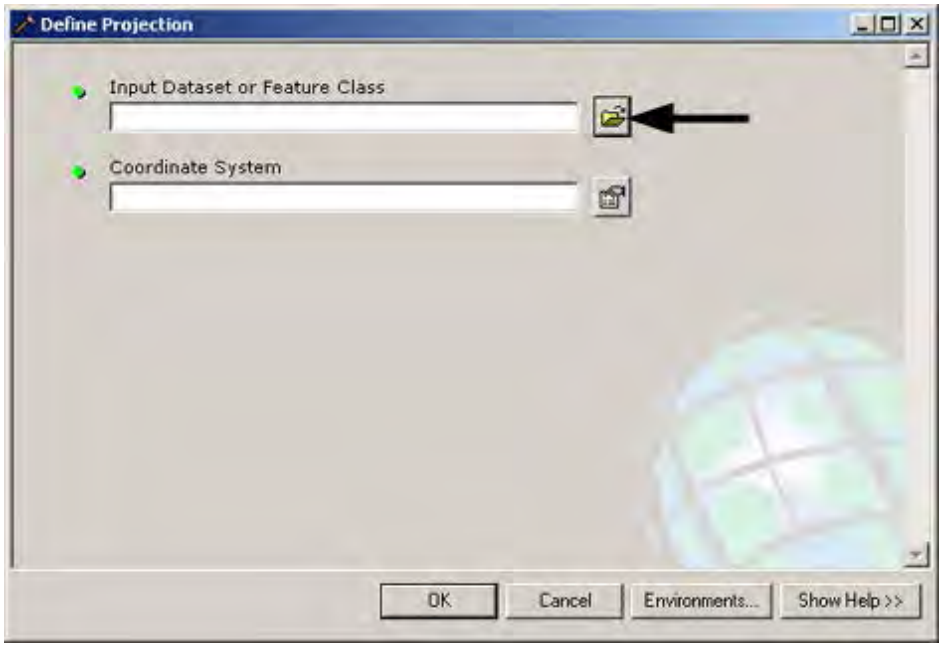
The ArcToolbox window

Three of the more commonly used toolboxes are: Analysis Tools, Conversion Tools, and Data Management Tools.

2) Navigate to the **Define Projection** tool under **Data Management Tools > Projections and Transformations** and double-click on it.

Navigating to the Define Projection tool

3) In this example, we will use a shapefile of Pennsylvania census tracts downloaded from the Census web site. Click on the **Browse** button to specify the Input Dataset or Feature Class.

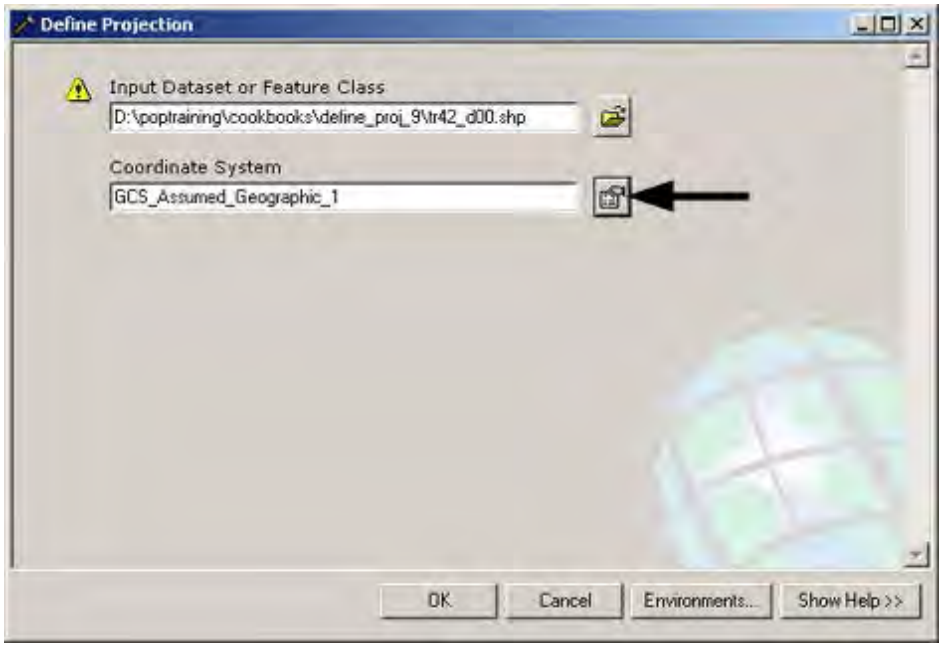


The Browse button on the Define Projection dialog box

ArcMap will first check to see if the dataset already has its projection defined. If it doesn't, the program will then scan the dataset's coordinates to see if they all fall in the range of -180 to +180. If the coordinates are in that range, ArcMap will assume that the data are in latitude/longitude (also referred to as Geographic) coordinates. That is the case in this example.

While the assumed projection may be correct, it is good practice to define the projection explicitly.

4) Click the **Properties** button to define the dataset's projection.



The Properties button on the Define Projection dialog box

The Spatial Reference Properties dialog box opens showing the projection properties of the dataset as it's currently defined. The dialog box provides three ways to define a dataset's projection:
1. **Select**: Select from a list of commonly used coordinate systems.
2. **Import**: Import the coordinate system definition from another dataset. Use when you know that your dataset is in the same projection as another dataset.
3. **New**: Create a new coordinate system. On rare occasions, your data may have been projected in a proprietary or uncommon coordinate system. This option allows you complete reign over the components of the coordinate system definition.

In this example, the **Select** option will be used. The coordinate system will be chosen to match the metadata information provided on the Census web site.

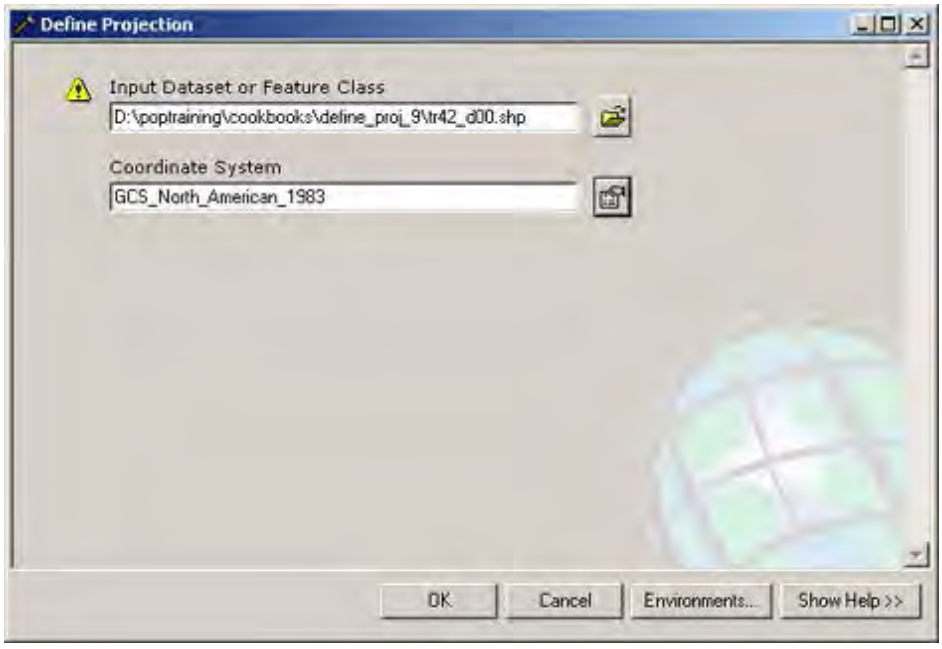
5) Click **Select**, then browse to the coordinate system through either the Geographic Coordinate Systems or Projected Coordinate Systems folder. In this example, the desired coordinate system is reached by navigating to **Geographic Coordinate Systems > North America > North American Datum 1983.prj**.

Browsing to the desired coordinate system

Many of the commonly used coordinate systems such as the State Plane and UTM systems can be accessed through the Projected Coordinate Systems folder.

Upon selecting the desired coordinate system, its detailed properties should appear in the Spatial Reference Properties dialog.

6) Click **OK** to dismiss the Spatial Reference Properties dialog. The name of the selected coordinate system should now appear in the Define Projection dialog.



The Define Projection dialog after coordinate system is selected

7) Click **OK** again to accept the selected coordinate system. A dialog box will report whether the projection definition was assigned to the dataset properly. Click **Close** to dismiss this dialog.

Note: Remember that this recipe is used simply to tell the software how a dataset is projected in cases when that metadata is missing or incorrect. It is critical that ArcMap have correct projection information for each data layer in order to perform on-the-fly re-projection. In some situations it is necessary to permanently re-project a dataset from one coordinate system to another. See the *Reprojecting data* recipe for details on this process. **Links:**

- 2000 Census Tracts Cartographic Boundary Files data used in the example .
- 2000 Census Tracts Cartographic Boundary Files Descriptions and Metadata used in this example.

Authored by: Jim Detwiler **Modified:** 1/14/05

Center for Spatially Integrated Social Science

close

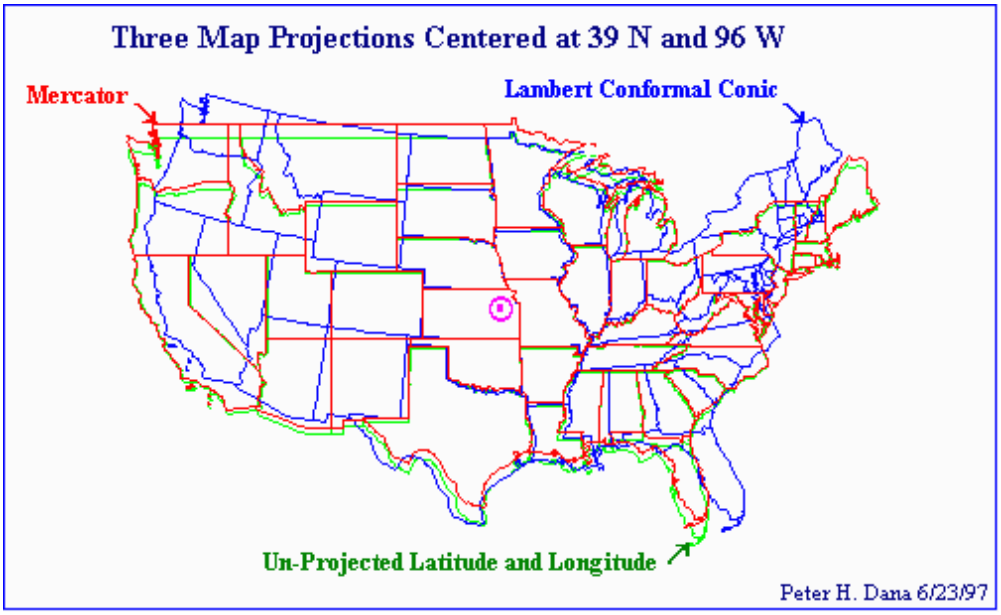
GIS Cookbook: Recipe - Reprojecting Data

Keywords: Projections, datums, coordinates, NAD, conic, match, conformal, planar, Robinson, geographic, azimuthal, cylindrical, longitude, latitude, Mercator, scale, skews, rotates, and shifts coverage, transform, geodata, spheroid
Category: Projections
Software: ArcView 3.2

Problem: The features on my map don't line up. Data occupies the same space in reality but is not displayed this way onscreen, how do I remedy this? ArcView 3.2

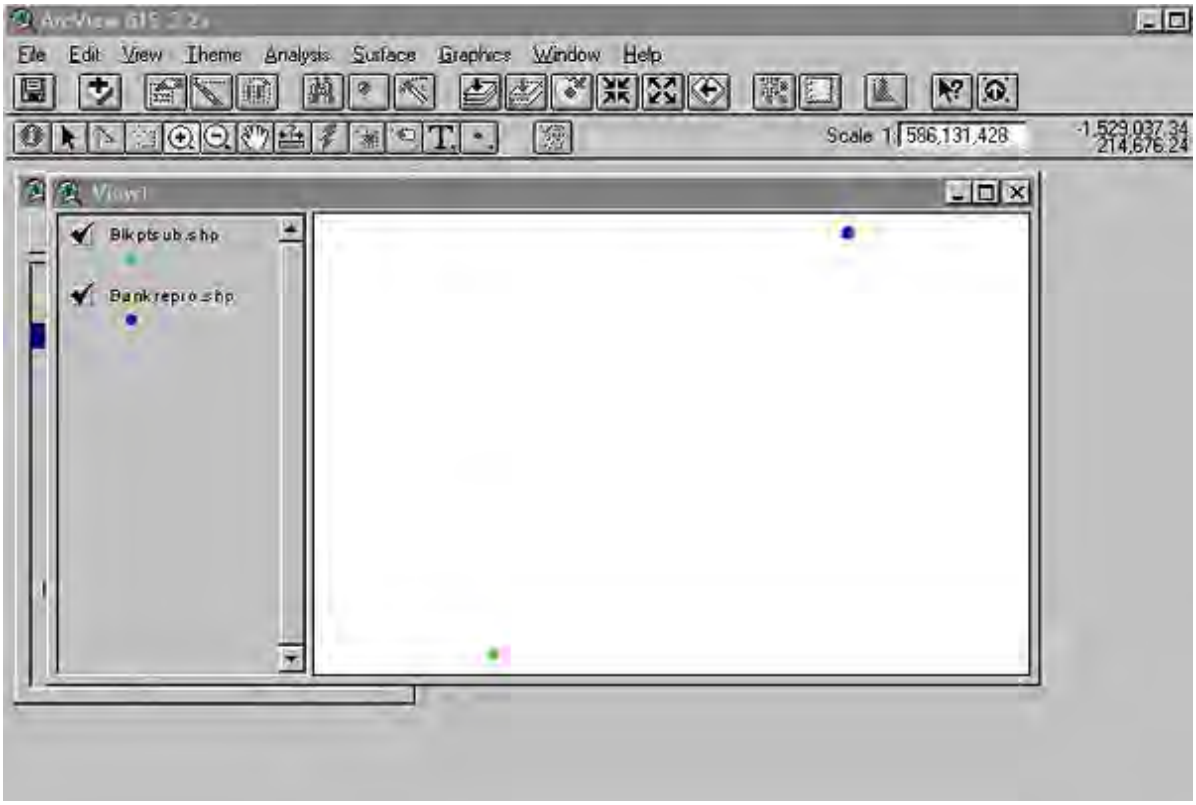
Description: Data from a spherical surface (Earth) can be displayed and distorted in numerous ways when placed on a flat surface, therefore the different ways of placing this data on the page are called projections. Geographic projections are different mathematical techniques to convert and portray features from a spherical surface (Earth) onto a flat surface; each map projection has certain strengths and weaknesses in terms of accurately representing shape, area, distance, and direction. Projections must be altered to make data line up and to present it in the most geographically effective manner.

Scenario:



buffer

Methodology:

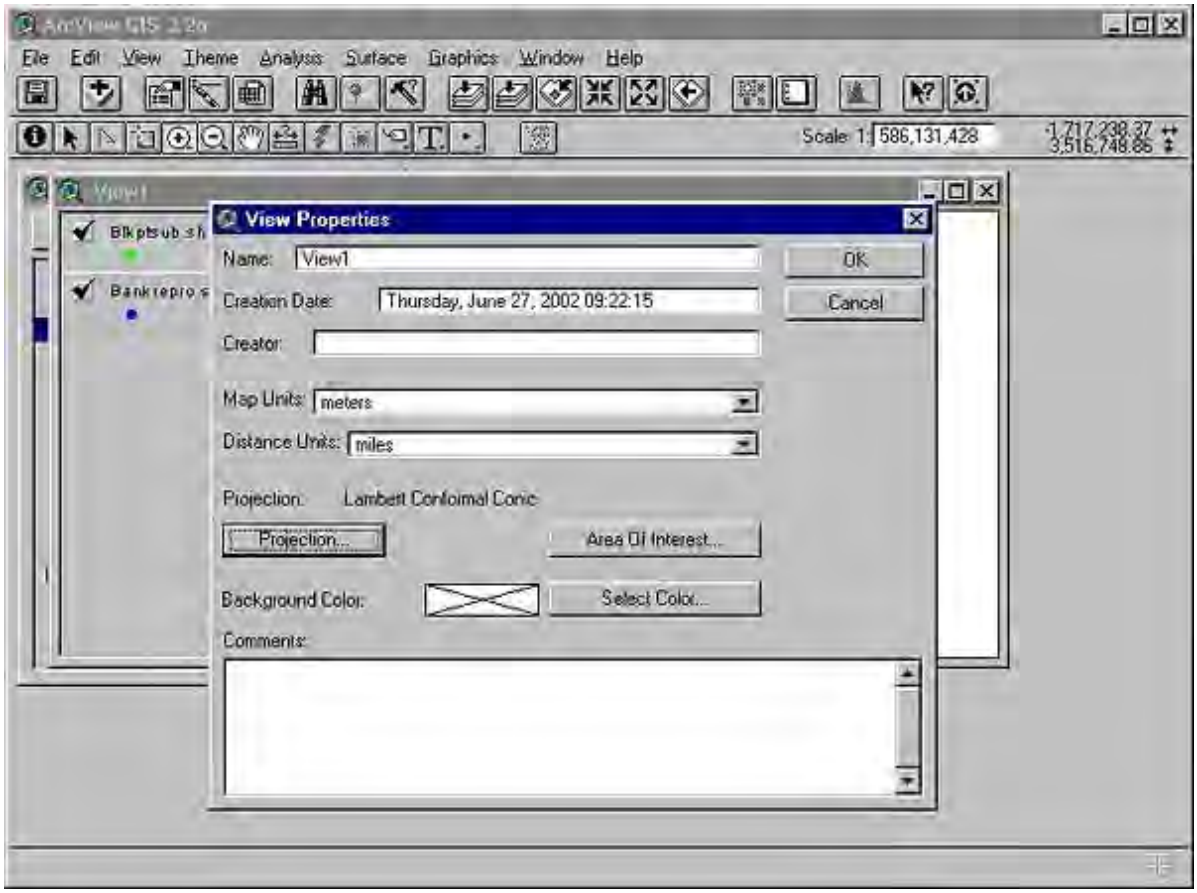


The problem, the data doesn't line up.

1) Identify what projection your data is currently in if you have not already done so. To identify the current projection, go to **View->Properties**.

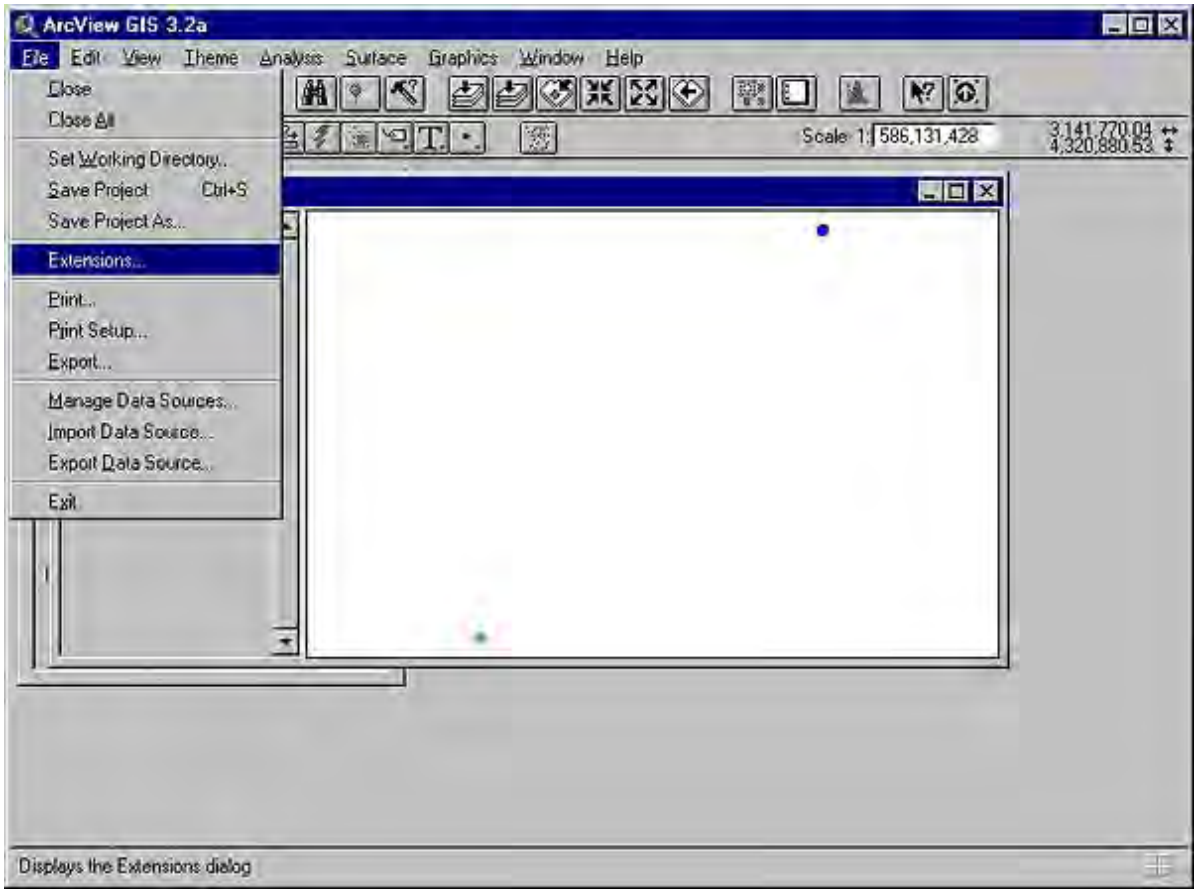
2) Make sure your map units are set within **View->Properties**. If you get an error while setting properties, See Pitfall 1.


ArcView GIS 3.2a
File Edit View Theme Analysis Surface Graphics Window Help
Properties...
Add Theme... Ctrl+T
New Theme...
Themes On
Themes Off
Layout...
TOC Style...
Full Extent
Zoom In
Zoom Out
Zoom To Themes
Zoom To Selected
Zoom Previous
Find... Ctrl+F
Scale 1: 586,131,428
Displays the dialog box to edit properties of the view



What Projection am I in

3) Open **File->Extensions**. Engage (i.e. check on) **Projector**. If you do not have Projector follow the instructions after the next screenshot.



Here's how you can get Projector, a free and easy-to-use script, if you do not already have it:

1) Go to http://www.arcscripts.esri.com, then type "projector" into the search line and hit the **search** button.

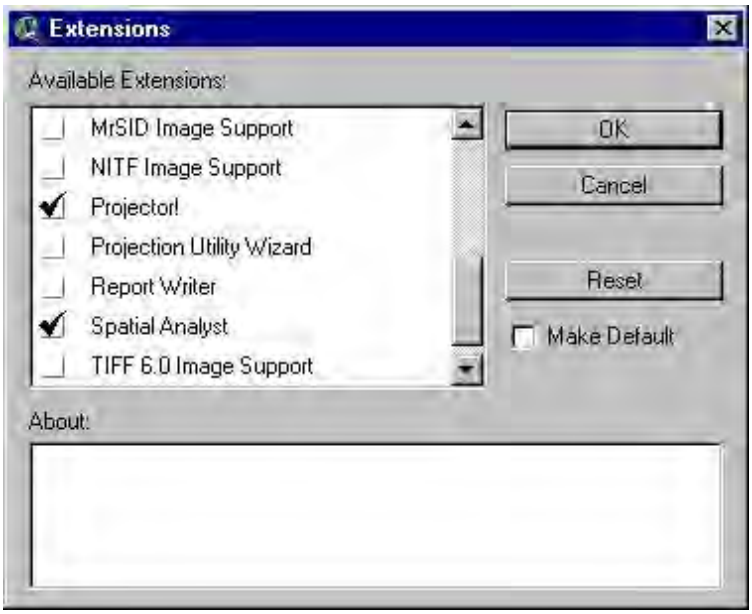
2) Select the **ArcScript projector** (which is authored by ESRI), click on it and select **download**.

3) Choose **accept** and download the file into your **Ext32** folder, which itself is within your **Av_gis 3.2** folder.

4) Open the **Ext32** folder and unzip your downloaded file into it. You will notice one of the results is a file with the ending **.avx**. This is your file extension.

5) If you have ArcView open, close it and then reopen it.

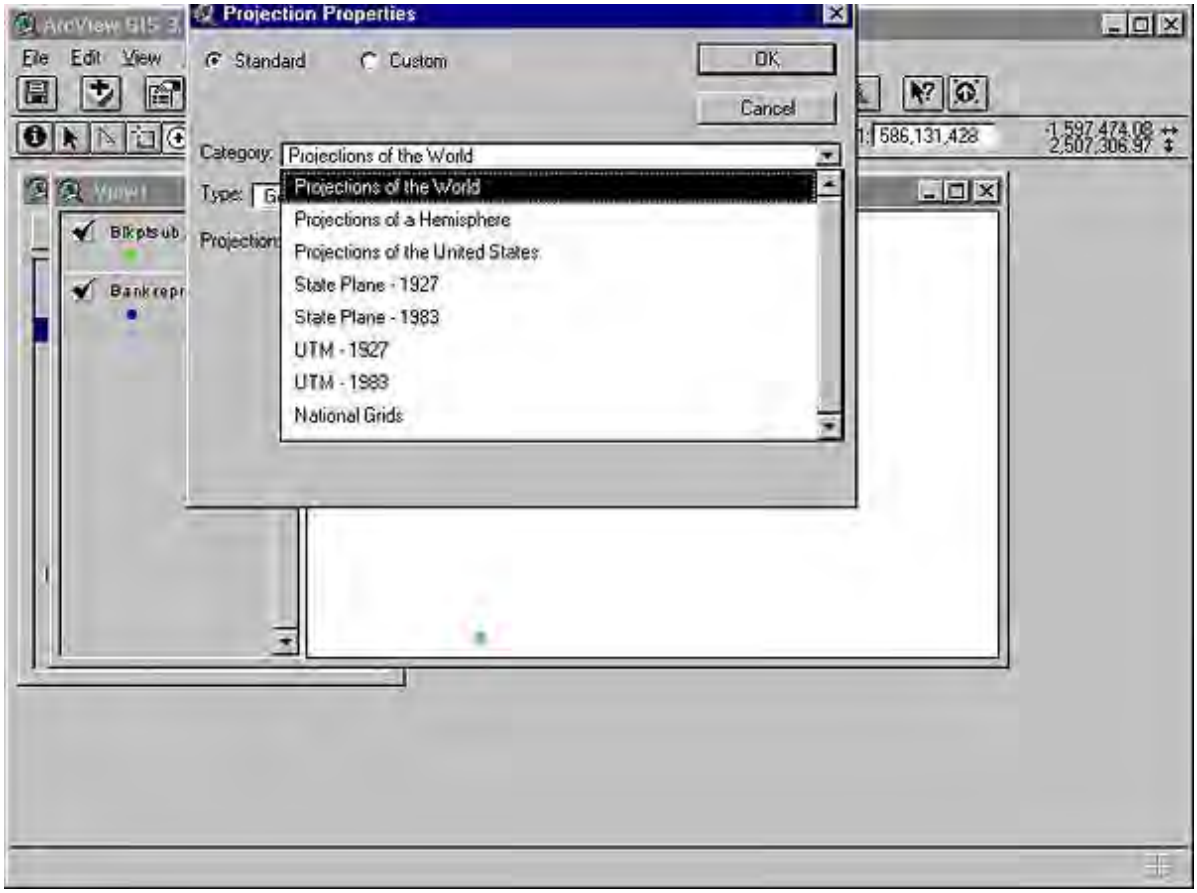
6) Choose **File Extensions** and click on the **Projector** extension.

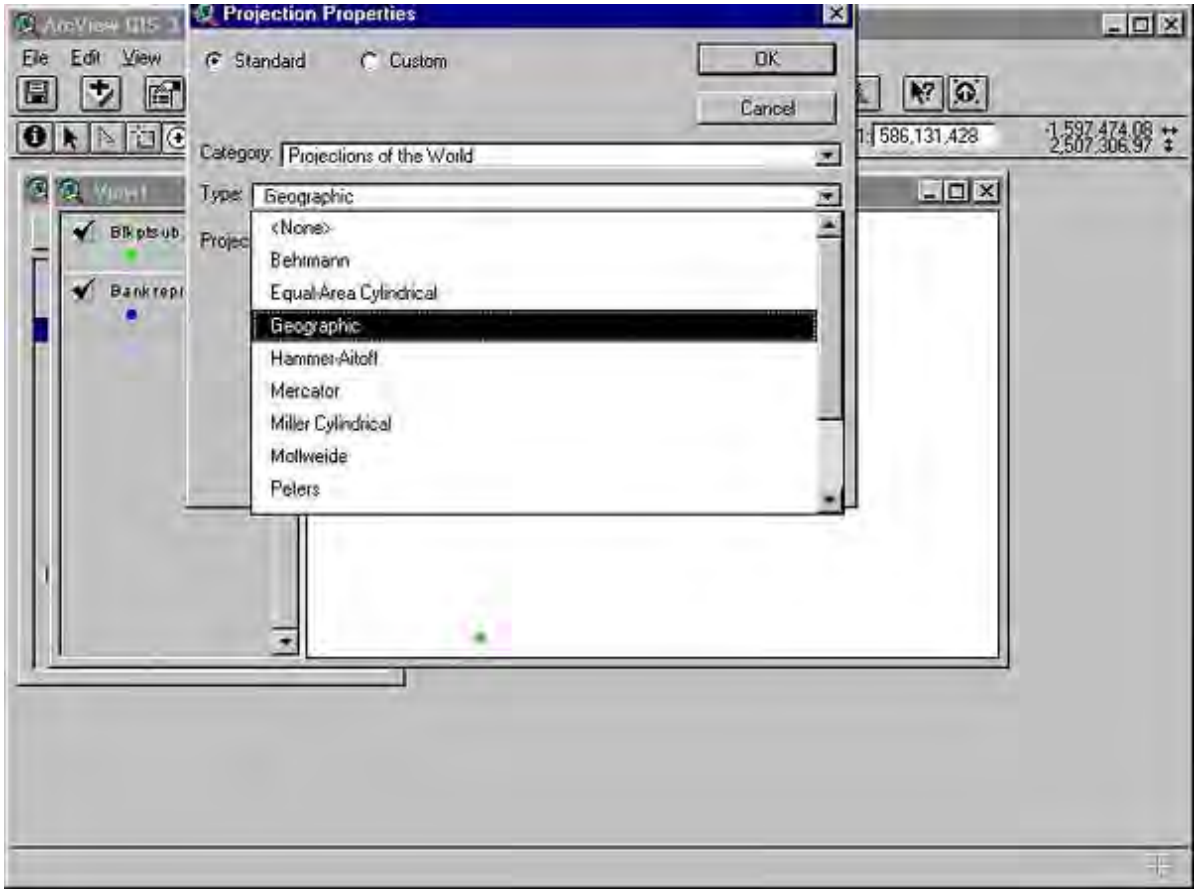


4) Close the extensions window and you will notice that a new icon appears on your ArcTools bar. If the icon does not appear, go to See Pitfall 2.

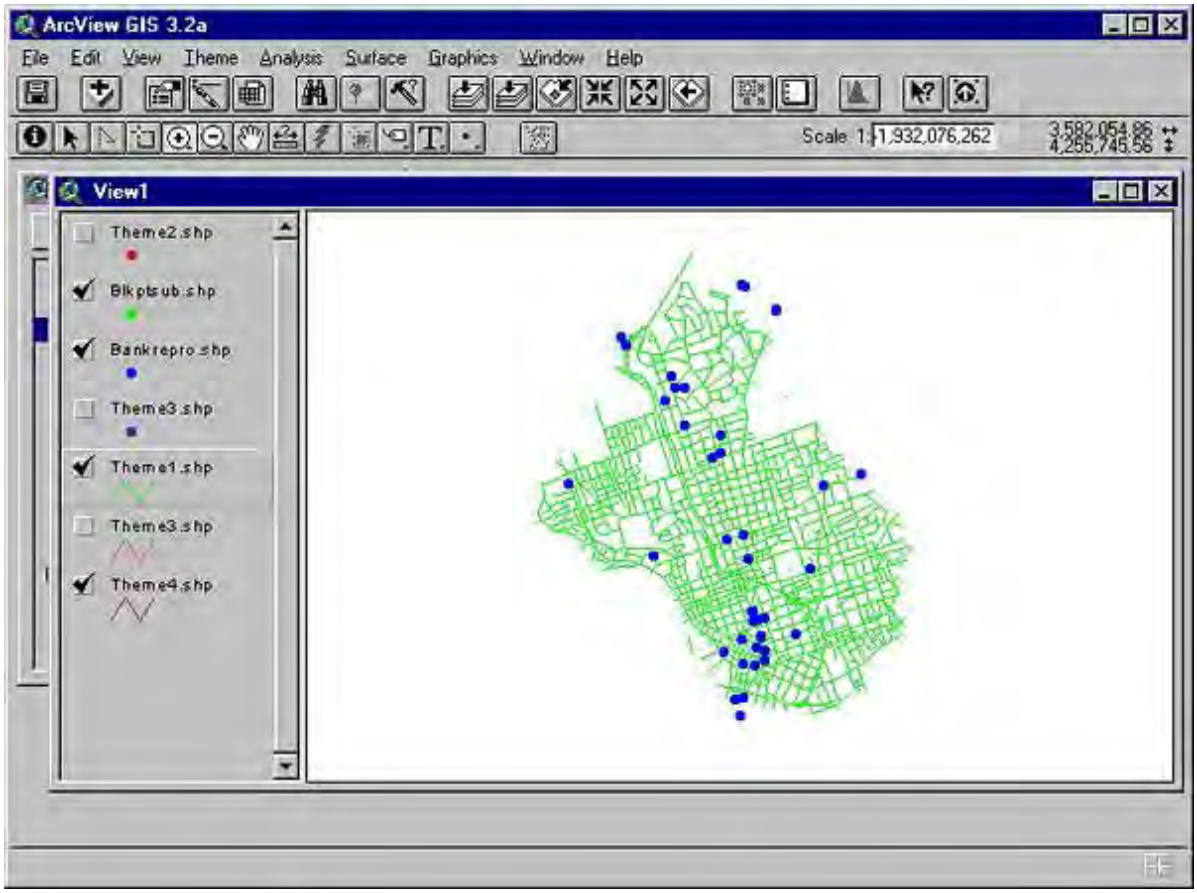
5) To make the theme you want to reproject active, select the key for that theme and click the **Projector** button

6) You will then be guided by a wizard, which will help you choose your units (usually defaulting to meters), then choose which projection family and type you want or need to make your data match up properly. If it is unclear how your data is currently projected, you may want to select a standard projection for every theme, using the **Projector** tool for each. Finally, you will add the newly projected data to whatever view you choose, then name the theme and store it in the appropriate directory.


Projection Properties
Standard
Custom
OK
Cancel
Category:
Projections of the World
Type:
Projection:
Projections of the World
Projections of a Hemisphere
Projections of the United States
State Plane - 1927
State Plane - 1983
UTM - 1927
UTM - 1983
National Grids
File
Edit
View
586,131,428



7) The result is that now all of the data is projected in the same manner (as shown below).



Pitfalls:

- **1)** This error message indicates you must change the map units to the units that you are working with. In this example we are working with meters. If you are doing any distance calculations it is generally good practice to change the distance units to meters also. To change these go to **View->Properties** to find the map units and distance units pull-down bars.
- **2)** If the Projector icon does not show up, exit out of ArcView entirely. Make sure the Projector extension is in the active "ESRI Ext32" folder and it is unzipped. Then run ArcView and turn the extension on. If it the extension still doesn't work, click here.

Authored by: Benjamin N. Sprague **Modified:** 9/10/03

Cookbook: Ben Sprague, Ethan Sundilson, Carlin Wong, Sam Ying

GIS Cookbook: Recipe - Buffering an Area

Keywords: Impact, assessment, government, buffer, analysis, regulations, influence, zone
Category: Buffers
Software: ArcView 3.2

Problem: To buffer an area of influence around an object at a specified distance

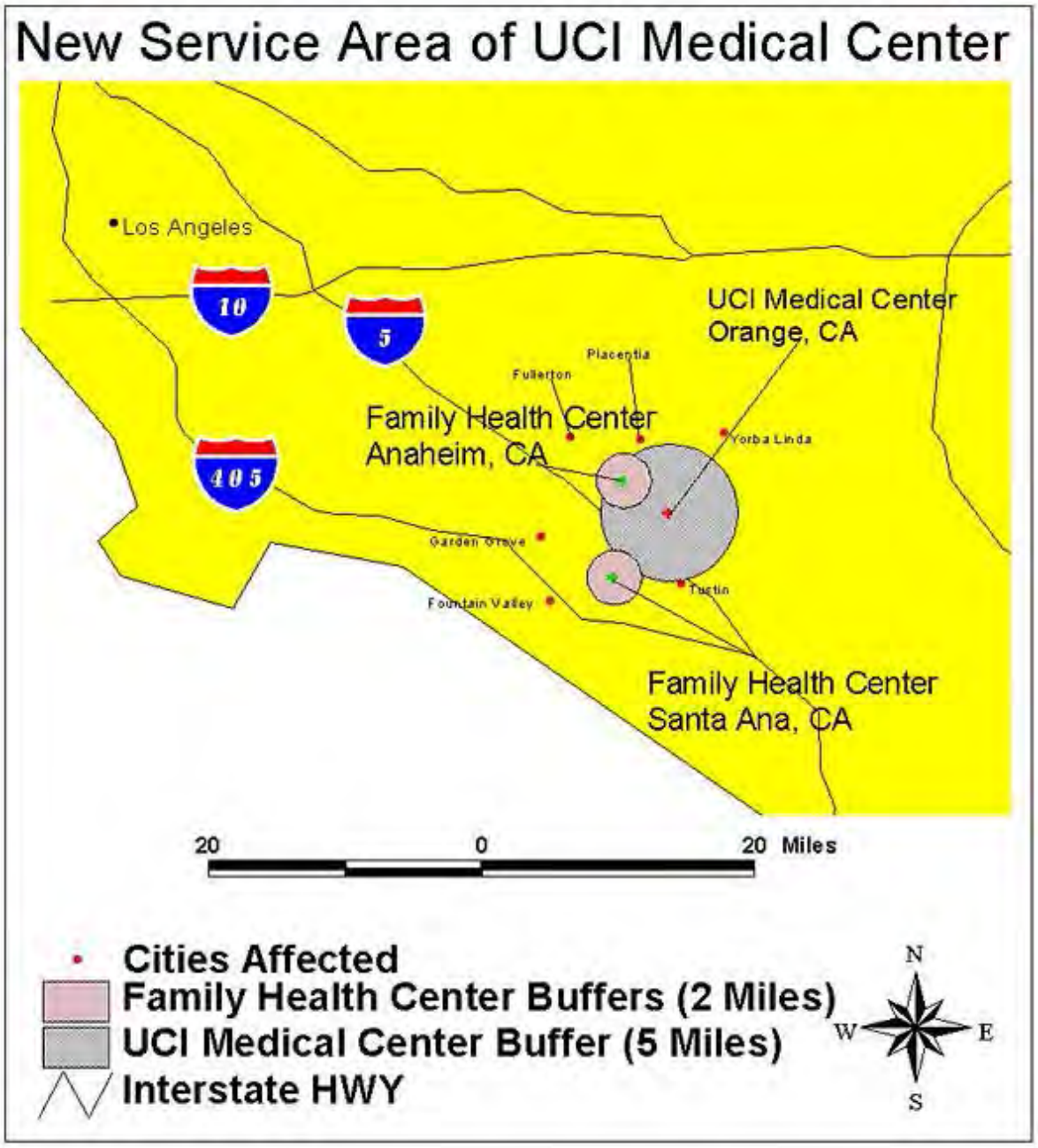
Description: A **buffer** refers to the area contained within a specified distance from an object in space. But why would we want to create one?

Objects in space frequently have some sort of impact on the objects and areas around them. For example, factories emit fumes that can affect people for miles around. Freeways create "noise pollution" that can be heard blocks away. Buffers can be used in these instances to depict a **sphere of influence** in which the people and places within this "sphere" are more significantly impacted by a given phenomenon than those on the outside.

Buffers can also be used to show the reverse -- that is places that are *less* significantly impacted by a given phenomenon *because* they are within a certain distance of an object. These sorts of buffers, known as **zones of protection**, are frequently drawn in relation to regulations attempting to provide protection for special places. Examples include areas around school where liquor stores are prohibited, or protected lands around which shopping malls and urban development are not permitted.

Scenario:
A story appearing in the *Los Angeles Times* provides an illustration of how buffers can be used to analyze and solve problems.[1] The article explained that Irvine Medical Center had found it necessary to reject many of its indigent patients due to a shortage of available hosptial beds. In order to make this adjustment, UCI Medical Center decided to map a five-mile discrete buffer around the hospital, along with a two-mile buffer around the UCI-owned Family Health Centers in Anaheim and Santa Ana, California. In order to display this, buffers were created around the care centers. (In this example we are creating buffers around point features, but buffers can also be done on lines, and areas). When these buffers are in place, indigent people living outside of these buffers will be turned away.

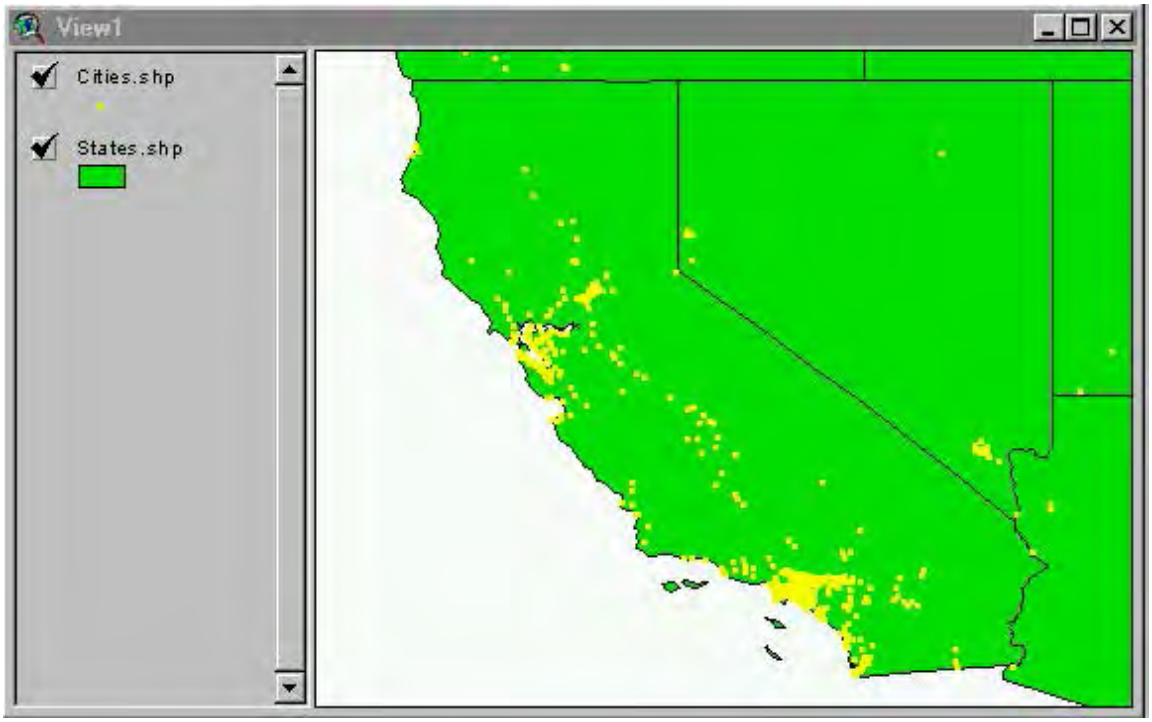
[1] "UC Hospital Capping Indigent Care." *Los Angeles Times*, August 1, 2002.



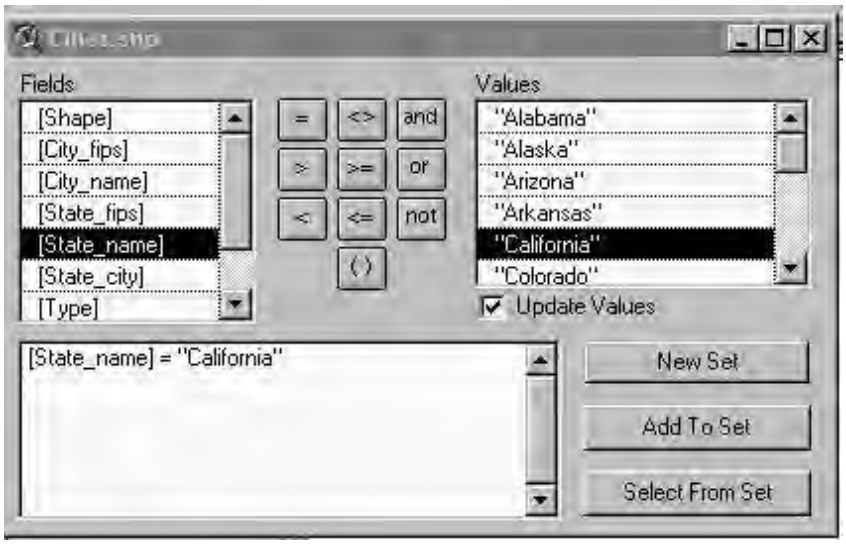
Methodology:

1) Start up ArcView and open a new view.

2) Add the themes that you would like to use in your view for analysis. For information on adding data/themes see ***How to Add Data after opening a New View*** in the *Getting Started* section.



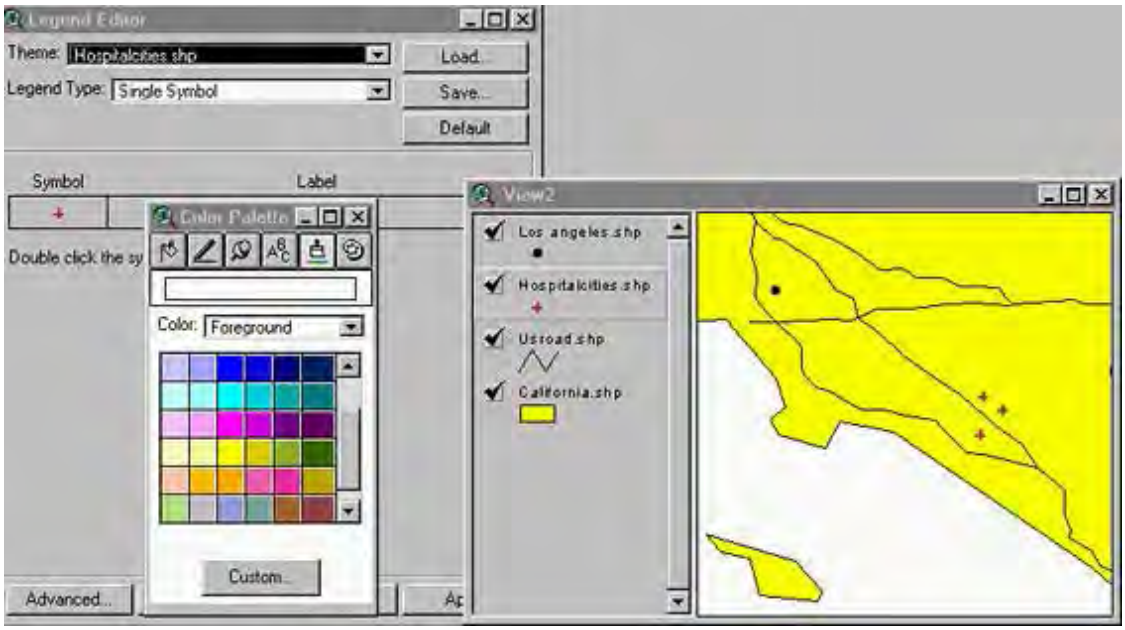
3) Perform queries as necessary to limit your data to relevant areas. By performing queries you are simplifying your data into data relevant to your project. For example, in the illustration below, by entering [State_name]="California" you are selecting only cities in California. Because the buffers to be created only lie in California this query is helpful.



