The Payments for Ecosystem Services (PES) Program that the Mexican Government operates nationwide since 2003, is an effort that has preserved more than 3.2 million hectares of forests and has given direct compensations to more than five thousand landowners that voluntarily have decided to practice good land management activities.

The program has evolved along these ten years, trying to better suit the national conditions. Since 2008 the real users of the ecosystem services, including local governments, water utilities and private companies, got involved in the payments.

Forest Conservation in Mexico

Ten years of Payments for Ecosystem Services

Overview

Mexico has played an important role in payments for ecosystem services (PES). Ten years ago, the Federal Government through the National Forestry Commission (CONAFOR) undertook two initiatives: the Hydrological Ecosystem Services Program (PSAH) in 2003, and the Program to Develop Ecosystem Services Markets from Carbon Sequestration and Biodiversity (PSA-CABSA) in 2004. Since 2006, the two programs were merged under a single concept called PES National Program (CONAFOR, 2011), which through the years has been simplified to the extent that nowadays there are only two types of payments: for watershed services and those derived from biodiversity conservation.

The program works on a contract basis between CONAFOR and the landowners, where CONAFOR agrees to make a fixed payment per hectare for a period of five years while the landowner is committed to perform sustainable management practices that maintain or improve the provision of ecosystem services.

Over the years, the program has received funding from various sources that include contributions from water users, a budget yearly approved by the legislature, state and municipalities' governments, as well as privates, all of which are channeled to landowners through the Mexican Forest Fund, a mandate that allows committing resources in five year contracts, doing annual payments.

Since the program's inception, geographic analysis and monitoring are key elements to ensure the success of its objectives. The potential pay zones were selected according to solid information on various forest variables, vegetation cover, poverty, water and land use.

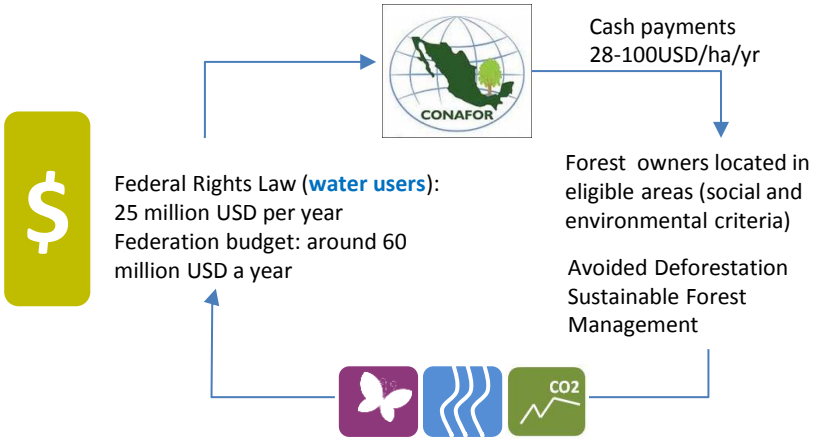

Figure 1. Schematic representation of the key players

Background

Before the existence of the National PES Program, Mexico already had pioneering PES experiences in the late 1990s, like the carbon project Scolel Te [1] (Tipper, 2002), the watershed payments experience in the mountains of Coahuila [2], or costal landscape payments in Oaxaca (CONAFOR, 2011). Also, the hydrological services program of Coatepec municipality, which consists on a public trust promoted by the municipal government that collects fees (USD 0.10 or 0.20) from water users through the water bill, was the pilot project which marked the way to the PES National Program (Manson, 2004).

The PSAH program was created based on the Coatepec experience, as well as the Costa Rican PES program that started in the late 1990s, which remunerated forest owners for promoting conservation by no touching the forest (McAfee and Shapiro, 2010). However, through the years the Mexican program has evolved and has targeted areas with higher risk of deforestation, vulnerable ecosystems, poverty and indigenous communities, promoting sustainable forest management, and lately involving real users of the service in the payments. Also, the Program has grown much faster than other examples in the world (Pagiola, 2008).

Objective

The PSAH Program was designed to address the problem of deforestation in areas with water supply problems and where commercial forestry could not compete with the land use change for agriculture and livestock activities (Muñoz-Piña et al., 2008). Monitoring is a cornerstone to select suitable areas to be receiving payment, and it is conducted on an annual basis through techniques of direct and indirect measurement, and its used to *i)* create the baseline for the agreement with the landowners, *ii)* establish the amount contracted, and *iii)* to monitor the performance prior to each annual payment established in the contract.

