Integrating Remote Sensing and GIS for Groundwater Potential Zone Delineation: A Multi-Criteria Decision Analysis Approach

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Abstract
In the semi-arid region of Thevur Firka, Salem, Tamil Nadu, including around 87 km², groundwater is vital for fulfilling domestic and agricultural needs. This work uses Geographic Information System (GIS) and Remote Sensing (RS) techniques to identify groundwater potential zones. Inverse Distance Weighting (IDW) interpolation is employed to generate spatial patterns in themed maps. Thematic layers were developed utilising satellite data and other maps, encompassing lithology, lineament density, slope, soil type, land use/land cover, elevation, drainage density, and precipitation. A composite Groundwater Potential Index (GWPI) was created by assigning weights to each layer based on relative characteristics. The area is divided into three zones on the final groundwater potential map: high, moderate, and low groundwater potential. The central and northeastern regions of the Firka had reduced groundwater potential owing to advantageous lithology, thick lineament networks, and mild slopes, whereas the southwestern rocky uplands displayed intermediate potential conditions. Statistical validation approaches serve as an efficient instrument for groundwater prospecting and facilitate sustainable water resource management in Thevur Firka.

Keywords: Groundwater, NDWI, NDDI, NDVI, GIS, Overlay Analysis.

Introduction

Groundwater is an important freshwater resource for domestic, agricultural, and industrial uses worldwide. Groundwater is the major source of water in semi-arid and hard rock areas, due to the lack of regularity in rainfall, the availability of surface water in a few seasons in a year, and growing water demand (Kalaivanan et al., 2019; Kom et al., 2024). The stresses placed on groundwater resources in many developing countries, including India, have been growing due to rapid population growth, agricultural expansion, urbanisation, and climate variability. The continuous removal of groundwater without recharge has led to falling groundwater levels, compromised water quality, and decreased groundwater sustainability across some areas of Tamil Nadu.

Groundwater potential zones and recharge areas should be accurately identified for sustainable groundwater management. Normal hydrogeological studies are time-consuming and costly, and have limited applicability to extensive geographic areas. Over the past few decades, the use of geospatial technologies like Remote Sensing (RS) and Geographic Information Systems (GIS) has become an effective means of groundwater exploration and resource assessment (Bagyaraj et al., 2012; Murugesan et al., 2025; Nijagunappa et al., 2007). These methods allow for the integration of several thematic factors affecting groundwater occurrence, such as geology, geomorphology, drainage density, land use/land cover, slope, lineament density, condition of the vegetation, and hydrological characteristics.

Groundwater investigations have also been enhanced by remote-sensing-derived spectral indices, which provide data covering vegetation health, surface moisture and drought conditions. Various indices like Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), and Normalized Difference Drought Index (NDDI) have been employed to assess groundwater recharge and moisture retention related environmental conditions. Likewise, GIS weighted overlay and Multi-criteria Decision Analysis (MCDA) methods aid spatial integration and ranking of thematic layers to outline groundwater potential zones more reliably (Balasubramaniyan et al., 2025; Pragadeeshwaran et al., 2026).

Groundwater potential mapping using GIS and remote sensing techniques in various hydrogeological environments has been carried out by a few researchers. The effect of lineament density, drainage regime, land use pattern, and topographic variations are shown to be significant variables on the occurrence of groundwater in hard-rock areas from previous studies (Halder et al., 2025; Shiwani et al., 2026) . While significant advances have been made in the assessment of groundwater potential, most of the previous investigations were based on the regional scale and did not incorporate spectral drought indicators into hydrogeomorphological parameters. Several studies also gave some limited practical suggestions for groundwater recharge planning and sustainable management at the local scale.

Thevur Firka in Salem District, Tamil Nadu, is characterised by semi-arid climatic conditions, uneven rainfall distribution, and increasing dependence on groundwater resources for agriculture and domestic consumption. Secondary porosity, weathered zones, fractures and structural discontinuities are the primary controls on groundwater occurrence in this area; most of it is under hard-rock terrain (Arulbalaji & Gurugnanam, 2017b; Kalaivanan et al., 2019; P & B, 2016). In spite of the growing stress on groundwater resources in this region, a detailed geospatial investigation based on a combination of hydrological, geological and drought-related parameters is still limited.

