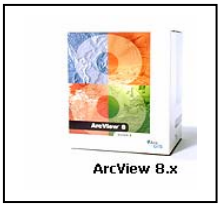
Landscape Ecology and Analysis
RNG 450/550

Lab # 2: Introduction to ArcGIS 8.x



Purpose:

The first laps cover fundamental GIS concepts as well as how to query a GIS database, manipulate tabular data, edit spatial and attribute data, and present data clearly and efficiently using maps and charts. You will learn how to use ArcMap™, ArcCatalog™, and ArcToolbox™ and explore how these applications work together to provide a complete GIS software solution. This software was developed by Environmental Systems Research Institute (ESRI), California.

Specific learning objectives:

Find out what a GIS is used for and the basic concepts you need to know to work with one.

Learn the structure of ArcGIS and how its different parts provide integrated and powerful tools for solving real-world problems.

Learn about the basic functionality of ArcCatalog™, ArcMap, and ArcToolbox™

In this lab, you will learn:

- The three ArcGIS applications that comprise ArcView 8 and about some of their primary functions.
- How these new ArcGIS applications work together to make it easier for you to learn and use the software.
- Ways you can customize how you work with ArcView 8

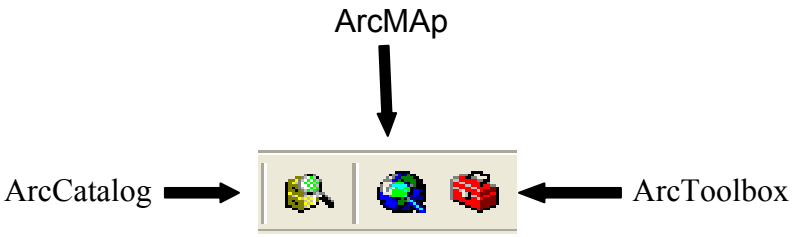
Data set:
Esri exercise

Introduction

ArcView 8 is a powerful GIS data visualization, query, analysis, and map creation solution designed for Microsoft® Windows.

ArcView includes ArcCatalog, ArcMap, and ArcToolbox:

- ArcCatalog— the tool for exploring and managing your data. It is used to browse and manage geographic data sources and create and update metadata
- ArcMap— the application for feature display and editing, mapmaking, and analysis
- ArcToolbox— the environment for performing operations such as data conversion and geoprocessing tasks. It contains powerful tools for performing geographic analysis and data conversion



ArcGIS works with extension products, including:

- Spatial Analyst
- ArcView 3D Analyst™
- Geostatistical Analyst

With ArcView 8 you can:

- explore, display, and query spatial data
- access a comprehensive suite of editing tools for shapefiles and perform simple feature editing on personal geodatabases
- perform geoprocessing operations
- create presentation-quality maps with a comprehensive suite of cartographic tools and wizards
- create reports and sophisticated two- and three-dimensional graphs
- perform layer-level projection (including imagery)
- create and manage annotation
- view maps from the Internet
- import data from and export data to a variety of common formats

ArcCatalog 

ArcCatalog is the ArcView 8 application you use to find, explore, and manage your data. With ArcCatalog, you can browse and preview data stored on your local computer, network, or even on the Internet. You can directly access maps and data. You can launch ArcMap and ArcToolbox from within ArcCatalog to begin working with your data any time.

Step 1: Start ArcCatalog and open a geodatabase

If you have a shortcut icon for ArcCatalog on your desktop, double-click it to start ArcCatalog. Another way to start the application is to click the Start menu, then click Programs, ArcGIS, ArcCatalog.

The Catalog Tree

The first time you open ArcCatalog, you will see your computer's hard disks plus Database Connections, Geocoding Services, and Internet Servers entries on the left side of the application window. To access data stored on a CD–ROM, floppy disk, or another computer on the network, you must connect to them. The collection of connections you set up to geographic data is called the Catalog. After you connect to a folder or database, your connection appears in the Catalog Tree.

You use the Catalog Tree, which is similar to Microsoft's Windows Explorer, to browse your data. Once you've found the data you want to work with, you can preview it in ArcCatalog. You can also drag the dataset from the Catalog Tree and drop it directly into ArcMap for enhanced display, mapping, and analysis. You can even drag and drop files from ArcCatalog into ArcToolbox wizards and tools.

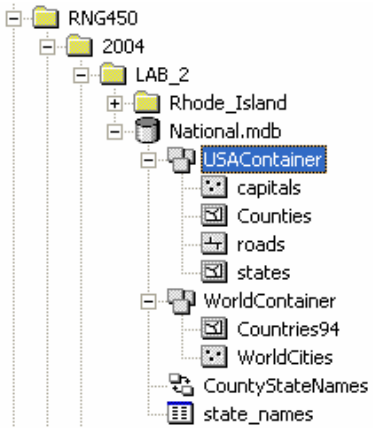
When ArcCatalog opens, look in the Catalog Tree on the left side of the window. You should see a connection to the folder that contains the data for this lab (Lab_2).

If you don't see this connection, click the Connect to Folder button  . Navigate to the RNG450 folder on your computer where the data for this lab has been saved (C:\RNG450\LAB_2\Section_a). Click OK.

In the Catalog Tree, expand the folder connection you just set up by clicking its plus sign (+). Double-click **National** to open it.

National.mdb is a personal geodatabase, a new type of data model introduced with ArcGIS.

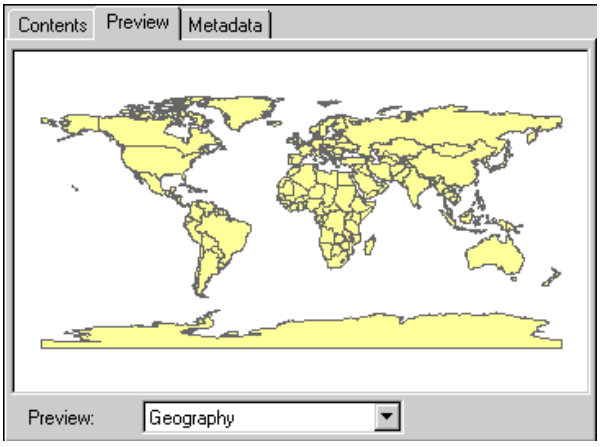
Expand both the USAContainer and the WorldContainer.



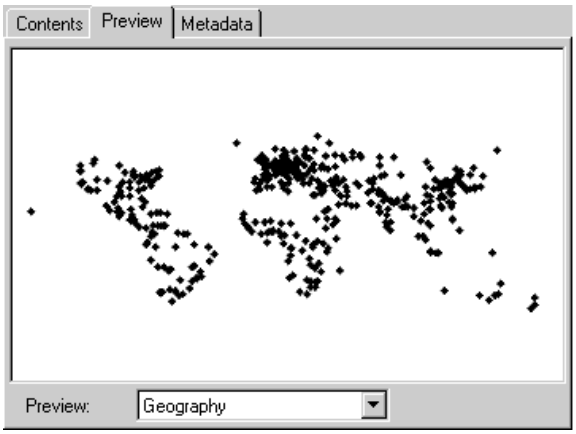
Step 2: Preview features from the geodatabase

In ArcCatalog, you can preview both geography and attributes for spatial data. In the Preview tab, you display geographic features using Geography view.

On the right side of the ArcCatalog window, click the Preview tab to make it active. In the Catalog Tree, double-click WorldContainer. Click Countries94 to make it active.



Now click WorldCities to preview the world cities.



Step 3: Preview a feature class table

In the Preview dropdown list below the preview area, choose Table. Now you see the World Cities attribute table. Examine its fields.

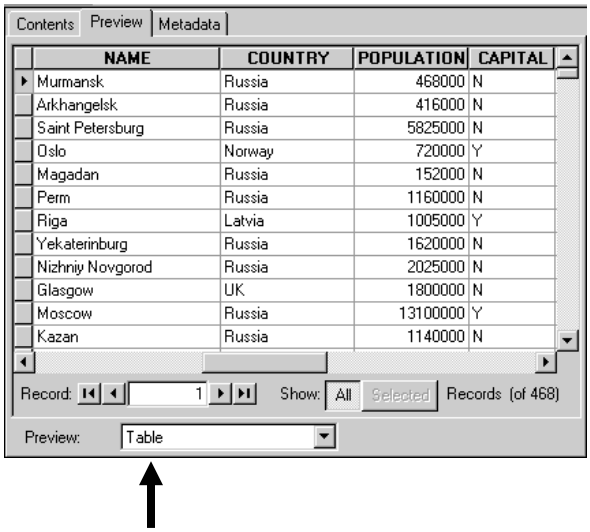


Table Preview mode allows you to investigate and compare attributes.
You can sort fields, add fields, and export the table.

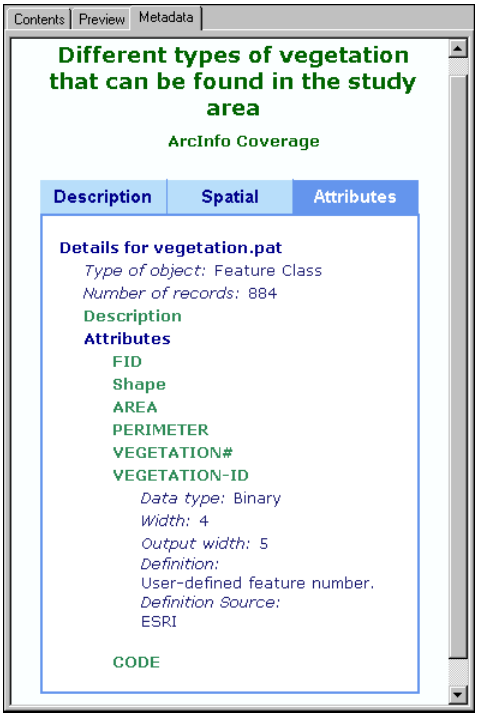
ArcCatalog also includes familiar tools to zoom, pan, and identify features.

