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Land use land cover and spatio –temporal changes in wetland ecosystems using geospatial technologies in Hajo, Assam, India

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Abstract
The wetlands are the transient ecosystem in nature and regarded as the kidneys of nature. But in due course of time most of the wetlands undergone drastic changes due to both natural and anthropogenic factors. Land use Land cover (LULC) of Hajo area for the year 2012 and spatio- temporal changes in wetland ecosystem for the year 1998, 2006, 2013, has been studied. The wetlands are initially identified and mapped from topographical maps of 1:50,000 scale. The spatio temporal change, identification and delineation and area of these wetlands etc are taken from satellite imageries. Spatio-temporal changes and landuse and land cover patterns of the wetlands in the study area are done by utilizing Erdas Imagine 9.3 software and ArcGis 9.3.1 software.

Keywords: LULC, ArcGis 9.3.1, Erdas Imagine 9.3, Software, Wetland, Ecosystem

Introduction
Wetlands are important assets of nature because they provide diverse habitat for flora, fauna, avi-fauna and act as ecosystem unit. Wetlands help in retaining water table high and relatively stable. The absence of suitable land development in wetland areas has caused the disintegration of wetlands.

LULC act as an important indicator for studying the interactions of human activities with the environment and help in simulate changes. Geographic Information System (GIS) techniques are used to monitor changes over a period of time to identify the impact of various natural and anthropogenic factors on wetland health. LULC changes study has been reported in the north-west district of Delhi during 1972 to 2003 using remote sensing and GIS techniques [1]. Spatio-temporal pattern of LULC changes in the Yalnizeam and Ugurlu forest planning units in Turkey has been studied [2].

LULC help in studying both the natural and social processes and to characterize the dynamics of changes in Avellino (Southern Italy) during a 50 year period (1954-2004), processing multi-temporal set of images; aerial photos (1954), and Landsat scenes (MS 1975, TM 1985 AND 1993, ETM + 2004) [3]. Land cover changes has been studied in the Yarlung Tsangpo River (YTR) basin in 1985 and 2005 and found that only 1 % of land cover in the YTR basin changed during this period of time [4]. Changes in land use and land cover has been studied in Kodaikanal Taluk over 40 years period (1969-2008) [5]. Wetland dynamics and wetland loss has been studied in Choke Mountain range in Nile river basin by using sattlete remoste sensing imageries during 1986 to 2005 [6].

Research on spatio-temporal changes by using satellite imagery to evaluate spatio-temporal LULC changes in the Bale Mountains, Ethiopia for a decade of 4 decades [7].

Methodology
The wetlands or the beels are initially identified and mapped from topographical maps of 1:50,000 scale. The spatio - temporal change, identification and delineation and area of these wetlands etc are taken from satellite imageries for the study. Spatio-temporal changes and landuse land cover patterns of the wetlands of the study area are done by utilizing ERDAS IMAGINE 9.3 software and ArcGis 9.3.1 software

Study Area: **Description of the study area**

The Hajo Development Block is situated in between 26º 10' N and 26º 29' 30"N latitude and 91º 26' 50" E and 91º 41' E longitude of the Kamrup (rural) district, Assam. The altitude is about 602m above mean sea level and ground water level is considerably high while the topography is smooth and plain.

