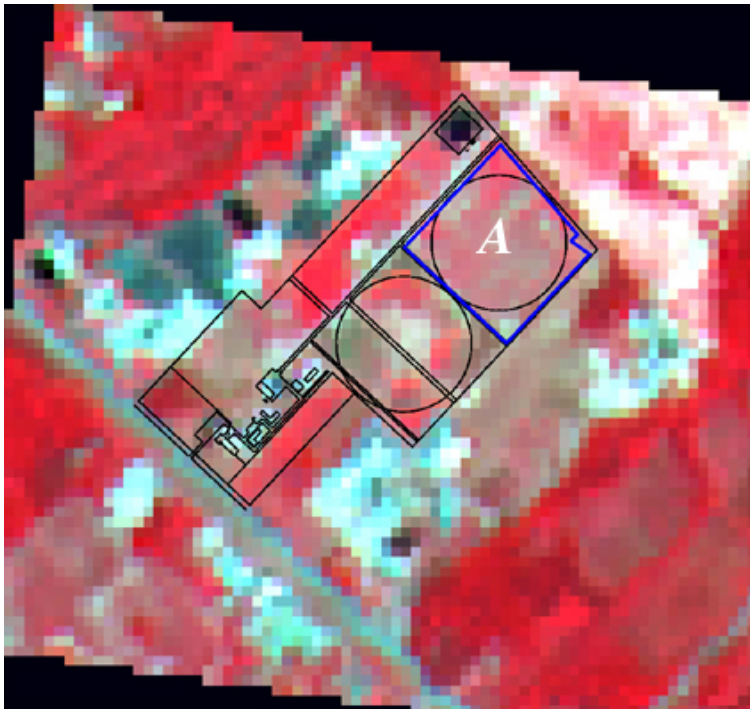
Seasonal Progression of the Normalized Difference Vegetation Index (NDVI)

For this exercise you will be using a series of six SPOT 4 images to look at the phenological cycle of a crop. The images are SPOT 4 scenes of a soybean field in Florence, SC maintained by the USDA Coastal Plains Soil, Water, and Plant Research Center. The field measures about 280 x 280 m. We will be looking at pixel locations in a soybean field and investigating the change in spectral response and NDVI over a period of four months (from August to October).

In August the soy field is green (see photo below).

By the end of October the crop has finished its growing cycle (below):

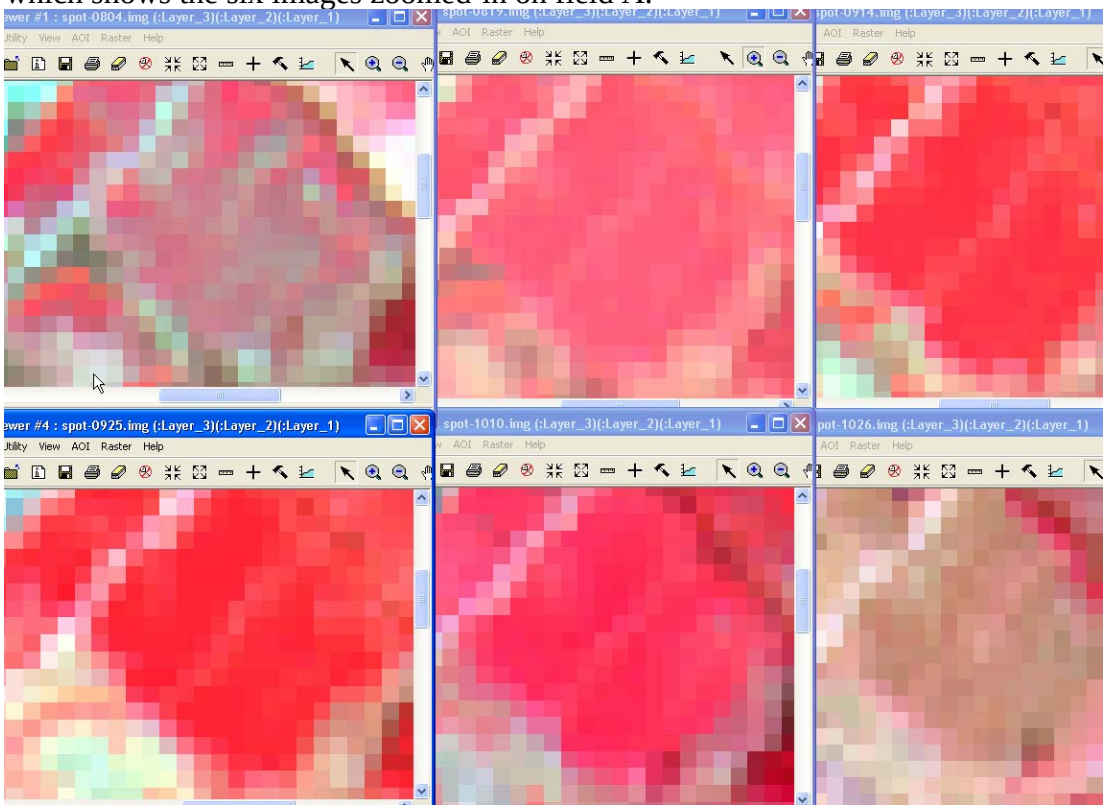
The Imagine files spot-0804.img, spot-0819.img, spot-0914.img, spot-0925.img, spot-1010.img, spot-1026.img present 4-band SPOT images of the area taken between August 4 (0804) and October 26 (1026). The location of the soy field we will examine is shown by field 'A' in the image below:



