GP40-The Earth From Space- Spring 2001 **Handout #14**
Lab Exercise #3

Topic 1: Color Combination. *We will see how all colors can be produced by combining red, green, and blue in different proportions. Images you see digitally are all combinations of these wavelenths. Something which appears red is especially bright in the red wavelength range. Something which appears yellow is bright in both the red and green wavelengths.*

1. Turn on the computer monitor and log in using the class account 'gp40' and password as given in class. Download the Ex. 3 zip folder from the class web site. Unzip the Ex. 3 folder to the desktop so that it will be easy to locate.

2. Start the Adobe Photoshop program either from the start menu or from the icon with the eyeball in the row of icons along the bottom of the screen.

3. In the small window at the lower right of your screen, click on the tab labeled "Channels".

4. Under the File menu, select item "Open as...".

5. Find the file "Colors" in the Ex. 3 folder on the Desktop, and single click to highlight it. The name will appear in the box below the file list. Then, under the "Open as" pulldown menu on the same subwindow, scroll down to the bottom and select "TIFF." Now click the "open" button to view the file.

Notice how all colors may be reproduced by combining red, green, and blue light in different proportions. Images you see digitally are are combinations of red, green, and blue wavelengths. An object that is red would be particularly bright at this wavelength, and so forth. Green objects are highly reflective for green wavelengths. Other colors, such as yellow, are bright in both red and green wavelengths, or channels.

6. Click sequentially on the channels labeled Red, Green, and Blue in the lower right window to get an idea of how three separate images may be combined to form a multicolor image. Compare with the RGB channel display.

Now you can quit the Photoshop program.

Topic 2: Multispectral analysis of the Stanford campus

7. Open MultiSpecW32.exe from the Ex3 directory. Under 'File', select 'Open Image'. Select 'Campus-732'. Click 'OK' on the spec window that pops up.

8. This image was taken from an airborne scanner on July 24,1990 with 3 bands (7,3, and 2) selected from the 24 band dataset. The resolution is 6m/pixel. Locate the Main Quad, the Oval, the Stadium, and Mitchell Building. Use the buttons that look like large and small mountains (the right-most buttons) to zoom in and out. Click on where you want to zoom in and press button with the large mountains.

9. How is this image, which looks generally like a photograph, being produced? What wavelengths are being displayed?

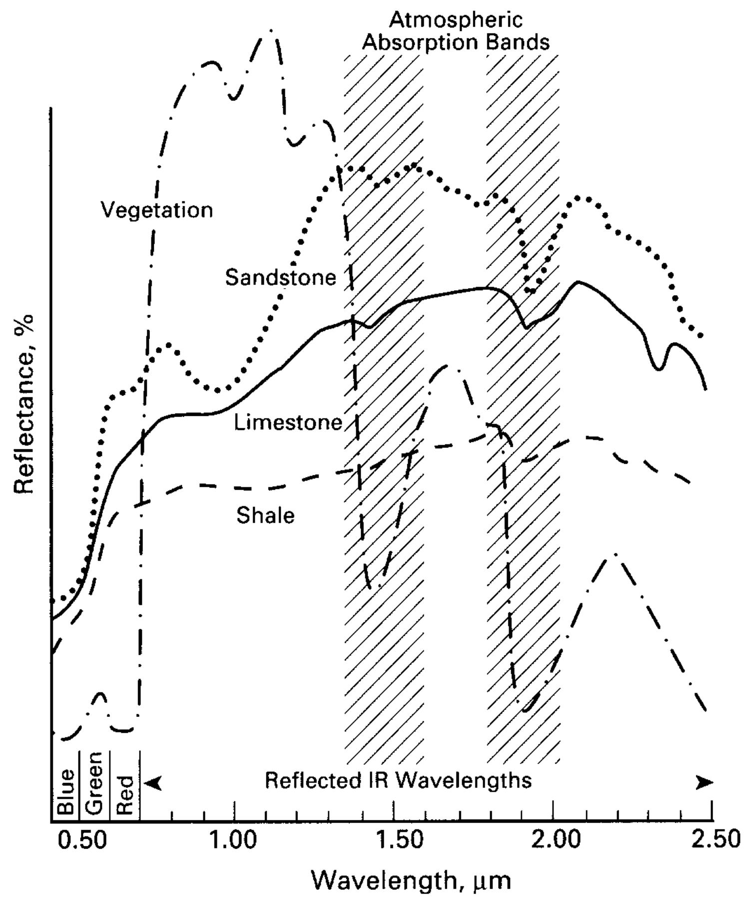
10. Go to 'Processor', select 'Display Image', select 'Descriptions...' in the 'Channels' box. What kind of light do these wavelengths correspond to? (red, near IR, etc?) Note that bands and channels are different things.