Use the Geography toolbar to zoom and pan or identify features in your data.

Step 4: Create metadata

Metadata: Descriptive information about a collection of data. Metadata for geographic data may include the source of the data; its creation date and format; its projection, scale, resolution, and accuracy; and its reliability with regard to some standard. Metadata consists of properties and documentation. Properties are derived from the data source (e.g., the coordinate system and projection of the data), while documentation is entered by a person (e.g., key words used to describe the data set).

An important feature in ArcView 8 is the ability to create and store metadata GIS files or database. ArcCatalog provides the tools to create, view, manage, and export metadata. Clicking the Metadata tab shows you descriptive information about the data you are exploring. Metadata includes properties and documentation. ArcCatalog derives and records properties from the data source, while the user generates documentation.



Inside the Metadata tab, there are three additional tabs to help you organize metadata. In Description, you can document your data in detail. In the Spatial tab, ArcCatalog automatically records the bounding coordinates and spatial data information. The Attributes tab, shown above, shows table and field definition parameters.

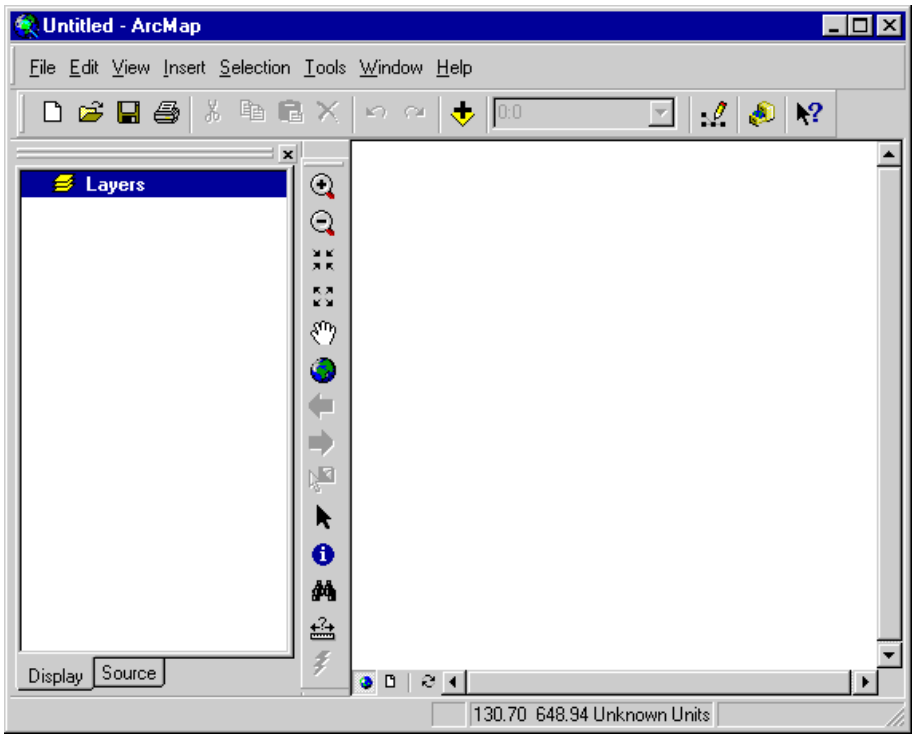
ArcMap

ArcMap is the ArcView 8 application that you use to visualize, create, edit, query, analyze, and present your data. In many ways, the ArcMap software interface is most like the ArcView 3.x interface you are familiar with. There is a map display area for viewing spatial data and a Table of Contents (TOC) in which dataset names and symbology are listed.

Step 1: Start ArcMap.

Click the Launch ArcMap button . You can also start ArcMap by clicking the Start menu, then choosing Programs, ArcGIS, then ArcMap.

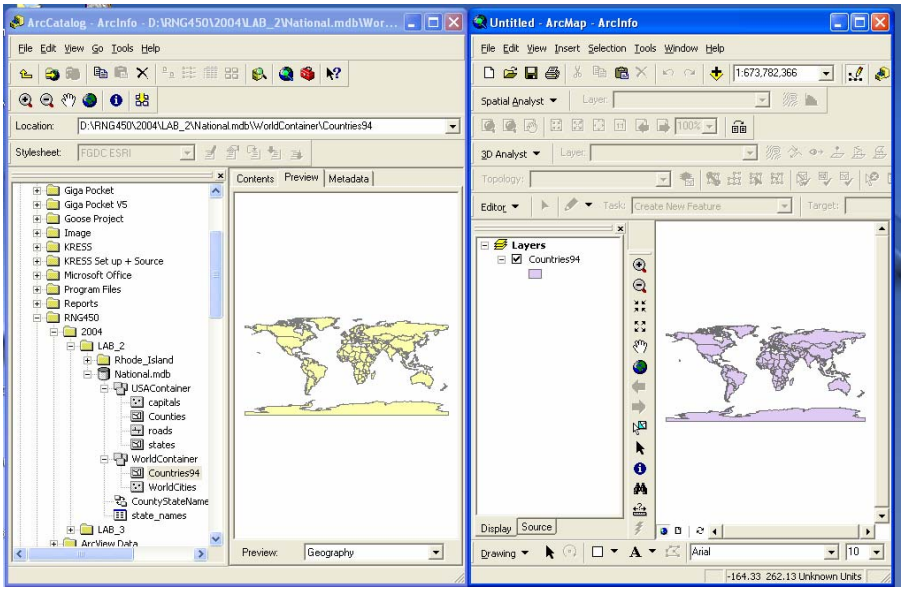
If an ArcMap dialog appears, click "A new empty map" and click OK.



Arrange and resize the ArcMap and ArcCatalog application windows so that you can see both application windows and their contents at the same time on your screen.

Step 2: Drag and drop data into ArcMap

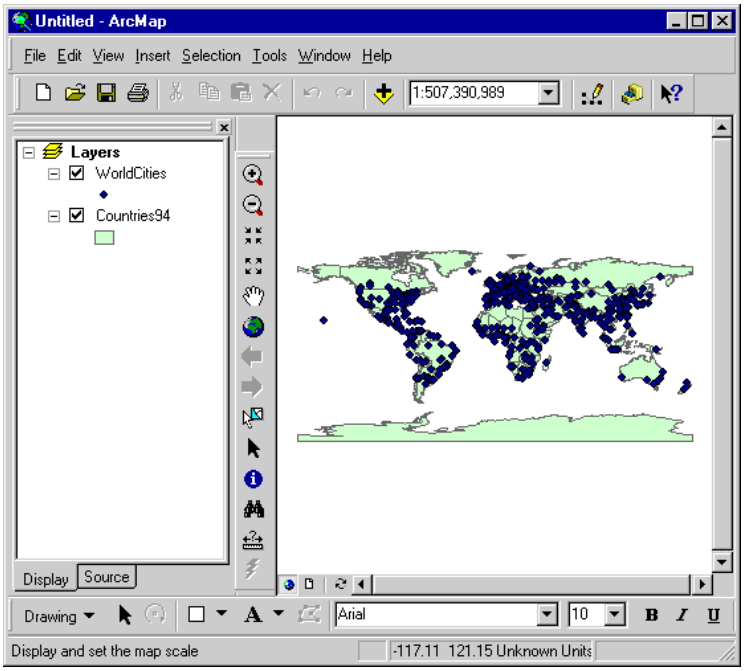
In ArcCatalog, click the Contents tab, then in the Catalog Tree, click WorldContainer. Click Countries94 and drag it into the ArcMap map display area.



The world countries are displayed in ArcMap.

Minimize ArcCatalog.

You can also click the Add Data button  . In the Add Data dialog, click the Connect to Folder button  and navigate to the RNG folderfor this lab (C:\RNG450\LAB_2\Section_a) double-click **National.mdb**, then double-click the **WorldContainer** dataset. Finally, click **WorldCities** and click Add



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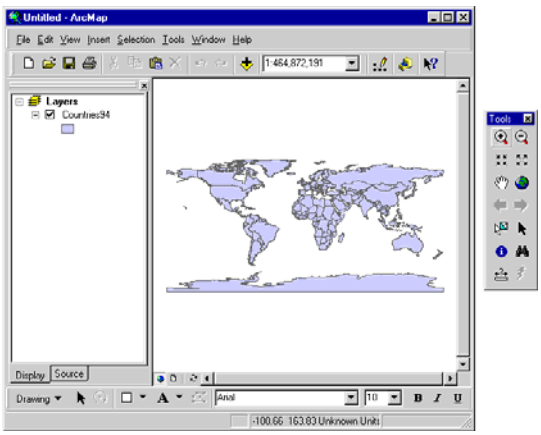
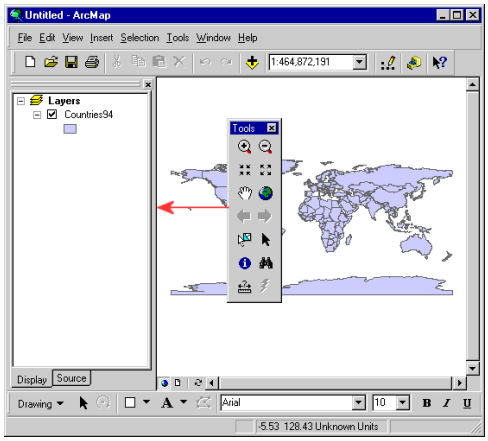
Step 3: Dock the tools toolbar

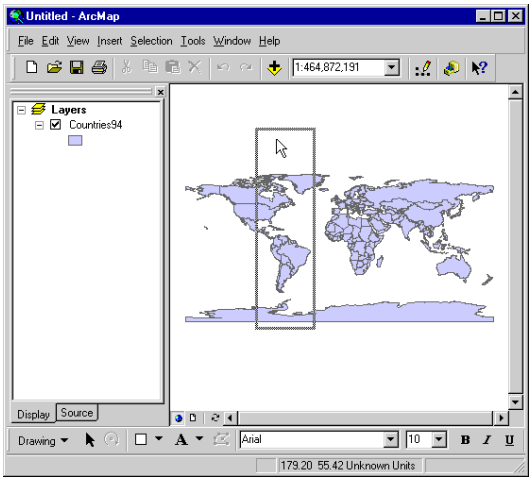
If the Tools toolbar is floating separately on your desktop, drag it into the middle of the ArcMap window so that it is docked between the Table of Contents and the map display area as shown in the View Result graphic below.





