

## RESEARCH ARTICLE



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# Impact of vanished and encroached lakes: A case study of Bangalore metropolitan region

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## Abstract

A lake is a terrain feature, a body of liquid on the surface of the world that is localized to the bottom of basin and moves slowly. It is a body of fresh or salt water of considerable size that is surrounded by land. The Bangalore Metropolitan Region lies towards the south-east in the south Indian state of Karnataka. The Bangalore Metropolitan Region situated between 12° 14' 16" to 13° 30' 26" north latitude & 77° 2' 51" to 77° 57' 45" east longitude. The total geographical area of Bangalore Metropolitan Region is 8005 sq Km. The main aim of the paper is to understand the situation and impact of vanished and encroached lakes. To reach set goals first literature collected from various works and to prepare maps for topography of Bangalore metropolitan region remote sensing data and GIS techniques are used. The results of environmental pollution of the lakes cause a serious chain of reaction in transfer, bio accumulation & deposition of pollutants in the system. For example aquatic plants play a key role in protecting water quality & providing habitat. In some cases the streams are cut off or blocked by constructions which often lead to urban floods during the heavy rains.

**Keywords:** Encroachment; lake; metropolitan region

## Introduction

A lake is a terrain feature, a body of liquid on the surface of the world that is localized to the bottom of basin and moves slowly. It is a body of fresh or salt water of considerable size that is surrounded by land.

Where there is water on earth, virtually no matter what the physical conditions, there is life. This colourless, odourless and tasteless liquid is essential for all forms of growth and development-human, animal and plant. Also, water is a fundamental basic need for sustaining human economic activities. While water is a renew-

able resource, its availability in space (at a specific location) and time (at different periods of the year) is limited, by climate, geographical and physical conditions, by affordable technological solutions which permit its exploitation, and by the efficiency with which water is conserved and used.

Surface water resources have played an important role throughout history in the development of human civilization. But, these sources also serve as the best sinks for the discharge of domestic as well as the best sinks for the discharge of domestic as well as industrial wastes. This unscientific

disposal of wastes has caused immense problems but not only to human beings but also to the aquatic environment worldwide. (Das & Acharya, 2003).

Lakes and ponds are important freshwater habitats throughout the world but increasing human populations result in an accelerating demand on water supplies for domestic, industrial and agricultural use. The expected population increase coupled with economic development and changing life-styles over the next 25 years will result in that availability of freshwater resources is predicted to be one of the great issues for humankind to solve in the 21st century (Johnson et al. 2001). In spite of their fundamental importance to humans, freshwater systems have been severely affected by a multitude of anthropogenic disturbances, which have led to serious negative effects on the structure and function of these ecosystems.

The results of environmental pollution of the lakes cause a serious chain of reaction in transfer, bio accumulation & deposition of pollutants in the system. For example aquatic plants play a key role in protecting water quality & providing habitat. They also provide shelter for fish, wildlife & invertebrates that in turn to provide food for other organisms. They help improve water quality protect shorelines & lake bottoms while playing significantly in adding to aesthetic quality of the lake (Jafari, 2007).

In spite of the great importance to humans of access to fresh water of high quality, fresh water systems have been mis-used for many centuries. Small lakes and ponds have been drained or filled in to extend arable land, regulated to reduce water-level fluctuations, used as dumps for an array of anthropogenic wastes ranging from untreated sewage to synthetic substances, and many natural populations of commercially-important freshwater species have been over exploited. All these factors will alone and in combination negatively affect the quality and availability of water for human consumption. Moreover, these anthropogenic disturbances have had, and will continue to have, serious effects on the natural systems and their biota (Sala et al. 2000), having far-reaching effects on ecosystem functioning and biodiversity.

The drainage of Bangalore Metropolitan Region radiates from high grounds in radial pattern. The Bangalore city has three important valleys are those of Hebbal, Vrishabhavati and Koramangala or Challaghatta and Naravanaholla. The Bangalore Metropolitan Region have been covered by four river basins like Arkavati, Kanva, Vrishabhavathi, Dakshina pinakini.

At present, some of the streams are highly polluted to an extent that they are no more streams but drains of household sewage and let outs of industrial waste. In some cases the streams are cut off or blocked by constructions which often lead to urban floods during the heavy rains.

## Objectives

The main aim of the paper is to understand the situation and impact of vanished and encroached lakes.