11. Try a different display, for instance change to R=1, G=2, B=3. What difference do you see? Note that you are not changing the <u>information</u> (wavelengths); you are just changing the way it is being displayed. The display seen when RGB=3,2,1 is used is called a "False Color" image in this case. Generally, near infrared wavelengths are displayed as red in these types of images.

12. Go to processor, select 'Display Image' again. This time, under 'Display Type', select 'Side by Side Channels'. Click 'OK'.

13. Zoom out as necessary, and extend the window size (by dragging the lower right hand corner) so that you can see all three images side by side. Each image shows the intensity of the corresponding wavelength.

14. Locate areas that differ markedly from one to the other. For example, compare the appearance of the Oval and the Stadium between the 3 channels.



15. On the above diagram, draw the channel wavelengths used. Suggest reasons for the differences of the appearance of certain objects from channel to channel.

16. Go back to the 'Processor', 'Display Image', '3 Channel Color', RGB=3,2,1 settings. This should result in a "false color" image.

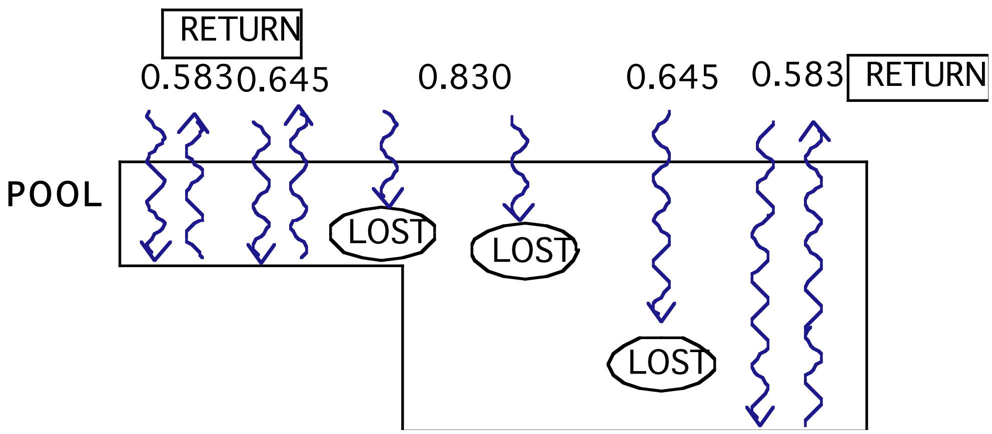
17. Why are certain areas very red?

18. Look at the Main Quad; why do the rooftops appear green? What about the green ring inside the stadium?

19. In what season was this image taken? How can you tell?

20. Locate DeGuerre Pool. Notice the different shades of blue. The shorter the wavelength, the deeper the penetration into the water. Knowing this, which is the deep end of the pool? What color does it appear?

21. Close 'campus-732'.



Topic 3: Multispectral analysis of San Francisco

San Francisco: a natural color image

22. Open 'sanfrancisco1' in MultiSpec.

23. Go to the channel descriptions in the same way as before. Write down these descriptions, along with their corresponding range names.

24. Decide how to display the channel so that a "natural color" image will result. (what channel should be red? blue? green?)

25. Locate familiar features such as the Golden Gate Park. Zoom in to see individual streets and piers. Does everything look the way you'd expect?

26. Close sanfransisco1.

San Francisco: a false color image

27. Open sanfrancisco2. Go to the channel descriptions. Write them down.

28. Decide how to display the channels so that a false color image will result. Your vegetation should appear bright red.

29. Look at side by side channels as well.

30. Close sanfrancisco2. Close MultiSpec, and Scion Image. Log out of your PC.

Landsat Thematic Mapper Spectral Bands

Band	Wavelength, μm	Characteristics
1	0.45-0.52	Blue-green. Maximum penetration of water, which is useful for bathymetric mapping in shallow water. Useful for distinguishing soil from vegetation and deciduous from coniferous plants.
2	0.52-0.60	Green. Matches green reflectance peak of vegetation, which is useful for assessing plant vigor.
3	0.63-0.69	Red. Matches a chlorophyll absorption band that is important for discriminating vegetation types.
4	0.76-0.90	Reflected IR. Useful for determining biomass content and for mapping shorelines.
5	1.55-1.75	Reflected IR. Indicate moisture content of soils and vegetation. Penetrates thin clouds. Provides good contrast between vegetation types.
6	10.4-12.5	Thermal IR. Nighttime images are useful for thermal mapping and for estimating soil moisture.
7	2.08-2.35	Reflected IR. Coincides with an absorption band caused by hydroxyl ions in minerals. Ratios of bands 5 and 7 are used to map hydrothermically altered rocks associated with mineral deposits.