



## Analysis

## Efficiency of Payments for Environmental Services: Equity and additionality in a case study from a Biosphere Reserve in Chiapas, Mexico

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## ABSTRACT

Payments for Environmental Services (PES) have been claimed as a more efficient way of accomplishing conservation and development goals than other indirect strategies, reaching their optimum when the buyer pays the opportunity costs of the foregone benefits. Different inefficient situations have been described, like lack of additionality, where payments are given for practices that would have been adopted anyway. Trade-offs between efficiency and equity of PES have usually emerged as well. In this paper we assess the equity, additionality and stakeholders' perceptions of a PES scheme in a Mexican community inside a Biosphere Reserve. We applied structured interviews to all adults, a total of 66 people from 31 households. Our results show a dual response in equity and additionality, depending on land tenure. PES have an egalitarian effect within landowners and landless groups, but it broadens the gap between them. Additionality is low for landowners and high for the landless people in the community, even though the former are the ones with full decision over the land. Although the scheme does not seem efficient under the classical PES paradigm, it is perceived as a reward, reinforcing conservation attitudes even though most of the interviewees claim it to be insufficient.

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### 1. Introduction

Trying to achieve conservation and development in rural remote poor areas in developing countries has been one of conservationist's major concerns (Redford et al., 2008; Sunderland et al., 2008). Among the new alternative strategies to achieve this goal, measures like direct Payments for Environmental Services (PES) have gained support (Chichilnisky and Heal, 1998; Jenkins et al., 2004; Powell et al., 2005; Wunder, 2005). PES have been claimed as a more efficient way of reaching conservation and development goals than indirect strategies like Integrated Conservation and Development Projects (ICDPs) (Engel et al., 2008; Wunder, 2006).

PES schemes were designed in the framework of the Environmental Services (ES) approach (Daily, 1997; De Groot et al., 2002; MEA, 2005), as a way to create markets to cope with the lack of exchange value that environmental services had in a market economy (Bayon, 2004; Gómez-Baggethun et al., 2010; Pagiola et al., 2002; Pearce, 1992). The rationale for PES schemes can be based on two comple-

mentary arguments: foregone benefits and proactive conservation activities (Engel et al., 2008; Wunder, 2005). The first one refers to the income the compensated owners could have obtained by making an unsustainable use of their territory that would have degraded environmental services. The latter are payments for actions required in order to maintain a steady flow of one or more environmental services. It was expected that paying for environmental services would encourage rural communities to conserve as they would at least receive the foregone benefits from the beneficiaries of the service. It is therefore a mechanism to internalise what otherwise would be a market externality (Pagiola and Platais, 2007).

PES have been defined as a voluntary transaction between at least one environmental service buyer and at least one environmental service provider where a well defined the environmental service is paid only if the provider consistently provides the defined ES over time (Wunder, 2005). This latter point is referred as conditionality. In practical terms, PES has unfolded as a broader concept applied to a variety of situations (Farley and Constanza, 2010; Sommerville et al., 2010). Hence, Wunder's definition has been questioned for not adjusting to the wide range of "real life" existing PES schemes (Muradian et al., 2010) and because the conditions for the ES provision are more based on socially constructed ideas than in scientific knowledge (Kaimowitz, 2004; Kosoy et al., 2007).

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The efficiency of PES has been a much discussed issue (Kemkes et al., 2010; Pagiola, 2005; Wunder, 2006). A fundamental condition for PES to be considered efficient is that the buyers – especially if they are the service users – pay the opportunity cost of the foregone benefits (but see Gregersen et al. (2010); Karsenty et al. (2010), who dispute that the opportunity costs reflect the full cost of the service), being otherwise socially inefficient (Engel et al., 2008; Wünscher et al., 2006). Another of these inefficient situations stands for lack of additionality, where payments are given for practices that would have been adopted anyway (Sierra and Russman, 2006). This is considered economically inefficient, especially where funds for PES are limited (Engel et al., 2008). The inefficiency of this situation has been questioned because it might have positive aspects on conservation and development like community's empowerment (Corbera et al., 2007), institutional reinforcement (Kosoy et al., 2008) or act as a reward for good environmental practices (Muradian et al., 2010), strengthening conservation values.

This last point leads to a new debate which argues that PES can replace other non chrematistic forms of valuing ecosystems (Child, 2009; Martin et al., 2008; McAfee, 1999; Redford and Adams, 2009), with the risk of “selling conservation out on nature” (McCauley, 2006). Some authors suggest that PES could attract political support for conservation, but could also result in a commodification of a growing number of environmental services (Gómez-Baggethun et al., 2010; Kosoy and Corbera, 2010; Ledant, 2008).

Trade-offs between different environmental and social goals are also likely to emerge in PES schemes (Kosoy et al. 2007). Among them, a classical efficiency versus equity dilemma has been discussed (Börner et al., 2010; Muradian et al., 2010; Pascual et al., 2010). Although PES, as a fundamentally conservation tool, were not designed as a poverty alleviation strategy (Wunder, 2008), it still has an impact on the poor. The fact that many ES providers live in remote rural areas makes it difficult to deal with PES without taking poverty issues into account. Hence equity and efficiency are inter-dependent and “from a conceptual point of view, should not be tackled in a piecemeal way” (Pascual et al., 2010, pp.1238).

Relationships between PES and poverty are complex. On one hand PES have been frequently used as a poverty alleviation tool, mainly when governments stand as service buyers (Kemkes et al., 2010; Pagiola, 2005; Wunder et al., 2008). But PES have also been questioned because it might negatively affect the poor by increasing poverty gaps among those who have access to land and those who don't (Landell-Mills and Porras, 2002). These arguments have been largely discussed in the literature concluding that PES have frequently benefited well-off landowners (Börner et al., 2010; Corbera et al., 2007; Kaimowitz, 2008; Lee et al., 2007; Zbinden and Lee, 2005), but still having positive effects on the poor (Grieg-Gran et al., 2005; Pagiola, 2005; Wunder, 2006) who are mainly handicapped if property rights are insecure, if there is lack of market information and access, or if PES programmes encourage less labour-intensive practices (Landell-Mills and Porras, 2002; Pagiola, 2005). Corbera et al. (2007) studied the equity in access, decision making and outcomes, finding no equity in all three aspects, especially in protected areas. To avoid these potential shortcomings, pro-poor PES programmes and measures have been proposed, including secure property rights, strengthen capacity for market participation, reducing smallholders' transaction costs and removing inappropriate access restrictions (Grieg-Gran et al. 2005; Landell-Mills 2002; Leimona and Lee 2008; van Noordwijk et al. 2007; Pagiola, 2007).

