

Bhoj Wetland: Management and Conservation

Ratnam Swamy¹ and Anugya Shandilya²

^{1,2}Maulana Azad National Institute of Technology
E-mail: ¹ratnamswamy193@gmail.com, ²anugya.shandilya@gmail.com

Abstract—The Upper and The Lower lakes, both of which are man made reservoirs form what we call the Bhoj Wetland. Van Vihar National Park surrounds the upper lake on the south, human settlements on the east and north, and agricultural fields on the west, whereas lower lake is surrounded by human settlements from all sides and has a partial urban component in its catchment (361 sq km in area) on the eastern end while the remainder is rural.

The Lower Lake on the other hand, has a small catchment area of 9.60 sq km and supports a wide variety of flora & fauna. More than 20,000 birds have been observed annually in this region. Issues that have been identified for our research are Excessive growth of Aquatic Plants, Encroachment in Catchment Area, Cattle rearing on the grasslands present on the wetland, this not only removes the green cover from the soil due to excessive grazing but also invites tigers from the Bhoj wetland to come out and enter the city.

The study involves visual surveys, biological and chemical test on the quality of water, collection of information through secondary sources after which maps will be generated using GIS for conducting slope analysis. Also, Flow Mapping, Flow Accumulation mapping would be carried on to understand the catchment area.

The proposals would include recommendations to improve marine ecosystem based on the laboratory tests and other proposals would include strategies to manage the wetland and the ongoing activities.

1. INTRODUCTION

Bhoj Tal, which is a part of Bhoj Wetland, is a man-made lake which satisfies the domestic and recreational needs of the residents of Bhopal. The study has been conducted to analyse and understand the current scenario of Bhoj Wetland in order to find out the basic problems and solutions to these problems. Upper Lake is the source of water for 40% of the population of Bhopal. This statistical value not only defines the significance of the lake but also forces us to think about the upkeep of the lake considering the rising population of the capital of Madhya Pradesh.

The area is rich in biodiversity and therefore needs to be protected to conserve the natural environment of the state. Proper guidelines are required to be followed for the catchment areas in order to save the water body. These guidelines can also be modified as per the demands. Conservation of nature is the need of the hour.

2. MATERIALS AND METHODS

2.1. Locale of Study

The study was made on the catchment areas of the Upper Lake and Lower Lake (Map 1) from where the water samples were collected for the testing. The untreated water was collected from Upper Lake and treated was collected from Nagar Palika Water Treatment Plant.



MAP 1 Upper Lake

2.2. Data Collection

Visual Surveys, photographs, biological and chemical test to check the quality of water, was carried on. Secondary sources involve Research works and various reports available online.

3. BACKGROUND

3.1. History

The Bhoj Wetland consists of two lakes: The Upper and The Lower lakes which are manmade reservoirs. The Upper Lake or *Badee talab* was created in 11th century by constructing an earthen dam across the Kolans river and the lower lake constructed nearly two centuries ago immediately downstream of the Upper lake, have catchment of 361sq.km, respectively. Van Vihar National Park surrounds upper lake on the south, human settlements on the east and north, and agriculture fields on the west whereas lower lake is surrounded by human settlements from all sides and has a partial urban component in its catchment (361 sq km in area) on the eastern end while the remainder is rural.

The Lower Lake, locally known as Chhota *Talab*, was created in 18th century. It is situated towards the east end of Upper lake and is fully surrounded by built-up areas. Compared to the Upper Lake it has a small catchment area of 9.60 sq km. A wide variety of flora & fauna is supported by the wetland hence it is rich in bio-diversity. A total of more than 20,000 birds have been observed annually.

3.2. Need for the study

The study was conducted keeping in mind the recent cases of tiger sighting in the inner areas of Bhopal, like New Market. Also, the reduction in the number of migratory birds and floods of 2016.

Some of these issues have been addressed to reach some conclusion and the most appropriate solution in each case that is being discussed.

