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# Linking Forest Tenure Reform, Environmental Compliance, and Incentives: Lessons from REDD+ Initiatives in the Brazilian Amazon

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**Summary.** — Pervasive tenure insecurity in developing countries is a key challenge for REDD+. Brazil, a leader in REDD+, has advanced efforts to link forest tenure reform and environmental compliance. We describe how these policies have shaped sub-national interventions with detailed data on land tenure and livelihoods in four REDD+ pilot sites in the Brazilian Amazon. Despite different

local contexts, REDD+ proponents have converged on a similar strategy of collaborating with government agencies to clarify tenure and pave the way for a mix of regulatory enforcement and incentive-based REDD+ mechanisms. This polycentric governance model holds promise for effective and equitable REDD+ implementation.

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## 1. INTRODUCTION

Strategies to reduce carbon emissions through avoided deforestation and forest degradation and enhancement of carbon stocks (REDD+) have been proposed as a cost-effective way to mitigate global climate change through interventions in developing countries. REDD+ is also seen by many as a way to bolster livelihoods of local communities and promote other social and environmental co-benefits (Brown, Seymour, & Peskett, 2008; Stickler *et al.*, 2009). Since the Bali Road Map of 2007, where the idea began to take shape, hundreds of first-generation REDD+ initiatives have emerged at the sub-national scale throughout the tropics, including many in the Brazilian Amazon (Cenamo, Paván, Campos, Barros, & Carvalho, 2009; GCP, 2011; Sills, Madeira, Sunderlin, & Wertz-Kanounnikoff, 2009). These initiatives range from localized projects to jurisdictional REDD+ approaches. While these REDD+ projects are pursuing initiatives include diverse strategies to reduce emissions and enhance stocks of forest carbon, they almost universally face the challenge of poorly defined and/or enforced tenure rights to both forests and carbon (Sunderlin *et al.*, 2013). The success of REDD+ hinges in part on finding ways to clarify these tenure rights, either as a pre-condition or as an initial step in REDD+ interventions (Larson *et al.*, 2010; Streck, 2009; Sunderlin, Larson, & Cronkleton, 2009). Incipient sub-national REDD+ initiatives in the Brazilian Amazon offer insights on tenure issues, providing an important test of whether or not national advances in linking forest tenure reform and environmental compliance have made a difference for early REDD+ implementation on the ground.

Tenure rights have important implications for all common REDD+ interventions, including both regulatory enforcement measures and incentive-based conservation tools, such as payments for environmental services (PES) and promotion of alternative livelihoods based on the sustainable use of natural resources. For instance, under Brazil's Forest Code,<sup>1</sup> which establishes a minimum level of 80% forest cover on private lands in the Amazon, the legality of clearing can only be determined with knowledge of land ownership or use rights. Likewise, if land is claimed by more than one individual, liability for environmental offenses may not be clearly established. REDD+ that is based on direct conditional payments, in principle, faces even greater challenges than regulatory measures when it comes to contract enforcement; PES requires not only *de jure* rights to land but also the ability to *de facto* prevent third parties from changing land cover without consent (Börner *et al.*, 2010). Such rights must be defined to minimize the risk of deforestation under PES contracts and allow for effective measurement, reporting, and verification. Similar challenges would apply to REDD+ support for promotion of sustainable livelihood alternatives (Sunderlin & Sills, 2012): to use this as a performance-based REDD+ strategy, it must be clear who gets the credit for forest conservation, and who bears the responsibility for deforestation. Clarifying and securing tenure rights—before REDD+ begins—is thus

needed for the application of both regulatory and incentive-based REDD+ mechanisms.

Brazil is distinctive among tropical countries for its record of providing ownership and access rights to forest-dwelling people, especially in the Amazon (Sunderlin, Hatcher, & Liddle, 2008). More recently, Brazil stands out for its policies linking forest tenure reform efforts with environmental compliance. Despite these initiatives, poor land rights delimitation and pervasive tenure insecurity in the Amazon, even in some areas with allegedly well-defined tenure, are considered major barriers to national REDD+ implementation (May, Millikan, & Gebara, 2011). Thus, the proponents of sub-national REDD+ initiatives in the Brazilian Amazon face tenure difficulties typical of tropical forest regions, but with perhaps a unique opportunity to leverage national policies to address these challenges.

The Brazilian Legal Amazon<sup>2</sup> encompasses about 60% of the Amazon biome, which is the largest contiguous tropical forest in the world, alone containing half of global terrestrial biological diversity and one-fourth of its primary productivity (Soares-Filho *et al.*, 2004). From 1996 to 2005, an average 19,500 km<sup>2</sup>/year of Amazonian forest in Brazil was cleared for pastures and croplands (Nepstad *et al.*, 2009) and even larger areas degraded through conventional logging and forest fires (Asner *et al.*, 2005; Cochrane *et al.*, 1999), making it a key region for REDD+ action. In a demonstration of leadership in the ongoing international climate change discussions, Brazil committed to reducing its Amazonian deforestation to 80% of 1996–2005 levels by 2020, including this target in its 2010 national climate change mitigation plan. In fact, Brazil has achieved substantial reduction in Amazonian deforestation since 2005, largely due to the implementation of several national conservation policies (Assunção, Gandour, & Rocha, 2012). These advances, however, are threatened by recent changes to the Forest Code,<sup>3</sup> which lessen environmental compliance requirements and could lead to a new wave of deforestation.

Brazilian sub-national REDD+ initiatives provide a concrete testing ground for design and implementation of REDD+ interventions in a setting where there is government commitment to and progress in clarifying forest land tenure. We examine four incipient REDD+ initiatives in the Brazilian

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Amazon and ask the following questions to better understand the potential for and challenges associated with REDD+ implementation at the regional level: (1) What is the current land tenure and livelihood situation at the four REDD+ pilot sites?; and (2) Is the complete package of REDD+ strategies well aligned with these specific local contexts? In answering these questions, we identify a common approach to integrating tenure reform into these diverse REDD+ pilot initiatives in the Brazilian Amazon. Thus, we contribute a concrete example to the ongoing debate about whether and how REDD+ can be implemented in the context of pervasive tenure insecurity throughout the tropics, and its possible forest conservation and human well-being outcomes. Despite continuing challenges, Brazil's progress in linking forest tenure reform with environmental compliance could bode well for successful REDD+, as sub-national initiatives are bolstered by national processes.

## 2. SETTING THE STAGE FOR REDD+ IN THE BRAZILIAN AMAZON: LINKING LAND TENURE REFORM AND ENVIRONMENTAL COMPLIANCE

Brazil has a long history of granting rights to landholders in the Amazon, which has resulted in great inequality in land claims. From the initial distribution of state-sized land grants for those who curried favor with the Portuguese court during the colonial period, to the delivery of large blocks of land in the Amazon basin to private companies under the military regime, large landholders have consistently benefited from government support at the expense of smallholders and landless rural workers (Aldrich, Walker, Simmons, Caldas, & Perz, 2012; Schmink & Wood, 1992; Simmons, Walker, Arima, Aldrich, & Caldas, 2007).

Over several decades, agricultural land reforms have sought to redress this fundamentally unbalanced land distribution pattern. The settlement of smallholders in the Brazilian Amazon has occurred in two ways. The first involves government-sponsored colonization to distribute public lands to smallholders, which began through granting 100 ha parcels to landless peasants in the 1970s (Pacheco, 2009); such settlement was justified by the government as a way to secure national borders and alleviate social pressure in more populated areas. The second, and now more common, is the redistribution of large private landholdings and public lands that have been invaded by smallholders (Moran, 1981; Pacheco, 2009; Sawyer, 1984) either spontaneously or as part of well-organized social movements, both of which are known as Direct Action Land Reform (Simmons *et al.*, 2011). The federal agency responsible for creating and supporting these settlement projects is the Institute of Colonization and Agrarian Reform (INCRA). This agency requires that landless peasants organize into associations, invest in productive land activities, and draft a plan for development of the settlement. Once the plan is approved, INCRA is required to provide infrastructure, which in principle includes educational, health, and transportation services for the association, along with temporary food assistance, with the idea that the settlement project will be "emancipated" when smallholders are eventually granted titles.<sup>4</sup> While settlers often hold documentation that authorizes their land occupation, official titles are less common, especially since settlers may avoid obtaining title to maintain their access to INCRA services and subsidies (Simmons *et al.*, 2011).

