Decentralized Payments for Environmental Services:

Comparing the Cases of Pimampiro and PROFAFOR in Ecuador

Revised version of a paper presented at the ZEF-CIFOR workshop on „Payments for Environmental Services: Methods and Design in Developing and Developed Countries“, Titisee, Germany, June 15-18, 2005

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Keywords: Payments for Environmental Services, Watershed Protection, Carbon Forestry, Ecuador

Word count: 8082

ABSTRACT

Few PES schemes in developing countries operate outside of the central state's umbrella, and are the same time old enough to allow for a meaningful evaluation. In fact, Ecuador has two such experiences that are both decentralised and consolidated: the five-year old Pimampiro municipal watershed-protection scheme and the twelve-year old PROFAFOR carbon-sequestration programme. We compare the two cases, using a common PES definition and methodology, drawing on both primary interview-based information and secondary data. We find that both schemes have been relatively effective in reaching their environmental objectives, in terms of probably high additionality levels and low leakage effects. A strong focus on the targeted environmental service and a strong degree of conditionality seem to be two key factors explaining these achievements. Although neither scheme has targeted poverty alleviation or other side objectives, both are likely to have improved PES recipients' welfare, mostly through higher incomes. We highlight several observations with more general relevance and lessons for the design of PES schemes.

1. Introduction

In Ecuador, several payments for environmental services (PES) initiatives have been developed. Unlike in Costa Rica where a central PES implementing authority exists, the Ecuadorian schemes are decentralized. In this article, we define PES as voluntary and conditional transactions over well-defined environmental services (or land uses likely to produce the services) between at least one supplier and one user (Wunder, 2005, p.3). In the following, we analyze the two Ecuadorian experiences that are probably closest to this theoretical concept of PES: first, the five-year old watershed scheme in Pimampiro has become a model for small municipalities protecting their watersheds; secondly, PROFAFOR which for the last 12 years has been establishing carbon-fixing plantations mainly in the highland region.

For this article, in 2005 interviews and community workshops were conducted in Quito, Pimampiro and in the communities of Nueva América, Totorillas, Galte Laime and 5 de Abril. We also took advantage of data gathered in 2002 and 2003 by the first author for a study on the socioeconomic impacts of PES systems, financed by the International Institute for Environment and Development (IIED). In Pimampiro, 11 “suppliers” (service-protecting households that receive the payments) and 36 “buyers” (water consumers in the town of Pimampiro) were interviewed. For PROFAFOR, information was gathered from six community plantation contracts through community-based workshops and household interviews.

2. Services, stakeholders, and implementation

Pimampiro

In 2000, the Municipality of Pimampiro (12,951 inhabitants) launched a payment programme for the protection of the upper watershed delivering their drinking water. The PES system was originally proposed as part of the forest management plan for the corresponding upstream area (see

below). The executing NGO, the Ecological Corporation for the Development of Renewable Resources (CEDERENA, for its name in Spanish) identified several alternatives for forest conservation and sustainable use, including ecotourism, medicinal plant extraction, and PES. Young engineers familiar with Costa Rica's PES system included this latter innovative element (CEDERENA, 2003, pp. 7). Facilitating factors for the successful introduction of PES in Pimampiro were a long drought in 1999, followed by the construction of a canal to increase the water flow. The subsequent remarkable improvement of the drinking water service increased users´ willingness to pay (A.Guerrero, pers.comm. 20 January 2005). Thus the municipality took advantage of this situation, in order to put in place a system designed to regulate water quality and quantity (CEDERENA, 2003, pp. 13-23).

The PES target recipients are the landowners of the Nueva América Cooperative, 27 families with an area of 638 hectares, located 32 km from Pimampiro at between 2,900 and 3,950 masl, in the upper watershed of the Palaurco River. At the end of this sub-watershed, the 60 l/s water flow is piped to feed the Pimampiro urban area. Before the introduction of the PES system, 10% of the forest area had already been used in short-cycle crops and 18% of páramos for cattle grazing, with a clear trend of expansion and ongoing land-use conversion. The families do not live *in situ*, but mainly in lower-altitude, consolidated agricultural areas, and some in the nearby towns of Pimampiro, Ambuquí, and Ibarra. Currently, 19 families with 496 ha (77% of the total area) participate in the PES system (Table 1).

Table 1]

All PES contracts last five years, and are thus up for renewal in 2005. Under the contract, each household receives monthly US$0.5 per hectare of forest or páramo in recovery, and one US$ per hectare of primary forest or undisturbed páramo. This payment is financed with a 20% water-

consumption fee paid by the 1,350 families in Pimampiro that possess a water meter (Figure 1), plus the interests generated by a fund with an initial capital of US$15,000.

[Figure 1]

PROFAFOR

PROFAFOR is an Ecuadorian company acting as an extension of Forest Absorbing Carbon Emission (FACE) consortium, financed by Dutch electricity companies interested in offsetting their carbon emissions. Since 1993, PROFAFOR has signed contracts with private landowners and communities for carbon fixation through reforestation and afforestation, 95% of which (160) are in the Sierra and 5% (8) in the coastal region (Figure 2). At the national level, policy makers saw PROFAFOR as a strong support for national reforestation plans (Albán and Argüello, 2004, pp. 19). Even if PROFAFOR's reforestation eventually remained well behind FACE's original ambitious schedule, the 22,306 hectares planted constituted almost half of the area reforested in all of Ecuador during the 12 years of PROFAFOR´s lifetime. Initially, PROFAFOR used exclusively exotic rapid-growth species such as pine trees and eucalyptus, but since 1999 it also began to experiment with native species. PROFAFOR is expected to fix on average 100 t CO_2/ha over the first 20 years of the plantations, with a range of 3-10 t CO_2/ha/year (FACE 2004). This average is well under the capture potential (180 t CO_2/ha,), mainly for problems related to pests and fires (L.F.Jara, pers.comm., Quito, 20 January 05). The projected total would correspond to 2.23 million t CO_2 for the first 10 years of the plantations. PROFAFOR yearly measures fixed sample parcels and extrapolates to the rest of the contracts. The process is certified by the Swiss company SGS. 70% of the captured carbon is not eligible to the Kyoto protocol framework, as its year of launching is before the one established in the Protocol (Table 1).

