School of Geography & Earth Sciences
McMaster University

EARTH SC/ENVIR SC/GEOG 2GI3: GEOGRAPHIC INFORMATION SYSTEMS

EXERCISE 1: INTRODUCTION TO ARCGIS

Introduction

ArcGIS is a geographic information system (GIS) software package for visualizing, managing, creating, and analyzing geographic data. In this course, your will make use of ArcGIS Desktop, the most complete desktop GIS on the market. It includes the functionality listed above, plus it adds advanced spatial analysis, extensive data manipulation, and high-end cartographic tools. This exercise serves as your entry point into the world of ArcGIS, and as such, the focus of the exercise is designed to introduce you to the working environment. In this exercise, you will make use of two components of ArcGIS Desktop: ArcCatalog and ArcMap.

Due:	Beginning of your lab period on Week 4.
Instructions:	Answers must be typed using MS Word, OpenOffice, or some other word-processing package.
Grading:	Style and format is worth 20% of your mark. 1 mark is deducted for each unique mistake up to a total of 5 marks since your exercise is worth 26 marks. Please consult lab notes for Exercise 1 (Exercise 1: Overview, which is found under Exercises) for style and format.

Exercise (26 marks)

Part A: Adding Connections to Folders, Unzipping Files and Previewing Contents of Spatial Databases in ArcCatalog

A. The data for this exercise are located on Avenue under Exercises in a zip file called EX1. Copy the data to C:\Student on the local drive of your computer and unzip them to this folder. In order to unzip, right click on the file, select Extract All from the menu, type in "C:\Student" as the folder to extract the files to, and then click the Extract button. Alternatively, you can extract the files to your flash drive if you have one.

B. Open ArcCatalog by either clicking on the icon on the desktop (if available) or accessing it from the Start button (Start\Programs\ArcGIS\ArcCatalog). Examine the Catalog Tree on the left side of the screen. Here you will find all of the connections that you can make to your desktop and to servers. The Folder Connections section is where you would manage all connections or paths to the different workspaces or data storage areas on your computer. At the moment, there is nothing stored under here, so you will need to connect to a folder. On the button bar you will find the Connect to Folder button (a folder with a "+" button on it). Once pressed, a popup window will appear allowing you to navigate to any folder you choose just as you would in Windows Explorer. Navigate to C:\Student\EX1\Hamilton. If you saved the data to your flash drive, then the path will be different (for example, E:\EX1\Hamilton). Do not select any of the subfolders in the Hamilton directory.

Once you add a connection in either ArcCatalog or ArcMap, it will be present until you decide to delete it. Always remember to keep connections uncluttered and simple. What this means is that any connections that are no longer needed should be deleted, and you should not have multiple pathways to the same folder.

C. Now you will begin to explore some of the options in ArcCatalog. Click the Contents tab in the ArcCatalog main window. On the main menu bar, click Customize then ArcCatalog Options. Under the General tab, ensure that the box next to Hide File Extensions is unchecked. Click OK to close the menu and apply the changes. Notice that all extensions are visible in the Contents window.

ArcCatalog provides users with different ways to obtain information about their spatial data. The left window has the Catalog Tree, while the right window has three tabs: Contents, Preview, and Description.

D. The Contents tab is used to explore contents of folders and geodatabases, and it is quite similar to Windows Explorer. It offers four different viewing styles for content: large icons, list, details, and thumbnails. Locate these buttons on the button bar and toggle back and forth between them to see the different styles that are available.

Question (2 marks)

1. How many of each data type are stored (i.e., shapefiles, geodatabases, etc.) in the Hamilton folder? (2)

E. The Preview tab helps to explore the contents of each data set, including both the map data and the attribute data. Select ONwer.shp and click the Preview tab. The view changes to display the polygons.

F. Locate the Identify tool and click on it. Placing the tool on any of the polygons and clicking will bring up the Identify Results box, listing the attributes of the specific feature you clicked on.

Questions (2 marks)

2. What is the FID for the largest polygon in the ONwer.shp file? (1)
3. What type of feature is associated with this polygon? (1)

G. Now experiment with the zoom tools. Click the Zoom In tool and draw a box around the largest polygon in the ONwer.shp file and notice how the view changes. To return to the full extent of the map, click the Full Extent tool (the "globe" button). Now click on the Pan tool (the "hand" button). Click and drag somewhere on the screen and notice how the theme moves around. Again click the Full Extent tool to return to the full extent of the map.

H. You can use the Preview tab to create thumbnails of data sets that will appear in the Contents tab when the data sets are viewed. Click on ONveg.shp in the Catalog Tree. Change the view to the Contents tab. Notice the thumbnail image that is currently being used. This is the generic thumbnail for all polygon shapefiles. Now change to the Preview tab. A map of Hamilton should be displayed. Locate and click the Create Thumbnail button on the button bar (next to the Identify tool). Now switch back to the Contents and notice how the thumbnail has changed. If all data sets have thumbnails created in this way, you can quickly browse your themes much the same way that you would browse a catalog from a department store.

I. Now switch back to the Preview tab. You are now going to explore the attribute data that comes with the ONveg.shp file. Choose Table from the drop-down menu that currently reads Geography. The ONveg table appears.

Question (1 mark)

4. How many records (rows) are there in this table? (1)

One can also view the properties of a data set in ArcCatalog. Each type of data (rasters, geodatabases, shapefiles, etc.) can have different properties. You will explore some here. In later exercises, you will learn how to work with and change some of the properties of these data sets.

