

Conservation and management of Urban lakes; A case study of Udaipur city

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ABSTRACT

The pressure of population and economic activities has as impact on the urban lakes. The over exploitation of water from the lakes and discharge of effluent in the lakes are serious problems. Establishment of hotels on the bank of lakes to attract more tourists is a serious issue, which needs careful investigation. The city of Udaipur is situated in the Western Part of India and is also known as the lake city of India. Udaipur city is considered for the study. The present study was carried out to understand the pressure on the lakes of Udaipur. The study includes the analysis of factors that are responsible for the degradation of the water quality and lake's aesthetic value. On the basis of the results obtained it was concluded that the lakes need conservation and management strategies for the sustainability of lakes.

Key words: Urban lakes, Conservation, Management, Sustainability

Introduction

India is blessed with several small and big wetlands. Wetlands can be natural or man made. It includes lakes, ponds, streams, lagoons etc. Lakes are the integral part of wetland ecosystem. Traditionally, lakes had been used for several purposes like washing, fishing and agriculture. Apart from these functions lakes are ecologically vital because they helps to recharge ground water, channelize the water flow and act as a host to wide variety of fauna and flora. Urban lakes are located in the urban fabric of the city. Urban lakes are important because they act as a source of drinking water, boosts touristic activities, improve microclimate of the city and holds important aesthetic and cultural values. Urban lakes are also act as natural aquifers that maintain groundwater level (Saraf *et al.*, 2015). Urban lakes are generally manmade. Reddy *et al.*, (2006) define

urban lakes as fresh water bodies, which are surrounded by land on all sides. Urban lakes are reservoirs that are used to store rainwater and surface runoff.

Udaipur city is famous for its pristine lakes, which provides an element of divinity to the city. It is also called as the "city of lakes", because of the numerous lakes and ponds. Besides these water reservoirs the city had 121 baories of which 83 have dried up (Mangal *et al.*, 2015). Lakes of Udaipur are important to the city, as they are act as a backbone of the city's economy as it attracts thousands of tourists from all parts of world throughout the year. The lakes make a profound influence on the environment by bringing favorable changes to the microclimate in a region where people are facing low humidity, scorching heat and glare (Samant, 2010).

Materials and Methods

The Study area

Udaipur city is a historical city situated in south-western part of Rajasthan. It has semi arid climate type. It is also called the “Land of Kings” as it has produced many brave leaders and kings. The city was founded by Maharana Udai Singh ji in 1553. Udaipur’s lake system comprises of 10 lakes as shown in Figure 1. The upper lakes are Badi Lake, Bada Madar and Chota Madar. The urban lakes are Pichola, Rang Sagar, Kumaharia talab, Swaroop sagar, Fateh sagar and Goverdhan sagar. Lake Udaisagar is downstream lake located in the outskirts of the Udaipur city.

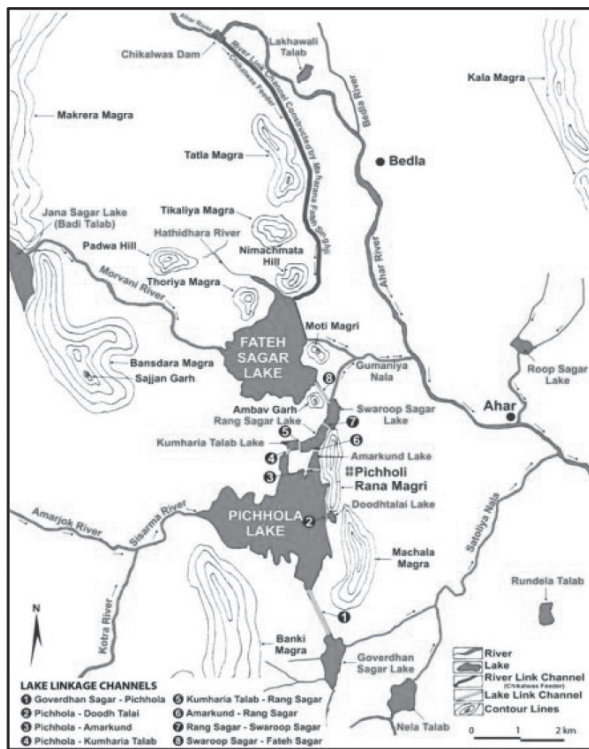


Fig. 1. Lake system of Udaipur

Study method

The steps of methodology that has been adopted are given in Figure 2. Firstly, background study of the area was done. Then objectives were clarified and formulated. Literature review was done in detail about the urban lakes and Udaipur lakes. Data is collected through various means like questionnaire and interview with the local population of Udaipur.

