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Imperiled Wetlands of Guwahati and Their Conservation

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Abstract

The ever-increasing trend of human population in Guwahati city has attributed to two contradictory demands in recent years, one is to occupy the wetland areas for human habitat development and the other one is to conserve the wetlands for natural and recreational purposes. The total population of Guwahati metropolitan area was 8,90,773 in 2001 which is now steadily increasing with a population growth rate of about 15,867 per year. Managing this huge population growth will be more difficult in coming years. During the study, six major lentic water wetlands are encountered in the main Guwahati area. These are Deepar beel, Barchola beel, Saruchola beel, Damal beel, Hanchora beel and Silsako beel which are under threat of extinction. It is observed that there is a tremendous anthropogenic influence particularly in changing the land use pattern and increased built-up land within the wetland areas which play a pivotal role in transforming and degrading the wetlands. Two different aspects of degradation of these lentic water habitats are recorded, one is the shrinkage of the wetlands due to natural and anthropogenic activitis and the other is degradation of quality of wetland environment thereby bringing change among the biotic components of the wetland.

Key words : Guwahati, Population, Wetlands, Conseration.

Present communication is based on the studies on some of the problems of wetland degradation in and around greater Guwahati, India. The term Guwahati means depressed area, surrounded by hills and hillocks (1) Toposheet (1911s) also carries information regarding the presence of several lowlands including wetland and marshland in this area (Survey of India). Till fifty years ago, areas of the today's city, namely, Chandmari, Zooroad, Gandhibasti-Sharania, Kahilipara, Hatigaon, Hatigarh, Jyotinagar, Noonmati, Narengi, Hengrabari and Kalapahar were either cultivated field or rich fishing ground. The people of Guwahati hardly purchased fishes in the market. Earlier, there were no Chalani fish (imported fish) in the market. It is also evident from available sources that British government encouraged cultivation for the development of Guwahati (1). But, now almost all these paddy fields are occupied by the people for construction of houses. Hills and hillocks are become human habitat. Also there are only a few fishable wetlands in these areas. Most of these transformations are now beyond the limit of assessment. Due to the ever-increasing human population in Guwahati, naturally two contradictory demands are now growing among the masses of the city; one is to occupy the wetland areas for human habitat development and the other one is to conserve these wetlands for natural and recreational purpose. However, we must keep it in mind that wetlands are natural components of environment and have many uses in nature (2—6). In the wetlands, four major useable resources namely, soil, water, plants and animals accumulates for human use and can be a source of income for the people this area (7). Conservation of wetlands in these areas has therefore utmost importance. In the present text, the major causes of threats to the wetlands of Guwahati and its adjoining areas are discussed and some of the recommendations are forwarded.

Methods

Wetlands were physically visited to otain the data. During the survey, primary data were collected from fringe areas of the wetlands through simple questioners. Pertinent data were also collected from various office sources. Water samples were analyzed fol-

Table 1. Land use pattern for Guwahati in 2001 (Source : Town and Country Planning Department of the State).

Sl. No	Land use	Percentage
1	Residential	25.10
2	Commercial	2.50
3	Industry	5.20
4	Special category Government	6.20
5	Recreational and Parks	5.40
6	Pulic and Semi–Public	9.40
7	Transport	12.90
8	Green belt	15.40
9	Water bodies, hills	17.70
Total		100%

lowing APHA et al. (8).

Results and Discussion

Geographical Location of Guwahati City

Guwahati is situated on the bank of river Brahmaputra with its cardinal points as $26^0 10'$ north latitude and $92^0 49'$ east longitude. It is located towards the south-eastern side of Kamrup district, which is surrounded by Nalbari district in the North, Darrang and Marigaon districts in the East, Meghalaya State in the south and Goalpara and arpeta districts in the West. The plain area has varying altitudes of 49.5 to 55.5 m above mean sea level (MSL).

Expansion of Guwahati City and Total area

Available records reveal that in 1878 Guwahati was upgraded to a Municipal area. However, in 1893,

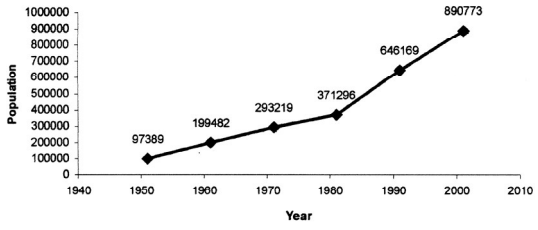

Figure 1. Population growth in Guwahati metropolitan area (1951-2001). (Source : statistical hand books). The 1981 population figures have been extrapolated on the basis of the 1971-1991 CAGR.