This false color image projects SPOT bands 3, 2, 1 as R, G, B.

1. To what wavelengths do SPOT bands 1, 2 and 3 correspond?

The greening of the field and its subsequent browning are evident in the screen capture below which shows the six images zoomed-in on field A.



Your job is to make 2 plots:

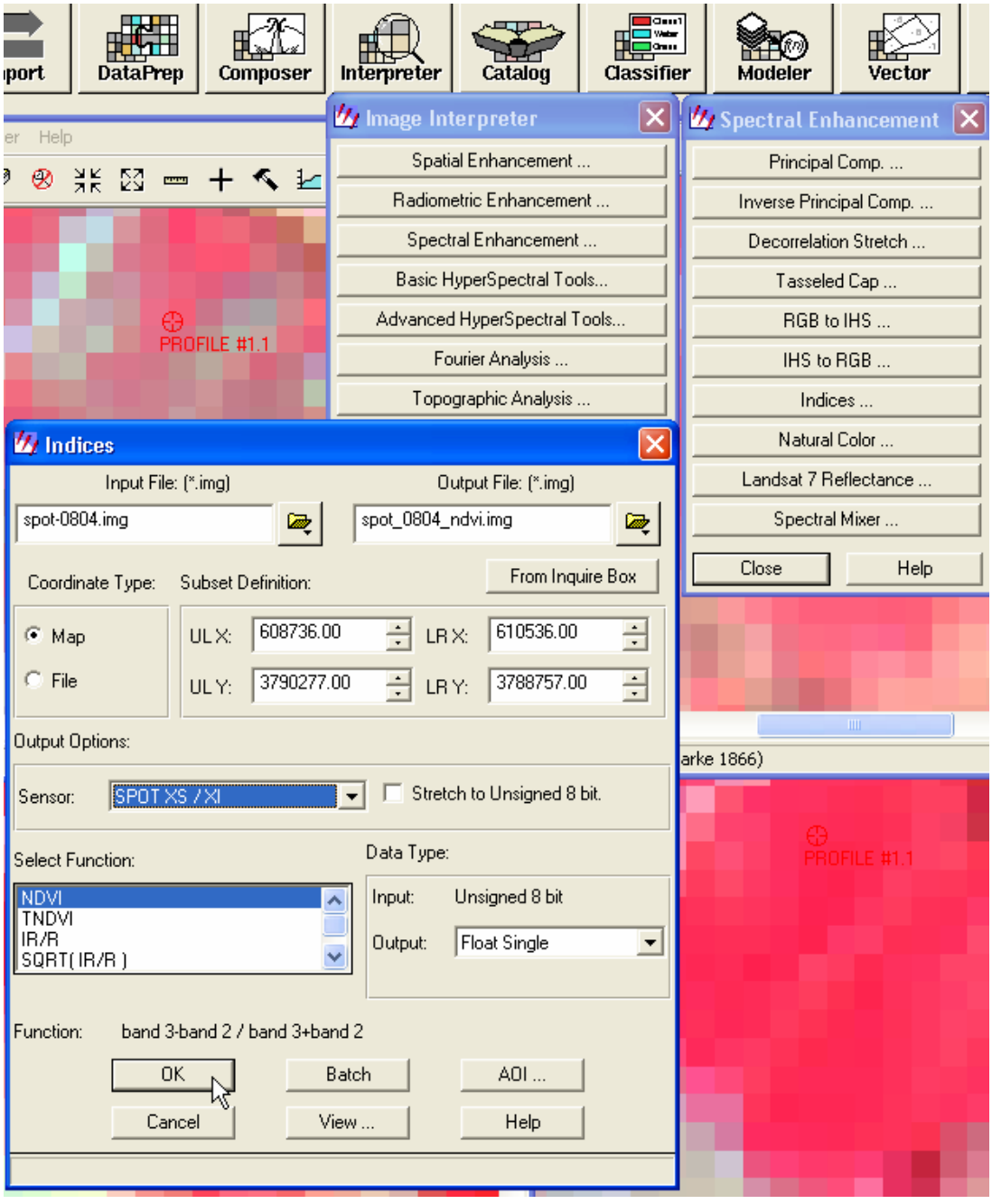
1) showing the seasonal progression of the NDVI for two or more pixels in the soy field
2) showing the spectral signature for soy and track its seasonal change

