Drivers and scenarios of agricultural expansion in the Argentine Chaco

Maria Piquer-Rodríguez1, Van Butsic2; Gregorio Gavier-Pizarro3; José N. Volante4; Ignacio Gasparri5 & Tobias Kuemmerle1

1Humboldt-Universität zu Berlin; 2University of California - Berkeley; 3INTA, Buenos Aires; 4INTA, Corrientes; 5Universidad de Tucuman and CONICET

*maria.piquer-rodriguez@geo.hu-berlin.de, Unter den Linden 6 10099, Berlin, Alemania; +49 30 2093 9341

Background

- Agricultural expansion into natural ecosystems is one of the main drivers of biodiversity loss worldwide.
- Understanding the current and future drivers of land-use (LU) change patterns is thus important to inform land-use and conservation planning.
- Argentina is a prime region where land-use decisions strongly depend on global market prices and demands.
- But how these factors influence land-use change patterns across gradients of climate, soil quality, population density and accessibility remains unclear.
- Moreover, drivers of land-use change have not been assessed across eco-regions in Argentina, despite links among regions.

Research goals

- To better understand the underlying drivers of agricultural land-use change in the Pampas and Chaco regions from 2000-2010.
- To explore effects of future market conditions and revenue changes on land-use conversions.

Approach

- Net returns model to incorporate costs and revenues from agriculture 2000-2010.
- Three land-use changes: Forest to cropland, Forest to pasture, pasture to cropland

Revenue conversion scenarios

- Crop revenues, soil quality, and crop area in 2000 primarily determined LU conversion patterns.
- Other location factors such as slope and precipitation were less important.
- Crop revenues not only drive conversions to cropland (from forest or pasture) but also the conversions from forest to pasture (Fig. 3).
- Pampas: conversions to cropland were sensitive to increases in crop revenue (see Fig. 2, pink line).
- Chaco: revenues were a weaker driver compared to the Pampas. Soil fertility and distance to agriculture were important location factors. Climate was important but in a non-linear way.

Fig. 1: The Pampas and Chaco eco-regions as defined in this study

Results

- High cropland revenues increased the likelihood of forest to pasture conversion - This suggests that conversion to pasture is an intermediate step to the ultimate conversion to cropland.
- The importance of crop area in 2000 in determining conversions indicates potential agglomeration effects due to knowledge and technology transfers.

Conclusions

- Sustainable LU planning can benefit from understanding the role of LU change drivers for defining future development pathways:
  - In the Pampas: underlying drivers
  - In the Chaco: underlying drivers and location factors
- Models that include only location factors result in more expense areas being highlighted for conversions.
- By additionally considering underlying drivers in our model we narrowed down the potential areas in which strategic land-use planning can make an impact in mitigating ecosystem loss.

Data sources:

- Climate: INTA weather stations
- Elevations: SRTM 1 km
- Soils: INTA index of agr. Suitability (FAO)
- Population: INDEC
- Distances: cost distance to provinces
- Revenues: Production(soy, wheat, corn, sorghum, cotton): SIIA and Sigma; Census (INDEC); Costs: MAGyP and Margenes Agropecuarios

References:


Contact information

mara.piquer-rodriguez@geo.hu-berlin.de
Biogeography and Conservation Biology Lab, HU Berlin
www.geographie.hu-berlin.de | Tel.: +49.30.2093. 9341