Local participation in Costa Rica's Payments for environmental services program: A case study in San Gerardo, Perez Zeledon, Costa Rica

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Local participation in Costa Rica's Payments for environmental services program: *A case study in San Gerardo, Perez Zeledon, Costa Rica*

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Preface

For my study (Tropical forestry) at Van Hall Larenstein University of applied sciences, I carried out my thesis at Cloudbridge Private Nature Reserve, Costa Rica. Cloudbridge is situated in the South-West coast of Costa Rica in the Cordillera Talamanca mountain chain. The reserve forms a biological corridor between the Talamanca Private Nature Reserve and Chirripo National Park. Cloudbridge aims to preserve a piece of precious tropical cloud forest in the Talamanca region by; conservation, reforestation and research activities.

This study investigated obstacles landowners experience in a payment for environmental services program (PSA) around the village of San Gerardo de Rivas. It looks at; knowledge, property characteristics and opinions of landowners around the village of San Gerardo. Additionally the investigation looks at organizations involved in the participation process. With a better understanding about the participation obstacles, this study aims to provide an insight on how participation in the PSA program around the village of San Gerardo can be improved.

Acknowledgements

Hereby I would like to show my gratitude to all the people who have supported me during my thesis.

To start with, I would like to thank Cloudbridge Private Nature Reserve for giving me this opportunity. With the greatest pleasure I conducted my research at the Cloudbridge institute, for the organization supported me throughout my research and gave me a friendly and hospitable stay. My stay at the Cloudbridge institute has been unique and educative.

Next in order; I want to thank the people who supported me during the research. Special thanks to; Jason Monge, his support with the questionnaires was essential for this research. Thanks to; Tom Gode, his knowledge of the area benefited the research design. Thanks to; Mauricio Contreras, for translating the questionnaires and advice on how to conduct them.

In regard to the data; I would like to thank all the people who cooperated with the questionnaires and interviews. As important were the people who gave me a pleasant stay at the Cloudbridge institute. At last I would like to thank my parents for their support throughout my study.

Abstract

The Talamanca mountain range, a unique ecosystem and ecological corridor between other Costa Rican and Central American nature reserves, is threatened by fragmentation. As local landowners use their land for farming, migration of animals and plants in between parks is reduced, compromising the ecological corridor function of the Talamanca region. The Costa Rican government is well aware of the value of nature and has therefore specific programs, like the pagos por servicios ambientalis program (PSA), to protect and improve the Costa Rican nature reserves. The PSA program, which provides funding to landowners for changing farmland into nature or using it environmental friendly, could be a good solution to reduce fragmentation in the Talamanca mountain range. Though, so far the implementation of this program in the Talamanca area has not been a success, indicated by a low participation rate of local landowners (Zbinden & Lee, 2005).

This study, examines what obstacles are withholding landowners from the Talamanca region to participate in the PSA program. Therefore local landowners from San Gerardo, a typical small village enclosed by multiple nature parks in the Talamanca mountains, where interviewed. During the interviews a questionnaire was filled in focusing on what kind and how many hectares land was owned, the awareness on the PSA program and willingness to participate. The landowners who filled in a questionnaire were subdivided in three different classes separating the small (1<5ha), intermediate (5<10ha) and large (≥10ha) landowners. This way differences in obstacles to participate in the PSA program could be pinpointed between these three classes.

The results of the questionnaire showed that although 80% of all the landowners are willing to participate in the PSA program only 20% is currently doing so. Of the small and intermediate landowners the participation rate is 0% and 11% respectively, which is very low compared to the large landowners of which 43% participates. One of the main reasons of the low participation of small and intermediate landowners is that they were unaware of the PSA program. Also the funding received per participant is based on how many hectares are provided to the program, making it more attractive for large landowners to participate as they have more spare hectares, which is sometimes already or still nature. Improving the awareness on the PSA program and making it more attractive for small and intermediate landowners to participate could improve the participation. This way the PSA program can become a real solution to reduce fragmentation in the Talamanca mountain range.

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Acronyms and Abbreviations

MBC - Mesoamerican Biological Corridor

PSA - Pagos por Servicios Ambientalis (Costa Rica's payments for environmental services program)

PES- Payments for environmental Services

UNESCO - United Nations Educational Scientific and Cultural Organization

FONAFIFO - National Forestry Financing Fund

UNEP - United Nations Environmental Program

GEF - Global Environment Facility

KFW - Kreditanstalt fur Wiederaufbau

GPS - Global Positioning Satellite

ha- Hectares

ES- Environmental Services

1.0 Introduction

Fragmentation is one of the biggest threats to the unique ecosystems of the Talamanca mountain range in South Costa Rica (figure 1)(Daily et al. 2003; Gomes et al. 2008; Kappelle 2001). Areas outside of Private and national parks are mainly agricultural land, creating a physical barrier for animals that want to migrate in-between the parks (Sanchez-Azofeifaa et al, 2003). This endangers Talamanca's wildlife while this area has one of the highest rates of biodiversity and endemism in the world (Miller, 2001). Because of this biological significance it is included in the UNESCO world heritage list and appointed as an important site that needs to be protected (UN-Environment Program, 2011). Unfortunately fragmentation of the natural environment has negative consequences: (1) Loss of native plant and animal species , (2) invasion of exotic species, (3) a higher rate of soil erosion, and (4) poorer water quality (Collinge, 1996; Keyghobadi, 2007).
An innovative Costa Rican conservation program called: pagos por servicios ambientalis (PSA), which is a payment for environmental services program and could be a solution to the fragmentation issues in Talamanca. This program is designed to compensate landowners which provide environmental services. These services could be: sequestrating greenhouse gases (like CO_2), generating green energy, preventing water pollution, improving the natural scenery and biodiversity (Sánchez-Azofeifa et al. 2007). FONAFIFO is the organization responsible for the implementation of the PSA program in the Talamanca region. They are managed from within the government to contribute to national environmental objectives. By making use of local organizations, which are familiar with the landowners in the Talamanca region, FONAFIFO tries to implement the PSA program in the Talamanca region.

One local organization that is interacting with local landowners is Couldbridge. This organization takes care of a 283ha (700ac) nature reserve located in the Talamanca mountains, there property forms a biological corridor between the Talamanca Private Reserve (1.600 ha; 4.000ac) and Chirripo National Park (50.850 ha 125.650ac) (figure 1). Together these parks are part of the essential infrastructure of the biological corridor throughout Central America Mesoamerican Biological Corridor (MBC). The participation of landowners would benefit the environment in the vicinity of the Cloudbridge reserve. For locals that participate in the PSA program would reduce fragmentation in the area (Ferraro & Simpson, 2002), which benefits the conservation efforts of Cloudbridge Reserve.
However participation in the PSA program is currently low according to a study done by Zbinden en Lee carried out in different areas of Costa Rica (Zbinden & Lee, 2005; Engel et al., 2008). Zbinden & Lee (2005) defined that low participation was caused by; the payment per hectares provided to the program, the need of legal documents showing land ownership and the availability of information on the PSA program. This makes it particularly difficult for small and intermediate farmers (<10ha land), which are the majority of the landowners, as they have no spare hectares or knowledge on how to take part in the PSA program.

In this study we aim to pinpoint the exact obstacles for landowners (>1ha land), in the vicinity of Cloudbridge reserve, to participate in the PSA program. The research will focus on San Gerardo, a small village enclosed by agricultural fields and the natural reserves (Cloudbridge, Chirripo, Talamanca Private reserve). This vilage has been designated as a key area for participating in the PSA program (UNEP, 1990; Vergas 2013). This research will be the first social survey conducted for this specific purpose (finding participation obstacles PSA) in the area of San Gerardo.

With this information clear recommendations can be made to adjust the PSA program for survin a bigger group of landowners in the area. Also communication recommendations can be made to improve the awareness of the local community on the program. Subsequent, the results from this study on San Gerardo may be used as a model to improve PSA participation elsewhere.

Figure 1: Talamanca Mountains and study site: The study area is the village San Gerardo de Rivas.

1.1 Problem statement

According to Cloudbridge (Gode, 2013) the participation in the PSA program by landowners around San Gerardo is currently low. Literature of other areas in Costa Rica support the same conclusion (Zbinden & Lee, 2005; Pagiola, 2008; Daniels et all, 2010; Jenkins & Richards, 2007) . This is an undesirable situation because; current protection is unable to provide the gamut of ecosystems necessary to support altitudinal migrants (Hogan, 2012). In order to find out the exact reasons why some landowners do not participate in the PSA program a social survey needs to be conducted. Because it is currently unclear why landowners around San Gerado do not participate in the PSA program, what obstacles they experience and what their opinion is about the PSA program. Furthermore the current approach of organizations for finding participants remains unclear. Identifying root causes for non-participation is essential for designing recommendations that will increase PSA participation. Higher participation will lower deforestation and fragmentation (Schedlbauer, et al., 2008). This has all sorts of advantages some of which are; improved natural protection, water quality and carbon sequestration (Echeverria, 2010). Besides positive effects on the environment it also improves the socioeconomic situation of the poor and small farmers according to (Locatelli, Rojas, & Salinas, 2008).

1.2 Research objectives

In order to increase the number of PSA participants in the vicinity of San Gerardo. A better understanding of the causes responsible for low participation in the PSA program is necessary. Here fore it has to be identified what the application obstacles are for landowners around San Gerardo and what their reasons are for not participating in the PSA program. Additionally it has to be clear in what way Coopeagri is responsible for the implementation of the PSA program and how they find landowners to participate in the PSA program. When it is established why landowners do not participate and how Coopeagri tries to find new participants, recommendations on how to increase the amount of participants in the PSA program can be made. These recommendations can anticipate on the wishes of the landowners and could make finding participants more effective for implementing organizations. More participation could then contribute to the defragmentation of the Talamanca region. In order to achieve a better understanding for low participation in the vicinity of San Gerardo the following research questions where used;

Main Objective
Get a better understanding on the reasons why landowners around San Gerardo do not participate.

Main question:
What are the current obstacles to apply for participation in the PSA program for the landowners living around San Gerardo?

Sub Questions:

1. What are the reasons not to apply for the PSA program for the landowners living in the vicinity of San Gerardo?

2. What is the opinion about the PSA program of the land owners living around San Gerardo?

3. How do organizations responsible for the implementation of the PSA program currently approach potential participants around San Gerardo?

