Land use and Land Cover analysis using Remote Sensing and GIS:A case study In Gudur area , Nellore District, Andhra Pradesh, India.

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ABSTRACT:

Land use/land cover information is essential for selection, planning and implementation of management strategies to meet the increasing demands for basic human needs and welfare of the ever growing population. The aim of the research was to analyze and monitor land use/land cover in Gudur area, Nellore district ,Andhra Pradesh, of south India by using integrated approach of remote sensing and geographical information system. The total study area is about 247.29 km2. The National Land use/Land cover classification developed by National Remote Sensing Centre (NRSC) and Indian Space Research Organization (ISRO) divides the land in the study area into five Level I classes, 11 Level II classes, and fifteen Level III classes. From this three-level hierarchic based classification. The land use and land cover analysis on the study area has been attempted based on thematic mapping of the area consisting of built-up land, cultivated land, water bodies, forest land, barren land and uncultivated land using the satellite image. The result shows that the agriculture lands area well distributed entire study area and it covers 159.83 sq.km (65%). Forest occupies 15.22 km^2 (6.0%), Built up urban and rural area covers 5.31 km^2 and 6.56 km^2 respectively. quarry and industrial area covers 1.78 km2 and 0.43 km^2, Water bodies and uncultivated lands occupy 24.62

km^2 (10%) and 33.29 km^2 (13%) respectively. This research provides useful and up-to-date information to local land use planners, managers and policy-makers to step up towards sustainable development in the study area.

Key words: Remote sensing, GIS, Land use/land cover. Gudur area

1.0 INTRODUCTION:

Land use/land cover is two different terminologies which are often used interchangeably (Dimyati et al., 1996). Land cover refers to the physical characteristics of earth's surface, captured in the distribution of vegetation, water, soil and other physical features of the land, including those created solely by human activities e.g., settlements where as land-use refers to the way in which land has been used by humans and their habitat, usually with accent on the functional role of land for economic activities (Kumar et al., 2013). The land use/cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. (Rawat et al., 2013) The reliable and updated information on the LU/LC maps and their dynamics can help to provide base information for further decision making in watershed management activities (Rojan et al.,2004) Therefore, the LU/LC change is considered as an important measure to evaluate the impact of applied watershed management measures. Various studies have been undertaken to improve the accuracy of classification using different RS and/or GIS based ancillary data at various stages of classification (Jones et al., 1988; Franklin and Wilson, 1992; Ricchetti, 2000; Shalaby and Tateishi, 2007; Yacouba et al., 2009). Hence, proper information on LU/LC is essential for implementing numerous developments, planning, and Land use schemes to fulfill up the increasing demands of basic

human needs. In study area contains world richest mica deposits and rapid expansion of mining industries, population growth, transport, economic, tourism and being a educational hub. In view of that, an attempt has been made to analyze the urban growth, monitoring the dynamics of LU/LC and also the path ways that impact urban ecosystem.

2.Study area:

The present study area is included in the toposheet no.57 N/11 and covers an area of area of 247.29 km2. It is located between longitudes 79°42'30"E - 79° 54'30"E and latitudes 14°13'00"N - 14°16'30" N (Fig.1). The study area has a subtropical climate with a mean annual temperature of 24.3^{o}C to 32.9^{o}C. The humidity is usually in the range of 6-84 %. The annual normal rainfall of the study area is about 1084 mm. The mean daily maximum temperature in the district is about 42°C in May and

the mean daily minimum temperature is about 20°C in December/ January.

3.Materials and Methods:

In this study, thematic maps have been generated using the Survey of India toposheet 57 N/11 of 1: 50,000 scale and IRS-P6-LISS-III (FCC) images of October-November 2011, January 2012 and April 2012 were used. The data therefore represents Rabi, Kharif and Zaid seasons. The standard false color composite (FCC) images of the study area was prepared using bands 4 (NIR) 3 (Red), and 2 (Green) and discrimination of features were made by visual interpretation (on screen) using these images. The interpretation key was based on the relationships between ground features and image elements, like, texture, tone, shape, location and pattern. The interpreted

maps are checked in the field and modifications if any are incorporated and the map is finalized.

3.1 Classification Scheme

There are three levels of classification, viz., Level-I, Level-II, Level-III. Level-I is used on 1:100000, Level-II is used on 1:250000 and Level-III is used on 1:50000 scale. In the Level-I, the broad classification is shown Agricultural land, Forest. In the Level-II category is further sub divided into indicating Crop land. The classification that is followed in the classification levels based on NRSC and ISRO (2011). In this level- III on 1:50000 scale is adopted that is acknowledged below.

Table.1 Land use/land cover classification levels based on NRSC and ISRO (2011).

