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“I like to conserve the forest, but I also like the cash”. Socioeconomic factors influencing the motivation to be engaged in the Mexican Payment for Environmental Services Programme

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ABSTRACT

Two of the main motives for people to be engaged in the Mexican Payment for Environmental Services (PES) programme are forest conservation and the income received from the programme. We explore the socioeconomic conditions that support choosing these motives. We used data from a 2012 nationwide survey, processed through *logit* models. Significant factors influencing the desire to conserve as a motive were family welfare improvement, land use change intention, and training. Those affecting income as a motive were formal education, indigenous people participation and training. Finally, factors related to both conservation and income, as a motive, were formal education, training, PES influence in water management, and land boundary conflicts. Income and conservation are not mutually exclusive motives for engagement

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in the programme, given that in developing countries income from PES may reduce the socioeconomic pressures triggering land use change, and has a role in conservation efforts, already present in many rural communities.

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Introduction

The concept of environmental or ecosystem services (ES) was devised originally to highlight the importance of the benefits derived from ecosystems' functioning for human life (Costanza et al., 1997). Since the 1990s, public policies have fostered their valuation and incorporation into markets in the form of payment for environmental services (PES), as an incentive to promote forest conservation (Wunder, 2008; Pagiola et al., 2005; Gómez-Baggethun et al., 2010). From economic perspectives many ES are positive externalities that provide benefits to third parties, but that are not recognized as such by society and therefore they are not internalized in economic decision-making (Kosoy and Corbera, 2010). Thus, it is assumed that PES programmes, as an economic instrument for environmental management, can potentially halt ecosystems degradation, resulting in the maintenance or even increase of ES provision (Kelly and Huo, 2013). According to Wunder (2008), ideally PES transactions are voluntary, involving at least one "user" and one "provider", being both well defined, and should include criteria such as conditionality and additionality.

Various authors have shown that, in practice, most PES programmes do not comply with this model, and Mexico is not an exception. Deviation from the ideal market model results from the diverse institutional arrangements that develop in different social, economical, political, cultural and environmental contexts in which PES is implemented (Kosoy and Corbera, 2010; Shapiro-Garza, 2013). The diversity of PES schemes and those conditions under which they are applied have a strong influence in the programmes performance, and in who participates and how. Hence, Muradian et al. (2010) highlight the need for a more flexible concept that incorporates the socio-environmental complexity of local contexts in which these mechanisms operate and the inherent uncertainty of information about ES provision. The programme should then be more like an incentive or reward system designed to align the interests of different social actors towards models of land management that maintain ES provision.

The Mexican PES programme beneficiaries are social actors characterized by their particular identity, social values and specific perceptions about their relation to non-human nature, and are often organized through social interactions and local institutions (Corbera et al., 2009). The main objectives of the Mexican PES programme are both forest conservation and poverty relief, but the particular socioeconomic contexts of the programme's beneficiaries may influence their motivations to be engaged in it. Various authors have analyzed the motivations to be enrolled in PES programmes, in diverse socio-environmental contexts (e.g. Kosoy et al., 2008; Echeverría, 2010; Neitzel et al., 2014). In this study, we explore some of the socioeconomic variables influencing the main motives to be engaged in the PES programme in Mexico: the desire to conserve the forests and/or the income received. Our research is guided by the following research question: Which socioeconomic factors influence forest conservation and/or income, as the main motives of beneficiaries to be engaged in PES?

In this text we first present a brief review of the Mexican PES programme, followed by a theoretical framework regarding the socioeconomic factors that may influence forest conservation and/or income as the motives for rural communities to be engaged in it. We then explain the methods used in this investigation and analyze the socioeconomic factors influencing the motives of beneficiaries to be engaged in the Mexican PES. Finally we discuss our results in the light of the long-term viability of the programme, and the accomplishment of its objectives.

The Mexican Payment for Environmental Services Programme

Mexico has approximately 138 million ha of forested lands (nearly 70% of the country's total area). More than 50% of this surface is held in common property by *ejidos* and agrarian communities.¹ As a result, almost 12 million people live in 30,000 forest communities, frequently in poverty conditions (Merino and Martínez, 2014). In the 1990s, the annual rate of forest loss was of around 1.3% (Muñoz-Piña et al., 2008).

The proximate driver of deforestation is the conversion of forested areas to agricultural land, pastures and urban-industrial uses. Underlying factors are many, such as historical unsustainable forest and agricultural policies, deficient control measures, poverty, comparative disadvantages of forest domestic production in the national and international markets, given high transaction costs; property rights conflicts in various regions, illegal logging and corruption at different governance levels. It is also common that, at different government levels (federal, state, and local), forest management policies are designed seeking different and often opposing objectives (Neitzel et al., 2014).

