Estimation of Ground Water Prospectus Mapping for Watershed in Karnataka State, India.

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Abstract- *Remote Sensing and Geographic Information System (GIS) has proven as most effective tool in mapping and modelling of terrain features in the study. The context an attempt has been made to find area comprises of gneissic rock of olden age. Thematic layers are generated on geomorphology and land use and land cover, drainage etc. Based on Potentiality to Ground water. Weights are generate to each thematic layers and ranks are features in each of theme and by multiplying both and features score are derived. Thematic layers were converted into raster dataset and added in raster calculator. The final integrated map was re grouped into five classes of ground water prospectus zones as very good, Good, moderately good , moderately poor and very poor.*

Keywords- GIS, erosivity, land use and land cover, watersheds.

I. INTRODUCTION

The concept of Integrated Remote Sensing and GIS has proved to be an efficient tools in urban planning and Groundwater Managements Hydro geomorphological studies with the Hydro Geological and structural or lineament have proved to be very effective tools to estimate Ground water potential zones in the Watershed.

The Ground water potential zones using GIS for the study area the following thematic maps are used. Lithology, Slope, Soil, Land use, land covers Rainfall Hydro-geomorphology, and Groundwater level maps.

Suitable Capability Values (Cv) and weighted capability values (WCV) have been assigned to each component of the thematic layer and classified into five categories viz., Very good and good, Moderate, Poor and Very poor, based on characteristic features listed in Table 1. brief explain of thematic maps and weightage scale assigned for each parameter based on logical reason has been discussed briefly in the following paragraphs.

Table 1 Characteristic features of thematic layers

Thematic Layers	Characteristics
Geomorpholgy	Land forms , weathered zones etc.,
Lithology	Rock type, weathering character, thickness of weathering, joints, fracture etc.,
Land use and land cover	Forest area, barren land, vegetation land etc.,
Rainfall	Depth of rainfall
Slope	Slope percent
Soil	Permeability, porosity, texture
Groundwater level	Water level in dugwells

II. METHODOLOGY

In this method of various thematic maps are Lithology map, Slope map, Lineament and Geomorphology map, for the study area are observed.

1. Preparing digital toposheets which are obtained from Geological Survey of India.
2. Preparing different thematic maps such as Geomorphology, Geology, Soil, Land use/ Land cover using Remote sensing and GIS Techniques.
3. To determine Prospectus zones.

III. STUDY AREA OF THE RESERCH

The Kushavathi watershed covers the south part of the Kolar district which is situated in the south - eastern part of Karnataka at a distance of 70 km east of Bangalore city. Geographical area of the district is 8223sq.kms and has a population of 15.41 lakh (2011 census). The area forms a plain to undulating land and drained by North Pinakini, South Pinakini and Palar rivers which are ephemeral in nature. There are no surface water irrigation projects except minor irrigation tanks. Groundwater is practically the sole source of domestic, irrigation and industrial requirement. Net sown area is 3604 sq.km (43.8% of total area) and net irrigated area is 918.05 sq.km (25.5% of net sown area). Vegetables, ragi, jowar, mulberry, mango and paddy are the main crops.

The district falling in the eastern agro-climatic zone has a semi-arid climate. The normal rainfall (IMD 1971-2000) of the district is 727.3 mm. South-west monsoon is predominant, contributing about 55% of the annual rainfall and north-east monsoon contributes 30%. Rainfall gradually increases from the north-western part to the south-eastern part.

IV. COVER MANAGEMENT FACTOR

The Cover Management Factor (C) represent the effect of vegetations, Management, and Erosion control practices on the soil losses. the C value is a ratio comparing the existing surface condition at a site to the standard condition of the unit plot as defined in previous paragraph. RUSLE used a sub factor method to estimate soil loss ratio, which are the ratios of soil losses at given time in the management sequences to soil losses from the standard conditions. The sub factors used to determine a soil loss ratio values are prior land use, land cover, surface cover and surface roughness and soil moisture.

The land use/ land cover for Kushavathi watershed is shown in table 2.

Land cover type	Water	Urban	Wetland	Forest	Paddy field	Crop Land
CM factor C	0	0.01	0	0.03	0.06	0.37

