Remote Sensing of Deforestation near Rondonia Brazil

Data Collection, Remote Sensing & Analysis, and Map Creation by: Graham Jones

Remote Sensing in Environmental Analysis
Geography 422, Spring 2011
Professor: Dr. Eman Ghoneim

UNCW
Dept. of Geography & Geology

The objective of this study was to determine the amount and extent of deforestation in the Amazon Rainforest using remote sensing techniques with free and easily accessible satellite imagery. The images used in this change analysis were chosen in equal intervals and were collected during the same month to most accurately represent the data and eliminate seasonal variations. Generally speaking, scientific study is most heavily limited by the quality of the data, and remote sensing of satellite imagery is no exception, the first limiting factor is inevitably the resolution and associated spectral information (infrared, radar, thermal, etc.). The images used for this study were collected by NASA's Landsat Thematic Mapper satellite, their spatial resolution is 30 meters, the associated infrared data they contain is vital for accurate analysis of the extent and health of vegetation. Although this is no ordinary vegetation in the forests of the Amazon, as the world's largest forest, a carbon sink providing 20% of the world's oxygen, they contain over half of the world's 10 million species of plants and animals.

Methods:

- Locate and Acquire Landsat TM images from glovis.usgs.gov

- Convert the spectral data associated with the image from DN values to reflectance values, this allows for functionality when using the Normalized Difference Vegatation Index (NDVI)

- Mosaic the 2 images from each year together, allowing them to be processed and displayed as one image

- Process the images using two seperate classification processes to explore the differences; Unsupervised classification and NDVI then Unsupervised classification

- Combine the spectral classes identified by ENVI software into two classes of land cover, Forested and Deforested

- Conduct accuracy assessments on each classified image

- Conduct Change Detections for the successive years based on the images classified with the unsupervised method only

- Explore and analyze the results of the process

Results:

The images below represent the areas of change for their respective 10 year period. The areas in green had no change in land cover type, and the areas in white were deforested.

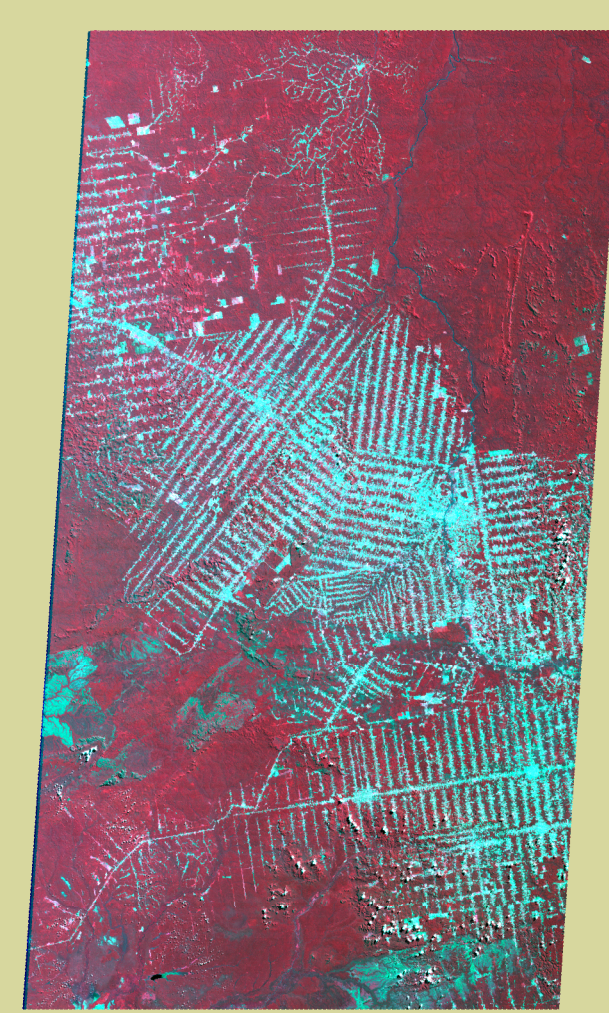**Landsat TM image shown with bands 3,2,1** — **Landsat TM image shown with bands 4,3,2** — **Images classified unsupervised using NDVI** — **Images classified unsupervised w/out NDVI**

