

A roadmap to restoring the glory of the Rudrasagar Lake – the call for sustainable water management in the Lake area

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A ROADMAP TO RESTORING THE GLORY OF THE RUDRASAGAR LAKE – THE CALL FOR SUSTAINABLE WATER MANAGEMENT IN THE LAKE AREA

Lake Rudrasagar is the most important lake of the state of Tripura. It is located at a distance of about 50 km from the capital city Agartala. The total area of Lake Rudrasagar is 240 ha, and is one of the 432 wetlands of the state. Because of its ecological and socio-economic significance, Lake Rudrasagar was selected as India's thirteenth national lake. In addition, the Lake Rudrasagar was accorded Ramsar status in 2007 after the Conference of the Contracting Parties (COP9) held in Uganda, and was designated as Ramsar Site No. 1572. The Rudrasagar provides excellent habitat for self-sustaining populations of several wild catfishes, minor, and locally important weed fishes. Apart from these fishes, the lake also provides habitat for scampi, crabs, freshwater mussels, aquatic weeds and turtles, including the IUCN Red-listed Three Striped Roof Turtle. Rudrasagar Lake is much smaller than it was once. While reviewing the status of the lake chronologically, it has been observed that the lake ecosystem has deteriorated owing to siltation, pollution and reclamation of the catchment for alternative land uses. Rudrasagar Lake is also a significant source of groundwater recharge for water users in the surrounding area. However, water quality in the lake has suffered from significant pollution from agricultural run-off, heavy metals, and sewage. Since more than three lakh people visit the *Neermahal*, the Water Palace inside the lake, a lot of solid waste is dumped. Lake Rudrasagar has been historically supporting livelihood of fishing communities around it in Tripura. However, siltation, shrinkage of lake area, and pollution now are pushing those communities to switch over to agriculture from fisheries. Fisheries in the lake is declining along with heavy shrinkage of the lake area and increasing encroachment of the periphery by agriculture. It is disheartening that presently more than half of the lake's area has been encroached by agriculture. This has adversely affected the livelihood of the fisherfolk communities dependent on the lake. This situation is compelling them to alter the primary resource use pattern from fisheries to agriculture regardless of this being beneficial for the sustainability of the lake or not. The issue for analysis is whether the on-going community adaptation in trading off the lake area for agriculture is optimally efficient, which should be judged both from economic and environmental view points. Analyzing the resource use patterns and trade – offs among them in Lake Rudrasagar involving fisheries, agriculture, horticulture and tourism is an urgent need of the hour for sustainable water management of the lake.

1. INTRODUCTION

The establishment of appropriate legal regimes and governance strategies are the most effective ways of conserving a habitat and its biological diversity (McNeely, 1988). While accounting the benefits of conserving biological resources, it is useful to consider the environmental costs of depletion, in terms of the time and effort required to restore the resource to its former productivity. With natural resources becoming scarcer, justification of conservation of biodiversity over alternative land uses, such as, agriculture, is difficult (Antrobus and Law, 2005). Indigenous people in the area of Tucuruí Dam in Brazil prior to dam construction survived on fishing; gold and diamond mining and subsistence

agriculture. Environmental Impact Assessment Reports suggested that there were large scale fish deaths occurring downstream as a consequence of the dam construction, and thereby fish diversity was reduced by 19 % (La Rovere and Mendes, 2000). The result of it was that R\$ 30,000 to R\$ 287,900 was paid as compensation to the affected. Loomis (2005) quantified the economic benefits, local employment and income effects from the maintenance of the Snake River's (in the U.S.) ecological conditions and associated fisheries. Through careful management, the river can support traditional economies related to irrigated agriculture and hydro-power generation along with a robust recreational economy. The income and employment trade-offs in a multi-objective environment in paddy-fishery enterprise system was determined in Kuttanad region of Kerala state (Krishnan, 1993; Krishnan and Sharma, 1996). The income and employment maximization was juxtaposed in an area-production compromise situation in the low lands of Kari, Karapadam, and Kayal lands of Kuttanad in the context of the operation of the erstwhile Thaneermukhom barrage. The issue of aquatic resource management involving multiple-stakeholders is, therefore, a complex one requiring good decision protocols and decisive information for achieving optimality, efficiency and equity. The research work discussed here is an on-going project about analyzing the resource use patterns and trade-offs existing in terms of multiple and competing uses of the water resources of the in Lake Rudrasagar in the state of Tripura. The answers to the research questions raised in the project are in the process of exploration as the research hypothesis was brought to inception recently in the year 2012.