4. LITERATURE STUDY

4.1. Range of Biodiversity

4.1.1. Flora

106 species of Macrophytes (belonging to 87 genera of 46 families), which includes 14 rare species and 208 species of Phytoplankton comprising 106 species of Chlorophyceae, 37 species of Cyano phyceae, 34 species of Euglenophyceae, 27 species of Bacilariophyceae and 4 species of Dinophyceae.

4.1.2. Fauna

105 species of zooplanktons, which includes (rotifera 41, Protozoa 10, Cladocera 14, Copepoda 5, Ostracoda 9, Coleoptera 11, and Diptera 25). Fish fauna consist of 43 species (natural and cultured species), 27 species of avifauna, 98 species of insects and more than 10 species of Reptiles and Amphibians (including 5 species of tortoise) have been recorded so far.

4.1.3. Justification for Designation as Ramsar Site

It is an unique man-made wetland, characteristic of the Central Indian Plateau region. During the intervening 900 years the ecosystem has stabilized and presently it represents a near natural wetland.

The wetland supports a wide variety of flora and fauna. Diverse flora provide ideal habitat in the form of food and shelter for a large number of avifauna. Due to biotic interaction and natural selection process a characteristic relationship between vegetation and the avifauna has developed.

A recent phenomenon is congregation of more than 100 - 120 sarus cranes in the lake. The largest bird of India, sarus crane (*Grus antigone*) is known for its size, majestic flight and life time pairing.

4.1.4. Ecological Aspects of the Upper Lake

A wide variety of flora & fauna is supported by the wetland thus promoting its ecological significance as a wetland. Following are some important ecologic features of the lake:

- I. Phytoplankton: 208 species
- II. Zooplankton: 115 species
- III. Fish fauna: 43 species
- IV. Avifauna: 179 species
- V. Insects: 98 species
- VI. Reptiles and Amphibians: 10 species

4.1.5 Basic scenario of the Lake

The lake has a catchment area of about 370 sq. km spreading in two administrative districts of Bhopal and Sehore. The catchment area can be easily categorized in rural (70%) and urban (30%) catchment with different variations in landuses and impacts.

The Urban portion of the catchment constitutes about 18% area of the Bhopal city inhabited by 20% population of the city spread over in 23 wards out of 66 municipal wards of the city. Problems associated with urban catchment area: As stated earlier the urban area due to its landuse pattern has higher population density having following main problems associated with urban area.

Information on land use/ cover pattern, especially the extent and spatial distribution is a prerequisite to understand the catchment characteristics. The land use/cover information help in formulation of policies and programmers for wetland management. [3]

4.2. Other Uses of Upper Lake

Fishery Resources: The lake supports a wide variety of fish resource. 35 species of fishes have been distinctly identified and reported from the Upper Lake. About 200 fishermen families are dependent on fish resources of the lake. The catch of the lake is major source of fish to the local resident.

The Bhojpal Fishermen Cooperative Society, a cooperative society of the local fishermen is the leasee of the lake issued every year by the Bhopal Municipal Corporation.

Trapa Cultivation:

The local fishermen community have been traditionally growing *Trapa* (Water Chestnut) in the lake. About 100 ha of the lake area, specifically near the Khanugaon is under *trapa* cultivation.

Trapa community uses water of the lake as a fertile soil. This further enhances the abilities of the lake water.

4.3. Multiple Stakeholders of the Lake

Since the lake is a multiple use waterbody hence it has a multiple stakeholder community.

- I. Govt. Agencies. BMC, Distt administration, railways, PHE, Tourism, Wildlife, Housing and Environment.
- II. Civil Society: NGOs
- III. General Community.
- IV. Educational and Research Institutions
- V. Fishermen and trapa cultivators

5. DATA COLLECTION

Visual Survey

A few photographs have been taken to show the healthy natural ecosystem of the region.



