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Mapping And Change Detection Analysis Of Land Use / Land Cover By Using Geospatial Technologies

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Abstract: The pattern of land use and land cover of any province is result of socioeconomic and natural components which are making use by human being in the space-time. Land cover change is a crucial treat of universal replace. The analysis and modeling of land cover change is required to the assessments of consequent changes. The use of remote sensing and GIS techniques has become increasingly important in describing data sets and their applications to estimate changes in the landscape. In this research study, land use / land cover mapping along with change detection analysis of Vempalli Mandal of Cuddapah District was done using Remote Sensing and GIS techniques. Temporal spatial data of Indian Remote Sensing Satellite data sets have been used to map the land use / land cover. Change detection analysis carried out by using satellite imageries of 2004 and 2011. Digital image processing and image processing techniques are used for classification of land use / land cover analysis. Present research focuses the significance of geospatial technologies and digital data modules to interpret the land use change detection of the study area.

Index Terms **- Geospatial Technology, LISS-III, Land Use / Land Cover Classification, Change Detection.**

I. INTRODUCTION

The place land is one of the significant natural resources. Many living things and huge amount of growth level activities are happening on the surface of the land. It is very crucial to understand, estimate the land for further purposes. Land cover change has been identified as one of the most important factors of changes in ecosystems. Land use / Land cover changes have impacts on a wide range of environmental and landscape attributes. These changes result from population growth and migration of poor rural people to urban areas economic development. However, information on the consequences of land cover change for services and human needs at regional scale is largely absent. Land use / land cover change is analyzed from unlike aspects in order to recognize the mechanics of land use / land cover change, action and outcomes. LU / LC changes have become major elements in the present plan action for the management of resources and tracking the environment change (Kiran VSS, 2013). Land cover change patterns are helping in generation of disaster action plans and finding new zones which are fit for the development schemes (Balamurugan G and M.S.Aravind, 2015). The main cause and concern for the degradation of land, water and air, which leads to change in climate and biodiversity, is people's unplanned development (Muthusamy S et al, 2014). Geospatial technology plays a vital role in the management of natural resources and environment, and sustainable development. For making any development plans, LU / LC patterns with spatial distribution and time scale changes over a period are prerequisite (Srimani. P.K. and Nanditha Prasad, 2013). Applications of geospatial technology make it potential to analyze the change patterns in land use / land cover in quick time with less price. This tool provides systematic procedures for the modeling and planning of land use analysis (Sunandana Reddy M, 2015 and Prakasam C, 2010). Remote Sensing & GIS technologies permits

investigations and spatial tracking where the comprehension of the authorities can be consolidated (Abate S, 2011).

1.1.Objectives and Scope

The fundamental objectives of studying land use / land cover is to investigate the social, economic and spatial causes of changes so that proposals can be made on the suitable use of land and patterns of development. Land use / land cover change detection studies coupled with spatial analysis serves as an effective tool for scientists and policy makers for efficient land management plans. Geospatial Technology plays a vital role by offering an advantage of rapid data acquisition for land use land cover mapping. Remote sensing and Geographical information systems are well established information tools, the value of which for applications in land and natural resources management are now widely recognized.

To prepare the land use / land cover map and change detection analysis over a period of 7 years using satellite images of years 2004 and 2011. The goal of the work is also to map and monitor the land use / land cover and identify the area of changes occurred during the period. Land use and land cover change mapping will help to take up clear strategies for managing natural resources and monitoring environmental changes. Information like knowledge of drainage, land use/land cover and hydro geomorphology and other terrain attributes are important for planning and management activities. Geospatial technologies have demonstrated to be successful tool in the development and planning for the management of Water and Land Resources.

II. MATERIALS AND METHODS

2.1. Study Area

The study was conducted in Vempalli Mandal of Cuddapah District, Andhra Pradesh. Area is situated between co-ordinates of 140 15' to 140 15' N Latitude and 780 15' to 780 45' E Longitude included in Survey of India toposheets no. 57 J/7 and 57 J/11. Study area is in SW part of Cuddapah District with a geographical area of 172 km2. It has an average altitude of 201m above sea level. The annual rainfall in this area is only 675mm. Research area is a part of Cuddapah basin geologically. Location map is given in the figure (Fig.1).

