TEMPORAL LANDUSE/ LAND COVER CHANGE IN GOLATAPPAR SWAMP WETLAND OF DEHRADUN THROUGH GEOSPATIAL TECHNIQUES

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Abstract - *The last few decades showed an emerging trend in the destruction of freshwater wetlands. While fighting climate change on one hand, these swamp wetlands have faced indiscriminating and unscientific exploitation by the locals leading to their continuous degradation and depletion. Rapid urbanization and anthropogenic activities resulted the question on existence of Golatappar swamp wetland in district Dehradun, Uttarakhand. The aim of the present study was to assess the changes in land use pattern of Golatappar swamp wetland in Dehradun during the last 13 years. The results revealed that there is an urgent need of attention to preserve these productive ecosystems of swamp wetland.*

Keywords: Wetland, Swamp, Ecosystems, Anthropogenic, Remote Sensing, GIS

1. INTRODUCTION

Wetlands are defined as 'lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water[18] . They are an essential part of human civilization meeting many crucial needs for life on earth like sustaining life processes, water storage (domestic, agriculture and industrial usage), protection from storms and floods, recharge of ground water, water purification, storehouse for nutrients, erosion control and stabilization of local climate (such as temperature and rainfall), helps in the maintenance of the ecological balance. Wetlands type is determined primarily by local hydrology and the unique pattern of water flow through an area. There are four main types of wetlands – marsh, swamp, bog and fen (bogs and fens being types of mires) [16].

Wetlands have been drained and transformed by anthropogenic activities like unplanned urban and agricultural development, industrial sites, road construction, impoundment, resource extraction, and dredge disposal causing substantial long-term economic and ecological loss [20]. Among all other, urbanization and industrialization are considered the most important factors for change in shape, size and function of wetlands. The last few decades showed an emerging trend in the destruction of freshwater wetlands. It results increase in fragmentation and change in the ecological function of wetlands [6][3]. Removal of partially or fully wetland system causes loss of feeding and breeding places of wildlife, worsen the water quality and decrease in landscape diversity.

Remote sensing data in combination with Geographic Information System (GIS) are effective tools for wetland conservation and management. In the past, visual interpretation of wetlands from maps, aerial photography, and hard copy of satellite images have been used extensively [19][17]. Currently, digital image processing and GIS model is used for demarcation of wetland boundaries and land use changes [1].

Dehradun has always been enriched with water bodies. Its swampy vegetation has been the result of its distinctive topographical identity that favours oozing of water in its southern periphery. Mothronwala, Karwapani, Ramgarh, Nakraunda, Gularhghati, Dudhpani, Golatappar and Laltappar swamp wetlands are amongst some of last surviving swamps of Dehradun. While fighting climate change on one hand, these swamps have faced indiscriminate and unscientific exploitation by the locals leading to their continuous degradation and depletion. Taxonomic study of swamp forests of Doon valley was first carried out by [14], since then number of studies have been conducted by various workers for landscape diversity[[7][8][12][15], successional studies[22] and community dynamics [13].

The aim of the present study was to assess the changes in land use pattern of Golatappar swamp wetland in Dehradun using digital change detection approaches. Spatial technique of land use change detection using multi-temporal satellite data followed by GIS techniques were used to assess the land use/ land cover changes.

2. STUDY AREA

The Golatappar swamp [2] lies at 30o05'40" N latitude 78o12'30" E longitude, (Figure 1) at an altitude of 370 meter and is located in the east of Dehradun district of Uttarakhand state in India at a distance of 35 km.