Fig. 1 Bhoj Wetland

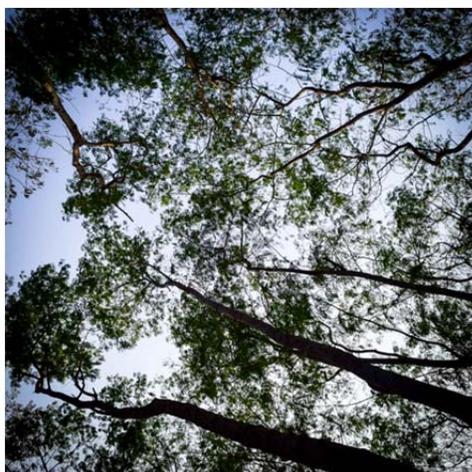


Fig. 2 Flora in Bhoj Wetland(a)



Fig. 3 Upper Lake from Bharat Bhavan



Fig. 4 Flora in Bhoj Wetland(b)



Fig. 5 Fauna in Bhoj Wetland (Arachnid)

6. LABORATORY TEST FOR WATER QUALITY

Table 1 Chemical Test

Parameters	Unit of Measurement	Before Treatment	After Treatment
Colour	Hazen Unit	35	<1 unit
pH		7.2	7.5
Turbidity	NTU	13.0	1.04
Total Dissolved Solids	mg/l	160	120
Chloride (Cl)	mg/l	15	25
Carbon Dioxide (CO ₂)	mg/l	1.76	<1
Biological Oxygen Demand (BOD)	mg/l	36	<1
Chemical Oxygen Demand	mg/l	120	<1

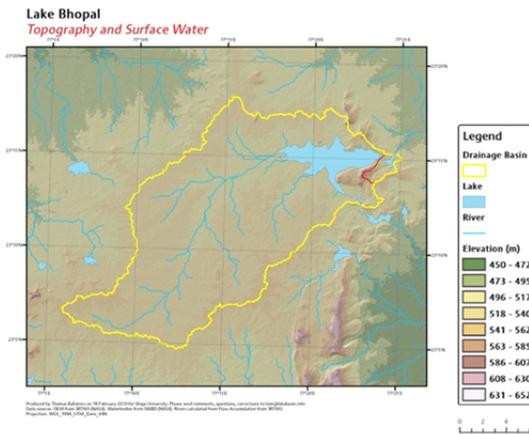
Table 2 Bacteriological test

Test	Unit of Measurement	Results
Escherichia coli	In 100 ml	Absent
Coliform bacteria	In 100 ml	Absent

7. ANALYSIS USING GIS

Several maps have been used for analysis, these maps are as follows:

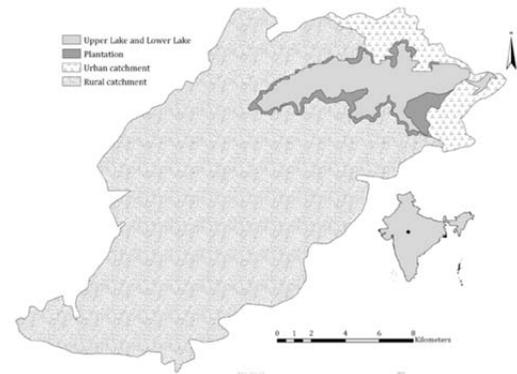
8. TOPOGRAPHY AND SURFACE WATER



MAP 2 Topological Map

This map shows that the Surface Water is spread in the whole region. Topography is plain and does not have any evident feature.

9. MAP SHOWING CATCHMENT AREAS.

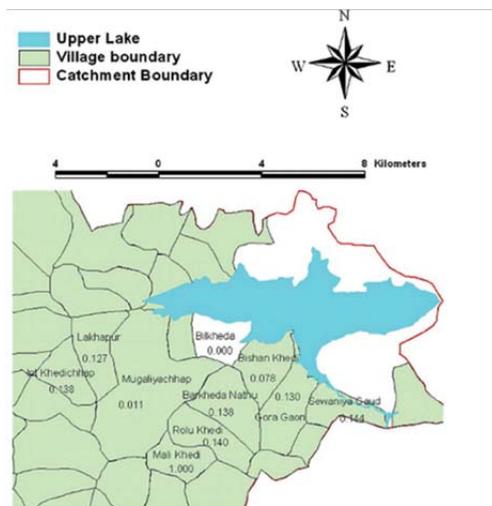


MAP 3 Catchment area of Urban Rural settlement[2]

This map shows the combined Urban+Rural areas and their respective catchment areas including both the lakes[2]. With this map, one can also conclude that plantation is only around the water body. This makes the catchment area less green and prone to soil erosion.

