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GIS AIDED MICRO LEVEL RESOURCE MANAGEMENT- A CASE STUDY OF VETAPALEM MANDAL OF PRAKASAM DISTRICT, ANDHRA PRADESH, INDIA.

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ABSTRACT

Development of any region depends upon proper planning and utilization of its natural resources. The essential component in planning is the availability of reliable and up-to-date database of existing resources and their spatial extent. Geospatial technologies, *viz.*, GIS, remote sensing, GPS play a key role in generating timely and reliable information for planning and decision making at all the levels for a region. The present study deals with the generation of integrated information system on natural, physical and demographic setup of Vetapalem Mandal of Prakasam District, India. An attempt is made to prepare a query based system under GIS environment (Arc/Infoand Arc/ View) using AutoCAD and remote sensing software (ERDAS). The thematic maps developed for the study are broad based suited to different users wherein provide mandal information at a quick instance and also acts as a store house of experts opinion.

KEYWORDS: Geospatial technologies, Remote Sensing, GIS, Arc/info, Arv/View, ERDAS, Thematic maps.

INTRODUCTION

The natural resources are finite and are essential for human survival. Over exploitation of these natural resources has led to serious environmental degradation throughout the world. Ineffective management and implementation of unsystematic planning have accelerated the deterioration and depletion of these natural resources to a serious degree that, if no remedial actions are undertaken immediately the human kind has to face a disastrous situations in the near future. Therefore, natural resources management and planning is the need of the hour, necessary to bring about sustainable development *(McCall,M.K,2002)*.

India is basically an agrarian country with 70% of population live on agriculture. Since the agriculture sector is the major contributor to the economy of the country, any shortage in the output of food production due to degradation of natural resources are now leading to all problems as anticipated. It is becoming a hindrance to economic development, and has led to riots at some places and migration of people from drought affected areas. Worst of all, water has been the reason for many regional disputes and bitter inter-state water conflicts.

In order to solve these problems, a long – term planning and management strategy is to be evolved and implemented on the basis of Natural resources management essential of effective control of water, soil, air, and biodiversity *(Ghosal,A and Ghosh,S., 1992*). Recent technological advances in domain of Geospatial technologies are making considerable impact in planning activities (*Arun Chaturvedi, Sexena R.K.,Tamgade D.B, 2001).*

These domain of planning is of prime importance for countries like India with varied geographic patterns, culture activities etc. The purpose of using GIS is that, maps provide an added dimension to data analysis which brings us one step closer to visualizing the complex pattern and relationships that characterize-real world planning and policy problems *(Kanse,S. 2001*).

Study Area

The study area selected for the project is a part of Prakasam District of Andhra Pradesh. The study area is located in -15^0 45'- 15^0 53' latitudes and 80^0 15' – 80^0 24' longitudes with Chirala mandal on North, Chinnaganjam mandal on South, Bay of Bengal on East and Naguluppalapadu mandal on West.

Objectives of the Work

The primary objectives of the present work are:

1. To generate database on natural, physical and demographic setup of Vetapalem Mandal from the analysis of data from satellite and different governmental organizations.

2. To prepare a user interactive information system, which facilitate the retrieval and query on spatial and non spatial database of the area for the planners in support of decision making.

Data used
Four types of data are mainly used, Remote Sensing data, topographical data, socio-economic data and climatologically data.

METHODOLOGY

The methodology adopted for developing the user interactive information system of the study area is based on the analysis of the integrated database of both spatial and non-spatial data under GIS environment.

The spatial data is comprised of land use/land cover, Geomorphology, drainage, watershed, physiography, base details, slope, geology and soil maps. The non-spatial or attribute data is composed of socio-economic data collected from different government departments.

Data Types
Basic data types used in creating all the GIS maps for the present study are
1. Topographical data
2. Thematic data
3. Field data
4. Collateral data

Spatial Data
The spatial data is derived from satellite sensing system and survey of India toposheets. The satellite sensor data of IRS-ID satellite, Survey of India toposheets are of 66A/5 and 66A/6 on 1:50,000 scale.

