

# CLAG FIELD STUDY POST-AWARD REPORT 2018

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*Forest or Fallow? Assessing the Diachronic Impact of Swidden-Fallow Agriculture on Upland Rainforest in Alto Chirripó, Costa Rica*

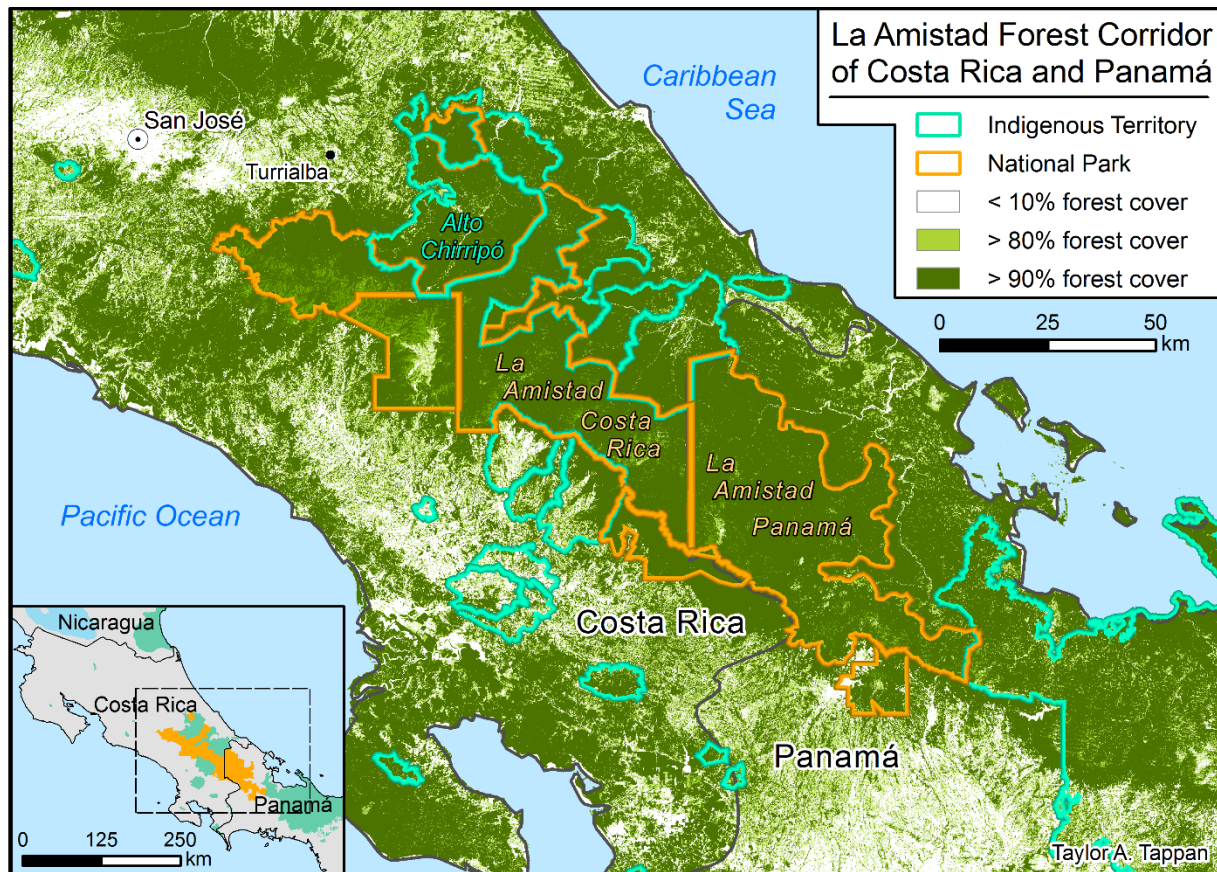
## **I. Context**

What impact on tropical rainforests is brought about when states decentralize forest governance to indigenous communities through land titling? Can swidden-fallow agriculture continue to support growing rural populations without jeopardizing forest conservation initiatives? Is land accumulation by individual households threatening rainforests *within* collective indigenous territories? These questions are paramount for indigenous leaders, environmental managers, and policymakers seeking to promote sustainable agroforestry and natural resource management in Central America, yet geographic studies addressing these concerns are scarce for the region's most remote indigenous territories where some of the last remaining stands of old growth tropical rainforest are found.

