Project:

Working toward cooperative non-timber forest management: integrating economic, institutional, and ecological analysis to balance community livelihoods and forest conservation in Western Amazonia

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Kleinhans Fellowship for Non-Timber Forest Product

FINAL TECHNICAL REPORT

Rainforest Alliance

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BRAZIL

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Content

Acronyms and Abbreviations

AES	Agroextractive Settlements
CS	Colonization Settlements
ER	Extractive Reserves
NTFP	Non-Timber Forest Products
TFP	Timber Forest Products
UFAC	Federal University of Acre

Summary

This technical report describes the lessons from a project conducted in the Amazon region aimed at evaluating the conditions under which local forest can be managed without expanding deforestation while also supporting local livelihoods. The project is part of a doctoral research supported by the Kleinhans Fellowship Program for Research in Tropical Non-Timber Forest Products of the Rainforest Alliance. After two years of intensive fieldwork and analysis of resource management strategies of local communities, the report presents results, summarizes lessons learned and proposes some opportunities and challenges for enhancing conservation efforts in the region.

Our motivations rely on the fact that forestry, cattle and agriculture are essential sources for livelihood of thousands of people residing in different community types in the Amazon region. These three strategies, however, represent antagonist forces shaping conservation and development outcomes in the region. Extractive reserves (ER), agro-extractive settlements (AES), and colonization settlements (CS) are three models of communities accounting for approximately 21% of the Brazilian Amazonian territory (~ 902,000 km^2) where cattle, agriculture, and forestry have been pieces of solutions or threats to conservation and local poverty. While cattle and agriculture are underlying drivers of deforestation, economic arguments place them as effective alternatives to support family income across different communities. On the opposite direction, while collaborating to conservation efforts, forestry management is limited to support family income.

This project confronts that dilemma and situates the role of non-timber forest products (NTFP) to protect tropical forests and improve livelihoods of local poor people. To achieve this goal, it identifies their constraints, effects on local forests, and alternatives for increasing their economic returns as strategy to promote conservation. Working collaboratively with a number of local partners in the Amazon region, this project contributes with this attempt by informing:

1. *Which set of NTFP are more profitable in each community type.*
2. *The influence of NTFP on reducing or decreasing deforestation.*
3. *How resource management strategies vary across community types.*
4. *The economic and institutional constraints related to NTFP across community types.*
5. *Alternatives to enhance cooperative resource management as way to improve economic returns and reduce trends toward deforestation.*

To achieve this goal, the report includes seven parts:

Part A. *Description of where the communities are located.*

Part B. *Who are the landowners and how do they manage their resources?*

Part C. *Methods used in the project*

Part D. *The importance of forest and non-forest products to household income*

Part E. *Resource management and forests*

Part F. *NTFP and collective decisions: two center pieces for resource governance*

Part G. *Final remarks, challenges and opportunities*

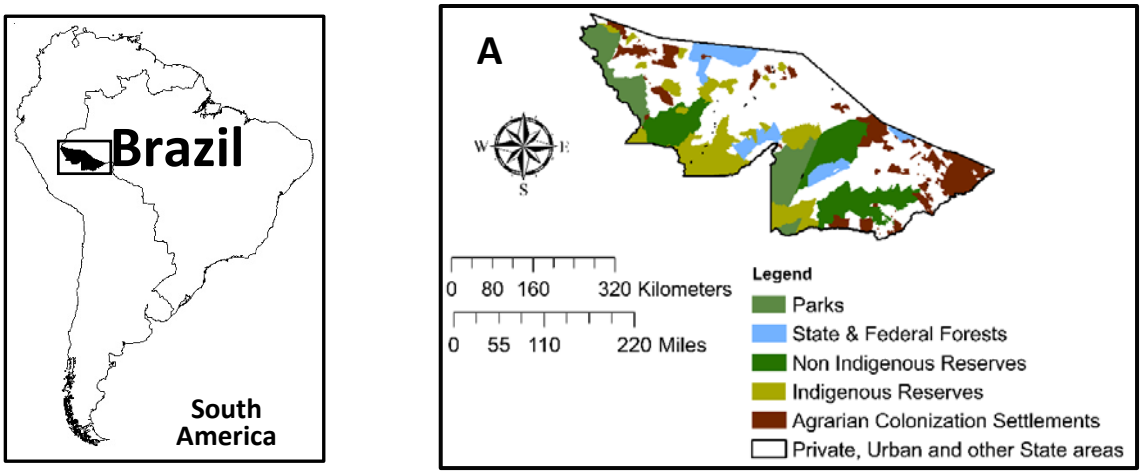
Part A. Description of where the communities are located