August 1989

Forested area = 18,675 sq miles or 77%
Deforested area = 5,725 sq miles or 23%
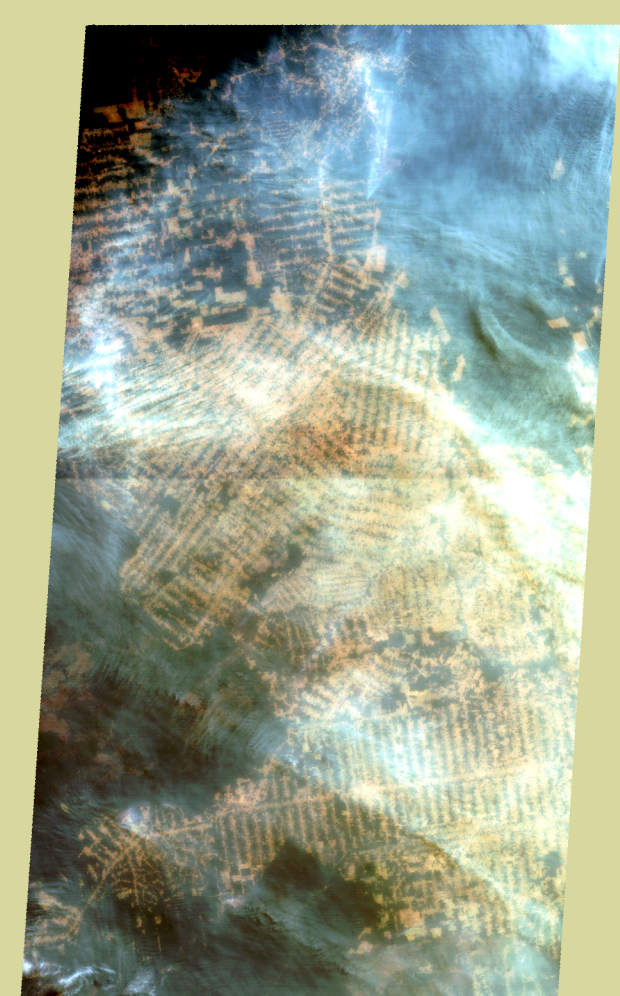
Overall Accuracy = 97%
Kappa Coefficient = .94

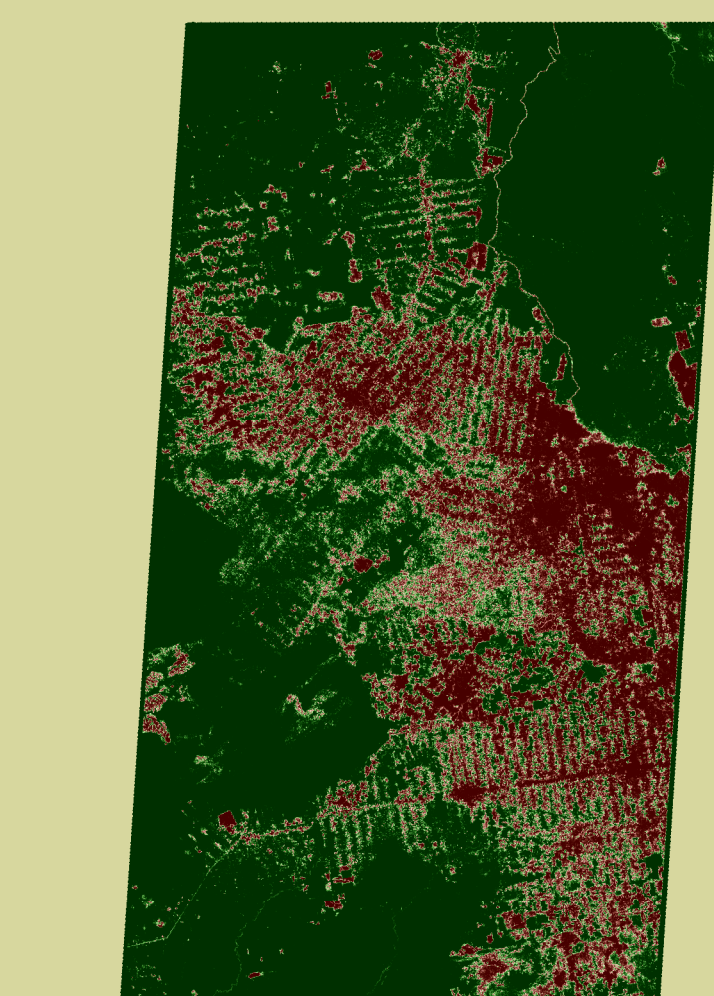Overall Accuracy = 99%
Kappa Coefficient = .99

From August of 1989 to August of 1999 the Forested Area decreased by 2,240 sq miles or -12% and the Deforested Area increased by 2,625 sq miles or +45%.

