


Mastering the Skills

Teaching Tutorial

Preparing to begin

Each step of the tutorials in this book is illustrated by a video clip on the book's CD. You can view these clips whenever you want a demonstration of one of the steps in the tutorial. To view videos, do the following.

- Place the book's CD in the computer's CD-ROM drive. Wait for the splash screen to appear.
- Click the button to accept the license agreement. The main window appears (Fig. 1.18).
- Size the document window to a narrow strip on the left side of the screen. Put your ArcMap window on the right so that you can see it also.
- In the Chapter 1 section, click on the number of the tutorial video you want to see. Windows Media Player will start playing the clip. If asked whether you want to open the clip in Windows Explorer, say NO.
- Size the play window as large as possible for best resolution.
-  → When the video finishes, click the Minimize button in the upper-right corner of the Media Player window to get it out of the way.
- The headings under the Skills section contain links to performing different skills introduced in the chapter. Use these videos as a reference if you have forgotten how to do something.
- Before starting the tutorial, make sure that you have installed the mgisdata folder from the CD to the computer hard drive. See the Preface for detailed instructions.

Chapter 1 Video clips				
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
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Tutorial videos

Skills reference videos

Chapter 1 Skills
Starting ArcMap, ArcCatalog and ArcToolbox
Connecting and disconnecting to folders
Connecting to an Internet Service
Setting options
Viewing the contents of a folder
Previewing the contents of a layer
Creating and Viewing thumbnails
Resizing a table

Fig. 1.18. The Video Index provides links to demonstration videos.

Beginning the tutorial

The following examples provide step-by-step instructions for doing basic tasks and solving basic problems in ArcGIS. The steps you need to do are highlighted with an arrow →; follow them carefully. Click on the video number in the Video Index to view a demonstration of the steps.

We will begin with an overview of ArcCatalog just to highlight some of its capabilities as a preview to what GIS is about. You will learn more about these functions in the chapters to come.

TIP: In these tutorials, values you must enter are shown in this font: type this.

Adding connections to folders

ArcCatalog (and ArcMap) access data through **connections**, which are links to folders containing GIS data. By default, the main computer hard drive will always show as a connection (C:\).

→ Start ArcCatalog.

1 → Examine the folder tree on the left side and find the default connection, C:\.

1 → Click the plus sign next to it to expand the contents of the drive and see the subfolders.

Although you can navigate through folders to find any data on C:\ from the default connection, you can also establish connections to subfolders, thus creating handy shortcuts to frequently used data. You may already have one shortcut to the mgisdata folder, or it may be absent. If no mgisdata connection exists, then you can add one.

1 → Click the minus sign by the C:\ connection to collapse it again.

1 → Look for a connection to the mgisdata folder as shown by the red oval in Figure 1.19. The first part of the name may be different, depending on where the data were installed (such as C:\student\mgisdata).

1 → If the connection is already there, go to step 3.



2 → To add the connection, click the Connect to Folder button.

2 → Navigate to the directory containing your mgisdata and click on the mgisdata *folder* to select it. Do not select any of the subfolders, just the mgisdata folder.

2 → Click OK to add the connection.

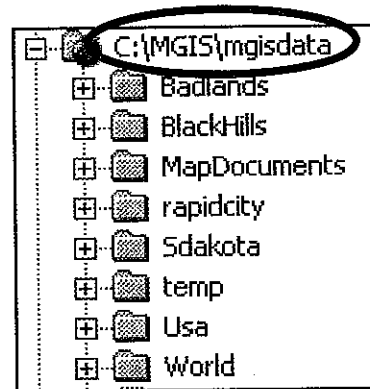


Fig. 1.19. A connection to the mgisdata folder in ArcCatalog

Adding connections is critical for accessing data not on C:\, such as on a second disk drive, a network drive, or a CD-ROM drive. Once you add a connection, it will show up in ArcMap also and be present until you delete it. Connections tend to build up over time, so once in a while go through them and delete ones no longer being used. Also, having multiple pathways to the same folder, such as through connections to C:/MGIS/mgisdata and C:/MGIS/mgisdata/World, can cause unstable behavior in ArcGIS. Keep connections uncluttered and simple.



3 → Locate the connection to the mgisdata folder just added. Click to select it and then click the Disconnect button. It disappears from the list.



3 → Click the Connect button, navigate to the mgisdata folder, and add the connection again.

Before we start exploring data with ArcCatalog, however, we will see how to use the Options in ArcCatalog to control some of the options associated with displaying data.

4 → Click the Contents tab in the ArcCatalog main window.

4 → Adjust the folder tree by clicking the plus signs until you can see the mgisdata\MapDocuments folder and click it to highlight it.

- 4→ Click Tools > Options on the main menu bar.
- 4→ Click the General tab.

The General tab can control which types of files and services appear in the Catalog. By default, all are shown. You can also choose to hide or show file extensions, such as .shp or .mxd.

- 4→ Uncheck the box next to Hide File Extensions.
- 4→ Click OK to close the Options menu and apply the changes. Notice that the map documents now appear with an .mxd extension.

ArcCatalog gives users many ways to get information about data. The left window shows a folder tree. The right window has three tabs: **Contents**, **Preview**, and **Metadata** (Fig. 1.20). The Contents tab shows what is inside a folder or a geodatabase. The Preview tab allows the user to explore the spatial or attribute data of a feature class. The Metadata tab is used to view or edit metadata.

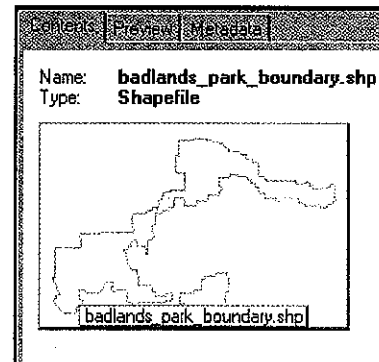


Fig. 1.20. View tabs

The Contents tab

The Contents tab is used to explore the contents of folders and geodatabases and is similar to Windows Explorer. It is the fastest option and shows information about what is currently highlighted in the folder tree. It offers four view styles for content (from left to right in Figure 1.21): Large Icons, List, Details, and Thumbnails.

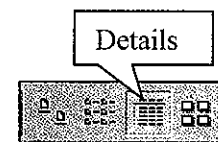


Fig. 1.21. Content view styles

- 5→ Make sure that the Contents tab is clicked.
- 5→ Click on the button for each view style to examine it, and then end by clicking the Details button (Fig. 1.21).
- 6→ Expand the mgisdata folder, if necessary, and click on the Rapidcity folder to highlight it. Examine its contents (Fig. 1.22). (It will not match the figure exactly.)
- 6→ Expand the plus sign next to the Rapidcity folder to see the types of spatial and attribute data that it contains.
- 6→ Click the plus sign next to the citybnd layer. The expanded list shows each of the feature classes of the coverage. The shapefiles do not expand because they can only have one feature class.
- 6→ Expand the TM_24sep98MS raster to see the seven bands in the image. Each band shows a different range of light wavelengths measured by the Landsat satellite.

Name	Type
eastpat	Folder
rapidnets.mdb	Personal Geodatabase
landuse	Coverage
onsite	Coverage
wshds	Coverage
gasstation.shp	Shapefile
gypsum.shp	Shapefile
landuse.lyr	Layer
landuse.txt	Info Table
rceast_nw.sid	Raster Dataset
rcsoilatt.dat	Info Table
rcwgeology.shp	Shapefile
rds_dp.shp	Shapefile
restaurants.dbf	dBASE Table
roadnet.lyr	Layer
WaterNet.lyr	Layer

Fig. 1.22. Data sets in ArcCatalog

- 6→ Click one of the entries in this folder and notice the information that appears in the main window. A coverage lists all the feature classes. A shapefile has a name and a **thumbnail** picture. Click on each type of data you can find in this folder and watch the Contents window update.

