Impact of Industrial Activities on the Degradation of Soil pollution and Functional Ecosystem of Duwani Wetland a Case Study of Aluminium Factory in Teteliya Village, Kamrup Metropolitan District of Assam, India

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ABASTRACT

Wetlands are the most important natural function of the terrestrial surface of the earth. It is a habitat of many aquatic plants and animals. On the other hand in industrialization is the processes of human development. In India the industrial activities have been rapidly increasing and urbanization process has also been fastest growing. Due to the industrial activities negative impacts on nature. In the study area the Duwani wetland is the most valuable and productive wetland of Assam. Because this natural wetland is connected with the mighty Brahmaputra river. The industrial activities on the bank of this wetland have mostly polluted the soil function. In this research works soil quality of the wetland is tasted on laboratory. Various parameters have taken for analysis. Some of the parameters like Potential of Hydrogen (pH), Electrical Conductivity (EC), Organic Carbon (OC), Nitrogen (N), Potassium (K), Phosphorus (P), Chloride (Cl) etc. The soil samples are measuring both the WHO and USPH standard. From this analysis have found the amount of soil pollution and functional ecosystem of Duwani wetlands

Keywords: Ecosystem, wetlands, Industrialization, Soil pollution, environment.

INTRODUCTION

In 21st century the industrialization processes is rapidly increases in globally. The urban development and economic growth also fastest developed. India is the 5th largest economic developed countries in the world. In Assam wetlands are locally known as *beels*. The area Duwani wetlands is located in the eastern part of Kamrup Metropolitan district of Assam, India. Wetlands are the most productive and economically valuable ecosystems in the world. Wetlands provide critical ecosystem goods and services, including carbon storage, biodiversity conservation, fish production, fuel production, water purification, flood and shoreline surge protection and erosion control, and recreation. In an ecosystem the relationship between living and non living organisms are dynamic in nature.

The main reason behind this the non living organisms such as climate, soil, atmospheric activities is changeable. The industrial activities also impact on climate. The climatic factors like rainfall, temperature, humidity, air quality are influenced from the industrial release. The present study is try to focuses on the soil quality of Duwani wetland from Teteliya village of Kamrup Metro district of Assam.

The growing numbers of urban centre and increasing industrial activities in India is a major key factors of pollution. Here we try to focuses how industrial activities come under village or in rural areas and it's badly impact on natural ecosystem.

Soil is vital in maintaining the productivity of water body. Soil quality is one of the three components of environmental quality, besides water and air quality (Andrews et al., 2002). It is one of the main interfaces

through which nutrient is released to the water medium. Apart from helping mineralization of the organic deposits at the bottom, soil provides shelter and food to the benthic fauna and flora, which play a significant role in maintaining the nutrient status of overlying water. Distribution of soil types in Assam is four types. These are namely old alluvial soil, red loam soil, laterite soil, recent alluvial. Soils of the floodplain wetlands receive additional input in terms of organic matter, inorganic minerals, silt, and clay. Since most of the floodplain wetlands are heavily infested with aquatic vegetation, there is a heavy accumulation of dead plant materials at the bottom that undergoes decomposition. Consequently, the nature and properties of bottom soils of floodplain wetlands changes from year to year.

Therefore, it is essential to study the soil of such water at frequent intervals in order to assess their role in actual productivity (Ecology and Fisheries of Beels in Assam, P16,2000). In the study area the wetlands are rich in local fishes. Some are productive wetland and some are unproductive wetland. The major wetlands Duwani and Bomani are situated near the cement and aluminium industries. Both wetland are tasted the soil quality.The permissible range of soil quality and productivity in freshwater for fish and fish culture with comparative soil quality in Assam beels as suggested by P.N. Dutta and Lahon,

Table No :1 Recommended ranges of soil quality and productivity of fish in freshwater

Sl No	Parameters	Range in Unproductive water bodies	Range in Average productive water bodies	Range in high Productive water bodies	Range in beel fisheries of Assam
1	pH	5.5-8.0	5.5-6.5	6.5-7.5	4.4-6.4
2	OC% (Organic Carbon)	0.5-2.5	0.5-1.5	1.5-2.5	0.6-7.0
3	Phosphorous in 100mg	3.0-25.0	3.0-6.0	6.0-15.0	0.22-3.0

Source: Compendium, Workshop on Development of Beel Fishery in Assam, 1987.

MATERIALS AND METHODS

The soil sample analysis in the study area, Duwani important wetlands have been selected. The soil sample of the wetlands in the study area were collected during monsoon season in 2022 from the selected locations of the surrounding areas.

The soil sample were collected from surface soil layer at a minimum depth 0 to 10cm in a clear one kilogram capacity of polythene bags. After the collection of soil completely dried up under direct sunlight. The duration of drying process was kept several months.

