

# **Economic Valuation of Bhoj Wetland for Sustainable Use**

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## **EXECUTIVE SUMMARY**

### **Introduction**

The Ramsar Convention defines wetlands as: *“Areas of marsh, fen, peatland, or water whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, depth of which at low tide does not exceed six meters”* and may include *“riparian and coastal zones adjacent to the wetlands or islands or bodies of marine water deeper than six meters at low tide lying within”*. (IUCN, 1971)

Wetlands are generally highly productive ecosystems, providing many important benefits. These benefits some times described as ‘goods and services’, may be wetland functions (e.g. ground water recharge, flood control), uses of wetland or its products (e.g. site for wood collection or research site) or attributes of the wetland (aesthetic component of the landscape, religious significance).

These multilateral ecosystems through their numerous functions provide substantial benefits to society. However despite their important role in maintaining the ecology and economy of the regions, almost all wetlands in India are endangered by lack of appreciation of their role. A few of the country's wetlands, which have a great deal of biological wealth are protected under the wildlife protection Act, whereas others which may not be as biologically rich do not share the same protection, and are easy target of developers. Considered wastelands, wetlands are the obvious choice when land is needed for development. However more often than not these benefits are recognised and undervalued, as they fall outside the ambit the market economy (Sustainable Wetlands, Cap 21).

Bhoj wetland being located in the urban area of Bhopal city of Central India is one such example of degradation of wetlands ecosystem on account of degradation of wetlands ecosystem on account of excessive use by the fast increasing urban population comprised of multiple stakeholders. For this wetland also various benefits are either underpriced or not priced at all as various environmental values are not considered in the existing management strategy of the wetland.

### **Project Objectives**

1. To value fully the wetland benefits / resources for appropriate allocation of wetland use
2. To help planners and policy makers, to develop a socially acceptable, environmentally sound and economically feasible strategy for wetland management.

The study first develops an 'Ecosystems Model' for the Bhoj Wetland using water quality parameters and then uses appropriate valuation techniques to capture the values of the wetland in the perspective of various stakeholders and recommends suitable measures for its sustainable management in future.

### **Study Area**

The Bhoj Wetland comprises two lakes the Upper and Lower Lakes. The Ministry of Environment & Forests (MoEF) of the Government of India has declared the Upper and the Lower Lake to be a Wetland of National Importance in the year 1988. Bhoj Wetland is one of the sixteen wetlands in the country that have been so far identified for conservation and management.

The Upper Lake is the highly diminished remains of the large lake constructed by Raja Bhoj, in the 11<sup>th</sup> century. The seasonal river Kolans, originating from Sehore, some forty eight kilometres from

Bhopal, and several small feeder streams at the western side of the lake, form the source. It has a catchment area of 361 km<sup>2</sup> and a waterspread area of 31 km<sup>2</sup>.

The Lower Lake also known as the Chotta Talab or Small Lake, is situated towards the east end of the Upper Lake and is almost fully surrounded by built-up areas. It has a small catchment area of 9.60 km<sup>2</sup> and a water spread area of 1.29 km<sup>2</sup>. Lower Lake receives its inflow in the form of seepage from the Upper Lake in addition to the drainage coming from 8 nallahs or drains. Water level is maintained constant by regular outflow through a waste weir at Pul-Pukhta into Patra Nallah.

### **Uses of the Bhoj Wetland**

**Drinking Water** – Nearly half of the city's drinking water supply comes from the Upper Lake and this is the most important use of the wetland as far as the welfare of the citizens is concerned.

**Employment** - The Bhoj Wetland provides employment to various communities like the fishermen, washermen, boatmen, vendors and so on. Approximately, 300 families are engaged in fishing and *trapa* cultivation while some 100 washermen also make their living from the Wetland. There are some 50 boatmen whose livelihood is dependent upon the Bhoj Wetland.

**Microclimate stability** - The microclimate of Bhopal is quite moderate as compared to the surrounding areas. The city according to its geographical location should actually have an extreme type of climate, but owing to the proximity of the Wetland, moderating effects on temperature and again cool land breeze during the evenings can be experienced which makes the evenings even during the peak of summer very enjoyable. Off course the moderating effects are also influenced by other factors such as the vegetative cover and all but the effect can be largely attributed to the Wetland.