[Figure 2]

The trees are planted after a contract between the landowner and PROFAFOR has been signed. Contract duration is between 25 and 99 years, based on the (re)establishment and maintenance of vegetation cover. The landowner receives a single payment of US$100-150 per hectare, 75% of which in the third year when the success of the plantation has been demonstrated, and 25% at the end of the cycle if the contractor agrees to reforest after harvesting. He/she is also entitled to the full proceeds from the sale of the harvested trees at the end of the productive cycle, and from by-products of thinning, felling, etc. during the cycle. This thus represents a PES-subsidized productive asset that eventually serves as an in-kind payment for the environmental service.

2. Implementation and Transaction Costs

Pimampiro

The transaction costs presented in this section relate to the resources needed to design, negotiate, and run a PES scheme. In the launching phase of Pimampiro's PES, three CEDERENA technicians and a municipal representative worked together for one year in the design of the system, a process financed by the Inter-American Foundation. The negotiation process among stakeholders and the legal procedures for the payments took four months. The entire start-up phase cost US$38,000 (Echavarría *et al*., 2002, pp. 32). correspond to US$76 per hectare (Table 2).

[Table 2]

Pimampiro's annual operational PES costs are around US$3603, of which 41% are management and 59% monitoring costs, the latter currently being covered by the general municipal budget (Table 3). The payments and transactions costs in Pimampiro are financed by US$5,200 annually from fees paid by commercial and domestic water users, plus the management support of the municipality (about US$900 per year). When subtracting management and monitoring costs from the fund's endowment, it is decapitalized annually by US$550-600.

[Table 3]

There are four main threats for the financial sustainability of the fund and the PES system:
(i) Resources are not held in a proper trust fund but in a simple savings account, so they could easily be deviated to other ends if political winds in the municipal administration changed.
(ii) Many users in Pimampiro (e.g. unmetered household taps, irrigators) do not pay for their water.
(iii) After the departure of CEDERENA in 2003, it remains uncertain if and how the municipality will finance the monitoring and management costs.
(iv) Strong pressures exist in Nueva América to increase the PES per-hectare rates.

PROFAFOR

During its launching phase, FACE took around two years for the initial country selection, and 12 months in its design and implementation phase. The costs of this process have been estimated in US$4.1 million (L.F.Jara, pers.comm. 20 January 2005; Milne 2001; Albán and Argüello 2003), of which 86% correspond to the costs of project design (contracts, scheme and monitoring design, modifications due to recommendations by the certification agency, and negotiation processes). Attributing these initial costs is difficult, due to the complex interaction among FACE projects worldwide (Milne *et al*. 2000, p. 31). PES operational costs are US$1.3 millions until 2005. In the last years when no payments were made, most costs were administrative (52%). Total costs for PROFAFOR are around US$5.4 million. 75% of this corresponds to launching costs (184 US$/ha), and 25% for operational costs (Table 4). The sustainability of the PROFAFOR system depends also on FACE's capacity to "sell" the bonds to the electricity companies (or eventually on the extra-Kyoto market), since 70% of the contracts were signed before 1999 and are not Kyoto-eligible.

[Table 4]

3. Permanence and leakage

Pimampiro

In principle, both providers' service delivery and water users' payment horizons are infinite, which would favour the permanence of the PES. However, the specific contracts last for five years. This year (2005) will be crucial for PES permanence, since contracts will be renegotiated. The flexibility of renewable contracts allows for adjustments that could benefit the PES scheme, but the municipality will face the challenge to avoid blackmailing by the community: since the PES scheme's introduction, the community knows that drinking-water access is a highly strategic asset.[1] Fund revenues could prove insufficient to cover growing payment demands (see above).

As to leakage effects, there has not been a displacement of environmental impacts to other areas. The families of Nueva América have two main income sources: salaried work in urban construction and agriculture in lower-altitude areas. In principle, the deforestation avoided in Nueva América could be transferred to the properties in the lower area. But, firstly, these areas have already been transformed a long time ago. Secondly, the intake and piping of drinking water is done much higher up, so any modification in the use of lower lands would have no effect on the water service. A potential danger in the same watershed is that the vegetation cover on the left margin is until now not PES covered. This area is more inaccessible and does not seem threatened by conversion, so until now it has not been considered necessary to make payments to these landowners.

PROFAFOR

To assure the permanence of the plantations, in 1999 contract duration was increased from 25 to 99 years, but 95% of all contracts were signed before 1999, and thus last only 25 years. It is difficult to

[1] When negotiations stranded around efforts to establish a similar watershed PES system in the Ecuadorian city of Ambato, the upstream "service providers" there temporarily blocked the drinking water intake, making a military intervention necessary (M. Kosmus, pers.comm., 2 February 2005 .

guarantee that PROFAFOR will be monitoring the contracts for 99 years; thus the communities we interviewed seem not to take this change very seriously. The payments are also now made in the third year of after plantation establishment, contingent upon good survival rates; in a few contracts, payments have even been divided into three parts and are disbursed up to the fifth year. PROFAFOR hopes that the revenues generated by selling the wood at the end of the forest cycle constitute a strong incentive to maintain plantations. In practice, permanence is influenced by long-run socioeconomic changes (e.g., population pressure or prices of timber and agricultural products), though these are hard to predict locally. From the carbon fixation point of view, the longer duration of the contract is a tool for permanence, but its de facto social viability is questionable.

