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# **Can financial incentives encourage a more pro-environmental behavior?**

**- A case study of Payments for Environmental Services in Costa Rica**

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## **Abstract**

Financial incentives are increasingly being used to promote provision of environmental services (ES). Costa Rica was early with launching their Payments for Environmental Services (PES) scheme that rewards provision of ES and prevents further losses of the same. This study examines the links between Costa Rican PES scheme, pro-environmental behavior and forest conservation. PES-beneficiaries and farmers that do not benefit from the PES scheme (non-beneficiaries) were interviewed and their answers were compared in the process of analyzing the connections between PES, pro-environmental behavior and forest conservation. The purpose of the interview questions was to frame features that induce pro-environmental behavior and investigate the interviewees' forest ownership. The result from the statistical analysis showed correlation between the pro-environmental behavior and forest conservation among non-beneficiaries, i.e. where the forest owners were not financially compensated. There was not a convincing link between participating in the PES program and demonstrating pro-environmental behavior, but the beneficiaries had somewhat stronger tendency to demonstrate pro-environmental behavior. This tendency correlated with years of education, which has a recognized positive effect on pro-environmental behavior and was significantly higher for the beneficiaries, indicating that the level of education, and not the participation in the program, caused the altered tendency for pro-environmental behavior.

*Keywords:* Payments for environmental services, pro-environmental behavior, forest conservation, Costa Rica.

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## Introduction

The value of ecosystems has increasingly gained recognition for fulfilling the purpose of provisioning environmental services (ES), i.e. benefits people obtain from ecosystems (MEA, 2005). Costa Rica is widely acknowledged for its beautiful nature and rich biodiversity. Despite arising awareness of the inherent and economic values of Costa Rica's natural biotopes, which provide ES such as water purification, carbon sequestration and pollination, they have lost ground to alternative land usages, such as agriculture, forestry and urbanization (Zbinden and Lee, 2005, MEA, 2005). The forests provide most of the ES in Costa Rica and hold substantial higher biodiversity levels than pasture, both counting for number of species and number of individuals (Ibrahim et al., 2006). Central America saw an annual deforestation rate of approximately 2% in the later decades of the 20<sup>th</sup> century, a rate which was far higher than contemporary average international levels, causing complications as soil erosion and watershed contamination (de Groot and Ruben, 1997, FAO, 1997). The dire consequences from forest degradation and diminished ES have raised global concerns resulting in international political forums negotiating the endorsement of important schemes to secure the presence of indispensable ES. Costa Rica was the first country to implement a nationwide program of Payments for Environmental Services (PES), in original language 'Pagos por Servicios Ambientales', to reward provision of ES and prevent further losses of the same (Alpizar et al., 2012).

The scope of PES varies depending on which definition one chooses to follow. In this thesis I use the semi broad definition by Tacconi (2012) being 'a PES scheme is a transparent system for the additional provision of environmental services through conditional payments to voluntary providers.' Costa Rica's PES, launched in 1996, is not very different from the forthcoming international PES system REDD+, elaborated within the environmental treaty 'United Nations Framework Convention on Climate Change' (UNFCCC). REDD+ is still being formulated, but its purpose is set to be building systems for transferring funds from developed to developing countries where they should be used to reduce carbon emissions, mainly by preventing deforestation and forest degradation in tropical forests (Bond et al., 2009).

ES are in many cases open access resources, i.e. commodities free to use without exclusion. Consequently the beneficiaries often do not compensate the providers of ES, e.g. carbon dioxide sequestration, freshwater purification and pollinator habitats, as their services are not internalized into commodity prices. The above mentioned ES are positive externalities, they produce values that are not accounted for. Their degradation is therefore cheaper than it would have been if the incentives for keeping them were internalized. Indeed the degradation of ES is seen as a market failure that could be solved by creating a market where beneficiaries compensate the providers (Grieg-Gran et al., 2005). According to Stern (2007) climate change is the largest market failure to have existed so far. Stern (2007) presents political actions that are necessary to successfully mitigate climate change. Two of these are the need of pricing carbon and to educate people about how to take actions to mitigate climate change (Stern, 2007), elements that are embraced by PES and believed to induce pro-environmental behavior<sup>1</sup>. During recent decades an increasing number of in practice schemes have emerged, creating national or regional markets for PES. In developing countries these count to more than 200 and the number continue to grow (Landell-Mills and Porras, 2002, Pattanayak et al., 2010).

Despite widely requested in studies on PES systems, there are very few surveys investigating if PES programs crowd out intrinsic pro-environmental behavior. It is essential to recognize the potential conflicts between intrinsic and extrinsic motivation<sup>2</sup> to understand the indirect effects of using PES as an instrument for extrinsic motivation. In a behavior study in Mexico and Tanzania, Kerr et al. (2012) found that monetary incentives raised participation in actions when motivation was low, but did not increase participation, rather reduced satisfaction, when social norms favored participation. The low additionality<sup>3</sup> rate of PES in Costa Rica suggests that there might be an out-crowding effect on pro-environmental behavior.

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<sup>1</sup> Pro-environmental behavior is defined by Kollmuss & Agyeman (2002) as 'behavior that consciously

<sup>2</sup> Intrinsic motivation derives from implementing the task itself while extrinsic motivation derives from the possible outcome of accomplishing the task.

<sup>3</sup> In this thesis additionality refers to how much forest and other natural biotopes that are preserved from becoming deforested, or deteriorated, by the presence of PES. The concept is further explained in section The workings of PES.