The present study aims to fill this research gap by combining thematic layers which have been generated using remote sensing and GIS techniques to identify groundwater potential zones in Thevur Firka. The novelty of the study is the use of the hydrogeomorphological parameters, spectral drought indicators, and the combined use of the weighted overlay analysis in a GIS environment to assess the groundwater occurrence in a semi-arid hard rock terrain. The study also tries to offer some spatially explicit information for groundwater management which could contribute to sustainable planning and resource protection(Arulbalaji & Gurugnanam, 2017a; Boobalan & Gurugnanam, n.d.).

The prime aims of the study is to (i) analyse the effect of different geological, hydrological and environmental factors on groundwater occurrence, (ii) prepare thematic maps with the help of remote sensing and GIS techniques, (iii) delineate groundwater potential zones by the help of weighted overlay analysis and (iv) suggest suitable groundwater recharge and conservation strategies for sustainable water resource management in Thevur Firka, Salem District.

Study Area

The research region is the Vur Firka in Salem District, Tamil Nadu, covering 87 km², shown in Figure 1. The region possesses a tropical climate, characterised by consistently high temperatures throughout the year, with an annual temperature range of around 16.7°C to 39.8°C (62°F to 104°F). Average annual precipitation ranges from 759 mm to 844 mm in certain studies, with a district mean of approximately 998 mm. The Salem area has a semi-arid to tropical savanna climate, situated within the North Western agro-climatic zone of Tamil Nadu. It endures elevated temperatures throughout the year, with the exception of the monsoon season, and is significantly dependent on seasonal precipitation.

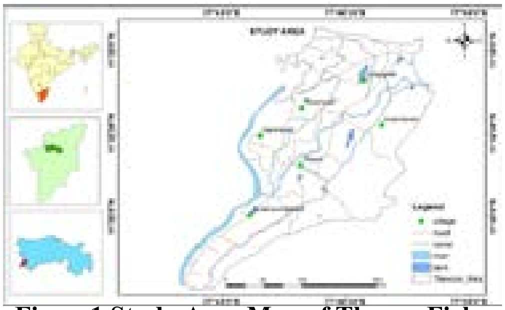

Figure1 Study Area Map of Thevur Firka

Geology of the Study Area

The rocks are predominantly Archaean crystalline formations of Precambrian origin, resistant to weathering, and provide the stable bedrock beneath Thevur and the adjacent communities. Granite and gneissic rocks are prevalent basement formations in the Vur Firka and adjacent taluks. Charnockite group rocks are resilient metamorphic formations that constitute remnant hills and rocky outcrops. The principal minerals of granite are quartz, feldspar, and mica, while the accessory minerals include amphibole and pyroxene. The principal minerals of gneiss are quartz, feldspar, and mica, with accessory minerals including pyroxene, amphibole, garnet, and sillimanite (Figure 2).

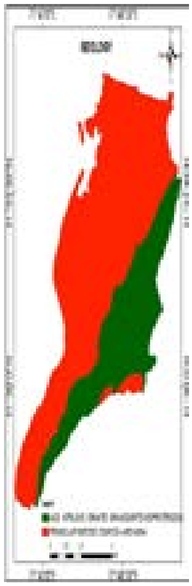

Figure 2 GIS map_Geology

Methodology

An integrated Remote Sensing (RS) and Geographic Information System (GIS) based approach has been used in the present study to identify groundwater potential zones in Thevur Firka, Salem District. This methodology included the preparation, analysis, and integration of several thematic layers that control the groundwater occurrence and conditions of groundwater recharge in the study area. The data acquisition and preprocessing process, data theming, spatial analysis, weighted overlay modelling and groundwater potential zone classification are the overall workflow Figure 3.

Data Collection and Preparation

The base maps used to extract drainage features, surface water bodies and settlement information were the topographic maps provided by the Survey of India (SOI). Thematic layers of hydrogeomorphological and environmental data were derived from satellite imagery and auxiliary data to provide information on groundwater occurrence. Satellite data was acquired and geometrically corrected and projected onto the Universal Transverse Mercator (UTM) coordinate system with the WGS-84 datum for consistency (Chrisben Sam & Gurugnanam, 2022).

Processing of the datasets was done in ArcGIS and remote sensing software platforms. Thematic analysis was carried out after performing the following preprocessing operations: image enhancement, stacking of layers, georeferencing and clipping to the study area boundary.