J. In the Catalog Tree, right click on ONlur.shp and select Properties. Click the General tab. There is not much to set here, but it does tell you the type of features you are working with. Click on the Fields tab. Here you can see what fields are stored in the shapefile, and their data types. Now click on the Indexes tab. Features have two types of indices: attribute and spatial. Attribute indices are used to enhance performance when searching a field. Spatial indices decrease the time required to draw and query a theme.

K. Now click the XY Coordinate System tab.

Questions (3 marks)

5. What is the name of this coordinate system? (1)
6. What is the name of the datum? (1)
7. What is the unit of measurement (i.e., angular unit)? (1)

L. If you click on other data types (i.e., raster, geodatabase etc.), you will notice that the property tabs are different.

The final tab to explore is the Description tab. Users of geographic information rely on descriptions known as metadata to provide information to help evaluate if the data are suitable for a particular purpose. Learning to read metadata is the first step.

M. In the Catalog Tree, click ONlur.shp. Now click the Description tab to examine the information. You will notice that there is not much information stored about this data set. To see a more complete description, you will need to view the proper metadata that comes with the shapefile. To view this information, go to Customize on the menu bar and choose ArcCatalog Options. In the Metadata tab, change the style from Item Description to FDGC CSDGM Metadata and then click OK. Now at the bottom of the Description page, you should see two additions, ArcGIS Metadata and FGDC Metadata. If these two additions do not appear automatically you will need to refresh the screen by clicking on another theme in the Catalog Tree, and then clicking on ONlur.shp. Explore the FGDC Metadata for ONlur.shp to answer the following questions.

Question (3 marks)

8. Who created this data set (termed "Originator" in the metadata), and when was it published? (2)
9. What is the Horizontal Datum Name of this data set? (1)

N. Exit ArcCatalog.

Part B: Working with ArcMap

A. Open ArcMap by either clicking on the icon on the desktop (if available) or accessing it from the Start button (Start\Programs\ArcGIS\ArcMap). From the pop-up window choose to "Browse for more…" under Existing Maps. In the pop-up window, navigate to C:\Student\EX1\Hamilton. Once in this directory, click on CityofHamilton.mxd and press OK. You should now see the basic ArcMap interface, with the outline of the City of Hamilton in red. In the event that nothing is on your screen, look at the Table of Contents on the left hand side of the screen. You may see exclamation marks beside each of the entities listed. Since you are using a map document that was created in a different work environment, you may have to reestablish linkages to the data. To do this, right click on each of the entities in the Table of Contents in turn (i.e., do each of them one at a time). In the context menu that appears select Properties. In the pop-up window entitled Layer Properties, click on the Source tab. You can see in the Data Source window the type of data, the name of the feature class, and the location that the map document expects to find a particular entity. Click the Set Data Source button and navigate to where your file is stored to reestablish the linkage. Do this for each entity associated with an exclamation mark.

B. Turn on the Elevation and Landuse layers (at the bottom of the Table of Contents). You will notice that the Landuse layer is not visible on the map. ArcMap draws all features in the order in which they are listed in the Table of Contents. Immediately under the words "Table of Contents," click on the List by Drawing Order button. Using your mouse, click on the Landuse layer and drag it above the Elevation layer. You should now see the land uses on your map.

C. Now you need to reset the workspaces that you will use for all subsequent analyses. First, go to Geoprocessing on the menu bar and select Environments. A new popup window will appear entitled Environment Settings. Click on Workspace and set the Current Workspace and the Scratch Workspace to C:\Student\EX1\Hamilton.

Press OK to accept the change and to close the Environment Settings window. At this point, be sure to save your map document.

Questions (6 marks)

Use the Help menu to answer the following questions.

10. What are workspaces? (1)
11. What is the purpose of a scratch workspace? (1)
12. What is a shapefile? (1) What are the three required components (i.e., file extensions) of a shapefile? (1.5) What does each component contain? (1.5)

D. In ArcCatalog you explored the properties of features. In the same way, you can explore properties in ArcMap. However, you will notice a difference in the properties that can be explored in this package. Right click on the Landuse layer and select Properties. Click the Symbology tab. You may notice that the colors are a bit odd for land use and should be changed. To change a color, double click on the rectangle beside each of the descriptions (e.g., double click the brown rectangle beside Waterbody). Once that is double clicked, the Symbol Selector is launched. You can now change the color of your symbol. Change the colors of each of the land use types to the following: Waterbody to blue, Resource and Industrial to Grey, Residential to Coral, Parks and Recreational to Green, Open Area to Olive, Government and Institutional to Orange, and Commercial to Sun. In each case ensure that the outline width around each of the symbols is set to 0. When completed, press Apply to change the colors. Click OK.

Questions (4 marks)

13. What is a layer file and how is related to a shapefile? (use the Help menu to answer this question) (2)
14. Provide a screen capture of the newly colored land uses in the City of Hamilton. To take a screen capture, hold the Shift key and press the Print Screen key on the keyboard. Next, paste the screen capture in your Word or OpenOffice document. Your screen capture must not be cropped in any way – that is, all parts of the screen must be shown – otherwise, you will receive a 0 on this question. (1)
15. Still in the Layer Properties, explore the different tabs that are available. What is the Extent of the Landuse layer file (to receive full marks, you must show units)?

E. Now you will explore properties of some of the other data sets that are included in this map document.

Questions (5 marks)

16. How many educational buildings are there? (open the attribute table to answer this question) (1)
17. How many rows and columns does the Elevation layer have? (1) What is the cell size? (1) What is the average elevation? (to receive full marks, you must show units) (1)
18. How many of each type of road exist in the Road Network layer? (you can figure this out through the Symbology tab) (1)