

CyVerse-NEON AOP Workshop

November 2020

Bridget Hass
Remote Sensing Scientist
Airborne Observation Platform (AOP)

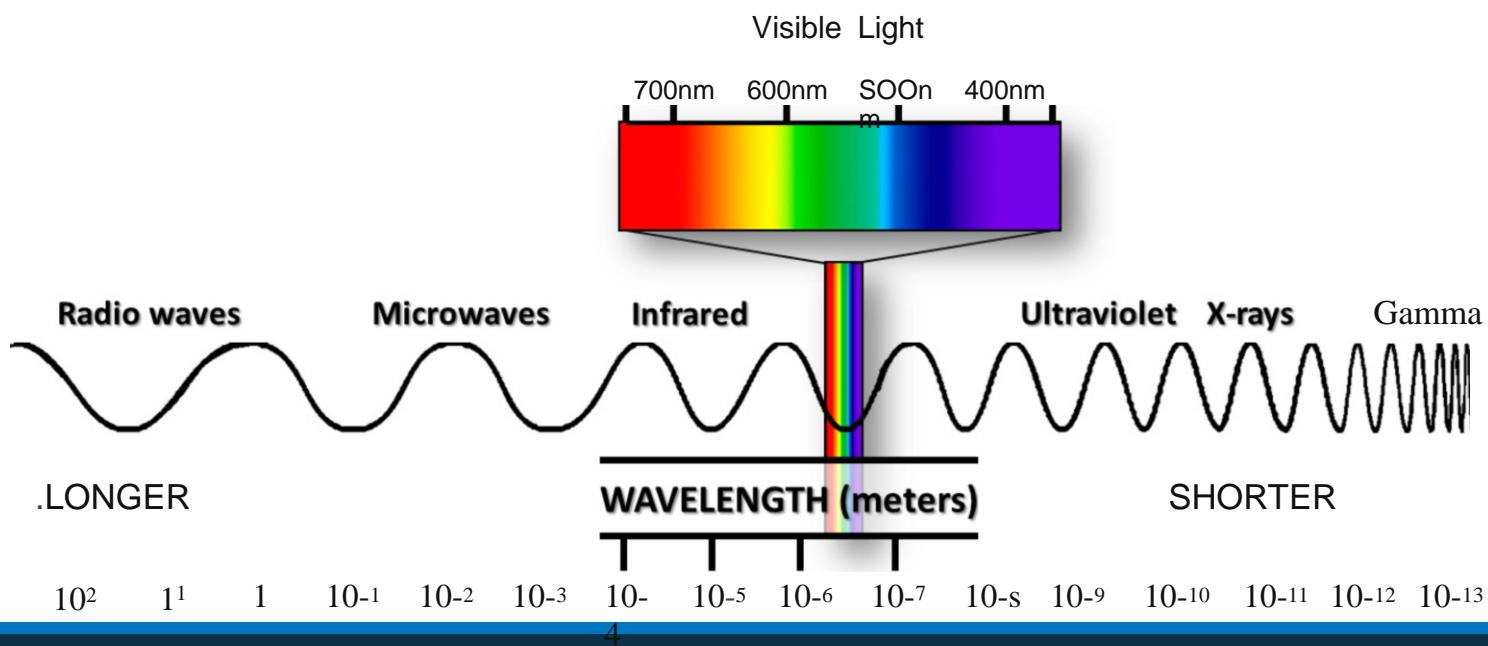
Introduction to the NEON Imaging Spectrometer (NIS)

National Ecological Observatory Network

A project sponsored by the National Science Foundation and proudly operated by Battelle

Digital Camera

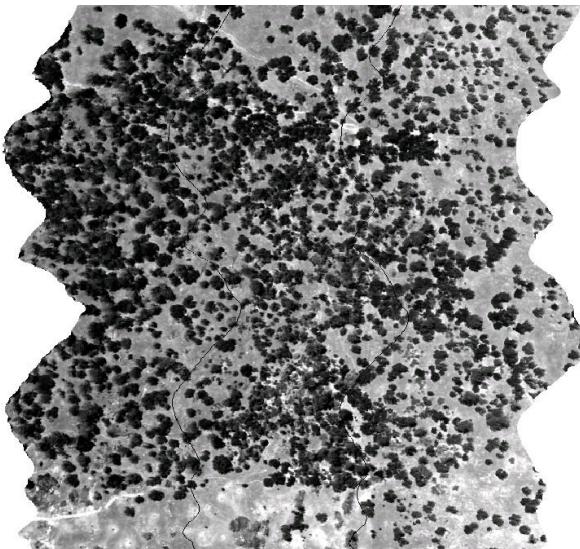
- Includes 3 bands (R,G,B) from the visible portion of electromagnetic spectrum



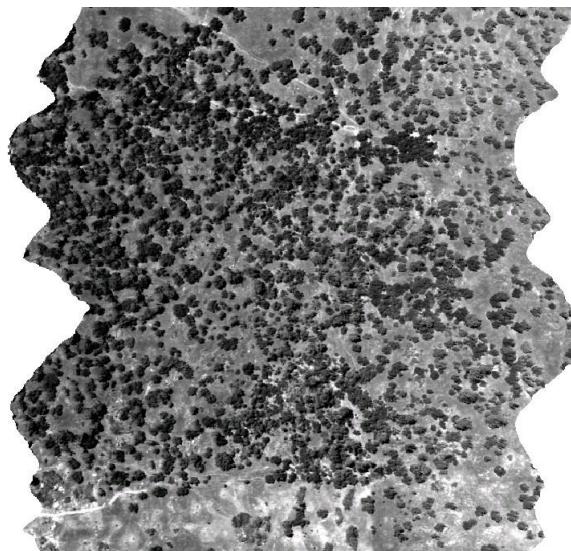
RGB image

- Each band can be considered as the signal strength within selected wavelengths
- Red: 620 – 750 nm
- Green: 495 – 570 nm
- Blue: 450-495 nm
- Dark areas represent low signal, white high signal

