



LESSON 3

Displaying Data



Overview

- Maps in ArcInfo 8
- Introducing ArcMap
 - The ArcMap Interface and the tools
 - Data View and Layout View
 - Layers, data frames, and map elements
- Displaying
 - Spatial Data
 - Attribute data



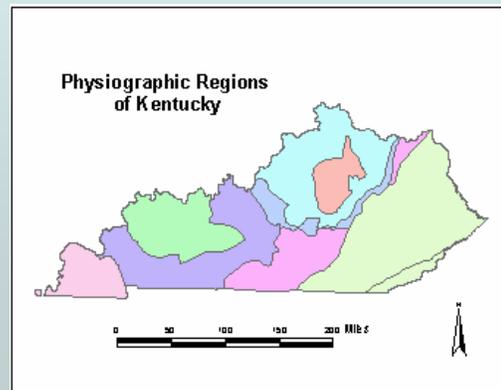
Overview

Things you can do with the map

- Focus on a particular geographic area
- Browse its contents
- Display it at a specific scale
- Query features
- Analyze and explore relationships
- Edit the geographic data it contains
- Prepare it for printing (visual balance)
- Save as a document

The concept of a map in ArcInfo 8

- The map
 - The fundamental component in ArcMap
 - Stored on disk and managed with ArcCatalog
- In ArcMap you can work with the map in two views
 - Data view
 - Layout view



The concept of a map in ArcInfo 8

Opening a map

To work on a map, you open it in the ArcMap application. If you know its location on disk, you can navigate to it with the ArcCatalog application and open it in ArcMap. If you already have ArcMap running, you can open it up directly within that session.

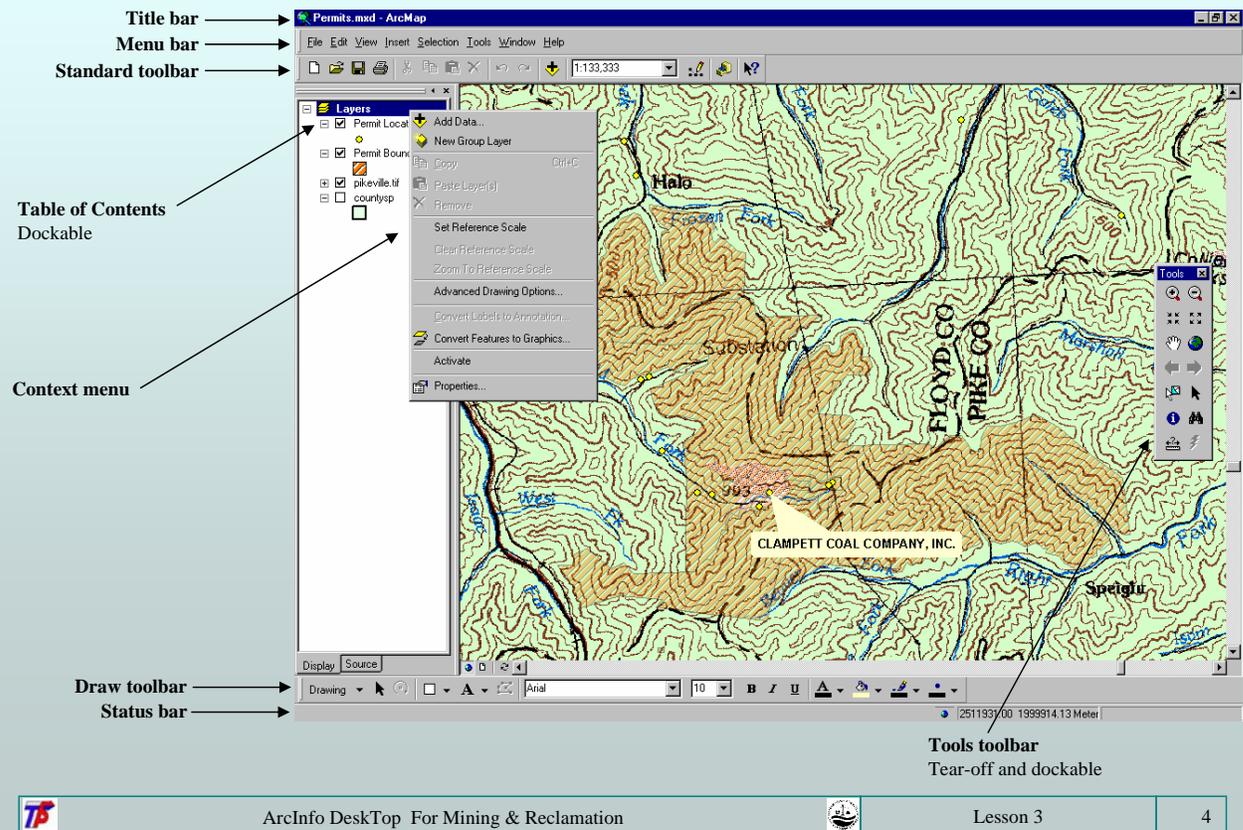
If you are not sure where your map is located, use ArcCatalog to find it by name or browse for it in the folders that comprise your database. ArcCatalog lets you preview a map before you open it, so you will always open the right one.

A map does not store the spatial data displayed on it. Instead, it stores references to the location of these data sources (e.g., grids, coverages, shapefiles) on disk. Thus, when you open a map, ArcMap checks the links to the data. If it cannot find some data - for instance, if the source data for a layer has been deleted or renamed, or a network drive is not accessible - ArcMap prompts you to locate it. If the data is currently unavailable, you can ignore the broken link and display the map without the layer. The layer will still be part of the map and listed in the Table of Contents, it will just not display.