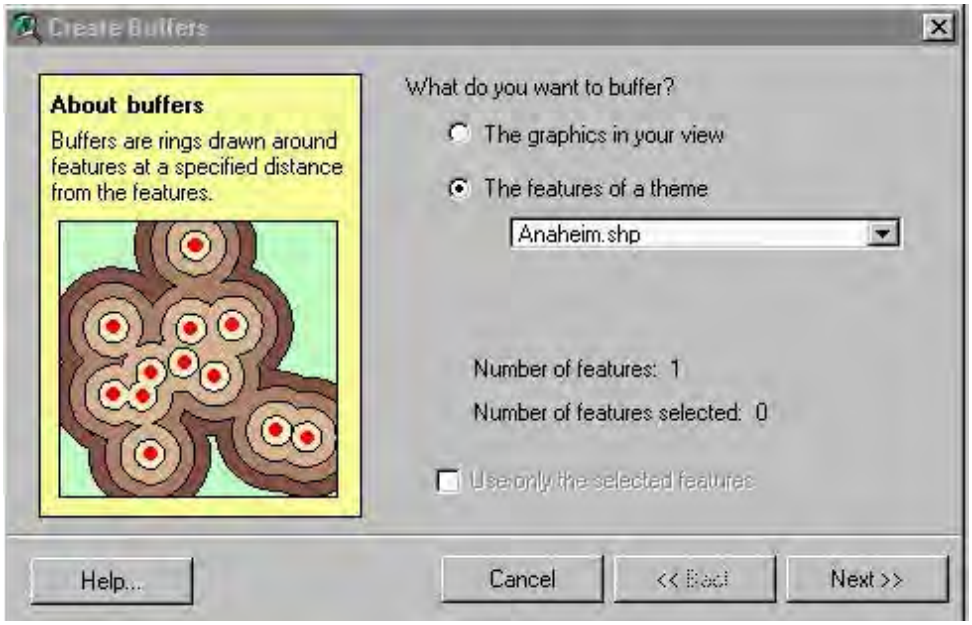
If you are getting a syntax error message on your queries, See Pitfall 1.

4) After you have selected the points, lines, and areas of interest in your project, you need to convert them to shapefiles. To do this, go to **Theme->Convert to Shapefile**. After you have created new shapefiles, you can delete unnecessary themes selecting those themes are clicking **Edit->Delete themes**.

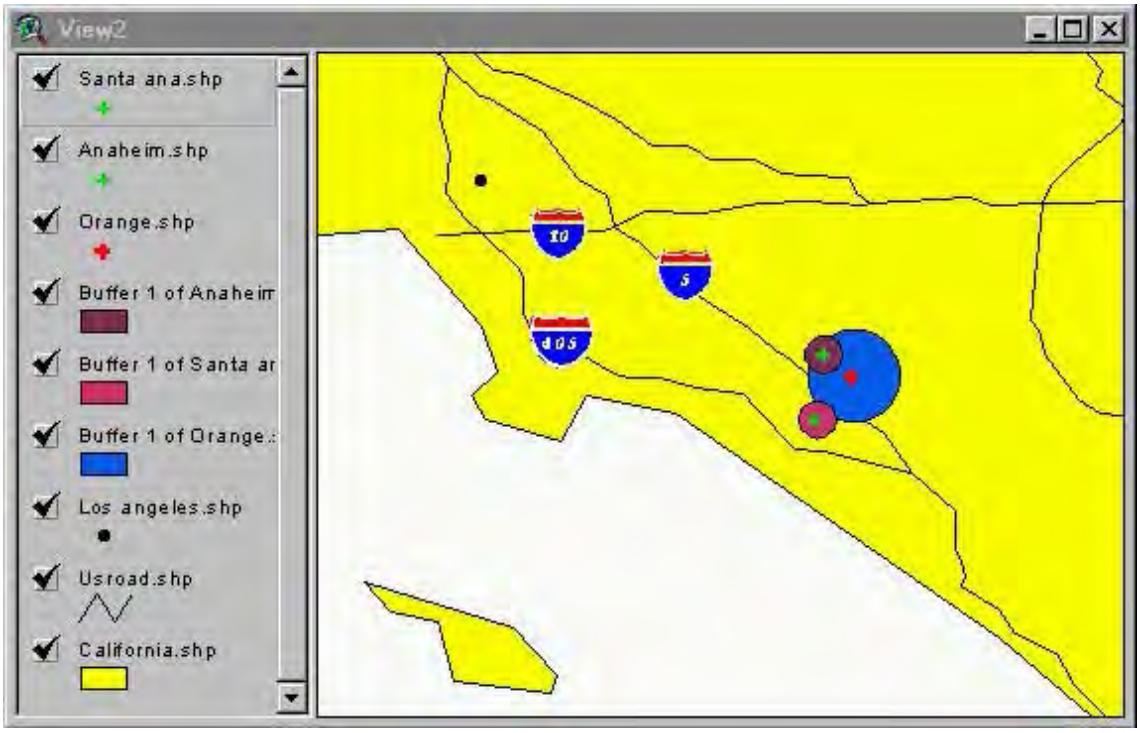
5) Next, double click the themes in your view that you want to edit and now you can change the font, style, and symbol of themes. (In this example, the care centers were given hospital cross symbols, hospitals were changed to red to stand out on the yellow California background, and highways were given highway markers). Now you have a view with themes that are ready to buffer.



6) To create a buffer for your selected theme, go to **Theme->Create Buffers**; in our case we would select the care centers. The buffer wizard will first ask if you want multiple rings or one ring around the geographic area that you want to buffer. This is an important consideration, because sometimes a phenomenon tapers off with increasing distance from an object, rather than ending abruptly at the outside boundary. Multiple buffers allow us to factor in levels of gradation that would be invisible when using a single buffer. In our example, however, the care centers wish to draw a boundary that separates those indigents who are eligible from using the their services from those who are not, so a single, abrupt boundary for each is justified.

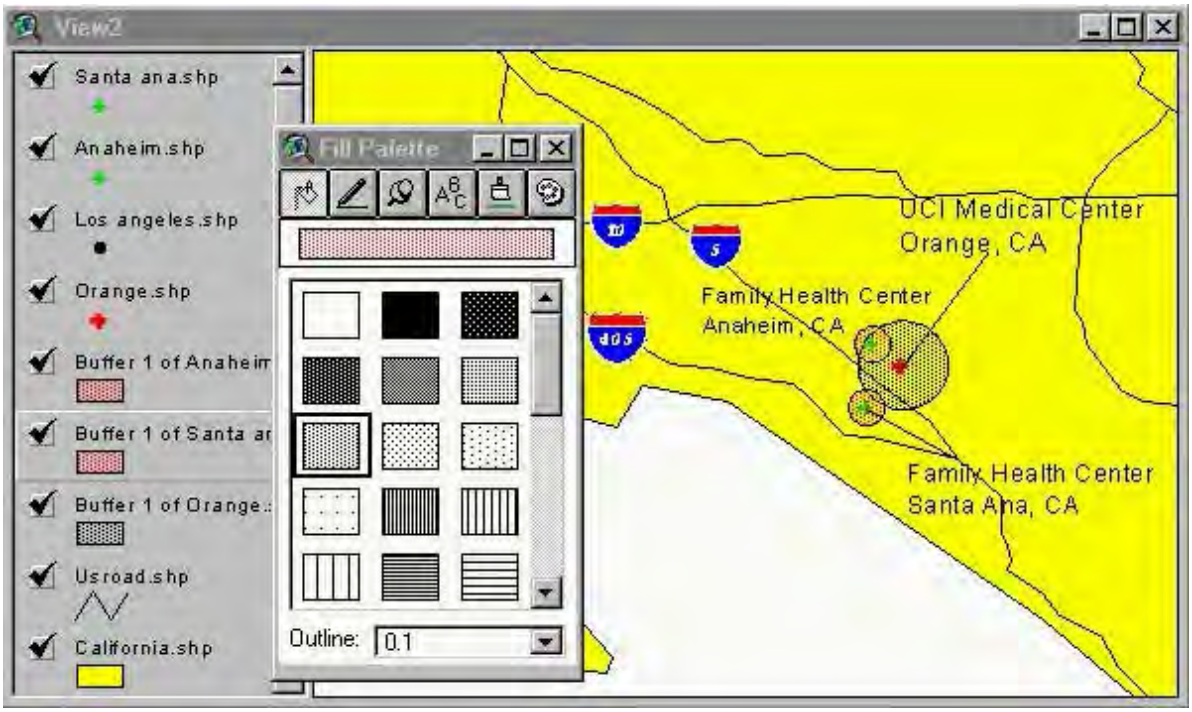


7) Next provide the distance units to use and the distance to include in your buffer. (Be sure that the distance units used in your view matches the distance units specified for the buffer. If you need to change the view distance units go to **View->Properties**). Here, miles were used as the distance units, as the map is of a relatively large scale. (Smaller distance units should be used when using smaller scale maps). Next specify whether or not to dissolve barriers in the buffer. (Choosing to dissolve barriers will unite that theme's buffered zones into one area. Conversely, choosing not to disolve barriers, will give each new buffer a discrete area). Finally, add completed buffer as a new theme in order to add data to your view. (To change colors on the display, go to CSISS Cookbook section *Cartographic Design*.)



If you have specified multiple rings and only one buffer ring is shown, See Pitfall 2

8) To make your buffer rings transparent, first bring up the **Legend+Editor class=term>Legend Editor** by double clicking on the theme. Then double click the symbol to open the pallete. Select the middle pallete on the left side. Next click the **paintbrush** symbol and choose any color foreground that you want along with no background. Click **Apply**.

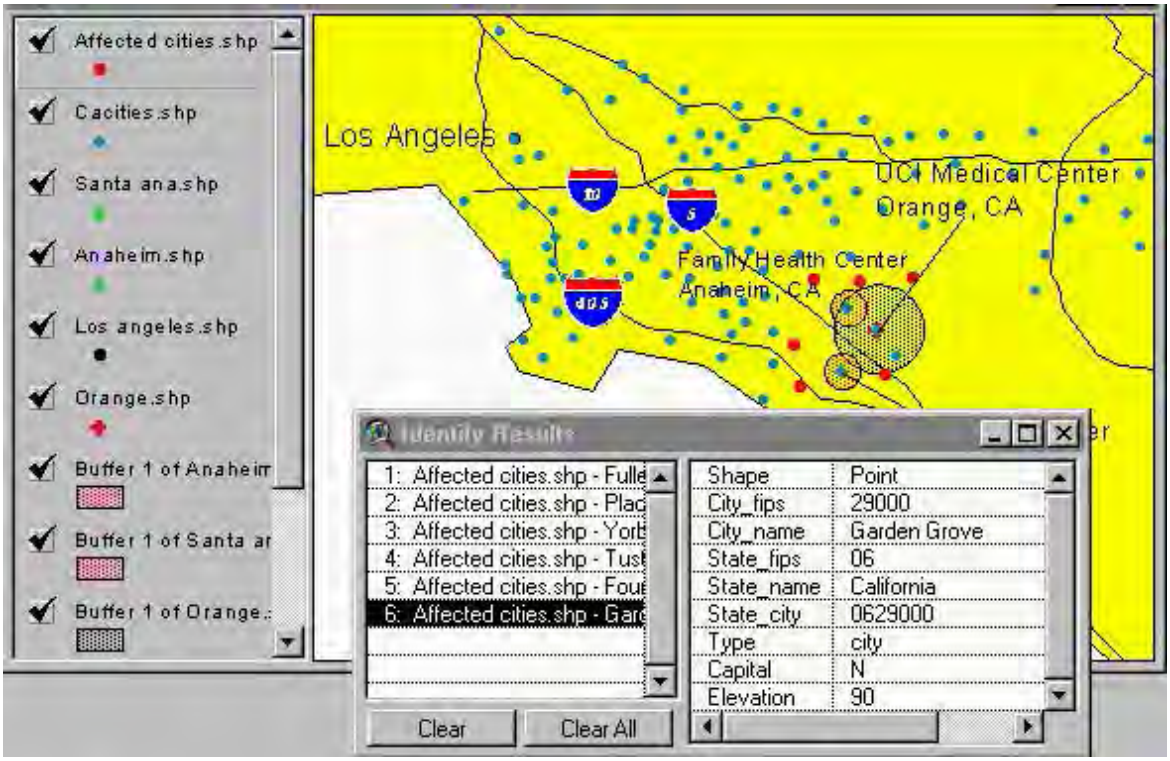


9) To label themes, with the theme selected go to **Theme->Auto-label...** .
Select the field that you want to label and check themes text label placement property. You can move the labels around by clicking on the map and dragging each individual label.

If you are unable to label a certain theme, See Pitfall 3

10) In this example, people affected by the buffers are people living outside of the influence buffer. Because of this, a good application would be to select the cities that are found just outside of the buffer. In order to do this, you would first click the **Select Feature** tool and choose the cities that you want to

select. After you have done this, **Convert to Shapefile...** and add it to your view. To get a description of each point, you would use the identify tool to see the attributes of each point. (Another way to select cities that are close to the buffered zone, is to make another buffer(s) around the existing buffers.



11) Again, add labels as needed. To create a map go to **View->Layout.** Edit your title, legend, Scale+Bar class=term>scale bar, north arrow, and neatline(s) to make the map more dynamic.

12) Finally, export your map to a format that suits your needs such as jpeg or bitmap. To do this go to **File->Export...**.

August 7, 2002

CITY_FIPS	CITY_NAME	STATE_NAME
86832	Yorba Linda	California
28000	Fullerton	California
57526	Placentia	California
29000	Garden Grove	California
80854	Tustin	California
25380	Fountain Valley	California

Pitfalls:

- **1)** If you receive a syntax error on your queries you are not giving your query in the correct form. For example, you may be missing a parentheses or having a spelling error. An easy way to eliminate the very common parenthesis problem is to query values one at a time, and after each one clicking **Add to Set.** This will cut down on the number of parenthesis used and thus will give less errors. Link
- **2)** If only one ring is shown, you must specify on the legend editor that you want graduated color as your legend type. In addition, you need to have buffer distance as your classification field in order to display the buffer. Link
- **3)** If you are unable to label a certain theme, it is probably because the theme that you are trying to label does not contain a field in its associated attribute table that contains labels that can be put on a map. For example, the new buffer theme will only contain two fields before editing, namely shape and buffer distance. To be able to label theme areas, you must use a theme that contains fields that can be used for labeling such as the field "city name."

Authored by: Ethan Sundilson **Modified:** 9/17/03

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GIS Cookbook: Recipe - Buffering an Area

Keywords: Buffers, impact, assessment
Category: Buffers
Software: ArcGIS 8.x

Problem: You want to an area of influence around an object at a given distance.

Description: A **buffer** refers to the area contained within a specified distance from an in space. But why would we want to create one?

Objects in space frequently have some sort of impact on the objects and areas around them. For example, factories emit fumes that can affect people for miles around. Freeways create "noise pollution" that can be heard blocks away. Buffers can be used in these instances to depict a **sphere of influence** in which the people and places within this "sphere" are more significantly impacted by a given phenomenon than those on the outside.

Buffers can also be used to show the reverse -- that is places that are *less* significantly impacted by a given phenomenon *because* they are within a certain distance of an object. These sorts of buffers, known as **zones of protection**, are frequently drawn in relation to regulations attempting to provide protection for special places. Examples include areas around school where liquor stores are prohibited, or protected lands around which shopping malls and urban development are not permitted.

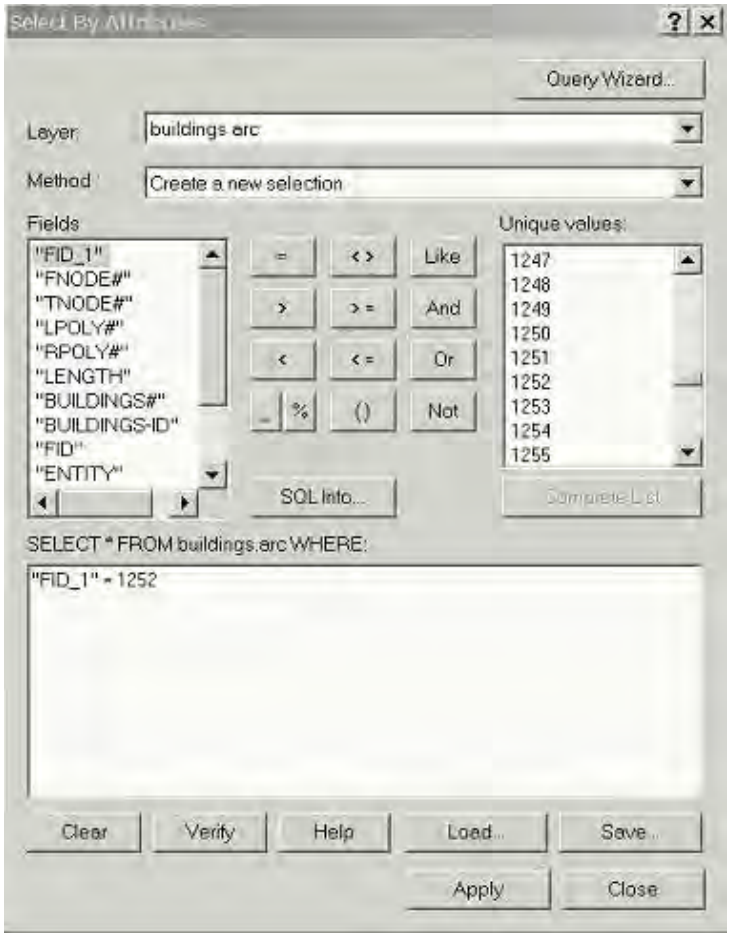
Methodology:
1) Open ArcMap.

2) Add your datasets. If you need assistance with adding your data, see Add Data.

3) Click to hightlight the that contains the to be buffered.

To .

Enter the fields and unique values.



Note: Be sure the correct layer is being used and that Create a New Selection is set as the method.

Click **Apply**.

4) Return to the same layer in the display window and right click on this layer.

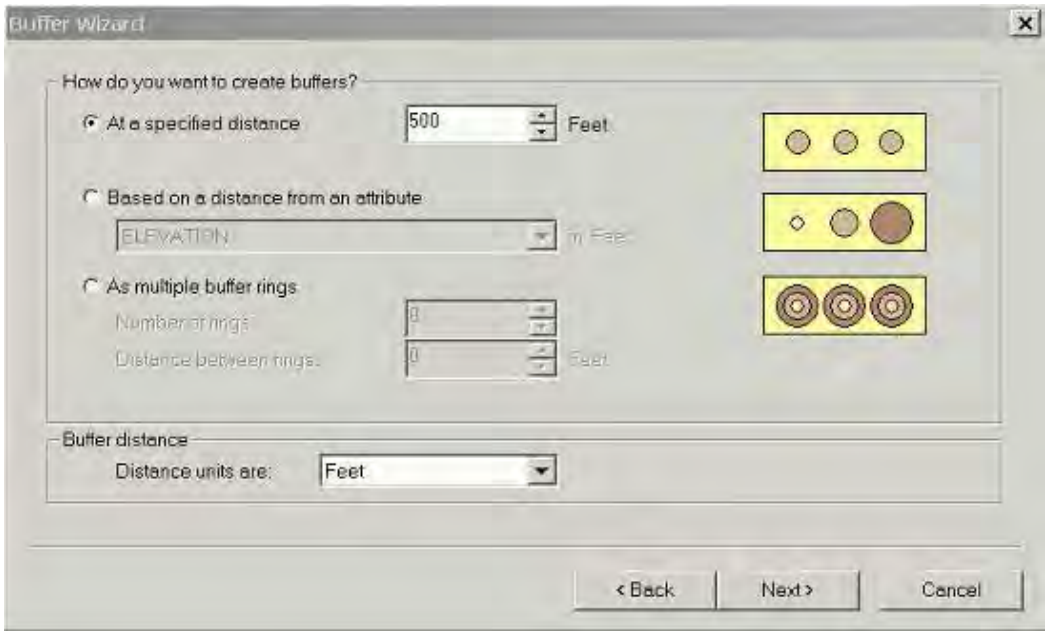
Scroll down to **Selection**, then to **Create Layer From Selected Features**.

5) Go to Tools and scroll down to **Buffer Wizard**.

Note: Be sure the newly created layer is being used

-Click **Next**.

6) The buffers are created according to one of three options: 1) at a specified distance; 2) based on a distance from an attribute; or 3) as multiple buffer rings.



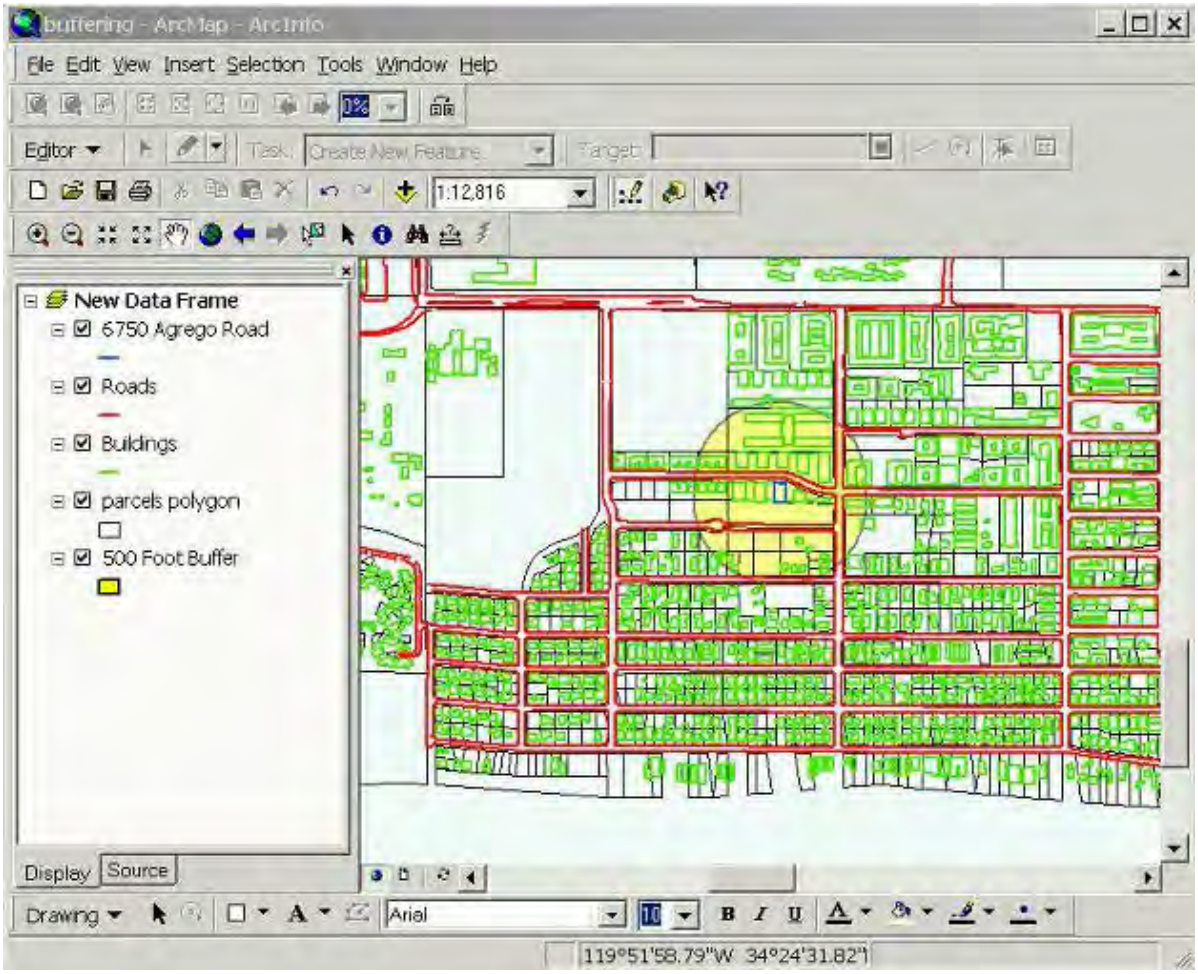
7) Select a **Buffer Distance**.

8) Click **Next**.

9) Choose whether to **between buffers**.

10) Enter an output name under **Specify output shapefile** or
.

11) Click **Finish**.



Authored by: Carlin Wong **Modified:** 9/10/03

Center for Spatially Integrated Social Science

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GIS Cookbook: Recipe - Buffering an Area

Keywords: Buffers, impact, assessment
Category: Buffers
Software: ArcGIS 9.x

Problem: You want to an area of influence around an object at a given distance.

Description: A **buffer** refers to the area contained within a specified distance from an in space. But why would we want to create one?

Objects in space frequently have some sort of impact on the objects and areas around them. For example, factories emit fumes that can affect people for miles around. Freeways create "noise pollution" that can be heard blocks away. Buffers can be used in these instances to depict a **sphere of influence** in which the people and places within this "sphere" are more significantly impacted by a given phenomenon than those on the outside.

Buffers can also be used to show the reverse -- that is places that are *less* significantly impacted by a given phenomenon *because* they are within a certain distance of an object. These sorts of buffers, known as **zones of protection**, are frequently drawn in relation to regulations attempting to provide protection for special places. Examples include areas around school where liquor stores are prohibited, or protected lands around which shopping malls and urban development are not permitted.

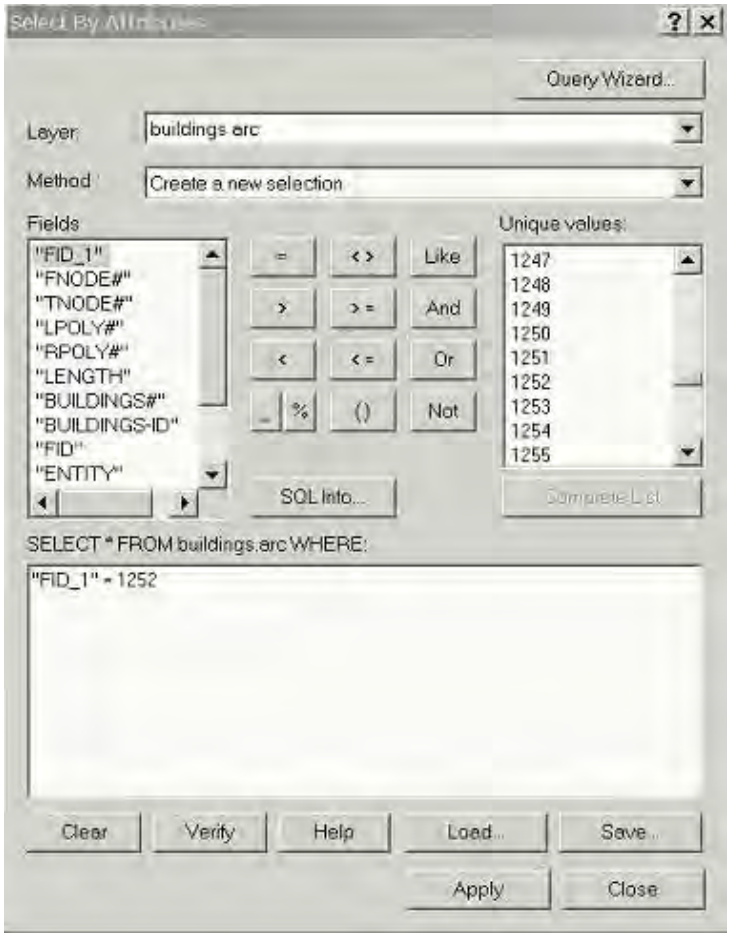
Methodology:
1) Open ArcMap.

2) Add your datasets. If you need assistance with adding your data, see Add Data.

3) Click to hightlight the that contains the to be buffered.

To .

Enter the fields and unique values.



Note: Be sure the correct layer is being used and that Create a New Selection is set as the method.

Click **Apply**.

4) Return to the same layer in the display window and right click on this layer.

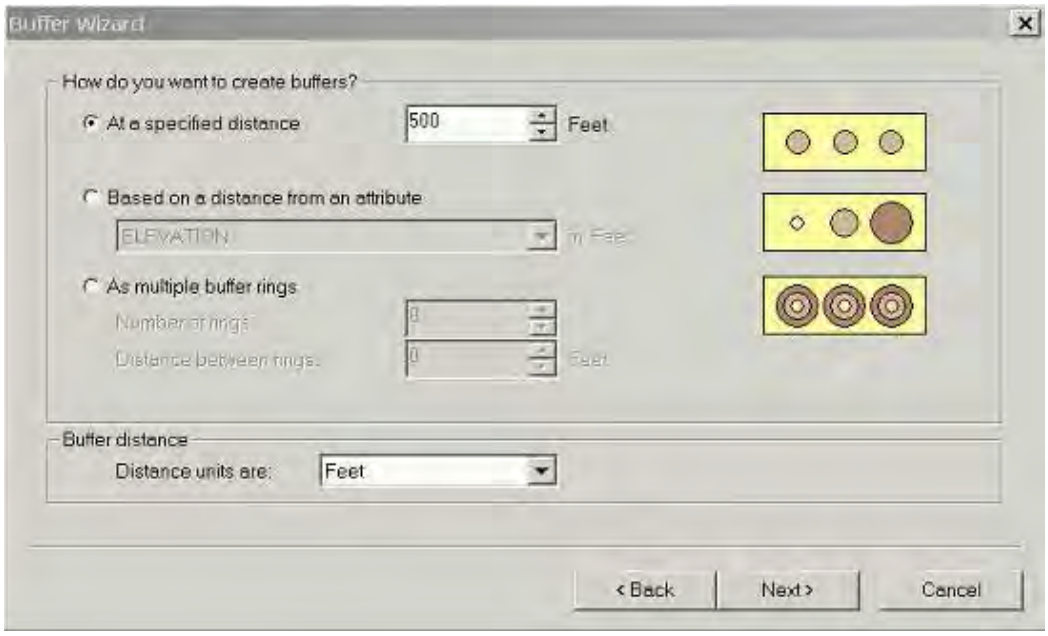
Scroll down to **Selection**, then to **Create Layer From Selected Features**.

5) Go to Tools and scroll down to **Buffer Wizard**.

Note: Be sure the newly created layer is being used

-Click **Next**.

6) The buffers are created according to one of three options: 1) at a specified distance; 2) based on a distance from an attribute; or 3) as multiple buffer rings.



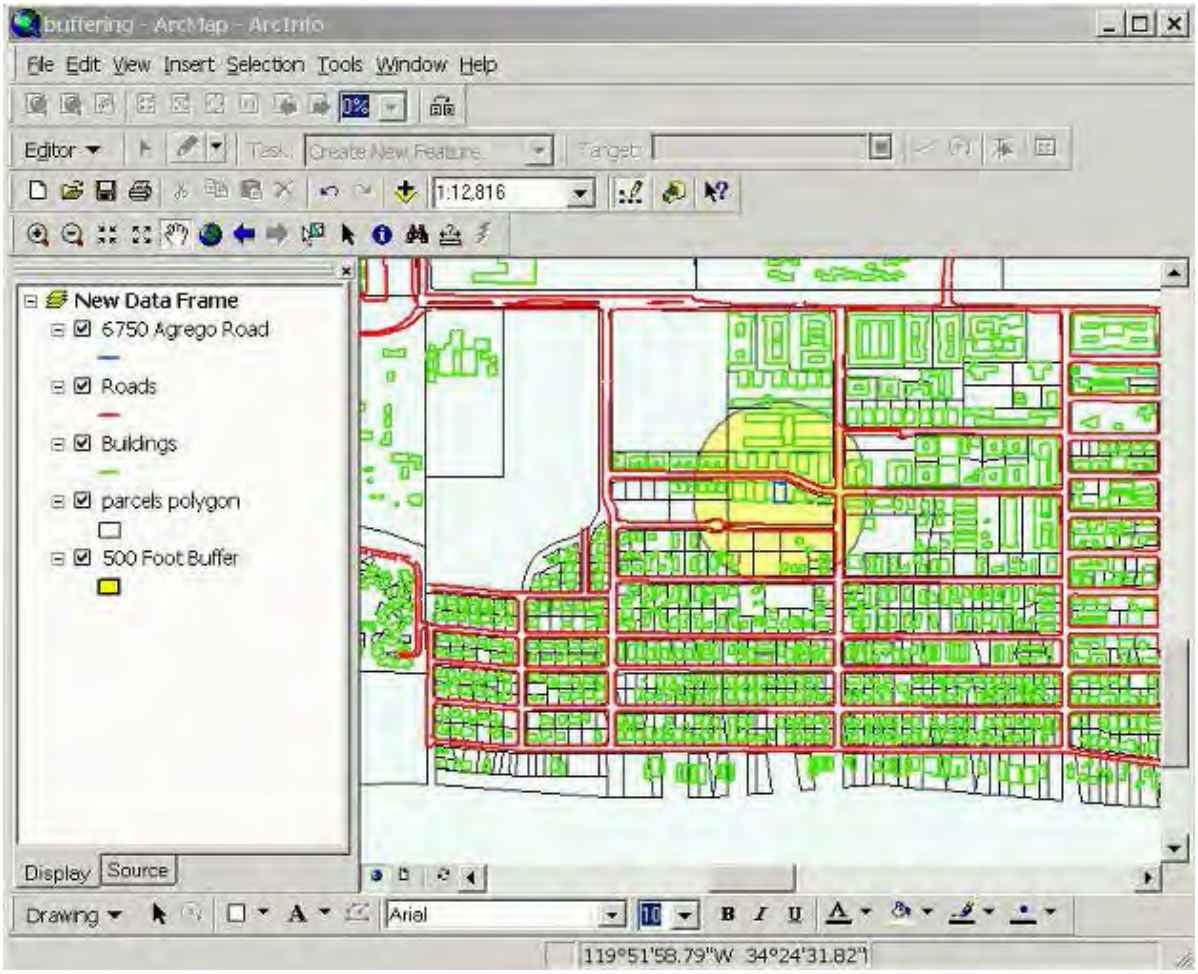
7) Select a **Buffer Distance**.

8) Click **Next**.

9) Choose whether to **between buffers**.

10) Enter an output name under **Specify output shapefile** or
.

11) Click **Finish**.



Authored by: Jim Detwiler **Modified:** 11/9/04

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GIS Cookbook: Recipe - How to Geocode Addresses

Keywords: Geoprocessing, geocode, geocoding, address, address matching, street, zip, zone, address number, street name, location, address table
Category: Geocoding
Software: ArcView 3.2

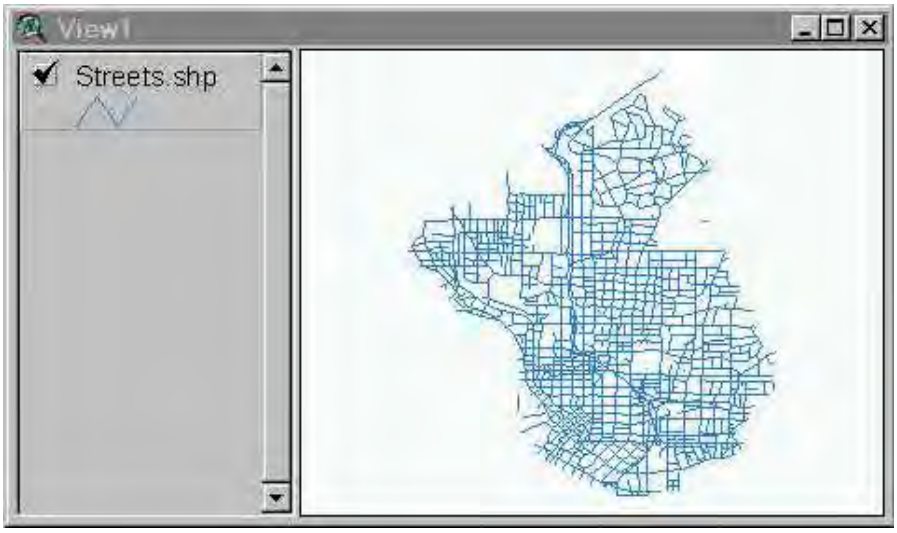
Problem: I have a list of patients' addresses. How do I plot their locations on a map?

Description: buffers and density estimation.

Scenario:
A fictitious epidemiological study taking place in Atlanta, Georgia, will be used as the example for this recipe. A sociologist working with an emergency room doctor is trying to see if there are any patterns in the distribution of children who enter emergency rooms with fevers. The research group is prepared with an Excel DBF4 table of the patients' home addresses and a street network of Atlanta as their reference theme feature onto which the addresses will be geocoded. Their table of addresses is far from perfect and this recipe will guide you through the different pitfalls one might encounter when geocoding.

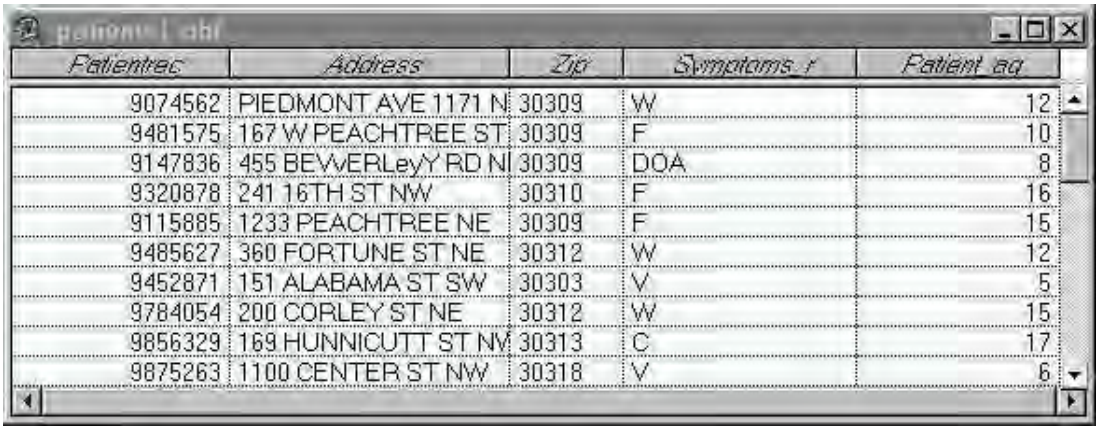
Methodology:
1) Open a New View and use the Add Data button

to add your reference theme feature (in this case, it is the street network of Atlanta, GA) After we added the street network, the view now looks like this:



2) Go to the project window and click on **Tables**.

Click **Add** and navigate to *.dbf* (the suffix for database files) file of address. Below is a screen shot of the *.dbf* we are using. Fields in the database include the patient record number, the patient address, zip code, symptoms when entering the emergency room, and the patient age.

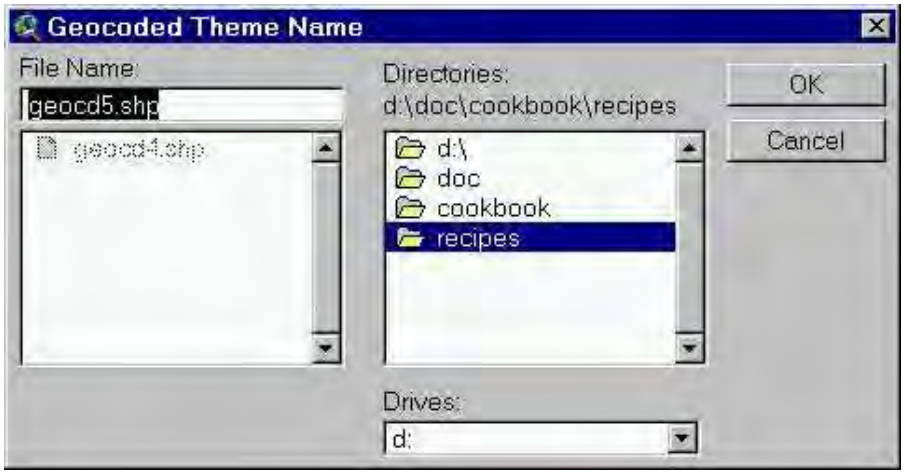


Patientrec	Address	Zip	Symptoms_r	Patient_ag
9074562	PIEDMONT AVE 1171 N	30309	W	12
9481575	167 W PEACHTREE ST	30309	F	10
9147836	455 BEVVERLeyY RD NI	30309	DOA	8
9320878	241 16TH ST NW	30310	F	16
9115885	1233 PEACHTREE NE	30309	F	15
9485627	360 FORTUNE ST NE	30312	W	12
9452871	151 ALABAMA ST SW	30303	V	5
9784054	200 CORLEY ST NE	30312	W	15
9856329	169 HUNNICUTT ST NW	30313	C	17
9875263	1100 CENTER ST NW	30318	V	6

3) Make the View1 window active by clicking on it. Go to the main menu bar and click **View->Geocode Addresses**. The Geocode Addresses window should pop up. Fill in the fields following the field labels.

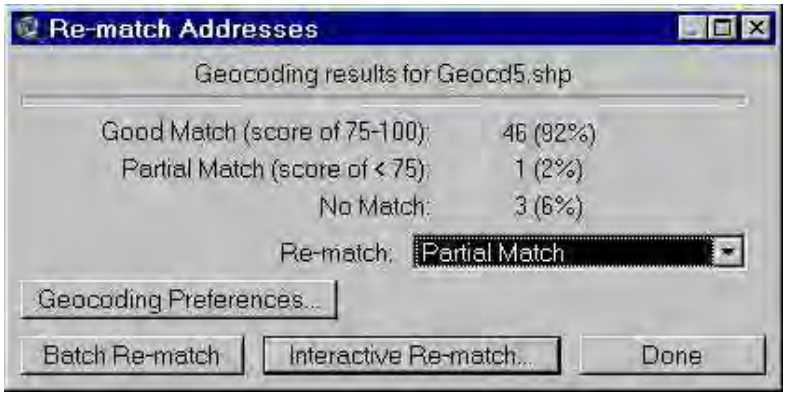
Remember to select in which folder you would like to save your new geocoded address shapefile. Click the Folder button

and navigate to the appropriate directory (it may be helpful to save your new file in the same folder as your *.dbf*, but this is not required).



After you have selected your file location, click the Batch Match button

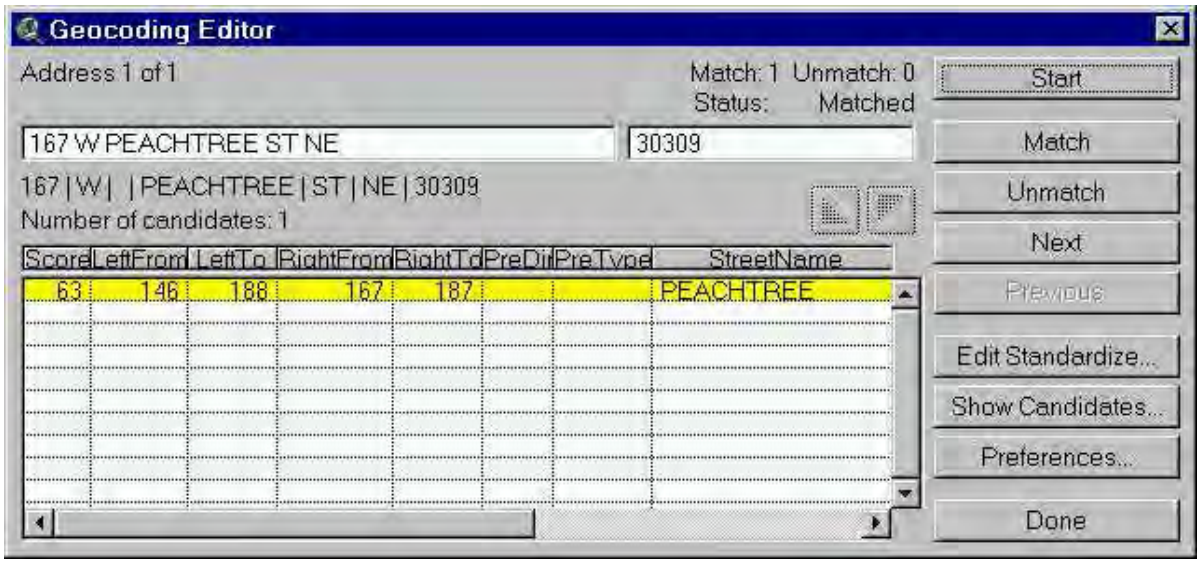
4) A window showing your geocoding results will pop up.



Because of errors in your address database, in this case it was in the *patient1.dbf*, you will get *Partial* or *No Matches*. *Partial matches* occur when the address record appears partially on the reference theme (e.g. the street name is correct, but the address number does not fit what is available in the reference theme). *No Matches* occur when there are gross spelling mistakes where the program cannot recognize the name, or other mistakes that would cause the reference theme to not recognize the address at all within the options in the reference theme. Information about these scenarios is included in the ArcView 3.2 *Help Menu*.

5) In this example we were able to match all addresses in the *patient.dbf* file except for one partial match and three that did not match anything at all. To view why the addresses did not match, click the Interactive Re-match button

6) The Geocoding Editor should appear.

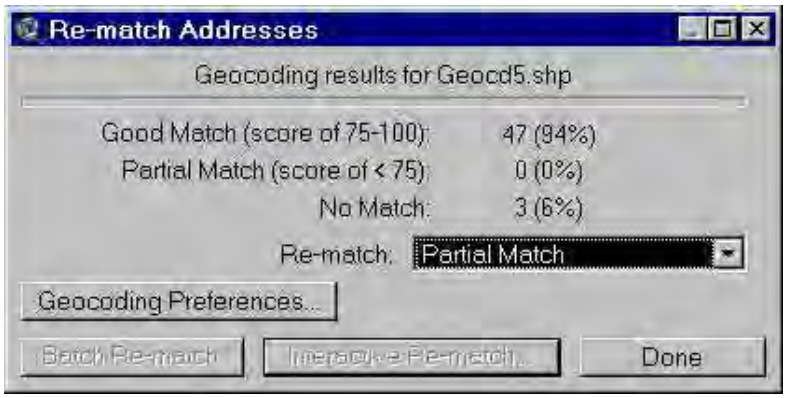


The editor displays the address shown in *.dbf* file of address, and below that, show the closest options available within the reference theme. You can either change your address entry if you find there is a mistake, or you can select one of the addresses the editor gives you. In this case, a 0 has been omitted from the address number. So we will change it from "167 W Peachtree" to "1670 W Peachtree".

After you are done with the adjustments, click the Match button.

