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Groundwater potential and recharge zones mapping using remote sensing and GIS for Kadegaon Taluka, Maharashtra, India

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Abstract

Year by year the water is becoming the scare source all over the world. Water resources available on earth are in the two forms namely surface water and ground water. According to the study of scientist the total volume of the ground water is very less as compared to the total water available in the globe. There are many areas in our country that are facing scarcity of water, and this is due to the no proper planning of the ground water development, results in the fall of water levels, drying of wells, etc. The over exploration of ground water in certain parts of the country may also leads in the lowering of ground water table, and this requires the scientific resource management and conservation. The source of water available below the surface of earth and that can be used as the prime source of water for water supply system majorly for agriculture, and also used for domestic and commercial uses. Groundwater has crucial importance and value for human life and economic development. The ground water has major contribution in the earth's water circulatory system known as hydrologic cycle.

Keeping in mind the growing rate of the population and as result of it the needs of the society could not be satisfied by the available surface water resources. Thus the man has started massive search of water resources. Such massive mining of ground water has leads to drastic decline of ground water table. Thus the ground water has become the precious resources for the agriculture and domestic use. Hence in order to ensure a sensible use of ground water the proper evaluation and management is required.

Keywords: groundwater, precipitation, infiltration, groundwater level fluctuation etc.

1. Introduction

Geospatial technology is a quick and low-cost tool for producing valuable data on geology, geomorphology, lineaments slope, and other topics that aid in determining groundwater potential zones. The systematic integration of these data with the subsequent hydrogeological investigation allows for the rapid and cost-effective delineation of groundwater potential zones. Although it is possible to visually integrate these data and delineate groundwater potential zones, it is time consuming, difficult, and introduces manual error. In recent years, digital techniques have been used to integrate various data in order to delineate not only the groundwater potential zone but also to solve other groundwater-related problems. Using a geographical information system (GIS) software tool, these various data are prepared in the form of a thematic map. These thematic maps are then combined with the "Spatial Analyst" tool. The "Spatial Analyst" tool, which includes mathematical and Boolean operators, is then used to create a model based on the goal of the problem at hand, such as the delineation of groundwater potential zones.

In groundwater resource mapping and planning, integrated remote sensing and GIS can provide an appropriate platform for convergent analysis of diverse data sets. This work aims to develop and apply integrated methods for better understanding the groundwater resource of the Kadegaon taluka in Sangli district, Maharashtra, by combining information obtained by analysing multi-source remotely sensed data in a GIS environment. Since the study area is connected by a national highway, both industrial investment and population growth have increased, and as a result, water scarcity is gradually becoming the most damaging issue in such a region.

Because available water sources are insufficient, there is a need to find alternative water sources, such as ground water, and thus ground water over-exploration has emerged as a serious threat to the study area. In an equilibrium state, the natural recharge process is insufficient to match ground water exploration and source maintenance. Because the groundwater level has dropped, ground water recharge techniques should be used.

In recent years, many workers such as Chatterjee & Bhattacharya (1995) [3], Shahid & Nath (2000) [9], and Saraf & Choudhary (1998) [8] have used the approach of remote sensing and GIS for groundwater exploration and identification of artificial recharge sites. Jaiswal *et al*. (2003) [4] have used the GIS technique for generation of groundwater prospect zones towards rural development. Krishnamurthy *et al*. (1996), Murthy (2000) [5], Obi *et al*. (2000) [6], and Pratap *et al*. (2000) [7] have used GIS to delineate groundwater potential zone. Shahid *et al*. (2000) [9], Boutt *et al*. (2001) have carried out groundwater modeling through the use of GIS.

Objectives

To assess the ground water potential zones in Kadegaon Taluka using geospatial techniques.

2. Study area

The study area lies in west a part of Maharashtra state bounded by Latitude 17^{O} 08’ 29” N to 17^{O} 25’ 34” N and Longitude 74^{0} 14’ 52” E to 74^{O} 31’ 41” E. falling partially survey of India topographical sheet no 47 K – 7, 10, on the scale 1:50,000 shown in Fig. no. 1 it covers total area of 560 km^2 and perimeter of 125 km includes district Sangli in Maharashtra. This district experiences a tropical wet-dry climate characterized by alternating wet and dry spells. The study area receives rainfall during South-West monsoon from June to September. The distribution of rainfall isn't even all over the study area. The typical annual rainfall increases from 1038 mm within the western side to 288 mm within the east side. The rainfall is scattered. The numbers of rainy days during a season are less. It has been observed that about 20% rainfall is received during post- monsoon and by thunder showers within the month of May. The temperature may rise to 42ºC in summer and should fall down to 8ºC during winter. The wet and dry seasons generally occur between July and October and between January and May, respectively. The climate of the region is defined as subtropical with hot and dry weather in the summer. The main cause of annual rainfall variability in Western Maharashtra is the changing position of synoptic systems.

