Fachhochschule Köln
Cologne University of Applied Sciences

UNIVERSIDAD AUTÓNOMA DE SAN LUIS POTOSÍ
FACULTADES DE CIENCIAS QUÍMICAS, INGENIERÍA Y MEDICINA
PROGRAMAS MULTIDISCIPLINARIOS DE POSGRADO EN CIENCIAS AMBIENTALES
AND
COLOGNE UNIVERSITY OF APPLIED SCIENCES
INSTITUTE FOR TECHNOLOGY AND RESOURCES MANAGEMENT IN THE TROPICS AND SUBTROPICS

PAYMENTS FOR ENVIRONMENTAL SERVICES IN THE HUASTECA POTOSINA REGION, MEXICO: FOREST COVER IMPACTS AT REGIONAL LEVEL AND SOCIO-ECONOMIC IMPACTS AT LOCAL LEVEL

THESIS TO OBTAIN THE DEGREE OF
MAESTRÍA EN CIENCIAS AMBIENTALES
DEGREE AWARDED BY
UNIVERSIDAD AUTÓNOMA DE SAN LUIS POTOSÍ
AND
MASTER OF SCIENCE
TECHNOLOGY AND RESOURCES MANAGEMENT IN THE TROPICS AND SUBTROPICS
IN THE SPECIALIZATION: RESOURCES MANAGEMENT
DEGREE AWARDED BY COLOGNE UNIVERSITY OF APPLIED SCIENCES

PRESENTS:

BIÓL. ADRIANA GONZÁLEZ GONZÁLEZ

CO-DIRECTOR OF THESIS PMPCA
DR. HUMBERTO REYES HERNÁNDEZ
CO-DIRECTOR OF THESIS ITT:
DR. JUAN CARLOS TORRICO ALBINO
ASSESSOR:
DR. MIGUEL AGUILAR ROBLEDO

SAN LUIS POTOSÍ, MÉXICO AUGUST 2013.

PROYECTO FINANCIADO POR:
"Proyecto Cambio Climático y Gestión de Áreas Naturales Protegidas" con PN 10.9070.3-001.00
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) y Comisión Nacional de Áreas Naturales Protegidas (CONANP)

PROYECTO REALIZADO EN:

PMPCA

COORDINACIÓN DE CIENCIAS SOCIALES Y HUMANIDADES

UNIVERSIDAD AUTÓNOMA DE SAN LUIS POTOSÍ

CON EL APOYO DE:

DEUTSCHER AKADEMISCHER AUSTAUSCH DIENST (DAAD)

CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA (CONACYT)

LA MAESTRÍA EN CIENCIAS AMBIENTALES RECIBE APOYO A TRAVÉS DEL PROGRAMA NACIONAL DE POSGRADOS (PNPC - CONACYT)

Erklärung / *Declaración*

Adriana González González

Matri.-Nr. / N° de matrícula: 11090030 (CUAS)., 204031 (UASLP)

Ich versichere wahrheitsgemäß, dass ich die vorliegende Masterarbeit selbstständig verfasst und keine anderen als die von mir angegebenen Quellen und Hilfsmittel benutzt habe. Alle Stellen, die wörtlich oder sinngemäß aus veröffentlichten und nicht veröffentlichten Schriften entnommen sind, sind als solche kenntlich gemacht.

Aseguro que yo redacté la presente tesis de maestría independientemente y no usé referencias ni medios auxiliares a parte de los indicados. Todas las partes, que están referidas a escritos o a textos publicados o no publicados son reconocidas como tales.

Die Arbeit ist in gleicher oder ähnlicher Form noch nicht als Prüfungsarbeit eingereicht worden.

Hasta la fecha, un trabajo como éste o similar no ha sido entregado como trabajo de tesis.

San Luis Potosí, den /*el* 23 de agosto de 2013

Unterschrift / *Firma*: _____

Ich erkläre mich mit einer späteren Veröffentlichung meiner Masterarbeit sowohl auszugsweise, als auch Gesamtwerk in der Institutsreihe oder zu Darstellungszwecken im Rahmen der Öffentlichkeitsarbeit des Institutes einverstanden.

Estoy de acuerdo con una publicación posterior de mi tesis de maestría en forma completa o parcial por las instituciones que otorgan el grado con la intención de exponerlos en el contexto del trabajo investigación de las mismas.

Unterschrift / *Firma*: _____

Acknowledgements

To Dr. Humberto Reyes Hernández, Dr. Juan Carlos Torrico Albino and Dr. Miguel Aguilar Robledo for their trust and advice in the different stages of the work.

To *Consejo Nacional de Ciencia y Tecnología* (CONACYT) and *Deutscher Akademischer Austausch Dienst* (DAAD) for granting me the financial aid I needed to complete my studies.

To all the administrative, logistic and academic body of the ENREM master program that made possible this experience.

To Ing. Nicolasa Rodríguez Cubillos and Ing. Alejandro Durán Fernández for providing first-hand information and support during the research.

To my colleagues who shared their energy, friendship and knowledge through every conversation.

To all the people from Ejido Laguna del Mante and Ejido Xochititla for their participation in the interviews and questionnaires. Specially, to Don Hermelindo, Don Martín and their families for grating me their friendship during the fieldwork.

To Gustavo, thank you for your excellent editing work.

And last, to my family and friends for their trust and support through the entire process.

Agradecimientos

Al Dr. Humberto Reyes Hernández, Dr. Juan Carlos Torrico Albino and Dr. Miguel Aguilar Robledo por su confianza y guía a lo largo de las diferentes etapas de la investigación.

Al Consejo Nacional de Ciencia y Tecnología (CONACYT) y al *Deutscher Akademischer Austausch Dienst* (DAAD) por brindarme el apoyo económico que necesitaba para completar mis estudios.

A todo el personal administrativo, logístico y académico del programa ENREM por hacer posible esta experiencia

A la Ing. Nicolasa Rodríguez Cubillos y el Ing. Alejandro Durán Fernández por proporcionar información clave y su apoyo durante la investigación.

A mis colegas, quienes compartieron su energía, amistad y conocimiento, a través de cada conversación.

A todos los habitantes del Ejido Laguna del Mante y el Ejido Xochititla por participar en las entrevistas y cuestionarios. En Especial a Don Hermelindo, Don Martín y sus familias quienes me brindaron su Amistad durante el trabajo de campo.

A Gustavo, por su excelente trabajo de edición.

Y finalmente, a mi familia y amigos, por su confianza y apoyo durante todo el proceso.

Table of content

Abstract

Payments for environmental services (PES) arise as an alternative to alleviate the general ecosystem degradation because they reduce pressure on ecosystems, finance nature conservation and good natural resource management, and intend to maintain an adequate standard of living for its beneficiaries. For that it is necessary to evaluate their performance and ensure their long-term duration. The objective of the study was to evaluate the effectiveness of the PES program in improving the quality of life of its beneficiaries, and in the conservation of forest ecosystems in the Huasteca Potosina, San Luis Potosí, México, locally and regionally, in the period of 2007 to 2012. Changes in the forest covered areas from the supported sites were determined during the studied period, at regional level. At local level, the use of the economic incentive was determined in two communities: Ejido Laguna del Mante and Ejido Xochititla, as well as the relationship between the PES and other governmental social programs. Between 2007 and 2012, 291 PES projects were presented in the Huasteca Potosina, from which 74 were financed. The surface supported by the program sums 55,871.58 ha worth 116.64 million MXN (9.07 million USD). 48% of the PES projects are located in the northern sub-region; 43% in the southern sub-region; and 9% in the central sub-region. From the 74 PES projects, 75% are in communal land while 25% in private properties. 58 projects are for hydrological services and only 16 for biodiversity protection. The spatial analysis showed that 44 polygons presented no changes in the forest covered area; 6 presented negative changes (51 ha); 11 positive changes (637 ha). In Xochititla, the PES was divided amongst the participants, having approximately 450 MXN (34.99 USD) per ha per year. In Laguna del Mante the incentive was divided in three activities: conservation purposes, investment in community's welfare and division amongst beneficiaries, having 500 MXN (38.89 USD) per participant family per year. Within the activities done for conservation are firebreaks, keeping of troughs, surveillance patrolling, water catchment terraces and environmental education recommendations. At family level the resource is mostly used in food. PES schemes have a complementary relation with subsidies from other official instances such as SEDESOL, SEMARNAT, CONANP and CONAFOR; but have a potential opposite relation with subsidies from SAGARPA. The effectiveness of PES in the improvement of the quality of life of its beneficiaries goes from moderate to low, while in conservation and maintenance of forest ecosystems of the supported areas is high.

Key words: Payments for environmental services; Huasteca Potosina; socio-economic impacts; forest cover impacts

Resumen

Los pagos por servicios ambientales (PSA) surgen como una alternativa, para contrarrestar la degradación de los ecosistemas, ya que reducen la presión sobre los ecosistemas, financian la conservación de la naturaleza y el buen manejo de los recursos naturales, y procuran que sus beneficiarios mantengan un nivel de vida. Por ello es necesario evaluar su desempeño y garantizar su duración a largo plazo. El objetivo del estudio fue evaluar la efectividad de los PSA en el mejoramiento de la calidad de vida de sus beneficiarios, y la conservación de los ecosistemas forestales de la Huasteca Potosina, San Luis Potosí, México, a escala local y regional, durante el periodo de 2007 a 2012. Se determinaron los cambios en la cobertura forestal en el interior de los polígonos apoyados durante el periodo de estudio. A nivel local, se determinaron el uso de los incentivos económicos en dos comunidades: Ejido Laguna del Mante y Ejido Xochititla, y la relación del programa con otros programas de apoyo gubernamentales. Entre el 2007 y 2012 se presentaron 291 proyectos de PSA en la Huasteca Potosina, de los cuales fueron financiados 74. La superficie total apoyada es de 55,871.58 ha, con un monto apoyado de 116.64 millones MXN (9,07 millones USD). El 48% de los PES financiados se encuentran en la sub-región norte, el 43% de la sub-región sur, y del 9% en la subregión central. De los 74 proyectos de PSA, el 75% se encuentran en tierras comunales mientras que el 25% en propiedades privadas. 58 proyectos son por servicios hidrológicos y sólo 16 por la protección de la biodiversidad. El análisis espacial mostró que 44 polígonos no presentaron cambios en el área cubierta forestal; 6 cambios negativos presentados (51 ha); 11 cambios positivos (637 ha). En Xochititla el PES fue dividido entre los participantes, teniendo cada uno aproximadamente 450 MXN (34,99 USD) por ha por año. En Laguna del Mante el incentivo se dividió en tres partes: actividades para la conservación, inversión en la comunidad y la división de la comunidad entre los beneficiarios, resultando en 500 MXN (38,89 USD) por familia participante por año. Entre las actividades realizadas para la conservación se encuentran brechas cortafuegos, mantenimiento de los bebederos y recorridos de vigilancia, terrazas de captación de agua y jornadas de educación ambiental. A nivel familiar, el recurso se utiliza mayormente para la alimentación. Los esquemas de PSA tienen una relación de complementariedad con los subsidios provenientes de otras instancias oficiales como SEDESOL, SEMARNAT, CONANP y CONAFOR, pero tienen un potencial de relación de oposición con las políticas de SAGARPA. La eficacia de los PSA en el mejoramiento de la calidad de vida de sus beneficiarios va de moderada a baja, mientras que en la conservación y mantenimiento de los ecosistemas forestales en los predios apoyados es alta.

Palabras clave: Pago por servicios ambientales; Huasteca Potosina; impactos socio-económicos; impactos en cobertura vegetal

Mi responsabilidad en el mundo comienza con el mundo.
–Edmond Jabès

1. Introduction

Since its origins, human kind has depended on Earth's ecosystems and the services they supplied for its development. Ecosystems provide us with services and goods that the conventional market instruments have not been able to evaluate yet. Some examples of such goods and services are food, water filtration, maintenance of soil fertility and natural pollination. In spite of them, to meet society's needs, natural systems have been changed to agricultural or urban systems; this landscape conversion is even considered one of the greatest threats to biodiversity. Locally, its impact can be seen as a rapid loss of habitat and biodiversity, ecosystem fragmentation and soil degradation. The policies that have promoted these changes have not taken into account the long term social cost (Reyes-Hernández *et al*., 2011; Sarukhán *et al.*, 2009). The Millennium Ecosystem Assessment (2005) indicates that the ability of ecosystems to provide goods and services has been greatly diminished by the general environmental degradation. It states that 60% of all the environmental services assessed were being degraded or used unsustainably. In the last few decades, there has been a large amount of scientific investigation about environmental services considering their functioning, assessment and management (Vihervaara *et al*., 2010).

As a result of the scientific work and the international awareness of the general environmental degradation, political action has been made necessary. There has been a serious effort invested into halting or reversing ecosystem degradation and the loss of ecosystem services. The environmental problems could be seen as opportunities to create markets where it is considered that conservation and good ecosystem management results in benefits. Thus, there have arisen various environmental policy instruments that seek to promote sustainable use of ecosystems (Céspedes-Flores and Moreno-Sánchez, 2010; Vihervaara *et al.*, 2010).

One of these efforts is the implementation of the economic incentive known as Payment for Environmental Services (PES henceforth) as a new managing tool. The PES seeks to reward conservation and good management of natural resources, reduce human pressure on ecosystems, and help reduce poverty in the benefited communities by providing additional income (Pagiola *et al*., 2005). The idea is that those who benefit from ecosystem services pay directly, and through a contract, to land managers to ensure the conservation and restoration of ecosystems (Wunder, 2007).

Most of the growing body of research on this economic incentive focuses on proposals and mechanisms for its implementation and few studies assess its performance (Engel *et al*.,

2008). It is known that the introduction of new policies may impact society that may include changes in the government and changes in costs faced by people, within others (Virani and Graham, 1998). The evaluation of policies is used as a political judgment on the benefit, efficiency and effectiveness, with the intention of deciding changes, improvement and the further development of the policy (Wang and Cao, 2009). There is a need to improve the environmental policy-making process, to overcome malpractice and obstacles during execution and to stimulate the life-force of the policy in the long run. The focus of the evaluation may vary from the effect, the effectiveness or the impact of the policy (amongst other criteria) in the environmental, social or economic systems (Wang and Cao, 2009). Whichever the focus or methods used on the policy evaluation, the objective is the same: to measure the policy's outcomes (Bennear and Dickinson, 2008). In addition, it is noteworthy that the ecological and economical approach has been more frequently used by researchers that work with ecosystem services, while the social and political points of view have had minor attention (Vihervaara *et al*., 2010). In terms of the evaluation of PES programs, some issues that are commonly assessed are whether the program rules are leading to achieve the hypothetical goal, whether the program enhances management practices that improve the service flow, the collateral benefits and negative outcomes induced at local level, and the outcome of the interaction between different institutions (Corbera *et al.*, 2009). From this emerges the need to evaluate the effectiveness of PES programs and their impact on human welfare.

In Mexico, deforestation and land use change have been found among the most serious environmental problems. Reports show that the country has lost over 95% of its tropical forests and more than 50% of its temperate forests (INE, 2007 cited in Céspedes-Flores and Moreno-Sánchez, 2010). The causes of deforestation may vary from region to region, but they are often related to a wide range of interconnected reasons. For example, deforestation can be associated to governance structures, land tenure systems and law enforcement, market and cultural values of forests, rights of indigenous and local communities and benefit sharing mechanisms, poverty and food production policies (Thompson *et al.*, 2011). Consequently, the solutions, such as the PES program, need to be tailored to the environmental and socio-economic conditions of each country. Another need that is identified is the evaluation of the results of this program in the different regions within the country. One of the regions in Mexico with this program is the Huasteca Potosina. And although the areas which have priority to receive this incentive in the region have been researched, so far there has not been an assessment of the results of the on-going projects. Therefore, an evaluation at regional and local levels is required to assess the effectiveness of PES in the quality of life of its beneficiaries and therefore in forest conservation.

2. Objectives

2.1. Main Objective

To evaluate the effectiveness of the economic incentive Payment for Environmental Services Program in improving the quality of life of its beneficiaries and in the conservation of forest ecosystems in the Huasteca Potosina, both locally and regionally.

2.2. Secondary Objectives

1. To evaluate land-use change of the properties participating in the Payment for Environmental Services Program in the Huasteca Potosina.
2. To analyse the socio-economic impacts of the economic incentive at the local level and its effect on the conservation of vegetation cover.
3. To analyse the relation between the different government assistance programs and the Payment for Environmental Services Program at local level.

3. Literature Review

3.1. Environmental Services

Currently, under the sustainability paradigm, there are schools of thought that lead to the economic valuation of ecosystem's functions, goods and services (Hopwood *et al*., 2005). There has been a great effort to even valuate those services provided by ecosystems that are not obvious. These are called environmental services, although they may be referred also as ecological services, ecosystem services or ecosystem goods (Vihervaara *et al.*, 2010). Environmental services are defined as "those benefits that people obtain from ecosystems"; these benefits may be direct or indirect depending on how we perceive them (Millennium Ecosystem Assessment, 2005). Other authors define them as "the ability of natural components and processes to provide goods and services that satisfy human needs" (De Groot (1992), cited in Moreno-Díaz, 2005).

The Millennium Ecosystem Assessment (2005) gives one of the most cited ecosystem services classifications, which depends on the link between the welfare of human populations and ecosystems, and on their method of production. They classify them as supporting, provisioning, regulating and cultural services; and explain what kind of service they deliver (Table 1). The relations between abiotic and biotic elements that assemble ecosystems produce ecosystem services. Depending on the time scale, some services may be put into more than one category. In addition, many ecosystem services are related to each other. For example, the provision of some goods (food, water, fuel) is related to primary production and biogeochemical cycles. Because of these interrelationships, the modification of an ecosystem service in one place is reflected in the other components of the ecosystem and thus changes other services. For example, the conversion of forest to agriculture (to increase the provisioning environmental services) can change water quality and quantity downstream of where the ecosystem change took place. However, it can also go the other way around. For example, the protection of forests for the conservation of biodiversity can reduce carbon emissions and ensures the protection of water supplies (Challenger, 2009; Millennium Ecosystem Assessment, 2005).

Environmental services are affected in different scales by direct and indirect drivers of change. Indirect drivers include demographic, economic, socio-political, cultural, religious, scientific and technological factors. Jointly these factors affect the level of production and consumption of the ecosystem services. With the growing population and economic activities, the consumption of environmental services increase and may have harmful impacts on the ecosystems, depending on the efficiency of the technologies used. These indirect drivers can trigger or strengthen direct drivers, such as land-use change, climate change, species introduction or removal, pollution and the overexploitation of resources. For terrestrial ecosystems, the most important direct driver of change has been land-use

change, especially to cropland that increases the supply of the provisioning services (Millennium Ecosystem Assessment, 2005; Vihervaara *et al.*, 2010).

Table 1. Classification of environmental services

Services	What are they?	What do they do?	Influence
Supporting	Primary production, soil formation, biogeochemical cycles	Provide what is necessary for the production of all other environmental services	Indirect and long term
Provisioning	Food (livestock, farming, fishing, crops), fuels, fibres, drinking water, other resources	Supply basic sustenance of human life	Direct and short term
Regulating	Regulation of pests and disease, natural pollination, soil degradation, and extreme natural events	Regulate the environmental conditions in which the human kind does its productive activities	Direct and relatively short term
Cultural	Spiritual, recreational or educational benefits	Collective perceptions of the environment and its components	Direct and long term

Source: Based on the Millennium Ecosystem Assessment (2005)

3.2. Policy instruments

Within the environmental economic theory, the problem of ecosystem degradation is viewed as a market failure, which can be solved through transfers between the beneficiaries and the providers of the ecosystem services (Arriagada *et al.*, 2012; Wunder, 2005). The most common types of market failures regarding natural resources are externalities and public goods.

Externalities occur when those producing or consuming a good do not incur all the costs or benefits associated with them. While externalities can be positive or negative, the latter being generally the focus of government intervention due to its creation of a none-optimal economic situation. Following this line of thought, the effects of externalities are persistent and develop over time. Many natural resources fit into this category and when there is resource management failure it is considered to be an economic cost (BDA Group and CSIRO, 2007; Requier-Desjardins *et al.*, 2011).

Externalities can be classified in three different types: congestion externalities, prodigal externalities of income and interdependence externalities rising from an economic activity and the natural production of environmental services. The first ones refer to the negative effects of the exploitation of a resource on the revenue resulting from exploitation of other portions of that resource. The second ones refer to the decrease of individual productivity when there is collective use of a resource. The third refers to the environmental services

used by economic actors or for the production of other ecosystem services (BDA Group and CSIRO, 2007; Requier-Desjardins *et al*., 2011).

Concerning property regimes, public goods are defined as goods which are non-rival and non-excludable. Because of these characteristics, those individuals producing these goods cannot capture the benefits created, and so they will be undersupplied. In other cases, governments may intervene where market impediments are leading to transactions costs or market power which prevents efficient levels of production (BDA Group and CSIRO, 2007).

The presence of the market failures mentioned before has forced the government to create and implement policy interventions to promote more sustainable resource management since the 1970s. The purpose of these instruments is to "manage externalities" and provide incentives to land owners to invest in resource conservation decisions. The policy instruments can be classified as: command and control, voluntary agreements, education and information, and market based instruments. The command and control instruments consist of the promulgation and enforcement of laws and regulations prescribing objectives, standards and technologies that polluters must comply with. The voluntary approaches are commitments from polluting actors to improve their environmental performance. They usually come from a private initiative in agreement with the public authorities. What the education and information approach try to do is to influence an individual's behaviour; it is useful when a lack of information is causing individuals not to adopt a change which has a net private benefit. The market based instruments seek to influence resource management practices through changing price signals rather than through explicit directives (BDA Group and CSIRO, 2007; Requier-Desjardins *et al.*, 2011). Market based instruments can be categorised as price based, quantity based or market friction.