This study takes on the query of how Costa Rica's PES program affects pro-environmental behavior by analyzing structured interviews with landowners enrolled to PES and non-enrolled to find out if there is any difference in pro-environmental behavior. Farmers represent the non-beneficiaries on the basis that they typically own land with some forest and that many PES-beneficiaries are or have been farmers. According to Locatelli et al. (2008) participants in PES-programs obtain induced environmental awareness and knowledge and have a more positive image of forest protection. Yet their study did not have the tools to distinguish between the effect from PES and the Costa Rican environmental education program. In this essay I contribute to the literature by focusing on the effects of PES on the beneficiaries' pro-environmental behavior and then examine how pro-environmental behavior correlate with forest conservation. This is done by answering the following thesis questions:

- *Does Costa Rican PES scheme affect pro-environmental behavior?*
- *Does pro-environmental behavior result in forest conservation among landowners in Costa Rica?*

The thesis is structured into different sections where the thesis questions are discussed further. In the following section, The workings of PES, the origin of the Costa Rican PES program is presented together with earlier studies' thoughts on its efficiency and how it works as an instrument of motivation. In the next section, Theoretical framework, the model of pro-environmental behavior is explained. The methods that were used to answer the thesis questions are described in the section Empirical approach. Next comes the presentation of results. The thesis is concluded with a discussion on the results followed by final conclusions.

# The workings of PES

## PES in Costa Rica

Considering its size, Costa Rica is one of the most species rich countries in the world, hosting approximately 5% of the world's known species (Honey, 1999). For long an increasing pace of deforestation made way for agricultural products, especially the profitable cattle ranching, threatening the rich ecosystems of Costa Rica. Since the beginning of the 20<sup>th</sup> century, 80% of the forest has disappeared (VivaCostaRica, 2003). Periodically between 1960 and 1980, the deforestation rate in Costa Rica was about the highest in the world (Camino et al., 2000). Forest conservation was largely being outcompeted by governmental subsidies boosting exports of agricultural products. The excessive rate eventually waned owing to several synergic events. Interest was raised among non-governmental environmental organizations to protect the species rich forests, and pressure was put on the government to protect the remaining areas of virgin forests. The Costa Rican government launched a sustainable forest management program and passed laws to prevent further losses of virgin forest and other natural values. The opportunity cost of conserving forest decreased as the prices of agricultural commodities fell in the 80s. Meanwhile tourism became increasingly important, constituting 25% of the national income in the late 90s, much deriving from the Eco-tourism<sup>4</sup> (Watson et al., 1998). Such political, social and economic incentives are believed to underlie the impressive increase of protected natural area, lately covering approximately 25% of Costa Rica's total area - a larger proportion than in any other country (Sanchez-Azofeifa et al., 2007). Consequently Costa Rica has earned international recognition for its accessible national parks and wildlife activities (Honey, 1999).

A wide range of environmental programs underlies the successful continuity of nature conservation in Costa Rica. One of the most acclaimed is the national PES system that was initiated in 1996. The program was founded as a tool to create financial incentives for reforestation and reward provision of ES. Payments are made to owners of forests, or land where forest can be planted, in order to provided financial support for

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<sup>4</sup> Ecotourism is responsible tourism to natural areas, which conserves the nature and brings welfare to the people of the region.

conserving or reforest areas that provide ES. Three national laws form the framework of the Costa Rican PES system:

- The 1995 Environmental Law 7554 about a 'balanced and ecologically driven environment for all'.
- The 1996 Forestry Law 7575, which regulates a 'rational use of all natural resources and prohibits land cover change in forest'.
- The 1998 Biodiversity Law, which regulates 'conservation and rational use of biodiversity resources'.

The Forestry Law 7575 bans forest clear-cutting in Costa Rica. Forest is defined in Article 3, point d) in law 7575. Nonparticipants of PES can operate selective timber extraction, which means taking out a few trees of greater value without clear-cutting or affecting the tree coverage profoundly (Johns, 1988). Despite its minor ecological impact compared to clear-cutting, adverse ecological consequences have been traced to such silviculture in rain forests (Johns, 1988). The Forestry Law 7575 also recognizes four different ES that should be preserved and provided by PES funding:

- Mitigation of greenhouse gases
- Protection of water resources
- Protection of biodiversity
- Protection of scenic beauty

These ES are mainly preserved and provided by conserving forest and through reforestation. The Ministry of the Environment and Energy (MINA)E) administrates the PES system through the National Forestry Financing Fund (FONAFIFO). The system is largely funded by taxes on hydrocarbons, voluntary contributions and loans and grants from international organization (Brown and Bird, 2011).



There are three different PES programs that are formed to provide and preserve the four ES from law 7575. Landowners can apply to participate in any of them (Alpizar et al., 2012). The different programs are:

- Forest conservation

Landowners receive payments of \$320 to \$400 per hectare for not taking out any wood from the forest in 10 years.

- Reforestation

Landowners receive payments of \$980 to \$1,470 per hectare they reforest and maintain for 10-15 years.

- Agroforestry

Landowners receive payments of \$1.30 to \$2.60 per tree planted in agricultural land.

The size of the payment is not dependent on opportunity costs but can take them into account and adjust the price according to the intervals above. In rare cases the payment is allowed to exceed the interval, as in the Río Segundo area where high opportunity costs led to an increase of PES payments offered to landowners of almost 50 % (Pagiola, 2006). Until 2008, FONAFIFO had signed over ten thousand contracts with landowners and paid out more than \$200 million (Porrás, 2010).

## Evaluation of PES

PES is gaining popularity in the pool of different nature preservation programs that sustain ES. Much is due to its flexibility as a market-based instrument. Compared to command-and-control regulations, e.g. national parks, PES has the potential of being adjustable depending on values of ES and land prices, hence accounting for opportunity costs for property owners who receive payments for ES provision (Engel et al., 2008). In developing countries the ES providers are often worse off than the ES users, which argues for stimulating them with funds instead of targeting commodities with environmental taxes (Engel et al., 2008).

