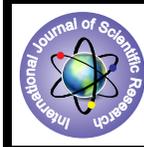


An Analysis on Land Use/Land Cover Using Remote Sensing and GIS–A Case Study In and Around Chigicherla Watershed Anantapur District, Andhra Pradesh, India



Geology

KEYWORDS : Land use/ Land cover, Remote Sensing and GIS.

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ABSTRACT

Land use and land cover map forms the backbone for any developmental planning, 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 Chigicherla Watershed Anantapur District Andhra Pradesh, India covering an area of about 211 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 topo sheets No: 57 F10, 11,13 and 57 F 14. 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, Agriculture land, water bodies, forest and waste 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.

INTRODUCTION:

To create Geo spatial thematic layers primarily for four themes (Land Cover, Infrastructure, Settlement and Drainage) for the entire watershed boundary, where as for two themes (Soil and Ground Water Prospect) will be prepared for the prioritized area. Apart from these geo-spatial resource themes, geospatial layers by using the remote sensing techniques these processes are described classification techniques, requirement of input layers, geo database schemas, field verification procedure etc. This will help in the systematic organization of contents and removal of redundancy while creating the database. The procedure described to create Geo-spatial layers are applies to the on screen delineation procedure and applicable to popular image processing and GIS software packages. However, there can be some deviation in the steps to be followed but the end output will be confirming to the total report. This chapter will be detailing the creation of following geo-spatial layers using ortho rectified high resolution (5.6) satellite LISS-IV imagery.

STUDY AREA:

Chigicherla watershed area Anantapur District, Andhra Pradesh state longitude 77° 35 ‘ 00” to 77° 46 ‘ 00” latitude 14° 30’ 00” to 14° 35’ 00” watershed area around 211 sq km. Five Mandals are covered namely Anantapur, Rapatadu, Kanaganipalle, Batalapalle and Dharmavaram. The Study area is mostly plain land and western part is covered with residual hills, denudational hills and some pediments are there. Anantapur district area experiences semi-arid climate, the summer is very hot and the Mercury rises to + 42^o Celsius. Winter is pleasant; night temperature is about 13^o Celsius to 15^o Celsius. Average rain fall per annum 550 mm in the year of 2013.

METHODOLOGY:

This is prepared by visual interpretation of satellite data of two seasons, viz., summer and rabi and is further supplemented by the information from topographical maps and other census. The interpreted maps are checked in the field and modifications if any are incorporated and the map is finalized.

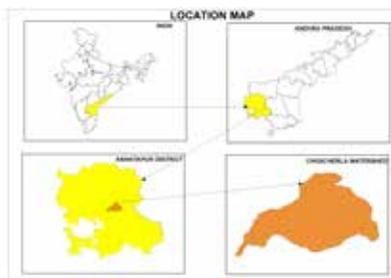


Fig: 1 Location map of Chigicherla watershed

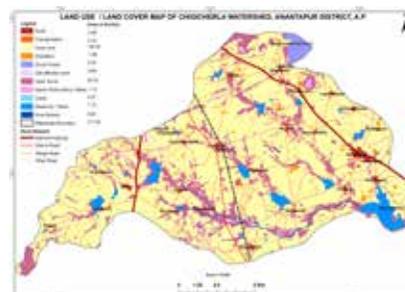


Fig: 2 Land use land cover map of Chigicherla watershed

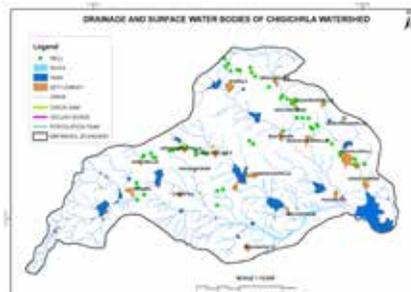


Fig: 3 Base map of Chigicherla Water shed, Anantapur district, A.P

Themes created using Satellite imagery

1. Land Use / Land Cover
2. Infrastructure
3. Settlement
4. Drainage

CLASSIFICATION:

There are three levels of classification, viz., Level - I, Level - II, Level - III in the preparation of the LU / LC maps. Level - I is used on 1: 100,000, Level - II is used on 1: 250,000 and Level - III is used on 1: 50,000 / 25,000 scale. The minimum polygon size that can be shown is 3mm x 3mm. In the Level - I, the broad classification is shown with a numerical value. For example, 2 - Agricultural land, 3 - Forest; In the Level - II, the category 2 is further sub divided into 2.1, indicating Crop land, 2.2, pointing to Fallow land etc.. In Level - III, Crop land 2.1 is further split up into 2.1.1 as Kharif and 2.1.2 as Rabi etc. This clearly indicates that as the level increases the information that has to be documented also increases. The said pattern is followed in the IMSD method. The classification that is followed in the thesis is after (NRIS), National Resources Information System. In this level - II on 1: 50,000 scale is adopted that is documented below, (Table. # 1).

