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**Payments for Ecosystem Services: Opportunities and Challenges in the
Brazilian Amazon**

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**Payments for Ecosystem Services: Opportunities and Challenges in the
Brazilian Amazon**

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Payments for Ecosystem Services: Opportunities and Challenges in the Brazilian Amazon

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Brazil has committed to reducing deforestation in the Amazon and has identified target goals for 2020. A variety of environmental policies and tools are used to reduce deforestation in the region, including payments for ecosystems services (PES). This report analyzes whether payments for ecosystem services are a viable option for supporting conservation and socio-economic goals in the Amazon. PES schemes provide economic incentives in exchange for meeting an environmental goal. They have been relatively successful in developed countries but have had limited applications or success in developing contexts. This report identifies the agents and activities that drive deforestation in the Brazilian Amazon and determines which of these may be suitable for PES applications. It also provides a framework for analyzing current PES schemes in order to draw out best practices and lessons learned which may be applied to future program. PES schemes do have a role to play as one of the tools used in addressing deforestation in the Amazon. They can be cheaper than indirect approaches but do face some challenges in evaluation. Future PES applications may benefit from the lessons learned in the early applications of these programs.

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Chapter 1: Introduction

Brazil has committed to reducing deforestation in the Amazon and has identified targets to meet by 2020. One of the criticisms that Brazil has faced in its efforts to reduce deforestation is a lack of a national strategy that it can apply in the region. In practice, a variety of approaches are used with varying success throughout the region to support environmental goals. Some initiatives aim for conservation and others for reforestation. This report will analyze whether payments for ecosystem services specifically are a viable option for supporting conservation and social-economic goals in the Amazon.

Payments for ecosystem services (PES) are schemes that provide economic incentives to individuals or groups in exchange for an environmental goal such as conservation. They have been used successfully in developed countries such as the United States where they target conservation of vulnerable habitats on private pasture and farm land. Costa Rica implemented one of the earliest examples of PES schemes in Latin America and used these to support sustainable logging and conservation practices in the forest. PES schemes have subsequently been applied in Mexico and more recently in the Amazon. Identifying some of the lessons learned from these early applications can provide some guidance to future applications of these programs.

This report connects the components and objectives of PES schemes with the realities of which agents and activities driving deforestation the Amazon. It questions whether current applications are appropriately structured and targeting the right groups which manly only have a minimal impact on the environment. Future iterations of PES schemes might be successful with more targeted applications in order to maximize the potential to achieve environmental outcomes. PES schemes can also move from local and limited applications to become a part of larger strategies to address deforestation under

the auspices of programs like the United Nation's program on reducing emissions from deforestation and degradation in developing countries (REDD+). Recent changes to the REDD+ program have made it possible to include PES schemes as one of the tools to address deforestation. PES schemes that are used within the REDD+ program stand to benefit from the expertise and resources that the program brings.

In order to determine how best to apply PES schemes in the Amazon moving forward, this report analyses deforestation drivers in the region. A literature review was conducted with the objective of identifying the principle agents and activities that drive deforestation in the Brazilian Amazon. There was both consensus and debate about the role that different agents and activities play on deforestation historically and currently, and their potential role in the future. A review of PES schemes was also conducted in order to identify the key components, best practices, and challenges of PES schemes. This framework was then applied to analyze current applications of PES schemes in the Amazon in order to determine which components have been effective and which may require adjustments for future applications in the region. Lessons learned were identified from the analysis of this material

This report is organized into five chapters that analyze this topic. Chapter two provides a history and background on the agents and activities that contribute to deforestation in the Amazon. It identifies which groups and activities play a larger role in deforestation and which may be suitable targets for PES schemes. Chapter three outlines the components and challenges in the structures of PES schemes. Chapter four analyzes current PES scheme applications in the Brazilian Amazon and the possibility of incorporating these into broader REDD+ frameworks. Chapter five draws out the lessons learned from recent applications and best practices in order to determine some possible next steps in the field.

Chapter 2: Human impact in the Brazilian Amazon

The Amazon rainforest has critical economic and environmental implications not only for Brazil but for the health of the entire planet. Often referred to as the “lungs of the planet” because of the leading role it plays in carbon storage and climate regulation, the Amazon rainforest is threatened by rapid land cover change (Ferreira et. al., 2007). The Amazon rainforest incorporates an area of over five million square kilometers or approximately 40 percent of Brazil’s total territory and also accounts for about 60 percent of the world’s remaining tropical rainforests (Campari, 2005; Laurance et. al, 2002). The region discussed in this chapter is limited to the Legal Amazon, which is a political definition that includes states with more savannah land cover than forest.

Human impact can be felt throughout the forest in the form of deforestation. The 1990s were a significant period of high deforestation which average rates of about 2 million square hectares a year (Laurance et. al, 2002). Before analyzing payments for ecosystem services (PES) as tools that support conservation in the Amazon, it is important to understand the agents and activities that perpetuate deforestation in the region. An understanding of the forces that drive deforestation can help PES proponents determine the most impactful applications of these tools within the Brazilian Amazon.

DEFORESTATION IN THE BRAZILIAN AMAZON

Brazil has faced increasing pressure from other nations and international organizations to address deforestation in the Amazon region over the years. In response, the Brazilian government has committed to reducing deforestation to historically low levels by 2020.

Measuring deforestation levels

There are few different definitions to deforestation which can lead to different ways of measuring it. Generally, deforestation is used to discuss different types of forest loss, however problems arise as different agencies which record data on deforestation use different definitions and thus collect different rates (Cleuren, 2001). The *Instituto Nacional de Pesquisas Espaciais* (National Institute of Space Research or INPE) defines deforestation as the “conversion of areas of primary forest by human activities aiming at the development of agriculture/cattle ranching activities, as detected by orbiting satellites” (Margulis, 2004). The deforestation data for this project comes entirely from Project PRODES, an initiative of INPE, therefore this is the only definition this report will address. It should be noted, however, that INPE has been criticized for possibly overestimating the extent of deforestation (Margulis, 2004).

The 1990s saw high rates of deforestation in the region with the highest absolute rate of deforestation during this period (Laurance et al., 2002). Concern over deforestation began in the 1980s and policies began to directly address deforestation in 1988 (Andersen et al., 2002). The Brundtland Report also put conservation into the forefront by linking poverty and conservation (Wunder, 2005). Environmental policies that address both components have been promoted since.

Deforestation is most prominent in what is known as the arc of deforestation, which is in the southeastern part of the Legal Amazon (Durieux, 2003). Here, 221 municipalities, covering over 3 million square kilometers are responsible for about 92 percent of all deforestation (Ferreira et al., 2007).

Impact of deforestation

The impacts of deforestation are multidimensional. The Amazon plays a significant role in climate regulation and land changes could have large-scale detrimental

effects on climate (Durieux et al, 2003). Additional benefits that are lost with deforestation include: water and nutrient recycling, fire control, erosion control and watershed protection, carbon storage, and biodiversity (Andersen, et. al, 2002). Deforestation can also be a cyclical process, especially in terms of migration. Rural settlers push the frontier further in search of land after exhausting already poor-quality land that will only yield a couple of years of crops (Bilsborrow, 2002).

KEY AGENTS OF DEFORESTATION IN THE AMAZON

The population of the Amazon today is comprised of the indigenous groups who have called the forest home for centuries, descendants of European pioneers in search of economic wealth in the forest, migrants from colonization schemes organized by the Brazilian government, small and large landowners, and rural migrants who continue to push the frontier further and further. Some of these groups have played a larger role in driving deforestation than others. It is important to understand the role that these groups play in deforestation in order to determine what applications of PES schemes might be more effective than others.

Indigenous groups

Indigenous groups have long occupied the Amazon and continue to do so to this day. The Amazon indigenous population represents a critical constituency for managing the rainforest. Today, indigenous groups represent only about one percent of the Amazon's population and live in 400 recognized areas that cover approximately 1 million square kilometers or about 21 percent of the Brazilian Amazon region (Schwartzman & Zimmerman, 2005). Over time, indigenous groups have gained greater protections from the governments through recognition of indigenous territories within the Amazon. In the 1988 Brazilian Constitution, instituted after the military dictatorship, indigenous groups

received land rights, although mineral and water rights continued to belong to the government (Schwartzman & Zimmerman, 2005).

Indigenous groups have occupied the Amazon for thousands of years. People reached the upper Amazon at approximately 4,000 B.P. and then created small settlements in the region at 3,000 B.P. (Moran, 1981). Over time, indigenous groups have used the land in different ways. Hunting and gathering, fishing, and agriculture have been employed throughout the forest (Moran, 1981). There is some debate about whether the impact of indigenous groups has been negligible prior to European contact however. Evidence of charcoal content throughout Amazon soils indicate that slash and burn by indigenous groups was more widespread than once believed (Deneven, 1992). This contends the ideas that indigenous groups have always been the best stewards of the Amazon rainforest, ideas that are sometimes promoted within the environmental movement. The population was transformed by European contact and settlement and at only one percent of the Amazon's population today, indigenous groups are not driving a lot of the changes in the forest. Indigenous groups before and after European contact utilized slash and burn. These practices along with long fallow periods can be sustainable within limits (Moran, 1981). The economic benefits of logging and extractive activities change the appeal of practicing sustainable agricultural for indigenous communities, however.

The Kayapó and Xingu indigenous communities provide two examples of resource management in the Brazilian Amazon. The Kayapó, found mostly in Pará and Mato Grosso, have used their land rights to grant controlled logging and mining in exchange for payments which are sometimes invested in the protection of the land (Schwartzman & Zimmerman, 2005). The Xingu have also used their land rights for economic gain but to a different extent. Instead of allowing logging and extractive

activities, the Xingu have partnered with two groups and seen economic benefits from creating a research station and ecological reserve and to pursue sustainable harvesting of organic honey (Schwartzman & Zimmerman, 2005).

Indigenous groups do not represent a large portion of the population in the Amazon but economic incentives could be used as a tool to encourage sustainable management of land within indigenous territories.

Traditional populations

European contact in the Brazilian Amazon brought population changes to the region. The individuals who settled in the Amazon after contact and prior to the Brazilian government's colonization schemes will be referred to as traditional populations of the forest. This group's primary impact on the forest is in the form of extractive activities.