4. How can Cloudbridge help landowners that wish to participate in the PSA program?

2.0 Materials and methods

Materials used for gathering the data where questionnaires and interviews. Reasons for using a questionnaire where: being able to approach relatively large numbers of people (Mellenbergh, 2008). Furthermore every respondent answers the question in the same way which makes the answers reliable and the general PSA participation obstacles can be identified more easily (Kaplan & Saccuzzo, 2009). Other reasons for using a questionnaire where costs and reduced verbal effort of the questioner because it is conducted in Spanish. Considerations for choosing semi-structured interviews where: open both-way communication and reasons for the respondents answers. It is also a more personal approach which enables you to ask more sensitive questions (FAO, 1990). The relative small amount of organizations that had to be interviewed made it possible to focus on the details in a semi-structured interview.

2.1 Background information

In the late 1980's Costa Rica had one of the highest deforestation rates in the world and was one of the most deforested countries in Central America (Zbinden & Lee, 2005; (Sanchez-Azofeifa, et al., 2001). Deforestation was driven by: road expansion, Cattle farming and laws in favor of deforestation (De Groot & Ruben, 1997). To counter deforestation Costa Rica constructed a system of national parks and private reserves, which today accounts for over 25% of national territory. However deforestation outside the reserves continued, resulting in a fragmented landscape of national parks and private land (Sanchez-Azofeifa, et al., 2003).

To counter environmental degradation on private land Costa Rica experimented with payments for environmental services programs, which provide funding for environmental services on private land. This eventually led to Costa Rica's famous PSA program, authorized by the fourth national forestry law in 1996 (Pagiola, 2008; Rojas & Aylward, 2003). Owners of private land can participate through changing their land use in to; regeneration or protection of natural forest, establishing sustainable timber plantations or agroforestry systems (Karousakis & Brooke, 2010). The participants receive annual payments for carrying out one of these activities, the height of the payment depends on the activity, location and the amount of hectares submitted (Supplementary data C). Key areas for conservation are accepted more easily into the program (UNEP, 1990; Blackman & Woodward, 2010).
Participation is possible for any person who legally owns at least one hectare. Most contracts for application are negotiated between landowners and the National Forest Finance Fund, in Spanish Fondo Nacional de Financiamento Forestal (FONAFIFO). FONAFIFO is a government agency responsible for the implementation of the PSA program. The Fund is financially supported by special oil taxes and multiple donators (the World Bank, the Global Environment Facility and a German development bank called Kredietamstalt fur Wiederaufbau (Tacconi, 2012; Blackman & Woodward, 2010).

In the case of San Gerardo FONAFIFO uses an intermediary (COOPEAGRI) that helps them with the implementation of the program. Coopeagri is familiar with the landowners around the village of San Gerardo because they try to bring agricultural innovations to the farmers. For the implementation of the program Coopeagri uses a point system. Where points are given to characteristics such as; proximity to a river, biologically diversity and proximity to a nature park (Daniels et al. 2010; Vargas, 2013). The more points a property has the more easily it is accepted within the PSA program. The payments made to the participants are given in (supplementary data C) and differ between the different kinds of activities.

2.1.1 Organizations involved in PSA participation San Gerardo

FONAFIFO is a semi-autonomous agency which means that it is managed from within the government, but is responsible for its own personnel and fund management. The government focusses on the following subjects with the FONAFIFO agency; forest protection, water services, sustainable utilization and rejuvenation(Pagiola, 2008). There activities are monitored by geographic information systems, modern sustainable forestry techniques, auditing and certification. These measurements try to ensure the participant's dedication to the program and to measure the environmental benefits. Their funding is available for participants with properties (ranging from 1 to 300 hectares). Their mission is to contribute to national objectives and policies in line with sustainable management, conservation and ecosystem development (Daniels et al., 2010).

The general participation requirements of FONAFIFO

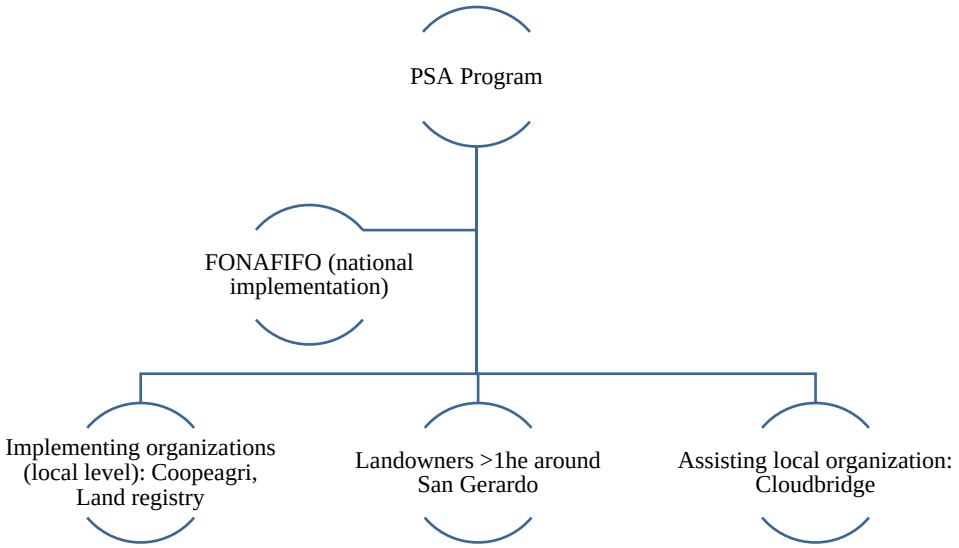
1. The property and organization has to be "legally constituted and recognized in Costa Rica**,** according to existing regulations, able to exercise rights and acquire obligations."
2. "Have technical, administrative and accounting systems that are acceptable according to the criteria of the Trustee or receive the technical assistance that makes it possible to comply with this requirement."
3. "Be willing to accept and apply the recommendations of a technical and administrative nature suggested by FONAFIFO's Credit Department and Trustee."

(FONAFIFO, 2013)

2.1.2 Coopeagri

Coopeagri was established in 1962 as a solution for the commercialization and industrialization of small and mid-sized coffee farmers. Coopeagri brings these farmers new technologies and efficient production systems (COOPEAGRI, 2013). Because Coopeagri is familiar with farmers around San Gerardo, they are functioning as a link between the farmer and the PSA program. More specifically Coopeagri distributes information on the PSA program to farmers around San Gerardo to make them aware of the program.

To ensure that the right properties are admitted in the program Coopeagri uses a point system; the points correspond with ecosystem services the property can provide, thus more points means a higher priority (admissibility in the program) **(Vargas, 2013)**. For every landowner that participates in the PSA program because of Coopeagri the organization receives some payment.



2.1.3 Cloudbridge

Cloudbridge is a private nature Reserve located in the Talamanca mountain range (Figure 1). It was founded in 2002 and had the goal to conserve precious tropical forest. To achieve this goal Cloudbridge has several main activities; preservation of the current tropical cloud forest, help reforest those areas that have been converted into cattle pasture and to protect the biodiversity in the area. With this study Cloudbridge tries to increase participation in the PSA program which would benefit the preservation of biodiversity in their surroundings. Cloudbridge is also willing to assist in reforestation activities for the PSA program, because it is one of their aims to convert cattle pasture into forest (Cloudbridge, 2012).

2.1.4 Explaining PES programs

Because consumption around the world has increased significantly ecosystems are under pressure worldwide (FAO , 2000). This causes the loss of environmental services throughout the world. These services are often not well understood and undervalued by policy makers and companies. Here fore they are not taken into account in the open market. PES tries to fill this gap by giving financial incentives for the provision of environmental services (ES). To achieve the provision of environmental services it has to be clear what an ES precisely is.

A defined description of an ES is given in (Rosa H. et al. 2003):
Those provided by forests and forestry plantations that have an impact on environmental protection and improvement. They are the following: mitigation of greenhouse gas emissions (fixing, reduction, sequestration, warehousing and absorption); protection of water for urban, rural or hydroelectric use; biodiversity protection to conserve it and for sustainable, scientific and pharmaceutical use; genetic research and improvement; protection of ecosystems, life forms and natural scenic beauty for tourism and scientific ends.

Often PES is defined by the 5 criteria of Wunder 2007. These criteria state that it is a service provided on a voluntary basis. It is clearly defined what the ES will be provide. There is a buyer for the ES and a provider. Finally the ES buyer will only pay if the ES provider will consistently deliver the ES over time. (Wunder, et al., 2007)

Before the development of PES schemes the protection of environmental services could only be achieved by law and enforcement. PES is different because it gives and incentive to local people to protect their natural environment. This is more cost effective because there is no need for enforcement resources (Mayrand, 2004).

2.1.3 Literature review

Abundant scientific Literature has been written about payments for environmental service programs (PES). There content is about the funding mechanisms, the effect on the environment and the implementation and participation of PES programs. In this literature review we look at the effects on the environment and the participation in PES programs. The final section (page 14) gives the relevance of this study within the existing literature.

PES programs have become increasingly popular for providing ecosystem benefits to people. Their popularity is increasing because ecosystems are in decline worldwide(Engel et al., 2008). With these PES programs countries try to protect their natural environment and keep the environmental benefits derived of the ecosystems. A PES program is designed to protect ecosystem services by giving it a market value, so that local actors will start to provide these services(Pagiola, 2008).
Despite the promising concept the benefits to the environment may be overestimated. Leakage can happen directly when landowners just start to use a different part of their property. It may also occur that when the final date of the contract is reached that the owner immediately removes the ecosystem service. Moreover landowners would only subscribe parts which they would not have used in the first place, resulting in no net benefits from the PES program (Chomitz, 2002).
A research by the World Agroforestry Centre in 2013 was aimed to see what the exact benefits of payments for environmental services are. They concluded that the landowner often benefits from PES schemes and that it effectively provides ES services. It is however sensitive to change since market value changes can overrule the PES payment. Therefore law and enforcement are important factors in making PES programs a success (Kissinger, Patterson, & Neufeldt). When implemented correctly it results in a situation in which both the land user and the consumer of the ecosystem services benefits(Engel et al., 2008). It remains difficult to measure the precise environmental benefits of PES programs, but the study (Ferraro & Simpson, 2002) shows that PES programs are one of the most effective ways to promote conservation.

The possibility to participate in a PES program for a landowner will depend on its social economic situation and the opportunity costs of a PES activity. Common participation factors are: (1) availability of spare land, (2) legal issues, (3) property protection (because the land will be legally owned by the participant when admitted in the program, (4) environmental awareness. (Arriagada et al, 2009). These are general reasons, participation reasons can however differ per region (Petheram & Campbell, 2010). Factors that influence a landowner's decision to participate are given in (Figure 2)

Poorer farmers often have lower participation in PES activities that require high opportunity costs(Cole, 2010;Pagiola, Rios, & Arcenas, 2010). However when the program provides participation without high opportunity costs the participation in the PSA program is the same for different socio economic backgrounds(Pagiola et al., 2010). PES participation often has a positive effect on the social economic situation of the poor/ small(land) farmers according to (Rodríguez et al, 2011; Pagiola, Arcenas, & Platais, 2005).

