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Land Tenure Center

Research on land tenure, forest governance, and land use change in the northern Ecuadorian Amazon

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Overview: As part of our overall engagement with partners in Ecuador, we are performing research in the provinces of Sucumbios and Orellana, in the northern Ecuadorian Amazon, referred to locally as the “Oriente”. We explore the relationship between land tenure and land use change in this region, looking specifically at land tenure security, deforestation, and the varying impacts of different forms of forest management and land tenure on forest cover outcomes. Our two main studies, along with information on our partners, are outlined below. A primary objective of this overall body of research is to help inform the ongoing implementation, monitoring, and amplification of Ecuador’s national PES program, SocioBosque.

Research partners:

University of Wisconsin-Madison, Land Tenure Center: Lisa Naughton, Susana Lastarria, Margaret Holland (joint research fellow with Conservation International)

Ecolex: Manuel Morales (Executive Director)

CI-Ecuador: Luis Suarez (Director), Free deKoning (Technical Director), Christian Martinez (Spatial Analysis Coordinator), Montserrat Alban (Ecosystem Services Coordinator)

Ministry of the Environment / SocioBosque: Maria Jeaneth Delgado Aguilar (Manager, Land use change unit), Gladys Jeanneth Alvear (consultant, land use change analysis unit)

Study #1:

Title: Shifts in land tenure and land use change at the forest-farm interface in the Ecuadorian Amazon: implications for the implementation of PES/REDD+

Abstract: The discovery of oil in 1967 along with a rapid expansion of access roads ignited a period of spontaneous colonization and dramatic deforestation in the northern Ecuadorian Amazon, or *Oriente*. Historical settlement patterns (highest rate of population growth in any region of the Amazon in the 1990s), along with the rate of forest conversion to agriculture offer insight into the transitions at the forest-farm interface that can occur in the absence of formal governance, planning, or incentive programs (Pichón 1997; Bilsborrow et al., 2004). Past research in this region indicates that the deforestation front is characterized primarily by its level of fragmentation, even more so than its rate and extent (Sierra 2000). Similarly, observations regarding population growth and colonization in the region have pointed to a trend of land subdivision and intensification – a phenomenon quite different from the tendency toward land consolidation in other parts of the Amazon (Bilsborrow et al., 2004). Research on the influence of tenure security on patterns of land use related to colonist households in the region confirms the hypothesis that a lack of formal title leads to an increased pace of conversion to agricultural production, in order to establish claim to the land, (although the land parcels with insecure title

were much smaller, on average, than those with title) (Pichón 1997). Yet this rich literature and provocative set of conclusions regarding settlement and forest conversion at the Amazon frontier have yet to be revisited and updated. For this study, we access recently published datasets, provided by the Ecuadorian government, on plot-level characteristics of land use, land tenure, and household activity for the municipality of Joya de los Sachas, an area populated primarily by migrant households and situated at the heart of this region. Coupled with an analysis of land use change across two time periods (1990-2000 and 2000-2008, produced by the Ministry of the Environment), we analyze the relationship between changes in land tenure and tenure security on conversion of forest to agriculture or livestock production.

Using regression analysis, we assess the relative influence of shifts in land tenure on deforestation and agricultural expansion or intensification, while controlling for other factors present in the biophysical and socioeconomic landscape. Our preliminary findings confirm those of past research with higher rates of deforestation, forest fragmentation, and conversion to agriculture closely linked with insecure land title, recent occupancy, and land subdivision due to sales. By analyzing these relationships across two time periods of change, we can connect the land tenure and socioeconomic characteristics of land plots to the more recently observed decrease in deforestation and forest regeneration. While our analysis focuses on two new datasets and up-to-date information, we connect our findings with previous research results cited above and long-term field experience by our team in the region addressing land conflict and deforestation.

