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The tragedy of wetlands: Two case studies from Assam

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Abstract
The freshwater wetlands of Assam are located in two river plains - the Brahmaputra plains (56,480sq. kms) drained by the river Brahmaputra and its tributaries and the Barak plains (6962sqkms) drained by the river Barak and its tributaries. In the floodplains of these rivers, there are a large number *beels*, swamps and marshes known as *jalah, doloni, hola, pitoni,* etc. Interestingly, all these water bodies comprise a vast sheet of water with varying shapes, sizes, and depths with abundant flora and fauna. There are 1907 registered beels covering an area of 63019.8 hectares of land. Though the wetlands provide some important services to human beings, nevertheless, these are now very much threatened due to various anthropogenic activities and consequently degrading over the years. The growing trend of degradation of wetland perturbs its ecological role and reduces its competence to provide various services, otherwise, it would provide. This paper is a humble effort to assess the plight of such wetlands and to identify their drivers. Two major beels or wetlands, i.e., Morikolong beel, an urban wetland of Nagaon district and Solmari beel, a lesser-known rural wetland of Marigaon district of Assam have been taken for detailed investigation. Policy failure and massive anthropogenic pressure are found to have been the major causes of degradation of the wetlands. It is also realized that designing proper policy at the local and regional level along with its strict implementation is the need of the hour.

Keywords: anthropogenic pressure, ecosystem people, livelihood, community fishing, endemic

Introduction

Wetlands have been defined by the Ramsar Convention (Scott. D.A., 1989) [16] as "areas of marsh, fern, peat, land or water whether natural or artificial, permanent or temporary, static or flowing, fresh or brackish including areas of marine water the depth of which at low tides does not exceed 6 mt". India has 27, 403 wetlands, of which 23,444 are inland and the rest are coastal wetlands. Wetlands are now considered the last remains of freshwater bodies on the earth excluding the perennial rivers (Bhagawati, 2010) [4] that sustains all life forms and perform useful functions in the maintenance of ecological balance. Their importance in human and urban lives has been increasing with the increased population and thereby the population-based pressures (Mitsch & Gosselink, 2000; Davis & Froend, 1993; Abhishek & Nathawat, 2004) [13, 10]. The floodplain wetlands, the prime fishery resources in Assam, are highly productive ecosystems (Chandra, 2010; Chandra and Sharma, 2011; Chandra et al., 2013) [6, 7, 8] providing livelihood support to a large section of the population next only to agriculture. Besides, the wetlands perform extremely important ecological services such as conservation of biodiversity, controlling floods, groundwater recharge and discharge, improvement of water quality, storm protection and stabilization, supporting different food webs, regulating hydrological cycle, trapping energy and shelter large numbers of flora and fauna having great ecological and economic value (Bennet, 1962; Oglesby, 1985; Malakar and Boruah, 2017) [3, 14, 12]. Although wetlands are gaining attention worldwide as they perform a variety of ecological, economic, and recreational functions, their values are still least appreciated and hence they are still under constant threat from ever-increasing human activities. The Wildlife Institute of India's survey reveals that the wetlands are disappearing at a rate of 2–3 percent every year. Rapidly expanding human population, large-scale changes in land use/ land cover, burgeoning development projects and improper use of watersheds have all caused a substantial decline in wetland resources in the country. Significant losses have resulted from its conversion threats from industrial, agricultural and various urban developments (Phukan and Saikia, 2014) [15]. Thus, it is quite apparent that though the pressures are created on the wetlands due to both natural and man-made factors, man-made factors are found to be more serious to cause degradation of the wetlands the world over. Most of the wetlands are being occupied by humans and being converted into settlement areas primarily due to the ever-increasing human population.

Wetlands are used in many different ways as they offer a range of benefits, however, exploiting different resources from the same source tends to overuse the wetland resources making the ecosystem increasingly weak and vulnerable (Bhagawati, 2010) [4]. Covering around 3 percent of the country's land surface, the wetlands of India are subject to increasing threats due to immense pressure from human beings in the form of urban sprawl, waste disposal, and extensive uses for different purposes along with a lack of policy measures for its development and protection. As ecosystems – such as floodplains, marshes, mangroves, and seagrass – are degraded, the surrounding cities and regions become increasingly prone to extreme weather events and challenged by environmental stressors such as water shortage, urban heat waves, land subsidence, and drought. Knowing the fact that wetlands are extremely important for humans' little efforts are made to conserve them. The plight of wetlands like Deepor beel, the lone Ramsar site in Assam, can be cited as a glaring example of administrative negligence among many lesser-known but extremely important wetlands of the state.