August 1999

Forested area = 16,435 sq miles or 66%
Deforested area = 8,350 sq miles or 34%

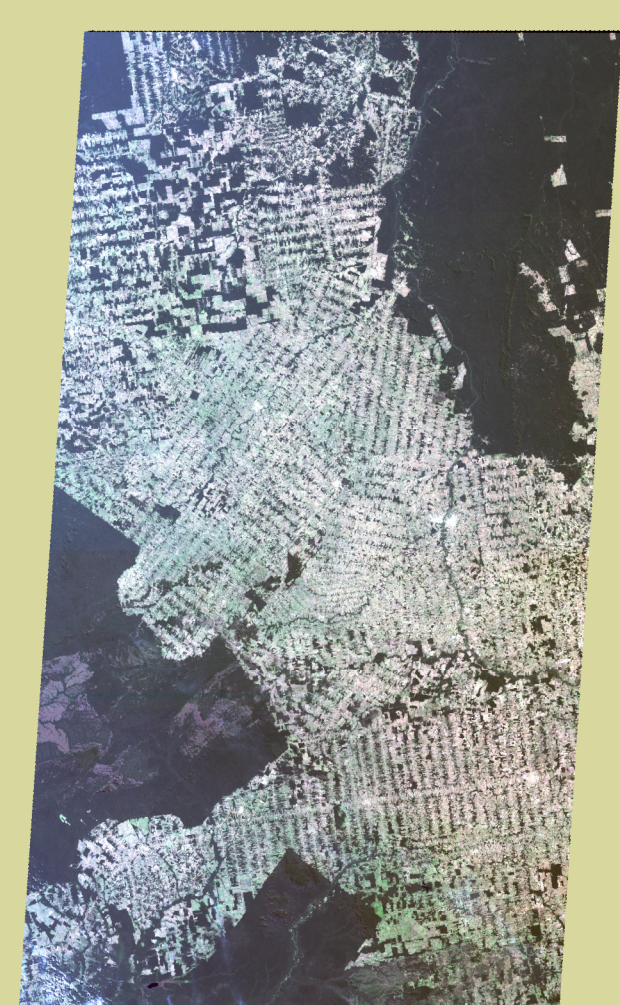Overall Accuracy = 84%
Kappa Coefficient = .67

