

Morphological Analysis of Water Bodies-A Case of Bangalore

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I. INTRODUCTION

In an urban ecosystem, Lakes are one of the elements responsible for environmental sustainability. The function of environmental sustainability is carried out through various processes such as recharging water tables, as catchments that prevent floods, source of drinking water, serving as a hub of biodiversity that in turn supports livelihood and other economic sectors such as agriculture, domestic and industrial. Regardless of its origin, lakes form pockets of important urban green forms in a metropolitan city that is characterized by rapid urbanization.

Unplanned urbanization patterns have caused not only the exploitation of peri-urban areas but also encroachment of natural green pockets in the urban areas such as parks, open areas and water bodies. Owing to the nature of ownership of lakes, Bangalore has witnessed a rapid transition of lakes and other low lying areas to human activity hubs. This act of vanishing lakes has adversely affected the agricultural sector and a decline of fresh water sources. Undue growth of settlements and pollution has led to the growth of aquatic weeds on the surface of lakes and phenomena like eutrophication has caused lakes to lose the flood absorbing capacity which have in turn led to urban floods.

II. HISTORY OF BANGALORE LAKES

Bangalore as we know it today has been attached with various names like Garden City, Pensioner’s paradise, the air conditioned city and so on. One of the lesser known names is ‘The City of Lakes.’ Owing to the natural ridged terrain of the city, Bangalore has three main water valleys namely the Hebbal Valley, Vrishabhavathi Valley and the Koramangala-Challaghatta Valley as shown in Fig.1. These major valleys were characterized by major streams and tanks and manmade lakes formed appropriate intermediate green spots to facilitate the daily lives of the residents as it served as a vital source of fresh water.

The fact that Bangalore is no longer the ‘City of Lakes’ is an alarming call. As Bangalore is transforming from a Metro to a Mega City, the worst hit sectors are the lakes and are put to misuse, causing the water scarcity, loss of Biodiversity of the region. The intense urbanization has resulted in lakes being replaced by bus terminals, stadiums, High rises, public buildings and layouts.

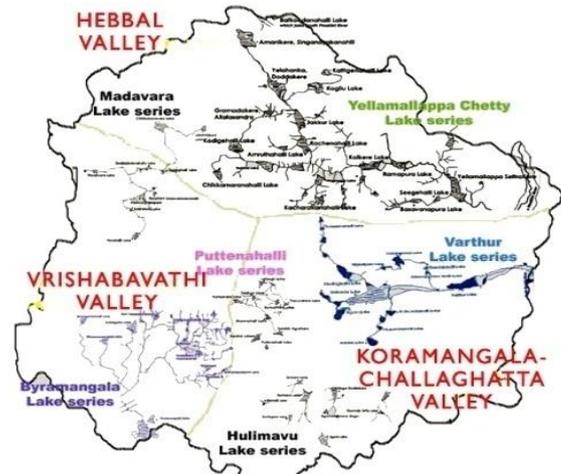


Fig 1:- Three major valleys of BBMP area
 Source: LDA

➤ Morphology of Lakes

An analysis of the land use change over the past 4 decades shows a consistent decline in Water Bodies and an increase in the Built up area as shown in Fig.2. A city that constituted as much as 5% in Lake Area is now being represented as a downward curve dropping down to as low as 0.53% as depicted in Fig.3.

