WETLAND ASSESSMENT FOR LAND COVER CHANGES USING GIS IN CHANDUBI LAKE, NORTH EAST INDIA

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Abstract: Wetlands are one of the most productive ecosystems on earth delivering a bouquet of ecosystem services from microclimate regulation to maintenance of biodiversity. The degradation of freshwater ecosystems especially the wetlands has been a global issue. The causal factors behind such degradation are multifarious and calls for sustainable approaches for long-term mitigation. The current study site, Chandubi lake is situated in Rabha Hasong Autonomous Council, Kamrup district in Assam and one of the most prolific wetland sites of North-east India with significant ecological wealth. The decadal degradation of the wetland is prominent but very few scientific investigations have been documented from the area. The current study deals with the gradual degradation, impact and sustainable development challenges of Chandubi Wetland with the aid of remote sensing approaches. Land use and land cover changes were observed using Landsat 8 and Landsat 5 data across 2011 and 2020. Over-exploitation of wetland resources and siltation were reported as the major drivers of such changes with direct and specific impacts on both ecosystem services as well as livelihoods. Depletion of natural resources such as fish stocks and fodder were also identified. The tourism opportunities also suffered a loss due to environmental degradation in the area. These observations call for urgent need for a comprehensive participatory management plan incorporating the sustainable developmental goals for environmental management and restoration of health of the wetlands.

Keywords: Biodiversity; Degradation; Ecosystem; Livelihoods; Wetlands.

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INTRODUCTION

The Chandhubi wetland is a tectonic wetland located in the west Kamrup district of Assam within Loharghat and is represented in the figure 1 below. Chandubi tectonic lake came into being on June 12, 1897, due to a devastating earthquake. The Chandubi lake (Sandubi, documented in the Survey of India toposheet of 1911-13) by the year 2002 occupies water spread area of 119 Ha, which was about 1023 Ha during 1911-13, thus, losing 88.36% of its original water spread area since 1911, and transforming the same into alluvial tracks. The lake area has suffered from tectonic disturbances subsequently as the upper sequences of the sediments are fine clayey lacustrine deposits. There are numerous upright tree trunks located in the north-eastern part of the lake. The probable explanation for this phenomenon is the rise of water level in the area, thus submerging the existed thick forests surrounding the lake. The one boat association named Chandubi Nauka Poribahan Samiti. Almost 80-90 youths are directly dependent on boating for tourists. Around 50 personals are dependent on fishing directly from the wetland. There are 5 Nos. of temporary shops with various Shops/Stalls for food items. Around 40 persons are dependent/involved with livelihood by these shops. There are two private resorts
also at the Chandubi area for tourists and visitors. As per local boat members from boat association during the field survey interview, the area consists of 400 households with the population as 1500. On the west side of the lake, there are two numbers of Garo villages and other sides of the lake are surrounded by the Rabha community only. Water is very clear around the year except for the rainy season. The average depth of the lake is 9-10 feet villages as Kathalguri Joramkhuriya, Pub Rajapara, Paschim Rajapara Santibeel, Jupangbari (Kalita, 2017). Change detection study and land use land cover study has been done by many researchers using LANDSAT satellite imagery (Afify, 2011; Al-doski et al., 2013; Ashraf et al., 2015). NDVI, NDWI, NDBI helps in vegetation, water resources and settlements studies respectively (Kennedy et al., 2003; Muttitanon and Tripathi, 2005; Ji et al., 2009; MoEF, 2011; Kavyashree and Ramesh). Such studies help in monitoring wetland change, resource management as well as helps in adopting present and future conservation strategies. The species richness, biodiversity and distributions of plant species are dependent on water level fluctuations (Nandy and Kushwaha, 2011; Panhalkar and Panwar, 2014) as well as highly influenced by climate change and anthropogenic activities. Therefore, such study will help in land use planning and lake ecological conservation.


### Current Scenario of Land Use Pattern

Studies on land use aspects of eco system play an important role to identify sensitive issues and to take appropriate action for maintaining ecological homeostasis in the region. The main objective is to provide a baseline status of the area, so that temporal changes due to the proposed project on the surroundings can be assessed in future.