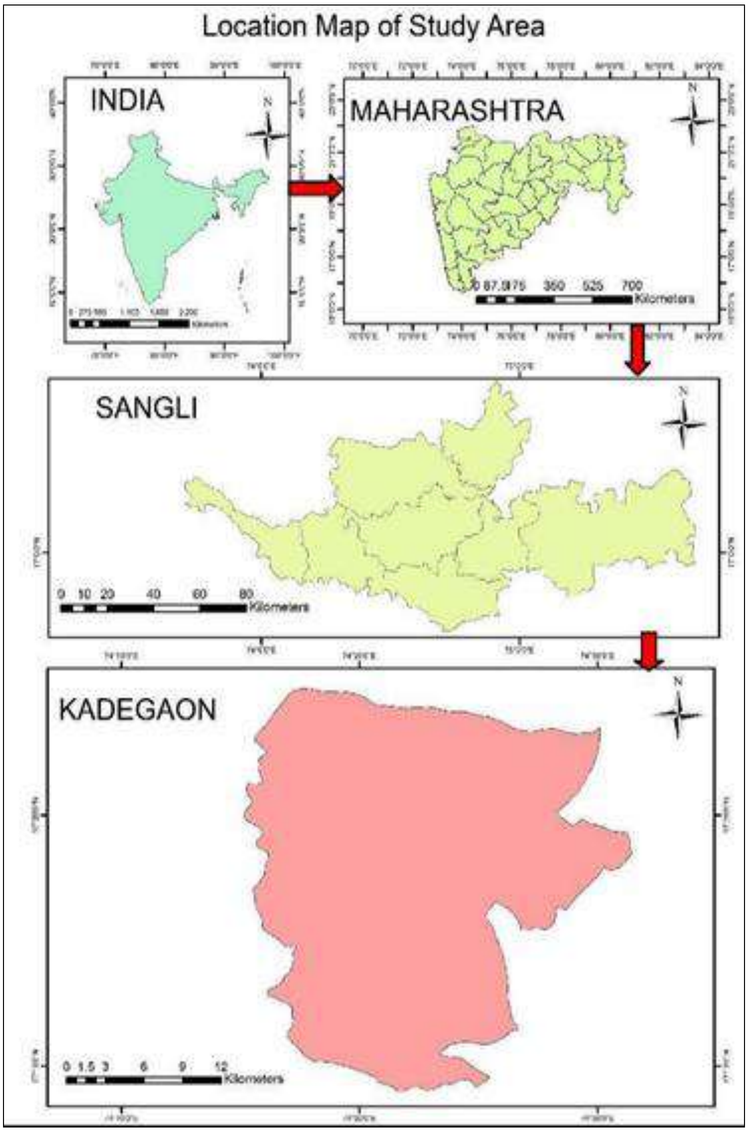

Fig 1: Location Map of study area

3.1 Methodology

The methodology used in this study is divided into three stages. In the first stage, the soil map and geological map of the study area on 1: 250,000 scale were obtained from the National Bureau of Soil Survey Land Use Planning, Nagpur, and the Geological Survey of India, Bhopal, respectively. These maps have been geo-referenced and converted to digital format. The contour, road network, drainages, and well locations were digitized from SOI topographical sheets, in the second stage, and a Digital Elevation Model (DEM) was created from the contour map. The slope and aspect maps of the study area were created using Erdas Imagine and a DEM.

To analyze the digital data, various digital image processing techniques such as principal component analysis, band radioing, band multiplication, enhancements, filtering, and supervised classification were used (Jensen 1986; Mather 1987), and the processed image was geo-referenced using ground control points obtained from topographic sheets. Erdas Imagine has created a land use/land cover map using unsupervised image classification. Visual interpretation was used to create a geomorphological map and a lineament map using an image interpretation element and ground information. The third stage entails assigning weightage to various units/classes of lithology, geomorphological features, slope, and soil based on their individual roles in groundwater perspective, and then overlaying and integrating the maps to produce a groundwater potential map using the Weighted Overlay Analysis method in a GIS environment using ARC GIS.

3.2 Geographical Information System (GIS)

The Geographical Information System (GIS) combines hardware, software, and data to capture, manage, analyses, and display all types of geographically referenced data (ESRI, 2009). It is a very powerful tool for studying water resources because it assists in locating features, determining the extent of coverage, monitoring the resources, and generating models for scenarios by analyzing spatial data, all of which aid in optimizing resource utilization. Furthermore, it aids in the collection, storage, retrieval, transformation, and display of real-world spatial data. It is increasingly becoming a valuable management tool for managing, analyzing, and visualizing disparate datasets related to soils, topography, land-use, land-cover, and climate. Remote sensing and GIS technology are used in forestry, wasteland mapping, agriculture crop acreage and yield estimation, ground water targeting, drought monitoring, and water body studies, amongst other applications. It provides precise input data for further interpretation, study, and analysis. It also saves time and is easily accessible in all aspects. When remote sensing and GIS work together, they generate useful data that can be processed.

Integration of remote sensing and GIS modeling for groundwater potential zone mapping. The groundwater potential zones were obtained by overlaying all the thematic maps in terms of weighted overlay methods using the spatial analysis tool in ArcGIS 9.2. During the weighted overlay analysis, the ranking has been given for each individual parameter of each thematic map and the weightage were assigned according to the influence of the different parameters. These weightage have been taken considering the works carried out by researchers such as Srinivasa & Jugran (2003), Krishnamurthy *et al*. (1996) Saraf & Choudhary (1998) [8].

All the thematic maps were converted into grid (raster format) and superimposed by weighted overlay method (rank and weightage wise thematic maps and integrated with one another through GIS (Arc / Info grid environment). As per this analysis, the total weights of the final integrated grids were derived as sum of the weights assigned to the different layers based on suitability (Environment System Research Institute Inc.'s ArcView GIS Software, 1997).

The full potential of remote sensing and GIS can be utilized when an integrated approach is adopted. Integration of the two technologies has proven to be an efficient tool in groundwater studies (Krishnamurthy *et al*., 1996). In models derived through integration of various thematic maps using a GIS approach, several parameters are commonly involved to assess groundwater potential in the study area.

