CHANGE DETECTION IN LAND USE /LAND COVER BY USING REMOTE SENSING AND GIS TECHNIQUES IN KUNAVARAM WATERSHED, EAST GODAVARI DISTRICT, ANDHRA PRADESH

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ABSTRACT

Land resources are being exploited faster than they are renewed, as a result ecosystems are degraded, life support processes are threatened and biodiversity, being the key factor in maintaining biospheric resilience is decreasing at an alarming rate. Land use Land cover is an important component in understanding the interaction of the human activities with the environment. Soil, water, flora and fauna are the important land resources, which together influence in the survival of human beings by supporting food production and providing a congenial living environment. Watershed development programmes were under taken in rain fed areas has also contain enormous potential in encouraging village communities to become self-reliant and to facilitate their economic development. The Government of India has accorded highest priority to the holistic and sustainable development of rain-fed areas through integrated watershed development approach. Watershed management programmes are mainly targeted for optimal utilization of land and water resources with minimum hazards to natural resources and environment. The remote sensing technology has immense potential to meet the challenges of land resource mapping, evaluation and management. This technology facilitated scientific methods to evaluate the watershed between two different years (before and after watershed program implementation) for land use land cover changes. These changes are assessed by interpretation and mapping of land use land cover classes using high resolution satellite imagery(LISS III) in GIS environment.

KEY WORDS: Remote sensing, GIS techniques, LULC, Change detection.

INTRODUCTION

The term 'watershed' strictly refers to the divide separating one drainage basin from another. However, over the years, the use of the term watershed to signify a drainage basin or catchment area has come to stay.

Hydrologically, watershed could be defined as an area from which the runoff drains through a particular point in the drainage system. Watersheds exist naturally and due to human intervention for agricultural purposes the changed ecology and management practices affect the well equilibrated ecologies. If watersheds are not managed properly then the natural resources are degraded rapidly and in due course cannot be used for betterment of humans. Soil, water, air, and vegetation are the most important natural resources for the survival of human beings and animals. For maximum production of vegetation all the resources have to be managed efficiently and effectively. Efficient management of these resources is possible through a suitable unit of management so that these resources are managed and handled effectively, collectively, and simultaneously. Watershed management can be defined as rational utilization of all the natural resources for optimum production to fulfil the present need with minimal degradation of natural resources such as land, water, and environment. Water can be managed if a watershed is taken as a unit. Since soil and vegetation can also be conveniently and efficiently managed in this unit, a watershed is considered the ideal unit for managing the vital resources of soil, water, and vegetation. In a watershed, people and animals are the integral parts of the watershed community. Humans and animals depend on the watershed for their survival and in turn are responsible for the good or bad use of the resource.

EVOLUTION OF WATERSHED DEVELOPMENT PROGRAMMES IN INDIA

Watershed development is a programme that evolved over a period of 50 years and now identifies the integrated interaction between various natural resources belonging to a watershed which is a natural phenomenon. This ensures least disturbances in the natural processes of protecting environment.

Having large tracts of rain shadow zones, the state suffers drought and has a long history of droughts. Early efforts were to provide drinking water and hence the drilling technology was adopted by Voluntary Organizations, identifying the need, a suitable pump was evolved within Action for Agricultural Renewal in Maharashtra (AFARM) and large number of installations of hand pumps was executed. Unbalanced exploitation of groundwater enforced the change in attitude towards impounding larger quantities of water. Thus the progress was from locating water well sites scientifically, drilling and installation of hand pumps, conjunctive use of water to Water Cycle itself. However, such progress always fell short since other natural resources harmoniously interaction with water.

The Watershed development Programme evolved out of large number of experiments carried by Member Organisations to eliminate drought. Today the programme takes into account - the soil, the rocks, the water, the geography, the biomass living within and above the earth. Thus as many as 6000 impounding structures were

constructed during the period of learning along with bore wells, lift irrigation schemes etc. Today Action for Agricultural Renewal in Maharashtra (AFARM) proposes participatory Watershed Development where people using their traditional knowledge, available material, imagination and creativity to plan their watershed and implement a programme approved by themselves.

OBJECTIVES

The following are the objectives of the study:

- Generation of thematic layers such as settlement locations and transport network, drainage and surface water bodies, Geology /Geomorphology, slope, aspect, land use and land cover of the kunavaram watershed using RS & GIS techniques.
- To study the distribution of drainage system and other water bodies
- To study the drainage density
- To study the Geology and Geomorphology
- To study the Land use/Land cover patterns of the study area.