During the last decade, one of the main strategies of the Mexican government to halt forest degradation has been the PES programme. Its main purpose is to transform forest management behaviour and to improve the livelihoods and welfare of woodland communities (Pagiola et al., 2005). Yet, various authors contend that payments are insufficient to solve basic needs and mainly operate only as subsidies, which may create or increase dependency (Muñoz-Piña et al., 2008). During the 2003–2010 period, CONAFOR (Mexican National Forestry Commission) assigned MX\$ 5289 million (in 2012, \$430 million USD; 1 USD = \$12.35 MX) for the implementation of 4646 projects, covering 2,767,000 ha. The payment per hectare is calculated on the basis of the opportunity costs of maize production² (other crops and cattle husbandry have higher opportunity costs), resulting in figures ranging from MX\$ 382 to MX\$ 1100/ha/year (30.9–89.1 \$USD). However, the Mexican programme has experienced an explosive growth and annual applications always exceed its financial capacity.

The high demand experienced by the programme may be a consequence of the reduced or lack of financial support for primary economic activities (forestry, agriculture and stockbreeding) for poorest forest areas in Mexico. In this context, the scheme indeed works more like a consumption subsidy and less like a policy designed to reduce poverty. On the other hand, forest technical advisors that operate as an intermediary between CONAFOR and communities,³ may receive relatively high payments from the programme, possibly introducing a bias observed as a higher participation of communities in PES (PUMA-CONAFOR, 2012).

The Mexican PES programme bears distinctive features derived from the particular socioeconomic and political conditions in which it was developed (Shapiro-Garza, 2013). Land tenure in forestlands is mostly collective, as *ejidos* and agrarian communities own nearly 60% of these (Madrid et al., 2009). Collective management of natural resources requires social participation and organization, and for *ejidos* and agrarian communities, general assemblies are the designated spaces where collective issues are negotiated, discussed and decided (Klooster, 2000; López-Barrera et al., 2010). Even though decisions about PES are voted in general assemblies, there may be different personal perspectives about the programme and even dissent and lack of interest/participation (Neitzel et al., 2014). Moreover, not all interested parties in forest management are included in decision making processes, as only right holders constitute general assemblies, whereas non-right holders (usually women and young people) are excluded from them and from the benefits of other government programmes (Caro et al., 2015).

In Mexico, the resulting PES scheme is more adapted to the social conditions of Mexican forest communities, and includes some social safeguards in its operation (Corbera et al., 2009;

¹ *Ejidors* resulted from the agrarian reform implemented after the 1910 Mexican Revolution, whereas agrarian communities are restitutions of lands to indigenous communities that historically owned or occupied them.

² Opportunity costs were calculated, for 2008, given average annual profits of US\$37/ha from growing maize, and of US\$66/ha for livestock production (Muñoz-Piña et al., 2008). Yet opportunity costs are highly heterogeneous depending on environmental conditions and the diversity of economic activities.

³ Forest technical advisors are independent professionals, responsible for counselling beneficiaries about the programme's operation, who actually act as an intermediary between them and CONAFOR for enrolment, bureaucratic procedures, and reporting results of monitoring.

Shapiro-Garza, 2013). Also, in this case the State functions as an intermediary between ES “providers” (private owners, *ejidos* and agrarian communities) and users (in this case, the society as a whole). To date, efforts are made to involve third parties (i.e. private sector, NGO’s), as this sort of financial collaboration is expected to exert more control on compliance and monitoring of ES provision. Yet, these experiences are still incipient.⁴ Finally, the participation in the programme is limited by a set of eligibility criteria, established by CONAFOR. These criteria have evolved through time and include an index of deforestation risk,⁵ which aims to maximize additionality. They also prioritize hydrologic ES by paying for the preservation of forests in regions with high demand or scarcity of water.

Several independent evaluations⁶ of the Mexican PES programme (González, 2007; PUMA-CONAFOR 2012; Alix-García et al., 2014) have detected some limitations in the programme’s performance, including the lack of information that beneficiaries have about issues such as the programme’s objectives, their rights and obligations, and their role in the processes of conservation and provision of ES. These limitations strongly influence the motivations for participating in PES, and in the relationship established between them and CONAFOR, as an intermediary in this transaction.

The motives for involvement in the PES programmes

People may be engaged in PES for several reasons, but the objectives of this programme may be of particular relevance. The income received by the programme might be an important motivation, particularly in contexts of high social marginalization, of low opportunity costs, and when the lands included in PES, as is often the case, are inadequate for developing productive activities (Kosoy et al., 2008; PUMA-CONAFOR 2012; Zhao et al., 2012; Neitzel et al., 2014; Zanella et al., 2014). Even though the payments may be low, they may still have a role in poverty alleviation (Pagiola et al., 2005), particularly in Mexico, as most PES payments in 2010 (78%) were directed towards regions with elevated levels of social marginalization (PUMA-CONAFOR, 2012).

Two processes can influence the capacity of PES payments to alleviate poverty: the exclusion of non-right holders and local decisions about the distribution of the revenues of PES in the community. In the first case, most governmental programmes linked to productive activities and land management are directed to right holders, whereas non-right holders are excluded from this support and from the general assembly, therefore also unable to participate in decision-making processes. This is common for women and young people, given the social structure of land-rights in Mexico (Merino, 2012). In the second case, the income received might be used to pay salaries for forest management activities (clearing firebreaks, surveillance), invested in community infrastructure (improvements for the school, the clinic, etc.), or it may simply be distributed among individual beneficiaries (right holders); but at least part of it must be invested in forest management activities, according the programme’s rules of operation. These decisions determine if there is a redistribution of income that benefits more people, besides right holders, or not. All these processes depend on each socioeconomic and cultural context (PUMA-CONAFOR, 2012).

