# Land Use/ Land Cover Analysis Using Remote Sensing and Gis, a Case Study on Pulivendula Taluk, Kadapa District, Andhra Pradesh, India

**T. Lakshmi Prasad[*] and G. Sreenivasulu[**]**

[*] Department of Earth Sciences, Yogi Vemana University, Kadapa, Andhra Pradesh, India.
[**] Department of Geology, Yogi Vemana University, Kadapa, Andhra Pradesh, India.

***Abstract*-** Land, a non-renewable resource, is central to all primary production systems. The geospatial technology of Remote Sensing 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 about various surface features of the earth. Therefore, we have used Remote Sensing and GIS to study land use land cover changes, and Drainage pattern of Pulivendula Taluk, Kadapa district, Andhra Pradesh, India. The study area situated between parallels of $77^0$55' to $78^0$31'33" E longitude and $14^0$15' to $14^0$45'N latitude with intended boundary falling in Survey of India toposheet no.57J02, 57J03, 57J06 and 57J07. The total area covered is approximately 1506 square kilometers. By using satellite images IRS- P6, LISS-III data of the study area four thematic maps such as location, Land use/ Land cover and drainage maps were prepared. It is observed that the important land use features like crop lands, barren lands or uncultivated lands, forest, built-up, soil and drainage pattern. The result shows that the crop lands are well distributed throughout the study area and it covers 887.03 sq. km (57.9 per cent). Forest occupies 162.49 sq. km and sharing about 10.79 per cent of the total land use land cover of the study area. The built-up land occupies 13.70 sq. km (0.91 per cent) and there was a rapid expansion of built-up lands. Barren land occupies 419.87 sq. km (27.88 per cent). Well developed dendritic drainage pattern is there in the study area. The spatial information of the surface will help in the optimal land use planning at the macro and micro level.

***Index Terms*-** Land use/ Land cover Analysis, Remote Sensing and GIS, Pulivendula Taluk

## I. INTRODUCTION

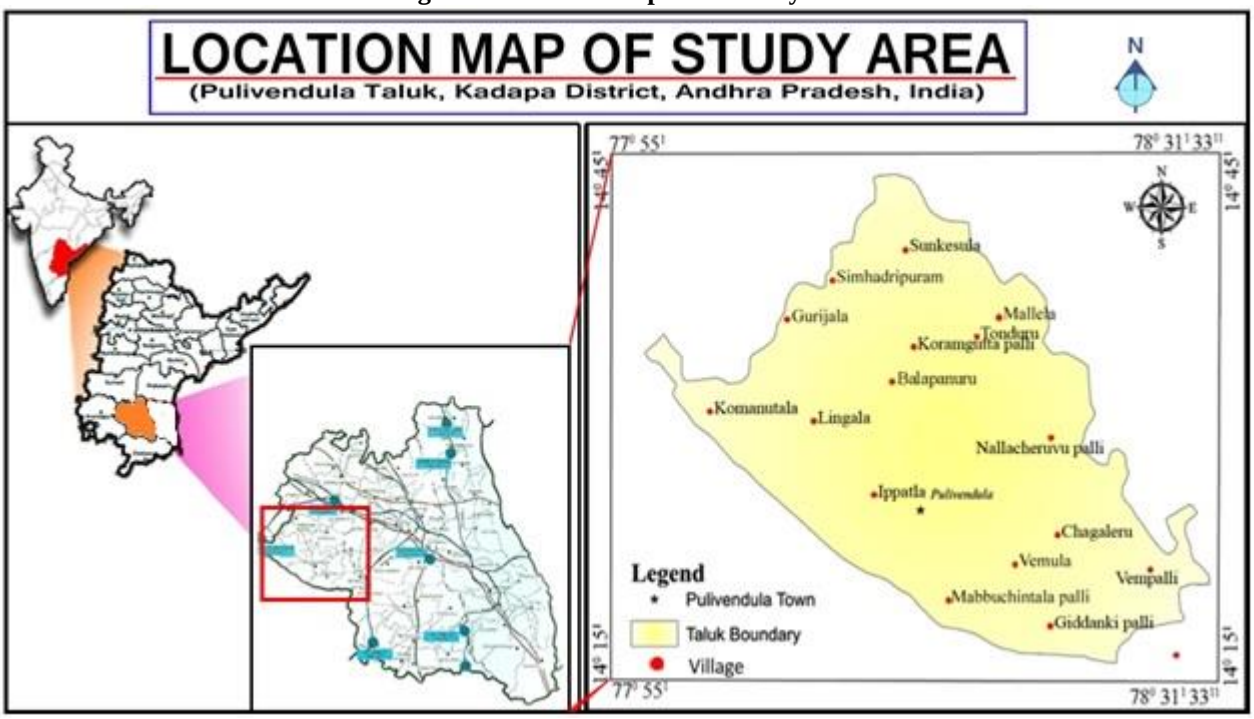
Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. The advancement in the concept of vegetation mapping has greatly increased research on land use land cover change thus providing an accurate evaluation of the spread and health of the world's forest, grassland, and agricultural resources has become an important priority. 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 (Sreenivasulu *et al.* 2013). 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 data represent a powerful tool to understand the dynamics of the agriculture where the images allow a synoptic view of the area. In addition to an integrated data base, a Geographic Information System (GIS) combines different data sets and simultaneously, facilities spatial and temporal analysis (Kurt Fedra *et al.* 1998). The RS and GIS have played an important role in the present study to assess the natural resources. Anthropogenic changes in land use and land cover are being increasingly recognized as critical factors influencing global change (Jayaraju *et al.* 2011).