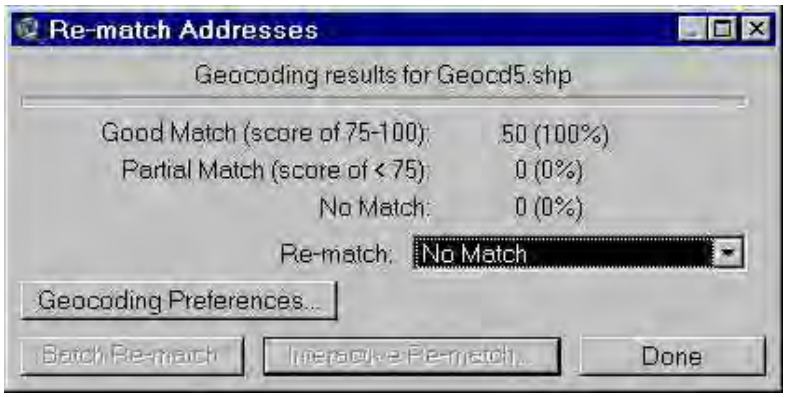
7) After selecting **Match**, the editor will search through the reference theme once more and give you a new list of options. Usually, if there is a match, the correct one will be highlighted in yellow.
After you are done, click the **Done** button.

8) The Geocode Editor will then return you to the Re-Match Address Window showing you have now resolve the partial match address.



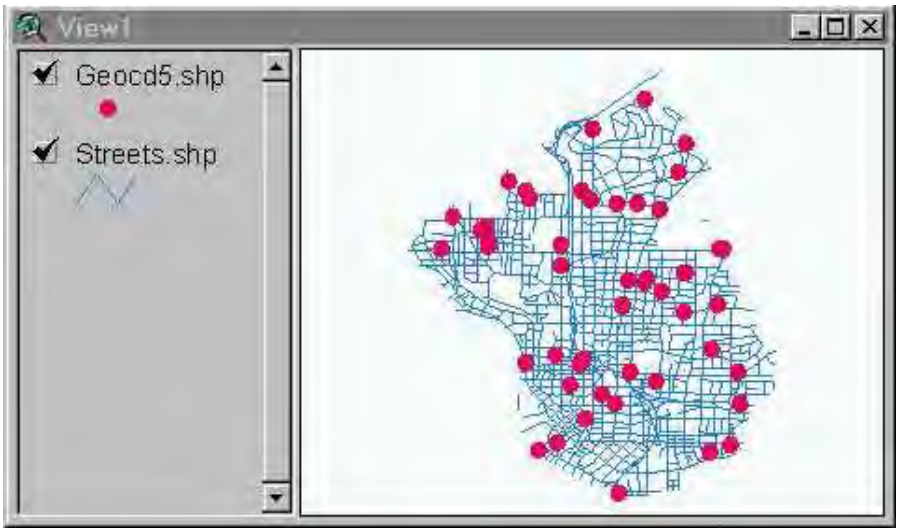
Next to Re-Match, scroll down the menu to select the No-Match option. Repeat the same procedure you executed with the partial matches to find the correct matches. Select **Done** when you have corrected all the un-matched addresses. If you are still having problems, See Pitfall 1.

9) After you have matched all the addresses correctly, the Re-match Address window should show 100% matches.



Click **Done**.

10) Within your View1, there should now be the added geocoded address theme. Click the box next to your new theme's name for the theme to display your geocoded points.



11) To change the look of your points, please see CSISS Cookbook section *Cartographic Design*.
Pitfalls:

- **1)** A partial or no match result can be due to one of several mistakes. If your address has not been entered in the standard format (i.e. address number, street name, street type, and direction), you may get an error result. Extreme misspellings of street names (usually involving four or more incorrect

letters) will cause a no match result. You can lower the spelling sensitivity (and thus give more leeway for typos) by going to the preference menu on the Re-match Address window. In addition, pairing an Incorrect zip code with a correct address will cause a no match result.

-

Authored by: Sam Ying **Modified:** 9/10/03

Center for Spatially Integrated Social Science

close

GIS Cookbook: Recipe - How to Geocode Addresses

Keywords: Geocoding, geocoding services, geoprocessing, geodatabase, address matching, address number, locations, representations, reference theme, street, street name, zones, zip code
Category: Geocoding
Software: ArcGIS 8/9.x

Problem: I have a list of locations of armed robberies, how do I display these locations onto a map?

Description: Geocoding is the process of matching a particular address with a geographic location. This is done through matching records in two databases, one containing a list of addresses, the other containing information about a street network. The geocoding tool will match a given address with its unique position within the street network. Since the street network will already have been located in geographic space with reference to some coordinate system, assigning a given address on the street network also has the effect of locating that address in geographic space as well.

Scenario:
A criminologist wants to map the reported cases of armed robberies on businesses in Atlanta, Georgia, in order to reveal spatial patterns in the robbery data that may shed new light on the phenomenon. Such information can be used to predict future crimes or even as evidence against a known suspect. The criminologist is working with two files. One is a table of victimized business addresses and the other is an Atlanta, Georgia street shapefile.

Methodology:
The geocoding in this recipe will be done in ArcCatalog. Note that geocoding can also be done in ArcMap (**Tools > Geocode Addresses**).

1) Open ArcCatalog.

2) Find the address table you want to geocode.
See Pitfall 1

Note: The table icon should look similar to this.

OID	NAME	ADDRESS	ZIP
0	Ace Market	1171 PIEDMONT AVE NE	30309
1	Andrew's Gasoline	1670 W PEACHTREE ST NE	30309
2	AP Supermarket	455 BEVERLY RD NE	30309
3	Atlanta Market	241 16TH ST NW	30318
4	Beans and Stuff	1233 PEACHTREE ST NE	30309
5	Big Sky Groceries	360 FORTUNE ST NE	30312
6	Breakfast in Atlanta	151 ALABAMA ST SW	30303
7	Bud's Gas Station	200 CORLEY ST NE	30312
8	Camp Service Station	169 HUNNICUTT ST NW	30313
9	Central Petroleum	1100 CENTER ST NW	30318
10	Charlie Cota Inc.	400 EIGHTH ST NW	30318
11	City Food Market	501 ETHEL ST NW	30318
12	Clemenly's	421 SPRING ST NW	30308
13	Crossroads Theater	120 MEMORIAL DR SE	30312
14	Damar Sales	388 7TH ST NE	30308
15	Dan's Taco Emporium	1032 CENTER ST NW	30318
16	Derby's Market	1001 CENTER ST NW	30318
17	Dream Ice Cream	77 MILLS ST NW	30308
18	Eastern Express	150 6TH ST NE	30308
19	Flash in the Pan	101 BAKER ST NW	30308
20	Food Mart	670 10TH ST NW	30318
21	Foodmart	20 WILLIAMS ST NW	30303
22	Gelroy Deli and Cafe	762 ARGONNE AVE NE	30308
23	Henry's Deli and Imports	1250 FRANCIS ST NW	30318
24	Hometown Plaza	500 RANKIN ST NE	30308
25	Hugh's Service Station	299 MILLS ST NW	30313
26	Ivy's	701 JUNIPER ST NE	30309
27	Lass's Supermarket	191 15TH ST NE	30309
28	Le Cafe	555 10TH ST NE	30309
29	Los Angeles Plaza	220 6TH ST NE	30308
30	Lyle's	290 CLIFTON PL NE	30308
31	Merchant's	162 WESTMINSTER DR NE	30309
32	Mike's	661 14TH ST NW	30318
33	New Screen Center	1000 TECHWOOD DR NW	30318
34	Oar and Co	400 7TH ST NE	30308

Note: When opened, the table should contain an address field similar to the one in the example above.

3) Right-click on this table and select **Geocode Addresses**.

4) Select a geocoding service to use, then click **OK**.

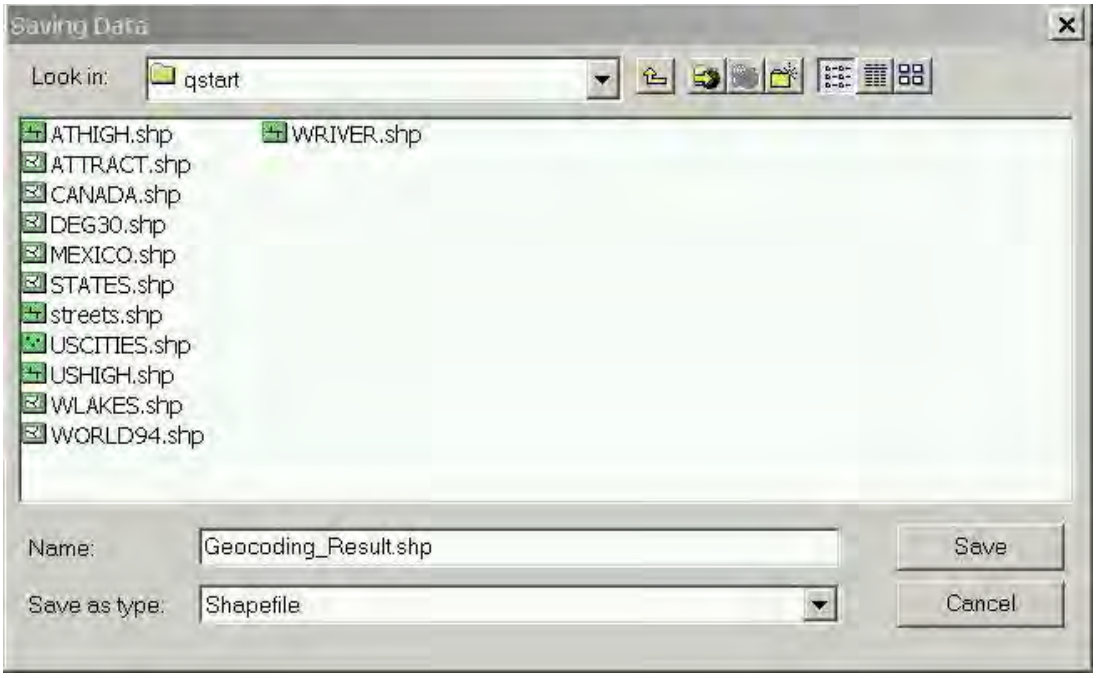
Choosing a geocoding style.

-If no services are shown, then click **Browse for service**.

-If the desired geocoding services are still unavailable, they must be created. See **"Creating a Geocoding Service/Address Locator"**.

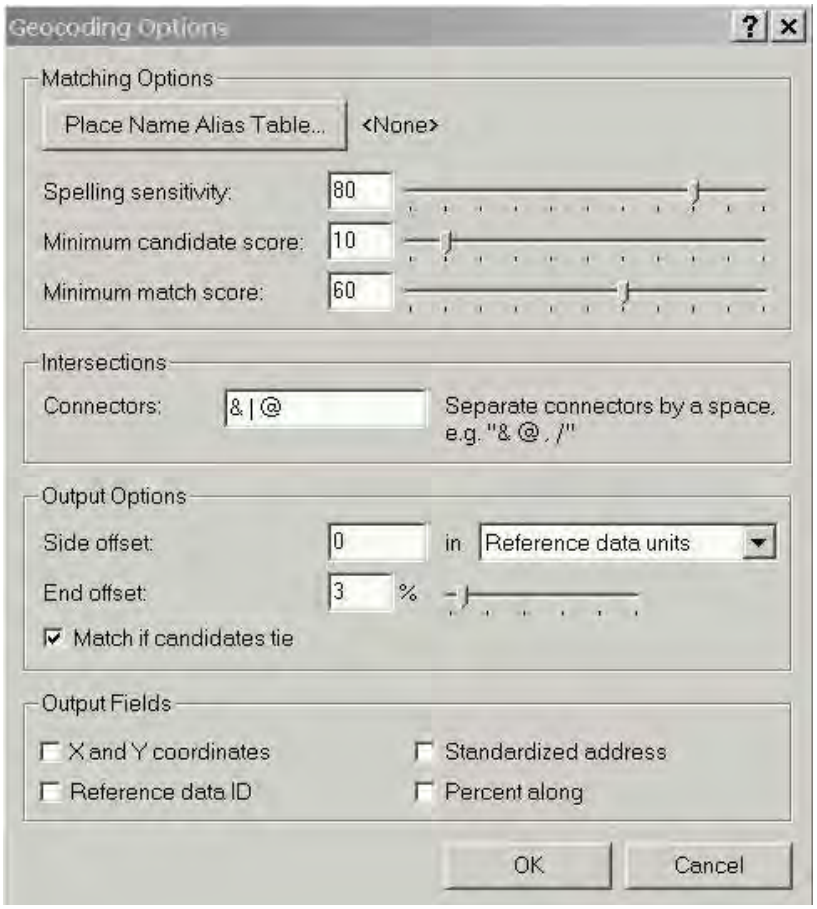
5) In the Geocode Addresses window, the Address Input Fields should have been automatically set based on the geocoding service. If not, click on the dropdown list to choose the name of the column that has the correct address attribute.

6) Under *Output shapefile or feature class* click on the folder button to navigate to the folder in which you want to save your output file. Name this file, then click **Save**.



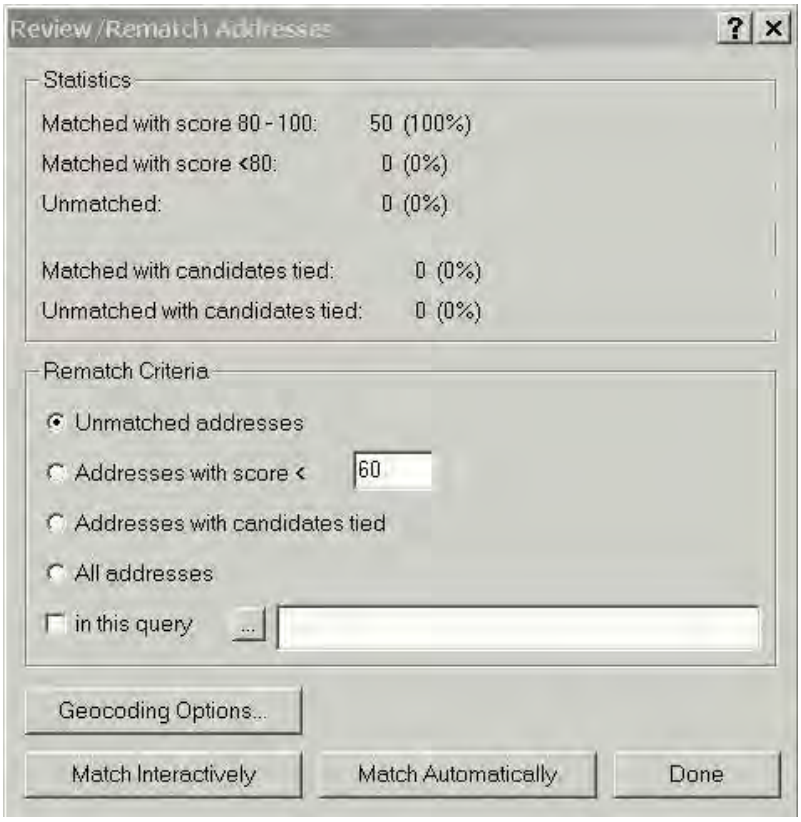
7) Click **Advanced Geometry Options** if you want to set the output coordinate system to something other than the coordinate system used by the reference (street) data.

8) Click **Geocoding Options** if you want to modify the settings used to match addresses to the street database. See **"Creating a Geocoding Service/Address Locator"** for more information on these settings.
See Pitfall 2



9) Click **OK** on the Geocode Addresses window to begin the address matching process.

10) After processing, a window will report the address matching results and provide an opportunity to re-process unmatched or poorly matched addresses.

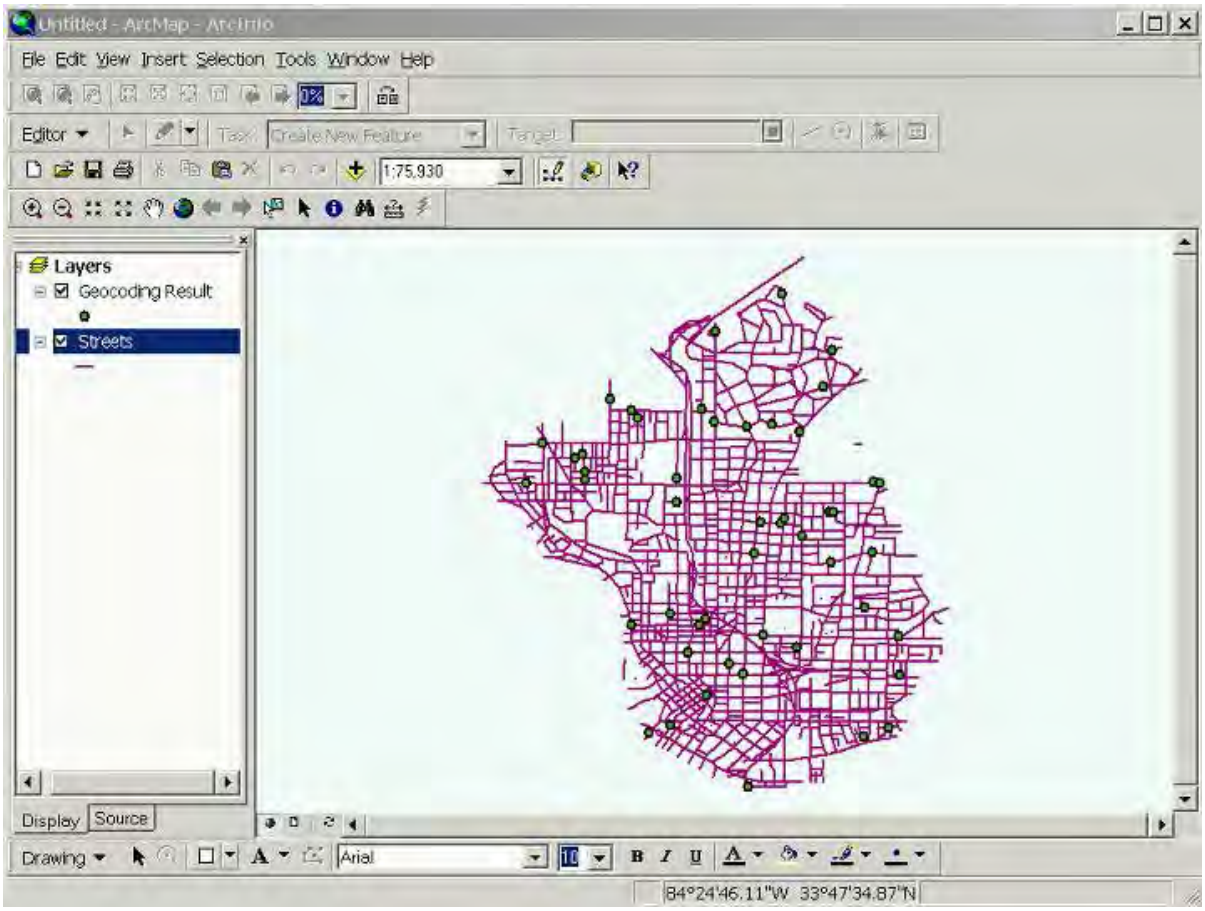


11) Clicking the **Match Interactively** button opens a window that allows you to review the unmatched addresses one at a time. The unmatched addresses are shown in the upper half of the window. The selected address is highlighted in blue. The way the software parsed the selected address into individual address components is shown in the middle of the window and candidate street segment matches are shown at the bottom. If there is an obvious mistake in the way the address has been parsed, click the **Modify** button to fix the mistake. After fixing the mistake, an updated list of candidate street segments should appear. If one of these candidates is an acceptable match (note the **Score** value, with 100 being a perfect score), highlight the street segment and click **Match**.

12) Repeat the review process for each unmatched address, then click **Close**.

13) Click **Done** to finish the geocoding session.

14) To display your geocoded result, open ArcMap and add this file. Here is an example of the final product.



Note: The green points are the geocoded addresses.

Pitfalls:

- **1)** Giving a street the wrong suffix or street type, like "Court" instead of "Avenue," or providing no suffix when there are multiple streets with the same name in the database, will cause errors. Misspelled street names or street names not in the database can also cause errors, although the software will try to match abbreviations and account for possible misspellings. This can be adjusted in the Geocoding Options window. It is also possible that there are errors or outdated information within the street database itself that could cause additional errors.
- **2)** Street addresses are estimated along block faces; therefore, the true locations of the addresses may not be represented. For example, an address with a house number of 50 will be placed exactly halfway along the 0-100 block even though the actual location of the house is not likely to be at the exact midpoint of the street segment. Also, pay close attention to the offset setting (i.e., the distance from the street centerline the addresses will be placed). The offset can be adjusted in the Geocoding Options window.

Authored by: Carlin Wong **Modified:** 4/4/05

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GIS Cookbook: Recipe - Selecting From Geocoded Addresses

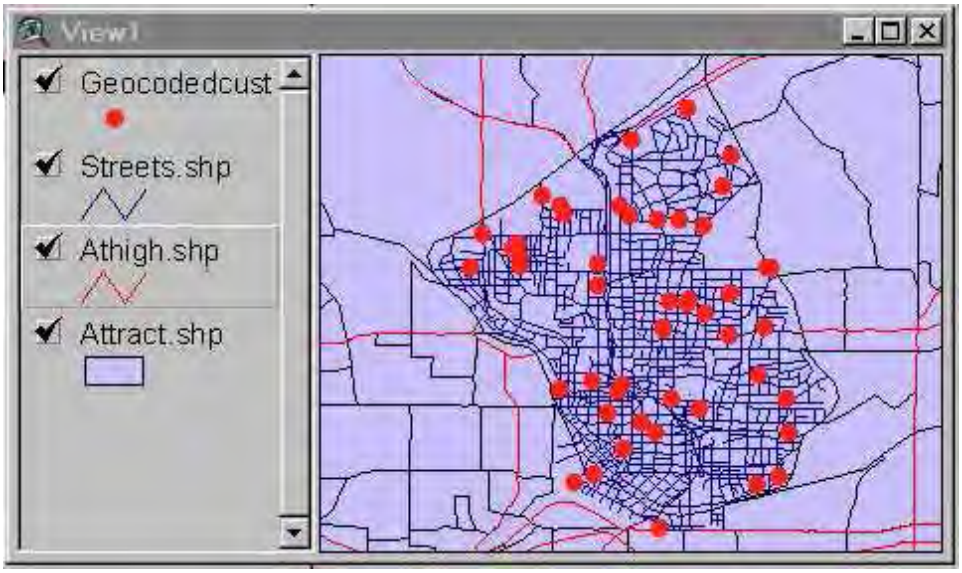
Keywords: Geocoding, query, query builder, select from set, new set, add to set
Category: Geocoding
Software: ArcView 3.2

Problem: I have geocoded a table of addresses (see recipe *Geocoding a database of addresses*), how can I select all of the restaurants?

Description: After a table of addresses has been geocoded, often times the user needs to attribute table would be very time consuming.

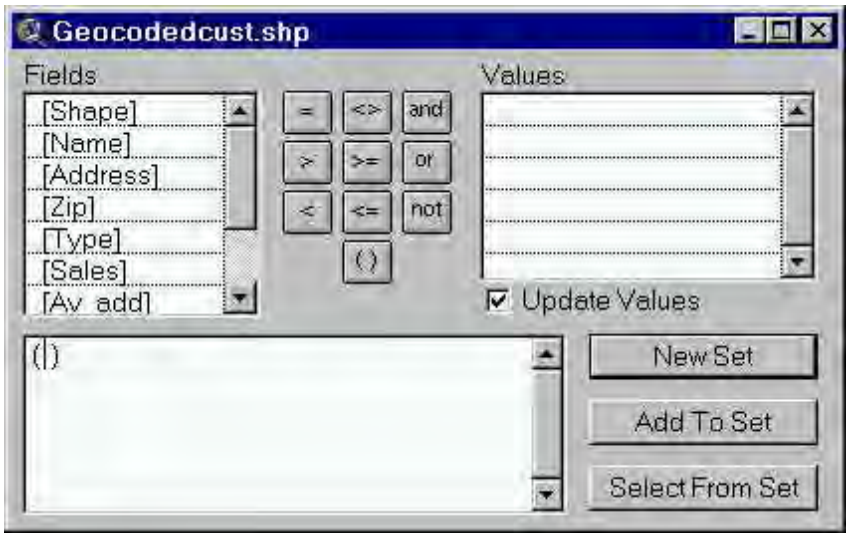
Scenario:
After geocoding a list of address of local commercial buildings, a city planner would like to locate all the restaurants in the area. This recipe will show users how to build a query using the Query Builder. This recipe will also allow users to learn the difference between the **Add to Set**, **Select from Set**, and **New Set** options within the Query Builder.

Methodology:
1) A list of addresses that have been geocoded may look similar to the picture below, taking the example from the recipe ***Geocoding a database of addresses***.



Click the  button to use the Query Builder.

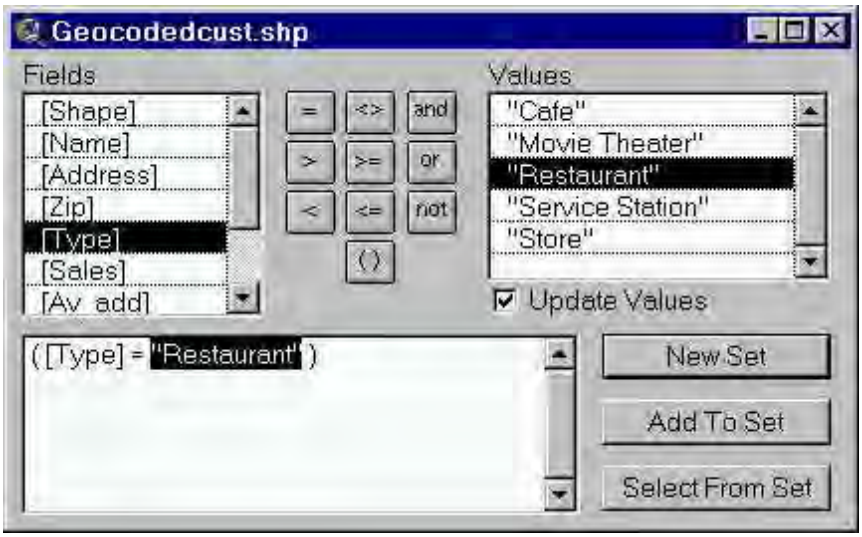
2) Highlight the attribute table.



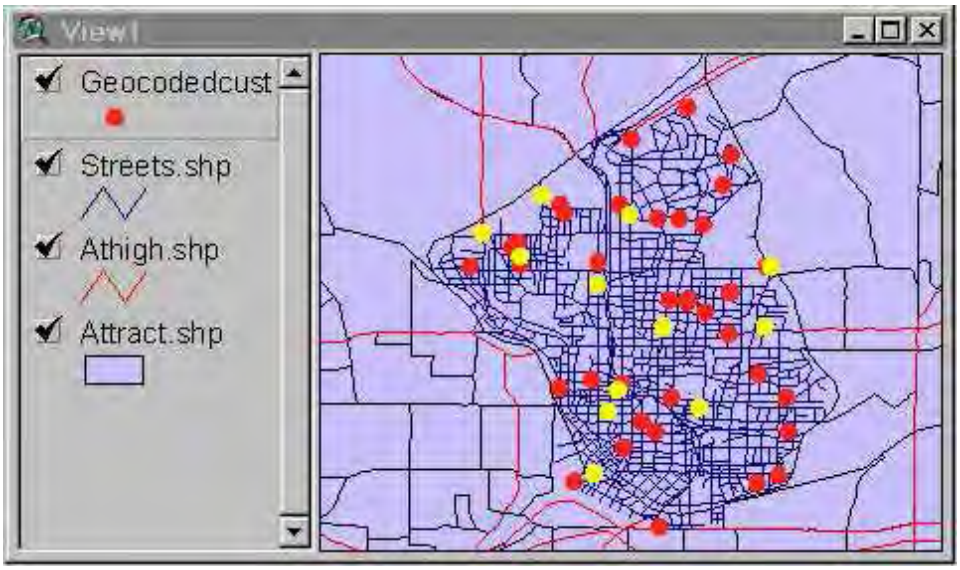
NOTE: To learn about what each function is within the Query builder refer to the Help Menu within ArcView 3.2. Click on **Help**, select **Help Topics**, select the **Index tab**, type "query builder".

3) In this example, we would like to query the locations of all the restaurants within the geocoded layer. We will build a simple query to accomplish this task.

To begin, we double-click on the option **[Type]** in the left hand column; in our example it separates the businesses in our database into various categories. Next, click on the **=** sign, which will link our business type to a given value. We will select that value from the set of choices in the right-hand column by double-clicking on the word **"Restaurant"**. Spaces will be automatically placed into your query, which appears in the space below the function buttons. Be careful about altering the spaces within your query; you may be surprised by a errors in processing your query. (See Pitfall 1.)

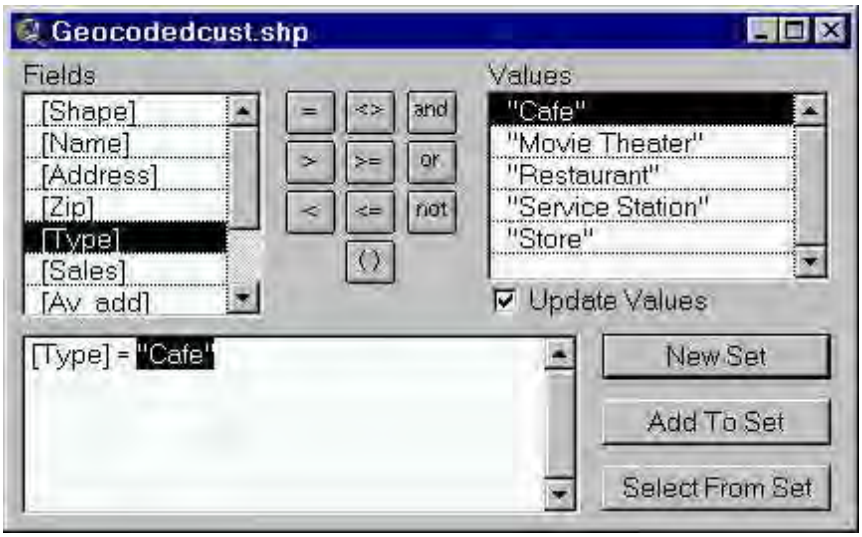


Select **Add to set**. Your view should now have the locations of all restaurants highlighted in yellow.



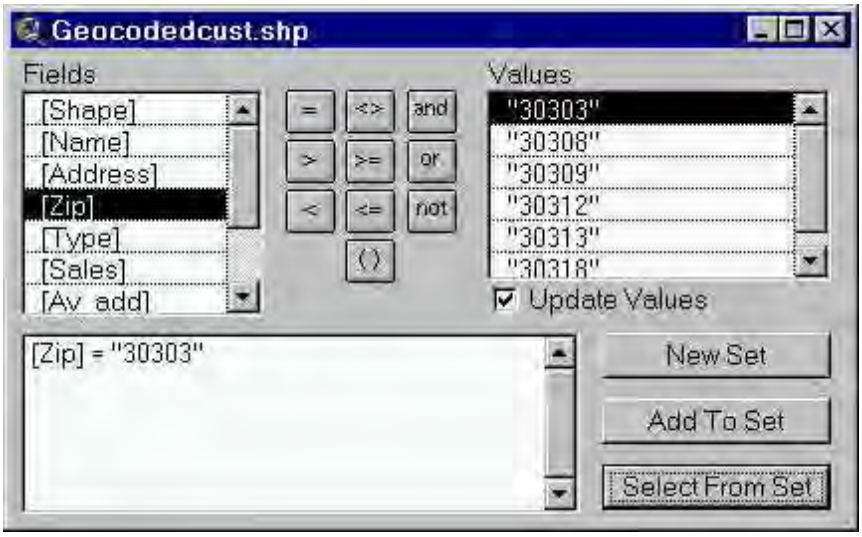
4) Suppose now you would like to select all the cafes also. Delete the old query and enter a new query in the same format as used to query the restaurant locations except double click **"cafes"** instead of **"restaurants"** .

Your query should look similar to the following:

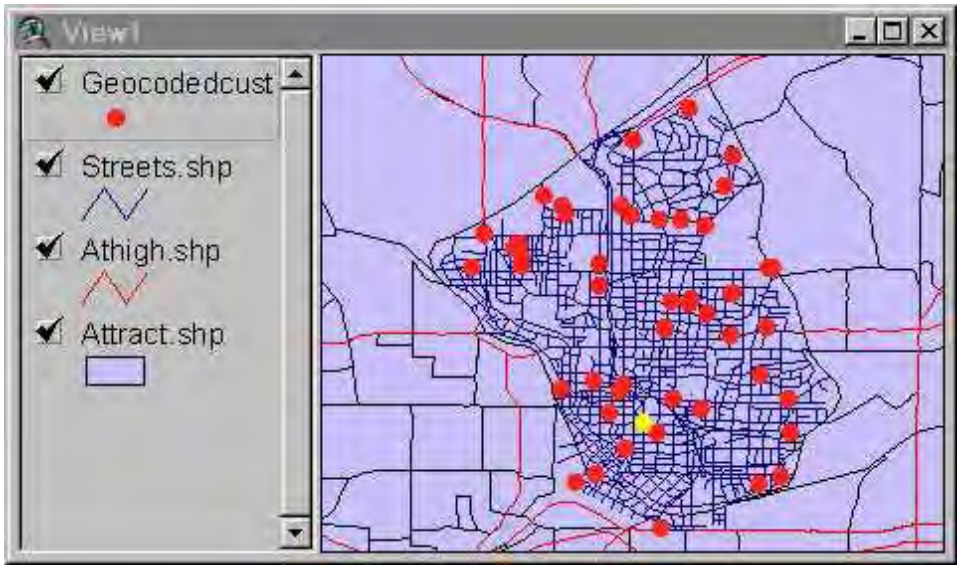


If you would like to *ADD* the locations of the cafes to your already highlighted locations of restaurants select the **Add to Set** button. If you would like to clear the restaurant selections and ONLY have the cafes, select the **New Set button**.

5) The **Select from Set** button lets the user query for something within the already highlighted choices. For example, below, the planner has selected all the cafes and restaurants and would like to select within that set, all restaurants and cafes within a certain zip code. The following query displays how to build a query to perform this task.



Now click the **Select from Set** button. Your results should be narrowed down to only the locations within that zip code zone.



Pitfalls:

- **1)** Syntax errors may be faced when building queries. To see suggestions on how to correct the syntax of your query, go to the following links, or go to the help file and type *query builder*

Links:

ESRI tutorial - ESRI's tutorial for K-12 (this recipe references this page)

Authored by: Sam Ying **Modified:** 9/10/03

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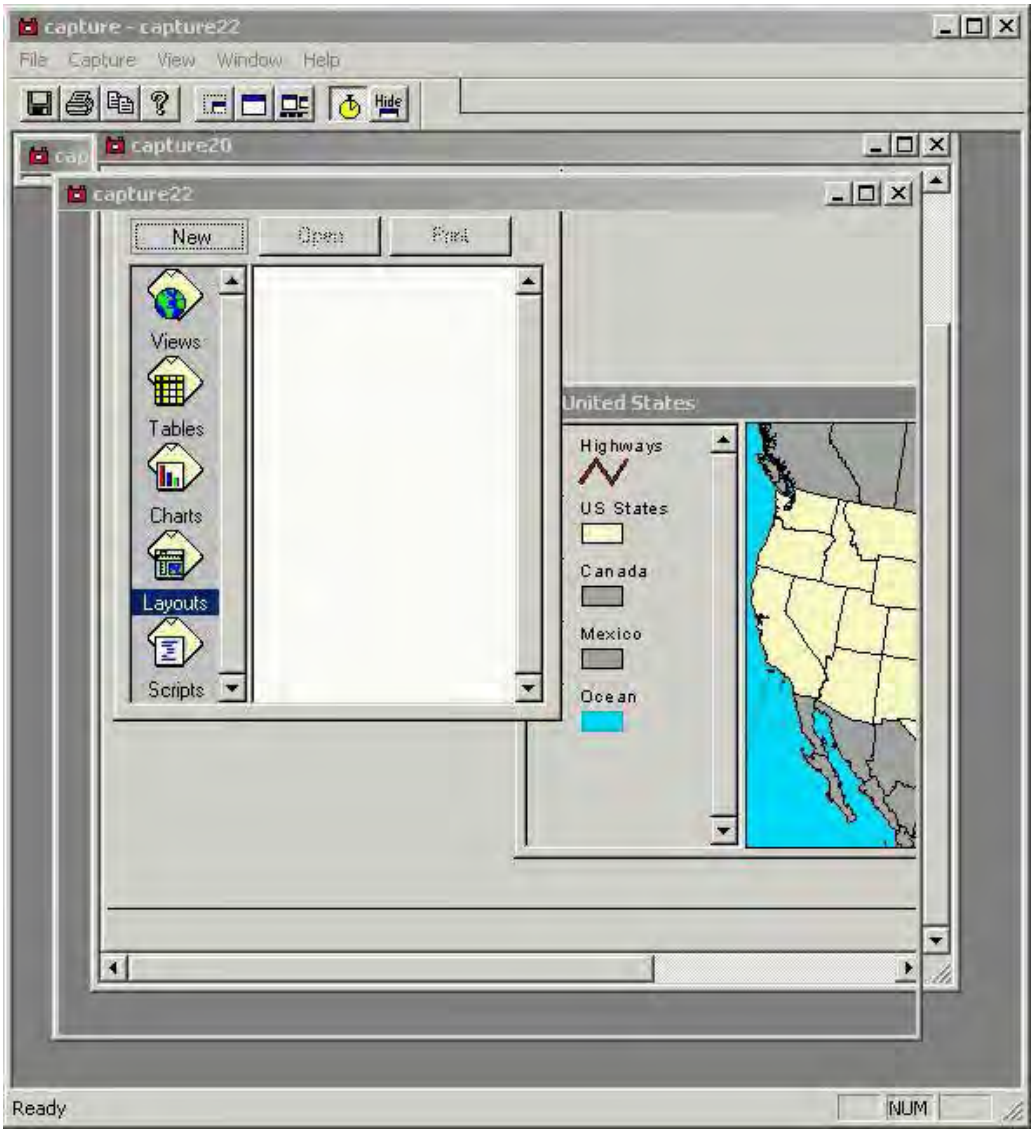
GIS Cookbook: Cartographic Design - Preparing your map for presentation (*without* using a template)

Keywords: Presentation, finishing, printing, cartographic elements, layouts
Category: Cartographic Design
Software: ArcView 3.2

Problem: How do I prepare my data for presentation without using a template?

Description: You are satisfied with the data in your MapView window and would like to move the map into a layout form to prepare my map for presentation or printing.
Note: Preparing your map without a template allows you to fine tune your map to your own style without following any pre-set guidelines, however, it may be more time consuming.

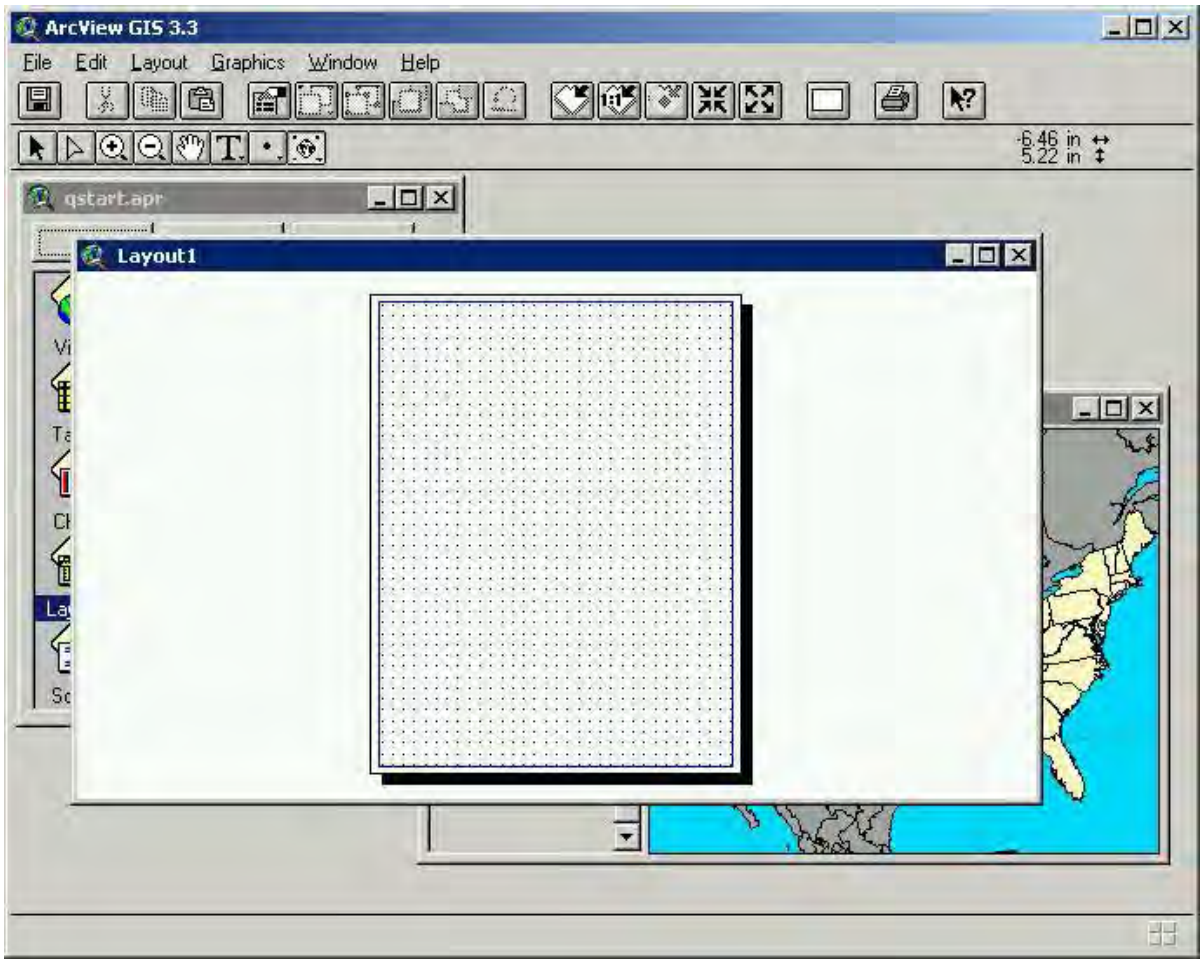
Methodology:
1) Note the name of the View window that contains the data you would like to present. On the following image, the View window is titled "United States."
2) To create a layout file, click on the **Layouts Icon** on the project manager window.



Project Manager Window is shown on the left side of this image. Note that the layouts icon is highlighted.

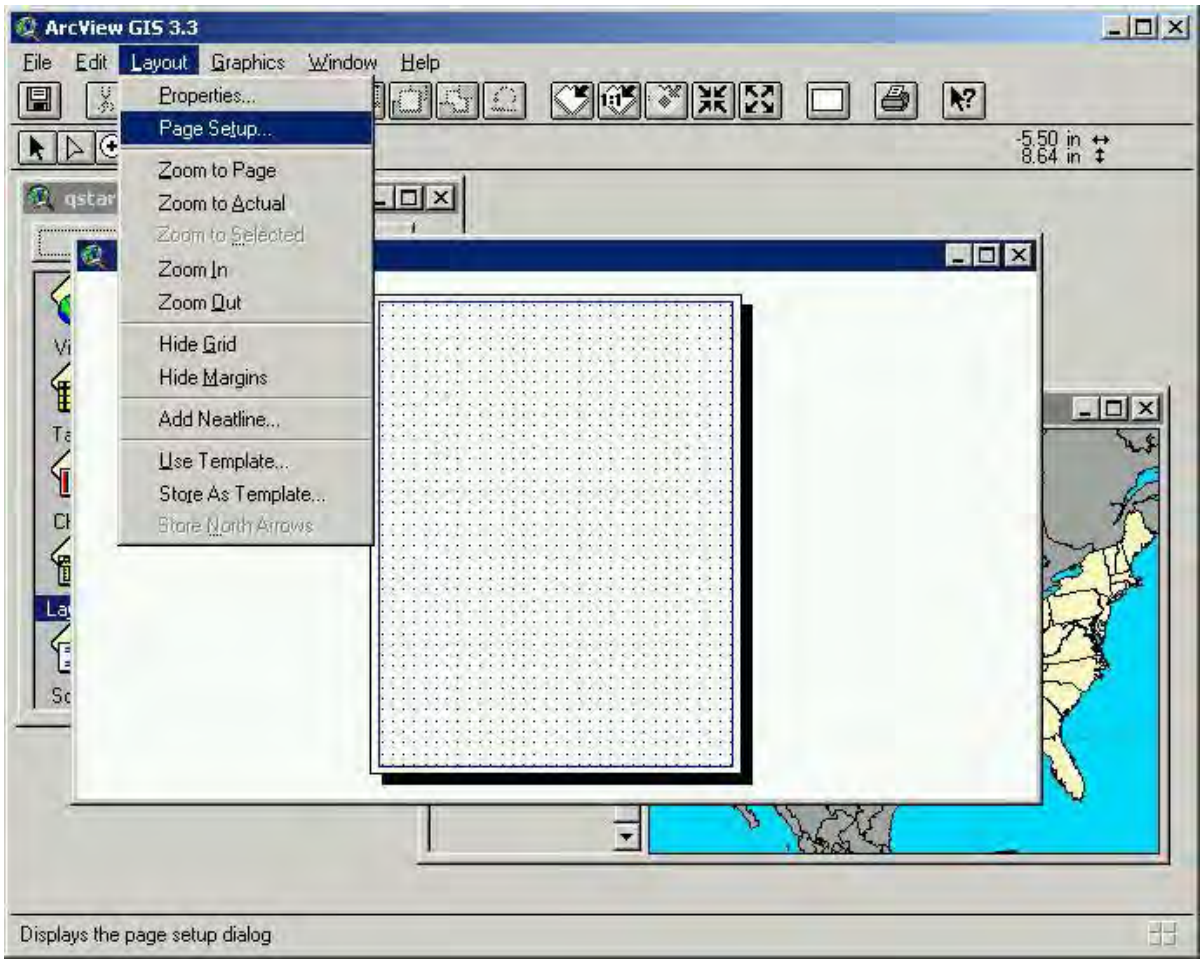
3) Now that you have highlighted the Layouts icon, click the **New** button on the top of the project manager window.

4) A new window will open and should look similar to the following image.



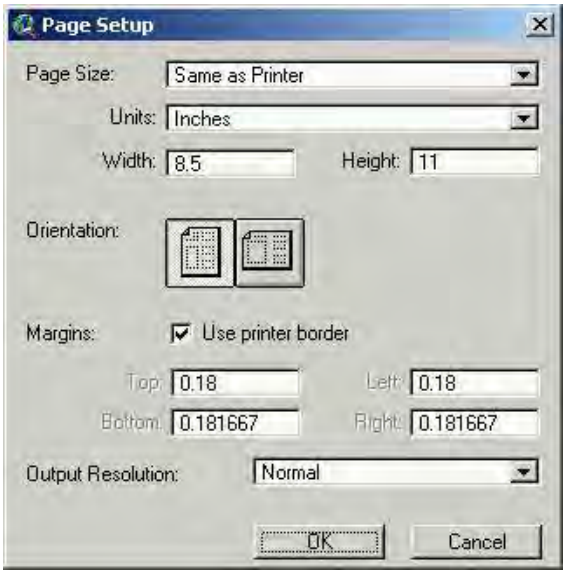
Main Layout Window

5) To specify the size and orientation of the paper you are using to print your map select **Layout ->Page Setup**



Layout -> Page Setup

6a) The Page Setup window will appear.



Page Setup window

Enter the dimensions of your printing paper under *Page Size*.
Note: The maximum paper size you are able to use is usually determined by the type of printer.

