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A Qualitative Analysis of Effectiveness, Efficiency and Equity of Payment for Ecosystem Services in a User-financed and a Government-financed Program

Tanya Williams

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of

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DEDICATION

For Amil, Andrea and Ari
My forever lights

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Abstract

Payment for Ecosystems Services (PES) programs which are considered as incentivized mechanisms has been implemented in Latin America as a strategy to reduce deforestation by rewarding landowners (sellers) to protect forests and to provide ecosystem services to ecosystem users/beneficiaries (buyers).

Two common management structures for PES programs have been implemented in Latin America: Government-financed and User-financed. User-financed PES programs are promoted as being more environmentally effective and cost-effective compared with Government-financed programs. Government-financed PES programs are perceived as less effective than User-financed PES due to the inclusion of equity as a critical policy outcome of PES.

In this thesis, an analysis is conducted of the program structure of two PES programs in the program's ability to support environmental effectiveness, equity, and cost-effectiveness. Two case studies were used in the analysis: the Costa Rica National PES Program, a Government-financed program and the Los Negros Valley, Bolivia Reciprocal Watershed Agreements (RWA), a User-financed Program. This thesis also investigates the role of the type PES program structure in the inclusion of equity in PES design and implementation.

The analysis indicated that the Government-financed PES program was better structure to support higher indicators of environmental effectiveness, equity and cost-effectiveness. The findings of the study showed that the program structure of PES is likely to influence whether equity is included in the design of the PES. A Government-financed PES is more likely to include equity as a policy outcome.

Chapter 1

Introduction

The purpose of this thesis is to conduct an analysis of the program structure of two PES programs the Costa Rica National PES Program, a Government-financed program and the Los Negros Valley, Bolivia Reciprocal Watershed Agreements (RWA), a User-financed Program, in the program's ability to support environmental effectiveness, equity, and cost-effectiveness. This thesis also investigates the role of the type PES program structure in the inclusion of equity in PES design and implementation.

1.1 Deforestation in Latin America

Tropical forests "contain over half of the world's biodiversity" (UNEP-World Conservation Monitoring Center, 1992, 1). Over fifty-percent of those tropical forests are found in the neotropics (Butler 2012). The neotropical ecozone "extends from central Mexico in the north to southern Brazil in the south, i.e., including Central America, the Caribbean islands and most of South America" (Antonelli and Sanmartín, 2011,1). The countries of Latin America and the Caribbean constitutes 25% of the world's forests and possess the highest biodiversity value in the world (United Nations Environmental Program 2011, 4).

The rich biodiversity of Latin America's tropical forests is continuously under threat of habitat and species loss and of species extinction due to unsustainable development. Chief amongst the activities contributing to forest biodiversity loss is forest conversion for subsistence farming, large commercial-scale agricultural development and logging. Between 1990 and 2005,

the total deforestation rate in Latin America and the Caribbean was estimated to be 69 million hectares (United Nations Environmental Programme, 2010, 1).

In the context of this thesis, deforestation refers to the "complete long-term removal of tree cover" resulting from changes in land use (Kaimowitz and Angelsen, 1998, 3). It is undeniable that deforestation, specifically tropical deforestation, is not simply a localized issue, but extends beyond the borders of impacted countries. Tropical deforestation is a global concern due to the projected future acceleration of habitat and species loss, human and infrastructure loss from natural disasters, the increase of atmospheric carbon emissions driving climate change and the overall domino effect of these changes on trade and economy, health, and regional and global security.

Tropical forest loss has a significant impact on global climate. Through the photosynthesis process, tropical forests absorb 1.4 billion tons of the 2.5 billion tons of carbon dioxide (CO_2) absorbed by carbon sinks (Schimel, Stephens and Fisher, 2014, 440). The tropical forests in Latin America account for 84.2% of above-ground carbon stock. However, the reverse occurs in deforestation as tropical forests become CO_2 emitters contributing 3.7 billion tons of CO_2 into the atmosphere (Baccini, Goetz, Walker et al., 2012, 4). According to a 2007 report by the United Nations Environment Programme (UNEP), deforestation in Latin America and the Caribbean "was estimated to be responsible for 48.3% of global CO_2 emissions".

> Chomitz et. al (2007) predict that the rate of tropical forest loss at 5 percent a decade will be responsible for the addition of 3 billion tons of CO_2 into the atmosphere each year, causing many harmful consequences: "intensifying climate change; loss not just of many species, but also entire ecosystems; and across the tropics, widespread changes in water flows, scenery, microclimates, pests, and pollinators" (Chomitz, 2007, 1).

The developing countries of Latin America and the Caribbean are in a quagmire between the drive for economic development and addressing poverty, while at the same time protecting critical tropical forests and their rich biodiversity. Significant efforts are being made at the national, regional and global levels to develop and implement strategies to reduce forest degradation and deforestation in order to address climate change.

The command-and-control approach has been the primary public policy option for addressing environmental problems in Latin America and the Caribbean.[1] However, implementation of the command and control approach to addressing deforestation and forest cover and biodiversity loss has not been effective (Bulte, Lipper, Stringer, and Zilberman 2008). As a stand-alone strategy to natural resources management, this approach "often results in unforeseen and undesirable consequences" (Holling and Meefe, 1996, 329).

Causes and drivers of deforestation are heterogeneous with complex interplays between motivations and behaviors; this causal complexity makes command and control approach not as effective. Geist and Lambin (2002) theorize that "multiple factors, rather than single-factor causation" drive deforestation citing "economic, institutional, technological, cultural and demographic outcomes with identifiable regional patterns of causal factor synergies" (Geist and Lambien, 2002, 1). A mix of policy options, including incentive-based mechanisms such as payment for ecosystem services (PES) programs, have been implemented in an effort to support the continued provision of ecosystem services, including those services provided by forests.

[1] Command and control approaches to natural resources management, including forest management, use non-voluntary laws and regulations to control changes to natural resources through setting standards, fines, etc. Command and control regulatory approaches are in contrast to approaches that influence behavior by supporting voluntary participation, such as through the use of incentives.

1.2 Ecosystem Services

Ecosystem services are defined as the benefits people derive from ecosystems – the support of sustainable human well-being that ecosystems provide (Constanza, d'Arge, de Groot, Farber, et al. 1997; Millennium Ecosystem Assessment (MEA) 2005)[2].

There is a diversity of models for ecosystem services. This thesis will use the Millennium Ecosystem Assessment's model, which groups the services into supporting, provisioning, regulating and cultural. Using the Millennium Ecosystem Assessment Ecosystem Services model provides the best fit for the ecosystem services which are currently being incentivized based on demand in payment for ecosystem services programs (Mayrand and Paquin 2004).

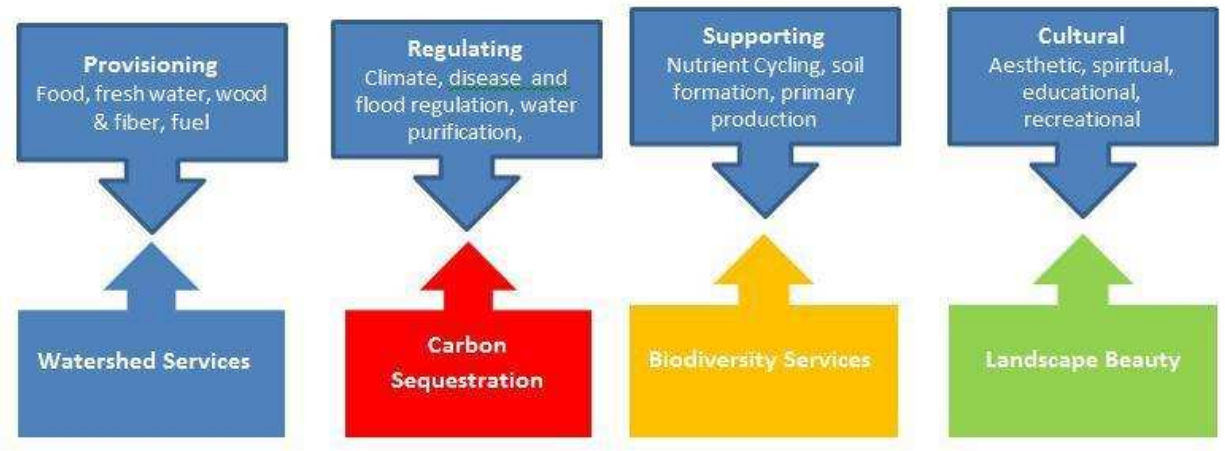

Figure 1: a) Millennium Ecosystem Assessment defined ecosystems. (b) Ecosystem services being sold/on demand from payment for ecosystem services. Model shows the ecosystems services provided under payment for ecosystem services schemes

Article 2 of the Convention on Biological Diversity (CBD) defines ecosystems as a "dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit." In 2005, the United Nations concluded a five-year

[2] Ecosystem services is also referred to as environmental services in some literature. The differences between the two terms is defined in differing ways. One definition identifying the differences refers to ecosystems services as being the natural environment while environmental services refers to both the natural and built environment (Bulte, 2008, 2410. Another definition is that environmental services refers to specific, defined services while ecosystem services refers to systemic, synergies of services (Wunder, 2008, 2).

global ecosystem assessment - the Millennium Ecosystem Assessment (MA). One of the key objectives of the assessment was to study the links between ecosystems and human well-being and identify the impacts that changes to ecosystems have on the well-being of humans (Millennium Ecosystem Assessment, 2005). Findings of the study found that 60-70% of the global ecosystems evaluated were being "degraded or being used unsustainably" with potentially dire consequences for the world's poor particularly in terms of the provision of freshwater and arable lands (Millennium Ecosystem Assessment Synthesis Report 2005, 20).

1.3 Incentivizing Forest Protection and the Management of Ecosystem Services

Conservation strategies, specifically protected areas, have been implemented throughout Latin America as a key strategy for reducing deforestation rates and biodiversity loss. The results have been mixed in reducing forest cover and biodiversity loss. To strengthen the support of the public in avoiding deforestation strategies, incentivized strategies, including payment for ecosystem services program have become the frontline public policy tool. Due to the relation between deforestation and poverty, further pressures to implement sound strategies are being promoted by global agendas such as the Millennium Development Goals. Scaling up of PES has occurred in the establishment of REDD+ (Reducing emissions from deforestation and forest degradation in developing countries) which occurs at the country level (Pagiola 2011).

Constanza (1997) valued ecosystem services, estimated at between "$16 – 54 trillion with the average being no less than $33 trillion, higher than the entire world gross national product". A 2011 reassessment valued ecosystem services at an estimated US$125 trillion/year. Valuation of ecosystem services is seen as critical to drive decision making and public policy development in the management of ecosystem services (Constanza 1997). Further validation for valuation is made in the context of incentivized initiatives such as payment for ecosystem services. It is argued that

for these initiatives to be effective, the value of the ecosystems services must be properly accounted for.

Valuation of ecosystem services and incentivizing their management through payment for environmental services is not without criticism as literature presents another perspective of valuation as the commodification of ecosystem services (Huberman 2008; McCauley 2006; Kosoy and Corbera 2010). The opposition to valuation and payment for ecosystem services raises concerns of "property rights over ecosystem services" and failure to account for intrinsic or non-use value (Kosoy and Corbera, 2010, 1234).

Constanza et al. (2014) and Farley and Constanza (2010) disagree with the position that valuation equals commodification, positing that ecosystem services are public goods or common pool resources that do not fit the privatization or conventional market model and that valuation allows greater understanding of the importance of ecosystem services. As public goods, ecosystem services are non-rival and non-excludable meaning they can be consumed without affecting the opportunity for others to consume those same goods and services (Farley and Constanza 2010). Ecosystem services are also considered as common pool resources (rival but non-excludable) (Farley and Constanza 2010). Rival but non-excludable refers to ecosystem services that are not infinite but are not closed off from any groups to use (Farley and Constanza 2010). Significant implications for PES arise over differentiation in the category in which ecosystems services fits. Club resources are more likely to be managed by a private entity or within a User-managed PES program (Dunn 2011).

There is an exception to ecosystem services being public goods and common pool resources. Some ecosystem services, such as watersheds, fall into a third category referred to as "club resources". Club resources are rival and excludable, therefore, ecosystems services which

are club goods can be used amongst many people but there is not a deleterious effect on distribution to others (Dunn 2011). However, as in a "club" with members, "non-members can be prevented from using the services" (Dunn, 2011, 26).

Another concern raised overvaluation and creating market-based incentives as payment for ecosystem services is the potential for the increase in issues of inequity in accessing resources and further marginalization of the poor and indigenous people (Greig-Gran and Porras 2005). Further implications for poor communities may arise in a User-financed program should equity/fairness not be a high consideration in PES design

The issue of equity in payment for ecosystem services is explored further in this thesis as a critical component of payment for ecosystem services design.

This thesis will contribute to research on payment for ecosystem services by analyzing the effect of PES program structure on achieving environmental effectiveness, cost effectiveness and equity as outcomes of the program. The analysis will be conducted in the context of a Government-financed PES and a User-financed PES program. In addition, I hope to contribute to a new line of enquiry in evaluating whether the program structure of a PES determines the inclusion of equity in the design of the PES as an intended outcome.

Chapter 2

Literature Review

A purposive sample approach (Randolph, 2009, p. 4) was undertaken to conduct the literature review. The literature review is divided into two sections: (1) Payments for ecosystem services as a conservation tool, and (2) existing work in evaluating program structures for payment for ecosystem services with focus on research on decentralized or User-financed PES programs and Government-financed PES programs and (3) the inclusion of equity in the policy outcomes of PES.

2.0 Defining Payment for Ecosystem Services

Pagiola (2004) describes payments for ecosystem services "as a method of internalizing the positive externalities associated with a given ecosystem or a specific resource use"[3]. Externalities are "the costs and benefits which arise when the social or economic activities of one group of people have an impact on another, and when the first group fails to fully account for their impact" (Europe Commission, 1995). Using a hypothetical scenario of Farmer A and B: Farmer A clears riparian forest upstream which results in increased sedimentation and turbidity in the source of drinking water for a downstream community. This would be considered to be a cost or a negative externality. In contrast, Farmer B decides to maintain a riparian buffer in a watershed which increases the water quality for the downstream community. Farmer B's actions are considered as a benefit or a positive externality. Payment for ecosystem services targets the

[3] An effect is internalised if the loss of welfare is accompanied by a compensation equal to the damage cost by the agent causing the externality. European Commission, DG Environment (2000). *A Study on the Economic Valuation of Environmental Externalities from Landfill Disposal and Incineration of Waste Final Main Report*. Retrieved from http://ec.europa.eu/environment/waste/studies/pdf/econ_eva_landfill_report.pdf

development of a positive externality through the "provision of ecosystem services" (Pascual, Muradian, Rodríguez and Duraiappah, 2009, 3). The underlying concept for PES is that without incentivizing the participation of landowners to change existing or potential land use behavior that is degrading or damaging critical forests and their provision ecosystem services, a high risk exists that those services would be lost (See Figure 3).

