

Name: _____

Remote Sensing of the Environment
GEOG/GEOL 4093/5093
Fall Semester 2009

Lab Exercise #11: 11/19/2009
Due 12/03/2009

Vegetation/Biosphere Applications of Remote Sensing

Part I: Normalized Difference Vegetation Index (NDVI)

The pigment in plant leaves, chlorophyll, strongly absorbs visible light (from 0.4 to 0.7 μm) for use in photosynthesis. The cell structure of the leaves, on the other hand, strongly reflects near-infrared light (from 0.7 to 1.1 μm). The more leaves a plant has, the more these wavelengths of light are affected, respectively. Researchers can measure the intensity of light coming off the Earth in visible and near-infrared wavelengths and quantify the photosynthetic capacity of the vegetation in a given pixel of land surface. In general, if there is much more reflected radiation in near-infrared wavelengths than in visible wavelengths, then the vegetation in that pixel is likely to be dense and may contain some type of forest. If there is very little difference in the intensity of visible and near-infrared wavelengths reflected, then the vegetation is probably sparse and may consist of grassland, tundra, or desert. Nearly all satellite Vegetation Indices employ this difference formula to quantify the density of plant growth on the Earth — near-infrared radiation minus visible radiation divided by near-infrared radiation plus visible radiation. The result of this formula is called the Normalized Difference Vegetation Index (NDVI). Written mathematically, the formula is:

$$\text{NDVI} = (\text{NIR} - \text{RED}) / (\text{NIR} + \text{RED})$$

Calculations of NDVI for a given pixel always result in a number that ranges from minus one (-1) to plus one (+1); however, no green leaves gives a value close to zero. A zero means no vegetation and close to +1 (0.8 - 0.9) indicates the highest possible density of green leaves.

Launch Internet Explorer and type [\\nyx\rs4093](http://nyx.rs4093) into address bar and hit enter, that takes you to the remote sensing class folder “rs4093” in CIRES server. Copy the folder “Lab_11” to “C:” drive.

Begin by opening the file “C:\lab_10\k_ordway_preserve_TM” in ENVI. This is a Landsat TM scene of the Katherine Ordway Nature Preserve in Gainesville, FL.

Display a color composite of the image and compare it to the topographic map (nw_ordway_topo.jpg). The set of lakes in the north-central TM image correspond to the lakes in the east-central topographic map image.

1. Do the lake levels appear higher in the image or on the topographic map (4)?

Perform an NDVI (under Transforms menu in the ENVI toolbar) on the TM image. Output the NDVI to Memory. Choose Gray Scale. Open in a new window and link to composite. Use the topographic map for locations and comparisons.

2. What areas have the highest NDVI? Is this different than expected (4)?

3. What areas are lowest in NDVI? Is this expected? (4)

Part II: Ratio Vegetation Index (RVI)

The RVI is a simpler vegetation index, and is over 30 years old. The RVI is defined as: $RVI = NIR/RED$ and simply divides the near infrared reflectance values by the visible red reflectance values. Here we will compare the two indices. Under Basic Tools, choose Band Math. Enter the following Expression:

float(b4)/float(b3)

This instructs the computer to divide the NIR (b4) channel by the Red channel (b3). The **float()** operator is necessary here since we are looking for values that are fractions and our original data are all integers.

Upon clicking OK, you are asked to define the variables **b4** and **b3**. Choose Band 4 and Band 3 of the TM image for the variables, respectively. Output the calculation to Memory.

4. Open RVI in Display #1 (still linked to NDVI display). How do these indices compare (4)?

8. Make a 2D-Scatterplot of NDVI vs. ISODATA. Why does the scatterplot look like this? What is the flaw in comparing these two algorithms (4)?