

Anthropogenic Impact on the Lake Ecosystem

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ABSTRACT

Introduction. In today's world rapid urbanisation travels at a very high pace, tarnishing our nature and wanderlust ecosystem without discriminating with any of the specific ecosystems. Human activities play a very prominent role in causing disruption to the wetland ecosystem and disbalancing the lake equilibrium. **Objective.** The present paper deals with the impact of anthropogenic activities on water resources and the lake ecosystem is degrading due to the encroachment of local livelihood. **Methodology.** To know about the human impacts on Anasagar Lake, conducted informal and open-ended interviews with local people residing near the lake area. To get more information about the human impact, interview the nearby farmers who have been practising agricultural activities for more than 20 years. This analysis attempts to identify the strategic factor which is responsible for the degradation of the lake. **Result.** There are multiple agents which are responsible for degradation of Lake Anasagar. It is important to find out the particular human activities that are responsible for lake water degradation. At the same time, it must be highlighted that the lake is in stress due to the encroachment of the basin, discharge of untreated sewage, fertilizer run-off, pesticides and solid waste dump. **Conclusion.** The majority of Lake Anasagar is facing the problem of Eutrophication due to discharge of untreated waste water, fertilizers, sewage and run offs containing higher values of chemical nutrients. It has caused a severe effect on fishes, frogs, crabs, etc. The out migration of birds is one of the easily recognisable changes of ecological pattern caused by anthropogenic activities. These factors are responsible for continuous degradation of Anasagar and they are often mutually reinforcing.

Keywords: human intervention; wetland ecosystem; degradation; sedimentation; water quality; urbanisation.

1. INTRODUCTION

The water resources of a country play a significant role in agriculture, horticulture, industrial activities, factories, fisheries, navigation, and recreational activities. The scarcity of water in an arid and semi-arid environment leads to intense political pressures, often referred to as "water stress" (Wolf, n.d.). Water for basic needs such as drinking and cooking is rationed to meet other needs such as irrigation, livestock watering, manufacturing of material goods, and recreational activities. However, agriculture and industry use the largest quantity of water annually.

In the past, wetlands were considered wastelands and drained for agricultural use, now wetlands are recognized for their value in improving water quality and their intrinsic value as ecosystems. Wetlands play an important role in improving the water quality by filtering sediments and nutrients from surface water (Mitsch & Gosselink, 2000). Aquatic vegetation helps in removing around 90 percent of the dissolved nutrients like nitrogen and phosphorus and in adsorption of heavy metals. Lake is one of the important water resources used for irrigation, drinking, fisheries, and flood control purposes. It also

provides habitat for invertebrates, fishes and aquatic birds.

Anasagar wetland is one of the important productive ecosystems. A number of resources have been present in the vicinity of the lake area. Water is one of the important resources, which is used for irrigation, fishing, and recreational activity. On the other hand, it also provides a habitat for invertebrates, fishes and aquatic birds. This lake plays a significant role in the hydrological and ecological stability of the surrounding landscape. Changes in water quality were due to the use of land for agriculture after the water recedes in the dried-up area of the wetland, waste disposal and other polluting practices around the lake.

2. AREA UNDER STUDY

Anasagar Lake is an artificial lake situated in the city of Ajmer in Rajasthan state in India. This is one of the most

beautiful lakes in India. Later, Mughal Emperor Jehangir contributed to the Daulatbagh gardens and Shah Jehan built the Baradari. It is situated at the centre of Ajmer city (74° 38' - 74° 42' and 26° 25' - 26° 29' N) (Fig. 1.). The lake is spread over 13 km. The lake has a capacity of 4.75 million cubic metres up to a maximum depth of 4.4 m. It has a catchment area of 70.55 sq. km (Mathur et al., 2010). Among the existing lakes in Ajmer, Anasagar Lake is the biggest one with the maximum catchment area. Foy Sagar is another major lake in the city. There are more than a dozen small ponds in Ajmer city. The Rajasthan High Court has banned construction in the catchment areas of the lake basins (Pandey et al., n.d.).