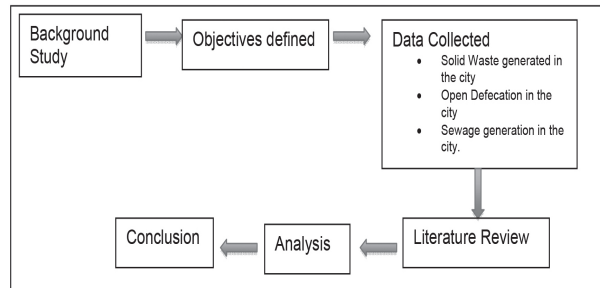


Fig. 2. Methodology

Individual observations have been made time to time to assess the water quality of lakes. Detailed analysis has been done based on the objectives. The paper is concluded on the basis of the analysis and results.

Results

Urban lakes are dynamic structures, which are influenced by the activities taking place in and around their vicinity. The data collected during the study had been tabulated in Table 1, 2 and 3. Table 1 and Figure 3 shows the total waste generated in Udaipur city everyday.

Table 1. Waste Generated in Udaipur city.

Categories	Waste generated in kg	Waste generated in Metric Tones
Domestic waste	140672	140.672
Commercial waste	75026	75.026
Other Sources	15241	15.241
Total solid waste generated in a day	230939	230.939

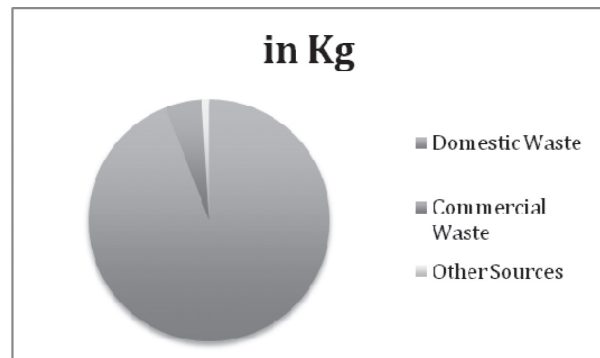


Fig. 3. Total waste generated in Udaipur city

Open Defecation is another problem along the banks of Pichola Lake and Fateh Sagar Lake. Table 2 and Figure 4 show the number of toilets and per-

Table 2. City population using toilets.

Indicator	Nos
Total households	88,859
No. Of household toilets	83,366
Population using toilets	4,39,928
Household with no toilet	5612
Population going open defecation	28,980
Community toilets	0
Public toilet complexes	50

centage of the population using the toilets and percentage of population going for open defecation. Approximately 0.5% of the population goes open defecation around these lakeshores.

