Geoprocessing Using ArcGIS 9.0

Idaho State Tax Commission
January 2005

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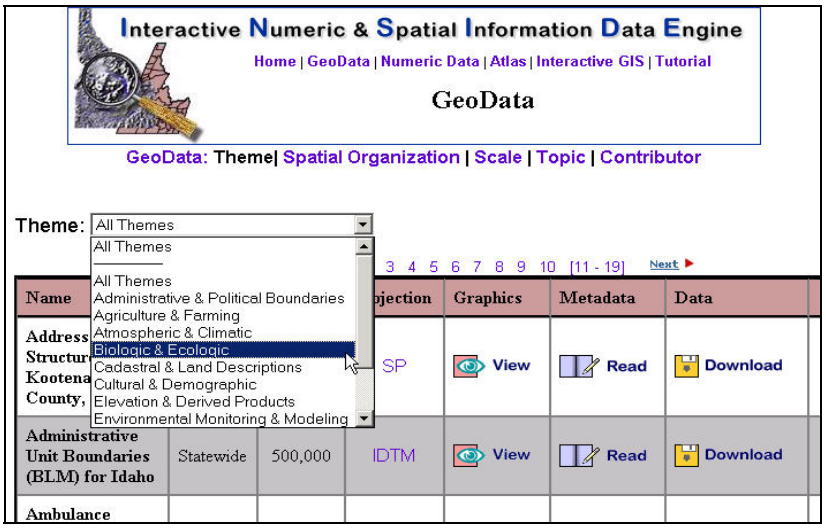
Section 1 – Inside Idaho

Inside Idaho is a great website for finding free Idaho spatial data and is the State GIS Clearinghouse. The URL for Inside Idaho is http://inside.uidaho.edu. Below is a snapshot of their home page.

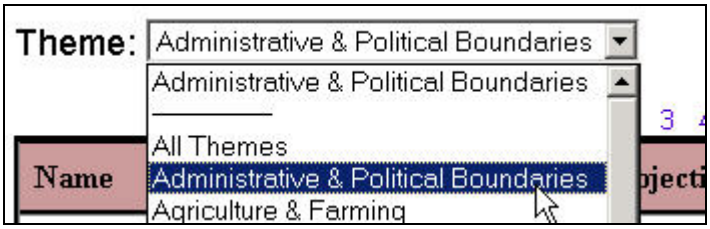
Note: Websites are updated frequently so the look and feel may change. Keep that in mind when reading this documentation.

There are many good things to view on the website but this documentation will concentrate on how to download the data.

Under the heading **GEODATA** are links to the free GIS data on this site, other GIS related websites, as well as a link for submitting data. Hit the "Browse GIS Data" link. This new page has the list of downloads for the data.



There are many ways to sort the available data. This snapshot shows the data sorted alphabetically by Topic, but you can sort the data by Theme, Spatial Organization, Scale, and Contributor. View the data by clicking on each of the sort methods.



You can choose from a variety of topics. Data coverage may or may not be available for every county depending on the downloaded data.

The following snapshot is a portion of the datasets found under the topic “Administrative”.

State Boundary	Statewide	100,000	IDTM	View	Read	Download	INSIDE
State Parks	CRBAB Idaho	2,000,000	IDTM	View	Read	Download	ICBEMP
Stewardship Status	Statewide	100,000	IDTM	View	Read	Download	LDL
Tax Code Areas (2002; CAD)	Statewide	500,000	IDTM	View	Read	Download	ISTC
Tax Code Areas (2002; Shapefile)	Statewide	500,000	IDTM	View	Read	Download	ISTC

You can find a lot of information about each dataset before you decide to download it. Information is also available on name, extent, scale, projection, graphics, metadata, data, and contributor. The following datasets are available for Hydrography:

Hydrography

Name	Extent	Scale	Projection	Graphics	Metadata	Data	Contributor
Hydrography Line Features	BNF	24,000	IDTM	View	Read	Download	BNF
			UTM	View	Read	Download	BNF
Hydrography Line Features (Miscellaneous)	BNF	24,000	IDTM	View	Read	Download	BNF
			UTM	View	Read	Download	BNF
Wild and Scenic Rivers	Statewide	2,000,000	IDTM	View	Read	Download	ICBEMP

Name: This is the name of the dataset.

Extent: The extent tells you which areas of the state the data covers. In the example of hydrography above, the Hydrography Line Features dataset only covers the BNF (Boise National Forest) while the Wild and Scenic Rivers dataset has coverage for the whole state.

Scale: The scale shows the positional accuracy of the data. For example, 1:24,000 data will be more accurate than 1:100,000 data. If you sort the data by scale, some standard categories for scale of the data are on this website.

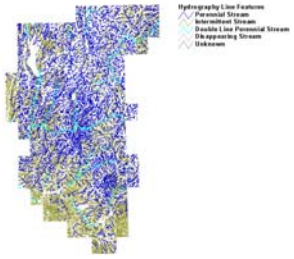
Scale: 12000 | 24000 | 100000 | 250000 | 500000 | 1000000 | 2000000 | 2500000 | 3000000 | 3500000 | 4000000 | 5000000

Projection: The projection column tells you the projection used for the data. Selecting the link allows you to view the parameters for each dataset. Most datasets on Inside Idaho are either in IDTM (Idaho Transverse Mercator) or in UTM (Universal Transverse Mercator). Some datasets are in IDTM as well as UTM and that is why there are two download options for some datasets. Select the IDTM link to view the parameters.

Projection Name:	PROJECTION TRANSVERSE
Units:	UNITS METERS
Datum:	DATUM NAD27
Projection Specific Parameter Values:	PARAMETERS
Scale Factor at Central Meridian:	0.99960
Central Meridian:	-114 00 00
Latitude of Origin:	42 00 00
False Easting:	500000
False Northing:	100000

Note: You'll notice that none of the datasets available for download are in State Plane, which is the projection for the County parcel data. These datasets will need to be reprojected to State Plane if you want to overlay them on your parcel data.

Graphics: The Graphics show you a view of what the data looks like. Click on the link to bring up the image. The following example is a view of Hydrography Line Features dataset.



Metadata: Metadata is data about the data. Metadata should include information about the data such as data quality, dates, contact information, purpose, spatial reference, developer, etc. If you are adding data to your GIS from other sources, it is very important to know as much as possible about that data.

Contributor: Clicking on this link will take you to the website of the agency that submitted the data.

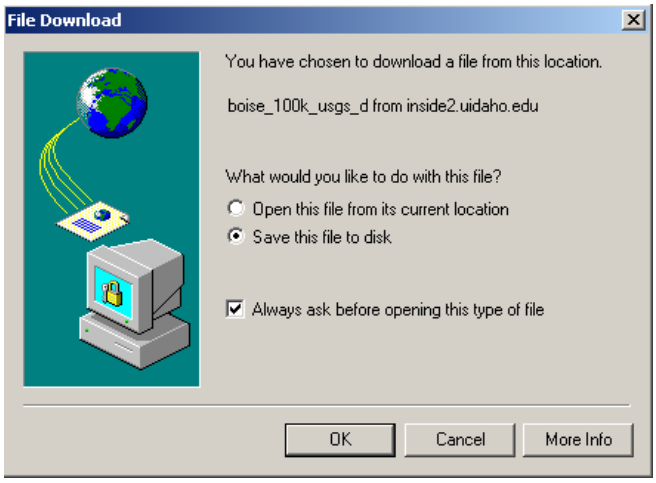
Data: Click on the **DOWNLOAD** link to get the data to download. The data will download to your computer; zipped in a .tgz format. To view the downloaded data, you will need free software to unzip the data. When the files are unzipped, you'll see that they are in shapefile format. See Section III for "zip" instructions.

Section 2 – Download Instructions

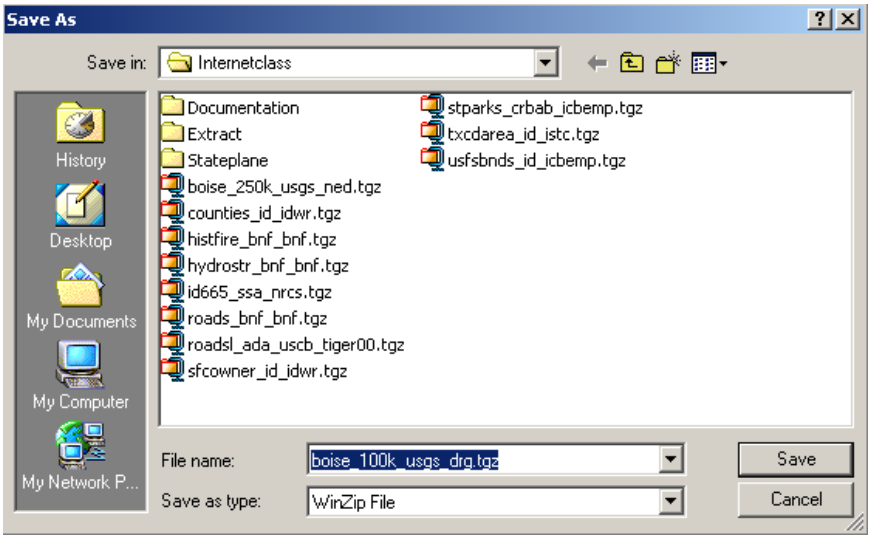
To download a dataset, simply select the “Download” link of the desired dataset.

You will need to select a certain spatial extent for some datasets before you can download the data. For example, to download a DRG (digital raster graphic), another window will come up and prompt you to select a quadrangle. Once you “select a quadrangle”, you can download the selected quadrangle.

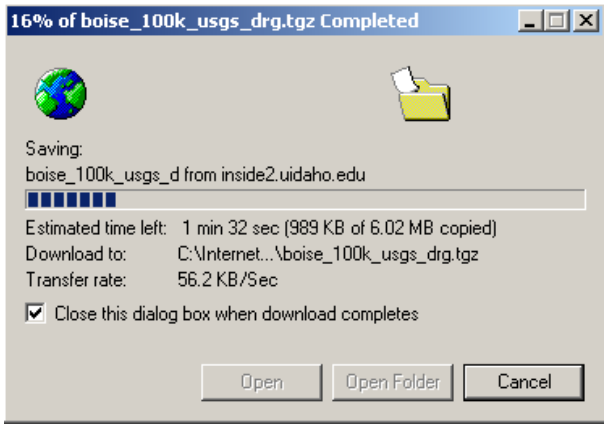
Then you will get a window entitled **File Download**. Ensure that the “Save this file to disk” radial button is checked, and hit “OK**”**.



A window will appear asking you where to save the file. Browse to the folder where you want to save it, rename the file if you like, and select the “SAVE” button.



Once you select the “Save” button, a status window will appear and stay visible until the data is downloaded to your computer.



When the download is complete, navigate to the folder in your file manager and double-click on the .tgz file you downloaded. To get to your file manager, right-click on the **Start** button in the bottom-left-hand corner of the monitor and select **Explore**.

The .tgz file is a compressed (zipped) file that needs to be unzipped before it is viewable. Files are zipped to decrease file size. You will need free software to unzip this file. Once the file is unzipped, you’ll then see the shapefile or other format of the original data.

There are many free compression/decompression softwares that can be downloaded from the web. For free software options and instructions go to the Inside Idaho homepage (http://inside.uidaho.edu), select “Tutorial” on the left side of the page and then go to SOFTWARE. There will be a list of decompression softwares with download options. Choose one of the decompression softwares and follow the installation instructions provided on the screen. We will use WinZip in this class.

Section 3 - WINZIP

In your file manager, navigate to the folder containing your downloaded data and double-click on the file. WinZip opens automatically. Click "Extract", in the Extract dialog box navigate to your geonet folder.

Click "Extract" and close WinZip.

If WinZip does not open automatically when you double-click the .zip file, try right-clicking the filename in your file manager while holding down the Shift key, then click Open With and choose WinZip.

If you have never used decompression software to decompress (unzip) files, there are instructions for PowerArchiver on the Inside Idaho website as well. PowerArchiver is decompression software similar to WinZip. To get the PowerArchiver instructions for decompressing a file, go to the Inside Idaho homepage (http://inside.uidaho.edu), select "Tutorial" on the left side of the page, then go to DECOMPRESS.

> NOTE: There are also online instructions for downloading data off the Inside Idaho website. For download instructions, go to the Inside Idaho homepage (http://inside.uidaho.edu), select "Tutorial" on the left side of the page, then go to DOWNLOAD.

Section 4 - The Geoprocessing Wizard

We will start by reviewing the processes in the Geoprocessing Wizard Tools.