The involvement in PES may also be triggered by the desire to conserve forests, natural resources (e.g. water), or sacred/culturally relevant places. Many communities conserve portions of their forests without any external financial support. This voluntary and customary conservation is usually present in well-organized communities and is associated to values and traditions linked to forest conservation (Borrini et al., 2004). Other factors influencing the desire to conserve the forest in rural communities have been explored. Among them are traditional practices of land management, the view of the forest as patrimonial heritage, the livelihoods and socioeconomic conditions of forest dwellers, rural-urban migration, and the structure and processes of governance (Moon and Cocklin, 2011; Zhao et al., 2012; Rico García-Amado et al., 2013; Cotler et al., 2013). But some authors argue that PES programmes may transform the incentives that rural communities have to conserve, through the commodification

⁴ There are only few cases where the Programme of Concurrent Funds is in operation, such as in Sierra de Manantlán, in the state of Jalisco; Coatepec, in Veracruz, and Chichila, in Guerrero (CONAFOR, n.d.).

⁵ This index is based on deforestation trends and other criteria such as the proximity of lands to urban areas, roads and local food markets (Muñoz-Piña et al., 2008).

⁶ External evaluations carried out by independent research teams, and funded by CONAFOR.

of ecosystems, eroding the traditional forms of conceiving and relating to nature. As a consequence, forest conservation would only be pursued as long as it is profitable (Corbera et al., 2009).

The motivations to be engaged in conservation initiatives may be influenced by the reliability of governmental programmes, the social perception of potential risks concerning property rights, personal benefits, and the programme's objectives (Moon and Cocklin, 2011). Particularly in the case of Mexico, various authors found that collective organization and participation in the general assembly, conservation and cultural/patrimonial heritage values, conservation of rivers derived from an awareness of the relation between forest health and the quantity and quality of water, formal education, and household income are variables positively correlated with enrolment in PES. Contrastingly, the perception of corruption, lack of confidence in CONAFOR and agricultural activities are negatively correlated with enrolment (Kosoy et al., 2008; Echeverría, 2010; Rico García-Amado et al., 2013; Neitzel et al., 2014).

Conservation and income as motives to participate in PES are not mutually exclusive. Forest communities may perceive the income from PES as an incentive for maintaining conservation practices that would be implemented even in the absence of the programme (Kosoy et al., 2007), but that are facilitated with this financial support. Moreover, voluntary conservation should not be expected to take place without external support in contexts of high socioeconomic pressures that induce land-use change or where socioeconomic conditions related to forest conservation and management deteriorate.

Yet, some authors argue that transactions involved in PES are not completely voluntary when beneficiaries face high social marginalization. In such cases they accept the payments, no matter how low they are, given their high poverty levels and the low opportunity costs (Muradian et al., 2010). Also, participation is doubtfully voluntary when, as is frequently the case, PES beneficiaries are insufficiently informed about their involvement and its implications (Neitzel et al., 2014).

Methods

This study is based on data collected during the external evaluation of the 2010 budgetary implementation of the Mexican PES programme. This study was carried out in 2012 by the Programa Universitario de Medio Ambiente, Universidad Nacional Autónoma de México (PUMA-UNAM) and funded by CONAFOR. It was based, partly, on the social perceptions of beneficiaries about the programme, investigated through a semi-structured survey applied to *ejidatarios*, *comuneros*,⁷ and smallholders. The survey was designed to inquire about the beneficiaries' perceptions regarding the processes of enrolment, the programme's operation and their future perspectives. The survey also covered issues about socioeconomic conditions of the beneficiaries and social organization related to natural resources management. We designed the survey in accordance to the University of Wisconsin "Tracking Tools", used in the Global Environmental Facility (GEF) projects, following the Sustainable Livelihood Approach (SLA) conceptual framework (DFID, 1999).

Sample and survey design

The total number of landholdings⁸ supported by the PES programme in 2010 was 688, out of which 409 corresponded to collective land property and 279 to private property (smallholders).⁹ For the present study only beneficiaries with collective land tenure were surveyed. We made a random selection of *ejidos* and agrarian communities ($n = 128$). The sample size is representative according to the equation of Yamane (1967) for a 90% confidence level with a standard error for the sample of 6%. During the random selection process, we had to exclude sites that did not meet minimum-security

⁷ *Ejidatarios* and *comuneros* have legal rights over land and belong to *ejidos* and agrarian communities, respectively. They are right holders.

⁸ Throughout this text, landholdings may refer to the community/*ejido* lands, or the individual parcels of beneficiaries. In the latter case, reference is made to his/her landholding.

⁹ There is an upper limit to the total area supported by the programme. For *ejidos* and communities (common property tenure) the mean supported surface is 1245 ha, whereas for private landholdings it is 127 ha.

Table 1

Surveys applied, in 2012, to beneficiaries enrolled in the Mexican PES programme per state.