Albeit the main purpose of PES is by definition to provide provision of ES, it has been suggested to also have the capacity of improving socioeconomic premises among the beneficiaries. As owners of forest or agricultural land constitute the potential beneficiaries, of which the majority are small-scale poor farmers, PES could even reduce poverty (Pagiola et al., 2005). According to FONAFIFO the PES program has been shaped to suite small-scale farmers (Alpizar et al., 2012). However, the ability of PES systems to reduce poverty is widely criticized and studies have found such relationship difficult to prove (Grieg-Gran et al., 2005). Instead the PES system in Costa Rica seem to benefit wealthier land owners with on average higher socioeconomic values than not enrolled farmers in the same regions (Alpizar et al., 2012, Zbinden and Lee, 2005). Ecuadorian scheme Socio Bosque is shaped with the purpose of reducing poverty and creating a market for PES simultaneously (SENPLADES, 2009). The program has still not proven to be efficient in combing ES preservation and poverty alleviation (Krause and Loft, 2013)

There are some noteworthy inefficient features embedded in PES schemes. The communication of the program does not reach out to a large proportion of the country's farmers and the application procedure is experienced as very bureaucratic and time consuming (Zbinden and Lee, 2005). The value of the ES provided from the PES participants may be lower than the cost of using their land socially suboptimal (Engel et al., 2008). It has been debated about how beneficiaries will respond to ceased contributions. In an experimental set up Deci (1971) found that a group of people receiving compensation was highly motivated to perform a task, but when the incentive was removed, they were less motivated than a control group who had never received any incentive at all. The PES conservation contracts in Costa Rica only run for ten years

at a time (contracts signed before 2010 only run for five years), and as funding might vary, and some landowners are not accepted to renew their contracts, what happens after the payments cease is a critical query to reach continuous provision of the ES.

PES often rewards ES providers with payments for preserving forest that they anyways would not have cut down, hence not generating additionalities. Based on Costa Rica's average deforestation rate Pfaff et al. (2008) found that more than 99% of the enrolled land would not have been deforested or degraded in the absence of the PES payments. The enrolled land tended to have lower risk of deforestation than the average in Costa Rica, which is problematic if the system should be used for preserving additional ES. The problem of prevailing low additionality rate is supported by the popularity of the program. There are at least three times as many applicants as enrolled to PES in Costa Rica, which reveals prevalent lower opportunity cost than the size of the PES payments (Pagiola, 2006). This suggests that a larger area could have been enrolled to the PES program with the available funds if the size of the payments was lower and distributed to more land. In an analysis of the participants who signed contract between 1997 and 1999 a majority would even have had negative returns from deforestation (Pfaff et al., 2008). Moreover, many participants state that they would have protected the forest anyway (Malavasi et al., 2003, Miranda et al., 2003). Still the low payment rate was a common source of discontent when Locatelli et al. (2008) performed an interview study with PES beneficiaries.

There seems to be a dilemma, where lower payments could generate more enrolled land with the same funds, but with the risk of attracting land with low or negative opportunity costs that would have been preserved anyway. Or raise the payments to increase the attractiveness of the program for landowners with other lucrative alternatives that in the absence of PES would consider deforestation or equivalent. When considering these two different approaches, and analyzing the low additionality rate, it is important to note that the Costa Rican forestry law 7575 bans clearing forest, whether participation in the PES program or not. Despite the law, changed land usage does occur illegally (Personal communication with Natlia Hernández at FONAFIFO, December 2013). This means that the actual possible outcomes from PES are in fact increasing reforestation, reducing selective extraction of timber, increasing the acceptance of law 7575 and reducing the illegal deforestation.

One of the requisites for REDD+ is that the funds are to be used purposely for additionalities. Even though PES in Costa Rica is not REDD+, half of the funding comes from international organizations and countries that typically have the same requests on additionalities, and may therefore not continue their funding if additionalities are not increased (Brown and Bird, 2011). In an evaluation of how PES programs in Latin America can reduce poverty, Pagiola et al. (2005) concluded that PES programs need to satisfy the service recipients in order to be sustainable. Without this fundamental criteria satisfied, payments are likely to cease and no poverty reduction or preservation of ES can be realized.

With the Forestry Law 7575 banning deforestation, there might be reason to question if PES can create additionality at all. As deforestation still does take place, different studies have lifted the question whether payments should target areas that are likely to be deforested in its absence, making it more efficient (Pfaff et al., 2008). This approach has raised concerns that it would have negative impact on intrinsic motivation for pro-social behavior<sup>5</sup> (Nordén, 2013). It has been speculated that such system could backfire and cause deforestation amongst disappointed landowners that otherwise would not deforest (Nordén, 2013). Further if areas with high deforestation rate are more likely to receive payments, this will probably create incentives to increase deforestation to receive higher payments in the future (Engel et al., 2008). There might also be the converse effect, making it more attractive to keep forest as it can bring payments in the future (FONAFIFO, 2005). When PES hinders deforestation in one area, a maintained demand for wood or alternative land usage will likely create leakage<sup>6</sup> and result in deforestation somewhere else (Brown and Bird, 2011). However Ross et al. (2006) claimed the economy-wide effect of Costa Rica's PES program to be insignificant until then.

The literature has often evaluated PES based on the created ES additionalities. As clear-cutting is prohibited in Costa Rica, and as the review in this section reveals, additionality in Costa Rica can only arise from preventing illegal forestry and inducing reforestation leading to promoted ES. These variables are difficult to measure and consequently additionalities from PES cannot be estimated efficiently.