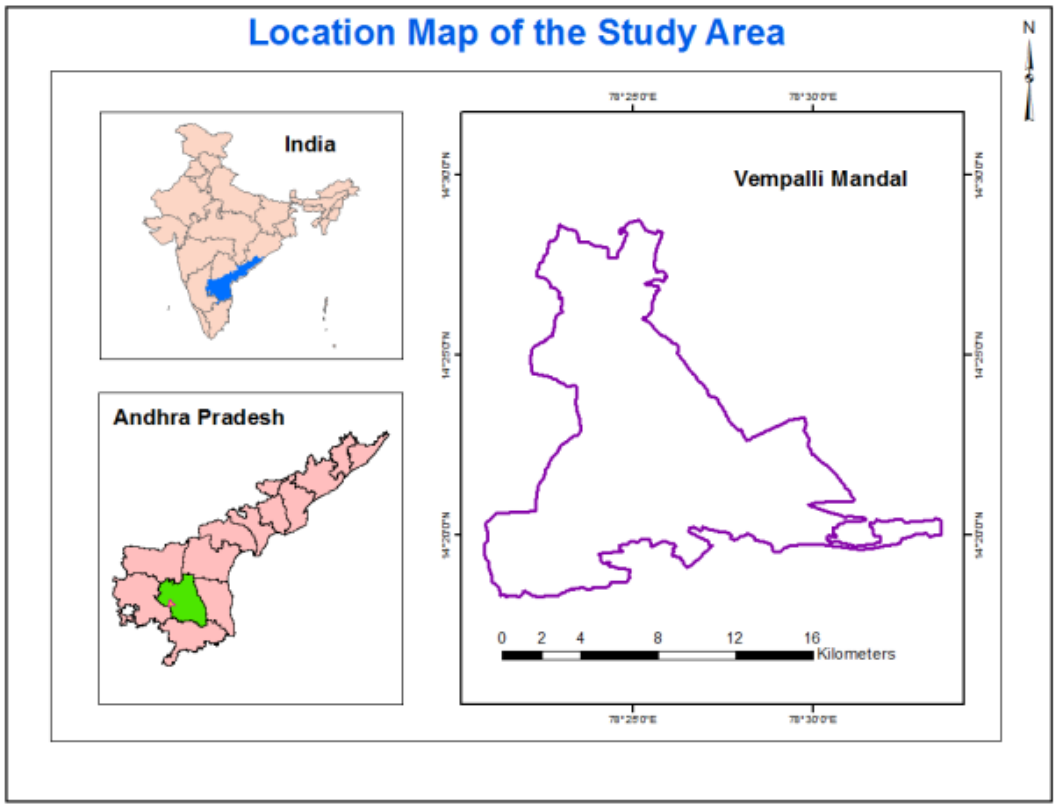

Fig.1: Location Map of the Study Area

2.2. Materials used

The area of 172 km2 was delineated and classified by using the pairs of Indian remote sensing satellite images. IRS-ID, LISS-III data of 2004 and Resourcesat-2, LISS-III of 2011 are used to classify the study area. All the data were used in this research were projected to the Universal Transverse Mercator (UTM) projection system in 1:50000 scale. ERDAS IMAGINE and ArcGIS are used at data processing, image enhance, data preparation, mapping and classification.

2.3. Methodology

Land use land cover patterns for 2004 and 2011 were mapped by using LISS-III data. The land use / land cover classification system through supervised classification is employed with the field information (Prakasam C, 2010). An attempt has been made to prepare land use land cover maps from remote sensing data for the years 2004 and 2011 applying supervised classification as well as change detection techniques to determine the changes in different types of classes. A supervised signature extraction with the maximum likelihood algorithm was employed to classify the images. The process of image classification is to assign the pixels of a raster image to predefined land cover classes. The LU / LC classes of the study area are agriculture land, land with or without scrub, built up land, deciduous forest, forest scrub, barren area, mining area, plantation and water bodies (Machireddy, 2019). The general technique of image classification is to allocate the pixel values of a raster to pre-defined land use / land cover system (George J et al, 2016). The basic way of image classification is by visual interpretation. The process of methodology is arranged in the given figure (Fig.2).

