ANALYSIS AND INTERPRETATION OF LAND RESOURCES USING REMOTE SENSING AND GIS: A CASE STUDY

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ABSTRACT

The human Activities are Constantly adding industrial, domestic and Agricultural wastes to the ground water reservoirs at an alarming rate. In the last few decades, parallel with rapidly developing technology, increase in population and urbanization we have been witnessing alarmed phenomena all over the world. Anthropogenic activities including generation and indiscriminate disposal of solid wastes and extensive use of fertilizers have resulted in increasing levels of air, water and soil pollution, changing land use patterns, decrease in arable land and other dominant problems. The thematic map of the study area is prepared from linearly enhanced fused data of IRS-ID PAN and LISS-III merged satellite imagery and Survey Of India (SOI) toposheets on 1:50,000 scale using visual interpretation technique and using AutoCad and Arc/Info GIS software forming the spatial database.

KEYWORDS: Thematic maps, groundwater quality, remote sensing and GIS

I. INTRODUCTION

Man needs Land for domestic purposes such as cooking, cleaning utensils, gardening, washing clothes and above all for drinking. It is also needed for commercial, industrial and recreational purposes. Land used for such purposes should be not polluted, but should be of good quality. Urbanization and industrialization have directly or indirectly polluted most of the land sources on a global scale. Impact studies can contribute to improve urban development and environmental planning at the project and policy levels and it also introduces analytical tools to support such planning. Remote sensing applications have been operationalized in most of the natural resource management themes and at present the trend is on integrated surveys to arrive at sustainable developmental packages. Keeping this in view, an attempt is made.

II. STUDY AREA

The Maripeda Mandal lies geographically between latitudes 17° 20’ 00” and 17° 35’t 00” and longitudes 79°45’ 00” to 80°00’ 00” is covered in the Survey of India toposheet numbers 56 O/14 and 56 O/15. It is one of the 51 Mandals of Warangal district, in Andhra Pradesh. Maripeda town is at a distance of 90 kms. from Warangal (District H.Q.) and 120kms from Hyderabad (State Capital).
2.1 Study Objectives

- To prepare the digital thematic maps namely Base map, Transport network map, Geomorphology map, Ground Water Potential map, Land use/ Land cover, Hydro geomorphology, Physiographic map, Waste land map, Drainage map etc. using satellite data, collateral data and field data on ARC/INFO GIS platform. This constitutes the spatial database.

III. METHODOLOGY

3.1 Data collection

Different data products required for the study include Survey of India (SOI) toposheets bearing with numbers 56O/14 and 56O/15 on 1:50,000 scale. Fused data of IRS–1D PAN and LISS-III satellite imagery obtained from National Remote Sensing Agency (NRSA), Hyderabad, India. Collateral data collected from related organizations, comprises of water quality and demographic data [2].

3.2 Database creation

Satellite imageries are geo-referenced 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 as shown in Figure 1. These thematic maps (raster data) are converted to vector format by scanning using an A0 flatbed deskjet 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, road network using Survey of India (SOI) toposheets and fused data of IRS - ID PAN and IRS-ID LISS-III satellite imagery (Figure 2).

![Fused satellite imagery](image)

**Figure1.** Fused satellite imagery

3.2.1 Spatial Database

Thematic maps like base map and drainage network maps are prepared from the SOI toposheets on 1:50,000 scale using AutoCAD and Arc/Info GIS software to obtain a baseline data. Thematic maps of the study area was prepared using visual interpretation technique from the fused satellite imagery (IRS-ID PAN + IRS-ID LISS-III) and SOI toposheets along with ground truth analysis. All the maps are scanned and digitized to generate a digital output (Figure 1).
IV. RESULTS AND DISCUSSION

4.1 Village Map

This shows the geographical locations of all villages in the Mandal is called Village Map [1]. This map is prepared by digitization of the maps of Central Survey Office. Revenue boundaries of all the villages are plotted in this map. The entire data of the village available is attached to this Map as database using GIS. This database is very useful to know the present scenario of a village. This map is used for analyzing village wise land resources. In the study area there are 23 revenue villages, out of these Maripeda, which is the Mandal head quarter. By preparing the Village map feature of the individual village can be easily identified.

4.2 Base map

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. The information content of this map is used as a baseline data to finalize the physical features of other thematic maps.

4.3 Transport Network Map

In the study area all the settlements are connected either by Metalled road or Un-Metalled road. Where as, State Highway connects Maripeda. Railway network does not exist in the Maripeda Mandal. The nearest railway station is Khammam, which is at a distance of 18kms SouthEast of Maripeda village.

