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An Analysis on Land Use/Land Cover Using Remote Sensing and GIS – A Case Study In and Around Vempalli, Kadapa District, Andhra Pradesh, India

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Abstract- Remote Sensing as a direct adjunct to field, recently playing an important role in the study and assess the natural resource in any part of the world. Anthropogenic changes in land use and land cover and land use are often assumed to be identical, they are rather quite different. Land cover may be defined as the biophysical earth surface, while land use is often shaped by human, socio-economic and political influences on the land. Remote Sensing (RS), integrated with Geographic Information System (GIS), provides an effective tool for analysis of land use and land cover changes at a regional level. The geospatial technology of RS and GIS holds the potential for timely and cost – effective assessment of natural resources. The techniques have been used extensively in the tropics for generating valuable information on forest cover, vegetation type and land use changes. Therefore, we have used RS and GIS to study land use land cover changes in and around Vempalli area of Kadapa district, Andhra Pradesh, India covering an area of about 711 sq. km. In this view the present work has been taken up to study and assess some of the natural resources and environmental potential of study area which is falling in the Survey of India toposheets No: 57 J 07 and 57 J 11. Under this study three thematic maps such as location map, drainage map and land use / land cover maps were prepared. 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 and uncultivated land using the satellite image. The research concludes that there is a rapid expansion of built-up area. Land use and land cover information, when used along with information on other natural resources, like water, soil, hydro-geomorphology, etc. will help in the optimal land use planning at the macro and micro level.

Index Terms- Land use/ Land cover, Remote Sensing and GIS, Kadapa District, Andhra Pradesh.

I. INTRODUCTION

Multidisciplinary scientific integrated surveys were carried out to quantify the resource potential of the area, to know the status of exploitation of resources and to identify any degradation due to unscientific management. The investigation agents broadly outline the development options based on available resources. The thematic maps produced on resources will enable planners to formulate programs to optimize productivity from existing resources, and to initiate measures to correct imbalances due to unscientific management and inherent deficiency.

The land use/land cover pattern of a region is an outcome of natural and socio – economic factors and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use / land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population. Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. The advancement in the concept of vegetation mapping has greatly increased research on land use land cover change thus providing an accurate evaluation of the spread and health of the world's forest, grassland, and agricultural resources has become an important priority.

Viewing the Earth from space is now crucial to the understanding of the influence of man's activities on his natural resource base over time. In situations of rapid and often unrecorded land use change, observations of the earth from space provide objective information of human utilization of the landscape. Over the past years, data from Earth sensing satellites has become vital in mapping the Earth's features and infrastructures, managing natural resources and studying environmental change.

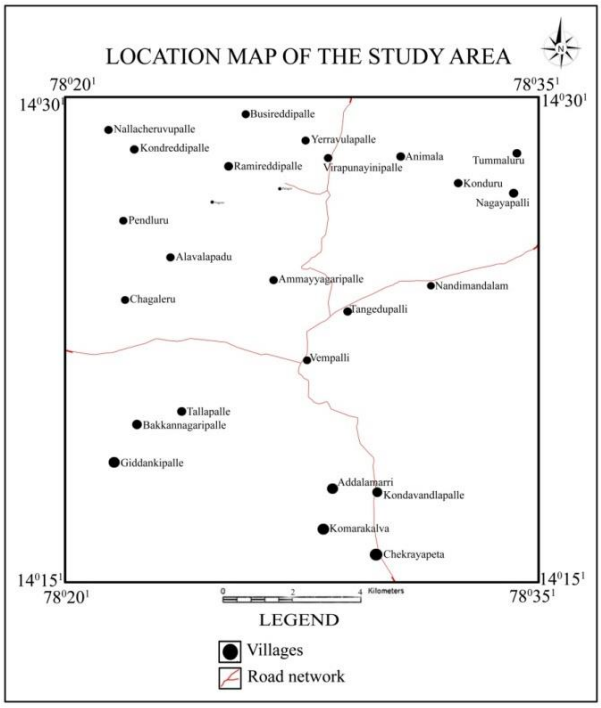
Remote Sensing (RS) and Geographic Information System (GIS) are now providing new tools for advanced ecosystem management. The collection of remotely sensed data facilitates the synoptic analyses of Earth - system function, patterning, and change at local, regional and global scales over time; such data also provide an important link between intensive, localized ecological research and regional, national and international conservation and management of biological diversity (Wilkie and Finn, 1996).

