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REVIEW

Is small-scale agriculture really the main driver of deforestation in the Peruvian Amazon? Moving beyond the prevailing narrative

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Abstract

A key premise underlying discussion about deforestation in Amazonian Peru is that small-scale or so-called migratory agriculture is the main driver of deforestation. This premise has been expressed in government documents and public outreach events. How the Peruvian government understands drivers of deforestation in the Amazon has profound implications for how it will confront the problem. It is therefore important to critically revisit assumptions underlying this narrative. We find that the narrative is based on remote sensing of deforestation patch sizes but not on field data, potentially conflating distinct drivers of deforestation under the umbrella of "migratory," "small-scale," or "subsistence" agriculture. In fact, small patches of deforested land may indicate any number of processes, including sustainable fallow management and agroforestry. Moreover, the data underlying the narrative tell us little about the actors driving these processes or their motivations. Different processes have distinct implications for environmental sustainability and require targeted policy responses. We unpack these diverse actors, geographies, and motivations of small-patch deforestation in the Peruvian Amazon and argue that differentiating among these drivers is necessary to develop appropriate policy responses. We call for researchers to revisit assumptions and critically assess the motivations of observed deforestation to appropriately target policy action.

Introduction

For decades, discourse around deforestation in Peru among government and nongovernment conservation actors has highlighted small-scale—or "migratory"—agriculture as the key driver (Watters 1971; Dourojeanni 1987;). This same discourse continues today (Velarde *et al.* 2010), with the government claiming that 90% of deforestation in Peru is caused by migratory agriculture (MINAM 2014). At the same time, recent research indicates that other major drivers are growing in importance, including the conversion of primary forest for the installation of industrial monoculture plantations such as oil palm (Gutiérrez-Vélez *et al.* 2011) and cacao (EIA 2015), gold mining (Asner *et al.* 2013; Scullion *et al.* 2014), oil

and gas extraction sites (Finer *et al.* 2008), and roads through rural and wilderness areas (Mäki *et al.* 2001).

This discourse that focuses on small-scale agriculture is often accompanied by the assertion that poverty and social conflict in the Andean highlands create an impetus for out-migration to the Amazon, which underlies deforestation linked to migratory movements (Dourojeanni 1976; Ugarte-Guerra 2009; but see Ichikawa *et al.* 2014 for intraregional migration patterns). However, migration is also linked to agriculture policy and programs (Alvarez & Naughton-Treves 2003; Chavez *et al.* 2014). In reality, deforestation events—including small-scale ones—have multiple and complex underlying causes (Geist & Lambin 2002; Almeyda Zambrano *et al.* 2010; Coomes *et al.* 2011), including policy incentives, shifting market conditions,

changes to infrastructure, and the availability of investment capital.

How the Peruvian government understands the drivers of deforestation in the Amazon has critical implications for how the country addresses the problem. It is therefore important to revisit the mainstream narrative about deforestation and its drivers. We examine the evidence that has been used to support the attribution of deforestation to small-scale agriculture, and argue that it is imprecise, outdated, and inhibits the design of an effective strategy for combating deforestation. We applaud recent communications from the government (e.g., MINAM 2015) that present a more nuanced message about causes of deforestation, as they provide a stronger basis for addressing the problem. Nevertheless, the discourse among government agencies in the Peruvian Amazon continues to blame Peru's small-scale farmers, who have been consistently marginalized in the country's development agenda and through past forest policy (Sears & Pinedo-Vasquez 2011). In this article, we trace the origins of this narrative to give it a critical look, and ultimately propose a more nuanced approach to understanding drivers of small-scale deforestation that could enable policy makers to respond more appropriately.

The purpose of this article is to raise questions about how deforestation is viewed by key decision makers, outline alternative interpretations of deforestation drivers, and issue a call for new research that clarifies the current confused narrative. This article ultimately does not present new data on the drivers of deforestation, but rather calls for such data to be collected smartly. This need is pressing given the current dearth of such data along with the recent emergence of new actors and processes that drive deforestation in the Peruvian Amazon (Finer & Novoa 2015).