The area is in a stressful situation because of the urban activities which are taking place near the water body. This will eventually affect the water spread of the lake. Construction activities and disposal of chemicals and fertilizers in the lake are eventually polluting the water

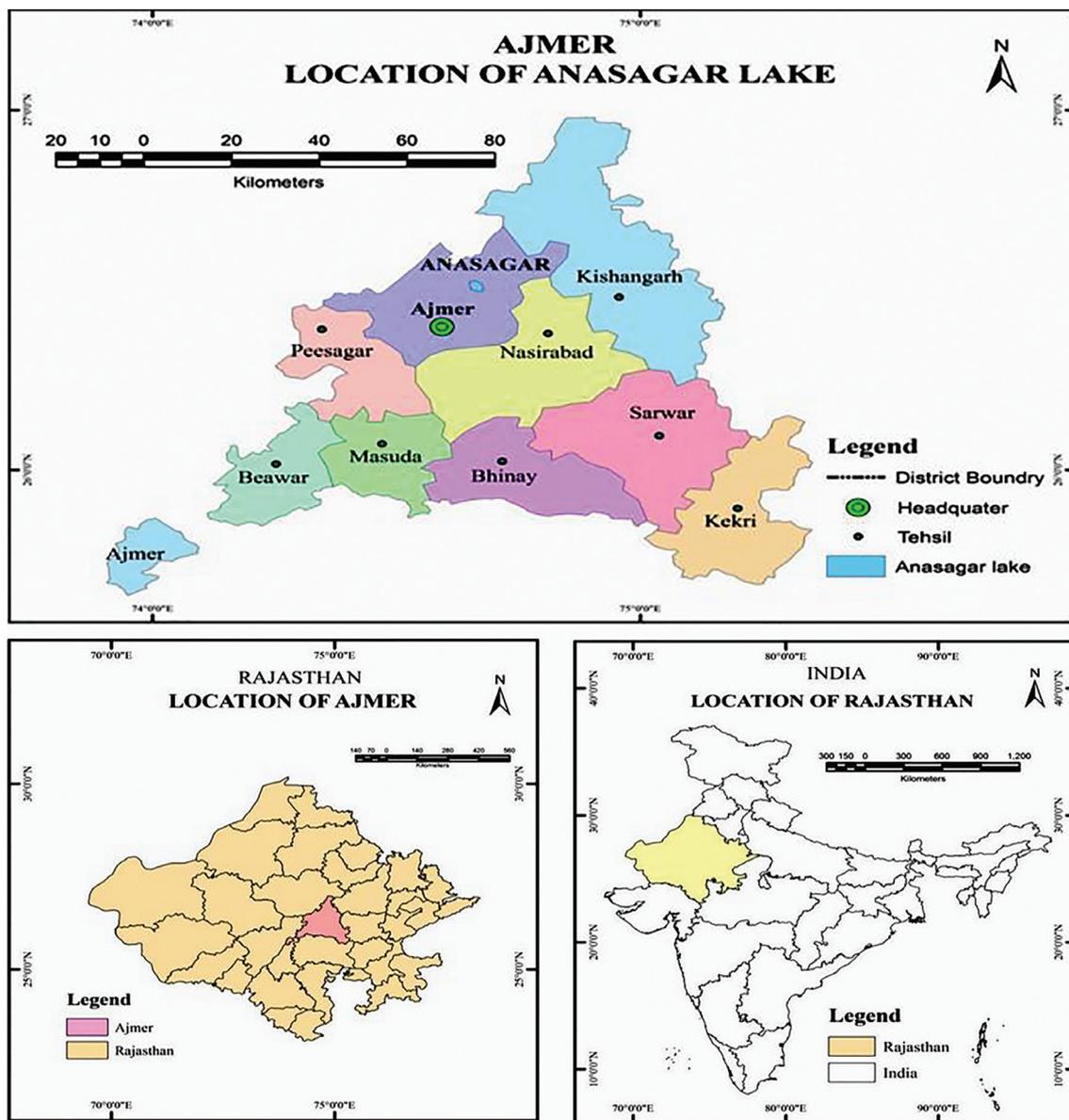


Figure 1. Location map of study area.

and directly affecting the habitat. Agricultural activities near the wetland lead to the influx of pesticides and harmful substances used by farmers for the cultivation of crops are changing the physiochemical composition of the lake. There is no proper disposal of garbage near the wetland, which is also a major reason for the lake's degradation.