STUDY AREA

Kunavaram is located in East Godavari District of Andhra Pradesh. The Kunavaram watershed is situated it lies between 17°35'21.12° and 17°33'38.67°N   latitude and 81°16'7.95° and 81°14'20.48°E longitude and the total area is 613 ha. It has population of 4798 of which 2252 are males while 2546 are females as per 2011census.Average Sex Ratio of Kunavaram is 1131 which is higher than Andhra Pradesh state average of 993. Child Sex Ratio for the Kunavaram as per census is 1020, it has higher literacy rate compared to Andhra Pradesh. In 2011, literacy rate of Kunavaram was 69.30 % compared to 67.02 % of Andhra Pradesh. In Kunavaram Male literacy stands at 77.82 % while female literacy rate was 61.85 %. It has substantial population of Schedule Caste & Scheduled Tribe population. Schedule Caste (SC) constitutes 30.41 % while Schedule Tribe (ST) 11.84 % of total population in Kunavaram. In Kunavaram out of total population, 2115 were engaged in various livelihoods. About 73.43 % of workers are main workers engaged either in Employment or Earning for more than 6 Months, while 26.57 % were involved in Marginal activities providing livelihood for less than 6 months. Among the main workers, 143 are cultivators (owner or co-owner), and 802 are Agricultural labourers. Tobacco, Paddy, Sugarcane, Ground nut, are the major crops that are cultivated mostly in this area. Dwaraka Tirumala, Polavaram Project, Kolleru Pelicanry and Birds Sanctuary, Natta Rameswaram, EluruAshram, Venu Gopalswamy Temple, Pattiseema, Ksheerarama, Somarama, Biology Science Park are the major tourist attractions near to Kunavaram.

Study Area Map- Kunavaram
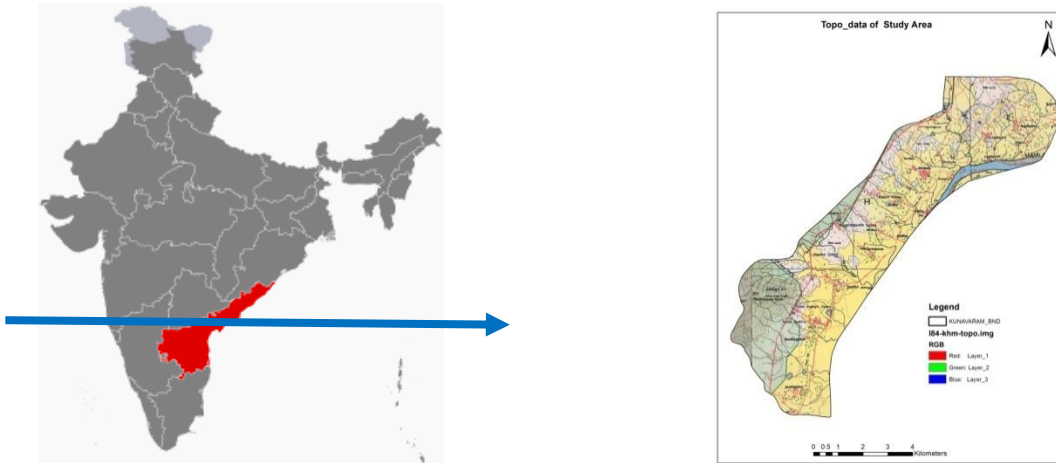
DATA USED

IRS – 1C PAN and LISS III merged data on 1:50,000 scale for the years 2005-06 and 2011-12 were used for the   study. Survey of India top sheets on 1:50,000 scale were used to collate topographic information, preparation of base maps, location of sample areas / ground truth sites and planning for traverse routes in the field .The other relevant information indicating geology and geomorphology of the study area was used from existing maps and reports.

For the present study data used for years 2005-06 and 2011-12 from TRAC (Telangana State Remote Sensing Applications Centre Hyderabad). Data regarding to Land use/Land cover map, Transportation, Slope, Aspect, Geology, Hydro-geomorphology, Rain Water Harvesting Structures, Settlements, drainage and surface water resource etc have been collected from TRAC.

