

Transformation of Urban Wetlands As An Effect of Urban Development: An Analysis of Deepor Beel in Guwahati, Assam

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Abstract: Deepor Beel is a Ramsar Site and a wetland of great biodiversity, which is situated towards the South-western part of Guwahati. The Rani and Garbhanga Reserved Forests are adjacent to the wetland, which altogether stands as a complete ecosystem providing environmental solutions, food security and different types of biodiversity to the city. The forest serves as an abode to the Northeastern region's Asiatic elephant (*Elephas maximus*), which is an endangered species. But with various recent urban developments, the wetland and the whole ecosystem has been under threat of diminishing area of the wetland, extinction of biodiversity, as well as transformation of land use pattern of the entire area and its surroundings. The Indian Railways constructed the southern railway track in 2001, an action which gradually divided the Deepor Beel into segments and, thus, affected the wetland in particular and the ecosystem as a whole. Illegal settlements, setting up of factories, construction of highways, etc. have also hampered the wetland in many ways while also posing a threat to the urban areas. This paper shall analyse the various developments affecting the wetland and shall find strategies to regulate further developments around the wetland.

Keywords: Biodiversity; Transformation; Settlement; Urban; Wetland

1. WETLANDS AND THEIR FUNCTIONS

Wetlands, as the name suggests, is any land which is wet or contains water. Wetlands are not only the most productive ecosystems on earth that support numerous unique flora and fauna, but are also directly linked with livelihood and food security as well as to much economic benefit. Wetlands serve as natural rainwater harvesting sites by collecting the precious rainwater within it. Water supply to many big cities are sourced from wetlands alone. Wetlands

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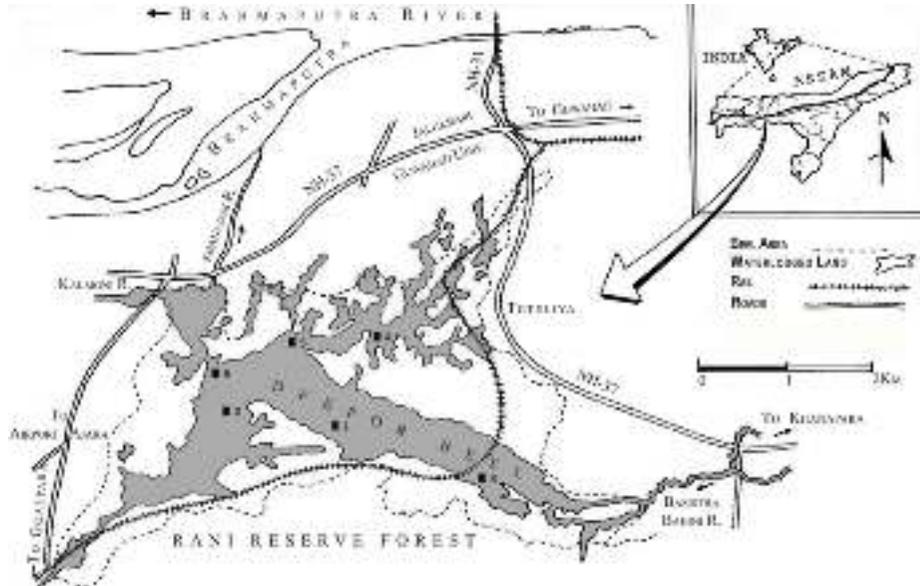


Figure 1: Location of Deepor Beel.

in close vicinity of rivers also act as buffers that control flood and river flow. When the level of the river rises, water flows into the wetlands. Similarly, when river water level decreases, water from these wetlands gushes into the river, thus maintaining its average flow. Mangroves mostly found in such ecosystems not only protect the land from speedy waves but offer protection from cyclones as well. During the 2004 Tsunami, it was found that the coasts with good mangrove vegetation were least affected.

