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Assessment of Water Spread Area of Osmansagar using Remote Sensing and GIS

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Abstract: ***The present study of Osmansagar is a source of water for irrigation and drinking to twin cities. Keeping this in view the aims of this study therefore were to identify the past and present spatial extent of wetlands, their changing patterns, in water spread area during 2001 - 2011 using remote sensing and GIS of the Osmansagar lake with reference to reveal the qualitative and quantitative changes in wetland during the past ten years and for analyzing the primary causes.***
Keywords: GIS, Remote sensing, Osmansagar, Water spread area, Land use.

I. INTRODUCTION

The Remote Sensing means the sensing of the Earth's surface from space by making use of the properties of electromagnetic waves emitted, reflected or diffracted by the sensed objects, for the purpose of improving natural resources management, land use and the protection of the environment.

Remote Sensing Technology makes use of the wide range Electro-Magnetic Spectrum (EMS) from a very short wave "Gamma Ray" to a very long 'RadioWave' 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 (Cowardin and Myers 1974; Scarpace et al. 1981; Bancroft and Bowman 1994). Various studies have been realized to assess the land use evolution and its environmental impacts by applying various methods (Abdulkareem et al. 2018; Barakat et al. 2018a, b; Zadbagher et al. 2018 Hegazy and Kaloop 2015).

Classification is a fundamental task for RS applications (Kettig and Landgrebe 1976; 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 (Castaneda *et al.*, 2005; Hung andWu 2005; Sridhar *et al.*, 2008). With GIS, the maps can be updated on a constant basis and it provides the managers more current data than what was previously available. With GIS technology, the average age of the information in the database could be reduced from 20 years to only a few months.

II. STUDY AREA

Osman Sagar popularly known as Gandipet was created by constructing a dam on the Musi River in 1920, to serve as drinking water reservoir for Hyderabad, and also to save the city from the disastrous floods, witnessed when Hyderabad suffered in 1908. It was built during the reign of the VIIth Nizam of Hyderabad, Mir Osman Ali Khan; hence it is named after him. The Osmansagar catchment comprising Vikarabad, Shankerpally,

Appajiguda, Mahajanpet, Chandangar, Khanapur, Janwada, Reddypally, Kollur is spread over 280 sq. miles. The maximum capacity of 1.05 lakh cusecs and the latter. In June 2012, the water level at Osmansagar was 1769.8 feet. On October 1(2012), the water level was 1771.8 feet, an increase of a mere 2 feet. Similarly, In October 2011, the water levels at Osmansagar 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 wetland of Osmansagar 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 wetland due to natural and anthropogenic influences.

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III. METHODOLOGY

A. *Material*

In order to compare the water body of Osmansagar image of, ETM 29th October 2001 and 11th November 2011 data were used. 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.

B. *Software Used*

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. GIS tools, such as area of interest (AOI) were applied to the data using visual analysis, reference data as well as local knowledge to split and record these covers so they more closely reflected their true classes (Dewan, 2009). By applying these techniques, the result obtained using unsupervised classification which ultimately improved the output results. Classified images were analyzed using ArcGIS 9.2 software. With some additional shape file of permanent water body and final output maps of wetland of different years were pre-pared in GIS environment. SOI maps served purpose of delineating the basin boundary and stream networks and authentication of various features on the satellite image.

IV. RESULT

A. *Landuse And Cover*

In the beginning of 2001 to 2011 the total extent area of Osmansagar wetland of Hyderabad as a whole is estimated to be 16,113Ha (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 Osmansagar of total geographical area most of the land use is under agriculture (65.9% of area 10,612 Ha as this is main occupation of people, scrub is a vegetative cover predominantly occupied by shrubs with crown density 10.4%. It is the third most dominant vegetative class covering an area of 1672.7 Ha in Osmansagar, Water land occupies significant area, which is about 12.8% and which second dominant class covering an area of 2057 Ha. Orchids land contributes significantly to the land cover Osmansagar with 2.1%. (Fig – 1a, 1b).The lake total extent of water occupy is about 2057 Ha.

