HUMAN AND PHYSICAL DIMENSIONS OF LAND USE/COVER CHANGE IN AMAZÔNIA: TOWARDS A MULTISCALE SYNTHESIS

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LBA-WIDE INTEGRATION AND SYNTHESIS ACTIVITIES –

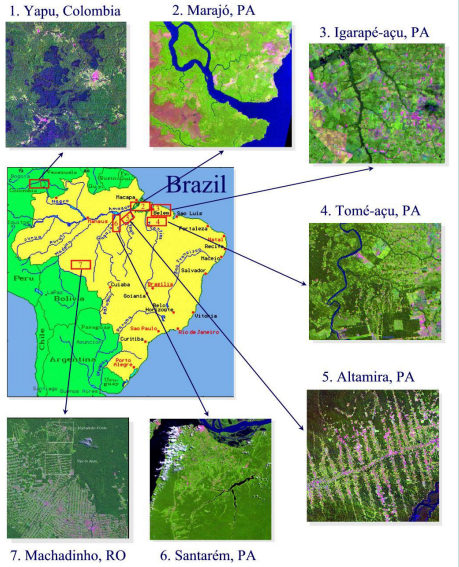
Asner, *Regional Effects of Selective Logging on Canopy Damage and Nutrient Dynamics in Amazonia: Linking Landsat ETM+ and Field Biogeochemical Studies*
Potter, *Modeling the Effects of Land Use Change and Surface Hydrology on Carbon and Trace Gas Fluxes over the Amazon Region*
Laurance, *Anthropogenic Land-use Change and the Dynamics of Amazon Forest Biomass*
Brown, *Land-cover Land-Use Changes in the Tri-Frontier Area of Brazil, Bolivia, and Peru: Implications for Sustainable Land Use in Southwestern Amazonia*
Fernandes, *Carbon and Nutrient Stocks and Regrowth in Reduced Impact and Conventionally Logged Forests and Settlements in NW Mato Grosso, Brazil*
Zarin, *Carbon Dynamics in Amazonian Regrowth Forests*
Reis, *A Basin-Scale Econometric Model for Projecting Future Amazonian Landscapes*

ABSTRACT

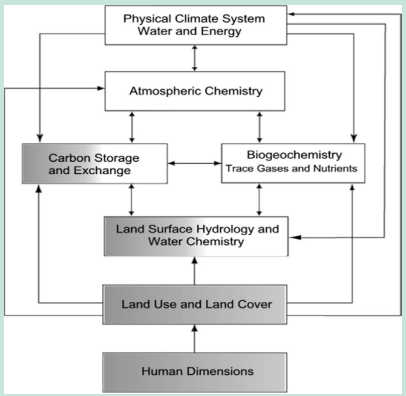
Building on 30 years of research experience in the Amazon, this study will advance our understanding of land use and land cover change through integrative science activities and by collaboration with other LBA projects. This project builds on a seven-region study, along the LBA transects, supported for six years by NSF and NIGEC, and then for the past three years by LBA funds. We have used a nested-georeferenced approach that collected soil analyses, vegetation stand structure and composition (100+ sites), land use histories, institutional analyses, demography of 600+ households, and land cover classification using Landsat MSS and TM multitemporal data to understand land use and land cover change (LCLUC) trajectories. The seven regions in our study represent a soil fertility gradient across Amazônia from most (i.e. alfisols) to least (i.e. spodosols) fertile and include a wide array of land uses and land cover types along an east-to-west transect extending from the Amazon estuary and Bragantina region east of Belém, all the way to Rondônia in the west. We will, in Phase II of this NASA/LBA project:

1. **Develop a *multi-scale synthesis of land use and land cover change dynamics* integrating our seven study areas, in order to understand the role of demographic, economic, institutional and biophysical variables on LCLUC trajectories during the past 25 years.**
2. **Develop a *multi-sensor analysis* of the capabilities and limitations of different platforms (IKONOS-TM & ETM+-MODIS) for land cover discrimination using the full capabilities of *artificial neural networks* for classification and modeling.**
3. **Develop an integrated study of land use, land cover, and land-water interactions by using a *watershed approach*, encompassing at least two of our most intensive research sites (i.e. the Santarém-Altamira region), thereby addressing fundamental questions of the landscape-level controls on nutrient-carbon interactions within, and sustainability of forests in the Amazon Basin.**
4. **Develop a *comprehensive scientific collaboration* strategy within LBA projects to contribute to modeling and synthesis efforts by formal collaboration with other proposed LBA research projects, by providing experience to Brazilian doctoral students, by providing a number of other opportunities for mid-career training—preferentially to colleagues at Amazonian institutions—by testing the usefulness for the larger LBA community of the *Amazon Information System (AIS)*, and through a series of in-country training courses on the human dimensions of LCLUC in Amazônia in collaboration with Amazonian institutions and LBA researchers.**

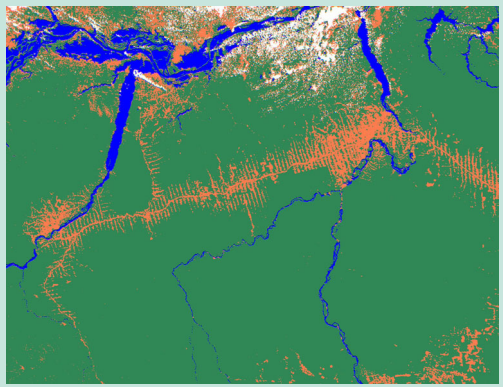
ACT Study Areas



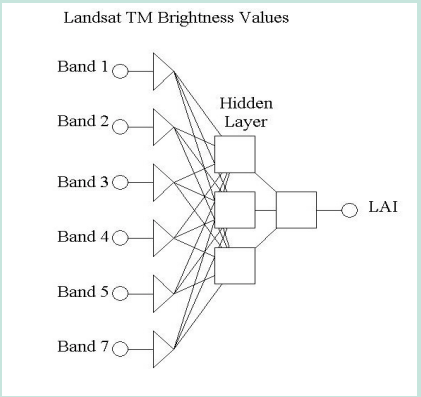
LBA-ECO areas shaded in full or in part below reflect the research interests of this project



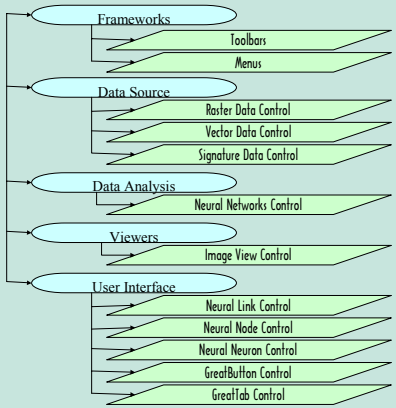
Watershed study of Altamira & Santarem areas



Schematic of artificial neural network



Functions of the Amazon Information System



Human dimensions research in this project will focus on the dynamics of the migratory process over time. By linking biophysical initial conditions to the demographic and economic initial conditions of households we characterize the dynamics of population and the physical environment in the context of landscape-level controls and site-specific controls on outcomes. In phase II we consider not only land use and land cover and carbon sequestration in secondary succession, but also nutrient dynamics through a study of primary stream biogeochemistry to understand landscape-level controls. The focus area for the watershed study will be the Altamira-Santarem corridor.

A neural network classifier will be implemented using the Amazon Information System. The research will compare results from a neural network classifier with those from a conventional classifier. The project will analyze three images at different spatial resolutions to examine performance of the two classifiers on images at different scales. We will use IKONOS (4 meters), ASTER (15 meters), and Landsat TM (30 meters), for Altamira, Brazil. Preliminary research results confirm that neural network classifier work yields superior results to maximum likelihood classifier. The object-oriented approach to the implementation provides flexibility in interface, interaction, versioning and porting. During phase II of LBA we will focus on the development of a parallel-based strategy to shorten training time and the time for constructing alternative neural networks.