

Governing for sustainability in agricultural-forest frontiers: A case study of the Brazilian Amazon

Introduction

The expansion of agriculture is estimated to be the direct cause of more than three quarters of the clearance of old-growth forests worldwide (Kissinger et al. 2012). The fate of tropical forest biodiversity and ecosystem services provided by these forests is at a critical juncture, due to the combination of deforestation, widespread forest degradation from timber and wood extraction, the loss of fauna that maintain critical ecological connections, the spread of fire, landscape fragmentation, invasion of exotic species and pathogen spread, increasing atmospheric carbon dioxide (CO₂) concentrations and climate change (Malhi et al. 2014).

The expansion of agriculture into tropical ecosystems has made a large contribution to economic development in many tropical nations, yet these same regions are also home to many of the world's most impoverished and vulnerable farmers, who depend largely on subsistence agriculture for their livelihoods.

Setting more sustainable development trajectories for tropical forest regions thus requires an ability to simultaneously work to alleviate poverty, meet rising demand for agricultural commodities and natural resources, and protect and restore natural ecosystems and the critical services they provide.

The urgency of this challenge is magnified in tropical agricultural-forest frontiers where rates of deforestation, forest degradation, and poverty remain high. Achieving a more sustainable and just governance of such regions is made particularly challenging by the fact that they are often occupied by a diverse mix of actors, including recent arrivals, who may have starkly different cultural backgrounds and highly unequal economic situations: from smallholder subsistence farmers, to large-scale cattle ranchers and technology-intensive commercial farms.

In the context of uncertain land tenure and a weak government presence, differences in the make-up of actors and the way in which they interact and compete for land and available resources can have profound consequences for the development trajectory and environmental stewardship of frontier regions.

This discussion brief examines the diversity, interactions, and dependencies of actors commonly found in tropical agricultural-forest frontiers and the implications of this complexity for sustainability governance in the coming decades. We examine the defining characteristics of agricultural-forest frontiers, and use a case study of the Brazilian Amazon to explore challenges for the sustainability governance of frontier regions. This analysis provides the basis for policy recommendations highlighted at the start of this brief on the need to foster a more actor-tailored approach to achieving sustainable and socially just land use policies in agricultural-forest frontiers.

A focus on the Brazilian Amazon

While many of these issues and challenges are generic to agricultural-forest frontiers throughout the tropics we use the Brazilian Amazon as a case-study for discussing four interrelated

Why focus on frontier regions in tropical forest nations?

- Landscapes across the developing world are experiencing rapid changes due to agricultural and infrastructure expansion and rapidly shifting patterns of human occupation and the use of land, many of which are unprecedented in their scale and intensity. There are few places where such changes are more evident today than in some of the last major frontiers of agricultural expansion in tropical forest regions around the world.
- Agricultural-forest frontiers – areas that still retain large areas of forest yet continue to be rapidly deforested through agricultural expansion – often have a very diverse mix of actors. In the Brazilian Amazon, for example, they range from export-driven commercial agriculturalists, to some of the poorest subsistence farmers in the country. This diversity, coupled with the rapid pace of land use change, presents both risks and opportunities to improve the sustainability of development in the region.
- To be effective and fair, policies that aim to ensure sustainability in agricultural-forest frontiers need to account explicitly and comprehensively for the typically diverse and interconnected nature of frontier societies.
- A failure to foster synergies and cooperation between the diverse set of actors in rapidly changing frontier landscapes may result in missed opportunities to foster more equitable systems of land and resource use.

Policy implications for frontier governance

- Policies should be tailored to the needs, responsibilities and capacities of different actors, moving away from a “one-size fits all” model.
- A policy targeted towards a given group of actors can include provisions to minimize possible unintended and negative consequences for other actors.
- Policies can take advantage of actor diversity and interdependencies by creating incentives for cooperation and benefit sharing.
- An initial focus on shared benefits or concerns, such as water security, credit access, or education can be a vital step in establishing the common ground necessary for tackling problems of environmental degradation among a broad set of actors.
- Multi-sector partnerships for improved social and environmental governance in agricultural-forest frontiers should be fostered, while recognising the complementary capabilities and roles associated with state, civil society, and private actors in engaging with sustainability challenges.

issues that embody both challenges and opportunities created by the development frontier regions.

First, the Brazilian Amazon represents the largest remaining expanse of tropical forest, comprising roughly 40% of all remaining humid tropical forests in the world. The fate of this forest is of



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Smallholder farmer in Arapiuns, Santarém, Pará.

global significance: the Amazon basin discharges about one-fifth of the world's freshwater, hosts a large proportion of the world's terrestrial and freshwater biodiversity, and represents the largest above-ground carbon stock on the planet, equivalent to one decade of human-induced carbon emissions (Gardner 2013).

Second, Brazil is one of the world's leading producers of agricultural commodities; it is the largest producer of soy and hosts the world's largest cattle herd (FAO 2014). Agriculture continues to be one of the strongest sectors of the Brazilian economy, and international and domestic demand for food and animal feed continues to rise, so this prominence, and the importance of the Amazon region to the Brazilian agricultural sector, is likely to only increase.