3.2.1. Market based instruments

The price based instruments play the role of an incentive to the landholders. Their objective is to rehabilitate, protect or improve a natural resource management outcome, as there are negative and positive incentives; intended to remove the wedge between private and social costs and benefits. The negative ones include charges, taxes and financial enforcement incentives. They aim at internalizing environmental costs by paying a price for the use of natural resources which generally are under-priced in terms of social costs. Since such prices are not fixed spontaneously in the existing markets, administrative prices can be arranged through an intervention of public authorities, hence by imposing taxes or charges. By doing this, they incentivize the introduction of new technologies, products or processes to minimise impacts, and hence avoid the charge or tax. They are useful when it is easy to measure the environmental outcome. It is important to mention that their effectiveness will depend on the price elasticity of supply of the regulated emission, activity or product. Two

of the advantages to use these instruments are that they constitute a permanent incentive to reduce pollution and that they provide a source of revenue to the government (BDA Group and CSIRO, 2007; Requier-Desjardins *et al.*, 2011).

Within the positive incentives we can find subsidies, tax concessions and direct grants. They operate by providing a financial incentive to encourage a desirable activity and are used when it is difficult to identify, monitor or enforce a tax approach. However, subsidies are regarded as inefficient instruments in the long run, and they might be claimed by enterprises for doing certain activities or measures that they would have taken even without the subsidy. Another detected counterproductive effect is that a subsidy scheme may make it profitable for an enterprise to pollute more in order to qualify for larger subsidies, hence providing less inducement for the development of permanent new reduction technologies (BDA Group and CSIRO, 2007).

The quantity based instruments operate by creating tradable rights or by altering the existing ones to environmental resources. The idea is that the government would distribute or sell pollution permits corresponding to the total amount of tolerable or allowable pollution. These permits can be sold and purchased on the market. For this, a market has to be created in order to minimize the effects of pollution reduction, in which such transactions can benefit trading partners. This requires the establishment of a clear regulatory framework, a regulator/administrator, rules for the creation and use of tradable rights, a system for exchange of rights, a compliance and enforcement framework, scheme boundaries, funding arrangements, within others. The main issue of this approach is that the initial allocation of permits may be free of charge or sold. The second main issue is that the administrative costs of the system requires a series of rules and infrastructure to monitor transactions (BDA Group and CSIRO, 2007).

The market friction instruments are focussed on improving the operation of existing markets through the provision of information or lessening of transaction costs. This approach includes strategies such as labelling, certification and changing management practices (BDA Group and CSIRO, 2007).

3.3. Market Mechanisms for Forest Conservation

Forests provide several environmental services to humanity, such as conservation of water resources, flooding prevention, reduction of run-offs, control of soil erosion, biodiversity preservation and cultural preservation (Thompson *et al.*, 2011). Nonetheless, these benefits are neither priced nor marketed, so resource users do not consider the degradation of these services in their resource management or land-use decisions (Corbera *et al.*, 2006; Grieg-Gran *et al.*, 2005). Therefore, in order to avoid the conversion from natural forests to agricultural use, it has been assumed that the introduction of market mechanisms is

necessary. They intend to enable landowners to capture more of the value of the ecosystem services than they would have done in the absence of the mechanism. In general, they consist of the sale of environmental services to change the incentives of forest managers or to generate resources to finance conservation efforts; involving payments –in kind or in cash–, tax incentives or compensations between different partners (Grieg-Gran *et al.*, 2005).

3.3.1. Clean Development Mechanism (CDM)

The first time when governments accepted legally binding constraints on their greenhouse gas emissions to mitigate global climate change was in 1997, when they signed the Kyoto Protocol. The main objective of the Protocol was to reduce the emissions of these gases. As it does not matter where emission reductions are achieved in benefit of climate, the Protocol includes three flexibility mechanisms aimed at achieving cost effective reductions: International Emissions Trading (IET), Joint Implementation (JI), and Clean Development Mechanisms (CDM henceforth) (Olhoff *et al*., 2004).

The CDM is contained in the Article 12 of the Kyoto Protocol and has the objective of promoting sustainable development in developing countries, while allowing developed countries to contribute to the goal of reducing atmospheric concentrations of greenhouse gases. It allows governments or private entities in Annex 1 countries to implement emission reduction projects in Non-Annex 1 countries and receive credit in the form of "certified emission reductions" (CERs) -measured in tonnes of CO_{2e}-, which they may count against their national reduction targets (Grieg-Gran *et al.*, 2005; Olhoff *et al*., 2004). From the developing country perspective, the benefits of the CDM would be the inflow of capital for projects that assist in moving towards low-carbon economic development; providing opportunities for technology transfer; prioritizing investment in projects that meet sustainable development goals; and providing local environmental benefits (Kavi-Kumar, 2010)

The most common projects are for biomass energy, hydro power, energy efficiency industry, wind and agriculture; however the projects with more CERs per year are for HFC projects, N_2O, landfill gas, biomass energy, energy efficiency industry, hydro power and wind (Olsen, 2007). In 2010, most of the projects were located in China and India (59%), followed by Brazil and Mexico (13%) (Kavi-Kumar, 2010).

Some authors have studied the success of CDM projects to achieve sustainable development. The criteria to assess said impact differ from country to country, but there is an emphasis on local environmental benefits, employment generation, and poverty and equity issues (Olhoff *et al.*, 2004). There is a growing consensus that CDM is starting to

work as true markets, involving trade-offs between producing low-cost emission reductions at the expense of achieving sustainable development (Olsen, 2007).

3.3.2. Reducing Emissions from Deforestation and Forest Degradation (REDD)

Land-use change contributed to approximately 20% of global greenhouse gas emissions during the period 1990–2000 (Corbera and Schroeder, 2011). In this context, another strategy to mitigate global climate change developed as the use of equitable financial incentives to reduce emissions from deforestation and forest degradation. This strategy emerges from previous efforts to avoid deforestation and address climate change, such as forestry as carbon sinks under the CDM. In 2007, the United Nations Framework Convention on Climate Change strategy was reviewed and some concepts were added to it. These were conservation, sustainable management and the enhancement of forest carbon stocks in order to avoid creating incentives for countries whose rates of deforestation remain at very high levels while rewarding those whose forest cover is more protected due to conservation and sustainable management. From this point onwards, the strategies are referred as REDD+ (Thompson *et al*., 2011).

This strategy is mostly promoted by the UNFCCC and other organizations of the United Nations, and the World Bank's Forest Carbon Partnership Facility. The intention is to address a large fraction of global anthropogenic greenhouse gases emissions and economically compensate developing countries in the proportion to the amount of carbon emissions that are reduced on voluntary basis, but only if they reduce their national deforestation rate below the baseline. In addition, this strategy would enhance synergies between climate change mitigation, local livelihoods and biodiversity conservation (Requier-Desjardins *et al.*, 2011; Thompson *et al.*, 2011).

REDD+ activities are probable to be coordinated and led by governments, with sub-national activities being developed in cooperation with government agencies, promoted by local private or public actors (Corbera and Schroeder, 2011). Therefore, this is viewed as a top-down strategy and with a very state-centered focus. For this, it has been criticized in the context of the Global South, where the state does not have the local capacity or legitimacy to enforce the regulations (Corbera and Schroeder, 2011; Requier-Desjardins *et al.*, 2011; Thompson *et al*., 2011).

3.3.3. Payments for Environmental Services (PES)

This instrument is based on the assumption that the ecosystem degradation is a result of the conventional markets' failure to internalize the environmental service economic value (Corbera *et al.*, 2009). The PES is defined as [1] a voluntary negotiated agreement, [2] where a well-defined environmental service, [3] is bought by at least one buyer, [4] to at least one environmental service supplier, [5] if, and only if, the provider continues to supply such service (Wunder, 2007). The environmental service should be measurable, such as tons of carbon sequestered, or land use to ensure that the service is offered, such as forest conservation to ensure water supply. The transaction can be directly between those involved or through an intermediary. The environmental service should be provided continuously all the way through the duration of the contract, because there are conditions established between provision and payment. Ideally, payments should be made up on a sliding shape based on the amount or quality of the environmental service being offered, to reach a mutual agreement. Finally, it is worth noting that payments can be made in cash or in kind, through training or materials that the beneficiaries require. For a PES scheme to be considered genuine, it must meet the five conditions stated above (Wunder, 2007).

The most frequently traded environmental services are carbon storage and sequestration, biodiversity protection, watershed protection and scenic beauty protection (Grieg-Gran *et al.*, 2005; Requier-Desjardins *et al*., 2011; Wunder, 2007). In recent decades, there has been interest in the PES worldwide, surpassing 400 operating PES schemes in 2011, but even more in developing countries for two reasons (Requier-Desjardins *et al*., 2011): one is the belief that the protection and long-term sustainability of diverse ecosystems is only possible if all services provided are valued economically (Corbera *et al.*, 2009); the other reason is that it has been found, thanks to natural disasters, that the population largely depends on the environmental services for their survival (Pagiola *et al.*, 2005).

The PES scheme is believed to be able to improve livelihoods and well-being of the beneficiaries, promote local sustainable forest management, strengthen community-based institutions, improve ecosystem health and secure new sources of funding for biodiversity conservation (Corbera *et al*., 2006).

In general, one could describe the PES in Mexico as those where the government pays rural communities for providing an environmental service, such as climate regulation through carbon sequestration by forests, water quality provision through the maintenance of vegetation cover, or species and genetic pools conservation through the safekeeping of forests at hotspots (Corbera *et al*., 2009).

3.4. Forests in Mexico

In the recent history of Mexico, there have been high deforestation rates; however the last reports say that the forest cover loss rate has decreased. According to Mexican reports to the FAO, the deforestation rates decreased from 354 thousand ha per year from 1990-2000 to 155 thousand ha per year in the period of 2005-2010 (CONAFOR, 2012a). Since 2007, the estimate of temperate and tropical forests' extension has not changed, covering approximately 65 million ha of the Mexican territory covered (CONAFOR, 2012a, 2010). However, in addition to deforestation, the estimated area of forest degradation lies between 250 and 300 thousand ha per year (CONAFOR, 2010).

The main reason for these deforestation and degradation patterns is the land-use change that happens without control and coordination within the different government institutions. The changes go from natural ecosystem, mainly, to agriculture and livestock production land-uses, and later to urban or industrial land uses. However, the specific reasons for the changes may vary depending on the region; they are pushed by direct and indirect drivers. The first ones are those which favour the growth of agricultural and urban systems, and some deficient management activities like overgrazing or illegal logging. These direct drivers of change may be enhanced by indirect ones such as weak national markets for forestry products, lack of investment on forestry enterprises, and the need of economic development of rural communities. The latter includes the problems of low income for forest managers, government subsidies for agricultural development, illegal extraction, poverty and lack of opportunities for the communities (CONAFOR, 2012a, 2010; OECD, 2013).

3.4.1. Institutional Framework for Forest Governance

The National Forestry Commission (CONAFOR) has its responsibilities stated in the General Law for Sustainable Forest Development. Within the said responsibilities, their participation in the formulation and application of national policies for sustainable forest development stands out; as well as the implementation of forestry policy instruments. For this reason, CONAFOR is in charge to design and enforce the PES schemes and REDD+ programs –amongst other policy instruments–, in Mexico (CONAFOR, 2010; Congreso General de los Estados Unidos Mexicanos, 2012; OECD, 2013).

Furthermore, there are other institutions that seek to reduce deforestation and ecosystem degradation with their conservation policies. Such institutions are the National Commission of Protected Areas (CONANP), National Commission of Knowledge and Use of Biodiversity (CONABIO), National Institute of Ecology and Climate Change (INECC), Federal Attorney's Office for Environmental Protection (PROFEPA) and the National Water Commission (CONAGUA). There are also other institutions within forest territory

that deal with rural development such as Agriculture, Livestock, Rural Development, Fishing and Food Secretariat (SAGARPA) and Social Development Secretariat (SEDESOL) (CONAFOR, 2012a, 2010; OECD, 2013).

These institutions work at different levels of government (federal, state, and municipal) in Mexico and have some degree of influence in the design of policy instruments and everyday decisions. This has sometimes resulted in independent, separate diagnosis from each institution to problems that are transsectoral and that need a coordinated strategy.

3.4.2. Policy Instruments for Forest Conservation in Mexico

A great number of strategies and programmes to promote sustainable use of biodiversity and forest conservation have emerged and been refined in the last decade. They can be divided in regulatory approaches, economic instruments and voluntary and information approaches. The regulatory approaches include the Official Mexican Norms (NOMs) for biodiversity and forest conservation created since 2000, the establishment of protected areas, the creation of Ecological Land Use Plans and Action Programmes for Species Conservation –that includes measures for habitat conservation. However, most of the national territory is left out of these instruments (Álvarez-Icaza and Muñoz-Piña, 2008; OECD, 2013), so other strategies have been necessary.

The voluntary agreements and information approaches in Mexico relate to green certification. The products that have been certified are coffee, timber and tourism-related businesses, with most of the certifications taken by the private sector; however, further efforts are needed to involve them in forest conservation (OECD, 2013).

Most economic instruments applied in Mexico are subsidy based. This serves the additional purpose of poverty alleviation; a total of 10.9 million people who live in forests are considered to live in extreme poverty. Within the economic instruments related to biodiversity and forest conservation are access fees to protected areas, the PES Program and the Forest Land-Use Change Compensation Mechanisms. In addition, the Pro-Tree (ProÁrbol) program supports landowners for reforesting degraded forest land, providing seedlings and training. These instruments have been appointed as more effective than regulatory approaches to promote biodiversity conservation (Álvarez-Icaza and Muñoz-Piña, 2008; OECD, 2013)

3.4.3. Payment for Environmental Services Program

The PES program was created in 2003 by CONAFOR under the name of Payment for Hydrological Environmental Services (PSAH). The program pays for forest conservation in critical watersheds with the revenue from water rates. In 2004, the program to Develop

Environmental Services Markets for Carbon Sequestration and Biodiversity Derivatives and to Establish and Improve Agroforestry Systems (PSA-CABSA) was created. However, in 2010, some modifications were made to these programs and the PES mode for carbon sequestration was removed. Nowadays, PES are integrated into two modalities: for hydrological services and for biodiversity conservation. The latter includes the improvement of agroforestry systems. The program also has an environmental endowment fund and the promotion of local PES mechanisms through matching funds (González-Avilés, 2011; OECD, 2013; Pagiola *et al.*, 2005).

In both programs, CONAFOR provides an economic incentive for 5 years to the owners and holders of temperate and tropical forests whom choose to join the program (SEMARNAT and CONAFOR, 2011). This program and other market-based systems for conservation of forest ecosystems are promoted within Mexico's General Law for Sustainable Forest Development. Roughly speaking, the PES is funded by the Federation Expenditure Budget, a levy of national water tax payments, the World Bank and the Global Environment Facility (González-Avilés, 2011). The PSAH has a constant budget funded by a national fee on water use channelled to the Forestry Fund. However, the PSA-CABSA's budget is not fixed. It has to be negotiated every year in Congress (Corbera *et al.*, 2009; OECD, 2013).

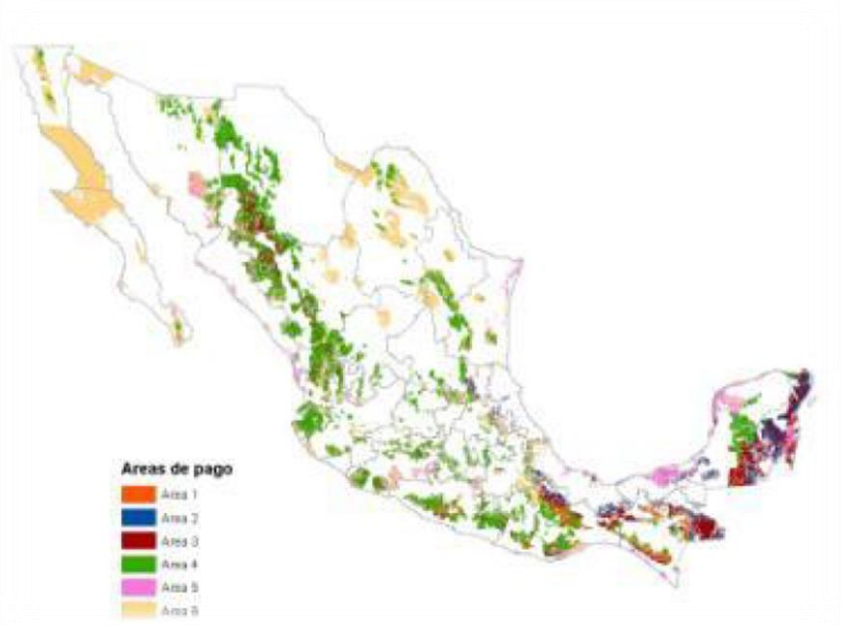


Figure 1. Eligible areas for PES
Source: CONAFOR, 2012b

The payments are done once a year and are settled by processing information of the eligible areas, as shown in Table 2 (OECD, 2013; SEMARNAT and CONAFOR, 2011). Such areas are selected combining information of the Land-use and Vegetation series (INEGI), the

Deforestation Risk Index (INE), Natural Protected Areas location (CONANP), the Priority Mountains location (CONAFOR), the Population and Housing Census (INGEGI) and the Watershed locations (CONAGUA) (CONAFOR, 2012b). The most relevant ecosystems are the cloud forest and the tropical rainforests with a high value of the deforestation risk index (CONAFOR, 2012b). In Figure 1, the eligible areas are presented in different colours following the classification in Table 2 for the whole country.

The 2010-2011 Specific Evaluation Performance Report–conducted by CONEVAL–revealed that the PES program's budget has grown from 3.16 million MXN (245.77 thousand USD[1]) in 2004 to 805.24 million MXN (62.63 million USD) in 2011; this is reflected in the amount of supported surface. Since 2008, the potential surface has not changed, remaining at 27'400,000 ha. However, for 2010 the target surface grew from 375,000 ha to 410,000 ha. The difference between these two concepts is that the potential surface is the surface that may be supported due to certain forest characteristics; whereas the target surface is the surface within the potential population areas, which was planned to be covered in the fiscal year 2010. So far, these incentives are distributed in 31 states and 204 municipalities. Figure 2 shows with red dots the municipalities that were supported in 2011. The light grey state, Baja California Sur, had no PES program at the time (Carrasco-Vargas, 2011).

Figure 2. Location of municipalities with PSAH or CABSA projects
Source: Carrasco-Vargas, 2011

The markets for environmental services do not operate in isolation. The PES projects may be influenced by existing institutions which may undermine or enhance the effectiveness of resource management and the policy impacts (Corbera *et al*., 2006).

[1] 1 USD = 12.8572 MXN by the June 11, 2013 exchange rate.

Table 2. Differentiated payments for ecosystem services

Modality	Payment region	Ecosystem type (INEGI)	Deforestation risk index (INE)	Payment/ha/year		Eligible area(ha)
				MXN	USD*	
Hydrological	1	Cloud forest	Very high	1,100	85.56	47,777.56
	2	Cloud forest	High, medium and low	700	54.44	1’149,681.48
	3	Coniferous forest Tropical dry forest Oak forest and pine-oak/oak-pine forests	Very high, high, medium, low and very low	382	29.71	18’647,528.64
	4	Tropical rainforest	Very high, high, medium, low and very low	550	42.78	5’468,897.57
Biodiversity protection	5	Tropical dry forest and thorn forest	Very high and high	382	29.71	3’441,876.29
		Mangrove	Very high, high, medium, low and very low			
	6	Tropical dry forest and thorn forest	Medium, low and very low	280	21.78	19’911,839.35
		Desert and semi-desert Natural grassland	Very high, high, medium, low and very low			
			Total surface eligible for PES			**48’667,600.89**

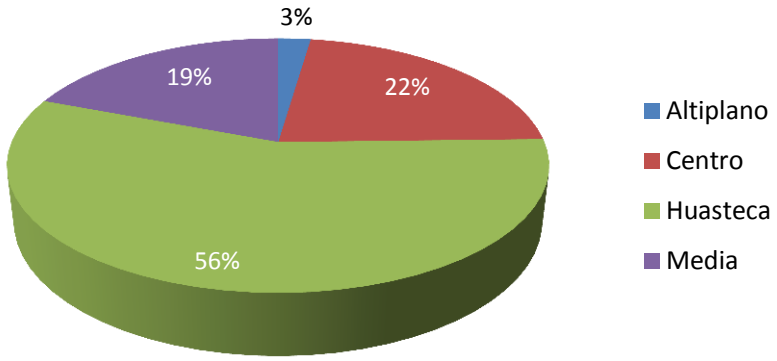
Source: CONAFOR, 2012b

4. Methodology

The study focused on two scales of analysis. The regional scale included 73 sites that have or had the economic incentive in the Huasteca Potosina, while the local scale consisted of the Ejido Laguna del Mante, Ciudad Valles and the Ejido Xochititla, Matlapa.

4.1. Study area

The State Strategic Forestry Program of San Luis Potosi 2006-2025 aims to incorporate 74,000 ha to PES program in its two modalities, within other strategies (Flores-Rivas *et al.*, 2008). During the period of 2007-2012 there were 130 active PES in San Luis Potosí (Figure 3); 54% in the Huasteca region, 19% in the Media, 22% in the Centro and 3% in the Altiplano, having a total of 99,203 protected hectares (Graph 1) (CONAFOR, 2013).



Graph 1. PES in San Luis Potosí by region Source: CONAFOR, 2013

4.1.1. Huasteca Potosina

The Huasteca is a macro-region integrated by parts of six Mexican states: Hidalgo, Querétaro, Veracruz, Tamaulipas, Puebla and San Luis Potosí; its constituents share a common socio-economic, cultural, political, historical and natural background (Rivera, 2010). The area of the Huasteca located in the state of San Luis Potosí is known as Huasteca Potosina and covers around one million hectares (González-Sierra, 2011). This region has a great ecological importance because it represents the transition zone between the Nearctic and Neotropical biogeographical regions (Mendoza-Rodríguez, 2010). In addition, thanks to the topographic diversity –that makes possible a variety of climatic and soil conditions–, the biodiversity in the region is extraordinarily high (González-Sierra, 2011). The vegetation types that can be found range from oak forests to thorn forests, going through cloud forests, dry tropical forests, and natural and induced grasslands. In this region, close to 200 species of reptiles and amphibians, 200 of mammals, more than 2,500 vascular plants and more than 300 birds –from which 40 are endemic– have been recorded (Sahagún-Sánchez *et al.*, 2013).