TIP: You can click the edge of a contents column and drag it to change the column width.

1. How many geodatabases are there in the folder mgisdata\Rapidcity? _____ How many coverages? _____ How many tables? _____ How many rasters? _____ How many layer files? _____ How many shapefiles? _____ How many feature datasets does the rapidnets geodatabase contain? _____ How many total feature classes does eastpat have? _____

- 7→ Close the Rapidcity folder contents by clicking on the minus sign in the box next to it. Click the plus sign to expand the Oregon folder.
- 7→ Expand the oregon.mdb personal geodatabase (Fig. 1.23). Expand the Transportation **feature dataset** to see the **feature classes** (including two line feature classes and one point feature class).

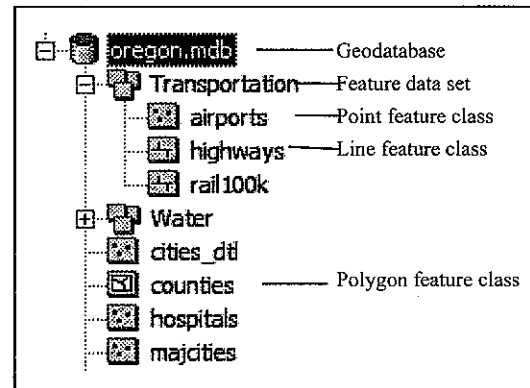


Fig. 1.23. A geodatabase in ArcCatalog

The Preview tab

The Preview tab helps explore the contents of each data set, including both the map data and the attribute data. We will begin by exploring the Tools toolbar (Fig. 1.24).

- 8→ Select the counties feature class in the mgisdata\Oregon\oregon geodatabase, and click the Preview tab. The view changes to display the polygons.



- 9→ Locate the Identify tool and click on it.
- 9→ Place the tool on top of one of the counties and click. The Identify Results box will appear, and the county will flash on the screen. The attributes of the county are displayed in the Identify window.
- 9→ Close the Identify window by clicking the X in the upper-right corner.

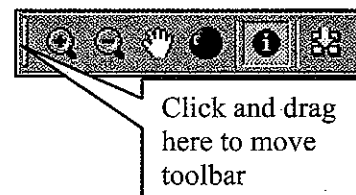


Fig. 1.24. The Geography toolbar

2. What is the name of the county in the northeast corner of Oregon? _____

Toolbars in ArcMap can be moved and docked at different locations, even outside the program. Hold down the Ctrl key while moving a toolbar to prevent it from docking.

- 10→ Locate the toolbar with the Identify button again (called the Geography toolbar). At its top or left, find a faint gray line. This is its handle.

- 10 → Click the handle and drag the toolbar out of the ArcCatalog window. Then click it and drag it to a spot with the other menu bars at the top of the window. Leave it wherever you like.

Now we will experiment with the zooming buttons.



- 11 → Click the Zoom In tool. Place the cursor at the upper-left corner of the state and click and hold. Continue holding the mouse button down and drag a box down and right to include a couple of counties. When finished, let go of the mouse button.

- 11 → Click once in the lower corner of the map and notice that the view both zooms in and places the point you clicked at the center.



- 11 → To return to the full extent of the map (useful if you made a mistake or do not like the area you selected), click on the Full Extent button.



- 11 → Click on the Zoom Out tool and click in the upper-left corner of the state again. The view zooms out with the point clicked at the center. Both Zoom In and Zoom Out place the clicked spot at the center of the new field of view.

TIP: You can also draw a box using the Zoom Out tool. If a large box is drawn, the view zooms out a little bit. If a small box is drawn, the view zooms out a large amount.



- 11 → Click on the Pan tool and then click and drag inside the display window to move the map around.

You can use the Preview tab to create thumbnails of a data set that will appear in the Contents tab when the data set is viewed.

- 12 → Click the Contents tab and notice the thumbnail picture. It shows the entire country (the original data source from which the Oregon counties were extracted).

- 12 → Click on the Preview tab again. Make sure that the counties layer is highlighted.



- 12 → Click the Create Thumbnail button to create a snapshot of the current view. Nothing apparently happens, until . . .

- 12 → Click the Contents tab. The updated thumbnail appears.

Not only can you see a data set's features in Preview mode, but you can also look at its attribute table, change the appearance of the table, and even add and delete fields.

- 13 → Make sure that the Preview tab is active and then click on the cities feature class in the oregon geodatabase.

- 13 → Choose Table from the drop-down menu that currently reads Geography. The cities table appears.

- 13 → Scroll to the right through the end of the table, noting all of the fields.

3. How many records (rows) are there in this table? _____

- 13 → Hold the cursor over the right edge of the FEATURE field until it turns into a double arrow bar. Click and drag the edge to the left to reduce the width of the column.

- 13→ Click the Options button in the table window (if necessary, expand the window to the right to see it better).

Note the menu options. Find searches the table for particular text. Add Field adds a new field to the table, and Export saves a copy of the table as a .dbf file. Other options are also available.

- 14→ Click the Options button again, if necessary, and choose Find.
- 14→ Type **Portland** in the Find what box and click Find Next.
- 14→ The cursor jumps to the record for Portland and highlights the city name.
- 14→ Close the Find box.

A context menu gives access to several commands relating to the individual fields.

- 15→ Right-click the field name POP_98 to display a context menu. Choose Sort Descending. (Make sure you scroll back to the top of the table to see the largest city, which should be Portland.)

4. Which town has the smallest (non-zero) population? _____

- 15→ Right-click the POP_98 field and choose Statistics to see basic statistics and a frequency diagram of the values. Close the Statistics menu when done looking.
- 15→ Right-click the NAME field and choose Freeze/Unfreeze. This places the field to the left of the table and keeps it there as you scroll to the right.

TIP: More than one field can be frozen at a time. Unfreezing allows the field to scroll again, although it remains on the left side until ArcCatalog closes.

You can even add or delete fields from the table in Preview mode.

- 16→ Click the Options menu and choose Add Field.
- 16→ Type **MAYOR** for the field name.
- 16→ Use the drop-down box to set the field type to Text.
- 16→ Enter a length of **25** for the field. Click OK.
- 16→ Scroll to the right to see the new field added to the end of the table. To add data to the fields, you would need to edit the table in ArcMap. We won't try that yet.
- 17→ Right-click the new MAYOR field and choose Delete Field. Choose Yes in the warning box.

TIP: Except for the Add/Delete field options, none of these operations changes the data that are stored on the disk. You can sort, freeze, and do statistics without changing the source data.

Feature class properties

Every data set has various properties that can be viewed and set in ArcCatalog. Each different type of data (shapefiles, coverages, rasters, etc.) can have different properties. We will examine some of these properties now, and future chapters will show how to work with the properties.

- 18→ Expand the contents of the Rapidcity folder in your mgisdata folder.
- 18→ Right-click the gas_stations shapefile and choose Properties from the menu.
- 18→ Click the General tab. There is not much to set here.
- 18→ Click the Fields tab. You can view, add, and delete fields here, too, and you will learn to do so in Chapter 4.
- 18→ Click the Indexes tab.

Feature classes can have two types of indices. An attribute index can be created for individual fields and enhances performance when searching that field. A spatial index decreases the time needed to draw and query the layer.

- 18→ Click on the XY Coordinate System tab.

The XY Coordinate System is an important property of a feature class. Every feature class has a coordinate system and should have a label like this one. You will learn more about coordinate systems later, but for now focus on finding two important pieces of information.

5. What is the name of this coordinate system? _____ What linear units are used to store the x - y values? _____

Shapefiles, coverages, rasters, and geodatabases all have different properties and some of the tabs will be different.

