



# Delineating the Groundwater Potential Zone in Tirunelveli Taluk, South Tamil Nadu, India, Using Remote Sensing, Geographical Information System (GIS) and Analytic Hierarchy Process (AHP) Techniques

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**Abstract** The water present in the subsurface is considered as a high treasured water source. The present study deals with the delineation of groundwater potential zone in Tirunelveli Taluk, Tamil Nadu, South India. The study area lies between longitude 77°32'16" to 77°48'8"E and latitude 8°40'12" to 8°56'34"N with an area of 558.42 km<sup>2</sup>. The groundwater potential zone of the Tirunelveli Taluk was inferred by the following layers, namely geology, geomorphology, lineament density, drainage density, rainfall, slope, soil and land use/land cover. These layers are digitized with the scale of 1:50,000 in GIS environment from the spatial data sources such as SOI topographic maps, GSI geology map, LANDSAT 8 satellite image, SRTM DEM, Tamil Nadu Agricultural Department daily rainfall data and available existing maps. The weights of the feature layers and ranking of each feature classes arrive from the pairwise comparison techniques of AHP technique. The prepared thematic maps are reclassified based on the influence of the layers feature classes on the groundwater availability. Finally, the reclassified layers are overlaid using weighted overlay tool to prepare groundwater prospect map. The finally this study resulted that 5.76 km<sup>2</sup> of the study area is identified as very high groundwater

potential. The high potential area covers 382.9 km<sup>2</sup>, and medium potential zone covers 169.72 km<sup>2</sup>.

**Keywords** GIS · AHP · LANDSAT 8 OLI/TIRS · SRTM DEM

## 1 Introduction

Groundwater is a highly valuable water resource of finite extent. It shares the considerable role in human life and their water requirements because it acts as an important fresh water source in many parts of the world. The socioeconomic development of any region relies on the fresh and quality of water available in the area [1]. The groundwater sources are replenished by the infiltration process of precipitated water. In the world scenario, the exploitable fresh water resources are about 11% of groundwater, 1% of surface water remaining as in the form of glacier and unexploitable groundwater. The over-extraction of groundwater resource and inadequate aquifer recharge are the major cause of groundwater depletion in different parts of the world [2]. In India, around 839 administration blocks are categorized as an over-exploited blocks out of 5723 [3]. More than 90% of the rural population and 30% of the urban population are using groundwater as a source of their drinking purpose, and also more than 60% of country irrigation uses groundwater as a source [4]. Groundwater is a hidden and valuable resource, and hence, mapping this resource is a challenging task [5]. Nowadays the Remote Sensing and GIS techniques play an effective role in groundwater investigation compared to traditional investigation methodologies. The satellite images are used to prepare morphological layers like geology, geomorphology, land use/land cover, drainage pattern,

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slope and lineaments, etc., which are the base layers used to infer the potential zone of groundwater because the optical remote sensing system only provides surface information of the terrain and this kind of data could not have any kind of subsurface information. The sustainable development and management of groundwater resources require precise quantitative assessment based on the scientific principle and modern techniques [6]. Many scientific researchers around the world have utilized remote sensing and GIS for their groundwater-related studies and also they proved that integrated remote sensing and GIS approach will play an efficient role in subsurface studies [7–15].

Generally, the selection of suitable thematic layers varies from every researcher based on the data accessibility, availability and groundwater influencing parameter of the study area. The current study utilized 8 thematic layers such as geology, geomorphology, soil, slope, drainage density, lineament density, land use and rainfall for delineating groundwater potential regions. The appropriate weights for these layers are assigned based on the direct and indirect relationships among different thematic layers and AHP analysis. This integrated AHP and GIS approach is most suitable for groundwater studies with systematic allocation of weights through AHP technique and weighted overlay analysis of GIS environment. AHP's major innovation was the introduction of pairwise comparisons. It employs a consistent way of converting such pairwise comparisons into a set of values relative priority of each criterion.

The prime objective of this study is to identify the groundwater potential zones in Tirunelveli Taluk which was located in Tirunelveli district, Tamil Nadu, South India, using AHP and integrated remote sensing and geographical information system. AHP techniques analyze the multiple data sets which are used to calculate the percentage of influence of each parameter for inferring groundwater availability in GIS platform.

## 2 Study Area

Tirunelveli Taluk is one of the Taluk in Tamil Nadu, India. It is a hard rock terrain with a total area of 558.4 km<sup>2</sup>, and the location map of the study area is shown in Fig. 1. Geographically, the study region lies between longitudes 77°32'16" to 77°48'8"E and latitude 8°40'12" to 8°56'34"N and is covered by the 1:50,000 scaled survey of India (SOI) topographic sheets 58H/9, 58H/10 and 58H/13. The climate in this Taluk is generally subtropical associated with a more than 500 mm mean annual rainfall. The major geological units that exist in the study area are granite gneiss, biotite gneiss and hornblende biotite gneiss (HBG) which

are minor rock types present in this region. The major streams passing through this area are Thamirabarani and Chittar which form a dendritic pattern of drainage in the area. Topographically, the area is plain with gentle slope except in the few parts and the elevation of this region range of 13 to 194 above the mean sea level. Generally, these areas enjoy pleasant weather during the periods from December to January and hot from May to June. The percentage relative humidity is on an average between 79 and 84, and the respective mean temperature of this area lies between 22.9 and 33.5 °C [16]. Demographically, this area consists of 6, 43,341 inhabitation (based on 2011 censuses) with the average population density of 1152 which is more from Urban and less in rural parts of this Taluk.

## 3 Material and Methodology

### 3.1 Thematic Layer Preparation

The delineation of groundwater prospects in this study begins with the selection and preparation of eight geo-data layers of the study area, namely geology, geomorphology, lineament density, drainage density, rainfall, land use, slope and soil. These were digitized in GIS from the spatial and non-spatial data sets which are collected from various organizations. These thematic layers are projected with UTM-WGS 84 (projected coordinate system) projection. The spatial data sets such as LANDSAT 8 OLI/TIRS are downloaded from USGS official web server for path 143, Row 54 which is acquired on May 11, 2014, Geodetic Survey of India topographic maps (58H/9, 58H/10, 58H/14) with 1:50,000 scale, SRTM DEM with 90 m resolution, existing maps like European Soil Data Centre soil map and Geological Survey of India's geological maps. The non-spatial data set consists of an average annual rainfall prepared from 10-year data (2004–2013) of Tirunelveli district collected from the District Agricultural Department. The 1:50,000 scale morphology maps like geomorphology, land use and lineament are visually interpreted and digitized from the LANDSAT 8 image. The lineament layers are prepared from shaded relief image of SRTM DEM data. The drainage layers are digitized based on SOI topographic maps, and it will be updated from SRTM DEM data. The slope map was derived from SRTM data. The geological map was digitized in ArcGIS environment from the published map of Geological Survey of India (1998). Similarly, the soil map was prepared from the published map of European digital archives using the digitizing technique in ArcGIS 9.3. The average annual rainfall layer of the Tirunelveli Taluk was prepared from seven rain gauge stations based on the available Agricultural Department rainfall data with the aid of the IDW tool

