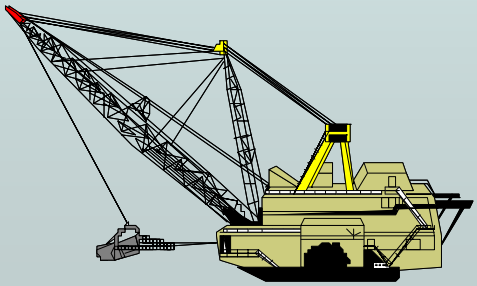
LESSON 7

Automating Data



In most GIS environments, persons with specialized training generally are responsible for the bulk of geospatial data automation. This practice ensures data accuracy, adherence to established data standards, more efficient production of larger volumes of GIS data sets at lower cost, and standardized access to the data by all users when the data is installed on a centralized GIS data server. In developing a geographic information system, the cost of automating geo-spatial data is the most significant expense. Estimates of this cost ranges from 50 to 90 percent of the total GIS budget. The GIS developer must understand both the acquisition and maintenance costs of automating data. In this lesson, we will explore some of the principles and techniques used in data automation.

Automating Data

Data automation is the conversion of data from one type of format to another.

Such as:

Non-digital to digital format

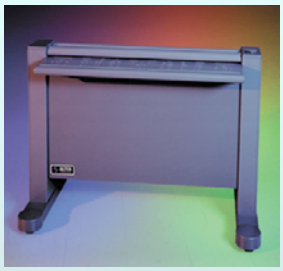
Digital to another digital format

Automation includes all the steps necessary to get data into a geo-spatial database. Automation may require conversion from a non-digital format, such as a paper map manuscript, or from another digital format, such as an AutoCAD drawing file to a digital format. This includes correction of digitizing errors (such as intersection errors, node errors, and label errors), building appropriate arc relationships and polygon topology, and adding and correcting feature attributes. This process is sometimes referred to as “data capture and updating” or “data entry”. The term data automation also includes metadata documentation.

Non-digital to Digital Data Automation

Scanning

Flatbed scanners



Wide format scanners

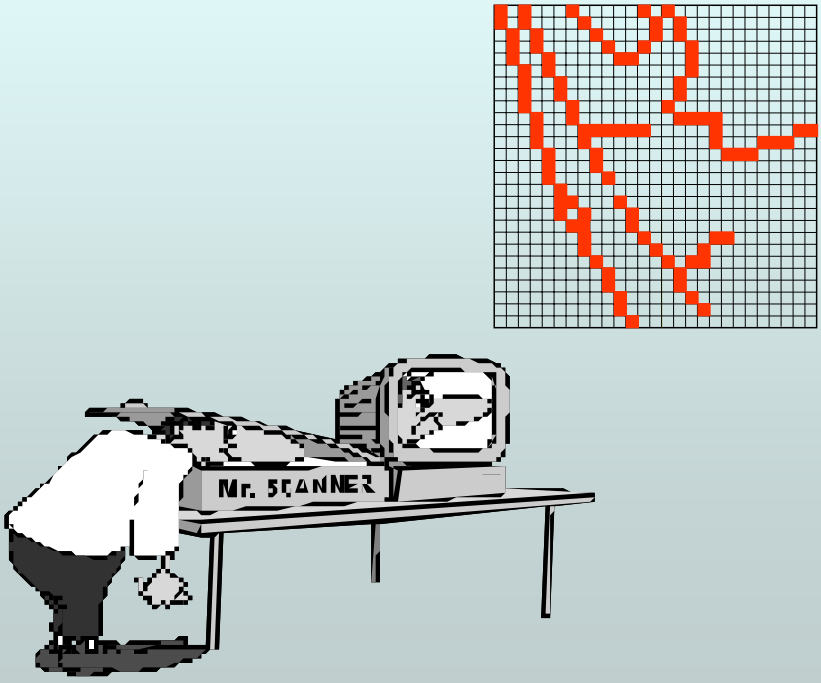
Digitizing

Tablets

Tables

Conversion of data from a non-digital to a digital format frequently requires a paper manuscript, such as a mining operations map. In practice, the manuscript is either read by a scanner or is digitized by hand on a digitizing table. The scanner reads the manuscript to produce a raster image file of the entire contents of the page. The raster file is then further processed to remove scanning errors and extract only the desired data. During digitizing, a person interprets the drawing symbols on the manuscript and creates point, arc, or polygon feature classes in a vector-based file format to represent the point, linear, or area features located on the ground. Further processing is required to correct errors in both methods.

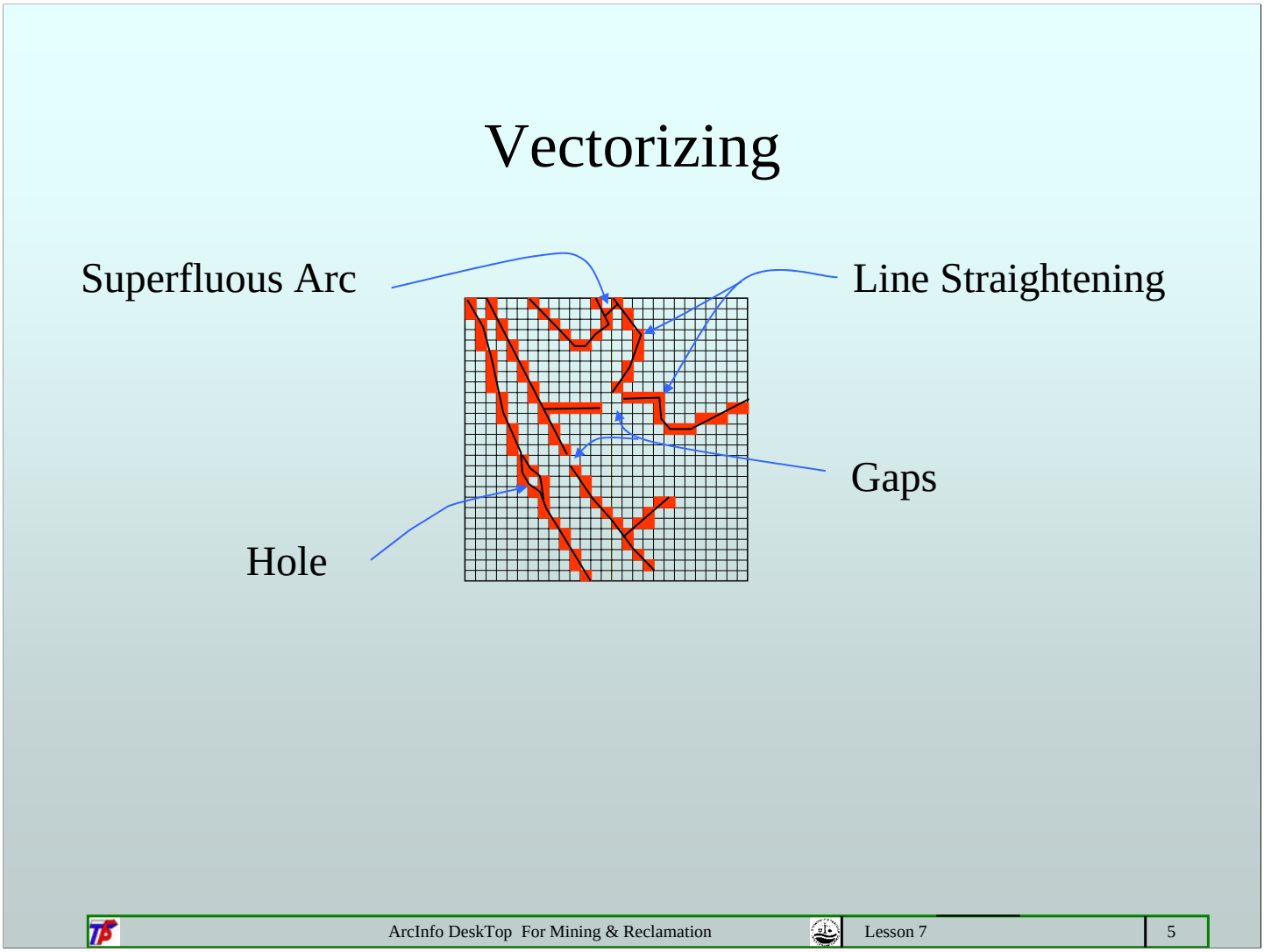
Scanning



A scanner divides an image into a grid of cells with each cell having a numeric value in bits. The value is determined by the light reflected from the manuscript to a sensor. The matrix of bits constitutes a bit map which is stored in a digital file. Scanning software on the computer is used to operate the scanner, select and position the area of the manuscript to be scanned, set the resolution and exposure settings, adjust the image quality and color, preview the output, and determine the output format. The initial file produced is not registered to geographic coordinates. Some scanning software also will convert raster files to vector format and georeference the output file.

Scanning is an excellent tool for acquiring data which is to be permanently retained within a GIS in a raster format, such as aerial photography and digital raster graphic (DRG) images of 7.5-minute USGS topographic quadrangle maps. Depending on the condition of the manuscript, scanning also can be a fast and efficient method of initially acquiring data from mining operations maps for later conversion into vector-based file formats, such as ArcInfo coverages. This conversion process, known as vectorizing, produces best results when the manuscript is a bi-level image of only two contrasting colors such as black and white or black lines on mylar film.

Scanning is not supported in Desktop ArcInfo 8.1.



Scanning and vectorizing are commonly viewed as the easiest and fastest methods of acquiring large amounts of error free GIS data without digitizing by hand. However, this procedure is not without errors. Post scanning processing is frequently required. Vectorizing may produce errors such as gaps in arcs (due to missing cells or the staggered nature of cell values representing a diagonal feature), dashed line recognition, problems in "hole" recognition (when the vectorizing software must make a decision to either go around or through a cell of different value but surrounded by cells of the correct value being vectorized), and problems with line straightening or generalization (curves) due to variations in line widths represented by cells.

Vectorizing is not supported in Desktop ArcInfo 8.1.

Vectorizing Methods Available in ArcInfo Workstation

ArcScan	3 Licenses
ArcInfo GRID	28 Licenses
ArcEdit	28 Licenses

Vectorizing tools are provided in Workstation ArcInfo. All three methods perform operations on an ArcInfo grid. Use the command Arc: imagegrid to convert the image to a grid.

ArcScan, integrated into ArcEdit, is a raster editor and a raster-to-vector converter. To run ArcScan, the TIPS user issues the command Arc: arctools edit. A menu-based editing and processing environment is then created for the user to interact with the ArcEdit graphic editor. All actions in ArcScan are performed on an input grid to produce an output coverage.

The ArcInfo GRID subsystem is a raster analysis program for cell-based modeling accessed through the command Arc: grid. GridEdit supports raster viewing, editing, error correction, georeferencing, data rotation, flipping, mirror-imaging, clipping, and merging adjacent grids. In GRID, the gridline( ) function exports raster data to a vector format.

Workstation ArcInfo can convert grids to coverages. For example, Arc: gridline <inputgrid> <outputcover> positive nothin filter round # 25 15 10. The arguments are very sensitive and produce highly variable results. The initial arc coverage can be edited in ArcEdit by a skilled user to produce a high quality data set.

Table Digitizing

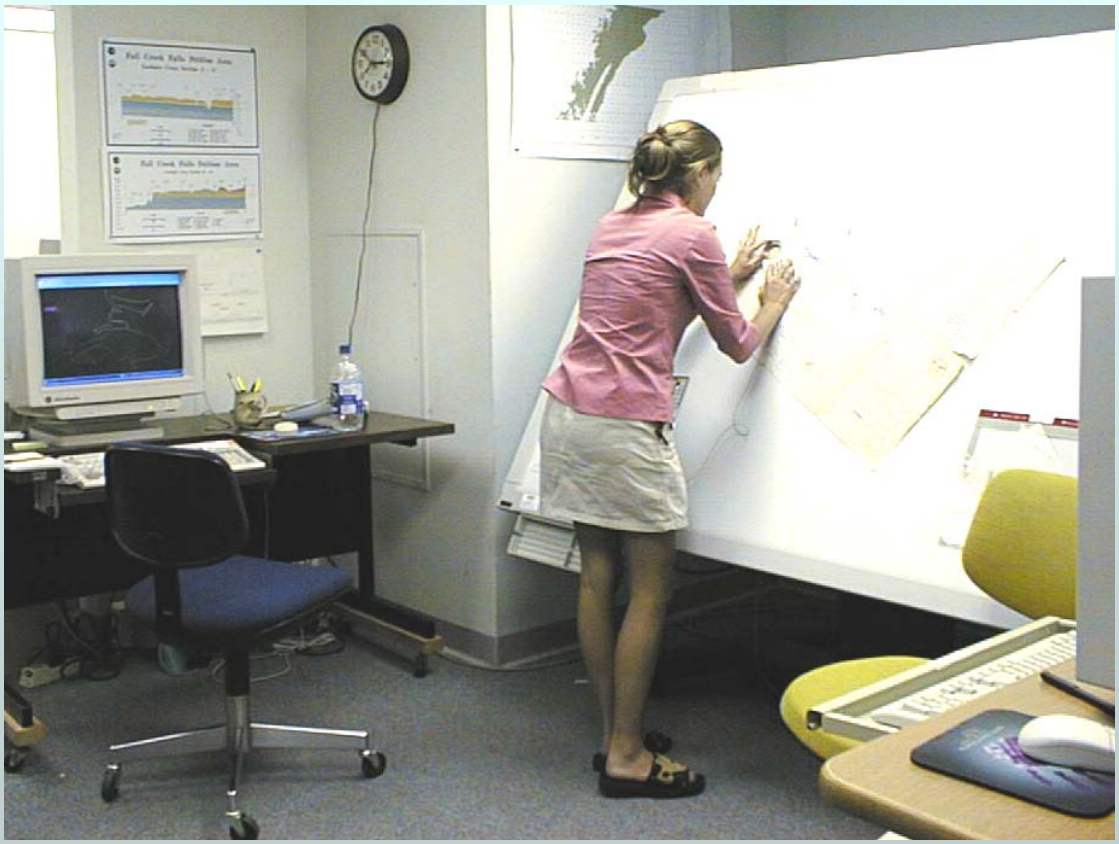
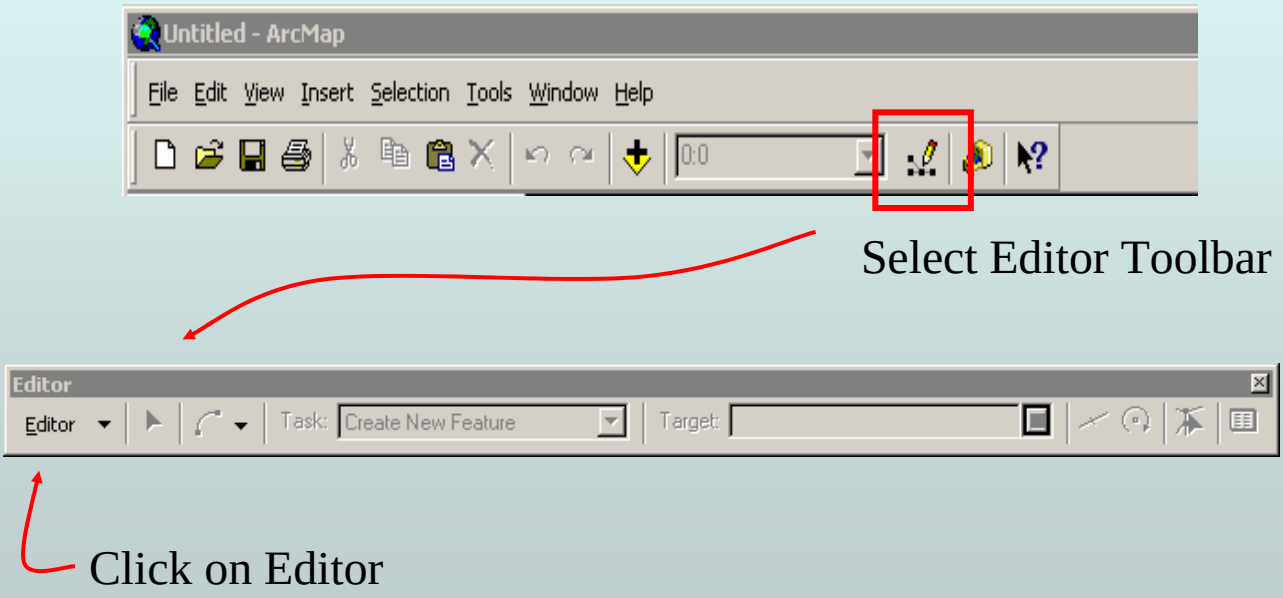


Table digitizing is the process of converting features on a paper map to a digital format. During the digitizing process, a person places a paper map on a digitizing table and traces the features with a digitizing puck. As the feature is traced, X Y coordinates on the board are written to an electronic data file as spatial data. The features on the map become point, arc, or polygon feature classes in the digital file.

In ArcMap, the Editor is used to create or update these feature classes. In practice, a coverage or other editable data set, such as a shape file or geodatabase, must exist before digitizing can occur. The data set must have the structure of the feature class created.