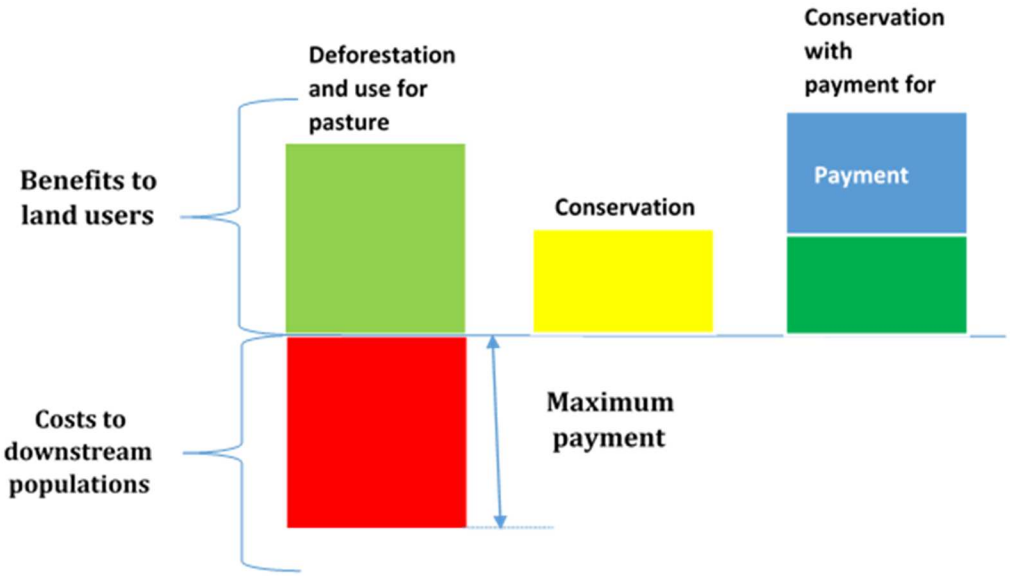

Figure 2: The logic of payment for ecosystems services. Source: Stefano Pagiola and Gunars Platais, 2005

PES is one of the tools being used to correct the "failure of markets to value biodiversity and ecosystems" (The Economics of Ecosystems and Biodiversity, 2010, 15). The concept of PES is that the traditional markets do not account for ecosystem services. Indeed, the PES model is indicative of the shift in the attitude and decision making towards nature in general, and the benefits of ecosystem services in particular, as being a public good with no quantifiable value (Costanza, et. al. 1997).

PES is categorized as a market-based approach whereby a value is placed on the benefits of ecosystem services (in terms of payments made to provider), similar to any product being placed on the market, and then charging end Users[4]. The common ecosystem services (Chomitz, Brenes and Constantino 1998,Wunder 2008) included within payment for environmental programs are:

1. watershed protection
2. biodiversity protection
3. carbon sequestration and,
4. preservation of intrinsic values, e.g. scenic/landscape beauty

Ecosystem services may be sold as a "bundled" of services in a payment program (Wunder, 2005, 2) whereby an enrolled area of land is considered to be delivering several ecosystem services (Mayrand and Pacquin 2004). "Bundling" is considered to be more efficient as the transactions costs are reduced. Contrastingly, "bundling" is considered less effective in meeting environmental targets compared with payments for individual services (Mayrand and Pacquin, 2004, 15).

2.1 The Economic Nature of Payment for ecosystem services

There is no single universally accepted definition of payment for ecosystem services. However, the definition of PES by Wunder (2005) is widely referenced in literature (Forest Trends, the Katoomba Group and UNEP 2008). The definition of PES by Wunder (2005) defines PES as:

1. a voluntary transaction where
2. a well-defined environmental service (or a land-use likely to secure that service)
3. is being 'bought' by a (minimum one) service buyer

[4] Payment for ecosystem services is commonly defined as a market based mechanism. However, that categorization has drawn criticism that PES does not fit the scope of a market based mechanism and some literature differentiates between PES and MES (markets for ecosystem services). *Vatn, A. An Institutional Analysis of Payments for ecosystem services. Ecological Economics 69 (2010) 1245-1252.*

4. from a (minimum one) service provider
5. if and only if the service provider secures service provision (conditionality).

The theoretical basis for Wunder's five criteria and (generally speaking) the payment for ecosystem services framework, is the Coasean theorem. Coasean theorem states that *paredo efficient (*market efficiency) can be achieved where private individuals voluntarily reach an agreement to address an externality. However, an agreement that internalizes the externality can only be reached where property rights are clearly defined, there is an enforceable contract and the agreed transaction/negotiation are low. Government's intervention is only required to define property rights.

However, the Coasean approach to PES is challenged as not being realistic to local realities. Further criticisms have arisen citing the definition produced by Wunder (2005) as being more a "theoretical reference point" (Vatn, 2010, 147) and that the "often perceived" Coasean approach to PES is not reflected in the literature analyzing existing PES structures (Lapeyre and Picard, 2013, 10).

Farley and Costanza (2010) asserts that the foundation of Wunder (2005) definition - the Coasean theorem - does not apply to all PES programs and emphasizes that "ecological sustainability takes precedence over market efficiency." The aforementioned position is supported by Lapeyre and Picard (2013) observing that a review of the literature on PES shows that PES arrangements "lean towards regulatory price changes e.g. subsidies" to effect change in land use by landowners. Case in point, the Costa Rica National PES program is partially funded by fuel and water taxes (Blackman and Woodward 2010). Financial input into the payments for ecosystem services in Mexico is an earmarked US$18 million from water taxes towards PES and the World Bank and Global Environment Facility have invested US$8 million in a regional integrated

silvopastoral program between Costa Rica, Nicaragua and Colombia (World Bank 2008). Non-voluntary contributions to PES for public goods may be necessary to prevent free riding (Jack, Kousky and Sims 2007)

Vatn (2010) suggests that PES programs on the ground are a "mixed between Coase and Pigou." Ironically, the development of payment for ecosystem services was considered a shift from the Pigouvian theorem which prescribed subsidies or taxes to achieve positive externalities (Pattanayak, Wunder and Ferrano 2010).

Emerging from the discourse which describes PES as a mix of voluntary and non-voluntary buyers, is an attempt to reshape the concept of PES. Muradian et al (2010) define payment for ecosystem services as "a transfer of resources between social actors, which aims to create incentives to align individual and/or collective land use decisions with the social interest in the management of natural resources."

It is highly relevant to discuss existing and emerging definitions of PES as the adoption of one definition over the other guides the analyses/evaluation of PES programs. Subscribers to the Coasean approach to PES are likely to determine that user-managed/private programs are more effective and efficient than Government-managed/public sector programs[5] (Wunder, Engel, Pagiola 2008). In addition, the Coasean approach to PES supporters are less likely to view equity as a critical part of the PES and more as a corruption of the efficiency of PES or as a "side objective" (Wunder, 2008, 2; Engel, Pagiola and Wunder, 2008, 9). As Pascual, Muradian, Rodríguez and Duraiappah (2009) point out "Coasean policy approaches tend to disregard equity

[5] The Coasean approach advocates for limited Government involvement and lower transactions costs. Literature reviewed showed that in Government versus User managed program, the Government managed programs had higher transaction costs particularly due to the number of participants. *Wunder, S, Engel, S and Pagiola, S. Taking Stock: A comparative analysis of payments for ecosystem services programs in developed and developing countries (2008).*

issues since they are based on the premise that efficiency gains may be independent of the allocation of property rights."

Subscribers to a mixed approach to PES along the lines of the Muradian et al (2010) re-definition, give consideration to equity (poverty alleviation, protection of rights, etc.) into the design of PES (Vatn 2010) and of equal value as effectiveness and efficiency in measuring PES (Porras, Barton, Chacon-Cascante and Miranda 2013).

2.2 PES Framework

A PES program includes buyers/users, who are charged for the benefits that they derived from environmental service; service sellers/providers who are compensated/rewarded/incentivized for protecting forests which provide those ecosystem services (Wunder 2005) and intermediaries brokering the payment program. Commonly in Government-financed PES programs, the buyers are dispersed amongst a general population and financing for PES is indirect e.g. through water tax. In contrast, in user-financed programs, the buyer is a direct beneficiary and financing for PES is direct.

The other critical actor is the seller. PES' fundamental theory is that without compensation/reward/incentivizing of targeted landholders to adopt better land use practices, the provision of the ecosystem services would be compromised. Property rights are one of the key components of payment for ecosystem services. For a seller to be considered for inclusion in a payment for ecosystem services program, the seller must have rights over the area to be contracted. There has been an evolution of sorts in defining property rights from the requirement of strict land title to the recognition of variations of land tenure (Lea and Mahanty 2009). Communal land rights, which is the traditional method of land management amongst indigenous people, have also been recognized for inclusion into PES programs as well as collective holding (Vatn 2010). The

requirement for property rights or land ownership in PES programs has raised concerns over whether PES supports inequity by blocking poor farmers from entering into PES agreements or cause the displacement of poor farmers due to land grab by richer, larger scale farmers (Vatn 2010).

Intermediaries are the third actors in PES programs. Their role may include acting as the go-between the buyer and seller and function in a range of positions including as negotiator, contractor, and administrator of the PES program (Huber-Stearns 2012). In national PES programs such as in Costa Rica and Mexico, the Government often acts as the intermediary. However, even in these programs, there are other smaller intermediaries which may act on the collective behalf of sellers (Chomitz, Brenes and Constantino 1998).

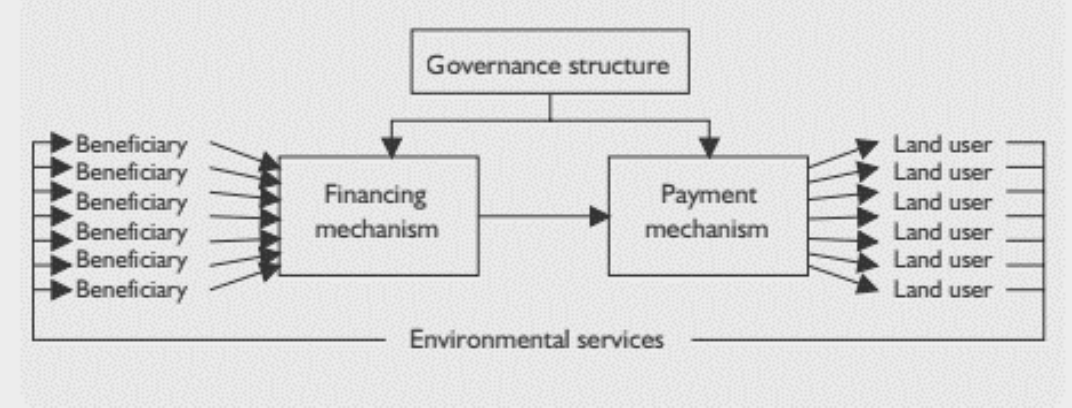

Figure 3: The Flow of Compensation from Beneficiaries to Land Users in Payment for Environmental Services. Source: Pagiola, S. and Platais, G. Environmental Strategy No. 2. The World Bank 2002.

The financing mechanism for payment for ecosystem services is used to collect and manage the funds contributed into the program by the buyers/beneficiaries (Mayrand and Pacquin, 2004). Financing sources vary amongst programs and may include: direct payment from beneficiaries and taxes, subsidies, loans and grants particularly found in Government-financed PES programs.

Markets for Ecosystem Services

In developing countries, the concept of the market is localized without services being sold outside national boundaries. The exception is carbon sequestration. Carbon sequestration is traded as carbon credits through the international carbon market which is supported by the Kyoto Protocol of the United Nations Framework Convention on Climate Change (Arriagada and Perrings 2014).

2.3 Costs, Permanence, Leakage, Additionality

There are four major evaluative factors for payment for ecosystem services programs efficiency and effectiveness: costs, additionality, leakage, and permanence. Costs in a PES program includes (1) opportunity costs and (2) transaction costs.

Opportunity costs refer to the projected costs of a landowner forgoing economic activities e.g. agriculture, cattle raising for activities such as afforestation, shade agriculture or no action which protect the provision of ecosystem services. Transactions/implementation costs addresses expenses that include negotiations, contract development, conducting baseline studies, monitoring and enforcement and capacity building (Jack, Kousky and Sims 2007).

Measuring the effectiveness of a PES program requires the establishment of an accurate baseline. The baseline is critical to determining what provision of ecosystem services have occurred since the implementation of the PES, this baseline is called the counterfactual. A payment for ecosystem services should produce changes in land use supporting the provision of ecosystems services – which is called additionality. The determination of additionality means that without the implementation of PES, the land use change would not have occurred.

Leakage occurs outside the contract areas of a PES program and is directly linked to the implementation of PES. Degradation and damaging activities to ecosystems within the PES contract area spills over to adjacent areas. Payments for ecosystem services are generally

structured on a five-year participation period for participants. After this period, the goal is that the landowners would continue with the provision of ecosystem services in the long-term (Wunder, Engel and Pagiola 2008). When the long-term provision of ecosystem services is achieved, permanence of the PES is indicated.

2.4 The Issue of Equity in PES Programs

Land rights and access to resources create power asymmetries, changing the power structure by placing decision-making powers in the hands of those with resource rights (Kuponiyi 2008). Resource rights and access determines "allocation, costs and benefit sharing" (United Nations Environment Programme,2012,8) and can create unequal access and asymmetric power relations (Vatn 2010). The potential for marginalization and increasing inequities is ever present in natural resources management (Quesada-Aguilar and Franks 2014). Often times it is the poor or marginalized that bear the most costs and are displaced as they are the most resource dependent for subsistence use as well as economic livelihood.