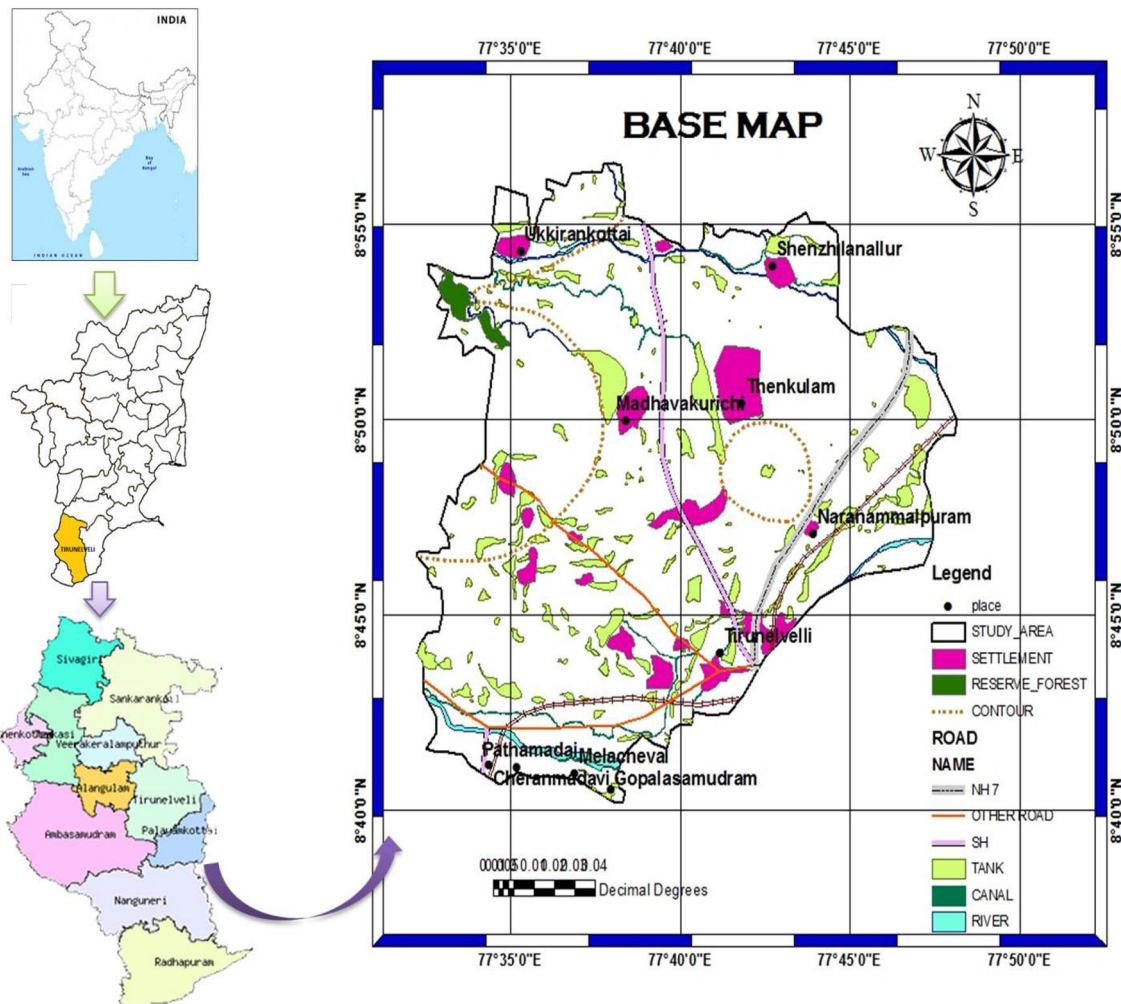


Fig. 1 Location map of Tirunelveli Taluk

of ArcGIS. The prepared layers are reclassified as four classes based on the influence of the feature class on the groundwater potential.

### 3.2 Analytical Hierarchical Process

The analytic hierarchy process is proposed by Saaty [17]. The percentage influence of these prepared layers can be derived from the pairwise comparison decision making AHP technique. Based on the expert’s opinion, the current study utilizes the theory of hierarchies for delineating groundwater potential. The current groundwater decision making problem is clearly defined and decomposed into eight thematic layers, each with several feature classes, and the judgments about the interactions among each layer are generated by the pairwise comparison matrix. The principal eigenvalue of this matrix is considered as the percentage of the influence of the thematic layers. Finally the consistency index and consistency ratio are calculated from the following formulas to check the consistency of the analysis [18].

$$\text{Consistency index} = \frac{\text{Max principal Eigen value} - \text{Number of factors}}{\text{Number of factors} - 1} \quad (1)$$

$$\text{Consistency ratio} = \frac{\text{Consistency index}}{\text{Random consistency index}} \quad (2)$$

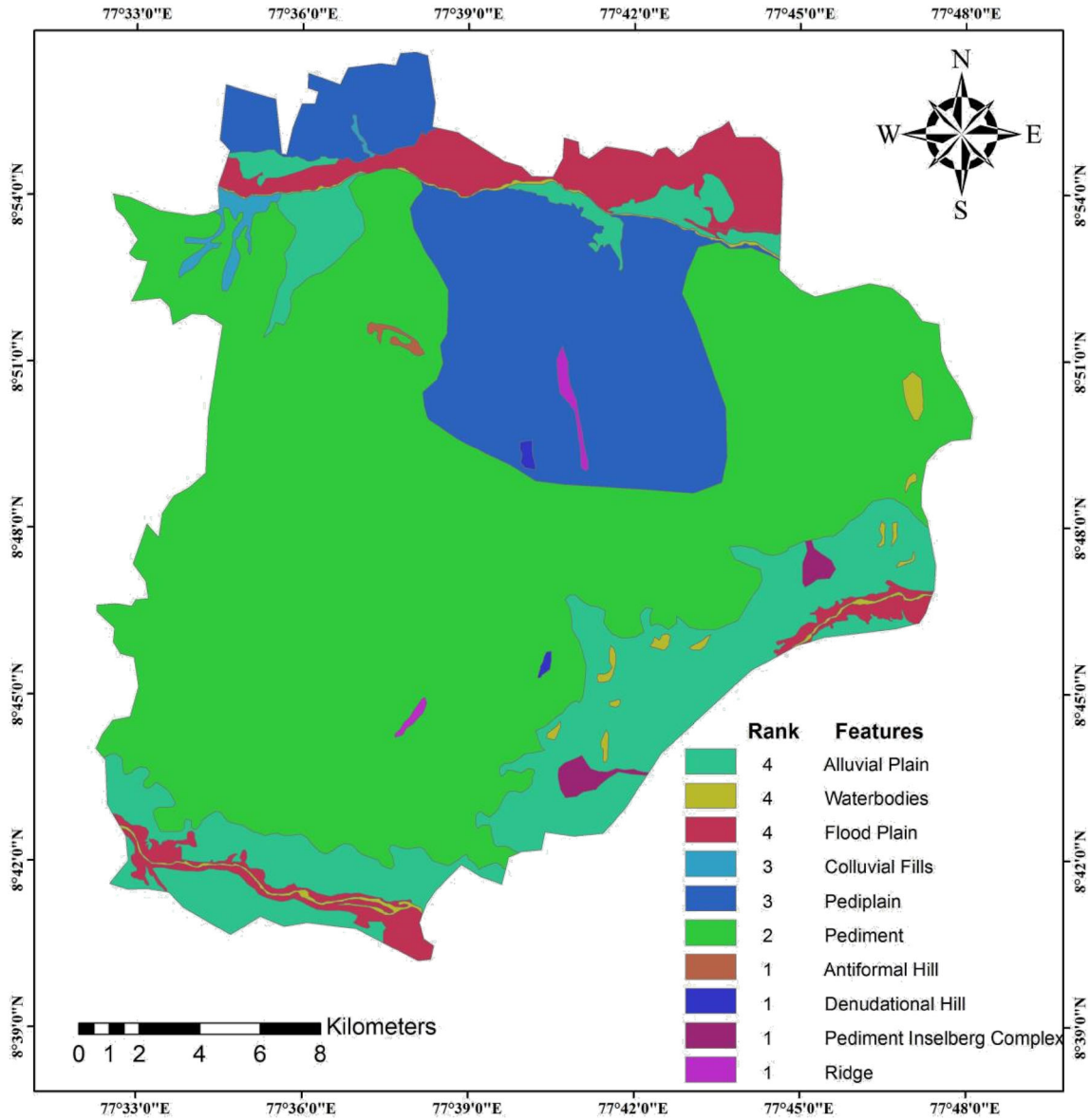
The random consistency index is obtained from Table 1 [18]. If the consistency ratio exceeds 10%, the corresponding weights of each layer should be reevaluated to avoid inconsistency of hierarchy process. Parameter scale used for AHP pair-wise analysis and the ranks and weights assigned to a particular theme were shown in Tables 2 and 3.

### 3.3 Delineation of Groundwater Potential

Finally, prepared thematic layers are overlaid based on calculated weights for preparing the groundwater potential

**Table 1** Saaty’s random consistency index for different  $n$  values Agarwal [6]

$n$	1	2	3	4	5	6	7	8	9	10
RCI	0	0	0.58	0.89	1.12	1.24	1.32	1.41	1.45	1.49



**Fig. 2** Geomorphology map of Tirunelveli Taluk

map. The ground water potential index (GWPI) is determined by Eq. 3.

$$\begin{aligned}
 &GWPI \\
 &= \left( \frac{MWM_r + RWR_r + DWD_r + GWG_r + SWS_r + LWL_r + TWT_r + L_u WL_{ur}}{\text{Total weight}} \right) \tag{3}
 \end{aligned}$$

where  $M$  geomorphology,  $R$  rainfall,  $D$  drainage density,  $G$  geology,  $S$  soil,  $L$  lineament density,  $T$  slope,  $L_u$  land use,  $W$  weight of a layer,  $r$  rank of a class in the layer.