The modeling involves delineation of zones of varying groundwater potential based on integration of four thematic maps in a raster based GIS. The five parameters considered are: Soil, Geomorphology, Land use/ Land Cover, Lineament and Drainage. Every class in the thematic layers was placed into one of the following categories *viz*. (i) Good (iii) Moderate (iv) Poor, depending on their level of groundwater potential. Considering their behavior with respect to groundwater control, the different classes were given suitable values, according to their importance relative to other classes in the same thematic layer.

The spatial distribution of the various zones of groundwater potential obtained from the model generally shows regional patterns related to lithology, soils, drainage, geomorphology, Lineament and Land use patterns. The good zonal categories are along major lineaments and drainage channels with and without structural control, highlighting the importance of lineaments, geomorphological and soil units for groundwater investigations. Areas with moderate groundwater potential are attributed to combinations of lithology and landform. The poor categories of groundwater potential are distributed mainly along hills, ridges and pediments and to some extent along lineaments in the low to poor slope classes

3.3 Visual interpretation and Digital Image Classification

It divides the image into clusters with similar spectral properties that represent earth surface objects. To generate a land use/cover map from the images, a series of image classification operations were performed. The ERDAS 10.1 image processing module was used. Various land cover features were identified and chosen as training sets for a land cover class based on visual interpretation. In this study, the Maximum Likelihood Classification (MLC) method was used to classify the image into different land use classes. All four IRS P6 LISS-III satellite images from 2014, 2015, 2016, and 2018 were used to define five land use/cover classes: Water bodies, Rocky area, agricultural land, waste land, settlement land, as the residential area covered in the study area is comparatively small, it is directly added wasteland. The maximum likelihood classifier was used in this study to classify land use, which is based on the probability that a pixel belongs to a specific class. Distances to class means are calculated for each feature vector. This includes determining the variance-covariance matrix for each class.

3.4 Preparation of thematic maps

The base map and remote-sensing data are used to create various thematic map layers, such as a village map, drainage map, drainage density map, contour map, slope maps, flow direction and accumulation map, hydrological soil map with proposed water harvesting structures, and so on. On the base map, the watershed boundary, contours, and drainage are digitized, and contour and drainage maps are generated. The digital satellite data was geo-referenced and corrected using a base map layer.

The scanned maps were geo-referenced in Arc GIS using control points that were already established on the base map. After rectification, the four control points on the map's top left, top right, bottom left, and bottom right corners were assigned corresponding latitude/longitude values and converted into a polyconic projection system using Arc/Info GIS software. On-screen digitization of scanned maps was performed in Arc GIS software, and appropriate editing was performed to remove digitization errors. Following the completion of the error-free coverage attributes were assigned to units belonging to various categories of land use, drainage, and soils, etc. in respective thematic maps. The catchment hydrology is influenced by the surface morphology. By digitizing contour lines on topographic maps and conducting ground surveys, additional elevation data sets are created. For spatial analysis modelling, DEM data is combined with land use/land cover data, soils, and other variables.

3.4.1 Soils map

The spatial distribution of soil types depends on its physiography and lithology. The soil types present in watershed are Calcareous, Clayey calcareous, Clayey, Fine Calcareous, Loamy, and Well drained loamy. Figure no. 2 shows the spatial distribution of soil types in the study area. Soil map gives an idea about stability and suitability for water harvesting structures

