

Question 1 (5 points):

Blacksburg (37.2°N, 80.4W, 1800ft elevation)

Roanoke (37.2°N, 79.9W, 1000ft elevation)

According to Hopkins' Law, how many days earlier is budburst expected in Roanoke compared to Blacksburg?

Question 2 (10 points):

Phenology is an important factor of pest management. How are indicator species used to determine vulnerable life stages of insects?

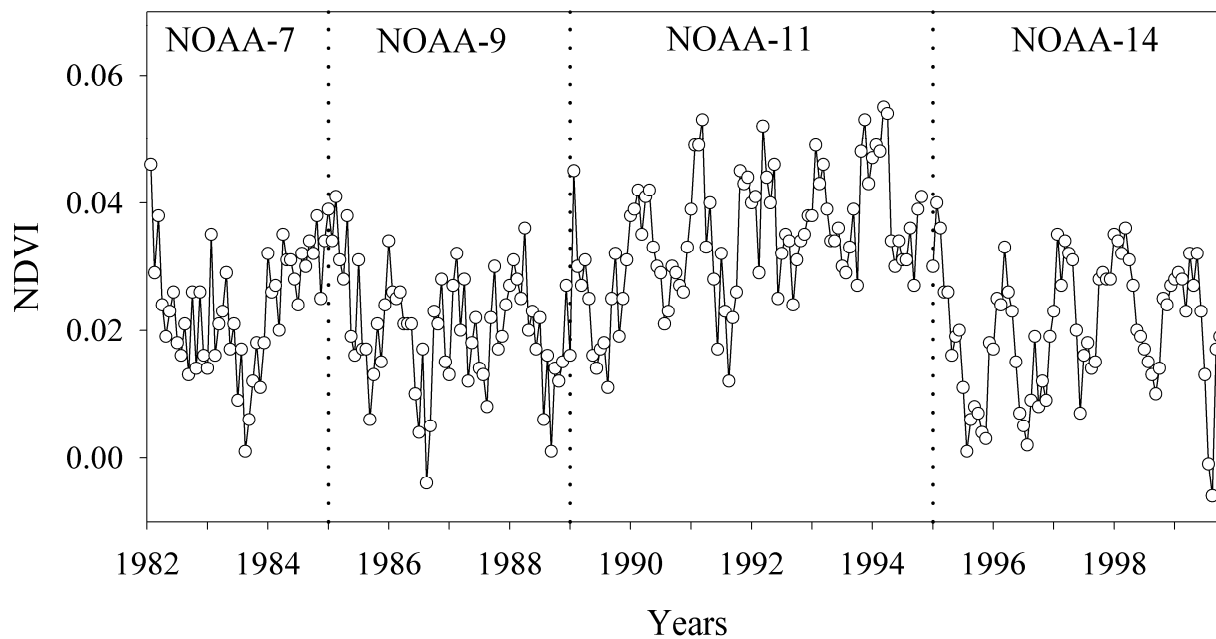
Question 3 (10 points):

- a) What are the main characteristics of birds involved in reliable bird phenology studies?
- b) What are the 2 measurable phenological events with respect to birds?
- c) Why are birds especially sensitive to phenological mismatch under climate change?

Question 4 (5 points):

The following figure shows the NDVI of 1 pixel over time.