However, there are very few field-based detailed studies that assess equity and additionality of PES and try to relate these issues with the way they are perceived by local stakeholders (Corbera et al. 2007; Kosoy et al. 2007; Petheram & Campbell 2010; Sommerville et al. 2010). Even though this type of social analysis has increased in recent years, further research is needed to fully understand the political economy behind PES (Petheram and Campbell, 2010).

In this paper we assess the equity, additionality and stakeholders' perceptions of a PES scheme in a Mexican community inside a Biosphere Reserve. Mexican PES have been less studied than other national PES such as that of Costa Rica, offering at the same time the opportunity to analyze a community oriented PES (a tendency that is likely to be reinforced with REDD+). We first introduce PES in Mexico and a description of the study area; in Section 3 we present the methodology; Section 4 contains the results of the three main components of the study; Section 5 discusses these results and explores the way forward; the paper closes with the key conclusions and some recommendations in Section 6.

## 2. PES in Mexico

Mexico has a very active, forest-focused, PES programme (Corbera et al., 2009; Muñoz-Piña et al., 2008). In most cases the Federal Government acts as the buyer (Muñoz-Piña et al., 2008), but there are some initiatives financed by private actors or NGOs (Rosa et al., 2003), like the community-based Monarch Butterfly Conservation Fund (Honey-Rosés et al., 2009) or the Scoliel Té Project in Chiapas, one of the earliest carbon sequestration international programmes in the world (Jong et al., 2000). The first government initiative, a Payment for Hydrological Environmental Services (PSAH in Spanish), was launched as a five years programme in 2003 by the Comisión Nacional Forestal (CONAFOR, National Forestry Commission). Biodiversity and Carbon Sequestration PES programmes (PSA-CABSA) came afterwards. The PSAH programme started with 200 Mill. MX\$ (18.35 Mill. US\$<sup>1</sup>) in 2003 (Muñoz-Piña et al., 2008), reaching 1060.8 Mill. MX\$ (97.3 Mill. US\$) in 2007 (González, 2008). Mexico's PSAH funds come from a federal water fee yearly approved in Congress (Muñoz-Piña et al., 2008). This amount has been insufficient to cover all the applications (Muñoz-Piña et al., 2008), a situation common in most Mesoamerican countries (Kaimowitz, 2008). The same problem happened with PSA-CABSA, the carbon sequestration PES (Corbera et al., 2009).

Hydrological services users are distributed throughout the country, mainly in the cities, but they do not have a direct link with the providers or with the source of water. This, along with the fact that funds depend on Congress approval every year and that there has been a struggle over the allocation of water fees (Muñoz-Piña et al., 2008) made the programme unstable. In order to solve this problem, CONAFOR wanted municipalities to be in charge of PSAH after the first 5 years. This should in theory have allowed the development of local markets where direct users would pay the fees of the water they were using (González, 2008). However this has seldom been the case (Alix-García et al., 2005), forcing CONAFOR to keep funding the programme, and to look for new sources such as Global Environment Facility (GEF) and REDD's funds (CONAFOR 2009a).

Land distribution in Mexico favours a wide allocation of payments, as 52% of the land, and 80% of the forests are held by ejidos (Barnes, 2009). Ejidos were created after the Revolution as a way to give land to poor peasants. They work as communal lands, although the Constitution was changed in 1992 to legalize the privatization of ejidos (Cornelius & Myhre 1998). Ejidos have two types of dwellers: *ejidatarios*, owners of their own plots and the common land, and *pobladores*, who usually own smaller plots of land, but do not have rights to the common land and cannot vote in the assembly.

PES in Mexico, as opposed to standard individual programmes, are given to communities as a whole, who have to voluntarily apply for them, being afterwards distributed among the members according to the assembly's agreements. As a consequence, Mexican PES have been considered pro-poor oriented because most of the payments have

<sup>1</sup> We are using the exchange rate of January 2008 (when the interviews started) of 1 US\$ = 10.9 MX\$. However the exchange rate has changed notably from January 2003 to December 2010.

been allocated to rural poor communities with a high percentage of indigenous people (Kaimowitz 2008; Muñoz-Piña et al. 2008; Pascual et al. 2010) even though Corbera et al. (2007) found no evidence of strong equity in a case study, showing differences in access, project development and outcomes among stakeholders. Recent reviews have also showed that most of the payments seem to have been spent in places with little deforestation risks (Alix-García et al., 2005; González, 2008; Muñoz-Piña et al. 2008), thus having a dubious additionality effect.

Since 2007 the Mexican PES has been incorporated in PROARBOL, a comprehensive programme including other development strategies such as reforestation, commercial plantations, certification or tourism (CONAFOR, 2009b). Starting in 2010, shade coffee and palm plantations are also eligible for receiving PES (CONAFOR, 2010). Overall, the Mexican scheme meets most of Wunder's definition, with some particularities, notably that the National Government is the main buyer and ejidos act as the most important providers. Moreover, conditionality has been documented not to be monitored enough (Honey-Rosés et al., 2009).

### 2.1. Study area

We chose to study the *Ejido Sierra Morena*, placed in *La Sepultura* Biosphere Reserve (Chiapas, Mexico). The criteria for selecting this ejido were its early inclusion in PES schemes, its long tradition of ICDPs projects, and the willingness to receive our group of researchers. Sierra Morena covers 1750 ha with an altitudinal range between 700 and 1400 masl, the settlement being at 1000 masl. Sierra Morena was established in 1970 when a group of landless peasants from nearby lowlands occupied mountainous public land that was illegally used by a landowner. Early attempts by the new settlers to introduce traditional 'milpa' (beans and corn) systems failed, leading to a new, environmentally more sustainable approach based on shade coffee and the extraction of non-timber forest products (NTFP), notably camedor palm (*Chamaedorea* spp.). Since the creation of the Biosphere Reserve in 1995, the ejido has benefitted from conservation and development projects. Nowadays shade coffee and camedor palm are the main income generating activities in the *ejido* but there is also other NTFP gathering and some farming for self-consumption. The total population is 130 people corresponding to 31 families.

