What's New In ArcGIS Desktop 9.0 *(Pre-release)*

27 February 2004.

Contents

Highlights

■ **Completely new environment for geoprocessing, modeling and scripting.** Includes new dockable ArcToolbox window with comprehensive set of geoprocessing tools available in all applications for all types of data. Integrated model builder lets you link geoprocessing operations together and build models interactively. New command line interface. All geoprocessing functionality can be scripted using third-party scripting languages. Tools, models and scripts can be customized, distributed and stored in folders and geodatabases.

■ **New and improved tools for labeling maps and creating and editing annotation.** Includes new Labeling and Annotation toolbars in ArcMap. New Label Manager lets you specify label properties without visiting layer properties dialogs individually. The annotation in a geodatabase annotation feature class can now be stored in multiple annotation classes inside that feature class, each with its own set of properties. This makes it easy to create different sets of annotation for the same features. New tools for converting coverage and CAD annotation to geodatabase annotation.

■ **Raster data can now be completely managed through ArcCatalog and is fully integrated into the geodatabase.** Various improvements including new tools for building and working with raster catalogs in geodatabases, which now appear in ArcCatalog with their own icons and a special contents browser combining table and geographic view. New raster rendering options. Raster datasets and raster catalogs can now be stored in personal geodatabases. Raster data (such as digital photos of buildings, etc.) can be stored as raster attributes in geodatabase feature classes and standalone tables.

■ **Usability, performance and quality improvements in ArcMap.** It's now easier and faster to manipulate layers and data frames in the Table Of Contents. Many other fixes. ArcMap starts up more quickly and it is quicker to launch the Add Data dialog. New export formats and options added. ArcMap now supports layer-based masking via the Advanced Drawing Options dialog.

■ **Geodatabase scalability**. There are many improvements to performance and scalability of the geodatabase in a multi-user workflow. All multi-user geodatabase users will benefit from these performance gains.

■ **Geodatabase open data exchange using XML**. You can export all or any part of a geodatabase, such as individual feature datasets, feature classes, and tables, to an XML file. Another user can then import the XML file into a geodatabase. Disconnected edits can also be transferred and checked-in using XML. This makes geodatabases completely open and interoperable because the XML specification will be published by ESRI.

■ **GPS toolbar is now standard in ArcMap.** Before 9.0, the GPS toolbar was a separate free download.

■ **New desktop and server deployment opportunities.** At 9.0, two separately available new products are introduced: ArcGIS Engine, for cross platform deployment of applications based on core ArcGIS functionality, and ArcGIS Server, for deploying server-based ArcGIS services and applications on intranets and the Internet.

Extensions

■ **3D Analyst extension: Completely new ArcGlobe application for performing stunning 3D visualizations.** Allows gigabytes of data to be seamlessly merged on the fly into a single visualization.

■ **3D Analyst extension: enhanced 3D symbology and texture support in ArcScene and ArcGlobe.** Enables you to create realistic displays and animations. Hundreds of new symbols, objects and textures.

■ **New extension for advanced cartographic label placement: the Maplex extension.** Fully integrated with the new labeling and annotation tools in ArcMap.

■ **Publisher extension and ArcReader:** new options for publishers including data packaging and time out. New customization options gives developers access to the controls behind ArcReader, so they can be embedded in customized solutions on the desktop.

Welcome to ArcGIS 9.0 (Pre-release)

ArcGIS 9.0 is the next major release of ArcGIS. This release builds on previous releases and adds important new capabilities. We've also worked hard to improve quality and performance in a number of areas. This document guides you through the key features of ArcGIS 9.0. This document does not include changes and enhancements that have been made since ArcGIS 9.0 pre-release was released. *Some of the functionality described here may be modified and further enhanced prior to the final release of the product.*

Getting more information

■ Use the **books** that come with the product. If you don't have access to the printed books look for the ESRI Software Products Library CD that comes with the release. This contains the books in PDF format.

■ Use the **ArcGIS Desktop Help**. You can launch this from the Windows Start menu or by choosing Help > ArcGIS Desktop Help in any of the ArcGIS applications. In response to a survey and other comments from users, we've improved and updated a lot of the help content and how it is indexed.

■ You get detailed **context sensitive help** about tools, commands and dialogs as you use the software:

- To get help on a command in a pulldown menu or a button in a toolbar, click the What's This tool  in the Standard Toolbar and then click the item.

- To get help on a command in a context menu (menu launched by right-clicking something), highlight the command and press **SHIFT+F1**.

- To get help on a control in a dialog, click the ? control at the top of the dialog and then click the control.

- Some dialogs have a 'Help' or 'About...' button that launches a topic giving you quick information and tips.

- To get help on a window, such as the Table Of Contents or the Identify Results window, first click inside the window and then press **SHIFT+F1**.

- To get help on a control in a geoprocessing dialog you launch from the new ArcToolbox window, click in or on the control and then press the Show Help button to expand the help panel. When the help panel is expanded, you can click the Help icon at the top of the panel to launch the Desktop help topic for the tool.

Context help is up to date for much of the new functionality but not all. You'll occasionally see 'debug' topics that have yet to be authored.

Geoprocessing

ArcGIS 9.0 presents a comprehensive set of geoprocessing tools that work with all the supported data formats, including geodatabase features. It also offers a completely new framework for working with these tools that enables you to launch them individually, combine them together in a visual modeling environment, write scripts in standard scripting languages, and run the tools as commands in a command line window. With this new geoprocessing environment, ArcGIS 9.0 completes the transition of ESRI's GIS tools to the desktop that began with the introduction of ArcGIS 8.0. ArcGIS 8.x provided a new framework for managing, sharing, mapping and editing data, along with a comprehensive new data model: the geodatabase. Now ArcGIS 9.0 completes the picture with a powerful new environment for putting that data to work.

New ArcToolbox window

■ In ArcGIS 8.x, ArcToolbox was a standalone application. At 9.0, ArcToolbox is now a dockable window integrated into all the ArcGIS Desktop applications. For example, when you run tools from the ArcToolbox window inside ArcMap, you can use the current map's layers as inputs, and the outputs can be added directly into the map as new layers.

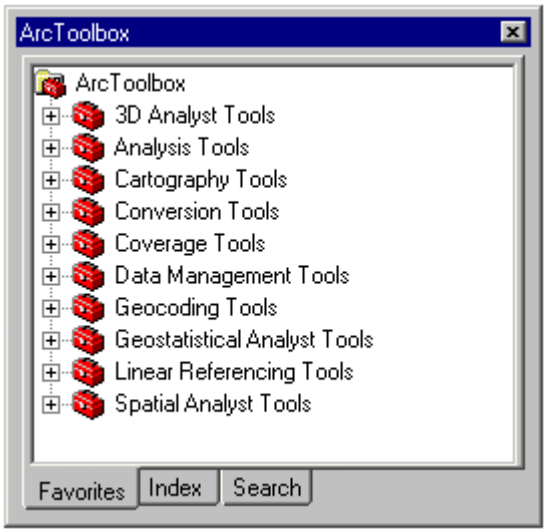
■ The geoprocessing framework is common to all the ArcGIS Desktop applications and is included with each of the ArcGIS products: ArcView, ArcEditor and ArcInfo. The number of geoprocessing tools you'll see in your ArcToolbox window depends on which product and extensions you are using:

- **ArcInfo** is the primary platform for advanced GIS analysis and modeling and therefore provides the complete set of geoprocessing tools (around 200). If you install ArcInfo Workstation these tools include the 'Coverage Tools' toolbox, which contains the complete set of analysis, conversion and data management tools for use with coverage data.

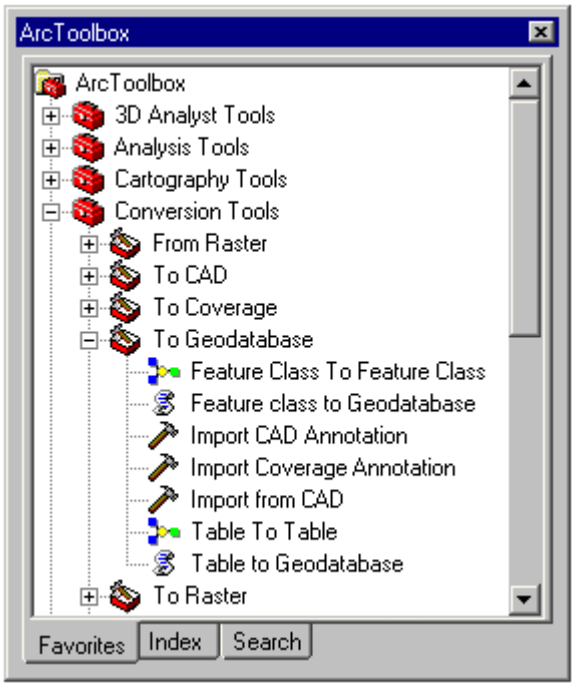
- **ArcView** and **ArcEditor** continue to have the standard map based analysis tools (around 30) commonly associated with project work.

- More than 200 additional tools are provided by the ArcGIS **extensions**, such as ArcGIS 3D Analyst and ArcGIS Spatial Analyst.

Here's what's in the ArcToolbox window if you're an ArcInfo user and you've also installed all the ArcGIS extensions released with 9.0:



■ When you look inside a toolbox, you'll notice that the tools it contains are usually organized into toolsets:



Here's what you'll see in a toolbox:

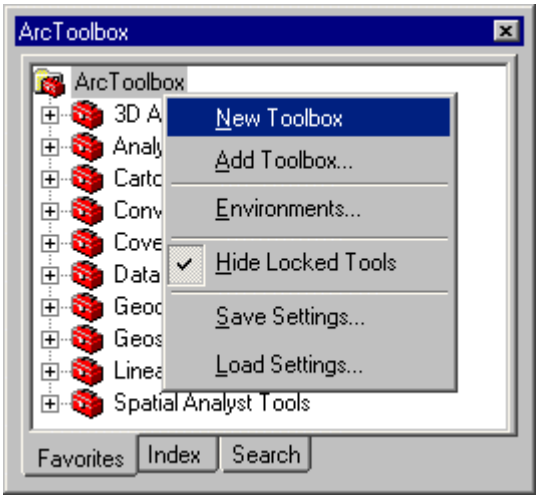
Toolset: a container for organizing the contents of a toolbox.

Tool: runs an underlying functions in the geoprocessing framework.

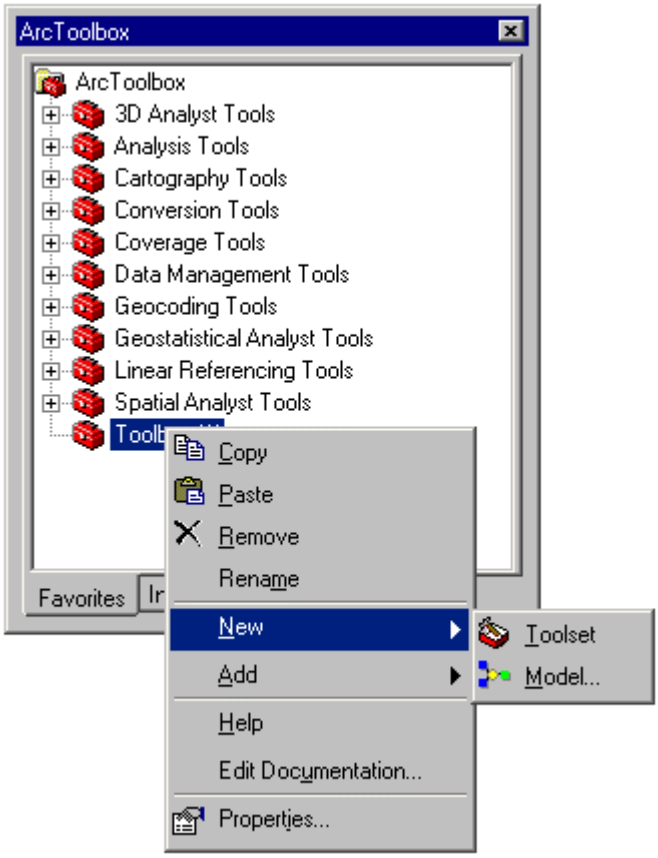
Script: can be written in any COM compliant scripting language, such as Python, JScript or VBScript. An ArcInfo Workstation AML can also be added into a toolbox as a script.

Model: You can view and edit these in the new integrated ModelBuilder window.

■ You can re-organize and save the contents of the ArcToolbox window in any way you like. You can create your own toolboxes too. To add a new, empty toolbox into the ArcToolbox window, right-click the ArcToolbox entry at the top of the tree, and choose New Toolbox:



Once you've created a new, empty toolbox, you can add existing tools and scripts to it, and create models in it. For example to create a new model in the new, empty toolbox you've just added, right-click the toolbox to get its context menu and click the New Model command in the New pullright:



■ Toolboxes you create can be stored as .tbx files in folders or stored directly in geodatabases. This makes it easy to manage, distribute and share custom tools, models and scripts. For example, all the tools created by a GIS department for use with a particular enterprise geodatabase can be stored in that geodatabase and accessed and updated centrally. It is very easy to 'package' models and scripts that you make as tools for others to use. When a user double-clicks on a model you've created, they'll see a dialog prompting them for the inputs. The user only needs to see the visual model or the actual script if they want to. In fact, several of the standard conversion tools provided in 9.0 are actually models or scripts that run underlying functions, which means you can easily inspect them to see how they work.

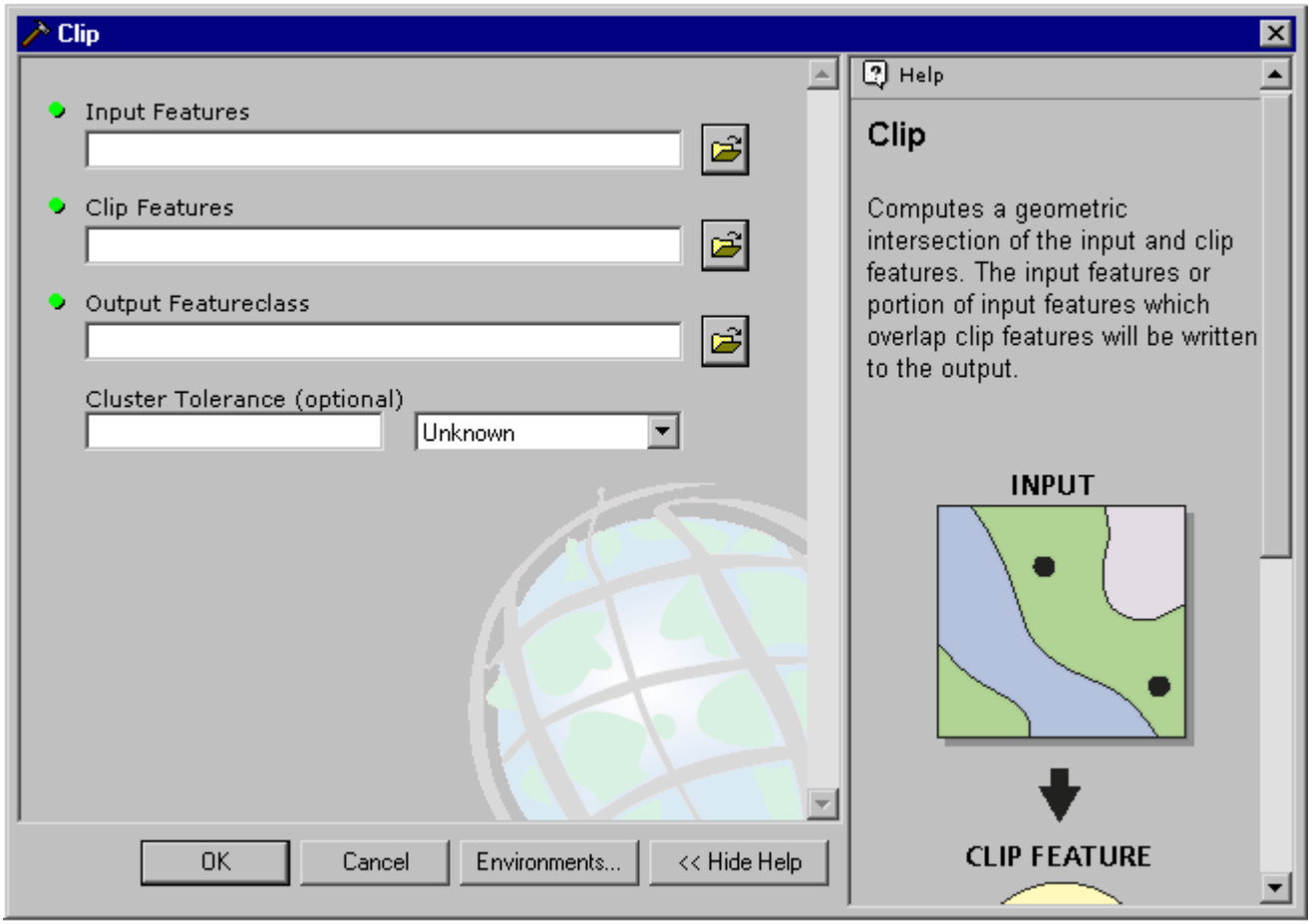
■ An integrated Documentation Editor makes it easy to create documentation and metadata for models, scripts, and toolboxes you create. Documentation you create for models and scripts can be accessed via the Help panel of the dialog that appears when they are launched, or by right-clicking them in ArcToolbox and choosing Help. Documentation for toolboxes can be accessed by right-clicking them in ArcToolbox and choosing Help. Metadata for the contents of toolboxes can be accessed via ArcCatalog's Metadata tab.

Using the geoprocessing framework

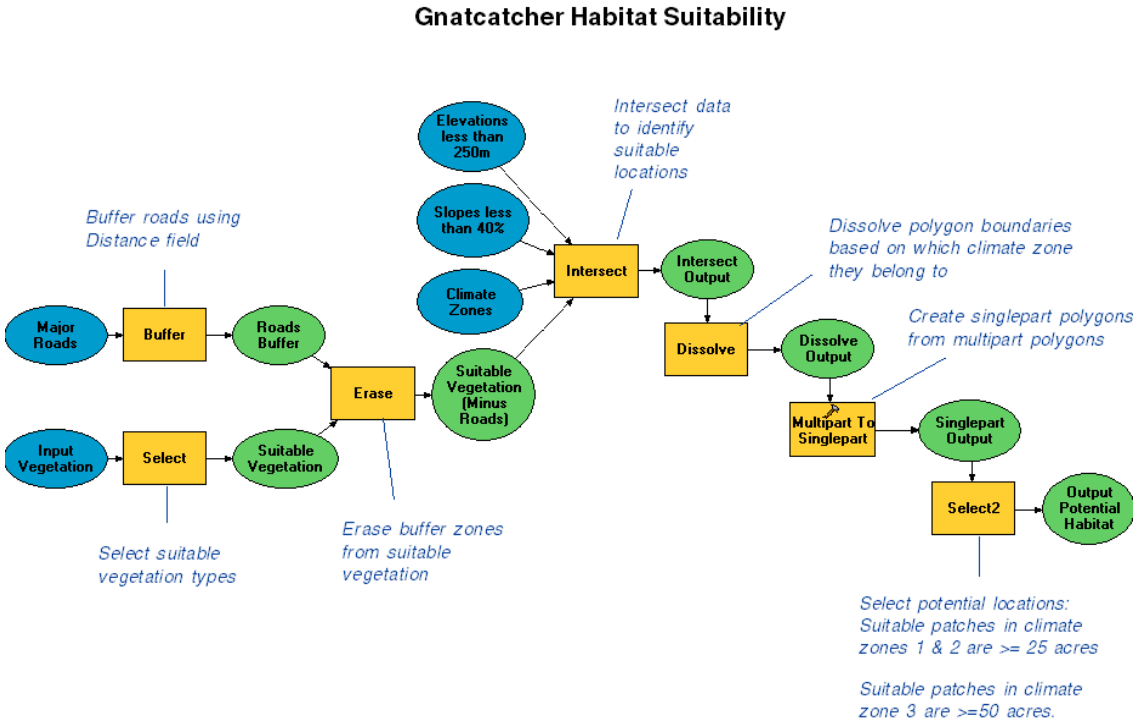
■ There are five ways to perform geoprocessing at 9.0, summarized in this table:

Method	Description	Use To
Tool dialog 	A form in which input data and other necessary parameters are defined. Full embedded context sensitive help is provided.	- Run any geoprocessing tool from inside any application. - Get familiar with a tool and its parameters.
Model 	An interactive visual model that links processes, data and parameters together. Models are created and edited in the integrated ModelBuilder window.	- Build models, workflows and processes without scripting or programming. - Document or present a process. - Explore alternative scenarios. - Present methodology and workflow to others.
Command Line 	Dockable Command Line window offering usage pop-ups for commands, auto-completion, etc.	- Run tools quickly without launching their dialogs. - Useful shortcut for advanced users. - Already familiar to long term ArcInfo users!
Script 	File written using a standard scripting language such as Python, Jscript or VB Script.	- Automate repetitive tasks. - Full control of process based on any conditions, states, time delay, etc. - Brings the 'traditional' working environment for advanced GIS users to bear on the full range of ArcGIS Desktop functionality. Scripting is back!
ArcObjects 	Geoprocessing objects can be accessed in the ArcGIS development environment to create custom tools and applications using Visual Basic 6, C++, Visual Basic .Net, and C#.	- Incorporate tools into new and existing applications. - Create custom dynamic link libraries that incorporate geoprocessing tools. - Create custom toolbox functions (DLL, EXE, or OCX).

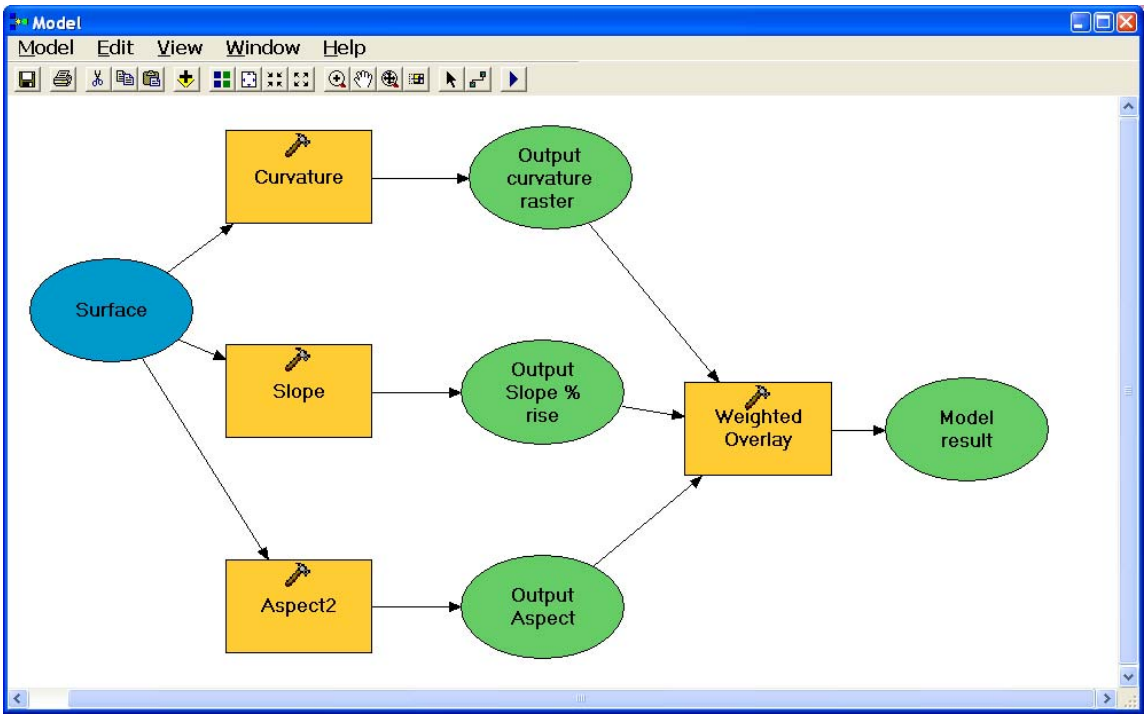
■ Geoprocessing tools can be launched directly by double-clicking on the tool in the ArcToolbox window. This will open the **tool dialog** so you can specify the necessary inputs and execute the tool:



■ You can also create **models** that will execute a sequence of geoprocessing functions. For example, an output data source that is projected in one function becomes the input for an overlay function, and so on.



Models are viewed and edited using the integrated ModelBuilder window. The ModelBuilder window lets you drag and drop tools and data into the model diagram to build processes that can be connected into a logical flow. You can run a model from within the ModelBuilder window and inspect the flow of control. Models can also include scripts and other models as steps. You can save models in toolboxes and use them as tools or distribute them to other users. A model can also be exported from ModelBuilder window as a script, so you can first build a process as a model, export it as a script, and then add additional automation or advanced flow of control.

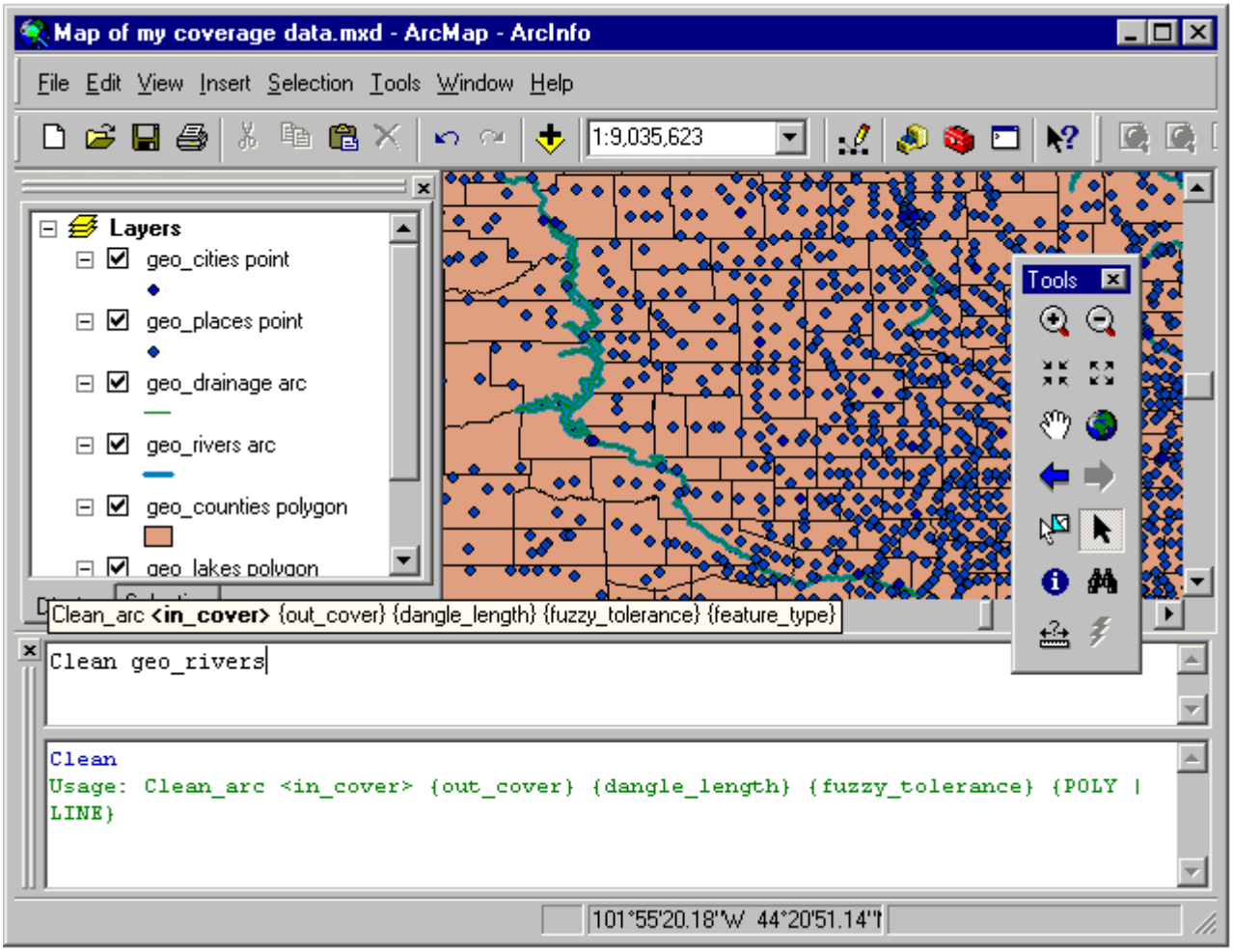


■ Geoprocessing tools can also be used within **scripts** to allow the automation of repetitive processes or complex flow of control. Scripts have traditionally been the staple working environment of long term ArcInfo users. At 9.0 scripts are back! Scripts can include calls to geoprocessing tools, models, and other scripts. Scripts are easy to author in the COM compliant scripting environment of your choice, such as Python, VBScript, and JScript. After a script is authored, it can be exposed to users as a standard tool and embedded in other models or scripts like any other tool. The script shown below is written in Python:

```
# ---------------------------------------------------------------------------
# batch_buffer.py
# Created on: Fri May 02 2003 04:55:13 PM
#   (generated by ArcGIS/ModelBuilder)
# ---------------------------------------------------------------------------

# Import system modules
import sys, string, os, win32com.client

# Create the Geoprocessor object
gp = win32com.client.Dispatch("esriGeoprocessing.GpDispatch.1")

# Set the workspace
gp.workspace = "C:/DATA/Roads/workspace.mdb"

# List all the feature classes in the workspace
fcs = gp.listfeatureclasses()

#Loop through the list of feature classes
fcs.Reset()
fc = fcs.Next()
while fc != "":
    # Set the outputname for each output to be the same as the input plus "buff"
    out_feature_class = gp.workspace + "\\" + gp.validatetablename(fc + "buff" , gp.workspace)

    # Buffer each input feature class in the list
    gp.Buffer_analysis(fc, out_feature_class, 10)

    # Repeat with the next feature class
    fc = fcs.Next()
```

Support for existing ArcInfo Workstation AML scripts via ArcToolbox has been improved at 9.0. Any AML can be added as a script in a toolbox at 9.0, not just those that execute Arc commands like in ArcToolbox 8.3. The only stipulation is that the AML start in the Arc module. The AML can then go to ArcEdit, ArcPlot, Grid, etc. Also, in ArcToolbox 8.3 the dialog for running an AML-based script was limited to one input field for all the arguments. At 9.0, you can define individual parameters for AML-based scripts, like you can for any other tool, script or model you create. You can specify the parameter types and the system will validate input values against these. You can also add coded value or range domains to a parameter. The AML-based script you've created can then be used like any other geoprocessing tool: you can run it stand-alone tool from the ArcToolbox window, add it into model as a processing step, run it from the command line, or call it from another script.

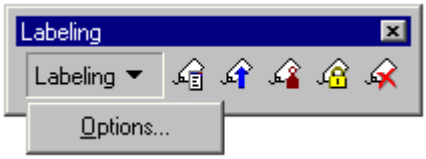
■ The geoprocessing environment includes a dockable Command Line window. This window provides an easy way to run any tool, model or script. This command line makes repetitive tasks quick and easy, similar to command line executions in ArcInfo Workstation. Messages are shown in the lower part of the window to document the progress of tools run in any session. Tools can be re-executed by interacting with the window. Like the ArcToolbox window, the Command Line window is available in all ArcGIS Desktop applications and can be docked into the application's window:



Labeling

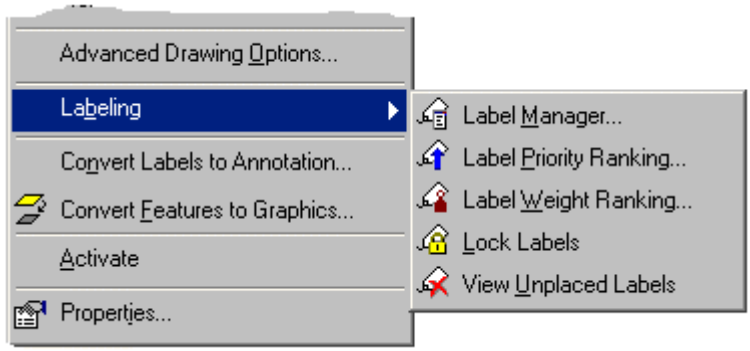
At 9.0 we've improved the user interface for labeling and provided new core functionality. In addition, a new labeling extension is available at 9.0. The **Maplex for ArcGIS** extension allows high quality cartographic label creation using advanced label placement and fitting techniques. Maplex uses an advanced conflict detection algorithm to automatically generate labels. There's a separate section in this document about the Maplex extension.

■ There's a new toolbar and some new dialogs for specifying and managing the labels drawn for layers. From View>Toolbars choose the new Labeling toolbar. Here's what the Labeling toolbar looks like:

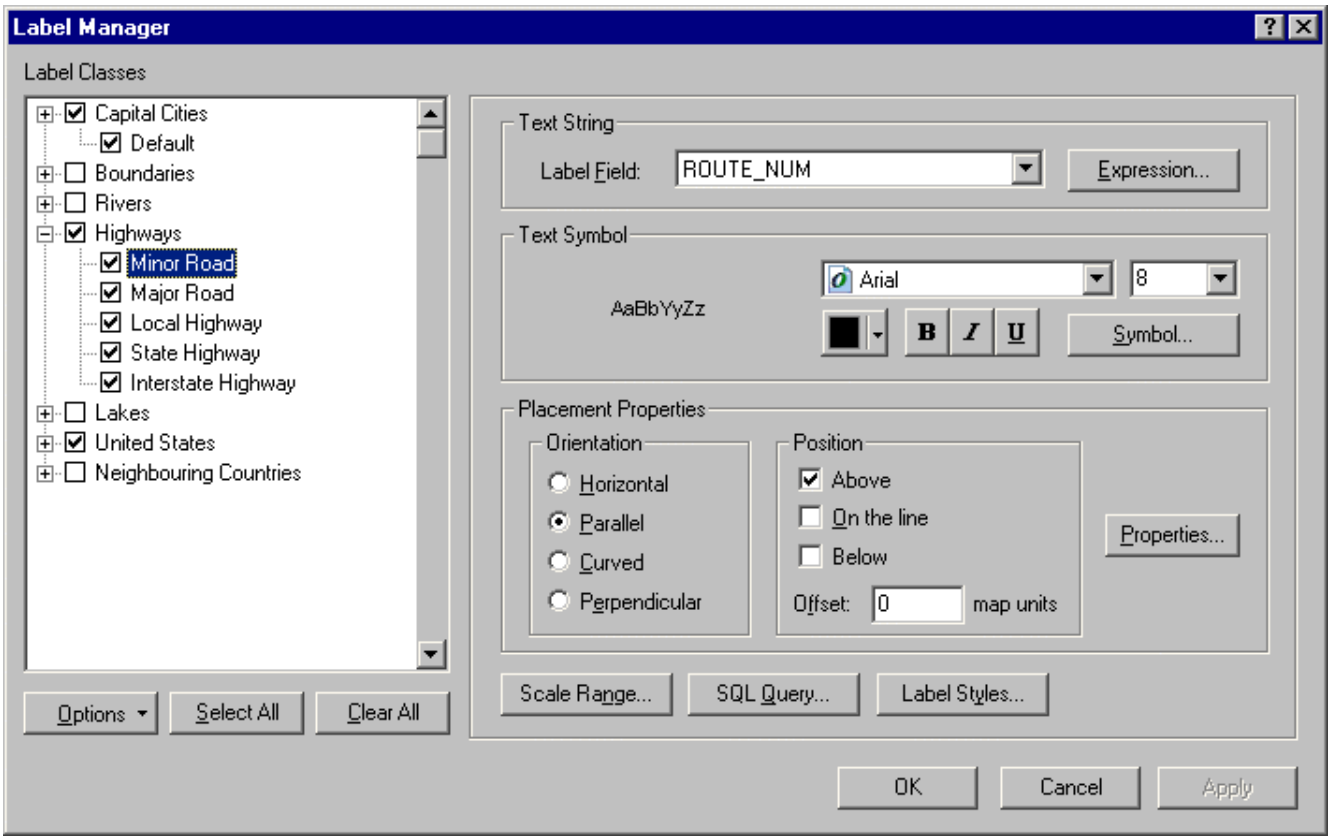


■ If you have installed the Maplex for ArcGIS extension, the Maplex commands will also appear in this new toolbar. There's not a separate toolbar for the Maplex extension. Here's what the Labeling toolbar looks like if you have installed the Maplex extension:

■ You can also access the new labeling commands via a new Labeling pullright that has been added into the context menu for a data frame:



■ The new Label Manager dialog launched from the Labeling toolbar or the Labeling pullright lets you turn labeling on and off for any label classes in the layers in the active data frame, change the properties of any label class, and create, delete and copy/paste label classes. The Label Manager makes it easy to specify labels for layers without repeatedly having to visit their property dialogs.



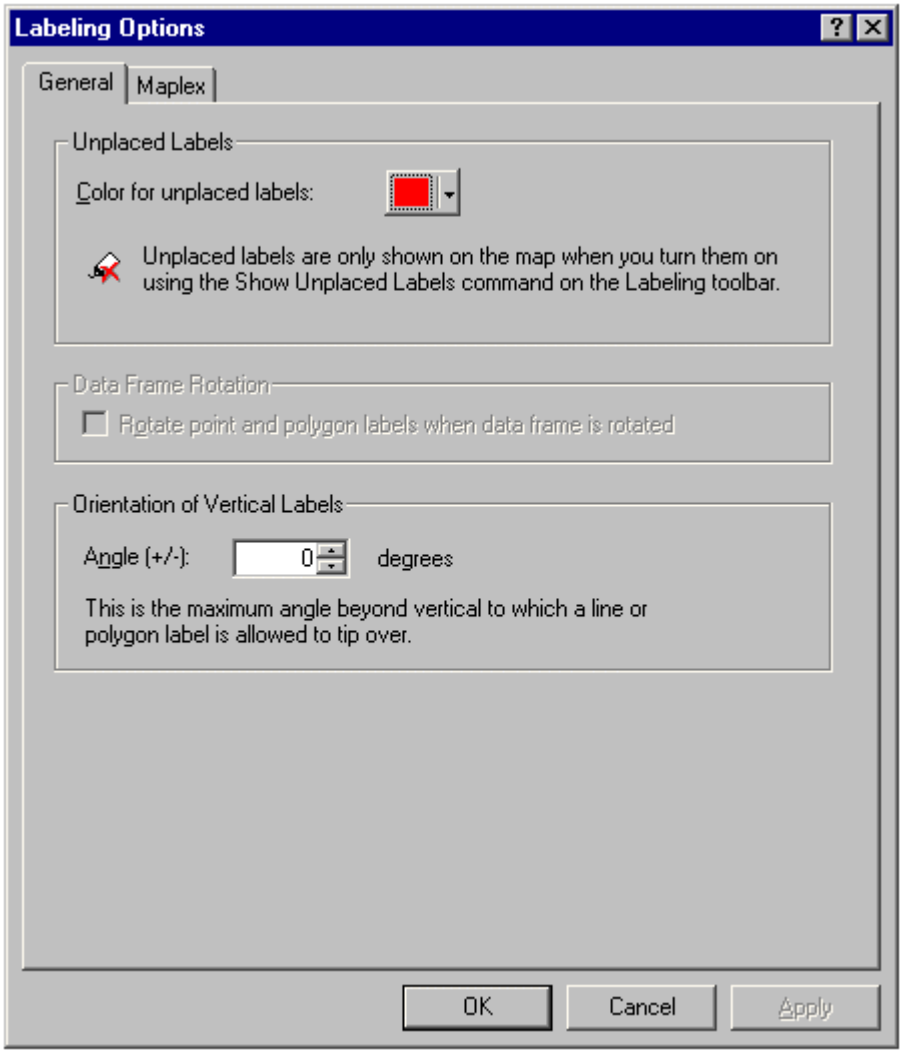
The Label Manager replaces the Labels tab in the Data Frame Properties dialog, which has now been removed.

■ The Label Priority Ranking dialog lets you rank the drawing priority of the label classes in the active frame.

■ The Label Weight Ranking dialog lets you control which labels will be placed when there are potential conflicts (overlaps) between features and labels.

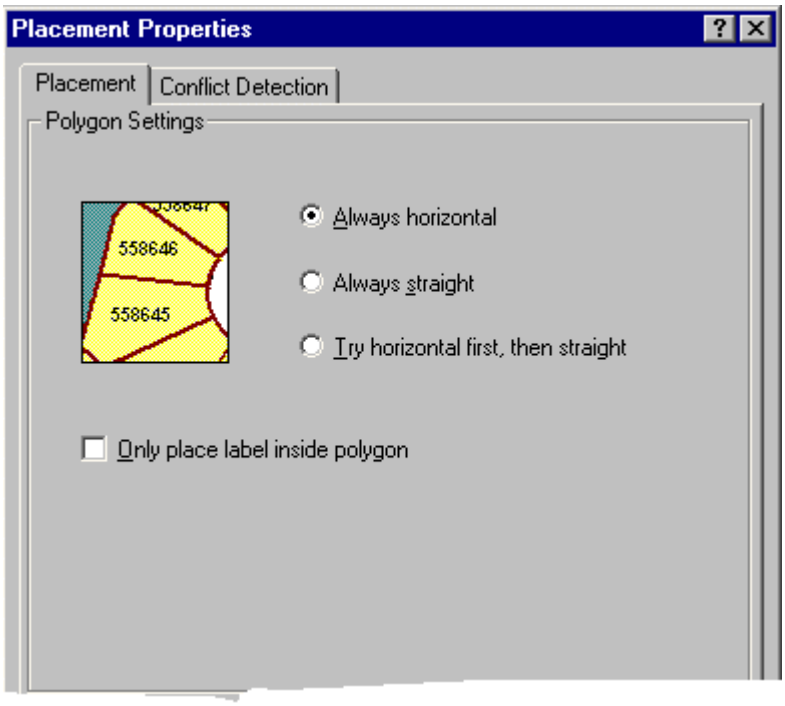
■ Layers still have a Labels tab in their Properties dialog, which has been enhanced to include controls for quickly specifying the main properties of the text symbol.

■ The Options command in the Labeling pulldown menu launches the new Labeling Options dialog. This contains a General tab with options that apply to both the standard and the Maplex label engine. If you have installed the Maplex extension and are using the Maplex Label Engine for the active data frame, a Maplex tab will also be present in the dialog containing options specific to Maplex.



In 9.0 pre-release the Data Frame Rotation option was not implemented and is therefore always disabled, and the Orientation of Vertical Labels option is only enabled if you are using the Maplex Label Engine.

■ In previous releases of ArcGIS there were no placement options for labeling polygons. 9.0 adds some of the most frequently requested options for polygon label placement:



■ At 9.0 a wider range of fonts is supported. The Font picker dropdown lists in ArcMap and all the other applications in ArcGIS have also been improved to better reflect the available fonts. In ArcGIS 8.x, we supported only TrueType and TrueType-based OpenType fonts, and we used two icons next to font names in the dropdown lists to indicate the font type:

Font is only available while printing
True Type font

At 9.0 these icons have been replaced with this new set to reflect the range of fonts that are now supported :

Font is not available on this machine so type detection is impossible
OpenType font (TrueType-based, Type1-based and Type2CFF-based)
TrueType fonts (TrueType fonts, TrueType Collection and MultipleMaster)
Type 1 font
Raster-based font only used in the user interface (e.g. for the Table of Contents or table window)

■ Label placement options for line features have been grouped differently on the label placement properties dialog.

■ Layer Properties dialog Labels tab: The Label Placement Options button on this tab has been renamed to Placement Properties to match the name of the dialog it launches.

■ Text formatting tags now work for curved annotation.

