THE DYING WETLANDS OF ASSAM: A CASE STUDY OF SILSAKO-NUMALIJALAH WETLANDS OF GUWAHATI CITY

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Introduction

The wetland is an important and a useful category of land found at the interface of the terrestrial and aquatic systems. It is actually a piece of land, saturated with or submerged under water (less than six meters of depth). The wetlands abound in biodiversity and productivity. They are a very significant unit of land from the geomorphological, hydrological and ecological points of view. The wetlands perform some very useful functions in the maintenance of overall balance in an ecological system and in the geosystem as well. The presence of wetland(s) in an area is a boon to its ecology for it helps in the specific transfer of energy and matter in the ecosystem through the interaction process among a variety of organisms and their interaction with the physical environment. The wetlands maintain ecosystem diversity, as they are the natural store-house of valuable flora and fauna of an area. Besides these, they are also used for various economic purposes by the people living in and around it through different activities like fishing etc. and also for the recreation purpose. Undoubtedly, the wetlands are of great value for

both man and environment, especially today when such ecosystems with rich biodiversity are under threat from man due to his short sightedness and plundering attitude.

Degradation and decline of the wetlands has been going on for a long time in the world as a whole, particularly in and around urban centres, due to various anthropogenic factors. This is because of the increasing demand for the land for different development works associated with the process of urbanisation and industrialisation. Most of the wetlands have either turned into cesspool or have been encroached upon, and a number of them are on the verge of extinction. Agricultural expansion and development is equally responsible for the degradation and even extinction of a large number of wetlands of the world. Many of the wetlands of the world have either dried up due to draining off of their water or became highly polluted as the sewage and effluents from urban centres and industrial units are emptied into them leading to their degradation. Or the area of the wetlands has been brought under settlements, transport, industries and other developmental works leading to shrinkage of their area and finally to extinction. On the other hand, the natural processes do cause silting/filling up of the wetlands as a part of the alluviation process in the plains and valleys.

The wetlands of Assam, particularly in and around urban centres like Guwahati City are also facing some of these problems very seriously, as they have either got dried up or have become polluted or are encroached upon for various purposes. In fact, Guwahati is settled either on the hills or *beels* (wetlands). Therefore, an attempt has been made in this paper first to ascertain the degradation and shrinkage of the Silsako and Numalijalah wetlands and secondly to find out the causes responsible for such deplorable state of the valuable ecosystem.

Methodology and Database

The whole problem of dying and degrading wetlands in the world is seen as that of the 'human impact on environment'.

Mostly it is the case of adverse impact of man on environment due to his erroneous activities leading to extinction and/or degradation of these valuable ecosystems. Only in rare cases wetlands have been modified by man for much better and more productive uses than in the natural state, *e.g.*, reclamation of the wetlands (the flat valley lands) in the mountains, no doubt at the cost of the biodiversity.

This paper is based on the data collected on the declining area of these wetlands due to encroachment, and also on the pollution of the wetlands; collected from both primary and secondary sources. The toposheets and satellite imagery of different times have been used to ascertain reduction in the area of the wetlands. Nature and type of human impact on the wetlands have been identified in the field. While the water pollution levels have been tested in the laboratory. Relevant data have also been collected from various government departments and census reports.

What are the Wetlands?

Before coming to the main point it is worthwhile to explain the meaning of the 'wetlands' because the way this term is used nowadays it is definitely going the way the term 'ecology' has gone where the meaning is stretched beyond limits. Not only it will clarify the meaning of the wetlands but also remove a number of ambiguities in this regard.

At the outset it can be said that the term 'wetland' with the present meaning probably did not exist prior to the late 1970s, as evident from the various dictionaries of geography and environment. However, traditionally there used to be a term similar to it in pronunciation but written differently as 'wet land' (*i.e.*, with a gap), meaning those lands which receive very high rainfall (on an average more than 1250 cms per year, but most areas receiving more than 2250 cms) and thus are considered inhospitable/uncongenial for human occupance. This meaning is determined by the climatic element—the rainfall. The opposite

of wet land is dry land in the traditional sense. Interestingly, when written with out a gap as 'wetland' it carries altogether a different meaning with which we are concerned. Actually, the 'wetland' is a type of land that is at the interface between the terrestrial and aquatic ecosystems, characterised by water-saturated soil or land submergence under shallow water occasionally, periodically or permanently (not more than six metres).

