Ground Water Potential Mapping in Chinnar Watershed (Koneri Sub Watershed) Using Remote Sensing & GIS

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Abstract

The present work deals with the assessment of groundwater potential zones in Chinnar watershed (Koneri sub watershed) at Perambalur district of Tamil Nadu based on remote sensing and GIS approach, in which, the IRS-P6 LISS III and survey of India Toposheet number 58I/15 & 58I/16 on scale 1:50,000 have been used for generating the thematic maps like geology, geomorphology, land use & land cover were prepared and assigned with differential weightage values. These maps have been overlaid by using spatial analysis tool in Arc GIS 9.3 version .The groundwater potential map for the study area was derived and considering their respective weightage value. Finally the area was classified into four zones of groundwater potentials i.e., excellent, good, moderate, poor.

KEYWORDS: Groundwater potential mapping, Chinnar watershed (Koneri sub watershed), Perambalur District, remote sensing and GIS

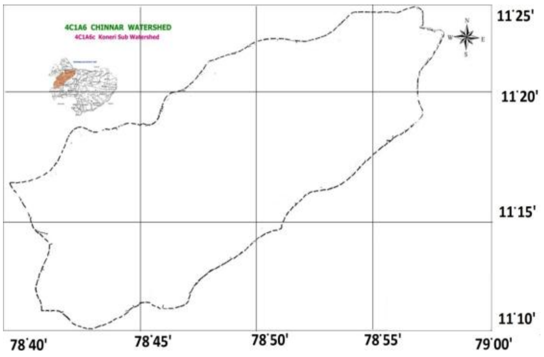
1. Introduction

The conventional methods of groundwater prospecting surveys include well inventory, geophysical surveys, bore well logging, mapping of aquifer characters; water sample analysis etc., An addition to this branch of groundwater mapping is remote sensing. Remote sensing technology provides a synoptic view of the hydro geologic and geologic situation which facilitates better understanding of the groundwater hydrology of a large area. The importance of remote sensing in groundwater studies is based on the fact that images provide the much needed information on morphological and structural features that influence ground water flow. The study area around Chinnar Watershed is located in Perambalur district of Tamilnadu and lies between 11° 10' to 11°25' latitude and 78° 40' to 79° 00' longitude.

Remote sensing data provide surface information, whereas ground water occurs at depth, may be few meters deep. Hence, remotely sensed image data are unable to provide any direct information on groundwater. However, the surface regime which primarily governs the subsurface water conditions can be suited and mapped. Therefore remote sensing acts as a very useful guide and an efficient tool for regional and local groundwater exploration.

2. Study Area

The watershed lies in the Southern plateau & hill zone of Agro-climate regional planning with characteristics of semi-arid climate. The Chinnar watershed having geographical area of 467.023sq.kms, which covers Peramablur district in the Southeastern starting portion of Tamil Nadu. It lies between 11°25' and 11°10' of the Northern latitude and 78°40' and 79°00' of Eastern longitude. Watershed code no :(4C1A6).



3. Methodology

The work consists of the following tasks:

1. Identification and delineation Chinnar watershed from topographic maps of 1:50,000 scale
2. Georeferencing of the topographic maps
3. Preparation of base map
4. Digitization of drainage lines, tanks from topographic maps
5. Georeferencing and digitization of geology and soil maps
6. Georeferencing and image rectification of satellite imagery.
7. Identifying and extracting the study area from the scene of satellite imagery
8. Extracting the study area from the scene of satellite imagery
9. Image interpretation and preparation of land use /land cover, geomorphology maps from the satellite imagery.
10. Integration of the thematic layers such as geology, geomorphology, soil, land use/land cover and drainage texture using GIS techniques for delineation of groundwater potential zones.

4. Result & Discussion

In this study, an RS/GIS based methodology that supports the relative importance of various thematic layers and their corresponding classes affecting groundwater, has been used to evaluate groundwater potential zone. The groundwater potential evaluated by the weighted linear combination of weights. Results indicated that only 12.5 % of the area was classified to have excellent groundwater potential and 30 % of the area was classified as good groundwater potential, with over 37.5 % being moderate and 20% area is poor groundwater potential. Thus the above study has demonstrated the capabilities of remote sensing and GIS techniques for the identification of groundwater potential zone. The wells having 'Excellent' groundwater potential zone has higher cumulative frequency than the wells falling in 'good' groundwater potential zone. Similarly the cumulative frequency of the wells falling in moderate zone is lower than that of wells having 'poor' groundwater potential. This gives more realistic groundwater potential map of the study area which is used for sustainable development of groundwater resource management. Based on the result of the study, concerned decision makers can formulate an efficient groundwater utilization plan for the study area.

4.1 Geology Map

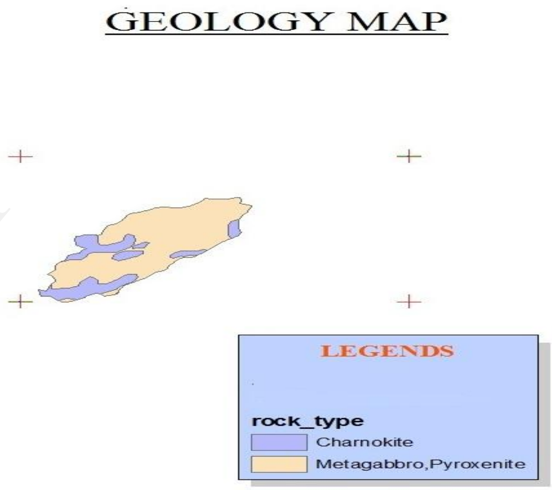


Table 1: Weightage values for different lithological units (score: 20)