Unfortunately, this land reform process has been fraught with violent conflict and has been linked to deforestation beyond what would have been cleared for agriculture alone

(Aldrich *et al.*, 2012; Alston, Libecap, & Mueller, 2000). Deforestation is often a way to establish rights to land, a strategy that has been accepted and even promoted historically by governments throughout Latin America (Ankersen & Ruppert, 2006). Brazil is no different; the Brazilian Constitution, ratified in 1988, requires that private property perform a "social function" and allows for the expropriation of lands that have failed to demonstrate this function. While it is acknowledged that smallholders are not the primary agents of Amazonian deforestation (Pacheco, 2009), their settlement invariably leads to forest clearing, since most invasions occur in forested areas, and colonists then strive to show that their land is productive through clearing (Fearnside, 2001). Additionally, Direct Action Land Reform that is motivated by social movements has encouraged migration from urban to rural areas, which also increases pressure on forestlands (Simmons *et al.*, 2011). In response to invasions by smallholders, large property owners have been known to employ militia or private gunmen to defend their properties from invasion, resulting in prevalent violence against smallholders and increased rural resistance (CPT, 2011). The high profile murders of rural leaders such as Chico Mendes (Schmink & Wood, 1992; Schwartzman, 1991), Sister Dorothy Stang, and João Claudio Ribeiro da Silva and Maria do Espirito Santo, have drawn national and international attention to Amazon land conflicts.

Recent policy initiatives in the Brazilian Amazon have sought to address these past environmental and social failures by linking land tenure reform and environmental compliance. One of the most important national initiatives is the Legal Land (*Terra Legal*) Program, which the Ministry of Agriculture implemented in 2009 as part of the broader land reform law 11.952/2009. The program's objective was to grant land titles to approximately 300,000 smallholders who claim rights to non-designated public land (*terra devoluta*) in the Amazon. To receive titles, smallholders must have occupied the area peacefully and cultivated a portion of the land since 2004, be Brazilian citizens, and not own other rural properties or have previously benefited from land reform efforts. A title is conditional on compliance with the current Brazilian Forest Code, which is determined by mapping and registry of the individual landholding in a Rural Environmental Cadastre (CAR). The Forest Code dictates that state governments implement the CAR process through joint efforts by INCRA with their state-level environmental and agrarian reform agencies. For property owners with less than 80% of its area in forest, CARs expire in 6 months if not followed up with recovery plans for ensuring environmental compliance. *Terra Legal* was piloted in 43 Amazonian municipalities that had been blacklisted by the Ministry of Environment due to their high rates of deforestation. Producers in blacklisted municipalities are denied access to agricultural credit and are subjected to product supply embargoes until the municipality has registered 80% of its properties in CARs and substantially lowered deforestation.<sup>5</sup> Supporters of *Terra Legal* viewed it as a way to support smallholders' rights and productive activities; critics considered it a way to legalize land grabbing (Thomas, 2012).

Despite the advance in making environmental compliance explicit in land reform efforts, *Terra Legal* faced substantial challenges in its first 2 years of implementation (Brito & Barreto, 2011). For instance, while 87,992 lots were registered (covering an area of 10.3 million ha) only 611 rural land titles were actually granted, and less than half of these had registered CARs. Furthermore, the values of lots sold by government bodies within this program were much lower than market prices, easily promoting land speculation. Clearly linking land reform and environmental compliance has far to go,

especially in light of the changes to the Forest Code that lessen environmental regulations on private properties.

Poorly defined land tenure is a major barrier to the implementation of REDD+, including the regulatory and incentive-based mechanisms that are currently being discussed at the national level. Payments to promote environmental compliance are considered a cost-effective and politically-acceptable REDD+ strategy given high levels of illegal, yet tolerated historical deforestation and high opportunity costs that would be borne by large landholders and small colonist settlers, in particular, for the 2020 national target of reduced deforestation to be reached (Börner, Wunder, Wertz-Kanounnikoff, Hyman, & Nascimento, 2011). Although deforestation in the Brazilian Amazon occurs primarily on land with unclear tenure rights, Börner *et al.* (2010) suggest that it would only be possible to implement PES in the roughly one-third of threatened forests with relatively clear tenure rights given the requirements for PES described earlier. According to the same study, potential beneficiaries of REDD+ based on direct conditional payments could be occupants of indigenous lands (~22% of Brazilian Amazon), sustainable use protected areas (~10%), land reform settlement projects (~13%), and private lands (~24%). Since inhabitants of non-designated public lands (~24%) and strict protected areas (~7%) do not hold exclusive rights to land, they would likely not qualify for PES. REDD+ support for alternative livelihoods would also

be challenging on lands with unclear tenure, since investments in such strategies require long-term commitments to more sustainable land use.

### 3. RESEARCH METHODS

#### (a) REDD+ site selection

In the Brazilian Amazon, there are at least 25 pilot initiatives for avoided deforestation, in addition to a number focused on afforestation/reforestation and forest restoration (Lin, Patanayak, Sills, & Sunderlin, 2012). The REDD+ initiatives are highly diverse in terms of scale, proponents, local actors involved, and interventions planned. We selected four REDD+ initiatives in Brazil that were interested in an outside evaluation and had identified specific areas and communities for REDD+ interventions (Figure 1). All four had been approved or nearly approved by the Amazon Fund, an important national source of REDD-readiness funding managed by the Brazilian National Development Bank and fomented by large donations from Norway and Germany, and more recently by the Brazilian company Petrobras.<sup>6</sup> Partly due to the uncertainty about the future of an international REDD+ system, most projects funded and implemented voluntarily by the private sector are moving forward slowly, and it was therefore