Click the title bar of the Tools toolbar and drag it over the ArcMap interface. (If your Tools toolbar was already docked, click the gray bar at the top of the toolbar and drag.)

A gray box representing the position of the Tools toolbar appears when you move the mouse over the interface.

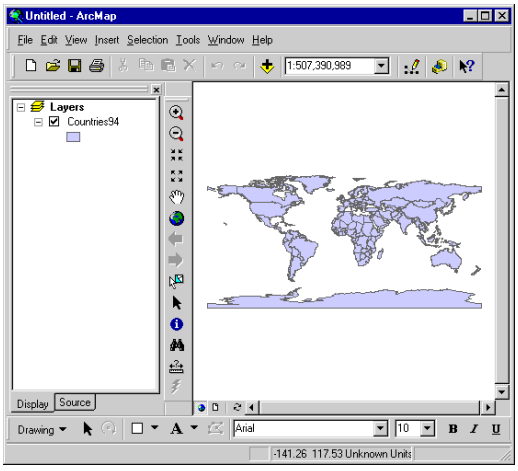


Keep holding the mouse button down and move the toolbar over the top and edges of the ArcMap window.

The gray box changes shape, indicating different docking locations in the interface.

Move the toolbar's outline so it is over the bar that separates the Table of Contents from the map display area. The gray box turns into a tall thin rectangle. Release the mouse button.

The Tools toolbar is now docked between the Table of Contents and the map display area. Your ArcMap interface should look like the one in the View Result graphic below.

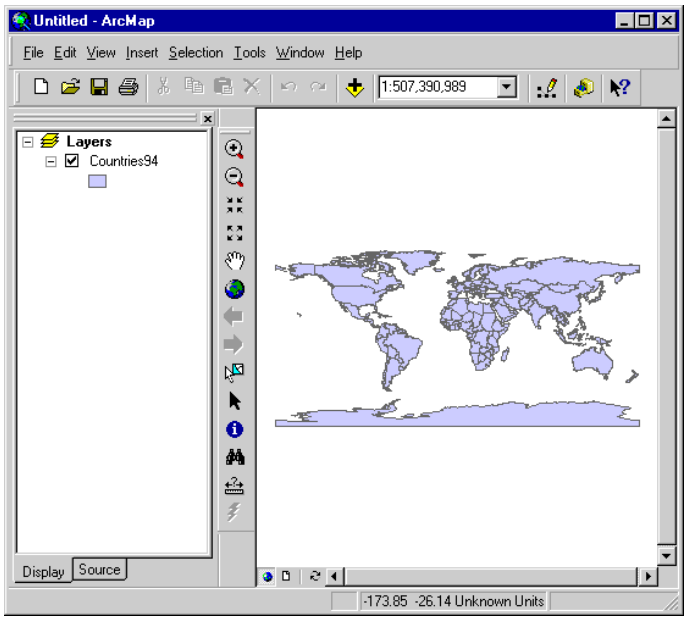


Step 4: Hide the Draw toolbar

The Draw toolbar appears at the bottom of the ArcMap window. Because you won't be needing it in this lab, you will hide it. (If your Draw toolbar is not visible, from the View menu, choose Toolbars and click Draw to display that toolbar.)

From the View menu, choose Toolbars, then click Draw.

The Draw toolbar is removed from the ArcMap interface.



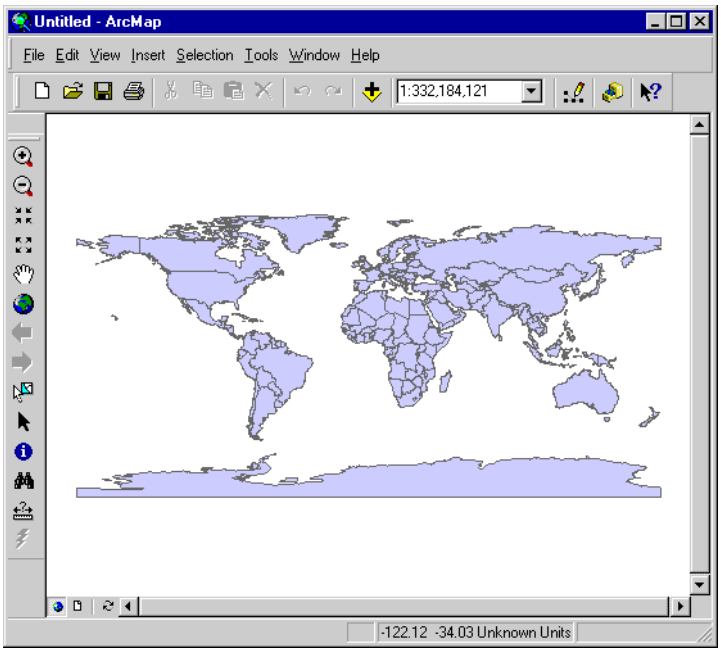
The Toolbars command in the View menu has a list of all the toolbars. The ones currently displayed are checked.

Step 5: Close and reopen the Table of Contents

You can also remove the Table of Contents from the interface.

In the upper-right corner of the Table of Contents, click the X.

The Table of Contents disappears from the interface.



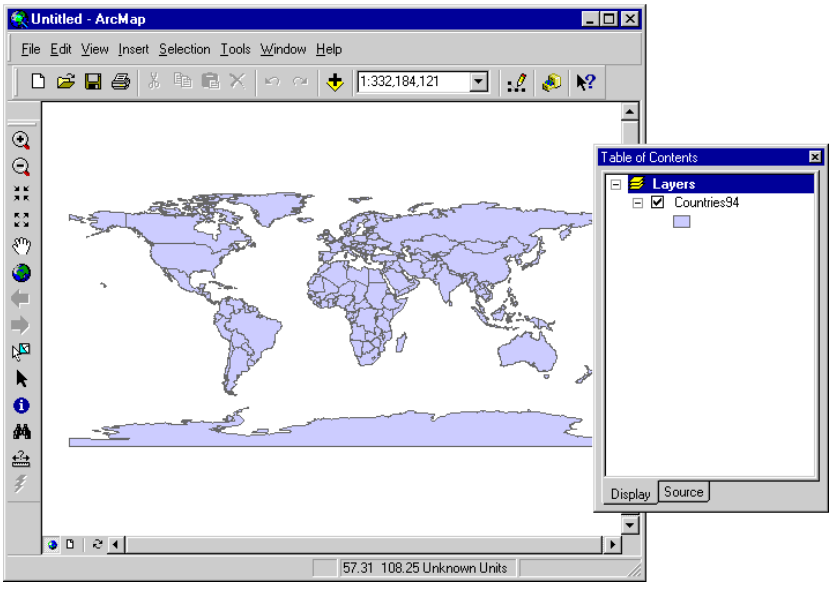
To display the Table of Contents again, from the View menu, choose Table of Contents.

The Table of Contents is restored to the interface.

Step 6: Undock the Table of Contents

You can undock the Table of Contents to make it its own floating window.

Click on the double bar above the Table of Contents and drag it away from the ArcMap window. The Table of Contents undocks and floats off to the side.

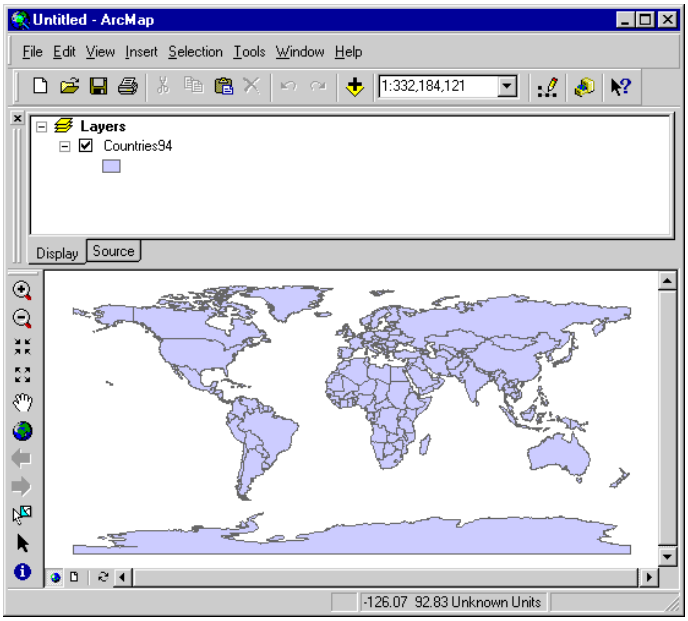


Step 7: Dock the Table of Contents

The Table of Contents is similar to other toolbars. You can dock it many places on the ArcMap interface.