There were early European efforts to increase settlement in the Amazon region that did not prove fruitful. During the colonial period, the Portuguese found success in Northern Brazil with plantation agriculture but failed in their attempt to bring plantations to the Amazon rainforest (Moran, 1981). The limited success of plantations meant that larger populations could not be supported in the Amazon. Because plantation practices did not spread during this period, deforestation was low and mostly concentrated along waterways (Andersen et al., 2002).

Where the Portuguese failed to create a plantation economy, the Jesuits attempted to find success through missions in the region. These missions employed indigenous labor and focused mostly on subsistence and export crops such as manioc, rice, beans, fruit trees, tobacco, and sugar cane (Moran, 1981). The key is that the focus was on subsistence and not surplus. The mission system ended under Portuguese regent Pombal

and during this period deforestation was also a minimum because the missions had to pay tithes which discouraged surpluses and the clearing of additional land (Moran, 1981).

Descendants of these early European settlements have become known as the traditional population of the Amazon, which is distinct from colonists. One distinction of the group is that traditional populations have diverse land uses that include extractive activities and which all contribute less to deforestation than other groups (Caviglia-Harris & Sills, 2005). Although this group may partake in typically subsistence activities, there is a history exploitation of flora and fauna from this group. During the colonial period, this group over-extracted fruits, nuts, tree spices such as clove, and animals for their fat, oil, and eggs (Moran, 1981).

Both indigenous groups and traditional populations have conventionally been thought of as having minimal impact on the Amazon forest. Evidence shows that this has not always been the case. Although extraction has historically, exploited forest resources, today it does not have as large of an impact as other economic activities in the Amazon. PES targeting these groups may not be very effective in achieving added value to environmental goals if the groups are generally not driving activities that should be reduced.

Colonists & colonization schemes

Colonization schemes throughout Brazilian history have attempted to populate the vast land of the Amazon region with limited success. The colonization schemes of the colonial period did not dramatically increase population in the forest as did the efforts of the Brazilian government in the 1970s and 1980s. Colonization schemes helped to fuel population growth throughout the Amazonian region. Population grew almost everywhere throughout the region in the 1970s but slowed down in the mid-1980s

(Andersen et al, 2002). A recession in the 1980s slowed overall growth and frontier expansion, although rural GDP continued growing during this time as urban GDP fell (Andersen et al, 2002).

After the failed efforts to establish plantation economies in the Amazon during the colonial period, emigration to the region was encouraged but did not take off until after the government-sponsored colonization schemes of the 1960s. After World War II, there was some government-supported migration into the Amazon where colonists practiced subsistence agriculture and limited extractive activities (Moran, 1981). During the 1960s, there was a renewed focus on the economic development of the interior of Brazil. Operation Amazonia was a set of policies that supported the development and colonization of the Amazon region. It provided access to credit, tax breaks, and land allocations among other incentives for Amazonian development projects (Andersen et al., 2002). Access deeper into the rainforest also became easier during this period. Government-sponsored projects to create new highways into the Amazon pushed the frontier further into the forest (Anderson et al, 2002). Government policy called for the construction of ports and supported investments in agriculture, industry, and livestock (Moran, 1981).

The colonization schemes during this period opened the doors to population and economic growth in the Amazon. Prospective colonists were drawn to the region thanks to an attractive benefits package that included land, financing, stipends to cover the lag until crops appeared, houses, schools, and medical facilities (Moran, 1981). Subsidies to agricultural projects also increased settlements in the region. Cattle ranching, logging, mining, and the construction of dams all played a role in deforestation during this period (Andersen et al, 2002). The concerns over the future of the forest began emerging as a result of the changes brought upon the Amazon by these groups.

Projects that encourage settlement continue into the present. During 2000-2003, *Avança Brasil* was another attempt to further investment into the region. This project involved funding for infrastructure such as roads, bridges, and ports as well as schools, health and sanitation facilities (Andersen et al., 2002). Infrastructure such as roads requires the clearing of forest and in turn facilitates access further and further into the forest. It is no surprise then that continued deforestation is anticipated as a result of these projects (Andersen et al., 2002).

Addressing deforestation from this group seems to be two-fold. First, facilitating population growth in the Amazon requires infrastructure and incentives which serve as draw for more and more colonists. Second, once individuals have settled, their activities may lead to deforestation in the areas they settle in. PES schemes may have a role to play in mitigating the activities that lead to deforestation in some of these regions.

Small and large landowners

Another set of agents key to understanding deforestation in the Amazon are small and large landholders. Large landholders in particular play a more significant role in deforestation compared to small landholders, and there is a relationship between the two in terms of how land is accumulated in the Amazon.

Government-sponsored colonization schemes promoted the growth of a small landholder class in the Amazon. The frontier was cleared by small-landholding families (Carr, 2009). This was a part of a larger movement to alleviate poverty in other parts of Brazil and also promoted outward-looking policies in terms of development. Colonization schemes encouraged small landholding cultivation in order to develop a sort of “bread basket” region in the Amazon that could provide export staples for the rest of the country (Moran, 1981). This was not difficult to implement. Startup costs for small

landholders are low and the labor required is not as intensive as with larger plots of land (Cleuren, 2001). Although each may hold small plots of land, the cumulative effects are larger. In some states such as Pará, a large portion of forest clearings are attributed to small landholders (Walker et al., 2009). These colonization efforts of small landholders set the stage for landholder to accumulate larger and larger plots of land.

Land cleared for small plots and the nature of agriculture feasibility in the Amazon leads to larger land accumulation. Small landholders cultivate land until it no longer provides sustainable yields and then sell it to larger landholders (Campari, 2005). This group has more financial resources to intensify land use and continue to make it productive, or convert it to pasture for cattle. Land concentration is visible throughout the Amazon. In some states, land concentration is 255 percent higher than in other Brazilian states and deforestation is also intense in these areas of concentrated ownership (Ferreira et al., 2007). A great portion of this titled land is used for cattle ranching. Approximately 42 percent of owned land is used for pasture with greater concentrations in Maranhão and Mato Grosso (42 and 43 percent respectively) than in Acre and Amazonas (19 and 16 percent) (Lentini et al., 2003). These large landholders play a significant role in deforestation through the various activities that they engage in such as cattle ranching and large-scale agriculture. They are responsible for a disproportionate share of deforestation in the Amazon (Walker et al., 2009).

While initial deforestation from these agents may have come from clearing for small landholding, the larger concern involves the activities that perpetuate deforestation on a wider scale. One possible strategy to reduce deforestation is to target specific agents. Small landholders have different needs than larger landholders. Initiatives like PES schemes can play a role by focusing on providing economic incentives to promote conservation to a target population.

Rural migrants

Despite the expansive territory, there are concentrations of population throughout the region. Census data shows that over two-thirds of the Amazon's population lives in urban areas and the remainder in rural areas (Garcia et. al., 2007). Although most people in the Amazon live in urban areas, rural settlers are having the largest sustained impact on the forest as they migrate throughout the region in search of cultivatable land. Rural migration, significantly more so than urban migration, correlates strongly with deforestation in the region (Laurance et al., 2002). Figure 1 shows how most of the Amazon is characterized by low-density, rural settlement. Areas with higher population density are in or around state capitals and mostly along the north-west portion of the region. This is important to note because implementation of PEs schemes may have a great impact in rural areas where deforestation is more a risk than in urban areas where population is concentrated.

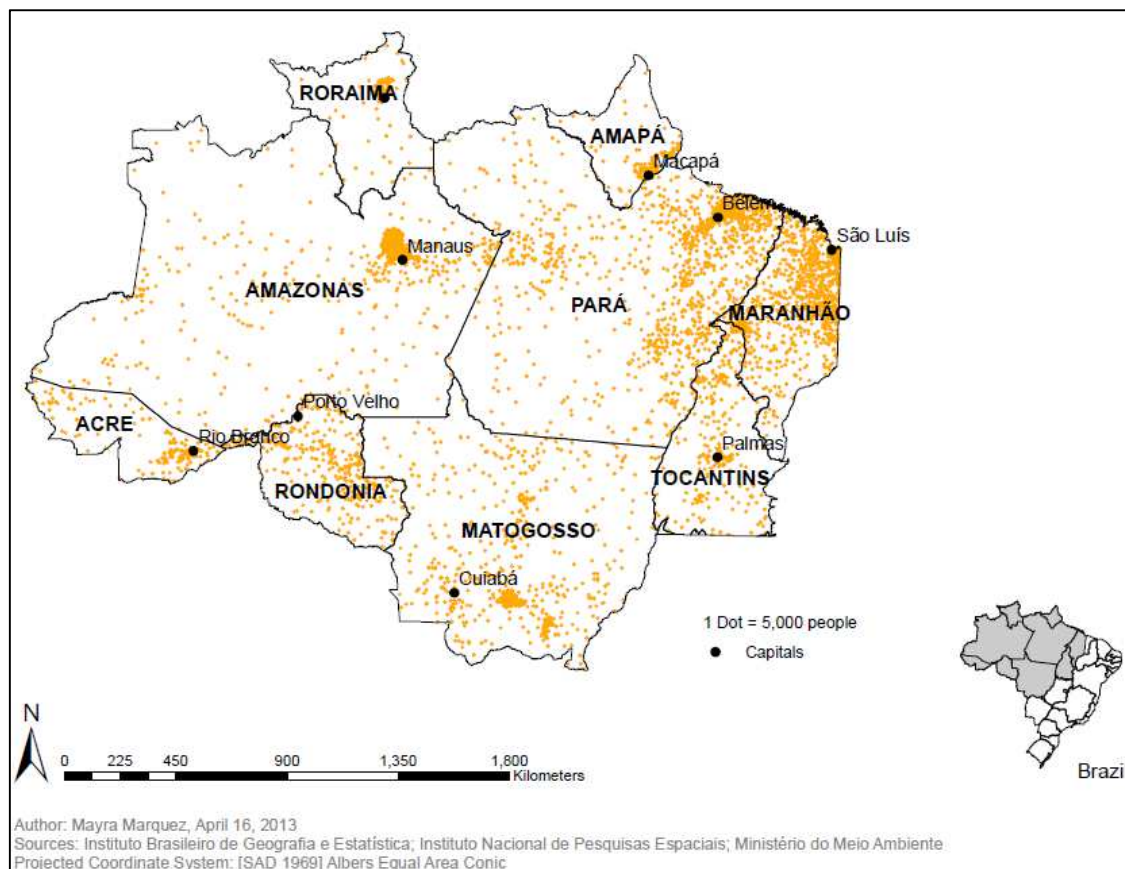


Figure 1: Population density in Amazon states (2010)

These rural settlers that push the frontier of the Amazon are having a greater detrimental impact on the forest than later settlers in that they are more likely to clear significant portions of the land in the places they settle (Laurance et al., 2002). From the 1970s forward, population grew at about five percent a year thanks to the variety of government incentives offered during the colonization schemes (Andersen et al, 2002).