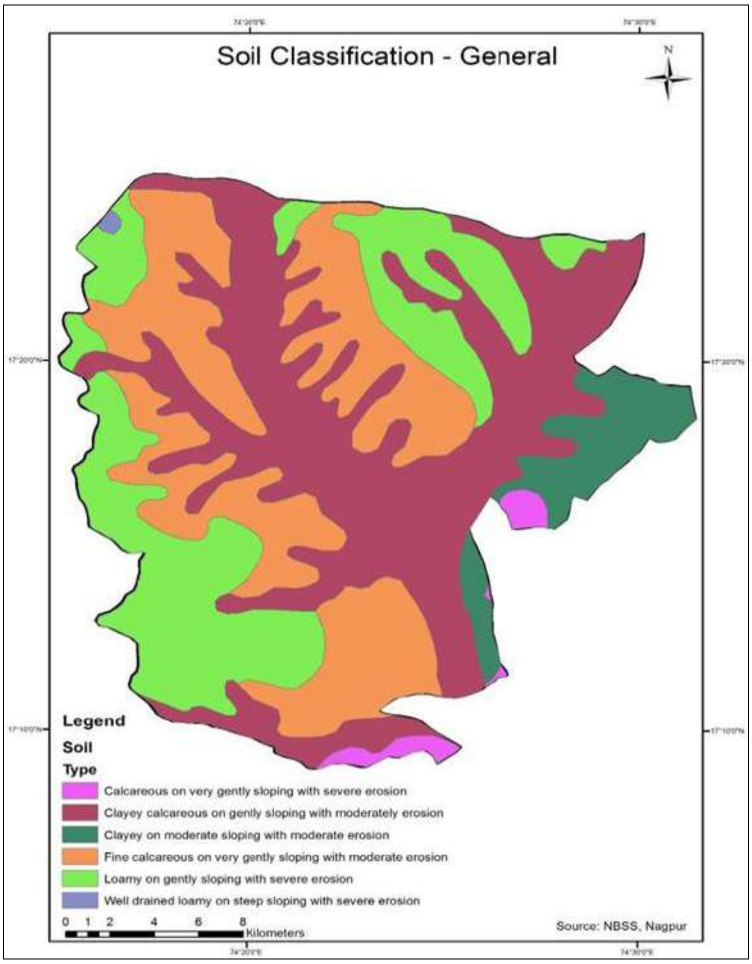

Fig 2: Soil Map of Kadegaon Taluka

3.4.2 Geology of the region

The geology of the region is dominated by basaltic rock. The study area has been subjected to numerous tectonic movements in the past, as evidenced by varying folds, faults, and lineament associations with hills located on the western side of the study area. Basaltic flows associated with Deccan volcanic activity from the Cretaceous to the Eocene ages cover the region. We are known as the Deccan Trap because we have a phase-like topography. These flows range in thickness from a few centimeters to 40 meters within the independent flow. They stretch for quite some distance. The mineralogical and chemical composition of basaltic lava flows is nearly uniform. Basaltic flows are frequently classified as compact, fine-grained, massive basalt and vesicular, amygdaloidal basalt, with vesicles filled with secondary minerals such as quartz, chalcedony, and calcite, among others. Rocks that are relatively soft and friable are easier to break. The boundary of the basalt flows is determined by the presence of red beds, changes in the jointing and weathering pattern, ropey surface, and so on.

Another criterion for identifying various basaltic flows is the formation of a flat surface at different altitudes. These flat surfaces can be used as flow tops. Basaltic flows are typically separated birred beds,' which are red to brown colored clay rocks. The thickness of the red bed varies between a few centimeters and more than two meters. It also has a gradational relationship with the underlying flow's highest section. These rocks have negligible primary porosity but are porous and permeable due to secondary porosity caused by fracturing and weathering. (Zende A.M. *et al*., 2012) [1].

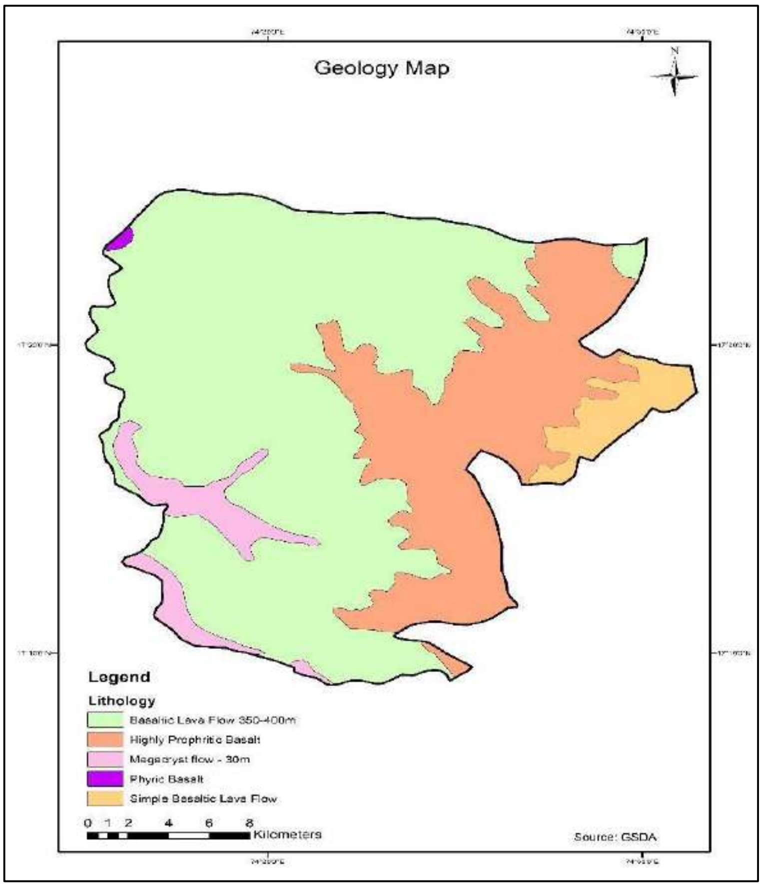

Fig 3: Geology of the Kadegaon Taluka

3.4.3 Drainage Density

Permeability is inversely proportional to drainage density. The less permeable a rock, the less rainfall infiltration, which tends to be concentrated in surface run-off. This is the source of a well-developed and fine drainage system. Because drainage density can indirectly indicate groundwater potential of an area due to its relationship to surface run- off and permeability, it was considered as one of the indicators of groundwater occurrence in the current study. Drainage density measurements have been taken for all of the area's micro watersheds, and they range from 0.5 km to 2.5 km. It is divided into three classes based on the drainage density of the micro basins: (i) 0–0.75 km, (ii) 0.75–1.5 km, and (iii) 1.5–2.25 km. As a result, these classes have been classified as ‘good,' ‘moderate,' and ‘poor,' respectively. The majority of the study area (70%) has a drainage density of 0.75 – 1.5 km.

Drainage is created by digitizing individual streams from Survey of India topographic sheets 47 K - 7, and 10 at scale 1:50000 scale and assigning stream orders using Strahler's law of stream order (1964). When two first-order streams meet, they combine to form a second-order stream. When two second-order streams meet, they combine to form a third-order stream. The factors that influence drainage density are similar to those that influence stream length, namely resistance to weathering, permeability of rock formation, climate, vegetation, and so on. Drainage density controls the time it takes for water to travel within the basin. It has a low value in general in regions underlain by highly resistant permeable material with vegetative cover and low relief. High drainage density has been observed in areas with weak and impermeable subsurface material, sparse vegetation, and mountainous relief. (Nag SK, Chakraborty S. 2003) It is the average length of the stream per unit area of the basin.