Click the title bar of the Table of Contents window and drag it over the top part of the ArcMap display area until it turns into a horizontal rectangular shape. Release the mouse button.

The Table of Contents is now docked above the display.



Step 8: Hide scroll bars and the status bar

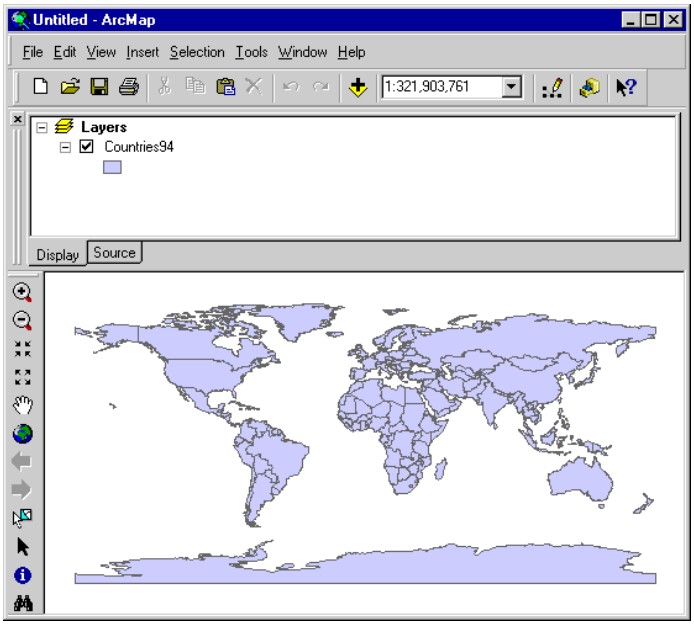
If you want to create more room for the map display area, another thing you can do is hide the scroll bars and the status bar.

To hide the scroll bars, from the View menu, click Scrollbars.

The display window scroll bars disappear.

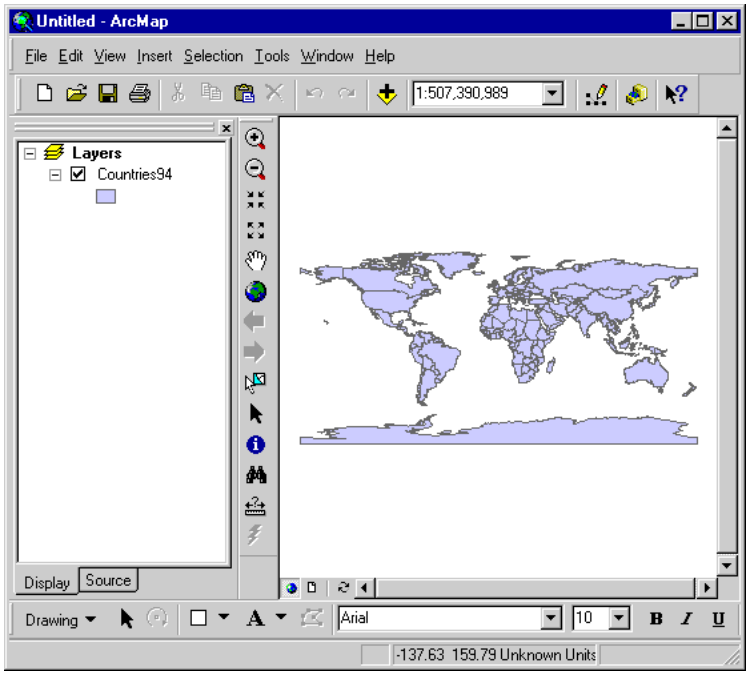
To hide the status bar, again from the View menu, click Status Bar.

The status bar disappears as well.



Step 9: Change the interface again

For this step, use what you've learned to return the interface to its appearance at the end of Step 3. It should look like the View Result graphic below when you're finished.



Step 10: Identify a feature

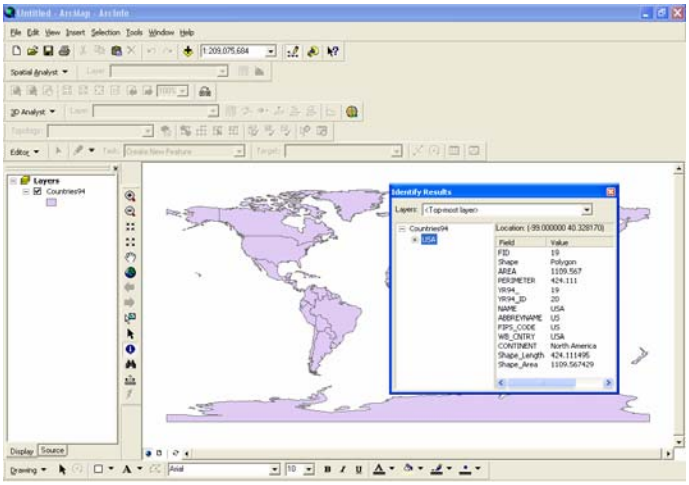
Identify button

When you click the Identify button (by default, located on the Tools toolbar) and then click a feature on the map, the Identify Results window displays and shows the attributes for the feature. Identify is a quick way to find features with specific attributes.

On the Tools toolbar, click the Identify button .

Click the USA on the left side of the map.

The Identify Results window opens. Examine the attribute values in the Identify Results window to find the area and perimeter's value.



Step 11: Find a feature

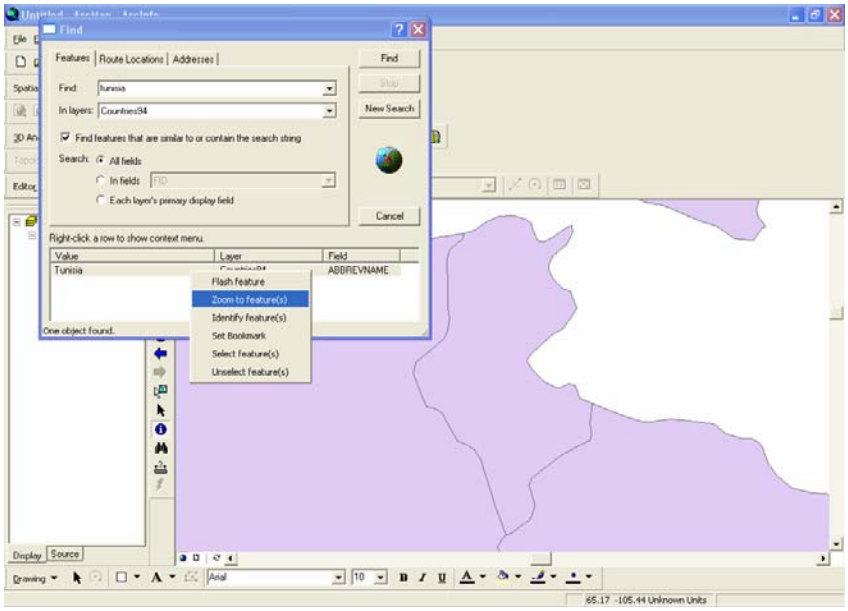
Find button

If you want to locate a feature in the map display and you know what one of its attributes is, you can use the Find button. When you click the Find button, a dialog displays. You can specify an attribute and the layer or layers in which to search. You also have the choice of searching all the fields in a layer, specific fields in a layer, or each layer's primary display field (the default field used for feature labeling and map tips).

On the Tools toolbar, click the Find button  .

In the find box type Tunisia and In Layers select Countries94.

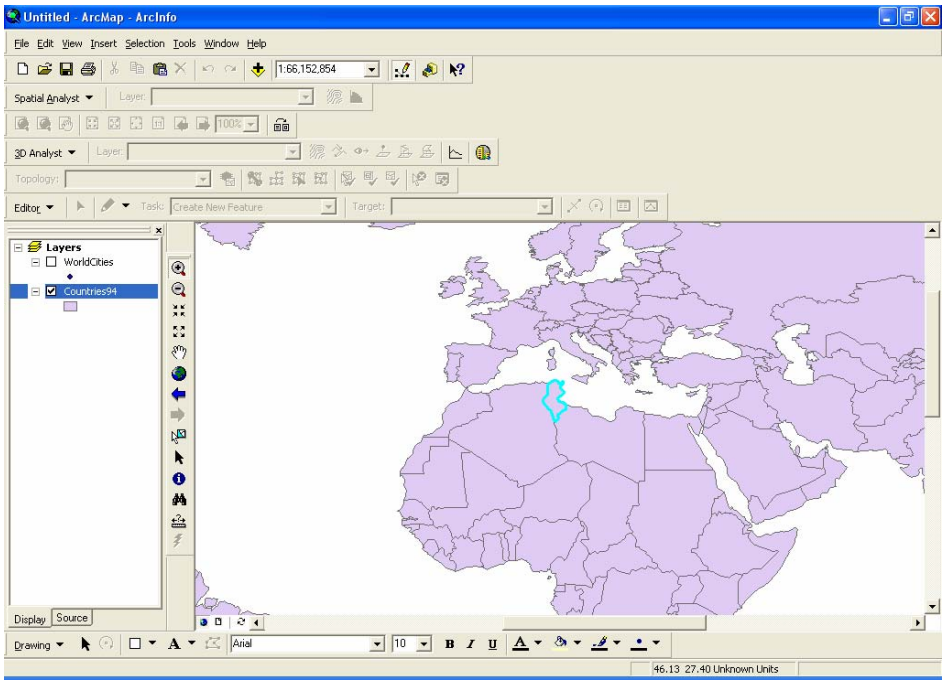
When the search is complete, ArcMap displays all the layers and fields that matched the attribute you typed in. Right-clicking a search result displays a context menu where you have options to flash the feature in the display, zoom to the feature, select or unselect the feature, or create a bookmark. If you choose flash feature, you may not be able to see it if you're not zoomed in enough. Or, zoom to the feature and then use the zoom out tool until you can recognize the country's location in the world.



