LBA Abstract

Agricultural Colonization in the Ecuadorian Amazon: Population, Biophysical, and Geographical Factors Affecting Land Use/Land Cover Change and Landscape Structure

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We propose studies in two theme areas of LBA Ecology: land use and land cover change (LULC), and Carbon Storage and Exchange. This will involve examining the human and biophysical dimensions of LULC in the Ecuadorian Amazon associated with high rates of spontaneous colonization (land clearing) by agricultural settlers migrating into the region since the early 1970s. A satellite time series from the 1970s through 1998, along with GIS thematic coverages of biophysical gradients and geographical accessibility, will be linked to data collected on the ground from a unique scientific sample of georeferenced farm household plots and nearby communities. Data will be collected from the latter in 1998-99 on the same settler plots surveyed in 1990 to measure LULC over time in detail, and to relate it to population and socioeconomic characteristics of settler households. Image processing to characterize LULC and spatial analyses of landscape structure will be used to assess the rate and nature of LULC and to model the effects of LULC, secondary plant succession, and land fragmentation on carbon budgets and assimilation rates for landscape strata and the study area as a whole. Statistical models will be used to estimate the demographic, socioeconomic, biophysical, and geographic determinants of LULC at the farm and community levels. Agricultural extensification and intensification will be documented at the three spatial scales of the farm plot, the sector or community of which it is a part, and the region.

The project will be carried out in an area which is in the Amazon headwaters, one characterized by extraordinary biodiversity, undergoing more rapid colonization and deforestation than elsewhere in the Western Amazon due to its being opened following the discovery of large oil deposits. A scientifically representative sample of 480 household settler plots interviewed in 1990 will be re-visited in 1998 to provide a unique, representative assessment of changes in LULC over time, including land extensification, land intensification (and sustainability of agricultural technology), land abandonment, and secondary sucession, with implications for the carbon budget. Lessons will be learned about the process of LULC and its implications for carbon budgets as well as policies to promote to improve sustainability of methods and forest preservation.

Research Team

Richard Bilsborrow, University of North Carolina: LULC, survey design and data collection, statistical modeling

Stephen Walsh, University of North Carolina: LULC and carbon measurements, GIS imagery

Aaron Moody, University of North Carolina: LULC and carbon measurement, GIS imagery, statistical modeling and projections

Laura Murphy, University of North Carolina: LULC, data collection and processing, statistical estimation

Lawrence Band, University of North Carolina: carbon measurements

Danilo Silva, Ecociencia, Quito, Ecuador: LULU, data collection and GIS imagery

Gustavo Rodriguez, Quito, Ecuador: LULU, data collection, cleaning, analysis

Project Site

The central part of the two northern Ecuadorian Amazon provinces of Napo and Sucumbios, the principal area of oil discovery, road-building, and in-migration in Ecuador since the 1970s.

Activities

(This assumes we can begin field activities in mid-1998 at the latest.)

- GIS: Acquire remote sensing images, historical and current base maps and maps of roads and towns and infrastructure (to the extent possible, such as of schools, health clinics, oil camps and pumping stations and pipelines, etc.), hydrography, topography, aerial photography. Order GPS units and load software onto laptops for data collection and correction. Preprocessing of satellite data and digitization of map data into ARC/INFO format. Train Ecociencia (Ecuador) staff in use of GPS devices and GIS. 1998

- Household and Community Surveys. Prepare/revise household- and community-level questionnaires. Hire and train interviewers in Ecuador. Conduct pretests of questionnaires and of GPS devices and calibrate measures of land use with satellite imagery. Procure equipment for fieldwork. Conduct field surveys. Clean and process survey data. 1998 to mid-1999.

- LULC classification validation using both ground/survey and satellite data. 1999

- Carbon storage and sequestration. Estimate biomass and leaf area. Assess pattern metrics and landscape structure associated with fragmentation. Estimate carbon dynamics associated with LULC. 1999-2000

- Assess extent of extensification and intensification and determinants thereof. Conduct multivariate and multi-level analyses of LULC, derive policy implications, and prepare papers for presentation at conferences, journal submission and a book in both English and Spanish. 1999-2000

- Transfer of data and technology to Ecuador and other LBA investigators. 2000