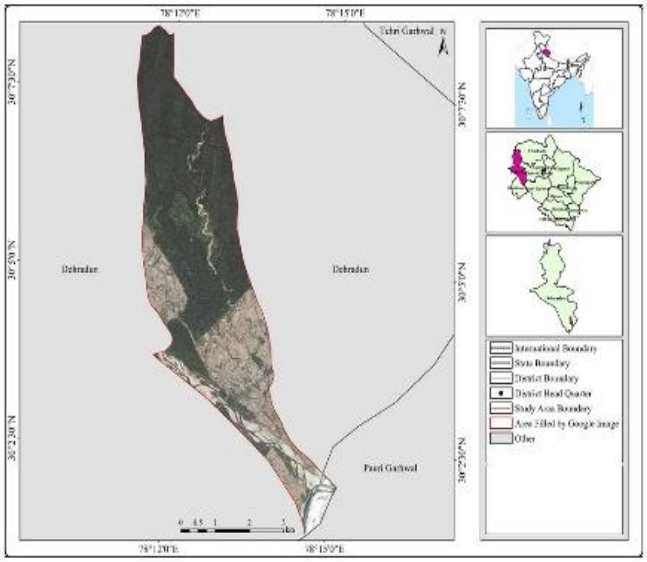

Fig.1: The Golatappar swamp

It occupies an area of approximately 2 km. This swamp forms a part of the group which lies near the village Khiri of Dehradun district in Uttarakhand. River Towa flows along its southern limit which is one of the tributaries of the Song-Suswa-Jakhan complex that fans out here in innumerable streams over a wide area before it meets the river Ganga at Satyanarayan Temple. The soil is of two types: in the swamp proper, the bed of slow-moving streams is of the gravel which usually supports no vegetation. The remaining vast area is covered with black muddy flats rich in humus accumulated by the death end and decay of the herbaceous communities. The swampy zone lies in a depression and is surrounded on all sides except the south by a clay bed of immense thickness overlying the great mass of the gravel deposit.

3. Materials & METHODS

Data from different sources was used for the present study and temporal changes were analyzed. Satellite data, Landsat Enhanced Thematic Mapper Plus (ETM+) (2005) was acquired from USGS Glovis archive and downloaded via Earth Explorer. IRS P6 LISS III (2010 and 2015) was obtained from NRSC, Hyderabad.

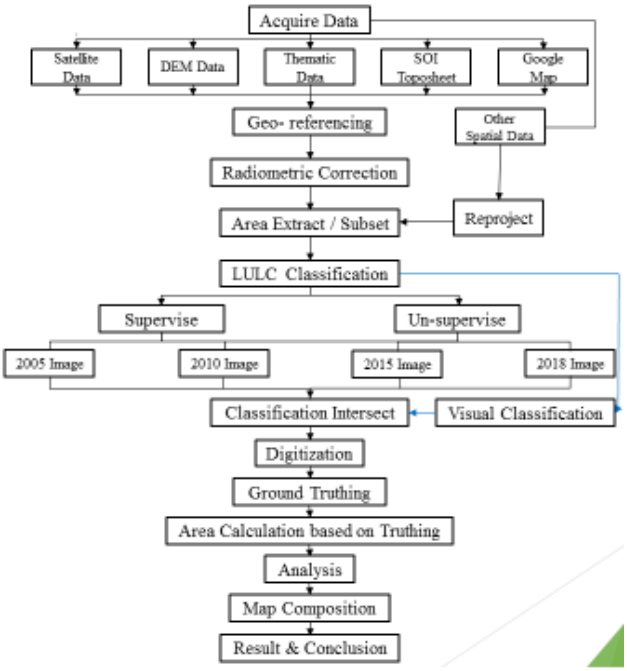

Fig. 2: Flowchart of methodology

Google earth and Sentinel 2a (2018) was downloaded through QGIS software. The satellite data was processed using ERDAS IMAGINE image processing software.

All the Geometric and Radiometric corrections was done and the image was further processed for the image enhancement. After the enhancement the subset of the area was taken with a buffer distance of 10km. Hybrid classification of satellite images was done with major classes (Water, Agriculture, Forest, Swamp, Builtup) and digitization was performed in Arc GIS 10.2. Number of site visit were carried out for collection of sample data GPS point for ground truthing and verification of land use land cover classes. Ancillary information was also collected by surveying nearby villages. Final Landuse/Landcover maps were prepared with the help of ground verification and visual interpretation. Flowchart of methodology is given in figure 2.