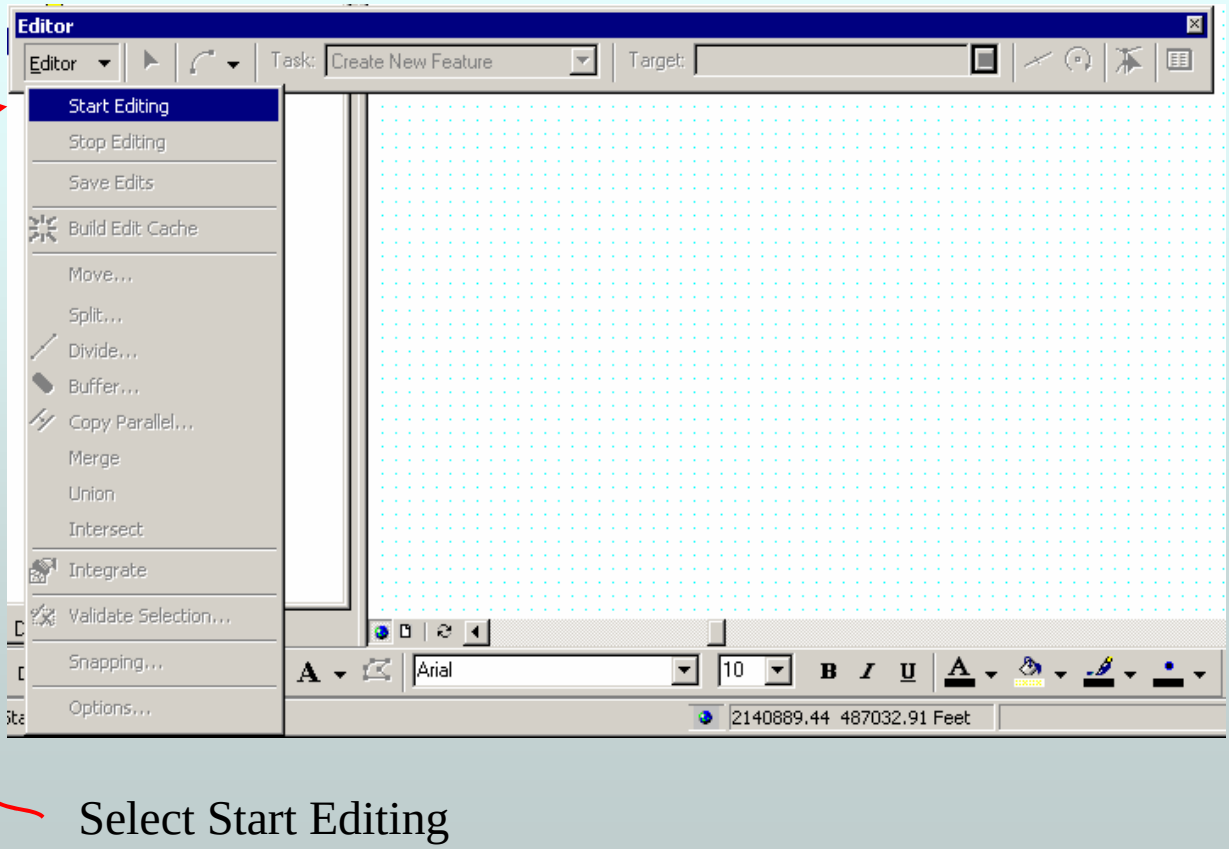
Using a Digitizing Table to Capture Features from a Paper Map

In the Table of Contents, Select a Data Set to be Edited, then



All digitizing in ArcMap, whether from a digitizing table or during on screen digitizing, is initiated by launching the Editor Toolbar.

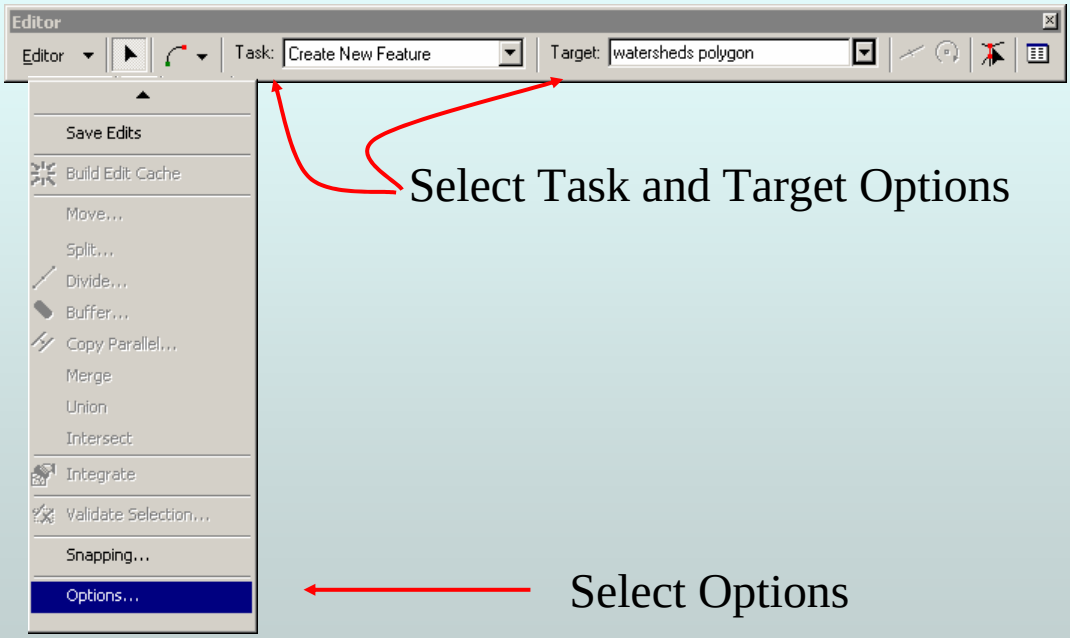
Digitizing from a Table



Select Start Editing

To create features in an empty coverage, tics must be present. If the coverage contains other feature classes, such as arcs, the coverage can be edited without tics being present. If no tics or other feature classes are present, the coverage can not be edited in ArcMap. The Start Editing choice on the Editor drop down menu will be grayed out.

Table Digitizing -continued

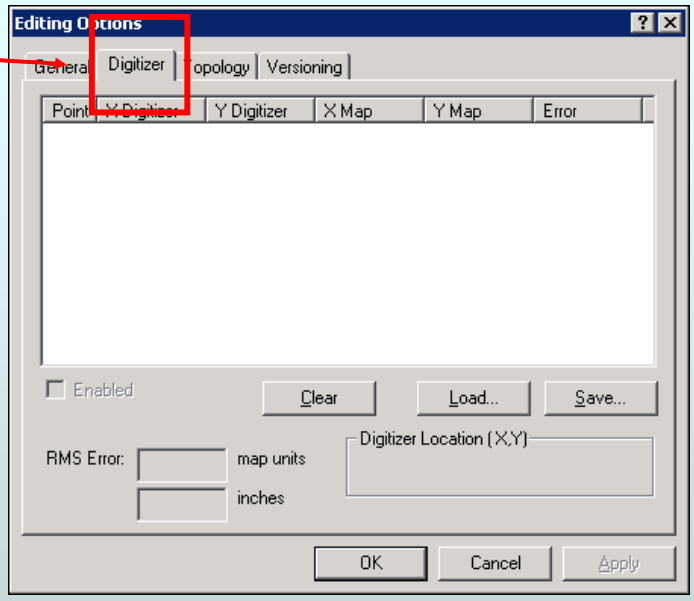


After Start Editing is selected, the Task and Target dropdown boxes will be enabled. The Task options allow the user to choose the action to be performed. The Target option identifies the feature class of the data set to be edited.

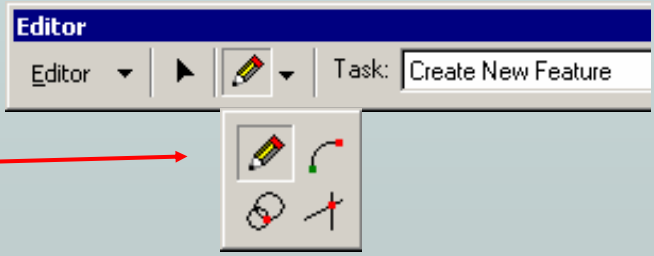
Clicking on Options launches the Editing Options menu. This is the gateway to enable the use of a digitizing table.

Table Digitizing - continued

To Register the Map to the Table



Select Sketch Tool
to Begin Digitizing



Registration calibrates the input from the digitizing table to the map units of the coverage based on the coordinates of the control points (tics). In ArcMap, the Digitizer tab of the Editing Options menu provides the controls for registration. If tics have not been established in a file, digitize the control points from the map and then type the ground coordinates for each tic. The ground coordinates can now be saved in a tic text file, if desired. Click Enabled to set the digitizer to the monitor in digitizing mode, click Apply, and click OK. If tics already exist in a tic text file, these can be loaded into the menu by selecting the file. Click the first tic and digitize its control point from the map. Continue until all tics are registered. Click Enabled, Apply, and OK.

On the Editor Toolbar, select the Sketch tool to begin digitizing with the digitizing puck. The default digitizing mode is point mode digitizing, suitable for most mining work. Stream mode digitizing can be selected by toggling the F8 key. To save your work, click Stop Editing on the Editor toolbar and choose Yes when prompted to save your edits.

Note: If the digitizer tab is missing, ArcInfo may have been installed on the computer before the digitizer. To add the tab, you must register the digitizer.dll file. Navigate to c:\arcgis\arcexe81\bin and type “regsvr32 digitizer.dll”. The WINTAB32.dll file must be present before the digitizer.dll file can be registered. This file is obtained during installation of the WinTab driver to operate the digitizing table.

Correcting Digitizing Errors

After digitizing, the results must be evaluated to determine if the spatial data set is accurate. The reviewer should make such determinations as:

Have the boundaries of the features on the map manuscript been correctly interpreted in the digital data set?

Do the lines representing these features connect in the proper location, and are polygons closed as they should be?

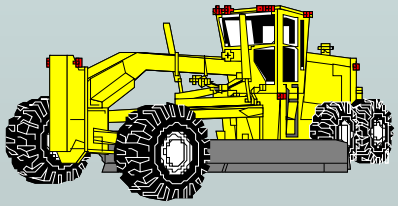
Are the features in the digital data set shown in the correct location and relationships with other data sets?

Digital to Digital Data Automation

On Screen Digitizing

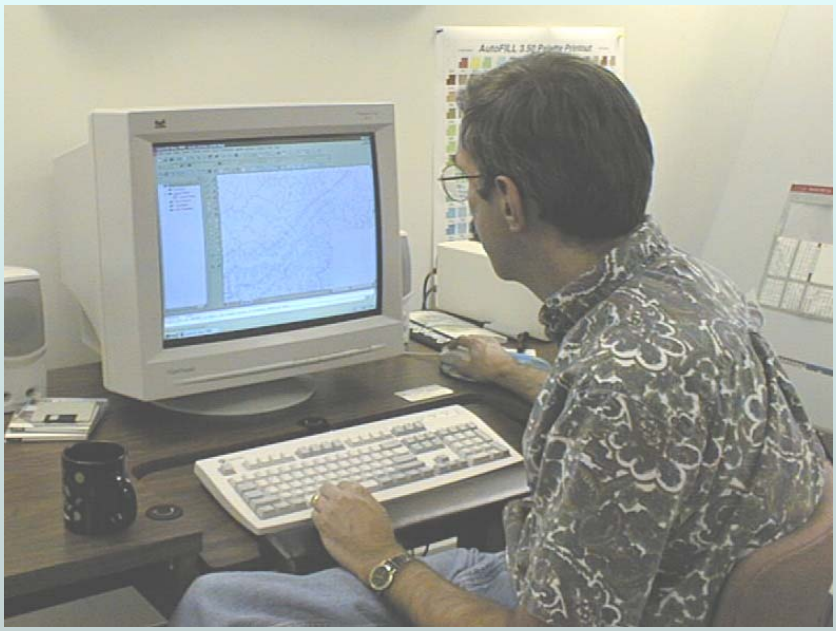
Geo-spatial data from ASCII format

Geo-spatial data from proprietary formats



Conversion between digital formats may be done for several reasons. For example, if accuracy requirements are not great and the task is relatively small, it may be easier to produce a vector data set by digitizing the desired features on a computer monitor than by digitizing from a table. An example may be the digitizing of a watershed boundary as shown on a digital raster graphics (DRG) image of a 7.5-minute USGS topographic quadrangle map. Or, on screen digitizing, also called "heads up" digitizing, may be required if updated features of interest are found only on a digital orthogonal quarter quadrangle (DOQQ) of a recent aerial photograph already contained on the GIS data server. Sometimes, conversion may be necessary because the file format used for ease of transfer of the data from the producer to the consumer may not be appropriate for analysis, such as a digital elevation model (DEM). But most often, the file format native to one type of software may require conversion to another format so the data can be analyzed or presented in a different software application.

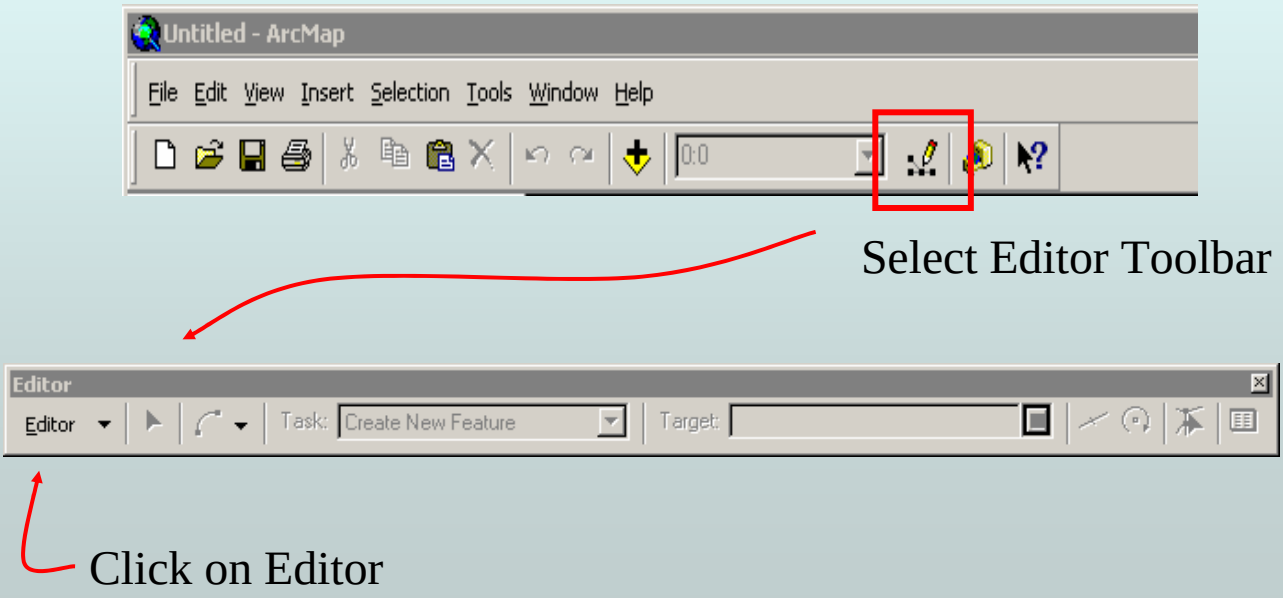
On Screen Digitizing



On screen digitizing may not be as accurate as tablet digitizing depending on the mechanical properties of the mouse to position the cursor and the scale of the digitizing to be performed. Sometimes it is more difficult to reposition the image in the software graphic editor window than to digitize from a paper map. Depending on the quality of the image, it may be easier to view the digitizing area on the paper map than on the monitor. However, minor updating of features and correcting digitizing errors on screen may be easier, more accurate, and significantly faster than from a digitizing table, and also does not require registration of the digitizing table. There are advantages and disadvantages of both on screen and table digitizing. Depending on the work to be performed and the work environment, factors such as accuracy, speed, comfort, and ease of use can vary significantly. Sometimes, the choice of which method to use depends on the personal preferences of the user.

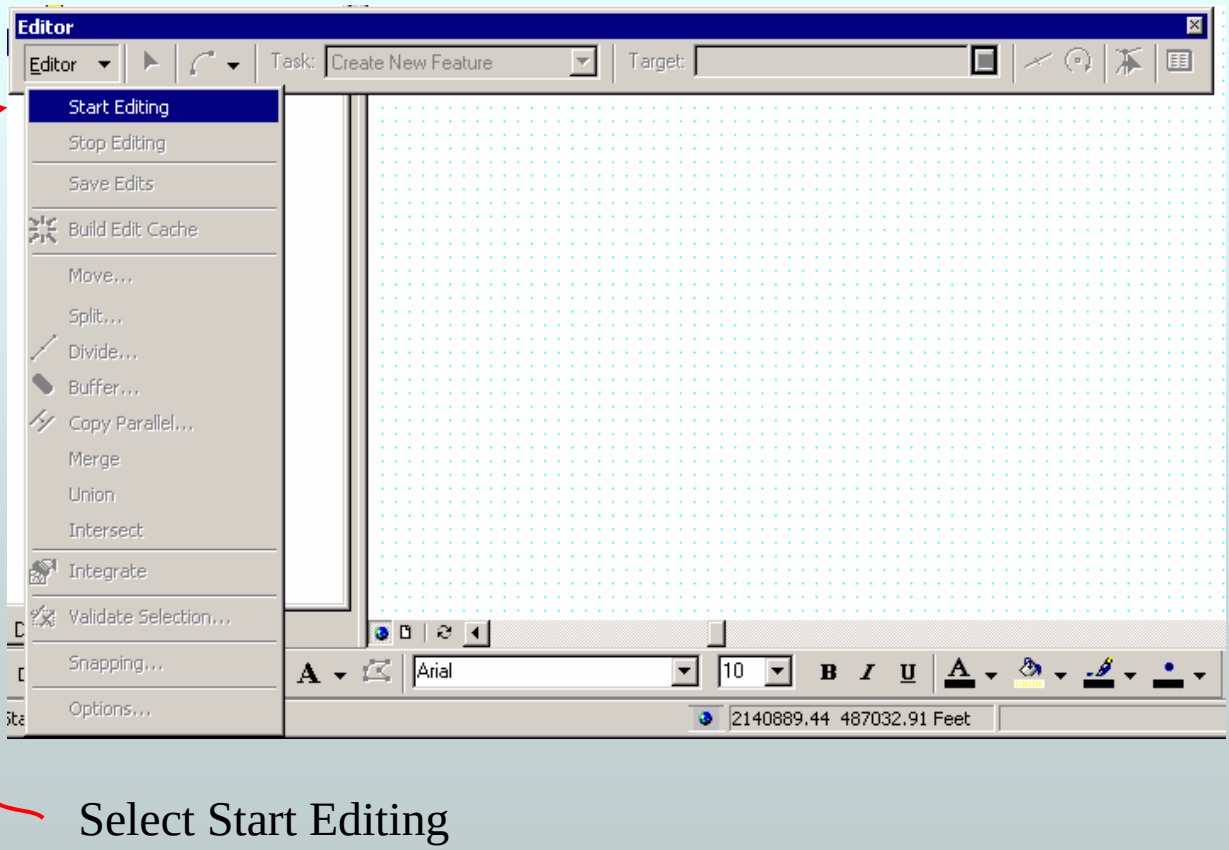
Using a Computer Monitor to Capture Features from the Screen

Select a Coverage to be Edited, then



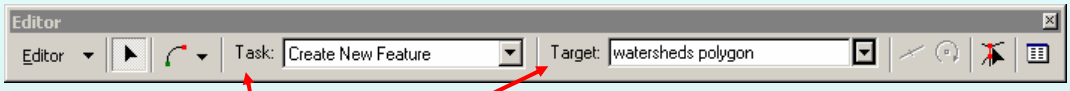
All digitizing in ArcMap, whether from a digitizing table or during on screen digitizing, is initiated by launching the Editor Toolbar.

