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Change Detection Matrix in Land Use and Land Cover Classification using GIS

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Abstract: ***Land Use (LU) and Land Cover (LC) have predominant roles in the part of urbanization. The LU and LC represent crucial factors in geographical studies, environmental analysis and spatial planning approaches. They are dynamic variables reflecting the interaction between socio-economic activities and regional environmental changes. The present study aims to find out the improvement of Infrastructure growth in Chennai district. The satellite imageries Landsat4-5TM C1 Level-1(2010), Landsat 8 OLI/TIRS C1 Level-1(2020) data's have been used to identify the changes in water bodies, plantation, forest area, urban land and barren land. The land use and land cover maps have been prepared by using GIS software to gauge the changes.***
Keywords: Land use and land cover, Urbanization, GIS, Satellite image, Infrastructure growth.

I. INTRODUCTION

Land-use and land-cover (LULC) change has become a fundamental and essential component in current strategies for monitoring environmental changes and managing natural resources. Land use and land cover studies could be a ground survey and made by Satellite imagery. Land use / Land cover exhibit the physical and economic situation of any region. The development of human race started to convert the land cover region to land use. Careful section of techniques is important as it must suit the satellite data. Moreover, different changes in the techniques may highlight different types of Land use and Land cover change. The Satellite land cover change information provides an inventory level of data indicating location, nature and extent of change. In order to obtain this information and to contribute effectively to sustain development strategies, it must be integrated into a database in which the process, effects and inter-actions of change with the surrounding environment that can be identified and assessed. Descriptive data on natural and socio-economic components accruing in the study area, including Remotely Sensed data, are collected through Geographic Information System (GIS). The change detection techniques have been developed (Jensen et al 1983) by means of visual interpretation of the Satellite imagery in a digital format. Remote sensing and GIS are being increasingly used in resources evaluation and planning (Rajesh et.al 2010).

II. STUDY AREA

The study area is located in Chennai District from Tamil Nadu. It is the most important urbanized block in Tamil Nadu. It is situated between 13.0827° N, 80.2707° E . It is one of the largest cultural, economic, and educational centres of south India. Aaccording to the census of India, Chennai city was ranked as the fifth-largest city and fourth populous urban agglomeration in India. The urban area of Chennai has increased from 1.46 to 18.55% in two decades (1991 – 2012), the vegetation cover has reduced by 22% during this period. The fast growth of the city in an unplanned manner has its impact on the social, political, economic, and ecological landscapes of cities. The intense development of Chennai city in the outskirts results in surrounding peri-urban areas which lack basic amenities. The district map and location maps are shown in fig(1). Fig.2. shows the layout of the Chennai map (study area).

A. Land Usage

In 2018, 14.9 percent of the city had a green cover, against the World Health Organization recommendation of 9 square meters of green cover per capita in cities. The city had a built-up area of 71 percent. Waterbodies cover an estimated 6 percent of the total area, and at least 8 percent of the area has classified as open space. In 2017, the total volume of water harvested was 339 mcft and groundwater recharge was 170 mcft.

Fig. 1 Location of map of the study area.

Fig. 2 Layout of Chennai map(study area)

III. OBJECTIVES

The following are the objectives of this study..

1) To understand the overall topography of the study area.
2) To Study the land use and land cover categories
3) To derive the land use and land cover categories from the past and present data
4) To collect the data from various sources
5) To compare the Land use Land cover change between the years 2010 and 2020.

IV. METHODOLOGY

1) Methodology

The land use and land cover studies involve mapping of different types of land use and land cover features from the satellite imagery. The success met with the land use and land cover mapping from imagery has encouraged the Researcher to rely on satellite imagery for obtaining accurate results.

The methods adopted for image classification are unsupervised classification, supervised classification and combined classification. This study analysed images adopting the supervised classification which is more accurate and feasible to work. In this study, imagery and shape files are mainly utilized for mapping.