Table: 1
STATUS OF WETLAND AND OTHER LAND USE OF OSMANSAGAR LAKE AND SURROUNDINGS (AREA IN HA.)

S.No	Class	Area in 2001	Area in 2011
1	Water	1755	2359
2	Scrub	1728	1618
3	Built up area	1128	1727
4	Agriculture	11153	10071
5	Orchards	349	339
2011		16113	16113

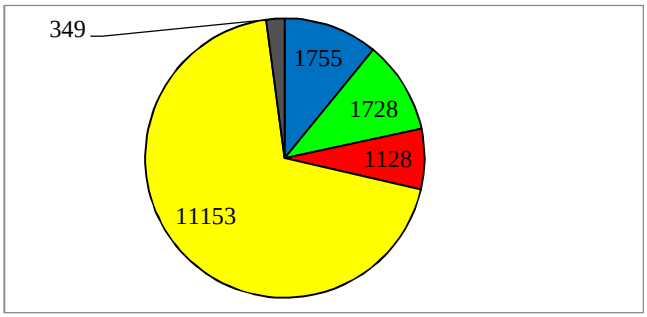

Fig. 1a Wetland and other land use of Osmansagar lake (Area in Ha) 2001

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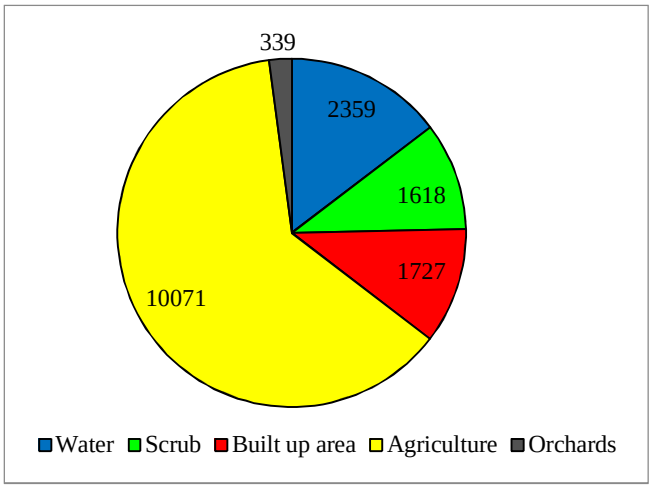

Fig. 1b Wetland and other land use of Osmansagar lake (Area in Ha) 20011

V. DISCUSSION

A. Time Series Analysis

Using time series analysis it is observed that changes were occurred. In comparison to previous and following decades an ever increasing trend of wetlands is found in between 2001 and 2011. An area of water 1755 Ha in 2001 was increased to 2359 Ha by 2011 and mostly agriculture land has been converted. An area of 110 Ha of scrub is converted to built up area by 2011. Built up area was increased to 1128 Ha to 1727 Ha as compared with time period of 2001.Urban expansion has been encroaching in the areas to cope with population growth, is the main reason for the increase of areas. (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 area were significant over the ten years (Fig-3,4,5,6). From the study it is evident that area of drinking water body of Hyderabad city found to be increased. Significant correlation of gain of wetland are also found with increasing 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 Osmansagar Lake(2001 To 2011)

S.No	2001/2011	Water	Scrub	Built up area	Agriculture	Orchards	2001
1	Water	1755	0	0	0	0	1755
2	Scrub	0	1618	110	0	0	1728
3	Built up area	0	0	1128	0	0	1128
4	Agriculture	603	0	479	10071	0	11153
5	Orchards	0	0	10	0	339	349
2011		2359	1618	1727	10071	339	16113

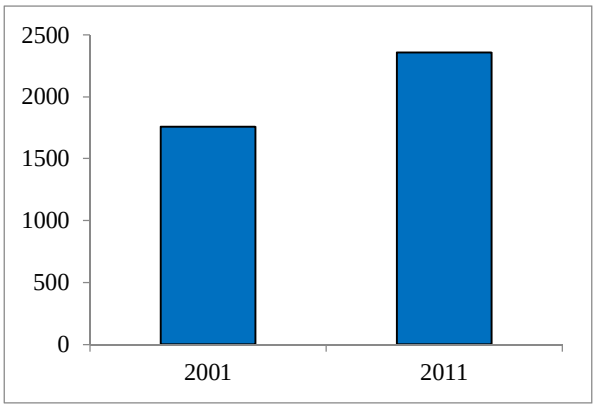

Fig : 2 Dynamics in extent of water in osmansagar lake (2001-2011)