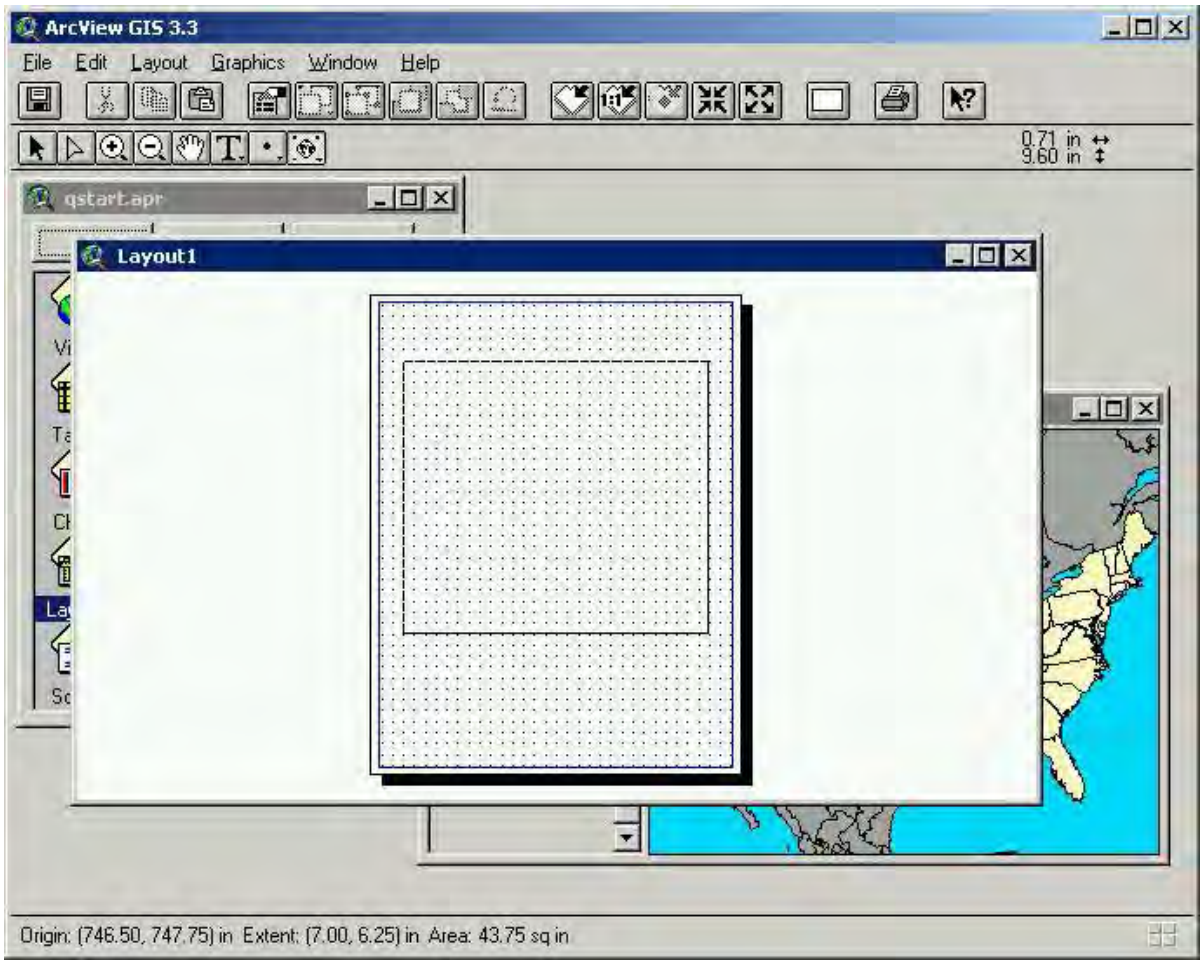
6b) Now choose the orientation of the paper you would like to use.

6c) When you have made all your selections click **Ok**.

7) Then click on the *earth shaped icon*,

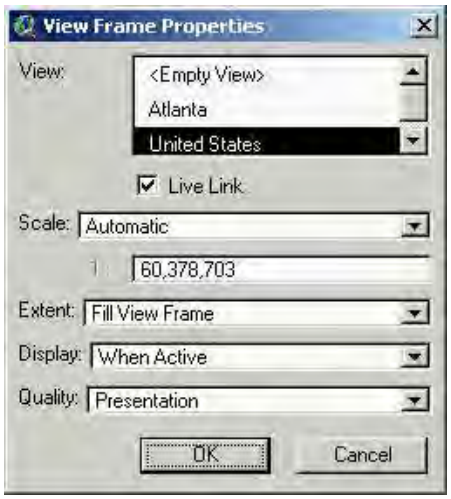
your cursor should change to a plus sign shape.

8) Move your mouse to the area of the layout page where you would like to place your data image. While keeping your mouse down, drag the mouse diagonally. Release the mouse button when the square is the size you want your image.
Note: Make sure you leave room for a title, scale bar, and the other cartographic elements.



Location of the map

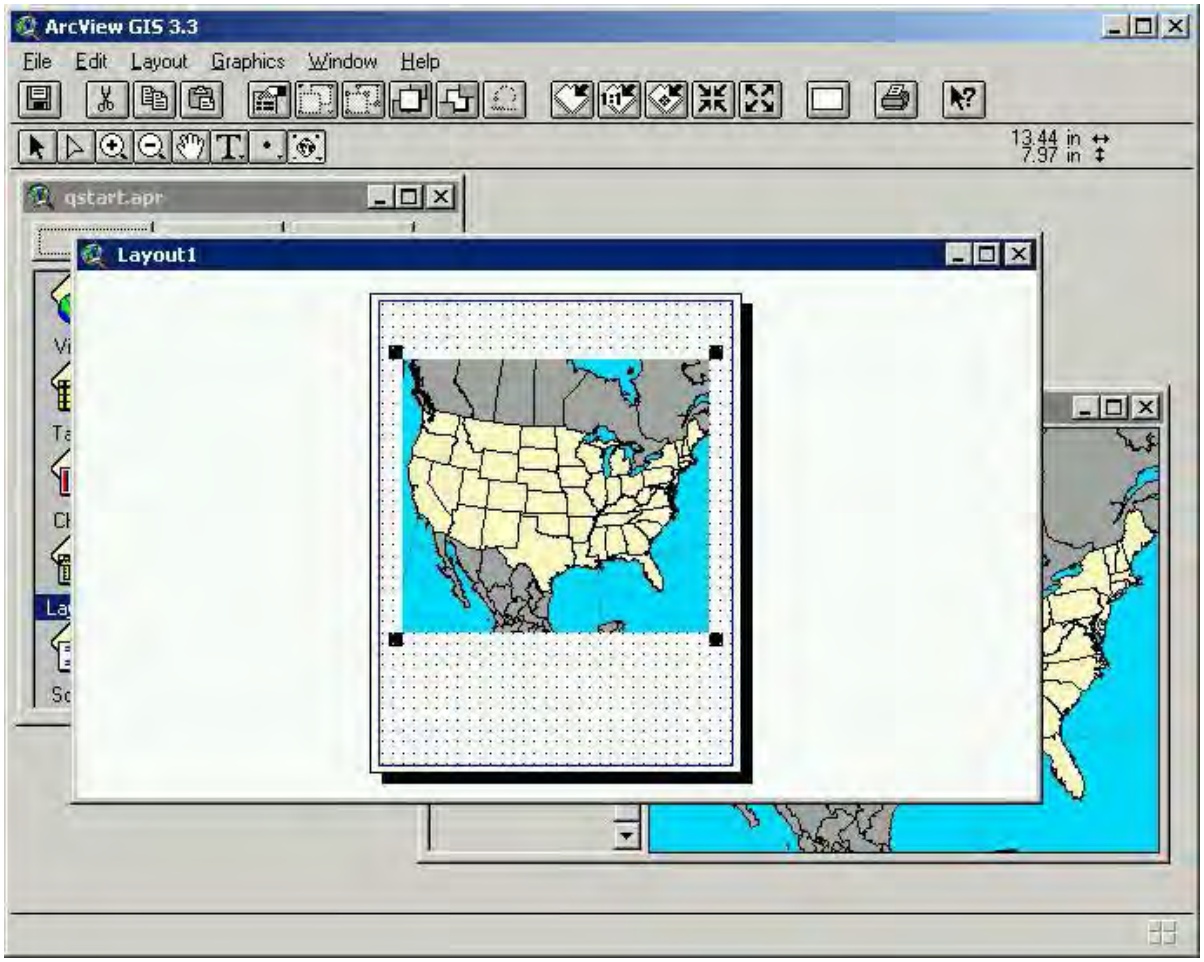
9) The view frame Properties window will appear after you release the mouse button.



View Properties window

Select the view you wish to display. Make sure to uncheck the *live link* box so that your view will be preserved even if you alter the view window. Take note of the scale in case you want to include it in your map credits later. Then click **OK**

10) Your map should appear in the box you created.



Ready to add more

Now you are ready to add other information (e.g. title, scale bar, north arrow, credits, etc.) to your map.
Note: You may also want to include more than one map view in your final layout. To do so follow the above steps again. Unless you are making the second map a *locator* map, too many maps in one layout may confuse the user.
Links:
Making Maps with GIS - Getting Started with Geographic Information Systems
Prof. Keith Clarke's Home Page - Links to help with selected topics in geography and cartography

Authored by: Benjamin N. Sprague **Modified:** 8/27/03

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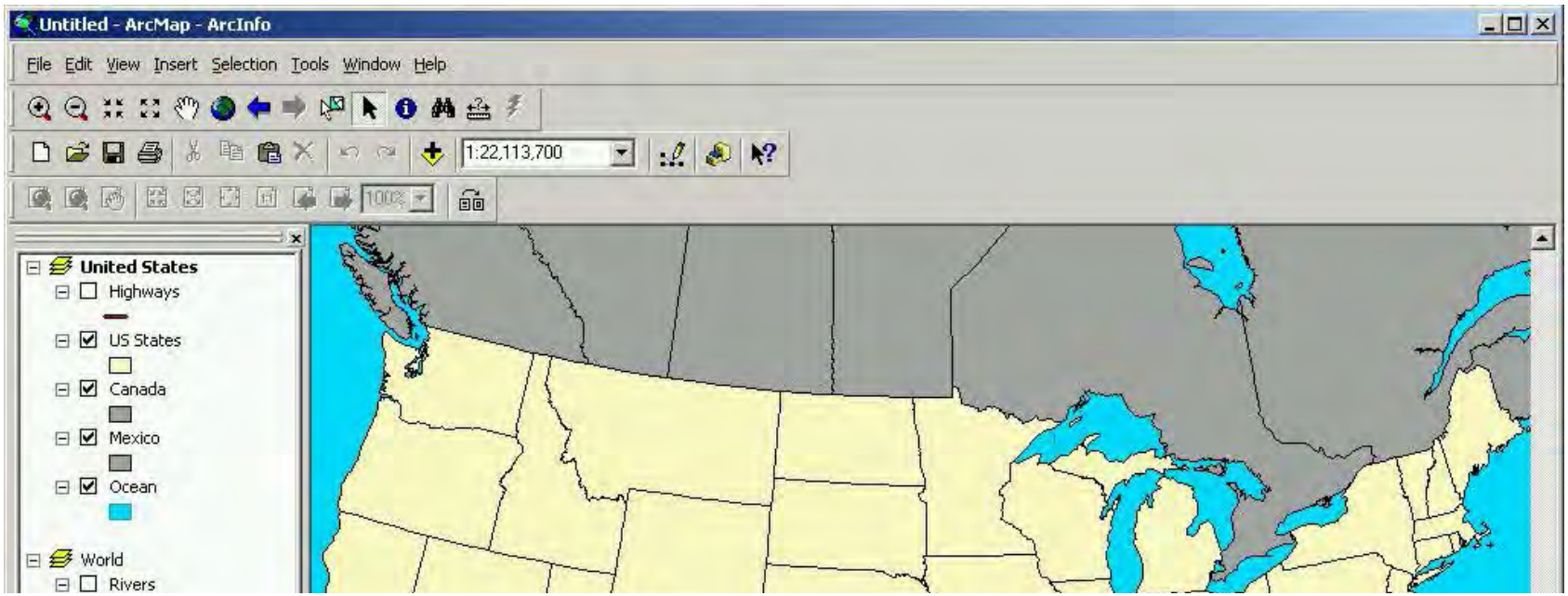
GIS Cookbook: Cartographic Design - Preparing your map for presentation (*without* using a template)

Keywords: Presentation, map, layout, printing
Category: Cartographic Design
Software: ArcInfo 8

Problem: How do I prepare my data for presentation?

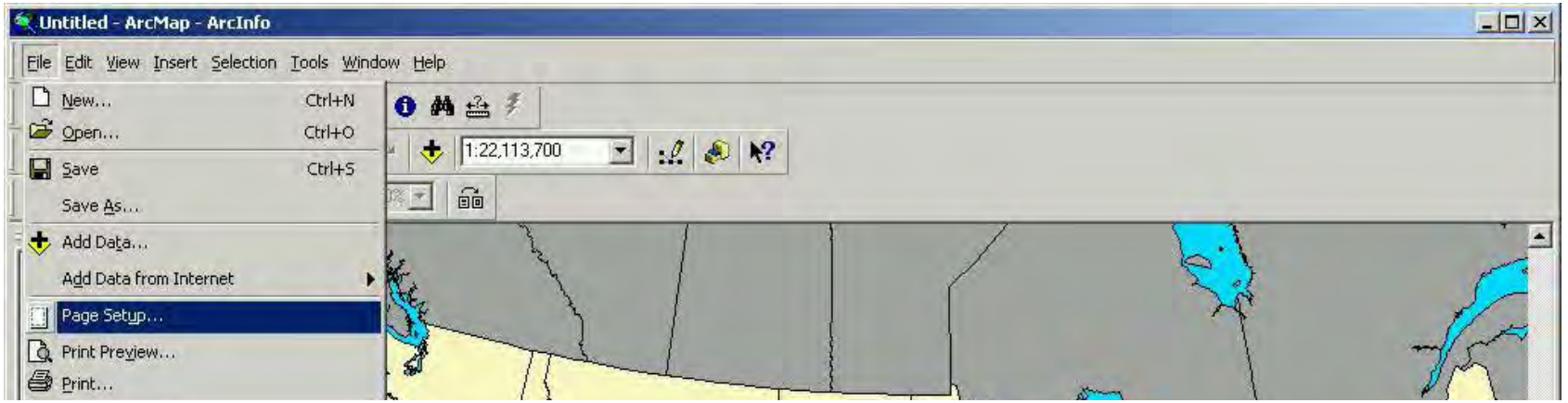
Description: You are satisfied with the data in your Data View window and would like to move the map into a layout form for presentation or printing.

Methodology:
1) To prepare your data for presentation first make sure that you want to display all the data frames and all the turned on data you have in your table of contents.



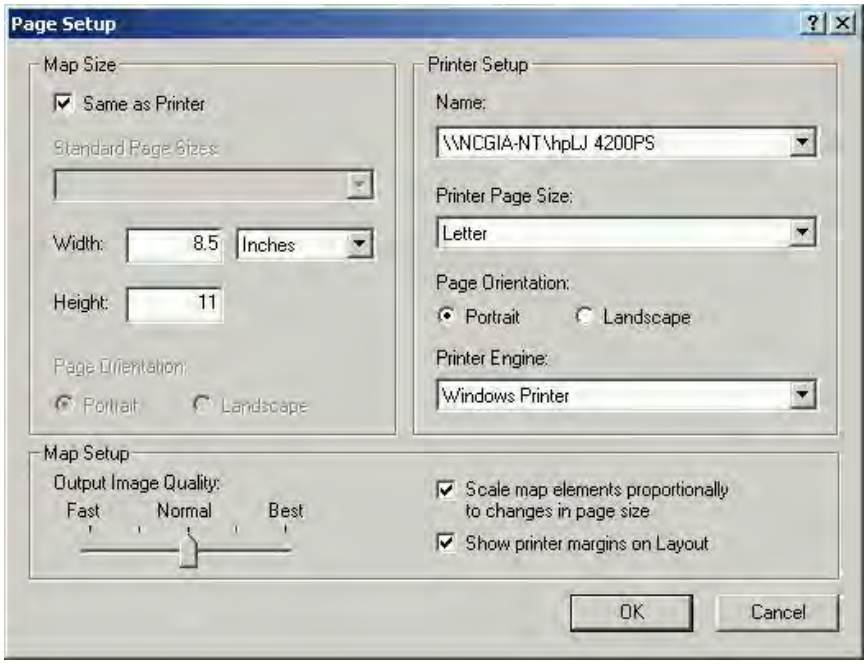
I want to display this.

2) Before proceeding you need to determine how large you want your map presentation to be. So select **File ->Page Setup**



Page Setup

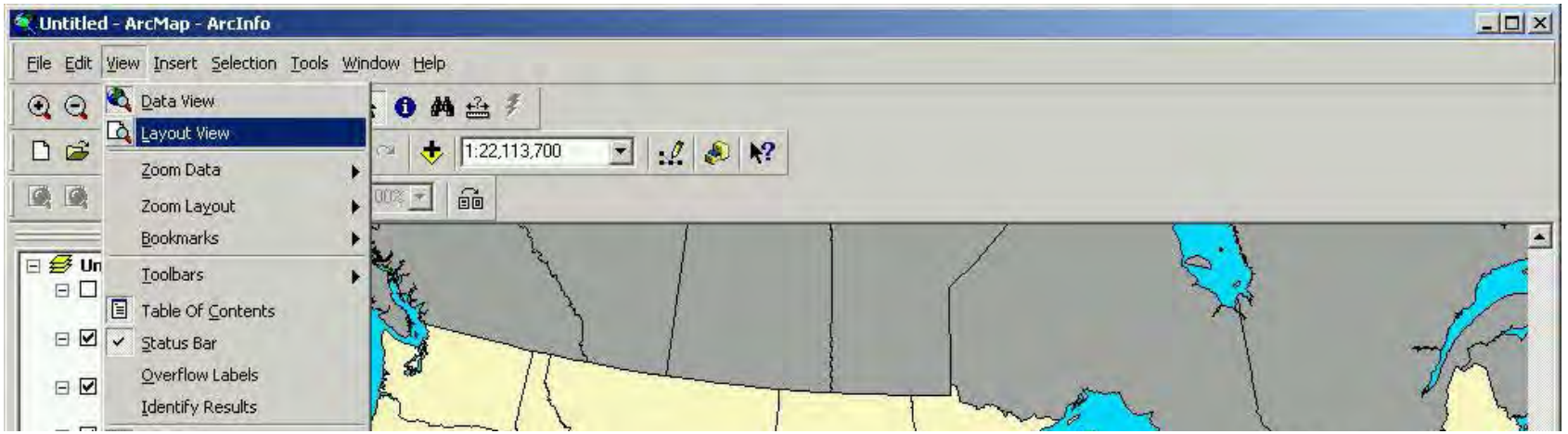
3) Choose the size of your paper, keep in mind that many sizes require special printers, so do not select a size that cannot be handled by your printer. You can also choose here whether you want a portrait or landscape format.



Page Setup Window

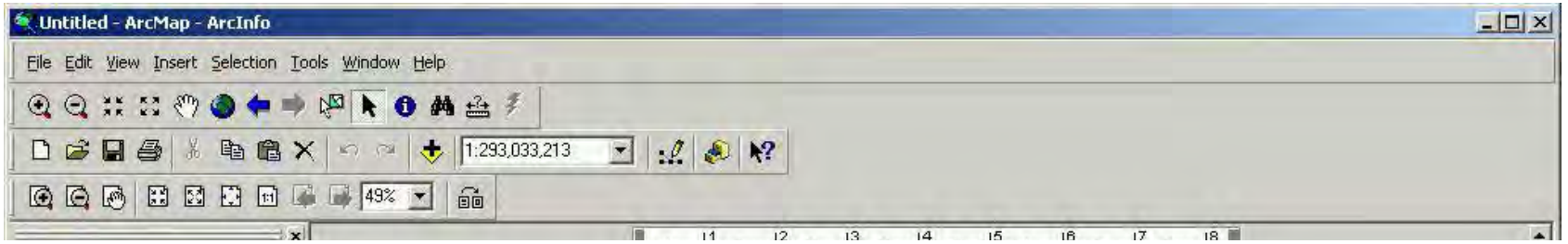
When you have made your selections click **ok**

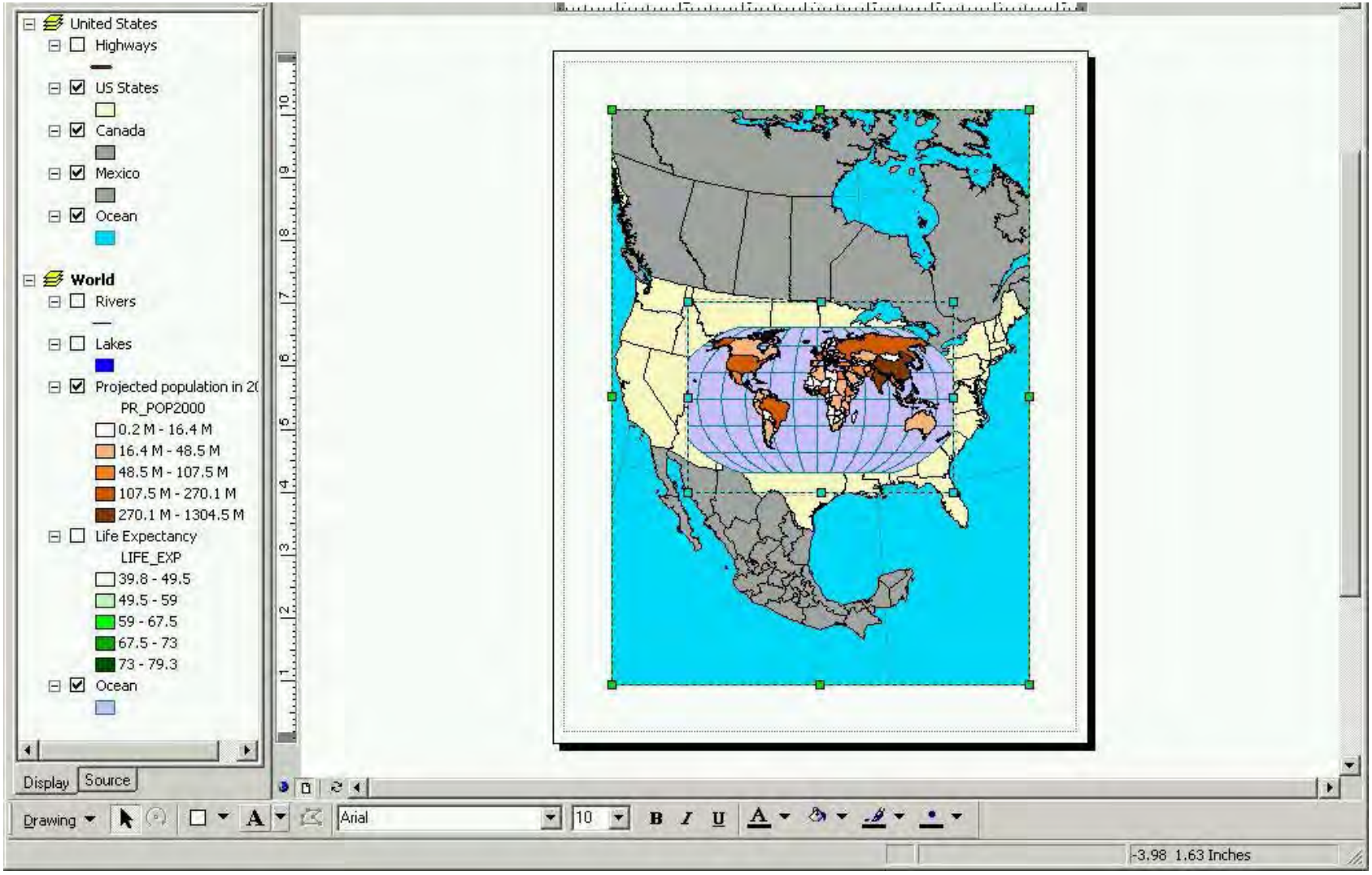
4) To get to a layout, select **View -> Layout View**



Changing to the layout view

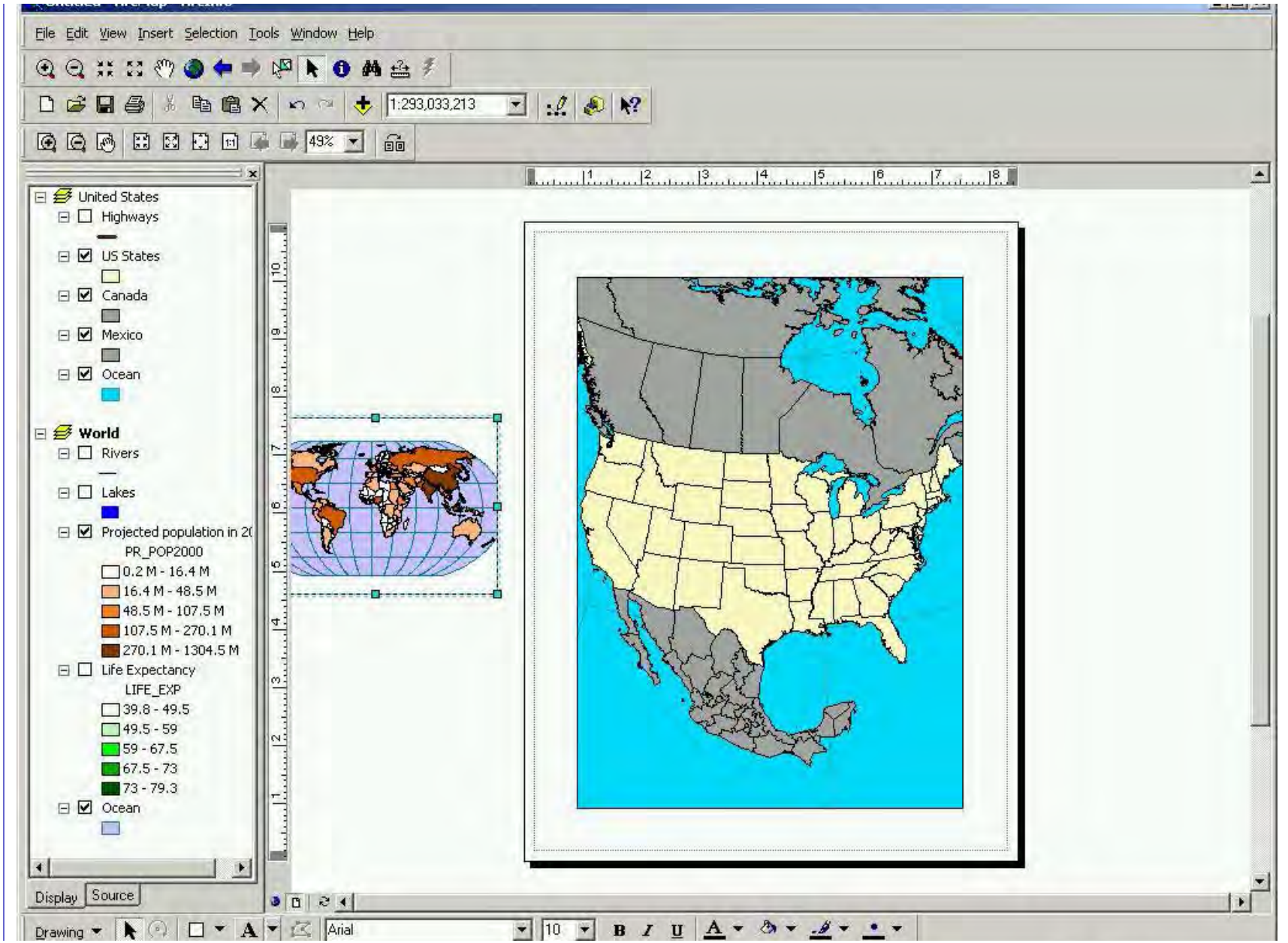
5) You layout view will appear with your data frame windows centered in the middle of the layout page.





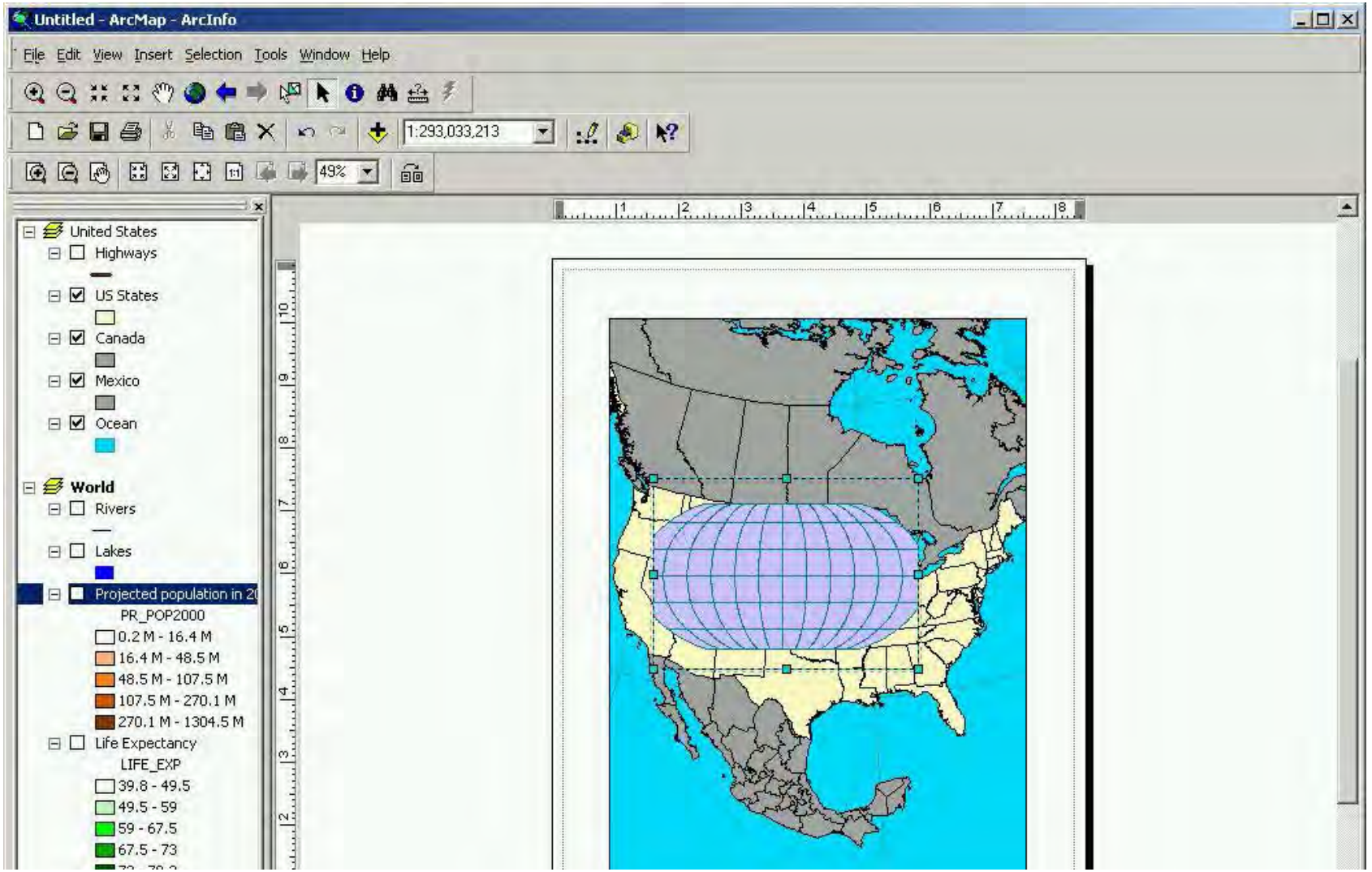
Both Data frames are shown

6) Organize the map windows in the size and location you would like them (Note: If you would only like to display one of them you can move the dataframe you don't want to display out of the way


File Edit View Insert Selection Tools Window Help
1:293,033,213
49%
United States
Highways
US States
Canada
Mexico
Ocean
World
Rivers
Lakes
Projected population in 2(
PR_POP2000
0.2 M - 16.4 M
16.4 M - 48.5 M
48.5 M - 107.5 M
107.5 M - 270.1 M
270.1 M - 1304.5 M
Life Expectancy
LIFE_EXP
39.8 - 49.5
49.5 - 59
59 - 67.5
67.5 - 73
73 - 79.3
Ocean
Display
Source
Drawing
Arial
10

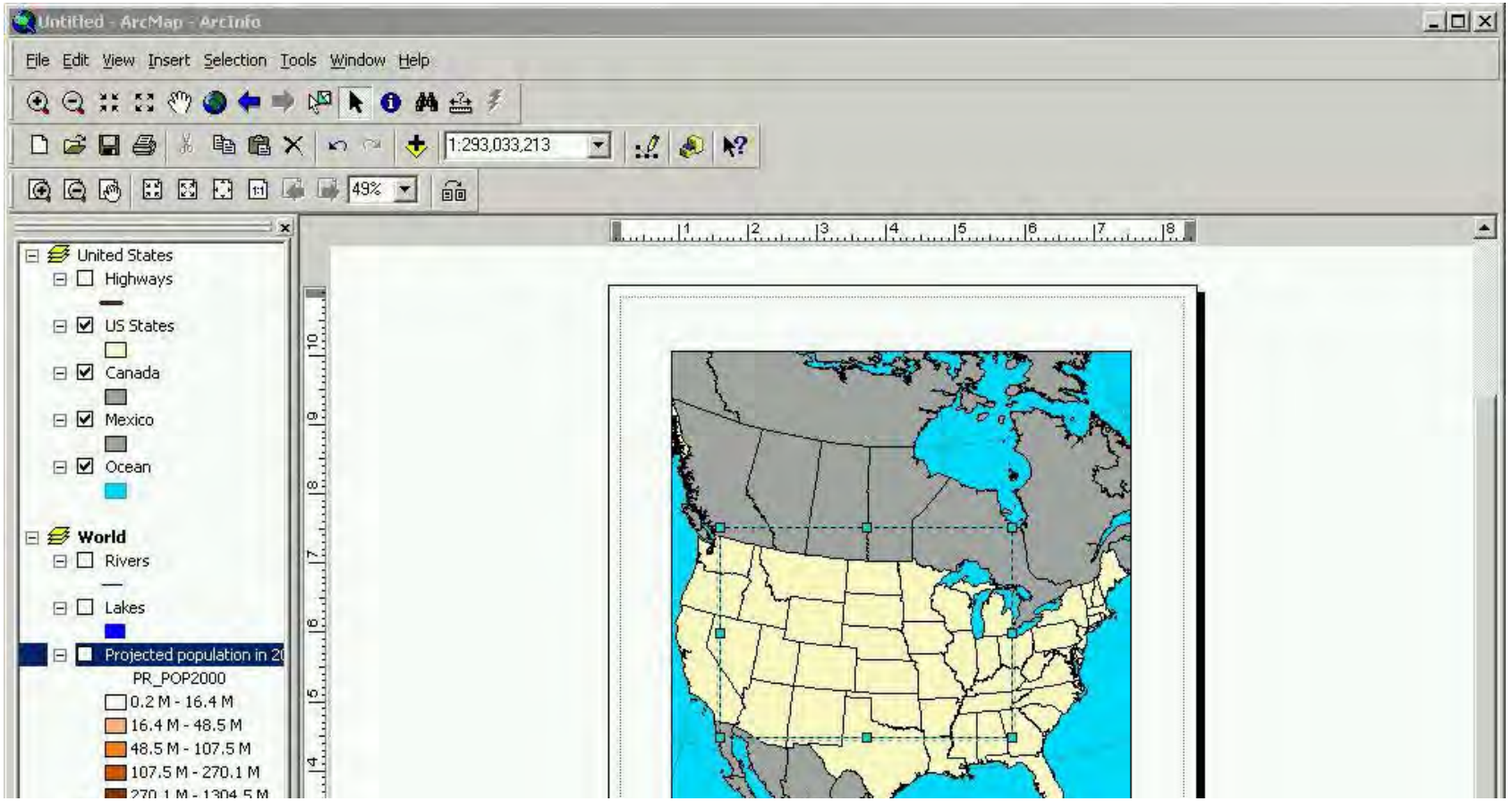
Just select it and move it out of the way

, or you can turn off the themes which you do not want to display.



Turn the individual themes off

,



Themes off

7) Now you are ready to add the other Cartographic Elements.

Authored by: Benjamin N. Sprague **Modified:** 9/11/03

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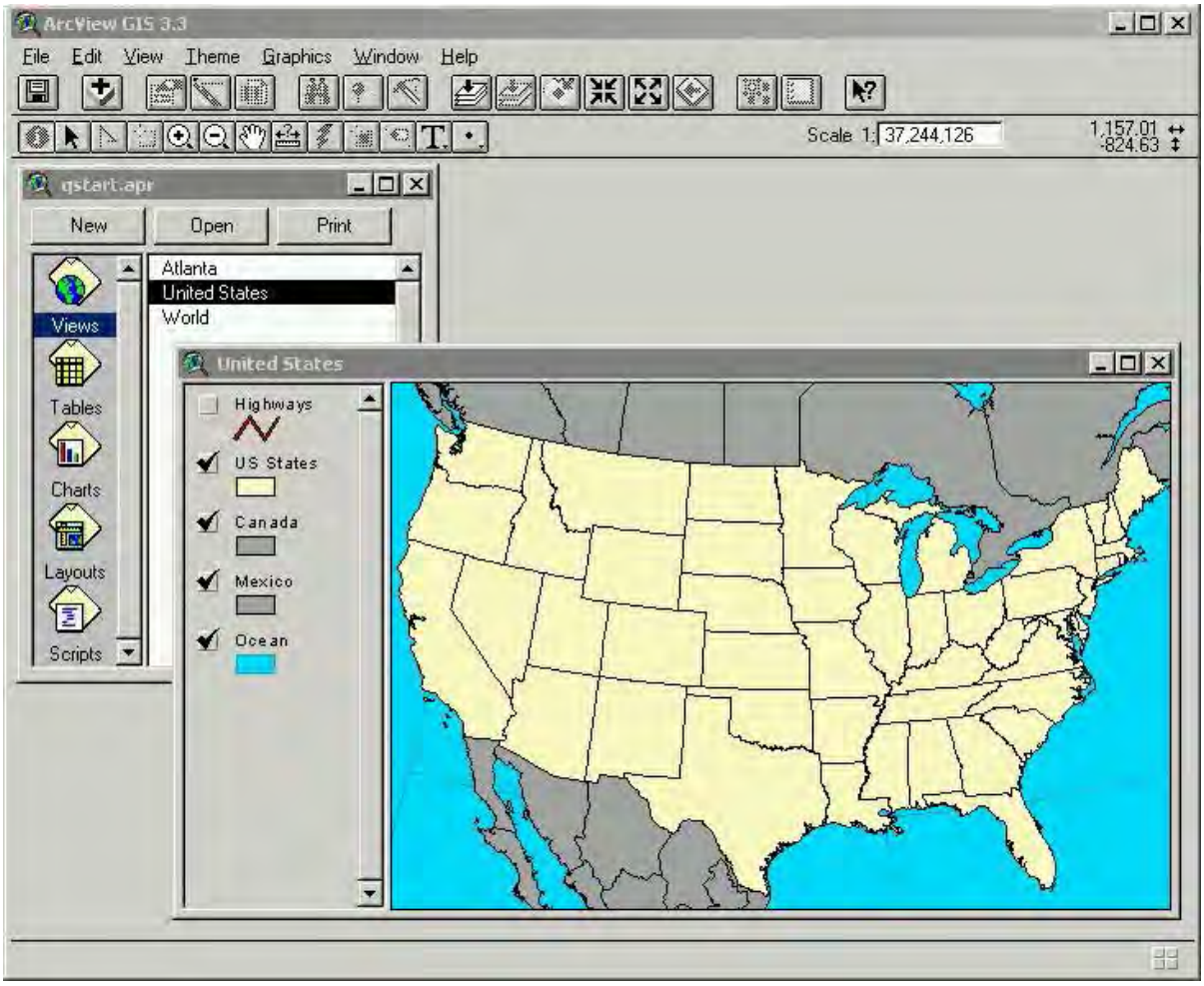
GIS Cookbook: Cartographic Design - *Shortcut* to preparing your map for presentation (using a template)

Keywords: Presentation, finishing, printing, cartographic elements, layouts,
Category: Cartographic Design
Software: ArcView 3.2

Problem: How do I quickly prepare my map for presentation (or printing)?

Description: You are satisfied with the data in your MapView window and would like to move the map into a layout form for presentation or printing.

Methodology:
1) Highlight the window (by clicking on it) that is displaying the data (map) you would like to prepare for presentation



Highlight your map by clicking on the image or the title bar

2) Adding cartographic elements such as a legend or north arrow are done in the *layout* window, select **View -> Layout**

3) When the Template Manager window appears, choose the page layout you would like to use.

Template Manager Window

Note: You are only given a limited number of options in the template mode, to expand these options see ***Moving your map into the presentation stage (without using the template)*** recipe. Click on the layout you would like to use then click **Ok**

4) Select *New Layout* from the View-Layout window and click **Ok**

5) Your new layout will appear with a scale bar, a legend, a neatline, a title and a north arrow. You can edit each of these by double clicking on them.

Your resulting templated layout

6) For more information on how to edit selected cartographic elements including scale bar, legend, neatline, title, and north arrow, see the corresponding recipes.
7) If you would like your final print out to include more than one map on a single page, refer to the recipe titled ***Moving your map into the presentation stage (without using the template)***. **Links:**
Prof. Keith Clarke's Home Page - Links to help with selected topics in geography and cartography
Getting Started with Geographic Information Systems - Introduction to GIS and basic help with making maps

Authored by: Benjamin N. Sprague **Modified:** 8/27/03

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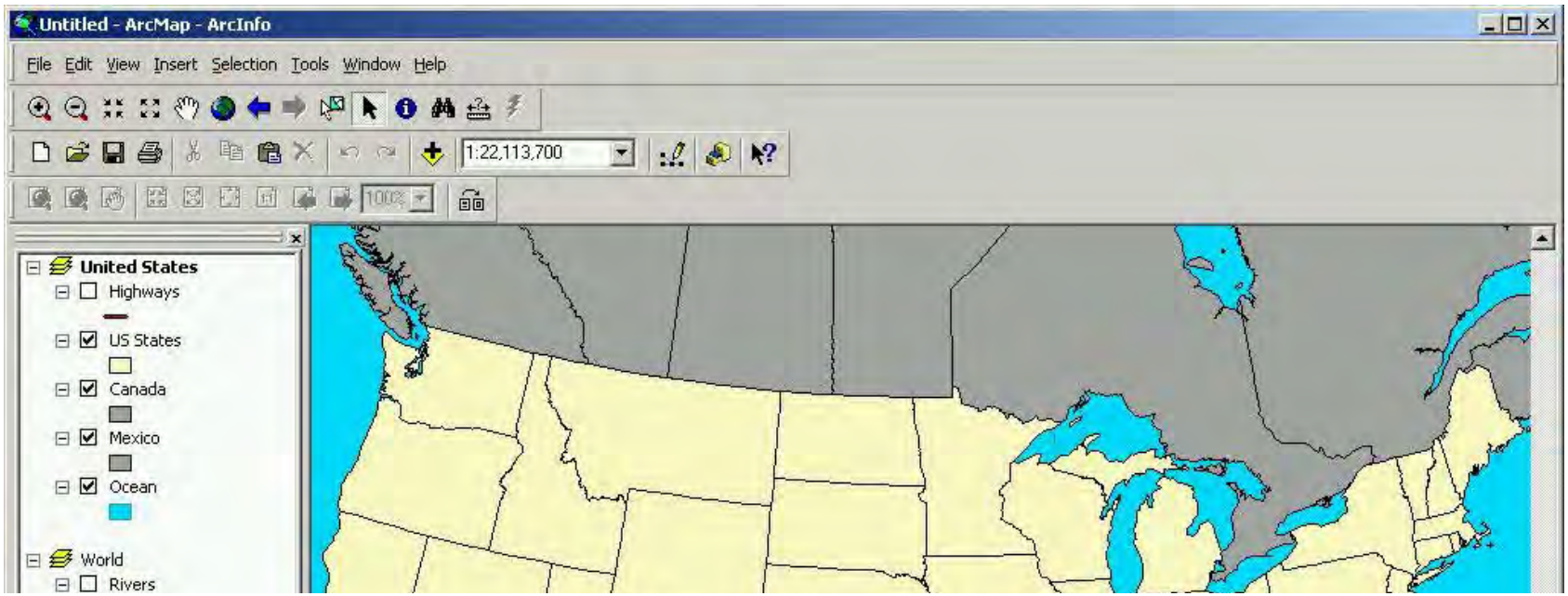
GIS Cookbook: Cartographic Design - *Shortcut* to preparing your map for presentation (using a template)

Keywords: Presentation, map, layout, printing
Category: Cartographic Design
Software: ArcInfo 8

Problem: How do I quickly, neatly prepare my data for presentation or printing?

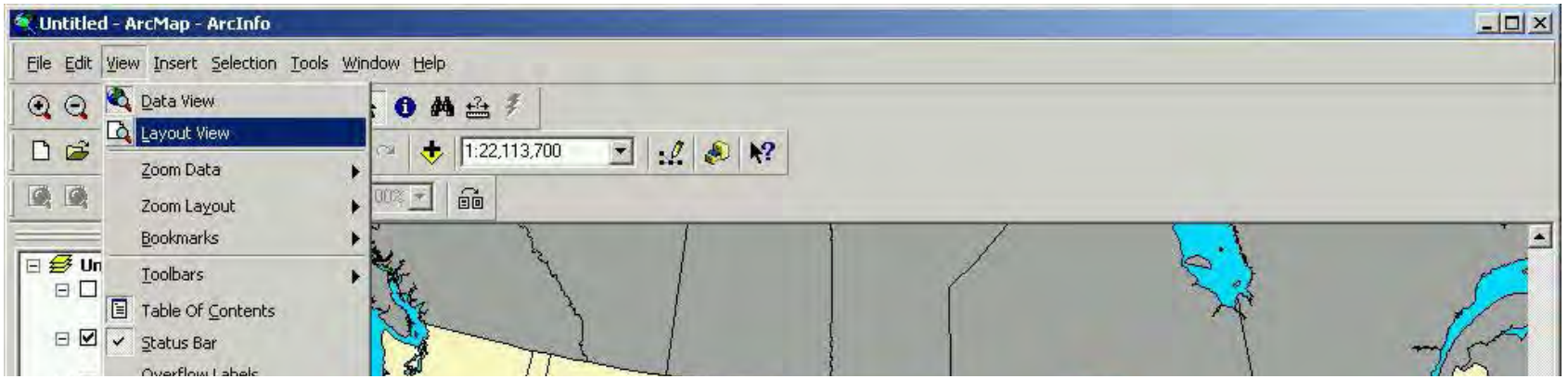
Description: You are satisfied with the data in your Data View window and want to move the map into a layout form for the effective presentation of information.

Methodology:
1) To prepare your data for presentation first make sure that you want to display all the data frame you have in your table of contents.