State	Surveys	
	No.	%
Campeche	17	12.5
Chiapas	16	11.8
Estado de México	24	17.6
Oaxaca	14	10.3
Querétaro	15	11.0
Tabasco	15	11.0
Veracruz	7	5.1
Yucatán	28	20.6
Total	136	100.0

conditions for the field team.¹⁰ This resulted in a sample bias, as we did not incorporate particular processes developing in these areas.

We performed a total of 136 surveys in eight states (Table 1) from February to May 2012. The limited time available for fieldwork, forced us to contact beneficiaries through the state-level delegations of CONAFOR and the forest technical advisors; many surveyed beneficiaries were selected by local authorities or by the forest technical advisor. This resulted also in a sample bias, as respondents may be those with better knowledge about PES and higher acquaintance with it. On the other hand, although it was explained to the respondents that that the survey team did not belong to CONAFOR, in most cases, beneficiaries felt as being evaluated and at risk of losing the PES support. These methodological limitations should be considered in the interpretation and scope of our results.

Variable selection

Through the survey, we gathered data for nearly one hundred variables, from which we made a first selection. The dependent variables represent the motives to be engaged in the PES programme. Beneficiaries could choose among various options that were not mutually exclusive. The most frequent motives of respondents to be engaged in the programme were the desire to conserve their forest (55.2%) and the income received (55.8%). These were selected as dependent variables, considering that the remaining answers (such as maintaining a reservoir of lands for future use and improvements in the community) were chosen by less than 10% of the interviewees. In order to explore the factors influencing each answer we separated interviewees in three different groups: (a) those who mentioned forest conservation but not income, as a reason to be engaged in the programme, (b) those who mentioned income, but not forest conservation, and (c) those who included both motives in their answers.

We selected independent variables based on two criteria: (a) that could be relevant according to the literature and economic rationale, and (b) that had the highest potential to explain the dependent variables, according to the factorial and econometric analyses performed. Table 2 summarizes the selected independent variables and their expected influence to explain the dependent variables. We verified the models to avoid multi-collinearity¹¹ and heteroscedasticity. For multicollinearity, we used the variance inflation factor (VIF), and for heteroscedasticity the Breusch–Pagan test. We classified these variables into three different groups representing broad concerns about the context and functioning PES: (a) socio-economic welfare, (b) PES management and (c) social organization (Table 2).

¹⁰ Landholdings located in the states of Coahuila, Chihuahua, Durango, Guerrero, Michoacán, Nuevo León, San Luis Potosí, Sinaloa, Tamaulipas and Zacatecas, were excluded from the sampling universe. This decision implies a possible bias in our research, since some regions are under-represented in the sample.

¹¹ Multicollinearity exists when there is a strong association between independent variables. Heteroscedasticity, on the other hand, occurs when the error term of the econometric model is a random variable with non-null mathematical expectation and non-constant covariance matrices. If multicollinearity and/or heteroscedasticity occur, the estimators or coefficients estimated by minimum ordinary squares (MOS) are not of minimum variance and are not significant (Pérez, 2007).

Table 2

Selected independent variables used for constructing the models to explain forest conservation, income and both variables combined as motives of beneficiaries to be engaged in PES. Data for all variables were dichotomous (yes/no). Percentages of positive responses and assumptions made about the influence in the dependent variables are presented.

Variables	Explanation	Assumptions C: conservation/I: income	Affirmative answer (%)
Dependent variables^a			
Conservation	Their main motivation to be engaged in PES is to conserve the forest (income was not mentioned)		28
Income	Their main motivation to be engaged in PES is the income received (conservation was not mentioned)		29
Conservation and income combined	Both reasons were the main motivation to be engaged in PES		27
Independent variables			
<i>Socioeconomic welfare</i>			
Family welfare improvement	Did your family welfare improved as a result of being engaged in PES?	I: Income will be a likely motive if respondents perceive an increment in welfare derived mainly from the income received. Income will also be important when poverty is high. C: Conservation will be a likely motive if respondents view welfare as a concept broader than income that includes other benefits/values derived from forests, such as patrimony, heritage, living in a conserved area.	74
Formal elementary education	Did you complete elementary education?	I: Income may be favoured since formal education may increase the awareness about the social and economic value of ES provision beyond their territory. C: Conservation as a motive may be favoured by formal education since it may facilitate social organization and participation related to natural resources management through capability building practices.	65
Opportunity costs	Did you discontinue economic activities as a result of being engaged in PES?	I: Income may be favoured by the existence of opportunity costs if they are lower than PES income.	38
Income improvement	Did your family income increased as a result of being engaged in PES?	I: If respondents perceive that their household economy has improved due to their participation in the programme, it is likely that opportunity costs are low, parcels inscribed in PES are unproductive, and/or there are high poverty levels. All these factors may favour income as a motive.	42
Indigenous people participation	Do you consider yourself as part of an indigenous ethnic group?	I: Indigenous identity of respondents may be linked to income as a motive given that indigenous communities usually face a higher social vulnerability. C: Conservation may be favoured as a motive in some indigenous communities that share values that foster conservation and sustainable forest management.	71

Table 2 (Continued)