Opening a map from ArcCatalog

1. From ArcCatalog, navigate to the folder that contains your map.
2. Double-click the map to launch ArcMap and open the map.

The ArcMap interface



The ArcMap interface

Features of the ArcMap interface

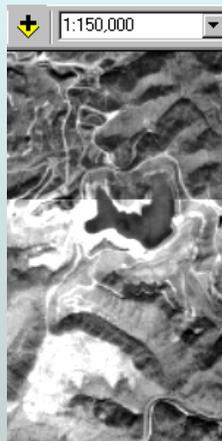
- The title bar displays the map name (Permits.mxd in the example above).
- The toolbars are dockable.
- The Table of Contents lists the data views and layer legends. The Table of Contents is dockable and can be resized by dragging the vertical divider between the Table of Contents and the display area horizontally.
- The display area is where the map features draw.
- The Status bar, besides reporting the coordinates, displays a description of the selected buttons and menu items.

Data View tools

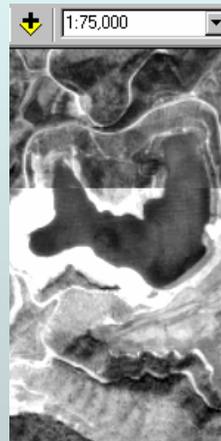
•Scale changes



1:150,000



1:75,000



1:20,000

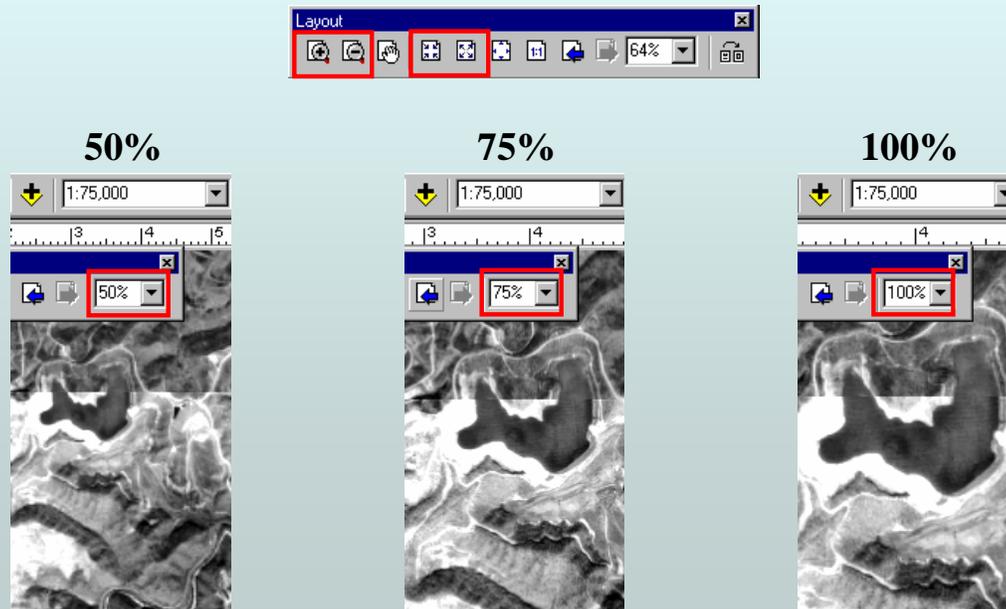


Data View tools

When the Zoom-In and Zoom-Out buttons on the Tools toolbar are clicked in Data View, an actual scale change occurs in the view. The scale fraction window will reflect that scale change. The selected view scale will be used later for map creation in Layout view.

Layout View tools

- Scale remains the same 1:75,000



Layout View tools

When you move from Data View to Layout View another toolbar named "Layout" appears. The Layout toolbar has its own Zoom-In and Zoom-Out buttons, as well as a display of percent reduction or enlargement window.

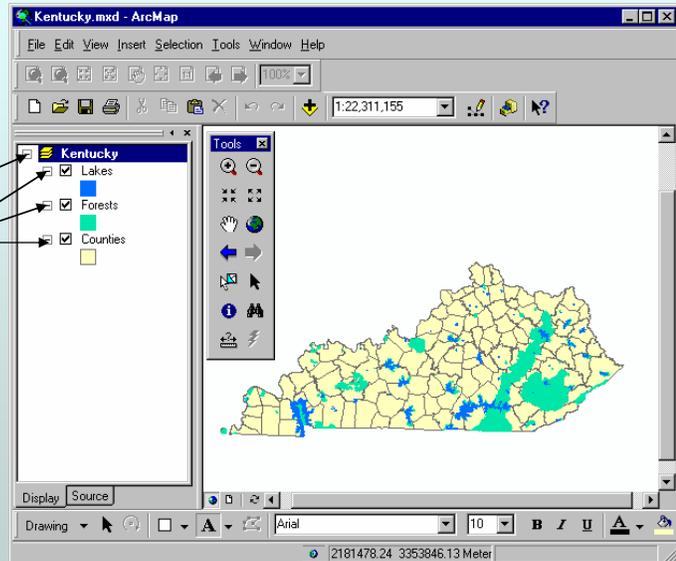
Do not confuse the Layout toolbar's Zoom-In and Zoom-Out buttons with the ones on the Tools toolbar. The buttons on the layout toolbar enable zooming in and out in order to view how the map elements will look at different percent reductions and enlargements. The monitor's screen cannot show the full size of the map (e.g., a 36 in. x 24 in. map size) so these buttons allow you to look at a real-size map (i.e., 100% enlargement) by using these buttons. This way you have more control over your map design because you know exactly how your symbology, and so on, look at real size.

Notice as you zoom in or zoom out at different percentages using the Layout toolbar, that the actual scale of the view (as inherited from the Data View, or as set earlier in Layout View) remains the same (shown above with 1:75,000).