A number of definitions of wetlands have come forth in recent times from the scientists of different disciplines due to rising concern shown about it the world over, but keeping the limitation of space in mind only a few comprehensive ones are given here. (Clark, 1985: 689) defined wetland or wetlands as 'a general term applied to an ecosystem intermediate between the terrestrial and the aquatic, a natural or artificial landscape in which fresh or salt water plays a key role, *i.e.*, where the soil is waterlogged, the water table is at or near surface, or the land is covered occasionally, periodically or permanently by shallow fresh or salt water (*i.e.*, bog, carr, fen, marsh, swamp, flooded pasture land, inter tidal mudflats)'. Whereas in the words of (Maltby, 1986) wetland is 'a collective term for ecosystems whose formation has been dominated by water, and whose processes and characteristics are largely controlled by water. A wetland is a place that has been wet enough for a long time to develop specially adapted vegetation and other organisms'. In fact, these definitions carry the shades of the definition adopted at the first International Convention on wetlands held at Ramsar (Iran) in 1971, which goes like this- 'the wetlands are areas of submerged or water saturated lands, whether—natural or artificial or permanent or temporary and whether the water is static or flowing or fresh, brackish or saline including areas of marine waters, the depth of which at low tide does not exceed six metres' (De Roy and Hussain, 1993). Likewise there are many more definitions of 'wetlands' (*e.g.*, Abbasi 1997 and others). On the basis of these definitions the meaning and characteristics of the wetlands can be

concluded here for the sake of clarity of identifying and studying the wetlands. One thing is very clear that the meaning of the wetlands is not governed by the climatic factors (as in case of the traditional wet land) instead it is determined by the hydrogeomorphological factors. These determinants include first of all the land/soil saturated with or submerged by water that could be fresh or saline, static or flowing, and permanent or temporary/occasional but not more than six metres of depth, and lastly it could be on the continents or coastal areas. Traditionally we know of such lands as swamps, marshes, bogs, etc. It is significant to mention that no where in these definitions we get a clue that a lake or river or pond is included as wetlands because actually they are water bodies in geomorphological terms. Of course, on the periphery of a lake a shallow portion of land that is subjected to seasonal submergence under water, especially during the monsoon period in Indian situation, could be included in the wetland category of land, but not the entire water body which is an aquatic ecosystem. Whereas the wetland is the transitional zone (like ecotone in plant ecology) between the terrestrial and the aquatic ecosystems, neither fully former nor the latter, but partly former and partly latter.

Chatrath (1992) has defined the wetlands 'as swamps and other damp areas of land but in common parlance the word is used interchangeably with "lakes" which denotes a large body of water surrounded by land'. Such interchangeable use of the term wetland with lake has created a lot of confusion and today even the surface water bodies that are traditionally known as lakes and rivers are included in the wetland studies. Definitely, wetlands are not like lakes, though there may be impoundment of water in the wetlands. It is the depth of the water accumulation that actually separates a wetland from a lake. In the case of the latter the depth of water is usually more than six metres. Apart from this, the saturated soil/land, periodic submergence of the soil/land, both terrestrial and aquatic characteristics, typical ecology and a number of other

hydrogeomorphic parameters distinguish a wetland from a lake. Moreover, the wetland is basically a category of land characterised by saturated soil and where the ground water table can be at or near the surface. The basic hydrogeomorphic feature characterising a wetland is 'poor drainage condition'. It means that piece of land where soil remains saturated with water due to poor drainage. With this clarity of meaning in mind the Silsako-Numalijalah wetlands of Guwahati City have been studied.