The prevailing narrative of deforestation in the Peruvian Amazon

The idea that migratory or small-scale agriculture is the main driver of deforestation can be found in many current documents and discussions in Peru. For example, Peru's 2013 REDD+[1] Readiness Plan (MINAM 2013) cited small-scale agriculture as the main driver of deforestation. We heard this statement repeated by representatives of the Ministry of Environment (MINAM) and the Ministry of Agriculture and Irrigation (MINAGRI) in public events related to the United Nations Framework Convention on Climate Change Twentieth Conference of Parties (UNFCCC COP 20) in Lima in 2014. Perhaps the most striking expression of this narrative was found in the Forests Pavilion at the COP 20 on a poster intended to educate the general public about deforestation in Peru.

It stated, "90% of the logging and burning of Peru's Amazon forests occurs at the hands of peasants living in poverty who migrate from the highlands and practice subsistence agriculture" (MINAM 2014, translation by the authors). This statement is troublesome for three reasons. First, it places blame firmly on migrants to Amazonia, apparently excusing other groups. Second, it conflates the *actors* who are deforesting with the *practices* that lead to deforestation, which can range from small-scale shifting cultivation, to forest conversion for pasture or cash-crops, to mining. Third, the data-source (CDI/INDUFOR 2012; MINAM 2012) on which this claim is based reports on the *frequency* of deforestation patch sizes and not total *area* deforested.

This generic narrative is also reflected in the draft of the National Strategy on Forests and Climate Change (MINAM 2015, translation by the authors), which states:

> "Traditional small-scale agriculture is the principal driver of deforestation in the Peruvian Amazon. The area of these landholdings varies between 5 and 30 hectares … The majority of deforestation is associated with subsistence agriculture, although the final state of deforested lands may be pasture, perennial crops, or secondary forests."

These examples illustrate how the Peruvian government considers a broad group of actors, including recent migrants and longer term resident small-scale farmers, to be responsible for most deforestation in the Peruvian Amazon. The above statement also reflects the assumption that land use change tends to move from forest to a final deforested state, without allowing for the dynamic equilibria between forests, croplands, and fallows that are found in smallholder production systems in practice (Padoch *et al.* 1985; Marquardt *et al.* 2013). Before unpacking these issues around land use change in the Peruvian Amazon, we examine the evidence for the narrative that small-scale subsistence agriculture is responsible for the vast majority of deforestation in the region.

Where do these conclusions come from?

The 2014 draft National Strategy on Forests and Climate Change (Rodríguez *et al.* 2014), which informed public discussions at the COP20, cited reports from The World Agroforestry Center (Velarde *et al.* 2010) and a report from Peru's Ministry of Agriculture (MINAG 2002). Velarde *et al.* (2010) themselves rely on MINAG (2002) to suggest that shifting cultivation is a principal driver of deforestation in the Peruvian Amazon. The MINAG report emphasized the linkages between agriculture and deforestation, suggesting that 81% of deforestation was

caused by shifting cultivation using data from INRENA (the former agency responsible for natural resource management), which was calculated from an analysis of Landsat imagery from the late 1990s and early 2000s. The report explained, "contrary to popular belief, timber extraction does not destroy forests. The activity that has the greatest impact is agriculture and livestock (migratory agriculture), as farmers burn enormous forest areas to uncover lands" (p. 42, translation by the authors).

In addition, a widely cited report from CDI/INDUFOR (2012) bases its conclusions on a MINAM (2012) analysis of remote sensing data. The MINAM data showed that deforestation in both 2005 and 2009 occurred in very small patches: about 75% of deforested patches were smaller than 0.5 ha, and another 15% were smaller than 1.0 ha. Based on this, the CDI/INDUFOR report concluded: "It is evident that the deforestation that occurred during both periods was dominated, at the national level, by the activities of peasant farmers, who require small areas for settlement" (p. 31, translation by the authors). In this way, the report linked the frequency of small deforested patches to small-scale agriculture as a driver.

Examining this evidence base, we find that the government's statement that most deforestation in the Amazon is driven by migratory agriculture is ultimately based on the frequency of a certain size of patches detected in analysis of remote sensing data. We found no evidence that the major studies used to support this narrative collected field data or systematically analyzed the actors involved in land use practices on the ground or their motivations. Methods for linking remote sensing and social science to provide a complete picture of land use change dynamics have been the subject of lively debate for some time (Liverman *et al.* 1998; Wood & Skole 1998; Rindfuss *et al.* 2003). Considerable attention has been paid to the importance of ground-truthing along with remote sensing, and the discussion is ongoing (see Hansen *et al.* 2014). Even as remote sensing technologies provide increasingly accurate information about the nature of land use change on the ground, alone they still cannot reveal which specific actors were involved and what their underlying motivations were, nor how political negotiations and policies influenced them (Tropek *et al.* 2014; Vergara-Asenjo *et al.* 2015). Understanding such details is essential for assessing land cover change comprehensively.