The ejido as a whole is still formally a common property and originally worked collectively. After 1980, and by internal decision of the assembly, the most productive area (340 ha) was allocated individually, with the rest (1410 ha) remaining still as common property. This privatization however has not been formally registered. Currently there are 23 families of ejidatarios and 8 families of pobladores living in Sierra Morena. Pobladores tend to be members of the family that did not inherit the ejidatario title but preferred to remain in the community working small plots of land.

Practically all common land corresponds to natural forests covering the highest and steepest parts of the ejido, being partly included in one of the Biosphere Reserve's core zones. Some degree of NTFP extraction is allowed, but logging and hunting are forbidden. Shade coffee is grown in individual plots between 1000 and 1200 masl. Formerly wild extracted camedor palm has recently shifted to small plots plantations under forest canopy. Corn, beans and some pastureland occupy the lower part of the ejido. Most coffee and palm producers are organised in three organic coffee and one palm cooperatives all of them entirely composed of ejido members. All these activities have been financially and/or technically supported, in a sort of ICDP, mainly by the Comisión Nacional de Áreas Naturales Protegidas (CONANP, National Commission for Natural Protected Areas), who has been working in the area since the beginning of the Reserve in 1995, although CONAFOR offers sporadic collaboration in these initiatives.

The ejido joined PSAH in 2004 having renewed the programme for another 5 years in 2009. Payments are received to compensate for some restrictions (forest clearing, hunting, poaching and habitat alteration), obligations (cattle limitation, surveillance patrolling and holding a workshop on the programme) and recommended activities (like erosion-control terraces). The initial area covered 762 ha of mature forest of the ejido. In 2009 it was partially changed and expanded to 800 ha. According to the deforestation risk map made by the Mexican Instituto Nacional de Ecología (INE, 2010), 68% of this initial area stands for 'very low risk', 19% is under 'low risk' and the remainder 13% are in a 'medium risk' category. The new area has even less risk, with 93% falling under the 'very low risk' category and 7% under 'low risk'. These results match with the very low deforestation risk diagnosed for the ejido by several environmental institutions (IDESMAC et al., 1999).

### 3. Methods

General information was obtained from bibliographical sources and interviews with key informants (ejido's authorities, original members of the community, guides and representatives of the cooperative groups, and officers from CONANP and CONAFOR). Detailed data about socio-economic conditions, income and subsistence activities, conservation status and threats, and opinions about PES was gathered based on a structured questionnaire administered to all adults (both men and women) amounting to a total of 66 people from the 31 households. One ejidatario (who planted coffee, palm and received PES) refused to be interviewed, resulting in complete data for 30 households. Fieldwork took place between January and March 2008, coinciding with the end of the coffee season, and in January 2010.

Net total income was estimated adding cash income and subsistence production converted to monetary value using shadow prices at farm gate and subtracting expenses in wages and materials. Total and cash income analyses tend to give similar results; given that subsistence activities are marginal (about 12% of total ejido's income), we present here those based on cash income that are more in line with the market approach of PES.

Data analysis (descriptive statistics, regression techniques, multivariate analysis, and diverse parametric and non-parametric tests) was done using SPSS v.17.0. Income inequality was assessed using Gini coefficients for different components of income, including PES.

### 4. Results

#### 4.1. PES disbursement and distribution

The 762 ha of forest from Sierra Morena included in the PSAH in 2004 meant a yearly payment of 228,600 MX\$ (20,972 US\$) representing 11% of net cash income of the ejido. This amounts to 300 MX\$ per hectare (28 US\$/ha), which is very low compared to the 6289 MX\$/ha (577 US\$/ha) net coffee income and 4685 MX\$/ha (430 US\$/ha) net palm income.

PES allocation inside the community was decided by the assembly. It was distributed among 28 out of 31 households. The three households excluded were pobladores. Two of them did not receive payments because they had recently arrived at the community. The third had been penalised by the community's assembly for complaining about the little money pobladores were receiving from PES.

PES disbursement was allocated based on tenure rights and participation in the pre-established activities (patrolling to control illegal logging and hunting) to which all households receiving PES had to contribute. The allocation for older ejidatarios (the founders of the ejido, who had been holding rights since its establishment) was 9000 MX\$/year (826 US\$/year); that for new ejidatarios 6000 MX\$/year (550 US\$/year). Pobladores, who hold no rights to the ejido's common land, only received the amount corresponding to the surveillance

**Table 1**  
Gini coefficient for different activities.

Income base	Gini coefficient
Total income	0.38
Coffee	0.50
Palm	0.53
PES	0.36
PES ejidatarios	0.19
PES pobladores	0.47

activities, obtaining between 1500 and 2000 MX\$/year (138–183 US\$/year). Due to this difference, PES represent a two points percent increase in the income gap between ejidatarios and pobladores. When including PES, the share of aggregated cash income of the ejido that goes to ejidatarios increases from 89% to 90%, whereas that of pobladores decreases from 11% to 10%.

Table 1 shows the Gini coefficient of net cash income per activity. The Gini value of 0.38 for net income is relatively high for a small rural community, but low compared with the Mexican Gini value of 0.48 (UNDP, 2009). Coffee and palm Gini coefficients are significantly higher, indicating strong inequalities in the two main sources of income, which together represent 70% of net cash income. In contrast, a PES Gini of 0.36 indicates a more evenly distributed source of income. PES stand for an extra income received by most of the households, thus acting as a modest correcting factor of the community's differences. PES Gini coefficient for ejidatarios has a fairly low value of 0.19, pointing at a very egalitarian distribution among this group. By contrast, PES Gini coefficient for pobladores goes up to 0.47 indicating the split of this group between those who receive PES and those who do not.

Because of the general distribution of PES among most households in the ejido, this source of income tends to have a differentiated impact among farmers grouped by net cash income terciles, as showed in Fig. 1A. PES are relatively more important for the lowest income tercile in the 23 households that compose the group of ejidatarios (Fig. 1B), whereas for the eight pobladores households the trend is reversed, with PES being relatively more important for the middle income category (there are no pobladores belonging to the high income tercile) as seen in Fig. 1C.

The comparison of income inequalities with and without PES appears in Table 2. The inclusion of PES represents a reduction of Gini coefficients in all cases, being particularly relevant in the ejidatarios group of households. This is consistent with the above findings related to the lower Gini coefficient of PES and to their more egalitarian distribution among ejidatarios.

