

Getting Started with ArcGIS: Visualizing and Analyzing Ecological Landscapes

Geographic Information Systems (GIS) are software systems used to visualize and analyze geospatial data. What makes geospatial data unique is that they can be put on a map; that is, they have defined spatial relationships to one another and to other sets of geospatial data and they have coordinates that define their absolute position on the face of the earth. GoogleEarth and other such applications are simply large, preselected GIS presentations. But GIS software was first developed as a much more flexible tool to be used in any number of applications, from regional planning, to geology, to warfare.

As you can imagine, GIS is a very useful tool for ecologists, since we are concerned with the interactions between organisms and their environments. All of those interactions take place in some geospatial context at some particular place on the face of the earth.

Today's exercise is built around learning some of the basics of GIS, using the most widely-used GIS software package, ArcGIS. Here at Kenyon, ArcGIS is available on most of the public computers in the biology department (including the reading room and the Fischman 009 lab), so you can access it at almost any time.

Getting Started: Define the locations of the data you want to use

We have to begin by letting the program know where to look for data, for this we use the program ArcCatalog.

- Start ArcCatalog (Start > Programs > ArcGIS > ArcCatalog)
- Maximize the window
- File > Connect Folder
- Navigate to: P:\data\maps\Knox Orthos 2004 04 15 and click OK, then
- Navigate to: P:\data\BIOLOGY\Biol229\BFECGIS and click OK
- Expand this directory in the left window of ArcCatalog and highlight "BFEC_gis"

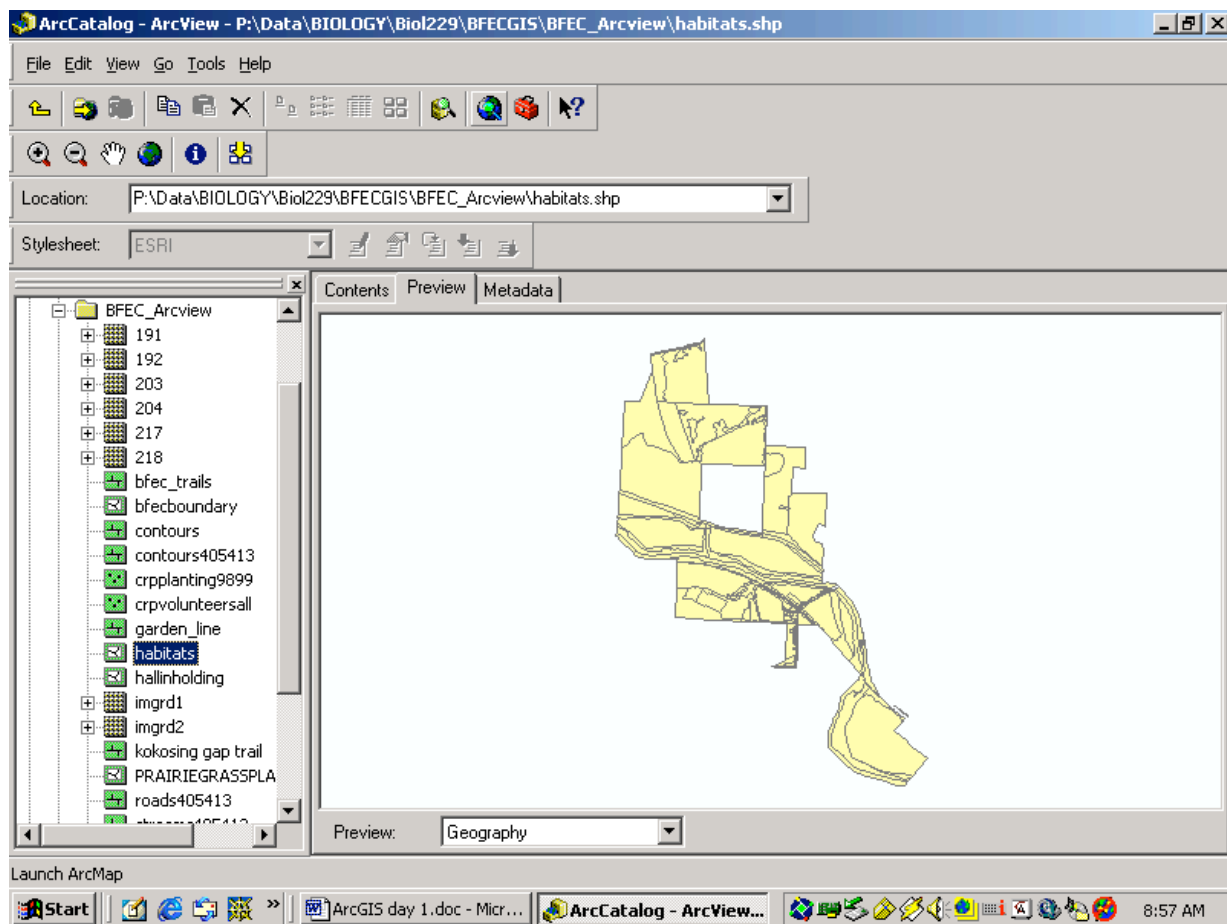
There are two basic types of data in a GIS