A total of three thematic maps such as location, drainage and land use and land cover maps were prepared based on image interpretation studies with limited checks. The land use-land cover pattern falls under the broad categories of built-up land, cultivated land, forest land, water bodies and uncultivated lands. In this study area major natural resource is forest. Because of human activities the extent of the land under forest is getting reduced. In the same way land used for cultivation is also decreasing. But at the same time land under built up area is

increasing. Recently the functioning of the real estates people and property promoters are bringing a serious disaster to forest area and agricultural land. This is an unhealthy situation of land management. In this context studies on land use land cover change detection are essential to understand the existing situation and plan for the future.

Study area: The study area lies between Kadapa and Pulivendula, Kadapa district, Andhra Pradesh, India, situated between parallels of $78^0$20' to $78^0$35'E longitude and 14^0 15' to $14^0$30'N latitude with intended boundary falling in Survey of India toposheet no.57J07 and 57J11. The total area covered is approximately 711 square kilometers.

Figure 1: Location map of the study area



The climatic conditions of this area as its minimum temperature in November-January at about 28-30^0 C. The hottest temperature ranges between the 40-45^0C ranges during April-May. There are extensive outcrops of limestones, Dolomites, Granite and Quartzites in major parts of the area, which could be utilised as building material. The major minerals in the study area are vein type barites, asbestos and the small deposits of white clay and iron ore. Vempalli, Chakrayapeta, Virapunayunipalli are the mandal head quarters and Nandimandalam, Komarakalva, Kondavandlapalli, Addalamarri, Tallapalli, Bakkannagaripalli, Giddankipalli, Ammayyagaripalli, Chagaleru and Tummuluru are the important villages in the study area.

OBJECTIVES

- To study the present status of water resources, natural resources, land resources, soil productivities, cropping patterns, forest cover etc using satellites data, collateral data and field data.
- To prepare the thematic maps namely location, land use-land cover, and drainage.
- To prepare action plan for land resources and water resources.

II. MATERIALS AND METHODS

The study has made use of various primary and secondary data. These include Survey of India (SOI) topographic sheets of 57J07 and 57J11 of 1:50,000 scale and satellite image IRS P6 geocoded data of 1:50,000 scale. The Indian Remote Sensing Satellite (IRS) data was visually and digitally interpreted by using the image interpretation elements (such as tone, texture, shape, pattern, association etc.) and ArcGIS software was used for processing, analysis and integration of spatial data to reach the objectives of the study. Adequate field checks were made before finalization of the thematic maps. The main goal of this study is to extract the land use/land cover changes and categories of the study area.

Preparation of thematic map

These maps are the true representation of earth's phenomena such as spatial distribution of natural resources existing at the time of survey (Ravi Gupta, 2003). In the present study satellite image (IRS P6) which is a true record of the various environmental resources information on the base map. These map showing spatial distribution of forest, agriculture, soil, water resources etc., and prepared by visual interpretation of the satellite imagery. Visual interpretation is carried out based on the image characteristics like tone, size, shape, pattern, texture etc. in conjunction with existing map/literature. These pre-field thematic maps are modified substantiated and confirm after limited field checks.

Figure 2: Cartographic Model

III. RESULTS AND DISCUSSIONS

Analysis of Land use /Land cover by using Remote Sensing Data: The land use/land cover categories of the study area were mapped using IRS P6 data of 1:50,000 scale. The satellite data was visually interpreted and after making thorough field check, the map was finalized. The various land use and land cover classes interpreted in the study area include, built-up land, cultivated land, forest land, uncultivated lands and water bodies.

