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MAPPING CHANGE IN WATER SPREAD AREA OF HIMAYATSAGAR USING REMOTE SENSING AND GIS

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ABTRACT- *The present study is to analyse the spatio-temporal changes in wetland of Himayatsagar during 2001 and 2011. Reference map Landsat ETM image of 29th October 2001 and IRS P6 AWIFS image of 11th November 2011 was used. It is aimed to reveal the qualitative and quantitative changes in wetland during the past ten years and for analyzing the primary causes.*

Key Words: Remote sensing, GIS, Himayatsagar, Water spread area, Wetland.

1. INTRODUCTION

Mapping and monitoring of land use and wetlands are the foremost requirements for planning, management and conservation. Remote Sensing, GIS and GPS play vital role in mapping of existing land resources information at a particular period. The multi-spectral data obtained from remote sensing satellites like Landsat, IRS, SPOT, IKONOS have been used to study features either by visual interpretation or by processing digital data using digital computers. It provides excellent capability to monitor composition of ecosystem and impact of management and degradation processes. Remote sensing (RS), with its utility for surveying large areas in a time and cost-effective manner, offers a solution to difficulties of this type as illustrated by its successful application to wetland ecosystem mapping (Bancroft and Bowman 1994). Classification is a fundamental task for RS applications (Hay et al. 1996; Li and Xiao 2007). However, classification accuracy needs to be considered to satisfy the requirements of desired baseline data applications (Zhang *et al.* 2013). Mostly, wetlands classifications have been done at broad scale, using satellite imagery that covers large extents such as Landsat (Frohn *et al.* 2009; Frohn *et al.* 2012) but with coarse spatial resolution. Visual interpretation is a commonly used method for classification and band selection in wetlands (Hung andWu 2005; Sridhar *et al.,* 2008).

2. STUDY AREA

The present study Himayatsagar is one among the beautiful lakes located about 20 km from Hyderabad in Telangana, India. The storage capacity of the reservoir is about 3.0 TMC. The construction of reservoir on Esi a tributary of Musi River was completed in 1927, for providing drinking water source for Hyderabad, and also saving the city from floods, which Hyderabad suffered in 1908. The Himayatsagar was the source of water supply for drinking and irrigation to the twin cities of Secunderabad and Hyderabad, but due to the growth in population and increase in the need of peoples it was finally decided by the state government to make it as a point of interest. The Engineer at the time of construction was Late Khaja Mohinuddin. The Himayatsagar spread over 500 sq. miles covers Pargi, Venkatapuram, Shamshabad and other areas. The maximum capacity of 1.60 lakh cusecs. In Himayatsagar, the water level in June (2012) was 1743.3 feet and on October 1(2012), it was 1,747.4 feet, an increase of about 4 feet. Similarly, In October 2011, the water levels at Himayatsagar were 1754.9 feet respectively. There are few studies on wetlands using satellite remote sensing in India i.e. Pant *et al.,* 1992; Pattanaik & Reddy, 2007; Reddy *et al*. 2007; Reddy and Roy, 2008; Reddy *et al*., 2008 a,b,c,d,e,f; Navatha *et al.,* 2011 a and Romshoo and Rashid, 2012. The main aim of the present study is to analyse the spatio-temporal changes in wetlands of Himayatsagar during 2001 and 2011. It is also aimed to reveals the qualitative and quantitative changes in wetlands during the past ten years and for analyzing the primary causes. In this study change refers to increases or decreases in extent of water spread of wetlands due to natural and anthropogenic influences.

3. MATERIAL METHODS

Data used in the study of Himayat sagar lake, image of, ETM 29th October 2001 and 11th November 2011. Band 1, 2, 3 was used for image classification. All three reflective bands were used in image classification. Images represent wet season as they were captured in the month of October and November on different images. It was assumed that temporal changes of water body remained insignificant over the period of months, at least for city wide change analysis. The study has been carried out under

