AMAZALERT/ROBIN MEETING

Impacts of climate and land-use on rainforest biomes and their services in Latin America
Alter do Chão/Santarém-PA

Land Use and Land Cover Change Scenarios for the Bolivian Amazon

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Introduction

In Bolivia, tropical forests cover more than 50% (FAO-FRA, 2010), even though the country is one of the 12th countries with the highest deforestation rate between 2000-2012 (Hansen et al. 2013). The political decisions pretend to increase the agricultural frontier (IBCE, 2013). Also, oil and mining exploration together with road constructions will expand to intact forest including protected areas and indigenous territories (Jiménez, 2013). These policies together with climate change variability which derives in extreme floods, droughts and fires, are threaten the Bolivian Amazon forest conservation.

We generate three spatially explicit scenarios of land use and land cover change (LUCC), contributing to the LUCC data set for the whole Madeira River Basin in the context of AMAZALERT project:

- Scenario **A "Sustainability"**, the most optimistic situation where all the environmental laws are enforced.
- Scenario **B "Business as usual"** with current trends
- Scenario **C "Expansion of the agricultural frontier"**, the worst and immediate situation

Material and Methods

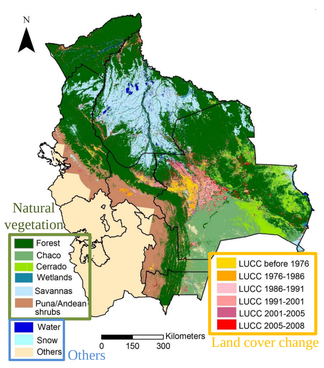

Figure 1. Study area, eastern lowland Bolivia below the natural montane tree line (~3000 m). LUCC data is from Killen et al. (2012). LUCC classes were grouped in three classes according to the boxes.

Table1. Model parameters description

Spatial scale:	
Area:	*Bolivian Amazon*
Resolution:	*(25km x 25km) 625 km²*
Temporal Scale:	
Period:	*2001-2008*
Resolution:	*annual*
Data for statistical analysis :	*2001*
Data for calibration/validation:	*LU data 2005 and 2008*
Period of scenarios analysis:	*2050*
Land use and cover change data:	
Classes:	*(1) Natural vegetation (Forest, Chaco, Cerrado; Savannah/Wetlands; Puna/Andean scrublands); (2) Others; (3) Deforestation*
Source:	*Museo de Historia Natural Noel Kempff Mercado (Killen et al. 2012)*
Kind of model:	*Continuous*
Relationship between use and location factors:	
Methods to quantify the relationship between LU and location factors:	*Spatial lag regression*
Quantification of land use change:	
Period of observed data:	*2001-2008*

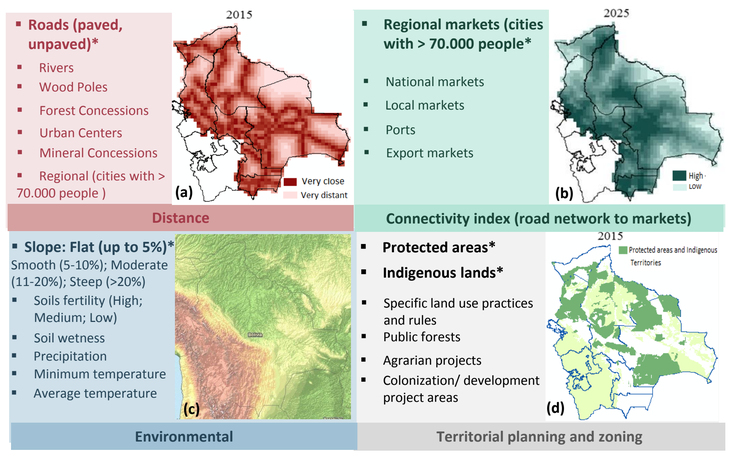

Figure 2. Independent variables analyzed, determinant variables after the statistical analysis are with *. (a) Distance to the logarithm of closest paved or unpaved road; (b) Connectivity index via the road network to regional markets (cities with > 70,000 people); (c) Slope; (d) Protected areas and indigenous territories