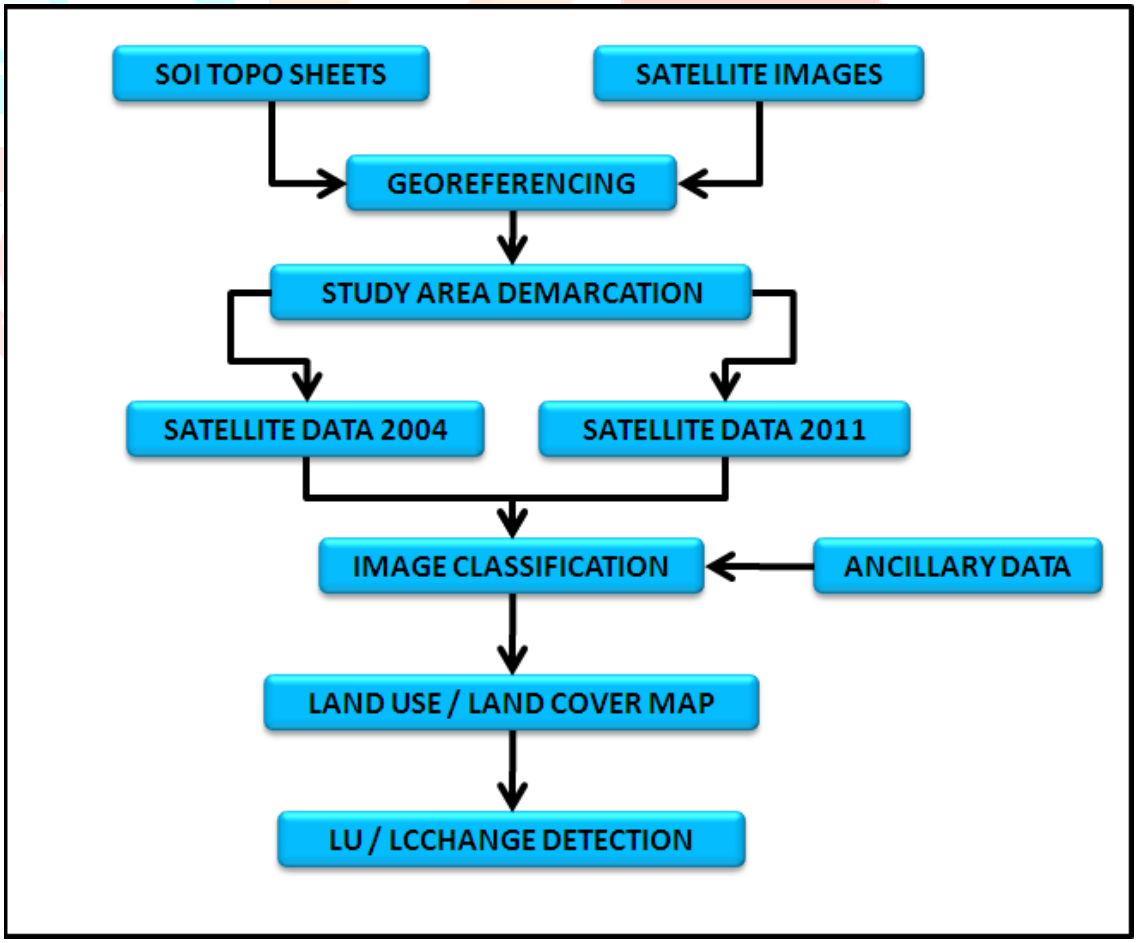

Fig.2. Flowchart of LC / LC mapping

Land use / land cover interpretation key using satellite imagery is extracted as per Manual of Nationwide Land use / Land cover Mapping using Satellite Imagery published by National Remote Sensing Agency (NRSA).

III. RESULTS AND DISCUSSIONS

In the present area, LISS-III satellite imagery of different years (2004 and 2011) were classified and compared for the land use / land cover analysis. The land use / land covers of the Vempalli Mandal are given in the following figures (Fig.3 and Fig.4), which are obtained from the supervised classification of satellite images. The findings of the present study area are tabulated in the given table (Table.01).

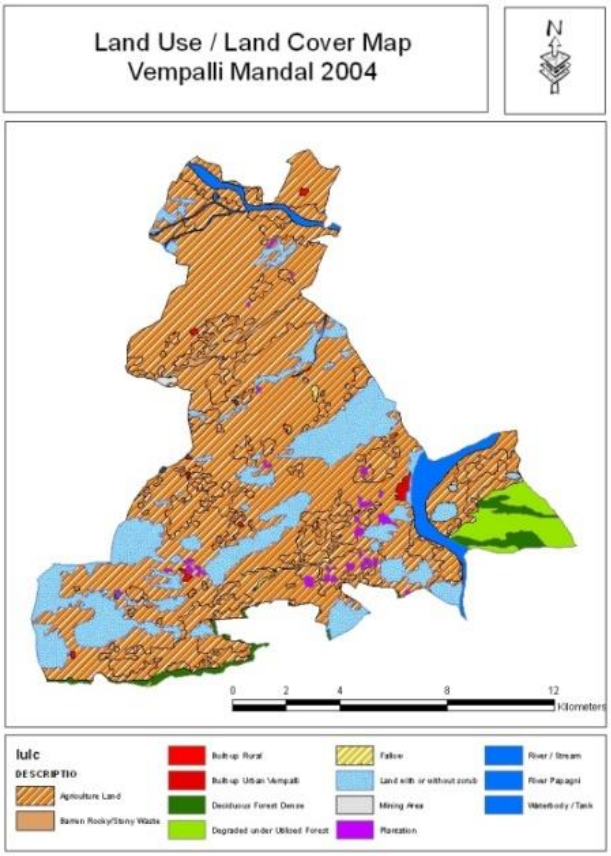

Fig.3. LU / LC Map of the study area (2004)