Equity in payment for ecosystem services is commonly perceived as morally and politically significant, but negatively impacting the economic efficiency and environmental effectiveness of PES (Pascual, Phelps, Garmendia et al. 2014). The early developmental phase of payment for ecosystem services, equity and legitimacy were not part of the discussion (Corbera and Adger 2007) and the focus was solely on environmental effectiveness and economic efficiency. Adger, Brown, Fairbrass et al. (2003) states that in sound environmental decision-making, equal attention must be paid to "efficiency, effectiveness, equity and legitimacy" as critical outcomes in project design. Equity as a critical outcome in PES design is gaining traction, however, the debate rages on whether or not the inclusion of equity considerations lessens the program's effectiveness and efficiency, and if the trade-offs are worth it.

How is equity defined and is it important for PES to work? There is no single definition for equity as the perception of equity is not consistent across social groups (Quesada-Aguilar and Franks 2014), but equity frameworks commonly refer to four dimensions of equity and principles (McDermot, Mahanty and Schreckenberg 2012, Quesada-Aguilar and Franks 2014, Pascual, Phelps, Garmendia et al 2014). The four dimensions of equity are (1) procedure, (2) distribution, (3) recognition and (4) context. Figure 5 shows the principles for each dimension.

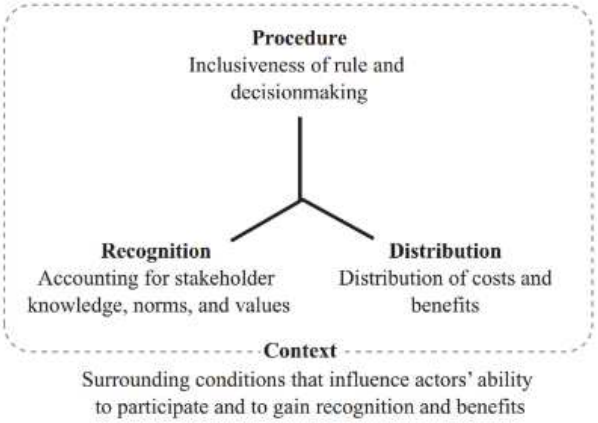

Figure 4: The three dimensions of social equity with context encompassing all three. Source: Pascual, Phelps, Garmendia et al. 2014

The inclusion of equity dimensions as an equal weight with environmental effectiveness and costs effectiveness can result in positive results including stronger legitimacy, improvement in compliance and participation (Pascual, Phelps, et al. 2014). Beyond the potential for equity actions in PES to support cost effectiveness, there is a moral obligation to protect the basic needs of all people, including the poor and marginalized.

In the inception of PES as a conservation tool, the exclusion of equity was contrary to the theoretical understanding of the program's purpose in totality (Corbera and Adger 2007). Payment for Ecosystem Services was envisaged as a conservation strategy that would not only be "more

economically efficient and environmentally effective than previous strategies", but it was anticipated that PES' that economic and social benefits would be fairly distributed (Corbera and Adger,2007, 1). According to Landell-Mills and Porras (2002), because payment for ecosystem services target is biodiversity conservation, the expectation is that the outcome would be positive both environmentally and economically. Further assumption made is that the marginalized would benefit. These assumptions have created a vacuum in the PES literature on "the issue of distribution" (Landell-Mills and Porras, 2002, 61). Rather than discussing distributional outcomes, the focus was on aggregate outcomes with the aim to "do no harm" to the poor.

The following section of this thesis expands the discussion on the varied positions on the trade-off between economic efficiency and equity is broadened.

2.5 Trading Equity for Efficiency

Payment for ecosystem services programs are implemented using varied institutional/program models (Appendix A), however, they share similar design elements which allow for analysis of models. This thesis' area of interest is the analysis of the program structure of a Government -financed and User-financed program's in their ability to deliver environmental effectiveness, cost-efficiency, and equity.

2.5.1 Existing Research

The literature on PES rarely, until the most recent works, rarely integrated the three critical policy outcomes of PES: environmental effectiveness, cost-effectiveness and equity (Jack, Kousky and Sims 2007). Historically, the general focus has been on environmental effectiveness and cost-effectiveness as direct policy outcomes. Research based on the Coasean approach to PES

invariably approaches equity as a side objective that negatively affects the cost-effectiveness and environmental effectiveness of the PES program (Engel, Pagiola and Wunder 2008, Engel, Pagiola and Wunder 2008, Wunder and Alban 2008, Pattanayak, Wunder and Ferraro 2010). Wunder (2013) expounds on this theory and aligns equity as a side objective in Government-financed PES programs, asserting that User-financed PES programs are better able to be effective in meeting the PES goal. Government financed PES programs are determined to be "politically adrift into win-win spheres of multiple side-objectives, such as poverty alleviation, regional development, or electoral motives" (Wunder, 2013, 45).

There is a small, but growing discussion, on equity as critical to PES success (Leimona, Joshi and van Noordwijk 2007) in line with "Muradian" refocusing of PES. Pascual, Muradian, Rodriguez and Duraiappah (2009) advances the argument beyond the inclusion of equity, to the interdependency of cost effectiveness, and equity and its effect on PES (Martin, Gross-Camp, Kebede and McGuire 2014, Pascual, Muradian, Rodriguez and Duraiappah 2009). The theory underpinning the link is that perceived inequities in PES programs may lead to inefficiency that "undermine cooperative behavior and foster conflictive behavior" (Martin, Gross-Camp, Kebede and McGuire, 2014, 224;Fripp, 2014, 24).

Wunder, Engel and Pagiola (2008) have produced the most significant body of work in the analysis of PES design focus on the management structure, i.e., Government-financed versus User-financed. The comparative analysis is based on the "synthesis" of 12 case studies of PES in developed and developing countries (Wunder, Engel and Pagiola, 2008, 3).

Case studies reviewed include Wunder and Alban (2008) which examined two User-managed PES programs in Ecuador the Pimampiro program - watershed protection and the PROFAFOR program - carbon sequestration. The findings of the case study of the two User-

managed programs indicated successful outcomes in achieving the "environmental objectives" including additionality, negligible leakage and meeting conditionality (Wunder and Alban, 2008, 696). Equity/fairness including poverty alleviation and other pro-poor initiatives are presented as "side objectives" (Wunder and Alban, 2008, 696).

The findings of the comparative analysis as it relates to equity/fairness follows the criticism that the Coasean approach looks at aggregate net gain and loss and not distributional outcomes (Pascual, Muradian, Rodriguez and Duraiappah 2009).

2.6 Limitations and Research Questions

The existing theory is that a User-financed PES program is better programmatically structured to be effective in meeting the PES goals than a Government-financed program. However, the existing theory is based largely on research which is limited to analyzing only effectiveness and efficiency outcomes without equal and comprehensive consideration given to equity. The argument put forward to not include equity consideration in the design of a PES program is that this can lead to a distortion or introduction of "side objectives" in the purpose of the PES (Wunder, 2008, 2; Engel, Pagiola and Wunder, 2008, 90). There has been growing research focusing on the inclusion of equity in the design of PES including linking equity and efficiency as interdependent outcomes, the impact of PES program on poor communities and landowners and measuring the distributional outcomes of PES[6].

The purpose of this thesis is to use two case studies to investigate whether the program structure of a PES program determines its environmental effectiveness, cost-effectiveness, and

[6] Equity/fairness is often referred to as pro-poor, poverty alleviation, poverty reduction and equal participation.

equity, and whether or not a PES program can be environmentally effective and cost effective and still be equitable.

Thus, the following inquiry will be made.

1. How does the program structure of a user-financed PES program differ from a Government-financed program in cost effectiveness, environmentally effectiveness, and equity?
2. Does the program structure or institutional design of payment for ecosystem services determine whether equity/fairness is planned for in the design of PES program?

Chapter 3

Methodology

The purpose of this thesis is to analyze the program structure of a user-financed and a Government-financed PES program in achieving environmental effectiveness, cost effectiveness, and equity. The case study design is used in this qualitative research. A case study is:

> an empirical inquiry about a contemporary phenomenon, set within its real-world context—especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2014, 16).

Further, a qualitative case study design was used to present the research. A qualitative case study is defined as "an intensive, holistic description and analysis of a bounded phenomenon such as a program, an institution, a person, a group or policy" (Merriam,1998, xii).

The qualitative case study design was the most appropriate research design as the study was done on the phenomenon in its natural setting without any intervention. Secondly, the qualitative case study method allowed for the collection of data from "multiple sources of evidence" (Yin, 2009,117), allowing for triangulation of data collected as well as reducing biases from informants, authors and myself as the researcher (Yin 2009). Thirdly, qualitative research advances the collection of descriptive data wherein the thesis focus area requires a detailed description to thoroughly understand the components of the cases being studied. Lastly, the qualitative case study design is appropriate as the cases being investigated through the case study design are "well-bounded and specific", i.e. there are clear limits to the cases being studied and the data being collected (Stake, 2005, 443; Merriam,1998,27).

Using a multiple-case design, two contrasting cases: Costa Rica National Program, a Government-financed for PES program and Los Negros Valley, Bolivia's User-financed PES

program are investigated. The multiple case design allows for studying the phenomenon using more than one case, fitting the scope of this thesis which focuses on two distinct program structure types implementing PES programs. One of the key advantages to using multiple cases versus using a single case study is that multiple case study allows for supporting the claim of "literal or theoretical replication" (Rowley,2002,21; Yin, 2009, 54). A literal replication refers to the "prediction of similar results" (Rowley,2002,21; Yin, 2009, 54) and a theoretical replication indicates "the prediction of contrasting results" (Rowley, 2002, 21; Yin, 2009, 54) with expected reasons for the differences.

Stake (1995) indicates that the pursuit of research through case study are underpinned by different end goals for researchers. Similarly, to Yin (2009), Stake (1995) notes the use of a multiple cases in research which he refers to as collective case study. A collective case study may include cases that are "similar or dissimilar" (Stake,1995,237). Further, the collective/multiple case study defined as being instrumental as it provides for an in-depth understanding of "an issue or refinement of a theory" (Stake, 1995, 237). The cases being studied are both similar in that they are PES programs and dissimilar as the buyers of the ecosystem services are not the Users in the Government-financed program, contrasting with that of the User-finance structure.

The case study design has been criticized for being weak in the ability to establish external validity (Falk and Guenther 2006). As Yin (2003) indicates, conducting a multiple case study is advantageous as it increases the external validity or generalization of the research. A caveat, however, is that multiple case studies do not create statistical generalization, i.e., generalization to the whole population, rather, case studies produce analytical generalization which is a generalization of existing, expanding and generating theories (Yin 2009).

3.0 Case Study

Two case studies were purposively selected for the research (Patton, 1990, 169) based on their program structure: (1) Government-financed PES - Costa Rica's National PES, and (2) User-financed PES – Bolivia. Purposeful sampling lends to the inclusion of cases that will provide comprehensive information on the phenomenon being studied. Various sampling strategies can be employed in purposeful sampling. The strategy implemented for Costa Rica's PES program is a typical case sampling providing an "illustrative sample" (Patton, 1990, 173). In the selection of the Los Negros Valley, Bolivia's PES program, intensity sampling was used (Patton, 1990, 171). In intensity sampling, the cases are "excellent or rich examples of the phenomenon of interest" (Patton, 1990, 171).

The selection of the cases was based on (1) location (Latin America), (2) established ≥10 years, and (3) program structure. Latin America was chosen as the site for the cases as the region is of critical importance to the provision of global ecosystem services and reducing Climate Change due to the high biodiversity in the region. The region also has high poverty rates and dependency on natural resources which creates a flash point for resource use and the implementation of conservation strategies. In addition, PES has increasingly become a policy tool in Latin America to protect the provision of ecosystem services.

Costa Rica PES program is the longest running Government-financed program and has been well-documented and promoted as a model (in most part due to its longevity) for other countries to follow for a national level payment for ecosystem services program. However, as noted in the literature research section, there is limited studies in researching the outcomes of environmental effectiveness, cost-effectiveness and equity in Costa Rica's PES program or any other PES program. Los Negros Valley, Bolivia is a far lesser documented PES program, but

provides a strong case for User-financed PES program. The reward system for the PES program is a direct result of negotiations between ecosystem services providers and downstream Users facilitated by an intermediary.

Using the cases of Costa Rica and Los Negros is appropriate to develop analytical generalization, in this case generalization by expanding on an existing theory.

3.1 Data Collection Methods

Data was proposed to be collected through a focused interview and document analysis. Primary documents analyzed for the Costa Rica case study were retrieved from links provided by Fondo Nacional de Financimiento Forestal - FONAFIFO (The National Forestry Fund) found at www.fonafiffo.go.cr and include legislation (decrees), financial and modality statistics. For the Los Negros, Bolivia case study the document: Fundación Natura Bolivia: Achievements to Date and Scale Up Plans shared by Fundación Natura Bolivia was used. Other documentation was then used to verify data found in the informants' documentation. Multiple sources of data collection support triangulation and increases internal validity and reliability of the research findings (Yin 2009, Stake 2010, Yazan 2015). Data triangulation is defined as using multiple source points to reach to a sort of "convergence of enquiry" (Yin,2009,115) to confirm or expand the researcher's understanding of the data collected (Stake 2010).

The primary sources of data collection employed for this research was a questionnaire that was to be followed by a focused interview and document analysis. A focused interview's main purpose is "to corroborate information that you already know" (Yin, 2009,107). The data collection procedure created for the questionnaire and interview was to firstly forward the questionnaire to the informant and then follow-up with an interview via Skype. However, during the course of scheduling a Skype call, the informant chose to fill in the questionnaire outside of

the interview and forwarded the completed questionnaire. The second informant chose to not conduct the interview but forwarded documentation based on the questions in the questionnaire and fielded additional questions and clarifications through email. Both provided links to data on their organizational website which provided additional data.

The most appropriate corrective action that could have been implemented to address the non-participation in the questionnaire/interview process would be to select another case. However, time constraints and lack of another appropriate case selection did not allow for choosing another case. Two other cases in Ecuador had been selected as options 1 and 2 for the case study. However, an earthquake resulted in an informant from option 1 withdrawing from being a part of the research and option 2 was non-responsive.

As noted on the questionnaire (See Appendix B: Questionnaire), some of the data on the cases are widely and readily available through documentation. However, corroboration was required to ensure the data was up to date.

For the questionnaire, a mix of both open-ended and closed-ended questions were used. Closed-ended questions allowed for the collection of factual data such as a number of persons participating in the payment for ecosystems services. Open-ended questions were included to allow the free flow of discussion that may have provided additional insights. The questionnaire was standard for both case studies. Due to the predominant language used in the targeted region for the cases, the questionnaires were presented in both English and Spanish. The questionnaire was built based on Jack, Kousky and Sims (2008) which provides a blue-print for best practices for environmental effectiveness, cost-effectiveness and equity.