Regarding leakage, the plantations typically crowd out livestock activities in low-productive grasslands. In some cases, people take their livestock to other, previously underutilized areas, or they rent access to grasslands (Albán and Argüello, 2004, pp. 42). One cannot exclude the possibility that the plantations sometimes create a land scarcity that would motivate forest conversion to grasslands in other places, but that does not seem to be the typical case.

4. Conditionality, monitoring and sanctions

Pimampiro

The baseline information, conditionality and monitoring refer exclusively to land use, not to service provision itself. The Palaurco River has an average flow of 60 l/s (CEDERENA, 2002, pp. 16), but the question remains how water services (annual flow, dry season flow, water quality) are affected by potential land-use changes in Nueva América. There has not been a site-specific hydrological analysis of the water retention capacity and runoff rates in natural páramos and forests, compared to the deforested areas. The promotion of natural vegetation cover by PES is largely based on the

precautionary observation that these vegetation types have provided a satisfactory water service in the past, while the hydrological effects of conversion remain widely uncertain. Thus it is also not possible to clearly assert to what extent PES-induced conservation in Nueva América will be sufficient to guarantee water services to Pimampiro in the future.

In principle, the municipality should carry out one monitoring visit every three months, randomly choosing three contracts for thorough land-use inspection. In practice, since the departure of CEDERENA these inspections have been limited by the scarce personnel of the Municipal Environmental Unit (A.Guerrero, pers.comm., 28 January 2005.). This has rendered the monitoring and control system less credible; the community has clearly perceived a decline in monitoring, particularly in remotely located properties (I.Juma, pers.comm. 18 January 2005).

Monitoring results are reported to the Fund Committee, which then decides on possible sanctions. A range of alternatives exists (PES suspension for 1-3 months, permanent exclusion), according to the type of infraction (extracting secondary products without authorisation, selective felling, clear-cutting). Of the 27 families in the community, 23 originally signed the agreement. In the second year of the scheme, nine families were temporarily excluded due to infractions. Currently, five families have been reincorporated, so 19 families are now receiving payments. The system has thus been truly conditional, and participants have learned over time that they need to comply with the rules in order to get paid. The current challenge for the municipality is to maintain a credible monitoring system that sustains conditionality.

It is noteworthy that the PES system functions on top of the pre-existing but ill-enforced Forest Law, which in this high-altitude area prohibits both forest conversion and commercial timber extraction. The payment is thus an additional incentive to obey this law. The Ministry of the Environment is very seldom carrying out inspections or imposing legal sanctions. If the law was

consequently and successfully enforced, obviously the PES scheme would as an incentive become redundant. However, this is not realistic to expect. On the other hand, increased partial enforcement efforts can at the margin stimulate greater PES participation of service providers by decreasing their expected return from the alternative illegal land uses. The Ministry of Environment has recently initiated one legal process against a local family, which has motivated the others more to avoid clear-cutting (A.Guerrero, pers.comm. 28 January 2005).

PROFAFOR

At the aggregate level, the SGS certification scrutinizes the annual carbon uptake of PROFAFOR's plantations. At the plot level, all contracted areas are visited once annually to verify the condition of the plantations and to make management recommendations. The signatory communities and individuals are obliged to carry out active plantation management (e.g., fire control, surveillance, and keeping livestock out). Among these activities, grazing inside the plantations is the most difficult to monitor. In cases of obvious non-compliance, various contracts have been cancelled and modified (L.F.Jara, pers.comm. 20 January 2005). Those early contracts where payment was effectuated directly upon contract signature would not be truly conditioned upon proper maintenance of the plantation (Milne *et al*., 2002, pp. 59); moving payments now to the 3rd year has clearly increased the degree of PES conditionality.

However, supplementary strategies are also necessary to assure service providers' compliance. In the case of individual owners, the contract establishes a mortgage on their lands, which constitutes a strong leverage in contractual terms. The law prohibits mortgages on communal lands, so instead the contract here specifies that if the community does not fulfil its terms, its members will have to pay back the fees received. In practice, PROFAFOR is legally pursuing severe infractions of individual contracts with some success, while it de facto has proved more difficult to monitor and

sanction minor infractions (grazing, inadequate silvicultural management), and it is close to impossible to get defaulting communities to pay back their fees.

5. Additionality

Pimampiro

As explained above, there is no scientific evidence supporting PES-related baselines and additionality in terms of water services proper. In terms of the land uses supposed to produce these services, there is a much stronger case – although no formal baseline exists. Not only has deforestation been stopped; native vegetation cover has increased markedly. Prior to PES (year 2000), 198 ha (31% of the total area) had been converted to cropping and pastures, while currently (year 2005) only 88 ha (14%) are under agricultural use (A.Guerrero, pers.comm., 30 June 2005).

In terms of forest degradation, little forest extraction seems to have occurred, in spite of a road crossing the area; in similar areas in Ecuador such access roads typically generate a two-km strip of deforestation and degradation (Maldonado *et al*., 2003, pp. 21). If neighbouring communities (La Florida, Bellavista, San Antonio) with similar road access are considered as proxy control areas, the additionality of PES also seems probable, since they have extensive and expanding agricultural systems, thus following a very different land-use pattern from that found in Nueva América.

PROFAFOR

The carbon baseline was built based on vegetation and soil criteria on parcels adjacent to those under contract (L. F.Jara, pers.comm. 20 January 2005). Net fixation values are still controversial, due to the impact of reforesting páramos with exotic species. Páramos have a high proportion of volcanic soils with a high capacity of water retention and humus protection, while pines may dry out soils and liberate carbon in the process. The below-ground carbon loss in the young volcanic

soils of the northern highlands could at the extreme be just as high as those amounts captured by above-soil tree growth; in the old soils of the Southern highlands, carbon loss is only 5% of what is gained above ground (Hofstede, 2000, pp. 40-1).

In relation to land use, one can safely affirm PROFAFOR´s additionality not only from plot-level extrapolation, but also by comparing performance to the limited reforestation results elsewhere in the country. However, increased economic incentives, organization and better technical forestry capacity in the communities coud arguably improve plantation management and additionality much further. There may be a good case for supplementary investments on behalf of carbon buyers to facilitate this.