- 19→ Close the Shapefile Properties window.
- 19→ Expand the oregon geodatabase in mgisdata\Oregon so the feature classes are visible.
- 19→ Right-click the parks feature class and choose Properties. There are many tabs here, some similar to the Shapefile tabs. Close the Properties box when finished.
- 19→ Right-click the oregon.mdb geodatabase and examine its properties. Notice that it only has two tabs, General and Domains. Close the window when finished.
- 19→ Right-click the Transportation feature dataset and open its properties. Examine each of the tabs and close it when finished.

Recall that a feature dataset can contain multiple feature classes, but all must share a common coordinate system. Thus, the coordinate system is defined for the feature dataset rather than for the feature classes within it.

Although shapefiles and geodatabase feature classes are spaghetti data models, feature datasets can be used to store topology information as a planar topology for finding and fixing errors or as a network topology for analyzing flow. Both topologies are built from existing feature classes.

- 20→ Expand the rapidnets geodatabase in the mgisdata\Rapidcity folder.

- 20→ Expand the Transportation feature dataset. Notice it has a single feature class, roads, and two feature classes that form the network, Road_Net and Road_Net_Junctions. Preview each of the feature classes.
- 20→ Expand the Utilities feature dataset. It has many feature classes that form part of the network, including waterlines, Endcaps, Tvalves, and Galleries. It also has the two feature classes forming the network, Water_Net and Water_Net_Junctions.
- 21→ Expand the fivestate geodatabase in the mgisdata\Southdakota folder.
- 21→ Expand the stuff feature dataset. It has three feature classes and a planar topology named stuff_Topology.
- 21→ Right-click the stuff_Topology feature class and choose Properties.
- 21→ Click the General tab. Notice that errors are currently present in this topology, awaiting correction.
- 21→ Click the Feature Classes tab. It shows that all three feature classes are participating in the topology.
- 21→ Click the Rules tab. It shows the rules that have been set up for this topology. Close the Topology Properties window.
- 22→ Finally, examine the properties of one of the rasters and one of the tables in the mgisdata\Rapidcity folder.

Layer files

A **layer file** provides a way to set and store properties related to a feature class, such as how it should be displayed. A layer file is based on a feature class, but instead of storing the feature data inside the layer file, it only stores a pointer to where the feature class resides on the hard drive. The layer file can be displayed in ArcCatalog. It can also be added to ArcMap.

- 23→ Make sure the Preview tab is clicked, and expand the folder tree to show the feature classes in the usdata geodatabase in the mgisdata\Usa folder.
- 23→ Click on the states feature class.
- 23→ Use the Zoom In tool to draw a box around the conterminous 48 states.
- 24→ Right-click the states feature class and choose Create Layer.
- 24→ Navigate to the Usa folder, if necessary, and type in **StatesLayer** as the name of the layer file. Click Save.
- 24→ Click on the new StatesLayer.lyr entry in the folder tree and examine the preview it shows of the data.
- 24→ Right-click the **StatesLayer** layer file and choose Properties from the context menu (or double-click it to accomplish the same thing).

You are no longer looking at the feature class properties as you did before. You are looking at the Layer Properties. Notice all the tabs in this window. Each tab sets various properties of the layer and will store the settings in the layer file. Note that we are not changing the underlying data set used to create the layer, the states feature class. The properties in the layer file only act upon that basic data. The same feature class can be referenced by multiple layer files.

First, we will change the **symbol** used to draw the states. The layer is assigned a random symbol when the layer file is created, but it might not be the one we want.

- 25→ Click on the Symbology tab.
- 25→ Click on the button containing the symbol being used to draw the states.
- 25→ The Symbol Selector appears. Click on a different symbol to select it.
- 25→ Click OK to finalize your choice and close the Symbol Selector window.
- 25→ Click OK to close the Layer Properties window and make the change.

- 26→ Open the properties for the **StatesLayer** layer file again.
- 26→ Click on the Symbol to open the Symbol Selector. Scroll down to see all of the available symbols.
- 26→ Click on the More Symbols button. A list appears with the top two checked, your user name and ESRI. These entries are called styles.

Styles are sets of symbols stored together. The first checked one is your personal style, which is currently empty because you have not created or saved any symbols. The second is the default style, ESRI. The other entries are styles containing more symbols.

- 26→ Click on the More Symbols button again to show the list, if necessary, and choose the Geology 24K style. The new symbols are added to the bottom of the current symbol display, so you won't see them yet.
- 26→ Scroll down to view the new geology symbols added to the ones available.
- 26→ The geology symbols don't look appropriate for this map, so click on More Symbols and choose Geology 24K again to uncheck the entry and remove the symbols from the symbol window.

TIP: Styles can be viewed and managed using the **Style Manager**, which makes it easy to examine styles, copy symbols between styles, and edit symbol properties. See ArcGIS Help.

If the available symbols aren't quite what is wanted, they can be edited. A few simple edits can be made in the Symbol Selector window.

- 27→ Choose one of the solid fill colors from the ESRI style again, such as Jade.
- 27→ Click on the Fill Color button and choose a light blue color.
- 27→ Click on the Outline Color button and choose a medium gray.
- 27→ Click OK to close the Symbol Selector window.
- 27→ Choose Apply in the Layer Properties window. Move the Layer Properties window a little, if necessary, so part of the states map can be seen.

TIP: As a general rule, choosing Apply enacts the changes you have just made and leaves the window open. Choosing OK enacts the changes and closes the window.

Next we will create a layer file from a point feature class.

- 28→ Close the Layer Properties window.
- 28→ Right-click the cities layer in the usdata geodatabase and choose Create Layer. Save the layer in the Usa folder and name it **StateCapitals**.
- 28→ Open the properties for the StateCapitals layer.

This layer contains all the cities, not just the state capitals. However, we can specify that only a subset of the feature class be included as part of the layer. We do this by establishing a **definition query**. A query is a database term for finding features that meet a stated condition, and a definition query extracts the features that will form the layer. Like all other layer properties, this query does not affect the original file.

- 29→ Click on the Definition Query tab.
- 29→ Click on the Query Builder button.

The Query Builder lets us enter the condition defining the capitals (Fig. 1.25). The cities attribute table has a field named [CAPITAL] that contains a 'Y' if the city is a capital and an 'N' if it is not. We will enter a statement describing the query in the lower box. The entire query will look like [CAPITAL] = 'Y'. Follow the directions carefully—it is better to use the buttons rather than trying to type it.

- 29→ Scroll down the field list to find the [CAPITAL] field and double-click it to enter it in the Query box. Make sure it appears before going on.
- 29→ Click on the button with the equals (=) sign.
- 29→ Click the Get Unique Values button to see a list of possible values in the field.
- 29→ Double-click on 'Y' to enter it in the box.
- 29→ To test that your query is properly entered, click the Verify button. If it is successfully verified, click OK. If not, click the Clear button and try again.

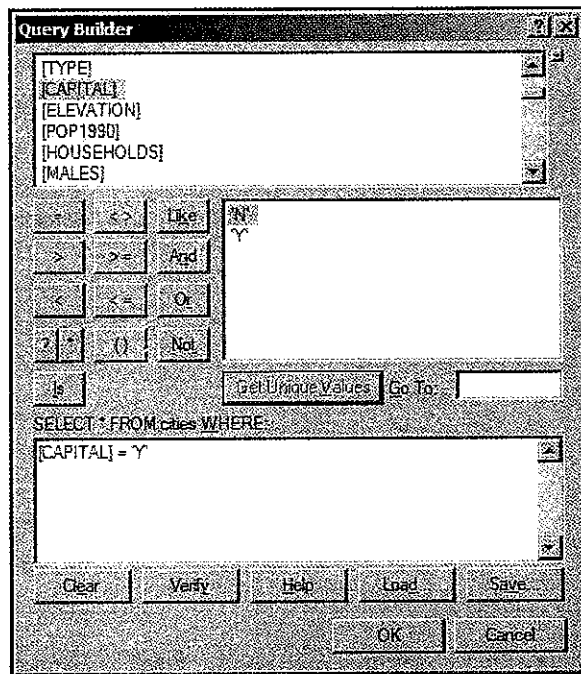


Fig. 1.25. The Query Builder window

TIP: If the query is incorrectly entered, it is likely that no features will show up on the map. Thus, testing the query expression with the Verify button is very important.

