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Environmental Groundwater Impact Assessment Arround Akot Region, Maharashtra Using Geospatial Techniques

KEYWORDS: Environmental Assessment, geomorphometric analysis, drainage basin

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ABSTRACT *The present study refers to some hydrographic basins and environmental assessment in the Akot region and appeals to geomorphometric methods based on the Horton Strahler river hierarchy system by plotting the lineament, river drainage network, inputs of geological, soil and geomorphological using satellite data. The investigation based on numerous cross sections across the hilly terrain have demonstrated the presence of marked, flat terraces at different levels which indicates the penultimate stages of the cycle of erosion and landform development.*

Introduction

GIS and remote sensing is widely used as tools to digitize remotely sensed data complemented with various ground-truth data, which are geo-coded using a global positioning system (GPS). Analysis and assessment tools like GIS along with Remote Sensing have proved data to be very efficient and effective and hence very useful. The region is delineated with a well defined topographic boundary and water outlet. It is a geographic region within which hydrological conditions become concentrated within a particular location The main crops grown in the district are Jawar, Wheat, Cotton, Tur and Mung. The two main rivers are the Purna and Penganga. The tributaries of the Purna are Katepurna, Shahanur, Morna, Mun, Nand, Man and Uma, the Arna and the Pus are of the Penganga. The present study intend to find out how the local geology lineament and river drainage interacting which generated from Akola and surrounding areas through the help of Remote sensing and GIS techniques.

Study area

The Akot city is located at 20°54′ and 21°14′ latitude north and 76°46′ and 77°03′ longitude east, covering an area of 150 Km^2 and falls in parts of Survey of India degree sheets 55 D/14 and 55 H/2 (Fig. 1). The elevation of the study area ranges from 261 m to 323 m above sea level. The slope angle ranges from 0 to 4°. The climate of the district is characterized by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. The mean minimum temperature is 12.6°C and means maximum temperature is 42.4°C. The normal annual rainfall over the district varies from about 740 mm to 860 mm. The average annual rainfall for the last ten years 2006-2016 ranges from 637.8 (CGWB, 2007).

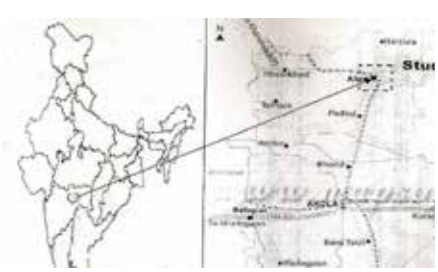

Fig. 1 Location Map of the study area

Contour & Drainage pattern

A contour map is a map illustrated with contour lines, for example a topographic map which thus shows valleys, hills and the steepness of slope. In contour maps when the contour lines are close to each other denotes steep terrain and when these lines are widely spaced slope is uniform. Counter map of the study area extracted from the SRTM DEM 90 m resolution. The northern fringe of the district is hilly and forms part of Satpura Range. South of these hill ranges, covering almost entire north-central part constitutes the alluvial plain. Southern part of the district is characterized by hilly rugged terrain as a part of Deccan Plateau. Two types of soils have been observed in the area namely medium black soil occurring in plain central part of trap origin and deep black soil occurring in valley in northern part. Dendritic to subdendritic drainage pattern is most common pattern is formed in a drainage basin composed of fairly homogeneous rock without control by the underlying geologic structure. The longer the time of formation of a drainage basin is, the more easily the dendritic pattern is formed. The study area has dendritic to sub dendritic drainage type pattern (Fig. 2). It is characterized by a tree like branching system in which tributaries join the gently curving main stream at acute angles. In the study area at some places the drainage pattern is slightly parallel due to parallel orientation of lineament. The purpose of this study is to analyze the spatial distribution of lineaments extracted from satellite images according to their density, intersection density, length and orientation in order to contribute to the understanding of the structural setup of the area and large accept the view that the lineaments are surface expressions of faults, fractures (Sonder 1947; Wilson, 1948). The present study is based on the remote sensing spatial data as well as the non-spatial data available from the various sources for different periods. The Indian Remote Sensing Satellite IRS 1C Linear Imaging Self Scanner (LISS-III) imageries with 23.5 meters spatial resolution. Analysis of the remote sensing data through visual interpretation of IRS imagery was carried out to prepare the geomorphologic map the study area. Extensive field mapping was carried out to trace and correlatetheeral extent of individual lava flows andflowquences.Fig. 2 Drainage pattern of the study area

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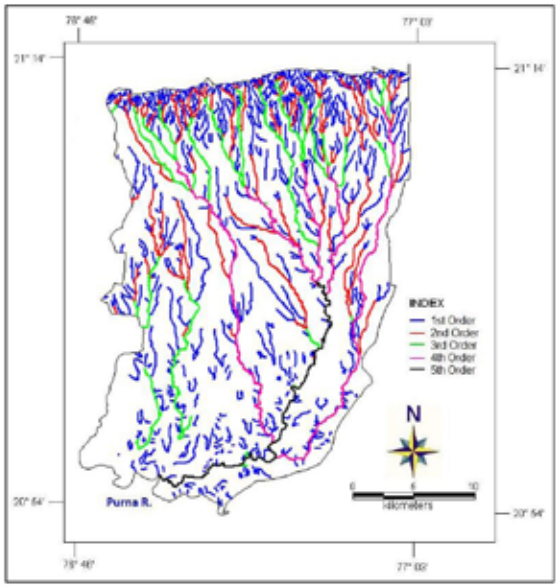

