Payment for Environmental Services at the Local Level:

Comparing two Cases in Ecuador

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1. Introduction

In Ecuador, a series of experiences of payment for environmental services (PES) have been developed. Contrasting from what happens in Costa Rica, where a central PES implementing authority exists, the initiatives in Ecuador are developed in a decentralised fashion. Here we define PES as those voluntary and conditioned transactions of well-defined environmental services between at least one supplier and one user (Wunder, 2005, pp.3). In this article, we analyze the two local experiences that are probably better related to this theoretical concept of PES: PROFAFOR, which has been establishing plantations to fix carbon, mainly in the Sierra for the last 13 years, and the pioneering experience of Pimampiro, which is five years old and has become a model of protection of water resources among small municipalities.

For this article, we took advantage of available data gathered in 2002 and 2003 for a study on the socioeconomic impacts of PES systems, financed by the International Institute for Environment and Development (IIED). In Pimampiro, 11 “suppliers” (families that receive the payments) and 36 “users” (water consumers in the town of Pimampiro) were interview. For PROFAFOR, information

was gathered from six community plantation contracts through; community-based workshops and family-level interviews. Such data was updated and supplemented in a selective way, new data was gathered on the implementation and administration costs of the projects, and interviews were conducted with Aurelio Guerrero, Head of the Environmental and Tourism Unit of the Municipality of Pimampiro; Luis Fernando Jara, Manager of Profafor; Nueva América Community, Pimampiro, Imbabura province; Totorillas Community, province of Chimborazo; Galte Laime Community, province of Chimborazo, and 5 de Abril Community, province of Pichincha, in January 2005.

2. Services, stakeholders, and implementation

Pimampiro

In 2000, the Municipality of Pimampiro (12.951 inhabitants) launched a payment programme for the protection of their drinking-water service. The PES system grew from their forest management plan. The executing NGO, the Ecological Corporation for the Development of Renewable Resources (CEDERENA for its name in Spanish) identified several alternatives for the conservation and sustainable use of the forest, including ecotourism, medicinal plants, and PES. Young engineers acquainted with Costa Rica's PES system included this latter element, introducing significant modifications that constitute a clear innovation (CEDERENA, 2003, pp. 7). A facilitating factor for the implementation of PES in Pimampiro was the long period of drought during 1999 and the construction of a canal to increase the flow of water. The following remarkable improvement of the drinking water service increased the willingness-to-pay by the users (A. Guerrero, pers. comm.). Such circumstance was explored by the municipality to establish the payment system, in order to maintain the regulation of the water's quality and quantity (CEDERENA, 2003, pp. 13-23).

The community that receives the PES is made up log the owners of Andean forests, páramos, short-cycle crops, and grasses of the Asociación Nueva America, located 32 km from Pimampiro between

2.900 and 3.950 masl. In the upper watershed of the Palaurco river stands the intake of drinking water that lose to 60 l/s and feeds the urban centre of the municipality. 27 families, with an area of 638 hectares, compose the upstream population. The landscape looks disturbed. Before the introduction of the payment system to the association, 10% of the forest area had been used in short-cycle crops and 18% of páramos in grasses for cattle. The families do not live *in situ* but in lower areas such as the towns of Pimampiro, Ambuquí, and Ibarra. Nowadays, 19 families (70%) with 496 persons (77%) participate in the PES system (Table 1).

[Table 1]

The contracts last five years and they are expected to be updated in 2005. Each family with a contract receives 0,5 US$ per hectare of forest or páramo in recovery and 1 US$ per hectare of primary forest or undisturbed páramo per month. This payment is financed with the interests generated by a fund with an initial capital of 15.000 US$ and 20% of the water consumption fee by the 1.350 families that possess a water meter in Pimampiro (Figure 1).

[Figure 1]

The payment difference is based in the supposition that primary forests and páramos mean a better water protection than areas under recovery. Unfortunately, each supposition has not been confirmed by hand data.

PROFAFOR

PROFAFOR is an Ecuadorian company acting as the elongated arm of the FACE foundation, which is financed by Dutch electric companies interested in making up for their carbon emissions. Starting in 1993, PROFAFOR has signed contracts with private owners and local communities for tree plantation and subsequent carbon fixation (Figure 2); of these, 160 contracts are in the sierra and

eight on the Coast region. At a national level, PROFAFOR was seen as a good support for the national reforestation plans (Albán and Argüello, 2004, pp. 19). PROFAFOR has reforested 22.306 hectares, corresponding to 31% of the total reforestation planned by FACE. Initially, it used single exotic rapid-growth species such as pine trees and eucalyptus; starting from 1999, it began to introduce some native species. FACE (2004) reports that Profafor has a fixation average of 100 t CO2/ha, at a rate of 3 to 10 t CO2/ha/year, estimated for the first 20 years of life of the plantations. The average is well under the capture potential (180 t CO2/ha,), mainly for problems related to pests and fires (L.F. Jara, pers. comm., Quito). The total amounts to 2'230.602 t CO2 for the first 10 years of the plantations. PROFAFOR measures the service every year through fixed sample parcels extrapolated to the rest of the contracts. The process is certified by the Swiss company SGS, but the captured carbon is not eligible to the Kyoto protocol framework as its year of launching is before the established in the Protocol (Table 1).