For the most recent time period of change, post-2000, we explore both the exogenous factors (e.g. shifts in government policies and market pressure), along with plot-level colonist household practices that might best explain the emerging trend of decreasing rates of deforestation, including forest regeneration in the region. We then examine the relevance of our findings regarding shifts in land tenure, present-day colonist land use patterns, and identified opportunities for forest conservation with the prioritization and implementation of Ecuador's national PES scheme known as the Forest Partners Program, or *SocioBosque*. *SocioBosque* has yet to be administered within the municipality of Joya de los Sachas, with current incentives in the region targeted primarily to larger landholdings under communal or indigenous title. We discuss both the opportunities for areas in the municipality to be incorporated into the *SocioBosque* program, and examine the bottlenecks related to land tenure and current colonist behavior that should be better understood and addressed prior to implementing PES in the region. Finally, given this region's importance for the national REDD+ strategy and the continuing dominance of oil production and exploration, we suggest a framework for understanding the various actors and drivers behind deforestation, forest fragmentation and regeneration in Joya de los Sachas, and the potential policies and interventions for addressing these drivers at the forest-farm interface in a critical frontier for conservation of the Ecuadorian Amazon.

References:

Bilsborrow, R.E., A.F. Barbieri, W. Pan. 2004. Changes in population and land use over time in the Ecuadorian Amazon. *Acta Amazonica* 34(4): 17pp.

Sierra, R. 2000. Dynamics and patterns of deforestation in the western Amazon: the Napo deforestation front, 1986-1996. *Applied Geography* 20: 1-16.

Pichón, F.J. 1997. Settler households and land-use patterns in the Amazon frontier: Farm-level evidence from Ecuador. *World Development* 25(1):67-91.

Datasets and variables

1. Predios / land parcels

Total #: 8,632

Land area: 114,463 hectares

Min parcel size: 0.006 hectares

Max parcel size: 7,560.56 hectares

Mean parcel size: 13.26 hectares

No title / sin título: 1,082 predios/parcels

Title / con título: 7,550 predios/parcels

Characteristics/variables associated with each predio/parcel:

Variable	Description / categories
Area	Parcel area in hectares
Title	Yes / No (Con título / Sin título)
Acquisition method	(see table for description of categories)
Land use	Categories based on primary land use activity current to 2008
Water source	Well, piped, potable, no info
Electricity	Yes / No
Telephone	Yes / No
Sewage system	Yes / No
Irrigation	Yes / No
Building/structures	Yes / No
Road type for primary access road	Type indicates relative accessibility
Name of property owner	Gives indication of individual or communal
# yrs occupied	# years occupied by current owner/occupant
Land purchase price	Where available

Other datasets for Joya de los Sachas:

1. Land use by parcel
2. Roads
3. Rivers
4. Schools
5. Health clinics
6. Population centers

Other geospatial datasets:

1. Land use/cover change: 1990-2000 and 2000-2008 by MAE/SocioBosque.
2. Oil wells, pipelines, mining concessions, hydroelectric project sites.
3. Roads – both for province as a whole and for Joya de los Sachas (includes road type / viabilidad)
4. Rivers – including navigable rivers
5. Towns/cities – includes population numbers
6. Protected areas
7. Sites currently participating in SocioBosque (current as of 2010)
8. Indigenous lands