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<sup>5</sup> Behavior that derive from the intent to benefit others even when it entails a cost to oneself (Nordén, 2013)

<sup>6</sup> Leakage means that prevented deforestation or deterioration at one place, might lead to its occurrence in another area.

## **Motivation and incentives**

Motivation is often categorized as either intrinsic or extrinsic. People may vary in what motivates them to behave pro-environmentally. PES has the potential of increasing the motivation by adding the extrinsic instrument money. However how this affects the intrinsic motivation is still unknown. The difference between intrinsic and extrinsic motivation can be derived from the purpose that cause the action to take place. Intrinsic motivation comes from taking an action because it is enjoyable or interesting per se, and when extrinsically motivated one undertakes an action because of contingent rewards. In a derivation of intrinsic motivation, Deci and Ryan (1985) means that intrinsic motivation will be facilitated by feedback and rewards related to competence, given that there is a feeling of autonomy.

Money is obviously a fundamental extrinsic incentive for receiving positive responds. Yet, studies have shown that in some cases the effect might be opposite to what is desired. The classical experiment by Titmuss (1971) showed that blood donation decline when donators were monetarily compensated. According to the model of Bénabou and Tirole (2005) the extrinsic motivation instrument 'money' will crowd-out the intrinsic motivation of donating blood, and in this experiment not quite reach the same result as the intrinsic motivation. Cardenas et al. (2000) set up a common property resource game<sup>7</sup> where participants could collect wood from the nearby forest, being informed about the ecological and social consequences of overusing the resource. When external regulation was implemented, restricting the amount of wood allowed to collect, self-regulation driven by intrinsic motivation was crowded out, leading to unsustainable extraction of wood. Evidently there is a risk of crowding out intrinsic motivation with weaker extrinsic motivation, leading to poorer results. Though in this kind of framed experiments pro-social behavior tend to be more altered than in real market situations (Levitt and List, 2007). The extrinsic motivation in Costa Rican PES, being the payments, may crowd out intrinsic motivation, imposing a money market with price as the main variable, where social norms and altruistic behavior used to rule.

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<sup>7</sup> A common property resource game (Kerr et al., 2012) is recognized by participants having to make a choice based on social values between what is best for him or her or the whole group when distributing recourses (Kerr et al., 2012).

# Theoretical framework

## Kollmuss' & Agyeman's model for pro-environmental

The gap between being environmentally aware and behaving pro-environmentally has been illuminated by various studies trying to frame the causes of pro-environmental behavior. Kollmuss and Agyeman (2002) uses existing models to derive their own differentiating of aspects affecting pro-environmental behavior. Their model was used when formulating the interview questions for this study. The factors affecting pro-environmental behavior are divided into demographic factors, external factors and internal factors. A summary of the model follows:

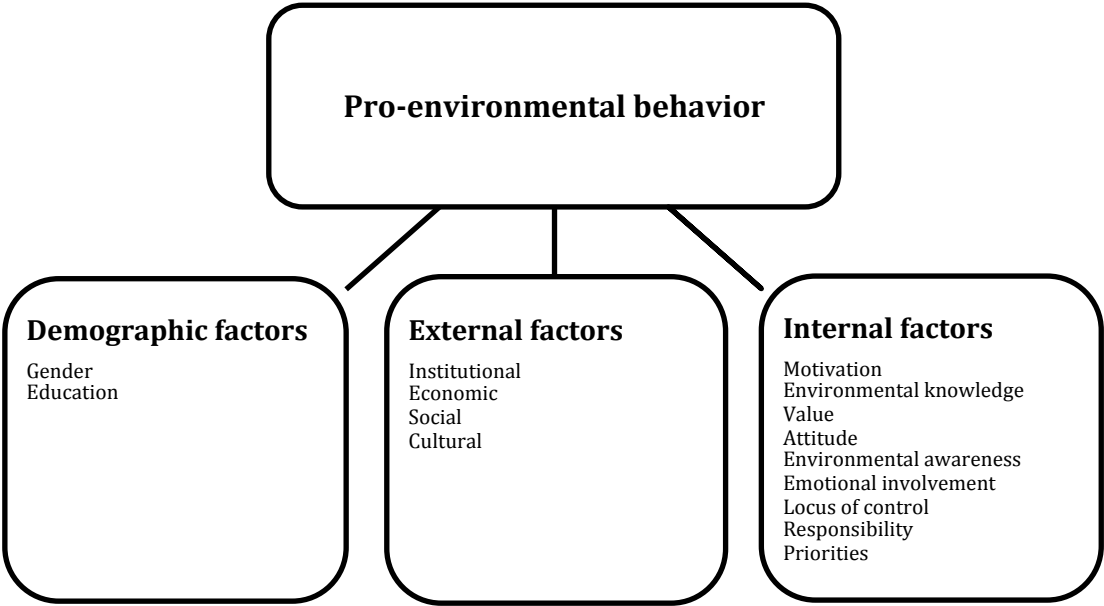


Figure 1. The different aspects of Pro-environmental behavior according to Kollmuss and Agyeman (2002) summarized in a model.

## **Demographic factors**

### *Gender and education:*

Even though they on average have less knowledge about environmental degradation, women are more likely to be emotionally concerned and keener to change their behavior than men. There is also a correlation between years of education and knowledge of environmental issues that affect the pro-environmental behavior positively.

## **External factors**

### *Institutional factors:*

Services that facilitate pro-environmental behavior, e.g. infrastructure, public transport and recycling facilities are institutional factors.