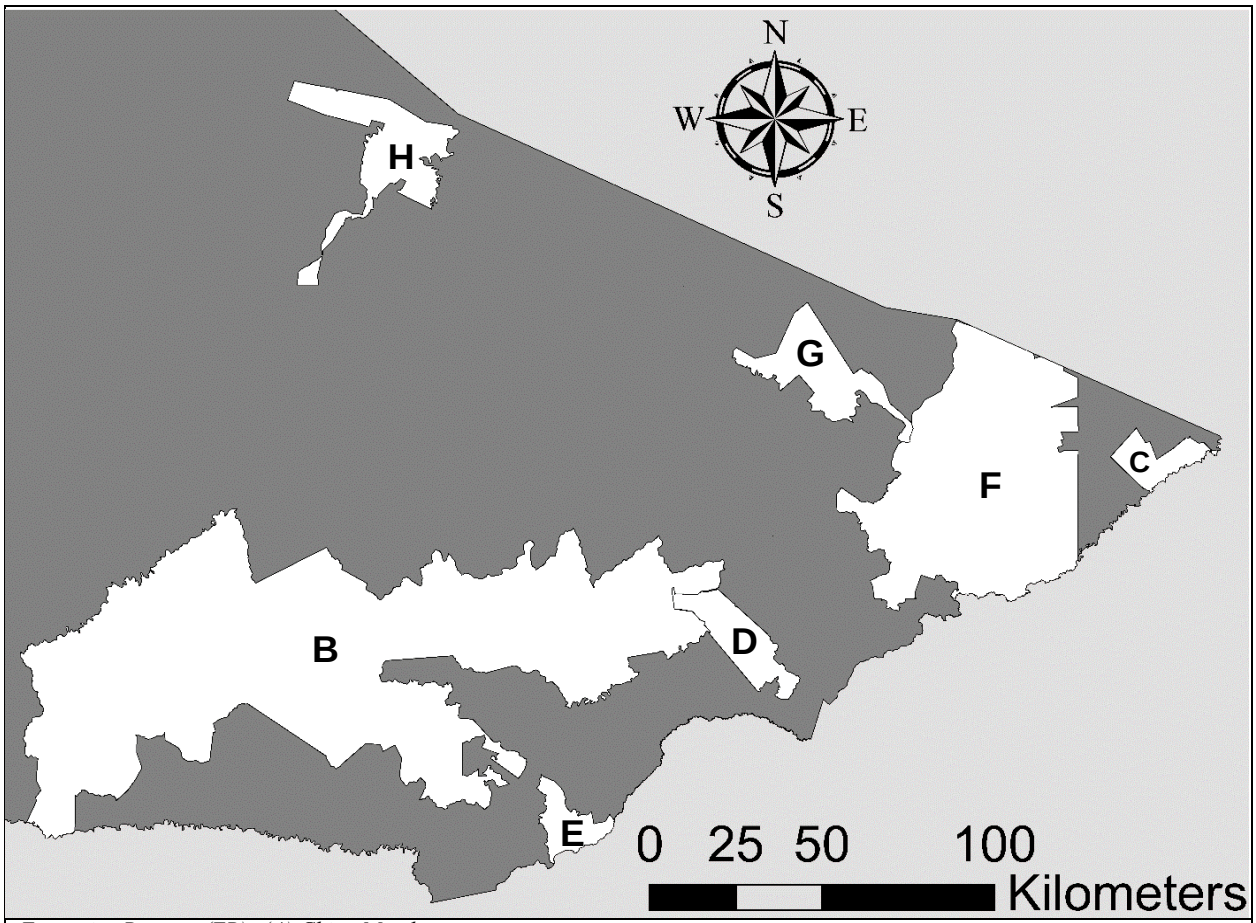
The state of Acre, in the western Amazonia, with an area of 16.4 million hectares, is home to considerable social and biological diversities. On the conservation side, this part of the Amazon region concentrates the highest number of both mammals, birds, and tree species for the Amazonian biogeography realm (Daly and Mitchell, 2000; McGinley, 2008). In addition to its diversity of animal species, large patches of natural vegetation of critical importance to local livelihoods, such as Brazil nuts and a range of other non-wood forest products, occurs in this part of the region (Wadt et al. 2008; Kainer et al. 2003). This biological diversity is present in almost 90% of its area maintained under forest cover (INPE 2013). On the social side, 56 percent of its territory (~9 million hectares) is under some form of community regime including indigenous and non-indigenous reserves, where most inhabitants are forest-dependent people (Acre, 2006) (Figure 1, A). A combination of multiple forest products, for example, Brazil nuts, rubber trees, fruits, medicinal plants, and so on, have supported local livelihoods for centuries.