Please use the following tools to aid you.

Task 1.

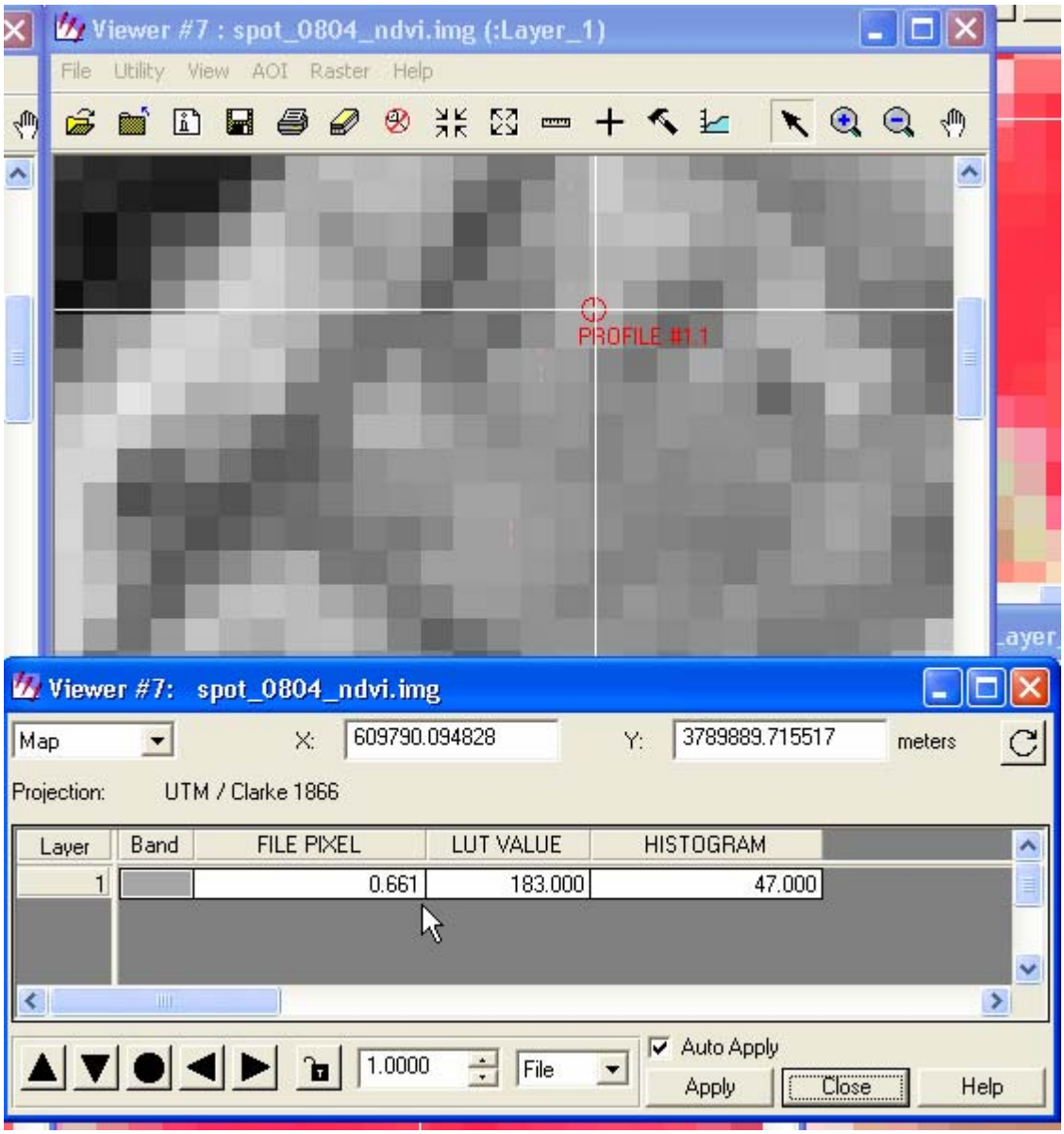
NDVI is computed for an image through the Interpreter menu -> Spectral Enhancement -> Indices. Give the input and output file names, choose SPOT as the sensor, set the function as NDVI, and make sure that the output is specified as "Float Single".