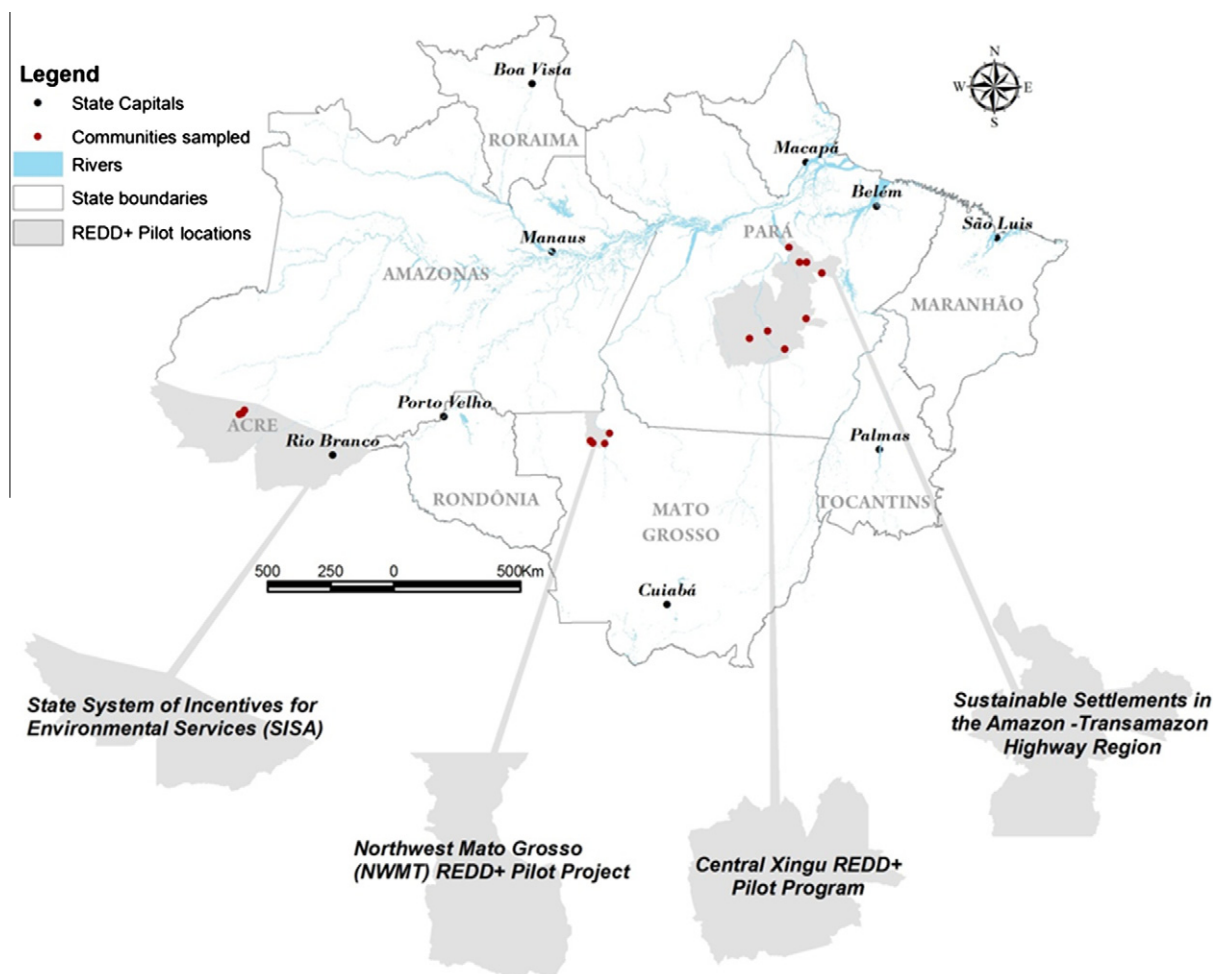


Figure 1. Map of REDD+ project sites and communities sampled. Map credit: Nathália Nascimento.

not possible to include them in the initial sample. Our sample also does not include any of the initiatives that are operating primarily in indigenous areas, due to the caution with which the proponents of these initiatives are approaching these groups, along with difficulties in terms of obtaining permission from the Brazilian National Indigenous Peoples' Foundation for research in these areas. Other than these two dimensions (private sector and indigenous populations), the four sites are representative of the range of incentive-based REDD+ initiatives in the Amazon, including some led by non-governmental organizations (NGOs) and some by state governments, operating at multiple scales, and planning diverse interventions across three states. The first, "System of Incentives for Environmental Services (SISA)" in Acre, is a state-wide initiative led by Acre's State Government. The second, "Sustainable Settlements in the Amazon: the challenge of transition from family production on the frontier to a low carbon economy" in the Transamazon Highway Region of Pará, is led by an NGO, the Amazon Environmental Research Institute (IPAM). The third is the "Central Xingu REDD+ Pilot Program" in São Félix do Xingu, Pará, which is led by The Nature Conservancy (TNC) and the municipal government of São Félix do Xingu, and the fourth is the Northwest Mato Grosso REDD+ Pilot Program, led by three NGOs, the *Instituto Centro de Vida* (ICV), TNC, an international affiliate of the National French Forest Service (ONF-I), and the State Environmental Secretariat of Mato Grosso. In the specific study area in Acre, there were no prior investments in land tenure reform, whereas the other REDD+ pilots were sited in areas of established frontier settlement, where land reforms, while certainly not resolved, have been underway for some time. Our expectation was that the proponents of REDD+ initiatives would build on national advances to link land tenure reform and environmental compliance and have a broader package of REDD+ strategies at sites where tenure rights were clearer.

#### (b) *Surveys with REDD+ proponents and target communities*

We used methods from the Global Comparative Study (GCS) on REDD+<sup>7</sup> of the Center for International Forestry Research (CIFOR) to conduct initial baseline research at these four sites from April 2010 to May 2011. We held two interviews with the main proponents of all initiatives—once at the beginning of the baseline research and 1 year after the research was complete—to identify and characterize communities where interventions were planned and understand design and implementation strategies. We also explored the broader land tenure context within the project sites and specifically asked about REDD-readiness activities that were related to land tenure.

At the onset of the baseline research, we selected 16 communities that were targeted by proponents for REDD+ interventions (four at each site; Figure 1). In Acre, we sampled all four communities in an area where SISA was likely to be implemented initially. At the Transamazon, Central Xingu, and Mato Grosso sites, four communities were chosen from 15 potential intervention communities identified in each site, representing a diversity of community-level characteristics.<sup>8</sup> Importantly, the communities sampled in the Transamazon did not correspond to locally-defined associations, as in the other cases, but rather were based on groupings of households (*nucleos*) established as part of *Proambiente*, a "PES-like scheme" in Brazil that ended in 2006 (Hall, 2008; Wunder, 2006). At that site, we used the existing *nucleos* as the starting

point to define community boundaries for our work based on local definitions of social organization.

In each of the sampled communities, we interviewed local leaders about community characteristics and held community-level meetings. In the meetings, we asked community leaders to invite meeting participants with an aim of 15 participants that included both men and women. The majority of meetings exceeded the target number of participants and included more men than women. We also conducted household-level interviews with approximately 120 families at each site (an average of 30 families per community). Families were randomly selected from a stratified sample to include participants and non-participants in the local REDD+ initiative. Through the interviews with local leaders, community meetings, and household interviews, we assessed the tenure situation in each community through the use of a typology that categorized formal, or statutory, owner(s) or manager(s) of forest resources as well as the customary resource user(s) into one of three categories: (1) public (state); (2) private; or (3) communal. We addressed conflicts, perceptions of tenure security (secure or insecure in terms of the ability to continue to use a land area at least for the next 25 years), current rules for resource use, the right and capacity to exclude outsiders, and management rights, especially monitoring and rule enforcement. In the community meetings, we asked participants to provide consensus opinions in terms of tenure security, and exclusion and management rights for their particular community. In the household-level interviews, we also gathered information on household land use and measured subsistence and cash income derived from forests and other on- and off-farm activities. Our quantification of rural income was based on the method used in CIFOR's Poverty and Environment Network project—a comprehensive assessment of the role of forests in rural livelihoods in 26 tropical countries (<http://www.cifor.org/pen>; Angelsen, Olsen, Larsen, Lund, & Wunder, 2011). The baseline study permits us to evaluate the current land tenure and livelihood situation at these four REDD+ sites, assess how proponents are addressing challenges related to tenure security and livelihoods, and make preliminary observations regarding potential outcomes of REDD+ for forest conservation and human well-being.

## 4. CASE STUDY RESULTS

### (a) *Acre's state system of incentives for environmental services*

#### (i) *Background*

Acre's System of Incentives for Environmental Services (SISA) was passed into state law on October 22, 2010 (2.308/2010). The entire state is eligible for the incentive program (Figure 1; Table 1). Yet, an initial focal area for proponents' efforts and resources was the Priority Assistance Zone, a 5 km buffer along either side of the unpaved BR-364 Highway, located within the municipalities of Manoel Urbano and Feijó. This area is minimally deforested (4%), but threatened by recent highway paving, which opened up the more remote, western portion of the state to year-round access and likely colonization. The Priority Assistance Zone is essentially a "no man's land" in terms of formal property rights. Until recently, it was inaccessible during 8 months of the year when the BR-364 was impassable due to rain. Migration to the area began during the rubber boom of the late 19th century, when forestlands in the area were held in large estates for the extraction of rubber (*Hevea brasiliensis*), which became active again during World War II (Barham & Coomes, 1996; Weinstein,

Table 1. *Comparative characteristics and strategies of four sub-national REDD+ pilot initiatives studied*