In contrast to its socio-environmental diversity, in the center of the newest route in South America for exporting primary commodities, Acre's territory can potentially experiment drastic changes in the coming years. Together with three other Amazonian states (Amazonas, Mato Grosso, and Rondônia), Peru and Bolivia, the region contains a human pressure of over 50 million people (Governo do Acre 2011). The region is also home to a number of ongoing mega-infrastructure projects including three hydroelectric dams (US$ 10 billion) and a new network of highways connecting the Amazon region to the Pacific Ocean (US$ 1.5 billion) that can potentially accelerate forest destruction that inevitably lead to biodiversity losses (Cesario et al. 2011). After its complete regional integration, this region will probably transform itself into a major market corridor in South America to export food (soybeans and beef) and high-value woods to Asian markets (Perz et al. 2008). In parallel, social and environmental impacts, including land conflicts and deforestation, can emerge (Soares-Filho et al. 2006; Paula 2013).

In the middle of this social-environmental change, inhabitants of different community types have emerged as protagonists of innovative solutions to mitigate socio-environmental drawbacks from ongoing regional integration. In the state, three institutional arrangement regimes, which covers over 30% of its territory, have housed a mosaic of multiple resource management strategies (Figure 1, A). First, within extractive reserves (ER), which represent over 22% of the state territory (~3.6 million hectares), inhabitants are dedicated to gather various NTFP to meet their livelihood needs while also reducing pressure toward deforestation. Second, residents of agro-extractive settlements (AES) control 1.5% of the Acre's territory (~240 thousand hectares) and have provided an original hybrid model of forest management by combining NTFP and timber forest products (TFP). The third group includes inhabitants of colonization settlements (CS) distributed in over 1.6 million hectare or 10% of Acre's territory. The later moved from leaders of deforestation in the 1980s to leaders of initiatives aimed specifically at working forest recovery and reforestation through agroforestry systems and sustainable management of NTFP and TFP within their remaining forests. With focus on these three community types, the project evaluated the role of forest management for influencing family income and forest conditions under different community property regimes.

Figure 1. State of Acre: land tenure regimes and selected communities (Brazil).





*Extractive Reserve (ER): (**A**) Chico Mendes*
*Agro-extractive Settlements (AES): (**B**) Porto Dias, (**C**) Remanso, (**D**) Cachoeira*
*Colonization Settlements (CS): (**E**) Peixoto, (**F**) Humaitá, (**G**) Boa Esperança*

Part B. Who are the landowners and how do they manage their resources?

Agriculture, cattle and sustainable forest management are three conflicting resource management strategies shaping efforts of reconciling conservation and development in Amazonia. The state of Acre, located in the western part of this region, becomes a reference state in the region where colonists and rubber tappers have moved from struggling against deforestation in the end 1980s to making a statewide productive conservation policy after 1999. However, almost fifteen years later, there is still a lack of empirical analysis evaluating how household economics as well as forest conditions have changed within different community types in this state. This project responded to this gap by combining household and community survey data with spatial data of forest cover and fragmentation from seven communities representatives of ER, AES, and CS.