Figure 3: Land use/ Land cover map of the Study area

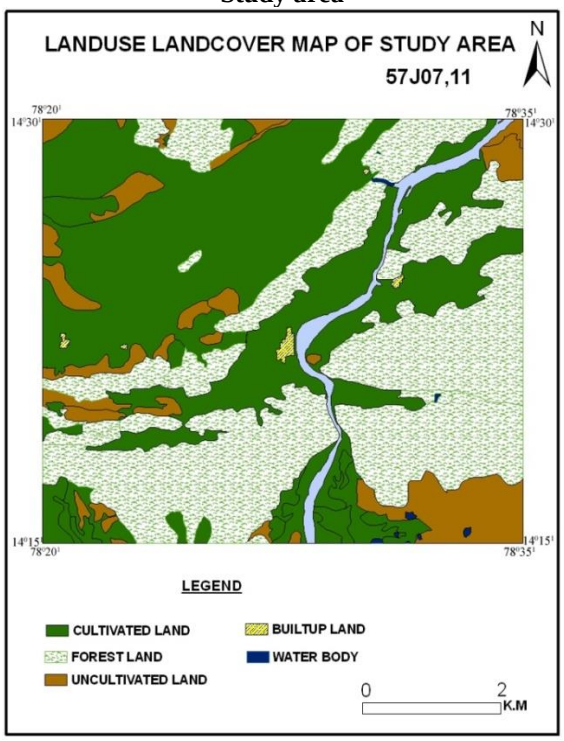


Table 1: Land use land covers classification system

LEVEL 1	Area in Sq. Km	Percentage of the area %
1.Built-up land	8.2	1.15
2. Cultivated land	335.13	47.13
3.Forest land	296.55	41.71
4.Water bodies	1.42	0.2
5.Uncultivated land	69.60	9.79

Detailed accounts of these land use /land cover classes of the study area are described in the following section.

***A. Builtup Land*:** Built up land is composed of areas of intensive with much of the land covered by structures. Included in this category are cities, towns, villages, industrial and commercial complexes and institutions. In the study area major towns or villages are vempalli, Nandimandalam, Chagaleru, Tallapalle, etc. The transportation facilities in the study area are roads. The highway roads are present in the area are routes between, Pulivenduala- Kadapa, Vempalli- Rayachoti, Vempalli-Jammalamadugu. The industrial mining of asbestos, serpentine and uranium minerals is carried out at some places in the study area.

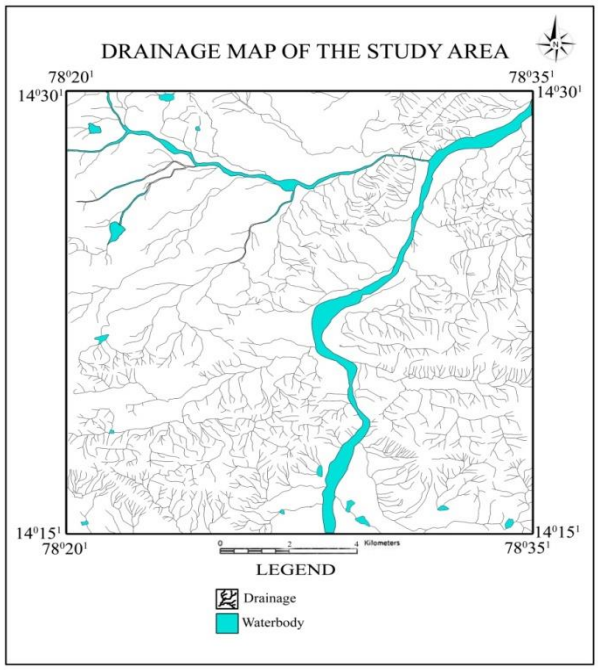
B. Cultivated land: All the cultivated land with or without crops orchards and plantations are considered in this class. This land use class is further subdivided into two sub-classes they are wet land (crop land) and dry land (fallow land). Crop lands are the agricultural lands under crop. In the study area the crop lands have wet cultivation and dry cultivation. Wet cultivation includes food crops such as paddy, wheat, etc. were present on either side of the Papagni River and its tributaries noticed in Vempalli, Tummuluru, Konduru, Alavallapadu, Kondavandlapalli,Ramireddipalli and Addalamarri. Dry cultivation includes trees orchards, groundnut, etc and the areas which have this type of cultivation is noticed at Ammayyagaripalli, Virapunayanipalli, Chagaleru, Chakrayapeta..etc.