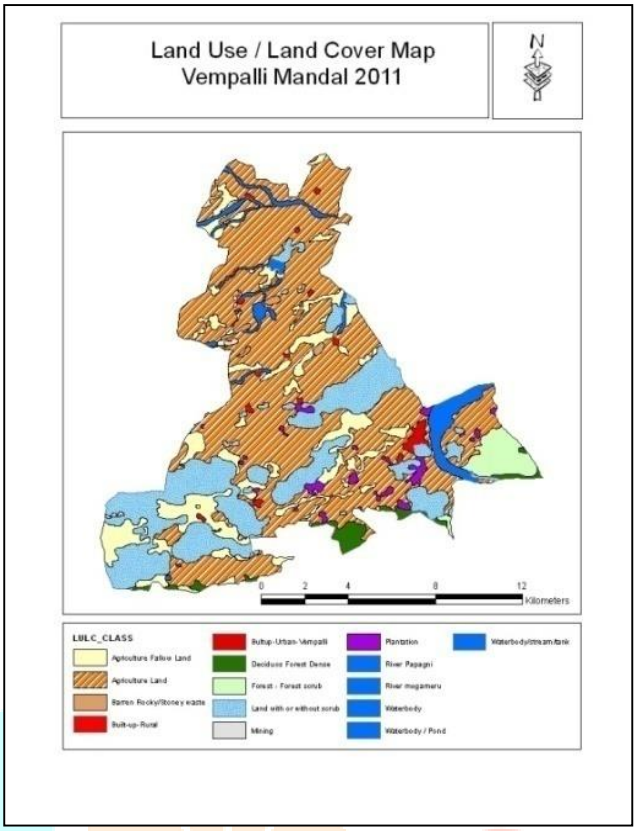

Fig.4. LU / LC Map of the study area (2011)

The major land use class of the research area is agriculture land. It occupied 72.38% of the total area in 2004 and 66.37% of the area in 2011. Agriculture land got reduced from 72% to 66% with respect to total area may be due to less rainfall and migration of people from agricultural sector. Built up land, land with or without scrub land and plantation area are increased due to population growth and human activities even for sustainable development activities like plantation.

Table 1: Land Use / Land Cover statistic of Vempalli Mandal, 2004 – 2011

Year	2004		2011		Change
LU / LC Class	Km^2	%	Km^2	%	%(2004-2011)
Agriculture Land	124.72	72.38	114.36	66.37	- 6.01
Barren Rocky / Stoney waste	0.72	0.41	0.72	0.41	0
Built-up Land	0.67	0.38	1.71	0.99	0.61
Deciduous Forest	3.64	2.11	3.25	1.88	- 0.23
Forest Scrub	5.28	3.06	5.02	2.91	- 0.15
Land with or without scrub	29.59	17.17	36.59	21.23	4.06
Mining	0.19	0.11	0.24	0.14	0.03
Plantation	1.59	0.92	2.51	1.45	0.53
River / Water body	5.89	3.42	7.89	4.58	1.16

The varying trend of both land use / land cover classes over a period of 7 years is shown in the graph (Fig..3). The main objective of this research study was to evaluate and quantify the land use / land cover changes that have taken place over Vempalli Mandal from 2004 to 2011 using remote sensing and GIS technologies. From the results obtained considerable changes observed and interpreted from 2004 to 2011. The percentage area of each LU / LC classes are represented in the following pie diagrams (Fig.5 and Fig.6).