In this context, my dissertation research identifies the autonomous Cabécar territory *Alto Chirripó* (Figure 1)—the largest indigenous territory in Costa Rica and an integral component of Central America's broader Mesoamerican Biological Corridor--as a test site for the following three overarching inquiries: (1) *What is the long-term (40-year) signature of swidden-fallow agriculture on Alto Chirripó's upland rainforest?* (2) *Which factors drive local farmers' decision-making processes in creating and maintaining forest fallows?* and (3) *Are individual households accumulating land within Alto Chirripó, and if so, what social and environmental consequences play out through this process?*

I seek a holistic answer to these inquiries by integrating a multi-scale and multi-temporal approach that combines *on-the-ground*, community-based methods from participant observation (PO), participatory rural appraisal (PRA), and participatory research mapping (PRM) with *in-the-sky* interpretation of satellite imagery and aerial photography. The following four objectives drive the Co-PI's methodological approach: (1) map 40 years of land use/land cover change and develop an associated geographic information system (GIS) for Alto Chirripó; (2) document how much cultivated and fallow land is required to support a family's annual subsistence needs; (3)

determine whether land use *expansion* or *intensification* is reshaping forest cover dynamics in Alto Chirripó; and (4) describe the social and environmental impacts of the Cabécar Association's new internal cadastral registry within the collectively titled limits of Alto Chirripó.

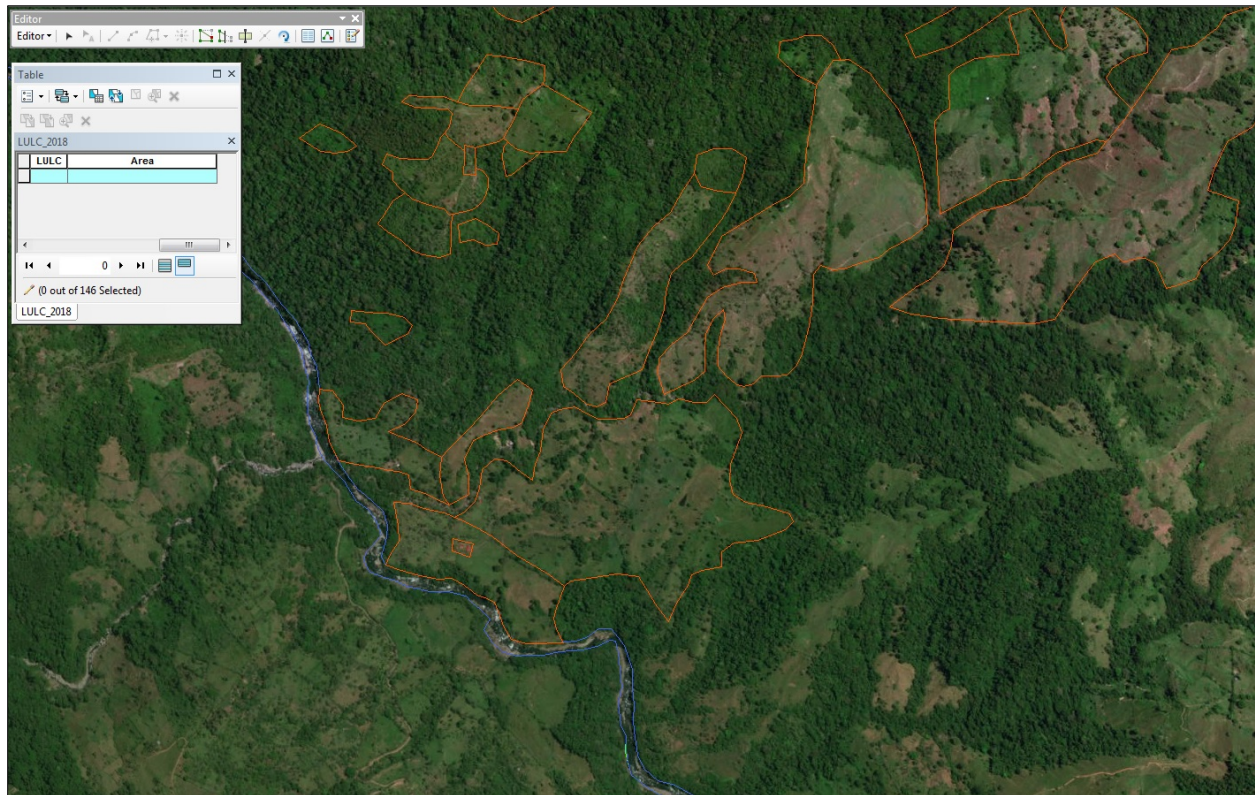


**Figure 1:** Alto Chirripó in the Amistad Forest Corridor (source: Hansen *et al.* 2013; Herlihy, Tappan, and Fahrenbruch 2018)