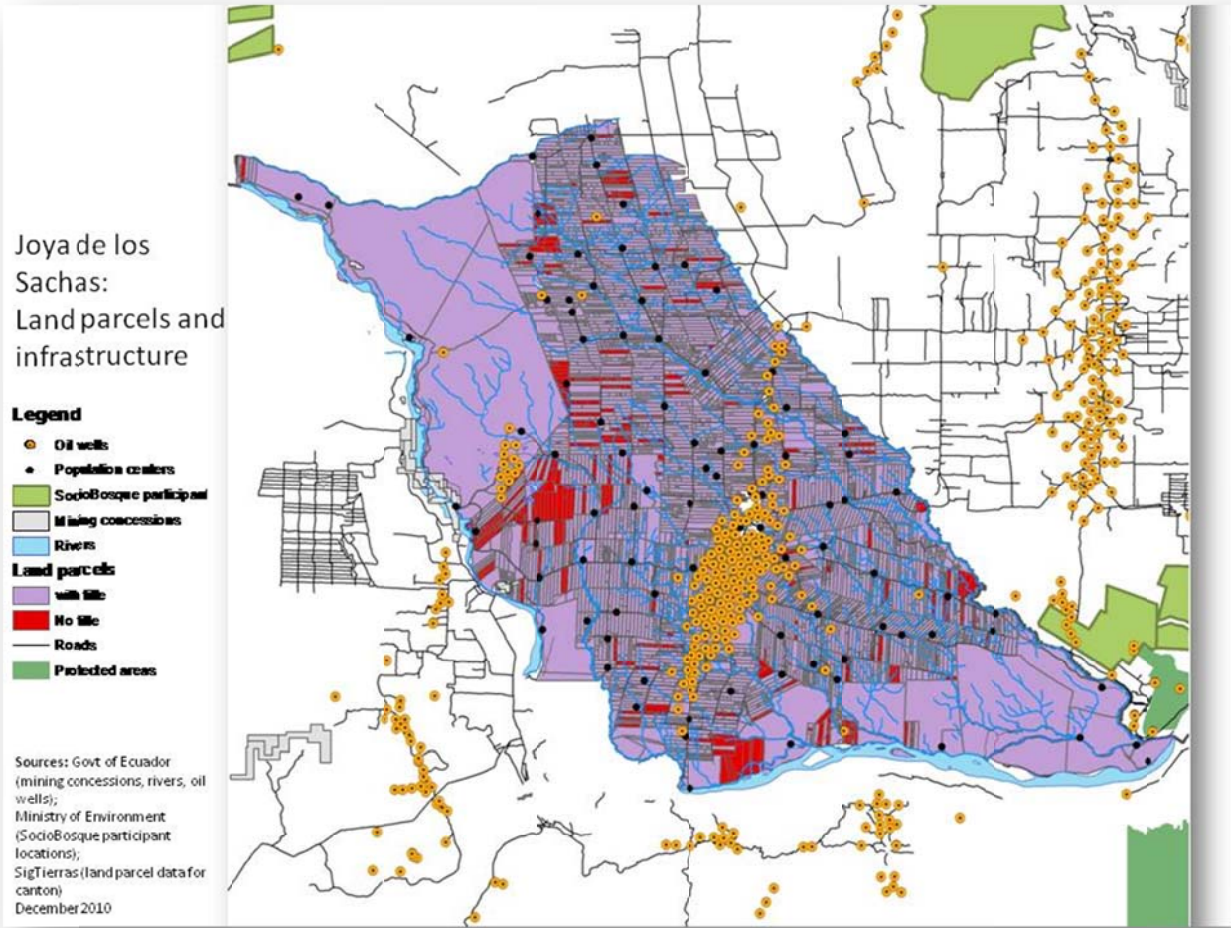


Figure 1. Study region for Study #1: Canton Joya de los Sachas with land parcels and infrastructure delineated.

