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Unit 3 Quiz

1. Name at least 3 types of remote sensors that can be used on both aerial and satellite systems.

   True color
   RADAR
   Hyperspectral
   (another is multispectral)

2. What is the difference between an "ortho photo" and a "true ortho photo"?

   An "ortho photo" is registered to a high quality geographic base and can be used to make high quality measurements and can be used for digitization or other purposes. The "ortho photo" does not have any of the vertical anomalies removed from it.

   A "true ortho photo" is the same as above, but it has all or most of the building tilt or other vertical anomalies removed from the ortho photo product. The "true orthophoto" is typically used in urban environments with tall buildings, bridges, and overpasses.

3. How is an image formed by a RADAR system and what are some uses of RADAR imagery?

   A RADAR sensor emits a radio wave pulse that hits the ground and this is reflected back to the sensor. The sensor records these responses to generate the image. RADAR is useful for wetland mapping, flood mapping, buried features in arid environments among others.

4. How is an image formed by a LiDAR system and what are some uses of LiDAR imagery?

   A LiDAR sensor emits a high speed pulse of a laser beam that hits the earth and is reflected back to the sensor. The LiDAR records this response. LiDAR is typically collected for high resolution elevation and topography data that can include the bare surface and vertical structures like trees and buildings. LiDAR is often used to generate a high resolution digital elevation model.

5. What is the major difference between hyperspectral image data and multi-spectral image data?

   Hyperspectral data collects image data in hundreds of specific narrow wavelengths, whereas, multispectral image data is collected in only a few (usually 4-10) broader wavelength ranges. Hyperspectral data has a much better potential of identifying specific materials in the environment.

6. Name and describe the major parts of a digital image.

An image from remote sensing data is made up of bands, rows, and columns. The bands (or sometimes called channels, layers, rasters, or grids) correspond to individual wavelengths that the sensor detects. Each band is organized into the same number of rows and columns. The fundamental image component that contains the information is the pixel. A pixel often records the reflected energy intensity from the ground in the form a specific digital numbers that represent the brightness values of an image. Pixels can also contain information such as elevation values, or specific land cover thematic categories. Most of the time the pixel values are integer, but can also be in a decimal or (floating point) format.

7. What does 8-bit data mean?

   8-bit refers to the total brightness range of an imaging system. 8-bit indicates that a total of 256 unique brightness values can be recorded on the sensor. The total brightness range for a given system is 2 to the x power. For 8-bit data, the total range can be expressed as 2 to the8th power.

8. Why does healthy green vegetation tend to reflect higher in the infrared part of the electromagnetic spectrum than the green wavelength?

   The energy from the sun tends to reflect higher in the infrared wavelengths versus green because of the internal structure of the plant leaf or needle.

9. Why does water tend to not reflect much in the infrared part of the electromagnetic spectrum?

   Water tends to absorb infrared energy rather than reflect it. As a result, water tends to show up very dark on an image that records infrared wavelengths.

10. Briefly explain how different remote sensor bands can be viewed on a color display.

    A specific wavelength of a sensor is recorded on individual image bands. These image bands are assigned to one of the color display panes (blue, green, or red) of a color monitor. Depending on the image band assignment, the analyst can display true color or a variety of false color image band combinations.

11. What are some of the important characteristics when ordering and acquiring imagery from the following:

    a. Aerial Systems

Pixel size
Leaf on or leaf off conditions
Is LiDAR needed?
Adhering to National Map and digital data standards
Is true ortho processing needed?
Level of detail needed to be seen in the imagery
Will the project be collected as an individual organization or through a partnership
(others found in the lecture material)

b. Satellite Systems

Repeat period
Pixel resolution
Number of bands to collect
Time frame for tasking the satellite
Quantity of cloud cover
Are merged products required?
Additional processing performed by the distribution company
(others found in the lecture material)

12. Name and describe 3 pre-processing routines that can be used in ArcGIS.

Image Composition – this routine allows for a multi-band image to be built from its individual sensor bands. This may be required if the raw data is provided as individual bands or image data is downloaded from spatial data clearinghouses.

Image Subset – this routine provides the ability to clip or create a smaller area from a larger image data set

Image Mosaic – this routine provides the ability to merge adjacent images in the same geographic area together to create a larger single image

13. What is a histogram and what does it show?

A histogram is a distribution of the count (or frequency) for individual brightness values in an image band. Image band histograms can provide insight as to the kinds of unique pixel values are present in a given image band.

14. What can band ratios be used for?

Band ratios can be used for normalizing brightness values for the same kind of material that may occur on different areas through the image such as different slopes, aspects, or elevations. Band ratios can also be used to derive biophysical properties from the image such as quantity of biomass and plant stress.

15. Briefly describe the NDVI ratio and what is it typically used for.

The NDVI, Normalized Difference Vegetation Index, is a unique band ratio that can be used with sensors that provide the true color and at least one infrared band. This ratio computes how much healthy green vegetation exists in a given image. This ratio can be used on multiple dates in the same geographic area to map changes in healthy green vegetation such as those resulting from growing seasons, plant stress, fire, and mining, to name a few.

16. Briefly describe the tasseled cap transformation and what it is typically used for.

The tasseled cap transformation is a unique transformation that can be applied to Landsat and IKONOS image data. The Tasseled Cap values must be empirically derived for each sensor. Only a few sensors have these values derived. The tasseled cap transformation produces three components, Brightness, Greenness, and Wetness. Each of these components can be used to map bright areas (such as urban environments), green areas (such as healthy green vegetation) and wet areas (such as those found in wetlands or to look at changes in water quantity contained in vegetation over time).