Table 2. Temporal variation of beel areas located in Guwahati city. (1967-2002).

	Name of the beel	Area in hectare 1967	2002
1	Deepar beel	778.5	752.7
2	Saruchola beel	4.75	2.5
3	Barchola beel	6.25	4.5
4	Silshako beel	2.5	1.75
5	Damal beel	2.0	1.5
6	Hanchora beel	3.0	2.5
	Total	797.0	765.45

the northern part of Guwahati (North Gauhati) was omitted from the municipal area. During that time the boundary of Guwahati town was the junction between MCB road and GNB road to the east, Bharalumukh to the west, Bharalu river and Chalabeel to the south and river Brahmaputra to the north. In 1899, the boundary of the town was expanded to incorporate the areas like Kharghuli, Silpukhuri, Chandmari, Rajgarh, Barpul, Bhangagarh, Sarania, Ulubari, Rihabari, Santipur and Bhutnath. During 1901 the town area was aout 4.5 sq km. and had a population of only 14, 244. Presently the Guwahati Metropolitan region covers an area of 264 sq km comprising of Guwahati Municipal Corporation Area (GMCA), North Guwahati Town Committee area, Amingaon and some revenue villages. It is also noteworthy that the extended boundary encompasses more natural wetlands in Guwahati Metropolis.

Demography of Guawhati City

Overall Decadal Population Growth in the City. It is found that Guwahati is a fast growing metropolis. With the increasing land area the city is also expanding in population. According to 2001 census the total population of Guwahati Metropolitan area is 890,773. Based on the above study, it can be projected that the total population of the Guwahati Metropolitan area will reach near to a total of 27 lakh by 2031 (Fig. 1).

Population Density of the City. The population density of Guwahati has been steadily increasing. Figure 2 depicts the rising trends in population density since 1981. It appears that present density (3,374/km^2) is far greater compared to the total population density of Assam (340/km^2) based on 2001 census.

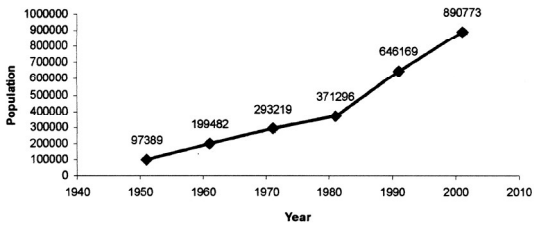

Figure 2. Population density of Guwahati city (1981-2001).

Table 3. Some of the water quality parameters studied in the wetlands of Guwahati city.

Parameters	Barchola	Hanchora	Deepar	Silsako
pH	6.7	7.3	6.8	6.8
Turbidity	51.3	13.6	38.4	12
Alkalinity	70	16.6	10	95
Hardness	266	20	36.6	40
Dissolved oxygen	0.8	9.07	3.4	7.8
Free carbon dioxide	9.5	1.4	2.8	6.2
BOD	68.5	3	11.4	Not assessed
Phosphate	1.3	2	0.05	Not assessed
Amonical nitrogen	3.8	0.8	1.1	Not assessed

Moreover, if the projected population in 2031 has to accommodate within the present boundary of Guwahati, the population density will be nearly 10,000/ km^2. There will be naturally population congestion in Guwahati for which new area development has deemed required.

Housing and Land Built-Up Profile of the City. It is observed that the total number of households in the city are 200,258 the (Census of India, 2001) of which 178,738 is used for residential purposes. In 1991 census the total number of households was 137,459.

The land use pattern for Guwahati based on the Town and Country Planning Department of the State in 2001 is given in Table 1. The land is used predominantly for residential purpose (25.10%). Industry and commercial development do not form a major part of the land use. Moreover, there is 15.40% green belt and 17.70% water bodies and hills including natural flow and artificial drainage. The roads and transport system covers 12.90%.