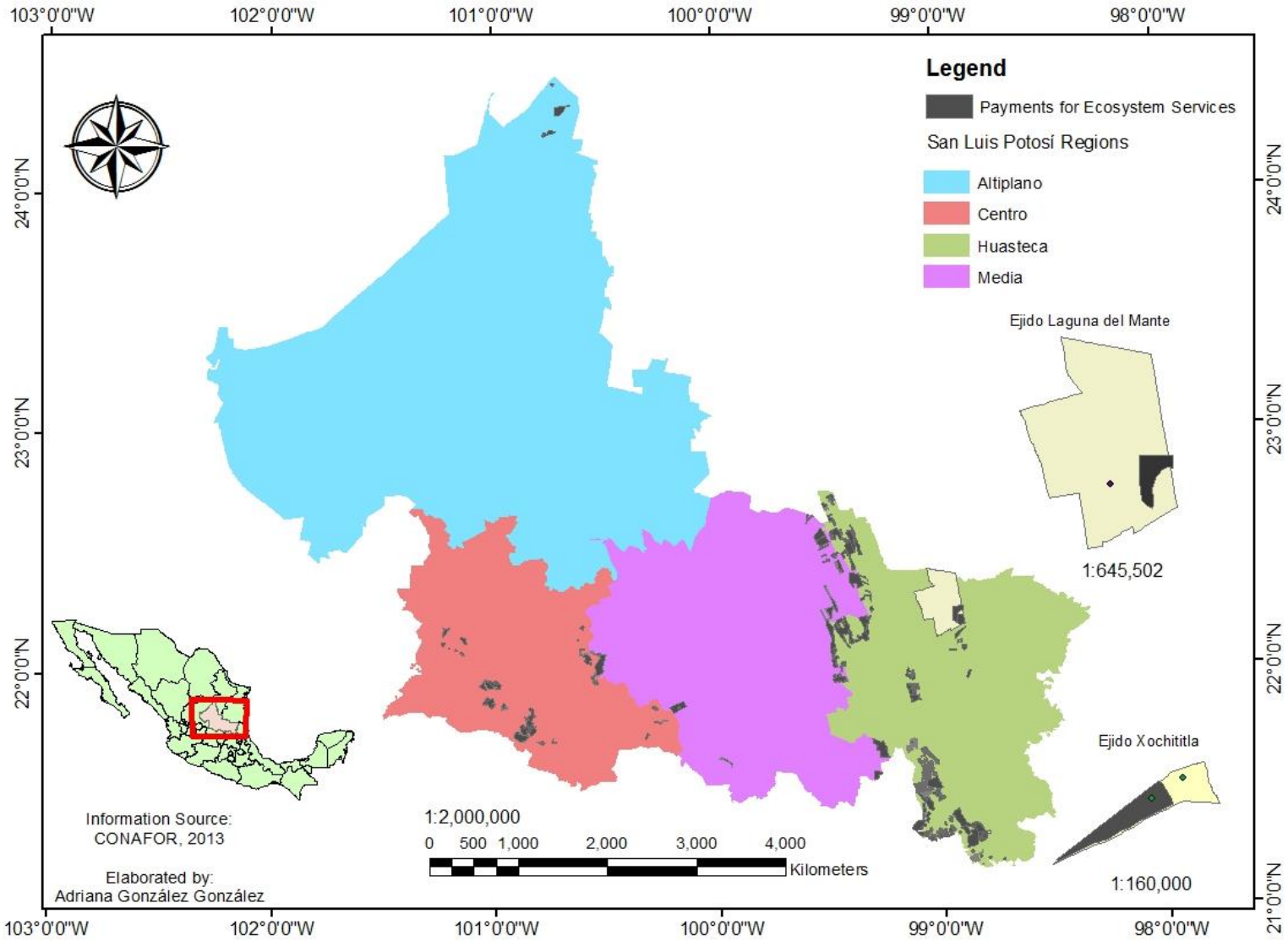


Figure 3. Location of PES program in San Luis Potosí State (2007-2012), Laguna del Mante and Xochititla are enhanced

Throughout history, the Huasteca Potosina has been managed by different cultures, generating changes in the environment. The peoples that have dwelled in this region have used the resources for food, shelter and other uses, making it into a key area for economic exploitation (Quintero-Ruiz, 2012). Since the late 16th century the Huasteca Potosina was oriented towards livestock raising and sugar cane production (Rivera, 2010), and these survive as the main productive activities in the area even nowadays.

Notwithstanding the ecological importance of the Huasteca Potosina, and due to the intensive and extensive economic activities, the region has gone through a severe deforestation process –intensified after the mid-20th-century. During the 1970s this process of deforestation was intensified by the Pujal Coy Project, which purpose was to replace the extensive cattle raising with intensive irrigated agriculture. From 1973 to 1985 the annual deforestation rate in the area was kept at 11%. Since then, the deforestation rate decreased to 6.6 % during the period 1985-1990 and to 5.4% during 1990-2000 (Reyes-Hernández *et al.*, 2006). Hence, during the period of 1976 to 2000, more than 428,809 ha of forests and tropical forests were lost and transformed into corn and sugar cane crops (González-Sierra, 2011). With local variations, this process affected the entire Huasteca Potosina region.

4.1.2. The Ejidos

A mosaic of land tenures composes the Mexican territory, as a result of a long and rich history of policies' landholding. One of the outcomes of the 1910 Mexican Revolution is Article 27 of the 1917 Mexican Constitution, which recognized community-based land tenure and highlighted the importance of public over private institutions (Barnes, 2009; Bonilla-Moheno *et al*., 2013). In 1992, Article 27 was amended to define the current land tenure regimes: public (4% of the national territory), private (38%), and common property (58%). The common property is subdivided in *ejidos* and *comunidades agrarias*. A *comunidad agraria* is owned by original groups with ancestral rights to the land and that share traditional practices (Bonilla-Moheno *et al*., 2013). 16th-century New Spain *ejidos* referred to the communal lands that were in the outskirts of towns and were used collectively for livestock foraging or timber gathering. In the current Mexican Constitution, they are defined as parcels of land collectively owned and either collectively or individually worked by the official tenants or so called *ejidatarios* (Assennatto-Blanco and de León-Mojarro, 2006; Barnes, 2009)

In 1992, there were three major changes in the legal status of the *ejidos*. First, the *ejido* parcels were individually allowed to enter into joint ventures with outsiders. Second, certified individual agricultural and residential lots could be sold to other members or leased to outsiders. And third, *ejidos* were empowered to change their tenure regime to private property (Barnes, 2009). So in 1993, with the agrarian reform, the Certification Program of Ejido Rights and Title to Land (PROCEDE for its acronym in Spanish) was

established as an instrument to enforce the 1992 agrarian reforms (Assennatto-Blanco and de León-Mojarro, 2006; Bonilla-Moheno *et al.*, 2013; Pech-Jiménez, 2010).

The land in an *ejido* is divided for three main uses: human settlements, a portion of common-use lands, and parceled land for individual exploitation. The property rights of the common-use lands and the parcels are passed on to family members. Besides that, the ownership and management of natural resources on which the income levels depend on are governed by the internal organization of the *ejidos*. The *ejidatarios* are organized by a committee for decision making called Ejidal Assembly (Asamblea Ejidal), a representative committee or Ejidal Commissariat (Comisariado Ejidal) that enacts and enforces the resolutions executed by the Ejidal Assembly –composed by a President, a Secretary and a Treasurer–, and a vigilance committee (Consejo de Vigilancia) (Assennatto-Blanco and de León-Mojarro, 2006; Bonilla-Moheno *et al.*, 2013; Pech-Jiménez, 2010). The judge, who arbitrates conflicts among community members, plays an important part in the *ejido's* governance (Kosoy *et al*., 2008).

Ejido Laguna del Mante, Ciudad Valles, San Luis Potosí

In the northern part of the Huasteca Potosina is located the Ejido Laguna del Mante, in the municipality of Ciudad Valles (Figure 3). The northern part of the municipality of Ciudad Valles is located in the mountains of the Sierra Madre Oriental; while the central and southern parts are located in plains. From the north, the Naranjo and Gato Rivers connect to form the Valles River. In the southeast of the municipality the Coy River is located. The predominant weather is tropical; with the mean annual temperature of 24.5°C, with a maximum of 45.5°C and minimum or 6°C (SEGOB, 2010a).

Ejido Laguna del Mante was established as an *ejido* in 1974 and has an extension of 46,000 ha. It has an estimated population of 2036 inhabitants, from which 446 are *ejidatarios*. Only the 6% of the population aged 5 or above speak an indigenous language (INEGI, 2010). Although the municipality presents a low Social Marginalization Index, the locality presents a high value; however it is not classified as an area of priority attention and is not listed as a beneficiary of the Program for Development of Priority Areas (SEDESOL, 2010). Amongst its main economic activities are sugar cane, lemon and mango agriculture; cattle and sheep raising; and fish farming. A peculiarity of this *ejido* is that a third of its territory, 14,000 ha, is part of the Biosphere Reserve Sierra del Abra Tanchipa, which was enacted in 1994 with an area of 21,000 ha. Within this territory, part of the Reserve, the *ejido* has an area of 1947.73 ha in the PES for Biodiversity Conservation, in the period of 2010-2015.

Ejido Xochititla, Matlapa, San Luis Potosí

Ejido Xochititla is located in the southern part of the Huasteca Potosina, in the municipality of Matlapa (Figure 3). The municipality of Matlapa is also located in the mountains of the Sierra Madre Oriental. Within it, there are small inflows that flow into the Matlapa stream, which runs from south to north leading to the Tancuilín River. The predominant weather is semi-warm humid with rain throughout the year. The mean annual temperature is 25°C, with a maximum of 44°C and minimum or 1°C. The dominant ecosystem is tropical rainforest (SEGOB, 2010b).

In 1936, Xochititla was established as an *ejido* in an extension of 750 ha. It has an estimated population of 571 inhabitants of whom 141 are *ejidatarios*. 64% of the population aged 5 years or above speak an indigenous language (INEGI, 2010). The locality presents a High Social Marginalization Index and is classified as an area of priority attention and is beneficiary of the Program for Development of Priority Areas (SEDESOL, 2010). Amongst its main economic activities are orange and corn agriculture. However, most of the people work as day labourers in near towns. Contrary to Laguna del Mante, this community is not part of a Protected Area. However, during the period of 2008-2012 they had the support for PES for Hydrological Services; with a supported area of 258.07 ha. Last year, they received the last payment; but now they are trying to renew the contract for another 5 years.

4.2. Indicators

In order to evaluate the effect of the PES a series of indicators were generated. They were classified by the scale, in which the analysis was held, and the topic, for which they provided information. Following Corbera's classification for PES analytical domains, most of them belong to the evaluation of institutional performance; with the exception of the last ones (for objective 3) that belong to the evaluation of institutional interplay. The first ones intend to assess the way PES schemes achieve their objectives. The second ones relate to the way a set of institutions relate to each other, in this context considering only social programs (Corbera *et al*., 2009) (Table 3).

Table 3. Indicator table

Objective	Topic	Level of analysis	Indicator
General	Program functionality	• Regional	• Number of PES per year • Number of PES renewed • Number of PES revoked
General	People's acceptance	• Local (family)	• Perception of program by community

Objective	Topic	Level of analysis	Indicator
1)	Land-use change	• Regional	• New protected forest area per year • Land-use type to which forest changed
2)	Use of incentive	• Local (*ejido*)	• Money invested in conservation • Money invested in community's welfare
		• Local (family)	• Received money per family Individual use of PES money • PES influence in family budge (percentage)t
2)	Conservation	• Local (*ejido*)	• Fire prevention (investment in awareness campaigns, fire-fighter's equipment, forest firebreaks) • Biodiversity conservation (Survey of flora and fauna, protection of nesting habitat, establishment and maintenance of wildlife feeding and drinking troughs, …) • Investment in environmental education programs
2)	Community's welfare	• Local (*ejido*)	• Educational level (investment in infrastructure, furniture, books or educative materials) • Number of generated jobs with PES money • Investment in public works (roads, electricity supply installations, water supply infrastructure) • Investment in health services (infrastructure of clinic/hospital, medicines, equipment, salary of doctors and nurses)
3)	Other policies	• Local (*ejido*)	• Number of active social programs in community • Importance of social programs
		• Local (Family)	• Number of social programs per household • Importance of social programs

4.3. Regional level analysis

For the regional analysis specific information was asked from government officials in CONAFOR; related to the number of beneficiaries, the economic value of each year's support and modalities of the PES program. The people in charge of the PES program were interviewed in order to get this information. In addition, geographic information about each lot that has the economic incentive was asked for from the same authorities. This information was gathered in the shapefiles with data from the PES projects of each year (active and with insufficient budget). In addition, a complementary database in Excel was delivered.

To determine land-use change, SPOT 5 images of 2007 and 2011 were used. The images from 2007 were provided by the "Agenda Ambiental"; part of the Universidad Autónoma de San Luis Potosí. The images from 2011 were attained thanks to the project "Procesos de deforestación y escenarios futuros en la Sierra Madre Oriental, en el Estado de San Luis Potosí" with the code 20110707-174219-411; they were provided by ERMEXS-SEMAR. The list of images that were used is:

- SPOT 5 585/305 (08 Jan 2007)
- SPOT 5 586/305 (08 Jan 2007)
- SPOT 5 587/306 (08 Jan 2007)
- SPOT 5 588/306 (08 Jan 2007)
- SPOT 5 588/307 (08 Jan 2007)
- SPOT 5 588/308 (24 sep 2007)
- SPOT 5 585/305 (18 Feb 2011)
- SPOT 5 587/305 (03 Jan 2011)
- SPOT 5 587/306 (03 Jan 2011)
- SPOT 5 587/307 (08 Feb 2011)
- SPOT 5 588/306 (23 Jan 2011)
- SPOT 5 588/307 (23 Jan 2011)
- SPOT 5 588/308 (18 Jan 2011)

The information referring to national, state and municipal limits was downloaded from the institutional web site of the National Institute for Geographical and Statistical Information (INEGI) http://www.inegi.org.mx/geo/contenidos/geoestadistica/M_Geoestadistico.aspx

With these images vegetation cover for each lot that is supported by PES was delimited in each year. Once the polygons were outlined, the vegetation cover data was cartographically overlapped. The area was divided in three sections so it would fit the scale 1:100,000 in each year. The results of the division were printed in 60x90cm size. The prints were visually contrasted to detect any change in the forest area inside the PES polygons. The ones that were detected with changes were analysed with the software *Arc*Gis 10.1. These zones were drawn in a new shapefile and the area was calculated using the Data Management Tool Geometry Calculator. The resulting area was added to or subtracted from the original polygon's area to get the change in coverage in hectares (Bocco *et al.*, 2001).

4.4. Local level analysis

The local unit of analysis covered the protected area of two communities. The first criterion to select them was to be of the same land tenure; *ejidos* were selected for their wider distribution in forests. The second one was to differentiate between a PES scheme inside a Protected Area and one outside them. The third criterion was to differentiate between an on-going program and one that had already finished. As a result of these criteria, the Ejido Laguna del Mante and Ejido Xochititla were selected.

In the first phase of the field work, an exploratory approach was used. In order to get a better understanding of local dynamics of Laguna del Mante, the involvement in a series of participatory workshops for the analysis of livelihood vulnerability to climate change was necessary. During these workshops demographic, economic and historical data of the Ejido was collected. These were part of the project "Multi-scale Analysis of Vulnerability to Climate Change in Priority Terrestrial Ecosystems and Rural Population Livelihoods in the Central Area of the Sierra Madre Oriental, Mexico", conducted by CONANP and the German Agency for Technical Cooperation (GIZ), together with different Mexican universities. Some of the participatory tools that were used are: foot transect, participatory mapping, welfare ranking, trend lines and seasonal calendars, brainstorming on the use of resources and livelihood strategies, identification and classification of risks, adaptation mechanisms to risks and institutional mapping (GIZ, 2012).

Additionally, semi-structured interviews were conducted with people, previously identified as key players in decision making about PES in the *ejido*. This helped to identify how the people perceive this kind of economic incentive in the community, how they use it and whether it represents a support for their family's welfare. Also, since the *ejido* is part of the Biosphere Reserve Sierra del Abra Tanchipa, and the lot referred to the PES is within the protected area, an additional interview was conducted with the director of the protected area to know the establishment and operation process of PES in the Reserve. The information collected with these interviews were firstly transcribed and ordered.

The second phase of the local analysis consisted of applying questionnaires to *ejidatarios* of both *ejidos*. The questionnaires in Laguna del Mante had the purpose of going into detail about the use of the incentive at the community and family levels. The sampled population consisted of 40 *ejidatarios*, representing the 10% of this sector of the community.

Regarding Xochititla, the questionnaires gave the general perspective of the use of the incentive and the detailed use of it in the family level. The sample population consisted of 19 *ejidatarios*, representing 18% of the sector of the community. It was decided to only question them for two reasons: they are the ones with power in the decision-making processes inside the *ejidos*, and they are the direct beneficiaries of the PES program. In

both cases the *ejido's* authorities were questioned with a different questionnaire, in order to go into detail of the use of the incentive at the *ejido* level.

The three questionnaires in Spanish are annexed in the Appendix 9.1 Sample questionnaires. From them, the following variables were generated and captured as an Excel database: Genre, Age, Occupation, Formal education, Monthly income, Monthly expenses, PES income, Family PES expense, Community PES expense, Conservation PES expense, Access to other policies, and Program perception. Subsequently, the database was imported to *IBM SPSS Statistics 21*, where descriptive statistical analysis was done. In addition, the non-parametric statistical tests of Chi square test and Pearson correlations were done to select variables that are not correlated with each other and have greater explanatory power were conducted. With this, multiple regression models were built to relate the maintenance of vegetation cover by period and PES, with the socioeconomic and demographic aspects (Reyes-Hernández *et al.*, 2003).

5. Results

5.1. PES in San Luis Potosi

The PES program in Mexico has been growing since its creation. In San Luis Potosí, the interest for said economic incentive has been shifting. In 2009, the number of new projects was almost half of those in 2008, showing that the number of new projects has not been continuously increasing every year. However, the interest of the communities and the government to continue with the program remains. This can be seen with the number of new projects submitted every year (Table 4).

Table 4. Number of new PES projects per year in San Luis Potosí, 2007-2012

	2007		2008		2009		2010		2011		2012	
	App.	I.B.	App.	I.B.	App.	I.B.	App.	I.B.	App.	I.B.	App.	I.B.
Altiplano	0	0	1	2	0	2	0	2	1	1	1	0
Centro	5	4	6	0	1	3	1	11	6	11	10	5
Huasteca	17	26	16	68	15	29	14	28	5	28	6	38
Media	4	4	4	2	2	6	4	31	6	20	5	19
Sub-Total	26	34	27	72	18	40	19	72	18	60	22	62
Total	**60**		**99**		**58**		**91**		**78**		**84**	

App. Approved PSA and I.B. Projects with insufficient budget
Source: CONAFOR, 2013

All of the projects quantified in Table 4 had all the conditions for becoming beneficiaries of the economic incentive; however, not all of them were supported economically. The number of projects with insufficient budget is always larger than those approved and financed; with more than 50% of not supported in most years and regions (the Media region was the exception in the year 2008, where there were more financed projects than those that lacked budget). This is explained by the fact that funds available for the program are not enough to support the total number of successful applications. As the budget is limited, CONAFOR's personnel have to prioritize the projects in relation to social criteria, the size of the suggested area or other ecological criteria. The projects that did not get the incentive one year, can apply with a simplified form the next year.

Matching to the number of new projects, the supported area and the budget invested shifts through the years, 2010 stands out for the amount of money invested (Table 5), and the region with most submissions and financed PES projects is the Huasteca. This may relate to the ecosystems that are in the region and the pressure over them resulting in a high risk of deforestation. It must be noted that the projects last for five years each, and the money allocated for each project is distributed in five payments accordingly. So, the money reported per year is only for the projects approved during that fiscal year.

Table 5. New area protected and money invested in projects in San Luis Potosí, 2007-2012

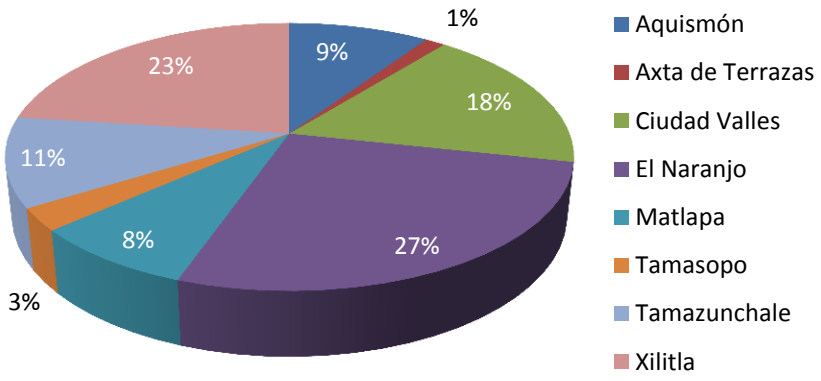
	Area (ha)	Budget (MXN)*	Budget (USD)*
2007	15,941.25	26.14	2.03
2008	13,323.68	25.80	2.01
2009	10,899.74	24.10	1.87
2010	24,716.05	58.45	4.55
2011	13,494.24	26.84	2.09
2012	20,828.04	44.36	3.45
Total	**99,203.00**	**205.69**	**16.00**

*Millions of pesos or dollars, respectively
Soruce: CONAFOR, 2013

5.2. Regional analysis

Between the years 2007 and 2012, 291 PES projects for the Huasteca Potosina were submitted. From these, 74 were financed, while 217 were not. Considering this information, almost 75% of the demand is not being met in the region. The breakdown of supported surfaced of the financed projects by municipality is presented in Table 13 (Appendix 9.2 Results breakdown).

The financed PES are located unevenly in the region (Figure 4); 48% in the northern sub-region (Ciudad Valles, El Naranjo and Tamasopo); 24% in the southwestern (Axtla de Terrazas and Xilitla); 19% in the southeastern (Matlapa and Tamazunchale); and 9% in the central sub-region (Aquismón) (Graph 2).