On Screen Digitizing

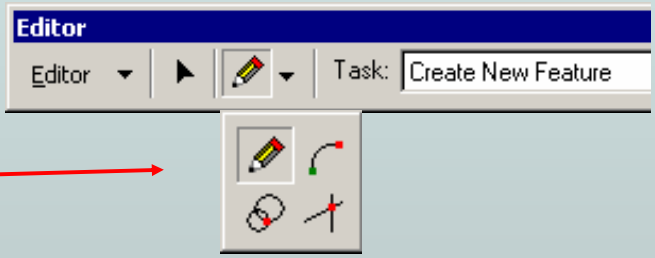


To create features in an empty coverage, tics must be present. If the coverage contains other feature classes, such as arcs, the coverage can be edited without tics being present. If no tics or other feature classes are present, the coverage can not be edited in ArcMap. The Start Editing choice on the Editor drop down menu will be grayed out.

On Screen Digitizing



Select Task and Target Options



Select Sketch Tool to Begin Digitizing

ArcInfo DeskTop For Mining & Reclamation | Lesson 7 | 17

The Sketch tool allows on screen features to be digitized into the coverage. Digitized features will have the coordinates of the map units displayed on the monitor.

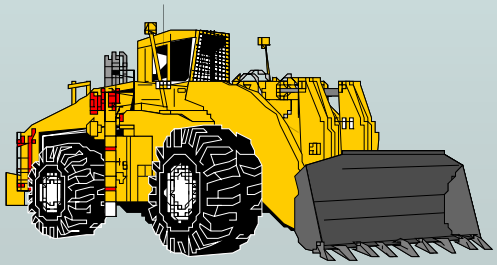
Geo-spatial Data from ASCII Format

Examples:

Digital Line Graphs (DLG)

Digital Elevation Models (DEM)

Text Files (Comma Delimited, Tab Delimited, Etc.)



Examples:

Conversion of a USGS digital line graph (DLG) representing streams shown on a 7.5-minute quadrangle map to arcs in an ArcInfo coverage.

Conversion of 10-meter posting of elevations on a 7.5-minute quadrangle map in a USGS digital elevation model (DEM) to an ArcInfo grid.

Conversion of points or lines contained in an earthVision data file to an ArcInfo coverage.

ArcInfo Desktop 8.1 will not directly read a DEM, DLG, or ASCII text file. These file formats must first be converted using either ArcToolbox tools, such as the DLG to Coverage wizard, DEM to Grid tool, or the Generate to Coverage Wizard. If a needed tool does not exist in ArcToolbox, you must use ArcInfo Workstation commands.

Geo-spatial Data from Proprietary Formats

autodesk

Trimble
www.trimble.com

ESRI
GIS & MAPPING SOFTWARE

SPACE IMAGING

Examples:

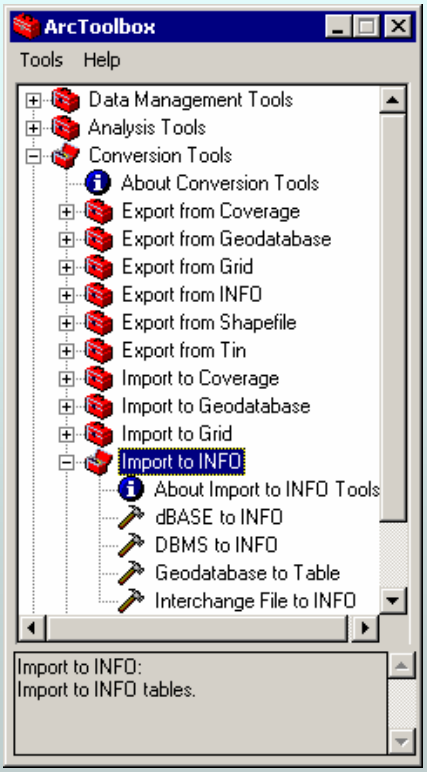
Conversion of lines in an AutoCAD drawing file to arcs in an ArcInfo coverage. Use the ArcToolbox DXF to Coverage wizard. ArcMap can view but not edit an AutoCAD drawing file.

Conversion of points in a Trimble Navigation .ssf or .cor GPS file to points in an ArcView shape file or ArcInfo coverage. The file must be exported from Trimble Pathfinder software. There are no tools in ArcInfo for file conversion from Trimble format. ArcMap can not directly view the contents of a Trimble GPS file.

Conversion of LANDSAT satellite imagery to an ArcInfo grid. ArcMap supports various image file formats to allow their use as backdrop images for display of vector data in the foreground. However, if data is to be extracted from the image, such as landuse information, the image file must be converted to an ArcInfo Grid.

Conversion from one ESRI data format to another ESRI format. For example, it is necessary to convert an ArcView shape file to an ArcInfo coverage to perform topological overlay operations because shape files do not contain topology.

Converting Attribute Data

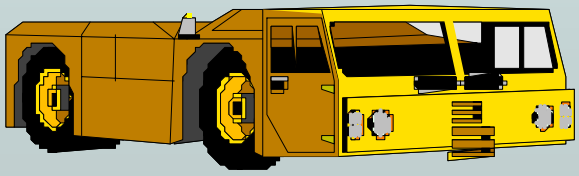


ASCII Text Files

dBase

DBMS

INFO

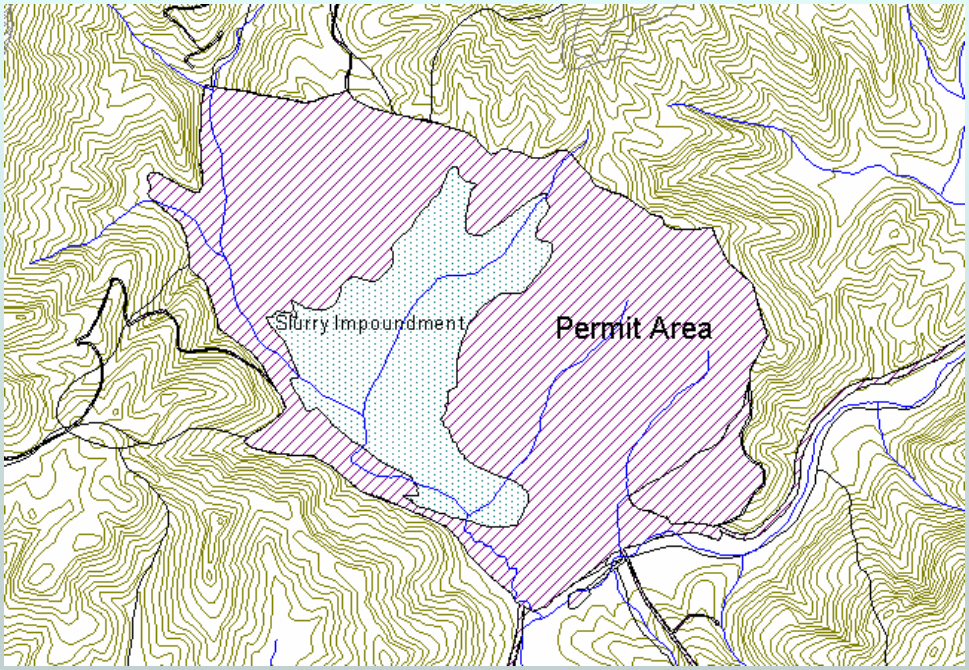


The native database file format for ArcInfo is INFO, which can be edited in both Workstation and Desktop ArcInfo. In Desktop ArcInfo 8.1, other database file formats, such as dBASE can be viewed and edited in either ArcMap or ArcCatalog including shape file .dbf files. ArcToolbox provides wizards for the conversion of selected database file formats, including OLE DB, to INFO or dBASE files.

For attribute data contained in ASCII text files, ArcInfo Workstation provides commands to import the data into an INFO file. Briefly, the procedure for this conversion is to first define the item definitions for an INFO file and then read the data from the ASCII text file into the INFO file using the INFO command ADD FROM.

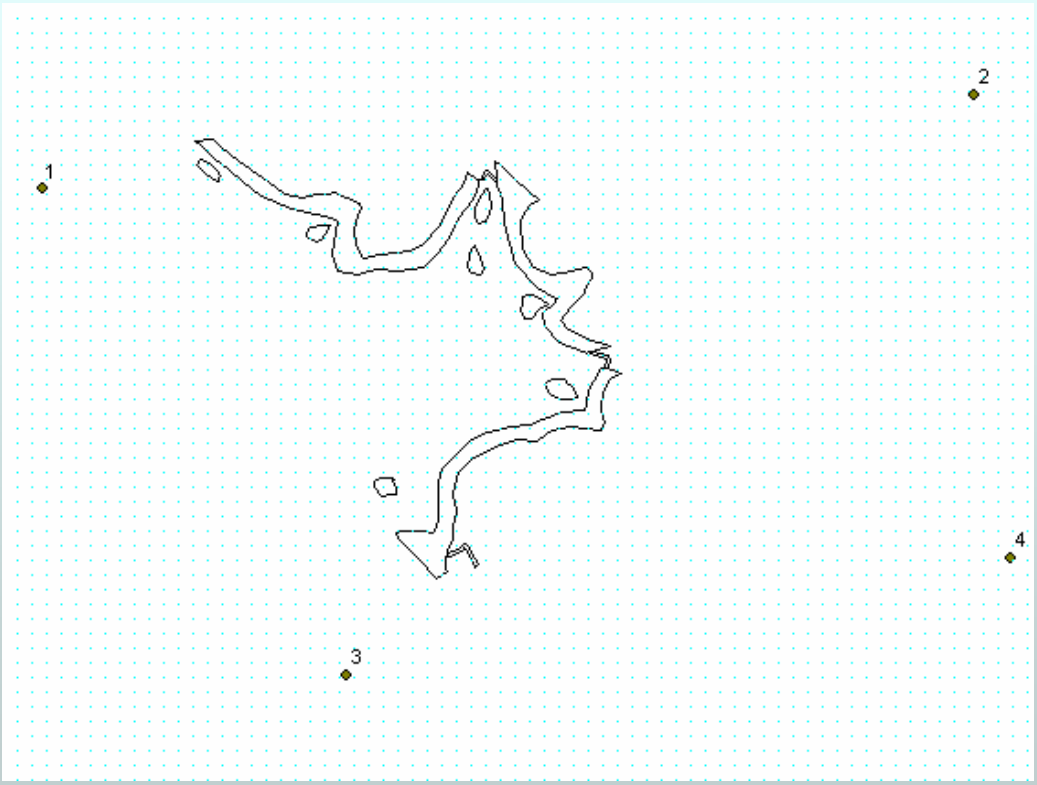
Attribute data from an INFO file can be physically joined to an ArcInfo coverage using the command Arc: joinitem.

Georeferencing Data



To make spatial data usable, its coordinates must be written in the map units of a standardized cartesian coordinate system based on a known projection and datum. If all data sets contained within the GIS are registered to the same coordinate system, they will be correctly displayed in relationship to each other. If a user at another location needs to convert your data into the coordinates of his GIS, the projection of this data will be a simple matter if you have documented the projection information in the coverage.

Tics

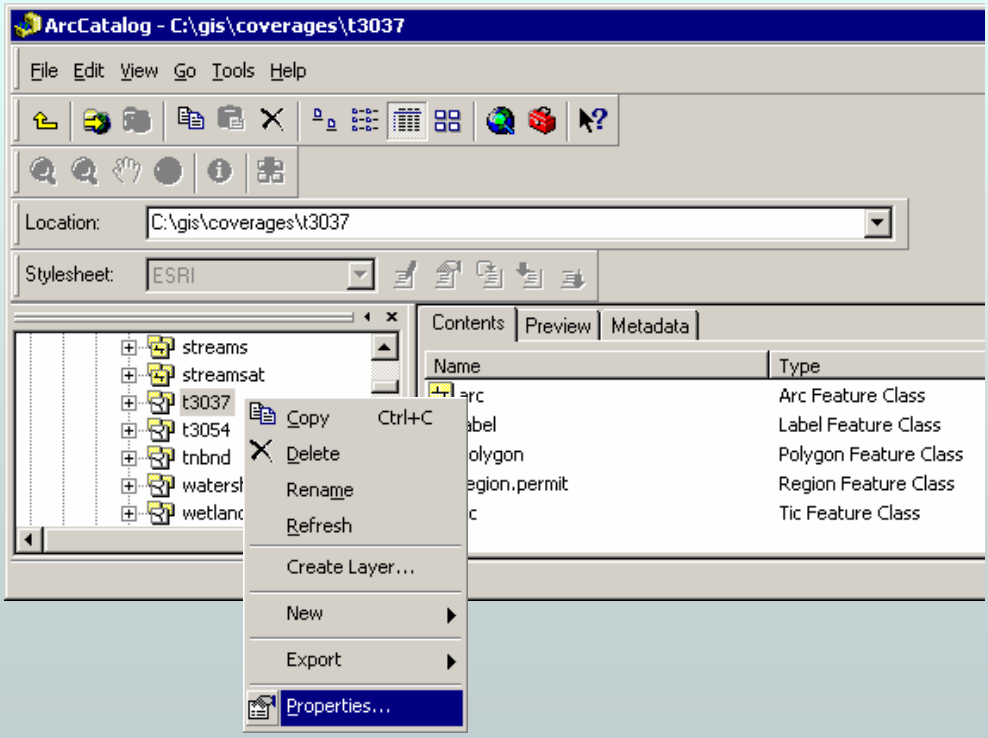


In ArcMap, geographic data sets are registered to real world coordinates through the use of ground control points known as tics. Tics represent the coordinates of known locations on the earth's surface. Tics are used to calibrate map manuscripts on the digitizing table to the computer screen and to perform transformations of the coordinates of the data set from digitizer units to a real world coordinate system.

At least four tics are required for registration. While these may be physically located anywhere on the map, best results are obtained if they are located in an approximate box-like pattern surrounding the digitizing area. Tics located in a flat diagonal pattern produce poor registration results.

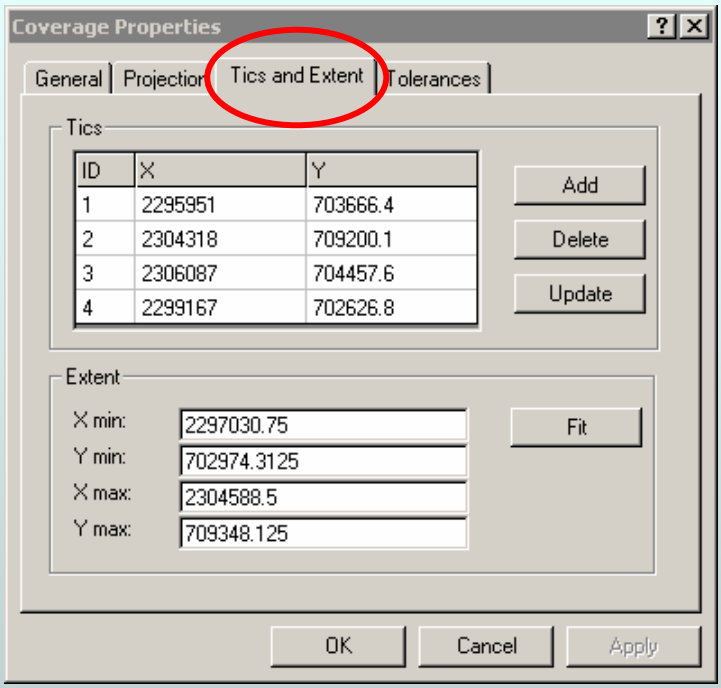
In ArcMap, tics are recorded using the Digitizer tab of the Editing Options menu and can be saved in a tic text file for later use.

Using ArcCatalog to Edit Tics in a Coverage



In ArcCatalog, select the catalog tree and right click on the coverage. Select Properties.

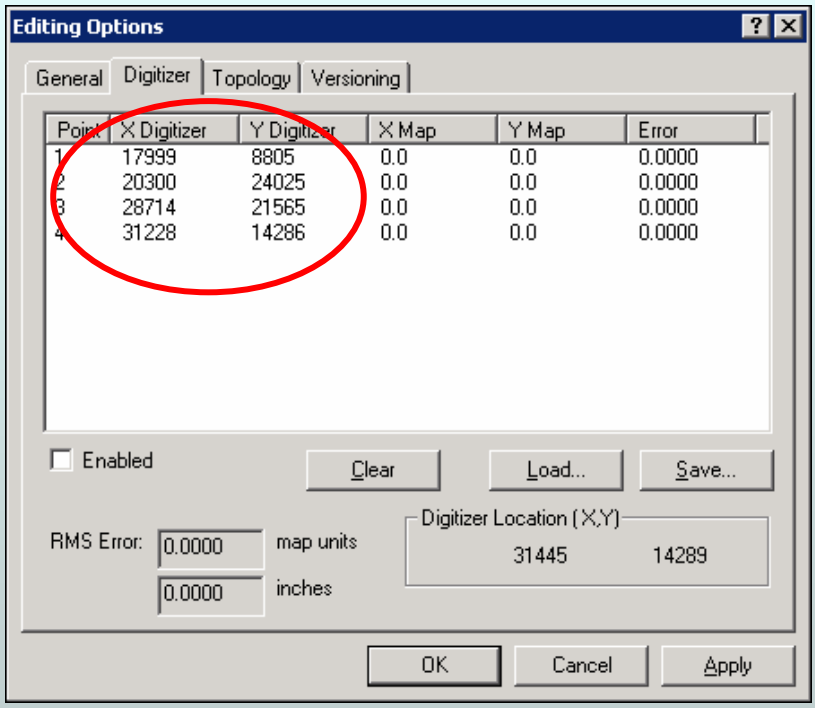
Editing Tics in a Coverage



By selecting the Tics and Extent tab of the Coverage Properties menu in ArcCatalog, you gain access to the tic coordinates located within the coverage. Here you can add, delete, or change the coordinates of the tics.