LEVEL -I	LEVEL-II	LEVEL=III
Built-up	Built up (Urban)	Built-up/core urban/peri-urban
	Built UP (Rural)	Village/hamlets/dispersed house hold
	Mining/Industrial area	Industrial mine/quarry
Agriculture land	Agriculture plantation	Agriculture plantation
	Cropland	Cropland
Forest land	Forest	Forest
Water bodies	Reservoir/tanks	reservoir /tanks
	River/stream/drain	River/stream/drain
waste land	Barren rocky	Barren rocky

	Salt affected	Salt affected
	Scrubland	Open scrub/dense scrub
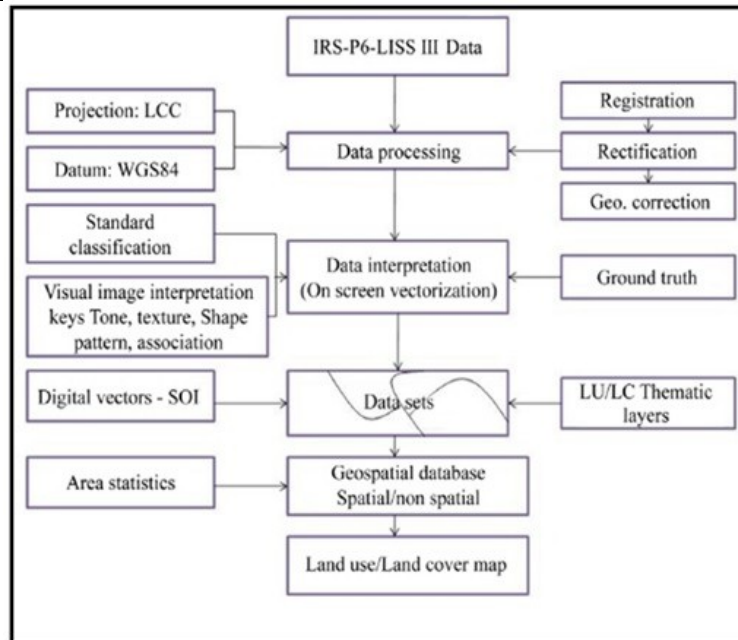
Fig:1.1 Methodology for the land use/land cover map of the study area

4.0 RESULTS AND DISCUSSION:

For the better comprehensive development and management of the Gudur area and its surrounding areas, it is needed to have proper information on land use/land cover. IRS p6 LISS III data of 2012 was visually interpreted for the delineation of land use/land cover categories of the study area. The statistical distribution of land use/land cover map of Gudur area is depicted in table 1.2 and figure 1.2 shows the land use /land cover map of Gudur area.

4.1 AGRICULTURE LAND:

Agricultural land is described as the land primarily used for farming and for the production of food, fiber, and other commercial and horticultural crops. It includes land under crops (irrigated and un irrigated, fallow, plantations etc). The major cropped area appears bright red in color and areas without crop appear yellowish to greenish blue on the satellite imagery depending on the soil cover and surface moisture. In

the study area, agricultural land includes agricultural plantations ,croplands, Fallow, aquaculture and different crops such as rabi, kharif and Zaid, which covers an area bout 159.83km^2 (65%).

4.2 Built Up - urban:

In the study, an urban area is characterized by high human population density and vast human-built features in contrast to the areas surrounding it. Built Up Compact (Continuous) may be cities, towns or conurbations, but the term is not commonly extended to rural settlements such as villages and hamlets. It covers an area of 5.31 km^2 .Built Up - Compact (Continuous) and Built Up - Sparse (Discontinuous) are the identified subcategories under this category. Built Up Compact are defined as areas with high population densities (2900 per square kilometer or more) and high transit, walking and cycling work trip market shares (20 percent or more). The Built Up -

Sparse areas as those areas adjacent to built-up areas of high population concentrations (that is, urban), they specified that they are the zones where traditional farming activities come into conflict with alternative economic, residential and recreational interests (Thomas M.L et al, 2000). The geographical extents of Built Up - compact and Built Up - Sparse sub categories are about 2.9 km2 (1%) and 2.38 km2 (1%) respectively.

4.3 Built- up rural:

The rural area is characterized by agricultural and allied sectors and non-commercial activities with population size less than 5000 generally lack supporting facilities. Most of the people are involved in the primary activity of agriculture. Village, hamlets/dispersed households are the identified sub

categories. The Village is a small group of households in a rural area usually larger than a hamlet.(Nagaraju et al.,2016) The areas covered under village/hamlet/dispersed household categories are about 6.56 km2 (3.0%).

4.4 Quarry and industrial area:

These are characterized by the removal of surface and sub-surface earth material by manual and mechanized operations. The geographical extents of quarry and industrial area about 1.78 km^2 (1%) and 0.43 km^2 (0.043%).

4.5 Forest: These are the areas bearing an association predominantly of trees and other vegetation types (within the notified forest boundary). In the satellite image, such forest is identified by red to dark red in tone with a coarse texture and scrub land appear light yellow to brown and greenish blue in color. Forest land contributed the predominant land cover category in the study area, forest land was divided into different categories like Deciduous, Forest Plantation, Scrub Forest and Vegetated / Open Area. These components were covered an area of about 15.22km^2 (6.0%).