Graph 2. Municipalities with PES in the Huasteca Region
Source: CONAFOR, 2013

Of the projects with insufficient budget, 10% were submitted again in successive years and got the incentive (Graph 3). The area proposed for each project changed, with exception of the Ejido Soledad de Zaragoza (15) and Ejido Las Cuevas Paraje Lomas (19). In most

cases, the area was reduced, most notably in Minas Viejas (8) with a reduction from 4451 to 200 ha, and Los Alamos (12) from 4522 to 375 ha. The opposite is true for Matlapa Indígena (5), Xochititla (6) and San Nicolás de los Montes (20), where the area was increased: for the first one, the area was increased from 1171 to 1249 ha; the the second one from 469 to 1249 ha; and the third from 2951 to 5880 ha.

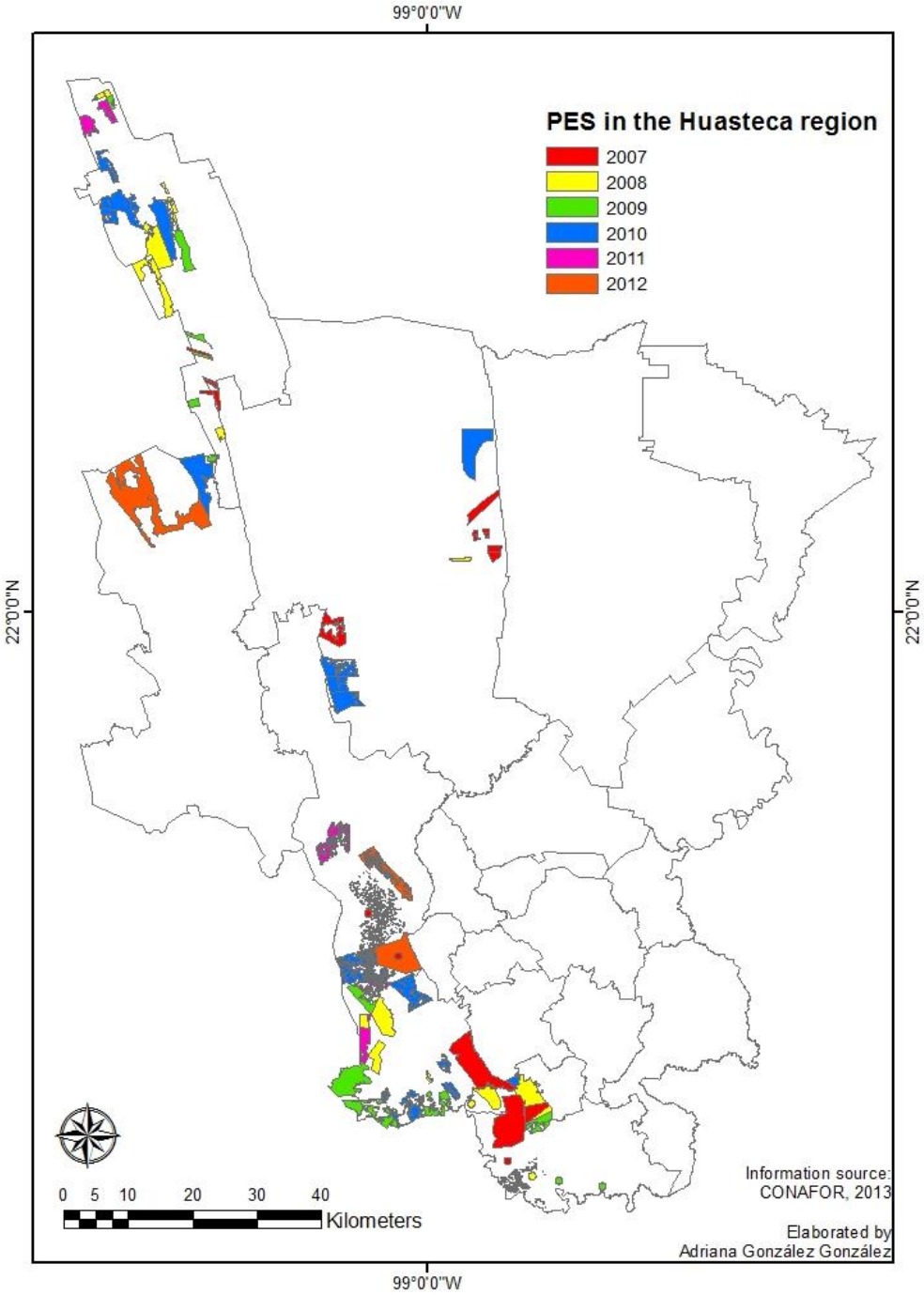
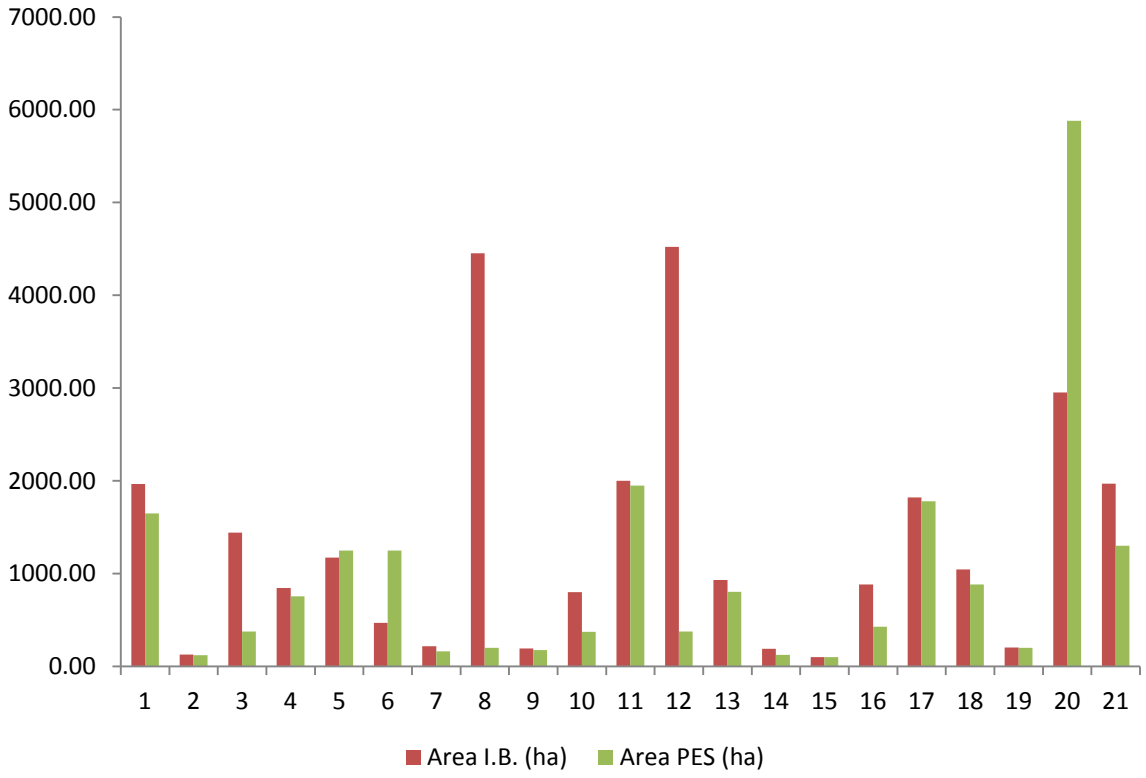


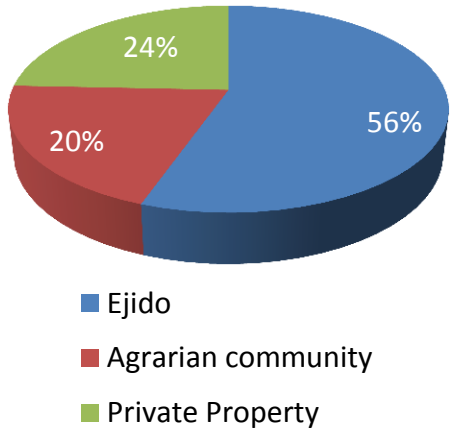
Figure 4. PES in the Huasteca Potosina, 2007-2012



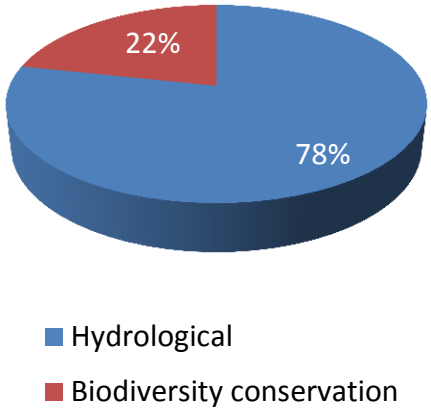
Graph 3. Relation of area rejected (I.B.) and accepted (PES) in projects submitted more than once in the Huasteca Region, 2007-2012
1: Las Abritas y su Anexo La Hierbabuena 2: No name 3: Salto de Agua 4: Cuaquentla 5: Matlapa Indígena 6: Xochititla 7: Mesa de Guadalupe 8: Minas Viejas 9: Olla Verde 10: Amayo Zaragoza 11:Laguna del Mante 12:Los Álamos 13:El Sabinito 14:Rancho Los Cerdos 15:Rancho Nuevo 16:Mecatlán 17: Soledad de Zaragoza 18: Ojo de Agua Tierra Nueva 19: Las Cuevas Paraje Lomas 20: San Nicolás de los Montes 21: Tampate
Source: CONAFOR, 2013

At the same time, of the projects accepted on 2007 ended in 2011, three renewed their contract: Comunidad Tamapatz, Comunidad Atlamaxatl and Ejido Los Sabinos Número Dos. However, the area changed in two of them, as did the money received by all of them. In the case of Comunidad Tamapatz the area remained the same, while the money increased by 26%. In Comunidad Atlamaxatl the area decreased by 32% but the economic incentive increased by 9%. Regarding the Ejido Los Sabinos Número Dos, both the area and incentive decreased by almost 50%.

From the 74 PES projects, 41 are in *ejidos* (55%), 15 in agrarian communities (20%) and 18 in private properties (25%) (Graph 4). Furthermore, 58 are for hydrological services and only 16 for biodiversity protection (Graph 5, Table 13).



Graph 4. Land tenure types in the Huasteca Potosina, 2007-2012
Source: CONAFOR, 2013



Graph 5. Project types in the Huasteca Potosina, 2007-2012
Source: CONAFOR, 2013

During 2010, the biggest area that was added to the program, with the consequent greater amount of money invested, was of 15,457.99 ha and 37.02 million MXN (2.88 million USD). The year with less new area covered and money invested was 2011, with 3293.24 ha and 7.41 million MXN (0.58 million USD). Considering the projects that are active nowadays (2008-2012), the area covered by the program is barely 4.48% of the region (Table 6, Figure 4).

Table 6. New area protected and money invested in PES in Huasteca Region, 2007-2012

Year	Area (ha)	Budget (MXN)*	Budget (USD)*
2007	11,051.43	18.16	1.41
2008	9,466.99	17.44	1.36
2009	7,051.66	15.73	1.22
2010	15,457.99	37.02	2.88
2011	3,293.24	7.41	0.58
2012	9,550.27	20.87	1.62
Total	**55,871.58**	**116.64**	**9.07**

*Million pesos or dollars, respectively
Source: CONAFOR, 2013

The spatial analysis of the satellite images from 2007 and 2011 showed that 44 sites had no changes inside of the polygons, 11 presented an increase in forested areas, six presented clearings and 13 properties could not be analyzed due to the set of information available. Seven of latter were in the northern region (Ciudad Valles, El Naranjo and Tamasopo), one in the central (Aquismón) and five in the southern (Xilitla). These images could not be analyzed for two reasons: first, some sites were represented as a dot which does not represent the real protected area; second, the PES project is represented as a series of small

areas, instead of a polygon, which are too small to allow an assessment of the changes in the different years (Figure 5).

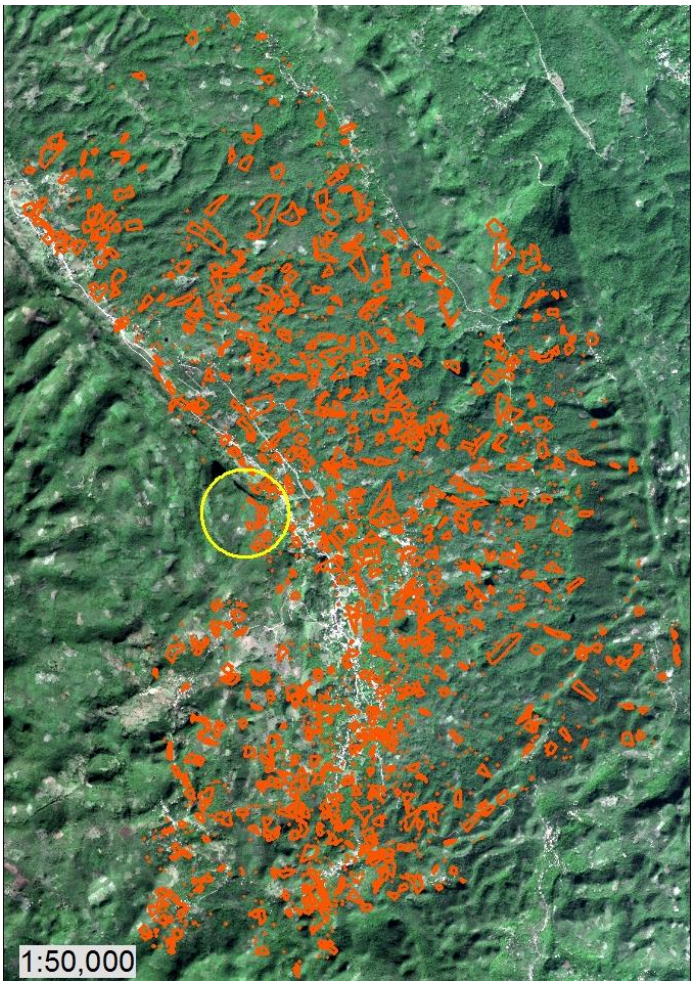
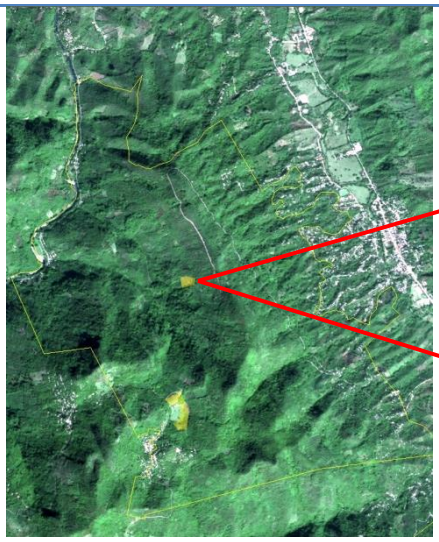
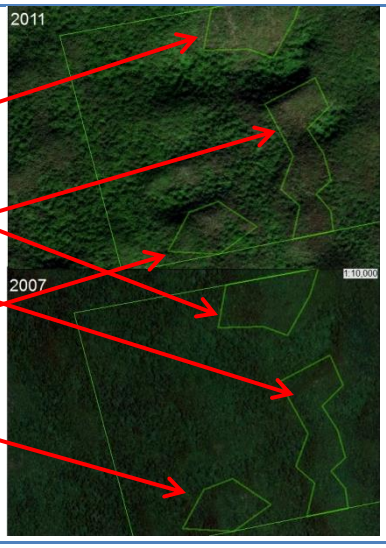


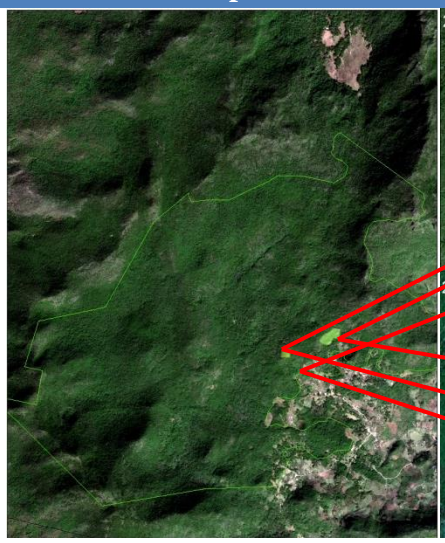
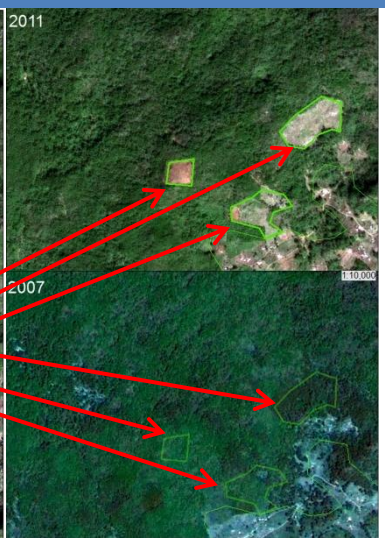
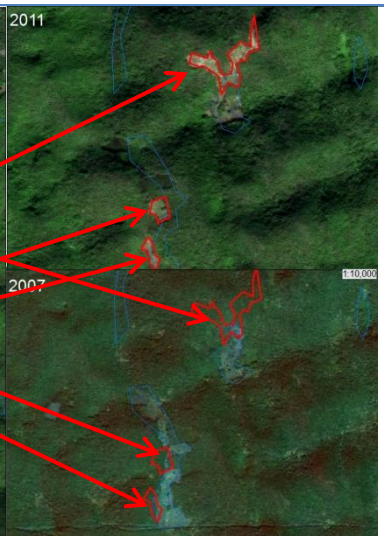
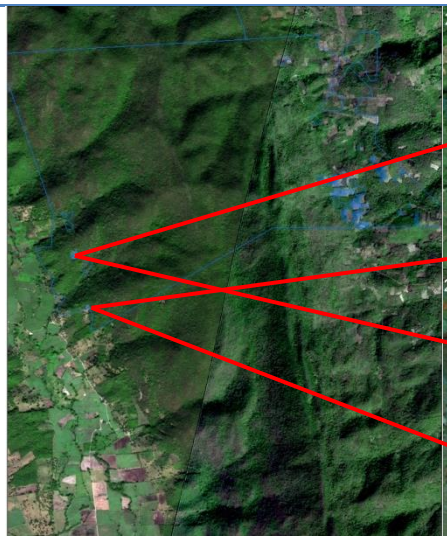
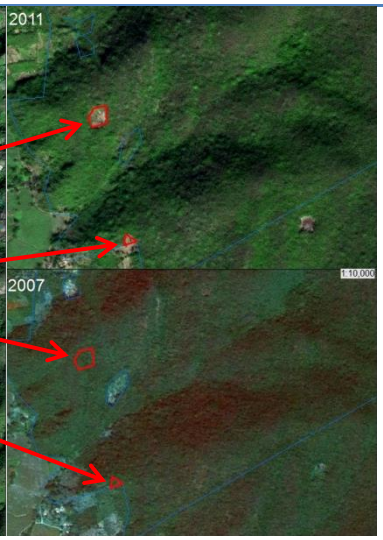
Figure 5. PES projects in Tamapatz, Aquismón in 2007 (yellow) and 2012 (orange)
Source: CONAFOR, 2013

Four sites with positive changes are located in the northern region (El Naranjo); while seven are in the southern one (Matlapa, Tamazunchale and Xilitla).

Regarding the sites that presented clearings, four of them are in the northern region of the Huasteca Potosina (El Naranjo and Ciudad Valles); while two are in its southern one (Matlapa and Xilitla). The site with the biggest alteration is Olla Verde (16.8% of the original area), followed by Ejido La Subida (0.9%) and Ejido Matlapa Indígena (0.5%); while the smallest changes are located in Ejido Soledad de Zaragoza, Ejido Maguey de Oriente and Ejido Rancho Nuevo (0.2% in each) (Table 7). Almost none of these sites are amongst the marked PES beneficiaries with delayed or frozen payments in the original database provided by CONAFOR; only Ejido Soledad de Zaragoza is marked amongst them because they did not provide their Best Practice Management Plans.

Table 7. PES projects with perceived deforestation, Huasateca Potosina

PES project	Complete	Zoomed in
Maguey de Oriente, El Naranjo **Δ area = 2.16 ha**		
Matlapa Indígena, Matlapa **Δ area =7 ha**		
Olla Verde, El Naranjo **Δ area = 29.45 ha**		

PES project	Complete	Zoomed in
Soledad de Zaragoza, Xilitla **Δ area = 4.03 ha**		
La Subida, Ciudad Valles **Δ area = 6.08 ha**		
Ejido Rancho Nuevo, Ciudad Valles **Δ area = 2.33 ha**		

The sum and percentage of the area per year that changed in a positive (reforestation) or negative (deforestation) way is presented in Table 8. This part of the analysis encompassed the period of 2007 to 2010, because changes in the lots from 2011 and 2012 cannot be related yet to the effect of the PES program. The areas calculated for the categories of no changes and unanalyzed data refer to the whole polygon while the areas of the categories of reforestation and deforestation refer to the shifting areas.

The established areas for the projects submitted since 2010 seem to use images from 2007. In two properties, the positive changes registered are not part of the polygon but are inside the outline. The clearings that existed in 2007 were not considered in the PES project, however, in 2011, these clearings are not present anymore. It is also noteworthy that in one of the properties, Ejido Rancho Nuevo, Ciudad Valles (last item on Table 7), the changes seem to be caused by slash and burn agriculture.

Table 8. Land-use change by year, Huasteca Potosina, 2007-2010

Year	No changes		Reforestation*		Deforestation*		Unanalyzed	
	ha	%	ha	%	ha	%	ha	%
2007	6,804	62	79	1	0	0.0	2,449	22
2008	3,624	38	449	5	10	0.1	1,217	13
2009	2,966	42	28	0	33	0.5	679	10
2010	8,230	53	81	1	8	0.1	2,196	14

***The areas of no changes and unanalyzed refers to the whole polygon while the areas in reforestation and deforestation refers to the shifting areas of the polygons**
Source: CONAFOR, 2013

During the studied period, 15 of the PES projects had their support withdrawn; 67% because they did not deliver their Best Practice Management Plans, 13% because some fires were registered in the protected area, 13% because they did not comply with the compulsory activities they agreed upon to do, and 7% because there was a change in the delimitation of the protected area. The property regime type and the PES type were thought to be related to the land-use change status (positive, negative, and neutral); however, at a 0.05 level, no statistical significance was found between these variables.