Wetland resources in Assam

In the tropical areas, notably, in the Indian subcontinent, and particularly, in the Assam region and adjoining places such as Bangladesh, wetlands are usually shallow depressions that could normally be in the form of a basin at the centre of hillocks on all sides; or, could be an abandoned segment of a river (oxbow wetland); or, could be a shallow portion of a river course which may be detached from the main river course during the dry season (Kar, 2019) [11]. The state of Assam is endowed with large aquatic resources with a total area of nearly 4.89 lakh ha which is the highest in the country (Chandra, 2014) [9]. The wetlands of Assam are the most vital ecological bases for its economic development and ecological maintenance with 1.29% of its total geographical area. In the flood plains of the river Brahmaputra and Barak, there are large numbers of wetlands (as in map-1). It is comprised of lake-like wetlands with clear water spread areas in the center, which are locally called 'Doba', 'Hola', 'Pitoni', 'Doloni', Jalah, Haor, etc. (Kar, 2019) [11]. All the districts of Assam have wetlands of various sizes and types. Assam Remote Sensing Application Center (ARSAC) of Assam Science Technology and Environment Council (ASTEC) has identified 3513 numbers of wetlands which account for an area of 10123 sq. km. Figure 1 shows the river networks of Assam and table - 1 represents the district-wise distribution of wetlands in the state.

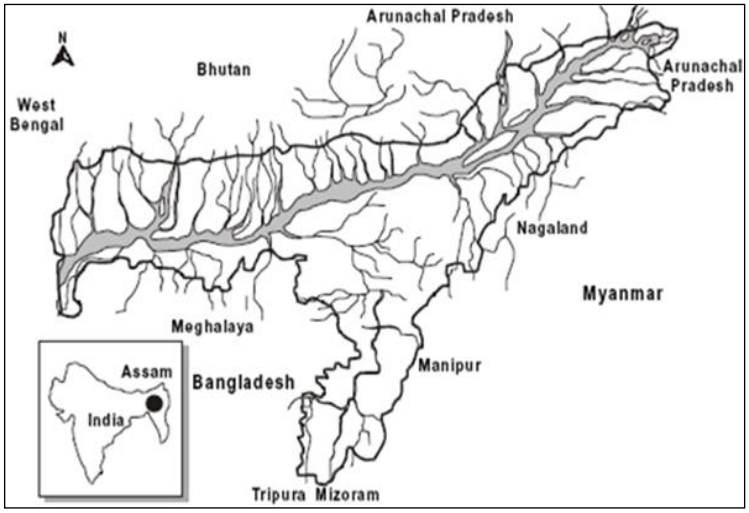

Fig 1: Map – River networks of Assam

Among all the districts of Assam, Marigaon and Nagaon district holds the highest numbers of wetlands along with the area under wetland, which accounts for 9.59% and 2.615% respectively of the total area of the districts. However, compared to the total geographical area of the districts, Bongaigaon and Morigaon districts have the highest area under wetland followed by the Nagaon district.

Table 1: District-wise distribution of wetlands in Assam

S.N.	District	Number	Area(ha)	% of wetland area against the total geographical area of the district
1	Barpeta	97	3301.00	0.998095123
2	Bangaigaon	100	3158.50	10.07978299
3	Cachar	340	7188.00	1.90195461
4	Darrang	103	3515.50	1.01448648
5	Dhemaji	139	3960.00	1.259894627
6	Dhubri	233	6459.70	2.352831907
7	Dibrugarh	86	2752.50	0.793769808
8	Goalpara	165	3832.50	1.514552748
9	Golaghat	330	5467.50	1.544055352
10	Hailakandi	47	840.0	0.63495423
11	Jorhat	109	2108.50	0.723402065
12	Kamrup	352	11407.0	2.409692002
13	Karbi-Anglong	77	897.0	0.198938551
14	Karimganj	70	5719.50	3.110114192
15	Kokrajhar	85	1578.40	0.334654935
16	Lakhimpur	151	3033.50	1.211810105
17	Morigaon	183	11658.00	9.558401522
18	Nagaon	379	11295.50	5.578575662
19	N.C. Hills	10	2552.50	0.52198364
20	Nalbari	68	1988.00	0.460286406
21	Sibsagar	109	2135.00	0.820238964
22	Sonitpur	206	3651.00	0.694740448
23	Tinsukia	74	2732.50	0.768363393
Total		3513	101231.	