Data frames, layers, and maps

- Data frame
 - Organizes layers
 - Default name (Layers)
- Layers
 - Represent symbolized feature classes
 - Can be grouped
- Map
 - Contains data frames, layers, and map elements

Data frame
Layers



Data frames, layers, and maps

A data frame simply groups layers that you want to display together in a separate frame.

You always get a data frame when you create a map - it is listed at the top of the Table of Contents with a default name called "Layers." In the example above, the data frame name was changed to "Kentucky".

For many of the maps you make, you will not need to think much more about data frames; you will just add layers to your map and, depending on how you order them in the Table of Contents, some layers will draw on top of others.

Group layers

When you want to work with several layers as one layer, you gather them together into a group layer. For example, under the Kentucky data frame you have two layers on your map representing lakes and forests. You might choose to group these layers together and name the subsequent layer "Natural features".

A group layer appears and acts like an individual layer in the Table of Contents. Turning off a group layer turns off all of its component layers. The properties of the group layer override any conflicting properties of its constituent layers.

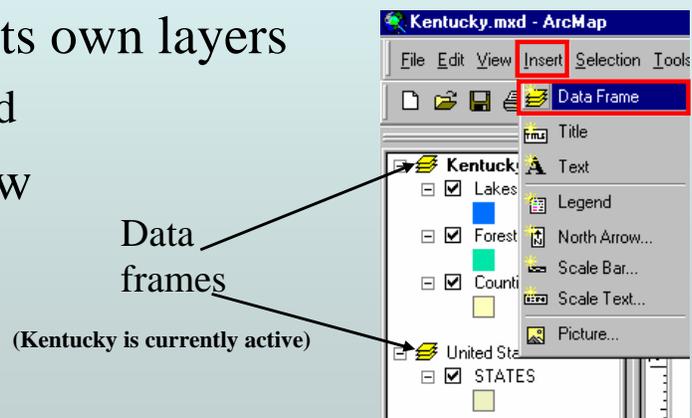
You can still work with the individual layers in the group. For instance, you can change how an individual layer is drawn, adjust the scale it displays at, and control whether or not it draws as part of the group. You can change the drawing order of the group and add and remove layers as needed.

Group layers can be created by right-clicking the data frame and selective New Group Layer. A new group layer appears in the data frame. To add a layer to a group:

1. Right-click the group layer in the Table of Contents and click Properties
2. Click the Group tab.
3. Click Add.
4. Navigate to the data source you want to add as a layer to the group.
5. Click OK.

Data frames

- Maps can have many data frames
 - Index and inset maps
- Each data frame has its own layers
 - Layers can be grouped
- Added in Layout View



Data frames

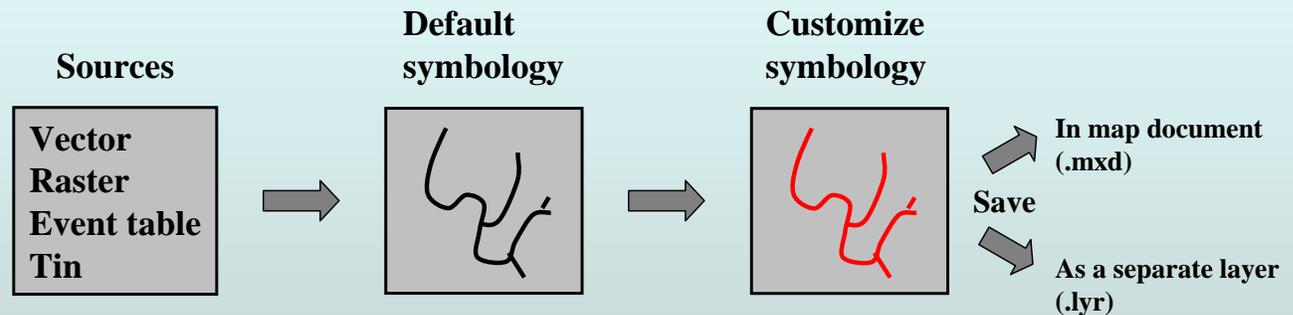
You will want to think more about data frames - and adding additional ones - when you want to compare layers side by side or create insets and overviews that highlight a particular location.

When a map has more than one data frame, one of them is the active data frame. The active data frame is the one you are currently working with. For example, when you add a new layer to a map, it gets added to the active data frame. You can always tell which data frame is active because it is highlighted on the map and its name is shown in bold text in the Table of Contents. Of course, if a map has only one data frame, it is always the active one.

In order to make a data frame active, right-click the data frame, and click Activate from the context menu.

Layers

- Reference data sources



- .lyr files

- Load into another map document
- Preview in ArcCatalog
- Create a Thumbnail



Layers

You can display geographic information on a map as layers, where each layer represents a particular type of feature. A layer does not store the actual geographic data, but instead references the data contained in the dataset. Datasets can be either of the following:

1. Vector datasets (feature layers) - Coverages, shapefiles, CAD files, geodatabase, and SDE databases.
2. Raster datasets (raster layers) - Grids and images
3. Tabular datasets (event layers) - x,y files (GPS, measures)
4. TIN datasets - TINs

Referencing data in this way allows the layers on a map to automatically reflect the most up-to-date information in your GIS database.

The Table of Contents lists all the layers on the map and shows what the features in each layer represent. The check box next to each layer indicates whether it is currently turned on or off: that is, whether it is currently drawn on the map or not. You can change how an individual layer is drawn and adjust the scale it displays at (i.e., the properties of the layer controls its display).

One of the main features of a layer is that it can exist outside your map as a file on disk. This makes it easy for others to access the layers you've built.