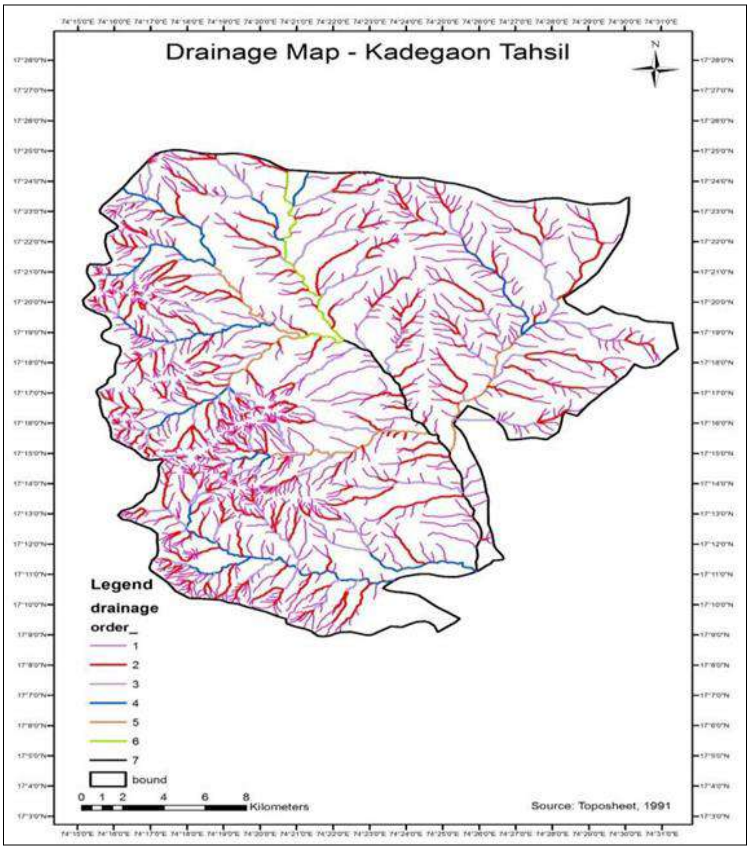

Fig 4: Drainage Density Map of Kadegaon Taluka

3.4.4 Land use / land cover

The identified land use/land cover features from the IRS imagery of the study area are Water Body (6% stream and tank), Rocky area (9%), Agricultural land (28% cropland, fallow land and plantation), wasteland (48% land with or without scrub and barren rocky area), and settlement (9%). Fig. no 5 shows the Landuse / Landcover map of study area. The principal crops grown in the area are Sugarcane, Wheat and rice (grains of this plant used as food), chili (capsicum species used as food), tobacco (leaves of this plant used for smoking, chewing or snuff), cotton (soft white fibrous substance covering the seeds of the plants used for preparation of cloths), tomato (glossy red or yellow pulpy edible fruit used as food) and black gram (Indian pulse variety used as food).

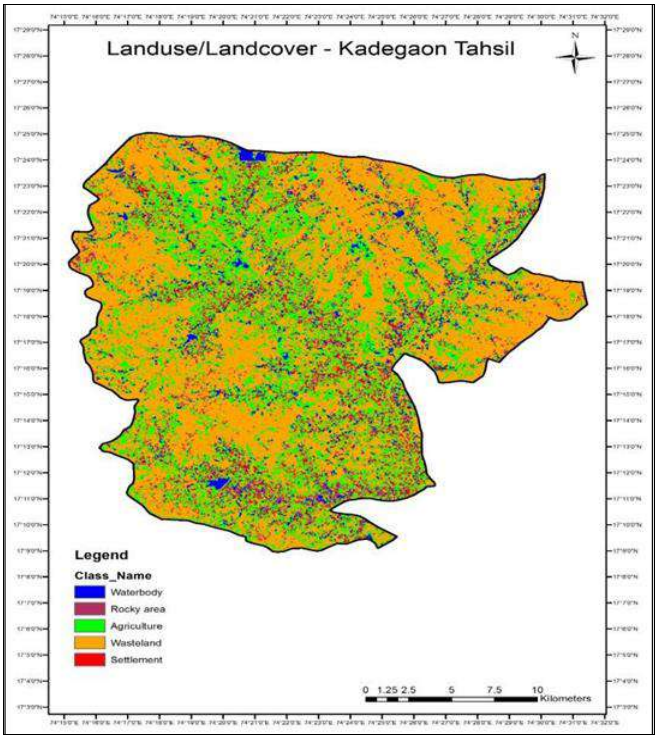

Fig 5: Land use and Land cover Map Kadegaon Tahsil

3.4.5 Contour map: With the help of topographic map contour map is digitized at 10m contour interval. Contour map is used to from DEM by using interpolation of contour.