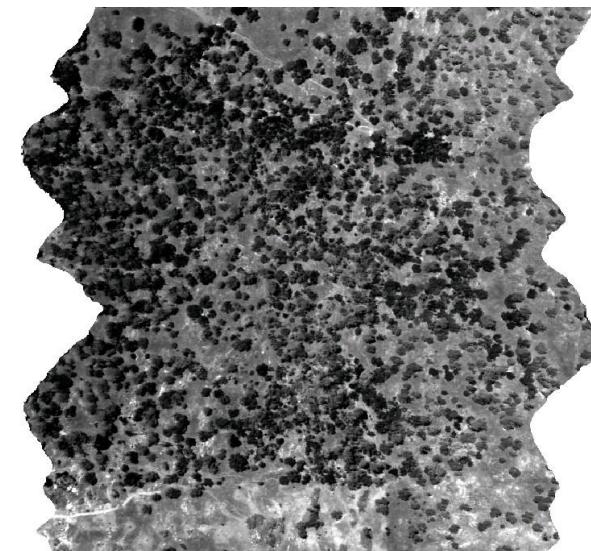
Red



Green

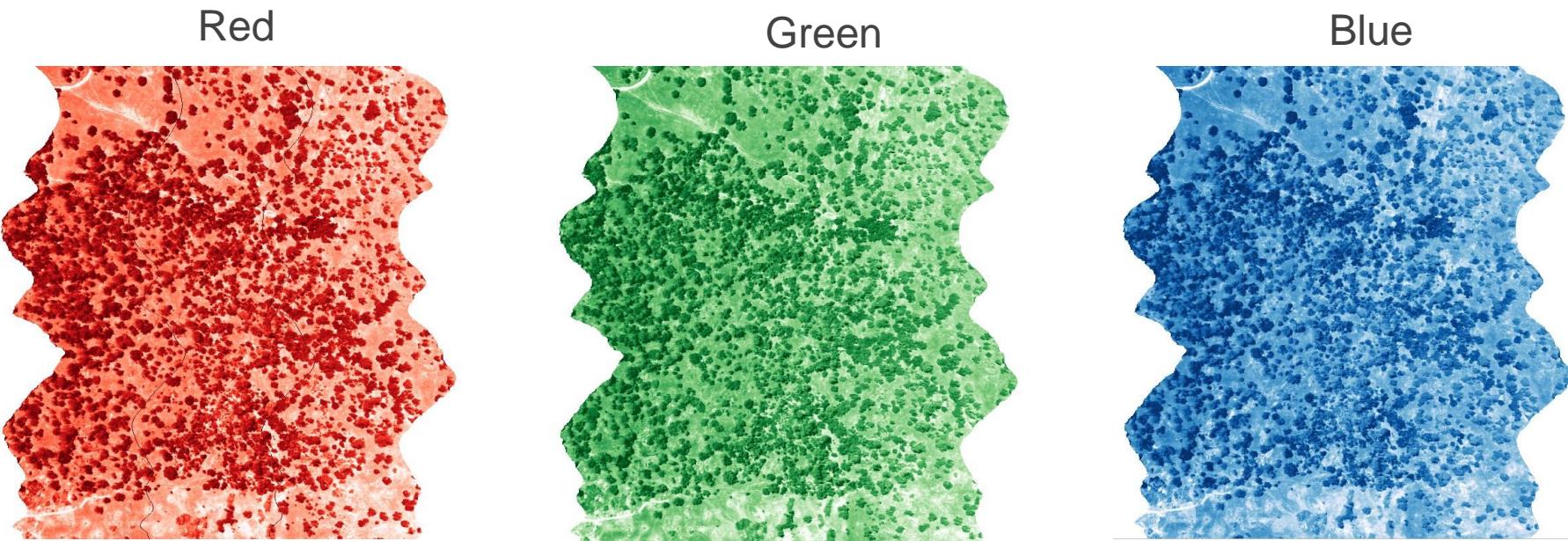


Blue



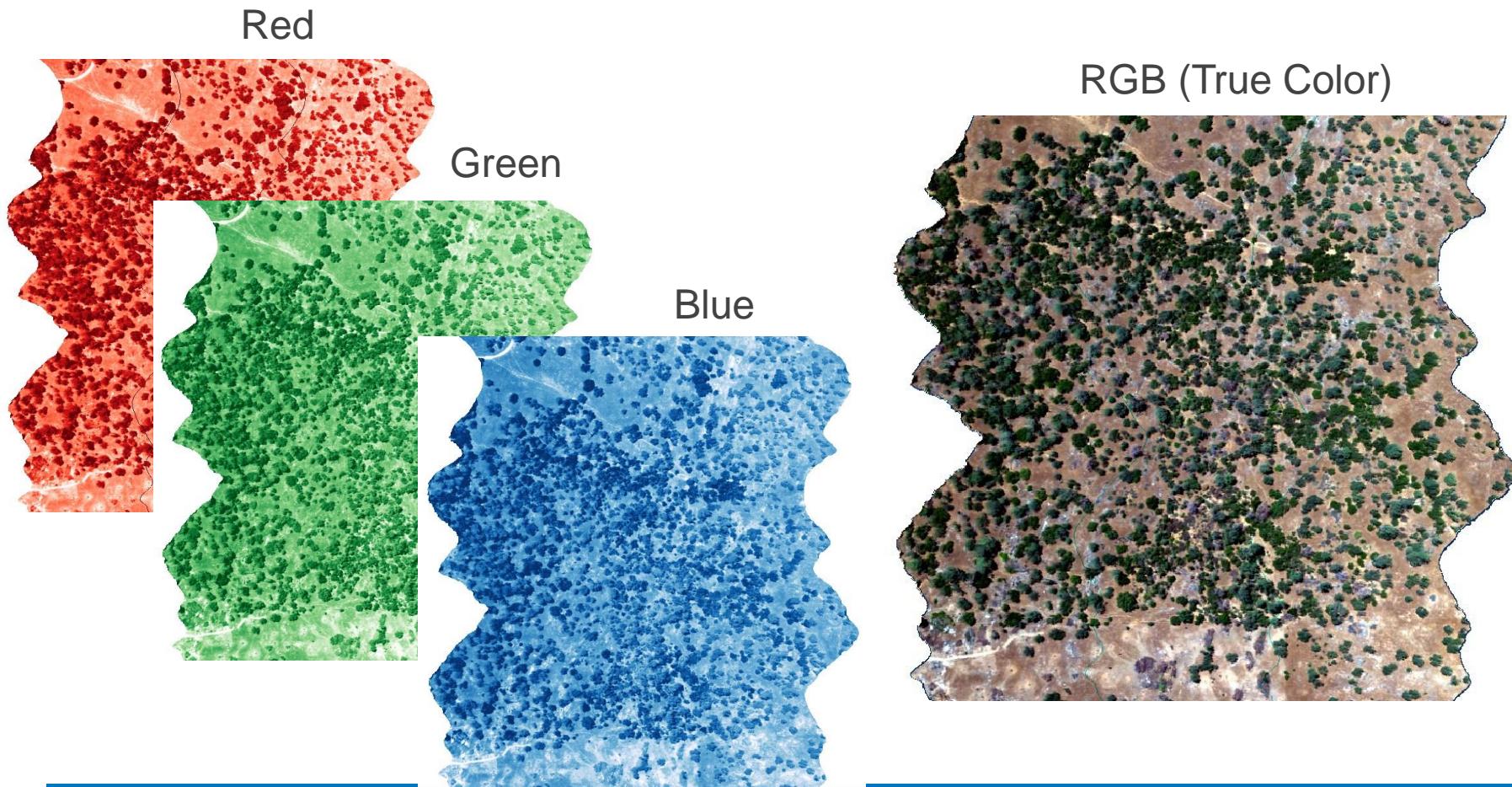
RGB image

- Each band can be considered as the strength of detected energy within selected wavelengths
- Red: 620 – 750 nm
- Green: 495 – 570 nm
- Blue: 450-495 nm



RGB image

- Each band can be considered as the strength of detected energy within selected wavelengths