Wetlands act as natural rainwater recharging zones. Water stored in the wetland percolates slowly in the aquifers. Every water body has a self cleaning system. Many aquatic flora and micro fauna present in wetlands are found to be effective in treating water with high coli form percentage as well. Many species of algae and plants have remarkable capacity of accumulating heavy metals in their mucilage and leaves and are known to be hyper-accumulators. Wetlands also play a great role in regulating local climate, particularly temperature and moisture. The phytoplankton community are very good carbon sequesters and absorb carbon dioxide much faster than terrestrial plants. Wetlands are, thus, also considered as local carbon sinks. The most productive ecosystem, wetlands harbour a great variety of animals and plants. It is a paradise of bird watchers and many birds find hostage in wetlands all around the world.

2. DEEPOR BEEL

‘Beel’, in Assamese, means a wetland or a waterbody with diverse flora and fauna. Deepor Beel is located towards the southwest of Guwahati and, is considered as an important riverine wetland in the Brahmaputra valley of Assam. Deepor Beel has an area of 40.14 sq km as recorded in the rainy season, with an encroached area of around 30.8 sq km. The present area of the wetland is around 9.27 sq km. But eventually the actual area has been found to be 4.1 sq km. Depth of the Beel ranges about 6 m to 1.5 m, based on the season (Fig. 1).

A large number of permanent and migratory birds are found in and around the Beel, which has made the wetland a significant Bird Sanctuary. It has also been designated as an Important Bird Area by Birdlife International. Due to its biodiversity and, the significance it has in the urban area, Deepor Beel was also recognized by the Ramsar Convention as a Ramsar Site in 2002.

3. HYDROLOGICAL LINKAGES OF THE BEEL

The wetland receives the majority of its water content which from the River Basistha and the River Kalmani during the monsoons. It then flows down to the Brahmaputra through the Khanajan stream, making Brahmaputra the natural storm runoff area for the city of Guwahati. Deepor Beel spreads perennially to around 10 sq km area and, expands almost four times to an area of 40 sq km during the monsoons. The Remote Sensing study of Deepor Beel reports that the existing area of the wetland has been compressed to around 405 hectares, i.e., 14% in the last decade. An area of 414 hectares has been designated as the Bird Sanctuary but most of the area has been encroached by illegal settlements.

4. ORIGIN AND TRANSFORMATION OF THE WETLAND DUE TO URBAN DEVELOPMENT

With urban development at its forefront, the waterbody and the biodiversity of Deepor Beel are under threat. The wetland was connected to the Brahmaputra basin through the Borsola Beel and other low-lying zones of Pandu, lying towards the Northeast. But, with the construction of the National Highway-37 and, other urban infrastructure projects in the surroundings, this link has been shallowed down and, even cut off in some parts.

The major blunder in the development process of the city, which affected the wetland the most, is the construction of the Northeast Frontier Railway track undertaken in 2001 across the Deepor Beel . The track divided the wetland in two parts, which further led to the drying up of one part of the Beel (Fig. 1). As

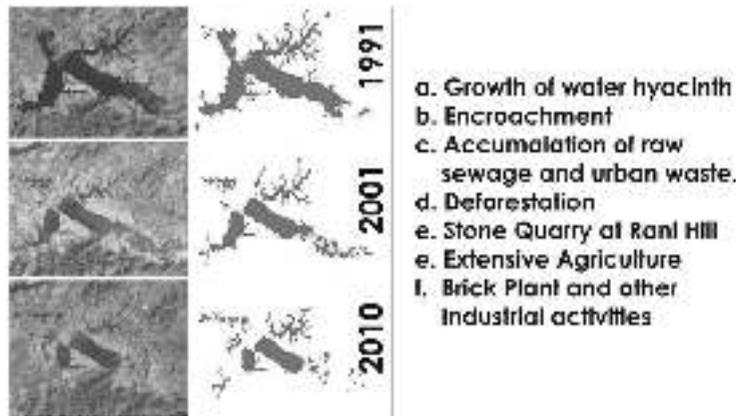


Figure 2: Major Shrinkage of the waterbody from 1991 to 2010.

the part dried up, settlements gradually started to develop in the area. When the settlements grew in size, other commercial activities also started to support the settlements. In the meanwhile, many factories and industries also developed their base in the surrounding areas and, disposed off their garbage and wastes into the Beel. These activities began to pollute the wetland and threatened its biodiversity. The recent establishment of the city's garbage centre at the heart of eastern boundary at the Boragoan area has also contributed to heavy pollution of the waters of the Deepor Beel and, consequently, the spread of water borne contagious diseases and disease vectors.