## Methodology

To reach set goals first literature collected from various works and to prepare maps for topography of Bangalore metropolitan region remote sensing data and GIS techniques are used

## Study area

The study region lies in the southern maiden region of the state and is by and large an open country which is lacking in natural barriers. Bangalore metropolitan region bounded on the north by Chikkaballapura district; on the east Tumkur & Mandya district; on the south Mandya & Chamaraanagara district; on the west Kolar & Tamil Nadu states; The Bangalore Metropolitan Region lies towards the south-east in the south Indian state of Karnataka. The Bangalore Metropolitan Region situated between  $12^{\circ} 14' 16''$  to  $13^{\circ} 30' 26''$  north latitude &  $77^{\circ} 2' 51''$  to  $77^{\circ} 57' 45''$  east longitude. The total geographical area of Bangalore Metropolitan Region is 8005 sq. Km.

The Bangalore metropolitan region is well-known for its lakes and tanks which take care of the drinking water requirements of the city with an average annual rainfall of 1100 mm. One of the major reasons for the disappearance of lakes, their storage capacities and shrinkage of their area is encroachment. However, the information on this issue is inadequate to understand its magnitude and impact. Even the existing limited information is not enough to draw any inferences as it differs across the sources. However, one thing is clear that both public and private sectors have encroached upon vast tracts of lakes. The public agencies, in the course of developing public infrastructure of various kinds have either completely or partially encroached upon lakes. The magnitude of such encroachment has been presented below. The government agencies such as Bangalore Development Authority, Bruhat Bangalore Mahanagara Palike, Karnataka Road Transport Corporation, Karnataka Housing Board, Sports Authority of India, Karnataka State Pollution Control Board and other government departments have expanded their activities beyond the city limits and town municipalities for providing housing, public amenities and infrastructure facilities for the growing population, besides booming information technology and its embedded services. In the process of expansion several lakes were either destroyed or encroached upon. This is reflected in the decline in the number of lakes.

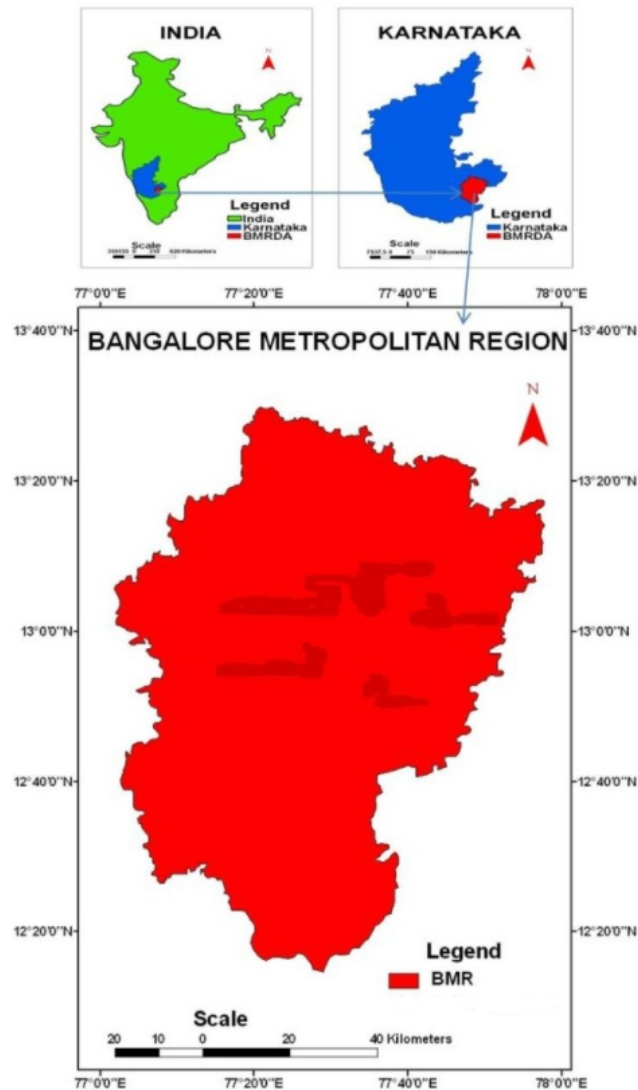


Fig. 1. Location map

The number of tanks decreased from 262 in 1960 to 81 in the conurban area in 1986 and 67 in 2006. This meant disappearance of 195 tanks. The surviving 67 are also at different stages of deterioration.

The story of 262 tanks in the greenbelt area and 60 live lakes in conurban area is no better in recent times, as many of these tanks have been partially encroached upon by government and private individuals for various purposes. However, there is no adequate and reliable information that does not help us understand its magnitude due to variations across the sources on this aspect. From the table it is evident that the extent of encroachment of water spread areas of lakes in Bangalore city was between 228.02 acres and 519 acres. When looked at the proportion of water spread area encroached.