Attribute Data
The collateral data used for this study are irrigation information, agricultural data, demographic details, industrial and other related environmental data acquired from various organizations

The spatial data related to the present work is broadly based on
a) Satellite data derived themes
b) Topographic sheets derived themes
c) Attribute data based themes

a). Satellite data derived themes
Satellite Data Processing
In this study, the remote sensing data in the digital mode is used and is obtained by LISS III of IRS ID. Map of 1:50,000 scale obtained from SOI covering the entire study area is used to extract the Ground Control Points (GCPs) and to demarcate the boundary of study area. This information is then used for image registration of LISS III digitally using ERDAS software.

Visual Interpretation
LISS III imagery of FCC mode is used for visual interpretation to extract the thematic data by applying both pre-visual interpretation, ground-truthing and post visual interpretation techniques.

Generation of Thematic maps
The thematic maps namely, land use/land cover, Geomorphology, geology, groundwater prospectus map and soil are generated from satellite digital hardcopy. The standard basic elements and key elements for visual interpretation are applied on this satellite hardcopy digital image so as to extract the entropy or information extent in accordance with the above thematic maps. At the end of the interpretation process the above thematic maps in the form of paper based maps are ready for subsequent scanning and automated digitization and then created a digital database for GIS data analysis.

b). Topographic sheets derived themes
Creating a GIS spatial database is a complex operation, which involves data capture, verification and structuring processes. In the present study, the base layers generated from toposheets are,
- Base map (location map)
- Drainage map
- Transportation Network map
- Watershed map
- Physiography map
- Slope map

These paper-based maps are then converted to digital mode using scanning and automated digitization process. These maps are prepared to the scale and show the attributes of entities by different symbols or colouring. The location of entities on the earth's surface is then specified by means of an agreed co-ordinate system.

c). Attribute data
Attribute data describe the characteristic of spatial features. Spatial data and attribute data in a GIS are typically linked through the feature Ids.

In the present study, the attribute data is comprised of socio-economic data and other field based information associated with spatial patterns.

Integration in GIS environment
In GIS, topology is the term used to describe the geometric characteristic of objects, which do not change under transformations and are independent of any coordinate system. Topology consists of metric aspects of spatial relations, such as size, shape, distance and direction. The geometric relationship between spatial entities and corresponding attributes are very crucial for spatial analysis and integration in GIS.

In topology creation both the spatial and attribute data are linked from which different parameter maps are generated. These maps depict the spatial distribution of non-spatial information on spatial locations. The final maps are brought into Arc View software to prepare a

conceptual query based information model comprising all the spatial and non-spatial data sets in integrated format.

The following are few themes derived based on the attribute data

- Irrigation sources map
- Land utilization map
- Major crops map
- Population – literacy map
- Ration card holders map
- Education map
- Agriculture based people map
- Query based map
- Electric connections