Variables	Explanation	Assumptions C: conservation/I: income	Affirmative answer (%)
<i>PES management</i> Trust in CONAFOR	Do you consider that PES management should be administered by CONAFOR?	I&C: If respondents trust government institutions regarding the program's management (i.e. the institution fulfils its economic and environmental commitments) enrolment will be favoured both for conservation or income as motives.	53
Land-use change intention	Do you plan to change the land-use in the landholding supported by PES once the programme ends?	I: If respondents plan to change the land use, it is unlikely that their engagement is motivated by conservation. Instead, income might be relevant.	34
PES training	Have you receive training from the programme about ES?	I: If PES training emphasizes the economic and social values of the provision of ES, and that it should be rewarded by society (commodification), then income is favoured as a motive. C: If PES training emphasizes the conservation objectives of the programme, respondents may assume this institutional discourse or consider that it is aligned with their own objectives, and favour conservation as a motive.	67
Knowledge about land holding requirements	Do you know the land holding requirements to participate in PES?	I&C: Both elements reflect the level of knowledge about the program's operation rules. The knowledge of this may enhance participation in the programme by both motives.	87
Knowledge about duration of the programme	Do you know the duration of the programme?		75
PES influence in water management	Do you consider that PES has a positive impact on the management of local water resources?	C: If there is the need to improve the management and conservation of communities' water sources, conservation as a motive may be favoured. I: If PES income is perceived by the respondents as a fair retribution for the hydrological ES provision beyond their territory, income may be important as a motive.	55
<i>Social organization</i> Organized forest protection activities	Are there organized activities in the community to protect and manage the forest?	I&C: If the community is engaged in organized forest protection activities, conservation may be favoured as a motive. On the other hand, these activities require also financial support; therefore income may also be favoured as a motive.	90
Agreement level	Does the community make decisions about PES by consensus in the general assembly?	I&C: If there is a high level of agreement, it may reflect some degree of social organization, social capital and the possibility of collective action. Trust relations regarding rule compliance and transparency are also necessary. These elements foster engagement for both motives.	85
Land-boundary conflicts	Are there landholding boundaries conflicts inside the community?	If there are internal land conflicts, they may erode social organization and the incentives for conservation and trigger property insecurity. We expect that these conflicts disincentive engagement in the programme, independently of the motives.	10

^a Multiple answers were possible.

The models

Since the dependent variables were transformed and systematized as dichotomous (0, 1), the *logit* econometric model is the most appropriate for its analysis. Formally, the *logit* model is expressed as follows:

$$Y_i = 1, \text{ if } Y_i^* = X_i\beta + V_i > 0 \text{ or } Y_i = 0 \text{ if otherwise}$$

where Y_i is the dependent variable (conservation, income or both variables combined as the motive for engagement in PES), X_i is the independent variable, β is the coefficient, V_i is the residual, and i represents each observation. In this sense, the probability that $Y_i = 1$ is:

$$\text{Prob}(Y_i = 1) = \text{Prob}(V_i > -X_i\beta) \tag{1}$$

If we define $F(\cdot)$ as the function of accumulated density of the residual distribution V_i :

$$\text{Prob}(Y_i = 1) = 1 - F(-X_i\beta) \tag{2}$$

Similarly, the probability of $Y_i = 0$ to occur is:

$$\text{Prob}(Y_i = 0) = F(-X_i\beta) \tag{3}$$

Since the beneficiaries' decisions in this exercise are binary, maximum verisimilitude techniques should be used, and to estimate Y_i^* , a normal distribution of V_i for the *logit* model has to be assumed:

$$L = \prod_{y_i=0}^n F(-X_i\beta) \prod_{y_i=1}^n [1 - F(-X_i\beta)] \tag{4}$$

The parameters found in this estimation are used to calculate the marginal impact of a change in X_{ik} on the probability of observing $Y_i = 1$, where X_{ik} is the k -ith element of the vector of independent variables, and β_k is the k -ith element of the β coefficients. Then, the following calculation has to be made:

$$\frac{\partial F(-X_i\beta)}{\partial X_{ik}} = \theta(X_i\beta)\beta_k \tag{5}$$

If the distribution of V_i is $F(\cdot) = \exp(-e^{-V_i})$, then it is a logistic distribution. Therefore, the probability for the beneficiary to indicate that the motive of his/her engagement in the PES programme is to conserve forests/for income/for income and to conserve forests, is given by the following expression:

$$\text{Prob}(Y_i = 1) = \text{Prob}(1 - X_i\beta) = \frac{e^{(X_i\beta)}}{1 + e^{(X_i\beta)}} \tag{6}$$

The marginal impact of each variable depends on the point of the distribution that is being evaluated, that is:

$$\frac{\partial L(X_i\beta)}{\partial X_{ik}} = \frac{e^{(X_i\beta)}}{[1 + e^{(X_i\beta)}]^2} \beta_k \tag{7}$$

The proposed *logit* models consider that the dependent variables (the main motive of beneficiaries to be engaged in PES is: (i) conserving the forests, (ii) receiving income and (iii) conserving the forests and income) are a function of the independent variables shown in [Tables 2 and 3](#).