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, crop land, forest land and barren lands. In this study area major natural resource is forest. Because of human activities the extent of the land under forest is getting reduced. Recently the functioning of the real estate 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. The present study describes the various land use/land cover changes and categories of the study area.

**Study area:** The study area lies between parallels of $77^0$20' to $78^0$31'33"E longitude and $14^0$ 15' to $14^0$45'N latitude with intended boundary falling in Survey of India toposheet no. 57J02, 57J03, 57J06 and 57J07. The total area covered is approximately 1506 square kilometers. The climatic conditions of this area as its minimum temperature in November-January at about 28-300 C. The hottest temperature ranges between the 40-450C ranges during April-May. There are extensive outcrops of limestone, Dolomites, Granite and Quartzite 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.

**Figure 1: Location map of the study area**




## II. MATERIALS AND METHODS

The study has made use of various primary and secondary data. These include Survey of India (SOI) topographic sheets of 57J02, 57J03, 57J06 and 57J07 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 maps:*** These maps are the true representation of earth's phenomena such as spatial distribution of natural resources existing at the time of survey (Sreenivasulu *et Al*. 2014). 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.

## III. RESULTS AND DISCUSSIONS

***1). Analysis of Landuse / Landcover by using Remote Sensing Data:***The land use/land cover categories of the study area were mapped using IRS P6 LISS-III 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, Forest land, built-up land, uncultivated land, cultivated land, rivers, water bodies.