Agents and their interactions with the environment have varying effects on the Amazon forest. Population and infrastructure seem to play a role in driving deforestation in the region. Spatial analysis research has shown that population density, construction of highways, distance to roads, and dry-season severity are contributing toward increasing

deforestation (Laurance et. al, 2002; Pfaff, 1999). This implies that access into the forest facilitates deforestation. The current and future population of the Amazon will continue to contribute to deforestation without restricting further access into the forest, providing incentives for conservation or economic alternatives to clearing the forest. PES schemes can play a role in providing incentives for some of these agents.

KEY ACTIVITIES THAT DRIVE DEFORESTATION IN THE AMAZON

The activities in which agents participate drive different levels of deforestation. The economy of the Amazon forest has oscillated from subsistence to export commodities throughout history. Some activities, such as converting land to pasture for cattle and livestock, play a more significant role than others. PES scheme designs that aim to promote conservation should target the activities that are a larger threat to conservation but that are also economically feasible to compensate through financial incentives.

Subsistence and extractive activities

The history of human impact in the Amazon has mostly been characterized by subsistence agriculture and extractive activities until the recent decades. Indigenous groups practice subsistence agriculture in the missions and prior to European contact. During the colonial period there was more of a focus on extractive activities of forest flora and fauna leading to the local extinction of some animals during this period (Moran, 1981). Extractive activities required a particular kind of colonist resilient to the nature of work and also led to the exploitation of these prospective wealth-seekers. These activities were mostly seasonal, requiring access to financial resources or credit to sustain periods without income (Moran, 1981).

Rubber

The rubber boom created a fervor and excitement of wealth in the Amazon forest. Until vulcanization was invented, rubber use was limited to indigenous use for sport, foot-coverings, erasers, surgical tubing, and waterproof capes (Moran, 1981). Even though rubber traders went deep into the forest there was no additional investments made to sustain livelihoods in the region or any focus on long-term development (Moran, 1981). One of the most notable examples of the rubber boom was in Henry Ford's Fordlandia. In order to compete with rubber prices and secure a strong supply, Ford received 10,000 square kilometers and planted 800,000 rubber trees which were exploited until a fungus outbreak decimated production and he returned the land to the Brazilian government (Moran, 1981).

There was a boom and bust nature to rubber during this period. Fordlandia exemplified both the boom and the bust but this effect also occurred on a smaller scale. Rubber made some prospectors wealthy during a limited period, but it did not sustain development in the region, and did not make a great impact on deforestation (Andersen et al., 2002). Following the bust, the Brazilian economy shifted its focus to another region. Rubber extraction continues today but not at a scale to serve as a driver of deforestation.

Cattle ranching

Cattle ranching is the most important economic activity in the Amazon region. The cattle herds in the Amazon are large and profitable thanks to cheap land (Walker et al, 2009). Land cover data shows that pasture land is the largest portion of land cover in the Amazon. There are approximately 719,000 square kilometers of land cover identified

as accumulated deforestation in 2008 and pasture land represented approximately 83 percent of this area¹ (EMBRAPA-INPE, 2011).

Government policies and new laws allowed for the expansion of cattle ranching. Government provided companies with subsidies and tax exemptions for agriculture and livestock investments in the Amazon (Walker et al., 2009). One of the principle reasons why cattle ranching has succeeded in the region is because of access to cheap land which in turn has helped to turn cattle ranching from a regional activity to one that exports to other parts of the country (Walker et al, 2009). Deforestation is a concern when it comes to cattle ranching because it is an extensive process that requires clearing of large expanses of land (Moran, 1981). There are approximately 70 million animals in the Amazon which represent about one-third of all national livestock (Walker et al, 2009). The concentration of cattle ranching in the Amazon has formed a type of “cattle arc” frontier (Walker et al., 2009).

The economics of cattle ranching involves large landholders and a significant amount of financial resources. The scale of PES schemes may be too small to serve as viable incentives to change the behaviors of agents that participate in this activity.

Agriculture

Another major activity responsible for land clearing in the Amazon is agriculture. Soy farming in particular generates great revenue in the region and means that Brazil supplies 27 percent of the world’s total soy harvest (Walker et al, 2009). Government policies of infrastructure investments and genetic modifications of plants, make them more suitable for conditions in the Amazon (Walker et al, 2009). Demand is expected to continue growing from markets in China as well as from demand to use soy for livestock

¹ Calculated by adding percentages of land cover for clear pasture, secondary growth, shrub pasture, regeneration with pasture, and pasture with exposed soils from EMBRAPA-INPE 2011 report.

feed (Walker et al., 2009). Like with cattle, there is also a “soy frontier” with a concentration of farming in the Center South states of Mato Grosso, Rondônia, Tocantins, and Pará (Walker et al., 2009). Agriculture can contribute to increasing deforestation levels in the Amazon. Soy bean farming for example, provides further incentives to build additional highways which serve as a catalyst for deforestation throughout the forest (Fearnside, 2008).

Agriculture provides a large economic benefit to the region but its impact on land cover is not as significant as that of cattle ranching. According to satellite data gathered from 2008, annual crops constitute only 4.9 percent of land cover (EMBRAPA-INPE, 2011). Incentives that make it easier to profit from vast landholdings Access to cheap vast land has helped fuel the soy frontier (Walker et al., 2009). Incentives such as PES schemes may not be large enough to compensate the highly profitable agricultural or cattle-ranching activities but they may be helpful in decelerating the accumulation of larger and larger tracts of land by agents participating in these activities.

Logging

Logging is another driver of deforestation but it has historically not been a very significant one. Government regulation and incentives have a potential role to play in keeping this activity from becoming a contributing factor to deforestation.

The Amazon is vast and provides a setting for both legal and illegal logging activity. The abundance of land and difficulty associated with enforcement and monitoring of this activity allows for logging throughout the region and there is a concern that it is spreading (Barreto et al., 1997). Illegal logging is a real problem and indigenous lands can be particularly vulnerable to this activity (Moran, 1981). Access to cheap and vast expanses of land contributes to the ease of logging. Some loggers entice farmers

with payments for the right to cut trees on their land and the farmers in turn are also motivated by the potential infrastructure loggers bring such as roads (Andersen et al., 2002). Roads in turn perpetuate deforestation by providing easier access into the forest.

Even though logging is not a significant driver of deforestation, there is potential to limit its scale even further. Research indicates that planned forest management can be more productive and profitable and less wasteful than unplanned logging, but it is also more costly (Barreto et al., 1997). Providing financial incentives to encourage planned logging may be a niche that PES schemes can fill. Financial incentives could be used to encourage planned timber harvest in designated regions in order to keep illicit logging activity from spreading to other regions. There seems to be some movement toward encouraging managed logging in that the government has moved in recent years to create managed timber regions (Andersen et al., 2002). Regulation and incentives should be explored further as mechanisms to limit future threats of logging.

CONCLUSION

The Brazilian government has made a commitment to curb deforestation. By 2020, the government has pledged to reduce deforestation to 20 percent of the rate from 1996-2005 (Nepstad et. al, 2009). Indeed, recent reports from Brazil seem to indicate that progress is being made. INPE reports that deforestation rates have been declining and 2012 had the lowest rates in 24 years (BBC News, 2012). For deforestation to continue to decline, policies should aim to address the multiple factors driving the process in the region.

There are multiple agents and activities that drive deforestation throughout the region. Analyzing the factors can help to determine where PES schemes may or may not be suitable for mitigating deforestation. Some agents and activities play a more

significant role than others in deforestation. Traditional populations, indigenous groups are not contributing as much to the deforestation landscape as large landowners clearing land for cattle pastures. Identifying which groups are feasible targets and which activities can be regulated via financial incentives will be key to determining the success of PES schemes in the Brazilian Amazon. The next chapter will outline the key elements of payments for ecosystem services and highlight best practices that may be applicable to this region.

Chapter 3: Payments for Ecosystem Services: *A response to conservation*

Payments for ecosystem services (PES) are an innovative response to environmental conservation around the world. In the Brazilian Amazon, they represent an opportunity to complement existing environmental efforts to protect the forest. They are typically a direct approach to address specific kinds of environmental impact. PES schemes can also support sustainable development and provide poor, rural communities with additional income. While primarily found in developed countries, PES schemes represent an opportunity for developing countries like Brazil to complement existing conservation efforts.

Definition

A typical PES scheme includes four key features: a user who pays for the ecosystem services (Wunder, 2005); a provider able to safeguard the ecosystem services directly (Wunder et al., 2008); an agreed-upon payment (Ferraro & Kiss, 2002); and an environmental goal or a unit of the environment preserved in exchange for payment (Ferraro & Simpson, 2002). The users can vary in terms of income levels and occupations. Providers can come from the private or public sector or some combination of both. Examples of ecosystem services that are typically included in negotiation agreements include biodiversity, carbon storage, watershed protection, and aesthetics (Wunder, 2005).

Essential to PES schemes are the commodification of natural resources and qualifying ecosystem services such as biodiversity and carbon storage as economic goods. The global scarcity of these types of ecosystem services makes them suitable for trading on the market (Wunder, 2005). Additionally, the economic goods in the form of

ecosystem services found in the Amazon are finite and irreplaceable. Valuation can be difficult to pinpoint as many different ecosystem services can be included in this calculation. One approach is to calculate carbon stocks. There are estimates that the Amazon stores about 100 billion tons of carbon, which is threatened by activities such as forest clearing for logging and livestock (Fearnside, 2008). Another approach is to take the value of direct resources like timber, indirect values (functions of the forest), the expected value of benefits from the forest, and the existence value (Pearce, 2002). Practical applications of these theoretical approaches are a challenge as it can be very difficult and subjective to value different ecosystem components.