From ESRI help: The Geoprocessing Wizard allows you to combine layers in different ways based on the geography of the features in the layers. The Geoprocessing Wizard lets you:

- **Dissolve** - Aggregate features that have the same attribute value in a single layer.
- **Merge** - Append two or more adjacent layers into a single layer.
- **Clip** - Reduce the spatial extent of one layer based on the extent of another.
- **Intersect** - Find those features falling within the spatial extent common to two layers.
- **Union** - Combine two polygon layers.

See Appendix 1 for descriptions of the effects of each of the Geoprocessing Wizard functions.

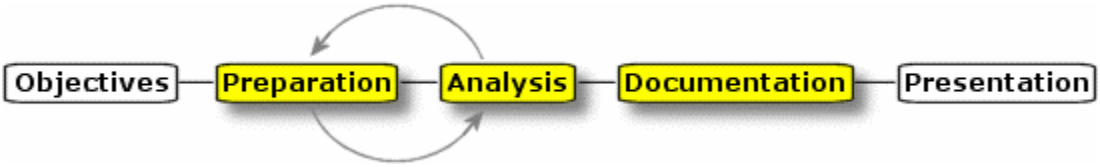
Geoprocessing:

1) Any GIS operation used to manipulate data

2) Spatial data processing tasks

3) GIS operations such as geographic feature overlay, coverage selection and analysis, topology processing, and data conversion

Geoprocessing typically follows a common workflow regardless the type of project.

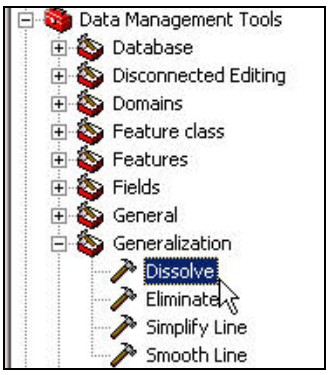


The tasks highlighted in yellow represent the stages of your geoprocessing workflow. Depending on what form your presentation takes, you might also use some geoprocessing tools in the last step of your project (specifically, cartography tools), but for the most part, the geoprocessing framework provides functionality for data preparation, analysis, and documentation. (Copied from ESRI Virtual Campus Course, *Geoprocessing with ArcGIS 9 (for ArcInfo)*)

NOTE: Open ArcCatalog if not already open. We will open all the map projects from the ArcCatalog table of contents.

Section 5 - Adding the Geoprocessing Wizard Tools

In ArcGIS 9.0, they dissolved the Geoprocessing Wizard, so tools such as Merge, Union, and Clip are now available in a variety of other toolboxes. For example, the Dissolve tool is in the Generalization toolset within the Data Management Tools Toolbox, and Clip is an Extract tool within the Extract Toolset in the Analysis Tools Toolbox.



Fortunately, ESRI did update the 8.3 Geoprocessing Wizard to function in 9.0. Whether accessed from the GeoProcessing Wizards Tools toolbox, or from their individual locations the processes are exactly the same. For most of this class, we will use the Geoprocessing Wizard Tools. You must download the Wizard from the ESRI support web site.

Below is the link to the Geoprocessing Wizard Tools JavaScript.

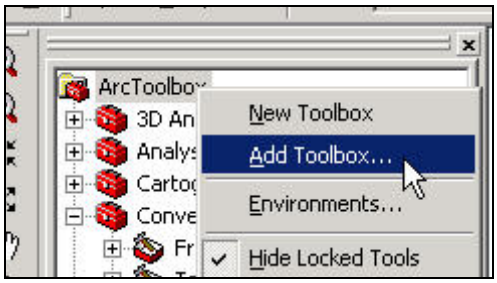
http://support.esri.com/index.cfm?fa=downloads.geoprocessing.gateway

This will download the JavaScript 

. Place this on your hard drive where you can easily access it.

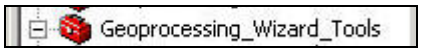
In your ArcMap session, click on your **toolbox**  if it is not already open.

Right-click on the main **ArcToolbox** and choose **Add Toolbox**.

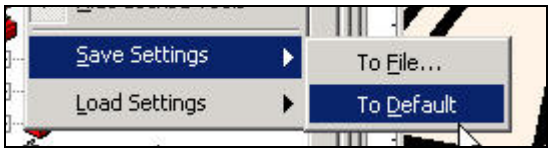


Browse to the class folder and select **Geoprocessing_Wizard_Tools**.

Your Toolbox “table of contents” will now have the Geoprocessing_Wizard_Tools toolbox.



Right-click again on **ArcToolbox,** hover over **Save Settings** and choose **To Default** from the drop down list. This will add the Wizard tools to your .mxd normal template.



Create your own Toolbox

If you consistently use the same tools you can place them in a custom toolbox and toolsets. This will eliminate the need to search for individual tools scattered throughout ArcToolbox.

Open ArcCatalog and then ArcToolbox.

Right-click on ArcToolbox and choose New Toolbox.

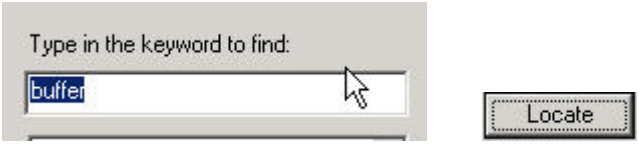
A new Toolbox will appear at the bottom of the ArcToolbox Table of Contents.

Rename the toolbox to MyTools.

Now we are going to add the following tools to our toolbox: Dissolve, Intersect, Clip, Union, and Buffer.

Using either Index or Search find all the tools and copy and paste them to your folder.

Either method will assist you in finding the tools you need and operate in relatively the same manner. You simply type in a keyword, such as the name of a tool, and then click the Locate button if in the Index window or hit the Search and then Locate button if in the Search window.



Section 6 - Dissolve

You can aggregate features of a layer that have the same attribute values. You can accomplish this with the Dissolve tool. Dissolve has the advantage of combining like elements in a map and then displaying them as a single feature versus separate entities.

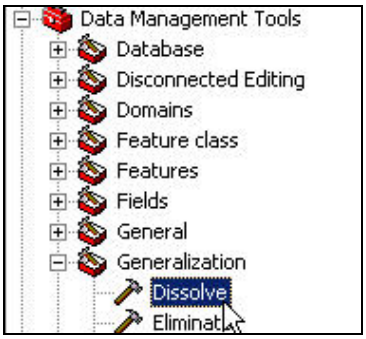
Issue: *When you do a dissolve outside a Personal Geodatabase, it is important to note that the aggregated table values WILL NOT summarize. For example, the area values will not calculate to represent the new larger polygon size.*

Start by opening the attribute tables of the layer and noting the item names. We will reevaluate the tables once the Geoprocessing task is finished.

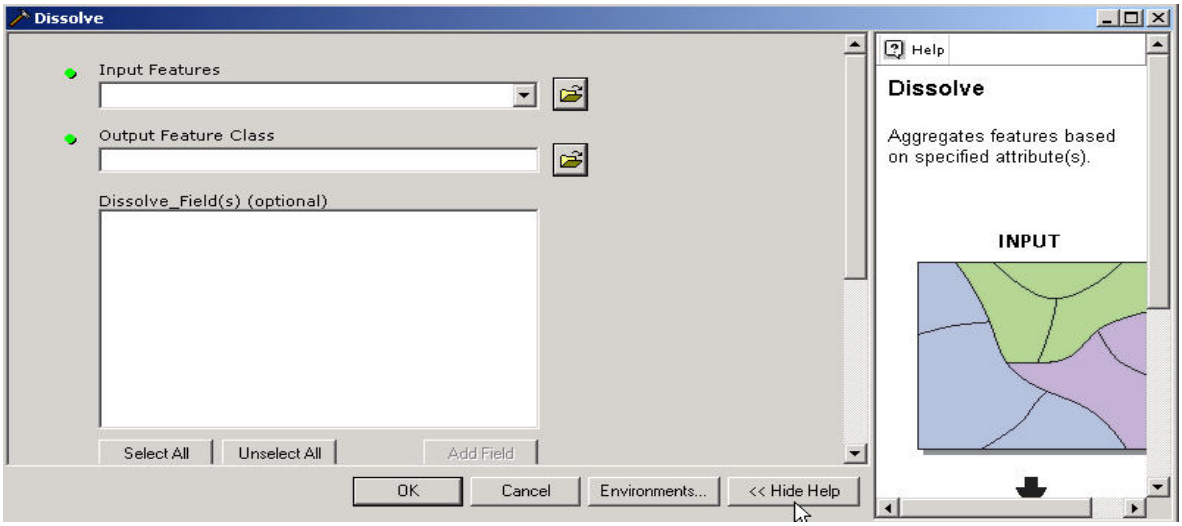
1) First open **Toolbox**  and dock the Toolbox on your window.

2) In ArcCatalog, open the **Dissolve folder** then open **Dissolve9.mxd.**

3) In the Toolbox window, expand **Data Management Tools**, then the **Generalization** toolset.

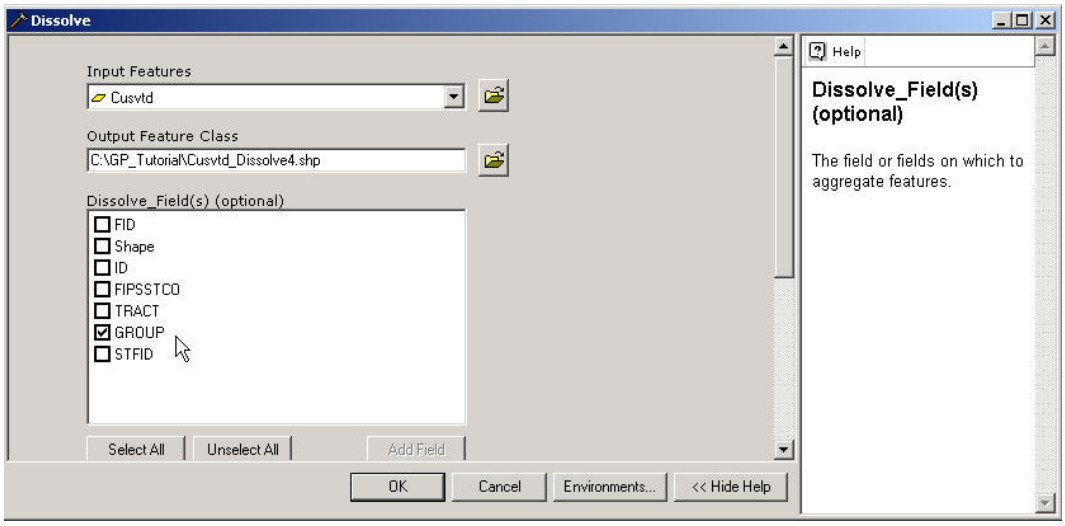


4) Double-click the **Dissolve Tool** and the Dissolve dialog window will appear.



5) From the **Table of Contents,** drag the **Cusvtd layer** into **Input Features** or choose it from the drop down list.

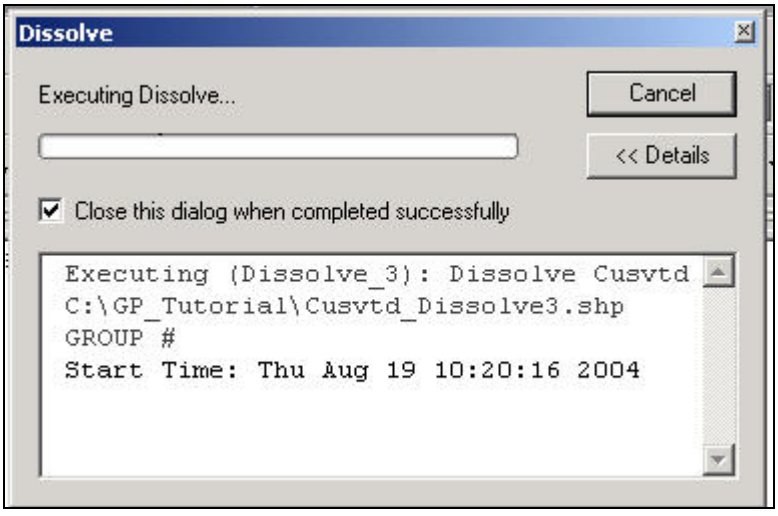
The Output Feature Class and Dissolve_Field(s) will automatically populate (see below), but you will need to change the output field to D:\classesfolder\data and name it whatever you want.