[Figure 2]

The trees are planted after the signature of a contract between the landowner and PROFAFOR, with a duration of 25 or 99 years, based on the (re)establishment and maintenance of the vegetation cover. The landowner receives a single payment of 100-150 US $ per hectare, 75% of it on the third year, when the success of the plantation has been demonstrated, and 25% at the end of the cycle if the contractor is interested in reforesting after the harvesting. He/she is also entitled to the product of the sale of the harvest at the end of the productive cycle (and of the by-products of thinning, felling, etc., during the cycle), which represents an in-kind payment for the environmental service.

2. Implementation and Administration Costs

Pimampiro

The transaction costs presented in this section are related to the effort, time, and necessary resources to negotiate, begin and (possibly) reach a PES agreement. In the launching phase, three CEDERENA technicians and a representative of the Municipality worked together. The design of the system took one year (it was financed by the Inter-American Foundation) and both the negotiation process among stakeholders and the implementation of the payments were carried out in 4 months. In this phase, 38.000 US$ were invested (Echavarría *et al*., 2002, pp. 32), which represents 76 US $ per hectare (Table 2).

[Table 2]

On the other hand, the annual PES administration costs fall around US$ 10.871, of which 39% are covered by the users' payment for the service, and 61% that are the monitoring and administration costs, which are covered by the general budget of the municipality. Table 3 shows the annual flow of the fund, where the sources of the fund can be seen.

[Table 3]

The payment mechanism in Pimampiro is financed by 5.200 US$ per year from contributions of both commercial and domestic water users, plus the returns of the capital seed (550-600 US $ per year). To this the support of the municipality must be added, which amounts approximately to 6.600 US $ per year. According to the current level of expense, the fund is capitalised annually with between 1.000 and 1.500 US $ and 74% of it is invested in payments to the families.

There are four threats for the financial sustainability of the fund:

(i) Today the resources are not incorporated in a trust fund but in a saving account, and they could easily be deviated to other ends due to the municipal control on the decision-making organ of the fund.

(ii) There is not a good collection system for the water billing of Pimampiro.

(iii) After the departure of CEDERENA, it is uncertain if the Municipality will assume the monitoring and management costs, and from what sources it would finance it.

(iv) Strong pressures exist in Nueva América to increase the PES amounts.

PROFAFOR

During its launching phase, PROFAFOR took around two years in the initial country selection, and 12 months in the design and implementation phase (L.F. Jara, pers. comm.). This whole process could be estimated in ca. 4'101.200 US $ (L.F. Jara, pers. comm.) (Milne 2001) (Albán and Argüello 2003), of which 86% are the design costs of the project (contracts, design of the outline, design of the monitoring, modification recommendations by the certification agency, negotiation processes). The accounting of these initial costs are difficult to define as expressed by Milne et al (2000) due to the interaction that exists among all FACE projects. The PES operation costs are of US$ 1'7 millions, and the major items represent up to 68% according to the year, but in the last years, when no payments have been done, the largest item corresponds to administrative costs (52%).

The total costs for Profafor are around 5'843.103 US $ for a 25-year period. It is distributed as follows: 70% for the launching costs and 30% for operational costs expenses. The costs for hectare arrive at 184US$/ha (Table 4).

[Table 4]

The sustainability of the PROFAFOR system is tied to the capacity of FACE to “sell” the bonds in the secondary market, since 70% of the contracts were signed before 1999.

3. Permanence and leakage

Pimampiro

Both the service and the payments horizon to water users are infinite, something that would favour the permanence of the service. However, in the case of Pimampiro, the contracts last five years and they must be renegotiated after each period. This year (2005) will be crucial to evaluate their permanence since new contracts will be negotiated with new rates (as suggested by the community). The flexibility of this mechanism allows adjustments and changes that would benefit the scheme, but the municipality will face the challenge to avoid blackmailing by the community. Complications could also arise if the fund revenues prove to be insufficient to cover the PES (see above). In this scheme, the establishment of a trust fund could be thought as a means to assure that the resources will be dedicated to community payments. Now, the funds are in a saving account, the use of which can easily be altered.