Table2. Land use and cover change scenarios assumptions for the Bolivian Amazon

	Variables	2015	2025	2045
Scenario A: *Sustainability*	**Roads**	No new roads	Construction are unpaved	
	GPM to regional markets[1]	No new roads	Construction are unpaved	
	PA[2] and IT[3]	PA and IT maintained	New PA are incorporated	
	Deforestation rate	Tendency of 2005-2008 until 2013, then decrease of 50%		
Scenario B: *Business and usual*	**Roads**	Unpaved are paved Construction are unpaved	Planned are unpaved Unpaved are paved	Planned are paved
	GPM to regional markets[1]	Unpaved are paved Construction are unpaved	Planned are unpaved Unpaved are paved	
	PA[2] and IT[3]	No new PA		In oil exploration zones no longer PA
	Deforestation rate	Tendency of 2005-2008	Tendency of 2005-2008	Tendency of 2005-2008
Scenario C: *Expansion of the agricultural frontier*	**Roads**	Unpaved are paved Construction are unpaved	Construction are paved Planned are paved	
	GPM to regional markets[1]	Unpaved are paved Construction are unpaved	Construction are paved Planned are paved	
	PA[2] and IT[3]	No new PA	In oil exploration zones no longer PA and IT	
	Deforestation rate	Tendency of 2005-2008	Increase to 13 million ha	

1. Connectivity index via the road network to regional markets (cities>70,000 people). 2. PA: Protected areas. 3. IT: Indigenous lands

We apply the LuccME framework, for spatially explicit land use change modeling, with a spatial resolution of 25km x 25km of regular cells giving an area of 966,250 km2.

Results and Discussion

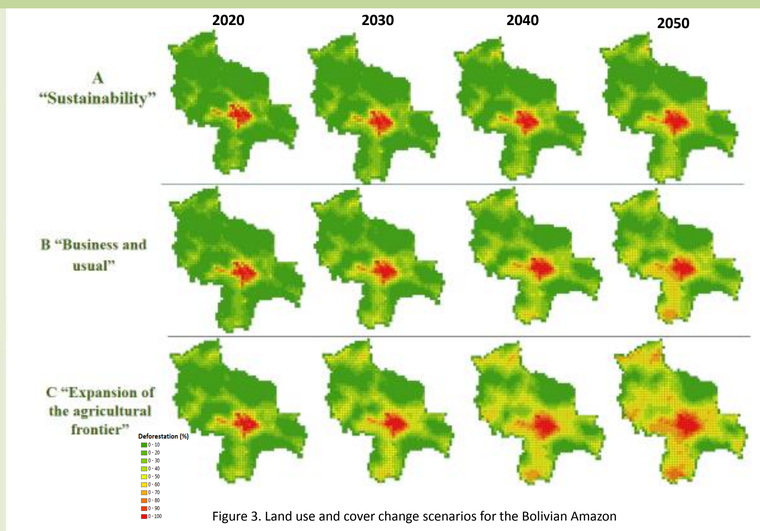

Figure 3. Land use and cover change scenarios for the Bolivian Amazon

Scenario A, with less deforestation shows the relevance of protected areas (PA) and indigenous territories (IT) and few new roads construction. This scenario is not likely to happen unless there is a high environmental law accomplished.

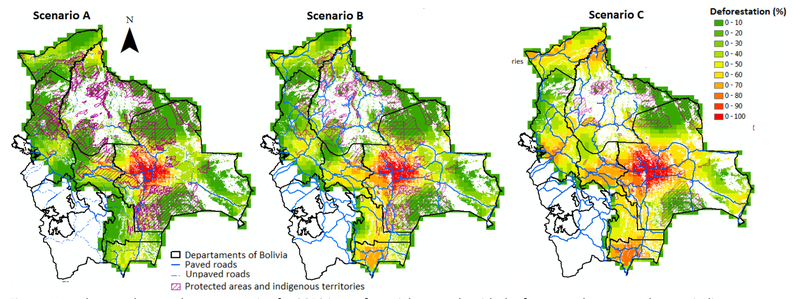

Figure 4. Land use and cover change scenarios for 2050 in a referential way, only with the forest mask, protected areas, indigenous territories and roads. Scenario A: Sustainability; Scenario B: Business and usual; Scenario C: Expansion of the agricultural frontier

Scenario B, with high deforestation in places where there are no longer PA, due to oil exploration or increment in road networks (consequently more connection to regional markets).

Scenario C, shows the worst and immediate situation in terms of deforestation, and is not far off from reality considering the increase of agriculture frontier, according to plans of the Government and Santa Cruz farmers to reach 13 million ha of extensive agriculture in 2025 (IBCE, 2013) and expand road network and oil exploration (also in PA and IT).

Conclusions

LUCC scenarios are a relevant tool that not pretends to predict the future but to show how the actual and future decisions could affect the deforestation trend of the Bolivian Amazon in a spatially-explicitly way.

The real scenario could be a mixture of the three scenarios, the next steps should be participatory scenarios construction with Amazon stakeholders.

At scale of the study the LUCC data used satisfied the requirements, for a local downscaling with a small regular cell (e.g. 5 km x 5 km) another LUCC data sets could be used (as RAISG (2012) or Hansen (2013)).

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