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Land Resources Action Plan in Guntur District Using Geographical Information System

KEYWORDS: GIS, Thematic Map, Spatial Distribution Map

Dr.M.Anji Reddy
Centre for Environment, IST, JNTU, Hyderabad

Uma Devi Randhi
Centre for Environment, IST, JNTU, Hyderabad

Dr.K.Santosh kumar
Centre for Environment, IST, JNTU, Hyderabad

Dr. T. Vijaya Lakshmi
Centre for Environment, IST, JNTU, Hyderabad

ABSTRACT *The natural resources are considered as more efficient and appropriate for necessary survey and investigation for the assessment of the natural resources and subsequent planning and implementation of various developmental programmes. The Remote Sensing and GIS tools could be helpful in getting the precise and valuable spatial information in understanding the present scenario contemplating with the past data and predicting the future trends. The main objective of the study is to create the spatial information for natural resources in COMMAND AREA and to develop methods for its efficient utilization and sustainable management utilizing remote sensing and GIS techniques. The thematic layers are derived from IRS-ID PAN + LISS-III merged satellite imagery and Survey of India (SOI) topomaps using visual interpretation technique. These maps are converted to digital format using AutoCAD software and further integrated using Arc/Info and Arc View GIS software for the generation of final outputs.*

1.0 Introduction:
To improve the management of natural resources, with an improvement of water and Land quality, greater knowledge about their quantity and quality is required. There is also a need for regular and systematic of geographical, hydrological and hydro- geological data, together with a system for processing the quantitative and qualitative information for the various types of water bodies and Land resources (Krishnamurthy J et al., 1996). Moreover keeping an adequate inventory of water availability is one of the desirable pre-requisites for the quantification of water – user rights, for the formulation of water quality standards, for the adjustment of economic inceptive systems and for the development of many other administrative measures. The study area is for sure helpful in micro level natural resources management planning and in sustainable development for this remote sensing and GIS techniques.

2.0 Methodology:
2.1 Study Area:
Guntur district was formed on the 1st October, 1904 with Head Quarters at Guntur after bifurcating Krishna and Nellore districts. The district is bounded on the North by Krishna and Nalgonda districts, on the West by Prakasam and Mahaboobnagar districts, on the South by Prakasam district, on the East by Krishna district and Bay of Bengal. It is situated between $15^0\ 16^1$ and $16^0\ 50^1$ of the Northern Latitude and $70^0\ 10^1$ and $80^0\ 55^1$ of the Eastern Longitude.(Fig-1)

Fig:-1 Toposheet of Guntur District

2.2 Data collection:
Different data products required for the study include Survey of India (SOI) toposheet (56O/14,15), fused data of IRS–1D PAN and LISS-III satellite imagery obtained from National Remote Sensing Agency (NRSC) and collateral data from related organizations comprising of collateral data and demography data.

2.3 Database creation:
Satellite imageries are georeferenced using the ground control points with SOI toposheets as a reference and further merged to obtain a fused, high resolution (5.8m of PAN) and colored (R, G, B bands of LISS-III) output in EASI/PACE Image processing software. The study area is then delineated and subsetted from the fused data based on the latitude and longitude values and a final hard copy output is prepared for the generation of thematic maps using visual interpretation technique (Giriraj Kumar Songara and Nidhi Rai, 2010). These thematic maps (raster data) are converted to vector format by scanning using an A0 flatbed desk Jet scanner and digitized using AutoCAD software for generation of digital thematic maps using Arc/Info and ARCVIEW GIS software. The GIS digital database consists of thematic maps like Land use/ Land cover, drainage using Survey of India (SOI) toposheets and fused data of IRS - ID PAN and IRS-ID LISS-III satellite imagery.

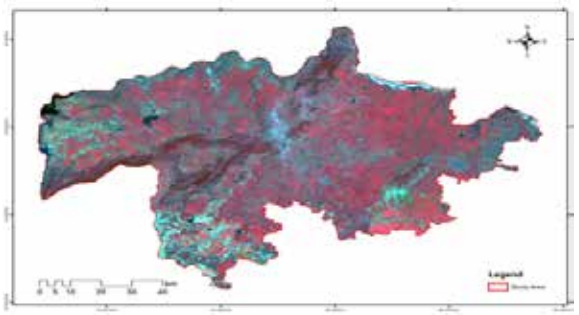

Fig:-2 Satellite Map of Study Area

2.4 Spatial Database:
Creating a GIS spatial database is a complex operation, which involves data capture, verification and structuring processes. In the present study, the layers generated from toposheet and satellite data using visual interpretation technique include base map, drainage map from SOI Toposheet. The procedure consists of a set of image elements, which help

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in the recognition or interpretation of various land use / land cover features systematically on the enhanced satellite imagery during the classification of features. The thematic maps generation system used in this study is the system, which is pioneered by United States Geological (USDA, 1951) and is modified by National Remote Sensing Agency (NRSA) according to Indian conditions. The base map is overlaid on the satellite imagery. Then the different thematic layers features are extracted from the satellite pictorial data. (Fig-2)

2.5 Attribute database:
The thematic maps are converted to digital mode using scanning and automated digitization process. These maps are prepared to a certain scale and show the attributes of entities by different symbols or coloring. The location of entities on the earth's surface is then specified by means of an agreed co-ordinate system. It is mandatory that all spatial data in a GIS are located with respect to a frame of reference (NRSC, 1995). For most GIS, the common frame of reference co-ordinate system is that of plane, Orthogonal Cartesian co-ordinates oriented conventionally North-South and East-West. This entire process is called geo-referencing. The same procedure is also applied on remote sensing data before it is used to prepare thematic maps from satellite data. This digitized data is then exported to ARC/INFO, Arc View GIS to create digital database for subsequent data analysis.

