

Section 1: Introduction to ArcGIS 9.1/9.2

Exercise

Course Scenario

This course will effectively walk students through a GIS project, start-to-finish, including data discovery, incorporating data received from other organizations, performing basic analysis and editing, and finally presenting the findings in the form of a map. The project setting is in Montana, more specifically in Glacier National Park's Lake McDonald/Apgar area, near the park entrance in West Glacier. Students will use some of Glacier's base cartographic data and a subset of its Bear Information Management (BIMS) database to visualize and analyze in two separate analyses bear sightings/activity with respect to residences as well as a wastewater treatment facility. Students will explore the proximity of bear sightings to these features of interest, distinguish between black bear and grizzly bear sightings, and will perhaps learn something about bear behavior through the analyses.

Note: This course was primarily written for use with ArcGIS 9.2 so its contents may not be compatible with other versions. It can also be used with version 9.1, but some of the steps vary and there are different instructions provided where needed. Version 9.2 was just being released as the course was completed so for more information on any differences in the newer version refer to the "What's New in ArcGIS 9.2" resource on ESRI's website:

<http://www.esri.com/software/arcgis/about/whats-new.html>

ArcCatalog

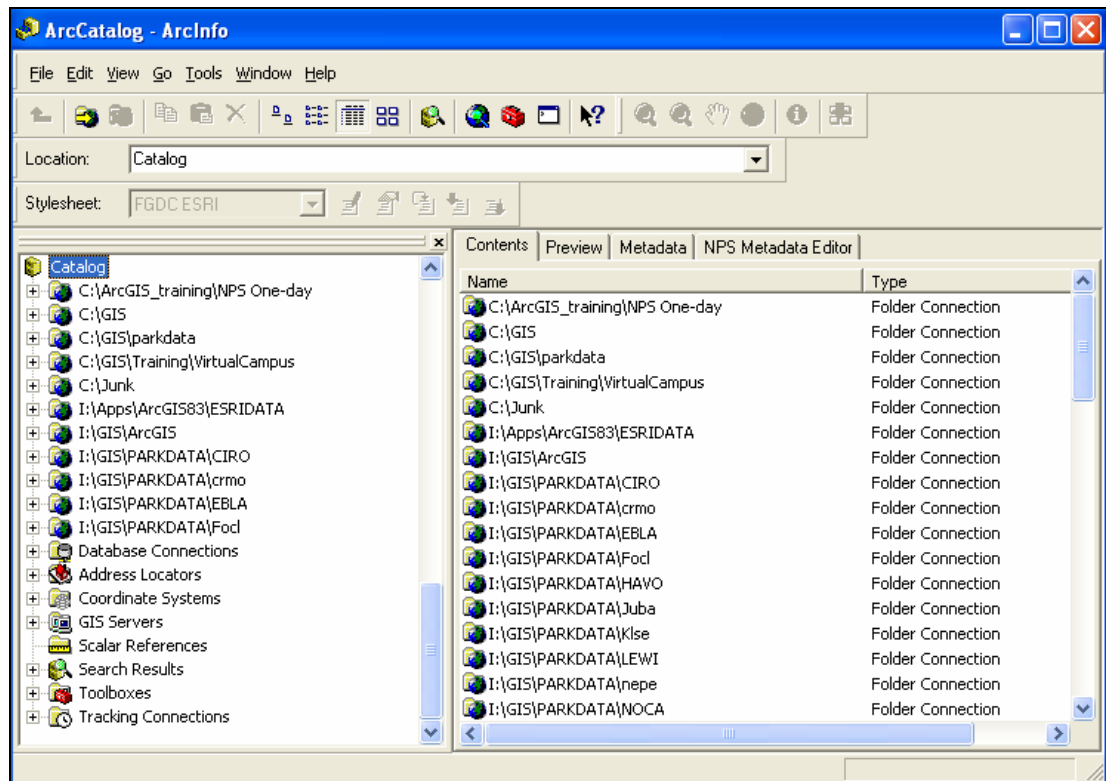
Recall that ArcCatalog is the data management application of ArcGIS. ArcCatalog allows you to import, export, and preview datasets, drag and drop data to open ArcMap, and create new data sources. The Metadata function of ArcCatalog allows you to view, create, and/or edit metadata.

Launch ArcCatalog

1. From the **Start** menu, select **Programs > ArcGIS** and click on the **ArcCatalog** icon.
2. When ArcCatalog opens, take time to hover the pointer over each of the buttons until the pop-up label appears, displaying a short description of the button's function and a more detailed explanation in the status bar located in

the lower left of the ArcCatalog window. (Notice how similar the interface looks to that of Windows Explorer.)

3. In the Catalog tree on the left side, you see the various drives and folders on your computer, as well as other connection options (e.g., Database Connections, Address Locators, GIS Servers, etc.). You do not see all of the files and folders on your computer; instead you see only those folders to which a connection has been established.



Folder Connections

Now, connect to the folder where the files for this course are stored, as follows:

1. Click on the **Connect to Folder** icon  in the **Standard** toolbar.
2. In the **Connect to Folder** dialog, navigate to the folder where the data for this course is stored, **...\intro_arc9** (the instructor will tell you where the course data is stored), in the **Connect to Folder** dialog.
3. Click **OK**. The **...\intro_arc9** folder now appears in the **Catalog tree**.

Now, remove the folder connection to your hard disk, e.g., C:\, as follows:

1. Right-click on the connection to your hard disk in the Catalog tree and select **Disconnect Folder** from the context menu that appears.

