

ENVR/GEOG/BIOL 260 – Introduction to Geographic Information Systems
LAB 1 – Introduction to ArcGIS

Due date: September 19, 2002 (start of class)

NOTE: This lab is fairly extensive, but there are many instances where I ask you to address specific items or questions in your lab write-up. **These will be denoted by bold face and underlined text.** Be sure that you address these items in your write-up, as this is where much of your grade will come from! Also, be sure to sign the Honor Pledge below and turn in this lab sheet with your write-up.

Honor pledge: “I pledge that I have neither received nor given any unauthorized assistance during the completion of this work”

Signature: _____

Introduction

The purpose of this lab is to allow you to become familiar with some of the basic functionality of the ArcGIS software package, as well as introduce you to the basic data structures that are common to GIS analysis. You will be using the data that can be obtained off the Blackboard site for this class in the “Assignments” section (which will also contain the PDF file of this document).

While there are many tools that are useful in performing spatial analysis, GIS has become the most popular, due to its ability to integrate both spatial (ie, locational) data with non-spatial (“attribute”) data. This combination allows for a wide variety of problems to be addressed from multiple viewpoints simultaneously, an essential quality for detailed spatial problem solving.

Data

The data are in “zipped” format, which means you need to “unzip” the data to your Zipdisk prior to starting the lab. I suggest you create a folder specifically for this Lab 1 assignment, and place the data files into that folder. (Proper organization in advance of starting any project will make things go much more smoothly later in the course!) The data are included in a file called “lab1data.zip”.

The basic vector data unit in ArcGIS is called the “shapefile,” which is actually a term used to describe a combination of files that include the spatial and attribute information you are seeking to analyze. The basic shapefile structure contains a minimum of three files:

- the shapefile itself, containing the spatial data (<filename>.shp)
- an attribute database file (<filename>.dbf)
- an index file that helps to “glue” the whole package together (<filename>.shx)

These files must be in the same place for ArcGIS to be able to use the data. Also, it is very unwise to attempt to make changes to these files outside ArcGIS (for example, with a text editor or a database program), since ArcGIS is expecting a particular structure to the files. (You will learn in a later lab how to add attribute data to the shapefile by joining the database file to an external database.)

The data you will be using in this lab contains several types of land, hydrologic, and cultural features relating to the University of Richmond area, extracted from the main City of Richmond data sets. These data are in the form of shapefiles, which means that they are immediately importable into ArcGIS without any form of conversion.

In addition, you will have one raster file, containing an aerial photo of the UR campus and its surroundings. This file is in the form of a “TIFF” file, which is a common format for imagery.

LAB PROCEDURES

Part 1. Starting ArcGIS and entering existing data

Much of the basic keystroke information can be found in the Getting to Know ArcGIS Desktop book (hereinafter, “GTKAD”). In particular, chapter 2, contains information about the desktop interface and its components, and chapters 3 and 4 tell you how to add data to, and navigate, the desktop system.

Since you will be using raster imagery in this exercise, you should load the appropriate extension, by going to Tools>Extensions...” and clicking on the “Spatial Analyst” checkbox. Click OK to continue.