Note: This tab applies only to the tic.adf file located within the coverage and not the tic text file used by ArcMap to register a coverage to the digitizing table.

Georeferencing New Data in ArcMap



Editor Toolbar > Editor > Options > Editing Options

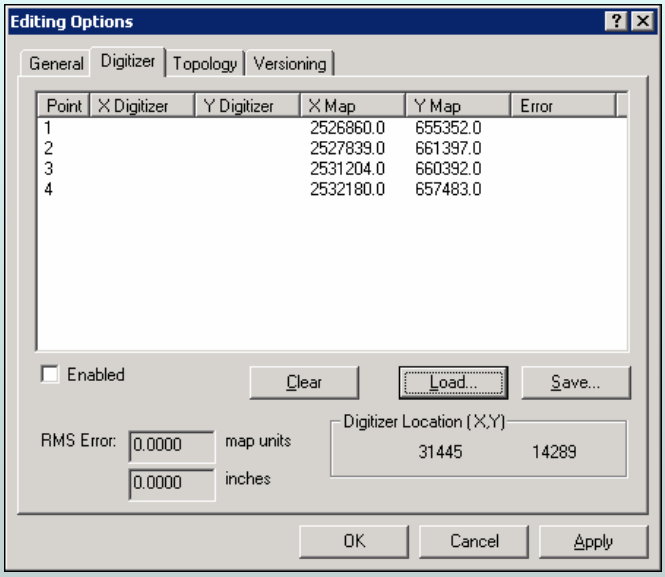
To set the first tics in an empty coverage, use the Digitizer tab of the Editing Options menu on the Editor Toolbar to record the coordinates for each tic. In practice, the digitizing puck is used to digitize the tics from the paper map. In the illustration above, the digitizer units are represented in thousandths of inches as reported from the digitizing tablet by the WinTab driver.

Two approaches to georeferencing are available. The user can either digitize entirely within the units of the digitizing table and later transform the coverage to the appropriate real world coordinates, OR set the digitizer units directly to the real world coordinates. In the first method, the user simply begins digitizing and saves all work without specifying ground location coordinates. In the second method, the X Y coordinates reported by the digitizing table are transformed to the map units of the real world location based on the ground coordinates of the tics.

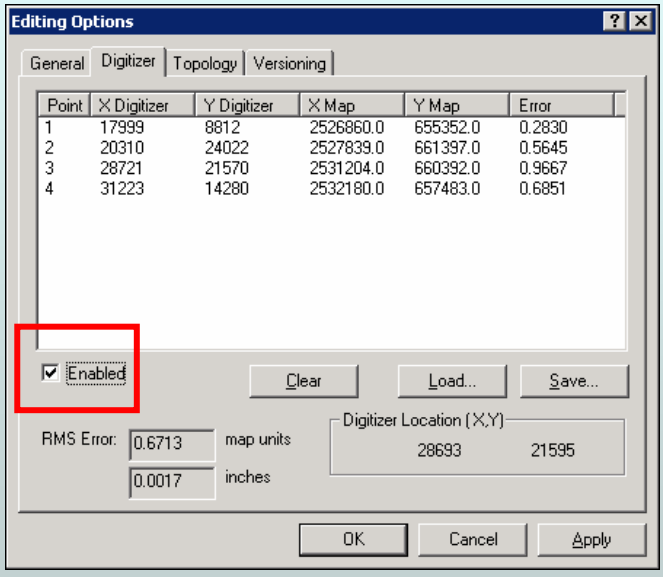
To use the second method, use a left mouse click to click on the appropriate tic record in the Digitizing tab. Then type the ground coordinates for the tic. This procedure is necessary to register the map to the data set before the user can begin digitizing feature classes into the data set. Check the RMS error. For digitizing units, acceptable ranges of RMS error are 0.004 inches for fine work, and 0.008 for rough work. The RMS error for map units depends on the user's experience with the data. If the RMS is acceptable, click Enabled, click Apply, and then click OK. Begin digitizing.

Georeferencing Existing Data

Load Tic Text File



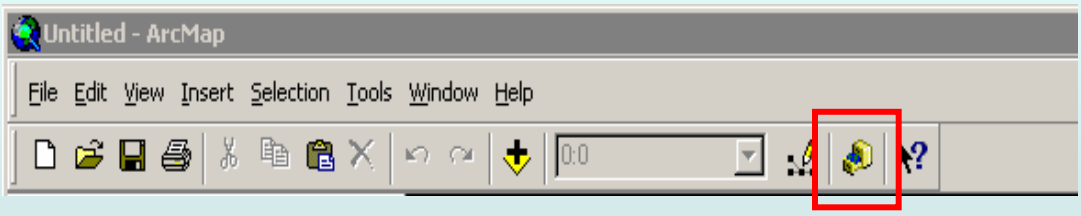
Register Table to Tics



To register an existing coverage back to the digitizing tablet, the Digitizer tab is again selected from the Editing Options menu. Load the tics from a text file. Click on the first tic record in the Digitizing Tab window with a mouse. Use the digitizing puck to click on each tic location in order on the paper manuscript on the digitizing table. Note the RMS error. If acceptable, continue. Otherwise, shoot the tics again. Click Enabled to enable the digitizing puck and to lock the display on the screen to the extent of the digitizing area on the digitizing table. Click OK.

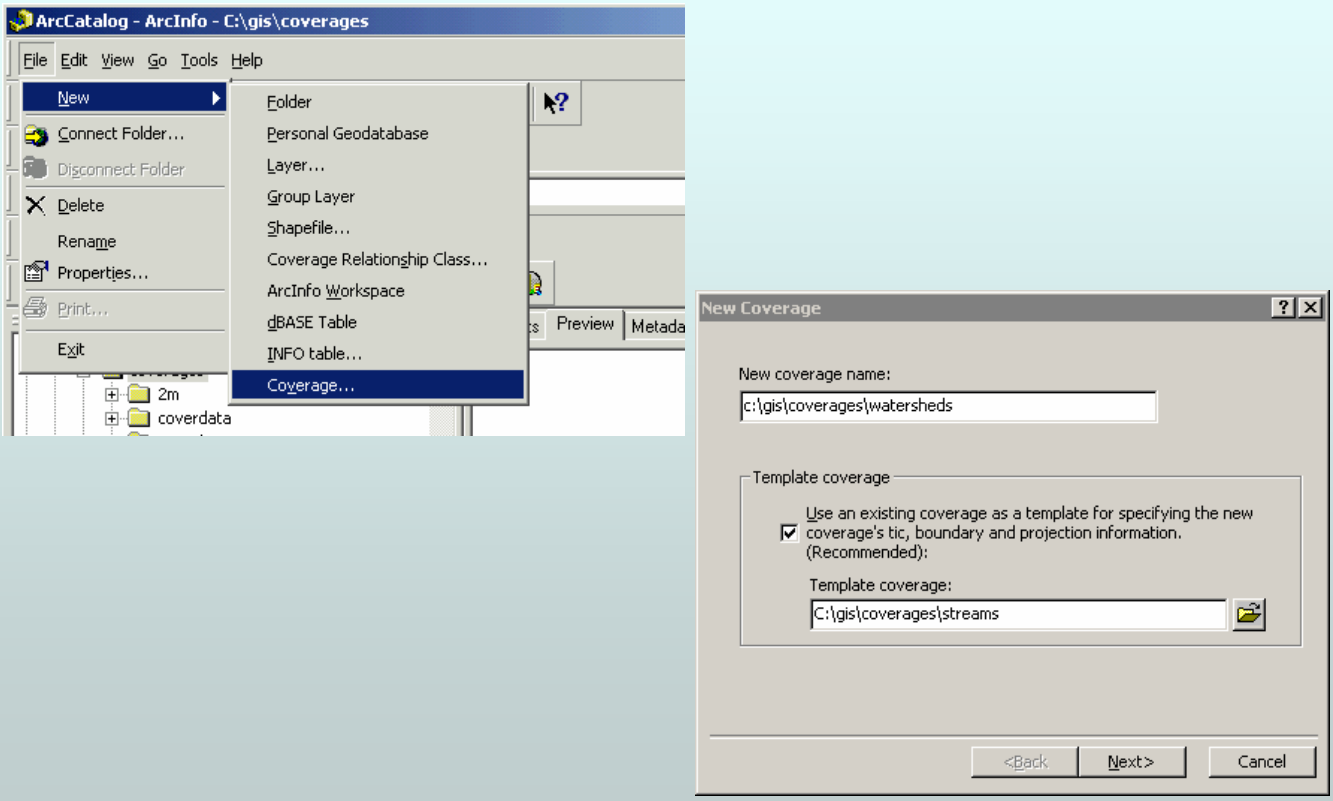
Using ArcCatalog to Create a New Coverage

From ArcMap, ArcCatalog can be launched:



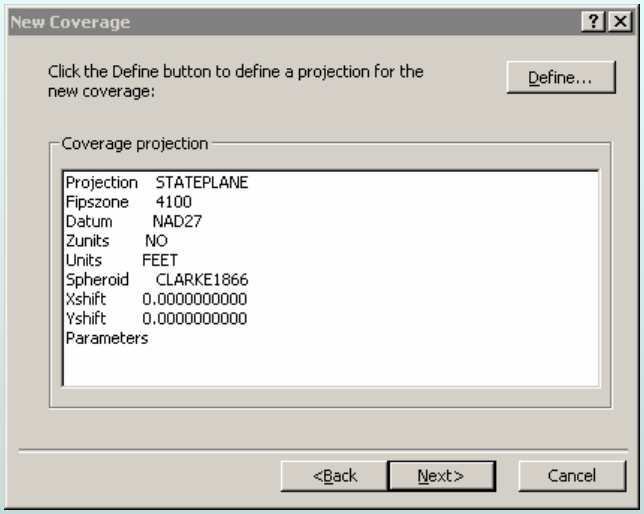
ArcCatalog can create a new coverage using an existing coverage as a template, OR create a new coverage without using a template

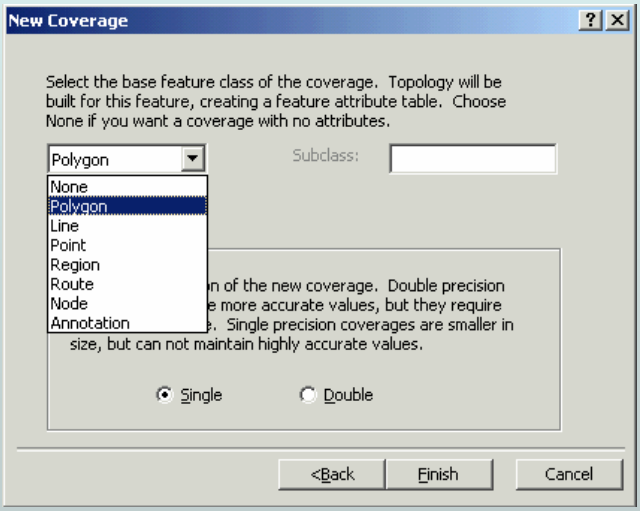
Creating a New Coverage With a Template



Select the workspace in which the new coverage will be placed. Then click on File, New, Coverage, and follow the prompts. It is easier to create the new, empty coverage based on an existing coverage as a template.

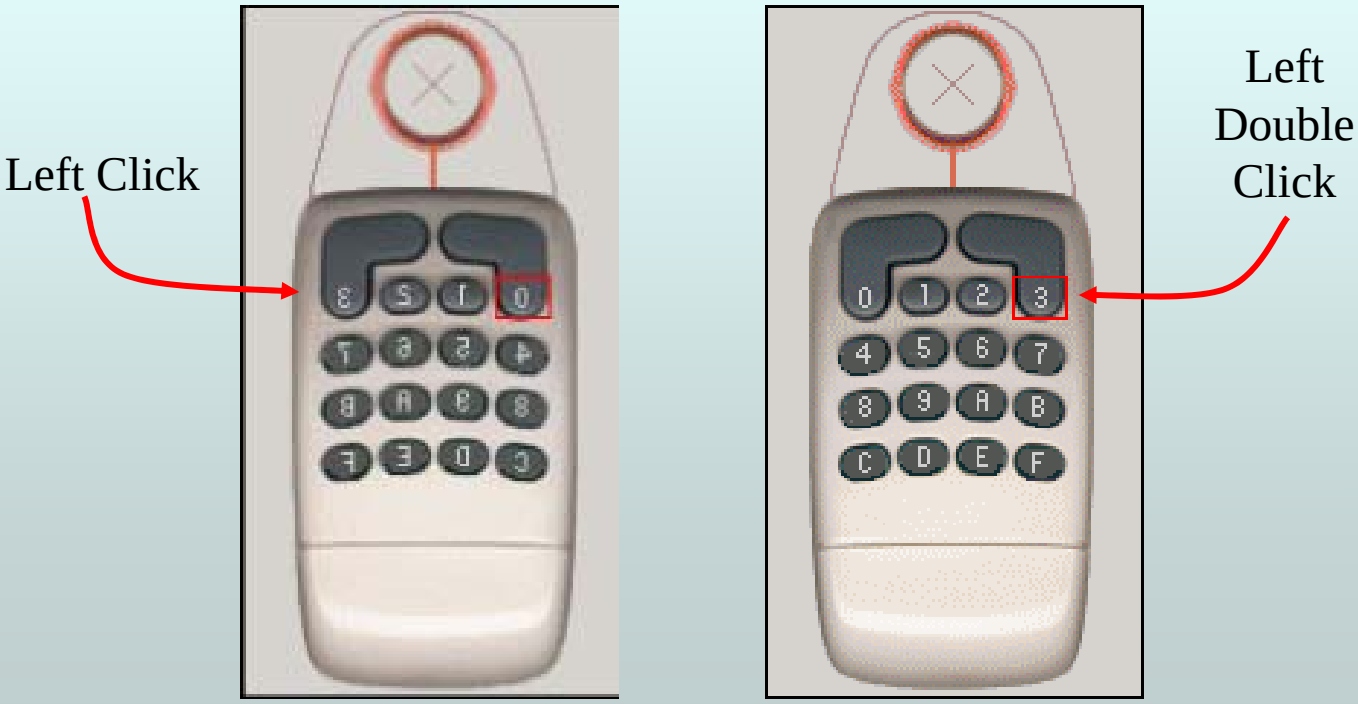
Creating a New Coverage With a Template - Continued





Examine the existing projection information. Redefine this information if necessary. Identify the feature classes to be created. This last process will determine the features to be edited later. Click the Define button to edit projection information.

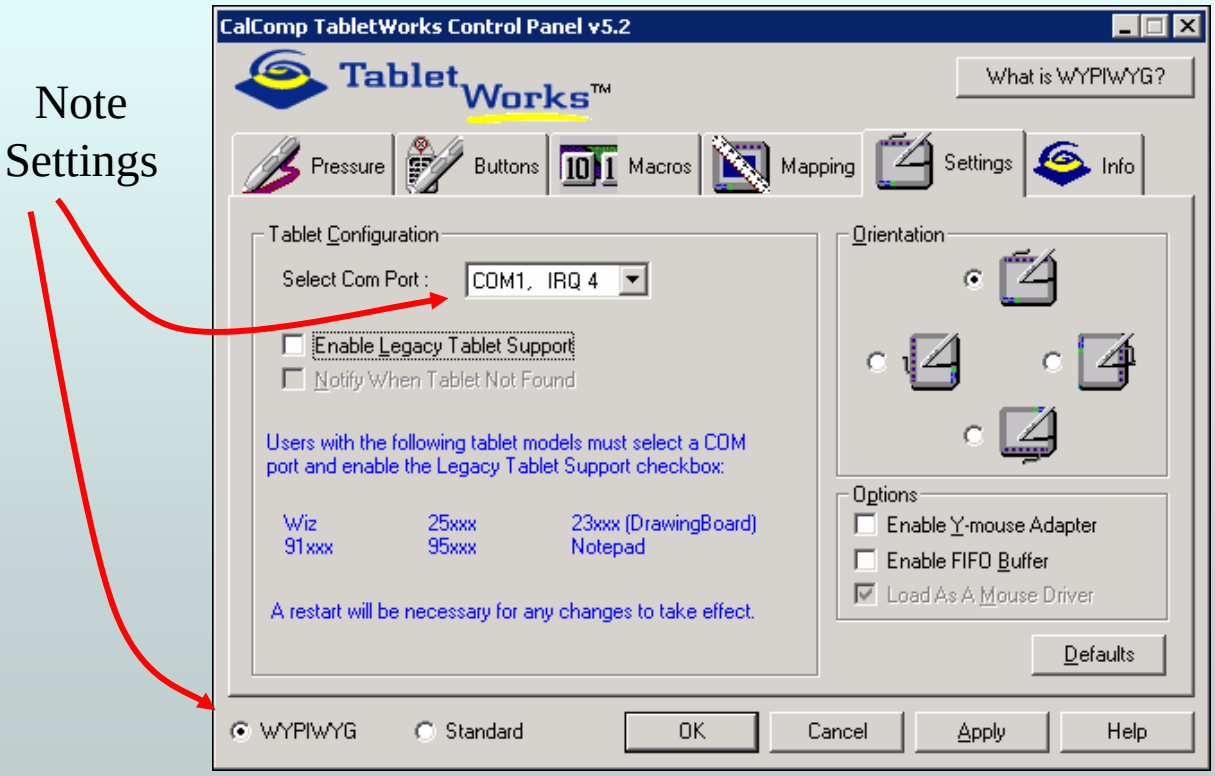
Configuring a Digitizing Puck for Use in ArcMap