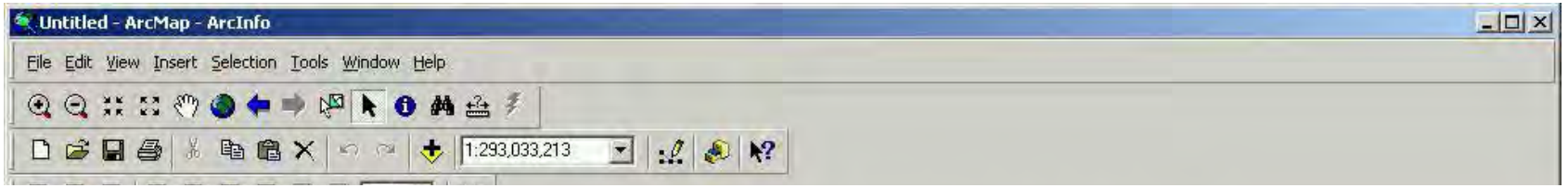
This is what i want to display.

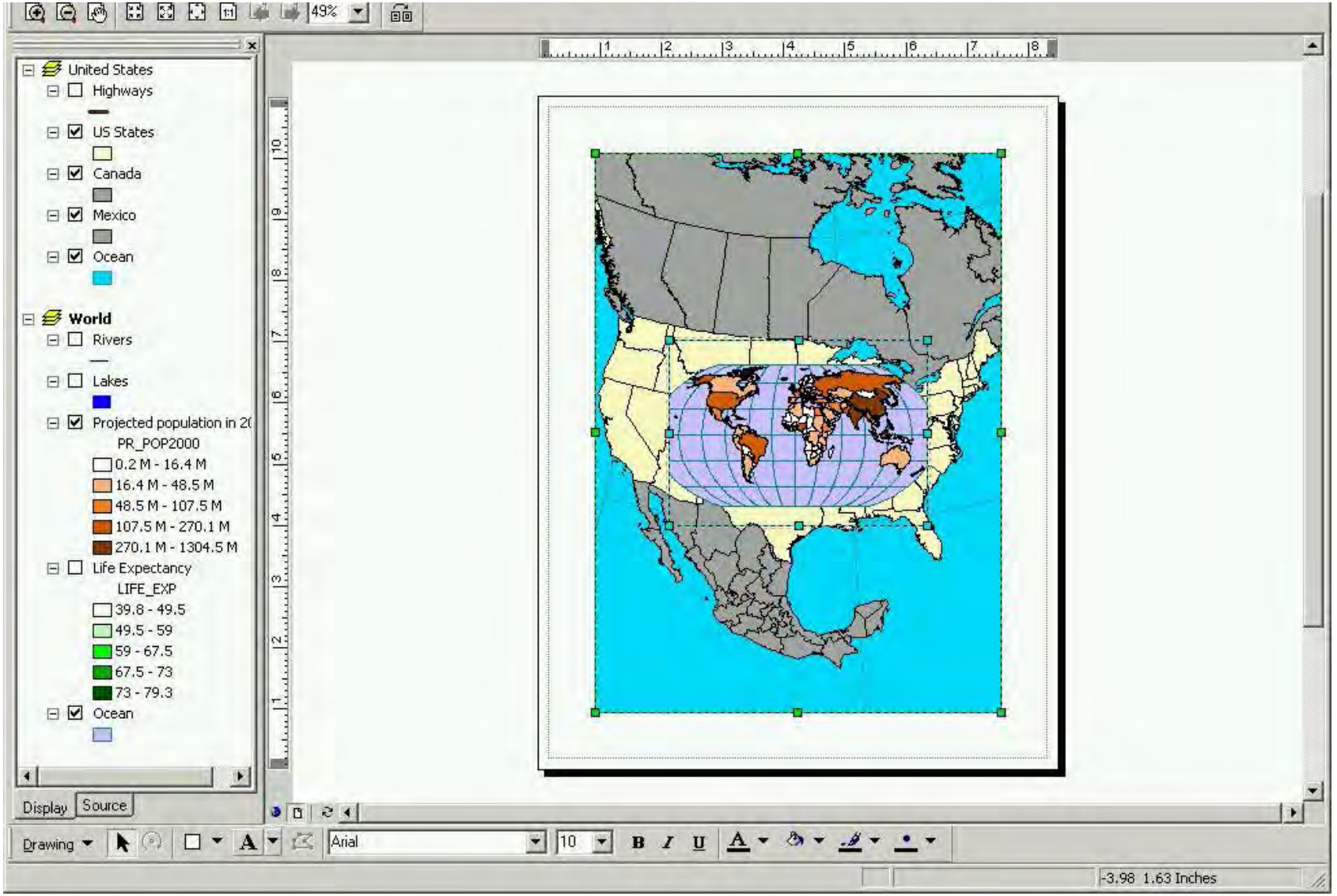
2) To get to a layout, select **View -> Layout View**



Getting to the Layout View

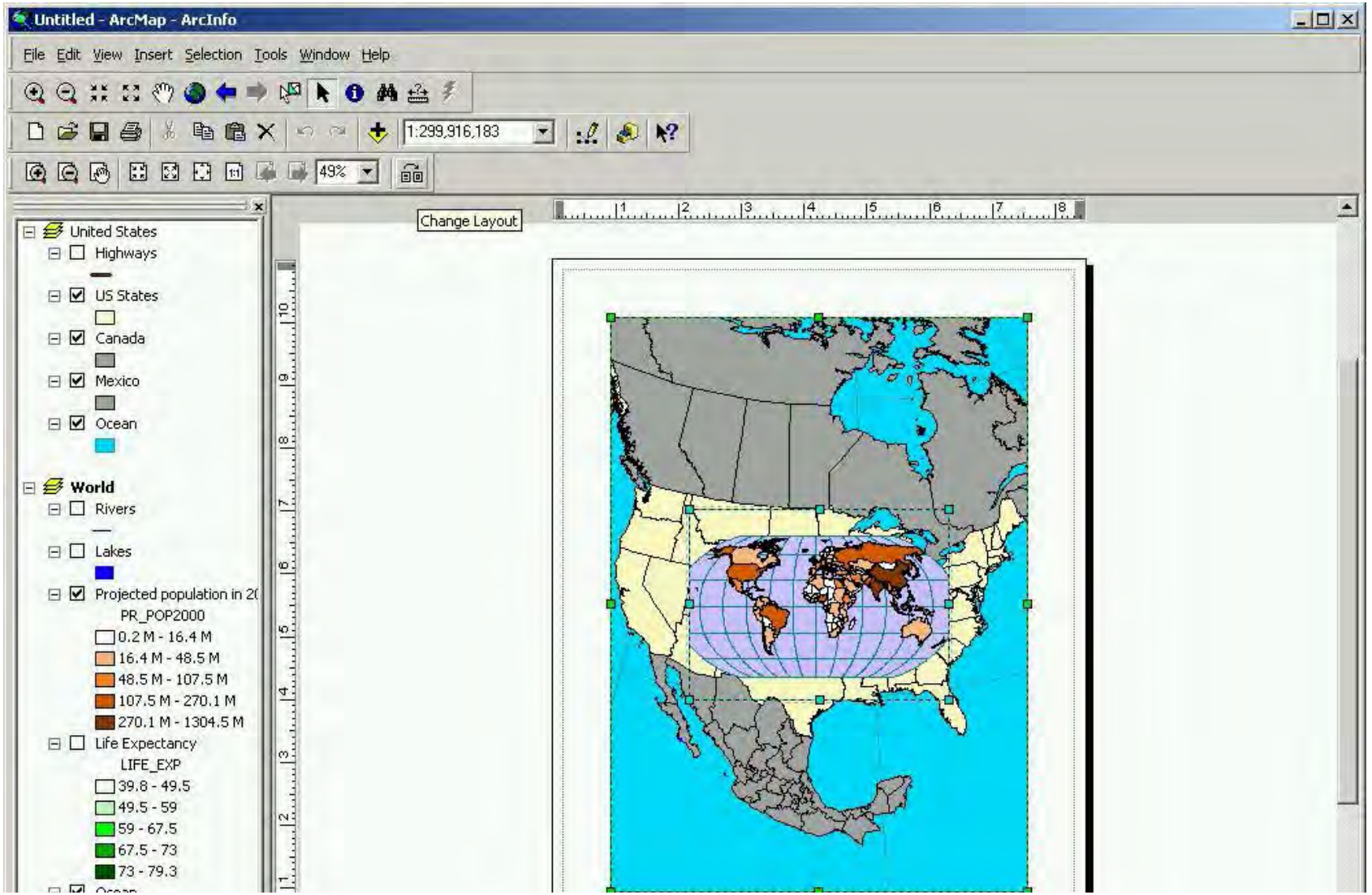
3) You layout view will appear with your data frame windows centered in the middle of the layout page.

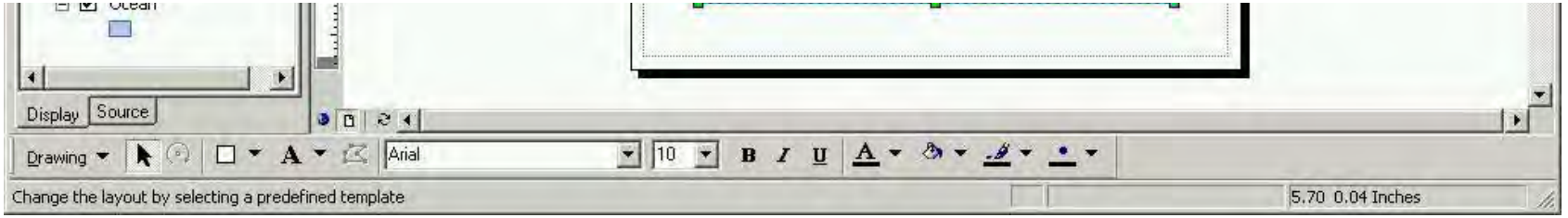




Layout View

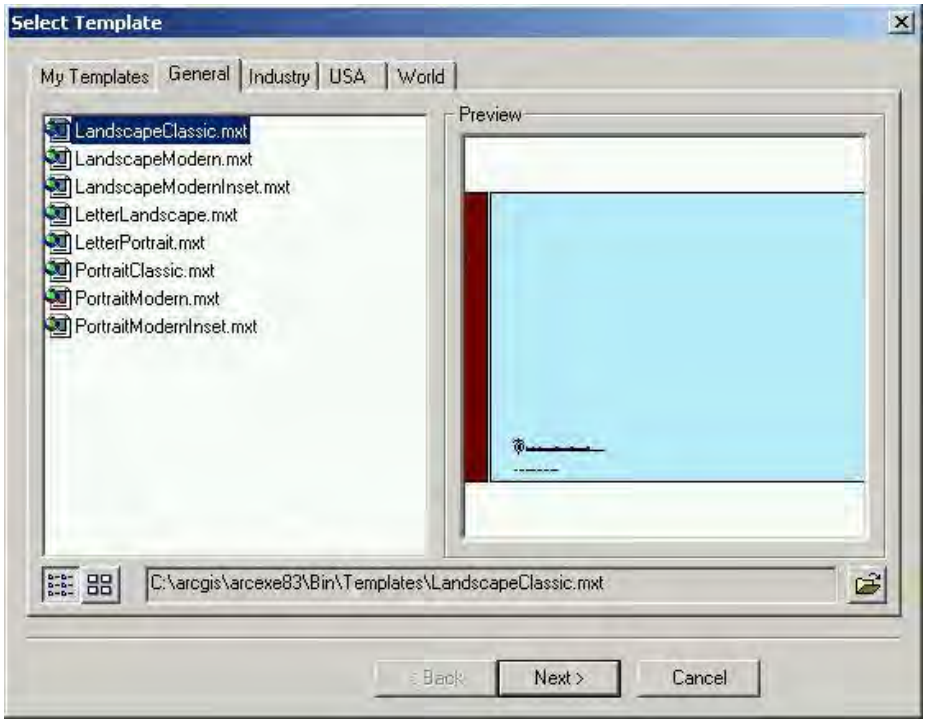
4) To use a templated layout , click on the **Change Layout Button**


Untitled - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:299,916,183
49%
Change Layout
United States
Highways
US States
Canada
Mexico
Ocean
World
Rivers
Lakes
Projected population in 2(
PR_POP2000
0.2 M - 16.4 M
16.4 M - 48.5 M
48.5 M - 107.5 M
107.5 M - 270.1 M
270.1 M - 1304.5 M
Life Expectancy
LIFE_EXP
39.8 - 49.5
49.5 - 59
59 - 67.5
67.5 - 73
73 - 79.3



Change Layout Button

5) The **Select Template Wizard** window will appear.

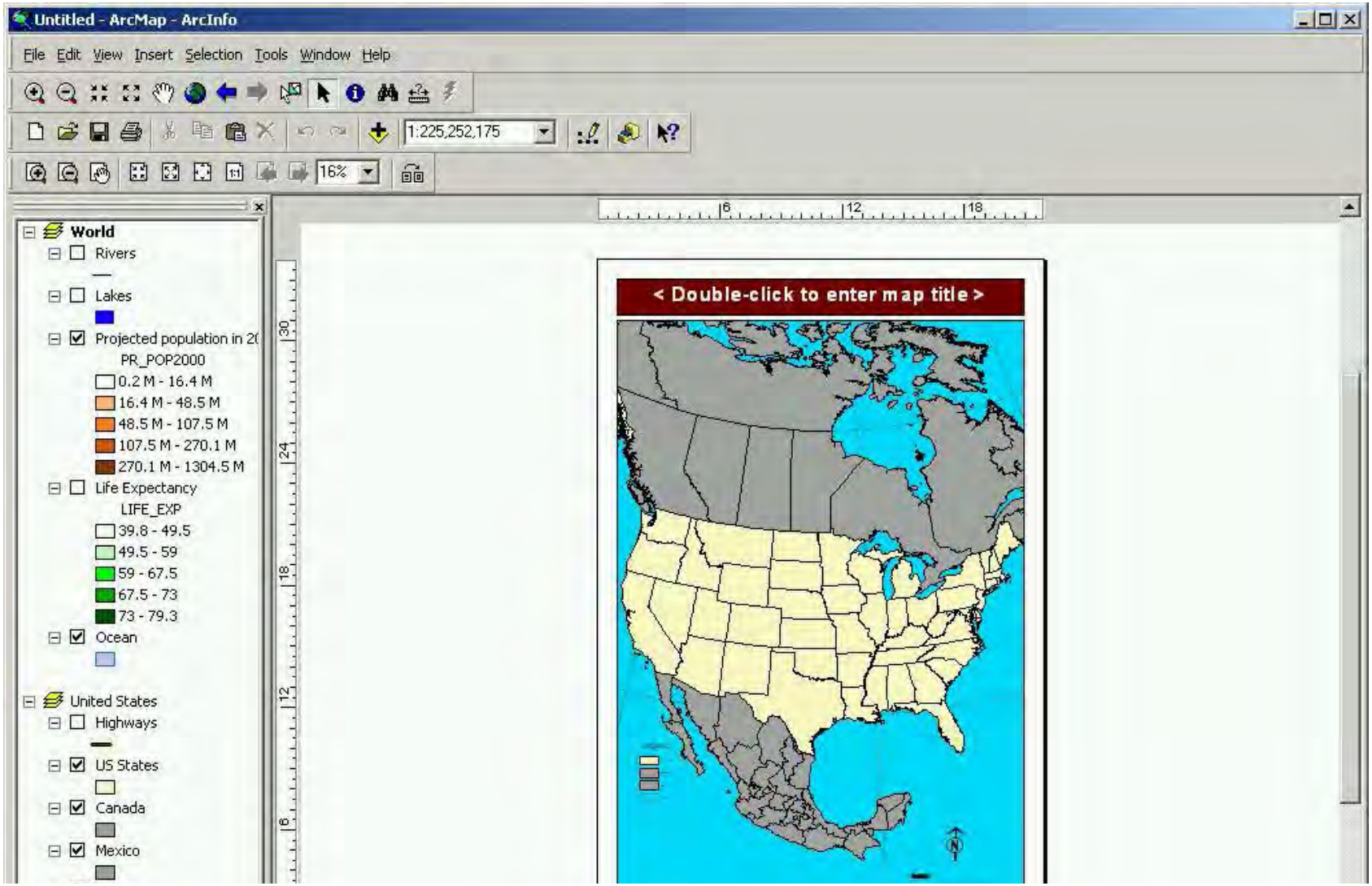


Layout Wizard, Simply follow the instructions

6) Choose the tab and the template you would like for your map. (Note: If you have more then one map in your data frames you can choose to display one or all of them simply follow the prompted instructions.)

7) When you have finished selecting all your preferences, simply click **Finish**

8) Your map layout will appear with the basic cartographic elements embedded within them.



Enter in the final touches

Some elements will require further detail, such as in the case with text, you will be prompted with text saying Simply double click and add your title or text.

9) If you are unhappy with some of the organization of your map you can click on the object (ie. North Arrow, Legend, Scale Bar) that you would like to move and simply drag it where you would like it.

10) You are now ready to print your map layout. If you wish to personalize your map layout further see the other recipes within the *Cartographic Design Section*

Authored by: Benjamin N. Sprague **Modified:** 8/11/03

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GIS Cookbook: Cartographic Design - Creating a Report

Keywords: Report, chart, extension, display
Category: Buffers
Software: ArcView 3.2

Problem: I have map data and I would like to present it in a report.

Description: An easy way to create a report of data from themes is to create a report using the Report Writer extension. The extension will allow you to produce a report of specific fields of a theme in minutes.

Scenario:
Building on the scenario Buffering an Area recipe, you now want to make a report of the cities that are most affected by the buffers around the Irvine Medical Center and Family Health Centers.

August 7, 2002

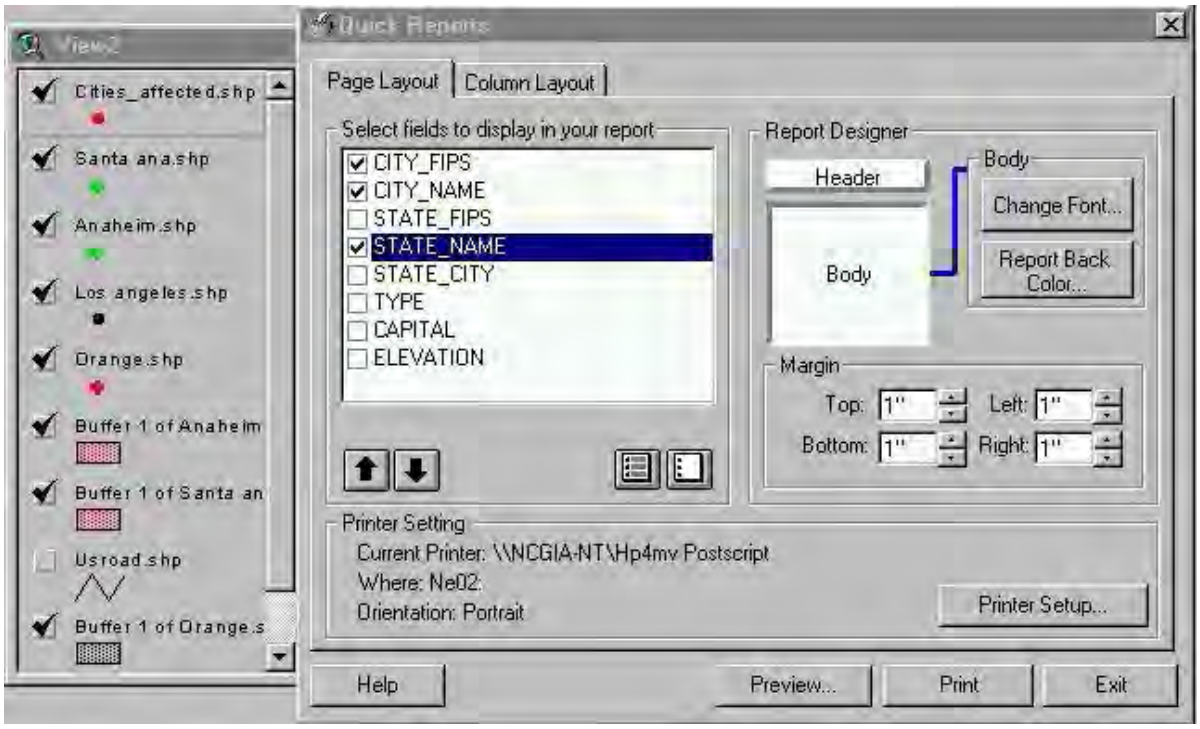
CITY_FIPS	CITY_NAME	STATE_NAME
86832	Yorba Linda	California
28000	Fullerton	California
57526	Placentia	California
29000	Garden Grove	California
80854	Tustin	California
25380	Fountain Valley	California

Methodology:
1) Go to **File->Extensions** and put a check by the Report Writer extension.

2) Select the theme in your view for which you wish to write a report.

3) Go to **Theme->Create a Report**. You will need Quick Report checked. Next click on the amount of records that you would like to use in your report (All or Selected Records). Click **Finish**.

4) Next you will need to designate which fields you would like to use in your report. You can also set the font and spacing of the report and margins. Finally, you are now ready to print your report.



If you are having problems printing to your specifications, See Pitfall 1.

If you are having trouble viewing or saving your report digitally, See Pitfall 2.

Pitfalls:

- **1)** In order to change the printer options, you must first preview your report. The **Preview** option is found at the bottom of the Layout tab where you selected what fields need to be in the report. When you have selected the **Preview** option, click the button that shows a printer and a wrench symbol. Now you can change the paper size, and specify the printer that you want to use.

  Link

- **2)** To save your report in a specific format, first you will need to preview it. To save, click the button that looks like an envelope. You will then choose the format you would like to save it as. (Saving it as a Microsoft Word document makes it very easy to view.) Finally, specify that your destination will be a disk file and click **Save**.

Links:

Authored by: Ethan Sundilson **Modified:** 9/10/03

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GIS Cookbook: Cartographic Design - Adding and Editing a Legend to a Layout

Keywords: Presentation, finishing, printing, cartographic elements, layouts, legends, symbols, defining
Category: Cartographic Design
Software: ArcView 3.2

Problem: How do I add a legend to my map?

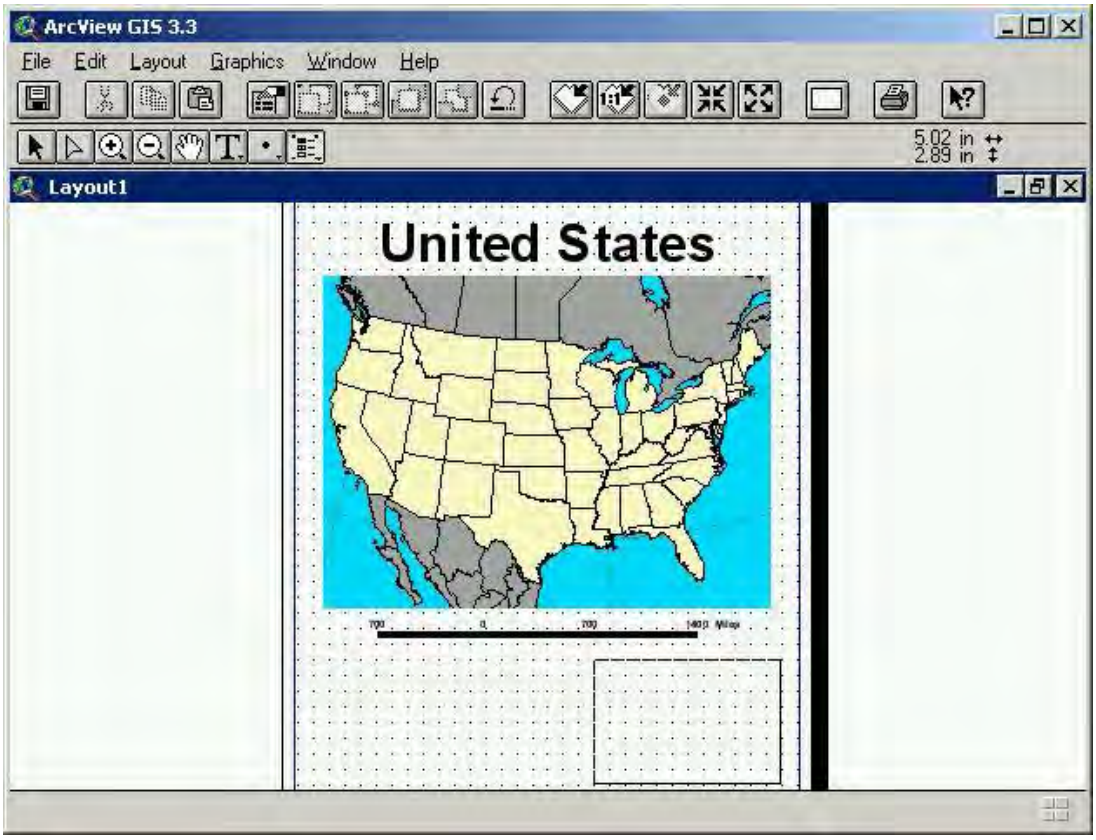
Description: Your map is in the Layout format and you would like to add a legend.
Note: For help on getting your map into the Layout format, refer to recipe ***Shortcut to moving your map into the presentation stage (using a template)***

Methodology:
1) Click and hold the last button on the layout tool bar.

Legend Tool

2) Select the **Legend** icon

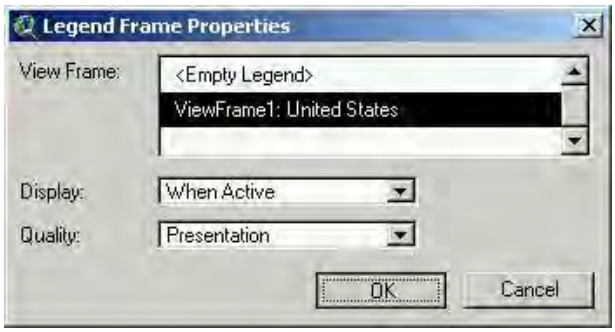
3) While holding down the mouse button, drag the cursor over to where you would like to place the legend.



Selecting a location for your legend

Release the button when the square shows the appropriate size for your map. The square indicates the size of the legend you are creating.

4) The Legend Frame Properties window will appear.

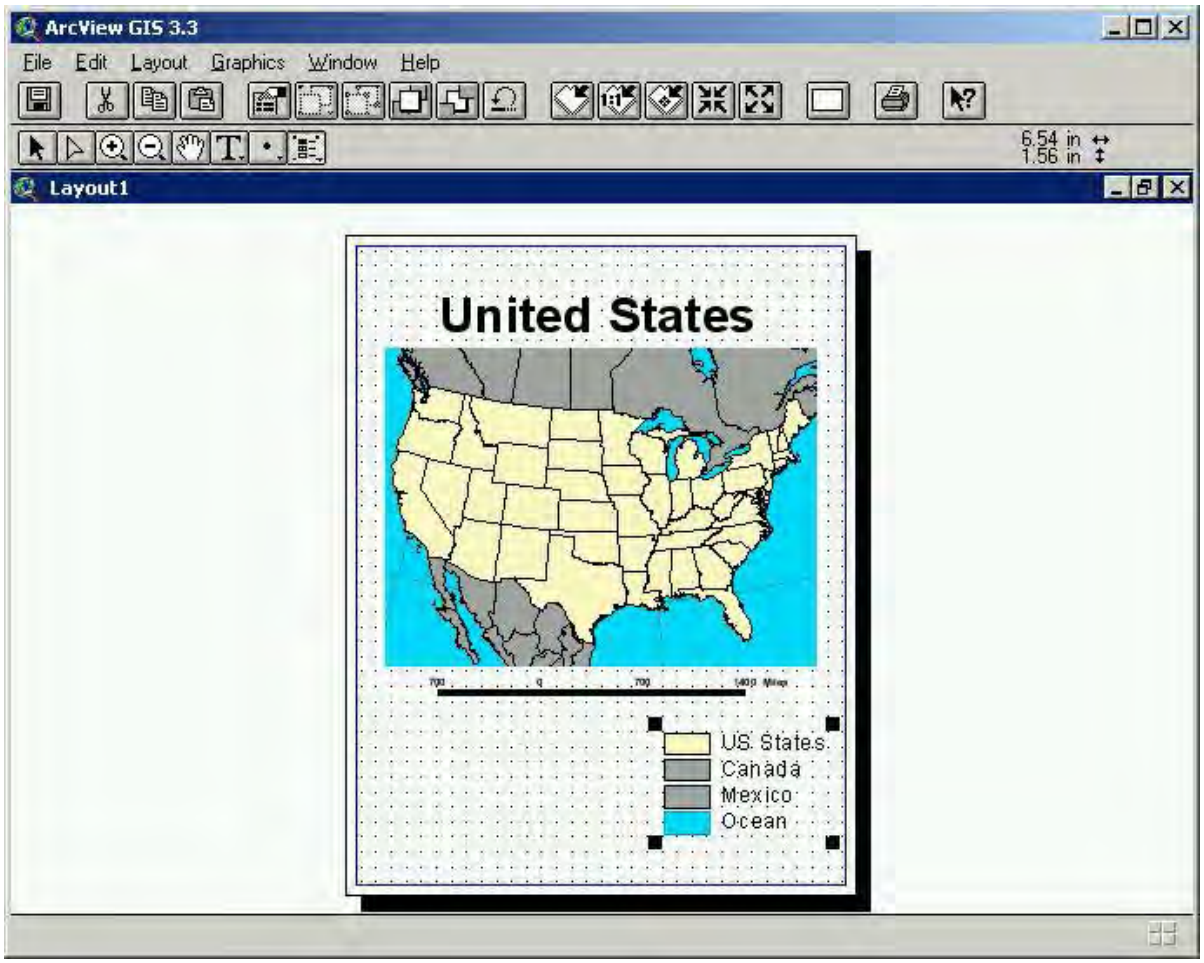


Legend Frame Properties window

Select the view within which you would like to display your legend.

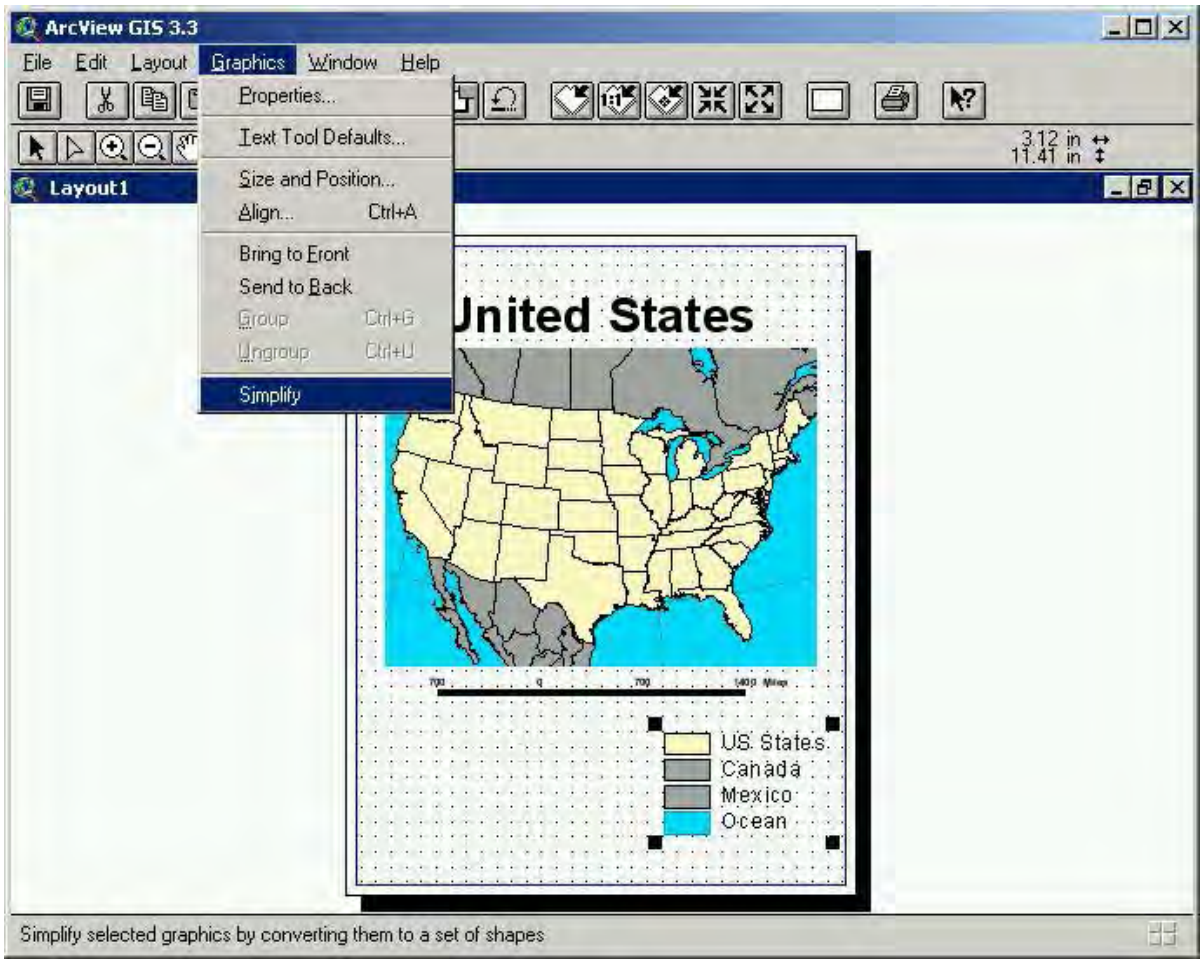
5) Your legend should appear in the selected location on your map. The name of each layer of data used in creating your map will automatically be used within the legend labels.

6) To change the graphics and text of your legend click on the legend so that dark squares appear on all four corners.



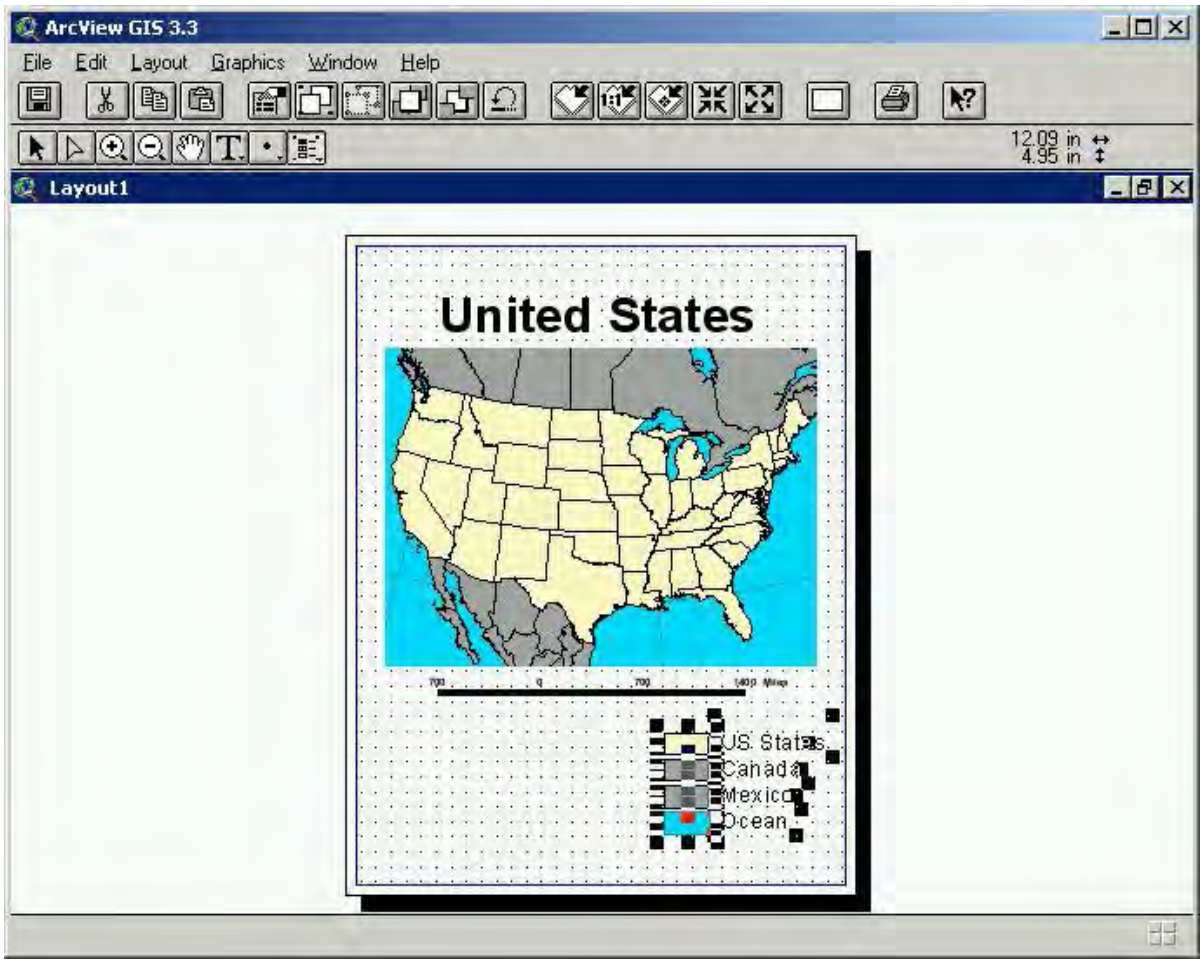
Legend selected

7) Go to the menu item **Graphics-->Simplify** .



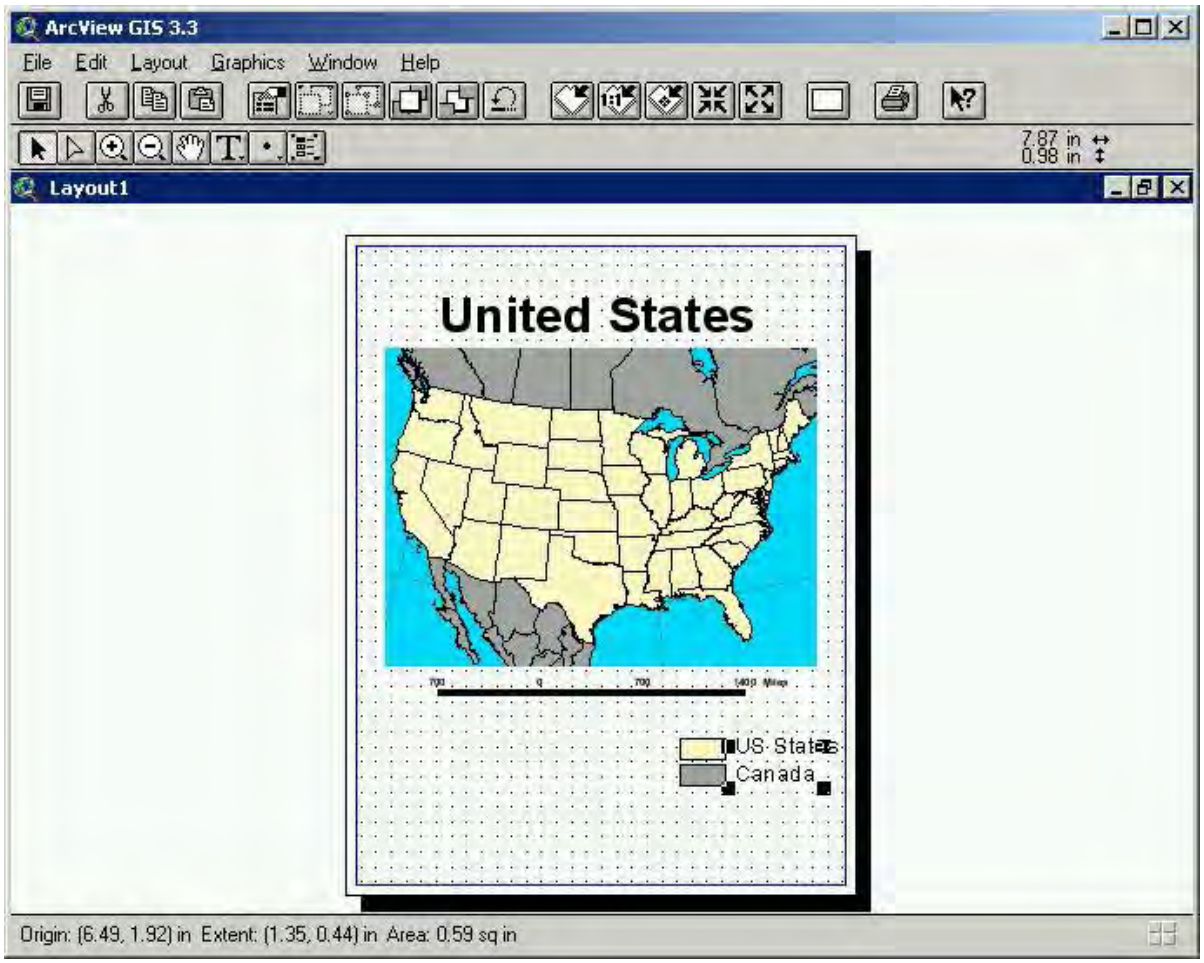
Simplify

This will change the legend object from one object to a number of individual objects (i.e., ungrouping). You can then move, delete, add, or change the individual legend elements to match your presenation style. You may also change the text font and symbols used within the legend.



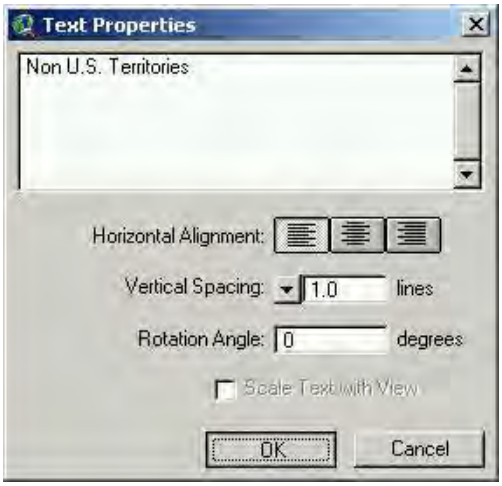
Ungrouped objects after simplify tool

You may also decide to add or delete certain elements from your legend that may not be necessary to include in your presenation. Click on each unwanted element then press **Delete**.



Editing your legend

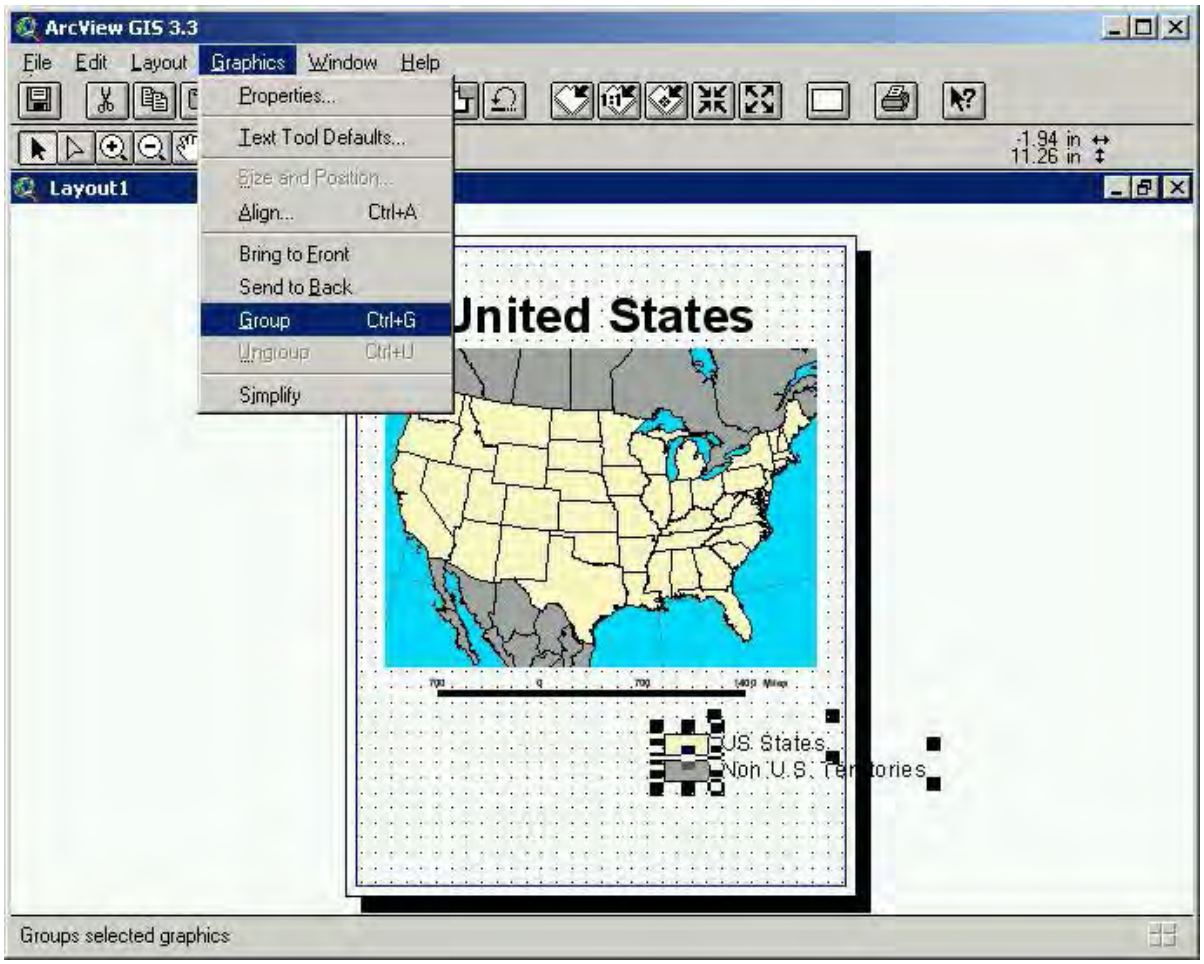
8) To alter the font and size of your legend text, or the specifics of your symbol simply press **Control P** while the object you wish to alter is selected and then choose your palette properties. You can also edit the content of your text by double cliking on the text object you would like to change.



Changing the text in your legend

Note: To learn more about editing text refer to the recipe ***Adding text to a layout***

9) Once you have configured the individual legend elements to your own standards you must re-group the elements. Select all the elements you would like in the legend. Then select the menu item **Graphics-->Group**.



Grouping the objects in your legend to one object

All of the selected elements will re-group into one object. You can go back and forth by ungrouping and grouping objects, editing and reediting them until you are satisfied with your presentation.

Note: Once you have simplified and grouped for the first time, use **Graphics-> Ungroup** and **Graphics-> Group** to edit your legend. The Simplify command is only used the first time.