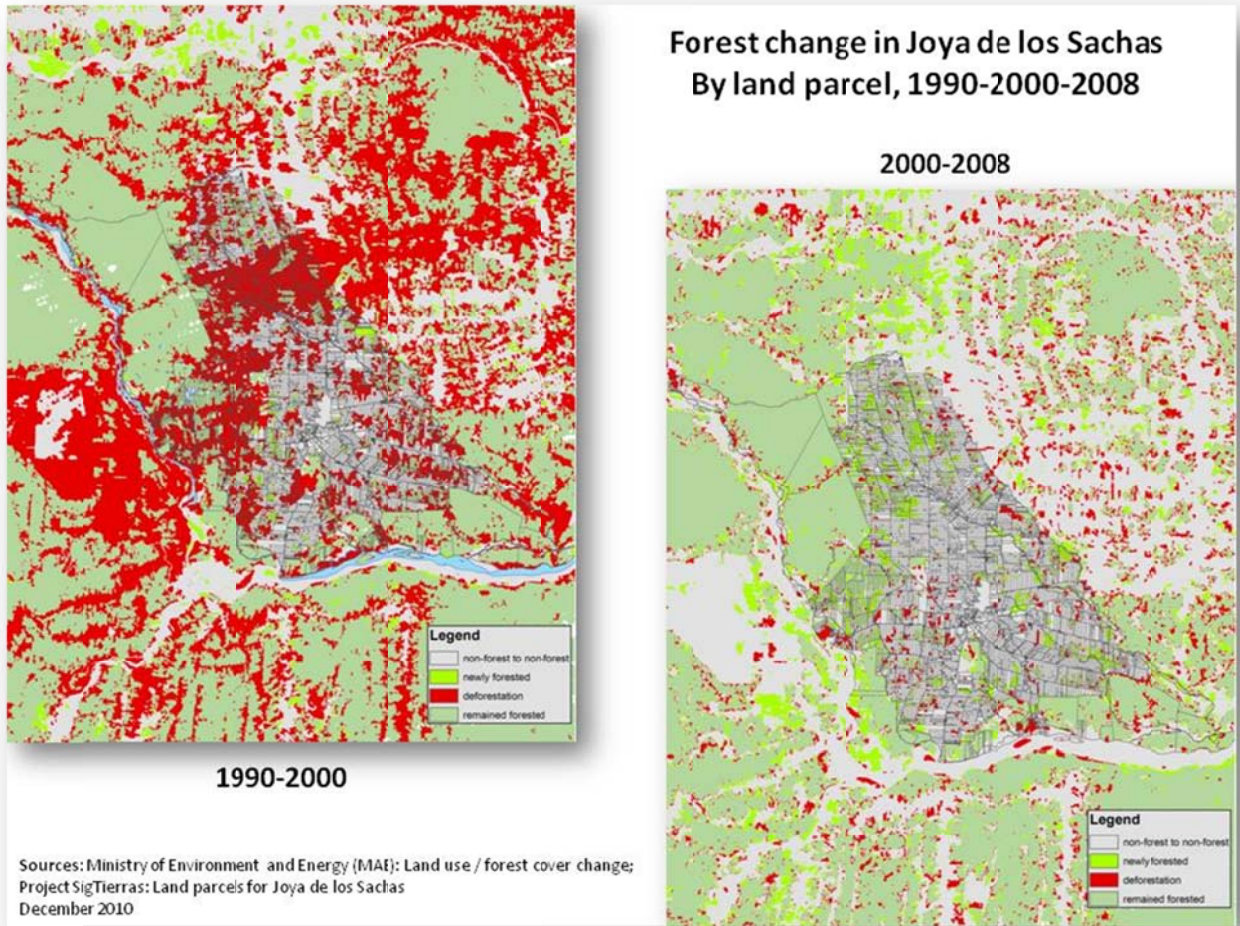


Figure 2. Study area #1 with forest cover change for 1990-2000, and 2000-2008.

Study #2:

Land use change in the northern Ecuadorian Amazon: assessing effectiveness across varying forms of forest governance

Abstract

Since the discovery of oil several decades ago in the northern Ecuadorian Amazon region, or *Oriente*, the region has experienced rapid and spontaneous colonization, a human population boom, and dramatic deforestation.

In this study, we explore the influence of varying forms of forest governance and management on past land use change and predicted future deforestation in the provinces of Sucumbios and Orellana in the northern Ecuadorian Amazon. Our dataset for land use change covers two time periods (1990-2000 and 2000-2008), and was produced by the Ministry of the Environment in Ecuador as part of their efforts to establish a national forest cover baseline for REDD+ implementation. Forest governance and management types in this region are challenging to categorize, with many overlapping types in the same area (see map figures below). We expect zones where governance is clearly delineated, i.e. core/intangible zones of protected areas, indigenous lands, and protection forests to experience less forest conversion than areas under colonist settlement, or otherwise in a zone of historic conflict (e.g. the “head” of Cuyabeño Reserve).

Using the Map Comparison Kit (developed by the Netherlands Environmental Assessment Agency), we use Kappa statistics to compare changes in land use across the following categories of forest governance in the region: core protected area, patrimony forest (patrimonio forestal), protection forests (bosques protectores), indigenous territory, and colonist settlement area, including separate categories for where two or more types of governance overlap. We trace the land use change trajectories for the plot samples from each category, paying particular attention to the overall changes (forest loss and regeneration) and fragmentation of forest cover over time. We then develop a model of predicted future deforestation across the region using Idrisi’s Land Change Modeler, based on past forest cover change (1990-2008), and considering the drivers of deforestation that can be spatially defined, (including those listed as landscape factors below).