Documentation provides "broad coverage" (Yin, 2009,103), but bias can be created based on (1) the researchers'/authors' biases and (2) my own selective bias (Yin 2009). To decrease

biases, primarily, documentation was accessed from the questionnaire responses and data sharing, and secondarily through an exhaustive review of available documentation on (1) PES design, (2) PES program case studies and (3) outcomes being analyzed.

Informants used for the case studies were Fundación Natura Bolivia and The National Forestry Fund (Fondo Nacional de Financimiento Forestal - FONAFIFO).

3.2 Data Analysis

Coding

The coding process was performed manually using descriptive coding (Saldana 2009) for questionnaire and email question responses. Using the manual process was suitable due to the small amount of data that was being coded. The questions had predefined codes which were synthesized to ensure they were mutually exclusive (Saldana 2009). Synthesizing the codes resulting in 3 categories and 9 sub-categories as presented in Table 2. Codes used were verified to be mutually exclusive (Saldana 2009). The definition for the categories and sub-categories was guided by Camhi (2012) and Jack, Kousky and Sims (2008), and are discussed further in the Findings section.

Table 1: Categories and sub-categories of the coding process

Categories	**Sub-Categories**
Environmental Effectiveness	Policy/Institutional Framework Monitoring Compliance and Enforcement Sustainability of the Provision of Ecosystem Services Sustainability of Program
Cost Effectiveness	Payment structure
Equity	Property Rights Requirements Distribution Social Legitimacy

An example of the coding process is demonstrated below. The example used highlights that a question with predefined codes can elicit additional content that may fit predefined codes or emerging codes (Saldana 2009). In the discussed example, the content fits predefined codes as explained below.

Interview Question: Is there any [intentional targeting of the poor] in the RWA?

Code: social and economic data used for targeting

Interview Response: [1][No], we target poor communities in Bolivia, but the [2][critical criteria for whether a farmer is eligible for voluntary participation is does the person have a piece of land that provides an environmental service].

[1] **Category: Equity**

Sub-category: Distribution

Code: Socio-economic data not used for targeting

[2] **Category: Environmental effectiveness**

Sub-category: Sustainability of the Provision of Ecosystem Services

Code: targeted approach

Analyzing Categories

The categories and sub-categories created in the coding process as presented in Table 2 were used in the analysis. Seventeen indicators were developed to identify the presence of each sub-category. If an indicator was determined as present, a 'Yes' was marked to that indicator. The 'Yes' was then assigned a score of 1. If an indicator was not determined as present, a 'No' was marked to that indicator. The 'No' was then assigned a score of 0.

By summing up the 1s and 0s from each sub-category, a numerical value was determined for each category. A 9 point interval scale, demonstrated in Table 2, was used to produce a subjective determination of the level at which each case study achieved the individual category.

Table 2: 9-point scale for individual categories

SCALE			
0	1 to 3	4 to 6	7 to 9
Not indicated	Low	Medium	High

Weights were then added to raw scores of specific sub-categories of the environmental effectiveness and equity categories. The addition of weights was used to increase the importance of specific sub-categories and compare those weighted scores for the user-financed case study and the Government-financed case study.

The cost-effectiveness category was analyzed differently from the other two categories. One sub-category was assessed under the cost effectiveness category, i.e., payment structure. In addition to the payment structure sub-category, indicators from the environmental effectiveness and equity categories were used as variables to assess the two case studies level of achieving cost effectiveness. Not all indicators were used; only indicators associated with bearing costs were used.

A table was created to assign selected indicators as either bearing high transaction costs or low transaction costs. The results from the payment structure category were included in the table as well. Indicators are appropriate to use as they "reflect changes in a particular context" (Church and Rogers,1996,44).

3.3 Protection of Human Subjects

The questionnaire was reviewed and approved by the Institutional Review Board (IRB) through an expedited Review Procedure as it qualified as no more than minimal risk to human subjects.

Informants were forwarded a consent form (See Appendix C: Consent Form) and asked to indicate acceptance via email prior to the questionnaire being sent to them. The consent form informed them about (1) the scope, (2) risks and benefits, (3) confidentiality, (4) voluntary nature of their participation and (4) contact information for any questions or concerns about the questionnaire or overall research.

3.3 Limitations

Major limitations are noted in conducting the case study. Firstly, my inability to conduct in-person interviews with informants due to lack of resources made it challenging to lock-in informants to an interview schedule. The data collection methodology in the data collection procedure was amended to ensure that data would be received from the individual case informants. Amending the data collection decreased the robustness of the case study.

Conducting a multiple case study is time-consuming and can be expensive, however, the more cases within a multiple case study, the stronger the replication logic (literal or theoretical) (Yin 2009). While, this thesis includes two distinct program structure to investigate units of observation of Payment for Ecosystem Services program, the inclusion of additional cases under the individual program structures would increase the replication logic of the study. Due to accessibility to data on additional cases and time constraints, additional cases could not be included.

Lastly, the use of indicators to determine the presence of the three policy outcomes may affect the validity and reliability of the study (Patton, 1996, 159). There are no existing standardized indicators of PES evaluation. I attempt to establish indicators based on exhaustive research of literature on payment for ecosystem services.

Chapter 4

Findings

Chapter 4 describes the findings of the data collected for the case studies. Table 3 provides a summary of the results for the categories of environmental effectiveness, cost-effectiveness, and equity.

The Costa Rica PES indicated that the program structure enabled the program to have high environmental effectiveness and equity outcomes. For the Los Negros Valley, Bolivia Reciprocal Water Agreements Program (RWA) indicated the program structure enabled a medium level of environmental effectiveness, but a high level of equity outcomes (Table 3). The Government-financed program had a greater number of low transaction cost elements than high transaction cost elements indicating that the program structure is somewhat cost-effective. For the User-financed PES program, the high transaction cost elements were greater than the low transaction cost elements indicating a program structure that is less cost-effective than the Government-financed PES program (Table 4).

Table 3: Summary of Findings for Environmental Effectiveness and Equity - Costa Rica National PES and Los Negros Valley, Bolivia

	Categories	
Country	**Environmental Effectiveness**	**Equity**
Costa Rica	7	7
Bolivia	4	7
Range		
0 = not present	low 1 - 3	Medium 4 – 6	High 7 – 9

Table 4: Summary of Findings for Cost Effectiveness - Costa Rica National PES and Los Negros Valley, Bolivia

	Low Transaction Cost Elements		High Transaction Costs Elements
Costa Rica	4		2
Los Negros Valley, Bolivia	2		3

4.0 Case Study Context

4.0.1 Government-financed Payment for Ecosystem Services - Costa Rica National Payment for Ecosystem Services Program

Costa Rica is situated in Central America and has forests of high biological diversity value (Committee on Noneconomic and Economic Value of Biodiversity and Commission on Life Sciences, 1999). A system of national parks has been established to protect the country's diversity. However, during the period 1970 – the early 80's, the country's high biodiversity was being over-exploited by cattle ranching and agriculture, resulting in high deforestation. Agriculture, logging, cattle ranching and related commercial activities were being supported by Government policies which allowed for subsidies and loans directed at these industries. The result was forest cover decreasing to 20% from a high of 70% (Porras, Barton, Chacón-Cascante and Miranda, 2013,5).

In 1997, Costa Rica's National Payment for Ecosystem Services program ([7]Pago por Servicios Ambientales – PSA) program was implemented as one of the policy responses to significant deforestation. Forestry Law No. 7575 of 1996, the legal framework for PES, was enacted allowing for the implementation of payment for ecosystem services in Costa Rica, marking

[7] The literal English translation is Payment for Environmental Services, however to remain consistent with the document the term Ecosystem is used.

the first national PES program. The law prescribes for contracting land enrollment for the provision of four ecosystem services:

- Carbon sequestration
- Watershed protection
- Biodiversity protection
- Scenic beauty

The ecosystem services are sold as a bundle. PES implementation was perceived as a more cooperative compliment to protected areas. According to Vatn (2010), the progression for PES in Costa Rica is normative as PES programs are implemented within an existing institutional framework. The Costa Rica PES program has a total of 340,432.99 hectares contracted under the payment for ecosystem services program. Land under PES is spread across the country's 7 provinces (Figure 6). Five thousand and eighty-one (5,081) contracts are currently within the program. The provinces of Puntarena and Limon have the largest hectares contracted under PES with 76,971.12 and 66,858.82 hectares respectively, while the province of Guanacaste has the largest number of PES contracts with 1,259.

	Hectáreas PSA		Árboles PSA	
Provincias	Contratos	ha	Contratos	Árboles
SAN JOSE	687	31,495.24	543	963,131
ALAJUELA	1,091	64,630.59	122	308,144
CARTAGO	126	16,377.50	54	141,932
HEREDIA	435	28,635.81	27	63,208
GUANACASTE	1,259	55,463.92	88	136,596
PUNTARENAS	829	76,971.12	84	518,659
LIMON	654	66,858.82	244	694,633
Totales	**5,081**	**340,432.99**	**1,162**	**2,826,303**

Figure 5: Contracts and hectares under PES per provinces. Source: FONAFIFO, 2016

The PES Program has a total of 6[8] thematic areas: (1) forest protection, (2) reforestation, (3) agroforestry system, (4) forest management based on pre-determined conservation area, (5) natural forest regeneration and (6) existing forest plantations.

According to FONAFIFO, the "National Forestry Development Plan goal is to maintain land under PES in the low 300 thousand hectares" (email questionnaire response, FONAFIFO, May 4, 2016).

[8] Each thematic area has 17 modalities: (1) forest protection, (2) water resource protection, (3) forest protection in conservation gaps, (4) protection within protected areas, (6) afforestation, (7) reforestation with native species endangered, (8) reforestation protection areas, (9) Second Harvests – management of existing forest plantation, (10) natural generation for Clean Development Mechanism, (11) natural regeneration, (12) natural regeneration of forests productive potential, (13) agroforestry systems, (14) agroforestry for coffee production, (15) agroforestry systems for endangered species of trees, (16) agroforestry systems for native species and (17) forest management. www.fonaifo.go.cr/psa

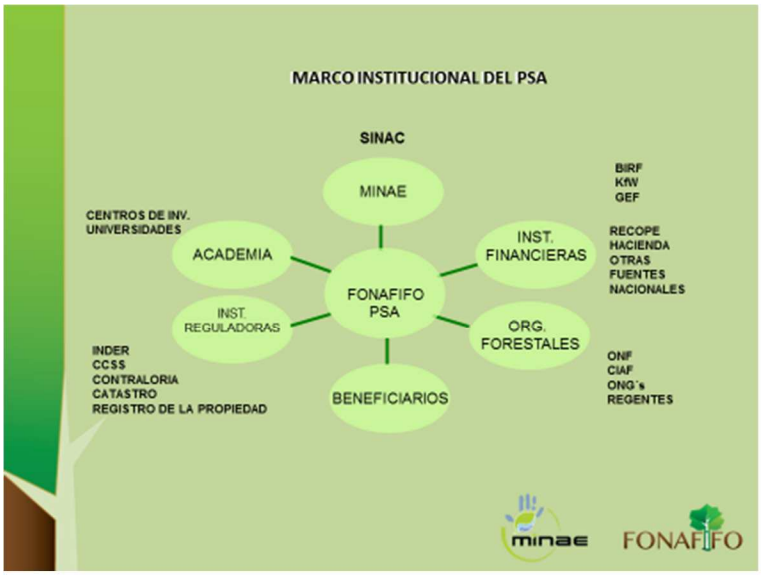

Figure 1: Institutional Framework for the Implementation of PES in Costa Rica. Source: FONAFIFO, 2016.

The PES program was designed through participatory consultation with various sectors including the forest and tourism sectors, indigenous people, Ministry of the Environment and Energy (MINAE), National System of Conservation Areas (SINAC) and National Forestry Office (ONF) and continues to be revised. Costa Rica's PES Program is administered by The National Forestry Fund (Fondo Nacional de Financimiento Forestal - FONAFIFO), which falls within the Ministry of the Environment and Energy, a Government entity. FONAFIFO has established eight regional offices to serve PSA participants.

4.0.2 User-Financed Payment for Ecosystem Services - Los Negros Valley, Bolivia PES/Reciprocal Watershed Agreement

The Los Negros Valley is located in the Department of Santa Cruz in Bolivia, South America. Bolivia has high biodiversity, particularly its cloud forests which is home to endemic bird species, however, these forests are at high risk for deforestation and forest degradation. For the indigenous Andean communities surrounding the Los Negros Watershed, these cloud forests

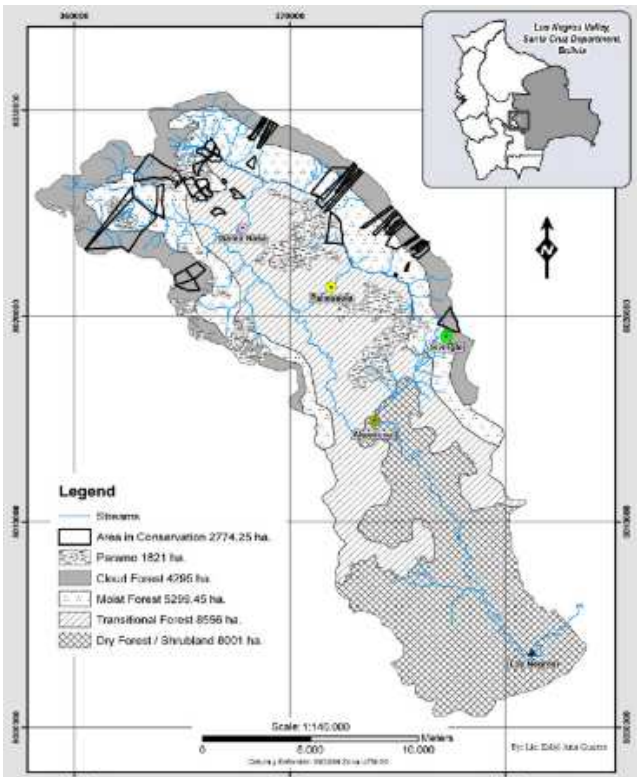

Figure 6: PES conservation areas in the Los Negros Valley. Source: Asquith, Vargas and Wunder, 2007

are a source of clean drinking water. In the Andean culture, water is held "as a universal and communal right" and its distribution should be equal based on the "needs, traditions and community norms that respect the water cycle." Further, water is seen as free (common good) and should not be sold.

