

International Seminar



## **Land System Science in Latin America: achievements and perspectives**

**A Ciência do Uso da Terra na América Latina: Avanços e Perspectivas**

**La Ciencia del Uso de la Tierra y el Territorio en América Latina: Avances y Perspectivas**

- **Food-Energy Water nexus, trade-offs and teleconnections in Latin America**
- **Socio-cultural diversity, governance and co-production of knowledge on Latin American land systems**
- **Land use, GHG emissions and monitoring systems in Latin America**
- **Land systems and biodiversity in Latin America**

Centro de Ciência do Sistema Terrestre ; Instituto Nacional de Pesquisas Espaciais

São José dos Campos, SP, Brasil

9 to 11 November 2015

## **Introduction**

Land system science has emerged as an integrative field of research that deals with the human use of land, its consequences, and the related socioeconomic, technological and organizational processes (Verburg et al. 2013). As the largest international research coordination initiative in this field, the Global Land Project (GLP) has been performing worldwide coordination and conceptual synthesis activities related to land system science under the flag of the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme (IHDP), and, since 2014, the Future Earth programme.

Since January 2012, the GLP International Project Office has been based at the Instituto Nacional de Pesquisas Espaciais (INPE) in São José dos Campos, Brazil, and has acted not only as the international coordination office of the project, but also as a regional hub advancing and promoting land system science in Latin America. Recent advances in Latin American land system science linked with GLP, are for example the study of land systems and the forest-agriculture interface, with emphasis in the Amazon region (de Espindola et al. 2012), modelling of land use change, biomass and related greenhouse gas emissions (Aguar, Câmara, and Escada 2007; Aguiar et al. 2012; Ometto et al. 2014), and discussion about the between agricultural production and nature conservation (land sparing vs. land sharing) models (Grau, Kuemmerle, and Macchi 2013).

Land system research is evolving rapidly both in terms of the scope of questions, and in terms of methods and theory; with growing importance in articulating different disciplines and perform research on linked outcomes of land resources, such as the nexus of food production, water, and energy. In this context, there is a need for Latin American research to engage and develop a regional perspective to emerging international research agendas and funding programs related to sustainability, global environmental and climate change, assuming cross-disciplinary collaboration, co-production of knowledge and stakeholder engagement, and using integrative cross-level methodologies.

### **Objectives:**

This seminar has the objective of gathering, synthesizing and conceptualizing existing advances in land systems science in Latin America, and of establishing perspectives of this research field for the region, under a common basic conceptual framework. Besides this objective, the seminar will also aim at establishing the particularities of the Latin American region that enables researchers to take a leading role in advancing specific aspects of land system science. Can we speak about a “Latin American school” in land system research? What can the rest of the world learn from the Latin American experience?

Proposed sub-topics for the seminar are:

### **Food-Energy Water nexus, trade-offs and teleconnections in Latin America**

Land use dynamics affect the provision and distribution of fundamental ecosystem services like food, energy and water. Latin America has the world’s most urbanized population and an overall diminishing rural population (UN-Habitat, 2012). Nevertheless, agricultural frontiers into forested areas persist and are increasingly linked to distant drivers like a growing demand for agricultural products from overseas (Gasparri and de Waroux 2014). On the other hand, the region also

experiences understudied land change patterns, such as land abandonment, urban sprawl, tree plantations and mining activities. What are the potential trends in distal and local drivers in the region and how might they shape the region's landscapes during the coming decade? What are the potential trade-offs in the provision of food, energy and water associated with potential scenarios of land change?

### **Socio-cultural diversity, governance and co-production of knowledge on Latin American land systems**

Latin American land users are characterized by their settlement history, and by social, political and economic power relations among and within groups (Brondizio 2013; Killeen et al. 2008). Indigenous peoples, African-, European- and Asian-descent colonists, *mestizo* and *mulato* farmers, Andean colonists in the Amazon, planned and spontaneous settlements, have different socio-cultural and socio-economic backgrounds, which shape their views, interests and relationships with the land. Pressures over land resources have often resulted in conflictive relationships between these actors. On the other hand, territorial governance instruments have flourished in the region, including conservation areas, reserves, indigenous lands and other land rights recognition processes. Are these territorial governance instruments adequate to deal with pressures over land resources? How can efficient and equitable land governance be implemented in the region? How can the different knowledge systems claimed and used by land users be bridged?

### **Land use, GHG emissions and monitoring systems in Latin America**

In the last decades, there have been substantial advances in researching the relationship between land use change and greenhouse gas emissions, as well as in developing land change monitoring systems in Brazil and Latin America. These advances include the biomass and emission models (Aguar et al. 2012), the quantification of emission from tropical dam reservoirs (Fearnside and Pueyo 2012), and the live monitoring of forest cover change. More generally, Latin American research institutions are increasingly producing their own datasets, analyses and knowledge corpus. What are the perspectives of these advances and their implication for global change research? More generally, how can uncertainties in knowledge of land-atmosphere interactions be tackled?

