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Payments for Environmental Services: An Alternative for Sustainable Rural Development?

The Case of a National Park in the Central Highlands of Mexico

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The Nevado de Toluca National Park, Mexico, performs important support, regulation, natural production, and cultural functions. Today these functions are severely endangered by the use of the Park's natural resources by people living within and near the National Park. Do payments for environmental services (PES), including schemes for carbon sequestration, offer alternatives that enhance livelihood options for local people and at the same time conserve the multiple

functions of the protected area? This question was the basis of an assessment that elaborated the pros and cons of PES, with a special focus on the constraints of entering global carbon markets—the proposition emerging from today's increasingly globalized world. We compare the potential benefits of PES against the market value of forest resources for the local population. Alternative schemes, which do not necessarily involve monetary valuation, are proposed.



A National Park under pressure

The Nevado de Toluca National Park (NTNP) was established in 1936, with the aim of preserving a 51,000-ha area surrounding the Xinantécatl, or Nevado de Toluca volcano, the 4th highest mountain in Mexico (4600 m). The snow-covered peak surrounded by temperate forests (Figure 1) is part of the natural heritage of Central Mexico and performs important environmental functions, including the capture of atmospheric carbon (C) and regulation of the regional hydrological cycle and climate of the Valley of Toluca (population: 2 million). The volcano—once a sacred site for pre-Hispanic cultures—is now a symbol of cultural identity for the people of the State of Mexico. The piedmont is characterized by hills covered by broadleaved forests. The slopes of the mountain massif have large extensions covered by conifers. Alpine grasslands dominate the higher areas. These plant communities are an important reserve of endemic species of local and regional importance.

Despite its crucial significance, the Park faces complex problems. Since its establishment, more than half of the original tree biomass has been lost. The population of the communities inside the Park and in the surroundings (around 81,000) carry out agricultural and livestock activities requiring larger areas. Illegal wood, firewood and soil extraction (for gardening) has increased. Under these conditions, forest depletion is rapid, not only as the result of deforestation but also through density loss and the growing number of pests and diseases.

PES in protected areas: some critical reflections

The idea of payments for environmental services (PES) was recently proposed by the Technical Advisory Commission for the Ecological Recovery of the NTNP, in order to promote the preservation of the Park's natural resources among the local population and guarantee that the protected area continues to supply environmental services such as carbon sequestration and hydrological regulation.

Our in-depth analysis of the appropriateness of PES for the NTNP revealed that the concept of PES has some inherent contradictions. The PES approach conceives of the environment as a discrete group of services to which an economic value can be allocated, in an ambiguous situation in which supply and demand rarely share the same geographical space. Environmental services do not have a market that allows free competition and price fixing; buyers do not have options and the seller is constrained to a limited group of institutions; moreover, information

FIGURE 1 The Nevado de Toluca volcano (4600 m). (Photo by Angel Endara-Agramont)



FIGURE 2 Rainfed agriculture is carried out on steep slopes with marginal soils. (Photo by Rafael Calderón-Contreras)



FIGURE 3 Sheep grazing is one of the main sources of cash income. (Photo by Carlos González-Esquivel)



between buyers and sellers is imperfect and it is not always clear what is being bought or sold. In this context, the value that is often allocated does not necessarily reflect the real value of benefits received.

In the specific case of protected areas, an important issue is to define *who* should receive the payments. If environmental services come from public domain goods, as in the case of national parks, subject to protection laws, is it appropriate to pay people for complying with the law? Our conclusion is that it is probably better to define payment of services supplied by the local population for the protection of common goods, rather than PES. In this sense, contributing to local development by paying natural resource conservation and protection services implies more equity in terms of remuneration, since what is being paid for is not the right of use of a private good, but the work done by people for the preservation of a common good.

Payments for carbon sequestration: a potential?

The establishment of a carbon sequestration payment program in Mexico is very recent. In the first call for projects by the National Forestry Commission in 2004, 14 projects were presented in the State of

Mexico (although none in the NTNP), of which only 3 were approved, corresponding to 8000 ha (about 1% of the total forest area), and a payment of around US\$ 78,500 (or US\$ 11 per ha). Payments were based on the national estimates for biomass formation, equivalent to 0.5 tons of C/ha/year for temperate forests.