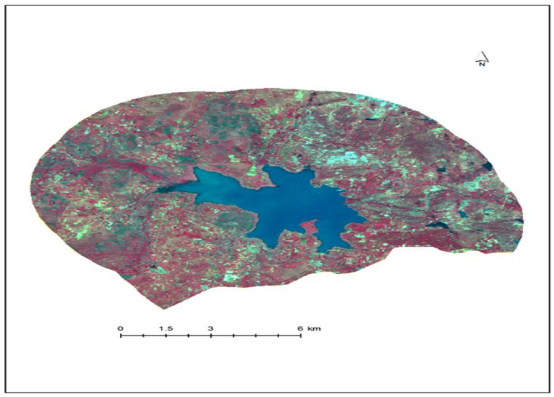

Fig: 3. Landsat Etm Fcc Image Of Osmansagar Lake And Its Surroundings (October 2001)

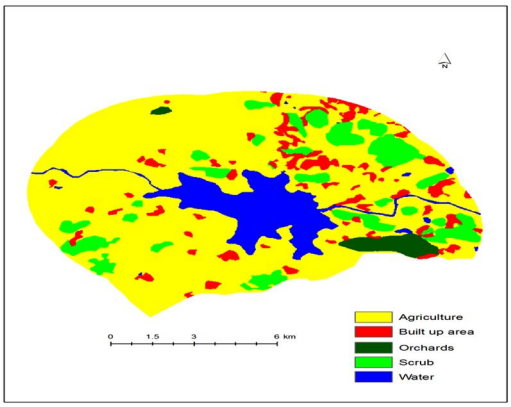

Fig: 4. Wetland Map Of Osmansagar Lake And Its Surroundigs (October, 2001)

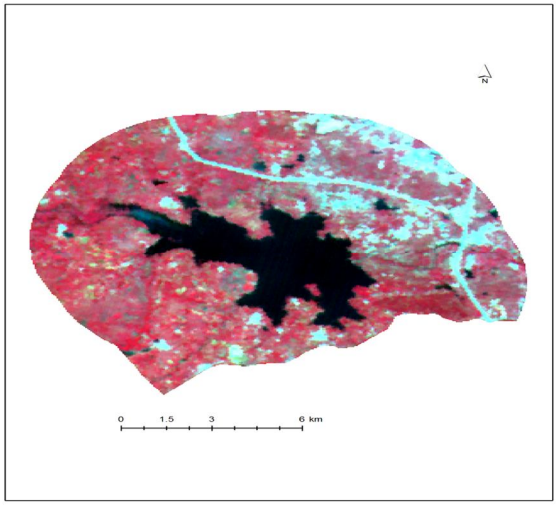

Fig: 5. IRS P6 Awifs Fcc Image Of Osmansagar Lake And Its Surroundings(November 2011)

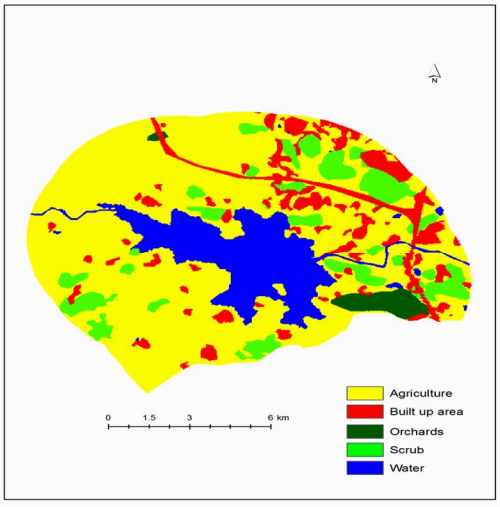

Fig: 6 . Wetland Map Of Osmansagar Lake And Its Surroundings (November, 2011)