**Figure 2: Land use/ Land cover map of the Study area**

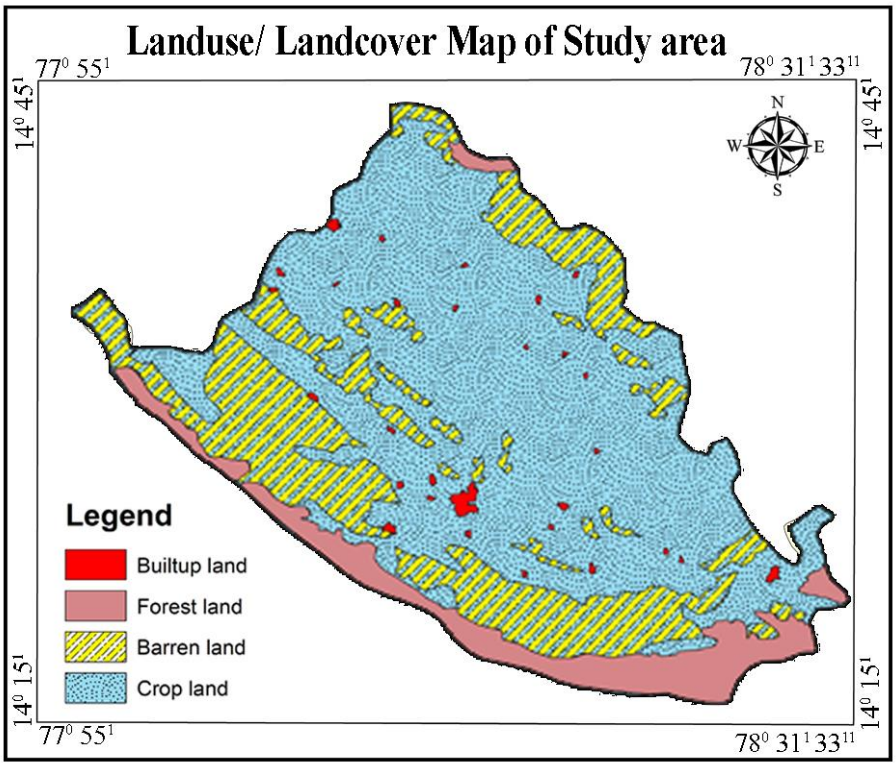



**Table 1: Land use land covers classification system**

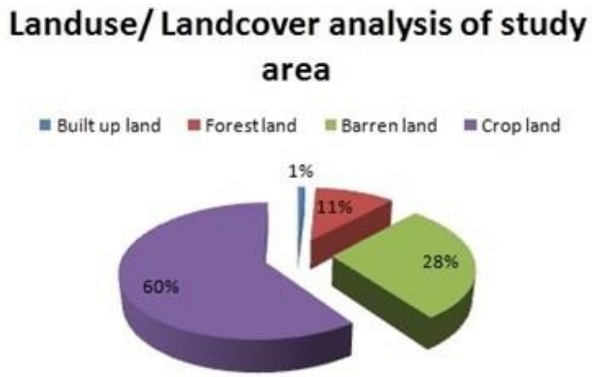
| S.No | Name of the class | Area in Sq. km | Percentage % |
|---|---|---|---|
| 1. | Built up land | 13.70 | 0.91 |
| 2. | Forest land | 162.49 | 10.79 |
| 3. | Barren land | 419.87 | 27.88 |
| 4. | Crop land | 887.03 | 58.96 |

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

***1.1) Built–up land:*** Built–up land includes educational, health and socio-economic facilities like: games/ sport viewing centres and shops etc. These features are identified with their dark bluish green tone in the core and bluish tone on the periphery. They have a typical coarse and molted texture. These areas are also associated with the network of canals, roads and railway lines. In the study area, is an urban centre, found in the central part of the study area. Some smaller settlements and tiny towns are also found in the study area. The total area covered by the major and minor settlements in the study area constitutes 13.70 sq.km or 0.91 per cent of the study area. (Table 1).

***1.2) 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, Komanuthala, Mabbuchintalapalli, Sunkesula, etc. The total forest land occupies 162.49 sq. km (10.79%) of the study area.

**Figure 3: Pie Diagram of Land Use/Land Cover**




***1.3) Barren Land:*** Barren land covers all lands which are uncultivable like mountains, deserts, bare exposed rock, strip mines, gravel pits and quarries. The areas which comprise barren lands are surrounded by the villages Lingala, Ippatla, Pulivendula, Vemula, Thonduru, Simhadripuram, and Chagaler. These lands occupy 419.87 sq. km (27.88%) of the study area and are suggested to be used for industrial and urbanization purposes (Table 1).

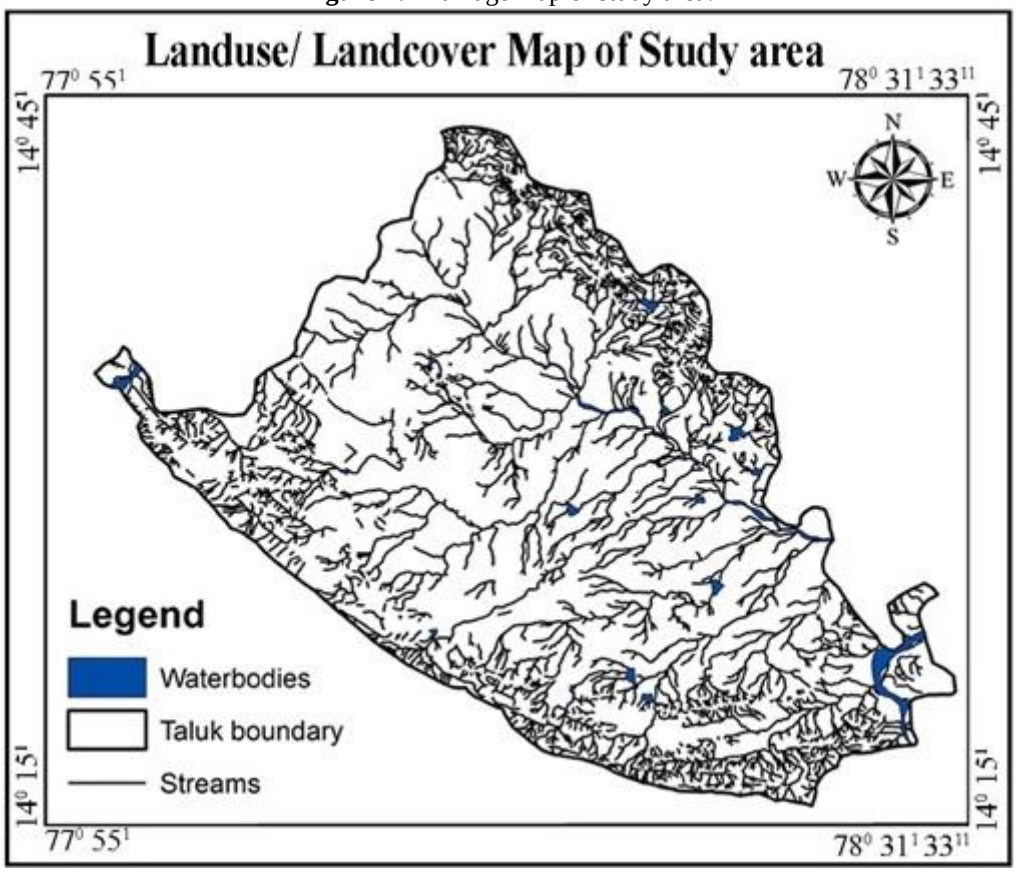
***1.4) Crop Land:*** This encompasses both cultivated and irrigated lands. These are the lands mainly used for farming and for production of food and other commercial and horticultural crops. The help of satellite data, it is possible to identify various