A. Data source and method of analysis

The land use map/satellite images of the study area were obtained from USGS Earthexplorer (https://earthexplorer.usgs.gov), Landsat4-5TMC1Level-1(2010), Landsat 8 OLI/TIRS C1 Level-1(2020) + image at path (142) and row (51) with the cloud cover 6.87% which is less than 10%, spatial resolution of 30 m × 30 m, acquisition date (16-10-2010 and 07-07-2020). The satellite images were classified using ground truth points and Google Earth linkage with ERDAS Imagine 2015 software and Arcmap 10.3. This has been used to represent the land use according to the specific land cover types such as water bodies, plantation, forest,urban land and barren land.

B. Land use/land covers classification

The objectives of land use land cover are, to understand the general procedures of land cover classifications from satellite images, to conduct land cover classification from the Landsat4-5TM C1 Level-1(2010), Landsat 8 OLI/TIRS C1 Level-1(2020) using Supervised classification and to understand how the image classification accuracy worked well.

C. Satellite Image Data

The satellite images of the study area were downloaded from USGS earth explorer. The datasets were downloaded considering the time period between 2010 and 2020 having a cloud cover less than 10% to avoid the classification error.

D. Image pre-Processing

Satellite images need to be pre-processed prior to change detections. It is essential to establish a more direct linkage between the data and biophysical phenomena.

The methodology adopted for this study has various image pre-processing operations, including geometric correction, atmospheric correction, image enhancement and interpretation. The images collected have been layer staked. Many images used in IMAGINE cover a large area, while the actual area being studied can only cover a small portion of the image. The processing of data has been done with the ERDAS IMAGINE 2015.

E. Image Enhancement

Image enhancement increases the quality of satellite image. It is the process of making an image more readable for a particular application.

Enhancement makes important features of raw, remotely sensed data with more details to the human eye. Enhancement techniques are often used rather than classification techniques for feature extraction to study and locate areas and objects with useful information from images.

The image enhancement in this study are spectral enhancement and principal component analysis for the enhancement of identification of every land cover types. Spectral Enhancement options are image transformation techniques specifically designed for data containing quite one band.

Generally, these enhanced images are only utilized in visual analyses, while original images are used for automated analyses. In the present study, contrast stretching on the chosen images was applied to visually interpret them.

F. Land Classification

Prior to image classification, LULC features were categorized into five broad types: water bodies, plantation, forest, urban land and barren land and are given in Table 1.. These five types are identified based on the visual interpretation of the satellite imagery and verified from field inspection.

Table 1 LULC CATEGORIES

S.NO	CLASS	DISCRIPTION	COLOUR
1.	Water bodies	River, open water, lakes, ponds and reservoirs. Areas with surface water.	Blue
2.	Plantation	Commercial horticulture plantations, orchards and tree cash crops, single trees or plant.	Light green
3.	Forest	Woody vegetation with a percent cover >60% .Almost all trees remain green all year. Trees are presents densely.	Dark green
4.	Urban land	Land covered by buildings and other man-made structures	Red
5.	Barren land	Exposed soil, sand, rocks, or snow and never have more than 10% vegetated cover during any time of the year empty land.	Light violet

Based on the supervised classification, the images indicating the land classification in the study area are shown in Fig 3. And Fig 4. for the years 2010 and 2020 respectively.