4. RESULTS AND Observations

The change scenario of the Land use and Land cover for different years are depicted in (Figure3-5) and the area of each category that is changed within 13 years are presented in Table 1

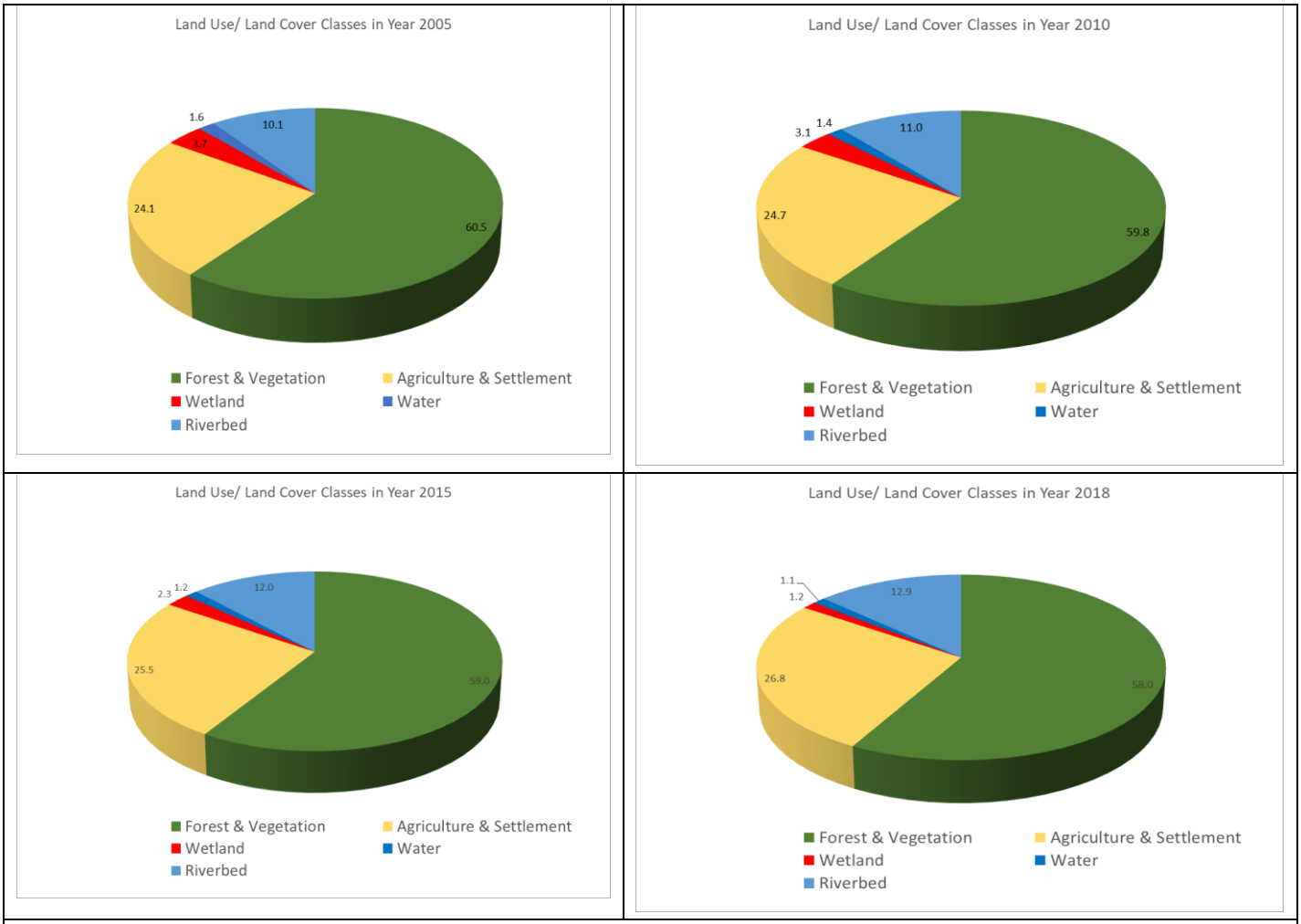

Fig. 3: land-use/ land cover area for different years, 2005, 2010 2015 and 2018.