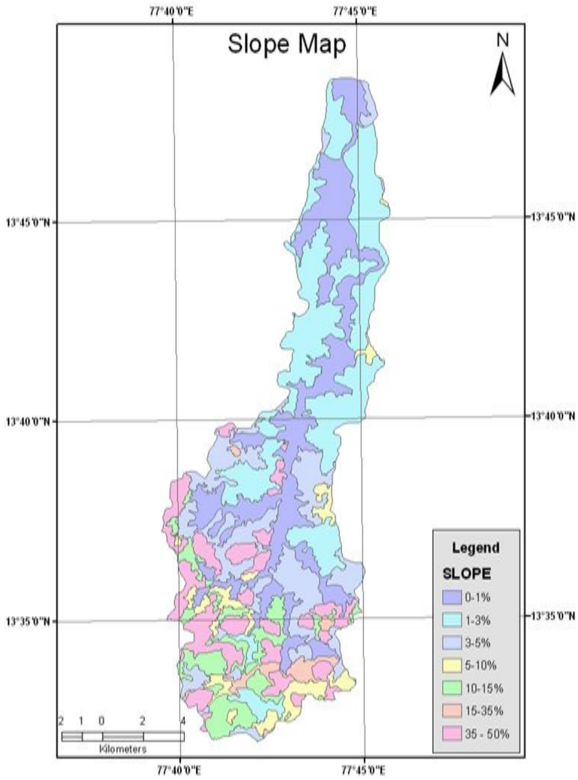

Figure 1: Slope Map

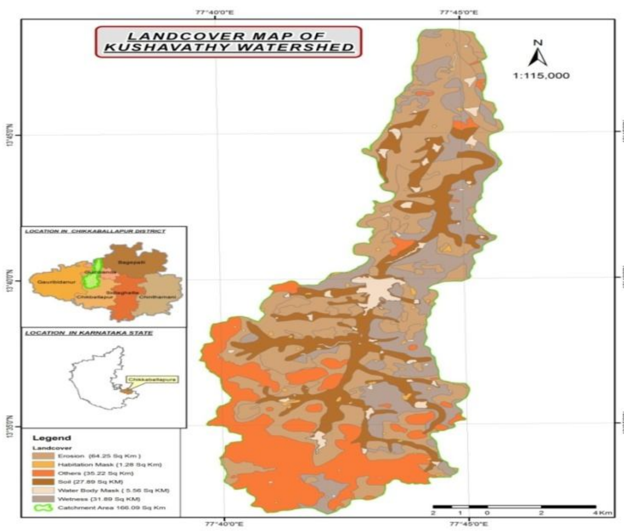

Figure 2 : Land Cover map of Kushavathi Watershed

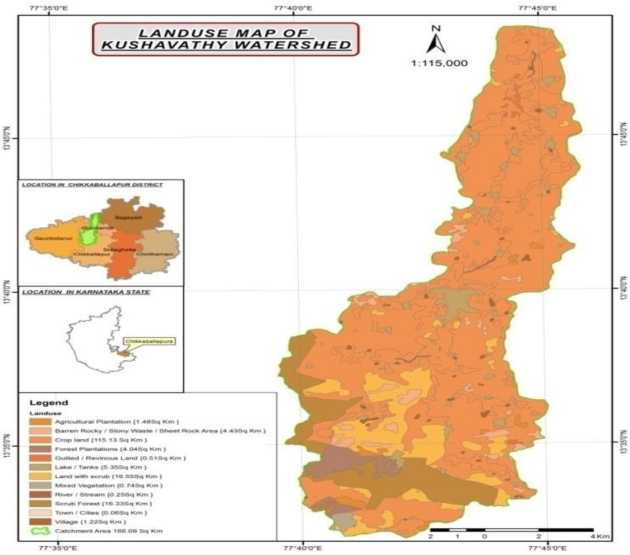

Figure 3 : Land Use map of Kushavathi Watershed

Table 3 : Support practice factor

Slope (%)	Contouring	Strip Cropping	Terracing
0.0 – 7	0.54	0.26	0.11
7 - 11.3	0.61	0.31	0.13
11.3 - 17.7	0.81	0.41	0.17
17.6 – 26.9	0.91	0.46	0.19
26.9 >	1.01	0.51	0.21

The support practices factor are estimated based on the relations between terracing and slopes in the paddy field area and is calculated according to the relations both contouring and slopes in the field areas. Table shows the annual average soil loss rates based on the land cover types. The sum of annual average soil loss rates of the kushavathi watershed is about 0.126 million tons/year.

Table 4 : The Annual average soil loss rate based on the land cover

land surface types	Area (km2)	Portion of areas (%)	soil loss rates (tons/km^2/year)	portions of soil loss rates (%)
water	1.99296	1.3	0.0	0.0
Urban	20.2618	12.2	1222.8	0.05
Wetland	0.49824	0.3	0	0
Forest	10.7952	6.5	1222.8	0.05
Paddy	53.976	32.5	1283940	52.5
Crop land	78.5558	47.3	1159214	47.4

V. GROUND WATER POTENTIAL MAP PREPARATION

Ground water map prepared based on index overlay method using hierarchical weights. Depending on the importance of their role in availability and movement of ground water, weights have been assigned for the individual themes and each of them assigned based on hierarchy of rankings from 1 to 4 based on the significance of with reference to their ground water potentials. In this ranking 1 represent poor, 2 represent moderate, 3 represent good and 4 represent very good ground water potential.