Wetland Profile of Guwahati City

Presently there are six major lentic water wetlands in southern part of main Guwahati Metropolitan Area, besides several small water bodies. These are Deepar beel, Barchola beel, Saruchola beel, Damal beel, Hanchora beel and Silsako beel. However, towards its eastern extension there is Khamranga beel. In North Guwahati (part of the Guwahati city at the northern bank of Brahmaputra river) also, some major wetlands are located. There are also some ponds namely, Dighali pukhuri, Sil pukhuri, Nagputa pukhuri, Jur pukhuri and D. C. bungalow Pukhuri.

The main lotic water system of Guwahati includes the river Brahmaputra, river Bharalu, river Basistha-Bahini-Morabharalu system and Bonda river.

It is observed that all of the studied lentic water wetlands are under the stress of degradation. The two different aspects of degradation of these wetlands are noticed. One is the shrinkage of the wetlands due to natural and anthropogenic activities and the other is degradation of quality of wetland environment thereby bringing change in the ecosystem.

The temporal variation of wetland in last 35 years till 2002 is given in Table 2. It appears that all these wetlands are directly or indirectly connected with natural flowing system of the area. Therefore, the shrinkage of the wetlands happens due to the silts received from neighbouring hills and from the river Brahmaputra. Hanchora and Deepar beel has good connection with the river Brahmaputra for which reason these two wetlands receive sufficient amount of silts during monsoon. However, the other beels receive silts mainly from neighbouring hill areas.

There is a tremendous anthropogenic influence particularly in changing the land use pattern and increased built-up land within the wetland areas which play a pivotal role in transforming and degrading the wetlands in the studied zone. Lands are occupid by the people mainly for construction of residential houses. Government also has extended their help in such and occupation and construction works. There is also a misbelief that wetland should only be in government lands and not in the *patta* land. It appears from a case study that the actual boundary of Deepar bell is far greater than the present demarcation in the settlement map across 37 National highways towards its east and western boundary. But all these lands are *patta* land where people started construction works in recent years. Commercial utilization of this part of

Table 4. Common aquatic plants of the wetlands of Guwahati city.

	Vegetation type	Name of the plants
1	Free floating	1. *Azolla pinnata*, 2. *Eichhornia crassipes*, 3. *Lemma pausicostata*, 4. *Salvinia cucullata*, 5. *S. natans*
2	Floating -leaved emergents	6. *Euryale ferox*, 7. *Hygrorhiza aristata*, 8. *Nelumbo nucifera*, 9. *Nymphaea nouchali*, 10. *N. sellata*, 11. *Nymphoides chistatum*
3	Rooted-emergents	12. *Cyperus iria*, 13. *Eleocharis atroparpuria*, 14. *Eclipta prostrate*, 15. *Enhydra fluctuens*, 16. *Fimbristylis globulosa*, 17. *Jussiaea repens*, 18. *Murdannia nudiflora*, 19. *M. triquentra*, 20. *Monochoria hestata*, 21. *Panicum auritum*, 22. *P. repens*, 23. *Polygonum* sp.
4	Rooted-submerged	24. *Apomogeton* sp. 25. *Blyxa aubertii*, 26. *B. echinosperma*, 27. *Caldesia parnassifolia*, 28. *Ceratophyllum demerssum*, 29. *Hydrilla verticillata*, 30. *Limnophyla indica*, 31. *Najas indica*, 32. *Nechamendra alternifolia*, 33. *Ottelia alismoides*, 34. *Potamogeton actundrus*, 35. *Potamogeton* sp. 36. *Trapa bispinosa*, 37. *Utricularia flexuosa*, 38. *U. stellaris*, 39. *Vallisneria spiralis*.

land is also notable. Several write-ups in this context expressing agonies by the environmentalist have been published in current national dailies and also in scientific communications (7, 9—11). The same incidents are going on in other wetlands also (12, 13).

Degradation of the quality of water, thereby causing changes to the vegetation and animal composition in the wetlands are also noticed. The changes to the quality of wetland water also can be attributed from the earlier works of Goswami (10, 14—16). All these reports have explained bio-chemical detection of many toxic components to the aquatic environment beyond permissible level, thereby causing degradation to the quality of water and soil. However, a few of the bio-chemical detections of the wetland water are given in Table 3.

These wetlands are the habitat for many aquatic plants and animal species. Major vegetation of the wetlands is shown in Table 4. It is observed that there are nearly 39 aquatic plant species common to these wetlands. However, these are under the verge of disappearance from the studied area. Among these plant *Nelumbo nucifera* was once abundant in all the wetlands of Guwahati which now has become restricted to some particular areas only.

