Use of Landsat data
GEPL 4490/5490

In this lab, we will work with a Landsat 7 image of someplace in Ohio. This is an Enhanced Thematic Mapper Plus image. We will look at the effect of different band combinations and stretching of the contrast of the image. We will also make histograms of each channel so we can observe how the DN's vary with cover type.

Look at the individual channels to answer the following questions…

Resolution:

1. What is the smallest object you can detect in the image (name one or two specific things you can find)?

2. Often in satellite images, we are able to detect objects that are smaller than the resolution of the image. How are we able to detect these objects? I.e. what properties about the object allow us to detect it.

Spectral Profile:

3. Use the Spectral Profile Tool to print out a profile of image for water, forest, agriculture, sedimented water and urban areas. In the Viewer menu bar, click on Raster → Profile Tools… In the Select Profile Tool window that pops up, click on Spectral and click on OK. In the Spectral Profile Viewer that pops up, click on the "+" and then click on the image on a pixel that is the cover type you want. The spectral profile for the pixel you have chosen should be shown. Repeat this for all of the cover types and print out the profile results. Click on Edit → Chart Legend to change the names of the legend, the color of the lines and the thickness of the lines so your plot can be read more easily.

Stretching Data:

Contrast stretching the digital numbers will allow you to "see" or "highlight" things in the image that were not previously visible. For each of the following questions use the spectral profiles from above and image stretches listed below in a and b. You may want to stretch individual channels in different ways to optimize the contrast for your image. There are several ways to affect the contrast of an image channel.

a. Go to Raster → Contrast → General Contrast in the Viewer Menu bar. Make changes to the entire image and all of channels simultaneously in this manner by choosing each of the stretches in turn.
b. Another is to open the Breakpoint Editor from going to Raster → Contrast → Breakpoints… The Breakpoint Editor will open up showing histograms for red, green and blue. These are the histograms that you are to look at in question #10 below. Click on the lightning bolt to open an individual histogram. Click on the breakpoints and drag to change the stretch of the image. You can also add breakpoints or take them away.

4. Which individual band(s) show urban/cultural features best? As you answer this question remember that a brighter (white) signal corresponds to higher reflectance.

5. Which individual channel shows vegetation best? Water? Sediment?

6. Aside from intensity of signal, what other photo interpretation elements can you use to identify vegetation, agricultural vegetation and forested areas?

Now, change the channels in the ERDAS Viewer so that the channels will make the image appear as a true color photograph i.e. put channel 1 in blue, channel 2 in green and channel 3 in red. Do this in Raster→Band Combinations.

After stretching the individual bands using the breakpoint editor to enhance your interpretation of the image.

7. How does color help or hinder identification of agriculture between this image and the false color image?

8. Can you see any topographic relief in this image (I know, Toledo is pretty flat, but there is some)? Since it is so flat, there will be no shadows. But there is something else about the landscape that allows you to see the topography. What helps you determine the occurrence of hills?

9. Name two features that are more easily discernible with information from multiple channels than if you looked at only one channel. Explain why they are more discernible.

Making and Using Histograms:

On the main Erdas tool bar, go to Tools → Image Information. You will then need to open the image in the Image Information tool. Use View→ Histogram to make a histogram for each band.

10. Print out a histogram for each channel to hand in with this lab write-up. Are there any natural breaks in the histograms? A break is an area in the histogram where the distribution is not continuous, i.e. there is a dip. Specify the channel and the value of the break. You will have more than one channel.

11. What is the most likely cause of the break? To assist you in answering this question, use the Inquiry Cursor to look around the image to see what typical values of each cover type is.

Unsupervised Classification:

For the end of this lab, I would like you to do an unsupervised classification of the cover types in the image. This will be a quick and dirty type of classification. ERDAS will perform the unsupervised classification for you using what is called the ISODATA algorithm. You just have to specify the number of classes that you want in your image. Next semester we will do a supervised classification. This will take much more user interaction. We can then compare the outcomes of the two.

-Click on the Data Prep icon on the main menu. The data preparation menu will open.
-Select Unsupervised Classification. A new window will pop up.
-Enter your image as the input Raster file
-Enter the output image name
-We would like to find 7 classes.

The computer will cluster the pixels into 5 classes using the Landsat channels. ERDAS will go through a number of iterations until all or a percent of the pixels fit into one class or another. Specify 24 as the maximum number of iterations. Specify .95 as the convergence threshold. This says that it will stop classifying the image when 95% of the pixels fall within a class.

-Click on OK. This process may take a long time also.
-Open the image in a viewer.

12. What are the main cover types of the 7 classes that the program identified?

13. Would having more or less classes help?