the frame work of Geographic Information System (GIS) and Remote Sensing. Most case studies were conducted using GIS techniques to explore environmental impacts of growing urbanization based on the analysis of spatial and temporal relationships between various land use classes (Xiao et al. 2013; Hegazy and Kaloop 2015; Song et al. 2015; Abdulkareem et al. 2018; Nautiyal et al. 2017; Zadbagher et al. 2018; Gashaw et al. 2018). The image processing task has been carried out using (Earth Resource Data Analysis System) ERDAS 9.2 image processing software (Leica Geosytems Geo- spatial Imaging, LCC). Data on wetland features has been extracted by ERDAS Imagine 9.2 software. However, GIS task has been carried out using ArcGIS 9.3.1 version. SOI maps served purpose of delineating the basin boundary and stream networks and authentication of various features on the satellite image. Several variations of these methods exist, each process uses multiple bands of the images to isolate unique spectral classes. No definite advice can be made about which classifier is best in all circumstances (Townshend, 1992). The digital image classification as such seems to be simple process but in reality there are complications that limit the accuracy of land cover classification (Mather 1991). In the unsupervised approach, pixels are grouped into different spectral classes by clustering algorithms without using prior information (Jensen 1996). ISODATA, an unsupervised classification technique was used in order to group the pixels into clusters. 100 spectral clusters with 95% convergence value were selected with the aim of performing unsupervised classification. Unsupervised classification examines the spectral characteristics of each pixel and statistically groups similar pixels into classes. User further aggregates the spectral classes into information classes. In unsupervised classification any individual pixel is compared to each discrete cluster to see which one it is closest to. A map of all pixels in the image, classified as to which cluster each pixel is most likely to belong, is produced (in black and white or more commonly in colours assigned to each cluster). This then must be interpreted by the user as to what the colour pattern may mean in terms of classes, etc. that are actually present in the real world scene.

4. Result

In the beginning of 2001 to 2011 the total extent area of Himayatsagar wetland of Hyderabad as a whole is estimated to be 13,879 Ha (Table-1). The land use/cover classes classified into 5 categories and area of each class has been calculated. There is a depiction between 2001 and 2011 of Himayatsagar of total geographical area most of the land use is under agriculture (10737.3 Ha of area 77.4%), as this is main occupation of people, scrub is a vegetative cover predominantly occupied by shrubs with crown density 10.4%. It is the vegetative class covering an area of 1.7% in Himayatsagar. Water land occupies significant area, which is about 14.6% which second dominant class covering an area of 2022.2 Ha. Built up area which includes urban/ rural settlements represents an area of 1427.2 Ha, it third dominant class of an 5.8%. Orchids land contributes significantly to the land cover with Himayatsagar 0.5%. (Fig -1a,1b). In the lake the total extent of water occupy is about 2022.2 Ha.

TABLE: 1 Status Of Wetland And Other Land Use Of Himayatsagar LakeAnd Surroundings (Area In Ha.)

S.No	Class	2001	2011
1	Water	1924	2120
2	Scrub	244	241
3	Built up area	587	1023
4	Agriculture	11051	10423
5	Orchards	72	72
Total		13879	13879

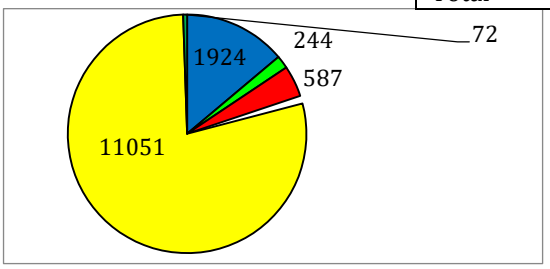

Fig: 1a Wetland and Other Land Use of HimayatsagaLake (Area In Ha) 2001

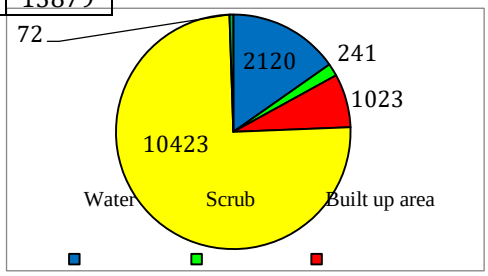

Fig: 1b Wetland and Other Land Use of HimayatsagarLake (Area In Ha) 2001

5. Discussion

The change matrix analyses allowed mapping of the abrupt changes in wetland. The results confirm that land cover has changed significantly since 2001 with agriculture land being transformed to wetland. From analysis it is observed that an area 195 Ha of water was increased by 2001. Built up area was increased twice by 2011 were 43 Ha of agriculture land have been converted. Changes that have occurred from the period 2001-2011 were presented in (Fig – 2) and (Table- 2). The time series wetland mapping demonstrated the existence of water spread area of the lake. Comparisons between 2001- 2011 indicated that changes in overall wetland areas were significant over the ten years. (Fig – 3 to 6). From the study it is evident that area of drinking water bodies of Hyderabad city found to be increased. Significant correlation of gain of wetland are also found with in-creasing water spread area and urban population and build-up area showed wide expansion, where as agriculture land reduced from 2001 to 2011 (Table-1). Human induced activities are also now becoming important factors for change of wetland after 2015. Climate change may increase, causing threat to natural environment.