4.4 Drainage

Drainage map is prepared by using Survey of India Topographic maps on 1:50,000. All the streams and tanks existing in the study area are marked in this map. These streams further classified based on stream ordering. Only two minor rivers namely Palleru and Akeru exists [3]. The drainage system existing is dendritic. Tank bunds are also marked in the map.

4.5 Watershed characteristics:

The watershed map is prepared in accordance with the National Watershed Atlas and River Basin Atlas of India, 1985. According to this, India is divided into 6 regions out (watershed Atlas of India, 1990) of which the present study area comes under Region-4 and part of basins D, catchment 1,sub-
catchment C,D. The study area is under sub-catchment C watersheds (4D1C6,4D1C7) and under D sub-catchment. (4D1D2) are coming under these watersheds 71 sub-watersheds has delineated [4].

4.6 Slope map

Slope classes 1, 2 and 3 are observed in the study area. Most of the study area is covered by nearly level, very gently, gently slope class (92%). Small part of the study area (4%) comes under moderately sloping class 4 and (2%) study area comes under the strongly sloping class 5 (IMSD Technical Guidelines, 1995).

4.7 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 (Figure 3). Major part of the study area is covered with single crop and double crop (93%). About (0.015%)of the study area is under built-up land and Industrial area is( 0.017%). From the satellite data the agriculture area (96.05%) could be clearly delineated as four categories, single crop, double crop, fallow land and plantations [5]. 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( 0.18%). About (0.46%) 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 (0.24%) and barren sheet rock area (0.09%) are observed (Figure 3).

Figure 3: Flow chart showing the methodology adopted for the present study
4.8 Geomorphology

The geomorphological classes observed in the study area are Pediplain with moderate weathering (PPM) (42%), Pediplain with shallow weathering (PPS) (31%), valley (v) (14%), pediment (PD) (8%), pediment inselberg complex (PIC) (2%), inselberg (1%), pediment (1%) and dyke and dyke ridge (0.12%).

4.9 Geology:

The study area constitutes mainly a granitic terrain (pink-grey) exposive a variety of archaean granitoides of peniusular gneissic complex (PGC) and schistoic (older metamorphic) rocks. They are intruded by basic dykes (Proterozoic) and covered locally by the deccan traps (upper cretaceous to lower Eocene) [6]. The geological categories observed in the study area are mainly granite (98%), basalt (2%), and some of lineaments, dolerites and pegmatites.

4.10 Soil

The specific objectives of soil mapping are identification, characterization and classification of the soils of the area. The soil types identified in the study area are (1) loamy-skelital,mixed, rhodicpaleustalfs (55%). (2) Fine loamy, mixed, fluventicustropepts (10%) (3) Fine, montmorillonitic, typichaplusterts (35%).

4.11 Groundwater potential

The groundwater potential map is prepared based on the analysis of various themes such as geomorphology, land use / land cover, lineament, intersection points, drainage pattern, lithological evidences by using converging evidence concept, besides the collateral data obtained from State Groundwater Board with necessary field checks [7]. The groundwater potential map reveals the available quantum of groundwater and is delineated into zones showing high (53%), medium (30%), low (17%), groundwater potential areas.

V. CONCLUSIONS AND RECOMMENDATIONS

1. Through the analysis of soils attribute data, it is clear that 39% of the study area is effected by erosion. In future this may lead to sedimentation and other consequential problems to the major water bodies of study area. This could be best controlled by construction of gully control bunds and extensive reforestation or through agricultural soil conservation and management practices.

2. As irrigation water requirement varies with different crops, cropping pattern in the study area is to be changed for optimum utilization of this resource. Crops like pulses, vegetables should be cultivated, which may result in the reduction of water requirement as well as fertilizer and pesticide load in the study area.

3. The three key activities that are essential for the development of a watershed area are,
   - Irrigation management
   - Catchment management
   - Drainage basin monitoring and management

To address these three activities planners need physical characteristic information on comprehensive lines. Hence, the present work, concentrated on the development of physical characteristics for this study area. The planners at execution level can rely upon such kind of physical characteristic information system for various other watersheds.

4. This study has been concluded to above stated findings. But this study will be useful as input base line data for models like LWAT (Land and Water Assessment Tool) that give more precise and detailed long term predictions on land and water resources.
REFERENCES


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A. Sivasankar is working as Assoc. Prof., Deptt. of Civil Engineering, KL University, Green fields, Vaddeswaram, Guntur, A.P, India. He has 14 years of research experience & supervised 2 M.Sc & 2 M.Tech Dissertation. He was Principal Investigator DST Sponsored Fast Track Young Scientist Project cost of Rs15,24,000/-.