Without evidence of the direct drivers from the ground, to what extent can these data sources rigorously support the notion that the vast majority of deforestation in the Amazon is driven by small-scale and so-called "migratory agriculture"? We argue that policy makers need a more nuanced picture of small-scale deforestation that draws

distinctions between the various types of actors involved in clearing small patches as well as the varied factors that motivate their behavior.

"Small-scale" and "migratory" agriculture: clarifying the terminology

Key Peruvian agencies have variously used the terms "small-scale agriculture" and "migratory agriculture." However, these terms frame the debate in ways that obscure processes at work on forest frontiers and may hamper the formulation of appropriate policy responses.

There are at least two concepts that the term "migratory agriculture" may refer to that merit explicit distinction, and that are problematic if subsumed under a single umbrella term. First, in Spanish, the term "migratory agriculture" often refers to swidden-fallow agriculture, or shifting cultivation, wherein farmers rotate production among active fields of annual crops and regenerating forest areas, or fallows. An extensive literature on shifting cultivation in Peru (see Denevan & Padoch 1987) describes a tremendous diversity of strategies and practices used by farmers in Amazonia. Rather than leading to permanent land conversion, shifting cultivation involves patterns of growth, fallow, and regrowth. Such cycles produce temporal and spatial mosaics of crop fields and forests that can be relatively stable and sustainable.

A second meaning of "migratory agriculture" is "agriculture by migrants" (Che Piu & Menton 2014). This refers to the expansion of the agricultural frontier via the influx of immigrants who may spontaneously occupy forestland and transform it into agricultural land. While some immigrants become resident in a given area, others may only exploit the land until it is degraded and move on to new frontiers, sometimes participating in land speculation schemes. These processes have long been studied both in Peru and elsewhere in the Amazon (e.g., Collins 1986; Rudel 2013).

The first sense of the term "migratory agriculture" refers to *how* agriculture is being practiced, whereas the second refers to *who* is practicing agriculture. The current discourse conflates the two. It seems to suggest that all deforestation for small-scale agriculture is bad, and that it necessarily occurs in forested areas not designated for conversion. The implicit problem, from the government's point of view, is that these small-scale cultivators are moving into and spontaneously settling areas that should not be converted.

Distinguishing between who deforests, why they deforest, and where the deforestation takes place is essential for designing policy actions and understanding their trade-offs, yet these distinctions are often lost in

the dominant discourses described above. To illustrate, we describe several distinct behaviors and processes that produce small deforested patches, explain how the motivations and incentives for these behaviors differ, and show how recognizing these differences leads to different sets of policy alternatives.

First, we distinguish between the types of actors and behaviors that deforest in small patches, and also between the motivations and incentives for these behaviors (Table 1). Most small farmers in Amazonia practice shifting cultivation to meet subsistence needs on long established landholdings. Many of the very small deforestation events detected by remote sensing analysis are likely the periodic clearing of 1, 2, or up to 5 hectares of forest, usually secondary, to rotate and sometimes to expand a productive area. In such cases, deforestation is one phase in a relatively stable pattern of land use that over the long term results in a diversified mosaic of fields, pasture, agroforests, and forests (Pinedo-Vasquez *et al.* 2002). These strategies are employed by both indigenous and mestizo communities in Peru. On the other hand, some farmers, and especially those new to an area, convert shifting cultivation systems to monocultures, pasture, and plantations in a bid to intensify production. Such conversion may be motivated by offers of credit and future profits by private firms or government agencies, or opportunities arising from global commodity booms, including, importantly, the illicit cocaine trade (Salisbury & Fagan 2013).

These diverse land use scenarios should elicit distinct policy responses from the government. For example, cyclical on-farm deforestation in stable settlement areas, without expansion of the original landholding, is likely of little environmental concern. However, policy makers treat these traditional (yet adaptive, see Vogt *et al.* 2015) diverse farming systems as a problem, seeing them as inefficient, unproductive, and backward. Traditional development programs encourage a transition toward agricultural intensification and greater reliance on external markets through policies related to land tenure and credit incentives. Instead of continuing these policies, decision makers could seek ways to encourage sustainable family farming.