The laboratory tests of soil were carried out for the analysis of soil pH, Electrical Conductivity (EC), Organic Carbon (OC), Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), Sulfur (S), Chloride (Cl), Manganese (Mn), Aluminium (Al^{3+}), Hydrogen (H^+). The laboratory work has been done in" Neoland Technologies" in Guwahati city Assam.

Study Area

The Duwani wetland is located in Teteliya village of Sonapur revenue circle. The Duwani wetland is a connected water channel of Bomani wetland. In the eastern part a elongated wetland is named Duwani wetland. This wetland was a very productive wetland among from all the wetlands of Kamrup Metro district. The length of

Duwani wetland is around 3km. Both the north and south bank of Duwani wetland the agriculture practices by local cultivator since from past.

The industrial and institutional development processes were start in the bank of Duwani from 2011. The halco aluminium industries and RIPT group of institution, B.ed college were newly growth institute in the bank of Duwani wetland. Presently the Duwani wetland facing problems due to industrial activity and institutional development. Therefore the soil study in Duwani wetland are selected for research.

Figure No :-1 Location Of Duwani Wetland, Teteliya Village of Sonapur revenue circle, Kamrup Metropolitan District, Assam
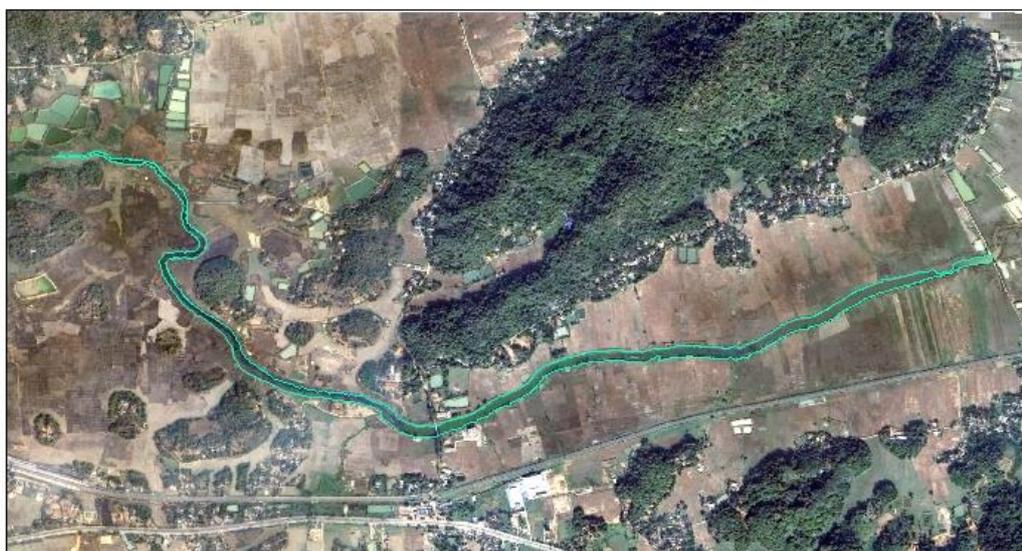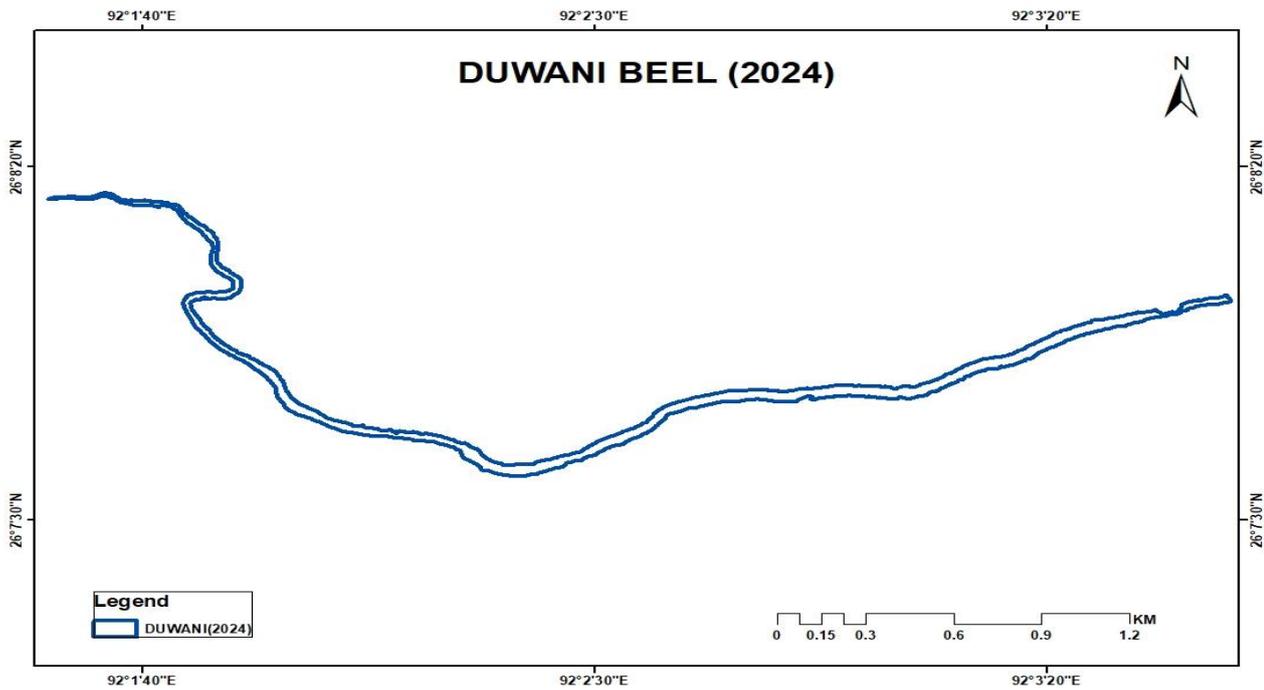
Figure No: 2 Status of Duwani wetland in 2024

