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Land Use/Cover Mapping of Bheemili Beach Road, Visakhapatnam District, Andhra Pradesh using Geospatial techniques

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***Abstract*— Quickly progressing geospatial technologies like Remote Sensing, Geographic Information Systems and Global Positioning System offer a proficient, convenient and advantageous methodology for mapping resulting from its wide area coverage; giving information about inaccessible areas and timely repetitive coverage of the same area. In the present study, the land use/cover mapping of Bheemili beach road, Visakhapatnam district in the province of Andhra Pradesh has been carried out on IRS-1D, LISS-III satellite image with standard visual interpretation strategies. The identified land use/cover features are beach, deciduous forest, single and double crop, fallow land, gullied land, marine sand dunes, non-perennial tank, perennial tank, plantation, reservoir, main river courses, rural and urban built-up land, scrub forest and un-irrigated land. Maximum area is covered by deciduous forest (26.63%) followed by scrub forest (15.07%), gullied land (13.26 %) and double crop (11.02%). The other land use/cover classes individually cover less than 10% of the Total Geographical Area.**

***Keywords*— Remote Sensing, Geographic Information Systems, Global Positioning System, land use, land cover, Total Geographical Area.**

I. INTRODUCTION

India had the refinement of being the world's biggest economy in the advent of Christian times as it represented around 17% of the total populace. Land is essential for human survival since it is open for people with living space to fulfil each and every required need of humankind like sustenance and other raw materials which are utilized in the satisfaction of his needs. It is the key factor for human headway. Land utilities like environment, water, soil, topography are not identical on the earth; along these lines, diverse country activities of humankind are constrained. The unparalleled addition in people advancement has achieved the extending demands for sustenance, feed and safe house resources. This calls for level-headed use of the accessible land especially in a nation like India where farming is the only means of livelihood for majority of individuals. Such examinations are essential for future organizing and thus the examination of its characteristics is critical in planning the administration and improvement designs. The word "land use" describes how much land distributed on the ground is being utilized. This has been related to economic activity which can often be changed. "Land cover" denotes the permanent features such as water bodies, rocky knobs, forest lands etc. This is more or less a permanent feature and within the land cover often land use may take place. E.g. agriculture activities in forest area, lumbering in forest area. Both these terms are associated, perfect and dynamic in nature that gives an entire perception of the correspondence and relationship of manmade activities with the earth.

In the present days, progressed geospatial innovations like Remote Sensing, Geographic Information Systems and Global Positional System are excellent tools for mapping the land use/cover and provide accurate information to understand the dynamics of land use due to human activities. Numerous scientists have completed the land use/cover examination through visual or computerized translation of satellite data. Most extreme probability procedure for mapping land use/cover of Ramnagar town, situated in the lower region zone of the Uttarakhand state and categorization into five different classes, viz. built-up area, vegetation, agricultural land, water bodies and sand bar [10]. Landsat MSS, Landsat TM and IRS-P6-LISS III satellite imageries to evaluate the land use and land cover changes through visual understanding methods and detailed investigation conveyed for as far back as 36 years in Nilgiris district of Tamil Nadu state during the periods 1973-2009 [5]. Land use/cover using LISSIII sensor data of IRS P6 satellite through visual translation and connected to

socioeconomic data of submergence area of Polavaram in the state of Andhra Pradesh [8]. Critically assess the distinctive land use/cover types spread on different landforms and to ponder the impact of the physical factors on the kind of land use using IRS LISS III of the Chintapalli, Visakhapatnam district, Andhra Pradesh [7]. The diverse kinds of land use/cover categories i.e. crop land, dense forest, fallow land, barren rocky land with or without scrub, plantations and water bodies of Madurai district in Tamil Nadu [1]. The point by point data about the degree and spatial data of different land uses can be helpful for viable planning for future by considering the present example of land use and factors responsible for its change [9]. Land use/cover categories can be delineated on remote sensing data on different scales for sustainable development of an area (Bishat et al., 1995, Brahmabhatt et al., 2000, Bansal, et al., 2008). In perspective of this, the general land use /cover patterns of Visakhapatnam area was identified using these geo-spatial technologies.

