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Research paper



Application of GIS Techniques to Determine Suitable Areas for Artificial Groundwater Recharge in Kollimalai Hills

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Abstract

The groundwater is taken into consideration because the foremost source of ninety nine % of all retrievable clean water, opti mization of its utilization could be very essential. Identity of potential zones for groundwater recharge has end up an essential occasion to fill up the groundwater sources. The recharge ability is ruled by various functions of surface, subsurface and hydro meteorological parameters. Remote sensing approach is observed to be very powerful device for the combination of various functions of these elements. In this work, an try has been made to identify groundwater recharge potential zones in Kollimalai hill. Namakkal district which is located in Tamilnadu , India. Evaluation (WIOA) changed into done in this study using the software Arc GIS by using integrating the thematic layers of geology, soil, geomorphology, land use/ land cowl geology, geomorphology, lineament, land use/ land cowl, groundwater degree and slope, rainfall. The groundwater potentials were described as suitable, moderately suitable and unsuitable.

Keywords: *GIS Techniques, Areas, Artificial Groundwater, Recharge and Kollimalai Hills.*

1. Introduction

In recent years, international scientific communities have shown great interest on this topic and thus, many works have focused on the environmental management for the groundwater safety further, environmental effect of numerous point and non-point supply pollutants to groundwater assets is equally vital for both scientific communities and regulating agencies. Groundwater pollution on account of leachates made from garbage dumps or uncontrolled commercial effluents at ground surface can create considerable deterioration in the water great of many aquifers. Groundwater fine has been deteriorated in many nations both in city landscapes in which a excessive stage of infection is anticipated and additionally in rural areas with predominantly agricultural landscapes.

1.1. Advantages of Artificial Recharge

Following are the main blessings of artificially recharging the ground water aquifers.

- No big garage systems had to store water. Structures required are small and value-effective
- stepped forward water first-class because of dilution of harmful chemical compounds/ salts
- No detrimental results like inundation of massive floor areas and loss of vegetation
- Local population without displacement
- Reduction in cost of strength for lifting water mainly in which upward thrust in ground water level is substantial
- Makes use of the excess floor runoff which otherwise drains off.

1.2. S8tudies Conducted

- Hydro-meteorological studies
- Hydrogeological studies
- Geophysical studies

1.3. Quality of Source Water

1.3.1. Chemicals and Salts

Problems which stand up due to recharge to ground water are in particular related to the satisfactory of raw waters which are to be had for recharge and which generally require some kind of remedy earlier than being used in recharge installations. They're additionally related to the adjustments inside the soil shape and the organic phenomena, which take location while infiltration starts, thereby inflicting environmental issues. The chemical and bacteriological analysis of supply water and that of ground water is consequently crucial

1.4. Objectives

The primary intention of gift study is to behavior the far off sensing and GIS generation a good way to pick out the right web sites for artificial ground water recharge zones with an included approach of far remote sensing and GIS approach strategies which can be being accompanied by means of these objectives.

- To apply of remote sensing and GIS technique in groundwater recharge investigations in Kollimalai hill.

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- To prepared the groundwater ability zones inside the Kollimalai hill.
- To become aware of the interrelationships of recharge regions with geology, geomorphology, soils and structure of the sub watershed.
- To indicate suitable web sites and strategies for artificial floor water recharge.

2. Methodology

The best way to determine the suitable places for synthetic groundwater recharge, elements such as slope, infiltration rate, depth to groundwater, great of alluvial sediments, and land use of the Quaternary regions are used. For this motive one of a thematic maps were prepared from current maps and records sets, remotely sensed pictures, and discipline investigations. The thematic layers for the all above parameters had been prepared, categorised, weighted and incorporated in a GIS environment. To discover approximately the relationships among geomorphological gadgets and appropriate sites for groundwater synthetic recharge, land-use and geomorphological maps had been extracted from remotely sensed picturess. Slope is an important thing in determining the maximum suitable regions for flood - spreading functions. Water pace is without delay associated with land slope and its depth. On steep slopes, runoff is extra erosive, and can greater without problems remove free sediments down slope.

3. About software

3.1. About GIS

A geographic facts device (GIS) is a pc-based device for mapping and analysing feature activities on this planet. GIS generation integrates common database operations, along with question and statistical evaluation, with maps. GIS manages region-based information and offers gear for display and evaluation of diverse statistics, which include populace characteristics, financial improvement opportunities, and vegetation types. GIS lets in you to hyperlink databases and maps to create dynamic shows.

4. Artificial Recharge

4.1. Selection of Artificial Recharge Site

A remote sensing and GIS based totally technique is found to be very beneficial in suitability evaluation for artificial recharge websites in the sub watershed. For such analysis the first venture became to perceive the elements facilitating recharge to take location. the present artificial recharge system in the location has been studied with appreciate to its hydro geomorphology, topography and reaction in the water level of the wells. Based based on these observations, a hard and fast of guidelines has been designed to demarcate the most suitable site and also to find out the exact websites for artificial recharge

5. Study Area

Tribal humans believed the Goddess has been guarding the hills from evils. The Kolli hills an area of 283 km^2 with an elevation degrees among a thousand m to 1390 m above sea level. It has slight climate and the place is understood for natural cultivation. The vicinity of Kolli hills have become Taluk with population of 63,888, as per 2001 census and spread over 14 villages positioned at the hills. The Ghat street lies in between 11° 18'30"N and 11° 19'50"N latitudes and 78° 19'31"E and 11° 21'7"E longitude. Fig.1 suggests the important thing map of the study vicinity.

