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# Do Payments for Hydrological Services Reduce Poverty and Strengthen Social Capital? An Examination of Household Welfare and Collective Action in the Sierra Norte of Oaxaca, Mexico

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FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

DO PAYMENTS FOR HYDROLOGICAL SERVICES REDUCE POVERTY AND  
STRENGTHEN SOCIAL CAPITAL? AN EXAMINATION OF HOUSEHOLD  
WELFARE AND COLLECTIVE ACTION IN THE SIERRA NORTE OF OAXACA,  
MEXICO

A thesis submitted in partial fulfillment of the

requirements for the degree of

MASTER OF SCIENCE

in

ENVIRONMENTAL STUDIES

by

Lindsey Roland Nieratka

2011

To: Dean Kenneth Furton  
College of Arts and Sciences

This thesis, written by Lindsey Roland Nieratka, and entitled Do Payments for Hydrological Services Reduce Poverty and Strengthen Social Capital? An Examination of Household Welfare and Collective Action in the Sierra Norte of Oaxaca, Mexico, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this thesis and recommend that it be approved.

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Joel Heinen

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Date of Defense: April 1, 2011

The thesis of Lindsey Roland Nieratka is approved.

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Dean Kenneth Furton  
College of Arts and Sciences

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Interim Dean Kevin O'Shea  
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Florida International University, 2011

## DEDICATION

This thesis is dedicated to my loving husband. Without his support, patience, love, and calming nature this work would not have been possible.

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ABSTRACT OF THE THESIS

DO PAYMENTS FOR HYDROLOGICAL SERVICES REDUCE POVERTY AND  
STRENGTHEN SOCIAL CAPITAL? AN EXAMINATION OF HOUSEHOLD  
WELFARE AND DECISION-MAKING IN THE SIERRA NORTE OF OAXACA,  
MEXICO

by

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Florida International University, 2011

Miami, Florida

Professor Pallab Mozumder, Major Professor

Payments for Environmental Services (PES) is a method of attaching market value to environmental benefits which have typically not been valued in the marketplace. This thesis investigates the impact of the government hydrological services program in two communities in Oaxaca, Mexico. Using interviews, semi structured and household surveys, I investigate the effect the PSAH has had in alleviating poverty and increasing social capital in the communities as well as investigate willingness to accept (WTA) payment for additional PES programs. The PES payments put household incomes above national poverty lines. Social capital improved both within and between communities. WTA for additional PES depends on the use of the land in question. Overall, participation in the PSAH has had a positive impact in both communities.

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## CHAPTER I –OVERVIEW AND INTRODUCTION

### OVERVIEW

Payments for Environmental Services (PES) is a method of attaching market value to benefits received from the environment which have typically not been valued in the marketplace for the purpose of providing an incentive and economic rationale for conservation (Engel *et al.* 2008). Payment for Environmental Services programs strive to achieve conservation by making it economically viable through making direct connections between those who utilize services provided by nature, such as water, and those who protect the land or processes that allow the service production (Wunder 2005). Particularly in Latin America, PES have been increasingly more common, and Mexico currently boasts one of the world's largest PES schemes in scale and scope, paying for carbon, biodiversity, agroforestry and water (Corbera *et al.* 2009, Brauman *et al.* 2007, Muñoz-Piña *et al.* 2008), although the carbon capture program was curtailed in recent years as a result of uncertainties in the carbon prices and the presence of voluntary markets.

My study will examine payments for hydrological services currently being received by two communities in the Sierra Norte region of Oaxaca, Mexico. Under the land tenure system in Mexico an estimated 60-70% of forests are owned communally by two forms of state-regulated common property called *ejidos* or *comunidades*. The Mexican Revolution (1910-1917) started a process of land and forest redistribution and also established agrarian legislation for two forms of agrarian reform community governance. *Ejidos* are agrarian units of previously landless peasants who were

collectively given a parcel of land. *Comunidades* are indigenous communities that have been given legal tenure to lands that they traditionally inhabited. In the Sierra Norte of Oaxaca, seven *comunidades* have joined together to form an inter-community organization called the Committee of Natural Resources of the Chinantla Alta (*comite de recursos naturales de la Chinantla Alta*) or CORENCHI. The organization created a coordinated governance structure under which the seven community-owned forests are to be managed. As CORENCHI, the communities have declared portions of these forests as Community Conserved Areas (CCAs) in order to gain recognition from the government, with CCAs now officially recognized as part of Mexico's national protected areas system under new legislation in 2008. The seven communities share a common ethnic background as Chinantec indigenous peoples and relatively large territories (>32,000 ha in total), large portions of which are not suitable for agriculture and so have historically been left unexploited.

Six of the seven CORENCHI communities are currently receiving payments as part of Mexico's Payments for Hydrological Services program (PSAH, *pagos de servicios ambientales hidrologicos*), established in 2003. My study will focus on two of the seven communities, Santa Cruz Tepetotutla and San Pedro Tlatepusco. Through semi-structured and structured surveys, my study will determine the steps that led to the community applying for and receiving the government payments for PSAH, the communal decision-making process that determines who benefits and how the funding is distributed and the impact of the payments in terms of community social capital, community benefits and household welfare. In addition, I will investigate community willingness to accept (WTA) payments in order to expand the program for the inclusion

of other ecosystem services. This question will be asked under three circumstances; WTA for payments within the conservation area, WTA for payments requiring changes to private coffee plots and WTA for a project that would require restoring an area covered by an invasive pest plant.

Mexican land reform and the social structure and organization of the two communities in our study differentiate the current study from most others published studies. In the case of the CORENCHI communities, the hydrologic services are being provided by land uses and forest conservation under a common property regime. This common property regime as well as support from local non-governmental organizations (NGOs) and the specifics of the government program allow the CORENCHI communities to avoid many of the common barriers of poor participation in PES programs and improves equity to poor participants (Landell Mills and Porras 2002, Wunder 2008). The existing literature on PES has few examples of PES in a common property regime and none of the existing studies take place in communities with the governance structure found in my two study communities or with similar payment distribution schemes as that which will be presented here. My study can offer a unique perspective into the PES literature.

## LITERATURE REVIEW

### **ENVIRONMENTAL SERVICES**

Humans derive many benefits from nature. The types of services that are provided by natural systems include provisioning services such as water, regulating services, such as climate regulation through carbon sequestration, and cultural and

supporting services, such as biodiversity. These services are referred to generally as environmental or ecosystem services. The terms ecosystem services and environmental services are often used almost interchangeably. Ecosystem services usually refer to benefits from natural unaltered ecosystems and environmental services refer to the benefits associated with ecosystems whether they are natural or managed. In this thesis, I will use the term environmental services because it is an all-encompassing term. The concept of environmental services is used for the purpose of creating or revisiting the understanding that we are dependent on natural systems and that they provide services that cannot be sufficiently mimicked by technology. The ecosystem services framework allows these services to be quantified, providing a common metric for weighing them against other land uses (Brauman *et al.* 2007).

Environmental resources are often contained on private property. Privately owned environmental services allow for economic growth but compartmentalizing the services also can create externalities that cross property boundaries. Using markets to solve problems of externalities only increases the separation. To connect resource “owners,” Vatn (2009) and Brauman *et al.* (2007) suggest some solutions. The first solution is the creation of common property and a common governance structure. Second, they suggest state ownership in the form of protected areas or command and control regulation on actions on private property. The third suggestion is to create new markets where the externalities between properties can be traded in a voluntary exchange. Fourth, government incentives can be established to conserve land to produce the desired services. These third and fourth recommendations justify programs for payments for environmental services. In the Mexican case I will be considering, a common pool

resource and common property regime were not created for the sake of the program but were previously created by state action. Thus, my example shows the use of the first, third and fourth recommendations in a single program.

Before there was a framework for quantifying environmental services they were given a value of zero in cost/benefit analyses making them unable to influence decision making. By providing a value for ecosystem services we are creating a common metric by which we can compare land uses. Most often this metric is created by considering a single service, such as water quality allowing meaningful decisions to be made about the most efficient and profitable land use (Brauman *et al.* 2007).

The environmental service approach aims to combine ecological and economic outcomes in order to appropriately make tradeoffs in natural resource management, balance goals and make decisions about the allocation of resources (Wainger *et al.* 2010). An element in deciding the value of a service is to identify alternatives to the service, such as water treatment systems as an alternative to watershed protection. The cost must also include all impacts both biologically and socially on long and short terms and be based not just on opportunity costs, but on substitution of the service with technology and the quality of the service (Wainger *et al.* 2010). Determining the true value of a service will require a better scientific understanding about the connection between the land use and the desired service.

The water provided by forests is a common pool resource in that it is non-excludable and rival. No one can be prevented from using them but one person's consumption can affect another's. This provides no incentive for service users to pay providers as they can access the good without payment, thus encouraging free riders.



Free riders result in a market failure that, in terms of forest services, means that there is under investment in the protection of the services through forest management, protection, or establishment of protected areas (Landell Mills and Porras 2002). Common pool resources are most effectively managed through collective action and, for economists, justify government intervention rather than a market approach so that the government ensures the provision of the goods (Landell Mills and Porras 2002). However, Stavins (2000) shows that well designed market approaches can achieve environmental goals at a lower cost and with more positive incentives to continue innovating and improving than command and control approaches. Financial incentives require government subsidy while markets for Environmental Services (ES) require that users pay for the service and the price is controlled by supply and demand, which should be more efficient than government set prices (Landell Mills and Porras 2002).

## **PAYMENTS FOR ENVIRONMENTAL SERVICES**

Wunder (2005) defines PES with the following five criteria:

1. A voluntary transaction where
2. A well defined environmental service (or a land use expected to provide that service)
3. Is being bought by a minimum of one seller
4. By a minimum of one provider
5. If and only if the environmental service provider secures the provision of the environmental service

According to Engel *et al.* (2008), PES is an appropriate policy mechanism for protection of public goods, such as water, when the providing ecosystems are mismanaged because the managers perceive benefits as externalities. It should be remembered that the objectives of PES programs are first and foremost for environmental protection and secondly for human well being. Although the stated goal of PES is not poverty alleviation, in order to be effective the payment must at least be more than the payoff of an alternative land use (Engel *et al.* 2008) and thus have the potential to provide larger incomes than the alternative land uses. Payments for environmental services programs are seen as more efficient than command and control because they are more adaptable and flexible to fit the specific details of each case. As well, command and control are likely to be either unenforced or put unreasonable restrictions on use (Engel *et al.* 2008).

The Coase theorem is the conceptual framework from which the idea of payments for environmental services stems. It states that when there is a direct connection and open dialogue between users and providers an efficient outcome will result (Coase 1960, Kosoy *et al.* 2007, Engel *et al.* 2008). Environmental services are seen as positive externalities resulting from healthy ecosystems and PES programs are meant to create the forum for upstream providers and downstream users to come to an agreement on land uses by users compensating providers for the cost of providing the service. This “beneficiary pays” approach differs from the standard “polluter pays” approach of pollution abatement and it takes the burden and cost of environmental protection off the land owners (Kosoy *et al.* 2007). Polluter pays is utilized in most cases of pollution when the polluter is a corporation and to have the beneficiaries pay for the cost of pollution

abatement would cause perverse incentives for the polluter to continue polluting. A beneficiary pays strategy like PES is a valuable tool when the owners of the land of interest are poor or marginalized.

Most of the globe's water resources originate in mountainous areas but are used in floodplains, deltas and coastal transitional zones meaning that the users of the resource are a significant distance apart from those that provide them (Garrido and Dinar 2009, Pagiola 2002). As a result, those who are concerned with water quality and land use are generally not the same nor are they connected (Wang 2001). This disconnect is both physical but also cultural and socio-economic. It is common for development in mountainous regions to be behind development in other areas, causing the residents in water providing areas to be poorer and often more marginalized than downstream users. This is a phenomenon that occurs in both developed and underdeveloped countries (Garrido and Dinar 2009). In the case of the Mexican PSAH the issue of lack of connection between upstream and downstream user has been dealt with by the government serving as an intermediary. The government agency is ideally creating a situation that is beneficial for both groups of users. Attempts by the Mexican government to make the PSAH a more direct, market based program have largely dissolved into the current new initiative of matching funds, known locally as "*fondos concurrente*." These will be explained in more detail later.

Payment for environmental services programs have not been without their critics. Often they are critiqued for being inefficient economically and environmentally, unfair or inequitable or illegitimate (Wunder 2006). These critiques do not negate the usefulness of PES. Inefficiency because of job losses, costs of enforcement and land can be dealt

with through strong governance, upstream job creation as a result of program activities and excludability even where land tenure is weak (Wunder 2006). Restrictions of the PES program may restrict other development opportunities. Fairness and equity can be achieved as PES programs in fact bring in rare financial capital, creating opportunity that would not otherwise have been present, as well as diverse non-income benefits such as international NGO attention, increased social organization and capacity building among participants, thus opening up many investment and development opportunities that will not interfere with the PES program goals. Illegitimacy is assumed because of restrictions on the development of land. However, if carefully designed, PES has the ability to increase opportunities. Also, PES programs are by definition voluntary meaning that if at any time a service provider feels they are being unfairly treated or restricted, they can remove themselves from the agreement (Wunder 2006).

Projects that do not have a direct market between service user and service provider have been referred to by many names including Compensation or Rewards for Ecosystem Services, Markets for Ecosystem Services, International Payments for Environmental Services, or “PES-like.” These classifications make these programs seem inferior to PES programs which are considered those that follow the original 5-point definition (Wunder 2005, Sommerville *et al.* 2009). For this reason, new definitions of PES have been developed. Muradian *et al.* (2009) conceptualize PES as “a transfer of resources between social actors which aims to create incentives to align individual and/or collective land use decisions with the social interest in the management of natural resources” (Muradian *et al.* 2009). Sommerville *et al.* (2009) believe that PES should be used as a blanket term for a wide range of incentive programs. According to these

authors, the framework for PES should consist of two main criteria and two principles. They define PES as an approach with the “aim to (1) transfer positive incentives to service providers that are (2) conditional on the provision of the service, where successful implementation is based on a consideration of (1) additionality and (2) varying institutional contexts.” (Sommerville *et al.* 2009). In Mexico, the PSAH gives cash payments to service providers as an incentive to conserve. Additionality, benefits that would not have otherwise been provided without the program, is not a large consideration in the PSAH as payments are often given for forests that are not under the risk of deforestation.

Within these two definitions, collective action is needed to coordinate all actors (buyers, users, intermediaries) so that there results a socially desirable outcome. PES should have the goal of giving incentives for the provision of environmental services so that behavior for the good of the individual or group is altered away from being destructive to the environment and turned towards protection. However, some evidence suggests that without internal incentives towards conservation, economic incentives may not be enough to change behavior (Muradian *et al.* 2009). In the communities addressed in this study there is a strong internal culture of conservation which aids in the effectiveness of the economic incentive.

The new definitions of PES presented here take away the need to make the program economically efficient or to function as a market (Muradian *et al.* 2009). Also, it allows PES to function without complete information and allows that under some institutional contexts where land use change may be illegal, PES may not be strictly

voluntary (Sommerville *et al.* 2009). The definitions do not distinguish between PES and “PES-like.” (Muradian *et al.* 2009, Sommerville *et al.* 2009).

### **PES Efficiency**

Several authors write about the requirements for effective PES. The following list of efficiency requirements is synthesized from Kosoy *et al.* (2007), Wunder *et al.* (2008) and Pagiola *et al.* (2005).

1. The compensation received by land owners should be at least equal to the opportunity costs of the land use.
2. The compensation received by land owners should be lower than the actual value of the negative externalities resulting from land use change.
3. Service providers must be enrolled in the PES program, any services provided by non participants cannot be considered as a benefit.
4. Compliance must be monitored, often through site visits and satellite imagery.
5. Compliance must lead to a change in land use – additionality, benefits that would not exist without the program, is easiest to measure in programs where there is a clear land use change required, such as reforestation, and more difficult when the result is avoided deforestation.
6. The land use under the program must provide the desired service – Water services are not easy to directly measure and observe. Because of this assumptions are made about the relationship of land use to provided services and these land uses are used as a proxy measure of service provision. Because of these uniform payments per hectare of forested land are offered, as in Mexico, with higher

prices for forest types that are considered more hydrologically valuable, such as cloud forest in Mexico. Benefits to water services from forest cover are largely assumed and the conservation of forests is largely based on the precautionary principal.

7. There should be some permanence – assurance that the service will be supplied for a long term – which may include raising the payments when alternative land uses become more economically attractive
8. Limited leakage, or moving undesired land uses to another area. This is not as important in water PES programs where the goal is to protect hydrologically important areas and undesired activities are moved to a less hydrologically important area but may be important for programs of biodiversity or carbon payments if deforestation is moved to a new area.
9. Prevention of the creation of perverse incentives that may result when promoting enrollment of only land at high risk of degradation.
10. Recipients of payments should be chosen on criteria that increase the provision of the ES while decreasing the risk of losing the ES. Criteria based on other factors, such as poverty alleviation, should not be used.

Efficiency in environmental service provision is difficult to measure as there is often not a direct measurable relationship between land use and the services provided, with the provision of services often being implied by cultural beliefs rather than scientific evidence. This is particularly true for water services (Pascual *et al.* 2009). The costs of creating a monitoring system to better capture the relationship may be prohibitive. Where there are high levels of uncertainty between the actions being rewarded and the

desired service, Coasian designs are not feasible as there is not enough information available for open discussion and decision making (Pascual *et al.* 2009).

There are issues of equity that must be addressed when implementing PES programs. Is it more equitable to give payments on the basis of the contributions of a provider or to give payments to those with the most economic need? Can income be used as a measure of equity, particularly in situations where values such as social capital are important or where the actions of setting aside land prevent the participants from other livelihood increasing activities? In the example of my study sites, within the community equity is dealt with in two ways. First, every community member who fulfills their duties to the community is given an equal share of the funds. Second, decisions about how the money is distributed or used within the community are made on the basis of majority rule in community assemblies in which every member gets a vote. Though there are other examples of PES programs functioning within a community (Logan and Moseley 2002, Huang *et al.* 2007), none of the examples in the literature outside of Mexico show a community level decision making structure such as this one.

Equity is based on a baseline and a pool of relevant stakeholders. Efficiency is dependent on additionality, value of the services and the cost of implementation. On the basis of these factors it is determined that PES designs that pay for common goods or those that are egalitarian (paying the same to each provider) are high in equity but low in efficiency (Pascual *et al.* 2009). Schemes that are compensation for conservation rather than payments can have low efficiency if there is no additionality and high equity if those being compensated are poor or indigenous groups. The latter may be true in my study sites.



Pascual *et al.* (2009) argue that the PSAH program has positive equity but negative efficiency. Their assessment is largely based on three factors, willingness to pay, willingness to accept and the cost of implementation. In the PSAH the cost of implementation is borne mainly by the government agency CONAFOR with the cost to the communities being low. For efficiency, payments must lie between minimum willingness to accept of providers and maximum willingness to pay by users or government (Pagiola *et al.* 2005). Willingness to accept also is low for the PSAH because there is little opportunity cost. This is the case in the two study communities, as will be seen later. The PSAH is set at just above the average opportunity costs, ideally just enough to tip the scale toward conservation. Willingness to pay is not assessed because the payments come from water user fees which were in place before the initiation of the program.

Alix-Garcia (2004) determined that if the PSAH program in Mexico was targeted toward areas of greatest hydrologic importance they could quadruple the ES benefits. Currently however the majority of participants in PSAH are located in aquifers that are not overexploited and where there was not a high risk of deforestation (Alix-Garcia *et al.* 2009) as is the case in the study communities studied in this thesis. Alix-Garcia *et al.* (2009) found that in most cases the amount of money offered for the PSAH was not enough to create a behavior change. In the case of my study, most of the behavioral changes had been self imposed by the communities before they began participating in the PSAH and thus the money is not so much a reason to change behavior but rather a reward for the behavior they already exhibited.

## PES AND POVERTY ALLEVIATION

One question that has been prevalent in the literature is whether or not PES can be used as a tool for poverty alleviation (Landell Mills and Porras 2002, Pagiola *et al.* 2005, Bulte *et al.* 2008, Wunder *et al.* 2008). Wunder (2001) identifies four pathways out of poverty and PES has the potential to address them all. First, PES can lead to diversification into non-farm activities by providing financial capital and reducing risk associated with change. Second, PES can lead to and be affected by labor movement and relocation. Migration out of rural areas to cities relieves some pressure on forests and creates more available land to enter into PES. As rural families have more income they may choose to use it to send children to cities to study and work. The third and fourth pathways are traditional rural development and aid and public investments. In many cases PES is not a direct market approach but rather, as described by McAfee and Shapiro (2010), a compensation program or direct subsidy. When PES programs are designed in this way they can provide money for further investment into conservation or may result in the investment of money into public goods, as is seen in the case study by Alix-Garcia (2009).

Potential participants in PES should neither be included in nor excluded from the program because of their socioeconomic status as this could undermine the real environmental goals of the programs. However, in many places the poor are largely the ones who are responsible for undeveloped land and thus those providing the desired services. Where this is the case PES has the potential to be a poverty alleviating tool (Pagiola *et al.* 2010). For example, in Mexico, much of the remaining forested land is owned by poor *comunidades* or *ejidos*.

Case studies compared by Wunder *et al.* (2008) show that whether targeted or not, the poor often are able to gain access to PES programs and generally benefit from them. Because PES is a voluntary program it assumes that land owners (service providers) are at least no worse off than they were before (Pagiola *et al.* 2005). However, the willingness to accept (WTA) of the poor may be skewed so that they may not be able to refuse even the smallest of offerings, making their involvement questioningly voluntary (Muradian *et al.* 2009). Because the poor have lower opportunity costs than the wealthy, lower prices can be offered to the poor allowing more land to be entered into the program, placing the burden of conservation on the poor (Muradian *et al.* 2009). Another concern for the poor is that the payments will increase the value of land which will give an incentive for more powerful to take it over (Pagiola *et al.* 2005). In the case of the PSAH in Mexico, prices are set according to the type of forest enrolled in the program and not based on the opportunity cost of the individual participants. Also, because of the land tenure system, there is no fear that land will be bought up by the wealthy as the value increases.

In Latin America many poor have been interested in participation in PES programs (Pagiola *et al.* 2010). One reason is that PES is less risky than crop production because as long as the regulations of the PES contract are followed, an annual payment is guaranteed for the time period of the contract. In comparison to crops that may fail, be subject to uncontrollable environmental disasters, or be neglected because health or other personal issues prevent labor from being available, PES is much less risky. This low risk may explain the popularity of the idea of PES in Mexico and Costa Rica where

applications to participate offer three times the amount of land than funding available (Pagiola *et al.* 2010).

One study of poor participation in a PES in Columbia showed that the poor were able to participate at a similar level as the better off and that the main factors influencing participation came from remoteness and size of farms (Pagiola *et al.* 2010). This and most other PES studies concentrate on individual farmers and land owners. The study presented in this paper will consider poor participation when the service is a common pool resource under a common property regime.

Since PES programs are typically voluntary, a main way to increase the ability of PES to alleviate poverty is to remove any barriers to participation by the poor. Several authors have outlined the most common boundaries to poor participation in PES (Wunder 2008, Pagiola *et al.* 2005, Landell-Mills and Porras 2002). The first barrier facing the poor is eligibility, meaning whether or not they own land and if the land produces the target services. Under Mexican law the land tenure of the *comunidades* is clear and legally secure. In the case of the CORENCHI communities, their land contains hydrologically important forest types based on the guidelines of the PSAH program, namely cloud forest, which is situated within the Papaloapan watershed, one of the largest in Mexico. The second barrier to participation outlined by Wunder (2008) is desire to participate. Reasons that some poor may not desire participation is if other uses of the land may seem more favorable (high opportunity cost), the amount of risk involved in participation and whether there is trust in the buyer or intermediary. My study communities have practiced conservation of their forests for generations and, before participation in the program, had decided against extractive land use options. Thus,

opportunity cost for the community is low and there is little to lose from participation. Opportunity cost for individuals within the community might differ. The intermediary in the PSAH is a government agency and five year contracts are guaranteed. A trusted NGO, *Geoconservación*, introduced the communities to the program allowing the community leaders to have trust in the program itself. *Geoconservación* itself was introduced to the communities in the first place by a trusted intermediary who later became the state delegate for CONAFOR, Salvador Anta. The third restriction is the ability to participate. Ability may be limited by organization or capital. The communities have a well established internal organization and a standing relationship with *Geoconservación* which allows them to relatively effortlessly, in terms of relatively lower transaction costs, and handle the organization necessary to participate. The final barrier is relative competitiveness. Competitiveness comes in the form of reliability and low transaction costs. The communities are reliable because they have a long history of conservation; there is relatively little risk on the buyer side that the communities will not honor the arrangement. Transaction costs can be kept low because the land included in the program is owned neither by a single nor many individual land owners. Rather, the land entered into the program is owned by the community as a group and the payments made to the community organization rather than individual small land owners. Thus the community itself is the single beneficiary of the payment and distribution of the money within the organization is done based on internal decision making. The costs of the PSAH program are significantly lowered by this as only one application need be processed and one payment given by the buyer.

## **Poverty in Mexico**

Poverty in Mexico is defined by the Social Development Secretary (*Secretaría de Desarrollo Social* or SEDESOL) in three levels. The highest level of poverty is known as nutritional poverty meaning that a family is unable to meet basic nutritional requirements. This level of poverty was defined in 2002 as any per capita household income below 15.4 pesos per person per day. The next poverty level is capability poverty and is defined as the inability to cover basic nutritional needs, health costs and education. In 2002 this level of poverty was considered any per capita household income that provides less than 18.9 pesos per person per day. The lowest level of poverty is asset poverty any per capita household income that does not meet the costs of basic nutrition, clothing, housing, healthcare, public transportation and education. This level, in 2002, was 28.1 pesos per person per day. These numbers are for rural households, the poverty lines for urban households are higher (SEDESOL 2002).

## **CASE STUDIES**

My thesis will present a case study of a PES program, the PSAH in Mexico, within two communities with a common property regime and strong internal governance. Many case studies have already been done on existing PES programs. These case studies mainly focus on individual land owners (Kosoy *et al.* 2007, Southgate *et al.* 2009) or on contracted restoration workers (Turpie *et al.* 2008). In fact, Wunder *et al.* (2008) looked at fourteen PES programs in developed and developing countries and only two, the PSAH in Mexico and the CAMPFIRE program in Zimbabwe, cite the providers as communal land owners. Other programs exist which give payments to communities or

groups of individuals. In Asia, the RUPES program encourages small land owners to form groups to receive payments as their land holdings are too small to be efficiently paid for (Huang *et al.* 2007, Kerr 2002). The CAMPFIRE program in Zimbabwe provides capital to communities to initiate revenue generating wildlife management programs. However, the rules, decisions and enforcement of CAMPFIRE are done at the district government level and not by the communities themselves (Logan and Moseley 2002). In Pimampiro, Ecuador, payments are given to members of a cooperative of cattle and potato farmers. Not all members of the cooperative participate in the PES program and not all members of the community are members of the cooperative (Southgate and Wunder 2009). In other common property situations PES is not given in cash payments but rather in the form of conservation and development programs (Southgate and Wunder 2009). An attempt in Brazil to organize landowners together to receive the PES, Proambiente, has been largely unsuccessful and lacking in collective action and communal governance (Southgate and Wunder 2009). From these studies I can conclude that a study of a PES program functioning in a community with a strong common property regime and with strong internal governance deciding restrictions on land use and on distribution of payments where every man, woman and child in the community is involved in the program, is rare in the literature.

Some work has already been done in Mexico to study the effect of the PSAH in *comunidades* and *ejidos*. In one case study by Alix-Garcia *et al.* (2009), in all but one case where 100% of the money was evenly distributed among members, anywhere from 3% to 100% of money received from payments for hydrologic services was invested into a public good such as equipment for the forestry activities and community infrastructure.

The *ejidos* may have chosen to distribute funds into public goods because investing in public goods seems more fair and egalitarian, allowing non-member residents to benefit as well. Investments into public goods may see a higher return than handing out annual cash payments. In all but two of the cases the receipt and distribution of payments did not change the social dynamics of the community. Where it did, the PES program was on land held privately, not communally, and the owners of the land were able to use that as leverage for demands of more payment. In one case participation in the PES led to an increase in environmental awareness. One of the factors causing this was likely that the payments were not distributed equally among members but distributed according to participation in activities deemed necessary for participation in the program (Alix-Garcia *et al.* 2009). My study also looks at communities where part of the PSAH money is invested into public goods but will go more in depth into the social processes of decision making and contribution of the PSAH to collective action.

## **COMMON PROPERTY**

Conservation can be seen as a commons issue. Watershed services are considered common pool resources. As common pool resources the benefits from watersheds are controlled and then utilized by many different stakeholders leading to rivalry in use (Kosoy *et al.* 2007). Water is a public good meaning that in most cases it is non excludable. People generally do not pay for these services and willingness to pay cannot be determined by demand (Brauman *et al.* 2007). Since water is a public good, pricing needs to include social value and social equity. Protecting these services is often



considered to be collectively beneficial but can be individually costly (Kosoy *et al.* 2007).

When the phrase “common property” is used many might immediately think of the “tragedy of the commons,” an idea put forth by Garrett Hardin in 1968 to describe the outcome of multiple individuals using a limited resource and acting independently. This The “tragedy of the commons” is better referred to as the tragedy of open access as common property actually implies a framework of rules regarding use. The tragedy of open access happens when rational agents are unlikely to cooperate even when it is in their mutual best interest (Hardin 1968, Ostrom 2000). Much of environmental policy has been built on the assumption that individuals are unable to overcome problems of cooperation in order to achieve a mutual benefit by working collectively and so externally enforced regulations are used to control these resources (Ostrom 2000). A great deal of field experience shows this to not always be true as individuals around the world in different cultures and situations have organized themselves voluntarily to achieve benefits from trade, natural resources and risk protection. Evidence shows that externally enforced rules can crowd out voluntary cooperation. Free riding is a problem, but self organized governance often invests resources into the avoidance of free riders (Ostrom 2000).

Experimental evidence shows that there are multiple types of individuals who all accept different behaviors for collective action (Ostrom 2000). Experiments have found that those who believe others will cooperate are more likely to cooperate themselves and, in game theory experiments, as the number of rounds played increases and the game is learned better cooperation increases. Communication between subjects and the existence

of punishment for non-cooperators also increases cooperation (Ostrom 2000). Thanks to these experiments, multiple types of “players” in public goods “games” have been identified. There are four main types: norm using, conditional cooperators, willing punishers and rational egoists. Conditional cooperators are trusting and trust worthy and will initiate cooperation when they feel others will reciprocate. Willing punishers will punish free riders and together with conditional cooperators create an ideal situation for collective action by creating an environment where there is both trust and punishment for those who violate that trust (Ostrom 2000). Humans have an evolved ability to learn social norms and to check for cheaters of these norms (Ostrom 2000). Conditional cooperators will more frequently receive a higher payoff, since they are trustworthy, while rational egoists will consistently receive a lower payoff since they will not be trusted. Where type is known, only the trustworthy will survive. If there is no information about a player’s type in a large population, only rational egoists will survive (Ostrom 2000). Social norms have longer staying power than externally enforced rules which may not be enforced or are subject to change (Ostrom 2000).

