RESEARCH FRONT

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MORPHOMETRIC ANALYSIS OF SURLI BASIN OF KARAD TAHASIL : A CASE STUDY

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ABSTRACT

Morphometric analysis of a watershed provides a quantitative description of a drainage system . It is an important aspects of the watershed characterization . The present study aims to assess the morphometric characteristics of Surli basin . Surli drainage basin comprises an area about 287 sq.km. Study area lies between latitudes $17^0$28' N to $17^0$34' N. and longitudes $74^0$15' E to $74^0$29' E and forms a part of SOI toposheet 47K/7, surveyed on the scale 1:50,000. The study area is a part of the Karad tehsil of Satara district of Maharashtra. Strahler's , Horton's and Schumm's methods have been used to assess the fluvial characteristics of the study area . Evaluation of morphometric parameters such as Stream Order, Stream Length , Bifurcation Ratio , Drainage Density , Stream Frequency , Texture Ratio , Elongation Ratio , Form Factor is an basic aim of this study . This study would help local people to utilize resources for sustainable development of the study area.

Keyword : Morphometric Analysis , Surli basin ,

INTRODUCTION

Aim of the work is to study morphometric characters of the Surli drainage basin, along with lineament analysis to find out structural control over this basin. Morphometric analysis is refers as the quantitative evaluation of form characteristics of the earth surface and any landform unit. This is the most common technique in basin analysis, as morphometry form an ideal areal unit for interpretation and analysis of fluvially originated landforms where they exhibits and example of open system of operation. The composition of stream system of a drainage basin in expressed quantitatively with stream order, drainage density, and bifurcation ratio. Geology and geomorphology, structure and drainage patterns especially in hard rock terrains are the primary determinants of river ecosystem functioning at the basin scale . Understanding the drainage pattern of an area gives a perspective view of the topography of the area which helps in the planning and development of watersheds and also provides an indication of the potential zones for obtaining ground water.

STUDY AREA

Surli drainage basin covers an area about 287 sq.km. Study area lies between latitudes $17^0$28' N to $17^0$34' N. and longitudes $74^0$15' E to $74^0$29' E and forms a part of SOI toposheet 47K/7, surveyed on the scale 1:50,000. The study area is a part of the Karad tehsil of Satara district of Maharashtra.

Geologically area is covered by Deccan basaltic terrain of Cretaceous to Eocene age. The basalt show variation in jointing pattern and fracturing and red layer. The Deccan volacanics have erupted close to Cretaceous-Tertiary boundry at about 65 Ma (Duncun and Pyle, 1988). 5,00,000 sq.km. area of western and central India today covered by basalt. The type of basalt lava flows occurring in the area are simple and compound (Pahoehoe type). The Deccan Volcanic Province (DVP) is one of the largest continental flood basalt provinces

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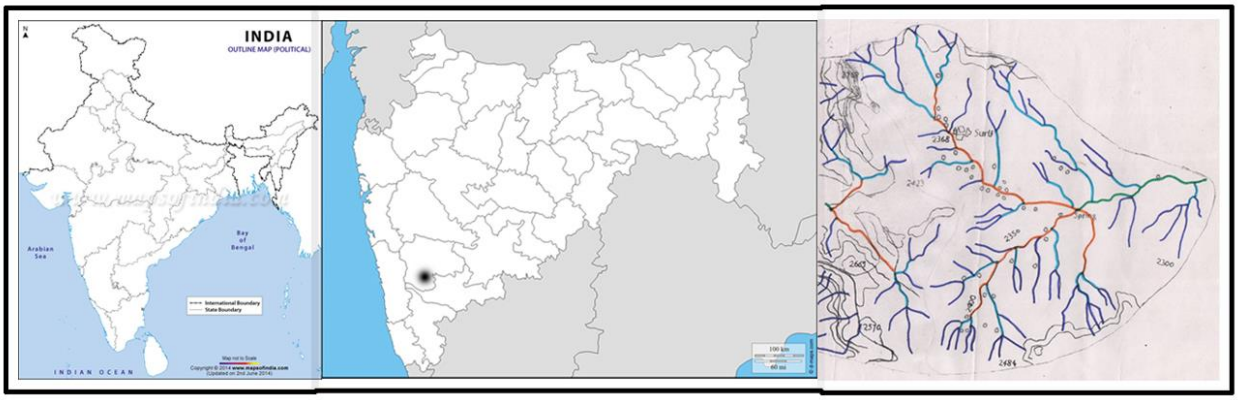
in the world, extending over hundreds of kms. across western and central India. Thickness of basaltic flows, dominantly tholeiitic in composition, are over 2 km. in the western part of the province. In between two lava flows there are red colored bed are commonly called as 'Red boles.' These red boles are products of different type of weathering of older lava flow. Due to weathering of older basalt clay soil is formed, which is baked by next coming younger lava flows. Baking effects gives red colour to soil. (Wilkins et al., 1994)



OBJECTIVES AND METHODS

Aim of this work is carry morphometric analysis of Surli drainage basin emphasizing of the linear aspects of the basin. For the preparation of base map SOI toposheet on 1:50000 scale of no 47K/7 were used. Drainage network and stream order was calculated using method proposed by Stahler (1964). The first step in morphometric analysis of a drainage basin is the designation of the stream orders. The Strahler system (1964) of stream orders based on hierarchic ranking of streams has been used here.

