

How to Minimize the Negative Impacts on Bundala National Park due to Irrigation Development of the Kirindi Oya River Basin

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Abstract

The environment is an important water user, and one that often finds itself at the bottom of the list of priorities when supplies become scarce. This research studied how the needs of wetlands can coexist in parallel with irrigation demands and other human activities.

Sri Lanka is a signatory to the Convention on Wetlands of International Importance for Migratory Waterfowl, known as the Ramsar Convention and Bundala Lagoon was declared Sri Lanka's first Ramsar site, a wetland of international importance for migratory waterfowl, in 1990, because of its high bird species richness. The delicate ecological balance of these lagoons will be severely affected by the on-going Weheragala Reservoir project, which is designed to divert excess water from Manike Ganga River basin to Kirindi Oya River basin and the Mala River basin development project. The main negative impacts are eutrophication, accumulation of pesticides and insecticides in the lagoons and siltation, and that lagoons will be converted to fresh water bodies.

This research studied how to minimize these negative impacts using social, economic and engineering tools. The research findings are useful for researchers, policymakers and decision-makers, who must find opportunities to improve farmers' incomes and national food production, while and at the same time ensuring sustainable management of wetland ecosystems in Sri Lanka.

Introduction

In Sri Lanka there are two extreme groups: the environmental group with a strong belief that the environment is a holy asset that should be protected at all costs; and the other which is concerned only with financial and economic development, forcing severe actions to overcome poverty in the rural sector and ignoring the environment. Many professionals have joined one of these schools of thought. They play a key role in highlighting this position to the general public and try to implement interventions that match this position, through the existing political authorities. As usual most of the politicians are willing to agree to whichever option that gives them support from the majority of the people.

There is a third group of professionals who hold a balanced opinion on environmental management and economic development, but they find it difficult to raise their voices against the politically supported extreme views. The lack of access to information and knowledge on how to manage environmental issues in tandem with economic development is a constraint to popularizing sustainable development by striking a balance between conservation and production.

It is actually in the interests of national level planners to pay more attention to socio-economic development that makes good and sustainable use of natural resources, and at the same time to consider the fact that a healthy population requires a healthy environment. This will ultimately make development efforts more effective and it is therefore advisable that all parties, even though their views may be divergent, try to work together. The purpose of this research is to develop a sustainable management system by minimizing negative impacts, and to improve the standard of living for farmers in the adjoining areas. The research uses Bundala National Park as a case study.

Context of the Study Area

Lunugamwehera Reservoir was built in the 1980s as part of the Kirindi Oya Irrigation and Settlement Project (KOISP), extending a traditional system of ancient 'tanks' used to irrigate paddy fields in the Kirindi Oya flood plain for hundreds of years. Typical of recent dam-building schemes in the country, KOISP is not just geared to irrigation for food production but also to development. Delivering water to two extra canals, one each side of the plain, it irrigates some 5,000 hectares of new farmland, created by bulldozing jungle. This new land was offered to 5,000 settler families, mostly from Sri Lanka's overcrowded wet zone, as well as those displaced by the reservoir, as part of a government scheme to alleviate poverty.

The project has also had its environmental costs. Apart from the ancient tanks and paddy fields under Lunugamwehera Reservoir, the biggest casualty is Bundala National Park. The Park was designated a protected wetland in 1990, which led to the declaration of Bundala as Sri Lanka first Ramsar wetland, a wetland of international importance, especially for migratory water fowl. It is envisaged that visitors will enjoy their visit to Bundala, learn about its biodiversity and contribute towards the conservation of this globally significant eco-system.

Bundala National Park, covering an area of 6,216 ha, is located about 250 km southeast of Colombo in Hambantota District. It is within the south-eastern arid zone of Sri Lanka, where the general climate can be classified as hot and dry with a mean annual temperature of about 27°C and an average annual rainfall of about 1,074 mm, with the highest monthly rainfall occurring in November. Topographically, the Park is generally flat with sand dunes bordering the coastline. Most agricultural activities are timed to take place within the two wet seasons, the *maha* cropping season from September to January and the *yala* cropping season from April to June.