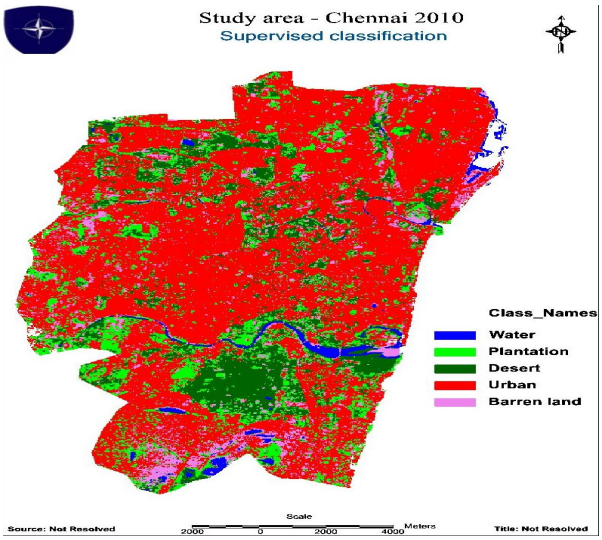

Fig.3.Supervised classification in study area Chennai-2010

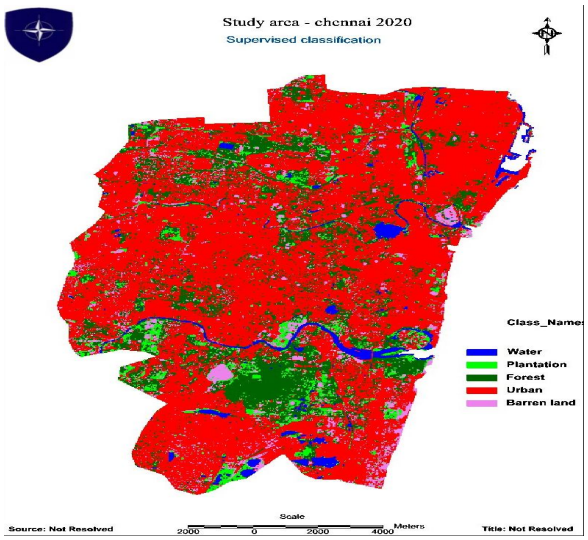

Fig.4.Supervised classification in study area Chennai -2020

G. Change Detection

Following are procedures adopted for detection and quantification of LU LC from images for the years 2010 and 2020. Spatial analysis was carried out to describe structural land use and land cover patterns, overall land use changes over the time period and measure the rate of change at the various land. Land cover change results were obtained by using ERDAS IMAGINE 2015 from Landsat4-5TM C1 Level-1(2010), Landsat 8 OLI/TIRS C1 Level-1(2020). In change detection, the maps are compiling with each other as shown in fig.5. This has been used to identify the changes between (2010-2020) for the land uses such as water, plantation, forest, urban and barren land.

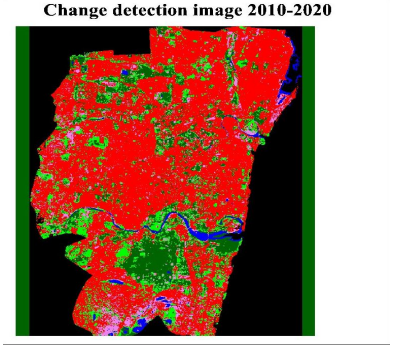

Fig.5.change detection image in study area Chennai: from 2010 to 2020

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V. RESULT

Five types of land cover classes have been identified from the satellite images of the area. The water bodies consist of river, open water, lakes, ponds and reservoirs. Areas with surface water are also considered as water bodies. Commercial horticulture plantations, orchards and tree cash crops, single trees or plant are considered as plantation. The forest covers woody vegetation with a percent cover >60%. Almost all trees remain green all year. Land covered by buildings and other man-made structures are coined as urban land. The barren lands are exposed soil, sand, rocks, or snow and never have more than 10% vegetated cover during any time of the year. Empty lands are also considered as part of barren lands.

The quantified land cover classes are given in change detection matrix as shown in Table 2. The percentage change in LULC between the years 2010 and 2020 is represented in Table 3 and Chart 1 .

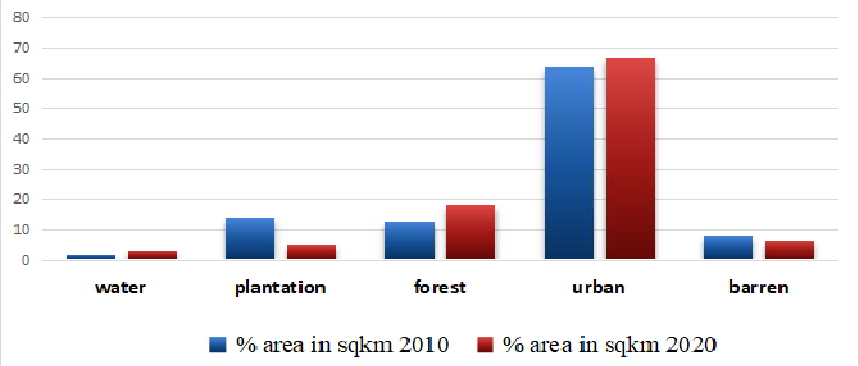
Table 2 Change Detection Matrix in SQ km