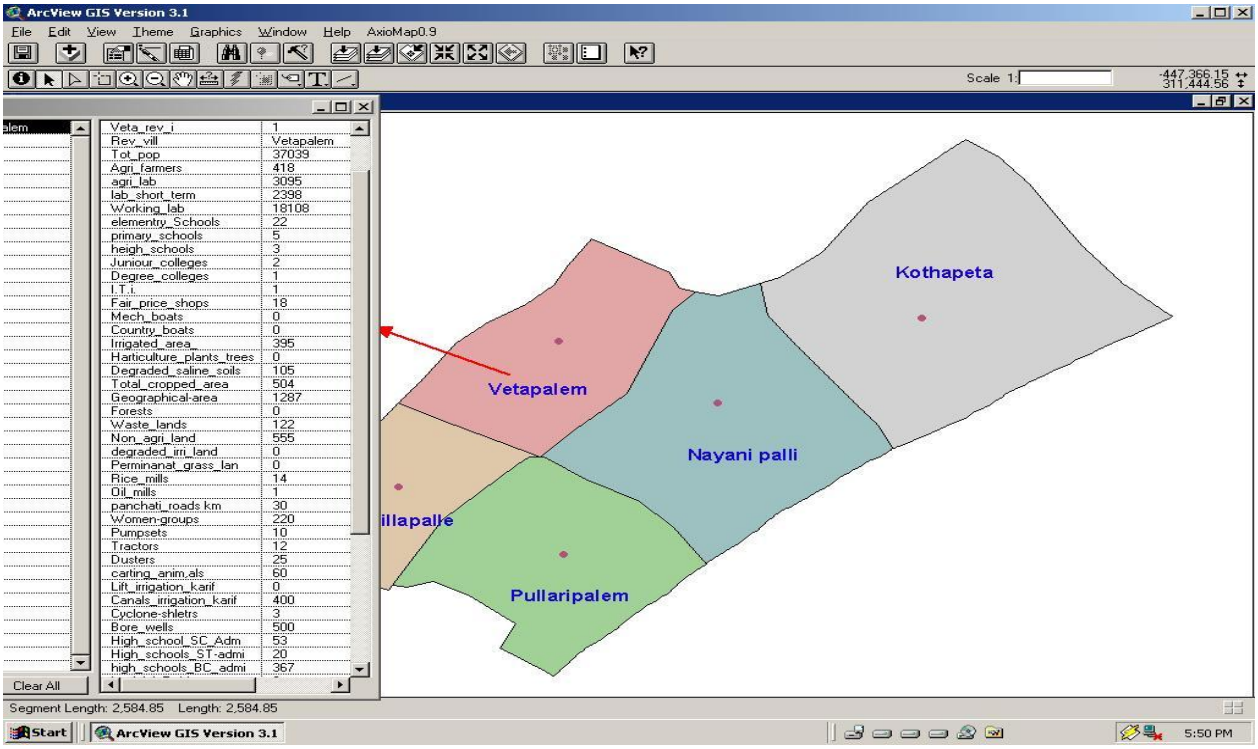

Fig 1: Map with integration of spatial and attribute data of Vetapalem Mandal.

