

GIS AND PUBLIC HEALTH EXERCISE 1 - INTRODUCTION TO GIS (ArcGIS 10)

GETTING STARTED

Download the **exer1** folder you will need for this exercise from the online supplement.

All of the databases and files used in the exercises will be stored in various subfolders within the folder called **exer1**. The following instructions are written for this folder to be located on the **c:** drive. If the folder is located on another drive, the path names shown below should be modified accordingly. Some of the folders are empty. They have been included because you may need to save the results of an operation to one of these folders.

The map documents created using ArcGIS 10 reference the spatial databases and tables in the application based on the directories and paths where the data are stored. Changing the locations of databases in the system can prevent a GIS application from working properly.

Connecting to a Folder in ArcCatalog

ArcGIS software encompasses a number of separate modules. One of the first modules users must access is ArcCatalog. In ArcCatalog, users can connect to folders containing geographic databases and other files. You can also explore the system design, view a database as a table or a map, prepare metadata, and access other modules of ArcGIS through the ArcCatalog interface.

Go to **Start** ⇒ **Programs** ⇒ **ArcGIS** ⇒ **ArcCatalog 10** to start ArcCatalog.

Find the button labeled **Connect to Folder** and click the button. Navigate to **c:\exer1** then click OK and look at the Catalog Tree in the left window to see that the folder has been added.

When you highlight a folder in the Catalog tree, the **Contents** tab will show the contents of that folder. When you highlight a file like a shapefile in the Catalog tree, the **Contents** tab will show the properties of that file.

Exploring the System Design

The organization of the files in a GIS application is an important part of the system design. A useful approach to organizing files is to create a folder for the entire project (**exer1**) and then to create folders for data, documents, map documents, picture images, templates, and other classes of files.

Within the data folder, data can be organized in folders identifying the agency that produced the data and then by the format of the data. For these exercises, you will consider yourself to be working for the organization called “agency” that is creating the GIS. Data formats may include access, dbase, excel, grids, images, shapes, or other formats.

As you work through the exercises, you will be retrieving data from and saving data to specific folders. Please make sure you understand the System Design for the exercises.

ArcCatalog Interface

Navigate to **c:\exer1\data\ctdepl\shapes** in the Catalog tree window to the left and look at the list of available databases. Click on the shapefile **TOWN_INDEX** to highlight it and then click on the

Contents tab in the window to the right of the Catalog Tree. This shapefile is a Connecticut Department of Environmental Protection geographic database distributed by the agency.

Explore the ArcCatalog interface while previewing the TOWN_INDEX shapefile.

Click on the **Preview** tab in the window to the right. When you highlight a database in the Catalog tree, Preview will show what the database looks like in terms of its geography or its table. Switch back and forth between the Geography and the Table of the TOWN_INDEX shapefile using the pull-down menu at the bottom of the window.

Metadata

Click on the **Description** tab to see the shapefile's metadata. Metadata are data about data.

Click on the TOWN_INDEX.shp shapefile to highlight it. Click on the **Description** tab in the ArcCatalog window and scroll through the metadata available with the shapefile.

Working with metadata is covered in greater detail in Exercise 2.

Help

Click on the **Help** menu and select the ArcGIS Desktop Help item. Click on the **Search** tab and enter the search term "contents tab" then click Ask to search for help on Contents. The topic "The Catalog tree and item properties in ArcCatalog" should be listed. Click topic to view the information. Read about the Contents tab and data management in ArcCatalog.

HELP IS YOUR FRIEND! Even frequent users do not always remember how to do something in ArcGIS 10. Make liberal use of the desktop help, print help topics using **Options** ⇒ **Print** to construct your own user guide, and explore help to learn more about what you can do with GIS.

Close the "ArcGIS 10 Help" window. Use the **File** ⇒ **Exit** menu to close ArcCatalog.

EXPLORING GIS

ArcMap is the module of ArcGIS 10 where databases are integrated, edited, analyzed, and mapped. Users can manage multiple data frames in ArcMap and toggle back and forth between data frames and map layouts. Users can also access ArcCatalog and ArcToolbox from ArcMap.

When you save a project you are working on in ArcMap, the file is saved with the extension **.mxd** which indicates an ArcMap map document file. ArcView 10 users will spend most of their time using ArcMap.

Go to **Start** ⇒ **Programs** ⇒ **ArcGIS** ⇒ **ArcMap 10** to start ArcMap.