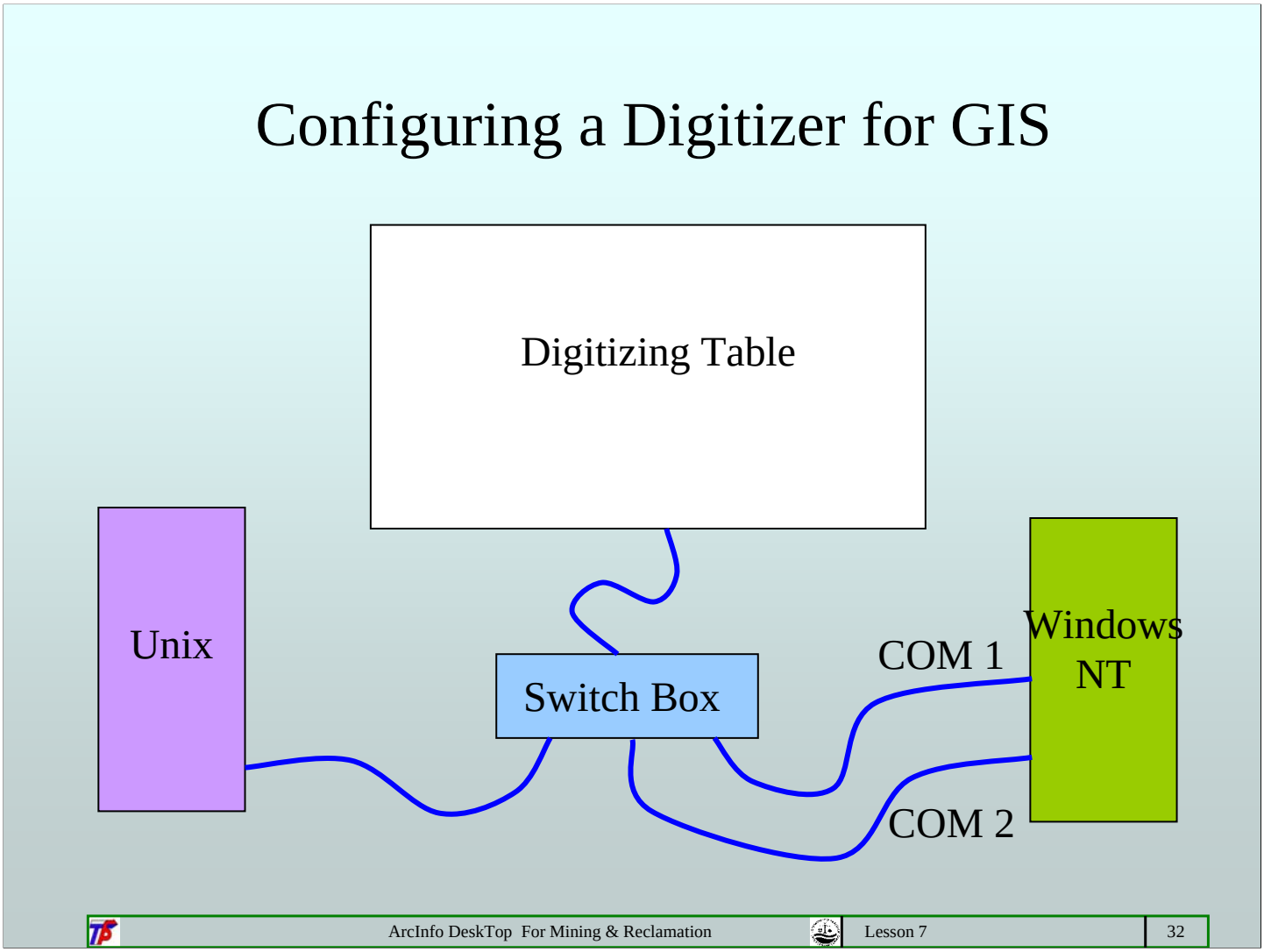
In ArcMap, the digitizing puck works somewhat like a second mouse. If the mouse is moved, control of the cursor is passed to the mouse. If the digitizing puck is moved, cursor control is immediately passed to the puck. The user can interactively use both mice and the keyboard. The WinTab driver for the digitizing table provides limited customization of the puck buttons. ArcMap only requires that one button on the puck be configured as a left click and a second button as a left double-click. If desired, additional customization beyond these requirements can be obtained by VBA code in either the map document or one of the templates.

In ArcInfo Workstation, configuration of the digitizing puck is very different from ArcMap. In ArcEdit, once control is passed to the tablet, all user responses must come exclusively from the puck. All other input sources are blocked. To respond to the digitizing menu options shown on the monitor and also return control to the mouse and keyboard, the puck must return an alpha-numeric value to the program when a given button is pressed. These values are mapped in a special file located in the c:\arcexe80\bin\digform directory. This file is read and the digitizing port is configured when ArcEdit is launched.

Configuring a CalComp DB III to Use a WinTab Driver in ArcMap



If the GIS environment uses a CalComp Drawing Board III, the CalComp TabletWorks version 5.2 WinTab driver can be configured to work with ArcMap. WYPIWYG ("Where You Point Is Where You Go") should be checked (this setting makes the digitizing puck work like a puck instead of another mouse used to make menu selections), two buttons of the digitizing puck are configured for left click and left double click, and the Com Port should be set to COM1. Do not check Enable Legacy Tablet Support.



In a GIS environment, it is necessary to use a digitizing table with multiple applications from more than one operating system platform. Resolving settings required by software applications, COM port device drivers, and digitizing table configuration settings is an interesting exercise.

For the Windows computer, one solution is to have two serial (COM) ports reserved exclusively for communication with the digitizing table. Allow the WinTab driver to control COM1 for use by applications such as ArcMap and AutoCAD Map. A serial cable from COM1 connects to a 3-position serial data switch box. When the computer is started, WinTab controls the COM1 port and the digitizer configuration if the switch is set to the appropriate position.

COM2 is reserved for use by applications which do not use WinTab drivers. For example, ArcInfo Workstation uses its own I/O method that requires free access to a COM port. If the WinTab driver controls the port, access by ArcInfo Workstation (the ArcEdit graphics editor) is blocked. A second serial cable from COM2 connects to the switch box. To remove WinTab control of the digitizer table, the switch is set to the appropriate position and the digitizer is turned off and then back on. The third position on the switch box receives a serial cable from the Unix computer. The single input to the switch box connects to the digitizing tablet.

Exercise 7A

Using Geospatial Data for Mining Applications in ArcMap

Using ArcToolbox for Data Automation

Topology

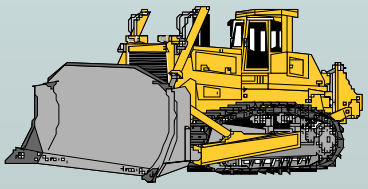
Build

Clean

Projectdefine

Transform

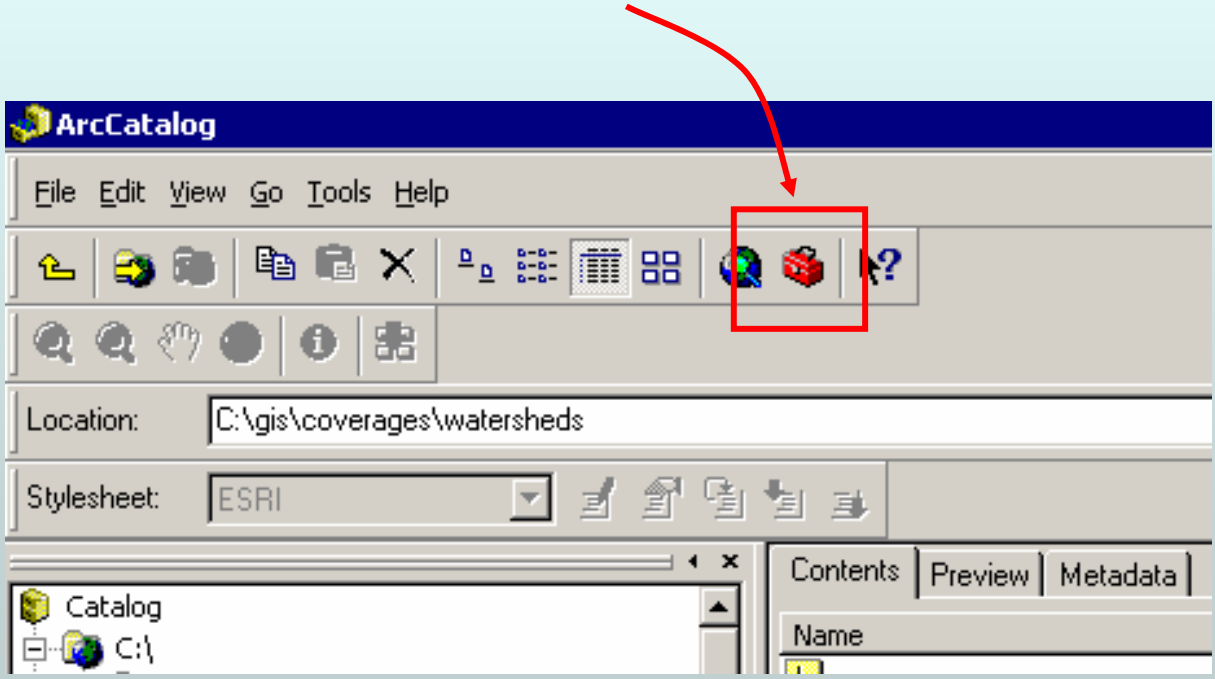
Project



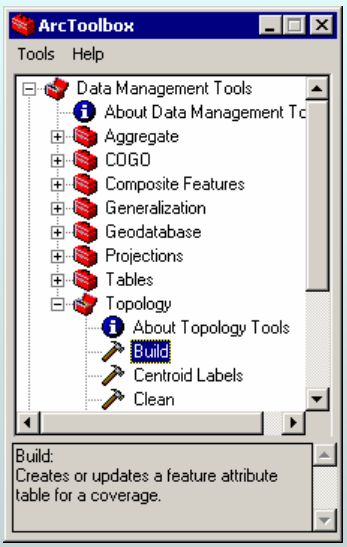
ArcToolbox is a collection of approximately 100 of the most common geo-processing commands available in ArcInfo Workstation. These are presented in ArcToolbox as individual groups of similar tools and “wizards”. These tools can convert most major spatial data formats to and from ArcInfo coverages, grids, and triangulated irregular networks (TINS).

Launching ArcToolbox

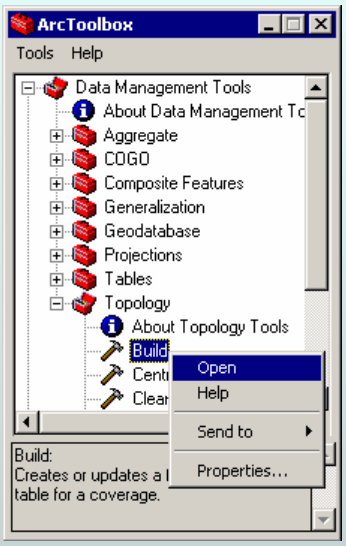
ArcToolbox can be started from ArcCatalog, or from Windows Programs



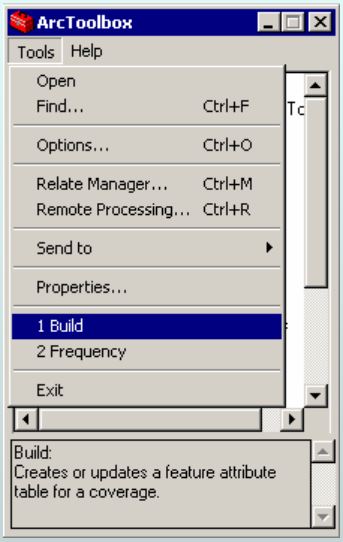
Starting Tools in ArcToolbox



from the tree

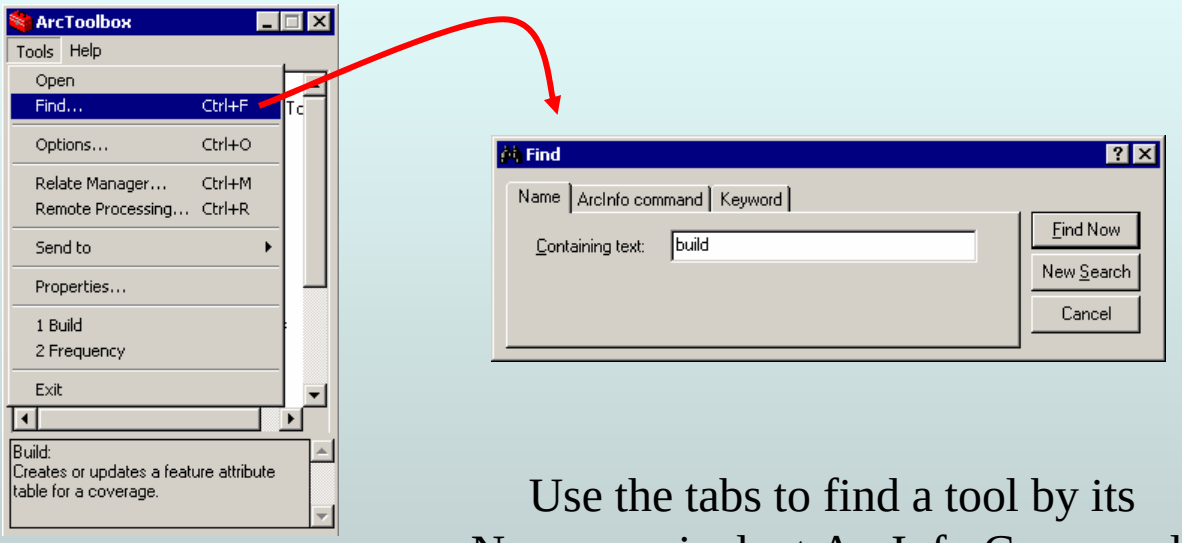


from its context menu



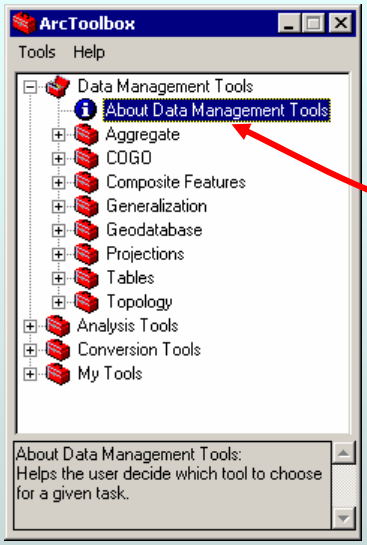
from the Tools menu

Finding a Tool in ArcToolbox

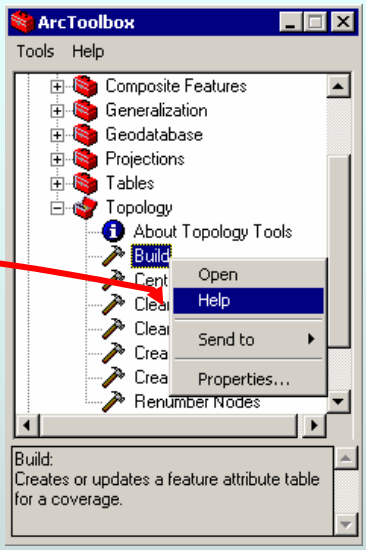


Use the tabs to find a tool by its Name, equivalent ArcInfo Command, or Keyword

Getting Help in ArcToolbox

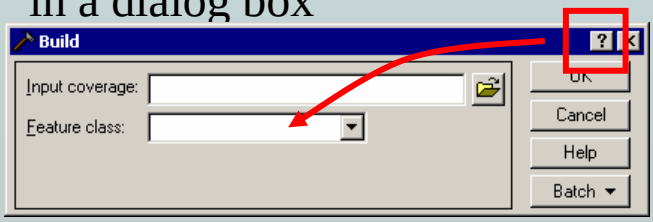


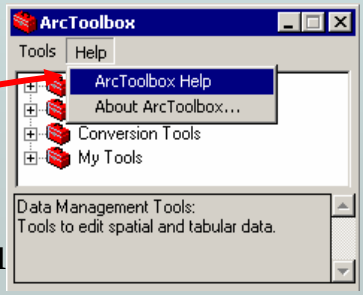
using Help nodes



using a Tool's context menu

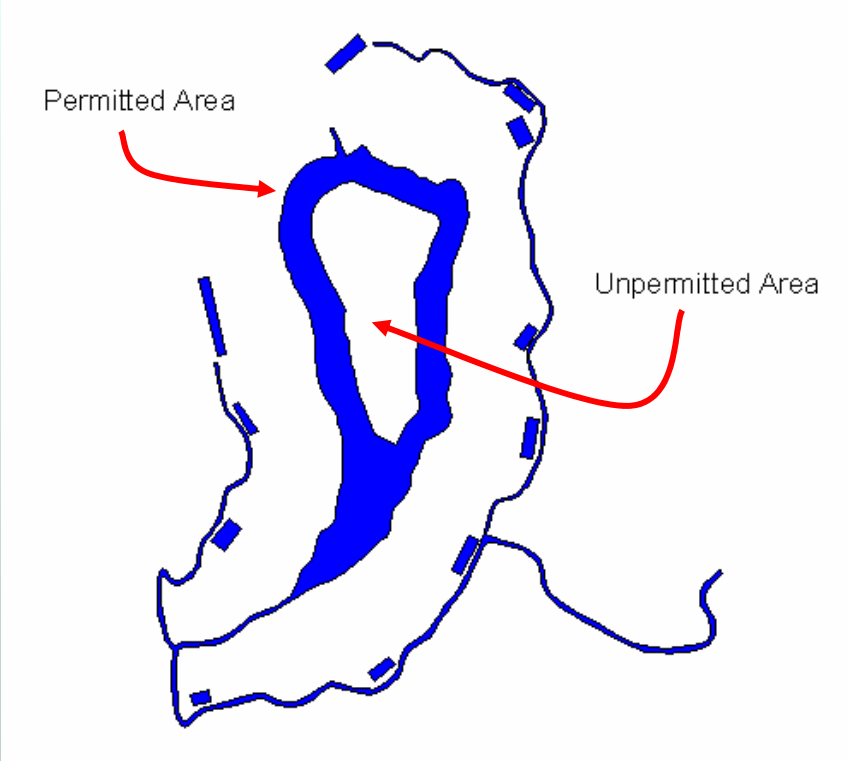
in a dialog box





from the Help Contents menu

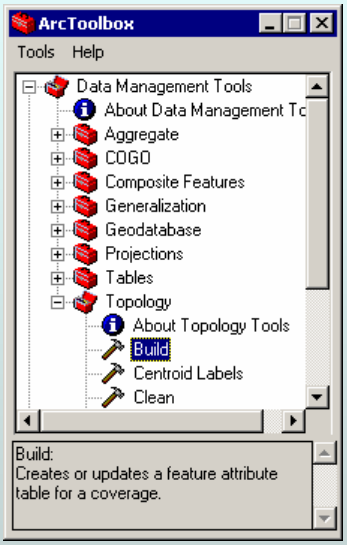
Topology

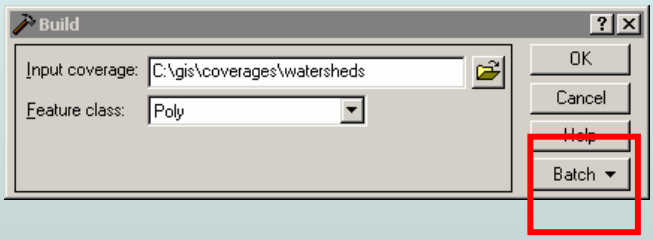


The principles of topology were introduced in Lesson 1. Topology defines the spatial relationships between features. For example, a coverage consisting of many permit boundaries is composed of arc, polygon, and label point feature classes. Topology allows for the calculation of the perimeter and area of a permit area polygon by identification of the arcs which compose the polygon and calculation of their lengths. Because topology also keeps track of the polygons on the left and right side of each arc, accurate determinations of area can be made even if the permit boundary contains unpermitted areas inside it. Additionally, topology allows creation of data sets with overlapping features and preservation of their spatial characteristics, such as overlapping permit boundaries. The use of topology is efficient because it reduces the file size of the data model through elimination of redundant data coordinates and it allows use of topological operators in spatial modeling operations, such as unions and other overlay operations.