Generation of Thematic Layers

Several factors are interrelated in hard-rock terrains, governing the occurrence of groundwater. Hence, several thematic layers were produced and assessed to determine the groundwater recharge and storage potential.

Water Bodies on the Surface and Drainage Density

Drainage networks, rivers, canals, tanks and ponds were clipped from SOI toposheets and satellite images. Buffer zones were created around key drainage areas to define areas conducive to groundwater recharge. To estimate runoff and infiltration properties in the watershed, drainage density was calculated (Suvedha et al., 2009). The drainage density of the areas was determined to be a good indicator of suitability for groundwater infiltration, with lower densities being considered more suitable.

Lineament and Lineament Density

Fractures, faults and structural discontinuities were mapped using satellite imagery. To locate areas of improved secondary porosity and permeability, lineament density mapping was performed. High lineament concentration was identified as favourable for groundwater occurrence as it creates fractured zones which allows groundwater movement and storage in hardrock aquifers.

Land Use and Land Cover (LULC)

Multispectral satellite images were used to classify land use and land cover by applying supervised classification techniques. The categories that were classified were: Vegetation, water bodies, fallow land, barren land, settlements, and transportation networks. The infiltration, evapotranspiration, and groundwater recharge rate varies with different land use categories. Built-up and barren surfaces have lower infiltration than vegetated and water covered surfaces.

Spectral Indices

The condition of vegetation, moisture availability, and drought characteristics were determined in the study area using remote sensing based spectral indices.

The Normalized Difference Vegetation Index (NDVI) was generated to evaluate vegetation density and surface moisture conditions using near-infrared and red spectral bands.

NDVI = \frac{NIR - Red}{NIR + Red}

Higher NDVI values indicate healthy vegetation and relatively favourable moisture conditions that may support groundwater recharge.

The Normalized Difference Water Index (NDWI) was derived to identify moisture-rich zones and open water features.

NDWI = \frac{Green - NIR}{Green + NIR}

Higher NDWI values denotes possibilities of water content.

The Normalized Difference Drought Index (NDDI) was used to evaluate drought severity and moisture stress conditions.fi.

NDDI = \frac{NDVI - NDWI}{NDVI + NDWI}

Lower NDDI values indicate relatively lower drought stress and improved moisture availability.

Weighted Overlay Analysis

All thematic layers were standardized and reclassified by their relative influences over the groundwater occurrence. Each thematic parameter was assigned appropriate weights and ranks that were related to the hydrogeological significance and the groundwater recharge characteristics. The weighted overlay analysis was conducted in the GIS environment that involved combining all thematic layers into one composite groundwater potential model (Kom et al., 2022).

Groundwater potential index was produced by overlaying the thematic layers in a GIS environment with giving weights to the layers. The study area was divided into three groundwater potential classes, namely high, moderate and low, using the index values.

Validation and Interpretation

The groundwater potential zones were interpreted in relation to lithology, drainage, vegetation cover, and structural features of the study area. Analysis of the spatial distribution of favourable groundwater zones was carried out to determine areas suitable for groundwater development and recharge planning. The integrated GIS-based methodology created a systematic approach to assess groundwater potential and implementation of sustainable water management in Thevur Firka.

Figure 3 Flow Chart workflow

Findings & Discussion

Surface Waterbody

Toposheets and satellite images are employed to map the surface water bodies, including Ponds and Eri. It is directly related to water resources. Thirty meters of buffering were implemented in the water body zone. Water resource mapping is assigned a relatively greater weight. In the studied area, the total square kilometres of the tank and river are 0.65 and 3.19, respectively, and the total length of the canal is 44.96 (Figure 4) (Table 1).

Figure 4 Spatial Distribution Map of Surface Waterbodies

Table 1 GIS Results_Surface Waterbodies

Surface waterbodies	Rank	Area_Km²
River	3	3.19
Canal	2	44.96 (length)
Tank	1	0.65

Drainage and Drainage Density

Drainage density is an important hydrogeomorphological parameter and it affects the surface runoff, infiltration, and groundwater recharge in a watershed. The drainage network of Thevur Firka has been delineated in the present study from the Survey of India toposheets and satellite images using GIS techniques. A buffer zone of 30 m was created around the drainage channels to determine the potential groundwater recharge areas because the areas around the drainage features have higher infiltration and subsurface water movement. Groundwater recharge potential was estimated to be good for areas with less dense drainage and better for areas with more dense drainage, in keeping with the concept of less surface runoff and higher infiltration capacity, respectively, for the two types of areas. The drainage density map, Fig.5 and Table.2, revealed that moderate drainage density occupies the largest portion of the study area (38.2 km²), followed by low drainage density zones covering 29 km², while high and very high drainage density classes extend over 13.9 km² and 5.6 km², respectively. These results indicate that several parts of the study area possess favourable hydrological conditions for groundwater occurrence and recharge.