#### 4.2. PES and attitudes towards conservation

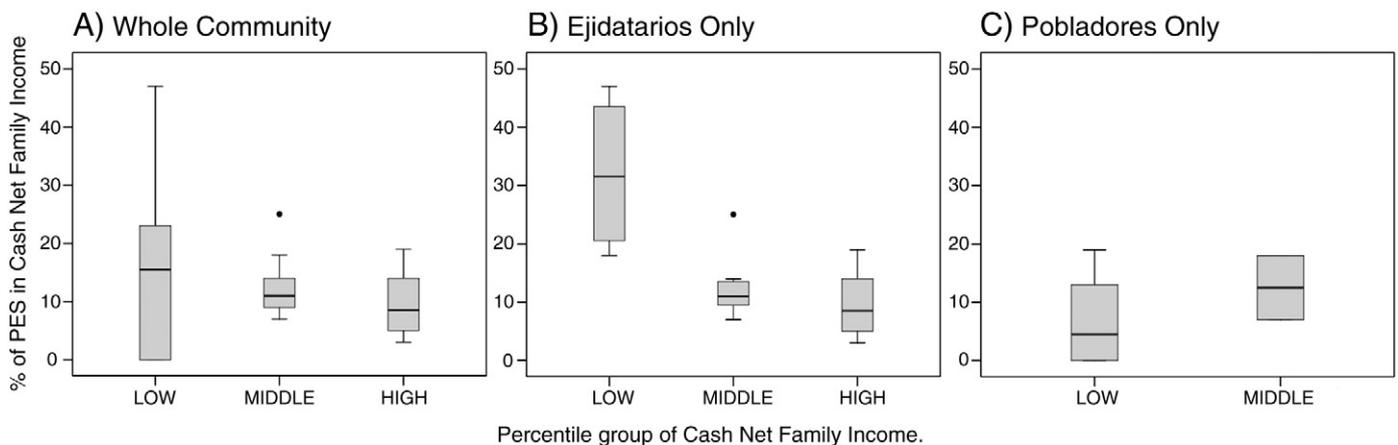
All respondents without exception agree that the PES programme is good for the ejido and consider that it benefits conservation goals (mostly meaning avoiding deforestation, but also fire prevention and not using pesticides). Although the return to effort of this payment is considerably higher than for other activities, 87% of people thought the amount was insufficient to compensate their expectations. The rest considered it to be a fair amount, while no one said they were getting too much money. The reasons justifying PES were differently perceived ( $p < 0.10$ ) between ejidatarios, who thought it should be linked to holding forest land rights, and pobladores, who thought it should be related to proactive conservation activities ( $\chi^2 p = 0.099$ ).

The interviewees were asked if conservation initiatives to maintain forests would continue in the absence of PES. Sixty four percent of respondents answered positively. Women significantly tended to give more negative answers than men ( $\chi^2 p = 0.054$ ). Likewise, pobladores responded more negatively than ejidatarios ( $\chi^2 p = 0.041$ ). Table 3 crosses the answers by gender and land tenure rights. In this case, the group of male ejidatarios stands as giving significantly more positive answers than the rest ( $\chi^2 p = 0.044$ ).

The same question was analysed in relation to other continuous or ordinal variables (age, time of residence, years of schooling, number of training courses, family income and % of PES on family income). For the whole sample only formal education was statistically significant (Mann–Whitney  $p = 0.043$ ), with lower education being associated with positive answers.

No statistically significant differences were found in relation to this question within the group of women, whereas men showed differences for age (Mann–Whitney  $p = 0.061$ ), number of years of residence (Mann–Whitney  $p = 0.079$ ) and formal education (Mann–Whitney  $p = 0.063$ ); older males who had been living long time in the ejido and who had low formal education tended to consider that forests would be maintained in the absence of PES. Likewise, no statistically significant differences were found within the group of pobladores or ejidatarios.

Fig. 2 represents the Factorial Correspondence Analysis of the matrix that combines respondents' features with their reasons for supporting or not supporting conservation measures in the absence of PES. The first axis, that absorbs 23% of variance, splits positive from negative answers. Conservation without PES relates to a higher environmental awareness and the appreciation of ecosystem services that tend to occur in older male ejidatarios with higher income. Conversely, requesting PES in order to conserve relates to lack of money and a perceived shortage of land to expand activities, as well as for more impacting forest related activities like hunting.



**Fig. 1.** Percentage of PES in Cash Net Family Income among Cash Net Family Income percentile groups.

**Table 2**  
Intra-group effects of PES on Gini coefficient.

Population	Gini coefficient without PES	Gini coefficient with PES	Difference in Gini coefficient (%)
All	0.40	0.38	−6.4
Ejidatarios	0.35	0.31	−10.8
Pobladores	0.25	0.23	−5.7

**Table 3**  
Cross-custom table for answers about conservation without PES.

Sex		Land tenure rights		Conservation without PES		
				Yes	No	Total
Male	Land tenure rights	Ejidatario	21	4	25	
		Poblador	5	5	10	
	Women	Ejidatario	12	9	21	
		Poblador	3	5	8	
Total			41	23	64	

The last group of questions refers to the appreciation of living conditions and plans for the future. Results were analyzed using the percentage of the answers given (after categorization) and looking for significant differences between the two tenure categories of ejidatarios and pobladores (see Table 4). Ninety four percent of interviewees indicated that they planned to stay in the community, and all of them replied that they will keep conserving. The existence of good climate conditions (regulating service) is the most valued aspect of the place, followed by the good conservation status (cultural service that appeals at the beauty of the landscape).

The main reason for staying in the community was land property, an answer given by a significantly high number of ejidatarios. The second reason refers to the environmental quality of the area, helping to explain why conservation issues are successful, given that the exceptional environmental conditions are hard to find in other places in the region.