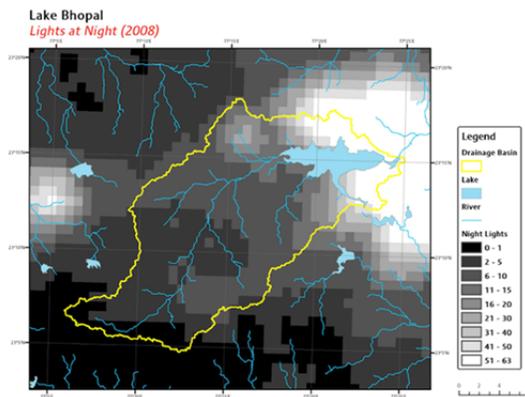
10. MAP SHOWING RURAL CATCHMENT

This map shows the villages that come under the catchment area. The presence of villages yet again becomes a problem, which is, cattle excessively feeding upon grasses or over grazing. The rural catchment area is harboring 86 villages having 14000 households. Agriculture is the main activity in the area and 70% of the land in the catchment is under cultivation. Animal husbandry is the second main activity of the catchment.



MAP 4 Map showing village boundaries and catchment area[2]

11. FLOW ACCUMULATION



MAP 5 Map showing Flow Accumulation

The results show that the drainage basin is along the southern direction of the Bhoj Tal. This shows that the southern part of the district is a flood prone area.

12. ISSUES IDENTIFIED

I. Overgrazing

Overgrazing becomes a major concern here because this not only loosens up the soil and causes soil erosion but also the cattle attract the tigers from the nearby-protected areas.

II. Negligible Buffer Zone

Currently, a buffer zone of around 30-50m is there to prohibit construction near the water body. This also allows tigers to escape. There are only 6 tigers in the region and it can be an easy task to manage these tigers with proper measures and by following guidelines.

13. RECOMMENDATIONS

The cattle can be shifted elsewhere, or the tigers can be given a GPS(Global Positioning System) Tag which can locate all the six tigers. A real time monitoring system is required. Fencing should be increased but regular maintenance will also help to control any mishaps.

Aeration can help stabilize the pH of the water along with causing reduction in alkalinity, removing carbon dioxide. Promoting the breeding of fishes in the region.

14. CONCLUSION

Opting for better planning can not always be backed up by policies and guidelines. Even something as small as a fish can improve the condition of the lake. In addition to this, latest technological innovations must be incorporated in day to day planning work. This can include a GPS, use of GIS to analyze relevant data for future projections or to solve current problems.

Bhoj Tal is very important for Bhopal since it is the only option that saves Bhopal from Urban Heat Island Effect. The water acts as a natural cooling system and an absorber.

REFERENCES

- [1] Najeeb Ahmad Bhat, Ashwani Wanganeo, Rajni Raina. "Variability in Water Quality and Phytoplankton Community during Dry and Wet Periods in the Tropical Wetland, Bhopal, India", *Journal of Ecosystem and Ecography*(ISSN: 2157-7625), 2015
- [2] Madhu Verma & Dhaval Negandhi "Valuing ecosystem services of wetlands—a tool for effective policy formulation and poverty alleviation"(*Hydrological Sciences Journal*) ISSN: 0262-666 , 2011
- [3] Vipin Vyas, Shriparna Saxena and Pradeep Shrivastava "Conservation and Management of Bhoj Wetland" (Upper Lake) of Bhopal, India, With Reference To Integrated Lake Basin Management