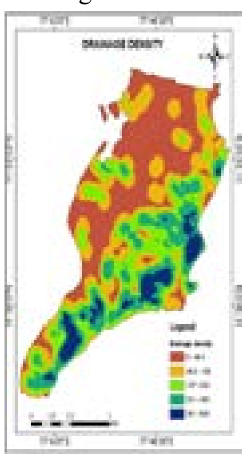

Figure 5 Spatial Distribution Map of the Drainage Density

Table 2 GIS Map_Drainage Density

Drainage density	Rank	Area_km^2
Very high	1	5.6
High	2	13.9
Moderate	3	38.2
Low	4	29

Remote Sensing

Lineament and Lineament Density

Lineament is a natural trait that is longer and weaker than linearity. In order to create the lineament map, satellite imagery was used (Fig. 6). This is directly connected to the availability of water supplies. Satellite photography is utilised in the process of creating the lineament density. If the lineament density is higher, then the likelihood of groundwater being present is also higher. These characteristics were used to derive the lineament density zone weights, which may be found in Table 3.

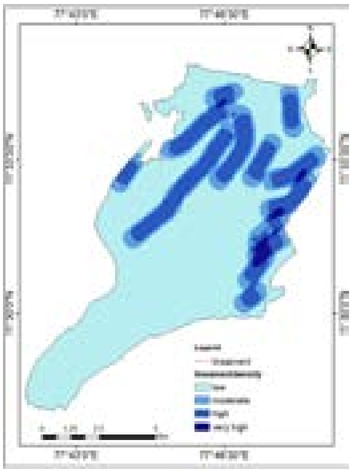

Figure 6 GIS Map _Lineament Density

Table 3 GIS Map_Lineament density of Thevur Firka

Lineament Density	Rank	Area_Km^2
Very high	1	0.9
High	2	12.1
Moderate	3	15.2
Low	4	58.6

Landuse/Land Cover

Land use and land cover (LULC) play a crucial role in controlling infiltration, runoff, evapotranspiration, and groundwater recharge conditions within a watershed. In the present study, LULC mapping was carried out using supervised classification of multispectral satellite imagery within the GIS environment. The study area was classified into major categories such as vegetation, water bodies, fallow land, barren land, settlements, rivers, and road networks Fig.7 and Table 4. Different land cover types exhibit varying influences on groundwater occurrence; vegetated areas and water bodies generally enhance infiltration and groundwater recharge, whereas built-up areas and barren surfaces restrict percolation and increase surface runoff. The analysis revealed that vegetation covers approximately 31 km² of the study area, followed by barren land (15 km²), fallow land (11 km²), settlements (7 km²), road networks (18 km²), water bodies (1 km²), and rivers (2 km²). Areas dominated by vegetation and water bodies were identified as favourable zones for groundwater recharge due to higher moisture retention and infiltration capacity.

Table 4 GIS Map Results

LULC	Weightage	Area (Km^2)
Settlements	2	7
Vegetation	5	31
Waterbodies	6	1
Fallowlands	4	11
Roadways	1	18
Barrenlands	3	15
River	7	2

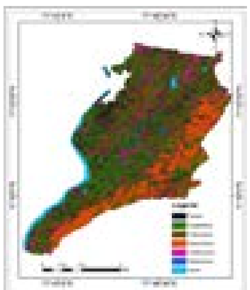

Figure 7 GIS Map LULC

Normalised Difference Vegetation Index

The Normalized Difference Vegetation Index (NDVI) was used to evaluate vegetation density and surface moisture conditions in the study area using satellite-derived spectral information. NDVI is an important remote sensing indicator for identifying vegetation health and its relationship with groundwater recharge conditions. Healthy and dense vegetation generally reflects higher moisture availability and favourable infiltration characteristics, which indirectly support groundwater occurrence. The index was generated from the red and near-infrared (NIR) bands of the satellite imagery using the following equation:

$NDVI = \frac{NIR - Red}{NIR + Red}$

Higher NDVI values indicate dense vegetation cover and relatively better moisture conditions, whereas lower valFiues represent barren land, sparse vegetation, or dry surfaces. The NDVI analysis of Thevur Firka showed that Fig.8 and Table.5 medium vegetation density occupies the major portion of the study area, covering approximately 49.5 km^2, while high and low vegetation classes extend over 12.6 km^2 and 24.7 km^2, respectively. Areas with higher NDVI values were considered favourable for groundwater recharge due to improved infiltration and soil moisture retention characteristics.

