Matthew Hansen
South Dakota State University

Project Abstract

Establishing a Global Forest Monitoring Capability Using Multi-Resolution and Multi-Temporal Remotely Sensed Data Sets

Definitive information on the rates and patterns of global forest cover change has been limited due to the difficulties in establishing forest cover change map accuracy and the uncertainty of the estimates of overall rates of change. Furthermore, previous efforts have not been able to provide information on the biogeographical variations of the mechanics and characteristics of forest cover change. A CEOS calibration/validation panel determined that while global land cover maps have proven useful for a wide range of applications, the absence of robust characterization of the uncertainties of the maps have retarded their utility. The CEOS panel also concluded that the problem was particularly challenging for change maps and recommended research that would provide accuracy assessments and statistical characterization of global land cover change datasets. Our proposed research extends previous NASA-sponsored research on global forest cover dynamics and land cover change estimation to establish a robust, operational forest monitoring and assessment system that:

1) Quantifies rates and describes patterns of global forest cover change by biome and ecoregion.
2) Identifies and quantifies sources of uncertainty of forest cover change maps and areal estimates of change
3) Determines impacts of forest cover change on select ecosystem services.

Our strategy combines the strengths of global forest change mapping to produce a spatially explicit depiction of change at moderate resolution and statistical sampling to provide precise areal estimates of change in forest cover based on more accurate, higher resolution data. In addition, our monitoring strategy generates the data necessary for a statistically rigorous validation of the global forest change maps, thus successfully integrating accuracy assessment within a forest monitoring framework. The research will focus on four primary tasks:

1. Use existing MODIS and AVHRR percent tree cover maps to map areas of likely tree cover change from 1990 to 2000 to 2005.
2. Implement a remote-sensing based, probability sampling framework that combines the global forest cover maps and high resolution forest characterizations derived from Landsat images to: (a) estimate biome change and the uncertainty of each biome estimate, and (b) determine the overall and individual biome accuracy of the global MODIS and AVHRR tree cover change maps.
3. Evaluate the strengths, weaknesses, and biases of the remote sensing inputs, and how these vary geographically for accurately characterizing forest change, including the ability to quantify deforestation versus afforestation, and natural versus anthropogenic change.
4. Assess the impact on ecosystem services, including a prioritization of ecoregions within each biome that are most threatened by forest cover change.