In the "ArcMap – Getting Started" window, close the window you would use to open an existing map document or make a new map using a template. Then explore the ArcMap interface.

Float the cursor over various buttons and tools in the user interface to see that a label with the name of the tool appears and read the text in the lower left corner which briefly describes the function of the button or tool.

Data Frames, Layers, and Databases

When you open ArcMap, a single Data Frame is created called Layers. A Data Frame simply groups a collection of data layers that you want to display together.

So far, we have not added any data to the Layers data frame. To avoid confusion, rename the Layers Data Frame by right clicking the word Layers and selecting the **Properties** item in the menu. Then select the **General** tab and next to "Name:" enter the name Towns. Note that the map units of the display in the Data Frame are unknown. Click on the **Coordinate System** tab and note that the coordinate system is unknown. Then click OK. The name of the Data Frame in the Table of Contents window should now appear as Towns.

Add Data

Find the button labeled **Add Data** and click it. Then, click on **Folder Connections**. You should find the **c:\exer1** folder. If not, please connect to the folder using the **Connect to Folder** button.

Navigate to **c:\exer1\data\ctdep\shapes** and add the **TOWN_INDEX.shp** shapefile.

You have now added a Layer to the Data Frame. A Layer does not actually store geographic data, but it references the geographic database source stored on the computer. As we go through the exercise, we will be adding multiple layers to a single data frame, and creating multiple data frames in a single table of contents.

Right click on the Towns Data Frame (not the TOWN_INDEX shapefile) and select the **Properties** item in the menu. Click the **General** tab and note that the map units are feet then click the **Coordinate System** tab and note that the Coordinate System is now:

NAD_1983_StatePlane_Connecticut_FIPS_0600_Feet

Adding the TOWN_INDEX shapefile with its projection information set these properties of the Data Frame. Then click OK to close the Data Frame Properties.

Table of Contents

The window to the left displays the table of contents. To close the table of contents, click on the "x" in the box in the top right corner of the table of contents window. To reopen the table of contents, go to **Window** ⇒ **Table of Contents** and click the table of contents open again.

Now, look at the buttons at the top of the table of contents window. Click on the **List by Source** button to view the complete path to the data layer. Explore other list options. Then click on the **List by Drawing Order** button to return to the original table of contents.

Data Properties

Right click on the name of the TOWN_INDEX data layer and select **Properties**. Click on each tab and review its function. The **Source** tab shows that the source for this layer is the TOWN_INDEX shapefile and gives it spatial reference information. The **Symbology** tab can be used to change the appearance of the layer seen in the Data View. This tab is used in several other exercises. The **Labels** tab specifies how labels will be applied to the data layer if features are labeled.

Layer Visibility

Make the TOWN_INDEX data layer invisible by clicking off the check mark in the box in front of the name. Make the TOWN_INDEX data layer visible again by clicking the box to check that the layer is visible.

Legend Visibility

Click on the minus sign in the box in front of the TOWN_INDEX to hide the legend symbol for TOWN_INDEX in the Table of Contents. Then click on the plus sign to show the legend again.

Layer Symbology

Click on the colored rectangle for the TOWN_INDEX layer in the Table of Contents to open the "Symbol Selector" window. Change the fill color and the outline color and width and click OK. You should see that the appearance of towns in the display changes and the legend will be updated.

When you add a data layer into a Data Frame, ArcGIS applies a default symbology. If you want the data to appear the same every time you add the data layer, you can set the symbology and then save it as a layer (.lyr) file. Right click on the TOWN_INDEX layer and select **Save As Layer File**. Then navigate to **c:\exer1\data\agency\layers** and save the file as **myTOWN_INDEX.lyr** and click OK.

Then, click the Add Data button and navigate to **c:\exer1\data\agency\shapes** and add the **myTOWN_INDEX.lyr** to the Data Frame. Then click the **Add Data** button and navigate to **c:\exer1\data\ctdep\shapes** and add another copy of the **TOWN_INDEX.shp** shapefile to the Data Frame. Compare the appearance of each of these by turning the layers on and off.

Draw Order

You can change the order in which layers draw in the Data View when you have the **List by Drawing Order** button clicked in the **Table of Contents**. Click on the layer you want to appear at the top and, holding down the left mouse button, drag the layer to the top of the list. You should see a black line appear above the layer name as you do this. When the layer is where you want it to be, release the mouse button.