In Pimampiro, a displacement of environmental impacts to other areas has not been witnessed. The families of Nueva América have two main work sources: in the cities, they work in the construction sector; in the lower areas, they do agricultural work in parcels. In principle, the deforestation avoided in Nueva América could move down to the properties in the lower area, but, firstly, these have already been transformed for a long time. Secondly, the intake of drinking water is done in an area that lies well above these alternative lands, so any modification in the use of these lands would not have any effect on the water service. A potential danger in the same watershed is that the vegetation cover is not protected on the left margin, but to these days, this margin does not seem to be threatened neither affected by the implementation of PES processes in the right margin.

PROFAFOR

In the case of PROFAFOR, to assure the permanence of the plantations, the number of years of the contracts were increased from 25 to 99 years, but 95% of the contracts are of 25 years. It is difficult to guarantee that Profafor will be monitoring the contracts in 99 years; therefore, the communities interviewed seem not to care much about this requirement. The payments are also carried out on the third year of the establishment of the plantation, when there is a good rate of survival. PROFAFOR hopes that the revenues generated by selling the wood at the end of the forest cycle are a strong incentive to maintain the plantation. In practice, the permanence can also be influenced by social and economic changes of the community such as population pressure and prices of traditional products, among others; but it is difficult to predict the situation of one multi-generation period. From the point of view carbon fixation, the duration of the contract is a tool for the permanency; however, from the social point of view, its viability is questionable.

Regarding leakage, in PROFAFOR it has been possible to verify that, in some cases, the limitation to manage livestock in the reforested areas has typically motivated the families to take their livestock to other areas already transformed, meeting with the correspondent costs of renting grasslands (Albán and Argüello, 2004, pp. 42). The possibility cannot be excluded that, in some cases, the plantations would cause deforestation for grasslands in other places, but that does not seem to be the typical case. On the other hand, in terms of reduction of methane emissions related to cattle raising (another important greenhouse-effect source), it seems probable that the shepherding activities will move since there are no initiatives related to the increase of the carrying capacity.

4. Conditionality, Monitoring and sanctions

Pimampiro

In Pimampiro, the monitoring and base line schemes include only land use, not the service itself, i.e. the quantity or quality of water. If the Palaurco River has a flow of 60 l/s (CEDERENA, 2002, pp. 16), the question remains about how much of this flow is associated with the type of land use in the forests of Nueva América. There has neither been a hydrological analysis of the water retention capacity and running rates of the soil in the páramos and forests, nor of the consequences of allowing the persistence of deforestation. Therefore, it is not possible to assert that the PES-related activities carried out in Nueva América are sufficient to guarantee the water flow to Pimampiro in the future.

Ideally, the Municipality should carry out a visit every three months and choose three contracts at random to thoroughly evaluate the land use. These visits, in the case of Pimampiro, are limited by the current scarcity of personnel and low budget of the Municipal Environmental Unit (A. Guerrero, pers. comm.). These limitations render the monitoring and control system not very credible. The community has perceived that the monitoring has de-intensified since the departure of CEDERENA (I. Juma, pers. comm.), something that reduces the monitoring probability in each contract.

After carrying out the evaluation of the contracts, a report is sent to the Fund committee, which decides on the sanctions. A range of alternatives exists (suspension of one month, three months, total elimination of the scheme) according to the impacts (taking out secondary products without authorisation, selective felling, total felling). Of the 27 families in the community, 23 signed the agreement and 19 are currently receiving payments. According to the sanctions, two families could be soon included in the fund. In the second year of payments, there was a considerable quantity of sanctions (nine families) and their return to the fund in latter years seems to be a positive sign of the operation of the scheme. The participants have complied with the incentive rules, and the challenge

for the municipality now is to maintain a credible monitoring system that would condition the families to continue with the agreements.

An additional aspect that has been assumed by the community is the obligatory nature imposed by the Forest Law to avoid land use changes (of forests to grasses or crops). It is understood then that the payment is an additional incentive to obey this law. In this sense, the support of the Ministry of the Environment in the carrying out of inspections and legal sanction processes is very important in order to reinforce the communities' commitment. A case of legal sanctions by the Ministry from the Environment has already happened to a family, which has motivated other families to avoid total felling practices (A. Guerrero, pers. comm.).

In Pimampiro, the scheme is conditional. The conditionality in Pimampiro is given by the quarterly payment the community receives and by the monitoring and sanction system. The sellers, when signing the contract, are subject to a system where there is a forest law that is being enforced, and they are also subject to penalties at the Fund level. Therefore, if they want to improve the situation they choose the option of entering negotiation processes to increase the payment.