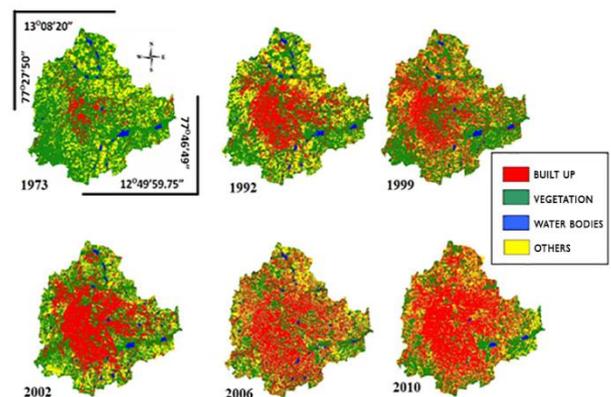


Fig 2:- Analysis of Land use changes
 Source: Geospatial World

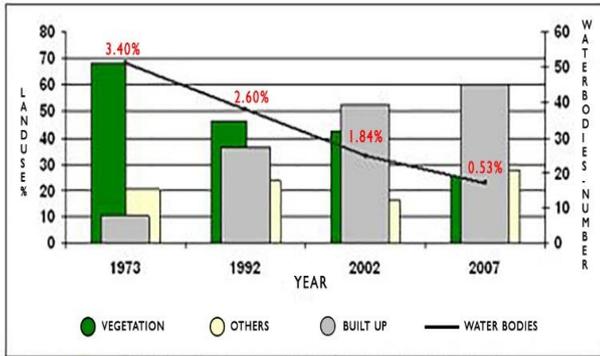


Fig 3:-Graph showing decline in Water Bodies over the years

Source: Geospatial World

III. ISSUES

- Lake areas are seriously threatened by encroachments of slums along the margins.
- Discharge of sewage in to lake waters.



Fig 4:- Encroachment and Pollution of Rajakaluves in Bangalore

Source: Report on Bangalore’s Lakes and Impact on Ground Water.

- Contamination of lake waters due to dumping of garbage and immersion of Ganesha idols.



Fig 5:- Pollution in Lakes due to Immersion of Idols. Source: Annabel Cooks for blogs. Ft.

- Privatization of Bangalore Lakes.
- Urban floods.



Fig 6:- Floods in Hosur Main Road and Bilakahalli Source: Report on Bangalore’s Lakes and Impact on Ground Water.

- Eutrophication of plants and animals.
- Depletion of surface and ground water supply.
- Washing clothes, bathing cattle on the lake beds.
- Covering of lake water by water hyacinth.



Fig 7:- Water Hyacinth cover on Subramanyapura Lake Source: Author

IV. INTERVENTIONS

A. Prototype – Conservation of Subramanyapura Lake

➤ Aim

Conservation and rehabilitation of Subramanyapura lake in an ecologically viable and socially sensitive manner based on cost effective and economically feasible technologies.

➤ Objectives

To identify the threats and disturbances to the lake ecosystem.

- To assess the extent of encroachment in to the lake using various maps.
- To propose appropriate measures for the protection of the lake area.
- To identify the potential for constructed wetland and a tree park system in the Rajakaluve.
- To identify an alternative space for rehabilitation of slums, who have encroached the lake.
- To promote ecologically wise methods, to enhance the bio-diversity value of the lake.

➤ Location

Located in Bangalore south, Subramanyapura village limits, Uttarahalli, Hobli.

➤ Key Threats and Disturbances to the Lake

The lake area is seriously compromised by encroachment along the lake margin.

- Lake waters are highly polluted and eutrophic due to inflow of untreated sewage from Gubbalala village discharge from large apartments blocks of Mantri and Gokula(ISCKON).
- Lake is contaminated by disposal of garbage as a means to landfill and encroach from the margins.
- 90-100% coverage by water Hyacinth during 2009-10.
- Serious encroachments on its northern and eastern sides by the slums.
- Watershed is threatened by the immersion of the Ganesha idols during the festival.

➤ *Potential Impacts of Neglect*

Possible encroachment of lake and its watershed, especially Rajakaluve.

- Eutrophication and consequent fish kills and extermination of other aquatic life forms.
- Public health hazards due to infection of drinking water sources.
- Extinction of Habitat of birds, depletion of surface and ground water flows, resulting in local water scarcity.