The construction of the Northeast Frontier Railway also hampered the existing natural Elephant Corridor near the Rani-Garbhanga Reserve Forest. The first consequence of this action is a reduction of the population of this endangered species (*Elephas maximus*), as many elephants died while crossing the railway line. The second consequence is that the wild elephants come out from the forest to the surrounding villages, which stand on the land that was once their house, and destroy agricultural fields and any type of cultivation along with the settlements.

Thus, residents of the surrounding settlements can never think of going in for any type of cultivation and, hence, the surrounding fertile lands now lie barren. since these cultivable fields have been lying barren for more than 10 years, the original agricultural landuse is getting transformed to an institutional one. Taking advantage of this transformation, many other agencies are also filling up parts of the wetland for different types of constructions such as residential, commercial, institutional and, some government buildings as well.

The images in Figure 2 and the Figures 3a, 3b, 3c, 3d, 3e, 3f explain the different stages of transformation in the size and patter of the wetland.

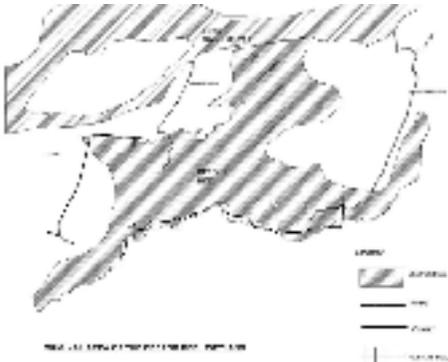


Figure 3a: Original area of Deepor Beel.



Figure 3b: Deepor Beel during British Era.



Figure 3c: Deepor Beel during N.F. construction works



Figure 3d: Deepor Beel during construction of the University, AEC & Ayurvedic College.

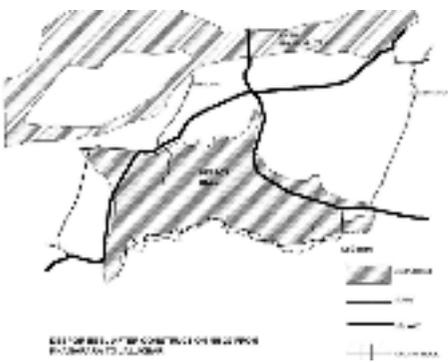


Figure 3e: Transformation of the Deepor Beel and shrinkage of the wetland area -- Deepor Beel after construction of NH-37 from Khanapara to Jalukbari.



Figure 3f: Transformation of the Deepor Beel and shrinkage of the area of the wetland — Deepor Beel after construction of Maligaon-Azara railway track.

5. ZONAL ANALYSIS SHOWING THE MOST AFFECTED AREAS

With urban development at its forefront, the natural waterbody and the biodiversity of Deepor Beel has been facing threats, which in turn affect the whole city. This paper analyses, in detail, such areas in and around the Ramsar site, which are most affected by different types of urban development. The areas, which have been highly transformed, are as follows:

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- i. Zone-A: Kalmani creek beside the National Highway
 - ii. Zone-B: Dharapur
 - iii. Zone-C: Maligaon-Azara Railway track

The details of each of the above zones are discussed below.

5.1 Zone-A: Kalmani Creek beside the National Highway

As depicted through dotted lines in plan, the Kalmani Creek existed in the location where the national highway, NH-37 now has been constructed (Fig. 4). The Kalmani Creek acted as a storm water channel connecting the city to the Deepor Beel. But, with the expansion of the movement networks, which further escalated the growth of settlements, almost filled up the creek making the river-bed very shallow and, thus, gradually converting it into a dead river. The links to the catchment areas have been filled up and, the creek now is just used as a dumping yard or, has been converted into service lanes in some parts. Due to this, the natural flow of storm water into the Beel has been obstructed, due to which problems of artificial water-logging have occurred in various parts of the city.