The relevance of this study within the existing literature is that it is the first time such a study is being carried out around San Gerardo. It is important to understand local dynamics according to Petheram & Campbell 2010 if to achieve an increase in participation for the PSA program. Understanding the landowners around San Gerardo can reveal what assistance is necessary to make it possible for landowners in the vicinity of San Gerardo to apply for the PSA program. Besides the environmental benefits higher participation would induce (Ferraro & Simpson, 2002). Better accessibility to the PSA program can also contribute to poverty alleviation in the vicinity of San Gerardo(Rodríguez et al., 2011; Pagiola et al., 2005)

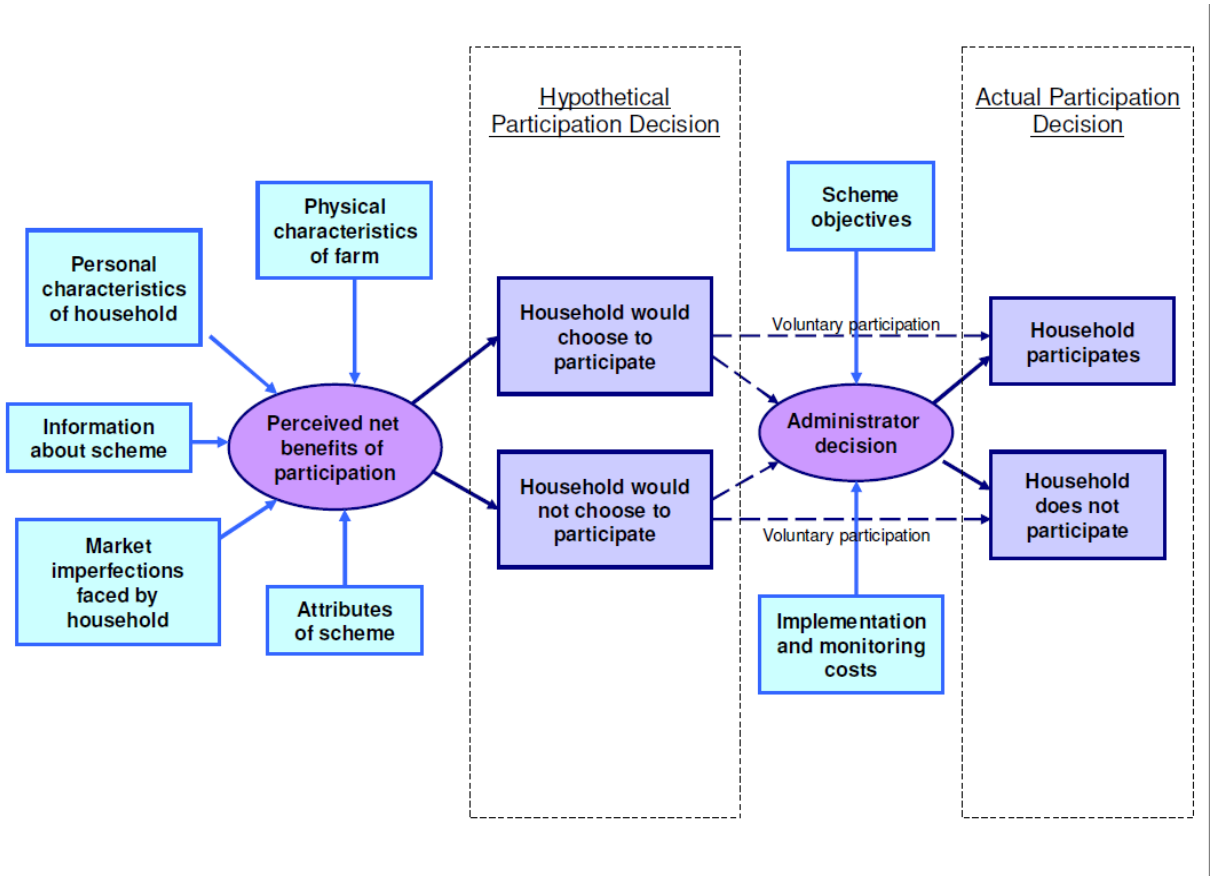


Figure 2: factors influencing decision to participate, Source;(Mullan & Kontoleon)

2.2 Background study area

The study site the village; San Gerardo de Rivas, Perez Zeledon, Costa Rica is situated in South-central Costa Rica, along the Cordillera Talamanca mountain chain (Figure 1). The houses of the village are spread within an elevation of 1000m to 1800m. San Gerardo's precise (Global Positioning Satellite) GPS location is (N 928.088 W 8335.514).The village is surrounded by vegetation comprised of low mountainous rainforest, typically known as cloud forest which has high species diversity (Souers, 2004). Agriculture is found in the form of pasture land, coffee plantations and silvicultural activities. The highest parts of the village border Chirripo national park which is a UNESCO world heritage site. San Gerardo is found on mid-mountainous altitude, which has a lower average temperature; ranging from 12 to 26 degrees Celsius (Giddy, 2006). Rainfall is high throughout the year with an average precipitation of 4300 mm yr-1 (Giddy, 2006).

2.2.1 Population

The registry in San Isidro (the closest city) estimated the population of san Gerardo and its surroundings to be about 600 persons (Anauya, 2013). Traditionally San Gerardo is an agricultural region, producing primarily coffee. This is however changing with the coming of tourism because economic activities herewith related are becoming more important. Tourists visit San Gerardo for its scenic beauty and use it as a starting point to climb the highest mountain in Central America (Cerro Chirripo) (Community-San-Gerardo, 2000). This new economic activity is seen in San Gerardo by the number of bars and hotels.

2.2.2 Land use and risks around San Gerardo

Human activity in the Talamanca Mountains covers a wide range of agricultural practices. Firstly the cultivation of various crops like; coffee, maize and tomatoes. Thereafter the use of pasture land with mainly cows for meat and dairy products. Thirdly, tree cropping founds less often around the village of San Gerardo species used are; '*Alnus* spp., cypresses, pines and eucalyptus' (Chaverri-Polini, 1998). Before such activities can take place the area must be cleared by felling and burning. The clearing of vegetation brings various risks such as; erosion, degradation and water pollution. These negative impacts of agriculture could have an even greater negative impact in the mountains. This is so because cold temperatures cause slower recovery of vegetation and steeper slopes have a potential higher erosion rate. In addition fragmentation of the land causes the reduction of plant and animal speciation (Chaverri-Polini, 1998).

2.2.3 Description of the target group

In order to question the correct landowners with the questionnaires, they had to meet some criteria. These criteria where; own at least 1 hectare and be currently residential around San Gerardo de Rivas. According to FONAFIFO people who comply with these characteristics can participate in the PSA program (Daniels et al., 2010). As a result this study only approached people that met these criteria.

2.3 Data Collection

The questionnaires were conducted from 23-4-2013 till 10-5-2013 from 7 am till 4pm. Besides the main village (San Gerardo) some houses in the neighboring towns (Herradura and Angeles) where visited. The location of the houses where the questionnaires were held is stored with GPS data points, this information can be found in (Supplementary data F). Jason Monge an inhabitant of San Gerardo de Rivas helped with finding the landowners. He was a familiar face for most of the respondents; which made the respondents more comfortable to answer the questions.

The semi-structured interviews were conducted on 13-05-2013 with Cloudbridge. On 15-05-2013 was the interview with Coopeagri (San Isidro) and 20-05-2013 the interview with the national registry (San Isidro). These interviews have been conducted by Jorn Schoffelen. The interviews of cloudbridge were with Mauricio Contreras and Tom Gode. The interview at Coopeagri was done with Luis Diego Zoniga Vargas and at the registry with Anauya Milagro.

2.3.1 Questionnaire

Every questionnaire had a text explaining the reason of the investigation. They inquired the date, name and size of their property before starting the questionnaire. The questionnaire was comprised of 4 parts with different topics related to the research questions. The questionnaires were conducted at the houses of the landowners. After the questionnaire was finished a GPS point of the location was taken for future research. The questions have been designed together with Mauricio Contreras a native Spanish speaker. He made the questions understandable for a broad public. On average the questionnaire took about 20 minutes to be completed. Below the English version of the questionnaire can be found. The original Spanish version in (supplementary data A)

Figure 3: Conducting Questionnaire

Semi-structured Interview

2.3.3 Sampling design

It is difficult to estimate the exact sample size required for the questionnaire. However the questionnaire has advantages over other methods; “One of the real advantages of quantitative methods is their ability to use smaller groups of people to make inferences about larger groups that would be prohibitively expensive to study” (Holton & Burnett, 1997). The sample size in this study is determined by the following formula.

$$n_0 = \frac{(t)^2 * (s)^2}{(d)^2} =$$

Figure 4: Sample size formula (Bartlett, Kotrlik, & Higgins, 2001)

The acceptable error we take in this research is 5 % so error is 1.96 T value. For the population around the village of San Gerardo there is an estimate of 600 inhabitants (Anauya, 2013), so S is 0.6 (Bartlett et al., 2001). Question 1 of the survey has 5 possible answers and the accepted error is 5% so d is 5*0.5. This results in the following formula to determine the required sample size.

N0= (t)^2*(S)^2/(d)^2= (1.96)^2(0.6)^2/(5*0.05)^2= 22

The survey had to question at least 22 people for a 5% sampling error. In reality not everyone owns more than 1 hectare therefore the questionable population is much lower than 600. Nonetheless this study has conducted 35 questionnaires.

2.4 Data Analyzing

All of the answers given on the questionnaire have been saved in a digital database. In the results section this data is presented in tables and graphs. Text above the tables and graphs explains what the tables and figures mean, giving information about the average and results of statistical tests. Furthermore numbers are indicated as a percentage of the total answers given.

To show the difference between answers given by; small size (<5ha) hectare, intermediate size(>5<10ha) and large size (≥10ha) property owners, a CHITEST test was applied to yes or no questions. When the CHITEST test gives a number smaller than 0,5 there is a difference. If it is smaller than 0,05 there is a significant difference. The P-value for indicating a significant difference is therefore the same or lower then 0,05.

