

Anthropogenic Landscape Changes and the Dynamics of Amazon Forest Biomass

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***Biological Dynamics of Forest Fragments Project**

- **LBA – Large Biosphere-Atmosphere Experiment in the Amazon.**
- **BDBFF/INPA/SI – Biological Dynamics of Forest Fragments Project.**
- **Co-Investigators:**
 - **Heraldo Vasconcelos (BDBFF/INPA)**
 - **Ana Albernaz (BDBFF/INPA)**
 - **Susan Laurance (BDBFF/STRI)**
 - **G. Bruce Williamson (LSU)**
 - **Goetz Schroth (BDBFF)**

Project Goals:

- ✓ **Determining effects of fragmentation on forest dynamics, floristics, and aboveground biomass**
- ✓ **Assessing litter dynamics in fragmented and continuous forests**
- ✓ **Examining destructive synergisms between forest fragmentation and fire**
- ✓ **Evaluating the influence of soils and topography on aboveground forest biomass**

Project Goals (continued):

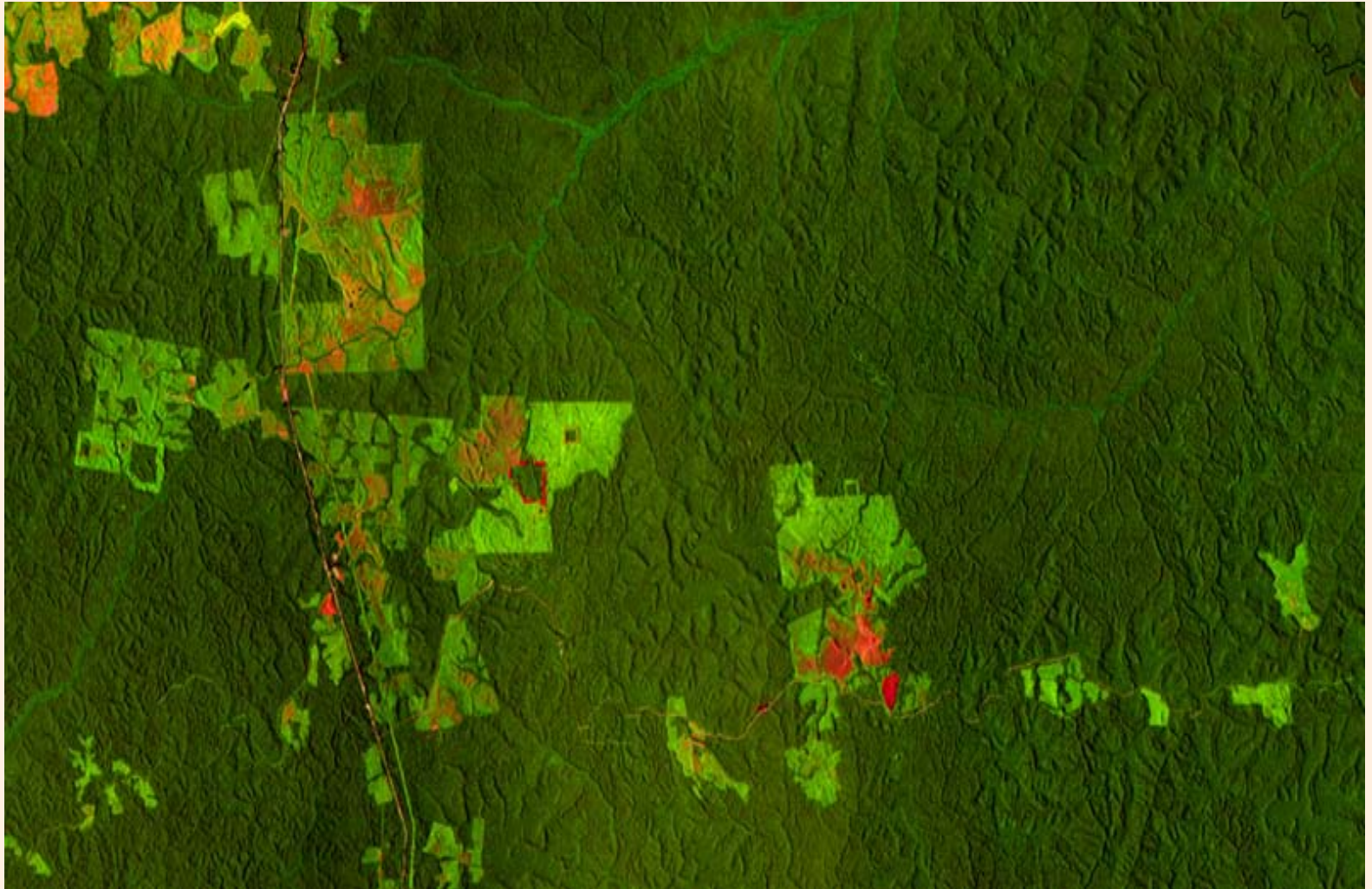
- ✓ **Assessing factors affecting trajectories of forest regeneration and carbon sequestration on abandoned lands**
- ✓ **Testing the hypothesis that intact Amazonian forests are a carbon sink**
- ✓ **Developing GIS models to investigate major development trends, deforestation, and spatial patterns of forest fragmentation in the Brazilian Amazon**

Study Area

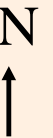
Biological Dynamics of Forest Fragments Project

- **The BDBFF is a binational, collaborative research project between Brazilian Institute for Amazon Research (INPA) and Smithsonian Institution (SI).**
- **Is a experimental fragmented landscape spanning around 1,000 km² in the central Amazon, located 80 km north of Manaus, Brazil.**

BDFFP Experimental Site



Landsat TM 4,5,6 1995







BDBFF Reserves Arrangement

- 3,500 ha of isolated and non-isolated forest reserves, ranging in size from 1 to 1,000 ha.
- There are four isolated 1-ha fragment, three 10-ha fragments and two 100-ha fragments which contain 39 1-ha permanent plots.
- There are nine reserves inside continuous forests (>500 m away from the nearest forest edges) in which contain 27 control 1-ha plots.

Key Findings in the Last Years

In fragmented forests, edge effects can operate over large spatial scale

- *Forest fragment edges have experienced elevated rates of tree mortality → substantial loss of forest biomass*
- *On average, forest fragments lost about 3.5 tons ha-1year-1 during the first 17 years after fragmentation*

As a result of floristic changes, fragmentation alters forest carbon storage and cycling

- *In forest fragments, old-growth trees have declined in favor of shorter-lived successional trees and lianas → declining of carbon storage in forest fragments*
- *Production and turnover of necromass have increased in forest fragments → rates of carbon cycling have accelerated*

Land-use history strongly affects trajectories of forest succession and carbon sequestration in secondary forests

- *Abandoned sites subjected to high fire incidence have lower biomass and richness species than light-use sites*
- *Fragmented forests are highly vulnerable to edge-related fires*

Deforestation rates in Brazilian Amazonia may be accelerating

- *Major investments in highways and infrastructure could pose serious threats to Amazonian forests*
- *GIS-based model investigation predicts that the Brazilian Amazon might have about 42% of the actual area by the year 2020*

Key Indicators of Progress

- ✓ **77 journal articles (> 30 in leading international journals)**
- ✓ **Active training program for graduate students, postdoctoral fellows, and interns**
- ✓ **Dynamic public-outreach program for Amazonian residents**
- ✓ **Many short-courses for Amazonian decision-makers and students**