Step 12: Select a feature

Arrange your windows so that you can see both the Find dialog and the map. Right-click the Tunisia name in the search result box and choose Select Features. Close the find menu box. In the main ArcMap frame, click on the extent zoom (add image) and then zoom into Northern Africa.

The feature is selected in the map display.

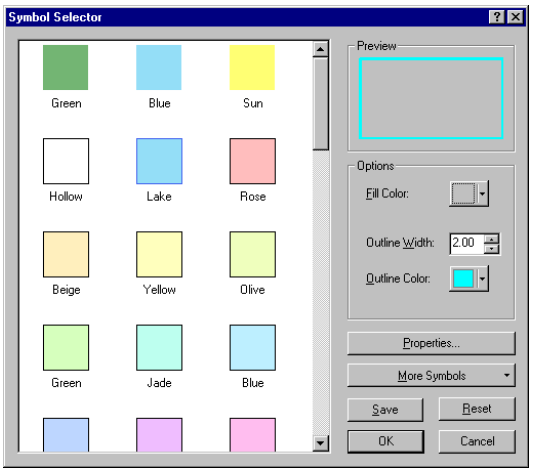


Step 13: Change the selection color

Now you'll change the selection color.

In the Table of Contents, right-click Countries94 and choose Properties. In the Layer Properties dialog, click the Selection tab.

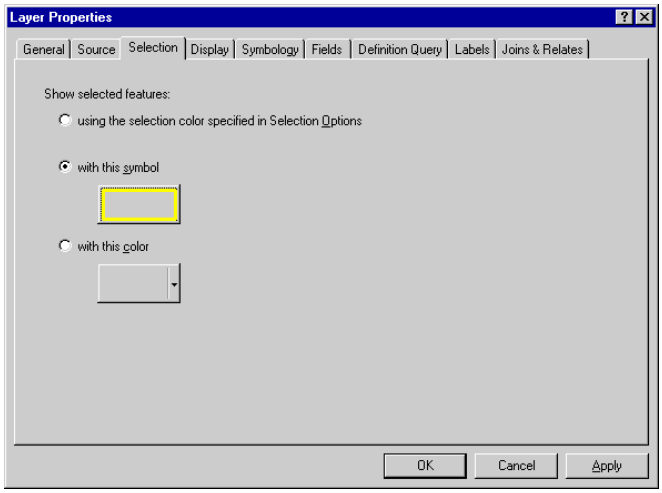
Click Show selected features with this symbol. Click the symbol button to open the Symbol Selector.



In the Symbol Selector's Options area, click the Outline Color box. In the Color Picker, click a yellow square.

The Preview area shows the new color you selected.

Click OK to close the Symbol Selector.

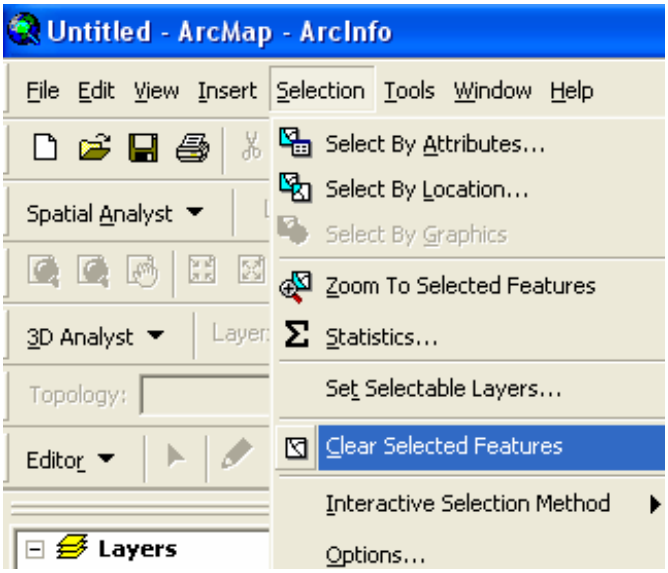


In the Layer Properties dialog, click OK to apply the new selection color.

The building is now selected with a yellow outline.

Step 14: Unselect Feature

From the selection menu select Clear Selected Features.



Step 15: Set a bookmark

Re-open the find dialog.

In the Find dialog, right-click the Tunisia for the selected country and choose Set Bookmark.

Close the Find dialog.

From the View menu, choose Bookmarks, then click Tunisia.

The map zooms to the extent of the country.

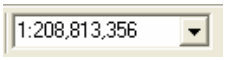
To return to the original extent, click the Previous button  or the Full Extent button  .

You can also set, access, and manage bookmarks from the View menu.

Step 16: Change the map scale

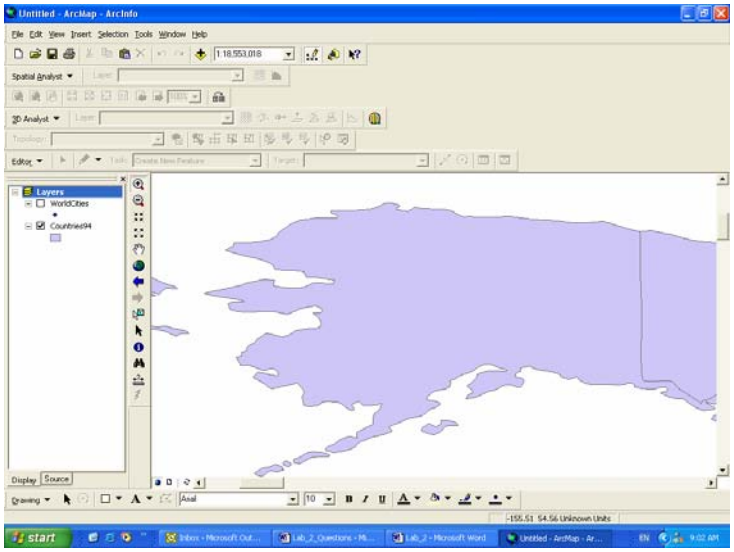
The countries and cities are drawn at a scale that allows them to fit in the ArcMap map display area.

Look at the scale box on the Standard toolbar to see the scale of the map. Depending on the size of your ArcMap window, your scale may be different than the one shown in the View Result graphic below.



The scale box tells you that one unit on the map (e.g., one meter, foot, or mile), is equal to (in this example) 208,813,356 of the same units on the ground.

Click the Zoom In button  . Click and drag a box around Alaska.



Notice that the scale changed when you zoomed in (it became larger—a larger scale equates to a smaller denominator in the scale ratio) and that the amount of detail in the map increases with the scale.

The coordinate location of your mouse pointer is displayed in the status bar at the bottom of the ArcMap window. Move your mouse pointer around the map (without clicking). Notice that the coordinates change.

Step 17: Change the symbology for world countries

In this step, you will change the color of the country polygons.

In the Table of Contents, right-click the Countries94 polygon symbol (the square).

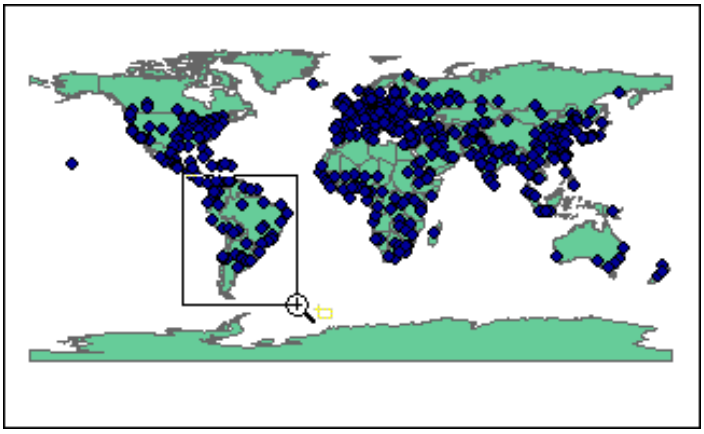
The Color Picker displays. Experiment with changing the colors of the country polygons.

Step 18: Zoom in to South America

Turn the cities layer back on by clicking the box next to the file name.

Next, you'll zoom to South America to narrow the area of interest.

On the Tools toolbar, click the Zoom In button  . Draw a box around the South American continent.



ArcMap zooms in to the contents of the box.

Step 19: Label map features

In this step, you will label features on a map and add map tips. A map tip is a way to see attribute information about a feature.

In the Table of Contents, right-click WorldCities (its name, not the symbol) and click Label Features. Labels appear for the cities. If some of the cities are not labeled, enlarge the display area.

Now you will add the map tips.

Again, in the Table of Contents, right-click WorldCities and click Properties. In the Layer Properties dialog, click the Display tab, then check the box next to Show Map Tips.

Click OK. Move your mouse pointer over a city on the map to see the associated map tip.

The map tip appears in a box and should be the same as the city's label.

Step 20: Start an analysis project

For the remainder of this lab, you will work with data from Aquidneck Island, Rhode Island to perform geoprocessing tasks that are part of a fast food restaurant location analysis.