RESULT

The result of soil study in Duwani wetland recorded 4 soil sample from field. The East, West, North and South. In the table no 1 has listed the records of result in various parameters Table No1 Result of Soil Sample of Duwani Wetland. The record of soil sample result can investigate the soil quality of Duwani wetland and it's functional mechanism.

Table No: 2 Result of Soil Sample of Duwani Wetland, Kamrup Metropolitan District, Assam

Sl No	Parameters	Duwani Wetland			
		East	West	North	South
1	pH	6.16	5.52	4.74	4.94
2	OC%	0.03	0.02	0.01	0.03
3	EC (dSm^{-1})	0.32	0.68	1.40	0.40
4	N (ppm)	47.41	100.76	207.44	59.27
5	P (ppm)	1.00	3.50	1.00	3.50
6	K (ppm)	87.50	81.25	108.25	71.25
7	Ca	0.12	0.06	0.04	0.07
8	Mg	0.05	0.04	0.02	0.02
9	S	50.00	57.81	14.06	74.22

10	Cl	56.80	92.30	85.20	92.30
11	Mn (ppm)	206.40	223.60	258.00	223.60
12	Al^+ (meq/100gm soil)	0.1	0.1	0	0
13	H^+ (meq/100gm soil)	0.2	0.3	0.2	0.4

Source: Author field visit and analysed by author

1. p^H : The soil p^H of Duwani wetland are tasted on east, west, north and south bank of the wetland. In eastern part it is 6.16, western part 5.52, northern part 4.74 and southern part 4.94. In four sides of the wetland resulted various records. In eastern part the soil quality is as usual like other wetlands fishery of Assam, the western part soil quality is low and it transforming towards acidic soil. On the other hand the soil quality of north and south bank of the wetland is acidic soil. Both the north and south bank are affected from industries and human activities. It basically polluted from aluminium factory.

2. Organic carbon (OC %): The result of organic carbon of Duwani wetland is varies in all sides of the wetland. The entire four sides of the wetland resulted below one percent of organic carbon. It is very low percentage of organic carbon present in soil. The of OC in east 0.03 %, west 0.02%, north 0.01% and south 0.03 %. The above result of organic carbon of soil in Duwani wetland found very low amount.

3. Electrical Conductivity (EC): The electrical conductivity of soil in Duwani wetland are tasted. In eastern and western sides of the wetland the EC is $0.32 dSm^{-1}$ and 0.68. dSm^{-1} on the other hand northern side is resulted $1.40 \ dSm^{-1}$, lastly the southern part is $0.40 dSm^{-1}$.

4. Nitrogen (N): Nitrogen is a essential compound of soil. It play important role in wetland ecology. For fish production and development the nitrogen play important role. In the present study of Duwani wetland resulted in east 47.41ppm, west 100.76ppm, north 207.44ppm and south 59.27ppm in kg/ha. The result of nitrogen in Duwani is very low in all the parts. It is below tolerance limit.

5. Phosphorus (P): Phosphorus of soil is an important nutrients for plants. It play major role in plant nutrition and growth. The present study of Duwani wetland phosphorus result is varies in east 1.00ppm, west 3.50ppm, north 1.00ppm and south 3.50ppm in kg/ha. The phosphorus found in Duwani wetland is very low.

6. Potassium (K): Potassium minerals are the important elements of soil. In present study the soil quality of Duwani wetland potassium is tasted. The result of potassium is in east 87.50ppm in kg/ha, west 81.25ppm in kg/ha, north 108.25ppm in kg/ha and south 71.25ppm in kg/ha. The present status of Duwani wetland is below acceptable limit or it is consider as very low.