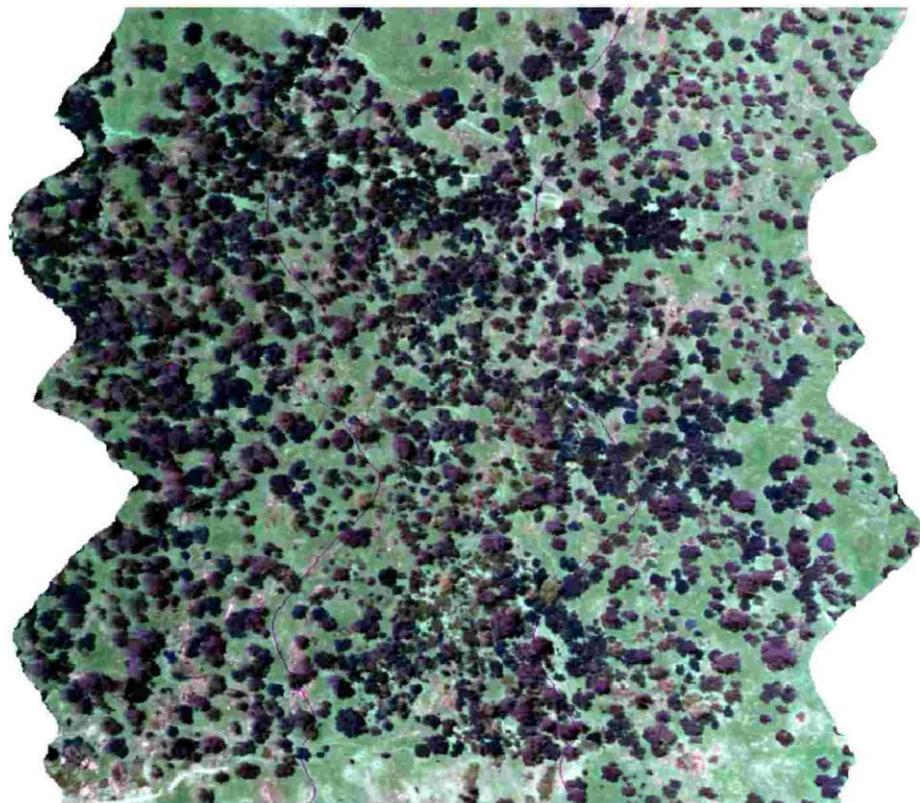
RGB image

- Can do other combinations of the bands if we want!

BGR (False Color)

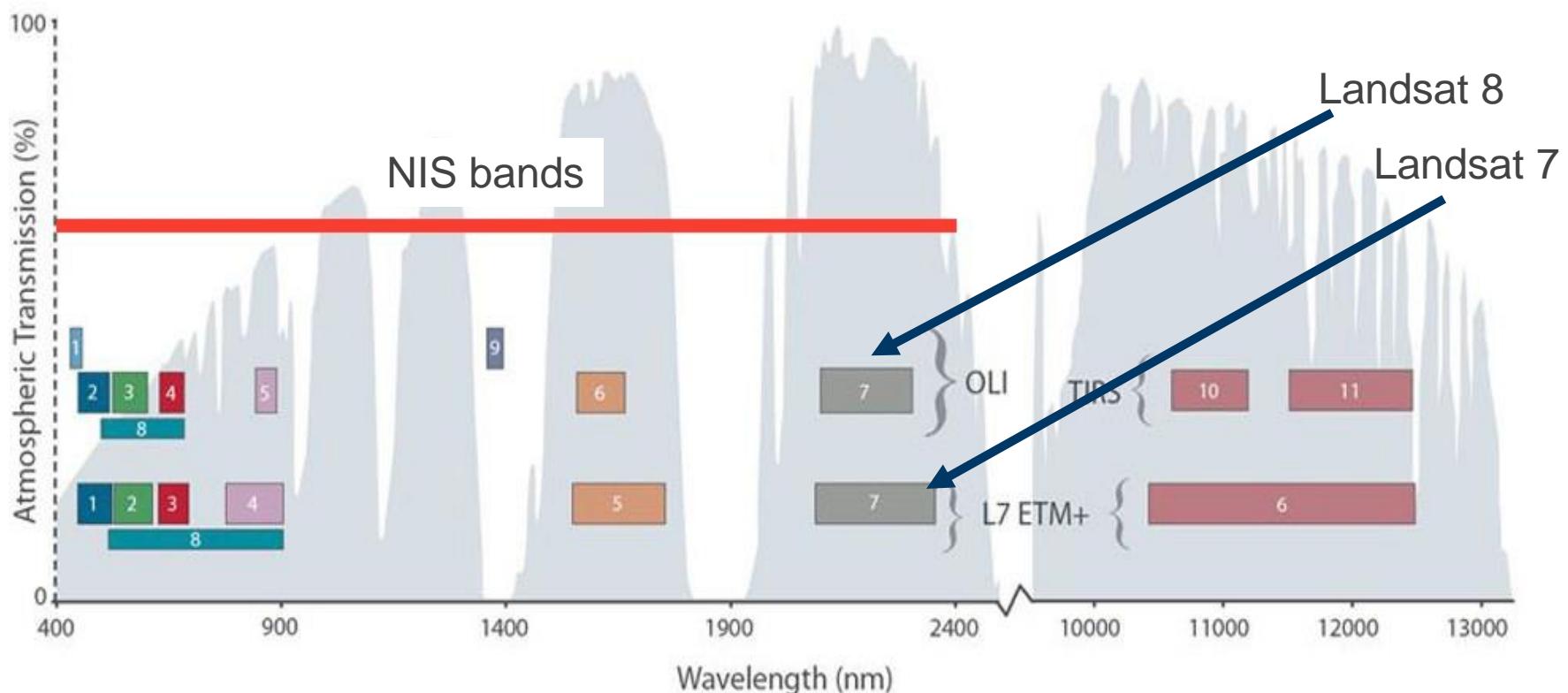


BRG (False Color)



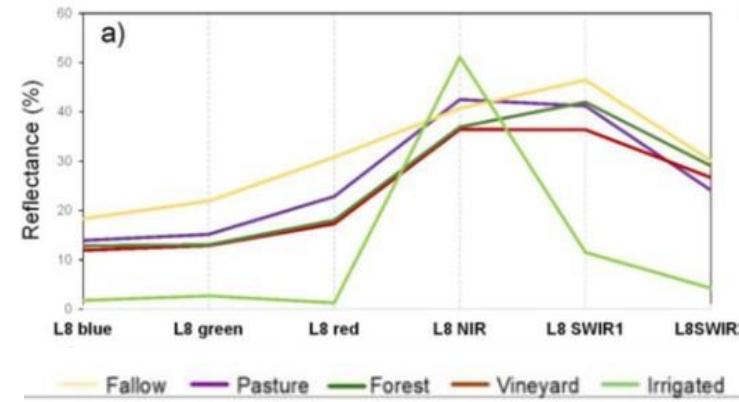
Multispectral Sensors and Hyperspectral Sensors

- Includes several bands (R,G,B, others) from the visible and other portions of electromagnetic spectrum