The main stated reason for maintaining conservation practices referred to increased environmental awareness and the effect of the educational process (including training courses) that had raised

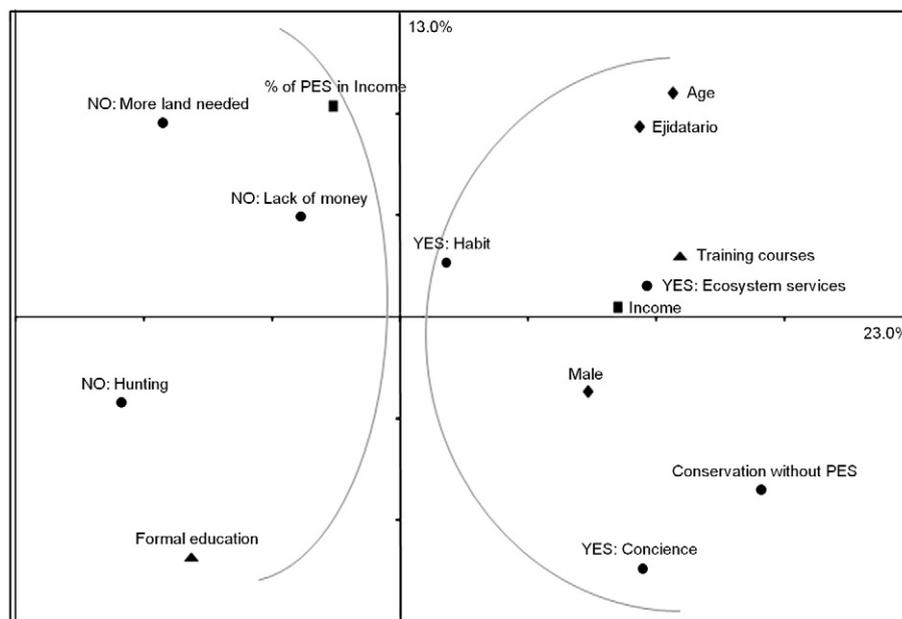
interest for conservation, an opinion significantly supported by ejidatarios. Prestige was the second reason for maintaining conservation strategies. The community has obtained awards, has been set as an example for other communities and has received visitors from abroad, which has raised a feeling of pride among dwellers, turning conservation into the hallmark of the place. Pobladores significantly alluded to the fact that conservation can be a source of income, a reason that appears in third position in the list.

**5. Discussion**

Although PES represent a relatively small contribution to the ejido's economy, their disbursement among most members of the community leads to a slight reduction in income disparities of Sierra Morena dwellers as a whole. The same results are observed within the two main land tenure categories of ejidatarios and pobladores. The fact that part of the payments are given for active conservation work offers the opportunity to pobladores to receive money even though they do not hold land rights on the common forests. However, the amount is not high enough to mitigate the differences in payments due to land tenure rights. Rather, the higher payment received by ejidatarios slightly broadens the differences between the two groups. PES in Sierra Morena therefore show an ambiguous effect with regards to the equity considerations of Landell-Mills and Porras (2002) and their concern with a possible risk of widening the poverty gap.

Equity and fairness in access and decision making of PES are determined by the institutional structure of the ejido that gives all decision power to those holding full land rights. Based on Pascual et al. (2010) fairness criteria classification for PES, Sierra Morena follows a dual system with a status quo approach between ejidatarios and pobladores, and an egalitarian approach within each of these two groups. Consequently the income gap is not significantly reduced for the poorest of the poor, who tend to be excluded from decision making, a situation common to other places in Mexico (Corbera et al., 2009; Muñoz-Piña et al., 2008).

Our results confirm that land tenure is a crucial aspect for PES to have impact on the poor (Grieg-Gran et al., 2005; Landell-Mills, 2002; Pagiola et al., 2005). In its absence, PES might widen the gap within communities and become the origin of conflicts, as shown by the case



**Fig. 2.** Correspondence Factorial Analysis for the reasons of supporting or not supporting conservation in the absence of PES related to some characteristics of the interviewees. Circles: Answers about conservation without PES; Diamonds: Personal features; Squares: Income characteristics; Triangles: Educational characteristics.

**Table 4**  
Perceptions of environmental quality and future plans.

	% <sup>a</sup>	$\chi^2$ <sup>b</sup>
<i>Most valued aspects</i>		
Climate (regulating service)	57.4	–
Conservation status (culture service)	37.7	–
Way of life	21.3	–
Other ecosystem services (fresh water, harvesting, provisioning services)	16.4	–
Job opportunities	16.4	
<i>Reasons to stay in Sierra Morena</i>		
Tenure rights	45.0	Ejidatario ( $p = 0.069$ )
Environmental quality	41.7	–
Adaptation	28.3	–
Tranquility	16.4	–
<i>Reasons to keep conservation</i>		
Conscience and education	59.1	Ejidatario ( $p = 0.072$ )
Prestige	15.9	–
Source of job and income	13.6	Poblador ( $p = 0.053$ )
Ecosystem services provided	11.4	–
Health	4.5	–

<sup>a</sup> Frequency of a given answer.

<sup>b</sup> Significant differences ( $\chi^2$ ) between ejidatarios and pobladores.

of a poblador penalised for complaining about PES distribution. Similar social conflicts have been reported in other cases (Corbera et al., 2007). Thus, PES cannot be separated from the land problem.

Since payments are received by the ejido as a whole, there is a possibility that they get distributed equally among all the families. But communities are not homogeneous and the fact that ejidatarios (who have the final decision) think that PES should be linked to holding forest land rights rules out that possibility in practice. However, even if pobladores receive less than ejidatarios, community-based payments still may offer an opportunity for the landless to become part of a PES programme, being potentially more effective than individual PES schemes for reaching the poor. For this reason the expansion of community rights has been proposed as a precondition for implementing a PES programme (Rosa et al., 2003).

The view that conservation activities can be sustained in the absence of PES is predominant among old male ejidatarios. This seemingly higher environmental awareness could be linked to their fight for the land and their guarantees of continuity in it (Soule et al., 2000), along with the higher number of training courses they have received. For them PES are more like an award for owning well conserved land (van Noordwijk et al., 2004). Pobladores, being economically disadvantaged and with no access to the common land, require more economic incentives and tend to think that conservation cannot be accomplished without PES. Their request of compensation for restrictions imposed in order to preserve environmental services is closer to the original PES idea (Wunder, 2005). This depicts differentiated additionality within the same community – low for ejidatarios and high for pobladores. Since ejidatarios own the mature forests under PES, we conclude that Sierra Morena has received the payments even though it did not have much risk of deforestation, a situation confirmed by previous community assessments. Muñoz-Piña et al. (2008) claim this situation to be common in Mexico.