3.0 Results

3.1 Surveyed landowners

Landowners that participated with the survey had the following gender distribution; 30 men, 5 women. The GPS locations are given in (supplementary data F), locations of the properties of the landowners are given in the map below (Figure 4) these are both the participating and non-participating properties n=22. It shows how close the properties are to Chirripo national park. The Central village is San Gerardo, north is Herradura and to the south is Angeles. The main income source for the landowners was agriculture and tourism. Some did not use their land because they had an income source from outside of San Gerardo. The average property size of the land holdings was: 2.6ha for 1 to 5 hectares, 7.2ha for 5-10 hectares and 47 for a size holding above 10 hectares. The distribution of property sizes and is given in (Table

Table 1: Distribution of landholdings (n=35households)

Size land holding	Percentage of household questionnaires
1 to 5 hectares	34% (12)
5-10 hectares	26% (9)
More than 10 hectares	40% (14)

3.1.1 Participating landowners

Twenty percent (20% 7 households) of the questioned landowners participated in the PSA program. Five of these households are located near the village of Herradura (Figure 5). Six of the participants in the PSA program had a property bigger than 10 hectares.

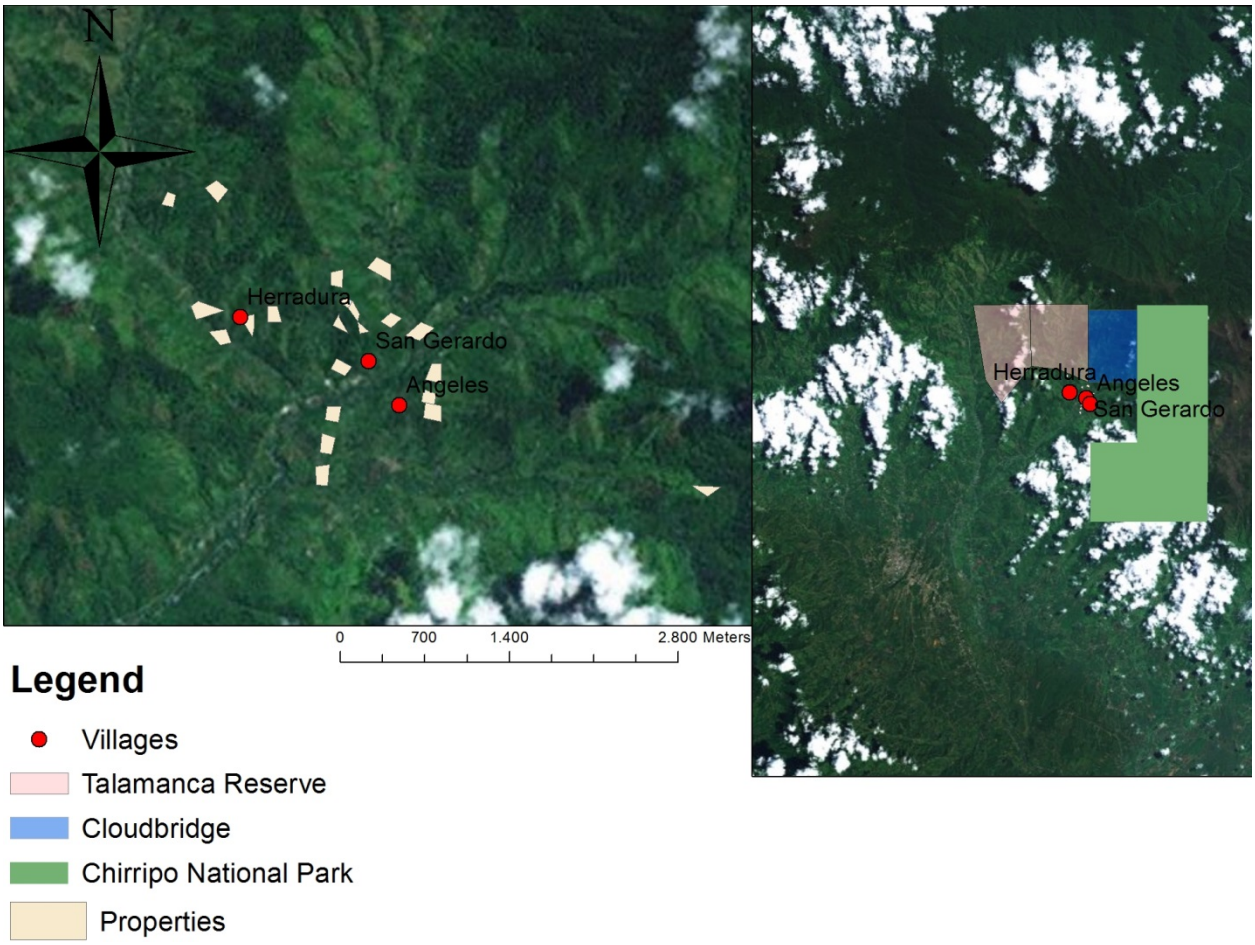


Figure 5: Locations of the properties

When comparing the size of landholdings, it appeared that those farmers who participated tend to have more land than those who do not participate in the program. Six of the seven (85%) of participants had more than 10 hectares of land.

Forty-two (42%) of the landowners with properties larger than 10 hectares participate in the PSA program. Whereas none of the landowners with holdings smaller than 5 hectares participate in the PSA program. When comparing the different holder size groups and their participation with a CHITEST, a significant difference (P<0, 05) between participation of the different groups is found (0,0181). So this means that participation under landowners (<10ha) is significantly less.

Table 2: Participation in the PSA program per size group

Participating landowners	1 <5 hectare	5<10	≥10	Total
Nr. Landowners	12	9	14	35
yes	0	1	6	7
no	12	8	8	28
Percentage participate	0%	11%	43%	20%

3.2 Obstacles for participation

The majority (65%) of the questioned landowners had little to no knowledge about the PSA program. (Figure 6) shows the percentage of answers given by the landowners about the knowledge of the PSA program. Of the remaining 15 people 53% was very familiar with the PSA program. The average of the respondents is 2,2 ($\bar{x}$= 2+1+2+1+4….)/35. The classes in (Figure 6) can be defined by the following definitions. *Not familiar* means that the respondent never heard of the PSA program. *Aware* is that the respondent heard about the PSA program but possesses no further information. *Some idea* means that the respondent knows the PSA program and where it is for. When the respondent is *familiar* he knows what the program is for and understands the application process. When someone is *very familiar* he knows exactly how to apply for the program where it is for and what the payments are for the different activities.

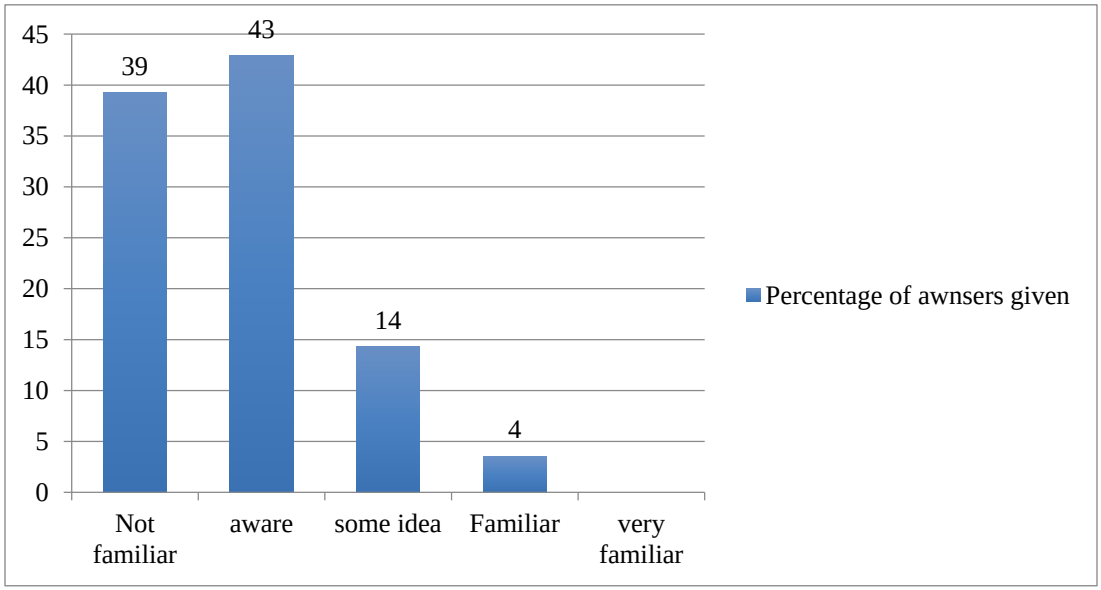


Figure 6: Knowledge on the PSA program displayed in percentages of the answers given n=35

When landholders who participate in the PSA program are not accounted for (82%) has little to no knowledge about the PSA program (Figure 7). This means 4 in 5 landowners who did not participate in the PSA program has little to no idea about the program. Eighteen percent (18%) of the landowners that does not participate is familiar with the PSA program.

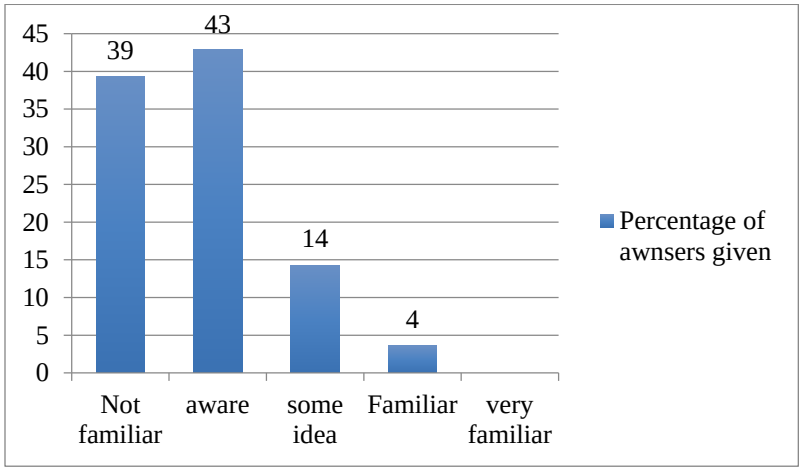


Figure 7: Knowledge on the PSA program only non-participating n=28

A Majority of the landowners about (70%) is aware of the possibility to apply for activities such as; forest protection, reforestation, natural regeneration and agroforestry (Figure 8). There is no real difference between landowners that participate and the landowners who do not participate. These activities have not only been available in the PSA program for landowners indicated that it was possible to do conservation activities in the past with Coopeagri. Coopeagri said that these activities were for reducing erosion in the area. Therefore these results cannot be directly linked to the activities of the PSA program.