Authored by: Benjamin N. Sprague **Modified:** 8/27/03

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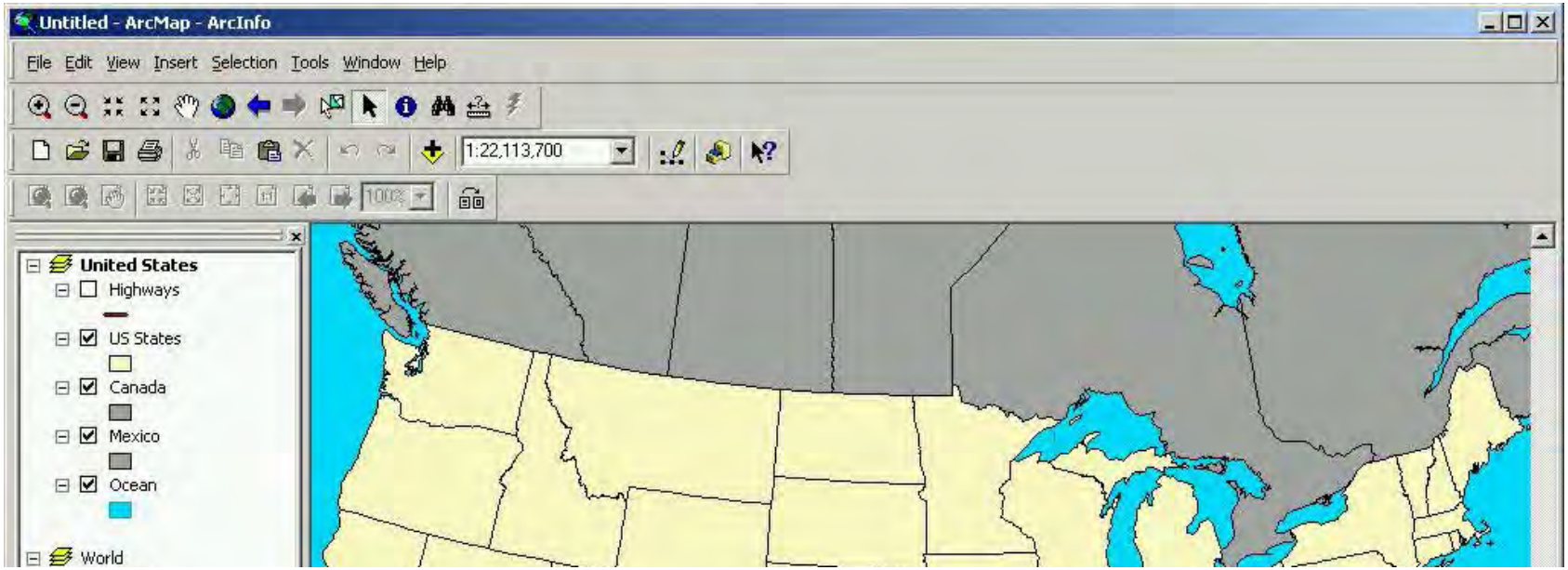
GIS Cookbook: Cartographic Design - Adding and Editing a Legend

Keywords: Presentation, legend, display properties, definition, printing, cartographic elements, symbols
Category: Cartographic Design
Software: ArcInfo 8

Problem: How do I add a legend to my map?

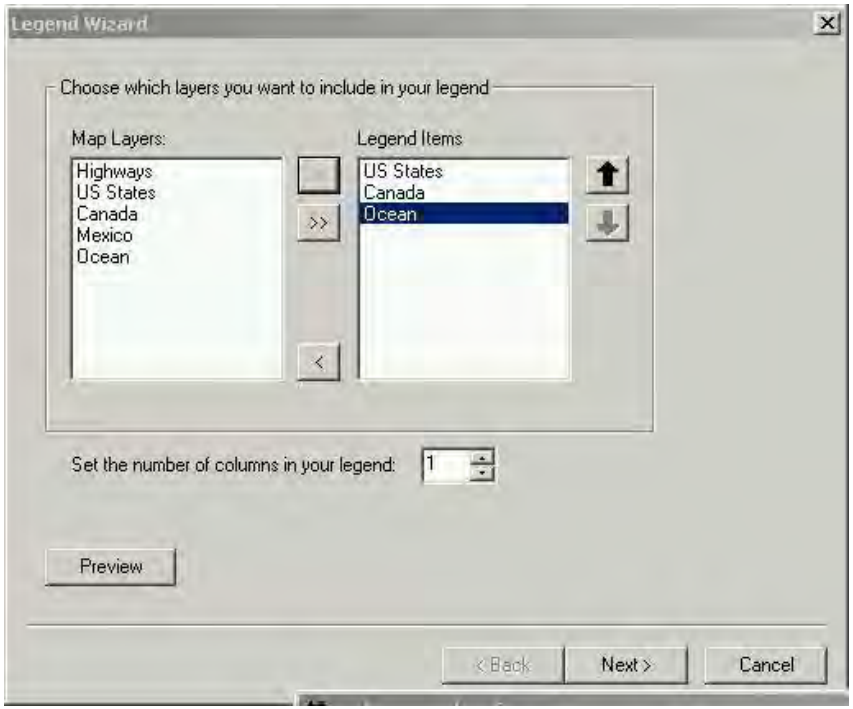
Description: Your map is inthe Layout format and you would like to add a legend.
Note: For help on getting your map into the Layout format, refer to recipe ***Shortcut to moving your map into the presentation stage (using a template)***

Methodology:
1) In the layout view window, make sure the dataframe you want to work with is selected by clicking on the dataframe name. We would like to add a legend that includes the information for the United States dataframe, so we would click on the name "United States" to highlight it. Then select **Insert -> Legend**



Inserting a legend

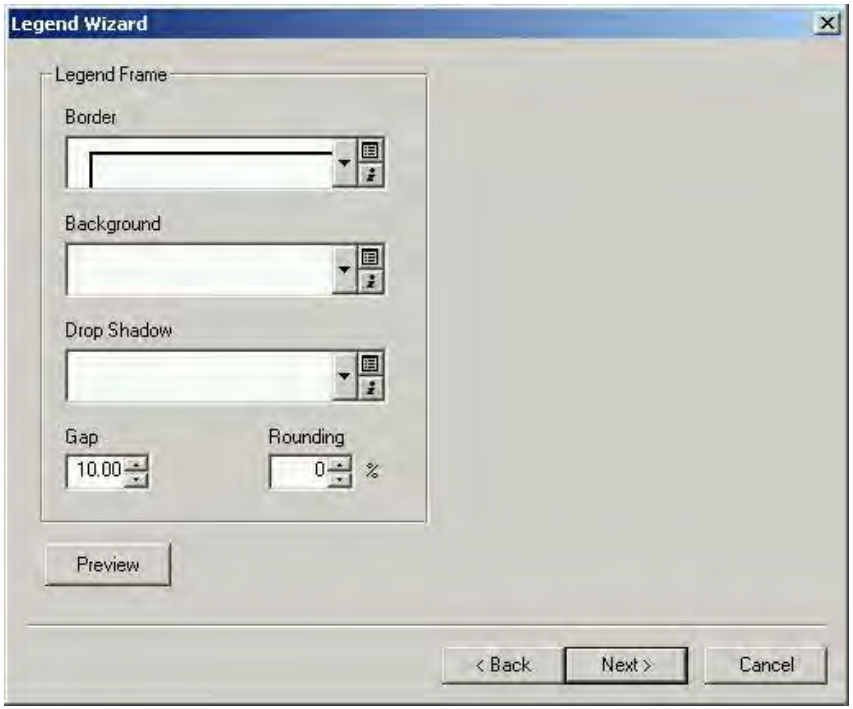
2) The *Legend Wizard* window will pop up. Follow the steps to create your legend. First choose the specific symbols from the table of contents that you want to use in the legend.
Note:If the themes from the wrong data frame appear in the your legend wizard window, See Pitfall 1.



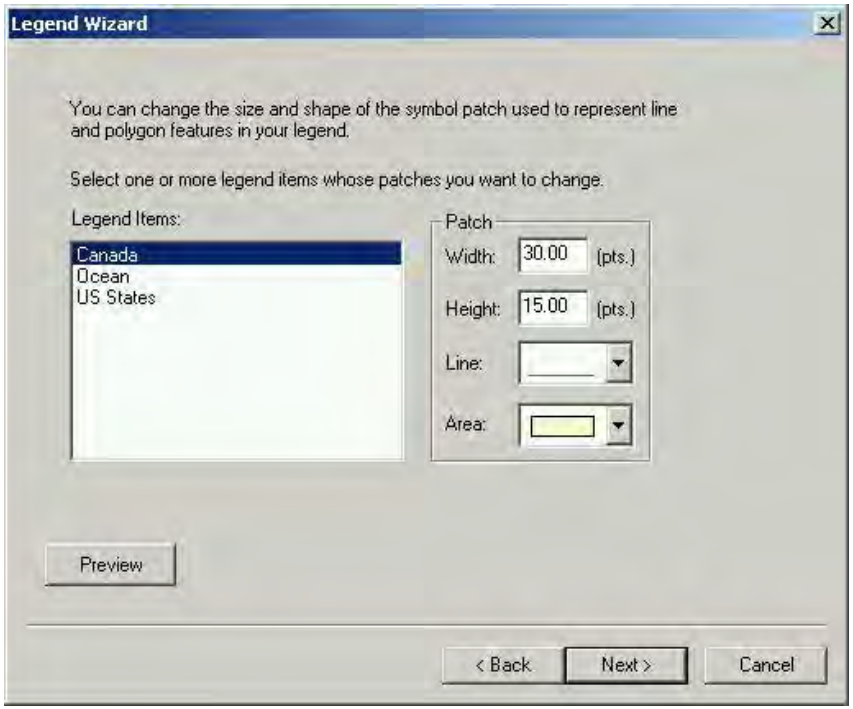
Legend Wizard (Choose the information you want displayed)

4) Now add a title and an outline by selecting the style and shape of the legend symbols presented to you in the *legend wizard*. You may also want to change the spacing within the legend.

Enter a title in the text area



Choose the styles of borders. If you do not want a border you may select a blank pattern.



Change the way certain elements are represented on your map.

Choosing the spacing between your legend elements.

5) Once you have finished personalizing your legend, click **Finish**

6) Your legend should appear on your map layout. You can then drag it by clicking on it, and holding down the mouse button, then moving the cursor to where you would like to place the legend.

Your legend will appear, click and drag it to its final destination.

7) You may want to further edit your legend to change the names of features or delete certain text or symbols. To edit make these additional changes RIGHT CLICK on the legend and select **Convert to graphics**. By doing this you will make the legend into an image independent of the map and make your necessary changes on the legend without it influencing your map.

Convert to Graphics

8) To edit the pieces of your legend individually, right click on the legend and select **Ungroup**

Ungroup the Graphics

9) The individual pieces of your legend will then each become highlighted and selected.

The resulting Ungrouped Graphics

Click on them individually to edit them.
Note: You may have to ungroup some parts of the legend more then once to edit the more detailed elements.

Personalized map legend

10) Be sure to re-group the elements by right clicking on the legend and selecting **Regroup** when you are finished modifying the individual elements within the legend.
Pitfalls:

- Press cancel to exit the window and activate the dataframe that includes the information you would like to use for your legend.

Authored by: Benjamin N. Sprague **Modified:** 8/27/03

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GIS Cookbook: Cartographic Design - Adding a Scale bar to a Layout

Keywords: Presentation, map scale, scale bar, distance, printing
Category: Cartographic Design
Software: ArcView 3.2

Problem: How do I add a scale bar to my map?

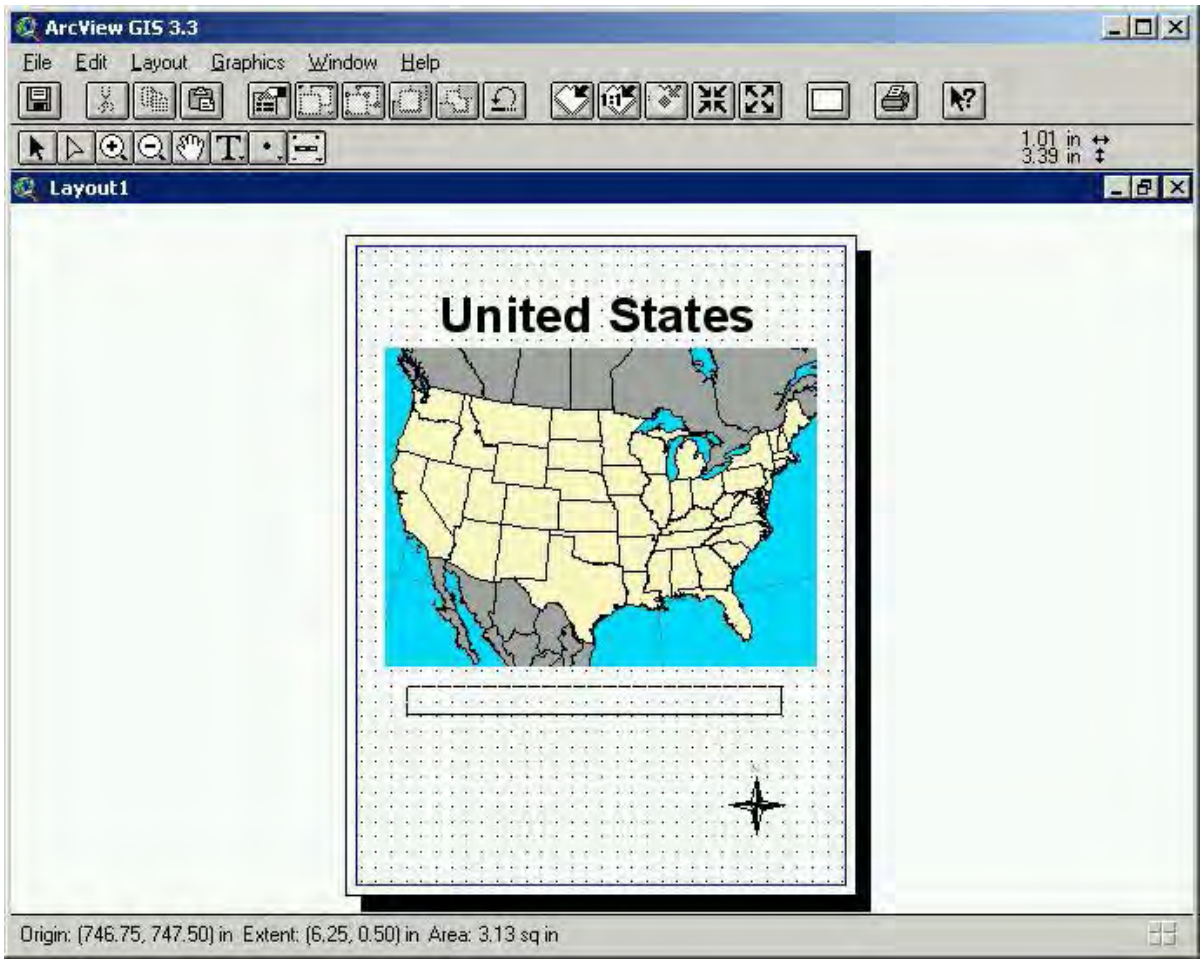
Description: Your map is in the Layout format and you would like to add a scale bar.
*Note:*For help on getting your map into the Layout format, refer to recipe ***Shortcut to moving your map into the presentation stage (using a template)***

Methodology:
1) Click and hold the last button on the Layout tool bar.

Selecting the scale bar tool

2) Select the **Scale Bar icon**

3) While holding down the mouse button, drag the cursor over to where you would like to place the scale bar.



Selecting the appropriate location for your scale bar

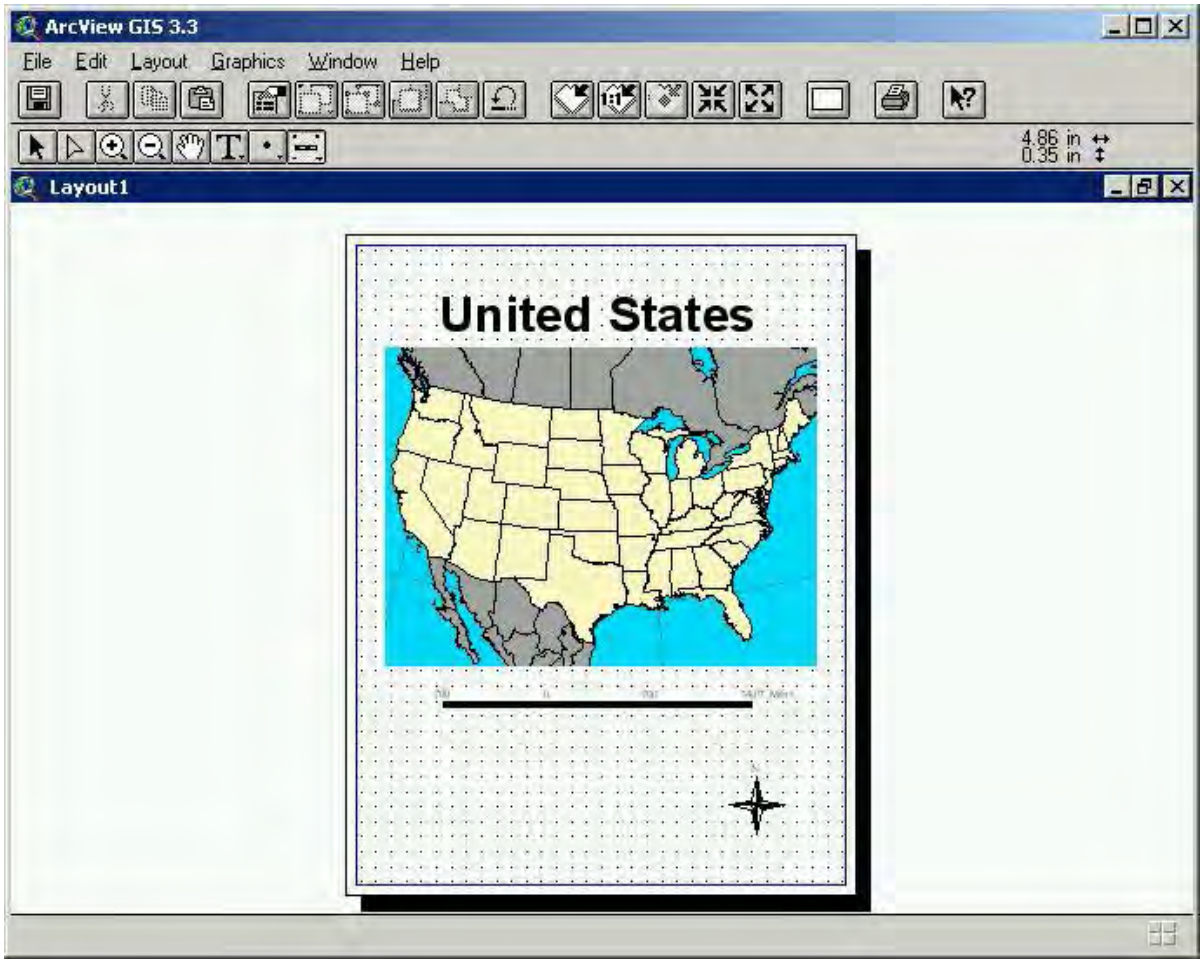
Release the button when the rectangle shows the appropriate size. The rectangle indicates the size of the scale bar you are creating.

4) After releasing the mouse button the Scale Bar Properties menu will appear.

Scale Bar Properties window

Select the View within which you would the to display the scale bar. If your view does not appear please See Pitfall 1)
Select the style and map units you would like and click **ok**

5) Your north arrow should appear in the selected location on your map.



Pitfalls:

- If your view does not appear you must set the units (meters, feet, miles, etc.) of your view for your map. To select a unit measurement for your map go to the Views section of the project manager window and select **View->Properties** . Select the map units you would like to use using the distance units pull down bars.

Authored by: Benjamin N. Sprague **Modified:** 8/27/03

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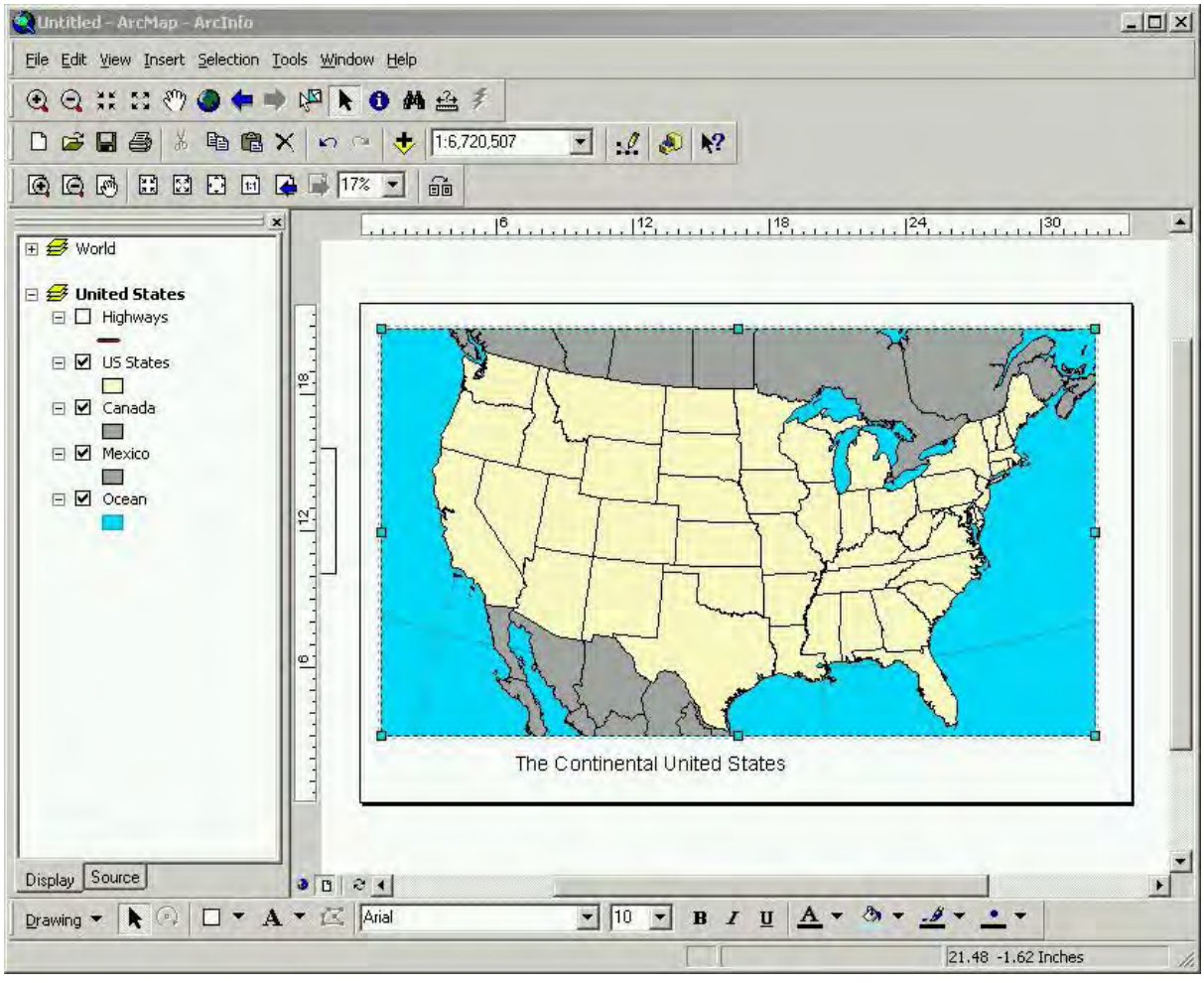
GIS Cookbook: Cartographic Design - Adding a scale bar to your layout

Keywords: Presentation, map scale, scale bar, distance, printing
Category: Cartographic Design
Software: ArcInfo 8

Problem: How do I add a scale bar to my map?

Description: Your map is in the Layout window, now you would like to add a scale bar.

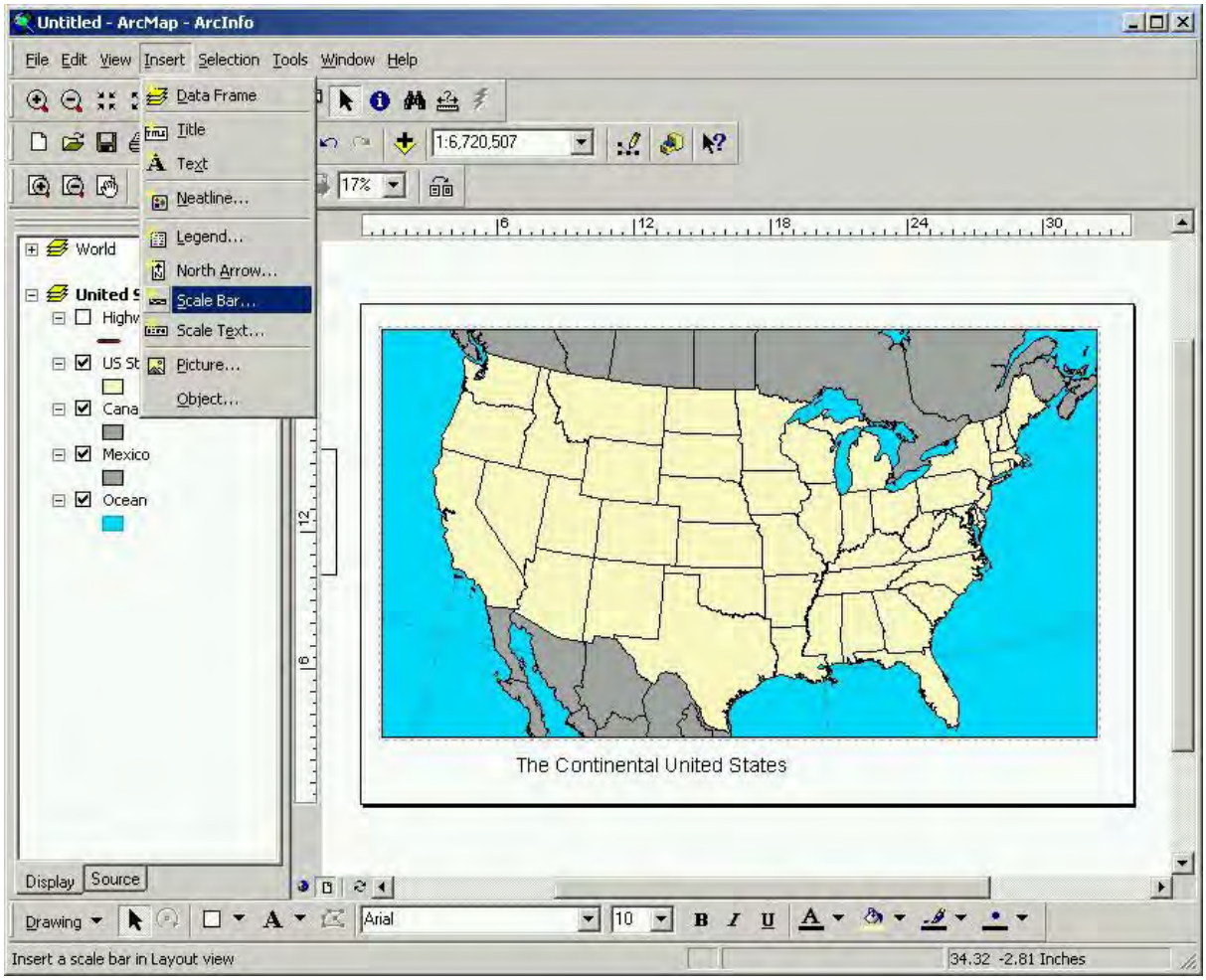
Methodology:
1) In your layout view highlight the data frame that includes the data layers to which you would like to add a scale bar. To select it click on it once.



Select your the data feature you want to display

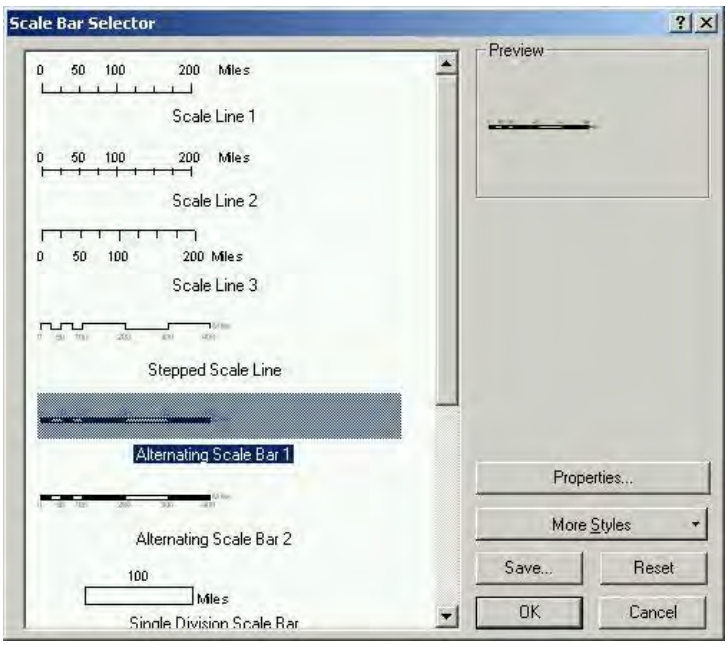
Note: If the wrong data frame is selected then your scale will have incorrect measurements.

2) Then select **Insert -> Scale Bar**



Insert a scale bar

3) The Scale Bar Selector window will appear. Choose the style you would like to use for your scale bar.

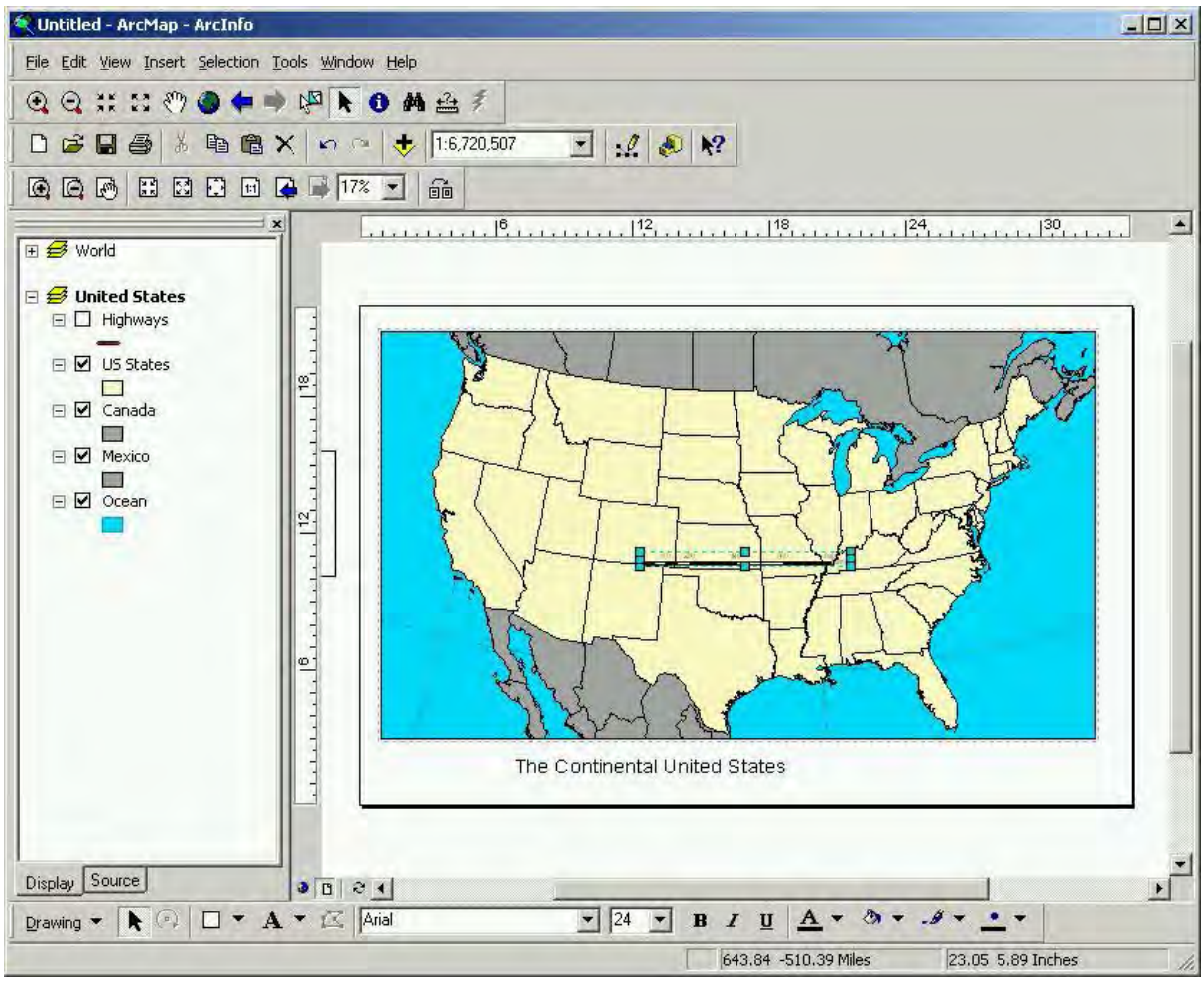


Scale bar selector

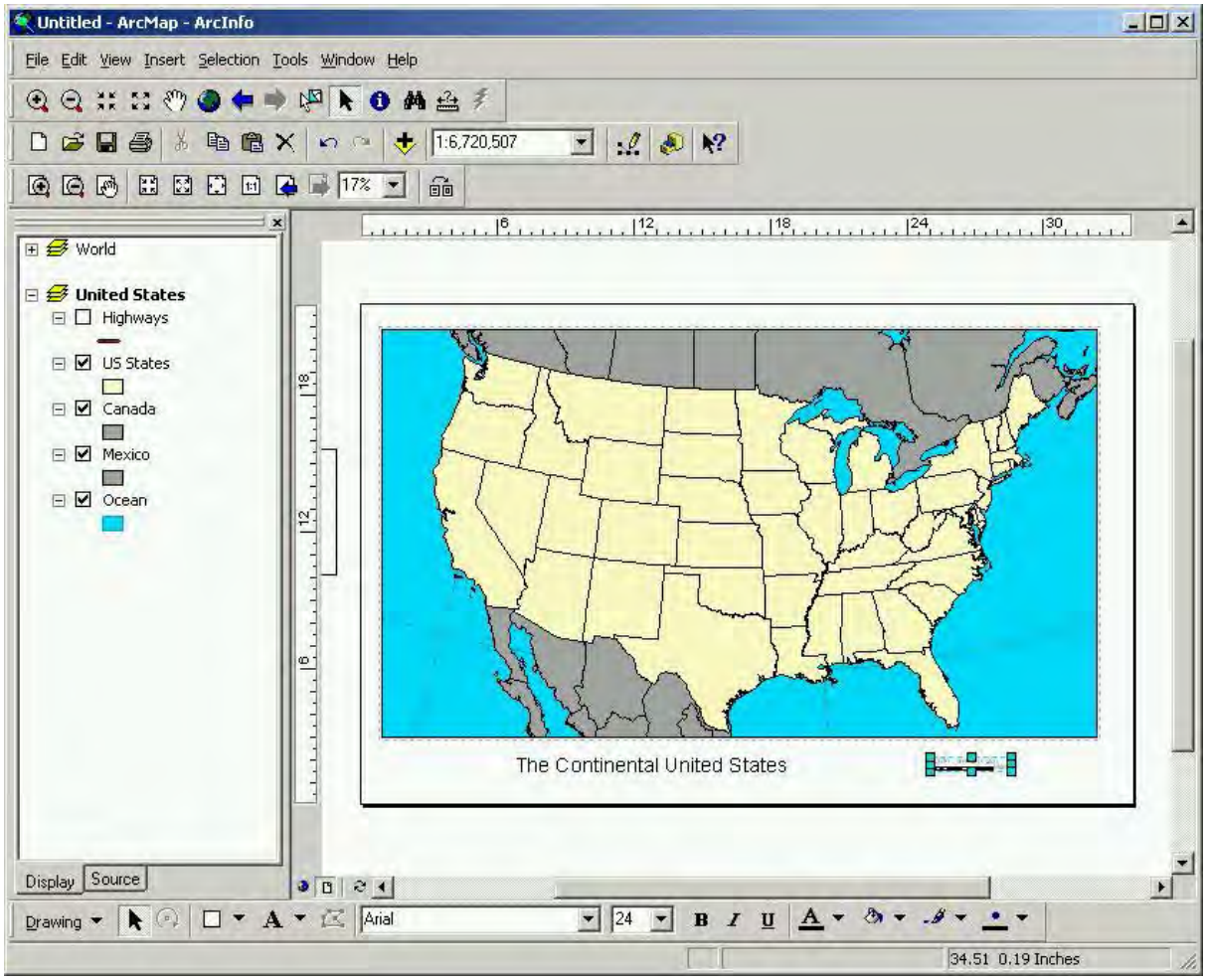
4) You can further change the specifics of your scale bar by clicking the **Properties** button.

5) When you have made all your selections click **Ok** .

6) You scale bar will appear in the center of your map layout.



You can then resize it and drag to the desired location on your map layout.



7) You can further change the scale bar by double clicking on it and following the menu commands.

Authored by: Benjamin N. Sprague **Modified:** 9/2/03

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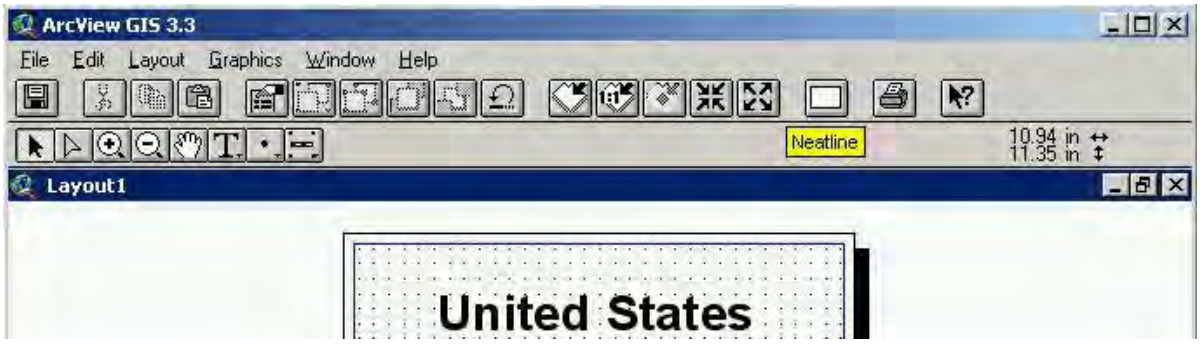
GIS Cookbook: Cartographic Design - Adding a Neatline or Borders to a Layout

Keywords: Presentation, finishing, printing, cartographic elements, layouts, borders, outlines
Category: Cartographic Design
Software: ArcView 3.2

Problem: How do I add a border to my map?

Description: Your map is in the Layout format and you would like to add a border.
*Note:*For help on getting your map into the Layout format, refer to recipe ***Shortcut to moving your map into the presentation stage (using a template)***

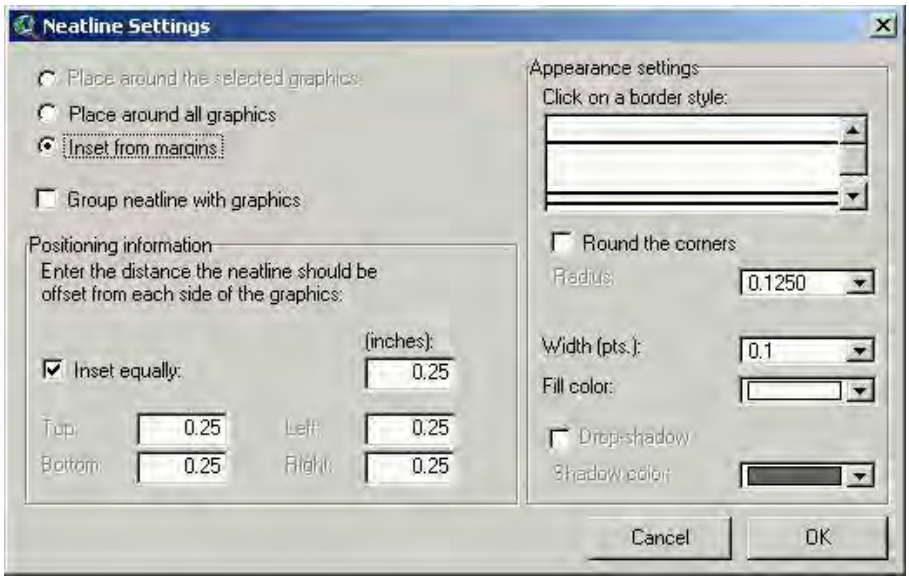
Methodology:
1) Select the object or objects you would like to include within the border. If you would like the border to surround the entire presentation area (i.e., Neatline), do not select anything. This should be your last step before printing.



Finding the Neatline icon

2) Select the **Neatline Button**

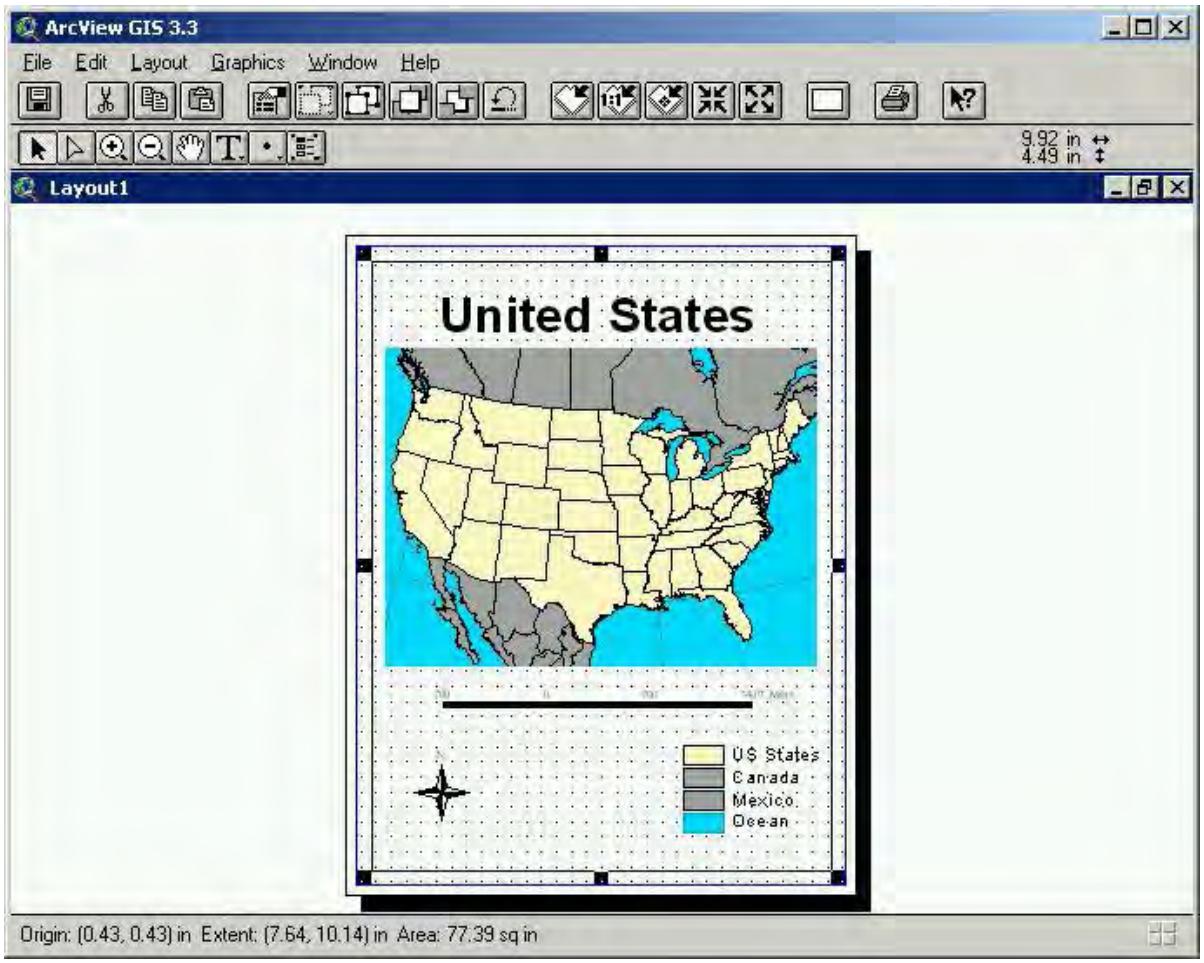
3) The Neatline Settings window will appear.



Neatline Settings window

Select the appropriate styles and details for your border. Suggestion: Use the *Inset from Margins* selection if you would like to place a border around all map elements.

4) When you are finished click **ok** and the map border will appear.



5) To add another border select the object or objects you would like to include within the second border and repeat the above steps.

Note: Finding the appropriate settings for your border requires trial and error and also depends on your presentation style.

Authored by: Benjamin N. Sprague **Modified:** 8/27/03

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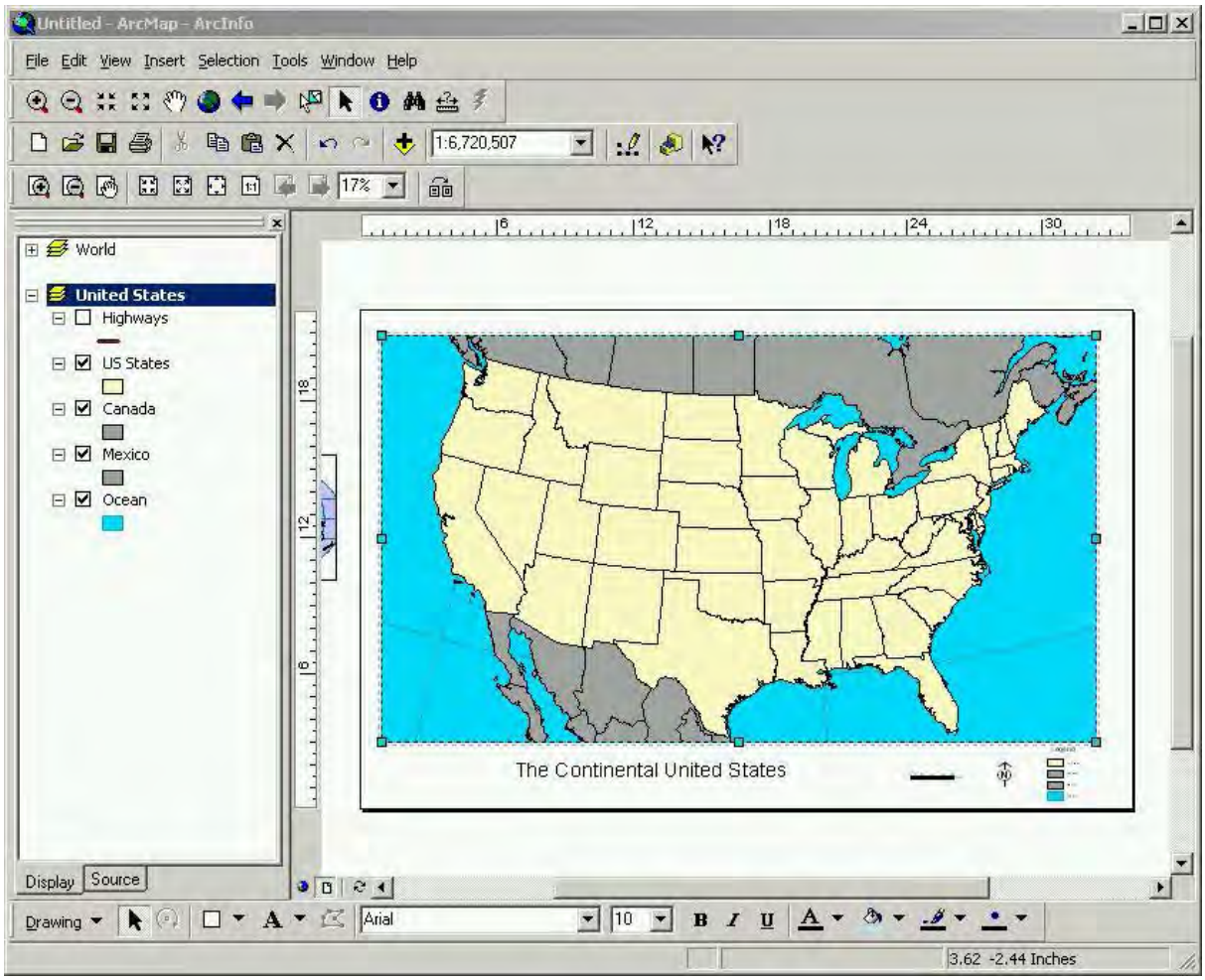
GIS Cookbook: Cartographic Design - Adding a Neatline or a border to your map layout.