METHODOLOGY

Survey of India (SOI) topographical sheets and normal false colour composites (FCC) of IRS-1C Pan and LISS-III merged data dated 2005-06, 2011-12 were used for the study. Preliminary information about the geology of this area was collected, through literature review which served the basis for carrying out pre field interpretation and post field interpretation. The satellite data was visually interpreted using the elements like shape, size, pattern, tone/colour, texture, association etc., and terrain elements like topography, drainage, vegetation and land use pattern etc.
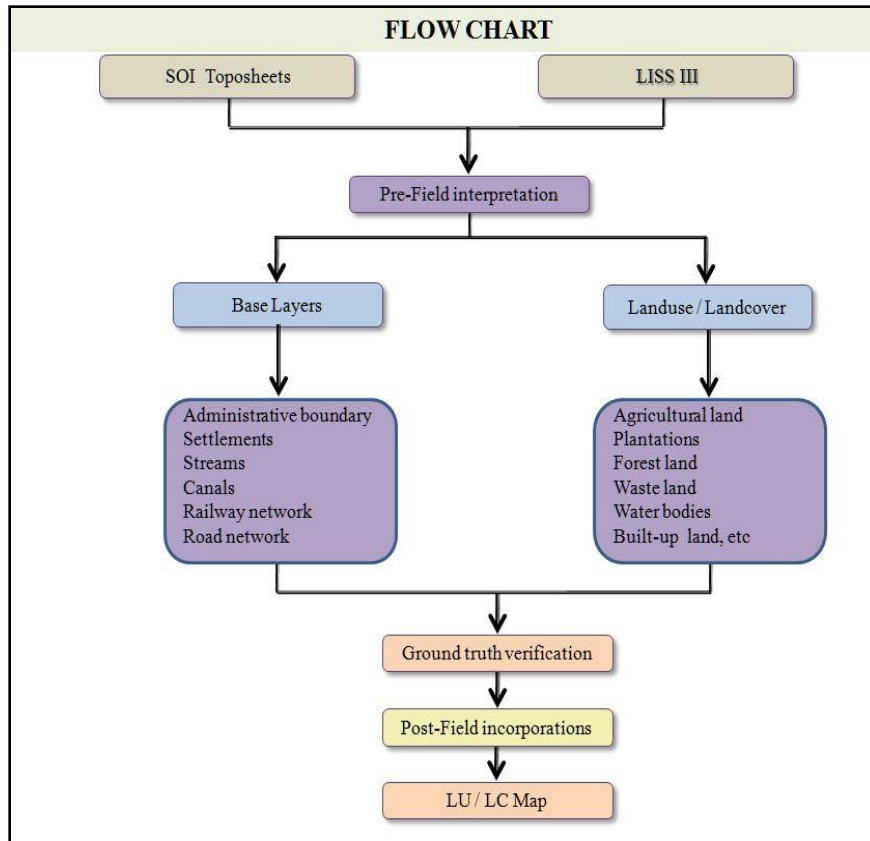
The study was carried out specifically for the years, 2005-06 and 2011-12:

➢ Base maps including road, railway, settlement, village location and watershed boundary extracted from the topographic sheets and converted into GIS database.

➢ The modifications in the LULC map updated with Remote Sensing Imageries.

➢ The functionalities of GIS namely, to identify the areas of changes taken place, the density and spatial distribution and to identify land resource inventory.

The Change Detection of Land use/ Land cover of the study area (2005-06) & (2011-12) and its area extent are shown in Table 1 and Table 2.

Table 1
Land use/ Land cover of the Kunavaram Watershed (2005-06)

S. No	Description	Area (ha)	Area (%)
1	Crop Land	3721.01	60.66848
2	Built-up	102.28	1.667604
3	Waste Lands	661.14	10.77943
4	Water Bodies	235.06	3.83249
5	Forest	1413.86	23.052
Total		**6133.35**	**100.00**

Table 2
Land use/ Land cover of the Kunavaram Watershed (2011-12)

S. No	Description	Area (ha)	Area (%)
1	Crop Land	3705.9	60.42167
2	Built-up	100.736	1.642418
3	Waste Lands	660.9	10.77543
4	Water Bodies	234	3.815178
5	Forest	1431.86	23.3453
Total		**6133.396**	**100.00**

RESULTS AND DISCUSSION

- The major common Land Use categories such as agricultural land, wastelands, Settlements, Forest & Water bodies identified and mapped from the SOI topographic sheets.
- The land use of the year 2005-06 was mapped, classified and calculated accurately from the toposheets, it was compared with those prepared from the satellite imageries (IRS 1C LISS III).
- The IRS 1C LISS III data used as the source for the land use/land cover mapping.
- The registration and digitization of the watershed was done using Arc GIS 10.2 Software to create land use coverage.
- Five land use categories i.e. Crop land, Wastelands, Settlements, Forest & Water bodies are identified.
- Land use/Land cover map of 2005-06 was prepared from toposheets while those of 2011-12 were prepared from the satellite imageries.
- The area occupied by each of these categories during 2005-06 and 2011-12, the % increase and % decrease is shown in Table 3.

Table 3
Comparative Area Statistics of Land use/ Land cover for of the Kunavaram Watershed (2005-06   -2011-12) in %

S. No	Description	Area (%)	Area (%)	% Change
1	Crop Land	60.66848	60.42167	-0.24681
2	Built-up	1.667604	1.642418	-0.02519
3	Waste Lands	10.77943	10.77543	-0.00400
4	Water Bodies	3.83249	3.815178	-0.01731
5	Forest	23.052	23.3453	0.29330
Total		**100.00**	**100.00**	**0**

CONCLUSION

The results have shown that in the total study area of 6133.35 Ha, consideration of the existing socio-economic scenario is necessary before implementing any sort of land use practices in the study area in future. It is expected that the findings of the investigation will undoubtedly be of use to planners and local bodies to implement suitable land use plans in the watershed, thereby achieving eco-preservation and enabling the restoration tanks under various watershed programmes.

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