Third, the Brazilian Amazon is home to more than 20 million people. The vast majority of those who live in rural areas are poor smallholder farmers, many of whom live alongside much wealthier landowners who have access to modern agricultural technology and are connected to international markets. In most Amazonian municipalities, poverty, illiteracy, and infant mortality rates are well above the national average (IBGE 2010).

Finally, set against the environmental and economic importance of the Amazon region, and the development challenges it still faces, Brazil stands out among virtually all other tropical nations for the extent to which the federal government, national and international civil society, and private-sector groups have sought to improve environmental and social governance. By 2012, deforestation in the Amazon had declined by more than 80% since a peak in 2004, when an area larger than Belgium was cleared in

a single year, even as the value of agricultural production in the region increased by more than 20% (Barreto and Silva 2013).¹

In addition, during the last three decades, federal social security and benefit transfer programmes have had widespread success in reducing extreme poverty (Ferreira et al. 2010). The combination of these factors means that while the fate of agricultural-forest frontier regions in the Brazilian Amazon is of critical importance in its own right, these regions also provide an instructive case study of the potential for adopting more sustainable development pathways elsewhere.

The changing make-up of tropical agricultural-forest frontiers

For our analysis, we define agricultural-forest frontiers as relatively remote areas where large expanses of forest remain, but rates of forest clearance and social and economic fluidity are relatively high. Agricultural-forest frontiers also often have less-developed financial services, law enforcement, supply chains and civil society institutions (Becker 2001; Pacheco 2012). While the concept of an agricultural frontier is not clear-cut, it provides a useful geographic lens for differentiating how policy goals and outcomes may be different vis-à-vis regions that no longer have such high levels of natural capital, land cover change, or socio-economic fluidity.

¹ Deforestation in the Brazilian Amazon has more or less stabilized since 2010, with official government figures showing a relative increase of 28% between 2012 and 2013 followed by a decrease of 18% between 2013 and 2014 (www.inpe.br).

Table 1: Agricultural-forest frontiers in the Brazilian Amazon.

Frontier stage	Definition	Area (km ²)	% Amazon biome	Number of municipalities
High forest conservation	>50% forest cover <1% annual deforestation	1.4 million	33	141
Early frontier	>50% forest cover >1% annual deforestation	2.1 million	50	112
Late frontier	<50% forest cover >1% annual deforestation	0.14 million	4	60
Post frontier	<50% forest cover <1% annual deforestation	0.56 million	13	256

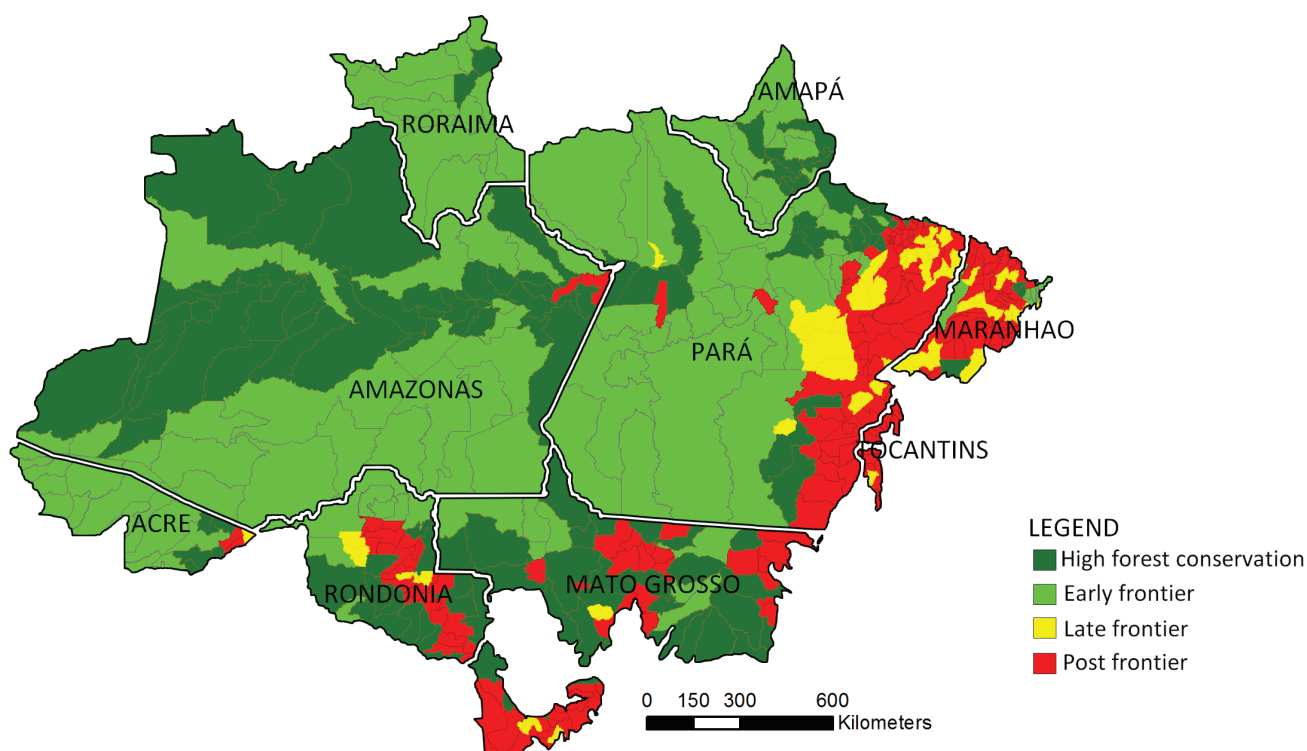


Figure 1: Distribution of early, late and post frontier as well as high forest conservation regions in the Brazilian Amazon. See text and Table 1 for definitions. Protected areas and Indigenous Lands are not shown for simplicity.

