Payments for Environmental Services for Sustainable Water Management in Loktak Lake, Manipur

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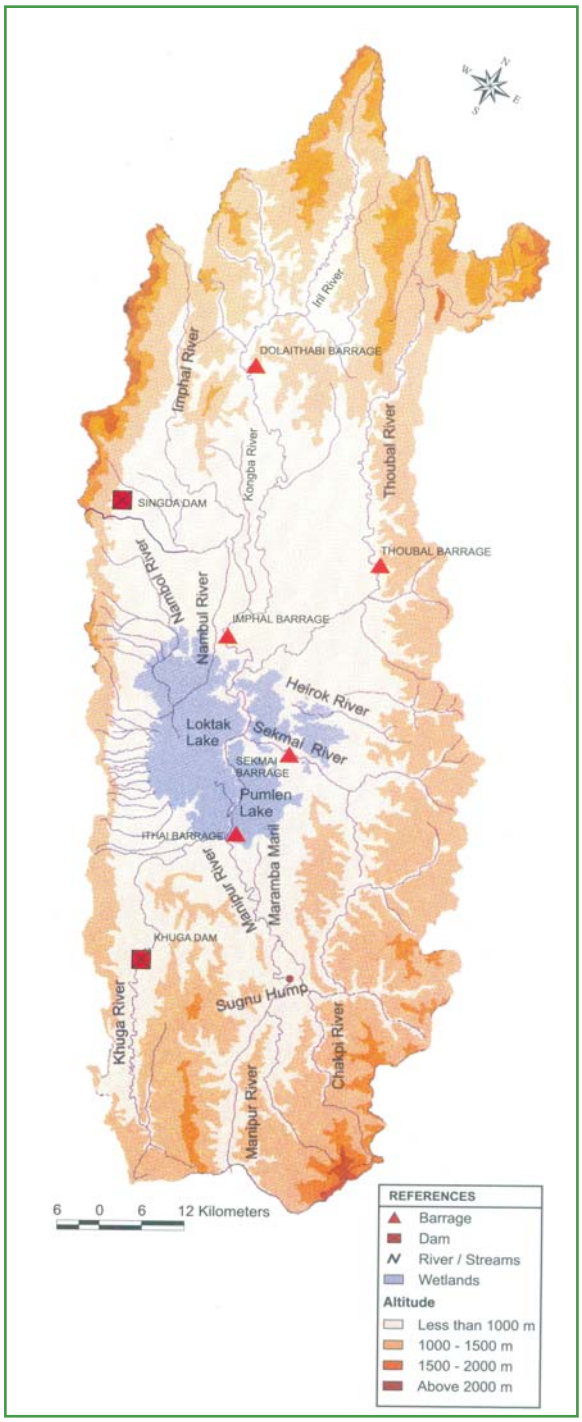


Map 1: Loktak and associated Lakes within Manipur River Basin

Loktak and associated wetlands

Loktak and associated lakes are multifunctional systems providing the basis of ecological and economic security to the entire northeastern region of India. These floodplain wetlands provide fish and vegetables, moderate floods, support rich biodiversity and are inextricably linked to the culture of the Indian state of Manipur. They extend to 469 sq km, with Loktak being the largest wetland system of the basin accounting for over 60% of the overall regimes. The characteristic feature of the lake is the presence of floating lands, locally called *phumdis*, which are thick mats of vegetation intermixed with sediments. The southern portion of Loktak Lake forms the Keibul Lamjao National Park (KLNP), which is the habitat of the globally threatened ungulate species Brow Antlered Deer (*Cervus eldi eldi*). Based on its high ecological and socioeconomic importance, Loktak was designated by the Government of India as a Wetland of International Importance under the Ramsar Convention in 1990.

