

Remote Sensing Application



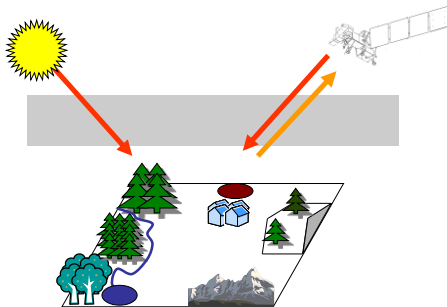
Tran Quang Bao
Vietnam National University of Forestry

What is remote sensing?
Types of remote sensing
General characteristics of all remote sensing

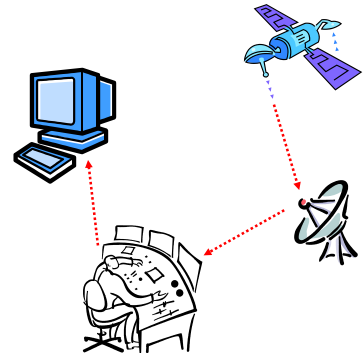
Remote Sensing and our view of earth...



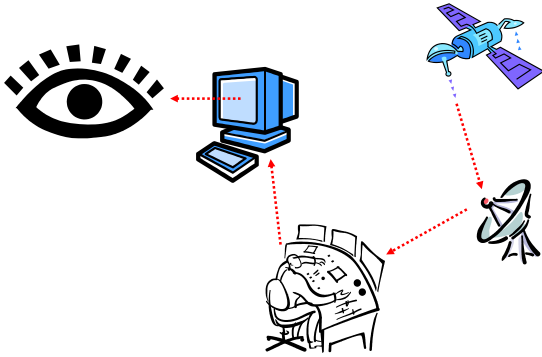
Understanding Remote Sensing Data



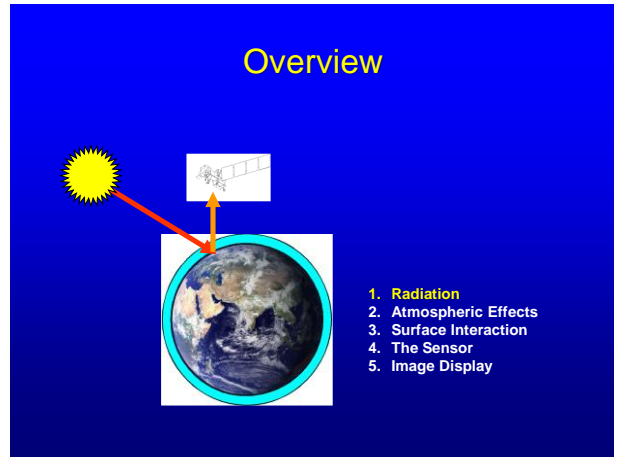
Processing Remote Sensing Data



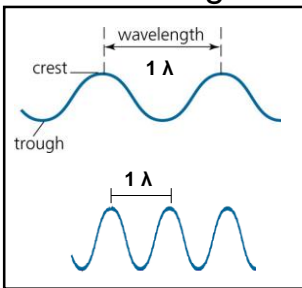
Processing Remote Sensing Data



Overview



Wavelength and Frequency



$$c = \lambda * \nu$$

$$\nu = \frac{c}{\lambda}$$

$$\lambda = \frac{c}{\nu}$$

where

c = speed of light ($2.998 * 10^8$)

λ = wavelength

ν = frequency

Units

0.7 μm (micrometers=1 millionth of 1 m) *

=

0.7 μ (microns)*

=

700 nm (nanometers) *

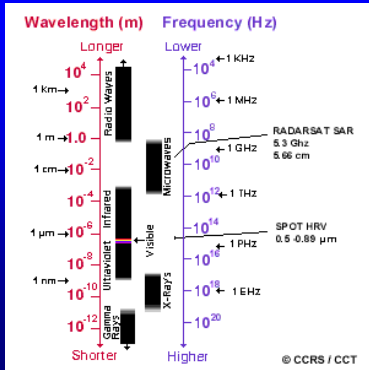
=

7000 Å (Angstroms)

