

Bolivia- Los Negros

Compensation for Hydrological Environmental Services in Los Negros Cloud Forest

SUMMARY

NGO-led initiative, underway since 2002. Protection of a buffer zone around Amboró National park (community of Santa Rosa), through in-kind payments (beehives, barbed wire, fruit trees) to landowners, subsidized by donor funds. Once water quantity benefits of the scheme become apparent, it is expected that the downstream community of Los Negros will start to trust the upstream community, and will be motivated to contribute to the scheme. This initiative aims at the combined provision of watershed and biodiversity services.

MATURITY OF THE INITIATIVE

Ongoing since 2002. One-hundred-twenty beehives have been distributed and over 1,100 hectares of forest placed under protection (out of a total watershed area of 25,000 hectares).

DRIVER

Fundacion Natura Bolivia (Natura) organises and promotes the initiative. Downstream land values (one hectare with water = \$7,000, without water \$500, for similar location and soil characteristics) and agricultural production (the main activity) are highly dependent on the availability of water, especially in the dry season (one hectare of farmland can provide a net return of up to US\$100 per hectare per annum without irrigation and US\$400 per hectare per annum with irrigation (Vargas, 2004). Over the past 10 years water levels have fallen in both rainy and dry seasons (Vargas, 2004) and in the early 1990s this even led to Los Negros residents blocking the roads to Santa Rosa and demanding no more colonists enter the area to deforest the headwaters. The downstream community was accusing the upstream community (be they inhabitants of Santa Rosa or landless farmers migrating to the area) of diverting more water for irrigation and increasing cloud forest clearance for agricultural expansion.

STAKEHOLDERS

Supply

Private landowners in the town of Santa Rosa de Lima (upstream) - adjacent to the Amboró National Park. So far 1,100 hectares of forest are protected (2004, first year: six farmers = 500 hectares, with an average of 10 hectares each, but ranging from 3 to 390 hectares; 2005: seven more farmers = additional 600 hectares). The main objective of Natura is to protect 2,500 hectares of forest under the compensation system, and 500 hectares as community water conservation reserves (one 60-hectare area is already nearly established in Sivingal). Farmers choose which parts of the land to set aside and contracts are renewable annually.

Demand

International NGO: In addition to funding provided by international and local NGOs, water users in the town of Los Negros in the Municipality of Pampagrande (downstream) contribute through the payment of the previously mentioned tariff instated in 2007. However, they are not currently paying for the watershed services. For domestic use, water is extracted directly from the river in Los Negros and at various other downstream villages. Irrigation systems draw off their water through eight canals in or just upriver of Los Negros. The idea behind this scheme subsidised by Natura is to raise landowners' levels of trust, both upstream and downstream, hence leading to more active participation in the future as reflected in the current tariff.

By mid 2006, the Municipality of Pampagrande and downstream water users were expected to be contributing 60 per cent of the cost of annual payments (including all

transaction costs); for the period 2005/2006 the target was 30 per cent. In 2004, the municipality had already contributed \$US2,000. It should be noted that most of the farmers in Los Negros view increased water supplies as their most important service need. According to Natura (2004) farmers perceive that water supplies have fallen by over 50 per cent in the last two years as a consequence of deforestation upstream. If this is so, a 50 per cent reduction in two years suggests either serious climate change effects, or water being diverted to other uses. The inhabitants of Los Negros believe the cause of falling water levels lies upstream: the people of Santa Rosa were "diverting too much water for irrigation and clearing the forests that were vital to river protection" (Robertson and Wunder, 2005).

Intermediary

Local NGO (Natura): The NGO is planning to expand to other environmental services and to other watersheds in Sivingal (where Natura has already implemented a community water conservation reserve), Palmasola and Agua Clarita. It hopes to benefit 2,600 inhabitants of the Florida provinces, one of the poorest departments in Santa Cruz.

Facilitators

Funds are donated by the US Fish and Wildlife Service to establish a Payment for Environmental Services (PES) system to protect both bird habitat and the watershed functions.

MARKET DESIGN

Service

Enhancement of water quantity and reduced sedimentation through conservation of cloud forests. The main threats to forests include slash and burn agriculture, permanent agriculture and cattle grazing.

Commodity

Conservation and protection of existing ecosystems through forest conservation contracts - prevention of deforestation in cloud forest.