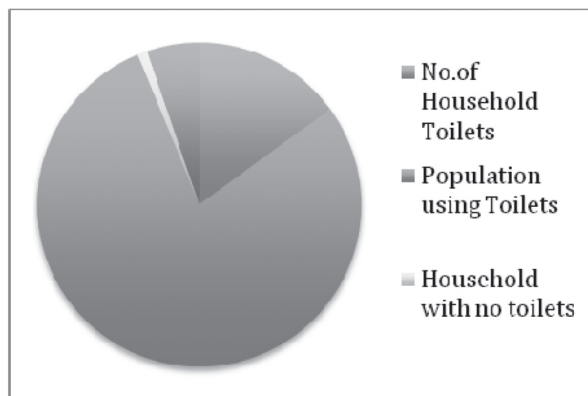
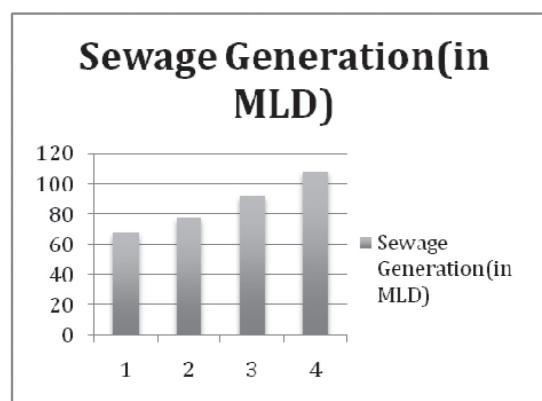
The city lakes are always vulnerable to sewage discharges as they act as an easy dumping grounds. The total sewage generated in the city has been discussed in Table 3 and Figure 5. There is one sewage treatment plant, which has a capacity of 20MLD. 50% of the treated sewage water is reused in the internal operations of the STP and 30% of the sewage water disposed off in Ayad River. 20% of the sewage water is discharged in the city water bodies. According to the results obtained the lakes of Udaipur are facing three major issues: (i) Dumping of solid waste in the lake water. (ii) Open defecation at the lakeshores. (iii) Discharge of untreated sewage water.

Table 3. Sewage Generation in the Udaipur city

Year	Sewage Generation (in MLD)
2014	67.353
2021	77.744
2031	92.137
2041	108.553

Discussion

According to Barlow, (2007) India's urban water demand is expected to be double by 2025 and the industrial water demand is going to be triple. Water resources in India are depleting at a very high pace so it is extremely important to conserve these precious resources before they totally vanish. Udaipur's urban lakes are facing anthropogenic pressure. Between the years 1991 to 2001, the city experienced a 59% increase in population (Rathore, 2008). Udaipur is an economic hub due to presence of lakes, natural beauty, historical structures that

**Fig. 4.** Representation of the Population using toilets**Fig. 5.** Sewage generation in Udaipur city

provide lucrative business opportunities to the local population all round the year.

According to Table 1 and fig. 3 the domestic waste is the major contributor of the waste produced in the city. 94% of the total waste is the domestic waste, which is being generated from the households. Where as, only 5% of the waste is commercial waste, which is generated by hotels, small eateries, dhabas etc. However, 1% is the waste, which is generated from different sources like sweeping, cleaning of road etc. Open defecation is another problem, which the urban lakes of Udaipur are coming across, as human faeces have coliform bacteria. Thus, open defecation causes bacteriological pollution in the lakes as it gets carried away to the lakes by runoff and storm water. The open drains and which directly discharges waste water into the lakes. As shown in the Table 2 and Fig. 4, 5% of the total population goes open defecation out of that 0.5% of the population goes open defecation around the lake shore of Swaroop sagar and Rang

sagar. It reduces the hygiene of the lake shore and water and also reduces the aesthetic value of the lake. Every year, Udaipur receives large inflow of foreign and domestic tourist, so this problem can act as a set back for the tourism industry.

As shown in Table 3 and Fig. 5, the sewage generation of the city estimated to be increased by 40% by 2031. Around 30% of the untreated sewage water gets its way into Ayad River which is one of the freshwater sources for Udaipur lakes. Around 20% of the sewage gets discharged into the urban lakes. Untreated sewage discharge is reducing the water quality and making the water nutrient rich. There are about 53 hotels around the lakes. Because of lack of sewerage system all these hotels release their wastewater into the lakes (M.E.P, 2006).

Conclusion

The goal of the research work is to understand the environmental conditions prevail in the Udaipur city, and to analyze the importance of lakes to the city. As per the analysis the lakes of Udaipur are facing multiple issues like rapid urbanization, degradation of catchments, degradation of water quality and their aesthetic value. There are several factors, which are responsible for the degrading water quality of lakes. In this paper 3 factors Solid waste generation, Open defecation and Sewage generation have been discussed in details. On the basis of the results obtained we can observe that the lakes are

under constant pressure. Immediate action is required for the sustainable management of lakes. These lakes are vulnerable for the further destruction as the development in the city is never ending, so it should be understood from the analysis that appropriate conservation strategies needs to be formulated and should be applied for the sustainability of lakes.

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