Geog 1000 - Lecture 30

Introduction to Remote Sensing

http://scholar.ulethbridge.ca/chasmer/classes/

Today's Lecture (Pgs 25 - 28)

1. Finish Wednesday's lecture
2. What is remote sensing? Why use remote sensing
3. Image channels and reflected radiation
4. True vs. False Colour composites
5. Band ratios

Monday: Assignment 4 due at the beginning of class. Please do <u>not</u> email it to me (unless we arranged to do so).

Also: Class evaluations emailed to you.

What is Remote Sensing?

"Remote sensing is the field of study associated with extracting information about an object without coming into physical contact with it" – *Schott* 1997.

We remotely sense things every day with our eyes…

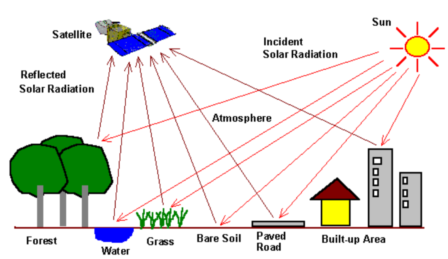
We acquire → process → output data.

Definition of remote sensing includes: Vision, astronomy, medical imaging, sonar, earth observation from a distance, etc.

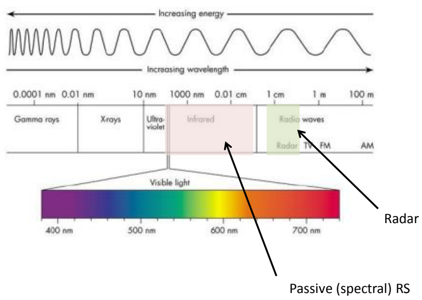
Focus: Earth observation from aircraft, satellite.

What is Remote Sensing?

Let's start with passive remote sensing



Sun's Electromagnetic Radiation:



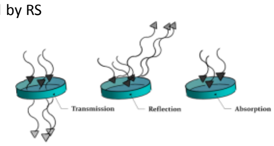
Radiation transmission, absorption, reflection

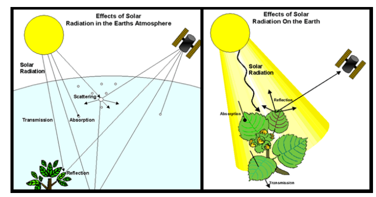
<u>Energy can be transmitted, absorbed, or reflected</u>:

Reflection = albedo (α) → What is measured by RS

Good absorbers are good emitters!

Any examples?





Why is remote sensing useful?

Gives us a historical view of the spatial world…

ALSO:

Gives us a different view of the world (from a different angle) → more *synoptic* view over a larger area.

Gets rid of the problem "Can't see the forest for the trees…"

AND:

Allows us to look at the world beyond "visible" wavelengths

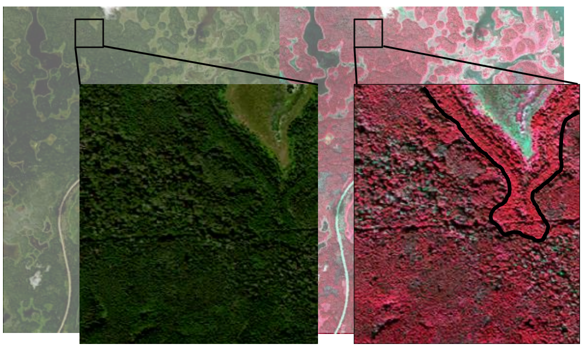
Why is remote sensing useful?

Wetlands, forests and lakes in blue, green red

Wetlands, forests and lakes in green, red, NIR

Another Example

Our eyes: Adapted for variability in visible spectrum.



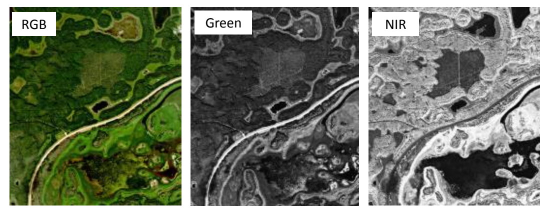
Energy interaction with features

Total EM energy transmitted, reflected and absorbed:

Two important things to note:

1. Proportions of each vary depending on object (bio)geochemistry.
2. Proportions of each vary per wavelength.

Things that look the same in one wavelength, look very different in another wavelength:



Biochemical Influences on Reflection

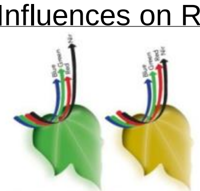


Figure 3a. Differences in reflected light between a healthy and unhealthy leaf.

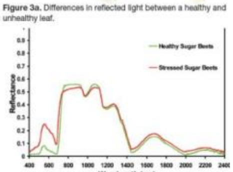
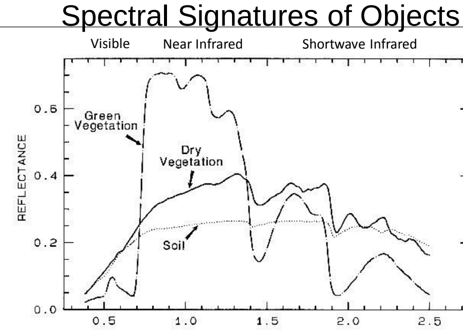


Figure 3b. Change in spectral reflectance for a portion of the EM spectrum for a healthy sugar beet plant and one under water stress.