***most often used**

* No longer considered correct

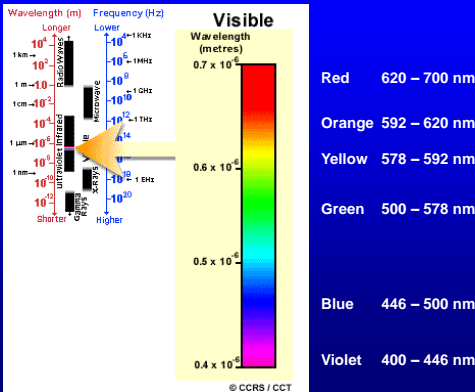
The Electromagnetic Spectrum



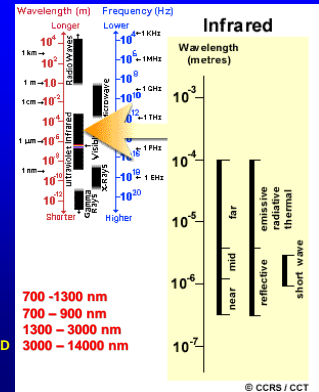
Visible Spectrum

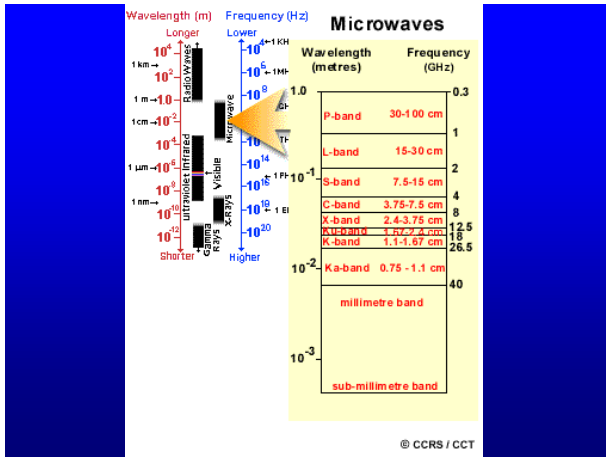
- The light which our eyes - our "remote sensors" - can detect is part of the visible spectrum.
- It is important to recognise how small the visible portion is relative to the rest of the spectrum.
- There is a lot of radiation around us which is "invisible" to our eyes, but can be detected by other remote sensing instruments and used to our advantage.

Visible Light



Infrared Light



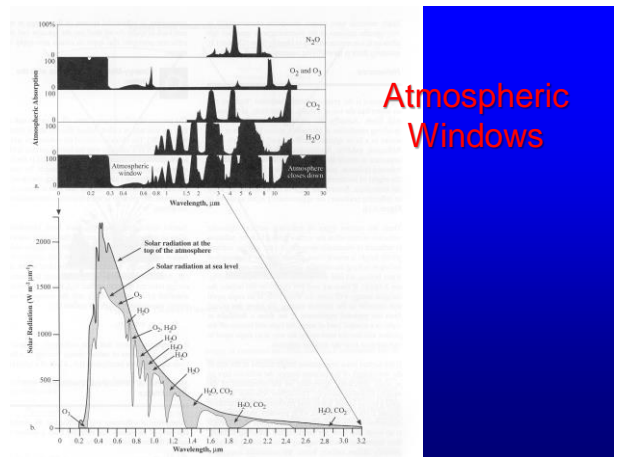


Overview

1. Radiation
2. Atmospheric Effects
3. Surface Interaction
4. The Sensor
5. Image Display

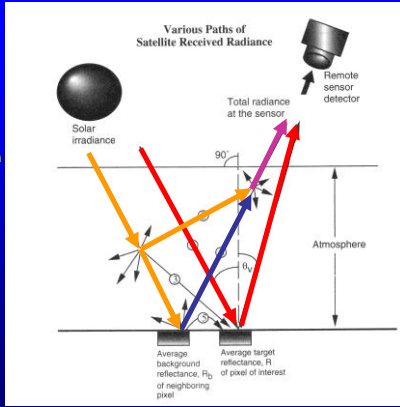
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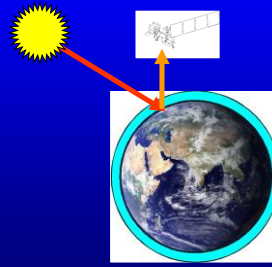


Radiometric Correction

- Direct Illumination
- Scattered Illumination
- Adjacent Reflections
- Path Radiance