- 29→ Click OK and OK to establish your changes. Now only 48 cities should appear.
- 30→ Open the properties window for StateCapitals again.
- 30→ Click on the Symbology tab and click on the symbol to change it.

- 30→ Scroll down the symbols window in the Symbol Selector and find the Star 3 symbol. Click on it to select it.
- 30→ Change the symbol color to yellow and click OK and OK to view the changes.
- 31→ Open the properties window for StateCapitals and click on the Source tab.
- 31→ Examine the Data Source and notice that it refers to a feature class called cities and includes the location on the disk. This is the feature class upon which the StateCapitals layer is based. The original feature class still contains all the cities, even though we are only looking at a subset of them in this layer.
- 31→ Close the Layer Properties window.

A group layer stores references to multiple feature classes and allows them to be displayed and changed together.

- 32→ Right-click the Usa folder and choose New > Group Layer.
- 32→ The new group layer appears with the default name, New Group Layer.lyr, highlighted in blue. Type the new name **USAGroup** and press Enter.
- 33→ Open the Properties for the USAGroup layer.
- 33→ Click on the Group tab and Choose Add.
- 33→ Navigate to the Usa folder and select the StatesLayer layer file. Hold down the Ctrl-key and also select the StateCapitals layer file. Click Add.
- 33→ Click Apply to make the change to the group layer. The states and capitals appear in the window. The states appear with labels (in Version 9.3).

You can add either layer files or feature classes to a group layer and set the properties separately for each one.

- 34→ Click Add again on the Group tab, and double-click the usdata geodatabase to see the feature classes inside it.
- 34→ Click the rivers feature class.
- 34→ Hold down the Ctrl-key and click on cities to select it also. Click Add and OK. Both feature classes will be added to the group layer.

Now this group layer is starting to look like a map, but it needs work. The layers are cluttered. The cities dominate the composition and obscure several areas. We can use the **scale range** to set a maximum scale at which the cities appear so that they only show up when the user zooms in.

- 35→ Open the USAGroup layer properties and click the Group tab.
- 35→ Click on the cities layer to highlight it, and then click the Properties button.
- 35→ Click the General tab.
- 35→ Change the Layer Name from cities to **Cities**.
- 35→ In the Scale Range section, fill the button to Don't show layer when zoomed.
- 35→ Set the Out Beyond limit to 1:5,000,000 (one to 5 million) by typing just the number **5000000** in the box.

35→ Click OK and OK to make the changes to the group layer.

The cities have disappeared from the map, but they will show up again when you zoom in to a smaller area.

36→ Click on the Zoom In tool and draw a box around the state of Maine. The cities should show up. Zoom in a little closer, if necessary, until they appear.

36→ Notice that the cities are drawn on top of the capitals so that each capital star symbol has a city symbol on top.

37→ Open the USAGroup properties and highlight the StateCapitals layer in the Groups tab. Click the Up arrow to move the capitals layer to the top of the list. (The layers are drawn from bottom to top, so the capital stars will be drawn last.)

37→ Click OK and notice that the star capital symbols are now clearer.

37→ Click the Full Extent button and then zoom back in to the conterminous 48 states.

Labeling features

Layer files can also store information for creating labels for feature classes. They are called **dynamic labels** because they are created and updated each time the view of the map changes. An algorithm is used to find overlaps between conflicting labels. If some labels cannot be placed without overlapping others, they will be omitted from the map.

38→ Open the USAGroup properties, click on the Groups tab, highlight StatesLayer, and choose Properties (Fig. 1.26).

38→ Click on the General tab and rename the layer **States**.

38→ Click on the Labels tab in the Layer Properties window.

38→ The box to label the features is already checked.

38→ Change the Label Field to STATE_NAME.

38→ Make sure the text symbol is 8-point Arial Bold. Click OK and OK.

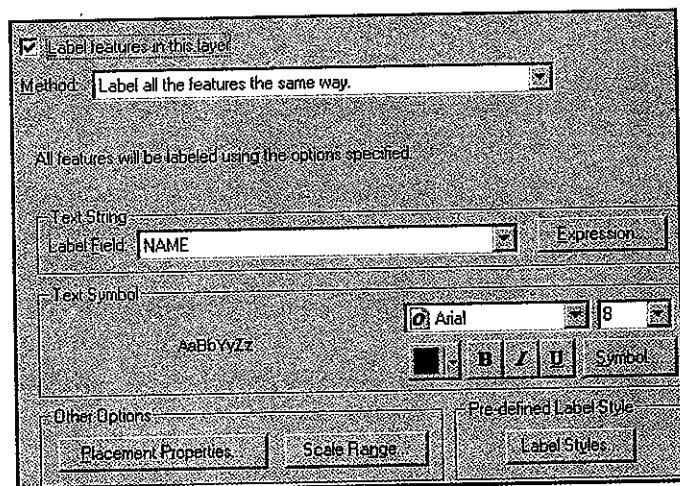


Fig. 1.26. Set the labeling properties of dynamic labels using the Labels tab in the Layer Properties window.

Notice that the northeast looks cluttered. We can modify the Placement Properties of dynamic labels to help manage this clutter.

39→ Open the label properties for the States layer in the USAGroup layer again.

39→ Click the Placement Properties button and click the Placement tab. Examine the settings.

- 39 → Check the box to only place labels inside the polygon and to make them always horizontal. Click OK, OK, and OK.

The map now looks neater, although some of the state labels are missing. Unfortunately dynamic labels don't offer much control. For greater control of labels you must use annotation, which is described in Chapter 3. However, if you zoom in closer, the missing labels will appear.

- 40 → Zoom in to the New England area, and the missing state names will appear.
40 → Use the Full Extent button again and zoom in to the conterminous states.

Placement properties vary depending on whether points, lines, or polygons are being labeled (Fig. 1.27). Polygon labels are generally placed horizontal or straight along the longest boundary of the polygon. Line labels can be splined along features.

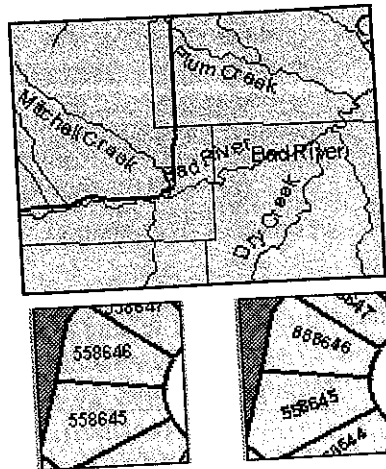


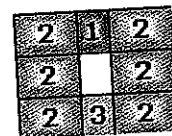
Fig. 1.27. Label placement options for lines and polygons

- 41 → Open the properties for the rivers layer in the USAGroup layer.
41 → Click on the General tab and change the name to **Rivers**.
41 → Click on the Symbology tab and choose a dark blue color for the river symbol.

42 → Click on the Labels tab and choose to label the features.
42 → Make sure the Label Field is set to NAME.
42 → Change the Text Symbol to 8-point Italic Arial in a dark blue color.
42 → Click on the Placement Properties button and click the Placement tab. Examine the placement properties in this window.
42 → Choose Curved for the Orientation.
42 → Check both Above and Below for the Position.
42 → Fill the button to Remove duplicate labels so that multiple sections of a river won't be labeled multiple times.
42 → Click OK, OK, and OK.

Point labels are usually placed on top of the point or at the most advantageous position around it. A point label graphic shows the first, second, and third priority locations and can be changed, if desired (Fig. 1.28).