II. STUDY AREA

The area of investigation is located in between 17^0 73^1 and 17^0 80^1 North latitude and 83^0 32^1 and 83^0 45^1 East longitudes. Geographically, the area is covering 236 km^2 out of which approximately half of the area covers under the jurisdiction of GVMC and rest comes under the Bheemili municipality. The study area is a part of Visakhapatnam and Bheemili municipalities of Visakhapatnam district of Andhra Pradesh. The study is confined to recent expansion of four lane roads connecting between Visakhapatnam to Bheemili. The road is laid adjacent to the sea coast of Bay of Bengal and it is under the natural vagaries of sea coast on one side and land and its natural activities on the other side render the road vulnerable. Recent developments include IT Parks, Rama Naidu Cinema Studio, several resorts and urban built up come into existence. These anthropogenic activities have altered the topography along the road system. The major important places located enroute of this road are Rushikonda, Bojjannakonda, Erramattidibbalu etc. Apart from natural and historical importances, INS Kalinga is established adjacent to this road. Traffic load is increasing year after year. In view of the traffic load recent road expansion has been taken up in place of old road network. This activity has led to cutting of hill flanks, foothills, sea sand dunes, culverts, drainages and highly denuded land forms etc. Hence, this topic has been taken up to study the soil creep, rock creep, solifluction, land slips, landslides, tidal action and beach erosion along the Bheemili road.

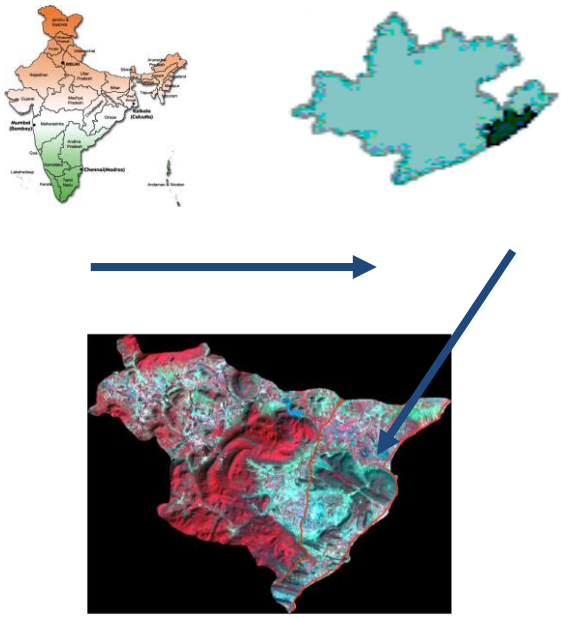

Fig. 1 Location map of the study area as viewed on IRS 1D, LISS III, 2004.

III. MATERIALS AND METHODS

The examination zone covers 2 quantities of Survey of India (SOI) topographic maps and they are 65 O/5 and 65 O/2 on 1: 50000 scale. These topographic maps are geo-rectified and anticipated to polyconic projection (the Metric framework units – meters are utilized as in the present examination). The Visakhapatnam topographic map has been scanned, saved and then imported into image format. Then, it is referenced to polyconic projection using ERDAS IMAGINE 9.1.software. The examination zone limit is digitized and overlaid on Mosaic toposheet and demarked the investigation zone limit on 1:50000 toposheet and confirmed by ground truthing and important amendments were made and checked in the field with the assistance of GPS. Image processing was carried out for IRS – ID LISS – III (23.5m resolution) imagery dated April, 2004. (Satellite imagery is shown in Figure1). After applying necessary image enhancement techniques that improve the disparity between the features from the geo-coded IRS –ID LISS – III imagery, the land use /cover features have been precisely captured through onscreen visual interpretation based on basic image characteristics such as size, shape, shadow, location, association, texture, tone/colour, pattern and various other related features. In this analysis, only Rabi (April) data have been used to decipher land use and land cover of the area. In fact, this analysis requires two seasons' data, however, double crop has been interpreted where kharif and rabi are practiced. In this analysis, level-1 and level-2 categories have been identified as per the guidelines given by

the National Remote Sensing Centre (NRSC, 1990). The land use/cover classification of NRSC is given in Table 1. The land use/ land cover map of the area is shown in Figure. 2.