6. The selection of participants

Pimampiro

Considering the services' high spatial specificity – the conservation of the Palaurco watershed – PES selection has focused on Nueva América because it is located near the water intake, over other communities that are located less strategically in the watershed. There have been some requests to expand the PES system to neighbouring La Florida village (Scott *et al*., 2002), but its location is less strategic and so far threat levels there also do not appear high. Apparently no other criteria (e.g. opportunity cost, synergies with other ecological service) have been used to select or screen individual participants.

Property sizes under PES range from one to 93 ha (average: 23 ha), but smallholders dominate: 70.4% hold up to 20 ha (Table 5). Among the eight non-PES participating families, four have less than 10 ha while the other four are in the 10-20 ha range (A.Guerrero, pers.comm., 28 June 2005). One can thus say that the smallest properties are to date slightly under-represented in the scheme.

This occurs mainly because the smallest farmers tend to work their farms more intensively, while those with more acreage have less workforce availability and thus lower per-hectare conservation opportunity costs.

[Table 5]

PROFAFOR

The process of plantation-site selection was carried out until 2000, based on biophysical conditions (e.g., slopes, soils, altitude) and economic criteria (e.g., >50ha per contract, timber species locally marketable, concentration in geographical blocks) (PROFAFOR-FACE 1999:5). In the highlands, the contracts distribute equally among small, medium, and large properties, the last category including communal contracts (Table 6). PROFAFOR has six contracts in the coastal region, a total of 357 ha (PROFAFOR 2002). Since 2000, PROFAFOR defined that, given the transaction costs associated to each contract, the minimum-size contract area should be 50 ha.

[Table 6]

Some differences in payment levels exist both between and within the coastal and Sierra projects. The coastal payments are in the range of 100-160 US$/ha while those in the Sierra receive 70-150 US$/ha (PROFAFOR 2002). Our rough analysis did not show a clear correlation between payment level on the one hand and altitude, area, contract date or type on the other. Payment variability seems determined by the different individual negotiation processes, the parameters behind which are harder to explain. In the highlands, the range may be larger than on the coast due to a higher variability in land opportunity costs (Figure 3).

[Figure 3]

7. Participation of disadvantaged groups

Pimampiro

For participating landowners, PES transfers average US$21 per month, corresponding to 31% of the household expenditure reported by the interviewees in a 2003 survey (Figure 4). It seems probable that this share for most households exceeds their conservation opportunity, resulting in net income gains from PES. The additional income is reported to be used both to cover basic needs (i.e., food, gas, etc.) and as investments in human capital (e.g. school expenses) (Echavarría *et al*., 2003). Some incipient income diversification from conservation-enhanced activities like medicinal plant extraction and ecotourism has also occurred, providing until now occasional employment opportunities as cooks and tour guides.

[Figure 4]

In many PES schemes worldwide, low-income service sellers experienced strengthened community organization as a side-effect from PES participation (Rosa *et al*. 2003; Robertson & Wunder 2005). Was this also the case in Nueva América? The answers seem ambivalent. Some people believe community organization has weakened because cattle ranching, the mainstay of the economy, has been strongly cut back. Others stress that the community has become more entrepreneurial, e.g. applying for project funds for extractive and tourism activities on PES-conserved land.

PROFAFOR

In communal contracts, payments are received only in the third year (labour-compensation fee), in the year of thinning and at the end of the cutting cycle (both wood sales revenues). All three payments are likely to have a significant impact on the generally cash-poor highland communities. Fees make up between 6% and 50% of the benchmark (without-PES) annual household monetary expenditures. Thinning would produce on average higher but also more variable income. In the

best case, it provided US$3357 per household, more that three times the annual expenditure (US$1024) – in the worst case, it would only be 4%. The main economic benefit clearly comes from the sale of wood at the end of the forestry cycle. It is estimated that harvesting benefits would range from levels constituting between 24% and 1285% of household expenditure (average: 561%) (Albán and Argüello 2004). A one-time transfer equalling 5-6 years of monetary expenditure is obviously a huge financial injection. Experiences from other highlands reforestation programmes show that communities selling wood at the end of the cycle typically use the bulk of their proceeds for investment in other assets, both private and communal ones.

In terms of stylizing the wider socioeconomic effects of PES, at the risk of over-simplification we can identify two main groups. The 'successful' cases typically unite consolidated community organisation and a large quantity of land per person, especially abundance of degraded lands with near-zero opportunity costs. These communities have invested in schools, family orchards, machinery (including tractors), infrastructure and creation of micro-credit schemes. The 'not-so-successful cases' typically exhibit organisational weaknesses – at the extreme, communal leaders have run away with the PES funds. They have thus also lacked the capacity to manage the plantation well, so that tree growth has been sub-optimal (Albán and Argüello, 2004, pp. 37).

As for productive diversification indirectly promoted by PES land uses, edible mushrooms could potentially be grown in the plantations, but this has not yet been developed. Training provided to individual landowners and communities has expanded their human capital, but in communities only community leaders have been trained, so at the intra-community level the expansion of skills has remained limited. The impact on 'natural capital' is quite variable. In some cases, negative environmental impacts like reduced water availability and soil acidification have had a negative livelihood effect. In other cases, communities report that the plantations help controlling desertification and restoring degraded lands.

[Table 7]

8. Current situation and next steps

Pimampiro

So far, the municipality has not yet fully informed water users about the PES process: they are paying a surcharge without exactly knowing what it is for. In spite of surveys in 2002 demonstrating that 83% of users were willing to pay for watershed protection (Echavarría et al., 2003, pp. 44), municipal stakeholders fear a political backlash from explaining the exact use of this 'new tax'. A critical success factor for PES is how to confront upcoming contract renegotiations, with the pressure from Nueva América to increase the payment rate. At the same time, monitoring costs need to be internalised into users payments to make the system financially sustainable. PES fund management directly depends on the municipality, since four of five committee members are also members of the municipal council. This situation can become problematic when making difficult fund-related decisions that also have political implications.