Payment mechanism

Intermediary-based transaction (NGO). Los Negros farmers give one artificial beehive per year to each Santa Rosa landowner who agrees to set aside 10 hectares of primary forest for conservation. In addition to the provision of bee hives, other in-kind payments such as fruit trees and barbed wire (to reinforce land tenure) are present in the scheme. The strength of the link with downstream users is weak in practice. The system is voluntary.

Terms of payment

To providers: *In-kind:* Natura has drawn up an agreement between the downstream and upstream farmers for the protection of upstream forests. At present, values associated with various commodities have evolved and expanded. All values are derived from yearly payments per hectare and are specified as such: US\$3 for cloud forest and grassland without intervention, US\$2.25 for moist forest and old growth forest subject to temporary cattle grazing, US\$1.50 for old growth subject to permanent cattle grazing and secondary forest. The current agreement is valued at US\$3 per hectare payable in beehives (the actual incentive is one beehive and training in apiculture per 10 hectares of cloud forest protected). So far, 120 bee boxes have been distributed as well as training on how to use them. One of the perceived benefits of these arrangements is a stronger claim on land (see social benefits below).

According to Robertson and Wunder (2005), support for an in-kind payment instead of cash came from the community environmental committees and from some farmers themselves, with the view that 'if people receive a cash payment, they will probably spend it quickly. What we want Natura to do is help us develop something that can give us some lasting benefits.' Others would have preferred a more flexible in-kind or even cash payments, as the beehives also require personal investment in order to harvest the

"payment." Interestingly, some local recipients predicted they would sell the next hives to those in the village specializing in bees, thus creating a secondary market to exchange beehives for cash within the village.

From users: One-off payments - so far the majority of the funding comes as one-off grants from international donors. The Municipality of Pampagrande has contributed with US\$2,000 in 2004 and negotiations for the 2005 municipal contribution are already underway.

Funds involved

Payments are currently being subsidised by *donor funds*: Natura's funding partners for the initiative are Conservation International (legal issues), the Conservation, Food and Health Organization (FAO) and Yale University (economic study and analyses), and the US Government's Fish and Wildlife Service, the Garfield Foundation and the *Grupo Nacional de Trabajo Participativo* a Bolivian NGO funded by the UK Department For International Development (DFID). In the near future, downstream users (the community of Los Negros) are expected to finance the project if this initial stage can sufficiently illustrate the benefits of the system in terms of avoided losses in agricultural production. To ensure financial sustainability of the initiative at the local level, since 2007 an ordinance introduced a tariff for hydrological service (nine per cent increase for water use) from water users. These contributions are administered as part of a water fund which will also receive contributions from Natura and the Pampagrande Municipal Government for a 10-year period. Collected funds are used for upstream conservation.

ANALYSIS OF COSTS AND BENEFITS

Economic

Transaction costs: include costs of negotiations, and monitoring. These costs, alongside training, are about 10 times higher than the cost of the visible payment (the beehive, approximately US\$35).

Opportunity costs for the participant farmers: The level of compensation is below the average return to agricultural land in the area. It is therefore likely that the participating farmers are choosing areas that they are not planning to convert anyway. *Present livelihood options*: Main activities in the Santa Rosa area include slash-and-burn agriculture, cattle and agriculture. Bees are expected to provide additional sources of livelihood for the families. At the same time, the land use restrictions in the areas under PES could reduce opportunities for farm labourers. *Communities involved*: Upstream community of Santa Rosa with 481 inhabitants (only 13 so far receive payments), and downstream inhabitants in Los Negros (2,970). In 2004, the average annual income for a farmer in Santa Rosa was approximately US\$1,024. Los Negros was more prosperous with an average annual income of US\$1,459.20 per household (Vargas, 2004).

Financial benefits for the participant providers: (note: local wage rate is about US\$64 per month) according to Natura's estimate based on local market prices for honey, each farmer could make an income of US\$100 per bee box, per year (about 40 kilograms per box per year) (Vargas, 2005). However, according to Robertson and Wunder (2005), since most of the honey is consumed domestically as a subsistence product, the actual value of the benefit is probably lower than this estimate based on market price. After deducting start-up costs borne by Natura (training) and labour input from the participant, the actual PES payment would mean that "skillful and lucky beekeepers could make a PES return of US\$12.66 per hectare, but the less fortunate ones would have negative returns, i.e. returns for labour would fall short of the local wage rate. This calculation underlines the lack of competitiveness of the PES scheme, and it helps to explain why some PES recipients want to exchange their beehives for cash...those recipients who are not skillful beekeepers may, in extreme cases, be losing money because they could potentially allocate their labour to more remunerative activities."

