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Water Resource Management through Remotesensing and GIS in a Watershed of Gundlupet Taluk, Chamarajanagar District, Karnatak, India

KEYWORDS

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ABSTRACT *Water is essential commodity for the survival of the human being on the Earth. Fortunately, it is available in sufficient amount both from the surface and groundwater sources. But unfortunately its distribution in space and time is highly uneven. Therefore, water resources management practices should be identified using the dynamic form of spatial data set collected through remote sensing and the resulting spatial information and related descriptive attribute must be analyzed through sophisticated computer based data analysis system known as Geographical Information System (GIS).*
Remote Sensing and GIS have been extensively used in management of water resources by various workers in different geo-environment setup. In view of above, watershed of part of Gundlupet taluk which is a semi arid region has been carried out using remote sensing and GIS techniques. Though Gundlupet receives copious rain but the terrain and soil condition is as such that it allows very little storage of water and hence the region faces shortage of water in dry seasons.
Strategy for water management has been studied using the IRS LISS III data, geophysical resistivity and has been analyzed through GIS software, finally water prospects map of the area has been prepared and discussed in this paper.

INTRODUCTION

Water which is available both as groundwater and as surface water is a precious commodity for the survival of human being. Therefore, water resources management techniques/ practices should be carried for exploitation and conservation of water. Such techniques enhance the quality of land-water vegetation of a geographical area under control of a hydrological system, i,e., a watershed unit.

Thus the management of entire land area served by various aquifers that drains into a particulars body of water is termed as Watershed Management. This is the most appropriate geographical unit for studying the water resources where water circulates, being transferred from precipitation to soil –moisture and groundwater available. Soil moisture is the water available for plant production and is represented by the seepage of water into the soil.

Water resources management requires the study of topography, drainage lines, erosional features and land cover mapping. The terrain characteristics (geomorphology) and drainage pattern reveals the nature and availability of groundwater. The erosional features provide details of soil-slope pattern and also rain fall – run off characteristic. Vegetation and agriculture gives the clue of soil moisture condition. Thus the identification of drainage lines of a watershed unit with pattern of geomorphology, slope and soil helps in formulating the water resources management practices of a region.

The above types of thematic maps could be either generated through conventional surveys or from non-conventional surveys. As the conventional surveys over a large area is labour intensive and time consuming the non-conventional techniques of satellite remote sensing is applied because of its digital form of recording in multispectral – multi-temporal modes in real time.

Several Remote Sensing Satellites are in operation which is managed by various countries. Fortunately, India operates its own remote sensing satellites and presently IRS-IC and 1D have payload with high spatial resolution sensors (PAN-5 mt; LISS III-35 mt; WIFS – 180 mt). for details of IRS-1C and 1D satellites, user may refer the various issues of INTERFACE published by National Remote Sensing Agency, Hyderabad. These satellites imagery are used to prepare various required thematic maps (spatial data) and are then analyzed interactively with descriptive (attribute) data through sophisticated Geographic Information System (GIS) software's. The GIS allows storing, retrieving and analysis of geographically referenced data of spatial in nature (map data) and associated non-spatial data (attribute/tabular data) for decision making results through sophisticated hardware and software system. Several commercial GIS software's are available in the market (details are avoided here).

Watershed Management studies through Remote Sensing and GIS have been carried out by various workers under various terrain conditions (Chakravorty, 1993; Chakravorty, 1995; Rao et al, 1995; Thomas et al, 1999).

In the present paper water resources management of Gundlupet taluk watershed has been carried out through remote sensing and GIS with S.O.I Toposheet as base map and other associated ancillary data, field checks as ground truth, results have been discussed in reference to ground water prospect and alternative land use practices for proper resources management of the area.

GEOGRAPHY, GEOLOGY AND HYDROLOGY OF THE STUDY AREA

The study area lies between latitude 110321 to 110581 N latitude 760241 to 760501 E Longitude in Chamarajanagar district, Karnataka, and is situated about 60 km form Mysore in SW direction. It covers about 1406 sq km, which is one of the largest taluks and drought prone areas of Chamarajanagar district. The basin is characterized by poor soil cover, scarce vegetation, erratic rainfall and lack of soil moisture for most part of the year. Recurring drought coupled with increase in groundwater exploitation results in decline in groundwater levels. In order to manage and develop sustainable scheme, it is to delineate the groundwater potential zones. The entire area is drained by a small stream, which flows towards southwest. The high altitude area in the Southeastern part is at about 786m above mean sea level (MSL), whereas the southern most part where river flows out is at 460 m AMSL. The area receives an average annual rainfall of about 765 mm,(from 1901 to 1970). The surface runoff goes to stream as instant flow. Most of the drainages flow southeastward forming upper catchments. There are few tanks across these drainages; however, most of these remain dry The climate of the region is semi arid to tropical and gets copious rain during rainy season.