In 2003, the downstream community of Santa Cruz was at a crisis point after a long drought and low water flow and quantity, which made irrigation for crops challenging. The downstream users held the upstream farmers responsible for the changes to the water quantity and quality due to the clearing of riparian forests within the watershed. The non-Governmental organization, Fundación Natura Bolivia (Nature Foundation) assisted in the formation of a community-based PES program to protect the Los Negros Watershed. With funding from the US Fish and Wildlife Foundation, Fundación Natura Bolivia facilitated 6 downstream irrigators and upstream farmers to negotiate contracts to preserve cloud forests and protect their livelihoods. In

exchange for every 10 hectares of forest not deforested, upstream landowners receive non-monetary rewards in a beehive, apiculture training and barbed wire for compliance.

An evolution of the initial PES program has resulted in the program being formally titled as Reciprocal Watershed Agreements (Acuerdos Recíprocos por Agua – ARA). Fundación Natura Bolivia asserts that the term "payment" should not be used in non-monetary schemes and promotes RWA as an "alternative to PES" (Asquith 2014). The purpose of the Reciprocal Watershed Agreements (RWA) is to protect the water supply through the protection of upstream forests and creating an enabling environment for downstream water users to contribute to such forest protection (Fundación Natura Bolivia). Currently, 95 farmers are enrolled to protect 4,500 hectares of forests.

4.1 Findings for Environmental Effectiveness Category

Environmental effectiveness is defined as the degree to which the contracted provision of ecosystem services is achieved (Porras, Barton, Chacón-Cascante and Miranda, 2013,5). There are five sub-categories used in this study to indicate environmental effectiveness in PES: (1) policy context/institutional framework, (2) monitoring, (3) compliance and enforcement, (4) sustainability of the provision of ecosystem services and, (5) sustainability of the program.

The Costa Rica PES program scored a 7 for environmental effectiveness which is considered as a high level for environmental effectiveness based on the 9- point scale. Los Negros Valley RWA scored a 4 which indicates a medium level of environmental effectiveness. The environmental effectiveness category is further discussed supported by results from the sub-categories and indicators which contributed to the final score.

Table 5: Summary Findings for Environmental Effectiveness Category

		Sub-Category					
Environmental Effectiveness	**Country**	**Policy/Institutional Framework**	**Compliance and Enforcement**	**Monitoring**	**Sustainability of the Provision of the Ecosystem Services**	**Sustainability of Program**	**Total Score**
	Costa Rica	2	2	1	1	1	7
	Los Negros	1	1	1	1	0	4

Not indicated = 0 Low = 1 -3 Medium = 4-6 High = 7-9

4.1.1 Policy Context/Institutional Framework

Two indicators were used in the policy context/institutional framework sub-category:

a) *Legislative legitimacy* - refers to the establishment of the PES by legislation, decree, and other legal mechanisms giving authority for the management structure and other guiding principles for the PES.

b) *Political support* – refers to tangible buy-in, recognition and support from decision-makers for the PES at the formal political level, e.g. national and local Governments.

Table 6: Findings for Policy Context/Institutional Framework Category

		Indicators	
Policy and Institutional Framework	**Country**	**Political Support**	**Legal Legitimacy**
	Costa Rica	1	1
	Los Negros, Bolivia	1	0

a) Costa Rica's National PES program (Score: 2)

Costa Rica's PES Program has legal legitimacy through the enactment of Forestry Law No. 7575 of 1996. Forestry Law No. 7575 provides for the establishment of PES as a policy tool and for the institutional framework to operationalize the policy. The National Forestry Fund (FONAFIFO) is the implementing agency for the PES program. FONAFIFO is a component of the Ministry of the Environment and Energy (MINAE), a Government entity headed by a Minister of Government. The placement of the implementing agency for PES within a Government Ministry is critical to the long-term viability of the PES program and provides strong political support for the national PES program.

Amendments, through legal decrees, have been made to the legislation to address gaps and make the program more effective. A historical review of the PES program informs that amendments have included new modalities and a targeted approach that recognizes: (1) "heterogeneity in land productivity" (Alix-Garcia, de Janvry and Sadouletand, 2008), (2) the risk of deforestation, (3) the conservation value of land, and (4) poor landowners and non-traditional land possession.

b) Los Negros, Bolivia Reciprocal Watershed Agreements (RWA) (score: 1)

Los Negros Valley RWA is local in scope and is not directly supported by national or local legislation[9]. Funds for purchasing the program rewards (beehive, apicultural training, and barbwire fencing) for participants in the RWA is disbursed through the Municipal Government. The inclusion of a Government entity as an integral actor in the disbursement process indicates

[9] Scaling up of RWA is occurring across Bolivia amassing 36 municipalities implementing the program as well as in neighboring countries. However, the research area being investigated is singular and specific to Los Negros Valley, therefore the reference to the RWA being local in scope.

that the Los Negros Valley RWA has significant political support, specifically at the Municipal Government level.

Municipal Governments have been given legislative power over natural resources management through the Law of Popular Participation 1581 of 1994 also known as the decentralization law. The legislation also formalized the relationship between civil society and the Government of Bolivia (Seemann 2004). Indirectly, the Law of Popular Participation gives a degree of legal legitimacy to the Los Negros RWA giving legal recognition of the role of civil society in resources management in Bolivia. However, there is no legislation dedicated to the operationalization of RWA in Bolivia.

Further, Fundación Natura Bolivia ([10]Nature Foundation of Bolivia) as a non-Governmental (non-profit) organization has acted as a facilitator for the program and has received international donor funding for the start-up costs and operations. The ability to attract funding and to operationalize the program, shows de facto legal legitimacy of the RWA program, however, this is the extent of any legal backing for the Los Negros RWA.

The lack of a legal framework for the Los Negros RWA is Bolivia's unstable political environment and disjointed environmental policy context may have a direct influence on the non-existent enabling legal environment for RWA in Los Negros.

4.1.2 Monitoring

The monitoring category has two indicators:

a) *Baseline*: refers to the systematic collection of bio-physical data to establish the flow of ecosystem services against which any changes to ecosystems post-PES intervention can be measured.

[10] Nature Foundation of Bolivia role is also comparative to that of an intermediary as discussed in the equity variable.

b) *Monitoring for the provision of ecosystem services: refers* to a planned monitoring program to ensure participants are providing ecosystem services in accordance with the PES contract.

A counter-factual baseline is critical to determining whether or not a PES program is working in obtaining additionality, i.e. the provision of ecosystem services that would not occur without PES. The counter-factual baseline hypothesizes a scenario without and with PES (Wunder, Efficiency of Payments for Environmental Services in Tropical Conservation 2007) feeding into the design and monitoring of the PES. Without the establishment of counterfactual baseline, the evaluation of the real impact of PES is weak and can negatively affect environmental and cost-effectiveness.

Table 7: Findings for Monitoring Category

		Indicators	
Monitoring	**Country**	**Counter-factual baseline established**	**Monitoring f/ provision of ecosystem services**
	Costa Rica	0	1
	Los Negros, Bolivia	0	1

a) Costa Rica's National PES program (score: 1)

The baseline for the PES program was established in 1997 using Landsat imagery of forest cover. In the early stages of the PES program, a "static baseline" (Wunder, Efficiency of Payments for Environmental Services in Tropical Conservation 2007) was used where payment was being made for forest-cover without the determination of whether forest protection would occur without PES. Enrollment in the program was first-come, first accepted to match several criteria. The evolution of the Costa Rica Program has resulted in more targeted approach through establishing

national priorities for the selection of land to be enrolled in the program such as land to fill conservation of biodiversity gaps, land within biological corridors and land within critical watersheds. As noted in the Policy and Institutional Framework section, a targeted PES program increases the environmental cost-effectiveness of the program.

b) Los Negros, Bolivia Reciprocal Watershed Agreements (RWA) (score:1)

One known baseline data collection was done through Landsat imagery in 2001, similarly as was done in the Costa Rica Program. The image captured land use types for Los Negros. No hydrological baseline studies were conducted and the information used to initiate the program in 2003 was based on associating low water levels with upland deforestation.

Monitoring for ecosystem services provision is conducted in both programs through field visits to farms enrolled under PES as well as geospatial technology to track and monitor the PES Program. As discussed in the Compliance and Enforcement section, both programs use proxies to assess additionality - provision of ecosystem services. Proxies are contracted actions or non-actions, e.g. not cutting a certain hectare of forests or planting a specified number of trees, with the end goal being the additional provision of ecosystem services.

Monitoring is critical to ensuring adherence to the contract, and ostensibly the actual provision of ecosystem services, thus improving environmental effectiveness as well as building trust between seller and buyer. As one of the downstream irrigators in Santa Cruz said:

> For us, it is very important that we have an environmental committee to monitor if they are really looking after the watershed or not. (RARE, Watershed Protection in Bolivia: Reciprocal Water Agreements 2010)

Costs associated with monitoring can be considered high transaction cost or a low transaction cost. An untargeted PES will require more monitoring, increasing cost (high-cost

transaction). Contrastingly, a targeted PES can allow for a tailored monitoring program and reduce costs.

4.1.3 Compliance and Enforcement

PES has two models for payments: output based and input based payments. Output-based payments require direct measurement of additional provision of ecosystem services. Carbon sequestration is the only ecosystem services for which output based payments have been made. Input based or proxy based payments reward land owners for land-use behaviors such as not clearing forests, planting a number of trees etc. or outcomes from these actions such as increased forest cover. The theoretical underpinning is that these activities should provide ecosystem services as the opposite action degrades or causes loss to ecosystem services. Using proxies can be effective if a strong causal relationship can be ascertained between the proxy and the expected provision of ecosystem services (Jack, Kousky and Sims 2008).

Appropriate proxies contribute to the environmental effectiveness and cost effectiveness by improving the opportunity to secure additional ecosystems services. A direct relationship between the PES intervention and changes to ecosystems services can be better established.

The compliance and enforcement sub-category has three indicators:

a) *Payment based on output based performance*: refers to payment based on the measured provision of ecosystem services (additionality). For example, carbon sequestration can be calculated by the number of tress, types of species, age of trees etc.

b) *Payment based on appropriate proxies*: refers to payment based on actions such as the number of trees planted, hectares not deforested etc. and associates the input with changes to the ecosystem services targeted. "Appropriate proxies" relates to the certainty between

proxies and the provision of ecosystem services desired (Jack, Kousky and Sims 2008, 9467).

c) *Enforcement of contract*: refers to the administration of the contract signed through enrollment and the imposition of sanctions when the terms of the contract are violated.

Table 8: Findings for Compliance and Enforcement Sub-category

		Indicators		
Compliance and Enforcement	**Country**	**Payment based on provision of ecosystem services**	**Payment based on appropriate proxies**	**Enforcement of Contract**
	Costa Rica	0	1	1
	Bolivia	0	0	1

a) Costa Rica's National PES program (score: 2)

Payment for land enrolled under PES is input based versus output-based. The Costa Rica PES program contracts land under PES based on priority areas with identified conservation values. An Executive Decree is issued indicating the priority modalities, the maximum hectares for each modality and the priority land-use types. Costa Rica's PES program uses a targeted approach to PES participation which improves the certainty of the proxy.

FONAFIFO explained the enforcement of the PES contract:

> All conditions of the contract are enforced and the contract compliance rate is 98%. Enforcement is through the control and scheduled payments, in addition to [the use of] all applicable legislation.

Sanctions may include the termination of contract and repayment of funds paid to seller and removal from the PES program.

b) Los Negros, Bolivia Reciprocal Watershed Agreements (RWA) (score:1)

The Los Negros Valley, Bolivia RWA is also input based. Enrollment of farmers into the RWA is dependent on the ability of their land to provide the desired ecosystem services. The process to determine the ecosystem services provision is untargeted as all farmers in the upstream area (Santa Cruz) are invited to enroll. Accepted lands are mapped after which a conservation area is set aside as land under PES. The untargeted approach decreases the certainty of the proxy.

The conditions of the contract are enforced. Sanctions for non-compliance include the return of the incentive or its value in cash.

4.1.4 Sustainability of the Provision of Ecosystem Services

Reforestation can take between 50 – 100 years. Using a minimum realistic timeframe for the growth of secondary forests into shrubs (Food and Agriculture Organization), a contract period of not less than 5 years was assigned for the indicator of Sustainability of the Provision of Ecosystem Services.

The sustainability of the provision of ecosystem services has one indicator:

a) *Contract term < 5 years:* refers to the timeframe which the landowner has agreed to have their land under PES being greater than 5 years.

Table 9: Findings for Sustainability of Provision of Ecosystem Services Category

		Indicators
Sustainability of the Provision of Ecosystem Services	**Country**	**Contract term < 5 yrs**
	Costa Rica	1
	Bolivia	1

a) Costa Rica's National PES program (score:1)

Contracts terms are formulated by FONAFIFO and published in the *La Gaceta,* the Official Gazette (a publication which forms part of the legal requirement for public notification). Contracts are differentiated based on the modality. For the priorities for 2015 which are reforestation and afforestation contracts, the contract terms are between 5 – 16 years: Reforestation <9; afforestation 10 – 16 years based on tree species; agroforestry and forest management = 5 years.

b) Los Negros Valley, Bolivia Reciprocal Watershed Agreements (RWA) (score: 1)

The RWA contract term is for a period of 5 years for land in upstream with the option for renewal.

4.1.5 Sustainability of Program

A PES which does not have long-term financing mechanisms is likely to be environmentally ineffective due a lack of permanence associated with a disrupted PES program.

a) *Long-term funding*: refers to the availability of funding for the long-term to support the costs related to the implementation of PES.

Table 10: Findings for Sustainability of Program Sub-category

		Indicator
Sustainability of Program	**Country**	**Long-term funding**
	Costa Rica	1
	Bolivia	0

a) Costa Rica's National PES program (score:1)

A diverse funding base for the Costa Rica program supports the likelihood of long-term financing for the continuation of the program. Diversification of the funding base was a result of evaluation the financial mechanism for PES.

> The fuel tax has given a minimum stability to the Programme, but we have been constantly exploring fresh sources. We quickly realized that as a small country we were not going to be able to compete under the original Kyoto and Clean Development Mechanisms, so we looked inside our own country instead (I. Porras 2012).

Funding sources for Costa Rica: 3.5% fuel tax, budget allocation by the State, sale of greenhouse gases emission credits on international markets, sale of ecosystem services certificates for businesses donating towards payment for ecosystem services as credit towards conservation, sale of hydrological services to hydroelectric plants, allocations to the National Forestry Financing Fund and international donors. According to FONAFIFO:

the bulk of the budget comes from the excise tax on fuels, but [there are] other sources such as [11]water canon, the voluntary carbon markets, some awards or payments for biodiversity and the tourism sector contributions.