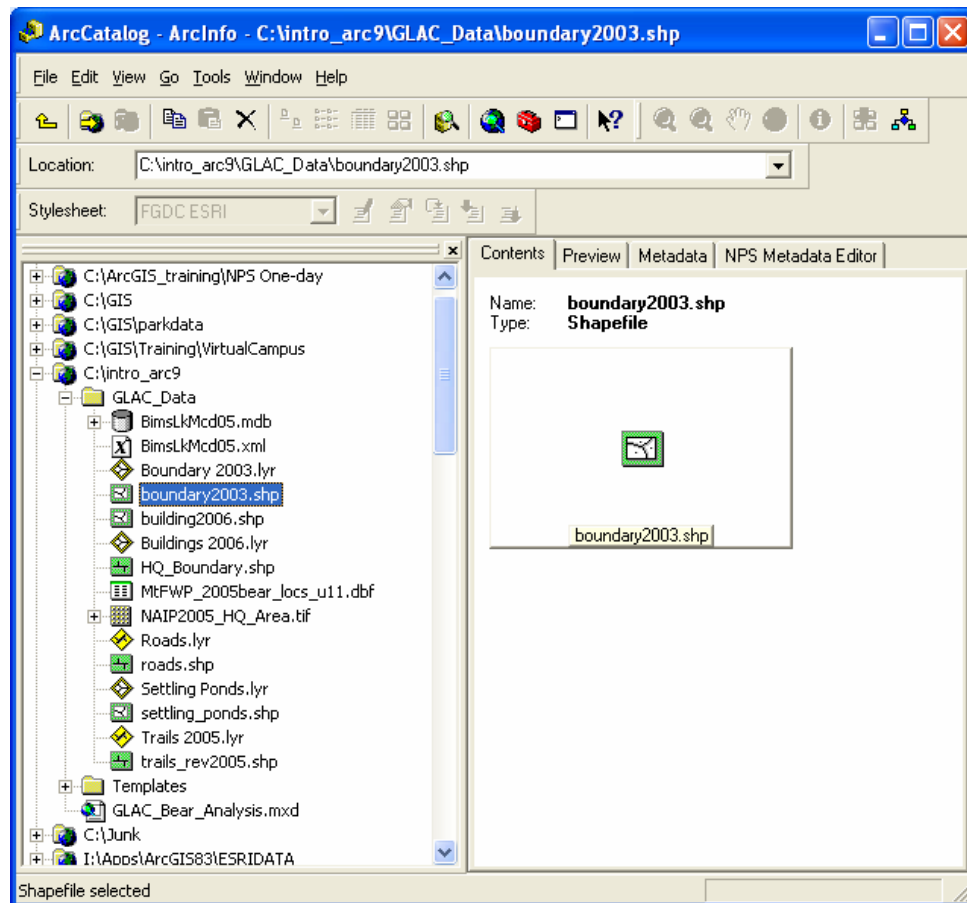


Notice that “C:\” no longer appears in the Catalog tree.

Preview Spatial Data

ArcCatalog is a great way to browse and become familiar with the available spatial data.

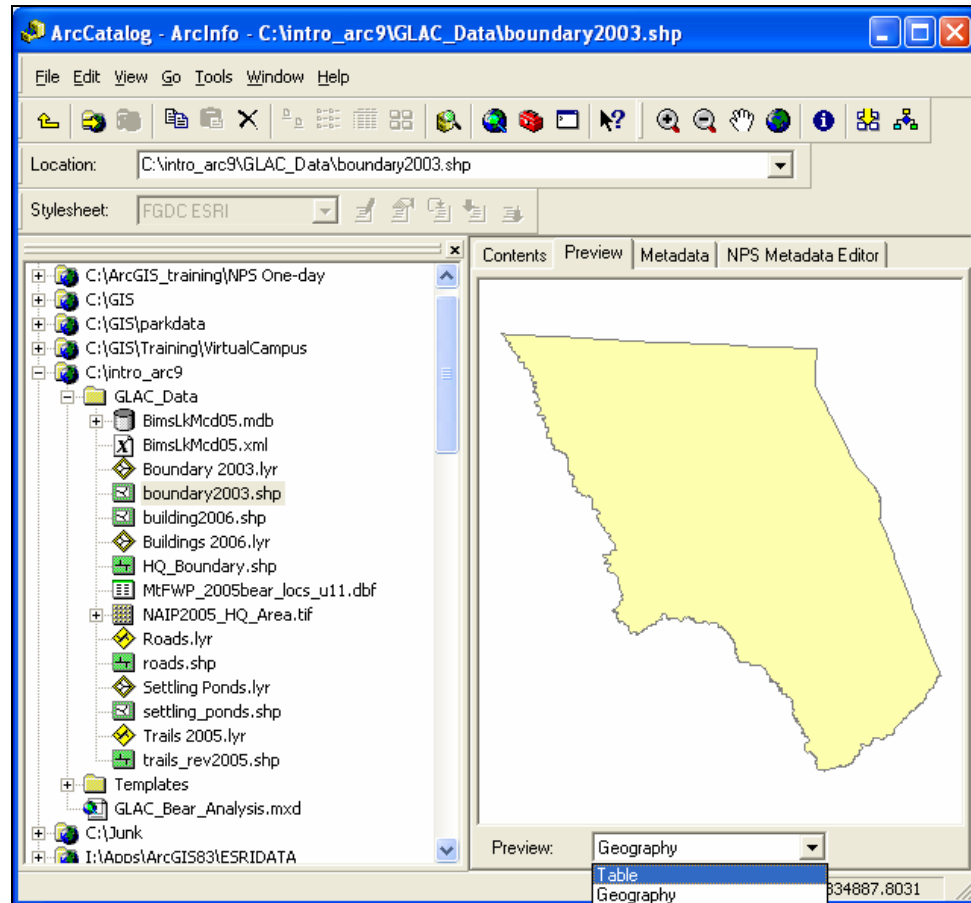
1. In the Catalog Tree on the left side of the ArcCatalog window, expand the course data folder, ...\\intro_arc9, and navigate to ...\\intro_arc9\\GLAC_Data. Click on *boundary2003.shp* in the Catalog tree on the left side of the ArcCatalog window. If not already selected, click on the **Contents** tab and you will see that this dataset is a shapefile and just below this you will see an icon indicating that it contains polygon features.