2. To what does the line "band 3 – band 2/ band 3 + band 2" refer?

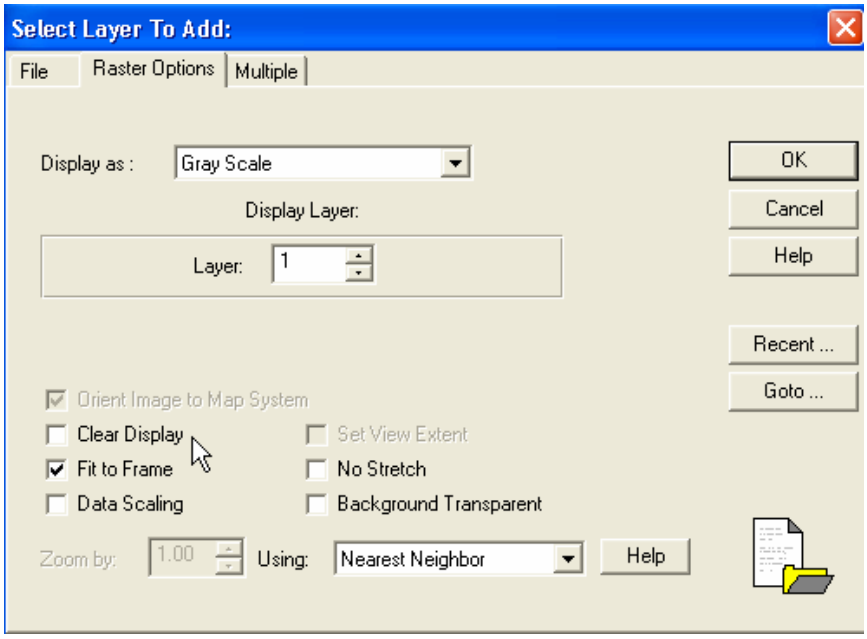


You will need to create six NDVI Imagine files – one for each of the SPOT images (August thru' October).

