Valuation of management options for irrigation tanks in Kala Oya, Sri Lanka

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Short title: Water tank rehabilitation benefits rural development, Sri Lanka

Key Message: Traditional management practices were found to be most effective in maintaining ecosystem services and biodiversity of traditional irrigation tanks with greatest benefits for local livelihoods.

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Picture 1: Small tank. Siltation is visible and is caused by soil erosion
Courtesy: IUCN SL

Picture 2: Inland fishing
Courtesy: IUCN SL

What is the problem?

Sri Lanka has one of the oldest traditional irrigation systems in the world, dating back as far as 500 BC. The early Sri Lankan society developed a system of irrigation tanks that retain river runoff mainly for the purpose of irrigation agriculture. Until today it provides many direct and indirect services for millions of people. Besides the production of rice the tanks provide goods such as fish, lotus flowers and roots that diversify household income. The seepage from the tanks maintains water quality in wells and is the main source for drinking water. The tanks also provide fodder and drinking water for livestock.

Since the 1970's, the increasing demand for water in upstream areas for modern, large-scale agriculture and hydropower has lead to the decline of water flow into the tank system and increased the sediment load and siltation. There was a rapid expansion of irrigated lands, mainly designed for water intensive paddy crop cultivation. This system however, ignored other functions derived from other natural assets, such as, forests, wetlands, flora and fauna. This together with the loss of traditional management practices caused a decline in the water holding capacity of the tank system, resulting in negative consequences for the livelihood of

downstream users. While in the traditional system the local communities were in charge of maintaining the tanks, over the past decades the national authorities took over the responsibility and invested in the rehabilitation of the tanks. The Mahaweli Authority of Sri Lanka (MASL) manages the tanks by raising the spill in order to rapidly restore their capacity for water storage. However, this option does not solve the problem of tank sedimentation and wetland degradation.

What was done to solve the problem?

The formulation of the Water Resource Policy for Sri Lanka was the inducement for identifying strategies for integrated water resource management that allows a comprehensive, river basin oriented approach. Kala Oya is one of the 103 river basins in the country, situated in the North-Western dry zone of Sri Lanka. With the Kala Oya river basin (2772 sqkm) as the pilot site, the International Union for Conservation of Nature (IUCN) together with the MASL conducted an economic valuation of the goods and services that the traditional tank system provides for the livelihood of local communities. It aims to analyse the link between wetland management and poverty reduction, and also to identify strategies for restoring and maintaining the function of the tank system.

Which ecosystem services were considered and how?

Environmental benefits can be categorized as use values, option values and non-use values. The study team conducted 46 focus group discussions with the villagers living around the tanks, located in the Nochchiagama Block of the Mahaweli irrigation area and the Giribawa cascade of the Non-Mahaweli irrigation area, during a period of 4 months from August 2003 to November 2003.

Primary data on the direct value of the goods produced in and around and the benefits from water were collected for 23 tanks (Table 1) using Participatory Rural Appraisal (PRA) methods, including interviews and focused group discussions. The economic value was determined by using the market price of the different goods. Over a period of four months 46 group discussions were undertaken with the villagers living around the tanks. On average households receive water and aquatic resources from the tanks worth US$ 425 per year (Emerton 2004). In terms of tank area including inundated areas the direct use value of ecosystem services are worth US$ 2972 per hectare per year (Table 1). This is a significant contribution to the peoples livelihood as half of the population is considered to be poor, and having an income of less than US$ 15 per month (Emerton 2004).

Resource	% of households	Value per Household (US$/hh/yr)	Value per Unit Area* (US$/ha/yr)
Paddy cultivation	13%	177	161
Vegetable cultivation	7%	86	39
Banana cultivation	3%	1150	209
Coconut cultivation	13%	238	216
Domestic water	93%	226	1,469
Livestock water	13%	369	335
Commercial water	2%	132	12
Fishery	16%	309	351
Lotus flowers	10%	106	72
Lotus roots	7%	235	107
		Total	2,972

Table 1: Percentage of households engaged in different income generating activities and their income in the Kala Oya catchment (Vidanage 2005), *total inundated area.

The direct value of the services is dependent on the water holding capacity of the tanks, which in turn depends on how the tanks are managed. Four different scenarios (options) were assessed: S1 keeping the status quo and letting the tanks degrade further, S2 raising the spill ways in order to increase the water table but letting the sedimentation load remain the same, S3 raising the spill ways and decreasing sedimentation load, and S4 increasing water holding capacity of the tanks by removing the silt. The different management strategies also impact the value of the indirect services, which was qualitatively assessed using a rating system from plus (+) to minus (-) based on information provided by Woodward and Wui (2001) and local experts (Table 2). Also the natural capital (NC) of the tanks was considered, which is the ability of the tanks to provide ecosystem services beyond the period of 30 years.