As part of your analysis, you need to find busy roads in several strategic ZIP Codes. First, you will buffer the target ZIP Codes by 1.5 kilometers. You will then overlay the

buffer polygons with the island's street network to isolate those streets that fall within the buffers. In the second part of the analysis, you will identify the busy streets in the target areas.

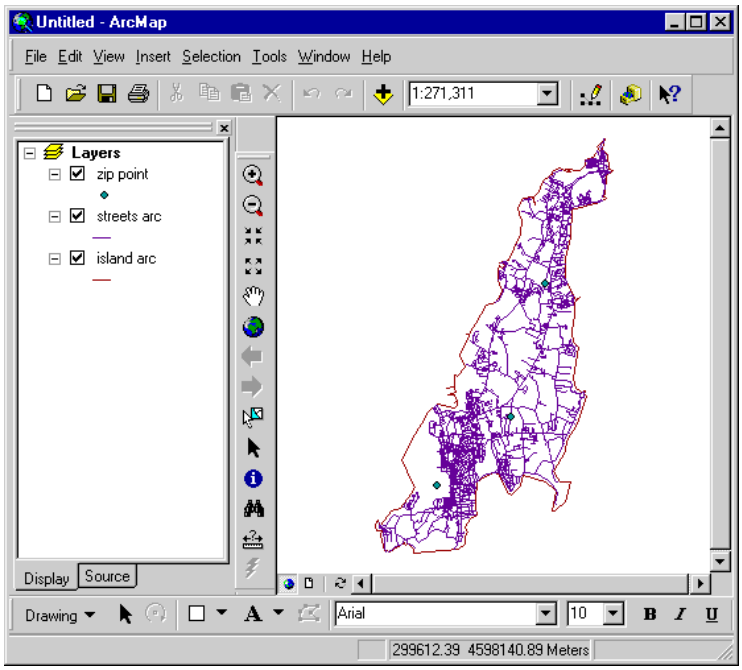
First, you will buffer the ZIP Codes that fall within Aquidneck Island, Rhode Island.

Restore ArcCatalog. Arrange ArcCatalog and ArcMap so that both application windows are visible.

In ArcCatalog, expand the Rhode_Island folder.

In ArcMap, click the New Map File button  . Click No when prompted to save your changes.

From ArcCatalog, drag the island, streets, and zip feature classes into ArcMap.



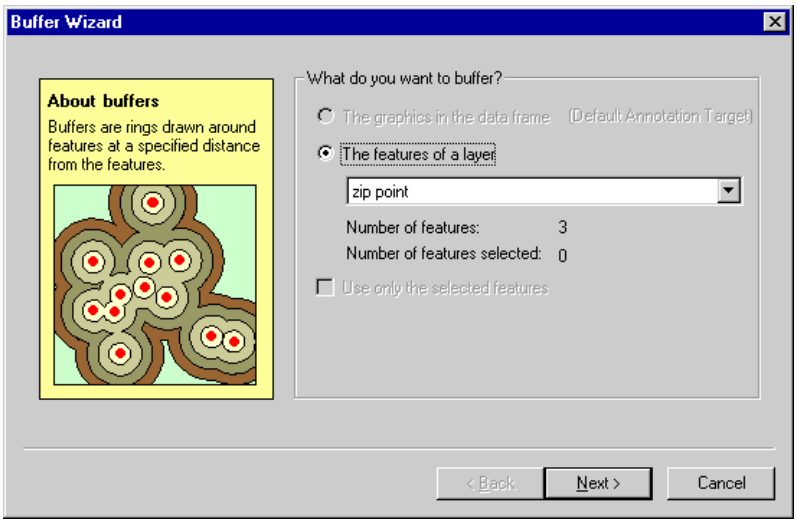
Minimize ArcCatalog.

Step 21: Use the Buffer Wizard to create buffers

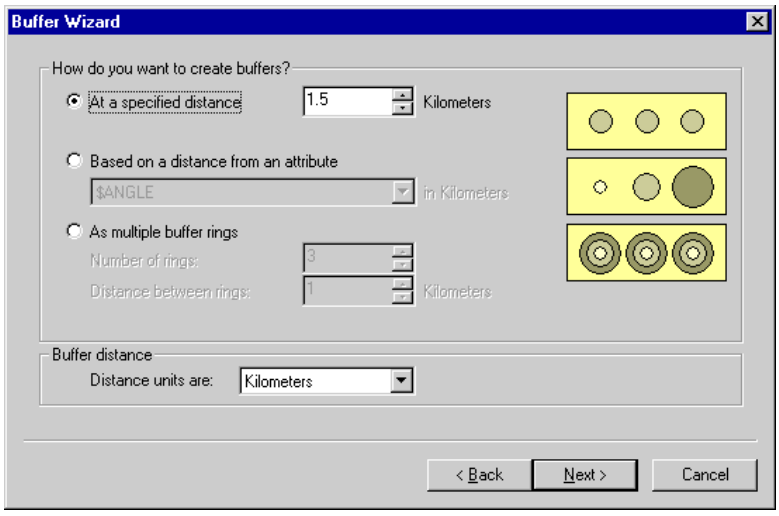
Now you'll open the Buffer Wizard so you can buffer the target ZIP Codes.

From the Tools menu, choose Buffer Wizard.

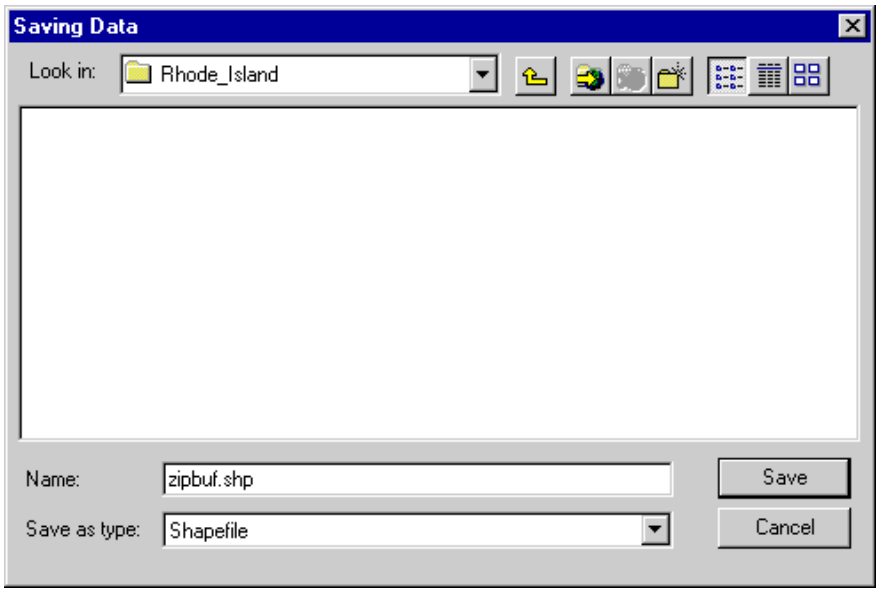
In the first wizard panel, click the option to buffer the features of a layer and choose zip point as the layer.



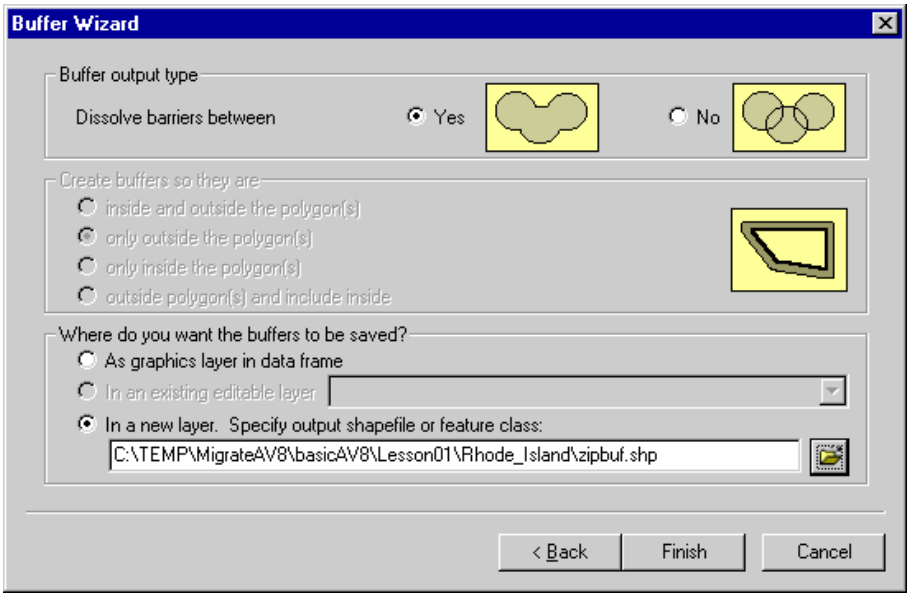
Click Next. In the next wizard panel, in the Distance units dropdown list at the bottom of the panel, choose Kilometers. Enter **1.5** for the buffer distance.



Click Next. Click Yes to dissolve barriers between buffers and click the option to save the buffers to a new layer. Click the Browse button and navigate to C:\RNG450\LAB_2\Section_a folder and save the layer as a shapefile named **zipbuf**.



Click Save.