Costa Rica's PES program appears to be designed to be innovative and diverse in its funding base to reduce any potential impact of policy cycles associated with Government-financed PES Programs (Arriagada and Perrings 2009).

b) Los Negros, Bolivia Reciprocal Watershed Agreements (RWA) (score:1)

[11] The water canon is tax created to pay small forestry owner in high conservation priority areas. Water Users are charged the tax based on the purpose of the use of the water and quality use. Executive Decree No. 26635-MINAE of 18 December 1997

Downstream water users of Los Negros pay US$.50 as a water tariff. The water tariff is a component of the PES financial mechanism from which the Santa Cruz upstream farmers are rewarded for the provision of ecosystem services. Funds collected from the water tariff and other funding sources are used to purchase in-kind rewards for the upstream which includes beehive and barb wire, as well as technical training.

International donor funding has also been infused into RWA for implementation. Secure long-term funding is influenced by the agreements signed between the parties, however, if the buyer chooses to withdraw from the program, the long-term financial security may be threatened. One of the primary differences between a user-financed and Government financed PES program is that in the user-financed program there is direct seller-buyer negotiations and payments. The Coasean approach to PES states that a buyer/user would only withdraw from a program when the ecosystem services are no longer being provided (Arriagada and Perrings 2009). Withdrawal of the buyer from the PES when the services are no longer being provided would be indicative of a PES structure working as it should.

However, the RWA is not a simple buyer-seller structured user-financed program. In the Los Negros RWA, the buyers include direct beneficiaries (downstream irrigators) as well as local Government (municipal government) and indirect global beneficiaries (external funder). The withdrawal any one funding source could prove detrimental for this PES Program, therefore, it is considered to not have long-term sustainability.

4.2 Findings for the Equity Category

Equity is defined as the fair distribution of costs and benefits through inclusive participation and decision-making and recognition of traditional rights, norms, and knowledge.

There are three sub-categories for the Equity category: (1) property rights requirement, (2) distribution and, (3) social legitimacy.

a) *Property rights requirement*: refers to the property rights required for enrollment in the PES program
b) *Distribution*: refers to who bear the costs and benefits of the program
c) *Social legitimacy*: refers to buy-in and support at the community level for the PES program.

Table 11: Summary of Equity Category Findings

		Sub-categories			
Equity	**Country**	**Property Rights Requirement**	**Distribution**	**Social Legitimacy**	**Total Score**
	Costa Rica	2	2	1	5
	Los Negros	2	1	1	4

No present indicated = 0	Low = 1 -3	Medium = 4-6	High = 7-9

4.2.1 Property Rights

PES requires well-defined property rights to secure the provision of services. Requiring property rights can preclude the poorest from participating in PES programs (Vatn 2010, 1248) and is indicative of the inherent inequity of PES.

The property rights sub-category has three indicators:

a) *Land title*: refers to formalized land ownership recognized and registered in the Government cadastral system.
b) *Traditional land management*: refers to recognized traditional land ownership such as communal lands.

c) *Alternative land possession*: refers to the recognition of land without formalize ownership such as land squatting.

Table 12: Findings for Property Rights Requirement Sub-category

		Indicators		
Property Rights Requirement	**Country**	**Land title**	**Traditional/ Customary land management**	**Alternative possession rights**
	Costa Rica	1	1	0
	Bolivia	1	0	1

a) Costa Rica's National PES program (score:2)

As part of the enrollment process, a land owner interested in participating in the PES program must submit a land title or other ownership documents. The land title is verified with FONAFIFO's cadastral system for authenticity.

The land title requirement does not apply to indigenous groups who use traditional land management, i.e. communal land management. Communal lands are formally recognized by Costa Rica's National Land System. The acceptance of communal land in the PES system is not a direct equity strategy from within the PES program, but a by-product of national equity and human rights policy actions that contributes to equity in the PES program.

b) Los Negros, Bolivia Reciprocal Watershed Agreements (RWA) (score:2)

Traditional land ownership (titling) in the rural areas of Bolivia is an anomaly rather than the norm. Land ownership is complex with few farmers possessing Government issued titles with most landowners possess generational purchase agreements. In addition, the rural areas are populated by indigenous groups who use communal land management.

The RWA has a major challenge with landless immigrants, referred to as colonists, who squat on private land not fenced (demonstrating ownership) or land within conservation areas (Asquith, Vargas and Wunder 2008). As these immigrants do not possess the elusive Government issued titles or the generational ownership through purchase contracts, they are not included in the RWA. However, the landless immigrants have an effect on the RWA as they deforest in critical forest areas (Asquith, Vargas and Wunder 2008).

4.2.2 Distribution

The distribution category has two indicators:

a) *Smaller properties <50 hectares included*

b) *Socio-economic data used in targeting*

Table 13: Findings for the Distribution Sub-Category

		Indicators	
Distribution	**Country**	**Smaller properties included <50 hectares**	**Socio-economic data used in targeting**
	Costa Rica	1	1
	Bolivia	1	0

a) Costa Rica's National PES program (score:2)

The Costa Rica PES program allows the registration of property less than 50 hectares for inclusion in the PES program. Properties less than 50 hectares that are within identified critical conservation areas are prioritized as important to include in the PES program. That importance is

highlighted by assigning 25 additional points for these types of properties in calculating the optimal properties to achieve the PES goals. The inclusion of smaller properties is indicative of a PES program's attempt to include poorer land owners and make the program more equitable.

Central to Costa Rica's PES program is the integration of environmental protection, economic development and poverty alleviation in the program design. Notably, in the preamble of the Executive Decree No. 39083 which declares the priority areas for the period of July 2015, Costa Rica's National Development Plan is identified as the overarching guiding principle for defining priority areas. The Development Plan is built on the principles of social and economic justice to alleviate poverty.

The focus on poverty alleviation per the Development Plan is indicated in the scoring for priority areas with criteria such as forests within indigenous communities' territory awarded 85 points, the highest additional assigned score. Additionally, forest farms in districts with a Social Development Index (SDI) of less than 43.4% receive 10 additional points. The SDI is used to target low-income areas that are also within the conservation target areas, however, the Index is criticized for not fulfilling the objective of inclusion of the poorest in PES (I. Porras 2012). However, while there are efforts to address equity through creating a targeting approach, there are program design problems which are critical barriers to the poor entering the PES program as well as a significant threat to environmental effectiveness as one PES participant explained:

> PES has helped us a lot and has given me the opportunity to ensure my economic future, not one hundred percent, but I am not complaining. The paperwork to obtain PES is getting more difficult… I don't know whether I will be eligible in the next period…if I am not eligible, I will probably start cutting, and SINAC [the conservation area authority] does not have the capacity to stop us (Barton 2014).

Intermediaries can be beneficial in assisting participant's in enrolling in the PES program, but there are costs associated with the inclusion of intermediaries that not all PES participants are able to afford.

b) Los Negros Valley, Bolivia Reciprocal Watershed Agreements (RWA) (Score:1)

Properties that are 1 hectare and above can be enrolled in the RWA. Los Negros Valley's population is mainly poor, indigenous people and landless migrants. Targeting the poor or special groups is not a part of the RWA as the situational context makes these groups natural participants. As Fundación Natural Bolivia explained, targeting the poor is not a consideration in enrolling participants in the program.

> No, we target poor communities in Bolivia, but the critical criteria for whether a farmer is eligible for voluntary participation is does the person have a piece of land that provides an environmental service.

The landless migrants, discussed in the property rights requirement sub-category, are not part of the RWA program.

4.2.3 Social Legitimacy

The social legitimacy sub-category has three indicators:

a) *Participatory/Consultative Process*: refers to the inclusion of critical stakeholders in the design, implementation and evaluation of PES process
b) *Awareness/Education Programs*: refers to intentional actions to inform and educate PES participants and potential participants about PES.
c) *Intermediaries*: refers to organizations, individuals, etc. who act as the go-between for the buyers and sellers, negotiating prices and other conditions.

Table 14: Findings for Social Legitimacy Sub-category

		Indicators		
Social Legitimacy	**Country**	**Participatory/ Consultative Process**	**Awareness/ Education**	**Intermediaries**
	Costa Rica	1	1	1
	Bolivia	1	1	1

a) Costa Rica's National PES program (score:3)

According to FONAFIFO, the Costa Rica National PES program design and evaluation "is a dynamic process of constant revision, always with the participation of various sectors, producers, indigenous, MINAE, SINAC, ONF" **(**Email questionnaire response, FONAFIFO, May 4, 2016). Using a participatory approach in design and evaluation is likely to create greater acceptance in the local communities creating social legitimacy. Social legitimacy supports political buy-in as politicians are more likely to support a program that does not have community resistance.

Both social and political support can be linked to environmental effectiveness with the former contributing to securing PES land from leakage and in the provision of ecosystem services, whilst the latter ensures long-term funding. A participatory approach with diverse stakeholders also provides an enabling environment for building an equitable PES Program.

With amendments to the institutional structure, regional FONAFIFO offices have been established throughout the country allowing for more direct interaction with PES participants. The establishment of local offices is a significant change to the program structure that can improve targeting and monitoring increasing environmental effectiveness and cost effectiveness.

Public awareness and education is continuous, particularly to gain and maintain the trust of communities to participate in the PES program. Building and maintain trust is critical to the

success of the PES Program. In the past, landowners, particularly indigenous people, have expressed concerns that PES was an attempt to take their land rights.

> When the PES began, people were confused. They thought that if we sold the air from the trees, it was a step from there to lose our land (I. Porras 2012)

> You should understand that during the last 25 years, under the banner of 'protecting the environment' the authorities have progressively taken our land rights, which IDA [Land Reform Institute] previously said were ours… so it's natural that us locals are angry (Barton 2014).

FONAFIFO has focused on increasing trust and social legitimacy through establishing local offices, public awareness, and education. Intermediaries also play a critical role in bridging the information gap between PES and applicants, particularly for the indigenous communities.

Non-Governmental Organizations (NGOs), community organizations and farmer cooperatives act as intermediaries where they negotiate PES contract for a group of landowners with FONAFIFO. In a now revised program structure, intermediaries would sell the ecosystem services to FONAFIFO and sign the contract on the behalf of the land owners they represented. However, FONAFIFO revised the PES program whereby if an intermediary is used, the individuals the intermediary is representing must sign an individual contract with FONAFIFO.

b) Los Negros Valley, Bolivia Reciprocal Watershed Agreements (RWA) (score:3)

The RWA management approach is highly participatory and consultative amongst the supporting institution/intermediary, Fundación Natura, the communities of Los Negros and Santa Cruz, Water Cooperatives and the Municipal Government. A key outcome of the participatory environment is the in-kind and technical training rewards structure which was specifically chosen

by the sellers as fulfilling an income-generation need. Trust-building has been a major challenge for the implementation of RWA. The lack of trust is tied to a general lack of trust in Government and other authorities based on Bolivia's history of corruption and marginalization of the poor and indigenous people.

While there is no formal public awareness campaign in the Los Negros Valley, the trust building activities with the sellers and buyers have acted as an informal public awareness channel. Fundación Natura role as a supporting institution for the RWA extends also to the role as intermediary working with sellers and buyers. The intermediary role is not self-declared by Fundación Natura.

4.3 Findings: Cost-Effectiveness Category

Cost-effectiveness is defined as the ability of a payment for ecosystem services program to achieve its environmental goals at the lowest possible cost compared with other strategies (Jack, Kousky and Sims 2008).

There is one sub-category for the Cost Effectiveness Category in PES - payment structure. Using the findings from the Environmental Effectiveness and Equity categories and the findings of the payment structure sub-category, a determination is made on cost effectiveness.

4.3.1 Payment Structure

The payment structure category has two indicators:

a) *Differentiated payment*: refers to payment structure created to include opportunity costs of PES participants and the conservation value of the forests being protected. A PES participant protecting forests in a modality of high conservation value will get a different

per hectare payment compared to a participant protecting forests in a lesser conservation value area.

b) *Front loaded payment*: refers to a payment structure which allows for a large percentage of funds to be paid upfront, i.e. in the 1st year of the contract. For example, in year 1, a PES participant may receive 50%, year 2 – 20%, year 3 – 15%, year 4 – 10% and year 5 – 5%.

Table 15: Findings of the Payment Structure Sub-category

		Indicators	
Payment Structure	**Country**	**Differentiated Payment**	**Front loaded payment**
	Costa Rica	1	1
	Bolivia	1	1

Differentiated payments in PES programs is indicative of targeting based on pre-assigned conservation values and is considered to be cost effective. Upfront payments help to cover sellers' costs, especially for poorer participants.

a) Costa Rica's National PES program (score:2)

Costa Rica's PES program payment structure was revised from a flat payment structure, which is considered less cost-effective than a differentiated payment structure. The differentiated payment structure is based on the modality the land is being enrolled. Differentiated payment has been introduced for the modalities of: forest protection, agroforestry systems, and reforestation. The 2015 Call for Participants indicates differentiated payment based on the conservation value of the land relevant to priority areas for PES (spatial targeting) and the type of species being planted (reforestation and afforestation modality). Natural Regeneration, forest management, and forest plantation are on a flat payment structure.

Front loaded payment is offered for the agroforestry and reforestation modalities with first payments at 50% in advance. For the reforestation modality, front-loaded payment applies to PES activities on land 50 hectares or less. The front-loaded payment for landholders with less than 50 hectares is a signal of the PES program having been designed to be inclusive of poorer landholders.

b) Los Negros, Bolivia Reciprocal Watershed Agreements (RWA) (score:1)

A differentiated payment structure is utilized based on the number of hectares (based on a scale), forest types and use. Payment ranges from US$1.5/hectare to US$3/hectare. Los Negros, unlike Costa Rica's PES program, does not pay participants in cash as the reward is through in-kind payment or technical assistance. Cash is used to purchase beehives, barbed-wires, and technical training, particularly apicultural training. The reward was negotiated between sellers/buyers as the best option as one seller noted, "If I receive money, I will spend it quickly, but honey production has helped me diversify my income" (Fundacion Natura Bolivia 2015)

Approximately 7 days after contract signing, the incentives are provided to the farmer, therefore, the RWA is considered as offering front-loaded payment.

4.3.2 Analysis of transaction costs

Transaction costs are all the costs involved in implementing the PES program including implementation costs and opportunity costs on the administrative end and costs for enrollment on the participants' end. Opportunity costs for the participants are not included in the transaction costs.

