Global Environmental Change 28 (2014) 205–215

Contents lists available at ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

Forest protection and tenure status: The key role of indigenous peoples and protected areas in Panama

Gerardo Vergara-Asenjo [a,b,*], Catherine Potvin [a,c]

[a] Department of Biology, McGill University, Montreal, Quebec, Canada
[b] Forest Research Institute (INFOR), Chile
[c] Smithsonian Tropical Research Institute, Panama

ARTICLE INFO

Article history:
Received 25 March 2013
Received in revised form 12 June 2014
Accepted 6 July 2014
Available online

Keywords:
Land tenure
Deforestation
Protected areas
Indigenous peoples
REDD+

ABSTRACT

Using recent land cover maps, we used matching techniques to analyze forest cover and assess effectiveness in avoiding deforestation in three main land tenure regimes in Panama, namely protected areas, indigenous territories and non-protected areas. We found that the tenure status of protected areas and indigenous territories (including comarcas and claimed lands) explains a higher rate of success in avoided deforestation than other land tenure categories, when controlling for covariate variables such us distance to roads, distance to towns, slope, and elevation. In 2008 protected areas and indigenous territories had the highest percentage of forest cover and together they hosted 77% of Panama's total mature forest area. Our study shows the promises of matching techniques as a potential tool for demonstrating and quantifying conservation efforts. We therefore propose that matching could be integrated to methodological approaches allowing compensating forests' protectors. Because conserving forest carbon stocks in forested areas of developing countries is an essential component of REDD+ and its future success, the discussion of our results is relevant to countries or jurisdictions with high forest cover and low deforestation rates.

1. Introduction

The proposal for reducing emissions from deforestation and forest degradation (REDD+), which was advanced by the United Nations Framework Convention on Climate Change (UNFCCC), is the first global mechanism to combat climate change using the forestry sector (Pistorius, 2012). Since 2005, it has been subject to negotiation at successive Conferences of the Parties (COPs) of the UNFCCC. In addition to activities to avoid deforestation and forest degradation, REDD+ also includes conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries.

Lessons from forest conservation might help REDD+ avoid reinventing the wheel. Designation of protected areas (PA) is a widespread environmental policy tool that has been used to protect forests (Bertzky et al., 2012). Covering extensive areas at global scales, protected areas have been identified as being potentially efficient for preventing deforestation (Andam et al., 2008; Nelson and Chomitz, 2011). Latin America, for example, has a higher percentage of terrestrial protected areas (20.4%) than either developed countries (11.6%) or other developing regions (13.3%) (United Nations, 2012). In general, protected areas are more effective than other forms of land tenure in reducing deforestation (Nepstad et al., 2006; Clark et al., 2008; Joppa et al., 2008; Nelson and Chomitz, 2011; Porter-Bolland et al., 2012). Their success, however, generally depends upon location, governance, and budgets (Nelson and Chomitz, 2011).

While the creation of protected areas in Latin America and the Caribbean has been one of the most popular top-down instruments for protecting forests (Elbers, 2011), most of their recent expansion (1990 and 2000) has been associated with some previous level of protection or by the presence of indigenous areas (Nelson and Chomitz, 2011). The underlying assumption is that indigenous territories also can play an important role in forest conservation (Nepstad et al., 2006; Hayes and Murtinho, 2008). In several Latin American countries, forest-based peoples possess extensive areas of land, as is the case in Brazil (135 million ha), Bolivia (12 million ha), Mexico (39 million ha), and Colombia (36 million ha) (Larson et al., 2010). In Latin America, studies have shown that when the governments have recognized traditional local rights, indigenous people are better able to control deforestation than private land

* Corresponding author at: Department of Biology, McGill University, 1205 Dr. Penfield Avenue, Montreal, Quebec, Canada. Tel.: +1 514 398 6726.
E-mail address: gerardo.vergaraasenjo@mail.mcgill.ca (G. Vergara-Asenjo).

http://dx.doi.org/10.1016/j.gloenvcha.2014.07.002
0959-3780/

regimes and can successfully prevent incursions into their forested territories (Nepstad et al., 2006; Hayes and Murtinho, 2008). Across the tropics, apart from protected areas, lands under the control of indigenous peoples also exhibit low deforestation rates and have shown a high potential for conserving forests (Hayes and Murtinho, 2008; Lu et al., 2010; Porter-Bolland et al., 2012).

Using Panama as a case study, we specifically tested the hypothesis that protected areas and indigenous territories ensure forest conservation. We considered indigenous territories as geographic areas that are legally recognized, that are in the process of recognition, or that are claimed by indigenous peoples. Our study addresses two main questions: (1) What is the extension of forests in indigenous territories of Panama and how it has change through time? (2) Are protected areas and indigenous territories effective in reducing deforestation in Panama? To answer these questions, we first mapped indigenous claimed lands, then compared forest cover through time under three main land tenure regimes, viz., protected areas and indigenous territories versus non-protected areas. Evaluating the effects of forest conservation requires controlling for landscape characteristics (Joppa and Pfaff, 2010). For example, factors that are associated with remoteness, topography and access, such as distance from roads, distance from populated areas, slope steepness and soil fertility, affect land-use decisions (Joppa and Pfaff, 2010; Nelson and Chomitz, 2011). We devised an empirical test to support, or refute, the hypothesis that protected areas and indigenous territories are effective in reducing deforestation. To do so, we used matching methods (Rubin, 1973), a statistical impact analysis technique that allowed pairing protected and indigenous territories with unprotected areas with similar landscape characteristics. We also discuss the implications of our findings for the Panamanian REDD+ strategy, together with potential positive incentives that could reward forest conservation in high forest cover/low deforestation rate countries or subnational initiatives.