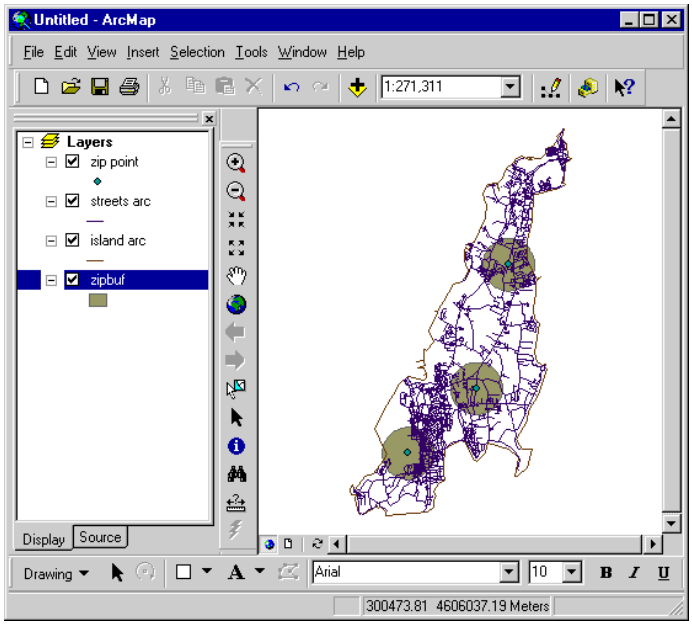


Click Finish to have the Buffer Wizard create the buffers.

Step 22: Clip data with the Geo-processing Wizard

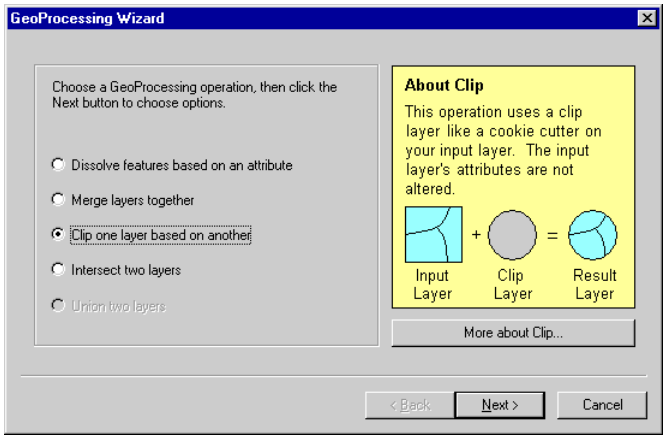
When the Buffer Wizard is finished processing, the zipbuf layer is added to ArcMap.

Arrange the order of the layers in the Table of Contents so that zip is at the top, streets is underneath zip, island is underneath streets, and zipbuf is at the bottom.



Now you will use the ArcMap Geoprocessing Wizard to clip the island's streets to the buffer polygons you created around the ZIP Code points.

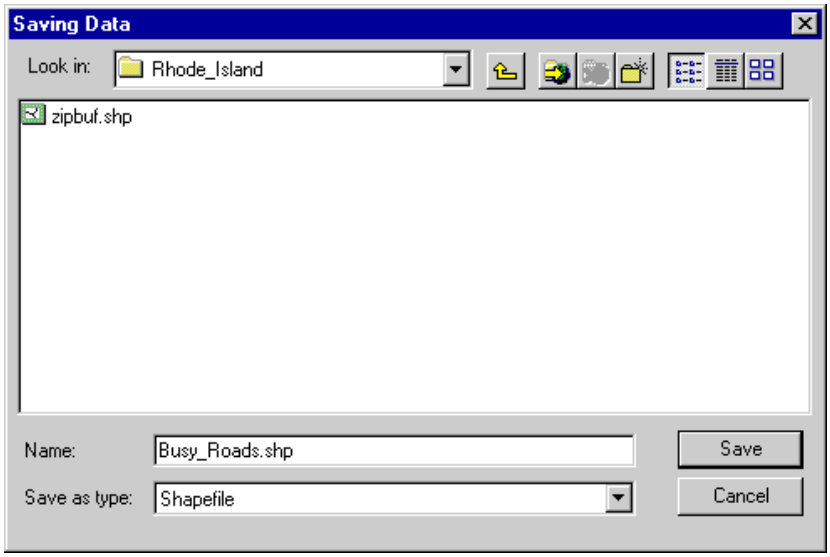
From the Tools menu, choose GeoProcessing Wizard. Click Clip one layer based on another.



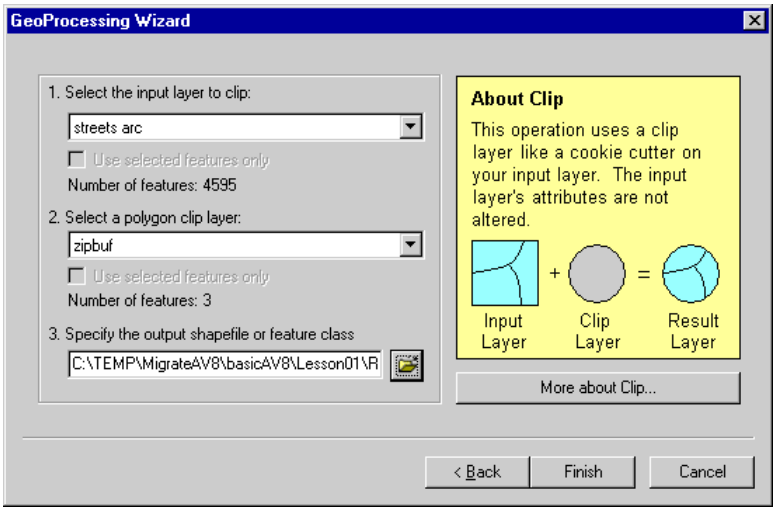
Click Next.

Next, you need to specify the clip parameters.

For the input layer to clip, choose streets arc. For the polygon clip layer, choose zipbuf. Click the Browse button and save the output clip layer as a shapefile named **Busy_Roads.shp** in your Rhode_Island folder.



Click Save.

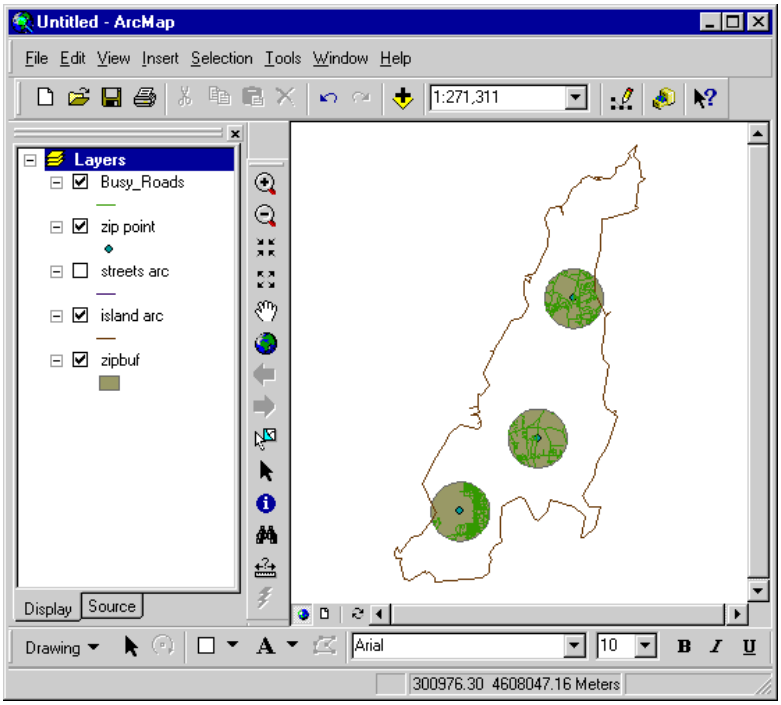


Click Finish to clip the streets using the polgons from zipbuf. After a moment, the new layer is added to the Table of Contents.

Step 23: View the results in ArcMap

All the busy roads within 1.5 kilometers of the ZIP Code points are displayed in ArcMap.

In the Table of Contents, uncheck the streets arc layer. Now you see only the roads contained within the ZIP Code buffer polygons.



Step 24: Measure distance

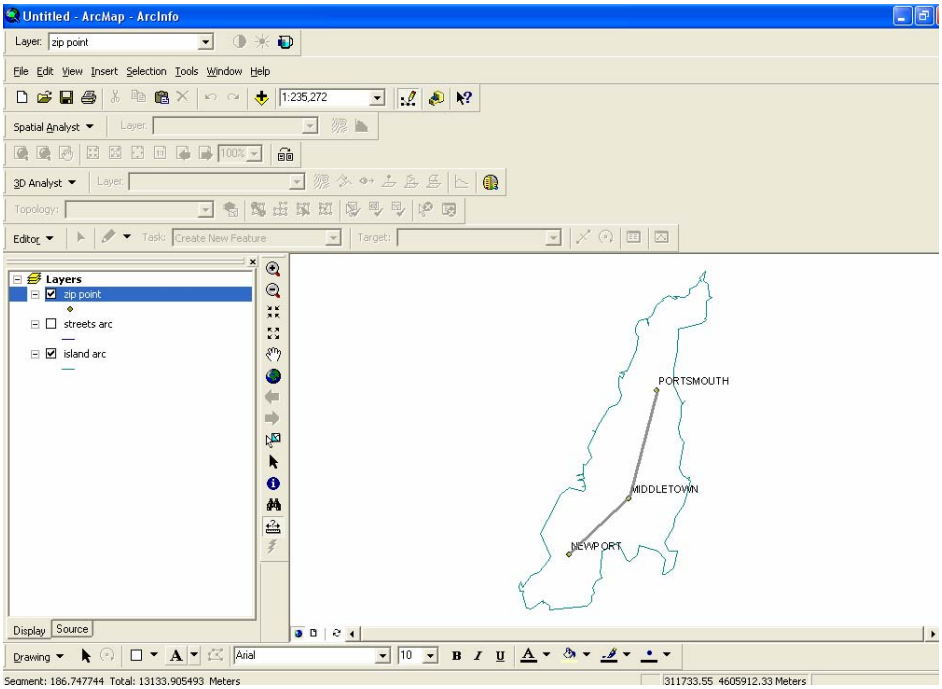
When you want to measure linear distances between features on the map, you use the Measure button. As you start clicking at different point locations on the map, a thick line will appear.