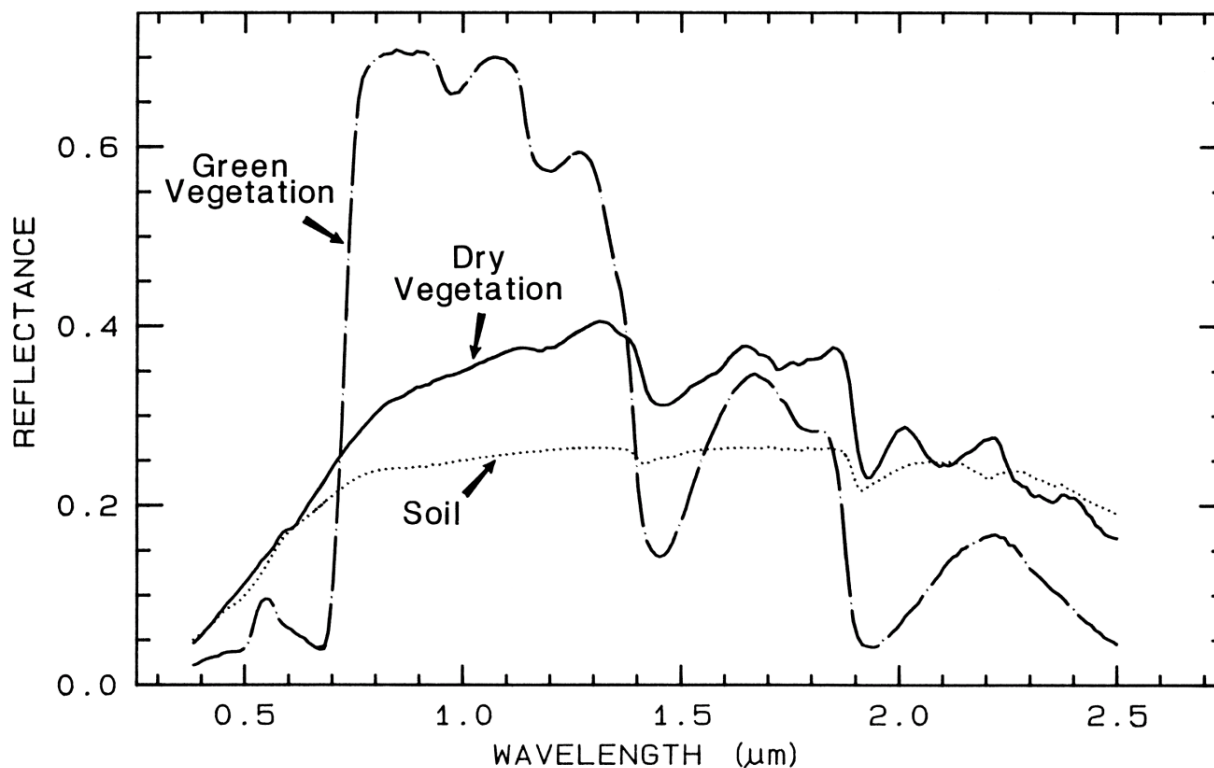
- In what type of biome do you think this pixel is located?
- Discuss the temporal pattern of the pixel. What most likely happened between 1989 and 1994 in this biome?

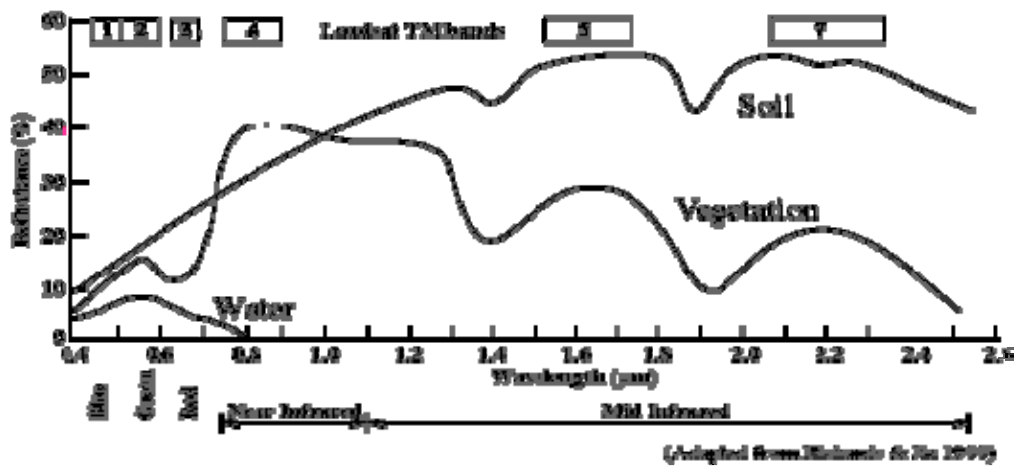


Question 5 (20 points):

The graph below gives the reflectance spectra of photosynthetic (green) vegetation, non-photosynthetic (dry) vegetation, and a soil.

