Ecological Economics 153 (2018) 56–67

Contents lists available at ScienceDirect

Ecological Economics

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

Analysis

Titled Amazon Indigenous Communities Cut Forest Carbon Emissions

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ARTICLE INFO

Keywords:
Amazon
Brazil
Bolivia
Climate
Colombia
Deforestation
Ecuador
Forest carbon
Indigenous community
Matching
REDD

ABSTRACT

Indigenous communities (ICs) have emerged as important players in global efforts to reduce forest carbon emissions, in part because they are viewed as conscientious stewards of the forest lands to which they have legal title. Yet ICs tend to be located in remote areas where deforestation would be limited regardless of who manages them. Therefore, to determine whether IC management actually cuts forest carbon emissions, it is important to control for such confounding factors. To that end, we use propensity score matching and regression to analyze the effects on 2001–2013 deforestation and forest carbon emissions of IC management in the Amazon regions of Bolivia, Brazil, Ecuador and Colombia. We find that IC management reduces both deforestation and forest carbon emissions in Bolivia, Brazil and Colombia. We are not able to discern a statistically significant effect in Ecuador. These findings suggest that IC management can, in fact, help combat climate change.

1. Introduction

Forest clearing and degradation contribute one-tenth to one-seventh of global greenhouse gas emissions, roughly the same amount as the transportation sector (Baccini et al., 2012; Harris et al., 2012; van der Werf et al., 2009). Over the past two decades, indigenous communities (ICs) have emerged as increasingly important players in efforts to address this problem (Schroeder, 2010; Wallbott, 2014). Associations such as the International Indigenous Peoples' Forum on Climate Change (IIPFCC) now represent ICs in climate negotiations. Media coverage regularly touts the benefits of IC forest carbon management (Popkin, 2015; Fogarty, 2014; Kahn, 2014). And the 2015 Paris Agreement establishing a post-2020 international climate policy architecture contains numerous references to ICs. For example, the agreement recognizes the need to "strengthen knowledge, technologies, practices and efforts of local communities and indigenous peoples related to addressing and responding to climate change" (Paris Agreement, 2016).

Recent research appears to support the contention that IC management can help stem forest carbon emissions. We now know that ICs have formal legal title to a significant portion of the world's forest carbon—one-fifth, by one recent estimate (MAPF, 2015). In addition, remote sensing data indicate that rates of deforestation inside legally recognized ICs (hereafter, simply 'ICs') tend to be significantly lower than rates outside (Oliveira et al., 2007; Nepstad et al., 2006; Stevens et al., 2014). For example, Stevens et al. (2014) find that between 2000 and 2012, deforestation rates inside ICs in the Brazilian Amazon were seven times lower than rates outside, and rates inside ICs in the Colombian Amazon were three times lower.

However, the fact that ICs contain considerable forest carbon and tend to have relatively low rates of deforestation is by no means proof that IC management causes significant reductions in forest carbon emissions. There are at least two reasons. One is that forests under IC management may have pre-existing geophysical and socioeconomic characteristics, such as location in remote, thinly populated areas, that are at least partly responsible for relatively low deforestation rates. A recent *Science Magazine* article neatly articulates this concern.

> [S]ome question whether data support indigenous communities' claims to be better forest carbon stewards than outsiders. One confounding factor … is that many remaining indigenous territories are in remote, humid tropical forests with low population densities, meaning that lack of development pressure, rather than effective management, may explain why such forests have remained standing. (Popkin, 2015)

A second reason is that on a conceptual level, it is not altogether clear what effect we should expect IC management to have on

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https://doi.org/10.1016/j.ecolecon.2018.06.016
Received 7 July 2017; Received in revised form 14 May 2018; Accepted 24 June 2018

deforestation in any given geography.[1] Although there are certainly good reasons to expect IC management to reduce clearing, there also are good reasons to expect the opposite. As for the reasons to expect it to reduce deforestation, perhaps most important, IC management could in principle prevent a 'tragedy of the commons'—overexploitation due to ill-defined and insecure property rights (Hardin, 1968; Bromley, 1992). Research suggests that weak property rights can encourage land-poor households to colonize frontier areas (Clark, 2000; Oliveira, 2008), strengthen colonists' preferences for unsustainable productive activities with quick returns instead of investments in forests and other long-lived assets (Mendelsohn, 1994; Barbier and Burgess, 2001) and prevent land managers from participating in payments for environmental services and reducing emissions from deforestation and degradation (REDD) initiatives (Wunder, 2005; Gregersen et al., 2010). Forest management by local communities with formal legal title to their land could alleviate each of these problems.

But an equally plausible case can be made that IC management could spur forest cover change. Assigning property rights to entire communities instead of individual households can recreate common-pool resource problems on a local level, and communities vary considerably in their ability and willingness to successfully address these problems (Ostrom, 1990; Persha et al., 2011). Moreover, community control over forests can be undermined or co-opted by powerful private actors or by central governments (Johnson and Forsyth, 2002; Engel and López, 2008; Ribot et al., 2006). Finally, by improving communities' access to credit and/or extending their planning horizons, titling can raise the returns on agriculture relative to forests, thereby encouraging extensification (Liscow, 2013; Farzin, 1984).