Finally, using regression analysis, we test for the influence of forest governance category on past forest change and predicted future deforestation patterns in the region, by controlling for other landscape factors, including: accessibility to roads and markets, distance to navigable rivers, distance to oil production infrastructure, slope, and soil suitability. With results from this analysis, we discuss the implications for future forest governance in the region, with a focus on the implementation of the national PES program, *SocioBosque*.

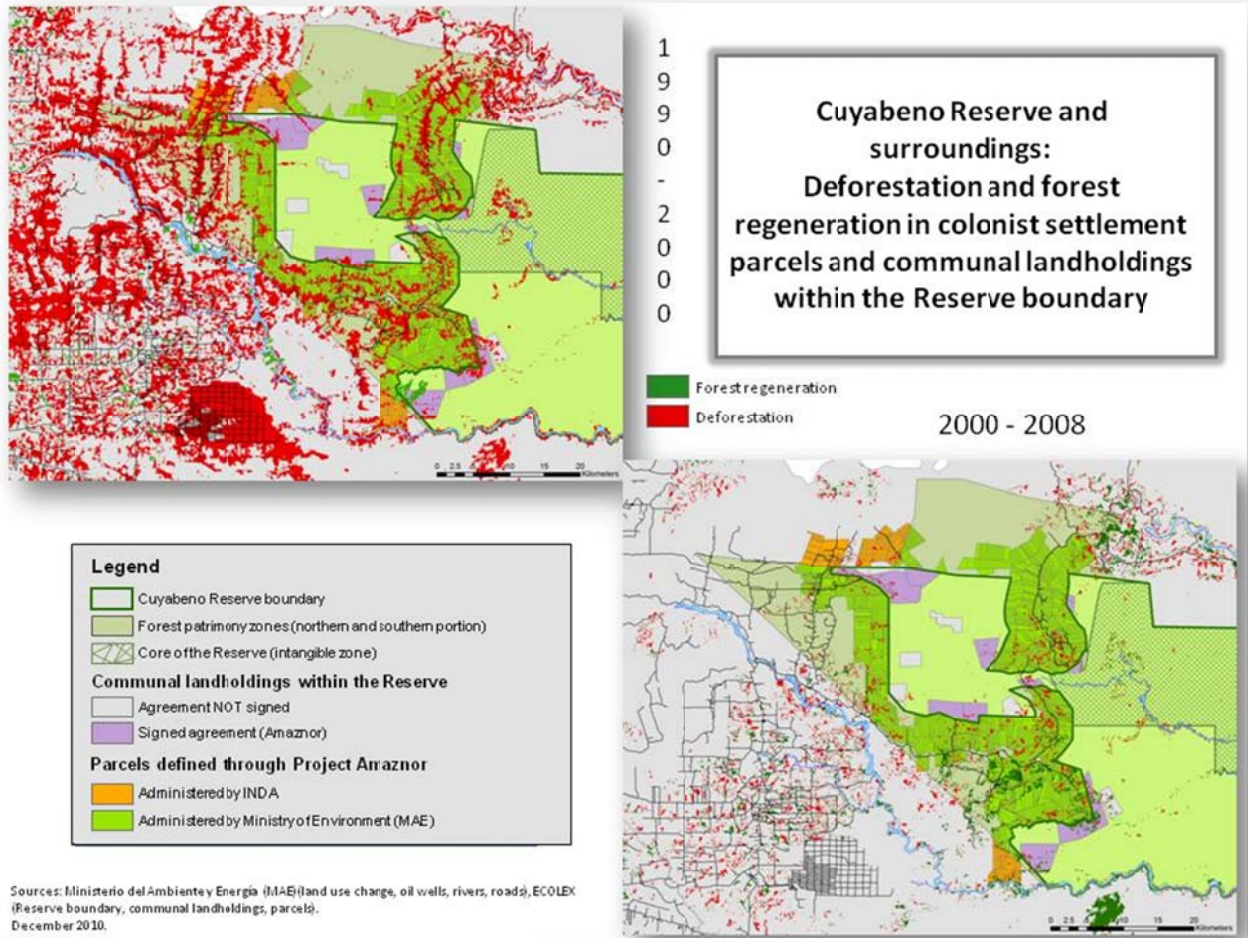


Figure 3. Example of varying forms of forest governance around Cuyabeno Reserve.