Public goods, such as environmental services, should face problems of overuse and free-riding. However, the above mentioned studies show that there are many situations in which people are able to collectively manage these resources. Conditional cooperation is responsible for much success in management of common public goods (Rustagi *et al.* 2010). When groups are heterogeneous in their mix of cooperators, those who are willing to cooperate are also willing to enforce cooperation even at a personal cost (Rustagi *et al.* 2010). Activities such as forest management would only be possible in communities which a high proportion of conditional cooperators not only because they

are willing to cooperate but also because they are willing to enforce cooperation even if it is at a personal cost (Rustagi *et al.* 2010). Because conditional cooperators will only cooperate if they expect that others will as well, common property management will be successful if there is governance in place that gives self interested individuals incentive to cooperate and punishes those who do not (Rustagi *et al.* 2010). Because of the results found in the study by Rustagi *et al.* (2010) that conditional cooperators are more willing to provide costly enforcement, where costly enforcement exists cooperation should be higher because of the larger number of conditional cooperators. With enforcement and cultural transmission, behaviors which are beneficial for the group should spread through the population (Rustagi *et al.* 2010). The communities in my study have a system in place of mandatory civic participation, even at a personal cost. Those who participate receive a portion of the money from the PSAH, providing incentive to cooperate, while those who do not forfeit the benefits of the PSAH program. This system of civic participation should encourage conditional cooperators to cooperate.

Common property management has been considered as effective as private property in the efficiency of resource use (Agrawal 2001). In the body of field research on collective action a common finding is that “when the users of a common pool resource organize themselves to devise and enforce some of their own basic rules, they tend to manage local resources more sustainably than when rules are externally imposed on them.” (Ostrom 2000). Common property functions within the safety net of rules and structure, both formal and informal. These rules and structure make unpredictable situations, such as the cooperation of multiple actors, into a predictable system (Rudd 2004). Agrawal (2001) synthesizes the characteristics necessary for successful commons

management identified from three influential papers (Baland and Platteau 1996, Ostrom 1990 and Wade 1988 as referenced in Agrawal 2001). According to these authors, resources that can be managed communally should be of a small size, or at least stationary, well defined and predictable. The groups performing the management should also be small with well defined boundaries, shared social norms and past successful experience with collective action (e.g. strong social capital). The groups should also have appropriate leadership, interdependence among group members and be similar in their interests and social identity while containing different sets of skills, resources and abilities and have low levels of poverty. In terms of the connection between the managers and the resource, the authors require that there be a geographic overlap between the resource and the managers, a dependency of the managers on the resource and a fair allocation of the resource among group members. There should also be a low level of demand for the resource and any change in the demand should be gradual. In terms of the institutional structure, rules governing resource use and group involvement should be clear and easily understood, developed locally and easy to enforce. Punishments for non-compliance should be graduated; the process to hold violators accountable needs to be low cost and the officials monitoring compliance need to be held accountable to group members and resource users. Additionally, the restrictions on the resource should match the nature of the resource and its renewability. On top of these internal factors, external factors influence the effectiveness of common property management. First, exclusion technology needs to be low cost. There should be limited use external markets and changes in the level of connection to the market should be gradual. State governments cannot impede the process by undermining local authority

and must create supporting sanctions (from Agrawal 2001). My study will investigate if this holds true for non-extractive resource management.

Threats to collective action as a remedy to common pool resource issues do exist. Immigration of individuals who do not share the existing social norms or emigration that results in losing key players in the community can reduce trust. The imposition of external rules, failures of transmission of knowledge between generation, over reliance on outside sources of aid which may ignore indigenous knowledge, or the increase of opportunism and corruption undermine collective action (Ostrom 2000).

### **PES and common property**

Vatn (2009) looked at how PES could be used to strengthen cooperative will and concluded the following. First, cooperation could be increased by ensuring land rights so that land cannot be bought up by the wealthy and thereby reinforcing existing inequalities. Cooperative will may possibly be improved by an assurance that working together will result in a betterment of well-being. Payments for environmental services can strengthen cooperation will since transaction costs are lower for paying communities rather than individuals in my study, working together resulted in benefits. If PES programs favor this structure it may encourage its formation in many areas where there was not previously community organization. For many services, like water, small parcels may not provide the desired service but be part of a larger area required. If the payments can only be offered if the entire area is under protection then this might encourage those land owners to group together, and put pressure on those who are less willing, so that all may benefit from the incentives.

Social capital is a characteristic of communities described in terms of trust, norms and networks that enable collective action (Bouma *et al.* 2008). Measuring social capital has policy relevance in that social capital can increase the sustainability and success of programs thus making them better investments of resources and effort. Social capital provides insurance that when one person acts in compliance with community rules others will as well (Bouma *et al.* 2008). This sense of accountability is one thing that Eleanor Ostrom and others have cited as important for social action.

## **PES IN MEXICO**

### **The need for forest/water conservation in Mexico**

Mexico is a country plagued by deforestation and water scarcity. Of the 188 most important aquifers in the country, two thirds are overexploited, with withdrawal at 190% above the recharge rate and serving 30% of the population (Muñoz-Piña *et al.* 2008, Alix-Garcia *et al.* 2009). Most of the remaining watersheds are being used to capacity (Muñoz-Piña *et al.* 2008). The problem of water scarcity has been largely addressed through technology and engineering with little emphasis on the management of demand or environmental management (Muñoz-Piña *et al.* 2008).

One of the largest concerns now in managing natural resources is how they will respond to climate change. In Latin America climate change will be especially damaging as it is expected to result in biodiversity loss, changes in water availability and losses of crop productivity which will have very damaging effects on the human populations (IPCC 2007). Any industry that is dependent on water will be compromised. Rainfall patterns will change which will cause a decline in aquifer recharge. Needs from human

consumption will compete with other demands such as the generation of hydroelectric power. Agriculture will be altered by droughts, desertification and erosion (Mendoza *et al.* 2005). Models have shown that the reduction in rainfall from climate change teamed with the ever growing population of Mexico will cause a shortage of water in many areas requiring costly methods of distribution which may not be effective since, as the water table lowers there is a high probability of water contamination (Mendoza *et al.* 2005).

Thirty percent of Mexico's land is covered by forests which encompass 64 million hectares (ENACC 2007). Despite this large amount of forest cover, almost half of Mexico's forests have been destroyed since the 1950s (Chandler *et al.* 2002) at a rate of about 1.3% annually (Alix-Garcia *et al.* 2005). Deforestation rates in the tropical forests are higher than in any other forest type (Alix-Garcia *et al.* 2009). Of the 64 million hectares currently forested, five percent is owned federally, fifteen percent is owned privately and 60% or more forests are owned by communally or by *ejidos*, a traditional form of Mexican land tenure (ENACC 2007). From 1990-2000, 348 thousand hectares of forest were lost and from 2000-2005 the number was 260 thousand hectares annually (ENACC 2007) putting Mexico's deforestation rates near the top in the world (Corbera *et al.* 2009). Fortunately, though deforestation rates are still high, they seem to be reducing.

### **Pagos por Servicios Ambientales Hidrológicos (PSAH)**

Mexico has one of the largest PES programs in the world. The services covered by the programs are water, biodiversity and agroforestry (Figure 3). Previous attempts to reduce deforestation in Mexico include direct regulation, such as logging bans, subsidies to sustainable forestry and police action (Muñoz-Piña *et al.* 2008). These policies were

largely unsuccessful in stopping deforestation. One management practice that has been found effective in stopping deforestation is community forestry (Ellis and Porter-Bolland 2008, Bray *et al.* 2008). In comparisons of similar communities where one was within the boundaries of and subject to the restrictions of a protected area and another that managed the forests communally, the community management scenario was more successful in reducing deforestation (Ellis and Porter-Bolland 2008). Another study found that communities that have been inhabited for a long period of time and practice management for timber can be as effective as uninhabited protected areas in providing long term forest protection (Bray *et al.* 2008). As an attempt to address Mexico's two largest environmental issues, the government instituted a program for the payments of hydrological services provided by forests in 2003 (PSAH, *pagos de servicios ambientales hidrologicos*).

The PSAH is run through the national forestry commission (CONAFOR, *Comision Nacional Forestal*). The purpose of this program was to give economic incentives to land owners not to deforest in areas that were both of hydrologic importance and under pressure from deforestation (Muñoz-Piña *et al.* 2008). The PSAH is paid to participating land owners directly through the government which receives the money from funds earmarked out of the fees collected by water users and aid from the World Bank and the Government of Japan. The money is collected from users all through the country and then redistributed to the programs supported under the PSAH (Muñoz-Piña *et al.* 2008, Alix-Garcia *et al.* 2009). Because of this aspect, the PSAH does not meet the qualification of a direct relationship between buyer and seller that Wunder (2005) requires for PES, but it is not unusual for a PES program to include an intermediary



(Pascual *et al.* 2009). It would have been difficult to make the PSAH a purely market based initiative because of the fact that the benefits provided are almost entirely public goods and since there were already fees on the use of Mexico's rivers, lakes and aquifers, it took little start up cost to initiate the program using that funding (Muñoz-Piña *et al.* 2008). Though direct market connection between individual users and providers will be difficult, there has been some talk of forming a connection between a large corporation, for example the Grupo Modelo breweries, and land owners for the payment for water services. Although CONAFOR's initial intention was to turn the program over to local entities after the first five year contract period, in 2008 all the contracts were renewed without further attempts to make them market based direct payments (Muñoz-Piña *et al.* 2008, Alix-Garcia *et al.* 2009).

People in Mexico, as is common in Latin America and many other places in the world, have a strongly held perception that forests and water are deeply connected. This perception allows a program that preserves forest for the purpose of improving water to be an easy sell to the public (Muñoz-Piña *et al.* 2008). However, the PSAH clearly is utilizing the precautionary principle as the actual link between forests and water is scientifically shaky (Brauman *et al.* 2007, Calder 2005).

The complexities of most PES schemes make the much used Coasian basis for PES unreachable (Muradian *et al.* 2009). One major barrier to the use of the Coase Theorem is the uncertainty in the connection between land use and water provisions. Services provided by watersheds include quantity, quality, location and timing of water delivery (Brauman *et al.* 2007) as well as providing habitat for animals, supporting biodiversity, mitigation of climate change through carbon sequestration, control of

erosion and sedimentation as well as aesthetic and recreational benefits (Postel and Thompson 2005). The ecosystem type or land use, particularly the associated vegetation, within a watershed is the major determinant of the quantity, quality, location and predictability of water moving through a watershed (Hoff 2009, Brauman *et al.* 2007).

Forests are usually of particular interest in watersheds. Forests are thought to result in watersheds that effectively moderate runoff and purify water supplies (Postel and Thompson 2005). Deforestation is held responsible for interrupting these services. However, the real connection between forests and water is not completely cut and dry. There is little evidence that forests increase rainfall and, if they do, the increase is likely small (Calder 2005). Forests may reduce runoff by holding the water within the vegetation (Calder 2005). Although in some cases forested watersheds increase dry season flows, most examples show a reduction in dry season flows. Infiltration is greater in forested watersheds than non-forested watersheds only when the non-forested land is highly degraded by activities such as agriculture or grazing associated with deforestation, but not by the lack of trees itself (Calder 2005).

The doubts in the connection between land use and water services makes paying for specific land cover types in order to improve hydrology questionable and the use of Coase Theorem logic to develop a payment scheme for hydrologic protection infeasible. Often, the connection is made on the basis of cultural beliefs on the connection between forests and water rather than actual science. In Central America, after the devastation caused by Hurricane Mitch in 1998, watershed management became a focus of policy (Kaimowitz 2004). Watershed management policies have favored forests. Even the small amount of evidence that existed of forests increasing rainfall was enough to

encourage policy makers in Central America to institute forest protection policies for watershed protection (Kaimowitz 2004). However, the policies do not ensure that farmers sustain the activities nor are most project areas large enough to have meaningful impacts on the landscape level and off-site impacts are rarely measured to begin with. Most of the benefits of such programs are assumed as a result of the belief in forest and water relationships. However, the benefits of such activities on long term ecological balances; climate and water flows are most likely substantial enough to support such policies on the basis of the precautionary principle (Kaimowitz 2004). In fact, the precautionary principle is a strong basis for hydrological PES programs in that it is better to protect forests on the basis of limited evidence than not to protect them at all. Forest protection offers a low risk option for solving problems of water quality, water flows and sedimentation (Kaimowitz 2004). As the author writes:

“A good basic principle is that if the current land use provides the quantity and quality of water the population demands with an acceptable intra and inter annual distribution, any alteration will increase the risk of that situation changing. This is a strong argument for maintaining natural forest cover in many contexts.” (Kaimowitz 2004)

Tropical Montane Cloud Forests (TMCFs) have varying definitions but generally can be defined as forests that are often covered by clouds or mist (Bruijnzeel 1999). These are often distinguished by elevation, but many factors including temperature and humidity affect cloud formation making it impossible to give an exact elevation where all cloud forests are found (Bruijnzeel 1999). Unlike other types of forest, TMCFs actually increase water infiltration and thus water availability because they collect water from the

atmosphere that would have otherwise remained as water vapor, allowing it to reach the soil by dripping from the vegetation. This collection of water from the atmosphere is the major distinguishing factor between TMCFs and other tropical montane forest types (Bruijnzeel 2004, Calder 2005). The amount of water gained this way is equal to 5-20% of rainfall and may lead to the increase of rainfall in the dry season (Bruijnzeel 2004) although the effect is difficult to quantify (Bruijnzeel 1999). The idea that TMCFs are linked to water is strengthened because it is culturally accepted since TMCFs are visibly wet most of the time. Watersheds under the influence of TMCFs have more stable dry season flows than other forest types (Bruijnzeel 1999). In terms of dry season flows, the loss of TMCFs may cause serious problems. This forest type, however, is under significant pressure and is being lost at a high rate. Threats include conversion of forests to grazing, agriculture, deforestation for charcoal, loss of forest for telecommunication towers and threats from climate change (Bruijnzeel 1999).

The importance of cloud forests in Mexico is recognized and reflected in the pricing scheme within the PES program. For water services, there is a two-tiered scale where an acre of cloud forest receives more than an acre of any other forest type in a 4:3 ratio (Muñoz-Piña *et al.* 2008). However, cloud forests in Mexico are located mostly in the southern states and most of the overexploited watersheds are in the northern part of the country, making the cloud forests of Mexico ill situated to aid these watersheds. Since the forest type where this link is the clearest is cloud forest, under PSAH cloud forests receive a larger payment per hectare per year than other forest types in a 4:3 ratio (Muñoz-Piña *et al.* 2008). The main forest types in my study area are tropical montane cloud forest (TMCF) and tropical montane forest with some more heavily fragmented

lowland tropical forest. Ultimately the choice to focus on forests to receive payments for hydrologic services is because the program is run through CONAFOR (Muñoz-Piña *et al.* 2008).

Eligibility of sites for PSAH is location, location, location; location within the recharge area of an overexploited aquifer or areas of water scarcity, location in the area of influence of an area with a population greater than 5000 individuals, and location in areas with high flood risk (Muñoz-Piña *et al.* 2008). The only regulation is that there should be no change in land use. Compliance is monitored by satellite and by random site visits. Because of the common property policies in Mexico, many of the participating lands are communally owned (Muñoz-Piña *et al.* 2008). Application to the program is cheap and easy, ensuring that marginalized communities would not be excluded because of costs of participation (Alix-Garcia *et al.* 2009, Pagiola *et al.* 2005). The application form is only two pages long and the only additional requirements are proof of legal ownership and, for *ejidos* and *comunidades*, a document that gives evidence of a community vote in favor of participation (Alix-Garcia *et al.* 2009 – see also rules for ProARBOL). This ease and low cost of application eliminates another one of the barriers for participation of poor in PES (Pagiola *et al.* 2005).

## **Results of PSAH**

In the first year a total of 180,000 hectares were enrolled for five years with an additional 169,000 ha added in 2005 with the majority of the land held communally (Muñoz-Piña *et al.* 2008). From 2003 to 2010, there were 2,767,000 hectares enrolled in CONAFOR's PES programs representing 5,289 million pesos (415.5 million US dollars)

and 4,646 individual projects (CONAFOR 2011). These programs benefited an estimated 5,400 *ejidos*, *comunidades* and small land owners in Mexico (CONAFOR 2011). Starting in 2010 CONAFOR will offer differentiated payments to ecosystems for new contracts (CONAFOR 2011). As of 2008, the program was reporting 100% compliance (Muñoz-Piña *et al.* 2008) though there is some evidence that satellite images have not picked up below canopy degradation that will lead to forest loss in the long term (Southgate and Wunder 2009). Unfortunately the largest portion of the enrolled land has low risk of deforestation, indicating that there were no additional benefits gained from participation (Muñoz-Piña *et al.* 2008). As such, the program is in practice a reward for good environmental behavior rather than a payment for an additional service provided. McAfee and Shapiro (2010) would consider this a compensation for environmental services rather than a payment. In a study done by Alix-Garcia *et al.* (2009) it was found that of 11 communities in Oaxaca participating in PSAH, only five had deforested prior to receiving payments and all of them had already been engaged in conservation activities. Less than 25% of the funding for PSAH has gone to projects in areas within overexploited aquifers, showing a lack of targeting in these areas (Muñoz-Piña *et al.* 2008). According to satellite images, most of the remaining forest in the country is not located within the overexploited watersheds and cloud forest are particularly ill positioned to be of much hydrologic value (Alix-Garcia *et al.* 2009). Despite cloud forests having the benefits outlined above, if the water does not drain to an area where water is being used or to an area that is overdrawn or water scarce, then in terms of payments for environmental services they are not as important. Prevalence of cloud forests in the program, perhaps because of the higher price received, is larger than would

be expected from the percentage of land they cover (Muñoz-Piña *et al.* 2008). Thus, the higher price encourages more cloud forest owners to participate even though these are not the forests of the most importance. In essence, these land owners are being paid to conserve forest rather than to provide a service, making the PSAH more of a conservation subsidy and a poverty alleviation mechanism than a PES scheme (McAfee and Shapiro 2010).

### **Lessons Learned**

The case study done by Alix-Garcia *et al.* (2009) led to the determination of multiple lessons to be learned from the Mexican PES example. These lessons are political, financial and in terms of targeting. First, politically, some of the communities studied were confused about the purpose of the PSAH. Before PES programs are promoted, clear objectives and criteria for participation need to be established. Second, the choice of implementing agency is vital. As a result of the selection of CONAFOR as the implementing agency the implementation costs of PSAH were kept low, but it also resulted in the program only including forested land and also led to the over involvement of commercial forests, as these were the ones that already had a relationship with CONAFOR and may have led to the fact that 84% of the PSAH area in 2004 were in aquifers categorized as not overexploited. The third lesson from the PSAH is that a PES must provide sufficient incentive to change behavior. The authors suggest using an auction process to reveal minimum payment, as Bond *et al.* (2009) use for determining prices for bundled services. The payments must be enough not only to change land use in

the project area but ideally to change behavior so that the land use is not simply moved to a non-project land.

Within the context of community property, it is important that the objectives of the program and the receipt of the payments are obvious not just to the community leaders but to all individual members. Only when all members are aware of the program will it change individual behavior (Alix-Garcia *et al.* 2009). The final political lesson suggests that the water service providers are involved more in the design and management of the PES. Though not utilized in Mexico, the providers could give valuable information in terms of targeting valuable land.

The first financial lesson Alix-Garcia *et al.* (2009) draw from the Mexican case study is the assurance of sustainability of funding. Mexico has intentions to develop local markets for water to create sustainable financing. However, the present design and distribution of properties participating make it costly to develop direct markets and unlikely that the downstream users will see a significant impact. Second, Mexico has a fund in place to ensure long term payments to program participants of at least five years. A different way of ensuring long term funding is by issuing payment certificates against which recipients can borrow money from banks. This approach is used by the agricultural subsidy program, PROCAMPO.

In terms of targeting, choosing a service, like water, that is of importance locally it is easier to secure funding from government and the possibility of local markets (Alix-Garcia *et al.* 2009). The last lesson from targeting is keeping the goal of paying the lowest price possible for the area of forest at the highest risk of being lost. As the statistics from the first few years show, the majority of PSAH land is under low risk of



deforestation. If payments were targeted to areas of high risk of deforestation, efficiency would increase (Alix-Garcia *et al.* 2009). The communities in this study, for example, have forests with very low risk of deforestation.

Targeting forests in overexploited aquifers and placing emphasis on forests with marginalized populations has not been followed by Mexican plan which is currently promoted as a subsidy, with little effort focused on making it a locally managed market based initiative (Alix-Garcia *et al.* 2009, McAfee and Shapiro 2010). The development of local ES markets is limited by two main factors. First, the number of hectares enrolled in the program may not be significant for downstream buyers to see a significant difference. Second, the way the participants are dispersed it will be costly to organize a direct market (Alix-Garcia *et al.* 2009). As long as the demand for the service is strong, the development of a direct market is possible, though it is unclear how it will be developed (Alix-Garcia *et al.* 2009). The World Bank opposed Mexico's move away from the market based program arguing that market based programs are more sustainable because they do not rely on donations and are determined by the self interests of the participants. Despite this, they support Mexico's development of REDD (Reducing Emissions for Deforestation and forest Degradation) schemes (McAfee and Shapiro 2010) and provide substantial funding for the PSAH.

## ANALYSIS

Mexico's PES program does not fit Wunder's (2005) definition of a PES exactly. Below is outlined the five characteristics of a PES as listed by Wunder and how the PSAH does or does not fit into the definition.

1. *A voluntary transaction:* It is voluntary for providers, who apply for funds and agree to protect the forest cover, but not beneficiaries who contribute through mandatory user fees, thus it is not an entirely voluntary program.
2. *A well defined environmental service or land use:* The land use, forest cover of over 80%, is well defined. However, what is not well defined is the provision of the desired service, improved water quantity and quality, based on that land use.
3. *The service is being bought by a buyer:* The service is being bought by a single buyer, the Mexican government. The funds are from user fees paid by Mexican citizens - which are not voluntary- as well as money from the World Bank and the Government of Japan.
4. *From a service provider:* The service providers are land owners being paid not to deforest their property.
5. *If the service provider ensured the provisioning of the stated services:* Payments are conditional on compliance which is monitored through random site visits and satellite images.

Vatn (2009) developed three questions that should be addresses when studying a PES. First, what is the distribution of rights and rules instituted to govern the interaction between agents? For most of Mexico, land tenure is clear. Land has been distributed since the Mexican Revolution to be managed communally either by *ejidos*, groups of previously landless peasants, or *comunidades*, indigenous groups with historic land rights. Second, Vatn (2009) asks, how do transaction costs influence the arrangements? Payments for the PSAH come from pre-existing user fees and international donations

processed through a pre-existing government agency. By using a pre-existing agency as intermediary, CONAFOR, and the pre-existing user fees as well as donations, transaction costs are low as new infrastructure and new institutional relationships are not necessary. Also, because of the land tenure system in Mexico, a large portion of the land in the program is owned communally. Paying a single entity, such as a community Assembly, for a large area of land rather than individuals with small parcels also reduces costs. Payments are distributed down to individual community members by the community leadership.

In the context of communal property it is interesting to understand how the payments are used within the communities. In case studies conducted by Alix-Garcia *et al.* (2009) the use of the funds by *ejidos* ranged from a pure distribution among members to a total investment into public goods. Public goods might include materials needed for conservation activities, infrastructure projects or school building. The reasons communities might choose to distribute funds this way are various. First, the amount per member might be insignificant and better used elsewhere where the return would be higher. Second, public goods can be utilized and enjoyed by everyone, even non members. Lastly, the investment in public goods may better fit societal ideas of fairness in a way that cash payments would be unable to accomplish.

Transaction costs are low for the participants who do not need to engage in any additional activities to participate. Since the goal of the PSAH the goal is to conserve existing forests not to reforest, the cost of meeting program regulations is low. For programs, such as Mexico's previous carbon sequestration program, costs come in the form of labor and resources needed for reforestation or afforestation projects. The third

question asked by Vatn (2009) is, what are the motivations included in the system and how this influences the outcome? As seen by the results, a large portion of the enrolled land had low risk of deforestation. The motivation to comply in this or any PES system is payment received, but in the case of Mexico there seems to be low additionality, indicating that motivation of receiving money is unnecessary to achieve the desired land use. In terms of PSAH, additionality would be the forests protected under the PSAH that would otherwise have been deforested. In many of Mexico's community forests, there is already sustainable management and strict regulation on forest uses. In the case studies done by Alix-Garcia *et al.* (2009) all of the *ejidos* studied were practicing some form of forest conservation before the implementation of the PSAH.

Payments for environmental services programs are well suited for Mexico where land tenure is secure and communities have full decision making capabilities. However, Pagiola (2007) suggest that direct user to provider programs are the most likely to succeed. Mexico's program is not direct user to buyer but is a publicly funded incentives program. For voluntary payments there must be a clear connection between the payments and the services provided with some certainty and trust that the services will continue. This is not done in Mexico where the payments are not voluntary and there is also not a direct connection between payers and providers, by nature eliminating the ability of water users to discontinue payments if they are dissatisfied with the results of the protection as the fees are compulsory and much of the program funding is from foreign sources, not the water users. There is no direct linkage between those who pay the user fees and the programs being funded, as the money is centralized and redistributed as the government sees appropriate. These compulsory user fees in Mexico's system eliminated the problem

of free riders. In summary, the PSAH is a type of environmental subsidy which, while internalizing costs, may have the problem of additionality and leakage.

## OBJECTIVES

The objectives of the study are as follow:

- (1) To determine the political and institutional processes that governed decision-making on the participation in the PSAH program.
- (2) To determine household impact and poverty alleviation potential of the payments.
- (3) To determine how participation in PSAH has aided in building social capital and increased potential for collective action within the study communities and between them and other communities
- (4) To determine if community members are satisfied with the structure of the program or if there is a more socially optimal way to distribute payments.
- (5) To estimate community member's willingness to accept (WTA) for additional conservation projects, specifically carbon sequestration, under various conditions of property rights and opportunity costs for hydrological purposes.

As shown through various case studies presented in this chapter, there is a vast body of work on PES. My study will contribute to the literature by providing a case study of a PES program functioning within a common property regime, something hitherto unexplored. This common property regime addresses issues of poor participation, equity and compliance with PES regulations in a way unique from programs that pay individual land owners.

## STRUCTURE OF THE THESIS

Chapter I of the thesis has laid out the concept of Payments for Environmental Services, particularly payments for hydrologic services. I then described the PSAH program in Mexico and placed my study in the context of the existing literature on PES programs.

In Chapter II I will describe my two study sites and the methods used in the study. I will describe the surveys and interviews used. Finally I will explain my analysis. Chapter III will provide an overview of the results of the surveys and interviews. In Chapter IV I will give the results of the willingness to accept for carbon payments questionnaire. The final chapter, Chapter V, will give our conclusions and fit our study into a broader realm of studies of PES.

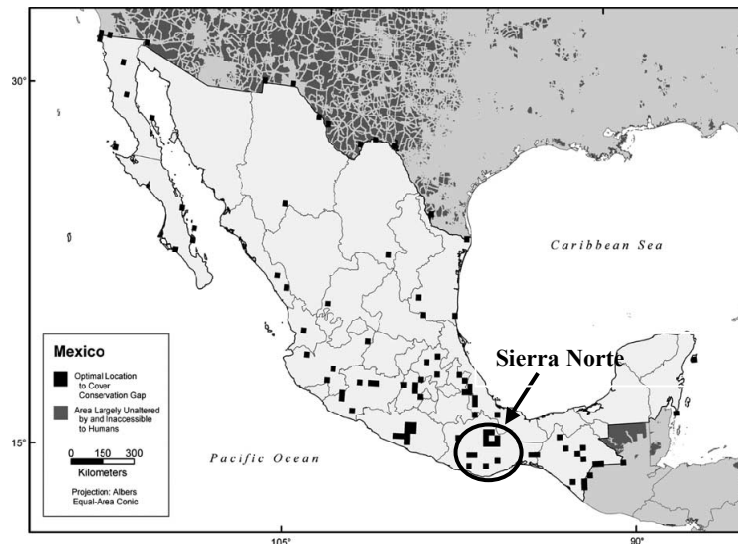
## CHAPTER II – STUDY SITES AND RESEARCH METHODS

### STUDY SITES

The two study communities for this project, Santa Cruz Tepetotutla and San Pedro Tlatepusco (here after, Santa Cruz and San Pedro), are located in an area of northern Oaxaca known as the Chinantla Alta. The Chinantla Alta is part of the Sierra Juarez mountain range just north of the area known as the Sierra Norte within the Papaloapan watershed.

Mexico is one of the world's most biodiverse countries and the state of Oaxaca is valuable for conservation because of its high biodiversity, species richness, and high rates of endemism (Oviedo 2002). There are few federally protected areas in Oaxaca. Community-level conservation is very important in Oaxaca not only because there are few federally protected areas but also because by the highest estimates up to 80% of land

**Figure 2.1:** Map of Mexico showing proposed locations for conservation areas. The circled area is the Sierra Norte of Oaxaca, the location of the two study sites. The map is adapted from Brandon *et al.* (2005).



in Oaxaca is owned by *comunidades* or *ejidos* (Oviedo 2002). Mexico itself has an extensive system of protected areas but there are still large areas of forest without federal protection and with high levels of deforestation. In an attempt to maximize conservation benefits of protected areas and minimize conflicts with agricultural productivity, Brandon *et al.* (2005) used spatial data for mammals, birds and amphibians overlaid with areas of human habitation. They determined areas suitable for conservation that would be sufficient enough to protect all unprotected Mexican species of mammal, bird and amphibian without causing major conflict with human populations. From this information they proposed areas where new reserves should be placed (Figure 2.1). One large block suggested by the authors is located in the Sierra Norte Region of Oaxaca. Although Oaxaca has very little area covered by federal protected areas, 93,121.03 hectares in the state are protected by what are called “*Areas de Conservacion Certificadas*” (Ortega de Valle *et al.* 2010) or, as we will refer to them, Indigenous/Community Conserved Areas or for brevity, community conserved areas (CCAs), a term used by the IUCN (Borrini-Feyerabend *et al.* 2004). Under a 2008 modification to the Mexican environmental law, CCAs in Mexico are formally considered part of the Mexican national protected areas systems, such as biosphere reserves and national parks except that the management is shared between the federal government, state and local governments or locally (CONANP 2009). The region that Brandon *et al.* (2005) suggest in the Sierra Norte is not protected by a formal protected area but owned by Zapotec and *Chinantec* communities and large areas are informally conserved and increasing areas are certified as CCAs.