When you save a layer to disk, you save everything about the layer. When you add the layer file to another map, it will draw exactly as it was saved. This is very convenient when others in your organization need to make maps but don't know how to represent or access the data in your database. All they need to do is add the layer file to their maps.

Managing the Table of Contents

- Rename data frames, layers, legend title
- Drag layers up or down to change display order
 - Smart defaults for layer draw order
 - Layers draw in their Table of Contents order, bottom-up
- Remove layers



Managing the Table of Contents

Rename

At times in your map design, you can rename data frames or layers.

For renaming a data frame or layer

Right-click on it and click Properties from the context menu.

Click the General tab and change the name.

Display order

The order of layers within the Table of Contents is important. The layers at the top draw on top of those below it. Thus, you will put those layers that form the background of your map, such as the county boundaries, at the bottom of the Table of Contents. ArcMap is smart enough to display a point feature class on top of a polygon feature class.

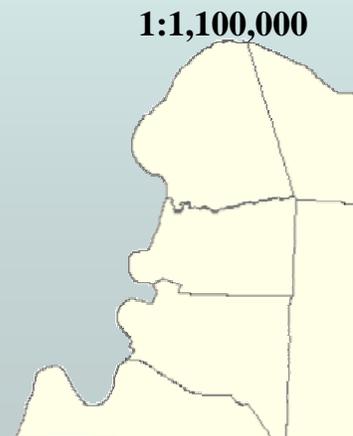
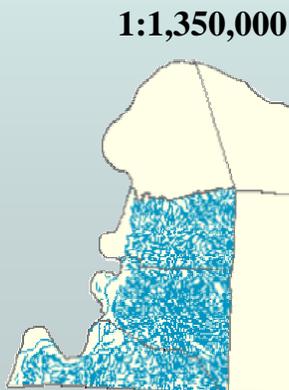
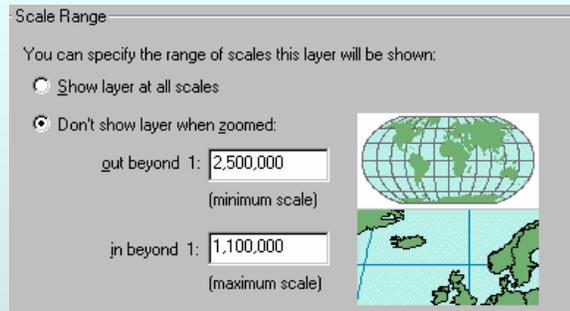
To change the order of display, simply click the layer and drag it to a new location.

Remove a layer

Undesired layers can be removed by right-clicking on the layer and clicking Remove from the Context menu.

Scale-dependent display

- A layer property
- Based on scale ranges



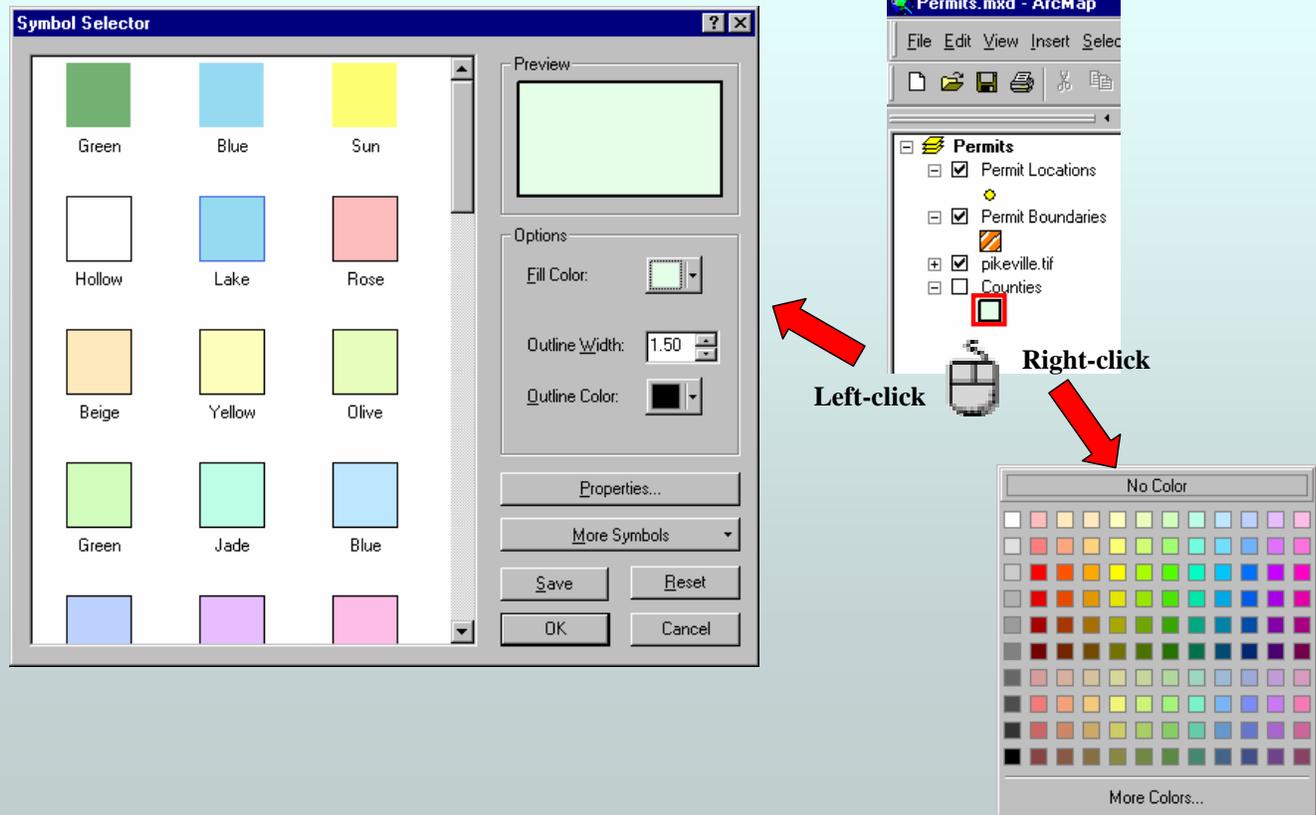
Scale-dependent displays

At times you may want to control the display of a certain layer so it will display only between a certain range of scales. This is useful for creating a less cluttered display.