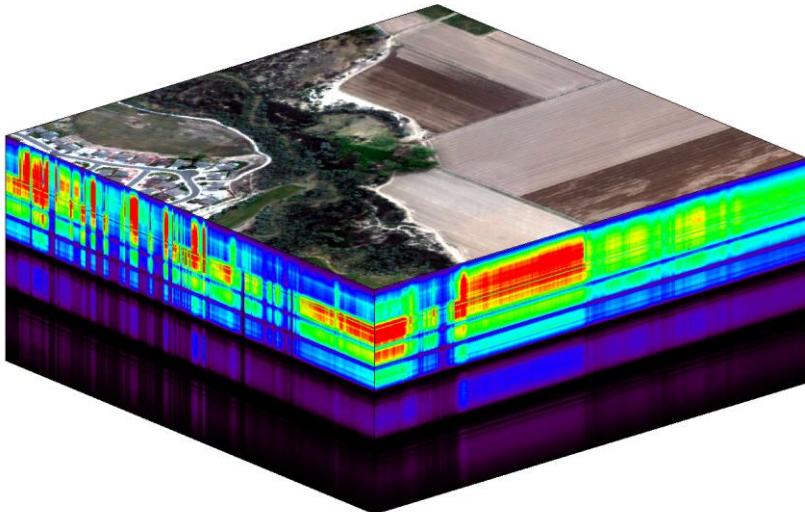


Landsat 8 - Multispectral

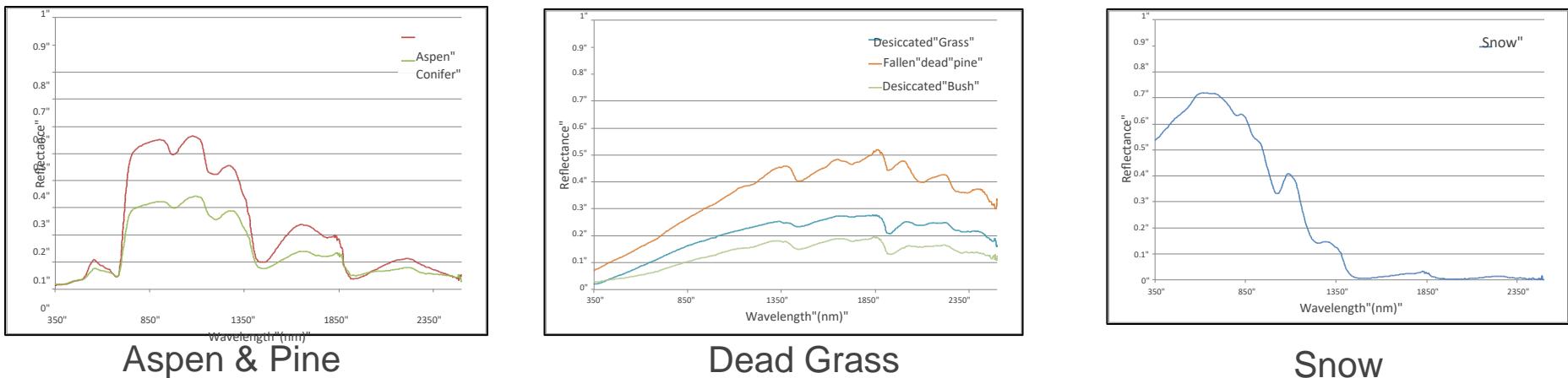
Band	Wavelengths	Spatial Resolution
Band 1 - Coastal / Aerosol	433 - 453 nm	30 m
Band 2 - Blue	450 - 515 nm	30 m
Band 3 - Green	525 - 600 nm	30 m
Band 4 - Red	630 - 680 nm	30 m
Band 5 - Near Infrared	845 - 885 nm	30 m
Band 6 - Short Wavelength Infrared	1560 - 1660 nm	30 m
Band 7 - Short Wavelength Infrared	2100 - 2300 nm	30 m
Band 8 – Panchromatic	500 - 680 nm	15 m
Band 9 – Cirrus	1360 - 1390 nm	30 m



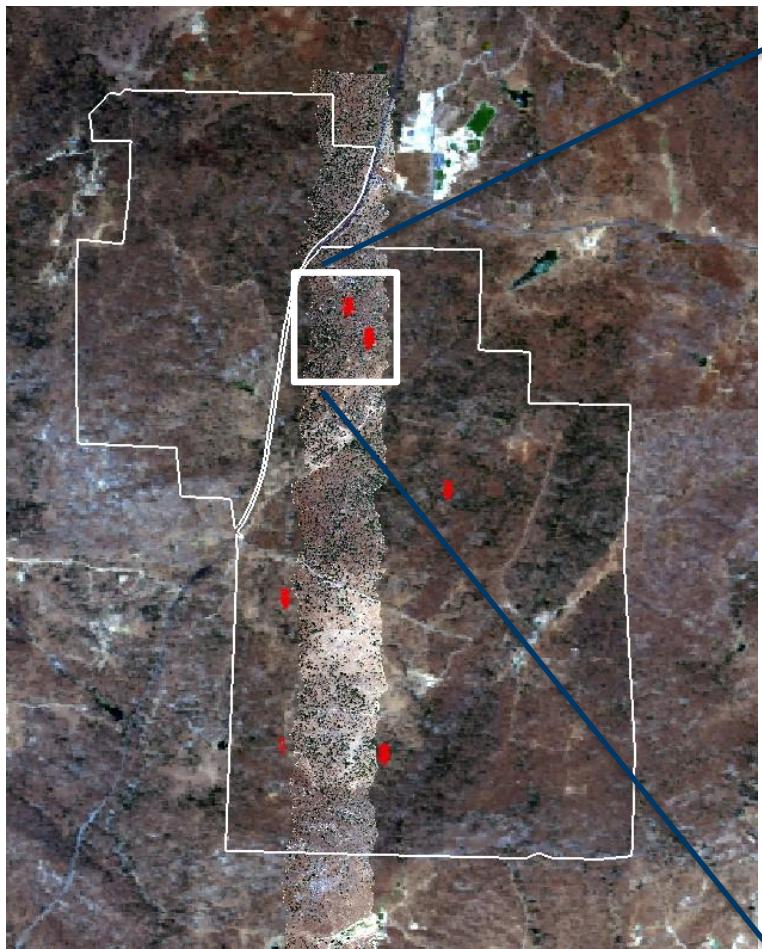
NIS - Hyperspectral



- ~426 bands at 5 nm wide between 380 and 2510
- 1 mRad IFOV
- 1 m pixels at 1000 m AGL



A Matter of Scales



AVIRIS Surface Reflectance – 18m spatial resolution

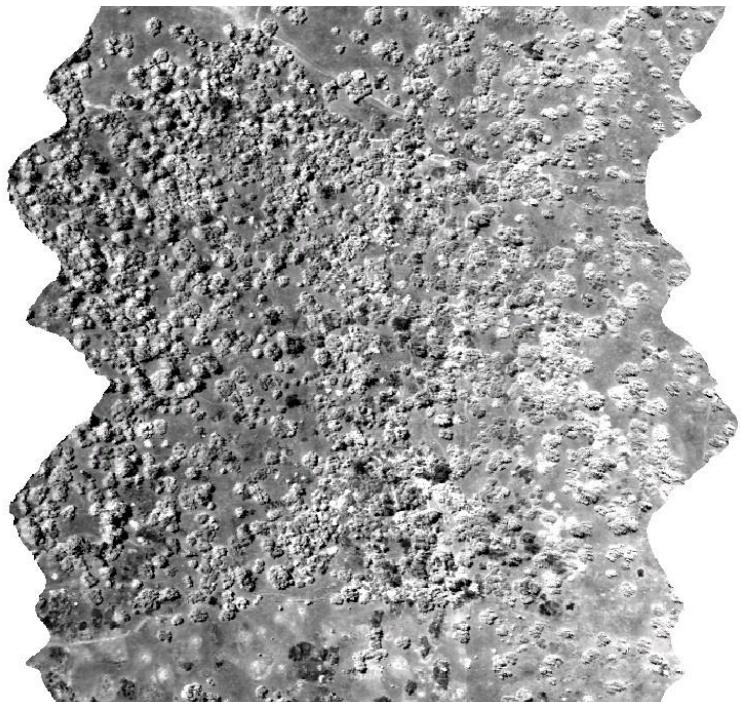


NIS1 Surface Reflectance – 1m spatial resolution
Red push pins mark field sampling sites