### *Economic factors:*

Goods that are burdened with higher price because of environmentally harmful content will likely be deselected. Likewise, electricity-consuming products that consume less electricity are more attractive, but only as long as the price is not too much higher and if the savings from less consumed electricity are high enough.

### *Social and cultural factors:*

The social and cultural values of the natural resources have great importance to how extraction and deterioration of them will be perceived. In some regions the forest will typically have a more important role in the community than in others.

## **Internal factors**

### *Motivation:*

Extrinsic and intrinsic motivation will affect the behavior. How motivation affects pro-environmental behavior depends on if extrinsic and intrinsic motivation work towards the same or opposite directions.

*Environmental knowledge:*

Knowing about the environmental issues can, but do not necessarily, induce pro-environmental behavior.

*Value:*

Emotional connection or valuing of the wellbeing of natural environments is connected to intrinsic motivation and affects the pro-environmental behavior.

*Attitude:*

People will have different approaches when solving environmental problems; some have more faith in technological solutions, hence less willing to change behavior. Pro-environmental attitude does not necessary induce pro-environmental behavior if the attitude and the behavior is not closely related (Ajzen and Fishbein, 1980).

*Environmental awareness:*

Understanding the human impact on the environment affects pro-environmental behavior.

*Emotional involvement:*

An emotional relationship to the nature is closely related to caring for nature and has been shown to have great importance for pro-environmental behavior.

*Locus of control<sup>8</sup>:*

People with strong internal locus of control believe that they can make difference, hence are more likely to behave pro-environmentally than people with external locus of control, as the latter do not believe there is anything they can do.

*Responsibility and priorities:*

People will prioritize what they value the highest. This can be in position with pro-environmental behavior.

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<sup>8</sup> Locus of control is a psychological term indicating where one perceives that the control is located, whether people believe that they influence the outcomes that affect them (internal), or if the events occur out of their control (external).



## Empirical approach

### Setting up the sample

This study was conducted by pursuing structured interviews<sup>9</sup> with both quantitative and qualitative questions in the northern plains of Costa Rica, consisting of the northern parts of the provinces Alajuela and Heredia. The region was chosen in accordance with FONAFIFO with the purpose of selecting a region with high frequency of PES contracts. The samples were selected randomly to eliminate systematic differences between the two groups. In total 61 owners of forest- or agriculture land were interviewed for the survey, 29 constituting the treatment group of PES-beneficiaries and 32 being the control group of non-beneficiaries.

FONAFIFO provided a master list with contact details from ca. 1500 PES-contracts signed with landowners in the northern plains between 1997-2013. I randomly picked out 29 people for interviews who had currently running PES-contracts. I made my sample of non-beneficiaries by visiting three locations in the northern plain lands within the same area as the PES-beneficiaries, and randomly selected farmers to interview. I selected farmers because they are likely the most comparable group to the PES-beneficiaries and have been used for comparative studies before (Zbinden and Lee, 2005, Alpizar et al., 2012).

### Interview questions

The first thesis question *'Does Costa Rican PES scheme affect pro-environmental behavior?'* was answered by asking the PES-beneficiaries and non-beneficiaries questions aiming at revealing their pro-environmental behavior. The interview questions were designed using the model of features that promote pro-environmental behavior from Kollmuss and Agyeman (2002). With five interview questions (pro-environmental question), listed in Table 1 below, I intended to grasp the internal factors of the model: *Motivation, Environmental knowledge, Value, Attitude, Environmental awareness, Emotional involvement, Locus of control and Responsibility and priorities*. The two demographic factors, gender and years of education, that according to the model

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<sup>9</sup> In structured interviews the same questions are asked in the same order to all interviewed, facilitating comparison between different groups.

affect pro-environmental behavior, were covered in two interview questions. The model also included external factors, none of which were included.

The second thesis question '*Does pro-environmental behavior result in forest conservation among landowners in Costa Rica?*' was answered by comparing the landowners' demonstration of pro-environmental behavior, obtained from answers on thesis question one, with the proportion of their land that comprised preserved forest.

All the interview questions are attached in Appendix 1.

### **Data and comparison**

Five questions aimed at measuring properties that enhanced pro-environmental behavior within the control group of non-beneficiaries and the treatment group of PES-beneficiaries. The questions were appropriated with answer alternatives on an ordinal scale of 1 to 5. As the collected data was of ordinal level, allowing ranking between values but not assuming equal intervals, the parametric two independent sample t-test was not applicable. Instead I used the non-parametric Mann-Whitney U test to test the difference of median between the two groups to find out whether they differed from each other in pro-environmental attributes. The null hypothesis was set to that PES-beneficiaries would not score higher than the non-beneficiaries. Data on years of education and gender was analyzed to investigate whether differences in these variables could underlie any difference in demonstration of pro-environmental behavior between the two groups. Shapiro-Wilk's test was used to find out if the data for years of education was normally distributed. Whether PES-beneficiaries were significantly different from non-beneficiaries was later tested with a Mann-Whitney U test for education and a Pearson Chi-Square test for gender. Regression analysis was performed where the answers on questions on pro-environmental behavior diverged significantly between the two groups. OLS linear regressions, with PES participation, gender and years of education as independent variable and question answers as dependent, revealed potential correlations. Pearson Correlation Test was used to find correlation between forest ration and answers on the pro-environmental questions. All the tests were performed using IMB SPSS Statistics 22.0.