Keywords: Presentation, border, frame, neatline, printing
Category: Cartographic Design
Software: ArcInfo 8

Problem: How do I add a border to my map?

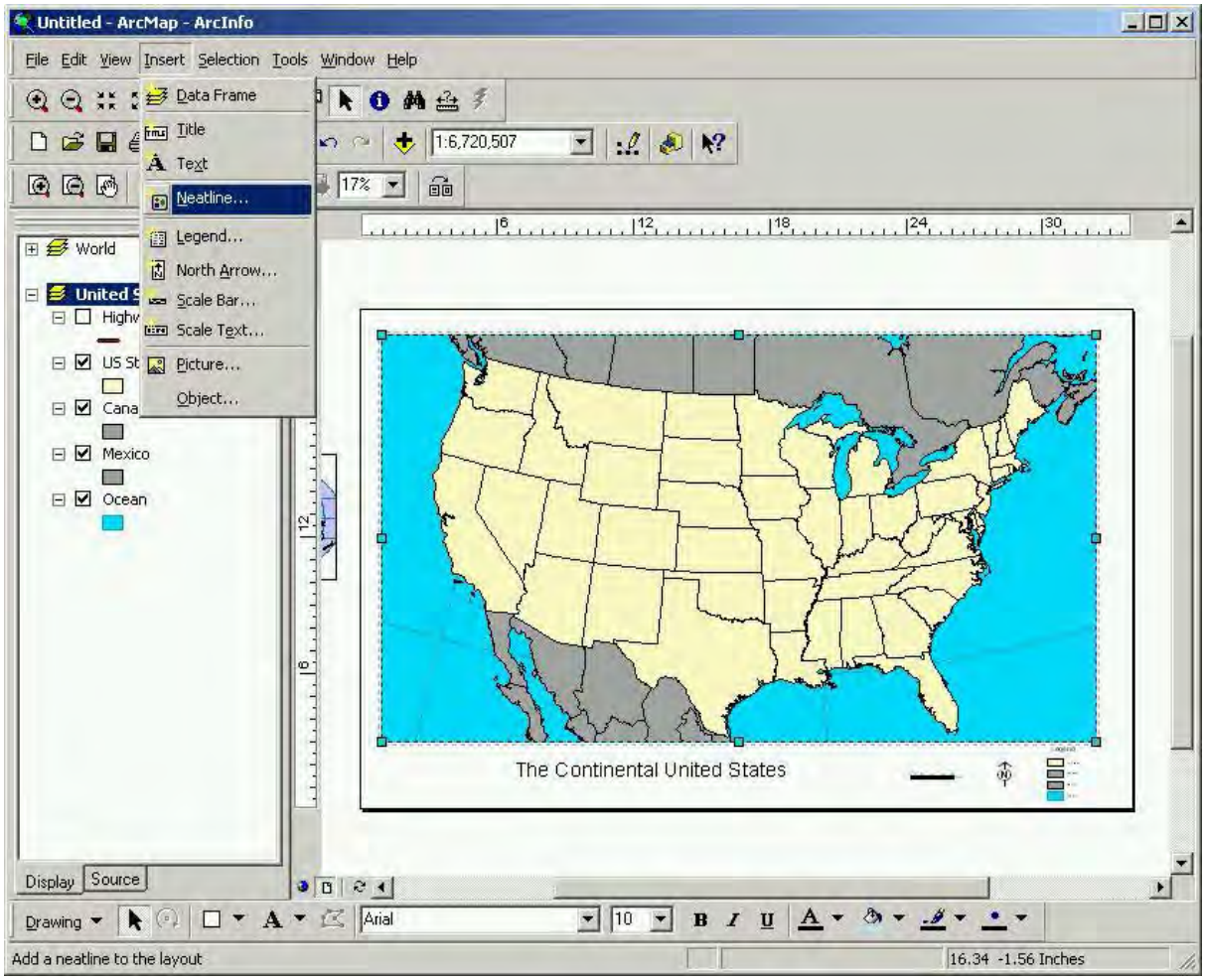
Description: Your map is in the layout window, now you would like to add a border or borders around or within the map.

Methodology:
1) In your layout window, select the object or objects you would like a border around. If you would like to place a border around the entire presentation area (i.e. a neatline), make sure that nothing in your layout has been is selected/highlighted.
Note: Adding a neatline is usually the last step before printing.



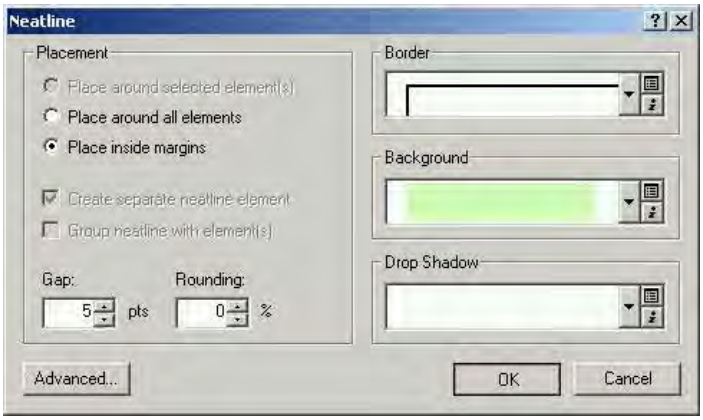
Neatline Manager Window

2) In the layout window, select **Insert -> Neatline** .



Your newly added neatline and background color

3) The Neatline window will come up

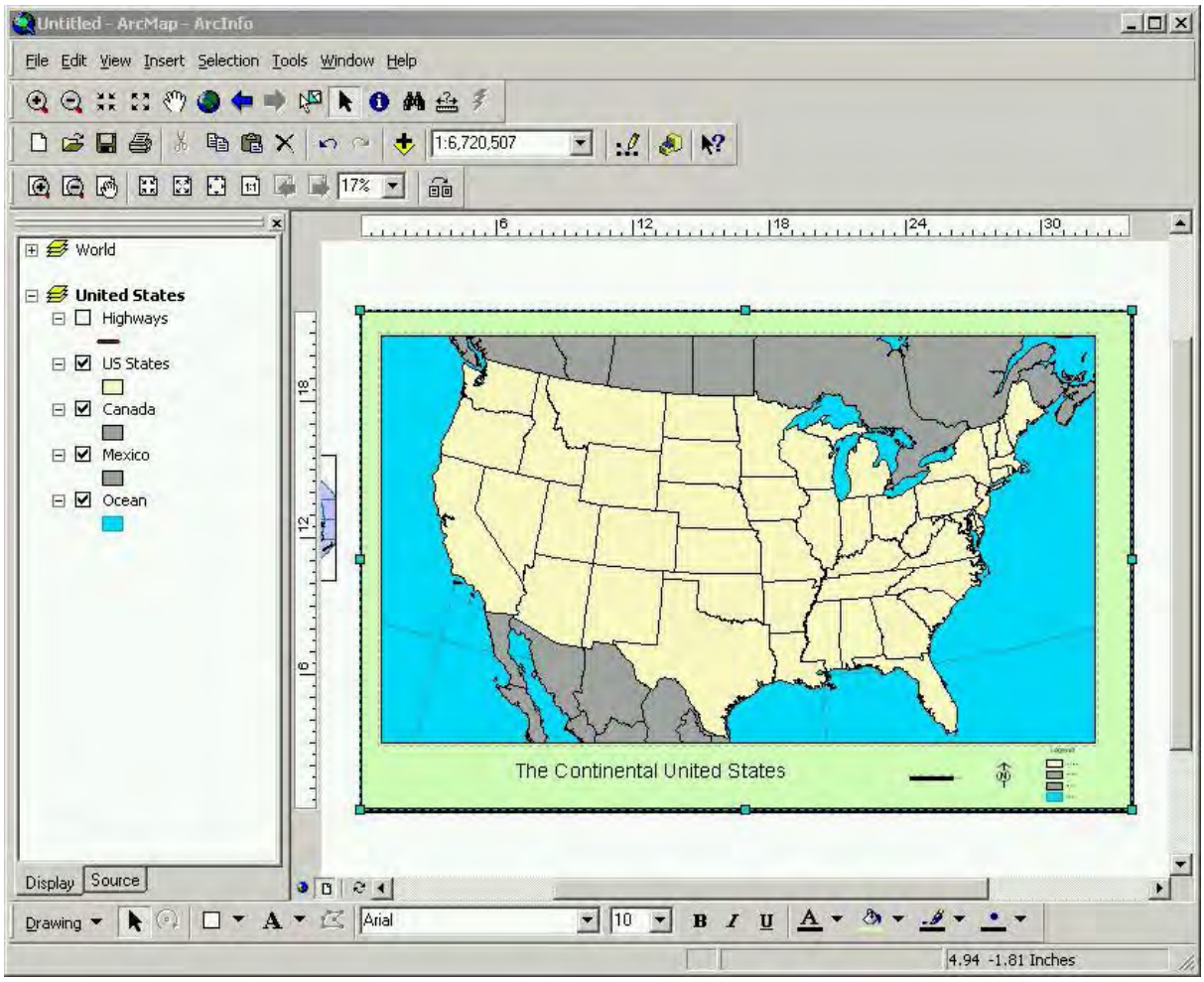


The layout to which you would like to add a neatline

4) Select the appropriate styles and details for your border. If you would like a default selection, use the *Inset from Margins* selection if you want a border/Neatline around your whole presentation.

5) You can also choose a background color and a drop shadow.

6) When you are finished selecting the different options, click **Ok** and your border should appear. Like all steps in preparing a presentation, finding the correct settings for your border requires trial and error.



7) You can further change the border/neatline by double clicking on it and following the menu options.

Authored by: Benjamin N. Sprague **Modified:** 8/27/03

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GIS Cookbook: Cartographic Design - Automatically Labeling your Map

Keywords: Presentation, map, labels, place names, identification, batch, layout
Category: Cartographic Design
Software: ArcView 3.2

Problem: How do I add labels to my map?

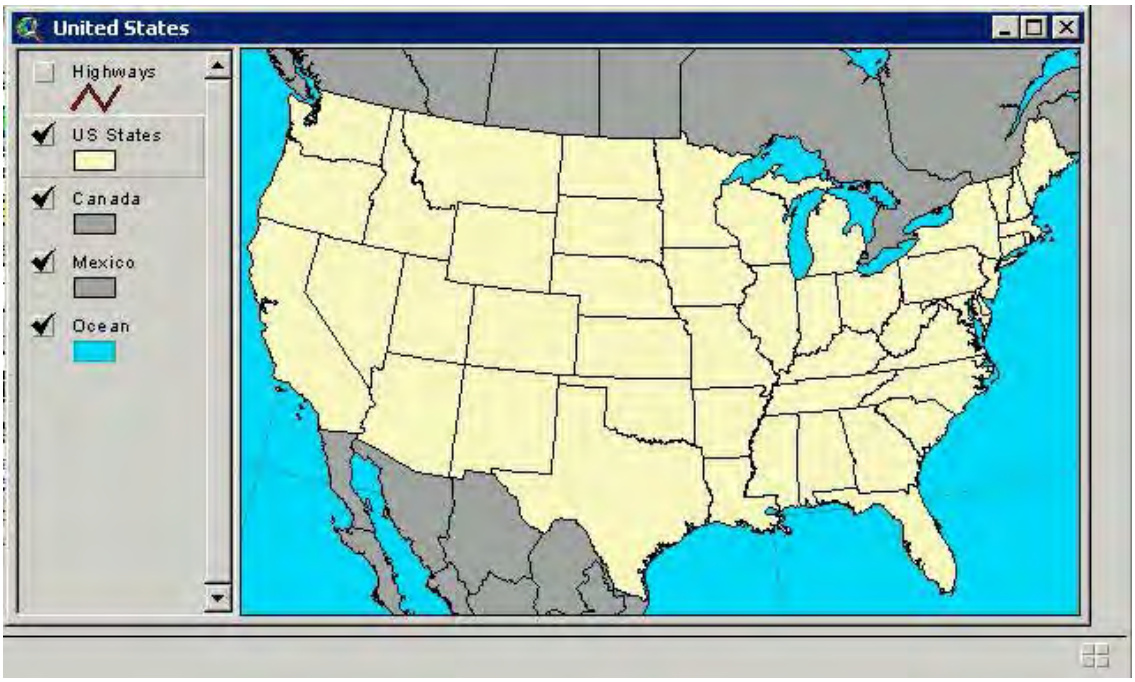
Description: You would like to add text labels to all the objects in one or more of your data layers. In this recipe, labels will be added automatically displaying the text in your *attribute table*.

Methodology:
1) Make sure your map is the set to the zoom of your liking before proceeding. Changing the zoom on your map after you add labels may change the size and placement of the labels.

2) Click on the theme to which you would like to add labels. In the following image, the theme called "Ocean" has been selected. To highlight the theme "US States," we clicked on it with the mouse.

U.S. States theme legend *not* selected.

Notice below the "US States" theme has now been highlighted.

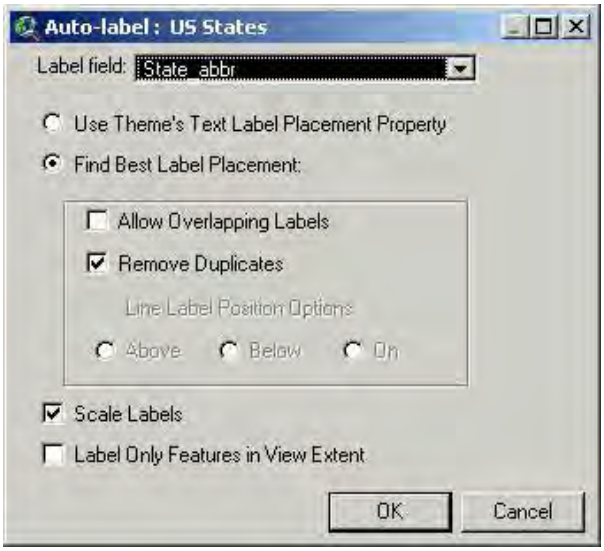


U.S. States theme legend selected.

3) Select **Theme -> Autolabel**.

Theme -> Auto Label.

4) The Auto-label window will appear.



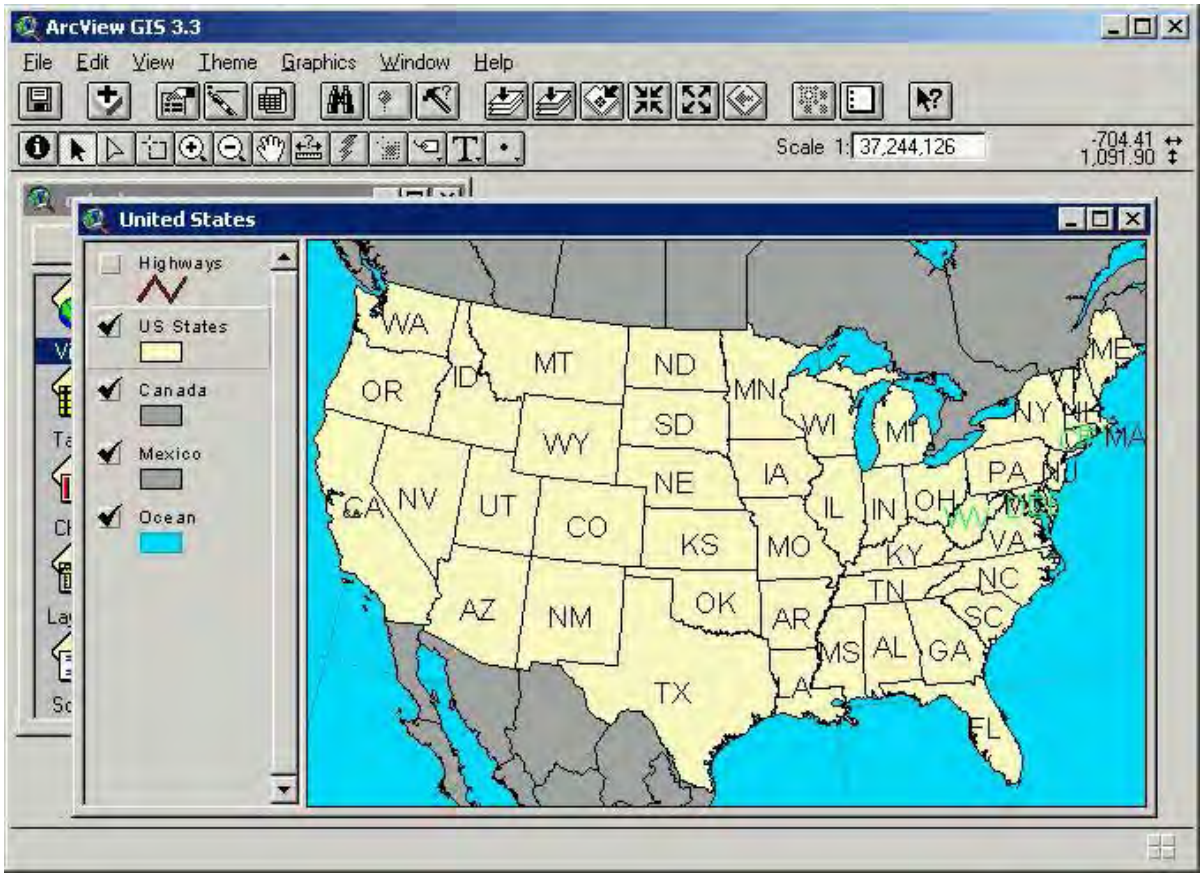
Label Field window.

To choose your label names, click on the pull down menu for *Label field* at the top of the window. Here we have chosen the attribute column titled "State_abbr."

Note: If there are no options in the Label Field window See Pitfall 1.

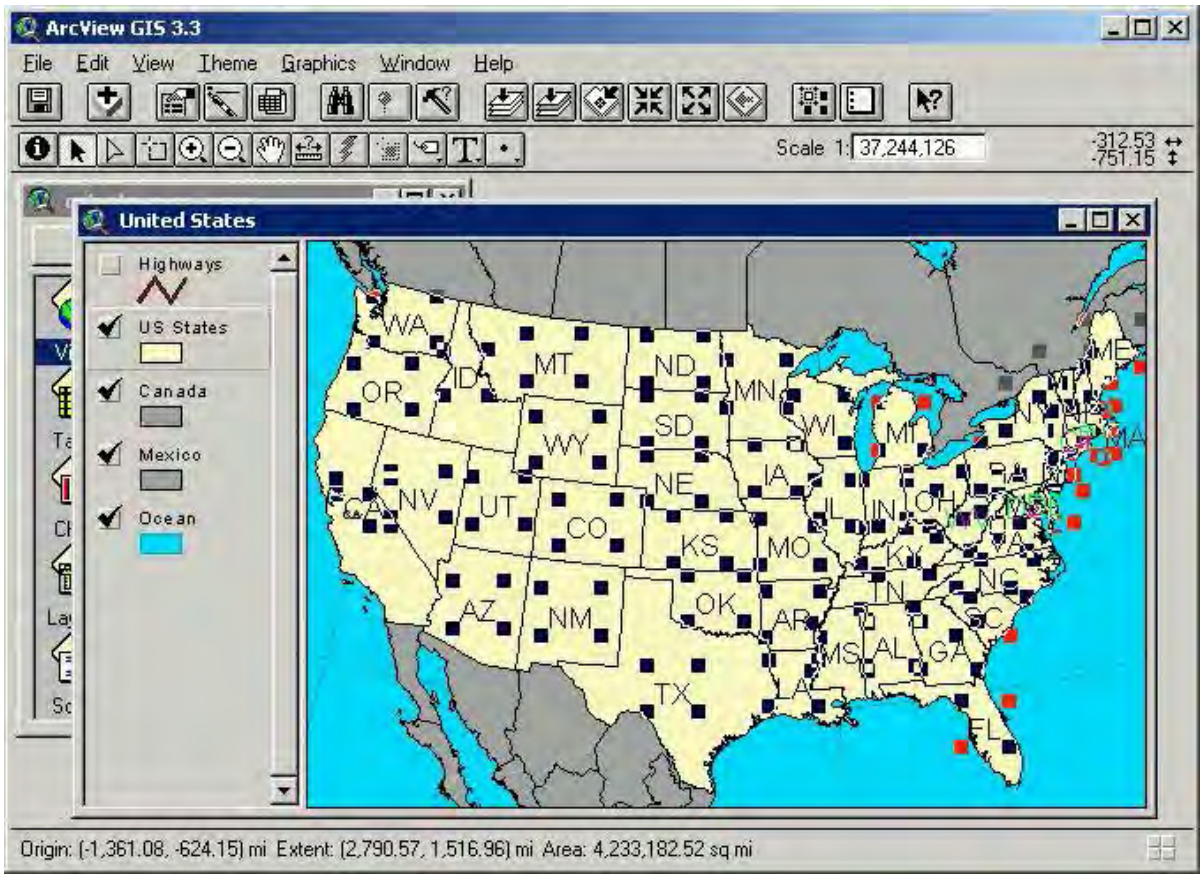
5) Once you have selected all the appropriate settings click **Ok** .

6) Labels should appear on your map on the appropriate places.



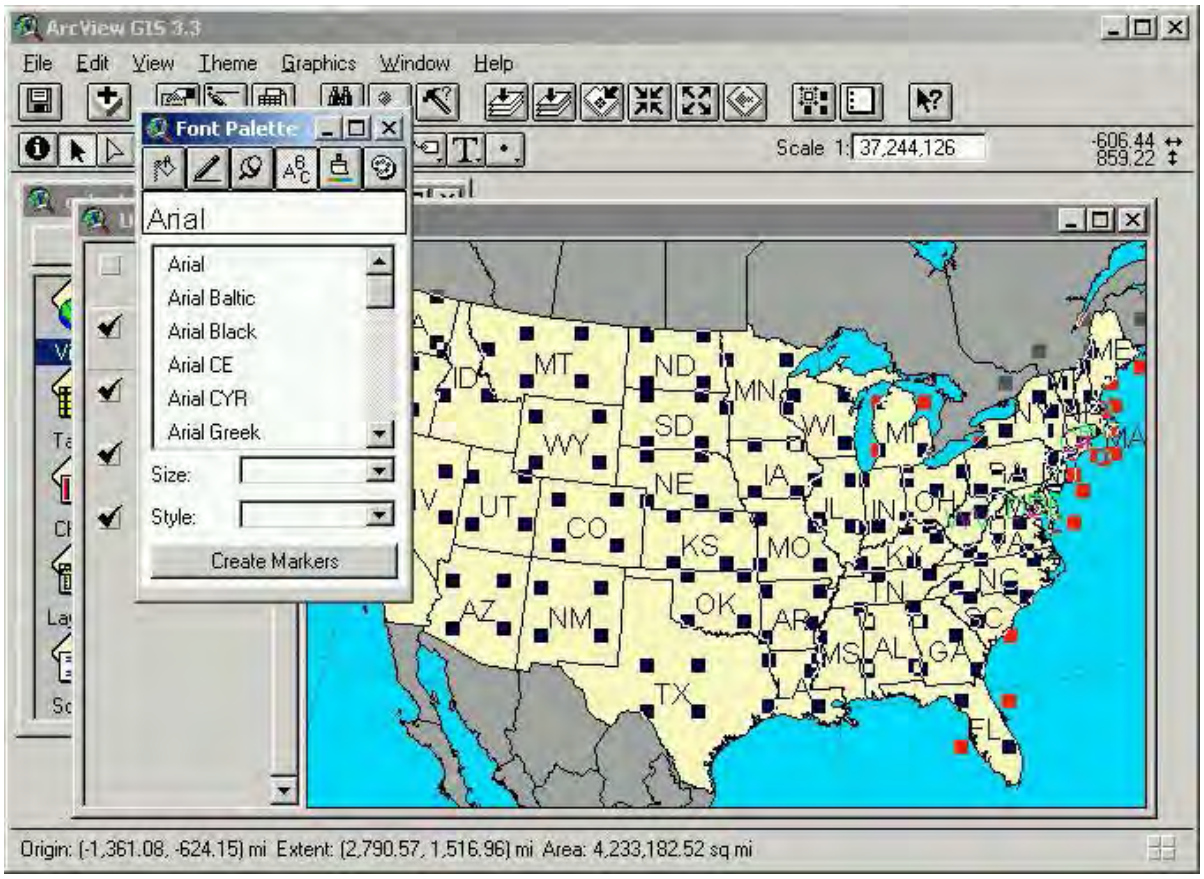
Notice the green labels are overlapping. It may be helpful to alter the size of the font being used.

7) If you are not satified with the appearence of the labels, you can edit all your labels at once by first selecting all of them by keeping your mouse button down and highlighting the entire labeled area.



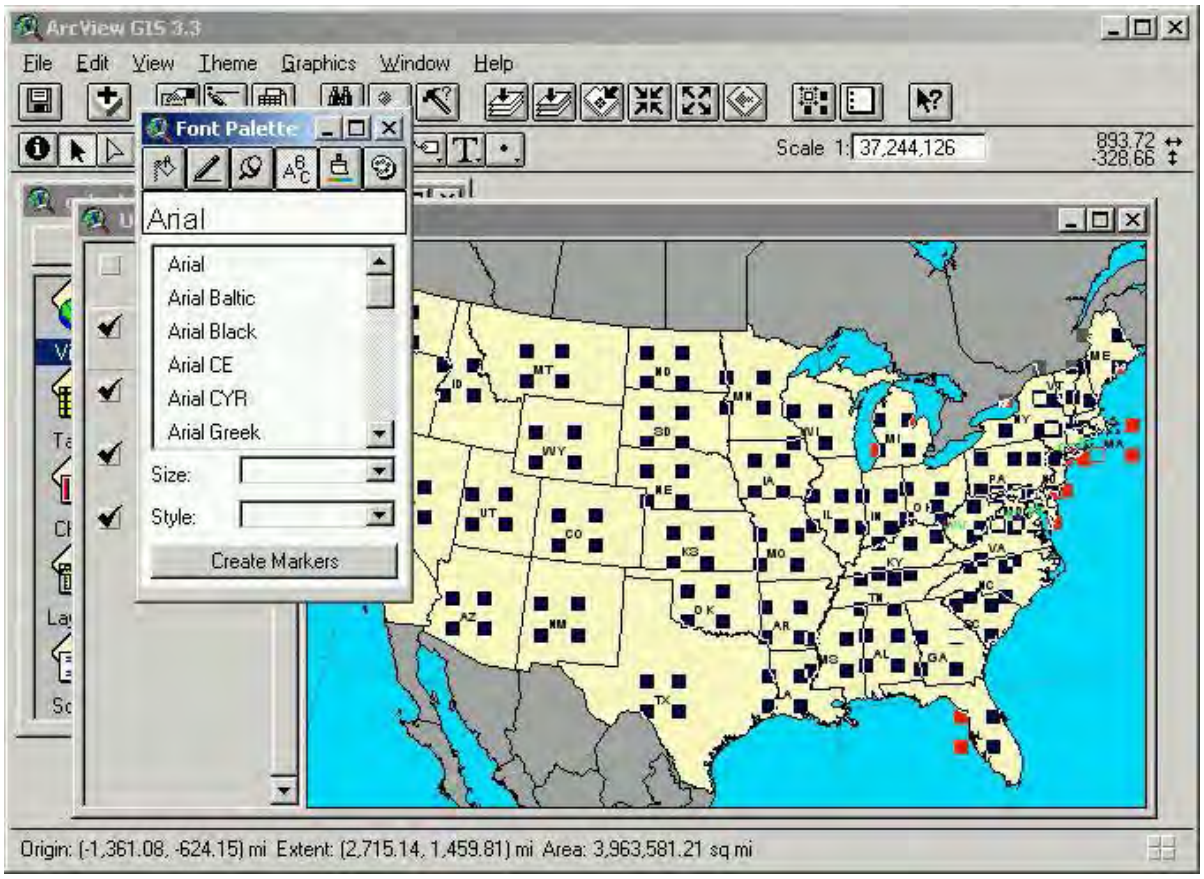
Selecting all the labels allows you to change their display all at once.

8) Then to change the font style, size, or color, press **Control P** and choose your new text properties from the pop-up *Palette* window.



Now the labels are presented at a more appropriate size.

If your labels do not fit the screen properly, it is helpful to choose a smaller font size.



After resizing your labels, it may be necessary to move your labels back into the proper location.

If you would like to move the labels, click once on the label you'd like to move and four black square should appear around the label text.
Click and hold, then drag to move the labels to a new location. Repeat this process to move the labels over one by one.

9) There are a few other properties that you may want to change to fit the style of your presenation. To see the other options, double click on one of the labels and the Text Properties menu should appear. After you are done, click **OK**.

Pitfalls:

- When the scroll down menu has no options it indicates that there are no columns in your *attribute* table that are appropriate for use in labeling. You must enter in each label one at a time. Please refer to the recipe Refer to the recipe ***Adding individual labels to your map***.

Authored by: Benjamin N. Sprague **Modified:** 9/11/03

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close

GIS Cookbook: Cartographic Design - Adding Individual Labels to your Map

Keywords: Presentation, map, labels, place names, identification, objects
Category: Cartographic Design
Software: ArcView 3.2

Problem: How do I add individual labels to my map?

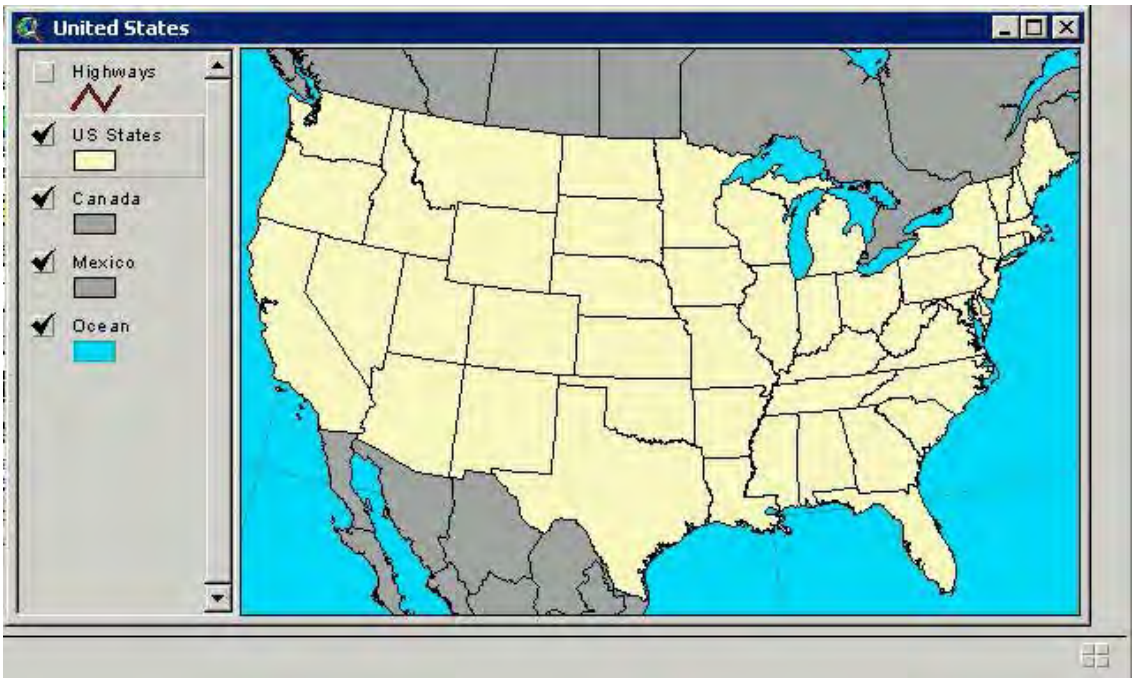
Description: You would like to add text labels to one or more objects within one or more of your data layers. In this recipe, you will be adding labels on one at a time. To see alternatives to adding labels to your map, please refer to recipe ***Automatically Labeling your Map***.

Methodology:
1) Make sure your map is the set to the zoom of your liking before proceeding. Changing the zoom on your map after you add labels may change the size and placement of the labels.

2) Click on the theme to which you would like to add labels. In the following image, the theme called "Ocean" has been selected. To highlight the theme "US States," we clicked on it with the mouse.

U.S. States theme legend NOT selected

Notice below the "US States" theme has been highlighted.



U.S. States theme legend selected

3) Click on the label tool menu (button with a tag on it). A drop down menu of all the label shapes and styles will appear. Click on the one that best suites your map style. The cursor will take the shape of a plus (+) sign after you select a label style.

4) Select the place on the map which you would like to label. Click on that area with the plus (+) sign cursor.

5) Use your arrow to move the labels around one by one. Click once on the label to select it. Four black dots will appear around it signifying that you can edit the label. To change the style of the text such as the font, size, or color press **Control P** while the text you wish to alter is highlighted and then choose your new text properties.

6) You can also change the angle at which the label is displayed and the actual label text content after labeling. To do this double click on the label and the Text Properties will appear. Follow the menu options to change the elements.

Pitfalls:

- To change the attribute you are going to display as the label on the map, follow the directions in the recipe ***Automatically adding Labels to your Map*** , at the appropriate step choose the label field you want. Click **Ok** . After all the labels show up simply select them all delete them (or select **Theme -> Remove Labels**) and then follow directions in this recipe.

Authored by: Benjamin N. Sprague **Modified:** 9/4/03

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GIS Cookbook: Cartographic Design - Adding a North Arrow to your Map Layout.

Keywords: Presentation, north arrow, printing, map elements
Category: Cartographic Design
Software: ArcView 3.2

Problem: How do I add a North arrow to my map?

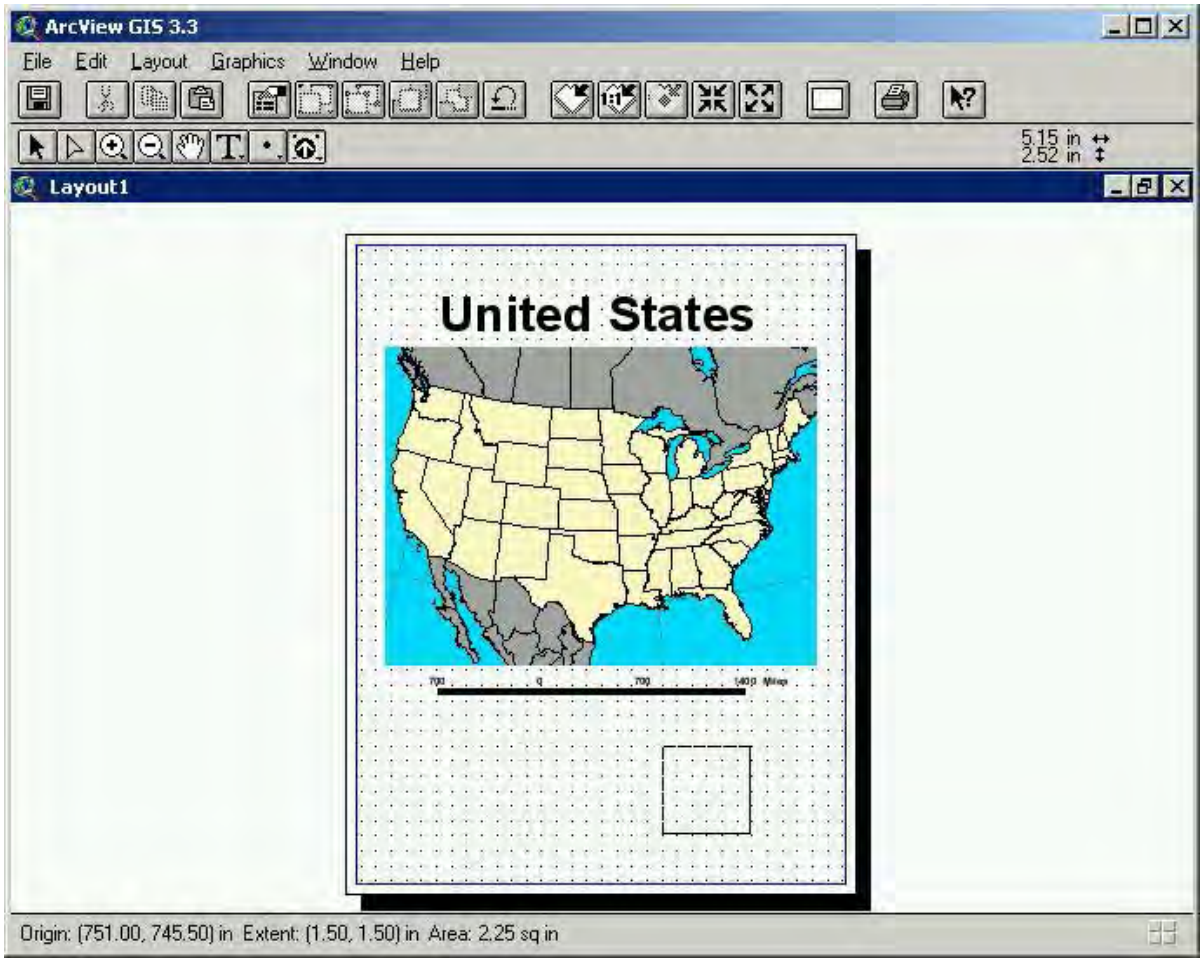
Description: Your map is in the Layout format and you would like to add a north arrow.
*Note:*For help on getting your map into the Layout format, refer to recipe ***Shortcut to moving your map into the presentation stage (using a template)***

Methodology:
1) Click and hold the last button on the layout tool bar.

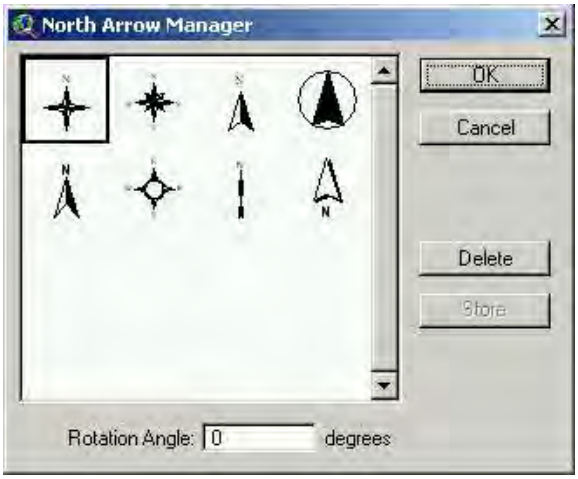
Finding the north arrow menu

2) Select the **North Arrow icon**

3) Drag the cursor over page area you would like filled by the North Arrow, while holding down the mouse button. Release the button when the square is approximately the size you want it.

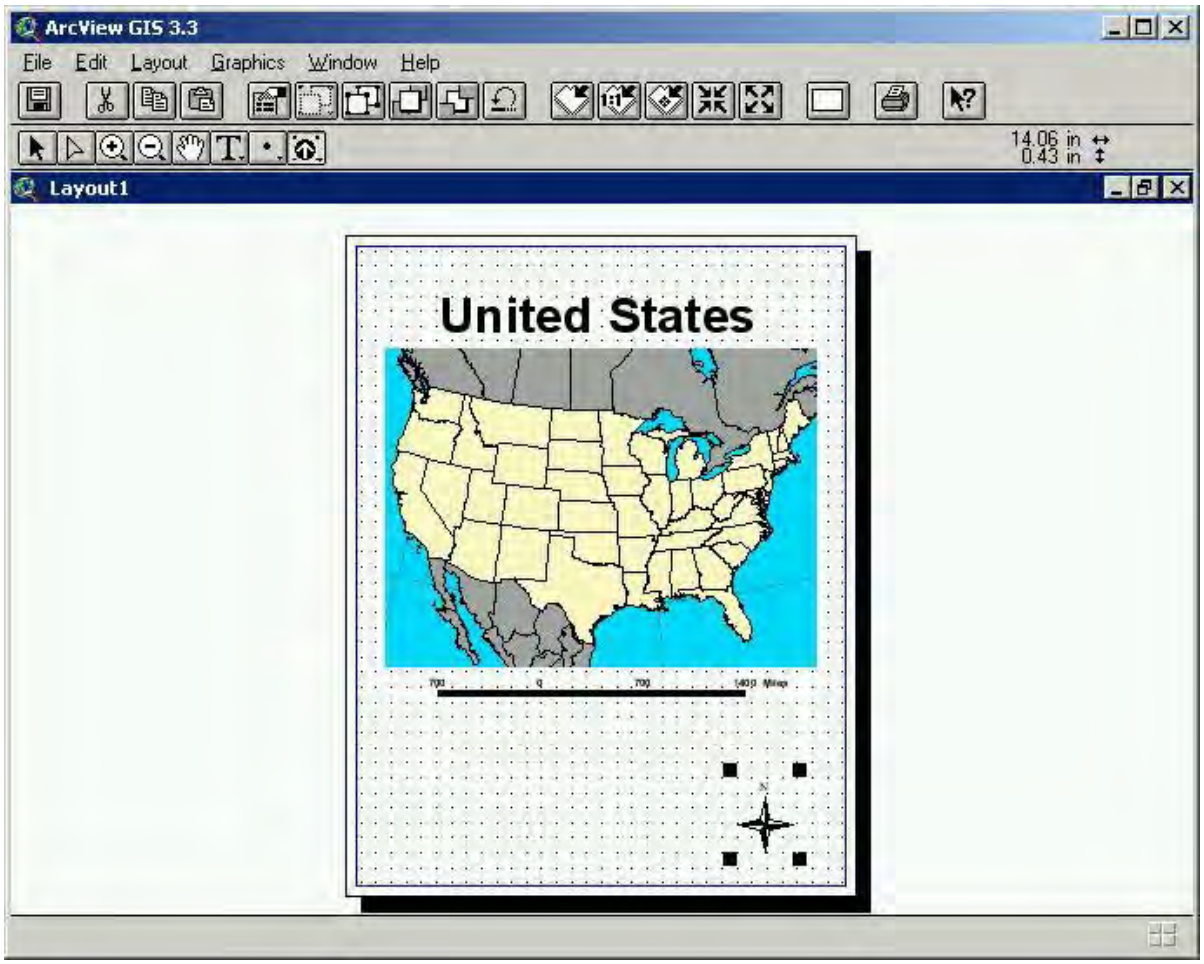


4) The North Arrow Manager window will appear after you release the mouse button. Select the style of north arrow you would like to use and then click **Ok**



Selelcting the size and area for the north arrow

5) Your north arrow will appear in your map layout. You can alter it by double clicking on it and following the menu options.



North arrow added onto the layout

Authored by: Benjamin N. Sprague **Modified:** 9/2/03

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close

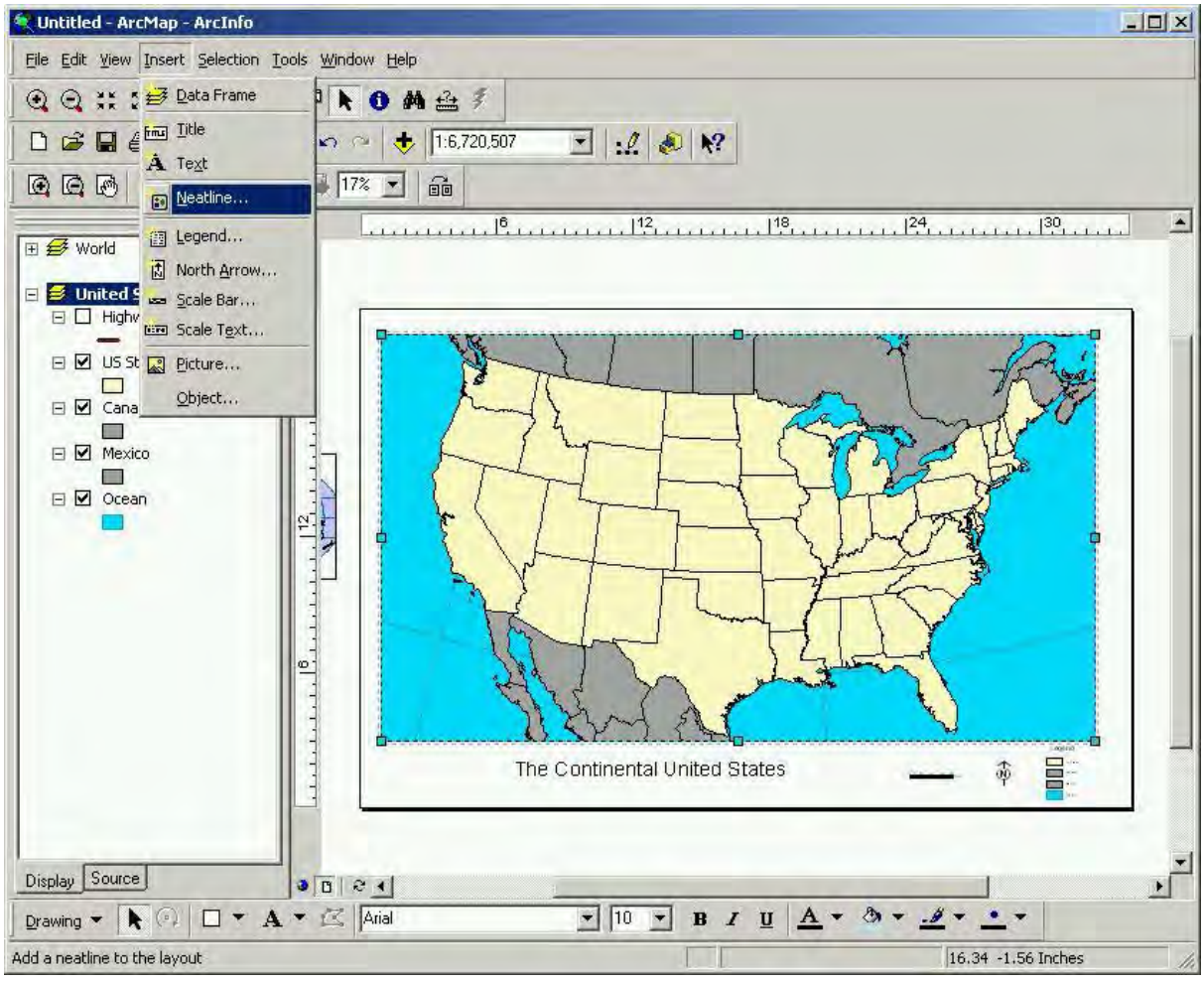
GIS Cookbook: Cartographic Design - Adding a North Arrow to your Map Layout

Keywords: Presentation, layout, north arrow, reference, printing
Category: Cartographic Design
Software: ArcInfo 8

Problem: How do I add a north arrow?