Activities	Participants (n=7)	Non participants (n=28)	Total (n=35)
Forest protection	71%	71%	71%
Reforestation	86%	71%	74%
Natural regeneration	71%	64%	66%
Agroforestry	57%	61%	59%

Figure 8: Awareness of the ability to apply for conservation activities (participating and non-participating landowners)

On average 71% of all the landowners is aware of the conservation activities (Figure 9). When looking at the small land size group (<5ha) and the intermediate land size group the awareness of the conservation activities is 64%. Compared to large land size owners (≥10ha) they are slightly less familiar because they have an average of (73%).

Activities	1<5 hectare (n=12)	5<10 hectare (n=9)	≥10 (n=14)	Total (n=35)
Forest protection	58%	78%	79%	71%
Reforestation	75%	67%	78%	74%
Natural regeneration	58%	55%	78%	74%
Agroforestry	66%	55%	57%	66%

Figure 9: Awareness to apply for conservation activities (grouped by land size)

The main reason for not participating in the program appeared to be lack of information, for 44% of the landowners mentioned this as their main reason. Other important reason were: lack of land, (19% of the households) and the PSA process (11% of the households). Landowners that did participate in the PSA program sometimes complained that the payments made by FONAFIFO where insufficient.

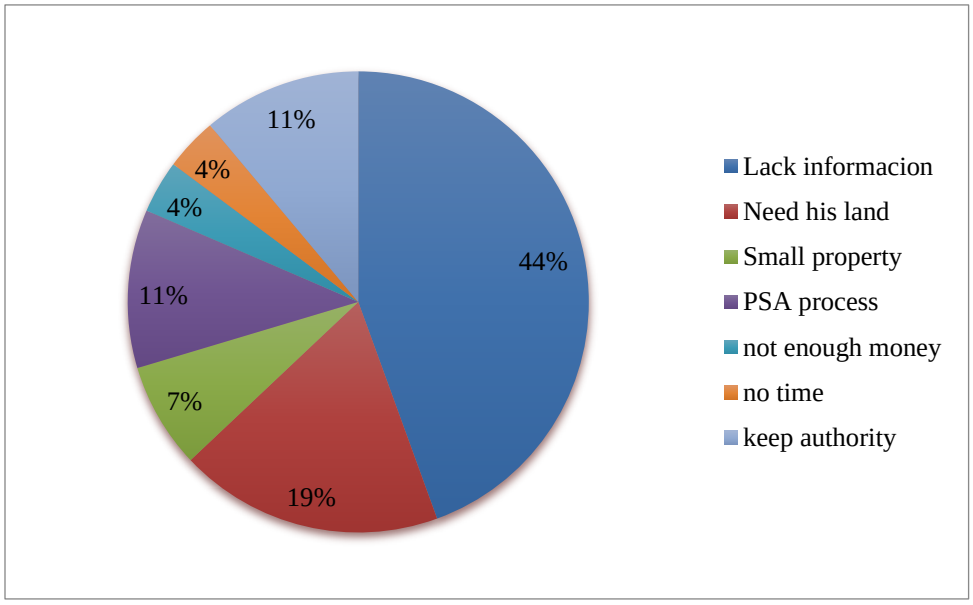


Figure 10: Obstacles for participation in percentages n=27

3.3 Opinion and reasons not to apply for the PSA program

All of the respondents indicated that they found the PSA program a good initiative. Moreover (46%) found the PSA program a really good initiative (Figure 11). In order for everyone to answer this question the PSA program was explained to before answering.

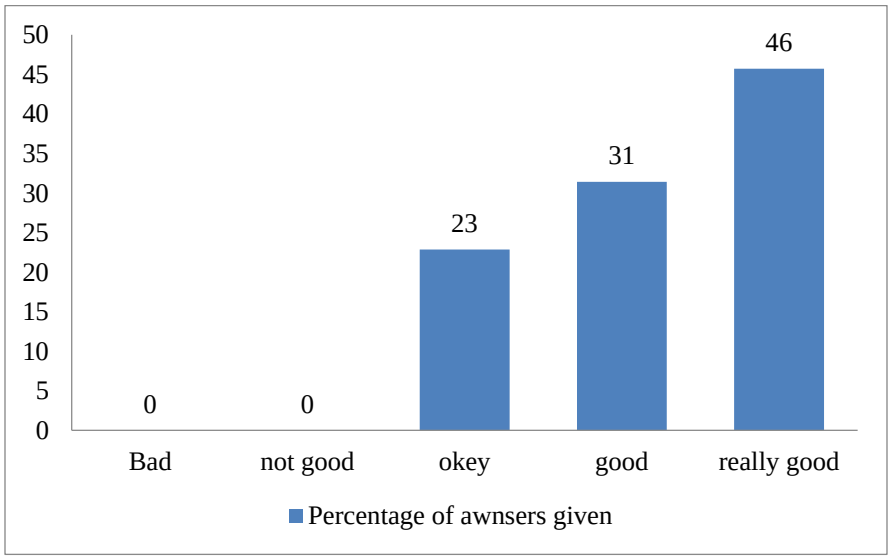


Figure 11: Opinion about the PSA program

The participating landowners all still found that the PSA program is a good initiative. Five of the 7 participants (71%) even found the PSA program really good. It is remarkable that the participating landowners grade the program so high for the payments were not always sufficient said two participating landowners.

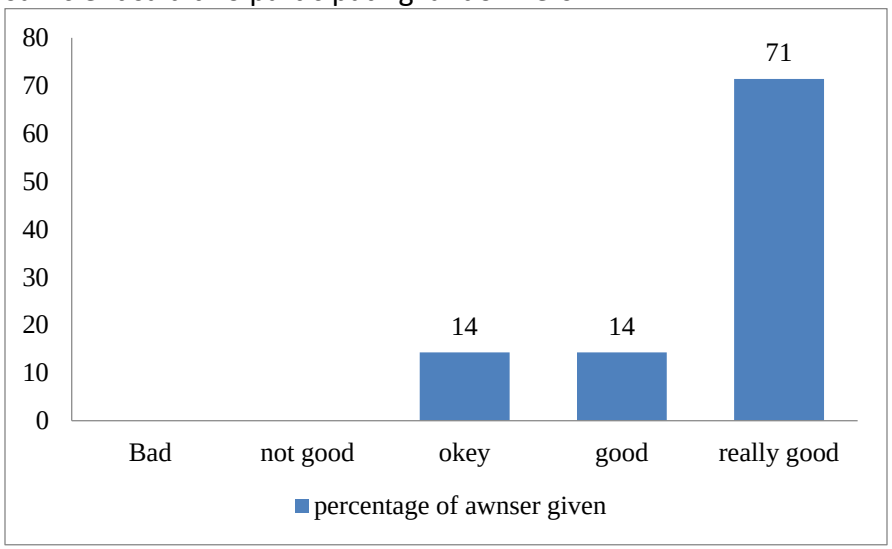


Figure 12: Opinion on the PSA program of participating landowners (n=7)

Almost 70% of the non-participating landowners said yes to the question if they would like to participate in the PSA program (Table 6). The relationship between the land size groups and the given answer is 0, 57 CHITEST. This indicates that small land holders (<10ha) would just as much like to participate as large land owners.

Table 3: Landowners that want to participate

would you like to participate?	<5	>5<10	≥10	total	percentage
yes	8	6	5	19	0,703703704
no	4	1	3	8	0,296296296
total	12	7	8	27	100

CHITEST: 0,57

Eleven of the 35 (31%) landowners said that conservation is the future goal of their property. Followed by ten on the 35 (28%) that say agricultural production is the main purpose of their land in the future. The question (Figure 13) future plans are about the main practice landowners see themselves do on their land in the future. Many landowners (40 would like do an activity related to conservation.

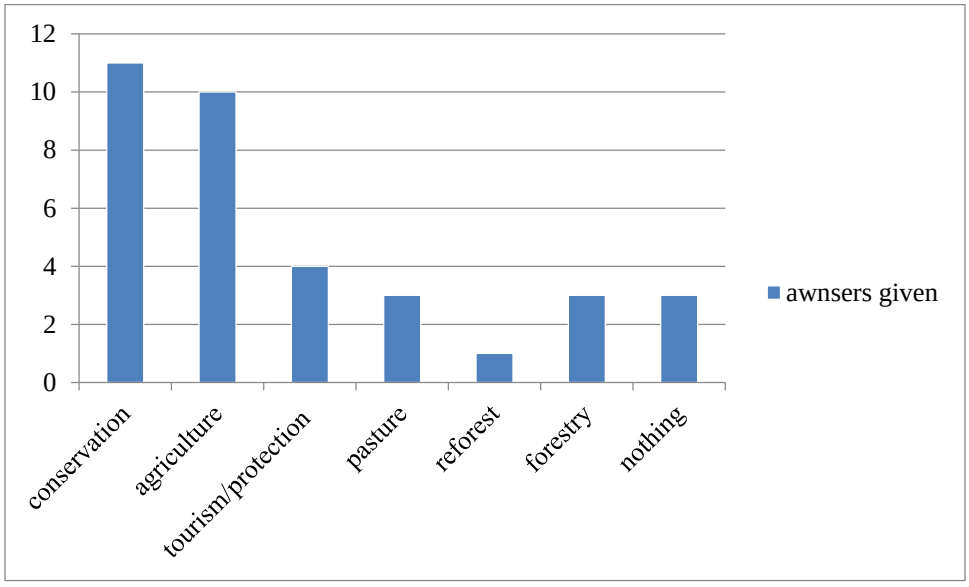


Figure 13: Future land use activities

3.4 property obstacles in the PSA program

Besides the obstacles landowners experience in the application for the PSA program. There is also the possibility to be denied into the program after application by an administrator (Figure 2). An administrator will look if the property complies with the goals of the PSA program and can provide the ES. A property has a higher change of being admitted when it is located close to a nature park, river or has the right characteristics such as forest coverage. The following tables are related to desired characteristics to be accepted into the PSA program.

About 10 landowners had 80-100% of forest cover, these landowners account for 30% of the questioned landowners. The average percentage of forest on the landowner's property is 38%. Six landowners indicated that they did not have any forest on their land.

Table 4: The percentage of forest cover of the questioned landowners

Forest percentage	*Number of properties*
0%	6
(>20%)	10
(>40%)	4
(>60%)	5
(>80%)	6
(100%)	4

More than 90% of the landowners had legal title for their land (Table 6). There were 3 persons who had no legal rights for their land. Larger land sizes (≥10ha) more often had no title (legal registration) than smaller land sizes (<10ha).