PROFAFOR

At an aggregated level, PROFAFOR has a system (certified by SGS) to demonstrate the success of the plantations and their level of annual growth. At an individual level, the contracts are visited every year, the condition of the plantation is evaluated, and recommendations are generated for its handling. The signatory communities and families are obliged to carry out management activities in the plantation such as fire control, surveillance, and livestock husbandry (outside the plantation). These activities are evaluated annually by Profafor, but in some cases grazing is the most difficult to monitor. There are clear evidences that, in the case of non-execution (such as burns or lack of

planting), measures are taken. Up to date, there have been contacts cancelled and reformulated (L.F. Jara, pers. comm.). For PROFAFOR the payments done in the day of signature of the contracts do not condition the maintenance of the plantation, because these payments are not carried out during the thinning or felling periods (Milne et al., 2002, pp. 59). The down payment is a strong incentive for the decision of participating in the mechanism, but since there are no later payments, the management of the plantation is neglected, something that affects the level of carbon fixation and the future revenues of the community. As mentioned, changing the payment to the third year of the contract is an effort to improve the conditionality of the mechanism, but other additional strategies are needed.

In the case of the private owners, the contract forces them to establish a mortgage on their lands, which constitutes a strong condition in contractual terms. For communities, the conditionality is different since the law prohibits the establishment of mortgages on community lands. For this case, the conditionality of the execution is established in the contract, where it is specified that if the community does not fulfil the terms of the contract, they will have to return the incentive received. The payment of the incentive at the third year of plantation also constitutes part of the purpose of maintaining the incentives.

5. Additionality

Pimampiro

Scientific evidence does not exist on the additionality of water of the PES, i.e., that with the execution of the payment a benefit has been generated in terms of water flow or quality. In terms of land use, it is possible to demonstrate that the native forest cover in the area has been maintained in 87% of the total cover. In terms of degradation, a vehicle road crosses the forest but corresponding affectations have not been noticed to the sides of the road. In similar areas in Ecuador, it has been

demonstrated that such an access road generates vegetation changes in a 2-km axis (Maldonado et al., 2003, pp. 21). The analysis of changes in the productive structure of the association is still limited for only 10 families have diversified their income sources with additional activities linked to the forest such as medicinal plants and ecotourism.

In the municipality of Pimampiro, 13,3% of the territory has a non-conservation land use, such as the cattle raising and intensive agriculture. If neighbouring communities (La Florida, Bellavista, San Antonio) are considered as control areas, the additionality seems probable, since there these communities have traditionally extensive agriculture systems that follow a very different pattern from that found in Nueva América, in spite of having the same type of accessibility.

PROFAFOR

In the case of PROFAFOR, the base line was built based on the land in parcels contiguous to the contract areas (L.F. Jara, pers. comm.), where vegetation, understorey and soils measurements are done to be included in the carbon model (see above). There is a controversy on the net capture value due to the impact of exotic species such as pine trees in the páramos. Páramos have a high proportion of volcanic soils that show a great capacity of water retention and decomposing humus protection, and the pine tends to dry the soil and to liberate carbon in the process (Hofstede, 2000, pp. 51).

In relation to land use, it is possible to conclude that there is additionality in the PROFAFOR reforestation projects since there have been limited results in other experiences in Ecuador compared to those achieved by PROFAFOR. According to the discussion in the previous section, the conditionality on the community contracts is limited; therefore, to be able to get an additionality

of the mechanism it is indispensable to think in improving the capability in the communities so that they can strengthen their forest practices and receive high revenues for the sale of the wood.

6. Participants' selection

Pimampiro

Considering the special specificity of the service - the conservation of Palaurco watershed- the selection has favoured the families that are near the water intake, to the detriment of other owners in the basin that PES considered less strategic. The Municipality has received some petitions to expand the system of payments to La Florida (Scott et al., 2002), but apparently this community does not feel any bitterness due to its exclusion from PES processes (President of community of La Florida, pers. comm.). Any other approach has not been applied to favour participation (opportunity cost, threats, or relationship level with the service).

A differentiation exists in the payment according to the type of vegetation cover: 1US $ for the primary forests and páramos, and 0,5 US $for the secondary forests and disturbed páramos. This is based on the belief that the water service is larger in undisturbed soils.

There are properties between 1 and 93 hectares, with an average of 23 hectares, but with a concentration of small properties (70,4% have up to 20 hectares) (Table 5). According to interviews with Aurelio Guerrero (Head of the Environmental and Ecotourism Unit) and participants of the community of Nueva América, the families that have left the fund are those with smaller extensions. The properties that have around 5 hectares receive 3 US $ monthly. However, the participants with more acreage have smaller workforce availability, and thus their opportunity costs per hectare are lower. The users of the service could do without a small percentage (5-10% of the

lands to be protected) without harming the water functions. In Pimampiro, this differentiation does not increase the transaction or the administrative costs.