7. Calcium (Ca): Calcium in soil is an important parameter. It play major role in aquatic life and fish production. In Duwani wetland the calcium in soil is resulted in east 0.12ppm, west 0.06ppm, north 0.04ppm and south 0.07ppm. The result of calcium found in soil of Duwani wetland is very low. It is not fit for good maintaining good soil quality.

8. Magnesium (Mg): Magnesium in soil of Duwani wetland is tasted on all four sides. The result of magnesium in east 0.05ppm, west 0.04ppm, north0.02ppm and south 0.02ppm. The magnesium concentration in soil is found below 1ppm. It is very low.

9. Sulfur (S): Sulfur is an important soil nutrient found in organic matter. In study area Duwani wetland is resulted in east 50.00ppm, west 57.81ppm, north 14.06ppm and south 74.22ppm in kg/ha. The sulfur in Duwani wetland crossed the tolerance limit accept northern part. The high sulfur is form soil acidification.

10. Chloride (Cl): In Duwani wetland chloride found in east 56.80%, west 92.30%, north 85.20% and south 92.30%. The chloride percentage is very high in Duwani wetland. The west and south bank are found similar result.

11.Manganese (Mn): Manganese is tasted on Duwani wetland. It is an important parameter of soil. The result of manganese in east 206.40ppm, west 223.60ppm, north 258.00ppm and south 223.60ppm. Average manganese of soil in Duwani wetland resulted 227.90ppm.

12. Aluminium: Aluminium is tasted in Duwani wetland for the analysis of soil quality. It is a toxic element mixed with soil. Generally in the bank of Duwani wetland a aluminium manufacturing industry developed. This industry were release industrial effluent, which are impact on soil. Therefore the aluminium as taken for research. The result of aluminium found in soil in east bank 0.1ppm, west bank 0.1ppm and north and south bank is 0ppm or nil result.

13. Hydrogen ion (H$^+$): The result of hydrogen ion in Duwani wetland is in the eastern part 0.2, west 0.3, north 0.2 and south bank is 0.4 meq/100gm soil. In southern bank result of hydrogen ion is maximum and east and northern bank is minimum.

DISCUSSION

The above result of soil quality in Duwani wetland resulted very poor soil quality. Because of the industrial activity the soil quality of the wetland are gradually degraded. As a result of that the functional ecosystem of Duwani wetland became very unproductive. As earlier before industrialization on that area these became reach in fish production and soil quality is favourable for agricultural activity. The wetland ecosystem of Duwani wetland reach in flora and fauna species. But the soil pollution has destroy fish diversity of Duwani wetland. Many local fishes are extinct from that wetland.

This are namely *puntius chola, swamp barb, green barb, chanda nama, Amblypharyngodon mola, Amphipnous cuchia Botia dario-Hamilton, channa punctata-Bloch, Opsarius barna, Channa gachua, Devario aequipinnatus, Danio rerio, Anabas testudineus and Trichogaster fasciata.* Due to acidification of soil in Duwani wetland is impact on the functional body of the wetland. On the other hand the degradation of soil quality also impact on the surrounding environment of the area. Many times due to soil pollution unproductive soil is form in surface soil horizon. It is the result of cause in the extinct fishes from Duwani wetland.

In present status soil pollution is a most important impact factors on the functional ecosystem. Soil play vital role to produce food and essential nutrients for all survival plants and animal species. Therefore the degradation of soil quality to be considered as unproductive soil.

In present status Duwani wetland also transforming towards unproductive wetland because of industrial activities near the bank of wetlands. Therefore must need to follow up sustainable techniques to protect soil of the Duwani wetland and surrounding environment. The global SDGS goal 9 have to demand for industry, innovation and infrastructure that build resilient infrastructure, promote inclusive and sustainable industrialization and forest innovation. Therefore if development is needed then to follow up SDGS goal 9 with concern about environment. Otherwise unplanned industrial growth can produce high rate of pollution.

The importance of protecting soil in 21st century is very must crucial. For the survival of life must needed to protect our soil. The can gives basic essential for all living organisms. We human also consume basic needs like food, shelter etc directly from soil. Therefore if soil pollution is increases in directly hampering on human health also and other organisms also suffered from soil pollution. In present status the soil pollution of Duwani wetland many aquatic organisms, plants, animals and human also suffered.

Many time local community of Teteliya village of Duwani wetland were protest against this soil pollution. But due to some factors still the unplanned industrial activity is process on that area. Therefore to suggest a mitigation role in scientific way to protect soil and the wetland and all living community also.

Disclosure statement

The authors report there are no competing interests to declare.

Notes on contributors

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