Map Figures of Varying Governance in entire Study Region (see next four figures)

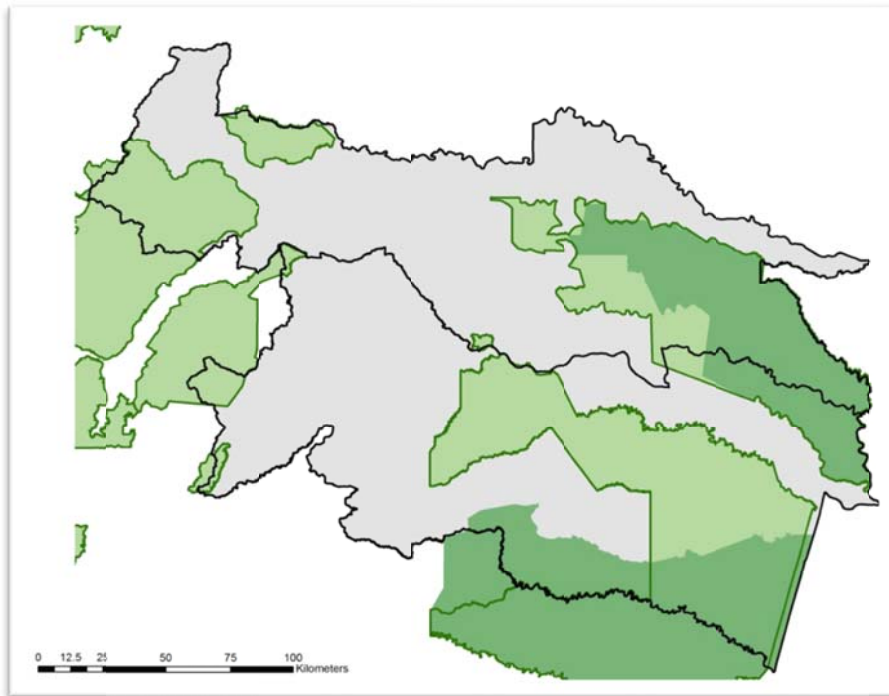


Figure 4. Protected areas (dk green = intangible zone / core area)