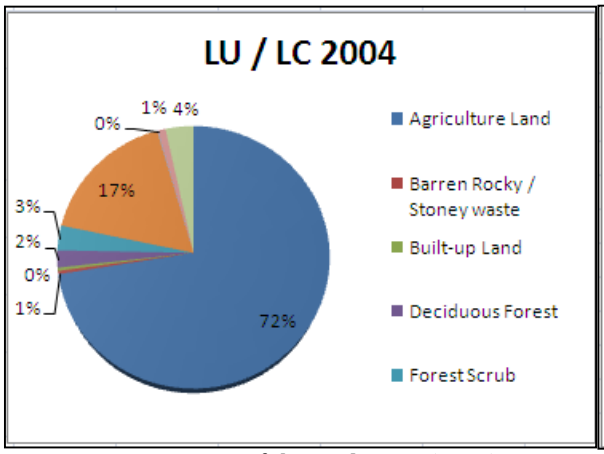

Fig.5. LU / LC Map of the study area (2004)

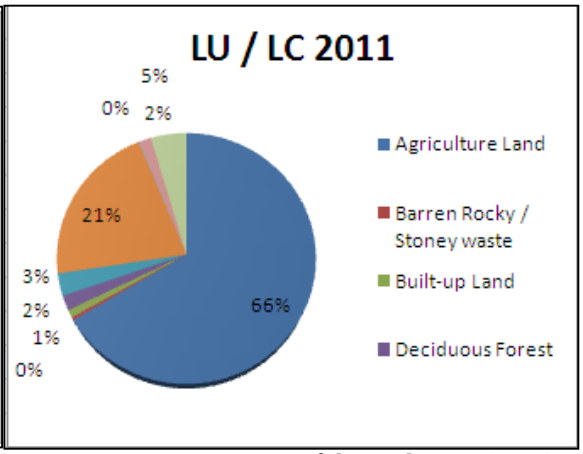

Fig.6. LU / LC Map of the study area (2011)

LU / LC Class		2011									
		Agriculture Land	Barren Rocky/ Stoney waste	Built-up Land	Deciduous Forest	Forest Scrub	Land with or without scrub	Mining	Plantation	River / Water body	Grand Total
2004	Agriculture Land	**98.14**	0	0.78	1.76	2.24	20.37	0.01	0.68	0.74	124.72
	Barren Rocky / Stoney waste	0	**0.72**	0	0	0	0	0	0	0	0.72
	Built-up Land	0.12	0	**0.24**	0	0	0.25	0.04	0.01	0.01	0.67
	Deciduous Forest	0.59	0	0.05	**1.49**	0.47	1.02	0.01	0.01	0	3.64
	Forest Scrub	1.86	0	0.07	0	**1.77**	1.04	0	0.42	0.12	5.28
	Land with or without scrub	13.65	0	0.49	0	0.41	**13.86**	0.08	0.54	0.56	29.59
	Mining	0	0	0.05	0	0	0.04	**0.1**	0	0	0.19
	Plantation	0	0	0.03	0	0.01	0.01	0	**0.85**	0.69	1.59
	River / Water body	0	0	0	0	0.12	0	0	0	**5.77**	5.89
	Grand Total	114.36	0.72	1.71	3.25	5.02	36.59	0.24	2.51	7.89	

Table 2: Land Use / Land Cover change matrix of Vempalli Mandal, 2004 – 2011

Change matrix shows the key facts regarding the spatial pattern of changes in LULC (Mishra K et al, 2019). Change matrix presenting the LC changes in each period prepared using rectified LISS-III images of 2004 and 2011 to judge the general changes in LU / LC classification system between 2004 and 2011. The major changes occur during the time gap between 2004 and 2011 are tabulated in the given table (Table.02). Comparative analysis of change detection values or classes is projected in the same table with comparison. The changes of each class with respect to previous classes of 2004 are listed with their percentages. These changes can give clues to identify the causes happened during the 2004 and 2011. According to the present scenario, policy makers can prepare action plans for the sustainable development.

IV. CONCLUSIONS

Mapping and monitoring of land use / land cover is important for many management and planning activities for understanding the earth and its whole system. The present research study shows how well LU / LC classification and its change analysis of the year 2004 and 2011 of the study area can be easily carried out using geospatial technology for the sustainable development. Present study area is evaluated and observed the LU / LC changes in the form of patterns in Vempalli Mandal of Cuddapah District using satellite data (LISS-III) from 2004 and 2011. The result showing that there is noticeable increase in scrub land, built-up land and plantation. The results revealed that area under agriculture land, deciduous forest and forest scrub are decreased. Hence, tools of geospatial technology are utilized to find out the trends in the form of changes of LU / LC pattern. Particulars on LU / LC and probabilities for optimal usage are mandatory for the strategies of land classification to meet the requirements of human being. Geospatial information of both verifiable and present time are critical for assessing and observing changes in LU / LC boundaries which are very useful in

demonstrating LU / LC through situation advancement, main thrust examination, model definition, and model approval.

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