Although PES income has a higher return to effort than other activities, most of the respondents think that the money they receive is insufficient, an expected result that has been confirmed in other places (Grieg-Gran et al., 2005; Kosoy et al., 2007). This may reflect the inclusion of the opportunity costs of the foregone benefits of agricultural expansion into their estimation, as the PES income per hectare is notably lower than those obtained for coffee or palm, a situation also perceived in other studies (Corbera et al., 2007; Kosoy et al., 2007). Still, agricultural expansion does not seem very realistic as there is little labour force available, extra land is remote and steep and

it would violate existing Biosphere Reserve's management plans. This suggests that other factors further from the opportunity costs, including a possible response bias,<sup>2</sup> may be influencing the estimation of a fair PES by producers.

Sierra Morena's population has therefore a dual response regarding additionality. On one hand most of the people think that monetary incentives are not necessary for conservation. On the other hand people believe the payments are insufficient. This contradiction illustrates the difficulty of trying to set an exchange value (payments) for something that only had a use value (environmental services provided by Sierra Morena's forest) (Gómez-Baggethun et al., 2010; Heal, 2000) and the problems attached to the opportunity cost approach for establishing it (Gregersen et al., 2010). It also supports the idea that people may join PES for non economic reasons, like the prestige or empowerment mentioned before, or because it does not mean a main source of income but "a small incentive, which does not entail changing the household productive structure significantly" (Corbera et al., 2007, pp.377).

At the same time, as shown in Table 4, there is quite a strong consensus between ejidatarios and pobladores on the most appreciated aspects of the community, mostly related to the quality of the environmental services, precisely those that are more difficult to integrate into the three necessary steps of commodification required by a PES scheme<sup>3</sup> (Kosoy and Corbera, 2010). Environmental quality, as it makes life more comfortable and enjoyable is in itself a reason to conserve. And the fact that the main income sources come from the organic market reinforces a very positive reception of environmental issues. In this sense, ICDPs seem to have cleared the way for PES in Sierra Morena, facilitating their adoption but also reducing their additionality. In fact, some PES-related pro-poor measures like access to market or securing land tenure (Grieg-Gran et al. 2005; Landell-Mills 2002; Leimona and Lee 2008; van Noordwijk et al. 2007) could also be considered classical ICDP interventions.

Overall, Sierra Morena's PES scheme resembles other low additionality, low commodification, indirect schemes that have been considered inefficient. However, these schemes have been defended in the alternative conceptual framework for PES proposed by Muradian et al. (2010) because they can still have social and ecological benefits, or in van Noordwijk et al. (2004) proposal for PES functioning as an award to recognize conservation made by the poor, thus reinforcing equity and intrinsic conservation. As Rosa et al. (2003, pp. 63) propose: "the challenge is finding other compensation mechanisms that recognize and reward ecosystem management practices that guarantee environmental services of interest to outside 'consumers'". Our results indicate that land tenure, environmental education and prestige seem to strengthen this causality, as it has been the case in other places (Attum et al., 2008; Erdmann, 2006).

It can be argued that these three conditions do not converge in many places where the rural poor live. Still, heading towards them can be a positive step in integrating conservation and development; as Sandker (2010, pp. x) suggests, "PES can reinforce landscape decisions resulting in a 'conservation scenario' only when this is already supported by intrinsic motivation spawned by non-cash benefits". Thus it could be more effective to make PES-ICDP hybrids (Wunder, 2006), that can ensure land tenure but also seek opportunities for people that do not own the land and, above of all, can become self-sufficient in the long term without depending on international funding. There are some examples of these alliances, but they have not been successfully sustained (Corbera et al., 2007). CONAFOR's

<sup>2</sup> Response bias is always possible in this type of questions. We have tried to minimize it through cross-checking of information during the numerous informal discussions we held throughout the six months of stay in the community.

<sup>3</sup> "First, it involves narrowing down an ecological function to the level of an ecosystem service (...). Second, it assigns a single exchange-value to this service and, third, it links 'providers' and 'consumers' of these services in market or market-like exchanges" (Kosoy and Corbera, 2010, pp. 1229).

new PROARBOL programme points out in this direction. After the first five years evaluation of PSAH, there has been a reconsideration of PES, which are now included inside all the activities (mostly production support programmes) offered by PROARBOL and linked to a Best Practice Management programme (programa de Mejores Prácticas de Manejo, PMPM) (CONAFOR 2010). Lastly it is worth stressing the need to overcome municipalities' reluctance to participate in PES in order to make locally-implemented schemes that can foster self-sufficiency, especially in cases like this where upstream and downstream actors are well defined and form part of the same watershed.

## 6. Conclusions

This case study illustrates some of the controversies around community-oriented PES in Mexico. The programme enjoys a broad acceptance among stakeholders, with applications going well above current funding resources. Mexican PES have usually been considered a pro-poor scheme. Our results show a dual response in equity. PES have an egalitarian effect within landowners and landless groups, but it broadens the gap between them. This highlights the difficulty to work with poverty issues where there is not an equal distribution of land, even though communities such as Mexican ejidos offer more opportunities for the poorest. There is also a dual response regarding additionality, being low for landowners and high for the landless people in the community. As the former hold full decision rights, the programme has little additionality. Thus, crossing equity with environmental concerns can lead to opposing and yet legitimate claims by different stakeholders.

Small percentage contribution of PES to family income favours conservation without direct payments, especially when the main economic activities require a certain degree of conservation, like shade coffee and palm in the case of Sierra Morena. Thus certified organic markets along with land tenure, ecosystem benefits awareness and prestige can also be keystones for making the rural poor escape out of poverty while safeguarding their ecosystem and reinforcing intrinsic value-based conservation.

PES are quite recent and there is a risk that monetary approaches gain grounds against others, and could finally replace them (Bowles 2008; Deci et al. 1999). In Sierra Morena, it remains unclear whether PES can strengthen or work against intrinsic values. This is important in order to tackle possible future problems like a probable shortage of funds for PES. For the time being, a lack of funds does not appear to be a major threat for the environment in Sierra Morena, especially among old ejidatarios, as the functional and ethical values of the forest surpass the chrematistic ones. Thus, introducing a reward could be a new and effective way of reinforcing existing values. The challenge is to find mechanisms that reinforce synergies between intrinsic values and monetary incentives (Farley and Constanza, 2010). We should pay attention and continue researching to detect early signals that the former are eroded by the latter.