The changes mentioned in table 1 are in percentage of total study area. The changes can be identified visually also through both the Land use and Land cover map shown in (figure 4). The maps are well defining the changes that have been taken place within the past 13 years i.e. the change in the area of wetland earlier it was 3.7% in year 2005 and changed to 1.2% in the year 2018 so, the total percentage of change in the wetland was 2.5%. The above table shows all the major classes of Land use and Land cover of the wetland that has been studied in the change analysis. The results clearly show that there is a rapid decrease in the

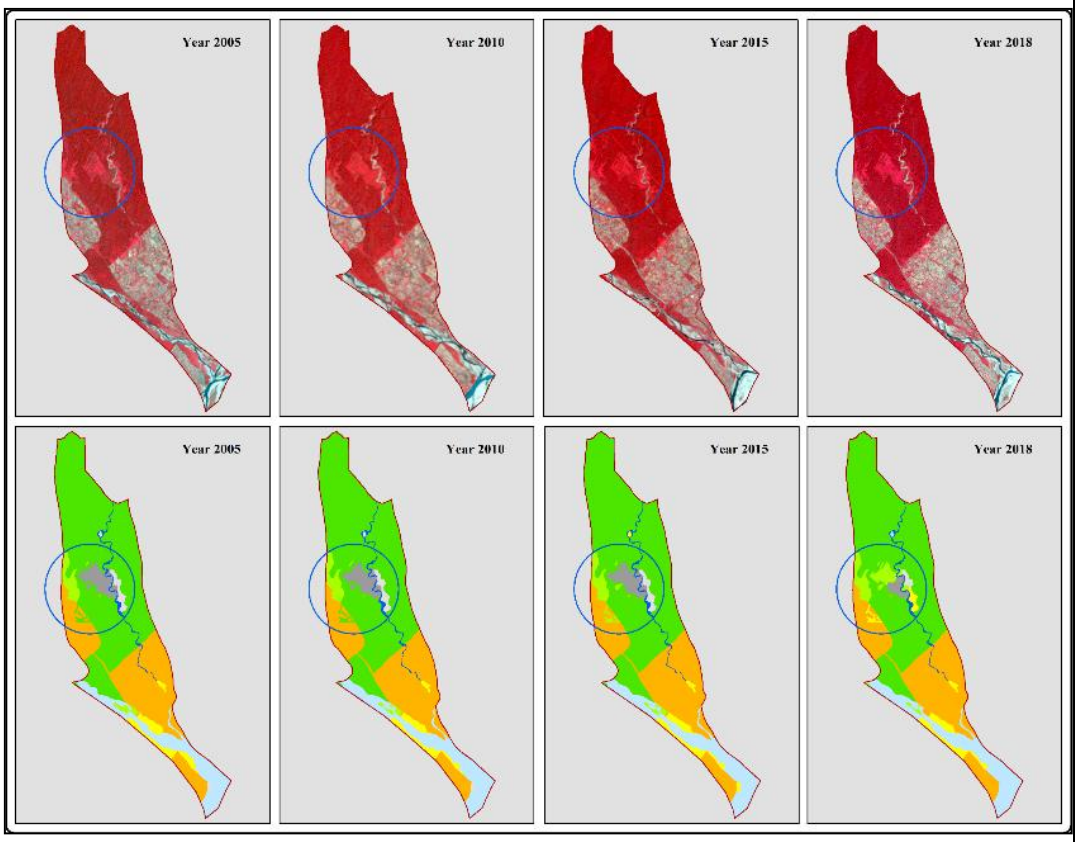

Fig. 4: Comparative land-use maps for different years, 2005, 2010 2015 and 2018.