■ Several new text formatting tags and attributes have been added at 9.0:

- Scale attribute added to the existing FNT tag. This lets you adjust the size of the text relative to the current size. Specify a scale factor in percent (100% = regular):

```
<FNT name= "Arial" size="12">This text is Arial 12 point.<FNT scale="200">This text is Arial 24
point.</FNT></FNT>
```

- Width attribute added to the existing CHR tag to change the character width. Specify a width factor in percent (100% = regular):

```
<CHR width="150">My text</CHR>
```

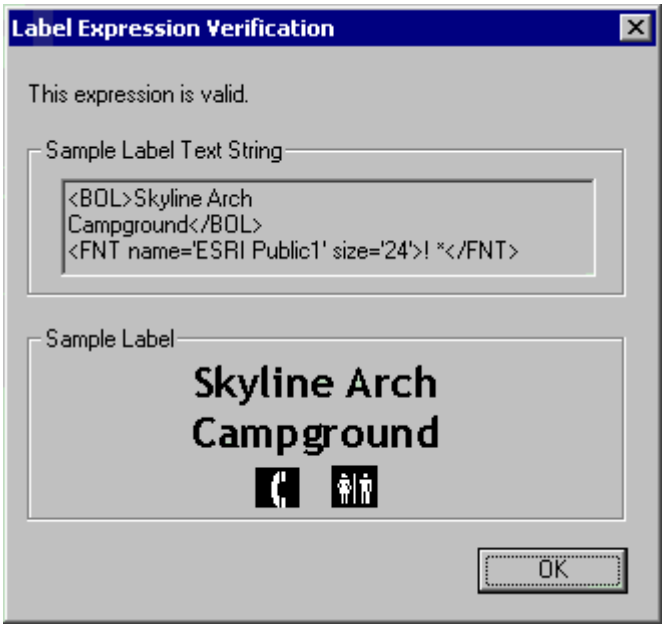
- _BOL, _ITA, _UND, _SUP and _SUB tags added to make text un-bold, un-italic, etc. Tags follow the rules of XML so you can't, for example, use the existing </BOL> tag to turn off bold for a text symbol whose base text symbol is already bold. To turn bold off you would use the new _BOL tag:

```
This is bold if the base text symbol is bold<_BOL>, but this is not.</_BOL>
```

■ The dialog launched by the Label tool has been renamed from 'Labeling Options' to 'Label Tool Options'.

■ The dialog for specifying a label expression has been renamed from Expression Properties to Label Expression and several improvements have been made:

- The dialog that appears when you verify your expression has been improved it make it clearer what the actual results of your expression will be and to give you a WYSIWYG sample label that fully interprets the results of any text formatting tags in the expression:



Also, if you have defined an SQL query for your label class, the sample label that the dialog shows you now contains the values from the first feature in your feature class that matches the SQL query. In ArcGIS 8.x the verification dialog always used the first feature in the feature class, which was confusing when you created a label expression specifically to label values you expected to be returned by the SQL query you defined for the label class.

- There's now a Reset button that removes the current label expression and replaces it with the default label field for the layer. Press the Reset button if you want to clear or remove the current label expression. It's a quick way to start again with your expression. (If you just delete the current expression and press OK you'll get an error because there has to be an expression in this dialog, even if it just the name of the default label field)

- The Add button has been renamed to Append to better reflect what it does. To define a label expression in which two fields are appended together, double-click (or drag and drop) the first field in the list of fields to add it into the expression, then select the second field and press Append.

- Double-clicking a field in the list no longer appends it to the end of your expression. Now when you double-click a field in the list it gets inserted into the expression at the current cursor location. This makes it easier to build expressions and also better matches the behaviour of the Select By Attributes dialog

- You can now copy values out of the Show Values subdialog for pasting into the expression, etc.

Annotation

ArcGIS 9.0 includes a number of improvements to the functionality and user experience for creating and editing geodatabase annotation. There is a new, more flexible model for storing annotation inside of a geodatabase that better suits your data modeling requirements. Also, annotation is fully integrated into the ArcMap editing user experience at ArcGIS 9.0. Both of these fundamental changes will increase productivity and make the creation and update of annotation features easier and more intuitive.

Updating annotation feature classes to ArcGIS 9.0

To take advantage of these improvements, you will need to upgrade your geodatabase version to ArcGIS 9.0 and then update each annotation feature class within the geodatabase to include a new schema that is required when editing annotation in ArcMap.

You can upgrade a personal geodatabase using ArcCatalog; this type of upgrade does not affect any data but makes some additions to the geodatabase system tables. For more information on how to upgrade a personal geodatabase in ArcCatalog, look in the ArcGIS Desktop Help index for 'upgrading, geodatabases' to get to the 'Upgrading a geodatabase' help topic.

The process for upgrading a multi-user geodatabase to ArcGIS 9.0 involves upgrading the ArcSDE software on the server. For more information on upgrading your multi-user geodatabase, see the 'ArcSDE Installation Guide' for your DBMS.

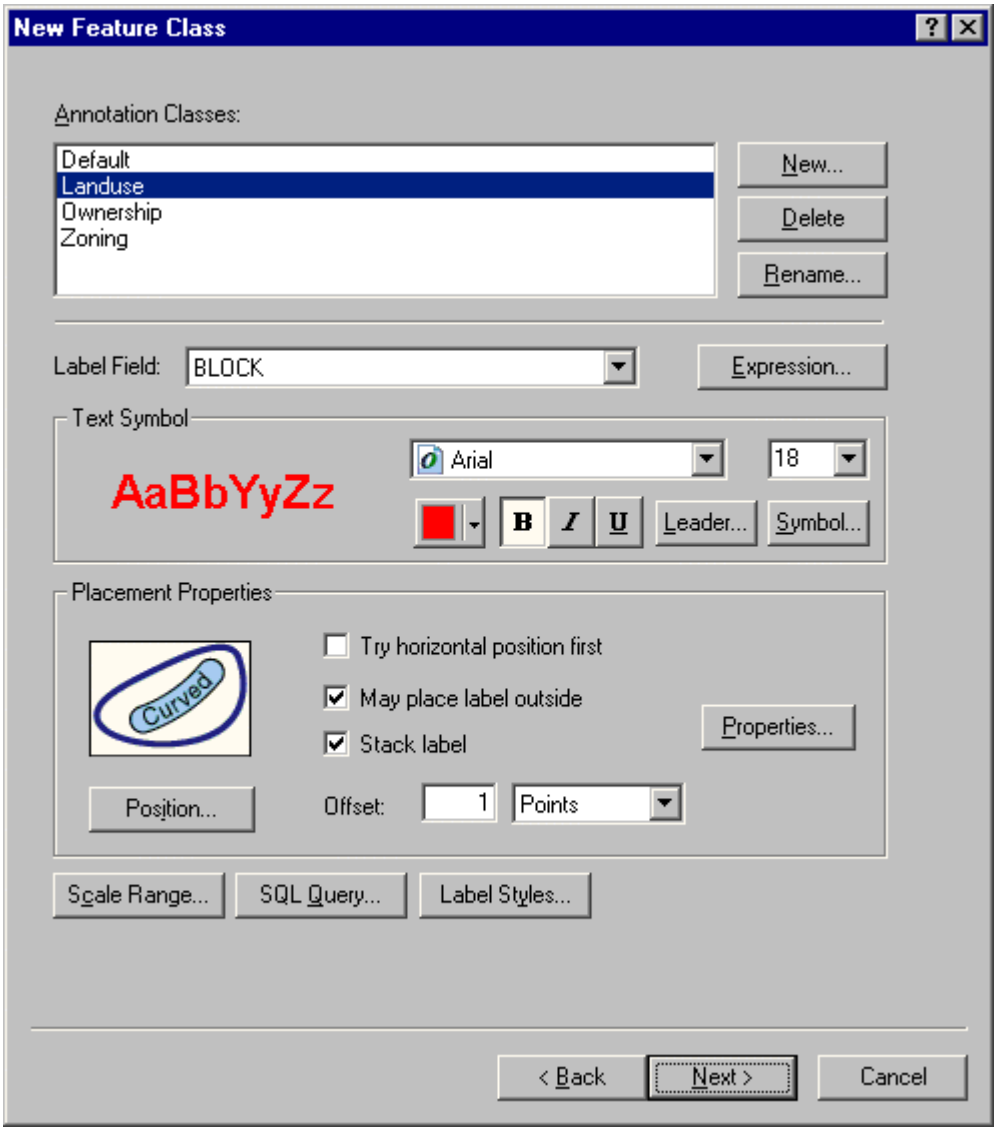
Once you have updated the geodatabase to ArcGIS 9.0, you can then update the schema of each annotation feature class in the geodatabase to take advantage of these improvements. Before you do so, you should consider the design of annotation feature classes in your geodatabase data model and consider taking advantage of the new schema. For example, you can now create annotation classes or subtypes within an annotation feature class. This enables you to classify annotation features by theme or scale and reduce the number of feature classes within the geodatabase.

To update the schema of your annotation feature classes, use the Update Annotation Feature Class tool found in ArcToolbox. You can find this tool in the Data Management Tools > Feature Class toolset. This will update the schema of the feature class and, optionally, each annotation feature within the feature class. The schema update will add additional fields to the feature class (Bold, Italic, Text, etc) and also ensure that there is a symbol within the symbol collection: without a symbol in the symbol collection you cannot use the improvements for constructing annotation features.

If you decide that you want to take advantage of annotation subtypes, you can merge annotation feature classes together and create subtypes. To do so, use the Append Annotation Feature Classes tool found in ArcToolbox in the Data Management Tools > Feature Class toolset. Append will merge annotation features from multiple classes into one annotation feature class and create the appropriate subtypes. If you use the Append tool within ArcMap, you can select features of a given scale or theme and append only those into the new feature class.

Storing annotation

■ The annotation in a geodatabase annotation feature class can now be stored in multiple **annotation classes** inside that feature class. Each annotation class has its own set of labeling properties, including expression, text symbology and placement properties. This enhancement saves you from having to define multiple annotation feature classes when you want to create different sets of annotation for the same features. You can create annotation classes in the New Feature Class wizard when you create an annotation feature class. You can create annotation classes in the New Feature Class wizard when you create an annotation feature class. If you are creating feature-linked annotation, you can specify the placement properties for the annotation in each annotation class:



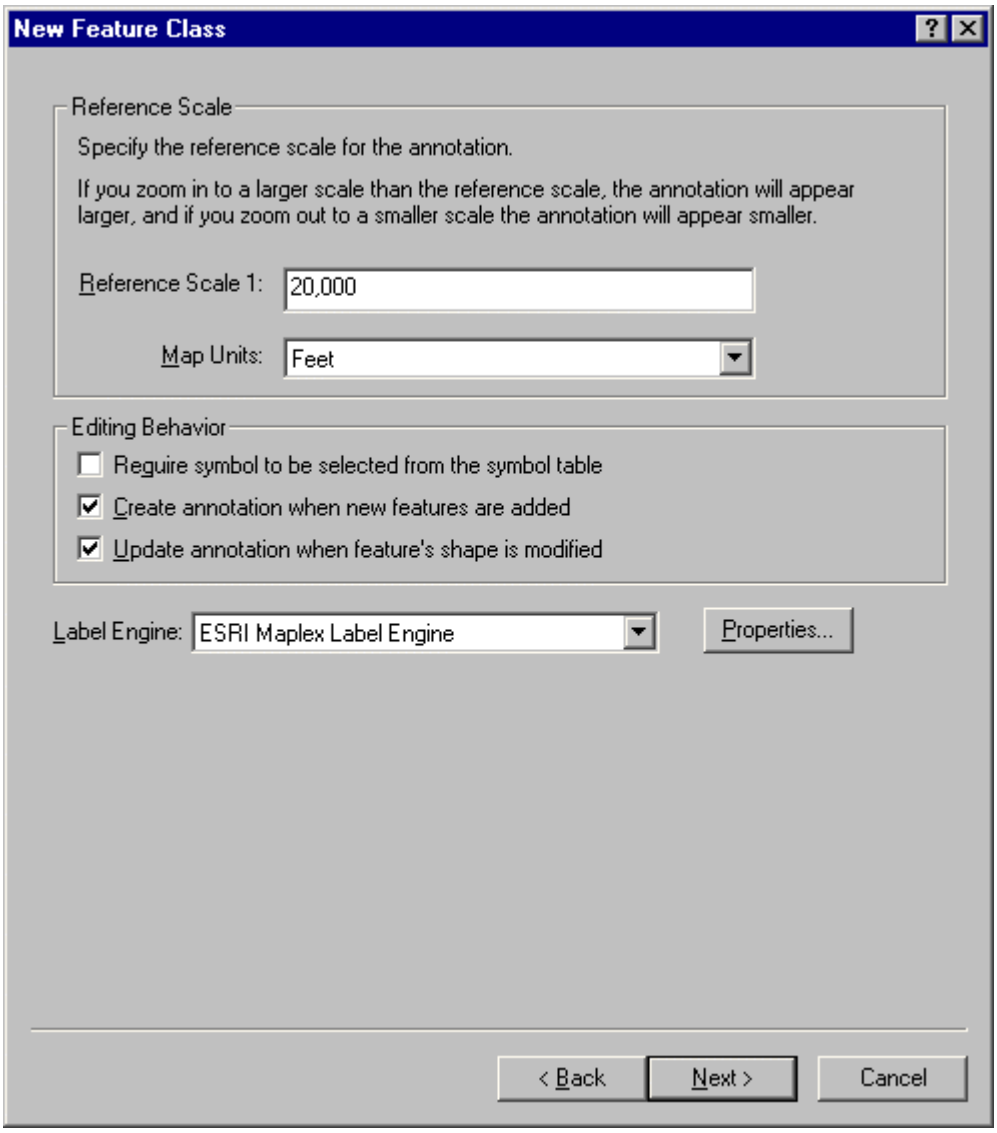
You can also create annotation classes using the Convert Labels To Annotation command in ArcMap (in the context menu for a layer). If you have defined label classes for your layer, each of these label classes becomes an annotation class in the annotation that gets created.

Annotation classes can be created and modified after you have created the annotation feature class by going to the new Annotation Classes tab in the Feature Class Properties dialog for an annotation feature class in ArcCatalog.

When you add a layer based on an annotation feature class into a map, the different classes of annotation it contains are shown as entries underneath that layer in the Table Of Contents:

■ When you create a new annotation feature class, the panels for specifying the annotation options have changed to accommodate new functionality.

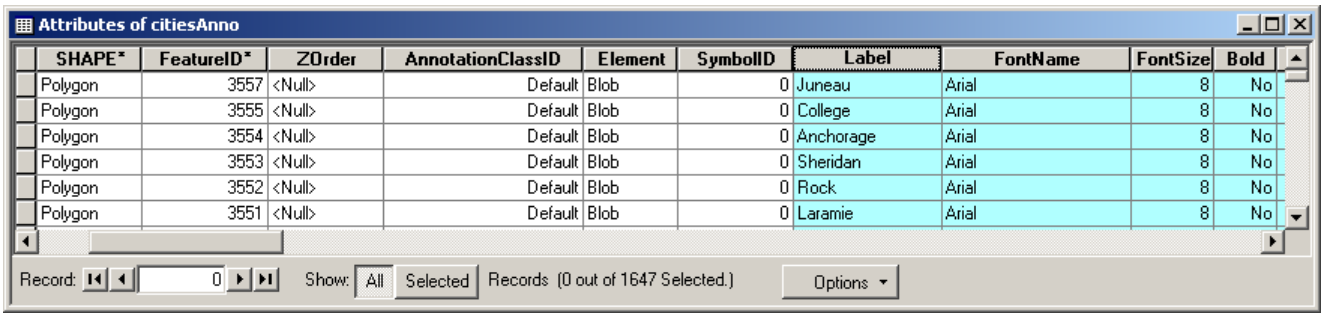
For example, when you create feature-linked annotation you can now specify the **label engine** that will be used to generate the annotation placement. In the example shown below, the Maplex Label Engine in the **Maplex for ArcGIS** extension has been chosen to generate the annotation placement. The Maplex for ArcGIS extension is a new extension introduced at 9.0 that provides high quality cartographic label creation using advanced label placement and fitting techniques:



Tip: You can view and edit an annotation feature class that uses Maplex label placement whether or not you have the Maplex extension. In the case of editing standard annotation (annotation that is not feature-linked) there's no difference. In the case of editing feature-linked annotation, ArcMap will automatically use the standard label engine when it needs to place new annotation if a Maplex license is not available.

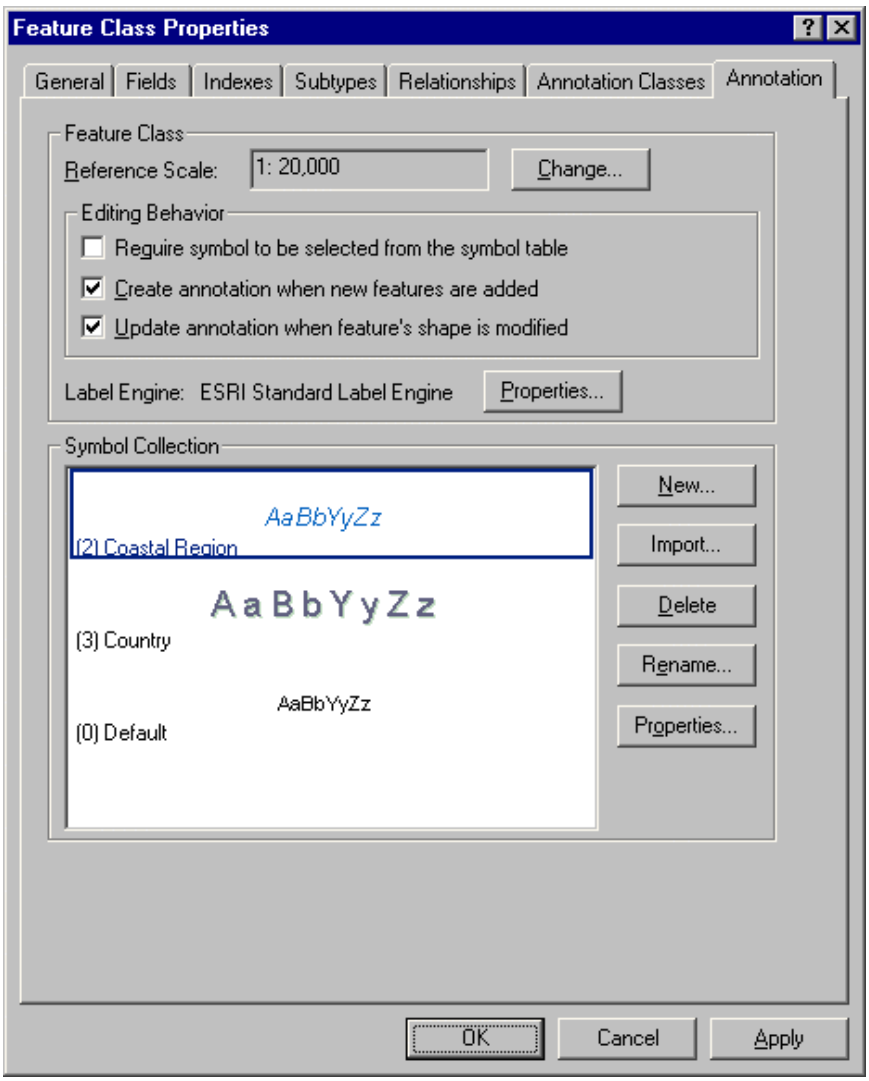
If you want to create an annotation feature class using Maplex label placement, or edit a feature-linked annotation feature class using Maplex to place new annotation, you'll of course need to have the Maplex extension.

■ Annotation text symbol properties are now shown in the attribute table for a layer based on an annotation feature class, including Label string, Font Name, Bold, Italic, and X/Y offsets. These fields support querying and are editable. You will also see these fields in ArcCatalog. The example below doesn't show all the fields:

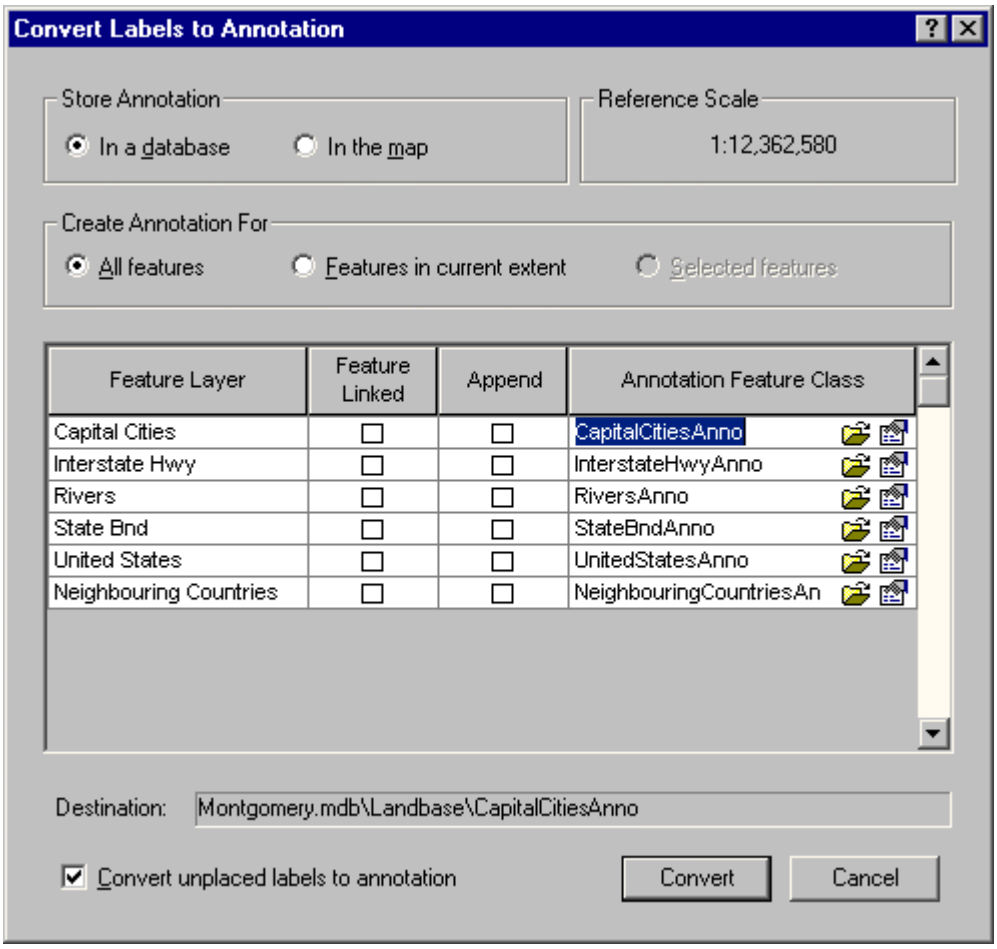


■ Multi-part annotation is now supported in ArcGIS Desktop . This was previously only supported in ArcInfo Workstation. With multi-part annotation, each part of the annotation can be adjusted individually, providing better options for placing text.

■ Symbols for annotation features are now stored in the geodatabase. Annotation symbols are specified on the Annotation tab in the Feature Class Properties dialog for an annotation feature class in ArcCatalog:



■ The Convert Labels To Annotation dialog in ArcMap has been overhauled at 9.0. When you choose to convert labels to annotation feature classes (the default), the list in the dialog lets you control the destination and properties of the annotation that will be created. Edit the output feature class names in the Annotation Feature Class column. Click the browse icon in the Annotation Feature Class column to specify the destination geodatabase for the annotation. Click the Properties icon to specify properties for the annotation class that will be created, including specification of a configuration keyword when storing data in ArcSDE.



■ If you save an annotation layer as a layer (.lyr) file you'll notice that we've updated the icon used for annotation layer files so they use the same 'A' graphic in their icon as the annotation feature class:

Layer file referencing an annotation feature class

Existing annotation layer files continue to use the old 'pencil' icon. If you want these files to use the new 'A' icon you have to recreate them.

■ There are new tools for converting coverage and CAD annotation to geodatabase annotation. You can find these in the 'To Geodatabase' toolset in the Conversion Tools toolbox in ArcToolbox.

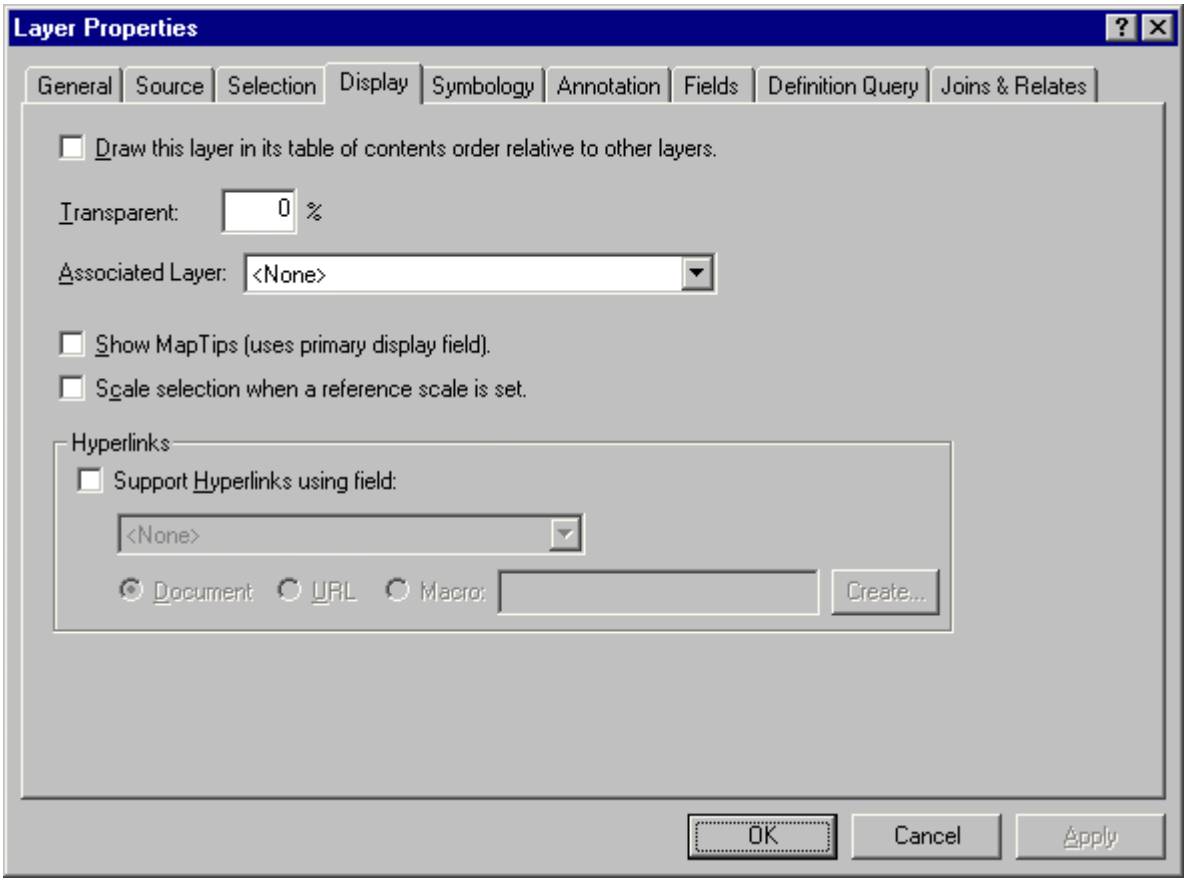
■ There is a Append Annotation Feature Classes Tool that combines two or more annotation feature classes into a single annotation feature class. You can find it in the 'Feature Class' toolset in the Data Management Tools toolbox in ArcToolbox.

Displaying annotation

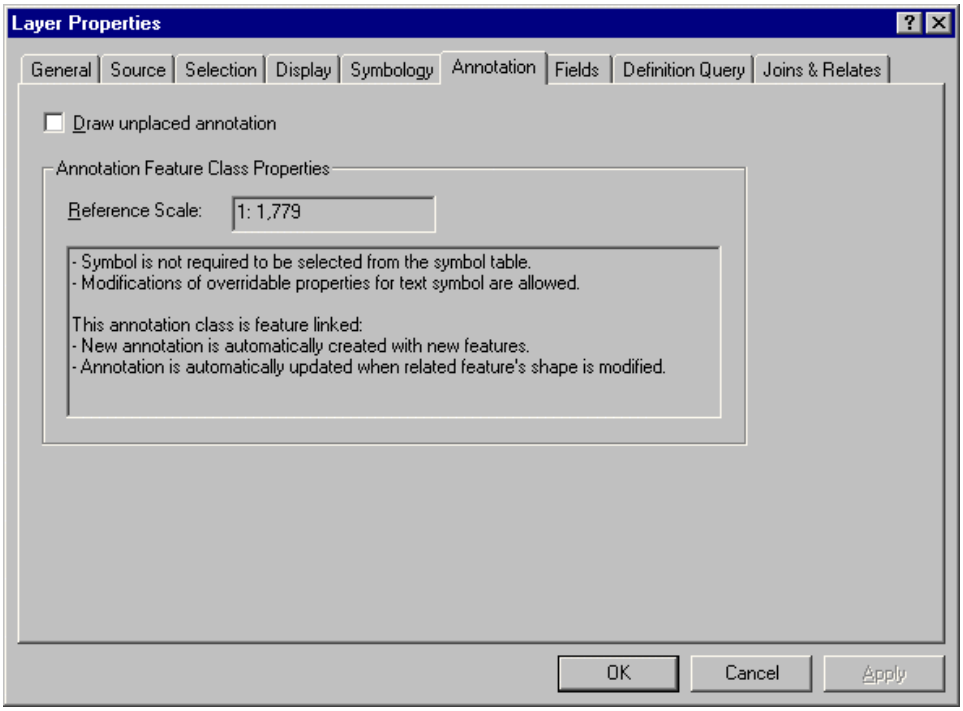
■ When you add a layer based on an annotation feature class into a map, the different classes of annotation it contains are shown as entries underneath that layer in the Table Of Contents:

■ By default, annotation layers now respect their drawing order in the Table of Contents just like any other layer. You change this behaviour on the new Display tab in the Layer Properties dialog for an annotation layer (see below).

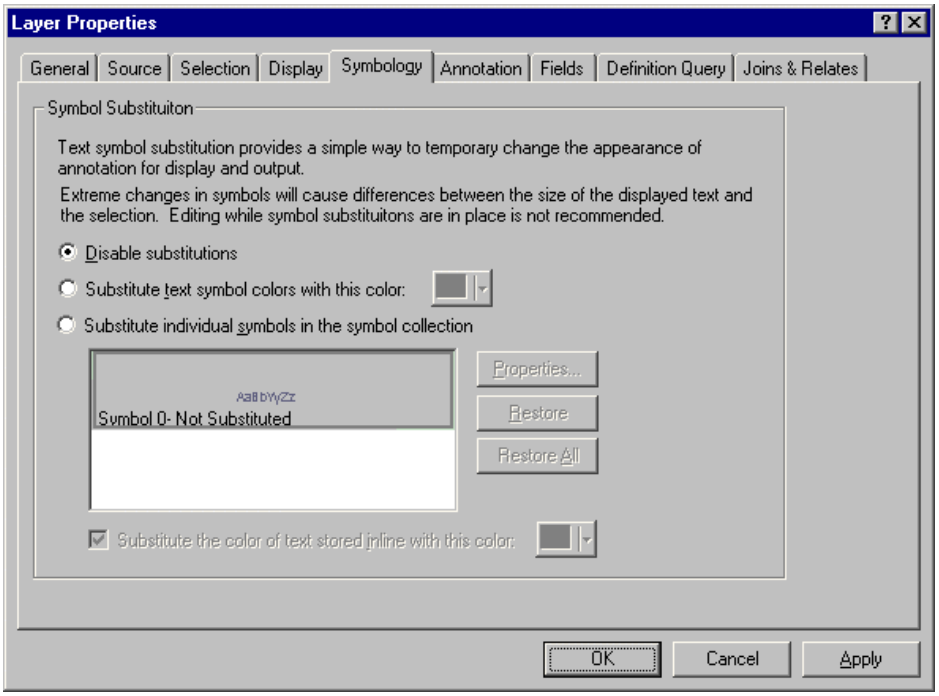
■ A new Display tab has been added into the Properties dialog for a layer representing an annotation feature class. With this tab you can specify transparency, set up map tips, and create hyperlinks for annotation. You can also specify a layer to which the current annotation layer is associated. Specifying an associated layer links the visibility of these layers in the map. When the associated layer is turned on or off in the Table of Contents, the annotation layer will also turn on or off.



■ The Labels tab in the Properties dialog for a layer representing an annotation feature class has been replaced with a new Annotation tab:



■ A new Symbology tab has been added into the Properties dialog for a layer representing an annotation feature class. This new tab lets you specify symbology that will override the symbology defined for the annotation feature class, without having to change the annotation feature stored in the geodatabase. For example, if the symbology of text is defined in the geodatabase as black, you can temporarily override this and make it red.



■ The Properties dialog for an annotation class listed underneath an annotation layer lets you review (but not change) the text symbol properties used to draw it. If the annotation layer is feature-linked, you can also review (but not change) the placement properties, SQL query and the expression used to generate new feature-linked annotation for the annotation class from the feature class the annotation layer is linked to.

Editing annotation

■ There is a new user interface for editing annotation, presented in a new Annotation toolbar:

The Edit Annotation tool has been moved out of the Advanced Editing toolbar and into this new Annotation toolbar. The tools on the new toolbar are:

- Edit Annotation tool for working with existing annotation.

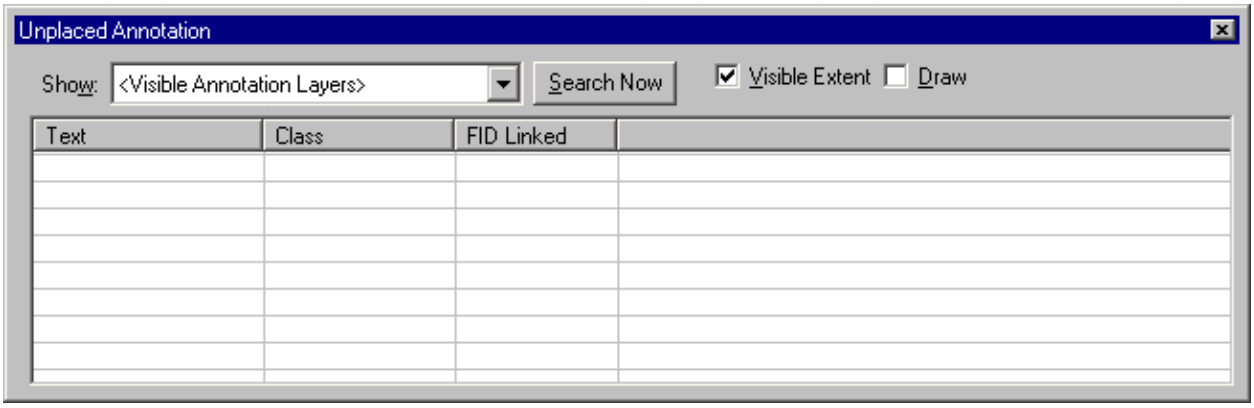
- Construction tools for creating horizontal annotation, angled annotation, and annotation using a leader line.

- Annotation **construction** method dropdown list. Lets you specify the construction method for the newly placed annotation. The available choices are Horizontal, Straight, Curved, Leader Line, and Follow Feature.

- Annotation **text** string used when creating new annotation. Enter text here, then use the construction tools to place annotation on your map. Multi-line 'stacked' text is supported. To enter stacked text, holding CTRL and typing ENTER will move the cursor to the next line.

- Annotation text **symbol** that will be used when creating new annotation. Symbols for annotation features are now stored in the geodatabase. This dropdown list shows all the available symbols defined for this annotation layer. Hovering over a symbol in the dropdown list will list its basic properties including font, font size, vertical alignment, and horizontal alignment. To add new symbols to this list you use ArcCatalog to open the feature class properties for the annotation feature class, and then look in the new Annotation classes tab.

- Unplaced Annotation Manager command launches a new dockable window that lets you find, list, and fix unplaced annotation. In the Unplaced Annotation window, use the Show dropdown list to pick an annotation feature class or a particular annotation class in that feature class. You can further refine the search criteria by checking the Visible Extent option. This option will constrain the search to errors that are within your current display extent:



■ New Keyboard shortcuts make annotation editing faster and easier *(note: not all of these may be implemented in the pre-release):*

E Cycle between the Edit tool, Edit Annotation tool and the Sketch tool.

A Activate the Current Text control on the toolbar (Sketch tool).

F Toggle follow feature functionality for the currently selected annotation. (Edit Annotation tool).

S Activate the Current Symbol control on the toolbar (Sketch tool).

L Flip annotation while using Follow Feature construction method (Edit Annotation tool and Sketch tool).

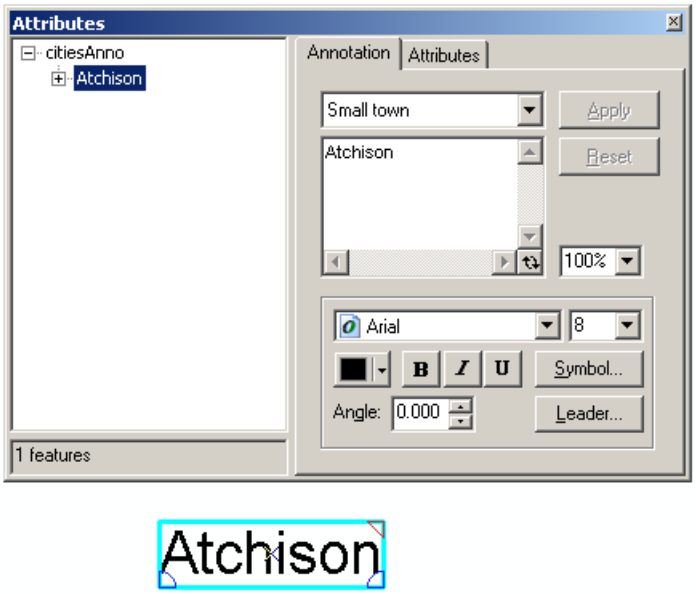
O Open the options dialog for the Follow Feature construction method (Edit Annotation tool and Sketch tool).

P Switch between perpendicular and parallel options while using Follow Feature functionality. (Edit Annotation tool and Sketch tool).

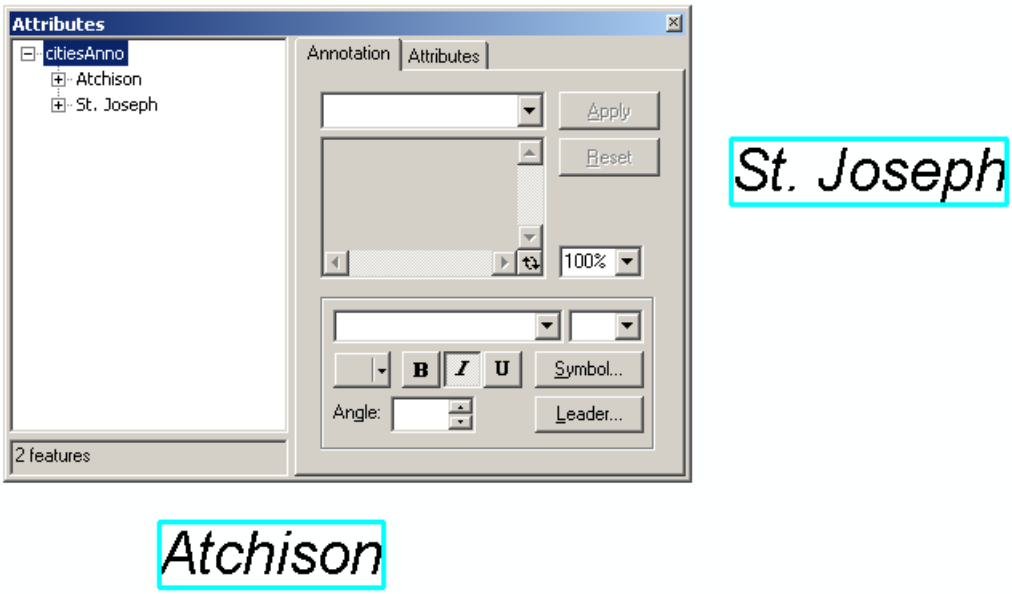
■ There's a new Annotation tab in the Editor>Editing Options dialog for use when editing annotation.

■ The Overflow Labels command in the View menu has been renamed to Overflow Annotation. When you launch this window you can now press **F1** or **SHIFT+F1** while it is active to get help about it.

■ When you edit annotation the Attributes window launched from the Editor toolbar has a new look. The window is smaller, the most common controls are easily available, WYSIWYG editing is available for editing annotation text with most ArcGIS formatting tags, and you can choose a symbol from the annotation symbol list:



In the example below, two annotation features are selected on the map. When the layer name is selected in the tree on the left of the window, changes to any of the annotation attributes shown on the right will be applied to both of the currently selected annotation features. When an individual annotation feature is selected in the list on the left, changes that you make will only be applied to that one feature.



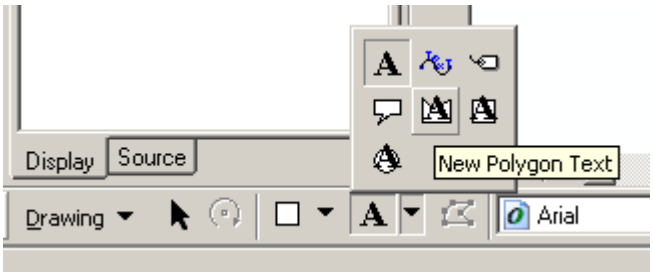
Even though this window doesn't have a ? control in its title bar, you can get context sensitive help on any control in the Attributes window by highlighting the control with the mouse or by pressing the TAB key, and then pressing **SHIFT+F1**. (This way of getting context help works with almost any floating window in ArcMap that does not have a ? control).

■ Three new text drawing tools have been added into the ArcMap Draw toolbar that let you draw a paragraph text annotation: a graphic element containing text formatted like a paragraph. The text flows within the graphic shape. The resulting element has text properties and graphics properties, and some new properties for setting columns and margins to control how the text is positioned inside the graphic. These new properties are presented in a tab called Columns And Margins tab you'll find in the Properties dialog for one of these new graphic elements.

New Polygon Text tool

New Rectangle Text tool

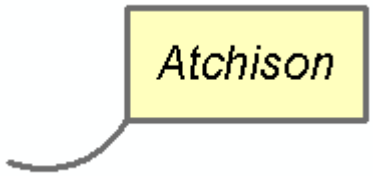
New Circle Text tool



To resize graphics created with these tools, select the graphic and use the handles to scale the graphic, or press the Edit Vertices command .

These tools can be used to create graphic elements, annotation stored in the map document, and annotation stored in a geodatabase. These tools give the same dimension feedback in the ArcMap status bar, and have the same options for specifying their dimensions via the keyboard, that the Circle, Rectangle and Polygon tools have been given at 9.0.

■ New curved leader lines: Two new curved leader lines are available for callouts. Select the Line Callout option when specifying the text symbol background for a text symbol drawn with the Callout tool to see these two new options:



■ The New Annotation Target command in the Draw pulldown menu can no longer be used to create an annotation feature class in a geodatabase, and this command and the dialog it launches has been renamed to New Annotation Group to reflect this change. With this simplification, there are now two basic ways to create an annotation feature class in a geodatabase: create a new, empty annotation feature class in ArcCatalog, or use the Convert Labels To Annotation command to create an annotation feature class from a layer's labels.

Raster data

At ArcGIS 9.0 raster data can now be completely managed through ArcCatalog and the underlying ArcObjects, and is fully integrated into the geodatabase. This results in many improvements in the way that rasters are stored, managed and displayed in ArcGIS. With ArcGIS 9.0. terabytes of raster data (e.g., air photos, scanned maps, and satellite images) can be stored in a central enterprise geodatabase and accessed by multiple users simultaneously. Rasters can be mosaicked into a single raster dataset or managed as a series of tiles in a raster catalog. A new user interface for raster catalogs makes them easier to work with. 9.0 also provides the ability to associate raster data such as digital photos, etc with geodatabase features and by storing the rasters as attributes in fields of type raster. Fields of type raster can also be defined in standalone tables in geodatabases.