Most of the analyzed communities in the region have a Social Marginalization Index that goes from High to Very High (Table 14 in Appendix 9.2 Results breakdown). This explains the high concentration of social and productive public policies in the area. The municipalities with more communities with social programs are Aquismón and Xilitla (Table 9), which average a Social Marginalization Index rated as very high and high, respectively. On the contrary, there is a statistical relation between the Marginalization Index and the land-use change status (χ^2 p=32.46); where the greater the degree of marginalization, the greater the possibility to have a neutral or positive effect on the land-use change status.

Table 9. Number of communities with social programs by municipality and its mean Marginalization Index, Huasteca Potosina

	1	2	3	4	5	6	7	8
Opportunities	44	1	6	0	14	2	31	38
Liconsa	35	1	0	0	11	2	22	22
Pension Program for the Elder	27	1	6	0	13	2	28	36
Program for Food Support	16	1	2	0	3	0	6	5
Your House	7	0	0	0	3	1	0	0
Agriculture	0	0	6	6	0	1	0	0
PESA (3 modalities)	0	0	0	0	21	0	8	0
Other	1	0	7	1	0	3	0	0
Total	**130**	**4**	**27**	**7**	**65**	**11**	**95**	**101**
Mean Marginalization Index	1.002	-0.05	-0.35	-0.21	0.163	-0.83	0.33	0.01
	VH	L	M	M	H	H	H	L

1: Aquismón 2: Axtla de Terrazas 3: Ciudad Valles 4: El Naranjo 5: Matlapa 6: Tamasopo 7:Tamazunchale 8: Xilitla
VH: very high H: high M: medium L: low
Source: CONAPO, 2013

5.3. Local analysis

5.3.1. Ejido Laguna del Mante

In 2007, Laguna del Mante tried unsuccessfully to become a beneficiary of the PES program for Hydrological Services (PSAH). In 2010, they changed strategy and submitted their project for Biodiversity Conservation (CABSA) and got the grant. From the common-use land of the *ejido*, which belongs to the Biosphere Reserve Sierra del Abra Tanchipa, 1999 ha were selected to be part of the PES program. For the tropical dry forest of the area, the government provided 320 MXN (24.89 USD) per hectare per year, in accordance with the 2010 Operational Rules. This represented 2,946,819.2 MXN (229,196.03 USD) for the whole period and the fee for the technical support of 220,000 MXN (17,111.04 USD).

In the Ejidal Assembly, the *ejidatarios* decided to divide the money in three equal parts: the first, to sustain activities related to the maintenance of the protected area; the second, to invest in the community; and the third, to distribute amongst them. Within the activities of the first group, there are 10 km of firebreaks, the keeping of feeding and drinking troughs, and surveillance patrolling within the protected area. In addition, they have bought a pickup truck and other equipment for the firefighting brigade. As part of the second group of activities, they have bought 300 chairs that are used in the Assemblies and other activities of the Ejido. For an approximate for the amount of the expense for the two first activity groups see Table 10. The expense was calculated for the two years that have elapsed from the PES outset; for example, the surveillance patrolling activities have been done every 3

months for the last two years; but the keeping of the feeding and drinking troughs has only been done during the last year.

Table 10. PES expense at *ejido* level in Laguna del Mante, Ciudad Valles, San Luis Potosí

Concept	Activity	Expense (MXN)	Expense (USD)
Protected area maintenance	5 firefighting pumps	15,000.00	1,166.66
	Firebreaks (10 km)	2,500.00	194.44
	Surveillance patrolling	12,800.00	995.55
	Feeding and drinking troughs	7,000.00	544.44
	Pickup truck	34,000.00	2,644.43
	Pickup truck arrangements	56,400.00	4,386.65
Community	300 Chairs for *ejido's* events	40,000.00	3,111.10

Source: Laguna del Mante's Comisariado Ejidal

The perceptions of the actions taken within the PES program are mixed. The most immediate way learn about said activities is during the *ejido's* assemblies; however, most people do not attend frequently to the meetings. Nonetheless, what people perceive relates to what the authorities reported. In relation to the protected area maintenance, the most perceived activity undertaken are the firebreaks (38%), followed by the firefighting and surveillance patrolling brigades (15%), the keeping of the feeding and drinking troughs (10%). The 8% of the respondents did not perceive any activity in the protected area and the 29% did not know. In relation to the community's improvement, the activities perceived by the people were grouped as infrastructure (keeping of main roads and kiosk), equipment (chairs and pick-up truck) and the authority's expenses.

Most of the money in this category is perceived as that to be used by the authorities to pay their expenses (20%), followed by the improvement of the streets and kiosk (18%) and finally, for acquiring the necessary equipment for the *ejido* (15%). 12% of the people answered that they do not perceive any activity related to the community's improvement and 35% said to not know. The creation of temporary employments with the economic incentive makes the number of new jobs to differ. The 25% percieves that the number of jobs created is between 11 and 20; while 12% says between 1 and 10 jobs and 8% more than 21 jobs.

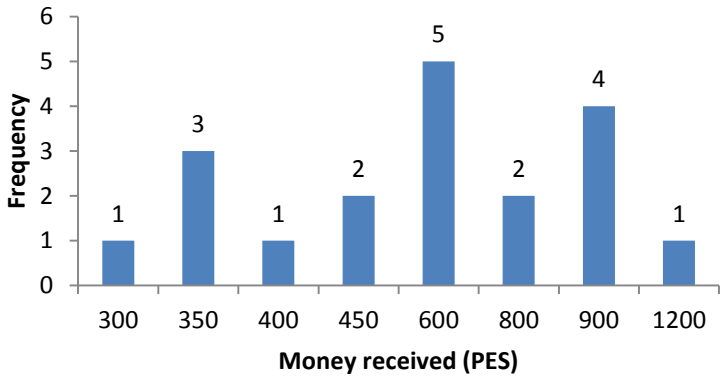
As shown in Table 11, there is a strong presence of public policies from SEDESOL and SAGARPA in Laguna del Mante. An account of the people subscribed to program Oportunidades (Opportunities) is not accurate in Laguna del Mante, since some of the

recipients have had their support withdrawn. Some people blame the fact that the public budget for this program is decreasing for the area.

5.3.2. Ejido Xochititla

Between the years 2008 and 2012, Xochititla had the PES program for Hydrological Services (PSAH). The area submitted was of 258.07 ha of tropical rainforest, in the lot called Tepezintla. In the 2008 Operational Rules, for said ecosystem the program was granted 328 MXN (26.06 USD) per hectare per year; which summed up to 548,896.29 MXN (43,607.5 USD) for the whole period. The 2008 Rules of Operation of the program were different from the ones in 2010 or even today. During that time, the beneficiaries of the program had the obligation of hiring a technical advisor to help them write a Best Management Practices Program during the first year. During the rest of the supported period the technical advisor would help to implement it and monitor the outcomes in order to write the reports for CONAFOR. This caused the amount of money that went towards the community to diminish.

From the 141 *ejidatarios* that live in Xochititla, only 102 were beneficiaries of the PES program. Contrary to the case of Laguna del Mante, the area that was in the program is the parceled section of the *ejido*. Depending on the hectares that each *ejidatario* gave to the program, the money received per lot changed. For this reason, in this case the *ejidatarios* decided to distribute the money in relation to the number of individual hectares in the program. The person who received the less money received 350 MXN, while the one that received the most got 1200 MXN (27.22 and 93.33 USD, respectively); five of the interviewees said they received 600 MXN (46.67 USD) each year (Graph 6). Assuming that everyone would receive the same amount of money, they would receive in average 882 MXN per year (86.61 USD).



Graph 6. Frequency of amount of money received by ejidatarios in Xochititla, Matlapa, San Luis Potosí
Source: Questionnaires applied in Xochititla, Matlapa, San Luis Potosí

Within that which they agreed upon to achieve, the activities that stand out the most include the water catchment terraces, environmental education recommendations about water-

saving culture and waste management, and a firebreak to mark the delimitation with another *ejido*.

The public policies present in Xochititla are almost the same as in Laguna del Mante. The only difference is that in the latter exists, in addition, ProGan and the water supply network; while in Xochititla there is PESA and Ecological heaters (Table 11).

Table 11. Number of people benefited from public programs in Laguna del Mante and Xochititla, San Luis Potosí

Gubernamental office	Program	Laguna del Mante	Xochititla
SEDESOL	Pensión para Adultos Mayores (Pension Program for the Elder)	100	75
	Empleos temporales (Temporary Jobs)	20-30*	-
	Piso firme (Steady floor)	150-180	200
	Oportunidades (Opportunities)	400	200
SAGARPA	ProCampo	60	60
	ProGan	10	-
	PESA	-	60
Municipality	Temporary jobs (firebreaks inside town)	20	-
	Ecological heaters	-	100
CONAGUA	Water supply network	n.a.	-

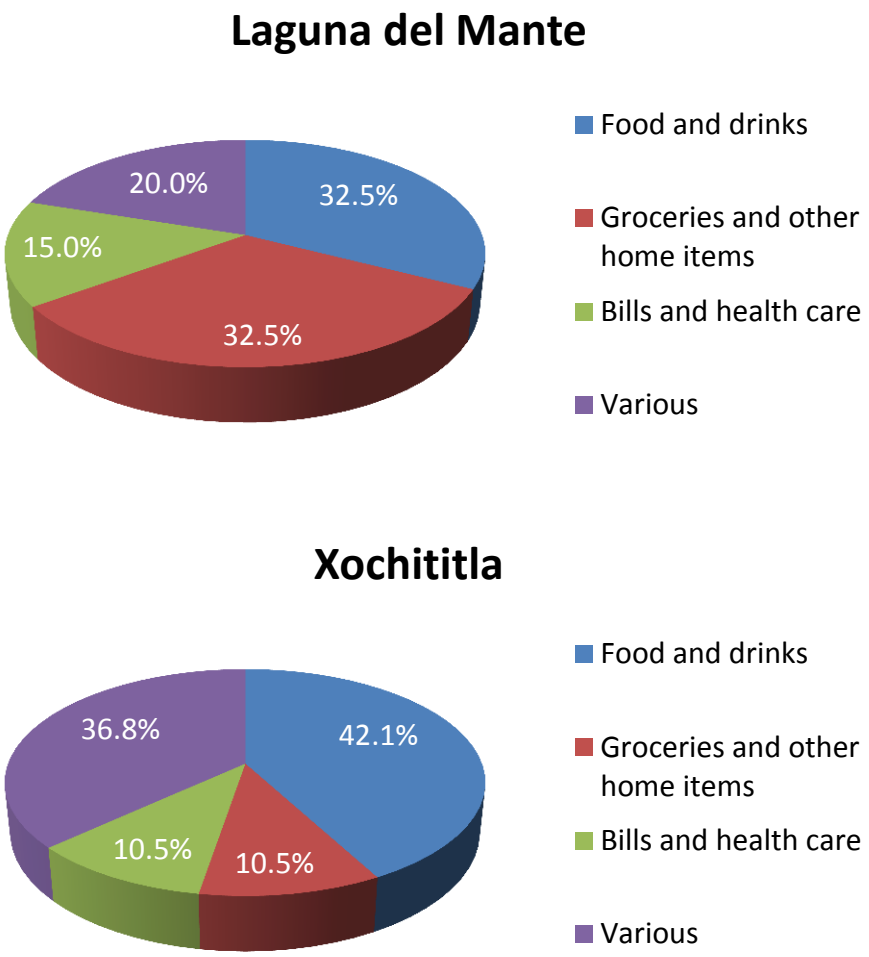
*Projects with different amount of people working on them
Source: Questionnaires applied in Laguna del Mante and Xochititla, San Luis Potosí

5.3.3. Program impact at family level

The PES expenses were divided in four groups: 1) food and drinks, 2) groceries and other home items, 3) bills and health care, and 4) various. The last category encompasses a combination of the other groups; for instance, some of the respondents answered they use the incentive for food and drinks and bills and health care. In both cases, people mostly use the incentive in food and drinks; while the least frequent use is to pay bills and health care (Graph 7). This relates to the fact that people in general have public health insurance. The combination of expenses plays an important role in Xochititla; while in Laguna del Mante the second most important expense is groceries and other home items.

In Laguna del Mante, 50% of the interviewees work as laborers, whether in their own ladn or anothers', 25% are retired, 15% are housewives and the remaining 10% have other occupations, such as builders and bus drivers. In Xochititla the situation is a little different. Most people are also laborers; however, they only represent 37% of the survey respondents.

Housewives and retired persons share the next position with 26% each; leaving 11% in other activities, such as bakers or teachers.



Graph 7. PES expense in Laguna del Mante and Xochititla, San Luis Potosí
Source: Questionnaires applied in Xochititla and Laguna del Mante, San Luis Potosí

Different factors –such as genre, the average of family members per household, occupation, income level, and access to other policies or formal education– were thought to influence the way the families spend the PES economic incentive. However, no statistical significant differences, at a 0.05 level, were found in the relation to these variables with the PES expense (Appendix 9.4 Statistical analysis results).

Although at *ejido* level the program ProGan is present in Laguna de Mante, none of the people who answered the questionnaire have said support. In Table 12 the total income in one year for each economic incentive is shown; as well as the mean yearly income. In addition, it also shows the percentage of the program in comparison with the extra and the total incomes. The estimation of the regular income disregards some factors that may

determine it to change, such as the occupation of the survey respondent and the seasonality of the job. To adjust the income, the mean monthly income reported by the respondents was multiplied by six, considering that the working season lasts only six months. Also, the revenue of foreign currencies is not considered in the extra income estimation. Some of the policies were excluded from the table, due to its payment in kind mechanisms (Steady floor, Housing, PESA).

The Pension Program for the Elder, also known as 70+, distributes pensions for people over 65 years (though it used to be for people over 70 years), consisting of 1050 MXN (81.67 USD) every two months (SEDESOL, 2013a). The Opportunities Program seeks to promote education, health and nutrition, while promoting the capacities development of the families that live in extreme poverty (SEDESOL, 2013b). The ProCampo Program consists of resource transference to support the rural producer's economy per hectare or fraction of a hectare (SAGARPA, 2013).

For what comes forth ward, every one of the people interviewed is assumed to receive the same amount of money for each program, though in reality it may be different. Considering the values in Table 12, PES program for Laguna del Mante represents 5% of the extra income per family; while in Xochititla, only 4%. If regular income is also considered, the PES program represents only 8 and 5% of it, respectively. For the families in Laguna del Mante social programs that represent a bigger aid are Opportunities and Pension Program for the Elder; while in Xochititla it is the Opportunities Program.

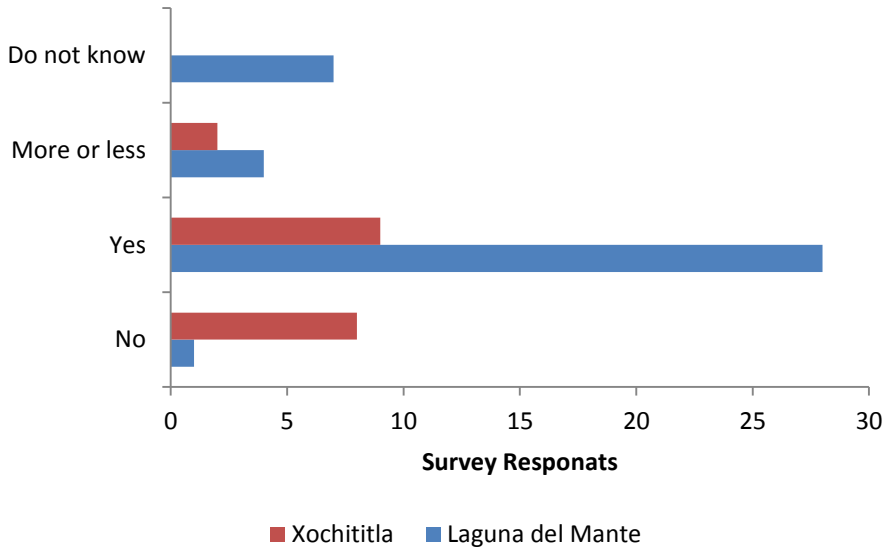
Table 12. Income from public programs in Laguna del Mante and Xochititla per year (family level)

	Laguna del Mante			Xochititla		
	Total (MXN)	E.I. %*	T.I. %**	Total (MXN)	E.I. %*	T.I. %**
PES	20000	5	8	12050	4	5
Pension Program for the Elder	89100	59	37	66300	40	27
Opportunities	91440	29	38	139020	49	56
ProCampo	22333	7	9	18800	7	8
Extra income Σ	**222873**	**100**	**94**	**236170**	**100**	**95**
Mean Regular income	15304.5			12126		
Total income	**238178**			**248296**		

* Percentage that the social program represents as extra income (E.I.) for the families
** Percentage that the social program represents in relation of the total income (T.I.) of the families
Source: Questionnaires applied in Laguna del Mante and Xochititla, San Luis Potosí

On the topic of people's perception of the effectiveness of the program to provide the ecosystem service, in Laguna del Mante, the perception is clearly positive, having 28 of the survey respondents answering the PES program benefits conservation objectives (70%). This can be explained by noting that the firebreaks and the firefighter brigade help to take

care of the mountain; that there is less extraction of materials or fauna thanks to the surveillance patrolling brigade; and that now there is an incentive to take care of it. However, seven of the respondents are not sure if it helps conservation objectives (17%), because many people are dissatisfied with the program; people who work there earn little money; others are not closely related to what happens on the common-use lands so they do not notice the effects of the program. Whereas in Xochititla, the judgment is quite contrasting, though it still tends to a positive perception. Nine of the surveyed say the PES program helps conservation objectives (47%), although they did not elaborated on the answer; eight of the respondents replied that it does not help to conservation objectives (42%); claiming that the incentive was too small to protect the area (Graph 8).



Graph 8. Perceived effectiveness of PES program in the Xochititla and Laguna del Mante, San Luis Potosí

Source: Questionnaires applied in Xochititla and Laguna del Mante

6. Discussion

6.1.1. General discussion

According to the definition of a PES by Wunder (2007), Mexican PES program has essentially well-defined the 5 elements to be acknowledged as such: 1) the communities or individual landowners submit their application to the program voluntarily; 2) the government plays the part of the environmental service buyer- representing the society as the direct beneficiary of the service; 3) while communities or individual landowners play the part of the service supplier; and 5) when there is a clearing inside the area supported by the program, the payment is adjusted to the new area. In addition, when the beneficiaries do not comply with the agreements that were settled at the beginning of the period, the next payment may be hold until they are done. The point that may be considered weak in the definition is 4) the clear description of how a land-use is related to the environmental service provision, as stated by Corbera and collaborators (2009). They explain that the payments are tied to the delivery of the service proxies, rather than services themselves because of the biophysical complexity and the costs of measuring the services.

Some services may be easier to measure with indicators, such as provisioning services, for example food provision where it may be measured as the production rate of some crop. Yet, other services are more difficult to assess, such as the regulation, supporting and cultural services, that refer to the ability of the ecosystem to support its processes and deliver the ecosystem service. In these cases, indicator proxies are used as a substitute measure to provide information about services that cannot be measured directly. For example, for the service of biodiversity conservation the proxy indicators that may be used are the number of endangered species in the area or the surface of intact ecosystem (WRI, 2009). This is the case of the Mexican PES scheme, where for each of the modalities they support the conservation of an area that is in good conservation state that would ensure the provision of the service.

In addition, with the Best Practice Management Guide CONAFOR enlists activities for the beneficiaries to promote the maintenance or improvement of the ecosystem and hence, its service. There are 5 groups of activities to choose from: protection against fires; water catchment and filtration; soil management and conservation; vegetation management; and other activities that ensure the maintenance or improvement of the service. Laguna del Mante and Xochititla have selected some of these activities for the PES duration. In Xochititla they had PSAH and implemented terraces for water catching and a firebreak– however the intention of the latter was to mark the border between *ejidos*. In Laguna del Mante they have CABSA, so their activities relate to biodiversity conservation. They have done firebreaks and see to the keeping of drinking troughs for the wildlife. With this, it can

be said that the program is financing the indirect maintenance of the environmental service by enhancing the habitat that provides it.

One of the major concerns about the program is its lack of economic stability. The number of viable projects submitted each year is more than the government can afford to pay. Since the beginning of the program, this has been a concern. Muñoz and collaborators (2008) mention that in 2003, less than a third of the applications were supported, as well as in 2004. Corbera (2009) reported that in 2007, about 5 to 10% of the projects had to be put on hold until more funding became available. García-Amado and collaborators (2011) reported that having an insufficient budget to cover all the applications is common in most Mesoamerican countries. This situation is observed in the case of San Luis Potosí, in general, as well as in the Huasteca region, in particular. Every year, the rate of projects with insufficient budget was bigger than 50%; 2010 was the greatest with 79%. The situation is similar in almost every region, with extreme cases of 100% of projects with lacking budget in the Altiplano region in 2009 and 2010. The opposite happened in the Centro region in 2008 and the Altiplano region in 2012 where all the approved projects were financed. In the particular case of the Huasteca region, the percentage of projects with insufficient budget is larger than 50% every year; with 2012 as the most critical year where 86% of the projects lacked budget

Although the PES value does not vary yearly for the granted projects, the funds for the program are yearly negotiated in the Mexican Congress. Therefore in order to guarantee the ecosystem conservation and its services provision, it is urgent to establish long-term financial mechanisms (Corbera *et al.*, 2009). These was partially addressed with the financial support received from the Global Environment Facility and the World Bank (Kosoy *et al.*, 2008). In 2011, the PES budget came from the Federation Expenditure Budget, contrary to previous ones, when the money came from different external sources (Salas-González, 2012); this may imply an increase of the total budget for the program. Nonetheless, it has not been enough to meet the demand of new projects and to strengthen market-schemes.

The shifting budget also makes it more difficult to CONAFOR to support more than once the same area, even if the beneficiaries seem to comply with the rules and have positive attitudes towards conservation efforts. In areas like Chiapas, some of the beneficiaries have expressed that the program should continue if they showed good organizational skills and tangible conservation results (Corbera *et al.*, 2009). This could be especially important for beneficiaries like the ones in Xochititla which PES program ended last year and are currently seeking to renew the contract. It is not certain that the area protected by the PES program will continue to be so once the program is over (Muñoz-Piña *et al.*, 2008). There is a chance that after the contract is fulfilled a community could turn to their old production

practices or turn to other kind of governmental programs that may not consider conservation efforts, which may result on losing the previous success.