5.2 Zone-B: Dharapur

There are huge encroachments in and around the Deepor Beel by government and private agencies, such as government universities, private institutions, factories as well as residential groups, which are affecting or are going to affect the wetland and the ecosystem as a whole. The recent establishment of the City Garbage Centre in the heart of the eastern boundary at the Boragoan Area has led to heavy pollution of the water of Deepor Beel and, consequent spread of water-borne contagious diseases and disease vectors (Fig. 5)

5.3 Zone-C: Maligaon-Azara Railway track

The Maliagon-Azara Rail Line has segregated the Wetland into more than three subsystems (Fig. 6). The railroad has also hampered the wetland-animal interactions. Wild elephants, originally, regularly visited the Deepor Beel Ramsar Site to forage on aquatic vegetation. But this frequency has now been



Figure 4: The plan showing the location and flow of the Kalmani Creek which existed before the construction of the Highway.

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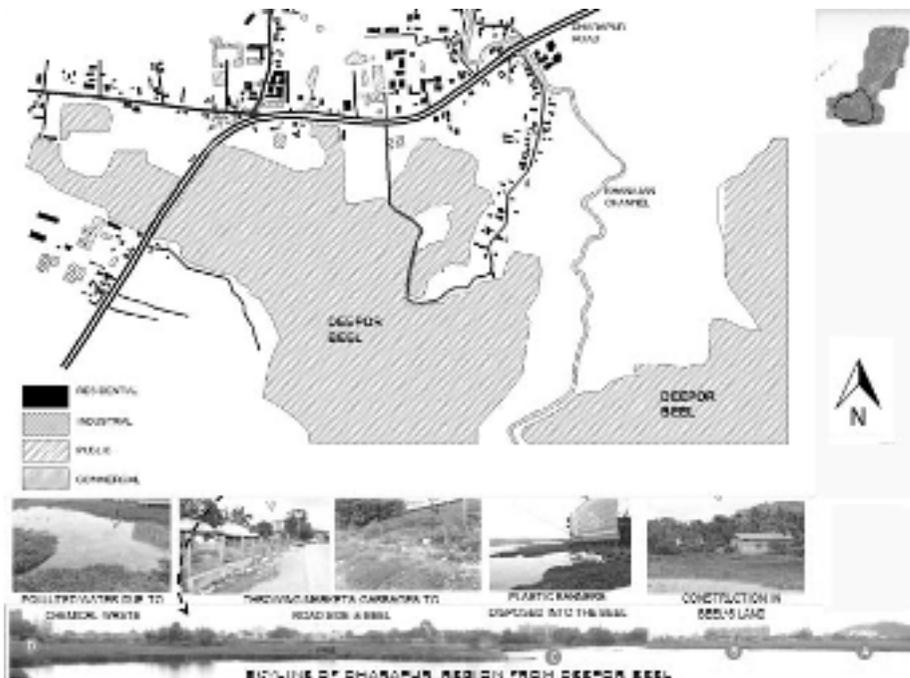


Figure 5: The Dharapur market area along the movement network which has converted part of the Beel into a dumping yard.

reduced alarmingly due to the presence of the rail line, since the elephants and their cubs could not be move easily and safely due to the frequent running of passenger and goods trains.

Stone quarries, which have also started functioning on this site, are affecting the biodiversity around the Beel and, also polluting the water body with all their drains leading directly to the wetland, which, in turn, also carries the pollution to its other linkages. All surrounding settlements drain their sewage effluents into the lake. This results in harmful contamination of the water, affecting the lake's aquatic eco-system.