➤ *Morphology of Subramanyapura Lake*

The village map reveals that the lake is surrounded by grazing pasture (Gomala) which are public commons. Today these commons are severely encroached.

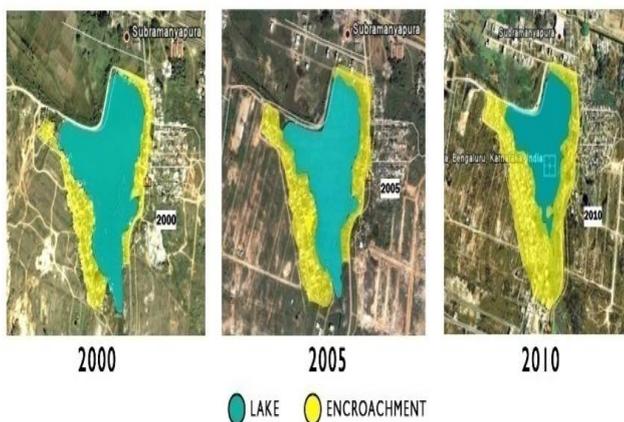


Fig 8:-Gradual increase of encroachment
Source: Google Earth Maps

➤ *Strategies and recommendation frame work*

Certain regulations applied on the micro scale that would produce beneficial effects on the macro scale.

- The existing slums on the lake bed can be rehabilitated in the place of Gomala land for group housing.
- The Rajakaluve can be converted in to a constructed wetland to purify the untreated sewage water.
- A Kalyani can be provided near the lake to immerse the Ganesha idols during the festival and also it serves as source of drinking water for the cattle.

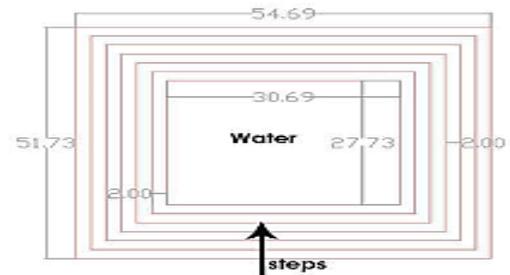


Fig 9:- Plan of Proposed Kalyani (Immersion Tank)
Source: Author

- Discharge of untreated sewage from the apartments should be stopped immediately.
- They must be allowed to discharge only treated sewage into the Rajakaluve.
- No garbage disposal in to watershed or lake bed must be allowed.
- The lake has to be desilted periodically in an ecologically sensitive manner.
- A recreational park may be developed in the Gomala land including the play facilities for the children.
- The CDP-2015 does not recognise the Gomala land, and lake area as public commons must be revised and corrected.
- The slums which are to be rehabilitated to be fully provided with proper sanitary facilities to avoid further contamination of lake water.
- The area around the Rajakaluve can be converted into an aesthetically pleasing and biodiversity rich tree park.
- Similarly, discharge from the surrounding villages should be channelized into constructed wetland for the treatment.



Fig 10:- Proposed Constructed Wetland
Source: Author

A Constructed Wetland is a transitional environment and the most biologically diverse of all eco-systems. Plant life found in wetland is Mangroves, Water lilies, Cattails, Sedges, Tamarack, Black spruce, Cypress, Gum etc. Animal life includes many different amphibians, reptiles, birds, insects and mammals.

Constructed wetlands serve as natural waste water purification systems. Raw or pre-treated waste water is piped into the plants and flows through a constructed passage. The elimination processes take place during this

passage. They are based on various complex physical, chemical and biological processes within the association of substrate, macro and micro-organisms.