In some earlier works, there was report of nearly 200 bird species in the wetlands of Guwahati city. However, present study reveals existence of 84 bird species in the studied area. Some of the birds namely Grey headed fishing eagle (*Ichthyophaga ichthyatus*) could not be recorded during the study. This bird was once abundant in these areas.

There are fish species recorded during the present study among which 30 are classified as ornamental, 13 are non-classified ornamental and 9 species belonged to the common food fish category. Fourteen fish species namely, *Puntius gelius, P. sarana, Bengala elenga, Parluciosoma daniconius, Rasbora rasbora, Nandus nandus, Chela laubuca, C. cachius, Notoperus chitala, Botia dario, Ompok pabo, Channa marulius, Colisa sola* and *Tetraodon cutcutia* which wee once abundant in the studied areas became rare in recent times (Table 5).

Assam is endowed with about 3,513 natural wetlands including 690 lake/ponds and 861 oxbow/cut-off meander in Assam. These wetlands include 4% of total floodplain area and 1.3% total area of the State (15, 17). The freshwater wetlands (beels) odf Assam, India, cocver an area of 101,232 ha.

Though, there is paucity of references on the degradation and transformation level of wetlands in the studied area, available data has indicated that most of the wetlands have threat from natural or anthropogenic activities. It appears that the studied area covers less than 1% of the total wetlands of Assam which is apparently negligible and their degradation and disappearance may create little effect in the total ecosystem of Assam as a whole. However, this does not negate the importance of wetlands in nature.

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 and industrial sewage, and agricultural runoffs as fertilizers, insecticides and feedlot wastes. The reason that wetland values are overlooked has resulted in threat to the source of these benefits. As wetlands are often described as kidneys of the land-

Tale 5. Recorded fish species of the studied wetlands of Guwahati city depicting the present status of occurrence. COFS=Classified, ornamental fish species, NCOFS=Non classified ornamental fish species, FFS=Food fish species, HT=Highly threatened,C=Common, R=Rare, Vu=Vulnerable.

	Name of the fish species	Category	Status of occurrence
1	*Notpterus chitala* (Hamilton-Buchanan)	FFS, NCOFS	Vu/R
2	*Notopterus notopterus* (Pallas)	FFS, NCOFS	C
3	*Cirhinus mrigala* (Hamilton-Buchanan)	FFS	C
4	*Cirhinus reba* (Hamilton-Buchanan)	NCOFS	Vu
5	*Labeo bata* (Hamilton-Buchanan)	FFS	C
6	*Labeo calbasu* (Hamilton-Buchanan)	NCOF	C
7	*Labeo gonius* (Hamilton-Buchanan)	FFS	C
8	*Labro rohita* (Hamilton-Buchanan)	FFS	C
9	*Catla catla* (Hamilton-Buchanan)	FFS	C
10	*Puntius conchonius* (Hamilton-Buchanan)	COFS	Vu
11	*Puntius gelius* (Hamilton-Buchanan)	COFS	Vu
12	*Puntius sophore* (Hamilton-Buchanan)	COFS	C
13	*Puntius ticto* (Hamilton-Buchanan)	COFS	C
14	*Chela cachius* (Hamilton-Buchanan)	COFS	Vu/R
15	*Chela laubuca* (Hamilton-Buchanan)	COFS	Vu
16	*Amblyparyngodon mola* (Hamilton-Buchanan)	*COFS*	C
17	*Danio aequipinnatus* (Hamilton-Buchanan)	COFS	Vu
18	*Danio devario* (Hamilton-Buchanan)	COFS	R
19	*Brachydanio rerio* (Hamilton-Buchanan)	COFS	C
20	*Esomus danricus* (Hamilton-Buchanan)	COFS	C
21	*Parluciosoma daniconius* (Hamilton-Buchanan)	COFS	Vu
22	*Rasbora rasbora* (Hamilton-Buchanan)	COFS	R / HT
23	*Lepidocephalus guntea* (Hamilton-Buchanan)	COFS	C
24	*Botia dario* (Hamilton-uchanan)	COFS	Vu / R
25	*Mystus cavasius* (Hamilton-Buchanan)	NCOFS	C
26	*Mystus vitatus* (Hamilton-Buchanan)	COFS	Vu

Table 1. Continued.