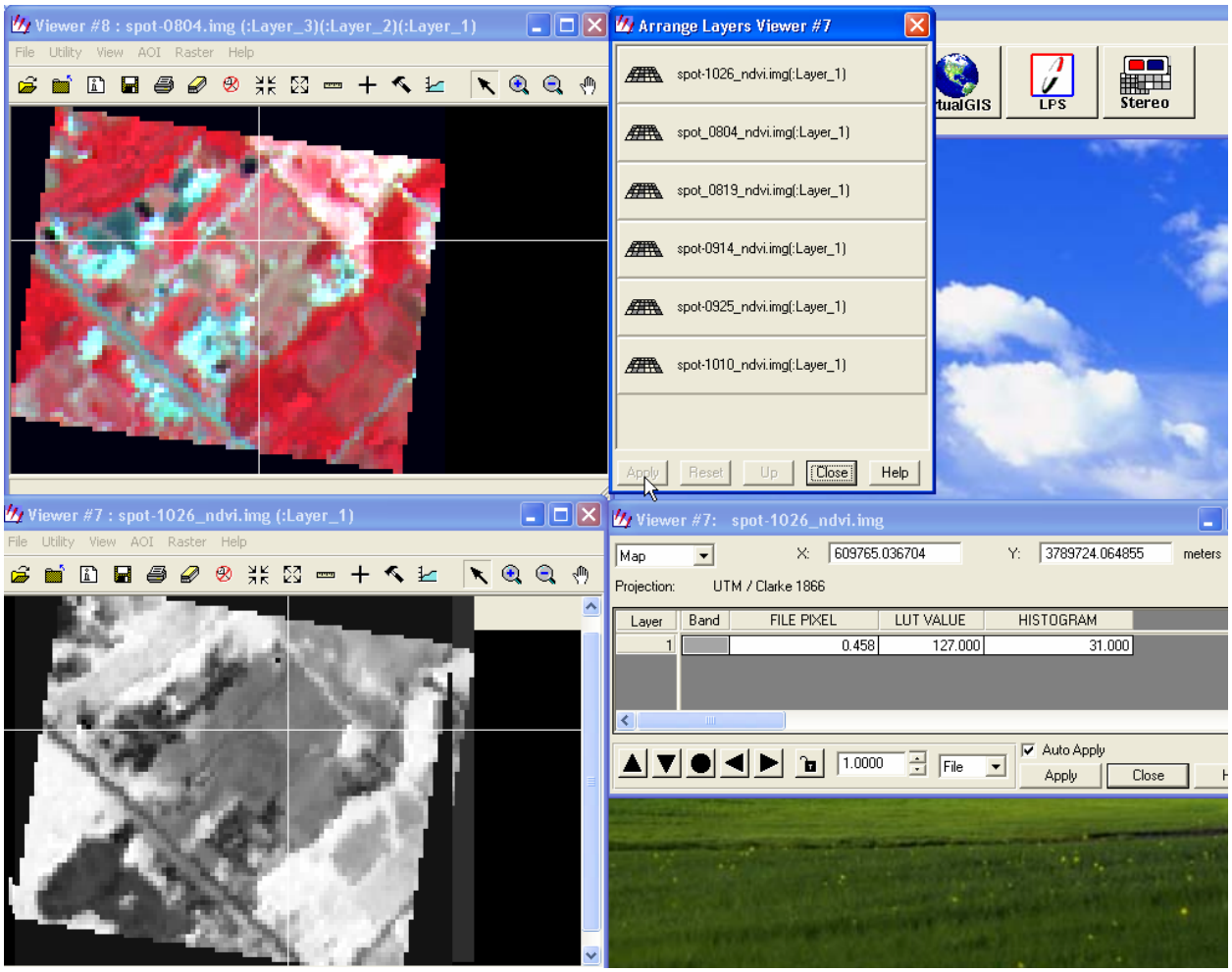
There is more than one way to examine the seasonal change in NDVI, but you need to make sure that you are selecting the same pixel in each of the images in the sequence. This can be done by linking six viewers, each of which contains one NDVI image, and then using the Inquire cursor to query the pixel value of some pixel. If the viewers are linked, the crosshair will be positioned at the same pixel in each of the images.



Another way to do this is to open each NDVI image as a different layer in a single viewer. (To do this open the NDVI image as a Raster layer but before selecting the 'OK' to Open the file, click on 'Raster Options', make sure the 'Clear Display' option is not checked, and check the 'Fit to Frame' box so they are all sized the same inside the window.)



Then the Inquire cursor can be used to find the pixel value of some pixel in the image. By then re-arranging the order of the layers, different images can be brought up to the top one at a time and the crosshair will stay positioned over the same pixel as you iterate through the layers.