2. Select the **Preview** tab to preview the contents of this shapefile. Notice the **Geography** toolbar, shown below, becomes active. You can use these tools for basic data exploration, including zooming, panning and identifying. Take a moment to experiment with these tools.



- At the bottom of the Preview area, click on the dropdown arrow to the right of the small window labeled **Preview:** and choose **Table**. This allows you to view the dataset's attribute table. Note that there is only one record in the data table, corresponding to the park boundary polygon.



View Metadata

The next tab is used to view **Metadata**.

1. Select the **Metadata** tab. The metadata for the *boundary2003.shp* file is now displayed. Notice that the **Metadata** toolbar becomes active.



2. Hover the pointer over each **Metadata** button to see its function.
3. If not already set, select **FGDC** from the **Stylesheet** dropdown list. The metadata is now displayed in the main window. Notice that there are links to each of the major sections of the metadata record below the **FGDC and ESRI Metadata:** heading. (You may need to scroll down slightly to see these links.) For example, click on the link for **Spatial Reference Information**. This section of the metadata record contains important information about the coordinate system in which these data are projected. Section 3, “Editing Data and Metadata”, will discuss FGDC (Federal Geographic Data Committee) metadata in more detail.

Preview a Data Table

As mentioned earlier you are going to perform analysis with bear data at GLAC during this course. In doing so you will be utilizing data stored in the park’s Bear Information Management System (BIMS) which is an Access database containing data collected on bear observations in the park. You are going to explore the contents of the data table it contains as well as the metadata in preparation for working with this data in subsequent course sections.

1. In the Catalog tree expand *BimsLkMcd05.mdb* and select *2005LakeMcD*.
2. Click on the **Preview** tab to make it active and scroll through the table, taking note of the fields and data it contains.
3. To view the metadata for the database click on *BimsLkMcd05.xml* from the Catalog tree and then click on the **Metadata** tab.
4. On the **Metadata** toolbar ensure the **Stylesheet** is **FGDC**.

5. Under **FGDC and ESRI Metadata** click on the **Spatial Reference Information** link and take note of the Spatial Reference Information:

Projected coordinate system name: UTM - Zone 12
Planar distance units: meters
Horizontal datum name: North American Datum of 1983

ArcMap

ArcMap is the ArcGIS application that you use to display, query, edit, create, and analyze geographic data.

Launch ArcMap

ArcMap can be launched independently or from ArcCatalog. Use one of the following methods to launch ArcMap with a new empty map:

- You may launch ArcMap by clicking **Start > Programs > ArcGIS > ArcMap**. When prompted, select **A new empty map** and click **OK**.
- To launch ArcMap from ArcCatalog, click on the ArcMap icon  on the **Standard** toolbar. ArcMap will take a moment to open. When prompted, select **A new empty map** and click **OK**.

This opens an **Untitled** map document, which is indicated in the **ArcMap Title Bar** located at the top of the ArcMap interface. By default the map document contains one data frame with the default name of **Layers** that is listed at the top of the **Table of Contents**. A **Data frame** contains a group of data layers that you want to display together. You can change the data frame name to something more meaningful, if desired. This is particularly useful when you have multiple data frames in a map document.

Add a Layer to a Map Document

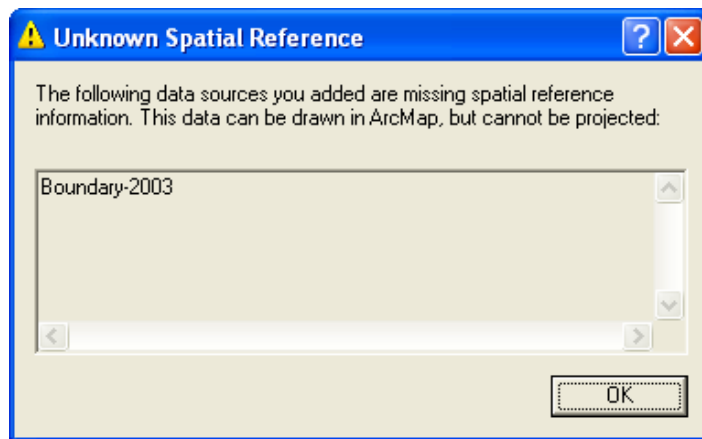
Now you'll add data layers to the currently empty map document.

1. If necessary, turn on the **Standard** toolbar, shown below, by clicking on the **View menu > Toolbars > Standard**.



2. Click on the **Add Data** button  on the **Standard** toolbar.
3. In the **Add Data** dialog, navigate to ...\\intro_arc9\\GLAC_Data, and select *Boundary 2003.lyr*, and click the **Add** button. Notice that the data layer, *Boundary-2003*, is added to the Layers data frame in the Table of Contents and is displayed in the map display to the right. The checkmark in the box located to the left of the layer name indicates that the layer is “on” or displayed. This layer contains a polygon feature of the GLAC boundary and it was also added from a layer file (*.lyr), which if you recall from the lecture references a data source and stores the cartographic properties, including symbology. This saves time by having to make minimal, if any, changes to the preset symbology.

Note: If the **Unknown Spatial Reference** dialog box appears after adding the *Boundary 2003.lyr*, click **OK**.



If a red exclamation mark (!) appears  and the layer does not draw, don't worry—you will fix that soon. This just means that the source data of the layer file is in a different location than when it was created and can not be found.

Add Multiple Layers to a Map Document

Now you'll add multiple data layers at one time.