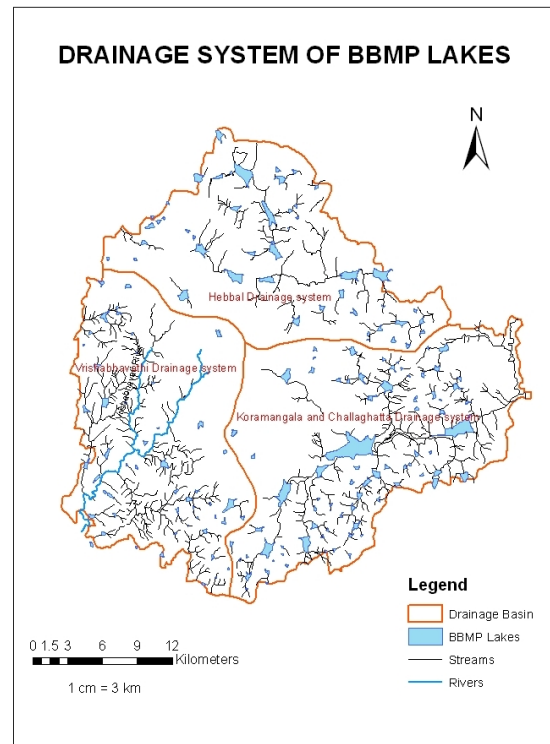


Fig. 2. Drainage system of BBMP lakes

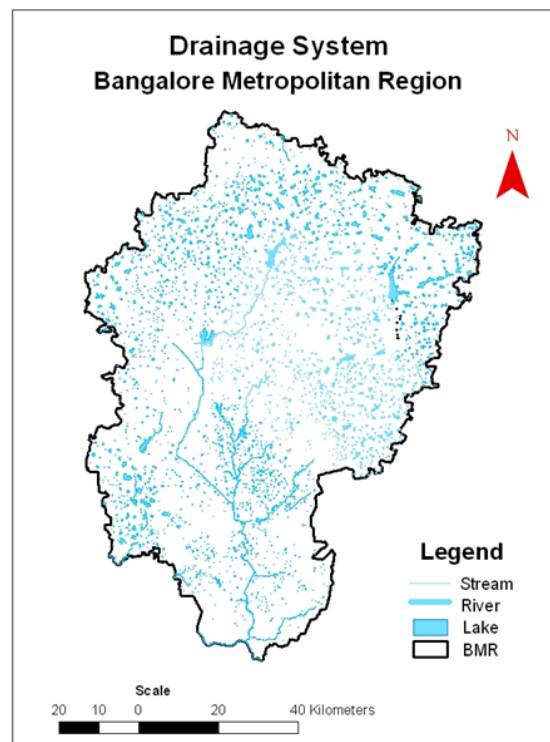


Fig. 3. Drainage system of Bangalore metropolitan region

**Table 1.** Status of lakes in Bangalore

Sl. No.	Current Status	No. of Lakes
1	Dried up and are leased out by the Government	13
2	Sewage water filled and some of them are in advanced stages of deterioration	60
3	BDA has breached for forming extensions, creating public utilities and house sites for general public	28
4	Unauthorised occupation by slums and private parties	15
5	Recognisable as small pool of water (cess pools) due to encroachments	7
6	Cannot be traced (fully encroached)	4
Total		127

**Table 2.** Encroachment areadetails in Bangalore

Sl. No.	Source	Extent (Acres)
1	Forest Department (2004)	519.00
2	Deputy Commissioner's Office. Bangalore Urban District (2006)	228.02
3	A T Ramaswamy Committee Report (2006)	2179 of encroachment in Bangalore Urban district by 1678 people. Out of these, 48 tanks which are in the Urban Forest division has an encroachment of 313 acres by 553 people.

Sources: 1. Forest Department

## Loss of irrigated, water-spread and catchment area

The immediate impact of disappearance and deterioration of lakes is the loss of irrigated area. However, data on this aspect are not readily available to assess the impact. However, data on this aspect are not readily available to assess the impact. However, one can roughly estimate the shrinkage of irrigated area based on the minor irrigation department data of the state as a whole. As per the latest data, there are 36,383 tanks in the state with a water spread area of about 438963 hectare and a command area of 690000 hectares, which work out to 18.82 hectare of irrigated area per tank and an average water spread area of 11 hectare. If we go by this norm, the disappearance of 195 tanks in Bangalore caused the loss of irrigated area of about 2540 hectare and water spread area of about 1485 hectare.

Alternatively, the loss of irrigated area of 24 tanks listed by the Lakshman Rao Committee report and as per the census

1981 accounts for 506.90 hectare which amounts to 21.12 hectare per tank. If we apply this norm, the loss of irrigated area of all 195 tanks works out to 4461.60 hectare.