4.6 Waste land :

It is limited to support life and in which less than one-third of the area has vegetation or other cover. This category includes such areas as Salt affected land, Scrub land-Dense scrub, and Scrub land-Open scrub (Ghosh et al., 1996).It is identified with light cyan tone and smooth to coarse texture on image. These were geographically extent an area about 33.29 km^2 (13%)

4.7 Water bodies:

The water bodies include both natural and man-made water features such as ponds, lakes, tanks and reservoirs flowing as streams, rivers, and canals etc. This category comprises areas

Classification	Area In
Agricultural Land-Aquaculture	0.206369452
Agricultural Land-Crop Land-	41.12869958
Agricultural Land-Crop Land-Kharif	3.480533699
Agricultural Land-Crop Land-Rabi	37.18715492
Agricultural Land-Crop Land-Zaid	0.116369383
Agricultural Land-Fallow	28.32390644
Agricultural Land-Plantation	49.38721669
Built Up - Compact (Continuous)	2.928798014
Built Up - Sparse (Discontinuous)	2.384689138
Built Up (Rural)	6.567393798
Built Up- Quarry	1.787151132
Built Up-Industrial	0.436058372
Forest-Deciduous (Dry/Moist/Thorn)-	4.978164952
Forest-Deciduous (Dry/Moist/Thorn)-	7.86101246
Forest-Forest Plantation	0.22212239
Forest-Scrub Forest	1.740493456
Vegetated / Open Area	0.426081008
Wastelands-Salt affected land	3.124320273
Wastelands-Scrub land-Dense scrub	18.38915096
Wastelands-Scrub land-Open scrub	11.78090571
Water bodies-Canal/Drain	0.650015805
Water bodies-Reservoir/Tanks-	4.636056226
Water bodies-Reservoir/Tanks-	16.01727949
Water bodies-River/Stream-Non	3.320698389
Wetlands-Coastal - Lagoon, creeks,	0.213589242
Grand Total	247.294231

with surface water, either impounded in the form of ponds,

lakes and reservoirs or flowing as streams, rivers, and canals etc. Water bodies are represented by light blue to dark blue in tone and smooth to mottled texture on satellite imagery (Nagaraju et al.,2016). Water bodies appear dark on satellite imagery due to absorption of incoming IR radiation. Surface water bodies such as tanks/reservoirs and river/stream/drains are identified in the study area and their geographical distributions are 24.62 km^2 (10%).

Table1.0: Identified land use/ l and cover classes in the study are
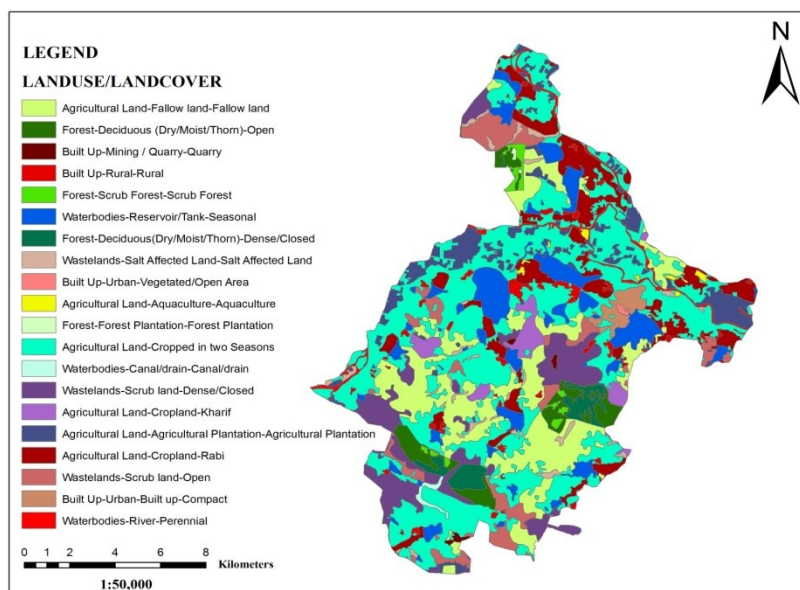
Fig   Land Use Land Cover Map Of The Gudur Area

5.0 CONCLUSION:

This study has demonstrated that the recent advancements in remote sensing and GIS technologies provide powerful tool for mapping of land use land cover. This research carried out in a part of the Gudur area Nellore district, Andhra Pradesh. In this study reveals that predominately occupied by the agriculture land with an area about 159.83 sq.km(65 per cent),followed by waste land 33.29 sq.km(13per cent),built up urban and built up rural land, water bodies, forest land quarry and industrial area respectively.   These   are occupied5.38sq.km(3%),6.56sq.km(3%),24.62sq.km(10),15.22 sq.km(6%),1.78sq.km(1%),0.43sq.km of the total geographical area .In this area highest occupied by agriculture land where as lowest occupied by the industrial area

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