Topology must be reconstructed after EVERY edit to the spatial data set, including projections of the data to a new coordinate system which will cause small changes in the relative positions of the feature classes. Reconstruction of these spatial relationships is accomplished when either the build or clean operation is performed. Unless the spatial relationships are reconstructed after editing, the polygon attribute data will not be available. Rebuilding topology restores the relationships of the feature classes to each other and to the polygon attribute data.

Build





Multiple operations are also possible

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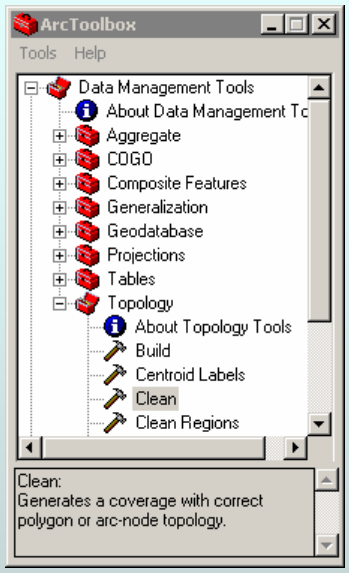
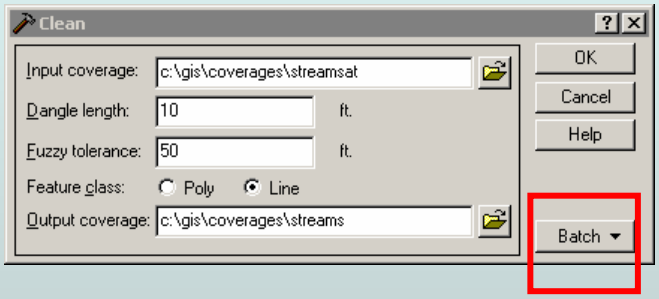
A build operation will create topology and create or update feature attribute tables for point, arc, and polygon coverages. Build will not perform coordinate editing. It will not create intersections at crossing arcs. A coverage can be built an infinite number of times without adverse effects. Build can also be performed in ArcCatalog by right clicking on the data set name in the Catalog tree, selecting Properties, clicking on the General tab, and clicking the Build button.

Clean

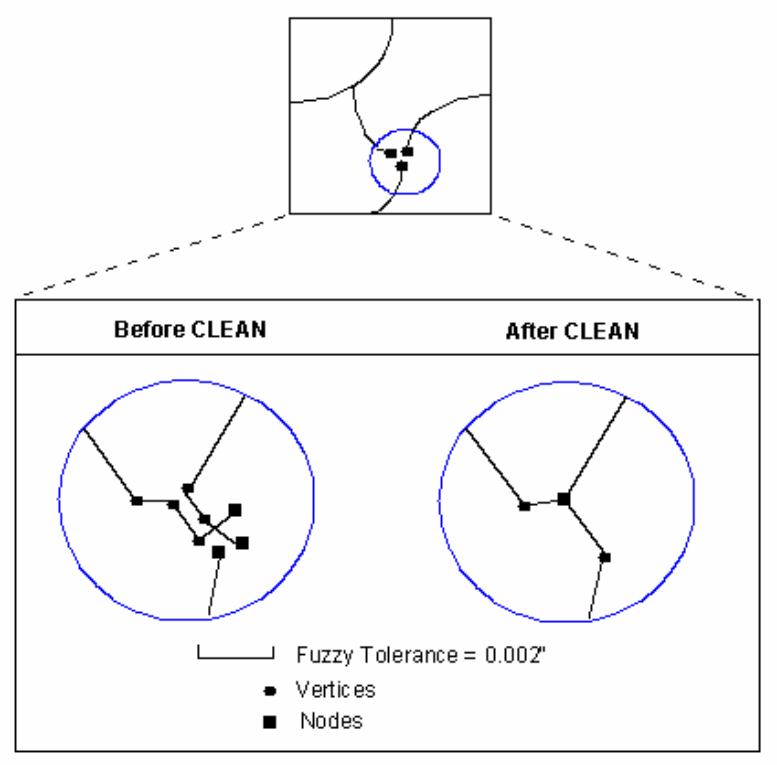




Multiple operations are also possible

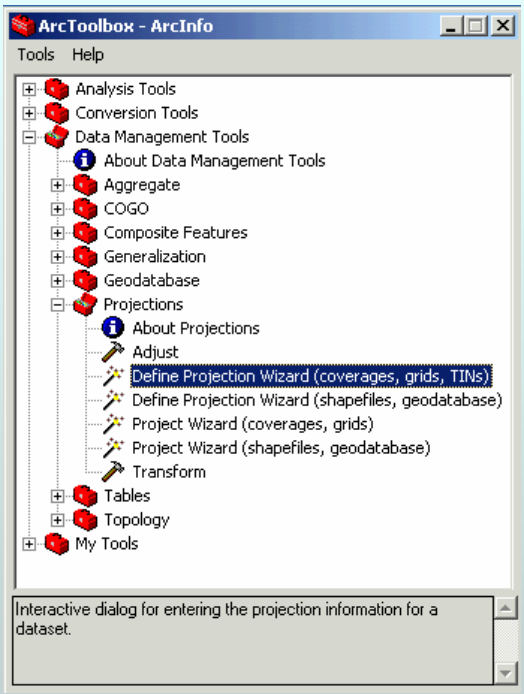
Clean will also build topology, similar to the build operation. Unlike build, clean does not assume that the coordinates are correct and will perform coordinate editing. In addition, clean will only create or update feature attribute tables for arc and polygon coverages. Clean performs a batch-like operation on the entire coverage, correcting all errors found which otherwise would have to be individually corrected during a editing session. Clean as few times as possible. Always try to create or reconstruct topology with a build operation first. Clean can also be performed in ArcCatalog by right clicking on the data set name in the Catalog tree, selecting Properties, clicking on the General tab, and clicking the Clean button.

What Happens During Clean



Clean will create intersections wherever arcs cross each other by placing a node at the intersection and splitting the arcs, remove dangling arcs less than the dangle length, and move vertices within an arc if they are less than the fuzzy tolerance to another vertex, snapping them together even if they are located in another arc. No two coordinates will be within the fuzzy tolerance after a clean is performed. It is advisable to use clean cautiously and carefully select the processing tolerances. It is generally safe to use clean once on a coverage and compare its results to the original coverage. Repeated cleaning operations may produce undesirable results.

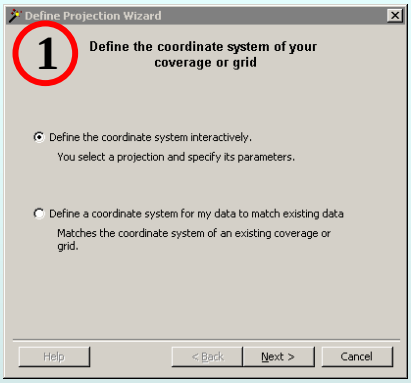
Using the Define Projection Wizard

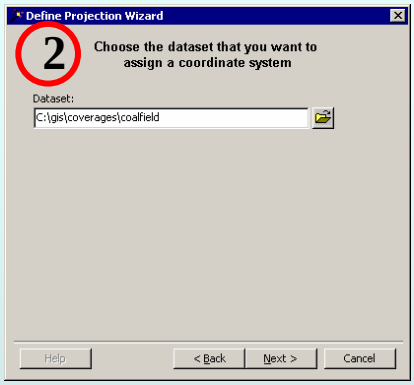


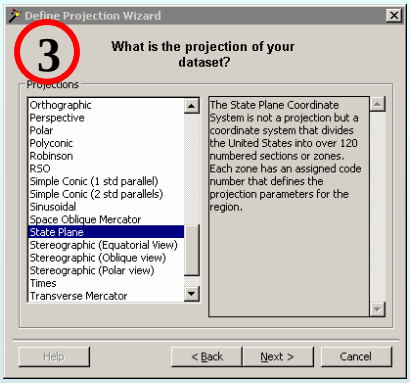
Projections can be defined interactively or by matching an existing coverage.

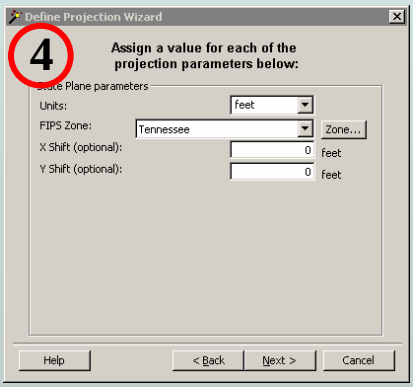
Defining a projection documents the coordinate system, datum, and map units of the data set. This information tells ArcInfo how to display the data, project it to another coordinate system for creation of a new data set, or perform an “on the fly projection” to display the data with data sets from other projections. Like metadata, this information can also be read by the user. In Desktop ArcInfo, the projection information can be documented interactively, or it can be “matched” (copied from a data set with the same projection information) by template.

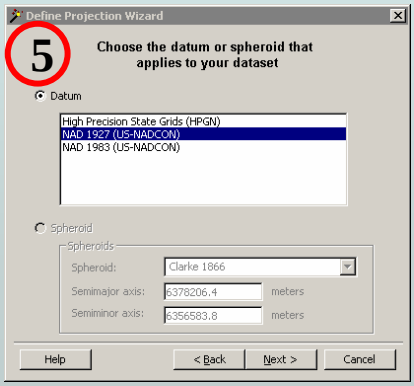
Defining a Projection Interactively

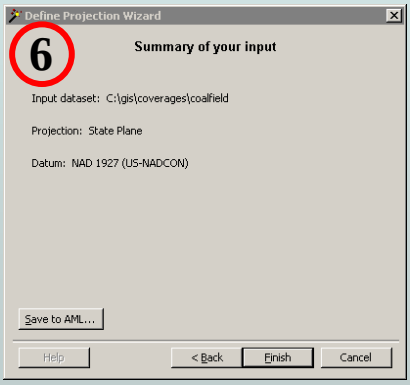




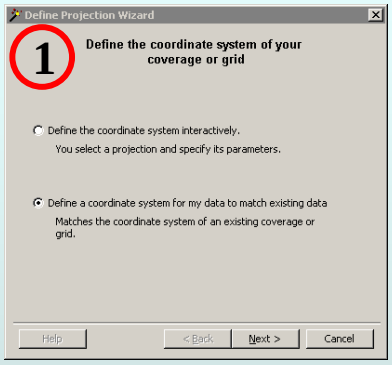


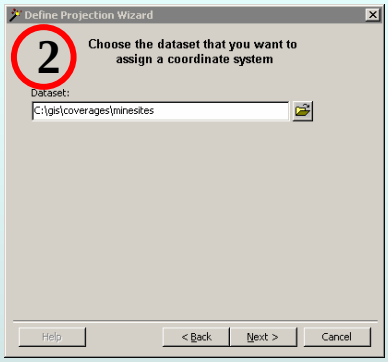


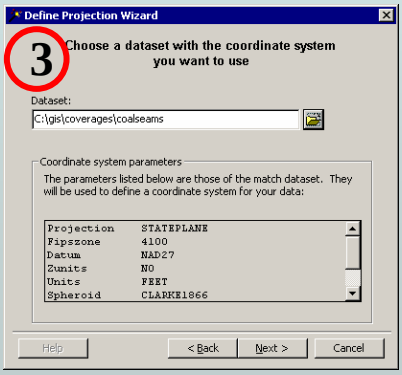




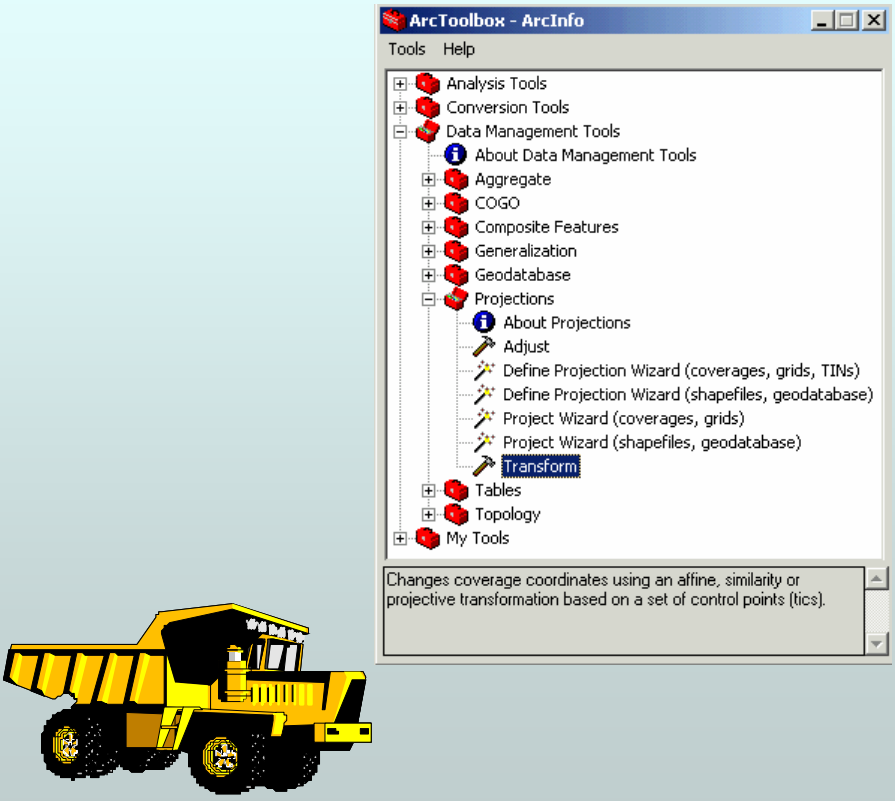
Defining a Projection by Matching







Transform



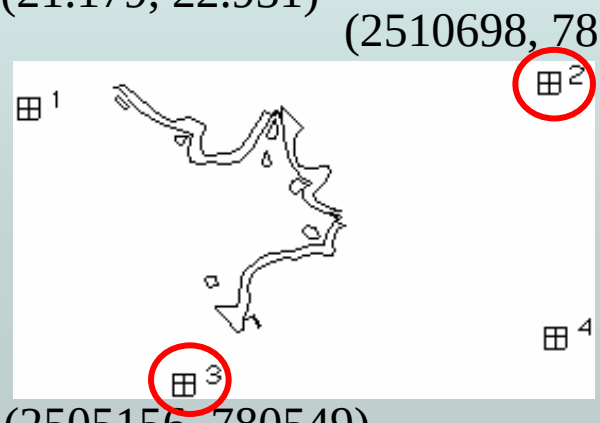
Transform converts coordinates from one cartesian coordinate system to another, as from the coordinates of a digitizing table to state plane map units of a coverage, based on a set of ground control points called tics. This operation is like a linear stretch. Ideally, a transform operation should be performed in the same projection as the source map. The operation is performed on the feature classes in the coverage based only on the tic locations. The user must know the map units of the coverage.

Before performing a transform, an output coverage containing only the final tic locations must be created in ArcCatalog. The input coverage can be used as a template for the tics in the output coverage. In ArcCatalog, the output tic coordinates are accessed as a property of the coverage and adjusted to the final locations. When the transform tool is used in ArcToolbox, the user only has to specify the existing input and output coverages to perform the operation.