[Table 5]

PROFAFOR

The process of plantation selection that was carried out until 2000 was anchored in biophysical (slopes, soil condition, forest aptitude, altitude) and economic (> 50ha per contract, local marketable species, concentration in geographical blocks) approaches (PROFAFOR-FACE, 1999, pp. 5). In the Sierra, the contracts are distributed equitably among small, medium, and large extensions, the last ones including contracts with communities (Table 6). In the Costa, PROFAFOR has six contracts with proprietors that possess between 20 and 125 hectares, with a total of 357 hectares (PROFAFOR, 2002). Starting in 2000, PROFAFOR defined that 50 hectares was the required minimum to sign a contract due to the associated transaction costs.

[Table 6]

Besides, a differentiation exists in the payment between Costa and Sierra projects. The Costa ones receive between 100 and 160 US $ per hectare while those in the Sierra get between 70 and 150 US $ per hectare (PROFAFOR 2002), probably because the opportunity costs of the land are lower in the Sierra's higher locations. Inside the mountain, different payment levels also exist (Figure 3) that correspond to negotiation processes. It is evident that the variation of payments does not bear any relationship with altitude, area of the contract, dates or contract type.

[Figure 3]

7. Participation of disadvantaged groups

Pimampiro

According to our surveys carried out in 2003, the additional family income is significant and is used both for basic necessities (food, gas, etc.) and as investments in human capital (education expenses). The economic impact of the payment to these families averages 21 US $ per month, corresponding to 31% of the family expense reported by the interviewees (Echavarría et al., 2003, pp. 46).

Although a wide conservation culture does not exist, the affluence of tourists (that has been growing in the last years due to the forest) has increased the interest to participate in this activity. Working groups have been created this way for shift-based cooking and guiding.

Finally, regarding the strengthening of the community of Nueva América, the families answer contradictorily. On one hand, there are people that think that the community organisation has weakened since cattle activities, its main reason of existence, are not considered. However, it is necessary to recognise that there has been a diversification of income sources via tourism and the production of medicinal herbs.

PROFAFOR

According to surveys related to community contracts, the payment appears to have a significant impact (50% of the family expense reported by the interviewees) only in the third year of contract implementation, in the year of thinning 4% (of the family expenses) for the worst cases and 328% for the best cases and at the end of the cycle 24% for the worst cases and 1285% for the best cases (Albán and Argüello, 2004).

In terms of wider socioeconomic effects, the PROFAFOR cases show variation depending on the level of organisation of the communities. In a simplified way, two groups can be identified. First, a group of recipients with much consolidated organisations, with a large quantity of land for person, and much disturbed lands, with a near zero opportunity cost. The most successful cases have bought lands for schools, family orchards, tools, community credit, infrastructure, funds for micro credits or purchase of tractors. On the other hand, not-so-successful cases exist. For example, due to an organisational weakness, the leaders have vanished taking with them the incentive, the community lacks the capacity to manage the plantation, the trees do not grow appropriately, and the environmental impacts are negative (both through the decrease of water sources of water and through processes of soil acidification) (Albán and Argüello, 2004, pp. 37).

As for secondary activities, the production of edible mushrooms has been identified, but there is no experience developed. The training to the owners and communities is limited (once per year and to the leaders) and does not allow the development of community skills. There are decisive data on the environmental impacts, but 50% of the plantations are above 3.500 masl and cause problems on the fragile páramo soil (Table 7).

[Table 7]

8. Current situation and next steps

Pimampiro

The Municipality of Pimampiro has not yet told the population of the city about the PES process. They fear that they will be against it, in spite of the surveys carried out in 2002, where the disposition to pay for the conservation of water sources was 83% (Echavarría et al., 2003, pp. 44). A prime factor at this time is to confront the renegotiation of the contracts and the pressure from the association to increase the payment rate. At the same time, there is pressure to internalise the

monitoring costs in the users' payments in order to offer sustainability to the system or to formalise the municipal investment. The financial management of the scheme very directly depends on the municipality for four of the five fund committee members belong to the municipal council. This can be a problem when making important fund-related decisions such as the increase of the collection rate, the enlargement of the scheme, etc.

The Municipality of Pimampiro has achieved a lot of publicity through the diffusion of their experience of the payment for the conservation of forests; it is participating in the design of diverse projects of biodiversity conservation (A. Guerrero, pers. comm.).

On the other hand, CEDERENA is replicating this experience in other small Ecuadorian municipalities. For example, in the Municipality of El Chaco a payment system is being established with four owners of 50-ha properties.