Has the PES scheme, or components of it, been replicated elsewhere? The Municipality of Pimampiro has achieved a lot of publicity through the dissemination of the PES experience. It is also participating in the design of different biodiversity-conservation projects elsewhere in Ecuador (A.Guerrero, pers.comm. 28 January 2005). On the other hand, CEDERENA is beginning to replicate this experience in other small Ecuadorian municipalities. For example, in the Municipality of El Chaco, a small payment system is being established with four owners of 50 ha properties.

PROFAFOR

In 2002, PROFAFOR suspended the signing of new contracts and started implementing cuts in administrative costs. Since 1999, Ecuador has had a monetary system based on the United States

dollar, which coupled with continued inflation has increased PROFAFOR´s costs and reduced its international competitiveness. Reforestation of one hectare can today cost around US$1,500 in Ecuador, while in Colombia or Peru it may be only half that price (M.McColm, pers.comm. 12 May 2005). PROFAFOR is thus supplementing its revenues through consultancy works related to reforestation. However, it is also assisting new initiatives of payment for conservation, replicating PES experiences from PROFAFOR (L.F.Jara, pers.comm. 28 June 2005)

9. Conclusions

In this final section, we will look at three overview questions: How were the two PES schemes constructed and what are their summary characteristics (PES design)? How effective are they in delivering the environmental service, vis-à-vis a laissez faire baseline (environmental efficiency)? What are the likely livelihood impacts for PES participants (welfare effects)?

a) PES Design

Both Pimampiro and PROFAFOR are private-sector PES, with consumers of (metered) drinking water and Dutch electricity companies as the buyers of watershed-protection and carbon-sequestration services, respectively. In Pimampiro, the municipality plays an intermediate role of coordinating buyer interests – a special case in the sense that water consumers do not know exactly what they are paying extra for. In addition, some free-riding beneficiaries do not pay, such as any agent benefiting from global climate-change mitigation (for PROFAFOR) and irrigators as well as non-metered drinking water users (for Pimampiro). The original initiative for PES establishment came in Pimampiro from the intermediary (CEDERENA engineers), while in PROFAFOR it came from the buyers. With respect to the payment form, the Pimampiro payments were exclusively made in cash. For PROFAFOR, the labour costs of tree planting were reimbursed in cash, but plantation establishment as the building of a long-term income-generating asset was also subsidized in-kind (e.g. seedling provision) and through some technical assistance (e.g. in situ training).

The sellers of environmental services are individual and communal landholders, mostly farmers on high-altitude lands. Most of these are pasturelands with low returns and thus low opportunity costs. In both cases, implementers had rough ideas about the size of these opportunity costs, but lacked a more precise picture, including about the variability of opportunity costs across sellers. In the PROFAFOR case, monetary payments were calculated based on a compensation of labour, rather than land opportunity costs. Calculating land opportunity costs more explicitly could arguably raise the environmental efficiency of the PES schemes by providing a "greater bang for the buck". For instance, Vogel (2004) proposes for the Pimampiro case to differentiate payments between road-near forest edge areas (high opportunity costs) and remote, core forest areas (low opportunity costs).

Most of PES recipients live in remote scarcely populated areas, and most can be characterized as poor. They were selected by the buyers and their intermediaries for participation based, in the one case, on strategic farmland location and revealed high threats to the environmental service (Pimampiro); in the other based on minimum plot size and a series of biophysical and economic criteria. No side objectives are targeted in the two schemes, neither in terms of welfare goals (e.g. poverty alleviation) nor of lateral environmental services (e.g. biodiversity protection), although to some extent the two PES schemes are likely to unwillingly contribute to these goals. Intermediaries had a key role in getting the schemes off the ground, in terms of a neutral 'honest broker' for Pimampiro (CEDERENA) and an organization representing buyers' interests for PROFAFOR.

How do the two schemes compare to the initial PES definition that we used (Wunder 2005)? Table 8 provides an evaluation of the five criteria. As can be seen, both schemes fit the conceptual framework very well: they are 'real PES schemes', by the standards of that theoretical definition. Participation is clearly voluntary in both cases, though in principle in Pimampiro PES-induced conservation is de jure mandatory through the weakly enforced Forest Law. One could discuss

whether water users' payment is really voluntary if they do not know what they are paying for, but at least they have manifested willingness to pay in a contingent valuation study. In both cases, the environmental service is defined at the plot level through the identification of land uses that are thought (Pimampiro) or approximately known (PROFAFOR) to be compatible with service provision. The watershed service itself is not measured in Pimampiro, while for PROFAFOR carbon sequestration is extrapolated at the aggregate level. As mentioned, the criteria of at least one buyer and one seller are also met. As will be argued in the following, both schemes have had a relatively high degree of conditionality.

[Table 8]

b) Environmental efficiency

Both initiatives can claim to have led to significant environmental progress over their lifetime. To prove that there is significant additionality, one needs to apply a laissez-faire baseline of what would have happened without them. Pimampiro lacks an explicit baseline – both of the service-provision and of the land-use trends. But if it had one, it would certainly show declining natural vegetation cover under laissez faire, based on pre-PES land-use trends in Nueva América, and the continuation of those in most neighbouring villages. The scheme has thus clearly achieved the conservation of forests and páramo, and significant natural restoration of previously converted areas. In PROFAFOR, plot-level explicit baselines are based on adjacent plots. In most cases, the baselines here are not declining but 'flat': in the absence of the programme, no major changes in carbon stocks would locally have occurred. The 22,306 hectares PROFAFOR has planted can thus largely be seen as additional, especially since a range of other reforestation projects in Ecuador have produced so limited results.

Is there a danger that the two schemes just shift targeted environmental pressures in place or time?

