

Changing Wetland Landscape and Effects of Urbanization: A Study on Silsako Wetland in Guwahati, Assam, India

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Abstract

Wetlands in Assam largely depend on the geo-ecological environment and they act as store-house of rich biotic and abiotic resources besides controlling flood, storm water surges and improving water quality. In Assam, as many as 5097 major wetlands and other 6081 small wetlands altogether account for 9.74% of the total area of the state. Among all the wetlands the urban wetlands are mostly suffer from the degradation process. The present study focuses on the Silsako beel, an urban wetland of Guwahati city, Assam. Silsako beel situated in the heart core of Guwahati is affected by unplanned urban expansion and rampant encroachment virtually causing changes of the landscape of the beel. Silsako is getting degraded due to impact of fast-growing urban development resulting a host of problems like waterlogging, reduction in aquatic flora and fauna, loss of water quality and other environmental problems. This study has revealed the gravity of degrading ecological problem of the wetland which calls for an adequate interdisciplinary policy and political will to implement sustainable management programmes for protection of the ecologically sensitive ecosystem in Guwahati city. The study uses Arc GIS software for analyzing the data and deriving the results.

Keywords: Wetland, urbanization, land use, waterlogging, Arc GIS.

Introduction

Wetland is the important physical feature of the earth surface. It is actually a piece of land, saturated or submerged under water (less than 6 meters of depth). According to Ramsar Convention's broad definition (2002), wetlands are "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters". Wetlands in Assam locally known as 'beel', 'pitoni', 'doloni', 'jalah', 'doba', 'hola', 'gedeng' 'haor' etc. Wetlands maintain the ecological diversity and play role as a store-house of bioresources. They are like backbone of ecosystem. Human beings also depend on wetlands for purposes including drinking water, fishes and other resources they use to lead their life.

The urban landscape of Guwahati city contains few wetlands. Silsako wetland or beel is an important beel of Guwahati which is surrounded by hilly terrain. With rapidly growing population and associated pressure in the city, the urban development processes are the main cause for the environmental degradation and natural resources depletion. Silsako beel is basically facing some serious problems like shrinking of area, encroachment, water pollution etc. which are highly responsible for degrading situation of the wetland environment (*Panigrahy, 2013*)

The main aim this study is to reveal the gravity of the water problem and to find out how to use the wetland in a sustainable manner and save it for future use. Silsako beel is a natural beel in the heart of the Guwahati city, which act as a most important natural reservoir to contain rainwater. Another significance of Silsako beel lies on the fact that it supports different food chains and food web that helps maintain the ecosystem in the urban environment.

Study area

Silsako beel is situated in the Guwahati city, Kamrup Metro district, Assam, India (Fig 1). It lies between 26°10'08.47" N latitude and 91°49'45.53" E longitude. Silsako beel is