Two methods are available:

1. Right-click the layer, click Visible Scale Range, then click Set Minimum Scale. Repeat to Set Maximum Scale. To remove this property, repeat but choose Clear Scale Range this time.
2. Right-click the layer, then click Properties. On the Properties window, click the General tab, and set the Scale Range as shown in the figure above.

Changing symbol properties



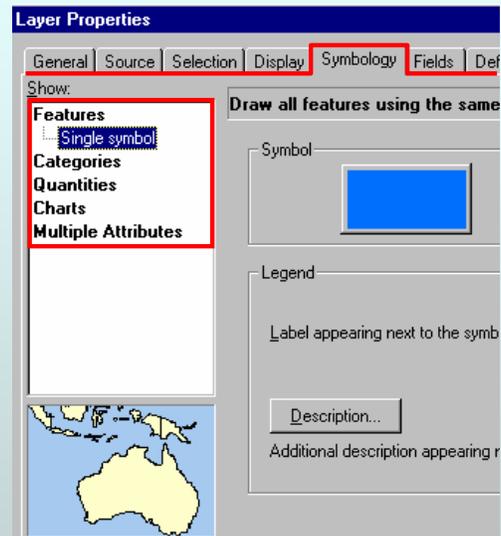
Changing symbol properties

Eye limitations and symbolization

ArcMap allows you to choose a large number of classes when you attempt to classify your data for the purpose of symbolization, however, the human eye is limited to deciphering not more than twelve different colors, or seven or eight different distinct shades of the same color, in one view.

Layer symbology in ArcMap

- Qualitative
 - Features (single symbol)
 - Categories (unique values, match to symbols in a style)
- Quantitative
 - Quantities (graduated colors or symbols, proportional symbols, dot density)
 - Multiple attributes (quantity by category)



Layer symbology in ArcMap

Qualitative thematic mapping in ArcMap

The *Features* option allows you to use a single symbol to display the entire dataset.

The *Categories* option gives you three choices:

1. Using *Unique values* - With this method each feature will be displayed by a unique symbol based on values from a certain field.
2. Using *Unique values, but many fields* - Here multiple fields can contribute values for symbolizing the features.
3. *Matching to symbols in a style* - This method uses an existing thematic symbol style to display the data. This method is useful for maps that use standard symbology.

Quantitative thematic mapping in ArcMap

The *Quantities* option offers you three choices:

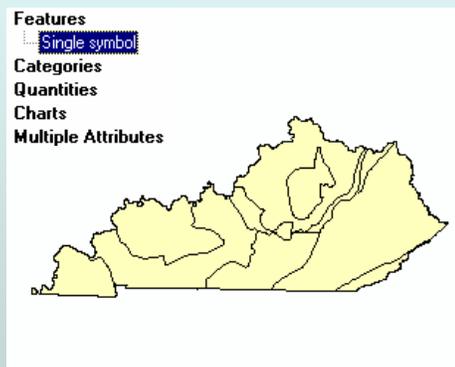
1. *Graduated colors* - With this method a color ramp is used to represent quantities that vary in size for different features.
2. *Graduated symbols* - Here symbols, such as circles, vary in size to show quantities with relative values.
3. *Proportional symbols* - Here symbols, such as circles, vary in size to show exact values of quantities.
4. *Dot density* - With this method quantities are represented by the density of dots of a specified size.

The *Charts* option offers a choice of pie charts, bar charts or stacked bar charts to represent quantities.

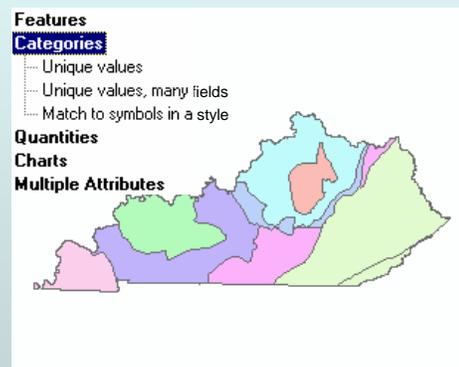
The *Multiple Attributes* option allows you to display multiple attribute values for a single feature class.