Table 16 provides an analysis of the transaction costs of each case study. Based on the exhaustive literature review, design elements of each case study were deemed either as low transaction cost elements or high transaction cost elements and assign to the appropriate category.

Table 16: Analysis of transaction costs

	Low Transaction Cost Elements		High Transaction Cost Elements
Costa Rica	• differentiated payments in some modalities • payments from multiple buyers consolidated to provide payment to the seller • targeted approach • bundling of services **(4)**		• many small landholdings participants • flat payment **(2)**
Los Negros Valley, Bolivia	• small group of buyers and sellers • payments from multiple buyers consolidated to provide payment to seller • bundled services **(3)**		• untargeted PES • monitoring costs • use of uncertain proxies **(3)**

For the Government-financed PES program, the targeting of poorer landholders to improve equity in the PES program resulted in many small landholders which are considered a high transaction cost element (Jack, Kousky and Sims 2008, Vatn 2010). Intermediaries can play a crucial role in reducing transaction costs by being the representative of a group of small landholders. Costa Rica's PES program was restructured to not include group participation (excluding communal landholding), therefore the intermediary acts in a more consultative capacity. Further, intermediaries are not a constant for cooperatives, etc. as FONAFIFO noted that

"there are organizations that support some of the owners of farms, but not always" (email response to questionnaire, FONAFIFO, May 4, 2016).

Flat payment in a PES program is considered to be both environmental and cost ineffective (Wu Yang, et al. 2013, Engel, Wünscher and Wunder 2007). Firstly, landholders with higher opportunity costs and higher ecosystem services provision may be deterred from entering the PES program, while those with lesser opportunity costs and lesser ecosystem services provision are more likely to enter. The latter type of participant is also more likely to enter land into the PES program that would not have been deforested.

Untargeted PES, monitoring costs, and uncertain proxies are inter-linked in increasing transaction costs for the user-financed program. An untargeted program and uncertain proxies can result in payments being overpaid, payments made for land not providing additional provision, and makes monitoring more difficult.

Table 17: Findings of Cost-Effectiveness Analysis

	Low Transaction Cost Elements		High Transaction Cost Elements
Costa Rica	4		2
Los Negros Valley, Bolivia	2		3

The Costa Rica's National PES program had 4 indicators considered to be of low transaction costs and 3 considered to be of high transaction costs. Los Negros Valley Bolivia Reciprocal Watershed Agreements had 3 indicators considered to be of low transaction costs and 3 considered to be of high transaction costs.

4.4 Weighted Scores

Weights were applied to the scores for the Environmental and Equity categories, with greater weights placed on the compliance and enforcement, and the monitoring sub-categories. Higher weights were placed on the compliance and enforcement and monitoring indicating greater importance in achieving environmental effectiveness than the other sub-categories. The two sub-categories were assessed as critical to enabling Environmental Effectiveness as without compliance, enforcement and monitoring, a PES program would be ineffective in accounting whether there has been the provision of additional ecosystem services.

As indicated in Table 18, the compliance and enforcement sub-category raw scores were weighed by 35% and the monitoring sub-category raw scores were weighted by 30%.

Table 18: Weighted Matrix for Environmental Effectiveness – Costa Rica PES Program and Los Negros, Bolivia RWA

Environmental Effectiveness – Weighted Scores						
Sub-Categories	Costa Rica PES Raw Score	Weight (%)	Weighted score	Los Negros, Bolivia RWA Raw Score	Weight (%)	Weighted Score
Policy/Institutional	2	15	30	1	15	15
Compliance & Enforcement	2	35	70	1	35	35
Monitoring	1	30	30	1	30	30
Sustainability of the provision of the Ecosystem services	1	20	20	1	20	20
		100	150		100	100

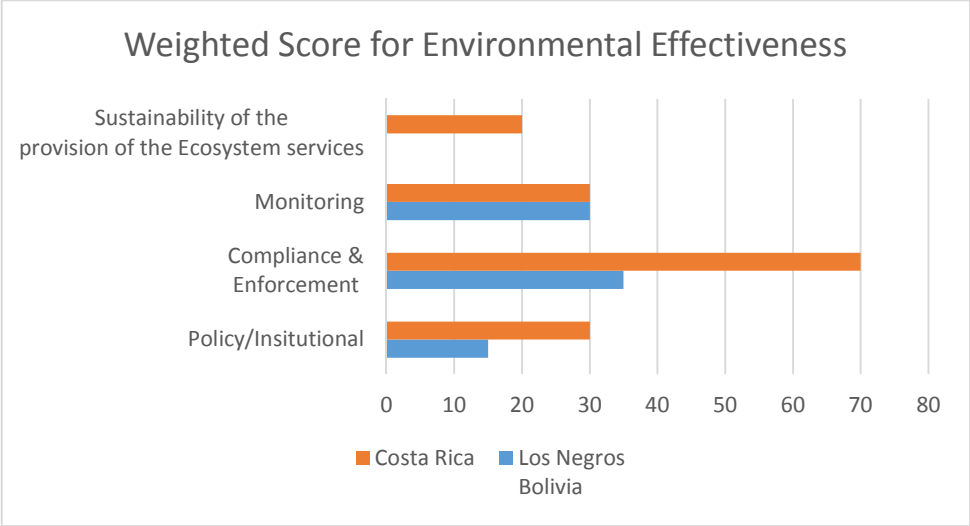

Figure 7: Comparison of Critical Sub-categories for Costa Rica and Los Negros, Bolivia PES programs

The weighted scores for the Environmental Effectiveness category indicated that Costa Rica's PES program is better designed to support compliance and enforcement than the Los Negros, Bolivia RWA. However, as figure 8 demonstrates, when the monitoring sub-category scores were equally weighted across the two PES, both the Los Negros, Bolivia RWA and the Costa Rica PES programs indicated that the program structures were equally designed to support monitoring of the respective programs.

The Equity Category scores were similarly weighed with the property rights requirements and the distribution sub-categories assessed as most critical to enabling equity in a PES program. At the foundation of PES concept is the requirement of land ownership/title. However, the requirement of property ownership also creates a built-in inequity in PES that has to be addressed to create equity in any program. The distribution sub-category is also critical to the PES program as it indicates who bears the costs and who benefits from the implementation of a PES program.

Table 19: Weighted Matrix for Equity

Equity – Weighted						
Sub-Categories	Costa Rica PES Raw Score	Weight (%)	Weighted Score	Los Negros, Bolivia RWA Raw Score	Weight (%)	Weighted Score
Property Rights Requirements	2	40	80	2	40	80
Distribution	2	35	70	1	35	35
Social Legitimacy	1	25	25	1	25	25

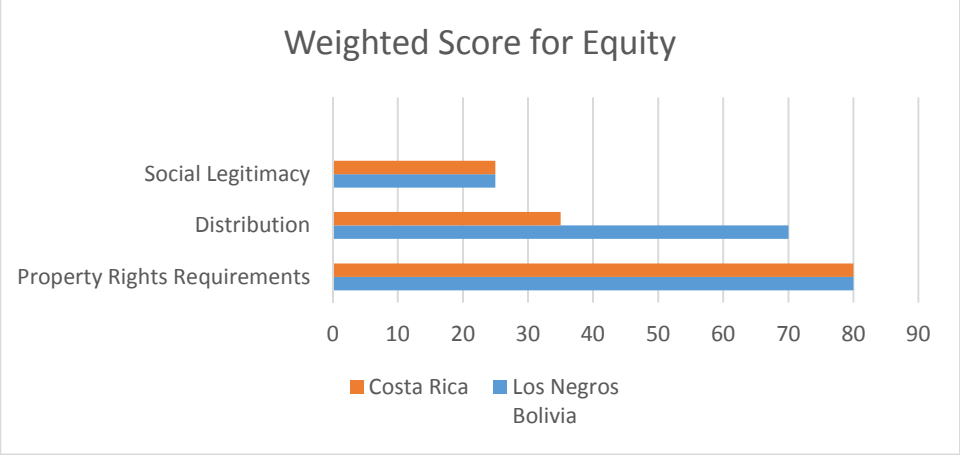

Figure 8: Comparison of Critical Sub-categories for Costa Rica and Los Negros, Bolivia PES programs

The weighted scores for the property rights requirements indicates that both the Costa Rica PES and the Los Negros, Bolivia RWA programs structure are equally designed to address inequity in the property rights requirements. Within the property rights requirements sub-category, land title, communal land management and alternative land rights are listed as indicators in a PES program. A PES program which allows for either communal land management or alternative land rights along with the requirement of a land title scores as more equitable. Scoring only on the land title being the established inequity in PES would be indicative of a poorly designed structure for equity in PES.

The distribution sub-category weighted score showed that the Costa Rica PES program structure was better designed to support equitable distribution of the costs and benefits of the PES than the Los Negros, Bolivia RWA.

Chapter 5

Analysis

The findings of the study cannot be generalized due to the limited study conducted, however the findings can provide relevant information and lessons learnt to improve policy outcomes for PES programs.

1. How does the user-financed PES program structure differ from Government-financed program in cost-effectiveness, environmental effectiveness, and equity?

Two case studies were used to analyze the program structure of a User-financed PES program and a Government-financed PES program in their ability to support environmental effectiveness, equity and cost- effectiveness. Existing PES theory is that user-financed programs are better able to provide environmental effectiveness and cost-effectiveness than Government-financed PES programs. The argument to support the existing theory that Government-financed programs are less environmentally effective and cost-effective is based on the assertion that a user-financed PES program is focused on achieving "environmental goals/effectiveness" in contrast with Government- financed programs "often de facto come to politically drift into win-win spheres of multiple side-objectives, such as poverty alleviation, regional development, or electoral motives" (Wunder, 2013, 231).

Based on the analysis of the two case studies, however, the Government-financed PES program had stronger indications of a program that is structured to support environmental

effectiveness compared with the User-financed PES program. That result is in reference to the unweighted scores for all sub-categories of the environmental effectiveness category.

Further analysis of the environmental effectiveness category where the scores were weighted, and the compliance and enforcement sub-category was assessed as the critical element to supporting environmental effectiveness produced a different result. With weighted scores, both the user-financed PES program and the Government-financed program ranked equally in having a program structure able to support environmental effectiveness.

Regarding cost-effectiveness, the Costa Rica PES program had a greater number of low-cost activities than high-cost activities, indicating that the Government-financed PES program was better structured to enable a cost-effective program in comparison with the Los Negros Valley PES program. In contrast to the Government-financed PES program, the User-financed PES had an equal number of low transaction costs activities and high transaction costs activities.

The analysis for equity indicated that the Government-financed and User-financed PES programs were equally structured to support equity in PES implementation. Notably, when the equity scores were weighted and the property rights requirements sub-category was assessed as the most critical to supporting equity, both the Government-financed and User-financed PES ranked equally. This outcome is highly interesting as at the foundation of the Coasean PES theory is the requirement of land ownership/title. However, within the property rights requirements sub-category, land title is not the only indicator. Indeed, the selection of the land title indicator only would indicate a program that is not designed to support equity. The other indicators for the property requirement sub-category are communal land management and alternative land rights which are indicative of a PES program expanding property requirements to increase equity. Therefore, a PES program which allows for either communal land management or alternative land

rights along with the requirement of a land title is structured to be more equitable. Scoring only on the land title being the established inequity in PES would be indicative of a poorly designed program for equity in PES.

In terms of cost effectiveness, it is an accepted reality that there are trade-offs between cost-effectiveness and equity. However, where equity strategies may on the surface increase transaction costs, the same strategies lend to environmental effectiveness and lower transaction costs in other areas. A PES program that has low social legitimacy, has a high probability of not achieving its environmental objectives as issues of trust and conflict may arise (Martin, Gross-Camp, Kebede and McGuire, 2014, 224), requiring more monitoring efforts and other interventions, therefore, increasing transaction costs. Further, where the distributional benefits of PES appear to promote unfairness and further marginalize the poor, these communities may further seek to engage in activities which undermine the PES goal in adjacent properties creating leakage.

The analysis showed that the Government-financed program was better structured to support environmental effectiveness and cost-effectiveness than the user-financed program. However, weighted scores identified that both programs are equally strong in program structure elements that significantly contribute to environmental effectiveness and equity. From the two case study results, there is no inherent bias that a user-financed PES program is a better-structured program over a Government-financed program.

2. *Does the program structure or institutional design of payment for ecosystem services determine whether equity is planned for in the design of PES program?*

For the case studies in this research, the program structure of the PES program was a factor in whether equity is planned for and integrated into the design of the program. In the Costa Rica

Government-financed PES, the principles of the country's overarching National Development Plan was integrated into the PES design, influencing the payment structure, prioritization of equity targets along with conservation targets and the intentional inclusion of small farmers through acceptance of small properties in the program. The inclusion of special groups such as indigenous people and the poor shapes the design of the PES in areas such as property rights requirements, where communal land rights are legitimized and in the use of socio-economic data in targeting. Equity strategies such as those integrated into Costa Rica's PES program reduces "barriers to entry that would exclude poor communities or landowners" (Salzman,2009, 54).

The User-financed program does not intentionally include equity considerations in its implementation. However, as the RWA target communities are rural communities, which includes poor upstream providers and downstream users, socio-economic data is unintentionally part of the RWA implementation.

A major failure to address equity in the Los Negros RWA is that the poorest and most likely to degrade ecosystem services are not included in the program (Asquith, Vargas and Wunder 2008). The exclusion of this group has significant implications for environmental effectiveness. Landless immigrants referred to as colonists squat on land not fenced or within conservation areas. As these immigrants do not possess Government issued titles or the generational ownership through purchase contracts, they are not included in the RWA. However, Asquith, Vargas and Wunder (2008) contend that the landless immigrants deforest old primary forests at a higher rate than "land owners". Exclusion of the poor can significantly affect a PES program's social legitimacy and environmental effectiveness.

The Government-financed PES in this study was better able to integrate equity strategies, particularly recognizing and including communal land management as formal property right and addressing distribution issues.