Costs for the participant users: An initial Willingness to Pay (WTP) survey revealed that 70 per cent of downstream farmers were willing to pay something, and on average, roughly two per cent of household income, or a total of US\$12,487-\$19,728. Anderson (2005) suggests that the discrepancy arises either through dishonest responses or from an inefficient collection system.

Higher compensation might be obtained if downstream farmers were to pay into the system, but this has not yet happened. (However differences in the price of land with and without irrigation indicate the importance of water services: one hectare of non-irrigated land is worth about \$500 while a similar hectare with a reliable water supply could be worth more than \$6,000). This may change given the implementation of the three per cent tariff.

Environmental

Effectiveness of the PES in delivering the environmental service: Upstream deforestation of cloud forest is perceived to contribute to lower water levels of the river, especially in dry season and this has been the base of the hydrological component of the scheme. A quick hydrological study in the area does not seem to support this perception (see Le Tellier et al., 2009), which seems to be in line with results from other countries. For example, Monteverde and Costa Rica have demonstrated that additional water input from fog deposition is smaller than initially thought (see Bruinjzeel, 2005 for details). However, cloud forests are highly endangered and their protection provides significant benefits for biodiversity, landscape beauty (with potential for tourism activities) and improved water quality.

- i) In this area, about 1.5 hectares of forest (either primary or secondary, depending on the availability) is cleared annually by each family (Vargas, 2004); therefore, *preventing forest conversion* is one of the key environmental benefits expected from this PES. However, since farmers could choose which lands to set aside, and given the level of the compensation being offered (approximately 2–10 per cent of the opportunity costs for setting aside agricultural land), it is likely that the areas enrolled in the PES were those with less potential for agriculture (areas on steep slopes) and therefore at less risk of being cleared (*lack of additionality*).
- ii) It is also possible that, enrolling forest land in the PES leads farmers to change the location of production to forest land areas elsewhere on the property (on-farm leakage) or on open access forest land higher up (leakage).
- iii) *Indirect environmental benefits:* Diverting labour and time to bee keeping reduces the chances of farmers converting forest elsewhere; strengthening of perceived property rights avoids invasion from squatters, who would be more likely to actually convert the land.

Le Tellier et al. (2009) write: "We developed a low cost research program to assess the forest cover-stream flow relationship in the Los Negros watershed in eastern Bolivia. We asked three questions: (1) can watersheds that are similar enough to undertake paired catchment studies be identified using only simple parameters such as size, aspect and geographic proximity; (2) can a functioning locally based hydrological monitoring system be set up for less than \$10,000 by training local farmers to collect hydrological data, and (3) can such data be used to improve the functioning of a Payment for Watershed Services (PWS) initiative? A land-use map of the upper Los Negros valley was created from a 2005 Landsat image and a digital elevation model used to calculate physical and hydrological properties of 10 sub-watersheds. Farmers measured stream flow rates in these sub-watersheds from 2005 to 2008 and maintained 10 automatic rain gauges. **We found no relationship between forest cover and stream flow.** This may indicate that no such

relationship exists, but could also reflect the short period of the study, the low quality of the data, and the fact that the sub-watersheds had relatively similar forest coverage (54–76 per cent). We conclude that (1) watersheds can be identified as “similar-enough-for-analysis” using the criteria of size, aspect and proximity without undertaking further research, (2) a useful hydrological monitoring system can be developed for less than \$10,000 and (3) although our local farmers did not collect sufficiently high quality data to fully explore the forest/water relationship in Los Negros, with improvements in methodologies, low cost, locally based monitoring has the potential to be an important component of future PWS initiatives. We recommend that stream discharge should be calculated directly; only the most locally relevant hydrological criteria, rather than scientifically complete criteria, should be monitored; locally based monitoring must be institutionalized to reduce staff turnover and hydrological monitoring must be embedded within a context that makes it socially acceptable.”