3. METHODOLOGY

The Human impacts on the Lake ecosystem have been analysed by primary information. In addition to this, the questionnaire and field survey has been used to analyse activities affecting lake areas like sewage and municipal solid waste, use of detergents, pesticides and fertilisers, bathing, boating, recreation, religious ceremonies and use of the lake which is useful for examination of different human activities. The survey and the selection of interviewees have been done using the Stratified Random Sampling method. Observation of the selected field has been carried out at different time periods. A graphical representation of tabulated data has been done to enhance the depth of the research work. Data was represented with the help of different graphical tools such as bar diagrams, pie charts etc. Map-making work with the help of Microsoft's Excel or Arc GIS Software, etc. has been done.

4. RESULT AND DISCUSSION

4.1 Human activities affecting Lake

Through careful study and analysis of the Survey, there are many factors responsible for the deterioration of the Lake ecosystem. Agricultural Practices, disposal of untreated sewage and municipal waste water, mixing of detergent solution in the lake, run-off of fertilisers and residual pesticides, ritual bathing during festivals by Pilgrims and dumping of flowers and sculptures are the Primary anthropogenic activities responsible for pollution of Anasagar.

4.2 Discharge of waste water

Anasagar which was once a source of water for Ajmer has turned into a sewage dumping site. Urban growth of the city has completely changed the utility of the Lake ecosystem. During 1884, Anasagar ensured stable piped water supply to almost 50,000 population. It supported the growth of the city. Ajmer, a bustling urban center which witnessed rapid increase in economic activities attracted many more people from the countryside towards the city centre. Almost one third of the population of Ajmer now resides in the catchment area of Anasagar. This flux of economic migrants with little to nearly absent urban planning led to growth of urban sprawls with no properly planned drainage facilities and

congested roads. Untreated domestic waste water made its way to the Lake through many small and larger Nallas that were interlinked. These Nallas had come up as the settlement became dense. They are made of both burnt bricks and mortar (Pakka Nallas) as well as temporary arrangements (Kaccha Nallas). At most places, these are open drains. Several buildings (both partly constructed and complete) are seen in the Lake area. During the field survey, it was found that the sewage and sullage arising from households of the Lake basin, is taken into Anasagar through various Nallas namely, the Shantipura Nallah, Christianganj Nallah-1, Christianganj Nallah-2, Kazi ka Nallah, Nagfani Nallah (near Jain mandir), Chaurasiawas Nallah (near new Mittal hospital) Bandi River Nallah, Mahaveer Colony Nallah, Ram Nagar Nallah, Antend Nallah (near the old mental hospital) and Nallah Near Maheshwari Public School. The lake water pollution gets compounded with disposal of municipal solid waste in it.

Garbage and organic waste generated by food courts and other shops operating in the area finds its way to the Anasagar as a dump. Unauthorised settlements, as discussed earlier and encroachments in the catchment area of the Lake have resulted in shrinkage of Anasagar. The untreated sewage discharge has been a problem since long and it has brought several long-term changes in the Lake ecosystem. For example, introduction of invasive species and algal bloom effecting the marine diversity of the lake.

Exponential growth of algae is found in the sewage affected sites. The presence of species such as *Achnanthes hungarica*, *Ankistrodesmus falcatus*, *Chlorella vulgaris*, *Chlorococcum infusionum*, *Pandorina morum*, *Pediastrum tetras*, *Scenedesmus quadricauda*, *Stigeoclonium tenue* and species of *Navicula* and *Oscillatoria*, indicate show that lake is polluted. Sewage pollution has also contributed to the periodic growth of aquatic weeds, such as Typha, Ipomoea, Azolla, Vallisneria, Trapa and *Potamogeton* species in large quantities. Discharge of sewage, municipal wastewater and agricultural runoff has increased the primary productivity and physio-chemical values of the lake, resulting in eutrophic conditions.