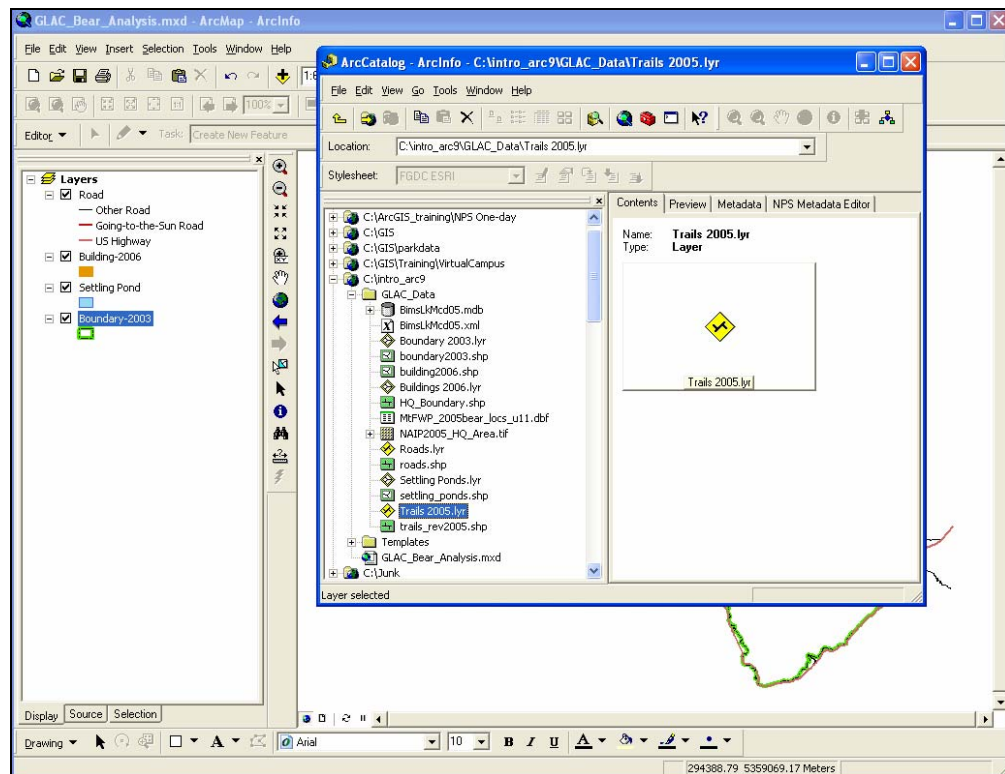
1. Again, click on the **Add Data** button  and navigate to ...\\intro_arc9\\GLAC_Data.

2. Select *Buildings 2006.lyr* and then hold down the **Ctrl** key and select *Roads.lyr* and *Settling Ponds.lyr* and click **Add**. The layers are added to the data frame.

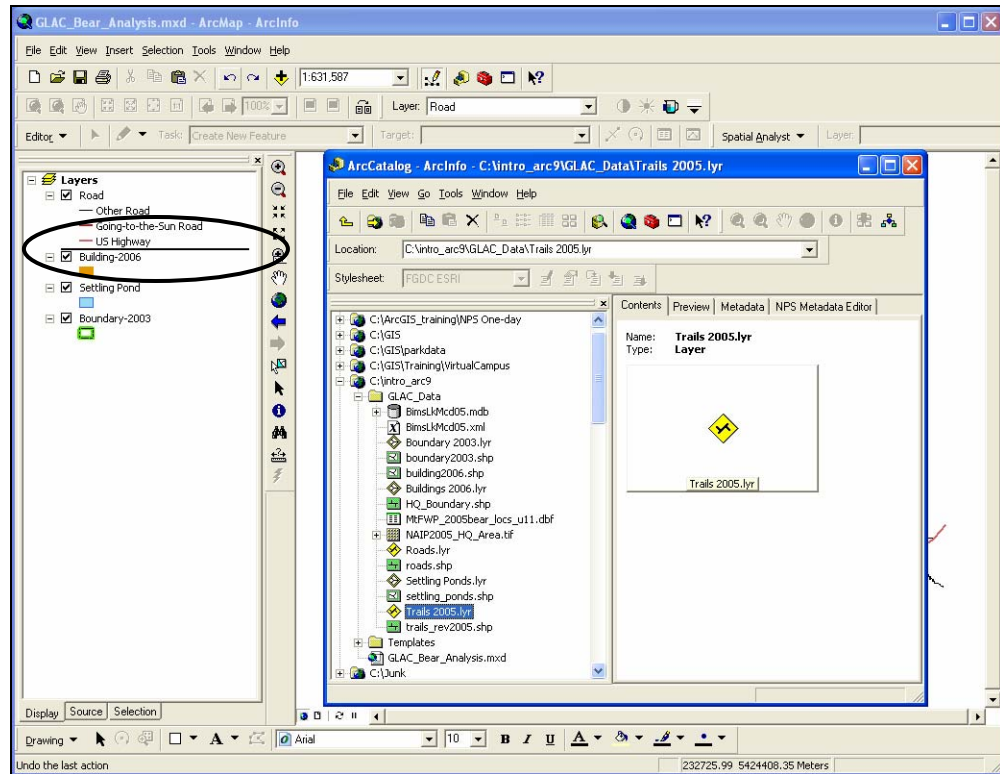
Add a Layer to a Map Document from ArcCatalog

Now you'll add a data layer by dragging and dropping it from ArcCatalog.

1. If **ArcCatalog** is still running select it from the Taskbar to make it the active application. If it is not running click on the **ArcCatalog** button on the **Standard** toolbar in **ArcMap**. Leave ArcMap open.
2. Reposition and resize ArcCatalog so it overlaps with ArcMap in such a way that both the ArcMap Table of Contents and ArcCatalog are visible, similar to the figure below:



3. From the **Catalog tree** in **ArcCatalog** select *Trails 2005.lyr* and click and drag it to the **ArcMap Table of Contents** and drop it between the *Road* and *Building-2006* layers, a black line will appear so you can see where the layer will be placed as shown below:



The Trail layer now appears where it was dropped.