	Ground and sub-surface water recharge	Nutrient and sediment retention	Biological diversity	Total
Option 1	- - -	- -	- -	7 -
Option 2	- -	-	-	4 -
Option 3	+	++	+++	6 +
Option 4	+++	++	++	7 +

Table 2: Qualitative assessment of the impact of different management options (scenarios) on selected regulating ecosystem services and biodiversity (Vidanage 2005).

Scenario	Net Present Value (NPV)				Indirect use trends (index)	Accumulated Natural Capital
	Investment cost (US$ '000)	Operating costs (US$ '000)	Incremental tank benefits (US$ '000)	Quantifiable net benefit (US$ '000)		
S1: Do nothing	0	0	0	0	-7	⬇⬇ NC1
S2: Raise spill	0.4	0	24.2	23.8	-4	⬇ NC2
S3: Raise spill and rehabilitate tank reservation	23.3	12.5	64.6	28.8	6	⬆ NC3
S4: Remove silt and rehabilitate tank reservation	50.3	12.5	120.7	57.9	7	⬆⬆ NC4

Table 3: Costs and benefits of alternative tank management scenarios (net present values (NPV) over 30 years at 6 % discount rate in 2004 US$ (Emerton 2004).

Scenario S4, increasing water holding capacity of the tanks by removing the silt, was found to be the management strategy with the highest economic return for local communities. Over 30 years with a discount rate of 6 %, scenario S4 has a net present value (NPV) of US$ 57,900 per tank compared to the lower NPV of scenario S3 with US$ 28,800 per tank, S2 with US$ 23,800 and S1 with US$ 0.0 per tank (Table 3, Emerton 2004). The NC is lowest for the scenario S1 as tanks are degraded. The traditional management S4 will maintain the highest NC as it ensures that the tanks will continue to deliver ecosystem services into the future (Table 3). The strategy proposed in S4 was already part of the traditional management that was performed by the local communities for centuries. Since the communities would directly benefit from the rehabilitation of the tank system they were positive about participating and taking over the restoration work.

It is worth noting here that the exact numbers from the study should be taken with caution as they are solely based on PRAs. The water storage efficiency of the tanks is also not considered. Notwithstanding these minor drawbacks, the study presents a good assessment of the tank ecosystem and the services provided.

What is the role of local policy makers?

The collaboration with the MASL allowed the dissemination of the findings to decision makers, involved in reforming the Water Resource Policy of Sri Lanka. Locally accepted authorities were important for the analysis in the field as they helped to build trust among the communities. The communities feared that an economic valuation would be used to make them pay for the use of the environmental goods and services. When emphasising that the study was aiming at identifying strategies for improving tank management and communicating the people's perspective to national decision makers, the local communities were willing to engage in the assessment. Since the use and access rights of the communities and individuals to the tanks are often unclear they need to be negotiated with local decision makers on a case-to-case basis in order to re-establish a community based management system.

The study can also be expanded further by taking into consideration other germane aspects related to ecosystems of the dry zone in Sri Lanka. Studies could go beyond conventional methodologies and understand the physical and social changes that took place during the last 30 years in the dry zone river basins. The source of the water also plays a pivotal role in the downstream developments. Furthermore, it is essential to dig deeper into the societal factors. Along with the earlier residents, society today also comprises of new settlers, who have migrated from water rich areas and have no knowledge of dry zone traditional water management systems.

Although there have been changes in the political system of Sri Lanka after the study was conducted, the Ministry of Environment expressed their interest in following up on the results of the study. Further, field visits and investigations have been planned since there is still a lack of basic knowledge about the ecology of the tank system, the socio-ecological links and the quantitative and qualitative value of the ecosystem services.

Lessons learned

The proposed strategy has been implemented in only a few communities where it has been accepted within the community, and where the local decision makers have shown environmental leadership. Most of the activities for maintaining and rehabilitating the tanks are focused on the larger tanks of 12ha or more. Courses in ecosystem services were included in a master's programme at the university level in order to improve knowledge on environmental management.

References:

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Picture 3: Interviews with the locals
Courtesy: IUCN SL

Picture 4: Field surveys
Courtesy: IUCN SL