Raster datasets

■ Raster datasets can now be added to personal geodatabases as well as enterprise (ArcSDE) geodatabases.

■ Raster datasets added to a **personal geodatabase** are **managed** by the personal geodatabase rather than being actually stored inside the geodatabase like they are with ArcSDE geodatabases. The personal geodatabase automatically stores the raster data locally as IMG files in a folder named after, and located in the same folder as, the personal geodatabase. For example, if your personal geodatabase is called Canada, the folder containing the raster data that it manages will be called Canada.idb. This folder is managed directly by the geodatabase and does not appear in ArcCatalog.

■ ArcGIS 9.0 introduces partial pyramid building for raster datasets stored in ArcSDE geodatabases, a major performance improvement from previous versions. Instead of rebuilding pyramids for the entire extent of the raster dataset, only the area affected by the data being loaded into the raster dataset (mosaic) needs to have it's pyramids rebuilt. This facilitates easy raster dataset mosaicking because now even very large raster datasets in ArcSDE geodatabases can be updated easily.

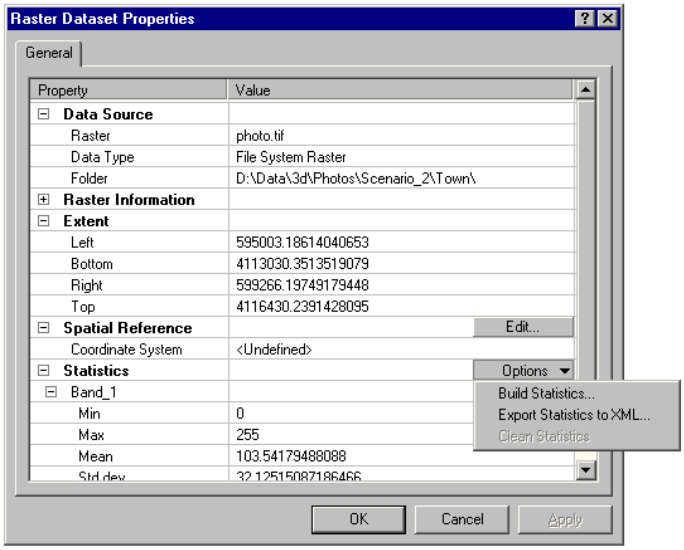
■ Versioning and geodatabase raster data at 9.0: Raster data cannot be versioned at 9.0, but this is functionality that we hope to implement in the future.

Note: Because fields of type raster (see the heading entitled 'Raster fields' later in this section for more about these fields) are stored in geodatabase feature classes and tables, and those entities themselves can be versioned, the raster data in this scenario does become a shallow version. The raster data of the parent version remains present as long as children versions of the data do not post any deletions or changes back to the parent. Addition of raster data also does not affect the parent version unless posting occurs.

■ *(This note reflects how 9.0 final release will work. It may or may not apply to the pre-release)* The ESRI GRID raster format is now able to hold more than 2.1 GB of data. At 9.0, there is no limit to the amount of pixel data which can be stored using an ESRI GRID. For very large imagery, however, the use of the enterprise (ArcSDE) geodatabase is recommended as large files/folders are difficult to manage and slow to process.

Additionally, more than 25 ESRI GRIDs can now be added to a single ArcMap session. This will improve the ability to look at many raster datasets at one time, in the same map document.

■ The raster dataset properties dialog in ArcCatalog now features a tree control that makes it easy to quickly browse through the various properties of a raster. The tree also gives access to options like building statistics:



(Note the Clean Statistics command shown above is removed for 9.0 final)

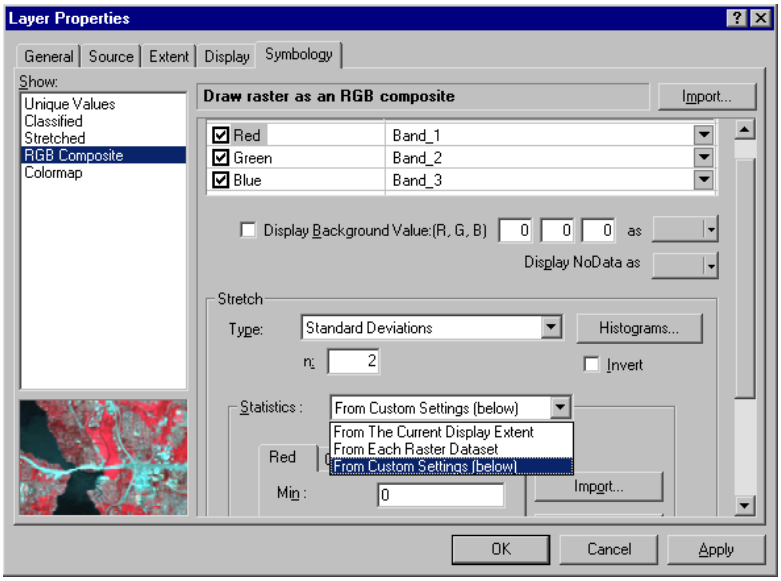
■ Additional rendering functionality is now available for drawing raster datasets. The Symbology tab in the properties dialog for a layer based on a raster dataset has been enhanced as follows:

- Better management of how image stretch rendering is applied: based on the statistics from the whole image, the visible portion of the image (per display raster stretching), or user defined statistics.

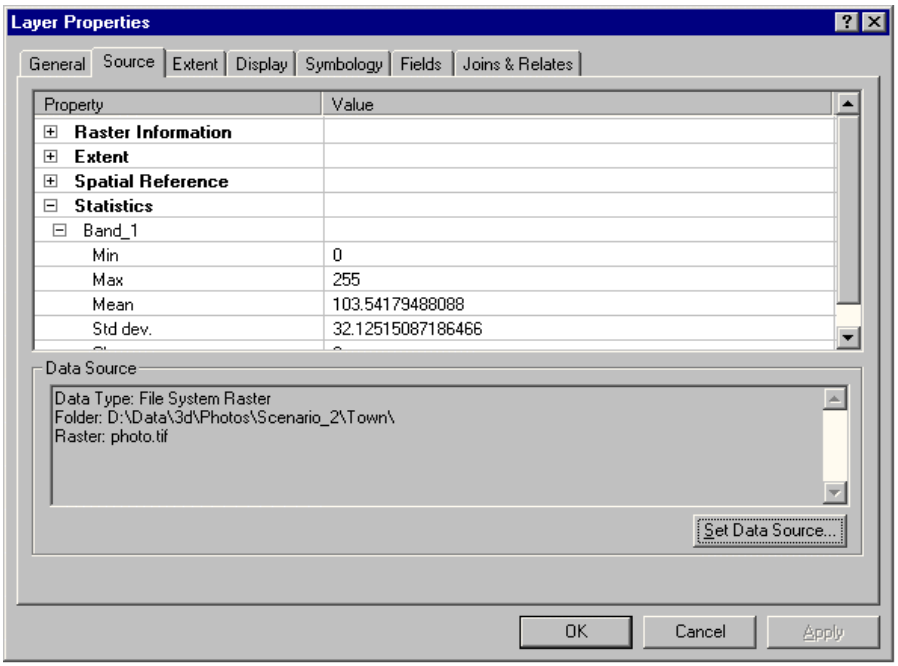
- A ColorMap renderer is now included to display raster datasets with built in colormaps.

- New Import button adds the ability to import raster symbology properties from a layer (.lyr) file. A limitation at 9.0 is that the Import button only imports the renderer settings. It doesn't change or set the renderer type. So for example if you import symbology from a raster layer which used the Stretch renderer, you have to already be in the Stretch renderer panel in the Symbology tab to import all the settings for this renderer correctly.

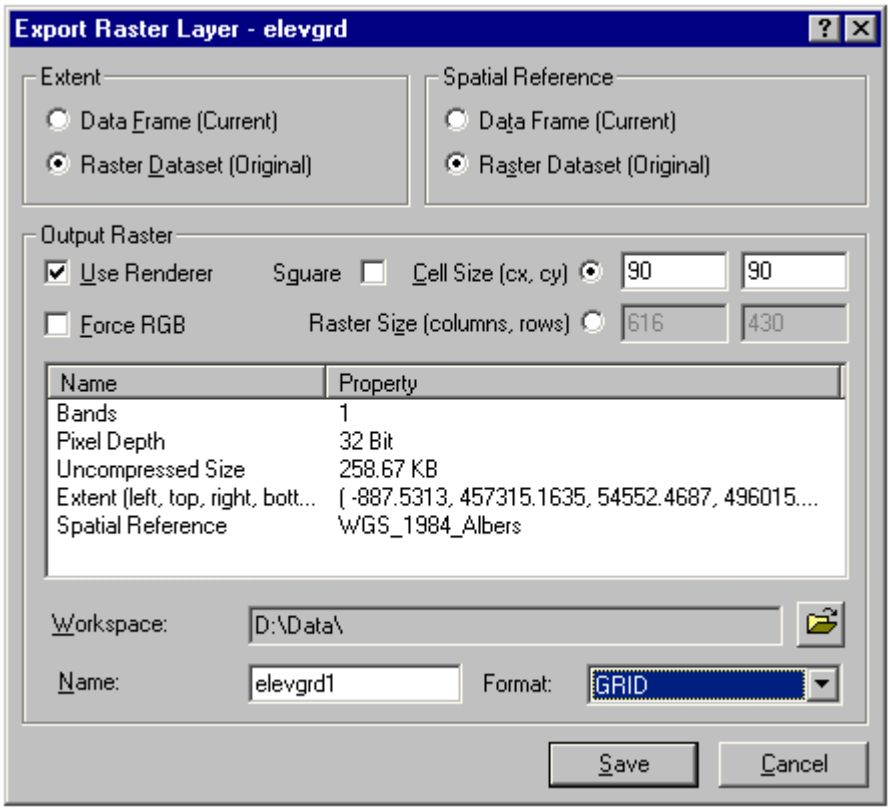
- New ability to choose background values as an RGB composite value.



■ The Source tab in the properties dialog for a layer based on a raster dataset has changed to include part of the same tree control used in the raster dataset properties dialog in ArcCatalog:



■ You can now export raster data from a layer based on a raster dataset in ArcMap using the new Export Data command you'll find in the layer's context menu. You can either use the extent of the raster dataset represented by the layer or the current extent displayed in the data frame. You also have the option of exporting the data using the layer's current raster symbology:



■ Several new raster dataset formats are supported at 9.0 (read-only):

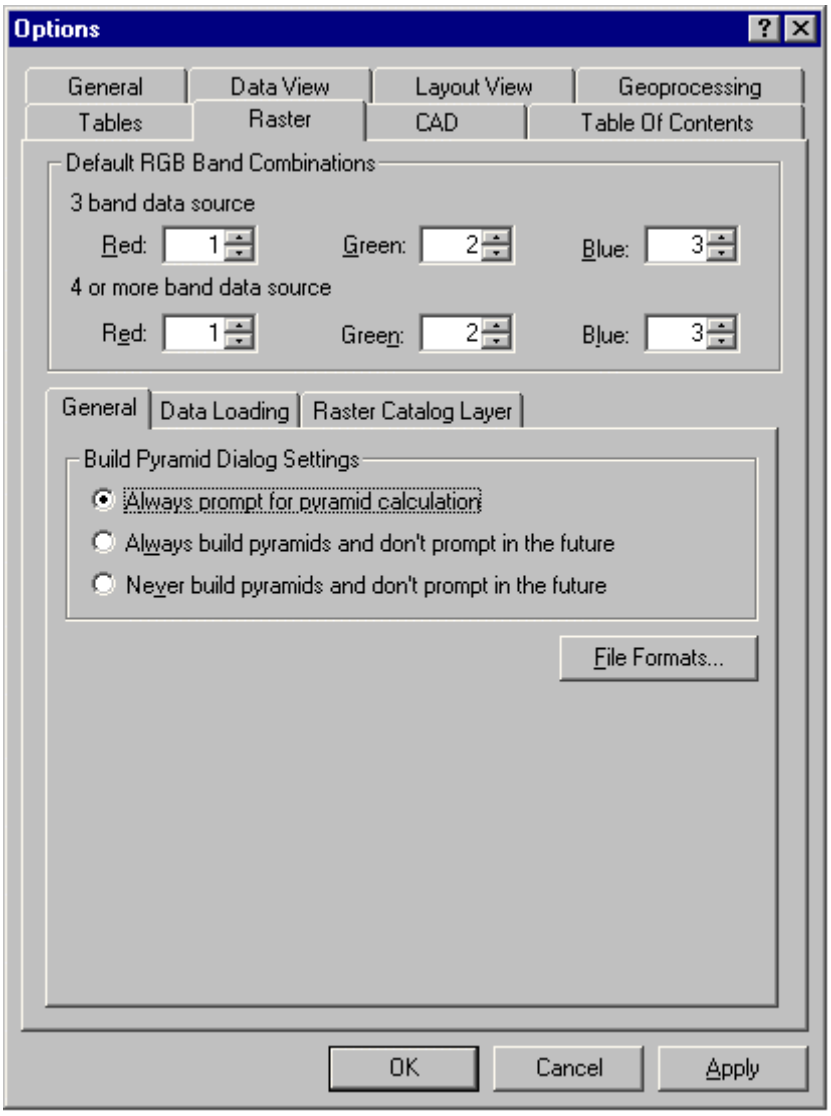
- JPEG2000 (i.e. GeoJP2 from MSI)

- Integraph's CIT/COT

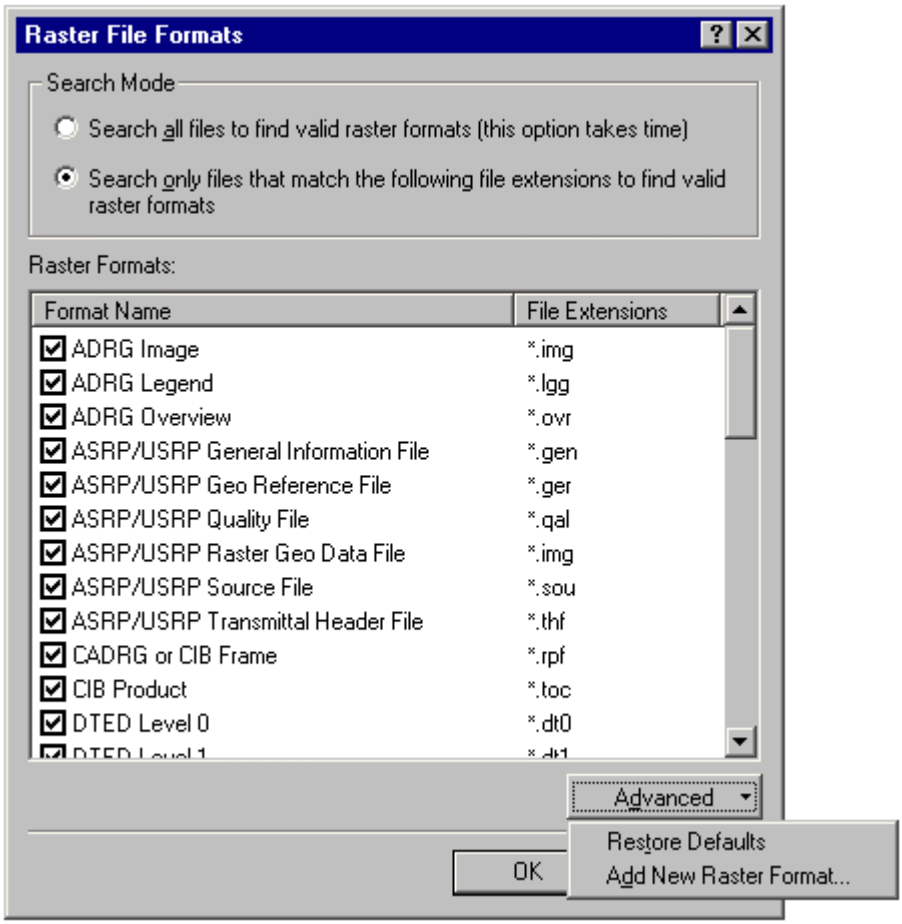
- DIGEST ASRP/USRP

- MrSID (generations 2 and 3). Note: the Export command Raster To MrSID outputs in MrSID generation 2 format.

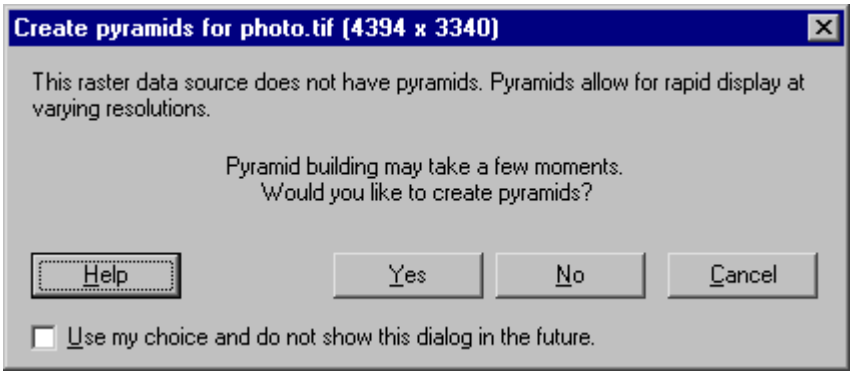
■ The Raster tab in the Options dialog accessed from the Tools pulldown menu in all the ArcGIS Desktop applications has been enhanced to provide additional settings via three sub-tabs.



The handling of raster file formats has been improved so that file formats are now specified in their own dialog launched from the General sub-tab on the Raster tab in the Tools > Options dialog. The Advanced menu button gives you the option of defining a new raster format by specifying a .dll (note: a .dll that requires additional helper .dlls may not be added using this option):



■ The dialog that prompts you about building pyramids when you add them into ArcMap, etc has been improved. You can now press Cancel to cancel the addition of the data and do nothing:



■ In ArcGIS 8.x, when you attempted to display the properties dialog a raster layer that had many unique values, a message pops up if there are more than 2048 unique values. The message tells you that because of the excessive number of unique values, the Symbology tab will not have a Unique Values renderer, and the Fields tab and Joins and Relates tab will not be present in the layer properties dialog. At 9.0 the behavior of rasters with many unique values is still the same, but the pop up message is no longer displayed.

Raster catalogs

■ The handling of raster catalogs has been revamped in 9.0. Raster catalogs can now be created in personal geodatabases and ArcSDE geodatabases as geodatabase objects appearing with their own icons in ArcCatalog:

 Raster catalog in geodatabase

You can create a new raster catalog by right-clicking a geodatabase in ArcCatalog and choosing the New>Raster Catalog command.

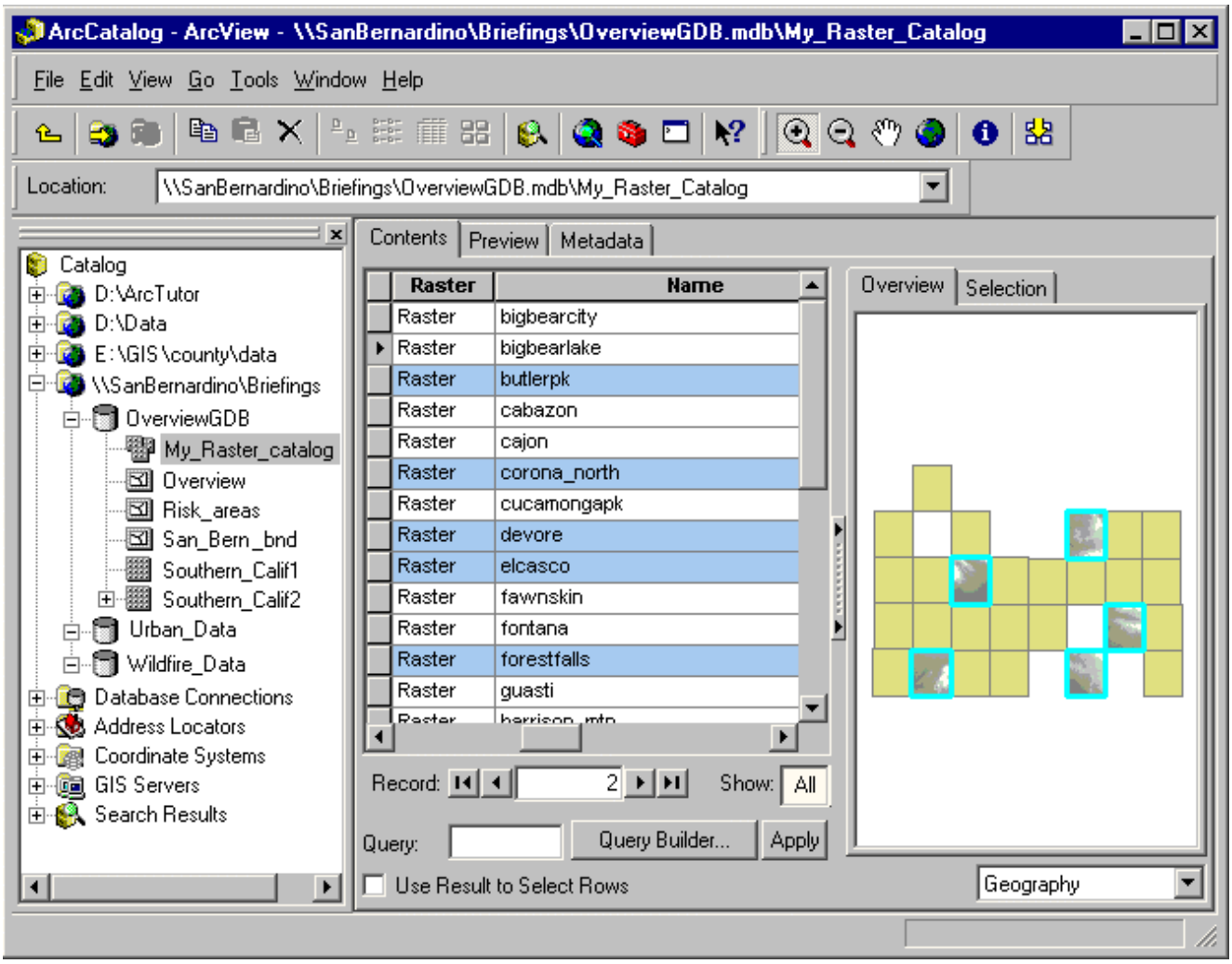
The footprints of each raster in a raster catalog are stored as polygon features with attribute information making it possible to perform spatial queries and selections for data management, corridor analysis, display, etc.

■ When you create a new raster catalog in a **personal geodatabase**, the raster catalog's data isn't actually stored inside the geodatabase like it is if you create it in an ArcSDE geodatabase. Instead when you create a raster catalog in a personal geodatabase you choose whether the data will be **managed** or **not managed** by the personal geodatabase. You make this choice in the New Raster Catalog Wizard in ArcCatalog by setting the 'Managed By' property on the raster field to either Yes or No:

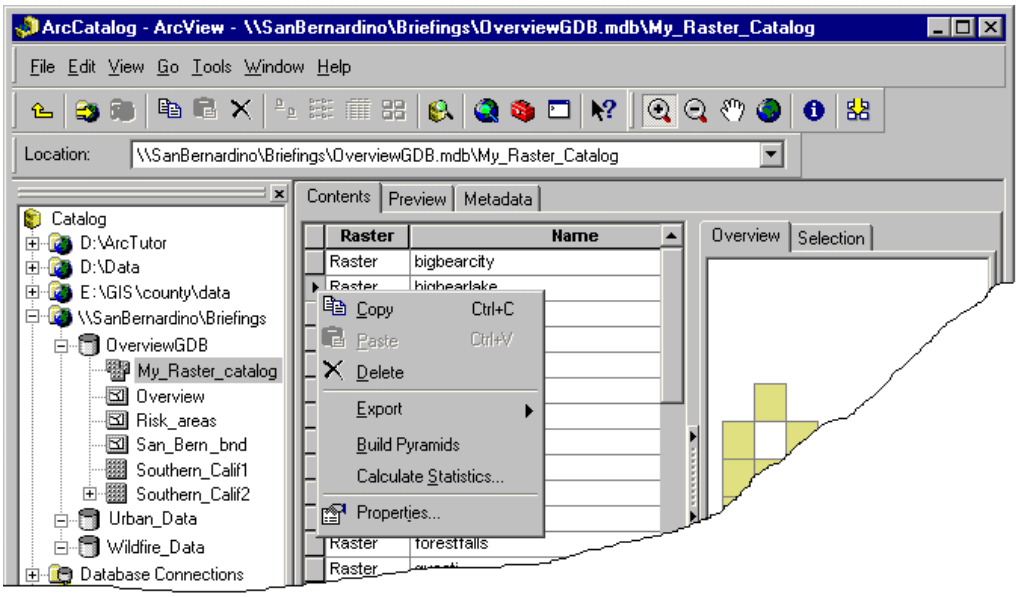
- If the raster catalog's data is **managed** by the personal geodatabase, the rasters in the catalog will be automatically stored locally as IMG files in a folder named after, and located in the same folder as, the personal geodatabase. This folder is managed directly by the geodatabase and does not appear in ArcCatalog.

- If the raster catalog's data is **not managed** by the personal geodatabase, the rasters in the catalog will be automatically referenced from the geodatabase to their disk location, linked by their pathname. This facilitates quick catalog creation and easy prototyping of managed solutions. Non-managed raster catalogs are similar to traditional image catalogs where the data is managed by the user and not by the database.

■ New tools are provided for browsing and managing these new raster catalogs. When you select a raster catalog in ArcCatalog, you see a special new view in the Contents tab that combines a table preview, a geography preview showing one or more rasters, and a query builder for selecting rasters. This facilitates straightforward management, display, and query of raster catalogs:



You can load raster datasets into a raster catalog by right-clicking it and choosing Load Data. To manage a raster dataset inside a raster catalog, in the Contents tab, locate the record for the raster dataset in the table, and then right-click in the first column (the grey column) in the table to the left of the record:



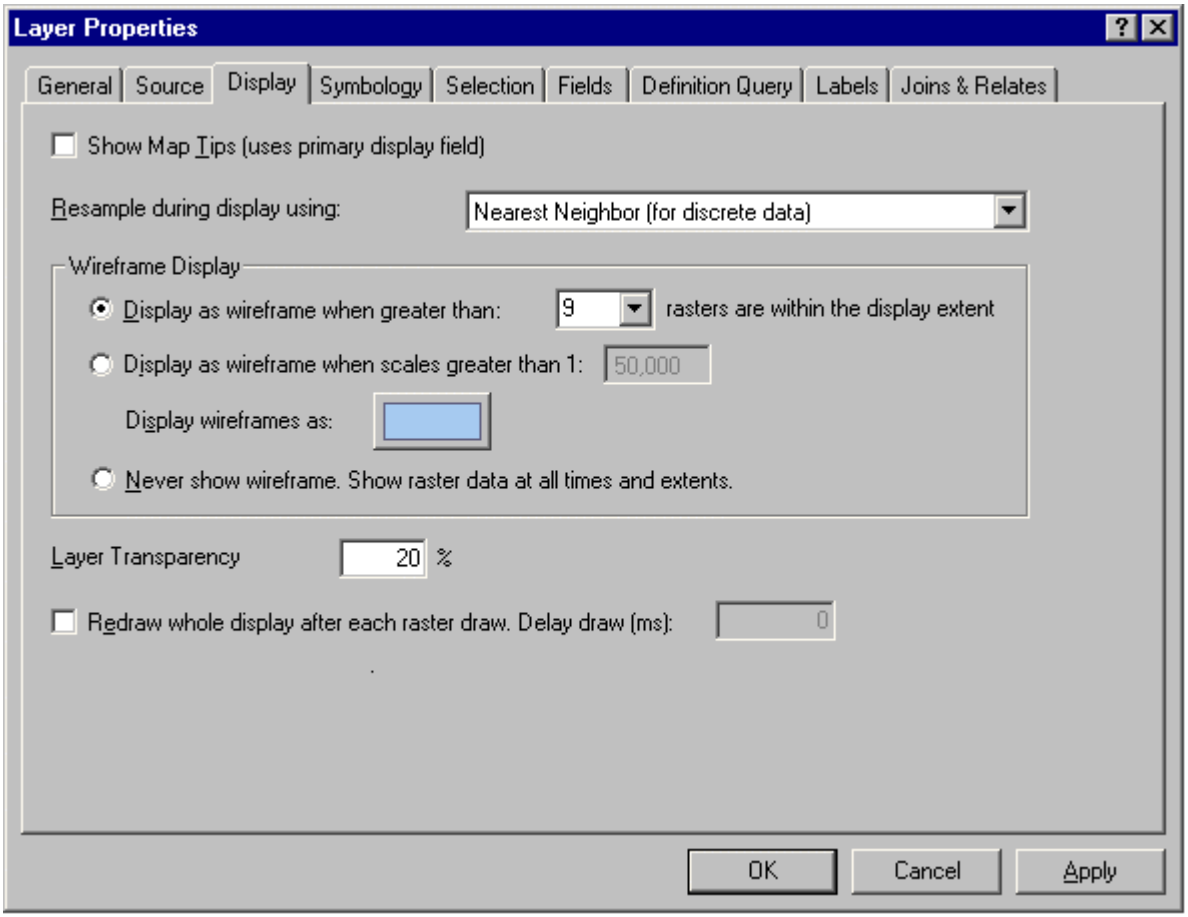
ArcGIS 8.3 raster catalogs and file based (*.dbf, *.txt, and INFO) raster catalogs can still be used but they do not have any of the new geodatabase raster catalog functionality and are not shown with the new icons.

■ Raster Catalogs can now store rasters of varying type (3 bands, B/W, colormap…) within a single raster catalog. Rasters within a raster catalog no longer have to be of the same type. A heterogeneous raster catalog can be rendered using different renderers for its members. Note that heterogeneous raster catalogs are not ideal for all applications and are not recommended if you are aiming for optimum performance. They tend to be slower to draw, and the stretching on the images tends to be harder to control. This multiple type functionality is available though because it can be useful in particular situations. In general rasters of different type should be mosaicked together into single rasters.

Since raster catalogs at 9.0 no longer have to be of the same type, you can specify **multiple renderers** when you use the Symbology tab in a Raster Catalog Layer's Properties dialog. The most appropriate renderer is automatically applied to the appropriate raster in the raster catalog. The Symbology tab lists the renderers that are available for the contents of the raster catalog. You can edit this his list of renderers to add or remove various renderers. Only the renderers in the list can be used in rendering. In the available renderers list, you'll see an asterisk next to each of the renderers that are currently active and are applied to one or more raster dataset members of the raster catalog. As multiple renderers can be used for raster catalog layers, raster catalog layers don't show their symbology in the Table Of Contents.

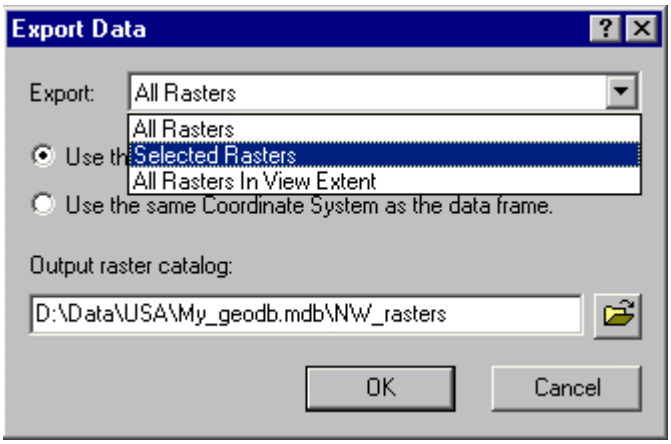
■ Rendering of raster catalogs has been vastly improved. Raster catalogs have the same new rendering capabilities as raster datasets (see the Raster datasets section above for more about improved raster rendering in 9.0).

In the Raster Catalog Layer Properties dialog, the Display tab lets you specify various options for viewing the contents of the raster catalog either as rendered rasters or just as a wireframe showing the footprint polygons:



■ As the footprints of the rasters in raster catalogs are polygon features, these raster footprints can be easily displayed and queried. You can open the attribute table of a raster catalog layer and work with these footprint polygons like any other features.

This also makes it very easy to perform sub-setting of raster catalogs. In ArcMap, you can right-click a raster catalog layer and choose Export Data. The Export Data dialog lets you create a new raster catalog from some or all of the rasters:



Raster fields

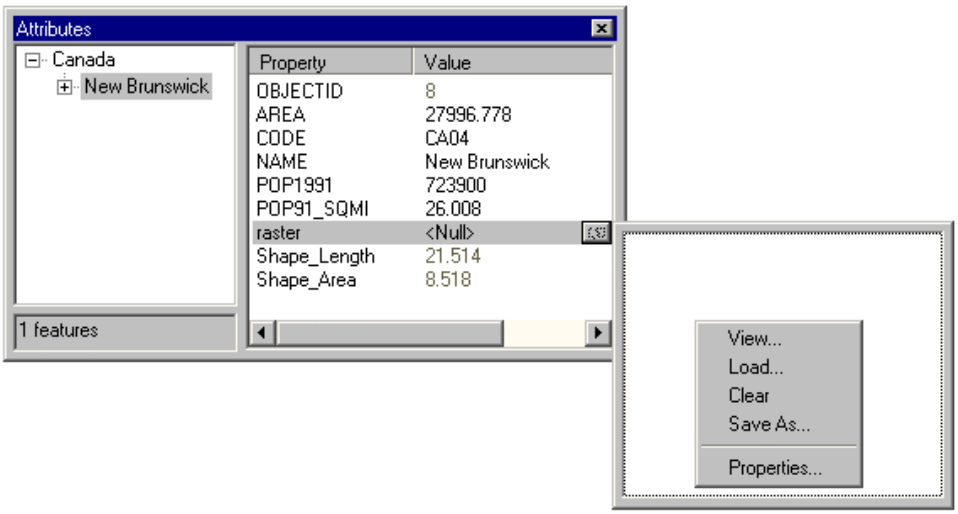
■ The attribute tables of geodatabase feature classes and standalone tables in personal geodatabases and ArcSDE geodatabase can now contain fields of type **raster**. A raster type field can contain any supported image, picture or raster dataset, such as a digital photo of a feature, a scanned floor plan, etc. Raster fields are defined in ArcCatalog when you create a feature class or table in a geodatabase or add fields to it after it has been created. They are not supported for shapefiles/dBASE tables or coverages/INFO files. Only one raster field can be defined for a particular feature class or standalone table. If more than one field of type raster is needed a related table can be used.

■ When you define a new raster field in a feature class or standalone table in a **personal geodatabase**, the raster field's data isn't actually stored inside the geodatabase like it is if you define it in an ArcSDE geodatabase. Instead when you define a raster field in a personal geodatabase you choose whether the data will be **managed** or **not managed** by the personal geodatabase. You make this choice by setting the 'Managed By GDB' property on the raster field to either Yes or No when you define it.

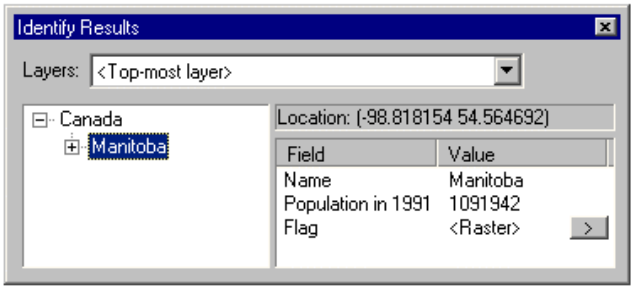
- If the raster field's data is **managed** by the personal geodatabase, the rasters in the field will be automatically stored locally as IMG files in a folder named after, and located in the same folder as, the personal geodatabase. This folder is managed directly by the geodatabase and does not appear in ArcCatalog.

- If the raster field's data is **not managed** by the personal geodatabase, the rasters in the field will be automatically referenced from the geodatabase to their disk location, linked by their pathname.

■ Once you've defined a raster field, you can add data into it in an edit session in ArcMap. In ArcMap, start editing in the normal way. Select the feature you want to add a raster to, click the Attributes button in the Editor toolbar to open the Attribute Inspector widow and then click the > button next to the raster field. In the empty popup window that appears, right-click and then choose the Load command. This will open a dialog that lets you choose the raster to load. This is also how you replace an existing raster with a different one. To delete a raster, choose the Clear command:

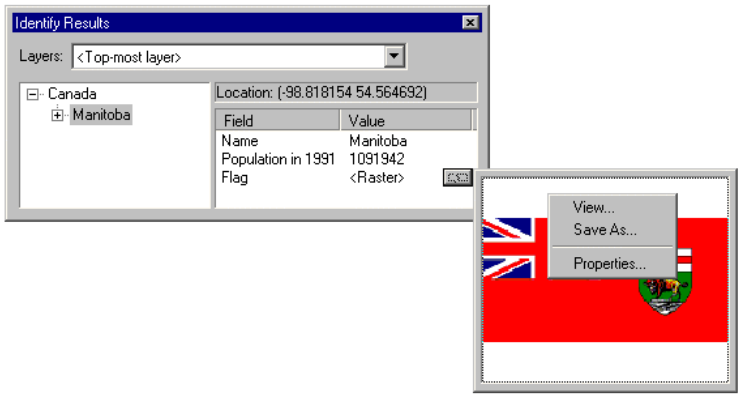


■ When you identify a feature containing a raster field in any ArcGIS Desktop application or in ArcReader, you'll see a small button next to the raster field if a picture exists for the record:



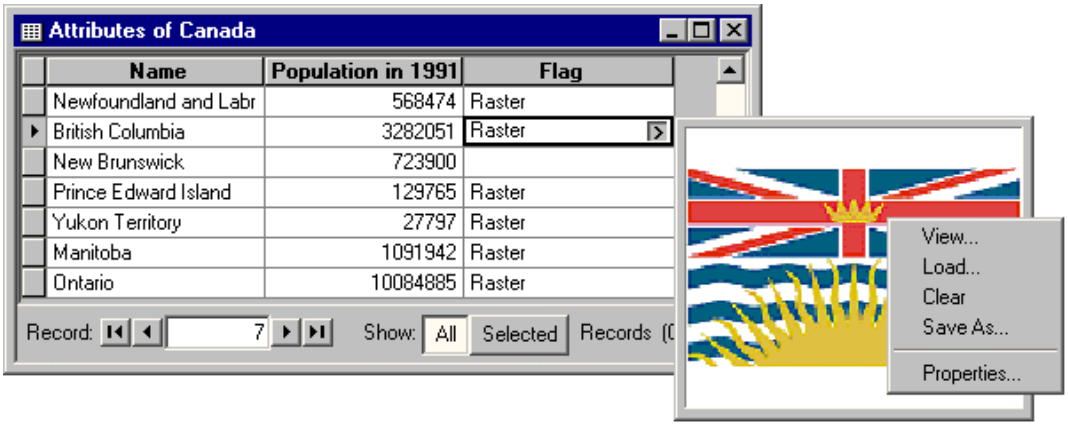
Click that button to see the raster in a small popup window:

Right-click in the popup window to see more options:



Choose the View command (or just left-click in the pop-up window) to view the raster in a floating resizable window:

■ You can also view the content of raster fields in Table window in ArcMap, ArcScene and ArcGlobe. In the Table window, first click inside the raster field to make the '>' button appear, then click that button to view the raster. In the Table window, records for raster fields that contain pictures are shown with the value 'Raster'. A record with an empty value for a raster field indicates that a raster has not yet been loaded into the field for that record. In the example below, the attribute table has been opened during an edit session in ArcMap, so the Load and Clear buttons in the context menu for the popup window are enabled.



Other ArcMap changes

Quick ArcMap 9.0 tips

■ When you add layers into ArcMap, they are now automatically selected in the Table Of Contents. This lets you find them easily and immediately perform operations on them all by right-clicking or using one of the shortcuts listed below. Added multiple layers and you just want to work with one of them? Click on the layer you want to work with to deselect the others.

■ You can now drag/drop and copy/paste multiple layers in the Table Of Contents.

■ You can now drag/drop and copy/paste multiple layers between two ArcMap sessions.

■ You can now drag/drop and copy/paste data frames between two ArcMap sessions.

■ To quickly duplicate layer(s) in a data frame:
- Hold down **CTRL** and drag/drop them in Table Of Contents.

■ To quickly activate a different data frame:
- Hold down **ALT** and click its name in the Table Of Contents.

■ To move layer(s) instead of copying them when you drag them between data frames or ArcMap sessions:
- Hold down **CTRL** while you drag/drop

■ To rename the selected item in the Table Of Contents:
- Press **F2**

■ To expand/collapse all items at one level in the Table Of Contents hierarchy:
- Hold down **CTRL** and click the +/- control next to any item at that level. If any items are currently selected, click the +/- control next to any selected item to just expand/collapse the selected ones).

■ To expand/collapse an item in the Table Of Contents while you are dragging data:
- Hover over the +/- control next to the item and wait a bit.

■ To add data directly into a group layer:
- Right-click the group layer and choose the Add Data command.

■ To give the Table Of Contents keyboard focus so you can use keyboard to navigate and interact with it:
- Click anywhere inside the Table Of Contents *or* press **F3**

■ To return keyboard focus to the map so key strokes are sent to the map instead of the Table Of Contents:
- Click anywhere on the map *or* press **ESC**

■ To turn on/off the currently selected layers in the Table Of Contents:
- Hold down **CTRL** and click the check box next to any of them *or* press **SPACE**

■ To open the properties of the selected item in the Table Of Contents:
- Press **ENTER**

■ To drop layer(s) so they come immediately after a group layer (without having to collapse the group layer):
- Drag the layer(s) after the group layer and then move the cursor over to the left before you do the drop. A little vertical line at the left end of the horizontal 'drop' bar indicates which level in the hierarchy the layer(s) will be dropped into.

Geoprocessing in ArcMap at 9.0

■ The new geoprocessing framework introduced at 9.0 is fully integrated into ArcMap. Geoprocessing tools can be run from inside ArcMap, either by launching them directly from the new ArcToolbox window or by entering them as commands in the new Geoprocessing command line window. Layers and tables in your current map can be used as inputs to geoprocessing, and outputs can be automatically added to the map as layers. You can combine tools together in models and scripts and run these inside ArcMap. See the 'Geoprocessing' section of this document for more about the new framework.

■ At 9.0, the two geoprocessing wizards in ArcMap:

- Geoprocessing Wizard 

- Buffer Wizard 

have been removed from the ArcMap Tools pulldown menu. In 9.0 we encourage you to perform geoprocessing using the tools in the ArcToolbox window to get the benefits of the new geoprocessing framework.