4. Minimize ArcCatalog and maximize ArcMap.

Set Layer Data Source

If any of the layers you just added in the previous few sections have a red exclamation mark (!) and are not displayed, follow the steps below to set the layer data sources, otherwise move on to the next section of the exercise. Again, this occurs when the source data of a layer file is in a different location than when it was created and can not be found.

1. Click on the red exclamation mark (!) next to the *Boundary-2003* layer:



2. In the **Set Data Source** window navigate to and select *boundary2003.shp* from the course data directory, **...\intro_arc9\GLAC_Data**.
3. If you are unfamiliar with the data source of a layer, right-click on the layer and select **Properties...** and click on the **Source** tab and the source information is listed under **Data Source**. Notice the data source could also be set here by clicking on the **Set Data Source** button.
4. When the data sources of multiple layers can not be found then you may save time by using the first method of clicking on the exclamation mark because it will also set the data sources of the other layers if they are stored in the same relative location. Notice that even though you only repaired the *Boundary-2003* layer, the data sources for the other layers were automatically set since they are stored in the same folder.

Add a Layer from a Data Source to a Map Document

Thus far, you have added layers from layer files to the map document. Now you'll add a layer directly from the data source to compare the results with adding a layer file.

1. Click on the **Add Data** button, navigate to **...\intro_arc9\GLAC_Data**, select *HQ_Boundary.shp*, and click the **Add** button. Notice that the data layer, *HQ_Boundary*, is added to the data frame. The *HQ_Boundary* layer contains a line feature of the study area, which is the GLAC headquarters. Since this layer was added directly from the data source it is added with default symbology and the layer name is the data source name. You'll change the symbology of this layer later in the exercise.
2. Now you'll add one last layer, a Digital Orthophoto Quadrangle (DOQ) image. Click on the **Add Data** button, navigate to **...\intro_arc9\GLAC_Data**, select *NAIP2005_HQ_Area.tif*, and click the **Add** button. If the **Create pyramids** dialog appears, click **No**. The image is then added to the data frame.

Note: For more information on pyramids refer to the **Raster pyramids** (ArcGIS 9.2) **Creating raster pyramids** (ArcGIS 9.1) or topic in the **ArcGIS Desktop Help**.

3. The data frame now contains the following layers, listed in drawing order from the top of the Table of Contents to the bottom:
 - a) *HQ_Boundary* – course study area
 - b) *Road* – roads in and adjacent to Glacier National Park
 - c) *Trail* – hiking trails in Glacier National Park, revised in 2005
 - d) *Building-2006* – structures/buildings in Glacier National Park, revised in 2006
 - e) *Settling_Pond* – sewage/wastewater settling ponds in Glacier National Park
 - f) *Boundary-2003* - Glacier National Park administrative boundary, revised in 2003
 - g) *NAIP2005_HQ_Area.tif* – Summer 2005 NAIP image of the Apgar/Headquarters area in Glacier National Park

Save the Map Document

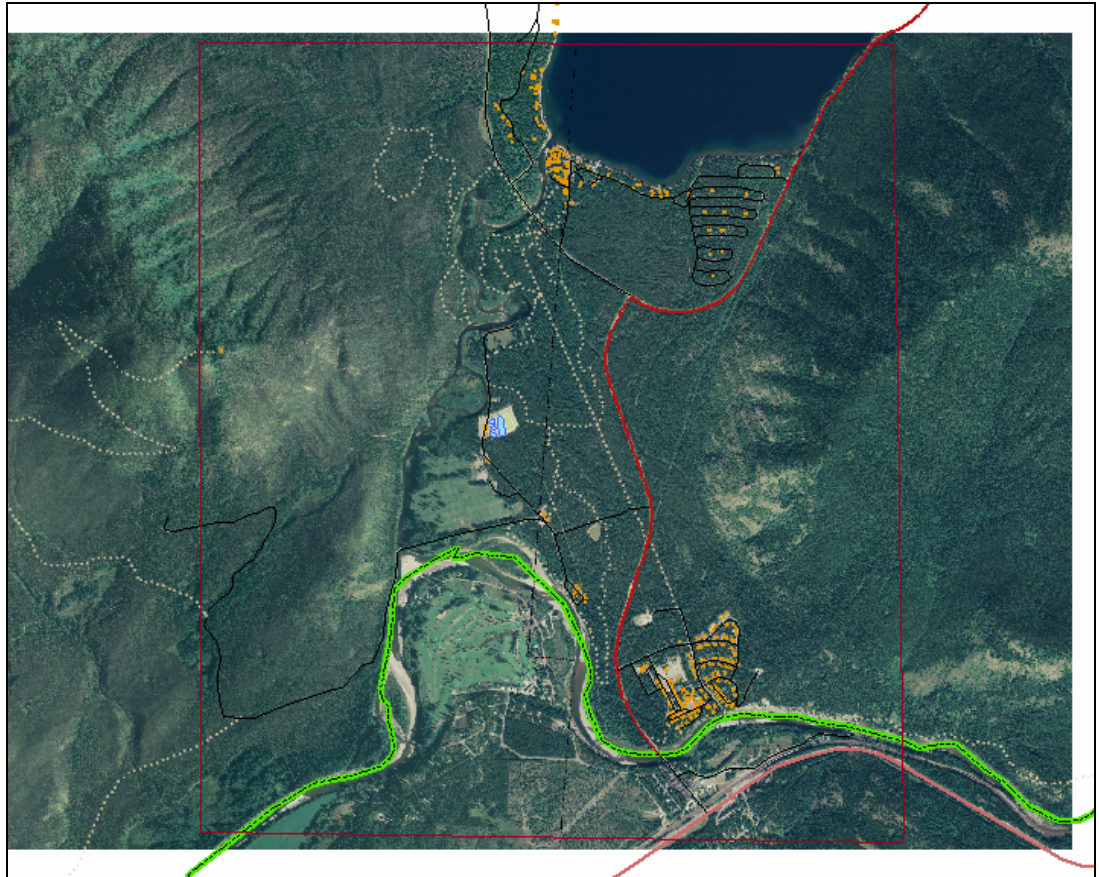
When you are working in ArcMap it is important to save often in order to minimize the amount of work that would be lost in the event it crashes, that is ArcMap closing unexpectedly. Up until this point you have been working in an Untitled map document which you will save to a new name.