Social

Property rights: Currently there are no clear property rights (especially regarding specific property borders) and possession is usually demonstrated by clearing (see Legislation Issues below). Although enrolment in the PES does not legalise property rights, the fact that the land is part of the scheme strengthens the idea that the land is being used even if not in a visible way (i.e. not cleared and farmed) and is owned by someone, which may help defend the land against squatters. The use of barbed wire as in-kind benefit helps farmers. In fact, participants have suggested changing the PES payment from beehives to barbed wire and other assistance in delimiting their forestland, so that they can better enforce their tenure rights. In this way, the PES actually becomes a very good incentive to participate in the scheme as it clarifies the ownership of the land.

Social infrastructure. The project provides a very useful example of experimentation and learning-by-doing. It has been successful in bringing together farmers in the upstream area to address problems that were previously acknowledged but not acted upon. Also, it has brought upstream and downstream farmers into dialogue, where “only resentment and bitterness existed” (Robertson and Wunder, 2005). Natura has helped set up the *Comite de Medio Ambiente* (Environmental Committee) formed by upstream/downstream communities to deal with water pollution, changes in water flows and sedimentation.

LEGISLATION ISSUES

Opening up the dialogue at a national level. The project takes place at a time of increasing interest in PES-type initiatives in Bolivia (Vargas, personal communication). The lack of legal property rights upstream is part of the problem. There are no valid property ownership deeds for the primary forest, giving the impression that it is “up for grabs” (Anderson, 2005). Perceptions of land ownership vary from “gentleman’s agreement” to open land access. In some areas the only way to demonstrate possession is by clearing and converting land. According to Anderson (2005), participating in the PES may be giving farmers the impression that it officially legalizes their ownership of the land (Natura’s land-conservation contracts explicitly identify boundaries and owners) and confusing people with papers that look official but are not, and may be causing an atmosphere of panic.

MONITORING

Currently, compliance monitoring is addressed via property inspection with GIS (Asquith et al., 2008) present a good description of the methodology used to draw contracts and monitor compliance.

Initial approach to monitoring: Although a monitoring system is under development, at the time of writing there had been no violations documented or sanctions applied (e.g. beehives to be returned to Natura). According to Robertson and Wunder (2005), Natura considers that fully enforcing that rule would have very high political costs, and therefore choose to simply not prolong the contract with the respective participant. In the authors’ opinion, this “softened management practice may be a realistic approach in this potentially conflictive setting.” However, it may create a situation where “any forest owner, even those firmly planning to deforest their land during the contract year, would want to enrol in

the system to receive the first-year beehive(s), which would thus become a public relations oriented welcome gift for subscribing to the system, rather than a truly contingent reward" (Robertson and Wunder, 2005).

MAIN CONSTRAINTS

- i) *Perception of the term "payment"* which is associated with privatisation and expropriation. Natura changed the term "payment" to "improved management of hydrological resources," but it seems this has resulted in further confusion, underscoring the importance of secure property rights and trust between participants.
- ii) *Lack of understanding of the PES's objectives:* having it confused with a first step towards general land use regulation, a potential means to expand the already contentious Amboró Park boundary or to begin charging for water (and there is a deep-rooted aversion to paying for irrigation water which is currently free; also organisational capacity among the irrigator groups is weak and unwilling).
- iii) *Lack of trust in the usefulness of the PES:* scepticism about the forest –water connection.
- iv) *Lack of engagement from the users,* in the first round of payments (2003), potentially due to a wait-and-see attitude because they suspected Natura would be able to find PES seed money from elsewhere — which actually occurred.
- v) *Lack of users' trust in the compliance of providers:* the Negreños expressed mistrust that the Santaroseños would hold up their part of the deal. As potential future buyers of PES, the Negreños wanted a demonstration that the Santa Rosa providers would indeed deliver before they handed over the money.
- vi) *Property rights issues, raised by the PES:* landless *campesinos* upstream consider handing over payments to those who are already better off to be unfair. Obviously these farmers have an interest in keeping land for open access and efforts to reduce open access are bound to create conflict, since, as Robertson and Wunder (2005) note, "under the present context of an open forest frontier with landless settlers seeking a homestead, one should remember that any conservation initiative trying to effectively reduce open access to the land and slow down deforestation is most likely going to have a catalytic effect increasing social tensions."