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## References

Alix-García, J., Janvry, A., Sadoulet, E., Torres, J.M., 2005. An assessment of Mexico's payment for environmental services program. Unpublished paper prepared for the FAO. <http://are.berkeley.edu/~sadoulet/papers/FAOPESreport.pdf>

- Attum, O., Rabea, B., Osman, S., Habinan, S., Baha El Din, S.M., Kingsbury, B., 2008. Conserving and studying tortoises: a local community visual-tracking or radio-tracking approach? *Journal of Arid Environments* 72, 671–676.
- Barnes, G., 2009. The evolution and resilience of community-based land tenure in Mexico. *Land Use Policy* 26, 393–400.
- Bayon, R., 2004. Making environmental markets work: Lessons from early experience with sulfur, carbon and wetlands. *Forest Trends*, Katoomba Group Meeting in Locarno, Switzerland, 2003.
- Börner, J., Wunder, S., Wertz-Kanounnikoff, S., Rüginitz Tito, M., Pereira, M., Nascimento, N., 2010. Direct conservation payments in the Brazilian Amazon: scope and equity implications. *Ecological Economics* 69, 1272–1282.
- Bowles, S., 2008. Policies designed for self-interested citizens may undermine “the moral sentiments”: evidence from economic experiments. *Science* 320, 1605–1609.
- Chichilnisky, G., Heal, G., 1998. Economic returns from the biosphere. *Nature* 391, 629–630.
- Child, M.F., 2009. The Thoreau ideal as a unifying thread in the conservation movement. *Conservation Biology* 23, 241–243.
- CONAFOR, 2009a. México impulsa acciones contra el cambio climático a través del pago por servicios ambientales. Press release: 10-15-2009 <http://www.conafor.gob.mx/portal/docs/secciones/comunicacion/B-432009.pdf> (last access 2/14/2010).
- CONAFOR, 2009b. Reglas de operación PROARBOL 2009. <http://www.sma.df.gob.mx/corena/descargas/proarbol/reglas2009.pdf>.
- CONAFOR, 2010. Reglas de Operación de PROÁRBOL 2010. <http://www.conafor.gob.mx:8080/documentos/docs/6/300Reglas%20de%20Operaci%C3%B3n%20Pro%C3%81rbol%202010.pdf>.
- Corbera, E., Kosoy, N., Martínez Tuna, M., 2007. Equity implications of marketing ecosystem services in protected areas and rural communities: case studies from Meso-America. *Global Environmental Change* 17, 365–380.
- Corbera, E., Soberanis González, C., Brown, K., 2009. Institutional Dimensions of Payments for Ecosystem Services: an analysis of Mexico's carbon forestry programme. *Ecological Economics* 68, 743–761.
- Cornelius, W., Myhre, D., 1998. The transformation of rural Mexico: reforming the ejido sector. Center For US–Mexican Studies. University Of California, San Diego.
- Daily, G., 1997. Nature's services: societal dependence on natural ecosystems. Island Press, Washington DC.
- de Groot, R., Wilson, M., Boumans, R., 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics* 41, 393–408.
- Deci, E.L., Koestner, R., Ryan, R.M., 1999. A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin* 125, 627–668.
- 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.
- Erdmann, M., 2006. Lessons learned from the conservation campaign for the Indonesian coelacanth, *Latimeria menadoensis*. *South African Journal of Science* 102, 501–505.
- Farley, J., Constanza, R., 2010. Payments for ecosystem services: from local to global. *Ecological Economics* 69, 2060–2068.
- Gómez-Baggethun, E., de Groot, R., Lomas, P.L., Montes, C., 2010. The history of ecosystem services in economic theory and practice: from early notions to markets and payment schemes. *Ecological Economics* 69, 1209–1218.
- González, M.J. (Coord.), 2008. Evaluación externa de los apoyos de los servicios ambientales. Ejercicio fiscal 2007. COLPOS-CONAFOR. [http://148.223.105.188:2222/gif/snif\\_portal/administrador/sistemas/evaluaciones/1232641675\\_PSA\\_2007.pdf](http://148.223.105.188:2222/gif/snif_portal/administrador/sistemas/evaluaciones/1232641675_PSA_2007.pdf).
- Gregersen, H., Lakany, H.E., White, A., 2010. Does the opportunity cost approach indicate the real cost of REDD+? Rights and Realities of Paying for REDD+. Rights and Resources Initiative, Washington DC.
- 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.
- Heal, G., 2000. Valuing ecosystem services. *Ecosystems* 3, 24–30.
- Honey-Rosés, J., López-García, J., Rendón-Salinas, E., Peralta-Higuera, A., Galindo-Leal, C., 2009. To pay or not to pay? Monitoring performance and enforcing conditionality when paying for forest conservation in Mexico. *Environmental Conservation* 36, 120–128.
- IDESMAC, SEMARNAT, INE, IHN, REBISE, 1999. Cultura forestal para la prevención de incendios forestales en la Reserva de la Biosfera La Sepultura, Chiapas, México.
- INE, 2010. Mapa de riesgo de deforestación de México. Data provided by INE. : 2010.
- Jenkins, M., Scherr, S., Inbar, M., 2004. Markets for biodiversity services. *Environment* 6, 32–42.
- Jong, B.D., Tipper, R., Montoya-Gómez, G., 2000. An economic analysis of the potential for carbon sequestration by forests: evidence from southern Mexico. *Ecological Economics* 33, 313–327.
- Kaimowitz, D., 2004. Forests and water: a policy perspective. *Journal of Forest Research* 9, 289–291.
- Kaimowitz, D., 2008. The prospects for reduced emissions from deforestation and degradation (REDD) in Mesoamerica. *International Forestry Review* 10, 485–495.
- Karsenty, A., Sembres, T., Radrianarison, M., 2010. Paiements pour services environnementaux et biodiversité dans les pays du sud. *Revue Tiers Monde* 202, 57–74.
- Kemkes, R.J., Farley, J., Koliba, C.J., 2010. Determining when payments are an effective policy approach to ecosystem service provision. *Ecological Economics* 69, 2069–2074.
- Kosoy, N., Corbera, E., 2010. Payments for ecosystem services as commodity fetishism. *Ecological Economics* 69, 1228–1236.
- Kosoy, N., Martínez-Tuna, M., Muradian, R., Martínez-Alier, J., 2007. Payments for environmental services in watersheds: insights from a comparative study of three cases in Central America. *Ecological Economics* 61, 446–455.