VI. CONCULSION

The total extent area of Osman sagar as a whole is estimated to be 16,113Ha. In the lake the total extent of water is about 2057 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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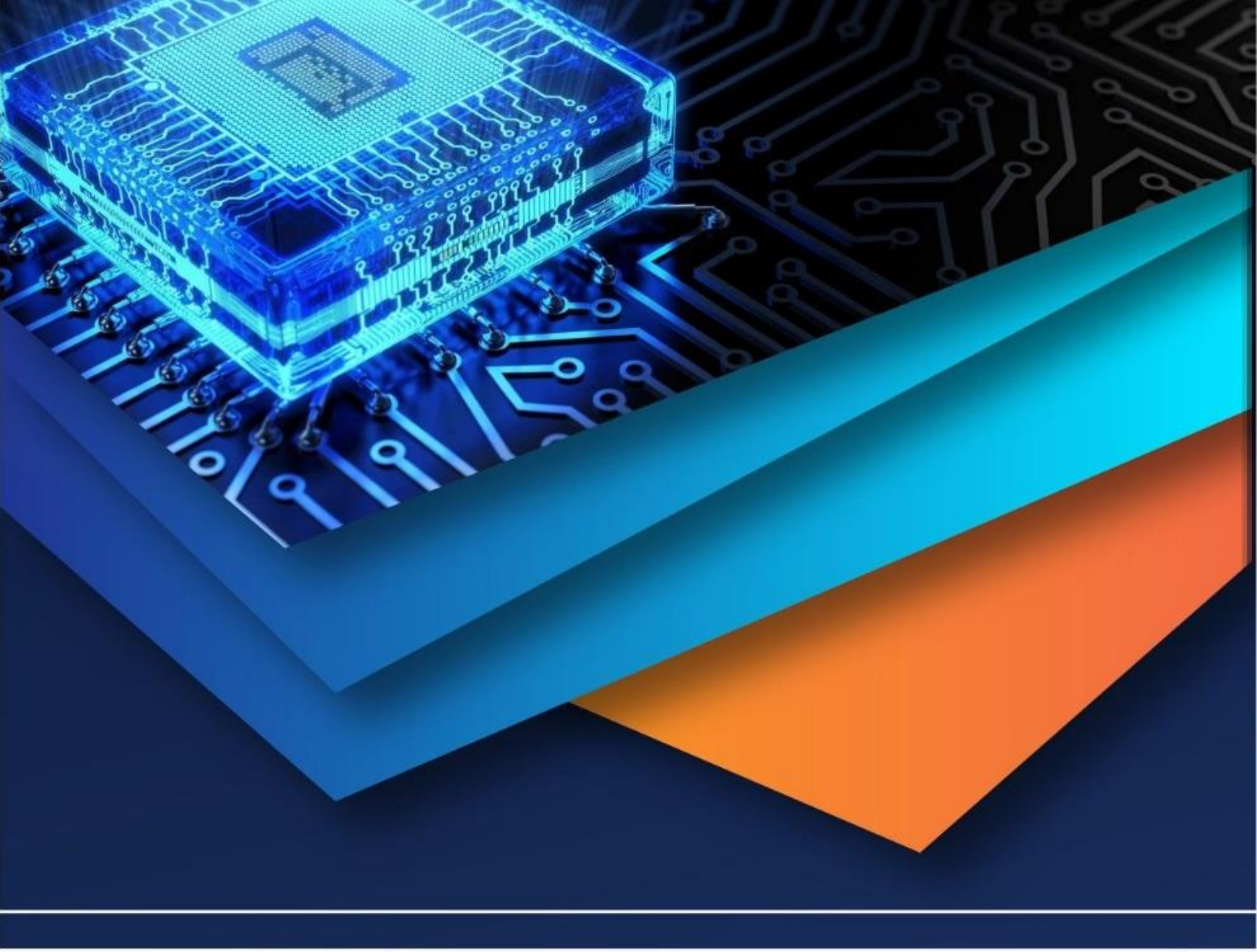

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