Tip: You can still find the two 8x geoprocessing wizards in the Tools category in the Tools > Customize dialog. If you still wish to use these wizards, you can add them into any ArcMap toolbar or pulldown menu from that dialog. One reason to use the 8x Buffer Wizard is that it allows you to buffer graphics drawn on the map. No further development is planned on these wizards. *Note: in 9.0 final the Geoprocessing Wizard is no longer available in the Tools > Customize dialog. It has been completely removed from the product.*

Where to find the 8x Buffer Wizard operations in the ArcToolbox window at 9.0:

Buffer at a specified distance or based on distances taken from a field:
'Analysis Tools' toolbox > Proximity > **Buffer**

Buffer creating multiple rings:
'Analysis Tools' toolbox > Proximity > **Multiple Ring Buffer**

Where to find the 8x Geoprocessing Wizard operations in the ArcToolbox window at 9.0:

Dissolve:
'Data Management Tools' toolbox > Generalization > **Dissolve**

Merge:
'Data Management Tools' toolbox > Feature class > **Append**

Clip:
'Analysis Tools' toolbox > Extract > **Clip**

Intersect:
'Analysis Tools' toolbox > Overlay > **Intersect**

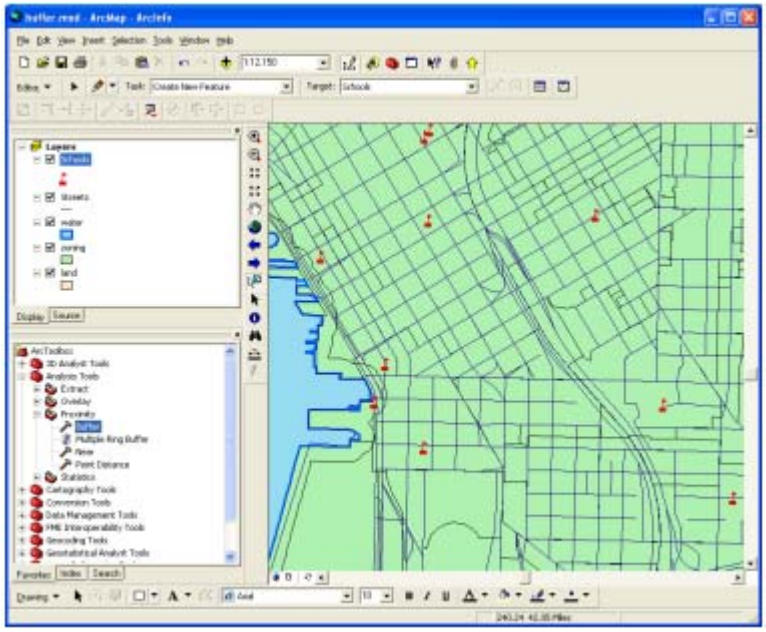
Union:
'Analysis Tools' toolbox > Overlay > **Union**

■ **Quick overview of how to perform geoprocessing in ArcMap at 9.0**

1. In ArcMap, open the ArcToolbox window by clicking the Show/Hide ArcToolbox Window  button on the Standard toolbar. When you open the ArcToolbox window from inside ArcMap, any tools you launch from the window are able to access the layers and tables in your current map document, and to add their output

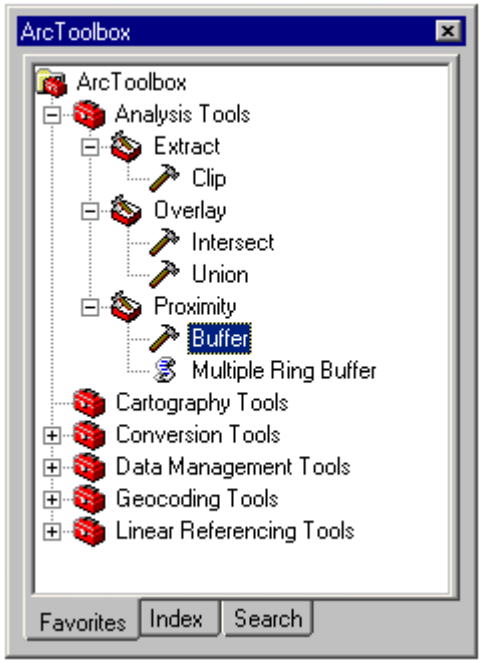
back into the map for immediate display. You can run the tools from inside ArcCatalog too, but the tools won't be able to access the contents of your map, only data sources in ArcCatalog.

Tip: The ArcToolbox window is a dockable window and the first time you open it after installing ArcGIS 9.0 it will dock vertically into your ArcMap window. A convenient location for the window is docked underneath the Table Of Contents window. You can just drag and drop it to that location:



Tip: To undock the ArcToolbox window, click the bar at the top of it. Once undocked, the window will normally try to dock when you move it over the ArcMap window. To prevent a dockable window from docking, hold down **CTRL** while you move it.

2. In the ArcToolbox window, double-click the tool you want to use. For example, here's what you see in the 'Analysis Tools' toolbox if you are an ArcView user:

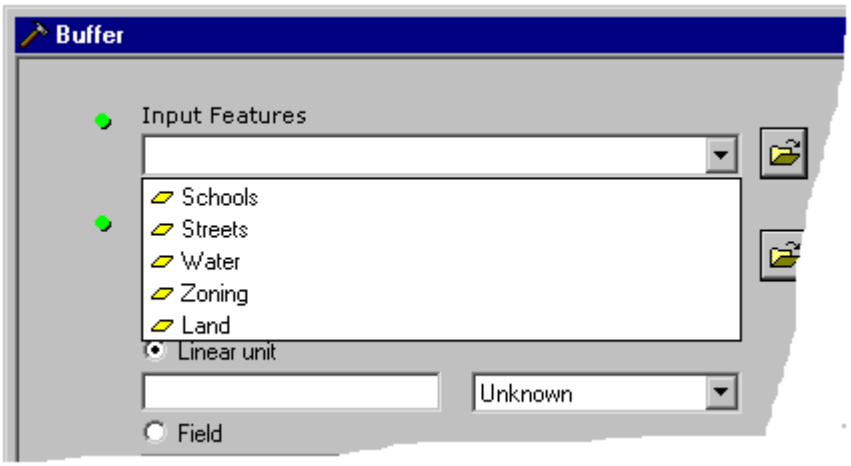


Tip: By default, core ArcGIS tools that you are not currently licensed to use are hidden in the ArcToolbox window. To see tools that you are not licensed to use, right-click the 'ArcToolbox' entry at the top of the tree and uncheck the Hide Locked Tools command. All the tools providing operations found in the Buffer Wizard and Geoprocessing Wizard at ArcGIS 8x are available in ArcToolbox 9.0 for all product licenses (ArcView, ArcEditor and ArcInfo).

3. If you wish to perform the operation on a subset of the features in a particular layer, you can make the selection before or after launching the tool. The new geoprocessing tool dialogs are non-modal, which means that you can continue to work on your map while a tool is open. Unlike the ArcGIS 8x wizards, you can adjust your feature selection after you launch one of the new geoprocessing tools. The tool dialogs look at what features are selected at the time you execute the operation (i.e. when you press OK on a tool dialog), not when you launch the tool dialog.

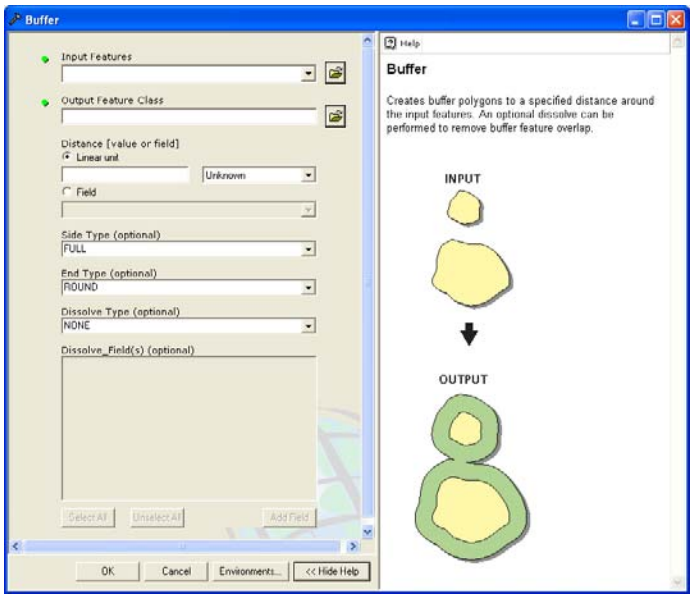
   When launched from inside ArcMap, the geoprocessing tools always respect the currently selected set of features. There's no option inside the geoprocessing tool dialogs to choose between using all the features in a layer or just the currently selected set. If a set of selected features exists for a feature layer you use as an input to a geoprocessing tool, that set of features will be used in the operation. If no set of selected features exists, all the features in the layer will be used.

4. In the tool dialog that appears for the tool you chose, specify the input data and other parameters. To specify a layer in your map as an input, click the dropdown list to choose one of the layers from your active data frame:



   To fill in input fields you can also drag and drop layers from ArcMap's Table Of Contents, click the Browse button and locate any dataset using the Catalog Browser, or type or paste in layer names or pathnames to datasets.

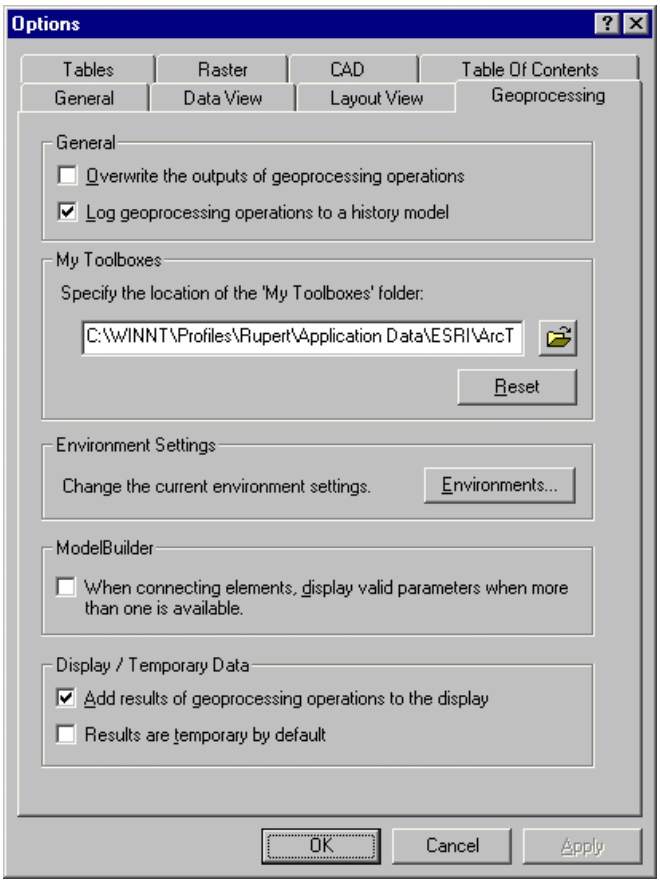
   Tip: Click the Show Help button in the tool dialog to display the Help panel. This panel gives you an overview of the tool. To get help on individual controls in the dialog, simply click them. Help about the control you clicked on will appear in the help panel. Click the Help button at the top of the panel to launch the topic about this tool in the ArcGIS Desktop Help.



5. While the operation is processing, a progress dialog appears. Once it has finished, a layer representing the output data will appear in the Table Of Contents.

■ More geoprocessing tips for ArcMap users

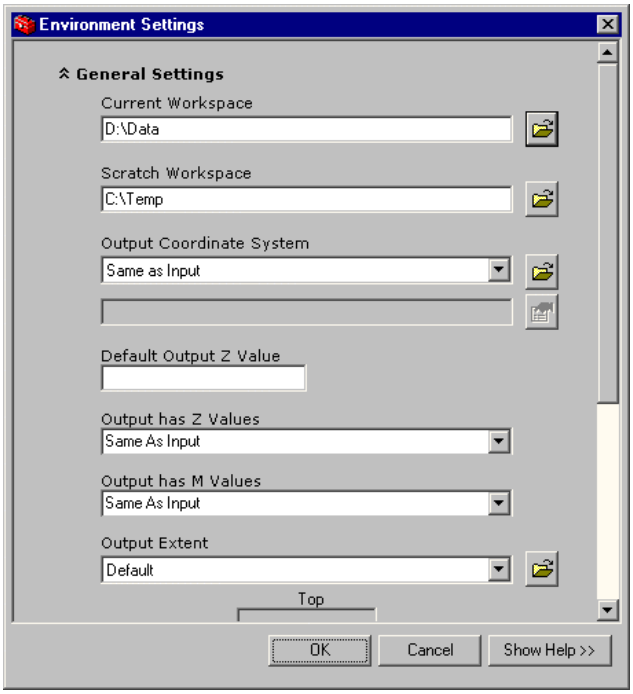
- You can control various aspects of how geoprocessing works by choosing the Options command from the ArcMap Tools pulldown menu and going to the new **Geoprocessing tab**. Settings you make in this tab apply to all the ArcGIS Desktop applications (the Display / Temporary Data options don't apply to ArcCatalog).



If you want geoprocessing operations to overwrite existing outputs with the same name, check that option at the top of the tab. When this is checked, geoprocessing operations don't prompt you if an output already exists: they automatically overwrite the output. *(In 9.0 Pre-Release, this option is checked by default).*

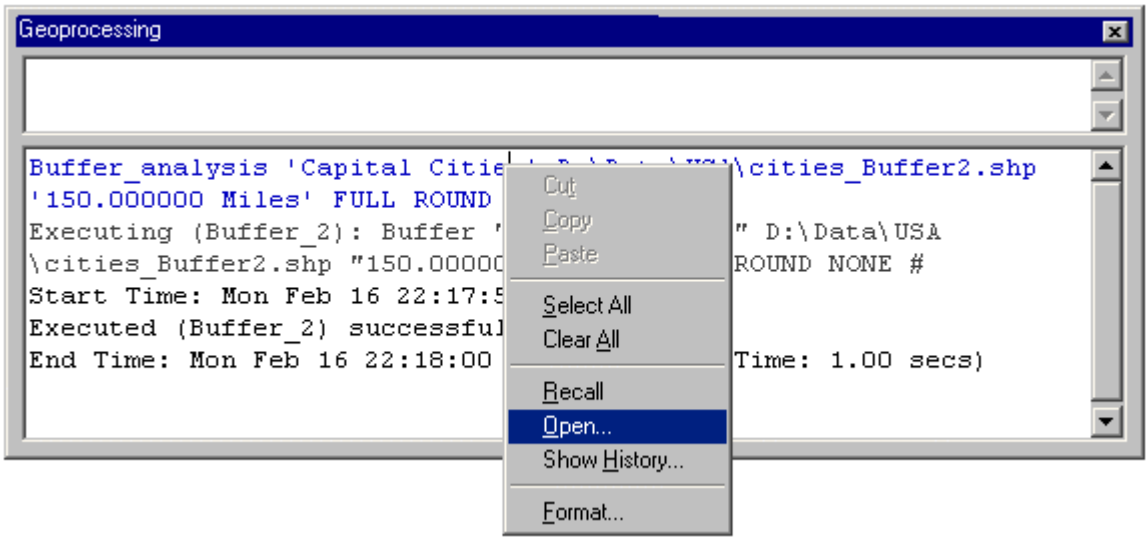
The 'Results are temporary by default' option at the bottom of the tab makes it easier to clean up unwanted output data, such as data representing intermediate steps in geoprocessing operations you perform. When this option is checked, a layer added into your map by a geoprocessing operation will be considered temporary by ArcMap. If you remove this layer from your map's Table Of Contents, ArcMap will automatically delete the data on disk that this layer represents when you close the map document or exit ArcMap. When you save your map document, any temporary layers remaining in the Table Of Contents automatically become permanent. If you close the application without saving the document, the data for temporary layers remaining in the Table Of Contents is automatically deleted.

- In the Tools > Options dialog Geoprocessing tab, press the **Environments** button to launch a dialog that lets you specify additional settings for your geoprocessing work. For example, the Current Workspace setting in the Environment Settings dialog lets you specify a folder or geodatabase which will serve as the default location for inputs and outputs you specify in geoprocessing tools, which saves you having to specify a pathname if you type in the name of an input or output:



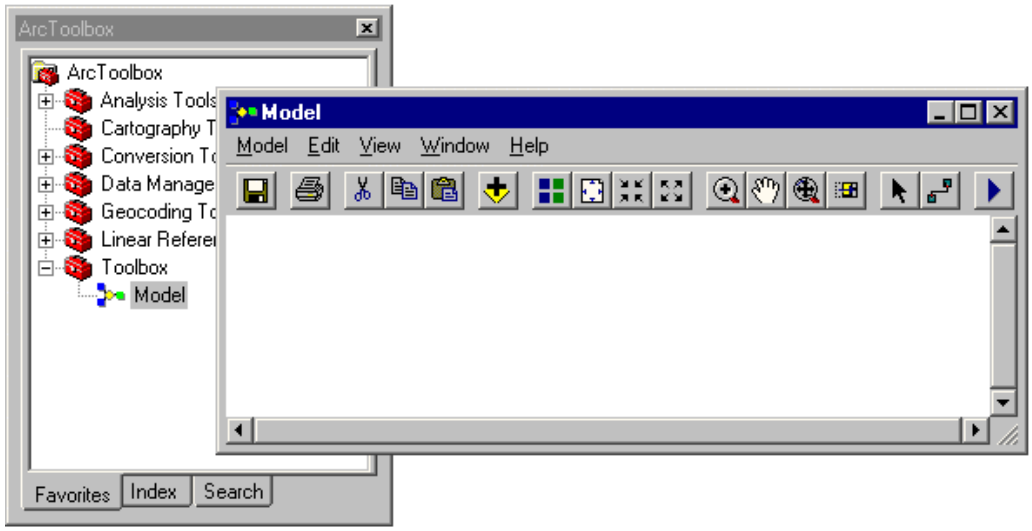
You can also launch the Environments dialog from the context menu you get by right-clicking the 'ArcToolbox' entry at the top of the ArcToolbox window tree. These settings apply to the current map document you are using and get saved into that document. To temporarily override your current environment settings for a particular operation you run from a tool dialog, press the Environments button on the tool dialog and modify the settings in the dialog that appears.

- To make it easy to re-execute operations you perform, open the Geoprocessing window before you run the geoprocessing tools. You can open this dockable window by clicking the Show/Hide Geoprocessing Window button on the Standard toolbar. When you run one of the geoprocessing tools from the ArcToolbox window, the underlying command executed by the tool will appear in blue in the message area of the Geoprocessing window. Right-click the command to access a context menu:



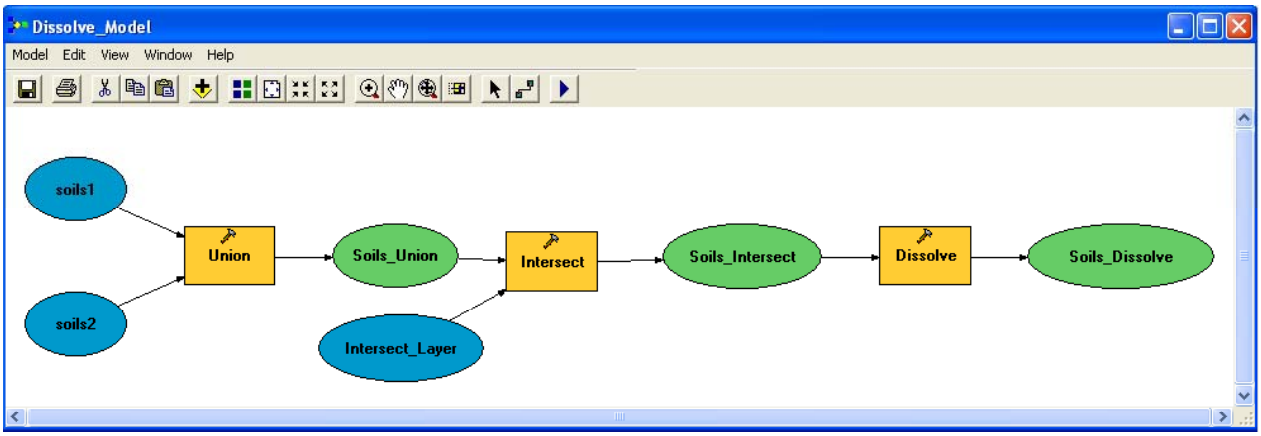
Choose **Open** from the menu to re-open the tool dialog for the operation you just performed. Choose **Recall** from the menu to put the command into the top part of the window so that you can make any adjustments to the options used, and then press RETURN to execute it. *(These two commands may not be available in the pre-release software)*

- You can combine geoprocessing operations together in models and scripts to automate repetitive tasks or create analytical models. To create a **model**, first create a new, empty toolbox in the ArcToolbox window to contain the model. Right-click the 'ArcToolbox' entry at the top of the tree and choose the New Toolbox command. Then right-click the new toolbox that appears and choose the New Model command. An empty ModelBuilder window will appear:



You can now drag and drop layers from the Table Of Contents and tools from the ArcToolbox window into the ModelBuilder window to build your model. In the ModelBuilder window, use the Add Connection tool to connect layers and tools. Double-click tools to launch their dialogs so you can enter their parameters. To run a model, press the Run button.

For example, the following model takes two soil layers and performs a Union to create an output layer. An Intersect is then performed on the output layer to create a new layer, Soils_Intersect. The Dissolve operation is then run on the output from the Intersect operation to create the final layer, Soils_Dissolve:

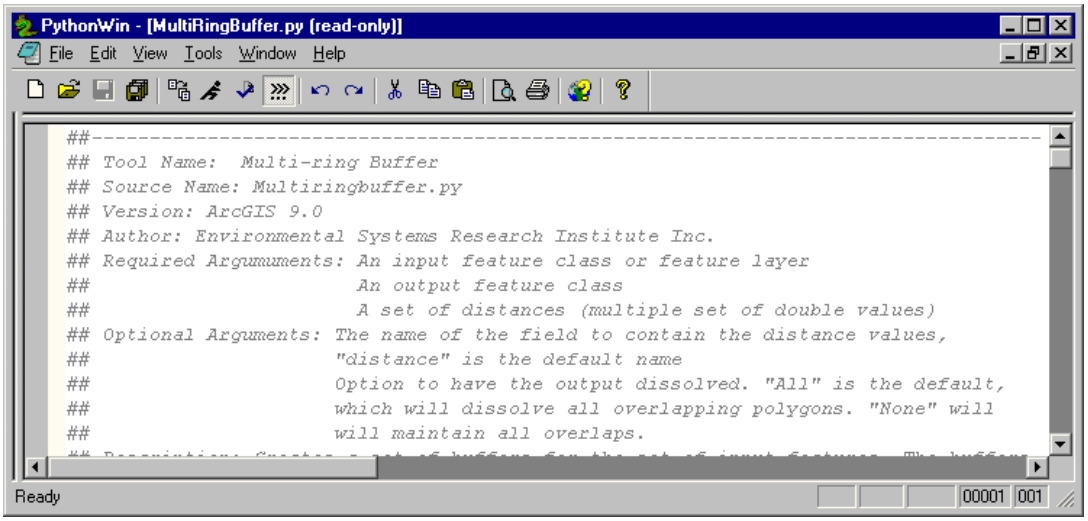


- When you create a new toolbox in the ArcToolbox window in ArcMap, that toolbox will belong to the map document you are currently working with. When you create a new map document or open a different one, the toolbox you created will not appear in the ArcToolbox window.

  To add a toolbox you have already created in another map document into the ArcToolbox window, right-click the 'ArcToolbox' entry at the top of the tree and choose the Add Toolbox command. You'll be prompted to browse to the toolbox you want to add. The default location for new toolboxes you've already added into the ArcToolbox window is your 'My Toolboxes' folder. You can find this folder in ArcCatalog inside the 'Toolboxes' folder at the top level of the ArcCatalog tree. (The physical location on disk for your 'My Toolboxes' folder is specified in the Tools > Options dialog Geoprocessing tab).

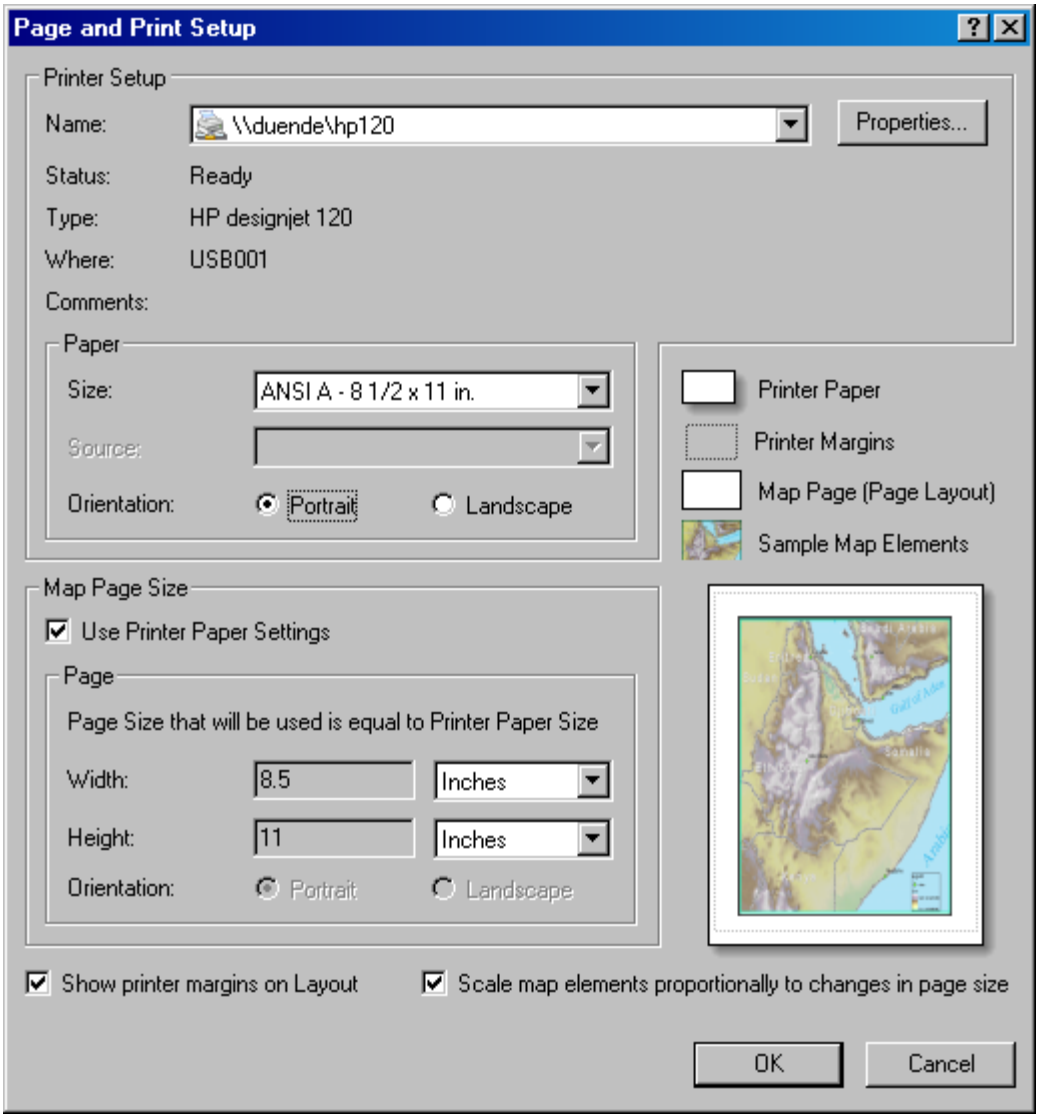
  To save all the changes and additions you make to the contents of the ArcToolbox window in ArcMap, right-click the 'ArcToolbox' entry at the top of the tree and choose the Save Settings command. This lets you save your customizations to an XML file that you can then easily load back into the ArcToolbox window using the Load Settings command when you open a different map document. For example, say you delete several of the toolboxes in the ArcToolbox window and add some of your own toolboxes. These changes will apply to the map document you are currently working with. If you'd like the ArcToolbox window in another map document to reflect these same changes, first use the Save Settings command, then open the other map document, and then use the Load Settings command.

- A good way to familiarize yourself with how **scripts** work in the geoprocessing framework is to create a model and then export it as a script by choosing Export To Script in the Model pulldown menu. Also, you may notice that some of the tools in ArcToolbox actually run scripts, such as the Multiple Ring Buffer tool in the 'Analysis Tools' > Proximity toolset. To view the script for a tool based on a script, right-click the tool in the ArcToolbox window and choose Edit. The script will appear in a window:



Printing maps

■ The dialog launched by the File>Page Setup command in ArcMap has been renamed to be the 'Page and Print Setup' dialog. This dialog has been improved for easier use and now includes a page layout preview. This makes it much easier to ensure that the map will fit onto the selected printer page. Also, the printer properties have been moved from the Print dialog to the Page and Print Setup dialog and the Print Engine drop down list has been moved to the Print dialog. This makes setting up the page altogether more intuitive and makes it easier to create custom printer page sizes. The Output Image Quality setting has been moved out of the Page and Print Setup dialog and onto both the Print and Export dialogs to improve ease of use as well.



The 'Same As Printer' option has been renamed to ''Use Printer Paper Settings'. When a map document is saved with the 'Use Printer Paper Settings' checked and then opened on a computer that is not connected to the same printer, ArcMap will automatically turn off the 'Use Printer Paper Settings' option so the map document will open properly.

■ The File>Print dialog has been improved in coordination with the new Page and Print Setup dialog. You now only need to select the Printer Engine and the Output Image Quality at print time. There is also a print layout preview so that you can ensure that the map will fit on the printer page. Printer properties has been moved to the Printer and Page Setup dialog, which makes creating customer printer page sizes easier:

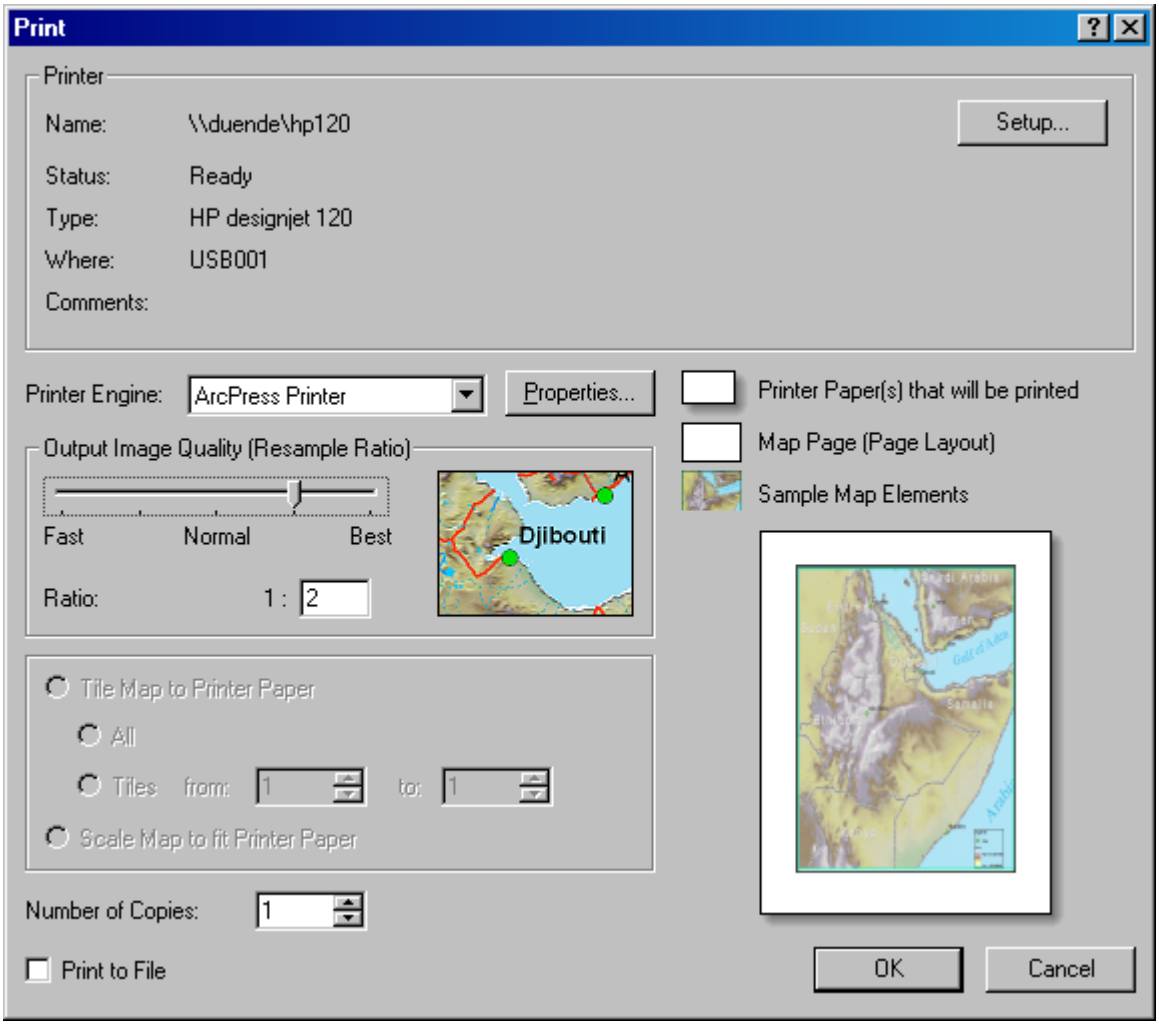


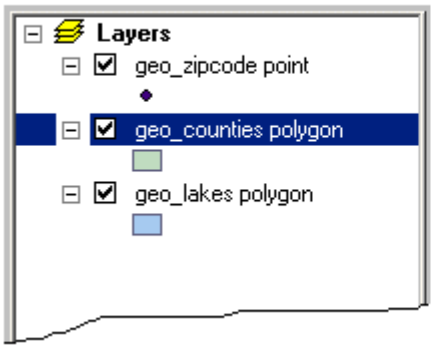
Table Of Contents

■ The pulldown menu command for hiding and showing the Table Of Contents has been moved into the Window menu. In this way, the core ArcMap commands that show and hide the dockable windows (the Table Of Contents, ArcToolbox & Geoprocessing windows) are in the same menu.

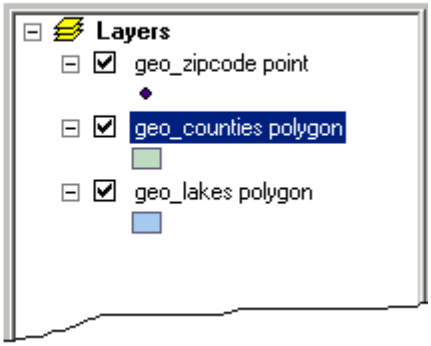
■ To get help on the various keyboard shortcuts for working with the Table Of Contents that have been added in 9.0, click inside the Table Of Contents to give it keyboard focus and then press **F1** or **SHIFT+F1**.

■ The highlight used in the Table Of Contents to show the selected item(s) has been improved so that it no longer extends across the whole window.

8.x



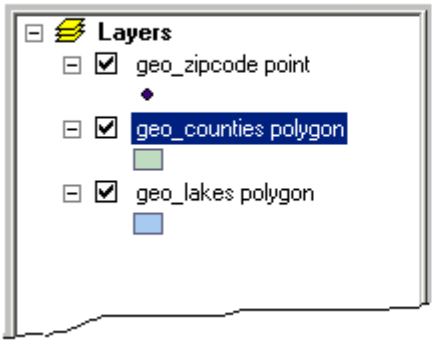
9.0



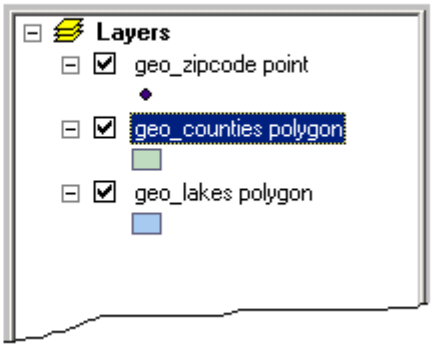
Note: to get the context menu for an item in the Table Of Contents you can still right-click on the item's name or anywhere to the right of the item's name.

■ You can now tell when the Table Of Contents has keyboard focus. You'll see a dotted line around the highlighted area when it has keyboard focus. When the Table of Contents has keyboard focus, you can use the new keyboard shortcuts (described below) to work with it.

Without keyboard focus:

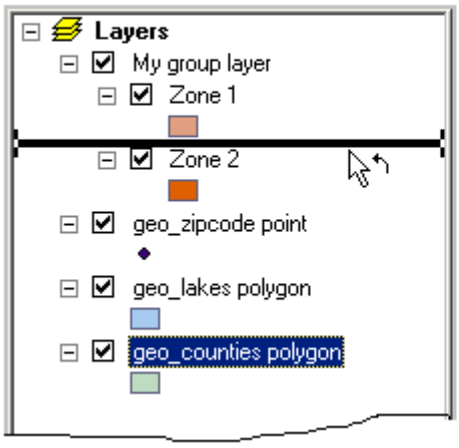


With keyboard focus:

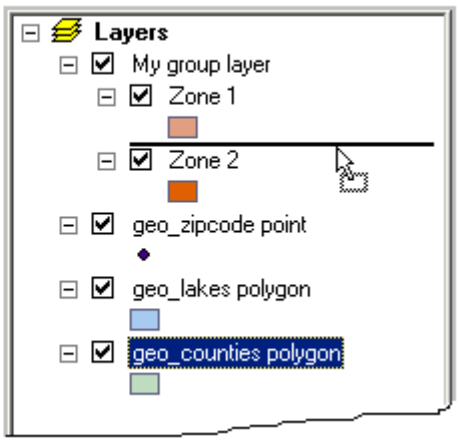


■ The horizontal insertion bar that appears when you are dragging layers over the Table Of Contents has been made smaller and more sensitive in 9.0. The bar now indents to reflect the position in the layer hierarchy at which the 'drop' will occur. For example, as you can see in the graphic below on the right, the insertion bar is indented in 9.0 to show that the current drop location is in a group layer. In addition, we've standardized the drag/drop cursor.

8.x

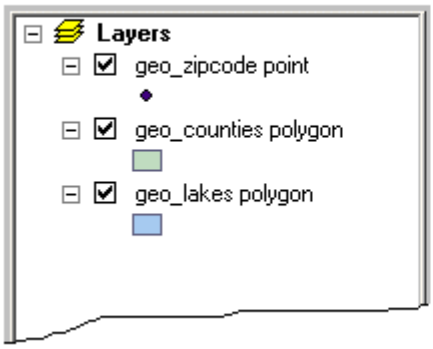


9.0

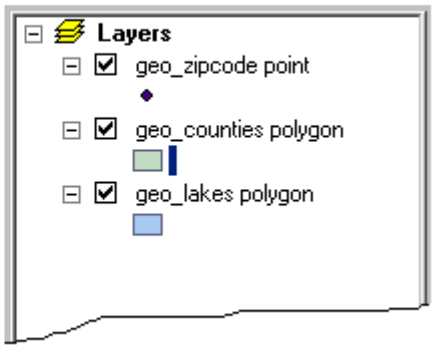


■ In 8.x, if you selected a symbol in the Table Of Contents that has no label (either by clicking on it or using the Up/Down arrows on the keyboard) there was no indication that the symbol was selected. This made it hard to use the Up/Down arrows to navigate through the Table Of Contents because you were always losing your place. We have fixed this in 9.0 so that when a symbol with no label is selected, a small area highlights (see below). When this area is highlighted you can now press **F2** if you want to specify a label for the symbol.

8.x



9.0



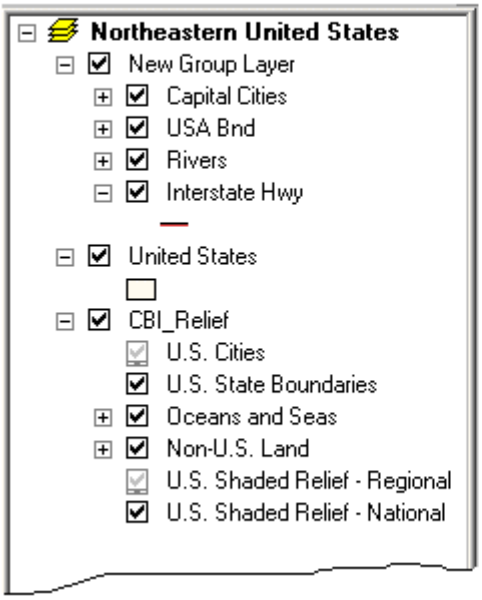
■ In the Tools > Options dialog, the TOC tab has been renamed to the Table Of Contents tab. When you use the options at the top of this tab to choose which tabs will appear in ArcMap's Table Of Contents, your choice of tabs is now saved for the application (i.e. in the Windows registry) instead of being stored in the map document. In this way, your choice of Table Of Contents tabs will always be the same irrespective of which map document you are working with.

■ In 8.x, there was no distinction in the Table Of Contents between group layers and layers such as ArcIMS image service layers and survey layers, etc, which can be expanded to view the individual sublayers that they contain. Unlike the layers belonging to a group layer, the sublayers don't have the full range of layer properties and cannot be dragged out of the layer they belong to: they are sublayers rather than independent layers.

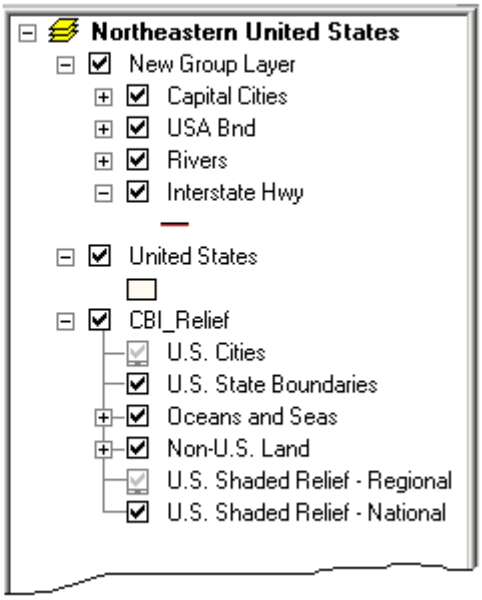
To make this distinction clearer in the Table Of Contents, at 9.0 you'll see 'tree lines' when you expand a layer that contains sublayers. The tree lines tie the sublayers together and help indicate that these sublayers belong

together and cannot be broken apart. The graphic below shows how the same Table Of Contents containing a group layer and an ArcIMS image service layer (CBI_Relief from the Geography Network) looks in 9.0 compared with 8.x:

8.x



9.0



■ New keyboard shortcuts have been added for working with the Table Of Contents. You can use these when the Table Of Contents has keyboard focus. If these shortcuts don't seem to be working, click inside the Table Of Contents to make sure it has keyboard focus.

- **ENTER** or **F12** opens the currently selected entry's property dialog.
- **F2** renames the selected entry.
- **SPACE BAR** turns drawing of the selected layer(s) on or off.
- **SHIFT+F10** or **Application key**  on Microsoft Natural Keyboard (or any other compatible keyboard) opens the context menu for the selected entry.
- **F11** activates the currently selected data frame. You can also hold down **ALT** when you click on a data frame's name to activate it.
- **Left/Right arrows** or the +/- keys expand/contract the selected entry.
- When the tabs at the bottom of the Table Of Contents have keyboard focus, **Left/Right arrows** switches between them
- **F3** returns keyboard focus to the Table Of Contents from the map. This enables you to continue working in the Table Of Contents with the keyboard if an operation you performed put the keyboard focus onto the map. Clicking in the Table Of Contents also gives it keyboard focus. (We also provide a new command - Focus Table Of Contents - that can be put into a pulldown menu or toolbar to return keyboard focus to the Table Of Contents. You can add this into your ArcMap user interface in the normal way, through the Tools>Customize dialog. It is in the View category)
- **ESC** returns keyboard focus to the map from the Table Of Contents. Clicking on the map also gives it keyboard focus.

■ It is now easier to expand/collapse multiple entries in the Table Of Contents. Hold down **CTRL** when you click on the expansion control next to a data frame or a layer to expand/collapse all of the entries at that level in the Table Of Contents hierarchy. For example, if you hold down **CTRL** and click the expansion control next to a data frame, all the data frames listed in the Table Of Contents will be expanded or collapsed. If any of the entries are selected, and you **CTRL+Click** the expansion control next to a selected entry, only the selected entries will be expanded/collapsed.

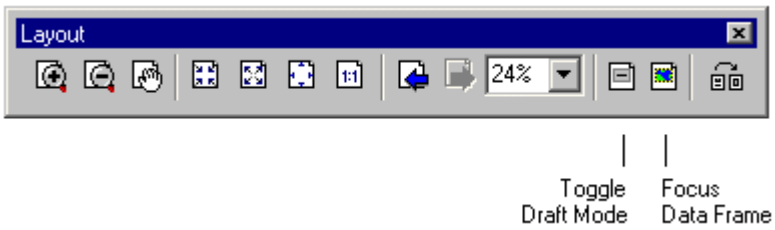
■ When you are dragging layers over the Table Of Contents, you can now expand and collapse any entry by hovering over its expansion control with the 'drop' cursor.

■ There is now better Undo/Redo support for actions performed in the Table Of Contents.

■ The Table Of Contents has been enhanced so that it doesn't flicker or redraw as much as it does in 8.x.