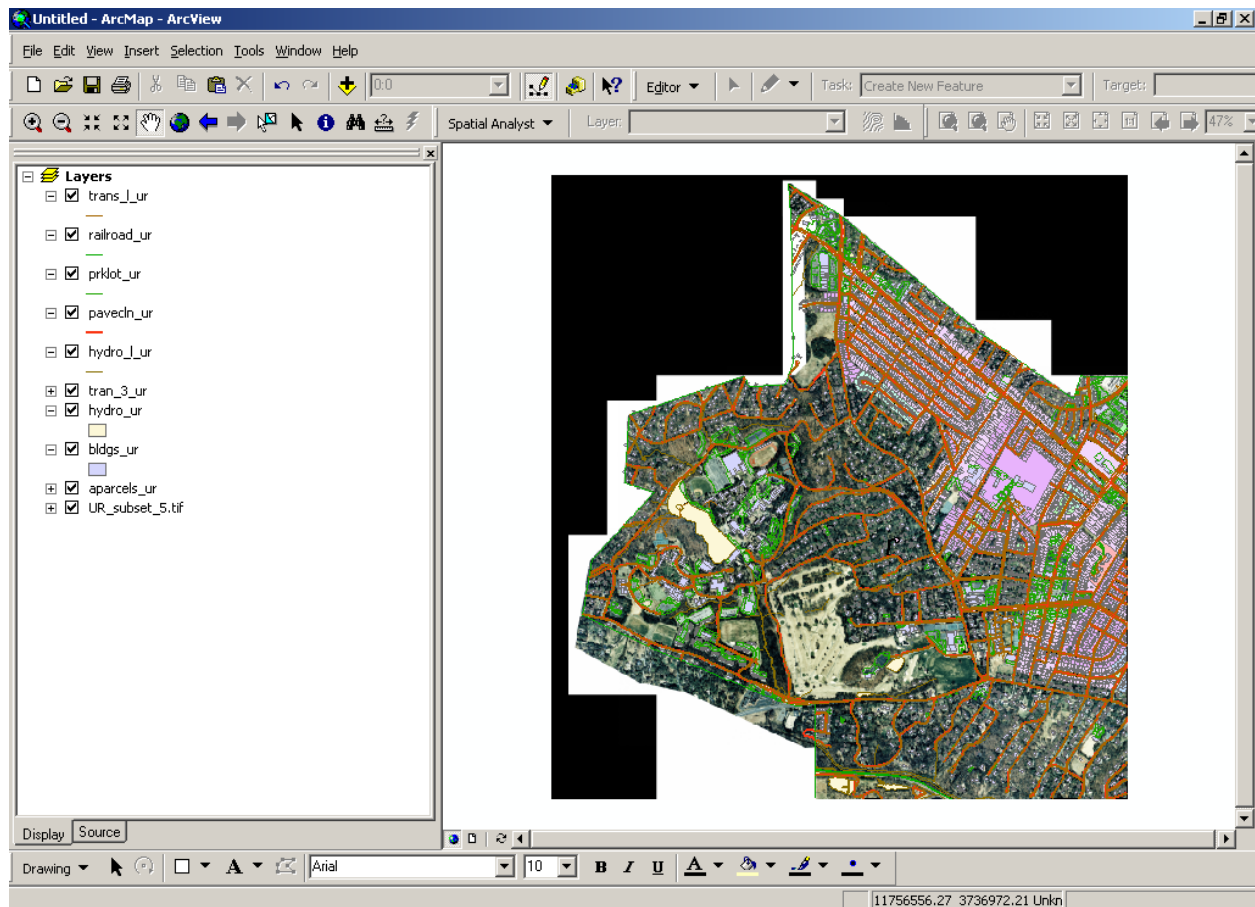
If you do not have your data directory listed when you add you data (“File>Add data...”, or by using the equivalent tool on the toolbar), you need to add the directory to the Catalog using ArcCatalog. Go to Tools>ArcCatalog to start the ArcCatalog application. Use ArcCatalog to add your data folder to the catalog (see chapter 4 of GTKAD). When you have finished, add the shapefiles to your table of contents (TOC) using the procedures in GTKAD, or simply go back to ArcGIS and use the File>Add Data tool.

You can add multiple shapefiles by holding down the “Control” key while you click on the file names. Add all the files which have either a “.shp” or “.tif” extension.

In addition, you may be asked if you want to create “pyramids” when importing the image; simply say yes, and continue the loading process.

ArcGIS is constructed along the following lines: Encompassing everything you do in ArcGIS is the “map file”, which contains all of the map information you are visualizing,

as well as any databases you are adding to your data, any layouts you construct, etc. Within a map will be one or more “data layers”, each of which contain data that has a common projection and coordinate system; in effect, the layers represent individual maps that will eventually show up on the final map product.. Each data layer can contain files that in turn hold some part of the map, such as a shapefile, a table of attributes, and image, etc. This is what the interface should look like when the shapefiles are added (the order of your items in the TOC might be different):



As you can see, you can have more than one layer going at any time, but remember that as far as ArcGIS is concerned, all the layers operate independently of one-another. You can determine what sort of data (point, line, polygon, image, etc.) you are looking at by right-clicking on the layer name, going to “Properties”, clicking on the “Source” tab, and looking at the “geometry” of the file. (Right-clicking brings up a “context-sensitive” menu, and provides access to much of the functionality of ArcGIS. You will be doing this a lot in this class!) **What are the names and types of shapefiles being used in this project?**

You can rearrange the data in the TOC by dragging them to whatever spot on the line-up you choose. Make sure the data are all turned on, and experiment with dragging various layers around, and notice how the map changes as a result.

One of the data sets is an air photo of the area in and around the UR campus. Drag the air photo to the bottom of the TOC, and turn it on. Notice how the air photo lines up with the other data sets. Zoom in to various areas to get a feel for the look and feel of the data as they relate to one-another.

In what order are the data displayed? (In other words, which layers are displayed “on top” of the map?)