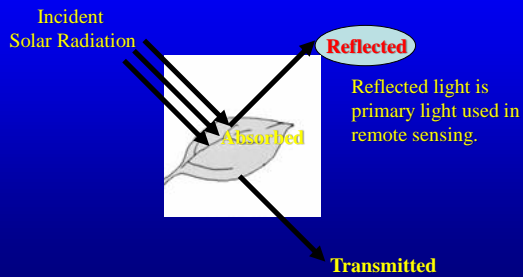


Overview

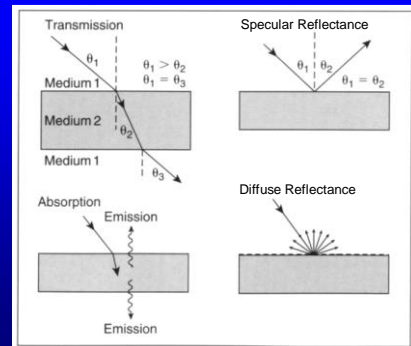


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Energy Balance Example



Fundamental Radiation-Surface Interactions



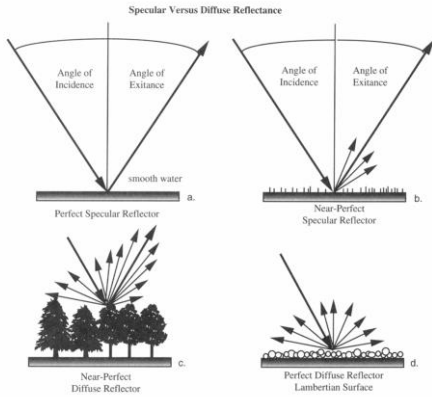
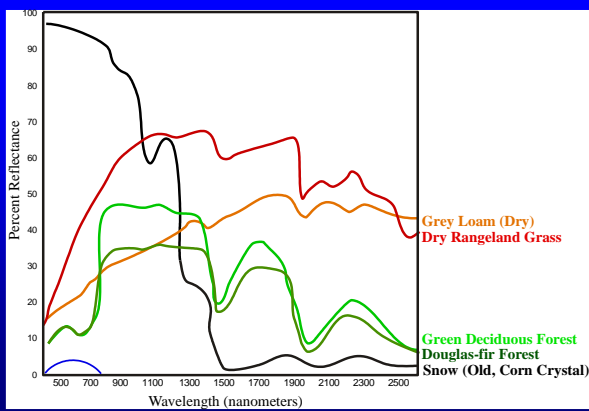
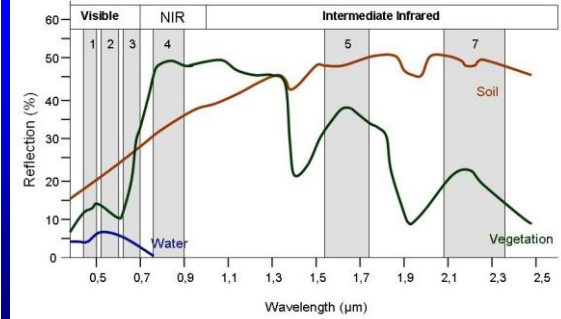
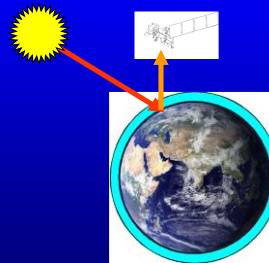


Figure 2-16 The nature of specular and diffuse reflectance.

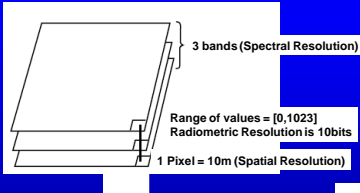


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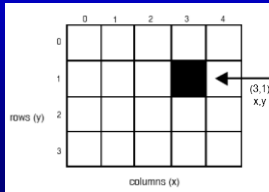
Basic Characteristics of Remotely Sensed Measurements



File coordinates—indicate the location of a pixel within the image (data file)

Map coordinates—indicate the location of a pixel on a map

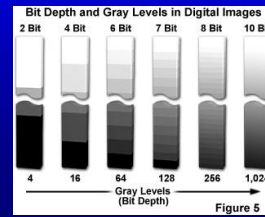
- Spectral
- Spatial
- Temporal
- Radiometric