We apply a simple definition of “early” and “late” agricultural-forest frontiers in the Brazilian Amazon based on a combination of deforestation extent and intensity to examine how actor and land use diversity differ in frontier vs. post-frontier areas (Rodrigues et al. 2009; Pacheco 2012). Those municipalities that have more than 50% primary forest cover and more than 1% average annual deforestation² in the last five years are classified as early frontier regions, while late frontier regions are municipalities with a high deforestation rate (> 1%) but less than 50% forest remaining. Taken in combination, these two agricultural-forest frontier zones make up a classical “arc of deforestation” along the southeastern fringes of the Amazon, and encompass many large-scale road-building and infrastructure projects (see Figure 1 and Table 1).

² A threshold of 50% was used to identify those municipalities that simply have more or less than half of their forest cover remaining, while a threshold deforestation rate of 1% is approximately equivalent to the average deforestation rate of different actors across private land in the Brazilian Legal Amazon in 2011 (Godar et al. 2014)

By contrast, areas that have less than 50% forest cover and a rate of deforestation under 1% could be classified as being “post-frontier” regions. They correspond to the arc of deforestation in the 1990s and early 2000s (see Figure 1 and Table 1). The remaining areas have high forest cover and low rates of deforestation and are either in the very remote northwest of the Amazon or in areas that have large protected areas or indigenous reserves.

This simple depiction of frontier regions masks substantial spatial and temporal variability in the distribution of deforestation activity, with much lower rates of deforestation in protected areas and indigenous lands than on private land, while the post-frontier regions include some of oldest agricultural-frontiers in the tropics. Yet placing these limitations aside it is possible to see that even with a crude classification based on municipalities, frontier regions are, on average, occupied by a more diverse array of actors than post-frontier regions (Figure 2), and that these actors are likely to be pursuing a larger variety of land use activities. They are also characterized by having consistently more challenging

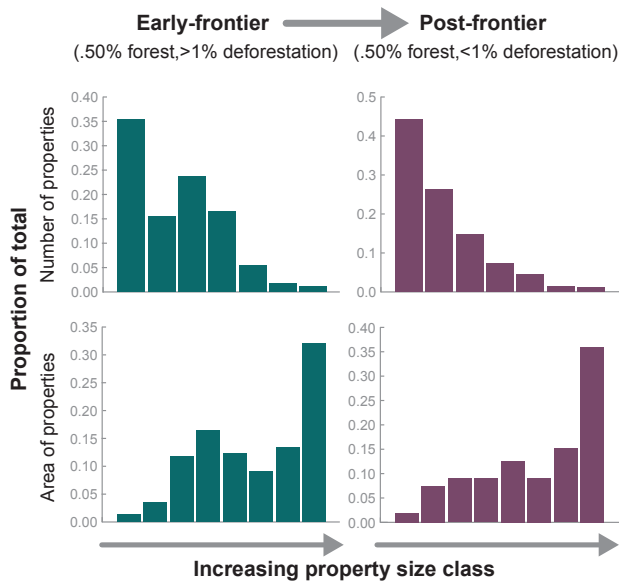


Figure 2: A shift towards a more uneven distribution of the proportion of total number of properties and farm area among different property-size classes in moving from early to post frontier regions. Property size class distribution includes 10-20, 20-50, 50-100, 100-200, 200-500, 500-1000, 1000-2500, and >2500 ha.

development conditions, especially for smallholders, with development indicators showing worse conditions in frontier vs. post-frontier regions, including lower proportions of smallholders with land titles, primary education, membership in farmers' associations, access to electricity, integration with markets, and access to agricultural credit (Figure 3).

As agricultural-forest frontiers become more occupied, they start to be reshaped as complex mosaics of old-growth and regenerating areas of forest interspersed with a shifting patchwork of agricultural areas and abandoned land – often on a trajectory towards more consolidated land use systems. As migrants colonize new areas of land, and some of the original inhabitants leave to find employment or cheaper land elsewhere, or adapt their livelihoods to the new socio-economic dynamics, many of these frontier landscapes are becoming inhabited, at least temporarily, by what we call “novel societies”.

Novel societies can be characterized by the emergence of new institutions and power structures set against a diversity of actors with markedly different interests, values, productive strategies, cultural backgrounds, migration histories, and access to capital, technology and markets. Such societies have emerged across the agricultural-forest frontier of the Brazilian Amazon, as well as many other areas of the tropics, over the last few decades.