Leakage effects certainly do not occur in the highly spatially targeted Pimampiro case; in PROFAFOR it also seems limited to any minor spatial substitution of extensive livestock grazing. Permanence issues differ much between the two schemes, since their temporal scale varies so much: renewable five-year intervals (Pimampiro) versus 25-99 years (PROFAFOR). In Pimampiro, permanence will depend on the renegotiations and on the financial consolidation of the scheme. For PROFAFOR, raising the contract period dramatically from 25 to 99 years was a move designed to increase permanence, but if it has the intended effect remains to be seen. Permanence will depend on strengthened incentives, continued monitoring, and improved technical skills. Previous highland reforestation schemes suggest that landowners do not reforest on their own after the contract expires, so to expect permanence after the contract is little realistic.

Have the two schemes been truly conditional? One basic lessons from this study is that the answer to this question is not a simple dichotomous 'yes or no' – there are degrees of (and changes over time in) conditionality. In Pimampiro, PES-induced conservation has been conditional as long as quarterly monitoring efforts were carried out well. The best proof is that seven households were sanctioned for infractions and temporarily excluded, but some of them have later re-entered the scheme. Recently conditionality has partially declined. The confirmation of conditionality in Pimampiro implicitly assumes that the existing Forest Law is largely defunct, so that households do have free land- and resource-use choices. For PROFAFOR, conditionality is much stronger for individual than for communal contracts, because mortgage over the land provides a strong conditionality for the former group. Moving the monetary payments to the third year has increased conditionality, but this is not always enough to ensure long-term compliance.

c) Welfare effects

In many PES cases worldwide, including some covered in this Special Issue, additional objectives beyond the paid-for environmental services are pursued, such as promoting non-paid environmental services (e.g. biodiversity conservation), enhancing regional development (e.g. by geographically earmarking funds) and especially to alleviate poverty (e.g. making PES recipients better off). This is not the case for our two schemes, which focus essentially on the environmental services proper. We suspect that the fact that focus was not diluted into multiple side-objectives is also one of the reasons why both initiatives have been relatively successful in meeting environmental objectives.

Even if no mechanism exists to positively discriminate smallholder's access to and gains from the PES schemes, that does not mean they did not benefit. The significant share of PES in participating households' monetary expenditure and other interview results make it likely that the majority of these households had non-trivial net income gains, although their individual opportunity cost from PES participation was not explicitly measured. In the PROFAFOR cases, these income gains differed much across sites according to land abundance: communities with large land areas per capita also gained much more income. Beyond of income gains, some secondary gains occurred (e.g. more forest-based non-PES benefits, improved local organization, training received, etc.), but none of these were dominant.

These results indicate that the vast majority of PES participants were made better off, mostly in terms of income. But to what extent did the disadvantaged groups actually gain access to the PES scheme in the first place? In both cases, there were some unintended obstacles that at least for some of the poorest households impeded access. For PROFAFOR, the minimum contract size of 50 ha excluded some individual smallholders; yet this rule was applied only recently and did not thus affect the vast majority of contracts. Nor did it matter for the larger collective contracts of highland communities, which are predominantly poor. In Pimampiro, the smallest landholders also tend to

cultivate their plots more intensively, and thus have higher per-hectare opportunity costs. For some, the offered PES rates were not competitive enough for them to enrol. If one follows the Vogel (2004) suggestion of varying the PES rates according to estimated opportunity costs, this could have the side-effect that more of the smallest landholders will join, since they will receive higher PES offers.

Who were the winners and losers from PES? Beyond of the service suppliers, and arguably the users receiving an improved service, there are also some institutional winners. The municipality of Pimampiro received nation-wide attention due to PES implementation and its promotion; the NGO CEDERENA received funds to start replicating PES in other municipalities. There seem not to be any clear losers, except perhaps those specific communities where PROFAFOR's plantations failed and ended up having some negative livelihood effects.

10. Discussion

What can we learn from these two cases for the broader PES-related conceptual and design questions? We flag four different issues here: the interaction between PES and command-and-control measures, the nature of the externalities underlying PES, the interaction with ICDP tools and the size of PES transaction costs.

First, PES has often been represented as a substitute for command-and-control measures, i.e. "using the carrot instead of the stick". For instance, in Pimampiro PES replaces a defunct forest law and proves to be much more efficient in achieving conservation. Had the law been effectively enforced from the outset, there would have been no need for PES, at least not in environmental-efficiency terms. However, note that the mere threat of even just partial law enforcement reduces opportunity costs of the illegal activity and makes PES-cum-conservation a more attractive alternative. In other words, environmental policy makers may be well advised not to abandon the stick entirely for the

carrot, since the former can provide additional leverage vis-à-vis targeted landowners. The only scenario where the strategy “to pay people to obey the law” can backfire is when some landowners already do comply, thus receiving a perverse incentive to cease doing so. However, this is probably not a dominant risk for the Pimampiro case, nor necessarily for many other cases.

Secondly, PES seems particularly suited for situations of hard, persistent lose-win/ win-lose trade-offs between landowners´ welfare and environmental service provision accruing as an uncompensated positive externality. But cannot these trade-offs be gradually eliminated over time, so that service buyers can stop paying in the future? In our cases, this seems unlikely. Even if PROFAFOR proves to be a profitable investment for poor communities, they are unlikely to reinvest their profits into forestry – experience shows that they will rather wait for the next donor to come along and pay another round of subsidies. Even if ecotourism and medicinal plant extraction continue to grow in Pimampiro, they are unlikely to make forest conservation self-sustained, compared to the cattle ranching alternative. In other words, if the service users want to secure service provision, they will need to continue to pay.