Resource management strategies and dependency on market for their family income differ across these three community types. The Chico Mendes ER (Figure 1. B), a case of collectively managed forest, represents a model with limited market dependency, considerable importance of farm production for family subsistence, and centered on NTFP as source of family income. In its conception, agriculture and livestock might be limited to support family's subsistence needs instead of oriented to commercialization (Allegretti 1994; Murrieta and Rueda 1995). Despite substantial improvement in the past ten years, access to rubber tappers communities in the Chico Mendes by roads is still very limited compared to AES and CS communities. Agro-extractive settlements exemplify a model mixing characteristics from ER and CS communities. As Chico Mendes, the three AES communities of this project are examples of communities collectively governed by their residents. However, facilitated by better roads, livelihood strategies within these areas are more concentrated on TFP and other products (for example crops and livestock) with high prices, which ultimately reveal a more explicit dependency on markets of their residents compared to Chico Mendes. In AES communities, cattle and agriculture are not

only a source for resident's family subsistence, but also most importantly a strategy for income generation. One crucial difference, from colonization settlements is that residents of agro-extractive settlements markedly invest on forests, especially TFP, as a major source of family income. For example, Cachoeira and Porto Dias (Figure 1, C and E) were the first community wood forest managements in Brazil to be certified by the Forest Stewardship Council (FSC) in 2002 and 2003 respectively. Remanso (Figure1, D) had its non-timber management certified by FSC in 2004. Residents in the three ACS communities, Peixoto, Humaitá, and Boa Esperança (Figure 1 F, G, and H) are strongly focused on agriculture and cattle as dominant strategies for their livelihoods. ACS areas also differ from ER and AES communities in the conditions (in quality and quantity) of roads located close to their properties, which reduce transportation costs and contribute to encourage investments in beef and crop commodities oriented to supply local urban areas.

Part C. Methods used in the project

The project relied on three sources of data. Longitudinal household survey provided the information on resource management strategies and other socioeconomic factors influencing household decisions. Satellite images were the source for data about forest conditions and landscape fragmentation. Finally, data from community workshops helped us to estimate the importance of collective resource management and community governance to protect local forests.

The first set of data included socioeconomic data from 760 households gathered in the seven communities representatives of ER, AES, and CS. These data came from surveys using the same protocol that, in its most part, were implemented in the same property within each site in 1997, 2006, and 2010. To allow a longitudinal comparison, for 2006 and 2010, we used properties surveyed in 1997 that represent a random selection, stratified by zones of high, intermediate and lower level of development within each community. In 1997, local NGOs, state agencies, representatives of community organizations, and community members helped us through the sampling procedure as well as identifying the sampled families. In 2010, local partners including the Federal University of Acre (UFAC), a public university in the region, as well as unions, associations, and cooperatives collaborated were critical to conduct interviews with local residents, community leaders. For all years, we used a structure questionnaire comprised by

four parts. Family's property information comprised of total area, year of arrival, titling, access etc. Social data consisted of household characteristics (age, family size, migration, gender, etc.). Data on economics constituted of information disaggregated by products on income, costs, family subsistence needs, credits, off-farm income, and government cash transfer.

To standardize data comparison across the years, we adjusted all economic data for inflation using the IGP-M (Market General Price Index), the most commonly used index in Brazil for that purpose, to May 2013. After correcting all data, we converted all values to the mean U.S. dollar – Brazilian real (R$) exchange rate for May 2013 of US$ 1.00 to R$ 2.028.

With these data, we drawn on the household economic literature (Gastal 1980; Hoffman et al. 1987; Hoffman 1998) extensively applied to economic analysis of smallholder in the western Amazonia (Souza and Maciel 2000; Souza 2001; Rego et al. 2003; Souza 2008; Maciel et al. 2011; Souza 2012) we followed three steps to estimate economic results from resource management strategies. First, we calculated total family income, which includes gross income from farm production, farm production for family subsistence, off-farm income, and government cash transference. Second, we computed costs for all farm production comprising of forestry management, agriculture, and livestock. Third, we elaborated a number of indicators to compare economic performance across institutional regimes and over time.