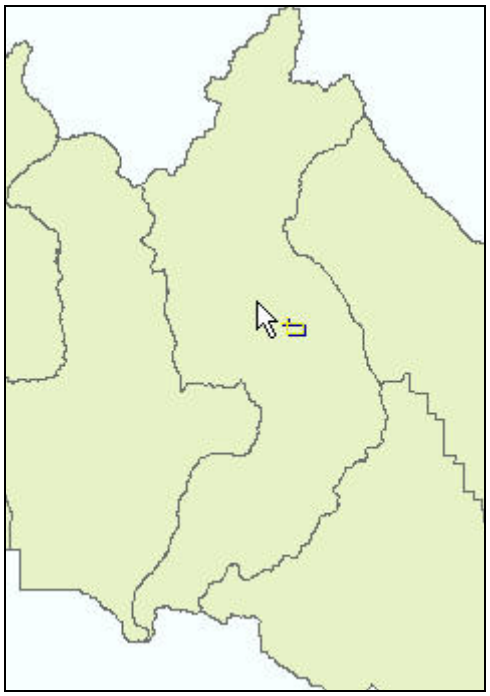
6) Check the box for **GROUP** in the **Dissolve_Field(s)** box. This designates the attribute field that you will use in the dissolve action.

Click "OK" and a Dissolve execution window will appear. This simply displays the progress of the chosen action.

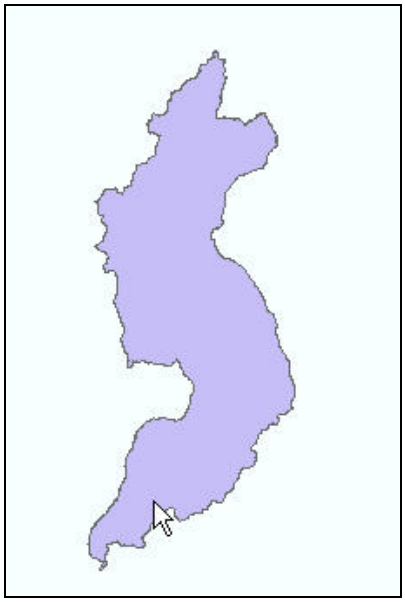
Check the **"Close this dialog when completed successfully**" box.



The two adjacent polygons in this example are now joined as one feature. You can see the line separating the two polygons is gone.



With the Dissolve operation, you can select attributes within a table, or in the Data View, and perform the operation just on the selected features. The resulting layer will display only the selected features (see below).



Open the **Attribute Table** for the new layer and review the changes.

Now open the **Attribute Tables** for both layers in the TOC and compare the resulting data.

Close the .mxd; you do not need to save it.

Exercise – Update Tool

With each Geoprocessing tool, you will get different outputs, both spatially and in the attribute tables, depending on which layers you identify as the input and associated file.

In this exercise, open the Update.mxd from the Exercise folder under the Classfolder. Now locate the Update Tool by either using the Index or Search tabs. With the Update Tool, you must identify the Input Features layer and the Update Features layer. Using the two layers in the project, run the Update Tool twice: once with each layer as the Input Feature, and the other as the Update Feature. When you run the process, take note of what happens spatially and to the table.

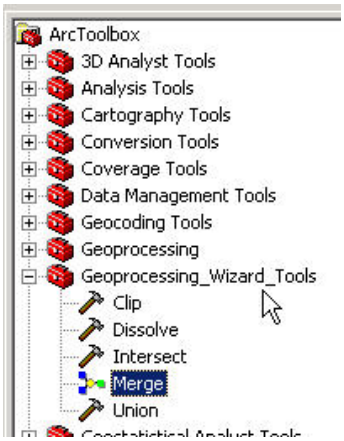
The point of this exercise is to emphasize that it is important to understand your data, the output required, and the tool you are using.

Section 7 - Merge

Merge allows you to append two or more layers or feature classes into one. For example, if you have two or more sets of road data, you can merge them so you only need to deal with one layer. The layers must be the same feature type, polygons with polygons and so forth.

In this example, parcel data was created separately in each Township and Range. We will combine four individual layers to create a single layer.

In **ArcCatalog**, go to the **Merge** folder and open **merge.mxd.**

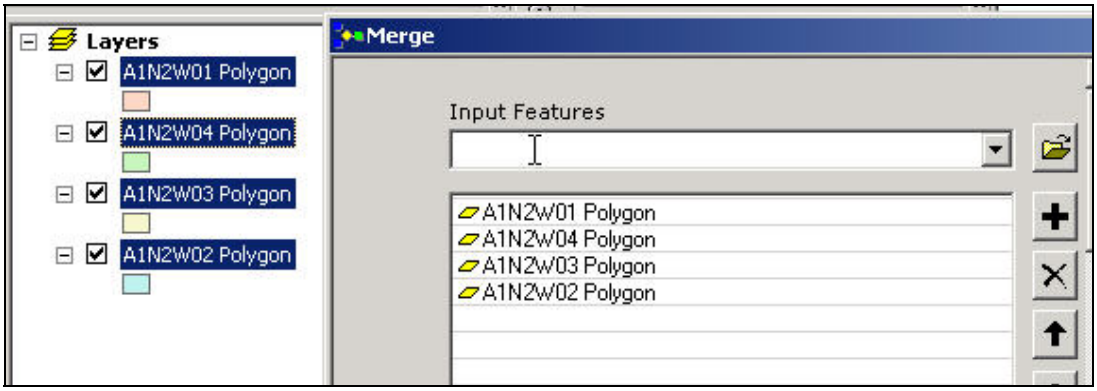


In ArcGIS 9.0, the easiest way to accomplish this task is with the Geoprocessing Wizard. If the Geoprocessing_Wizard_Tools toolbox is not under your ArcToolbox, then follow the directions on page 11 of this manual to add it.

Expand the **GeoProcessing_Wizard_Tools** toolbox.

Click the **Merge Tool** and this will bring up the **Merge Wizard**.

In the **table of contents** (TOC), select all the layers you want to merge, then click and drag them into the **Input Features** selection window. The items are added to the list below.



Scroll down to the **Output Feature Class Location,** then browse to the folder where you want to place the merged output layer. You are choosing the destination folder, not naming the file.

Name the output feature class. The green dot indicates a field that is required.

If the help section is not showing on the right side of the wizard, choose the **Show Help** >> button. 

The next choice allows you to define which layers attribute table to use as the template for the merged output table. Read the help section to the right. Essentially, if you do not choose a layer the attribute table will be relatively blank.

In this example, all the layers have identical attribute fields, so simply choose the first one by selecting the drop down menu button and clicking on the **first layer**.

Click "OK**"**.

Once the processing has finished, the new Merged Layer is added to the TOC.

Review the **attribute table**, what changes do you see?

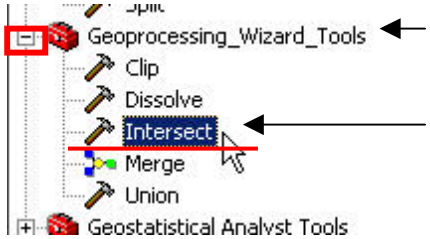
Close the .mxd; you do not need to save it.

Section 8 - Intersect

Intersect can be a very powerful tool. It has the advantage of spatial relationships by clipping two layers together, along with updating the attributes available to the resulting layer. When you intersect layers, you add the attributes of the overlay layer to the appropriate rows of the input layer.

In this example, we will intersect county parcels with the State Tax Commission's Tax Code Area coverage. By doing this, we will be able to populate each parcel with the appropriate Tax Code Area number.

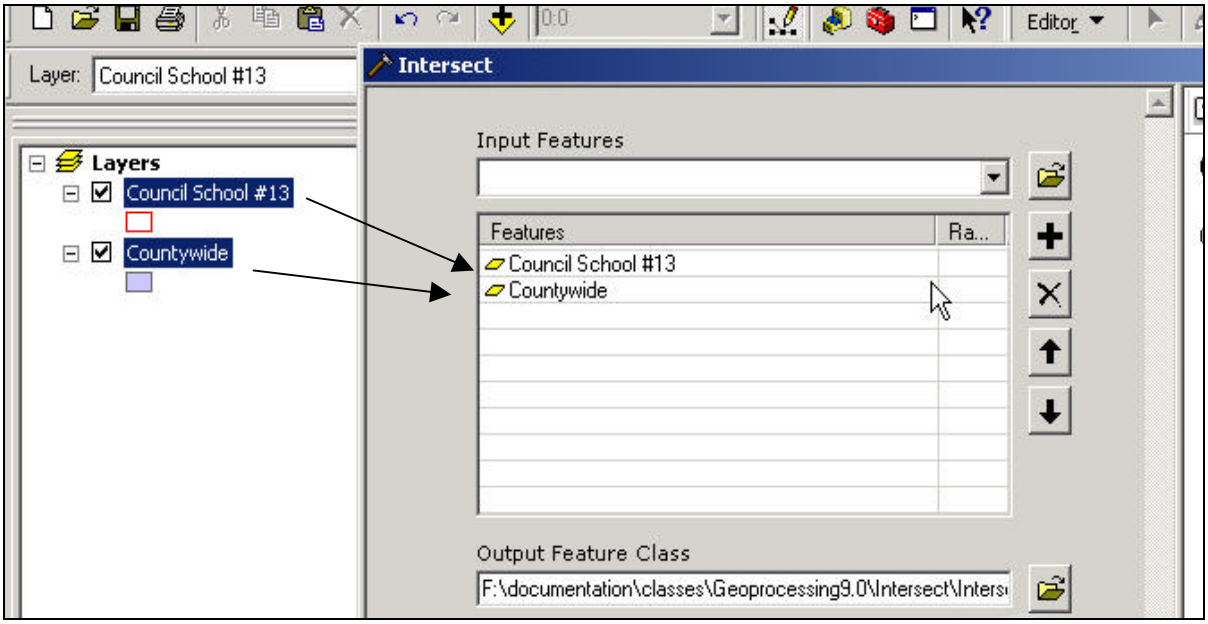
In ArcCatalog's **Table of Contents**, open the **Intersect** folder, then open **Intersect.mxd**.



Expand the **Geoprocessing_Wizard_Tools** toolbox.

Double-click the **Intersect Tool** to open the Intersect Wizard.

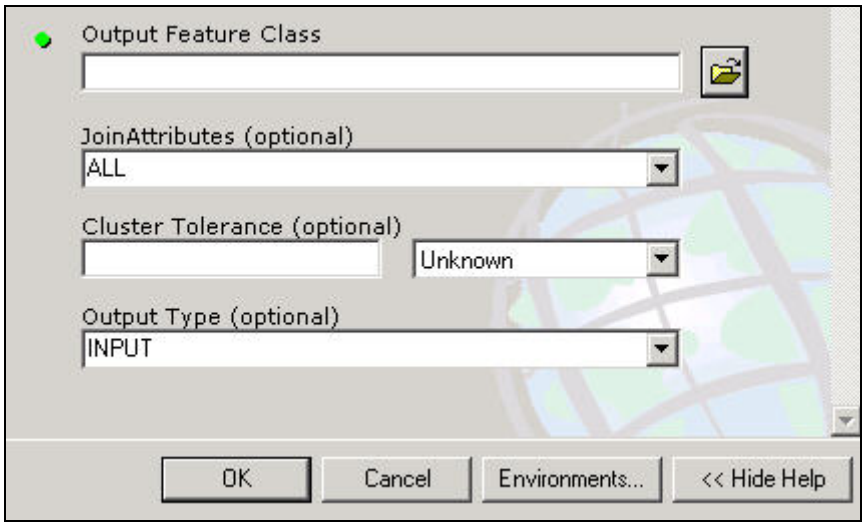
In the ArcMap **TOC,** highlight and drag both layers to the **Features** list.



In the **Output Feature Class,** browse to the appropriate folder and name the output feature class whatever you want.

At the bottom of the Wizard dialog are optional choices. The default settings should be appropriate for this exercise.

The defaults should read “ALL” in the JoinAttributes field, “blank” and “Unknown” in the Cluster Tolerance fields, and “INPUT” in the Output Type field.



Click “OK”.

The resulting layer is a combination of the two layers, as is the new attribute table (see below).

Attributes of Intersection_Output_3

FID	Shape*	MAPKEY	PARCEL_ID	LABEL	AREA	PERIMETER	ADMTCA04	ADMTCA04_I	TCA	TCANUM	COUNTY
0	Polygon	EEBB7	RP13N01E193000	3000	2911830020.39	357584.417273	27	26	0070000	7	ADAMS
1	Polygon	EEBB4	RP13N01E193600	3600	874762026	150813.171979	33	32	0250000	25	ADAMS
2	Polygon	EEF09	RP13N01W240001	0001	2911830020.39	357584.417273	27	26	0070000	7	ADAMS
3	Polygon	EEC2C	RP13N01E221801	1801	2911830020.39	357584.417273	27	26	0070000	7	ADAMS

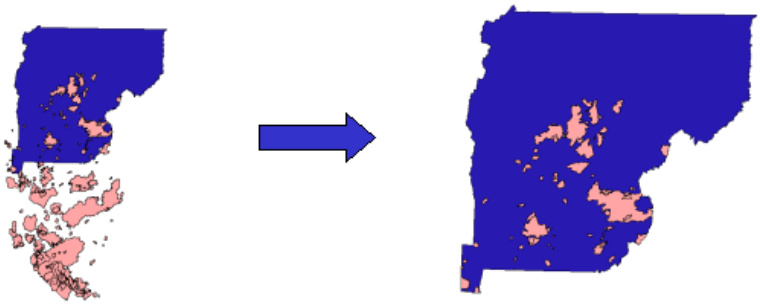
Now you can label all the parcels with Tax Code Area numbers.