MAIN POLICY LESSONS

The aim of the initiative is to build up the necessary organisations and institutions for well-functioning payments for environmental services schemes. "The creation and effective enforcement of community reserves will help prove to downstream water users that upstream forest protection is possible, that with appropriate funding Santa Rosa and Sivingal it can guarantee the water supplies to Los Negros, and that any investments that Los Negros makes in water protection would be secure." "Using short-term donor funds, the farmers are thus demonstrating to downstream users—the potential long-term supporters—that upstream watershed protection is feasible and trustworthy—as long as appropriate incentives are provided" (Vargas, M. T., 2005). However:

- i) All costs relating to the initiative are being borne by the intermediary using international donor funding. Sustainability will be an issue when the payments for land use are no longer subsidised by donor funds, if users are not yet contributing to the scheme.
- ii) The aforementioned lack of commitment from downstream farmers might be a result of a discrepancy in objectives. They are more interested in increasing

water quantity (rather than just quality) and they realize that additional irrigation upstream might be the problem rather than deforestation. This perception is backed by hydrological studies elsewhere that show that the additional contribution of cloud forests through fog deposition is small. On the other hand, Natura is pursuing a more holistic conservation of the many values of cloud forests. However, in this case, trying to justify the efforts in terms of water quantity will not suffice.

- iii) In this way, the project could benefit from: **a)** A hydrological study that clarifies the potential watershed benefits and how much they are worth in order to convince downstream farmers to pay up (if the benefits are indeed significant). This is already under development, with the support of Center for International Forestry Research (CIFOR). **b)** Targeting key areas and making payments proportional to their relative importance will increase the efficacy of the payment. **c)** Anderson (2005) suggests that cash might be the best compensation for foregone income to protect their land. **d)** As noted by Robertson and Wunder (2005), it is important to try to "effectively sanction non-compliance without losing too much hard-won local goodwill," otherwise the scheme may lose its effectiveness.

CONTACT

Maria Teresa Vargas, fundacion Natura-Bolivia: mteresavargas@naturabolivia.org.

REFERENCES

- Anderson, K. 2005. Payments for Environmental Services: A Review of the Literature and Nine Case Studies in Bolivia. La Paz, Bolivia, Bolivian Human Development Index UNDP. Cuaderno de Trabajo. <http://idh.pnud.bo/webPortal/Portals/2/F3%20Payments%20for%20Environmental%20Services.pdf>.
- Asquith, N., Vargas, M.T., 2007. Fair deals for watershed services in Bolivia, Natural Resource Issues International Institute for Environment and Development.
- Asquith, N., Vargas, M.T., Wunder, S., 2008. Selling two environmental services: In-kind payments for bird habitat and watershed protection in Los Negros, Bolivia Ecological Economics 65, 675-684.
- IIED internal reports.
- IIED. 2005. Fair deals for watershed services: learning from new attempts to develop pro-poor payments for watershed services. Draft Discussion Paper. International Institute for Environment and Development, London.
- Le Tellier, V., Carrasco, A., Asquith, N., 2009. Attempts to determine the effects of forest cover on stream flow by direct hydrological measurements in Los Negros, Bolivia. Forest Ecology and Management 258, 1881-1888.
- Natura. 2004. Compensación por Servicios Ambientales Hídricos en la Cuenca del Río Los Negros. <http://naturabolivia.org/Informacion/prospecto%20los%20Negros%20pagina%201.pdf>.
- Robertson, N. and Wunder S. 2005. Fresh Tracks in the Forest Assessing Incipient Payments for Environmental Services Initiatives in Bolivia. Bogor, Indonesia, CIFOR.
- Vargas, M.T. 2004. Evaluating the economic basis for payments for watershed services around Amboró National Park, Bolivia. M.A. Thesis, Yale School of Forestry, USA. (cited in Robertson, N. and Wunder S. 2005).
- Vargas, M. T. 2005. Personal communication: updates from Los Negros.



Wunder, S. 2005. Payments for environmental services: Some nuts and bolts. No. 42 Bogor, Indonesia, CIFOR Center for International Forestry Research. CIFOR Occasional Paper. http://www.cifor.cgiar.org/publications/pdf_files/OccPapers/OP-42.pdf.

Wunder, S., 2007. The efficiency of payments for environmental services in tropical conservation. *Conservation Biology* 21, 48–58.

LINKS

Natura Bolivia website: <http://www.naturabolivia.org/index1.htm>;
<http://www.naturabolivia.org/proyecto.htm>

On Rapid Hydrological Analysis: <http://www.naturabolivia.org/Informacion/Proy4.pdf>