

## EUTROPHICATION'S IMPACT ON ECOSYSTEM HEALTH: A CASE STUDY OF TWO GUJARAT WETLANDS

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### ABSTRACT

*Eutrophication, primarily driven by nutrient enrichment, has been a growing environmental issue affecting aquatic ecosystems globally. In Gujarat, India, wetlands play a crucial role in supporting biodiversity, water regulation, and the livelihoods of surrounding communities. However, anthropogenic activities have exacerbated eutrophication in several wetlands. This study investigates the impact of eutrophication on ecosystem health in two prominent wetlands in Gujarat: Nalsarovar Lake and Thol Bird Sanctuary. Through water quality analysis, biodiversity assessments, and the evaluation of human activities, this paper highlights the severity of eutrophication and its long-term consequences on the ecological integrity of these wetlands.*

**Keywords:** Eutrophication, Wetlands, Gujarat, Nalsarovar Lake, Thol Bird Sanctuary, Biodiversity, Ecosystem Health

### 1. INTRODUCTION

Wetlands are critical ecosystems that support a wide range of biodiversity and provide essential services, such as water filtration, flood control, and carbon sequestration. However, eutrophication, the excessive enrichment of water bodies with nutrients (mainly nitrogen and phosphorus), poses a significant threat to these ecosystems. The primary sources of nutrient loading include agricultural runoff, wastewater discharge, and industrial pollutants.

In Gujarat, wetlands such as Nalsarovar Lake and Thol Bird Sanctuary are renowned for their rich biodiversity, particularly avian species. However, increasing human pressures, such as

urbanization, agriculture, and industrial activities, have led to nutrient overloading, causing eutrophication. This paper explores the extent of eutrophication in these two wetlands and examines its effects on ecosystem health.

### 2. STUDY AREA

#### Nalsarovar Lake

Nalsarovar Lake is a shallow, freshwater lake located in the Ahmedabad and Surendranagar districts of Gujarat. It covers an area of approximately 120 square kilometers and is home to over 210 bird species, including migratory species. The lake has been designated as a Ramsar site, recognizing its global ecological significance.

## Thol Bird Sanctuary

Thol Bird Sanctuary, situated in the Mehsana district of Gujarat, is an artificial freshwater lake covering 7 square kilometers. This sanctuary supports a wide variety of waterbirds and serves as an important breeding and feeding ground. Despite its small size, Thol has faced growing eutrophication due to the surrounding agricultural and urban development.

## 3. METHODOLOGY

### Water Quality Analysis

Water samples from various locations within Nalsarovar Lake and Thol Bird Sanctuary were collected during the dry and wet seasons to assess nutrient concentrations. Parameters such as nitrogen (N), phosphorus (P), dissolved oxygen (DO), chemical oxygen demand (COD), and pH were measured. Data from previous years were also utilized for trend analysis.

### Biodiversity Assessment

The biodiversity of both wetlands was assessed through field surveys and secondary data analysis. Bird populations were monitored through regular counts, while fish and plant species were recorded during sample collection. Special attention was given to species known to be sensitive to eutrophication.

### Anthropogenic Impact Evaluation

The impact of human activities on the wetlands was evaluated through interviews with local residents, farmers, and authorities, as well as satellite imagery to track changes in land use over time. The

role of agriculture, sewage discharge, and urbanization in nutrient loading was also analyzed.

## 4. RESULTS

### Water Quality

#### Nalsarovar Lake

Water quality data from Nalsarovar Lake showed a significant increase in nutrient levels over the past two decades. Average phosphorus concentrations exceeded the threshold for eutrophic conditions, particularly in areas closer to agricultural runoff and settlements. Dissolved oxygen levels were lower in eutrophic zones, leading to hypoxic conditions that are detrimental to aquatic life.

#### Thol Bird Sanctuary

Thol Bird Sanctuary displayed similar trends, with phosphorus and nitrogen levels steadily rising over the past decade. The presence of floating algae and an increase in turbidity were observed, indicating advanced stages of eutrophication. Dissolved oxygen levels were critically low in areas with dense algal blooms, particularly during the summer months.

## BIODIVERSITY DECLINE

### Avian Populations

Both wetlands showed a decline in bird populations, particularly in species that rely on clear water and submerged vegetation for foraging. In Nalsarovar Lake, migratory birds such as flamingos and pelicans were observed in smaller numbers. In Thol, resident species like the Sarus crane faced habitat degradation due to the spread of

invasive aquatic plants promoted by eutrophication.

## Aquatic Life

Fish populations in both wetlands experienced a noticeable decline. In Nalsarovar, sensitive fish species like catfish showed a reduction in numbers, while in Thol, the diversity of fish species dropped significantly. The proliferation of algae and reduction in water clarity impacted submerged vegetation, disrupting the food web and habitat availability for aquatic organisms.

## ANTHROPOGENIC DRIVERS

### Agricultural Runoff

Agricultural runoff, particularly from surrounding farms, was identified as the primary source of nutrient loading in both wetlands. The use of fertilizers containing phosphorus and nitrogen in nearby agricultural lands contributed significantly to the nutrient influx, especially during the monsoon season.

### Urbanization and Industrial Activities

Increased urbanization around Thol Bird Sanctuary, coupled with untreated sewage discharge, has further accelerated eutrophication. Satellite imagery revealed that urban expansion and industrial activities near both wetlands have intensified in recent years, increasing nutrient inflows from non-point sources.

## 5. DISCUSSION

The results from both Nalsarovar Lake and Thol Bird Sanctuary highlight the alarming trend of eutrophication, driven by a

combination of agricultural, industrial, and urban pressures. Eutrophication has led to the degradation of water quality, biodiversity loss, and the disruption of ecosystem services.

In both wetlands, the increase in nutrient levels is primarily attributable to agricultural runoff, exacerbated by poor land management practices and the lack of proper sewage treatment. The presence of algal blooms, hypoxic conditions, and biodiversity loss underscore the severity of eutrophication. The reduction in avian species, especially migratory birds, could have long-term consequences on the ecological balance of these wetlands.

## 6. CONCLUSION AND RECOMMENDATIONS

Eutrophication poses a significant threat to the ecosystem health of Nalsarovar Lake and Thol Bird Sanctuary. To mitigate its impact, several measures are recommended:

1. **Improved Land Management:** Reducing the use of fertilizers in agricultural lands surrounding the wetlands and promoting organic farming practices can help lower nutrient inflows.
2. **Wastewater Treatment:** Establishing effective sewage treatment plants in urban areas near the wetlands is crucial to prevent untreated waste from entering the water bodies.
3. **Community Engagement:** Involving local communities in conservation efforts through

education and awareness programs can foster sustainable land and water use practices.

4. Monitoring and Restoration: Regular monitoring of water quality and biodiversity should be implemented to track the progress of eutrophication. Restoration programs, such as removing invasive species and enhancing natural filtration systems, can help restore the ecological balance of these wetlands.

## 7. REFERENCES

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