### EXPERIMENTAL

**Data Used:** United States Geological Survey (USGS) Satellite Data: Land sat 8 cloud free data has been used for Land use/Land cover analysis, Satellite Sensor—OLITIRS multi-spectral digital data has been used for the preparation of land use/land cover map of present study. Survey of India reference map on 1:50,000 scales have been used for the preparation of base map and geometric correction of satellite data. Ground truthing has been carried out to validate the interpretation accuracy and reliability of remotely sensed data, by enabling verification of the interpreted details and by supplementing with the information, which cannot be obtained directly on satellite imagery.

**Methodology:** ArcGIS 10.3.1 software was used for the mapping. Digital image processing techniques were applied for the mapping of the land use land cover classes of the provided area from the satellite data.
Figure 1. Location Map of Chandubi Lake, Assam, India

Figure 2. Flow Diagram for Land Cover Mapping and change detection
RESULT AND DISCUSSION

The contour of lake gradually increasing as distance increasing from the lake toward land. Near the lake, it covered in 50 to 100 m while in landward side, it is 500 m. The drainage in the lake third and fourth order. The slope of the study area varies between 5 to 60 degree only. On comparison of land use pattern for 10 years, it shows that the wetland water area (124.659 Ha. in 2011) has been increased (131.162 Ha. in 2020) approx. 6.5 Ha. while total wetland area has been decreased (Table 1). Other land cover pattern can be seen in figure 5 for better comparison and it can be predicted that settlement, fallow land and forest area has been increased while scrub land and shallow land has decreased. The false color composite (FCC) map (figure 4) depicts for the actual water area of wetland and other land cover in 5 km vicinity. The change is land use pattern or ecological changes will affect the surrounding as well.

Table 1. Comparison in Land Use Pattern of Chandhubi Lake in 2011 and 2020

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Features</th>
<th>Area (km²) 2011</th>
<th>Percent 2011</th>
<th>Area (km²) 2020</th>
<th>Percent 2020</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Settlement</td>
<td>1.641</td>
<td>2.046</td>
<td>1.864</td>
<td>2.324</td>
<td>0.278</td>
</tr>
<tr>
<td>2</td>
<td>Agriculture Land/Fallow Land</td>
<td>12.893</td>
<td>16.078</td>
<td>14.228</td>
<td>17.743</td>
<td>1.665</td>
</tr>
<tr>
<td>3</td>
<td>Lake area</td>
<td>1.247</td>
<td>1.555</td>
<td>1.312</td>
<td>1.636</td>
<td>0.081</td>
</tr>
<tr>
<td>4</td>
<td>Other Water Bodies</td>
<td>1.783</td>
<td>2.223</td>
<td>1.706</td>
<td>2.128</td>
<td>-0.095</td>
</tr>
<tr>
<td>5</td>
<td>Forest Area</td>
<td>40.778</td>
<td>50.851</td>
<td>41.669</td>
<td>51.962</td>
<td>1.111</td>
</tr>
<tr>
<td>6</td>
<td>Scrub Land</td>
<td>20.522</td>
<td>25.592</td>
<td>18.126</td>
<td>22.604</td>
<td>-2.988</td>
</tr>
<tr>
<td>7</td>
<td>Shallow Land</td>
<td>1.327</td>
<td>1.655</td>
<td>1.286</td>
<td>1.604</td>
<td>-0.051</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>80.191</strong></td>
<td><strong>100.000</strong></td>
<td><strong>80.191</strong></td>
<td><strong>100.000</strong></td>
<td><strong>0</strong></td>
</tr>
</tbody>
</table>

Figure 3. Study Area Map (5 km radius)
Figure 4a. False Color Composite Map of study area (2011)

Figure 4b. False Color Composite Map (2020)
Figure 5a. Land Use in 2011

Figure 5b. Land Use in 2020
CONCLUSION

Remote sensing technique provides fast, accurate and economic method for extraction of wetlands in an area. Wetlands are those landscapes which are saturated with water or covered by water either perennially or for a major part of the year. Due to transforming nature of the wetlands from aquatic to terrestrial, the related physical features are not easy to be monitored. The lake is a biodiversity hotspot with a rich variety of flora and fauna. Migratory birds flocking to the area during the winter months makes it a bird lover’s paradise. Being located quite close to Guwahati around 65 km away – the area has over the years developed into a major tourist attraction. The decadal changes in the wetland represent the lake area has been increased slightly but scrub land has been decreased 3% near the lake and surrounding which is alarming for next decade as this balances the ecosystem.

REFERENCES


Rathoure & Anand, 2020; Wetland Assessment for Land Cover Changes using GIS in Chandubi Lake, North East India

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