- 43 → Open the properties for the Cities layer in the USAGroup layer.
Click on the Labels tab.
43 → Check the box to label the features, and make sure that the Label Field is set to the CITY_NAME field.
43 → Set the Text Symbol to 8-point Arial.
43 → Click the Placement Properties tab and examine the options. Leave the default values and click OK to close the Placement Properties window.



Prefer Top Center, all allowed

Fig. 1.28.

- 44→ Click the Scale Range button. We already have a scale range set for the cities, so fill the button to use the same scale range as the feature layer.
- 44→ Click OK, OK, and OK.
- 44→ Zoom in to Maine once more to see the labels. Return to the view of the conterminous states when done. Your group layer should look similar to Figure 1.29.



Fig. 1.29. The group layer will look like this after step 44.

Now you have learned to use layer files to set and store properties of feature classes. Layers can save time by establishing default symbols for layers and by grouping layers that are commonly used together. In the next chapter, we will learn how to use layers and layer files in ArcMap.

Viewing metadata with the Metadata tab

We rely on metadata to provide information when data sets are shared and to help evaluate if the data are suitable for a particular purpose. Learning to read the metadata is the first step.

- 45→ In the ArcCatalog folder tree, navigate to the mgisdata\Usa folder, expand the usdata geodatabase, and click on the states feature class to select it.
 - 45→ Click the Metadata tab.
 - 45→ Make sure that the Stylesheet drop-down box on the Metadata toolbar says FGDC ESRI. Examine the information.
 - 45→ Click on the green text **Abstract**. The abstract information folds up and is no longer visible. Click **Abstract** again to display the text once more.
 - 45→ Scroll down and click **Publication Information**. It tells who created the data and who published it.
6. Who created this data set and when was it published? _____
- 46→ Click the Spatial tab at the top of the metadata. It switches to another “page” that contains information about the coordinate system, extent, and accuracy of the data.
 - 46→ Click the Attributes tab to see a list of the fields in the attribute table, their definitions, and their descriptions.
 - 46→ Click the AREA attribute and read the information about it. Notice that the description indicates the units are square miles. Had the creator of this data set not entered this information into the metadata, the user might have no idea whether the areas represented square miles or square kilometers.

Metadata is so important that a federal organization, called the Federal Geographic Data Committee (FGDC), has compiled standard rules about what kind of information goes into metadata and how it is organized and stored. These rules make up the FGDC Metadata Standard. The FGDC standard format is a text file with a very specific layout so that different programs can find the information they need.

- 47 → Click the Stylesheet drop-down tab in the metadata toolbar and change it from FGDC ESRI to FGDC Classic.
- 47 → Scroll down to examine the information, and then return to the top of the document.

Metadata contains seven main sections shown as hyperlinks to the information in the document. The metadata standard has hundreds of “fields” of information, organized into groups and subgroups for easy access. The field names are shown in italics, and the information is shown in plain text.

- 48 → Change the Stylesheet to FGDC. This format is similar to FGDC Classic but is a little easier to read.
- 48 → Click on the blue hyperlink at the top titled Data Quality Information.
- 48 → Read the data quality information for this data set, including the logical consistency, completeness, and positional accuracy.

All of the stylesheets use exactly the same information but present it in a different way. The information is stored in a formatting language called XML, or Extensible Markup Language. It is similar to the HTML used to create Web page documents.

- 48 → Change the stylesheet to XML to see what this file looks like. Then set it back to the FGDC ESRI stylesheet.

Working with Internet map services

Let's explore an Internet service site created by ESRI, Inc., the Geography Network.

- 49 → Click the Contents tab in the ArcCatalog window.
- 49 → Scroll down to the bottom of the folder tree and find the entry labeled GIS Servers.
- 49 → Double-click the icon labeled Add ArcIMS Server.
- 49 → For the URL type <http://www.geographynetwork.com>. Click OK.
- 49 → When the Geography Network service appears, expand its plus box in the Table of Contents to view what it contains.

A list of services appears as icons. These entries are similar to other ArcCatalog data sets, and they can be viewed with the Contents and Preview buttons. The only difference is that the information is transmitted via the Internet. Preview works slowly with Internet data, so it is best to keep ArcCatalog in Contents mode until you want to see a specific layer.

- 50 → Locate the FEMA_Flood service in the list and click it to highlight it.
- 50 → Click the Preview tab. Zoom in to the United States for a closer look.
- 50 → Zoom in to the state of New Jersey. Several cities should appear now.
- 50 → Zoom in to the Philadelphia area very closely (draw a small box around just the yellow city symbol).
- 50 → The FEMA flood zones of the Delaware River should now be visible, color-coded by type in shades of green. Notice that the service is providing data very similar to the layer files you've worked with previously, with different preset symbols, labels, and scale ranges.

The FEMA example demonstrates an image service. Now copy some data from a feature service.

- 51 → Locate the EPA Hazards FS feature service and click the plus sign to expand it.
- 51 → Preview the Superfund Sites layer. Then preview its table.
- 51 → Right-click the Superfund Sites layer and choose Export.
- 51 → Navigate to the Usa folder. No geodatabase appears yet because the window is set to store a shapefile.
- 51 → Change the Save As Type to File and Personal Geodatabase feature classes.
- 51 → Double-click the usdata geodatabase to open it.
- 51 → Name the feature class **supersites** and save it. Now it can be accessed any time.

- 52 → Navigate to the usdata geodatabase, click on the supersites feature class, and click the Preview tab.
- 52 → Change the Preview method to Geography instead of Table.
- 52 → Zoom to the full extent of the data set to see all of the sites (about 1400 of them).

- Explore more of the Geography Network services, if you have time.
- 52 → When finished, right-click the Geography Network service and choose Disconnect.

Some services don't require a GIS program. They are accessible from a Web browser. If you have a high-speed Internet connection on your computer, try exploring the USGS National Map.

- 53 → Open your Web browser and type in <http://nationalmap.gov> and click on the red Go to Viewer button.
- 53 → Click the Zoom In tool and zoom in to Colorado.
- 53 → Expand the Geology theme and check the box for Active Mines and Mineral Plants. Click Refresh Required in the lower right of the screen.
- 53 → Notice the Download icon on the left. You can actually retrieve certain layers using this browser. See the Help if you want to learn more.
- Explore the National Map more, if you wish.

This is the end of the tutorial.

- Close the Web browser and ArcCatalog.

More skills

Consult the Skills Reference section of this chapter to learn to do the following:

- Managing GIS files (creating, deleting, copying, renaming)
- Creating new symbols using the Symbol Properties Editor
- Searching for data sets in a folder, hard drive, or Internet service

Exercises

TIP: To submit certain answers to your instructor, you must capture an image from the screen and place it in an answer document. Whenever a question has the statement **Capture** in it, capture the answer by making sure the ArcCatalog window is active and simultaneously pressing the Alt and PrintScr keys. This action places the active window on the Clipboard, and it can then be pasted into a Word or PowerPoint document. For help, ask your instructor.

1. How many feature datasets are there in the oregon geodatabase in the mgisdata\Oregon folder? List their names. How many total feature classes does the geodatabase have? How many each of point, line, and polygon feature classes does it have?
2. What is the coordinate system of the country shapefile in the mgisdata\World folder? Of the parks feature class in the oregon geodatabase?
3. What type of information does the feature class cd106 in the usdata geodatabase have? For what year(s) is the information valid? What was the original source of the spatial data? What are the source scale and the horizontal positional accuracy of this feature class? Could you use it to determine which parcels in your town belong to which district?
4. What is the largest lake in the United States? What is its area?
5. Which state has a county named Itawamba?
6. What is the minimum, maximum, and average number of nozzles in Rapid City gas stations?
7. How many rasters does the mgisdata\BlackHills\rasters folder contain? List them.
8. How many rows and columns does the Landsat image TM_24Sep98_utm have? What is the cell size (including the distance units)? How many bands does it have? What is its coordinate system?
9. Create a layer file showing only the counties in Nevada. Label as many counties as possible as long as the name fits inside it (using 8-point Arial font). **Capture** the ArcCatalog window showing the layer.
10. Consider the watershed feature class in the southdakota geodatabase and the states feature class in the usdata geodatabase. Answer the following questions for each: Who originally created this feature class? Can I publish a map containing this feature class? Under what circumstances, if any, could I give this data to someone else?