Unplanned hill cutting and rarely regulated logging leads to heavy soil erosion which, in turn, causes rapid siltation in the wetland. Loss of trees also leads to loss of habitat. The cutting of timber in Rani and Garbhanga Forests has greatly affected the Asiatic Elephant population to in terms of food and habitat and has also led to an increase in man-animal conflicts.

6. MORPHOLOGICAL TRANSFORMATION OF DEEPOR BEEL

Large areas that were encroached for settlements have gradually pulled various other commercial and institutional functions to the Beel precinct. The main function of the wetland is to control the flood water and drain it towards the Brahmaputra. But, due to a reduction of the wetland area, the absorption capacity of the water body has also got reduced which, in turn, also contributes to the artificial water-logging of the whole city of Guwahati. As Guwahati is surrounded by hills, the storm water carries filth and mud, which makes the riverbeds of Bharalu and Bahini shallower. The industries and factories located in the periphery also drain their waste into the Beel, polluting the water and leading to loss and extinction of its aquatic species.

Thus, due to various illegal settlements and invasions, this significant wetland is reduced to largely become a heap of insensitive concrete jungle that only serves to add to the woes of never-ending urban problems. Concerning the need of the hour, the State Government has to initiate urgent measures to ban illegal constructions around the Ramsar Site. The industries and factories in the area should also to be shifted to stop further degradation of the ecosystem. The 'Guwahati Water-bodies Preservation and Conservation Act' has to provide effective measures to control water pollution, stop garbage dumping alongside water bodies and, to control noise -- all of which will help to preserve the flora and fauna of the precinct.

Being a Ramsar Site and a National Bird Sanctuary, the wetland needs to be protected against all the contamination and squatter settlements. The original settlements around the Beel could be developed into self-sustaining



Figure 6: The Railway track dividing the wetland into two segments.

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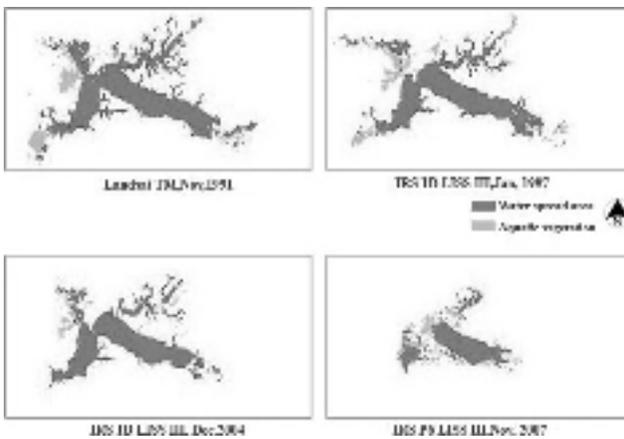


Figure 7: Satellite images showing the alarming rate of shrinkage of the Deepor Beel.

communities where the residents can earn their livelihood through developing fisheries in designated zones, developing organic farming in the fertile soil and, other such activities that can contribute in the economic development of the region as well as help in balancing the ecosystem. Tourism sector could be developed around the wetland but that again should be done responsibly so as not to disturb the sensitivity of the area (Fig. 7).

7. REGULATIONS AND GUIDELINES TO BE IMPLEMENTED

Rapid urban expansion and overexploitation are among the well-documented threats to the biodiversity and ecological integrity of the wetland. In order to prevent further deterioration of the waterbody, regulations should be imposed upon the users and, the surrounding developments should be controlled.

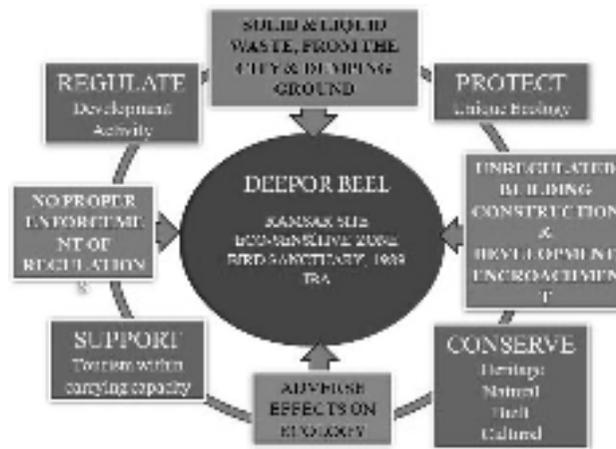


Figure 8: Regulatory measures recommended to save wetlands.