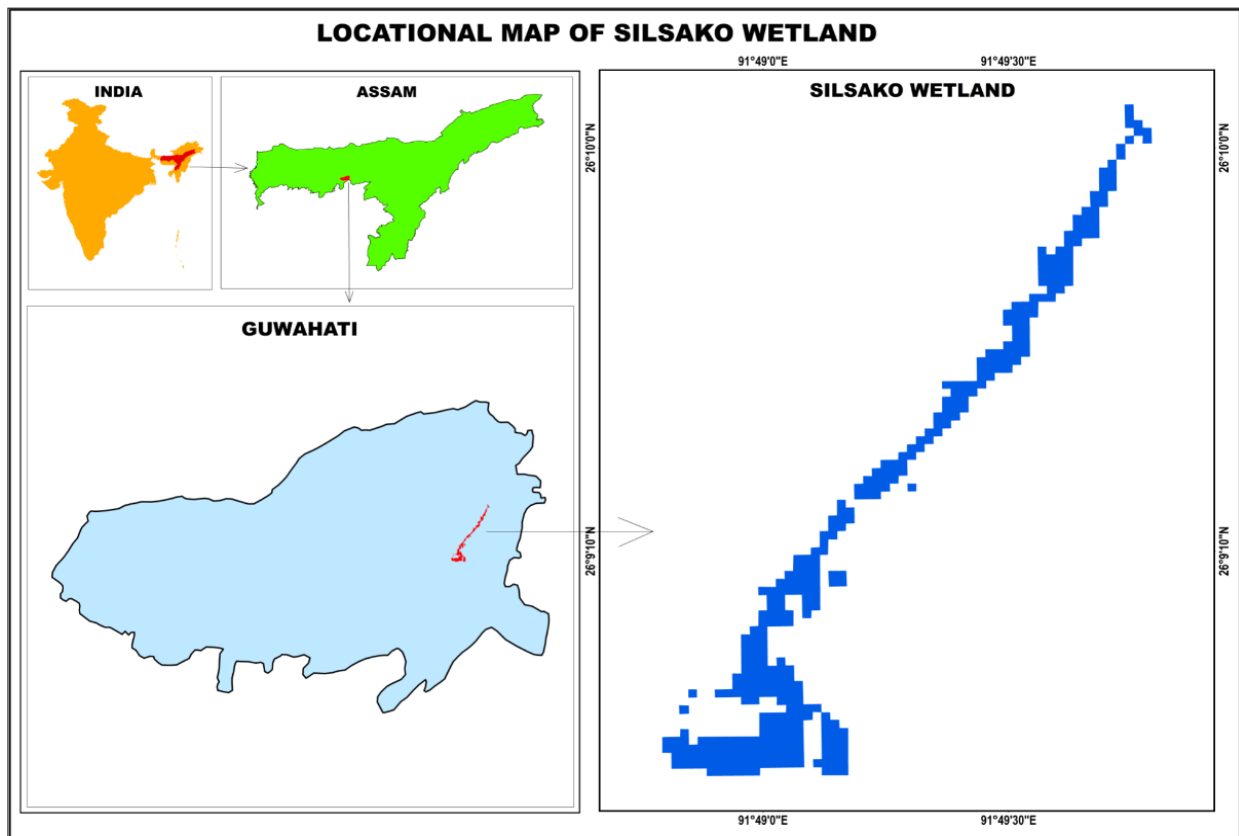


Fig. 1: Locational map of study area

surrounded by Amchang Wildlife Sanctuary in the east, VIP road and Chachal in the west, Narengi in the north and Panjabari in the south. In 1912, the total area of Silsako beel was 1758.47 ha. But in recent times, the area of the beel is getting reduced due to urban impacts.

Objectives

The study is mainly focusing on the following objectives:

- i) to study the changing landcover pattern in and around Silsako wetland,
- ii) to assess the impacts of urbanization on the wetland,
- iii) to examine the present geo-environmental scenario of Silsako wetland.

Database and Methodology

The nature of database and methodologies applied in the study are stated below:

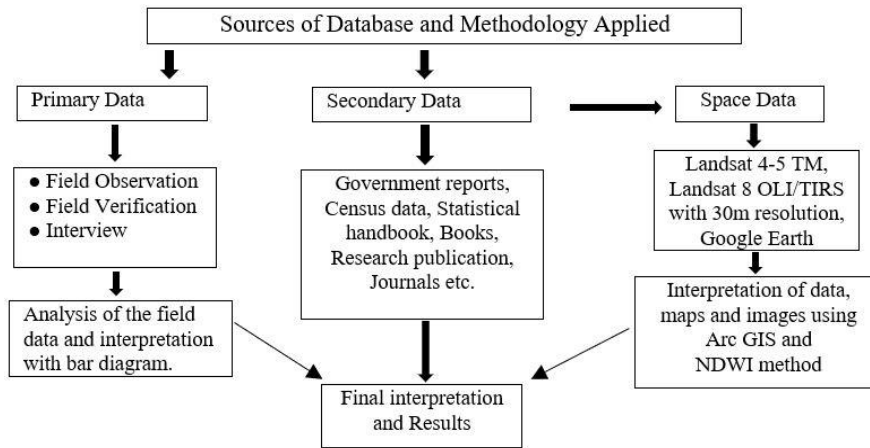


Fig.2: Methods of the study and data analysis

Analysis and Results

Changing landcover pattern of the wetland

Different types of wetlands have been developing under different geo-physical conditions. In the case of the various wetlands found in Assam, mainly five different shaped wetlands have been identified like linear, compact, irregular, discrete (fragmented) and ox-bow shaped wetlands. The study area Silsako beel (wetland) conforms with the linear shape, which is an elongated wetland.

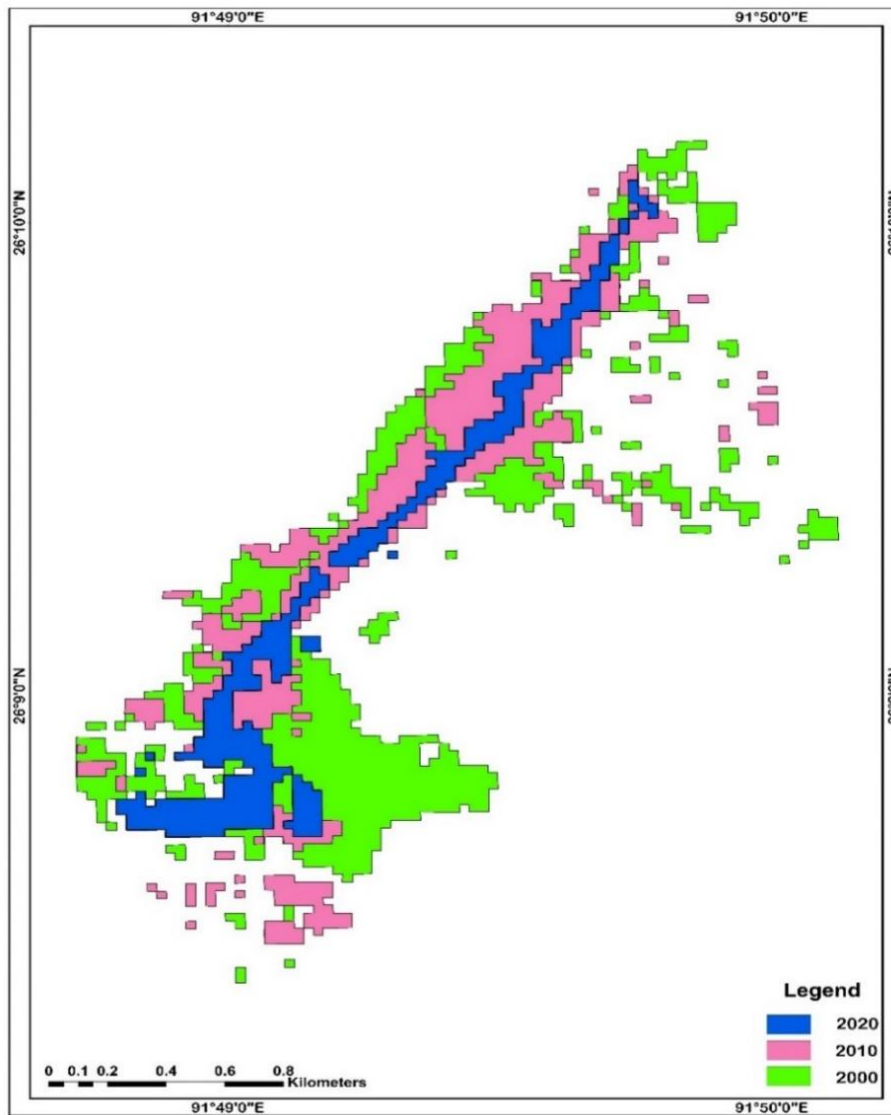


Fig.3: Changing areas of the wetland in different years using NDWI

The landcover map of the study area (fig.3) has been prepared using NDWI approach. From the figure, it is observed that the total wetland area is getting reduced from 124.15 ha in 2000 to 71.10 ha in 2010 over a period of 10 years. Again in 2020, it was reduced in area by 32.31 ha. During the primary survey it came to notice that, 12 hectares of wetland area is being illegally occupied by human settlements and some structures have come up including road work. It is interesting to note that some people have even converted the wetland areas under their occupancy into land class under permanent occupancy.

