

UNIVERSIDADE FEDERAL DE
MATO GROSSO

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Carbon and Nutrient Stocks and Regrowth in Reduced Impact and Conventionally Logged Forests and Settlements in NW Mato Grosso, Brazil

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Abstract

Selective logging of forests has become a dominant land use in the Brazilian Amazon. Estimates of the area logged in the Brazilian Legal Amazon approach 15,000 km² yr⁻¹. We have identified a new site located in northwestern Mato Grosso (MT). According to recent data from INPE, MT had the highest mean annual deforestation rate from 1991-1998 yet there is relatively little local information on the impact of forest conversion and logging in MT on biogeochemical processes. The site is also at a frontier currently experiencing active logging and settlement and is the focus of a major development project funded by the Global Environment Facility (GEF) aimed at improving natural resource management to enhance local livelihoods and conserve native biodiversity. We will examine the impact of conventional logging and reduced impact logging on carbon, nutrient and water fluxes and the effects on local streams. We will also estimate above and belowground forest biomass to develop more efficient allometric equations for lowland tropical forests in Amazonia. We will emphasize capacity building at the local level and have made provisions for training and research opportunities for the faculty and students at the UFMT, and collaborate with ProNatura, the NGO leading the GEF work.

Approaches

Measure aboveground biomass and nutrients in terra firme forest and critically test allometric equations.

- Biomass partitioning into: (1) above-ground live trees with DBH > 35 cm; (2) above-ground live trees, 15 cm < DBH < 35 cm; (3) above-ground live trees and shrubs, DBH < 15 cm; (4) vines and epiphytes; (5) all below-ground biomass; (6) above-ground fine necromass and (7) above-ground coarse necromass.
- Nutrients will be determined for (a) aboveground biomass, (b) litter layer, (c) topsoil, and (d) subsoil.

Quantify the impact of soil texture and fertility gradients on above and belowground C and nutrient stocks in local forests

- Fine root standing stocks
- Coarse Roots
- Nutrient stocks in belowground biomass and soil
- Modeling C dynamics (CENTURY)

Impact of conventional and reduced impact logging on above and belowground C and nutrient dynamics

- Throughfall and stemflow collection
- Canopy gap fraction

Impact of logging on soil, sediment, nutrient and carbon losses to stream water

- Net erosion rates
- Source of nitrogen leaching
- Source of stream water influx using hydrological tracers

Continuing Measurements of C sequestration in Agroforestry Systems at Manaus

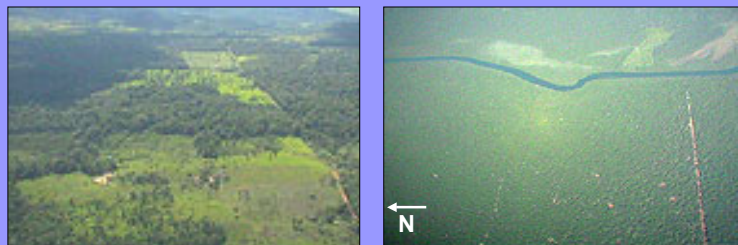
Scientific objectives

Measure existing forest biomass (carbon) and nutrient stocks and validate available models for estimating forest biomass.

Quantify the impact of soil texture and fertility gradients on above and belowground C and nutrient stocks in local forests

Measure the impact of conventional logging (CL) versus reduced impact logging (RIL) on:

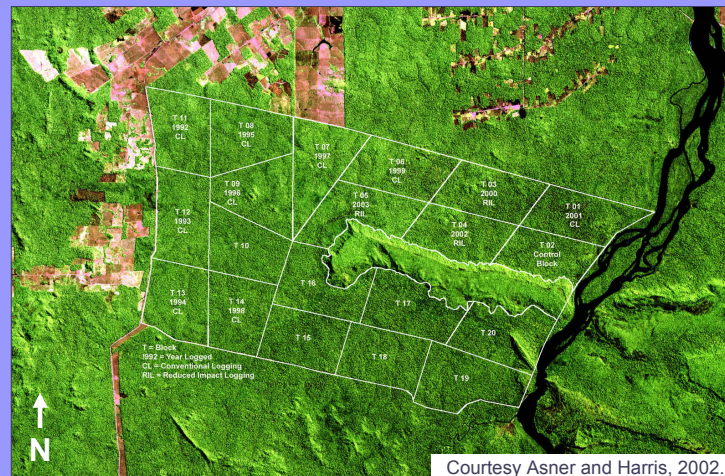
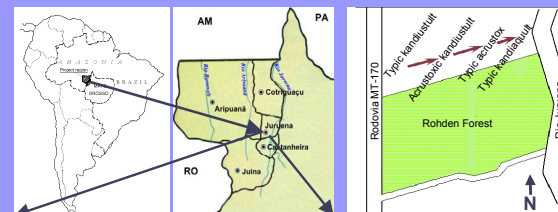
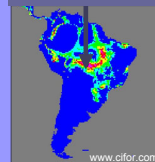
- C dynamics
- Composition and quantity of nutrients
- Water and organic matter entering and being processed within streams



Adjacent to the Rohden forest are settlements on sites with identical soil and forest types and landscape positions as the Rohden site.

Research Site

Juruena,
Mato Grosso



Courtesy Asner and Harris, 2002.

Chronosequence of selectively logged forest blocks, Rohden Forest (25,000 ha). Selective logging of 1,000 ha yr⁻¹ since 1991.

Integration and Synthesis

Our proposed research and expected data is especially relevant to LBA research and broader synthesis because the site is:

- Located in an area experiencing very active logging and settlement,
- Characterized by biophysical factors (elevation, potential evapotranspiration, total annual precipitation, precipitation of the driest month, precipitation range, minimum average monthly temperature, and maximum average monthly temperature) that are very typical in the "Arc of deforestation,"
- Located on a spatially compact soil gradient from flat upland to major river channel and contains the major repeating soil association in the Amazon basin – Ultisols and Oxisols (US Soil Taxonomy).

Significantly, we have also identified different levels of soil fertility in these major soil Orders. There are significant gaps in the current LBA efforts on the impacts of soil nutrients in the broader synthesis of data for the basin scale.

We plan to have quarterly planning and program output meetings with colleagues in the "Milênio-LBA" program in Mato Grosso. Prof. Paulo Artaxo coordinates the national program and Prof. Nicolau Priante (UFMT) is a PI undertaking research in the municipality of Cotriguaçu which is adjacent to Juruena. Erick Fernandes is an "international" collaborator in the Milênio-LBA program. We also plan to share data from our logging impact studies with Prof. Emilio Moran's team and collaborate with Dr. Michael Keller's team. Prof. Moran is collaborating with Dr. Greg Asner in the linkage of ground-based data with remotely sensed data for syntheses at landscape scales.