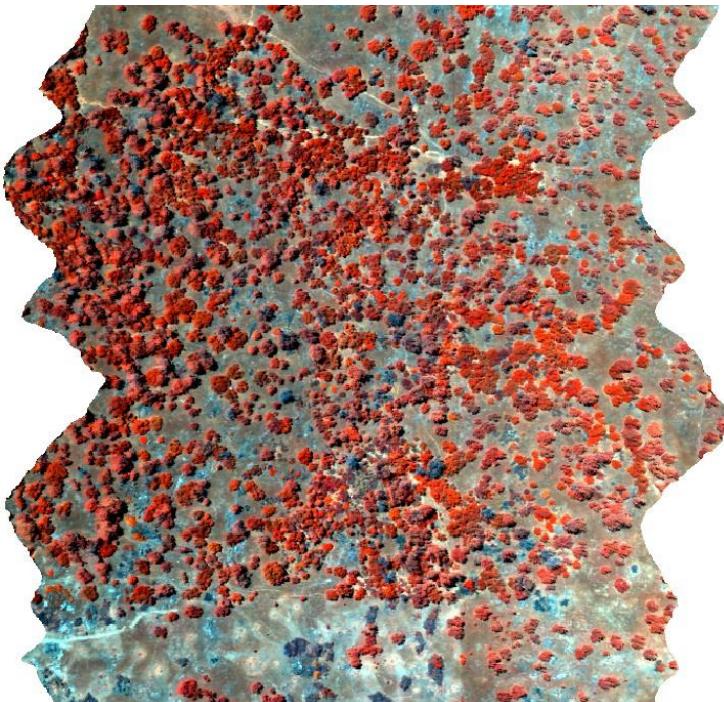
NIR (false color) image

- Trade NIR band for red band. “Healthy vegetation absorbs blue- and red-light energy to fuel photosynthesis and create chlorophyll. A plant with more chlorophyll will reflect more near-infrared energy than an unhealthy plant.”*

NIR



NIRGB (False Color)

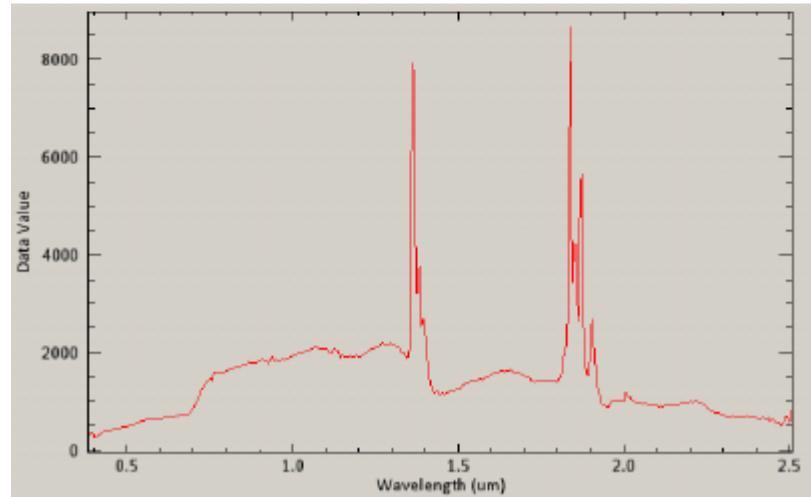
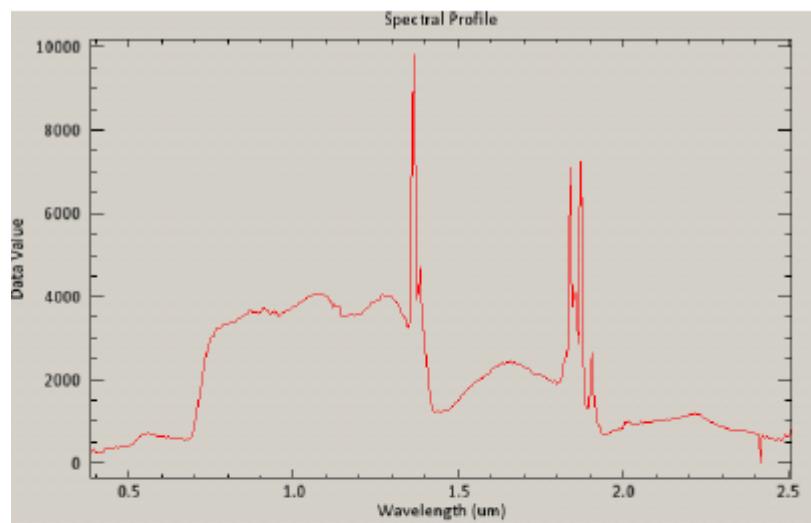
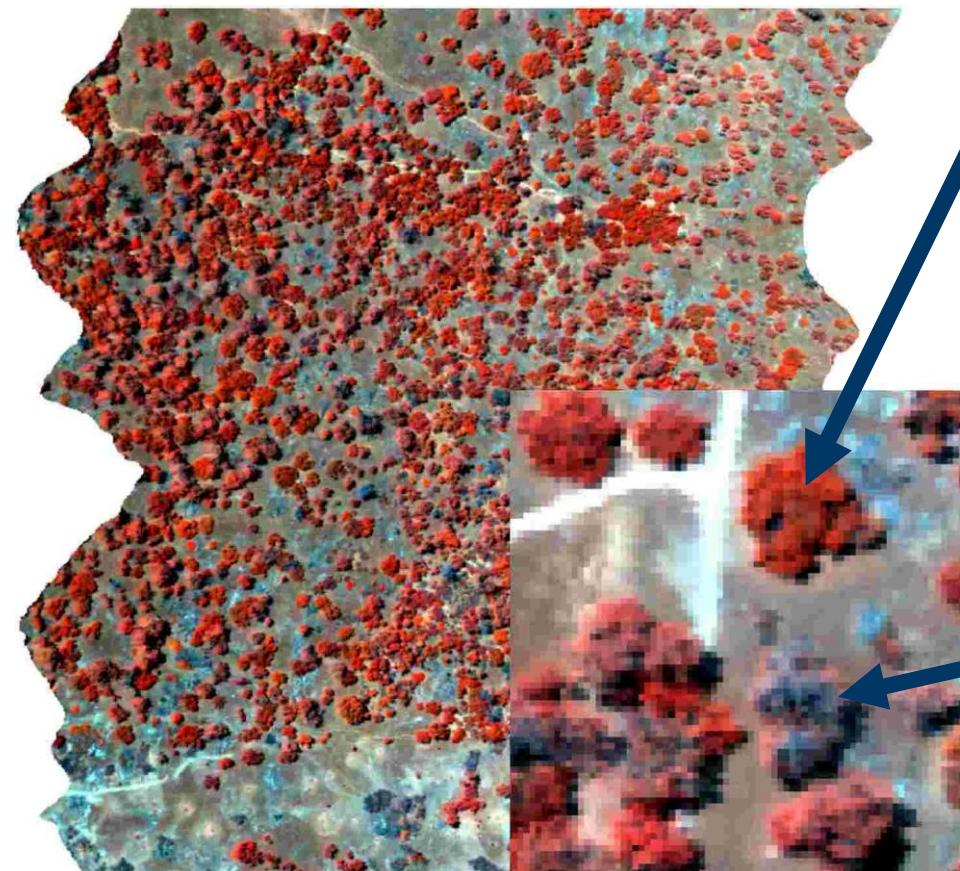