Remove Data

Right click on the name of a layer file and select **Remove** to remove it from the Data Frame. Then, remove the other layer file and one of the TOWN_INDEX.shp files so that you have a single TOWN_INDEX.shp file in the Data Frame.

Save

Use the **Save** button or go to **File** ⇒ **Save** to save your map document. Navigate to **c:\exer1\mapdocs** and save the file as **exer1.mxd**.

Open Attribute Table

With the cursor highlighting the name of the TOWN_INDEX data layer, right click on the data layer name and select **Open Attribute Table** from the menu that pops up. Look at the table of information for the TOWN_INDEX.shp shapefile.

To sort the records in the table based on a field, right click on the field name header in the table and select the desired sort option (**Sort Ascending** or **Sort Descending**) from the menu. Make sure that no other field is highlighted. The sort will be based on the active or highlighted field.

Right click on the field **SHAPE_area** that contains the area in square feet for each town and select **Statistics** from the pop up menu. Look at the descriptive statistics and then close the window where they are displayed. Then close the table.

Panning and Zooming

Find the pull-down window that displays the map scale. Use this to change the scale at which you are viewing the display. Type a scale into the window and click Enter. This will change the scale to a user-defined scale.

Experiment with the various panning and zooming controls: **Zoom In**, **Zoom Out**, **Fixed Zoom In**, **Fixed Zoom Out**, **Pan**, and **Full Extent**.

Use one of the zooming tools to zoom in on a portion of the map. Go to **Window ⇒ Overview** and investigate its function. Then go to **Window ⇒ Magnifier** and investigate its function.

Close the windows. Use the **Full Extent** tool to return the display to the full extent of the towns.

Selection

Open the attribute table for the TOWN_INDEX data layer. Using the mouse, click on the gray box at the beginning of a record to highlight the entire record. Notice that the corresponding town is highlighted on the map, too. Hold the mouse button down and drag to select more than one record. Use the **Show All Records** and **Show Selected Records** buttons at the bottom of the table to display all or only the selected records in the table. All records will show on the map.

Click **Switch Selection** at the top of the table to switch selections. Then click **Clear Selection**. Use **Switch Selection** after **Clear Selection** to select all records. Close the table.

It is also possible to select features graphically in the data frame. Click the **Select Features by Rectangle** tool and then click on a town in the Data Frame to select it or drag a rectangle around several towns to select them. Holding the Shift key will enable multiple sequential selections. Open the attribute table and click **Show Selected Records** to display the selected records only. Go to **Selection ⇒ Clear Selected Features** in the main menu above to clear the selection. It is also possible to select features by query. This option is used in other exercises. Close the table.

Identify

Use the **Identify** tool to identify towns by clicking the tool and then clicking in the town of interest. Close the "Identify" window.

Find

Look for towns with specific attributes. Use the **Find** tool to find all of the records that contain "Hartford" in them. Click on the **Features** tab and enter **Hartford** (no quotes) in the "Find:" box. Then, select TOWN_INDEX as the "In:" layer and click the Find button. Close the "Find" window.

Go To XY

Click on the **Go To XY** button. Make sure the units are set to Degrees Minutes Seconds using the pull-down list. In the longitude box enter **-72.670344** and in the latitude box enter **41.757763** then press Enter. Use the buttons at the top of the window to **Pan To** the location and **Zoom To** the location. You can also **Flash** the location, **Add Point**, **Add Labeled Point**, or **Add Callout**. Close the "Go To XY" window. To delete the symbols, click the **Select Elements** tool in the ArcGIS toolbar and drag a rectangle around all of the elements to select them. Then press **Delete** and save the map document.

Display Units and Measure Tool

To see the map units and display units for the Data View, go to the **View ⇒ Data Frame Properties** menu and select the **General** tab. The map units are feet because feet are the units of the Connecticut State Plane Coordinate system projection. The display units are currently feet but they can be changed. Close the "Properties" window.

Now use the **Measure** tool by clicking it to open the “Measure” window. You can measure lines, areas, or features using a variety of options and you can select the units of measurement. Explore the Measure tool. Double click to stop measuring. Then close the “Measure” window.

Layout View

Use the View menu or the button at the bottom of the View Frame to change from Data View to Layout View. Layout View is used to layout maps using the data layers you have integrated and analyzed in Data View. Make sure you click back to Data View to end.

Save and Close

Click the **Save** button and then use the **File** ⇒ **Close** menu to close the map document.