Source: Boruah et al. (1997) [5].

Two things are very apparent in Table 1. One, there are districts where the numbers of wetland and wetland areas are significantly high and secondly, there are districts where the number of wetlands is high in comparison to the total geographical area of the districts. The first one represents the individual concentration of wetlands and the second one represents the concentration in a spatial context. Both are ecologically and environmentally important.

The vast wetlands of Assam are utilized for two purposes, i.e., to use commercially such as culture fish, and for conservation. However, it is observed that massive anthropogenic pressures have been put on the wetlands and thus most of the wetlands have been witnessing an unnatural death (Bhagawati, 2010) [4].

Objectives

The present study has been undertaken with the following broad objectives in mind.

1. To investigate the ecosystem services that the beels provide and in that context assess their present threats.
2. To examine the nature of conflicts that the beels confront.

Materials and Methods

This paper comprises two case studies to investigate the importance and status of wetlands. The case studies include Solmari beel, a rural wetland in the Marigaon district and Morikolong beel, an urban wetland of Nagaon. Two wetlands of different nature have been sampled since urban habitats differ from rural systems both physically and biologically (Baldwin, 2004) [2]. Both qualitative and quantitative data were collected during the study to understand the roles, the beel play in the life and livelihood of the people living in its vicinity and present status and the problems encountered by the beels. In order to collect the qualitative and quantitative data the Participatory Rural Appraisal (PRA) methods such as personal interview, focus group discussion and direct observation tools were administered. A fundamental requirement of qualitative research is recording observations that provide an understanding of reality. Since it is lesser-known wetlands there was a paucity of written literature regarding both the case studies and thus the data were collected by using various tools of PRA method mentioned above.

Results and Discussion

Case study 1

Solmari Beel: Assessing the facets of wetland and human association – case of fisherman's priority and annexation of development policy:

Location: The Solmari Beel is located at the intersection of 92˚24″ E and 26˚14″ N. It belongs to Solmari Gaon Panchayat under the Bhurbandha Development block of the Marigaon district of Assam. It is located at a distance of 7 km from the district headquarters of Morigaon in the south-eastern direction and 9 km from NH-37 in the North-eastern direction.

Solmari Beel: It is a sprawling wetland, ox-bow by shape, and originated due to the changing course of the river Kallang and there is an existing interlink with Latamari Beel through a narrow channel. The beel covers an area of 17 hectares and is the source of food and fodder for the human and cattle population of the villages in its vicinity.

Solmari village: According to the 2011 census, Solmari village is inhabited by 215 households having 1159 people belonging to the Tiwa tribe. The sex ratio of the village is slightly higher than the national average, i.e., 935. Among the villagers, the percentage of the main workers is 24.9%. The marginal workers and non-workers comprise 17.5% and 57.5% respectively. The literacy rate of the village is 77%.

25 out of 215 households are landless and depend absolutely on the Beel for their livelihood. Agriculture is the mainstay of the people of the village. Besides, a large section of the villagers works as agricultural laborers on the land of their fellow farmers and also nearby villages. A few of the households rely on fishing for their livelihood. Since agriculture is weather dependent, it fails as and when monsoon fails. Moreover, the perennial flood plays havoc on the village economy and most of the time the poor farmers are unable to harvest the Sali (winter) paddy and thus suffer from a crisis-like situation. It appears during the FGD that Solmari beel acts as a cushion at a time of crisis to fall back upon. People catch fish and sell it in the nearest urban markets to realise a sizeable income. Thus, the Solmari Beel has been a lifeline for the people of its surrounding villages. A few of the farmers, of late, have resorted to growing summer (Bodo) paddy instead of Sali to escape the vagaries of monsoon.

