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Impact of industrialization on water pollution in Bomani wetland of Kamrup metropolitan district, Assam, India

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Abstract

The Bomani wetland is the major wetland or beel of Kamrup Metropolitan district, Assam. It is an important wetland of south bank of the Digaru river. The geo-ecological status of this wetland is affected by industrial and human activities. The large-scale cement industries are polluting the ecosystem of the entire area. The Bomani wetland is very significant from the geographical perspective. The Bomani wetland is connected with the Digaru river through a narrow feeder channel namely Nogajan. This feeder channel plays an important role in the wetland ecosystem. Because from this feeder channel, local fishes are entering to the wetland, and thereby the wetland is rich in local fish. The shallow water flows from the mouth of the feeder channel, and it plays an important role in the reproductive system of fish. Therefore, the importance of the Bomani wetland is very relevant.

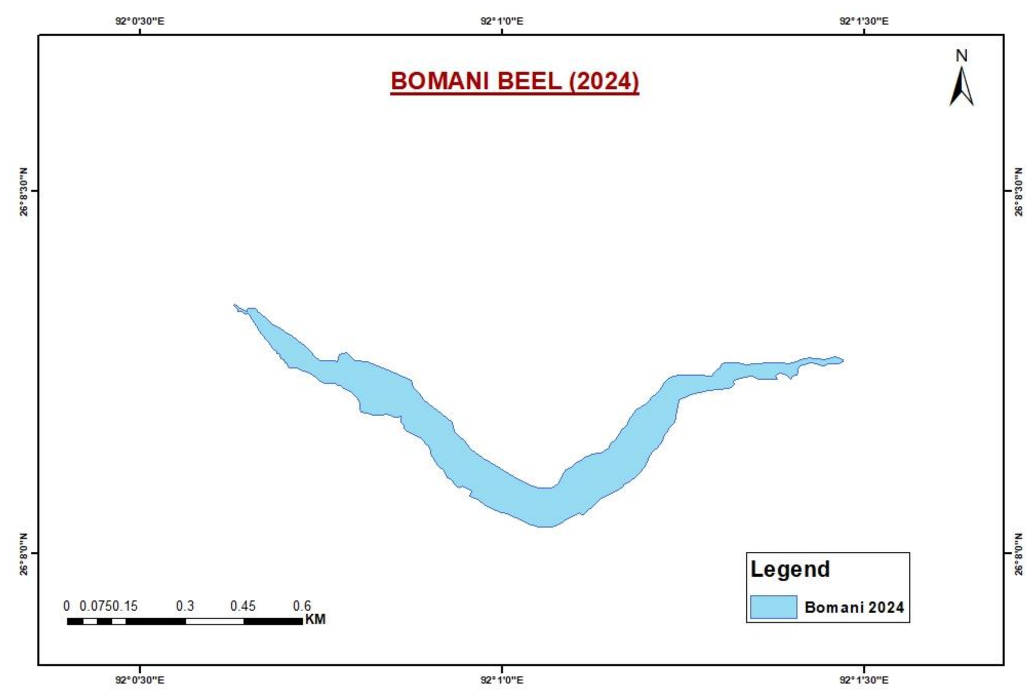
Keywords: Industrial activity, pollution, water quality, environment, ecosystem

1. Introduction

The relentless march of industrialization, while long heralded as a cornerstone of modern economic development and urbanization, frequently exacts a profound toll on fragile ecosystems. In the developing economies of the Global South, the spatial convergence of rapid industrial expansion and inadequate environmental regulation has precipitated severe ecological degradation (Sarkar et al., 2021). A poignant micro-cosmic illustration of this anthropogenic pressure is observed in the Kamrup Metropolitan District of Assam, India. Here, the burgeoning industrial corridors on the periphery of Guwahati are increasingly encroaching upon critical hydrologic sinks, most notably the Bomani wetland. Wetlands, functioning as the earth's natural kidneys, play an indispensable role in maintaining regional hydrological balance, flood mitigation, and biodiversity conservation (Mitsch & Gosselink, 2015). However, the unregulated discharge of untreated effluents containing heavy metals, organic pollutants, and chemical residues from neighboring industrial units into the Bomani wetland has transformed this vital ecological asset into a receptacle for industrial waste. This localized environmental crisis not only disrupts the complex biogeochemical cycles and severely depletes aquatic biodiversity within the wetland basin, but it also poses direct public health hazards to riparian communities dependent on local groundwater and aquatic resources for their livelihoods (Borah et al., 2020). Consequently, examining the nexus between industrial proliferation and water pollution within the Bomani wetland is both timely and imperative, offering critical insights into the broader ecological conflicts characterizing contemporary industrialization in Northeast India's fragile Brahmaputra valley.