Fallow lands refer to all land which was taken up for cultivation but is temporarily out of cultivation for a particular period. The study area have more fallow lands and are surrounded by the villages of Tangedupalli, Giddankipalli, Alavallapadu, Busireddipalli, Nandimandalam, Etc.

C. Forest Land: Forest, comprises of thick and dense canopy of trees. These lands are identified by their red to dark red tone and varying in size. They are irregular in shape with smooth texture. The forests are found on the south eastern part of the study area. The study area covers mostly the dense and scrub forest. The relative concentration of scrubs, bushes and smaller trees are predominant in this category. In the satellite image such forest are identified by yellow tone with smooth texture. The forest areas are Giddankipalli, Kondavandlapalli, Nagayapalli, Animala, Busireddipalli, etc.

D. Water Resources: The water bodies include both natural and man-made water features namely rivers / streams / lakes / tanks and reservoirs. The water features appear black in tone in the satellite image. The shallow water and deep water features appear in light blue to dark blue in color. Tanks with plantation are identified by the square/rectangle shape and red color tone. Tanks without plantation are recognized by the shape and light blue to dark blue tone. Embankments are noticed in Kondavandlapalli, Alavallapadu, Bakkannagaripalli, Chakrayapeta, Busireddipalli etc. A major river Papagni flows in the study area. Small canals are noticed in the vegetation area. Tanks are mostly concentrated in the south east and North West parts of the study area with few dry tanks scattered around in the northern parts.

Figure 4: Drainage map of the study area



E. Uncultivated Land: Land, which does not support any vegetation are known as uncultivated lands or waste lands. Barren rocky, salt affected land, land with and without scrub, sandy area, sheet rocks and stony regions include in this category. Such lands are formed due to the chemical and physical properties of soil, temperature, rainfall and local environmental conditions. In the study area uncultivated lands are present in the south east part.

i) Land with scrub: These lands are subject to degradation, erosion or thorny bushes. Such areas are identified from their yellowish tone and their association with uplands, and their irregular shapes. Land with scrub found in the western part of the study area.

IV. CONCLUSION

The study has classified as per the major land use/land cover types**.** The Indian Remote Sensing Satellite (IRS) data, image processing and Geographical Information System techniques were used to identify the land use categories such as built-up lands, cultivated lands, forest lands, water bodies and uncultivated lands. Satellite images in combination with predated topographic sheet of Survey of India were used for analyzing land use and land cover change detection. It is helpful for further macro and micro level planning. With the help of Geographic Information System the various land use and land cover zones are mapped, which in turn helps for decision maker for planning purpose. The cultivated lands are well distributed throughout the study area and it covers 335.13 sq. km (47.13 per cent). Forest occupies 296.55 sq. km and sharing about 41.71 per cent of the total land use land cover of the study area. The built-up land occupies 8.2 sq. km (1.15 per cent) and there was a rapid expansion of built-up lands. Uncultivated land occupies 69.60 sq. km (9.79 per cent). A water bodies occupy 1.42 sq. km (0.2 per cent) but well developed dendritic drainage pattern is there in the study area.

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