The economics of Fishery and Grass cutting: The beel is the only source of income for the fisherman community of the village. When the night's darkness descends over the waters of Solmari beel, the fishermen set out to catch fish in groups consisting of four-five members in each group. Each group has its own boat and catches fish in the placid expanse of the beel for about 4/5 hours a day. Each group catches 200-250 kg of fish, endemic to the state, each week. Some of the species caught by the fishermen are listed in Table 2.

Table 2: List of the fish species caught at Solmari beel

Sl no	Local name	English name	Scientific name
1	Kawoi	Climbing perch	*Anabas testudineus*
2	Magur	Magur	*Clarias batrachus*
3	Singi	Stinging catfish	*Heteropneustes fossilis*
4	Sol	Striped snakehead	*Channa striata*
5	Sal	Giant snake head	*Channa marulius*
6	Borali	Freshwater shark	
7	Kandhuli	Grey Feather back	*Notopterus notopterus*
8	Puthi	Swan/Chola barb	*Puntius chola*
9	Kholihona	Banded colisa	*Colisa fasciata*
10	Mowa	Indian carplet	*Amblypharyngodonmola*

11	Bheseli	Colisa	*Colisa colisa*
12	Rou	Rohu	*Labeo rohita*
13	Mali	Calbasu	*Labeo calbasu*
14	Botiya	Loach	*Noemacheilusbeavani*
15	Singara	Mystus	*Mystus bleekeri*
16	Kokila	Freshwater garfish	*Xenentodoncancila*
17	Chengeli	Smooth-breasted snake head	*Channa Orientalis*
18	Goroi	Green snake head	*Channa punctatus*
19	Bami	Spiny eel	*Mastacembalusarmatusarmatus*
20	Kuchiya	Gangetic mud eel	*Amphipnouscuchia*
21	Tora	One striped spiny eel	*Macrognathusaral*
22	Dorikona	Blackline rasbora	*Rasbora daniconius*
23	Patimutura	Bar eyed goby	*Glossogobius giuris*
24	Gedgedi	Mottled nandus	*Nandus nandus*
25	Gethu	Tiger loach	*Botia dario*
26	Chanda	Indian glassy fish	*Chanda ranga*
27	Dom vacheli	Badis	*Badis badis*

Source: PRA.

The fishermen generally can get hold of the endemic fish variety listed in Table 2. In the month of November/December, they generally set out a bit late at around 6/7 am and come back at around 12 noon. In the afternoon they move out to sell their catch at a bustling market of Marigaon and Jaluguti, a few kilometers away from their village. Though the price of the endemic variety of fish has been increasing, the catch has been dwindling in volume over the years.

Similarly, the grass cutters also set out for two/three hours a day and cut 50-60 bundles at the beginning of the day. They also sell it in the nearby market at the rate of Rs. 10 – 15/- per bundle. During floods they need not go to the market rather sell the grasses in the village itself, thus providing fodder for the livestock population and at the same time getting their own livelihood too.

Practices of Community fishing: Besides being the source of livelihood for the villagers, the Solmari Beel also promotes community cohesion by organizing community fishing twice a year once in the month of January on account of Magh and the other in the month of April in the occasion of Bohag bihu. In addition to the people from different villages in the vicinity of the beel, people from distant villages also congregate and participate in the community fishing. One is allowed to catch as many fish as he/she can. The decision to organize community fishing for a day on two different occasions is taken in the village meeting of Solmari Mikirgaon village. It is announced later on in public places such as *haat* or weekly public markets. The information, thus, gets disseminated and people from distant villages and from all corners participate in the community fishing.