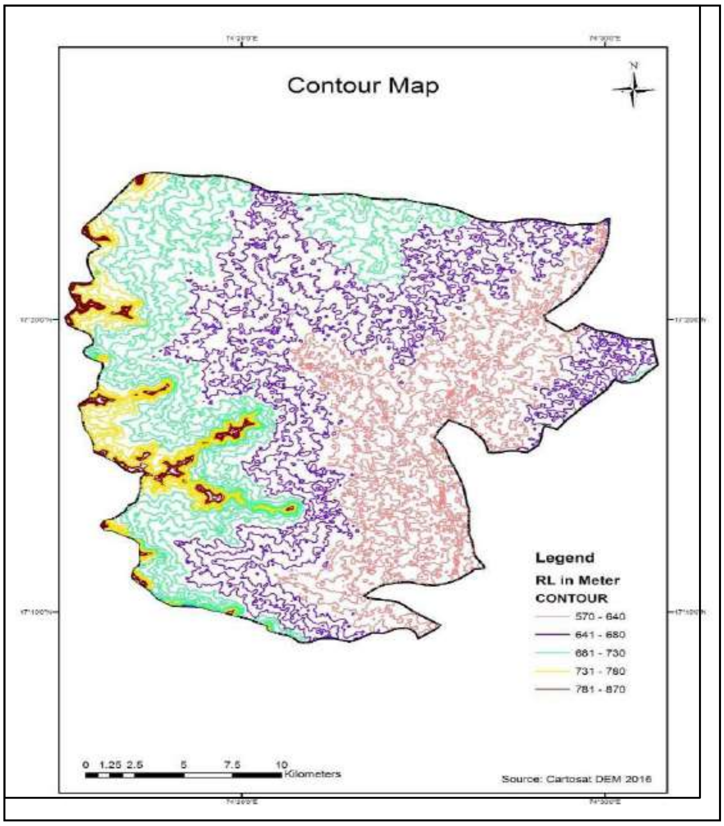

Fig 6: Contour Map of Kadegaon Tahsil

3.4.6 Digital Elevation Model (DEM)

DEMs are digital records of ground elevations at regularly spaced horizontal intervals. The Digital Elevation Model (DEM) was created using the Advanced Space borne Thermal Emission and Reflection Radiometer (ASTER). Topographic sheets contributed the highest and lowest point elevation values of 870m and 570m, respectively. The study area's western periphery has a higher elevation range, while the eastern part in the middle has the lowest slop, resulting in a flat surface. The DEM was used to calculate slope, aspect, flow direction and accumulation, and stream network data.

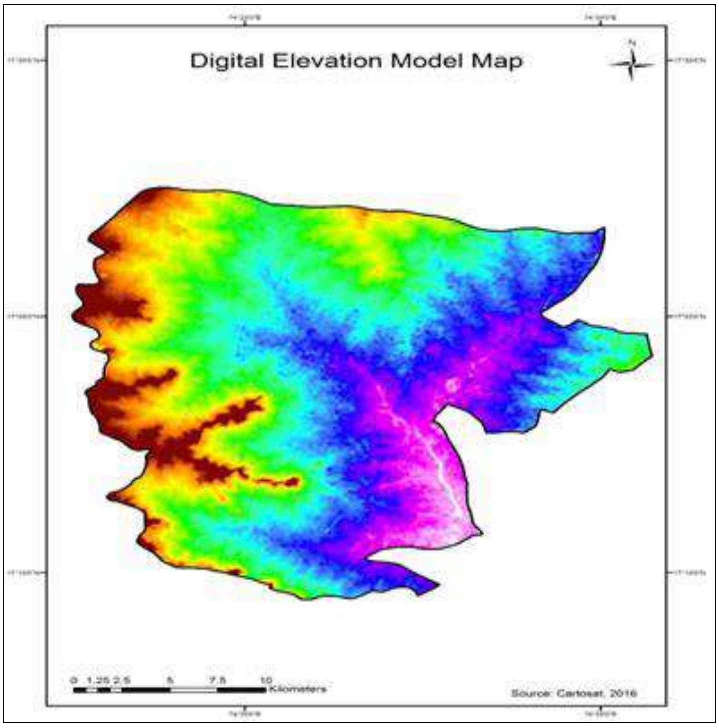

Fig 7: Digital Elevation Model of Kadegaon Taluka

3.4 Ground water potential index (GPI)

A groundwater potential index (GPI) was calculated for the relative assessment of groundwater potential zones, taking into account factors such as rainfall, slope, run- off, infiltration, soil cover, moisture content, lineaments, weathered and fractured rocks, drainage, groundwater levels, and vegetation in relation to geomorphological units. Each of the factors in this index was assigned a weightage based on their influence on the occurrence and movement of groundwater resources. A generalized classification of groundwater potential zones was evaluated using the total weight-score of GPI for a quick assessment of groundwater occurrence on a regional scale.

3.5 Factors controlling groundwater potential zones

GPI is proposed and computed for relative evaluation of groundwater potential zones by integrating all factors related to the occurrence and movement of groundwater resources such as rainfall, slope, run-off, infiltration, soil cover, moisture content, lineaments, weathered and fractured rocks, drainage, groundwater levels, and vegetation.

In this index, each factor is assigned one of three weightages (1–3) based on its influence on the occurrence and movement of groundwater. The weightage factor, 1) Indicates low groundwater potentiality, 2) Indicates moderate groundwater potentiality, and 3) Indicates high groundwater potentiality.

Rainfall is the primary source of groundwater recharge. The study area as a whole received the same amount of rain. As a result, the weightage factor for rainfall is considered uniform across the area. The soil zone has a significant impact on the amount of water that infiltrates. In areas where the soil zone is thin or absent, the rate of infiltration may be higher. Furthermore, the rate of infiltration is heavily influenced by the grain size of the soil. Because of their low permeability, fine-grained soils cannot easily infiltrate water into the ground.