### **Land systems and biodiversity in Latin America**

Latin America is home to 6 of the 17 identified megadiverse countries and among the most biodiverse regions on Earth. However species loss has been increasing steadily in the region due to the persistence of the conversion of natural habitats into industrial crops and grazing areas. While the diminishing rural population and the natural regeneration of ecosystems might represent an opportunity to biodiversity, new threats have also arisen, including urbanization, industrial development, and loss of cultural landscapes. On the other hand, the study of the highly diverse biological diversity of Latin America and its relations with land systems is still a challenge. What is the state of knowledge on biodiversity and land systems in Latin America? What are the lessons learnt up to now to conserve biodiversity in a sustainable and equitable way in the region?

### **Place**

Centro de Ciência do Sistema Terrestre, the Instituto Nacional de Pesquisas Espaciais (INPE) in São José dos Campos, Brazil

## Duration and Time

3 days, 9 to 11<sup>th</sup> of November 2015

## Languages of the workshop

English, Portuguese, Spanish

## Expected outcomes of the seminar

A synthesis article that outlines a research agenda for the region

An annotated list of emerging drivers/processes of land use change in LATAM

A characterization of LATAM particularities in terms of land use change patterns and processes

A characterization of the main teleconnections affecting land use change in LATAM

Publication of proceedings as an academic journal special issue

## References

- Aguiar, Ana Paula Dutra, Gilberto Câmara, and Maria Isabel Sobral Escada. 2007. "Spatial Statistical Analysis of Land-Use Determinants in the Brazilian Amazonia: Exploring Intra-Regional Heterogeneity." *Ecological Modelling* 209 (2–4): 169–88. doi:10.1016/j.ecolmodel.2007.06.019.
- Aguiar, Ana Paula Dutra, Jean Pierre Ometto, Carlos Nobre, David Montenegro Lapola, Claudio Almeida, Ima Célia Vieira, João Viane Soares, et al. 2012. "Modeling the Spatial and Temporal Heterogeneity of Deforestation-Driven Carbon Emissions: The INPE-EM Framework Applied to the Brazilian Amazon." *Global Change Biology* 18 (11): 3346–66. doi:10.1111/j.1365-2486.2012.02782.x.
- Brondizio, Eduardo S. 2013. "A Microcosm of the Anthropocene: Socioecological Complexity and Social Theory in the Amazon." *Perspectives: Journal de La Reseaux Francaise d'Institut D'études Avancées (RFIEA)* 2013 (10): 10–13.
- de Espindola, Giovana M., Ana Paula D. de Aguiar, Edzer Pebesma, Gilberto Câmara, and Leila Fonseca. 2012. "Agricultural Land Use Dynamics in the Brazilian Amazon Based on Remote Sensing and Census Data." *Applied Geography* 32 (2): 240–52. doi:10.1016/j.apgeog.2011.04.003.
- Fearnside, Philip M., and Salvador Pueyo. 2012. "Greenhouse-Gas Emissions from Tropical Dams." *Nature Clim. Change* 2 (6): 382–84. doi:10.1038/nclimate1540.
- Gasparri, Nestor Ignacio, and Yann le Polain de Waroux. 2014. "The Coupling of South American Soybean and Cattle Production Frontiers: New Challenges for Conservation Policy and Land Change Science." *Conservation Letters*, August, n/a – n/a. doi:10.1111/conl.12121.
- Grau, Ricardo, Tobias Kuemmerle, and Leandro Macchi. 2013. "Beyond 'land Sparing versus Land Sharing': Environmental Heterogeneity, Globalization and the Balance between Agricultural Production and Nature Conservation." *Human Settlements and Industrial Systems* 5 (5): 477–83. doi:10.1016/j.cosust.2013.06.001.
- Killeen, Timothy J., Anna Guerra, Miki Calzada, Lisette Correa, Veronica Calderon, Liliana Soria, Belem Quezada, and Marc K. Steiniger. 2008. "Total Historical Land-Use Change in Eastern Bolivia: Who, Where, When, and How Much?" *Ecology and Society* 13 (1): 36.
- Ometto, JeanPierre, AnaPaula Aguiar, Talita Assis, Luciana Soler, Pedro Valle, Graciela Tejada, DavidM. Lapola, and Patrick Meir. 2014. "Amazon Forest Biomass Density Maps: Tackling the Uncertainty in Carbon Emission Estimates." *Climatic Change* 124 (3): 545–60. doi:10.1007/s10584-014-1058-7.
- Verburg, Peter H, Karl-Heinz Erb, Ole Mertz, and Giovana Espindola. 2013. "Land System Science: Between Global Challenges and Local Realities." *Human Settlements and Industrial Systems* 5 (5): 433–37. doi:10.1016/j.cosust.2013.08.001.