Overall Accuracy = 99%
Kappa Coefficient = .99

From August of 1999 to August of 2009 the Forested Area decreased by 3,167 sq miles or -19% and the Deforested Area increased by 3,597 sq miles or +43%.
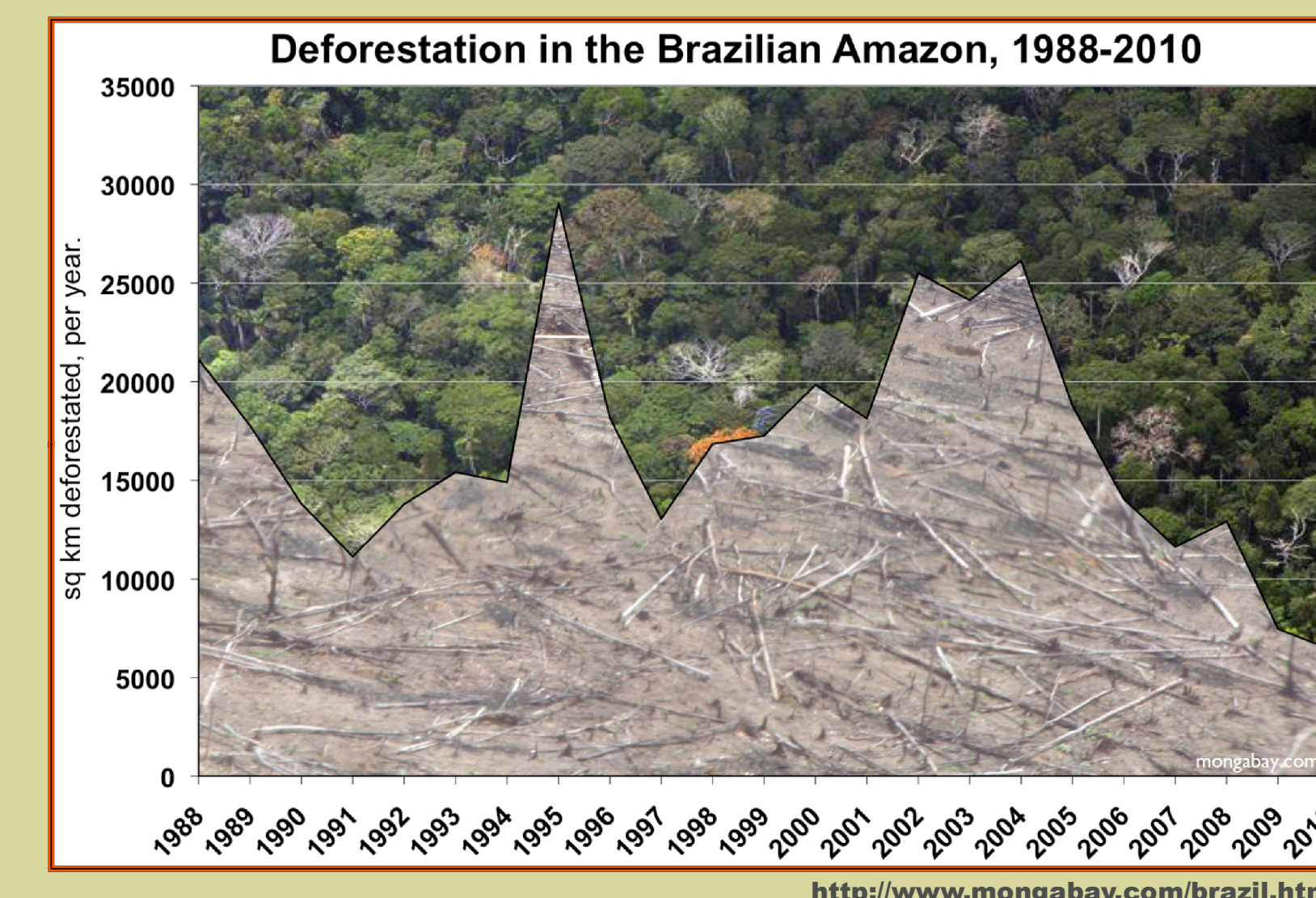
August 2009

Forested area = 13,267 sq miles or 53%
Deforested area = 11,948 sq miles or 47%

Overall Accuracy = 99%
Kappa Coefficient = .99

Overall Accuracy = 99%
Kappa Coefficient = .99

Conclusions:

The deforestation of the lower Amazon Rainforest near Rondonia, Brazil is occuring at an alarming rate. The deforested area within the boundary of this study went from 23% in 1989 to 47% in 2009, a total loss of 5,407 sq miles of natural, virgin forest. This is rampant and wasteful destruction of a highly productive and biodiverse ecosystem unlike any other in the world, facilitated by wealthy interests and encouraged by government, the timber is clear cut logged and the stripped land is used for grazing or agriculture; a situation similar to that of the US in the 19th and 20th centuries. We must drastically increase our Conservation and Education efforts to save the Amazon Rainforest, "the lungs of our planet."

Deforestation in the Brazilian Amazon, 1988-2010

http://www.mongabay.com/brazil.html

References:

Butler, Rhett. MONGABAY. n.d. http://www.mongabay.com/brazil.html.

Fund, Environmental Defense. Forest Maps. n.d.
http://www.edf.org/documents/2355_ForestMaps.pdf.

Watch, Global Forest. Human Pressure on the Brazilian Amazon Forests. n.d.
http://www.globalforestwatch.org/english/interactive.maps/Brazil_Datasets.htm.