Conversely, because negotiations between third-party investors and small landholders are private, it is challenging for the government to intervene. Policies that incentivize and create enabling conditions for family farming and make such rental arrangements less attractive could help reduce deforestation in this case.

Second, we distinguish between deforestation on established landholdings in areas of stable settlement, as discussed above, and deforestation taking place in forested state lands zoned for permanent forest cover or with high conservation value. The geography of deforestation determines its environmental significance, and should therefore frame policy alternatives. The latter cases are of greater concern, wherein spontaneous informal settlement is sometimes facilitated by logging interests as an excuse to establish roads and access timber, or where large-scale commercial entities manipulate institutional gaps to gain formal property rights from regional governments and deforest tracts of mature forest to install commercial monocultures. In other cases, smallholders themselves may deforest these lands in order to demonstrate "economic exploitation" of the land, which has been required to gain titles through national titling programs (e.g., Peruvian Legislative Decree 1089 2008).

Whether smallholders or other actors are converting primary forests into shifting cultivation mosaics or monocultures, the state has a key role in moderating these processes by providing smart incentives (e.g., Börner *et al.* 2011) and facilitating dialogues with multiple stakeholders to assess the costs and benefits of different land use options. Intelligent and enforced zoning that allows some conversion of forests, especially where it is likely to produce great benefits, but disallows it in ecologically sensitive regions or areas where present deforestation is likely to lead to future deforestation—including in and around protected areas—is critical.

Table 1 shows these diverse processes and elaborates on their distinct policy implications. It is important to note that this table implicitly disentangles proximate and underlying drivers of deforestation, a critical distinction (see Geist & Lambin 2002). The incentives for behavior are, in essence, underlying drivers; meanwhile, the specific behaviors that lead to small-patch deforestation are proximate drivers. While farmers felling small patches proximately leads to the observed patterns, examining factors such as the type of forest they are felling, the crops that they are planting, and the policy and historical factors that led them to deforest can reveal underlying motivations and suggest policy response options.

Two important conclusions emerge from this overview of the types of drivers of deforestation. First, the simplifying language of "migratory agriculture" or even "small-scale agriculture" that has pervaded discussions in and communications from the Peruvian government obscures important distinctions among classes of actors and deforestation drivers. Second, the various processes that drive deforestation in the Peruvian Amazon have distinct motivations, which means that any policy that is to successfully address excessive deforestation and forest degradation must attend to these underlying drivers.

Table 1 Examples of long-term land use impacts of diverse behaviors that produce small deforested patches and related policy options

Behaviors that are proximate drivers of small-patch deforestation	Location	Land use impact	Incentives and underlying drivers for behavior and policy problems	Viable policy responses
Smallholder shifting cultivation	In established landholdings and in areas of long-term stable settlement	Diversified mosaic of agriculture, pasture, fallow, and forest	Policy makers treat these systems as inefficient, unproductive, and backward. They instead encourage intensification and dependence on narrow range of market commodities	Incentivize diversified farming systems, recognizing their environmental sustainability and importance for livelihoods and food security Recognize forest fallows as a productive land use
Recent migrants establishing farms	Forested state land, recent spontaneous settlement, areas with little, or improvised, infrastructure	Initial fragmentation of mature forest areas, increased access facilitates population influx and more forest clearing for agriculture	Lax enforcement allows spontaneous occupation combined with ineffective sanctions for deforestation	Eliminate the requirement for land clearing to establish property claims Enact enforceable zoning to prevent new clearing in certain areas
Intensified smallholder annual and perennial production for commercial purposes	In established landholdings	Diversified production mosaics converted into monoculture cash crops plantations, and agroforestry systems	Intensification pushed by policy makers (e.g., incentives for mechanized agriculture and monoculture) for higher productivity and economic development	Consider targeted support for diversified farm mosaics by moving away from credit policies that incentivize monoculture
Outside investor-driven commercial agriculture and ranching	In established landholdings and in spontaneously settled state forest lands	High-input monoculture (e.g., papaya, maize, and rice) replaces extensive shifting cultivation mosaics	Struggling farmers lease or sell their land to investors; the State is absent from these private agreements	Ensure that such behavior does not spread into conservation areas Craft market policies like credits and incentives that create enabling conditions for diversified family farm production

The way forward

The Peruvian government and civil society have taken key steps toward confronting deforestation while simultaneously recognizing the importance of smallholder livelihoods issues, such as enacting new regulations under the Forestry Law that recognize diverse forestry activities on farms. The purpose of this article is not to disparage discussions and efforts being made to address deforestation and its drivers in Peru, but instead to urge critical reexamination of the current narrative. By tracing the origin of the notion that small-scale or "migratory agriculture" is the main driver of deforestation, we have illustrated how overly general assumptions can mask the real dynamics and drivers of deforestation. In this context, we have several suggestions to clarify the narrative and move forward.