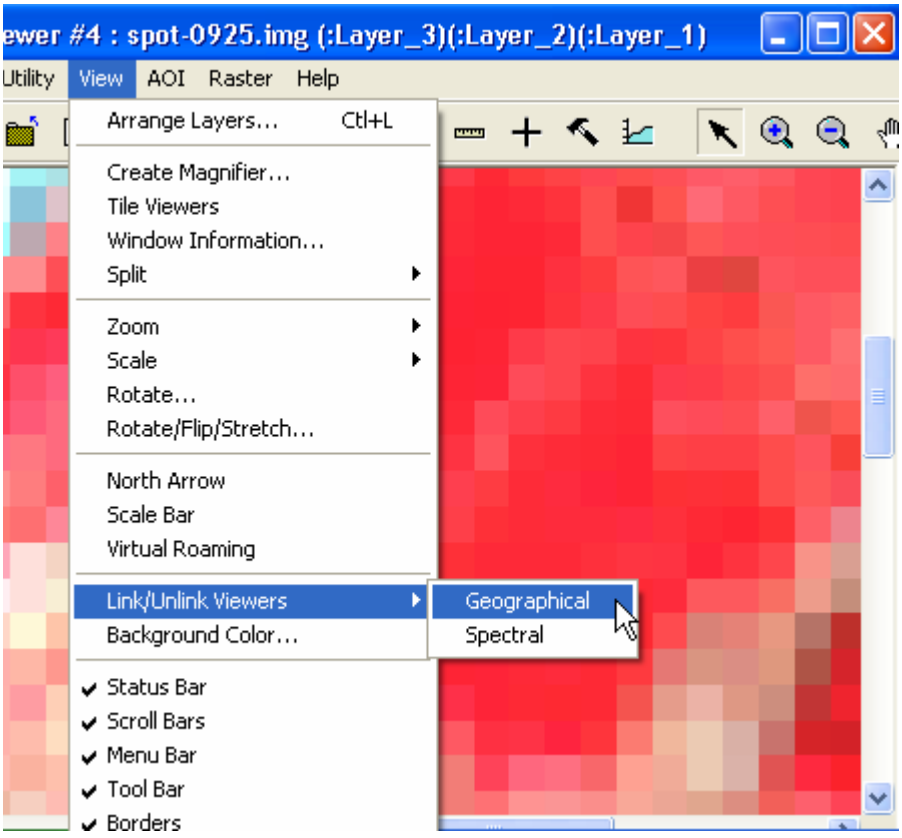


Record (write down) the NDVI (pixel) values on each date. Repeat for a second pixel in the field. Then use Excel (or some other plotting program) to plot the temporal change in NDVI between August and September.

Please turn in a plot showing date on the x-axis and NDVI on the y-axis. Your graph should show two lines, one for each pixel chosen. (Their shapes should be similar.)

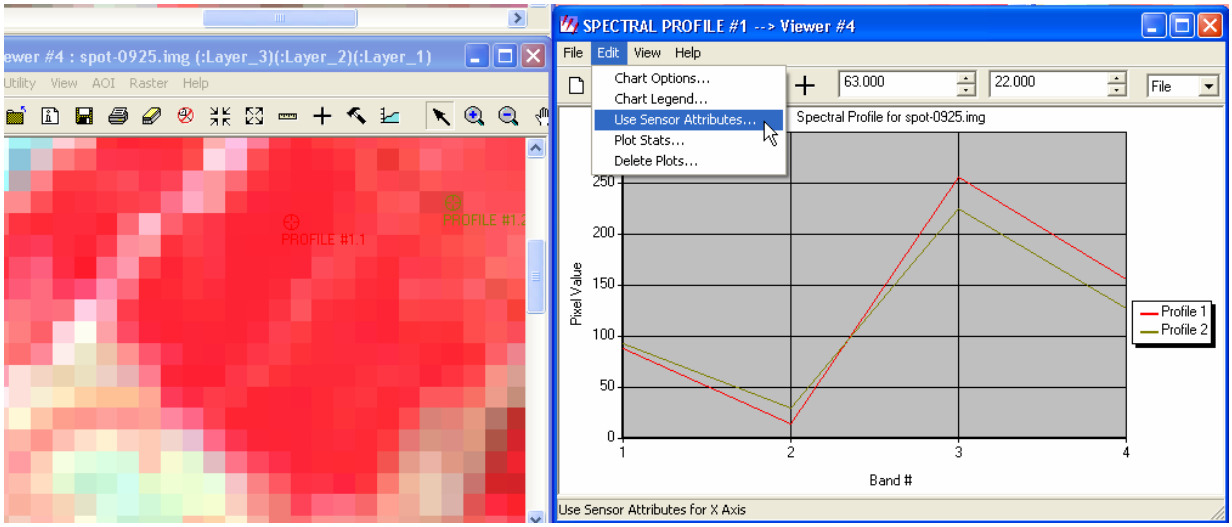
Task 2.

Plot the spectral signature for soy using either the Inquire Cursor, or the Spectral Profile tool. In either case you should link the images so that the same pixel is located by the crosshair in each image.