Degradation, Deterioration, Destruction, and Extinction of Wetlands

Before proceeding further it would not be out of place to deal with these points to grasp the problem at global, national, regional and local levels. Scientists from various disciplines have shown a great concern about the different problems related with the wetlands. The proceedings of the first International Conference on the wetlands entitled *Wetlands-Ecology and Management* contains an article by Brown and Lugo (1982) in which they have compared structural and functional characteristics of saltwater and freshwater wetlands in the Greater Caribbean Sea basin and South-eastern United States to formulate a general theory of wetland structure and function. Many other aspects of wetlands have also been studied by Wingham (1982), Lyon (1993), Zedler and Leopold (1998) etc. In this regard Dr. Julian Thompson's 2000 project on the Hadejia-Nguru wetlands of Nigeria is worth mentioning.

Though the wetlands of India have been studied traditionally from quite early times but in the modern sense of the term wetlands case studies have appeared during the 1980s only. Jhingram (1993) opined that the wetlands are among the world's most threatened habitats due to accelerated drainage, land reclamation, pollution and over-exploitation of wetland species. Mishra (1997) has elaborated the natural hazards in the wetland environs of the world famous Chilka Lake. Abbasi (1997) has brought

out three volumes on the wetlands of India. Saha (1998) has done commendable work on the another world famous wetlands of the Kolkata City. While Kumar (1998) studied hazardous affects of mining on the wetlands of Jharkhand. Gopal (2000) and Pfister (2001) have discussed about the human interference in the wetlands of the Chunglung area of Ladakh. Sethi (2001) has an important project funded by the World Bank to reclaim the sodic soils of the wetlands of the Western U.P. where these are termed as wastelands.

The different scientists including the geographers have also conducted a number of studies on various aspects of the wetlands of the North-eastern India, *e.g.*, Sarma and Goswami (1993), Deka *et al.* (1993), Sarma (1993), Agarwal and Chak (1996), Bora and Barman (1998), Baruah *et al.* (1998), Gogoi *et al.* (1998), Chawi (2000), Sharma (2001) etc. Particularly on the wetlands of Guwahati City there are works by Deka *et al.* (1993), Sahariah (1999) and others, where pollution of the wetlands has been highlighted.

The Silsako and Numalijalah Wetlands of Guwahati City

Assam truly has riverine landscape dominated by the Brahmaputra and the Barak valleys. However, both the valleys are separated by the North Cachar Hills and the Karbi Anglong Hills. These valleys are dotted with numerous types and sizes of wetlands, most of which are like swamps and marshes. A large number of human settlements have come up near the wetlands, like Guwahati, which has adverse impacts on the later.

Guwahati, the premier city of the Northeast India, is actually situated on the extended platform of the Meghalaya Plateau and the city landscape is dominated by two different types of landforms, viz., the hills and the *beels* (wetlands) owing to its typical geomorphological characteristics and location. The wetlands are basically found in the piedmont zone, low-lying areas, inter-mountain valleys and along the river courses, especially of the Brahmaputra river. Some of the wetlands also receive floodwaters from

the major rivers, hence acting as cushions in reducing the impact of floods and also playing their role in the regional hydrological system.

The Silsako wetland is located at the intersection of the 91°0′ E longitude and 26°10′ N latitude on the eastern periphery of the City and it covers about 407 ha area (as per the 1967–68 toposheet). On the other hand, the Numalijalah wetland is located on the northern boundary of the City across the Brahmaputra river, covering an area of about 433.68 ha (Figure 1).

Decline and Degradation of the Wetlands

Both the wetlands are suffering from the serious threat to their existence, mainly due to the horizontal expansion of Guwahati. Since the wetlands are located on the eastern and northern margins of the City they are also in the process of being gradually engulfed completely by the sprawl of the urban agglomeration as it has happened with the wetlands of the interior parts of the City. This is simply a case of the encroachment upon the wetlands by the people. The human encroachment of the wetlands has been going on for quite some time for the purpose of establishment of the settlements, industries, transport network, etc. Agricultural expansion has also contributed to the encroachment as the wetlands are on the outskirt of the City. Most of it is an irreversible change in the ecosystem, and it is the most disheartening aspect of the problems of the wetlands. As a result, on one hand the area of the wetlands is shrinking, and on the other hand, pollution of the land and water of the wetlands from various types and sources is deteriorating its quality, both leading to decline and degradation of the wetlands.