1. Click on the **Save** button.
2. Since you were working in an *Untitled* map document the **Save As** dialog will open. Navigate to ...\\intro_arc9, type GLAC_Bear_Analysis, and click on **Save**. Notice the title bar reflects the new map document name.

Zoom to a Layer

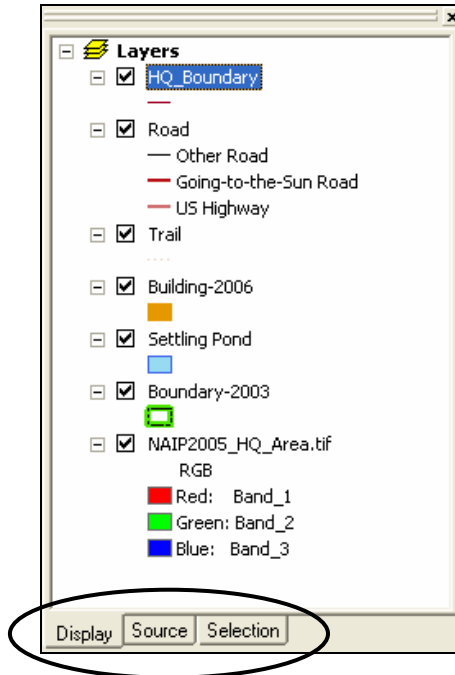
Now you are going to zoom to the *HQ_Boundary* layer to zoom in on the study area.

1. Right-click on the *HQ_Boundary* layer and select **Zoom to Layer**. Your map display should look similar to the figure below.



Change Layer Drawing Order

The order of layers within the Table of Contents is important because the layers at the top draw on top of those that are listed below them. At the bottom of the Table of Contents there are three tabs, **Display**, **Source**, and **Selection**, circled in the figure below.



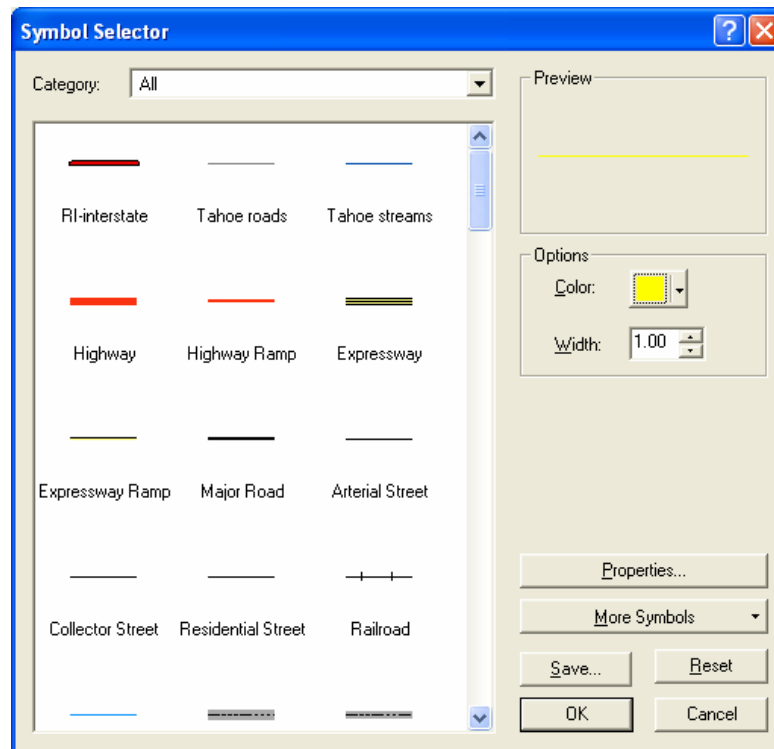
When you select the **Display** tab, you see the drawing order of the layers and you can move a layer up or down in the Table of Contents by dragging and dropping it. You will learn more about the other two tabs in subsequent course sections.

1. Move the *Road* layer to the bottom of the **Table of Contents**, by dragging and dropping it, so it is listed below the *NAIP 2005-Headquarters* layer. Notice that the *Road* layer is still on, but the road features are no longer visible in the map display because they are obscured by the image layer.
2. Now, move the *Road* layer back to its original position, between the *HQ_Boundary* and *Trail* layers, in the **Table of Contents**. Recall that the black line shows where the layer will be placed.

Change Layer Symbolology

When a layer is added directly from a data source to a map document, it is displayed with default symbology. Often you will want to change layer symbology so it is intuitive and easy for the audience to understand. ArcMap provides default symbols designed to handle the most common features on maps as well as thousands of additional symbols. Now you will change the symbology of the *HQ_Boundary* layer so it contrasts better.

1. Click on the *HQ_Boundary* layer symbol.
2. In the **Symbol Selector** dialog box under **Options** click on the **Color** dropdown list and change the color to **yellow**, similar to the color illustrated below.