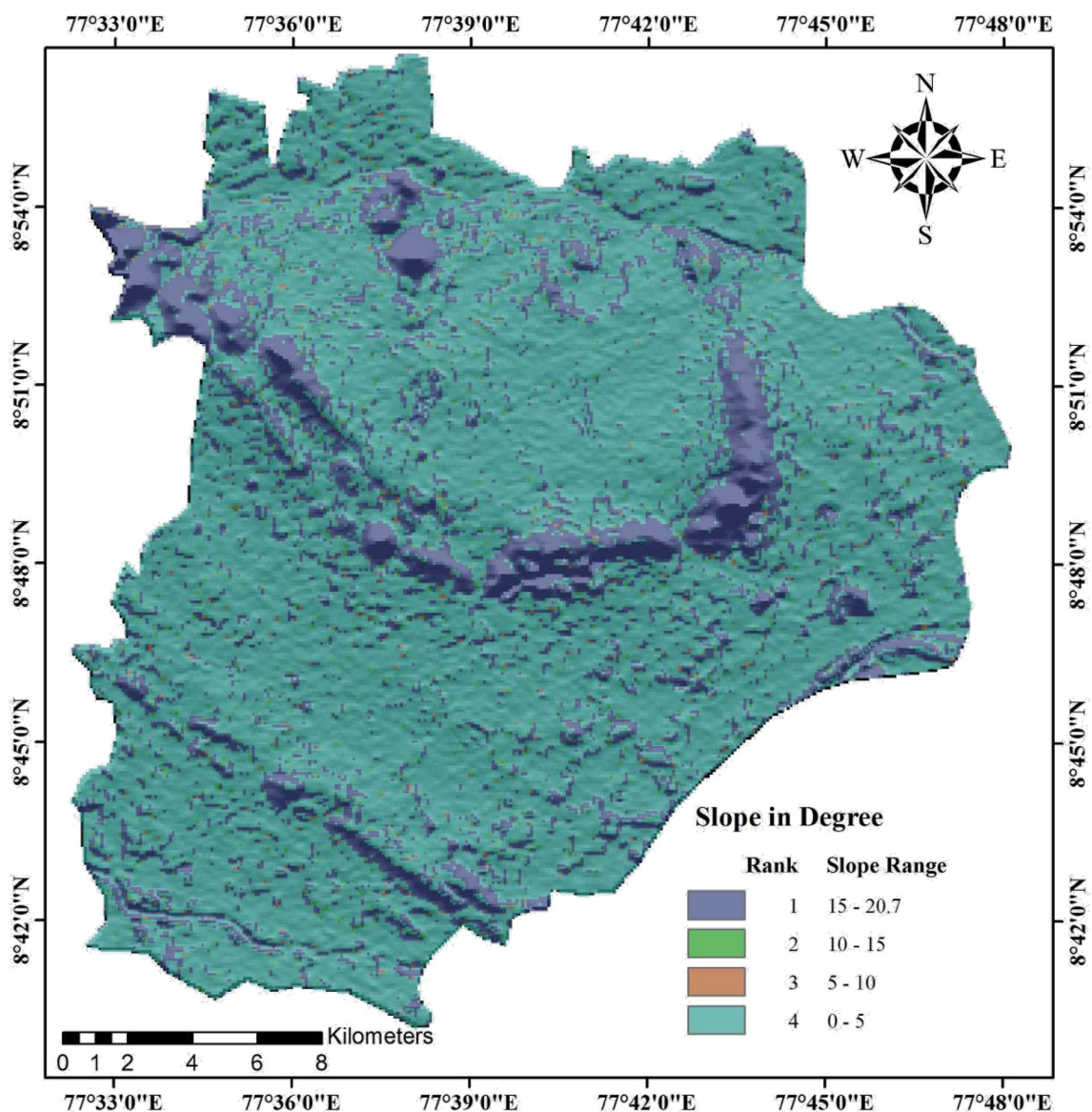
## 4 Results and Discussion

The groundwater potential zone of study area explored by analyzing the different surface parameters such as geology, geomorphology, slope, land use, lineament density, drainage density, soil and rainfall by means of AHP and integrated remote sensing and geographical information system techniques.

### 4.1 Analysis of Geomorphology

Geomorphology is a one of the significant parameters in the groundwater potential and prospect studies. Geomorphological features of the study area are interpreted and digitized from LANDSAT 8 image. The study area is

overlaid with ten types of geomorphic features that are alluvial plain, antiformal hill, colluvial fills, denudational hill, flood plain, pediment, pediment inselberg complex, pediplain, ridges and water bodies which are displayed in Fig. 2. Material associated with water bodies, flood plain, alluvial plain and colluvial fills has higher water holding capacity and therefore suitable landform for high groundwater potential which is associated with the Thamirabarani and Chittar rivers. More than 60% of the study area enclosed by denudational hill, pediment, antiformal hill, pediment inselberg complex and ridges is not suitable for groundwater amplification. The major part of the study area is covered with pediment and pediplain. The pediplain is the second major geomorphic unit of the area which covers



**Fig. 3** Slope map of Tirunelveli Taluk

14.4% (80.9 km<sup>2</sup>) study area, and it has moderate infiltration behavior.

## 4.2 Analysis of Slope

Slope plays an important role in infiltration of precipitated water. If the slope of the terrain is too large, then that area will have poor groundwater potential. This is because the precipitated water gets drained from that area. A slope map was prepared from available elevation values of Tirunelveli Taluk which was picked from SRTM DEM data. The slope map of the Tirunelveli Taluk is shown in Fig. 3. In Tirunelveli Taluk, the percentage of slope value varies from 0 to 20.7%, except the middle and northwestern part of the study area which have a very calm slope. It permits less

runoff, and this indicates these areas consist of very good groundwater potential. The elevation in the study area ranged from 13 to 194 above mean sea level.

## 4.3 Analysis of Lineaments and Lineament Density

Lineaments are linear fractured zone on geological structure of an area such as faults and dykes [19]. This kind of structural features is conduits and barriers the groundwater movement, so these features are a significant parameter for a groundwater study. The remote sensing data which offer a synoptic view of large area help in understanding and mapping the lineaments both on regional and local scale. Here, the lineaments of Tirunelveli Taluk were identified and digitized from shaded relief image of SRTM DEM and