## **Study limitations**

Geographically the study is limited to the agriculture dense northern plains of Costa Rica. FONAFIFO suggested the area due to the many PES contracts signed in the area and the appropriate data they could provide for this study. The time and resource limits of the study underlie the low numbers of interviews, which preferably should encompass more samples for performing the statistical tests. The interview questions aimed on capturing the internal and demographic factors from the model of Kollmuss and Agyeman (2002), but did not include the external factors due to implication difficulties and as they aim more on societies as a whole and were not expected to differ between the groups in this study. Even though the interview questions were explained similarly to the interviewees, they can have interpreted them differently, potentially impairing the causality of the results.

# Results

## Tests of difference

The performed Mann Whitney U test to find out whether PES-beneficiaries scored higher on pro-environmental factors resulted insignificant on the 0.05 level for all five questions. However, Q3, se Table 1, showed a significant difference on the 0.10 level and was examined further. Hence the null hypothesis that PES-beneficiaries would not score higher than non-PES farmers could not be rejected for four out of the five questions, but the low value of the 1-tailed test for Q3 indicated some difference. As I tested whether the PES-beneficiaries scored significantly higher than the non-beneficiaries on the pro-environmental questions, I did not account for difference caused by PES-beneficiaries scoring lower than the non-beneficiaries. The test is therefore 1-tailed and not 2-tailed. The mean rank from the test summarized in Table 1 depicts the similarity in answers for all questions but Q3.

Table 1. Summary of results from non-parametric Mann-Whitney U test on the pro-environmental questions.

<b>Internal factor</b>	<b>Question</b>	<b>Group</b>	<b>Mean rank</b>	<b>Asymp. Sig. (1-tailed)</b>
Emotional involvement Environmental awareness	Q1: In what extent do you feel affected by human caused environmental problems?	PES	31.707	<b>0.381</b>
		Non-PES	30.359	
Environmental knowledge	Q2: How severe do you think the environmental problems are in Costa Rica?	PES	30.655	<b>0.439</b>
		Non-PES	31.313	
Locus of control	Q3: In what extent do you think your actions can change these problems?	PES	34.707	<b>0.055<sup>a</sup></b>
		Non-PES	27.641	
Attitude	Q4: How would you classify the importance of ecotourism for Costa Rica?	PES	31.052	<b>0.490</b>
		Non-PES	30.953	
Value Responsibility and priorities	Q5: To what extent do you value the biodiversity in Costa Rica?	PES	32.276	<b>0.273</b>
		Non-PES	29.844	

a. Significant at the 0.1 level (1-tailed).

The Shapiro Wilk test came out significant at the 0.001 level and proved that years of education was not normally distributed. Table 2 shows that according to the Mann Whitney U test PES-beneficiaries had significantly more years of education than the non-beneficiaries. Also the second demographic factor, gender, diverged significantly between the control and treatment group, see Table 3.

Table 2. Results from analyzing difference in years of education between PES-beneficiaries and non-beneficiaries with a Mann Whitney U test.

Group	Mean	Standard error	Asymp. Sig. (2-tailed)
PES	13	3.4	<b>0.000<sup>a</sup></b>
Non-PES	7	3.7	

a. Significant at the 0.001 level (2-tailed).

Table 3. Difference in gender distribution with Pearson Chi-Square.

Group	Interviewed (N)	Female (%)	Exact Sig. (2-tailed)
PES	29	35	<b>0.018<sup>a</sup></b>
Non-PES	32	9	

a. Significant at the 0.05 level (2-tailed).

As the proportion of female and years of education was higher for PES-beneficiaries, these would be more likely to behave pro-environmentally according to the model of Kollmuss & Agyeman (2002). This means that they would also be more likely to score high on the pro-environmental questions (Q1-Q5), when only considering the demographic factors.

**Regression models**

Regressions were performed to examine conditional correlations between the results of Q3, the only pro-environmental question that came out significant in the test of difference, and the demographic factors, gender and years of education. An OLS regression was used to investigate the different relationships:

$$y_i = \alpha + \beta_i x_i + \epsilon_i$$

X represents the independent variables years of education and gender. Y represents the answers on Q3 and is the dependent variable. Two regressions were performed including all 61 interviews, one simple linear regression without years of education and gender, and one multiple linear regression where they were included:

1) 
$$y_i = \alpha + Z + \epsilon_i$$

2) 
$$y_i = \alpha + \beta_1 \text{EDUCATION} + \beta_2 \text{GENDER} + Z + \epsilon_i$$

Z is a dummy variable taking the value 1 for PES-beneficiaries and 0 for non-beneficiaries. The variable EDUCATION represents the years of education for both the control and the treatment group. GENDER was coded as a dummy variable with female being 1 and male being 0 for all the samples.

Z represents the treatment effect, i.e. whether PES-beneficiaries do or do not have a higher Y unconditional or conditional on years of education and gender. The first regression displays the effect of Z unconditional on years of education and gender. The first regression showed a significant strong positive relationship between the treatment effect and the answers on Q3 with the coefficient 0.63 on the 0.1 significance level. The second regression, when including the effects from years of education and gender, the coefficients  $\beta_1$  and  $\beta_2$  capture the relationship between years of education and gender with Y. The Z effect disappears when including years of education and gender, which argues for that there is actually no treatment effect. The model shows no correlation between the answers on Q3 and gender, but did show significant correlation on the 0.05 level with education<sup>10</sup>. The variables are correlated through a weak positive relationship of with the education coefficient 0.10. The result from the regressions is summarized in the Table 4.

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<sup>10</sup> There was no sign of any heteroscedasticity.