The third set of data used for the project account for forest conditions and landscape fragmentation for the communities between 1990 and 2010. These data build on two set of observations. First, land-cover change tends to arise when local socioeconomic conditions (e.g. land tenure and conservation policies and road accessibility) are altered. Second, these changes can drive forest fragmentation through a systematic forest cover transition from forest to agriculture and pasture, to regrowth or any conversion back from agriculture, pasture, regrowth to forest through time within each family property. Using multi-temporal satellite image data we conducted a forest cover change analysis focused on pasture/agriculture, forest regrowth, and forest. We then estimated land-cover transition through time. Finally, we performed a landscape analysis of forest fragmentation.

Part D. The importance of forest and non-forest products to household income

As illustrated in the Figure 2, results from this project reinforce three common perspectives about dominant resource management strategies in ER, ACS, and CS communities. First, NTFP are the most important resource management strategy among households of the ER, which contributes to over 40 percent of the mean family income of almost US$ 3,350.00/year. Logging is not allowed in the ER, which explains the limited contribution of TFP to the total mean income of household of this area. Second, CS communities place on the opposite situation with agriculture and livestock representing almost 100 percent of the mean income of household in these areas of US$ 8,300.00/year. Third, AES communities were confirmed as hybrid livelihood model where inhabitants combine multiple strategies to diversify their sources of family income. However, more than half of the mean annual family income of US$ 5,300.00/year of residents of AES areas were associated to forestry products (NTFP and TFP).

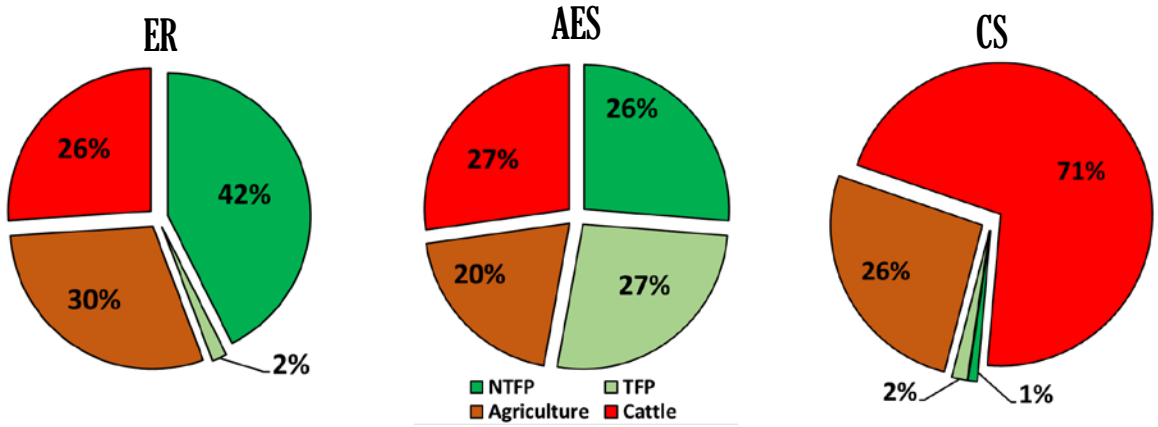


Figure 2. Family income in ER, AES, and CS by product type

Studies in the Amazon region confirm that local smallholders are not oriented to maximize profit (Pokorny et al. 2012). The project, then, assumed that profitability analysis as a not adequate method to compare ER, AES, and CS communities. Alternatively, together with our local partners and based on our experience with economic analysis of smallholders in the western Amazonia in the past 15 years (Souza and Maciel 2000; Souza 2001; Rego et al. 2003; Souza 2008; Maciel et al. 2011; Souza 2012), we elaborated four indicators of economic performance: FLCO, MER, RFT, and NTFI per capita/day. These four indicators account for four key determinants influencing resource management decisions: family labor as a constraint (FLCO), market dependency on consumption goods (MER), family labor daily compensation (RFT) from farm

activities, and daily net total income (NFTI per capita/day) after discounting total costs plus variable cost related to family labor.