1. VECTOR – for these the data are encoded by the position of points lines and polygons (e.g., property boundaries, roads, rivers, cover classes, individual trees, or nesting sites)
2. RASTER – for these the data are coded into cells or pixels that contain particular values (e.g., aerial photos, gridded elevation surfaces, satellite imagery)

Lets start by highlighting some vector data:

Highlight & preview *bfecboundary* (a vector file -- single polygon)

Preview 204 from “Orthos” (**do not build pyramids**) – this is a raster file
 Preview *bfec_trails* (a line file) and *habitats* (a set of polygons)



Beginning Visualization: Starting a map project for the BFEC

GIS allows you not just to catalogue a bunch of geospatial data, it also allows you to visualize how different data **layers** relate to one another. By putting different data layers together, you can develop a better picture of how different aspects of the environment are related to one another in space. Each of you will start your own map project for the BFEC. You will return to this project later, once we have collected and databased our own forest data.

- Launch ArcMAP (blue “globe & magnifier” icon on the toolbar)
- Select “a new empty map” and check “immediately add data”
- “Look in” the BFECGIS directory
- Select the following files: *229roads*, *229soils*, *229waterways*, *bfec_trails*, *bfecboundary*, *contours*, *habitats*, *hallinholding*, *Kokosing gap trail*.
 [A message indicating missing spatial reference info may pop up – click OK]

Maximize the ArcMap window.

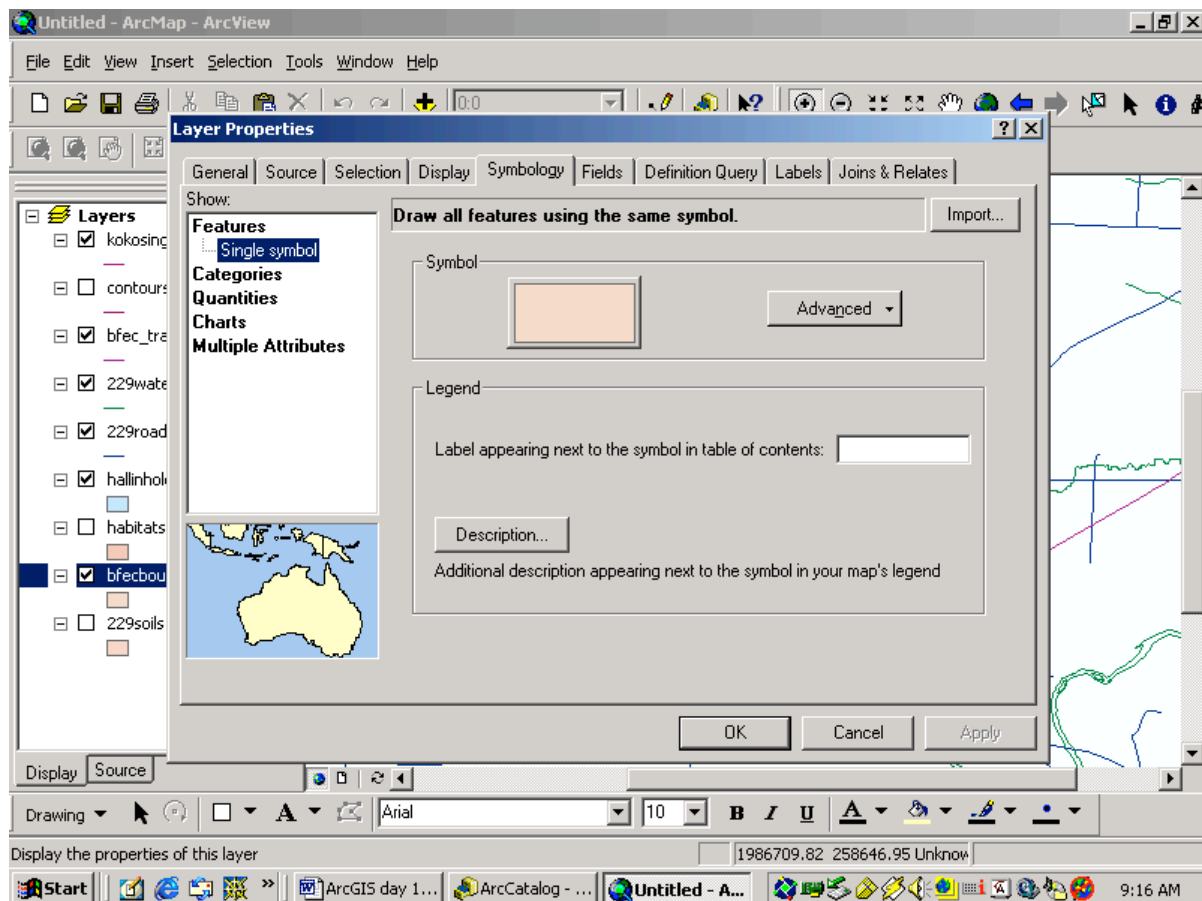
Note the Layers Window in the left panel. Uncheck *contours*, *habitats*, and *229soils* to simplify the Map Window on the right panel.