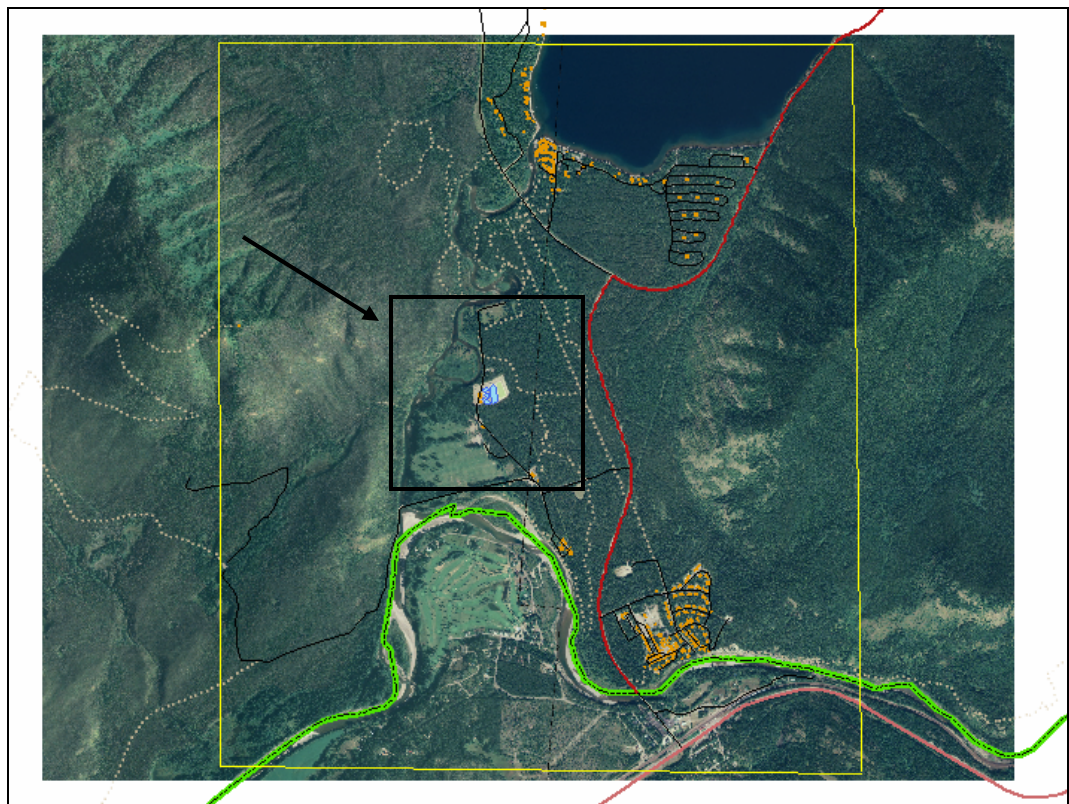


3. Leave the **width** at **1.00**. Click **OK** to apply the change and close the Symbol Selector dialog box.
4. Click-pause-click on the layer name *HQ_Boundary*, type Headquarters Boundary, then hit **Enter**.
5. Click-pause-click on the layer name *NAIP2005_HQ_Area.tif*, type NAIP 2005-Headquarters, then hit **Enter**.

Make a Layer Transparent

Now make the *Settling Pond* layer transparent so the orthophoto is somewhat visible through the pond features.

1. The settling ponds are located toward the middle of the Headquarters area, so zoom in on the settling pond features so you will be better able to see the effects of making the layer transparent. To do so use the **Zoom In** tool  to click and drag a box around the settling ponds, similar to the area illustrated below. Notice the ponds are currently opaque.



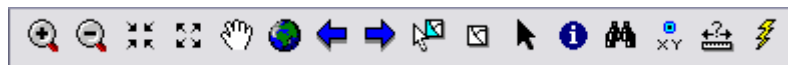
2. Right-click on the *Settling Pond* layer and select **Properties**.
3. Click on the **Display** tab in the **Layer Properties** dialog.
4. Type 50 in the **Transparent** box to make the pond features 50% transparent.
5. Click **OK** to close the **Layer Properties** dialog. Notice the pond features become transparent and the orthophoto is partially visible through them.

6. Experiment with other transparency values, such as 20% and 80%, to see the difference, however when finished make sure the transparency is set to 50%.
7. Click on the **Go Back to Previous Extent**  button to zoom back to the previous map extent, the course study area.

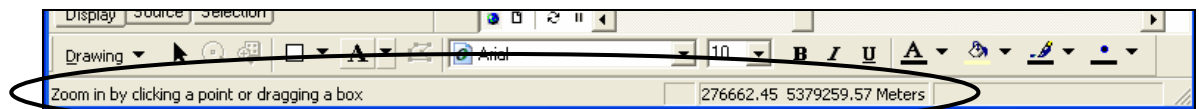
The Tools Toolbar

As you learned in the lecture, the **Tools toolbar** includes **tools** and **buttons** that allow you to interact with the data displayed in the map display window to carry out specific tasks. When a **button** is used the function is carried out immediately and when a **tool** is selected the pointer changes and the tool is used in the map display to perform a function.

1. Thus far you have used the **Zoom In** tool and the **Go Back to Previous Extent** button from the **Tools** toolbar, shown below, so now take some time to experiment with the other buttons and tools on the toolbar to become familiar with their functions. You will learn more about the **Identify** and **Measure** tools in Section 2.



2. If you hover the cursor over a button or tool the name will pop-up and a brief one-line description will appear in the **Status Bar**, located at the bottom left of the ArcMap window. The status bar also displays the coordinate position of the mouse pointer in the display window (bottom right) and information about the progress of particular operations, e.g., saving, printing a layout, etc. See the figure below.