The regulations should include protection measures of the Deepor Beel, control of unregulated infrastructure around the Beel, conservation of the traditional architectural and settlement patterns around the Beel, supporting tourism activities to generate revenue and, developing guidelines for the future developments. The solid waste management system also needs to be taken care of to maintain hygienic conditions in and around the waterbody. A State-level Wetland Regulatory Board should also be created to regulate developments around the wetlands and, to develop strategies for encouraging development of the traditional livelihoods. Programmes designed to make the area sustainable and saving further degradation of the natural systems should also be introduced. (Fig. 8).

CONCLUSION

Wetlands are the ultimate groundwater recharging areas which not only help collection of rainwater and making it available for percolation but also in cleaning the water, and enabling nutrient retention, flood protection and erosion control. Hence, they are also known as the ‘kidneys of landscape’. They are highly rich in biodiversity and, are also linked to food and water security of the country. Despite all the important functions and service they provide, wetlands in India are indeed facing a great threat from urbanization and growing population. It is a herculean task to protect the existing wetlands from different pressures. Increased public awareness, collaborative scientific and public efforts along with a great political will is needed to bring about the exemplar shift in conserving this beautiful architectural wonders.

REFERENCES

- [1] ASSAM POLLUTION CONTROL BOARD (1989) *An Environmental Impact Assessment reports on Deepor Beel Basin Area*. ACNE Publication on behalf of the Worldwide Fund for Nature: Directory of Asian Wetland, pp. 442–443.
- [2] BARUAH, P., DEKA, C.R. & GOSWAMI, D.C. (1992) Study of Seasonal variation in Water spread and Land use Pattern in the Deepor Beel Area Using Digital Image Processing and GIS Techniques. *Proc. Zool. Soc. Assam* (Special Edition) pp. 34–48.
- [3] CHETRY, G. (1999) *Limnology of Deepor Beel with special reference to its Biodiversity and Pollution Status*. PhD Thesis, Gauhati University, Assam. pp. 1–215
- [4] DEKA, S.K. and GOSWAMI, D. C. (1992) Hydrology, Sediment Characteristics and Depositional Environment of Wetlands: A case study of Deepor Beel, Assam. *Journal of Assam Science Society*, **34** (2), pp. 62–84.
- [5] DUTTA, A., KALITA, J., NUVAID, M., SHEIKH, M. S., and SARMA, D. (1993) Diurnal variations of Certain Physico- Chemical Parameters of two Standing water Bodies in the Vicinity. *Environment and Ecology*. **11**(4), pp. 820–824.
- [6] GOVERNMENT OF ASSAM (1990) *Report of the committee on environmental implications associated with the B.G. railway alignment through the Deepor Beel area*, Dispur, Guwahati, pp.1–116.
- [7] KUMAR, A., TAK, P.C. and SATI, J.P. (2006) Residential, population and conservation status of Indian wetland birds. In: *Proceedings of the Waterbirds around the world Conference, Edinburgh, April 2004*. Edinburgh: The Stationery Office, p. 308.
- [8] RAMSAR (2008) *The list of wetlands of international importance*. [Online] Ramsar Convention. Available from: <http://www.ramsar.org/pdf/sitelist.pdf> [Accessed September 2015].
- [9] VARSHNEY, J. G., SUSHILKUMAR, and MISHRA, J. S. (2008) Current Status of Aquatic Weeds and Their Management in India. In: *Proceedings of Taal 2007: 12th World Lake Conference*, Jaipur, 28 October – 2 November 2007. pp. 1039–1045.
- [10] MITSCH, W. J. and GOSELINK, J. G. (1986) *Wetlands*. New York: Van Nostrand Reinhold Company.