Qualitative symbology

Single symbol



Multiple symbols



Qualitative symbology

Qualitative thematic mapping in ArcMap

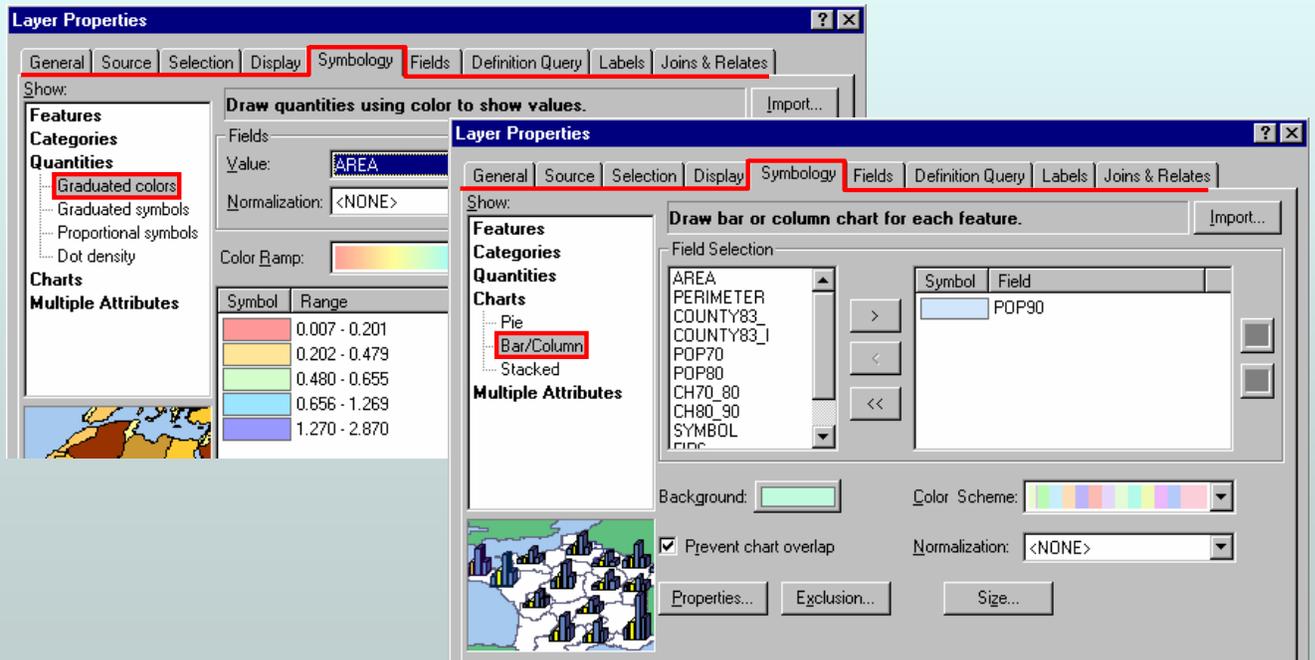
The *Features* option allows you to use a single symbol to display the entire dataset.

The *Categories* option gives you three choices:

1. Using *Unique values* - With this method each feature will be displayed by a unique symbol based on values from a certain field.
2. Using *Unique values, but many fields* - With this method each feature will be displayed by a unique symbol based on combinations of values from two or three fields. Each combination of values is represented by a different symbol or color.
3. *Matching to symbols in a style* - This method uses an existing thematic symbol style to display the data. This method is useful for maps that use standard symbology.

Quantitative maps

- Graduated colors or bar charts



Quantitative maps

Quantitative thematic mapping in ArcMap

The *Quantities* option offers you four choices:

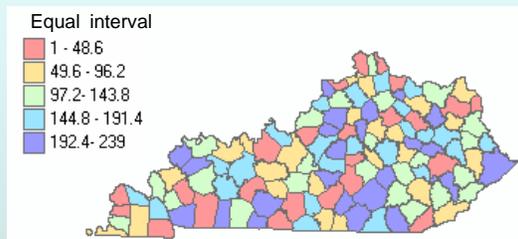
1. *Graduated colors* - With this method a color ramp is used to represent quantities that vary in size for different features.
2. *Graduated symbols* - Here symbols, such as circles, vary in size to show quantities with relative values.
3. *Proportional symbols* - Here symbols, such as circles, vary in size to show exact values of quantities.
4. *Dot density* - With this method quantities are represented by the density of dots of a specified size.

The *Charts* option offers a choice of pie charts, bar charts or stacked bar charts to represent quantities.

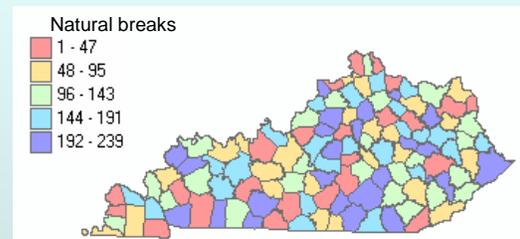
The *Multiple attributes* option allows you to display multiple attribute values for a single feature class. For example, you could draw a pie chart in each parcel showing the square footage of the lot and its taxable value.

Classification methods

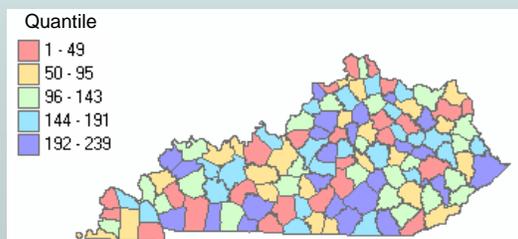
- Can modify classes



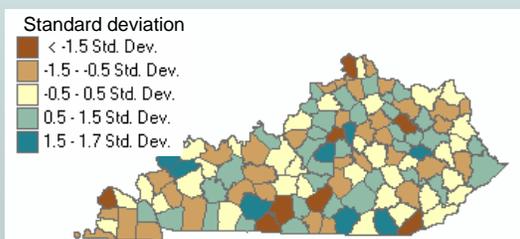
Equal interval



Natural breaks



Quantile



Standard deviation



Classification of quantitative data

Classification method

If you choose to map your data quantitatively with the graduated colors or graduated symbols methods, ArcMap allows you to select from four different classification methods.