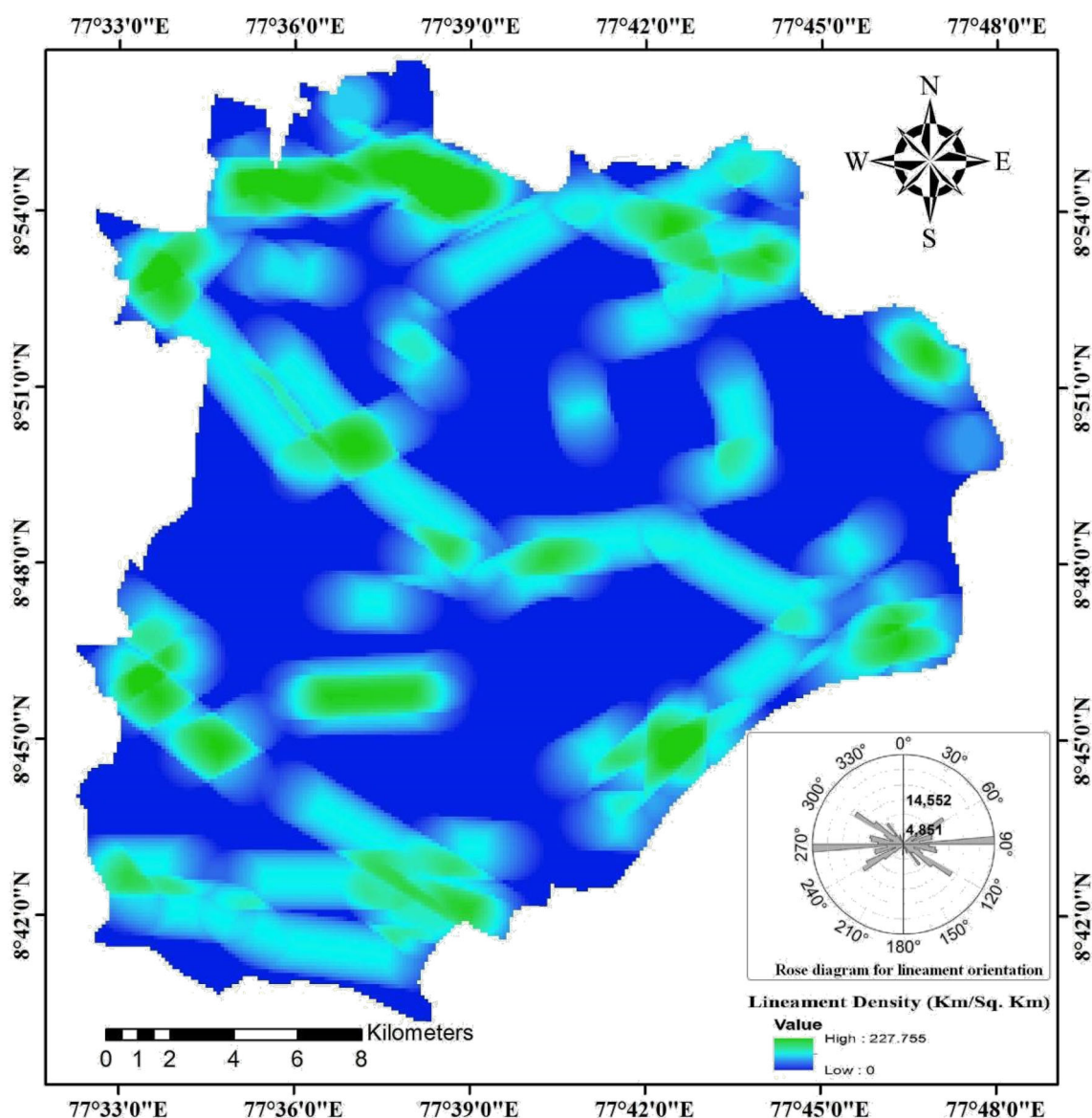
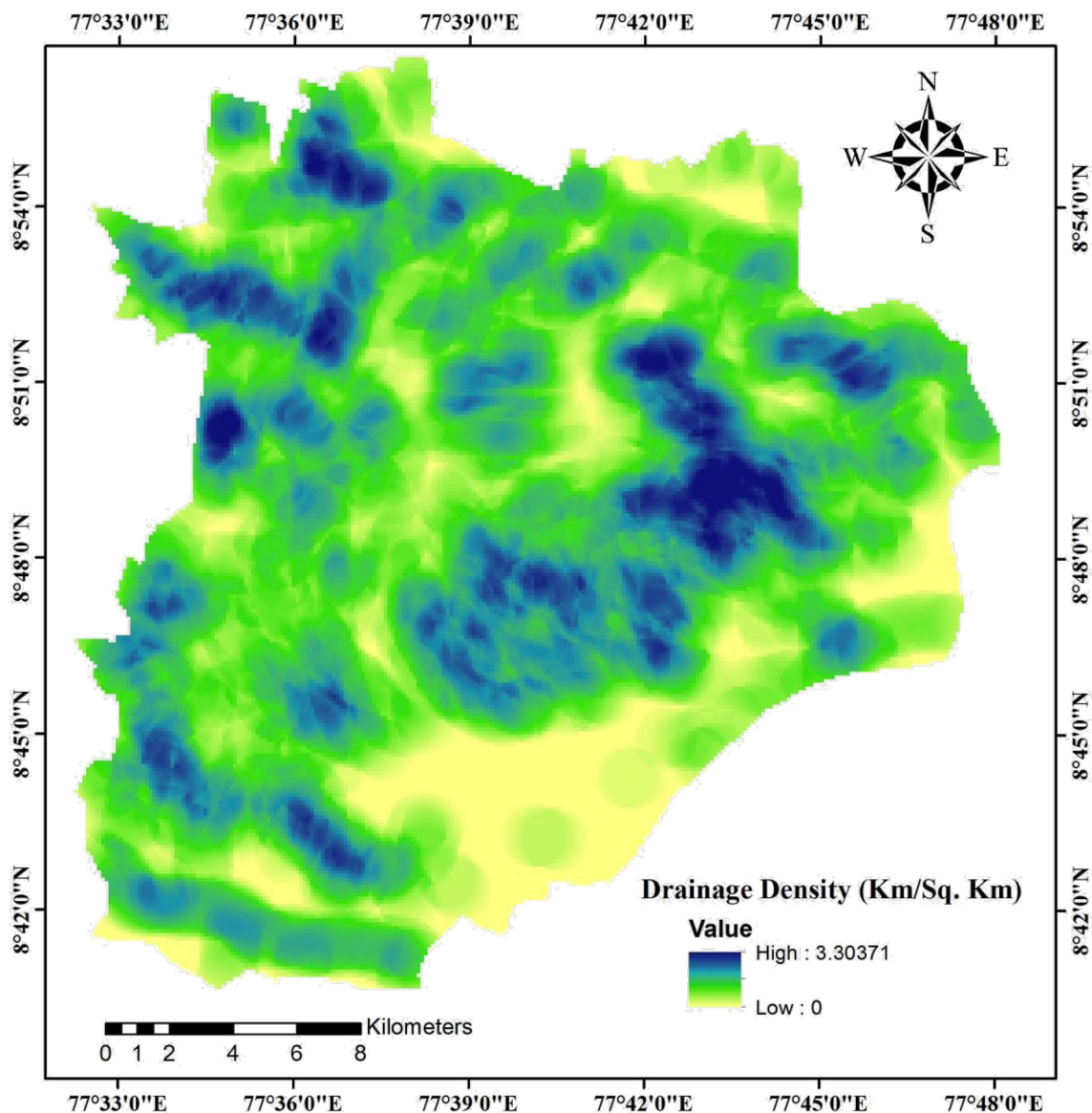


Fig. 4 Lineament density map

updated from LANDSAT 8 image of the study area. The lineaments trend in this area is primarily in NW–SE, N–S, W–E and NE–SW directions. The lineament density analysis is performed to compute the frequency of lineaments per unit area. Here, the lineament density map for this area is generated from line density tool of ArcGIS. The minimum lineaments density value is found to be 0 km/km<sup>2</sup>, and the maximum lineament density was 227.5 km/km<sup>2</sup>. The highest lineament density values were assigned as a high rank and vice versa. The spatial distribution map lineament density is shown in Fig. 4.

#### 4.4 Analysis of Drainage and Drainage Density

The Thamirabarani and Chittar rivers are a major drain of this area. The overall drainage pattern of this area is dendritic. The drainage map of Tirunelveli Taluk was digitized from Survey of India topographic sheets and updated from DEM which is shown in Fig. 5. The abundance of water drainage is an inverse action to infiltration, so it is a considered as the moderately influencing parameter in the groundwater potential study. The drainage density is defined as the ratio between the total length of drainage network and the area of the basin. If the area has high drainage density values, those areas have more runoff. The drainage density map was generally generated in basin level. The drainage density value of Tirunelveli Taluk