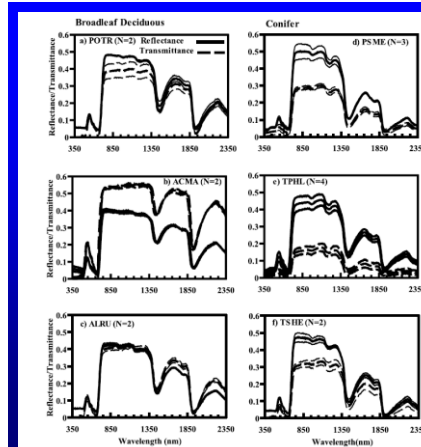
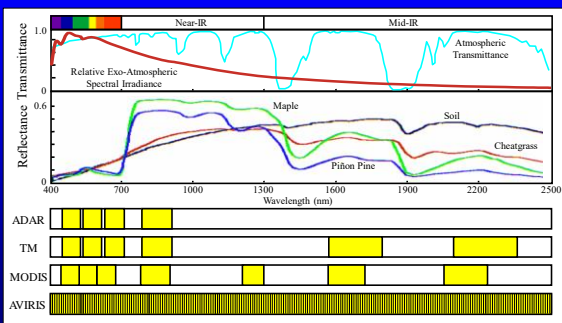
Basic Characteristics of Remotely Sensed Measurements

• Radiometric

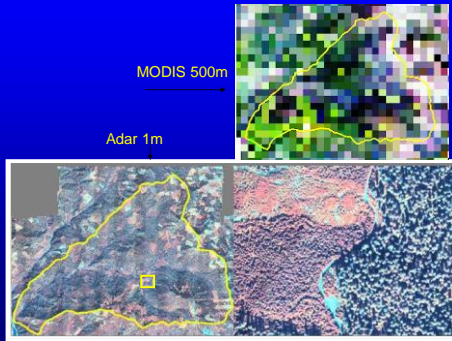
- The number of bits or levels of grayscale that a sensor can record.
 - Landsat 5 : 8 bits = 256 grayscale levels
 - AVHRR : 10 bits = 1024 grayscale levels
 - AVIRIS : 16 bits = 65536 grayscale levels



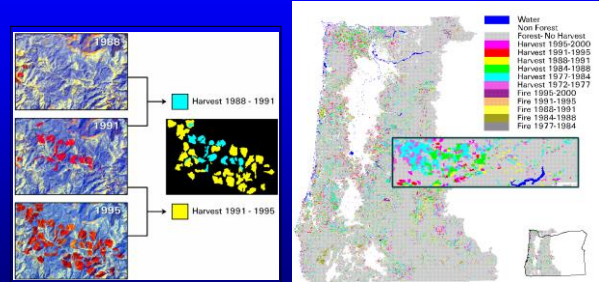
Spectral Resolution



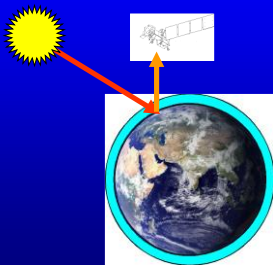
Basic Characteristics of Remotely Sensed Measurements: Spatial



Basic Characteristics of Remotely Sensed Measurements: Temporal

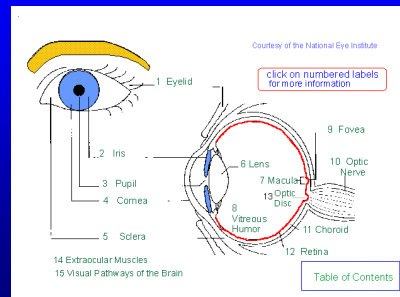


Overview

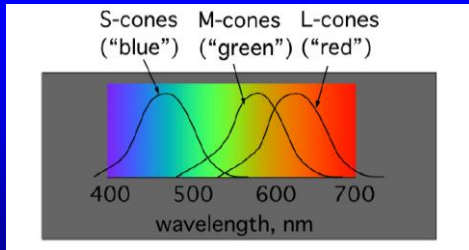


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The Human Eye

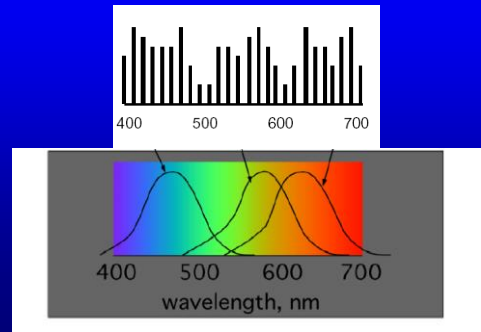


Humans have three types of color cones

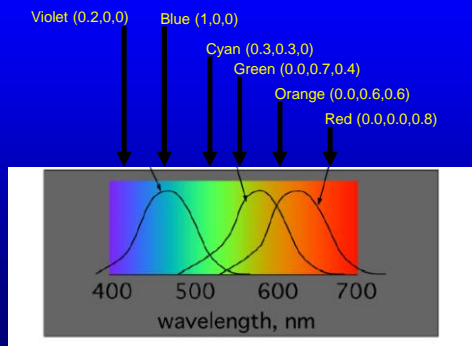


Cones are invariant (response is independent of wavelength)