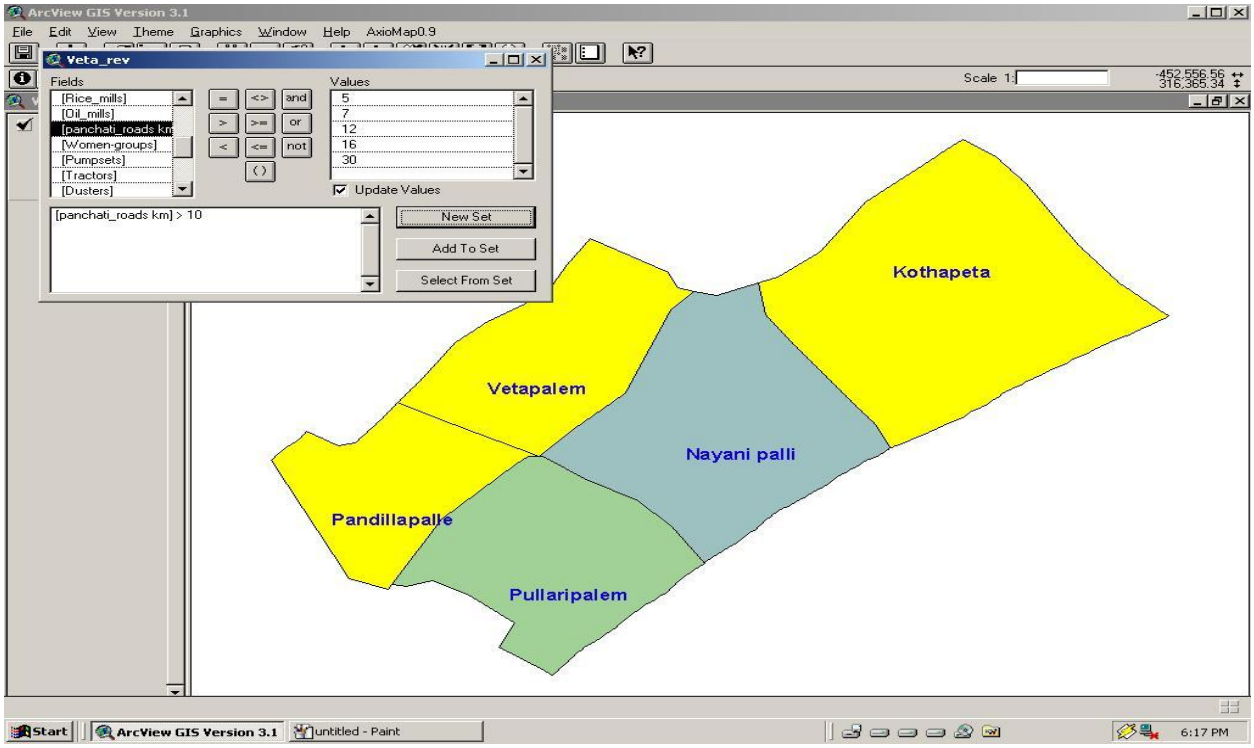

Fig 2: Query based map.

RESULTS AND DISCUSSIONS

This GIS-based model will help the users in analyzing village level information, to retrieve data/information, make useful queries on spatial and nonspatial database to identify candidate villages/entities; and generate various views or scenarios for taking better decisions.

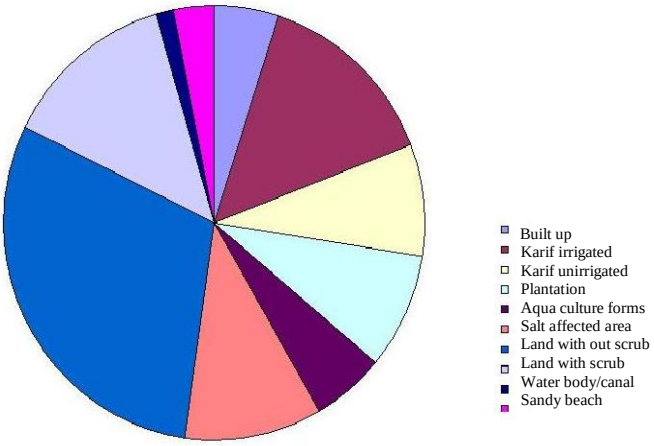

Chart: Land use / Land cover Classification of Vetapalem Mandal.

The land use land cover information of the study area is a veritable knowledge base of detailed land related information of the mandal, which can help in scientific planning and development. It is also evident from the fig. that 53.8% of the study area falls under different stages of degradation (Land with/without scrub, salt affected lands), 41.2% of agriculture lands (covering both seasons) and 5% of built up category.

The study area has a *good to moderate* ground water potential. The agriculture is mainly contributed through Canal based and lifts irrigation sources. There is wide scope for improving the irrigation processes during both seasons by implementing optimal ways of utilizing ground water and surface water. The major crops of the study area are paddy, groundnut and aqua-forming.

Measures must be taken to improve salt affected and scrub lands into arable lands and cultivate the fodder/plantations to reduce salt spread. The main reasons for the spread of these salty areas are aqua-farming and salt water intrusion as the study area is close to the sea.

Hence there is a need to coordinate information dissemination about new varieties of land forming based on modern agri-based technologies

CONCLUSIONS

The maps developed in the present project are broad based suited to different users wherein provide Mandal information at a quick instance and also acts as a store house of experts opinion.

The queries are flexible for an expert user to query for his present conditions and check for the spatial extent and accordingly suggest plans. This can be particularly useful to find the possible drawbacks or potential of an area before going in for any developmental activities of the study area.

Further mentioned that the present work is limited to mandal level, therefore it is needed to incorporate village level spatial components particularly the cadastral maps which has more significance to enhance the utility of the technology to guide and advise the farmer community at their individual land extent level with better accuracy.

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