The rules of the program have changed since its origins. As stated by some authors (Corbera *et al.*, 2009; Kosoy *et al.*, 2008), the rules' evolution show an ongoing learning process in CONAFOR. The main changes may be identified in two areas: first, it refers to the criteria of selection of the eligible areas for the program, and therefore the selection of beneficiaries. In 2006 the deforestation risk index was introduced to the Operation Rules in order to hierarchize the plots, jointly with other ecological and social criteria (Muñoz-Piña *et al*., 2008). The second refers to the changes of the rules under each PES component. For instance, at the beginning there was PES for carbon sequestration, but it has been removed from the program. In general terms, the procedural simplification helped to reduce the costs of the program development (Kosoy *et al.*, 2008).

6.1.2. PES impact in forest cover in the Huasteca Potosina

Between the years of 2007 and 2011, few changes have occurred in the forest cover inside the polygons of the PES program. In fact, there seems to be a positive effect on some of them; however to confirm this, a different kind of methodology is needed. With the remote sensed analysis used it is impossible to identify the quality of the forest or the quantity of ecosystem services gained (Arriagada *et al.*, 2012); for this reason it is important to do field verifications to ensure the effectiveness of the PES program. In this sense, the main objective of the present economic incentive is being met. It appears that the landowners give more value to the environmental service now that they have the incentive than they would in the absence of it. Nonetheless, there are some studies that show that the PES have been allocated in communities that would have preserved the forest either way (Alix-Garcia et al., 2012; Corbera et al., 2009; Engel et al., 2008; García-Amado et al., 2011), reducing the additionality of the program.

One of the main motivations to participate in the program may come from pre-existing conditions and positive perceptions about environmental conservation (Kosoy *et al.*, 2008). Even in a study case in Chiapas (García-Amado et al., 2011), some people expressed the hypothetic intention to maintain conservation initiatives even in absence of the PES program. In spite this, the lack of additionality has been counteracted because the economic incentive may have positive impacts on community's development, institutional reinforcement, or act as a reward for good management practices, all leading to strengthening conservation values (García-Amado et al., 2011).

Kosoy and collaborators (2008) note that most of the providers of the ecosystem services in Mexico are *ejidos*. San Luis Potosí is no different; 65.68 % of the projects are under communal tenure (*ejidos* and agrarian communities) and the remaining 24.32% are under

private management. This may be explained by the Mexican unique land-tenure mosaic, in which around 80% of the country's forests are held communally by *ejidos* or indigenous communities (Bray and Perez, 2004 referred in Barnes, 2009). In the sites where deforestation was detected, failure to promote activities whose social benefits exceed their costs (Engel *et al.*, 2008) may be taking place. Though most of the sites are communal property (75% *ejidos*, 12.5% agrarian community and 12.5% private property) individual interests may overpower the social benefits.

It is possible that payments are insufficient to induce the adoption of less profitable practices than agriculture. This being said, there was no significant difference found between the property type and the land-use change status; the same was found by Alix-García and collaborators (2012). The same authors also find a heterogeneous scenario when comparing the avoided deforestation with poverty; they found that where poverty is lower the program seems to be more effective. In the present study, all of the cases that presented a negative impact in forest conservation, except Olla Verde, have a high degree of Social Marginalization –which may agree with what them found–; however most of the cases for neutral or apparent positive effects have also a high degree of Social Marginalization – contradicting this idea. Hence more in-depth studies are necessary to provide a conclusive impression on the matter.

Some authors (Alix-Garcia *et al*., 2012; Arriagada *et al*., 2012) argue that the effect of the PSA programs on forest cover are moderate. In Sarapiqui (Costa Rica), the impact of the PSA was equivalent to a 10-15% increase of the farm's forest cover; however they could not determine how much of it came from preventing the clearing of mature forest or the encouragement of forest regrowth (Arriagada *et al.*, 2012). In Mexico, between 2003 and 2006, the deforestation rate was reduced up to 50% in the participant properties; however, when comparing this impact with a control group, the overall reduction of deforestation is modest. It suggests that much of the enrolled area would likely have remained as forest even in the absence of the payment (Alix-Garcia *et al*., 2012).

In the present study, it is only considered the area inside the PES polygons, so comparisons with these authors may not be possible at the moment. Some researchers have studied the influence of the program in the areas outside the protected polygons, referring to the leakage or spillage effect; which happens when the activities that are damaging the ecosystem service provision are displaced to areas outside the zone of PES intervention (Alix-Garcia *et al.*, 2012; Engel *et a*l., 2008). The two approaches used are to assess substitution effects (inside the same *ejido*) and output price effects (areas near the PSA intensify their productive activities).

6.1.3. PES socio-economic impacts in Laguna del Mante and Xochititla

Although the PES program essentially aims to conservation purposes and not to alleviate poverty (Pagiola *et al*., 2005), the Mexican PES strategy has some pro-poor characteristics (García-Amado et al., 2011). For instance, in the Operational Rules 2012, one of the social criteria of selection is being within the priority areas listed by SEDESOL due to the use of indexes of social marginalization. This index is a composite of eight variables reflecting household poverty, literacy, education, quality of well-being and access to public services in a particular population center (Muñoz-Piña *et al*., 2008). Hence, a great deal of the PES projects is granted to poor rural communities, with the expectation of having a positive impact on the poor; through direct payments, representing a source of income diversification, and through the investment in local public goods (Grieg-Gran *et al.*, 2005; Kosoy *et al.*, 2008).

Sometimes it is assumed that the PES positive effect on poverty happens automatically because the participation in the program is voluntary (Pagiola *et al.*, 2005), however the impact is mostly related to the distribution of the economic resource. In the case that *ejidos* or agrarian communities are the beneficiaries of the PES, it is given to the community as a whole and then they have to decide the way to allocate it. The decision-making process in *ejidos* takes place during the meetings of the Assembly; where *ejidatarios* gather, deliberate and agree the management practices that will be accepted in it. Thanks to this, the ultimate decision about how to allocate the PES resource belongs to the *ejidatarios.* García-Amado (2011) reported that *ejidatarios* believe that PES should be linked to holding forest land rights. This way the remaining inhabitants of the *ejido* are excluded from the decision-making process; therefore, they may also be excluded from the direct benefits of the PES program, even though they may be the most vulnerable sector of the population.

In *ejidos,* there are not only *ejidatarios*. There are also the *ejidatarios'* offspring, land buyers, laborers, artisans and merchants; all of them are known as neighbors (*avecindados* or *pobladores*). In addition, there are the people called possessors (*posesionarios*); who have bought some land from the *ejido* but are not *ejidatarios* (Assennatto-Blanco and de León-Mojarro, 2006; Barnes, 2009; Ferney-Leonel, 2011). In such a way, the PES becomes tied to land-controlling participants leaving the most vulnerable sector of the population aside, the *pobladores*. Though the impacts on the livelihood of this sector are not taken into account in the present study; it is considered that they may relate to the restriction of access to common resources that may have been available for the *pobladores* before the PES program was adopted.

However, there are also positive impacts of the PES in the rest of the community, though they may be indirect, such as the benefit gained by non-beneficiaries in the local economic transactions. In words of one of the *ejidatarios* in Laguna del Mante:

> *"No me beneficio nomás yo solo. Si yo me beneficiara solo… ¡me ganaría mi dinero y lo guardo abajo de una piedra! Pero no, nos beneficiamos el de la tienda, nos beneficiamos el que cosecha el frijol, nos beneficiamos el que cosecha el maíz, nos beneficiamos el que cría su pollo, nos beneficiamos el que cría su puerquito, nos beneficiamos el que cría su ganado, nos beneficiamos, por ejemplo, a los que hacen el aceite, o a los ingenios… a los cañeros porque compramos un kilo de azúcar en la tienda. Nos beneficiamos a los que siembran el trigo porque les compramos un pan. Y a todo eso… es una cadena… bien grande. Que por ejemplo, el de la tienda, con lo que yo le pagué por un kilo de huevos, un refresco o algo, con su ganancia de él, a lo mejor él también ocupó a otra gente que le puede ayudar en su parcela. A lo mejor aquel gente también le ayudó a una gente dos gentes que trae su parcela o un x en la tienda que trabajan, pues también ellos se beneficiaron con ese dinero".* –Don Hermelindo (2012)

In the case of Laguna del Mante, the PES polygon is in the common-use land area of the *ejido*; while in Xochititla it is in the parceled one. In the first case it means that the 446 *ejidatrios* have rights over the PES money and in the second that only the ones who donated lands to the PES program, reducing the number of direct beneficiaries to 101 *ejidatarios*. In the case of Sierra Morena (Chiapas) three out of 31 households were excluded from the payments for different reasons; two for being newcomers and one for complaining about the little money they would receive (García-Amado et al., 2011). In these study cases, the sectors of the population different from *ejidatarios* are being discarded as direct beneficiaries of the program.

Also during the *ejido's* Assemblies the way to distribute the PES incentive is agreed on. Some authors have described this in different places; reporting four common purposes for the money: the reward for people who participate in conservation or restoration activities, the distribution of the money between the community members, the payment of management and technical expenses, or a mixed strategy (Corbera *et al.*, 2009; Muñoz-Piña *et al.*, 2008). Corbera and collaborators (2009) reported that in San Bartolomé Loxicha (Oaxaca) 20% of the PES were invested in the Milenio Coffee Producers Organization and 80% was used to pay fees to farmers who participated in tree planting activities; in Orilla del Monte (Veracruz) 90% of the PES income was distributed amongst the participants and the other 10% was used to pay management and technical expenses; in El Cajón (Puebla) those who were involved in reforestation and patrolling activities were rewarded and some communication equipment was bought, representing the 43.66% of the total share of the investment; in Niños Héroes (Tabasco) they also used the PES money as a reward for those who participated in planting and patrolling activities. Similar is the case in Sierra Morena

(Chiapas) where they distributed 70% of the PES money amongst almost all the households (García-Amado *et al*., 2011). In Puerto Bello Metzabok (Chiapas), the income was used as a reward for patrolling activities, as an investment in equipment acquisition and in an eco-tourism project. In Peña Blanca (Chiapas), the income was used to fund the construction of a house for social events and the Assemblies, and support birdlife census (including external assistance) and forest patrolling activities. In la Corona (Chiapas), the money was divided between all the *ejidatarios.* In the *Ejido* Reforma Agraria (Chiapas), the PES was used to pay fees to the program's promoters and of the patrolling activities (Kosoy *et al.*, 2008). Regarding the present study cases, in Laguna del Mante 33% goes to conservation purposes, 33% to the improvement of communities welfare and 33% is distributed amongst the *ejidatarios.* In Xochititla the 100% was distributed amongst the *ejidatarios* whom had lands in the project, which also happens in La Corona (Kosoy *et al.*, 2008) and Sierra Morena (García-Amado *et al.*, 2011).

Said distribution in Laguna del Mante is believed to be influenced by the presence of the Biosphere Reserve Sierra del Abra Tanchipa. Before 1994, people used to manage their common-use land to gather firewood, construction material or hunting for food options (Sepulveda *et al.*, 2012). However, after being declared a Reserve, said activities were forbidden; leaving a vulnerable sector of the population in less favorable conditions. Though the reason for the management restriction is different, Pagiola and collaborators (2005) state a similar situation in which the enrollment of common-use land of an *ejido* in a PES program might limit such use, but the resulting payments may not necessarily be distributed in the same proportion as the lost benefits; therefore the differences between the sectors of the community may be enhanced.

The authorities of the Reserve have good relations with the authorities of the *ejido,* and works closely to a group of around 20 *ejidatarios* in different projects, such as the integration of the firefighter brigade (before the PES); also the Reserve's authorities work as a link between researchers of different universities and the *ejidatarios*. This close relationship between CONANP's personnel and the *ejidatarios* may have influenced the decision of leaving one third of the PES money to the maintenance of the environmental service. Said money is used to pay for equipment necessary for the activities and for paying the fees of those who participate in the activities. By doing this, the maintenance of the environmental service is being promoted in a direct way. Here there is a coincidence with the *ejidos* El Cajón, San Bartolomé Loxicha, Niños Héroes (Corbera *et al.*, 2009) and Sierra Morena (García-Amado et al., 2011). The fact that part of the payments is invested in conservation temporal jobs offers an opportunity to *pobladores* to receive money even though they are not *ejidatarios.* Opposite to what happens in Sierra Morena, in Laguna del Mante the people that has access and interest in this jobs are a small group of *ejidatarios* whom have a close relationship with the authorities of the Reserve.

Considering the indicators generated to evaluate the use of the incentive at *ejido* level, the investments detected to be for communities' welfare are not taken into account in either of the study cases presented. While in Xochititla designating part of the money for this purpose is not even considered, in Laguna del Mante they have the intention of investing one third of the PES value in the improvement of the community. However, it is not being met. One of the activities the authorities said they would do, and so people know about it, have not been done, such as the maintenance of the main streets of the *ejido*.

At household level, the impact of the program is directly related to the money each family receives. In Laguna del Mante it was equally distributed amongst the 446 *ejidatarios*, resulting in 500 MXN/year for each household. In Xochititla, they had a system of differentiated payments depending on the amount of land they had in the program. The *ejidatarios* should have received 450 MXN/year/ha; however some of the interviewees reported they only got 300 MXN/year/ha; while other got the full value of the PES. In Sierra Morena they also had a system of differentiated payments based on the land tenure rights. The older *ejidatarios* received 9000 MXN/year, the new *ejidatarios* 6000 MXN/year and the *pobladores* only 1500-2000 MXN/year -depending on degree of participation in patrolling activities (García-Amado et al., 2011). In Niños Héroes those who participated in the programed activities received 7,000 MXN/year per household (Corbera *et al.*, 2009).

In comparison with these other communities the money for the families in Laguna del Mante and Xochititla is much lower and may be associated with the number of community members that are direct beneficiaries of the program, the type of environmental service and the amount of surface protected. Nevertheless, the absolute value of the payment is not so important when evaluating the impact in the family budget. What must be considered is the weight the payment has in the regular family budget. In this sense, Grieg-Gran and collaborators (2005) reported a case in which the payments actually appear to be making a contribution to the household budget; in Pimampiro (Ecuador) the payments contributes in average for 30% of it on food, medicines and schooling. However, in Laguna del Mante and Xochititla it is only 8 and 5%, respectively. In these cases, although the payment is an extra income for most households, it does not represent such a strong influence in the regular family budget. This could be the reason why there is not statistical significant difference between the way families uses the incentive and their occupation, income, access to other policies, genre or formal education. It seems that people uses this money to satisfy their most immediate needs (food, drinks or house items). Most of the people surveyed have social healthcare so they do not need to invest in said category; however in Xochititla the medicines that they need are not available in said system, so they have to buy them elsewhere; being more important this category there.

Some authors state that the best way to evaluate the impact of the PES in a community is measuring the opportunity cost associated with the adoption of the program, and not the

financial benefit of the participants. The reason behind this is that PES assumes that the economic valuation of the environmental service would make the conservation more profitable than another land-use activity (Corbera *et al*., 2009) and that the Mexican PES program has been set to differentiate the payments based on the average opportunity cost of land (Pagiola *et al*., 2005). In a rough analysis, in Laguna del Mante, the opportunity cost of maintaining the PES is more profitable than the alternative, due to the management restrictions on the Biosphere Reserve; though losing additionality in said context.

When the opportunity costs of retaining land as forest are high the payment is likely to be accepted by landowner who intended to keep their land as forest in any case (Grieg-Gran *et al.*, 2005). As mentioned before, the land protected by PES in Xochititla is the parceled area of the *ejido,* where the *ejidatarios* still grow coffee and oranges. In these cases is where the influence of other government politics like ProCampo may compete against PES conservation purposes. Almost the 50% of the community has the ProCampo incentive and it represents the 8% of their total income, according to the survey (Table 11). The locations of the parcels with the different programs were not geographically referred, but the representatives of the *ejido* informed they are separate parcels due to the opposite nature of each program. However, there is always a possibility that the ProCampo support extends in the *ejido* when the PES is over; diminishing the long-term effect of conservation effort. Nonetheless, this year Xochititla is trying to renew their PES program, indicating a perceived improvement of their livelihood.

In regards of the influence of other public policies on the PES program, two situations may be found. On one hand, though it is likely to find social programs from SEDESOL –such as Temporary Jobs Program, Pension Program for the Elder, Steady Floor and Opportunities– in the same communities as the PES –due to the pro-poor characteristics of the latte–, they do not seem to influence each other. In this sense, the different policies act as a complementary extra income for the families. The PES program is complemented with other programs in the forestry sector and the National Network of Protected Areas, such as PROCOREF, PROCODES, PRODEFOR, Pueblos Indígenas y Medio Ambiente, and others from SEMARNAT, due to its common purpose of resource conservation *(Corbera et al.*, 2009; Salas-González, 2012). This seems to be the case in Laguna del Mante; however none of this were mentioned by the interviewees.

On the other hand, there are still policies that oppose the PES program, such as SAGARPA's ProCampo or ProGan. As mentioned before this program may undermine PES efforts when the opportunity costs are more profitable for cultivating crops with a high market value than conservation purposes. For example, in Niños Héroes, several farmers argued that they could not increase the amount of land dedicated to agriculture because of the *ejido's* involvement in the PES (Corbera *et al.*, 2009); a strategy that may be promoted by the other policies. This is more relevant in places like Xochititla, where the PES polygon

is the parceled area of the *ejido*, in which the *ejidatarios* may want to apply to the other policies; nevertheless, if the productive programs do not consider their environmental impact, they could be opposing each other instead of complementing each other (Salas-González, 2012).

The perception of the people about the program's effectiveness to preserve the ecosystem is contrasting in the two communities. On one hand, in Laguna del Mante 70% says it does help conservation purposes, while 2.5% say it does not. The main cause of the perception is that the firebreaks and the firefighter brigade help reduce the risks of the forested area to catch a fire. In addition, with the equipment and trained brigade for said purpose, now they can take care of fires not only in this part of the *ejido* but in other parts as well and protect their crops and the community. The situation is similar to Sierra Morena where the people surveyed say that the PES program benefits conservation goals (García-Amado et al., 2011). On the other hand, in Xochititla 47% says it helps to conservation objectives while the 42% says it does not. This may answer to the fact that the PES money was not invested in conservation activities, so they do not see a direct link between the program and the ecosystem conservation. 97% of all the interviewees consider that the payment is not sufficient to satisfy their needs. Something comparable happens in Sierra Morena where 87% of the surveyed people thought that the payment was insufficient to compensate their expectation (García-Amado et al., 2011) and in Niños Héroes, El Cajón, Orilla del Monte and San Bartolomé Loxicha (Corbera *et al.*, 2009), though the number of people who thinks that is not specified.

7. Conclusions

The Program's main objective of avoiding deforestation and the depletion of the environmental services appears to be being met. As seen in the regional analysis, the deforestation seems to be avoided inside most of the PES polygons; and even it appears to be having a positive impact on the forest cover in said areas. However, it is important to verify these processes in the field. Also, it is necessary to extend the present study's scope to the areas outside the protected ones, and in order to assess the impact of the program in a broader scale, the leakage effect that some authors refer to must be considered in subsequent researches.

It is clear that for the long-term program's functioning will be possible if the provisioning community's benefit is guaranteed. The impact of the program in the beneficiaries' quality of life may be related to the improvement of the environmental services (and therefore to the environmental quality in which they live), investment in infrastructure or equipment for the social welfare and the creation of temporal income sources (jobs). However, said effect is directly linked to the allocation of the economic resource, which answers to four approaches: maintenance of protected area, reward to participants in conservation activities, investment in equipment for social welfare and the combination of the strategies.

In Laguna del Mante a mixed approach was used, maybe influenced by the presence of the Biosphere Reserve Sierra del Abra Tanchipa and CONANP's personnel in the area; while in Xochititila, being outside any protected area has not this external influence and chose to distribute the money amongst the participants in the program. The money that the families receive from the program is so little that there was no statistical relation with other variables to the way they spend it. It seems that the decisions to spend the money certain way is guided by the immediate needs of the families, being usually spend on food, drinks and home items. The relatively low impact of the payments on the family or community level is a concern due to the pro-poor characteristics of the program. It must be noted that the socio-economic impact of the program in the community as a whole was not considered. To really assess it, it is considered that the sectors of the population that were disregarded (such as *pobladores* and possessors) should be taken into consideration.

The relation of the PES program with other public policies seems to diverge into two situations. The first one is of complementarity with social programs from SEDESOL and conservation programs from SEMARNAT, CONANP and other ones from CONAFOR. The second one is of potential opposition with productive policies from SAGARPA, due to more profitable opportunity costs of agriculture. To avoid this, the effort of having a transsectoral and integral state policies should be continued and enhanced.

Hence, the global effectiveness of the PES program in improving the quality of life of the beneficiaries, and in the conservation of the forest ecosystem is moderate. While it fulfills the goal of maintaining the forest cover inside the polygons, in this study it is not considered the situation outside the polygons (leakage effect), so the overall effect in avoiding deforestation and ecosystem degradation in the bigger picture is not clear. Regarding the influence of the program in the community's welfare, the effect goes from moderate to low, being directly linked to the particular allocation of the resource in the community. At household level the influence of the program is low, having no significant impact on family budget.

There is great room for improvement in the program. In order to continue the improvement process in terms of the effect on the environmental service quality and flow, and the quality of life of the beneficiaries some aspects should be considered. The number of successful applications for the program is always greater than the ones that can be financed. The budget for the program is limited so there is a possibility that a project, even though it fulfills all the requirements, cannot be supported. To ensure the long-term financial sustainability of the program two options are considered. The first one is to promote the creation of local PES schemes, where the buyers and providers could be better identified, so the contracts are more "personal".

The second one, linked to the latter, is to promote the development of private markets for environmental services. In this sense the government's approach may have the role to enhance the desirable conservation behaviors in the communities and work as a link and moderator of the private market schemes. A first step would be to find buyers who are willing to pay more for a product that is environmental beneficial and that would help poor communities to develop. The second one would be to define the compensation mechanisms that recognize and reward the best practices management of the ecosystems that would ensure the service provision. The third one would be to develop a strong base of ES promoters in charge of designing the PES scheme, facilitating the knowledge transfer and building local capacities to take over the governance of the projects. The fourth (and continuous) one would be the monitoring and improvement of the new local schemes.

