

# Davanagere Lakes – Issues and perspectives on pollution, Restoration and Management

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**Abstract** - *The environmental conditions of any lake systems depend upon the nature of that wetland and its exposure to various environmental factors. These fragile ecosystems must maintain the state of environmental equilibrium with the existing surroundings-particularly from a special perspective of anthropogenic activities and pollution. Even though various efforts and restoration are now being undertaken in checking the degradation of water quality of lakes, these urban lake systems as a result of encroachment, reclamation, sedimentation, excessive nutrient discharge, untreated sewage and effluent discharge and deforestation around the lake systems in Davanagere, still the problem of pollution persists. Pollution of lake systems in Davanagere has been largely attributed to the rapid and uncontrolled expansion of the city. Also, the increasing demand on land for development has resulted in putting the pressure on lakes and many small lakes have vanished under this pressure. Some lakes have been heavily affected by farming activities including the uncontrolled discharge of pesticides and fertilizers. Solving the problems at end point is a temporary measure with more serious repercussions. The solution to tackle this problem at source points with strict enforcement of our environmental laws and regulations. and also by preventing untreated waste water coming from various point and diffuse sources.*

**Key Words:** *Environmental pollution, Eutrophication, anthropogenic activities, point and non point source pollution.*

## 1. INTRODUCTION

Lakes and streams are known to be the ecological biometers of the health of the city. They regulate the microclimate of any urban center. The presence of lake in any region greatly influences the life of people living around it. Lakes are considered to be important with reference to climate, travelling, irrigation, recreation,

trade and fisheries. The natural undulating terrain of the davanagere city, with small hills and valleys, lends itself perfectly to the development of lakes that can capture and store rain water. These lakes play a very important role in urban ground water recharging network. Urban aquaculture and agricultural activities solely depend upon on the availability of these impoundments and their tributaries.

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Even though various efforts are now being undertaken in checking the level of environmental degradation facing these urban lake ecosystems as a result of encroachment, reclamation, untreated sewage industrial effluent discharge, sand mining, and deforestation around them, still the picture looks gloomy for many of these water bodies in the city.

However the city's population has already touched 4.35 lakhs, at present Davanagere spreads over 72 square kilometer and as per 2011 census with population density of 6000/square kilometer. Due to rapid growth in educational institutions population is increasing. This rising concern in the race to save the existing lakes of the city.

### 1.1 History of formation of Davanagere lakes

The earliest record of construction of artificial surface water catchments areas of Davanagere dates back to 12th century when the second largest lake in Asia Shanthi Sagara was built by Princess shanthi. Later on Sir.M Vishweshwariah designed and built an aqueduct and water is used for agriculture and irrigation purposes. Water from the other lakes such as Kondajji lake, Bathi lake, Hadadi lake, Avaragere lake was also used by the people for their water requirements.

Historically all the natural lakes and the construction and reclamation of them by the development authorities is the cradle of origin for today's Davanagere. These natural and other impoundments helped in checking floods, recharging and maintaining the ground water table, and

establishing agricultural activities. The Davanagere city now due to increase in population is witnessing is environmental degradation and pollution.

### **1.2 Major causes of degradation of lake systems in Davanagere**

The rapid growth of human population, proliferation of buildings, roads and vehicular traffic congestion in Davanagere has taken a heavy toll of wetlands including lakes. Further; encroachment and illegal waste disposal activities and bad management have threatened the very existence of many of the valuable and productive wetland habitats in the city. As a result the lakes are polluted from two major sources: the point source pollutants and non point source pollutants. Pollution coming from the point source contaminants include excessive nutrients from waste water coming from municipal and domestic effluents; organic and toxic pollution from industrial effluents, sediments and organic matter pollution along with storm water runoff from human settlements spread over areas along the periphery of the lakes and tanks.

Degradation of lakes forms another major part of the environmental problem. For example, the silting of lakes on account of increased erosion as a result of expansion of urban and agricultural areas, deforestation, road construction and such other land disturbances taking place in the drainage basin; diversion of streams and channels feeding the lakes reducing their sizes; competition arising for using lake water such as for irrigation, degradation of catchment areas, immersion of cultural idols; and growth of invasive species such as water hyacinth.