**Fig. 5** Drainage density map of Tirunelveli Taluk

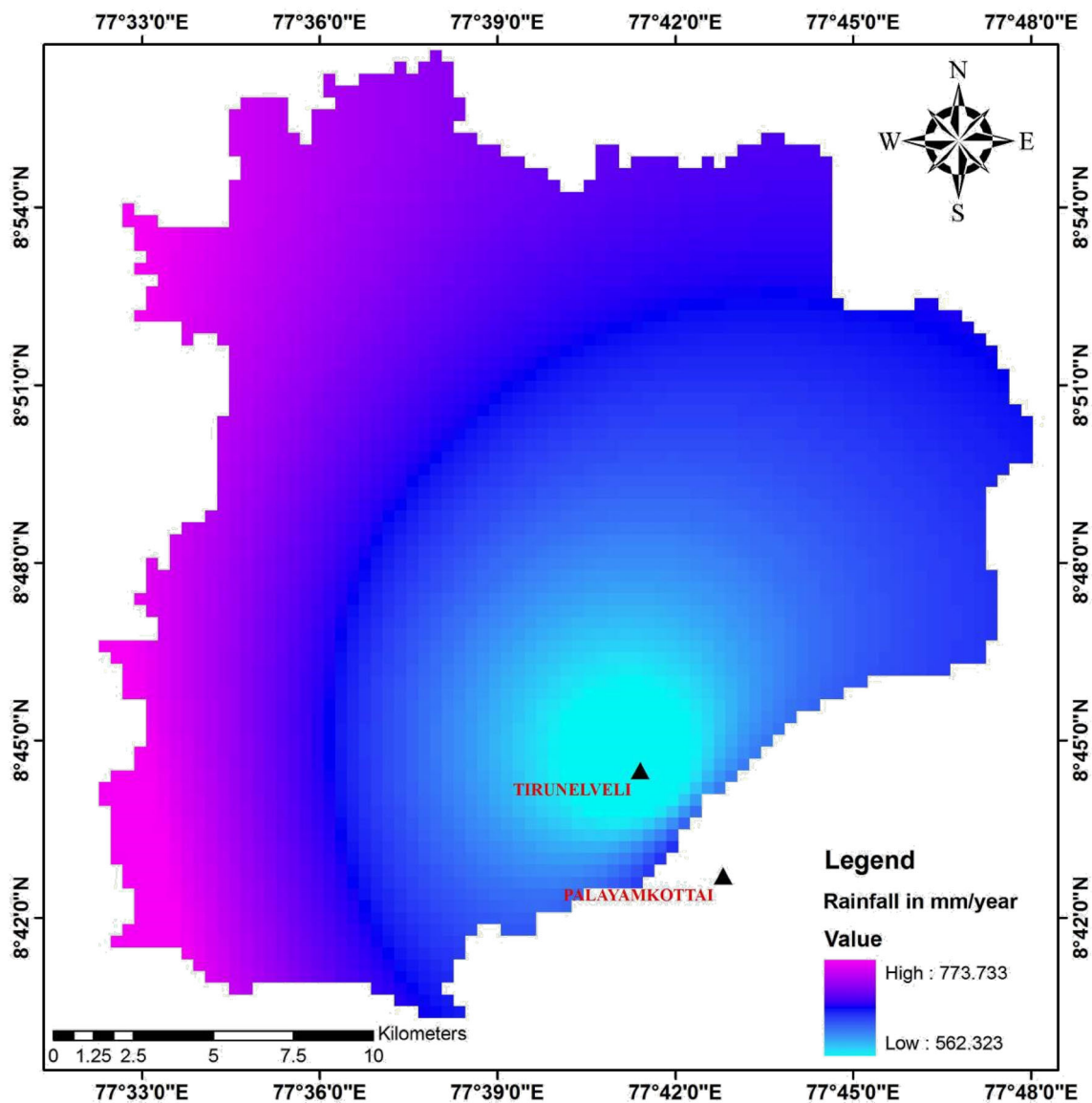


varies from 0 to 3.304 km/km<sup>2</sup>. High drainage density places are most favorable for high rainfall runoff, and for this reason, it indicates low groundwater potential. The higher ranks are assigned to low drainage density areas because the chance of infiltration is more. The low drainage density is due to the permeable nature of soil and vegetation availability.

#### 4.5 Analysis of Rainfall

The rain water is a primary source for groundwater, and the amount of precipitation is depending upon the land use pattern and climatic condition of this area. Around 10-year daily rainfall data for this area were collected from Tamil Nadu Agricultural Department, Tirunelveli. In the current

study, the rainfall layer is developed based on the annual average rainfall values of 7 rainfall stations by using spatial interpolation techniques like inverse distance weighted method which is available in ArcGIS. In this area, Palayamkottai and Tirunelveli rain gauge stations are influencing more compared to other rain gauge stations like Tenkasi, Ayikudi, Sengottai, Ambai, Sankarankovil. The rainfall values of the Tirunelveli Taluk range from 562 to 774 mm/year. The study area is divided into four rainfall zones: (1) > 800 mm, (2) 700–800 mm, (3) 600–700 mm, (4) < 600 mm. Figure 6 depicts the rainfall distribution in the study area. The highest rank is assigned for more rainfall area and vice versa.