**Recreation:** The Bhoj Wetland provides ample recreational opportunities to the people of Bhopal like parks, fountains and boating facilities.

### **Stakeholders of Wetland Uses**

Entire population – for drinking water & recreation

Lake front property owner for aesthetic beauty

Washermen - for washing clothes in the lake

Fishermen - for fishing activities

Trapa cultivators - for cultivating trapa

Water supply agencies - for water purification and distribution

Bhopal Municipal Corporation - for management of Lake

Department of Housing & Environment, Govt. of Madhya Pradesh - for decision making process

MPTDC - for tourism development in lake.

Vendors - for secondary benefits

### **Threats to the Wetland**

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Siltation

Solid waste pollutants

Sewerage

Washing Activity

Water Chestnut Cultivation

Encroachment

Increasing population

Weeds and eutrophication

Boating

Agricultural waste

Idol and *tadjia* immersion

Hospital Waste

### **Project Methodology**

Literature Review

Site Visits

Focussed Group Discussions

Secondary Data Collection

Workshops

Survey

Consultation:

Data Analysis

## **Ecosystem Modelling of Bhoj Wetland Using Water Quality Parameters**

The main objective of the Ecosystem Modelling of Bhoj Wetland was to understand the resource such that valuation process can be followed accordingly. The modelling exercise used water quality parameters to study the current status of the lake, followed by changes in the water quality parameters over the last few years and to project the status of the Upper and Lower Lakes in the future, based on past data and information from the restoration activities being carried out. It was expected that this exercise shall provide to the planner an insight for sustainable management techniques through prioritisation of various interventions and such that restoration activities shall be undertaken wherever required

The ecosystem modelling has been discussed in details in chapter V that begins with a general introduction to Ecosystem Modelling and then discusses the model for the Bhoj Wetland using water quality parameters. Further it gives an account of ongoing restoration activities taken up by the Bhoj Wetland restoration project executed by the Environmental Planning and Co-ordination Organisation (EPCO), Bhopal. It then gives values of the parameters at different points of time and their current status at seven Quality Monitoring Stations on the Upper and Lower Lakes. Using the data pertaining to water quality parameters at seven Quality Monitoring Stations on the Upper and Lower Lake, an advanced ecological model is developed using a software package STELLA. Based on 1985, 1991-92 and 1999 data of these parameters, compound growth rates have been determined and elasticities between various variables have been worked out so as to establish linkages between them. Having established significant linkages, the model has been developed and simulation runs have been performed first by using 1985 and 1991-92 data to find out what would be the status of the Lakes if such trends continued (without restoration and prevention activities, i.e. pre restoration and management activities) and then they are compared with another set of simulation runs using 1991-92 and 1999 data (after the commencement of restoration activities). The scenarios so obtained actually represent the health of the lakes ecosystem and stress the need to value the impact of changing health of the lake on economic system. They further throw light on prioritisation of future policy interventions which shall be required if the lake is to be managed sustainably. **Economic Valuation of Wetland Benefits**

Having attempted the ecosystem modelling, knowing the extent of degradation & threats, valuation was undertaken so as to cover the extent of monetary benefit or loss to various stake holder in case benefits are directly or indirectly marketed or people's perception for conservation of wetland resource in the absence of any such markets. As the uses are multiple it was difficult to capture one

single value for all of them together, hence a spectrum of valuation techniques have been used to capture economic value of various current uses only. Due to complexities and uncertainties no attempt has been made to capture the option and existence values.

The methodology for valuation of the uses, comprised of the following techniques:

1. Direct Valuation
2. Cost of Illness Approach and Defensive or Preventive Costs
3. Contingent Valuation Method (CVM)
4. Hedonic Pricing

The valuation exercise included calculating the values of supplying drinking water to the city, the value of benefits accruing to various people whose livelihoods depended upon the wetland, the value of preventive measures that people used to avoid water borne diseases and the willingness to pay of the people for enjoying better recreational facilities from the Bhoj Wetland. In addition to this the effect of the presence of the Upper Lake on the value of property prices was also studied and estimated. The summary of values through various valuation techniques is given in the following table.