S.no	Class	water	plantation	forest	urban	barren	total 2020
1	Water	2.81	0.41	0.81	1.32	0.50	5.86
2	Plantation	0.20	4.48	3.12	1.22	0.52	9.55
3	Forest	0.15	7.81	15.55	11.31	1.08	35.90
4	Urban	0.28	9.50	3.83	104.51	10.96	129.08
5	Barren	0.12	4.61	1.17	4.41	2.21	12.53
	total 2010	3.57	26.81	24.47	122.78	15.28	192.91

Table 3 Percentage Change in LULC

land cover type	LULC 2010		LULC 2020		Change in % from 2010 to 2020
	area	% of area	area	% of area	
water	3.57	1.85	5.86	3.03	0.22
plantation	26.81	13.89	9.55	4.95	-8.94
forest	24.47	12.68	35.9	18.14	5.46
urban	122.78	63.64	129.08	66.91	3.27
barren	15.28	7.92	12.53	6.49	-1.43

Chart 1: Percentage Change in LULC

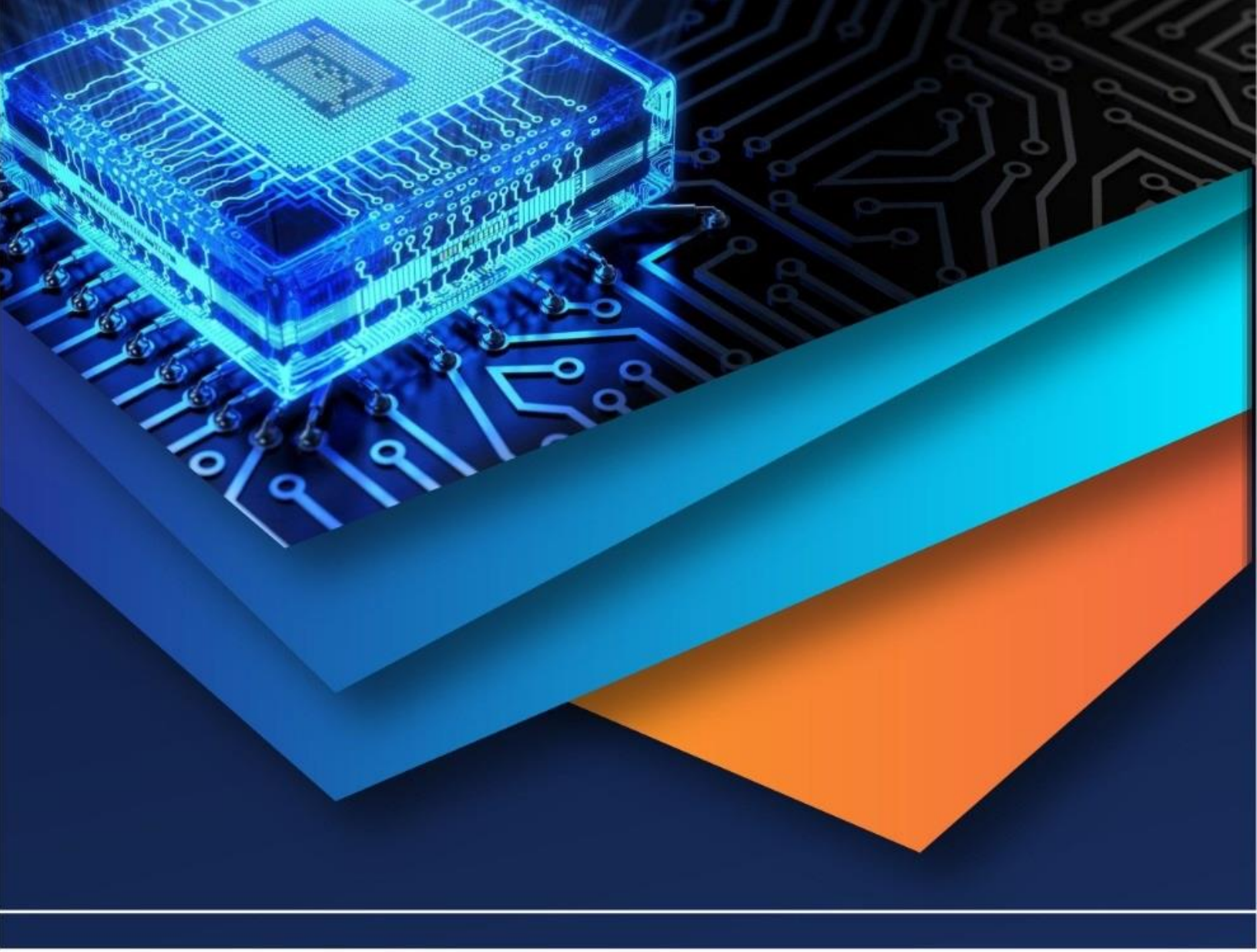


VI. CONCLUSION

The change detection between 2010 and 2020 in land use and land cover for Chennai district has been identified and quantified with the help satellite images of the respective years. It is observed that there has been increase in LULC with respect to water bodies, forest and urban land categories. There is significant decrease in plantation which requires attention to prevent the same. Considerable reduction in barren land also observed due to the Infrastructure development.

REFERENCES

[1] Land Use Change Detection Using Remote Sensing Technology Tesfa Gebrie Andualem*, Gizew Belay and Adebabay Guadie Department of Hydraulic and Water Resources Engineering, Debre Tabor University, Ethiopia
[2] Land Use Change Detection Using Remote Sensing Technology Tesfa Gebrie Andualem*, Gizew Belay and Adebabay Guadie Department of Hydraulic and Water Resources Engineering, Debre Tabor University, Ethiopia
[3] Detecting land use and land cover changes of Thanjavur block in Thanjavur district, Tamilnadu, India from 1991 to 2009 using geographical information system.