Table 5 GIS Map_ NDVI of Thevur Firka

NDVI	Rank	Area (Km^2)
Low	1	24.7
Medium	2	49.5
High	3	12.6
Low	4	58.6

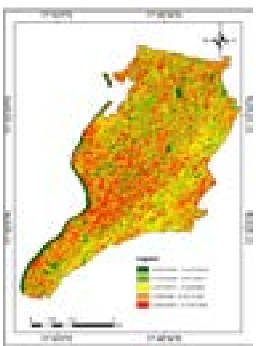

Figure 8 GIS Map _NDVI

Normalized Difference Water Index (NDWI)

NDWI was employed to identify surface moisture conditions and water-rich zones within Thevur Firka using satellite-derived spectral data. NDWI is an effective remote sensing indicator for detecting water bodies and evaluating moisture availability, which are closely associated with groundwater recharge potential. The index was calculated using the green and near-infrared (NIR) bands of the satellite imagery according to the following equation:

$NDWI = \frac{Green - NIR}{Green + NIR}$

Higher NDWI values generally indicate the presence of water bodies, wet surfaces, and higher soil moisture conditions, whereas lower values represent dry land and areas with limited moisture availability. The NDWI analysis, Fig.9 and Table 6, showed that medium moisture conditions occupy the largest portion of the study area, covering approximately 37.9 km^2, while high and low moisture zones extend over 15.6 km^2 and 33.4 km^2, respectively. Areas exhibiting higher NDWI values were considered favourable for groundwater recharge because of increased surface moisture and infiltration potential.

Table 6 GIS Map_NDWI _Thevur Firka

NDWI	Rank	Area (Km^2)
High	3	15.6
Medium	2	37.9
Low	1	33.4

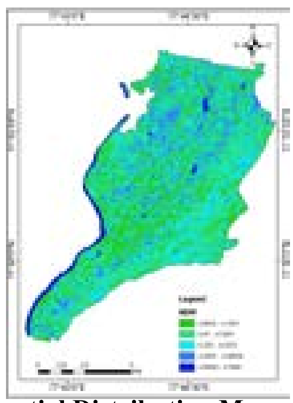

Figure 9 Spatial Distribution Map of NDWI of Thevur Firka

NDDI

The Normalized Difference Drought Index (NDDI) was used to assess drought severity and moisture stress conditions in Thevur Firka using remote sensing techniques. NDDI is an important spectral indicator that combines vegetation and moisture information to evaluate drought-related environmental conditions influencing groundwater recharge. The index was derived using NDVI and NDWI values according to the following relationship:

$$NDDI = \frac{NDVI - NDWI}{NDVI + NDWI}$$

Lower NDDI values generally represent regions with better moisture availability and lower drought stress, whereas higher values indicate dry conditions and reduced groundwater recharge potential. The NDDI analysis revealed that medium drought conditions dominate the study area, covering approximately 50 km², while low and high drought stress zones extend over 12 km² and 24 km², respectively. Areas characterised by lower NDDI values were considered more favourable for groundwater occurrence due to improved moisture retention and reduced environmental stress conditions.

The NDDI map is obtained from satellite data and is shown in Fig. 10. The results of the NDDI are shown in the table. The attribute shows the relative weight of water (Table 7).

