Name: _____

Remote Sensing of the Environment
GEOG/GEOL 4093
Fall Semester 2011
Lab Exercise #4: 09/23/2011
Due: 09/30/2011

Part I: Concepts

(1) How many Landsat ETM+ images can you find of Boulder for the last 9 years? Use online tools to find these images. Typically, you must know the lat./long. of your target area. **Provide a print-out for the Path/Row and order number for the images found.** (4)

(2) Name two spectral bands of the Landsat Thematic Mapper (TM) and discuss their use? (2)

Part II: Change Analysis: Lake Turkana, Africa

In this lab you will be analyzing two images acquired of Kenya's Lake Turkana from the Landsat Multi-Spectral Scanner (MSS). The lake borders Ethiopia and Kenya and is subject to periodic droughts and flooding. It is also extremely sensitive to other environmental changes in the area including deforestation and poor land-use management. The first image was acquired on 1-Feb-73 by Landsat 1 and thus has band numbers 4 through 7. The second image was acquired on 12-Jan-89 by Landsat 5 and thus has band numbers 1 through 4.

Importing Turkana Images

Navigate *to Z:\Geog Files\Hart\rs4093* and copy the folder "*Lab_4*" to *"D:"* drive. The 1973 and 1989 data should now be located in the folder "D:\lab_4\TURKANA". The file names are given as "FEB73" and "JAN89" with an extension that refers to the band number (e.g. "JAN89.CH1" for Band 1 of the MSS image from January of 1989). Unlike the data you have worked with in previous labs, these data are not in a format that is directly readable in ENVI. Frequently in remote sensing we must gather information about the images and then we must import them into our remote sensing software.

Every image may be thought of as a 2-dimensional array with brightness values associated with each array element. Your job is to tell the computer how many rows and columns there are in the image. In remote sensing we refer to rows as **lines** and columns as **samples**. This is the nomenclature that will be used throughout the course. Usually this information is provided by the data center (the people whom you ordered the image from) in a text file or a data description report. Below is an example of what a report might look like for one of the images. **The key information to focus on is the number of lines (NL) and samples (NS).** The number of bands (NB) is not important because they are each stored in individual files. The remainder of the data is all made up to demonstrate what a header file might look like. The date at the end, however, tells you which image this header file belongs to.

Header file for 1973 Images:

ENVI
description = {
File Imported into ENVI.}
samples = 3240
lines = 3243
bands = 1
header offset = 0
file type = ENVI Standard
data type = 1
interleave = bsq
sensor type = Unknown
byte order = 0
wavelength units = Unknown

(1) Write the number of lines and samples for the 1973 image below. Obtain this information from the header file above. (1)

Lines: _____ Samples: _____

Import one of the bands from this image into ENVI. When you choose "Open Image File", ENVI will prompt you for the information it needs to open the file. Use the number of samples and lines from above. **Specify that there is only 1 band in each file. You may use the defaults for the rest. ENVI will now create its own header file for this image. Consequently, you will not ever have to specify this information again.** In fact, the header file will apply to all images with the same file name (regardless of the extension), so all other bands from that image will open without providing this data. Load all four bands of the first image into the available bands list.

(2) Display as close to a true-color composite as you can. Which bands did you use? (4)

Header file for 1989 images:

samples = 3548
lines = 2983
bands = 1
header offset = 0
file type = ENVI Standard
data type = 1
interleave = bsq
sensor type = MSS
byte order = 0

Again, import each of the bands of the 1989 image into your available bands list. You can have more than 1 image open at a time by clicking "display #1" and selecting "New Display", which will open up a new image window that you can load bands into.

(3) Display as close to a true-color composite of the 1989 image as you can. Which bands did you use? (2)

(4) What band or combination of band allows you to most clearly see the Lake Turkana delta and *why*? (4)

Calculating the Area Change

Display the images so that you can best see the entire delta. You will use the **"Region of Interest" (ROI)** feature in ENVI to calculate the area of the delta in each image. This feature may be found under "Basic Tools in the ENVI main menu or under "Tools" in the Main Display Window. Define the ROI by selecting a window to work in (i.e. image window, scroll window, or zoom window) and then carefully digitize (draw) a polygon around the vegetated area of the delta below the large fork in the river in the 1973 image. Do this by holding down the right mouse button or by clicking the left button to connect individual points. To end the polygon, double-click the right mouse button. Do this for both images (open a ROI tool for each image).

(5) Under the "Options" menu in the ROI window, select "Report Area of ROI's". Select the appropriate units (m^2). You must tell the program the pixel resolution of the image you are using. The net area change will be reported in a new window. Report the area of the delta in each image. Show any calculations and provide explanation of how you determined the change. (5)

(6) Speculate why the delta has grown so much. Also comment on why the delta (even though it is relatively new) is so well vegetated. (4)

(7) What do you think that the bright feature is to the north east of the lake in the 1989 image? Why do you think this? (4)