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Evaluation of Spatial Database For Land Resource Management for Regional Planning Using Gis For Rangareddy District, Telangana.

KEYWORDS

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ABSTRACT *On the 21st century, the world community has been exposed to tremendous technological advancements. Information has become almost instantaneous. In spite of these relevant changes there are certain basic needs which never change the exploding population and growing needs are creating pressure on the finite natural resource and the un-event distribution of rainfall is adding fuel to the effect. A scientific approach on a holistic manner is necessity today, for the proper monitoring and management of natural resources. The planners and executers at field level are to be provided with the accurate information in all aspects to cater to the demanding needs. An attempt was made in semi-arid tropic area, by availing the high resolution satellite data, implementing GIS and collection of GPS points to assess the suitability pattern and to involve a widely acceptable model to suggest and develop the proper land use planning, the indigenous high resolution satellite data are availed for two seasons (Khariff & Rabi) to generate the necessary thematic information which are analysed for the land resource management.*

1. INTRODUCTION

Land, a finite resource, is shrinking in extent and deteriorating in quality as a result of expanding urbanization, industrialization, varied civic uses and mismanagement of water resource. The current gap between demand and supply of land, fuel, fodder and timber is likely to worsen in near future as a consequence of continuing degradation of land and reduced per capital land availability. Irrigation in a particular situation may degrade the land, if not scheduled and planned properly as per the requirement of crop and soil. Suitability evaluation of land for irrigation is a systematic appraisal of land and their designations by categories or classes on the basis of physical and chemical characteristics. The characteristics of land that determine its suitability for irrigation are topography, wetness, texture, depths to bed rock, $CaCo_3$, water retention and infiltration rate. Land evaluation aims at assessing resent projection performance level and its production potential for a specific purpose.

Remote Sensing has shown great potential in Land resource model mapping and monitoring due to its advantages over traditional procedures in terms of cost and time effectiveness in the availability of information over larger areas. Hence, it is proposed to use remote sensing data for the mapping of natural resources. Nevertheless, the surface reflectance spectra over a wide range of objects and conditions should be identified and interpreted into meaningful outputs prior to decision-making and applications. Satellite Remote sensing images, such as IRS-LISS, PAN and WIFS are used. GIS (Geographic Information System) has become an important tool because it enables to integrate the complex decisions to be taken under multivariant situations of the resource base and their dynamics. Survey of literature reveals that GIS techniques have been employed for development of Land resource model for Irrigation Management.

2. OBJECTIVES

- To generate GIS and MIS digital database for the study area "Addanki Branch Canal of Nagarjunasagar command area" namely,
- Spatial database consisting of thematic data derived from Satellite data (2015) and topographic data from Survey of India
- Attribute database consisting of collateral data acquired from various organisations and the data collected through field studies.

3. LOCATION OF THE STUDY ARE

The Ranga Reddy district of Telangana state lies 7 km away from mandal headquarter Chavalla of Ranga Reddy district. This village is located between 17°15′ and 17°16′ North latitudes and 79°05′ and 77°06′ East longitudes.

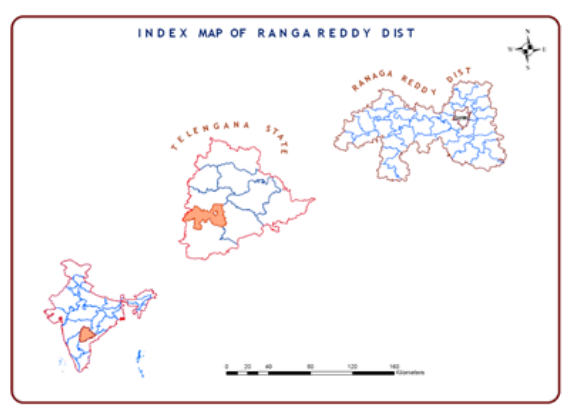

Figure 1.1: Location Map

4. METHODOLOGY

a)Generation of Thematic Maps

The thematic maps namely, land use/land cover, geomorphology, geology, groundwater prospects map and soil are generated from hardcopy of the satellite digital data. The standard basic elements and key elements for visual interpretation are applied on the satellite hardcopy image so as to extract the entropy or information content in accordance with the above thematic maps. At the end of the interpretation process, the above paper based thematic

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maps are ready for subsequent scanning and automated digitization for creation of a digital database for GIS data analysis and modeling.

b)Generation of Topographic Maps

Creating a GIS spatial database is a complex operation, which involves data capture, verification and structuring processes. Raw geographical data are available in many different analogue and digital forms such as toposheets, aerial photographs, satellite imageries and tables. Out of all these sources, the source of toposheet is of much concern to natural resource scientist and an environmentalist. In the present study, the base layers generated from toposheet are,

1. Base map
2. Drainage map
3. Transportation Network map
4. Watershed map
5. Slope map
6. Physiography map

These paper-based maps are then 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 GIS are located with respect to a frame of reference. 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.

5. ATTRIBUTE DATA

The attribute data in the present study consists of collateral data, which includes demographic details, soil quality data, water quality data acquired from various Government organizations like Telangana Pollution Control Board (TPPCB), Central Ground Water Board (CGWB), Bureau of Economics and Statistics (BES) etc.