Map documents

■ Two new commands have been added into the Layout toolbar:



Toggle Draft Mode - Toggles all the map elements such as data frames, legends, pictures, etc in your map between normal drawing mode and **draft mode**. In ArcMap 8.x draft mode was called 'fast drawing' mode and the only way to enable it was to check a box in Frame tab of the map element's Properties dialog. You can still do that, but this new command makes it easy to put all the frames into draft mode at once. In draft mode, the contents of the elements are not drawn. Instead, their frames are shown as light blue boxes labeled with the name of the element. Using draft mode makes it quicker to layout your map because you don't have to wait while the contents of frames, especially data frames, are drawn.

Focus Data Frame - Puts the active data frame into **focus**, making it the target for graphics and text you draw on top of it while you are in Layout View. The ability to put a data frame into focus has always been available in ArcMap (by double-clicking a data frame in the layout). We've added this command to make it more obvious that this ability exists. Lets you work with graphics and text drawn on a data frame as though you were in Data View, while remaining in Layout View. The Focus Data Frame command is also available in the context menu that appears when you right-click a data frame on the page layout. When a data frame is in focus, a thick line will appear around it, compared to the thin dashed line you see around the active data frame:

The Focus Data Frame button remains depressed while the data frame is in focus. This provides an additional indication that the data frame is in focus which is useful in the situation where you are zoomed in on your layout and therefore can't see the edge of the data frame.

To take a data frame out of focus, either click on the layout outside the data frame, or click the Focus Data Frame button again.

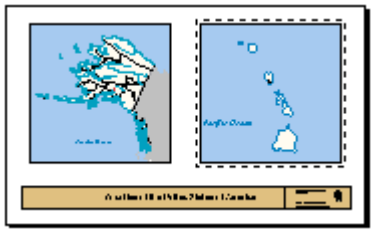
■ The Legend Wizard now defaults to including just those layers that are currently turned on in your data frame. We've also added a Remove All button (<<) to the wizard and the property dialog.

■ When you create a new map document, the 'Save thumbnail image with map' setting in the File > Map Properties dialog no longer defaults to being on. It is now off by default for new maps you create. This avoids the performance overhead of having to wait for the thumbnail to be regenerated whenever you save a map. If you want your map document to be saved with a thumbnail, turn this setting on. This setting is stored in the current map document, and this change has no affect on maps you have already created in 8.x: your existing maps will use the setting for this option that was current when you last saved the map. To prevent your existing maps from saving thumbnails, open each map and uncheck this option in the Map Properties dialog.

■ A new command called Pause Drawing has been added into the Pan/Zoom category in the Tools > Customize dialog. You can add this command into one of your ArcMap pulldown menus or toolbars so that you can temporarily suspend all drawing in ArcMap. While drawing is suspended, you can continue to work with the program, but the display is not redrawn. This is useful if you want to make a number of changes to your map, for example, changing the symbology for a number of layers, without having the map redraw. Once you have made your changes, you can then choose this command again to turn drawing back on. This command works in both Data View and Layout View.

■ The contents of the View > Toolbar pullright are now sorted alphabetically to make it easier to find toolbars. The exception is the Main menu bar, which is always shown at the top of the list.

■ In the Tools > Options dialog's Layout View tab, a check box option called 'Show dashed line around active data frame' has been added that lets you control whether the indication will be drawn showing you which data frame is currently active when your map contains more than one data frame. By default, when your layout contains more than one data frame, one of the data frames is shown with a dashed line around it to indicate that it is the **active** data frame:



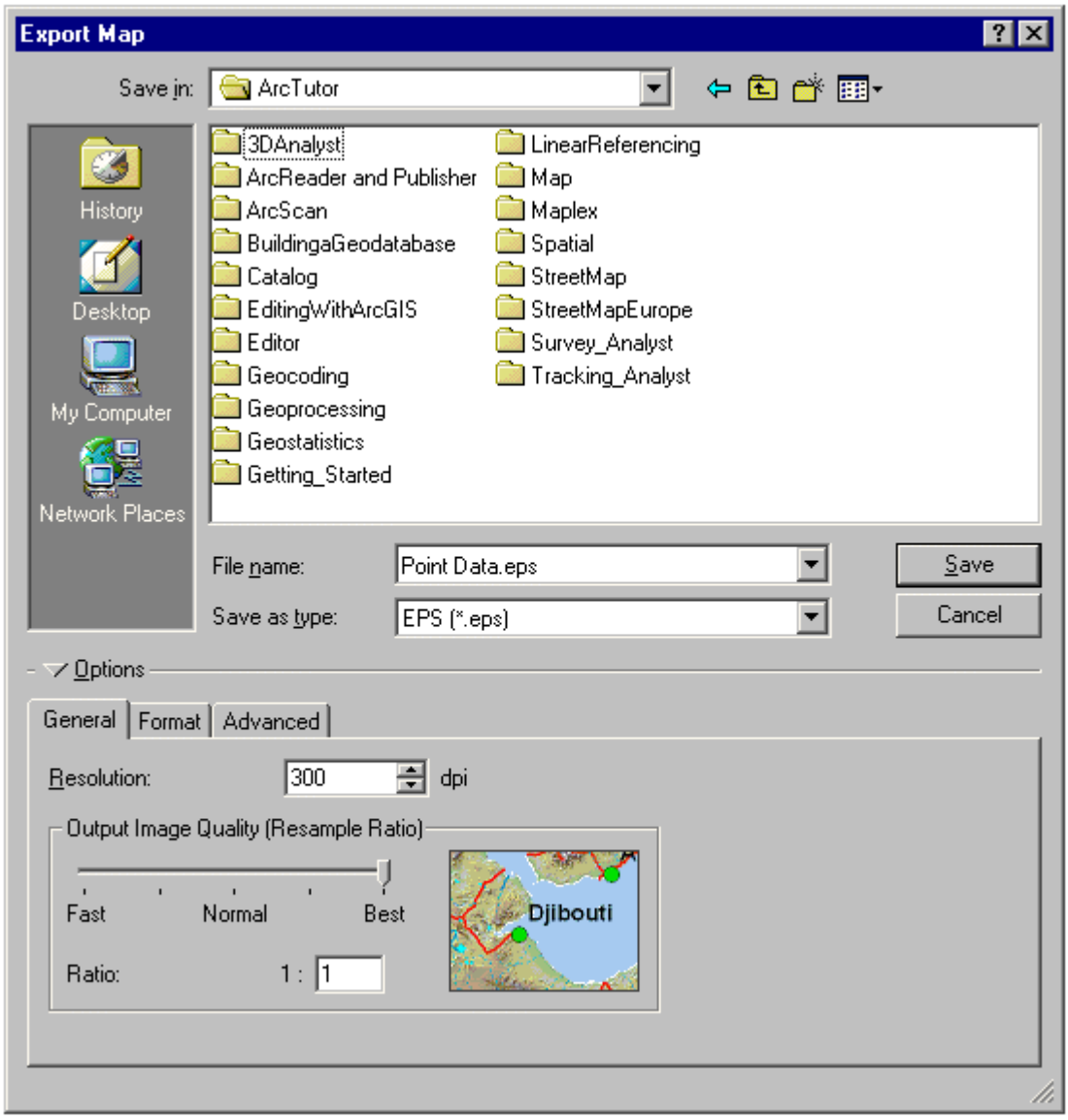
The active data frame is the one to which commands that you use such as Add Data, Full Extent, Select By Attributes, Zoom To Selected Features, etc. will be applied when you are working in Layout View.
This active data frame indication is not part of your map layout and does not appear on your map when you print it out. However, you may sometimes want to hide this indication, for example, if you want to view your map exactly as it will appear when printed. If you turn off the active data frame indication you can still see which data frame is active by looking in the Table Of Contents: the active data frame's name is always shown in bold.

■ In the Tools > Options dialog, the Application tab has been renamed to the General tab and the tab called TOC has been renamed to Table Of Contents. This dialog also now remembers the last tab you were using instead of defaulting to either the Data View tab or the Layout View tab.

■ Your choice of which tabs appear in the Table Of Contents is no longer stored in the map document. Your choice of tabs and their order (which is set in the Tools > Options dialog) is still specified in the Tools > Options dialog but your choice is now stored at the application level and does not vary based on which map document you are using.

■ The File>Page Setup and File>Print dialogs have been redesigned to clarify the process of setting up a map for printing.

■ The File>Export Map dialog has been improved to add an expandable Options panel. This makes it much easier to browse and set the options for a particular output format. Several new graphic export options and formats have been added, as well as an overall improvement of all the graphic exports.



New **raster** map export formats:

- PNG
- GIF (license may be required by user)

When you export a map to a raster format, you can now:

- See the exact size in pixels of the image you about to export.
- Write out a world file for any raster format
- Pick from various compression choices and color depths for all raster formats
- Specify transparent color for PNG and GIF formats
- Specify 1-bit mask or threshold export.

Output image size is no longer limited for raster formats.

New **vector** map export format:

- SVG (compressed and non compressed forms)

Layering is now retained in AI, PDF and SVG export so that graphical objects are conveniently grouped and named.

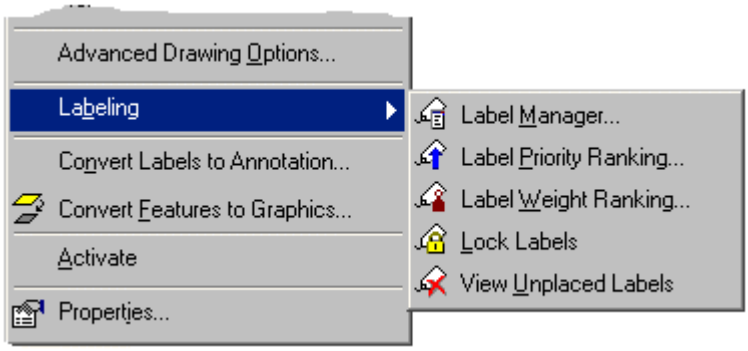
Also font mapping is no longer required because read the information from the font file. Fonts are converted to appropriate format for embedding into exported file when it required.

In ArcMap 8.x font embedding worked in a simple way: either the characters outlines (also known as Type3 fonts) were embedded or we exported a polygon representation of the text string. In 9.0 we now embed fonts directly as Type1, Type42, TrueType or Type2CFF, depend on the source fonts and the requirements of the destination file format.

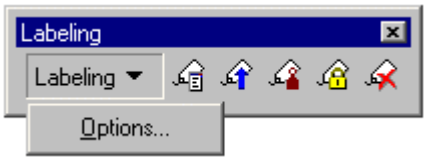
CGM format was removed from ArcMap's Export Map functionality since problems associated with this format prevented any improvement and we received very little user demand for continuing to have this export format in ArcMap.

Data frames

■ Data Frame Properties dialog: the Labels tab has been removed. Its functionality is now provided by the Label Manager dialog, along with separate Label Priority Ranking and Label Weight Ranking dialogs. You can access these dialogs via the new Labeling pullright in the context menu for a data frame.



or via the new Labeling toolbar:



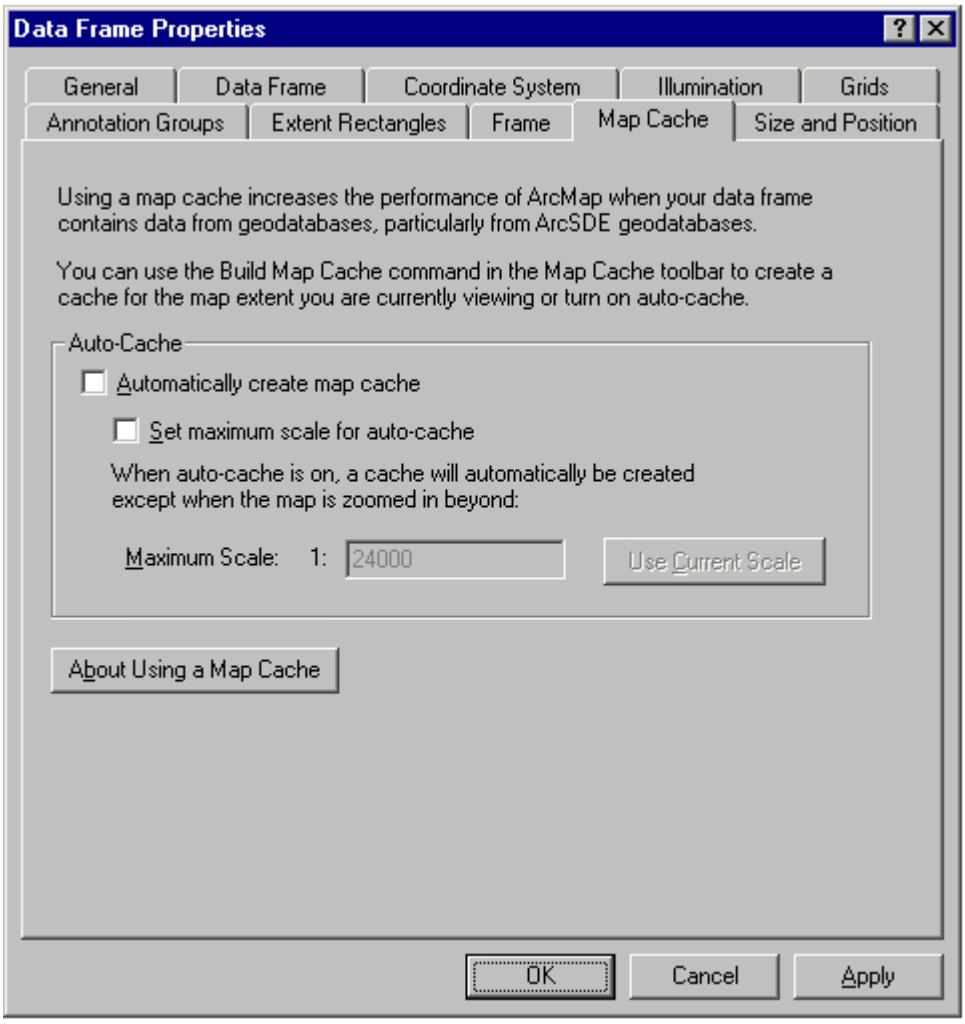
■ In 8.3, the **edit cache** can be used to improve the performance of editing, drawing and selection of geodatabase features during an edit session, especially those stored in an ArcSDE geodatabase. In 9.0, the edit cache has been renamed to the **map cache** and moved into the core ArcMap user interface because it now operates on geodatabase features either inside or outside an edit session. The map cache has no impact on the performance of other data types.

In an enterprise environment, using the map cache can significantly improve the overall performance of the ArcGIS system by reducing the number of queries to the geodatabase, the number of features retrieved from the geodatabase, and the overall network traffic. Since retrieving features from the computer's memory is a fast

operation, using the map cache will often result in performance improvements in ArcMap for editing, feature rendering, and labeling.

- The new Map Cache toolbar (in 8.3 this toolbar was called the Edit Cache toolbar) lets you build and manage the map cache:

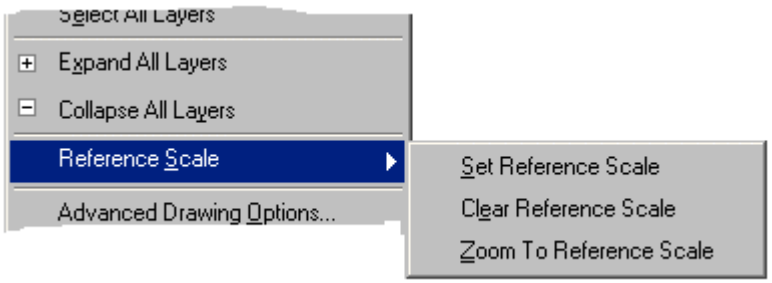
- There is also a new Map Cache tab in the Data Frame Properties dialog:



■ Data Frame Properties dialog Data Frame tab: if you use the fixed extent option for a data frame you now have the choice to specify the coordinates of the extent in degrees instead of map units. An Advanced button has been added next to the coordinates that gives you additional options for specifying the fixed extent coordinates.

■ Data Frame Properties dialog Extent Rectangles tab: Extent rectangles now default to having a red frame.

■ The three reference scale commands in the context menu for a data frame have been moved into a pullright called Reference Scale to help make this context menu shorter.

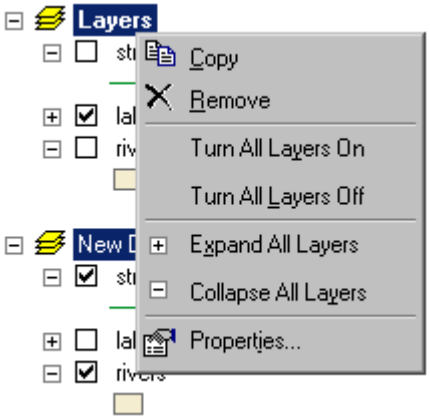


■ You can now drag/drop data frames up and down in the Table Of Contents. Hold down **CTRL** when you drop the data frame(s) to copy rather than move.

Moving data frames in the Table Of Contents simply lets you change the order in which they are listed and no longer has an effect on the order in which they are drawn on the map. This fixes the issue in 8.x where new data frames you added at the bottom of the Table Of Contents unexpectedly appeared at the top of the Table Of Contents the next time you opened the map. You can still control the drawing order of data frames on the page by using the Bring To Front/Send To Back commands in the Drawing pulldown menu when you are in Layout view.

■ The Copy command in the data frame's context menu in the Table Of Contents is no longer disabled when you are in Data View.

■ When multiple data frames are selected in the Table Of Contents, you can now right-click one of them to access a menu that lets you perform operations like copy, remove, and turn all layers on/off, on all of the selected data frames at once:



■ You can now drag/drop and copy/paste data frames between ArcMap sessions (i.e. between different map documents). Drag/drop between ArcMap sessions copies the entries being dropped. Hold down **CTRL** when you drop if you want to move rather than copy.

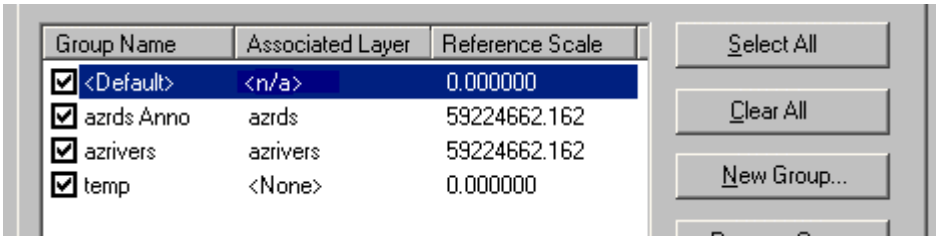
■ Two new keyboard shortcuts speed up activating data frames from the Table Of Contents:

- **F11** activates the currently selected data frame. You can also hold down **ALT** and click on a data frame's name to activate it.

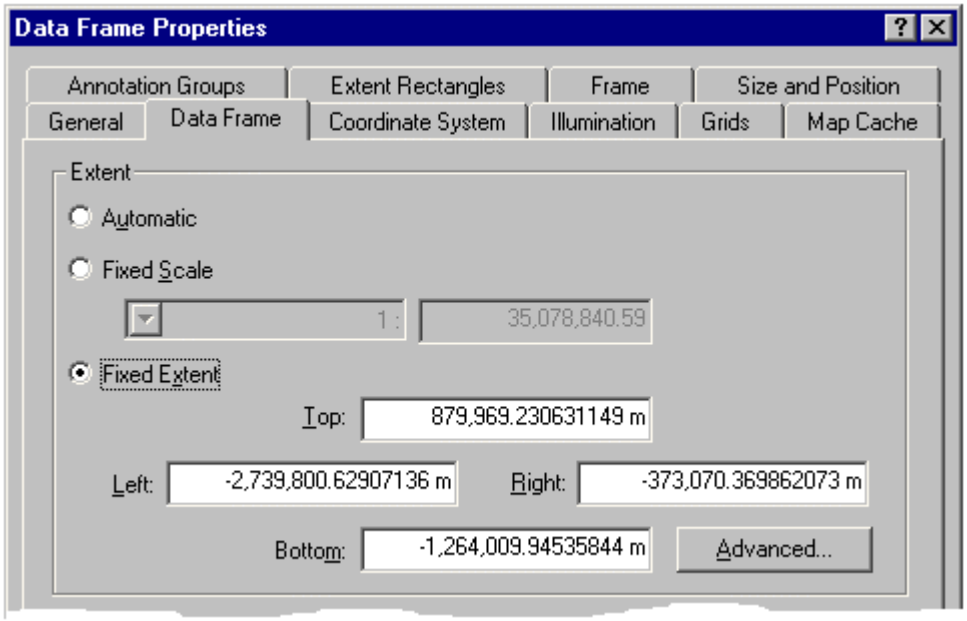
■ In 8.x, if you right-click an inactive data frame in the Table Of Contents and choose certain commands such as Properties, Copy and Advanced Drawing Options, they operate on the active data frame instead. This has been fixed in 9.0.

■ In 8.x, if you copy/paste a data frame while you are in Data view, it gets pasted into the map as a graphic. This has now been fixed so that when you paste a data frame it always gets pasted into the map as a data frame, irrespective of which view you are in..

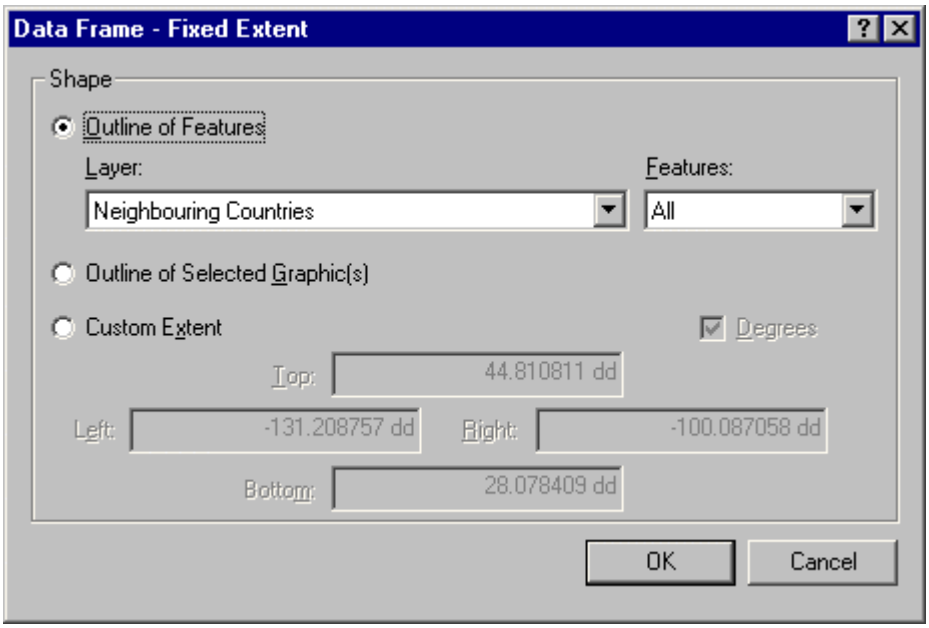
■ Data Frame Properties dialog Annotation Groups tab: The buttons to the right of the annotation groups list have been standardized, to add Select All and Clear All buttons. You can also use the keyboard shortcut for selecting and clearing all the entries in a checkable list: CTRL + click on any check box in the list. You can now also double-click a grid in the list to see its properties.



■ Data Frame Properties dialog Data Frame tab, under Extent options we have added an Advanced button to access additional options for setting a fixed extent.



Pressing Advanced displays this dialog:



You can set your data frame extent to the extent of all, visible, or selected features in a layer, to the extent of graphics inside the data frame, or to a custom extent specified in display units or in decimal degrees. This gives you greater flexibility over determining a map extent. For example, you could set the extent to fit a particular set of features and even if you change the map scale the features would still fit the frame. Or you could draw a rectangle graphic that fits your data view, set the fixed extent to use the graphic and then both the data view and the layout view would show the same extent. These are just a couple of examples of the flexibility the advanced options can provide.

These options are the same as the options for data frame clipping, but work slightly differently in that for setting the extent the minimum bounding rectangle of the chosen option is used.

Another advantage of the advanced options is you could set the display units to a different unit from your map units and then set the fixed extent by the display units. For example, meters is very commonly used as map units, but you might find it easier to set your extent in kilometers or miles.

Layers

■ Layer Properties dialog Source tab: the Source details information now includes the actual name of the coordinate system in which the layer's data is stored, and the linear units, if known:

8.3:

Projection: Transverse_Mercator
False_Easting: 500000.00000000
False_Northing: 0.00000000
Central_Meridian: -111.00000000
Scale_Factor: 0.99960000
Latitude_Of_Origin: 0.00000000

9.0: (new items shown in bold):

Projected Coordinate System: NAD_1927_UTM_Zone_12N
Projection: Transverse_Mercator
False_Easting: 500000.00000000

False_Northing: 0.00000000
Central_Meridian: -111.00000000
Scale_Factor: 0.99960000
Latitude_Of_Origin: 0.00000000
Linear Unit: Meter (1.000000)

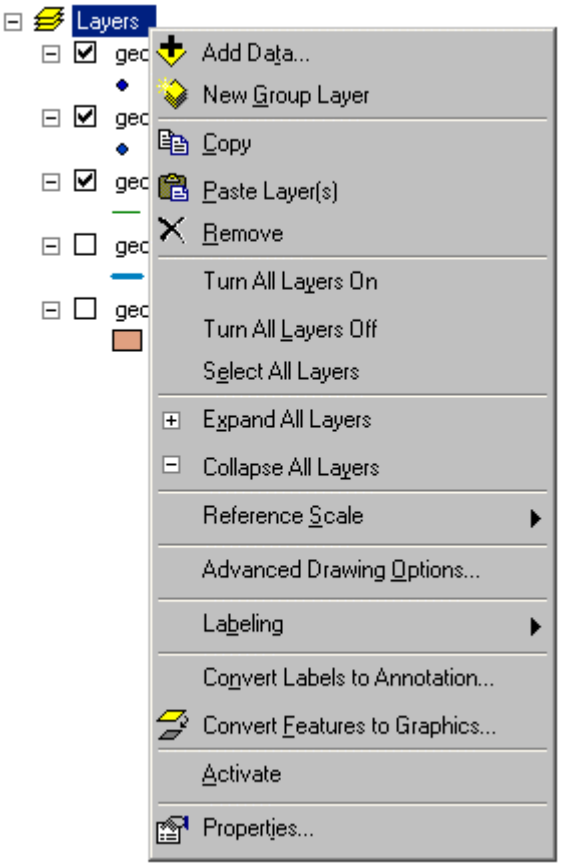
■ You can now copy/paste and drag/drop multiple layers in the Table Of Contents.

■ New commands have been added into the context menu for a data frame to make it easier and faster to work with layers.

- Turn All Layers On/Turn All Layers Off: checks or unchecks all the layers in the data frame. This option was in 8.x but only as a keyboard shortcut (hold down **CTRL** and click any check box).

- Select All Layers: selects all the layers in the data frame. This makes it easy to quickly select all the layers and then perform an operation on them, such as right-clicking and choosing Remove to remove all the layers.

- Expand All Layers/Collapse All Layers: shows or hides the legends for all the layers in the data frame. (We've also added a keyboard shortcut for this action: to expand/collapse all the layers in a data frame, hold down **CTRL** and click the expansion box next to any of the layers).



■ When you drag/drop layer(s) inside the same data frame, you can now hold down **CTRL** when you drop the layers if you want to copy the layer(s) instead of moving them. This makes it easy to quickly duplicate layers.

■ Drag/drop of layer(s) between different data frames in the same map now copies the layers instead of moving them. This makes it easier to duplicate layers, such as layers providing backgrounds, between data frames and then modify them. Hold down **CTRL** when you drop the layer(s) if you want to move them instead.

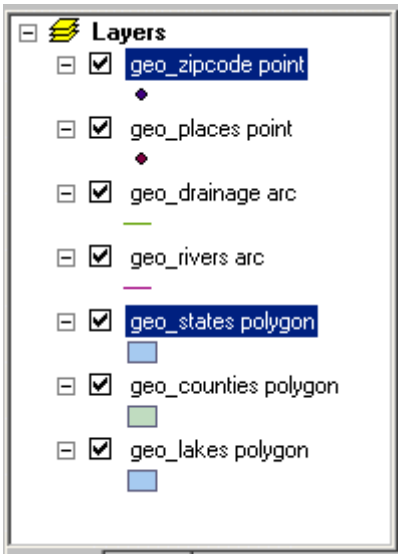
■ Layers can now be dragged and dropped between different ArcMap sessions (i.e. between different map documents). Drag/drop between ArcMap sessions copies the entries being dropped. Hold down **CTRL** when you drop if you want to move the layer(s) rather than copy.

■ When multiple layers are selected in the Table Of Contents:

- you can turn them all on or off with one click: Hold down **CTRL** and then click on the check box next to any of the selected layers. If one or no layers are selected, holding down **CTRL** and clicking any check box will turn all the layers on or off, the same as it does in 8.x.

- you can expand or collapse them all with one click: Hold down **CTRL** and then click on the expansion box (the + or - box) next to any of selected layers. If one or no layers are selected, holding down **CTRL** and clicking any expansion box will expand or collapse all the layers.

■ When you add layers they are now automatically selected in the Table Of Contents so you can see where they are positioned. In the example below, geo_zipcode point and geo_states polygon have just been added to the map. This also enables you to immediately perform operations on the newly added layers without having to reselect them. For example, you can right-click any one of the selected layers and choose any command, such as Remove, Group, Zoom To Layers, etc, or hold down CTRL and click the expansion control next to any of the layers to expand or collapse them all.

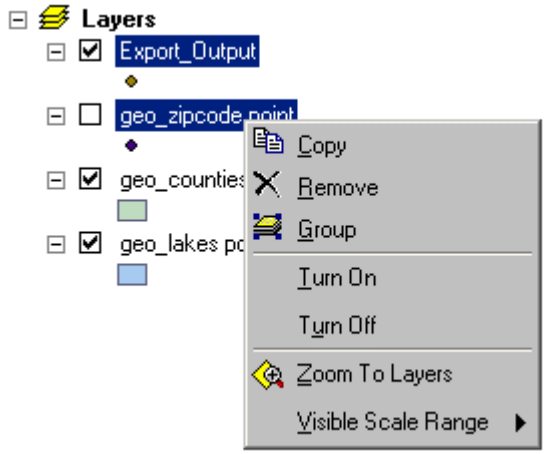


■ In 8.x the context menu that appears when you right-click a group layer is the same as the one that appears when you select multiple layers and right-click. At 9.0 these are now two separate context menus.

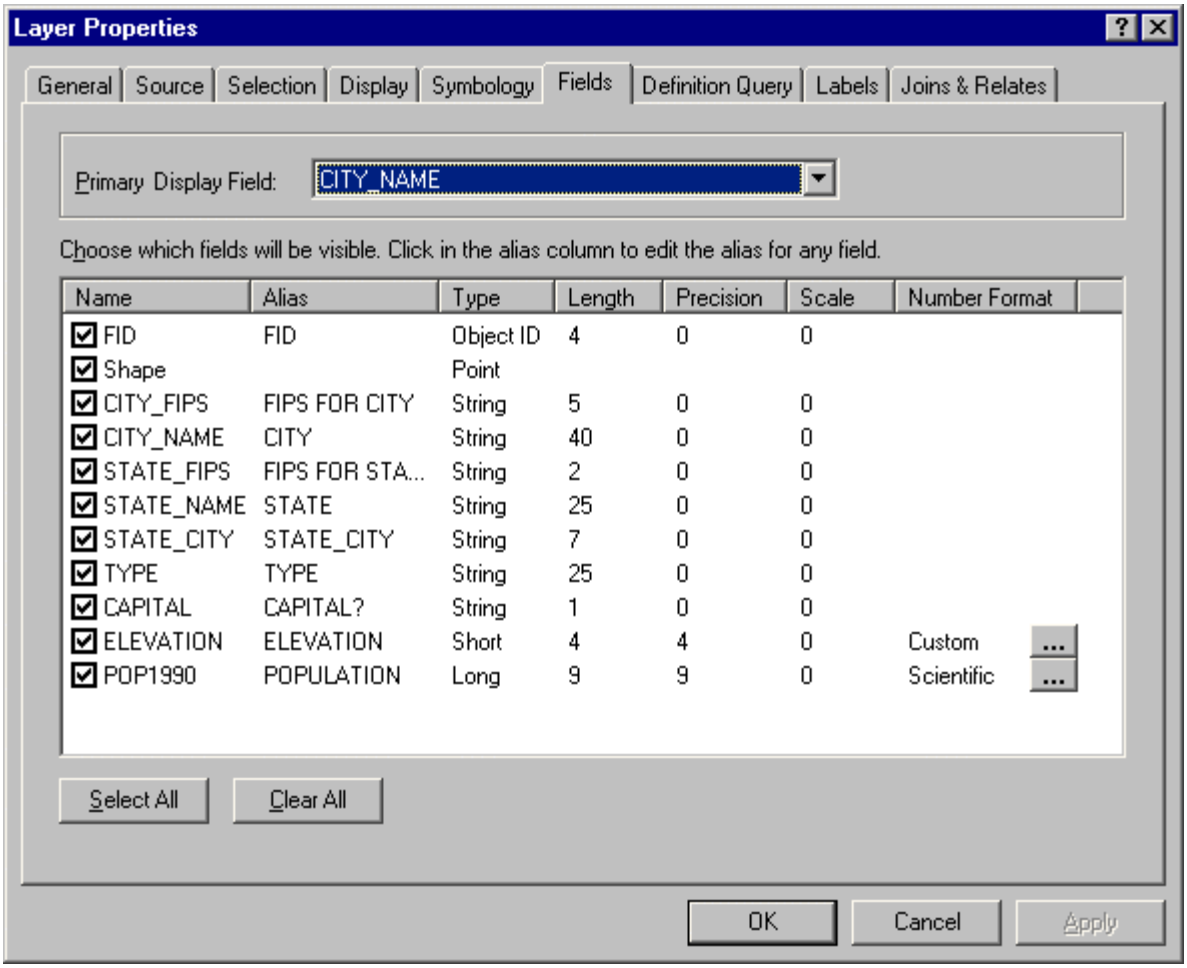
■ New commands have been added into the context menu you get if you select two or more layers and right-click:

- Turn On/Turn Off: checks or unchecks all the selected layers.

- Zoom To Layers: zooms the geographic extent encompassing the extents of all the selected layers.



■ Layer Properties dialog Fields tab: The user interface for specifying the field properties of a layer or a table has been improved to make it faster and easier:



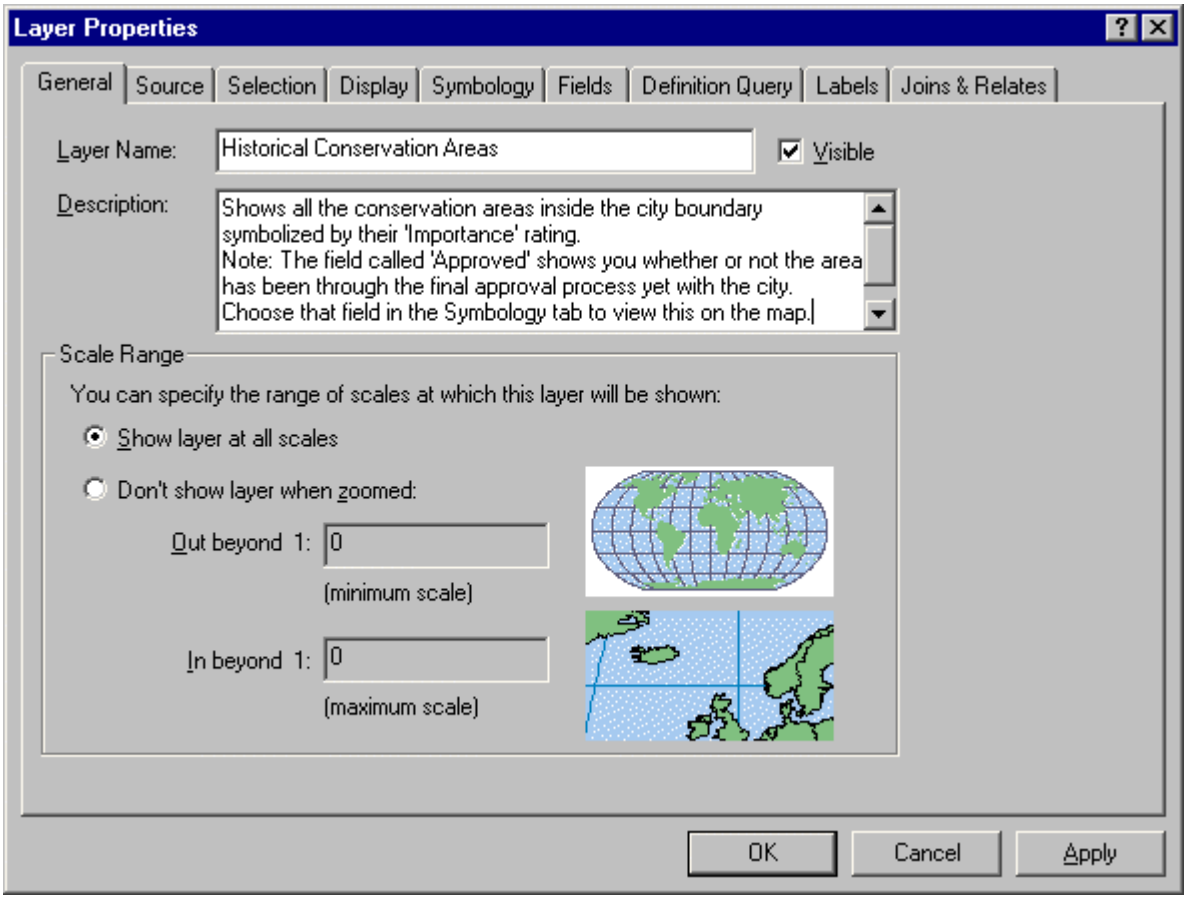
To hide or show fields, click their check box. Press Select All or Clear All to hide or show all the fields.

To specify an alias for a field, type into the Alias column.

To set the number format for a numeric field, click the button in the Number Format column.

■ Layer Properties dialog General tab: A description field has been added to the General tab for all layer types. This enables you to store comment or description text as a layer property.

This has been implemented for most but not all layer types.

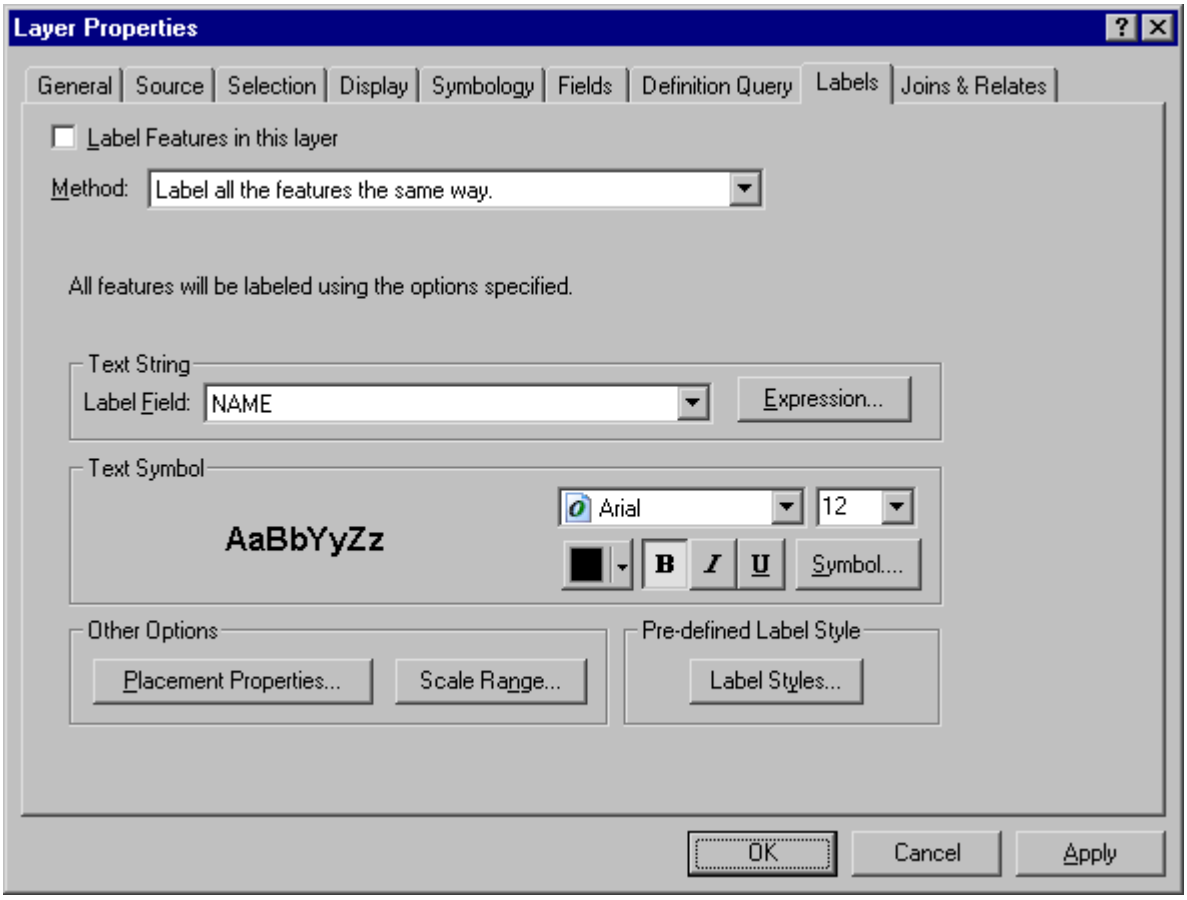


■ Layer Properties dialog General tab: When you use the 'Don't show layer when zoomed' option, the scale values you enter no longer disappear if you change your mind and use the 'Show layer at all scales' option. This lets you, for example, temporarily turn off scale-dependent drawing for a layer and then turn it back on later without having to re-type the scale values you originally entered.

This has been implemented for most but not all layer types.

■ Layer Properties dialog Labels tab has several enhancements.

- Controls have been added into the Labels tab to let you quickly specify the font, size, color, etc of the text symbol. In 8.3 you had to press the Symbol button to specify these:



- When a layer is getting its labels from an expression instead of a single label field, you'll now see the text <expression> in the label field. This makes it clearer that an expression is being used:

■ At 9.0, **symbol level** advanced drawing functionality has been improved and symbol level properties can now be defined at the layer and group layer level, rather than at the data frame level as in 8.3. In this way, these properties get saved with the layers when you create layer files, etc. Symbol level drawing enables you to take advantage of ArcMap's ability to 'join and merge' multi-layered symbols, such as those used for cased road and street symbology. You can now define symbol levels via commands added into the Advanced menu buttons on the Layer Properties dialog Symbology tab for feature layers. You can also now turn **symbol level drawing** on and off for a layer by using the new Use Symbol Levels command that has been added into the context menu for a feature layer. See the Symbology section in this document for more information about what's new in symbol level drawing.

■ The size and shape of layer properties dialogs has been standardized so that they are all now roughly the same. This change is most noticeable with the group layer properties dialog and the ArcIMS image service layer properties dialog, which now are now sized and shaped more like the standard feature layer properties dialog. The property dialog for some layer types may still be larger than usual because one or more of their tabs need to be larger in order to accommodate all their controls.

Group layers

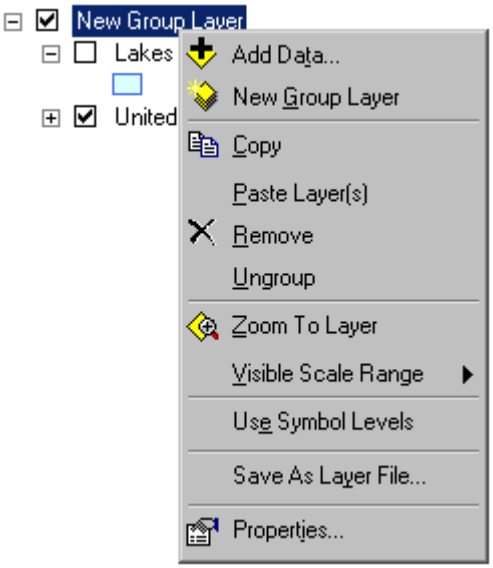
■ It is now easy to create group layers that contain other group layers. This was possible in 8.x but required that you use layer files to do it. There are several ways now to create nested group layers:

- You can now drag/drop any group layer into any other group layer.