[4] Land-Use and Land-Cover (LULC) Change Detection in Wami River Basin, Tanzania
[5] Prakasam C (2010) Land use and land cover change detection through remote sensing approach: A case study of Kodaikanal Taluk, Tamil nadu, India. International Journal of Geomatics And Geosciences 1: 150.
[6] Shiferaw A, Singh KL (2011) Evaluating the land use and land cover dynamics in Borena Woreda South Wollo Highlands, Ethiopia. Ethiop J Bus Econ 2: 1.
[7] Sarma VVLN, Murali Krishna G, Hema Malini B, Nageswara Rao K (2001) Landuse/landcover change detection through remote sensing and its climatic implications in the Godavari Delta Region. J Indian Soc Remote 29: 85-91.
[8] Pandian M, Rajagopal N, Sakthivel G, Amrutha DE (2014) Land use and land cover change detection using remote sensing and GIS in parts of Coimbatore and Tiruppur districts, Tamil Nadu, India. J Indian Soc Remote 3: 1. .
[9] Imbernon, J (1999) Pattern and development of land-use changes in the Kenyan highlands since the 1950s. Agriculture, Ecosystems & Environment 76: 67-73.
[10] Shalaby A, Tateishi R (2007) Remote sensing and GIS for mapping and monitoring land cover and land-use changes in the Northwestern coastal zone of Egypt. Appl Geogr 27: 28-41.
[11] Dewan AM, Yamaguchi Y (2009) Land use and land cover change in Greater Dhaka, Bangladesh: Using remote sensing to promote sustainable urbanization. Appl Geogr 29: 390-401.
[12] Wyman MS, Stein TV (2010) Modeling social and land-use/land-cover change data to assess drivers of smallholder deforestation in Belize. Appl Geogr 30: 329-342.
[13] Sage C (1994) Population and income. In: Meyer W.B. and Turner B.L. (Eds) Change in land use and land cover. A global perspective. Cambridge University Press, Cambridge, UK. pp: 263-285.



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