Although Brazil has seen increased economic power, the Amazon region in particular remains relatively poor compared to the rest of the nation and a position to argue for charging for the ecosystem services it provides. Ecosystems like the Amazon provide vital global benefits, which are typically concentrated in mostly low-income countries that are not well-positioned to provide them for free (Ferarro & Simpson, 2002). Brazil's GDP per capita in 2010 was US\$10,993 (United Nations, 2013) and poverty has decreased from 30.8 percent of the population in 2005 to 21.4 percent in 2009 (World Bank, 2009). Amazonian states contribute about 13.5 percent to national GDP (IBGE, 2009). The economic output across the Amazon state varies greatly. For example, in 2010 the GDP per capita in Maranhão was US\$4,062 and \$11,585 in Mato Grosso² (IBGE, 2010). Understanding these disparities may help identify areas that may benefit the most from the potential poverty alleviation aspects of PES schemes. PES payments give individuals the economic incentive to protect natural resources and have

² Calculated GDP per capita from IBGE Estados and converting to US dollars using December 2010 rate at www.x-rates.com

the potential to supplement income levels in the region that could stand to benefit from increasing incomes.

While there are several options to protect and conserve environmental resources, PES schemes are a more direct solution to addressing conservation. One alternative is an indirect conservation approach, such as eco-tourism, which has been criticized for having limited success and challenges to implementation (Ferraro & Simpson, 2002). Direct approaches however hold more weight in terms of value. Would-be users or donors are more likely to fund direct efforts like PES because they are a more cost-effective approach (Ferraro & Simpson, 2002). The process of negotiation of payments helps to bring into alignment the potentially opposing interests of users and providers. PES schemes recognize that sellers or providers have options for land use therefore payments must incorporate the trade-offs and conflicting interests between users and providers (Wunder, 2005). Through negotiation, users and providers attempt to achieve an optimal payment and reduce transaction costs. High transaction costs involved when negotiating with many providers, however, could pose a big challenge for PES schemes (Wunder, 2005). Active participation in the process of bargaining may also build more ownership over goals.

There are a few inherent assumptions or conditions that enable PES schemes. First, there is an assumption that there are willing buyers and sellers for these ecosystem services and payments (Ferraro & Kiss, 2002). One of the key features of PES schemes is that they are voluntary and thus participation is sought through economic incentive. Another assumption is that ecosystem providers will automatically engage in eco-friendly activities given the payments (Ferraro & Simpson, 2002). While payments are given on the condition that particular environmental objectives are met, monitoring is still a necessary component of managing PES schemes. Given the direct nature of these

payments, there is an incentive, however, for the user to monitor and ensure compliance. Additionally, providers have competing choices over land use (Wunder, 2005). This choice enables users to provide a comparable or more attractive payment in return for conserving the resource based on the opportunity costs of shifting land use activities. PES schemes use active participation and give more control to ecosystem providers to negotiate payments from users. Active negotiation can build greater ownership of PES goals and this process can potentially lay the foundation for greater success than indirect programs with less ownership over goals.

Examples of applications

Payments for ecosystem services are more prevalent in developed countries than they are in the developing world. The United States Department of Agriculture's (USDA) Conservation Reserve Program (CRP) is a prominent example of a PES scheme in the U.S. The program is a voluntary initiative funded by the Farm Service Agency (user), that pays farmers (ecosystem providers) rental payments and technical assistance (transaction) enrolled in the program to "plant long-term, resource conserving covers to improve quality of water, control soil erosion, and develop wildlife habitat" (ecosystem service) (USDA—Fact Sheet, 2013). This direct approach is voluntary for participants, payments are structured based on productivity of the land, lands are prioritized by environmental services offered, and contract enrollment ranges from 10 to 15 years (USDA—Fact Sheet, 2013). The program has been in effect since 1985 and serves as an added support for farmers in years of crop failure (The Silver Lining, 2012) Note that this program is administered by the USDA and not an environment-focused agency like the Environmental Protection Agency. This seems to acknowledge the value of protecting and preserving environmentally sensitive land through management by an agency

charged with “expand[ing] economic opportunity through innovation” (USDA website, 2013) rather than one like the EPA which seems to play an enforcement and compliance role in environmental protection. USDA’s management positions CRP primarily as an economic initiative and secondarily as an environmental one.

PES schemes are not entirely unknown in Brazil but are mostly in the early stages of development. The Inter-American Development Bank (IDB) is currently supporting PES initiatives in the Atlantic Forest region of Brazil. The project, currently in the early stages, will be supported by approximately \$26.7 million in IDB financing. One of the stated outputs is to create a private conservation unit and pilot a PES scheme in the states of Sao Paulo, Minas Gerais, and Rio de Janeiro (IDB, 2012).

There are a few examples of PES schemes in other Latin American countries including Costa Rica and Mexico. In Costa Rica, a program pays users for environmentally friendly practices including sustainable logging and conservation (Pagiola et al., 2005). The Costa Rican example is one of the earliest implementations of PES schemes in Latin America and it is not without criticism. Perhaps due to its early development and need for adjustments, the payments under this scheme have been criticized for being too high (Ferraro & Simpson, 2002). Revisiting payment levels at specified periods might help to overcome inflated payment prices over time. Flexibility to PES schemes seems to be necessary as payment levels and scale may need to be revisited throughout a program’s horizon.

Key components of PES schemes

The four key components of PES schemes are users, providers, a payment, and an agreed-upon environmental goal. Negotiation is used align different interests and may build ownership over goals. The interests of the user and provider differ in terms of how

much each is willing to pay or how they value the environmental goal. The provider wants to get a larger payment while the user wants to pay less. Negotiation helps the parties to reach a middle point.

Users

The users, donors, or buyers in a PES scheme usually benefit directly or indirectly from the ecosystem services. Users can be private or public entities such as government agencies, civil society, or even companies. There are benefits and risks involved when the government acts as the primary user. Government can yield its power and funding to implement larger scale projects but programs where government acts as the user may be vulnerable to changes in policy or officials (Bond et al., 2009). PES systems are likely to be more effective when the users are directly involved in the financing of these schemes. Creating intermediaries or additional layers between the users and providers may alter incentives. When government acts as an intermediary, the direct users may have less incentive to monitor compliance with program goals (Wunder et al., 2008). The effectiveness and reputation of governments may vary across regions and participation may either bring credibility to a project or suspicion. Government can also play an enforcement and management role but this role may be limited depending on the strength of government institutions.

There are limits to how many users can be included in PES schemes and there is a potential for free-riding with a higher number of participants. For example, not all users who enjoy the benefits of clean air around the world would be willing to pay for it and make payments to PES schemes supporting forest conservation. Some however, are willing to pay for the goods that many enjoy even though free-riding may be an issue. If the number of users is very high, government financing through required fees, may help

to eliminate or reduce free-riding (Wunder et al., 2008). The governments of Mexico, China, and Costa Rica collect taxes in order to pay for PES schemes within their countries (Wunder, 2005). Mandating fees might be a challenge however if there is a potential issue in whether the users have the ability to pay or not. In the U.S., the USDA and Farm Services Agency acts as the user or buyer in the sense that they provide payments to farmers in exchange for conservation goals under the Conservation Reserve Program.

Providers

The providers are typically those individuals or communities benefitting directly from the ecosystem services through their daily activity and interaction. Under PES schemes, they are charged with guarding or conserving the agreed-upon ecosystem services in exchange for payments.

Although PES schemes are sometimes seen as poverty alleviation strategies, the poorest of the poor are not necessarily those that stand to benefit the most from these initiatives. Indeed PES schemes tend to favor those with access to capital especially in terms of tenure rights (Wunder, 2005). PES schemes do however hold the potential for poverty reduction and could help increase the income levels of regions like the Brazilian Amazon. Arguments supporting PES state that they support development by increasing cash flows and giving providers access to additional sources of income (Ferraro & Kiss, 2002). Not all providers of ecosystem services, however, are in fact poor. Residents in Guatemalan PES scheme target areas tend to be poor while Costa Rican participants are wealthier (Pagiola et al., 2005). If poverty alleviation is an intended goal of a PES scheme, the design phase must assess the socioeconomic status of the targeted population alongside valuing the ecosystem services.

There is an assumption that the payments themselves reduce poverty by simply increasing income but this is limited by how many people, and especially whether the poor, are able to participate (Pagiola et al., 2005). The poor, however, might not be the best-case providers for PES schemes in all circumstances. They may not constitute enough of a threat to the targeted ecosystem to serve as an ideal provider for these types of transactions (Wunder, 2005). There is no one-size fits all strategy to designing PES schemes and development needs to consider impacts on the population in addition to the environment.

Payment

PES schemes unlike other conservation approaches incorporate an economic incentive or direct payment to the providers. According to Wunder the payment can be negotiated depending on the area targeted for conservation, products from the area, whether the goal is to restrict public or private use or whether the PES initiative aims to increase assets in the community (2005).

One of the concerns about issuing payments to providers is in determining whether payments should be made to those without appropriate land titles. Payments could potentially attract land squatters in the Brazilian Amazon. Brazilian law allows squatters to obtain formal titles after occupying land for ten years in order to redistribute historically large landholdings (Andersen et al., 2002). PES scheme designs will need to determine whether payment is contingent not just on conservation goals but also on property rights. Whether to enforce property rights or not is a challenge for PES implementation (Ferraro & Simpson, 2002).

A component of appropriate payment is determining which conservation activities are within an ideal range for PES schemes and what payment levels are appropriate to

induce voluntary participation and compliance with environmental goals. In determining which activities are most appropriate for compensation and participation in PES schemes, it is necessary to assess the value of different land-use options. The ideal activities to finance via PES schemes are not those with the highest or lowest returns, but rather those in between and that are marginally more profitable (Wunder, 2005). The price point for payments should be more than the alternative, and negative, land-use option for the provider but less than the value of the user's benefit so that there is incentive to pay for it (Pagiola et al., 2005). The level of payments for ecosystem services relies on the opportunity costs of land-use. It may be more efficient to adjust payments according to varying opportunity costs in different locations throughout one region but this could potentially pose implementation challenges (Wunder, 2005).