Table 7 GIS Results of NDDI of Thevur Firka

NDWI	Rank	Area (Km²)
Low	3	12
Medium	2	50
High	1	24

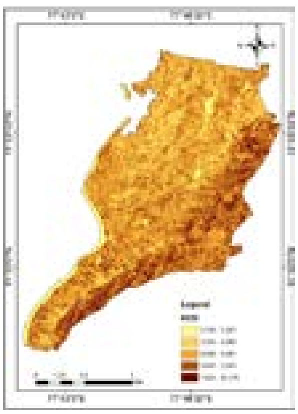

Figure 10 GIS Map _NDDI

Groundwater Potential Zones Mapping

Groundwater occurrence in the study area. Each thematic parameter was assigned a weight and rank based on their relative importance in controlling the groundwater recharge and storage conditions Table 8. Union was used to combine the prepared thematic layers of the GIS environment in order to have the drainage density, lineament density, land use/land cover, surface water bodies, NDVI, NDWI and NDDI. The composite groundwater potential map was created by the combined analysis, which showed the spatial distribution of occurrence of groundwater in Thevur Firka. From the weighted overlay analysis, the study area was divided into three groundwater potential zones: high, moderate and low. The use of remote sensing and GIS techniques was found to be an effective and reliable method for identification of groundwater potential zones and sustainable assessment of groundwater resources. The final groundwater potential map was presented in Fig. 11 while the statistical results showed in Table 9.

Table 8 Groundwate Potential Zone Weightage Table

Thematic layer	Layer weight	Class	Rank (1-7)
Surface waterbody	25	River	3
		Canal	2
		Tank	1
Drainage Density	20	Low	4
		Moderate	3
		High	2
		Very High	1
Lineament Density	20	Low	4
		Moderate	3
		High	2
		Very High	1
Land use/ Land cover	15	Vegetation	5
		Settlements	2
		Barren land	1
		Fallow land	4
		Water bodies	6
		Road	3
		River	7

NDVI	7	High	3
		Medium	2
		Low	1
NDWI	7	High	3
		Medium	2
		Low	1
NDDI	6	Low	3
		Medium	2
		High	1

Table 9 GIS _Groundwater Potential Zones of Thevur Firka

Groundwater Zones	Rank	Area (Km²)
Low	1	10.7
Moderate	2	60.6
High	3	16

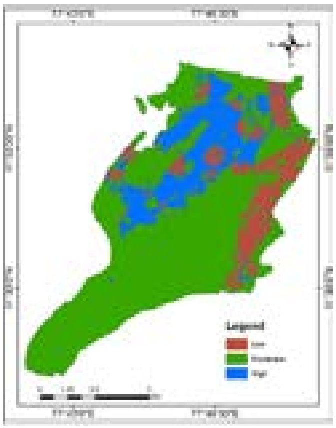

Figure 11 GIS Map _Groundwater Potential Zones of Thevur Firka

Conclusion

The present study revealed that the usage of Remote Sensing (RS) and Geographic Information System (GIS) techniques were effective in groundwater potential zone delineation in semi-arid hard rock terrain of Thevur Firka, Salem District, Tamilnadu. Multiple hydrogeomorphological and environmental parameters such as drainage density, surface water bodies, lineament density, land use/land cover, NDVI, NDWI, and NDDI were analysed with a weighted overlay method, to determine occurrence and recharge potential zones of groundwater.

The groundwater potential showed significant spatial variation throughout the study area. Around 16 km² of the total area falls under high groundwater potential zones, while almost 60.6 km2 was categorized as moderate potential zones and 10.7 km2 as low potential zones. These areas with high groundwater potential were mainly linked to favourable geological and geomorphological characteristics like high lineament density, low drainage density, vegetation cover and moist surfaces. Low groundwater potential areas were primarily found in rocky uplands and in structurally less fractured areas where infiltration is limited and the runoff conditions are higher.

Using spectral indices, like NDVI, NDWI, and NDDI, further explained the condition of vegetation health, surface moisture distribution, and drought-related stress that affected groundwater recharge. The study validated the capability of geospatial tools as tools for groundwater assessment, especially in data sparse semi-arid regions where traditional hydrogeological assessments are challenging and costly.

The produced groundwater potential map can be useful for regional water planners, water resource managers and local administrative bodies in the process of sustainable water resource planning. The identified moderate and high groundwater potential zones can be considered as target areas for artificial recharge structures like recharge pit, percolation ponds, check dams and watershed conservation practices. In addition, sustainable groundwater use should be practiced and regular groundwater monitoring should be carried out to reduce the depletion of the aquifer and thus ensure long-term groundwater security of the region.