First, right click on the zip point layer and select label feature. You can see that the buffered areas around Portsmouth, Middletown, and Newport.

With the Measure button, you can click on locations in the map's display area and get the distance between them. The distance is reported in the status bar at the lower left of the ArcMap application window.

You specify the display units reported in the status bar in the General tab of the Layer Properties dialog.

As you move the mouse pointer from Newport towards Middletown, the status bar will report the length of the last segment as well as the total length of all the segments in the measurement transaction. To finish measuring, double-click at the end point. The gray connecting line will disappear, and the status bar will continue to show the last measurement.



Step 25: Perform a spatial query

You will create spatial and attribute selections and queries and create a selection layer.

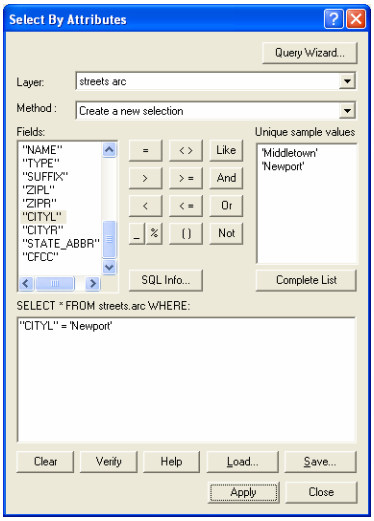
In this step, you will create a spatial query to select all the streets inside the Newport area. From the Selection menu, choose **Select By Attribute**.

The Select By Attribute dialog opens.

First clear all selections (click on selection → clear selected features)

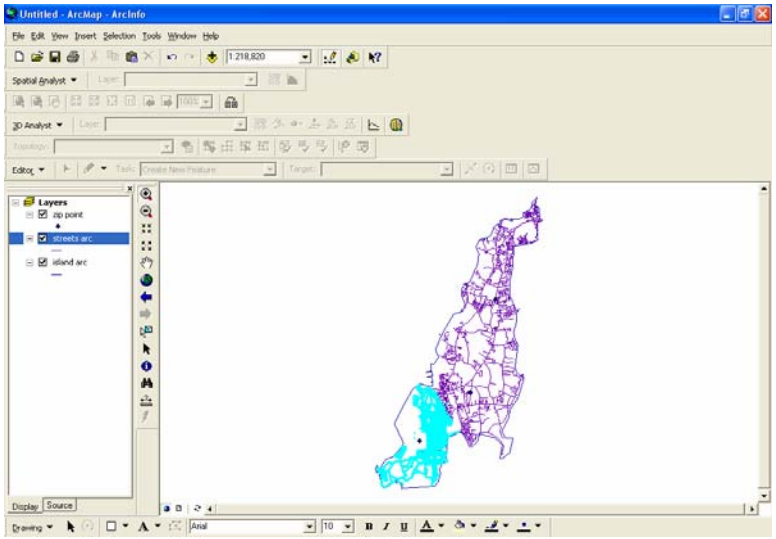
Display the **streets arc** layer.

In the Select By Location dialog, select streets layer that are within the city limit “CITYL”. Make sure your selections match the View Result graphic below.



Click Apply, then click Close.

After the query is applied, features in the Buildings layer are selected.



This selection is now available for use in other operations. For example, you could create another dataset with it (i.e., a layer with fewer features), or you could calculate statistics for the selected buildings (like the total value of the flooded buildings).

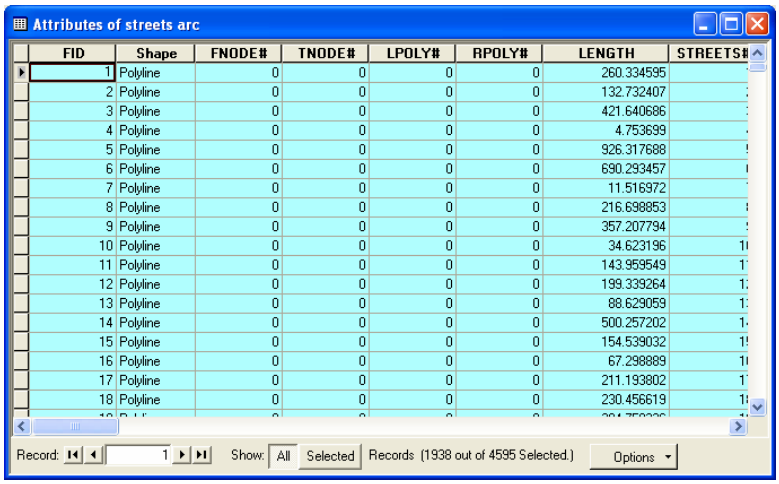
Spatial queries are important GIS tasks. They demonstrate the power of GIS to use spatial relationships to find answers that will help in decision making.

Step 26: Examine your selection in the attribute table

In this step, you will examine the attribute table for the streets layer.

In the Table of Contents, right-click streets arc and choose Open Attribute Table.

The Attributes of streets arc table displays.



Notice that the total number of records (4595) and the number of selected records (1938) are shown at the bottom of the table window. When features are selected on the map, their corresponding records in the feature attribute table are also selected. Scroll down to examine the selected records.

If you want, you can view only the selected records rather than all the records in the layer.

Click the Selected button at the bottom of the table.
Now you see only the records for the 1938 selected features. These are the streets inside the Newport area.

Click the gray record box to the left of a record. The record is highlighted both in the table and in the map.

Close the table.

Step 27: Close ArcMap and ArcCatalog

Close both ArcMap and ArcCatalog. Click No when you're prompted to save changes to the map document.

In this exercise, you used ArcMap and ArcCatalog to find data, display it on a map, and perform some common geoprocessing tasks. In the coming modules, you'll learn more about each application and have the opportunity to experiment on your own.

Step 28: Exit ArcMap

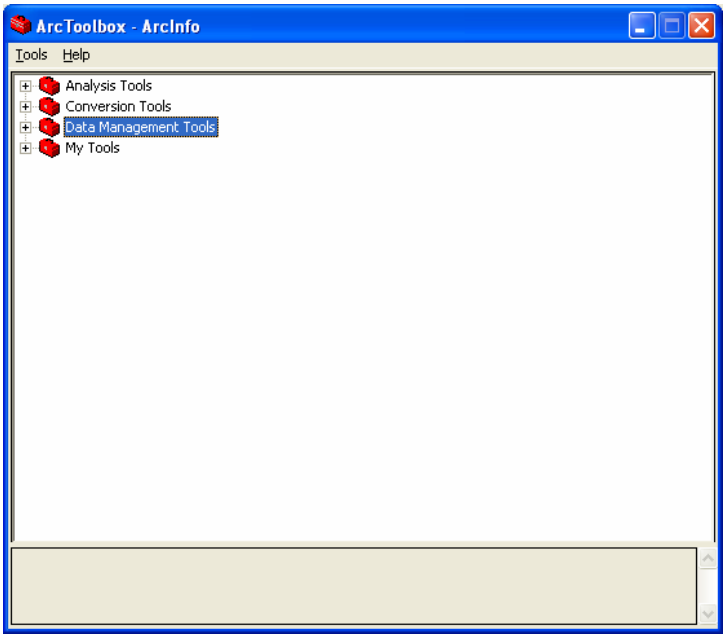
You should now feel more confident about changing ArcMap's interface. You've learned how to hide and display toolbars, the Table of Contents, the scroll bars, and the status bar. You've also learned how to open, close, float, and dock the Table of Contents in the ArcMap window.

It should be clear that you can customize ArcMap's interface to match your preferences, whatever they are.

Exit ArcMap. Click No when you're prompted to save your changes.

ArcToolbox 

ArcToolbox is the third standard application that comes with ArcView 8. As its name implies, ArcToolbox contains tools for working with your data. For ArcView 8, the tools in ArcToolbox are organized into two main toolsets: Conversion Tools and Data Management Tools. ArcToolbox also contains a third toolset called My Tools where you can store frequently used tools and custom tools.



ArcToolbox contains both tools and wizards. A tool, indicated by a hammer icon in ArcToolbox, contains several input fields that you fill in with command options to complete the particular task. Tools have smart defaults—some fields are automatically filled in after others are filled in. Tools also allow you to run multiple jobs at once using a batch mode.

Wizards are available to carry out more complex commands or sets of commands. Wizards, indicated in ArcToolbox with a magic wand icon, are like tools but instead of using one dialog for entering command options, wizards use multiple dialogs. The wizard dialogs walk you through the parameters you need to specify and include

instructions that help you fill in the options. Wizards are used for more complex tasks that require many parameters to be specified.

ArcToolbox tasks are concentrated on shapefiles and geodatabases. For instance, you will find wizards for changing shapefile and geodatabase projections in the Projections toolbox of the Data Management Tools. In ArcView 8, ArcToolbox does not contain tools for geoprocessing tasks. The ArcMap Tools menu is where you access the Geoprocessing Wizard.