Payment for Environmental Services – an approach to enhancing water storage capacity

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Payment for environmental services (PES) is an emerging paradigm in the management of environmental resources. Rather than governments relying on regulatory instruments such as prohibitions and standards, PES relies on adopting innovative mechanisms that are tied to incentives, and are flexible, voluntary, and contextualise the socioeconomic reality. The basic rationale of PES is to provide incentives and benefits for people agreeing to utilise ecosystems in ways that protect or enhance their environmental services for the benefit of the wider population. In other words, people are rewarded for providing environmental services on the basis of negotiated contracts. The incentive-based mechanisms stimulated by PES help primarily to realign private and social costs and benefits by accounting for externalities. In economic language this 'corrects market failure' and increases the welfare of society by valuing environmental services and avoiding the uncompensated exploitation of resources.

Fish enclosures in the Kulekhani reservoir, a way for poor upland farmers to generate income

There is a growing interest in PES among countries in the Hindu Kush-Himalayan region. Recognising the value of incentive-based mechanisms, China has implemented an Upland Conversion Programme while India has initiated a Watershed Development Programme to reduce floods and droughts. In addition, there are now benefit sharing policies in the hydropower sector in most Himalayan countries. This article examines the use of PES as a policy instrument in the Kulekhani watershed in central Nepal, and how it has played a role in enhancing the capacity of water storage.

Kulekhani hydropower (Nepal)

The Kulekhani watershed is located 50 km southwest of Kathmandu and is the source of water for the Kulekhani reservoir, which supplies water to hydropower plants downstream. The 92 MW Kulekhani hydropower plant is different to most hydropower plants in Nepal in that it relies entirely on monsoon rain collected in a reservoir rather than on rivers emerging from the Himalayas. As with similar reservoir systems, the plant was designed to supplement peak load in the drier seasons.

In 1973, Nepal generated 39 MW of electricity, of which 32 MW came from run-of-the-river (RoR) systems (Ghimere 2004). At this time, the demand for electricity was increasing by around 4% per year. The generating capacity of the RoR plants was nearly one-third less in the dry season. In 1980, the peak load requirement was 65 MW, indicating a need for an additional 40 to 60 MW by the mid 1980s. The 92 MW Kulekhani hydropower plant was commissioned by the Nepal Electricity Authority in 1982. The original gross capacity of the reservoir was 85.3 million cu.m, of which 73.3 million cu.m was live volume. The reservoir, designed with a life-span of 50 years, was expected to last 100 years (Sthapit 1996). However, the main problem for reservoir type hydropower plants in Nepal is sedimentation. Sediment loads in Nepal's watersheds are among the highest in the world; 85% of the runoff occurs during the monsoon yielding 98% of the sedimentation load (Mahmood 1987 in Sangroula 2006).

The Kulekhani watershed

The hydropower reservoir depends on the water from a 12,500 ha watershed with a mosaic of different land uses (Table). The watershed has 8000 households with over 45,000 residents, spread over 8 VDCs living in a subsistence economy based on (sloping land) agriculture and livestock rearing. Communities also manage forests to extract timber, fuelwood, fodder, and litter. The four monsoon months account for around 80% of the annual precipitation; this rain is the main source of water for agriculture. In general, there is a shortage of water during the remaining eight months.

Table: **Land use in the Kulekhani Watershed in 1991**

Land use category	Area (ha)	%
Sloping terrace	4254	34.0%
Level terrace	237	1.9%
Valley terrace/fans/tars	713	5.7%
Forest	5455	43.6%
Shrubland	1147	9.2%
Grazing and grassland	200	1.6%
Barren land/rock	50	0.4%
Lakes	216	1.7%
Gullies/landslides	18	0.1%
Other	210	1.7%
Total	12,500	100%

Source: IWMP 1992 in Sthapit 1996

The Kulekhani watershed receives 1500 to 1700 mm of rainfall annually on average but the rainfall is often uneven. In July 1993, the watershed received 542 mm over a 24-hour period with rainfall reaching 80 mm in an hour, causing a massive landslide, flooding, and siltation. The plant required major repairs. Over 20 years of operation, the reservoir has lost more than 25% of its storage capacity due to siltation (Sangroula 2006).

The PES mechanism

With the rapid loss in capacity of the reservoir, the government recognised that Kulekhani was a critical watershed of strategic importance and started programmes targeted at participatory conservation. More attention was paid to promoting proper land use management in the uplands to reduce siltation. Activities to promote watershed conservation included community forestry, conservation education, terrace improvement, and fruit plantations.

Various studies (e.g., Amatya 2004; Ghimere 2004) have shown that soil erosion from agricultural land is as much as 73 times higher than that from forested land. Analysis of land use patterns showed that forest cover in the watershed declined between 1978 and 1992, but that it had recovered to earlier levels by 2001. An analysis of sedimentation patterns indicated that the rate of sedimentation in the Kulekhani Reservoir declined with the increase in forest cover and that the dry season water flow gradually increased (Upadhyaya 2005). Maintaining forest cover appeared to be an efficient way of reducing siltation. In 2003, in line with this, the Rewarding the Upland Poor for Environmental Services (RUPES) programme (WAC no date) started to work with upland communities in Kulekhani and the hydropower plant authorities to foster a win-win situation based on a PES mechanism (Upadhyaya 2005). The RUPES programme empowered local communities and organised them into a Watershed Conservation and Development Forum to promote the conservation of forested lands in the upland watershed to reduce siltation. The aim was for the electricity authority to finance the activities through a PES mechanism with the upland people living in the catchment area receiving a payment from the hydropower plant in return for the community managed forests they conserve.

RUPES was successful in establishing a payment mechanism channelled through the district development committee (DDC) based on the 1999 Local Self-Governance Act and the 1992 Decentralisation Act. The Nepal Electricity Authority pays the upland farmers for implementing the conservation activities via the central government, which allocates 12% of the royalties generated from the Kulehkani plant to Makwanpur DDC under the Environment Management Special Fund. Of this, 50% is allocated to the village development committees (VDCs) in Makwanpur District and the remainder to upland settlements (20%), downstream settlements (15%), and the VDCs that house the power plant, generator, dam, and reservoir (15%).

The Kulekhani case reflects the start of a paradigm shift in Nepal, with the government taking action to introduce PES. So far, three annual payments have been made. The VDCs, together with other local bodies such as civil society groups, political parties, and NGOs, organise themselves to formulate a plan which is discussed at village level meetings and then presented to the DDC for approval for financing according to the agreed allocation. The budget is in addition to the regular VDC budget and depends on the power generated from the plant.

So far, much of the payment has been used by the local population for rural development work of immediate benefit, such as village electrification and road construction. While the payments, in principle, should be used for activities that reduce soil erosion and siltation, this has not yet happened. Village politics often lead to short-term gains over long-term benefits, and forest user groups have not been able to benefit as planned. PES is still in its experimentation and learning phase, now attention and follow-up is required to institutionalise the PES concept at the grass roots level.

Conclusion

Globally, the services that watersheds provide in terms of quality and quantity of water are decreasing due

The Kulekhani watershed: a mosaic of different land uses

to unsustainable land management practices, but the demand for such services is increasing. The PES mechanism is an evolving policy instrument that offers innovative solutions by offering incentives to promote sustainable land management. The Kulekhani case shows that a reward system for upland farmers that leads to reduced siltation and enhanced water storage capacity can be implemented, although more needs to be done to ensure that the desired outcome is achieved. This is the beginning of a paradigm shift in natural resource management in Nepal. The drawing of lessons from the Kulekhani case to formulate national policies in Nepal is underway.

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