Shrinking Area

As per the 1912–13 toposheet the original total wetland area of the Silsako was 1758.47 ha and the total water spread area was 543.47 ha (Table 1). In 1967–68 the total

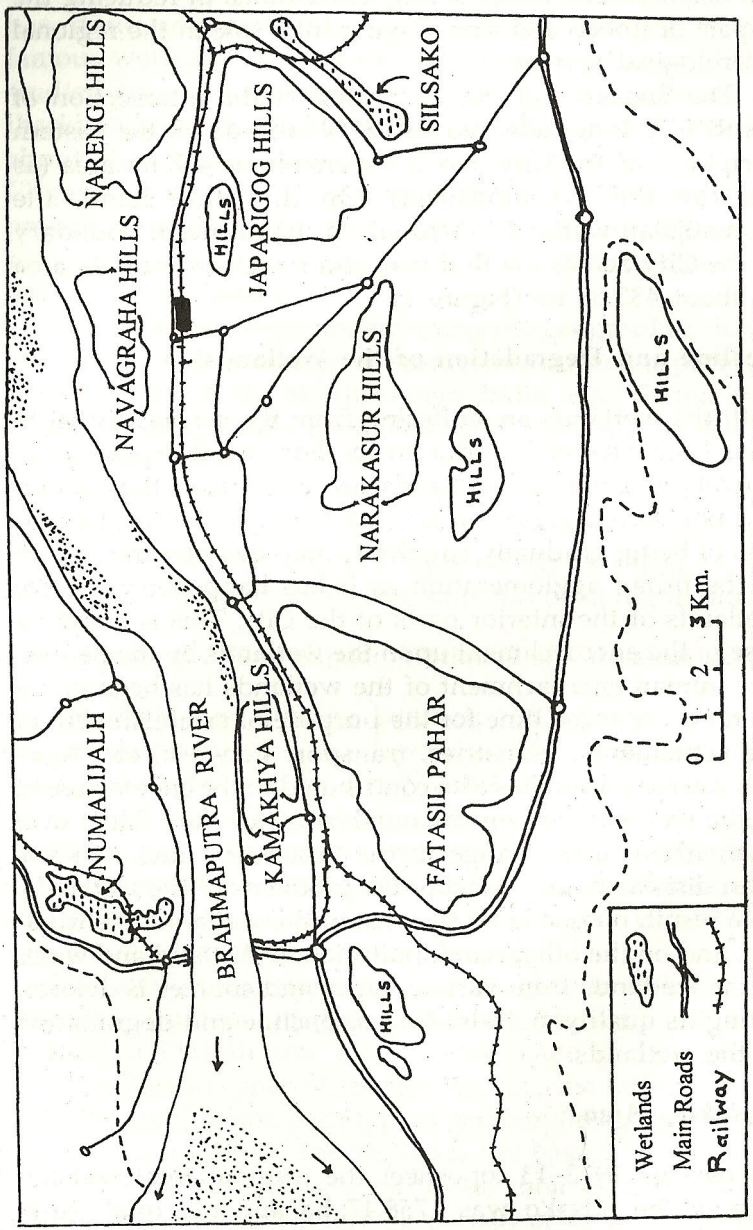

Figure 1: Silsako and Numalijalah Wetlands of Guwahati City

Table 1: The shrinking area of the Silsako and Numalijalah wetlands (in hectares)

Name of	1912–13		1967–68		2001	
Wetlands	TWLA	TWSA	TWLA	TWSA	TWLA	TWSA
Silsako	1758.47	543.47	407.07	150.36	340.20	58.95
Numalijalah	N.A.	878.85	433.68	198.80	85.25	–

Source: Toposheets of 1912–13, 1967, 1983, and sequential satellite imagery.
TWLA = Total Wetland Area, TWSA = Total Waterspread Area

wetland area and the total water spread area declined to 407.07 ha and 150.36 ha, respectively. It means 23.15 per cent of the total wetland area and 27.67 per cent of the total water spread area was left. Whereas, in 2001 it declined to 19.35 per cent and 10.85 per cent, respectively. Surely, it means that the water-saturated land has already been occupied for different purposes. Not only that, even the boundaries have been marked within the water-spread area to claim ownership over it and use it for any purpose in future. It clearly shows that not a single piece of the wetland is left now which could be called as natural one, a painful condition of such a valuable natural ecosystem indeed.