Because of the high permeability of coarse-grained soils, water can easily infiltrate into the ground. Soils with greater thickness and greater permeability are given more weightage. In general, flat and gently sloping areas encourage infiltration and groundwater recharge, whereas steeply sloping areas encourage runoff and little or no infiltration. The area has a gentle slope, which allows for low overland flow discharge and a high rate of infiltration. The study area is expected to have greater groundwater potential. In the control of groundwater availability, massive rock lithology has little influence compared to topography. Though lithology is unimportant in this case, the rocks become aquifers as a result of weathering and fracturing caused by secondary porosity. As a result, appropriate weightages are assigned to the rocks associated with the weathering and fracturing portions. Lineaments and their intersections are important in the formation and movement of groundwater resources in crystalline rocks. As previously stated, groundwater level fluctuations are more concentrated in the southwest, and northwest, while lineaments are mostly concentrated in the southwest, and southeast part of study area. A comparison of the distribution of water-level fluctuations with the lineaments shows that where the lineaments are more numerous, the water-level fluctuations are lower, and where the lineaments are fewer, the water-level fluctuations are higher. As a result, lineaments are potential aquifer zones. Higher yields are obtained when the lineaments are parallel to the stream courses and/or tanks (surface water bodies) or when the lineaments interconnected. (Subba Rao and Prathap Reddy 1999; Subba Rao *et al*. 2001; Sankar 2002; Nag and Surajit 2003; Chakraborty and Paul 2004; Sener *et al*. 2005; Sreedevi *et al*. 2005). Fractures (lineaments) combined with topographically low ground can also serve as the best aquifer horizons (Subba Rao 1992). The high density of lineaments, which is closely associated with shallow groundwater levels, stream courses, and tanks, is given more weightage. The availability of water affects vegetative growth. A thick vegetative cover is expected if plants have enough water. This indicates a high moisture retention rate and a shallow water level. As a result, weightages are assigned to the vegetative cover.

3.6 Satellite image analysis

Surface conditions such as natural vegetation, cropped areas, reservoir water spread, and other land cover and land use features are revealed by multi-date satellite images. For the interpretation of False Color Composite and the preparation of user- friendly land use land cover, four different years of FCCs are downloaded from the Bhuvan website. Satellite images (IRS P6 LISS III, 2014, 2015, 2016, and 2018) were processed using ERDAS IMAGINE 10 software for visual interpretation, digital image classification, change detection, and water assessment analysis.

3.7 Visual interpretation and Digital Image Classification

It discretizes into clusters with similar spectral properties that represent earth surface objects. To generate a land use/cover map from the images, a series of image classification operations were performed. The ERDAS 10 image processing module was used. Various land cover features were identified and chosen as training sets for a land cover class based on visual interpretation. In this study, the MLC method was used to classify the image into different land use classes.

All four IRS P6 LISS-III satellite images from 2014, 2015, 2016, and 2018 were used to define six land use/cover classes: agricultural land, water bodies, open scrub land, fallow land, natural vegetation, and barren land. Because the residential area covered in the study area is comparatively small, it is directly added to wasteland.

4.1 Result and Discussion

4.2 Ground water Potential Zone map

Since groundwater cannot be seen directly from remotely sensed data, its existence must be inferred by identifying surface features that function as groundwater indicators (Das *et al*. 1997; Ravindran and Jeyaram 1997). Hence in the present study, hydro-geomorphological details derived through the visual and digital interpretation of the enhanced satellite products were used for delineating the groundwater prospective zone maps of the study area. Hydro geomorphological maps depict important geomorphic units, landforms, and underlying geology in order to provide an understanding of the processes, materials/lithology, structures, and geologic controls relating to groundwater occurrence and prospects. Such maps, which depict prospective zones for groundwater targeting, are critical as a foundation for planning and carrying out area-specific activities. The groundwater potential zone map categorized as Very high, High, Medium, Low as shown in Figure no 8. High and moderate groundwater prospect zones are mainly dominated by geomorphic units like valley fill and pediplains respectively. Lineaments are the visible surface manifestations of linear features such as joints and fractures. They have been delineated as linear features from the imagery and are confirmed after ground truthing. A higher order of groundwater potentiality is indicated where lineaments run along and across the alluvial zone. The criteria for delineation of groundwater potential zones was adopted from Krishnamurthy *et al*. (1992), Krishnamurthy and Srinivas (1995), Panigrahi *et al*. (1995), and Rao and Jugran (2003). Figure no. 8 shows the variation of groundwater potential zones in study area. The maximum part of middle portion of watershed is combined with high and moderate groundwater potential zones. The western boundary of study area showing poor groundwater potential zones because this area is mostly covered by hills. About 9% area comes under Very high potential zone, 41% area comes under High potential zone and 34% area comes under Medium and 16% Low potential zone. The groundwater potential map (Figure no. 8) demonstrates that the Very High groundwater potential zone is concentrated in the south region and high ground water potential zone is spread along central and north-eastern region of the study area due to the distribution of clayey calcareous on gently sloping area and agricultural land with high infiltration ability. This is an empirical method for the exploration of groundwater potential zones using remote sensing and GIS, and it succeeds in proposing potential sites for groundwater zones. This method can be widely applied to a vast area with rugged topography for the exploration of suitable sites.