At one extreme is the arrival of large-scale, high-technology and high-input arable farms with absentee owners, which specialize in export crops such as soy. At the other extreme are large numbers of smallholders who may also be recent migrants, or people who lived in these regions before the arrival of modern agriculture, and who manage comparatively diverse agricultural systems for both subsistence and sale to local markets. Between these extremes are a wide range of other actors, including small-scale (<100 hectares) mechanized farms that are managed solely by family labour, as well as large numbers of small and medium-sized properties that are varyingly

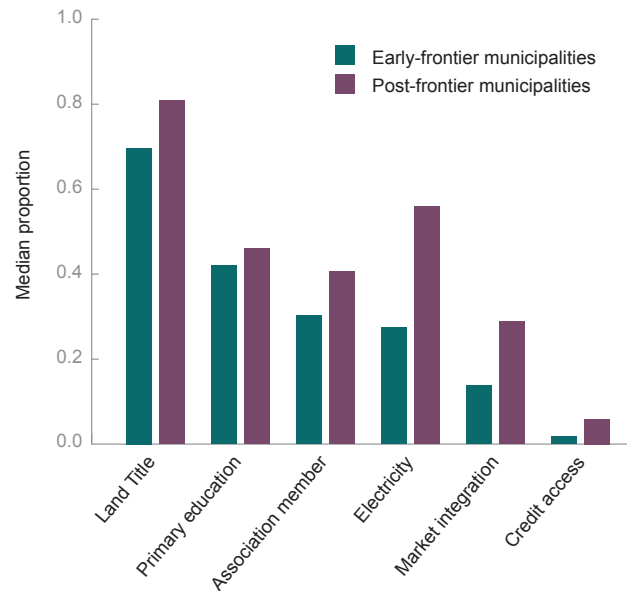


Figure 3: A shift towards consistently lower development conditions for smallholder farmers in early-frontier regions compared to post-frontier. Differences in median values of development indicators are significant for all early and post-frontier comparisons (Mann-Whitney U, $p \leq 0.05$).

Data from Brazilian Institute for Geography and Statistics, IBGE, agricultural census 2006

engaged with local, national and export markets and are often supported by income from off-farm employment and family members in urban centres (see Figures 4 and 5).

Another key characteristic of agricultural-forest frontier regions is that they are highly dynamic. The human population, infrastructure and rules are rapidly changing, driven in part by government-supported agrarian reform, credit subsidy programmes, and large-scale infrastructure projects. At the same time, economic opportunities across the Amazon are rarely stable, associated with intra-regional fluctuations in the price of land and the profitability of farming.

While in-migration to the Amazon region has slowed in recent years there is still a very high level of intra-regional migratory circulation (Perz et al. 2010), underpinned by increasing urbanization and the emergence of strong and dynamic rural-urban networks (Guedes et al. 2009). Agricultural-forest frontier regions also often experience rapid changes in supply chain structure, which can greatly accelerate the productivity and expansion of particular land use activities (Garrett et al 2013a). Meanwhile, these same regions often draw high levels of attention from international watchdog groups and environmental NGOs, leading to the development of new localized institutions and projects intended to bolster weak and/or unenforced national policies. The high pace of environmental and socio-economic change in frontier regions increases the likelihood that policy interventions in one place will have potentially unanticipated ramifications elsewhere (Brondizio et al. 2009).

Inter-actor dynamics and sustainability governance

The close juxtaposition of very different actors, in a dynamic landscape context with often fragile and incipient institutions, and in regions where stocks of natural capital remain relatively high, brings new challenges and opportunities for the adoption of more sustainable rural development strategies. Interactions and interdependencies between actors can result in both costs

and benefits for different members of an agricultural-forest frontier society, with cascading negative or positive effects for environmental and social sustainability. Identifying potential interactions, and giving them explicit consideration in land use decision-making processes, is a critical step in any effort to foster more sustainable and equitable development pathways.

Central to the governance challenge facing agricultural-frontier regions is the need to understand when, and under what circumstances, a given combination of actors with different levels of capital and access to technology can facilitate the adoption of more efficient and sustainable production practices. Conversely, it is important to understand when, and under what circumstances, actor diversity may accentuate differences and exacerbate the difficulties faced by vulnerable groups.

Some kinds of interactions are underpinned by clear, privatized markets (e.g. off-farm employment contracts or sales of agricultural services), while others reflect shared benefits and responsibilities and require collective action (e.g. construction of private roadways to reach markets or control of fire that has escaped into neighbouring properties). However, a lack of strong law enforcement and/or strong civil institutions and associated social norms, combined with uncertain markets for land and labour, undermine the ability of many actors to benefit from cooperation with other groups (Brondizio et al. 2009).

Social and environmental costs of multi-actor dynamics

Disparities in wealth and access to land, natural resources and

technology in an agricultural-forest frontier setting can generate both direct and indirect conflict among actors, with potential negative environmental and social consequences. The exclusion of many actors from rapid processes of agricultural development is one of the most commonly cited examples of negative interactions in frontier regions (Garrett and Rausch, in press).

Driven by strong market demand for increasingly globalized commodities, as well as increased connectivity with the outside world, many frontier regions in the Brazilian Amazon have become rapidly specialized in a small number of high-yielding land-uses, the most prominent of which is soy. Although increased soy production has been shown to reduce poverty indices and raise median rural incomes in the Brazilian Amazon, there is also evidence that it is associated with increased levels of inequality (Weinhold et al. 2013). Where land and capital are consolidated in the hands of a small minority actors who are unable to participate in this new system may become marginalized or displaced (Baletti 2014).