## **2. THE LAKE EUTROPHICATION**

Eutrophication is caused by the enrichment of a lake with chemical nutrients, typically components containing nitrogen or phosphorous. Eutrophication is a major form of lake pollution because it promotes excessive plant growth and decay, favoring certain weedy species over others, and causes severe water quality problems and depletion of dissolved oxygen. In the lakes, the enhanced growth of choking aquatic vegetation or phytoplankton disrupts normal functioning of the lake ecosystem, causing a variety of problems. Consequently, eutrophication decreases the resource value of the lakes affecting water quality, aquaculture, and even aesthetic activities. Health related problems can occur where eutrophic conditions prevail and interfere with drinking water treatment.

### **2.1 Sources of Lake Eutrophication:**

Sewage is the major source of nutrients worldwide. This can be treated by establishment of treatment plants. Moreover, fertilizer leaches largely nitrogen and phosphorous which are designed to boost plant productivity end up destroying the water quality and biodiversity of lake system. The general urban run-offs carrying detergents accelerate eutrophication and hence the death of a lake biodiversity. Urban monsoon floods increase the water levels in various waterways and drains.

The flushing and scooping phenomenon of storm water take with it enriched organic matter.

### **2.2 Effects of Eutrophication**

The effects of eutrophication include changes in algal bloom and species composition. This increases water turbidity, supersaturation with dissolved oxygen in the daytime. Some algal species produce toxins, notably the blue green algae which become dominant eutrophication proceeds. Excessive nutrient inputs also alter macrophyte composition. Initially, some tolerant species may flourish, but after the dissolved oxygen has been used up for decomposition of organic matter, the species begin to die out. Eutrophication also causes sediment changes. Death of phytoplankton blooms of macrophytes decay all add up to the consequence of eutrophication.

### **2.3 Eutrophication causes decreased biodiversity**

When an ecosystem experiences an increase in nutrients, primary producers reap the benefits first. In lake ecosystems, species such as algae experience a population increase (called as algal bloom). Algal blooms limit the sunlight available to bottom-dwelling organisms and cause wide swings in the amount of dissolved oxygen in the water. Oxygen is required by all respiring plants and animals and it is replenished in daylight by photosynthesizing plants and algae. Under eutrophic conditions, dissolved oxygen greatly increases during the day, but is greatly reduced after dark by the respiring algae and by microorganisms that feed on the increasing mass of dead algae. When dissolved oxygen levels decline to hypoxic levels, fish and other aquatic organisms like zooplanktons suffocate. As a result, fish and other bottom dwellers die off.

### **2.4 Eutrophication and toxicity**

Eutrophication may toxicity; some algal blooms are toxic to plants and animals. Toxic compounds they produce can make their way up the food, resulting in biomagnifications. Freshwater algal blooms can pose a threat to livestock. When the algae die or eaten, euro and hepatotoxins are released which can kill animals and may pose a threat to humans.

Eutrophication is also caused due to the increase in the concentration of nitrate (NO<sub>3</sub>), nitrate has been shown to be toxic to human babies. This is because bacteria can live in their digestive tract that convert nitrate to nitrite (NO<sub>2</sub>). Nitrite reacts with hemoglobin to form methemoglobin, due to its more affinity towards oxygen. It is a condition that does not carry oxygen. The baby essentially suffocates as its body receives insufficient oxygen.

### **2.5 An Overview on the status of water quality on Davanagere lakes.**

While Davanagere, Kundwada, lake have successfully been restored and maintained, more other number of lakes have continued to deteriorate. Field observation confirms that even in some of these restored lake systems confirms that signs of recurring trend of pollution and degradation.

The studies conducted on some of the lakes like avaragere, hadadi, bathi shows that more than two thirds of the 60 water samples collected on bimonthly basis, the pH is above 8, Turbidity levels vary between 20 to 300 NTU, with all lakes severely affected by total solids and organic matter. Total hardness value was found in the range of 90 to 200 mg/l. Levels of phosphates were found more than the permissible limit for more than 40% of the samples. Dissolved oxygen levels were found below 4 mg/l. with highly variable degrees of chloride. Sodium, potassium and pesticide pollution.

### 2.6 Sewage and water Hyacinth on urban lakes.

Studies reveal that Bathi Lake faces an impending challenge from the diverted sewage line of davanagere city from the west side. Here, the rising levels of sewage water are threatening to inundate the adjacent area and increase level of eutrophication along the periphery of lake. Avaragere lake is the another lake undergone the restoration recently by the district administration, just before the restoration the lake was completely covered with water hyacinth and sediment carried by the storm water caused decreased in the carrying capacity of lake. In some points the water looks greasy, farmers harvest the grass from these wetlands for fodder. They also let their animals feed on this wet field. This might cause health risk to both the animal and human beings.