Results and discussion

The independent variables related to socioeconomic welfare showed that the sample surveyed in our study was predominantly constituted by people from indigenous communities (71%), with a low level of formal education (65.5% completed elementary school). Most respondents perceived that family welfare has improved as a result of their participation in PES (77%). However, according to our interviewees, the income received had a positive impact in the family economy in less than half of the

Table 3

Results of the econometric models: (a) conservation as a motive, (b) income as a motive, and (c) conservation and income as motives.

Models	(a) Conservation model		(b) Income model		(c) Conservation-income model	
	dy/dx	P > z	dy/dx	P > z	dy/dx	P > z
<i>Socioeconomic welfare</i>						
Family welfare ^a	0.121	*				
Opportunity cost ^a	-0.104		0.216		-0.161	
Formal elementary education ^a	-0.070		-0.266	**	0.367	***
Income improvement ^a			0.001		0.133	
Young people participation ^a			-0.009		0.080	
Indigenous people participation ^a			0.343	***	0.127	
<i>PES management</i>						
Trust in CONAFOR ^a	0.120		-0.075		0.037	
Land-use change intention ^a	-0.237	***	0.173		0.186	
PES training ^a	0.128	*	-0.613	***	0.236	***
PES influence in water management ^a			-0.040		0.269	**
Knowledge about land-holding requirements ^a			0.137		-0.193	
Knowledge about duration of the programme ^a			-0.210		-0.078	
<i>Social organization</i>						
Organized forest protection activities ^a	0.018		-0.058			
Agreement level ^a	-0.087		0.052		0.089	
Land boundary conflicts ^a	-0.074		-0.101		-0.168	*
Pseudo R ²	0.176		0.366		0.349	
Prob > chi ²	0.002		0.003		0.008	
Participation	28%		29%		27%	

^a dy/dx is for discrete change of the dummy variable from 0 to 1.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

cases (46%). Nearly 60% of interviewed landholders did not discontinue any economic activities for participating in PES, therefore in these cases there were no associated opportunity costs. Descriptive statistics of dependent and independent variables are shown in Table 2.

Regarding the independent variables related to PES management, nearly half of the interviewees trusted in CONAFOR for the management and implementation of the PES programme, and almost 70% of them received training from this institution. These training efforts may be responsible of the fact that a high percentage of respondents knew the landholding requirements to be included in the programme (87%) and its duration (75%). On the other hand, a positive perception of the programme was present in nearly half of the respondents regarding local management of water sources. Finally, nearly 30% of the respondents expressed their desire of changing land use/cover in lands enrolled in PES, at the end of the programme.

Concerning the independent variables related to social organization, in almost all the communities included in this study, people were organized to implement activities of forest conservation, independently from PES implementation (90%). This result may explain that there was a high level of agreement about PES issues in general assemblies, since many communities may be interested in receiving support for their conservation activities. The existence of organized groups for forest

conservation within communities may also be favoured by the low incidence of internal boundary conflicts reported by the respondents (10%).

The independent variables in the three models were able to explain the dependent variables ($P < 0.10$) and the models fitted reasonably well as indicated by the goodness-of-fit test (Pseudo $R^2 = 0.3$). Variables that were statistically significant ($0.01 \leq P \leq 0.1$) represented 21% for the income model, 24% in the conservation model and 31% in the combined model (conservation and income; Table 3).

Income as a motive

The estimated model for income as a motive had a statistical significance at a 1% level ($\text{Prob} > \chi^2 = 0.003$). To explain why people were involved in PES for income, the group of variables related to socio-economic welfare had the highest number of significant coefficients, of the three variable groups. The variables representing social organization did not contribute significantly. Significant variables that explained the dependent variable were formal education (95% confidence), PES training, and indigenous people participation (90% confidence, in both cases). The sign of the coefficient was negative in the case of formal education and PES training against expectations (Tables 2 and 3).

If beneficiaries belonged to an indigenous ethnic group, the probability for being engaged in PES for income increased 34%. Indigenous communities usually face conditions of high social marginalization in Mexico as in most Latin American countries, and may be more dependent on governmental subsidies. These factors may influence the respondent's preference for income as a motive. These conditions are common in the surveyed sample, given that the PES programme criteria for selecting beneficiaries prioritize both high social marginalization and belonging to an indigenous ethnic group (PUMA-CONAFOR, 2012). On the other hand, in many of the visited communities, respondents had difficulties to understand Spanish, as it was not their native language. Spanish is used in training and in all relations with governmental institutions. As such, comprehension of the programme's objectives may be hindered when there is a language barrier, making income the only evident benefit (Ostrom and Nagendra, 2006; Perevochtchikova and Rojo-Negrete, 2015). These results do not exclude that many indigenous communities conserve or manage sustainably their forests, independently from PES payments (Muradian et al., 2010), a fact that is expressed in the positive influence of indigenous people participation in the combined model.

Being engaged in PES for income decreased 61% if beneficiaries have been trained about the programme, and decreased 26% if beneficiaries completed elementary school. Low levels of formal education may limit understanding the responsibilities and rights inherent to all actors involved in the programme, their ability to interact with more powerful external actors, their capabilities for accessing to funds for their projects and their autonomy when facing administrative procedures, among others. Yet, it does not necessarily influence the way people conceive and relate to their environment, which depends on other cultural, social and economic processes. For example, many rural communities worldwide have developed adequate natural resources management strategies independently from formal education skills (Cinner et al., 2012).