Federal protected areas have been considered Mexico's primary means of protecting biodiversity (Garcia-Frapolli *et al.* 2009), but CCAs are also appropriate to protect forests, in fact, approximately 95% of land in protected areas in Mexico is not owned federally but by *ejidos* (Garcia-Frapolli *et al.* 2009). The IUCN defines community conserved areas as "natural and modified ecosystems with significant biodiversity, ecological and related cultural values, voluntarily conserved by indigenous peoples and local communities through customary laws or other effective means" (Kothari 2006). Over half of Mexico's forests are owned by *comunidades* or *ejidos*. These communities have been shown to provide ecologically sustainable economic opportunities as well as ecological protection when managing the forests for logging (Bray *et al.* 2003). Similar results might be expected for forests which are conserved rather than logged.

Rural land reform in Mexico left rural communities with legal tenure over their lands in the form of *ejidos* and *comunidades*. The local authority and political structure of the *ejidos* and *comunidades* is recognized under Mexican law. For most communities the highest authority is the Community Assembly which is formed by all legal community members (Oviedo 2002). Local communities have been generally distrustful of federal protected areas which are seen as a weakening in their rights to their land and have instead elected to manage their natural resources within their own local governance (Oviedo 2002, personal communication with Geoconservación workshop and others). Previous to the certification of CCAs in the state of Oaxaca, a study done by WWF on community conservation in the state found that conservation implemented at the community level was long term, had clear and accountable administration and decision

making, managed to maintain a link with economic activities, and were able to protect the structure and function of ecosystems in a manner that was more integrated than is typical with federal protected areas, and that all of this was achieved at a low cost (Oviedo 2002). The successful community conservation initiatives studied showed similar conditions including well defined territories, strong community governance that allowed for actions to be taken with the confidence and support of the population, a basic understanding of biodiversity as a resource that provides tangible benefits to the people in a collective manner, a recognition of both collective rights and collective responsibilities to the resource and an approach to conservation planning that creates links to a broader landscape rather than seeing the conserved area as isolated (Oviedo 2002).

In the state of Oaxaca in total 69,455 hectares or 75% of the land protected by CCAs is owned by indigenous communities (Ortega del Valle *et al.* 2010). The Papaloapan region of Oaxaca has sixteen CCAs which cover an area of 32,935.63 hectares (Ortega del Valle *et al.* 2010). The Papaloapan region covers 867,815 hectares and 59% is under some type of conservation. Ecosystems present are dominated by humid tropical forest, cloud forests and temperate forests (Ortega del Valle *et al.* 2010). . The CCAs of our study sites; *Area de conservacion la Tierra del Faisan* of Santa Cruz and *Area de Conservacion San Pedro Tlatepusco* of San Pedro were both declared in 2004 (CONANP 2009). Both Santa Cruz Tepetotutla and San Pedro Tlatepusco are *comunidades* and are 96% and 100% ethnically Chinantec respectively (Ortega del Valle *et al.* 2010).

Of the different ethnic groups that exist in the state of Oaxaca, the Chinantecs have 14 of the 74 CCAs (Ortega del Valle *et al.* 2010). The Chinantecos have a long

history of conservation in their forests. This was documented as early as the 1930s by the ethnographer Bernard Bevan.

*“Nowhere have the Chinantec effected a permanent transformation of the forest, and the Chinantla retains its true climax vegetation to a degree perhaps unequalled elsewhere in Mexico. Such is the habitat of the Chinantec – a luxurious dripping forest, and where this forest comes to an end, there also ends their territory. So abrupt and striking is the transition that one finds along the very Chinantec border that the great hills present two different slopes: the one arid and treeless, or clad with a few oaks; the other moist and covered with dense tropical forest. The latter slope is Chinantec; the former belongs to another tribe”*

(Bevan, 1938: p. 11)

#### **Comité Regional de Recursos Naturales de la Chinantla Alta (CORENCHI)**

*“Our ancestors showed us the value of community conservation. In our community, the work of natural resource conservation passes from generation to generation. The forest is considered for us, 'home of Jaguar' from which comes the bird song and all classes of animal; taking care of the habitat of the curassow, brocket, Jaguar, armadillo and redfish is taking care of our territory”*

CORENCHI (as quoted in CONAFOR 2011: p.2)

The two study communities are part of a community organization called the Regional Committee of Natural Resources of the Chinantla Alta (*Comité Regional de Recursos naturales de la Chinantla Alta*), known locally as CORENCHI. The six communities that make up CORENCHI are Santa Cruz Tepetotutla, San Antonio del Barrio, San Pedro Tlatepusco Santiago Tlatepusco, San Antonio Analco and Nopalera del Rosario with a seventh, Vega del Sol, geographically separated from the others, recently gaining membership. Originally there were four communities, Santa Cruz, Santiago, San Pedro and San Antonio. Analco and Nopalera entered into CORENCHI later in order to take advantage of the PSAH after they saw that the program was successful in the original four communities. The six current CORENCHI communities contain 26,770 Ha of certified community conserved areas (Ortega del Valle *et al.* 2010). Formed in 2005, CORENCHI creates a joint strategy by which the member communities manage their natural resources and lobby government agencies for support in order to improve the socioeconomic situation in the communities. Together they have managed not only to declare the community conserved areas but also to take advantage of the government payments for environmental services program. The communities of CORENCHI, since their initiation into the PSAH through 2010, have received over 45 million pesos and conserves a total of 22,103 hectares (CONAFOR 2011).

The communities work closely with several government and nongovernmental organizations, including Oaxaca based NGO's, CAMPO and Geoconservación, in order to take advantage of different programs and solicit various types of aid. For example, through the NGO, CAMPO, Italian architectural students have come to three of the communities to build community houses that are used to host visiting researchers, NGO

and government workers as well as visitors from other communities. Grupo Modelo, a large brewery in Mexico, has giving assistance to three CORENCHI communities in the form of an ecotourism lodge, trail signs and a small hydroelectric plant. In 2006, one year after its formation, SEMARNAT awarded CORENCHI an honorable mention for the *Merito Ecological* (ecological merit) award and CORENCHI was also nominated for the 2008 Equator Prize ([equatorinitiative.org](http://equatorinitiative.org)).

### **Santa Cruz Tepetotutla**

A study published in 2000 shows that land distributed as shown in table 2.1. Though some of the numbers may have changed a bit, the land is distributed in mostly the same way at the time of the study (ERA 2000).

The Chinanteco name for Santa Cruz Tepetotutla means “land of the birds” or “home of the curassow” (ERA 2000). Until 2003 there was no road in or out of Santa Cruz and all travel had to be done by foot or with pack animal. At the end of the 1990s, the population of the town decreased as a result of a large amount of emigration from the community when the prices of coffee fell (ERA 2000) and currently the community has around 700 inhabitants with approximately 121 legal members recognized by the Assembly. Before the drop in coffee prices, coffee was a main source of income for the community where now a major source of income is reportedly remittances sent by those who emigrated (ERA 2000). In 2000, of the 150 people who had immigrated from the community due to the drop in coffee prices, seventy were in Oaxaca City, fifty were in Mexico City and thirty were in Los Angeles in the United States (ERA 2000).

**Table 2.1:** Distribution of land use in Santa Cruz.

<b>%</b>	<b>Land Use</b>
6.6	Rest phase of corn rotation
5	Forest dominated by <i>Pinus chapensis</i>
62	Montane tropical forest and cloud forest
8.5	Oak forest
3.6	Coffee fields
7.5	Agricultural land
2.1	Pasture
2.3	Secondary forest
1.8	Selva mediana perennifolia
0.5	Urban area
Total area: 11,245.78	

The certified CCA has been made possible not only by a long history of a culture of conservation as documented by Bevan (1938), but also by the concentration of agricultural practices. In the community, of the total 11,245.78 hectares (or up to 12,372 ha as cited by the NGO Geoconservacion) only a little more than 20% is taken up by some sort of agricultural activity or by urban areas (ERA 2000, personal communication with Geoconservacion). The concentration of agricultural practices was made possible through a history of intra-community struggles over land use, but where conservation-oriented leaders became increasingly dominant by the mid-2000s. With the instability in coffee prices and ensuing emigration, conservation was seen by some community leaders as a way to generate income in order to keep young people in the community. The

community members are limited to three areas for pasture for animals and these areas can only be used with permission by a person who has completed all of their requirements as *comuneros* (ERA 2000, Don Pedro Osorio Hernandez, personal communication). Slash and burn agriculture is practiced with a minimum of four years fallow. The land in the fallow phase reverts back to the community so that an area of land only pertains to an individual if they are actively working in it. People in the community generally respect areas that people have historically worked or where an individual cleared the forest. Also, projects such as the greenhouses promoted by CAMPO and the practice of policulture, growing crops such as corn, beans and coffee along with oranges, plantains, pacaya palm (*tepejilote*), and other indigenous foods, have allowed their food production to be intensified thus maximizing production on a limited area (Don Pedro Osorio Hernandez and Don Raymundo Osorio Garcia, personal communication). Agricultural abandonment from emigration may also be leading to a growth in secondary forest and increasing biodiversity (Masters thesis in progress of Ernesto de los Santos n.d., and Hite 2011). The zoning of agricultural activities and the forested areas is by community mandate and emerged from a land use zoning exercise (*ordenamiento territorial comunitario*) carried out in 2000 and approved by the community Assembly in 2003, and was in existence before the certification of the CCA (ERA 2000).

### **San Pedro Tlatepusco**

San Pedro Tlatepusco was originally founded more than five hundred years ago. The territory of the community is 6,289 hectares. The Santiago River passes through the middle of town with residents living on both sides connected by a hanging bridge

constructed in 1987. In 1928 the river flooded, destroying the entire community. The heavy rains at this time also caused landslides in the mountains around the town. Those who survived the flood returned to reestablish the community but the areas that were destroyed by the landslides never recovered their forests but were invaded by bracken fern (personal communication with Don Felipe Martinez Ortiz). To this date, these areas remain deforested and uncultivated. Bracken fern is a highly productive plant which is able to become dominant in disturbed habitats (Marrs *et al.* 2000). Bracken fern is not easily controlled and complete, labor intensive ecological restoration is required to eradicate or control it (Marrs *et al.* 2000). Because of the bracken fern, the agricultural zone is not close to the urban zone and many people walk more than an hour to get to their parcels.

As of 2003, the population of San Pedro was 278 people in 50 households. As in Santa Cruz, the people of San Pedro are ethnically Chananteco and speak both Spanish and Chinanteco, the indigenous language. Around 26% of the population over the age of 15 is illiterate. There is no road into the community and to reach the nearest road in the municipal center of San Felipe Usila is a four hour walk, depending on the pace. There is a radio in the community with which they can communicate to Usila and other CORENCHI communities, but there is no phone. There is a preschool and an elementary school as well as a health center without a permanent nurse.

The name Tlatepusco comes from the Nahuatl language and means “place behind the land.” Though some of the homes are built in the traditional style with walls made of poles and thatched roofs, the majority of the homes are cement with tin roofs (see figure 3.9). There is a catholic church, several evangelical churches, a community center, a



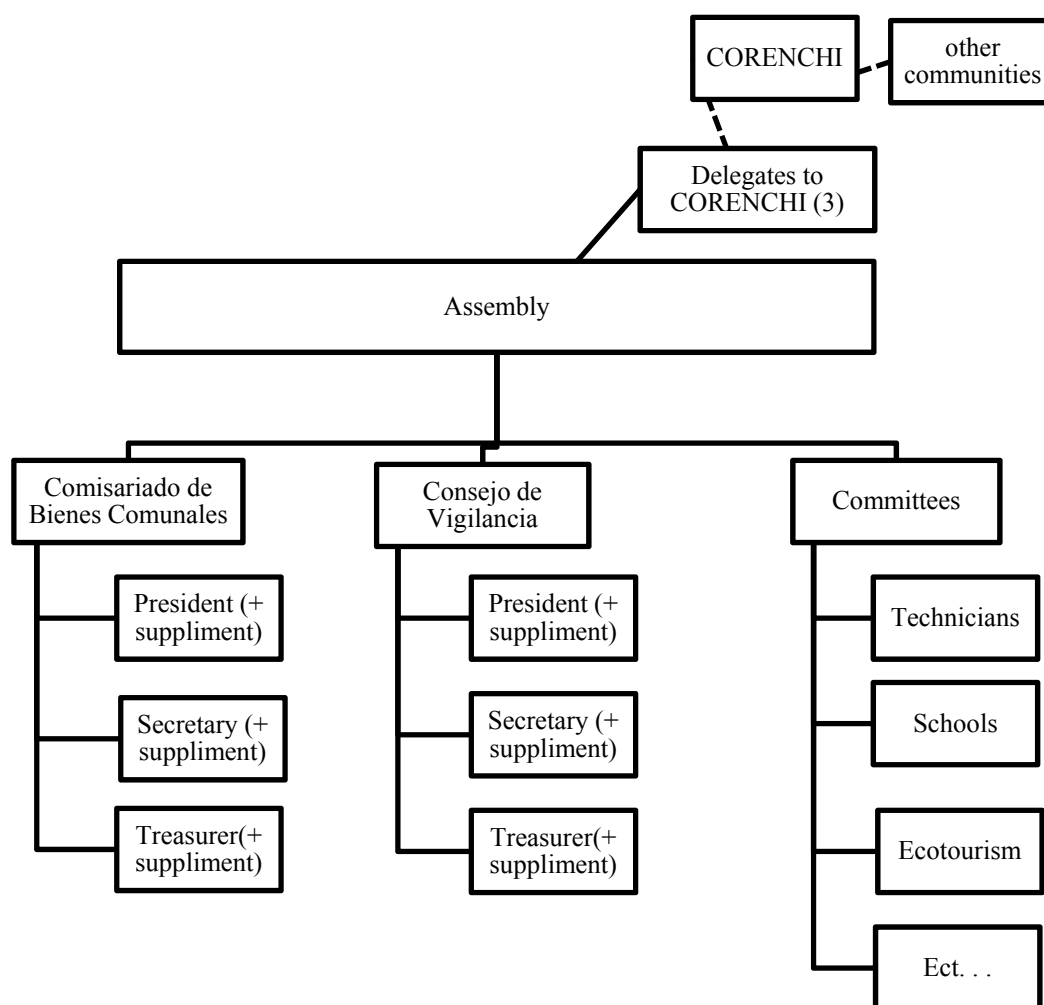
community house built by Italian engineering students and a community museum (Escalante y Ramero, n.d.).

In terms of agriculture, corn and beans are grown mostly for consumption. Other products that are grown are cacao, yucca, *tepejilote* (pacaya palm), *guasmol*, vanilla, sugar cane, and fruits such as oranges, bananas and mango. These are sometimes sold but most are grown for household consumption. Most families have coffee fields and many sell coffee for income. There have also been projects in the community for the production of honey, tilapia and vegetables (Escalante y Ramero, n.d.).

### **Community Governance**

Both communities are members of CORENCHI and have the same local governance structure (Figure 2.2). The structure includes the Assembly the *comisariado*, and the oversight committee (*consejo de vigilancia*) as is dictated by Mexican agrarian law. Leadership roles last for three years, rotate, and are mandatory. The main decision making body is called the Assembly and is constructed of all legally recognized community members. This basic structure is required by Mexican agrarian law, but the requirements say only that the groups meet twice a year. In the CORENCHI communities meetings of the Assembly are monthly or more frequently. Participation in CORENCHI is not required by law. That the communities go above and beyond what is required by law is evidence of high levels of collective action within and between communities. From the Assembly, three delegates to CORENCHI are selected and those delegates join with delegates from other communities. The leadership is made up of two main bodies, the *Comisariado of Bienes Comunes* (common property), hereafter

**Figure 2.2:** Community governance structure in San Pedro Tlatepusco and Santa Cruz Tepetotutla.



referred to as the *comisariado*, and the *Consejo de vigilancia* (oversight council) hereafter referred to as the *consejo*. In addition to these roles, community members are selected to form a variety of other committees to accomplish tasks of the community. These committees include technicians to work in conservation with a variety of agencies and organizations, committees for the schools, ecotourism including cooks and guides,

individuals to be in charge of transportation, the community store and other needs of the community.

## RESEARCH METHODS

### **Data Collection**

The study took place during the summer of 2010 (May 16<sup>th</sup> to July 27<sup>th</sup>, including a two week field course and orientation). In the two study communities, Santa Cruz Tepetotutla and San Pedro Tlatepusco, I conducted structured household surveys, semi-structured interviews with community leaders and informal interviews with some key informants. In Santa Cruz my key informants were Don Pedro Osorio Hernandez and Don Raimundo Osorio Garcia. The key informants in San Pedro Tlatepusco were Don Felipe Martinez Osorio and Don Fulgencio Manuel Felipe.

Informal interviews were conducted in both study sites following the guidelines of Bernard (2002). Informal interviews were conducted at various points throughout the investigation. The first interviews were during the finalization and pre-testing phase of the structured surveys. Through informal interviews we determined the structure of the payment for hydrologic services (PSAH) distributions, the history of how the distribution was decided upon and the format for which requests to use the funds are made. Documents were obtained from the office of *bienes comunales* including official amounts of money received, the number of scholarships given, the number of requests for money and the amount given, and also how much money each individual community member has received. Information was also obtained from attending a workshop in Santa Cruz on June 30<sup>th</sup> in which the key actors from Santa Cruz and CORENCHI shared information to

an *ejido* from the state of Chiapas about how CORENCHI communities initiated their conservation areas, CORENCHI, PES, and the *fondo concurrente*, an idea which will be described in detail later. Informal interviews were also used to determine how the community decided to enter into the PSAH, how the distribution of the funds was decided and other general background information. Informal interviews were recorded when possible and typically there was no guide and no translator present.

The semi-structured surveys were developed and executed following the guidelines of Bernard (2002). The surveys ask questions of present and past community leaders about the actions taken to participate in the PSAH and how the community has benefited or changed from participation. Semi-structured surveys were conducted at the end of the data collection period in Santa Cruz and before beginning structured surveys in San Pedro. This was done because of timing and coordination issues with other students. The semi-structured survey for this study was combined with the semi-structured survey of another study entitled “Analysis of governance institutions for collective action of biodiversity conservation in six Chinantec communities in Oaxaca, Mexico” being conducted by Oscar Antonio Molina Gonzalez for a Master’s thesis in progress at CIDIR Oaxaca. After obtaining a list of the community authorities since 1997 until now, individuals were selected from Santa Cruz and from San Pedro. These sample sizes were based on the idea that there are three year cycles of leadership, meaning that between 1997 and 2010 there have been 5 cycles of leadership. Semi-structured surveys were recorded when possible and were attended by a guide who was able to explain questions and translate between Spanish and Chinanteco when necessary.

Structured surveys were conducted in both Santa Cruz and San Pedro. The surveys were created following the guidelines of Nardi (2003), Bernard (2002) and utilizing some questions taken from a survey by David Runsten and Jessa Lewis on coffee and emigration in Oaxaca (the results of which are presented in Lewis and Runsten 2005). In Santa Cruz there are 121 listed *comuneros* and 58 surveys completed, representing 48% of *comuneros*. San Pedro has 69 listed *comuneros*, 28 surveys were completed representing 41% of *comuneros*. Mexican agrarian communities have a formal list (*padron*) of legal community members who constitute the Assembly and this was used to determine the sample rather than houses as it is rare that a household would not include a listed *comunero* and I was only interested in those who receive payments from the PSAH program. A random numbers chart was generated using Microsoft Excel and used to select *comuneros* from the list to survey. Some houses contain more than one listed *comunero* in the case that a child over 19 is living with his parents, an elderly parent is living with an adult child or that siblings may reside in the same house. This was more common in San Pedro than Santa Cruz. In San Pedro approximately 75% of the households were captured while in Santa Cruz the number was likely closer to fifty percent. In the case that multiple *comuneros* live together in the same house only one survey was completed by the individual with the most knowledge of the household income or, when possible, with all the *comuneros* in the house present so as not to sample the same household income more than once. The survey asked questions about household income including remittances received, agricultural production, and payments from government programs (see appendix I). Few individuals in either community sell corn and so corn production was not assessed. If any corn was sold it would fall under

“other cultivated products that you sell.” Income was estimated to establish what percentage of the income is from the payments for hydrologic services. Income was difficult to determine because no one receives a set salary and few individuals keep track of annual income. I determined income through a series of questions asking for incomes from various agricultural products, government programs, and common income generating activities in which the members of the household may be involved. Responses to income questions may have been intentionally lower than actual incomes as there is concern within the community that some of the government aid programs, such as OPORTUNIDADES which is paid to mothers of children in school, may be taken away if the government determines their incomes to be high enough not to need assistance.

Questions were asked in the structured survey about coffee production, the number of hectares of coffee plots owned and of those how much has been abandoned. This section included other uses of the land and other crops produced along with coffee. These questions will be used in a separate study by Hite (2011). Information about coffee production will be utilized in the current study to establish the opportunity cost of conservation in coffee areas. The coffee plots are the only agricultural lands that are considered as private property within the framework of communal ownership. Other agricultural land used for corn fields is communal. Corn fields have a rotation of five years. Every year a community member can select where and how much land they convert to corn, but it must be within the agricultural zone and have had at least four years of rest since it was last in production. Even though the same individual will often plant corn in the same location every rotation, the land is technically communal and

cannot be permanently claimed or altered to other uses by an individual the way the coffee fields are claimed.

The structured survey includes a section that asks about the payments for hydrological services which includes perception questions about conservation in general and also the distribution, use and quantity of the payments. I also asked about the amount of money each person had received from the payments. We found that this was difficult to obtain as the subjects either could not remember or were unwilling to say. The previous president of the *comisariado* in Santa Cruz had stolen money from the community, though not PSAH money. Because of this some trust was lost and community members felt insecure about their fund that was in the bank. Because of this insecurity, it was reported that all the money in the bank for Santa Cruz was taken out and each community member was given their share. A date that this transaction occurred was not obtained because of disagreement among the community members but is generally agreed to have happened after the 2009 funds had been disbursed in December 2008 but before the disbursement of the 2010 funds in December of 2009. The amount received was equal for everyone unless they had previously taken money from their account. Since this information is most likely inaccurate on the surveys, the quantity received by each individual was obtained from disbursement record in the office of *bienes comunales*. The date on which this distribution occurred could not be agreed upon by the informants in Santa Cruz. For this reason we did not use the income from the total distribution in determining household income for the year and in the data analysis. Also, this distribution happened only once and represents a large departure from their typical annual income.

The final section of the structured survey is intending to capture willingness to accept in a carbon payment project. Following Southgate *et al.* (2009), I first explained that forests are important not only for their ability to conserve water but also for the capture of carbon, which is a contaminant causing climate change. It is explained that governments and companies create projects of conservation or reforestation for the purpose of creating carbon credits that can be sold in the market. The subject was then asked if they would be willing to participate in a program where the community would be paid either to continue conserving or to plant trees for the sake of capturing carbon. If the subject responded negatively, the survey ended, but those who replied in the affirmative were asked four following questions. Half of the participants were told the market price of carbon which at the time of the study was \$0.10 according to the Chicago Climate Exchange (CCX, [www.chicagoclimatex.com](http://www.chicagoclimatex.com)) and told that their forests would be able to generate 200 carbon credits per hectare, a figure based on a meta-analysis of biome level carbon stocks by Gibbs *et al.* (2007). Since the exchange rate at the time of the study was roughly 11 pesos to the dollar subjects were given the round figure of 200 pesos per hectare. The remaining half of the participants were not given this figure. The following questions asked first about a payment for conservation and payment for reforestation. First, subjects were asked to give an amount per hectare per year that should be paid for carbon sequestration within the certified Community Conserved Area (CCA). This question was asked with the context of their currently receiving payments for 4,000 hectares while 5,000 hectares remain without payments in the case of Santa Cruz. In San Pedro 3,000 hectares receive payments and they have 1,300 hectares without payment in their CCA. When a response was received for how much should be paid, the subject was



asked what was the least they would be willing to accept. Of the 82 subjects who were asked this question, 79 eventually gave a response. In most cases, the response was difficult to obtain because subjects were reluctant to give an opinion on something they thought should be a community decision. Interviewers explained that the responses would be confidential. Subjects were asked to give the response that they would suggest to the Assembly if this topic were being discussed or the amount that they would vote for in the Assembly if it came to a vote.

The next set of questions asked the subject what should be paid per hectare per year to plant trees. During the pre-test we discovered that the corn fields are communal and thus respondents were unwilling to give an amount due to the fact that it is something that would have to be determined by the Assembly and it would be unlikely that the Assembly would decide to remove land from the agricultural zone for conservation because so much territory is already under conservation, and corn fields have to be held fallow for at least four years. Because of this we asked the question in terms of how much they would be willing to accept to give up their coffee fields for conservation. Since the coffee plots considered as though they were private property, individual subjects were able to give a response. We specified that they would have to be forest trees and not fruit trees.

In San Pedro we also added a question about willingness to accept to plant trees where there is currently only bracken fern. This was added because here is an area that is neither forest nor agricultural land. Santa Cruz did not have an area which was not either agriculture or forest. Also, in the first few interviews we saw that the people in San Pedro were generally unwilling to consider giving up their agricultural lands. This is

most likely due to the fact that so much of their land, an estimated one third, is unusable because of the bracken fern and they already have to walk long distances to get to their fields.

We had several difficulties in obtaining survey results. For example, the household incomes are difficult to capture for many reasons. First, many income generating activities are intermittent and people are unsure about how much they make for particular activities. Also, the subjects do not keep track of costs and income from regular activities such as stores or the sale of bread. We are also told by our guides that the subjects are unwilling to give accurate answers because they are afraid that they will lose some of their government assistance if it seems as though they have too much money. Even though we informed them that we were not from the government and that all the information that we received is confidential, the subjects did not always trust us. The guides helped us by reminding subjects of activities that they have not mentioned or by informing us later of information that we were not given. The most frequent information that was withheld was whether or not they own cattle and whether or not they receive remittances. There is thus a margin of error in income calculations but it is difficult to specify how large

Guides were present for all structured surveys. Very frequently they were required to translate questions and responses between Spanish and Chinanteco. It is not clear how much might have been lost between translations. In Santa Cruz five guides were used and one in San Pedro. Each guide was trained before assisting with the surveys. The guides were told the significance of each question, what information they

were allowed to give the subject to aid them in answering the question and encouraged not to lead the subject into any particular answer.

All monetary data were collected in Mexican pesos. When the results are presented they will be presented in pesos with us dollar amounts following in parentheses. The average exchange rate for June 2010 when most of the data were collected was 12.73 pesos to one US dollar. This is the exchange rate that will be used through the paper.

## **Analysis**

Structured survey data was analyzed using two different statistical packages, SPSS and Stata 9.0. Summary statistics and most graphs were created using SPSS. The statistical package Stata 9.0 was used to run multivariate regression analyses and to empirically estimate household willingness to accept (WTA) for the described conservation payment programs. The Heckman selection model considers the factors that influence whether or not an individual was willing to participate in the described program and what factors influenced the amount they were willing to accept. Because only those who were willing to participate named a price they were willing to accept, I needed a regression that did not have a selection bias from the self-censored sample. This is why the Heckman Selection Model was used (Heckman 1979). Other studies on WTA have used the Heckman Selection method to eliminate selection bias (Devkota and Paudel 2009).

### CHAPTER III – RESULTS OF INTERVIEWS AND SURVEYS

In this chapter I will present the results of the informal interviews, semi-structured surveys and structured household surveys. The results will be organized into sections which address the history of the *Pagos por Servicios Ambientales – Hidrológicos* (PSAH), decision making and funds distribution in the community, community approval of the program, household income effects, and the future options for the program.

Six semi-structured surveys were conducted in San Pedro and six in Santa Cruz. Informal interviews were conducted throughout the seven week study period. All of the twelve semi-structured surveys were conducted with male respondents. Women were not interviewed because only men hold higher up authority positions in the communities.

**Table 3.1:** Summary statistics of structured survey respondents

<b>Community</b>	<b>No. of interviews</b>	<b>No. Male</b>	<b>No. Female</b>	<b>Mean age</b>	<b>Average income</b>	<b>Average number of residents in household</b>
Santa Cruz	59 (67%)	47 (80%)	12 (20%)	54.52	26,979.24 (2119.34)	3.62
San Pedro	29 (33%)	19 (66%)	10 (33%)	43.73	33,085.86 (2599.05)	5.38
Total	88 (100%)	66 (75%)	22 (25%)	50.92	29,014.78 (2279.24)	4.21

In total 88 structured surveys were conducted at the household level. Table 3.1 provides an overview of the individuals interviewed. In total, seventy-five percent of the interviews were conducted with males. Generally, males are the heads of household. Interviews were conducted with the women in the house only if the male head of household were absent or unavailable. The mean age of respondents was 50.92 years, the

**Table 3.2a:** Variable names and descriptions

<b>Variable</b>	<b>Description</b>
CARGO	If the respondent has had a leadership position in the community (0=no, 1=yes)
RESIDENTS	The number of individuals that live in the home of the respondent
EDUCATION	The highest level of education in the house (1=preschool, 2=primary 1-3 <sup>rd</sup> grade, 3=primary 4-6 <sup>th</sup> grade, 4=secondary school, 5= preparatory school, 6= university, 0= did not attend)
GENDER	1=male, 2=female
CARBMARK	If the investigator explained carbon market price to the respondent (1=yes, 2=no)
EQUALDIST	If the respondent believes the payments are distributed in an equal manner among members (1=yes, 0=no)
USEFUND	If anyone in the house had requested money from the fund kept in the bank (1=yes, 0=no)
CHILDOUT	The number of children who live outside of the community
AGREEDIST	If the respondent agrees with the way the community uses and distributes the money received (1=yes, 0=no)
ECONIMPROVE	If the respondent felt that their economic situation had improved because of the payments (1=yes, 0=no)
COMMUNITY	1= Santa Cruz, 2=San Pedro
CHILDREN	The number of children under the age of 15 who reside in the house of the respondent
ELDERLY	The number of elderly over the age of 59 who reside in the house of the respondent
REMITTANCE	If the household receives income from remittance (1=yes, 0=no)
TOTALPES	The total amount, in pesos, the household received in PES. In Santa Cruz, this does not include the distribution of the funds from the bank
TOTALINCOME	The total household income in pesos
%GOV	The percentage of income that comes from government programs not including PES
PAYENOUGH	If the respondent believes that the 400pesos the community receives per hectare per year from the PSAH is sufficient (1=yes, 0=no)
COFFEEHA	Total number of hectares of coffee owned by residents of the house
WORTHRESTRICT	If the respondent believes that the payments are worth their restrictions on land use change (1=yes, 0=no)
COFFEETOTAL	Total income from coffee the previous year
CROPTOTAL	Total income from non-coffee crops last year

mean age was slightly higher in Santa Cruz than San Pedro. San Pedro reports a slightly higher mean household income than Santa Cruz but also has a larger average household size.