While the potential exclusion of smallholders from a rural economy following expansion of modern agriculture may often be a largely passive process, competition for land, when coupled with uncertain land-tenure arrangements, can also lead to further deforestation than would not otherwise occur to plant crops or pasture. This process, termed contentious or perverse land change by Aldrich et al. (2012), has been shown to result from preemptive deforestation by land claimants seeking to demonstrate ownership and productive use.

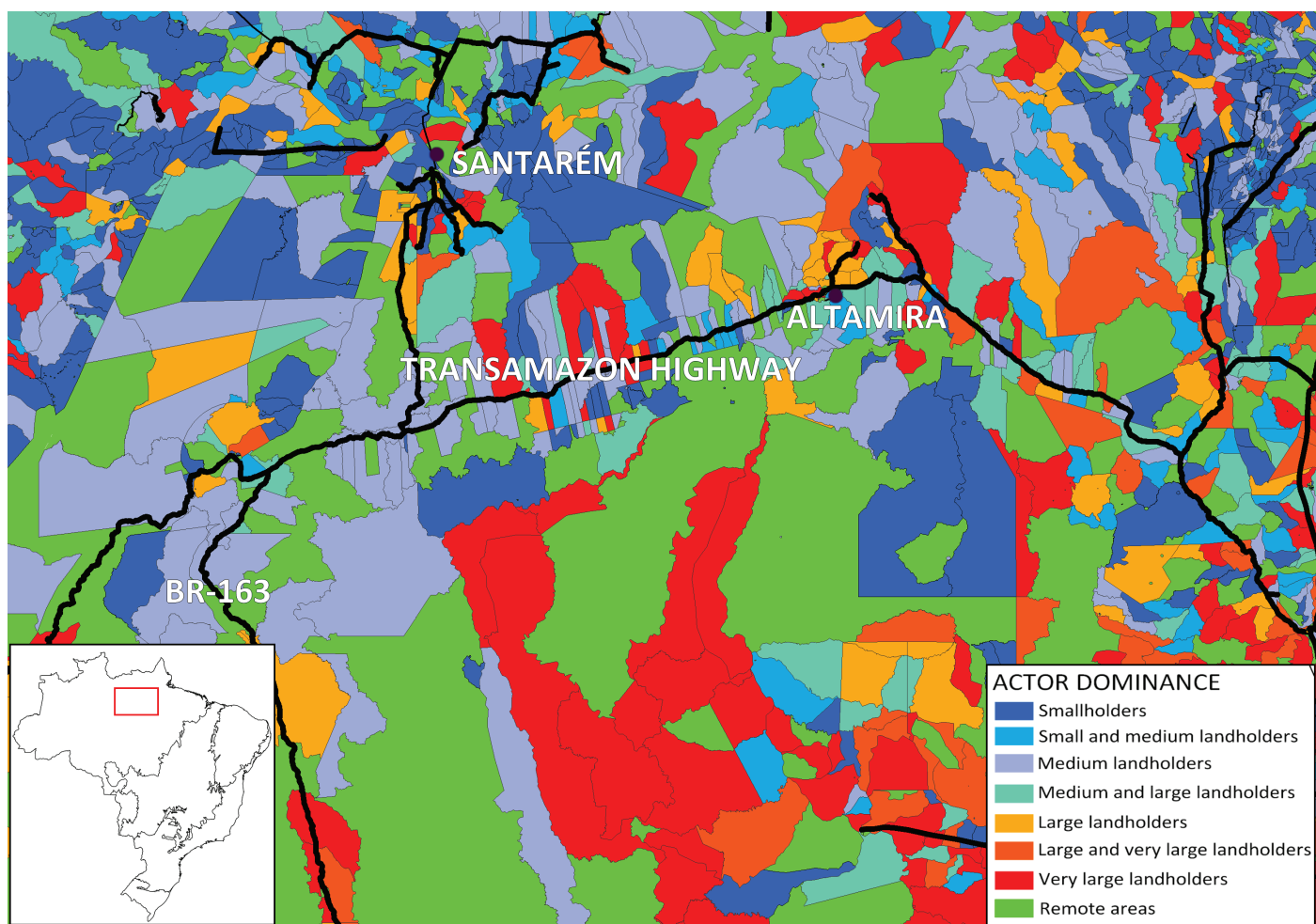


Figure 4: High levels of heterogeneity in actor-dominance, determined by property size-class, in an agricultural-forest frontier region along the Trans-Amazonian Highway.

Based on agricultural census data at the level of individual census tracts from the Brazilian Institute for Geography and Statistics (IBGE, 2006).



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Smallholder farmer using fire to clear fallow land, Arapiuns, Santarém, Pará.

There are other cases in which interactions between different actors can exacerbate the environmental damage that would otherwise occur if only one actor were present. A good example of this is when smallholders and large-scale logging operators may be jointly responsible for when a forest burns: smallholders because they produce most of the ignition sources, and logging operators because they reduce the flammability threshold of the forest by logging (Barlow et al. 2012).

Benefits of multi-actor dynamics

The increased proximity of previously isolated and distinct actors can bring new opportunities, including an increase in opportunities for employment, technology and knowledge sharing, supply chain development, and ways of complying with environmental regulations.

