Amazon Scenarios: Modeling interactions among land use, climate, and fire

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Introduction

Two important gaps in our understanding of regional land cover and land use change processes are (a) the role of understory fires in the overall flux of carbon from the Amazon Basin and (b) the future trajectories of understory forest and its interactions with trajectories of land use and climate.

Our project is designed to address these two gaps through the development of a policy-responsive model of the Amazon Basin that can be used to explore the interactions among climate, economic activities, and fire, and associated carbon fluxes.

Introduction

Questions:

- What is the contribution of forest understory fires to C emissions from the Amazon?
- What are the most likely trajectories of land use, forest fire, and climate? How do these trajectories respond to policy scenarios?

Goals:

- Develop an integrated model of land use (forestry, agriculture), climate, and fire.

Approaches:

- Land use: Transition matrices, CA, rent model for 4 land uses, econometric model, interviews
- Climate: GCM (COLA, CPTEC), RAMS
- Fire: water balance, field measurements, remote sensing (EO-1 Hyperion)

Results:

Most significant results:

- Spread of experimental forest fires can be accurately modeled using forest structure (LAI, height) and rainfall history.
- "RisQue" forest flammability model working at INPE/CPTEC for Brazil's "Proarco" fire prevention program
- Tree wood increment is most sensitive component of NPP to experimentally-imposed drought
- Panamazon model of deforestation (transition matrix & CA) and logging (rent) completed
- 11 graduate students supported; 2 field courses/yr

Future steps:

- Identify threshold of deforestation beyond which rainfall changes
- Quantify feedbacks between land use/climate/fire, and implications for carbon emissions.

Conclusions:

Most significant conclusions:

- Forest understory fires in the Amazon can cause carbon emissions similar to Amazon deforestation during severe droughts
- Preliminary results of integrated model have had important effects on government decision-makers and regional planning processes

Publications:

- Five peer-review publications accepted for publication during 2003 (1st year)
- Three peer-review manuscripts submitted during 2003.