Effects of urbanization on the wetland

Guwahati is one of highly populated and fastest growing cities in North-East India. Guwahati is located on the south bank of the Brahmaputra River. It started growing during the

colonial period (Bora, 2010). In 1911, the city offered shelter to 12,000 people, but in 2020 it has been inhabited by 11,35,000 population. In the period between 1991 and 2020, the population was about 5,84,342 in 1991; 8,18,809 in 2001 and 9,57,352 in 2011. The projected population for the year 2021 is 11,35,000. These statistics well substantiate the alarming growth of population in the city.

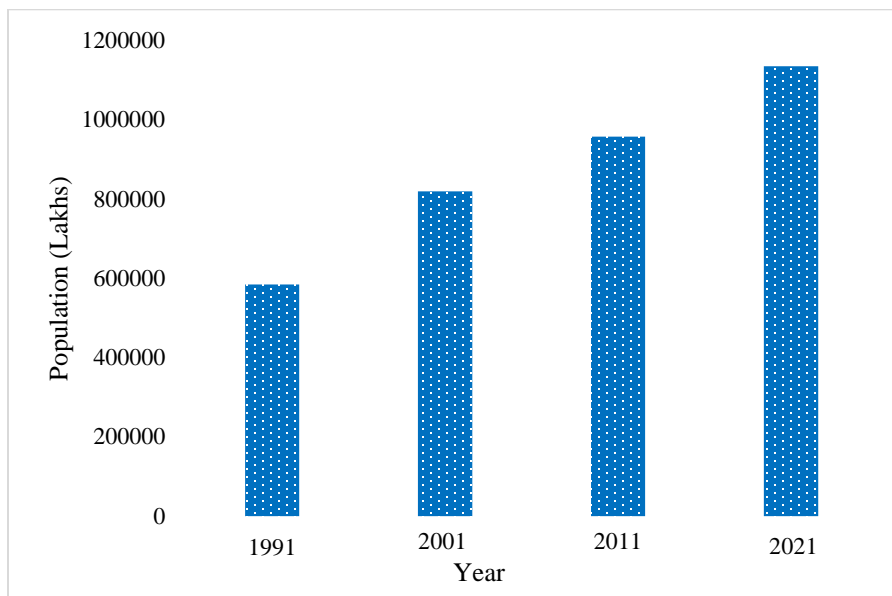


Fig.4: Population growth in Guwahati city (1991-2021)

The construction activities and the rapid industrialization in and around Guwahati city are the major causes for the growth of the city. The rapid increase in population causes increase in the need for housing which accelerates the real estate industry and reduces the area extent of the wetland. Expansion of city area has led to lack of land resources thereby causing dense urban settlements and structure (Kumar, 2012). The city is growing rapidly in last few decades with growth rates of 131.60 in 1971-1991 and 38.59 in 1991-2001. The total area of the city was only 43.82 square kilometers in 1971. In 1974 it came under the administration of Municipal Corporation with 34 wards and consequently the area increased to 216.79 square kilometers. According to 2011, the total city area was 262 square kilometers. At present 2021, Guwahati city has 31 wards under Guwahati Municipal Corporation (GMC) (Anonymous, 2012).