An example of this can be seen in some regions where smallholder farms are clustered around capital-intensive arable farms, and smallholders can benefit from the construction of new private roads. While improved road access, when coupled with weak law enforcement, can precipitate increased deforestation, road access is also of vital importance for increasing smallholders' access to markets, as well as schools and health care services. Modern mechanized farmers may also trade tractor services with neighbouring smallholders for day labour (Theis and Swette 2012), providing new opportunities to increase on-farm productivity and reduce dependence on manual labour.

At the scale of rural communities, the development of mechanized and more input-intensive agriculture can lead to the rapid development of local agribusiness, which not only brings new access to synthetic inputs and high-quality seeds, but can also stimulate the development of the local economy to provide

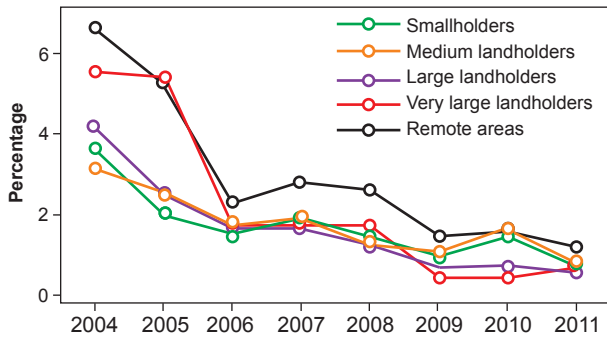
non-agricultural products and services (Garrett et al. 2013a). As families are linked through both farm and off-farm opportunities, the creation of a diverse local economy can enhance adaptive capacity to both market and climate shocks. Tax revenues from high-value export commodities can also potentially be reinvested benefitting all actors locally, although in practice local taxes on agriculture tend to be extremely low, and most national taxes are allocated elsewhere (Garrett and Rausch, in press).

The potential for collective action

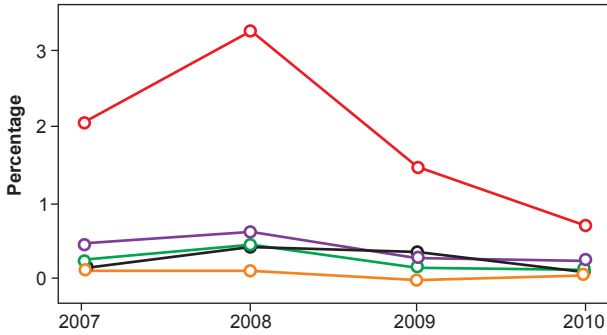
The high actor diversity in many tropical agricultural-frontier landscapes means that collective action and consensus among distinct groups of actors is often necessary to foster a more sustainable rural economy.

One of the most prominent examples of the potential for collective action by diverse actors in the Brazilian Amazon can be seen in the response of farming communities in Paragominas, in the state of Pará, to the federal government's development of a Red List of the municipalities with the highest rates of deforestation. Inclusion in the list resulted in an embargo on the sale of agricultural products and a restriction on access to credit from public banks. To exit the list, a municipality had to reduce deforestation and register at least 80% of the area of private lands.

As part of a collective effort to exit the list, a wide range of actors in Paragominas signed a zero-deforestation pact. The group included the mayor's office, the soy and cattle farmers' union, the smallholder farmers' labour union, and the timber union, with support from two leading environmental NGOs. Paragominas was the first municipality to exit the Red List, in 2010. This unprecedented collaboration involving stakeholders from across the rural community became the inspiration for a statewide



a. Annual rate of deforestation change.



b. Percentage forest degradation per hectare of forest.

Figure 5: Annual deforestation and degradation dynamics per type of actor in the Brazilian Legal Amazon.

Adapted from Godar et al. (2014)

Green Counties program in Pará that integrates efforts across state government departments to foster sustainable development (Guimares et al. 2011).

While the example of Paragominas underlines the possible benefits of collaboration among diverse actors in frontier regions, it is also easy to find examples of where a failure to collaborate

has contributed towards negative outcomes for many actors. One such example is the case of foot-and-mouth disease (now absent from Brazil), which led to a widespread embargo on imports of beef from the Amazon. This kind of blanket restriction, similar to the aftermath of the embargo on beef from the Amazon by Brazilian supermarkets in 2009, may have disproportionately negative effects on smallholder cattle farmers who are more vulnerable to market shocks.

Taking actor diversity into account when assessing and designing policy

Governing land use and land cover processes in tropical agricultural-forest frontier regions often comes with major challenges and tensions. There is an obvious need for policies to take into account the different conditions and interdependencies of actors when assessing existing policies or designing new governance approaches, particularly considering the challenging conditions faced by the millions of smallholder farmers who inhabit frontier regions (Figure 3).

At the same time, regional and national governments, as well as many private sector actors, often have a strong preference for simplified policy frameworks that are easier and cheaper to implement and monitor, especially given the limited capacity and resources in many frontier regions. Underlying all these difficulties is the fact that many government agencies and decision-making processes are strongly aligned with the needs of a particular group of actors or a particular sector, with little focus or capacity to understand the relative roles, interactions, and capabilities of the full constituency of actors who make up frontier societies.

There are at least three potentially complementary ways in which actor diversity can be taken into account in unilateral or hybrid forms of public and private governance. Below we examine each



Smallholder farmer and fisherman, banks of the Tapajós river, Pará.

of these approaches to land use policy, with examples from the Brazilian Amazon.

