



## INTER-AMERICAN INSTITUTE FOR GLOBAL CHANGE RESEARCH

### From landscape to ecosystem: across-scales functioning in changing environments (CRN2005)

How are ecosystem boundaries defined? How do they relate to water availability and climate; how do they shift under global change? Can we predict ecosystem displacements? This study compares the transition zones (ecotones) between forest and non-forest sites under different climate and land use pressures in one Canadian and four South American sites.

#### Goals

- Analyze interactions between vegetation and environment in time and space
- Identify current ecotones, and map past changes
- Examine the processes of species colonization at ecosystem boundaries
- Predict future advances of ecosystems over others under climate change
- Indicate risks to ecosystem services when ecosystems are displaced

#### First results

- Ecotones are explained by functional traits of plants that determine the plant's vulnerability to climate change and human intervention. In the Andes, the boundary between  *páramo* and forest is defined by the effect of temperature and its extremes on trees and on seedling success. Trees, once established, modify the environment to their own advantage, stabilizing the boundary. In contrast, human disturbance favors  *páramo* species, moving the ecotone downward even against climate trends. In Southern Brazil, sediment cores show that forest-grassland boundaries have moved back and forth under variable climate over centuries.
- The extensive (80%) deforestation of the Gran Chaco dry forest is due largely to land use, responding to remote markets -e.g., soybean- and facilitated by increasing rainfall.
- In Canada and Brazil, increased atmospheric CO<sub>2</sub> has increased tree productivity, but that effect is counter-balanced by decreasing water availability, now leading to declining tree growth. This challenges the assumption that increasing CO<sub>2</sub> levels invariably boost plant growth.
- The project has shown explicable interactions between anthropogenic and natural factors that define ecotones – this can now be explored for conservation and adaptation decisions.

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**List of publications:** <http://iaibr.liaj.int/bs?publications/CRN2005.pdf>



*On the high slopes of the Venezuelan Andes, a winding treeline seems to be advancing upwards over the paramo vegetation due to the twentieth century climate warming.*



*Recurrent fires are crucial drivers controlling the distribution of montane forest and grasslands in the Sierras de Córdoba, Argentina. LEAF aims to understand the specific mechanisms involved in the maintenance of forest-grassland mosaics.*



*In the high and moist tablelands of Rio Grande do Sul, Brazil, mosaics of Araucaria forests, shrublands, natural grasslands and croplands seem to be under the control of climate, land forms, fire and grazing, overlying an extended history of climate fluctuations and ecosystem displacements.*