	SISA, Acre	Sustainable Settlements in the Amazon, Transamazon Highway Region, Pará	Central Xingu REDD+ Pilot Program—São Félix do Xingu, Pará	Northwest Mato Grosso Pilot REDD+ Project—Cotriguaçu
<i>REDD+ initiative characteristics</i>				
Proponent(s)	Government: Acre State System of Incentives for Environmental Services (State Law 2.308/2010)	NGO: Amazon Environmental Research Institute (IPAM)	NGO-Government partnership: The Nature Conservancy (TNC) and municipal government of São Félix do Xingu	NGO-Government partnership: ICV, TNC, and State Environmental Secretariat of Mato Grosso
Scale	Entire state; Zone of Priority Assistance along the BR-364 as one initial focal area (11,405 km <sup>2</sup> )	Three reference land reform settlements (2,288 km <sup>2</sup> ); 350 families in three municipalities who were part of <i>Proambiente</i> program (318 km <sup>2</sup> )	Central and northern part of municipality, including indigenous lands and conservation units that exceed municipal limits (total area approx. 110,000 km <sup>2</sup> )	Northwest Mato Grosso (7 municipalities), with one municipality (Cotriguaçu) as the pilot area (9,123 km <sup>2</sup> )
Target actors	Extractivists, indigenous groups, small/medium/large agriculturalists, timber producers	Colonist settlers	Colonist settlers, indigenous groups, small/medium/large landholders, multi-level government agencies	Colonist settlers, medium/large private landholders, indigenous groups
Drivers of deforestation and forest degradation in intervention area	Road paving, illegal logging, cattle ranching, swidden agriculture	Illegal logging, cattle ranching, swidden agriculture	Cattle ranching, illegal land-grabbing, illegal logging, swidden agriculture, lack of production alternatives	Cattle ranching, illegal logging, lack of governance in rural settlements (e.g., invasions of Legal Reserve areas)
<i>REDD+ mechanisms*</i>				
Land tenure regularization	Partner with state land agency to georeference and demarcate properties in the Zone of Priority Assistance along the BR-364 as part of <i>Terra Legal</i>	Partner with INCRA to register smallholder properties and implement Rural Environmental Cadastre (CAR) as part of <i>Terra Legal</i>	Partner with municipal government, state land and environmental agencies, and farmer's union to develop more precise digital maps, and identify landholders' property limits for CAR implementation as part of <i>Terra Legal</i>	Partner with INCRA to map rural properties and implement CARs in settlement projects as part of <i>Terra Legal</i>
Regulatory mechanisms	Assure environmental compliance	Assure environmental compliance	Assure environmental compliance, improve protected area management	Improve municipal governance to assure environmental compliance
Incentive-based mechanisms	PES/rewards, public services, sustainable land use alternatives	PES, sustainable land use alternatives	Sustainable land use alternatives	Sustainable forest management and cattle ranching/milk production

\* In addition to these REDD+ mechanisms, all initiatives include capacity-building activities for local actors.

1983). These rubber areas were either abandoned when the price of rubber dropped, subdivided by rubber workers, or colonized by small and large producers from other parts of the state.

#### (ii) *Local tenure and livelihood conditions*

There are four communities on state lands in the Zone of Priority Assistance that hold customary claims to individual landholdings (Table 2). They are comprised of descendants of rubber tappers or more recent colonists who arrived in the area in search of land. Most informal settlements are along the main highway, but there are also rubber tapper households distributed throughout the forests with no direct road access. Individual smallholder properties along the road tend to be smaller and more rectangular, whereas landholdings farther from the road tend to be irregular and based on the distribution of rubber trees throughout the forest in a tree tenure system that is common in tropical forests

(Fortmann & Bruce, 1988). In two of the four communities studied in Acre, people reported being unable to exclude outsiders and other community members from their forestlands. The main problem was the usurpation of forests by a timber company that did not have a permit to operate in these communities. In one of the two, people also complained that members of a neighboring community stole açai (*Euterpe precatoria*)—a locally-valuable non-timber forest product. In all four communities, tenure was perceived as insecure; local people mostly attributed this insecurity to the lack of land titles and, in the two communities that lacked the ability to enforce local rules on forestlands, to competition from the timber company and other outsiders. Community members also complained of one non-resident claimant who, in 2010, initiated several lawsuits against local people, arguing that he had inherited almost all land in the area as the descendent of the former owner of a rubber estate. Importantly, even though tenure was generally

Table 2. *Community and household-level variables measured at four REDD+ pilot sites*

	SISA, Acre	Sustainable settlements in the Amazon, Transamazon highway region, Pará	Central Xingu REDD+ Pilot Program—São Félix do Xingu, Pará	Northwest Mato Grosso Pilot REDD+ Project—Cotriguaçu
Community-level variables	(n = 4)	(n = 4)	(n = 4)	(n = 4)
<i>Basic characteristics</i>	<i>Mean (range)</i>	<i>Mean (range)</i>	<i>Mean (range)</i>	<i>Mean (range)</i>
Total land area (ha)	28,700 (4,800–60,000)	16,725 (1,900–41,000)	131,738 (5,000–500,000)	5,699 (4,500–7,296)
No. households (2010)	87 (32–120)	174 (120–220)	159 (45–226)	65 (45–100)
Year established	1999 (1996–2001)	1982 (1977–1987)	1991 (1975–2000)	1999 (1992–2006)
<i>Land tenure situation</i>				
Legal (de jure) owner/manager <sup>a</sup>	State	State/private	State	State
Actual (de jure) user	Individual	Individual	Individual	Individual
Perceived rights of exclusion	2/4	4/4	4/4	3/4
Perceived tenure security	0/4	4/4	2/4	2/4
Household-level variables	(n = 127)	(n = 137)	(n = 124)	(n = 122)
<i>Environmental compliance</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>
Land area (ha)	128 (44)	90 (70)	74 (66)	55 (30)
Forest cover (%; 2010) <sup>b</sup>	87 (14)	69 (17)	44 (25)	41 (28)
Forest cleared (ha; 2008–2010) <sup>b</sup>	2.4 (1.8)	3.6 (4.9)	3.1 (5.7)	2.8 (5.6)
<i>Income 2009–2010 (USD/capita)<sup>c</sup></i>	<i>Mean (SD); %</i>	<i>Mean (SD); %</i>	<i>Mean (SD); %</i>	<i>Mean (SD); %</i>
Total income	1874 (1292); 100%	2645 (5694); 100%	3439 (4813); 100%	3852 (4717); 100%
Forest income	304 (356); 16%	103 (246); 4%	130 (606); 4%	144 (609); 4%
Non-forest environ. income	48 (115); 3%	34 (65); 1%	45 (93); 1%	370 (1416); 9%
Crop income	510 (617); 27%	824 (1420); 31%	814 (1700); 24%	603 (1587); 16%
Livestock income	284 (613); 15%	920 (4687); 35%	1759 (3750); 51%	1142 (3270); 30%
Wage and business income	366 (771); 20%	385 (783); 15%	332 (949); 10%	809 (2092); 21%
Other income (e.g. aid)	362 (481); 19%	379 (632); 14%	360 (1011); 10%	784 (2581); 20%
<i>Assets (USD/capita)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>
Livestock herd	1294 (1790)	1991 (5113)	6370 (7953)	9352 (19720)

<sup>a</sup> De jure state ownership considered in this study includes two different categories. The first refers to colonists who maintain landholdings inside land reform settlement projects and are recognized as official settlers by the Brazilian government, but do not hold titles. The second refers to squatters, who also occupy settlement projects and other public lands, but are not officially recognized by the government. The private ownership category encompasses two of the four Transamazon communities studied where a portion of households held titles.

<sup>b</sup> Forest includes mature forests and secondary forests and fallows.

<sup>c</sup> Forest income includes all raw and processed products collected in forests, including wild plants, fruits, seeds, game (mammals, fish and insects), fuelwood and timber. Non-forest environmental income represents natural products collected from deforested areas. Crop income includes grains, fruits and vegetables cultivated in agricultural plots and home gardens. Wage income includes payments for both on- and off-farm labor. Livestock income includes all animals (chickens, pigs, sheep, cattle, fish raised in ponds) slaughtered or sold; the value of the livestock herd is listed separately from income. Business income represents earnings from on- and off-farm businesses, including transport services for forest products. “Other” income sources include government and NGO support, and remittances.

considered insecure in the Acre case, three of the four communities sampled, including one without exclusionary rights, reported higher security in comparison with 2 years prior. This increase in security was related to their hope of gaining land titles through the state’s recent land tenure clarification activities as described in more detail in the REDD+ strategy below.

In the sampled communities in Acre, there was higher reported forest cover and forest income reliance than at the other four REDD+ sites studied (Table 2). Individual landholdings were larger overall, and it was the only site where smallholders were compliant under the current Forest Code (at least 80% of landholding in forest), with an average of 87% forest cover on individual landholdings. Recent forest clearing was also lowest at this site at just over 1 ha per year. While the main income sources were crops (27%), wage labor and business (20%) and government payments (19%), the share of forest-based income was much higher in Acre (16%) than at any other Brazilian REDD+ site in the study. Notably, total annual per capita income (USD 1874) was the lowest of the four sites.