Implementing PES schemes across large areas may make it difficult to calculate multiple opportunity costs. Although there are many factors to consider in deciding upon an appropriate payment level, one of the benefits to PES schemes is that a full economic valuation is not necessary as negotiation of payments between providers and users makes it easier to determine payment levels (Wunder, 2005). Incorporating the participation of providers throughout the design and implementation of PES may help to ensure compliance with environmental objectives.

Environmental goal

Enforcement and monitoring is necessary to ensuring compliance with a variety of possible environmental objectives. There are four main types of environmental objectives which PES schemes attempt to achieve: carbon sequestration and storage, biodiversity protection, watershed protection, landscape aesthetic (Wunder, 2005). Additionally, PES schemes can be tailored in size and scope. They can be designed to

protect large ecosystems or specific flora and fauna (Ferraro & Kiss, 2002). Monitoring costs may increase with size and application of projects.

Sustainable harvesting of forest products may also be included as a component of PES schemes. One of the challenges with including activities such as sustainable rubber-tapping and nut-harvesting are that these activities are not as valuable as other, more harmful activities in the forest (Fearnside, 2008). PES schemes could be used in these instances to encourage sustainable practices so long as they provide a higher value to providers than the alternative of cutting down the forest. PES schemes may be more effective if they allow these activities and supplement their value instead of completely prohibiting forest-dwellers from this source of income (Fearnside, 2008). Supplementing the value of these activities may allow PES schemes to limit the amount of extractive resources sold without necessarily changing the income earned from these activities. There is, however, a risk that illegal activity may continue after PES scheme implementation.

Implementation and Management

There are some design considerations that need to be taken into account when implementing and managing PES schemes. Successful implementation may need to incorporate not just current threats to environmental landscapes but also anticipated threats. PES schemes might be a good fit for locations that are threatened but have not yet reached an environmental tipping point (Wunder, 2005). These areas may be able to serve as barriers to keep deforestation from advancing further. Instead of concentrating PES schemes on the arc of deforestation for example, a better application might be to locate them inside the arc to keep deforestation from advancing into the interior.

Implementation costs are also an important component of design. The costs of implementation may determine whether the poorest in a community, and thus those that may benefit the most may be able to participate in a PES scheme or not. PES schemes may be easier for large landowners to participate in that implementation and management is easier when a scheme covers large pieces of land with few owners versus smaller pieces of land and many owners (Pagiola et al., 2004). Promoting systems that encourage community management and enforcement may help to overcome the challenges of working with many providers in a single PES scheme. Additionally, implementing and managing PES schemes may be particularly difficult in remote areas (Wunder, 2005). Community management might help to overcome the challenges of working in remote areas and PES schemes should consider including incentives for community monitoring and compliance. This could be especially applicable to areas like the Amazon.

Sustainability of PES schemes poses another management challenge. An ideal PES scheme would be able to sustain itself with users continuously paying providers for the conservation goal, ideally in perpetuity (Ferraro & Kiss, 2002). Using payment structures such as taxes or user fees may help to sustain PES program payments in the long-term but may be vulnerable to political landscape changes. Because PES programs are voluntary in nature, there may not be an enforced requirement to continue payments in perpetuity.

Evaluation

PES schemes are more efficient than other conservation efforts because they take a direct approach. Incorporating the input of users and providers in the development, implementation, and management of PES schemes creates ownership and a built-in incentive for evaluation.

There are environmental and socio-economic outcomes to PES schemes that should be evaluated. One of the advantages of PES schemes is that they have built-in feedback systems to ensure compliance. The users or donors have an incentive to monitor compliance with environmental goals, request changes or withhold payments if compliance does not occur (Pagiola et al., 2005). Satellite imaging has been used to document changes in the forest. On-the-ground data gathering may also be helpful. Google promotes community forest monitoring through the use of Android-powered phones with cameras and GPS, and open source software like the Open Data Kit (Birch, 2011). As technologies like smart phones become cheaper over time and more accessible in developing countries, they may help to increase the ease and cost of monitoring and compliance. The Open Data Kit available at opendatakit.org is a tool that allows PES providers to become active participants in evaluation of program outcomes. The kit provides free access to forms and data-gathering and organization tools via mobile technology and is already used by indigenous groups in the Amazon like the Surui people who document illegal logging on their land (Open Data Kit website, 2013; Anokwa, 2011).

Measuring the amount of avoided deforestation is a major challenge for PES schemes. In order to evaluate these types of programs, it is important to establish the counter-factual, or what would have happened without the intervention, however, traditional evaluation concepts like control groups and randomization approaches are difficult to implement in nature meaning that success may simply be defined as not doing any harm (Caplow et al., 2011). Avoided deforestation measures are still fairly new and thus PES schemes may face challenges in proving their effectiveness as these methods continue to evolve.

Another challenge of implementing successful PES schemes is the issue of leakage. Leakage occurs when one area is set aside for conservation efforts and then deforestation activity shifts to a neighboring area instead (Wunder, 2005). The challenge for PES schemes in preventing or controlling leakages from occurring. This phenomenon could potentially go unreported if evaluation of PES schemes does not incorporate the effects of the program on surrounding regions. PES evaluations should address these concerns from the onset.

The second component of evaluation would be to look at how much better off providers are after receiving payments through PES schemes. Poverty alleviation is another potential benefit that PES schemes can support. Specifically, poverty relief efforts in rural settings have a potentially larger impact than in urban settings (Fearnside, 2003). This could be conducted through a qualitative analysis of livelihood improvement as well as quantitative measures of household earnings and expenses. Evidence of some PES schemes shows that payments can reduce the amount of people below the poverty line, create employment in the short-run, and help communities build assets in the long run (Wunder, 2005). In the long-run however, conservation goals may reduce employment in the region because keeping the forest in tact is less labor-intensive than activities that alter the forest (Pagiola et al., 2005).

Additional measures of success could look at the community benefits that PES schemes may provide. One unintended benefit to PES schemes may be that they may improve community structures. The process of negotiating contracts and transaction costs in designing PES schemes may increase the social capital of communities (Pagiola et al., 2005). These efforts could support the development of leadership in the community and promote management of the programs within the community itself instead of relying on outside organizations to maintain them. Making concerted efforts to increase social

capital as a component of PES schemes may support overall program success (Wunder, 2005).

Challenges to implementation and success of PES schemes

Although PES schemes hold a lot of potential for supporting conservation and socio-economic goals, there are a few challenges that have kept them from wide implementation. Evaluation is critical to measuring the success of PES schemes but it is not always easy. PES schemes require the capacity to monitor compliance with the stated environmental goals and this can come at a cost depending on the number and types of users and providers (Ferraro & Kiss, 2002). Many users and providers make it more difficult to implement, manage, and evaluate PES schemes. At the same time, incorporating many users into schemes may help to ensure payments to providers.

Challenges arise when intermediaries or third parties act between users and providers. These actors do not have the incentive to provide monitoring and compliance with environmental goals and thus the program may be overall less effective (Wunder et al., 2008). Moreover, there is a question of how effective these schemes may be when institutional structures are weak. This is a valid question to ask if PES schemes are to be implemented in regions not known to have strong enforcement and compliance institutions. For example, there is a risk that the intended protected resources may be harvested illegally which may then require compensation to stop the illegal activity (Wunder, 2005). This raises an ethical question of whether funds should support illegal actions and whether users would willingly provide payments to these groups.

Another challenge is to determine whether to compensate providers that do not have formal land titles as may be the case in many marginalized communities. PES payments could support moving the poorest members of a community out of poverty but

these groups typically do not have land titles. Alternatively, compensating land squatters may increase the incentive for outsiders to move to protected regions (Wunder, 2005). Efforts can be taken to mitigate the impact of squatters in regions like the Amazon. Creating formal land reserves may help to reduce the draw and impact of squatters, act as a barrier to stop deforestation, and support the water-cycle functions of the forest (Fearnside, 2008).

Additional challenges include the fact that communities may have limited experience negotiating contracts and there may be limited opportunities for non-agricultural investment or employment (Ferraro & Kiss, 2002). Creating and evaluating mechanisms to support community leadership development and supplementing income for sustainable non-agricultural activities like rubber-tapping and nut harvesting, when available, may help to overcome these challenges. The success of PES payments also depends on whether the payments are high enough for providers to forgo alternative, and environmentally harmful, land-use activities in favor of conservation approaches and whether enough providers are included in PES schemes to constitute a critical mass to alter the course of environmental degradation in a region (Wunder, 2005). Achieving a critical mass is important to the success of PES schemes. It may not be possible, however, to compensate all potential providers, depending on the structures of payments and programs (Wunder, 2005).

Another set of challenges for PES schemes is that they may alter the environment where they are implemented in unintended ways. PES schemes may call for shifts away from agriculture in order to preserve the forest. One potential consequence of this move is an increase in food prices as supply decreases (Pagiola et al., 2005). Land prices and holdings could also be affected by implementing PES schemes. PES schemes may increase the value of the land, shifting ownership to more powerful groups and away

from the land and resource poor, who stand to benefit the most from such schemes (Pagiola et al., 2004). The targeted resources for conservation may also be affected with detrimental consequences. There is a potential for PES schemes to displace biodiversity loss to regions outside the limits of PES agreements (Ferraro & Kiss, 2002). Institutional enforcement mechanisms are important in this regard in order to promote conservation goals outside of PES implementation areas.

Despite the challenges, PES schemes can be designed and implemented in order to promote conservation and social goals. Providing community incentives to monitoring can ease some of the challenges that accompany evaluation. There are appropriate applications of PES schemes in the Amazon dependent on what the environmental goal is and what role the agent or activity plays. Tailored applications can potentially be more effective at accomplishing these goals, although measurement and evaluation may continue to pose a challenge.

Chapter 4: PES and REDD+ *Avoided deforestation approaches*

There are several PES schemes in place within the Amazon. One of the earliest examples, *Bolsa Floresta* will be analyzed in this chapter for its strengths and weaknesses in addressing deforestation in the state of Amazonas. Lessons learned from this program may be applicable to other PES schemes currently in place or in development for implementation in the Amazon. The program will also be analyzed to determine whether PES schemes can be an effective mechanism for REDD+ projects. REDD+ is an initiative of the United Nations that aims to reduce emissions through reductions in deforestation and degradation in developing countries and utilizes different mechanisms, like PES schemes, to meet its objectives. REDD+ support for PES schemes means more resources for implementation and management of future programs.