In our recent research project, the potential for carbon sequestration in the Park was estimated by means of geographical information systems (GIS) and field measurements. Forest cover in the period of 1972–2000 was analyzed. Even though total forest area has remained similar, large areas of pine-dominated forest have lost density, becoming semi-dense or fragmented forests. Density in fir and broadleaved forests has remained stable. This reflects the preference of the local population for certain forest species. Over 13,000 ha have suffered some degree of perturbation in the period studied, although half of this area shows some signs of recovery in forest density. The Park is subject to an overall annual deforestation rate of 0.5%. According to the results of our research, the forest areas of the Park contained an estimated 4 million tons of C in 2000. Most of these areas have C contents below 50 tons/ha, which is considered low. Net C losses were estimated at 260,000 tons in the studied period.

Using the above-mentioned data, 3 scenarios were then designed for the 2000–2010 period, and economic benefits from participating in the global C markets were calculated for the annual increase in this period. Under the current scenario of partial losses and recoveries, pine forest cover will continue to decrease, which represents a total loss of 650,000 tons of C, or over US\$ 13 million. In the optimistic scenario, in which depletion of dense forest is halted and recovery of semi-dense forest is promoted, around 400,000 tons could be captured, which would represent an income of nearly US\$ 8.5 million. Under the pessimistic scenario, losses could increase to 1 million tons.

Current national forest regulations do not allow for payments of more than one environmental service at a time on a single plot, although forest cover can con-

tribute to hydrological regulation and, at the same time, to capturing carbon and maintaining biodiversity. The current scheme thus actually discourages conservation of natural resources.

Farmers' rationale for land use decisions

Agriculture is partially allowed in the Park (Figure 2). But according to local farmers, yields have dramatically decreased in the last decade due to low soil fertility, and there are signs of climate change in the form of reduced rainfall. Frequently, frosts and a delayed rainy season cause partial or total crop losses for many farmers, forcing them to buy staple foods outside the communities. In this situation, it is necessary to compare the potential amount of PES that farmers in the Park could receive with the market value of goods obtained from the forest. For example, a single pine tree can be sold for around US\$ 90.

Locally adapted alternative schemes

Thus the potential of current PES mechanisms to stop resource depletion in the Park is seriously limited. Alternative schemes should be adapted to local conditions, and, in the case of the NTNP, must be based on:

- A change of the Park's legal framework, which would derive from a management plan where conservation and buffer areas are clearly defined, establishing rights of access to common goods by the local population (Figure 3).
- Detailed assessments of the carrying capacity of forest resources, which would allow an estimation of the amount of wood and non-timber products that can be harvested by the local population. It is also urgent to control fires, pests, and diseases.

- Appropriate information for the local and regional population about the concept of PES, and how payments could be used to bring social benefits to the communities.
- Involvement of the regional population. It seems more appropriate to link resource users with the direct beneficiaries of the NTNP's environmental services (mainly the population of the Toluca valley), rather than with populations in developed countries who want to become "carbon neutral" but are not willing to change their lifestyles and have no relation with the regional context. Local taxes could be directed to pay the Park's inhabitants to help preserve common goods, as stated earlier, and according to their livelihood needs, rather than assigning uncertain economic values to each service.

There have been recent reforestation campaigns initiated by a private company and local owners, open to public participation, which have allowed recovery of contact between the urban population and the Park. At current prices, global carbon markets are not attractive, and the involvement of the regional population in payment schemes could create greater awareness about the importance of the Park in the regulation of regional cycles.

Apart from being based on the alternative schemes proposed, PES should be complementary to other policies such as subsidies to agro-ecological and soil conservation practices, or the development of products with regional labels. Concerted action between State, municipal, and local authorities is urgently needed. Unless payments are substantially increased and local inhabitants are appropriately informed, there is little chance for global initiatives to be successfully adopted.

"Many years ago the climate was more regular. If there was no snow on the peaks we knew that rain would come in time, otherwise, there would be drought, and so we prepared for sowing; Nature would always tell us. Not anymore, and droughts are now very severe... this year we had almost no rain." (Felipe Ramírez, an elderly farmer)

"We'd rather cut a tree and sell it than suffer from hunger.... We know that logging is illegal, but we have no other income options, and the salaries in nearby cities are not high enough to meet our needs." (Rey Escobar, member of the Dilatada Sur community [3200 m])

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