Remote Sensing - Exam 1 Study Guide

RS Definition
- Remote sensing is the practice of deriving information about Earth's land and water surfaces using images acquired from an overhead perspective, using electromagnetic radiation in one or more regions of the electromagnetic spectrum, reflected or emitted from Earth's surface

Basic history of RS, early platforms
- Nadar – 1800's – hot air balloon taking aerial photos of cities
- Balloons 1860
- Carrier pigeons/kites – 1903
- WW1 – cameras in planes to observe enemies/trenches
- 1960 – First earth-observing satellite TIROS
- 1972 – first land remote sensing system

Advantages/limitations of RS
> Advantages
> - Increased Perspective
> - synoptic view
> - repetivity
> - accessibility
> - broadened sensitivity
> - time manipulation/conservation
> - cost effective
> Disadvantages
> - External noise/interference
> - relies on surrogate measures
> - technical/ calibration issues
> - relies on passive energy source
> - atmosphere/clouds interfere with data collection

4 resolutions of digital RS data , examples of high/low resolution imagery
- Spectral – colors, bands
- Radiometric – bit depth, contrast
- Spatial – ground area viewed
- Temporal – return period (time-based)

Basic principles of EMR
- Energy radiates from the sun, interacts with the atmosphere, then objects and features on earth. Some energy is absorbed and other is reflected back through the atmosphere, and can be measured by sensors on the platform.

EMR spectrum, shortwave/longwave which matter?
> Shortwave → longwave

gamma → x-ray → UV → visible → infrared → microwaves → TV/FM radio → short-wave radio → AM radio → long-radio waves
Blue 0.4-0.5um, green 0.5-0.6um, red 0.6-0.7um
Shorter waves scatter more easily

Difference between scattering/absorption/transmission, emission, reflection, reflectance
- scattering – light is absorbed then redirected prior to reaching earth
- transmission – light passes through
- absorption – light is trapped/held in object
- reflection – light is redirected
- reflectance – the way an object reflects energy, is stored in pixels

Digital number value represents/how it varies between different spectral wavelengths
- DN numbers represent the reflectance values for the pixel it is representing.
- Do not record true brightness, but are scaled values that represent relative brightness w/in each scene.

How vegetation, water, and other surface features interact with EMR and how that"looks" in different bands of the spectrum (what are responses)
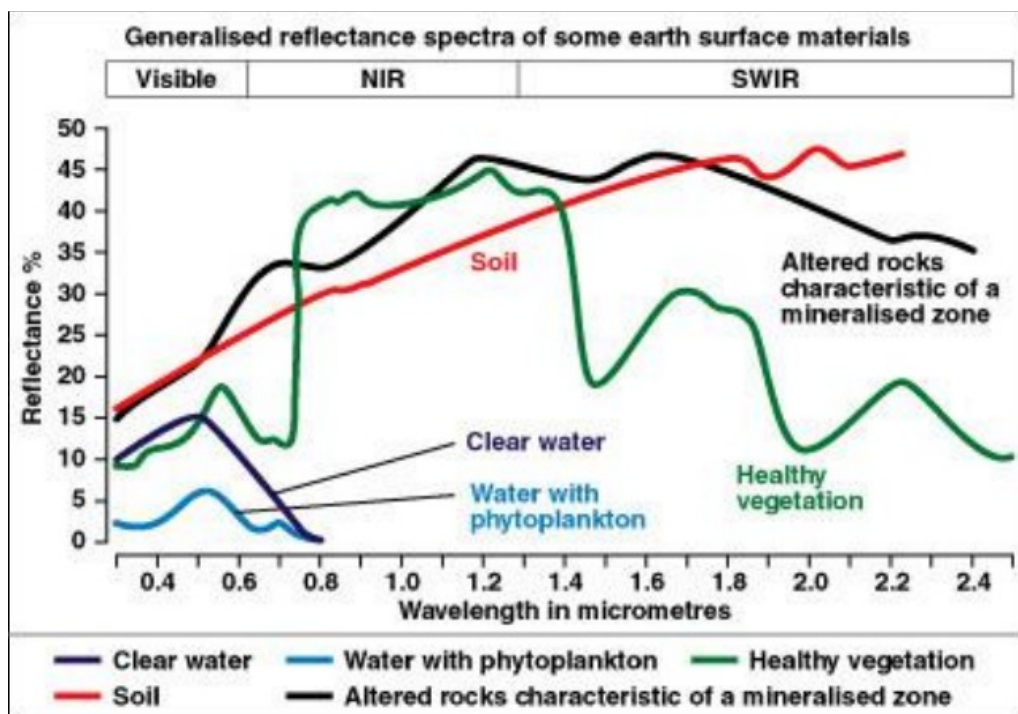
Basics of aerial photography and basic photgrammetry
- physical record on film > analog > brightness within photo proportional to brightness in scene

Distortion in aerial photographs, their corrections
- Optical distortions – flaws in lens, can't be corrected
- Tilt – select distances used for scale measurements as lines passing close to the principal point
- Relief displacement errors – Use a pyramiding projection of several patches with different scales of same area, placed one over another

Basics of multispectral RS
- Assignment of colors to represent brightness in differentregions of spectrum

Specific details of major satellite platforms and sensor characteristics (especially landsat)

- NOAA Satellites = GOES, POES (Geostationary/Polar-Orbiting Operational Environmental Satellites)
  - GOES: only weather
  - POES very high resolution radiometer sensor
    - vis, near-,mid-,and thermal IR
- Terra/EOS and Aqua/EOS
  - Polar-orbiting
  - Moderate Resolution Imaging Spectroradiometer (MODIS) sensor
    - High radoi/spectral/temporal resolution
- Landsat
  - First satellite designed to monitor earth's surface
    - longest running satellite program – conceived in 1965, launched in 1972, landsat 8 launched in 2013
    - goal: generate global archive of sunlit imagery over global landmass for research/commercial purposes
    - Most popular landsat sensor characteristics
      - MultiSpectral Scanner (MSS)
      - Thematic Mapper (TM)
      - Enhanced Thematic Mapper (ETM)
      - Enhanced Thematic Mapper Plus (ETM+)
      - Operational Land Imager (OLI)
      - Thermal Infrared Senesor (TIRS)

432,321 landsat images, excluding L8
- 432 – False color/Near infrared useful for vegetation studies, monitoring drainage, soil, crops
- 321 - True color images, representing red, green,blue

Elements of image interpretation, and how each is used
- Resolution – ability to render sharp image
- Location – geographic position
- Tone – brightness of object
- Color – describes intensities of objects represented as colors
- Size – size relative to surrounding objects
- Shape – general form, configuration, or outline of individual objects
- Pattern – spaatial arrangement of objects
- Shadow – outline/shape of object
- Texture – frequency and arrangement of tones
- Site – how objects are arranged with respect to one another
- Association – refers to identification of an object based on confirmation of another

Basic process of image enhancement
- contrast enhancement
- linear stretch
- histogram equalization
- density slicing
- edge enhancement