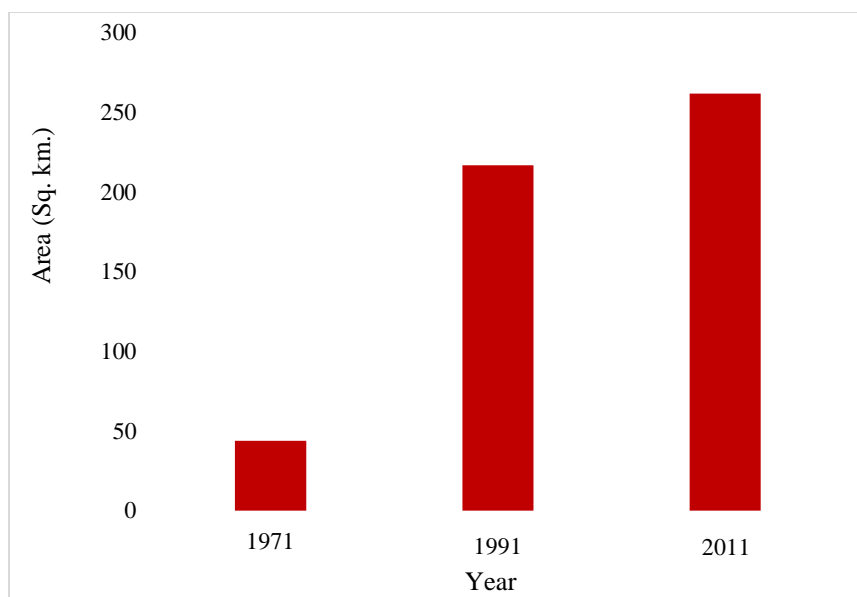


Fig.5: Expanding Guwahati city area (1971-2011)

Geo-environmental Problems

Being situated amidst an urban landscape, the Silsako wetland is obviously grinded by a host of geo-environmental problems. In fact, due to horizontal expansion of Guwahati city during last few decades, this wetland has been suffering from the serious threat to its existence. The following are the major problems faced by the wetland:

- i) **Urban encroachment:** Due to human encroachment in the Silsako wetland, the area has been shrinking a lot now than that was in early years. Urban encroachment has created serious problem leading to creation of a number sister problems.
- ii) **Areal shrinking:** The original total wetland area of Silsako was 1758.47 ha in 1912-13 ^[4]. In 1967-68 the total wetland area declined to 407.07 ha (*Gogoi*, 2013). Again, in 2001 its area decreased to 19.35% of wetland area. As revealed from the fig. 3, in 2020 the wetland area has come down into 32.31 ha. It can be clearly showing the natural character of the wetland is now no more due to high degree of shrinking during the period of from 2000 to 2020 under study.
- iii) **Choking of drainage, streams:** The wetland is in fact maintained by the input of water from surface and subsurface sources. The drainage channels, streams etc. are the major surface water sources but due to blockage caused by human activities, the water spread area has decreased along with shrinking of water saturated land area.

iv) **Flash flood:** Because of urban encroachment and shrinking of area, the water containing capacity of the wetland is getting reduced. As a result, there occurs frequent flash flood causing inundation of the nearby areas of the city.

v) **Pollution:** Garbage disposal is the most important issue in the wetland. The surrounding area has more residential plots and so dumping of household as well as industrial wastes both solid and liquid creates water pollution hazards leading to geo-environmental problems in and around the wetland and city area.

Present scenario and major threats

The wetland is suffering from the serious threat to its ecological existence, mainly due to haphazard horizontal expansion of Guwahati city. Since the wetland is located in the easternmost region of the Guwahati, the wetland is subject to process of being gradually engulfed through sprawl of urban agglomeration as it has already happened in the case of other wetlands within the city.

Wetlands are the kidneys of landscape. They purify groundwater and serve as store-house of water (*Chakravarty, 2016*). Humans depend on the beel for fishing, agriculture and other household purposes. They also influence a region's micro-climate and ecology. Silsako also has the similar rate. But recently it has turned into a grand multiplex. There are some establishments like tennis court, a hotel owned by the Tata Group, a hotel management institute, an institute for social studies. Most families found to settle on the wetland for last 15 to 20 years. The collapse of the rural and agricultural economy past 1990s and the boom in construction and service sector in Guwahati city have fueled the process of human encroachment in the wetland area.