Table. 1. CLASSIFICATION OF LAND USE LAND COVER

S.No.	LU / LC Category	Land Use / Land Cover Unit
1	Agriculture	Double Crop
		Single Crop
		Plantation
		Fallow land
2	Forest	Forest plantation
		Degraded forest
		Cropland within the Notified forest
3	Built-up Area	Land for commercial plants
		Settlements
4	Waste Land	Land with/without scrub
		Salt affected area
		Barren/Rocky/Stony-waste/Sheet Rock area
5	Mining Area	Mining area
	Water Body	River
		Tank
		Canal

DEFINITION AND EXPLANATION:

Land use refers to anthropogenic activities and the various uses which are carried on lands. Land cover refers to natural vegetation, water bodies, rock/soils, etc. Although land use is generally inferred based on the cover, yet both the terms are related and interchangeable. Categories that are enlisted here are broad land use/land cover classes. Such information is useful for general planning purposes when detailed information is not mandatory. Built-up land, agricultural land, forest, wasteland, and water bodies.

BUILT-UP LAND:

It is an area of human habitation developed due to non-agricultural use and that has a cover of Buildings, transport and communication, Utilities in association with water, vegetation and vacant lands. For delineating built - up land built up polygons interpreted under Settlement layer needs to be copied into LULC layer.

Built-Up Area (Rural):

The Chigicherla watershed built-up rural area is covered around 3.89 sq km. These are the lands used for human settlement and are of size comparatively less than the urban settlements of which more than 80% of the people are involved in the primary activity of Agriculture. All the agricultural villages covering 5 hectares area and more are included in this Category. These are the built-up areas, smaller in size, mainly associated with agriculture and allied sectors and non-commercial activities with

population size less than 5000, generally lack supporting facilities. They appear in dark bluish green in the core built-up area and bluish in the periphery; the size varies from small to big; irregular and discontinuous in appearance; can be seen in clusters contiguous or scattered.

Transportation:

These are the areas under use for the movement of people, goods and material. It is a measure of accessibility and connectivity. It includes railways, roads, airports, ports, waterways etc. The Road ways include major and minor roads, bridges and, rabi, season as well as two crop. This also includes fallow lands, which are areas taken up for terminal facilities such as bus and truck terminals. The rail facilities include stations, parking lots, repair and switching yards, tracks and related areas. Watershed transport area is covered 0.20 sq km

AGRICULTURAL LAND:

These are the lands primarily used for farming and for production of food, fiber, and other commercial and horticultural crops. It includes land under crops (irrigated and unirrigated, fallow, plantations etc.).

Cropland:

The Chigicherla watershed Majorly occupied crop land area is covered around 159.40 sq km out of 211 sq. km, these are the areas with standing crop as on the date of satellite overpass. Cropped areas appear in bright red to red in color with varying shape and size in a contiguous to non-contiguous pattern. They are widely distributed in terrains; prominently appear in the irrigated areas irrespective of the source of irrigation. Like paddy and wheat, Rabi season is crops are jawar, red grams Two cropping seasons exist in Anantapur District viz., kharif (June/July - September/October), and rabi (November/December - February/March) . Crop land categories also includes area under kharif cultivation but are temporarily allowed to rest, uncropped for one or more seasons, but not less than one year.

AGRICULTURE AND HORTICULTURE PLANTATION:

These are the areas under agricultural tree crops planted by adopting certain agricultural management techniques. Chigicherla watershed plantation is covered in 1.98 sq km, plantation like Banana, mango etc., which are normally grown in the hilly regions and closely associated with forest cover This category also includes the horticulture areas that refer to cultivation of citrus fruits, orchards and other horticultural nurseries, herbs, shrubs, fruits, ornamental shrubs and trees, vegetable gardens etc. mostly under irrigated conditions. Their association can be seen mostly with built-up and cropland areas.

FOREST:

In this watershed is covered scrub forest are in 2.02sq km, These are the areas bearing an association predominantly of trees and other vegetation types (within the notified forest boundaries) capable of producing timber and other forest produce. They comprise of thick and dense canopy of tall trees, which can be deciduous (moist/dry/thorn). Deciduous forest types are of predominantly composed of species, which shed their leaves once a year, especially during summer. They exhibit bright red to dark red in color in varying sizes, smooth to medium texture depending on the crown density, contiguous to non-contiguous in pattern based on their location. The size can be irregular and discontinuous occupying medium relief mountain/hill slopes within the notified areas.

Open Scrub:

This category has a similar description as mentioned in the earlier class excepting that they possess sparse vegetation or devoid of scrub and have a thin soil cover.

Barren/Rocky/Stony Waste:

These are rock exposures of varying lithology often barren and devoid of soil and vegetation cover. They occur amidst hill-forms as openings or as isolated exposures on plateau and plains. Such lands can be easily discriminated from other categories of wastelands because of their characteristic spectral response. They appear in greenish blue to yellow to brownish in color depending on the rock type. They vary in size with irregular to discontinuous shape with a linear to contiguous or dispersed pattern. They are located in steep isolated hillocks/hill slopes; crests, plateau and eroded plains associated with barren and exposed rocky/stony wastes, lateritic outcrops, mining and quarrying sites.