TABLE : 2 Change Area Matrix of Wetland and Land Use of Himayatsagar Lake (2001 To 2011)

S.No	2001/2011	Water	Scrub	Built up area	Agriculture	Orchards	2001
1	Water	1924	0	0	0	0	1924
2	Scrub	0	241	3	0	0	244
3	Built up area	0	0	587	0	0	587
4	Agriculture	195	0	433	10423	0	11051
5	Orchards	0	0	0	0	72	72
2011		2120	241	1023	10423	72	13879

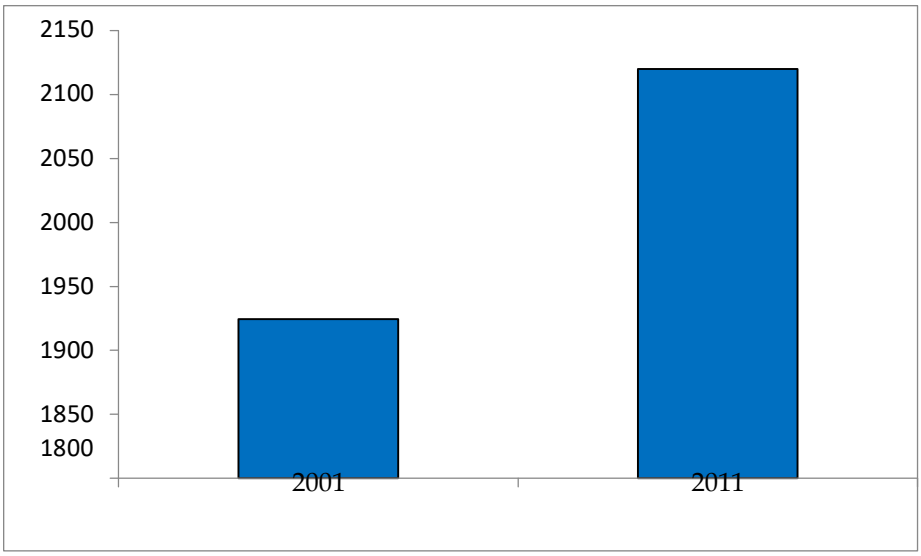

Fig : 2 Dynamics In Extent of Water in Himyatsagar Lake (2001-2011)

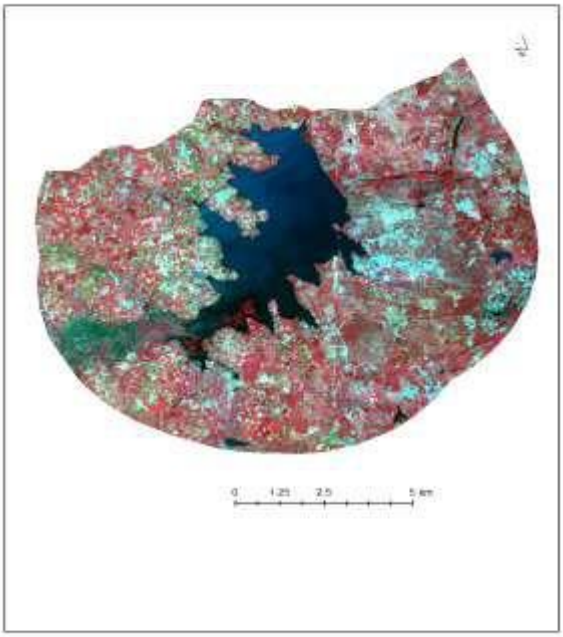

FIG: 3 LANDSAT ETM FCC Image of Himayatsagar Lake and its Surroundigs (October 2001)