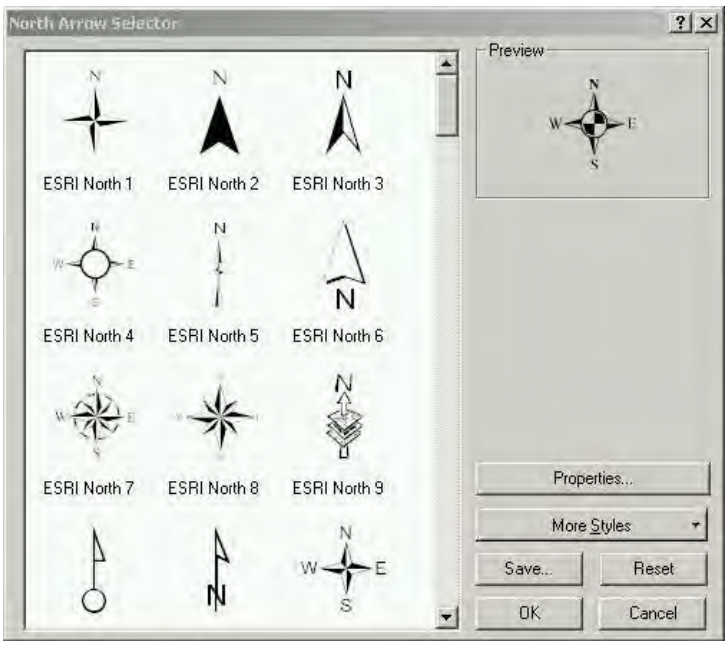
Description: Your map is in the layout window, now you would like to add a north arrow.

Methodology:
1) In your Layout view, select **Insert -> North Arrow**



Insert the north arrow into your layout

2) The North Arrow Manager window will come up. Choose a style for your north arrow.

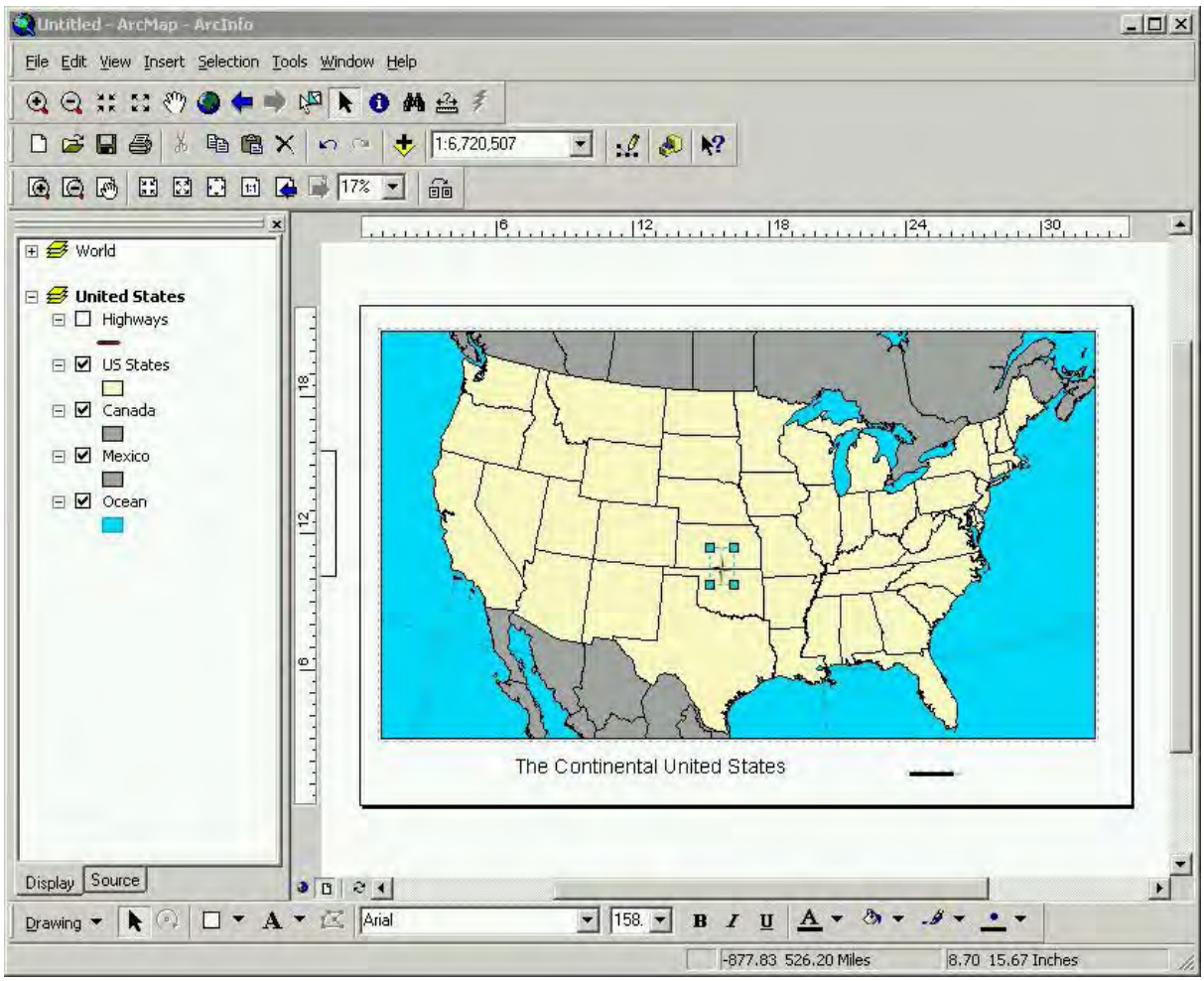


North arrow selector window

3) You can change the style of your north arrow by clicking the **Properties** button.

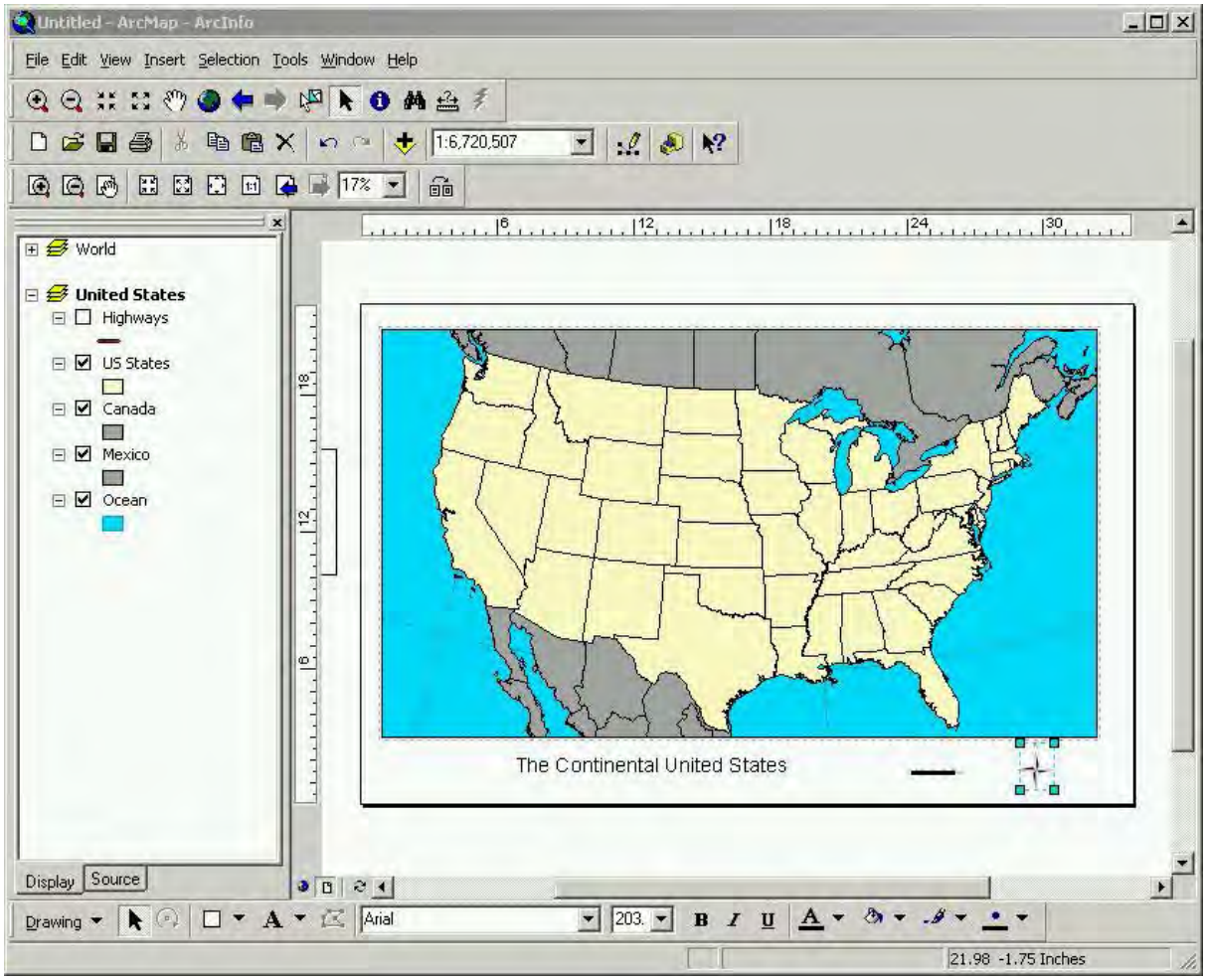
4) When you have made all your selections click **Ok** .

5) You north arrow will appear in the center of your map layout.



The result

You can then resize it and drag it to the desired location on your map layout.



Move and resize to your liking

6) You can further change the north arrow by double clicking on it.

Authored by: Benjamin N. Sprague **Modified:** 9/2/03

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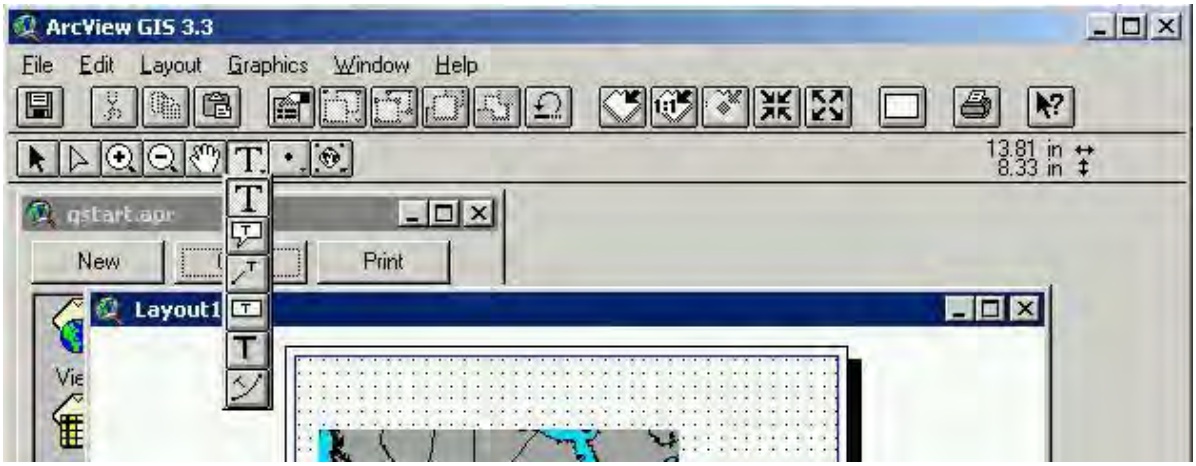
GIS Cookbook: Cartographic Design - Adding Text or a Title to a Layout

Keywords: Presentation, finishing, printing, cartographic elements, layouts, text, title, captions
Category: Cartographic Design
Software: ArcView 3.2

Problem: How do I add text to my map?

Description: Your map is in the Layout format and you would like to add some text (e.g. title, credits, date, etc.).
*Note:*For help on getting your map into the Layout format, refer to recipe ***Shortcut to moving your map into the presentation stage (using a template)***

Methodology:
1) In the Layout view, click and hold the third to last button on the layout tool bar, this will access the text menu.

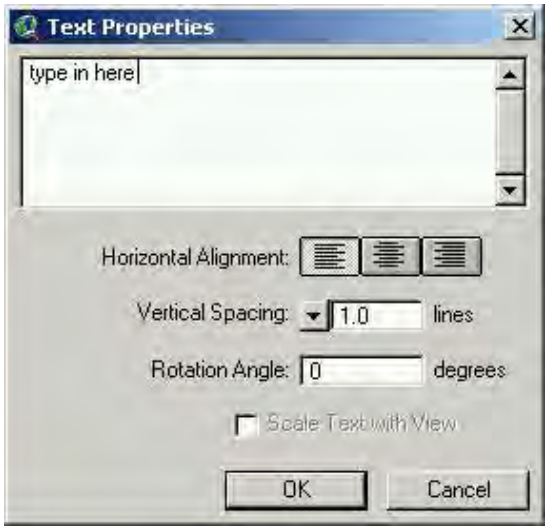


Text Icon Toolbar

2) Select the **Text Button** of your choice.

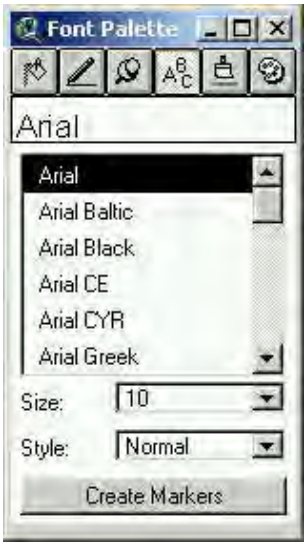
3) Now use the cursor and click on the area to which you would like to add text.

4) The Text Properties window will appear. Type the text you would like to disply in the window and click **Ok** .



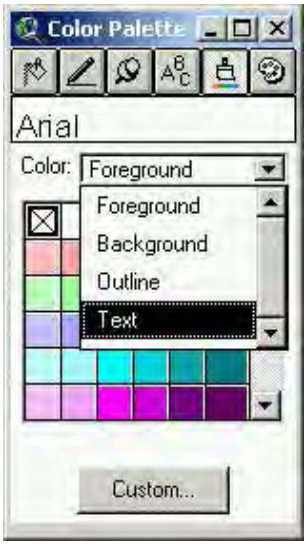
Text Properties Window

5) To change the size, color, and/or font of the text, highlight the text with your mouse and then hold down **Control P** to bring up the palette window.



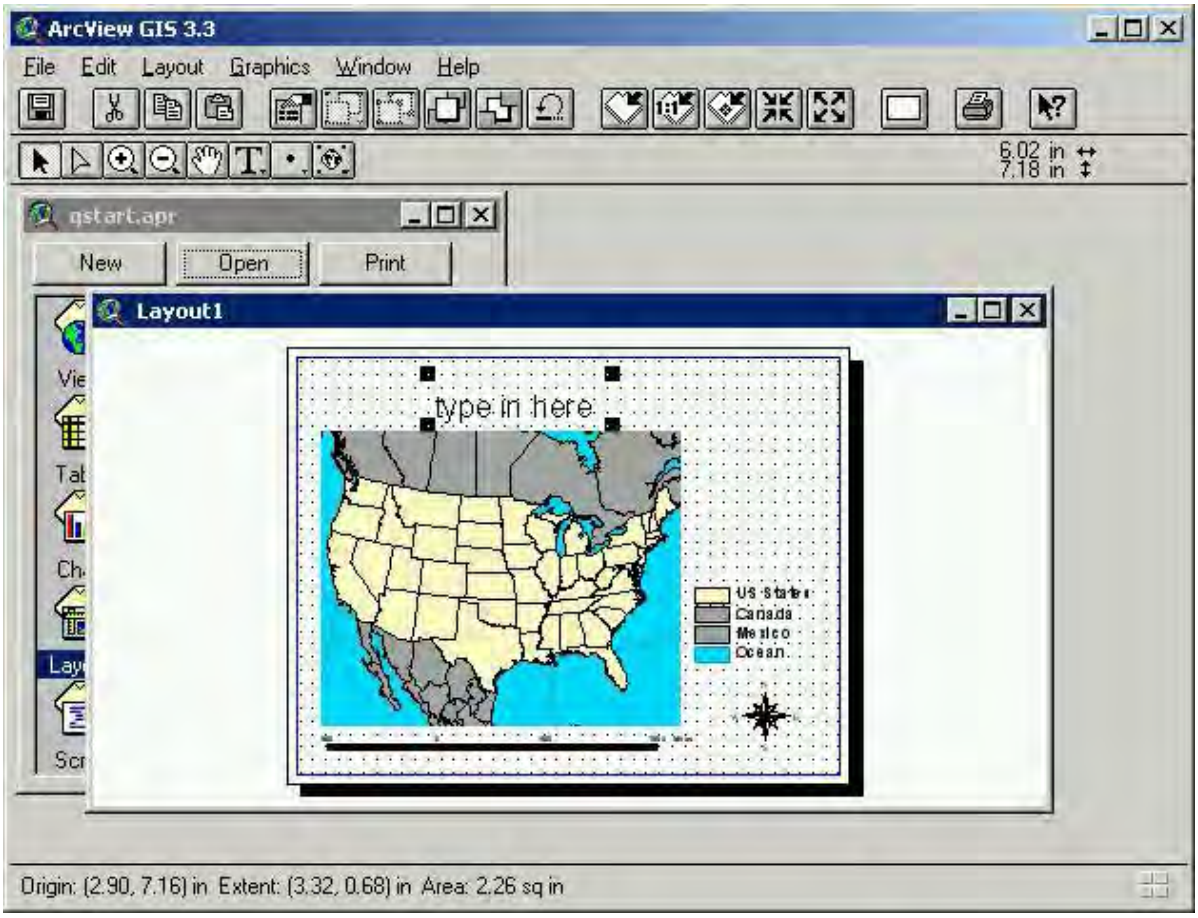
Text Palette

Now modify the text to your liking using the palette tools. If you have the correct text selected, but the text color will not change when you click to change it using the palette, please refer to See Pitfall 1



Text Palette Color Pitfall

6) You should now be able to see text in the style you chose from the palette. Now you may move the text to the appropriate location by clicking on the text box, holding down the mouse button, and dragging it to the desired location on your map.



Text inserted

7) You can repeat these steps as many times as you'd like.

Note: You can edit your text or change the angle your text is displayed by double clicking on the text itself.
Pitfalls:

- Pitfall 1: Make sure that you have selected text in the color pull down menu, not background or others.

Authored by: Benjamin N. Sprague **Modified:** 9/11/03

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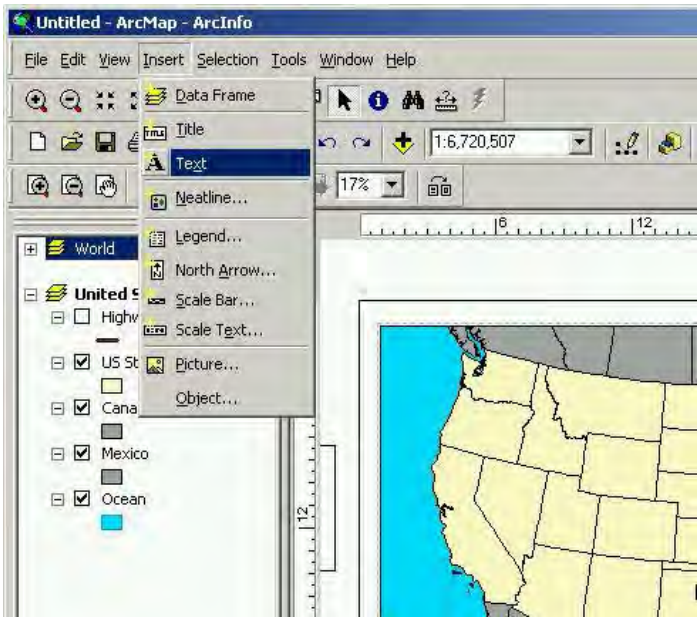
GIS Cookbook: Cartographic Design - Adding a title or other text to your layout.

Keywords: Presentation, layout, printing, title, text
Category: Cartographic Design
Software: ArcInfo 8

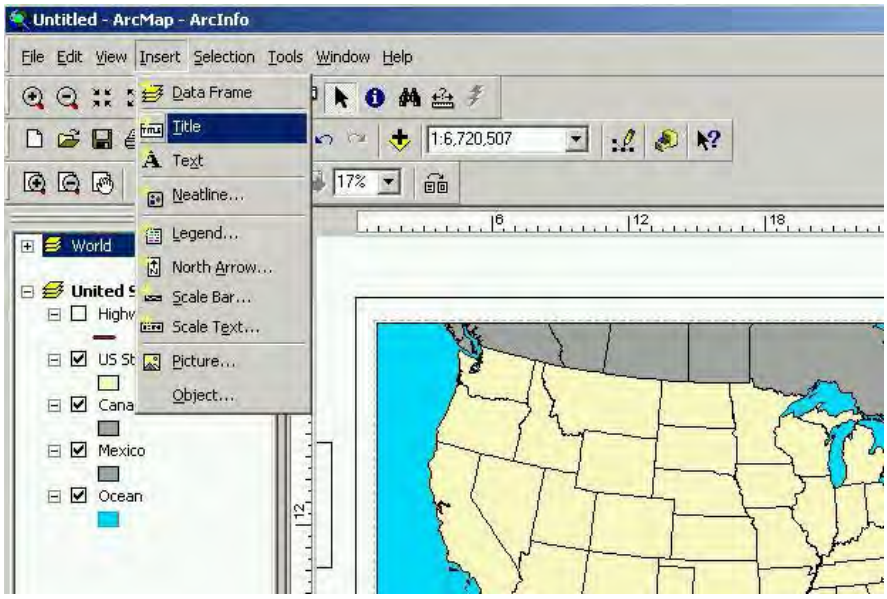
Problem: How do I add text to my map?

Description: Your map is in the layout window, now you want to add text such as a title, captions, etc.

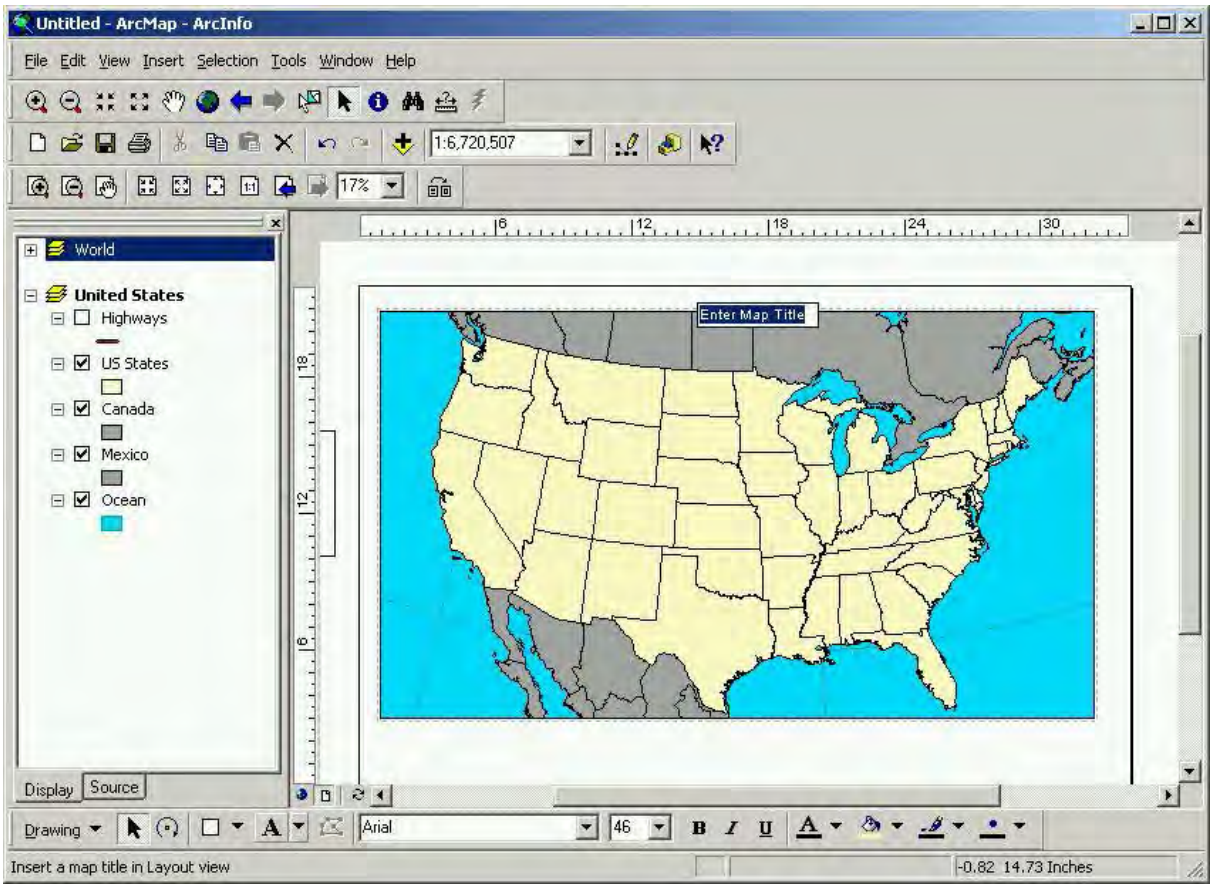
Methodology:
1) In the Layout view, select **Insert -> Text** *or* (see below figure)



Insert -> Title. Both selections will essentially accomplish the same task.



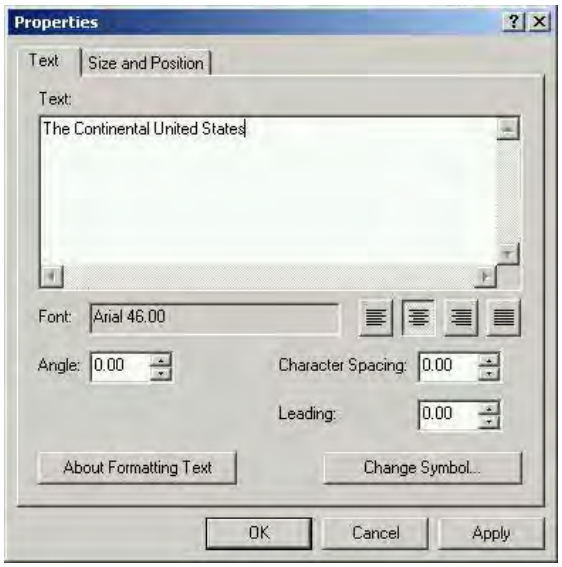
2) A box will appear in the middle of your layout page with highlighted text saying *Enter text/title here*



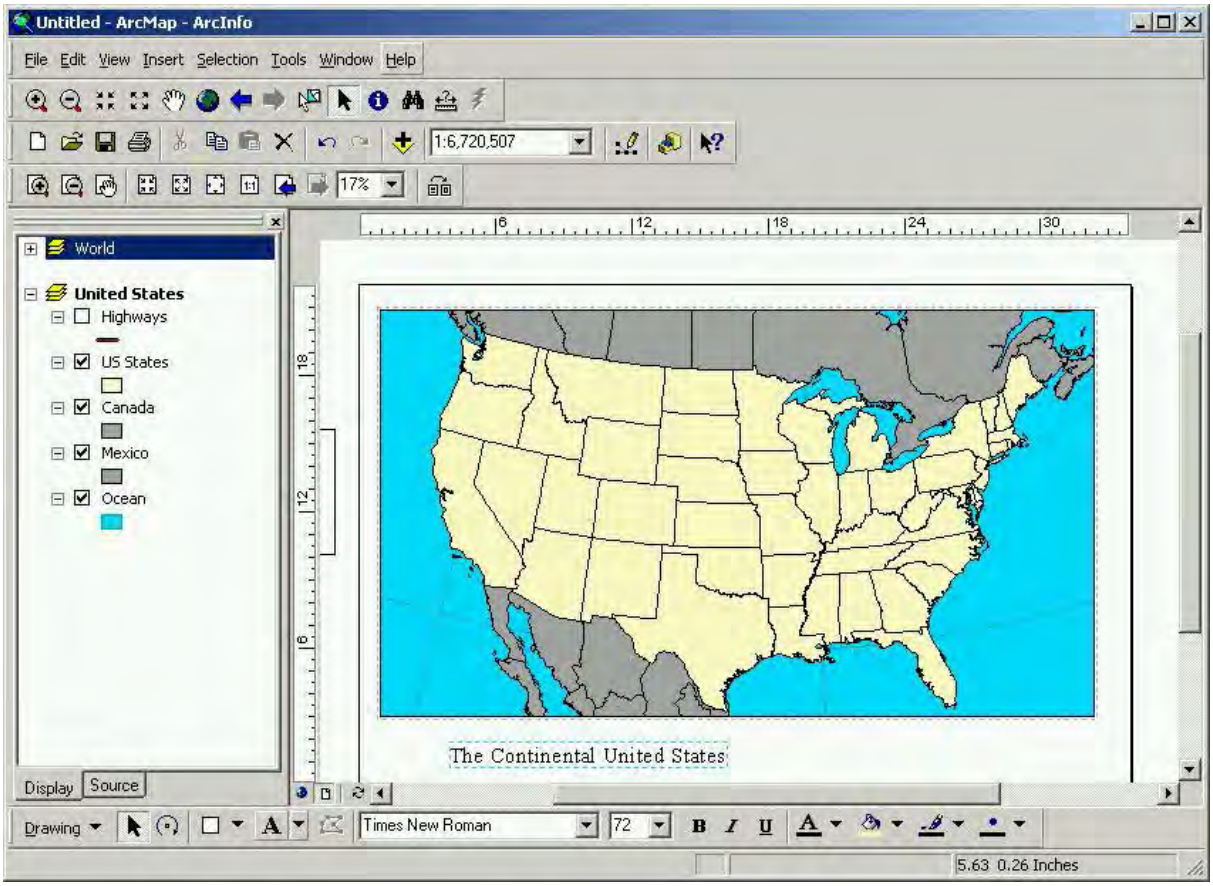
Double click on this box and the properties window will appear.

3) Enter your text here.

4) To change the font and size of your text click *Change Symbol* .



5) Then move your title to where you would like it by clicking on the text box, holding your left mouse button down, and dragging the text box to the desired location.



6) You can further change the text by double clicking on it and following the menu commands.

Authored by: Benjamin N. Sprague **Modified:** 9/2/03

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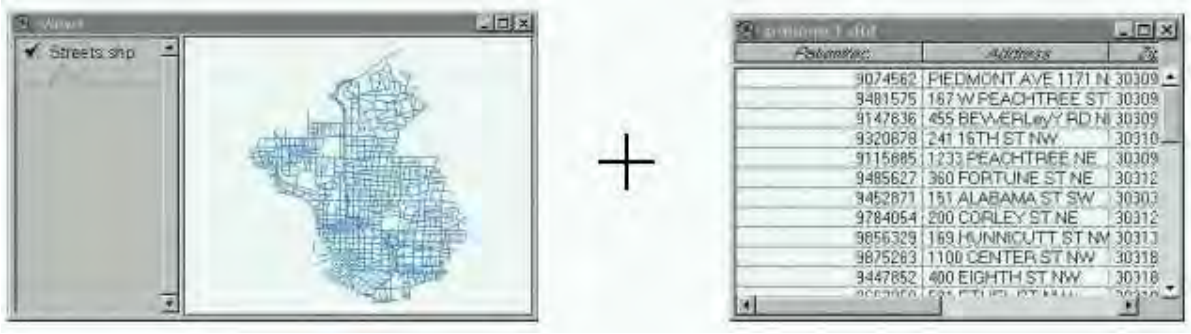
GIS Cookbook: Background - Background Information about Geocoding

Keywords: geoprocessing, geocode, geocoding, address, address matching, street, zip, zone, address number, street name, location, address table, Extended 911, geolocating, condominium, apartment, multi-unit complex, Japan addres
Category: Geocoding
Software: ArcView 3.2

Background: Geocoding in the simplest terms is "the act of assigning locations to things within the geographic frame of reference" (Goodchild, 2001). Geocoding has many synonyms including georeferencing and geolocating. The key to a georeferencing system is that each location has a unique code. This is possible only to a certain limit because of the overwhelming amount of information that would be needed for all things to have a unique code in the reference frame of the entire globe. Commonly, address number with street address and zip code are used to locate buildings within a reference frame. Street direction (i.e. north, east, south, or west) and street type (e.g. street, avenue, boulevard, etc.) may also be added to increase the precision of the output. Addresses are inputted in a tabular form and then matched with a geocoded reference theme. The reference theme is a digital map that has all the locations geocoded and can be displayed graphically or in tabular form. The reference theme includes many categories of information about each street location by listing street name, city name, zip code, the range of numbers on the right and left side of the street, street type, and street direction. Geocoding is not only limited to street addresses, for a less precise geocoding process, one can use only the zoning description, such as zip code or zoning number assigned by the city zoning ordinance. Different types of codes used for differentiating one location from another can be used to geocode within ArcGIS 8 by selecting a specific geocoding service.

Pros: There are many advantages to using the geocoding tool within a GIS. It can be applied in numerous social science fields and makes spatial analysis much more efficient. After a researcher has attained the necessary data to make a geocoded map (the database file of addresses and a geocoded reference theme), processing and producing the final geocoded address map may take as little as twenty minutes. After all the addresses have been mapped, one can do pattern analysis and many other types of spatial analysis.



The images above show a table of addresses (*upper right*) being geocoded using the reference theme (*upper left*) to create the final map on the bottom (*center*).

Cons: There a few disadvantages to geocoding with addresses. A drawback is the lack of uniqueness of each location as the area of interest gets bigger. Almost every city has a street called "Main Street." To avoid this problem one can assign more precise descriptors as mentioned above, such as direction or street type.

Many problems arise when working with rural areas. The street address numbers are given as a range of number on either side of a road and are assumed to be evenly spaced apart. This becomes very inaccurate in rural areas where the distances between houses vary considerably. Many rural addresses are just labeled as rural delivery route numbers, but sequential numbering on houses is increasingly common because of Extended "911", which mandates local governments to re-number their rural addresses in the interests of improving emergency response (Goodchild, 2002).

When geocoding addresses that are within high-density areas, one can experience problems similar to geocoding rural addresses. Structures such as condominiums, apartments, and other multi-unit complexes do not always have addresses ordered sequentially along roads. Also, within some apartment complexes of multiple buildings, some streets are not named, causing another confusion as to how to give each address a unique set of information.

When viewing the results of a geocoded list of addresses, one should be aware of the level of precision and accuracy of the end product. Geocoding gives the coordinates of the building as being directly lined up at the street whereas in real life, some structures may be set back very far from the road, such as if a house or business had a very long driveway.

Authored by: Sam Ying **Modified:** 9/10/02

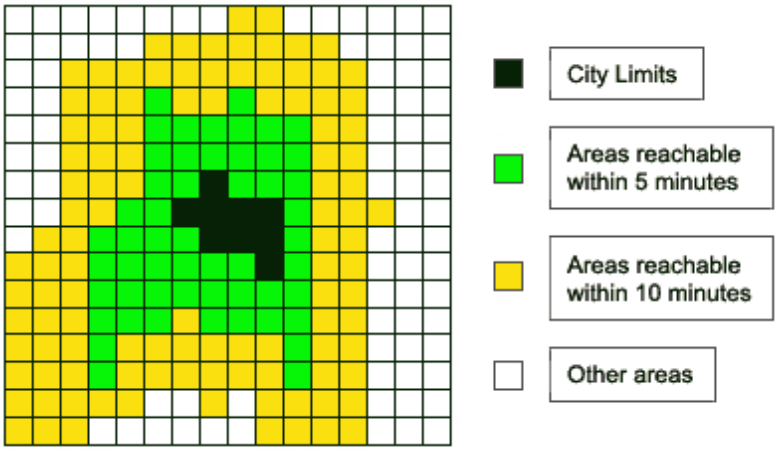
GIS Cookbook: Background - Background Information about Buffers

Keywords: Buffer, points, lines, polygons, raster, vector, topography
Category: Buffers
Software: ArcView 3.2

Background: When buffering, the user creates a new object that displays and identifies which areas are found within a specified distance of the original object. The buffer operation results in new boundaries around points, lines, or polygons.

Examples of buffers are listed in the description section of the recipe
A common concern among people using buffers is figuring out what buffer width to use in their map or analysis. Because buffer width designation can vary substantially between projects, various factors could be used. These factors include:
1) Input from the Source: An attribute of the object being buffered is used to determine buffer width. For example, buffer width could depend on the amount of chemical spilled from a refinery
2) Internal Factors Within a Buffer: Variables affecting the area inside the buffer boundaries such as topography within the buffer and weather conditions. eg. If the object being buffered lies where annual winds blow out of the east, the buffer distance around the object will probably be greater to the west of the object
3) Outcomes: What is probably going to happen because of variables inside and or outside the buffered area. An example would be if certain populated areas are given priority evacuation due to the chemical spill

Pros: There are many advantages to using buffers in GIS. First of all, buffers can be applied to both vector and raster data, which is abnormal for most GIS operations. A buffer made in raster format is unlike one made in vector. In vector a new object is formed in the shape of a buffer, however in raster, cells are merely classified to whether they are inside or outside the buffer zone. A good example of a raster application is shown below with travel times.



Another advantage to using buffers in GIS is the ability to use multiple rings for varying buffer distances. Because of this, if you want to show that certain distances have more impact than others you do not need to create several buffers. Finally, two other advantages specific to ArcMap include the ability to buffer coverages, and the choice of whether to round area, or line buffer edges. These advantages add precision to your results.

Cons: There are few disadvantages for using buffers in Arc View and Arc Info. One disadvantage however, is of topography. When buffering at a certain distance you are measuring that distance as the crow flies and you are not taking in account the differing slope of the land. For example if regions to the east of the point, line or area being buffered have a high slope and regions to the west have minimal elevation increase, your buffered regions will cover different total areas on each side. But when you specify a buffer distance such as ten miles, ten miles will not take in account slope, and thus may skew results.

Authored by: Ethan Sundilson **Modified:** 9/12/02

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GIS Cookbook: Background - Background Information about Presentations and Finishing

Keywords: Presentation, Cartographic design, finishing, details professional, layout
Category: Datums
Software: ArcView 3.2

Background: A map can be defined as a graphic depiction of all or part of a geographic realm in which the real world features have been replaced by symbols. (Clarke, 2001)

Once you have created, analyzed, and altered the content of your map to your satisfaction. It is time to make a layout which will put your map into context and explain its content and significance to the map reader. It is important that the map layout be a self contained unit, it should be self explanatory even when it is being used to supplement another document. Therefore your main map image needs to be supplemented by certain cartographic elements to make the map self sufficient. The main cartographic elements are; the title, neatline, scale bar, legend, inset map, and north arrow.

The Cartographic Elements (Clarke, 2001)

It is important to include all the Cartographic elements to make your map presentation complete. Adding all the Cartographic elements will give the map reader all the information he or she needs to understand the map and its context. This will complete your map presentation. After this you will be ready to print and present your map.

NOTE: (There are many nuances and specifics to map presentations, who your target audience is, what your goal is etc.). There is a plethora of literature on map presentation and the best way to go about it. These recipes are just a simple, get it done quick, guide to presenting your map. We suggest you do some outside reading if you want to maximize the effectiveness of your map presentation. Hope this helps)

If this is your first time using the presentation features of your mapping software, we highly recommend that you read chapter 7 of *Getting Started with Geographic Information Systems*, by Keith Clarke (Prentice Hall, 2001).

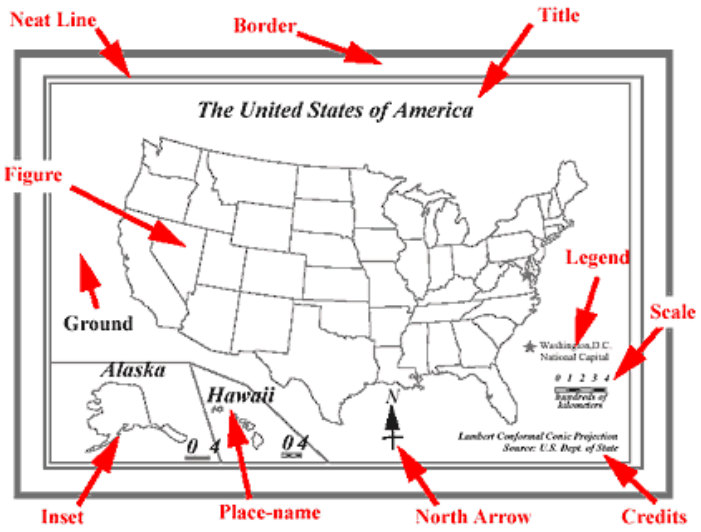
Pros: The presentation packages provided in ArcView 3.2 are useful tools for the presentation of your spatially referenced information to a larger audience. You can provide all the information needed to make your map presentation a useful tool. Large presentation size maps posters can be developed incorporating everything from tables to charts, graphics maps and images. Furthermore the presentation of your information in a spatial context will add credibility to your research by putting within real world scale and context. Adding of the different cartographic elements make the map entirely accessible to the map reader.

Cons: The presentation part of this package is very comprehensive. However this creates a problem. It is very difficult to come up with an error free presentation. There is always room for improvement. It is easy to have too much, or too little information. It is also easy to have a ineffective presentation due to cartographic inconsistencies. E.g. Having attention drawn to the wrong elements, having somethings too big and others to small, or too light or too dark etc. The only solution to this problem is trial and error. So keep at it and you will come up with a great presentation.

Authored by: Benjamin N. Sprague **Modified:** 11/17/03

GIS Cookbook: Glossary

- **Address matching** - Address matching is the process of assigning x, y coordinates to addresses so they can be displayed as points on a map. This process allows two or more data files to be related using a common address field.
- **Attribute** - A trait or characteristic of a feature on a map. For example, attributes of a county may include its area, perimeter, name, total population, etc. Attributes can be viewed through the attribute table such as within a shapefile.
- **Attribute table** - A table that is attached to a data layer that contains many characteristics of a feature on a map. The table is made of columns and rows where the columns represent values or description for different attributes and each row represents a different feature. For example, the attribute table for a layer of points that represents elementary schools may have columns labeled “number of students,” “number of teachers,” or “distance from police station,” and each row would represent a different school having values for each column.
- **Buffer** - A buffer is a region around a geographic area (point, line or polygon). Buffers are usually used for proximity analysis. Buffers can be created in both ArcView, and ArcInfo
- **Cartographic Elements** - One of the building blocks that make up a map from which all maps must be assembled. (Clarke, 2001) See Figure below.



- **Database management system** - A DBMS is a collection of computer programs and software for organizing the information in a database. A DBMS supports the structuring of the database in a standard format and provides tools for data input, verification, storage, retrieval, query, and manipulation.
- **Dissolve Barriers** - An option in the buffer wizard to treat a soon to be created buffer as either one object or several
- **Feature** - A digital representation of something in the real world. For example, dots or points on a map layer may represent the location of schools, a line may represent a river, and a polygon may represent the outline of an area such as a county.
- **Feature class** - Feature classes are classifications and representations of geographic features and supporting data in coverages. Feature classes represented as geographic features include points, arcs, nodes, route-systems, routes, sections, polygons, and regions. They can also store annotations, dimensions, x, y, z coordinates, and addresses. Feature classes can be found in a feature dataset where the same coordinate system can be shared and organized into a geometric network that can maintain topological relationships between its feature classes. Feature classes can also exist independently in the geodatabase.
- **Feature dataset** - A feature dataset is a collection of feature classes sharing the same spatial reference. These feature classes can take part in topological relationships with each other such as in a geometric network. Feature

datasets can also store object classes and relationship classes.

- **Geocoding** - Geocoding is also commonly known as address matching. It is the process of creating a spatial description of a place, such as a point feature from a nonspatial description of that place, like a street address. Recorded x, y coordinates of a location are cross-referencing between a standard reference grid and non-geographic data such as addresses or zip codes to accurately map that location. In order to geocode, a geocoding service must first be defined.
- **Geocoding service** - A geocoding service defines a procedure for changing non-spatial descriptions of places into spatial descriptions. These services define paths to reference data, rules for standardizing alphanumeric descriptions of locations and matching them to the reference data, and parameters for reading address data and creating output. Geocoding services can be used to find individual addresses and to geocode tables of addresses. Geocoding tables of addresses allow a user to review and rematch feature classes and shapefiles.
- **Geodatabase** - Geodatabase stands for geographic database and stores geographic information inside a DBMS or database management system. A geodatabase supports advanced capabilities such as geometric and logical networks, true curves, complex polylines, and user-defined features. They are the modern equivalents of shapefiles and coverages stored in a DBMS. Geodatabases support large collections of objects in a database table and features with geometry. The feature classes and tables contained in geodatabases can be related to one another. In order to define the relationships between objects in a geodatabase, a relationship class must first be created. These relationships allow someone to use attributes stored in a related object to symbolize, label, or query a feature class.
- **Geoprocessing** - Geoprocessing embodies GIS operations, which include data conversion, geographic feature overlays, topology processing, coverage selection and analysis.
- **Graduated Color** - Graduated Color Features are features that are displayed with the same symbol type, but the colors on each represent the progression of values for a data attribute you specify
- **Identify tool** - The Identify tool lets you display the attributes of features on a view by clicking on them with the mouse. Attributes of all features located at the same point are displayed
- **Layer** - A collection of similar geographic features within a particular area that is defined by the map display. An example of a layer may be a map of only rivers within a state. There are different types of layers (also called data layers) such as shapefiles, coverages, or grids. These data layers show different types of representations of the real world and can be accessed and managed like other types of data within your database.
- **Layout** - A layout is a map that lets you display views, charts, tables, imported graphics, and graphic primitives. The layout is used to prepare these graphics for output from ArcView or ArcInfo. A layout defines what data will be used for output and how they will be displayed
- **Legend** - Translates the symbols on the map into words by locating text and the symbols close to each other in the page coordinate space. (Clarke, 2001)
- **Legend Editor** - A menu that allows you to choose the legend type for a specific theme. (graduated color, graduated symbol, single symbol, unique value, or chart). It also allows you to change the font, style, fill color, thickness of the points, lines or areas of your theme
- **Locator Map** - Also known as an inset map, is an enlarged or reduced map designed to put the main map into geographic context, or to enlarge the area of interest whose level of detail is to specific for the main map scale. The locator map should have all the cartographic elements but at a highly simplified format. (Clarke, 2001)
- **Neatline** - Is the visual frame for the map. It is a border around the entire page. It usually provides the basis for a the page. (Clarke, 2001)
- **Object** - A set of points, lines or polygons in a spatial database that represent a real-world entity. These can be manipulated, and counted in a GIS, and are represented in a GIS as shapefiles
- **Query** - A question or request used for selecting features. A query usually appears in the form of a statement or logical expression. It can contain a field, an operator, and a value.
- **Relational database management system** - A database management system with the ability to access data organized in tabular files that can be related to each other by a common field. An RDBMS can recombine the data items from different files, providing powerful tools for data usage. RDBMS services include validation rules, relationships, and topological associations.
- **Rematching** - A re-geocoding of a subset of addresses (which can included all or fewer than the original set of addressed) of features in a geocoded feature class. Rematching is done when partial or unmatched records result when geocoding address with errors such as misspellings or other data entry errors.
- **Scale** - The distance ratio measured on a map to that distance measured on the ground between the same two points. For example if one cm on a map equals 1,000,000 cm in the real world the map scale would be 1:1,000,000. This scale of 1:1,000,000 on the map would be considered small scale compared to a map with a scale of 1:1,000
- **Scale Bar** - Is a visual expression of the relationship between ground coordinate space and that if the map page space. (Clarke, 2001)
- **Select feature tool** - The Select Feature tool lets you select features with the mouse by pointing at them or by dragging a selection box over them. Features that fall partly or wholly inside the box you define will be selected. Features will be selected from all of the currently active themes

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