Three streams, Malala Oya, Embilikala Oya and Kirindi Oya, discharge in to the Park and adjacent areas. The Park consists mainly of dry thorny scrubland and lagoons. The shallow brackish water lagoons located within the Park, Koholankala (390 ha), Malala (650 ha), Embilikala (430 ha) and Bundala (520 ha) form a complex wetland system that harbors a rich bird life, including many species of migratory birds. A total of 197 species have been recorded

in the park, over the past several years. These include 139 residents and 58 winter visitors. Among the resident birds, three species are endemic, while 10 species are nationally threatened. Of the migratory species, 46 are regular migrants and 12 are occasional visitors or vagrants.

The highlight of Bundala is the migratory greater flamingo, which visits in large flocks of over 1,000 individuals, from the Rann of Kutch in India. A large flock of flamingo feeding on zooplankton with their filter-feeding beaks is a unique sight in the Bundala Lagoon. From time to time these birds fly from one place in the lagoon to another, in search of new feeding grounds, and their graceful harmonized flight is amazing. It should also be noted that during the past 6 years, a flock of about 350 flamingo have remained in Bundala without returning to their usual breeding grounds.

The beaches within the Bundala park area are an important nesting ground for five marine turtles (only seven marine turtles species are recorded globally) of which three species are endangered marine turtles: the leather back (*Dermochelys coriacea*), the Oliver Ridley (*lepidochelys olivacia*); and the green turtle (*chelonian mydas*). Two further species are threatened marine turtles: the hawks bill and loggerhead. The lagoon systems are prime breeding grounds for fish and other brackish-water life that are essential for the overall biological system and provide both animals and humans with a valuable source of nourishment.

A major reason for the excessive depletion and conversion of wetland resources is failure to adequately account for their non-market environmental values in development decisions. Loss of environmental resource is an economic problem because when these resources degrade or are lost, choices and options are lost and so is value. These may include the loss of both important environmental function and in the case of complex resource system such as wetlands, many important biological resource and amenity values. Many of these values of the natural or managed environmental resource are not bought and sold in markets and they are generally ignored in private and public development decisions. The concept of total economic value provides a framework for the economic valuation of wetlands. Classification of total economic value for wetlands is shown in Table 1.

Table 1. Classification of total economic value for wetlands.

Use Values		Non-use value	
Direct use value	Indirect use values	Option and Quasi option value	Existence value
Fish	Nutrient retention	Future value of information	Biodiversity
Agriculture	Flood control		Bequest value
Fuel-wood	Strom protection		
Recreation	Groundwater recharge		
Transport	External eco-system support		
Wildlife harvesting	Micro-climatic stabilization		

A key concept underlying the principle of the Ramsar Convention is that wetlands have great value and their conservation can only be achieved if this value can be shown to be considerable and in some cases of greater value than the proposed alternative uses of the wetlands site. It may also be necessary to show that conservation is of equally or greater value

than an alternative use for the water that is sustaining the wetland. In line with this, contracting parties to the Ramsar Convention are asked to provide the physical and social values of wetlands as a part of the information required for identifying the kind of wetlands that ought to be included in the list of 'Wetlands of International Importance'. They are also required to make environmental impact assessments before initiating schemes that might affect wetlands, and such schemes should pay particular attention to maintaining the values of wetlands.

Problems of Bundala National Park

The eco-systems of the Malala and Embilikala lagoons have been severely affected by the drainage flow from the KOISP and Bandagiriya irrigation schemes. The drainage flow from the Bandagiriya scheme goes to Malala Lagoon and water from tracts 5, 6 and 7 of the right bank of the KOISP flows to Embilikala. Since the KOISP was implemented, the salinity of the lagoons has dropped due to the in-flow of upstream irrigation water. This change in salinity levels has influenced the population of birds as it has affected their food supply. Fortunately, for the past four consecutive years, tracts 5, 6 and 7 have only been cultivated in one season due to water shortages in the scheme, which has positively affected the Embilikala Lagoon.