### (iii) REDD+ strategy

Under the umbrella of Acre’s SISA, the four communities in the Priority Assistance Zone have started to benefit from three intervention strategies: (1) territorial planning, which includes official demarcation of customary landholdings; (2) technical assistance and direct cash payments for adoption of more sustainable agricultural practices through the Certification of Smallholder Properties Program, which was passed into state law in 2008 (2.025/2008); and (3) technical assistance for fish farming, chicken raising and reforestation with açai seedlings. Also, while carbon rights are public under SISA, regulations are in place to promote equitable benefit sharing.

Due to the tremendous land tenure uncertainty within the Priority Assistance Zone, along with the fact that it was an initial state REDD+ focal area,<sup>9</sup> Acre’s Government began an intense process of territorial planning there in 2009. As a REDD-readiness activity, Acre’s Land Institute is registering all smallholder properties, georeferencing boundaries, and mapping land uses to prepare land management plans, which has been primarily funded by the *Terra Legal* program at a

cost of approximately USD 700,000. The idea is to eventually incorporate smallholders in several Sustainable Development Projects<sup>10</sup> and State Forests, which will be created in the region. During the process of land tenure regularization, while Acre's Land Institute has recognized the basic location of producers along the road or in the forest, customary limits of individual landholdings have not necessarily been taken into account and parcel size has yet to be defined, although it is reported that smallholder lots will likely be 100 ha. Importantly, to dissuade deforestation, there are no plans to build secondary roads for access to more remote settlements, as are typically found in settlement projects in the Brazilian Amazon. Also, aside from the pending lawsuits of a few non-resident claimants, there is no formal process to deal with conflicts during the land reform process. Additionally, the SISA law affirms that above- and below-ground carbon rights are held by the State Government, which is responsible for sharing benefits with environmental service providers, but no details are given as to how this will be operationalized.

We might expect REDD+ intervention options to be limited due to the lack of tenure clarity at this site, yet in fact a broad package of incentives is being implemented. The initial incentive-based strategy through the Certification Program provides agricultural equipment and training for producers who are voluntarily-certified in more sustainable agricultural practices, including fire reduction, along with an annual monetary bonus of USD 250, which increases to USD 300 in later program phases and is based on compliance with these practices. Certified producers are required to stop burning agricultural plots and use a legume (*Mucuna* spp.) to fix nitrogen in the soil to reduce the need for burning. Along with *Mucuna* seeds, producers receive an agricultural kit (grass cutter, machete, planter, scythe, etc.) to help them implement and maintain these alternative production activities. To support this initiative, Acre's Government plans to expand and improve technical assistance and rural extension.

(b) *Sustainable settlements in the Amazon: the challenge of transition from family production on the frontier to a low carbon economy*

(i) *Background*

The Sustainable Settlements in the Amazon project focuses on conservation of standing forests, increased agricultural production in areas already deforested, and improvement in quality of life of small farmers in the Transamazon highway region of central Pará (Figure 1; Table 1). The Transamazon region began to be colonized in the 1970s with the opening of the BR-230 highway that attracted small farmers who received government incentives to settle in the region. Many were granted land titles by INCRA and credit to jump-start small production systems. Later during the same decade, however, the state reneged on its promised investments in the settlement projects in favor of large-scale agribusiness (Davis, 1978), which made the region highly attractive to loggers and land speculators. This resulted in serious land conflicts, especially between small farmers and more powerful actors. Beginning in 1987, settlers sought support from the Catholic Church to form a social movement to demand government support, improve their agricultural practices and build more viable production systems (Santos Souza, 2006). The social movement experienced high-profile successes (e.g., World Bank Pilot Program to Conserve the Brazilian Amazon in the 1990s) and losses, including the assassination of Sister Dorothy in 2005. Settlers in this region, with support of civil

society organizations, were instrumental in helping conceive *Proambiente*, which became a federal program and expanded to 12 pilot sites in the Brazilian Amazon (Medeiros, Rodrigues, Buschinelli, & Mattos, 2007). During 2005–2006, participating households in the Transamazon received payments over a six-month period based on adoption of more sustainable agricultural practices, including community fire management. While there were notable community organization, participation, and training benefits associated with *Proambiente* (Bartels, 2009), it was cut short due to lack of a national framework for PES, limited funding and implementation capacity, and contradictory policies for small-scale agricultural production (Hall, 2008).

(ii) *Local tenure and livelihood conditions*

At the Transamazon REDD+ project site, the four sampled communities are situated in land reform settlement projects with customary claims to individual landholdings (Table 2). There is formal recognition of customary land rights for official settlers, but not for those who have settled informally. In two communities, a portion of households held titles (in one community, 41% of households were titled, while in another, only 4% were titled<sup>11</sup>), and these were classified as privately-owned in our typology. All four communities considered land tenure to be secure and reported that there had been no change in this security within the past 2 years. Even in the two communities where land was shared between official settlers and people without recognized land rights, conflicts were minimal due to local clarity of property boundaries; disputes were limited to minor altercations between neighbors over hunting access. In addition to the low incidence of conflicts, land tenure security was related to the long-term occupation of individual lots, which people felt should guarantee their rights. In all communities, there were reported incidents of settlers buying and selling lots in settlement projects, which is illegal but tolerated. While some lots were sold to newcomers, in other cases, certain individuals were concentrating land to expand cattle ranching operations.

There were higher levels of forest clearing in the Transamazon site than in Acre, and local livelihoods were primarily focused on agriculture (Table 2). Households sampled were not environmentally compliant, having an average of 69% of forest cover on their landholdings, and recent annual deforestation was the highest of all sites. The main sources of income were livestock (35%) and crops (31%), followed by wage labor and business (15%) and government aid (14%). The share of forest-based income was only 4%. Total annual per capita income (USD 2,645) was the third highest of the four sites studied.

(iii) *REDD+ strategy*

The Sustainable Settlements in the Amazon REDD+ strategy in the Transamazon includes two levels of action: (1) investments in sustainable livelihood strategies in three settlement projects; and (2) PES and sustainable land use incentives for the 350 colonist settlers who were part of *Proambiente* (Table 1). As a REDD-readiness activity, the proponent plans to first improve the system of property registration in partnership with INCRA, given the fact that many smallholders have no official documentation of land rights (IPAM & FVPP, 2009). They will work with these farmers to georeference their properties directly on digital images of the area. The costs of this initiative will be covered by the Amazon Fund, but the total value is still unknown, since the specific methods are being defined. The ultimate formalization of the process will depend on INCRA providing the farmers with legal documentation of land rights (including, but not limited to, permanent land



titles), a notoriously slow process. For the 350 Transamazon households that were part of *Proambiente*, this REDD+ project is considered a way to build upon its positive aspects. Incentives include direct payments for families commensurate with the opportunity costs of avoided deforestation, which have been estimated at USD 218 annually<sup>12</sup> (IPAM & FVPP, 2009). The REDD+ project also includes incentives to improve agricultural practices and intensify production, strengthen local organizations, monitor deforestation and degradation, and improve infrastructure.

### (c) Central Xingu REDD+ Pilot Program

#### (i) Background

The Central Xingu REDD+ Pilot Program targets all actors in one, extremely large municipality in southern Pará: São Félix do Xingu (Figure 1; Table 1). São Félix has one of the highest deforestation rates in the Brazilian Amazon, and is currently on the Brazilian Ministry of Environment's blacklist, i.e., subject to a series of cross-compliance measures to enforce the adoption of minimum conservation standards. This municipality is characterized by a history of land and resource conflicts, as well as boom and bust cycles for a variety of extractive products. With the fall of rubber prices after WWII, former rubber tappers in the region first turned to collection of Brazil nuts and then to the profitable trade of wild animal skins and mahogany extraction. In the 1970s, mining became increasingly important in the region. At the same time, São Félix was included in the federal *PoloAmazonia* program to break the municipality's isolation, and construction of the PA-279 Highway began. Thousands of migrants arrived in the region by foot or by boat to stake their land claims before the road was complete. In the 1980s, confusion over land rights between migrants, indigenous people, large landholders, and businesses—magnified by unclear and often-conflicting land allocations by state and federal agencies—led to major conflicts as people struggled for land in São Félix (Schmink & Wood, 1992). Many of these people were settled in INCRA settlement projects, while others staked claims on other public or private lands.