Think of the first stage in color vision as a mapping from the space of spectra to the space of cone responses.

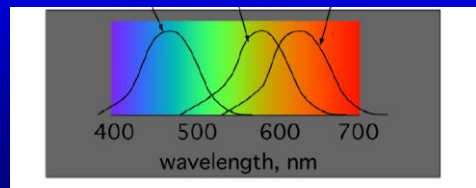


Color Mapped into Blue Green and Red Cones



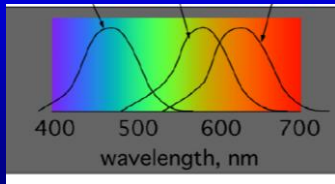
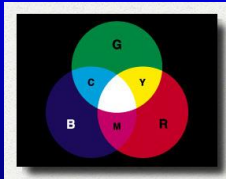
Why are there three primary colors?

Because we have three types of cones!

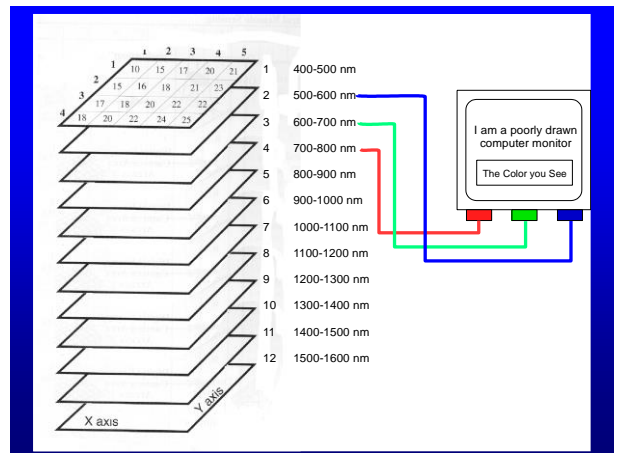
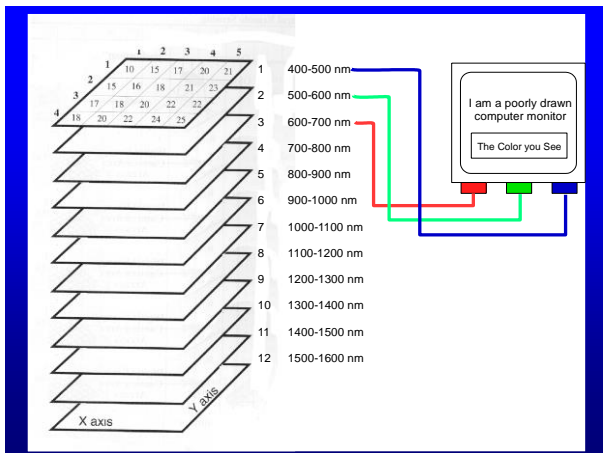
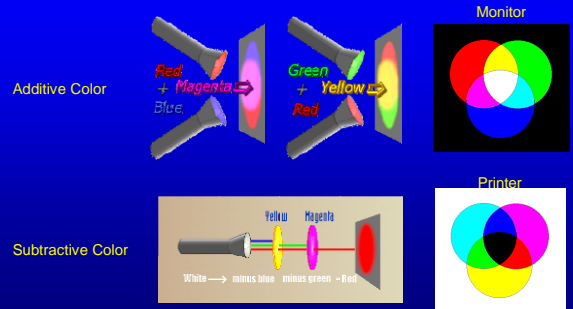


Why does green and red make yellow?