2. The Study

The Bomani wetland is the major wetland or beel of Kamrup Metropolitan district, Assam, India. It is an important wetland of south bank of the Digaru river. The Bomani wetland is located between Chamotapathar and Sukuripara in Hahara village of Sonapur Revenue Circle of Kamrup Metopolitan district, Assam. The geo-ecological status of this wetland is affected by industrial and human activities. The large-scale cement industries are polluting the ecosystem of the entire area. The Bomani wetland is very significant from the geographical perspective. The Bomani wetland is connected with the Digaru river through a narrow feeder channel namely Nogajan. This feeder channel plays an important role in the wetland ecosystem. Because from this feeder channel, local fishes are entering to the wetland, and thereby the wetland is rich in local fish. The shallow water flows from the mouth of the feeder channel, and it plays an important role in the reproductive system of fish. Therefore, the importance of the Bomani wetland is very relevant.



2. Materials and Methods:

The water quality of this wetland is tested in laboratory. The water samples are collected from Bomani wetland on 6th July 2022. The water quality parameters are tested on USPH standard. There are 19 parameters that are tested on the water quality of the wetlands. Table 3.1 shows the result of water quality tested so far.

3. Analysis:

Table 3.1: Water Quality in Bomani Wetland, 2022

Sl. No.	Parameter	Value	Acceptable Value
1	pH	6.56	6.0-8.5
2	TDS (ppm)	35	500ppm
3	EC (dSm-1)	0.04	-
4	Total Hardness (ppm)	64.00	180 ppm
5	Ca (ppm)	4.41	100 ppm
6	Mg (ppm)	3.65	30 ppm
7	Turbidity (N.T.U)	0.15	2.5 (N.T.U)
8	Iron (ppm)	0.42	<0.3 ppm
9	Sulphate (ppm)	4.8	250 ppm
10	Chloride (ppm)	11.36	250 ppm
11	Alkalinity (ppm)	40.00	200 ppm
12	Dissolved Oxygen	13.26	4.0-6.0 ppm
13	Ammonical Nitrogen	0	-
14	TSS	297	100 ppm
15	BOD	44.8	30 ppm
16	COD	112	250 ppm
17	Copper	0.009	0.05 ppm
18	Nickel	0.007	0.02 ppm
19	Aluminium	0.004	0.03 ppm

Source: Field Survey, 2022

1. Potentiality of Hydrogen (pH)

pH (potential of hydrogen) is a key parameter of water chemistry that reflects the overall condition of a water body. It is measured using a digital pH meter, and natural water typically ranges from 4 to 9. Each unit change in pH represents a tenfold change in hydrogen ion concentration. pH indicates the acidity or alkalinity of water, which is often slightly alkaline due to the presence of carbonates. However, pH can vary over time exposure to air, biological activity, and seasonal or daily changes. Industrial waste can also significantly alter pH levels. Most chemical and biological processes occur within a narrow pH range. The permissible pH range for potable water is 6.0–8.5, while the tolerance limit suggested by the Board of Industries is 5.5–9.0.

The recorded pH of the Bomani wetland is 6.56, which indicates relatively low productivity for fish culture. General pH ranges for fish culture in Assam wetlands have been outlined by Dutta and Lahon (1987).

Table 3.2: Permissible Scale of pH (Water Quality) and Productivity of Fish in Freshwater

Unproductive Water Bodies	**Average Productive Water Bodies**	**High Productive Water Bodies**	**In Beel Fisheries of Assam**
6.5-10	6.7-7.5	7.5-8.5	6.0-7.5

Source: Development of Beel Fishery in Assam, 1987

1. Total Dissolved Solids (TDS)

Total dissolved solids are an important physical parameter of water. It also identifies the quality of water. It is the amount of organic and inorganic matter dissolved in a volume of water. Total Dissolved Solids can be measured in parts per million (ppm) or milligrams per litre (mg/l). The result of TDS in Bomani wetland is 35 ppm.

3. Electrical Conductivity

Electrical conductivity is a major parameter of water. Electrical conductivity is measure of water's ability to conduct electrical current. In Bomani wetland it is 0.04 dS/m. It indicates very low concentration of conductive ions.

4. Total Hardness

Total hardness refers to the presence of calcium ions, magnesium, iron and manganese. There are four types of water found on the basis of hardness, namely, soft water, slightly hard water, hard water and very hard water. Bomani wetland shows 64 ppm which is considered to be slightly hard water.

Table 3.3: Hardness of Water

Sl. No.	Type of Water	Hardness
1	Soft Water	10 - 50 ppm
2	Slightly Hard Water	50 - 100 ppm
3	Hard Water	100 - 200 ppm

4	Very Hard Water	over 200 ppm

5. Calcium (Ca)

Calcium is a naturally occurring mineral in water and an important quality parameter. In the Bomani wetland, calcium concentration is 4.41 ppm, indicating a very low level.