On the other hand, PES training may be closely related to the knowledge that people have about the operation of the programme, including its duration. The training received by beneficiaries about PES is centred on conservation and its relation with the provision of ES, and less attention is paid to the economic objectives of the programme. Therefore, training may improve beneficiaries' understanding of the programme's objectives and the adoption of the institutional discourse (Haenn, 1999; Corbera et al., 2007, 2009; Méndez-López et al., 2014), thus favouring responses of conservation as a motive to be engaged in PES. Contrastingly, insufficient training may strengthen the perception of the programme's payments as a subsidy, favouring income as a motive.

The desire to conserve forests as a motive

The estimated model for conservation as motive had statistical significance at a 1% level ($\text{Prob} > \chi^2 = 0.002$). The group of variables related to PES management included the highest number of significant coefficients, while in the group of variables for social organization there were no significant

coefficients. Variables statistically significant to explain the dependent variable were: family welfare improvement and PES training (99% confidence), and land-use change intention (90%). The signs of the coefficients for the independent variables followed assumptions (Tables 2 and 3).

The probability of being engaged in PES for conservation reasons increased 13% if beneficiaries had been trained about the PES programme. As noted above, training facilitates the understanding of the programme's objectives and the adoption of the institutional discourse about conservation and ES provision; also, training may influence the beneficiaries' perception of the payment as a tool that facilitates their own independent conservation efforts (Corbera et al., 2007, 2009).

If beneficiaries perceived an increase in family welfare derived from PES, the probability of being engaged in PES to conserve their forests increased 12%. Perceived family welfare improvement as a result of PES was interestingly not related to income, but instead to conservation as a motive. This relation may be influenced by the conception of welfare as a broader concept beyond financial resources, including benefits from living in a conserved forest, the view of forests as heritage and patrimony and other cultural values (Thacher et al., 1996; Zbinden and Lee, 2005; Kosoy et al., 2008; Wunder, 2008; Moon and Cocklin, 2011; Zhao et al., 2012).

When respondents desired to change land use in the enrolled lands, at the end of the programme, it was 24% less probable that beneficiaries were engaged in PES to conserve their forests. It is straightforward, as the desire to conserve hinders land use change intentions. It is often the case that lands involved in PES are less suitable for productive activities and thus there is no incentive for land use change. When opportunity costs are absent, such as when these areas are already conserved by the community or are unproductive lands, conservation may be a more likely reason to be engaged in PES. Contrarily, land use change may be an option, when there is a lack of economic opportunities and other environmental and socio-demographic drivers such as the suitability of lands for economic activities, the need to secure livelihoods, and several (and often contradictory) governmental incentives that induce different land uses (Racevskis and Lupi, 2006; Chen et al., 2009). For example, various beneficiaries in the states of Oaxaca and Chiapas argued that their intention of land use change stemmed from the uncertainty faced to provide sustenance for their families, along with the possibility of earning income through more profitable activities. It is worth noticing that many traditional productive activities, such as shadow coffee planting, agro-silvicultural systems, or sustainable forestry may be compatible with biodiversity conservation and the provision of ES. Also, the opposition of conservation and land use change intentions may reflect contrasting views about the "adequate" uses of forestlands and of activities developed by local people as livelihoods (Méndez-López et al., 2014).

Income and conservation model

The estimated model for both income and conservation as motives had statistical significance at a 1% level ($\text{Prob} > \chi^2 = 0.008$). The independent variables related to PES management included the highest number of significant variables. The other two groups of variables (social organization and socioeconomic welfare) made the same contribution, with only one statistically significant variable each. Variables explaining that beneficiaries were engaged in the programme for both income and the conservation of forests were formal education and PES training (99% confidence), the influence of PES in water management (95%), and the existence of intra-community land boundary conflicts (90%). The signs of the significant variables were as expected (Tables 2 and 3).

This model reveals the perception of those beneficiaries that consider that conservation is relevant, but that also require financial support. We consider that this model reflects more accurately the socio-economic reality of beneficiaries (high social marginalization) and may be related with a view of forests not only as areas for strict conservation, but as the foundation that supports their livelihoods. This is particularly relevant for conservation and management of forests in underdeveloped countries, such as Mexico (Haenn, 1999; Singh, 2015). These considerations help understand the relations between the variables in this model.

Variables positively related to both conservation and income as motives were formal education, PES influence in water management, PES training and land use change intention. If beneficiaries completed elementary school, the probability to be engaged in PES for both reasons increased 37%, and if beneficiaries have been trained about the programme, this probability increased 24%. Higher formal

education, as noted above, increases local capabilities in several aspects related to forest management and community empowerment (Pascual et al., 2010). In conjunction with PES training, formal education may increase the understanding of the objectives and functioning of the programme (Neitzel et al., 2014), but also enable beneficiaries to link the desire to conserve with their economic needs independently from the institutional discourse. Therefore, payments may be viewed more as a fair reward for the provision of services, and less as a subsidy.