Eutrophication is an emerging problem in the lagoons. The water has a greenish color as a result of the accumulation of nutrients and increase in filamentous green algae. The main causes are over-grazing which results in animal feces entering surface water and runoff from upstream irrigated areas, which brings fertilizer and soil into the lagoon, as well as other agro-chemicals including insecticides, herbicides and fungicides, especially as these chemicals are sometimes applied in excess of agricultural requirements. Not only does this lead to eutrophication but the pesticides may be toxic and the soil leads to siltation. Grazing of livestock within the conservation area is also problematic because it results in direct competition between livestock and other wildlife such as deer.

Irrigation Development and its Negative Effects on the Bundala Park

The newly completed Mau Ara, Malala Ara diversion project conveys 32 million cubic meters (MCM) per annum to the Malala Ara basin. The total irrigable area of the basin is 2,372 ha but up to *yala* 2003 only 660 ha under the Bandagiriya scheme was cultivated due to water shortages. After the project was completed, cultivation was carried out in the total irrigable area in both *yala* and *maha* seasons. The ultimate result is increased drainage flow to the Malala Lagoon, which is severely threatening the lagoon ecosystem.

The newly started Menik Ganga diversion project will convey 90 MCM per annum to Lunugamvehera Reservoir and the current water shortage will be eliminated after completion of this project. For the past 4 years the right bank tracts 5, 6 and 7 (1,742 ha) have only been cultivated in one out of eight seasons, but after completing this project both *yala* and *maha* can be cultivated and drainage flow to the Embilikala Lagoon will be increased.

It is planned that right bank tracts 3 and 4 (1,800 ha), which are currently uncultivated in both seasons, will be cultivated under KOISP. The drainage water from this scheme will flow to the Bundala Lagoon.

Methodology

The study was undertaken in the right bank tracts 5, 6 and 7, which are managed by seven farmer organizations. A structured questionnaire was used to interview 21 farmers, who were chairmen, treasurers and secretaries of the each farmer organization. These interviewees were selected because they are fully aware of the situation inside their farmer organization boundaries. Officers from relevant organizations were also interviewed, these being: the Department of Wildlife Conservation, the Irrigation Department and the Department of Agriculture. The research was conducted between July and September 2004.

Results

The farmers all had landholdings of 1 ha and family sizes of 4-6. For the past 4 years they have only cultivated in the *maha* season because of water shortages and have cultivated bananas on 202 ha. The household incomes ranged from Rs. 1,666 to Rs. 4,888, which are derived from the sale of other field crops (OFC) and off-farm activities; in general, the income from off-farm activities accounts for 50-64 % of the total.

Even at times of water shortages farmers prefer to grow paddy and choose to grow paddy over OFCs. They also prefer not to cultivate paddy under the 'dry land farming' method. If they were to practice this method they would expect to be compensated by a third party if they were to lose their yield.

Ten percent of the sample would like to use micro-irrigation methods but a much larger number (80 %) would do so if the cost was borne by a funding agency. All are practicing direct sowing, which uses a high water volume. If they are transplanting then just 10-12 % of the water is required. Farmers said that they are willing to use alternative practices such as low water use methods and micro-irrigation, but only if a third party is prepared to pay the cost of these. The result of low water methods is that less fresh water will reach Bundala Lagoon, which will be beneficial in maintaining the salinity balance. In addition, if drip irrigation methods are used, this can reduce the fertilizer required by 25-30 %, which will reduce the eutrophication which is taking place.

Similarly, they all are aware of soil conservation but not a single person is applying these measures, although 60 % would be willing to do so if a third party paid the costs. If they did this it would reduce the siltation in Bundala Lagoon.