Challenge Problem

Search the Geography Network for three different feature services that cover the same geographic area of your choice. Download and save the data and use it to create a group layer file. Place the map in a Word document and include references for the data sets (providers, dates, etc.).

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Starting ArcMap or ArcCatalog

1. Look on the computer desktop for an icon named ArcMap or ArcCatalog (Fig. 1.30). Double-click it to start the program.
2. If no icon is present on the desktop, click the Start button on the computer's menu bar. Navigate to Programs > ArcGIS and choose the name of the program desired.
3. From ArcCatalog, launch ArcMap by clicking the ArcMap button in the menu bar.
4. From ArcMap, launch ArcCatalog by clicking the appropriate icon in the menu bar.

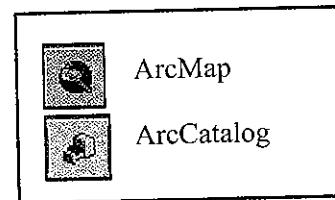


Fig. 1.30. Program icons

Starting ArcToolbox

ArcToolbox is a dockable window that sits inside ArcCatalog or ArcMap.

1. Click on the ArcToolbox icon in either ArcCatalog or ArcMap to open the window.

Connecting and disconnecting from folders

In order to access data files from ArcCatalog, you must set up a connection to the appropriate disk or folder. This saves time when frequently accessing data in a subfolder deep below the top. You can set up connections either to a drive letter, such as D:\, or to a subfolder in the drive. Connections can be deleted when they are no longer in use.

1. To connect to a folder, click on the Folder Connect button in ArcCatalog.
2. Navigate down the directory tree and select a folder to which to connect.
3. Highlight the folder (or drive letter) and click OK (Fig. 1.31).
4. To disconnect from a folder, click the connection in ArcCatalog to highlight it and then click the Disconnect Folder button.

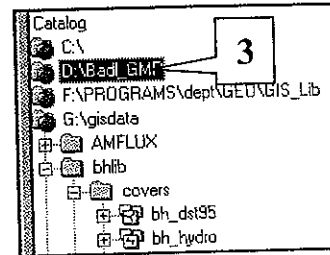


Fig. 1.31. Folder connection

Connecting to an Internet service

Using ArcCatalog, you can connect to and access data from Internet Map Servers. You must know the URL of the service, such as www.geographynetwork.com. Secure services also require a login and password. ArcGIS Servers are similar to ArcIMS servers but may serve data either over a local network or over the Internet.

1. In the left side of ArcCatalog, scroll to the bottom and expand the GIS Servers entry. Double-click the Add ArcIMS Server entry.
2. Type in the URL of the service in the top box.
3. If the server requires a user login and password, enter these at the bottom of the window and click OK.



Setting options

You can control the way the ArcCatalog performs various actions, displays information, and so on using this dialog box. You can also set defaults for the way tables, images, and other features are displayed.

1. Click Tools in the ArcCatalog menu bar and choose Options.
2. Click the appropriate tab to set the options.
3. When done setting options, click OK.

Viewing the contents of a folder

1. Click on the folder in the tree window.
2. Click on the Contents tab in the content window.
3. Choose one of the display options from the toolbar: Large icons, List, Details, or Thumbnails (Fig. 1.32).

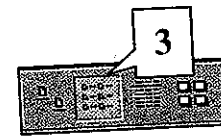


Fig. 1.32. View icons

Viewing and setting layer properties

Data sets, including layers and tables, have properties that can be modified in ArcCatalog. The types of properties will vary with the type of data set.

1. To access the layer/table properties, right-click on the layer/table name in the tree window and choose Properties. Double-clicking the layer/table also opens its Properties.
2. Click the tab containing the properties to change.

Shapefile tabs include: General, XY Coordinate System, Fields, and Indexes.

Geodatabase tabs for feature classes include: General, Fields, XY Coordinate System, Resolution, Tolerance, Domain, Indexes, Subtypes, Relationships, and Representations.

Coverage tabs include: General, Projection, Tics and Extent, and Tolerances.

Subsequent chapters will describe some of these properties and how to set them.

Examining the coordinate system

Every data layer has *x-y* coordinates that must be in some type of coordinate system. The coordinate system is stored as part of the information about a data set.

1. Right-click the feature class and choose Properties.
2. Click the XY Coordinate System tab (for feature classes) or the Projection tab (for coverages) (Fig. 1.33).

Using the Select, Import, or New buttons in this window will change the coordinate system label attached to this data set and should only be used on feature classes with an unlabeled or incorrectly labeled coordinate system.

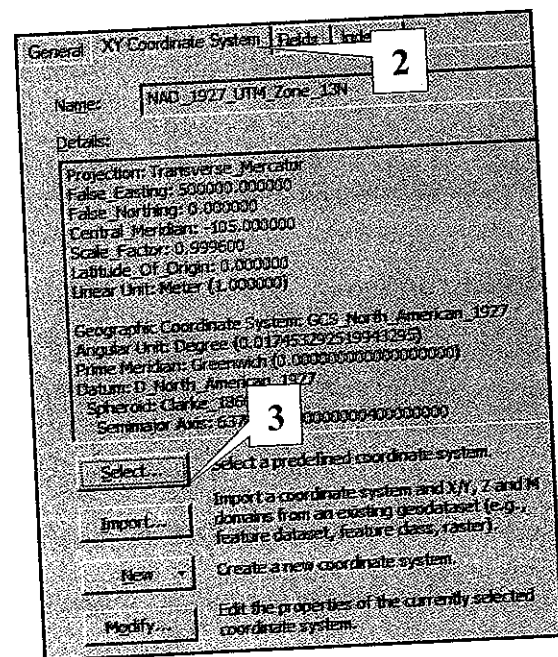
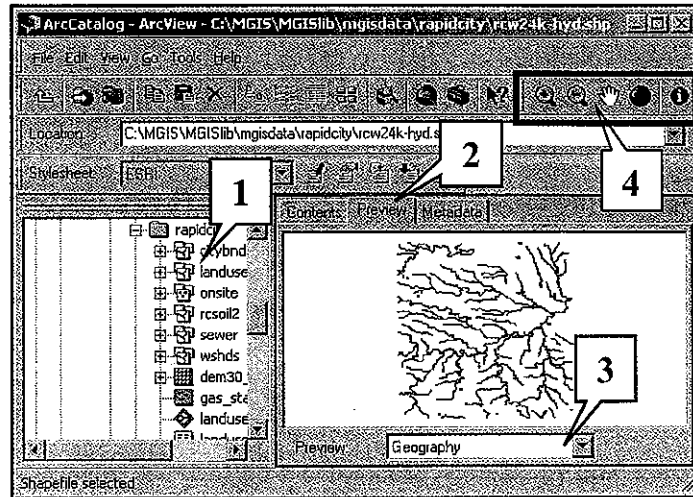


Fig. 1.33. Viewing coordinate systems of feature classes in ArcCatalog

Previewing layer geography

1. Click on the data layer to highlight it in the tree window.
2. Click the Preview tab (Fig. 1.34).
3. Choose Geography from the drop-down menu at the bottom of the Preview window to preview the spatial data, or choose Table to preview the table.



Use the Zoom, Pan, Full Extent, or Identify buttons to explore the geography preview.