	Name of the fish species	Category	Status of occurrence
27	*Mystus tengara* (Hamilton-Buchanan)	COFS	C
28	*Ompok pabo* (Hamilton-Buchanan)	NCOFS	Vu
29	*Wallago attu (Schneider)*	FFS	R
30	*Clariaas batrachus (Linnaeus)*	FFS	C
31	*Heteropneustes fossilis* (Bloch)	FFS	C
32	*Xenentodon cancila* (Hamilton-Buchanan)	NCOFS	R
33	*Aplocheilus panchax* (Hamilton-Buchanan)	COFS	C
34	*Monopterus cuchia* (Hamilton-Buchanan)	FFS	C
35	*Chanda nama* (Hamilton-Buchanan)	COFS	R
36	*Pseudambassis ranga* (Hamilton-Buchanan)	COFS	C
37	*Pseudambassis lala* (Hamilton-Buchanan)	COFS	VU / R
38	*Nandus nadus* (Hamilton-Buchanan)	COFS	Vu
39	*Badis badis* (Hamilton-Buchanan)	COFS	C
40	*Glossogobius giuris* (Hamilton-Buchanan)	NCOFS	C
41	*Anabas testudineus* (Bloch)	NCOFS	C
42	*Colisa fasciatus* (Hamilton-Buchanan)	COFS	C
43	*Colisa lalia* (Hamilton-Buchanan)	COFS	C
44	*Colisa sota* (Hamilton-Buchanan)	COFS	R
45	*Channa orientalis* (Bloch & Schneider)	COFS	VU
46	*Channa marulius* (Bloch)	NCOFS	Vu / R
47	*Channa punctatus* (Bloch)	NCOFS	C
48	*Channa striatus* (Bloch)	NCOFS	VU / R
49	*Macrognatlus arul* (Bloch & Schneider)	COFS	C
50	*Macrognathus pancalus* Hamilton-Buchanan	COFS	C
51	*Mastacembelus armatus* (Lacepede)	NCOFS	Vu / R
52	*Tetraodon cutcutia* (Hamilton-Buchanan)	COFS	Vu / R

scape (3) the studied wetlands help the neighboring areas in circulating and purifying the water and air components which cannot be overlooked.

The population increase and industrial development in the neighboring areas of the studied wetlands may have a relationship with the increasing toxic components in the studied wetlands. It is known

that the hydrologic conditions can directly modify or change chemical and physical properties such as nutrient availability, degree of substrate anoxia, soil salimity, sediment properties and pH. These modifications of the physiochemical environment, in turn, have a direct impact on the biotic response in the wetland (18) and its neighboring community. When hydrologic conditions in wetlands change even slightly, the biota may respond with massive changes in species composition and richness and in ecosystem productivity (18).

It is of great concern that most of the freshwater diversity are in crisis (19). Most of the tall grass species prefer damp (20—22). This characteristic is also the major factor for an ideal habitat of many grazers (23). Virtually grasses and other macrophytes of the aquatic habitats are subject to intense human pressures (21, 22, 24—27) which also corroborate with the present findings. All the recorded 39 species of aquatic macrophytes are under the verge of extinction due to the shrinkage of wetlands in the studied region and need conservation measures.

Animal composition in terms of fishes, birds and probably other aquatic animals are also under the threat in the studied wetlands. Over fishing is another major threat to the studied wetlandds. Despite the popular slogan for conservation of this particular ecosystem, people's movement and enthusiasm for collection of fish from these wetlands is rather ironical and is a deliberate over exploitation or abuse of fish components of these areas. The shrinkage of the wetlands also creates problem in storm water management in Guwahati. Annually new areas are inundated by the flood water during monsoon in the city.

Recommendations

For conservation of the wetlands and to restore its areas, imediate goverment requisition of neighboring private and public barren lands should be made and to convert the same to the government land. All the construction works inside and near to these wetlands and the permissions thereof should be reviewed by authority. There is a necessity of further increase of Guwahati Metropolis area so that some of the government offices and public quarters can be shifted to the new areas. There should be standardization in human dwellings and living patter in metropolis and the basic civic amenities should be supplied by the concerned authority. Mass awareness programs in these issues may have immense value. Practical demonstration and academic tour to the wetlands by school and college students may help in understanding and realizing the problem of evironment degradation thereby come up with innovative ways for conservation of our environment.

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