**Fig. 6** Spatial distributed rainfall map of Tirunelveli Taluk



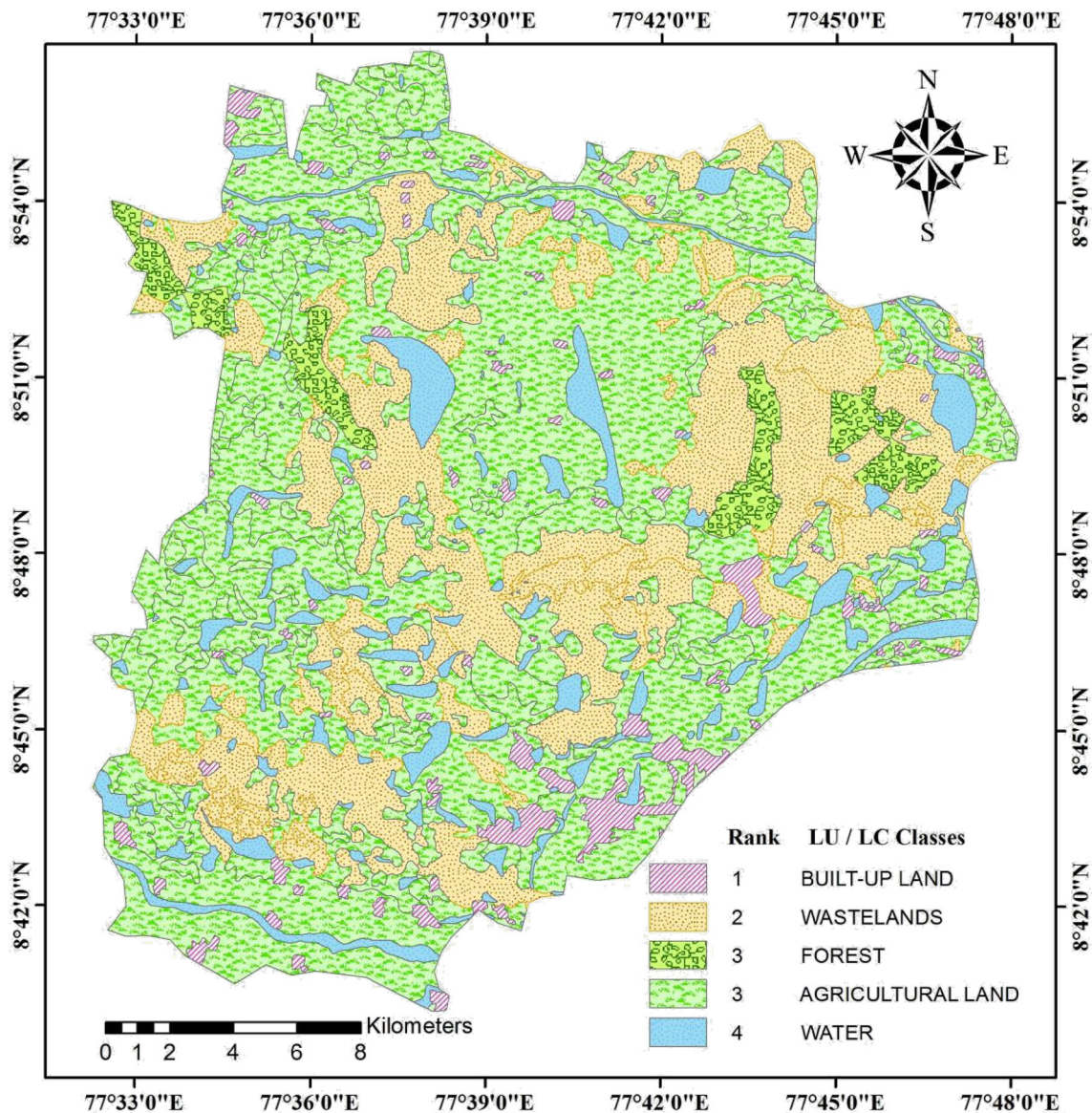


Fig. 7 Land use/land cover map of Tirunelveli Taluk

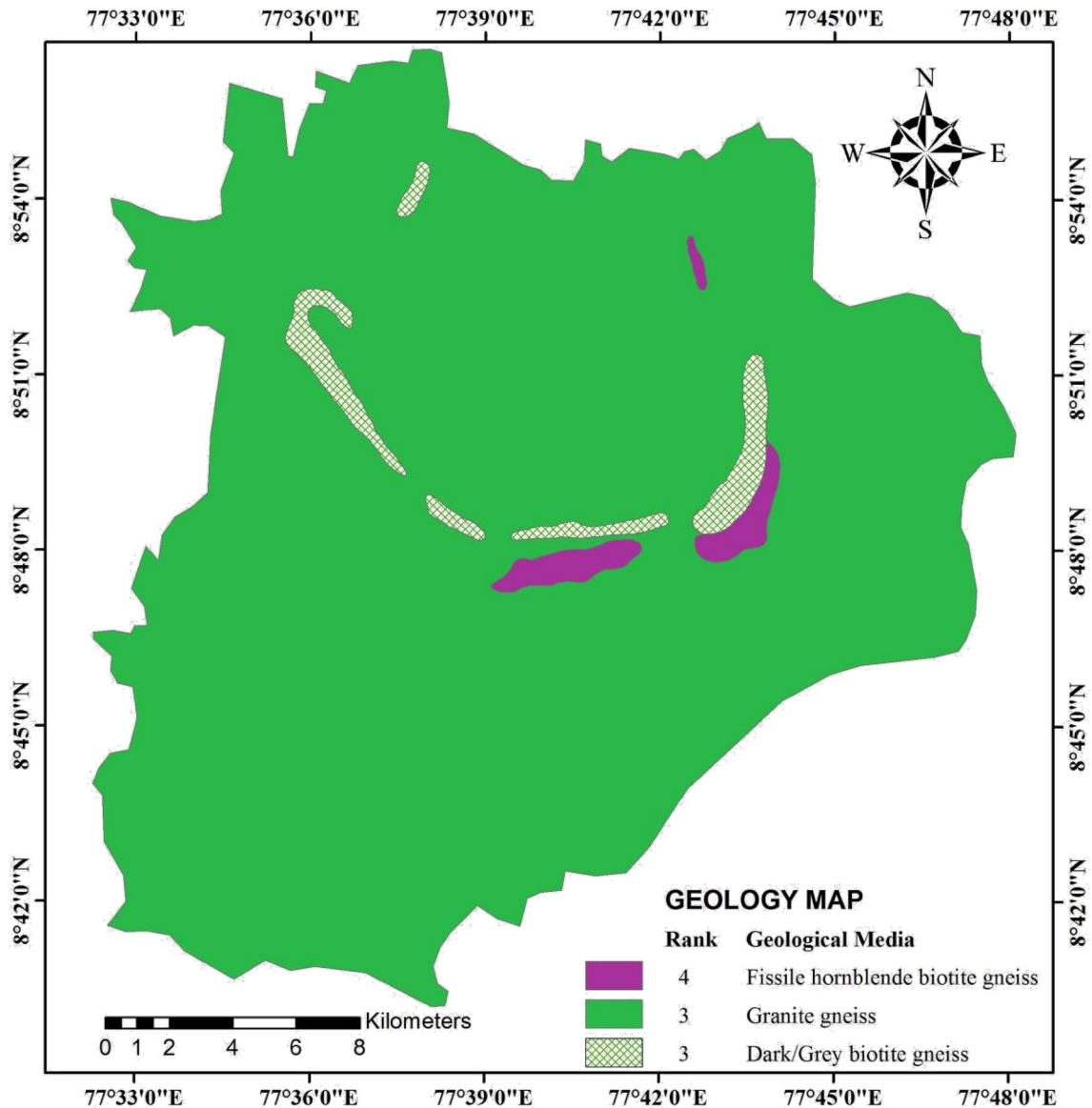
#### 4.6 Analysis of Land use/Land cover

Land use/land cover is a terrain surface character which affects the hydrological actions like evapotranspiration, surface runoff and infiltration. From the land use/land cover point of view, the Tirunelveli Taluk has agricultural land, built-up land, forest, waste land and surface water bodies. The 1:50,000 scale land use map for the Tirunelveli Taluk is visually interpreted and digitized from ArcGIS with the aid of visual interpretation key from the false color composite LANDSAT 8 satellite image. The agricultural land is the dominant class occupying 309.8 km<sup>2</sup> (55.4%) of the Taluk spread mainly very near to the water bodies. The water bodies like river, tank, lake and canal cover 52 km<sup>2</sup> of the study area. The surface water bodies and agricultural

land are good for groundwater recharge. The area under waste land is fairly high at 28.1% which is usually available between agricultural land and forest, and also, this land use class has low groundwater potential. The forest land and built-up lands of this area are spread between 19.2 and 20.2 km<sup>2</sup>, respectively. The built-up land has low groundwater potential due to low recharge and high surface runoff. Figure 7 shows the land use/land cover map of Tirunelveli Taluk.

#### 4.7 Analysis of Geology

The geological map of the study area was prepared from the Geological Survey of India 1:2, 50,000 scale geological map. The geological behavior of an area significantly



**Fig. 8** Geology map of the study area

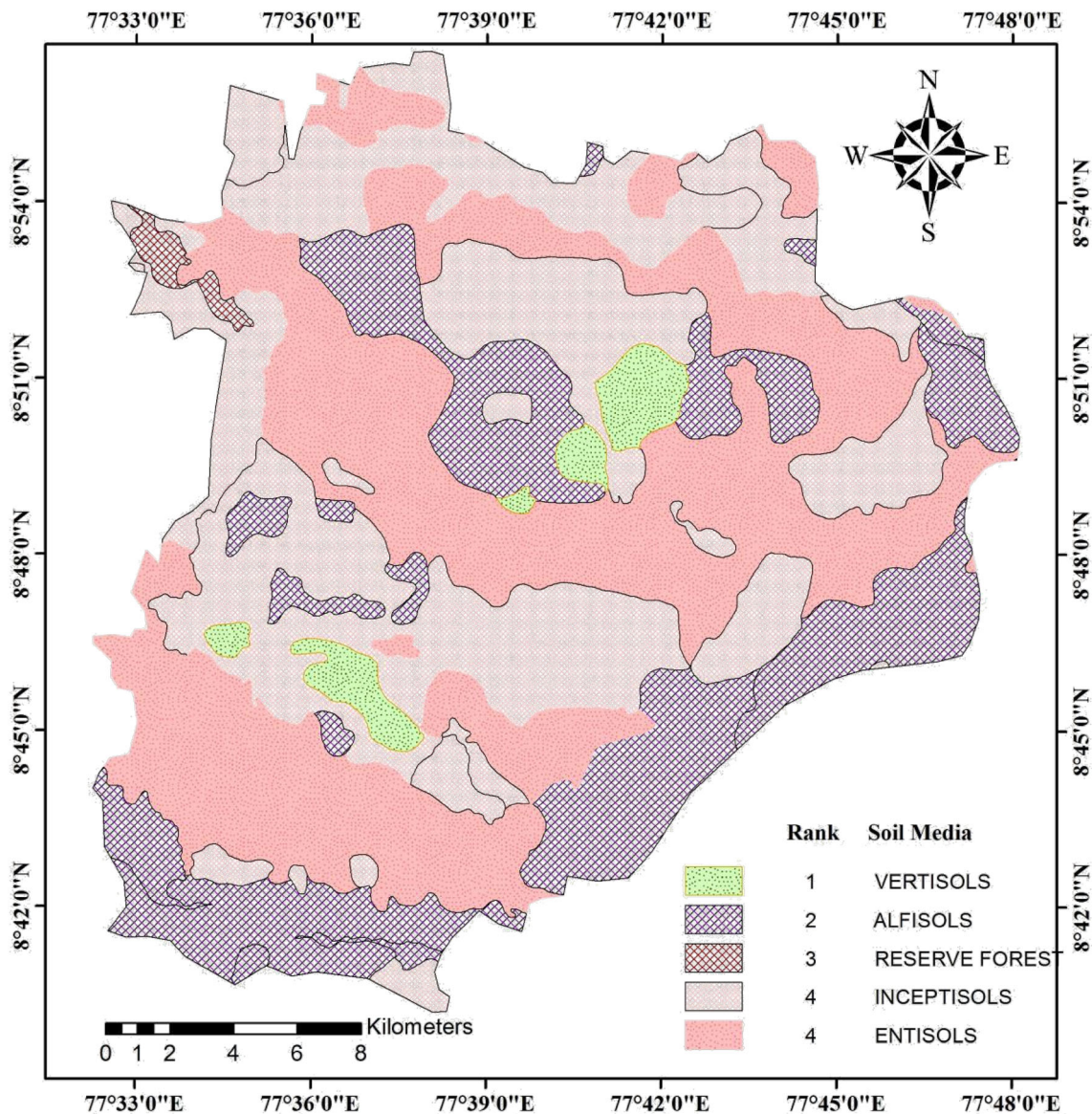
affects the groundwater recharge, especially in hard rock terrain. The geology map of the study region is shown in Fig. 8. The study area is underlined with intrusive and archean crystalline rock groups. The archean crystalline metamorphic complex will occupy hill ranges which consist of two lithological units, namely biotite gneiss and fissile hornblende biotite gneiss. Biotite gneiss is a migmatite rock type and considered as good for groundwater occurrence. Fissile hornblende biotite gneiss is a peninsular gneiss rock type which is very good for groundwater recharge, so high rank is assigned for this type of rocks. The 96% of the remaining area is occupied with granite gneiss which has also less influence on the groundwater potential. The deeper aquifers in hard rock terrains have

potential only when they are fed by fractures and thick weathered layers [20].