Groundwater occurs under unconfined condition in the

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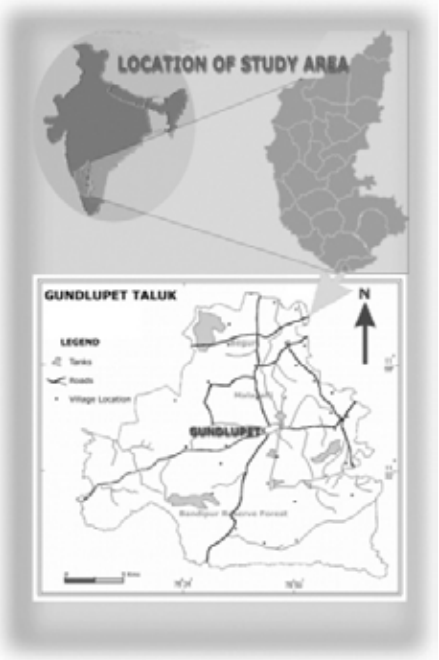
weathered zone of consolidated rocks and in the weathered zone. It also occurs under semi confined and confined states in deep fracture zones in the metamorphic and sedimentary rocks.



METHODOLOGY AND DATA USED

The basic data used for present study area:

(1) Digital data of IRS-IC – LISS III. Jan 1996. This was processed using the EASI-PACE software at RRSSC, Kharagpur for various enhancements and classification operations. The best enhanced data recorded in film and using multi band data standard F.C.C, was produced. The FCC in diapositive (35mm) form used in PROCOM2 for generating thematic maps in 1:250,000 scale. Following thematic maps generated using the standard photo-interpretation from this enlarged images.

(a) Drainage map supplemented and an noted with the help of Survey of India toposheet in 1:250,000 scale.
(b) Land cover map using the supervised classification technique.
(c) Geomorphic soil boundary map. Soil boundary map has been updated with the help of published map.
(d) Lineament map.

In addition at limited spots around Gundlupet taluk we carried out Schlumberger Resistivity Sounding Survey and the aquifer depths have been found around 150 mt to 200 mt of depth. Finally all these thematic maps have been analysed and a composite hydrogeomorphological map has been generated as shown in appropriate places.

RESULTS AND DICUSSION

The study and results have brought out the following five distinct geomorphic features which features which are discussed systematically here with respect to groundwater prospect, alternative land use practice and sites for check dams for conserving surface water for enhancing the water resources of the region.

Geomorphic Unit I: Hillocks and Mounds

Structural ridges : The area is covered with mixed forest and has steep to moderate slope (15 to 35%) resulting in high run off. Soil (DSI, DS2) is typical Ustrothents associated with fine loamy Haplasulf of reddish colour. It is shallow well drained gravelly loamy soil, non-sticking, friable when moist. The region is covered with few lineaments/fractures with sub radial drainage pattern and hence the groundwater prospect is low. The suggested land use is afforestation with mixed species……..

Geographic Unit II: Pediments

The area is covered with bushes with cultivated land has moderate to steep slopes (5 – 10%). Soil is typic Ustrothents.. associated with fine loamy Haplasulf of red colour. Also shallow well drained gravely loamy soil occurs on gentle sloping granite gneiss land scape with loamy surface and server erosion of loamy skeletal Typic Haplusalfs. Though the region has few lineaments and drainage pattern is dendritic to sub parallel with linear parallel radial drainage patterns. The groundwater prospect is moderate to poor. Check dams at suggested sites and drainage shall improve the water resources of the region.

Geomorphic Unit III: Pediplane

Undulating upland with intervening Land cover is wasteland with thin scrubs, grass and cultivated land fill region. Soil is yellowish deep moderately well drained, fine loamy on gently sloping undulating plateau with loamy surface and moderate erosion, Typic Haplusalf. Soil is associated with deep poorly drained fine soil, fine Aeric Ochraqualfs. The region is covered moderate number of lineaments with moderate drainage density of dendritic pattern.

Geographic Unit V: Peneplain Inselberg complex

Low eroded residual hill with rocky knolls. The unit represents barren land with shallow well drained gravely sandy soil on sloping landscape with severe erosion. Drainage density is poor with sub parallel to sub radial pattern and groundwater is poor. Suggested land use is plantation with suitable bushes/scrubs.

Geographic Unit V: Peneplain

Gentle to very sloping terrain. Grey to yellowish grey colour well drained gravely loamy soil (DS9. Also deep poorly drained fine soils occurring on very gentle sloping undulating low surface with moderate erosion-fine aeric ochraqualf.

Land covers is scrubly with intervening agriculture and pasture land. Drainage pattern is sub parallel to sub dendritic. Prospect of groundwater is moderate. Plantation with mixed. Species should be carried out to stop soil erosion.

Due to extensive mining in the area, landscape is ugly looking dotted with dumps of mining and coal materials with abandoned mining pits, headgears and coke oven plants. Besides few dykes have been also observed trending WNW-ENE.

SUMMARY AND CONCLUSION

By studying the hydrogeomorphological set up of Gundlupet taluk watershed through remote sensing and GIS it has

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been possible to decipher the water resources potentiality particularly for groundwater prospect of the five identified geomorphic units viz; i) hillocks and mounds ii)pediments iii) pediplains iv)pediments with inselberg complex and v) peneplains of gondwana terrains. Except in hillocks and mounds and in pediment inselberg complex, the ground water prospect in moderate to good. But in moderately weathered pediplains the groundwater prospect is very good and in shallow weathered pediplains potentiality is moderate.

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