The genesis of the conflict involving the beel: It is the decision of the local administration to improve the Solmari beel by implementing the *Hariyali* project which sparked the conflict between two sections of the villagers and also between the administration and the villagers. Initially, the innocent villagers were cajoled to be part of the project and promised that they would reap handsome benefits out of the *Hariyali* project once it is implemented in the beel. However, when a group of people started the cleaning work in the fringe areas of the beel, the untold story started unfolding. The villagers came to know that the beel has been allotted in the name of a group of youths from the village. A group of vibrant women under the "Solmari Mahila Sangha" wanted to know how the benefits of the *Hariyali* project would percolate down to those who are dependent on the beel. Not finding satisfactory answers, the villagers suddenly realized that they are going to lose their stake in the beel and once fully implemented, the benefits of the group will receive higher priority over the well-being of the mass. The villagers sensed the danger of losing their rights over the beel as a source of livelihood for the people in its vicinity. They also understood that once the project is implemented the endemic fishes will vanish along with the birds who prey on the fishes. The grasscutters and the fishermen who depend absolutely on the beel for their livelihood will be rendered jobless. Thus, the people started demanding not to bring the beel under the Hariyali project. It is the village women, under the "Solmari Mahila Sangha", who started raising objections under the active support of the Gaoburha (the village headman). 'Jangalei Mangal' (Jungle is for wellbeing) – the Gaonburha aptly commented about the necessity of the beel for the villagers. The villagers raised the issue with the District Commissioner of Marigaon and other concerned officials and expressed their disagreement and resentment over the Hariyali project to be implemented in Solmari beel. The issue lingered for some time on the negotiation table but finally, the administration was compelled to withdraw and retreat. The villagers of Solmari heaved a sigh of relief.

Observation

- Sometimes, while designing the development programs the local requirements and peoples' preferences are not taken into consideration which results in conflict.
- The concept of SHG may not be a viable option in the community-centric tribal society of the state. Instead of development, it creates misunderstanding and conflicts.
- Community fishing is not only a practice of catching fish but it also involves a culture of community cooperation and coherence. Handing over the ownership to a group of youths will defeat that very principle besides rendering many villagers jobless.

Case study – 2

The tragedy of an Urban Wetland – Morikalong beel of Nagaon:

Location: The area is located in the 26˚18.73´ N to 26˚0.6″ N latitude and 92˚41.2″ E to 92˚42.36″ E longitude. It is located in the southwestern corner of Nagaon town the district headquarters of Nagaon District.

Morikalong Beel: It is sprawling water spread locally known as Morikalong and Potakalong in two parts and covers an area of 6.35 sq. km. It belongs to the Nagaon municipal area of Nagaon town. It spreads from the township to the neighboring countryside along the NH36. It was an abundant channel of river Kalong and later bifurcated into Marikalong and Potakalong. The main cause of the origin of these wetlands may be the shifting of the course of the river Kalong before the 1897 earthquake. Such beels are, in general, rich for fish production. Both are oxbow lake due to the meandering character of the channels from which it was bifurcated. About 18 varieties of birds were counted in the beel and some of them are Little Grebe, Little Cormorant, Pond Heron, Cattle Egret, Smaller Egret, Lesser whistling Teal, Common Teal, Swamp Moorhen, Open bill stork, etc. However, since the habitat of the beel has been severely degraded over the years, most of such avifauna have ceased to visit the wetland. Following are some of the important ecosystem services Morikalong beel provides to the dwellers in its vicinity.

- It functions as a reservoir of rainwater and thus pacifying the intensity of rain-fed floods during monsoon.
- It provides the people with clean air,
- It is the source of employment for some sections of the people, i.e., the fishing community in the countryside largely,
- It enriches the natural beauty of the area,
- Breeding and feeding grounds for different variety of fishes and birds.

Human settlement, urbanization and anthropogenic activities

Both the eastern and western banks of the beel, i.e., Morikolong and Kachalukhowa, have emerged as important settlements since the 1970s as a result of growing urbanization. The number of settlements has been growing over the years and now there are more than 2000 households residing on both the banks of the beel.

The biggest threat faced by the wetland over the decades is encroachment by the people of the surrounding areas. Most of the people are aware of this encroachment but are not willing to raise their voices in protest because some of the encroachers are rich and politically powerful people of the area.

The second biggest threat faced by the wetland is the open lavatories. The people of economically deprived sections have *kuchha* toilets without septic tanks. The toilets have been directly connected to the beel with plastic pipes and thus polluting the water body immensely. Moreover, with unrestricted dumping of sewage and toxic chemicals, and discharge of the wastewater from the neighboring habitation, the water body has become polluted. It also comprises different types of products that create the process of eutrophication and rampantly increase the vegetation growth in certain patches. All these processes destabilize this sensitive ecosystem and reduce its potentiality of supplying the much talked about ecosystem services.