Table: Estimation of Economic Values of Bhoj Wetland (Annual for 1999-2000)

Uses / Impacts	Stakeholders	Valuation Techniques	Value (in Rs)
A. Drinking Water	Water supplying agencies	Supply Cost	9,54,13,962
B. Fish Production	Fishermen	Market Price of Existing Production	80,00,000
C. Boating	Boatmen	Income Estimation	24,37,880
D. <i>Trapa</i> cultivation	<i>Trapa</i> (water chest nut) Cultivators	Market Price of Existing Production	50,00,000
E Washing of clothes	Washer men	Income Estimation	36,00,000
F. Secondary Activities			
i. Maize cob selling	i. Maize Cobb sellers	i. Income Estimation	i. 1,44,000
ii. Sugar cane juice selling	ii. Sugarcane juice sellers	ii. Income Estimation	ii. 2,73,600
iii. Snacks & cold drink stalls	iii. Individual owners	iii. Income Estimation	iii. 2,06,400
iv. Horse rides	iv. Individual owners	iv. Income Estimation	iv. 7,92,000
v. MPTDC	v. MPTDC	v. a. Revenue Generation	v. a. 18,00,000
a. Cafeteria		b. Revenue Generation	b. 6,74,635
b. Boating			
G. Water borne Diseases	Population using lake's water	Cost of Illness	12,00,254
H. Quality water	Population using lake's water	Purification costs	1,24,35,876
I. Recreation	Entire population of the city	CVM (voluntary Payment)	4,84,68,956
J. Increase in property prices	Lake front property owners	Hedonic pricing	50% difference in property prices

**Note : Rs. 46 = One US Dollar**

### Conclusion

Finally, using the results that have emerged from the entire project, a set of recommendations – technical and policy related have been developed in order to provide a firm basis for further activities concerning the Bhoj Wetland. It is hoped that the authorities that matter would keep the recommendations in mind while implementing the current work and also before taking up fresh activities in the Wetland.

## **I Technical Recommendations**

As the restoration activities are going on & shall take another year or so to complete and their impacts could be rightly assessed only after their complete execution. At the same time has been observed that the restoration and prevention activities have not been taken up in sequential manner. Thus it is necessary to follow stepwise physical interventions to restore the status of both the lakes of the Bhoj Wetland. The following are suggested to effectively implement the restoration subprojects:

- a. *Preventive measures:* Floating fountains have been put up in the Lower Lake at huge costs without first of all completing the garland drain project which would stop the sewage from entering the Lower Lake. As a result sewage continues to flow unabated into the Lower Lake and at the same time, the floating fountains are supposed to aerate the Lakes. Naturally, the effect of the latter cannot be observed unless the flow of sewage is stopped.
- b. *Problems with the road:* Retghat –Lalghati road has been constructed on the left bank of the Upper Lake , which is supposed to act as barrier to prevent encroachment but sewage through neighbouring colonies still continue to flow underneath.

## **II. Policy Related recommendations:**

The critical need today is to recognize the inter-linkages and benefits that could be obtained if the wetland is managed in an ‘integrated manner’ and is ‘sustainably used’. It is a very challenging task and requires actions at many levels and delicate integrity of diversity of issues and management institutions. Such an approach must begin with involving all stakeholders in the wetland in the form of a local area institution that shall be helpful in eliciting their views for use and future management of the Bhoj Wetland. The Institution so formed could frame the action plan to cover all ecological, economic, social and institutional issues. To cover the above issues the following set of policy recommendation is proposed:

People’s Participation

Effective co-ordination

Transparency

Setting up of a Bhoj Wetland Management Committee

Economic Valuation

Setting of a Management Fund

Cost Benefit Analysis

Promotion of Ecotourism

Development of View Points

Prioritisation of Activities Using Simulation Runs of the Proposed Ecological Model

It is believed that the recommendations listed above, if taken care of by management authorities shall help in economically wise, environmentally sound and socially acceptable process for sustainable management of such an important 'Urban Wetland'.