- You can now select any layers in the Table Of Contents, including group layers, right-click and choose Group. The Group command is now always enabled, regardless of what type of layers you selected. You can also select layers that are already in a group layer, right-click, and then choose Group to create a nested group layer.

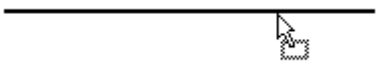
- You can now right-click a group layer, choose New Group Layer, and then drag layers into the new, empty group layer that is created.

■ We've added Add Data, New Group Layer, Paste Layer(s), and Ungroup commands into the group layer context menu, so it is much easier to rapidly assemble group layers and break them apart.

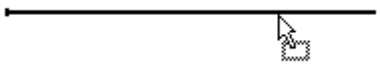


■ When you drag layers to the end of an expanded group layer, you can choose whether the layers get dropped into the group layer or after the group layer.

Normally, when you are dragging layers over the Table Of Contents, the insertion bar looks like this:

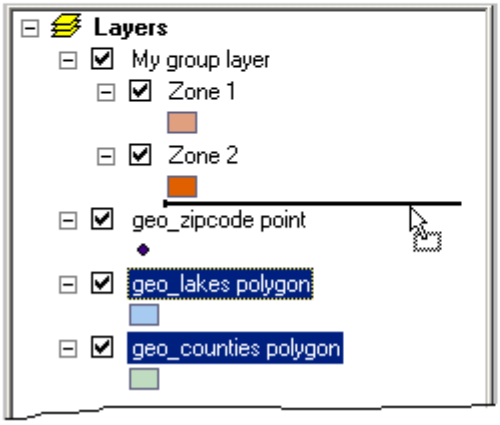


When the insertion bar is at the end of a group layer, you'll see a small indicator drawn at the left end of the bar:

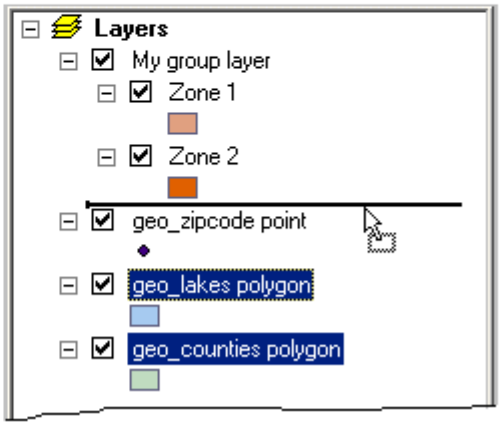


This indicates that you have a choice about where the layers you are dragging are dropped: They can either be dropped into the group layer or after the group layer. When you see the indicator on the insertion bar, you can move the cursor either left or right to make your choice. The insertion bar will extend to the left as you drag the cursor to the left, and the indicator at the end of the bar shows you where the layers will be dropped in the hierarchy.

1. **Drag layers up so the insertion bar is underneath the expanded group layer. If you want to drop the layers into the group layer, position the insertion bar so that it is indented to the right.**



2. **If you want to drop the layers after the group layer, instead of into it, move the cursor to the left. The insertion bar will extend to the left to show that the layers will be dropped after the group layer.**

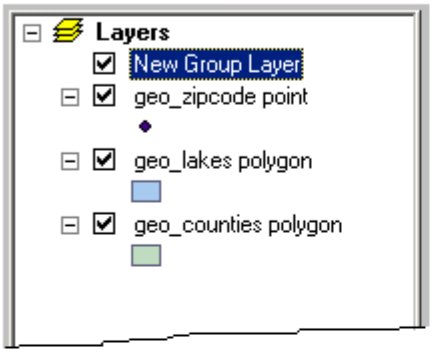


■ In the Group Layer Properties dialog's Group tab you can now double-click any layer in the list to access its properties.

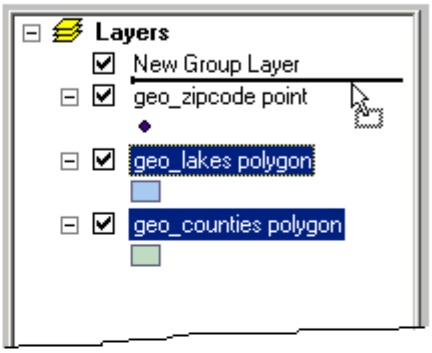
■ At 9.0, **symbol level** advanced drawing functionality has been improved and symbol level properties can now be defined at the layer and group layer level, rather than at the data frame level as in 8.3. In this way, these properties get saved with the layers when you create layer files, etc. You can now define symbol levels for a group layer via the new Symbol Levels button that has been added into the Groups tab in the Group Layer Properties dialog. Any of the feature layers in the group layer can participate in the symbol level drawing, including those in nested group layers inside the group layer. See the Symbology section in this document for more information about what's new in symbol level drawing.

■ You can now drag layers into a new, empty group layer. When you drag layers underneath an empty group layer, you can choose whether the layers get dropped after the group layer or into the group layer. When you see the insertion bar underneath the new group layer, you can move the cursor either left or right to make the choice.

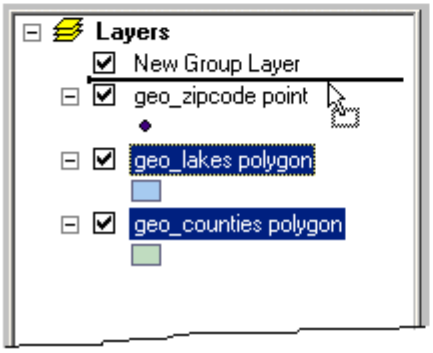
1. Right-click the data frame and choose New Group Layer



2. Drag layers up so the insertion bar is underneath the new group layer. If you want to drop the layers into the group layer, position the insertion bar so that it is indented to the right.



3. If you want to drop the layers after the new group layer, instead of into it, move the cursor to the left. The insertion bar will extend to the left to show that the layers will be dropped after the group layer.

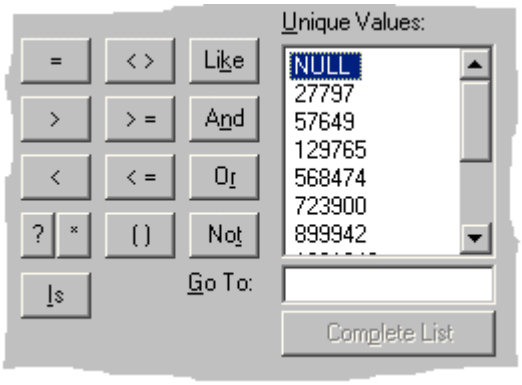


Selection

■ A check box has been added into the Selection>Select By Attributes and Selection>Select By Location dialogs that enables you to restrict the list of layers from which you choose to select features to layers which are currently set as **selectable**. When this box is checked, the list will only contain layers that are currently set as selectable. You can set layers as selectable by choosing Set Selectable Layers from the Selection pulldown menu. You can also set layers as selectable by using the Selection tab in the ArcMap Table Of Contents. (The Selection tab is turned off by default: to turn it on, choose Options from the Tools pulldown menu).

By default, all the feature layers in a data frame are selectable, so checking this new check box has no effect on the length of the list of layers if you have not yet turned off some of the layers in the Set Selectable Layers dialog or Selection tab for this data frame.

■ Selection>Select By Attributes and all instances of the Query Builder dialog: a control has been added underneath the Unique Values list that enables you to rapidly move through this list. Enter the first letter or number of the value, with or without quotes. As soon as you start typing ArcMap will try to go to the first value in the list matching what you typed in.



■ Selection>Select By Attributes and all instances of the Query Builder dialog: If you are working with a field that supports null values, it is now easy to build a query to select records that have or do not have null values. Null values are supported by fields in geodatabases and date fields in shapefiles/dBASE tables and coverages/INFO tables. When you select one of these fields in the Query Builder, you'll now see a NULL entry at the top of the Unique Values list if there is a null value in the values displayed by that list. If there are no null values in the list, you won't see a NULL entry at the top. You can double-click the NULL entry to add it into your query like any other value and use the IS operator to select null values. As you can see from the graphic above, we've added a button for the IS operator into the Query Builder. This query selects all the null values for a field in a geodatabase:

```
[POP1991] IS NULL
```

and this query selects all the values in the same field that are not null:

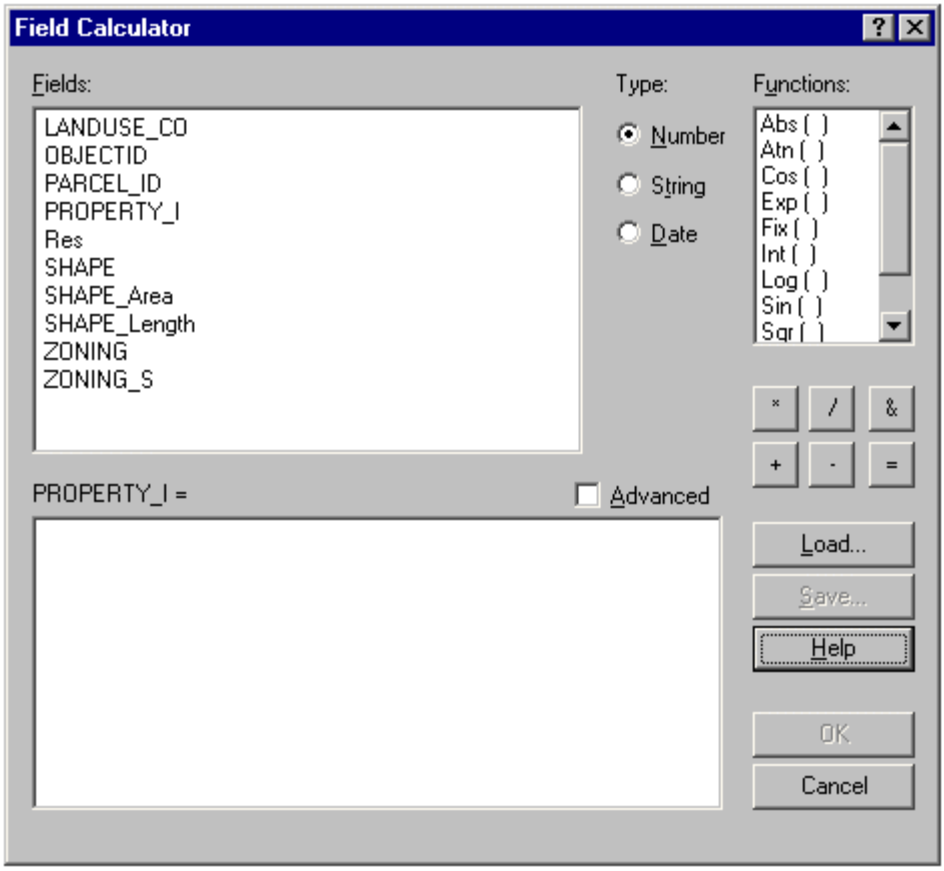
```
[POP1991] IS NOT NULL
```

■ Selection>Select By Attributes and all instances of the Query Builder dialog: The SQL Info button has been removed from the dialog. Instead, we now provide a SQL quick reference topic in the ArcGIS Desktop Help. Look for 'SQL reference' in the ArcGIS Desktop Help Index.

■ Selection>Select By Attributes and all instances of the Query Builder dialog: A progress dialog now appears when you get unique values for a field if the process takes more than a few seconds to perform.

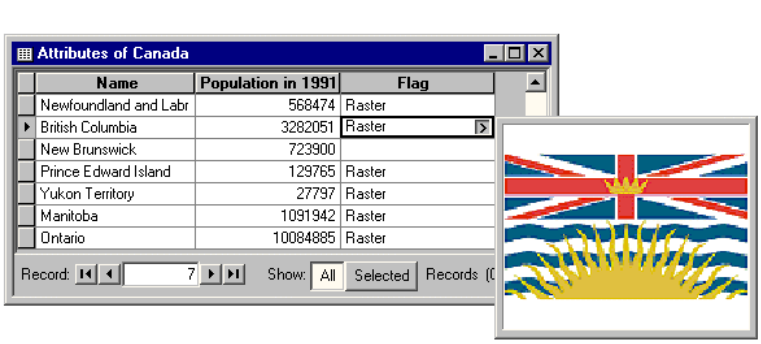
Tables

■ The Field Calculator dialog has been made larger to accommodate a longer and wider fields list. *Although we've found a bug in 9.0 pre-release at time of writing that causes fields to often not use the wider list.* We've also added a Help button which includes some commonly used examples to calculate fields based on area, length and perimeter, etc:

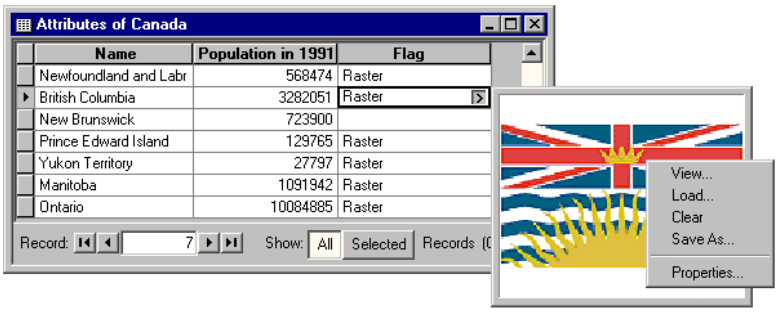


■ The attribute tables of geodatabase feature classes and standalone tables in geodatabases can now contain fields of **raster** type. A raster type field can contain any supported image or raster file, such as a photo of a feature. You can view the content of raster fields in Table window, in the Identify Results window when you identify a feature, and in the Attribute Inspector window launched from the Editing toolbar.

In the Table window, records for raster fields that contain pictures are shown with the value 'Raster'. A record with an empty value for a raster field indicates that a raster has not yet been loaded into the field for that record. Click a value in a raster field to make a small '>' button appear next to it, then click that button to view the picture in a popup window:



Right-click inside the picture popup or the value in the table to see a menu of additional options:



The Load and Clear options in the menu are only enabled if you are currently editing the layer that contains the raster field.

Choose the View command (or just left-click in the pop-up window) to view the raster in a floating resizable window:

For more about raster fields, see the Raster data section of this document.

Identify Tool

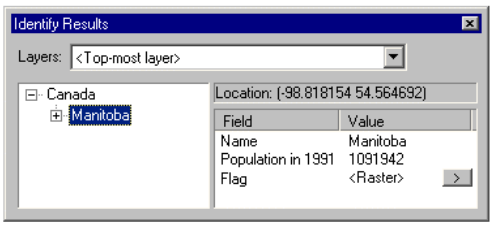
■ Identify Results window in Arcmap and all desktop applications: In the Identify Results window you can now click on field values for fields containing strings which are full URLs or full pathnames to documents to launch the URL or document that they point at. When you identified a feature, hover over the value for any field shown in the Identify Results window that contains a URL or pathname. The cursor will change to the 'hand' pointer to indicate that the value is 'hot'. (If the application cannot resolve the path to a document, the cursor won't change, and you'll get a 'file not found' message if you click on the value).

URLs included as values must start with either http:// or https://. Paths must start with a disk drive or be a full UNC pathname. That's how the Identify window recognizes these values as being links.

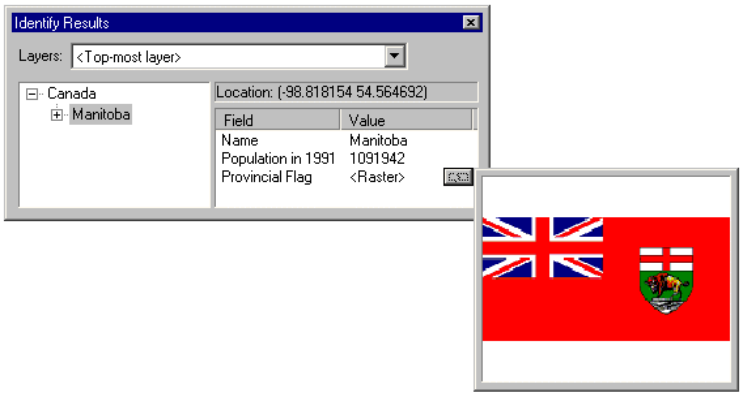
This enables you to include launch URLs and documents from fields in the Identify window without defining a hyperlink field in the layer's properties. You can have as many fields as you like containing URLs or pathnames to documents, and you can mix URLs and pathnames in the same field. The logic for recognizing these clickable URLs/paths is built into the Identify window and there's no layer or document properties to set. These links will work in any of the ArcGIS Desktop applications that have an Identify tool, even if those applications don't support field-based hyperlinks (i.e. ArcCatalog and ArcScene). They are also supported in ArcReader 9.0's Identify window if you publish your map document to a published map (.pmf) file using the ArcGIS Publisher extension. As these links are defined purely in the attribute table and don't require any accompanying layer file or map document, they are especially convenient: anyone who accesses the data will immediately be able to use the links via the Identify window of any ArcGIS Desktop application.

Note: These new links accessed via the Identify window will not support the hyperlink base property in the File > Map Properties dialog: they have to be complete URLs or paths. This is for robustness and because not all ArcGIS Desktop applications support the hyperlink base property. The values of a field-based hyperlink (i.e. a hyperlink specified in the Layer Properties dialog Display tab and normally accessed using the Hyperlink tool) will only be clickable in the Identify window if they contain complete URLs or paths: they are not supported in the Identify window if they use the hyperlink base property.

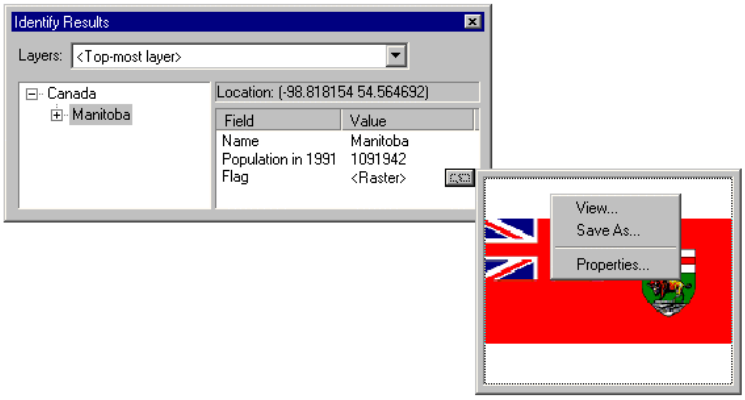
■ At 9.0 the attribute tables of geodatabase feature classes and standalone tables in geodatabases can now contain fields of **raster** type. A raster type field can contain any supported image or raster file, such as a photo of a feature. When you identify a feature containing a raster field, you'll see a small '>' button next to the raster field if a picture exists for the record.



Click that button to see the raster in a small popup window:



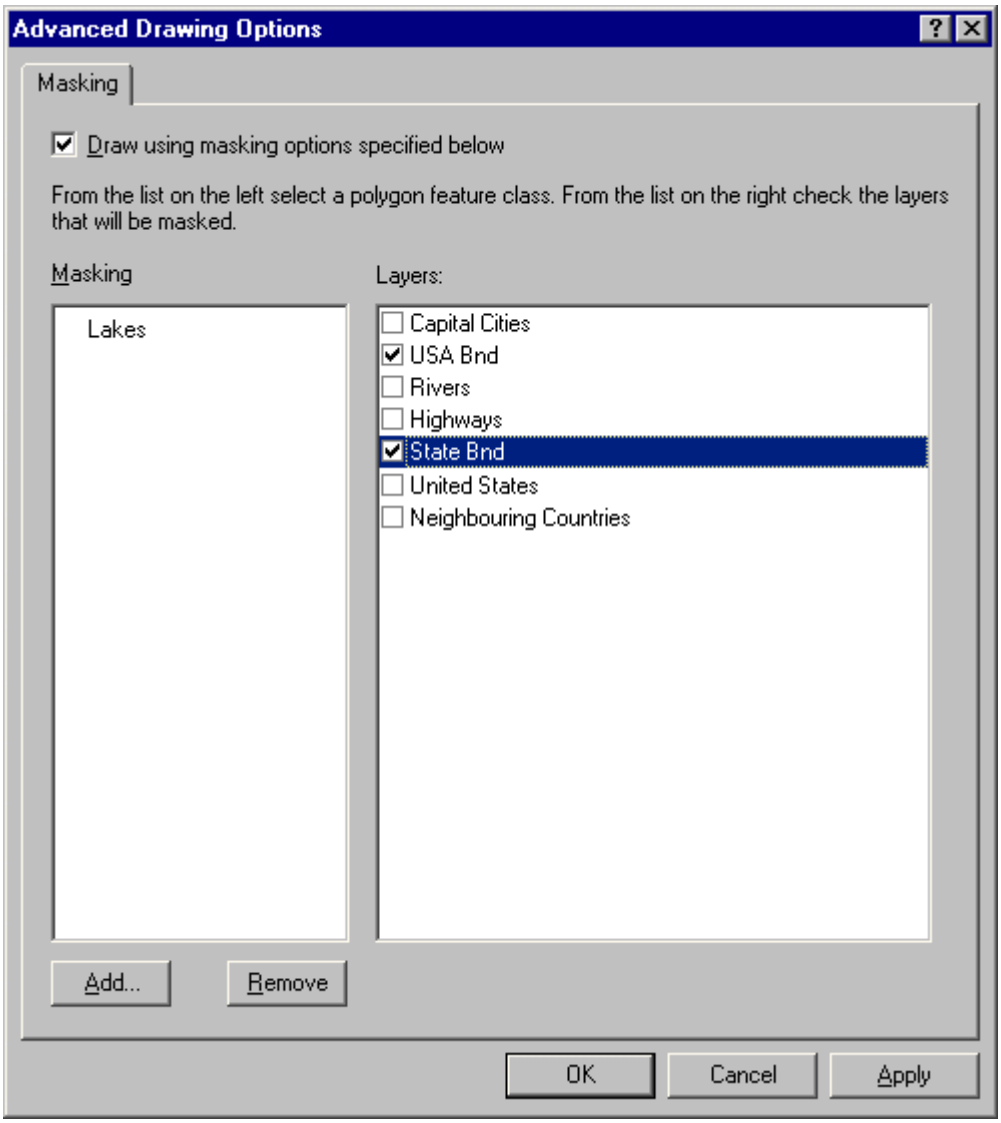
Right-click in the popup window to see more options:



Choose the View command (or just left-click in the pop-up window) to view the raster in a floating resizable window.

Symbology

■ The Advanced Drawing Options dialog has a new Masking tab that lets you specify that the features in one or more layers be masked by the features in a polygon feature class. To use masking, click the check box in the Masking tab, then click Add to add the polygon feature class that you want to use in the masking. You can add more than one polygon feature class and have each feature class mask a different set of the layers in your data frame:



■ In 9.0 how you work with **symbol level drawing** has changed. In 8.3, symbol level drawing is a property of the data frame. In 9.0 symbol level drawing is now a property of the layers for which it is defined. This means that the symbol level drawing specification for a layer is saved with the layer if you save it to disk as a layer (.lyr) file, and 'travels' with the layer when you copy/paste or drag/drop it inside the same map document or between two map documents.

You can still define symbol level drawing that includes symbols from multiple layers. Symbol level drawing is also now a property of group layers. Put all the layers whose symbols you want to include in the symbol level drawing specification into a group layer, and then define the symbol level properties for this group layer.

- If you open a map created with **ArcMap 8.x** when you are in ArcMap 9.0, you can still use the 8.x data frame-based symbol level drawing functionality via the Symbol Drawing tab in the Advanced Drawing Options dialog.

To get to this dialog, you still right-click a data frame and choose the Advanced Drawing Options command. When you open this dialog you'll see a new button at the top of the Symbol Drawing tab that enables you to upgrade your map document to use the new layer-based symbol level drawing functionality. We recommend upgrading your map documents to use this new functionality.

- If you create a new map in ArcMap 9.0, it will automatically use the new layer-based symbol level drawing functionality. If you look in the Advanced Drawing Options dialog, you will no longer see a Symbol Drawing tab.

- To access the new Symbol Levels dialog for a feature layer, open the layer's Properties dialog, go the Symbology tab, and click the Advanced menu button, and choose the Symbol Levels command.

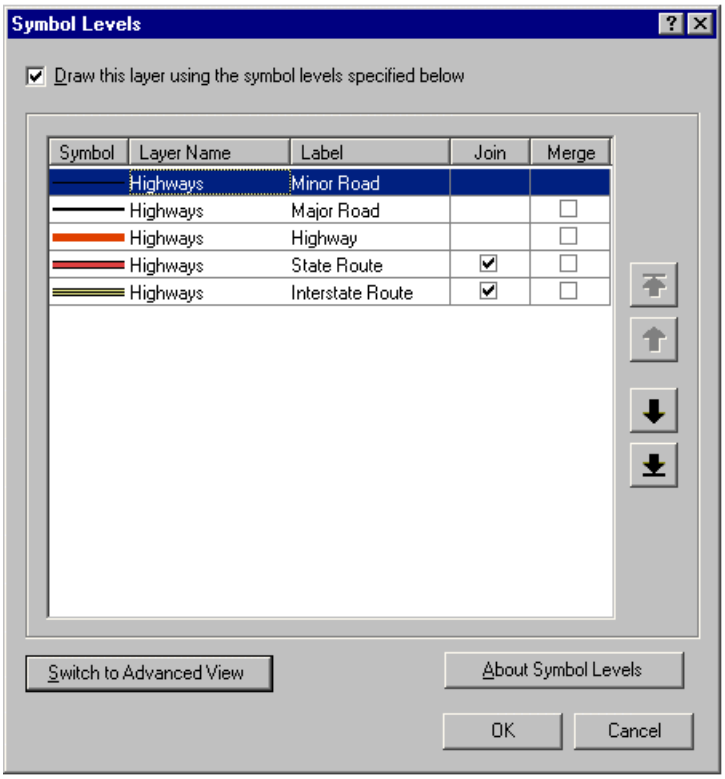
  To access the new Symbol Levels dialog for a group layer, open the group layer's Properties dialog, go to the Group tab, and click the Symbol Levels button.

  To turn symbol level drawing on and off for any layer or group layer, right-click the layer and choose the Use Symbol Levels command.

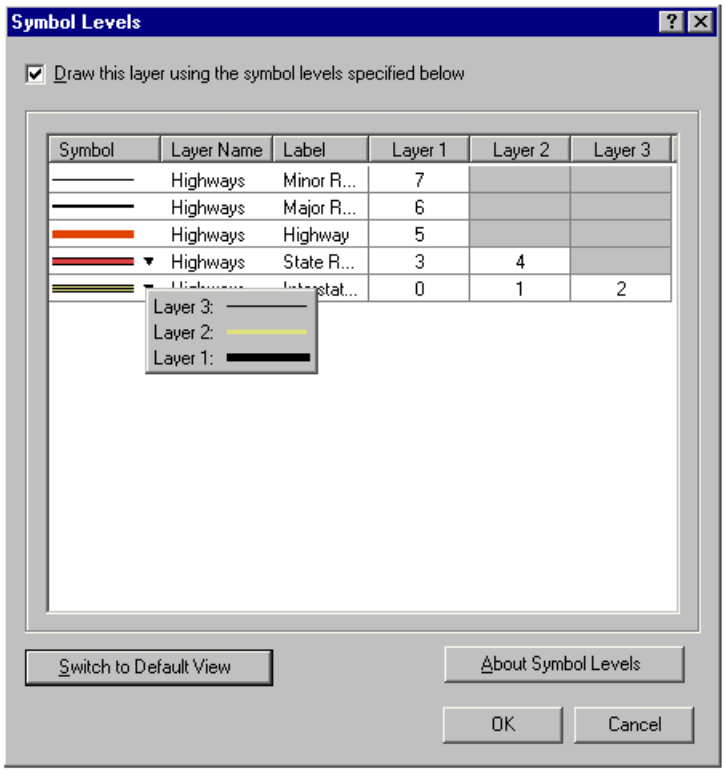
  If any of these commands are disabled, you are using a map document that was created in 8.x in which the symbol level drawing functionality is still tied to the data frame. To enable the commands, right-click the data frame, choose Advanced Drawing Options, and in the Symbol Drawing tab in the dialog that appears, click the Upgrade button.

  Tip: If you'll be using the Symbol Levels dialog frequently, there's a Set Symbol Levels command you can add into the context menu for feature layers and group layers that lets you launch that dialog without having to launch the layer's Properties dialog first. Go to Tools > Customize and look in the Layer category to find the Set Symbol Levels command.

- The new Symbol Levels dialog looks like the old Symbol Drawing tab in the Advanced Drawing Options dialog. The new dialog is more compact, and you can move multiple symbol levels up at down at once using the Up/Down arrows or by drag/drop:

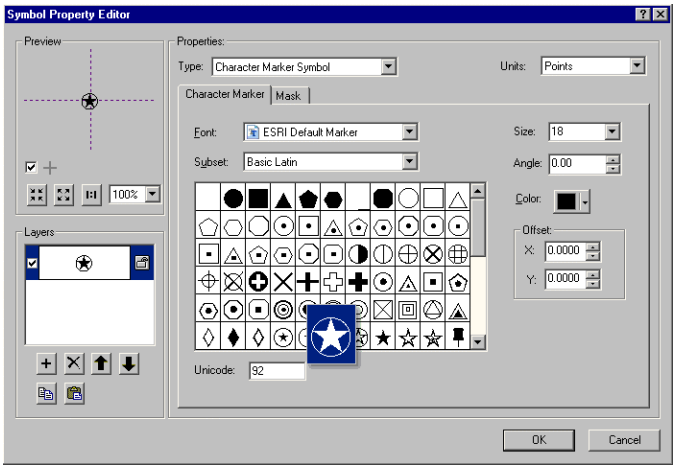


In the dialog there is also a new **Advanced View**, which gives you more control over the drawing order of symbol levels. Advanced View breaks each symbol into its component layers, and you can enter numeric values to specify where each symbol layer will be positioned in the draw order. This position is referred to as its symbol level. More combinations are possible in the Advanced View than in the Default View:



■ In the Symbol Property Editor dialog, we've improved and standardized the buttons for manipulating the preview and the list of symbol layers to make them better match the same buttons found elsewhere in ArcMap (see next point for screenshot).

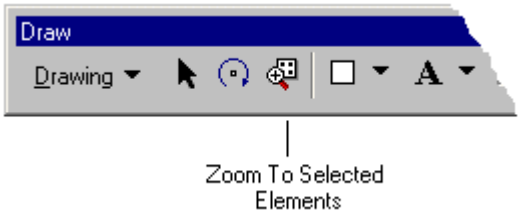
■ It is now much easier and quicker to choose fonts and glyphs when editing the properties of character marker symbols and north arrows. All the glyphs in the selected font and subset are listed in a scrolling list, and you can click on any glyph to see an enlargement. Here's what the character marker panel in the Symbol Property Editor for a marker symbol looks like now:



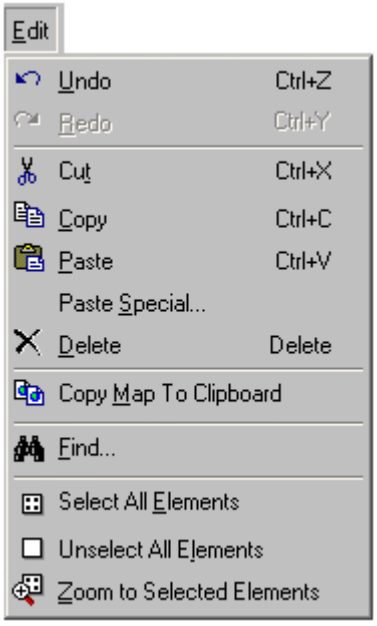
Elements

■ A new command called Unselect All Elements ❑ has been added into the Edit pulldown menu. This unselects all selected text elements and graphic elements if you are in Data View and all selected text elements, graphic elements and map elements if you are in Layout view. This command has the same effect as simply clicking any location on the map where there's no element. In some situations where you are zoomed in close on the map, there may be no such location you can click because one of the selected elements fills the ArcMap window. In those situations, this command lets you unselect all the elements without having to zoom out.

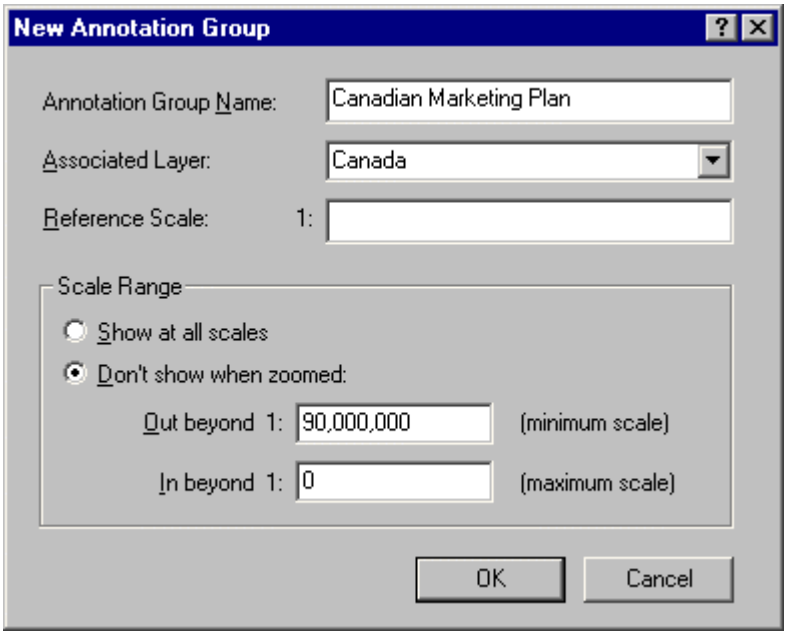
■ Zoom To Selected Elements command added into Draw toolbar:



This command zooms to the currently selected graphics, text or map elements in both Data View and Layout View. It is disabled if none of those items is currently selected. It has also been added into the Edit pulldown menu. In this way, the Edit pulldown now contains a group of commands for working with the selected elements on your map. We also added a matching icon to the existing Select All Elements command ⊞:



■ The New Annotation Target command in the Draw pulldown menu and the dialog it launches have been renamed to New Annotation Group because at 9.0 this command can no longer be used to create annotation feature classes in geodatabases. The dialog has also been enhanced so that you can now specify all the properties for the annotation group you create without having to visit the Annotation Groups tab in the Data Frame Properties dialog to set these. You can associate your new annotation group with a layer and also set a scale range at which the annotation group will be drawn:



As in 8.x, when an annotation group is associated with a layer it will be automatically turned on or off when the layer it is associated with is turned on or off. With the changes we have made at 9.0, it is now much easier to create an annotation group associated with a layer. Simply choose the New Annotation Group command, type in a name for your new annotation group, choose which layer you want to associate it with, press OK, and then start adding text and graphics elements to your map using any of tools on the Drawing toolbar. The elements you draw are automatically added into your new annotation group. You can choose a different annotation target using the Active Annotation Target command in the Draw menu.

■ When you draw rectangles, polygons, and circles their area is now shown in the status bar along with other dimensions. When you draw a line the length is shown. If you are drawing the graphics in Data View (or on top of a focused data frame in Layout View) the dimensions are shown in the data frame's **display units**. If you are drawing them in Layout View, they are shown in the **layout's page units**. In addition, you can enter coordinates and dimensions using keyboard shortcuts as described below:

Rectangle tool:
- The area, height and width are shown as you draw the rectangle.
- Press **c** on your keyboard to type in a coordinates of a corner point. This can be either the start point or the ending point of the rectangle.

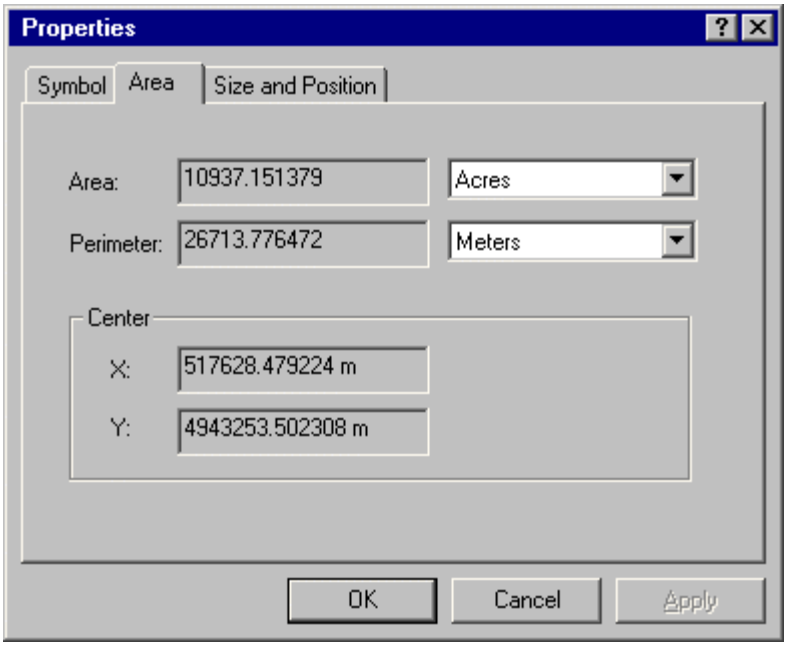
Polygon tool:
- The area and perimeter are shown as you draw the polygon.
- Press **c** on your keyboard to type in a coordinates of the next vertex.
- Press **e** on your keyboard to type in the coordinates of the last vertex.

Circle tool:
- The area, circumference and radius are shown as you draw the circle.
- A line representing the radius appears inside the circle as you draw it.
- Press **c** on your keyboard to type in the coordinates of either the start point (center point) or the end point of the radius.
- Press **a** on your keyboard to type in the area of the circle after the start point has been specified.
- Press **r** on your keyboard to type in the radius of the circle after the start point has been specified.

Line tool:
- The total length is shown as you draw the line.
- Press **c** on your keyboard to type in the coordinates of a vertex.
- Press **e** on your keyboard to type in the coordinates of the last vertex.

Edit Vertices tool
- When you edit the vertices of a polygon, its area and perimeter are shown in the status bar.
- When you edit the vertices of a line, its total length is shown in the status bar.

In addition, if you right-click a rectangle, polygon or circle, and choose Properties, you'll see a new Area tab in its Properties dialog. This shows you the area and perimeter of the graphic, and the coordinates of its center point. You can choose what units the area and perimeter are displayed in on this tab by using the dropdown lists of units:

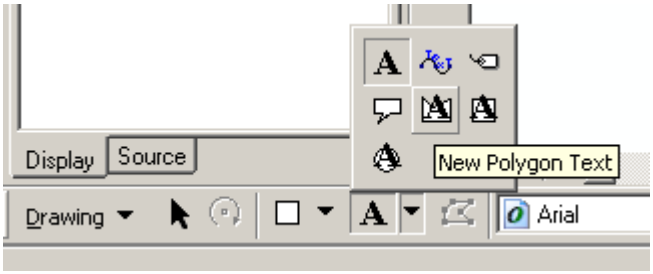


■ Three new text drawing tools have been added into the Draw toolbar that let you draw a graphic element containing text formatted like a paragraph. The text flows within the graphic shape. The resulting element has text properties and graphics properties, and some new properties for setting columns and margins to control how the text is positioned inside the graphic. These new properties are presented in a tab called Columns And Margins tab you'll find in the Properties dialog for one of these new graphic elements.

New Polygon Text tool

New Rectangle Text tool

New Circle Text tool

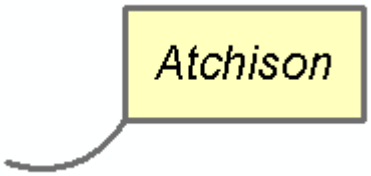


To resize graphics created with these tools, select the graphic and use the handles to scale the graphic, or press the Edit Vertices command .

These tools can be used to create graphic elements, annotation stored in the map document, and annotation stored in a geodatabase. These tools give the same dimension feedback in the ArcMap status bar, and have the same options for specifying their dimensions via the keyboard, that the Circle, Rectangle and Polygon tools have been given at 9.0.

■ A command called Create Text From Graphic Elements has been added into the Page Layout category in ArcMap's Tools > Customize dialog, from where you can add it into any menu or toolbar. This command creates a text element with the same geometry as the selected graphics element(s). The new element that is created from this command has the same properties, such as columns and margins, as a text element created with one of the three new text drawing tools added into the Draw toolbar in 9.0. This new command is useful when you want to create text elements based on graphic elements that you have already drawn on your map.

■ New curved leader lines: Two new curved leader lines are available for callouts. Select the Line Callout option when specifying the text symbol background for a text symbol drawn with the Callout tool to see these two new options:



Editing

■ The edit cache has been renamed to **map cache** and moved into the core ArcMap user interface because it now operates either inside or outside an edit session. Defining a map cache improves performance when you draw, edit, or select geodatabase features, particularly those stored in an ArcSDE geodatabase.

- The Edit Cache toolbar has been renamed to be the Map Cache toolbar and all the commands it contains have been renamed to reflect the new name.

- The Show Map Cache command has been enhanced to indicate the status of the map cache. Like the 8.x edit cache, the map cache only takes effect when your current display extent (i.e. the geographic extent you are currently viewing) is completely within the extent of the map cache. When your current display extent is completely within the extent of the map cache, the Show Map Cache command now turns green to show you that the map cache will be used.

When your current display extent is not completely within the extent of the map cache, the Show Map Cache command now turns red to show you that the map cache will not be used.

As in 8.x, the Show Map Cache command is disabled if your current display extent is entirely outside the extent of the map cache:

- The Edit Cache tab in the Editor > Options dialog has been moved into the Data Frame Properties dialog and renamed to the Map Cache tab.

See the Data Frames section above for more about map cache.

■ The Disconnected Editing toolbar is still in the user interface but it has been removed from the Editor > More Editing Tools pullright.

Internet data

■ When you add a layer based on ArcIMS image service layer into your map, the layer's entry in the Table Of Contents is no longer expanded by default. ArcIMS image service layers often have a large number of sublayers. This enhancement avoids the issue where adding an ArcIMS image service layer into your map caused an huge entry to immediately appear in your Table Of Contents. Now once you've added the layer, you can click the + sign next to it if you want to expand it to see a listing of its sublayers.

■ Working with ArcIMS image service layers: We've solved the problem where ArcIMS image service layers did not show up as layers in the Source tab of the ArcMap Table Of Contents. In 8.3 their sublayers appeared in the Source tab, but not the layers themselves.

■ Working with ArcIMS image service layers: We've solved the problem where expanding or collapsing the sublayers in a layer based on an ArcIMS image service was not saved when you saved your map document or saved the layer as a layer file.

■ Working with ArcIMS image service layers: When you expand an ArcIMS image service layer in ArcMap's Table Of Contents, you'll notice 'tree lines' between the layer and its sub-layers. These tree lines indicate that these sub-layers belong together and cannot be broken apart or used separately from the layer they belong to. These lines have been added at 9.0 to help differentiate these types of layers from group layers.

