# LBA Science Focus

- How does land cover change – deforestation, regeneration, logging – affect the functioning of the basin
- Requires: improved understanding of rates of LC forcings – rates, patterns, intensty
- Requires: improved understanding of the factors which control the rate, pattern, and intensity.
- Key questions:
  1. What are the rates and mechanisms of forest conversion to agricultural land-uses, and what is the relative importance of these land-uses?
  2. At what rate are converted lands abandoned to secondary forests; what is the fate of these converted lands, and what are the overall dynamic patteros of land conversion and abandonment?
  3. What is the area of forest that is affected by selective logging each year?
  4. What are plausible scenarios of future land-cover change in Amazonia?

# Focus for Activities

- Land Cover and Land-Use Change research conducted in LBA is aimed at emphasizing the following issues:

  – linking the spatial and temporal dynamics of patterns of land-cover change with the analysis of the of the underlying proximate, intermediate, and ultimate deterinants of land-use change;

  – developing new diagnostic and prognostic models of land-cover and land-use change with direct coupling to feedbacks from biophysical processes provided by other components of LBAresearch;

  – developing an improved understanding of spatial and temporal scaling, from the farmer to the basin scales; and

  – developing analysis defined in the IGBP/IHDP LUCC Sciencie Plan for the first two points, leading to regional integrated development of systems models.

# Activities continued

- Research activities are including:
  - measurements of land-cover change and its spatial pattern at less than 100 m resolution over the whole basin using synoptic satellite measurements of deforestation and secondary growth;
  - Improved measurement of land cover biophsyical characteristics, such as through continuous fields – cf. fractional cover
  - establishments of a suite of site-specific (~100 x 100 km) multi-temporal (annual) satellite analyses of land-cover change transition dynamics to define the transition probabilities and analyses of dynamics of secondary growth turnover;
  - Amazônia-wide coupling of sociodemographic (including migration), agricultural, and econometric data at the municipio level for a suite of specific variables in order to develop land-use change models;
  - field-based analyses of the decision-making processes for farmers and other land managers, using established techniques in community survey;
  - analyses of the spatial pattern and geometry of land-cover changes, which provide information on landscape patchniness and fragmentation,

# Monitoring LCLUC

- Dynamics of LCLUC using multi-temporal datasets at specific locations
  - Time series of changes at fine spatial and temporal scales
  - Evaluation of rates of LC transititions, and retention times in classes
- Basin-wide estimates of changes in cover across the full range of LC change: deforestation to degradation
  - Deforestation, regeneration, selective logging
- Basin-wide understanding of synergies between classes of land use/cover change
  - Fire as a function of other land uses and its spatial effects
  - Deforestation associated with infrastructure development
  - Fragmentation
- Land cover as continuous fields

# Case Studies of LCLUC

- Several projects are looking at household level dynamics of land use change
  - Decision making at the household level
  - Relationship to cropping systems
  - Expansion of the area of deforestation over time
- Others are looking at regional scale dynamics in key locations of the Amazon

# Modeling

- Case study diagnostic models at fine scales
  - level of household
  - Level of parcel
- Basin wide prognostic models
  - Level of basin using district data
- Merging of remote sensing with in-situ and census data
- Econometric, behavioral, empirical-spatial approaches

# Data Systems

- Collaboration through LBA-DIS to provide datasets to the user community

- NASA Commercial data buy

- Collaboration with the ESIP Federation to provide data and information services

# What I think we know

- Quantitative measures of land cover transformation, for e.g.
  - The rate of deforestation and its spatial extent
  - The persistence and fate of cleared areas
  - The rate of logging and its spatial extent
  - The persistence and fate of logged areas
  - Secondary growth magnitude
  - Fragmentation and its patterns
- A good understanding of the dynamics and controls on these transformations, for e.g.
  - Household level factors which explain deforestation event magnitude, and rates over time
  - Some community level understanding
  - Synergy between agents of land cover transformation
  - Prognostic models from several fronts converging on similar results

# What I think we don't know

- We do not know how various agents interact and what controls catalyze or diminish the interaction
- We do not yet know what controls basin wide variations in rates – ie cohort vs. period effects
- We do not know how LUCC controls experience feedback from ecosystem responses to disturbances
- We do not as yet have a comprehensive dynamic LUCC model, which could be applied basin wide, yet at fine scales at which they occurr
- Some critical measurement-related factors still under-determined (e.g. is fire important)

# Some directions?

- **Do temporal dynamics of the aggregate forcing function of forest cover change emerges from the coincident timing of different agents.**

- **Do legacy effects and hysteresis dampen external forcing and exogenous factors – ie cohort vs. period effects.**

- **Does diffusion mechanics and Path Dependency establish a spatial footprint on the regional landscape over time.**

- **How does the synergy between multiple agents of land transformation and their spatial topology work.**

- **Does change in density within forests and fragmentation result from multiple forms of agency and the spatial articulation and topology of land uses in the landscape.**

- **Does change in the size class distribution of clearings changes determine the aggregate deforestation rate.**

# Emerging issues

- *"We witnessed some excellent examples of land cover modeling based on socioeconomic drivers, and some excellent examples of land cover mapping. However, we were not able to see how an understanding and possible predictive capability for drivers of climate change were going to be connected with the land cover mapping for extensive prediction over the project domain"*

- *"With regard to landuse change modeling, we wondered whether they are being developed at the right scale, or whether there also should be some development of models with highly aggregated variables over large areas.*

- **In sum: how can we better define the explicit linkages between pattern and process, between satellite and ground observations, and between scales?**

# An action item

- Development of a cohesive statement on the state of our knowledge within the LBA campaign