Legal Framework

The Mexican Government took the decision, following a national public consultation, to include the concept of PES as part of the General Law for Sustainable Forest Development (GLSFD), so the concept articulates with the operational, information and financial instruments of this Law and its bylaw. In 2002, an amended was done to the Federal Rights Law (Article 223, paragraph A) to establish that a portion of the amount collected from the use, development and operation of national waters could be allocated to the development and operation of the PES program in hydrological priority areas. This amended was done with the purpose of recognizing the value of hydrological services provided by forest ecosystems, and in order to contribute to its maintenance.

Furthermore, it was established that the amount collected from the Federal Rights Law and any other resources allocated to the PES program should be transferred annually to the Mexican Forest Fund, a financial instrument that aims to promote the preservation, sustainable use and restoration of forest resources (GLSFD, Article 142), and which allows for multi-year projects (five years contracts with yearly payments).

[1]http://www.planvivo.org/projects/registeredprojects/scolel-te-mexico/)
[2]www.profauna.org.mx
[3]ttp://portal.veracruz.gob.mx/portal/page?_pageid=315, 4034835 & _dad = portal & _schema = PORTAL

The Providers of Environmental Services

Provider/Sellers of Environmental Service

The program works with private landowners, *ejidos* and indigenous communities, in the last two cases it is essential to have the approval of the community representatives to participate in the program. To formalize their participation in the Program, landowners sign a contract with CONAFOR, where the first agree to maintain forest cover and perform sustainable managements practices, and CONAFOR agrees to pay a fixed compensation per hectare for a period of five years.

Targeting providers

The PES program has an annual convocation. Landowners that are able to participate in this convocation are those that their lands are within the eligible zones determinate by CONAFOR, according to a geographical analysis to target priority areas, considering:

- Vegetation types, prioritizing cloud forests and jungles.
- Risk of deforestation,
- Overexploited aquifers,
- Natural protected areas, and
- Poor municipalities.

Also, beside the eligible zones, there are certain criteria to prioritize the lands that apply to the program. These prioritization criteria are:

- Socio-economic: poverty, indigenous, gender, collective organization.
- Environmental: tree cover, sites with high biodiversity, biomass density, disaster risk, water availability, land degradation, and priority watersheds.
- Criteria that involve other conservation or development efforts, such as presence of local PES mechanisms, community surveillance networks and community land use plans.

Each of these criteria includes a score according to their presence or absence in the area of interest, and will be part of the total score received by each application. Applications that have the highest score will be the most likely to be benefited and receive the payments (see PRONAFOR 2013 Rules of Operation).

Practices supported

The program has adapted and evolved from a payment based on the non-use of forests, to a program that promotes management practices that maintain and improve the provision of ecosystem services. The activities that beneficiaries should perform during the five years contracts are:

a) Maintain forest cover (avoid land use change)

b) Develop a Best Management Practices Program or Guide, which is a planning document that allows to have a diagnosis of the land enrolled, identify risks and define and schedule activities to preserve or improve the provision of ecosystem services, during the five years of the contract. For the preparation and follow up of the document, an additional compensation is given to beneficiaries, in order to pay for technical assistance.

c) Perform surveillance activities in order to prevent illegal logging and hunting, and other harmful activities in the enrolled land.

d) Install signposts in the area under conservation, so that neighbors could be aware of the activities allowed in that land.

In cases where landowners do not comply with these mandatory activities, CONAFOR applies sanctions, which can range from declining payments, cancellations or returning payments.

Incentives

The Providers of Environmental Services

Payment levels

Rates were established based on the average opportunity costs of forest conversion to corn production (Shapiro, 2013) and then negotiated with deputies to fit the program´s budget. At the beginning of the PES program, payments were fixed (USD 40/hectare/year for cloud forest because its importance in the hydrological cycle, and USD 30/hectare/year for other types of vegetation) (Table 1). However, since 2010 the program has differentiated payments, which are calculated based on the type of ecosystem and the rates of economic pressure to deforestation, in an effort to link the amount paid to the opportunity cost incurred by landowners by doing conservation activities (CONAFOR, 2011). Payments currently range from USD 28 to USD 100 per hectare per year approximately; being cloud forests at high risk of deforestation those receiving a higher payment.

Payment conditions

Monitoring consists in the analysis of high resolution multispectral images to calculate vegetation indices and the percentage of forest cover, and possible forest loss. Qualitative and quantitative variables from the National Forest and Soil Inventory and the Land Use and Vegetation map are also used. Monitoring activities are carried out by CONAFOR staff, at its headquarters and at the state offices.

Headquarters office are in charge of analysing satellite high resolution images (IKONOS, QUICKBIRD or Spot) that can provide resolutions up to within 5 meters, in order to identify small scale deforestation (FONAFIFO, 2012). Likewise, states offices hold field visits to verify the results of the remote sensing analysis and to verify that the field activities have been properly completed (CONAFOR, 2011). The baseline data corresponds to the year in which a landowner enrolled into the program.

