Monitoring Deforestation in Eastern Liberia: Analysis from 1986 to 2002

Overview

Deforestation is a cause for concern as it poses threats to biodiversity, exacerbates carbon emissions into the atmosphere and can have indirect effects of increasing soil erosion and reducing water quality. In Liberia, significant deforestation continues in order to make way for agricultural lands, growing communities and for small-scale mining efforts (Wiley, 2007). My analysis focused on the area in and around the East Nimba Nature Reserves in eastern Nimba County to analyze changes in forest cover from 1986 to 2002.

Example of deforestation in Liberia in Lofa County—photos by author in 2009

Methodology

Images from 1986 (using Landsat 5 TM) and 2002 (using Landsat 7 ETM+) with minimal cloud cover were obtained through the United States Geological Service's Global Visualization Viewer (Glovis). The Digital Number (DN) of the spectral bands of images were converted to reflectance and stacked to prepare the images for analysis.

Using the Normalized Difference Vegetation Index (NDVI) with the formula (Near-Infrared band - Red band)/(Near Infrared band + Red band), I created a differentiation in order to identify vegetation cover so as to minimize the misrepresentation from shadows and to exemplify the inverse relationship between chlorophyll absorption and increased reflectance for healthy plant canopies such as the forest tracts here.

1986   2002
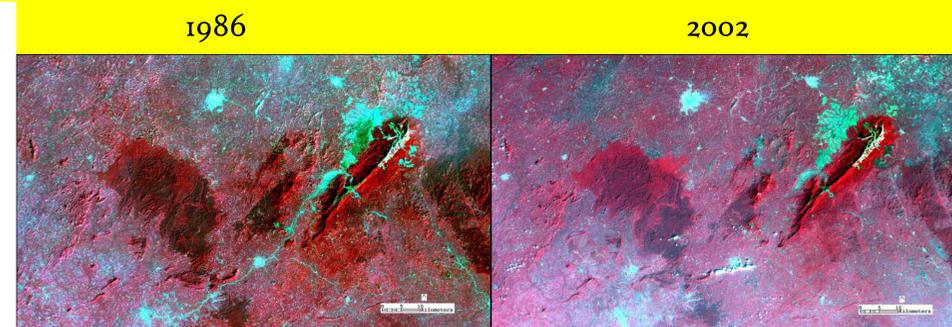
Above: Landsat images converted to reflectance
Below: Images classified using NDVI and categorized in 2 classes using density slicing
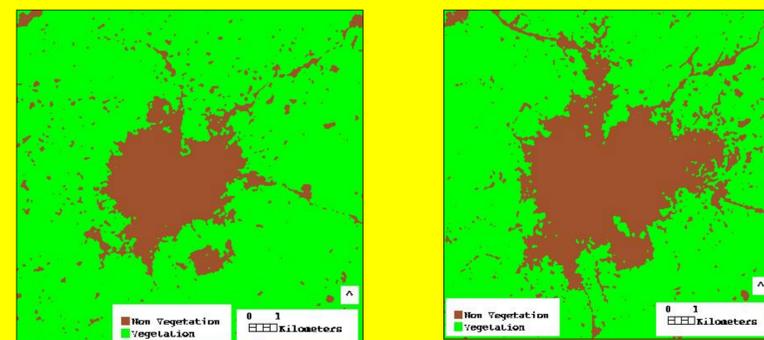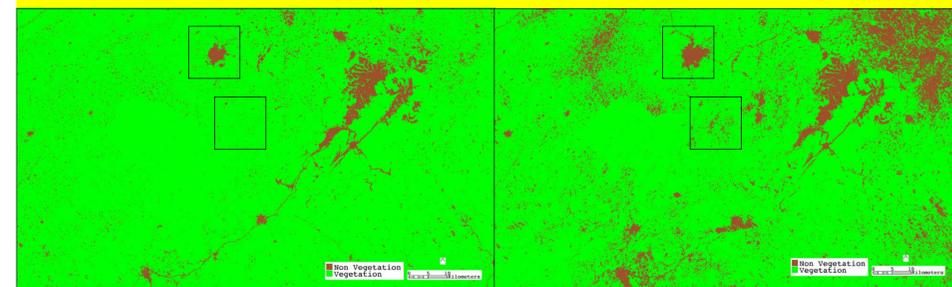
Above: Images exemplifying change in vegetation due to urban expansion
Below: Images exemplifying change in vegetation due to logging and small-scale mining
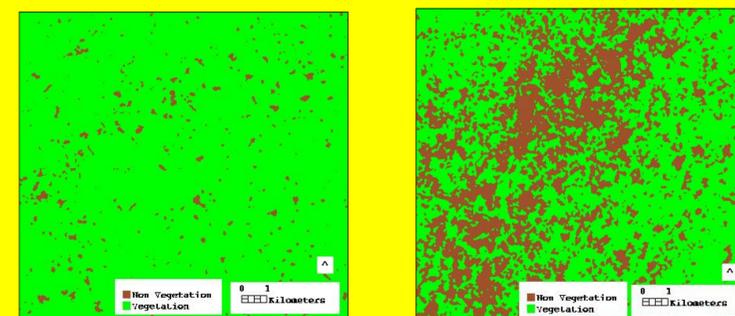
Findings

Through my analysis, I discovered that the change in vegetation cover from 1986 to 2002 resulted in a net loss of vegetation.

	Non Vegetation	Vegetation
Image Difference	888.50 sq. km	-888.47 sq. km

Using the Density Slicing technique with 2 classes, (vegetation and non-vegetation), ranges were developed for each image representing differences between cover types. For the 1986 image, the NDVI range for non-vegetation was from 0 to 0.43 whereas vegetation was from 0.43 to 1.0. For the 2002 image, the range for non-vegetation ranged from 0 to 0.44 and for vegetation from 0.44 to 1.0. Then, using the change detection statistics method I was able to identify the change in vegetation and non-vegetation areas between 1986 and 2002.

Conclusion

This analysis demonstrates that deforestation continues in Nimba County as human populations increase and the need for resources grows. Given the loss of nearly 900 square kilometers, or roughly 55 square kilometers per year, we could project great strain on the proposed protected areas in this region resulting in another 10% loss of forest area, in this region by 2020, if deforestation continues.

To abate deforestation, the government of Liberia in conjunction with local communities and civil society actors should aim to develop education programs to teach communities near these forests about sustainable management of their forests. One example is to expand knowledge of non-timber forest product harvesting and means of developing agroforestry systems so as to abate the need for slashing and burning wide swaths of forest (FDA). Collaborative efforts can work to prevent total loss of the forests in this important eco-region of West Africa.