#### 4.8 Analysis of Soil

Soil map was prepared from the published map of European digital archives using the digitizing technique in ArcGIS. Soil in the study area is represented by five categories, namely alfisols, entisols, inceptisols, vertisols and reserve forest, and this soil taxonomy classes are further converted as a hydrological soil groups, namely A, B, C and D based on its infiltration capacity. The soil group A which is having more infiltration capability includes soil categories such as entisols (218.9 km<sup>2</sup>), inceptisols (190 km<sup>2</sup>); therefore, this group is considered as the most





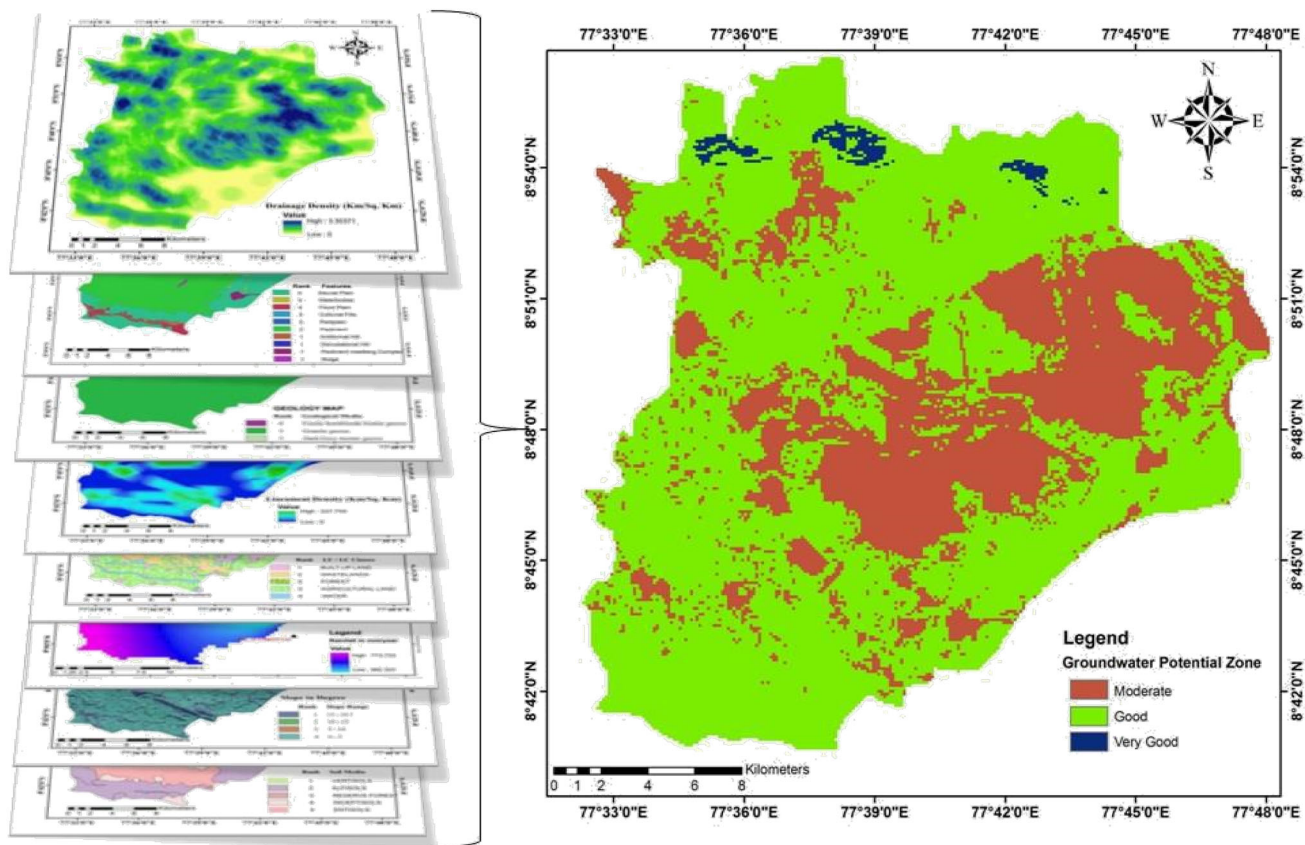
**Fig. 9** Soil map of Tirunelveli Taluk

suitable for groundwater potential. The second largest soil group of the study area is group C (alfisols) with 129.16 km<sup>2</sup> which has the moderate groundwater influence, and the remaining 3.6% of the study area is covered with both soil groups B and D. The soil map of Tirunelveli Taluk is shown in Fig. 9.

#### 4.9 Potential Zone of the Groundwater

The systematic analysis of AHP techniques on weighted parameters has produced a suitable groundwater potential zone map. The raster format operations are highly suitable for the weighted overlay analysis. Based on the recharge capability and other important criteria, the normalized weighted raster was classified into very high, high,

moderate and low for groundwater potential (Fig. 10). From the result, the plain surfaces in north accompanied by gentle slope area are explored as a very high potential zone for groundwater prospects. The total areal extent of this zone is 5.76 km<sup>2</sup> (2.93%). These zones are comprised of red sandy soil and black soil with 2.41–4.61 m soil depth, the lineament density ranges from 0 to 227.5 km/km<sup>2</sup>, and drainage density ranges from 0 to 3.303 km/km<sup>2</sup>. The total area of the Tirunelveli Taluk, which falls in moderate potential zone, is distributed all around in the area with 169.72 km<sup>2</sup> which is 30% of the total area. The high potential zone extends from the middle to the east of the study area with an area of 382.9 km<sup>2</sup>. The agriculture and forest were found to be good recharge potential zones (Table 4).



**Fig. 10** Groundwater potential zone map of Tirunelveli Taluk

**Table 2** AHP pair-wise analysis of parameters scale

Parameter	Gm	Ld	G	Dd	Ss	Sl	Rf	Lu
Geomorphology (Gm)	1.000	0.875	1.167	1.400	1.750	2.333	2.333	3.500
Lineament density (Ld)	1.143	1.000	1.333	1.600	2.000	2.667	2.667	4.000
Geology (G)	0.857	0.750	1.000	1.200	1.500	2.000	2.000	3.000
Drainage density (Dd)	0.714	0.625	0.833	1.000	1.250	1.667	1.667	2.500
Slope (Ss)	0.571	0.500	0.667	0.800	1.000	1.333	1.333	2.000
Soil (Sl)	0.429	0.375	0.500	0.600	0.750	1.000	1.000	1.500
Rainfall (Rf)	0.429	0.375	0.500	0.600	0.750	1.000	1.000	1.500
Land use (Lu)	0.286	0.250	0.333	0.400	0.500	0.667	0.667	1.000

#### 4.10 Data Validation

The generated potential zone of groundwater for Tirunelveli Taluk showed that very high groundwater potential zones are located along the Chittar river drain from northwest to northeast part of the study region. In this study, the cross-validation was carried out to justify the availability of groundwater potential based on the wells obtained from topographic maps published by SOI. The location of the wells (both dug wells and tube wells) was

manually digitized in the GIS environment. The statistical information of wells falling in the groundwater potential categories is shown in Table 5. Figure 11 shows the comparative information of the wells with areal extent of groundwater potential zones. Figure 12 explains the density of wells available in the each classes of groundwater potential layer. The well density in the very high potential zone is around 7 wells/km<sup>2</sup>. The well densities in the high and moderate potential zones are 2.03 and 1.14, respectively.