Thirdly, even if trade-offs are genuinely persistent, investments of the Integrated Conservation and Development Project (ICDP) type that accompany PES could raise PES cost efficiency by reducing opportunity costs (thus reducing payment needs) and by improving service provision (increasing additionality). For instance, tourism and extractivism incomes in Pimampiro can help motivating the community more for conservation, and it can also facilitate the difficult negotiation about whether to raise payment rates. Growing mushrooms in PROFAFOR’s plantations can have similar effects. More widespread community forestry training could improve plantation conditions and carbon uptake enough to make an investment worthwhile for the service buyers. Sometimes one could even design these complementary ICDP investments as conditional, thus making them more

directly compatible with PES modalities. The grey zone between ICPS and PES can prove a fertile field for future experiments.

Finally, PES is often seen as a more direct tool, and thus a cheaper conservation measure than in particular ICDPs. Our transaction-cost assessments caution that PES may have high start-up costs, in terms of gathering basic information, designing the tools and negotiating solutions. This is in particular valid when PES is in an infant stage, without pre-existing in-country experiences to look to for "copying" design components. On the other hand, the running costs of monitoring and administration seemed much more manageable. In other words, small municipalities wanting to develop a Pimampiro type watershed PES would hardly be able to auto-finance the start-up costs. There is thus a clear rational for external donors to help in the establishment of PES schemes by subsidizing initial costs.

Acknowledgments

We thank ….anonymous reviewers, Luis Fernando Jara, Claudia Romero and in particular Marta Echavarría for extensive comments. We are also grateful to the Swiss Agency for Development and Cooperation (SDC) for financial support.

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Tables

Table 1

General information about the study cases

	Pimampiro	PROFAFOR
Environmental service (Implicit)	Water quantity and quality	Carbon fixation
Conditioned land-use (Explicit)	Forest and páramo protection	Re- and afforestation
Beginning of project	January 2000	June 1993
External donors	Inter-American Foundation Rural Forestry Programme – FAO	FACE
Implementing organisation	Municipality of Pimampiro CEDERENA (Ecuadorian NGO)	PROFAFOR (Ecuadorian NGO)
Legal mechanism	Contract	Contract
Duration of contract	5 years (renewable)	25 and 99 years
Number of contracts	27 (2000)	170 (1995)
	19 (2005)	152 (2005)
Contract initial extension	638 hectares (2000)	70,000 hectares (1994)
Current area under the mechanism	550 hectares (2005)	22,306 hectares (2005)
Mean contract extension	24 hectares	125 hectares
Beneficiaries / sellers	Nueva América Agricultural and Cattle-Raising Cooperative	102 private landowners and 43 communities in the highlands; 7 private owners on the coast
Buyers and consumption	Pimampiro consumes 12 l/s; 1.350 families with water meters	FACE has 473 (t/ha) of CO_2 fixed
PES decision organisation	Committee of Environmental Services: Mayor and Financial Director of Pimampiro Municipality, Director of UMAT, Representative of CEDERENA	FACE-PROFAFOR
Economic incentive	0.5-1 US $/ha/month	100-200 US$ per hectare once, plus value of harvested wood.

Source: (CEDERENA 2002) (Echavarría et al., 2002) (FACE 2004) (Milne et al. 2000) (Milne 2001) (PROFAFOR 1999), personal interviews.

Table 2

PES start-up costs

	Pimampiro US$	**PROFAFOR US$**
Project design	31,000	3568,000
Baseline	5,000	2000,000
Seller identification	0	323,200
Sellers training workshops	1,800	10,000
Total	37,800	4101,200
Cost per hectare	76.2	183,9

Sources: CEDERENA (2002), Milne (2001), Albán and Argüello (2003), Echavarría et al. (2002), Personal interviews.

Table 3

Pimampiro operational expenses 2000 - 2005 (estimates and projections)

	2001	2002	2003	2004	2005
Management	360	360	360	360	360
Monitoring	504	504	504	504	504
Total operational costs	**864**	**864**	**864**	**864**	**864**

Fund up to 2005	**15.602**	
Operational expenses (anualized)	**3.603**	**6%**
Start-up costs (year 2000)	**37.800**	**65%**
Payments to the families (anualized)	**17.057**	**29%**
Total costs	**58.459**	**100%**

Table 4

PROFAFOR operational expenses 1993-2005 (estimates and projections)

	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Management	40000	40000	40000	40000	40000	40000	40000	40000	40000	40001	40002	40003
Payments	11260	146537	276736	523090	502158	255311	159385	107279	4271			
Monitoring	21600	21600	21600	21600	21600	21600	21600	21600	21600	21600	21600	21600
Certification							15000	15000	15000	15000	15000	15000
Total	**32860**	**168137**	**298336**	**544690**	**523758**	**276911**	**195985**	**143879**	**40871**	**36600**	**36600**	**36600**

Operational expenses	**1.336.501**	**24,6%**
Start-up costs	**4.101.200**	**75,4%**
Total	**5.437.701**	
US$/TON CO_2	**1,35**	

Table 5

Distribution of Nueva América properties under the PES

Hectares	Families under PES	Percentage
1-11	4	8.72%
12-19	5	15.90%
20-21	4	8.01%
22-30	5	27.93%
31-60	4	39.44%
Total	22	100.00%

Source: CEDERENA 2002

Table 6

Distribution of PROFAFOR contracts in the highlands in 2002

Hectares	Number of contracts	Percentage
5-20	37	22.8%
30-90	43	26.5%
100-190	38	23.5%
200-600	44	27.2%
Total	162	100.0%

Source: PROFAFOR Data Base

Table 7

Socioeconomic impacts of PES initiatives

Indicators	Pimampiro [a]	PROFAFOR [b]
PES impact on household income	Equals 30% of family expenditure (minus individual opportunity costs)	-Fee equals 6-50% of family expenditure in the third year - 4% - 328% thinning wood revenues -24% -1285% end-of-cycle wood revenues
Use of additional income	Raising current consumption and investments.	Investments in schools, orchards, machinery, community credit, etc.
Secondary gains from PES-induced land uses	Medicinal plants extraction and ecotourism	Potentially mushrooms (not yet developed)
Human capital	Some training in marketing, guiding, forest management.	Annual training in forest management for community leaders and private owners.
Community organization	The Cooperative applied for financing of new projects from its management plan.	Limited impact
Natural capital	Higher natural vegetation cover and conservation of wild fauna; less pastures and cropland.	- Less pastureland, more tree assets - Reduced water availability and soil acidification, in some areas - Erosion and desertification control, in some areas.