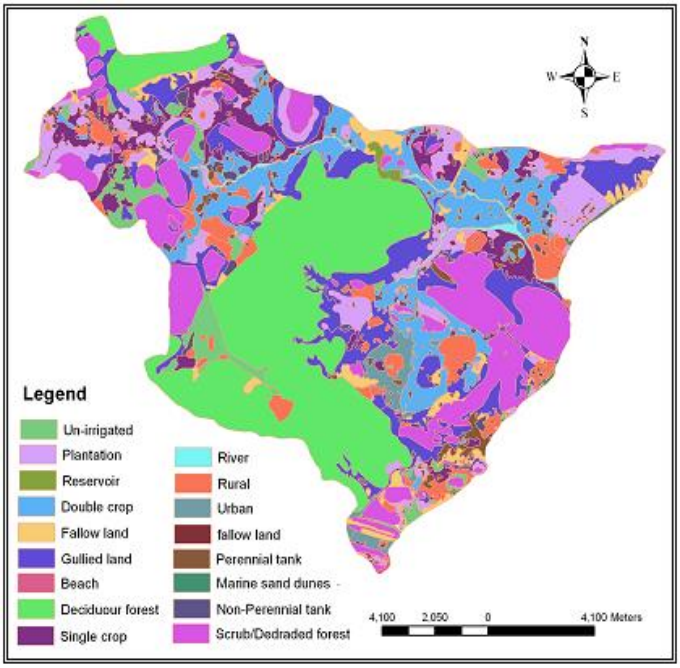

Fig. 2 Land Use/ cover map of the study area.

IV. RESULTS AND ANALYSIS

In this study, seven land use and six land cover categories have been observed. The image interpretation elements for observing the above classes are given in Table 1.

Out of seven land use classes, single crop covers an area of 14.717 km^2, followed by double crop 7.33 km^2 etc. Similarly, major land cover category observed in the area is deciduous forest which accounts about 62.835 km^2 followed by gullied and other classes in the descending order as given in Table 2.

A. Built-up land

It is a zone of human domicile created due to non-agrarian acts and exercises that has a cover of structures, transport and communication, utilities in relationship with water, vegetation and vacant terrains. The study area consists of urban, rural and transportation built-up lands in which urban built-up land covers an area 3.855 km^2 (1.63 % of the total geographical area of the study) and rural built-up land covers an area of 13.544 km^2 (5.74% of the total geographical area of the study).

B. Agriculture land

These are the terrains principally utilized for cultivating and creation of nourishment, fibre and other business and furthermore agricultural yields. The agricultural land was cultivated in Kharif as well as Rabi seasons which are suggested by the double crop areal extent of 25.996 km^2 (11.02% of total study area). Single crop covers an area of 14.644 km^2 (6.21% of total study area). There are some un-irrigated areas also in the study area of about 8.367 km^2 (3.55% of total study area). Plantations are likewise present and are cultivated on a broad scale in a large contiguous area, owned and managed by an Individual or an organization. About 20.065 km^2 area which is 8.5% of the total study area is under plantations.

C. Forest and Scrub land

The second highest land cover is the degraded forest /scrub land. In recent years, the area, particularly hill tops have been developed with IT Parks, Cinema Studios, etc. Large quantities of thick deciduous forest have been removed for the construction. Similarly hill flanks, foot hills have been quarried for road construction. These activities affected natural conditions which triggered erosion and earth materials moving towards road, these may liable to collapse as soil creep, sudden slip of unconsolidated kankar overburden and wedge failure / landslides at places. These are the potential threats to the traffic and road safety. Forest Plantation near Zoo Park is shown in Fig. 3 has been acquired from the field checks. The deciduous forest covers 62.836 km^2 of area (26.63% of the total study area) and the scrub forest occupies an area of 35.555 km^2 (15.07% of total study area).