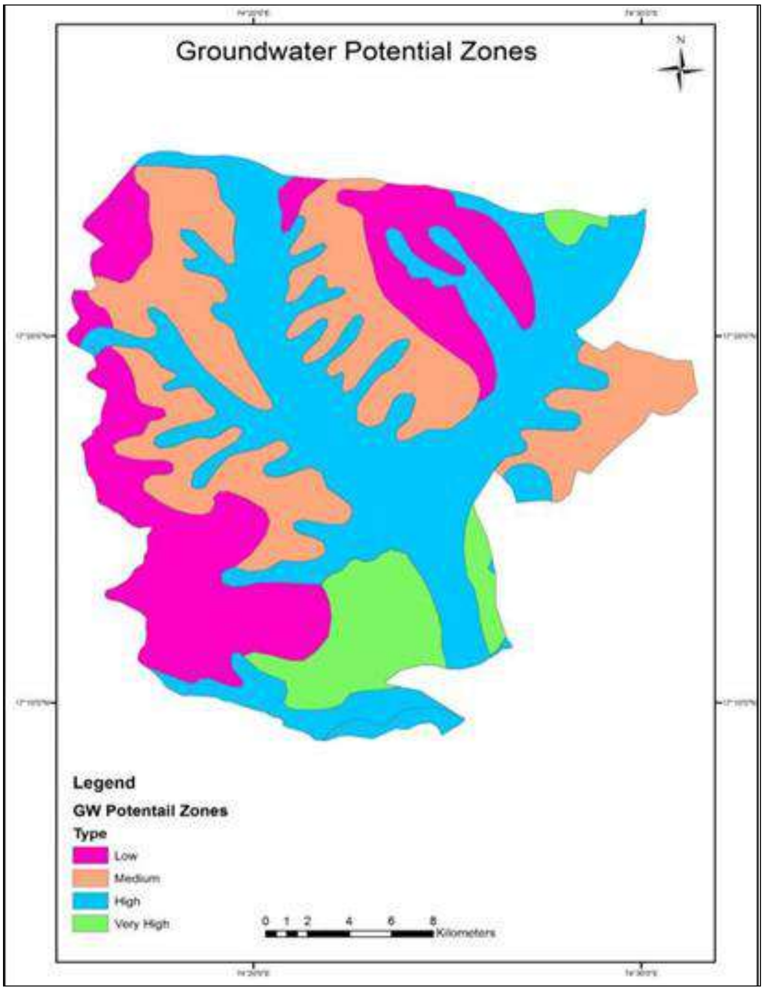

Fig 8: Groundwater potential zones in Kadegaon Taluka

4.3 Site selection for Artificial recharge

Several artificial-recharge methods, such as percolation ponding, recharge pitting, echelon damming, flooding, induced recharging, and the construction of a battery of wells, are successfully used all over the world other common soil and water conservation techniques include contour trenching, terracing, nalla-bunding, and inter-basin transfer. (Karanth 1987; Muralidharan and Athavale 1998).

The selection of suitable sites for the application of appropriate artificial-recharge techniques is critical for effective recharge and is dependent on several parameters that must be analyzed collaboratively in a GIS environment. According to a CGWB (1994) study on percolation tanks, if the site of a percolation tank is properly selected and the tank is properly designed, groundwater recharge through the tanks can reach up to 70%. (Raju 1998). Many researchers have developed various criteria based on groundwater conditions in the area for integrating various geological and hydrogeological parameters in order to select suitable recharge sites. (Ramaswamy and Anbazhagan 1997; Saraf and Choudhury 1998; Pakhmode *et al*. 2003).

Water table level fluctuation data, geological data (lineament density, depth to bedrock, and soil cover), and hydro geomorphological data (drainage density, slope, landforms, land use/land cover) are all important in site selection. The criteria for site selection are decided not only by groundwater conditions, but also, and more importantly, by the terrain's suitability for artificial-recharge. Artificial recharge must be implemented not only to supplement groundwater in areas where it is insufficient, but also as a precaution against future droughts. (Troch *et al*. 1980)

To identify the areas where artificial-recharge techniques can be used, a set of decision rules involving the hydro geomorphic parameters controlling groundwater flow must be considered. The primary task is to identify high, medium, low, and very low groundwater-potential zones (GWPZ) using a multi-parametric integrated GIS approach (Krishnamurthy *et al* 1996; Ravi Shankar 2003) for evaluating the GWPZ using several thematic maps corresponding to the hydro geomorphic parameters. (Ravi Shankar created the qualitative and quantitative GWPZ maps for the basins. (Kalu and Bhatsa 2003). The decision rules are derived from the hydro geomorphic parameters corresponding to the medium-to-low groundwater-potential zones requiring the use of artificial-recharge techniques.

5. Conclusion

This study was carried out to map the groundwater potential zones in the region of Kadegaon Tahsil, Sangli district, Maharashtra, India, is suffering from growing water shortages for both irrigation and domestic purposes. The over exploitation of groundwater has resulted in groundwater lowering in some parts of the study area, there by aggravating the water problem in the basin. To this end, a study was carried out to delineate groundwater potential zones in the Kadegaon Tahsil of Sangli, Maharashtra (India) using a multi-parametric approach by Geoinformatics techniques. Weighted overlay analysis was adopted to prepare a map of groundwater potential zones using seven thematic layers: geology, geomorphology, soil, lineament density, drainage density, rainfall and landuse. The delineated zones within this region were classified as very high, high, moderate and low groundwater potential zones. A groundwater table, contour map and the locations of existing well fields were overlaid with the groundwater potential map. It is observed that in the very high groundwater potential zones the groundwater table is reasonably flat. Further, it was identified that the existing well fields are located in regions with high groundwater potential zones. The method mainly uses surface features and hydrologic parameters, and hence it would be generally effective in identifying fairly shallow aquifer systems.

This study demonstrates the application of remote sensing and GIS techniques for integrating surface and subsurface information in a rapid and cost-effective manner, which may assist in locating sites for the development of groundwater well fields in the future. Overall, the results of this study demonstrated that the Geoinformatics technology is a powerful tool for assessing groundwater potential zone, based on which suitable locations for groundwater withdrawals could be identified.

6. References

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