LBA Abstract

Anthropogenic landscape changes and the dynamics of Amazonian forest biomass
<http://www.nmnh.si.edu/biodiversity/>

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Our study addresses the LBA Ecology theme of carbon storage and exchange. We propose a combination of field studies and computer modeling to estimate above-ground biomass in con tinuous forest, forest fragments, and secondary forests of different types through time and re late these measures to remote sensing data from LANDSAT TM images for a modified land scape in central Amazonia. Our objective is to develop a predictive model of carbon stocks and their dynamics based on readily identifiable landscape features derived from remote sens ing imagery.

BIOMASS DYNAMICS IN CONTINUOUS PRIMARY FOREST AND REMNANTS

We will use extensive existing data from a long-term phytodemographic project in the Amazon, coupled with additional field work, to estimate standing biomass in continuous forest plots and forest fragments. This unique data-set includes over 57,000 marked trees in 66 permanent, one-hectare plots. These plots were surveyed initially more than 15 years ago, and have been recensused 2-5 times to estimate tree growth, mortality, damage, and recruitment, thereby allowing us to monitor the dynamics of Amazonian tree communities and their intrinsic carbon stocks at a landscape level (ca. 1000 km2). In this project we will resurvey tree communities in all 66 permanent plots. Lianas will also be included in these surveys because recent results suggest that they could exhibit markedly increased growth rates in response to increasing atmo spheric CO2.

BIOMASS DYNAMICS OF REGENERATING FORESTS

We will develop biomass estimates for different ages and types of secondary forest, in order to assess the rate of carbon accumulation in fallow and regenerating lands following different successional trajectories. Both species-specific allometric equations and true destructive sampling in the field will allow the calculation of biomass estimates.

LANDSCAPE ANALYSIS

We will use detailed time-series remote sensing imagery of our extensive (20 X 50 km) research landscape in the central Amazon to produce a model of car bon dynamics as a function of identifiable landscape features (e.g. fragment size and shape, and the area and age of secondary forests). The procedure for the satellite analyses will be the following:

1. register all the thematic mapper images to a high resolution UTM map with precision GPS data from the field;
2. image to image registration will then be performed using the base map as the reference base;
3. an unsupervised cluster classification will be run in conjunction with a knowledge-based classifier to classify the 20 x 50 km
4. proposed study area into the 11 categories above;
5. the resulting classification will field checked and cor rected where necessary for each of the satellite images used in this study, based upon reference data collected in the field

using GPS, photographs, field notes, and aerial overflights; the resulting classification will be "vectorized" into an ArcInfo coverage and further edited where necessary;
6. additional GIS layers of topography, river courses, roads, and biological infor mation, including biomass estimates for each time frame, will be coregistered with the satellite data and included into the GIS; and
7. the resulting combination of the satellite classification(s) from 1982-1984-1986-1988-1990-1992-1994-1996 will be used to extrapolate the biological data spatially over the landscape.

PRODUCTS OF PROPOSED RESEARCH

The proposed research will provide the following products within the three years of operation:

1. Estimates of above-ground biomass stocks and their dynamics in primary tropical rainforest, in rainforest patches of varying sizes, and in different types and ages of secondary forests.
2. A spatially-explicit model that links temporal changes in the BDFFP landscape to predicted above-ground biomass stocks and their dynamics of above-ground biomass.
3. A working model of biomass dynamics and landscape features, available for testing in other Amazonian landscapes .
4. Training Brazilian graduate students and research professionals (in-country capacity-build ing).

RESEARCH TEAM

Claude Gascon, Smithsonian Institution: Biomass estimates and GIS Coordination

Jim Tucker , NASA/Goddard Space Flight Center: Remote Sensing imagery processing

William F. Laurance, Biological Dynamics of Forest Fragments Project, Biomass estimates in forest fragments and continuous forest reserves.

Rita Mesquita, Instituto Nacional de Pesquisas da Amazonia, Biomass Dynamics of Regenerating Forests.

G..Bruce Williamson, Louisiana State University, Biomass Dynamics of Regenerating Forests.

SITE

Work will be carried out at the INPA reserve site "Biological Dynamics of Forest Fragments Project".

ACTIVITIES

- 1980-1996 biomass estimates in forest fragments and forest reserves: June 1998 - June 1999
- Field recensus of plots: June 1998 - June 2000
- Secondary forest estimates of biomass: June 1998 - June 1999
- Remote Sensing and GIS modeling: June 1998 - Dec. 2000