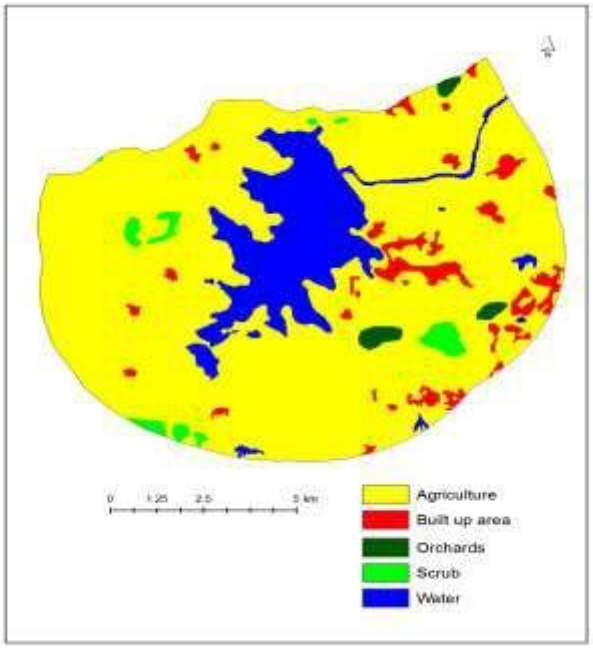

FIG: 4. Wetland Map of Himayatsagar Lake and its Surroundings (October, 2001)

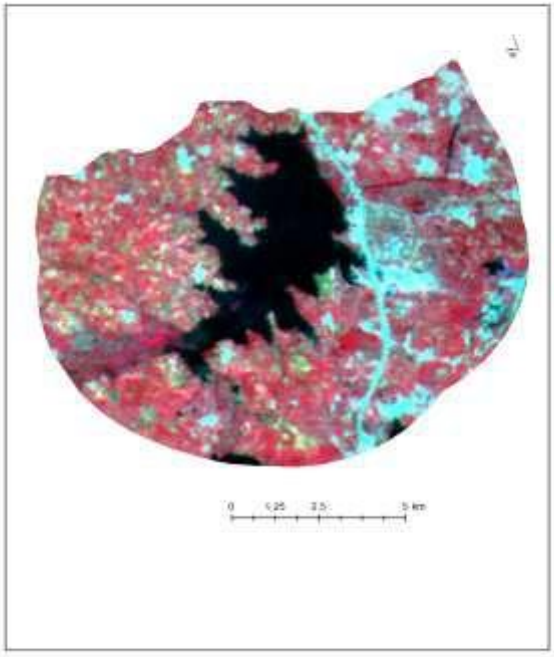

FIG: 5 IRS P6 AWIFS FCC Image of Himayatsagar Lake and its surroundings (November 2011)

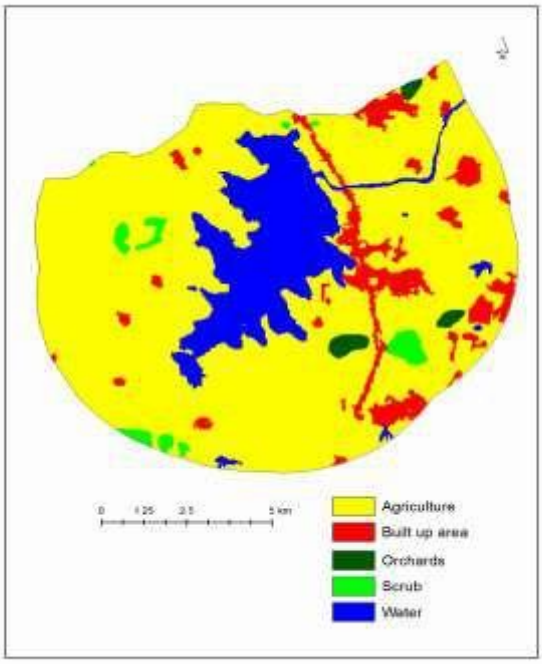

FIG: 6 Wetland Map of Himayatsagar Lake and its Surroundigs (November, 2011)

6. CONCLUSION

The total extent area of Himayat sagar as a whole is estimated to be 13,879 Ha. In the lake the total extent of water is about 2022.2 Ha. From the study it is evident that water spread area is increased and built up area showed wide expansion, where as agriculture land decreased from 2001 to 2011. It is clearly evident from remote sensing data an increase in built up area at present scenario in Hyderabad. In view of ecological significance of wetlands and long term conservation, mapping and monitoring is needed for sustainable management of natural resources.

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