Tailoring sustainable development policies to different types of actors

Actor-tailored policies are invariably more effective than one-size-fits-all approaches because they better account for the differences in the environmental and social impacts associated with each actor type, which often depend on differences in their legal responsibilities, voluntary commitments and capacities.

Brazil's policies to curb deforestation in the Brazilian Amazon through the federal Plano de Prevenção e Controle do Desmatamento na Amazônia Legal (PPCDAm, the Plan to Prevent and Control Deforestation of the Legal Amazon), and associated inter-ministerial and state-level processes (Nepstad et al. 2014), offer a good example of how the same policy can have markedly different implications for different groups of actors. While annual deforestation fell by 83% between 2004 and 2011 across the Brazilian Amazon, the rate of decrease was not consistent among areas dominated by different actors, with a drop of 81% for the largest properties (>2500 ha) compared with only 73% and 65% for small and medium properties and only 71% for the most remote areas (Godar et al. 2014; see Figure 6).

This outcome is unsurprising, considering that deforestation policies to date have focused on larger properties in hotspots of deforestation activity, but it means that to maintain their effectiveness, policies need to adapt to the changing context and share of deforestation that is associated with different actors. The work by Godar et al. (2014) also demonstrates that while deforestation fell more sharply in areas dominated by larger properties, the remaining forests in these areas are more degraded than in areas dominated by smallholder farmers.

One conclusion of these findings is that more investment is needed in incentive-based (versus punitive) measures, especially those that are targeted at smallholders who have fewer economic alternatives, yet who are also associated with some of the best-condition forests on private land anywhere in the Brazilian Amazon. While there has been a laudable increase in the number of incentive programmes for sustainable land-management in the Brazilian Amazon, associated with the third phase of PPCDAm, the largest programmes remain inaccessible to many actors. The flagship Low-Carbon-Agriculture (ABC) programme, launched in 2011, which makes about US\$1.5 billion available each year to support forest restoration and pasture improvement, has had little uptake in the Amazon region (Walker et al. 2013), especially by smallholders (Gil et al. 2015).

Another stark example of where a failure to tailor legal requirements to the conditions and capabilities of different actors has undermined policy effectiveness can be seen in the implementation of regulations for fire use by smallholders. Working with *caboclo* farmers in the eastern Brazilian Amazon, Carmenta et al. (2013) found that the vast majority of federal and state regulations over fire use were not enacted because they either require resources or capabilities that smallholder farmers do not have, or because they are naïve to the way in which fallow-farming systems depend on fire to maintain the productivity of the land.

Set against these examples, Brazil has formulated an increasing number of more actor-tailored policies in an attempt to increase both the effectiveness of measures to promote land use sustainability, as well as achieve a more equitable approach to achieving compliance. One of the most prominent examples of this is in the revision of the Federal Forest Code in 2012 to include a number of exemptions for smallholder farmers (generally < 100 ha but up to 440 ha in some parts of the Amazon), such as



Cattle herd in Paragominas, Pará.



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Harvesting maize, Paragominas, Pará.

an amnesty for illegal deforestation prior to July 2008 and a reduction in the extent to which riparian areas must be restored (Soares-Filho et al. 2014).

Alongside actor-tailored compliance measures, Brazil has shown significant innovation in developing actor-tailored development programmes. One of the most famous examples can be found in the Brazil's Food Acquisition Programme (PAA) and the National School Feeding Programme (PNAE). Together these government schemes represent one of the largest institutional procurement programmes in the world, prioritizing the purchase of staples and vegetables from smallholder family farms, while also providing a social safety net in the form of free meals for school children – 30% of the ingredients of which have to be purchased from family farms. This adds up to an investment of some US\$1 billion a year (IPC-IG 2013).

Another extremely important differentiated policy relates to the provision of federally subsidized loans for agricultural production. The Brazilian government has subsidized lines of credit with low interest rates for agricultural producers through federal banks. The interest rate of these loans depends on the size of the agricultural property and the producer's status as a "family farmer" or otherwise – defined based on a combination of farm size and the extent to which the farm management relies mainly on family labour. Through the Programme for Strengthening Family Agriculture (PRONAF), interest rates are substantially lower for the small and "family" producers, often below the rate of inflation.

More generally, Brazil has recently made concerted efforts to improve and expand technical assistance in rural areas for vulnerable farmers by making existing extension programmes more "participatory, multidisciplinary, equitable, and culturally appropriate" (Laws 12.188, 5.740; Comissão de Agricultura, Pecuária 2013). It is still too early to assess the success of these changes.

Accounting for impacts associated with non-target actors

The most common approach to accounting for the interdependent nature of actors living in agricultural-frontier landscapes and elsewhere is to include additional safeguards and provisions as part of any sustainable development policy or incentive measure targeted at a specific group. Without such provisions, an intervention may result either in negative unintended consequences involving non-target actors, or in a failure to capitalize on cost-sharing opportunities or synergies.

The most commonly cited example of a negative indirect effect of investing in the agricultural development of frontier regions is through indirect land use change, where intense competition for land and an associated increase in the price of land can lead to the displacement of actors engaged in less profitable activities. Richards et al. (2014) estimate that some 30,000 km² of deforestation can be attributed indirectly to soy expansion and displacement of cattle farms and other land uses since 2002.