6. Magnesium

Magnesium is another naturally dissolved mineral. Its concentration in the Bomani wetland is 3.56 ppm, which is also very low.

7. Turbidity

Turbidity measures the clarity of water in nephelometric turbidity units (NTU). The turbidity level in the Bomani wetland is 0.15 NTU, indicating clear water.

8. Iron (Fe)

Iron in water can be harmful to human health and aquatic life. Its sources include low pH, human and industrial activities, and plumbing systems. The permissible limit for drinking water is below 0.3 ppm. Earlier (2009), iron concentration in the Bomani wetland was 0.14 ppm, supporting high fish production. The current level is 0.42 ppm, which may contribute to reduced fish production.

9. Sulphate

Sulphate is a naturally dissolved mineral that can affect health at high levels. The permissible limit is 250 ppm. In the Bomani wetland, sulphate concentration is 4.8 ppm, which is within safe limits.

10. Chloride

Chloride is a mineral which is naturally dissolved in water. It can increase the electrical conductivity of water. Therefore, increases its corrosivity. These minerals are not harmful to humans or animals. The Bomani wetland shows the result is 11.36 ppm. A little amount of chloride is dissolved in this particular wetland water.

11. Alkalinity (CaCO3)

The alkalinity of water maintains a stable pH level. It can identify the measure of how well the water can neutralize acids. It also impact on taste of water. The moderate alkalinity is desirable, but strong alkaline water can taste unpleasant like soda. The alkalinity of the Bomani wetland is 40 ppm. It is quite low in water.

12. Dissolved Oxygen (DO)

Dissolved oxygen (DO) refers to the concentration of oxygen gas incorporated in water. Oxygen enters water by direct absorption from the atmosphere. (U.S. Environmental Protection Agency). In the Bomani wetland, 13.26 ppm was obtained in summer season, 2022. It is considered poor water quality for fish and aquatic animals.

13. Ammonical Nitrogen (NH3)

Ammonical nitrogen is a parameter that the amount of nitrogen in water presents as ammonia (NH_3) and ammonium (NH_4^+). It is a hazardous pollutant that can be harmful for aquatic life. In the first water sample analysis there is no ammonia found in the water, but in the second sample, the result of ammonia is found to be 11.4 mg/l.

14. Total Suspended Solids (TSS)

The Total Suspended Solids is a measure of the concentration of suspended material present in water. The tolerance limit of TSS is 100 ppm. The Bomani wetland has resulted 297 ppm. It is recorded as very high in the Bomani wetland.

15. Biological Oxygen Demand (BOD)

The Biological oxygen demand is an important parameter of water. It is a measure of how much oxygen is required to break down the organic matter in the water. It is also an indicator of polluted water. According to USPH, the tolerance limit of BOD in drinking water is 1-2 ppm, where waste water permissible limit is 30 ppm in India. In the Bomani wetland it is 44.8 ppm, which is considered as polluted water. The cement and aluminium industries polluted the water bodies of the Bomani wetland. Therefore, the environmental sustainability of this wetland is degraded day by day.

16. Chemical Oxygen Demand (COD)

COD is an important element of water. It measures the amount of oxygen required to chemically oxidize the organic matter and inorganic nutrients, such as ammonia present in water. The Bomani wetland resulted in 112 ppm.

17. Copper

Copper is also an important mineral in water. The Bomani wetland resulted in 0.09 ppm copper. It is found to be very low.

18. Nickel

Nickel is a parameter tested on the Bomani wetland. It is a metal that can be found in water due to industrial and human activities. The Bomani wetland is located near the industries therefore; the nickel is tested in its water. Nickel is the cause of cancer and other human health issues. This harmful metal found in water bodies of the Bomani wetland. Itis resulted in 0.007 ppm nickel in its water bodies. This is not a good sign for the wetland. The maximum tolerance limit is 0.02 ppm.

19. Aluminium

Aluminium is an element tested in Bomani wetland. It reacts with water to form aluminium hydroxide and hydrogen gas (2Al + 6H20 = 2Al (OH)3 + 3H2). Near the Bomani wetland, aluminium industry is established. The wastewater of aluminium industries can affect the ecosystem of the beel. Therefore, the aluminium is tested. The tolerance limit of Aluminium is 0.03ppm, and the result of the Bomani wetland is 0.004 ppm. The aluminium also present in the water bodies of the Bomani wetland. This is the present status of the Bomani wetland. Overall, this wetland is polluted.

4. Conclusion

The industrial activities and other human activities are now polluting the Bomani wetland. The large scale cement industries were highly release effluents and its impact on the water quality of the wetland. The present scenario of waterbodies of Bomani wetland is highly polluted. Due to this water pollution the aquatic animal are highly suffered. The key responsible factors of the water quality of the wetland are industrial activities. Therefore, the wetland environment is on unstable in nature.

Conflict of Interest: *The author declares no conflict of interest.*

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