**Table 3** Relative weights of thematic layers with their corresponding rank

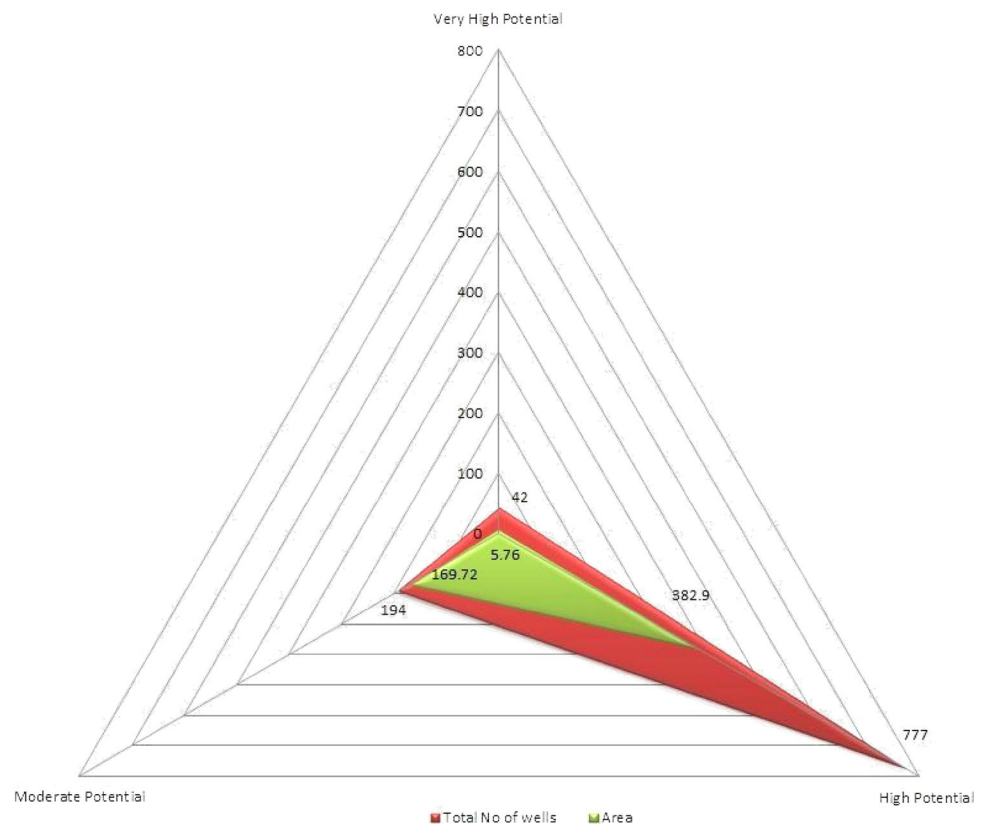
Thematic layer	Class	Area (km <sup>2</sup> )	Rank	Weight	Potential index
Geology	FHBG	7.75	4	16	64
	Granite gneiss	537.12	3		48
	Dark/Gray biotite gneiss	13.56	3		48
	Alluvial plain	91.2	4		72
	Antiformal hill	0.6	1		18
	colluvial fills	2.9	3		54
	Denudational hill	0.56	1		18
Geomorphology	Flood plain	34.65	4	18	72
	Pediment	316.92	2		36
	Pediment inselberg complex	2.6	1		18
	Pediplain	96.9	3		54
	Ridge	1.35	1		18
	Waterbodies	4.72	4		72
	Agricultural built-up	309.84	3		15
Land use	Forest	20.22	1	5	5
	Water	19.9	3		15
	Waste land	51.39	4		20
	ALFISOLS	157.56	2		10
	ENTIFISOLS	129.16	2		16
Soil	Inceptisols	218.9	4	8	32
	Reserve forest	190	4		32
	Vertisols	3.62	3		24
Lineament density	Low	16.71	1	21	8
	Medium	346.93	1		21
	High	162.37	2		42
	Very high	42.43	3		63
	Very high	6.67	4		84
Drainage density	Low	1.25	4	13	52
	Medium	55.15	3		39
	High	323.6	2		26
	Very high	269.41	1		13
	Low	57.0	1		8
Rainfall	Medium	255.33	2	8	16
	High	199.39	3		24
	Very high	46.65	4		32
	Medium slope	124.69	4		44
	Medium–steep slope	8.62	3		33
Slope	Steep slope	2.74	2	11	22
	Very steep slope	422.51	1		11

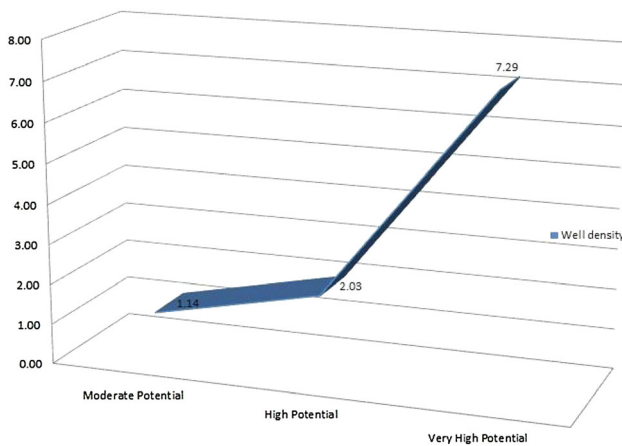
**Table 4** Hydro-geomorphological units with their influence on groundwater potential

Geomorphological units	Area (km <sup>2</sup> )	Description	Influence on groundwater potential
Alluvial Plain	91.2	Level plain, gently sloping with slightly undulating and land surfaces	Very high potential
Antiformal Hill	0.6	Moderately dissected hills and valleys	Low potential
Colluvial Fills	2.9	Any material that has been transported for short distances from the source essentially by gravity and especially near the foot hills is considered as colluvial fills	High potential
Denudational Hill	0.56	Small hills or heaps of angular boulders raising abruptly from surrounding and more runoff zone	Low potential
Flood Plain	34.65	A floodplain is an area near a river or stream which floods when the water level reaches flood stage	Very high potential
Pediment	316.92	Pediments occur as gently undulating plains with moderate slopes	Medium potential
Pediment Inselberg Complex	2.6	Pediments dotted with the number of inselbergs which cannot be separated and mapped as individual units	Low potential
Pediplain	96.9	Moderately sloping plain with < 10 m thickness of weathered zone	High potential
Ridge	1.35	Highly dissected hill and valleys which allows more runoff zone	Low potential
Waterbodies	4.72	Any significant accumulation of water on a planet's surface	Very high Potential

**Table 5** Comparison of SOI toposheet wells with groundwater potential zone map

GPZ categories	Area (km <sup>2</sup> )	% of the total area	Dug wells	Tube wells	Total no of wells	Well density
Moderate potential	169.72	30.39	115	79	194	1.14
High potential	382.9	68.57	492	285	777	2.03
Very high Potential	5.76	1.04	24	18	42	7.29

**Fig. 11** Radar comparison chart between SOI toposheet wells with areal extent of groundwater potential zones



**Fig. 12** Comparison chart between groundwater potential classes with well density values

## 5 Conclusion

The current study utilizes and proved that remote sensing satellite data are an efficient tool for obtaining morphological information of the terrain because the satellite images will provide real time information. The morphological characters of the features layers which are used for this study are geomorphology, soil, drainage, lineament and land use. Based on the calculated result of the AHP, the geomorphology is considered as a major influencing parameter instead of another seven parameters due to its influence on infiltration of precipitated water. The flood plains are composed of sand, silt and clay with a nearly gentle slope which is very good for groundwater potential, and the hills with high slopes (15–20.7%) show very low groundwater potential. The resultant groundwater potential map for the study is divided into four categories, namely low potential, medium potential, high potential and very high potential zones. The very high potential area covers 5.76 km<sup>2</sup>, high potential area covers 382.9 km<sup>2</sup>, and medium potential areas covers 169.72 km<sup>2</sup>. This study confirmed that the AHP and integrated remote sensing and geographical information system techniques along with field data are a prominent tool for groundwater studies and also that can be successfully used in identifying groundwater potential zone in the study area. In this study, priority of the parameters given in AHP is further revised based on the groundwater influence of this parameter in hard rock terrain from the existing literature. The generated groundwater potential map may be used as base data for groundwater exploration and for the further development and management of groundwater resources in Tirunelveli Taluk.

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