First, we call for renewed and rigorous investigation to identify and characterize the direct drivers of deforestation and forest degradation to complement the advances made in assessing land cover change by remote sensing (DeVries *et al.* 2015; Joshi *et al.* 2015). We suggest examining the underlying motivations for deforestation, particularly drawing links between agricultural and development policies, the historical socioeconomic marginalization of smallholders, and the current power dynamics embedded in decision-making about forests.

Such an approach will triangulate information gleaned from remotely sensed data that have driven much of the conversation in Peru about deforestation to date with complementary quantitative and qualitative data that will help policy makers to address the complexity of

land use decisions in forested areas. This should permit innovative policy design and, crucially, iterative policy learning. We urge the Peruvian government, civil society organizations, and academic institutions to capitalize on this opportunity.

Second, agencies in the government of Peru, Peruvian and international researchers, and civil society must work together to generate dialogue based on evidence about current drivers of deforestation and forest degradation. As the proliferation of industrial plantations for crops such as cacao and oil palm accelerates (Gutiérrez-Vélez *et al.* 2011; Dammert 2014; Potapov *et al.* 2014; EIA 2015; RAISG 2015), and the gold mining industry continues to boom in some parts of the Amazon (Asner *et al.* 2013; Potapov *et al.* 2014; Scullion *et al.* 2014), the profile of deforestation drivers is changing (Finer & Novoa 2015). Indeed, Scullion *et al.* (2014) found that in Madre de Dios, since 2007, artisanal gold mining has become the predominant driver of land use change, surpassing agriculture. Evidence from elsewhere in the Amazon, such as in Brazil, shows that even when small-scale agriculture—as diffuse and diverse as it is —does primarily drive deforestation, new processes such as land consolidation, plantation establishment, and large-scale ranching can and do become more significant drivers over time (Godar *et al.* 2012; Alencar *et al.* 2016). This dynamic context makes it ever more important to revisit assumptions and conduct rigorous research.

The implications of not fully understanding and addressing the drivers of deforestation in any country are significant, particularly with recent commitments by most governments to achieving REDD+ emissions reduction targets. The existing narrative risks perpetuating problematic generalizations about the expansion of the agricultural frontier have led to undue condemnation of a range of sustainable agricultural practices. It has justified policies that aim to eliminate shifting cultivation from conservation programs, even though traditional agricultural practices can in fact be key parts of a sustainable land use agenda (Padoch & Sunderland 2013; Van Vliet *et al.* 2013; Vieira *et al.* 2014).

Assuming that some deforestation will occur in the Amazon, a productive approach will be to examine the balance of social and environmental costs and benefits associated with different patterns of deforestation, and then prioritize outcomes that are desirable or that should be avoided. We support the notion that the expansion of the agricultural frontier into undesignated natural areas must cease in Peru and elsewhere, but we take issue with the suggestion that shifting cultivation is the main problem. If Peru is to reduce deforestation and forest degradation while still meeting development and livelihoods objectives, more rigorous mixed-methods research on the drivers of deforestation coupled with multistakeholder processes to evaluate trade-offs is required. Old assumptions about deforestation must be revisited. But acquiring better information to understand the drivers of deforestation is only an initial step in devising effective land use plans and policy interventions.

Ultimately, such information must be translated into action through political negotiations, and decision makers should commit to participatory processes to enable government, civil society, and local communities to work together, capitalizing on the management strengths of Amazonian people to achieve environmental, livelihoods, and development objectives. As is always the case, divergent interests will have to be negotiated. Even with better information, the relative importance of different drivers will likely still be contested by some actors. Nevertheless, understanding the realities of deforestation is a necessary starting point for such conversations. We suggest that other countries should likewise revisit their prevailing narratives about deforestation, and endeavor to collect data that captures the complexity and diversity of drivers of deforestation.

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web site:

Supporting Information

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Endnote

1. Reducing Emissions from Deforestation and Forest Degradation