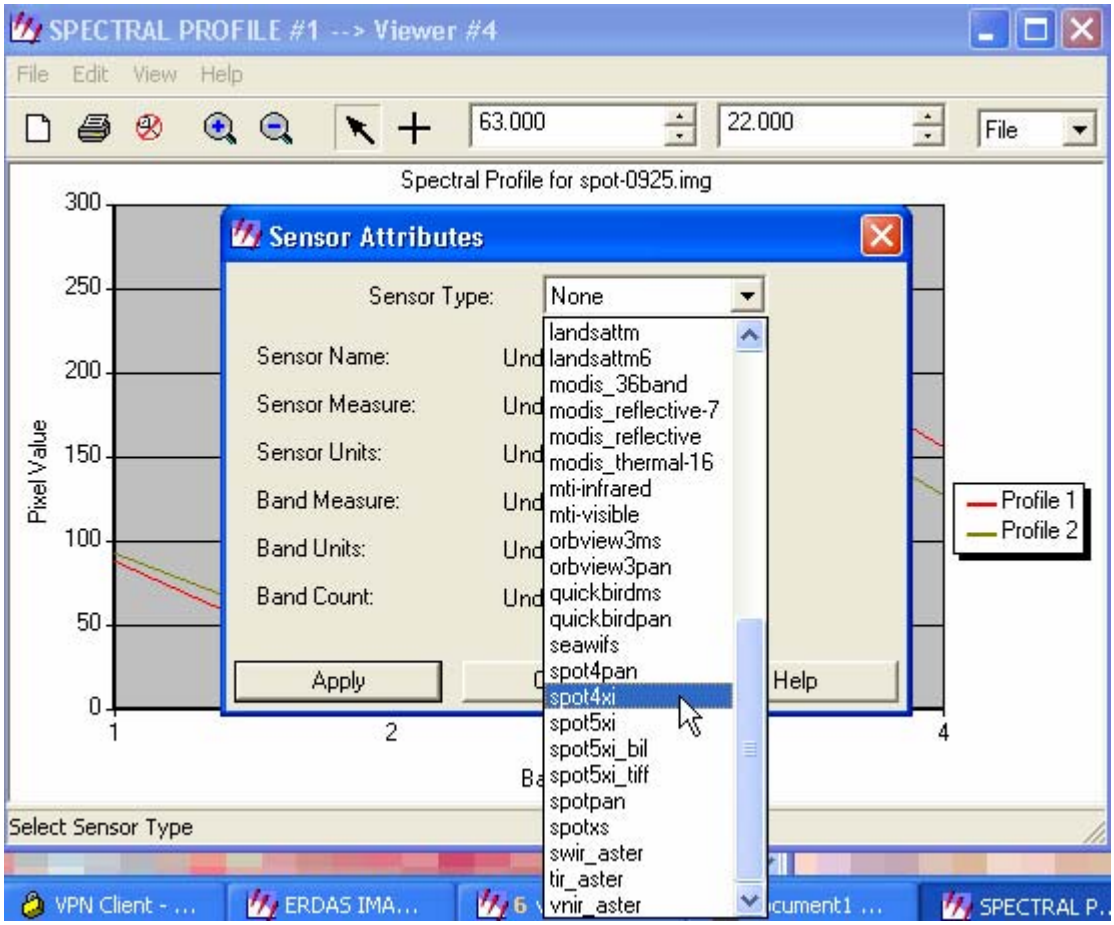


You can then either use the layering scheme outlined above to move each image into view one by one as you drag each image up to the top layer, or you can view all six simultaneously side by side using six separate viewers.

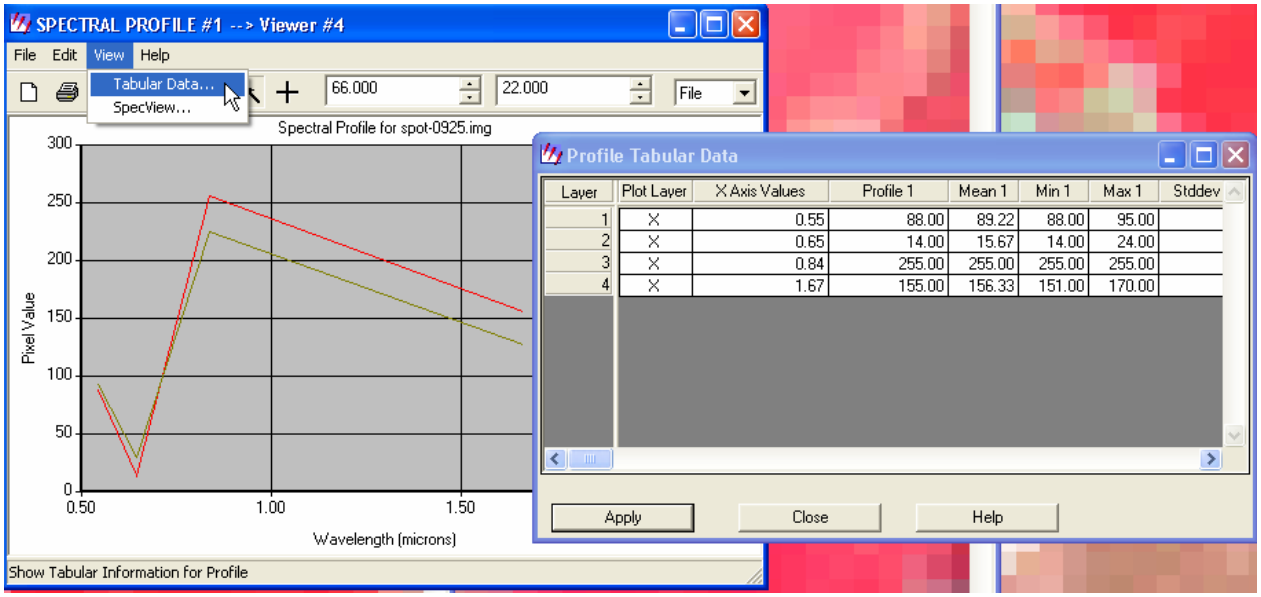
To plot the spectral signature choose Raster -> Profile Tools -> Spectral. Then use the '+' symbol in the menu bar and click on the image to select a pixel in the soy field. Its spectral signature will be plotted. To change the x-axis from Band # to wavelength, choose 'Edit' -> 'Use Sensor Attributes'.