Fig. 3 Forest plantation near Zoo Park

D. Gullied / Ravenous land

The study area has gullied lands at places along the road. The major gullied land is found adjoining to INS Kalinga which is famous for tourists' attraction and film makers. The area is highly denudated by the fluvial activity, as a result the area manifested into a different landscape. Geologically, this type of areas is called as bad land topography. It is described by gullied, scanty vegetation, sand traps and calcareous nodules. Wherever the calcareous nodule occurs, the area is partially escaped from erosion and denudation. It is attributed that the calcareous nodules are acting as a binding material around the nodules red soil forming as a lump. It the area is enriched with iron and clay it appears in red colour. These gullied lands transport impressive

sand and residue to the streets and amasses as pockets all through the barren wasteland region. The sand regularly makes street mishaps; slipping of vehicles is normal. These can be limited by giving legitimate holding dividers' neighbouring and at the edge of the street with the goal that the snapshot of lose sand towards the street can be halted. It covers 31.281 km^2 which contributes 13.26% of the of total study area. The study area also has fallow land with 7.307 km^2 (3.1% of total study area). A fallow land is a ploughed and harrowed but left for a period without being sown in order to restore its fertility or to avoid surplus production.

E. Water bodies

This classification comprises areas with surface water, either bounded in the forms of ponds, lakes and reservoirs or flowing as streams, waterways and channels. These are seen clearly on the satellite image in blue to dark blue or cyan colour depending on the depth of the water. The study comprises of a number of water bodies which include beach (0.05%), non-perennial tanks (2.43%), perennial tanks (1.59%) reservoirs (0.27%), the main river courses (0.72%) covering a total area of 11.902 km^2.

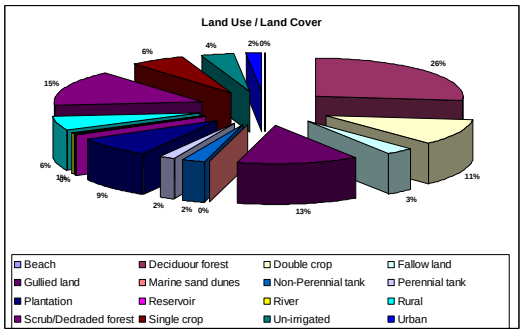

Fig. 4 Percent area of each Land use/ cover class.

TABLE I.
Land use/Land cover classification (National Remote Sensing Centre, 1990)

Level I	Level II
1. Built-up Land	1.1. Urban
	1.2. Rural
	1.3 Transportation
2. Agriculture	2.1 Irrigated
	2.2 Un irrigated
	2.3 Plantation
	2.4 Shifting cultivation
3. Forest	3.1 Evergreen forest
	3.2 Deciduous forest
	3.3 Scrub/ Degraded forest
	3.4 Forest plantation
	3.5 Mangrove
4.Wasteland	4.1 Salt affected land
	4.2 Gullied/Ravenous land
	4.3 Water logged marshy land
	4.4 Upland with or without scrub
	4.5 Barren rock/Sheet rock
5.Water bodies	5.1 Rivers/Streams
	5.2 Lakes/Reservoirs
	5.3 Canals
6. Others	6.1 Snow cover/Glacial cover

TABLE II.

Area under each category of land use/cover in the study area

Type of Land Use / Land cover	Area of each category (km^2)	Percent area of each category
Beach	0.111	0.05%
Deciduous forest	62.836	26.63%
Double crop	25.996	11.02%
Fallow land	7.307	3.10%
Gullied land	31.281	13.26%
Marine sand dunes	0.584	0.25%
Non-Perennial tank	5.725	2.43%
Perennial tank	3.745	1.59%
Plantation	20.065	8.50%
Reservoir	0.632	0.27%
Main river courses	1.689	0.72%
Rural Built-up	13.544	5.74%
Scrub/Degraded forest	35.555	15.07%
Single crop	14.644	6.21%
Un-irrigated	8.367	3.55%
Urban Built-up	3.855	1.63%
Total Area in Sq Km	**235.936**	**100.00%**