The variables used in the analyses are listed and described in Table 3.2. Important results from these variables will be described throughout this chapter. The following pages will describe the important finding from the household surveys, semi structured surveys and the interviews. Table 3.2b gives summary statistics for each of the variables described in table 3.2a. The importance of these statistics will be described through the chapter.

## **PROGRAM BEGINNINGS; EVOLUTION OF COLLECTIVE ACTION TOWARDS CONSERVATION AND PARTICIPATION IN THE PSAH**

The Oaxaca based NGO *Geoconservación* was instrumental in the participation of the CORENCHI communities in the PSAH program as well as the decision by the communities to declare significant parts of their territories as community conserved areas (CCAs). The communities had not been systematically practicing “conservation” in the modern sense before. Nonetheless, traditional agricultural practices, emigration, the many parts of the community territory too high in altitude for cultivation, and apparent traditional protection of some stands of mature pines in the agricultural areas had resulted in large areas of relatively intact forests. Land-use zoning and issues relevant to conservation did not become systematically addressed until the 1990s and early 2000s. Ecologists who began to work in the region in the 1990s introduced the concepts of the scientific value of the plants in their region and notions of modern conservation. In 2000,

**Table 3.2b:** Variable names and summary statistics.

<b>Variable</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
CARGO	0.53	.501	0	1
RESIDENTS	4.21	2.17	1	11
EDUCATION	3.29	1.24	0	6
GENDER	1.25	.44	1	2
CARBMARK	1.58	.50	1	2
EQUALDIST	.85	.36	0	1
USEFUND	.442	.50	0	1
CHILDOUT	2.8	2.85	0	10
AGREEDIST	.822	.385	0	1
ECONIMPROVE	.839	.370	0	1
COMMUNITY	1.33	.473	1	2
CHILDREN	1.25	1.69	0	7
ELDERLY	.659	.829	0	2
REMITTANCE	.379	.488	0	1
TOTALPES	7126.437 (559.81)	6209.341 (487.77)	0	32000 (2513.75)
TOTALINCOME	29014.78 (2279.24)	14450.46 (1135.15)	7040 (553.02)	81830 (6428.12)
%GOV	0.44	0.21	0.05	1
PAYENOUGH	.213	0.411	0	1
COFFEEHA	2.28	1.41	0	8.5
WORTHRESTRICT	0.72	0.45	0	1
COFFEETOTAL	2108.36 (165.62)	3497.87 (274.77)	0	24000 (1885.31)
CROPTOTAL	796.48 (62.57)	2323.24 (182.50)	0	17400 (1366.85)

an Oaxacan NGO, Estudios Rurales y Asesoría (ERA) was contracted with funds from a Government of Mexico-World Bank forestry program to carry out a land use zoning exercise (*ordenamiento territorial comunitario*) in the community (ERA 2000). In

Mexico, this has been a commonly used methodology as a first step towards land use with important conservation implications. The land-use planning resulted in three distinct zones. The first zone is the urban zone which is a small part of the territory and the only place that community members may reside. In Santa Cruz the urban zone makes up only 0.5% of the total territory (ERA 2000). The second zone is the much larger agricultural zone which contains corn fields, *acahuales* (corn fields in the resting phase of rotation) and coffee fields as well as some large stands of mature pines (*Pinus chiapensis*) which have been planted by community members. In San Pedro there is also a large area of the agricultural territory which is covered by bracken fern, as mentioned previously. High estimates indicate that as much as a third of San Pedro's territory is covered by this fern. The third zone is the conservation area, which is the largest area. This land use zoning was entirely internal.

During the period of the 1980's in Santa Cruz a community rule was passed which required community members to request permission before cutting trees. Other community rules called for keeping animals fenced in and keeping the paths within the community clean. In 2003 construction on the road leading to Santa Cruz was completed. In 2001, when the road had reached a stand of pine, the community had support to draw up a logging management plan, and logging was conducted for a year or two. But the community leader at the time absconded with funds from the sale and the community reaction was to stop all logging. One prominent community leader on conservation issues adamantly insists that the culture of conservation and the actions they have taken came purely from themselves rather than from NGO or government intervention. He argues that the original incentives to conserve came not from outside



actors but from their own desire to protect the health of the community members and secure continued access to the resources that come from the forest.

Prior to enrolling in the Payments for Hydrological Services (PSAH) program, the communities had experience with the concept of the value of environmental services. Dr. Julia Carabias, the director of a national NGO and later Secretary of the Environment of Mexico from 1994-2000 told the community in the in a visit in the early 1990's that they should take care of their forests because it may someday bring a benefit to them. From 2001-2003 the community received payments from the NGO Ambio to build tree nurseries and plant trees where the forest had been accidentally burned from traditional slash and burn agricultural practices, a pioneering effort at community-based carbon sequestration. In this program the community made the commitment to plant 15,000 trees for M\$8,000 a year for the purpose of sequestering carbon<sup>1</sup>.

In the 2003-2005 period, *Geoconservación* supported the communities in two significant conservation oriented initiatives, first seeking "certification," i.e. a newly created procedure for official government recognition for their conserved areas through the national protected areas commission, CONANP and second, enrollment in a new government PSAH program as a way for Santa Cruz and San Pedro to receive money for the conservation in which they were already active. They thought that this will give the communities motivation to continue conserving. The first step toward participating in the CONAFOR program of PSAH that the communities took was to have the forests certified

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<sup>1</sup> A large section of these trees were later lost when the road was extended to the community of San Antonio del Barrio.

as community conserved areas (CCAs) through CONANP<sup>2</sup>. Though this certification was not a requirement, it gave CONFAOR proof and assurance that the forests existed and also that they were being protected. The decision to declare a community conserved area was not unanimous but faced opposition by those with interest in cattle or possibly forestry. The declaration of the CCAs represents the first time the communities had to make any large, long term communal decision about land use and set the precedence for collective action on conservation decisions.

The second step towards gaining participation in the PSAH was that the communities of Santa Cruz and San Pedro had to formalize an alliance between themselves and other local communities. Within the communities, collective action had been strengthened and trust in conservation oriented leaders reinforced through working towards participation in the PSAH program. This newfound social capital within the communities helped form the basis for creating social capital between communities. All of the communities which now form CORENCHI<sup>3</sup> were having similar difficulty attracting the attention of the municipality and federal aid agencies. Santa Cruz previously had a strong relationship with the community of San Antonio del Barrio and San Pedro Tlatepusco which had a strong relationship with Santiago Tlatepusco because of their location in the same watersheds. Even with these informal connections, there has been a history of disputed over territory boundaries and some mistrust so that there had previously been no tradition of inter-community organization. With the promise of the PSAH and incomes from conservation, intercommunity trust was strengthened enough to

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<sup>2</sup> The certification procedure and official recognition of CCA's as part of the natural protected areas system was formalized as part of a 2008 modification to the environmental laws of Mexico (LGEEPA).

<sup>3</sup> The seven communities in CORENCHI are Santa Cruz Tepetotutla, San Pedro Tlatepusco, San Antonio del Barrio, Santiago Tlatepusco, San Antonio Analco, Nopalera and Vega del Sol.

trust each other to work towards PSAH participation. Through collective action, they organized CORENCHI and gathered enough political force to be noticed and given the opportunity to work with CONAFOR in the PSAH program. In a series of meetings, they decided to work together to help deal with the common problem of attracting attention from the municipality. In 2004, they signed an accord between the original four communities in order to develop common rules about conservation, a significant step towards regional land use planning. With the leadership of some community members, the communities formally created CORENCHI in order to take advantage of the CONAFOR programs and the PSAH program. The intercommunity organization of CORENCHI was not required by CONAFOR but gained them enough attention to be able to take advantage of the program. Once this alliance proved to be successful, the nearby communities of Nopalera and Analco joined CORENCHI. Because the forests owned by the CORENCHI communities are all extensions of the same forest, these communities were also able to access the PSAH program.

In order to enter the PSAH the some community leaders had to put forth some effort towards it. First, they had to convince the community members that this was the right course of action for them. According to the then president of the *comisariado* of San Pedro, they chose to enter the program so that they had more of a force to continue conserving. They felt they needed to take advantage of this program because they had never been offered money for what they were doing before and, if they did not join now, maybe never would be offered money again (interview with Felipe Martinez Osorio, July 10, 2010). In both communities the land was already conserved and they had made the decision to accept the certification as a CCA so there were few additional restrictions or

work that had to be done to make themselves eligible for the PSAH and for this reason some in the community were willing to enter the program. In both communities, some members had to be convinced. This was accomplished by holding assemblies with representatives from CONAFOR and *Geoconservación*. To enroll the communities the authorities had to travel to Oaxaca as much as twice a month to attend workshops and meetings and to sign paperwork. During this period the cost of this travel either had to be paid by the leaders themselves or by voluntary contributions by community members. This travel, and increased numbers of community meetings, represented the transaction cost of entering the PSAH program.

The only stipulation of the PSA that comes from CONAFOR is that there is no change in land use. To ensure that this is complied with both communities now must build fire breaks around the corn fields before they are burned in preparation for planting. The fire breaks are a practice that existed before entering the PSAH program but not to the same extent. Occasional surveillance of the conservation area must be done to ensure there are no fires and that no outsiders have entered the forest to hunt or cut wood. Both communities have made signs to mark the project area and both have built surveillance towers to watch for fires. Additional regulations (*estatutos comunitarios*) on forest use and behavior have been set by the community but are not requirements of the PSAH program. Regulations include the ban on hunting except for pest animals in corn fields, restrictions on trash disposal and rules about the upkeep of home and yard. Thus, collective action existed within the communities around conservation and lead to the creation of inter-community organization and strengthened social capital in the form of CORENCHI in order to take advantage of new opportunities for conservation.

Agents from CONAFOR arrive in the community twice a year. One visit is to observe the forest and the second is to deliver the money for the year. On the observational visit they walk through the forest and take pictures to make sure that there has been no change. Additional observations are made via collecting satellite images of the canopy cover of the forest.

**Table 3.3:** Total quantity in pesos (and US dollars) received by Santa Cruz and San Pedro from the PSAH.

<b>Community</b>	<b>Period</b>	<b>Total Area (ha)</b>	<b>Amount for 5 years in M\$ (US\$)</b>	<b>No. of years that have been paid</b>
Santa Cruz	2004-2008	2,534.80	5,069,604.38 (398,240.72)	5
	2007-2011	1,398.13	2,652,923.69 (208,399.35)	3
	2009-2013	1,543.37	3,326,342.46 (261,299.49)	1
San Pedro	2004-2008	2,534.80	5,069,604.38 (398,240.72)	5
	2007-2011	1,443.24	2,770,101.71 (217,604.22)	3
	2009-2013	1,504.53	3,209,394.88 (252,112.72)	1

<b>Community</b>	<b>Total area (ha) in 2010</b>	<b>Amount in M\$ (US\$) received up to 2010</b>
Santa Cruz	2,941.50	7,326,627.09 (575,540.23)
San Pedro	2,947.77	7,373,544.39 (579,382.91)

Both San Pedro and Santa Cruz entered the PSAH in 2004. In 2007 both communities received expansions of their program areas. The first payments expired in 2008 and a portion of the area was renewed for the program period of 2009-2013 (Table 3.3). The total pesos received by Santa Cruz and San Pedro from the first payment in

2004 to the disbursement of December 2009 were M\$7,326,627.09 and M\$7,373,544.39 respectively.

## **DISTRIBUTION OF FUNDS**

The funds from CONAFOR were given in a single payment to the community rather than in individual payments to each community member. The single payment is made possible thanks to the communal land tenure system of *comunidades* and *ejidos* in Mexico and where CONAFOR is able to distribute money in this manner, immediately eliminates equity concerns of funds going only to rich land owners that is experienced in other programs (Wunder *et al.* 2008, Kosoy *et al.* 2007). Each *comunidad* or *ejido* participating in the PSAH has the ability to determine their own methods of distributing the funds among members. Alix-Garcia *et al.* (2009) found that of the *ejidos* studied, 18% distributed all of the funds directly to the *ejido* members, 22% used all of the money for conservation related forestry activities, 18% gave the full amount to investments in non-forest related public goods and the remaining 42% invested the funds in a combination of those three strategies. *Geoconservación* was influential in this decision in the CORENCHI communities. Another government payment that community members receive is PROCAMPO, a corn subsidy, which is given directly to the individual corn producers. The communities and *Geoconservación* knew from this experience that the money from PROCAMPO is gone days after it is received and often spent on things outside of the program goals, such as alcohol. In order to try to avoid this with the PSAH payments, *Geoconservación* promoted a 10- 20- 70 scheme in the communities in which 70% would be available to the individual community members but not directly

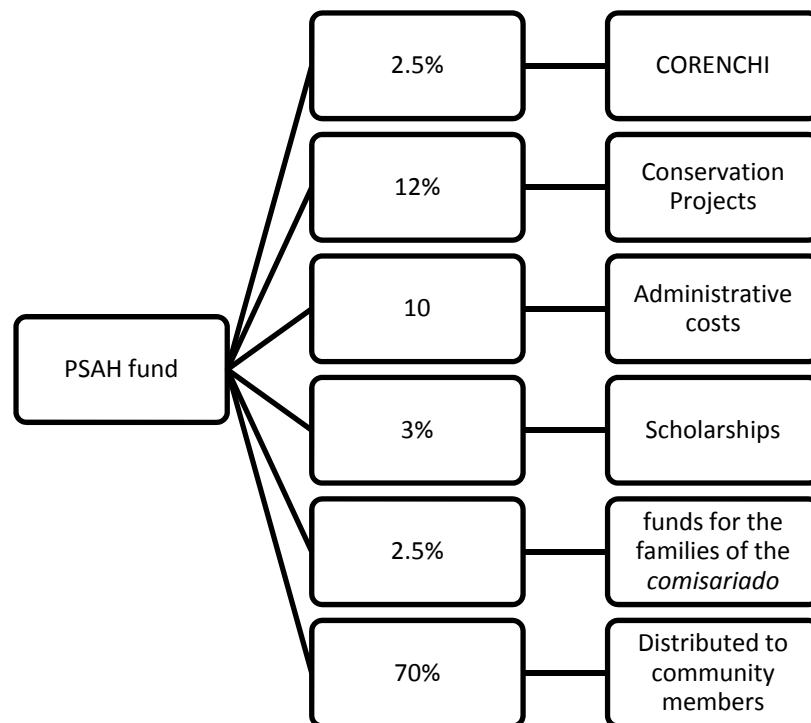
distributed, 20% used in community and conservation projects and 10% used for costs of the community leaders.

In San Pedro the community members wanted to see a larger part of the money distributed directly to the community members in cash payments with only the community funds held in a bank account, so they adopted a scheme in which 80% goes to the community members and 20% is kept for costs of community leaders and community projects. That community members receive payments is important because it gives them individual incentive to comply with the restrictions of the program (interview with Felipe Martinez Osorio, July 12, 2010). In Santa Cruz there are more community members than San Pedro and if the money were given evenly to each member no one person would receive very much. Community leaders argued that in the first year if they distributed the money it would be M\$16 a day per family which isn't enough to buy everyone a soda. In Santa Cruz the Assembly decided to distribute as cash a symbolic amount, but the remainder would be used to establish an interest generating savings account to which every community member contributes and has access. Each community member has an amount in the bank that pertains to them and they can request the money in cash for such things as medical emergencies, doctor's bills, home improvements and other situations upon approval from the *comisariado*. For example, access to funds has been granted for the repayment of debt or to pay for a community member to immigrate to the United States. Whether or not this money is given is at the discretion of the *comisariado* and no one is allowed to take out all of their money except in the case of medical emergencies. Community members are not allowed to remove their entire fund because they would no

longer be contributing to the interest gain and thus would not be allowed to benefit from the projects that use the fund.

During the sessions of CORENCHI in the first months of 2010, the decision making on fund distribution was addressed at the regional level. The communities asked CORENCHI to determine a distribution scheme that the delegates took to their respective communities to be approved by the Assembly (Figure 3.1). The plan proposed by CORENCHI keeps the 70% for payments to community members either directly or in savings and 10% for costs of the *comisariado* but then breaks the remaining 20% into smaller categories. Two and a half percent must be given by each community to CORENCHI so that the organization can function with its own budget. In addition, 12% should be used for conservation projects, 3% given as scholarships to students wishing to

**Figure 3.1:** Distribution of funds proposed by CORENCHI

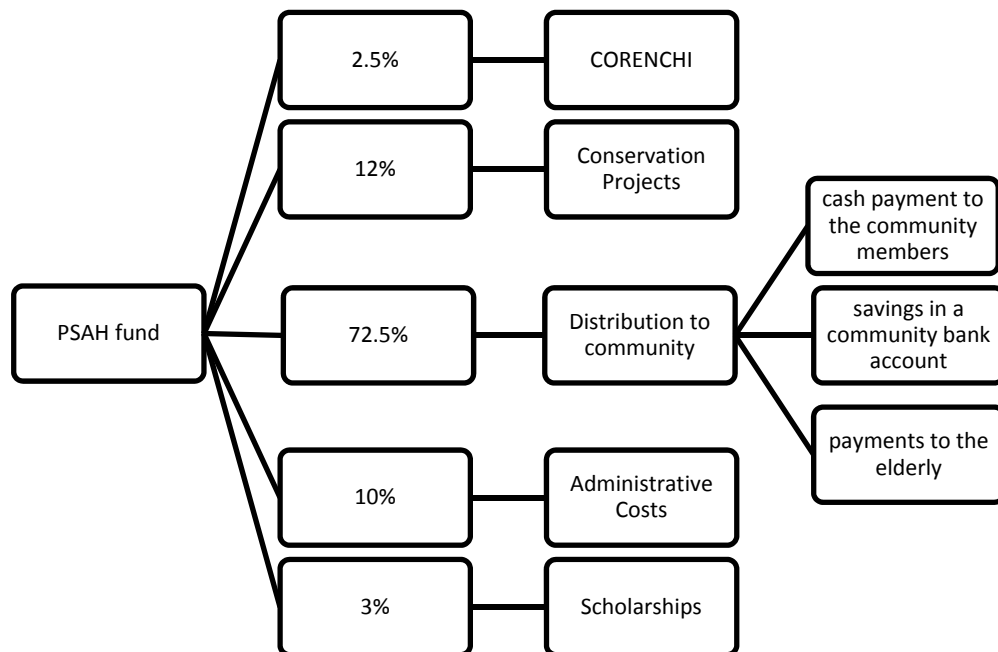




study beyond that which is available in the community and 2.5% given to the families of the members of the *comisariado* to buy food and to compensate for work lost during their service to the community. The contributions to the families of the *comisariado* and to CORENCHI help to strengthen social capital by allowing CORENCHI to function without requesting money periodically from the community and by allowing to members of the *comisariado* to devote more time and energy to their public service without worrying about their families suffering as a result.

Santa Cruz adopted the scheme set forth by CORENCHI with a few modifications (Figure 3.2). The Assembly decided not to give 2.5% to the families of the *comisariado*. The president of the *comisariado* in Santa Cruz for the 2007-2010 period was accused of stealing money from the community. The money stolen was not from the PSAH funds and, when the theft was discovered, the president was made to pay the money back. This

**Figure 3.2:** Distribution used in Santa Cruz (after approval from the Assembly)



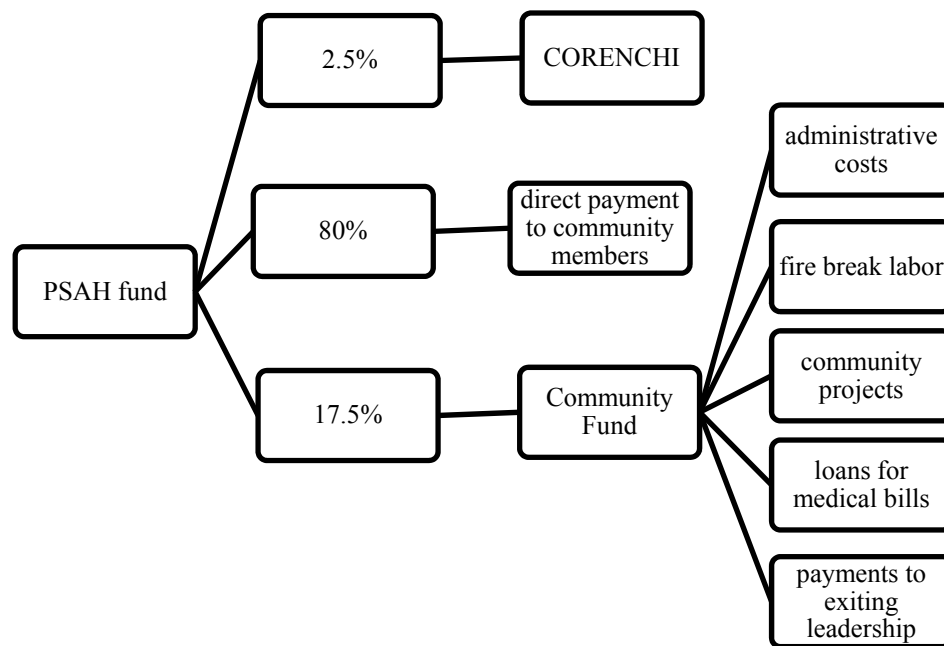
resulted not only in the president losing his position but in the community losing some trust in the authorities. At this point the Assembly decided that the money that had been saved in the account should be withdrawn from the bank and distributed to the community. Married couples received M\$20,000 and individuals M\$10,000 minus any amount they may have used prior to this date. The date of this distribution could not be agreed upon by community authorities but presumably happened sometime after the 2009 disbursement in December of 2008 but before the 2010 funds arrived in December of 2009. This incident also caused enough mistrust in the authorities to cause the Assembly to vote against giving any part of the conservation money to the families of the *comisariado* as a compensation for their service to the community. Also, the 72.5% which goes directly to the community members is not given in direct cash payments. Instead a small amount, M\$500/person during the study year, is given in cash and the remainder, M\$1,500/person is saved in the communal bank account. The elderly receive their full payment in cash in small increments over the year. The idea is that they will not benefit from the interest accrued from saving the money and thus do not need to contribute.

In Santa Cruz the money that is in the account can be requested if the individual has need. A request must be made to the *comisariado*. If the money is needed for a medical emergency up to 100% can be taken from the account. For all other uses, including non-emergency medical uses, up to 50% can be used. Of the 59 households surveyed in Santa Cruz, 38 (64%) had asked for money from this fund one or more times. Thirty-three of the households used the money for medical costs including medicine, six

used the money to make home improvements and 9 used the money for other purposes such as education, clothing, food and repaying debts.

San Pedro also did not adopt the CORENCHI proposal and introduced its own modifications. The Assembly in San Pedro preferred to keep a scheme similar to the

**Figure 3.3:** Distribution in San Pedro (after approval from the Assembly)

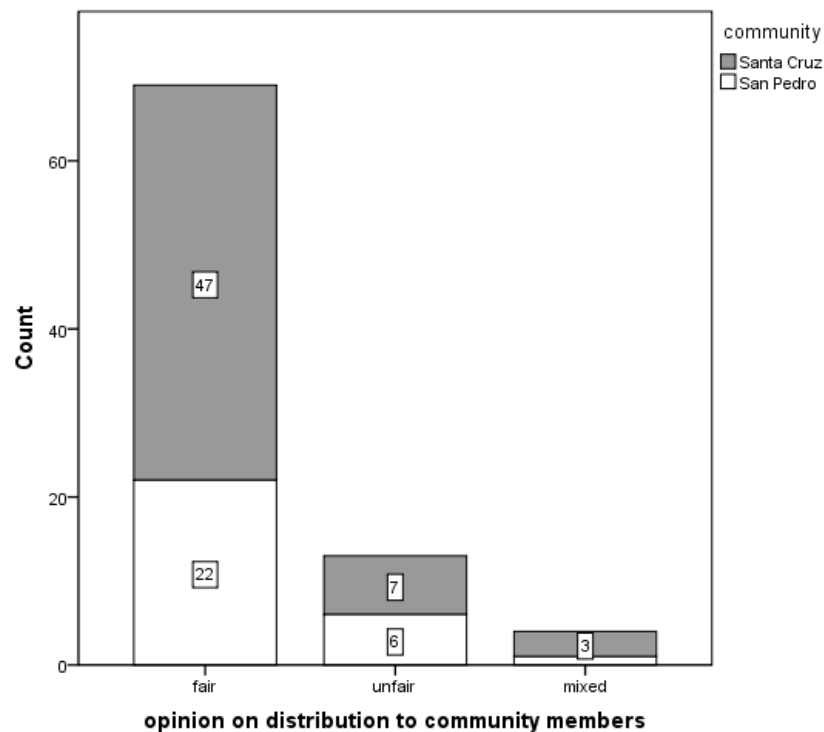


original 80/20 distribution, but including the payment to CORENCHI (Figure 3.3). This is for several reasons. San Pedro has roughly a third of the population of Santa Cruz but receives slightly more money from the PSAH. This means that when the money is split up among community members it is a larger amount per family than when it is split between community members in Santa Cruz. At the Assembly the community members decided that they would rather have the money themselves than keep it in a bank account. Since they give the money directly to the community members, money from the fund can

only be requested by an individual in the cases of health emergencies. When money is given it is given as an interest free loan and must be repaid.

Within the twenty percent kept for the community there is money programmed in to pay day wages for working on fire breaks, creating paid employment in the community and an additional source of income for some members. The bracken fern burns hot and there is always a risk that a fire set in a corn field may escape into the bracken fern and be carried into the forest. With the CCA and the PSAH the community cannot allow fires to escape into the forest. Before fields are burned to plant corn fire breaks must be built and the labor of the whole community is needed. Even individuals who are not *comuneros* receive money to work on the fire breaks, resulting in benefits of the PSAH spilling over

**Figure 3.4:** Community opinion on the fairness of the distribution of funds from the PSAH



to non-community members who cannot benefit directly. This is an encouragement to participate in community work and also to stay and work towards becoming a community member. In the last year M\$2000 from the community fund was given to every house for chicken wire to fence in their chickens. In August of 2009 every individual who worked the *tequios* (community work days) was given M\$8000. If individuals worked less or did not work at all they received M\$4000 or nothing. This payment was also given to individuals who are not *comuneros* provided that they had participated in the *tequios*.

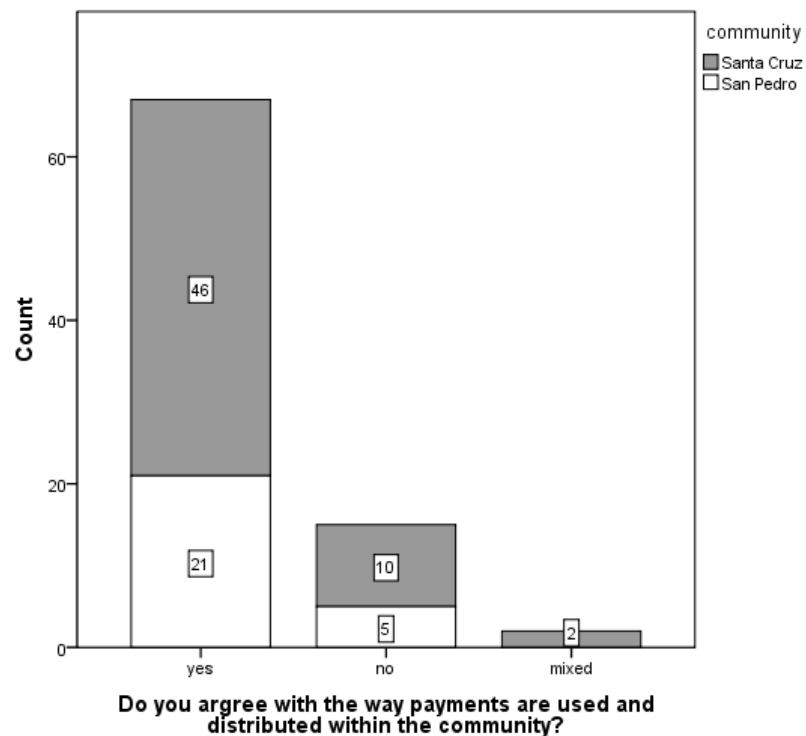
### **COMMUNITY PERCEPTION OF THE PSAH**

In the household survey, subjects were asked if they agreed with the way money was distributed to the community members (Figure 3.4). Opinion within the communities was primarily positive towards the equity of the distribution of the funds. Those who could neither approve nor disapprove of the distribution claimed to have no knowledge of how much others in the community were receiving. Three subjects in Santa Cruz and one in San Pedro did not consider the distribution fair because single individuals and the elderly did not receive as much as a married couple. In one case in San Pedro, the household did not receive payments because the head of household declined a leadership position he was assigned because of, according to him, a misunderstanding and mistakes in documentation. One woman interviewed in Santa Cruz disagreed because even though she and her husband both receive a quantity of money, both parts are given to her husband and he does not give her portion to her. In her opinion, the *comisariado* should give her husband his half and she should receive hers. A second female respondent in Santa Cruz disagreed because even though she is a

*comunera* and her husband not an official community member, the *comisariado* requires that she sign for the money but then gives the money to her husband. This indicates that women may not be benefiting equally as men under the rules of distribution. Those who qualified their agreement with the way the funds are distributed to community members stated either that everyone receives equal or that the distribution was determined by the Assembly and thus they have to approve.

The survey asked the subjects if they agree with how the funds from the PSAH are allocated within the community, i.e., if they agree with the schemes outlines in Figures 3 and Figure 4. Again, opinions were overwhelmingly in agreement with the distribution determined by the Assembly (Figure 3.5). In Santa Cruz 79% agreed while 4% were unsure and in San Pedro 81% were in favor of the distribution. Those who

**Figure 3.5:** Opinion regarding the allocation of funds within the community.



qualified their agreement either stated that they agreed because it was voted on by the Assembly or that they approved because if the funds were not used for such things, particularly the costs of the *comisariado*, that the people would have to contribute the money out of their pockets. The small percentage who disagreed had various reasons for disagreement. A female subject in Santa Cruz believed that some of the money should be allocated towards the schools and health center, neither of which is currently considered in the distribution in Figure 3.2. In both Santa Cruz and San Pedro subjects disagreed with how the money was being allocated because there was no transparency in how much the *comisariado* was using and on what. Other respondents thought that all of the money should be distributed to the community members directly without keeping aside some for community costs and projects. One respondent in San Pedro did not think the community should give any money to CORENCHI because, in his words (translated), “if the money is ours it should be ours.”