In some areas soy expansion has been held partly responsible for displacement of smallholders from farmland to cities (Baletti 2014). In the absence of strongly enforced environmental protection and strict zoning laws, indirect land use change is notoriously difficult to avoid, with difficulties further compounded by the fact that excessively strong enforcement measures targeted at one sector may only serve to shift landowners towards a different, less regulated land use.

One innovative approach to addressing these issues is currently being tested in the frontier region of Alta Floresta Mato Grosso. It is called a "Land-Neutral Agricultural Expansion" mechanism (Strassburg et al. 2012). This mechanism is an integrated approach that connects demand for land from the expansion of soy with a potential supply of land spared from increases in productivity of extensive cattle pastures, resulting, in theory, in zero deforestation or displacement pressure. A major regulatory



Smallholder farmer in Marabá, Pará.

challenge associated with any such “land-sparing” proposal is how to avoid the risk of rebound effects, where increased profitability from intensification could, in the face of continued high demand for both beef and soy, drive additional investments into agricultural expansion.

Recently international NGOs have responded to growing global concern over deforestation for agricultural commodities by encouraging powerful supply-chain actors to take corporate social responsibility measures. For example, they have encouraged moratoriums on purchasing products from recently deforested areas and minimum environmental and social certification standards.

However, while these measures include some safeguards to help reduce adverse impacts on smallholders, there is substantial evidence that both the development and application of these mechanisms have helped to solidify the existing power imbalance that characterizes much of the agricultural sector in Brazil and elsewhere (Garrett et al 2013b).

A number of pilot schemes are seeking to redress this and leverage wider social benefits from the expansion and development of modern agriculture. To promote social inclusion in the biofuels sector, the Brazilian government established the National Programme for the Production and Use of Biodiesel (PNPB) which requires traders and processors to buy oilseed crops, including palm oil, from smallholder farmers and provide technical assistance, with a target of 30% for the Amazon region. While this is an encouraging move in principle, levels of uptake have been relatively low, as many smallholder plots

are on land unsuitable for mechanization (Lima et al. 2011). Moreover, the law as it currently stands includes no provisions to ensure that environmental license exemptions available to smallholders do not provide a means for the industry to avoid basic compliance requirements. It also lacks provisions to ensure that smallholders retain sovereignty over their land if they wish to change their production system (e.g. back to staple crops).

Taking advantage of actor diversity and interdependencies through collective action

Although there have been an increasing number of attempts, in the Brazilian Amazon and elsewhere, to account for actor-specific needs, responsibilities and capabilities in policy design, including secondary provisions to minimize risks or maximize benefits for non-target groups, the majority have been a reaction to the failings of blanket measures. Very few policies targeting agricultural-forest frontier regions have sought from the outset to explicitly account for interactions and interdependencies among different actors. While such an approach requires adopting a more systems perspective and drawn-out process of participatory engagement, it is a key step in ensuring that sustainable land-use policies are both effective and fair in the long-term.

Promising examples of attempts to adopt a more participatory and integrated approach can be found. One example from the agricultural sector comes from a multi-sector initiative in Paragominas, where a leading local soy producer has partnered with the mayor’s office and the workers’ union, supported by finance from public banks, to build an abattoir for small



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A soy field bordering the forest in Santarém, Pará.

animals, providing a potentially significant opportunity to add value for small-scale poultry, pig and goat farmers.³ This is the first such initiative for the Brazilian Amazon region.

Another small-scale experimental initiative that has received widespread recognition for its explicit attempt to recognize the needs and objectives of multiple actors is a company-community forest management enterprise near Santarém in the state of Pará. This enterprise is a partnership between a timber harvesting company and the inhabitants of six agrarian reform settlements. It has sought to provide returns in the form of profits from reduced-impact logging, but also road maintenance, housing and agricultural extension services (Nepstad et al. 2004). However, the longevity of project has been plagued by difficulties in accessing the necessary permits and credit, pointing to the importance of strong government support to ensure the viability of private-sector or civil society-led partnerships.

There are considerable opportunities in more coordinated attempts to recognize the differentiated responsibilities and capacities among different actors in frontier landscapes, and to use this knowledge to develop more collective-action approaches to fostering sustainable development at the regional scale. Such opportunities include collective approaches to achieving legal compliance with environmental legislation, sharing of knowledge and technology on farming practices, and improvements in agricultural and forest-product markets through verticalization and supply chain development.

These interactions should not be seen as one-way, paternalistic relationships between “wealthy-modern” and “poor-traditional” actors, but as an opportunity to exploit complementary capabilities and experience to achieve more sustainable land management practices for all. To encourage these interactions, policies need to be designed to better reward and facilitate positive interactions, technology- and knowledge-sharing, and collective management between different socio-economic groups and land users, rather than targeting each group and commodity separately. The role of the state is vital in providing the enabling conditions necessary to incentivize and nurture sector innovations for multi-actor land-management initiatives, and to engage proactively in scaling up success stories.

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³ See: http://www.paraturismo.pa.gov.br/?q=pt-br/paragominas-ter%C3%A1-primeiro-frigor%C3%ADfco-do-estado-para-abate-de-pequenos-animais_

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