Aside from RFT and NFTI, collectively governed communities (ER and AER) were equally or more economically feasible than private communities (CS). For the complete period of this study (1997-2010), family labor does not seem to be a major problem for inhabitants of all property regimes. While residents of ER employed close to 40 percent of their total family labor to achieve their farm production, inhabitants of AES and CS used nearly half of their total available labor force. Compared to the local cost of opportunity of labor (from US$ 7.40 to US$ 11.35) in 2010, RFT, a measure of daily shadow wage, for household of all property regimes were better off than the mean value paid in local markets. The highest mean value was found among residents of ACS with daily shadow wage 5 to 7.7 times the local cost of opportunity for labor. ER and AES presented the lowest RFT values (US$ 21.62 and US$ 34.41), but even here higher than value paid in local market for waged labor force. Daily NFTI per capita for local communities varied from US$ 5.0 to US$ 11.0 per day. Most importantly, resource management strategies within all communities provided local residents with a daily income level above the World Bank's often used international poverty line of one dollar/day (World Bank 2006).

Part E. Resource management and forests

Over a period of 20 years (1990-2010) all communities had an expansion in their deforestation (see Figure 3). Porto Dias and Remanso, had the highest percent of forest losses among all communities with an increment of almost 700% and 500% respectively in their deforested areas. In Cachoeira, the third agroextractive community of this project, the area of converted forest increased 2.2 times. Trends of deforestation in Humaitá and Boa Esperança, two CS

communities, were almost similar one another doubling their total deforested area. The extent of deforestation in these two CS areas, however, were different. While total deforestation in Humaitá increased from 174 km² in 1990 to over 430 km² in 2010, in Boa Esperança the expansion grew from 140 km² to almost 380 km² in the same period. Despite being the oldest CS area in the state of Acre, deforestation in Peixoto is still rising. Increasing over 3 times from 1990 to 2010, the deforested area in Peixoto jumped from 880 km² to close to 2,700 km². In terms of percent increment, the expansion of forest conversion in the Chico Mendes ER was compared to Peixoto. Over the twenty-year period, the deforested area in this ER amplified 3.5 times, from 115 km² to 400 km².

Differences on total deforestation across communities followed a tendency as expected. With nearly 1 percent of deforestation in 1990 and 4 percent in 2010, the ER exhibited the lowest proportion of forest conversion among all sites. On the contrary, CS areas had the highest deforestation over time. With between 16% and 28% of deforested area in 1990, total deforestation in 2010 varied between 46% and 73% within CS's territories. Deforestation trends within AES areas revealed an intermediate tendency between ER and ACS sites. With their percent of total deforestation varying from 2% to 6% in 1990, deforestation in AES communities extraordinarily reached by between 7% and 18% of their total area in 2010. Cachoeira AES, however, has showed a stable deforestation since 2000 with approximately 7.5%.

Despite their increasing deforestation, this project confirmed ER and AES as more effective than CS to protect local forests. However, all communities share a common tendency of increasing deforestation. In the past decade, conflicts over best options to manage local forests as way to support family livelihood and reduce forest conversion have raised, which enforce the need for

better community governance to maintain and use forestry resources. Crucial to the equation is to constraint strategies with known potential to expand deforestation (e.g. cattle, logging and

crops) without reducing family income. Agroforestry systems, a well-known land-use strategy to recover degraded lands within ER, AES, and CS communities, have faced serious social, ecological and market constraints to be effective. NTFP have faced serious problems associated to production costs, scale of production, limited markets, and harvesting seasonality. Roads expansion and market integration will decisively affect all three community types focused on this project by facilitating invest with lower transportation costs and short-term economic gains, such as cattle and soybeans. While representing potential treats to local forests and forest-dependent people, these perspectives reinforce the importance of extractive reserves and agroextractive settlements as alternative policies against deforestation.

NTFP constitute the most important source of livelihood for residents of ER and AES communities, which were critical to reduce deforestation. It is then clear from this project that any strategy to face deforestation in the Amazon region must consider the potential of NTFP as mechanism to reduce deforestation. Results from econometric analysis, as summarized in the table 1, evidenced rubber and its related products (FDL and Latex) as the most influential forestry products contributing to maintain local forests. Moreover, Brazil nut while playing a critical role for supporting rubber tappers' livelihoods was also found highly significant to reduce deforestation. However, there was exception among forestry products: TFP are not an option to protect local forest and contributed to expand deforestation within local communities. Effect of TFP on forests was comparable to that observed with cattle and pork, both of them positively influencing the percent of deforestation among communities that consider them important for family income. Taking results together, we confirm the importance of NTFP to support local livelihood and by consequence promoting forest conservation.