## **II. Office Work**

The 2018 CLAG Field Study Award supported in part the first two months of my dissertation research (ongoing at the time of this report) in Costa Rica in which I began tackling the first of the aforementioned inquiries. The quantitative, GIS and remote sensing-based component of this research involves land use/land cover (LULC) mapping from satellite imagery and aerial photography (Figure 2). This is performed using a spatial software platform such as ArcGIS or its open source counterpart, QGIS. To detect and quantify changes through time in disparate LULC classes, one must have access to a time series of available imagery and the muster to spend countless hours interpreting, comparing, and digitizing. Indeed, LULC mapping

through visual interpretation is cumbersome and time intensive, but generally results are much more accurate than maps produced through computer-automated classification techniques. Visual interpretation is also better suited for detecting nuanced LULC changes at the hectare or sub-hectare scale, where much of the swidden-fallow agriculture plays out in Alto Chirripó.



**Figure 2:** LULC mapping involves digitizing polygons around clearings and assigning them classes (agriculture, short fallow, long fallow, plantation, water body, etc.). Image Source: DigitalGlobe 2018.

While working from an office in Universidad Nacional, my host institution in Costa Rica, I began creating a time series of LULC maps for Alto Chirripó and its immediate surroundings—an area of roughly 1500km<sup>2</sup>. This process was made possible through interpretation of high resolution aerial photography covering the study area for the years 2018 and 2005, and then ‘cascading’ backwards in time through the 1990s and 1980s when lower resolution Landsat imagery was the best available. Working backwards in time helps to offset the discrepancy between high resolution aerial photography for the present and lower resolution imagery for the past because a geographer with a highly-accurate map of current LULC characteristics would need only to overlay the layer atop the older imagery and modify only the areas that seem to have changed. In this scenario, it’s of pivotal importance to proceed with painstaking caution to



ensure that the current LULC coverage is as accurate as possible; subsequent iterations of LULC mapping then become much easier and more expedient. At the time of this report, approximately 750km<sup>2</sup> of my study area have been mapped at 1:10,000 scale for the year 2018.

### **III. Field Work**



**Figure 3:** Community of Simiriñak along the banks of the Río Pacuare, Alto Chirripó Territory. Photo credit: Taylor Tappan.

Qualitative community-based participatory rural appraisal (PRA) and participatory research mapping (PRM) represent the counterweight to the quantitative GIS- and remote sensing-based approaches for this study. In November 2018, I will move to Grano de Oro—a small community along the western margin of Alto Chirripó—to begin nine months of in-situ field work. Two field assistants appointed by the Cabécar Indigenous Association will be hired to carry out PRA and PRM activities in five focus communities dispersed throughout Alto Chirripó. Community-drawn sketch maps, resource use questionnaires with associated toponyms, crop cycle calendars, and transects diagramming land use and land tenure are among the tools we



will implement to address questions 2 and 3. Our small research team will convoke assemblies to review satellite imagery and aerial photography with community members; interview local farmers; and document the distribution and size of agricultural plots to learn how swidden-fallow agriculture and forest cover have changed over time in Alto Chirripó. A household census will provide insight into population dynamics in remote communities often neglected by national census-takers. All raw data and processed results of this study will be submitted to the Cabécar Indigenous Association as a contribution towards developing Alto Chirripó's first *ordenamiento territorial*, or management plan for use and allocation of land and natural resources.



**Figure 4:** Plantation agricultura and cattle pasture along the western margin of Alto Chirripó. Photo credit: Taylor Tappan

#### **IV. Agradecimientos**

I would like to extend a profound thank you to CLAG for the Field Study Award. Since my initial CLAG proposal submission, my adviser (Peter Herlihy) has helped me to improve my proposal, which was eventually selected for a Fulbright-Hays DDRA Fellowship to continue funding my dissertation research in Costa Rica in 2019. I look forward to presenting results of this research at a future CLAG meeting.