What Happens During Transform

Before Transform, Input Coverage in Digitizer Units

After Transform, Output Coverage in Real World Coordinates



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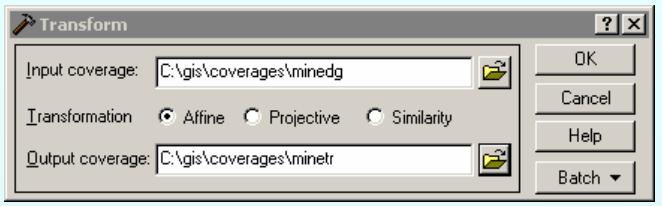
Before transform, these are the coordinates of the control points in the coverage which is in digitizer units:

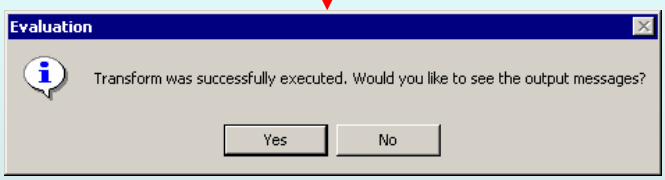
Record	IDTIC	XTIC	YTIC
1	1	14.917	33.949
2	2	35.789	34.989
3	3	21.179	22.931
4	4	36.088	24.793

After transform, these are the coordinates of the control points in the coverage which is now in a real world coordinate system, in this case it is Tennessee State Plane, NAD 27:

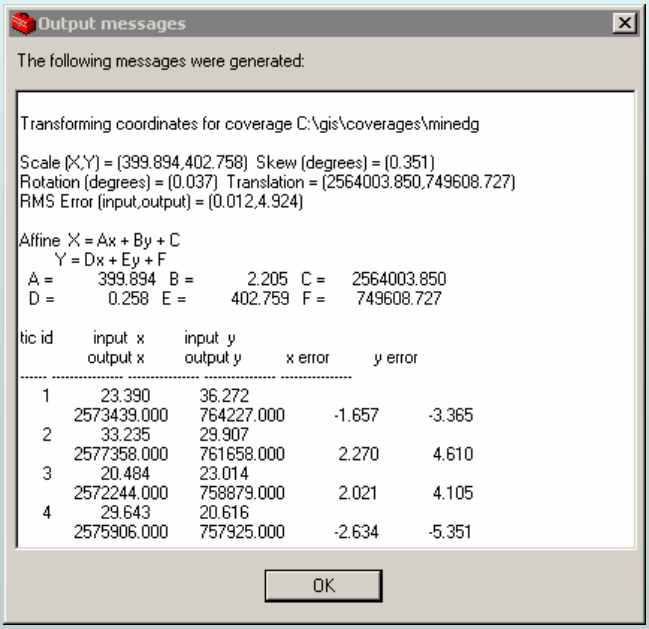
Record	IDTIC	XTIC	YTIC
1	1	2502467.000	784845.000
2	2	2510698.000	785679.000
3	3	2505156.000	780549.000
4	4	2511024.000	781592.000

Using the Transform Tool

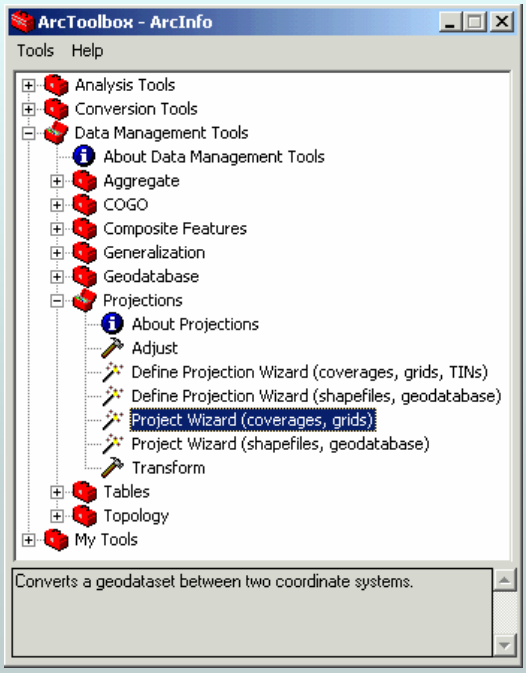




View the result

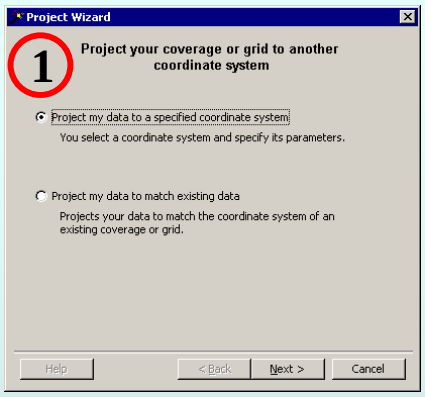


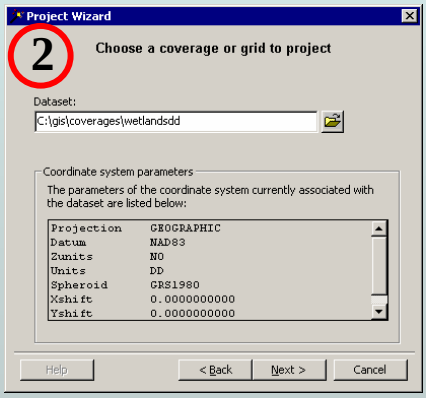
Using the Project Wizard

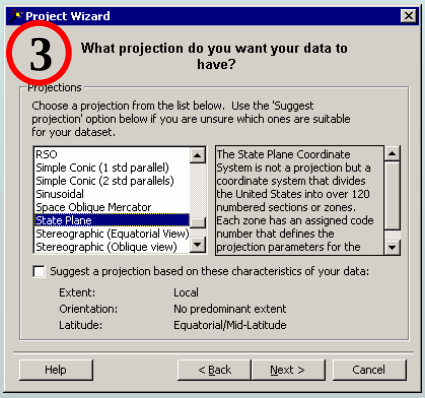


Projection converts the coordinates of feature classes in a data set from one standardized coordinate system to another standardized coordinate system based on known map projections and datums. It is a mathematical calculation, and is NOT based on tic locations. Changing a coverage's projection removes its topology. The solution is to build it again to restore topology.

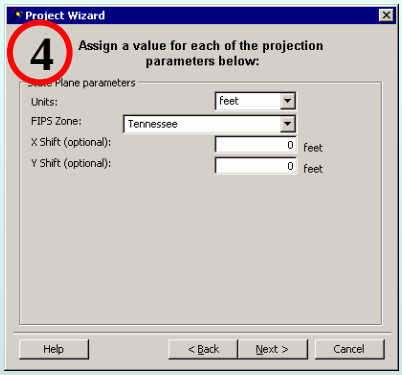
Projecting to a Specified Coordinate System

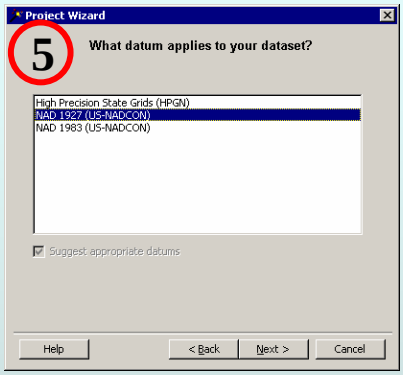


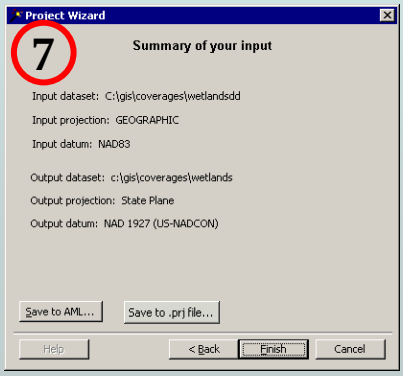




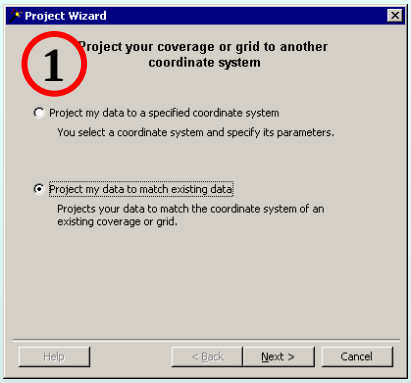
Projecting to a Specified Coordinate System - Continued

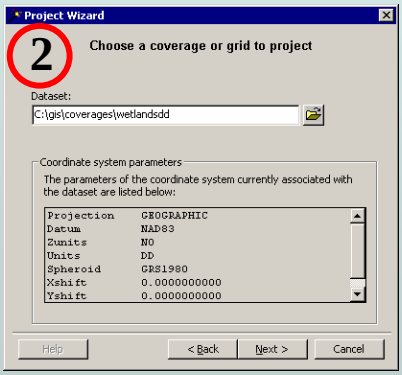


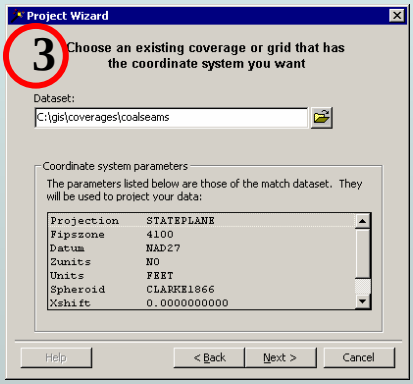




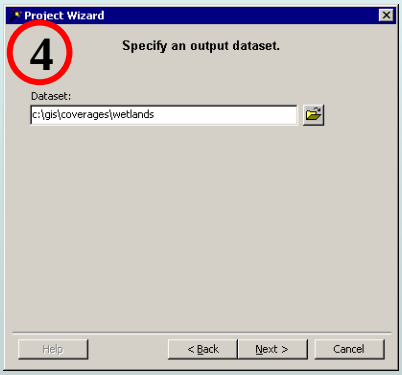
Projecting to Match an Existing Coordinate System

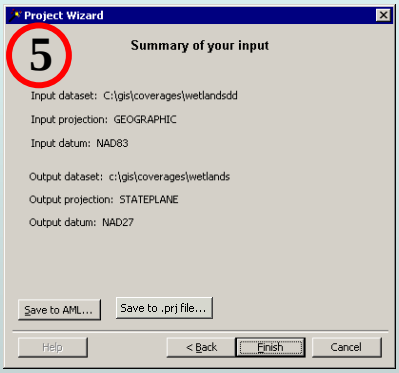






Projecting to Match an Existing Coordinate System -Continued



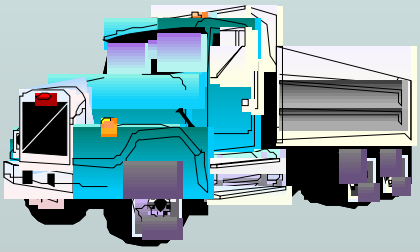


Metadata

Creating

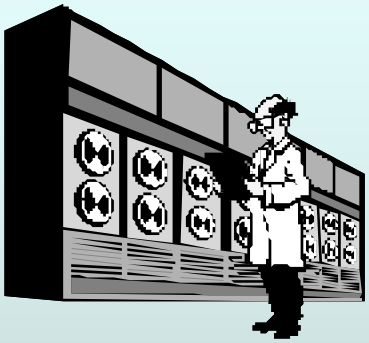
Editing

Viewing



Metadata is sometimes referred to as “data about data”. Metadata consists of properties and documentation. Properties can be automatically obtained by ArcCatalog from the data set. The data set creator/user provides relevant descriptive information as documentation. The documentation should include both the spatial and attribute data. When automation is completed, the producer should document data set creation in detail sufficient to allow the user to understand the data source, geographic accuracy, attribute accuracy, data set completeness, time period, and other relevant characteristics of the data.

Creating Metadata in ArcCatalog

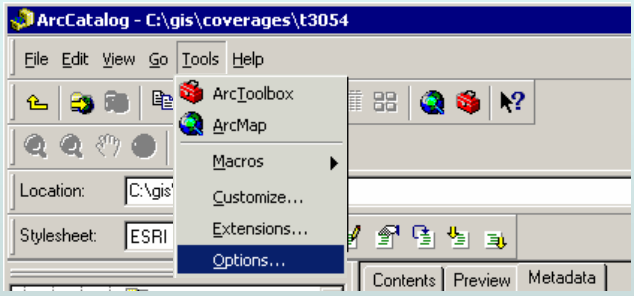


Automatic Creation and Updating by ArcCatalog

Manual Creation and Updating

When you attempt to view metadata using the Metadata tab, ArcCatalog will automatically create a limited amount of metadata, if it does not already exist, from the data set properties. Hints, which appear as gray text, are provided where no metadata information is available. Metadata for file-based data sets, such as coverages, shapefiles, and CAD drawings is stored in XML files and will not appear in the directory tree of ArcCatalog unless it becomes separated from the data set. Metadata for geodatabases is stored within the geodatabase. If ArcInfo Desktop is used to move, copy, or delete the data set, these operations will automatically affect the metadata file, too. Several standards exist for metadata documentation. One is the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata, also known as “the FGDC standard”, which attempts to provide a common definition for geospatial metadata. Using the FGDC standard allows a uniform search process when attempting to locate data through the National Spatial Data Infrastructure (NSDI) Geospatial Data Clearinghouse.

Automatic Creation and Updating of Metadata by ArcCatalog



Set the metadata defaults under the Options choice on the Tools menu

ArcCatalog can automatically create and update metadata for all data sets by setting its defaults.

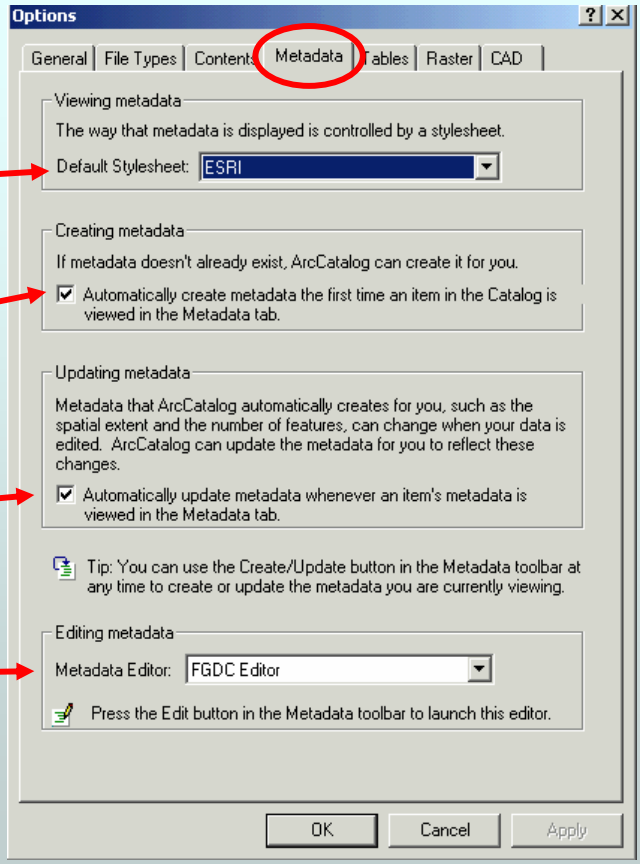
Setting Metadata Defaults

Stylesheet

Automatic Creation

Automatic Updating

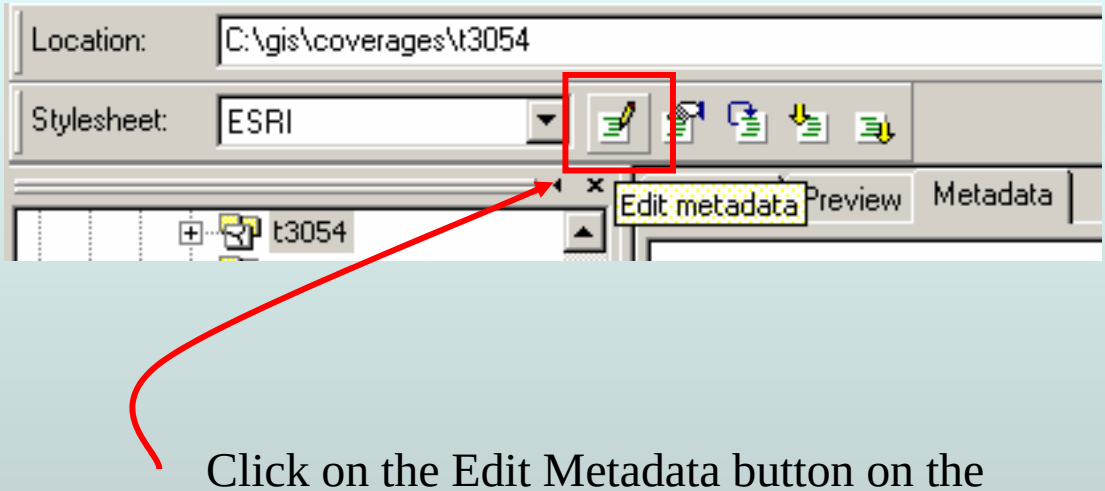
Metadata Editor



The defaults for automatic creation and updating of metadata will affect all data sets unless the individual data set has automatic updating turned off. To turn off automatic updating, select the data set from the ArcCatalog tree, click the Metadata tab, click the Metadata properties button on the Metadata toolbar, click the Options tab, and check the box “Do not automatically update metadata.”