Fig. 1.34. Previewing a layer

Creating and viewing thumbnails

1. Make sure that the layer is highlighted in the tree window and the Preview tab is clicked.
2. If desired, use the Zoom and Pan buttons to modify the appearance of the layer.
3. Click the Thumbnail button in the Zoom/Pan menu.
4. To view all the thumbnails in a folder, click on the folder, make sure the Contents tab is clicked, and choose the Thumbnail display option.
5. To view the thumbnail for a single layer, click on the layer in the tree window to highlight it and make sure the Contents tab is clicked.



Identifying features

1. Click on the Identify tool.
2. Click on the feature to identify.
3. Clicking the identified feature in the dialog box will cause it to flash briefly (Fig. 1.35).
4. In the Identify Results box, click the drop-down list at the top and select the layer(s) to identify.
5. Click on a layer to view the attributes for that feature. Click on a different layer to see its attributes.

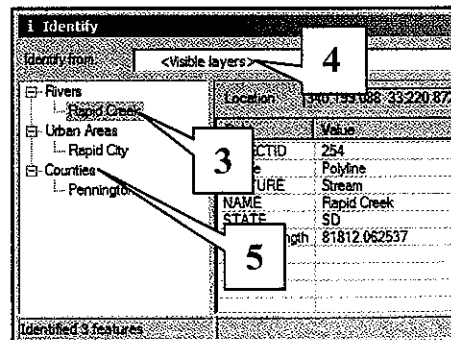


Fig. 1.35. Using Identify

Previewing a table

1. Click on a data layer or table in the tree window, and make sure that the Preview tab is clicked.
2. Choose Table from the drop-down box at the bottom of the Preview window.

Sorting the table

3. Right-click the field name and choose Sort Ascending or Sort Descending from the menu.

Getting statistics on a field

4. To get statistics for a numeric field, right-click on the field name and choose Statistics.

Freezing/unfreezing columns

5. To hold a field at the left side of the table while you scroll to the right, right-click the field and choose Freeze/Unfreeze from the context menu.
6. The field will move to the left edge of the table and remain there as you scroll to the right. More than one field can be frozen at a time.

Finding text in a field

7. To find text or values in a particular field, click on the field name to highlight the field (Fig. 1.36).
8. Shift-click to add additional highlighted fields to search, if desired.
9. Click the Options button in the lower right of the table and choose Find from the menu. (If necessary, enlarge the ArcCatalog window to the right to find the Options button.)
10. Type in the text to find. Modify the search settings, if desired, and click Find Next.

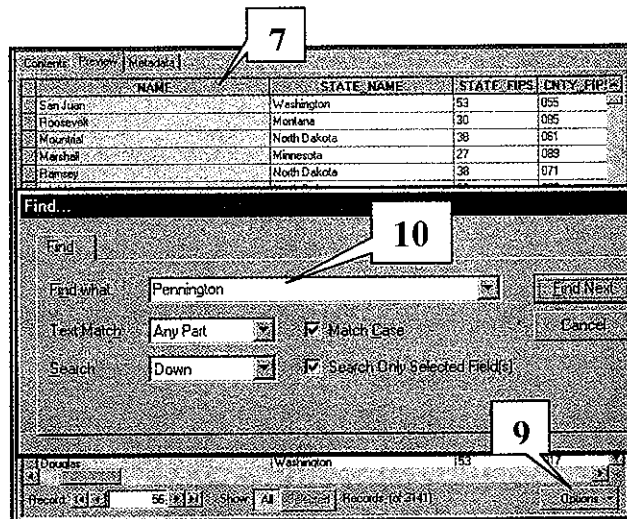


Fig. 1.36. Finding text

Adding/deleting fields from Preview mode

11. To add a field, click on the Options button and choose Add Field. Enter the table name and field type. For more information on adding fields to tables, see Chapter 5.
12. To delete a field; right-click on the field name and choose Delete Field. This action cannot be undone.

Viewing metadata

1. Click on the file you wish to view and click the Metadata tab.
2. Optionally, you can change the way the metadata look by choosing a different stylesheet from the drop-down menu. They are all based on the same metadata file, written in XML; they just present the information differently.

Setting symbols for a layer

You can set symbols a number of ways in ArcMap. Here are a few of the most common ways— all of these assume that all features in the layer are being drawn with the same symbol.

Changing the color of the current symbol

1. Right-click on the layer symbol in the Table of Contents and choose a color.

Changing properties of the current symbol

2. Click on the layer symbol in the Table of Contents to open the Symbol Selector window (Fig. 1.37).
3. Choose a symbol from the scroll box.
4. Modify the symbol's color, size, thickness, outline, or other attributes by setting the options provided. Make additional changes using the Properties button.
5. To load additional symbols in the scroll box, click the More Symbols button and choose from the list of categories.
6. Use the drop-down Category box to change which categories are currently visible in the box.
7. Click OK when finished modifying the symbol.

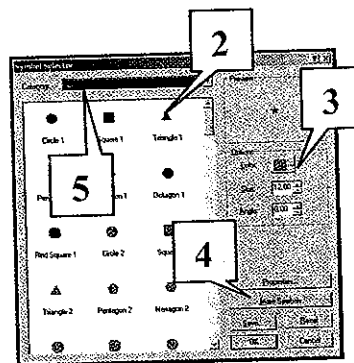


Fig. 1.37. Symbol Selector

Creating new symbols

Symbols are created from one or more layers of symbol objects. For example, the symbol in Figure 1.38 is composed of a blue cross layer and a light-blue circle layer. Users can create new layers, put predefined symbols in them, and modify their colors and other properties to create new symbols. Symbols can also be created from imported bitmap images.

1. Click the Properties button in the Symbol Selector to access the Symbol Property Editor (Fig. 1.38).
2. Add new layers using the + button in the Layer area of the window.
3. Select the type of symbol character to put in the layer.
4. Select the desired character.
5. Modify the size, color, thickness, and other properties of the character.
6. Remove layers or change the order, if necessary.
7. Click OK when finished creating the symbol.

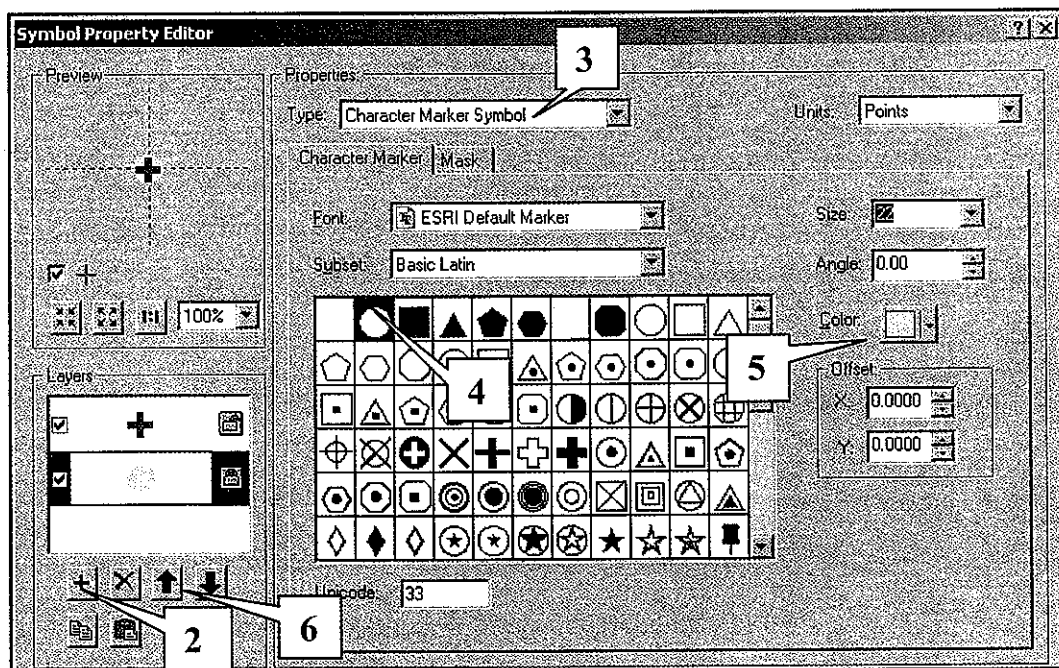


Fig. 1.38. Changing symbol properties

Labeling features using dynamic labels

1. Right-click the layer name in the Table of Contents and choose Properties from the menu.

2. Click the Labels tab.

3. Check the Label Features box (Fig. 1.39).

4. Make sure the method is set to label all the features the same way.

5. Choose the Label Field. Click the Expression button to enter a VBA (Visual Basic for Applications) script.

6. Edit the font settings, or select a predefined text symbol by clicking the Symbol button and choosing a predefined symbol style.