BOLSA FLORESTA, BRAZILIAN AMAZON

PES schemes are not completely unknown in the Brazilian Amazon. Their impact has remained limited but there are several examples to note including the *Bolsa Floresta* program in the state of Amazonas. The program is managed by the *Fundação Amazonas Sustentável* (FAS) or Amazonas Sustainable Foundation.

Overview

Bolsa Floresta is a PES scheme that provides monetary incentives to communities that commit to conservation and sustainable cultivation of forest products in the state of Amazonas, Brazil. *Bolsa Floresta* has both environmental and socio-economic objectives with strengths and weaknesses. It specifically targets traditional and indigenous communities with incentives to support health, education, transportation, and communication when families and communities in the 15 designated zones commit to zero-deforestation (*Fundação Amazonas Sustentável – Perguntas e Respostas*, 2013). One

of the primary objectives of the program is to support health and education initiatives in the state of Amazonas (Viana, 2008). The program was established by State Law no. 3.135, a law on climate change, environmental conservation and sustainable development of the state of Amazonas. Article 5, no. II establishes Bolsa Floresta as a payment for environmental services in traditional communities with the objective to develop the sustainable use of natural resources and conservation by incentivizing these activities through payments in protected areas (Law no. 3.135, 2007). There are 41 protected areas, or conservation units, defined and managed by the *Centro Estadual de Unidades de Conservacao* (CEUC) covering 19 million hectares in the state of Amazonas. Complementary Law no. 53/2007 defined protected areas in the state of Amazonas and provided penalties for offenses (Lei Complementar 53, 2007). The state of Amazonas has one of largest shares of indigenous reserves which function like a conservation unit but with fewer restrictions. In fact, indigenous reserves cover more land than conservation units and residents within IRs are exempt from land use restrictions (Andersen et al., 2002). Simply creating conservation units is not a viable option to protecting the forest. Implementation and monitoring costs can vary widely across different types of units , which include National Parks, Biological Reserves, Ecological Stations, and State Extractivist Forests among others (Andersen et. al, 2002). Conservation units also help illustrate some of the tensions between federal and state governments. The federal government and states have differing viewpoint about whether people should reside within CUs and whether resources should be exploited within these units, for example (Fearnside, 2003). Working within conservation units or indigenous reserves may add implementation challenges to PES schemes.

Components

The *Bolsa Floresta* program includes all four key components of PES schemes.

Users

The users under the Bolsa Floresta scheme are a combination of private and public sources as well as indirect and direct users. Law no. 3135 also authorized an initial donation in the amount of R\$20M from the government to the *Fundação Amazonas Sustentável* to initiate the program and an additional R\$20M donation from Banco Bradesco supplemented the creation of an endowment (Law no. 3315, 2007; *Fundação Amazonas Sustentável—Perguntas e Respostas*, 2013). The government contribution represents an indirect user under this design while Banco Bradesco takes on an indirect role with some direct elements. The bank offers its customers a Mastercard where 50 percent of the annual fee is directed to FAS and declares that conserving the forest is good for the customer and the entire planet (Cartões Sustentáveis Bradesco website, 2013). Using this approach, Banco Bradesco acts as an intermediary and gives the beneficiaries of the Amazon's ecosystem services, its customers, the option to make a direct contribution for their use of the forest's value. For Banco Bradesco and its customers, the forest in its entirety is the valued commodity.

Additional funding for the program comes from a variety of companies including Coca-Cola. Coca-Cola recently increased their investment and expects to contribute US\$13 million to FAS programs by 2017 to support their company goal of “water neutrality” through this investment. (Coca-Cola, 2012). Coca-Cola's funding approach is different from Banco Bradesco in that water conservation represents the valued ecosystem service of which Coca-Cola is willing to pay millions of dollars for.

Drawing funding from diverse sources like a domestic bank and multinational corporation in direct and indirect forms can be considered both a strength and weakness

for a program like *Bolsa Floresta*. Banco Bradesco created a product to pass on the costs directly to customers who voluntarily choose to contribute to FAS' work when they sign up for a credit card. Coca-Cola participation takes the form of a voluntary contribution for its direct use of water which it indirectly passes on to its customers through the sale of its products. Banco Bradesco's structure for payments can be seen as a strength in the sense that its customers are the direct users and thus have an incentive to ensure that the program outcomes are being met, or in other words, that their credit card's annual fee is used as intended. Unlike Bradesco, Coca-Cola customers do not have the incentive, but rather the company does to ensure compliance. Having large and powerful companies as funders can also present challenges for managing organizations like Amazonas Sustainable Foundation (FAS). These two companies represent just a few of FAS' donors and they have differing beliefs on what their funds support. Banco Bradesco supports the conservation of forests while Coca-Cola supports water conservation. Although related, there may be some risk that the scope of *Bolsa Floresta*'s approach may be misunderstood. This type of funding could help these programs grow as companies pay attention to their corporate social responsibility and consumers demand to understand their environmental footprint.

Providers

The providers in the *Bolsa Floresta* program are residents within the conservation units in the state of Amazonas. These individuals are seen as "guardians" of the forest and *Bolsa Floresta* rewards them for conservation with payments made out to the female householders in communities (*Fundação Amazonas Sustentável—Programa Bolsa Floresta*, 2013). The fact that payments are made out to women is significant because it demonstrates an objective to support development in these communities. Of note are two

of the United Nation's Millenium Development Goals focused on eradicating poverty and empowering women. The United Nations advocates for policies that promote gender equality in economic opportunities (UN Women, 2011). *Bolsa Floresta* seems to promote this objective by designating women as the beneficiaries of payments. Additionally, the payments help to address poverty in the region by providing individuals with a supplemental source of income (*Fundação Amazonas Sustentável—Pagamento por servicios ambientais*, 2013).

The targeted providers for *Bolsa Floresta* reside within conservation units and are indigenous or traditional communities. The state of Amazonas has 369,788 square kilometers or approximately 23.5 percent of its total land under protection in the conservation units (Veríssimo et al., 2011) and there are 135,000 indigenous people in the state of Amazonas as of 2010 (IBGE, 2010). As of 2011, *Bolsa Floresta* counts on the participation of 35,000 individuals across 15 conservation units in 541 communities in Amazonas with payments made to over 8,000 eligible families (*Fundação Amazonas Sustentável—Êxitos*, 2013).

One of the challenges of implementing PES schemes is managing large numbers of users and/or providers. *Bolsa Floresta* accounts for this by limiting possible providers of ecosystem services. In order to discourage migration into the conservation units, and therefore increase the human footprint in the region, participating families must reside for two years within a conservation unit in order to be eligible (Baez, 2011).

By limiting providers by region and residency, *Bolsa Floresta* defines the scope of its PES scheme.

Payments

There are four different types of payments that *Bolsa Floresta* offers participants with different incentives attached to each: Bolsa Floresta Income, Social, Family, and Association. A strong emphasis throughout these components is the role that the community plays in environmental protection and results thus far indicate positive outcomes at the community level.

Bolsa Floresta Income offers an initial investment of R\$140,000, or approximately US\$70,000, per year per conservation unit to support sustainable fishing, and harvesting of oils, fruits, honey, nuts, and other forest products as well as eco-tourism (*Fundação Amazonas Sustentável—Programa Bolsa Floresta*, 2013). Eco-tourism as a valued activity and provides community incentives and not just individual incentives to conserve the forest, potentially making this a powerful motivation to comply with conservation commitments. As an example, the community of Saraca was able to build a restaurant with this investment to support their eco-tourism activities in the community as a whole (*Fundação Amazonas Sustentável—Programa Bolsa Floresta*, 2013).

Bolsa Floresta Social designates another R\$140,000, or US\$70,000 to each conservation unit to improve education, health, communication, and transportation (*Fundação Amazonas Sustentável—Programa Bolsa Floresta*, 2013). This component also supports the community aspect of the program through these investments in social-economic outcomes. The community of Nova Aliança was able to use these funds to construct a community center which enables them to now hold meetings and gatherings in the space (*Fundação Amazonas Sustentável—Comunidade de Nova Aliança*, 2013).

Bolsa Floresta Family provides R\$50, or US \$25, per month to females of households within conservation units who commit to conservation and sustainable development and does not require land titles (*Fundação Amazonas Sustentável—*

Programa Bolsa Floresta, 2013). The minimum wage in Brazil recently increase to R\$678 or US\$326 per month (Biller, 2012). These payments represent only about a 7.6 percent supplement to the minimum wage. It is no wonder that there have been criticisms that these payments may be too low to be effective incentives. The lack of land title requirement is significant because many indigenous members do not hold them and would otherwise miss out from participating if this were a requirement (Baez, 2011). This transaction has both environmental and socio-economic implications. Participants must attend a workshop about environmental protection, sign an agreement to not cut down trees, and make sure their children are enrolled in school (Baez, 2011).

Bolsa Floresta Association aims to strengthen the role of community organizations within conservation units by giving community associations 10 percent of all the *Bolsa Floresta* Family funds given within that conservation unit (*Fundação Amazonas Sustentável—Programa Bolsa Floresta*, 2013).. Each of the transactions previously mentioned supports community development indirectly but this is the only one to explicitly designate funds to strengthen communities. Examples of this type of payment include capital equipment purchases for the community associations (*Fundação Amazonas Sustentável—Programa Bolsa Floresta*, 2013).

Environmental goal

There are several ecosystem services that qualify individuals to receive payments under *Bolsa Floresta*. These activities include sustainable fishing, and harvesting of oils, fruits, honey, nuts, and other forest products, eco-tourism, and commitments to zero-deforestation of primary forest (*Fundação Amazonas Sustentável—Programa Bolsa Floresta*, 2013). As a result of these efforts, estimates cite that approximately 3.6 million tons of greenhouse gas emissions will be averted in the first decade of implementation

through carbon credits (Baez, 2011). There are also social requirements of participants such as ensuring that children attend school in order to receive *Bolsa Floresta* payments. Another objective of *Bolsa Floresta* is to develop a methodology for determining carbon emissions (Viana, 2008). This could potentially be very helpful in evaluating the outcomes of *Bolsa Floresta* as well as other PES schemes.