Close the .mxd; you do not need to save it.

Section 9 - Clip

When acquiring data from other sources, there is a good chance that the spatial extents of the two datasets will not be the same. For example, a dataset for historic fires may cover the whole state but you only want information for the fires in your county boundary.

Clipping allows you to clip data from a larger dataset to get the spatial extent of the data that lie within your county boundary.

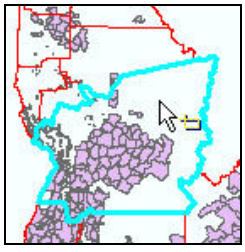


In the illustration above, the historic fires dataset was clipped to the extents of Valley County. Now there is only information for Valley County instead of additional information that doesn't pertain to Valley County.

In this example, we will create a single county layer from a layer with all the counties, then we will use that new layer to clip out the statewide rangeland allotments to the single county extent.

On the Tools toolbar, select the **Select Features** tool. 

Now select your own county. It should appear highlighted.

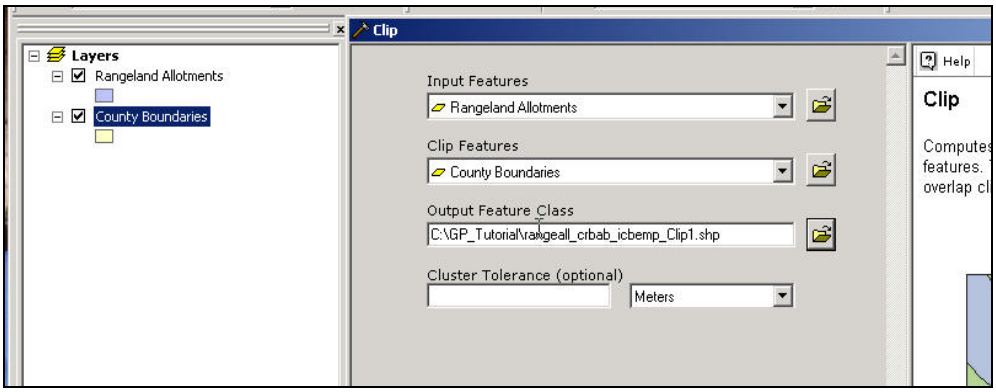


You can process the clip analysis at this point using the selected feature, or you can convert the selected feature to a layer and use the resulting layer to perform the clip.

In this example, we will clip with the selected feature.

Once a county is selected, expand the **Geoprocessing_Wizard_Tools**, open **Clip** and the Clip Analysis dialog will open.

In this dialog box, click and drag **Rangeland** from the TOC to the Input Features choice, then drag **County Boundaries** to Clip Features.



The Output Feature Class field will update automatically. In this field, you will both choose the destination folder and file name.

Click "OK".

After the Clip Analysis is processed, the new clipped feature class will be added to the TOC.

Open the **attribute table** for the new feature class and review the changes.

Close the .mxd; you do not need to save it.

Section 10 - Union

The Union function overlays/combines layers while retaining the extent of all the layers and the attribute values of the tables.

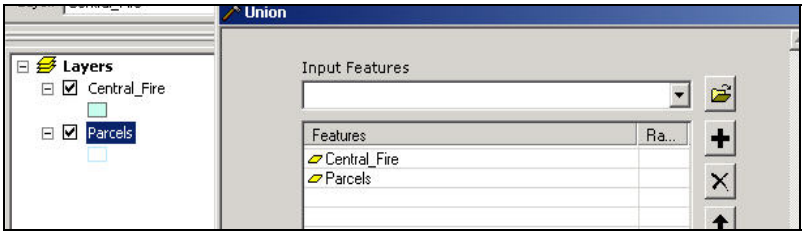
In this example, Jefferson County asked us to produce a map of Central Fire District and parcel data. The district extends beyond the Jefferson County boundary line into two additional counties. We will overlay Central Fire with Jefferson County parcels and retain the full extent of Central Fire outside the county boundary.

Start by opening the attribute tables of each layer and noting the item names. We will reevaluate the tables once the Geoprocessing task is finished.

In the ArcCatalog **TOC,** go to the **Union** folder and open **Union.mxd**.

Open the **GeoProcessing_Wizard_Tools** toolbox.

The Union Wizard dialog will open. Drag the two layers from the **TOC** to the features section in the dialog.



In the Output Feature Class, browse to the appropriate folder and name your output file.

The resulting layer has the extent of both layers and the attributes of both tables. Open the **attribute table** for the new layer and review the changes.

Close the **.mxd**; you do not need to save it.

Section 11 - Geoprocessing Wizard Exercise

Exercise: Use Exercise2.mxd for this task. You are asked to provide a layer of the Custer Tax Code Areas and the South Custer Fire District and the table needs to contain the data from both layers.

Section 12 - ModelBuilder

From ESRI: *"The geoprocessing tools in ArcGIS make it easy to process spatial data to model aspects of the real world. However, when there are many steps involved in your geoprocessing workflow, it can be difficult to keep track of the assumptions, tools, datasets, and other parameter values you have used.*

One of the easiest ways to author and automate your workflow and keep track of your geoprocessing tasks is to create a model. A model consists of one process or, more commonly, multiple processes strung together. A process consists of a tool—a system tool or a custom tool—and its parameter values. Examples of parameter values include input and output data, a cluster tolerance, and a reclassification table. Any element in a model that isn't a tool is a variable.

A model allows you to perform a workflow, modify it, and repeat it over and over with a single click.

"**Automate the geoprocessing workflow**

Models help you manage the complex combination of assumptions, tools, datasets, and other factors associated with your analysis. Models can be easily modified so that you can explore alternative outcomes or accommodate new information. The model updates dynamically. Changes to one part of the model are automatically carried through to the rest of the model.

Share geoprocessing knowledge

Models easily communicate what is being done. Models are represented as flow charts with distinct symbols for input data, spatial operations, and output data. The structure of the model and flow of data processing are apparent. This makes it easy for you and others to see the model's scope and understand how it works.

Record and document methodology

Models allow for simple or sophisticated geoprocessing workflows to be captured and documented. You can document the sources of input data and assumptions you made in the model for future use or to share your work with others. You'll learn more about documentation in Module 5 of this course.

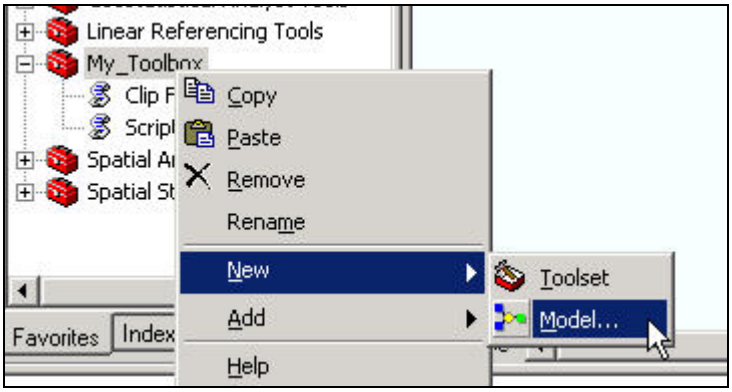
Add complexity as needed

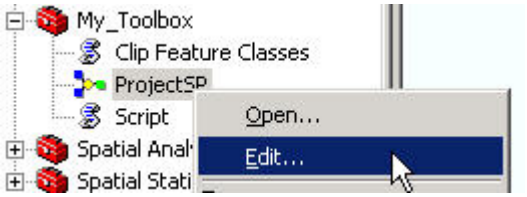
Models allow you to assemble simple and complex processes into one tool. For complex processes, you can create a separate model. These "submodels" can be added to primary models, allowing you to easily incorporate components developed by experts in various disciplines."

One approach is to start small by performing a "first-pass" analysis; a simple model that provides an easily understandable analysis. After you have confidence in the simple models, you can add additional detail and sophistication. You will take this approach. We will create a model that clips a layer and one that reprojects a layer from IDTM to State Plane. Then as an exercise, you can work through how to make one model that does the whole process at once.

Open **ModelBuilder.mxd**. If **ArcToolbox** is not already opened and docked, do so.

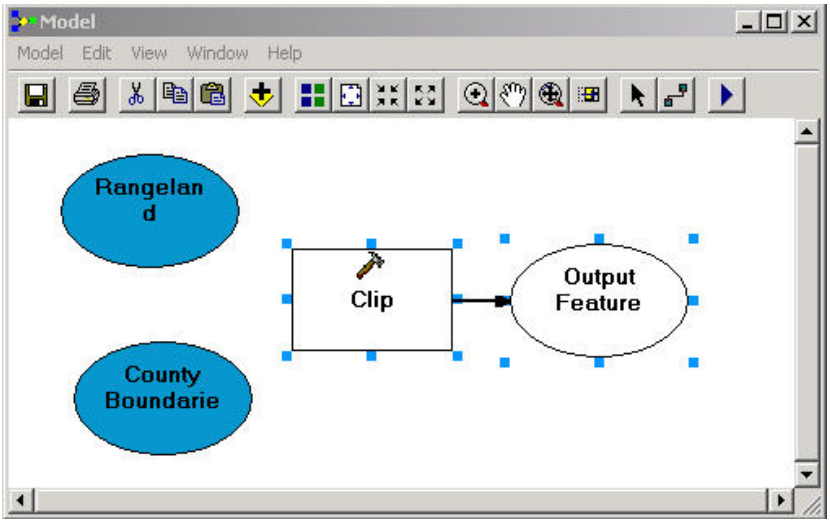
Right-click on **My_Toolbox**, pick **New** and then **Model**…





A new empty Model will be added to the toolbox  and an empty Model Window will appear. The Window is the dialog in which you will create and edit your processes. If an empty window does not appear, right-click on the model tool and choose edit from the drop down menu. This will open the Model window.

The Model window is the interface you will use to create your processes. In its simplest form a Process is a tool with its associated input and output files.



In ModelBuilder, there are easily identified shapes for each type of object in the window.

Blue Oval – Input Data
Yellow Square – Tool
Green Oval – Output Data

As you see in the dialog above the colors are missing from the tool and output objects. Hollow features indicate that the process is incomplete. Connecting the two input data sets to the tool will link the process and then the hollow objects will fill with color.

To populate your empty model window, simply click and drag the necessary items to the window.

Open the **Analysis Tools** toolbox and the **Extract** toolset to find the clip tool. Drag the **Clip** tool into your **ModelBuilder Window**. You will notice (as above) that the tool automatically comes with the Output Feature oval.

From the **Table of Contents** in ArcMap, click and drag the **County Boundaries** and **Rangeland** feature classes to a spot to the left of the Clip tool, in the **ModelBuilder Window**.

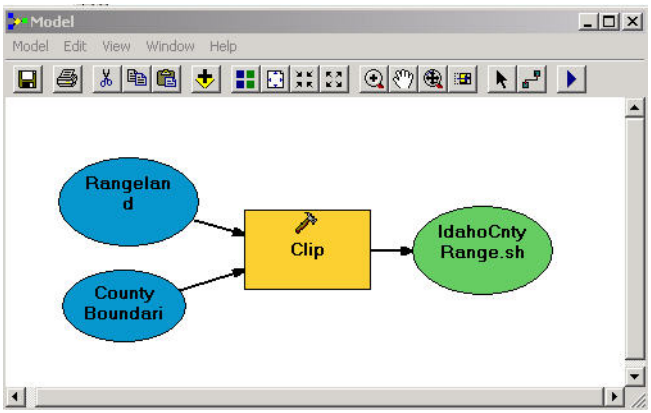
Now we will use the **Connection Button**  to make the connection from the Input Features to the tool. When you click on the Connection Button, the pointer  will change to a wand  . Use the wand to create the connection to the Clip Tool.

Left-click and hold on one of the **input ovals.** While holding, drag to the **Clip Tool**, then release. Do this for both the Input Features.

The Clip and Output objects will fill in.

The Process is complete, but the parameters for the Clip Tool and Output Feature need to be defined.

Double-click on the **Clip Square** for the tool. This will pop up the dialog for the Clip Tool.