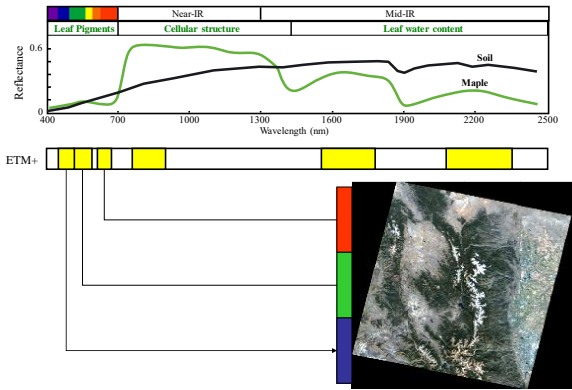
- Because Yellow activates Green and Red!



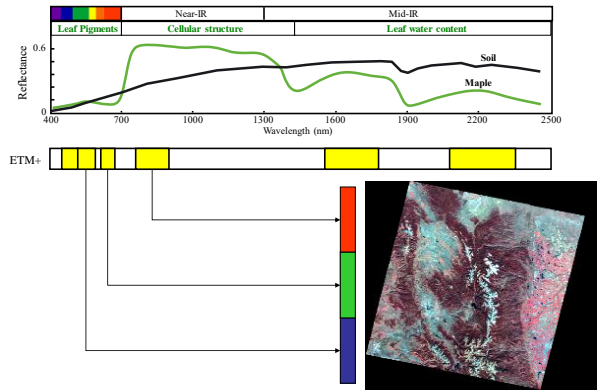
Additive and Subtractive Color



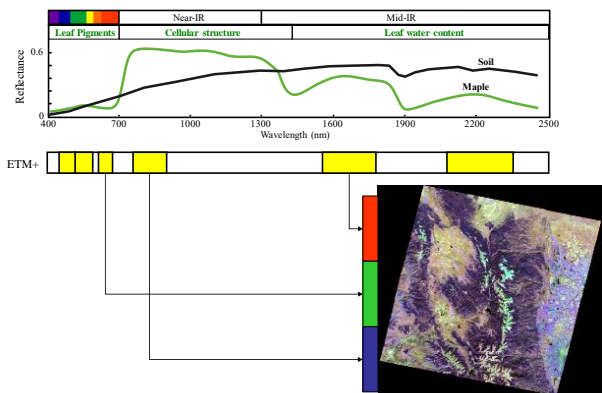
What to do with more than 3 bands of data



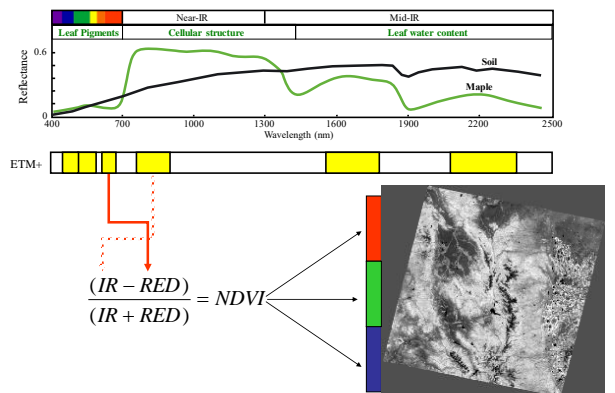
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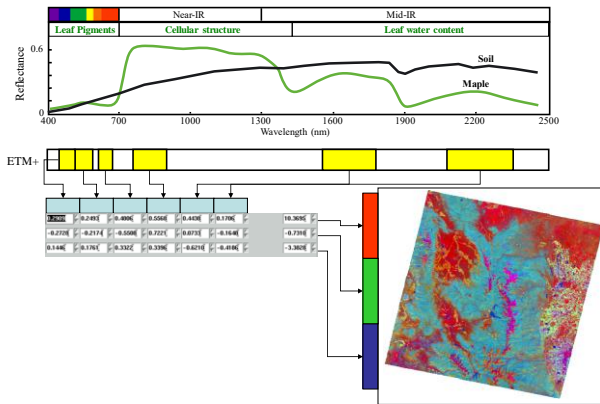
What to do with more than 3 bands of data



What to do with more than 3 bands of data



What to do with more than 3 bands of data



Passive Optical Sensors

1. Multispectral Moderate Resolution Sensors
 1. Landsat
 2. Spot
2. Multispectral Low Resolution Sensors
 1. AVHRR
 2. MODIS
3. Multispectral High-spatial Resolution Sensors ("Hyperspatial")
 1. IKONOS
 2. Quickbird
4. Hyperspectral Sensors
 1. AVIRIS
 2. Hyperion

Passive Optical Sensors