When asked if the payments from the PSAH were worth the restrictions placed on use of the forest, seventy two percent of the respondents to the surveys responded in the affirmative. Though seventy two percent is fewer than those who agreed with the equity of the distribution (85%) and those who agree with the way the funds are distributed among uses in the community (82.2%), it is still largely positive in favor of the PSAH program. These three variables, along with whether or not the respondents feel they are better off economically because of the payments from the PSAH (83.9%), a variable which will be discussed in more detail below, show an overall positive perception of the PSAH program among community members. The only variable which indicated dissatisfaction with the PSAH program was whether or not the payments received are

enough for the service that is being provided. In this case only 21.2% of the respondents gave a positive response. Many believed that, although they agree with how the money is being used in the community, that they are personally better off because of it, and that the money is worth the additional restrictions on forest use, that they should be receiving higher compensation.

### **USES OF FUNDS IN THE COMMUNITY AND IMPACT ON HOUSEHOLDS**

The funds from the PSAH have been used differently at the household and at the community levels. In Santa Cruz, the community fund created with the money accrues interest as it sits in the bank. This interest can be used for community activities that fall outside of the scheme described in Figure 3.2. The PSAH funds were used in Santa Cruz to help buy the community van and also to finish the ecotourism station that was initiated by Fundación Modelo.

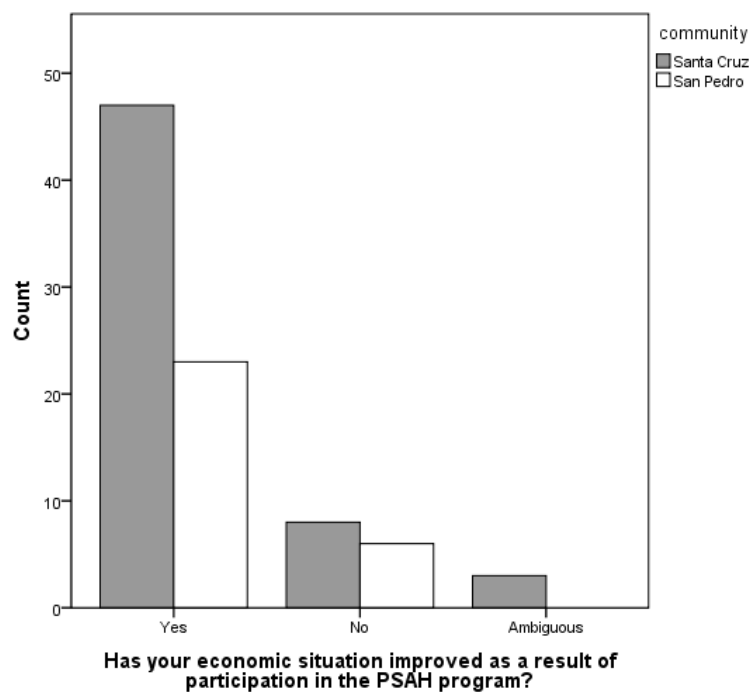
In San Pedro the community has used the funds from the PSAH to put up signs delineating the conservation area. Also, they pay for meetings held in their community or for the authorities to travel to meetings. The fund is also used to pay day wages for workers who are constructing the fire breaks. They have bought hoses to improve the potable water system in the community and have given money to individuals to build fences for chickens to improve public sanitation. As part of the conservation efforts groups are sent into the forest to look for poachers and fires. The day wages and expenses of these workers are paid from PSAH.

In both communities the fund has been an important resource for the *comisariado*. Participation in the PSAH requires higher transaction costs in the form of travel than



before to attend meetings and workshops and to deal with PSAH related paperwork in the cities of Tuxtepec and Oaxaca. Previously if the authorities had to travel the community members would each give money to help pay for the trip. With the funds from the PSAH the authorities can make these trips without asking for money, another positive impact on household incomes. The funds have also made the formation of CORENCHI not only necessary but possible and the funds are now helping to pay for meetings and activities.

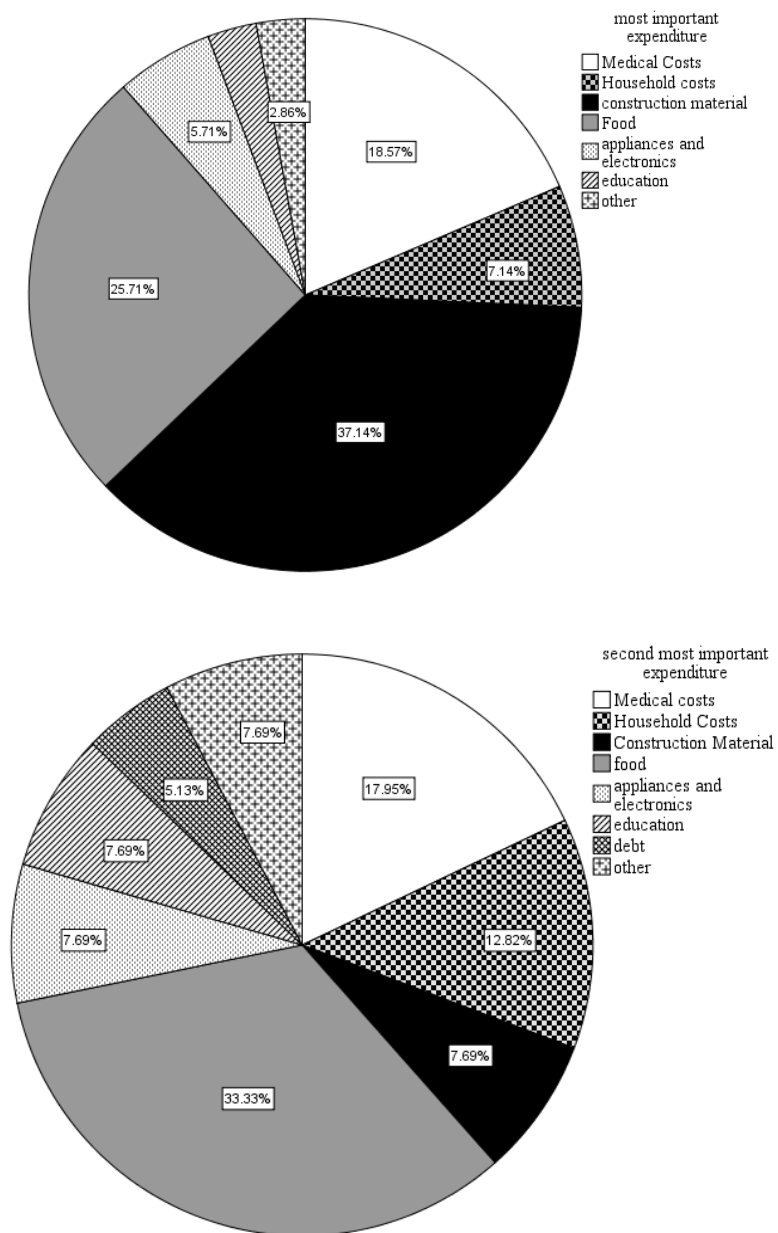
**Figure 3.6:** Perceived improvement in economic welfare as a result of participation in the PSAH



The funds have been put to use by individuals as well. In Santa Cruz 38 of the 59 households surveyed used money from their fund in the bank. In San Pedro of the 29 households interviewed, 8 had asked for loans from the PSAH funds for medical bills and of those, four received or accepted the loan. Most of those who responded to the survey, 83.9%, agreed that their economic situation had improved and that they are better off

financially now than they were before the PSAH payments (Figure 3.6). A few subjects in Santa Cruz felt that they were in the same financial situation as before. Several subjects felt that they are worse off because of the payments. The reasons stated for this

**Figure 3.7:** The first and second most important uses of the payments as reported by survey respondents.



negative response centered around restrictions on the forest such as an inability to hunt and decreased yields from using less crop land more intensively, so for some community members opportunity cost seems to be higher than for others. One of the most common uses of the PSAH money is the purchase of food (Figure 3.7) which may be a result of lower crop yields and hunting restrictions. It is important to note that, though attributed to the PSAH by some of the respondents to the survey, the crop rotation and restrictions to the agricultural zone as well as the hunting ban are self imposed community regulations and not required by the PSAH program. Only a portion of the forested land in the territory of either community is enrolled in the PSAH as a result of hectare limits. The restriction in hunting is also internally imposed in the communities and not a stipulation of the PSAH program.

The survey asked respondents to list the first and second most important items or services that they have purchased using the funds from the PSAH. The three most mentioned uses of the money were reported to be housing improvements, food and medical costs (Figure 3.7) and the three most common second purchases were food, medical costs, and household expenses (Figure 3.7).

In San Pedro, participation in the PSAH has allowed people to trade traditional mud floor thatched roof homes for cement floors, concrete walls and roofs (Figure 3.8). Also, before the payments were received, most community members only had income in lump sums when there was a harvest. The money from the PSAH provides money that can help residents meet needs between harvests, thus smoothing out the flow of income.

**Figure 3.8:** Traditional thatched roof home and new cement and tin home in San Pedro



Poverty in Mexico is defined in three levels by SEDESOL based on the average household income in pesos per person per day: nutritional poverty, capability poverty and asset poverty (SEDESOL 2002). In Santa Cruz, the average income per person per day including money received from the PASH program is well above all three levels of poverty at 32.5 pesos per person per day. In San Pedro the average income per person per day is 18.97 pesos, which is above nutritional poverty, barely above capability poverty and below asset poverty (Table 3.4). In the table, mean household income per person per day without PES is used as a comparison in order to determine the impact of the PSAH program on poverty. This number was determined by taking total annual income and subtracting total income from PES, dividing that by the number in the household and dividing that by 365 days and averaging the household results.

**Table 3.4:** Mean Income and Poverty Levels. Mean household income per person per day in Santa Cruz and San Pedro compared to national poverty levels in pesos (and US dollars) per person per day with PES income and without PES income

	Community	Mean household income per person per day in pesos (US\$)	Maximum household income per person per day in pesos (US\$).	Minimum household income per person per day in pesos (US\$).	Nutritional Poverty	Capability Poverty	Asset Poverty
PES	Santa Cruz	32.5 (2.55)	82.79 (6.50)	7.31 (0.57)	15.4 (1.21)	18.9 (1.48)	28.1 (2.21)
	San Pedro	18.97 (1.49)	46.96 (3.69)	4.12 (0.32)			
NO PES	Santa Cruz	20.43 (1.60)	65.44 (5.14)	5.22 (0.41)	15.4 (1.21)	18.9 (1.48)	28.1 (2.21)
	San Pedro	11.2 (0.88)	34.62 (2.72)	2.79 (0.22)			

## INDIRECT BENEFITS OF PARTICIPATION

Through informal and semi-structured interviews non-monetary benefits of the PSAH also became clear. The receipt of the payments has bolstered belief that conservation pays and will ensure that community members will want to continue conserving as well as increased trust in the leadership, trust in CORENCHI and inspired collective action at the intercommunity level. Felipe Martinez Osorio (president of the *comisariado*, interview July 12, 2010) stated that he has noticed it raining more since they began conserving, indicating a beneficial change in weather. True or not, this indicates a positive perception of changes attributed to participation in the PSAH program. The resources available to the *comisariado* to travel make it possible for community leaders to attend more meetings in Oaxaca and other communities. At these

meetings they have the opportunity to network with other community leaders and agency workers. These meetings and workshops are ideal opportunities to learn about new programs and opportunities for the community. This increases the social capital between the communities by increasing the possibility of support from other sources. The international NGO Global Diversity Fund (GDF) is currently working with the CORENCHI communities to help them develop management plans for their conservation area. Oliverio Pedro Osorio Robles, community leader and former president of CORENCHI, met the leaders of GDF at a meeting with *Geoconservación* about the PSAH program. Some members of the community have used the money from the PSAH to send children to school which is an investment in human capital. Oliverio himself stated that he learned a lot about time management and organization through involvement with the PSAH program, an example of an increase in human capital. An increase in human capital will have long term effects in the community as *comuneros* are better educated and have better access and more confidence in relating to the world outside of the community. Health has reportedly improved in both communities as more people have access to doctors and medicine. Several people mentioned that the PSAH means that there is less pressure to leave the community or immigrate to the United States to find work.

## **OPPOSITION AND NEGATIVE IMPACTS**

Several individuals in both communities were against the PSAH from the start. Much of the initial opposition was a result of a misunderstanding of the program and mistrust of the government. Some community members thought that they were selling

their forests to the government or that participation would give the government the ability to take the forest away from them later or increase the restrictions on forest use. Both communities are against the idea of their land becoming declared a biosphere reserve, a proposal pushed by CONANP, and some worried the PSAH would bring them closer to that possibility. There is limited space for pasture, and in recent years only a handful of people in each community have had cattle and herds have been reduced in size. Those who had cows opposed the program because it would increase the restrictions on where they could graze their cows.

Some negative results are attributed to the PSAH program. Declaration of the conservation area has led to less use of the forests as the community has imposed internal regulations of farming, firewood collecting and hunting. Though these regulations are self imposed and not required by the PSAH, community members do not often distinguish between self imposed regulations, regulations from the conserved area and regulations imposed by the PSAH. Many have given up keeping animals because of there has been an increase in jaguar encounters since the imposition of hunting restrictions and the expansion of conservation and forest cover has reportedly drawn the jaguars closer to the community (Figel 2008).

Some negative results can be attributed to the PSAH program. For example, since both communities use traditional slash and burn techniques, the building of fire breaks is imperative to protect the forest and to continue receiving payments. This practice was used before participating in the program, but not to the extent it is used now since conscription into the PSAH program. For San Pedro, where the problem of the invasive bracken fern makes escaped fires a real threat, the requirement of the fire breaks has

increased their work load and meant that there is less time for their own work. One benefit from the PSAH is that the funds from the PSAH pay the day wages of fire break workers, creating a new source of paid employment. A second negative result of the PSAH is that, because of the work required by the PSAH, there is a much larger work burden on the authorities than before. Most in the higher positions do not have the time to tend their own fields anymore and must buy food rather than grow their own. The authorities in San Pedro have the option of taking money from the PSAH to compensate for some of the losses but many, such as the current president of the *comisariado*, choose not to exercise this option because they are afraid it will lead to mistrust and problems with other community members. He is valuing his reputation in the community higher than the financial capital he could gain by exercising the ability to use the PSAH funds for his family. The communities have more meetings now to deal with issues related to the PSAH which demands time of all community members. In San Pedro they began paying day wages for work related to the PSAH from the funds of the PSAH program. Now in San Pedro people only want to work if they will be paid when before everyone worked voluntarily when there was something that needed to be done. These voluntary work days, called *tequios*, were previously expected of *comuneros*. There has been some conflict in the assemblies if there is disagreement in what has been distributed or how the funds have been used. Disagreements over money did not happen before there was money.



## PROGRAM SUSTAINABILITY AND VISIONS FOR THE FUTURE

All three of the major organizations involved, CONAFOR (federal government), CORENCHI (grassroots organization) and *Geoconservación*, (NGO) have put into practice some efforts towards a sustainable program that will create a system of payment that includes more direct connections between users of the services and the communities who protect the forests which provide them thus more closely meeting the requirement of direct exchange desired by Wunder (2005) and others. Currently, funding comes from water user fees, funding from CONAFOR, the World Bank, the government of Japan and several other international donors. The funding is only sustainable as long as the donors continue to give and the government administration looks favorably on these projects, and the government is already indicating that the program will not continue forever in its current form. For this reason, there is currently much discussion about how to sustain and possibly increase payments to the communities for conservation.

In Santa Cruz there had been a previous attempt to make a connection between the brewery *Grupo Modelo* and the community. *Grupo Modelo* assisted the community in making trail signs and building a research and eco-tourism lodge in the community. They did this by donating money to a Mexico City based NGO called *Betadiversidad*. The community felt it was correct for *Grupo Modelo* to be involved because they know that this and other companies use the water that they produce and feel that “every drop of water here goes to the rivers and the fish and if it is contaminated even the beer will be bad.” (Oliverio Pedro Osorio Robles, Santa Cruz, personal communication).

The PSAH will not continue indefinitely and the communities are actively considering alternative programs to continue receiving conservation payments. Knowing

what the communities would be willing to accept from these programs before entering into an agreement is valuable and will be addressed in the following chapter. The communities of CORENCHI may be eligible for REDD+ programs. The World Bank and UNDP are considering the communities for this program. Currently CONAFOR has started a program of matching funds titled “Promoting Local Payment Mechanisms for Ecosystem Services through Matching Funds” (*fondo concurrente*) in which private or corporate interests may match one for one the money offered by CONAFOR to the individuals and communities participating in the PSAH and other PES programs (CONAFOR 2011). CONAFOR will continue to contribute to the projects for no fewer than five years but no longer than fifteen (CONAFOR 2011). So far there are several companies interested in participating including the Cultural Institute of Oaxaca, Chevrolet dealerships, the rock group The Jaguars, beverage company Gugar and several local artists. Some of these groups are located in the city of Oaxaca, which is not downstream of the CORENCHI communities. Participation in the *fondos concurrentes* may prove to be more a form of social philanthropy than a market based or Coasian mechanism for resource provisioning.

The organization, CORENCHI, was originally formed in a successful effort at collective action to be able to present a united negotiating front of 6 communities (soon to be seven) rather than 6 individual ones, in order to channel more benefits from municipal, state, and federal government programs. The communities now know that they can use CORENCHI and the attention and power it has been able to attract to find additional programs that can help them continue to profit from conservation. One of the main goals of CORENCHI in this moment is to find more companies to join the *fondo*

*concurrente* or pledge support in other ways. Some of the companies benefit from the water being produced or benefit through social philanthropy and they are also the main environmental contaminators (Oliverio Pedro Osorio Robles, personal communication).

## **TRUST, SOCIAL CAPITAL AND GOVERNANCE**

In case studies of PES in other parts of the world, social capital and trust has had to be created between actors in order for them to create new institutions for the purpose of taking advantage of PES programs, particularly for water services which require large portions of land to be included in the program to provide the desired services (Southgate and Wunder 2009, Kerr 2002, Muradian *et al.* 2009). In the communities in this study a substantial degree of trust and social capital existed within the communities already. Participation in the PSAH not only has the opportunity to strengthen the existing social capital at the community level but has also generated trust and resulting social capital represented by the creation of CORENCHI. Internal governance in the communities aided this formation and the emergence of governance at the regional level.

There have been changes in the relationship between the community and the authorities in power at any given time as a result of participation in the PSAH program. There has been a positive change and also a negative change. The negative change is because, previously, there was no risk that the authorities would misuse their position to steal money since there was little money involved. Now there is fear that the authorities could steal PSAH money. This new mistrust of the authorities because of the money is balanced with increasing faith in the authorities because work and promises have paid off. The community leaders who discussed conservation for many years have been

validated as now the community receives money for the conservation they are practicing. Before the people of the community did not believe conservation would get them anywhere nor did they understand what it was. Though many still do not understand conservation, they now see that it brings benefits.

On the basis of responses from the semi structured and informal interviews, there is greater trust between the communities. They communicate and intermarry more than before, as made evidence by my guide, Carmen, in San Pedro who was originally from Santa Cruz but married a man in San Pedro. In all the CORENCHI communities the people are more organized and knowledgeable about environmental issues and projects in which the community is involved. The formation of CORENCHI has allowed for many workshops and trainings to come to the communities, forming a strong base for collective action

## SUMMARY

This chapter presented the results of the interviews, semi-structured interviews and structured surveys. Through these methods the formation of the internal and regional governance which have allowed the communities to participate in the PSAH program and make good use of the funds in the community became clear. Collective action and collective decision making has been important in determining a fair and equitable distribution of the funds within the communities. This style of decision making has resulted in favorable opinions on the distribution and use of the funds within the community by the community members. Accessing and utilizing the PSAH program has allowed households to improve their wellbeing by increasing incomes and allowing for

improved diets, homes and access to medical care. More indirect benefits of participation may become clear over time as the community makes investments and investigates sustainable options to continue benefiting from conservation.

## CHAPTER IV –RESULTS OF WILLINGNESS TO ACCEPT CARBON PAYMENTS

In the final section of the structured surveys, participants were asked questions about the potential of participating in additional compensation for conservation programs. First, the survey asked if the participants would be willing to participate in a payments for carbon services program. Then, the respondents were given two scenarios in Santa Cruz and three scenarios in San Pedro. The first scenario was payment for carbon sequestration in land that is within the community's conserved area (CCA) but not currently receiving payments for water services. The second scenario was the expansion of conservation into coffee plots through cutting down coffee plants and cutting forest trees. The third scenario asked in San Pedro was for a project of reforestation in the land currently covered by the invasive bracken fern. In each of these scenarios the respondent was asked to state the amount of compensation (willingness to accept or WTA) they would ask to provide the stated service. The mean responses are shown in table 4.1.

Southgate *et al.* (2009) found links in willingness to accept and willingness to participate in the amount of compensation being offered and the amount of land required respectively. In Costa Rica they found that the farmers with a successful commercial crop were less willing to forgo agricultural land and would require larger payments to participate. This may result in poor farmers being more open to participation, thus leading toward the goal of poverty alleviation, but means that important hydrologic areas are owned by relatively wealthy farmers, higher payments would be required to protect the important land. In terms of whether or not PES should be used as a poverty alleviation tool this is significant as more poor can participate as they demand less but

unless they are the owners of the important land in terms of service provision it may be worth it to pay higher prices to wealthier land owners. If payments were not equal then the poor would tend to receive less than more well off participants, thus not truly being useful for poverty alleviation (Southgate *et al.* 2009). My study investigates the same issues in a common property regime where the recipients of the payments are communities with internal governance determining funds distribution rather than payments to individual land owners and investigates this in two contexts, one in which the burden is shared by the entire community (in the conservation area or the area covered by the invasive bracken fern) and one in which the burden of conservation would be borne by individuals (namely, the owners of the included coffee plots).

The first question asked in this section of the survey is whether or not the respondent would be willing to participate in a second PES program. I have already discussed in Chapter 1 the barriers to participation in PES programs (as explained by Wunder 2008, Pagiola *et al.* 2005, Landell-Mills and Porras 2002) and how this applies in the case of the PSAH program. The first barrier to participation was eligibility. From San Pedro and Santa Cruz's prior participation in a hydrology PES, it is clear that the land produces that target service, and from the same forested area the production of carbon sequestering services can be expected. The second barrier to participation, and the one explicitly addressed in this survey, is desire to participate. High opportunity cost may prevent some poor from participating but I established that the opportunity cost of land in the conservation area is low. The survey asks about a second payment program in the conservation area which would have the same low opportunity cost but also asks about a program in individually owned coffee plots, where opportunity cost might be

higher. The survey questions also imply that the delivery of the hypothetical second program would be in the same manner as the PSAH, that is provided by a government agency, CONAFOR, and guaranteed for five years. This eliminates distrust in a new intermediary as a barrier to participation in a second PES program.

**Table 4.1:** Summary of WTA: Variable names, descriptions and summary statistics for a carbon payment program in the conservation area, coffee plots and bracken fern.

Variable	Description	Mean	St. Dev	Min	Max
WTA_CONS	What the respondent feels is the least they will accept to be paid for a carbon PES program in the conservation area. Price is given per hectare per year.	1,180.87 (92.76)	1518.05 (119.25)	150 (11.78)	8000 (628.44)
WTA_COFFEE	What the respondent feels is the least they can accept to be paid for a PES program that requires them to give up their coffee fields. Price is given per hectare per year.	3,714.13 (291.76)	2647.86 (208)	50 (3.93)	10000 (785.55)
WTA_FERN	What the respondent feels is the least they can accept to be paid for a PES program that requires them to plant trees in the area that is covered by brackenfern. Price is given per hectare per year. This question was only asked in San Pedro	344,183.3 (270337.18)	662543.2 (52045.8)	800 (62.84)	2000000 (157109.19)

## **WILLINGNESS TO ACCEPT – CARBON PAYMENTS IN CONSERVATION AREA**

All of the subjects were asked if they would be willing for the community to participate in an additional payment for environmental services program, specifically one for carbon capture. The question asked was “Would you be interested in participating in a program in which you would be paid to either plant trees or continue conserving the



forests with the end of removing carbon from the air?” In 42% of the surveys, the investigator explained the price of carbon to the subject. At the time of the study, the price of a ton of carbon on the Chicago Climate Exchange was ten American cents, or one tenth of US dollar<sup>4</sup>. According to a review of studies by Gibbs *et al.* (2007), Mesoamerican tropical forests sequester approximately 200 tons per hectare. With an exchange rate of 12.73 pesos to the dollar in June of 2010, I rounded the number to two hundred pesos per hectare as the market value for carbon that was explained to the subjects. The interviewer explained that the community has a certain amount of land in the conservation area and of this land only a part is currently receiving payments from the PSAH program while the remainder of the land receives no conservation payments. The question asked was “What should the community accept per hectare per year in payments for the capture of carbon inside the 5,000 hectares that do not have a payment within the area of conservation?”

Of the 88 subjects, 82 were willing to respond to the question. Of those 82, 72 (87.8%) were in favor of participation in an additional project. Of those 72, 69 were willing to name a minimum price they would be willing to accept. However, it was difficult for the interviewers to obtain answers from some of the subjects. Many were uncomfortable naming a price for something that would typically be a community decision made by the Assembly. Interviewers assured the subjects that their responses would not be made known to the rest of the community that no decisions were being

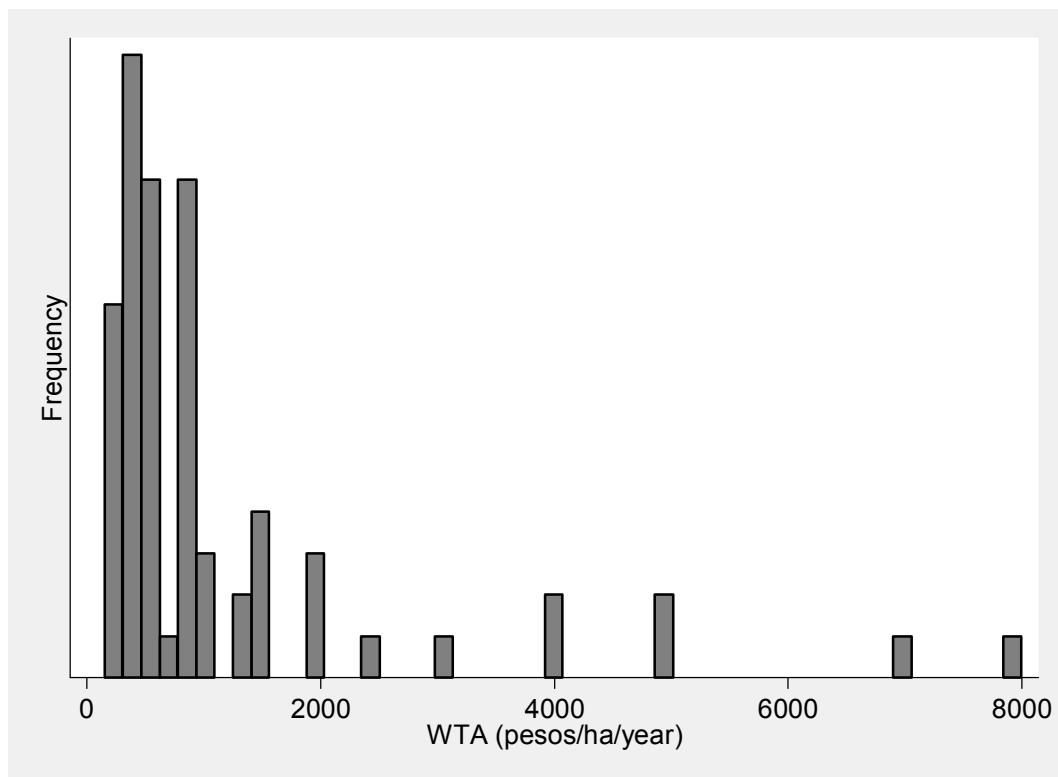
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<sup>4</sup> This price represents a collapse of carbon prices in 2010, down from a high of around \$10 a few years before. As of December 31, 2010 the Chicago Climate Exchange shut down its carbon trading system (Gronewold 2011)

made based on their response and each subject was encouraged to give the same opinion they would voice in an Assembly gathering if such a decision were being made.

Responses from the subjects for what they would be willing to accept for participating in a new PES program based on carbon capture within the conservation area that already exists ranged from 150 to 8000 pesos (or 11.78 to 628.44 US dollars, Figure 4.1). The mean response was 1180.87 pesos and the median response was 600 pesos.

**Figure 4.1:** Distribution of WTA, conservation: The distribution of responses for willingness to accept for participating in an additional PES program within the existing area of conservation (WTA\_CONS)



Heckman Selection Models were used to determine factors influencing the quantity stated by respondents that they would be willing to accept (WTA) for a new conservation program. Given that how much a household will accept for the carbon

capture program depends on whether the household is willing to participate in the program we consider Heckman Selection approach (Heckman 1979) to empirically model the WTA conditional on their willingness to participate in the program.

The first model found that, for both communities, gender, whether or not I explained the market price of Carbon at the time, if respondents thought that the money was given equally to all community members and whether or not they have used money from the fund, to be significantly correlated to how much they stated they were willing to accept (Table 2a).

**Table 4.2a:** Heckman Selection Model Results: willingness to accept payment for carbon services in conservation area (Dependent variable: WTA\_CONS, WANTNEWPES)

Number of observations = 79		
	Z	p >  z
Independent variables influencing the amount the subject was willing to accept for a second PES program in the conservation area		
GENDER	2.52	0.012
CARBMARK	3.92	< 0.001
EQUALDIST	-3.75	< 0.001
USEFUND	2.28	0.023
_CONS	-0.24	0.811
Independent variables influencing whether or not the subject was willing to participate in the proposed second PES program		
WANTNEWPES	12.49	< 0.001
CHILDOUT	-12.49	< 0.001
AGREEDIST	-2.2	0.028
ECONIMPROVE	3.4	0.001
COMMUNITY	-7.9	< 0.001
_CONS	6.46	0.000
Log Likelihood = -586.1364 wald chi2(6) = 707E+07		
LR test of ind. Eqns. (rho=0): chi2(1)=11.14 prob> chi2 = 0.0008		

Whether or not the respondent was interested in a new PES program in the conservation area, depending on whether they said yes or no to a new PES on the survey,

was influenced by whether or not they have children living outside of the community, if they agree with the use of the PSAH money within the community, if they feel their economic situation has improved because of the PSAH and which community they are a member of. Interestingly, in this model if a respondent did not agree with how the money is spent in the community (as determined by the distribution shown in figure 3.3) they were more likely to be interested in a new PES program. Similarly, those who did not believe that the money from the PSAH is distributed equally among community members had a higher WTA. Not surprisingly, the fewer children a respondent had living outside of the community the more likely they were to want a new PES. Children living outside of the community are often a source of income as they send remittances. Also, those in Santa Cruz were more likely to want a new PES program than those in San Pedro. By this model the predicted mean WTA was M\$1,395.85/ha/year compared to an actual mean of 1180.87 pesos per hectare per year (Table 4.2b).