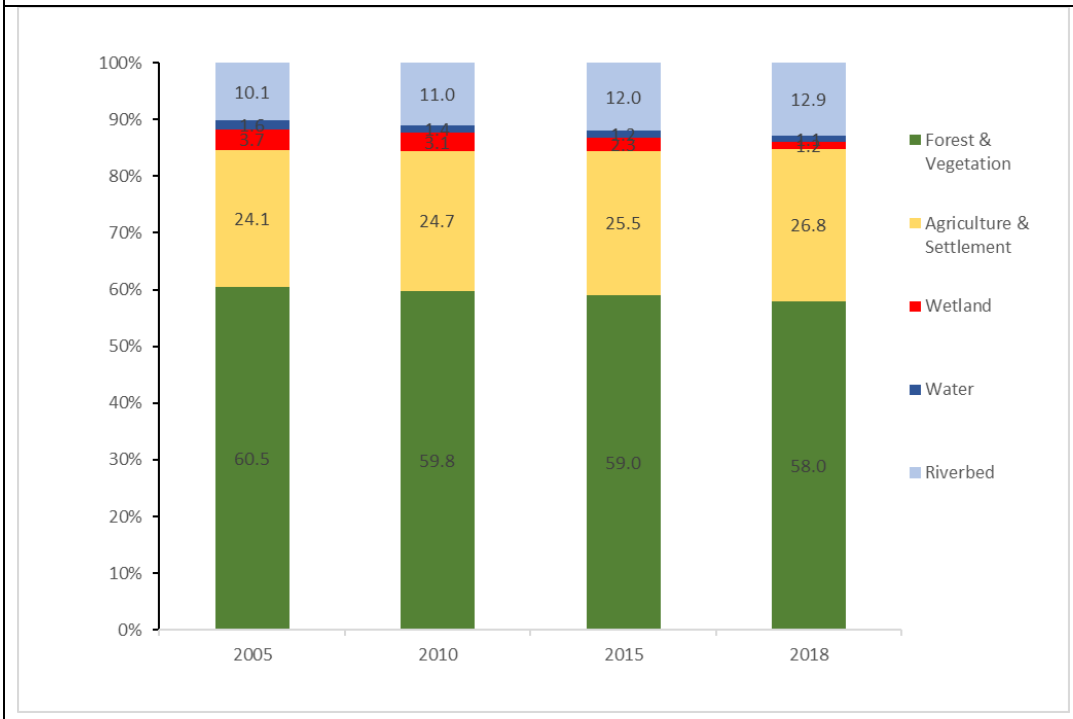

Fig. 5: Comparison in Landuse/ Landcover area change in Golatappar swamp wetland (year 2005 to year 2018)

Table1: Land

Land use Class	Area in % 2005	Area in % 2010	Area in % 2015	Area in % 2018
Forest & Vegetation	60.5	59.8	59.0	58.0
Agriculture & Urban Settlement	24.1	24.7	25.5	26.8
Wetland	3.7	3.1	2.3	1.2
Water	1.6	1.4	1.2	1.1
Riverbed	10.1	11.0	12.0	12.9

-use classes and their area (in %) in 2005 to 2018 at Golatappar

vegetation which is due to conversion of vegetation into urban area or agriculture lands subsequently there is an increase in urban area and fallow land (2.7% of total area) which is affecting the water quality and Biodiversity of the wetland. There is a remarkable fall in the percentage of water body (0.5%) and incremental in riverbed area (2.8%) which is deliberately affecting the primarily function of the Golatappar swamp wetland as the water is the basic requirement for all the living beings. The shrinkage in the water body is directly affecting the aquatic life and the flora of the wetland.

5. CONCLUSIONS

Wetlands are exceptional zones which are fundamental habitat to various sorts for flora and fauna. Wetlands especially swamps are under increasing stress due to the rapidly growing population, technological development, urbanisation and economic growth. Additional pressures are levied on wetlands from natural causes like subsidence, drought, erosion etc., and human threats coming from over exploitation, encroachment, reclamation of vast wetland areas for agriculture, commercial and residential development [21].

In the present study makes it very clear that the area of wetland which is under stress of human interference like settlements and other developmental activities is shrinking and subsequently causing the loss of vegetal cover. It was further noticed that the area which is free from human interference and disturbance results in positive growth of vegetation. The extent of wetland is observing a gradual reduction which might be due to anthropogenic activities like agriculture, non-point source pollution and urbanization.

Integrated approach towards wetland management has become the demand of hour. Geomatics permits the acquisition of temporal Remote sensing digital data on a repetitive basis. This repetitive coverage allows wetlands, as well as adjacent land cover and land use types, to be monitored seasonally and /or annually. Using digital data provides a standardized data collection procedure and an opportunity for data integration within a geographic information system GIS tools proved to be indispensable for quantifying and visualizing comparisons of assorted wetland data.

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