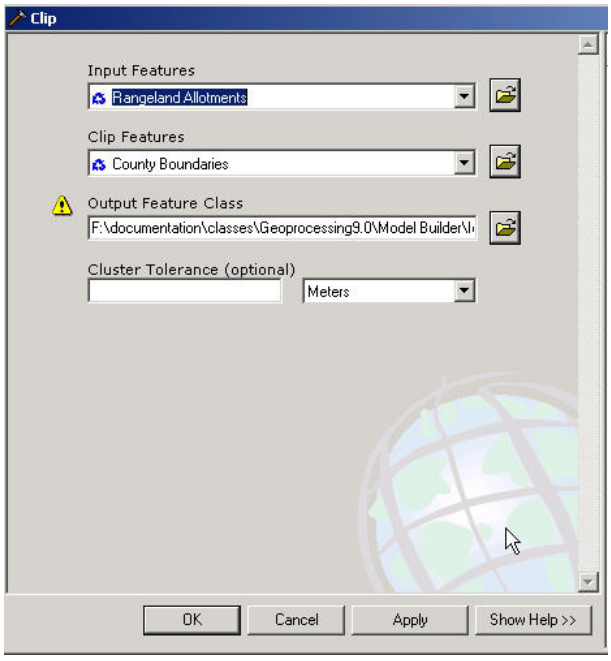


From the drop down menu for Input Features, choose the layer to be clipped "**Rangeland"**.

From the drop down menu for Clip Features, choose the "cookie cutter" layer, **County Boundaries.**

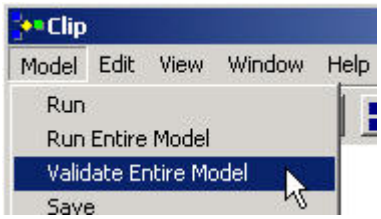
In the Output Feature Class, use the Browse and name the Output as **IdaRnge**.

Click "OK".



Double-click on the **oval for the Output Feature**. In the dialog window, use the browse button to identify the location of the **output file**.

Once you have the parameters set for the tool and output file, you are ready to validate your Model. In the main menu bar of the Model Window, choose **Model** and then **Validate Entire Model**. This will pop up an error message if there are problems with the model you have created.



If your model is valid, then you can either return to the Model drop down as shown here or hit the **run** button  .

Leave **ModelBuilder.mxd** open.

Projection Model

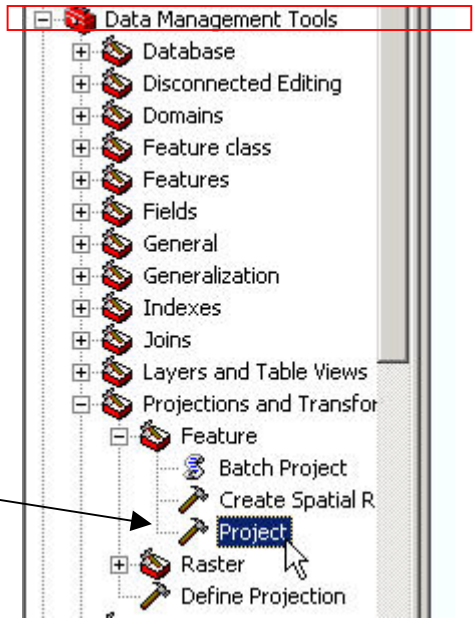
Ok, much of this process will be a repeat. If you don't remember how to perform some of the following steps look above in the Clip Model.

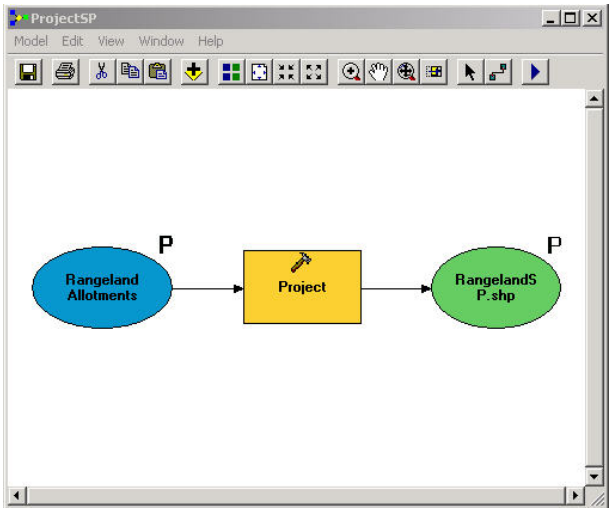
Add a **new model** to your **My_Toolbox** and name it "Projection".

Open the new **Model** for editing.

Open the **data folder** and drag the file you created from the clip model to the model window.

Find the **Projection Tool** and add it to the **model window**. Use the **connect wand** to connect the **Input Feature** to the **Projection Tool**.



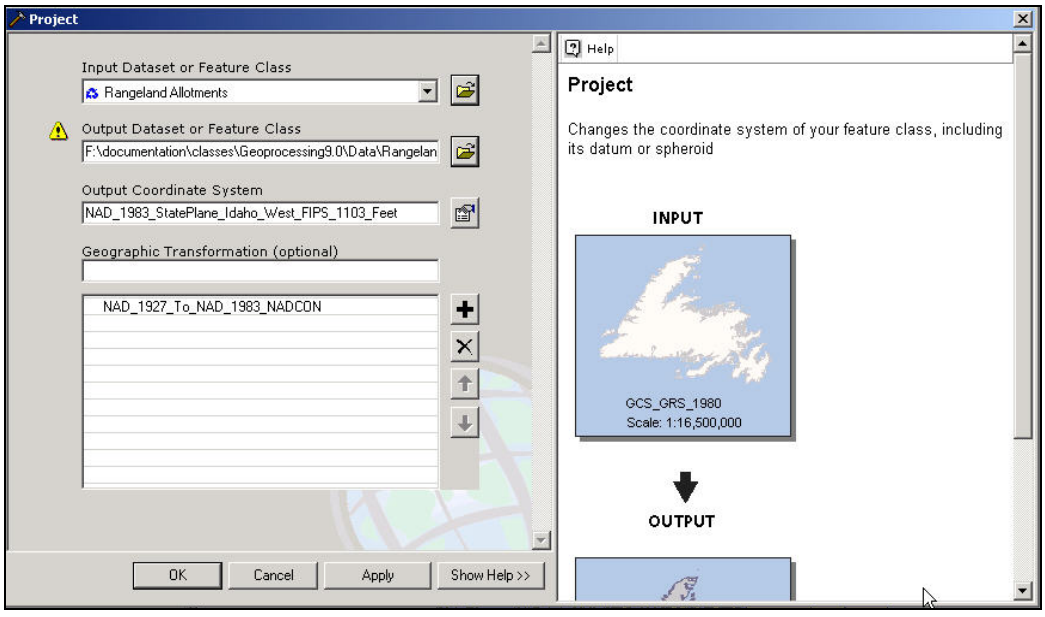


Double-click the **Projection Square** to open the dialog window. In this dialog, you will set the parameters for the projection.

The **Input Dataset** should be filled in since we connected it with the wand.

Browse for the output location and rename the file **RangeSP;** something that designates it as State Plane projection.

In the **Output Coordinate System,** we will add **Idaho State Plane, West, Nad83, Feet**.



ESRI's projection list shows the Idaho State Plane. Now you can simply select the coordinate system.

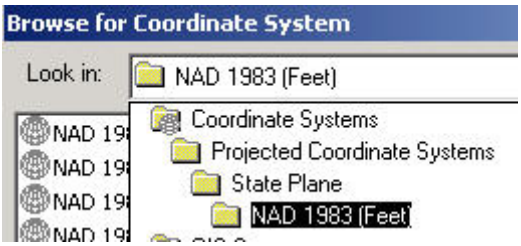
Click on the **Browse** button. 

Click the **Select** button. 

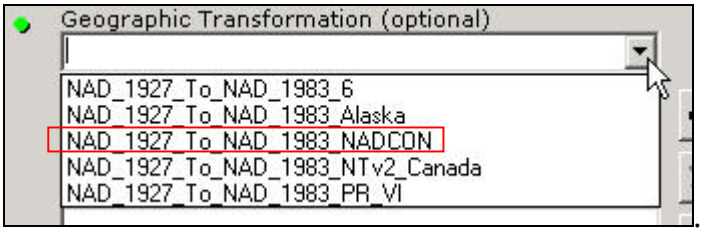
Next, double-click the **Projected Coordinate Systems** folder. 

As shown to the right, continue to browse to the **NAD 1983 (Feet)** folder.

Idaho State Plane has three zones, East, Central, and West. In this example, we want Idaho West.



To convert from IDTM (Nad27) to State Plane (Nad83), we need to use a Transformation. In the **Geographical Transformation** drop down, choose **Nad_27 to Nad83 NADCON**.



Click "OK"**.**

Now **Validate** the model.

If the Validation was ok, then **run** your model.

Open **ArcCatalog**.

In the **Table of Contents,** browse to the **output file**, highlight it, then choose the **Metadata** tab. After reviewing the metadata, you can see that the new file has been reprojected.

Close the Model.

DO NOT SAVE THE CHANGES to the ModelBuilder.mxd.

Model Builder Exercise

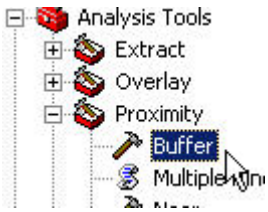
Re-open ModelBuilder.mxd. Using what you've learned above, try to complete one model that runs through both the clip and projection tools.

Section 13 - Buffer

A common analytical process is determining which features in a layer are within a specified distance of another layer, or a selected portion of a layer. This is accomplished by creating a buffer around a layer and then using the resulting graphic to identify the features of the second layer.

A buffer is useful for graphically identifying features within a distance of another feature and to create a layer to display on a map. For example, the area 100 meters from a stream. The most commonly used measurement to create a buffer is distance. But, by using attribute values, measurements can be displayed in increments of other types such as time or travel cost.

You can find the **Buffer Wizard** in your ArcToolbox.



In this example, however we will add the buffer Wizard to the Main Menu toolbar.

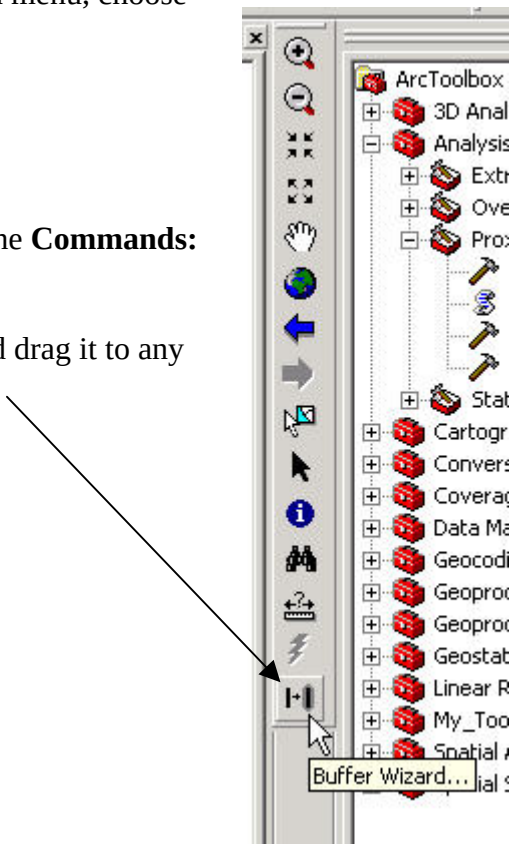
Go to **Tools** in your Main Menu. 

In the pull down menu, choose **Customize.** 

In the Customize dialog, choose the **Commands** tab.

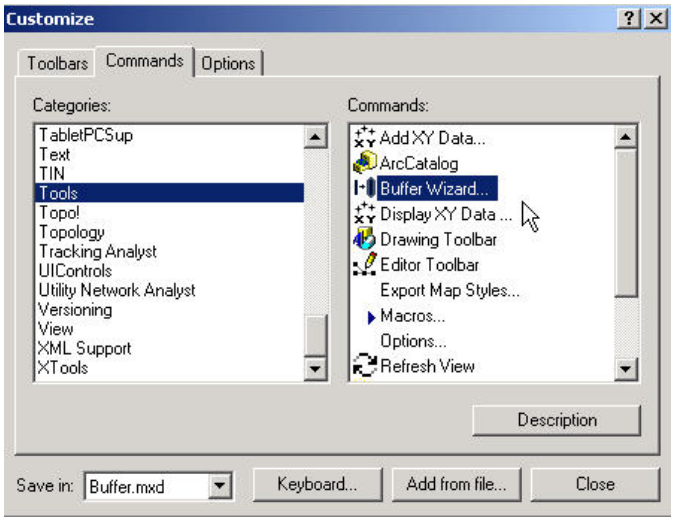
In **Categories:**, scroll down to **Tools** and click on it. The **Commands:** selection will change.