Lake Rudrasagar is the most important lake of Tripura, the second smallest state of the North-East India in the sub-Himalayan region. The lake lies in the Sonamura Sub-division in the Melaghar Development Block within the Sonamura District. It is located at a distance of about 50 km from the capital city Agartala. The Rudrasagar is a lake of national importance owing to its wide variety of fish species and aquatic flora. Because of its ecological and socio-economic significance, Lake Rudrasagar was selected as India's thirteenth national lake (Bhowmik, n.d.). In addition, Lake Rudrasagar was accorded Ramsar status in 2007 after the Conference of the Contracting Parties (COP9) held in Uganda, and was designated as Ramsar Site No. 1572.

The lake is situated approximately on the Tropic of Cancer, at 23° 29' N and at 90° 01' E. The maximum elevation of the site is 16 m; the minimum is 7 m. The lake is included in the floodplain wetland of the River Gomati Basin – the 150 km long Gomati is the largest river in Tripura. The total area of Lake Rudrasagar is 240 ha. It is one of the 432 wetlands of the state (TNN, 2011). From a hydro-morphological perspective, the lake is a low-lying natural sedimentation reservoir, which receives flow from three perennial streams: the Noacherra, Durlavanarayacherra and Kentalicherra (see Fig. 1). Suspended sediment in these streams settles in the lake; clear water flows from the lake to the River Gomati through a connecting channel called the Kachigang. The lake bed has been basically formed by silt deposit.

1.1. Important aquatic flora and fauna in Lake Rudrasagar

The Rudrasagar provides excellent habitat for self-sustaining populations of several wild catfishes including *Mystus spp.*; *Ompok pabda*; *Wallago attu*; *Heteropneustes fossilis*; and *Anabus testudeneus* (Khan, 2005). There are also several minor carps such as *Botia spp.*, *Labeo bata* etc (Deka, 2011). The lake is a source of locally important weed fishes including *Notopterus chitala*; *Puntius sophore*; *Esomus dendricus*; *Chanda ranga*; *Nandus nandus*; *Colisa fasciatus*; *Notopterus notopterus*; *Cirrihinus reba*; *Mastacembalus puncalas*; *Channa pucntatus*; *Macrogathus siamensis*; *Gudusia chapra*; *Cylonia spp.* and *Channa marulius* etc (Bhowmik, n. d.). Apart from these fishes, the lake also provides habitat for scampi, crabs, freshwater mussels, aquatic weeds and turtles, including the IUCN Red-listed Three Striped Roof Turtle. In 2007, the annual fisheries production was 26 metric tonnes (Bhowmik, n. d.). Aquaculture sites are currently limited to about 0.47 % of the total area. The more than 40,000 families that live in and around the periphery of the lake earn livelihood by fishing, agriculture and horticulture. The lake is also a home to a wide variety of resident and migratory birds such as Baer's Pochard, Ferruginous Duck, and Lesser Whistling Teals (Choudhury, 2010).

1.2. The regulatory environment of Lake Rudrasagar

The fishing rights in the permanent water area of Lake Rudrasagar have been leased to Fishermen Samabaya Samiti; fishing rights in the surrounding area portions of the lake have been leased to private land owners. The Rudrasagar Lake area comes under the jurisdiction of the Department of Fisheries, the Department of Tourism and the Department of Agriculture, Horticulture and Soil

Conservation. The Parliamentary Standing Committee on Tourism has envisaged a project worth Rs. 40 crores in the year 2011 (PTI, n. d.). Another scheme called the Rudrasagar Drainage Development Scheme worth Rs. 14.9 crores was approved by the Planning Commission in the present year 2012 (JagranJosh, 2012).