**Table 4.2b:** Predicted Mean WTA for carbon PES in the conservation area from the Heckman Selection Model number one.

variable	Observations	Mean	Std deviation	Min	Max
CONS_M1	73	1395.852 (133.22)	936.205	93.82726	3670.957

I ran a second Heckman selection model to include household size and composition (Table 3a). I added the number of residents, children and elderly as this may be a factor in both how much money is received from the PSAH and the costs and needs of the household. I found no significance of any of those factors, however, including them in the model made whether or not anyone in the household had used money from the fund

(meaning taken money from the bank in Santa Cruz or asked for a loan in San Pedro) no longer significant. By this model the predicted mean WTA was 1,397 pesos per hectare per year (Table 4.3b).

**Table 4.3a:** Heckman selection Model Results: willingness to accept payment for carbon services in conservation area with household size and composition included.  
(Dependent variables: WTA\_CONS, WANTNEWPES)

Number of observations = 79		
	<b>z</b>	<b>p &gt;  z </b>
Independent variables influencing the amount the subject was willing to accept for a second PES program in the conservation area		
GENDER	2.49	0.013
CARBMARK	3.61	< 0.001
EQUALDIST	-4.62	< 0.001
USEFUND	1.66	0.097
RESIDENTS	-0.72	0.470
CHILDREN	0.52	0.604
ELDERLY	-0.35	0.727
CONS	0.42	0.675
Independent variables influencing whether or not the subject was willing to participate in the proposed second PES program		
WANTNEWPES	8.08	< 0.001
CHILDOUT	-5.69	< 0.001
AGREEDIST	-2.06	0.039
ECONIMPROVE	3.43	0.001
COMMUNITY	-9.9	< 0.001
CONS	2.51	0.012
Log Likelihood -585.8799    wald chi2(6) = 3.05E+08		
LR test of ind. Eqns. (rho=0): chi2(1)=11.03    prob> chi2 = 0.0009		

**Table 4.3b:** Predicted mean WTA for carbon PES in conservation area from Hekman Selection model number two.

Variable	Observations	Mean	Std deviation	Min	Max
Cons_M2	73	1397.105 (109.75)	946.851	-27.51388	3758.901

Next, I ran the model adding whether or not the head of household has held any leadership positions. The community's participation in the PSAH has meant extra work for those with leadership positions. This and the idea that those who have held leadership positions would be more knowledgeable about the PSAH were reasons to include this as a factor in the model (Table 4.4a). Whether or not the head of household has held a *cargo* did not influence how much they were willing to accept for a second PES program. The predicted mean WTA from this model was 1383.806 pesos per hectare per year (Table 4.4b).

**Table 4.4a:** Heckman selection Model Results: willingness to accept expansion of conservation into coffee plots with household size and leadership roles. (Dependent variables: WTA\_CONS, WANTNEWPES)

Number of observations=68		
Variable	Z score	p >  z
Independent variables influencing the amount the subject was willing to accept for a second PES program in the conservation area		
GENDER	2.38	0.017
CARBMARK	3.09	0.002
EQUALDIST	-3.91	< 0.001
USEFUND	1.69	0.091
RESIDENTS	-0.95	0.344
CHILDREN	0.96	0.338
ELDERLY	-0.10	0.921
CARGO	1.00	0.319
_cons	0.05	0.957
Independent variables influencing whether or not the subject was willing to participate in the proposed second PES program		
WANTNEWPES	7.21	< 0.001
CHILDOUT	-5.19	< 0.001
AGREEDIST	-6.05	< 0.001
ECONIMPROVE	7.84	< 0.001
COMMUNITY	-5.44	< 0.001
_CONS	1.46	0.145
Log Likelihood -585.3639    wald chi2(6) = 2.39E+07		
LR test of ind. Eqns. (rho=0): chi2(1)=11.03    prob> chi2 = 0.0007		

**Table 4.4b:** The predicted mean value of WTA for carbon PES in the conservation area from the third Heckman Selection Model

Variable	Observations	Mean	Std deviation	Min	Max
Cons_M3	73	1383.806 (108.70)	945.7682	-149.3408	3776.826

### **WILLINGNESS TO ACCEPT- CARBON PAYMENTS IN COFFEE PLOTS**

The previous set of questions explored WTA for a program in communal areas of the community territory where access is already limited and conservation is already being practiced. The second round of questions explores WTA for carbon sequestration programs in the coffee fields. Because of the nature of coffee as a crop that requires a large amount of investment and maintenance for an annual crop, coffee plots are the only part of community territory that is considered as private property by individual community members and can be passed on to family members. Corn fields are only used by individuals for particular periods of planting and harvesting and cannot be altered to any use other than corn. Neither type of land can be sold. Coffee fields are the only part of the community territory that can be entered into a carbon payment program and be expected to provide additional benefits that would not have otherwise been provided.

The question was asked, what is the least you would accept for converting your coffee fields into tree plantations for carbon sequestration. Responses were given in amount per hectare per year for a period of five years. A single response of 9,000,000 pesos was dropped because it was an outlier. I counted that response instead with the respondents who said that there was no amount they would be willing to accept in order to give up coffee fields for conservation because nine million pesos seems unrealistically high.

Subjects replied to this question one of three ways. First, several individuals declined to respond. The reasons they gave for declining were that they were uncomfortable discussing money, they did not feel they could respond to a question they felt needed to be asked to the Assembly or they were simply bored with the survey and wished to stop. Second, many who had responded to the previous question about willingness to accept for land already under conservation responded that there was no amount of money they could be given to abandon their coffee fields. Stated reasons for this response were that there was plenty of land already in conservation and no need to expand into the agricultural areas and that the coffee fields were the only thing they owned and that they relied on them for food, firewood and income. Third, subjects gave a number in pesos per hectare per year that they would be willing to accept to convert their coffee fields to conservation. Sixty nine of the subjects responded to this question. Of those 69, 47 (68%) were willing to give a price that they would be willing to accept while twenty two (32%) responded that there was no price that they would be willing to accept to expand conservation into their coffee fields.

Heckman selection models were used to find the factors that influenced the willingness to accept for the expansion of conservation into coffee plots for those who would be willing to accept an amount (Heckman 1979, Table 4.5a). Factors influencing WTA were gender, whether or not the household receive remittance, the total amount the household receives from PES, community, the total household income, and the percentage of the household income that comes from government programs. Women respondents gave higher responses than men. The less remittance by the household received or the less the household receives from PES the higher their WTA. The higher



**Table 4.5a:** Heckman selection Model for willingness to accept carbon payments for land in coffee plots. (Dependent variables: WTA\_COFFEE, WTA\_COFFEE\_YESNO)

Number of observations = 68		
variables	z	p >  z
Independent variables influencing the amount the subject was willing to accept for a second PES program on land in coffee plots		
GENDER	646.09	< 0.001
REMITTANCE	-319.92	< 0.001
TOTAL_PES	-701.37	< 0.001
COMMUNITY	-3.92	< 0.001
TOTAL_INCOME	571.69	< 0.001
PER_INC_PES	621.26	< 0.001
_CONS	3.9	< 0.001
Independent variables influencing whether or not the subject was willing to participate in the proposed second PES program		
COMMUNITY	-4.99	< 0.001
CARGO	10.13	< 0.001
COFFEEHA	-10.13	< 0.001
PAYENOUGH	10.13	< 0.001
ECONIMPROVE	10.13	< 0.001
WORTHRESTRICT	10.13	< 0.001
_CONS	4.16	< 0.001
Log Likelihood -441.4741    wald chi2(6) = 1.14E+07		
LR test of ind. Eqns. (rho=0): chi2(1)=11.03    prob> chi2 = 0.0000		

the household income and the greater the amount of income came from government programs the more the respondent asked for WTA. The inhabitants of Santa Cruz had higher WTAs than those of San Pedro. In this model the factors influencing whether or not the respondent would be willing to receive payment for expanding conservation into coffee fields were the community, whether or not the head of household has held leadership positions, the number of hectares the household has in coffee, whether the respondent feels that what they receive for PSAH is enough, if they feel their economic situation has improved and if the PSAH is worth the restrictions. Respondents from

Santa Cruz are more likely to accept payment for expanding conservation into coffee plots than those in San Pedro. Those who have had positions of leadership, who feel that the PSAH pays well, feel that their economic situation has improved and believe the PSAH is worth the restrictions on the forest are most likely to accept expansion of conservation into coffee fields. The respondents from households with fewer hectares of coffee were more willing to accept payments for expanding conservation into coffee plots. With these factors as predictors, the predicted mean response for WTA was M\$1,708.24/ha/year compared to the actual mean of 3,714.13 pesos per hectare per year (Table 4.5b).

**Table 4.5b:** Predicted mean WTA for carbon payments for land in coffee plots from the first Heckman Selection Model

variable	Observations	Mean	Std deviation	Min	Max
COFFEE_M1	87	1708.238 (134.19)	2491.029	-3030.531	5770.284

When household size and non-coffee crop income were added to the model several of these factors changed (Table 4.6a). Whether or not a household receives remittance loses some significance for how much the respondent was willing to accept. Surprisingly, adding these additional factors into the model made whether or not the respondent thought the payments were worth the restrictions on the forest a much less significant determinant of whether or not they would be willing to accept payment to plant trees for carbon sequestration into their coffee plots. I investigated this factor because household size can affect both how much money the household receives if there are multiple adults in the household and also the costs of the household if there are many children.

**Table 4.6a:** Heckman selection Model Results: willingness to accept carbon payments for land in coffee plots with household size and income from non-coffee crops. (Dependent variables: WTA\_COFFEE, WTA\_COFFEE\_YESNO)

Number of observations=68		
variable	Z score	p >  z
Independent variables influencing the amount the subject was willing to accept for a second PES program on land in coffee plots		
GENDER	2.93	0.003
REMITTANCE	-1.79	0.074
TOTAL_PES	-2.06	0.039
COMMUNITY	-3.82	< 0.001
TOTAL_INCOME	2.05	0.041
PER_INC_GOV	2.72	0.006
RESIDENTS	-.35	0.726
_CONS	3.42	0.001
Independent variables influencing whether or not the subject was willing to participate in the proposed second PES program		
COMMUNITY	-4.78	< 0.001
CARGO	3.75	< 0.001
COFFEEHA	-4.80	< 0.001
PAYENOUGH	7.76	< 0.001
ECONIMPROVE	3.86	< 0.001
WORTHRESTRICT	1.39	0.765
CROPTOTAL	-0.75	0.450
_CONS	3.41	0.001
Log Likelihood -441.4155 wald chi2(6) = 1.23E+07		
LR test of ind. Eqns. (rho=0): chi2(1)=11.03 prob> chi2 = 0.0000		

Using this model the predicted mean response was 1,709.88 pesos per hectare per year (Table 4.6b).

**Table 4.6b:** Predicted mean WTA for carbon payments for land in coffee plots with household size and income from non coffee crops, from the second Heckman Selection Model

variable	Observations	Mean	Std deviation	Min	Max
COFFEE_M2	87	1709.883 (134.32)	2481.663	-3033.063	5791.791

I also wanted to take into account non-agricultural income and the number of adults in a house. I added into the model the households other income which meant any income unaccounted for at other points in the survey (Table 4.7a). This is income that is not from remittances, agriculture or government programs, all of which have already been considered in the model.

**Table 4.7a:** Heckman selection Model Results: willingness to accept carbon payments for land in coffee plots with non-agricultural income and number of adults residing in the house (Dependent variable WTA\_COFFEE, WTA\_COFFEE\_YESNO)

Number of observations=68		
variable	Z score	p >  z
Independent variables influencing the amount the subject was willing to accept for a second PES program on land in coffee plots		
GENDER	3.01	0.003
REMITTANCE	-1.67	0.96
TOTAL_PES	-3.17	0.002
COMMUNITY	-3.73	< 0.001
TOTAL_INCOME	1.36	0.173
PER_INC_PES	2.40	0.016
OTHERINCOME	0.03	0.973
ADULTS	-0.16	0.873
_CONS	3.17	0.002
Independent variables influencing whether or not the subject was willing to participate in the proposed second PES program		
COMMUNITY	-4.88	< 0.001
CARGO	1.79	0.073
COFFEEHA	-2.45	0.014
PAYENOUGH	3.58	< 0.001
ECONIMPROVE	2.27	0.023
WORTHRESTRICT	1.35	0.178
_CONS	3.38	0.001
Log Likelihood -441.4608 wald chi2(6) = 1.37E+07		
LR test of ind. Eqns. (rho=0): chi2(1)=11.03 prob> chi2 = 0.0000		

I found that there was no significant effect of non-agricultural income on the WTA of respondents. Because most adults receive money from the PSAH the number of

adults in the household affects the amount of money received. However, the number of adults in a house did not significantly affect the stated WTA of a respondent. Adding these factors to the regressions changed the significance of the total income and whether or not the PSAH payments are worth the restrictions. This model predicted the responses of the respondents and found a mean of 1685.65 pesos per hectare per year (4.7b).

**Table 4.7b:** Predicted mean WTA for carbon payments for land in coffee plots with agricultural income and number of adults residing in house from the third Heckman Selection Model

variable	Observations	Mean	Std deviation	Min	Max
Coffee_M3	87	1685.653 (132.42)	2500.823	-2929.827	5660.698

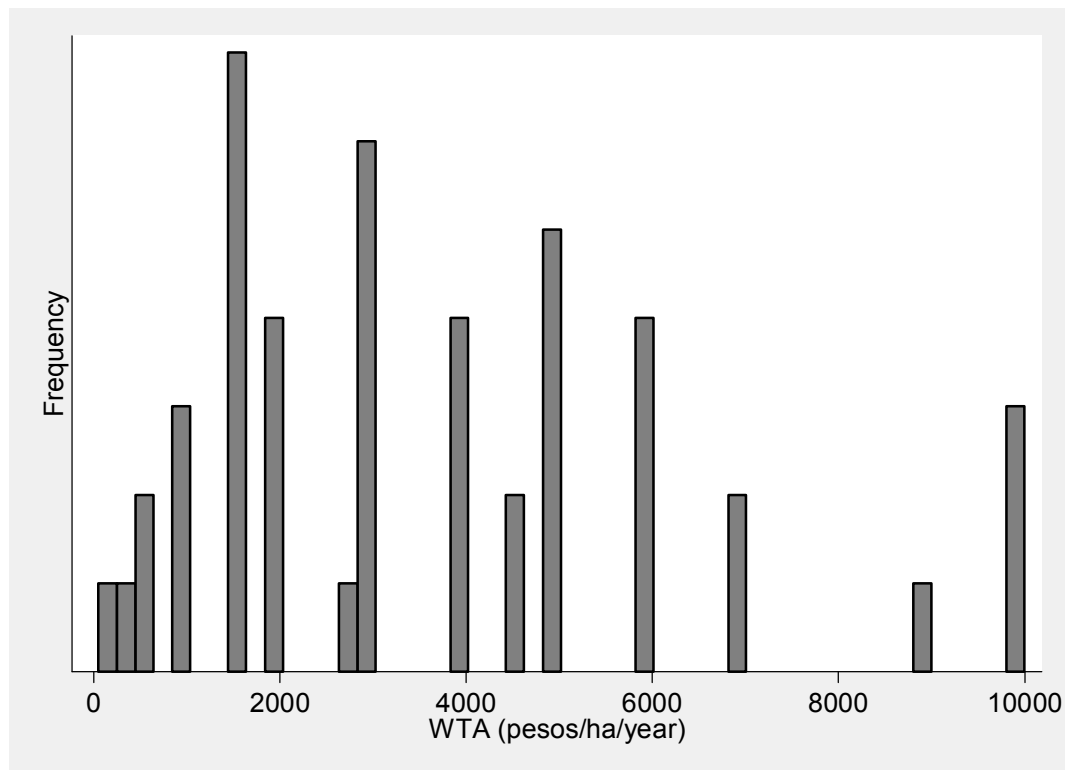
Willingness to Accept payments for expanding conservation into coffee plots elicited responses between 50 and 10,000 pesos per hectare per year (Figure 4.2). The mean response was 3,714.13 pesos with the expected response of 1708.24 pesos. The median response was 3000 pesos.

## **WILLINGNESS TO ACCEPT – CARBON PAYMENTS IN BRACKEN FERN**

Because of the invasive species problem in San Pedro I asked respondents in San Pedro if they would be willing to accept payments to expand conservation into the areas with bracken fern. Of the twenty nine individuals surveyed in San Pedro, twelve were willing to give a price for what they would be willing to accept to expand conservation to areas with bracken fern. Those who refused to respond did so either because they were not interested in such a program or because they were simply tired of the survey and

refused to continue. Those who were not interested in the program stated either that it would be impossible or too difficult to reforest the areas with bracken fern. Those who named a price mostly indicated a very high WTA, a reflection of how work intensive a bracken fern removal and restoration project would be for the community.

**Figure 4.2:** Distribution of WTA, coffee: Distribution of responses for willingness to accept payments for carbon payments for land in coffee plots



## SUMMARY

The results of all three WTA questions and the prediction models are shown in table 4.8 below. This is compared with opportunity cost, which was determined by

taking the household income from coffee and dividing it by the number of hectares of coffee owned by members of the household, and also with the total income from coffee during the study year of July 2009 to July 2010. It is clear that willingness to accept is lowest for programs within the existing conservation area, higher for programs that would require giving up coffee income and the highest for programs that would require reforestation of areas covered by bracken fern. Opportunity cost is lower than WTA in all cases but coffee income is higher than WTA per hectare to abandon coffee plots for the purpose of tree plantations for carbon sequestration.

**Table 4.8:** Summary of WTA with predicted values

Variable	Obs	Mean	Std dev	Min	max
WTA_CONS	69	1180.87 (92.76)	1518.05	150	8000
CONS_M1	73	1395.85 (109.65)	936.21	93.83	3670.96
CONS_M2	73	1397.11 (109.75)	946.85	-27.51	3758.90
CONS_M3	73	1383.81 (108.70)	945.768	-149.34	3776.83
WTA_COFFEE	46	3714.13 (291.76)	2647.86	50.00	10000.00
COFFEE_M1	87	1708.24 (134.19)	2491.03	-3030.53	5770.28
COFFEE_M2	87	1709.88 (134.32)	2481.66	-3033.06	5791.79
COFFEE_M3	87	1685.65 (132.42)	2500.82	-2929.83	5660.70
WTA_BRACKEN	12	193654.50 (15212.45)	428674.90	800	1,200,000
OPPORTUNITY	87	986.68 (77.51)	1282.27	0.00	6000.00
COFFEETOTAL	88	2108.37 (165.62)	24000.00	0.00	24000.00

A two sample T-test with unequal variances shows that WTA\_CONS and WTA\_COFFEE are significantly different from one another ( $t=-5.8768$ , d.f. = 64.8222,  $p<0.01$ ) meaning that subjects were willing to accept less where there was less personal loss or work involved by participating in a program within the conservation area rather than one in which coffee fields would be changed into tree plantations.

**Table 4.9:** Summary of WTA by community

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>Std dev</b>	<b>Min</b>	<b>max</b>
WTA_CONS (Santa Cruz)	51	1174.118 (92.23)	1602.098	150	8000
WTA_CONS (San Pedro)	18	1200 (94.27)	1291.602	400	5000
WTA_COFFEE (Santa Cruz)	43	3856.977 (302.98)	2680.986	50	10000
WTA_COFFEE (San Pedro)	3	1666.667 (130.92)	288.6751	1500	2000

Table 4.9 compares WTA between communities. Both communities gave similar responses for WTA\_CONSERVATION (Mann-Whitney test,  $z=-0.806$ ,  $p=0.4202$ ). Because of the small number of observations made for willingness to accept for the expansion of conservation into coffee plots for San Pedro, I could not determine if the WTA in San Pedro was significantly different than WTA in Santa Cruz. However, when comparing response rates between the two communities, respondents in Santa Cruz were more likely to be willing to accept payment for the expansion of conservation into coffee plots (43 out of 58) than those in San Pedro (3 out of 29) (Mann-Whitney,  $z= 4.511$ ,  $p=0.01$ ).



## CHAPTER V – DISCUSSION AND CONCLUSIONS

Chapter V will synthesize the results from this study and put it into context with other case studies within the literature of Payments for Environmental Services. In the next few pages I will explain the impact the payments from the PSAH program has had at the household level and the potential of poverty alleviation in the community. Next I will discuss the PSAH and the effects it has had on social capital within and between the communities. I will then discuss the participants' satisfaction with the program and how it has been functioning in the community and their willingness to accept for additional programs. Finally I will use my example presented here to discuss whether PES can be a valuable tool for conservation and poverty alleviation and address some of the common critiques of PES programs and how they are dealt with in the PSAH in my common property regime example.

### **COMMUNITY ATTITUDE TOWARDS THE PSAH**

Several of the variables measured during the household survey can be used to determine community attitude towards the PSAH program, whether they agreed with the distribution scheme of the funds, whether or not they thought community members received funds in an equitable fashion and whether or not they thought that participation was worth the restrictions on the forest. The variable measuring perceived economic improvement can also be used but will be discussed in detail in the section on household impact and poverty alleviation. Eighty two percent of the respondents to the household survey agreed with the distribution schemes used, eighty five percent thought that

community members receive equitable amounts from the fund, eighty four percent believed themselves to be economically better off because of the payments, and seventy two percent thought the payments were worth the restrictions on the forest. The distribution scheme used in the community and the amount received by each individual community member is determined communally and voted on by the assembly. A positive attitude towards these two aspects shows the success and strength of social capital in making community decisions. The percentage who feel the payments are worth the restrictions is high, indicating again strong social capital in order to make community decisions on land use that are acceptable to the majority, but the percentage is lower. The lower agreement might be a result of the respondent thinking the community should be paid more money, only 21.3% of the respondents think that the amount CONAFOR pays is enough. Many of the land use restrictions are imposed by the community itself but how much the community receives in compensation is an external decision made without collective action and trust with the community. The decision to participate in the program, however, is a communal decision. This may explain the slightly lower, but still high, positive attitude towards compensation for restrictions on land use.

## **HOUSEHOLD IMPACT AND POVERTY ALLEVIATION**

Without the income from the PSAH both communities fall below at least one of the three levels of poverty defined by SEDESOL (2002). As Table 3.4 shows, mean income per person per day without including funds from PSAH in Santa Cruz is 20.43 pesos which is below the level of asset poverty. In San Pedro mean income per person per day is 11.2 pesos which is below all three levels of poverty. With the income from

the PSAH Santa Cruz is well above all three defined levels of poverty with 32.5 pesos per person per day and San Pedro is slightly above capability poverty with 18.97 pesos per person per day but still below asset poverty. The difference between communities could be a result of larger household sized in San Pedro which has an average of 5.38 residents per house to Santa Cruz's 3.62 residents per house. Also, in Santa Cruz, there is a greater opportunity for diversification of income as a result of the road connecting Santa Cruz to potential markets, sources of employment and educational opportunities. In Santa Cruz the addition of money from the PSAH was enough to lift them out of asset poverty to a point in which they no longer meet the federal definition of poor. In San Pedro the addition of the PSAH was enough to lift them out of nutritional poverty and capability poverty into the lowest level, asset poverty.

It is worth mentioning that the measurement of household income in Santa Cruz may be more accurate than those from San Pedro. During the course of the field research I spent more time in Santa Cruz and was able to interact more with leaders and community members. My time in San Pedro was limited to ten days. In ten days I was less able to create relationships with community members and communication was more difficult because fewer adults spoke Spanish in San Pedro than Santa Cruz. In this way I was limited in the trust I was able to create in San Pedro compared to Santa Cruz where I was better known and possibly considered more trustworthy. I suspect that the results reflect truth and that the people in Santa Cruz do indeed have higher incomes per person than in San Pedro because of the factors I have already mentioned, but I suspect that the incomes in San Pedro are higher than what was reported.

On the individual household level, these results show that there have been welfare improvements. In 84% of the surveys the subjects indicated that their economic situation had improved as a result of receiving the PSAH funds. The most commonly reported uses of the money were medical costs, home improvements, food and general household costs (Figure 3.8). In addition, 44% of those surveyed have been able to ask for money from the community fund in the case of an emergency. In Santa Cruz this means taking one's own funds from the community savings account and in San Pedro taking money from the community fund is an interest free loan from the portion of the funds for community use. This indicates that the reason people are better off is that they have more diverse diets, better homes and improved health and access to medical care.

I suspect that some of the benefits of the PSAH will become more apparent in the future. Already, participation has resulted in more knowledge among the community leaders about government and NGO programs and possibilities. Participation in the PSAH has given the communities and the leaders experience traveling to other places, interacting in meeting and seminar situation and dealing with paperwork and funding. Experiences such as these may open up opportunities to participate in other programs and to search out other investments and opportunities. As part of the distribution laid out by CORENCHI and adapted by the communities (Figures 3.2, 3.3, and 3.4) scholarships can be given to students who wish to study beyond what is offered in the community. With the ability to rely on conservation payments, children are free to pursue education because there is less demand for agricultural labor. Time for education may result in the future in a more educated and connected population in the communities which will open up additional opportunities. Having educated children working in the cities is also a

social security option for older community members, allowing them to work less land in their old age which may open up more land for conversion to forest. The communities have only been involved in the PSAH since 2004, six years at the time of the study, which may be too short term to see some of the long term benefits that may arise.

As was discussed in the introduction, PES has the potential to alleviate poverty as long as the poor have access to the programs (Wunder 2008, Pagiola *et al.* 2005, Landell-Mills and Porras 2002). The first barrier to participation by the poor is eligibility. Eligibility comes in the form of location in a target area. The land within the PSAH has tropical montane cloud forest (TMCF) as the major vegetation type and TMCFs are favored by the PSAH program in terms of targeting for hydrologic benefits. The second barrier is whether or not the poor want to participate. Previous to participation in the PSAH both Santa Cruz and San Pedro had forest that they were not exploiting for lumber or agriculture and Santa Cruz had actively decided not to log their forests after the road reached the town. Therefore, there was no more profitable land use that the communities were deciding between and payments for the conservation they were already practicing was welcome. Trust in the buyer or intermediary may also influence the poor's desire to participate and the program was introduced to the communities by a NGO, *Geoconservación*, with which they had experience.

The third barrier to poor participation in PES is ability to participate. Ability may be limited by high transaction costs, land tenure and access to technical assistance. The communities in my study have legal land tenure over their territory. Technical assistance is provided in part by CONAFOR to the participating communities. Currently the NGO Global Diversity Fund has field agents who are working with the communities to create

management plans for the land under the PSAH, a new requirement of the PSAH program. Transaction costs of participation were not negligible. The community leaders had to travel to Oaxaca and Tuxtepec, the two closest cities, in order to attend meetings, meet with officials and sign paperwork. Now that the community is receiving payments there are funds which help the leaders pay for these trips. Before entering the program, the trips were paid for by contributions from the community. If the individual community members had to fund these trips themselves it would have made them unable to participate, the cost would have been too high. With every member of the community contributing the cost was spread out and was manageable. The ability to share the transaction cost is a result of the social structure of the community and allows them to overcome one of the most common barriers to poor participation.

Muradian *et al.* (2009) suggest that the PES may take advantage of the poor. For one, the willingness to accept of the poor may be so low that their participation could be considered only questioningly voluntary. Muradian *et al.* (2009) also suggest that there would be equity problems with poor participation in PES as, due to lower opportunity costs, their willingness to accept would be lower than wealthier land owners and thus the poor could be paid less for the same service. This is clearly not the case in my study. Though I do not have WTA data from wealthier land owners, the WTA for carbon payments stated by the participants in my study is well over what they have been offered for hydrological services and well above the market price for carbon. I believe this to be a result of collective participation within the community, between communities in the form of CORENCHI and between the community and CORENCHI leaders and delegates from CONAFOR and *Geoconservación*. Community members have confidence because

of the social capital and collective action that has been built and utilized during the last six years of participation in the PSAH that they know their forests are valuable, unique and worth something to others.

Whether or not the PSAH will alleviate poverty in these two communities, I think, is yet to be seen. It is clear that there has been an improvement in standard of living in many ways and that the communities have risen above some of the federal poverty lines, in the case of San Pedro, and above the federal definition of poverty in the case of Santa Cruz. However, the PSAH is not guaranteed indefinitely and unless the communities can make investments or find new programs which will continue to pay for conservation, when the PSAH program ends the benefits will end with it.

## **TRUST, SOCIAL CAPITAL AND GOVERNANCE**

The internal governance of Santa Cruz and San Pedro serves to reduce or even eliminate the problems of free riders and corruption, due to strict monitoring and enforcement of community rules, enhancing their ability to commonly manage the resources of the forest and the money that comes from conservation. Experimental evidence shows that collective management of resources is possible when there is evidence of cooperation and when there is enforcement of cooperation even when this enforcement comes at a personal cost (Ostrom 2000, Rustagi *et al.* 2010). In the communities of this study, cooperation is required in order to benefit from the PSAH payments and those who do not cooperate do not benefit. Monitoring of cooperation and sanction of not only free riders but those who cheat the system is prevalent in both communities.

In Santa Cruz, there was a recent example of a leader who stole money from the community. This individual was stripped of their leadership position and required to pay back the funds. In San Pedro we saw one instance of an individual rejecting the leadership position assigned to them and the result of that refusal which is that he and his family do not receive payments from the PSAH money. Also, in San Pedro, payment receipt is conditional on participation in community work days. This enforcement is based on internal regulations and is enforced by the chosen leadership and the individuals in the community. Holding leadership positions is personally costly, particularly now that the communities are involved in the PSAH program. Because of participation in PSAH, there are more meetings and more traveling required of the leaders which means that they have less time to work in their own matters, such as corn, coffee or their small businesses. Thus, participation in the monitoring and enforcement and regulation of the common resource of payment for forest conservation is personally costly but happens anyway. According to Rustagi *et al.* (2010) this is an indication of a high number of conditional cooperators, people who are willing to cooperate if they are assured that others will cooperate, in the population and shows the emergence of a culture that enforces cooperation. Cooperative will in conservation might increase as well as it becomes apparent that working cooperatively results in benefits to the community in the form of conservation payments.

The decision making institution in Santa Cruz and San Pedro is one reason that social capital is strong and collective action possible. Decisions are made by the Assembly. As described previously, the Assembly is made up of all the legally recognized community members, or *comuneros*. Whenever necessary, meetings are



called and the Assembly gathers in the community center. Issues are discussed and a vote is taken. Decisions in the community are made by simple majority and by secret ballot. If 100 *comuneros* are present and 51 vote in favor of something, it will be accepted. In my interviews, when I asked if there were people opposed to participation in the PSAH the informant usually replied that there were a few who opposed but it did not matter because the majority was in favor. The majority of survey respondents agree with the way the money is used in the community as this is a decision made by the Assembly. The Assembly meetings are called whenever necessary and will last as long as required to address the issues at hand. While I was in the community conducting this study a meeting of the Assembly was called to elect the new round of leaders and the meeting lasted for three days from nine in the morning to six at night. Attendance of Assembly meetings is mandatory. Those who are absent must send an adult representative from their household or pay a fine, one more example of monitoring and sanctioning of community rules.