Manual Creation and Updating of Metadata

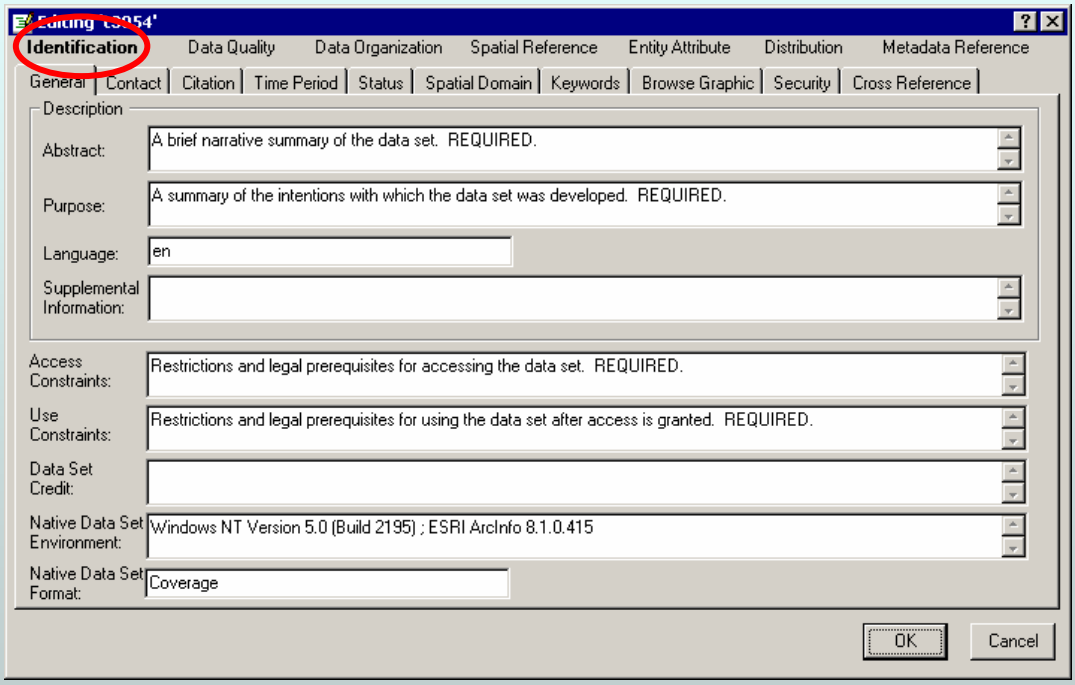
Editing Metadata in ArcCatalog



Click on the Edit Metadata button on the Metadata toolbar.

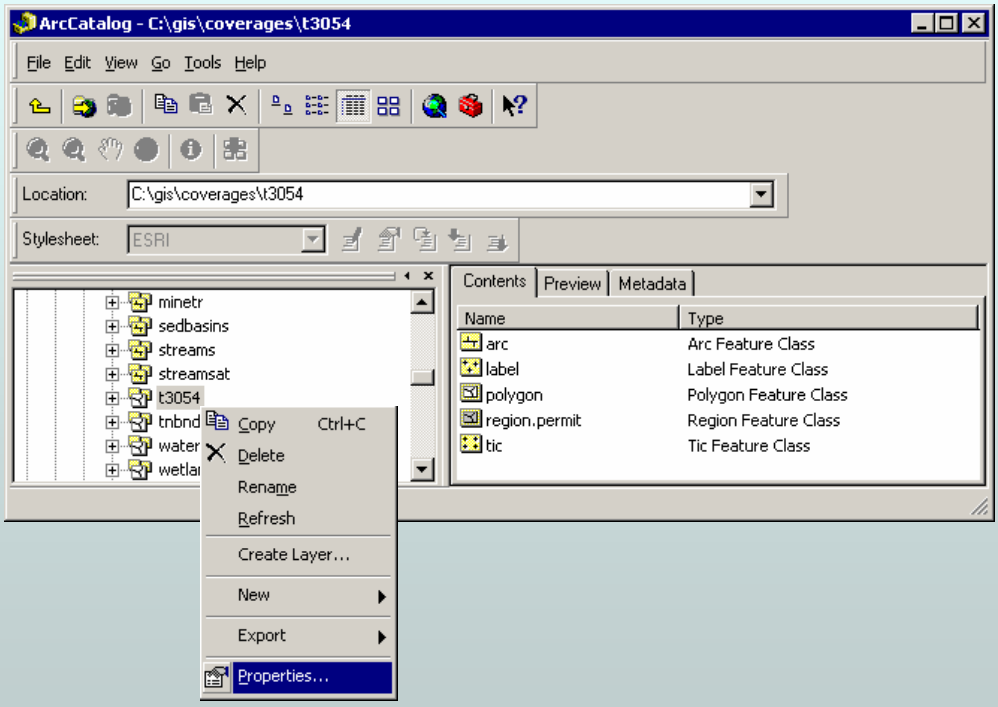
Every time the Metadata tab is accessed for a data set, ArcCatalog automatically updates the metadata properties with the current values of the data set if the user has write permission to the location where the data set is stored. To add additional information to the metadata file, use the metadata editor located on the Metadata toolbar.

The ArcCatalog FGDC Metadata Editor

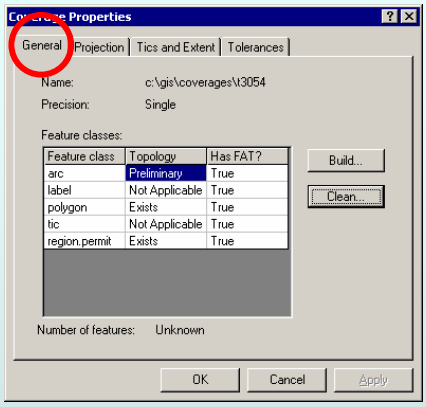


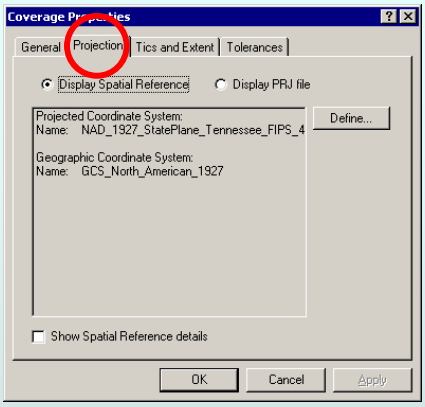
Note: If the FGDC Metadata Editor does not pop up after clicking on “Edit Metadata” on the Stylesheet Toolbar in ArcCatalog of ArcGIS Desktop 8.1, navigate to the Tools menu and click Options. On the Metadata tab of the Options menu, uncheck the checkbox for “Automatically create metadata . . .” under the Creating Metadata option and also uncheck the checkbox “Automatically update metadata . . .” under the Updating Metadata option. Click in both checkboxes to reapply the checkmark, click Apply, and OK. Now try the Edit Metadata button on the Stylesheet Toolbar. This should launch the Metadata Editor.

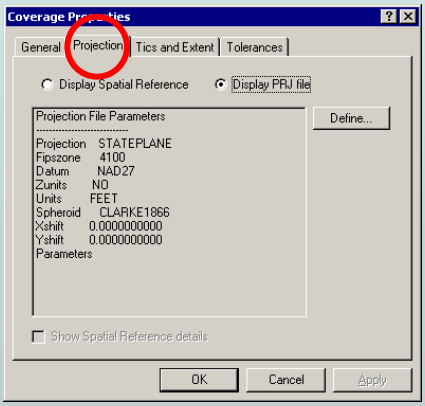
Viewing Data Set Properties in ArcCatalog

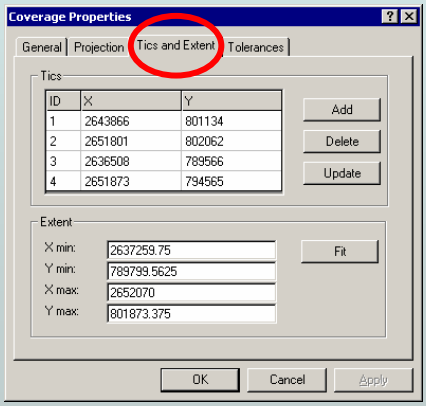


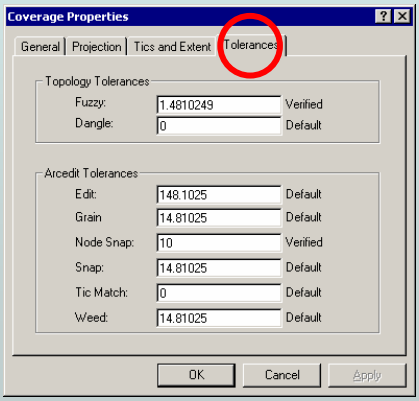
Viewing Data Set Properties



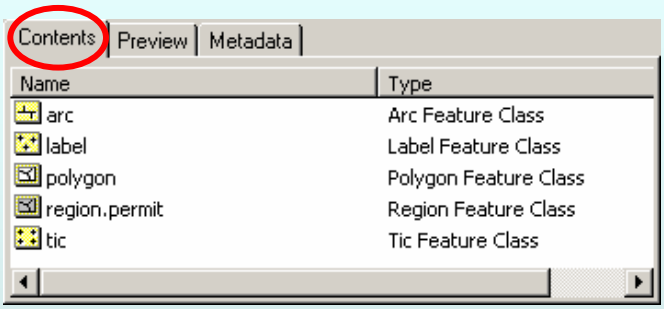


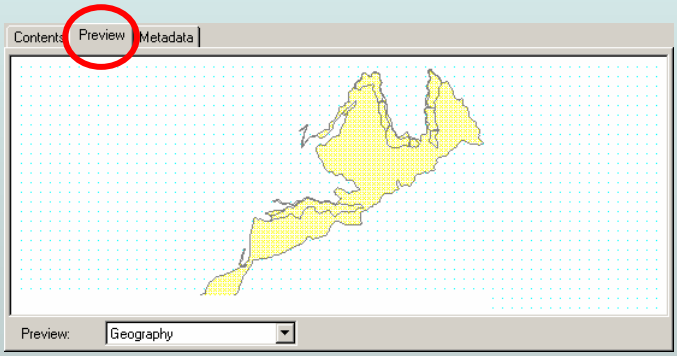


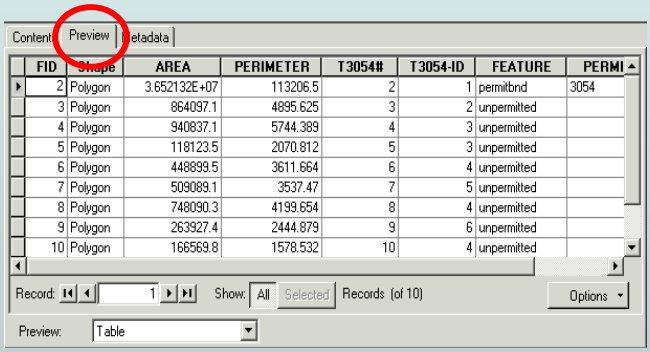


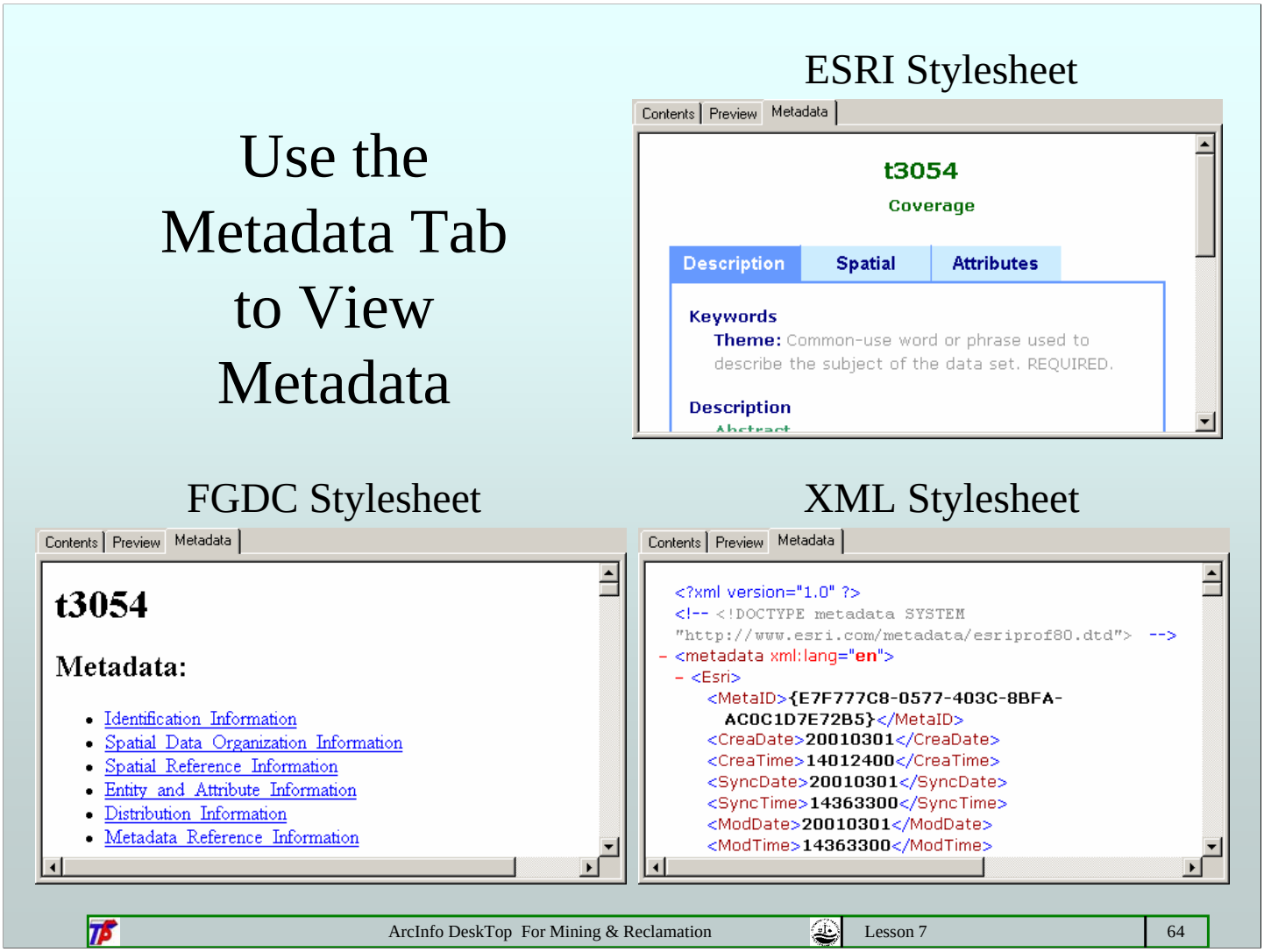


Previewing Data Set Contents





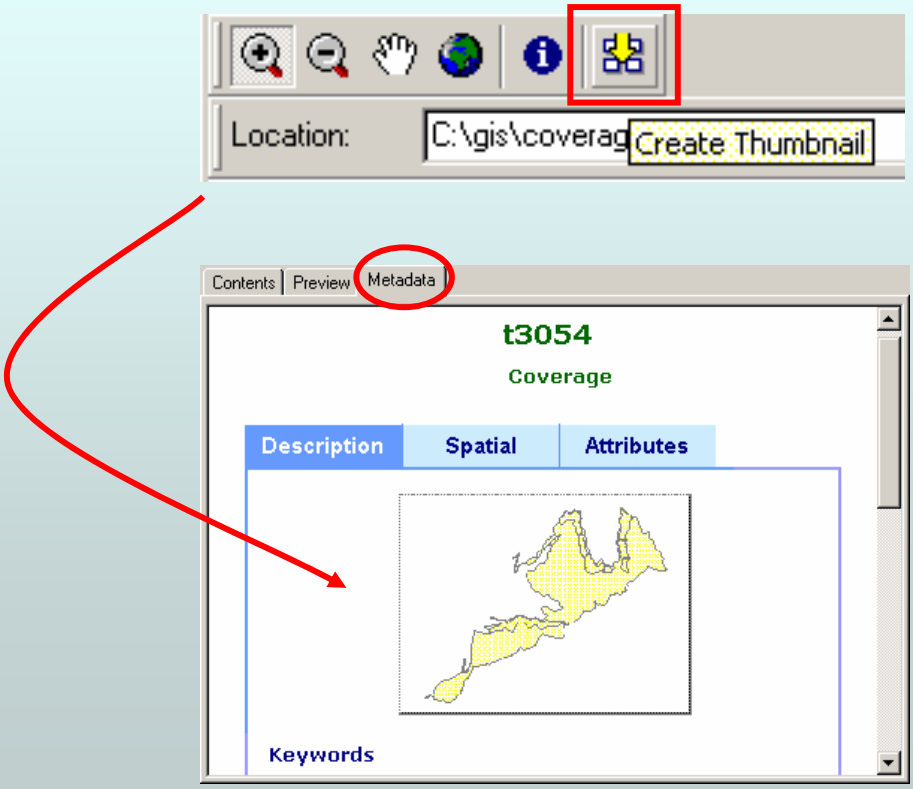




In ArcInfo Desktop, metadata is stored in a file as extensible markup language (XML) for file based data sets. However, it can be presented in three formats depending on the stylesheet selected. Use the dropdown list on the Metadata toolbar to select stylesheet you want for the desired appearance. The ESRI stylesheet is the default. You can change the default stylesheet on the Tools menu by selecting Options and click the Metadata tab. Select the default stylesheet from the dropdown list.

The XML file can also be viewed in a text editor, XML editor, or Internet Explorer 5. Metadata for geodatabases can only be viewed within ArcCatalog because the metadata is stored within the geodatabase instead of an XML file.

Creating Thumbnail Views of Data Sets as Metadata in ArcCatalog

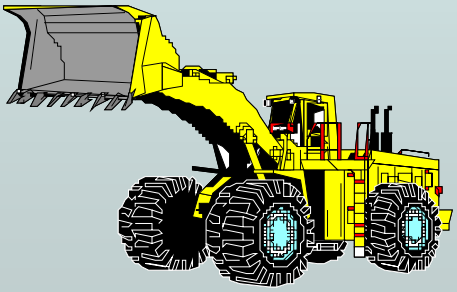


You can create a thumbnail sketch of the data set and view it in the ESRI stylesheet as part of the metadata. To do this, select the data set in the ArcCatalog directory tree, and either select the feature class you want in the tree or click on the Contents tab and select the feature class. Now click the Preview tab and select "Geography" from the preview dropdown arrow list. Click the Create Thumbnail button on the toolbar.

Note: In ArcGIS Desktop 8.1, if ArcScene is loaded you may have to click on "3D View" in the Preview tab to enable the Create Thumbnail button on the toolbar.

Exercise 7B

Managing Geospatial Data for Mining using ArcToolbox and ArcCatalog



Break Time