3.0 Results and Discussions:
3.1 Topographic map
A topographic map is a representation of the shape, size, position and relation of the physical features of an area. The base map is prepared using SOI toposheet on 1:50,000 scale and updated with the help of satellite imagery. It consists of various features like the road network, settlements, water bodies, canals, railway track, vegetation etc. delineated from the toposheet. The map thus drawn is scanned and digitized to get a digital output.

3.2 Soil:
Soil resource inventory provides an insight into the potentialities and limitations of the mapped area for its effective exploitation. It is important that we prepare an inventory of this resource so that we can develop optimum land use and conservation plans. The specific objectives of soil mapping are identification, characterization and classification of the soils of the area, which serve as a crucial input for preparing an integrated plan for sustainable development of the area (SS. Asadi et al., 2012). Soil surveys provide desired information on nature, location, extent and physico-chemical characteristics along with their spatial distribution.

3.3 Wasteland:
In the study area Land with or without scrub, Barren rocky/ stony waste/sheet rock area. The waste land map is prepared using the data extracted from the base map; land use / land cover map, Survey of India toposheet and interpretation of satellite imagery. In the study area, land with scrub (3%), land without scrub (1%) and sandy area (1%) (NRSA, 1986).

3.4 Physiography:
The purpose of Physiography layer is to understand disposition and distribution of barriers of winds. The Physiography is prepared using the contours derived from Survey of India topo sheets (SOI, 1978). The Physiography classes plains, undulating land, Hills are observed in the study area. According to the central pollution control board (CPCB) the plain area comes under low category and the hill area comes under high category. Most of the study area is covered by low category (98 % of the study area), high Category.

3.5 Land Use/Land Cover:
The land use/land cover categories such as built-up land, agriculture, forest, water body and wastelands have been identified and mapped from the study area. Major part of the study area is covered with single crop and double crop (66%). About (1%) of the study area is under built-up land and Industrial area is (0.017%). From the satellite data the agriculture area (80%) could be clearly delineated as four categories, single crop, double crop, fallow land and plantations. Though single crop and double crop has been observed at various parts of the study area and plantations are observed at some places of the study area, Water bodies occupied (2 %). About (1%) of the study area is under scrub forest and (4.21%) of area is under wasteland. Under this category land with scrub (3%), land without scrub (1%) is observed. Based on the land use/land cover categories, infiltration rates of water are less at built-up land and barren sheet rock areas. Consequently, groundwater potentials at these places are low, whereas the places where water bodies are present have high potentials and moderate potential at remaining categories.(Fig-3)

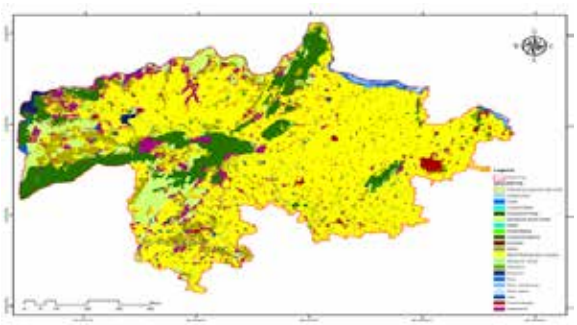

Fig:-3 Land Use/Land Cover Map of Study Area

4.0 Conclusion:
It is established that remote sensing technology and GIS of critical nature and Generation of resource information system like land and water resources which will become handy for the planners for their effective monitoring and management. This study recommends effective soil and water conservation measures to increase the subsurface aquifer capacity and identifies suitable cropping patterns, which help in reduced soil erosion, increased moisture conservation and improved productivity of the soil. The physical characterization of an area is also useful to plan the basic minimum needs of farmers, thereby improving their socio-economic conditions and helps in evolving a broad national policy which can be applied by decision makers for sustainable development of any given study area.

4.1. The general Action Plans for Land Resources:
In view of these semi-arid climatic conditions of the study area, the following measures are recommended for general soil conservation.

- Crops like Paddy, Red gram, Bengal gram, Chilles, Fruits and vegetables are recommended.
- Individual bunds of land parcels may be planted with Acacia-nelotika (Nalla tumma), Acacia- senegal, Neem, Papaya, Wild drumstick and tamarinds are suggested.

In common, each village may grow fodder species like Stylosanthes hamata, Stylosanthes scabra, dalichas lab-lab, Vigna, Unguiculata and Sorghum sudanense.

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