Table 5: Legal registration on property

do you have legal registration on your land?	<5	>5<10	≥10	total
yes	12	8	11	31
no	0	0	3	3
total	12	8	14	34
Percentage with legal registration	100%	100%	78%	91%

In total 58% of the properties bordered a river. This is important for being accepted within the PSA program. For watershed protection is an ES that the PSA program wants to provide (FONAFIFO, 2013).

Table 6: Properties bordering a river

4.3	Does your land border a river?	answers	percentage
	yes	20	58%
	no	14	41%
	total	34	

3.5 How landowners are approached for participation in the PSA program

Coopeagri functions as a link between landowners and the PSA program/FONAFIFO. Landowners receive information by presentations and person to person advertisement, but presentations have so far (15-5-2013) not yet been given in the area of San Gerardo. In 1998 Coopeagri started to work as a link between the landowner and the PSA program. When a landowner wants to participate Coopeagri can assist in the participation process. But currently Coopeagri is unable to assist in reforestation activities for they do not possess the required seedlings.

According to Coopeagri participation in the PSA program is reduced by several obstacles. The first being lack of available information on the PSA program. Secondly, low interest of the landowners. And in a later stage farmers often find out that they do not possess the required legal documents such as legal ownership over the land.

Coopeagri believes that when participation is improved it would result in a higher sustainability of the area. For the PSA program will retain and rejuvenate the forests. Furthermore the wildlife in Chirripo national park will benefit from reduced fragmentation. Finally, downstream inhabitants will receive less polluted water due to improved watershed protection.

3.5.1 Land registry

To find out what the land registry does to help landowners participate in the PSA program, an interview with the registry in San Isidro was conducted. However the registry was not aware of the PSA program nor had special assistance for PSA applicants. What an executive did say was; that land registration has become more complicated these days and that it is necessary to promote land registration for landowners in the area. What exactly had become more complicated was not specified.

3.5.2 Cloudbridge Nature Reserve

According to Cloudbridge difficulties for new participators are; titel to land, paper work, and relatively small farms. It is not possible for Cloudbridge to assist in these matters. However they can assist in environmental education (information), technical assistance for reforestation and providing seedlings and trees. Furthermore they allow presentations to be held about the PSA program in their classroom building. If Cloudbridge would receive information about the PSA program it is also possible that they convey the information to the landonwers around San Gerardo.

4.0 Discussion and Conclusion

This research showed that the major obstacles for participation in the PSA program by local landowners, around the village of San Gerardo, are (in order of importance): (1) the lack of information on the program, (2) the program does not benefit to the small landowners and (3) the small landowners don't have spare land to participate.

Though, the majority of the landowners are aware of the possibility to apply for conservation activities (up to 70%), they lack more detailed information on how they can participate in the PSA program. This lack of knowledge on the program was also pointed out in other studies to be a key obstacle to participate(Arriagada., et al; Pagiola, 2008; Colea, 2010; Locatelli et al., 2008). Reasons for this lack in information are that there is no active and specific advertisement of the program to local landowners and the low education level of the potential participants can be an additional obstacle for explaining to the possibilities to participate(Petheram & Campbell, 2010).

Participation of large landowners (≥10ha) is higher than landowners with an intermediate or small property (<10ha). This is mainly because the small landowners have less land that could be used for participation, as they need to use all their land for agriculture to support their living (Locatelli et al., 2008). As participants are paid per hectare provided to the PSA program the small landowners have a disadvantage, as they have not a lot of hectares to offer. Large landowners possess more spare hectares, which can be used for other purposes than food production and are sometimes already covered with forest that is more easily admissible in the PSA program (Engel et al., 2008).

One other aspect that other studies pointed out as a problem for PSA participation is the lack of legal documents on landownership (Pagiola, 2008; Colea, 2010; Locatelli et al., 2008). Though in this research this seems to be less of a problem as almost all interviewed farmers stated that they have legal documentation on the land they own. Therefore, based on this research, legal obstacles are less of an issue for participation around San Gerardo. Though, the lag of legal documents on landownership has been pointed out by the local organization Coopeagri as an issue for participation, so possibly the local farmers are unaware if there legal documentation is still up-to-date or valid.

In regard to the opinion of the landowners about the PSA program most are very positive. Despite this positive attitude about the program, only 31% indicated to have nature conservation in their future plans for the land they owned. This means that landowners are aware of the importance of nature conservation but often remain with agriculture for their main income, because nature conservation has never been presented to them as a good and stable substitute for their agricultural activities.
This is regrettable, as a lot of the lands these landowners possess could be of great value to the nature parks in this region. Of the properties included in this research the forest cover was 38% and 58% of the properties are next or close to a river, making these properties of extra value for nature conservation and the PSA program.
Because the investigated properties of San Gerardo are located on key locations between different nature reserves, they are of high value to the local nature and the biological corridor of Talamanca. Therefore an extra effort has to be made to overcome the obstacles for the local landowners to participate in the PSA program.

4.1 Recommendations and future outlook

One of the major problems limiting PSA program participation is the lack of information provided to local landowners. Though, this issue can be resolved by local organizations, as Coopeagri and Cloudbridge, which can communicate about the PSA program with the local community. Based on the conclusions of this study Cooperagri and Cloudbridge organized a PSA program information event, to which all participants in this study where invited. This way these organizations can directly communicate with the landowners and help them with applying to the PSA program.
A sticking fact is that most PSA participants are large landowners and small landowners hardly participated. This low participation of the small landowners could be addressed by giving special benefits to this group. For example by increasing funding for the first hectares a landowner offers to the program it can become attractive for small landowners to participate. This measure is not only in the benefit of preventing and reducing nature fragmentation but also to the social economical perspective of the small landowners, which are mainly poor farmers(Pagiola et al., 2010).
Future Research can be dedicated to see if the landowners of this study will increasingly participate in the PSA program. Additionally, research focusing on landowners that participate in the program can give valuable information on how to make participation improvements. The collaboration in this study with the local community and organizations as Cloudbridge proved to be very constructive, providing a good insight on the PSA participation issue. Therefore this research setup and its conclusions do not only apply on San Gerardo but could also be of use to improve PSA participation in other similar villages located in the Talamanca mountain range, by which fragmentation can be prevented throughout this ecological corridor.

(D*uring this study cloudbridge and Coopeagri agreed on giving a lecture about the PSA program at Cloudbridge classroom building, this thesis will also become available for both organizations)*

References

Anauya, M., 2013. *What is the function of the land registry in the PSA program?* [Interview] (23 May 2013).

Arriagada, R. a., Sills, E. O., Pattanayak, S. K., & Ferraro, P. J. (2009). Combining Qualitative and Quantitative Methods to Evaluate Participation in Costa Rica's Program of Payments for Environmental Services. *Journal of Sustainable Forestry*, *28*(3-5), 343–367. doi:10.1080/10549810802701192

Bartlett, J. E., Kotrlik, J. W., & Higgins, C. C. (2001). Organizational Research : Determining Appropriate Sample Size in Survey Research, *19*(1), 43–50.

Blackman, A., & Woodward, R. T. (2010). User financing in a national payments for environmental services program: Costa Rican hydropower. *Ecological Economics*, *69*(8), 1626–1638. doi:10.1016/j.ecolecon.2010.03.004

Chaverri-Polini, A., 1998. Moving mountains. *FAO,* Issue 195, p. 73.

Chomitz, K., 2002. Baseline, leakage and measurement issues: how do forestry and energy projects compare?. *Climate Policy,* Issue 2, pp. 35-49.

Cloudbridge, 2012. *cloudbridge.org/the-project/.* [Online]
Available at: http://www.cloudbridge.org/the-project/
[Accessed 2013 3 20].

Cole, R. J. (2010). Social and environmental impacts of payments for environmental services for agroforestry on small-scale farms in southern Costa Rica. *International Journal of Sustainable Development & World Ecology*, *17*(3), 208–216. doi:10.1080/13504501003729085

Colea, R., 2010. Social and environmental impacts of payments for environmental services for agroforestry on small-scale farms in southern Costa Rica. *International Journal of Sustainable Development & World Ecology,* pp. 208-216.

Collinge, S. K. (1996). Ecological consequences of habitat fragmentation : implications for landscape architecture and planning, *36*, 59–77.

Community-San-Gerardo, 2000. *Sangerardocostarica.* [Online]
Available at: http://www.sangerardocostarica.com/about/community-of-san-gerardo/
[Accessed 5 August 2013].

COOPEAGRI, 2013. *Coopeagri.co.cr.* [Online]
Available at: http://www.coopeagri.co.cr/espanol/info_gene/ig_quienes_somos.htm
[Accessed 21 may 2013].

Costaricafuntravel, 2013. *Costaricafuntravel.* [Online]
Available at: http://www.costaricafuntravel.com/About-Costa-Rica.html
[Accessed 7 August 2013].

Daniels, A. E., Bagstad, K., Esposito, V., Moulaert, A., & Rodriguez, C. M. (2010). Understanding the impacts of Costa Rica's PES: Are we asking the right questions? *Ecological Economics*, *69*(11), 2116–2126. doi:10.1016/j.ecolecon.2010.06.011

Daily, G. C., Pfaff, A. S. P., Sa, G. A., & Busch, C. (2003). Integrity and isolation of Costa Rica ' s national parks and biological reserves : examining the dynamics of land-cover change, *109*, 123–135.

De Groot, J. & Ruben, R., 1997. *Sustainable agriculture in Central America Introduction and summary.* New York: St. Martin's Press..

Echeverria, J. (2010). *THE IMPORTANCE OF BIODIVERSITY AND ECOSYSTEM SERVICES FOR ECONOMIC GROWTH AND EQUITY IN COSTA RICA NATIONAL ECONOMIST REPORT* (pp. 1–41).

Engel, S., Pagiola, S., & Wunder, S. (2008). Designing payments for environmental services in theory and practice: An overview of the issues. *Ecological Economics*, *65*(4), 663–674. doi:10.1016/j.ecolecon.2008.03.011

FAO , 2000. *Global Forest Products Outlook Study, Food and Agriculture Organization. ,* Rome: (Food and Agriculture Organization).

FAO, 1990. *Community Forestry Field Manuals.* [Online]
Available at: http://www.fao.org/docrep/x5307e/x5307e08.htm
[Accessed 27 5 2013].

Ferraro, P. & Simpson, R., 2002. The cost effectiveness of conservation payments. *Land Economics,* Issue 78, p. 339–353.

FONAFIFO, 2013. *http://www.fonafifo.com/.* [Online]
Available at: http://www.fonafifo.com/paginas_english/foresty_credit/i_cf_desea_optar.htm
[Accessed 8 August 2013].