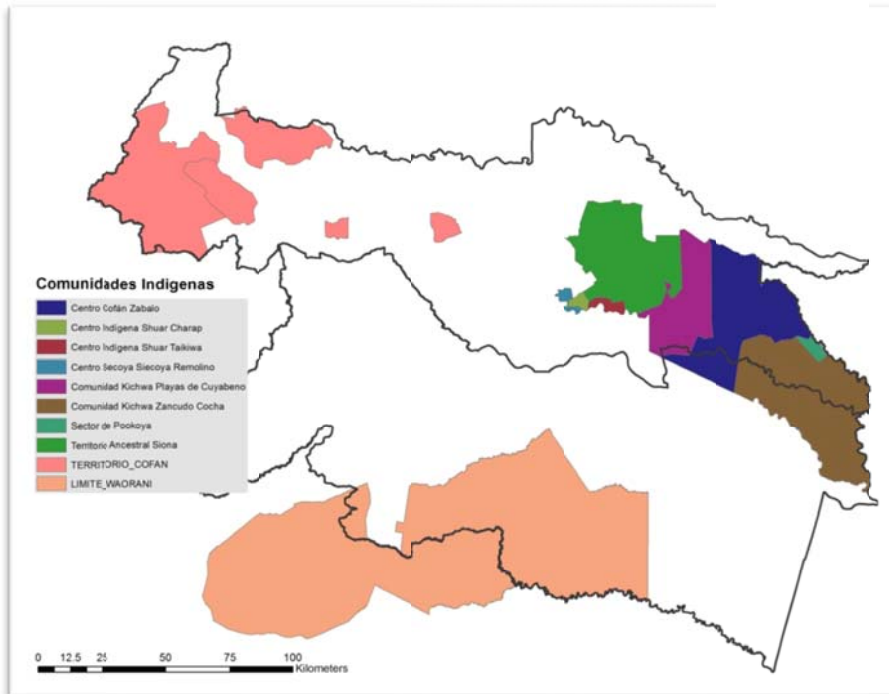


Figure 5. Indigenous communities / lands

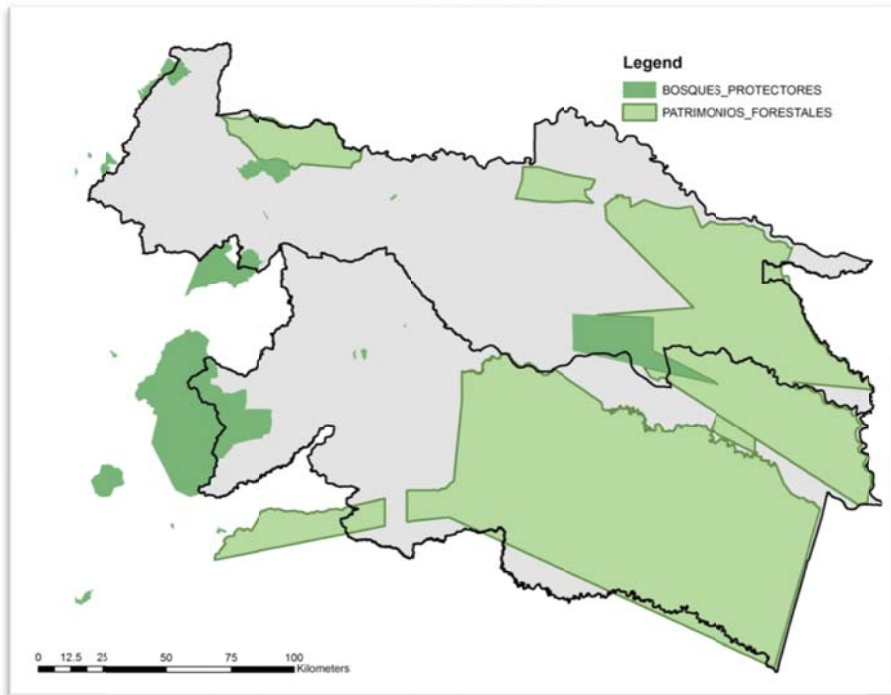


Figure 6. Patrimony forests and protected forests

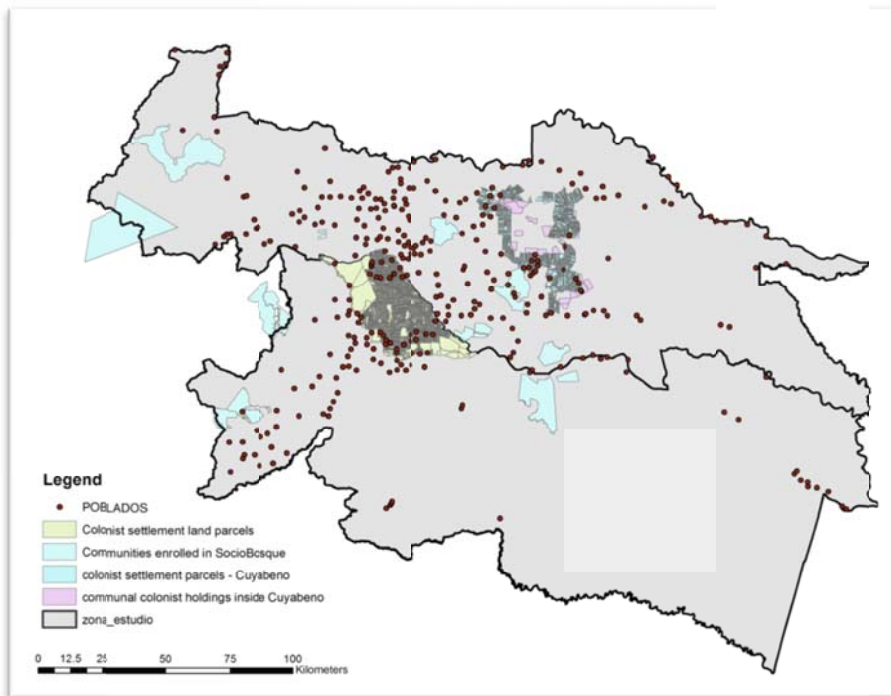


Figure 7. Colonist land parcels in Joya de los Sachas and Cuyabeno, communal landholdings inside Cuyabeno Reserve, and areas currently enrolled in SocioBosque.