RESULT & DISCUSSION

The study of the geometry of drainage network of an area gives information about the relationship between the surface runoff, the infiltration of rainwater and relative permeability of rocks exposed in watershed. The surface runoff and infiltration along with climatic factors, depends upon the physiographic factors such as shape of the basin, the stream frequency etc. This factor thus, gives information about the efficiency of drainage, the erosional processes and the hydrologic nature of the rocks exposed over the area. Drainage analysis generally involves evaluating the drainage parameters for a single watershed. These are measured through certain parameters called 'Morphometric drainage parameters.' They are discussed follow.

Stream Order (Nu) In the drainage basin analysis the first step is to determine stream orders. In the present study the channel segment of the drainage basin has been ranked according to strahler's stream ordering system. According to Strahler(1964), the smallest fingertip tributaries are designated as order 1. Sream order of basin is calculated as two first order streams meets and forms second order and when two streams of second order join together they forms third order and so on. In this basin fourth order stream is the highest order. Dendritic drainage pattern which is looks like tree or fern shape which indicates the homogeneity in texture and lack of topographic control. Higher numbers of first order stream which indicates steep slopes in the study area.

Stream Length (Lu) Stream length is one of the most significant hydrological features of the basin as it reveals surface runoff characteristics. Generally, the total length of stream

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segments is maximum in first order streams and decreases as the stream order increases. Stream length of each order is measured and given in table. Surli basin has the total stream length about 71.5 km.

Stream Frequency (F) 'Stream Frequency' is the ratio of the total numbers of streams of all orders within a givan basin to the basin area. A higher stream frequency indicates steeper gradients an lower permeability of surface. Higher frequency of first order stream which indicates steeper slopes in the upper reaches of the area.

Bifurcation Ratio (Br) In a drainage basin, the number of streams of any order will be generally greater than the number of streams of the next higher order. The ratio of the number of streams of a givan order to the number of strems of the next higher order is called 'Bifurcation Ratio.' Mean bifurcation ratio of this basin is 4.12.

Bifurcation ratio values above five are said indicate controls over the drainage. This means the fracture system largely control the drainage and therefore the flow of water. Values below five indicate little structural control and drainage is developed as per normal condition of topography and gradient.

Drainage Density (Dd) 'Drainage Density' is defined as the total stream length cumulated for all orders in a basin to the area of the basin. Drainage density can be said to measure the texture of the drainage basin. The drainage density indicates the closeness of spacing of channels. Higher drainage density indicates greater relief and lower permeability of surface and vice versa. Drainage density of study area is 0.25. Type of rock also affects the drainage density. Generally, lower values of D tend to occur on granite, gneiss, schist, and basalt regions. The chief rock of type in the study area is basalt which falls under the igneous volcanic group of rocks.

Constant of channel maintenance (C) The constant of channel maintenance is the inverse of drainage density. The constant denotes the area required to support a unit length of the stream. In present basin constant of channel maintenance is 4.01.

Table 1. Stream Analysis of Surli Basin.

	1st	2nd	3rd	4th
No of Streams (Nu)	61	11	3	1
Stream length (Lu)km	40.5	17	10.5	3.5
Cumulative Stream Length	40.5	57.5	68	71.5

Table 2. Linear Aspect of drainage network of Surli basin

Stream Order	No.of Streams (Nu)	Total length of Stream in km (Lu)	Log Nu	Log Lu
1	61	40.5	1.78	1.60
2	18	17	1.25	1.23
3	3	10.5	0.47	1.02
4	1	7	o.oo	0.54

Table 3. Bifurcation Ratio and Mean Bifurcation Ratio .

Bifurcation Ratio (Rb)of different order			Mean Bifurcation Ratio
1st /2nd	2nd /3rd	3rd/ 4th	
3.38	6	3	4.12

Form Factor Form factor may be defined as the ratio of the area of basin and square of basin length (Horton ,1932).The value of the form factor would always be greater than o.78 for a perfectly circular basin . Saller the value , more the elongated will be the basin . Rf

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value of study area is presented in table 4. The value of watershed indicates to elongated in shape .

Elongation Ratio Elongation ratio is the ratio between the Diameter of the circle of the same area as the drainage basin arid the maximum length of the basin . Values close to 1.0 are typical of regions of very low relief , values in the range 0.6-0.8 are usually show high relief . 0.4 indicates very high relief .

Texture Ratio Texture ratio is the total number of strean segment of all orders per perimeter of the that area (Horton ,1945). It depends upon natural factors such as climate , precipitation , vegetation , rock type , relief etc. In the present study the texture ratio of the basin is 3.57 termed as moderate in nature .

Table 4. Aerial Aspects .

Morphometric Characteristics	Formula	Result
Area (sq.km)	A	287
Perimeter (km)	P	23.25
Drainage Density (km)	Dd = L/A	0.25
Stream Length (km)	L	71.5
Stream Frequency	Fs = N/A	0.28
Bifurcation Ratio	Br =	4.12
Area Perimeter Ratio	Rap = A/P	12.34
Texture Ratio	Tr = N/P	3.57
Form Factor	Rf = A/L2	0.056
Infiltration Number	Fs* Dd	0.0672
Elongation Ratio	Re = Dc / Lb	0.4
Watershed shape		Elongated

Infiltration Number The infiltration number is defined as the product of Drainage Density and Drainage Frequency . The study area shows 0.0672 Infiltration number .

CONCLUSION

The Surli basin is in the hilly ranges of Sahyadri mountain ranges .This study was carried out to elucidate information on drainage basin morphometry in the Surli basin watershed .Such information was used to describe the basin as a landform . The First order stream number is 61 which is high , indicate higher runoff . It is due to the compact basalt lava flows at higher elevation of basin . It is noted that the Rf value of basin indicates that the area is elongated . The Drainage Density 0.25 suggest that the low drainage density depicting impermeable sub soil of study area .

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