4.3 Release of soluble detergents

Detergents get mixed with lake water through untreated municipal waste water discharge. People also use the lake for other utilities such as washing of clothes and bathing. It provides phosphorus to the lake which is a major nutrient responsible for Eutrophication. This phosphorus can also get mixed and deposited as sediments of the lake. This makes removal of excess nutrients difficult for longer duration. In case the concentration of iron is low, Phosphorus can remain in circulation between water and sediments for many years.

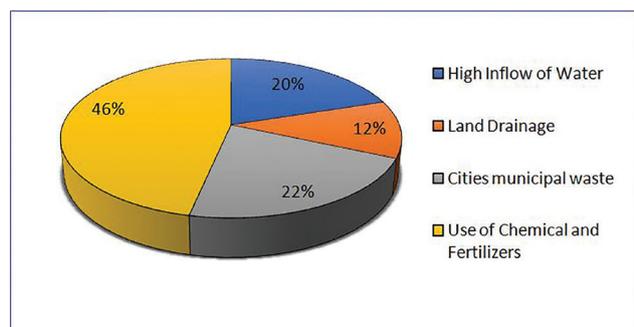
Aquatic life is also affected by a discharge of detergents, fishes are dying because of the high concentration of detergent dissolved in water.

Mostly the discharge of detergents takes place from dhobi ghat which is present near the lake for washing clothes they use lake water and drain their wastewater into the lake. Household work is also practised like washing utensils and washing of cloths by villagers present near the lake area. They are also discharging detergents in the Anasagar lake. The Anasagar Report file (2012), suggested that Internal cycling can generate over 90% of the Phosphorus that is available to plankton. In those water bodies where Nitrogen inflow is not reduced, Phosphorus is recycled between sediments and water. The phytoplankton of the water bodies is dominated by non-nitrogen fixing cyanobacteria such as *Microcystis*, *Planktolynbysa* and *Oscillatoria*. These *Microcystis* move vertically to consume phosphorus available at the water-sediment interface at the bottom and rise to form algal bloom at the surface of water bodies.

4.4 Influx of agricultural pesticides and fertilizers

The practice of unsustainable agriculture, aquaculture and horticulture in the catchment area of the lake is responsible for the influx of pesticides and chemical fertilizers. Farmers often use fertilizers very liberally in their fields to increase their produce. Excess fertilizer is washed into the lake during the irrigation or monsoon rains. Over-dependence on chemical pesticides for the cultivation of *Trapa bispinosa* and other fodder crops further exacerbates the situation. Organochlorine pesticides which are extensively used during cultivation, dissolve in water and with time get absorbed in the food chain of aquatic organisms. Through the survey, almost 46% of the population feels that a large area of the Lake is influenced by the discharge of chemicals and fertilizers in the Lake.

Lake Influenced by Pesticides and Fertilizers



Source: primary survey

4.5 Influence of Sedimentation

Nagpahar, Taragarh and Anted hills lie in the catchment area of Anasagar. During monsoon rain, the Lake receives a large volume of run-off water from the

hills which carries eroded soils. It causes sedimentation in the lake. These hillocks have a steep slope. Deforestation and removal of grass for domestic use has made it susceptible to erosion. Heavy rainfall in the area leads to strong downward current of water. It cuts through the already eroded landscape and intensifies erosion and sedimentation in the basin.

4.6 Urbanisation leading to lake encroachment

Rapid Urbanization in the city led to the encroachment towards the lake area. Construction activities near the wetland have boomed in recent years. This water body is administrated by the Urban Improvement Trust or Ajmer principal corporation department. The private ownership of commercial properties near the catchment area are disassociated with the proper management of pollution-causing factors. Various NGOs are inclined to create a pollution-controlled Environment, but they are prohibited by the private owners. Commercialization near the wetland promotes an unhealthy environment for the lake ecosystem. *Dhobhi Ghats* are one of the prominent metropolitan encroachments, allowing workers to rinse clothes and discharge detergents directly into the lake. There is no proper regulation to monitor such kind of actions by the authorities.