- Kosoy, N., Corbera, E., Brown, K., 2008. Participation in payments for ecosystem services: case studies from the Lacandon rainforest, Mexico. *Geoforum* 39, 2073–2083.
- Landell-Mills, N., 2002. Developing markets for forest environmental services: an opportunity for promoting equity while securing efficiency? *Philosophical Transactions. Series A, Mathematical, Physical, and Engineering Sciences* 360, 1817–1825.
- Landell-Mills, N., Porras, I.T., 2002. Silver bullet or fools' gold? A global review of markets for forest environmental services and their impact on the poor. Instruments for sustainable private sector forestry series. International Institute for Environment and Development, London.
- Ledant, J., 2008. Acheter les services de la nature? Une analyse des "paiements pour services environnementaux". Etopia, Publications, Analyses <http://etopia.be/IMG/pdf/ledant.pdf>.
- Lee, E., Leimona, B., Noordwick, M., van Agarwal, C., Mahanty, S., 2007. Payments for environmental services: introduction to feasibility, supplier characteristics and poverty issues. Insight: notes from the field. : RECOFTC, Vol. 2. World Agroforestry Centre ICRAF and Winrock International India WII, Bangkok, pp. 5–17.
- Leimona, B., Lee, E., 2008. Pro-Poor Payment for Environmental Services: Some Considerations. RUPES-RECOFTC, Bangkok, Thailand and Bogor, Indonesia. January brief.
- Martin, A., Blowers, A., Boersema, J., 2008. Paying for environmental services: can we afford to lose a cultural basis for conservation? *Environmental Sciences* 5, 1–5.
- McAfee, K., 1999. Selling nature to save it? Biodiversity and green developmentalism. *Environment and Planning, D, Society and Space* 17, 133–154.
- McCauley, D.J., 2006. Selling out on nature. *Nature* 443, 27–28.
- MEA, 2005. Ecosystems and human well-being. Island Press, Washington DC.
- 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.
- Muradian, R., Corbera, E., Pascual, U., Kosoy, N., May, P.H., 2010. Reconciling theory and practice: an alternative conceptual framework for understanding payments for environmental services. *Ecological Economics* 69, 1202–1208.
- Noordwijk, M., van Leimona, B., Emerton, L., Tomich, T.P., Velarde, S.J., Kallesoe, M., Sekher, M., Swallow, B., 2007. Criteria and indicators for environmental service compensation and reward mechanisms: realistic, voluntary, conditional and pro-poor. Working Papers b14964. World Agroforestry Centre, Bogor.
- Pagiola, S., 2005. Assessing the efficiency of payments for environmental services programs: a framework for analysis. World Bank, Washington DC.
- Pagiola, S., 2007. Guidelines for "Pro-Poor" Payments for Environmental Services. World Bank, Washington DC.
- Pagiola, S., Platais, G., 2007. Payments for environmental services: from theory to practice. World Bank, Washington DC.
- Pagiola, S., Bishop, J., Landell-Mills, N., 2002. Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development. James & James/Earthscan, London.
- 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.
- Pascual, U., Muradian, R., Rodríguez, L.C., Duraiappa, A., 2010. Exploring the links between equity and efficiency in payments for environmental services: a conceptual approach. *Ecological Economics* 69, 1237–1244.
- Pearce, D., 1992. Economic valuation and the natural world. Policy Research Working Paper 998. World Bank, Washington DC.
- Petheram, L., Campbell, B., 2010. Listening to locals on payments for environmental services. *Journal of Environmental Management* 91, 1139–1149.
- Powell, I., White, A., Landell-Mills, N., 2005. Developing markets for the ecosystem services of forests. *Forest Trends*, Washington DC.
- Redford, K.H., Adams, W.M., 2009. Payment for ecosystem services and the challenge of saving nature. *Conservation Biology* 23, 785–787.
- Redford, K., Levy, M., Sanderson, E., 2008. What is the role for conservation organizations in poverty alleviation in the world's wild places? *Oryx* 42, 516–528.
- Rosa, H., Kandel, S., Dimas, L., 2003. Compensation for Environmental Services and Rural Communities: Lessons from the Americas. PRISMA, San Salvador.
- Sandker, M., 2010. Scenarios for Conservation and Development. Participatory Modelling to support Decision Making in Tropical Forest Landscapes. PhD Thesis. Universidad Autónoma de Madrid.
- Sierra, R., Russman, E., 2006. On the efficiency of environmental service payments: a forest conservation assessment in the Osa Peninsula, Costa Rica. *Ecological Economics* 59, 131–141.
- Sommerville, M., Jones, J.P.G., Rahajaharison, M., Milner-Gulland, E.J., 2010. The role of fairness and benefit distribution in community-based Payment for Environmental Services interventions: a case study from Menabe, Madagascar. *Ecological Economics* 69, 1262–1271.
- Soule, M., Tegene, A., Wiebe, K., 2000. Land tenure and the adoption of conservation practices. *American Journal of Agricultural Economics* 82, 993–1005.
- Sunderland, T., Ehringhaus, C., Campbell, B., 2008. Conservation and development in tropical forest landscapes: a time to face the trade-offs? *Environmental Conservation* 34, 276–279.
- UNDP, 2009. Human Development Report 2009. Overcoming Barriers: Human Mobility and Development. UNDP, New York.
- van Noordwijk, M., Chandler, F., Tomich, T., 2004. An introduction to the conceptual basis of RUPES: rewarding upland poor for the environmental services they provide. ICRAF-Southeast Asia, Bogor.
- Wunder, S., 2005. Payments for environmental services: some nuts and bolts. Center for International Forestry Research, Bogor.
- Wunder, S., 2006. The efficiency of payments for environmental services in tropical conservation. *Conservation Biology* 21, 48–58.
- Wunder, S., 2008. Payments for environmental services and the poor: concepts and preliminary evidence. *Environment and Development Economics* 13, 279–297.
- Wunder, S., Engel, S., Pagiola, S., 2008. Taking stock: a comparative analysis of payments for environmental services programs in developed and developing countries. *Ecological Economics* 65, 834–852.
- Wünscher, T., Engel, S., Wunder, S., 2006. Payments for environmental services in Costa Rica: increasing efficiency through spatial differentiation. *Quarterly Journal of International Agriculture* 45, 317–335.
- Zbinden, S., Lee, D., 2005. Paying for environmental services: an analysis of participation in Costa Rica's PSA Program. *World Development* 33, 255–272.