6. RESULTS

Land resource is only meaningful with respect to specified kinds of use. This principle embodies recognition of the fact that different kinds of land use have different requirements. As an example an alluvial floodplain with impeded drainage might be highly suitable for cultivation but not suitable for many forms of agriculture. The concept of Land resource is only meaningful in terms of specific kinds of land use, each with their own requirement, like soil moisture, rooting depth etc. the qualities of each type of land, such as moisture availability or liability to flooding are compared with the requirement of each use. Thus the land itself and the land use are equally fundamental to Land resource evaluation. Satellite remote sensing, GIS and GPS has emerged as a potential tool and efficient technology for inventorying and monitoring of natural resources especially the crops, soils, irrigation management and drought monitoring. The remote sensing techniques are very effective in estimation of expansion and prediction of suitability model for different crops over large areas both in terms of cost effectiveness and timeliness over traditional method of area and production.

The generation of data base needs the source information comprising non spatial data and a spatial data. The spatial data is comprised of land use/land cover, drainage, base details and soil maps etc. The non-spatial or attribute data is composed of climatic parameters, crop pattern etc. In this chapter, the steps involved in deriving all these data products, the sources of data acquisition and the ways of transforming these data products suitable to GIS software are discussed.

This work has been accomplished with the use of the capacity of Geographical Information System (GIS) as a tool for remote sensing data processing and analysis. This chapter introduces spatial data issues involving data collection strategies, the use of cartographic and remote sensing products as sources of digital data and digital characteristics of spatial databases. Data collection issues include the choice of spatial model for discretizing geographic properties, for example, necrotizing the real world by objects with clearly defined boundaries, defining regions such as polygons with assumed internal homogeneity. These spatial models are transformed into various data structures such as the raster or vector formats. In this chapter the methods of generation of spatial database and analysis is presented.

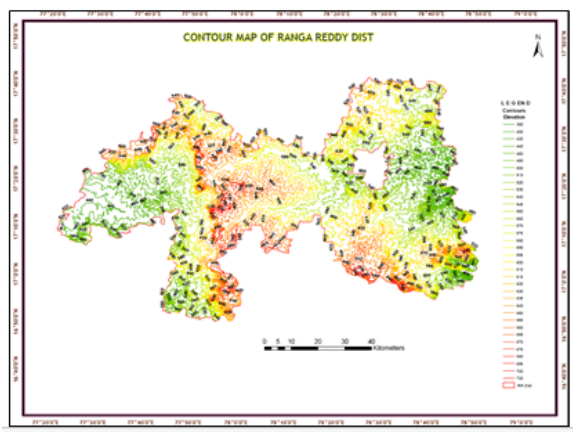

Figure 1.2: Contour Map

Figure 1.3: Geomorphology Map

6.1 SPATIAL DATABASE GENERATION & ORGANIZATION

Mapping of different themes is carried out using the data derived from remote sensing data analysis, supported with ground truth studies on GIS platform. Spatial elements of GIS database, which depends upon the end use and defines the spatial data sets that will populate the database. The spatial elements are application specific and are mainly made of maps obtained from different sources. The spatial elements are categorized into primary elements, which are the ones that are digitized and / or entered into the database, and derived elements, those that are derived from the primary elements based upon GIS operation. To perform this study, the spatial database is created with the help of scanning with automated digitization and GIS software. Thematic layers are generated for the study area using the data obtained from Survey of India toposheet, satellite digital data and ground observations. The step by step procedure for creating the spatial database is discussed in the following paragraphs.

a) Flow of operations in spatial database generation

Based on the design, the steps of database creation are worked out and a procedure lay down. The procedure for

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the spatial database creation adopted in general for preparation of all themes is described below:

b) Creating spatial frame work: The spatial framework of the GIS database can be organized in the GIS by specifying the registration points for the total database and specifying the registration points for the total database and specifying the coordinate system of the database. Registration points for the total area are entered through key -board.

c) Master template creation: A master template is created as a reference layer and consisting of the boundary, drainage and base map features etc. This template is then used for the component themes digitization.

d) Thematic map manuscript preparation: Based on the spatial domain, the different themes oriented information is transferred from the base map to a transparent sheet. Spatial data manuscripts are consisting features that are to be digitized. And the instructions like, registration point locations and identifiers, features codes as per the defined codes, feature boundaries, tolerance specifications and other relevant digitization / scanning instructions to be followed.

e) Digitization of features: The features of the spatial data set are then digitized / scanned using the GIS package. The digitization / scanning is done for each map sheet of the spatial reference. The master registration reference points are used for the digitization. Each theme prepared, digitization is done as a component into a copy of the master template layer.

f) Coverage editing: The digitized coverage is processed for digitization errors such as dangles, constituting the overshoots or undershoots and labels for polygons. And finally the coverage is processed for topology creation using GIS in ARC / Info workstation.

g) Attribute coding verification: The attribute codes for the different categories need to be then verified and additional attributes – feature name, description etc. are added into the feature database. After these operations the thematic coverage are ready for GIS analysis.

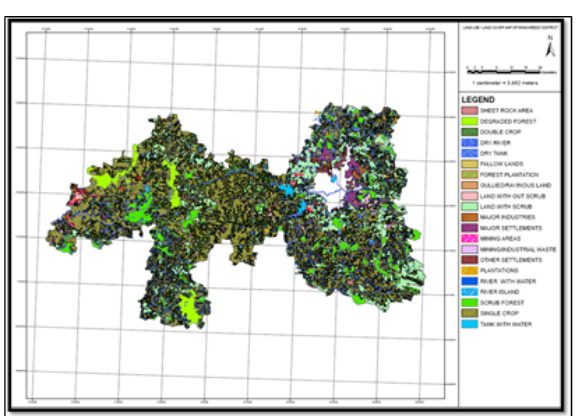

Figure 1.4: Land Use/Land Cover Map

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