*http://missionscience.nasa.gov/cmis/08_nearinfraredwaves.html

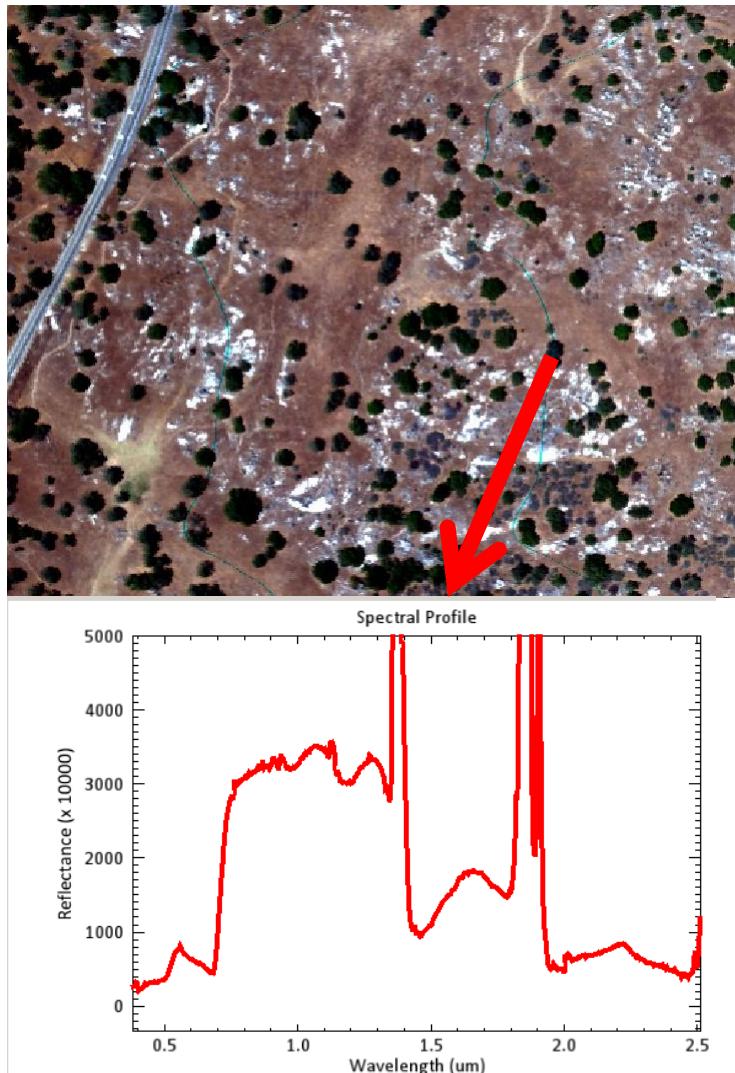
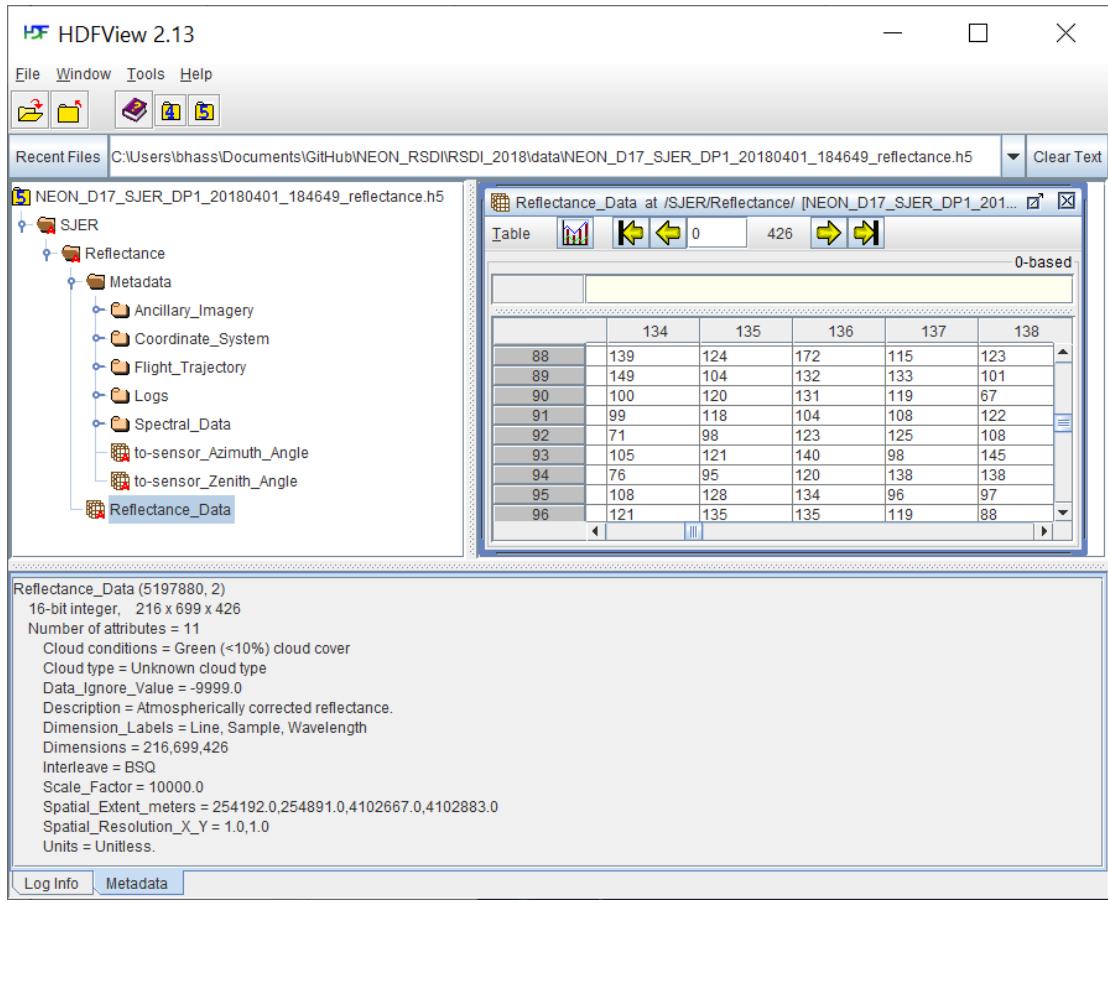
NIR (false color) image

- Trade NIR band for red band
- Identify traits within / between species

NIRGB (False Color)

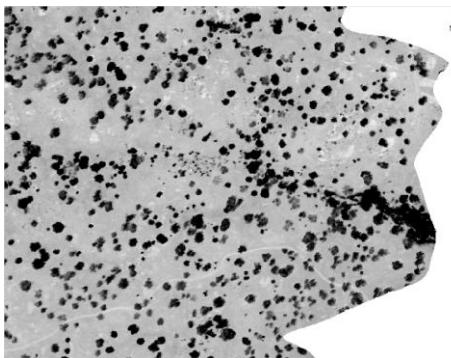


NEON Imaging Spectrometer (NIS) Reflectance

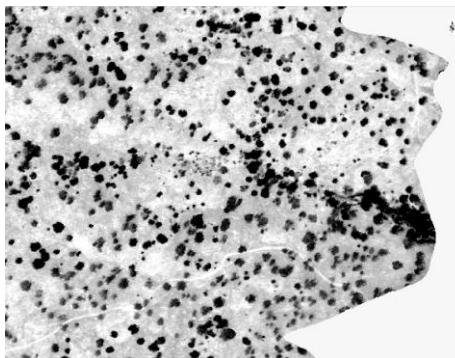


Vegetation indices (NEON.DOC.002391)