Implementation and management

Implementation and management of *Bolsa Floresta* involves the coordination of multiple government agencies, a non-governmental organization, as well as public and private funders. The Amazonas state agency, Secretariat for the Environment of the State of Amazonas (SDS) provides oversight for the program and works alongside Environmental Protection Institute of Amazonas (IPAAM), the Agency for Sustainable Development of Amazonas (ADS), Gas Company of Amazonas (CIGÁS) and with the advice of the following: the State Council on the Environment (CEMAAM), State Water Resources Board (CERH) and the State Board of Geodiversity Amazon (Forest Carbon Portal, 2012; *Secretaria de Estado do Meio Ambiente*, 2013). Law no. 3.135 also establishes systems to monitor protected areas of Amazonas and strengthens environmental licensing (Law no. 3.135, 2007).

There are a few challenges that may arise as a result of management structures of this program. The most prominent one is a potential coordination challenge given the number of agencies and actors involved. Fundação Amazonas Sustentável (FAS) is a non-governmental organization, subject to independent external audits. FAS utilizes Deloitte to manage payments and PricewaterhouseCoopers conducts a financial audit which is sent to the state prosecutor in Amazonas who then ensures compliance with the law (*Fundação Amazonas Sustentável—Transparência*, 2013) These multiple checks on

program management support the potential success of the program. The prosecutor in particular is in a strong position to enhance the accountability of government agencies (McAllister, 2008). The structures in place support one of FAS' most important non-environmental goals. One of the goals of the *Bolsa Floresta* program is to build up institutional trust with communities in the forest (*Fundação Amazonas Sustentável—Perguntas e Respostas*, 2013). Making progress toward this outcome could help to secure the longevity of Bolsa Floresta and future PES schemes in the Brazilian Amazon.

Another management challenge involves funding. In order for this program to be effective, the payment provided must exceed the benefit that the participants would otherwise get from cutting down the forest. Determining opportunity costs to potential participants is not a precise measurement necessarily. It typically involves estimating the returns to the land which vary from area to area and are difficult to apply over a wide landscape (Palmer & Engel, 2009). Another way to determine the costs of the program would be to estimate the costs of greenhouse gasses associated with deforestation, but this too proves to be dependent on a variety of factors (Palmer & Engel, 2009). Bolsa Floresta's intended development of a methodology for determining carbon emissions has yet to be announced by the *Fundação Amazonas Sustentável*.

Evaluation

Evaluation of *Bolsa Floresta* requires measuring environmental and social desired outcomes and using qualitative and quantitative measures. The *Fundação Amazonas Sustentável* and State Secretariat for the Environment and Sustainable Development (SDS) provide oversight for the project utilizing satellite imagery (McKenzie & Childress, 2011). The primary social outcomes are achieved via payments supporting health, education, and community development. Thus far, outcomes in these areas have

been reported via qualitative measures. A year after implementation, there were 4,244 families enrolled in the program (Viana, 2008). The *Fundação Amazonas Sustentável* touts it as a huge success. Success, however, seems to be defined primarily by the number of families enrolled in the program. Measuring avoided deforestation is notoriously difficult which may explain why official program documentation does not indicate how much deforestation has been avoided as a result. The *Fundação Amazonas Sustentável* is listed as a participant in Google's efforts around community-based forest monitoring using the Open Data Kit but FAS does not indicate how it has used this technology thus far and the results. Because the project is located in the state of Amazonas, a state with lower deforestation rates than its neighbors, this project may not be changing deforestation rates by much if they are not high in the first place. Additionally, the intended targets are traditional and indigenous populations which have not been significant drivers of deforestation. On the other hand, *Bolsa Floresta* could be helping to stop deforestation from advancing into the interior. Deforestation data also shows that deforestation has increased within the state of Amazonas, although it seems to have subsided by 2011, and programs like *Bolsa Floresta* may be keeping rates from increasing in the interior. It is difficult to say definitively without solid methods for evaluating the environmental impact of PES schemes.

In 2009 the *Fundação Amazonas Sustentável* issued a survey *Bolsa Floresta* participants about their satisfaction with the program. There were 84 participants across the Rio Negro, Uatumã, Juma, and Média implementation sites in this survey and questions focused on perceptions of the program and management, what components mattered most, how families use payments, and program areas for improvement. Program participants reported that *Bolsa Floresta* Family was the most important payment component and the primary incentive for participation. Income was used primarily to pay

for food and medicines. Improvements could be made by increasing the amounts of payment. Participants also value the education and health components of the program and view the *Fundação Amazonas Sustentável* positively. While these types of questions are important to assess participant satisfaction, which may help to indicate program compliance, they do not explicitly address the environmental goals of the program. There were no questions that whether compliance occurred or about the ease of compliance. Substantiating environmental and social outcomes is a challenge for PES schemes like *Bolsa Floresta*.

Challenges and future directions

For programs like *Bolsa Floresta* to be implemented in more communities, they must demonstrate success from pilot sites. Thus far, the program has been able to demonstrate that community members are interested in participating through enrollment and that they value the economic benefits to their families and communities realized from the program. More work is needed to evaluate the desired environmental outcomes of this program. Program management and monitoring may be supported through the use of tools like the Open Data Kit and mobile phones. Community members themselves may be charged with utilizing these tools to ensure compliance which may in turn increase ownership over the program outcomes.

Sustainability is another important challenge for *Bolsa Floresta* and other PES schemes. Key is whether funding is available to maintain the program beyond implementation. Having a diverse set of private and public funders may help to create a more sustainable funding base but long-term changes to policies may be necessary to entice direct users of ecosystem services to pay for their use in perpetuity.

The relatively recent strengthened role of the prosecutor within the Brazilian legal system can potentially provide assistance to the implementation and management of PES programs in the Amazon. The 1988 Brazilian Constitution created the *Ministério Público*, or Public Ministry, an independent branch of government with the enforcement authority to secure environmental regulations and laws (McAllister, 2008). The prosecutor within this branch plays an important role in enforcing environmental laws throughout the country. Prosecutors are respected, highly-educated and trained, and compensated appropriately making them, theoretically, less vulnerable to corruption (McAllister, 2008). Although PES schemes, especially those with direct users and providers, have built-in evaluation and monitoring mechanisms, additional supports for enforcement could help strengthen the impact of these types of programs. Another key change as a result of the 1988 Constitution is that the prosecutor became more accessible to the poor and marginalized in the country (McAllister, 2008). This is important because the targets of PES schemes may frequently be low-income individuals, vulnerable to more powerful actors. The prosecutor under the Public Ministry can potentially be a strong ally to the implementation and management of PES schemes.

The state of Amazonas does not have the highest rates of deforestation in the Brazilian Amazon but is threatened by the “arc of deforestation” surrounding it. The highest rates are found in the southern states of Rondônia and Acre. Implementing PES schemes in a region without current high levels of environmental degradation may help to create a buffer against future deforestation. Additionally, this program seems to be targeting the wrong audience. Traditional and indigenous groups are not the main agents of deforestation in this region.

PES SCHEMES AS MECHANISMS FOR REDD+ PROJECTS

The United Nations' Reducing Emissions from Deforestation and forest Degradation (REDD) program supports a variety of projects that aim to reduce deforestation and degradation in developing countries. Initially support was focused on reducing emissions but the scope of work has expanded to include conservation and sustainable management under the name REDD+ (IUCN - REDD+ website, 2013). Under the redesign, PES schemes now have the potential to serve as a tool for REDD+ programs. There are benefits and drawbacks to including PES schemes into larger REDD+ frameworks.

Implementation and management of REDD+ programs

The United Nations lists all current country participants and projects on their REDD website. While Brazil is not a partner country at this point, it does have a REDD+ program with the Juma Reserve in Amazonas. Here, the PES scheme *Bolsa Floresta* is used as a component of the more comprehensive REDD+ program.

One of the ways that REDD+ programs can be implemented is by creating a reserve where deforestation and degradation can be limited. In this application, the reserve can become the source of ecosystem services (Yanai et al., 2012). PES schemes may function well within reserves when external enforcement mechanisms are too weak to prevent deforestation from occurring within the reserve boundaries. Utilizing PES schemes in this scenario gives internal incentives to the residents within reserves to enforce any conservation regulations contingent on payment. The results thus far have been mixed and there is debate about the social and economic outcomes of these programs (Yanai et al., 2012). Of course in creating a reserve there may also be a question of whether people should be allowed to live in them in the first place. States may have a greater incentive to promote intensive use of resources within reserves and to

be for populated reserve than would be the federal government (Fearnside, 2003). In creating reserves, there is a concern that leakages, or a displacement of deforestation or degradation, may shift to areas outside of the reserve. Research indicates that leakages do indeed increase with reserves but that they stabilize over the long-term (Yanai et al., 2012).

Pilot programs like the Juma Reserve, are part of a multi-phase effort toward development of a national REDD+ strategy. PES schemes can represent a localized approach to managing ecosystem services depending on who the users and providers are within the context of a larger national strategy. Indeed PES schemes are more likely to initiate at a state level rather than federal level (Eloy et al., 2012). Localized control may be more important in a country like Brazil. REDD+ and PES programs both require strong governance which can vary widely in Brazil (Bond et al., 2009). PES schemes can also be issued on a smaller scale before become part of a larger REDD+ strategy. A PES scheme in Acre for example began in 2008 with public and foundation support at the state level where the government is now negotiating for additional support via REDD+ (Eloy et al., 2012). Additional implementation challenges may occur in taking a PES scheme from the local level to incorporating it into a larger REDD+ framework. REDD+ incorporates many more actors and levels than PES schemes and coordination issues must be resolved in order for them to be successful (Angelson et al., 2012).

Benefits to participating as a REDD partner are the institutional and financial resources that come with a United Nations initiative. REDD programs receive technical support in design and implementation from the United Nations. Creating a reserve as a REDD+ approach can be costly and PES schemes may be used as a means to help pay for the costs of the reserve (Yanai et al., 2012). PES schemes may be useful in facilitating the participation of the private sector and it may be helpful to proactively seek out this type

of participation. Governance issues for programs are easier to address when the private sector is involved (Pettenella & Brotto, 2012).

In implementing REDD+ projects, challenges may occur around determining the baseline from which to evaluate the outcomes of the project. It is important not to overestimate the baseline or else risk that the user will pay for an unsubstantiated amount (Yanai, 2011). Additionally, it may be difficult to determine how much to pay for regions with low deforestation already (Bond et al., 2009).