On the other hand, the original area of the Numalijalah wetland was 878.85 ha and the total water spread area was 433.68 ha in 1967–68, in both respects more than double of the Silsako wetland at the same time. Whereas, in 2001 the total wetland area and total water spread area has shrinked to 22.62 per cent and 19.66 per cent of the original, respectively. The data on the decline in the total wetland area and the total water spread area of the wetlands under study clearly indicates that encroachment has taken place on about 80 per cent area of these wetlands. The decrease in the area is also due to choking of the feeder channels that used to maintain the wetlands (a point elaborated later). The degree and extent of the decline in the area of the wetlands are easily discernible highlighting the seriousness of the threat to their existence.

Choking of the Nallahs and Streams

The wetlands are, in fact, maintained by the input of water from surface and subsurface sources, no doubt the direct atmospheric precipitation on the wetlands does contribute to it. The channels, nallahs, rivulets, streams and rivers are the major surface sources, blockage of which by human activity causes drying/shrinking of the water saturated land and the water-spread area of the wetlands. It can happen naturally such as due to changing geomorphological processes. The major nallahs flowing south to north into the Silsako wetlands are the Juripar, Pakka, Noapara, Satgaon, Patharkuwari-Satgaon and Bonda. Except the Satgaon and Bonda nallahs all are almost choked due to either silting up or construction works across their paths.

The case of the Numalijalah is different because it used to be originally fed by the streams/nallahs originating in the surrounding hills (east and west particularly) and also by the floodwaters of the Brahmaputra (since the southern periphery used to touch its course). Construction of embankment along the Brahmaputra to save the newly established colonies on the wetland, railway lines and roads (the National Highway No. 37) have disrupted the natural incoming flow of water into the wetlands, and thus affecting its hydrogeomorphology. The only connection now with the Brahmaputra river is through the Ghorajan nalah. Otherwise, a very little of the water spread area and the damp ground are left now (only 10 per cent of the original). Today we see the forest of concrete standing tall on the area that used to be pride of the wetlands. While the transport network has done the rest of the damage to it.

Encroachment

Construction of houses, colonies, industries, transport networks, agricultural fields etc. on the valuable wetlands is the main form of the encroachment on it. Both the wetlands suffer seriously from this problem basically due to

the horizontal expansion of the urban agglomeration of Guwahati City. The localities coming up on the area of the Silsako wetlands include Hengrabari, Satgaon, Birkuchi, Kalitakuchi, Bondagaon, and Madgharia. It is not only the urban dwellers who have settled here but people coming from different rural areas of Assam have also occupied the wetlands. In the south-western part and along the VIP road, newly constructed houses are found in the Silsako wetlands. The rural migrants have converted the area of the wetlands into the paddy fields, as these lands are very fertile. Whereas in the large area of the southern and eastern Numalijalah wetlands an NF Railways' Colony has been constructed.

Location of the industrial units on the wetlands is another form of encroachment in these wetlands. Most of the north-eastern part of the Silsako wetlands has been encroached upon by the Oil India Ltd. for various uses. Whereas Satgaon Army Cantonment has come up in the south-eastern corner. Besides these, there are many more industrial units located on the wetlands. The area along the N.H. No. 31 in the Numalijalah wetlands is full of industrial units now. Pollution created by these units is another problem added to the wetlands.

Transport networks of the railway lines and the roads are spread in both wetlands, not only showing occupation of the wetlands for it but also disruption of natural flow of water in the wetlands, except through the culverts and bridges.