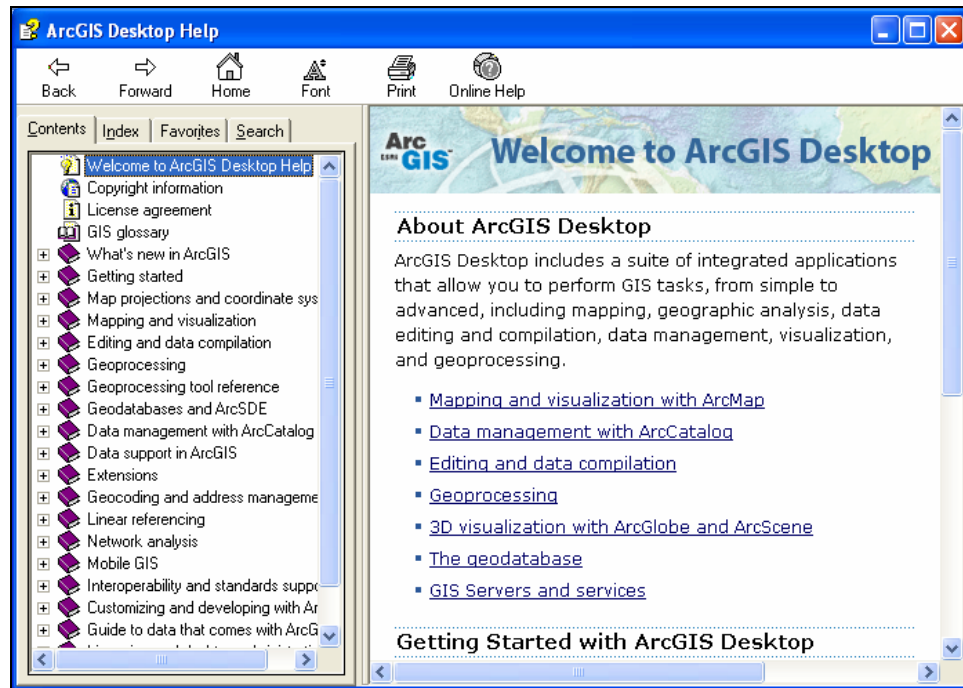


ArcGIS Desktop Help

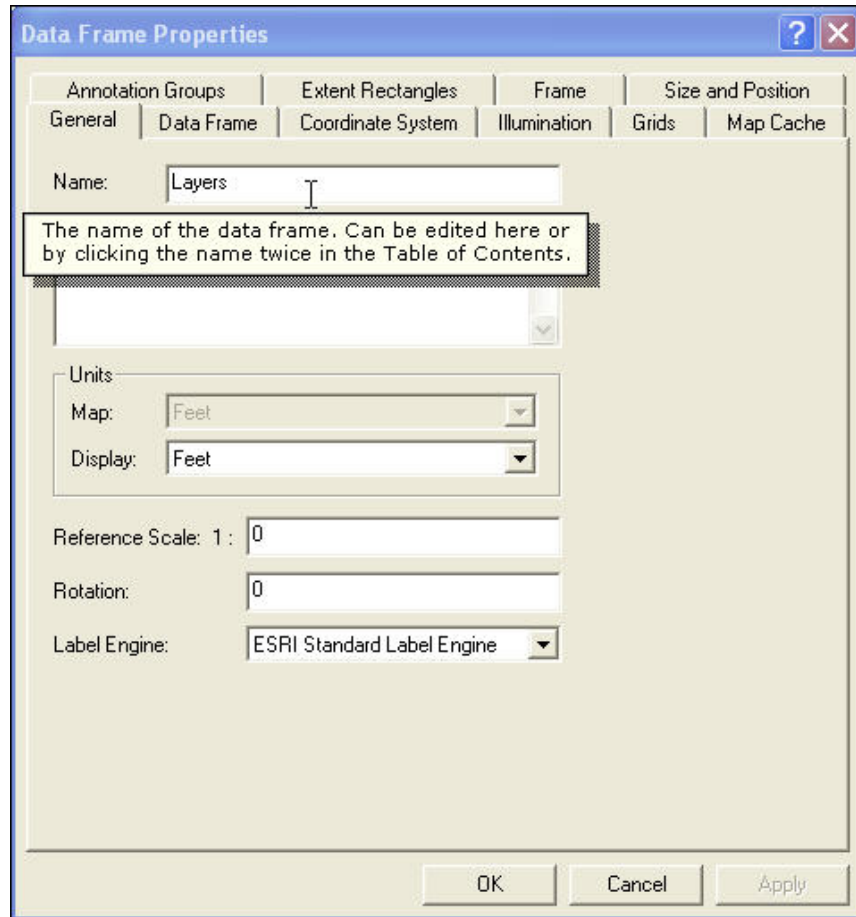
The help system in ArcGIS contains a wealth of information – it is well worth your time to learn how to access this information. Help can be accessed in a variety of ways.

1. Context Sensitive Help can be accessed with the **"What's This?"** tool , on the Standard toolbar. Select the **What's This?** tool then click on a menu item, button or tool, such **Go to XY** button , to see the definition or purpose of it.
2. Clicking on the **Help > ArcGIS Desktop Help** gives you access to the complete ArcGIS Desktop Help system.

The **ArcGIS Desktop Help** window has four tabs: **Contents**, **Index**, **Search**, and **Favorites**. The help documents are organized by topic and often by application, that is ArcCatalog, ArcMap, etc.



3. You can also press the **F1** key to access help about dialog box controls. Place the pointer over an item and press the **F1** key.



Take time to become familiar with each of these methods of accessing help information. It is also wise to observe patterns in what help routines take what amounts of time to access, which ones are less functional when other software is open, etc.

Save the Map Document

Save again, you can't save too often!

1. Click on the **Save** button. This will save the changes you have made to the map document. Notice that the Save As dialog did not open this time, that will only occur when working in an *Untitled* map document.
2. If you click on the **File** menu you will notice there are also options to **Save As...** and **Save A Copy....**

Challenge

Use the **ArcGIS Desktop Help**, including the **GIS Dictionary**, to answer the following questions:

1. How do you copy and past a layer in ArcMap?
2. Is it possible to view metadata in ArcMap?
3. How do you save a map document to a previous version of ArcGIS?
4. How do you group layers in ArcMap?
5. How do you display a subset of features in a layer in ArcMap?
6. How do you store a map document with relative pathnames and what is the advantage of doing so?