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Complex Tenure and Deforestation: Implications for Conservation Incentives in the Ecuadorian Amazon

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Summary. — This paper analyzes deforestation in areas of overlapping land tenure in the northern Ecuadorian Amazon. We use a random coefficients model to test for differences in forest cover across tenure forms over time. Tenure categories are significantly associated with changes in deforestation, even after controlling for multiple factors. Deforestation slows dramatically in the latter time period; and model results link parks with reduced deforestation. The same is true for lands where indigenous territories overlap with forest protection. Our results suggest that Ecuador's conservation incentive program could refine its targeting by focusing on indigenous areas and communal lands outside of parks.

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Key words — land tenure, deforestation, protected areas, indigenous territory, payment for ecosystem services, REDD, Ecuadorian Amazon

1. INTRODUCTION

Land tenure is a key factor affecting landholders' investment decisions on property and forest use. The impact of land tenure conditions on forest outcomes is difficult to predict given that in any area land tenure can be intertwined with multiple other factors shaping land use in unique ways. Thus much of the recent research on land tenure and tropical forest conservation is largely limited to comparing deforestation rates inside and outside protected areas (Andam, Ferraro, Pfaff, Sanchez-Azofeifa, & Robalino, 2008; Joppa & Pfaff, 2010, 2011). Other studies focus on the variable land use outcomes related to tenure security vs. insecurity and show that securing property rights can slow deforestation, or hasten agricultural expansion depending on local context (Barbier & Burgess, 2001; Robinson, Holland, & Naughton-Treves, 2011). Many studies of land tenure and deforestation assume that local land can be clearly classified into a single category (e.g., private, communal, or public) when in fact a given area may be subject to overlapping or even contradictory designations. This paper recognizes the complexity of land tenure in tropical forests and

asks how various and overlapping *forms* of tenure are associated with deforestation rates. With a detailed dataset on land tenure designations, infrastructure, and population data over nearly two decades in an ecologically important development frontier of the Ecuadorian Amazon, we provide a novel assessment of forest change, including in areas where tenure is clear and where there is ambiguity and overlap in tenure regime.

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Land tenure has emerged as a critical yet poorly understood component of incentive-based conservation mechanisms, such as Payments for Ecosystem Services (PES). The highest profile of these incentive-oriented policies, REDD (Reducing Emissions from Deforestation and Degradation), is part of the ongoing negotiations related to an international climate change mitigation strategy for post-Kyoto Protocol. Tenure is a key equity concern given that it determines the flow of benefits and assignment of responsibility for forest protection (Bruce, Wendland, & Naughton-Treves, 2010). Tenure regimes are often complex and overlapping in areas targeted for REDD, and this condition deserves more careful attention. Further, there is a lack of empirical analysis regarding the relationship between certain forms of land tenure and forest change.

Here, we look to the two northernmost provinces within the Ecuadorian Amazon (Sucumbíos and Orellana) and pose three questions:

1. Is there a significant variation in forest change across different forms of land tenure?
2. Are forest outcomes markedly different for areas where tenure forms overlap?
3. How might the interplay between land tenure form and deforestation help inform the implementation of a forest conservation incentive mechanism, such as Socio Bosque, which is included as a component of Ecuador's REDD strategy?

For this analysis, we conceptualize land tenure as it is defined by the US Agency for International Development (USAID): the institutional framework that determines how land (and its related resources) is accessed by individuals or groups, who is allowed to possess and use the land resources, under what conditions, and for how long (USAID, 2008). Tenure *form* refers to the individual, group, or entity to which the rights to the land are attributed and then administered. The most common forms tend to fall into four categories: individual, communal, state, and open-access (USAID, 2008). In this paper, we focus on state, individual, and communal land tenure forms in the northern Ecuadorian Amazon, paying special attention to areas where communal tenure overlaps with state forms.

