Name _______________________________ GL 1883
Lab - NASA UTEP and Climate Data Due: 26-Apr

Data Description

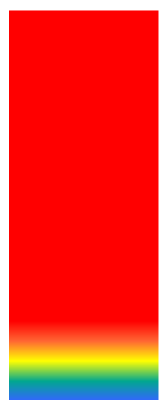
Landsat Data has been prepared for each participating campus. Using the 30 yr Landsat period from 1975 to 2005, data can be used to examine changes in land cover, abundance of vegetation in the summer (peak abundance) and relate changes to climate conditions. Each Landsat scene covers an area approximately 185 km x 185 km and the data is provided in a digital format. Landsat data from 1975 to 2005 was acquired for each campus location. Data consisted of an image from 1975, and one each from 1990, 2000 and 2005. Summer images were selected to acquire data near the time of maximum vegetation cover. CAVEAT: data was not acquired on the exact same date each year due to cloud cover or other data problems however, were collected within the same very small time frame.

- **Landsat 1975** data was acquired by the **Multispectral Scanner (MSS)**, the Landsat imager of that period, at 80m x 80m resolution. There were only 4 spectral bands, 2 in the visible spectrum (green and red bands) and 2 in the near-infrared spectrum.
- All Landsat data after 1984 are from the **Thematic Mapper (TM)** instrument. It has 30m x 30m pixels and has 6 reflected solar bands, 3 in the visible spectrum and 3 in the infrared spectrum.

In addition to the satellite images, climate data for the location of each institution is provided to facilitate interpretations of land cover change over time using minimum, maximum, and mean monthly temperature and precipitation values.

<u>Productivity</u>

For each Landsat scene we computed a standardized metric of plant productivity commonly used in remote sensing – the Normalized Difference Vegetation Index (NDVI). ***NDVI is a measure of the relative abundance of vegetation (sometimes biomass, other times closer to leaf area or canopy cover). While changes in the growth form or functional type of vegetation may not express linear changes, changes in health of a vegetation type (e.g., forest) is observed by the changes in tone between dates. The main reason NDVI is the most widely used measure of remotely sensed data is because it is very sensitive to variation in plant cover in the intermediate ranges of cover (about the density of a woodland or near canopy closure). Areas of bright red denote locations with high densities of vegetation while areas with dark blue denote locates with the least productive vegetation.*** See scale at right. It is also widely used because it is easy to produce:



- (Landsat band 4-Landsat band 3) / (Landsat Band 4 + Landsat Band 3).
  Where Band 4 is in the near-infrared spectrum and Band 3 is in the red part of the visible spectrum.

Objectives

- To apply your knowledge of remote sensing to a different physiographic location than Maine.
- To relate changes in productivity inferred from remote sensing data to records of local climate.
- To examine the relationships between water resources, human impacts, and possible impacts from climate change.

Assignment:

Complete the following and turn in a typed sheet with responses to all questions. No e-submissions. When referring to locations on the NDVI images, please reference using the column-row coordinate system (e.g. cell B2, NOT 2B). Recall from our climate discussion earlier in the semester, this region of Texas would fall under Koeppen's Bwh climate classification (Subtropical Desert) and all that it entails regarding controls on atmospheric circulation (e.g. Sutropical High). It might be easier to write answers/ideas/notes down for each question and type them up later prior to turning in the assignment.

1. Orient yourself on the NDVI images using the accompanying maps (GoogleEarth and GoogleMaps) to find common points on the landscape. Feel free to open a new browser window and visit one of the two Google sites to explore the area in a bit more detail. Does there appear to be a strong correlation between the most productive areas seen on the NDVI images and human activity? If so, explain (citing specific cells). Does there appear to be a correlation between other areas with "good" productivity and topography?

2. Interpret general patterns of productivity for the years 1975, 1990, 2000, and 2005. Make qualitative estimates for the amount of productive area seen on each image (e.g. one year has more/less/same amount of productive area; it is easiest to look for blue, green, and red areas as these colors represent relatively discrete levels of productivity). You can use specific cells as reference areas, but your estimates should be for the entire NDVI image as a whole.

3. Based on your qualitative estimates in #2, hypothesize about precipitation amounts (e.g. above/below trend) and temperatures (above/below trend) that support your qualitative comparisons (e.g. in 1982 I see only a small percent of productive area probably caused by low precipitation amounts and/or very warm temperatures). Make climatic hypotheses for each of the four NDVI images.

4. Based on your climatic hypotheses in #3, how would you describe changes in precipitation and temperature from 1975 to 2005 (referencing each year in your explanation; above/below average, greater than/less than, etc.).

Open the PPT file ElPasoTX_climate data (I will supply the password when you reach this point).

5. How would you describe precipitation and temperature for the years 1975, 1990, 2000, and 2005 based on the long term trend (e.g. above/below trend)?

6. Does the climate data (precipitation and temperature) support your qualitative estimates of productivity seen on the four NDVI images (e.g. the image for 1982 shows above normal productivity in response to above normal precipitation and temperature)? Explain, referencing the four years in question.

7. Does maximum precipitation or temperature exert a stronger control on productivity? Explain.

8. Based on your response to #1 and the level of human activity in the area, how might water resources near El Paso, TX be adversely affected by climate change in the future?

9. How well does the climate data correlate to the stream discharge data for the Pecos River in Orla, TX (located about 100 miles east of El Paso, the closest USGS stream gage with a record covering the time period of interest in this lab)? Provide the rationale behind your answer, referencing physical, geographic, or human factors whenever possible. Feel free to run a correlation analysis using the data provided in the Excel spreadsheet (EP_Precip-PR_Disch). Recall from the beginning of the semester that the equation is =correl(array1,array2).