It is considered that more scientific studies must be done to explain the nexus between the different land-uses and the provision of environmental services at a regional and local scale. These researches may contribute to the development of the proposed PES local schemes. The fact of having some of the PES projects revoked or frozen for an amount of time, indicates that the high resolution monitoring activities by CONAFOR are being led. With this, the conditionality requirement of the program is being considered. However, it may also indicate a lack of technical assistance for the creation and implementation of the Best Practices Management Programs of the communities.

Finally, it is considered that, in order to ensure a major acceptance of the program, the communication strategy should be in two levels. At first instance it should be to the *ejido's* authorities, in terms of the responsibilities they get and the specifications of the contract. At second instance, communication with the greater part of the population available should be warranted by CONAFOR's extension officials. The operational costs are reduced with the first strategy; however, it does not guarantee that the population is informed about the terms of the contract, their benefits and their obligations; giving space to ill-management of the resources.

8. References

Alix-Garcia, J.M., Shapiro, E.N., Sims, K.R.E., 2012. Forest Conservation and Slippage: Evidence from Mexico's National Payments for Ecosystem Services Program. Land Economics 88, 613–638.

Álvarez-Icaza, P., Muñoz-Piña, C., 2008. Instrumentos territoriales y económicos que favorecen la conservación y el uso sustentable de la biodiversidad, in: Políticas Públicas y Perspectivas de Sustentabilidad, Capital Natural de México. CONABIO, México, pp. 229–258.

Arriagada, R.A., Ferraro, P.J., Sills, E.O., Pattanayak, S.K., Cordero-Sancho, S., 2012. Do Payments for Environmental Services Affect Forest Cover? A Farm-Level Evaluation from Costa Rica. Land Economics 88, 382–399.

Assennatto-Blanco, S., de León-Mojarro, P., 2006. La democracia interna en el ejido.

Barnes, G., 2009. The evolution and resilience of community-based land tenure in rural Mexico. Land Use Policy 26, 393–400.

BDA Group, CSIRO, 2007. Use of market based instruments by Catchment Management Authorities in NSW to achieve landscape scale change.

Bennear, L.S., Dickinson, K.L., 2008. The Role of Program Evaluation in Environmental Policy: A Critical Evaluation of Incentive Structures.

Bocco, G., Méndoza, M., Masera, O.R., 2001. La dinámica del cambio del uso del suelo en Michoacán. Una propuesta metodológica para el estudio de los procesos de deforestación (parte 1). Investigaciones Geográficas (Mx) 18–38.

Bonilla-Moheno, M., Redo, D.J., Aide, T.M., Clark, M.L., Grau, H.R., 2013. Vegetation change and land tenure in Mexico: A country-wide analysis. Land Use Policy 30, 355–364.

Carrasco-Vargas, T., 2011. ProÁrbol- Programa de Pago por Servicios Ambientales (PSA). Comisión Nacional Forestal (Evaluación), Informe de Evaluación Específica de Desempeño 2010-2011. CONEVAL.

Céspedes-Flores, S.E., Moreno-Sánchez, E., 2010. Estimación del valor de la pérdida de recurso forestal y su relación con la reforestación en las entidades federativas de México. IA-INE 2, 5–13.

Challenger, A., 2009. Introducción a los servicios ambientales.

CONAFOR, 2010. Visión de México sobre REDD+. Hacia una estrategia nacional.

CONAFOR, 2012a. Bosques, cambio climático y REDD+ en México. Guía básica.

CONAFOR, 2012b. Anexo 1 del comunicado GSAB/0020/12. Descripción técnica de la clasificación de la Zona Elegible en áreas de pago diferenciado, para el Concepto de Apoyo B2. Servicios Ambientales de ProÁrbol, correspondiente a la Convocatoria 2012.

CONAFOR, 2013. Base de Datos Información Servicios Ambientales 2007-2012. Programa de Servicios Ambientales- Delegación San Luis Potosí.

CONAPO, 2013. Listado San Luis Potosí: Población total, indicadores socioeconómicos, índice y grado de marginación y lugar que ocupa en los contextos nacional y estatal por localidad, 20101.

Congreso General de los Estados Unidos Mexicanos, 2012. Ley General de Desarrollo Forestal Sustentable, Diario Oficial de la Federación.

Corbera, E., Kosoy, N., Martínez, T.M., 2006. Marketing ecosystem services through protected areas and rural communities in Meso-America: Implications for economic efficiency, equity and political legitimacy.
Corbera, E., Schroeder, H., 2011. Governing and implementing REDD+. Environmental Science & Policy 14, 89–99.
Corbera, E., Soberanis, C.G., Brown, K., 2009. Institutional dimensions of Payments for Ecosystem Services: An analysis of Mexico's carbon forestry programme. Ecological Economics 68, 743–761.
Engel, S., Pagiola, S., Wunder, S., 2008. Designing payments for environmental services in theory and practice: An overview of the issues. Ecological Economics 65, 663–674.
Ferney-Leonel, H., 2011. Gestión participativa de cuencas hidrográficas: el caso de la cuenca del Río Valles, oriente de México (Doctorado). Universidad Autónoma de San Luis Potosí, San Luis Potosí.
Flores-Rivas, J.D., Mireles-Sánchez, R., Flores-Cano, J.A., González-Silva, B.M., Chapa-Vargas, L., 2008. Programa Estratégico Forestal del Estado de San Luis Potosí (PEFE-SLP) 2006-2025 (Evaluación). Instituto Potosino de Investigación Científica y Tecnológica, San Luis Potosí.
García-Amado, L.R., Pérez, M.R., Escutia, F.R., García, S.B., Mejía, E.C., 2011. Efficiency of Payments for Environmental Services: Equity and additionality in a case study from a Biosphere Reserve in Chiapas, Mexico. Ecological Economics 70, 2361–2368.
GIZ, 2012. Lista de herramientas de metodología participativa para el análisis de vulnerabilidad de estrategias de vida al cambio climático.
González-Avilés, B.Y., 2011. Identificación espacial de áreas prioritarias para el pago por servicios ambientales (PSA) hidrológicos y derivados de la conservación de la biodiversidad en la Sierra Madre Oriental, San Luis Potosí, México (Magister Scientiae). Centro Agronómico Tropical de Investigación y Enseñanza, Turrialba, Costa Rica.
González-Sierra, E.R., 2011. Desarrollo sustentable y conservación del jaguar (Panthera onca) en tres comunidades de la Huasteca Potosina, S.L.P., México (Maestría en Ciencias). Colegio de Postgraduados, Estado de México, Méxicdo.
Grieg-Gran, M., Porras, I., Wunder, S., 2005. How can market mechanisms for forest environmental services help the poor? Preliminary lessons from Latin America. World Development 33, 1511–1527.
Hopwood, B., Mellor, M., O'Brien, G., 2005. Sustainible Development: Mapping Different Approaches. Sustainible Development 13, 38–52.
INEGI, 2010. Censo de Población y Vivienda 2010 [WWW Document]. Censos y Conteos de Población y Vivienda. URL http://www3.inegi.org.mx/sistemas/iter/consultar_info.aspx
Kavi-Kumar, K.S., 2010. Clean Development Mechanism (Dissemination Paper No. 13). Centre of Excellence in Environmental Economics- Madras School of Economics.
Kosoy, N., Corbera, E., Brown, K., 2008. Participation in payments for ecosystem services: Case studies from the Lacandon rainforest, Mexico. Geoforum 39, 2073–2083.
Mendoza-Rodríguez, V.H., 2010. Patrones de diversidad y potencial de conservación de aves de sotobosque en estadios sucesionales tardíos y dos tipos de selva de la Huasteca Potosina (Maestría). Instituto Potosino de Investigación Científica y Tecnológica, A.C., San Luis Potosí.

Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-Being. Island Press, Washington, D.C., U.S.A.

Moreno-Díaz, M.L., 2005. La valoración económica de los servicios que brinda la biodiversidad: la experiencia de Costa Rica (Técnico). Instituto Nacional de Biodiversidad, Costa Rica.

Muñoz-Piña, C., Guevara, A., Torres, J.M., Braña, J., 2008. Paying for the hydrological services of Mexico's forests: Analysis, negotiations and results. Ecological Economics 65, 725–736.

OECD, 2013. OECD Environmental Performance Reviews: Mexico 2013. OECD Publishing.

Olhoff, A., Markandya, A., Halsnaes, K., Taylor, T., 2004. CDM Sustainable Development Impacts.

Olsen, K.H., 2007. The clean development mechanism's contribution to sustainable development: a review of the literature. Climatic Change 84, 59–73.

Pagiola, S., Arcenas, A., Platais, G., 2005. Can Payments for Environmental Services Help Reduce Poverty? An Exploration of the Issues and the Evidence to Date from Latin America. World Development 33, 237–253.

Pech-Jiménez, M.N.N., 2010. "Es nuestra empresa porque la hemos hecho prosperar y de eso queremos vivir en un futuro..." Organización y manejo de recursos en un ejido de la costa yucateca (Maestría en Ciencias). Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional, México.

Quintero-Ruiz, J.R., 2012. Estudio ambiental y social comparativo del bosque humedo en base al cambio de uso de suelo entre la huasteca potosina, México y la mata atlántica, Río de Janeiro, Brasil (Maestría en Ciencias). Universidad Autónoma de San Luis Potosí, San Luis Potosí, México.

Requier-Desjardins, M., Adhikari, B., Sperlich, S., 2011. Some notes on the economic assessment of land degradation. Land Degradation & Development 22, 285–298.

Reyes-Hernández, H., Aguilar-Robledo, M., Aguirre-Rivera, J.R., Trejo-Vázquez, I., 2006. Cambios en la cubierta vegetal y uso del suelo en el área del proyecto Pujal-Coy, San Luis Potosí, México, 1973-2000. Investigaciones Geográficas, Boletín del Instituto de Geografía 59, 26–42.

Reyes-Hernández, H., Aguilar-Robledo, M., Fortanelli-Martínez, J., Mass-Caussel, J.F., Montoya-Toledo, J.N., Sahagún-Sánchez, F.J., Vázquez-Villa, B.M., 2011. Dinámica espacio-temporal de la deforestación en la sierra Madre Oriental de San Luis Potosí y escenarios futuros., Proyecto: Los procesos de deforestación en la huasteca potosina, sus implicaciones ante el cambio climático y escenarios futuros. FOSEC:SEMARNAT-CONACYT, C06-23754.

Reyes-Hernández, H., Cortina-Villar, S., Perales-Rivera, H., Kauffer-Michel, E., Pat-Fernández, J.M., 2003. Efecto de los subsidios agropecuarios y apoyos gubernamentales sobre la deforestación durane el periodo 1990-2000 en la región de Calakmul, Campeche, México. Investigaciones Geográficas, Boletín del Instituto de Geografía, UNAM 51, 88–106.

Rivera, N.A., 2010. La caña de azúcar y sus derivados en la huasteca San Luis Potosí México. Diálogos Revista Electrónica de Historia 81–110.

SAGARPA, 2013. ASERCA - Objetivo [WWW Document]. Procampo: Objetivo. URL http://www.aserca.gob.mx/artman/publish/article_183.asp (accessed 5.28.13).

Sahagún-Sánchez, F.J., Castro-Navarro, J., Reyes-Hernández, H., 2013. Distribución geográfica de la avifauna en la Sierra Madre Oriental de San Luis Potosí, México: un análisis regional de su estado de conservación. Revista de Biología Tropical 61, 897–925.

Salas-González, J.M., 2012. ProÁrbol- Programa de Pago por Servicios Ambientales (Evaluación), Evaluación de Consistencia y Resultados 2011-2012. CONEVAL / Universidad Autónoma de Chapingo.

Sarukhán, J., Koleff, P., Carabias, J., Soberón, J., Dirzo, R., Llorente-Bousquets, J., Halffter, G., González, R., March, I., Mohar, A., Anta, S., de la Maza, J., 2009. Conocimiento actual, evaluación y perspectivas de sustentabilidad, Capital Natural de México. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, México.

SEDESOL, 2010. Catálogo Localidades [WWW Document]. Unidad de Microrregiones. URL http://www.microrregiones.gob.mx/catloc/LocdeMun.aspx?tipo=clave&campo=loc&ent=24&mun=057 (accessed 7.17.13).

SEDESOL, 2013a. Funciones de Oportunidades [WWW Document]. Oportunidades. URL http://www.oportunidades.gob.mx/Portal/wb/Web/funciones_de_oportunidades (accessed 5.28.13).

SEDESOL, 2013b. SEDESOL | Pensión para Adultos Mayores [WWW Document]. SEDESOL. URL http://www.sedesol.gob.mx/en/SEDESOL/Pension_para_adultos_mayores (accessed 5.28.13).

SEGOB, 2010a. Municipio de Ciudad Valles [WWW Document]. Enciclopedia de los Municipios y Delegaciones de México. URL http://www.e-local.gob.mx/work/templates/enciclo/EMM24sanluispotosi/municipios/24013a.html (accessed 7.11.13).

SEGOB, 2010b. Municipio de Matlapa [WWW Document]. Enciclopedia de los Municipios y Delegaciones de México. URL http://www.e-local.gob.mx/work/templates/enciclo/EMM24sanluispotosi/municipios/24057a.html (accessed 7.11.13).

SEMARNAT, CONAFOR, 2007. Reglas de Operación del Programa ProÁrbol 2008.

SEMARNAT, CONAFOR, 2009. Reglas de Operación del Programa ProÁrbol 2010.

SEMARNAT, CONAFOR, 2011. Reglas de Operación del Programa ProÁrbol 2012.

Sepulveda, M.T., Newsham, A., Camacho, E., Cantellano, X., González, Y., Salvatierra, A., Muñoz, R., Shankland, A., Ulrichs, M., 2012. Análisis de los resultados de la aplicación de herramientas de metodología participativa para el análisis de vulnerabilidad de estrategias de vida (AVEV) al cambio climático. Comunidad de Laguna del Mante, Ciudad Valles San Luis Potosí. Universidad Autónoma del Estado de Hidalgo, Institute of Development Studies, GIZ México, Universidad Iberoamericana Puebla, México.

Thompson, M.C., Baruah, M., Carr, E.R., 2011. Seeing REDD+ as a project of environmental governance. Environmental Science & Policy 14, 100–110.

Vihervaara, P., Rönkä, M., Walls, M., 2010. Trends in ecosystem service research: early steps and current drivers. Ambio 39, 314–324.

Virani, S., Graham, S., 1998. Economic Evaluation of Environmental Policies and Legislation.

Wang, J., Cao, Y., 2009. Evaluation of the Social and Economic Impacts of Environmental Policy.
WRI, 2009. Welcome to the Ecosystem Service Indicators Database | Ecosystem Service Indicators Database [WWW Document]. URL http://www.esindicators.org/ (accessed 6.19.13).
Wunder, S., 2005. Pagos por servicios ambientales: principios básicos esenciales (Institucional No. 42). Centro Internacional de Investigación Forestal, Indonesia.
Wunder, S., 2007. The efficiency of payments for environmental services in tropical conservation. Conserv. Biol. 21, 48–58.

9. Appendixes

9.1. Sample questionnaires

9.1.1. Type 1: Ejidatarios (family level)

Sexo_____ Edad_____ Ocupación_____

I. Información socioeconómica

1. Número de personas en la familia:_____

2. Composición de la familia

No	Parentesco (Respecto a la cabeza de familia)	Sexo	Edad	Actividades a las que se dedica		Nivel Educativo
				Principales	Secundarias	
1	Jefe o jefa de familia					
2						
3						
4						
5						

3. ¿Cuánto gasta a la semana en…?

Alimento_____ Artículos para el cuidado personal_____
Bebidas_____ Cuidados de la salud_____
Cigarros _____ Transporte_____
Ropa y zapatos_____ Diversión _____
Artículos para la casa_____ Cuentas (gas, teléfono, electricidad)_____

II. Programa de Pago por servicios ambientales

4. ¿Conoce el Programa de Pago por Servicios Ambientales?

Si No

5. Si es así, ¿es beneficiario del programa? (Sino ¿Por qué no? y pase a la pregunta 8)

Si No_____

6. ¿Cuánto dinero recibe por el programa? _____

7. ¿En qué gasta el dinero que recibe?

Alimento_____	Artículos para el cuidado personal_____
Bebidas_____	Cuidados de la salud_____
Cigarros _____	Transporte_____
Ropa y zapatos_____	Diversión _____
Artículos para la casa_____	Cuentas (gas, teléfono, electricidad)_____

8. ¿Sabe cada cuánto se habla del PSA en las Asambleas Ejidales?_____

9. El dinero que se invierte en la comunidad, ¿sabe en qué se ha ocupado?
   Si_____
   No_____

10. ¿Sabe si se han generado empleos con el dinero de este programa?
    Si ¿Cuántos?_____ No_____ No sé_____

11. ¿Sabe qué otras actividades se realiza con el dinero de este programa?
    Si ¿Cuáles?_____
    No_____ No sé_____

III. Otras políticas

12. ¿Cuenta con algún otro apoyo del gobierno? Si_____ No_____
13. Si es así, ¿cuáles?

Dependencia	Programa	Monto
SEDESOL	70 y +	
	Atención a jornaleros agrícolas	
	Empleo temporal	
	Opciones productivas	
	Piso firme	
	Oportunidades	
	Otros	
SAGARPA	ProCampo	
	ProGan	
	Apoyos para integración	

	de proyectos	
	Apoyo rural por contingencias climatológicas	
	PESA	
	Conservación y Uso sustentable de suelo y Agua	
	Reconversión productiva	
	Otros	
CONAFOR	Pronafor	
	Microcuencas prioritarias	
	Plantaciones forestales comerciales	
	Proyectos especiales de conservación y restauración forestal	
	Compensación Ambiental por Cambio de Uso de Suelos en Terrenos Forestales	
	Fomento a la Organización Social Planeación y Desarrollo Regional Forestal	
OTROS		

14. ¿Cómo cree que se pudiera mejorar el programa PSA?

_____
_____
_____
_____

9.1.2. Type 2: Ejido's authorities- Laguna del Mante (ejido level)

Sexo_____ Edad_____ Ocupación_____

I. Programa de Pago por servicios ambientales

1. ¿Cuánto dinero recibe el ejido por el programa? _____
2. ¿Cada cuánto hablan del programa en las Asambleas Ejidales?_____

3. ¿En cuáles de las siguientes actividades se invierte el dinero?

			¿Cuánto?
Conservación	Prevención de incendios	Campañas de sensibilización	
		Equipo para la brigada contra incendios	
		Brechas corta-fuegos	
		Recorridos de vigilancia	
	Conservación de la biodiversidad	Muestreos de flora y fauna	
		Protección de zonas de nidos/madrigueras	
		Establecimiento de bebederos y comederos	
		Programa de educación ambiental	
	Otros		
Comunidad	Nivel educativo	Infraestructura de escuela	

		Muebles escolares	
		Libros, cuadernos o material didáctico	
	Infraestructura	Caminos	
		Alumbrado público	
		Suministro de agua	
	Servicios de salud	Infraestructura de clínica/hospital	
		Medicinas	
		Equipo y material para atención médica	
	Equipamiento	Sillas del salón ejidal	
		Mesas del salón ejidal	
	Empleos temporales		
OTROS			

4. A grandes rasgos, ¿sabe en qué gastan los beneficiaros el dinero que reciben del PSA?

Alimento_____ Artículos para el cuidado personal_____
Bebidas_____ Cuidados de la salud_____
Cigarros _____ Transporte_____
Ropa y zapatos_____ Diversión _____
Artículos para la casa_____ Cuentas (gas, teléfono, electricidad)_____

5. En su opinión, ¿cómo podría mejorar el programa?

_____
_____
_____
_____

II. Políticas adicionales

6. ¿Cuenta con algún otro apoyo del gobierno? Si_____ No_____
7. Si es así, ¿cuáles? ¿cuánto?

Dependencia	Programa	Número de personas	Monto
SEDESOL	70 y +		
	Atención a jornaleros agrícolas		
	Empleo temporal		
	Opciones productivas		
	Piso firme		
	Oportunidades		
	Otros		
SAGARPA	ProCampo		
	ProGan		
	Apoyos para integración de proyectos		
	Apoyo rural por contingencias climatológicas		
	PESA		
	Conservación y Uso sustentable de suelo y Agua		
	Reconversión productiva		
	Otros		
CONAFOR	Pronafor		
	Microcuencas prioritarias		
	Plantaciones forestales comerciales		
	Proyectos especiales de conservación y restauración forestal		
	Compensación Ambiental por Cambio de Uso de Suelos en Terrenos Forestales		
	Fomento a la Organización Social		

	Planeación y Desarrollo Regional Forestal		
Gobierno estatal			
Gobierno municipal			
OTROS			

9.1.3. Type 3: Ejido's authorities- Ejido Xochititla (ejido level)

Sexo_____ Edad_____ Ocupación_____

I. Programa de Pago por servicios ambientales

1. ¿Cuántas hectáreas se tienen protegidas con el pago por servicios ambientales?
   _____

2. Estas tierras, provienen de donaciones de las parcelas o eran tierras de uso común?
   Parcelas_____ Tierra de uso común_____ Otra_____

3. ¿Cuánto dinero recibe el ejido por el programa? _____

4. Cuántas personas son beneficiarias del programa?_____

5. ¿Cada cuánto hablan del programa en las Asambleas Ejidales?_____

6. ¿En cuáles de las siguientes actividades se invierte el dinero?

			¿Cuánto?
Conservación	Prevención de	Campañas de	

	incendios	sensibilización	
		Equipo para la brigada contra incendios	
		Brechas corta-fuegos	
		Recorridos de vigilancia	
	Conservación de la biodiversidad	Muestreos de flora y fauna	
		Protección de zonas de nidos/madrigueras	
		Establecimiento de bebederos y comederos	
		Programa de educación ambiental	
	Otros		
Comunidad	Nivel educativo	Infraestructura de escuela	
		Muebles escolares	
		Libros, cuadernos o material didáctico	
	Infraestructura	Caminos	
		Alumbrado público	
		Suministro de agua	
	Servicios de salud	Infraestructura de clínica/hospital	
		Medicinas	
		Equipo y material para atención médica	
	Equipamiento	Sillas del salón ejidal	
		Mesas del salón ejidal	
	Empleos temporales		

OTROS			

7. A grandes rasgos, ¿sabe en qué gastan los beneficiaros el dinero que reciben del PSA?

Alimento_____ Artículos para el cuidado personal_____
Bebidas_____ Cuidados de la salud_____
Cigarros _____ Transporte_____
Ropa y zapatos_____ Diversión _____
Artículos para la casa_____ Cuentas (gas, teléfono, electricidad)_____

8. En su opinión, ¿cómo podría mejorar el programa?

_____
_____
_____
_____

II. Políticas adicionales

9. ¿Cuenta con algún otro apoyo del gobierno? Si_____ No_____
10. Si es así, ¿cuáles?