2. PRESENT SCENARIO OF LAKE RUDRASAGAR

Rudrasagar Lake is much smaller than it was once. In 1947, the lake covered 2,066 ha, nearly ten-times its current area. At that time, the lake supported the livelihoods of about 12 families. Periodic flooding discouraged intensive development and thereby contributing to sustainable fisheries and agriculture. There are now about 2 lakh people dependent on the lake including the families of 2,000 fishermen (TNN, 2011). Over the past 60 years, the lake has shrunk, agricultural development has expanded, and bioresources have been degraded.

In view of the national and international importance of the lake, the Government of Tripura engaged Wetlands International South Asia (WISA) to formulate a Management Action Plan (Wetlands International, n. d.). It is worth mentioning here that the Lake hosts the only Water Palace in Eastern India christened 'Neer Mahal' by the world famous poet Rabindranath Tagore (Bhowmik, n. d.).

2.1. Concerns about Lake Rudrasagar

Rudrasagar Lake is a significant source of groundwater recharge for water users in the surrounding area. Its role as a water storage basin and source of groundwater has been compromised, in part, by, siltation. It is disheartening that presently more than half of the lake's area has been encroached by agriculture. Water quality in the lake has suffered from significant pollution from agricultural run-off, heavy metals, and sewage. Heavy metals are introduced into the lake through airborne and waterborne discharges from immersion of idols and brick kiln industries. Sewage discharges stem from the lack of community toilet facilities around the lake periphery. Since more than three lakh people visit the Neermahal, a lot of solid waste is dumped. Together, the nutrient rich sewage and agricultural run – off stimulate eutrophication of the lake.

2.1.1. Trade-offs between fisheries and agriculture

The research questions to be explored are:

- i. Has the expansion of agriculture contributed to the decline of fisheries? / If so, to what extent is the decline due to the encroachment of agriculture areas that were previously part of the seasonal flood plain and to what extent is the decline due to increased eutrophication due to agricultural run-off? / How important is agriculture as a supplement to fisher's income and does the opportunity to supplement fishing income with farm income lead to excess harvest effort in the fisheries? / How have changes in the character of Lake Rudrasagar affected the relative abundance of fish species? / Has eutrophication favoured some species relative to others how do those changes affect fishermen?
- ii. Can fisheries development help in the revival of the Lake Rudrasagar? If so, how should it be structured to generate the greatest benefits?
- iii. How can fisheries, tourism, and agriculture be structured to co-exist in the same management regime in the lake?

The hypothesis of the research is that owing to misuse and poor resource management of the Rudrasagar Lake by sectors which have competing interest in water resources affecting fishery, there is enough scope for improving the performance of the fishery with a properly developed fishery management programme.

The research objectives are to analyze the temporal growth in fisheries, agriculture, tourism and minor industries in and around Lake Rudrasagar and studying their interdependence, to study the socio-economic conditions of the fisherfolk and the farmers, fishery institutional arrangements, and

governance in Lake Rudrasagar, to understand and estimate the trade-offs in respect of fish production, and agriculture from the individual and societal perspective and to develop strategies for ensuring sustainable management of the Rudrasagar Lake in real and welfare terms.

2.1.2. Expected Outcome and Utility

The current resource use patterns of the Lake Rudrasagar region will be documented based on types of economic activities. The proposed research will be used to derive estimates of the economic impact of pollution on lake on fisheries. It will also be used to estimate trade-off values in terms of income or employment and output between fisheries and agriculture. The costs and benefits of alternative strategies development of Lake Rudrasagar fisheries will also be estimated. The outcome based on the adoption of study outputs will be the development of an eco-system-based policy for fisheries and agriculture development in the Lake Rudrasagar by the Government of Tripura.