#### (ii) Local tenure and livelihood conditions

While all four of the communities sampled in São Félix do Xingu are situated on state-owned lands with customary claims to individual landholdings, there are differences between these communities in terms of formal recognition of customary rights (Table 2). Two communities are located in official land reform settlement projects (one of which is located in the buffer zone of a national forest), and resident households hold formal land rights. The other two communities are informal settlements on public lands where formal recognition of rights is lacking: one is located within the *APA Triunfo do Xingu*, (a 1.6 million ha protected area<sup>13</sup> that was created in 2006 as a buffer zone in the network of protected areas in the region) and the second is on non-designated public lands. Land tenure was considered secure by the two communities within official settlement projects and insecure by the two that were informally settled on public lands. In the community within the *APA Triunfo do Xingu*, insecurity was attributed to the lack of land titles and ongoing conflicts with a neighboring cattle rancher who had consolidated land in the region since 1996. According to community residents, this particular rancher used a variety of methods to coerce residents into giving up their lands, mostly by allowing livestock to enter agricultural areas to destroy crops, burning crops, and spreading pesticides by airplane. In addition to this particular case, the

general tenure insecurity in *Triunfo do Xingu* was also attributed to the presence of the largest cattle ranch<sup>14</sup> in the region, which unofficially acquired 150,000 ha in the protected area in 2007, and has since occupied even more land. Residents of the other informal settlement on non-designated public land attributed their tenure insecurity to a lack of land titles, even though most households in this community had registered CARs.

In the communities sampled in São Félix do Xingu, the land use and livelihood dynamics reflect a high reliance on livestock (Table 2). Smallholders were not at all environmentally compliant with only 44% of forest cover on their landholdings. The value of livestock assets was much higher than in Acre and the Transamazon, and the share of livestock income was the highest of the four sites (51%). The livestock income share was followed by crop income (24%), income from wage labor and business (10%) and government payments (10%). Forest income reliance was relatively low at this site (4%), and total annual per capita income (USD 3439) was the second highest of the four sites studied.

#### (iii) REDD+ strategy

The Central Xingu REDD+ Pilot Program includes land use zoning, improved enforcement and compliance with environmental legislation, sustainable finance and management for indigenous and protected areas, sustainable production alternatives for all stakeholders, restoration of degraded lands, and enhanced participation of vulnerable groups in REDD+ decision-making (Table 1). A first focus of the pilot program is financial and technical support for CAR implementation with small, medium, and large landowners to remove the municipality from the federal blacklist. Based on the lack of state resources and institutional capacity for CAR implementation, TNC is supporting this process through a portion of a US\$19 million grant from the Amazon Fund, which has been distributed among 12 Amazonian municipalities, along with financial resources from USAID and the Vale Fund. TNC is promoting CAR implementation throughout São Félix do Xingu through a project called "Being Legal is Being Green," which promotes environmentally-legal cattle ranching and ensures political partnerships among key partners. It also seeks restoration of Areas of Permanent Preservation, along with maintenance of 80% forest cover on private lands, and includes training for government agents and farmers. Its main accomplishments to date have been the creation of a 1:25,000 digital cartographic base for a region of approximately 8 million ha to be used as a basis for CAR implementation and completion of CARs in most of the area that required regularization. As of July 2012, 85% of rural properties in São Félix had registered CARs, and in 2011, deforestation was reduced by 85% of the 2005–2008 average; the only factor that prevents the municipality from being removed from the federal blacklist is extremely high deforestation within the *APA Triunfo do Xingu* (OESP, 2012). In addition to the regulatory components, the Central Xingu REDD+ Program includes technical assistance and promotion of alternative livelihoods as incentive-based strategies, but proponents are still deciding whether or not to include PES.

### (d) Northwest Mato Grosso REDD+ Pilot Project

#### (i) Background

The Northwest Mato Grosso REDD+ Pilot Project targets all actors in the municipality of Cotriguaçu (Figure 1). Cotriguaçu has also been blacklisted by the Brazilian Ministry of Environment and was chosen by proponents for a REDD+

pilot due to its relatively high deforestation rates and diversity of land uses. This area, traditionally occupied by the Rikbaktsa indigenous group, was first colonized by outsiders in the mid-1980s. A private company from southern Brazil acquired one million ha of land in northwest Mato Grosso, some of which was used to create INCRA settlement projects to accommodate small farmers from the south who had been removed from their lands due to the construction of the Itaipu Dam. In the mid-1990s, there was a second wave of colonization, when INCRA encouraged settlement of landless people from the southern part of Mato Grosso and other neighboring states. The municipality had to absorb more people than expected, and INCRA did not provide the necessary conditions, such as electricity, health, and education access, to keep producers on these lands, which contributed to the abandonment and re-colonization of these areas by new settlers. Today, there are approximately 2100 rural settler families distributed within three settlement projects, which comprise an area of 141,000 ha (15% of municipal area; ICV, 2011).

#### (ii) *Local tenure and livelihood conditions*

All four communities sampled in Cotriguaçu are situated within these settlement projects with customary claims to individual landholdings; in only one of the four are customary use rights of forestland communal (Table 2). In this community, households individually manage half of their assigned landholding for agriculture. The other half is delegated to a common forest area, which contributes to their Legal Reserve requirement and can only be used minimally. While most communities in Cotriguaçu reported being able to exclude unwanted users, residents in the community with communally-held forestlands were unable to prevent invasions in this area. The invasions were, reportedly, motivated by local politicians who promised land to outsiders without land, and have resulted in deforestation and forest degradation of the community's Legal Reserve, a situation which has not yet been resolved by INCRA or the environmental authorities. Members of this community reported feeling less secure about their tenure situation than 2 years prior, due to the high incidence of invasions. Some members of this community felt additionally insecure, because they lacked land titles and local land was being bought up and concentrated in the hands of a few larger landholders. In a second Cotriguaçu community where tenure was considered insecure, the main reason given was a lack of titles, since people in this community were able to exclude outsiders from their individual parcels. Due to insecurity about the future of land rights in these communities, respondents reported that the local tendency was to exploit forested areas as much as possible through logging and conversion to pasture.

In the sampled communities in Cotriguaçu, we found the lowest reported forest cover and the highest value of livestock assets of all studied REDD+ sites (Table 2). Individual landholdings were the smallest in size and were only 41% forested, although recent reported forest clearing was lower than that at the Transamazon and Central Xingu sites. Households in Cotriguaçu were wealthier than those at the other sites and earned the largest portion of their income from livestock (30%)—mostly cattle. Other important income sources were wage labor and business (21%), government and NGO support (20%) and crops (16%). The forest income share was low (4%), which was similar to that of the Transamazon and Central Xingu sites.

#### (iii) *REDD+ strategy*

The first stage of the Northwest Mato Grosso REDD+ Pilot Project is known as the “Cotriguaçu Forever Green Project,”

which intends to promote a new trajectory of social and economic development in the municipality based on the conservation and sustainable management of natural resources (ICV, 2011; Table 1). One initial project activity is CAR implementation, supported by TNC's Amazon Fund project, which has also financed the environmental licensing activities in São Félix do Xingu. The CAR process is also being used in Cotriguaçu as a mechanism to remove the municipality from the federal blacklist, and proponents have targeted residents of land reform settlement projects for initial implementation. In collaboration with INCRA, proponents will systematically map individual property boundaries and assess the environmental situation on each; they expect to register 90% of the individual properties in the settlement areas. The proponents have acknowledged that land conflicts within the settlement projects are a significant obstacle to land tenure regularization, which is why they have entered into partnership with INCRA and plan to create community agreements to ensure local commitment for CAR implementation (ICV, 2011). Regulatory mechanisms include strengthening of municipal environmental governance for environmental compliance of the municipality's rural settlements and one indigenous area. Inclusion in the CAR system will be a pre-requisite for producers to access incentives of the REDD+ project, including promotion of sustainable forest management and support for best practices for cattle and milk production. PES, while not included in the first stage of the project, may be included later on.