Overlapping land tenure is of particular interest since it could be associated with contested, unclear or uncertain access rules, and thus imply potential tenure insecurity. Conversely, overlapping tenure could bolster, or reinforce, access rules in cases where such rules do not conflict, even if there are multiple forms. Specifically relevant to the Ecuadorian Amazon, where indigenous communities hold communal title, we aim to test whether indigenous areas that overlap with protected and restricted use areas have significantly different deforestation rates relative to other types of landholdings. In theory, this could have either a positive or negative effect on deforestation. Given that indigenous lands have management goals beyond forest preservation, one would expect higher deforestation rates than areas designated "protected" by the state. However, empirical analyses reveal highly variable deforestation rates, and in some cases indigenous lands appear more effective in maintaining forest (Nepstad *et al.*, 2006; Porter-Bolland *et al.*, 2011).

Proximity to roads, local institutional strength, and national government recognition are among the factors complicating this simple comparison (Nepstad *et al.*, 2006; Porter-Bolland *et al.*, 2011). Previous studies on deforestation and tenure ambiguity offered mixed signals: uncertain tenure status can discourage or hasten deforestation depending on an array of socioeconomic conditions (Robinson *et al.*, 2011). Few studies address overlapping tenure despite the fact that many indige-

nous areas are inscribed within or overlap with protected areas (Naughton-Treves *et al.*, 2006). Here we examine overlapping tenure as a distinct condition in itself. Because our definition of tenure form implies that each individual, group, or organizational identity can determine the access rules and management of resources, we assume that not all indigenous lands behave similarly with respect to deforestation. Where indigenous lands overlap with state-managed protected areas, we expect deforestation rates to be higher than in nonoverlapping, or "pure" protected area land. Outside of overlaps with tenure forms emphasizing forest protection and management, we expect forest change on indigenous lands to reflect similar rates to privately-owned lands.

(a) Study region

The dense forests of Ecuador's northern Amazon region (and the provinces of Sucumbíos and Orellana, specifically), contain globally significant biological and cultural diversity, and store significant carbon in the form of biomass. They also grow above substantial oil reserves (Figure 1). Land in this area is subject to multiple designations with different rules concerning deforestation and access to resources (Naughton-Treves *et al.*, 2006). We use a random effects model to test forest change across different tenure categories, overlapping forms, and across two time periods (1990–2000 and 2000–08). Recognizing that local drivers of Amazonian deforestation can change abruptly with national-level political change (Alvarez & Naughton-Treves, 2003), we note that these two time periods are marked by distinct political and economic conditions, as well as land tenure and land use developments. Previous research in the region reveals that deforestation is associated with road construction triggered by oil exploration, and is also affected by sociopolitical factors, especially indigenous vs. colonist land use practices (Mena, Bilsborrow, & McClain, 2006; Mena, Barbieri, *et al.*, 2006; Pan, Carr, Barbieri, Bilsborrow, & Suchindran, 2007).

This region is also targeted for Ecuador's national forest conservation incentive program, *Socio Bosque* or *Forest Partners*, a program aiming (1) to conserve 36,000 km² of forest and other native ecosystems, and (2) safeguard livelihoods and increase income for between 0.5 and 1.5 million people nationwide (de Koning *et al.*, 2011). One-quarter of the total national area and 16% of the agreements currently enrolled in Socio Bosque lie in this study region.

(b) Background

Increasing encroachment into the Amazon is a result of the dynamic frontier interplay of road expansion, resource extraction activities, and agricultural settlement. But the pattern and rate of deforestation are affected by more than the proximity of roads and rivers or human numbers—land tenure and land policy shape outcomes (Geist & Lambin, 2002). Amazonian frontier forest is typically cleared more rapidly in areas where land ownership is uncertain (Araujo, Bonjean, Combes, Combes Motel, & Reis, 2009). Here individuals clear forest to claim land and insure against the risk of expropriation or invasion (Fearnside, 2001). At a broader scale, official land use designations also affect forest clearing and fires, despite pervasive problems of "paper parks" and weak enforcement of indigenous reserves (Nelson & Chomitz, 2011; Nepstad *et al.*, 2006). If rural colonization policies, commercial resource extraction and road construction propel the initial sweep of forest loss in these frontier regions, land tenure shapes finer patterns of forest conversion.

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