In **Commands:,** choose **Buffer Wizard**, click on it, and drag it to any toolbar.



How to buffer a selected feature at a specified distance

Go to ArcCatalog and open **buffer.mxd.**



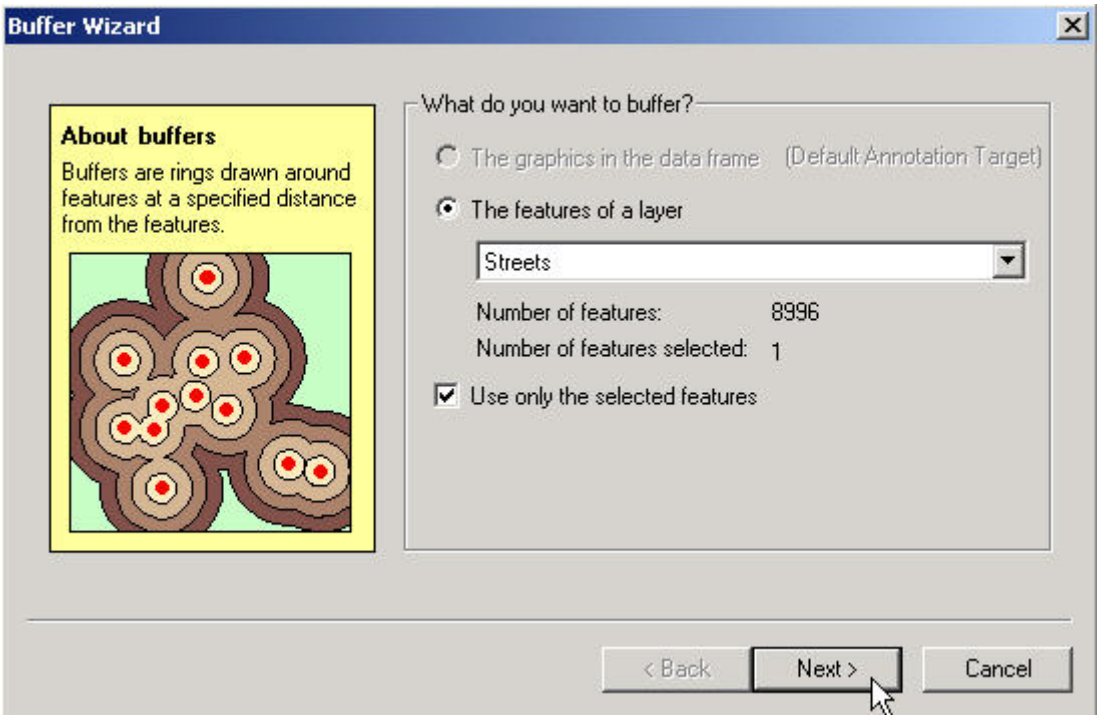
1) Click on the **Select Features** tool.

2) Choose the **feature segment** you want to build a buffer around, in the data frame. This could be a stretch of road, a stream, or a parcel.

3) Go to the Main Menu and choose **Tools.**

4) On the toolbar, click on the **Buffer Wizard.**

5) The first window of the **Buffer Wizard** dialog will appear.



6) Click the radio button for "**The features of a layer"**

if it's not already active.

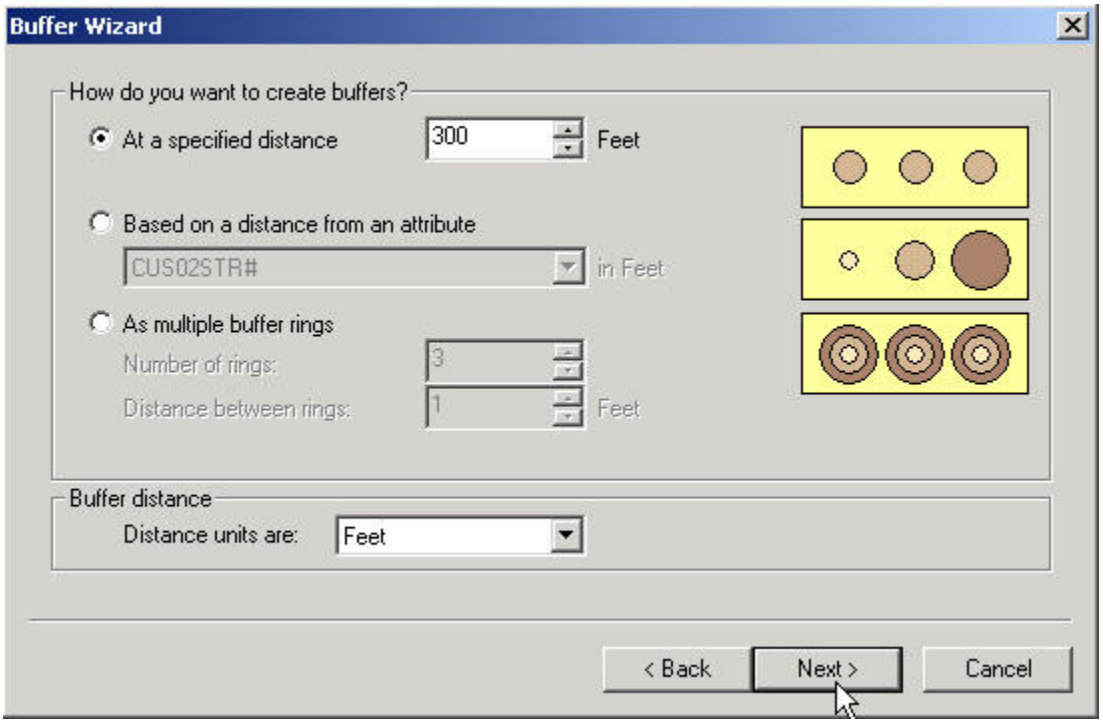
7) In the drop down arrow, select the "Streets" layer to buffer.

8) Because we selected a feature segment before we opened the Buffer Wizard, the box should be automatically checked for "**Use only the selected features"**, check it, if it is not checked.

9) Click **Next**.

10) We want to create a buffer at a specific distance, so choose the radio button for "**At a specified distance".**

11) Enter the distance of **300 Feet.**

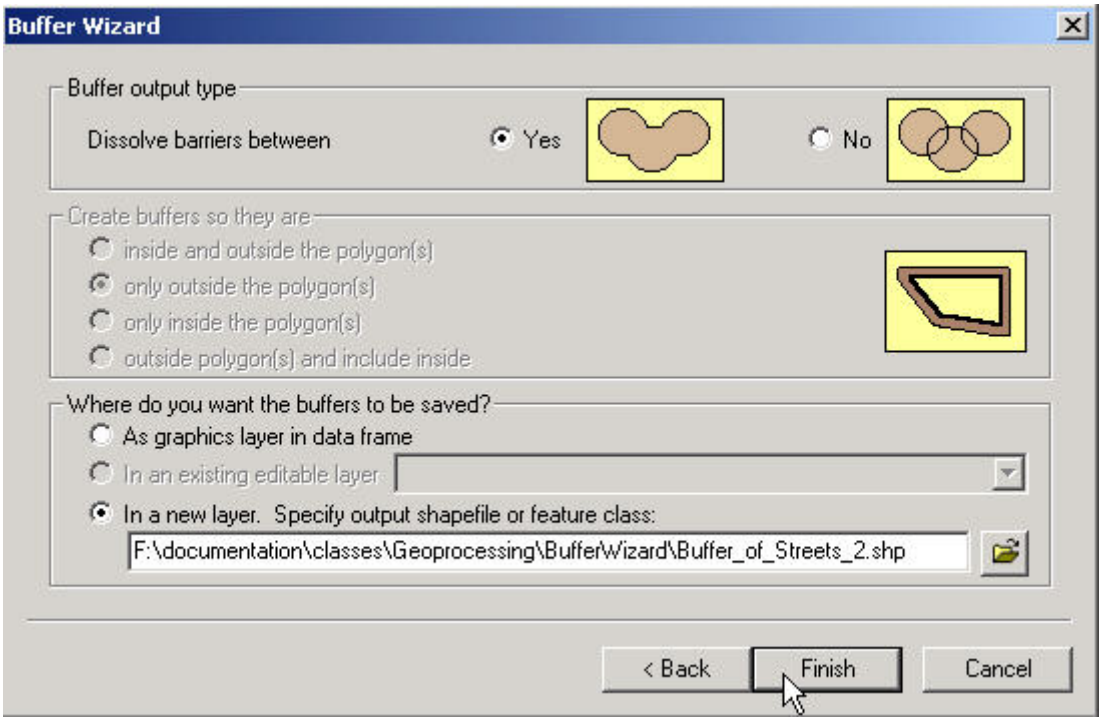


13) Click **Next**.

14) The output type will not matter in our example since we have only chosen one street segment.

15) We have two options for saving the buffer. Choose either to save it as a graphic, or **as a new layer.**

16) If you specify saving it as a new layer, save the layer on the d:\ drive.



17) Click **Finish**.

A graphic that measures 300 feet from the selected part of the feature, will be added to your data frame view.

Section 14 - Select by Attribute

Selection by Attribute is a process by which you will write a logical expression (query) on a database to identify data cells that fulfill the specific requirements of your query. Examples include the extraction of all cells that have a slope greater than 10 percent, or the extraction of all cells attributed with zoning for commercial development. This function requires a familiarity with the databases behind your spatial data.

With Select by Attribute, you can write simple logical expressions to select parcels, for example, value > $75,000. You can also create complex expressions that describe multiple criteria to select cells from the table. For example you could select all the parcels where value > $50,000, and value < $100,000, and zoning = residential. This will return all the residential parcels with a value between $50,000 and $100,000.

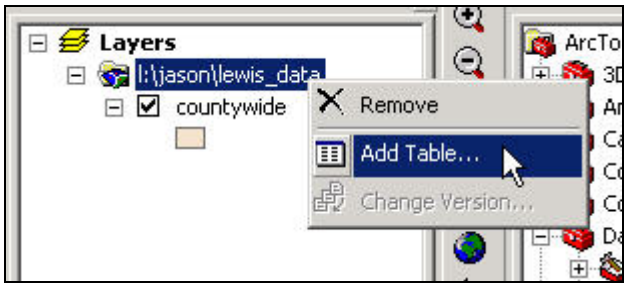
The typical format for a logical expression is [operand1][logical operator][operand2].

In this example, we will select the parcels that have not been appraised in 5 years. To do this, we need to **Join** the parcel table to the database that contains the data we are looking for, which is pcparc00.dbf.

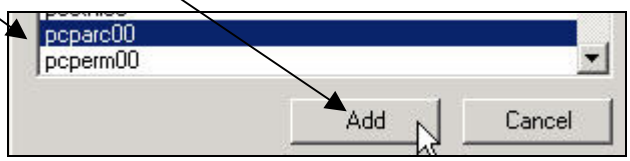
Go to **ArcCatalog** and in the **Select by Attributes** folder, open **selectbyattribute.mxd**.

To join tables, you can add a table to the map project or join to a table on your hard drive. At the bottom of the **Table of Contents,** choose the **Source** tab. 

Since the data for this example all resides in the same folder, right-click the source line and choose **Add Table**.



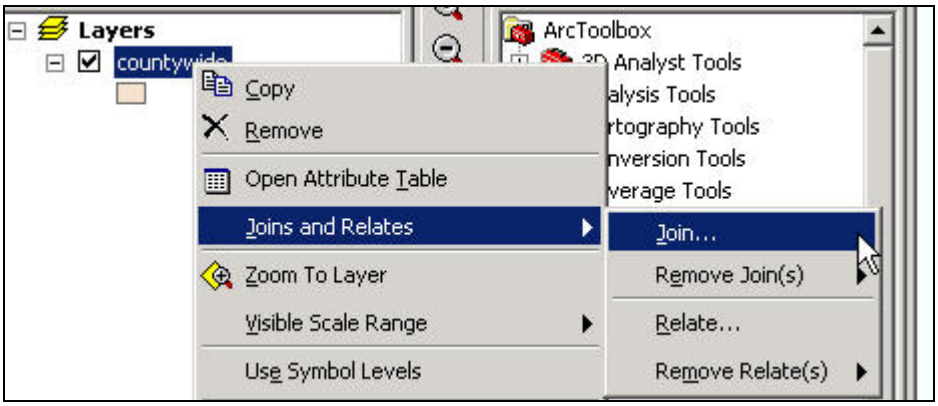
This will display all the tables that reside in the Lewis_data folder. Scroll through the list, select **pcparc00.dbf**, and click "Add"**.**



In the Source tab **Table of Contents,** you can see that the .dbf has been added. Click the **Display Tab** 

at the bottom of the Table of Contents, and this is where the County layer is visible.