Fig. 2 Drainage pattern of the study area

Geology of the Study Area

Geologically the Area Falls under two formation i.e. Deccan trap and Purna alluvium. Major part of the area is covered by basaltic lava flows of upper Cretaceous to lower Eocene age. The Deccan lava sequence is grouped under Satpura group in the northern part whereas in southern part it is grouped under Sahyadri group. The basalt forming the various flows varies in colour from dark grey to purple and pink. Some of the flow units are massive which are fractured to varying extent. Both sheet joints and vertical joints are seen. At places the rocks show vesicular character which are generally filled with secondary minerals like zeolites, carbonate minerals and secondary silica i.e. agate etc. giving rise to amygdaloidal character. Pipe amygdales are also observed. The lower part of a flow unit is usually of massive character which passes upwards into a vesicular or amygdaloidal (zeolitic) horizon. Vesicles and amygdales increase towards the top of a flow unit which in turn merges into a red bole, at some places. The red bole is overlain by the massive horizon of the next younger flow unit (Table 1). The red bole which generally occurs in the upper part of pink zeolitic basalt varies thickness from few cm. to about 1 mt. In all probability, it is a product of atmospheric weathering representing the ancient soil profile which was later buried under the next younger flow. This might have also caused the baking of the underlying soil to some extent due to which typical columnar jointing is developed in red bole in some sections. Hydrothermal alterations might have also been responsible to a limited extent for the formation of red bole. As the permeability of red bole is poor, it usually forms confining layers. At places where it has joints, it forms moderate to good aquifers.

Table 1: The stratigraphic succession of the study area

AGE	GROUP	FORMATION	LITHOLOGY
Recent	--	Black cotton soil Thick layer Alluvium	Black cotton soil
Quaternary (Pleistocene to recent)	--	--	Purna Alluvium
Cretaceous to Palaeocene	Deccan Trap	Ajanta Formation	Aa and Pahoehoe lava flow

Physical and chemical analysis of the study area

The physical and chemical characteristics of water samples of the dug wells have demonstrated the quality of groundwater. The physical properties such as pH reveals a range from 6.80 to 8.74, specific conductivity ranges from 248 to 2680mhos/cm at 25°C and chemical properties include the determination of calcium (22 to 284mgl), potassium (01 to 40mgl), sodium (16 to 579mgl), magnesium (8 to 283mgl) and Fe (0.1-0.2 mg/L) (Table 2). The physical and chemical parameters reveal that the values vary within the range of standard values determined for each constituent of W.H.O.

Table 2: Chemical Analysis of the study area

Sr. No.	Place	No. of Sample	Source	pH	EC µs/cm	TDS mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Fe mg/L
1	Akot	5	Dug Well	7.4-8.4	1000-4500	600-4550	40-80	50-150	80-850	01-150	0.2
2	Telhara	2	Bore Well	7.5-8.7	600-9950	1840-2000	60-180	07-200	100-800	10-90	0.1
3	Jainpur Pimpri	2	Dug Well	7.0-7.8	1596-2500	1700-2000	70-200	10-250	150-700	10-100	0.2
4	Umra	2	Bore Well	7.1-7.9	1200-2398	1600-2000	90-280	20-200	200-800	20-110	0.1
5	Adgaon Bk	2	Dug Well	6.8-7.5	1700-2700	1500-1900	100-280	30-280	100-800	30-110	0.2

Summary and Conclusion

The suitability of water for irrigation purpose can be classified on the basis of sodium percentage, electrical conductivity and sodium absorption ratio. The values of sodium percentage and electrical conductivity (after Wilcox, 1948) demonstrates that a majority of samples have been classifies as "good to permissible" for irrigation purpose and the remaining samples have been classified as "permissible to doubtful" for irrigation purposes as its sodium absorption ratio is 24 to 58.

The variations of electrical conductivity in various alluvial and Deccan Trap regions exposed in the study area indicate the presence of three distinct zones namely good (i) where the electrical conductivity (EC) values range between 250-750, (ii) permissible, where the EC values are between 750-2000 and (iii) doubtful, where the EC values are between 2000-3000. The results demonstrate the alluvial zone shows doubtful quality of groundwater, which is not suitable for drinking purpose in the northern most part of the study area with the gradual reduction of EC values towards south. It is interesting to note that none of the samples analyzed shows EC values > 3000 which indicates that the rate of salinity is not very high in this region. This proves that the salinity of the alluvial zone of the area is in the lower range which can be removed by employing

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suitable recharge methods and also by pumping the saline water into the Purna river during rainy season when most of the water goes as runoff.

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