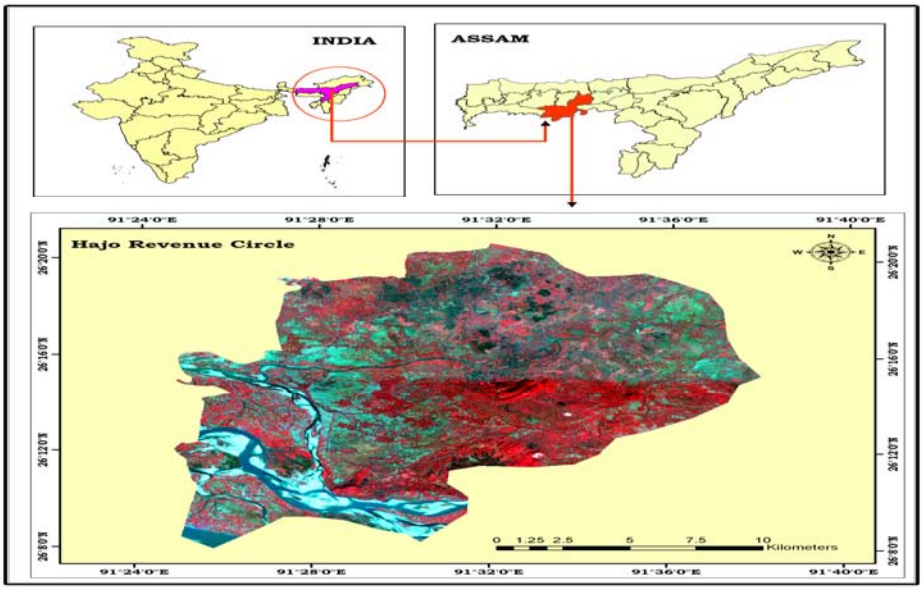

Fig 1: Study area map of Hajo

Results and Discussion

Table 1: Landuse pattern of Hajo

Landuse category	Area in sq kms	Percentage to total geographical area
Agricultural land	150.182204	47.584680
Forest area	4.45354	1.4110795
Grassland	11.006764	3.4874470
Built up area	.730158	.23147883
Sandy area	10.402284	3.2959255
Tree clad	48.295	15.302166
Wasteland	49.25102	15.60500
Waterbodies	41.27744	13.07860
Total	315.6104085	100