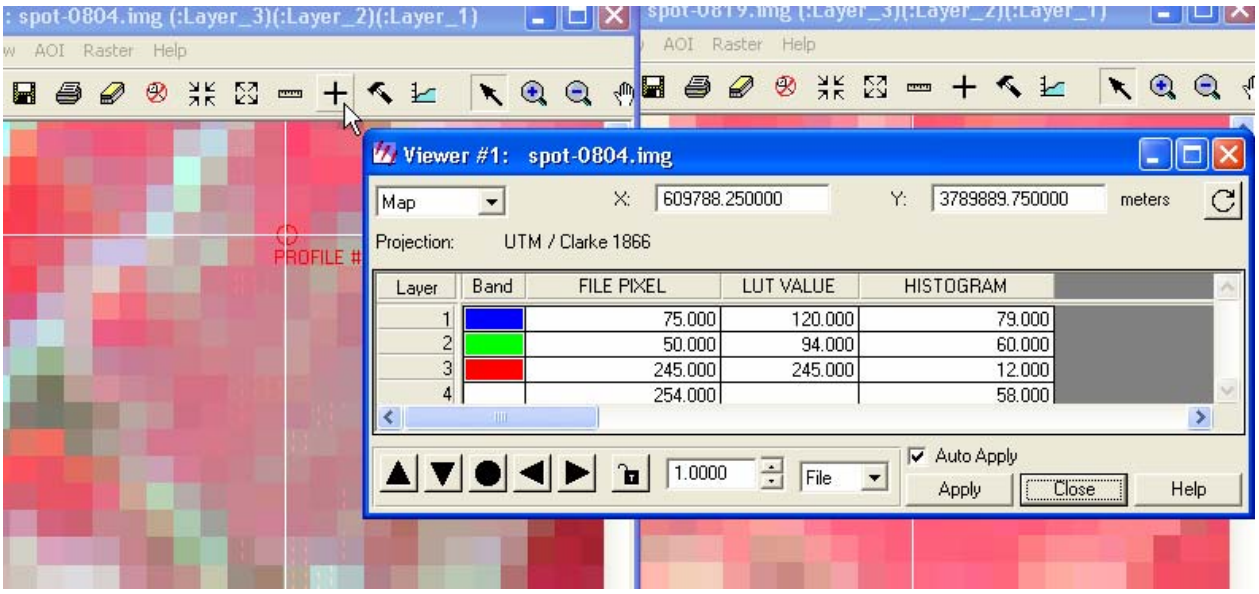
Then choose ‘spot 4xi’ as the sensor. The x-axis will change to wavelength.



The pixel values at each wavelength can be found from ‘View’ -> ‘Tabular Data’ within the Spectral profile window. You should record (write down) the actual brightness values for each band. Do this for each of the six images, making sure that you select the same pixel each time.



An alternative method is to record the pixel values directly from the Inquire Cursor.



Use Excel, or other plotting software to display a graph showing a series of the six spectral signatures from August thru' October.

Please turn in a single plot showing six lines (one for each date). The x-axis should be wavelength and the y-axis should be pixel value.

The images were obtained from http://www.cas.sc.edu/geog/rsbook/Exercises/Rse/e06.html.
This exercise was adapted from that of John R. Jensen, 2000, *Remote Sensing of the Environment: An Earth Resource Perspective*, Upper Saddle River, NJ: Prentice Hall.
Helen M. Cox, 2005.
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