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AN ANALYSIS ON LAND USE/LAND COVER USING REMOTE SENSING AND GIS–A CASE STUDY IN AND AROUND DOSALAVANKA WATERSHED, CHITTOOR DISTRICT, ANDHRA PRADESH, INDIA

Earth Science

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ABSTRACT

This study brings out to identify the changes of land use/land cover of Dosalavanka watershed of Chandragiri mandal, Chittoor district, A.P. The relationship between Land Use and Land Cover changes (LULC) has been identified by using IRS P6 LISS III. Further, the preparation of LULC map using Survey of India (SOI) Toposheet 57 O/ 6 of the year 1982 to know the land use pattern. In the same way, the various LULC image classified which has collected from NRSC (National Remote Sensing Centre), online interpretation using ArcGIS software. The agricultural practices under agriculture land and cropland has most important crash over the hydrological processes of the watershed. Thus, the change detection obtained from LULC serve in most favorable solutions for the selection, planning, implementation and monitoring of development schemes to meet the increasing demands of human needs has lead to land management. The Remote Sensing techniques also cost effective to detect the change in LULC over a large area due to natural and human activities. This study shall be very useful for further development planning.

KEYWORDS:

Identification of Land use and Land cover, Remote sensing techniques, SOI Toposheet, and GIS.

INTRODUCTION:

To create Geo spatial thematic layers primarily for four themes (Land Cover, Infrastructure, Settlement and Drainage) for the entire Dosalavanka 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 the classification techniques, requirement of input layers, geo database schemes, 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 orthorectified high resolution (23.5) satellite LISS-III imagery.

STUDY AREA:

Chittor district is one of the chronically drought affected Rayalaseema districts of Andhra Pradesh., is situated between North Latitudes 13°30'26.097"to 13°36'26.109" and East Longitudes 79°15'11.215" to 79°21'11.663" and is covered in the Survey of India

Topographical map number 570/6 on a scale of 1:50,000. It is bounded on the North by Cuddapah and Nellore District, on the East by Tamil Nadu state, on the West by Karnataka State. The District area is 15,359 sq.km and it has a Population of 4,170,468 lakhs people (census 2011). This District is located in a 3H zone of Andhra Pradesh.
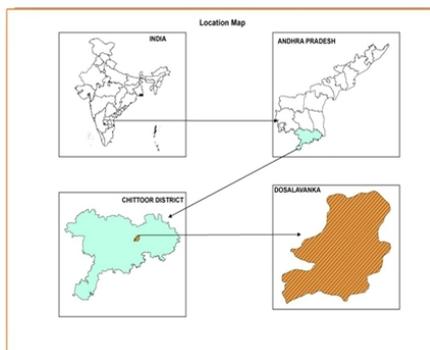
Fig: 1. Location map of Dosalavanka watershed
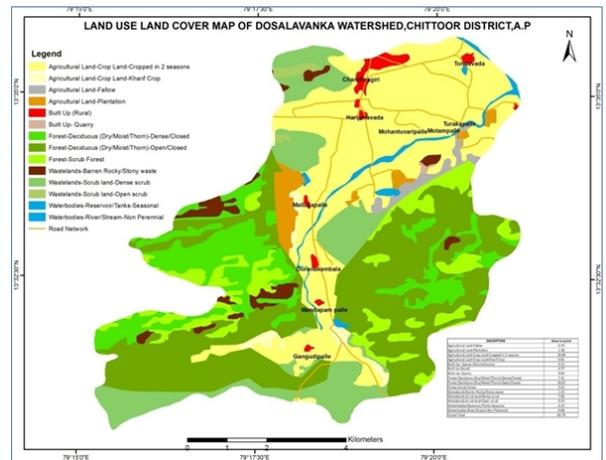
Fig: 2. Land use Land cover map of Dosalavanka watershed, Chittoor District, A.P.

METHODOLOGY:

This is prepared by visual interpretation of satellite data of two seasons, viz., kharif 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.

Data collection:

One year multi-temporal satellite imageries (Liss III of 2012) were used for the study. Field observations and focus group discussions with farming households (HHs) were also conducted to obtain additional information. Global positioning system and SOI topographical maps of scale 1:50,000 were used for ground truth verification.

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: 100000, 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...

Fig: 3. Base map of Dosalavanka watershed

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 paper 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	Built-up Area	Land for commercial plants
		Settlements
2	Agriculture	Double Crop
		Single Crop
		Plantation
		Fallow land
3	Forest	Forest plantation
		Degraded forest
		Cropland within the Notified forest
4	Waste Land	Land with/without scrub
		Salt affected area
		Barren/Rocky/Stony-waste/Sheet Rock area
5	Mining Area	Mining area
6	Water Body	River
		Tank
		Canal

1. 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. Web LULC map consists of 3 classes under built-up viz., urban, rural and mining.

i. Built-Up Area (Rural):
The Dosalavanka watershed built up rural area is covered by 0.77 sqkm out of 63sq. km. In study area the major village is Chandragiri mandal head quarter Chandragiri, and the remaining 6 are small villages used for human settlement of size comparatively less than the urban settlements of which the majority of population is involved in the primary activity of agriculture. These are the built-up areas, smaller in size, mainly associated with agriculture and allied sectors and non-commercial activities. They can be seen in clusters as non-contiguous or scattered.