Giddy, I., 2006. *Rainfall and Temperature,* s.l.: Cloudbridge.

Gomes, L. G. L., Oostra, V., Nijman, V., Cleef, A. M., & Kappelle, M. (2008). Tolerance of frugivorous birds to habitat disturbance in a tropical cloud forest. *Biological Conservation*, *141*(3), 860–871. doi:10.1016/j.biocon.2008.01.007

Gode, T., 2013. *How can Cloudbridge contribute to higher participation in the PSA program* [Interview] (Mei 13 2013).

Hogan, C. M., 2012. Ecoregions of Costa Rica. *Encyclopedia of Earth,* august.

Holton, E. & Burnett, M., 1997. *Qualitative research methods,* San Francisco: Berrett-Koehler Publishers.

Jenkins, M. & Richards, M., 2007. *Potential and Challenges of Payments for Ecosystem Services from Tropical Forests,* s.l.: Forest Policy and Environment.

Kaplan, R. M. & Saccuzzo, D. P., 2009. *Psychological testing: Principles, applications, and issues. Belmont, CA: Wadsworth.* Belmont, CA: Wadsworth.

Kappelle, M. (2001). *Ecology and Conservation of Neotropical Montane Oak Forests*. (G. M.M.Caldwell, Logan, USA G.Heldmaier, Marburg, Germany R.B. Jackson, Durham, USA O.L. Lange, Würzburg, Germany H.A.Mooney, Stanford, USA E.-D. Schulze, Jena, Germany U. Sommer, Kiel, Ed.) (Ecological., Vol. 185). San José, Costa Rica: The Nature Conservancy (TNC).

Karousakis, K. & Brooke, Q., 2010. *PES in Costa Rica,* Paris, France: Organisation for Economic Co-operation and Development.

Keyghobadi, N. (2007). The genetic implications of habitat fragmentation for animalsThis review is one of a series dealing with some aspects of the impact of habitat fragmentation on animals and plants. This series is one of several virtual symposia focussing on ecological topi. *Canadian Journal of Zoology*, *85*(10), 1049–1064. doi:10.1139/Z07-095

Kissinger, G., Patterson, C., & Neufeldt, H. (n.d.). Payments for ecosystem services schemes : project-level insights on benefits for ecosystems and the rural poor.

Kricher, J., 2011. *Tropical Ecology.* New Jersey: Princeton University Press.

Locatelli, B., Rojas, V., & Salinas, Z. (2008). Impacts of payments for environmental services on local development in northern Costa Rica: A fuzzy multi-criteria analysis. *Forest Policy and Economics*, *10*(5), 275–285. doi:10.1016/j.forpol.2007.11.007

Mayrand, K. (2004). Payments for Environmental Services : A Survey and Assessment of Current Schemes, (September).

Mellenbergh, G., 2008. *Advising on Research Methods: A consultant's companion.* Huizen(Advising on Research Methods: A consultant's companion): Johannes van Kessel Publishing.

Miller, K. e. a., 2001. *Defining common ground for the Mesoamerican Biological Corridor.* Washington: WRI-WWF-CATIE.

Mullan, K., & Kontoleon, A. (n.d.). Determinants of participation in PES programmes : evidence from China, 10.

Pagiola, S., 2008. Payments for environmental services in Costa Rica. *Ecological Economics,* 65(4), p. 712–724.

Pagiola, S., Arcenas, A., & Platais, G. (2005). Can Payments for Environmental Services Help Reduce Poverty? An Exploration of the Issues and the Evidence to Date from Latin America. *World Development*, *33*(2), 237–253. doi:10.1016/j.worlddev.2004.07.011

Pagiola, S., Rios, A. R., & Arcenas, A. (2010). Poor Household Participation in Payments for Environmental Services: Lessons from the Silvopastoral Project in Quindío, Colombia. *Environmental and Resource Economics*, *47*(3), 371–394. doi:10.1007/s10640-010-9383-4

Petheram, L., & Campbell, B. M. (2010). Listening to locals on payments for environmental services. *Journal of environmental management*, *91*(5), 1139–49. doi:10.1016/j.jenvman.2010.01.002

Rodricks, S. (2010). Enabling the legal framework for PES , Costa Rica. *gist*, 1–4.

Rodríguez, L. C., Pascual, U., Muradian, R., Pazmino, N., & Whitten, S. (2011). Towards a unified scheme for environmental and social protection: Learning from PES and CCT experiences in developing countries. *Ecological Economics*, *70*(11), 2163–2174. doi:10.1016/j.ecolecon.2011.06.019

Rojas, M. & Aylward, B., 2003. *What are we learning from experiences with markets for environmental services in Costa Rica? A review and critique of the literature,* London: International Institute for Environment and Development.

Rosa, H. e. a. 2., n.d. *Compensation for Environmental Services and Rural Communities. Lessons from the Americas and Key Issues for Strengthening Community Strategies.,* s.l.: Fundación PRISMA..

Sánchez-Azofeifa, G. A., Pfaff, A., Robalino, J. A., & Boomhower, J. P. (2007). Costa Rica's payment for environmental services program: intention, implementation, and impact. *Conservation biology : the journal of the Society for Conservation Biology*, *21*(5), 1165–73. doi:10.1111/j.1523-1739.2007.00751.x

Sanchez-Azofeifaa et al, G. C. D. A. S. P., 2003. Integrity and isolation of Costa Rica's national parks and biological reserves: examining the dynamics of land-cover change. *Biological Conservation,* 109(1), p. 123–135.

Sanchez-Azofeifa, G., Daily, G., Pfaff, A. & Busch, C., 2003. Integrity and isolation of Costa Rica's national parks and biological reserves: examining the dynamics of land-cover change.. *Biol. Conserv,* Volume 109, p. 123–135.

Sanchez-Azofeifa, G., Harriss, R. & Skole, D., 2001. Deforestation in Costa Rica: a quantitative analysis using remote sensing imagery 378–384.. *Biotropica,* Issue 33, p. 378–384..

Schedlbauer, Sesnie & Morse, 2008. Efficacy of environmental service payments for forest conservation in Costa Rica's San Juan – La Selva Biological Corridor. *Integr. Manag. Coastal Freshwater Syst,* 2(2), p. 31–35..

Souers, J., 2004. *A priliminary Study of stream chemistry on the Rio Chiripo pacifico from chirripo National Park to cannaan, Costa Rica,* s.l.: Cloudbridge Private Nature Rerserve.

Tacconi, L., 2012. Redefining payments for environmental services. *Ecological Economics,* Issue 73(1), pp. 29-36.

UN-Environment Program, 2011. s.l.:World conservation monitaring Centre.

United Nations Environment Programme. (1990). *TALAMANCA RANGE - LA AMISTAD RESERVES / LA AMISTAD NATIONAL PARK*.

Vargas, L. D. Z., 2013. *Coopeagri's activities for implementing the PSA program* [Interview] (17 5 2013).

Wunder, The, B. D. & E, I., 2007. The efficiency of payments for environmental services in tropical conservation. *Conservation Biology,* 1(21), p. 48–58.

Zbinden, S., & Lee, D. R. (2005). Paying for Environmental Services: An Analysis of Participation in Costa Rica's PSA Program. *World Development*, *33*(2), 255–272. doi:10.1016/j.worlddev.2004.07.012

Appendix A Questionnaire Spanish

Cuestionario de investigación PSA

Motivación

La investigación responde preguntas sobre el nivel de conocimiento de los propietarios de la tierra y de los obstáculos que se enfrentan en la participación de PSA. Este conocimiento puede ser utilizado por la reserva natural Cloudbridge para acercarse a otros propietarios de tierras que deseen participar en el programa de PSA en las actividades de conservación. Por otra parte las organizaciones como Coopeagri podrían ayudar mejor a las personas que se quieran participar en el programa. Una mejor comprensión tanto del programa de PSA y delos participantes va a mejorar la inclusión de los participantes en el programa de PSA.

Objetivos

- aumentar el conocimiento de PSA dueños de tierra o propietarios
- reducción de los obstáculos a la participación dueños de tierra o propietarios

---

Cuestionario número:.....

Fechas:.....

Detalles de la finca

Propietario:.....

Datos de contacto:.....

Tamaño de la propiedad:.....

GPS ubicación:.....

Sección 1

1.1 ¿Que tanto conoce usted del programa FONAFIFO de pago por servicios ambientales? Escala de 1 a 5.

Ni idea Alguna idea muy consciente

1	2	3	4	5

1.2 ¿Sabía que usted puede solicitar?:

1.2.1 ¿Protección de bosque? Si/No (Encierre en un círculo su respuesta)

1.2.2 ¿Reforestación? Si/No

1.2.3 ¿Regeneración natural? Si/No

1.2.4 ¿Sistema agroforestal Si/No

1.2.5 Si la respuesta a cualquiera de los anteriores es si, ¿donde se enteró?

_____

_____

¿Ha oído hablar de la organización Coopagri (Coopeagri)? Si/No

1.3 ¿Ha participado/a en alguno de los siguientes programas de PSA, ahora o en el pasado? SI/No

Tipo	Pasado (Si/No)	Presente (Si/No)	Individualmente o como parte de una organización (Si/No)
Protección del bosque			
Regeneración natural MDL			
Regeneración natural			
Protección de bosque en Vacíos de conservación			
Protección de Recurso Hídrico			
Manejo de bosque			
Reforestación			
Reforestación de especies nativas o en extinción			
Sistema Agroforestal con especies nativas o en vías extinción			
Sistema Agroforestal especies en vías de extinción/convenio ERP S.A			

1.5 Si la respuesta a cualquiera de las anteriores alternativas es 'si' ¿Cuál fue su motivación? (por ejemplo: control de la erosión, para promover el turismo, para proteger la naturaleza, financieros, etc)

_____

_____

_____

Sección 2

Si usted estuvo involucrado en el PSA programa:

2.1.1 ¿cuál es su opinión sobre el programa de PSA? Escala de 1 a 5.

No Me gusta	Que está bien			es muy bueno
1	2	3	4	5

2.1.2 ¿Tuvo algún problema durante su participación en el programa?

_____

_____

Si nunca estuvieron involucrados en el PSA:

2.1.2 ¿Por qué no participan, cuáles son los obstáculos?

_____

_____

Sección 3

3.1 ¿Qué porcentaje de su finca es bosque? (Encierre en un círculo su respuesta)

10	20	30	40	50	60	70	80	90	100

3.2 ¿Qué porcentaje de su finca es potrero?