Right-click the **County layer,** move the cursor over **Joins and Relates**, then click on **Join** in the next drop down.



The Join Data dialog will open.

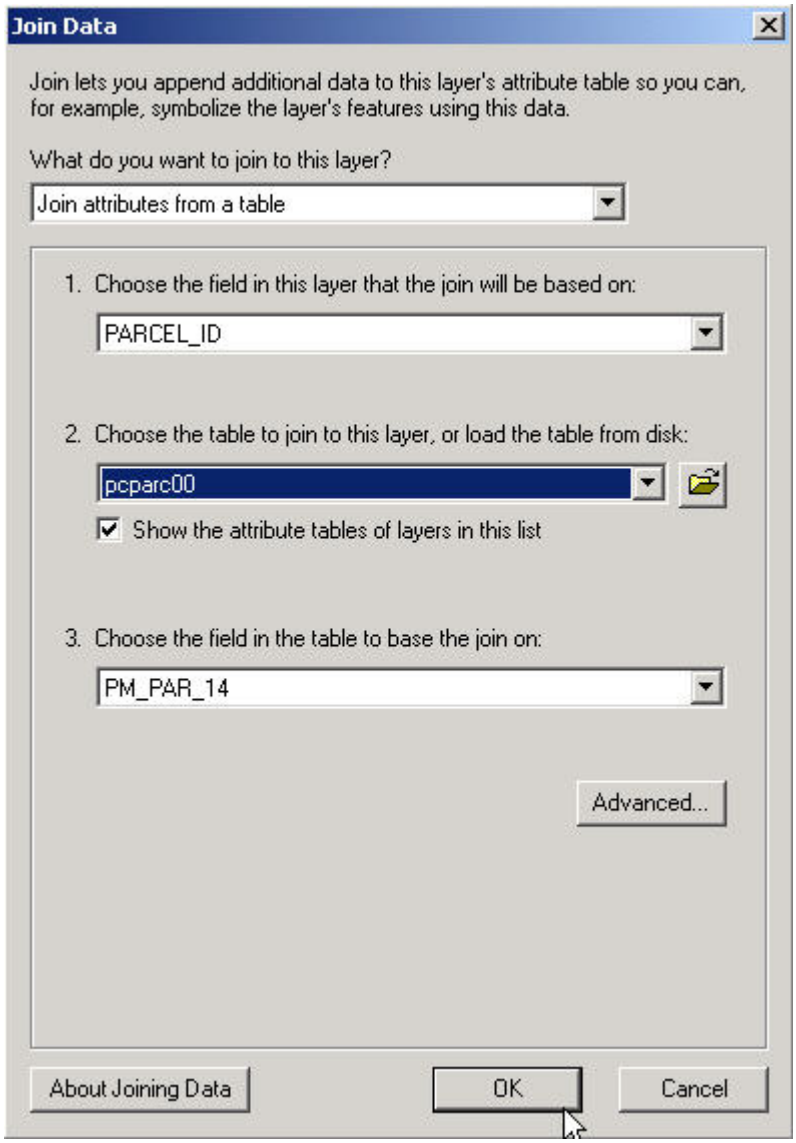
In "**What do you want to join to this layer?**", choose "**Join attributes from a table".**

In choice "**1.",** choose **PARCEL_ID**, the item from the County layer

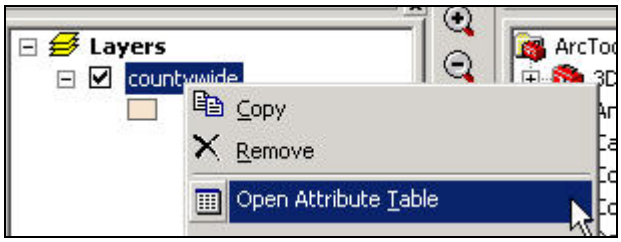
In choice "**2.",** choose **pcparc00.**

Then in choice "**3.",** choose **PM_PAR_14**, the table item from pcparc00.dbf that contains values matching **PARCEL_ID**.

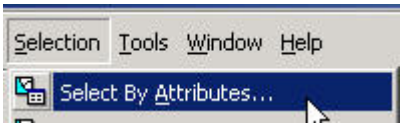
Click "OK".



Open the **attribute table** for the County layer by right-clicking the layer, then choosing **Open Attribute Table**. The records from the pcparc00.dbf now match the records in the County table.



In the main menu, click on **Selection,** then **Select By Attributes.**



The **Select By Attributes** dialog will open.

In **Layer**: we only have one choice and that is the **countywide layer.**

In **Method**: choose "**Create a new selection".**

Now we are set to write a logical expression or query.

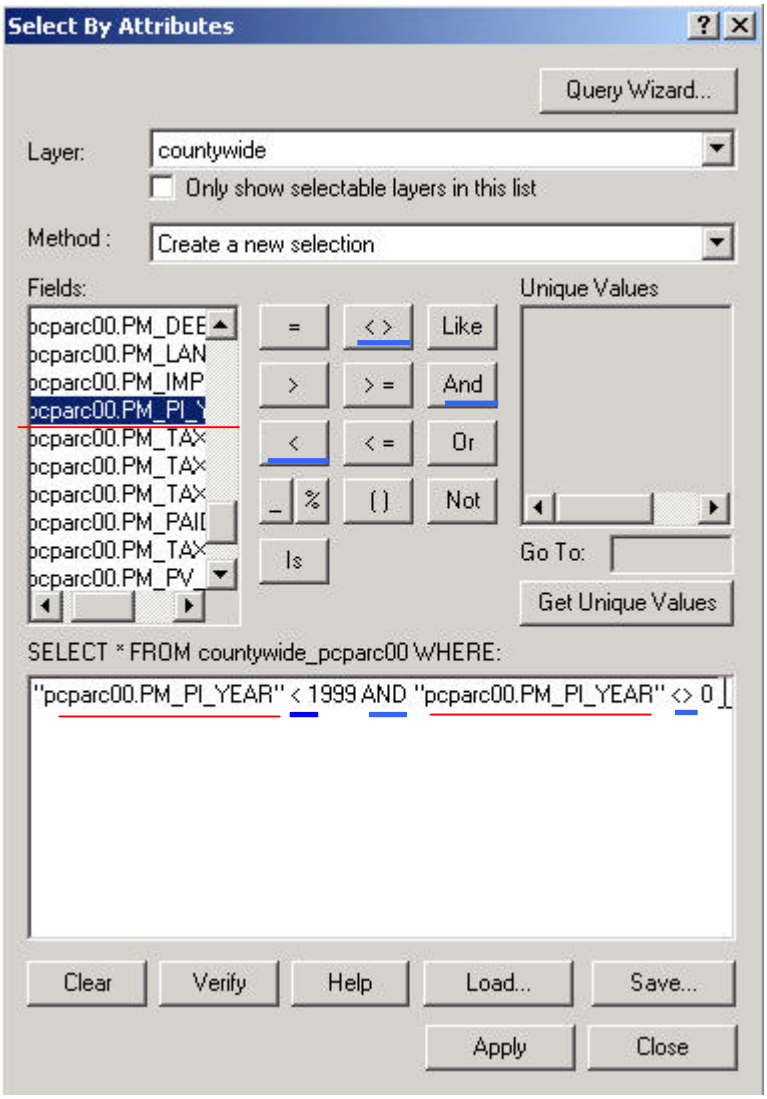
Double click on the field **pcparc00PM_PI_YEAR,** in the **Fields**: list.

Then click on the < operator symbol once.

Hit the **space bar** and then type in "**1999"**.

Click on the operator "**And"**.

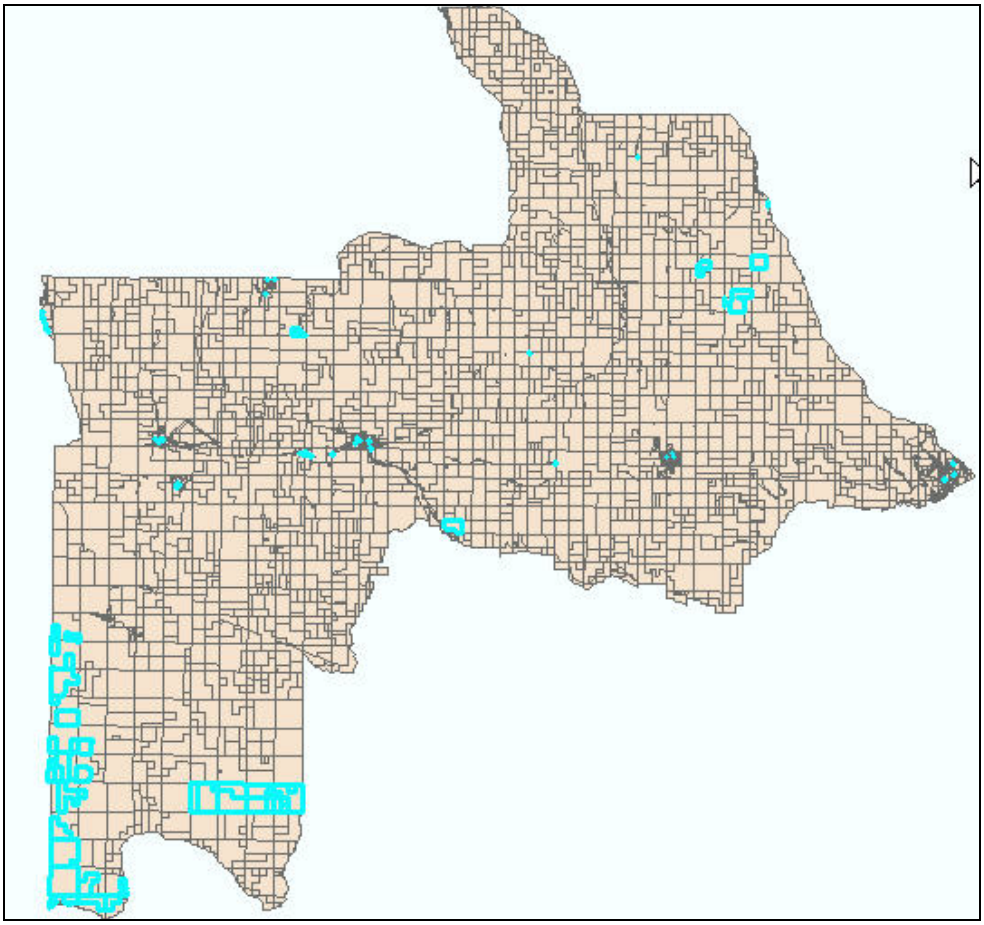
For the second expression, double-click **pcparc00PM_PI_YEAR,** then not equal to <> as the operator, and then type in" **0"**.



Click on the **Verify** button to ensure there are no problems with your expression.

If the verification is successful, click on **Apply,** and choose **Close**.

The result should be 89 records selected.



Section 15 – Are Within a Distance Of

ArcMap 9.0 provides the ability to select features based on their location relative to other features. Selecting the features of one theme with the features of another, is a method for creating a new set of data.

Some of the spatial queries for **Select by Location** are as follows:

Are Completely Within - selects features in the target themes if they fall completely within one or more of the selector theme's features.

Completely Contain - selects features in the target themes that completely contain one or more of the selector theme's features.

Have their Center In - selects features in the target themes if their center falls inside the selector theme's features.

Contain the Center Of - selects features in the target themes that contain the center of one or more of the selector theme's features.

Intersect - selects features in the target themes that intersect the features in the target. Intersection implies that at least one point is common to both the selector and the target, or one of them is completely within the other. If the selector and target are the same, Intersect will select adjacent features.

Are Within Distance Of - selects features in the target themes that are within a specified distance of the selector theme's features. You can specify the type of distance units in the **View Properties** dialog box.

As an example, you may want to identify which parcels are within 300 feet of a planning and zoning change along a road segment so you can notify the parcel owners.

Answering this question—and others like it—involves creating a spatial query. In this case, we will be using the query **"Are Within a Distance Of"** to identify the specific parcels along a selected road segment.

In the ArcCatalog table of contents, open the **Select by Theme** folder, and then pick **selectbylocation.mxd**.