Spectral Signatures of Objects



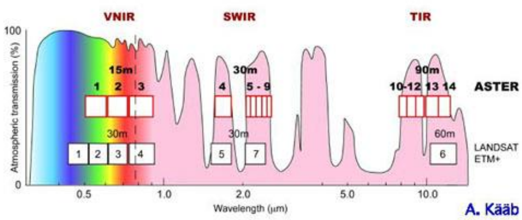
Reflectance:

$$\text{Reflectance (\%)} = \frac{\text{Energy at certain wavelength reflected from object}}{\text{Energy at certain wavelength incident upon object}}$$

Remote Sensing Uses KEY Wavelengths

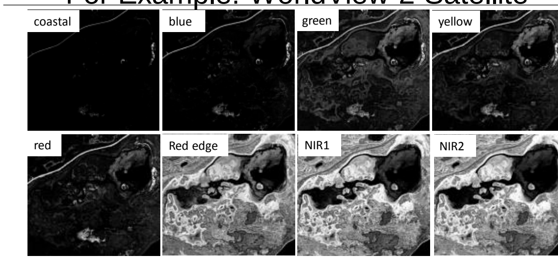
Bands → Discrete wavelengths that show greatest differences between things on Earth

AND are not scattered by atmosphere



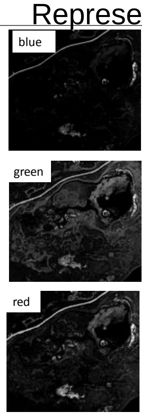
Each "Band" is assigned a RGB display colour

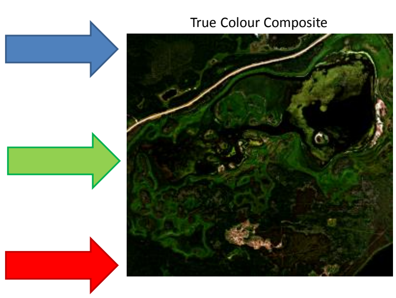
For Example: WorldView-2 Satellite



The same area, but differences in reflectance and absorption of electromagnetic radiation from the sun depending on object structure and chemistry.

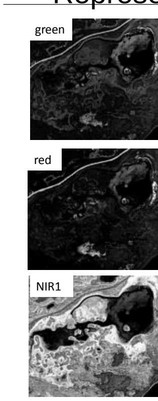
Representing Earth Surface Features

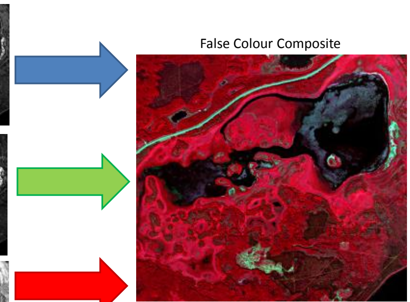




Everything that reflects "blue" wavelength looks blue
Everything that reflects "green" wavelength looks green
Everything that reflects "red" wavelength looks red

Representing Earth Surface Features



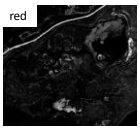


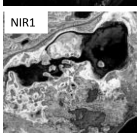
Everything that reflects "green" wavelength looks blue
Everything that reflects "red" wavelength looks green
Everything that reflects "NIR" wavelength looks red

We are most interested in absorption vs. reflection

How can we (vaguely) determine vegetation that is more/less healthy (or productive, or has more or less biomass)?

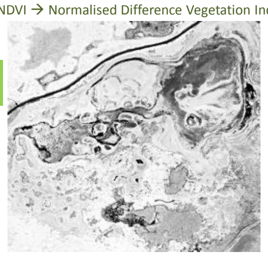
Ratio of red absorption vs. NIR reflection → healthiest veg will absorb the most red and will reflect the most NIR





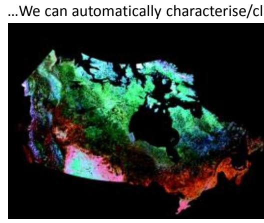
$$NDVI = \frac{NIR - Red}{NIR + Red}$$

NDVI → Normalised Difference Vegetation Index

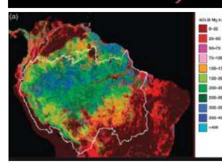


From this information…

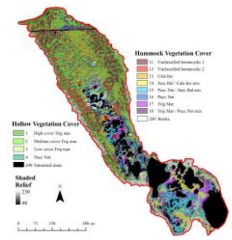
…We can automatically characterise/classify the land surface:



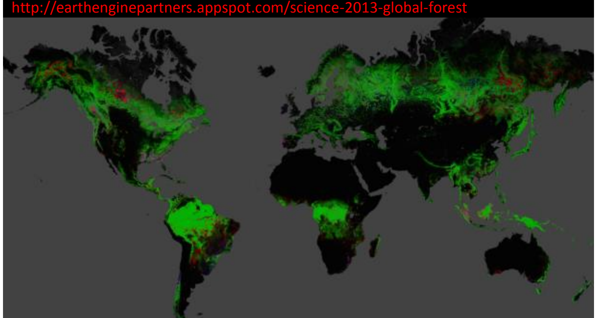
Areas as large as Canada to globe



to areas as small as wetlands…



This allows us to *monitor* our constantly changing planet.
http://earthenginepartners.appspot.com/science-2013-global-forest



Red = Loss
Blue = Gain
Purple = Loss and Gain
Green = Forest Cover

No Reading for the weekend.
Final Assignment introduced on Monday