If beneficiaries perceived that PES improved water management in their community, the probability of beneficiaries to be engaged in PES for both motives increased 27%. In Mexico, people living in rural communities strongly relate water quality and availability with the conservation of forests (Kosoy et al., 2008; Muñoz-Piña et al., 2008; Neitzel et al., 2014). Nonetheless, water management requires financial support and the income received by the programme may be relevant for minimal equipment or for sustaining water conservation practices. Therefore, income may be instrumental for sustaining conservation. Finally, beneficiaries may perceive income received through PES as a form of a deserved and fair retribution when they are aware of the importance of the hydrological services provided by their forests to others (nearby cities, big corporations), a view that may be strengthened by formal education and PES training (Caro et al., 2015; PUMA-CONAFOR, 2012).

Finally, if intra-community land-boundary conflicts existed, the probability of beneficiaries to be engaged in PES for both motives decreased 17%. Land boundary conflicts have a negative influence in all the models, which indicates that conflicts over land disincentive participation motivated by both reasons. Land-boundary conflicts within communities are a common problem¹² (Bremer et al., 2014). These conflicts usually complicate sustainable management of natural resources and induce uncertainty over land rights (Kosoy et al., 2008; Moon and Cocklin, 2011; PUMA-CONAFOR, 2012; Neitzel et al., 2014). In the context of market mechanisms, such as PES, clearly defined and enforced property rights are proposed as fundamental, as they allow determining who can (or not) provide ES, and therefore receive the economic incentives of the programme. Boundary conflicts can produce uncertainties and confrontations that restrict intentions and collective actions for conservation, as rights over land and resources are debated (Geist and Lambin, 2002).

Conclusion

Our results reflect different socio-ecological configurations and conditions of forest communities involved in PES. Income itself becomes central under conditions of high economic vulnerability and uncertainty, along with limited access to information through education and training. Contrastingly, conservation as the only motive may reflect two different realities. First, communities with access to training and education that have incorporated the institutional discourse as instrumental for relating to external actors in order to gain access to programmes of subsidies; here the perceived family welfare increase may also be instrumental in the search for other economic resources, as they portray themselves as conservationist communities. Second, communities that have developed traditional natural resources management practices and conservation systems, based on traditional values, and that, additionally, may perceive welfare as a complex ensemble of elements beyond income, such as living in a conserved forest, heritage and patrimony, or the pride derived from the recognition of society for their forest conservation. Finally, the combination of both motives for being engaged in PES may be delineating communities having more awareness about their role in any conservation programme, more control of decision-making over their territory, that view forests as simultaneously subject of conservation and the base of their livelihoods.

Our results suggest some elements useful to improve the design and implementation of PES and the socioeconomic and environmental conditions of forest communities involved in it. These insights may be applicable to other underdeveloped countries that share some of the described characteristics with Mexico, considering that our data come from an array of diverse cultural, environmental and socioeconomic conditions.

¹² 33% of forest communities in Mexico have inter-communities boundary conflicts, and are not allowed to participate in the PES programme (Merino and Martínez, 2014). Yet, internal boundary conflicts are not considered as eligibility criteria.

In these socio-economic contexts, new more flexible schemes of natural resources management, fostering context-specific practices, should be developed, such as the combination of conservation and sustainable community forestry or other sustainable economic activities. The latter could ameliorate opportunity costs of conservation and maintain the provision of ES in the long term. Increasing the flexibility of the programme may also disincentive land-use change and improve living conditions in forestlands. For the Mexican context, the model of PES proposed by [Muradian et al. \(2010\)](#) may be particularly adequate. These authors argue that PES should be a part of a larger portfolio of rural policies that favour an adequate management of forests, instead of a transaction between “providers” and “users” of services. Given the Mexican social reality, it is necessary to remember that what is economically efficient in a market context, is not necessarily desirable from the social and environmental perspective.

Even though PES training was a significant variable in all models, it should be improved. In communities involved in the Mexican PES, usually only local authorities and a handful of beneficiaries receive information and training, other beneficiaries expressed the interest and need of receiving it ([PUMA-CONAFOR, 2012](#)). Some studies have previously detected this same limitation ([PUMA-CONAFOR, 2012](#); [Corbera et al., 2009](#); [Neitzel et al., 2014](#)). Also, beneficiaries demanded in several occasions adequate training adapted and designed for their specific socio-cultural context, particularly to indigenous communities that are not Spanish native-speakers. Finally, to guarantee the medium and long-term continuity of the programme, it is important to reduce uncertainties for beneficiaries, and trust relations, transparency and accountability between beneficiaries, CONAFOR and the forestry technicians should be built or strengthened.

Future studies regarding decision-making about PES by beneficiaries should consider factors such as the proportion of remaining conserved forests in each *ejido* and agrarian community and the ratio of community lands in relation to the number of *ejidatarios* or *comuneros*. Also, it should be considered the manner in which the PES payments are distributed within each community, and the perceived costs of participating in the programme, which may influence the motives to be engaged in it. Also, more studies are needed to address the social, economic and environmental effects of this conservation and development initiatives. Insights about these issues may improve the long-term performance of PES, fostering an adequate management of forests by communities and their wellbeing, particularly in contexts of high social complexity.

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