Table 4. Regression results with demographic factors and PES participation as independent variables and answers on Q3 as dependent. All 61 interviews included

<b>Regression</b>	<b>Independent variable</b>	<b>Coefficient (s.e.)</b>	<b>P-value</b>
$y_i = \alpha + Z + \epsilon_i$	$\alpha$	3.094 (0.242)	<b>0.000</b>
	PES-Participation	0.630 (0.351)	<b>0.078<sup>a</sup></b>
$y_i = \alpha + \beta_1\text{EDUCATION} + \beta_2\text{GENDER} + Z + \epsilon_i$	$\alpha$	2.365 (0.417)	<b>0.000</b>
	PES-participation	-0.045 (0.459)	<b>0.922</b>
	Education	0.100 (0.049)	<b>0.046<sup>b</sup></b>
	Gender	0.351 (0.439)	<b>0.427</b>

- a. Correlation is significant at the 0.1 level (2-tailed).
- b. Correlation is significant at the 0.05 level (2-tailed).

The correlation between the forest ration and answers on the questions of internal pro-environmental behavior (Q1-Q5) was investigated with a Pearson Correlation Test. The test result answers the second thesis question of '*Does pro-environmental behavior result in forest conservation among landowners in Costa Rica?*'. The result displays that there is a correlation between high ration of forest and high score on Q3 for non-beneficiaries, but no correlation for PES-beneficiaries. The results are summarized in Table 5.

Table 5. Correlation between answers on the pro-environmental questions and ration forest conserved.

<b>Question</b>	<b>Group</b>	<b>Pearson Correlation</b>	<b>Sig. (2-tailed)</b>
Q1: In what extent do you feel affected by human caused environmental problems?	PES	-0.024	<b>0.900</b>
	Non-PES	-0.015	<b>0.935</b>
Q2: How severe do you think the environmental problems are in Costa Rica?	PES	0.131	<b>0.499</b>
	Non-PES	0.316	<b>0.078<sup>a</sup></b>
Q3: In what extent do you think your actions can change these problems?	PES	0.233	<b>0.224</b>
	Non-PES	0.349	<b>0.050<sup>b</sup></b>
Q4: How would you classify the importance of ecotourism for Costa Rica?	PES	-0.213	<b>0.268</b>
	Non-PES	-0.102	<b>0.578</b>
Q5: To what extent do you value the biodiversity in Costa Rica?	PES	-0.056	<b>0.771</b>
	Non-PES	0.210	<b>0.248</b>

a. Correlation is significant at the 0.1 level (2-tailed).

b. Correlation is significant at the 0.05 level (2-tailed).

Both Q2 and Q3 showed moderate positive correlations with forest ration for non-beneficiaries with a correlation value of 0.316 and respectively 0.349.



## Discussion

### **First thesis question: *'Does Costa Rican PES scheme affect pro-environmental behavior?'***

The PES-beneficiaries and the non-beneficiaries, represented by farmers who were not enrolled in PES, answered similarly on four out of the five pro-environmental questions. The answers were not significantly different and had very similar mean ranks. PES-beneficiaries had significantly more years of education and consisted of significantly higher ratio women than non-beneficiaries, two features that according to the model from Kollmuss & Agyeman (2002) should induce pro-environmental behavior. Still there was no difference in four out of five cases. Thus the positive effect from PES seems to be negligible. Conversely for one question, Q3, the two groups' answers diverged significantly with a p-value of 0.055. The difference is on the significance level of 0.1, but almost reaches the 0.05 level. In order to limit this study, I choose not to include the other questions in regression analysis, but instead focus on Q3 because of the difference between the groups. The interview question Q3 derived from the locus of control in the Kollmuss & Agyeman (2002) model. The model suggests that when interviewees believe that their actions can change environmental problems, they are more likely to take such actions. The PES-beneficiaries scored much higher on question Q3 than the non-beneficiaries. However, it was shown in the multiple linear regression from Table 4 that it was not the PES program per se that induced the feature, but the years of education. The regressions proved that the significant difference in answers response on Q3 between PES-beneficiaries and non-beneficiaries that was found with the Mann Whitney U test was due to the significant more years of education among the PES-beneficiaries. The model proved that the PES-participation and gender did not improve the correlation with answers on Q3.

My results indicate that PES has none to little effect on pro-environmental behavior. The null hypothesis that PES-beneficiaries would not score higher on interview questions than the non-beneficiaries could not be rejected except for Q3. PES-beneficiaries receive payments and education in environmental matters. Still the years of school education was the responsible variable for the difference in Q3, meaning that the two groups did not differ in internal factors from the Kollmuss & Agyeman (2002) model. It is important to remember that the five questions that target the internal

factors are arbitrary in the sense that they represent my attempt to frame the internal factors from the model of Kollmuss & Agyeman (2002). Even though this study's sample size is considered small, which could have an affect on the results, when looking at the test of difference on the pro-environmental questions, the mean ranks where so similar in all cases but Q3, that no tendency of differentiation that could be discovered with larger sample sizes could be discerned.

**Second thesis question: *'Does pro-environmental behavior result in forest conservation among landowners in Costa Rica'?***

The PES-beneficiaries showed no tendency of scoring higher on any of the pro-environmental questions when the forest comprised a larger portion of the land. Most of the interviewees answered that they had enrolled all land possible in the program. The portion of forest was rather related to historical land usages instead of the pro-environmental behavior. The non-beneficiaries had no economic outcome of saving the forest and in most cases related the purpose of saving forest to save water, biodiversity and scenic beauty. No one named the forest law 7575 that prohibits clear-cutting to be the reason to why they kept their forest. The non-beneficiaries showed a significant correlation between forest ratios and scoring on Q2 and Q3, suggesting that the larger ratio forest they had, the higher they scored on Q2 and Q3, and the more pro-environmental behavior they displayed. The correlation values of 0.316 and respectively 0.349 suggested moderate positive correlations.