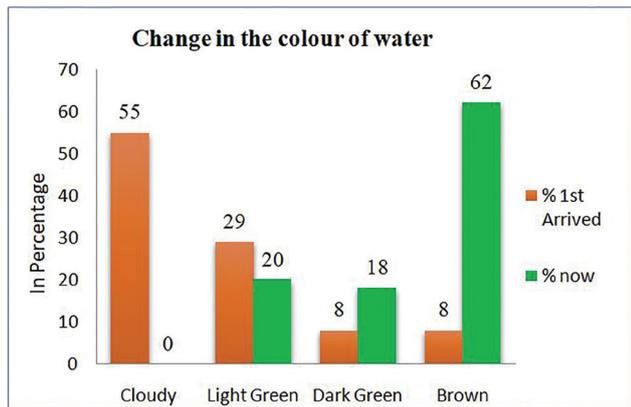
4.7 Religious activities contaminating water

Anasagar Lake is one of the most prominent tourist attractions in the city. Because of its religious values. Approximately 50000 people bathe on a daily basis during the Urs festival but the use of soap is forbidden as this rule is said by the citizen council of Ajmer. Sometimes the Hindu pilgrims offer flowers and *aagarbattis* to Anasagar Lake so it also has significance presents and serves as a sacred lake for Hindu pilgrims leading towards water contamination and water degradation.

4.8 Water quality and its effects on organism

During the survey which was performed on Anasagar found that the formation of algae on the top layer of water resulted in anasagar looking green. There a severe effect of fertilizers and pesticides on different organisms like fishes, birds, and macrophytes their life expectancy has been reduced. Migration of birds has taken place due to an increase in the pollution of lake water. Not only animals are dependent on this lake ecosystem but human beings are also dependent on this lake for agricultural practices, and fishing activities and they also collect plant products. There are different effects on different organisms which tells us more briefly about the human impacts on the lake ecosystem.

People perception about the change in colour of Lake water



Source: primary survey

4.9 Effect on the aquatic life

Despite of declaration of the protected area, agricultural encroachment is continued in the marginal land of the lake area and uncontrolled use of pesticides and fertilizer in the agriculture field hurts the aquatic life of the lake. The large numbers of farmers are using fertilizers and pesticides. These agricultural fertilizers, pesticides, and harmful chemicals are coming into the lake through the runoff during the rainy season. This increases the nutrients in the water and subsequently causes eutrophication in the lake. Eutrophication provides a base for the deterioration of water quality (Mazumdar et al., 2007).

Many aquatic organisms have been dependent upon water for their habitat like frogs, crabs, fish etc. Many amphibians are highly dependent upon aquatic habitats and also water for the development of the tadpole larva along with the completion of their life cycle. Due to the deterioration of water, quality has been caused by the weak development of the adult. Consequently, life expectancy has been reduced in the Lake area.

4.10 Effect on the fishes

Anasagar is rich in diversity of the fish fauna. The lake has been provided as the breeding ground for a large number of fish and stocking facilities for migratory fish coming into the lake at the time of flood. At present, water quality is suitable for the fish fauna but in trends of status of water quality may cause a decreasing effect on fish fauna.

4.11 Effect on the Macrophyte

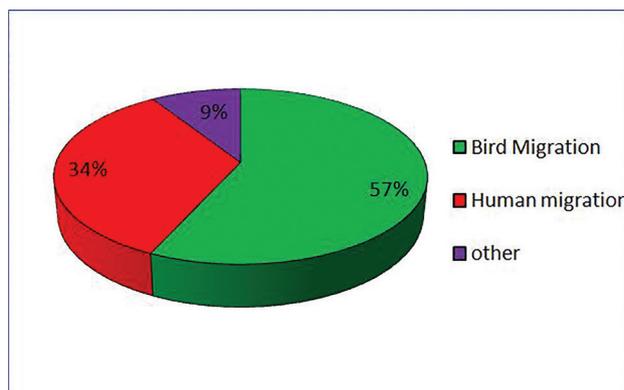
Anasagar Lake is rich in the macrophyte. Due to the shallowness of the lake, profuse growth of the macrophyte can be seen. However, the deterioration of the water quality of the lake causes more weed proliferation in the

lake. Weed proliferation also averted the growth of the other useful macrophyte.