Institutions and their roles

In order to ensure transparency in the operation of the program, the resources allocated to the landowners and the annual payments are authorized by a National Technical Committee (CTN), which consists of representatives from academia, government and civil society. The CTN approval work is done after the CONAFOR staff presents the yearly results of monitoring.

Also, to promote continuous improvement, the program has an Advisory Technical Committee (CTC-PSA), a participatory platform that is composed of representatives from different sectors of society and that has allowed the wide acceptance of the program among stakeholders. The CTC-PSA meets three times a year and includes government agencies like the National Institute of Ecology, which was involved in designing the program and performs annual efforts to analyze the results and recommends improvements in its operation, the National Protected Areas National Commission, and civil society organizations as the Mexican Fund for the Conservation of Nature, The Nature Conservancy, the World Wildlife Fund, among others.

Table 1. Payment Levels

Ecosystem type	Risk of deforestation Very High- 5; Very Low- 1	USD/ ha
Cloud forest	5	$100
	2-4	$70
Temperate forest, Sub-tropical forest, Oak forest	1-5	$38
Tropical forest	1-5	$55
Dry decidous forest	4-5	$38
Mangroves	1-5	
Dry decidous forest	1-3	$28
Arid and semi arid zones	1-5	
Natural pastures		

Source: CONAFOR, 2011

Innovative aspects of PES in México

Thanks to the lessons learned from ten years of operation, nowadays Mexico has a more flexible PES program that every year tries to adapt to the national reality and that has also adopted additional strategies based on schemes that allow responding to particular conditions on a territory:

The **Biodiversity Endowment Fund** was established in 2010 in order to create a financing scheme that allows long-term conservation of forest ecosystems that harbor globally significant biodiversity (CONAFOR, 2011). The endowment started with a donation from the GEF (Global Environmental Facility) and the Mexican Government through CONAFOR, and the interests generated are used to perform payments in order to build biological corridors. Nowadays there is one area in the State of Jalisco, receiving payments in perpetuity from this fund.

The **local PES mechanisms** are institutional arrangements that allow users of an ecosystem service to transfer resources to the landowners where the service is generated, in order to adopt sustainable management practices that will maintain or improve the provision of the service (CONAFOR, 2011). Since 2008 CONAFOR began to promote the development of local PES mechanisms through matching funds, a scheme that allows inviting users of ecosystem services to take co-responsibility in the maintenance of watersheds and biological corridors. In this effort, the user of the service pays at least 50% of the required amount and CONAFOR the remaining quantity.

The scheme, beyond seeking forest conservation, promotes the restoration of forest land, and is intended to be operated through local institutions (local partners) who have adequate knowledge of the territory and its management, so that they could develop operation rules, payment rates and types, and monitoring systems tailored to local realities.

This innovative financing scheme so far has enabled collaboration with water utilities, the National Water Commission, the Federal Electricity Commission, state and local governments, businesses and civil society organizations (CONAFOR, 2011). The costs of implementing a "local PES mechanism through matching funds" are divided between CONAFOR and the user, including operation, payments, contracts and monitoring activities. Local PES mechanisms have sought to be a complementary program and act in areas where there is a well-defined user. However, it is not possible to obtain payments of local PES mechanisms where there are already payments from the national program and vice versa.

Buyers/users of ecosystem services	Intermediaries	Providers
•Water utilities (Fidecoagua, Xalapa, Saltillo, Veracruz, Uruapan, among others) •Group of agricultures (Sinaloa) •International Donors (Monarch Butterfly Reserve) •Municipalities (Taxco) •State governments (Jalisco)	•Local non governmental organizations •Municipalities	•Small landholders •Ejidos •Indigenous communities •Farmers organizations

In the period 2003-2011, CONAFOR allocated USD $ 489 million under the PES program, placing into conservation 3.2 million hectares, benefiting more than 5,967 ejidos, communities and smallholders in the country (CONAFOR, 2011).

Achievements

Nowadays the National Forestry Commission currently considers two modalities within the PES Program: hydrological services and biodiversity conservation (CONAFOR, 2011). Both modalities are based on financial compensation to landowners to maintain certain ecosystem conditions that favor the generation of environmental services.

Since the program's inception, geographic analysis and monitoring of forest resources were a basis for the fulfillment of the program´s objectives. The Mexican Government has several instruments to monitor natural resources, vegetation cover, land use, groundwater, slope and erosion, and demographic and social aspects, among others.

Monitoring of polygons enrolled is done by high-resolution multriespectral images and algorithms to measure the normalized vegetation index, so that the owners and payers may interpret clearly and with sufficient technical and statistical robustness.

According to an analysis of 2004 beneficiaries' cohort, the average reduction deforestation rate compared to what would have happened without the program was statistically significant, though small (Alix-Garcia, et al, 2010).