agricultural land uses. These include the agricultural areas identified by their characteristic red tone, regular shaped agricultural fields and in associated with settlements, water bodies, etc. Crop lands are well distributed throughout the foot hills zones, along plain regions of the study area. These crop lands were noticed at Gurjala, Balapanur, Vemula, Kovaramguttapalli, Simhadripuram, Chagaleru, etc. Crop lands occupy 887.03 sq. km (58.96%) of the study area.

***2). Drainage pattern analysis:*** The arrangement of streams in a drainage system constitutes the drainage pattern, which in turn reflects mainly structural/ or lithologic controls of the underlying rocks. The area of study encompasses a miscellany of drainage patterns; however, dendritic drainage pattern is the most dominant type and occupies more than 95% of the area. Even though, difference in stream lengths and angle of connection, yet they are in general characterized by a treelike branching system, which is a dendritic drainage pattern that indicates homogenous and uniform soil and rocks.

Radial drainage patterns also exist in the study area. They appear either as one-set or two-sets of Radial drainage patterns are develop surrounding areas of high topography where elevation drops from a central high area to surrounding low areas.

**Figure 4:** Drainage map of study area.




***2.1). Stream order (U):*** Stream order is a method for classifying the relative location of a reach (a stream segment) within the river basin. The applied method followed the procedure that modified by Stahler [12]. Stream order 1 has one connected edge, and then at the confluence of two1st -order streams assigns the downstream reach of order 2, and so on for the rest orders. In the study area has 4-stream orders, and thus a map was obtained using GIS system. In addition, the used GIS system enabled calculating the number of reaches in each order.

***2.2). Stream Number (NU):*** The count of stream channel in its order is known as stream number. The number of streams decreases as the demarcated watershed has the following stream orders and stream number.

## IV. CONCLUSION

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 crop lands are well distributed throughout the study area and it covers 887.03 sq. km (57.9 per cent). Forest occupies 162.49 sq. km and sharing about 10.79 per cent of the total land use land cover of the study area. The built-up land occupies

13.70 sq. km (0.91 per cent) and there was a rapid expansion of built-up lands. Barren land occupies 419.87 sq. km (27.88 per cent). Well developed dendritic drainage pattern is there in the study area. The spatial information of the surface will help in the optimal land use planning at the macro and micro level.

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## AUTHORS

**First Author –** Dr. T. Lakshmi Prasad, Assistant Professor, Department of Earth Sciences, Yogi Vemana University, Kadapa, Andhra Pradesh, INDIA – 516 003, Email ID: tlpyvugeo@gmail.com.
**Second Author –** G. Sreenivasulu, Research Scholar, Department of Geology, Yogi Vemana University, Kadapa, Andhra Pradesh, INDIA – 516 003, Email ID: seenu9441@gmail.com.

**Corresponding Author's Email ID:**
tlpyvugeo@gmail.com