Hence, empirical research using quasi-experimental methods that control for pre-existing land characteristics is needed to gauge whether and to what extent legally recognized IC management actually reduces forest cover change. A handful of studies, mostly published in the past five years, have begun to fill that gap. They use cross-sectional data and methods, in essence measuring the effect of IC management by comparing the rate of deforestation on land under IC management with the rate on land without it, controlling for observable land characteristics. Most of these studies find that on net, IC management stems deforestation. Relying on multinomial logit regression models, Muller et al. (2012) show that ICs in Bolivian lowlands inhibited deforestation between 1992 and 2004. Using matching, Vergara-Aseno and Potvin (2014) find that ICs in Panama cut deforestation between 1992 and 2008, although not by as much as strictly protected areas. Using regression models, Nelson et al. (2001) conclude that ICs in Darién, Panama, reduced deforestation between 1987 and 1997. Based on a matching analysis, Nolte et al. (2013) conclude that ICs in Brazil avoided significant deforestation between 2000 and 2005, particularly in places with high deforestation pressure. And using similar methods, Nelson and Chomitz (2011) find that protected areas under indigenous stewardship (not ICs per se) in Latin America reduced fire incidence, a proxy for deforestation, between 2000 and 2008. In contrast to these five studies, Pfaff et al. (2014) conclude from a matching analysis that ICs in Acre, Brazil, did not have a significant effect on forest loss between 2000 and 2008.[2]

The present study uses cross-sectional matching and regression along with fine-scale satellite data to examine the long-run effects on both deforestation and forest carbon emissions of IC management in the Amazon region of four countries: Bolivia, Brazil, Ecuador and Colombia. We find that after controlling observable confounding factors, IC management reduces deforestation and forest carbon emissions in Bolivia, Brazil and Colombia. We are not able to discern a statistically significant effect in Ecuador.

Our study makes three contributions. First, as noted above, it adds to the thin literature that uses quasi-experimental methods to evaluate the effect on deforestation of IC management, controlling for pre-existing land characteristics. Second, to our knowledge, it is the first to directly estimate the effect of IC management on forest carbon emissions as well as deforestation. And finally, to our knowledge, it is the first to examine the effects of IC management in multiple countries using consistent methods and data, ensuring that results are comparable across countries.[3]

2. Theory of Change

As noted above, the goal of our analysis is to identify the effect of legally recognized IC management—our 'treatment'—on deforestation and forest carbon emissions—our 'outcomes.' The treatment comprises two separable components: IC management and formal legal recognition of that management, which we refer to as titling. To underpin our empirical analysis and discussion of results, this subsection presents a set of hypotheses for potential causal pathways between (i) each of these two components of the treatment and (ii) our outcomes.

To keep the discussion manageable, we make two expositional simplifications. First, although our empirical analysis includes two outcomes—deforestation and forest carbon emissions—we focus only on deforestation. The reason is that the two outcomes are directly related: reductions in deforestation necessarily imply reductions in forest carbon emissions. Second, although as discussed in the Introduction, our treatments could in principle either reduce or exacerbate deforestation, given our empirical findings, we frame the theory of change as a set of hypotheses about how they might reduce it.

It is important to emphasize that these hypotheses are only meant to establish the range of plausible causal mechanisms that might explain a link between formal IC management and deforestation, and that identifying which mechanisms actually drive our results is beyond the reach of our data and beyond the scope of our analysis. Finally, we note that given the considerable differences in the institutional, geophysical and socioeconomic characteristics of our study countries (discussed in Section 3), causal mechanisms may well differ across countries and even within them.

2.1. IC Management

Here we consider the effect of IC management separate from formal

[1] This paragraph and the next are drawn from Blackman et al. (2014).

[2] A second, smaller group of studies—Blackman et al. (2017), Blackman (2018); Ben Yishay et al. (2017), Buntaine et al. (2015) and Hargrave and Kis-Katos (2012)—uses panel data and methods to examine the link between ICs and deforestation. However, these studies measure effects that although related, are different from the one our study (along with the other cross-sectional studies just noted) measures in two important ways. First, our study aims to measure the effects on deforestation of both (i) IC management and (ii) formal legal recognition of that management. It does that by, in essence, comparing the rate of deforestation on land that has both (i) and (ii) with the rate on land that has neither (i) nor (ii), controlling for land characteristics. The aforementioned panel data studies, by contrast, measure only the effect of formal legal recognition of pre-existing IC management. They do that by, in essence, comparing the rate of deforestation on land that has both (i) and (ii) with the rate on land that has (i) but not (ii), again controlling for land characteristics. Second, in general, cross-sectional studies like ours measure long-run effects while panel data studies measure short-run effects (Houthakker, 1965; Egger and Pfaffermayr, 2005). Hence, our study examines the long-run effects of legally recognized IC management whereas panel data studies examine the short-run effects of providing legal title for land already under IC management.

[3] To our knowledge, Nelson and Chomitz (2011) is the only other quasi-experimental study that examines effects of IC management on forests in multiple countries. However, that paper only measures the effects of protected areas under indigenous stewardship, not ICs per se, examines effects on fire incidence, not forest cover change or forest carbon emissions, and does not disaggregate results by country.