3. ILLUSTRATIONS, DIAGRAMS AND PHOTOGRAPHS

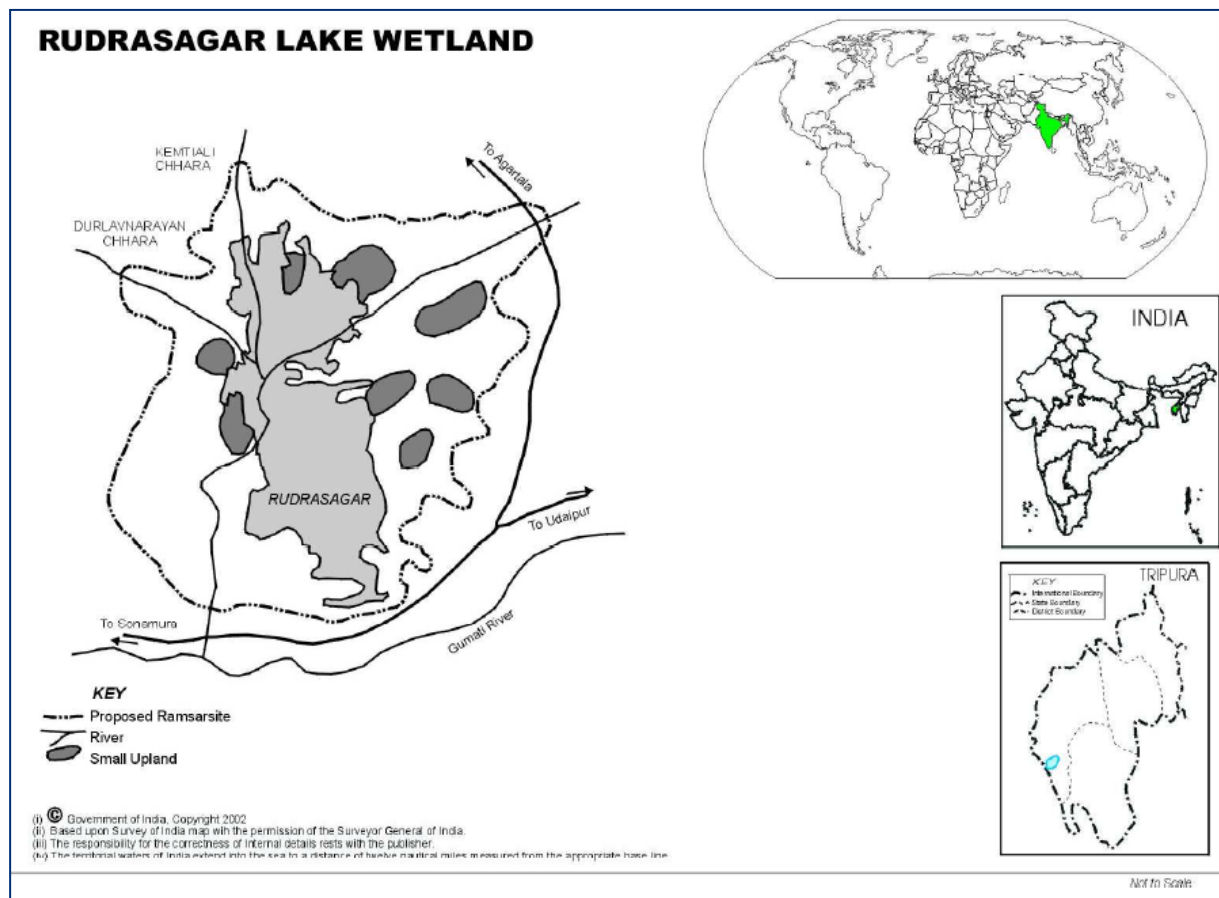


Figure 1. Rudrasagar Lake drainage pattern shown by the Map of Ramsar Wetlands International

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