10	20	30	40	50	60	70	80	90	100

3.3 ¿Qué planes tiene en el futuro para su finca?

_____

Sección 4

4.1 ¿Le gustaría participar en el programa PSA ?
Si
No

4.2 ¿Tiene usted registrada legalmente su tierra Si/No

4.3 ¿Está su terreno ubicado junto al río? Si/No

¡Ya está!
Muchas gracias

Por favor, siéntase libre de proporcionar cualquier información adicional que usted cree que puede ser importante:

Appendix B Questionnaire English

PSA Research Questionnaire

Motivation

This research answers questions about the familiarity of landowners with the PSA program and what obstacles they experience. This knowledge can be used by the natural reserve Cloudbridge to approach other landowners wishing to participate in the PSA program and coopeagri could better inform landowners who want to participate in the program. With a better understanding of the obstacles we wish to improve the uptake of new participants.

Objectives

- Improve the awareness of the PSA program
- Reducing the barriers landowners experience when applying for the PSA program
- Finding out what obstacles landowners experience in the PSA program

---

Questionnaire number: .....

Date: .....

Details of the property

Owner: .....

Contact information: .....

Size of the property: .....

GPS location: .....

Section 1

1.1 How well do you know the familiar PSA program/FONAFIFO?

Grade from 1 to 5

no idea some idea very

1	2	3	4	5

1.2 Did you know you could apply for;

1.2.1 Forest protection? Yes/No (Circle your response)

1.2.2 Reforestation? Yes/No

1.2.3 Natural regeneration? Yes/No

1.2.4 Agroforestry systems yes/No

1.2.5 If the answer to any of the above is yes, what did you find out?

_____

_____

¿Did you hear about the organization Coopeagri? Yes/No

1.3 ¿Did you participate in any of the PSA activities now or in the past? Yes/No

Type	Past (Yes/No)	Present (Yes/No)	Individual or with an organization (yes/No)
Forest protection			
Natural regeneration MDL			
Natural regeneration			
Forest protection and conservation			
Watershed protection			
Forest management			
Reforestation			
Reforestation with native species or endangered			
Agroforestry System with native species extinction or being			

Agroforestry System endangered species agreement ERP SA			

1.5 If the answer to any of the above alternatives is 'yes' What was your motivation? (eg erosion control, to promote tourism, to protect nature, financial, etc.)

_____

_____

_____

Section 2

If you were involved in the PSA program:

2.1.1 What is your opinion about the PSA program? Scale from 1 to 5.

I Don't like		Okay		Very Good
1	2	3	4	5

2.1.2 Did you have any problems during your participation in the program?

_____

_____

If you were never involved in the PSA:

2.1.2 Why not involved, what are the obstacles?

_____

_____

Section 3

3.1 What percentage of your property is forest? (Circle your answer)

10	20	30	40	50	60	70	80	90	100

3.2 What percentage of your farm is pasture?

10	20	30	40	50	60	70	80	90	100

3.3 What are your plans in the future for your farm?

Section 4

4.1 Would you like to participate in the PSA program?
Yes
No

4.2 You have legally registered their land Yes/No

4.3 Is your property located by the river? Yes/No

That's it!
Thank you very much

Please feel free to provide any additional information you think might be important:

Appendix C Payment table FONAFIFO

Table 7: payment table FONAFIFO

modality	status	criteria	Current payments	Priority zones
Forest protection	Dates from Forest Law 7575 to present	2 to 300 ha enrolled, up to 600 ha within indigenous areas	$64/ha per year for five year period; renewable	SINAC biological corridors; Existing biological corridors; Protection of AyA hydrologic resources; Unpurchased protected areas; Locations in cantons with MIDEPLAN Social Development indexes lower than 40%
Reforestation	Dates from first mention in 2005 to present	Between 1 and 300 ha enrolled	$816/ha over ten- year period	“High potential” forest plantations; Areas with threatened species; Pastures defined as Kyoto lands; Projects under natural regeneration for at least one year None specified
Natural forest regeneration	Dates from 2003 to present	350 to 3500 trees per participant; Up to 336,000 trees per joint project, cooperative or indigenous reserve; Specific requirements per ha.	$41/ha per year for five year period; renewable	Projects with organizations with FONFOFIFO agreements; Land as described in Ministry of Agriculture's Land Use Capacity Report (1995); Areas with specific agreements with FONOFIFO
Agroforestry systems	Dates from 2003 to present	Criteria determined by conservation area	$343 per ha, over five year period	Priority determined by conservation area (SINAC)

(FONAFIFO, 2013)

Appendix D Aerial photo and elevation study area

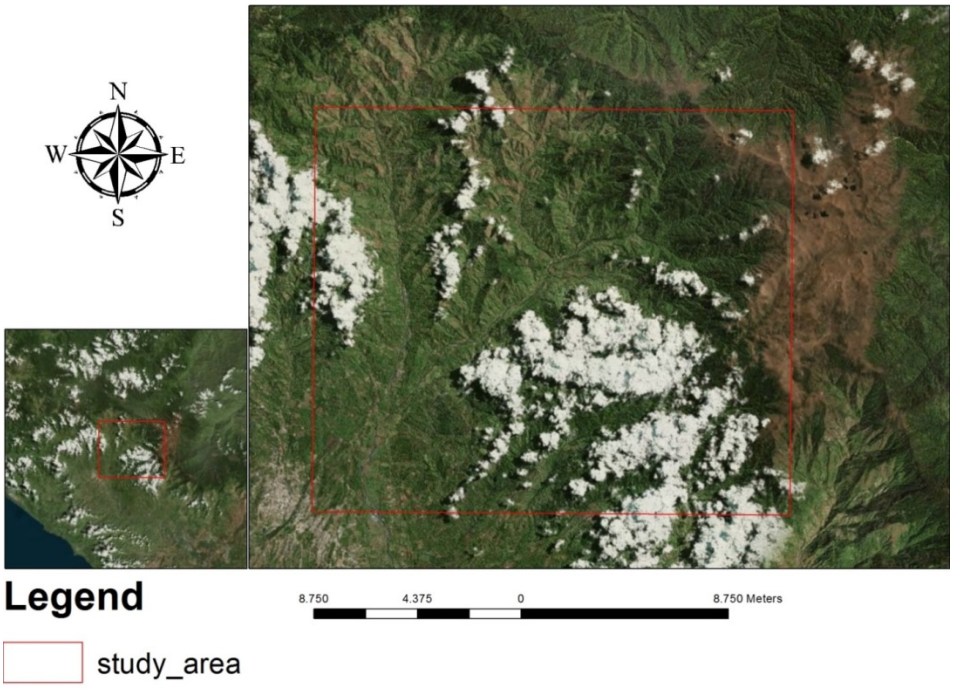


Figure 14: Arial photo study area

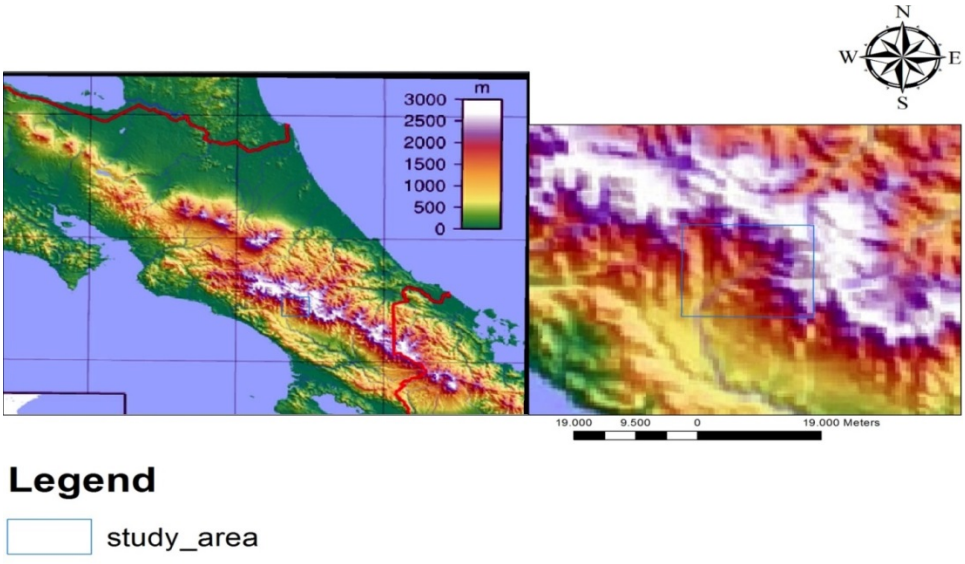


Figure 15: Elevation study area

Appendix E Legal Framework of the PSA program

The legal frame work of PSA is built around three laws. These laws focus on conservation, sustainable management, land cover change and biodiversity. It provides the legal basis for landholders to be compensated for their provision of ecosystem services (Rodricks, 2010). The PSA environmental laws state the following;

- The 1995 Environment Law 7554 mandates a “balanced and ecologically driven environment” for all.

- The 1996 Forest Law 7575 mandates “rational use” of all natural resources and prohibits land cover change in forests.

- The 1998 Biodiversity Law promotes the conservation and “rational use” of biodiversity resources.

(Sanchez-Azofifa 2007).

Appendix F GPS locations of the participating farmers

Questionnaire number	GPS location	Altitude
1	N 928.234 W 8335.117	1489m
2	N 928.114 W 8335.388	1490m
3	N 928.126 W 8335.552	1431m
4	N 928.088 W 8335.514	1382m
5	N 928.202 W 8335.508	1428m
6	N 928.261 W 8335.538	1407m
7	N 928.254 W 8335.527	1456m
8	N 928.401 W 8335.610	1470m
9	N 928.465 W 8335.631	1477m
10	N 928.564 W 8335.688	1434m
11	N 9 28.392 W 8335.592	1482m
12	N 928.032 W 8335.612	1446m
13		
14	N 927.918 W 8335.854	1329m
15	N 927.894 W 8335.984	1325m
16		
17	N 927.891 W 8335.951	
18	N 928.686 W 8336.690	1339m
19	N 928.616 W 8336.689	
20		
21	N9 28.069 W83 36.219	1328m
22	N9 27.969 W83 35.758	1334m
23	N9 29.314 W83 36.738	1568m
24	N9 29.275 W83 36.745	1565m
25	N9 29.142 W83 36.822	1560m
26	N9 28.821 W83 36.838	1509m
27	N9 28.848 W83 36.559	1616m
28	N9 28.782 W83 36.639	1613m
29		
30		
31		
32		
33		
34	N9 27.614 W83 35.711	1342m
35	N9 27.264 W83 36.430	1235m