Evaluation

Evaluating impact is a necessary component of managing REDD+ programs. One of the challenges to REDD+ program is that there are not a lot of strong evaluations of conservation efforts as they relate to both environmental and social outcomes (Caplow, 2011). PES schemes have challenges in demonstrating environmental and social impacts and using them as a component of a REDD+ program does not necessarily eliminate. Multiple studies point to the difficulties in determining what the effect would be without the stated program implementation (Caplow, 2011; Combes Motel et al., 2008) and in determining the baseline for evaluation (Yanai et al., 2012). Challenges in the design phase of evaluation may lead to problems demonstrating success. Many REDD projects have difficulties in showing additionality (Pettenella & Brotto, 2012). Social outcomes may be easier to demonstrate through qualitative measures such as those used by the *Bolsa Floresta* program. Socioeconomic evaluation of REDD programs typically includes impact information on income and employment (Caplow, 2011). *Bolsa Floresta* as a PES mechanism for a REDD+ project could be stronger if it included information in its survey about employment effects and more information to changes in family income.

Challenges and Future Directions

PES and REDD+ are not exclusive options in designing conservation strategies. They can be complementary with PES schemes possibly serving as an entry point toward a REDD+ programs. One of the benefits of using a PES scheme may be the ability to define a smaller scope and allow for flexibility. PES schemes can be implemented at the community level while REDD+ require national coordination and alignment. In this sense, PES schemes may be used as a way to test and adjust programs before incorporating into a broader framework. One of the criticisms of REDD programs is the exclusion of women in participation (Caplow, 2011). *Bolsa Floresta* on the other hand specifies payments to women for compliance with the family income component. In this sense, PES schemes may be more flexible than a REDD program in tailoring payment terms.

The use of PES schemes within REDD+ programming is a fairly new concept and continues to evolve. Some of the same challenges that plague PES schemes continue to pose problems for implementation into broader REDD+ frameworks. Additionally, there is a concern about fading interest in projects like PES and REDD+ is that there is fading interest in these types of avoided deforestation initiatives (Caplow, 2011). In order to overcome this major challenge, programs need to provide convincing evidence of environment and social impact.

PES schemes can be applied within and without REDD+ contexts. Major developing countries like Brazil are not yet official REDD programs but instead are making strides by testing the REDD+ waters with PES schemes.

Chapter 5: Lessons learned & future directions

PES schemes have the potential to promote conservation and support socioeconomic goals in the Brazilian Amazon. They are flexible and can be implemented locally with community participation in the design and management portions. Additionally, they have the potential to play a larger role as tools for internationally-supported programs like the United Nations' REDD+ program. The following are lessons learned from previous programs implemented in the Brazilian Amazon and possible future directions for PES scheme applications in the region.

PES: FUTURE DIRECTIONS

Incorporate the private sector

Research shows that participation from the private sector can make projects more efficient. The private sector can serve as a management and financial partner for PES schemes. Companies can participate in PES schemes as a means to meet their environmental objectives. In the Amazon, Coca-Cola is funding PES schemes in the Brazilian Amazon in order to support their green bottom line and decrease the environmental impact of their business. Others like Banco Bradesco support the initiative but allow their customers to make the choice of contributing or not. Communities that pursue developing PES schemes should seek appropriate partners from the private sector whenever possible.

Define a role for women

PES can support socioeconomic outcomes in poor, rural communities. To support these efforts, women should be included in program design. The United Nations acknowledges the role that women play in moving families out of poverty. PES schemes like *Bolsa Floresta* define a role for women by designating payments to female

householders. In addition, PES schemes should incorporate the voice of women in designing programs and identifying community needs to support. Including a role for women could help to promote stronger socioeconomic outcomes.

Employ qualitative and quantitative measures in assessing environmental and social outcomes

A lack of strong evaluations for environmental and social outcomes is one of the major challenges keeping PES schemes from becoming a larger part of environmental agendas worldwide. Capacity and cost are the barriers that make evaluation difficult in the Brazilian Amazon. Qualitative measures such as surveys and interviews can help ensure that program participants' expectations are being met. Using surveys to gather feedback in order to continuously improve upon a program can help keep ecosystem service providers engaged and invested in the outcome goals. Qualitative measures can also be used to gather information about the economic impact of PES payments on families. Questions should aim to answer how families use payments in order to show whether PES schemes are helping to alleviate the effects of poverty or not. Evaluation of environmental objectives is also necessary. Low cost technology such as mobile phones and open sources software can help ecosystem providers monitor environmental changes within their communities and provide users, who may live far away from regions where PES programs are implemented. These measures can be used in conjunction with traditional monitoring methods like remote sensing and satellite imaging but at a lower cost. Community monitoring can also support community engagement in program outcomes and promote the sustainability of PES schemes.

PES IMPLEMENTATION LESSONS

Spatial, agent, and activity targeting

PES schemes have the potential to be more successful if they are applied in regions with certain characteristics. One of the ways that PES schemes are used is in areas with current low deforestation but that may be at risk for future deforestation. Using PES schemes in these areas may help to keep the threat of deforestation in this area at bay a bit longer. Most of the deforestation in the Amazon continues to occur along the arc of deforestation but increases in deforestation are happening inside of the arc. Prioritizing regions in Amazonas, Pará, and Roraima for example may help to keep deforestation from pushing further and further into the forest.

One of the challenges associated with this approach may be monitoring in regions that are remote as the frontier has not yet reached them. It may be difficult to demonstrate additionality in regions where high deforestation rates have not yet reached. Focusing PES schemes in areas with low to no deforestation will have to concentrate on conservation outcomes as opposed to reforestation goals. Monitoring may also be more difficult for these projects. One of the reasons why deforestation may be low in these areas is because they are further and more isolated from some of the drivers of deforestation such as roads and thus access for monitoring in these regions may be a challenge. PES schemes should incorporate the support of the community and low-cost or free tools like the Open Data Kit to help monitor projects in remote regions.

PES schemes should also target the appropriate agents and activities that drive deforestation in the Amazon. Programs like *Bolsa Floresta* in Amazonas focus on traditional and indigenous communities who typically are not responsible for high rates of deforestation. Programs may be more effective in targeting small landholders for example who may be likely to sell their land to become a part of larger and larger

expanses of landholdings. Although large landowners have a greater impact on deforestation, it may be more feasible to provide incentives for conservation to small landowners instead. The costs for large landowners would simply be too high. Another possibility is providing incentives to support sustainable activities like extraction and managed timber harvest. The costs of these activities are much lower than large scale agriculture or cattle ranching, for example, so providing incentives to groups participating in these activities appears feasible.

Use PES as a component to try on REDD+

PES schemes have a potential role to play within larger, national-level frameworks. One of the advantages of PES schemes is that they can be implemented at the local level and adjusted as needed before being incorporated into larger, more complicated environmental agendas. Implementing programs on a smaller scale may also show whether they are effective at meeting stated outcomes. If they are not effective where implemented, the programs can be scrapped or altered before too much additional investment is made from programs like REDD+.

INSTITUTIONAL RECOMMENDATIONS

Share best practices outside of REDD+

Programs that are a part of REDD+ receive the institutional support of the United Nations. These programs also have dedicated space to share best practices and technical knowledge. PES schemes should have a similar space. Since the UN allows for these types of programs within REDD+ projects, one possible area where this information could be stored would be through the United Nations. The incentive for the United Nations would be that they could monitor potential projects for future incorporation in REDD+ and also be a part of the discussion of improving evaluation methodologies.

Evaluation is one of the areas of concern with PES schemes and sharing information about these programs worldwide may help the development of improved methods.

These lessons can provide a starting point to determine the next phase of PES scheme applications in the Brazilian Amazon. Early applications have provided limited evidence of environmental and social impact so future iterations will need to incorporate lessons learned if PES schemes are to have a future as mechanisms for promoting conservation in the Brazilian Amazon.

Chapter 6: Conclusion

This report has examined the agents and activities that drive deforestation in the Brazilian Amazon, payments of ecosystem services as mechanisms to promote conservation and social-economic goals in the region, and the future of these programs as a part of larger frameworks. There are lessons to be learned from previous applications of PES schemes in the Amazon which can be applied to current and future applications. PES schemes are just one of many tools that can be used to promote conservation and environmental stewardship in the region. Given the variety of inhabitants and economic activities across the Amazon, no single tool or mechanism can be solely effective in mitigating deforestation. PES schemes have the potential to play a role in supporting conservation efforts in the Amazon but adjustments must be made to improve implementation and evaluation.

A review on deforestation literature was conducted to identify the primary sources of deforestation. Some agents and activities were found to play a lesser role than others. This information was critical to understanding whether current PES scheme applications have the potential to meet their environmental objectives based on their targeted groups, implementation, and management. PES scheme key components and best practices were identified and recent applications in the target region were analyzed to determine future directions of these programs.

This report connects the agents and activities that drive deforestation to determine whether PES schemes are appropriately structured as is within current applications in the Amazon and identifies possible adjustments to make in the future. The research also identifies technological developments that may aid in the monitoring and management of PES schemes in remote regions of the Amazon.

The literature on deforestation in the Amazon and options to mitigate deforestation is vast. The discussion presented here was limited in order to provide an overview and identify key features of the agents and activities. Only some of the largest and oldest examples of PES schemes in the Brazilian Amazon were included in this analysis but there are other smaller schemes currently in development that merit attention as they are implemented. It would be good to revisit some of the lessons learned and future directions of this report as they relate to future PES applications to determine how these programs have changed over time and adjusted to address their weaknesses. There will likely also be new developments around REDD+ and the mechanisms it uses to address deforestation and degradation around the globe. These changes should be monitored to determine their effect on PES schemes and whether they are supportive of expansion of programs or not.

One of the biggest challenges associated with these programs is around evaluation. There are no decent evaluations available of current program and evaluation itself of the environmental and social outcomes can be difficult. Research should promote the collection of data to aid in these evaluations in the future. PES needs more evaluations in order to continue serving as tool addressing deforestation and poverty.

Payments for ecosystem services have a role to play in supporting the Brazilian governments' efforts on conservation and alleviating poverty. Past applications have provided a decent starting point from which to reassess and adjust for future applications. It's feasible that Brazil can meet its goals to reduce deforestation and PES schemes can serve as a tool to reach those goals. Even after the goals are met, PES can continue to play a role in ensuring that land is managed sustainably in perpetuity.

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