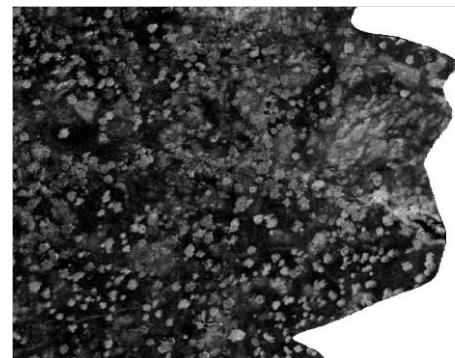
- L2 & L3 products derived from surface reflectance
- In Geotif raster format (.tif)
- By flightline & tiled, 1m spatial resolution



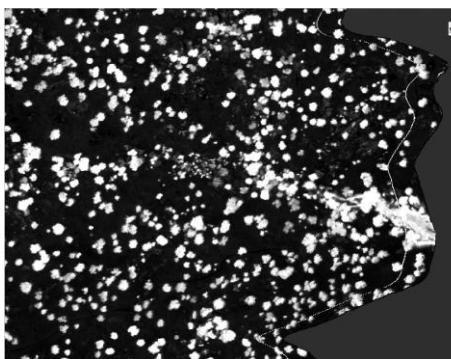
Normalized difference
nitrogen index



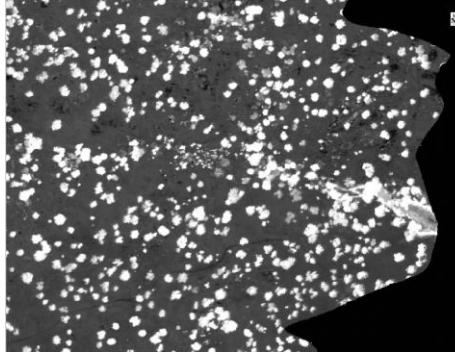
Normalized difference
Lignen index



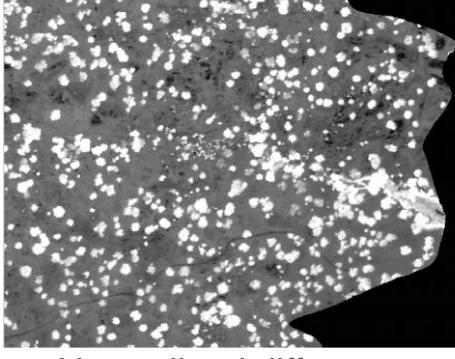
Photochemical reflectance
index



Atmospherically resistant
Vegetation index



Enhanced vegetation index



Normalized difference
nitrogen index

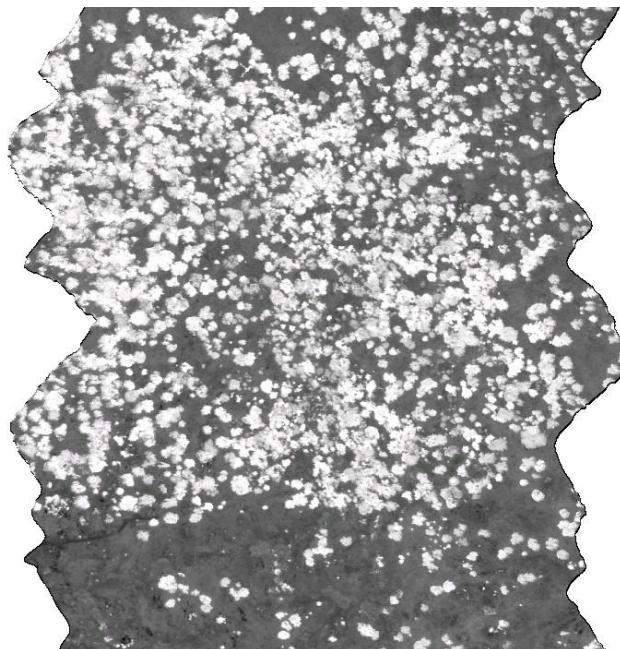
NDVI

- Calculated as

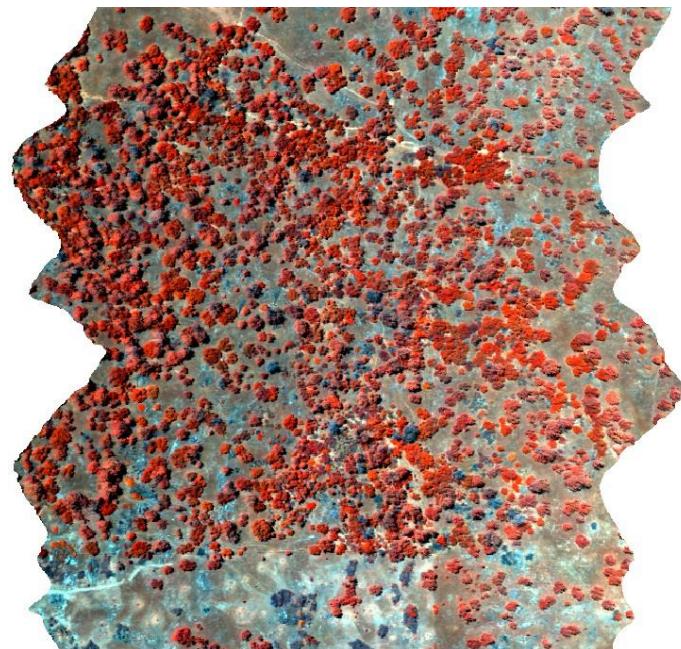
$$NDVI = (NIR - Red) / (NIR + Red)$$

where Red = ~648 (Band 54 on NIS 1), and NIR = ~ 859 nm
(Band 96 on NIS 1)

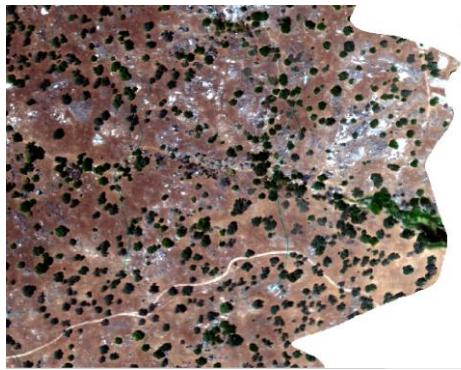
NDVI



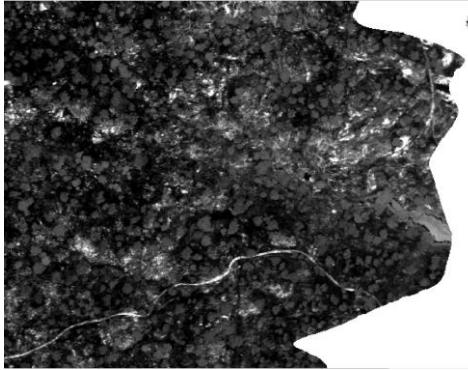
NDVIGB (False Color)