Dependencia	Programa	Número de personas	Monto
SEDESOL	70 y +		
	Atención a jornaleros agrícolas		
	Empleo temporal		
	Opciones productivas		
	Piso firme		
	Oportunidades		
	Otros		
SAGARPA	ProCampo		
	ProGan		
	Apoyos para integración de proyectos		
	Apoyo rural por		

	contingencias climatológicas		
	PESA		
	Conservación y Uso sustentable de suelo y Agua		
	Reconversión productiva		
	Otros		
CONAFOR	Pronafor		
	Microcuencas prioritarias		
	Plantaciones forestales comerciales		
	Proyectos especiales de conservación y restauración forestal		
	Compensación Ambiental por Cambio de Uso de Suelos en Terrenos Forestales		
	Fomento a la Organización Social Planeación y Desarrollo Regional Forestal		
Gobierno estatal			
Gobierno municipal			
OTROS			

9.2. Results breakdown

Table 13. Surface (ha) of PES sites by municipality, property regime type and modality

	Comunidad agraria		Ejido		Propiedad privada
Etiquetas de fila	CABSA	PSAH	CABSA	PSAH	PSAH
Tamazunchale					
COMUNIDAD SANTA MARIA PICULA	252				
MECATLAN Y SUS BARRIOS			426.88		
Xilitla					
EJIDO EL CHALAHUITE				645.13	
TERRENOS DE USO COMUN DEL EJIDO SOLEDAD DE ZARAGOZA				1780.14	
AMAYO DE ZARAGOZA				374.34	
EJIDO EL SABINO				376.11	
EJIDO POTRERILLOS				1064.37	
AQUISMÓN					
COMUNIDAD TAMAPATZ	2000				
COMUNIDAD TAMPATE	1301.67				
EJIDO INDIGENA TAMPAXAL			648		
EJIDO TAMPAXAL			648.16	1995.59	
EJIDO TANQUIZUL Y ANEXOS			1178.19		
AXTLA DE TERRAZAS					
LAS CUEVAS PARAJE LOMAS				200	
CIUDAD VALLES					
EJIDO LA LIMA				966.11	
EJIDO LAGUNA DEL MANTE			1947.73		
EJIDO LOS SABINOS NUMERO DOS			338.08	637.96	
EJIDO OJO DE AGUA				1000	
EJIDO RANCHO NUEVO				973.4	

	Comunidad agraria		Ejido		Propiedad privada
Etiquetas de fila	CABSA	PSAH	CABSA	PSAH	PSAH
EL DESTIERRO					120
LA SUBIDA				668.02	
PP. AGUA ESCONDIDA					100
PP. LA CHICHIMECA					95.12
PP. LA LAGUNITA					360
PP. PREDIO B EL DESTIERRO					58.28
EL NARANJO					
OLLA VERDE					175.46
EJIDO EL SABINITO				805.67	
EJIDO LA CONCEPCION				3644.82	
EJIDO MAGUEY DE ORIENTE				1240	
EJIDO MINAS VIEJAS				200	
EJIDO OJO DE AGUA DE TIERRA NUEVA				882.41	
EL SALTO		377.78			
HOYA VERDE LOTE 7					200
LAS ABRITAS Y SU ANEXO LA HIERBABUENA				1650	
LOS ALAMOS				375.42	
MESA DE GUADALUPE					164.48
MESA DE GUADALUPE II					99.98
PP. BUENOS AIRES					87.71
PP. PEÑA AMARILLA					275.41
PP. SAN PEDRITO					99.81
RANCHO LOS CEDROS					124.72
RANCHO NUEVO					100
RANCHO PEÑA AMARILLA					73.16
SIN NOMBRE					120

	Comunidad agraria		Ejido		Propiedad privada
Etiquetas de fila	CABSA	PSAH	CABSA	PSAH	PSAH
MATLAPA					
COMUNIDAD ATLAMAXATL	382.48	566.62			
COMUNIDAD CUAQUENTLA		755.08			
EJIDO MATLAPA INDIGENA				1249.27	
EJIDO XOCHITITLA				258.07	
TEXQUITOTE		290.04			
TAMASOPO					
DAMIAN CARMONA				1871.15	
EJIDO SAN NICOLAS DE LOS MONTES				5880.04	
TAMAZUNCHALE					
AGUAZARCA	216.74				
COMUNIDAD SAN FRANCISCO Y SUS BARRIOS		2894.14			
COMUNIDAD SANTIAGO Y SUS BARRIOS	175.68				
COMUNIDAD TAMAN Y SUS BARRIOS	234				
SANTIAGO Y SUS BARRIOS	1000				
Tamazunchale					
COMUNIDAD IXTEAMEL		272.32			
XILITLA					
AHUACATLAN				461.43	
EJIDO EJIDO LA TRINIDAD				256.27	
EJIDO CORONEL JOSE CASTILLO - TLAMAYA				1200	
EJIDO EL CHALAHUITE			365.26		
EJIDO EL CRSTIANO Y ANEXOS				2921.06	
EJIDO LA TRINIDAD				691.7	
EJIDO LA VICTORIA (EL BAGAZO)				525.59	
EJIDO OLLITA DEL PINO				648.8	

Etiquetas de fila	Comunidad agraria CABSA	Comunidad agraria PSAH	Ejido CABSA	Ejido PSAH	Propiedad privada PSAH
EJIDO PILANTENO				292.86	
EJIDO SAN PEDRO HUITZQUILICO				1308.37	
TIERRA BLANCA				75	
XILOSUCHICO				227.5	
Total general	5562.57	5155.98	5552.3	37346.6	2254.13

Table 14. Social Marginalization Index of sites with PES by municipality, property regime type and modality

	Ejido PSAH	Ejido CABSA	Comunidad agraria PSAH	Comunidad agraria CABSA
Aquismón				
COMUNIDAD TAMAPATZ				1.1310
COMUNIDAD TAMPATE				1.8187
EJIDO INDIGENA TAMPAXAL		0.8162		
EJIDO TAMPAXAL	0.7573			
EJIDO TANQUIZUL Y ANEXOS		0.9421		
Axtla de Terrazas				
LAS CUEVAS PARAJE LOMAS	-0.0460			
Ciudad Valles				
EJIDO LA LIMA	-0.1255			
EJIDO LAGUNA DEL MANTE		-0.7697		
EJIDO LOS SABINOS NUMERO DOS	-0.5219			
EJIDO OJO DE AGUA	-0.1045			
EJIDO RANCHO NUEVO	-0.7325			
LA SUBIDA	0.1508			

	Ejido		Comunidad agraria	
	PSAH	CABSA	PSAH	CABSA
El Naranjo				
EJIDO MAGUEY DE ORIENTE	-0.5569			
EJIDO MINAS VIEJAS	-0.4127			
EJIDO OJO DE AGUA DE TIERRA NUEVA	-0.5597			
LOS ALAMOS	0.6789			
Matlapa				
COMUNIDAD ATLAMAXATL			-0.1939	
COMUNIDAD CUAQUENTLA			0.4016	
EJIDO MATLAPA INDIGENA	0.1310			
EJIDO XOCHITITLA	-0.0683			
TEXQUITOTE			0.0626	
Tamasopo				
DAMIAN CARMONA	-0.8500			
EJIDO SAN NICOLAS DE LOS MONTES	-0.8027			
Tamazunchale				
AGUAZARCA				0.1748
COMUNIDAD IXTEAMEL			0.6153	
COMUNIDAD SAN FRANCISCO Y SUS BARRIOS			0.5727	
COMUNIDAD SANTA MARIA PICULA				-0.8141
COMUNIDAD SANTIAGO Y SUS BARRIOS				0.3947
COMUNIDAD TAMAN Y SUS BARRIOS				-0.8493
MECATLAN Y SUS BARRIOS		-0.3180		
Xilitla				
TERRENOS DE USO COMUN DEL EJIDO SOLEDAD DE ZARAGOZA	0.0174			
AHUACATLAN	-0.7259			

	Ejido		Comunidad agraria	
	PSAH	CABSA	PSAH	CABSA
AMAYO DE ZARAGOZA	0.2331			
EJIDO EL CRSTIANO Y ANEXOS	0.0167			
EJIDO EL SABINO	0.8475			
EJIDO LA TRINIDAD	-0.1594			
EJIDO LA VICTORIA (EL BAGAZO)	-0.2124			
EJIDO OLLITA DEL PINO	-0.1693			
EJIDO PILANTENO	0.3554			
EJIDO POTRERILLOS	-0.5410			
EJIDO SAN PEDRO HUITZQUILICO	-0.5662			
TIERRA BLANCA	0.4118			
XILOSUCHICO	-0.0408			

9.3. Interviewed people

Name	Institution / Description	Date
Ing. Alejandro Duran Fernandez	National Commission of Natural Protected Areas (CONANP)	19/03/2012
Octavio Balderas	Tesorero Ejidal (Laguna del Mante)	19/03/2012
Hermelindo Guzmán	Ejidatario (Laguna del Mante)	19/03/2012
Modesto Guzmán	Ejidatario (Laguna del Mante)	22/03/2012
Gregorina Castillos	Ejidataria (Laguna del Mante)	22/03/2012
Rufina Torres	Ejidatario (Laguna del Mante)	23/03/2012
Lorenzo Rodríguez	Ejidatario (Laguna del Mante)	23/03/2012
Claudia Yadira Salinas	Ejidatario (Laguna del Mante)	23/03/2012
Gloria Vidales	Ejidatario (Laguna del Mante)	23/03/2012
Martin Aguilar	Ejidatario (Laguna del Mante)	23/03/2012
Ing. Nicolasa Rodríguez Cubillos	National Forestry Commission (CONAFOR)	08/05/2012
Don Melquiades	Comisariado Ejidal (Laguna del Mante)	23/04/2013
Octavio Balderas	Tesorero Ejidal (Laguna del Mante)	25/04/2013
5 miembros Comisariado Ejidal	Comisariado Ejidal (Xochititla)	28/04/2013

9.4. Statistical analysis results

The SPSS syntaxes and results are presented next. The first part shows the results to the analysis for both localities and the second part shows them for each locality. The variables studied are:

- GastosPSA: allocation of PES resource 1) Food and drinks 2) Groceries and home items 3) Bills and health care 4) Various
- Sexo: gender of interviewee 1) Male 2) Female
- Ocupación: employment of the interviewee 1) Day Labourer 2) Housework 3) Retirement 4) Other
- Niveleducativo: educational level 0) None 1) Incomplete elementary school 2) Complete elementary school 3) Secondary school or above
- Familia: number of family members per household
- Apoyogob: access to other public policies 0) No 1) Yes
- Ingresomensual: mean monthly income 1) less than 2000 MXN 2) 2001-4000 MXN 3) more than 4000 MXN

BOTH COMMUNITIES

```
CROSSTABS
  /TABLES=GastosPSA BY Sexo Ocupación Niveleducativo Familia Apoyogob
Ingresomensual
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT
  /COUNT ROUND CELL.
```

Tablas de contingencia

Resumen del procesamiento de los casos

	Casos					
	Válidos		Perdidos		Total	
	N	Porcentaje	N	Porcentaje	N	Porcentaje
GastosPSA * Sexo	59	100.0%	0	0.0%	59	100.0%
GastosPSA * Ocupación	59	100.0%	0	0.0%	59	100.0%
GastosPSA * Niveleducativo	59	100.0%	0	0.0%	59	100.0%
GastosPSA * Familia	59	100.0%	0	0.0%	59	100.0%
GastosPSA * Apoyogob	59	100.0%	0	0.0%	59	100.0%
GastosPSA * Ingresomensual	59	100.0%	0	0.0%	59	100.0%

GastosPSA * Sexo

Tabla de contingencia

Recuento

		Sexo		Total
		1	2	
GastosPSA	1	14	7	21
	2	13	2	15
	3	5	3	8
	4	13	2	15
Total		45	14	59

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	3.700	3	.296
Razón de verosimilitudes	3.777	3	.287
Asociación lineal por lineal	1.051	1	.305
N de casos válidos	59		

GastosPSA * Ocupación

Tabla de contingencia

Recuento

		Ocupación				Total
		1	2	3	4	
GastosPSA	1	8	6	6	1	21
	2	9	2	2	2	15
	3	3	3	2	0	8
	4	7	0	5	3	15
Total		27	11	15	6	59

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	11.020	9	.274
Razón de verosimilitudes	14.080	9	.120
Asociación lineal por lineal	.512	1	.474
N de casos válidos	59		

GastosPSA * Niveleducativo

Tabla de contingencia

Recuento

		Niveleducativo				Total
		0	1	2	3	
GastosPSA	1	6	8	4	3	21
	2	1	7	4	3	15
	3	2	2	3	1	8
	4	3	4	7	1	15
Total		12	21	18	8	59

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	6.694	9	.669
Razón de verosimilitudes	7.134	9	.623
Asociación lineal por lineal	.279	1	.598
N de casos válidos	59		

GastosPSA * Familia

Tabla de contingencia

Recuento

		Familia						
		1	2	3	4	5	6	7
GastosPSA	1	0	3	6	6	3	1	1
	2	0	2	4	0	5	3	1
	3	1	3	1	1	0	1	0
	4	1	3	2	2	4	2	0
Total		2	11	13	9	12	7	2

Tabla de contingencia

Recuento

		Familia			Total
		8	9	12	
GastosPSA	1	0	0	1	21
	2	0	0	0	15
	3	1	0	0	8
	4	0	1	0	15
Total		1	1	1	59

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	29.635	27	.331
Razón de verosimilitudes	31.433	27	.254
Asociación lineal por lineal	.116	1	.734
N de casos válidos	59		

GastosPSA * Apoyogob

Tabla de contingencia

Recuento

		Apoyogob		Total
		0	1	
GastosPSA	1	3	18	21
	2	2	13	15
	3	1	7	8
	4	0	15	15
Total		6	53	59

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	2.300	3	.513
Razón de verosimilitudes	3.764	3	.288
Asociación lineal por lineal	1.779	1	.182
N de casos válidos	59		

GastosPSA * Ingresomensual

Tabla de contingencia

Recuento

		Ingresomensual			Total
		1	2	3	
GastosPSA	1	13	6	2	21
	2	8	6	1	15
	3	6	2	0	8
	4	9	3	3	15
Total		36	17	6	59

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	3.932	6	.686
Razón de verosimilitudes	4.423	6	.620
Asociación lineal por lineal	.070	1	.792
N de casos válidos	59		

EJIDO LAGUNA DEL MANTE

```
CROSSTABS
  /TABLES=GastosPSA BY Sexo Ocupación Niveleducativo Familia Apoyogob
Ingresomensual
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT
  /COUNT ROUND CELL.
```

Resumen del procesamiento de los casos

	Casos					
	Válidos		Perdidos		Total	
	N	Porcentaje	N	Porcentaje	N	Porcentaje
GastosPSA * Sexo	40	100.0%	0	0.0%	40	100.0%
GastosPSA * Edad	40	100.0%	0	0.0%	40	100.0%
GastosPSA * Ocupación	40	100.0%	0	0.0%	40	100.0%
GastosPSA * Niveleducativo	40	100.0%	0	0.0%	40	100.0%
GastosPSA * Familia	40	100.0%	0	0.0%	40	100.0%
GastosPSA * Apoyogob	40	100.0%	0	0.0%	40	100.0%
GastosPSA * Ingresomensual	40	100.0%	0	0.0%	40	100.0%

GastosPSA * Sexo

Tabla de contingencia

Recuento

		Sexo		Total
		1	2	
GastosPSA	1	9	4	13
	2	11	2	13
	3	4	2	6
	4	8	0	8
Total		32	8	40

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	3.782	3	.286
Razón de verosimilitudes	5.183	3	.159
Asociación lineal por lineal	1.797	1	.180
N de casos válidos	40		

GastosPSA * Ocupación

Tabla de contingencia

Recuento

		Ocupación				Total
		1	2	3	4	
GastosPSA	1	4	3	5	1	13
	2	8	1	2	2	13
	3	3	2	1	0	6
	4	5	0	2	1	8
Total		20	6	10	4	40

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	7.816	9	.553
Razón de verosimilitudes	9.312	9	.409
Asociación lineal por lineal	.744	1	.388
N de casos válidos	40		

GastosPSA * Niveleducativo

Tabla de contingencia

Recuento

		Niveleducativo				Total
		0	1	2	3	
GastosPSA	1	3	4	3	3	13
	2	1	6	3	3	13
	3	2	1	2	1	6
	4	2	3	2	1	8
Total		8	14	10	8	40

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	3.385	9	.947
Razón de verosimilitudes	3.705	9	.930
Asociación lineal por lineal	.312	1	.577
N de casos válidos	40		

GastosPSA * Familia

Tabla de contingencia

Recuento

		Familia							
		1	2	3	4	5	6	7	Total
GastosPSA	1	0	2	3	5	2	1		13
	2	0	2	4	0	5	1	13	13
	3	1	3	0	1	0	1	13	6
	4	1	1	1	1	4	0	6	8
Total		2	8	8	7	11	3	1	40

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	22.666	18	.204
Razón de verosimilitudes	26.929	18	.080
Asociación lineal por lineal	.301	1	.583
N de casos válidos	40		

GastosPSA * Apoyogob

Tabla de contingencia

Recuento

		Apoyogob		Total
		0	1	
GastosPSA	1	3	10	13
	2	2	11	13
	3	1	5	6
	4	0	8	8
Total		6	34	40

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	2.092	3	.554
Razón de verosimilitudes	3.202	3	.361
Asociación lineal por lineal	1.752	1	.186
N de casos válidos	40		

GastosPSA * Ingresomensual

Tabla de contingencia

Recuento

		Ingresomensual			Total
		1	2	3	
GastosPSA	1	7	4	2	13
	2	6	6	1	13
	3	5	1	0	6
	4	4	2	2	8
Total		22	13	5	40

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	4.536	6	.605
Razón de verosimilitudes	5.010	6	.543
Asociación lineal por lineal	.001	1	.972
N de casos válidos	40		

EJIDO XOCHITITLA

```
CROSSTABS
  /TABLES=GastosPSA BY Sexo Ocupación Niveleducativo Familia Apoyogob
Ingresomensual
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT
  /COUNT ROUND CELL.
```

Resumen del procesamiento de los casos

	Casos					
	Válidos		Perdidos		Total	
	N	Porcentaje	N	Porcentaje	N	Porcentaje
GastosPSA * Sexo	19	100.0%	0	0.0%	19	100.0%
GastosPSA * Edad	19	100.0%	0	0.0%	19	100.0%
GastosPSA * Ocupación	19	100.0%	0	0.0%	19	100.0%
GastosPSA * Niveleducativo	19	100.0%	0	0.0%	19	100.0%
GastosPSA * Familia	19	100.0%	0	0.0%	19	100.0%
GastosPSA * Apoyogob	19	100.0%	0	0.0%	19	100.0%
GastosPSA * Ingresomensual	19	100.0%	0	0.0%	19	100.0%

GastosPSA * Sexo

Tabla de contingencia

Recuento

		Sexo		Total
		1	2	
GastosPSA	1	5	3	8
	2	2	0	2
	3	1	1	2
	4	5	2	7
Total		13	6	19

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	1.396	3	.706
Razón de verosimilitudes	1.966	3	.580
Asociación lineal por lineal	.035	1	.851
N de casos válidos	19		

GastosPSA * Ocupación

Tabla de contingencia

Recuento

		Ocupación				Total
		1	2	3	4	
GastosPSA	1	4	3	1	0	8
	2	1	1	0	0	2
	3	0	1	1	0	2
	4	2	0	3	2	7
Total		7	5	5	2	19

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	10.101	9	.342
Razón de verosimilitudes	13.444	9	.144
Asociación lineal por lineal	4.547	1	.033
N de casos válidos	19		

GastosPSA * Niveleducativo

Tabla de contingencia

Recuento

		Niveleducativo			Total
		0	1	2	
GastosPSA	1	3	4	1	8
	2	0	1	1	2
	3	0	1	1	2
	4	1	1	5	7
Total		4	7	8	19

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	6.707	6	.349
Razón de verosimilitudes	8.002	6	.238
Asociación lineal por lineal	4.043	1	.044
N de casos válidos	19		

GastosPSA * Familia

Tabla de contingencia

Recuento

		Familia									
		2	3	4	5	6	7	8	9	12	Total
GastosPSA	1	1	3	1	1	0	1	0	0	1	8
	2	0	0	0	0	2	0	0	0	0	2
	3	0	1	0	0	0	0	1	0	0	2
	4	2	1	1	0	2	0	0	1	0	7
Total		3	5	2	1	4	1	1	1	1	19

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	26.227	24	.342
Razón de verosimilitudes	24.190	24	.451
Asociación lineal por lineal	.051	1	.822
N de casos válidos	19		

GastosPSA * Apoyogob

Tabla de contingencia

Recuento

		Apoyogob	Total
		1	
GastosPSA	1	8	8
	2	2	2
	3	2	2
	4	7	7
Total		19	19

Pruebas de chi-cuadrado

	Valor
Chi-cuadrado de Pearson	.
N de casos válidos	19

GastosPSA * Ingresomensual

Tabla de contingencia

Recuento

		Ingresomensual			Total
		1	2	3	
GastosPSA	1	6	2	0	8
	2	2	0	0	2
	3	1	1	0	2
	4	5	1	1	7
Total		14	4	1	19

Pruebas de chi-cuadrado

	Valor	gl	Sig. asintótica (bilateral)
Chi-cuadrado de Pearson	3.490	6	.745
Razón de verosimilitudes	3.986	6	.679
Asociación lineal por lineal	.521	1	.470
N de casos válidos	19		