Table 1. Effect of income from different products on local forests

Product strategy	*Effect on deforestation*
Brazil nut	Negative
Rubber	Negative
FDL (Rubber Liquid Smoked Sheet)	Negative
Fresh Rubber (Latex)	Negative
TFP	Positive
Cattle	Positive
Pork	Positive

Part F. NTFP and collective decisions: two center pieces for effective resource governance

NTFP play a critical role to support family livelihood and contribute toward forest conservation efforts, but they alone are not a complete incentive for preserving local forests. As important as forest products, collective governance revealed itself critically essential to reduce deforestation in local communities. With this view, contrary to seeing resource degradation of tropical forests as inevitable, these findings inform how local communities in the Amazon region have struggled to find the best options to

manage their local resources. At the same time, our analysis reinforces the importance of the two ancient basis from which extractive reserves and agroextractive settlements were created in the early 1990s: collective governance and commitment to forestry products as collective assets.

Table 2. Effect of community types on local forests

Community type	*Deforestation*	*Forest conservation*
ER	Negative	Positive
AES	Negative	Positive
CS	Positive	Negative

Fieldwork, workshop with local communities, and data analysis showed that associations, unions, and cooperatives are key mechanisms for cohesive collective resource governance as well as essential for forest conservation efforts. Linking econometrics and spatial analysis, results summarized in the table 2 evidenced that ER and AES communities contributed to reduce deforestation and maintain forest cover, while CS areas had an opposite effect. From here, we can definitely argue that compared to CS communities, ER and AES tend to have a negative effect on deforestation. Our analysis demonstrates the positive effect of effective collective governance (common collective resources, collective rules as well as enforcement mechanisms) and economic strategies (forest products) on forest conservation.

In parallel to collective governance, in the past decade there has been an effort to certify TFP and NTFP by the FSC (Forest Stewardship Council) as an additional mechanism to value forest products and protect them against deforestation. Communities with lower deforestation, where standard FSC certification exists, were the areas with higher presence of residents advocating for NTFP and collective governance as the best strategy to preserve local forests. On the other hand, inhabitants of communities with higher deforestation were the advocates for changing local governance to accommodate pasture and agriculture expansion as well as logging without which they anticipate a likelihood of negative outcome to people and forests.

Part G. Final remarks, challenges and opportunities

Almost twenty years have passed since the first extractive reserves and agro-extractive settlements have been established in Amazonia. Today the increasing deforestation faced by these models of community types reveal a crucial turning point where their inhabitants might be challenged to create innovative alternatives to confront the current wave of forest conversion within their communities. It is clear from our results that any policy can probably fail without considering the role of collective governance and forest management centered on NTFP to local communities.