Farmers would be willing to undertake afforestation in the tract 5, 6 and 7 reservation areas, if they were permitted to receive benefits from this, such as sale of timber. This would also help with soil conservation and reduce their poverty.

None of the farmers practice integrated pest management (IPM) even though it would reduce the quantity of pesticides reaching the lagoon.

Farmers were all aware that cultivation negatively affects Bundala National Park but they are poor and their first priority is to obtain a livelihood for their families. They therefore refuse to stop cultivation and strongly disagree with the idea of water pricing. They are willing to try alternative methods but only if they do not have to bear the costs. They would be happy to do things that simultaneously protected Bundala and increased their families' income.

Conclusions and Recommendations

Most of the farmers live in poverty and thus they put pressure on available natural resources. They want to protect these resources but not at the expense of their incomes. However, they are increasingly obtaining their incomes from non-farm activities, which may have less of an impact on the Park.

Poverty alleviation in the adjoining area is a major step towards minimizing harmful practices undertaken by farmers. This is because the high level of poverty leads to the abuse of available natural resources. Since poverty alleviation in rural areas first comes from irrigation development, this cannot be sacrificed to conserve Bundala National Park. However, the negative impacts can be reduced, by improving irrigation efficiency, increasing crop productivity and reducing drainage water flow. To achieve these targets, micro-irrigation methods, less water intensive crops, soil conservation methods, afforestation and providing possibilities to engage people in off-farm activities like environment friendly industries, could all be introduced. How such activities should be funded is the question, since the government does not have the capacity to fund such programs.

Bundala National Park is not only an asset to the country but to the world, and global environmental institutions should open their eyes to these types of environmental problems facing developing countries. Finally, at the Third World Water Forum, the International Union for Conservation of Nature (IUCN) committed itself to implementing a project to promote enhanced investment in sustainable ecosystem management within private and public sector participation.

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Wetlands and Agriculture – A Case for Integrated Water Resource Management in Sri Lanka

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Abstract

Wetlands are habitats with temporary or permanent accumulation of water. The degradation and loss of wetlands is more rapid than that for other ecosystems, and wetland-dependent biodiversity in many parts of the world is in continuing and accelerating decline. They have been confirmed to deliver a wide range of critical and important services vital for human well-being. Therefore, it is clear that sound wetland management is now expected to not only consider conserving the ecological integrity of the ecosystem but also to pay specific attention to the well-being of local people, thereby contributing to poverty alleviation.

Wetlands, both fresh and marine, have a multitude of benefits, in addition to environmental benefits, such as for agriculture, flood control, water purification, fisheries and recreation. For the maintenance and sustainability of wetlands the crucial requirement is water – a resource that has multiple demands and competition. The main competitor for the water resource around the world is agriculture for food production, a basic requirement for human survival. Therefore, in a situation of wetlands versus food production, the balance tips towards food production without considering the adverse consequences to the wetlands or adequately appreciating the benefits from achieving a balance. This is where Integrated Water Resource Management (IWRM) should be adopted to facilitate this process and enable wetland management and agricultural management to fit into the picture along with the other multiple uses of water.

Integrated Water Resource Management should be of considerable interest for Sri Lanka, being a country which has agriculture very high on the agenda. The country is also home to a range of wetlands including 103 distinct river basins and 42 lagoons, which support a multitude of functions and services to people. The relationship between agriculture and wetlands in Sri Lanka is complex. The proliferation of village level water storage structures (small tanks) has created an unusually large number of man-made wetland habitats that add significantly to the natural wetlands that are concentrated mainly in the coastal belt. The absence of an integrated approach to water resource development however, continues to erode natural wetland systems. Two major problems, which concern downstream fisheries and livelihoods, are high levels of agricultural pollution, especially through the excessive use of fertilizers, and modifications to the hydrology.