Land-Cover/Land-Use Change and Carbon Dynamics in an Expanding Frontier in Western Amazonia: Acre, Brazil

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Introduction

- Questions
  - *Given that estimates of state-level deforestation rates differ in some cases by a factor of two, how may we improve the accuracy of remote sensing estimates of deforestation and land-use at the local and regional scales such that the data are more useful both for modeling carbon fluxes and for land-use management?*
  - *The official data on logging and burning are frequently misleading. How can more dependable estimates of these activities be made? How can we differentiate the burning of felled forests, pastures and undergrowth in logged and primary forests?*
  - *Lateral migration of forest types with differing biomass, as well as in situ changes in mortality and growth, affect carbon fluxes between the atmosphere and the biosphere. How important are such migration and in situ changes for the carbon budget in western Amazonia?*
  - *How may the knowledge generated by this and other NASA research reach local and regional societies so as to promote the prospect of sustainable land-use?*

Goals

- To provide local, regional, and global societies with reliable information on land cover and land use change that they can use for deciding their future.

Approach

- Collaborative research with local institutions that involves concomitant human capacity building. Currently, we work with:
  - Sector of Land Use and Global Change Studies/Zoobotanical Park/Federal University of Acre -SETEM/PZ/UFAC
  - Center for Agroforestry Research - CPAF/Embrapa in Acre
  - Economic/Ecological Zoning Program of the Secretary of Science,Technology, and Environment of Acre State - ZEE/SECTAM
  - Executive Secretary of Forests and Extractivism of Acre State - SEFE-Acre
  - Institute of Biodiversity and Ecosystem Management of Western Amazonia - BIOMA

Results

- In western Amazonia, secondary forests are not important carbon sinks.
- Official estimates of logging in Acre State differ 20-fold. Approximately 90% was illegal in the late 1990s.
- Estimates of area deforested in Acre State by different institutions vary by 20 to 40+%. Consequently, uncertainty in rates of deforestation, a critical factor in carbon budgets, is probably greater than 40%.
- Carbon stocks in forests of eastern Acre are comparable to those of central Amazonia.
- Estimates of hot points (burning) differ 20-fold between those based on NOAA/AVHRR and those based on GOES-8.
- Deforestation in Extractive Reserves tends to concentrate in specific areas that may generate conflicting land-uses in the coming decade.

Future steps

- Field measurements of areas deforested and burned for accuracy assessment of satellite-based estimates of deforestation and burning
- Error analysis of deforestation rates at a municipal level
- Construction of scenarios of future land-use in eastern Acre State at the municipal level, including socio-economic drivers
- Forest-use analysis at the land-holder spatial scale with the development of new techniques for quantifying forest resource use
- Increased interaction with state and municipal governments to provide pertinent LCLUC information for local and regional development

Conclusions

- Reliable information is not a trivial issue for LCLUC. Official data often differ by an order of magnitude for logging and burning activities.
- Regional carbon budgets have greater uncertainty than are currently recognized due to significant differences among estimates of deforestation.
- Estimating the effects of public policy on deforestation and burning will be more difficult than is currently recognized and may affect the implementation of the Kyoto Protocol.

Publications

- Brown, I.F., K. Kainer, A.S. Alechandre, and E.F. do Amaral, In press. The role of extractive reserves and participatory research in the biogeochemistry of the Amazon basin. In: McClain, M., R. Victoria, and J. Richey. (eds.) The Biogeochemistry Of The Amazon Basin And Its Role In A Changing World.

- Salimon, C.I. and I. F. Brown. In press. Secondary forests in western Amazonia:significant sinks for carbon released from deforestation? Interciencia.

- Brown, I.F. Carlos A. Llerena, Benedita M. G. Esteves, Maria de Fatima A. Bigi, José de S. Nogueira, and Francisco Kennedy A. de Souza. 1999. Land-Use and Global Environmental Change in Southwestern Amazonia: Educational and Research Challenges for Regional Universities. Third International Symposium of Environmental Geochemistry in Tropical Countries. 25-29 October 1999. Nova Friburgo, RJ, Brazil. Extended Abstract.