Causes of the Decline and Degradation of the Wetlands

In fact, the valuable wetlands are gradually dying mainly due to human factors such as encroachment, higher level of pollution, siltation, and choking up of the streams and nallahs. The prime causes behind these factors are the horizontal expansion of the urban settlement as a result of increasing population of the City (both due to natural growth and in-migration), agricultural expansion, pollution

from the industrial units and laying of the tracks for the railways and roadways. However, there are some other minor but significant reasons too.

Table 2 clearly shows that the population of Guwahati Urban Agglomeration has been rising rapidly since 1901, especially after the 1951, and that is mainly responsible for the increase in the construction of the houses and colonies in the City. As a result a number of new localities/ settlements have come up on the wetlands. The growth and development of various government departments has also added to the construction of buildings and houses, mostly on the until recently unoccupied wetlands because there is no more open space available in the City, except the hills which are also gradually getting saturated.

Among the other causes the worth mentioning is the government apathy towards the wetlands, except the Dipar beel. There seems to be no concern for the invaluable wetlands. The City is actually growing at the cost of the wetlands found in and around it. Moreover, since both the wetlands under study are not the government reserved lands various government departments like the Revenue, Settlement, Urban Planning etc. have regarded these wetlands as open space within the boundary of the City. Thus, their area is subjected to be encroached upon, unlike the

Table 2: Decadal growth of population in the Guwahati Urban Agglomeration, 1901–1991

Year	Total Population (in persons)	Decadal Growth	
		Actual growth (in persons)	Actual growth (in percentage)
1901	11,661	–	–
1911	12,481	+ 820	+ 7.03
1921	16,480	+ 399	+ 32.04
1931	21,797	+ 5317	+ 32.26
1941	29,598	+ 7801	+ 35.79
1951	48,530	+ 1900	+ 64.20
1961	1,13,736	+ 65206	+ 134.36
1971	2,12,566	+ 98,830	+ 56.90
1981	N.A.	N.A.	
1991	6,62,699	+ 3,90,133	

Source: Census of India (1951, 1971 & 1991).

Dipar beel, which is a government reserved wetland and thus still intact.

As these wetlands are not reserved, government is utilising the area of the wetlands through the Revenue department. The streams and nallahs contributing water to the Silsako wetlands have been blocked due to the disposal of domestic, industrial and agricultural wastes in these small watercourses. Heavy siltation has taken place due to quarrying of rocks and the weathered material from the nearby hills, from where lot of sediment is transported to the wetlands during the rains. Moreover, the dumping of soil in the wetlands for different construction works has also caused heavy filling. The loose material before and after getting hardened is subjected to be carried to the bottom of the wetlands by the water from the atmosphere, surface, houses and industries. The quality of the water is so poor now that it is not worth drinking, and even not safe for bathe. Sadly, the fishermen eking out their livelihood have reported extinction of number of fishes from the wetlands due to pollution and increased turbidity in the water. Depletion of snails and avifauna has also been reported, all leading to decline in the biodiversity of the ecosystem.

Conclusions

Though the wetlands are a unique and invaluable category of land important from various points of view but they are facing a threat to their existence all over the world. The decline and degradation of the wetlands is due to encroachment and pollution. This is more common in and around urban agglomerations and industrial units. The same has happened in Assam and in and around Guwahati as well. Not only the wetlands found within the City have been encroached upon for residential and other purposes, but the process has now engulfed the wetlands lying on the outskirts of the City also. The Silsako and Numalijalah wetlands are best example of it. So much encroachment

has taken place due to horizontal expansion of the City and location of the industries that only 10 per cent of the original waterspread area is left now. Blockage of the feeder channels and pollution by the urban sewage and industrial effluents have contributed greatly to its degradation. We are greatly concerned about the fate of the remaining area of the wetlands, because the wetlands have to be maintained in the natural state not only to have an ecological balance in the ecosystem but also to conserve a productive and useful ecosystem as well.

The government and people have to take immediate steps about the conservation of the wetlands by formulating strict laws, which do not allow encroachment and pollution of the wetlands. Government policies and peoples' attitude have to be in favour of the wetlands, and not against them because these lands are very crucial for ecology of an area. A city can find some other land to spread but we would not get a new wetland. Hence, it is better to conserve the remaining wetlands for the posterity and the environment.

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