Table 5 : Rank, Weights and Scores for Attributes of Various Themes

Geology		
Geology (Weightage-10)	**Rank**	**Score**
Banded Biotite Gneiss	1	10
Pink Granulite	2	20

Geomorphology		
Geomorphology (Weightage-65)	**Rank**	**Score**
Denudational hills	1.	65
Pediments-Inselberg complex	2.	125
Pediments-Weathered buried	3	185
Residual hills	1	65
Structural hills	1	65
Water body	4	240

Landuse		
Landuse (Weightage-25)	**Rank**	**Score**
Built upland (Towns, Villages)	1	25
Agriculture-crop land	4	100
Mixed Vegetation	3	75
Agriculture –plantation	3	75
Water body (Tanks, Streams, Lakes)	4	100
Scrub Forest	2	50
Land with scrub	2	50
Forest –Plantation	2	50
Gullied/ravenous	1	25
Barren rock	1	25

Slope		
Slope % (Weightage-20)	**Rank**	**Score**
0-1%	7	140
1-3%	6	120
3-5%	5	100
5-10%	4	80
10-15%	3	60
15-35%	2	40
35 - 50%	1	20

5. Integration of Thematic Layer And Geographical information system Modelling

All thematic layers derived from satellite and collateral data are integrated in Geographical information system environment. The available and movements of ground water in an areas is controlled by different factors and influences of all factors need not be same in the areas. Hence each parameter is assigned weight depending on their influences on ground water. The different units in each of theme are assigned knowledge-based of rankings from 1 to 4 on the based on their significance with references to their ground water potentials. In this ranking 1 represent poor, 2 represent, 3 represent good and 4 as very good ground water potential. The final score of each unit of the theme is equal to the products of the rank and weight.

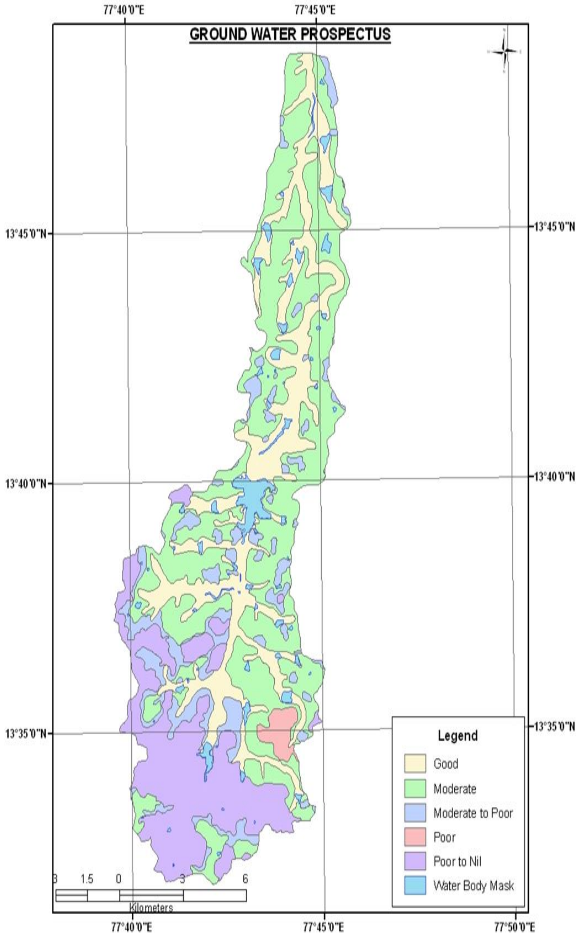

Figure 3 : Ground Water Prospectus Map

VI. RESULTS AND DISCUSSIONS

All the themes are overlaid using union in Arc View to generate composite map. Two thematic maps are overlaid at a time to generate a composite map. By this method a new map showing two thematic maps is obtained. Over this composite map a third map is overlaid and so on to get the final composite map. Each polygon in the final composite map associated with a particular set of information of all thematic layers. The evaluation of groundwater prospect of each polygon in the output is based on the added values of scores of various themes.

Theoretically the minimum total weight of 175 and maximum weight of 820 should have been obtained. But practically a minimum of 175 and maximum of 790 is obtained. This shows that the non-overlap of some of higher weights polygons with one another in the integrated layer.

The total scores obtained by integration have been classified into four categories to facilitate the delineation of very good, good, moderate and poor groundwater potential zones. The maximum score is 790 and minimum is 175. Mean of the resultant map is 492 and the standard deviation is 114. Very good prospect zone is assigned a value of 606 and above, which is the addition of standard deviation and mean. Similarly good has given a value of 492, moderate as 378 to 492 and poor less than 378. After assigning the value the resultant map is dissolved to get the final zonation map.

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