■ At 9.0, ArcGIS Desktop adds support for services being served using ArcGIS Server, which is a new server product in the ArcGIS 9.0 family purchased separately from ArcGIS Desktop. You can connect to an ArcGIS server either locally or via the Internet. See the ArcCatalog section of this document for more about how you connect to ArcGIS Servers. You can add map services from ArcGIS servers into your maps. When you add an ArcGIS map service into ArcMap, you'll see an **ArcGIS map service layer** appear in your Table Of Contents. It represents the contents of a map that is being served up from an ArcGIS server. If you have already worked with ArcIMS image service layers in ArcMap, this new layer type will seem quite familiar, because they are very similar: You can add them into ArcMap in the same way and they look and work very similar when they are in ArcMap. The main differences between how these layers work in ArcMap are:

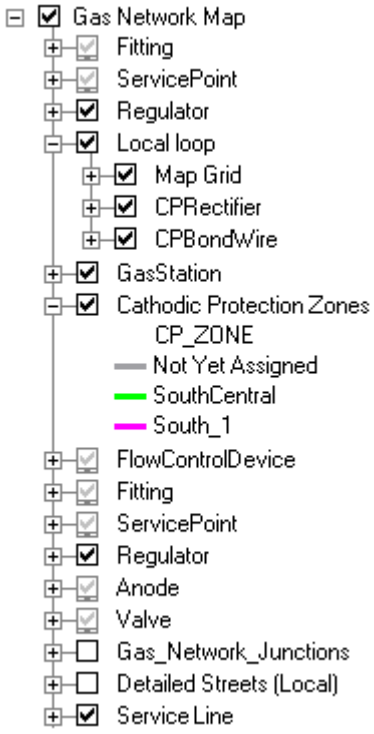
- You can't change the drawing order of the sub-layers in an ArcGIS map service layer. (You can change the drawing order of the sub-layers in an ArcIMS image service layer by using the Up/Down arrows in the Layer Properties dialog Layers tab).

- You can't select the features in an ArcGIS map service layer using ArcMap's selection tools and commands. So for example, if you look in the Set Selectable Layers dialog or the Select By Attributes dialog, you won't see these sub-layers listed. You can use the Identify tool and the Find command to query the sub-layers inside an ArcGIS map service layer.

- You can't open the attribute table for the data in an ArcGIS map service layer.

- The sub-layers inside an ArcGIS map service layer may have been grouped into a hierarchy by the author of the service. (These groups simply reflect group layers in the map document used to create the map service). These groupings make it easier to work with ArcGIS map services that contain a large number of sub-layers.

When you expand an ArcGIS map service layer in the Table Of Contents you'll immediately notice 'tree lines' linking together the sub-layers it contains. For example, here's an ArcGIS map service layer called 'Gas Network Map'. It contains a number of sub-layers, some of which are grouped under the heading 'Local loop':



This tree lines show you that, like the sub-layers inside an ArcIMS image services layer, the sub-layers inside an ArcGIS map service layer belong to that layer and can't be moved out of that layer.

Like the sub-layers contained in an ArcIMS image service layer, the sub-layers contained an ArcGIS map service layer don't provide all the functionality that ordinary layers have. If you right-click one of these sub-layers, you'll notice that the menu that appears only has a few commands. You can use the Identify tool and the Find command to query the sub-layers inside an ArcGIS map service layer. When you look in the Identify window or the Find dialog, you'll see these sub-layers listed in the usual way (if they represent data that can be queried in those dialogs).

Why don't ArcGIS map services support attribute tables and feature selection? An ArcGIS map service is designed to be literally a map service. It is intended to enable you to access a map that someone has published and 'embed' it into your own map as a layer and perform basic Find and Identify queries. It's not designed to be a whole collection of feature classes that you can work with. At 9.0, there is currently no equivalent in ArcGIS Server to the ArcIMS feature service. In future releases of ArcGIS Server there will be new services that allow you to work directly with data that is being published on an ArcGIS Server. An organization using ArcGIS Server can decide exactly how they want to serve their data, either as a map service with very restricted data query capabilities, or as data services, which will enable end users to work with the data directly as data sources in ArcGIS.

To emphasize the similarity between ArcIMS image service layers and ArcGIS map service layers, ArcCatalog uses the same icon for layer files created to store either type of layer:

Internet map service layer (based either on an ArcIMS image service or an ArcGIS map service)

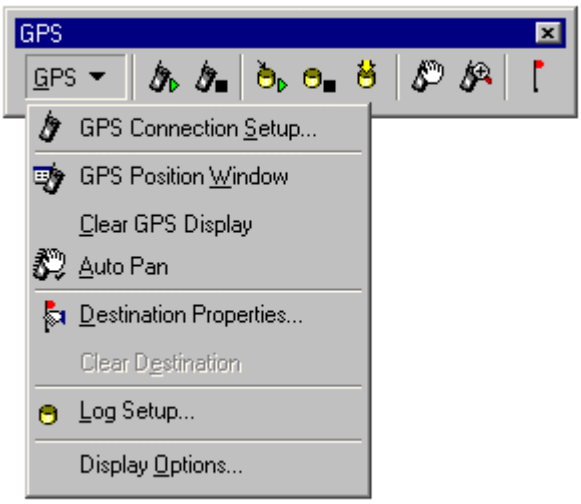
Linear referencing

■ The new geoprocessing framework introduced at 9.0 contains a set of tools for performing linear referencing. In the new ArcToolbox window, look in the 'Linear Referencing Tools' toolbox (available with ArcInfo license only).

At 9.0, the Route Events Geoprocessing Wizard  (available with ArcInfo license only) has been removed from the ArcMap Tools pulldown menu. You can still find this wizard in the Linear Referencing category in the Tools > Customize dialog. If you still wish to use this wizard, you can add it into any ArcMap toolbar or pulldown menu from that dialog. Note: No development has been carried out on this wizard since 8.3, and no further development is planned.

GPS support

■ The GPS toolbar is now standard in ArcMap. Before 9.0, the GPS toolbar was a separate free download.



Miscellaneous

■ We have improved ArcMap's performance in a number of areas, notably the time it takes to start the application, launch the Add Data dialog, redraw the map after changes have been made in the Table Of Contents, and draw legends.

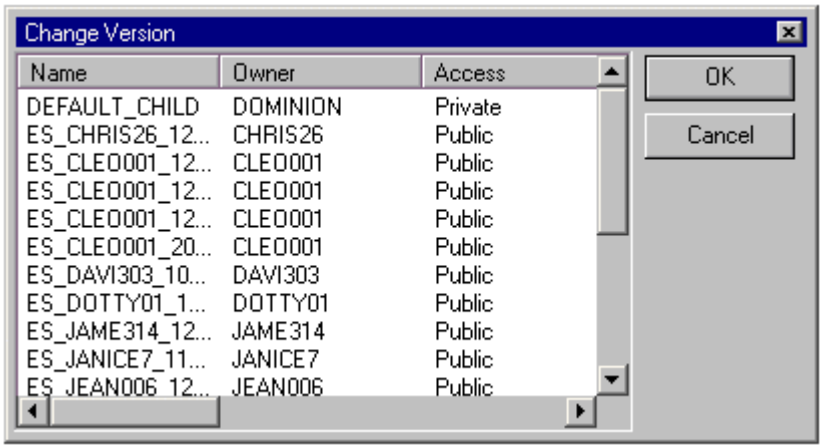
Other areas where there is an improvement in performance include the time it takes to launch the Tools > Customize dialog, update the Table Of Contents, and select large numbers of graphics.

We have also improved the logic ArcMap uses to determine whether or not the map needs to be drawn in response to changes or additions made to its contents. We've not eliminated the problem entirely at this release, but we have cut down on the number of unnecessary redraws you may experience.

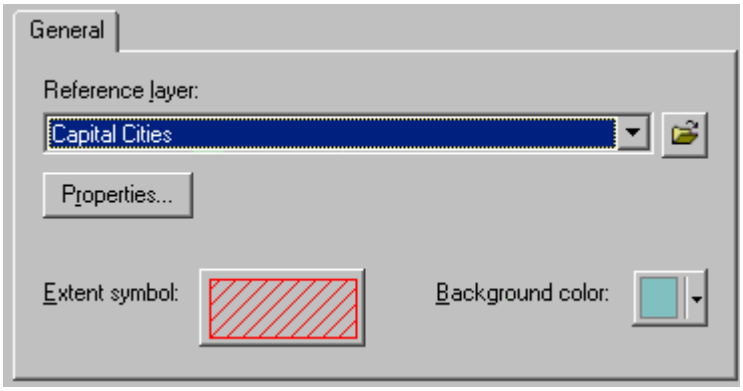
■ We have made a renewed effort to identify and track down random crashes and other error issues within ArcMap We have made a lot of progress in addressing the issues that have reported in this area.

■ The Edit > Paste command (and the Paste button on the Standard toolbar), now lets you paste layers you have copied. *(A bug in the pre-release stops this working if you have previously copied a data frame or an element to the clipboard).* Right-clicking a data frame and choosing the Paste Layer command, which has been renamed to Paste Layer(s) at 9.0, still works too.

■ Working with versioned data: You can now sort columns in the Versions Manager. The Change Version dialog has changed, and now allows you to sort the list by any of its three headings:



■ Overview window Properties dialog. You can now specify a background color for the Overview window. The option to browse for a reference layer has been removed from the dropdown list and standardized as a button to the right of the dropdown list.



■ Several new commands have been added into the Help pulldown menu for ArcMap and all the ArcGIS Desktop applications. These commands give you immediate access to ESRI support and training resources on the Web, including the ESRI Support Center, ArcObjects Online and the Virtual Campus.

Other ArcCatalog changes

General

■ We have improved ArcCatalog performance in a number of areas, notably the time it takes to start the application.

■ When you right-click a map document (.mxd file) in ArcCatalog, you'll see a new Set Data Source(s) command. This launches a dialog that makes it easy to update or repair some or all of the references to data sources in the map. By default, this dialog creates a copy of the .mxd file.

This command is also present if you right-click a published map (.pmf) file, although it is disabled if the publisher of the .pmf file chose not to provide full access to its contents in ArcGIS applications when it was published.

The Set Data Source command cannot be used to update or repair references to data in ArcSDE geodatabases.

Data conversion tools

■ At 9.0, new conversion tools are provided in ArcCatalog that make full use of the new geoprocessing framework. You'll see these tools in ArcCatalog in the Import and Export pullrights in the context menu that appears when you right-click data. Tools are provided for importing/exporting one item or multiple items. These tools can also be launched from the new dockable ArcToolbox window that's available in each of the ArcGIS Desktop applications. Like any tools in the new framework, the new conversion tools can be launched individually, run at the command line, used in scripts, or added into models. This makes it very easy to combine the tools with other functions and create complete conversion workflows.

■ Many of the ArcGIS 8x tools and wizards for performing data conversion are still available at 9.0. In ArcCatalog choose Tools > Customize and click on the Commands tab in the dialog that appears. You'll find the 8x tools and wizards in these categories:

'ArcGIS 8x Conversion Tools'
'ArcGIS 8x GeoDB Conversion Tools'

You can drag and drop any ArcGIS 8x tool into any ArcCatalog toolbar, pulldown menu, or the context menu for the appropriate input data type. If you add ArcGIS 8x tools into toolbars or pulldown menus, some of them (not all) will only become enabled when data of the appropriate input type is selected in ArcCatalog's Contents tab. Note: no new development has taken place on the ArcGIS 8x tools available via the Tools > Customize dialog since ArcGIS 8.3 was released: these tools are provided on an 'as-is at 8.3' basis.

Internet data

■ The Internet Servers folder in ArcCatalog has been renamed as the GIS Servers folder:

The new GIS Servers folder contains connections to two types of servers:

- **ArcIMS servers**: Apart from the icon used for these servers, these connections are unchanged at 9.0.

- **ArcGIS servers**: These are connections to servers created using the ArcGIS Server product, which is a new server product in the ArcGIS 9.0 family purchased separately from ArcGIS Desktop. You can connect to an ArcGIS server either locally or via the Internet. If you have the correct permissions, you can add new services to an ArcGIS server that you connect to locally. ArcCatalog provides tools for administering ArcGIS servers and their contents.

 Connection to ArcIMS server

 Connection to ArcGIS server over Internet

 Connection to ArcGIS server over local area network (LAN).

In this example, connections have been made to three ArcIMS servers, a local ArcGIS Server, and an ArcGIS Server on the internet:

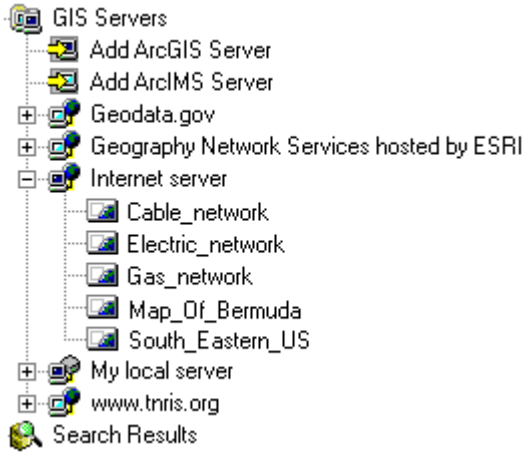
■ In 8.3, a connection to the Geography Network ArcIMS server at http://www.geographynetwork.com was automatically installed by ArcGIS. At 9.0, this connection is still automatically installed but as you can see in the graphic above, we've renamed it to 'Geography Network Services hosted by ESRI'. This connection still points to http://www.geographynetwork.com. This new name better reflects the fact that when you look at the services available on this server, you don't see everything that's available in the Geography Network. It only contains the services in the Geography Network that are hosted by ESRI on that particular ArcIMS server. There are hundreds of additional services on the Geography Network that are not hosted by ESRI. To access these, use the Add Data From Geography Network command in ArcMap's File menu.

■ When you look inside an ArcGIS server, you'll see the services it contains, the same way that you see the services that an ArcIMS server contains when you look inside it. The services you'll find inside an ArcGIS server at 9.0 are map services and geocoding services.

 Map service

 Geocoding service

In this example, you can see that this ArcGIS server contains five map services:



An ArcGIS map service is created by the person or organization publishing it using an ArcMap map document. All the layers in that map document will be in the ArcGIS map service but with this difference: when a user of ArcGIS Server creates a map service using an ArcMap document that contains multiple data frames, they choose which one of the data frames they want the service to primarily display when it is accessed via ArcCatalog. So each ArcGIS map service you access via ArcCatalog will display the contents of one data frame. (Custom applications based on ArcGIS map services can access all the data frames in the map service, not just the primary one).

■ There's a new Proxy Server tab in the Tools > Options dialog in ArcCatalog. *At 9.0 pre-release this only applies to connections that you make to ArcGIS servers in ArcCatalog or the Catalog Browser.* The proxy server you specify will be used when you access services from any ArcGIS server connection server in any ArcGIS application.

Metadata

■ We have fixed the problem where attribute information was scrambled after converting data to a different format or dropping attributes in the middle of a table.

■ Editing metadata in ArcSDE is now associated with data editing privileges in ArcSDE. You no longer need to be the owner of the data to edit its metadata.

■ Improvements have been made to the ArcIMS Metadata Service for better scalability and performance

■ We have added additional sample applications to the ArcGIS Developer Kit and support site, including an exporter for generating templates and a custom page for entering data quality information with the ISO metadata editor.

■ Note about support for metadata standards in ArcGIS 9.0: ISO 19115 has been finalized. Now a new standard, ISO 19139, is in development. ISO 19139 is the implementation specification for ISO 19115. It will define how ISO metadata should be stored in XML format; the new XML is much different than the format we use now. ISO 19139 is also pulling together several different TC 211 standards including spatial referencing, feature cataloging, data quality, GML, and part 2 of 19115, which adds remote sensing information. Groups that are requiring ISO metadata support are requiring support for ISO 19139 rather than 19115. We are already

working on supporting ISO 19139 for the next release after 9.0. Because of this change in tack we haven't added pages to the ISO 19115 version of the metadata wizard for 9.0.

■ The Gazetteer Loader command from ArcIMS 4.0.1 is now provided with ArcCatalog to make it more readily available. To add this command into ArcCatalog's user interface, go into the Tools > Customize dialog and drag the command out of the Gazetteer category. This command lets you populate a gazetteer in an ArcIMS metadata service with records, enabling you to customize your gazetteer by adding places that are not included in the default gazetteer or trimming it down so it just contains places inside the area of interest covered by your metadata service.

Geodatabases

Scalability

■ At ArcGIS 9.0, there are many improvements to performance and scalability of the geodatabase in a multi-user workflow. This means optimized queries and eliminating over usage of CPU and bandwidth. All multi-user geodatabase users will benefit from these performance gains.

Open geodatabase data exchange via XML

■ You can export all or any part of a geodatabase, such as individual feature datasets, feature classes, and tables, to an export file in XML format. The file can include all the data or just the schema. You can then send or transfer the file to another user who can import the data into their geodatabase. Disconnected edits can also be transferred and checked-in using the export file.

The XML schema used by geodatabases will be a published standard (much like shapefiles). This schema provides access to all geodatabase data types. This will allow other applications to import and export data in a geodatabase friendly format. This XML format is not engineered as a direct read format; rather it is a data exchange format. We would expect other applications to import the XML file to their native formats and then export back to XML format when editing. The geodatabase exchange format will allow complete export; change only export (i.e. disconnected editing), and schema only export. By providing a way to exchange geodatabase information, users can publish data models and share geodatabase datasets in a completely open and interoperable environment.

To export data from a geodatabase, in ArcCatalog right-click the geodatabase, feature dataset, feature class, or table you want to export and from the Export pullright choose the XML Workspace Document command.

To import data from an export file, in ArcCatalog right-click the geodatabase you want to import into and from the Import pullright choose the XML Workspace Document command.

Geodatabase conversion tools

■ At 9.0, new tools are provided for importing to and exporting from geodatabases that make full use of the new geoprocessing framework. You'll see these tools in ArcCatalog in the Import and Export pullrights in the context menu that appears when you right-click a geodatabase, any type of data in a geodatabase, or any file-based data that can be converted into a geodatabase. Tools are provided for importing/exporting one item or multiple items. These tools can also be launched from the new dockable ArcToolbox window that's available in each of the ArcGIS Desktop applications. Like any tools in the new geoprocessing framework, the new conversion tools can be launched individually, run at the command line, used in scripts, or added into models. This makes it very easy to combine the tools with other functions and create complete conversion workflows.

Tip: Most of the ArcGIS 8x tools and wizards for converting to and from geodatabases are still available at 9.0. In ArcCatalog choose Tools > Customize and click on the Commands tab in the dialog that appears. You'll find the 8x tools and wizards in the 'ArcGIS 8x GeoDB Conversion Tools' category. You can drag and drop any ArcGIS 8x tool into any ArcCatalog toolbar, pulldown menu, or the context menu for the appropriate input data type. If you add ArcGIS 8x tools into toolbars or pulldown menus, some of them (not all) will only become enabled when data of the appropriate input type is selected in ArcCatalog's Contents tab. Note: no new development has taken place on the ArcGIS 8x tools available via the Tools > Customize dialog since ArcGIS 8.3 was released: these tools are provided on an 'as-is at 8.3' basis.

New data types

■ At 9.0, **raster data** is fully integrated into the geodatabase, with improvements in how raster data is stored and managed, and new tools for building and working with raster catalogs in geodatabases. Raster datasets and raster catalogs can also now be stored in personal geodatabases. See the Raster Data section in the document for more information.

Geodatabase tools that previously only applied to feature data now also apply to raster data. For example, data in rasters and raster catalogs can be extracted using the Extract Data commands in the Disconnected Editing toolbar. Raster data can also be included in a check out, but changes to the rasters will not be checked in.

■ You can now define **fields** of type raster. They are supported for feature classes and standalone tables in personal geodatabases and ArcSDE geodatabases. They enable you to store rasters such as digital photos in tables so they can be accessed across all the ArcGIS Desktop application via the Table window and Identify function. See the Raster Data section in the document for more information.

■ Whenever you create a new table or feature class you select a data type for each field. **GlobalID** and **GUID** are data types new to 9.0 and store registry style strings that uniquely identify a feature or table row within a geodatabase and across geodatabases. Developers can use them in relationships or in any application requiring globally unique identifiers.

New file format for transferring disconnected edits

■ In ArcGIS 8.3, if you didn't want to check-in directly from the check-out geodatabase, you exported the changes only from the check-out geodatabase to a delta database, transferred the delta database, then checked in the changes from the delta database. Instead of exporting to a delta database, you can now export changes to a smaller XML file and transfer it. The changes can then be checked in from the XML file.

Geocoding

■ 'Geocoding services' have been renamed to 'Address locators' throughout ArcGIS. The Geocoding Services folder in the ArcCatalog tree is now the Address Locators folder:

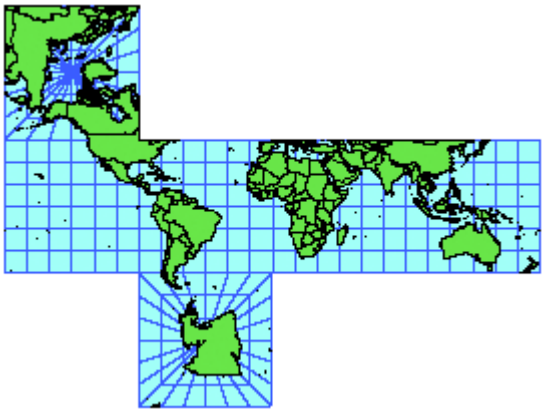
In previous releases, we used the terms 'geocoding service' and 'locator' somewhat interchangeably. 'Locator' is the term that was used for developers, and 'geocoding service' was the term used in the user interface. This caused some confusion for people. Also, at 9.0 the ArcGIS Server product enables users to create geocoding servers that provide geocoding-based services. Renaming geocoding services to address locators in the ArcGIS user interface removes possible confusion between address locators on disk or in databases, and geocoding-based services being served via ArcGIS Server.

Coordinate systems

In addition to the enhancements listed here, many quality and performance issues have been addressed in this part of the software too.

■ Additional map projection supported:

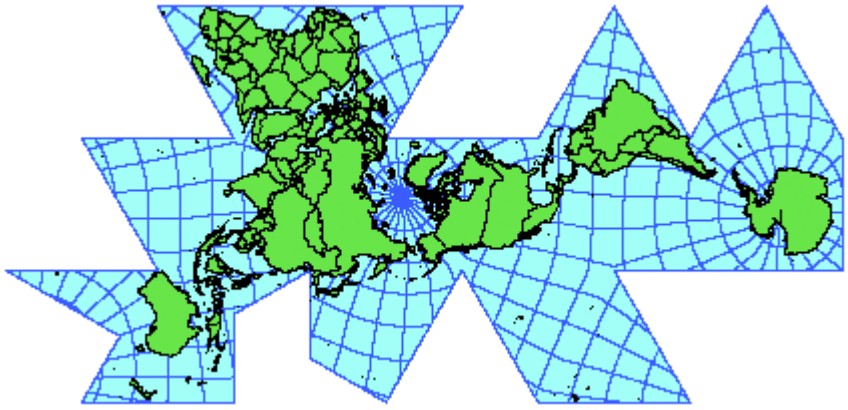
- **Cube** map projection added. This is a faceted projection used behind the scenes by the ArcGlobe application in the 3D Analyst extension when it prepares data for caching. The world is projected onto a six-sided figure with square sides. Not normally used directly in mapping. May be suitable for educational purposes



Note: The rest of the Coordinate Systems enhancements listed below are planned for 9.0 Final at the time of writing but are not in 9.0 Pre-Release:

■ *Additional map projections supported:*

- ***Fuller** projection supported: We support the final version that was described by Buckminster Fuller in 1954. This projection converts the globe into a 20-sided figure called an icosahedron.*



- ***Local Cartesian** projection supported: An improved version of the ArcInfo Workstation LOCAL projection. Unlike the Workstation version, the ArcGIS Desktop Projection Engine adds support for a scale factor, a rotation value, and false easting and northing parameters. This is a specialized map projection that does not take into account the curvature of the earth. It's designed for very large-scale mapping applications.*

- ***Robinson ArcInfo** supported: This is the same version of Robinson that's supported in ArcInfo workstation.*

- ***RSO*** *(Rectified Skew Orthomorphic) projection supported. This is used for coordinate systems in Malaya and Borneo:*

■ *Support has been added for over 250 additional geographic transformations. These include:*

- *Replacement of the state-level NTv2 files with the new national files for Australia.*

- *NTv2 transformations files for France, the island of Grand Terre, and the area around Noumea in New Caledonia.*

■ *New coordinate system (prj) files:*

- *Over 300 geographic coordinate system files including ones for the Minnesota and Wisconsin county systems, planets and moons in the solar system, and many others from the European Petroleum Survey Group (EPSG) (http://www.epsg.org/) database.*

- *Almost 1000 projected coordinate systems including the Minnesota and Wisconsin county systems, 3 degree Gauss-Kruger zones for China and Russia, EMEP grid systems, Lambert Azimuthal, and Lambert Conformal Conic systems for Europe, RSO systems for Malaya and Borneo, Australian ISG zones, UTM and large scale mapping zones based upon JGD2000, several US statewide zones, State Plane zones based on international feet, and more!*

Application development and deployment

■ ArcGIS 9.0 provides a complete system for GIS application development. ESRI offers developers enormous flexibility in selecting a development platform for ArcGIS. ArcObjects is at the core of these choices, offering an integrated collection of GIS software objects written in C++. Developers can choose from four development environments (Java, .NET, C++, and Component Object Model [COM]). Until now, developers have only been able to customize the ArcGIS Desktop applications. At 9.0 developers also have the ability to deploy ArcGIS solutions as independent applications on the desktop or as Web services across the Intranet or Internet.

Developers can choose from three deployment options:

- **ArcGIS Desktop**: Custom applications deployed with the Desktop applications

- **ArcGIS Engine**: embeddable GIS (separate product, new at 9.0) ArcGIS Engine is a new developer product providing a powerful collection of embeddable mapping and GIS components for creating and deploying custom GIS and mapping desktop applications. With ArcGIS Engine developers can build solutions and deploy them to customers without requiring the ArcGIS Desktop applications (ArcMap, ArcCatalog) to be present on the same machine. Developers can create new applications or add dynamic mapping and GIS capabilities to existing applications. Solutions created using ArcGIS Engine can vary from simple map viewers to more sophisticated GIS applications for integrated data visualization, analysis, and management. ArcGIS Engine supports all the standard development environments including .NET, Component Object Model (COM), Java, and C++ and all the major operating systems such as Windows, UNIX, and Linux.

- **ArcGIS Server**: server-centric GIS (separate product, new at 9.0) ArcGIS Server is a GIS enterprise application server that provides complete GIS capabilities throughout an organization while maintaining a centrally managed database. Mapping, geocoding, spatial queries, editing, tracing, and linear referencing are all examples of applications that developers can build using ArcGIS Server. These applications can be accessed by browser-based clients, custom applications built with ArcGIS Engine, and ArcGIS Desktop. ArcGIS Server supports all common development environments (Java, .NET, C++, COM). The initial release of ArcGIS Server runs on Microsoft Windows 2000 and XP. Other server platforms will be supported at subsequent releases.

  ArcGIS Server 9.0 is designed primarily for enterprise information system developers and integrators who wish to build server-side GIS applications in either a client/server or web services environment. It is complementary to ESRI's two other enterprise application server products, ArcSDE, which is used to access spatial data in a commercial DBMS, and ArcIMS, which is used for high volume Internet geo-publishing.

■ There's a new ArcGIS Developer website for 9.0 at:

http://arcgisdeveloperonline.esri.com

The ArcGIS 8.x ArcObjects Online website is still available at http://arcobjectsonline.esri.com

At pre-release, the ArcGIS Developer command in the Help pulldown menu in the ArcGIS Desktop applications still points at the ArcObjects Online website.

Licensing

■ For the 9.0 release, the name of the License Manager has changed. Previous versions of the software use the name 'ESRI License Manager'. ArcGIS 9.0 uses the name 'ArcGIS License Manager', which reflects the new vendor daemon used (ARCGIS). The default port number for the new ARCGIS daemon is 27004 and the license file variable is ARCGIS_LICENSE_FILE=@<host>.

■ At the 9.0 release, ArcIMS and ArcSDE software no longer use the FLEXlm License Manager. At 9.0, these products as well as ArcGIS Engine, ArcGIS Server, and ArcView (Single Use)/ArcEditor (Single Use) all require that you register and authorize the software for use.

■ ArcGIS Desktop and ArcInfo Workstation 9.0 cannot use an older version of the License Manager or pre-9.0 license files. To run ArcGIS Desktop and/or ArcInfo Workstation 9.0, you will need to upgrade your license file to a 9.0 license file. To do so, see http://service.esri.com. Once you have obtained your new file you can install the 9.0 License Manager from the Desktop or Workstation CDs.

■ During the transition period you can maintain both an 8.x and 9.0 License Manager on one machine or you can separate them on two machines. If you wish to use only one machine, then you must use your existing 8.x Hardware Key number to request your new 9.0 license file.

■ ESRI will systematically generate 2 license files that will be sent back to you:

- A 9.0 license file which will contain all the licenses you had on maintenance (licenses you were entitled to upgrade).

- An 8.x license file, which will contain the number of licenses you did not have on maintenance (or which you chose not to upgrade). Should you upgrade all of your licenses to 9.0, this 8.x file will not be generated.

■ While your organization is in transition you can continue to use your existing 8.x license file along with the License Manager you installed with 9.0. However, once the transition period is complete and all of your licenses on maintenance have been upgraded to 9.0 and installed you will need to either replace your existing 8.x license file with the new 8.x license file that was sent to you, or, if no 8.x file was sent, you will need to completely uninstall your 8.x ESRI License Manager.

For example: Only some of your licenses are on maintenance:

Software Name	License Type	Total Seats	On Maintenance	Maintenance Expiration
ArcInfo	Floating	5	3	10/31/04

If you decide to upgrade all licenses (those on maintenance) to version 9.0, then ESRI will generate and send you:

- A 9.0 file with 3 ArcInfo 9.0 licenses.

- An 8.x file with 2 ArcInfo 8.x licenses

■ For more information on these topics or any other portion of the License Manger please visit the License Manager Reference Guide found in the Documentation directory on your ArcGIS Desktop or ArcInfo Workstation 9.0 CDs.

3D Analyst Extension

At ArcGIS 9.0 the 3D Analyst extension presents new functionality in three major areas, 3D visualization, 3D symbology, and 3D geoprocessing. ArcGlobe is the next generation of 3D visualization. ArcGlobe allows for many gigabytes of data to be seamlessly merged on the fly into a single fast visualization experience. Enhanced 3D symbology includes true 3D symbols and realistic texture support. Finally, there is a new set of 3D Analyst tools presented in the geoprocessing framework at 9.0.

ArcGlobe

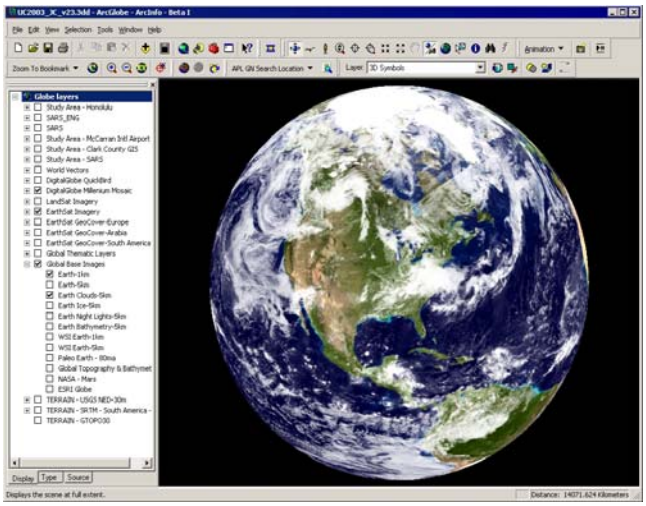
■ The 3D Analyst extension includes a completely new application called ArcGlobe. ArcGlobe provides a highly interactive 3D visualization and analysis application for working with large and varied GIS data sets. Using a special indexing structure, ArcGlobe allows users quickly navigate gigabytes and terabytes of GIS data without pre-processing the data. ArcGlobe also integrates with the new ArcToolbox framework allowing tools, models, and scripts to be executed within this highly dynamic environment.

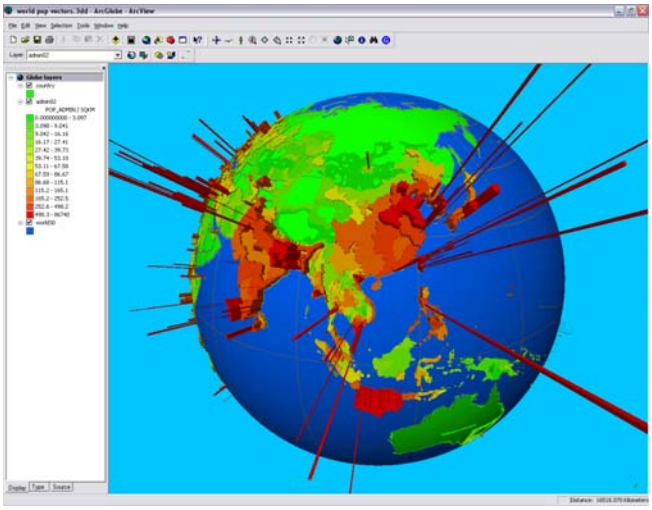
ArcGlobe provides the same basic functionalities as ArcMap, excluding graphics, editing, and page layout. This means users can:

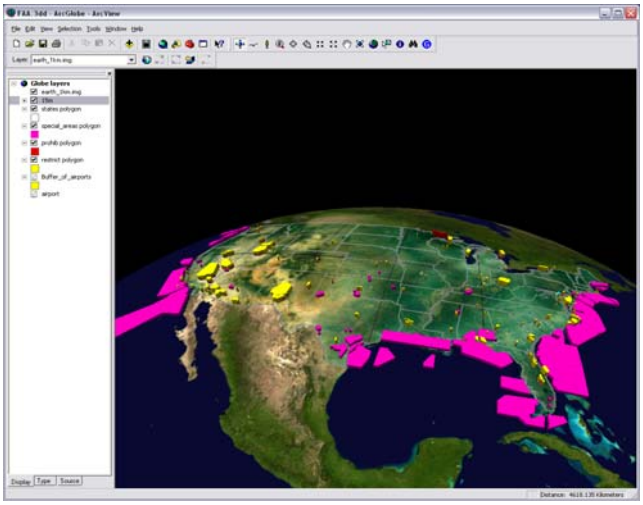
- Select by attribute, by location, or interactively
- Identify features
- Symbolize features
- Extrude features to 3D
- Use 3D Symbols
- Navigate (equivalent of pan, zoom)
- Find based on an attribute
- Find based on an Address
- Find based on a location using a global gazetteer.
- Rotate Globe
- Interactive Fly/walk mode
- Record Animation to AVI or QuickTime
- Animate the display automatically
- Integrate raster, vector, and terrain data, including data being served on the Internet.
- Display data on the surface, at specified elevation or on a different specified surface.
- Customize the application with VBA or COM
- And much more…

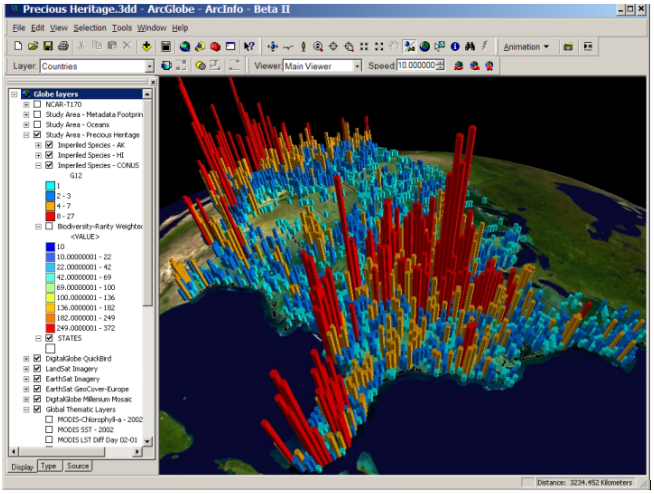
ArcGlobe and ArcScene, while engineered for different users, overlap in many areas of functionality. ArcScene is good for small local projects with relatively small amounts of data. ArcScene has more interactive tools and graphic support than ArcGlobe, making it ideal for some analysis and visualization tasks. ArcGlobe focuses on using larger amounts of data and allows the user to seamlessly integrate all their data into a single globe based document.

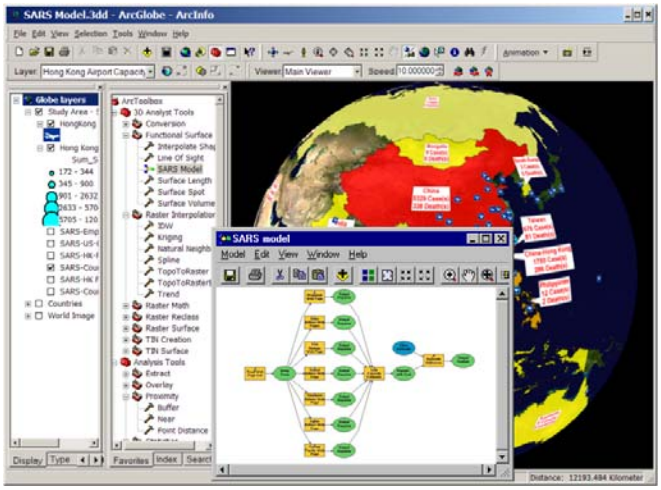
Examples of dramatic visualizations created with ArcGlobe. The screenshot at the left on the bottom row shows a model created with the new geoprocessing framework with results displayed in ArcGlobe. The tight integration of modeling and 3d visualization is a new and very powerful feature of the 3D Analyst extension at 9.0. (Some data shown below courtesy of DigitalGlobe & NatureServer (Natural Heritage Programs)).

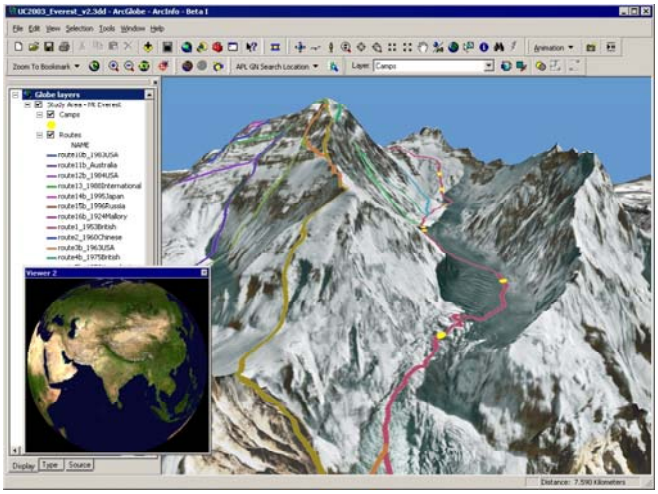












3D symbols

■ 3D Analyst adds support for using 3D symbols. This allows you to represent GIS features with 3D symbology, such as using houses or cars for point features, grass or water texture fills for polygon features, and tubes or textured lines for line features. ArcScene and ArcGlobe both support these new 3D symbols. In the standard symbol selector dialog you can choose various 3D symbol types:

For Points:
3D Character Marker: 3D Symbols from True Type fonts extruded.
3D Marker: Import of OpenFlight, 3D Studio, and VRML models
3D Simple Marker: simple shapes

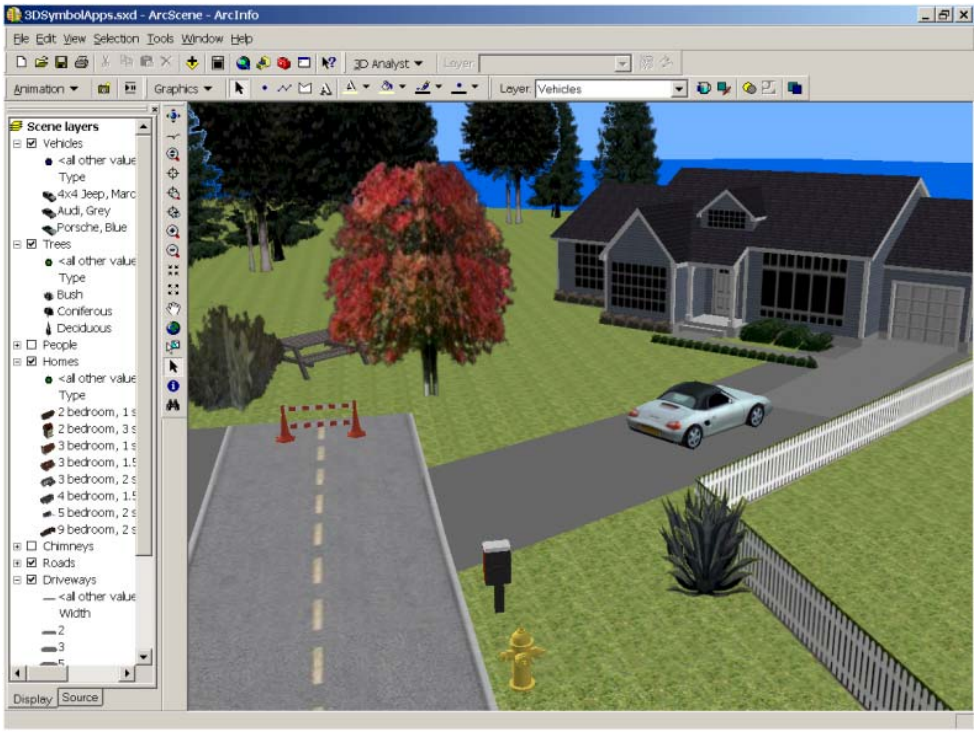
For Lines:
3D Simple Line: Simple line shapes of tube, wall, and strip
3D Textured Line: Strip line with image texture (like a photo of a road).