7. For detailed control of label placement, click the Placement Properties button.

8. Set the scale range, if desired, by using the label's scale range or by typing in new values. If the map scale is outside the specified range, the labels will not be drawn.

9. Select a label style, if desired. A label style includes BOTH a text symbol and predefined label placement options.

10. Click OK to place the labels.

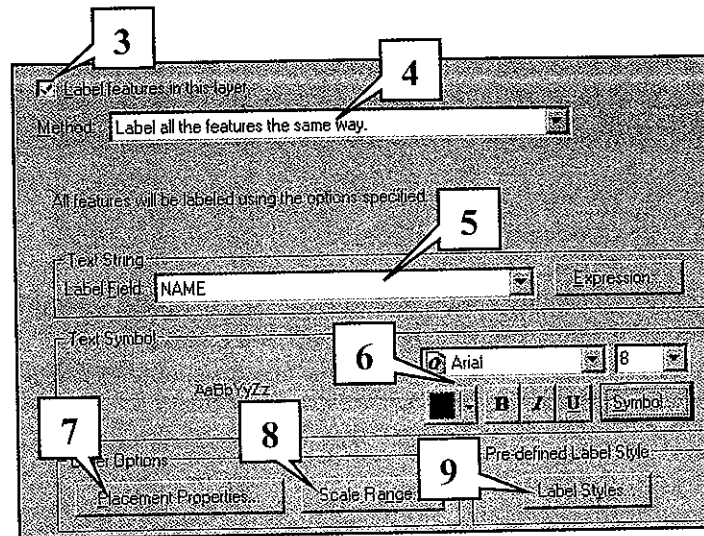


Fig. 1.39. The Label Properties window settings

TIP: Turn labels on and off for a layer by right-clicking the layer name in the Table of Contents and choosing the Label Features option. If the menu choice is checked, the labels are on, and choosing it will turn them off. If it is unchecked, choosing it will turn them on.

Managing ArcCatalog files

Creating new shapefiles and geodatabases

1. Click on the folder to contain the new file.
2. Choose File > New > and the type of file to create (Fig. 1.40).
3. Follow the instructions in the menu for creating the file. Different file types require different parameters.
4. To delete a file, right-click it and choose Delete. Click Yes to confirm that it should be deleted.

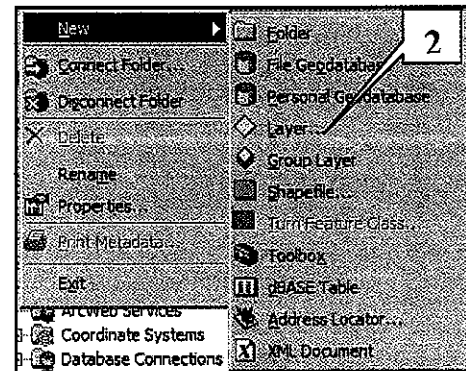


Fig. 1.40. Creating a file

Copy and paste files

5. Right-click the object to be copied and choose Copy.
6. Right-click the folder or geodatabase to place the object in and choose Paste.

Renaming files

7. Click twice slowly on the file name to highlight it. Type in the new name.

Searching for data

The search engine in ArcCatalog locates data sets on a particular disk or server that cover the geographic area specified. The results are written to a catalog entry and can be easily dragged into ArcMap or copied to a different directory.

TIP: The Search option uses the file metadata and may fail to find files if the metadata are missing or incomplete.



1. Click the Search button in ArcCatalog.
2. Click the **Name & location** tab (Fig. 1.41).
3. To search for particular types of files, choose them from the Type list. Use Ctrl-click to select more than one. To search for all types, don't select any or click Clear.
4. Choose Catalog to search only connected folders, or choose Disk to search the entire disk.
5. Set the disk or other location to search.
6. Click the **Geography** tab. Check to use geographic location in search.
7. If you know the map coordinates to search, type these directly into the boxes.

8. OR, to locate an area to search on a map, use the Map drop-down box at the bottom of the Geography tab to choose a display map to search on. Use one of the default maps or select a different one from the disk by entering <Other>.
9. OR use the buttons to zoom in to the appropriate region and draw a box around the target area.
10. OR select a place name from the list at the top of the tab. The list will depend on the map chosen in step 8. Thus, to search for a county, choose US Counties as the map layer.
11. Choose to search for data entirely within your location or overlapping your location.
12. To search for data for specific dates, click the **Date** tab. Fill out the information.
13. You can also search for explicit fields and values in the metadata by clicking the **Advanced** tab. This option is only recommended for experienced users. However, you can use it to find data produced by certain agencies or having certain keywords. There are many ways to refine a search.
14. In the Geography tab, type in a name under which to save the search or use the default, My Search.
15. When ready, click Find Now. Wait, as the search may take some time to complete. The status bar at the bottom of the window shows the folders being searched. Click the Stop button at any time to quit the search.
16. When the search is complete, click on My Search (or whatever you named it) in the ArcCatalog tree window to expand it and to view the results.
17. The Search routine places links to the original data inside the My Search entry. You can preview the geography and tables of these links just as you would other files and drag and drop them into ArcMap.

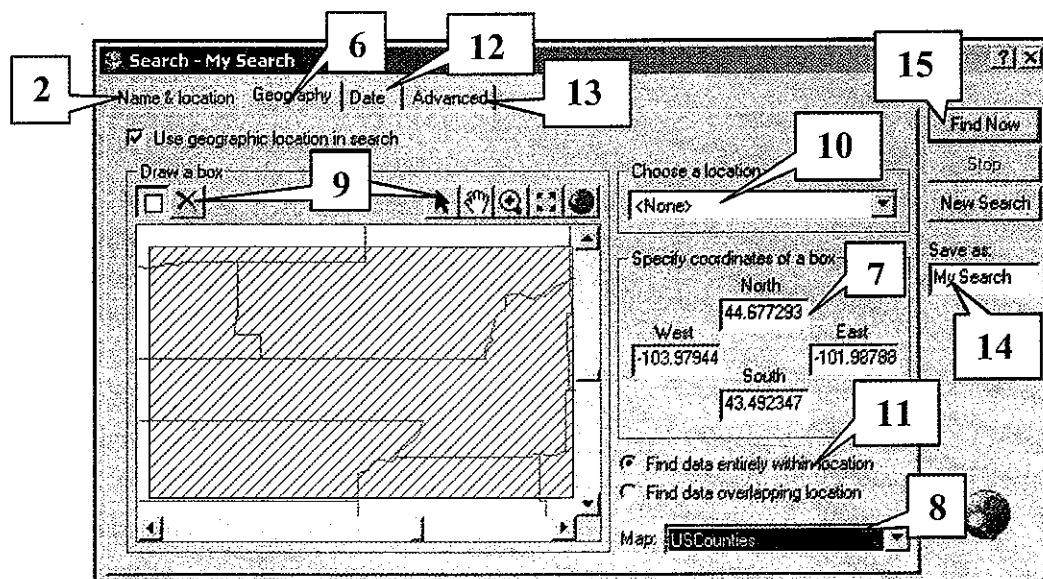


Fig. 1.41. Searching for geographic data