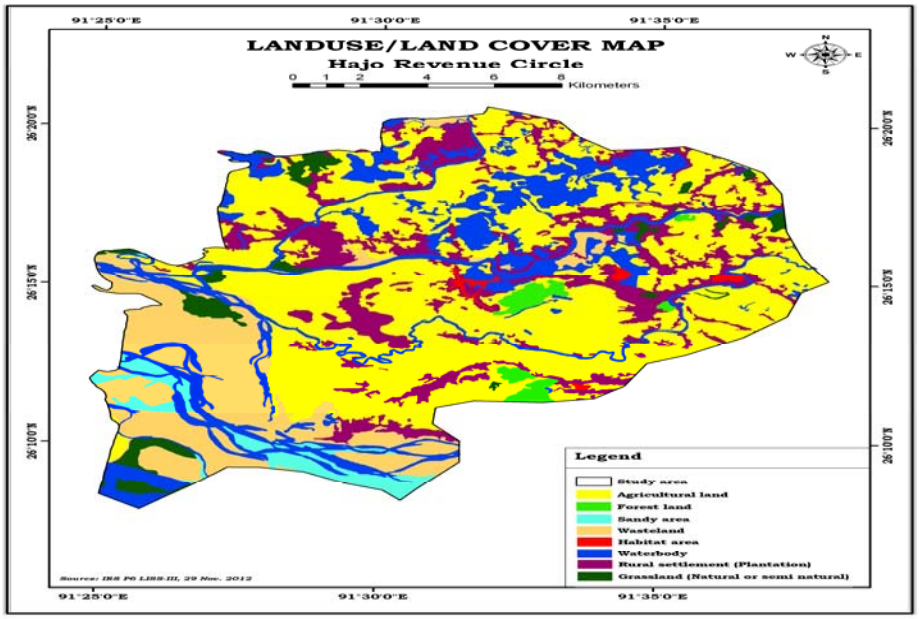

Fig 2: Land use and Land cover map of Hajo

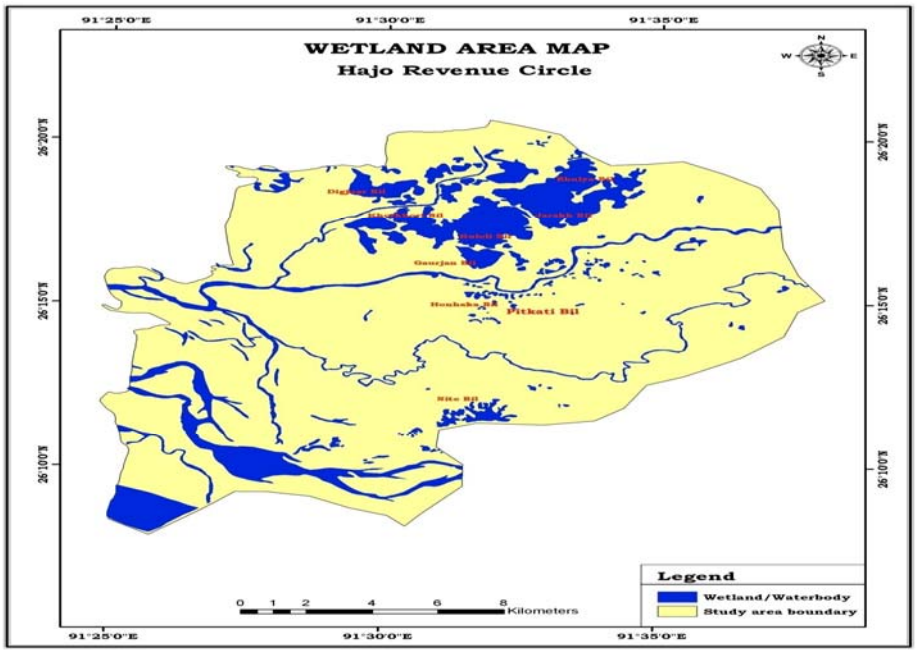

Fig 3: Wetland area map of Hajo

Table 2: Wetland area of Hajo

Year	Wetland area in sq kms
1998	33.8229
2006	14.2068
2013	32.4269

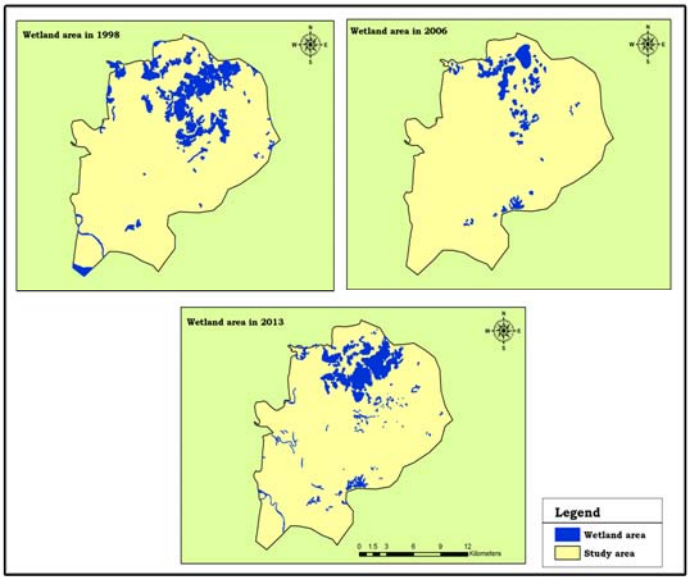

Fig 4: Spatio- temporal changes in wetlands in Hajo

Landuse category has been classified into eight classes for the Hajo area for the year 2012 using IRS LISS III image. The landuse category is shown area in square kilomoetres (sq kms). The total landuse category covers area 315.6104085 sq kms. The highest landuse in Hajo area is covered by agricultural land i.e 150.182204 sq.kms. The highest percentage to total geographical area shown in agricultural land in Hajo area i.e 47.584680 Bodo paddy is mainly grown in the study area. The lowest landuse category is covered by the built up area i.e. 730158 sq.kms and the lowest percentage to total geographical area is. 23147883. The waterbodies represents area cover of 41.27744 sq kms and percentage to total geographical area is 13.07860. The waste land covers 49.25102 area in sq kms and percentage to total geographical area is 15.60500. The forest area is showing low value of area 4.45354 sq kms and percentage total geographical area is also low i.e 1.411075. There has been many deforestation as well as expoitation of natural agricultural land too in the area in the past years. The table has been displayed in Table 1 and Figure 2.

Spatio-Temporal changes of wetland areas hase been showed for the year 1998, 2006 and 2013 by using ERDAS

and ArcGis software. The wetland areas of Hajo area showed considerable changes over the years. The wetland area in 1998 year was 33.8229 sq kms. The wetland area gets diminished and the area got shrinked to upto 14.2068 sq kms in the year 2006. Wetland area map is given in Figure 3.The table is shown in Table 2 and figure in Figure 4. The main reason behind this is the unprecedented flood which happened in the year 2004 in which the embankment of Puthimari river has been breached drastically and as a result siltation and sedimentation made the whole wetland area to shrink. In the year 2013 the wetland area has been gradually restored to upto 32.4269 sq kms.

Conclusion

In this investigation it was noticed that the LULC acts an important tool for examining the interaction between human activities or natural factors of an area which is governed by various factors such as agricultural land, water bodies, built up area, wasteland, grassland etc. The spatio- temporal changes in wetland also help in examining the area increase or decrease and to monitor the change detection in the wetland ecosystems. These techniques help for the monitoring of various changes occurring in area as well as help in restoration and scientific conservation techniques to save areas from disintegration by maintaing ecological balance.

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