Negative approaches to development administration

A few steps taken by the local development authority in the last two decades have made the process of degradation of the beel quicker. Among them, the following are the most repulsive:

In the beginning of the seventies in the last century, the local authority constructed a road over the wetland to connect the western and eastern banks of the water body bifurcating the waterbody into two parts.

During the year 1987, the local development authority allotted 12 bighas of land of the wetland to establish a bus stand that is to be relocated from the inner part of the town. It was the beginning of the land conversion of the beel with government patronization.

Another important issue is that the wetland is leased out to private parties. The lessee then sub-lease it to different fishermen traders. All the sub-lessees demarcate their areas and thus fragmentation of water areas occurs bringing to an end the free movement of the water and fish within the water mass. Moreover, the lessees don't allow to grow other aquatic life to grow and survive. Instead of an endemic variety of fishes, the carp variety is stocked in the beel. Huge quantities of feed along with fertilizer are poured leading and expediting the process of eutrophication.

During our field survey what we observed was that the people of both sides and especially the people of the western side of the beel have encroached upon the beel and slowly squeezed the waterbody. This will have long-term environmental implications on the locality.

All the domestic wastes have flown into the Marikolong beel without treating. The sceptic tanks of the lavatories of the people living in the fringe of the beel are open and connected to the beel.

People's preference

To understand the attitude and opinion of the people residing in the vicinity of the waterbody, a survey was carried out in the area. 150 households were taken into consideration for a focus group discussion. Out of which 52% are male and 48% are female and of the age group of 18 to 30 years (20%), 30 to 60 years (50%), and above 60(30%). Some of the important findings of this discussion reveal the following facts.

- 90% of the respondents consider it important from the perspective of the local ecology. People have understood that the wetland is providing countless benefits to them in terms of storm and rainwater storage and thus pacifying artificial flooding during monsoon; open air; esthetic beauty and most importantly the beel is an important source of fish. During the discussion, 65 percent of the discussants expressed their willingness to contribute for the development of the beel. 20 percent of the discussants were for maintaining the beel as a natural site. The remaining 15 percent of the members of the FGD wanted it to develop into a recreational line by constructing parks on its bank.
- However, there are also respondents who wish to develop the site as a market complex which would give them an earning in the form of rent and different types of petty businesses. It is worth mentioning that 85 percent of this group of respondents belong to 18 to 30 years of age group.

Conclusion

The interaction of man with wetlands during the last few decades has been of concern largely due to the rapid population growth - accompanied by intensified industrial, commercial and residential development further leading to pollution of wetlands by domestic, industrial sewage, and agricultural run-offs as fertilizers, insecticides and feedlot wastes. It is apparent from our study that the plight of urban wetlands or for that matter any commons is relatively more than that of the rural one. This happens because of the fact that wetland values are overlooked as the market for the services that a wetland or a natural resource offer to humankind is missing. Therefore, these wetlands are under constant threat of encroachment and pollution leading to an unsustainable situation. Thus, there is need for a separate policy or Act to manage the wetlands sustainably with a properly defined property right including certain rights to the residents in the vicinity.

However, every wetland is linked with the landscape where it is located in a unique way. It creates an association with the traditional social system which is evolved in a pattern of ecosystem people. But the changing time and changing lifestyle in a manner of bio-spheric people have severely distressed the traditional system and thus jeopardized the natural status and environment of the wetlands. For the conservation of such kinds of wetlands, there is no other option at this moment but to encourage the local people to join hands with the concerned authorities for their protection. Fortunately, various NGOs and committed individuals have come forward to work for the cause of wetland conservation. Furthermore, in order to arrest such a process of degradation, there is a need for a total landscape ecology-based approach considering watershed or micro watershed as a special unit with the pertinent technique of 3E approaches of Ecology, Economy and Ethos. The reward mechanism for the wise practices and payment and compensation for the affected sections to be cautiously taken care of in the form of alternative livelihood and other social security.

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