The study also underscores the need for the use of geospatial technology along with environmental management measures to tackle groundwater stress in the context of changing climate. Future research could include using more sophisticated machine learning algorithms, groundwater fluctuation data, and climate variability models to enhance the accuracy of groundwater prediction and enable adaptive groundwater management planning. The overall assessment of the present study gives scientific bases for the exploration and planning of groundwater in semi-arid hard rock area and its sustainable utilisation.

References

Arulbalaji, P., and B. Gurugnanam. "Geospatial Tool-Based Morphometric Analysis Using SRTM Data in Sarabanga Watershed, Cauvery River, Salem District, Tamil Nadu, India." *Applied Water Science*, vol. 7, no. 7, 2017, pp. 3875–3883.

Arulbalaji, P., and B. Gurugnanam. "Groundwater Quality Assessment Using Geospatial and Statistical Tools in Salem District, Tamil Nadu, India." *Applied Water Science*, vol. 7, no. 6, 2017, pp. 2737–2751.

Bagyaraj, M., et al. "Application of Remote Sensing and GIS Analysis for Identifying Groundwater Potential Zone in Parts of Kodaikanal Taluk, South India." *Frontiers of Earth Science*, vol. 7, no. 1, 2012, pp. 65–75.

Balasubramaniyan, G., et al. "AHP and Geospatial Technology-Based Assessment of Groundwater Potential Zones in Natham Taluk, Tamil Nadu, India." *Scientific Reports*, vol. 15, no. 1, 2025, pp. 1-16.

Boobalan, C., and B. Gurugnanam. "Mapping of Groundwater Potential Zones in Sarabanga Sub-Basin, Cauvery River, South India Using Remote Sensing and GIS Techniques." *Indian Journal of Applied Research*, n.d., pp. 364–369.

Chrisben Sam, S., and B. Gurugnanam. "Coastal Transgression and Regression from 1980 to 2020 and Shoreline Forecasting for 2030 and 2040, Using DSAS along the Southern Coastal Tip of Peninsular India." *Geodesy and Geodynamics*, vol. 13, no. 6, 2022, pp. 585–594.

Halder, S., et al. "Harnessing Groundwater Resources in Hard-Rock Terrain: A Geoinformatics Perspective of the Bandu Sub-Watershed of Purulia District, India." *Chinese Journal of Population, Resources and Environment*, vol. 23, no. 3, 2025, pp. 412–430.

Kalaivanan, K., et al. "Geoelectrical Resistivity Investigation for Hydrogeology Conditions and Groundwater Potential Zone Mapping of Kodavanar Sub-Basin, Southern India." *Sustainable Water Resources Management*, vol. 5, no. 3, 2019, pp. 1281–1301.

Kom, K. P., B. Gurugnanam, and V. Sunitha. "Delineation of Groundwater Potential Zones Using GIS and AHP Techniques in Coimbatore District, South India." *International Journal of Energy and Water Resources*, vol. 8, no. 1, 2024, pp. 85–109.

Murugesan, B., et al. "Deciphering of Groundwater Potential Zones in Hard Rock Terrain Using GIS Technology with AHP Statistical Methods: A Case Study of Nilgiri, Tamil Nadu, India." *Scientific Reports*, vol. 15, no. 1, 2025, pp. 1–16.

Nijagunappa, R., et al. "Road Network Analysis of Dehradun City Using High Resolution Satellite Data and GIS." *Journal of the Indian Society of Remote Sensing*, vol. 35, no. 3, 2007, pp. 267–274.

P, A., and B. G. "An Integrated Study to Assess the Groundwater Potential Zone Using Geospatial Tool in Salem District, South India." *Journal of Hydrogeology & Hydrologic Engineering*, 2016.

Pragadeeshwaran, K., et al. "Groundwater Potential Zones Demarcation in the Hard Rock Province of South India: Insights from Remote Sensing, GIS and AHP Techniques." *Scientific Reports*, vol. 16, no. 1, 2026, Article 6186.

Shiwani, K., et al. "Spatial Assessment of Groundwater Potential Using Geospatial Techniques and Analytical Hierarchy Process (AHP) in a Drought-Affected River Basin of Eastern India." *Evolving Earth*, 2026, Article 100140.

Suvedha, M., et al. "Multivariate Statistical Analysis of Geochemical Data of Groundwater in Veeranam Catchment Area, Tamil Nadu." *Journal of the Geological Society of India*, vol. 74, no. 5, 2009, pp. 573–578.

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