

**Exercise C: Reflectance Data**  
**Field Phenomics Workshop, Maricopa, Arizona**  
**Monday, April 7, 2014 3:20pm**  
**Instructors: Kelly Thorp and Pedro Andrade-Sanchez**

**Spectral Reflectance Data Analysis (Thorp)**

- I. Download 'Spectra.csv' from the workshop website.
- II. Open the file in Excel or your favorite text editor and understand the contents
  - A. Column A: Wavelength in nm
  - B. Column B: Percent reflectance of well-watered cotton cultivar 'Monseratt'
  - C. Column C: Percent reflectance of water-limited cotton cultivar 'Monseratt'
  - D. Column D: Percent reflectance of well-watered cotton cultivar 'Pima-S7'
  - E. Column E: Percent reflectance of water-limited cotton cultivar 'Pima-S7'
  - F. Column F: Percent reflectance of bare soil
  - G. Some wavelengths have been removed due to instrument insensitivity.
- III. Plot the data (Spectral reflectance on Y-axis and Wavelength on X-axis)
  - A. Do you understand what is shown?
  - B. What wavelengths can the human eye detect (visible light)?
  - C. Why is soil reflectance higher than vegetation in the visible spectrum?
  - D. Why do the vegetative spectra have a small peak at 550 nm?
  - E. Why is vegetative reflectance low at 400 nm and 650 nm?
  - F. What happens to vegetative reflectance at 730 nm? Why?
  - G. What wavelengths are near-infrared radiation?
  - H. Why is vegetative reflectance higher than soil reflectance in the near-infrared?
  - I. If  $NDVI = (NIR-RED)/(NIR+RED)$ , what does the index tell us? Why?
  - J. What drives the spectrum from 1300 to 2500 nm?
  - K. Why is vegetative reflectance less than soil reflectance in this range?
  - L. What spectral differences do you see among cultivar and water treatments?
- IV. Use the full spectrum data to understand filter options for active sensors
  - A. How does vegetation reflect radiation at common filtering wavelengths?
    1. 590 nm?
    2. 650 nm?
    3. 730 nm?
    4. 760 nm?
    5. 800 nm?
  - B. How might the band width of an optical filter affect measurements?
  - C. How might the selection of optical filters for active sensors affect the NDVI calculation? You may want to calculate NDVI for a few band combinations.

## Active sensor data processing (Andrade-Sanchez)

I. Download 'ACS-430\_grass-conditions.txt' and 'ACS-430\_height-test.txt' from the workshop website.

II. Open Excel → in file, select 'open new file' select 'ACS-430\_grass-conditions.txt' → in text import wizard, select 'delimited' then 'next' → select 'comma' then 'next' → select 'finish' → save this file as a spreadsheet with the name 'ACS-430\_grass-conditions.xls'

Repeat the process with file 'ACS-430\_height-test.txt'

III. Name columns A-E as follows:

Column A: Red edge (720nm)

Column B: NIR (780nm)

Column C: Red (670nm)

Column D: NDRE (Normalized-difference red-edge)

Column E: NDVI (Normalized-difference vegetation index)

IV. Organize data by condition during test:

A. Row correspondence for file 'ACS-430\_grass-conditions.xls':

- a. 1 – 1249 = green grass
- b. 1251 – 2511 = stressed grass
- c. 2513 – 3730 = fake grass
- d. 3732 – 4840 = bare soil

B. Row correspondence for file 'ACS-430\_height-test.xls'

- a. 1 – 1220 = 48"
- b. 1222 – 2401 = 36"
- c. 2403 – 3586 = 24"
- d. 3588 – 4805 = < 12"

V. Compute mean values and standard deviation for NDVI of all conditions in both tests. Tabulate the results and/or make plots. Follow class discussion on the effects of height and target condition.