Fig. 6: Photographs depicting present scenario of human encroachment in Silsako, 2020

The current status of the wetland can only be stated in terms of the effects on the delicate wetland ecosystem. Urban encroachment on Silsako beel has started filling up of the wetland thereby blocking the input-output system of the drainage channel. The surrounding buildings encroaching upon the wetland are commonly multiplied RCC structures. As a result, more of wetland areas have been converted to built-up areas. Garbage dumping and settlement expansion have continued ignoring government regulation and violating concerned laws and enforcement (Singha and Hussain, 2003). As a result, there has been a rapid shrinkage of the Silsako wetland area from 407 ha to 32.31 ha over the past few decades. All the changing patterns of land use and land cover are observed using technologies like remote sensing and geographic information system.

Based on field visits and data collected from secondary sources, the major threats to the wetland ecosystem have been associated which are summarized as follows:

- i) Due to fastest growth of city along with increase in built-up area, especially on the northern and eastern parts of the wetland there have been unwise and unwanted encroachment by some private and government organization.
- ii) Encroachment for different purposes has blocked the natural drainage with inlet-outlet system connected with the wetland which has led to degeneration and degradation of the vital ecosystem of the wetland.
- iii) Improper and unplanned catchment treatment and agricultural practices have caused sedimentation in the wetland resulting in wetland aggradation and threat to aquatic lives.
- iv) Reduction in the water retention capacity of the wetland due to heavy sedimentation triggered by unauthorised constructions going on in and around the wetland.
- v) Community fishing are causing sharp decline of fish productivity of the wetland.
- vi) One of the major threats is the incoming pollutants both in solid and liquid form from the urban fringe areas, which have created serious problem of water pollution in the wetland. As a result, the aquatic plants and animal life have lost their survival support.

As in the case of urban wetlands, the Silsako wetland is also facing serious geo-ecological problems rendering its ecosystem more fragile and critical. Therefore, there arises some pressing needs for conservation and management of the wetland which may be mentioned below:

- a) It is an urgent need to preserve the diverse habitats of various flora and fauna species along with the strategy to preserve the livelihood of the dependent communities.
- b) The Government should adopt proper policies and enact strict laws to conserve the wetland and its geo-environmental condition.
- c) Government should demarcate well defined boundary especially along the urban fringe area of the wetland to not cross the wetland and adopt strict restrictions to check illegal and unauthorised encroachment in any form.
- d) Drainage channels with inlet-outlet system should be properly maintained so as to keep the vitality of the wetland ecosystem alive and action.
- e) Commercial fishing should be controlled because due to commercial fishing, the varieties of aquatic flora and fauna are very much affected and lost.

- f) The removal of weeds in a scientific manner should be taken up as to keep the nutrient status and rich phytoplankton at desired level.
- g) Proper survey should be carried out for identification of threatened species and sustainable life of the wetland.
- h) The people and all the communities in and around the wetland should be imparted proper awareness about the present and future survival of the wetland system.

Conclusion

The stress and strains on the Silsako wetland constitute the core of the geo-environmental problems which have been plaguing the wetland with varying degrees. Wetland degradation as well as degeneration is a serious problem which result from the interaction of many physical, chemical and biological processes. Changing wetland landscape is attributable to growing human interference. Silsako plays a vital role in flood attenuation, silt trapping, and providing shelter to flora and fauna. But, due to unwise human activities along with urban development the wetland ecosystem gets degraded.

Expansion of the developmental activities has put tremendous ecological stress and strain on the wetland system. Growing urban sprawl combined with rapid pace of urbanization in the region has led to high rate of wetland degradation. Moreover, the rapidly expanding market centers coupled with growing population and expansion of settlement areas and road networks have seriously affected the wetland in terms of areal shrinkage, land and water pollution and garbage dumping. It has been also realized that government authorities should pay due attention to conserve the wetland ecosystem and resources.

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