If we look at the same fact in another way, the decline in irrigated area in Bangalore urban district is even higher than the state average. As per the DES data, the net irrigated area by tanks in Bangalore Urban district declined from 8004 hectares in the triennium ending 1988-89 to 2319 hectares in the triennium ending 2004-2005. The corresponding proportion of the tank irrigated in the total net irrigated area from all sources in the urban district also declined from 47.97 percent to 18.25 percent during the same period. This was due to breaching and encroachment of several lakes. The disappearance of the lakes in the city also led to the loss of catchment area. In Bangalore, the loss of independent and intercepted catchment was 869.70 sq. km and 1209 s km respectively. This estimate is obtained based on the average catchment area of tanks in rural areas which worked out to 11.18 sq. km.

## Human suffering

The loss of irrigated area and the resultant decline in production are directly related to the conversion of lakes into non-agricultural purposes. But the generation of wealth for the urban society is many times higher than the loss of production. But the farmers who had lost these lands are living in miserable conditions. No doubt many of the farmers, who had owned land under these lakes in the command and catchments. Were paid compensation at the time of acquisition, but that compensation neither provided a permanent solution to the loss of their land nor assured a good future to their children. More than this, 95 percent of the farmers who had owned land under these tanks were small and marginal farmers growing sugarcane, paddy and vegetables with assured income. This fact is evident from the recently conducted study by the institute for social and economic Change, Bangalore, where the farmers had lost their land for the formation of Bangalore development authority sites. According to this study, a large part of the compensation they received was spent on unproductive purposes. Further, they lost their agricultural skills and livestock.

## Loss of drinking water sources

Tanks were almost supplying 1/3<sup>rd</sup> of the total demand of the city. This source completely as a result of the destruction of tanks. The existing ones are also largely encroached upon and have lost not only their water-holding capacity but also potable water. The recharging capacity of lakes has also been reduced due to non-filling and loss of water spread area and storage. This situation has forces the civic bodies to shift from tank source to alternative sources for supplementing drinking



water, through at a high cost. Today, the city Bangalore is getting water from the river Cauvery which is 140 km away at an enormous price.

### Reduction of storage due to encroachment and sedimentation

The lakes have become dumping grounds for all kinds of waste materials-both solid and liquid industries, hospitals, poultrys, contractors, individuals households and the BBMP dump their waste into the lake beds. This has led to water pollution and silt formation in the lakes affecting the water holding capacity of these tanks. The sedimentation has also reduced the water impounding capacity of the lakes. The loss of water holding capacity due to siltation sedimentation has been estimated to be more in urban areas as compared to 23-30 per cent in the case of rural tanks. The loss of water depth and shallowness has led to drying up of tanks due to evaporation, leading to depletion of ground water levels, the ground water, which could be tapped earlier in the city at 80-90 feet, has gone down to 1000-1500 feet. The growth of water hyacinth and consumption of water by these weeds have also reduced the water holding capacity of several lakes in the city. The encroachment of tank bed areas by land mafia in the adjoining areas too has significantly contributed to the low storage levels.

### Pollution of water

In the heart of the city and extensions, the encroachment of tanks by individuals and public agencies has made the tanks not only very small but also reduced the storage levels. These encroached bodies have been used by public and private agencies for easy dumping of urban solid wastes, debris, domestic sewage, industrial effluents and immersion of Ganesha Idols. This has contributed to the deteriorating water quality, making it unfit for human consumption. Many studies on the quality of lake water in the city have found that water in the lakes contains high levels of phosphate, sulphate, calcium and alkalis which make the water very hard. The presence of high metal toxicity in the lake water prevents the farmers from using it for irrigation. The polluted water of these tanks also pollutes other water bodies due to the chain of tanks system.

### Conclusion

Rapid urbanization in Bangalore Metropolitan Region has posed a serious threat to natural resources around urban areas. The demand for land in urban areas increased fast. This was met not only by expansion in the peri urban areas but also by taking over the breathing spaces in urban localities. These included green lands, parks, and water bodies. The worst victims were the tanks and ponds in and around urban areas as the ownership was easily manoeuvrable. All this resulted in the disappearance of most of urban lakes.

The vanishing of lakes has caused loss of irrigated lands, drinking water sources as well as threatened agricultural activities, the fisher folk, greenery; and recreation activities. Even the existing lakes have become unfit as sources of drinking water due to the growth of water hyacinth and other aquatic weeds and encroachments. These have lost food absorbing capacity leading to the new phenomenon of urban floods. The urban floods are playing havoc in the cities due to the loss of natural drainage activities and the low-lying areas which were earlier under tank irrigation, having come under various human activities. Human beings and livestock living around these lakes are prone to severe vulnerabilities and disease vectors.

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