PROFAFOR

PROFAFOR suspended the signing of new contracts in 2000 and began a process administration costs decrease. Ecuador has since 1999 a monetary system based on the United States dollar, which has increased the implementation costs of the plantation. A hectare reforested in Ecuador can cost 1.500 US$ nowadays, while in Colombia or Peru it can cost half of that price (M. McColm, pers. comm.). However, Profafor is trying to expand its activities through other financing sources, participating in the design of new carbon-fixation projects (Encofor) and also working in projects that incorporate other environmental services such as water protection, for which it is using the same structure already implemented.

Among the challenges of Profafor is the use of native species for the plantations since there is strong concern about the impact of exotic species on the soil of fragile areas.

9. Conclusions

Is the environmental service conserved?

- The cases analysed indicate that the two projects contribute to the conservation and regeneration of forests and páramos. The PES in Pimampiro produces additionality for the maintenance of forests and páramos (around 400 hectares), contrary to the situation presented in other communities where a slow change in the productive structure is foreshadowed. In Profafor, the additionality is presented in the change in land use of 22.000 hectares, considering moreover that other reforestation projects in Ecuador have had limited results.
- To be able to establish the additionality in Pimampiro from a hydrological point of view, it is necessary to study the relationship between the service and the different land uses. Vogel (2004) furthermore proposes differentiated payment schemes between forest borders and centres that respond to different opportunity costs. As for the experience of Profafor, it could be proposed that training and the conditionality systems are key aspects to increase the projects' additionality.
- It would seem that the two PES are developed in places with a lesser dependence on intensive land use or on agricultural activities, and hence their effectiveness. The question now is if in higher demographic pressure zones the PES are as effective or not.
- In the case of Pimampiro, the system it is still weak, and any interference in the collection levels or in the increment of management costs would render it financially unfeasible. Small municipalities are still incapable to develop these schemes by themselves; hence, external

donors have a potential to help in the establishment of a PES process through subsidies during the start-up costs.

- In the two cases, there are no explicit mechanisms to assure the benefits beyond the duration of the schemes, nor a mechanism to assure the no-transferral of environmental damages. However, in Pimampiro it is possible to conclude that there are no pressures on other areas because the migrants go to cities and not to other rural areas. In Profafor there is a displacement of economic activities to other areas (e.g. grazing).
- In Pimampiro a third party motivated the initiative; the role played by CEDERENA was crucial, while in Profafor the initiative was motivated by the buyers. The consortium of six Dutch thermoelectric companies was fundamental to gather the funds and to set up the scheme.
- The PES promote the conservation of one service (water protection or carbon fixation) and the users are who pay for the service (consumers of drinking water and a consortium of Dutch thermoelectric companies). Regrettably, the PES do not incorporate all the users of the environmental service, such as irrigation water users and other global interested parties for the service of carbon fixation.
- None of the two cases has additional objectives beyond the conservation of the environmental service, and the execution of the contracts is a function of the land use.
- Pimampiro is a conditional system because the quarterly payment allows land users to consider in each cycle the alternatives besides there are monitoring systems and sanctions that works in spite of the risk imposed by the limitations of the Municipality. For Profafor this conclusion is not very categorical. The structure of the incentive does not allow its conditionality. The down payment is a strong incentive for the decision of participating in the mechanism, but since there are no subsequent payments, the handling of the plantation is neglected, which is something that affects the carbon fixation level and the future revenues

for the community. In the case of private landowners, the mortgage is a strong tool of conditionality but for the communities this is not applicable.

- Opportunity cost studies have not yet been incorporated for the establishment of the payment. In Pimampiro, the possibility of collection of the Municipality prevailed while in Profafor the payment was carried out in function of the labour and material costs for the implementation of the plantations. The opportunity cost of the land is expected to be covered by the revenues of selling of the wood.
- In Pimampiro, the differentiation system is related to the protection of the environmental service, and the proximity to the water intake is the priority. This differentiation does not seem to affect the constancy or leakage. Families that do not participate are those who own smaller extensions. However, this payment structure does support the additionality of the mechanism to motivate the conservation of primary forests. In Profafor, the differentiation is given in principle by the region (coastal vs. sierra); a question exists about if working in the mountain area is privileged even when it has a smaller level of carbon fixation than the coast.
- In Pimampiro, this differentiation does not increase transaction or administrative costs. In Profafor, the differentiation is thought up to reduce the administrative costs of contract monitoring.

Has poverty been reduced?

- In many PES cases, additional reasons beyond the conservation of environmental services are pursued, especially the reduction of poverty and the conservation of biodiversity. This does not apply for these two cases, which focus essentially on their own services. In Pimampiro, the involuntary bias to benefit the families that possess more hectares (that are usually not the poorest), has not been corrected for poverty is not an explicit aspect of the scheme. PROFAFOR is also focused in cost-efficiency parameters.