One place where social capital, collective action and democracy are weak is in the participation by women. Women are generally not legal community members except in the case of single mothers, women whose husbands are working and living outside of the community and widows. This limitation comes from agrarian law which only recognized the head of household as legal members of *comunidades* or *ejidos*. In the rare cases that a woman is the listed *comunera* and her husband is not, her husband is the one who attends the Assembly meetings in her place. Single women who are *comuneras* are not expected to attend Assemblies but to send a male representative in her place. Those who do attend are in the minority. In this way, the female voice is not heard at the assemblies. The

results of this were seen in some of the responses in the structured survey. Two women who were interviewed expressed displeasure that the PSAH payments were given to their husbands in its entirety even though half of the money was theirs. One woman mentioned that there should be more community money invested into the schools and the health center, two aspects of the community that are traditionally of most concern to women.

Social Capital, trust and collective action has been strong within the communities and this has allowed the PSAH to be successfully implemented in the communities. However, collective action was needed between the communities in the form of CORENCHI in order to attract the attention necessary to gain access to the PSAH and trust and social capital has not always been strong between communities. The communities of CORENCHI share territorial boundaries and in the past there has been disputed over the boundaries. This led to occasional violence between the communities and a lack of trust. When it became clear that forming an alliance between communities would be important for obtaining conservation payments, the communities had to come together and develop trust and communication between them. The successful formation of CORENCHI, frequent meetings and even that more people intermarry between communities is evidence that this trust was built and is being maintained.

Vatn (2009) explored the use of payments for environmental services programs as a tool for strengthening collective action by strengthening land tenure and requiring individual land owners to group together in order to offer parcels of land which are large enough to provide the desired watershed service. Programs such as RUPES in several Asian countries, Pimampiro in Ecuador and Proambiente in Ecuador attempt to organize

land owners in this way to take advantage of PES programs with varying success (Huang *et al.* 2007, Kerr 2002, Southgate and Wunder 2009). In Mexico, the program of PSAH started with strong community level governance and institutions and clearly defined land tenure. My two communities were able to use their strong land tenure and common property regime to successfully access the PSAH program. Rather than joining together unrelated land owners with no previous relationship, within the communities all land is communal and they joined together communities with similar cultural backgrounds and similar governance structures.

## **WILLINGNESS TO ACCEPT**

The responses for willingness to accept payment for carbon programs was different depending on whether the project would be within the conservation areas or in the coffee plots. From Figures 4.1 and 4.2 it is evident that WTA responses were clustered towards lower numbers where WTA in coffee fields responses were more spread out and were higher. Differences in responses between respondents may be because different individuals have different opportunity costs. The opportunity costs for the community as a whole may be low, but if an individual feels they have lost important resources from the forest or if they had interests in logging or cattle, their perceived opportunity cost will be higher than that of the community as a whole. The average of WTA for coffee plots was higher than the average for conservation in both the actual data and the predicted responses (Table 4.8). A carbon program in the conservation area is a proposal that is not unfamiliar as the communities already have experience with water payments in the conservation area. An Additional PES program within the conservation

area would not be much additional work for the community nor represent a personal loss for the survey respondents. A carbon program that would require cutting down coffee plants and planting forest trees represents a loss and a risk for the individual respondent. There is also a difference between community property and property which is claimed by an individual. between communal and private property. The conservation area is communal, the costs and benefits of the program would be shared by all the community members, while coffee plots are the closest to private property that exists in the communities. The costs and benefits of participating in a carbon program in the coffee plots would fall primarily on the owners of the parcels.

A second main difference between WTA for carbon capture PES in the conservation area and carbon capture PES in coffee plots was the response rate of the survey respondents. Most of the respondents, 87.8%, were interested in participating in a carbon capture program in the conservation area while only 67.14% were interested in participating if the program was in the coffee plots. If separated by community, In Santa Cruz 51 of the 59 people interviewed were willing to participate in the program in the conservation area while 43 of the 59 were willing if the program is in coffee fields. Those numbers were 18 of 29 for conservation and only 3 out of 29 for coffee in San Pedro. That means that 73% of those surveyed in Santa Cruz were willing to abandon coffee production in return for carbon payments but only 10% were willing to do so in San Pedro. In San Pedro I was often told that they were unwilling to give up their coffee fields because growing coffee is what they do. They also use coffee fields to grow other food crops for consumption or sale, such as *tepejilote* or *guasmol* and collect firewood from the plots. The people in San Pedro have less land in their agricultural zone to begin

with because so much of it is covered with bracken fern and already many community members have to walk an hour or more to reach their fields. Additionally limiting their access to land to grow food is not something most members of San Pedro were willing to consider. There was no price that they would accept to give up that source of livelihood and security. These results show a difference in willingness to participate not only between communal and private land, but also between individuals with different risk acceptance abilities. Those who rely more on the coffee are less likely to take the risk of accepting payments for payments for an activity other than coffee.

The authors of the Southgate *et al.* (2009) study found that farmers with successful crops were less willing to forgo agricultural land or would require a higher payment to do so. My study obtained similar results. As seen in table 4.5a, the less land a household had in coffee production, the more willing they were to want to participate in a program for carbon capture in coffee fields. Having less land in coffee may indicate less of a dependence on that crop and other uses on that land for their livelihoods. Additionally, if a family receives remittance income, they are willing to accept a smaller payment. Because the household receives this additional income, they are able to take more risk. Also, the more that a household receives in PES now, a function of the number of adults living in the house, the lower their WTA, which indicated that they are satisfied with what they are receiving and do not feel the need to get more. The higher the total income in the house the higher their WTA which is possibly a reflection of income generated by a combination of coffee and other crops grown on coffee land, such as *tepejilote* and *guasmol*, which can be sold for profit. In this way my results are similar to those of Southgate *et al.* (2009) in that those who have the most to lose, or the

highest opportunity cost in terms of land owned and income from that land, by participation demand the most payments.

Whether or not respondents were willing to participate in a carbon capture program in the conservation area and what they would be willing to accept was largely based on factors involving perception of the current PSAH program. If the respondent feels their economic situation had improved, they were more willing to participate in a second program. If the respondent was told the current market price for carbon, at the time of the study it was estimated to be 200 pesos per hectare of tropical forest, they were willing to accept a smaller payment than if they were not explained the market price. Explaining carbon prices had no influence on the WTA for a program in the coffee fields where income and opportunity cost factors were more important. If the respondent had used money from the fund, by asking for their saved money in Santa Cruz or requesting a loan in San Pedro, they reported higher willingness to accept. Using the fund may reflect larger needs in the form of medical costs and thus desire for higher payments. Two results that are difficult to explain are that agreement with the distribution of funds and whether or not they thought community members received money equally were negatively correlated with whether they would be willing to participate and what they would be willing to accept respectively. It is possible that if a respondent thought that not everyone in the community received their fair share of the PSAH money that receiving more money would help fix the problem, but those who are not in agreement with the distributions shown in figures 3.3 and 3.4 would want to participate in a new program more than those who are in agreement is difficult to explain.

The responses given in San Pedro for willingness to accept a carbon payment for tree planting projects in areas covered by bracken fern show that this project would come at a higher cost to the community than the others. The mean response was 193,654.50 pesos with a minimum of 800 pesos and a maximum of 1,200,000 pesos per hectare per year. Clearly this price is more than would be feasible indicating that a program to reforest the bracken fern areas is not feasible.

The prices given by the respondents of the survey are generally much higher than the market price of carbon and higher than what is being offered by current government programs, such as the PSAH program. In order to avoid this in future studies I would design the questions to be more similar to the questions of Southgate *et al.* (2009) which provided respondents with several different amounts and asked if they would be willing to accept each of them. In this way I could avoid receiving responses which are above what might ever be offered and determine if the communities would be willing to participate in programs at prices that are likely to be offered.

## **CRITIQUES OF PES**

One common critique of PES programs is of equity and efficiency. Generally it is thought that in order to target the poor, efficiency must be sacrificed, and in order to be efficient targeting should be towards hydrologically important areas regardless of the income of the owner of the territory (Pagiola *et al.* 2010). The poor may have lower willingness to accept because they have lower opportunity costs and cannot refuse even the smallest of payments (Muradian *et al.* 2009). In Mexico there is the unique situation of the land tenure of *ejidos* and *comunidades* in which the poor actually have strong

tenure rights over large areas of land. In addition, the land owned by Santa Cruz and San Pedro is within the Papaloapan watershed, one of the largest watersheds in Mexico, and one of the main vegetation types in the program area is Tropical Montane Cloud Forest which is particularly favored by the PSAH program. There is little additionality because the land in the program is also protected as a community conserved area and at very low risk of deforestation. Many of the behavior changes in the communities in terms of use of the forest resources have been self imposed and not imposed by participation in the PSAH. The money being received is not a reason to change behavior, but rather a reward for what they have been doing. Santa Cruz has decided not to log the forest for profit but opinion within the community may change on that issue. A behavior change might come from the payments from the PSAH and any other opportunities that come from it if they sway them away from logging again in the future.

The definitions for PES defined by Muradian *et al.* (2009) and Sommerville *et al.* (2009) are better descriptions of the PSAH, particularly in my communities, than the Wunder (2005) five-point definition. Rather than a direct transaction between user and buyer, as in the Wunder (2005) definition, the PSAH is a transfer of resources from the government to the communities with the intention that they continue the protection of their forests for the purpose of providing the assumed hydrological benefits from the forests. This is a much closer fit to the definitions from Muradian *et al.* (2009) and Sommerville *et al.* (2009) presented on page 9 of chapter one.



## CONCLUSIONS

Returning to my title question, “do payments for hydrological services reduce poverty and strengthen social capital?” for my two study communities it appears that the answer to both questions is strongly in the affirmative. If poverty alleviation is defined by raising incomes above the national poverty line then it is shown that in Santa Cruz this has happened and in San Pedro the incomes have risen above two of the three levels of poverty. In addition, community members believe themselves to be better off than before participating in the program and quality of life may have improved in the form of more diverse diets, better access to health care and more secure housing. Some indirect benefits of participation in the PSAH program may be delayed, such as better education and results of investments made with the new availability of financial capital. Social Capital existed in the communities before the arrival of the PSAH and certainly was influential in the communities’ ability to access the program. In addition the money from the PSAH has reaffirmed the communities’ faith in community leaders who had been advocating conservation and necessitated an increase in communication and trust between the communities who are part of CORENCHI. These results are unique to the community property regime found in the community. Equitable distributions of resources resulting in both an improvement in wellbeing and strengthening of the social institutions which determine it is a result of the communal decision making and mandatory and voluntary governance structure and built in enforcement. In this way, poverty has been alleviated and social capital strengthened in the study communities.

In addition, this study illustrated an interesting difference in willingness to accept for conservation payments on communal land and private property. On land that is communally owned and managed by community rules, willingness to accept is less. On private land where the costs of participation are borne by individuals and represents a greater risk for the individual, willingness to accept is more.

## LIST OF REFERENCES

- Agrawal, A. 2001. Common property institutions and sustainable governance of resources. *World Development*. 29(10): 1649-1672.
- Alix-Garcia, J. A. de Javery; E. Sadoulet, J. Braña Varela and M. Zorilla Ramos. 2004. An Assessment of Mexico's Payment for environmental Services Program. *Roles of Agriculture Project*, Agricultural and Development Economics Division. Food and Agriculture Organization of the United Nations.
- Alix-Garcia, J.; a. de Janvry; E. Sadoulet and J. M. Torres. 2009. Lessons learned from Mexico's payment for environmental services program. P. 163-188. In. L. Lipper *et al.* (eds) *Payment for Environmental Services in Agricultural Landscapes*, Natural Resource Management and Policy. Springer Science and Business Media, LLC.
- Berkes, F. 2007. Community-based conservation in a globalized world. *Proceeding of the National Academy of the Sciences*. 104(39): 15188-15193
- Bernard, H.R. 2002. *Research Methods in Anthropology*, 3<sup>rd</sup> edition. Altamira Press, Walnut Creek, CA.
- Bevan, B. 1938. *The Chinantec and their Habitat*. Instituto Panamericano de Geografía e Historia. Mexico D.F., Mexico. 229 pp.
- Bond, I; M. Grieg-Gran; S. Werts-Kanounnikoff; P. Hazelwood; S. Wunder and A. Angelsen. 2009. Incentives to sustain forest ecosystem services: A review and lessons for REDD. Natural Resource Issues No. 16. International Institute for Environment and Development. London, UK, with CIFOR, Bogor , Indonesia, and World Resources Institute, Washington, D.C., USA.
- Borrini-Feyerabend, G.; A. Kothari and G. Oviedo. 2004. *Indigenous and Local Communities and Protected Areas: Towards Equity and Enhanced Conservation*. IUCN, Gland, Switzerland and Cambridge, UK. Xviii+111pp.
- Bouma, J.; E. Bulte and D. van Soest. 2008. Trust and cooperation: Social capital and community resource management. *Journal of Environmental Economics and Management*. 56: 155-166

Brauman, K.A., G.C. Daily, T. K. Duarte and H. A. Mooney. 2007. The Nature and Value of Ecosystem Services: An Overview Highlighting Hydrologic Services. *Annual Review of Environment and Resources*. 332:67-98.

Brandon, K.; L. J. Gorenflo; A. S. L. Rodrigues & R. W. Waller. 2005. Reconciling Biodiversity Conservation, People, Protected Areas, and Agricultural Suitability in Mexico. *World Development*. 33(9): 1403-1418.

Bray, D.B., E. Duran, V. H. Ramos, J. Mas; A. Velazques; R. B. McNab; D. Barry and J. Radachowsky. 2008. Tropical Deforestation, Community Forests, and Protected Areas in the Maya Forest. *Ecology and Society* 13(2):56

Bray, D. B.; L. Merino-Perez; P. Negreros-Castillo; G. Segura-Warnholtz; J. M. Torres-Rojo and H. F. M. Vester. 2003. Mexico's community managed forests as a global model for sustainable landscapes. *Conservation Biology*. 17(3): 672-677.

Bray, D. B.; L. Merino Perez; and D. Barry. 2005. Community Managed in the Strong Sense of the Phrase: The Community Forest Enterprises of Mexico. In: ed. D. B. Bray; L. Merino – Perez and D. Barry. *The Community Forests of Mexico: managing for sustainable landscapes*. University of Texas Press, Austin.

Bulte, E.H.; L. Lipper; R. Stringer; D. Zilberman. 2008. Payments for ecosystem services and poverty reduction: concepts, issues, and empirical perspectives. *Environment and Development Economics* 13: 245-254.

Bruijneel, L.A. 1999. Hydrology of Tropical Montane Cloud Forests: A Reassessment. In *Hydrology and water management in the Humid Tropics: Proceedings of the Second International Colloquium*. Technical Documents in Hydrology. No. 52. UNESCO. Paris.

Bruijnzeel, L.A. 2004. Hydrological functions of tropical forests: not seeing the soil for the trees? *Agriculture, Ecosystems and Environment*. 104:185-228.

Calder, I.R. 2005. *Blue Revolution: Integrated Land and Water Resource Management*, 2<sup>nd</sup> Edition. Earthscan. London, Sterling, VA

Chandler, W., R. Schaeffer, Z. Dadi, P.R. Shukla, F. Tudela, O. Davidson and S. Alpan-Atamer. 2002. *Climate Change Mitigation in developing countries: Brazil, China, India, Mexico, South Africa, and Turkey*. The Pew Center on Global Climate Change. Arlington, Va.

Comision Nacional (CNA). 2010. *Estadisticas del Agua en Mexico*, edición 2010. SEMARNAT.

CONAFOR. 2011. *Servicios Ambientales y Cambio Climatico*. SEMARNAT

CONANP 2009. Certificación de Áreas destinadas voluntariamente a la Conservación de Ecosistemas Críticos en Chiapas [Lacadona] y Oaxaca [Chimalapas], Mexico.

Corbera, E., C. Gonzalez Soberanis, and K. Brown. 2009. Institutional dimensions of Payments for Ecosystem Services: An analysis of Mexico's carbon forestry programme. *Ecological Economics* 68:743-761.

Culas, R. L. 2006. Deforestation and the environmental Kuznets curve: An institutional perspective. *Ecological Economics*. 61(2-3):429-437.

Dailey, G.C.; T. Soderqvist; S. Aniyar; K. Arrow; P. Dasgupta; P.R. Ehrlich; C. Folke, A. Jansson; B. Jansson, N. Kautsky; S. Levin; J. Lubechenco; K. Maler; D. Simpson; D. Starrett; D. Tilman; B. Walker. 2000. The Value of Nature and the Nature of Value. *Science*. 289:395-396

Devkota, N. and K. P. Paudel. 2009. Production Termination as an Alternative to Mitigate Nutrient Pollution. Presentd at the Southern Agricultural Economics Association Annual Meeting, Atlanta, Georgia January 31 – February 3, 2009.

Dinda, S. 2004. Environmental Kuznets Curve Hypothesis: A Survey. *Ecological Economics* 49(4): 431-455

Ellis, E.A. and L. Porter-Bolland. 2008. Is community-based forest management more effective than protected areas?: A comparison of land use/land cover change in two neighboring study areas of the Central Yucatan Peninsula, Mexico.256(11): 1971-1983

Engel, S. S. Pagiola, S. Wunder. 2008. Designing a payments for environmental services in theory and practice: an overview of the issues.

ENACC 2007. Emisiones de GEI y Oportunidades de Mitigation. *Estrategia Nacional de Cambio De Climatico*.

Escalante Lara, J. M.; F. M. Romero Julian. San Pedro Tlatepusco: EL Pueblo Que se Inundo. Cuaderno de Antropologia de la Universidad Autonoma Metropolitana. Serie 1, Volume 6.

Estudios Rurales y Asesoría Campesina, A.C. (ERA) 2000. Estudio para la elaboración de un plan de uso del suelo en la comunidad de Santa Cruz Tepetotutla.

Figel, J.J. 2008. *Community Protected Areas and the Conservation of Jaguar (Panthera onca) and Their Prey in the Chinantla Region of the Sierra Norte, Oaxaca, Mexico*. Unpublished Master's Thesis. Florida International University, Miami, Florida.

García – Frapolli, E.; G. Ramos-Fernandez, E. Galaicia, A. Serrano. 2009. The complex reality of biodiversity conservation through natural protected area policy: three cases from the Yucatan Peninsula, Mexico. *Land Use Policy*. 26:715-722.

Garrido, A. and A. Dinar. 2009. Overcoming the constraints for a more integrated and adaptive water management. A. Garrido and A. Dinar eds. *Managing Water Resources in a Time of Global Change: Mountains, valleys and flood plains*. Routledge Taylor & Francis Group, New York.

Gibbs, H.K.; S. Brown; J.O. Niles and J. A. Foley. 2007. Monitoring and estimating tropical forest carbon stocks: making REDD a reality. *Environmental Research Letters*. 2:1-13

Gronwald, N. 2011. Chicago Climate Exchange Closes Nation's First Cap-and-Trade System but Keeps Eye to the Future. *The New York Times*. January 3, 2011.

Heckman, J. 1979. Sample selection bias as a specification error. *Econometrica* 47 (1): 153–61

Hite, E. 2011. Transformations in a coffee landscape in southern Mexico: A case study of emigration and conservation in the Sierra Norte, Oaxaca. Unpublished Master's Thesis. Florida International University, Miami, Florida.

Huang, M.; S. K. Upadhyaya, Winrock International. 2007. Watershed-based Payment for Environmental Services in Asia. Sustainable Agriculture and Natural resource Management Collaborative Research Support Program (SANREM CRSP). Working Paper No. 06-07.

Hoff, H. 2009. Challenges in upland watershed management: the green-blue water approach. A. Garrido and A. Dinar eds. *Managing Water Resources in a Time of Global Change: Mountains, valleys and flood plains*. Routledge Taylor & Francis Group, New York.

IPCC. 2007. Summary for Policymakers *Climate Change 2007: Synthesis Report*. International Panel on Climate Change.

Kaimowitz, D. 2004. Useful myths and intractable truths: the politics of the link between forests and water in Central America. In: *Ed. Bonell, M. and L.A. Bruijnzeel. Forests, water, and people in the humid Tropics: past, present and future hydrological research for integrated land and water management*. Cambridge University Press, Cambridge, U.K.

Kerr, J. 2002. Watershed development, environmental services and poverty alleviation in India. *World Development* . 30(8): 1387-1400

Kosoy, N.; M. Martinez-Tuna; R Muradian; and J. Martinez-Alier. 2007. Payments for Environmental Services in watersheds: Insights from a comparison study of three cases in Central America. *Ecological Economics*. 61:446-455.

Kothari, A. 2006. Community conserved areas: towards ecological and livelihood security. *Parks*. 16(1): IUCN. Gland, Switzerland.

Landell-Mills, N and Porras, T. I. 2002. Silver Bullet or Fools' Gold? A global review of markets for forest environmental services and their impact on the poor. Instruments for sustainable private sector forestry series. International Institute for Environment and Development, London.

Lewis, J. and D. Runsten. 2005. Does Fair Trade Coffee Have a Future in Mexico? The impact of migration in a Oaxacan community. Paper presented at "Trading Morsels" Conference, Princeton University. February 25, 2005.

Lipper, L. and R. Cavatassi. 2003. Land Use Change, Carbon Sequestration and Poverty Alleviation. *ESA Working Paper No. 03-13*. Agriculture and Development Economics Division, The Food and Agriculture Organization of the United Nations.

Logan, B. I.; W. G. Moseley. 2002. The political ecology of poverty alleviation in Zimbabwe's communal areas management programme for indigenous resources (CAMPFIRE). *Geoforum* 33: 1-14.

Marrs, R.H.; M.G. Le Duc; R.J. Mitchell; D. Goddard; S. Paterson and R.J. Pakeman. 2000. The ecology of bracken: its role in succession and its implications for control. *Annals of Botany*. 85(Supplement B): 3-15.

- McAfee, K. and E. N. Shapiro. 2010. Payments for ecosystem services in Mexico: Nature, Neoliberalism, social movements, and the state. *Annals of the Association of American Geographers*. 100(3): 579-599.
- Mendoza, V.M., E.E. Villanueva, and L.E. Maderey. 2005. Vulnerabilidad en el recurso agua de las zonas hidrologicas de Mexico ante el cambio climatic global. In: *Cambio climatic: una vision desde Mexico*. Editors: J.Martinez and A. Fernandez Bremauntz. Instituto nacional de Ecologia y la Secretaria del Medio Ambiente y Recursos Naturales. D.F., Mexico.
- Muñoz-Piña, C.; A. Guevera, J. M. Torres, and J. Braña. 2008. Paying for the hydrological services of Mexico's forests: Analysis, negotiations and results. *Ecological Economics*. 65:725-736
- Muñoz-Piña, C.; A. Guevara; J. M. Torres; J. Braña. 2008. Paying for the hydrological services of Mexico's Forests: Analysis, negotiations and results. *Ecological Economics*. 65: 725-736.
- Muradian, R.; E. Corbera; U. Pascual; N. Kosoy; P. H. May. 2009. Reconciling theory and practice: An alternative conceptual framework for understanding payments for environmental services. *Ecological Economics*. Doi:10.1016/j.ecolecon.2009.11.004
- Nardi, P.M. 2003. *Doing Survey Research: A guide to Quantitative Methods*. Allyn and Bacon, Columbus, Ohio.
- Ortega del Valle, D.; G. S. Benitez; C. S. Solano; M. A. H. Garcia; V. M. Olivia; and C. Galindo-Leal. 2010. Áreas de Conservación Certificadas en el Estado de Oaxaca. WWF, CONANP – SEMARNAT. Oaxaca, Mexico.
- Ostrom, E. 2000. Collective action and the evolution of social norms. *Journal of Economic Perspectives*. 14(3): 137-158.
- Oviedo, G. (ed) 2002. "The Community Protected Natural Areas in the state of Oaxaca, Mexico" WWF, Gland, Switzerland.
- Pagiola, S. 2002. Paying for Water Services in Central America: Learning from Costa Rica. In S. Pagiola; J. bishop and N. Landell-Mills. eds. *Selling Forest Environmental Services: Market- based Mechanisms for Conservation and Development*. Earthscan Publications Limited, London.



- Pagiola, S.; A. Arcenas; G. Platais. 2005. Can payments for environmental services help reduce poverty? An exploration of the issues and evidence to date from Latin America. *World Development*. 33(2): 237-253
- Pagiola, S. 2007. Payments for Environmental Services: From Theory to Practice. Global Workshop on Payments for Environmental Services. Mataram, Indonesia. World Bank.
- Pascual, U.; R. Muradian; L.C. Rodriguez and A. Duraiappah. 2009. Exploring the links between equity and efficiency in payments for environmental services: a conceptual approach. *Ecological Economics*. Doi:10.1016/j.ecolecon.2009.11.004
- Pires, M. 2004. Watershed protection for a world city: the case of New York. *Land Use Policy*. 21:161-175.
- Postel, S. and B. H. Thompson Jr. 2005. Watershed protection: capturing the benefits of nature's water supply. *Natural Resources Forum*. 29:98-108.
- Rudd, M. A. 2004. An institutional framework for designing and monitoring ecosystem-based fisheries management policy experiments. *Ecological Economics*. 48:109-124.
- Rushtagi, D., S. Engel; and M. Kosfeld. 2010. Conditional Cooperation and Costly Monitoring Explain Success in Forest commons Management. *Science*. 330:961-966.
- SEDESOL. 2002. Medición de la Pobreza: Variantes Metodológicos y Estimación Preliminar. Secretaría de Desarrollo Social, Comité Técnico para la Medición de la Pobreza. Serie: Documentos de Investigación 1.
- Sommerville, M. M.; J.P.G. Jones and E.J. Milner-Gulland. 2009. A revised framework for payments for environmental services. *Ecology and Society* 14(2): article 34
- Southgate, D.; T. Haab; J. Lundine and F. Rodriguez. 2009. Payments for environmental services and rural livelihood strategies in Ecuador and Guatemala. *Environment and Development Economics*. 15: 21-37.
- Southgate, D. and S. Wunder. 2009. Paying for watershed services in Latin America: A review of current initiatives. *Journal of Sustainable Forestry*. 28(3):497-524.
- Stavins, R. 2000. Experience with Market-Based Environmental Policy Instruments. In. K. Maler and J. Vincent (eds.) *The Handbook of Environmental Economics*. Amsterdam: North-Holland/Elsevier Science.

Turpie, J.K.; C. Marais; J.N. Blignaut. 2008. The working for water programme: Evolution of a payments for ecosystem services mechanism that addresses both poverty and ecosystem service delivery in South Africa. *Ecological Economics*. 65: 788-798.

Vatn, A. 2009. An institutional analysis of payments for environmental services. *Ecological Economics*. Doi:10.1016/j.ecolecon.2009.11.004

Wang, X. 2001. Integrating water-quality management and land-use planning in a watershed context. *Journal of Environmental Management*. 61: 25-36.

Wainger, L.A.; D. M. King; R. N. Mack; E. W. Price; T. Maslin. 2010. Can the concept of ecosystem services be practically applied to improve natural resource management decisions? *Ecological Economics*. 69: 978-987

Wendland, K.J.; M. Honzák; R. Portela; B. Vitale; S. Rubinoﬀ and J. Randrianarisoa. 2009. Targeting and implementing payments for ecosystem services: Opportunities for bundling biodiversity conservation with carbon and water services in Madagascar. *Ecological Economics*. Doi:10.1016/j.ecolecon.2009.11.004

Wunder, S. 2001. Poverty Alleviation and Tropical Forests – What scope for synergies? *World Development*. 29(11): 1817-1833.

Wunder, S. 2005. Payments for environmental services: some nuts and bolts. *CIFOR Occasional Paper No. 42*. Center for International Forestry Research, Jakarta, Indonesia.

Wunder, S. 2006. Are direct payments for environmental services spelling doom for sustainable forest management in the tropics? *Ecology and Society*. 11(2):23

Wunder, S. 2008. Payments for environmental services and the poor: concepts and preliminary evidence. *Environment and Development Economics*. 13: 279-297.

Wunder, S.; S. Engel and S. Pagiola. 2008. Taking Stock: A comparative analysis of payments for environmental services programs in developed and developing countries. *Ecological Economics*. 65:834-852.

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## Appendix I – Structured Survey, English

### Structured Household Survey for the Project: Sustainable landscapes in the Chinantla: **Payments for Hydrological Services and the Abandonment of Coffee**

<u>Name of Interviewer</u> Lindsey 1 Ernesto 2 Emily 3 Otro 4 _____	<u>Guide:</u>	<u>Date of the Survey</u>
--	---------------	---------------------------

Protocol: *1) make appointments in the houses 2)ask for the head of the house 3) if the head of the house is not home, do the interview with the spouse or elder child.*

#### Introduction:

Good afternoon. My name is \_\_\_\_\_. Soy part of a research team of IDRC-Oaxaca and Florida International University in the United States. We are working with Elvira Duran and David Bray. We are looking at the emigration of the community, coffee, and payments for watershed services received by the community. This should take one hour of your time. We have the commissioner's permission to do research in the community. All data and information that you give me during the survey will serve as part of my study only and are completely confidential. If you decide to participate in the study he makes a series of questions hoping that their answers are as complete as possible because the data that we collect could serve the community. May I continue?