Chapter 6

Conclusion

The purpose of this thesis was to analyze the program structure of two PES programs in the program's ability to support environmental effectiveness, equity, and cost-effectiveness. Two case studies were used in the analysis: the Costa Rica National PES Program, a Government-financed program and the Los Negros Valley, Bolivia Reciprocal Watershed Agreements (RWA), a User-financed Program. This thesis also investigates the role of the type PES program structure in the inclusion of equity in PES design and implementation. Based on lessons drawn from the study, the Government-financed PES program was better structured to support environmental effectiveness, cost-effectiveness, and equity. However, no conclusion was drawn that the type of PES program, i.e. user-financed or Government-financed programs determines a better-structured program. Critically, the Government-financed PES program attempts to address the inherent inequity of PES in the requirement of property rights. Property rights is a major barrier for the poor to enter into PES. The recognition of communal land rights and the regularization of long-term settlers to formal land ownership in the Costa Rica National PES program was a significant strategy to removing barriers for the poor from entering PES. The inherent equity remains in the User-financed PES scheme despite the tangible effect on environmental effectiveness

Secondly, Government-financed PES programs face stronger political and social legitimacy pressures to integrate equity into PES. For User-financed PES programs where the buyers are the Users of the ecosystems services, equity may be a secondary issue over environmental effectiveness and cost efficiency. the Los Negros Valley RWA indicates, failure to address equity can reduce the environmental effectiveness and increase costs. Addressing

equity as a critical part of PES is beneficial to achieving environmental effectiveness and reducing costs.

Thirdly and significantly, in regards to achieving the policy outcomes of environmental effectiveness and cost effectiveness, the type of program structure is not the determining factor. The Costa Rica National PES program demonstrated a more adaptive and flexible management approach, changing its approaches implemented earlier in the program to improve environmental and cost-effectiveness through spatial targeting, differentiated payments and bundling of services. As far as can be determined, the Los Negros Valley RWA has not had the same pace of change.

Lastly, achieving the policy outcomes of environmental effectiveness and equity requires trade-offs in cost effectiveness. Particularly, the inclusion of equity as a policy outcome and not a side objective has implications on cost effectiveness. Case in point is the inclusion of small poor landholders which improves equity, but creates a high cost in transactions. Continued evaluation and adaptation to findings can help to decrease costs and maintain and equitable PES program. As Landell-Mills and Porras (2002) affirms, a PES program works in the long-term if the communities benefit economically, socially and environmentally.

Undoubtedly payment for ecosystem services is evolving with environmental and socio-economic context in which it is being implemented. Scaling up of PES is being promoted through the REDD+ Initiative and increasingly developed and developing countries are implementing PES. With the evolution comes evaluation of what PES should look like and who should bear the costs and benefits. There is clearly an undercurrent to shift and modernize the theory of PES from the Coasean approach which focuses on cost efficiency and environmental effectiveness to the "Muradian approach" of a holistic approach to include equity as a key design element of PES.

The gradual shift from the dominant "do no harm" or "the better off than before" approaches are not sufficient as real strategies must be implemented to improve the distributional outcomes of PES.

6.1 Recommendations

Based on the case studies investigated through this study, the following are recommendations to integrate environmental effectiveness, cost-effectiveness and equity in Government financed and User-financed PES programs.

6.1.0 Recommendation 1:

Payment for ecosystem services programs must not be static, but designed to create an adaptive and flexible program to allow for changes to improve achievement of objectives.

6.1.1 Recommendation 2:

Equal weight should be given to Equity as a policy outcome in the design and implementation of the PES programs, whether Government or User-financed. This is particularly appropriate and necessary in developing countries where there is high poverty and dependency on natural resources.

6.1.2 Recommendation 3:

Baseline data for bio-physical and socio-economic data must be collected prior to the implementation of PES to reduce transaction costs (cost efficiency), environmental effectiveness and equity. The data should be used to create a counter-factual baseline. If a program is ongoing and no baseline data has been collected, a reconstructed baseline should be attempted using secondary data. Additionality cannot be accurately measured either through output or input performance without baseline data. Equity actions in PES program will not be successful unless they are targeted and based on sound scientific data.

6.1.3 Recommendation 4: Priority areas for PES must be established and a targeted approach to PES undertaken to gain additionality (environmental effectiveness) and equity. Untargeted implementation of PES program does not work (Pagiola, 2011, 12) and expends costs where provision of ecosystem services will not materialize.

6.2 Limitations

The inclusion of more than two cases would create a more robust study that would support stronger analytical generalization. However, time constraints and limited case selection made the addition of other cases a challenge.

A second limitation is asymmetric information from the case studies. FONAFIFO built their web site to include statistics and other data that are sought by researchers and organizational structure includes staff to respond to a public enquiry. In addition, a majority of the existing literature on PES includes Costa Rica. On the other, Fundación Natura as a small non-profit, has much less resources and lesser research information is available on the Los Negros RWA.

Thirdly, it was challenging to analyze transaction costs, particularly opportunity costs, qualitatively. In this case, opportunity cost was included in the cost-effectiveness outcome. From a qualitative analysis perspective, the determination of opportunity costs appropriateness could be made from using literature indicating a threshold of what is considered to be low payment or high payment. However, opportunity cost is based on the value of a forgone activity replaced with PES. The true determination of whether the opportunity costs being paid is cost effective would be first analyzed against the value of the forgone activity and compared with literature on opportunity costs. However, data was not available to conduct the needed analysis.

6.3 Opportunities for further studies

There are further areas of research that can be explored to expand on this thesis area, for example:

1. Analysis of the User-financed and Government-financed PES programs in a Developed country in comparison with a developing country.

Chapter 6
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Appendices

Appendix A: Types of payment for ecosystem services (adapted from Payment for ecosystem services: Getting Started, A Primer, Forest Trends, The Katoomba Group, and UNEP, 2008)

Types of PES	Description
Public payment programs for private land owners	These types of PES agreements are country-specific, where Governments have established focused programs (as in Mexico and Costa Rica). While specifics vary by program focus and country, they commonly involve direct payments from a Government agency, or another public institution, to landowners and/or managers.
Formal markets with open trading between buyers and sellers, either: **(1) under a regulatory cap or floor** on the level of ecosystem services to be provided, **or** **(2) voluntarily Regulatory ecosystem service markets**	These payment for ecosystem services programs are established through legislation that creates demand for a particular ecosystem service by setting a 'cap' on the damage to, or investment focused on, an ecosystem service. The Users of the service, or at least the people who are responsible for diminishing that service respond either by complying directly or by trading with others who are able to meet the regulation at lower cost. Buyers are defined by the legislation, but are usually private-sector companies or other institutions. Sellers may also be companies or there entities that the legislation allows to be sellers and who are going beyond regulatory requirements. **Voluntary markets** also exist, as in the case of most carbon emission trading in the United States. For example, companies or organizations seeking to reduce their carbon footprints are motivated to engage in the voluntary market to enhance their brands, to anticipate emerging regulation, in response to stakeholder and/or shareholder pressure, or other motivations. Voluntary exchanges are also a category of private payments (see below).
Self-organized private deals in which individual beneficiaries of ecosystem services contract directly with providers of those services	**Voluntary markets**, as outlined above, are a category of private payments for ecosystem services. Other **private PES deals** also exist in contexts where there are no formal regulatory markets (or none are anticipated in the near term) and where there is little (if any) Government involvement. In these instances, buyers of ecosystem services may be private companies or conservationists who pay landowners to change management practices in order to improve the quality of the services on which the buyer wishes to maintain or is dependent. The motivations for engaging in these transactions can be as diverse as the buyers, as is explored further in the step-by-step section that follows on finding buyers.

Appendix B: Consent Form

CONSENT FORM

You are being invited to participate in a research study conducted by Tanya Williams-Daley for a Master's Thesis through the Rochester Institute of Technology (RIT). The thesis research is on Environmental Effectiveness, Cost Efficiency and Equity in User-managed and Government-managed schemes using Programa Face de Forestación (PROFAFOR) as a case study. I ask that you read this form before agreeing to be in the research.

About the Study

As the administrator of Programa Face de Forestación (PROFAFOR), the institution/organization plays a key role in the design of the PES scheme and is directly involved in its implementation. It is in this vein that I would like to discuss with you, as an authorized representative of PROFAFOR-FACE, the key features of the payment for ecosystem scheme. While some of the information being requested has been found in past research, I am gathering additional information to ensure that the information presented in my thesis is as up to date as possible.

Procedures

If you agree to be in this study, I will conduct an interview with you. A questionnaire will be sent to you prior to the interview. I can arrange a Skype call or an alternate media more convenient to you where I would conduct the interview with you using the questions on the questionnaire. The areas of interest include: (1) the scope of the PES scheme, including the number of participants and acreage under the scheme, how participants are chosen, including if there is a pro-poor variable in participants selection (2) the methods of payment in the scheme, how the scheme is funded and, (3)how the scheme is monitored and how additionality is measured. The data collected will be used to compare against best practices for Payment for Ecosystem Services using the variables of environmental effectiveness, cost efficiency and equity/fairness.

The interview will take about 30 minutes to complete. With your permission, I would also like to do an audio recording of the interview.

Risks and Benefits

I do not anticipate any risks to you participating in this study other than those encountered in the provision of general information on the scheme. There are no benefits to you, but the recommendations from the thesis may be helpful to PROFAFOR-FACE.

Confidentiality

The information received from you will be cited to PROFAFOR-FACE. I will not include any information that will make it possible to identify you.

Voluntary Participation

Your participation is voluntary. By participating in the study, you are indicating that you have read and understood the information provided above and that you are willingly participating in the study. Please note that you may withdraw your consent at any time.

Contact

Please feel free to contact me at tanyamrlawilliams@gmail.com or 001-(512)963-2805 if you have any further questions. If there are any questions or concerns about your rights or if there is any concern about how the research is being conducted, please contact Ms. Heather Foti, MPH Associate Director at email: hmfsrs@rit.edu, at telephone 001-(585)475-7673 or via mail at Human Subjects Research Office (HSRO)University Services Center, Suite 240014, 1 Lomb Memorial Drive, Rochester, NY 14623-5608.

Appendix C: Questionnaire (Translated in Spanish as well)

I am currently completing a Master of Science Degree in Science, Technology and Public Policy from the Rochester Institute of Technology (RIT). My thesis research is on Environmental Effectiveness, Cost Efficiency and Equity/Fairness in User-managed and Government-managed schemes using Costa Rica National Payment for Environmental Services Program as a case study.

As the administrator of the Costa Rica National Payment for Environmental Services Program, the institution/organization plays a key role in the design of the PES scheme and is directly involved in its implementation. It is in this vein that I would like to discuss with you key features of the payment for ecosystem scheme managed by FONAFIFO. While some of the information being requested has been found in past research, I am gathering additional information to ensure that the information presented in my thesis is as up to date as possible.

The data collected will be used to compare against best practices for Payment for Ecosystem Services using the variables of environmental effectiveness, cost efficiency and equity/fairness.

I would appreciate if you could take a few minutes to answer the questionnaire that you will find attached. The questionnaire has been approved by RIT's Office of Human Subjects Research as being in accordance with the institution's research guidelines. Any information collected will be attributed to FONAFIFO and not to any person(s).

To complete the questionnaire, I can arrange a Skype call or an alternate media more convenient to you where I would conduct an interview with you. Prior to the call the questionnaire would be sent to you. The interview will take 30 minutes to complete.

Please feel free to contact me at tanyamrlawilliams@gmail.com if you have any questions. If there are any questions or concerns about your rights or if there is any concern about how this research is being conducted, please contact Ms. Heather Foti, MPH Associate Director at email: hmfsrs@rit.edu, at telephone 001-(585)475-7673 or via mail at Human Subjects Research Office (HSRO)University Services Center, Suite 240014, 1 Lomb Memorial Drive, Rochester, NY 14623-5608.

Sincerely,
Tanya Williams-Daley
MSc Candidate, Science Technology and Policy
Rochester Institute of Technology
Rochester, New York

Questionnaire for Administrative Body

I. Administration

1. When was the PES scheme established?

2. What is the institutional and policy framework for PES?

3. Was the PES established to replace any legislation?
   a. Yes. If yes, please answer questions **4 and 5**
   b. No

4. Which legislation or policy did PES replace?

5. What was the purpose of the legislation or policy which PES replaced?

6. How was the process of designing the PES approached, i.e, was there collaboration outside of administrative body?

7. What is the financing mechanism for the PES scheme?

8. Is there a financial sustainability plan for the PES scheme?

II. Scope, Monitoring and Conditionality

1. What is the acreage size of the PES scheme?
   i. Original acreage _____
   ii. Current acreage _____

2. What is the acreage size enrolled under contract?

3. How many participants/number of contracts are in the PES?
   i. Original Number _____
   ii. Current number _____
   iii. Projected Number _____

4. Please fill in number of participants for each type. If type does not apply, please leave blank.

Participants in Payment for Ecosystem Services Scheme	
Types of Participants	**Number of Participants**
Individual Landowners	
Private Entity	
Groups	

5. What ecosystem service (s) are being targeted? Are these services provided as single units or bundled?

6. Was a baseline established for the areas covered in the scheme?
    a. Yes. When was the baseline established (year) _____
    b. No

7. How is the scheme monitored?

8. Are participants given payments based on:
    a. Proxy actions, e.g. hectares of forest not cleared, reforestation, etc.
    b. Actual provision of the targeted ecosystem services
    c. Other (please explain) _____

III. Eligibility and Participation

1. Are there intermediaries involved in the PES?
    a. Yes. Please identify the type of intermediaries
    i) NGOs ii) investors iii) community groups iv) other _____
    b. No

2. Is there a contractual agreement for participants?
    a. Yes. If yes, please answer questions 3 - 5.
    b. No

3. What is the period of the contract? Do all participants get the same contract?

4. How is the contract renewed?
    a. Based on provision of service(s)/compliance
    b. Based on automatic renewal

c. Other (please explain) _____

5. How is the contract enforced?

6. What is the rate of compliance with PES contract?

7. Are participants required to have formal land titles to participate in the PES scheme?
   a. Yes b. No

8. Have any indigenous groups with communal or non-traditional land ownership applied to participate in the PES scheme? If yes, what is the rate of participation?

9. What variables are used to select participants applying to participate in the scheme? Please circle all that applies.

a. eligibility based on land size. Indicate set land size range _____
   b. proximity to ecosystem service (s) being protected, etc.? c. Opportunity costs
   d. Other

10. Was the issue of equity/fairness included in the selection of participants?

III. Payment and Financing Structure

1. Is the PES scheme based on a valuation study for ecosystems services?
   a. Yes. What was value of ecosystems services in the PES? _____
   b. No

2. Are payments differentiated or standard across the contracts? If differentiated, on what basis are payments made?

3. How are participants paid/incentivized for participating in the PES scheme? Please circle all that applies and add any additional information?
   a. Cash b. in kind c. training/capacity building d. extension services
   e. Other (please explain) _____

4. How is the PES scheme financed?