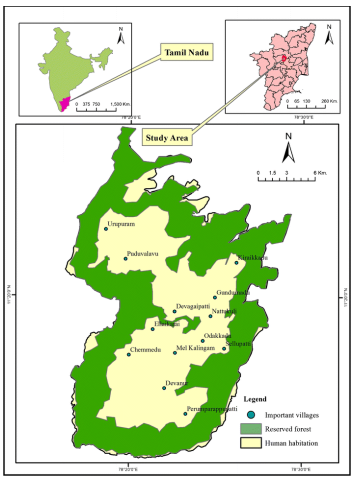


Fig.1: Key map of the study area

5.1. Geology

Spatial distribution map fig.2 reveals that the Kolli hills is sort of absolutely composed of Chamockites besides a small patch inside the south eastern a part of hills (within the Selur reserved forest) which consists of hornblende biotite gneiss. The dolerite dykes gift inside the look at vicinity are oriented within the northeast, southwest course. of these dolerite bands the most distinguished one passes right throughout the Kolli hills, extending the whole duration of the hills for approximately 30 Kms, from one give up to every other. Fig.2 indicates the geology map.

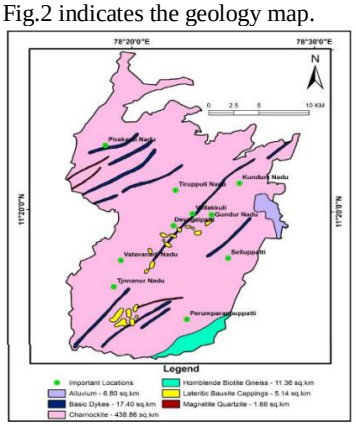


Fig.2: Geology map

Narrow, linear bands of magnetite quartzites are located to occur inside the north western (within the Bail Nadu reserved woodland) arid the southern (Thinnanur and Selur Nadu) components of the observe area. The laterite capping demarcated, which can be 19 in range, are irregular in shape and vary in thicknesses. The cappings are confined to the plateau landforms inside the southern and primary parts of the Kolli hills. The strike path of the rocks of the look at place is more or less NE-SW with dip quantities varying between 65°-75°. Geology is certainly one of maximum important parameter for landslide vulnerable and dangers sector.

5.2. Base Map

Kolli hills placed inside the boundary of two watersheds among Cauvery and the Vellar river machine. Kolli hills, few isolated hills and scattered ridges over Namakkal district in conjunction Kolli hills, the lawn of Namakkal District comprising of 14 village panchayats known as 'Nadu'. The hill top is a plateau area marked with the aid of deep ravines, high peaks and undulating terrain. The Western, jap and Southern aspects of the Kolli hills rise unexpectedly from the plain and the Northern facet comprises lengthy mild sloping spurs. in addition, the hill contains of escarpments, steep slopes, gullies, valleys and fractures. Most part

of the road section is blanketed by structural hill system. Ayyar River, a small tributary of Cauvery originated from the Kolli hills. Fig.3 suggests the base map.

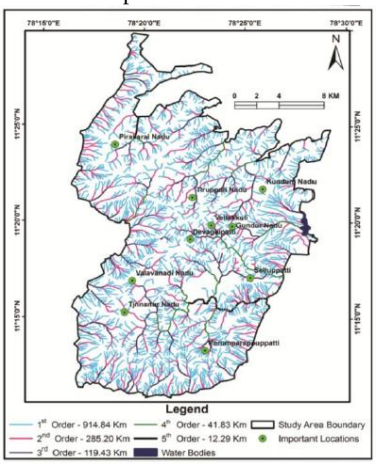


Fig.3: Base map

5.3. Drainage Map

The Kolli hills form a chief catchment area for the essential rivers of the place viz. the Aiyar River, the Thirumanimuthar river and the Sweta Nadhi. The tributaries of Aiyarriver drains the southern plateau region and the japanese slopes of the kolli hills. In standard these tributaries of the Aiyar river within the Kolli hills waft in a west to east path earlier than becoming a member of the primary river, the Aiyer, which flows in a north to south path within the adjoining plains on the jap facet of the Kolli hills. in addition, the streams, which drain the western slopes of the Kolli hills, drift in an east west course earlier than joining the Thirumanimuthar river, which flows in a north to south route inside the adjoining plains, on the western facet of the hills. Fig.4 shows the drainage map.