Community : \_\_\_\_\_  
 (SCT – Santa Cruz Tepetotutla; SPT – San Pedro Tlatepusco)

## Section 1 –Demography of the House

### 1.1 Head of Household

1.2 Name \_\_\_\_\_ 1.3 Gender M \_\_\_\_\_ F \_\_\_\_\_

1.4 Age \_\_\_\_\_ 1.5 civil state \_\_\_\_\_

1.6 What positions have you held in the *comisariado*?

1	
2	
3	
4	

### Home Information:

1.7 Type of floor: \_\_\_\_\_ dirt \_\_\_\_\_ cement . \_\_\_\_\_ clay \_\_\_\_\_ tile \_\_\_\_\_ other (Which? \_\_\_\_\_)

1.8 principal material of walls:

\_\_\_\_\_ brick \_\_\_\_\_ wood \_\_\_\_\_ sticks and leaves \_\_\_\_\_ adobe \_\_\_\_\_ cement

1.9 Material of the roof: \_\_\_\_\_ tin \_\_\_\_\_ tile \_\_\_\_\_ leaves

1.10 ¿how many rooms in the house? \_\_\_\_\_

1.11 ¿what type of bathroom?:

\_\_\_\_ flushing toilet      \_\_\_\_ rustic latrine      \_\_\_\_ dry latrine      \_\_\_\_ none

**Box 1.12** 1.12 Now I will ask you questions about the people who actually live in the house

First, can you tell me how many people live in the house? \_\_\_\_\_

No.	a) Name	b) Relationship to head of household Head .....1 Spouse.....2 child.....3 Sibling.....4 Grandparent.....5 Aunt or uncle.....6 Cousin(m).....7 parent in law.....8 parent.....9 son in law.....10 daughter in law.....11 cousin (f).....12 other family.....13 no relation.....14	c) Age	d) Education level Preschool .....1 Primary 1-3.....2 Primary 4-6.....3 Secondary.....4 Prep .....5 Undergraduate...6 Did not attend...7 Other.....8  Which?	e) Did you immigrate for a time to the US? Yes/No	f) ¿DO you contribute Money to the household? Yes or No
1		1				Yes
2		2				
3						
4						
5						
6						
7						
8						
9						
10						

1.13 How many children do you have in total? \_\_\_\_\_

1.13a of those, how many live in the house? \_\_\_\_\_

1.13b how many live in the community? \_\_\_\_\_

1.13c how many live outside the community? \_\_\_\_\_

1.13f how many have died? \_\_\_\_\_

## Section 2 – People who contribute money to the house

Now I would like to ask a few questions about the income that comes into the house.

2.1 Do you receive Mmoney sent by someone who is outside of the house?

Yes\_\_\_\_ No\_\_\_\_

### Box 2.2 Family members who send money.

a) Name	b) Where are they?	c) ¿have they send Money in the last 12 months? (yes/no)	d) ¿How often do they send money?	e) ¿What quantity do they send each time?	f) calculation
1					
2					
3					
4					
5					
6					

**Agricultural Activities.** Now I will ask about your agricultural activities.

## Café

2.3 How many hectares of coffee do the members of the household have? \_\_\_\_\_ In how many parcels? \_\_\_\_\_ (*probe for old abandoned plots that they may not remember*)

2.4 Did you sell coffee last year? Si \_\_\_\_\_ No \_\_\_\_\_

2.5 What was your total production in kilos last year? \_\_\_\_\_ kilos

2.5a ¿who did you sell to?	b) ¿how many kilos?	c) ¿what did they pay for the kilo?	d) ¿how much did they pay in total?	e) Kilos x Price =
1) Coffee Cooperative				
2) Coyote				
3) Other:				

### Box 2.6: Active coffee Emily's questions

Parcel	a) Where is it?	b) Cuantas veces lo limpia ud cada ano 1 vez.....1 2 veces....2	c) Qué tipo de café Orgánico.....1 Convencional...2	d) Has metido otros plantes en su cafetal?	e) Cual plantes? Frutales.....1 Maíz.....2 Frijoles.....3 Otro.....4	f) Se lo tumbo? Si.....1 No.....2	g) Si, Cuando lo tumbo? (año, más o menos)
1							
2							
3							
4							
5							



**Box 2.7: Café inactivo**

Parcela	a) Donde esta?	b) Actividad de la parcela.  Abandono Puro.....1 Transformada a un policultivo....2 Agricultura anual.....3 otro.....4	c) Cuando se abandono?	d) Actividades.  Leña....1 Ganado. . . 2 Otro . . . . 3	e) Agricultura anual. Maíz....1 Yuca....2 Otro....3	f) Por qué se abandono?  Precio.....1 Emigración...2 Infestación . . .3 Otro.....4	g) ( si la respuesta fue a) Cuando se abandono, alguien emigro de la casa para trabajar afuera? Si/ No	h) Ud. piensa tumbara en algún momento?  Si....1
1								
2								
3								
4								
5								
6								

2.8 ¿Antes de sembrar café, que sembraba en cada parcela? \_\_\_\_\_ 2.9 ¿En qué ano sembró café?

\_\_\_\_\_

2.10 ¿Sembró arboles de sombra? Si \_\_\_\_ No \_\_\_\_ 2.10a ¿Qué tipo de arboles de sombra sembró usted? \_\_\_\_\_

---

2.10b ¿Qué porcentaje de sombra tenía en sus parcelas (mención INMECAFE)?

---

### Maíz (Ernesto's questions)

2.11 ¿How many hectares of corn do the people in the house have? \_\_\_\_\_ 2.11a ¿En qué tantas parcelas? \_\_\_\_\_

2.12 Cuantos se rindió en kilos por hectárea el año pasado? \_\_\_\_\_

2.13 ¿Usted ha perdido un área para cultivo de maíz por acuerdo comunitario? Si \_\_\_\_ No \_\_\_\_

2.13a ¿Dónde estaba? \_\_\_\_\_ 2.13b ¿Qué tantas hectáreas? \_\_\_\_\_ 2.13c ¿En qué año fue perdido?

---

2.13d ¿Usted podría encontrar otra área para cultivo de maíz? Si \_\_\_\_ No \_\_\_\_

### Other products that you sold

2.14 ¿Other than coffee, do you have other products that you cultivate or collect that you also sell? Yes \_\_\_\_ No \_\_\_\_

2.14 a) Product/crop (Guasmol, tepejilote, naranja, plátano ect. . . )	b) ¿How much did you sell in the last 12 months?		c) ¿what Price did you receive per unit?	d) Calculation
	quantity	Unit of measure		
1)				
2)				

3)				
----	--	--	--	--

## Cattle and yard animals

2.15 ¿Do you have any cattle? Yes \_\_\_\_ No \_\_\_\_  
No \_\_\_\_

2.15a ¿Did you sell any cattle in the last year? Yes \_\_\_\_

2.15b ¿Did you sell any other animal last year? Yes \_\_\_\_ No \_\_\_\_

2.15c ¿What?	d) ¿How many?	e) ¿what price?	f) \$ for the year
1			
2			
3			

## Work in other parcels

**Box 2.16** ¿do you or anyone in the house work as a day laborer? Yes \_\_\_\_ No \_\_\_\_

a) Name	b) ¿How much do you earn per day?	c) ¿how many days did you work in corn?	d) ¿How many days did you work in coffee?	e) \$ for the year
1				

2					
3					
4					

**Other Sources of Income** *Now I would like to ask about other sources of income*

2.17 Does anyone in the house have another source of income? Yes\_\_\_ No \_\_\_

<i>a)</i> name	<i>b)</i> type of work	<i>c)</i> ¿how much do you earn per day/week/month?	<i>d)</i> \$ for the year
<i>1)</i>			
<i>2)</i>			
<i>3)</i>			
<i>4)</i>			
<i>5)</i>			

2.18 ¿other source of income? \_\_\_ Yes \_\_\_ No

## SECTION 3 – Sources of Income from Government Programs

3.1 Do you receive assistance from PROCAMPO? Yes \_\_\_\_\_ No \_\_\_\_\_

3.1a How many hectares? \_\_\_\_\_ (X 1300 = \_\_\_\_\_)

3.2 Do you receive assistance from OPORTUNIDADES? Yes \_\_\_\_\_ No \_\_\_\_\_ 3.2a how many children receive?

\_\_\_\_\_ Can you tell me their names?

No.	b) name of child	c) Gender Male.....1 Female.....2	d) grade level	e) amount received	f) amount for the year
1					
2					
3					
4					
5					

3.2g do you receive the payment for the mother? Yes \_\_\_\_ No \_\_\_\_ 3.2h ¿how much? \_\_\_\_ / dos meses

3.3 Does anyone in the house receive “SETENTA O MAS”? Yes \_\_\_\_ No \_\_\_\_

No.	3.3a Who?	3.3b how much?
1		
2		

3.4 Does anyone receive aid from temporary employment? (PET)? Yes \_\_\_\_ No \_\_\_\_

No	3.4a Who?	3.4b how often?	3.4c how much do they receive every time?

1			
2			
3			

#### SECCION 4 - Non monetary aid

4.1 have you received a greenhouse? Yes \_\_\_\_ No \_\_\_\_ 4.1a is it functioning now? Si \_\_\_\_ No \_\_\_\_

4.2 have you received an aquiculture project? Si \_\_\_\_ No \_\_\_\_ 4.2a is it functioning now? Si \_\_\_\_ No \_\_\_\_

4.3 ¿Hay are there any other programs that have benefited you? yes \_\_\_\_ No \_\_\_\_

4.3a what are they?

4.3b Organization	4.3c Program
1	
2	
3	
4	
5	
6	

#### Section 5 – PSAH

*Ahora quisiera hacerle unas preguntas sobre los pagos por servicios hidrológicos*

5.1 Do you know why the community is receiving payments for hydrological services?

Yes \_\_\_\_ No \_\_\_\_

5.1 a why?

5.2 How many people in the house have money deposited in the bank from the PES? \_\_\_\_\_ (X 1500 = \_\_\_\_\_ SCT / X \_\_\_\_\_ = \_\_\_\_\_ SPT)

5.3 When they distributed the entire fund from the bank, how much did you receive? (SCT) \_\_\_\_\_

5.5a What is the most important thing you bought with the money?

5.5b. What is the second most important thing you did with the money?

5.4 How many people received a direct distribution of the money last year? \_\_\_\_ (X 500 = \_\_\_\_\_ SCT / X \_\_\_\_\_ = \_\_\_\_\_ SPT)

5.5 Is there an elder in the house who receives the payment? Si \_\_\_\_ No \_\_\_\_ (X 200/mes = \_\_\_\_\_ SCT /

5.6 How have you used your money that is kept in the bank? (*keep pressing them as they may have forgotten*)

Use		a) How many times have you used the money this way?	b) How much have you used?
1	Medical costs		
2	Household improvements		
3	Production activities		
4	other		

5.7 Do you know how many hectares are within the PSAH program? yes \_\_\_\_ No \_\_\_\_ 5.8a How many? \_\_\_\_\_

5.8 What are the restrictions on use of soil within the program?

5.9 Do you believe that the payments are distributed in an equal manner? Yes \_\_\_\_ No \_\_\_\_

5.10a Why?

5.10 Do you think that the payments for hydrological services are worth the restrictions that are placed on the forest for conservation? yes \_\_\_\_ No \_\_\_\_

5.11 Do you agree with the way that the payments are distributed? Si \_\_\_\_ No \_\_\_\_ 5.12a Why?

5.12 Has your economic situation improved because of the payments for environmental services? Yes \_\_\_\_ No \_\_\_\_

5.13a why?

5.13 Do you think that the 400 pesos per hectare per year that the government is paying are enough? Yes \_\_\_\_ No \_\_\_\_

5.13a If no . . . what is the least they should pay per hectare per year?



## Section 6 – Disposition to accept payments for carbon services\*\*

*Trees are very important not only for water supply, but also for the climate control by reducing carbon, a pollutant that is causing climate change. In many parts of the world, governments and companies are paying landowners to plant trees or for conservation. In this way buyers will earn about carbon credits to sell on the market.*

6.1 - Would you be interested in participating in a program in which you would be paid to either plant trees or continue conserving the forests with the end of removing carbon from the air? Yes\_\_\_\_\_ No\_\_\_\_\_

*Every other survey explain that the market price is more or less 200 pesos per hectare per year. Explain that by asking for less means losing but to ask much more means that people can look elsewhere in the project. \_\_\_ explain \_\_\_ Do not explain*

6.2 -Now, , The community earns 400 pesos per hectare per year for the hydrological services. With this money the community pays for the costs of the comisariado, the activities of natural resource conservation and you receive a payment. You have more than nine thousand acres under conservation but only four thousand are in the program of payments for environmental services. Then there is no payment for 5000 hectares What should the community accept per hectare per year in payments for the capture of carbon inside the 5,000 hectares that do not have a payment within the area of conservation?

6.3¿What is the least the community will accept in carbon payments for conservation?

6.4 – In many cases, payments for carbon require that the recipients plant trees where there are none. What will the community accept per hectare per year to cut down coffee plantations and plant forest trees?

6.5 - What is the least the community would accept per hectare per year to cut down coffee plantations and plant forest trees?

\*Thanks to David Runsten and Jessa Lewis as some sections have been adapted from their survey titled Café, Migration y desarrollo rural en el sur de Mexico. Ecuesta 2005/2006

\*\* Methods adapted from Southgate et al. 2009 Payments for environmental services and rural livelihood strategies in Ecuador and Guatemala. Environment and Development Economics 15:21-37

## Appendix II – Structured Survey, Spanish

### Encuesta Estructurada de Hogares para el proyecto: **Paisajes sustentables de la Chinantla: Pagos por Servicios Hidrológicos y el abandono de café\***

¿Los pagos por servicios hidrológicos reducen la pobreza y fortalecen el capital social? Análisis del bienestar de los hogares y la toma de decisiones en la Sierra Norte de Oaxaca

<u>Nombre del encuestador</u>	
Lindsey	1
Otro	4
<hr/>	

<u>Guia:</u>
--------------

<u>Fecha de la encuesta</u>
-----------------------------

Protocolo: 1) *hagas cita en la casa* 2) *preguntas por el jefe* 3) *si no esté el jefe, hacer la entrevista con la esposa o a un hijo mayor*

Introducción:

/Buenas tardes. Mi nombre es \_\_\_\_ Soy parte de un equipo de investigación del CIIDIR-Oaxaca y la Universidad Internacional de la Florida en los Estados Unidos. Estoy trabajando con Elvira Durán y David Bray. Estoy estudiando los pagos por servicios hidrológicos recibidos por la comunidad. Esta debe tomar un hora de su tiempo. Contamos con el permiso del comisariado para hacer la investigación en la comunidad. Todos los datos y información que usted me dé durante la encuesta va a servir de parte de mi estudio solamente y son totalmente confidenciales. Si usted decide participar en el estudio le hare una serie de preguntas esperando que su respuestas sean lo más completas posible porque los datos que recopilamos podrían servir a la comunidad. ¿Me permite continuar?

Comunidad : \_\_\_\_\_  
(SCT – Santa Cruz Tepetotutla; SPT – San Pedro Tlatepusco)

## Sección 1 – Demografía de Casas

1.1 Jefe de la Familia

1.2 Nombre \_\_\_\_\_ 1.3 Género H \_\_\_\_\_ M \_\_\_\_\_

1.4 Edad \_\_\_\_\_ 1.5 Estado Civil \_\_\_\_\_

O puede ser ¿en qué año nació?

(pregunta el guía)

1.6 Usted ha tenido cargos en el comisariado?

1	
2	
3	
4	

## Datos de la vivienda:

1.7 Tipo de piso de vivienda: \_\_\_\_\_ tierra \_\_\_\_\_ cemento . \_\_\_\_\_ loseta \_\_\_\_\_ mosaico \_\_\_\_\_ otro  
(¿Cuál? \_\_\_\_\_)

1.8 Tipo de material con el que está construida principalmente las paredes de la vivienda:

\_\_\_\_\_ ladrillo \_\_\_\_\_ madera \_\_\_\_\_ palos y palma \_\_\_\_\_ adobe \_\_\_\_\_ adobe \_\_\_\_\_ cemento

1.9 Tipo de material con el que esta construida principalmente el techo de la vivienda: \_\_\_\_\_ lamina \_\_\_\_\_ teja \_\_\_\_\_ palma

1.10 ¿Cuántos cuartos tiene la vivienda? \_\_\_\_\_

1.11 ¿Con que tipo de servicio sanitario y drenaje cuenta?:

\_\_\_\_\_ baño con drenaje      \_\_\_\_\_ letrina rústica      \_\_\_\_\_ letrina seca      \_\_\_\_\_ ninguno

**Cuadra 1.12** 1.12 Ahora me quisiera hacerle algunas preguntas acerca de cada persona que actualmente viven en su casa  
Primero, me podría decir cuántos personas viven en su casa? \_\_\_\_\_

No.	a) Nombre	b) Relación con el Jefe de Familia Jefe .....1 Esposa.....2 Hijo o Hija.....3 Hermano (a).....4 Abuelo (a).....5 Tío o Tía.....6 Primo.....7 Suegro (a).....8 Padre o Madre.....9 Yerno.....10 Nuera.....11 Prima.....12 Otro familiar.....13 Sin Relación.....14	c) Edad	d) Nivel de Educación  Preescolar .....1 Primaria 1-3.....2 Primaria 4-6.....3 Secundaria.....4 Preparatoria.....5 Licenciatura.....6 No asistió.....7 Otro.....8  ¿Cual?	e) se emigro por un tiempo al Norte? SI/No	f) ¿Aporte con dinero al hogar? Si o No
1		1				Si
2		2				
3						
4						
5						
6						
7						

8						
9						
10						

1.13 ¿Cuántos hijos tiene en total? \_\_\_\_\_ 1.13a ¿De ellos, cuántos viven en su casa? \_\_\_\_\_

1.13b ¿Cuántos viven en la comunidad? \_\_\_\_\_ 1.13c ¿cuántos viven fuera de la comunidad?

\_\_\_\_\_ 1.13f ¿Cuántos hijos han murieron? \_\_\_\_\_

## SECCIÓN 2 – Personas que contribuyen con dinero a la casa

Ahora quisiera hacer algunas preguntas sobre los ingresos que llegan a la casa. Quisiera aclararle que la información que usted me dé es confidencial solo la voy a usar por mi estudio. El comisariado sabe de estas preguntas y también mi guía.

2.1 Usted recibe dinero mandado de familiares que están fuera de la casa?

Si \_\_\_\_\_ No \_\_\_\_\_

**Cuadra 2.2** Familiares que mandan dinero a su casa.

a) Nombre de familiares que mandan dinero	b) ¿Dónde está?	c) ¿Ha mandado en los últimos 12 meses? (sí/no)	d) ¿Cada cuando manda o trae dinero? (por ejemplo, cada 2 semanas, cada 4 meses, etc.)	e) ¿Qué cantidad le manda o le trae cada vez? (indique si es pesos o dólares)	f) calculation
1					
2					
3					

4						
5						
6						

**Activos Agrícolas.** Ahora voy a preguntar sobre sus actividades agrícolas.

### Café

2.3 ¿Cuántos hectáreas de café tienen las personas que viven en la casa? \_\_\_\_\_ En que tantas parcelas? \_\_\_\_\_ (*probe for old abandoned plots that they may not remember*)

2.4 ¿Ud. vendió café el año pasado? Si \_\_\_\_ No \_\_\_\_

2.5 ¿Cuál fue su producción total en kilos de pergamino seco en el último ciclo? \_\_\_\_\_ kilos

2.5a ¿A quién le vendió?	b) ¿Cuántos kilos?	c) ¿a como le pagaron el kilo?	d) ¿Cuánto le pagaron por todo su café?	e) Kilos x Price =
1) Organización Cafetalera				
2) Coyote				
3) Otro:				

2.6. En sus parcelas de café activo, tiene otros plantas? Si \_\_\_\_ No \_\_\_\_

2.6a ¿Qué? \_\_\_\_\_

2.7. En sus parcelas de café activo, tiene otros plantas o ha convertido a otros usos? Si \_\_\_\_ No \_\_\_\_

2.7a ¿Qué? \_\_\_\_\_

## Maíz

2.11 ¿Cuántas hectáreas de rozo tienen las personas que viven en la casa? \_\_\_\_\_ 2.11a ¿En qué tantas parcelas? \_\_\_\_\_

2.12 Cuantos se rindió en kilos por hectárea el año pasado? \_\_\_\_\_ 2.12a

## Otros Cultivos que se vende

2.14 ¿Además del café, tiene otros productos cultivados o que usted recolecta que también vende? Si \_\_\_\_ No \_\_\_\_

2.14 a) Cultivo (Guasmol, tepejilote, naranja, plátano ect. . . .)	b) ¿Cuánto vendió en los últimos 12 meses?		c) ¿Qué precio recibió por medida?	d) Calculation
	cantidad	Medida		
1)				
2)				
3)				

## Ganado y Animales Traspatio

2.15 ¿Usted tiene ganado? Si \_\_\_\_ No \_\_\_\_  
No \_\_\_\_

2.15a ¿Usted vendió algún ganado el año pasado? Si \_\_\_\_

2.15b ¿Usted vendió algún animal de traspato el año pasado? Si \_\_\_\_ No \_\_\_\_

2.15c ¿Cual?	d) ¿Cuántos?	e) ¿A qué precio?	f) \$ por el año
1			
2			
3			

## TRABAJO EN PARCELAS AJENAS DE PERSONAS DE LA CASA

**Cuadra 2.16** ¿Usted o otros miembros de su casa trabajan como mozo? Si \_\_\_\_ No \_\_\_\_

a) Nombre	b) ¿Cuánto le pagan por día?	c) ¿Cuántos días trabaja de jornalero en el maíz?	d) ¿Cuántos días trabaja de jornalero en el café?	e) \$ por el año
1				
2				
3				

**Otros Fuentes de Ingresos** *Ahora quisiera hacer preguntas sobre otras fuentes de ingresos que tienen los miembros de la casa.*



2.17 ¿Alguien en la casa tiene alguna fuente de ingreso como venta de comida, venta de miel o de envasados, trabajo como chofer, trabajo de guía o alguno otro trabajo? Si \_\_\_ No \_\_\_

a) Miembro de la casa	b) Tipo de trabajo remunerado	c) ¿Cuánto gana usted por año, mes o semana u otro periodo en esta actividad?	d) \$ por el año
1)			
2)			
3)			

2.18 ¿Tiene otro fuente de ingreso que no hemos mencionado? \_\_\_ Sí \_\_\_ No

### SECCIÓN 3 – Fuentes de Ingreso de Programa de Gobierno

3.1 Usted recibe apoyo de PROCAMPO? Si \_\_\_\_\_ No \_\_\_\_\_

3.1a Cuantas hectáreas tiene registradas con ProCampo \_\_\_\_\_ (X 1300 = \_\_\_\_\_)

3.2 Usted recibe apoyo de OPPORTUNIDADES? Si \_\_\_\_\_ No \_\_\_\_\_ 3.2a Cuantos niños lo reciben? \_\_\_\_\_

¿Me podrías decir sus nombres?

No.	b) Nombre del niño	c) Género Hombre.....1 Mujer.....2	d) Grado escolar	e) Cantidad recibida cada dos meses	f) cantidad por el año
1					

2					
3					
4					
5					

3.2g ¿Ustedes reciben el pago por el madre? Si \_\_\_\_ No \_\_\_\_ 3.2h ¿Cuánto es el pago por el madre? \_\_\_\_ / dos meses

3.3 Alguien en la casa recibe pagos “SETENTA O MAS”? Si \_\_\_\_ No \_\_\_\_

No.	3.3a ¿Quien?	3.3b ¿Cuánto?
1		
2		

3.4 ¿Alguien ha recibido apoyos del programa de empleo temporal (PET)? Si \_\_\_\_ No \_\_\_\_

No	3.4a ¿ Quien?	3.4b ¿Cuantas veces?	3.4c ¿Cuanto recibe cada vez?
1			
2			
3			

#### SECCION 4 - Apoyos No Monetarios

4.1 ¿Usted ha recibido un invernadero? Si \_\_\_\_ No \_\_\_\_ 4.1a ¿tiene producción ahora? Si \_\_\_\_ No \_\_\_\_

4.4 ¿Usted ha recibido un proyecto de acuicultura? Si \_\_\_\_ No \_\_\_\_ 4.2a ¿tiene producción ahora? Si \_\_\_\_ No \_\_\_\_

4.5 ¿Hay otros programas de alguna ONG o dependencia del gobierno que han beneficiado usted? Si \_\_\_\_ No \_\_\_\_

4.3a ¿ Cuáles son?

4.3b Organización	4.3c Programa
1	

2		
3		
4		
5		
6		

## SECCION 5 – PSAH

*Ahora quisiera hacerle unas preguntas sobre los pagos por servicios hidrológicos*

5.1 ¿Usted sabe porque a la comunidad le están dando pagos por servicios hidrológicos?

Si\_\_\_\_ No\_\_\_\_

5.1 a ¿Porque?

5.2 ¿Para cuantos personas en la casa recibe dinero del hidrológico? \_\_\_\_\_

5.3 ¿Qué es la cosa más importante en que se ha gastado el dinero de los hidrológicos?

5.3ª ¿Qué es la caso segunda más importante en que se ha gastado el dinero de los hidrológicos?

5.5 ¿Hay un anciano en la casa que recibe un reparto de lo hidrológico? Si\_\_\_\_ No \_\_\_\_ (X 200/mes = \_\_\_\_\_ SCT /

5.6 Antes del reparto ¿A qué uso le dio usted al fondo que han recibido del pago? (*keep pressing them as they may have forgotten*)

Uso		c) Cuantos veces que ha usado el dinero en este manera	d) Cantidad usado
1	Gastos médicos		
2	Mejoras en la vivienda		
3	Actividades de producción		
4	Otros (especifique)		

5.7 ¿Usted sabe que tantas de hectáreas están dentro del programa de PSAH? Si \_\_\_\_ No \_\_\_\_ 5.8a ¿Qué tantos? \_\_\_\_

5.8 ¿Cuáles son las restricciones sobre el uso del suelo del área que está en el programa?

5.9 ¿Cree usted que los pagos son distribuidos de manera igual dentro de la comunidad? Si \_\_\_\_ No \_\_\_\_

5.10a ¿Por qué?

5.10 ¿El apoyo por los pagos por servicios hidrológicos valen la pena por todas las restricciones que se han puesto en el bosque por conservación? Si \_\_\_\_ No \_\_\_\_

5.11 **(San Pedro)** El reparto aquí es

¿Está de acuerdo con esto? Si \_\_\_\_ No \_\_\_\_ 5.12a ¿Por qué?

5.12 ¿Su situación económica ha mejorado gracias al programa de los pagos por servicios hidrológicos? Si \_\_\_\_ No \_\_\_\_

5.13a ¿Por qué?

5.13 ¿Piensa usted que los 400 pesos por hectárea por año que está dando el gobierno son suficientes? Si \_\_\_\_ No \_\_\_\_

5.13a Si dicen “no” . . . ¿Cuánto es lo menos que debe pagar por hectárea por año?

## **SECCION 6 – Disposición para aceptar pagos de carbono y otros\*\***

*Los árboles son muy importantes no sólo para el suministro de agua, sino también para el control climático mediante la reducción de carbono, un contaminante que está causando el cambio climático. En muchas partes del mundo, los gobiernos y las empresas están pagando a los dueños de terrenos para plantar árboles o para la conservación. En esta manera los compradores se ganan unos créditos de carbono para vender en el mercado.*

6.1 -¿Usted Estaría interesado en participar en un programa en el que se le pagaría por plantar árboles o seguir conservando los bosques con el fin de limpiar el carbono del aire? Si \_\_\_\_ No \_\_\_\_

*Cada otra encuesta explica que el precio del mercado es ahorita mas o meno 200 pesos por hectárea por año. Explica que por pedir menos está perdiendo pero a pedir mucho mas significa que la gente pueden buscar otros lugares por el proyecto. \_\_\_\_ explica \_\_\_\_ no explica*

6.2 -Ahora, la comunidad se gana 400 pesos por hectárea por año por los servicios hidrológicos. Con este dinero la comunidad se paga por los gastos de comisariado, las actividades de conservación de recursos naturales y usted se gana una parte. Ustedes tienen más de nueve mil hectáreas bajo de conservación pero solo cuatro mil están adentro del programa de pagos por servicios ambientales. Entonces no hay pago por 5 mil hectáreas. ¿Qué aceptará la comunidad por hectárea por año en pagos por la captura del carbón adentro de las 5 mil hectáreas que ya no tienen pago adentro del área de conservación?

6.3¿Qué es lo menos que puede aceptar la comunidad de pagos por la captura de carbón?

6.4 - En muchos casos, pagos por carbono requieren que se siembren arboles donde ya no hay. ¿Qué cantidad aceptará por año por tumbear una hectárea de su cafetal y sembrar árboles del bosque?

6.5 -¿Qué es lo menos que se puede aceptar por hectárea en pago por captura de carbono por tumbar un hectárea de su cafetal y sembrar árboles del bosque?

\*Thanks to David Runsten and Jessa Lewis as some sections have been adapted from their survey titled Café, Migration y desarrollo rural en el sur de Mexico. Ecuesta 2005/2006

\*\* Methods adapted from Southgate et al. 2009 Payments for environmental services and rural livelihood strategies in Ecuador and Guatemala. Environment and Development Econo

Semi Structured Interview

**Name:**

**Date:**

***Cargos:***

**Notes:**

- 1. Describe how the community entered the PSAH program?**
- 2. Why did the community decide to participate in the program?**
- 3. ¿How difficult was it to enter the program? For example, how many meetings or trips to Oaxaca were required?**
- 4. Were there people in the community who opposed the idea of the community entering the PSAH program?**
- 5. What makes up the costs of administration?**
  - a. ¿Do you believe that the Money from the PSAH that is designated for administrative costs has allowed the leadership to function better than before?**
  - b. Has participation in the PSAH improved trust in the community leadership?**
- 6. How has the money from the PSAH been used?**
- 7. In terms of the money held in the bank, has there ever been a time that an individual has requested use of this money and it has been denied?**
- 8. Has participation in the PSAH program changed the confidence community members have in government officials?**
- 9. Other than trust, how has the community benefited from the PSAH program?**
- 10. Has participation in the PSAH brought any negative effects to the community?**
- 11. Did participation in the PSAH program influence the foundation of CORENCHI? How?**
- 12. Has participation in the PSAH program improved relationships between communities?**

Entrevista Semi-estructurado

**Nombre:**

**Fecha:**

**Cargos:**

**Notas:**

13. ¿Como fue que la comunidad se entro del programa?
14. ¿Por qué la comunidad decide participar en el programa?
15. ¿Qué tan complicado fue poder estar en este programa? ¿Cuántas reuniones y cuantos viajes a Oaxaca se requirieron pr ejemplo?
16. ¿Habia gente en la comunidad que so opuso a la participación de la comunidad en este programa?
17. En que consiste los gastos del comisariado?
  - a. ¿Usted cree que este dinero ha servido para que el comisariado de bienes comunales trabaje mejor?
  - b. ¿La participación en el programa ha mejorado la confianza en los representantes y lideres e las comunidades?
18. Como ha usado el dinero de los pagos por la conservación?
19. En cuanto los repartos individuales ¿alguna vez se ha rechazado la solicitud de un comunero cuando pide su dinero?
20. ¿La participación en el programa de PSA ha cambiado la confianza de la comunidad hacia las dependencias del gobierno?
21. Ademas de confianza, ¿Cómo ha mejorado la comunidad a partir de que se recibieron los pagos por servicios ambientales?
22. ¿Hay aspectos negativos que ha traído la comunidad el programa de PSA?
23. ¿La inscripción al programa de pagos por servicios ambientales influyo en la fundación de CORENCHI?
24. ¿El programa de PSA ha fortalecido la organización de las comunidades para la conservación?