Make sure your toolbars at the top of the ArcMAP window include the “Tools Toolbar” – Use “View>Toolbars” to add if necessary.

Use the “magnifying glass” tool to draw a box around the BFEC boundary, and zoom in.

Display of data can (and often should) be modified, for example, lets change the bfec boundary polygons so they are see-through, along with a few other changes.

- Right click on “bfecboundary” and select “properties”
- Click on the “symbology” tab at the top of the properties window
- Double-click on “symbol” and choose “hollow”
- Change the “outline color” to a red and the “outline width” to “1”
- Click on the “general” tab at the top of the properties window
- Change the “layer name” to “boundary”
- Click on “OK”



Use these same techniques to make streams blue, roads black, and soil polygons hollow

Now let's change the "habitats" layer to better highlight different types of habitat:

- Right click on "habitats," select "properties," and go to "symbolology"
- In the left panel, choose "categories" and "unique values"
- In the "Value Field" on the right, select "Habitat" then click on "Add All Values"
- You can modify the color and symbol for each habitat type if you wish:
 - Click on a symbol > select a symbol from the pop-up window

Note that the order of the layers (in the left-hand panel) influences the display of the map; top layers hide bottom layers. Click on all the boxes with a "minus" to hide the legends. Now use the mouse to drag layers for contours, roads and waterways to be at the bottom of the Layers Window.

Save your Project to your H drive so you have your own version to work with

Use a file name that makes sense, such as "bfec gis model"

Visualizing raster data: add aerial photos of the study area to your project

Aerial photographs can be used to create new layers for landscape features, and they are useful in interpreting context for your data.

You can add data to your project in two ways: through the "File" menu and selecting "add data" or by right clicking on "Layers" in the Layers Window and selecting "add data."

- A file dialog box appears. Select 203, 204, 217, and 218 (these are four of many aerial images of Knox County, but together they encompass most of the BFEC and Gambier area)
 - If another dialog box appears asking if you want to "build pyramids." Select **"NO"**

Make sure the photos are at the bottom of the Layer Window, then make sure they are visible.

Navigating in the map window

When different layers have very different extents, it is sometimes hard to get your bearings.

To quickly zoom to an appropriate scale: Right click on the layer defining the extent you want (e.g., the BFEC boundary) > "zoom to layer"

From the Tool Bar, you can use the "hand tool" to move the map location, or use the "zoom in" or "zoom out" icons to incrementally change the scale.

Starting Analysis: Getting information from your map

GIS is not just for making pretty pictures. The powerful part of the software is that all of the features, layers, and points that you can put on a GIS map can also have ***attributes (i.e., data)*** attached to them. For example:

- Right click on the “soils” layer > “Open Attribute Table”

What categories of information do you see? Information from different layers can be combined, and proximity to features can be calculated.

Later in the semester, we will use ArcGIS to analyze our forest survey data, as well as to relate changes in forest diversity, density, and species composition to differences in site conditions.

Save your Project again. In future sessions, you can open ArcMap and your project file by double-clicking on the file name.