4.12 Effect on the Birds

Anasagar is rich in diversity of the bird fauna. Because of the decrease in the population of fishes in the lake, birds are forced to eat dead fishes due to which bird fauna is also affected by this lake water and which cause bird migration from this area.

Urbanisation Effects on Bird Migration.



Source: primary survey

4.13 Effect on human health

The lake ecosystem is usually rich in fish, and biodiversity and may considered one of the most productive ecosystems for human beings. People reside the vicinity of the lake have been dependent on the for their livelihood and driving their life cycle for agriculture practises, Fishing activity, and collection of the plant product. Due deterioration of water quality has not been affected the only aquatic flora and fauna but also it affected the local habitat that resides near the lake. Fungal infection occurs as a common disease due to deterioration of the water quality.

5. CONCLUSION

Anthropogenic activities Like the discharge of sewage water from the city, Inflow of fertilizers and pesticides used in agricultural practices, and religious activities taking place in the vicinity of wetlands have forced the lake to become contaminated and degraded. Lake one of the main tourist places of the city is being converted into degraded Land where there is a smell that comes regularly when you pass by the water body.

The aquatic ecosystem is in a stress because of the decrease in the amount of dissolved oxygen required for survival. Religious activities like Pilgrim’s bathing during Urs festival create pollution in the lake. Public dump flowers, clothes, pooja articles and plastic materials in the lake creating water blockage towards the drain area. The act of discarding God’s sculptures for prosperity is

responsible for water pollution and severely damaging the quality of water. There is a need to create some government policies and public sensitisation for the conservation of the lake and make proper regulations for garbage disposal near the lake area. The lake ecosystem plays a very significant role in balancing the climatic condition of the city and is a key for development of Flora and fauna in the region.

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References

- Mathur, P.C., Patan, S., Sharma, K., Nair, N., & Shobhawat, A.S. (2010). Assessment Of Physico-Chemical Properties of Anasagar Lake of Ajmer (India). *Journal of Environmental Research and Development*, 4, 780-786.
- Mitsch, W. J., & Gosselink, J. G. (2000). The value of wetlands: importance of scale and landscape setting. *Ecological Economics*, 35(1), 25–33. [https://doi.org/10.1016-S0921-8009\(00\)00165-8](https://doi.org/10.1016/S0921-8009(00)00165-8)
- Mazumdar, Asis & Samal, Nihar & Roy, Debasri & Gangopadhyay, A.. (2007). Physico-chemical characteristics of water in a shallow lake Rabindra Sarobar in metropolis Kolkata. *Journal of the Institution of Engineers (India): Chemical Engineering Division*. 88. 32-40.
- Pandey, D. N., Gopal, B., & Sharma, K. C. (n.d.). *Evidence-Based Holistic Restoration of Lake Anasagar, Ajmer, Rajasthan, India*. <https://hdl.handle.net/10535/8795>
- Prakasam, V.R. & Joseph, M.L. (2000). Water quality of Sasthamcotta lake, Kerala (India) in relation to primary productivity and pollution from anthropogenic sources. *Journal of Environmental Biology*. 21. 305-307.
- Singh, Rajendra & Mathur, Praveen. (2005). Investigation of variations in different physico-chemical characteristics in a fresh water reservoir of Ajmer city, Rajasthan. *Indian Journal of Environmental Sciences*. 9. 57-61.
- Wolf, A. T. (2001). Water and human security. *Journal of Contemporary Water Research and Education*, 118(1), 5.

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