Lithological units	Weightage value	Groundwater potential
Metagabbro	1	Poor
Pyroxenite	1	Poor
Charnockite	3	Good

4.2 Geomorphology Map

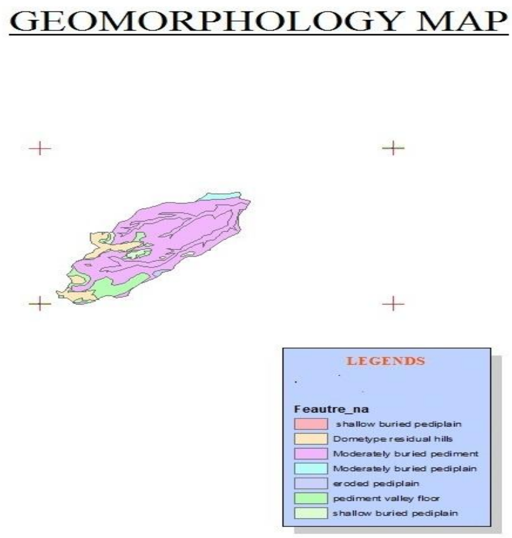


Table 2 Weightage values for Geomorphologic units (Score: 30)

Geomorphologic units	Weightage values	Groundwater Potential
Moderately buried pediment	3	Good
Pediment valley floor	4	Excellent
Dome type residual hills	1	Poor
Shallow buried pediplain	4	Excellent
Moderately buried pediplain	2	Moderate
Eroded pediplain	1	Poor

4.3 Land Cover/Use Map

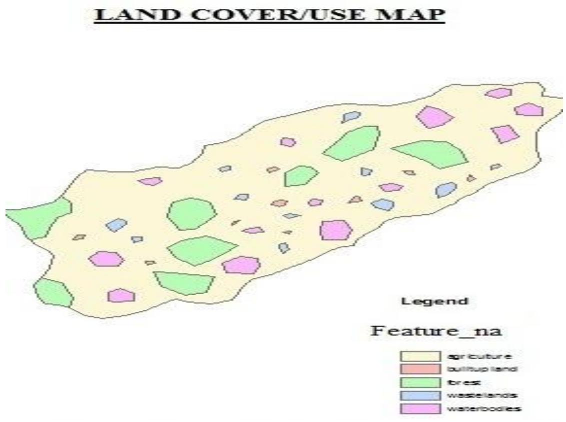
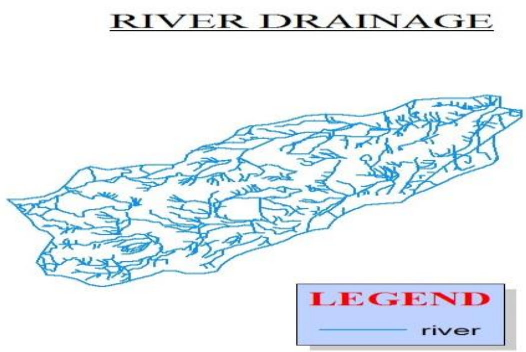


Table 3 Weightage values for Land use/ Land cover units (Score: 30)

Land cover/use units	Weightage values	Groundwater Potential
Agricultural land	4	Excellent
Water bodies	4	Excellent
Forest	3	Good
Wasteland	2	Moderate
Built upland	1	Poor



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4.4 Slope Map

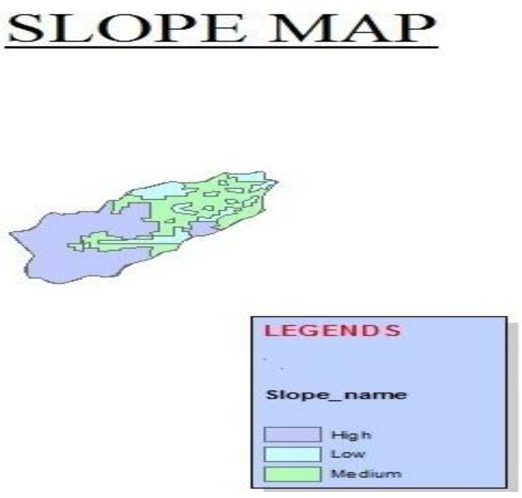
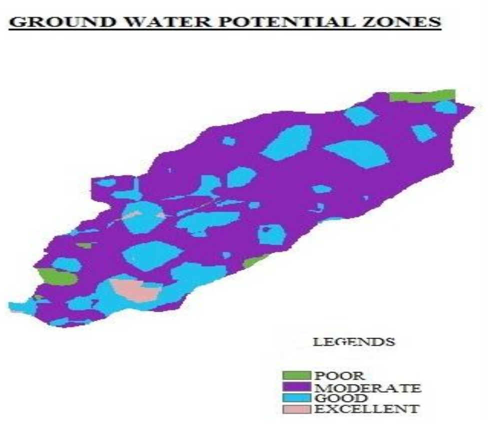


Table 4 Weightage values for Slope units (Score: 20)

Slope units	Weightage values	Groundwater Potential
High	1	Poor
Low	3	Good
Medium	2	Moderate

5. Conclusion

Results indicated that only 12.5 % of the area was classified to have excellent groundwater potential and 30 % of the area was classified as good groundwater potential, with over 37.5 % being moderate and 20% area is poor groundwater potential. The groundwater potential zones like moderate and poor areas may be used for optimum utilization of groundwater resources, preparation of better management plans.



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