Also, it was found that the program seems to be more effective in generating avoided deforestation where poverty levels are lower, and in the southern states and northeastern Mexico (Alix-Garcia, et.al, 2012); however, the latter study also found that deforestation spillovers may exist on properties that entered the program; however, further analysis is being conducted to corroborate this.

Figure 5 :Location of areas with PES contracts (years 2007 to 2011)
Source: CONAFOR, October 2011

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Lessons learned

Public-Private

- The Mexican Forest Fund (FFM), is a financial instrument that allows signing contracts with landowners for five years, paying annually.
- The Biodiversity Endowment Fund, is the financial instrument that allows for long term conservation (50% GEF, 50% CONAFOR).
- The "Local PES Mechanisms through Matching Funds" is an effort to involve real users of the ecosystem services in the maintenance of watersheds and biological corridors, while involving local organizations to manage the projects.

Incentives

- It has promoted the conservation of ecosystems in Mexico, while represented a supplement to the income of rural communities.
- Promotes social safeguards, such as differentiated attention to indigenous communities and the promotion of women's involvement.
- The program has adapted and evolved from a payment for non-use of forest to a program that promotes management practices that allow the maintenance and improvement of ecosystem services.
- However, payments focus only on conservation activities, and do not promote restoration of ecosystems.

Negotiation

- The national PES program operates at a national scale, so its design and implementation hardly consider local particularities, therefore the Local PES mechanisms through matching funds and the Biodiversity Endowment Fund were created.
- The concept of carbon sequestration, included as strategic in 2004, was removed years later because forest communities and their technical advisers did not have the technical knowledge to develop projects that comply with international methodologies. Thereafter CONAFOR has worked hard to define a strategy that includes carbon capture and benefit forest owners, however it is not ready yet, therefore not included in the PES program.

MRV

- Has improved its targeting strategy, addressing areas of greatest relevance. This improvement has been feasible due to the stakeholders acceptance of the program, the diversity of funding that has been obtained during ten years of operation, as well as the flexibility of operators (local NGOs, technicians) to follow up with the annual changes.
- The payments are based on results. Monitoring both through satellite images as field visits is a requirement for the release of payments each year.
- Use of high resolution remote sensing imagery that lower costs of field verification.
- A National Forest and Soil Inventory and the monitoring of land use, agricultural and socio-demographic variables.

Ownership

- The program requests landowners who have received payments in the past and want to enroll once again, to have a planning instrument such as a community land use plan, a timber forest management program or any other instrument that ensures the sustainable use of natural resources and the active participation of the community.
- It has a legal framework that will give permanence to the Program. The program is frame on both the General Law for Sustainable Forest Development as Federal Rights Law will.
- The Advisory Technical Committee (CTC-PSA), as a participatory platform for continuous improvement and acceptance by stakeholders (government, academia and civil society).

Future Outlook

The Mexican experience in PES has changed from a subsidies based program promoted by the federal government to ensure forest conservation, to a program consisting of various strategies that involve public and private funding, and that seeks to attend specific territorial conditions through sustainable forest management while strengthening local institutions.

According to Leon and colleagues (2012), in the future the national PES program will remain as an option to encourage forest conservation in priority regions that do not have a direct user to engage in the maintenance and improvement of ecosystem services. While regions that supply water to cities (40% of Mexico's total population is concentrated in 74 urban areas, where about 50% of GDP is generated) should engage the real users.

One of the most remarkable elements of the strategy of PES in Mexico is that the national PES program has promoted local and regional processes, and that it has promote partnerships with local governments, private sector and academia. We believe that these new conditions (combination of national and local efforts, and involving various stakeholders) will give CONAFOR a better chance to achieve a positive impact on the provision of environmental services.

Contacts
Paola Bauche Petersen, Independent consultant and ex-CONAFOR (paolabauche@gmail.com)
During five years she worked in the National Forestry Commission in Mexico, designing and managing the program *"Local PES mechanisms through matching funds"*,

Alberto Sandoval Uribe, FAO NRC (Alberto.Sandoval@fao.org)
Alberto was the leader of the PES program and National Forest Inventory at the National Forestry Commission of Mexico.

Photos: Boletín informativo de la Comunidad de Aprendizaje PSA http://www.conafor.gob.mx/portal/index.php/temas-forestales/servicios-ambientales

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Contacts

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Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla
00153 Rome, Italy
www.fao.org

Dr. Philipp Aerni
FAO-NRD/ETH Zurich
Philipp.Aerni@fao.org

Bernardete Neves
FAO-NRD
Bernardete.Neves@fao.org

Stéphane Jost
FAO-NRD
Stephane.Jost@fao.org

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