- In none of the cases, a mechanism exists to introduce small landowners into the scheme. In Pimampiro there is no risk that it would become a subsidy, because conservation objectives are being achieved, while in Profafor, control and surveillance mechanisms force the fulfilment of environmental objectives.
- The main current challenges in Pimampiro are the financial sustainability of the programme, the maintenance of municipal political support, the increase of support by the environmental authority via enforcing the forest law, and the limitation of the division of the land, a new heritage-related trend. Profafor requires the implementation of social approaches in the selection of the cases and the improvement of community training.
- The alternative to an acreage-based system of payments is to apply it equally to all the members of the community. In the case of Pimampiro, it would represent a family payment of 192 US $ per year or 16 US $ per month. This implies a payment of two extra dollars per month above the mean and it is possible to conjecture that at least five families would be harmed in between 14 and 31 US $ per month, which represents 156 hectares.
- The losers in the PROFAFOR PES are the communities whose natural capital is affected by the plantation; they have to assume additional costs for cattle grazing.
- There are two clear winners in the Pimampiro PES: the municipality, which has received a lot of attention due to the implementation of the scheme, and the NGO (CEDERENA), which has also received funds to replicate the experience in other municipalities; there are also families that receive more than 30% of their monthly expense. In Profafor, FACE, at the moment of trading the bonds, will have interesting gain margins since a ton of CO2 costs 1,5 cents (US$) and it is possible to trade 3 or more in the secondary carbon market.

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Table

Table 1

General information of the cases of study

	Pimampiro	PROFAFOR
Implicit environmental service	Watershed protection	Carbon fixation
Explicit environmental service	Forest and paramo protection	Reforestation
Beginning of project	January 2000	June 1993
Donating Organisation	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	70.000 hectares
Current area under the mechanism	549 hectares (according to Yaguache n/d) 496 hectares (according to Guerrero, pers. comm.)	22.306 hectares
Mean contract extension	23,6 hectares	125 hectares
Beneficiaries / sellers	Asociación Agrícola y Ganadera Nueva América (Agricultural and Cattle-Raising Association)	102 private landowners and 43 communities in the Sierra 7 private owners in the Ecuadorian coast
Buyers	Pimampiro consumes 12 l/s and there are 1.350 families with water metres	FACE has 473 (t/ha) of CO2 fixed
PES decision organisation	Committee of Environmental Services: Mayor of the Municipality, Financial Director of the Municipality, Director of the UMAT, Representative of CEDERENA	FACE-PROFAFOR and the organisation signatory of the contract
Economic incentive	0,5-1 US $ per month per hectare	100-200 US $for hectare during 25 or 99 years

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

Table 2

Structure of implementation costs of the PES

	Pimampiro US$	**Profafor US$**
Project design	31.000	3.568.000
Line base	5.000	2000.000
Sellers search		323.200
Training workshops to the sellers	1.800	10.000
Total	37.800	4.101.200
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 (estimates) (2000 - 2010)

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Earnings	**15000**	**12325**	**11029**	**12039**	**12099**	**12163**	**12229**	**12298**	**12371**	**12447**	**12526**
Initial capital	15000										
20% of water bill		5200	3833	4791	4791	4791	4791	4791	4791	4791	4791
Interest of initial capital		525	543	562	682	602	624	645	668	691	716
Interest of former period			53	85	126	169	214	262	312	364	419
Municipality support		6600	6600	6600	6600	6600	6600	6600	6600	6600	6600
Expenses		10819	10099	10871	10871	10871	10871	10871	10871	10871	10871
Management		1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Payments		4219	3499	4271	4271	4271	4271	4271	4271	4271	4271
Monitoring		4800	4800	4800	4800	4800	4800	4800	4800	4800	4800
Total	**15000**	**1506**	**930**	**1168**	**1228**	**1292**	**1358**	**1427**	**1500**	**1576**	**1655**
NPV	21055										
Running costs	60102										
Start-up costs	37800										
Total costs	97902										

Table 4

PROFAFOR operational expenses (estimates) (1993-2018)

	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Management	11260	146537	276736	523090	502158	255311	159385	107279	4271
Direct payments	21600	21600	21600	21600	21600	21600	21600	21600	21600
Monitoring							15000	15000	15000
Certification	40000	40000	40000	40000	40000	40000	40000	40000	40000
Total	**72860**	**208137**	**338336**	**584690**	**563758**	**316911**	**235985**	**183879**	**80871**
Running costs (present value)	1741903								
Start-up costs	4101200								
Total costs	5843103								
Tons per hectare	180								
Total Tons for 25 years	4015080								
US$/Ton CO_2	1,46								