Source: a Echavarria et al. (2003); b Albán and Argüello (2004), own interviews

Table 8: Comparing the initiatives to the PES definition

PES criterion **PES case**	Voluntary transaction?	Well-defined environmental service/ land use?	Minimum one buyer?	Minimum one seller?	Conditional payments?
Pimampiro	**Yes:** But PES adds on weakly enforced legal prohibition	**Yes:** For land use (conservation of natural vegetation) **No:** For watershed protection service	**Yes:** Water users - metered, unknowingly	**Yes:** Main part of Nueva América Cooperative	**Yes:** Conditional on conservation (but monitoring declining)
PROFAFOR	**Yes:** Fully unforced	**Yes (plot level):** For land use (re- and afforestation) **Modelled (aggregate level):** For carbon seques-tration service	**Yes:** Dutch electricity consortium – other carbon buyers	**Yes:** Contracted individual and communal landowners	**Yes:** But in communal contracts less than in individual contracts

Figures

Figure 1

Pimampiro Operational Scheme

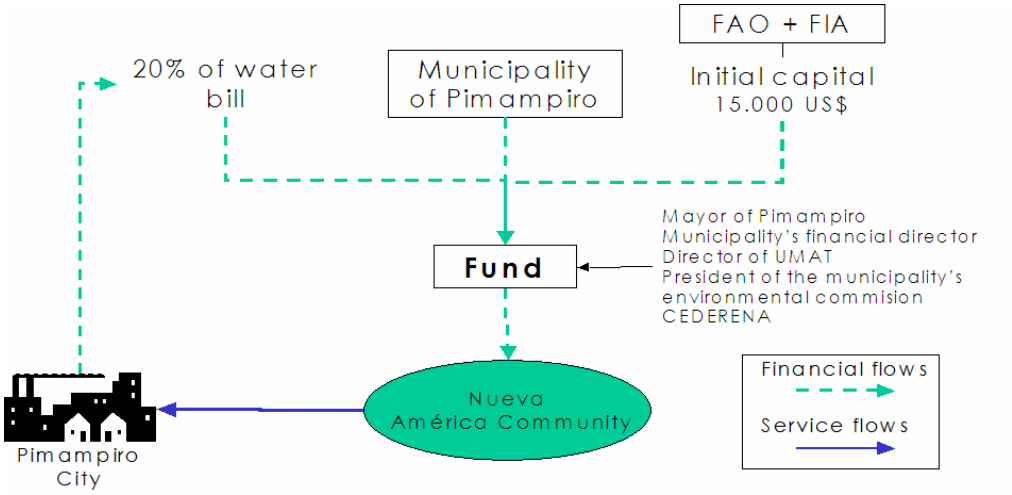

Figure 2

PROFAFOR Operational Scheme

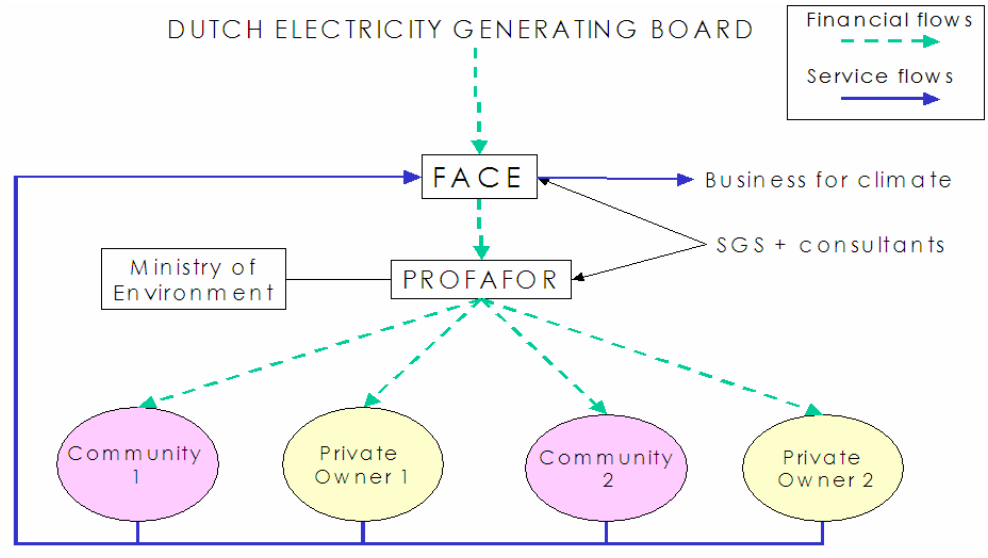

Figure 3

Distribution of per-hectare price in the highlands for PROFAFOR contracts

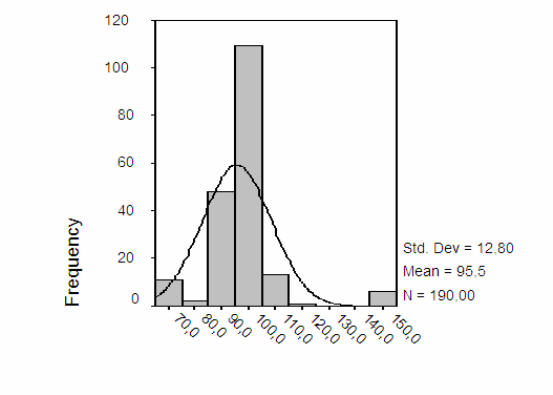

Figure 4

Payment distribution in Nueva América