### 3. LAKES AND ENCROACHMENT

Encroachment has been another biggest crisis facing lake in Davanagere. Acres of the former agricultural fields that once surrounded avaragere village along the eastern side are now busy construction sites for new real estates. This is also a similar trend in the eastern and western part side of Bathi Lake, once a pristine water system with natural clean quality. Encroachment of Avaragere and bathi lakes has already begun to accelerate the degradation of these tanks. Nevertheless, hadadi lake and kundwada tank faces similar fate. Earlier, villagers used to drink the water from the lakes. But situation has changed now with falling levels of Dissolved Oxygen and an increasing Biochemical Oxygen Demand.

### 3.1 Lake Water and Nitrates Toxicity

Bathi and Avaragere Lake is an exceptionally clear example of excessive use of Nitrates as agricultural fertilizers. Although Nitrates can be caused by other leaching effects of septic tanks and sewage, here in bathi and avaragere the major problem is the use of fertilizers especially for agricultural activities. Samples collected from various sampling points in the lake reveal excessive presence of Nitrates above its permissible level. The situation is more alarming in the ground water. Here; further studies are needed to assess the levels and effects

of Nitrates found in Ground water on the people living around the lakes. Nitrate can cause a "Blue-Baby Syndrome" for infants 6 months old.

### 3.2 Contamination of lakes with sewage

Bathi lake and avaragere lake symbolizes another environmental hazards emanating from the lake. The lakes are largely used for fishing and irrigation purposes. The visual quality of these lakes is enough to conclude that these lakes is now hazardous for any economic activities related to human consumption such as fishing, bathing and for other domestic use. Effluents along with the untreated sewage is discharged into these lakes which has decreased the water quality for substantial amounts and people in this area have been complaining of itching cases when they come in contact with the water of these lakes.

### 4. CONCLUSIONS

Although some lakes of the district are somewhat good in its water quality the bathi lake and avaragere lakes are prone to more degradation towards its ecosystem and water quality. Immediate restoration efforts should be made to bring back the water quality of the lakes to the acceptable limits and maintain the balanced ecosystem of these lakes.

### 4.1 Suggestions for restoration and management of lakes.

Source control is the most important aspect in protection of Lake Watershed zones. This practice includes soil conservation measures, bank/slope erosion control measures, afforestation, and drainage improvements, control of sewage and solid wastes, sewage interceptions and diversions and participations of people in watershed management measures. In lake treatment measures to remove eutrophication and improve water quality of Lake Water. These include lake dredging and desilting, De-weeding, Hyacinth control, Bioremediation controls. There are further number of methods which include:

- a) Establishment of protected parks and sanctuaries around the lakes.
- b) Shoreline management through controlled entry and demarcation of lake boundaries
- c) Public participation in conservation of lakes
- d) Establishment of resource and information centres for scientific and social studies related to lakes.
- e) Environmental education and awareness
- f) Production of guidelines for protection measures, watershed management, restoration measures, hydrological measures, pollution control measures, socio-economic development through community participation, monitoring and evaluation, public awareness and education, and legislative and administrative measures.

## 5. RESTORATION AND MANAGEMENT OF LAKES IN DAVANAGERE CITY

The Lake Development Authority, an autonomous body instituted in July 2002 has formulated the reinvigoration plan which it is implementing along with the agencies such as National river conservation Authority, Department of Ecology of GoK, Davanagere Mahanagara Palike. Karnataka State pollution Control Board, Karnataka urban water supply and drainage board and District Administration. The multi pronged programme primarily involves desiltation of lakes, sewage diversion and storm water drains that connect them and biological treatment of sewage entering the water bodies.

Recently in 2012 District Administration along with these agencies did the task of rejuvenation of Avaragere Lake. The principal objectives included desiltation, restoration and construction of new bund line for lake. Some of the other methods like eco-engineering of the lake shorelines and immediate catchment peripheries, resuscitation of lakes to boost aquifers, diversion and treatment of sewage lines, improving sanitation and health conditions of areas within the lake catchments systems, preserving the habitat and ecosystem of aquatic life, construction of sewage treatment plants, removal of water hyacinth should be carried out to preserve the lakes from deterioration.

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