For Polygons:
3D Texture Fill: Allows the user to pick an image to use as a fill pattern. (e.g., grass, water, pavement…)

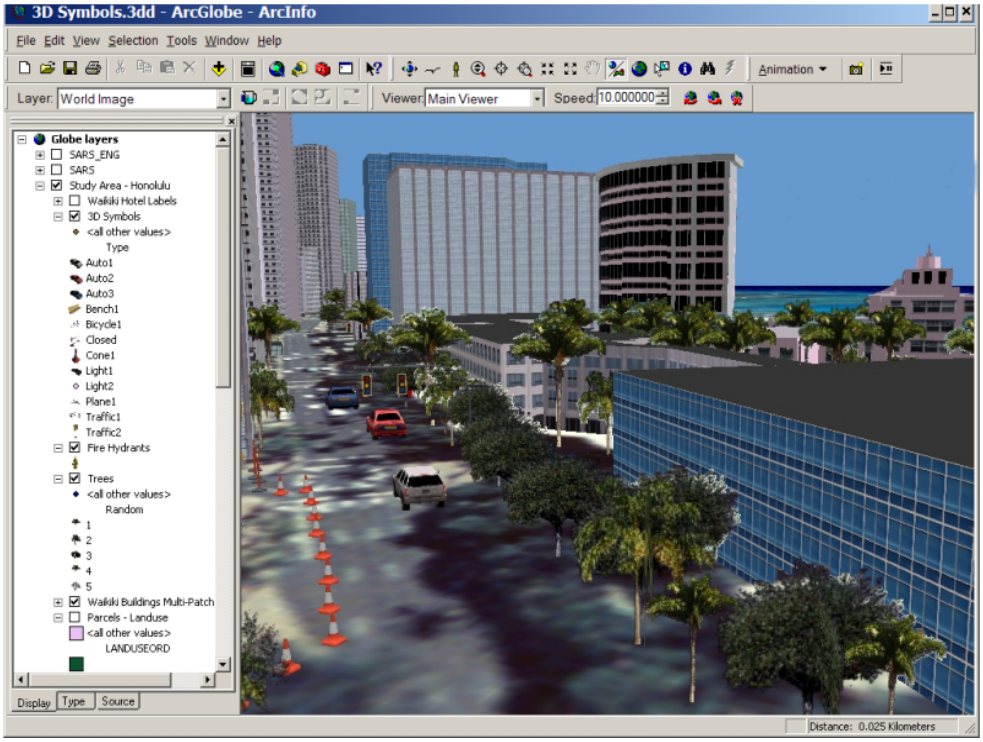
Additionally you can select from a variety of supplied 3D styles to choose from over 500 quality 3D objects. These styles include:

- 3D Houses
- 3D Skyscrapers
- 3D Industrial buildings and equipment
- 3D Basic shapes
- 3D Street furniture (signs, lights, benches…)
- 3D Trees (and shrubs)
- 3D Vehicles

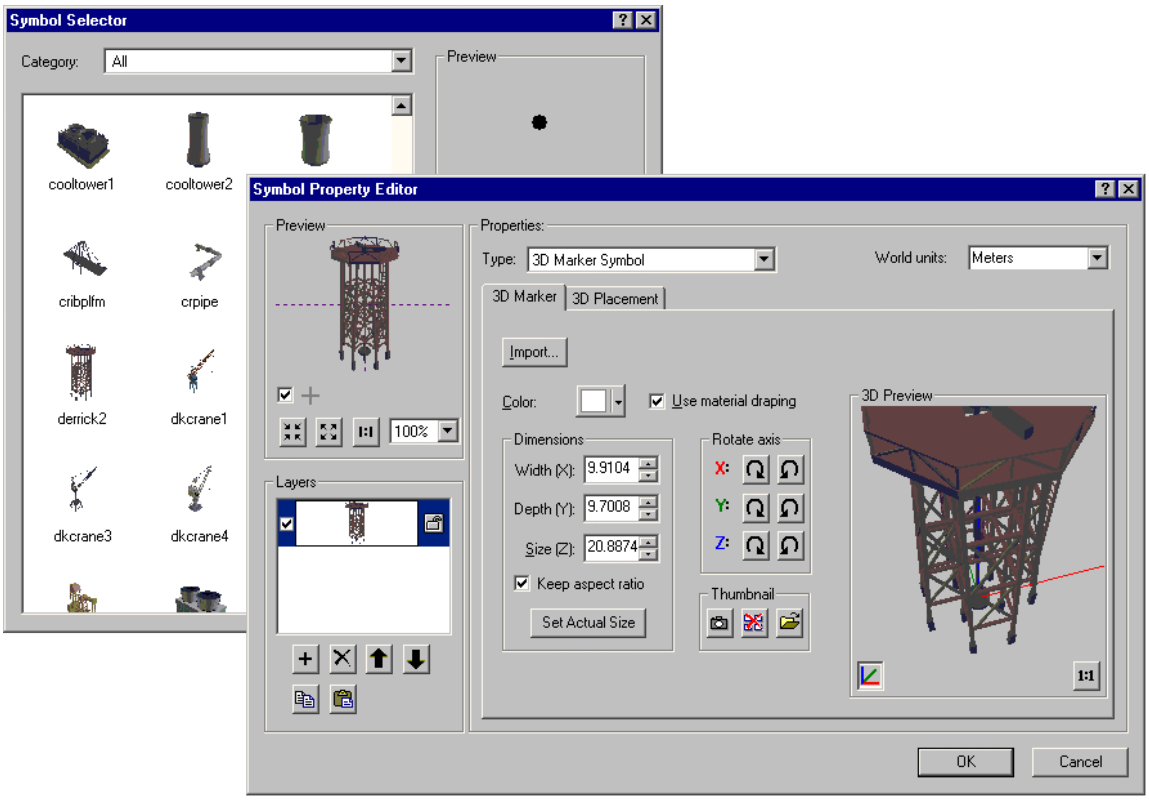
Various 3D symbols and textures used in ArcScene:



3D symbols including palm trees and textures on the buildings and ocean add realism to this ArcGlobe display. (Data Courtesy of the City and County of Honolulu):



3D symbol property editor:



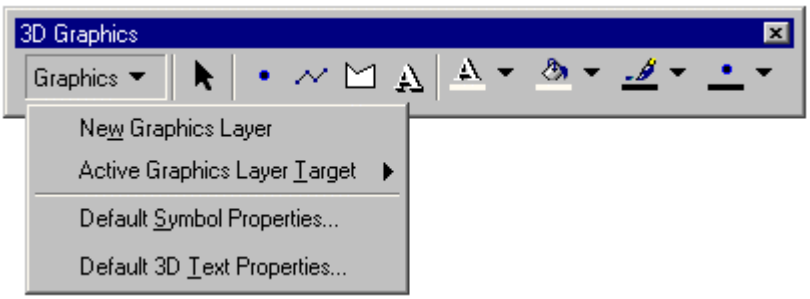
3D geoprocessing

■ The 3D Analyst toolbar you are familiar with from ArcMap 8x is still in the product (it is not provided in the new ArcGlobe application). However at 9.0 there is a new suite of geoprocessing tools for working with 3D data provided in the new geoprocessing framework. Use these tools to take full advantage of modeling, scripting, etc in your 3D analysis work. The new ArcToolbox window is available in ArcMap, ArcCatalog, ArcScene and ArcGlobe. For example, this means that for the first time you can perform your 3D analysis and data processing directly inside ArcCatalog.

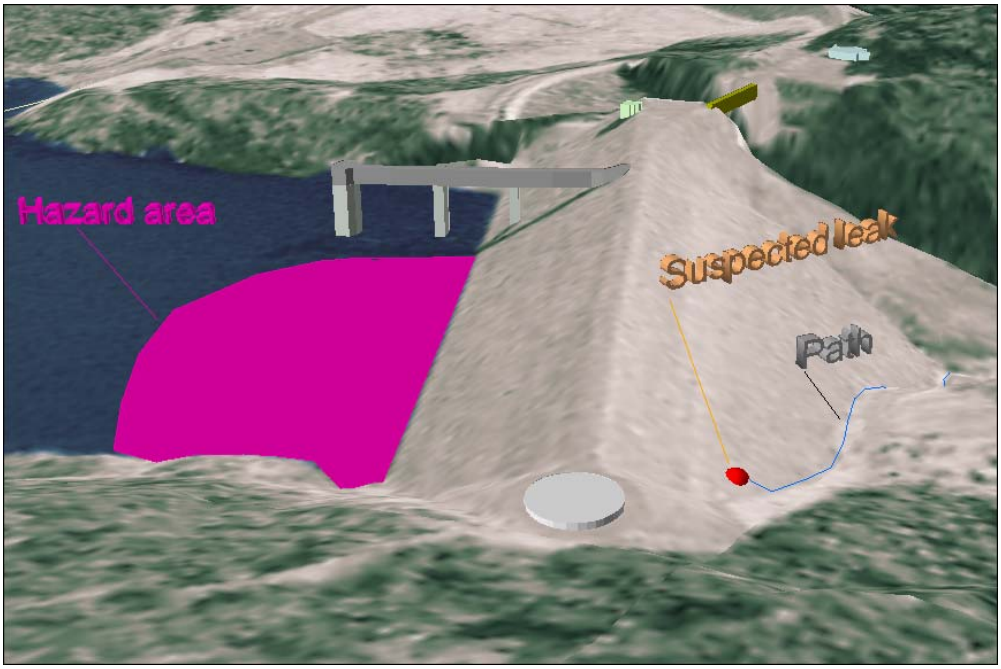
For a quick overview of how to use geoprocessing written from the point of view of working with layers in a document, see 'Geoprocessing in ArcMap at 9.0' in the 'Other ArcMap Changes' section of this document.

Other ArcScene changes

■ At 9.0, you can now draw 3D graphics and text directly onto scenes using the new 3D Graphics toolbar:

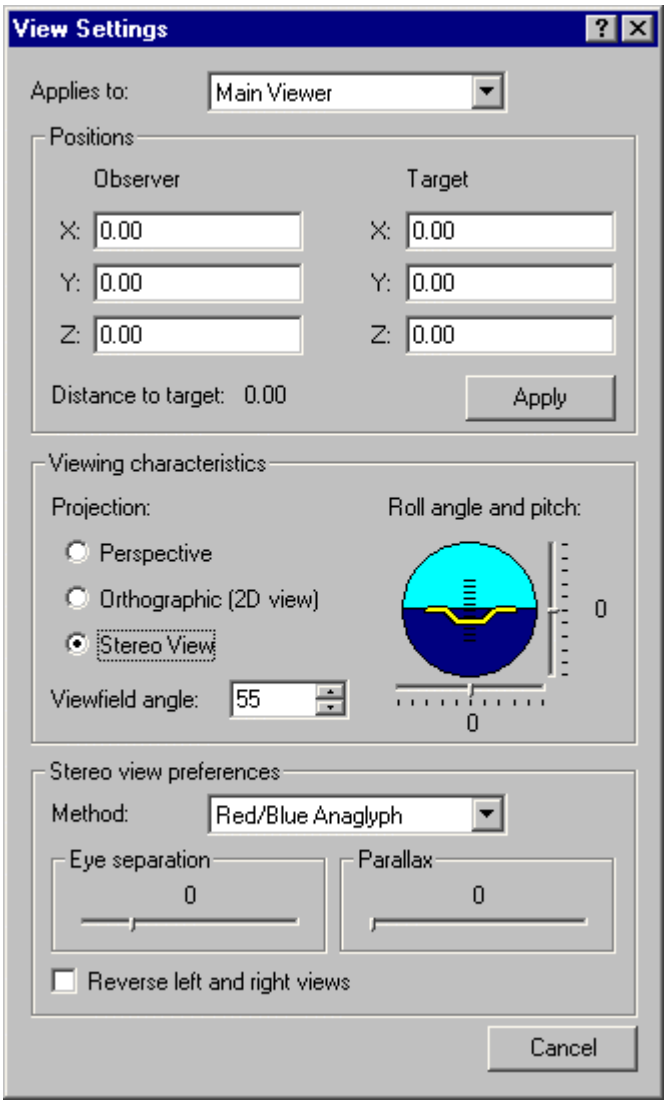


Use 3D graphics and text to enhance your scenes or 3D maps. You can draw points, lines, polygons, and 3D text to make highlight parts of your scene. For example, you might define a study area by enclosing it with a line or polygon boundary or label buildings with text indicating their names:



■ ArcScene now supports stereo viewing. Stereo viewing provides added depth and realism to your 3D scenes. You can view your scenes in stereo by using red and blue stereo viewing glasses, using a polarized stereo shutter for your monitor in combination with specialized eyeglasses, or projecting the images in a scene and viewing the images with specialized eyeglasses.

To specify stereo viewing, go to View > View Settings and choose the new Stereo View option in the Viewing Characteristics panel:

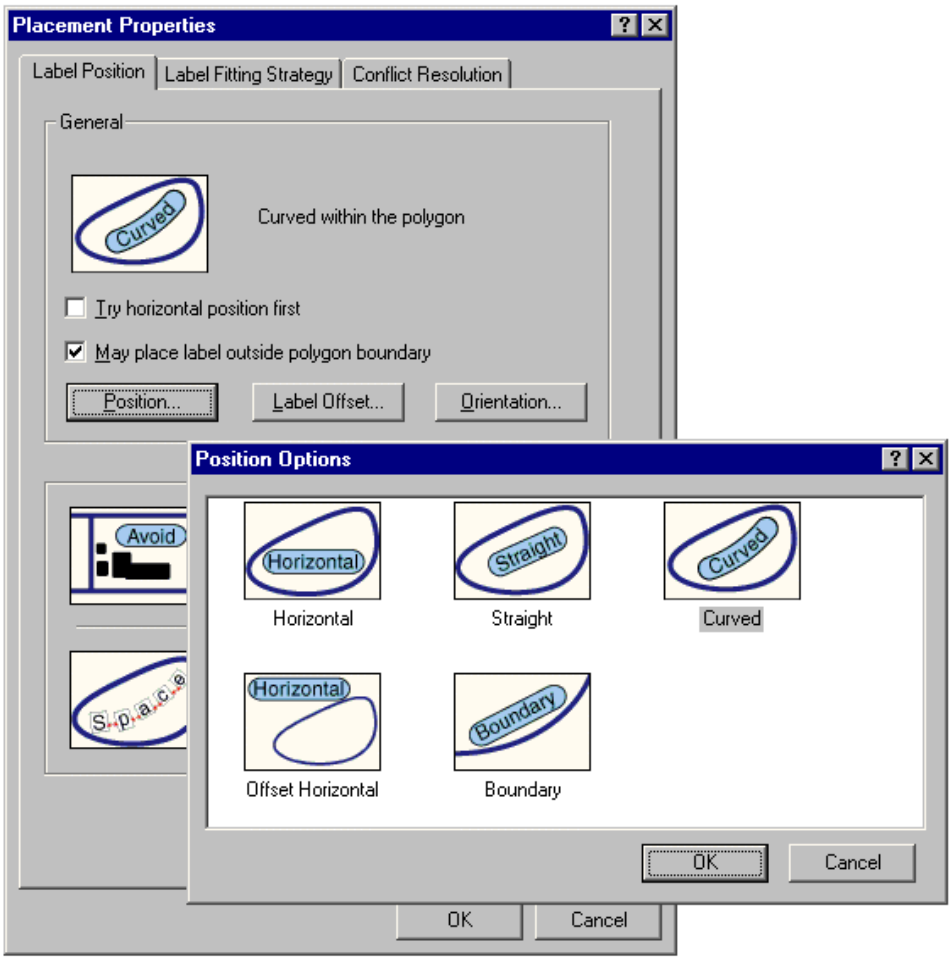


New Maplex for ArcGIS Extension

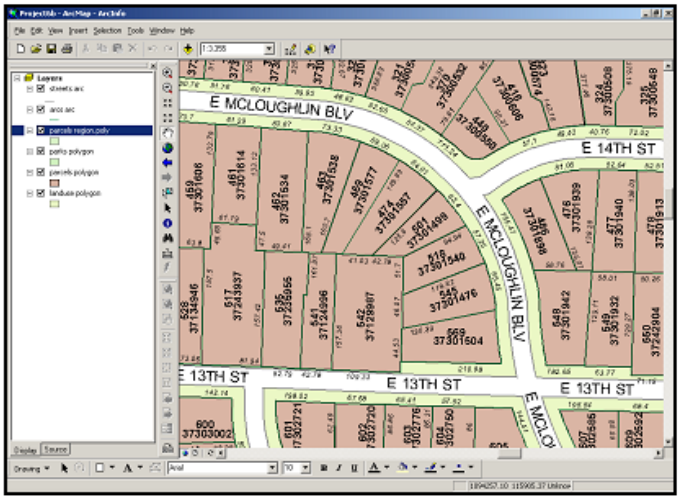
Maplex for ArcGIS allows high quality cartographic label creation using advanced label placement and fitting techniques. Using an advanced conflict detection algorithm, Maplex can place a larger number of labels in appropriate locations. If you need to produce cartographic labeling of the highest quality, the Maplex extension will save you many hours of intensive manual labeling time. The advanced label placement capabilities provided by the extension can also be used when you create and edit annotation feature classes in geodatabases.

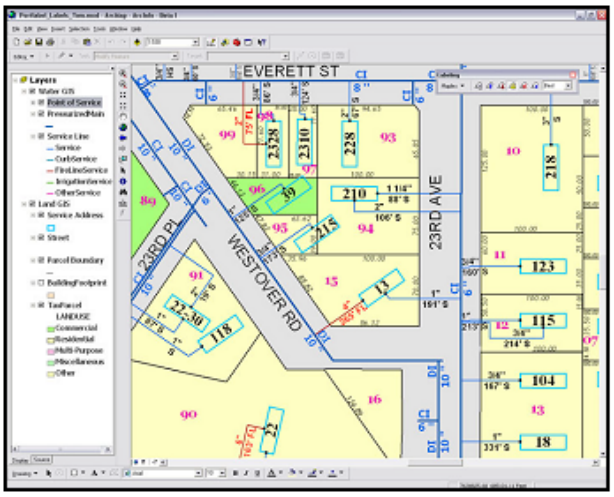
■ Maplex extends the standard label properties with advanced settings for placement and fitting. Some of these properties include:

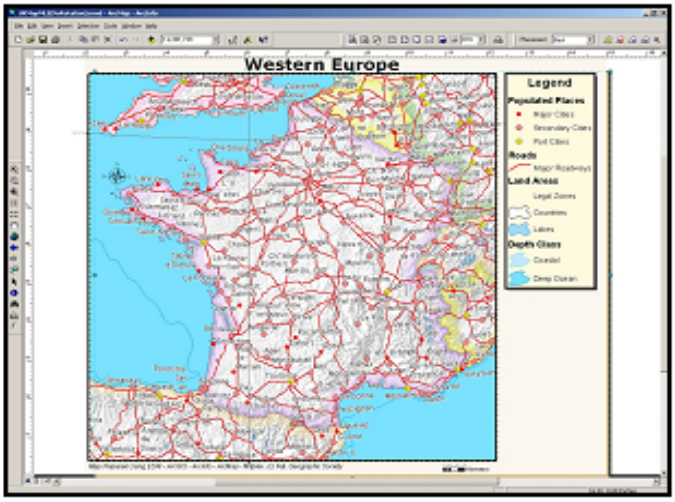
- Automatic Font reduction
- Automatic Label Stacking
- Automatic Abbreviation
- Boundary Placement
- Repeating Labeling
- Automatic Character Spacing
- Control the label Overrun on features
- Set Feature Weights
- Set Boundary Weights
- Draft or Production Quality placement
- And many more…

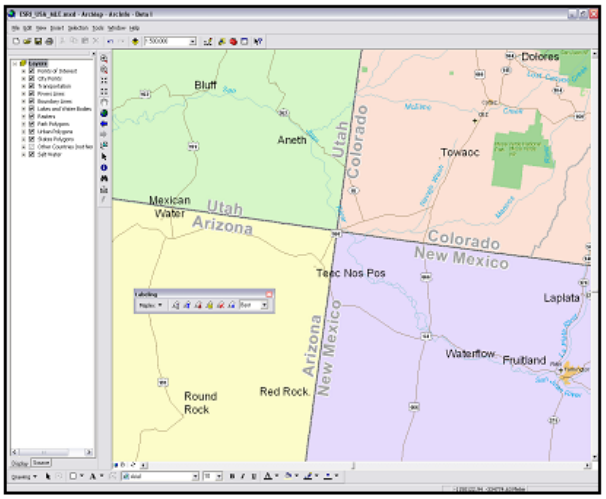


Some examples of labeling generated with the Maplex for ArcGIS extension:







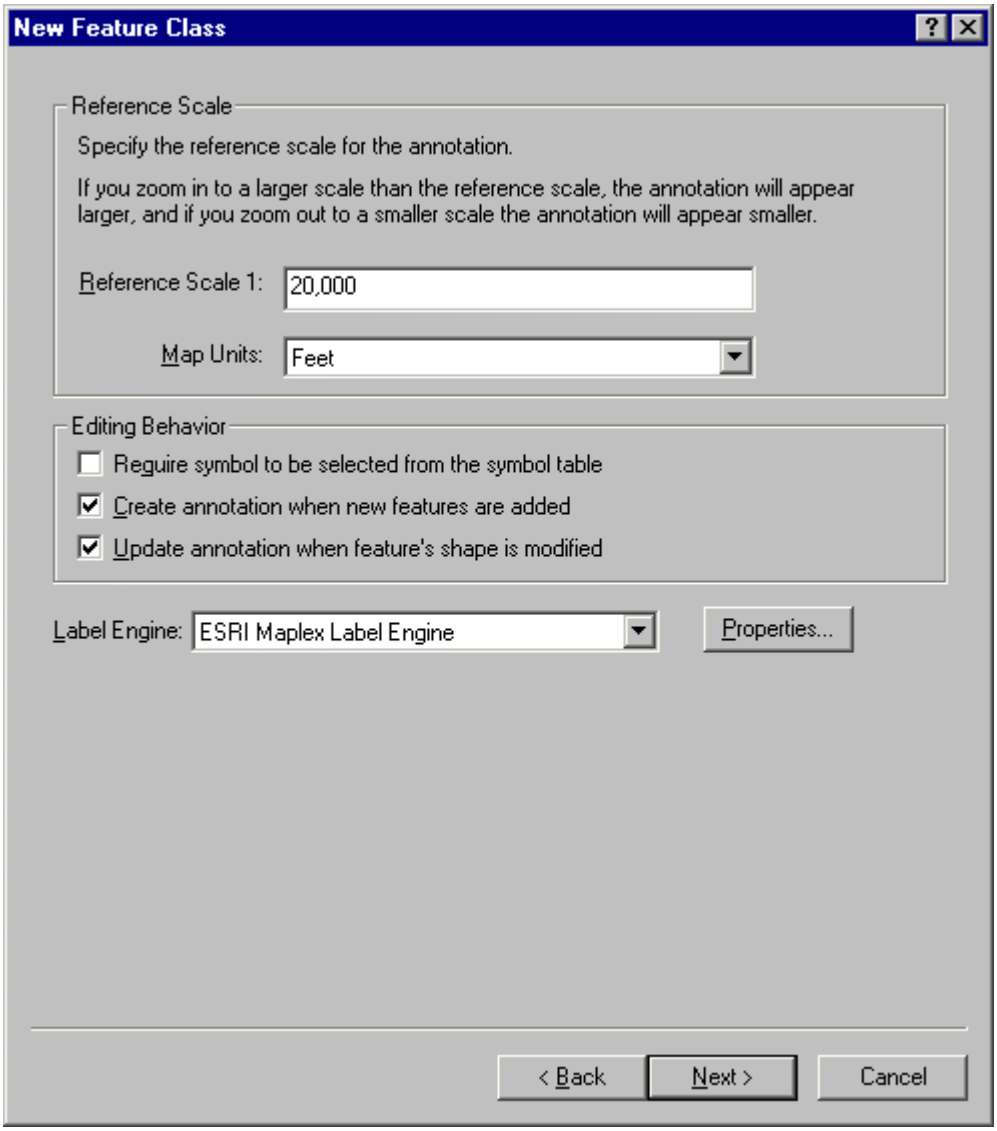


■ The Maplex For ArcGIS extension is fully integrated into the new labeling user interface in ArcMap 9.0. The extension uses the same Labeling toolbar and Label Manager as standard ArcMap, with the addition of new label handling options and functionality not available in the standard labeling user interface. There's not a separate toolbar for the Maplex extension. Here's what the Labeling toolbar looks like if you have installed the Maplex extension:

Tip: You can open a map document containing Maplex labels whether or not you have the Maplex extension. If you open a map document containing Maplex labels and you don't have the Maplex For ArcGIS extension, you'll simply get a message and the standard label engine will be used instead of Maplex to label the map.

■ The Maplex For ArcGIS extension is also fully integrated into the new annotation functionality in 9.0. When you create and edit annotation you can use Maplex to generate the annotation placement.

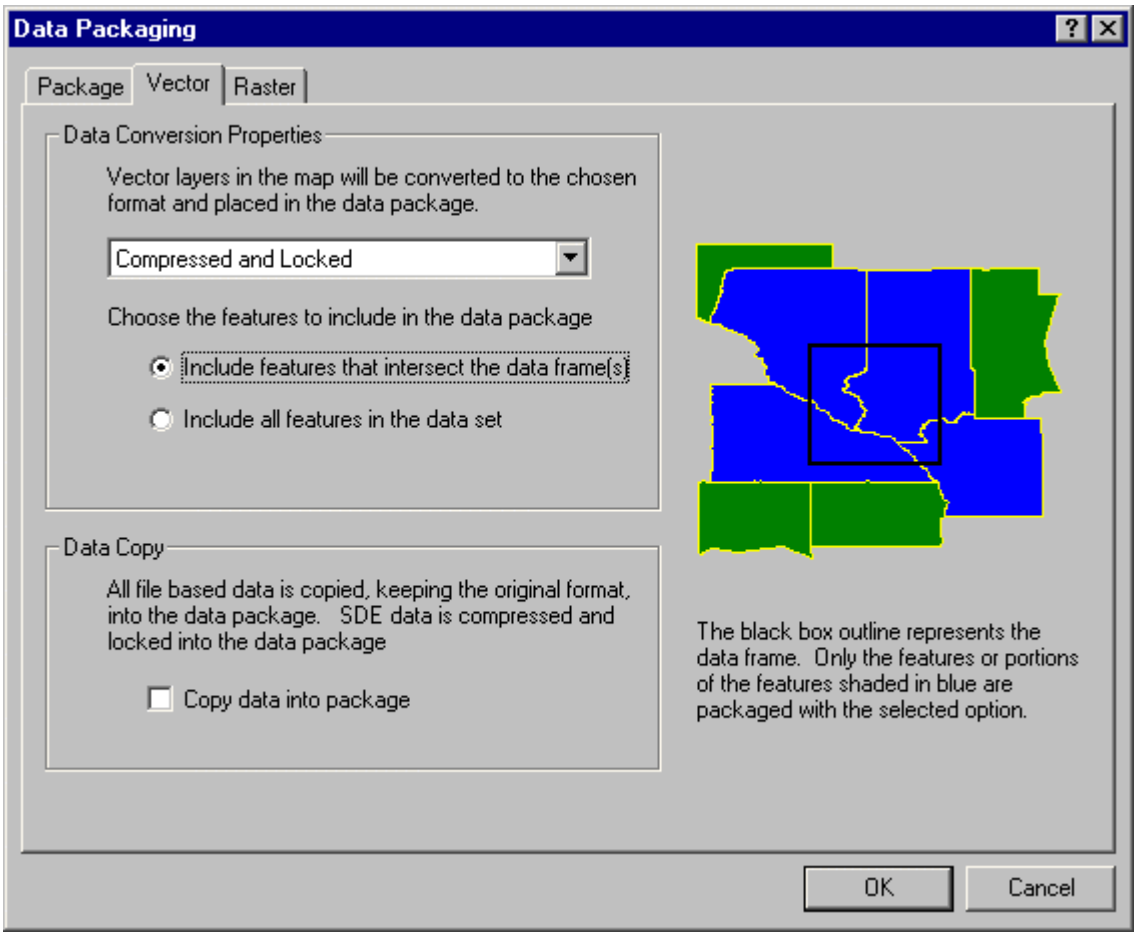
In the screenshot below, a feature-linked annotation feature class is being created in a geodatabase in ArcCatalog, and the Maplex label engine has been selected to generate the annotation placement:



Tip: You can view and edit an annotation feature class that uses Maplex label placement whether or not you have the Maplex extension. In the case of editing standard annotation (annotation that is not feature-linked) there's no difference. In the case of editing feature-linked annotation, ArcMap will automatically use the standard label engine when it needs to place new annotation if a Maplex license is not available.

If you want to create an annotation feature class using Maplex label placement, or edit a feature-linked annotation feature class using Maplex to place new annotation, you'll of course need to have the Maplex extension.

■ Data Packaging: Allows the data presented in a map document to be clipped and centrally packaged for distribution with the published map (.pmf) file. Various options are provided for vector and raster data:



■ Map Time out: Allows for the map author to define an optional message to warn users the map may be out of date or they can block access altogether to a published map after a specified date.

■ At 9.0, ArcGIS Publisher includes a programmable ArcReader control enabling developers to easily build and deploy ArcReader applications. ArcReader customization can be done using Visual Basic, .NET, Java or C++. With this new access to the developer controls behind ArcReader, you can build your own ArcReader-based applications and embed them in customized solutions on the desktop. This level of customization is very simple and only provides the 10 or so underlying objects and functionalities provided in ArcReader. Developers do not have access to ArcObjects using this customization.

■ New Set Data Sources command available when you right-click a published map (.pmf file) in ArcCatalog. This launches a dialog that makes it easy to update or repair some or all of the references to data sources in the file. By default, this dialog creates a copy of the .pmf file. This command is disabled if the publisher of the .pmf file chose not to provide full access to its contents in ArcGIS applications when it was published.

Spatial Analyst Extension

ArcGIS 9.0 is a significant step forward for the Spatial Analyst. In addition to the return of the ModelBuilder graphical modeling interface, there are over 100 new functions exposed in the Spatial Analyst user interface. Many of these functions were previously only accessible through ArcObjects or Map Algebra. All of these functions are accessible in 9.0 through the geoprocessing framework, which provides access to tools in dialogs, command line, ModelBuilder, and scripting.

The Spatial Analyst toolbar you are familiar with from ArcMap 8x is still in the product, with a few improvements and bug fixes. If everything you need is in that toolbar you don't have to change to use the Spatial Analyst tools in the new geoprocessing framework. However, if you are someone who has never had quite enough analytical tools, always wanted to combine Spatial Analyst tools with tools from other parts of the software, wanted to write batch scripts without learning VisualBasic, or wanted to create process models that you can save, share, and rerun without going through every dialog again, then explore the new tools and user interface options available for Spatial Analyst!

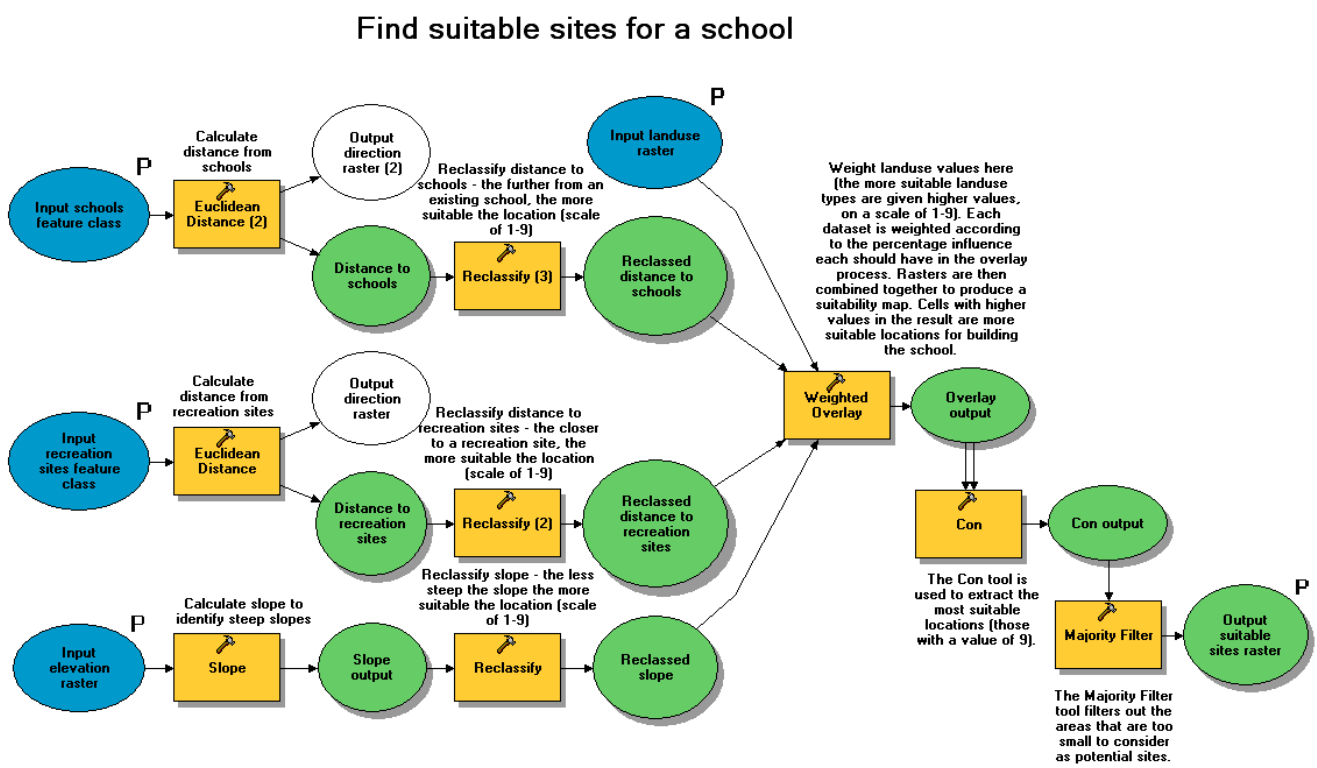
The Spatial Analyst tutorial (chapter 2 in the 'Using ArcGIS Spatial Analyst' book) has been rewritten at 9.0 to reflect the new user interface and functionality. (If you don't have access to the printed books look for the ESRI Software Products Library CD that comes with the release. That provides all the books in PDF format).

■ The Spatial Analyst extension is fully integrated into the new geoprocessing framework. For an introduction to the geoprocessing framework and its capabilities refer to the 'Geoprocessing' section of this document. For a quick overview of how to use geoprocessing written from the point of view of working with layers, see 'Geoprocessing in ArcMap at 9.0' in the 'Other ArcMap Changes' section of this document.

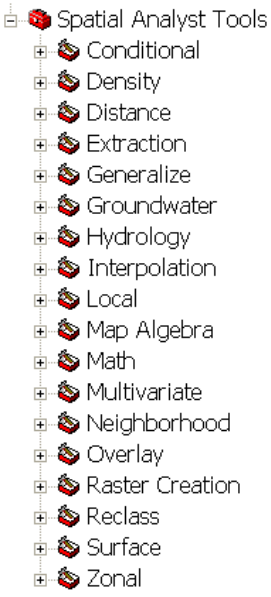
■ As the new ArcToolbox window at 9.0 is available in ArcCatalog as well as ArcMap, you can now perform spatial analysis inside ArcCatalog. If you also have the 3D Analyst extension, you can also access the Spatial Analyst tools inside ArcScene and ArcGlobe.

■ ModelBuilder, which first appeared in Spatial Analyst in ArcView 3 is part of the geoprocessing framework of 9.0. ModelBuilder is now a fully integrated part of the ArcGIS package containing over 400 tools and working on every ArcGIS supported data type. It is a graphical modeling environment used to create, edit, run, and document spatial models, and is a very natural paradigm for Spatial Analyst users who often wish to string many tools together as a process to solve a complex problem.

Here is a site suitability model created in the ModelBuilder with the Spatial Analyst tools:

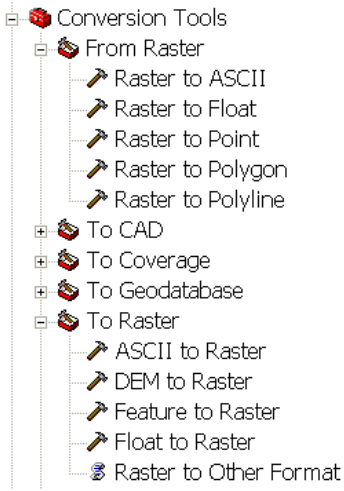


■ Within the ArcToolbox folder, the Spatial Analyst tools are organized into functional groups as toolsets as shown below.



■ The data management functions such as data conversion and import that have been part of the Spatial Analyst toolbar in the past, are now found in other toolsets that do not require a Spatial Analyst license.

- Tools for data conversion are found in the Conversion Tools toolbox:



- **Environments** – The Spatial Analyst toolbar has an Analysis Environment that is accessed from the Options on the toolbar. The geoprocessing framework also has a set of environment parameters, that can be accessed from the tool dialogs or by right clicking in the ArcToolbox window. These two environments, although they have some similar parameters, are not connected. For example, setting a cellsize in the Toolbar > Options will not affect the cellsize when running an ArcToolbox tool, and vice versa.

Because the geoprocessing environment is shared between many tools, parameters you may be looking for are not all in one place. The current workspace, default output workspace, output coordinate system, extent, and snap raster are found in the General Settings. Cellsize and mask are found in the Raster Analysis Settings. Parameters for loading rasters into the geodatabase are found in the Raster Geodatabase Settings.

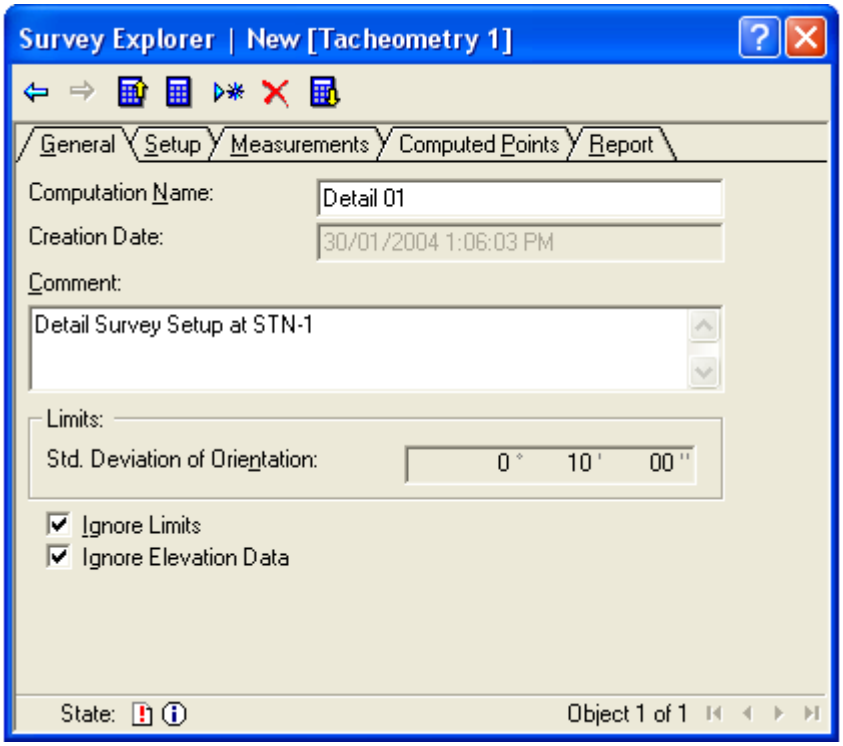
Survey Analyst Extension

A number of bug fixes and performance enhancements have been made for the 9.0 release. Some of the major improvements include the following:

- Survey datasets no longer use an over-sized spatial grid, greatly improving performance during map navigation

- Better processing feedback, such as the progress bars that indicate what is occurring during the import process, survey dataset creation, survey project creation, feature linking, and listing data in the Survey Explorer.

- For the TPS computations, there are now two options to choose whether or not to compute elevation data, and whether or not to enforce limit-checking:



ArcPress Extension

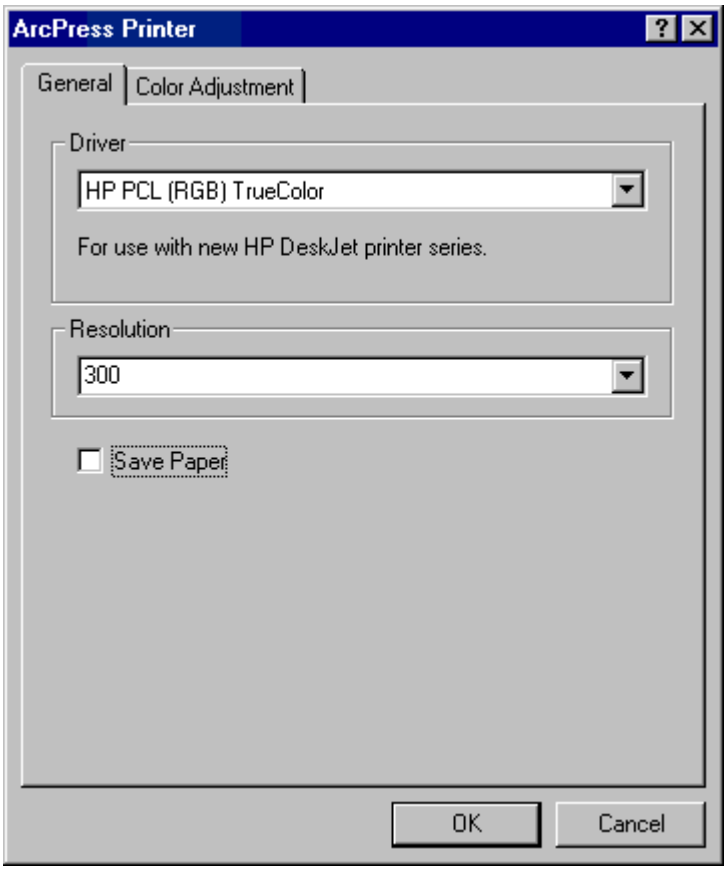
■ ArcPress for ArcGIS at ArcGIS 9.0 dramatically improves the user experience, performance, and quality of the output. ArcPress has been completely reengineered for 9.0, including a metafile interpreter and rasterizer, rewritten and brand new printer drivers, and a new user interface.

ArcPress 9.0 will no longer support graphic export, and instead will focus on providing a great printing solution. At 9.0 all of the graphic export formats are now supported as part of the core ArcGIS system.

The new rasterizer now interprets and processes the metafile directly whereas the previous ArcPress rasterizer required the metafile be converted to EPS. Because this conversion is no longer a requirement and the more efficient and robust rasterizer engine, ArcPress throughput power has been greatly improved.

In addition, all of the ArcPress drivers have been greatly improved. ArcPress 9.0 now includes true halftone drivers for RTL CMYK, RTL monochrome, PCL CMYk and PCL monochrome. Everyone's most favorite driver, the RTL Device Dithered RGB (now simply called "RTL RGB") has been tweaked to improve quality and performance. And ESRI is proud to announce that with collaboration with HP DesignJet, ArcPress 9.0 includes the PCL RGB driver which supports the following printers with outstanding picture and color quality: HP DesignJet 10ps, 20ps, 50ps, 500, 800, 100, and 120.

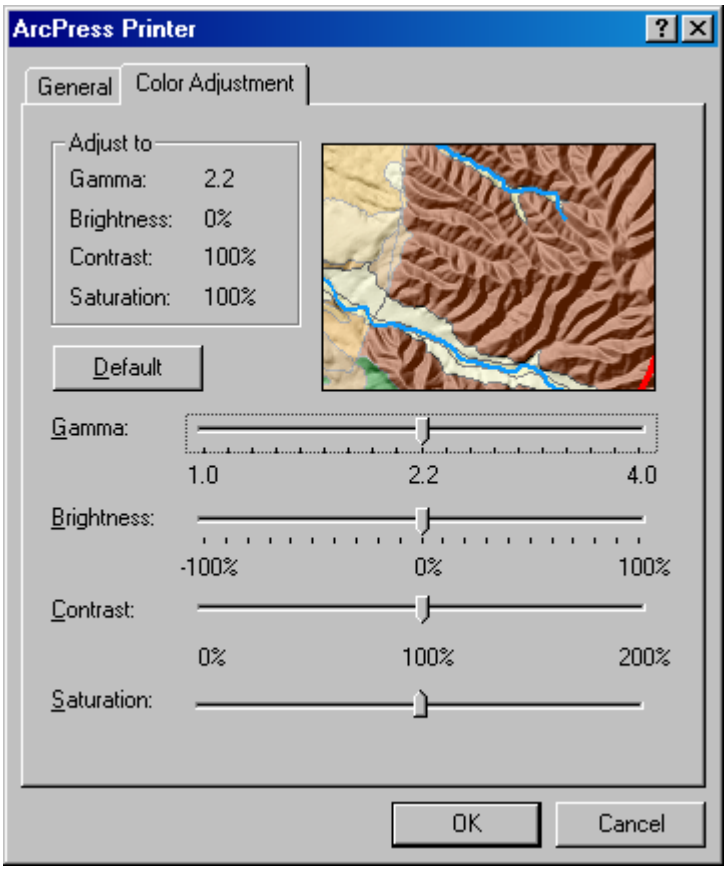
The File>Print>ArcPress Properties dialog have been improved to support the new printer drivers and improved color Adjustment options (for the halftone drivers). ArcPress will continue to automatically select the correct printer driver for the printer you have selected; if this can not be determined, you will be prompted to select one or to use the Windows printer engine.



ArcPress will now only show the output resolution(s) supported by the printer you have selected. This will eliminate any errors in selecting an unsupported output resolution.

ArcPress 9.0 now includes a "Save Paper" option. This will force a rotation on the print out if it will fit on the printer paper. Note: If you are printing to a printer that is wider than 36" (for example, the HP DesignJet 5500) and it is loaded with 36" and you select Save Paper while printing an E/AO-sized map, the map may clip when printed because there is no way to detect what width paper you have loaded in the printer.

The color adjustment options have also been improved for 9.0. They include Gamma, Brightness, Contrast and Saturation. A preview image is included to help visualize the changes. NOTE: color adjustments effect the total map. You cannot adjust the raster and/or vector data separately.



- Gamma: this allows you to adjust the total color by using display gamma units. The default is set to 2.2.

- Brightness: Based on the Hue-Lightness-Saturation model, brightness adds or subtract a percentage of lightness to each pixel's color in the map.

- Contrast: Changes the contrast between 0% and 200%. This percentage of contrast is applied to each pixel of color of entire map on output.

- Saturation: Based on the Hue-Lightness-Saturation model, saturation adds or subtracts a percentage of saturation to each pixel's color in the map.