The PES context

Water management within the state of Manipur has conventionally ignored the interconnectivity between the environmental services of the Loktak Lake and the hydrological regimes. In 1967, the Government of Manipur commissioned an ambitious multipurpose project in Loktak to control flooding of the Manipur River and reclaim shallow areas for agriculture. The natural reservoir of water in the Loktak and associated wetlands was seen as an opportunity to achieve these development objectives. In 1984, the National Hydroelectric Power Corporation constructed a barrage (*Ithai*) at the outlet of the wetlands, enabling storage of water in Loktak through regulation of water levels. Water was diverted to a 105 MW hydropower station through a conductor system constructed on the lake periphery. Construction of the *Ithai* barrage converted a naturally fluctuating lake into a reservoir. With the barrage operated to ensure maximum availability of water around the year, natural flushing was restricted. The situation was further compounded by construction of water control structures on all upstream tributaries of Manipur River. Changes in water management brought about significant impacts on the lake and its resources. Assessments by Wetlands International South Asia (WISA) highlighted loss of fisheries, agricultural land, proliferation of *phumdis* and degradation of the national park resulting from unsustainable water management.

At the core of lake degradation is the lack of integration of environmental services into developmental planning processes, leading to over provisioning of tangible environmental services while severely undermining relatively intangible regulating, cultural and supporting services of the wetland ecosystem. Water use for hydropower generation, although ecologically and economically inefficient, remains the major resource use. Despite an overall decline in the health of the lake ecosystem, water extraction for hydropower generation has been on an increase, because of its relatively visible impacts on the regional economy.

The hydropower pricing mechanism in place at present does not recognise the lake water as an input to production processes. The actual costs of hydropower generation have phenomenally increased due to environmental damages in the form of degraded habitats of KLNP, loss of fisheries and agriculture and enhanced siltation within the lake. While

the benefits of hydropower support economic activities within the downstream and upstream reaches, the environmental impacts have been shifted to the wetland communities through a gradual and continuous degradation of resources and livelihoods. Ultimately this would constrain the overall development of the entire basin, jeopardising its ecological and economic security.

WISA and the Loktak Development Authority (LDA), the nodal government agency for lake management, implemented an India-Canada Environment Facility (ICEF) supported project during 1998-2003 aimed at complete and exhaustive inventorisation of the ecological, socioeconomic and institutional features of the lake and its catchments, and identification of restoration strategies through implementation of demonstration projects (Trisal and Manihar 2004). The outcomes of the project supported the development of a river basin level management plan for Loktak and associated wetlands. The five year action plan envisages investment of US$ 110 million for lake restoration through implementation of action plans on catchment conservation, water management, biodiversity conservation, sustainable resource development and livelihoods, and institutional development (WISA 2005). At the core of the plan is balancing water allocation for human and ecological purposes, considering water requirements for maintenance of the national park and overall lake ecology along with hydropower, irrigation and domestic uses. The management plan is currently within the first year of its implementation with US$ 11.10 million invested through the Planning Commission of the Government of India into priority restoration programmes including *phumdi* management, catchment conservation and fisheries development.

While the current investment portfolio would address the major factors leading to lake degradation, sustainable lake management would require realignment of the incentive systems related with the lake resources. A unique opportunity therefore exists for internalising the environmental externalities generated by unsustainable water management through implementation of a payment scheme transforming environmental damages into conservation revenue flows for lake management and incentivising resource stewardship. This would greatly complement the ongoing conservation efforts and rationalise water use for various developmental purposes.

Within this context, the Loktak RUPES II initiative was launched in March 2009 with the primary objective of rationalising incentive systems within Loktak Lake to promote sustainable water management for ecological restoration and poverty alleviation. This is expected to be achieved through four interrelated components: a) economic valuation of environmental services; b) PES instrument design and implementation; c) institutional development and capacity building, and d) policy and advocacy.

Valuing the environmental services of Loktak

An economic valuation of the various environmental services of Loktak Lake was undertaken to demonstrate and quantify the "hidden economy". This involved application of market and non-market tools to assess the economic contribution of various environmental services from the wetland.