Q2 derives from the two internal factors 'Environmental knowledge' and 'Environmental awareness'. The results show that a stronger knowledge and awareness about the environment can induce forest conservation. The significant correlation between forest conservation and answerers on Q3 suggests that a stronger locus of control, which Q3 derives from, motivates the non-beneficiaries to preserve more forest. None of the other internal factors that were represented by the other pro-environmental questions had any correlation with forest conservation.

## Conclusion

According to my findings PES-beneficiaries demonstrate stronger pro-environmental behavior than non-beneficiaries and there is a correlation between pro-environmental behavior and forest conservation. Still PES' contribution to pro-environmental behavior is disputable. The additionality rate from the PES scheme is negligible and the correlation between forest ratio and pro-environmental behavior was only seen among non-beneficiaries. Even if PES-beneficiaries demonstrate more of a pro-environmental behavior, their pro-environmental behavior showed no correlation with preserved forest ration. Further the results from this study indicate that the altered demonstration of pro-environmental behavior among PES-beneficiaries is due to that they had significantly more years of education compared with the non-beneficiaries, and not the PES-participation per se. The PES-beneficiaries tended to have large areas of land that were covered with forest before entering the PES program and enroll most of the forest to receive the payments. The internal factors locus of control, environmental awareness and environmental knowledge from the Kollmuss & Agyeman (2002) model were incorporated into the pro-environmental questions that showed a significant correlation with forest conservation. This proved that intrinsic motivation to conserve forest exists among the non-beneficiaries but not the PES-beneficiaries. A possible reason to why it was absent among the PES-beneficiaries is that the intrinsic motivation was outcompeted by the financial incentives within the PES system.

Costa Rican PES has distributed over \$200 million to landowners (Porras, 2010), mainly for conserving forest where there is already a law ensuring the conservation of the very same forest, leading to small or no additionalities. The outcomes from PES forest conservation are, as discussed earlier, reduced selective extraction of timber, increased acceptance of law 7575 and reduced illegal deforestation. The extent to how these outcomes are affected by PES has yet not been estimated. My results indicate that conservation programs that target pro-environmental behavior could be a more efficient alternative than PES to induce additional forest conservation exceeding what is ensured by law.

Pro-environmental behavior is a broad concept that covers many features. This study showed that locus of control, environmental awareness and environmental knowledge can have a significant effect on the ratio conserved forest and that PES

participation per se does not alter any pro-environmental features. Further the results showed that one could not pair PES participation with increased degree of forest ratio. When participating in PES, the ratio of conserved forest is rather determined by traditional land usage and the prevailing forest coverage before 1996 when law 7575 made it illegal to implement clear-cutting. This means that the positive impact on the perception of forest protection that was traced to PES by Locatelli et al. (2008) is more likely derived from the Costa Rican environmental education program and not the PES program.

PES programs are popular and increasing in numbers. The Costa Rican PES program is a good example to study when designing other PES programs, including forthcoming REDD+, because of its scope and continuity. It is evidently very important to formulate the purpose of such program and when running evaluate its suitability. Costa Rican PES program has been widely investigated regarding the created additionalities and PES' ability to decrease poverty, and based on poor results, criticized for its inefficiency. The true potential of Costa Rican PES lies within increasing reforestation, reduce selective extraction of timber, increase the acceptance of law 7575 and reduce the illegal deforestation. Of these, only the consequences from reforestation have been subject to research. In the work of evaluating PES-systems, forthcoming studies could try valuing the above benefits from PES and compare it with alternative investments for the hundreds of million dollars that so far has been spent on Costa Rican PES. My results indicate that intrinsic motivation to conserve forest yields additionalities. This assumes that law 7575 is not always followed but that other reasons exist that may prevent farmers from clear-cutting. Possibly investing in increasing such motivation to conserve forest is a more cost efficient way to preserve the valuable ES. Finally I want to suggest future studies to continue investigating the roll of motivation and payments in the nexus of PES, pro-environmental behavior and forest conservation.

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# Appendix 1

Questions	Answers
<b>Age</b>	
<b>Gender</b>	
<b>Years of education</b>	
<b>In which Cantón do you live?</b>	
<b>How many hectares do you have?</b>	
<b>Of these, how many are forest?</b>	
<b>Why do you have forest?</b>	
<p><b>Q1: To what extent do you feel affected by human caused environmental problems? (from 1 to 5)</b></p> <p>Not at all    To little extent    To some extent    To a moderate extent    To a large extent            1                    2                    3                    4                    5</p>	
<p><b>Q2: How severe do you think the environmental problems are in Costa Rica? (from 1 to 5)</b></p> <p>Not severe    Not very severe    Somewhat severe    Severe    Very severe            1                    2                    3                    4                    5</p>	
<p><b>Q3: To what extent do you think your actions can change these problems? (from 1 to 5)</b></p> <p>Not at all    To little extent    To some extent    To a moderate extent    To a large extent            1                    2                    3                    4                    5</p>	



**Q4: How would you classify the importance of ecotourism for Costa Rica? (from 1 to 5)**

Very unimportant    Somewhat unimportant    Neither unimportant nor important  
1                                  2    3  
Somewhat important    Very important  
4    5

**Q5: To what extent do you value the biodiversity in Costa Rica? (from 1 to 5)**

Not at all    To little extent    To some extent    To a moderate extent    To a large extent  
1                  2                  3                  4                  5

**Are you enrolled in any of FONAFIFO's payments for environmental services programs?**

**If yes, how many hectares do you have enrolled in the PES program?**

**If no, do you know about the program?**

**If you are enrolled or have heard about the program, what is your overall opinion of the program?**

**What is it that you like the most with the program?**

**What is it that you like the least with the program?**

**What changes do you suggest to the program?**