1.1. Panama's national context

The Republic of Panama is a small Central American nation that covers about 74,000 km^2, and is officially divided into nine provinces and five legally established indigenous territories, which are referred to as *comarcas*. Panama is a country that is rich in biodiversity, with western Panama being considered part of the Mesoamerican hotspot and eastern Panama, a part of the Chocó/Darién/Western Ecuador hotspot (Myers et al., 2000). The country is uniquely situated as a biological corridor between Central and South America. Panama's deforestation rate was about 413 $km^2\ yr^{-1}$ between 1992 and 2000, and 134 $km^2\ yr^{-1}$ between 2000 and 2008 (CATHALAC, 2008). Over the last 20 years, forest cover in Panama has decreased from 36,951 km^2 (49.3% of the total land area) in 1992, to 33,507 km^2 in 2000, and to 32,433 km^2 in 2008 (CATHALAC, 2008). In 2008, Panama started to work with two REDD+ multilateral readiness programs, viz., the Forest Carbon Partnership Facility (FCPF) of the World Bank and the REDD program of the United Nations, with the goal of developing a national strategy that could reverse deforestation, while developing an economic framework to do so (World Bank, 2011; UNDP, 2012). Panama's REDD+ readiness proposal to the FCPF identified six main causes of deforestation: traditional and mechanized agricultural practices; extensive cattle ranching practices; exploitation of forests in a disorderly and unsustainable manner; poorly planned urban development; inadequate practices for exploiting mineral resources; and low levels of education and environmental culture (World Bank, 2008).

Since the creation of Altos de Campana National Park in 1966, protected areas have represented the Panamanian government's principal strategy for *in situ* forest conservation within the country (ANAM, 2006). Protected areas have also played a role in preventing the loss of Panama's forests (Nelson et al., 2001; Oestreicher et al., 2009; Haruna, 2010), which currently represent 35.8% of the total land area (ANAM, 2009). However, many of Panama's protected areas overlap with indigenous territories, thereby creating a mosaic of different tenures and tenure overlap zones, which are a source of diverse land-use conflicts. Indigenous territories within the borders of Panama are constituted as legally recognized areas and as areas being claimed by indigenous groups who wish to obtain legal recognition. These areas are hereafter referred to as "legally recognized territories or comarcas" and "claimed lands," respectively. Claimed lands in Panama are based on customary ownership. As defined by Sunderlin et al. (2008), customary ownership is determined at local level and based on oral agreements by the community itself rather than the state or state law (statutory land tenure). However, under Law 72 (Gaceta Oficial, 2008), indigenous groups that are living outside of comarcas can request official recognition of their lands. According to official data, comarcas encompass 12% of the country and include ~27% of national forests (CATHALAC, 2008; ANAM, 2009). Official statistics only report forest cover and deforestation for three of the five comarcas because only three comarcas have provincial-level status, while the other two only have sub-provincial status (*corregimiento*). As a result, the remaining two comarcas are merged with provinces in national reports (ANAM/ITTO, 2003; ANAM, 2009). This situation prevents a complete understanding of the role that indigenous territories might play with respect to forest conservation in Panama.

The comarcas are located in the western and eastern sections of the country, and along the Caribbean coast. The first comarca, Guna Yala, was established in 1938, while the most recent one was legally recognized in 2000 (Velásquez et al., 2011). Outside of the comarcas, the precise location of most claimed lands in Panama had not been mapped prior to our study, and as a result, the extent and percentage of forests inside these claimed lands was unknown. Under the authority of the General Congresses of the Collective Lands of Alto Bayano, the General Congress of Emberá-Wounaan Collective Lands, and the National Congress of Wounaan People, which are located in eastern Panama, the claimed lands are currently in the process of legalization under the country's Law 72 (Gaceta Oficial, 2008) and Decree 223 (Gaceta Oficial, 2010). The three remaining claimed lands, which are attempting to gain official recognition as comarcas, include Dagarkunyala, which is in easternmost Panama, and the Bribri and Naso territories, which are in western Panama. Over the past two decades, many of these areas have experienced an increase in invasion by non-indigenous groups, which has generated greater deforestation and other environmental problems. Most of these invasions are related to the expansion of the agricultural frontier by cattle ranchers or farmers (*colonos*) from other areas of the country (Wali, 1993; Peterson St-Laurent et al., 2012).

2. Methods

2.1. Mapping indigenous claimed lands

The first step in our study was mapping the claimed lands of Panama to determine the location and size of these areas. We began by gathering existing documentation on GIS coverage of national administrative units (provinces and comarcas) and the national system of protected areas, together with land-use maps from 1992, 2000, and 2008. These data came from three Panamanian institutions: the National Authority for the Environment (ANAM), the National Land Program (PRONAT), and the National Geographic Institute Tommy Guardia. A detailed list of the information that we obtained can be found in the Table S1 of