V. CONCLUSION

In this paper, the area of examination has been segregated into eleven Land use/Land cover classes in Supervised Classification. The major land use classifications are double crop, single crop, un-irrigated, gullied land, etc. The major land cover classes are deciduous forest, plantation, scrub/degraded forest, gullied/ ravenous land, tanks, reservoir. The study area has built-up land about 17.40 km^2 covering 6.7608% of the total area. In recent years, deciduous/scrub land (land cover feature) of hilly terrain along the seacoast are being converted into built-up lands, mostly IT parks and Film Studio etc.

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REFERENCES

[1] Chauhan, H.B., and Shailesh Nayak (2005). *Landuse/Landcover changes near Hazira region, Gujarat using Remote Sensing Satellite Data*, Journal of the Indian Society of Remote Sensing, Vol 33, No 3, pp. 413-420.

[2] Rao, D.P., Gautam, N.C., Nagaraja, R. and Ram Mohan, P. (1996). *IRS-IC application in land use mapping and planning*, Current Science, Vol 72, pp. 165-190.

[3] Ramprasad Naik, D., Appala Raju, N., Jagadeeswara Rao, P., Chandrasekhar Rao, T. (2015) *Land Use/Cover Mapping of Paderu Mandal of Visakhapatnam District, Andhra Pradesh Using Geospatial Techniques*, International Journal of Remote Sensing & Geoscience (IJRSG), Vol 4, No 6, pp. 23-28.

[4] Balaselvakumar, S., Kumaraswamy, K., Srileka, S., Jawahar Raj, N. (2003), *Application of Remote Sensing Data For Land Use / Land Cover Mapping A Case Study of Arjuna River Basin, Tamil Nadu*, Biosciences, Biotechnology Research Asia, Vol 1, No 1, pp. 43-48.

[5] Wawale Surindar, G., and Aher Aankush B.(2005*). Land Use / Land Cover Mapping using Remote Sensing Data in Pravara River Basin, Akole, Maharashtra, India*, International Research Journal of Environment Sciences, Vol 4, No 9, pp. 53-58.

[6] Skidmore, A.K., Witske Bijker, Karin Schmidt and Lalit Kumar (1997). *Use of remote sensing and GIS for sustainable land management*, ITC Journal, Vol 3, No 4, pp. 302-315.

[7] Merolla, Sivia, Mesto, Griseda, Calvanese and Gustavo (1994). *A GIS application for assessing agricultural land*, ITC Journal, Vol 3, pp. 264-269.

[8] Patel, N.K., Saxena, R.K., and Ajay Shiwalkar (2007). *Study of Fractional Vegetation Cover using High Spectral Resolution Data*, Journal of the Indian Society of Remote Sensing, Vol 35, No.1, pp. 73–79.

[9] Alaguraja, P., Durairaju, S., Yuvaraj, D., Shekar, M., Muthuveeran, P., Manivel, M., Thirunavukkarasu, A. (2010). *Land Use Land Cover Mapping-Madurai District, Tamil Nadu, India using Remote Sensing and GIS Techniques*, International Journal of civil and structural Engineering, Vol 1, No. 1, pp. 91-100.

[10] Dhrub Kumar Dwivedi (2016). *Globalization and Its Effects on Indian Economy*, International Journal of Advanced and Innovative Research, Vol 5, No 11, pp.26-28.

[11] Tulli Chandrasekhara Rao, Jaisankar, G., Aditya Allamraju, Amminedu, E. (2018). *Land Use/ Land Cover Mapping for Janjhavathi river basin of Odisha and Andhra Pradesh using Geo-Spatial techniques*, International Journal of Engineering, Science and Mathematics, Vol 7, No 3, pp. 171-177.

[12] Surya, S and Hari, N. (2018). *Diversity analysis and present status of Mangroves from Kerala, West coast of India*, International Journal of Advanced and Innovative Research, Vol 7, No 6, pp.1-15.0