Experiment with the order, and decide which order is most suited for these data. **What order did you decide on, and why? Is there a relationship between the optimal order and the type of data represented by the shapefile?**

Notice that in the lower part of the map window is a set of coordinates, reflecting the location of the cursor in the window. Since the data are already projected and have had a coordinate system applied to them, the coordinates you see in the map window correspond to the projected coordinates of the location of the cursor, and change as you move the mouse around. (More about projections and coordinates in a later lecture.) In this case, the data have been projected into a Lambert Conformal Conic customized for Virginia, and the Virginia State Plane coordinate system has been established for the data. This system has all of its coordinate information displayed in “feet” rather than degrees or meters (as is common in unprojected or UTM systems, respectively). In addition, the first number represents east coordinates (“easting”), and the second represents north coordinates (“northing”).

Use the zoom tools, and zoom in on the University of Richmond campus. **What are the coordinates for the following features at UR?**

East entrance to the Commons from sidewalk:
_____ east, _____ north

Gazebo on walkway across Westhampton Lake:
_____ east, _____ north

Center bell tower on Jepson Hall:
_____ east, _____ north

Bus stop at east entrance into campus:
_____ east, _____ north

Main campus welcome sign at entrance to campus off “Snake Hill”:
_____ east, _____ north

Part 2. Viewing shapefile information

Each of the themes inside a layer can have its appearance altered in the table of contents. This is especially helpful when the associated database files contain a variety

of attribute data that might help you to visualize the data. You can have the layers displayed according to some attribute contained in the database file. To do this, double-click on the layer name in the TOC (or right-click and choose “Properties”), and select the “Symbology” tab. Try this for the Pavement Clean Lines layer (“pavecln_ur.shp”) (In this case, the layer being used represents the “pavement clean lines,” which are the centerlines of all the paved streets in the area.) Click on “Categories”, then click “Unique values”, and click on the arrow next to the “Values Field” and choose “ST_type,” which contains the type of paved street in a separate legend category. (To make sure that you get all the values from this field added to the list, click the “Add all values” button.) **How many different categories of streets are represented in this file, and how many of each type exist in this file?** Experiment with changing the colors and line weights for some of the themes by double-clicking on the symbol, and choosing the various properties being displayed. (Note that you have to hit “Apply” for the changes to take affect.)

Go through each of the vector layers, and create an appropriate legend for each layer, using the information you discover when navigating the data. (Note that you cannot change the color scheme for the raster image, only turn it on and off.) Change the naming of each legend category, as well as the name of the layer itself, to best describe what you are looking at, using the “Properties” of each layer. (In other words, make the map as intuitive as possible for the viewer.) Note that for some data layers, it may be most logical to have only one legend category. Be sure to justify in your write-up your decision on categories!

Part 3. Using the Map Layout view.

One of the nice things about ArcGIS is that you can quickly make publication-quality maps. When you start working on a project, you are put into the “data” view by default. However, you can see how your current map might look by going to View>Layout View. In this view, you can click on a map to resize it, reposition it, and add extra map elements, such as scale bars, north-arrows, and legends. You can add multiple instances of objects, as well; for example, you can add several legends, each reflecting a different data element (hydrology, building parcels, etc.) on the map.

For this project, resize your finished map so that it fits neatly on the top portion of the layout page. Next, individually add legends for each of the data elements, using the legend tool found under Insert>Legends. Make sure you only add one legend at a time, since the legend box can get very cluttered otherwise, and remember that *neatness counts!* Accept the defaults when adding the legends, and then resize the legend so that it fits well on the page, with sufficient room to add the other legends. Also note that under most circumstances, you do not need to add legends if it was not appropriate to categorize the elements; for example, do not add a legend for the aerial photo. Rearrange all the legends so that things don’t get too messy, and make sure they don’t overlap!

Part 4. Exporting the resulting map.

You will often want to make a copy of the images you create in ArcGIS, for use in other programs (such as Word, in your lab write-up). To export the map, first make sure that you are in the Layout view, then go to File>Export Map. While ArcGIS allows you to export the view in several different formats, I recommend using the standard “JPEG” file type (**not** the ArcPress JPEG type, since we do not own a license for ArcPress), as the resulting files are (usually) much smaller than the others, and readily recognized by Word, PowerPoint, and other programs. Choose “JPEG” as the file type, navigate to the folder you want to put the file into, and give it a name. Go to “Options” and choose “300” for the image resolution (in general, try to match the image resolution to your output device; 300 for most printers, 96 for most displays), and place the “Quality” slider in the middle of the range. Click “export” when you have set the proper parameters, and the image will be placed in the folder you indicated above. This image can then be inserted into a document in MSWord, PowerPoint, etc. **When writing up your lab, be sure to include this file in your document.** (In Word, go to “Insert>Picture>From file...” and navigate to your file. Be sure to resize the image to fit well on the page!)