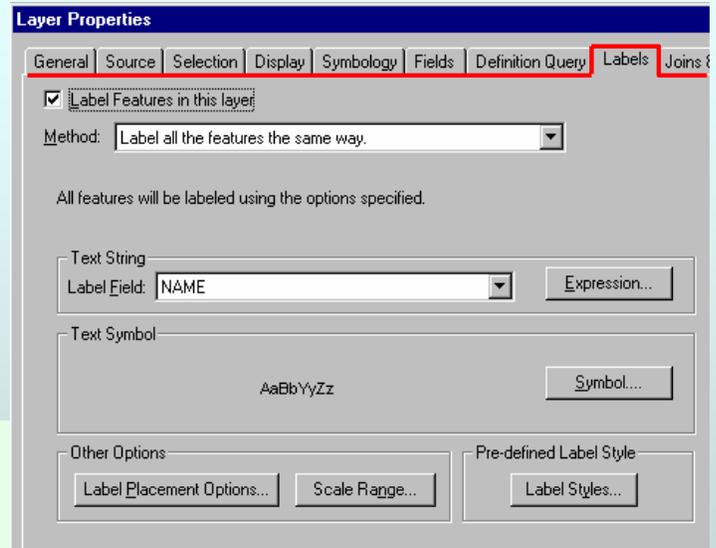
1. Equal interval - The range of values within each class is the same.
2. Quantile - The number of features within each class is the same
3. Natural Breaks - Gaps within the data are identified and the intervals are defined accordingly. Neither the range of values nor the number of features within each class may be equal.
4. Standard deviation - The range of values within each class is based on the standard deviation of the data.

Classification histogram

ArcMap displays a classification histogram which can help you decide on the range of each class. In most instances you can define the interval, number of classes, and classification method, or add or move class breaks.

Labeling features

- Adding text to a map
 - Layer properties
- Labels to annotation conversion
- Label symbology
 - Font, size, type, and so on



To label features, right-click the layer and click Properties. Click the Labels tab on the Layer Properties window and the Label Features in this layer check box. The Label Field input field allows you to label features using a specified field.

The Expression button allows for customization of labels. For example, you can apply VBA code to label a single feature with three lines of attributes.

The Symbol button opens the Symbol Selector window for choosing font style and color.

The Label Placement options button allows labeling with conflict resolution tools.

The Label Styles button allows you to choose from predefined label styles which determine text symbol and label placement options.

The Scale Range button allows specifying the range of scales at which labels will be shown.

Displaying attribute data overview

- Tables
- Charts
- Reports

Field (Column)

Record (Row)

FID	Shape	AREA	PERIMETER	NAME	SEAT
0	Polygon	7153574357.1	387142.091	BOONE	Burlington
1	Polygon	4446877330.2	366550.14	CAMPBELL	Newport
2	Polygon	4602710026.3	359461.118	KENTON	Covington
3	Polygon	7847591495.6	406388.836	PENDLETON	Falmouth
4	Polygon	2919510744.6	323180.456	GALLATIN	Warsaw
5	Polygon	5825549871	414133.301	BRACKEN	Brooksville
6	Polygon	7270549403.6	380244.554	GRANT	Williamstown
7	Polygon	6872404307.8	353691.346	MASON	Maysville
8	Polygon	3829451389.7	329774.162	CARROLL	Carrollton
9	Polygon	9885064507.3	516714.313	GREENUP	Greenup
10	Polygon	4355965165.1	294617.689	TRIMBLE	Bedford
11	Polygon	13814625902	744152.856	LEWIS	Vanceburg
12	Polygon	9879069483.8	585028.581	OWEN	Owenton
13	Polygon	2790955837.9	315539.815	ROBERTSON	Mount Olivet
14	Polygon	8115954423.5	466255.944	HENRY	New Castle
15	Polygon	8642822057.7	514473.393	HARRISON	Cynthiana
16	Polygon	9793066867.2	657677.678	FLEMING	Flemingshurn

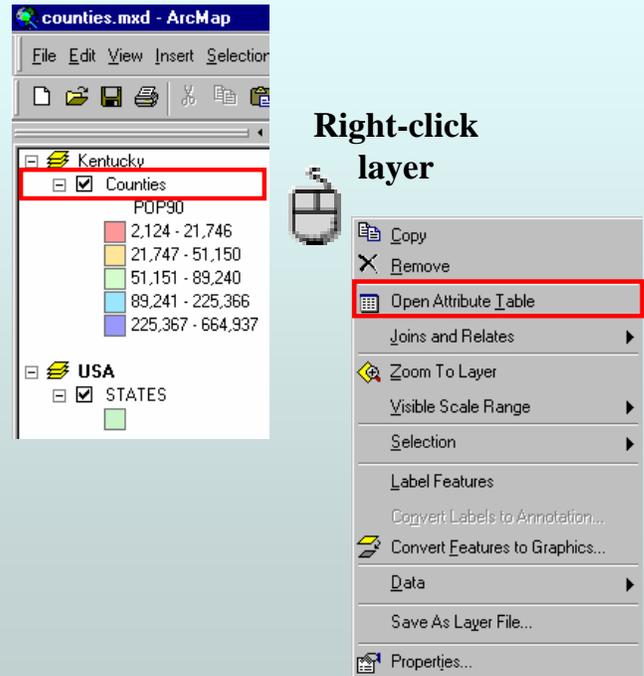


Attribute data can be displayed, or processed, in a variety of ways:

1. Displayed in a tabular format, where selected records are highlighted by the default yellow shade.
2. Displayed in a chart.
3. Displayed in a report.