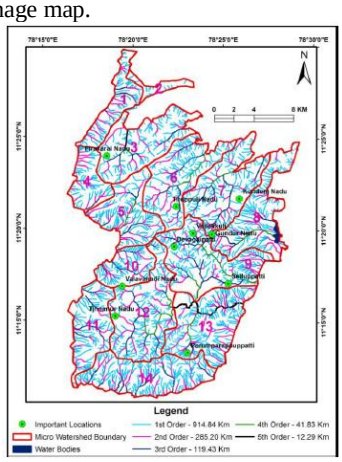


Fig.4: Drainage map

5.4. Land Use and Land Cover

Ground original data were collected from the field and also observed from the topographical maps. Resources at satellite image was interpreted to find various land use details in terms of vegetation cover. Fig.5 shows the land use / land cover map.

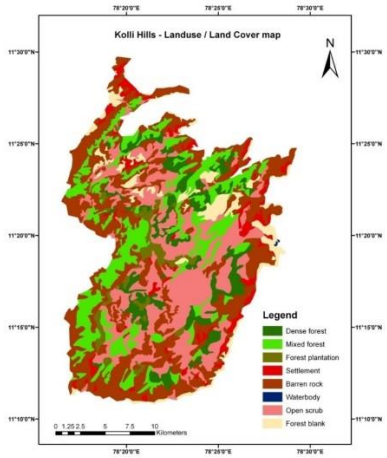


Fig.5: Land use / land cover map

5.5. Soil Map

Soil types Soils spatial distribution map of the study area are discovered to vary in admire of texture, intensity, drainage and profile improvement depending upon their position at the landscape and nature of figure fabric. The map symbols used within the soil map of the look at region is given as discovered inside the soil map published through the country wide Bureau for Soil Survey and Land Use Board (NBSSLB) and a short description of the map. The essential soils of this map symbol consist of excellent, mixed, typic Rhodustalfs and first-class mixed typic Haplustalfs. Fig.6 shows the soil map.

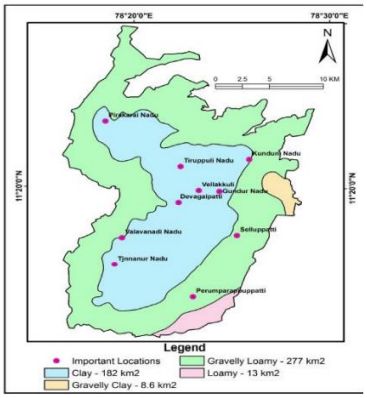


Fig.6: Soil map

5.6. Slope Map

The slope map of the study area was prepared by adopting the widely used Wentworth's (1930) average slope method Patches of near to surface class (gentle slope class (6 to 10°) (south western and central parts north eastern eastern part of Ariyur Nadu and western. parts of Valappur Nadu), and the eastern (southern and central parts of Vairichettipalayam reserved forest) and western outer slopes (lower portions of Bail Nadu reserved forests, Karavallikombai reserved forest). Small isolated patches of this slope class are found in the northern (Bail Nadu reserved forest) and the southern (Selur reserved forest) western (Karavallikombai reserved forest) slopes of the study area. Moderate slope areas (11° - 15°) are found well distributed in the plateau portion. slopes. A considerable area of the villages of Bail Nadu (northern and eastern parts), Thirupuli Nadu (small patches in southern). Fig.7 shows the slope map.

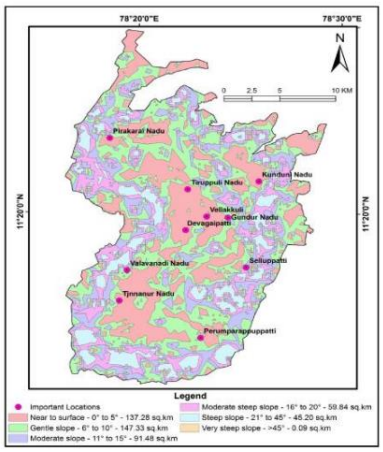


Fig.7: Slope map

Fig.8 shows the graph of suitability type.

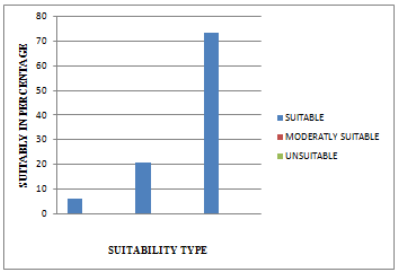


Fig.8: Suitability type

6. Conclusion

The site suitability modelling is used to locate the artificial recharge structures to ground water system and usage of GIS evaluation has an added more gain over traditional survey. The multilayer integration viz., geology, geomorphology, land use, drainage (density) and lineament (density) gives smaller suitability gadgets as a composite layer structures site of the look at area. To locate suitable sites for artificial recharging, a set of particular criteria such as slope, rainfall amount, closeness or distance from the faults and stream order were involved. Different parameters considered in choice of groundwater synthetic recharge places are numerous and complex. Parameters taken into consideration in choice of groundwater synthetic recharge locations are various and complicated. Included assessment of thematic maps the usage of a fuzzy common sense model evolved based on GIS strategies became a appropriate technique for figuring out preferred artificial recharge sites. Satellite data for pc information has proven to be very important and beneficial for surface observe, specially inside the coaching of modern-day and latest land-use and geomorphological map.

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