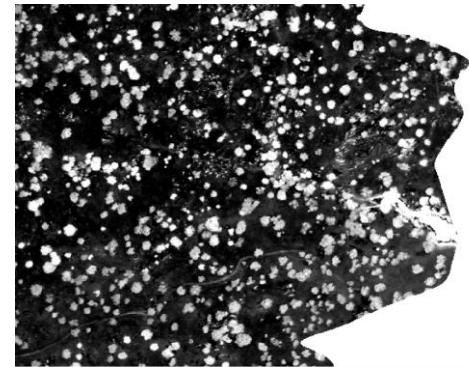
Water indices (NEON.DOC.004364)



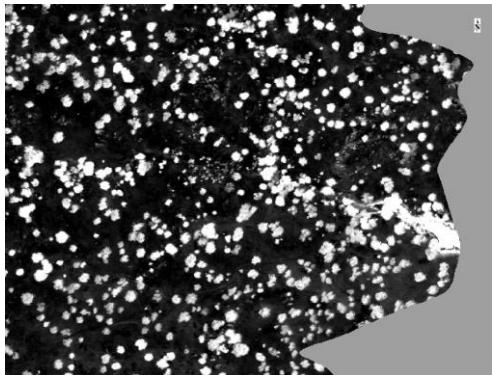
RGB reflectance



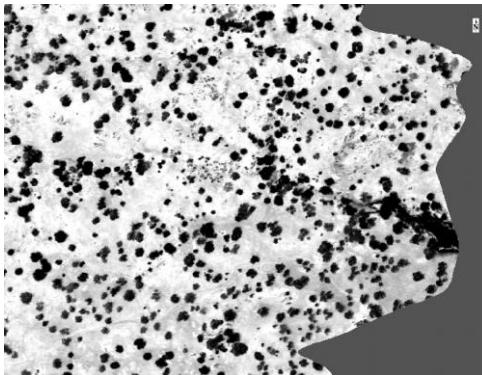
Normalized multiband
drought index



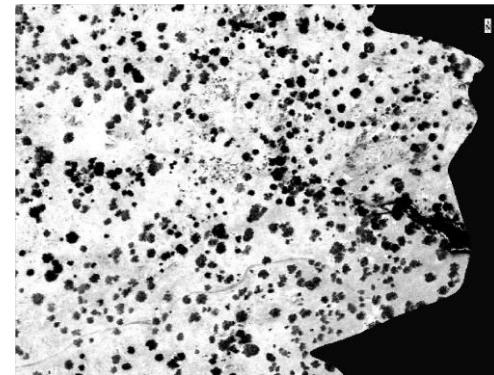
Normalized difference
water index



Normalized difference
infrared index



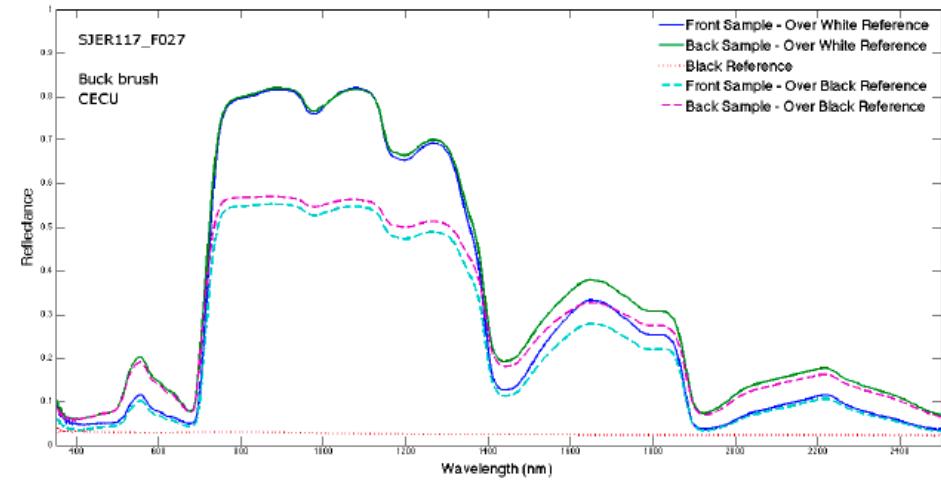
Moisture stress index



Water Band Index

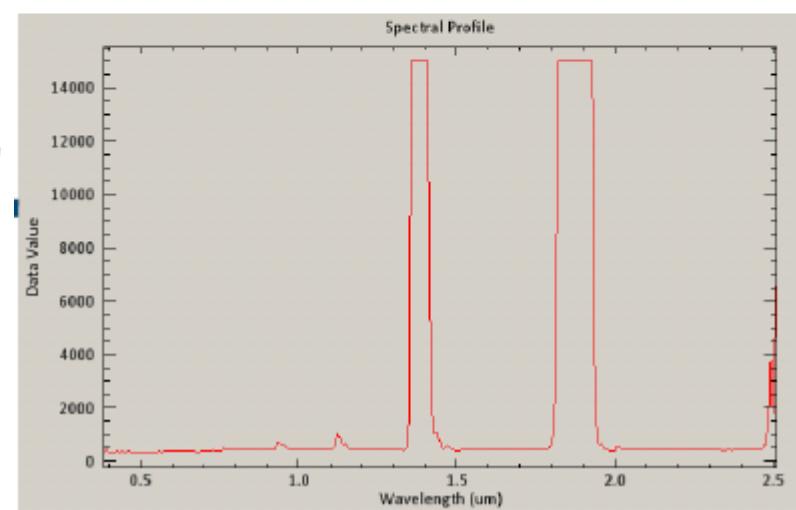
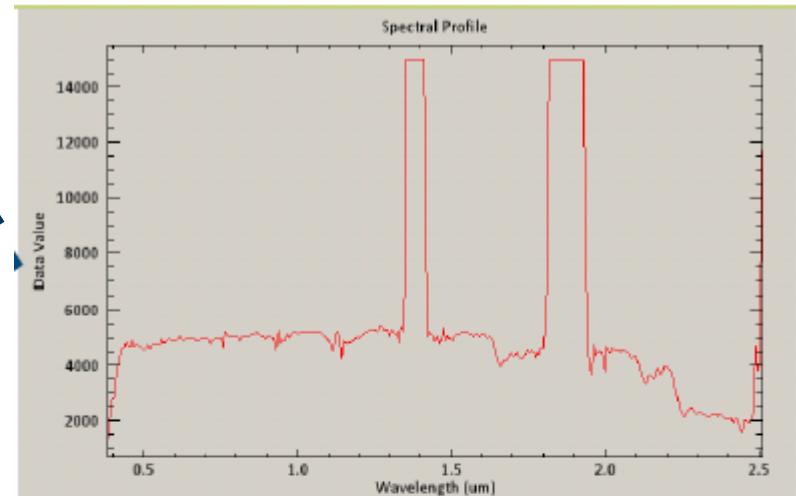
Field ASD spectra

- Obtained with a handheld spectrometer (ASD)
- Provides opportunity for calibration / validation of spectrometer data product
- Can be used as spectral end-members
- Linked to CFC (Canopy Foliar Chemistry) samples
- Level of effort data product, not included for all sites, collect at ~1-2 sites per year
- Pre-2019 data coming available on data portal soon!



Calibration - Reflectance tarps

- Constant reflectance across all wavelengths





BATTELLE
It can be done

720.746.4844 | neonscience@battelleecology.org | www.neonscience.org



National Ecological Observatory Network

BATTELLE
It can be done

720.746.4844 | neonscience@battelleecology.org | www.neonscience.org