- In the graph draw the NOAA AVHRR Red and Near Infrared bands. Be sure to place the band at the right wavelength and to depict the band width as accurately as possible (look at the Landsat example on the next page to get an idea).
- Do the same with the MODIS Red and NIR.
- If Red reflectance is 0.1 and NIR reflectance is 0.7, what is NDVI?
- What does it mean when a dataset has a high *spectral* resolution? Which sensor has the highest *spectral* resolution, AVHRR or MODIS?
- Considering AVHRR and MODIS bandwidth, discuss why a continuous NDVI product is not straightforward.
- Give a vegetation index that you can calculate based on MODIS data but not based on AVHRR. Why can you not create this index based on AVHRR data?
- Why would we want to use other vegetation indices than NDVI in (pick one!)
 - High latitude environments?
 - Dense vegetation environments?





Example

Question 6 (10 points):

The two figures below give NDVI during two different times of the growing season.

- a) Indicate the approximate timing for each image and discuss how you came to your answer.
- b) On each of the four provided graphs, indicate from which region (1,2,3,4) the spectra are taken. Discuss how you came to your answer.
- c) Which dataset do you think these curves were extracted from (PAL, GIMMS, MODIS)? Why?
- d) What does MODIS stand for?

Figure A

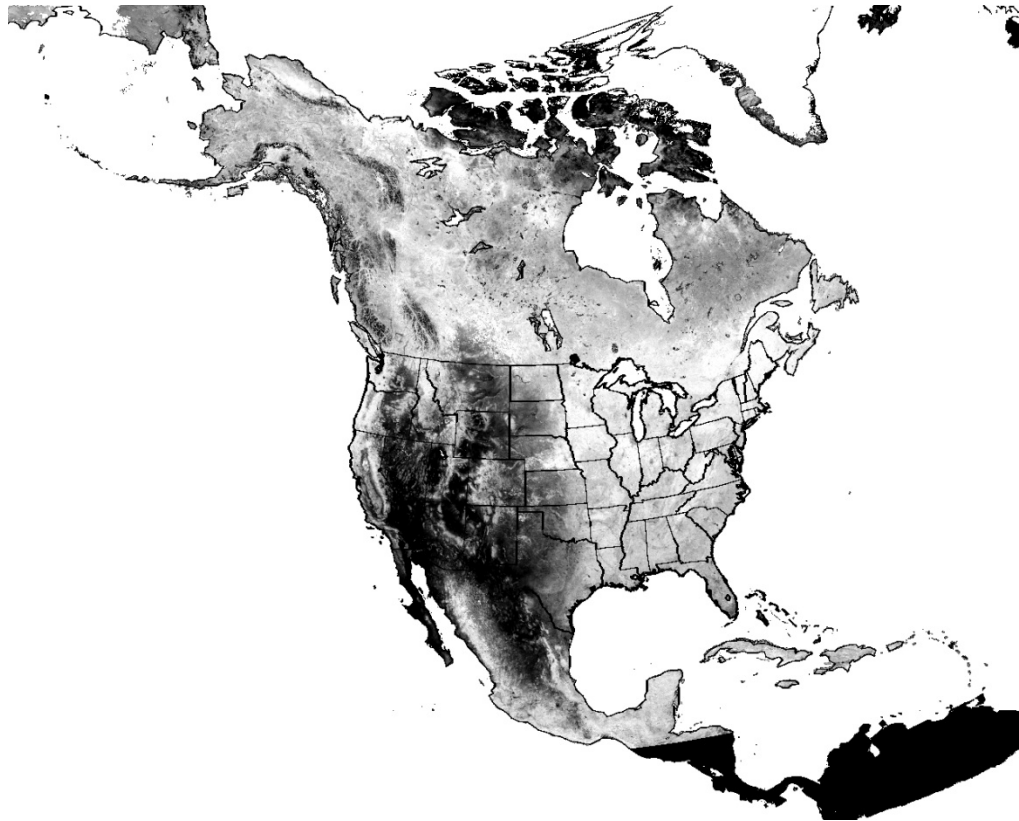


Figure B