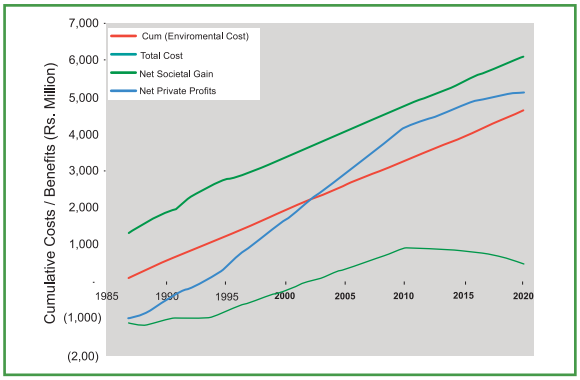
The assessments revealed that the annual benefits from Loktak Lake at 2006-2007 prices stood at Rs. 600 millions,[1] which is equivalent to nearly 2% of the state's gross domestic product. Direct benefits through provisioning of fisheries, water for hydropower generation and vegetation for use as fuel, food, fodder and raw material for handicrafts account for 48% of the overall benefits. Water use for hydropower generates 74% of the direct benefits accrued. Fisheries and vegetation account for 18% and 8% of the benefits respectively. Indirect benefits based on regulating, supporting and cultural features account for 52% of the overall benefits derived from the lake. Nutrient retention functions of *phumdis* form the basis of 12% of non-use benefits.

The assessment clearly indicated that more than half of the total benefits derived from Loktak Lake do not have market based prices. This led to significant underestimation of the overall contribution of Loktak Lake to the regional economy, and dominance of the more tangible use of lake resources, i.e. for hydropower generation.

Establishing the tradeoffs

A cost benefit analysis was undertaken to assess the economic impact of inefficient water management, with the negative impacts of unsustainable water management identified and quantified. The incremental sedimentation and *phumdi* proliferation resulting from barrage operation were estimated based on abatement costs. Loss of agriculture and fisheries were estimated using current market prices. Habitat degradation of KLNP was assessed using ecological – economic modelling, wherein the linkages of hydrological regimes were established with habitat and subsequently with willingness to pay for an improved habitat condition. Based on the assessment of costs and benefits, three parameters were derived: a) net private benefit to the hydropower company, estimated as the net operational revenue generated; b) environmental costs of hydropower generation, which is the cost attributed to sedimentation, *phumdi* proliferation, habitat degradation and loss of agriculture and fisheries, and c) total cost of hydropower generation, which is the sum of environmental cost and the operational cost. The outcome of the assessment is indicated in Figure 1 below:

Figure 1: Cost benefit analysis



The above analysis clearly highlights the inefficiencies of current water management practices. The assessment established that the actual cost of hydropower generation from Loktak is 400% more than what is presently received in payment (i.e Rs. 5.16 / unit against Rs. 0.96 actually charged).

Future actions

Conservation and management of Loktak mandates a strategic shift in water management, balancing human needs

[1] US $1=INR 47, as of 24/11/09

with the multiple environmental values of the lake adopting a stakeholder driven process. WISA and the LDA are developing a water allocation strategy that harmonises water allocation for ecological purposes (e.g. restoration of KLNP, improving water quality, restoration and conservation of natural fish and other aquatic life) with human purposes for hydropower, agriculture and domestic use. This rationalised water use plan will form the basis of operation of *Ithai* and other upstream and downstream hydraulic structures to enable allocation of water to meet various needs and maintenance of the multi-functionality of the wetlands. This approach recognises the crucial role of hydropower within the economy of the state, but proposes optimising its generation in a manner that does not conflict with other functions and values of the lake and livelihoods of local communities.

With the current restoration measures under implementation, the LDA would be in a unique position to serve as a provider of lake environmental services for hydropower generation. The hydropower producing company and the lake management authority are envisaged to be the respective buyers and sellers of sustainably provided water for hydropower generation. This would greatly complement the ongoing conservation efforts. The next stage of the project is therefore to design a suitable PES instrument for the local context and build institutional capacity and arrangements for its successful implementation.

References

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