Tables

- Descriptive information about features
- Each layer has one table
- One row for each geographic feature

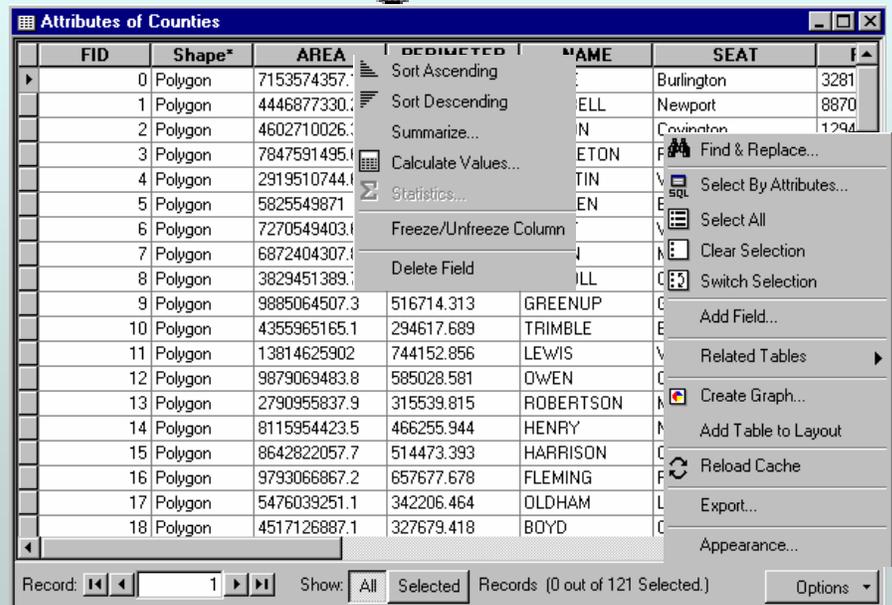


Tables

To open a feature attribute table, right-click the layer and click Open Attribute Table. The table contains descriptive information about the features. Each layer has one feature attribute table describing the feature class it belongs to. The feature attribute table consists of fields (also known as columns). Each field represents one type of descriptive information. Each row (also known as a record) contains the attributes of one feature in the dataset.

Table manipulation

- Sort ascending or descending  Right-click field
- Modify table
 - Order
 - Size
 - Move to top/
bottom of table



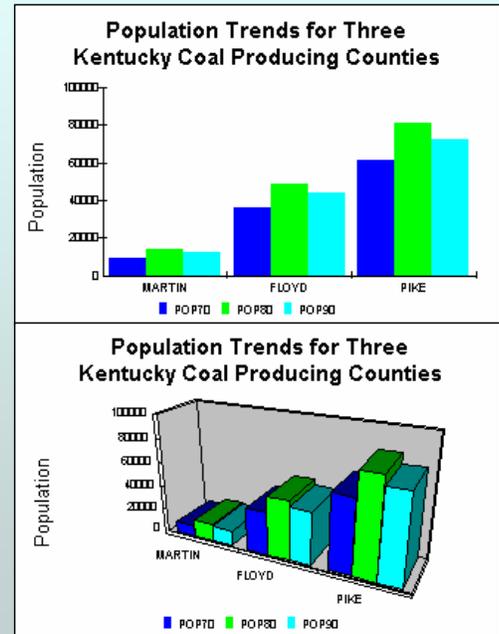
Click Options 

Many operations can be performed on the tables in ArcMap. These include the following:

1. If you right-click any field, a context menu is invoked that can allow you to do the following:
 - a. Sort the record values under the selected field either in ascending or descending order.
 - b. Create a table grouped by the values of the field containing statistics summarizing any of the other fields.
 - c. Calculate Values under the selected field of the selected records.
 - d. Generate a report of statistics for the selected values in the field.
 - e. Freeze or unfreeze a column.
 - f. Delete the field.
2. Show all records or only the selected records. The total number of records and the number of selected records appears in the status bar.
3. If you click the Options button, a context menu is invoked which can allow you to do the following:
 - a. Find and replace a value.
 - b. Select and unselect records.
 - c. Add fields.
 - d. Access related tables.
 - e. Create a graph.
 - f. Add the table to your layout.
 - g. Reload cached records from the source table.
 - h. Export all records or selected records to a new table.
 - i. Change the appearance of the table.

Charts

- Create statistical charts in ArcMap
 - Graph control and chart viewer
 - Chart types
 - 2D or 3D
 - Trend lines
 - Min, max, std, mean
 - Curve fitting
 - Error bars
- Chart manager
 - Open or remove a chart
 - Add a chart to layout
- Load .grf files into ArcMap



Charts

The charting tool included with ArcMap can help you create impressive statistical charts. Values for the chart come directly from the feature attribute tables. You have control of the graph's appearance and whether it is two-dimensional or three-dimensional. You have a chart viewer which can be manipulated to find the optimal viewing angle of the three-dimensional chart. Trend lines can be plotted representing statistics for the selected features including minimum, maximum, standard deviation, sum, and mean. Curve fitting options and error bars are available for many two dimensional charts. The chart manager allows you to open or remove a chart or add a chart to the layout. You can also browse for .grf files on your computer and load them into ArcMap

Reports

- Report writer based on third-party software
- You control
 - Fields to be included in report
 - Grouping methods
 - Sorting order
 - Styles and style customization
 - Size

County	1970	1980	1990
PIKE	61059	81123	72583
FLOYD	35889	48764	43586
MARTIN	9377	13925	12526



Reports

ArcMap comes with a third-party report writer. Values for the report come directly from the feature attribute tables. You can control the following properties of your report:

1. Field width, justification of the field name, as well as the values under the fields.
2. Grouping method used to display the contents under the fields.
3. Sorting the values under the fields.
4. Selecting a style and style customization.
5. Text color and size.

Exercise 3

Displaying Data and Creating a Map Document

- Define the Coordinate System and Add a Point Feature to ArcMap
- Change Layer Name and Symbolize Spatial Data
- Change Layer Display Order and Modify Image Display Properties
- Add Polygon Features and Classify Data
- Label Features
- Create a Map Layout Using Layout View
- Set Map Scale