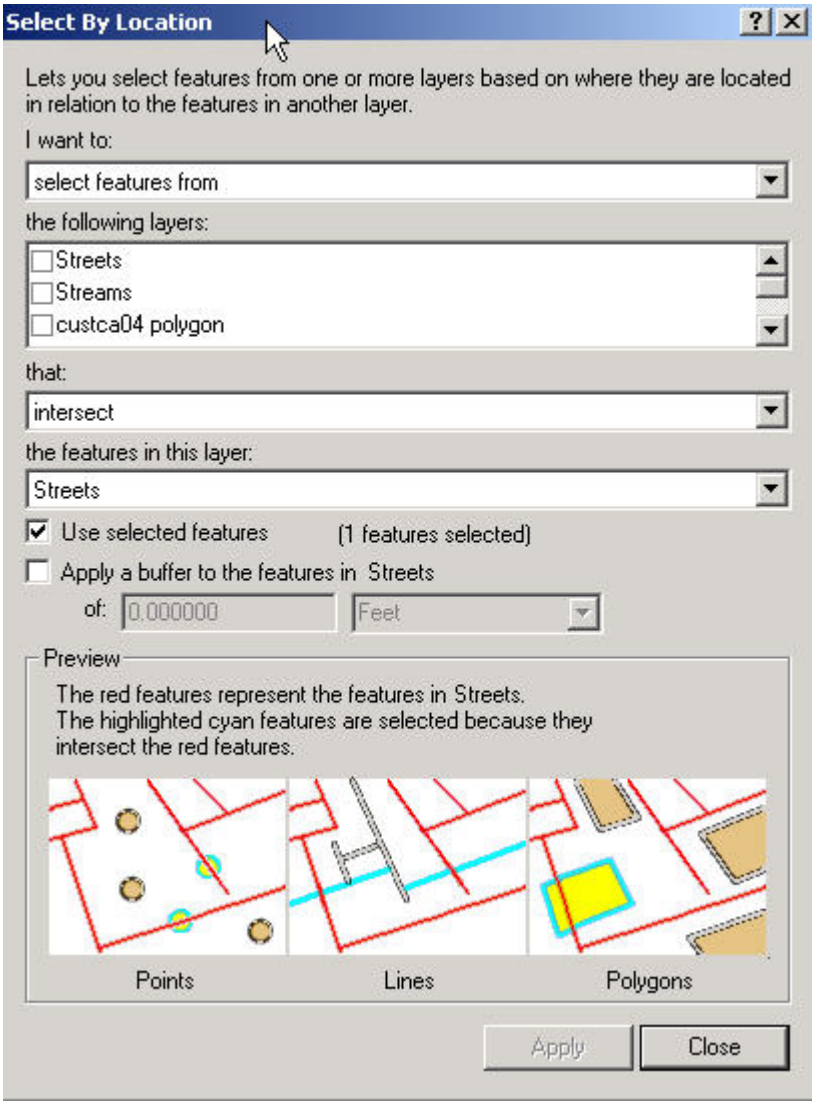
1) Activate the **Select Features** tool. 

2) Within the data frame, select the road segment where the zoning change is taking place. In this example, choose any road segment.

3) Choose **Selection** on the Main Menu bar. 

4) From the drop down menu, choose **Select By Location.** 

5) The **Select By Location** dialog box will appear.



6) In "**I want to:",** choose "**select features from".**

7) In "**the following layers:**", choose the "**parcels layer".**

8) In "**that:",** choose "**are within a distance of".**

9) In "**the features in this layer:",** choose "**Streets".**

10) Because we selected the Street, the **Use selected features** box is checked by default.

11) When we chose "**Are within a distance of"**, the **Apply a buffer to the features in** dialog was activated.

12) Type in a distance of **300** and choose **Feet,** if it's not already selected

13) All the highlighted parcels are within 300 feet of the road segment we chose.

14) Click **Apply** and then **Close**

15) To view the attributes of the selected parcels, open the attribute table and click on **Selected**.

Select By Location Exercise

Using the same .mxd, take some time and experiment with all the other options available in the **Select By Location** dialog.

Section 17 - Convert to Layer

To create a separate new dataset from selected features, you will have to use the **Create Layer From Selected Features** option.

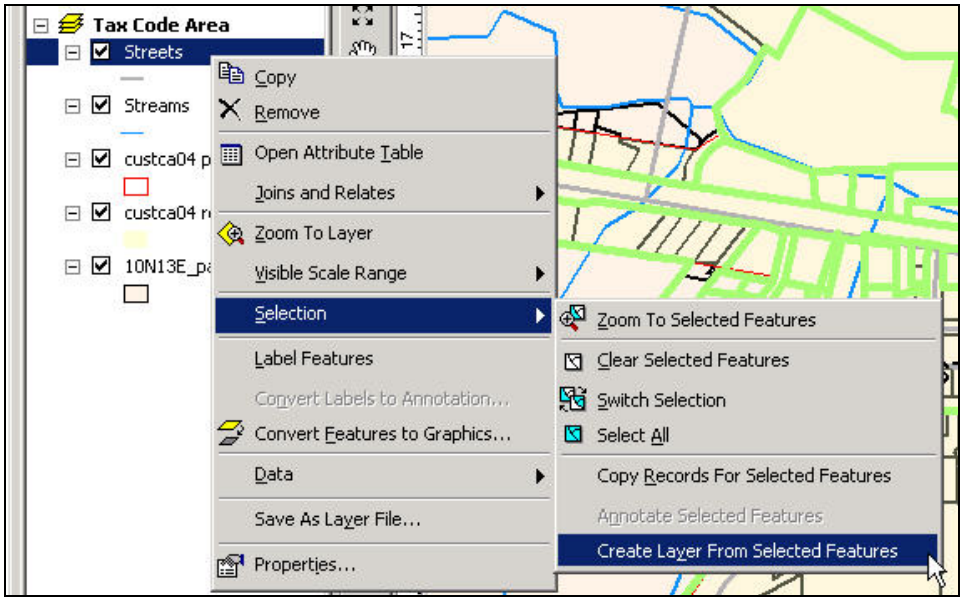
To accomplish this task, once features are selected:

1) Right-click the **layer with the selected features** in the Table of Content,

2) Move the cursor over **Selection,**

3) From the drop down menu, click on **Create Layer From Selected Features.**

This will convert the selected set to its own layer and add it to the data frame.



Exercise – Export and Select Tool

You just converted selected features to a layer. The issue is that a layer is contained within the .mxd, and not as an independent shapefile. Look in the data folder to see that the layer you created does not reside as a file.

But, you want an independent shape file, so there are two easy ways to do this. The first is to export the layer as a shape file, and the other is to not create a layer but, from the beginning, to use the **Select Tool**. Process the selected features to a shape file, and then using different selected features, use the **Select Tool** to create a shape file.

Section 18 – Erase Tool

The ability to remove/cut a section, or multiple sections, in the middle of a layer has been difficult to accomplish in previous versions of ArcGIS. This process essentially creates a doughnut in the layer.

For example, if a parcel owner requests removal from a fire district, removing that parcel from the database is easy; just delete the appropriate data row. However, your fire district layer only has attribute fields that list the fire districts and not the individual parcels contained within each district. To remove the necessary parcels, use the erase tool.

Open the **Erase.mxd** in the **Erase** folder.

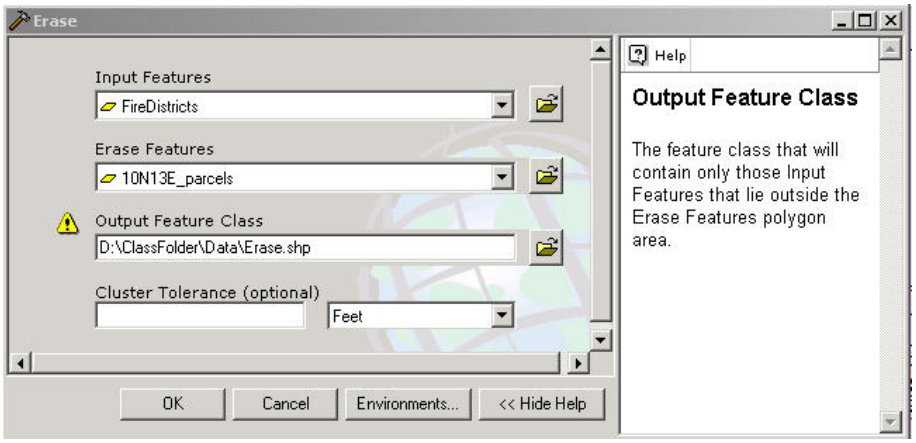
Following the example given above, we want to remove a parcel from the fire district.

Use the **Select Features** tool and select any parcel of the **10N13E** layer within the Fire District layer. 

Another method would be to select the parcels from the attribute table.

Find the **Erase Tool** by using your **Index or Search tabs**. 

Double-click on the **Erase Tool** to open the **Erase** Dialog window.



You are clipping from the **Fire District** shape file and using the selected parcels from the **10N13E layer** as the cookie cutter. Direct the output to the data folder, and name the file anything you want.

Click "OK".

Glossary *(Reproduced from ESRI)*

Active data frame - The data frame in the view that is currently being worked on, for example, the data frame to which layers are being added. The Active data frame is shown in bold text in the ArcMap table of contents.

Attribute - A piece of information describing a map feature. The attributes of a census tract, for example, might include its area, population, and average per capita income.

Or

A characteristic of a geographic feature described by numbers, characters, images, and CAD drawings, typically stored in tabular format, and linked to the feature by a user-assigned identifier. For example, the attributes of a well might include depth and gallons per minute.

Or

A column in a table.

Environment settings – Settings that can apply to all tools within the application, all tools within a model or script, or a particular process within a model or script. Environment settings include current workspace, output spatial reference, output spatial grids, cell size, and tile size. They are generally set before running tools.

Extent - The coordinate pairs defining the minimum-bounding rectangle (xmin, ymin, and xmax, ymax) of a data source. All coordinates for the data source fall within this boundary.

Geoprocessing – Spatial data-processing tasks.

Or

GIS operations such as geographic feature overlay, coverage selection and analysis, topology processing, and data conversion.

Item - A column of information in an INFO table.

Or

An element in the Catalog tree in ArcCatalog. The Catalog tree can contain both geographic data sources and non-geographic elements such as folders, folder connections, and file types.

Intermediate data – Data that results from geoprocessing that is not intended as a final result but may be the input of another process.

Join - The process of attaching tabular data to geographic features. Attributes in an attribute table are appended to the features in a spatial data table using an attribute or item common to both tables.

Layout - The design or arrangement of elements—such as geographic data, North arrows, legends, and scale bars—on a digital map display or printed map.

Layout view - The view for laying out your map in ArcMap and ArcReader. Layout view shows the virtual page upon which you place and arrange geographic data and map elements—such as titles, legends, and scale bars—for printing.

Logical Expression - A mathematical expression that combines logical and Boolean operators and results in a value of true or false.

Logical Operator - One of the set of mathematical operators, including less than (<), greater than (>), equal to (=), not equal to (<>), and various combinations of these. Logical operators are often combined with Boolean operators in a logical expression.

Operand - An item from an attribute table.

Or

A numeric constant.

Or

A character string enclosed in single quotation marks.

Or

An arithmetic expression for which the following operators are permitted:
+, -, /, *,

Parameter - In geoprocessing, a characteristic of a tool. Values set for parameters define a tool's behavior during run time.

Process - A tool and its parameter values. One process, or multiple processes connected together, creates a model.

Scale - The relationship between the dimensions of features on a map and the geographic objects they represent on the earth, commonly expressed as a fraction or a ratio. A map scale of 1/100,000 or 1:100,000 means that one unit of measure on the map equals 100,000 of the same unit on the earth.

Scale bar - A map element that shows the map scale graphically.

Scratch Workspace – A path to a container for file-based geographic data that can be set in the Environment Settings dialog box or at the command line, into which all automatically generated outputs will be placed.

Table of contents - In ArcMap, the table of contents lists all the data frames and layers on the map and shows what features the symbols in each layer represent. ArcScene also has a table of contents.

Tool - A command that requires interaction with the user interface before an action is performed. For example, with the Zoom In tool, you must click or draw a box over the geographic data or map before it is redrawn at a larger scale. Tools can be added to any toolbar.

Toolbar - A set of commands that let you carry out related tasks. The Main Menu toolbar has a set of menu commands; other toolbars typically have a set of buttons. Toolbars can float on the desktop in their own window, or you can dock them at the top, bottom, or sides of the main window.

Toolbox - An object that contains toolsets and geoprocessing tools. It takes the form of a .tbx file on disk, or a table in a geodatabase.

Toolset - In geoprocessing, a group of tools that perform similar tasks.

Variable – A placeholder that represents a changeable value (such as a dataset name or a number) or a value that has not yet been assigned. In geoprocessing, model variables can be shared between processes in the model.

Views - Different ways to see the contents of the selected item in the Catalog tree in ArcCatalog.