## 5. DISCUSSION

The four REDD+ initiatives analyzed in this paper are acting in very different contexts in terms of local land tenure security and rural livelihoods. Despite advances in national land tenure reform, there are at least some communities at most sites in our sample where land tenure is considered insecure and local residents are not able to exclude unwanted outsiders. In some of the study areas, there has been substantial deforestation, while other areas are largely conserved.<sup>15</sup> The highest reported forest cover is in Acre, where producers are more reliant on forest income, and the lowest in Central Xingu and Mato Grosso, where livestock is the main focus of local livelihoods. Despite these differences, legal clarification of land tenure, in concert with *Terra Legal* and in collaboration with government agencies, is an important REDD-readiness activity at all four sites to pave the way for a similar combination of regulatory enforcement and incentive-based REDD+ mechanisms, which are being adapted to local conditions. Even at the Acre site, where the tenure situation is most insecure, proponents are applying incentives, such as PES, that require secure exclusionary rights and make tenure reform efforts at that site all the more urgent.

#### (a) *Benefits and challenges of land tenure regularization as a REDD-readiness activity*

While investments in land tenure regularization are expensive, proponents consider them essential to the effectiveness of their initiatives, since they create a clear link with environmental compliance and will support implementation of a broad suite of REDD+ mechanisms. In addition to helping promote REDD+ effectiveness, the prioritization of tenure clarification by proponents also represents a way to potentially increase the equitability of REDD+. In particular, these early investments partly address the common concern that people

with legitimate rights<sup>16</sup> to lands with unclear tenure will be excluded from REDD+. In our study sites, REDD+ is motivating land tenure reform as opposed to simply excluding those without clear land tenure from direct and conditional compensation schemes (for another example of a PES scheme that promoted conditional land tenure, see *Leimona, Laxman, and van Noordwijk (2009)* on the RUPES-Sumberjaya project in Indonesia). The legal documentation of land rights at REDD+ sites was viewed positively by local people who participated in our research, highlighting how this readiness activity also serves as an important entry point for local people to engage with REDD+. For instance, in Acre, the perception of increased land tenure security in most communities was attributed to the property mapping activities of Acre's Land Institute, and specifically to the possibility of gaining land titles. At the Central Xingu and Mato Grosso sites, the CAR process will allow environmentally non-compliant households to once again access credit for productive activities.

Despite the promise of land tenure regularization at REDD+ sites, this process is not without its challenges. First, while proponents can perform much of the preliminary work in helping producers map their landholdings, the success of legalizing these properties will ultimately depend on INCRA's commitment to the process. For instance, while proponents of the Transamazon project recognize the political importance of including INCRA in the process, it is still unclear how its practical contribution will unfold. Second, the formal recognition of customary rights is complex, and land titling can easily result in customary rights being overturned (*Peters, 2007*). Titling that does not accommodate traditional land uses is also likely to lead to conflicts among neighbors, as has happened in similar situations when resource use follows irregular patterns based on tree tenure (*Cronkleton, Barry, Pulhin, & Saigal, 2010; Duchelle, Cronkleton, Kainer, Guanacoma, & Gezan, 2011*). Such difficulties are best illustrated by the Acre case where the studied area has essentially been devoid of state presence until very recently, and the needed land tenure regularization investments are huge and happening quickly. A lack of full attention to customary rights in a rapid land regularization process could be especially problematic for forest extractivists who live farther away from the road and manage larger, irregular landholdings based on the distribution of rubber trees. Through the creation of smaller, more uniform parcels, these producers could lose access to a good part of their traditional resource base. The proponent plan to create State Forests in these more remote areas would allow individuals to hold larger land areas, which could allow for customary use of resources, but would require investments to ensure local rights to those areas over time. Third, while progress has been made on forest land tenure, clarification of forest carbon rights remains as a future challenge in all of our study sites, except for Acre, largely because proponents are waiting for national regulation on this issue.

It is also important to recognize that there may be some trade-offs between the conservation and well-being outcomes associated with REDD-readiness tenure reforms. For instance, promises of access to land rights, and associated REDD+ benefits, may attract new waves of migration to intervention areas, which could compromise forest conservation. Measures to halt illegal land grabbing will then become as important as securing rights for those who already hold the land. That said, deforestation in settlement projects is directly related to smallholder land use strategies, with higher deforestation in areas where cattle ranching, as opposed to cultivation of annual and perennial crops, is the primary land use strategy (*Pacheco, 2009*). In this context, secure tenure

alone will not assure conservation by smallholders (*Gould, 2006; Vadjunec, Gomes, & Ludewigs, 2009*), and in fact, deforestation may initially increase when land rights are secured. For instance, a previous study in the Transamazon argued that land titles will not impact forest clearing in the short-run, but showed some evidence for credit (with title as collateral) as positively predicting deforestation (*Caldas et al., 2007*). Indeed, the agricultural credit that will be liberated once CARs and titles are in place could actually motivate more forest clearing. Given the importance of cattle at several of the REDD+ sites (*Table 2*), proponent plans for regulatory enforcement and promoting sustainable land use alternatives and technology transfer will be as fundamental as securing land rights for smallholders in these areas.

(b) *Regulatory mechanisms based on compliance with the Brazilian Forest Code*

Increasing compliance with the Brazilian Forest Code is the primary means to achieving REDD+ in all four sites, and proponents realize that tenure clarification is an essential first step in promoting, and later enforcing, environmental compliance. This situation may be more urgent at the Mato Grosso, Central Xingu, and Transamazon sites, where households are non-compliant under the current Forest Code, and could therefore face potentially high economic losses from more rigid enforcement of the Code unless proponents also help them maintain forest remnants and reforest degraded lands. Questions have been raised about the legitimacy of using REDD+ funds to promote environmental compliance, which should be enforced by law, and does not represent *de jure* additionality in terms of emissions reductions. Yet, research has demonstrated that paying for *de facto* additionality may be a cost-effective strategy in certain contexts (*Armas et al., 2009; Börner et al., 2011*). Indeed, in Costa Rica and Mexico, PES has been used to subsidize compliance with national environmental laws (*Muñoz-Piña, Guevara, Torres, & Braña, 2008; Pagiola, 2008*). Importantly, the REDD+ initiatives studied here demonstrate the synergies between government agencies and NGOs that are necessary for effective use of regulatory measures for REDD+. While only government agencies have mandates for tenure regularization and law enforcement, they sometimes lack institutional capacity to implement these actions effectively. NGOs may be more efficient, but lack the mandate to provide basic REDD-readiness conditions such as official legal documents for land and law enforcement. Partnerships between the two allow for maximization of organizational strengths. The success of such partnerships in our study was illustrated by the successful CAR implementation process in São Félix do Xingu, which was due to a collaborative effort between TNC, INCRA, Pará's Land Institute and Environmental Secretariat, the municipal environmental agency, and local farmers.

(c) *Incentive-based strategies focused more on sustainable livelihood alternatives and less on PES*

In terms of incentive-based mechanisms, all four initiatives are promoting sustainable land use alternatives, e.g., through technical assistance, while only two currently include PES-type incentives. Given the relative importance of income from crops and/or livestock at all sites, promoting more intensive production techniques represents a key intervention strategy. Some of the sustainable land use alternatives that are being promoted, such as cultivation of agroforestry systems (Transamazon, Central Xingu, Mato Grosso) and intensification of cattle production (Mato Grosso, Central Xingu), require

high up-front investments and are thus likely to be adopted only by land users under secure tenure conditions. To avoid the negative spill-over effects often associated with the adoption of improved agricultural technologies (Angelsen & Kaimowitz, 2001) or magnet effects, which could result in more people exerting pressure on forests, incentive-based measures must generally be well aligned with parallel tenure regularization and regulatory enforcement measures. Moreover, promoting sustainable livelihoods comes with the challenge of offering sufficiently large portfolios of technological alternatives, where smallholders specialize into diverse livelihood strategies within the same intervention. For instance, at the Transamazon site, there are three groups of households based on distinct specialization strategies: households who derive the majority of their income from livestock; households specialized on the cultivation of perennial and annual crops; and households that diversify their income portfolio through inclusion of off-farm sources and strong reliance on government aid (Cromberg, 2012).