Pollutant	% Reduction
Suspended Solids	80
Litter	70
Total Phosphorous	45
Total Nitrogen	45

Table I. Pollution reduction in constructed wetlands

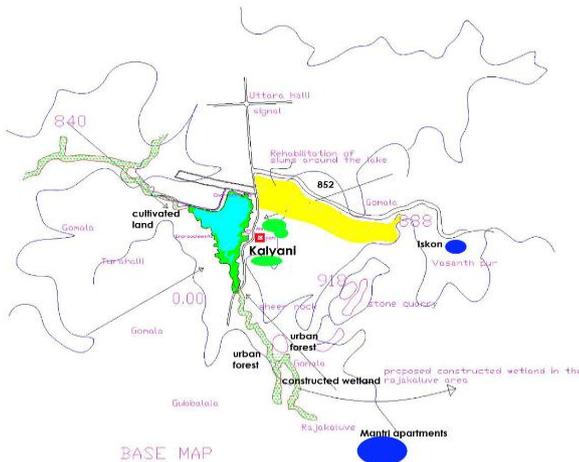


Fig.11. Schematic Diagram Showing the Proposed Interventions
Source: Author

Interventions as shown in Fig.7 include Greening of the encroached lake bed, Rehabilitation of Slums from Lake Bed, Kalyani to immerse Ganesha Idols and a Constructed Wetland to facilitate the purification of grey waters from the surrounding buildings before entering the Lake.

B. Immediate Action to Remove Encroachments

- Lake restoration to be taken up based on lake series and not in isolation.
- Stop entry of raw sewage.
- Select lakes that are relatively undisturbed and rehabilitate them into drinking water reservoirs.
- Lakes with high biodiversity to be notified for conservation.
- Promoting the involvement of local communities in lake preservation and restoration.
- Recommends constitution of lake management committees involving local residents and voluntary organizations.
- Highlights the need to protect the interest of traditional users of the lakes such as dhobis (washer men), fishermen etc.

V. CONCLUSION

The estimated population of Bangalore by the year 2020 would be around 120 lakhs (12 million) and it demands very proactive and effective regulation, planning and execution to face the challenges of water scarcity and to keep the city Habitable.

According to the study conducted by T.V Ramachandra [5], the predicted Land Use Map for 2020 shows a 0.2% increase in the Water Bodies from the current percentage of 0.54. This may be due to the strategies and framework implemented by various authorities, in view of restoration of the existing, misused lakes of Bangalore.

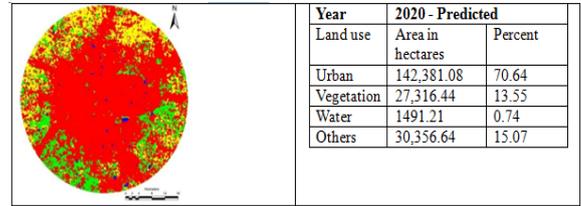


Fig 12:- Predicted Land Use Map for 2020
Source: Geospatial World

Although the various lakes in Bangalore are posed by numerous threats ranging from fires over lakes to loss of Aquatic life, the major issues revolving around all lakes are interwoven by a common thread. Adopting measures from the proposed interventions in Subramanyapura Lake, these design interventions may be used as a prototype and be implemented in lakes across Bangalore.

The Rajakaluves of Bangalore are the connecting link of all the water bodies in the city. Micro level interventions adopted by the Government and due co-operation by the residents of the encroached lake beds, surrounding villages and apartment authorities will resonate and produce a larger impact on the connected water bodies.



Fig 13:- Biodiversity rich tree park – Potentials of making micro level changes
Source: Author

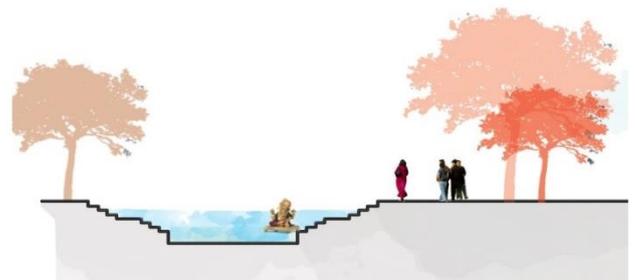


Fig 14:-Kalyani – Potentials of making micro level changes
Source: Author

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