Land affected by salinity/alkalinity:

Lands affected by salinity/alkalinity have excess soluble salts (saline) or high exchangeable sodium. Salinity is caused due to movement of water, capillary rise during extreme weather conditions leaving salt encrustation on the surface. Alkali lands have an exchangeable sodium percentage (ESP) value of 15 or more, which is generally considered as the limit between normal and alkali soils. Salt affected lands appear in a satellite image with different shades of dull white to white color in different geographic locations. In the irrigated alluvial plains of Punjab, Haryana, Uttar Pradesh, and north eastern Rajasthan, salt affected lands appear in bright white to white tone, while in inland coastal areas, like in Gujarat, appear in light blue colour. These are essentially delineated because of their high reflectance. They appear in white to light blue color depending upon moisture content ranging in small to medium sizes. Generally they are irregular in shape and discontinuous, closely spaced or dispersed depending on their location Valleys, coastal lowlands,

WATER BODIES:

This category comprises areas with surface water, either impounded in the form of ponds, lakes and reservoirs or flowing as streams, rivers, canals etc. These are seen clearly on the satellite images in blue to dark blue or cyan color depending on the depth of water.

River /Stream/Canal:

Rivers/streams are natural course of water flowing on the land surface along a definite channel/ slope regularly or intermittently towards a sea in most cases or a lake or an inland basin

in desert areas or a marsh or another river. Depending upon the nature of availability of water, rivers are sub-divided into perennial or seasonal. They appear in light to dark blue in color, long, narrow to wide depending on the size of the river. They appear in contiguous, at times non linear pattern and associated with drainage pattern on hill slopes, flood plains or uplands, at times with vegetation along the banks. While delineating this class river stream line layer from infrastructure needs to overlaid and polygon should be drawn by keeping it as center line.

Reservoir / Tanks:

Reservoir is an artificial lake created by construction of a dam across the river specifically for hydel power generation, irrigation, and water supply for domestic/industrial needs, flood control, either singly or in combination. Tanks are small lakes of impounded water ways constructed on land surface for irrigation. They appear in light blue to dark blue depending on the depth from small to large sizes. They possess regular to irregular shape dispersed to linear, occupying lowlands, plains. They are associated with croplands, low lands and reservoirs surrounded by hills with or without vegetation.

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, Agriculture lands, forest lands, water bodies and Waste 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 Agriculture lands are well distributed throughout the study area and it covers 211 sq. km. Forest occupies 2.02 sq. km. The built-up land occupies 3.89 sq. km and there was a rapid expansion of built-up lands. Waste land (Salt affected land, Open scrub and Stony waste/Barren rocky land) occupies 34.35 sq. km. Water bodies (Canal, River/Stream, Reservoir/Tank) occupy 1.42 sq. km but well developed dendritic drainage pattern is there in the Chigicherla watershed area.

REFERENCE

- Ahamad, E, 1987, "Indian Village Patterns, Part-II, Habitat and Economy" contributions to "Rural Geography", pp 83-93 by H.N.Misra.
- Bhagavan, S.V.B.K & Raghu, V., 1998, Implementation of remote sensing based action plan and impact analysis of check dams - A case study of Somaghatta watershed, Anantapur District, Andhra Pradesh. Workshop on Watershed Management - Problems and Prospects.
- FAO, 2005, Land Cover Classification System - Classification concepts and user manual, FAO Environment and Natural Resources Services.
- Horton, R.E., 1932, Drainage Basin Characteristics, Trans-American Geographical Union.
- Lillisand, T.M and Keifer, R.W., 1979, Remote Sensing and Image Interpretation, John Wiley and sons, New York.
- Montgomery, W.G., 2006, Environmental Geology, Mc Graw Hill International.
- Pandey, N, 1990, Principles and applications of photo geology.
- Porwal, M.C., 1997, Remote Sensing analysis of Environmental Resources for Planning and development, APH Publishing Corporation, New Delhi.
- Rajan, K.S. and Shibasaki, R., 2000, A GIS Based Integrated Land Use/Cover Change Model to Study Human Land Interactions. In: International Archives of Photogrammetry and Remote Sensing, Vol. XXXIII Part B7 (3), pp.1212-1219.
- Sabins, F.F., 1997, Remote Sensing Principles and Interpretation W.H. Freeman and Company, New yark.
- Sanjeeva Reddy, G., 2012, Drainage Analysis And Assessment Of Water Resources Of Valagalamanda River Basin Through Hydrogeological, Remote Sensing And Gis Techniques, Chittoor District, Andhra Pradesh, India: Unpublished Ph.D. Thesis, S.V.University, Tirupati, P. 132-149.
- Space Based Information Support For Decentralized Planning (Sis - Dp) Manual definition most use
- Sreenivasa Rao, Y, Krishna Reddy, T.V. and Naidu, P.T., 1997, Hydrogeomorphological studies by using remote sensing application in Niva River Basin, Chittoor District, A.P. J. Indian Soc. Remote Sensing, 25(3P):187-194.
- Sudheer, A.S., 1986, Hydrogeology of the upper Aranian river basin, Chittoor District, Andhra Pradesh, India, Unpublished Ph.D., Thesis, S.V.University, Tirupati, P.151-207.