While PES is currently included in the Acre and Transamazon initiatives as an incentive-based mechanism, such direct conditional payments may be included later on in Central Xingu and Mato Grosso, and thus warrant some discussion. In terms of clear tenure rights, the three communities in Acre and Mato Grosso that are not able to exclude unwanted outsiders from their land are not in the position to guarantee service provision under PES contracts, or any other performance-based incentives. Direct payments to the communities in Central Xingu, Mato Grosso, and Acre that do have exclusion rights would require further efforts to secure those land rights *vis-à-vis* invasive pressure from more powerful actors. Additionally, it has been argued that the value of payments will need to adequately compensate landholders for the opportunity costs associated with foregoing deforestation (Fisher *et al.*, 2011). One reason given by a proponent organization for the Mato Grosso site for not including PES in the REDD+ pilot program was that the opportunity costs of foregone deforestation in the municipality of Cotriguaçu would be too high to compensate. It is yet to be seen whether the bonus payments in Acre and the Transamazon, along with technical assistance and material inputs, will be sufficient to encourage producers to sustain modifications in their traditional swidden agriculture practices. In Acre, there were already complaints among local farmers about initial production losses in transitioning to agriculture without the use of fire, due to delays in distributing planting materials and lack of technical training at the onset of the program. In this case, proponent investments in training and technical assistance will be necessary to ensure a smooth transition to this new production system. Furthermore, for payment schemes to be effective, they must be designed with local livelihood dynamics in mind to account for the diversity of smallholder production strategies.

## 6. CONCLUSIONS

The idea of REDD+ quickly gained traction in the international dialogs about both climate change mitigation and

tropical forest conservation because of its potential to generate enough funding to compensate landholders for reducing emissions from deforestation and forest degradation over the long term. Despite postponement in the anticipated global finance mechanism, there have been important advances in REDD+ that could allow it to be one component of a broader “low-emission” rural development model (Nepstad *et al.*, 2012). Our study highlights how pilot REDD+ initiatives in Brazil operating in different contexts are being designed and implemented as a package of similar activities with land tenure regularization—in direct collaboration with government agencies and national initiatives—at their heart. While clear and secure land rights are fundamental to the application of both regulatory enforcement and incentive-based mechanisms, they are not simply a prerequisite of REDD+ but also a potential outcome. At several of our study sites, the Amazon Fund provided proponents with the needed financial resources for CAR implementation, which can lead to titling under *Terra Legal*. Land tenure regularization serves as an attractive entry point for local people into REDD+ initiatives, since land titles can provide a concrete benefit to producers living and working in contexts of insecurity. REDD-readiness funds, and the new partnerships that have been built in preparation for REDD+, could indeed be used to fill in gaps where government-led land reform efforts have not yet come to fruition, as seen in the Brazilian REDD+ pilot initiatives studied here, and subsequently have positive conservation and development implications.

In sites where local landholders are the main targets of REDD+ initiatives,<sup>17</sup> clear and secure tenure rights are necessary for—but cannot guarantee—the effectiveness and equitability of REDD+. While Brazil’s attention to forest tenure reform predates REDD+, local REDD+ initiatives have clearly been bolstered by recent national efforts to link land tenure reform and environmental compliance. The active partnerships that have been developed between NGO proponents and governmental organizations are essential synergies for making such reforms happen at REDD+ sites. That said, given the diversity of land tenure contexts across sites, the success of land tenure regularization efforts will depend on the legitimacy of conflict resolution processes, the negotiation of boundaries, and the resulting legal land rights documentation, such that neighbors and outsiders will respect property borders and owners will be able to enforce exclusion rights. It also will require law enforcement, such that titled areas are defended by the state in cases where local rights are not respected, as in the case of the rancher in the *APA Triunfo do Xingu* and of the timber company in Acre. While it seems impossible that even a fully inclusive REDD+ approach would resolve historically conflictive land tenure conditions to the full satisfaction of all stakeholders, great efforts must be made to reconcile the needs of REDD+ with the protection of local rights and livelihoods (Sunderlin *et al.*, 2013). Unfolding in Brazil is a model of polycentric governance, which links forest tenure reform, environmental law enforcement and incentives, and holds great promise for effective and equitable REDD+ implementation.

## NOTES

1. The Brazilian Forest Code was created in 1965 (Federal Law No. 4.771). In 1996, the minimum forest cover requirement (known as the Legal Reserve) area in Amazonian forests was increased from 50% to 80%

(Provisionary Measure 1.511) and created the requirement of conservation of forests in environmentally-sensitive areas, such as along streams and on hillsides (known as Areas of Permanent Preservation).

2. The Brazilian Legal Amazon includes the entire states of Acre, Amapá, Amazonas, Mato Grosso, Pará, Roraima, and Rondônia, as well as parts of Tocantins (north of the 130 parallel) and Maranhão (west of the 440 meridian). The region was delimited by government decree to facilitate the administration of economic development and was not based on uniform ecosystem characteristics (cf. Pacheco, 2009).
3. In December 2011, a proposal to change the Forest Code was passed by the Brazilian Senate. While the proposal called for large-scale reforestation of degraded lands, it also included a reduction in reforestation requirements for Areas of Permanent Preservation, and exemption from the 80% minimum forest cover requirement for Amazonian producers with landholdings less than 400 ha. In April 2012, a further modified Code proposal, including amnesty for all those who illegally deforested prior to July 2008, was passed by Congress. In May 2012, President Rousseff partially vetoed the most outwardly environmentally destructive items in the proposal, but further modifications were made by Congress. The President failed to veto all modifications in October 2012 despite demands by environmental civil society groups.
4. Although required by law, these services are often absent in INCRA settlements, including several of those in our sample.
5. To be removed from the federal blacklist, deforestation reduction requirements include: (i) an average annual deforestation in 2010–2011 that is 60% of the annual average in 2007–2009, and (ii) an overall annual deforestation that is equal to or less than 40 km<sup>2</sup>.
6. The Norwegian government committed US\$ 107 million to the Amazon Fund in 2009, and US\$ 134 annually in 2010 and 2011. The German government committed US\$ 27.4 million to the Fund through 2010 (Amazon Fund, 2011).
7. <http://www.forestclimatechange.org/The-Global-Comparative-Study-of-REDD+.html>.
8. We obtained comparable information for up to 15 communities located outside the intervention areas. These characteristics were then used in a statistical matching routine to identify the most comparable set of intervention and comparison communities. This method was developed to support the long-term impact evaluation plan, but also ensures that our selection of communities is not affected by any researcher biases, since it was driven by a pre-matching routine (Jagger, Sills, Lawlor, & Sunderlin, 2010).
9. The initial SISA design included eight priority areas that were identified through Acre's Ecological and Economic Zoning Plan, including the Zone of Priority Assistance along the BR-364 Highway. The concept of priority areas was subsequently diminished to allow for a more flexible REDD+ strategy across the entire state.
10. Sustainable Development Projects are adaptations of traditional land reform settlement projects and are often created in less deforested areas where forest reserve areas remain under communal use.
11. The difference in proportion of families with titles between these two communities can be attributed to the different settlement processes that occurred in the Transamazon region. In the community with 41% of lands titled, a large number of small plots (100 ha each) were granted to small farmers in the 1970s. In the community with only 4% of land titled, the land was held under a large farm that began to be occupied by small farmers in 1982 when it was abandoned due to non-productivity and debts with the government. The official settlement process by INCRA began there only in 2009.
12. The proposed payment value corresponds to the opportunity costs of one hectare of cleared forest comprised of 85% livestock and 15%, based on gross income of cattle production and swidden agriculture (USD 91/ha/year). The total value of USD 218 in the first year is based on the estimate that households deforest 2.39 ha/year with the idea that the value will increase based on conditional avoided deforestation over time.
13. The APA category in the national Brazilian protected area system is the least rigorous and restrictive type of protected area. While effective management of APAs is still incipient in Brazil, this status allows for the formulation of management plans and zoning of more restrictive areas. This protected area categorization is similar to that of the US Adirondack Park.
14. This ranch is administered by one of the largest investment fund managers in Brazil that is responsible for high levels of deforestation throughout the Amazon (Imazon, 2010).
15. According to Soares-Filho *et al.* (2006), who simulated deforestation in the Brazilian Amazon until 2050, all four proponents can claim substantial additionality as a result of targeting areas under future deforestation pressure.
16. Importantly, the determination of which rights are “legitimate” raises a number of additional questions that are beyond the scope of this paper.
17. It is possible, though not yet clear, that advance clarification of tenure rights will be a less urgent issue on some public forestlands in Brazil where human population density is far lower and where the goal of REDD+ is to maintain, enlarge, or create protected areas. Nevertheless, where traditional rights are contested in the creation of such protected areas, resolution of tenure conflict and ambiguity will be an important priority.

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