Table 5

Distribution of Nueva América properties

Hectares	Families	Percentage
1-10	6	22,2%
11-20	13	48,1%
21-30	2	7,4%
31-40	2	7,4%
41-50	0	0,0%
51-60	3	11,1%
+60	1	3,7%
Total	27	100,0%

Source: CEDERENA 2002

Table 6

Distribution of PROFAFOR contracts in the Sierra

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: Base de datos PROFAFOR 2002

Table 7

Social impacts of the projects

Approaches	Pimampiro [a]	PROFAFOR [b]
Impact on family expense	30% of family expense	50% of family expense at the third year, in the year of thinning 4% - 328% and at the end of the cycle 24% - 1285% .
Impact on financial assets - means of production	Purchase of agricultural tools.	Successful cases: lands for schools, family orchards, tools, community credit.
Secondary activities	Medicinal plants and ecotourism.	Production of mushrooms not yet developed.
Transmission of new knowledge	Some families participate in training workshops in commercialisation, guiding, species management.	Training in forest management for community leaders and private owners, once a year.
Strengthening of	The association has applied for	Limited impact on the organisation.

community organisation	financing of new projects from its management plan.	
Impact on natural resources	Positive impacts on vegetation cover and conservation of wild fauna.	50% of the plantations are above 3.500 masl causing problems on the soil of the páramo ecosystem. Wind barriers.

Source: a Echavarria et al. (2003); b Albán and Argüello (2004) Interviews (2005)

Figures

Figure 1

Pimampiro Operation Scheme

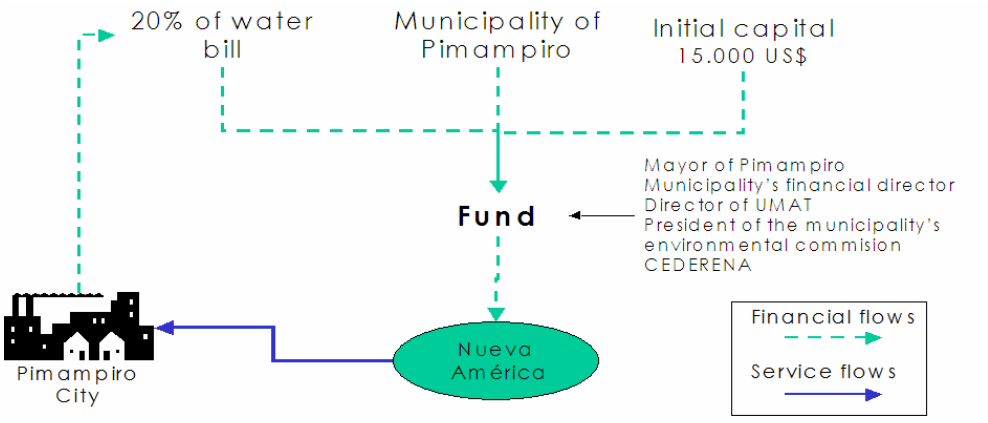

Figure 2

PROFAFOR Operation Scheme

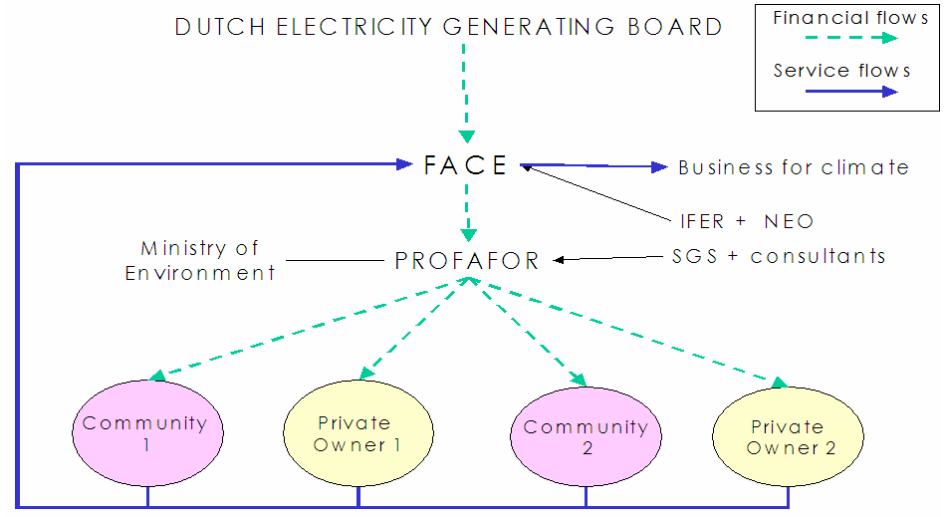

Figure 3

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