2. 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.).

i. Crop land:

The Dosalavanka IInd watershed majorly occupied by crop land area is covered around 20.89 sq km out of 63 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 sugar crane, Rabi season crops are jawor, red grams. Two cropping seasons exist in Chittoor 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, un-cropped for one or more seasons, but not less than one year.

ii. Plantations:
In Dosalavanka watershed plantation area is covered by 1.38sq km. These are the areas occupied by mango trees under agricultural tree crops adopting agricultural management techniques are exhibiting a dispersed or contiguous pattern. Use of multi-season data will enable their separation in a better way. It includes horticultural plantation (like mango, sweet orange etc.) areca nut, citrus fruits, orchards.

iii. Agriculture Fallow land:
Agriculture fallow land is covered by 0.74 sq km 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.

3. FOREST LAND:
This area is majorly occupied by Reserve forest with an area of 30.94 sq.km (percent 50%) of the total area. Reserve forest includes an area, which comprise thick and dense canopy of tall trees which predominately remain green throughout the year. These forests can be identified from their dark orange tone and smooth texture. Based on tonal and texture variation, it is possible to divide the Reserve forests of the study area into two sub categories namely, dense and open forest.

i. Deciduous:
This applies to the phenology of perennial plants that are leafless for a certain period of the year (Ford-Robertson, 1971). The leaf shedding usually takes place simultaneously in connection with the unfavorable season (UNESCO, 1973).

These are the forest types that are predominantly composed of Red sanders and srigandham trees which shed their leaves once a year especially during summer. It also includes tree clad area with tree cover lying outside the notified forest boundary areas that are herbaceous with a woody appearance (e.g. bamboos, palms, tree ferns etc…)

ii. Open scrub:
In the study area the Land without scrub occupied with an area of 3.41 sq.km (percent 0.47) of the total area. These lands are also found associated with high ground and formed by degradation or erosion. It could be identified in the satellite data from its Black tone and its association with high grounds. The observers of vegetation distinguish these categories from the earlier described one. In the study area land without scrubs are found near Thurakapalle village.

4. WASTE LANDS:
It is described as degraded land which can be brought under vegetative cover with reasonable effort and which is currently under – utilized and land which is deteriorating due to lack of appropriate water and soil management or on account of natural causes. Waste lands can result from inherent / imposed constraints such as by location, environment, chemical and physical properties of the soil or financial or management constraints. The wastelands identified in the basin / watersheds are described below.

i. Land with scrub (ls):
Dosalavanka watershed area is scrub land area is covered by 0.33 sq km. They copy relatively higher topography like uplands and marginal agricultural lands which have been left waste due various reasons such as lack of water, poor soils and erosion etc…With proper soil and water management this land could be brought under soil forestry. The total area that calculated under this category constitutes the total geographical area of the region.

ii. Land without scrub (lws):

These lands are normally devoid of vegetation and are prone to degradation or soil erosion. The total area that calculated under this category is 7.33 sq km. and it constitutes the total geographical area of the region.

5. MINING:

Dosalavanka mining area is covered by 0.05 sq km. Mining areas encompass under surface mining operations Near Thurakapalle. The recognizable impacts of these activities on the landscape are unmistakable giant pit mines covering few areas. Unused extractive areas; ponds or lakes are often an integral part of an extractive operation (USGS, 1999). It includes surface rocks and stone quarries, sand and gravel pits, brick kilns, etc. These are areas of stockpile of storage dump of industrial raw material or slag/effluents or waste material or quarried/mixed debris from earth's surface.

6. WATER BODY / WATER RESOURCES:

The water bodies include both natural and man-made water features namely rivers / streams / lakes / tanks and reservoirs. The deep water features appear black in tone in the satellite image and the shallow 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.

i. River:

Dosalavanka shed is water tributary of Swarnamukhi River and is occupied by 0.68 sq km and it is a natural course of flowing water on the land along definite channels. It includes from a small stream to a big river and its branches. It may be perennial or ephemeral.

ii. Tanks:

Dosalavanka water shed area is covered with four old tanks and in summer season the tanks are dry and the area occupied by tanks is 0.23 sq km. Consisting Reservoirs / Lake / Tanks / Canals: It is a natural or man-made enclosed water body with a regulated flow of water. Reservoirs are larger than tanks / lake and are used for generating electricity, irrigation and flood control. Tanks are smaller in area with limited use than the former.

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, Agricultural lands, forest lands, water bodies and Wastelands. 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.

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