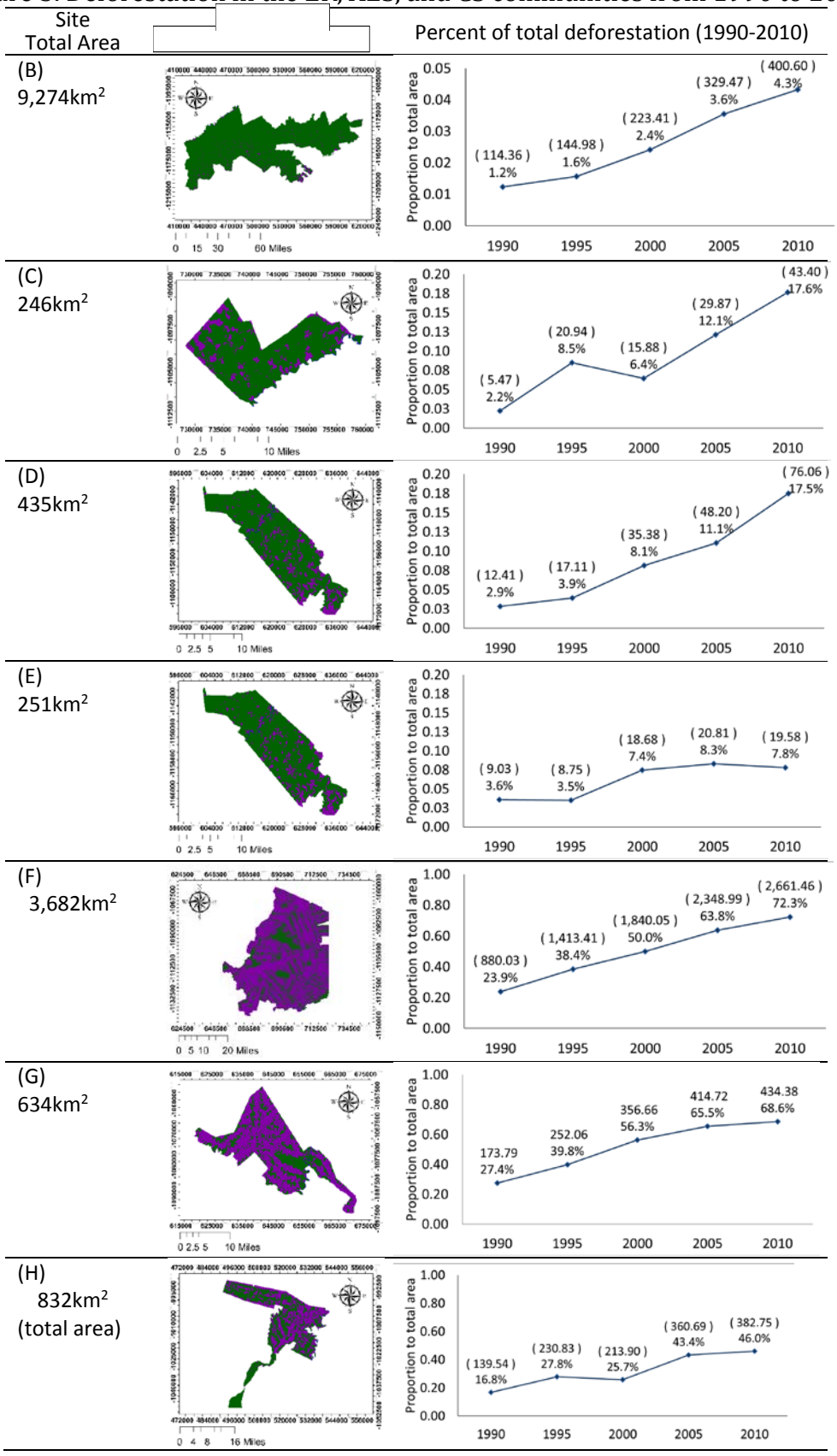
As such, the project reinforces the significance of ER and AES communities, as model of collective resource governance of forestry products in Amazonia, to balance local livelihood and conservation goals. However, instead of conjecturing on extractive reserves and agroextractive

settlements as panacea solution to ongoing conservation dilemmas in the Amazon region, we emphasize that without considering specific socio-economic-institutional contexts shaping resource management practices and deforestation at community level, neither sustainable or business-as-usual policies tend to increase their likelihood of failure to protect local forests.

To sum up, this report underlines that:

- Deforestation and forest fragmentation indistinctly increased in all communities, but rates and extent of deforestation varied over time, across communities and within each community. From here, we can imply forest conditions as a complex process in which each community responds differently to specific time-space incentives influencing resource uses and resident's decisions.
- Despite facing a tendency of increasing deforestation in the past twenty years, extractive reserve, where NTFP represent the major source of livelihood for residents, was the area with lowest total deforestation and largest patch size of forest cover among all communities.
- All community types were found economically unfeasible. Results for total cost-income ratio evidenced that, in mean terms, the total cost associated to farm production within ER, AES, and CS was between 1.9 to 3.9 times higher than household income obtained from forestry, livestock and agricultural products. However, ER and AES were more close to an equilibrium between total revenue and total costs than private properties (CS).
- These results suggest that state policies tend to be limited without considering or even promoting the multiple range of NTFP part of the livelihood of local communities and their collective resource governance

Figure 3. Deforestation in the ER, AES, and CS communities from 1990 to 2010.



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