International Scientific Journal of Engineering and Management
Volume: 01 Issue: 05 | December - 2022

The Implication of Morphometric Investigation of River Watershed

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Abstract:

Study of Morphometric parameter is an essential ways to understand the geomorphic analysis of any drainage area. The present work will explain the morphometric study of the Bharja river washbasin which is a portion of Ratnagiri district, Maharashtra. This analysis will give a numerical and quantitative explanation of the drainage washbasin that will helpful for different studies such as hydrologic modeling, prioritization of watershed, conservation and management of normal possessions, and its rehabilitation. The goal of the present study is to compute various linear parameters of River Watershed. Secondary data observation method has stood used for the full present study and data has been collected through toposheets. These maps are scanned, Geo-referenced and mosaic in ArcGIS software. The drainage network maps were digitized from the topoheets and the map had been made on QGIS software. The analysis of the present study exhibit that the a 5th-order brook. Total three methods of brook orders have been used in the 1142number of brooks found in the Bharja river basin as per to strahler's method. The drainage density is low which indicates a coarse drainage texture.

Keywords: Morphometric Analysis, Bharja River Basin, Drainage density, etc.

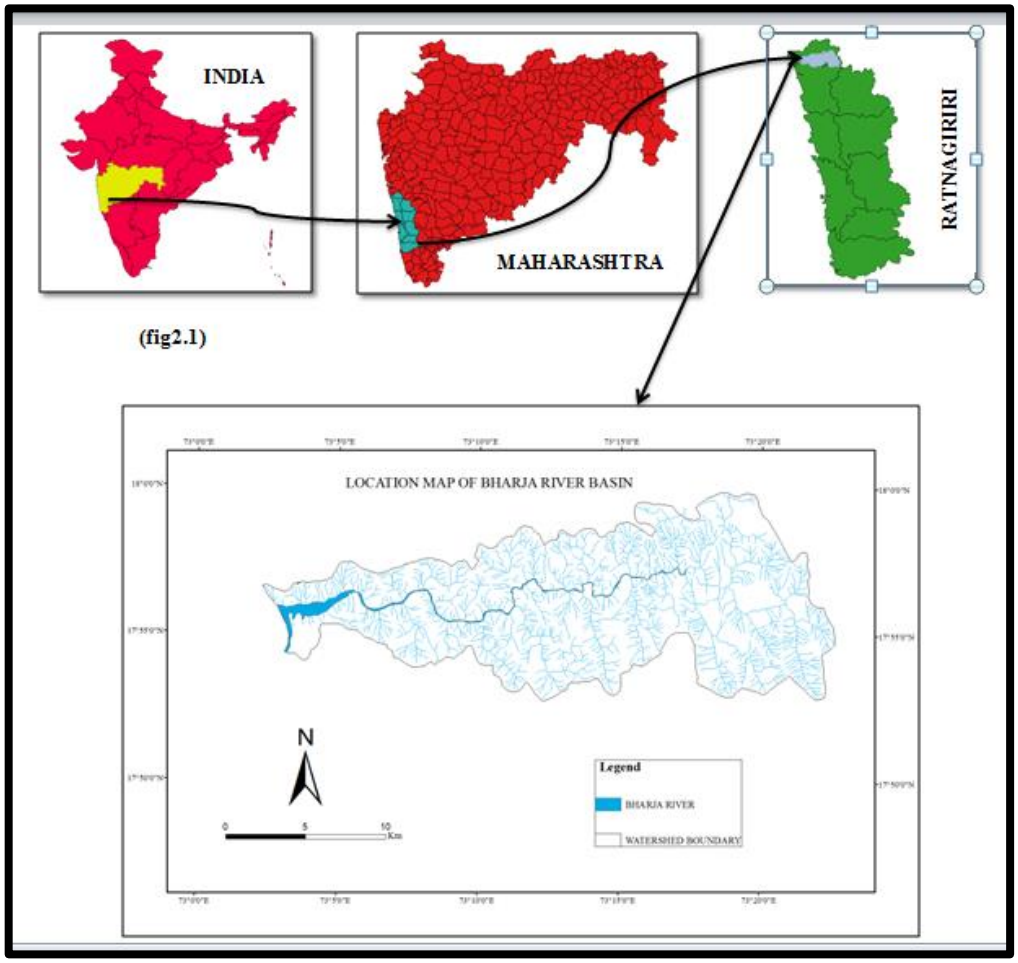
1) Introduction:

Natural Resources are very important on the earth's surface as life and many developmental actions are depends on them. There is a limitation in these resources and their uses or consumption is increasing constantly due to the increase in population size. The whole world is facing a severe problem of scarcity of water resources and people want a reason for diminishing those resources. Therefore there is need to study about planning of water resources, their conservation, and better management for sustainable development of a country like India which is continuously developing. Management of watersheds is necessary for water resources conservation and their sustainable development. Adoption of proper planning and watershed management will help to overcome problems of a flood, drought, excessive runoff, soil erosion, poor infiltration, human health, etc.

Morphometry is an important tool to appreciate the geomorphic training of a watershed area. With the aid of different (Linear, Aerial, and relief) parameters we can come to know about various appearances of the drainage washbowl. By using that we can understand the access size, runoff, etc. of the basin. The drainage network will help us for understanding the drainage decoration of the watershed. In the present work, GIS approach has been successfully used to calculate drainage morphometric characteristics by taking linear parameters of the Bharja river basin. This findingswill help us to understand hydrological, geological, and topographicalcharacteristics of the very complicated and unique Bharja river basin.

2) Study part

The contemporary study is conducted in the Bharja river basin Ratnagiri district of Maharashtra, India. Bharja River is a west-flowing river and the span of the Bharja drainage basin is 48.2 sq. km. The total area of the crunch is 269 sq. km. The elevation of this river ranges between 0 to 500m. The highest elevation of this river is 532m which is found near the sources The Absolute location of the river washbasin is 73^0 0' E to 73^0 25' E and 17^0 50' N to 18^0 0' N. River generally comes under Dapoli and Khedtaluka of Ratnagiri district. The study area location



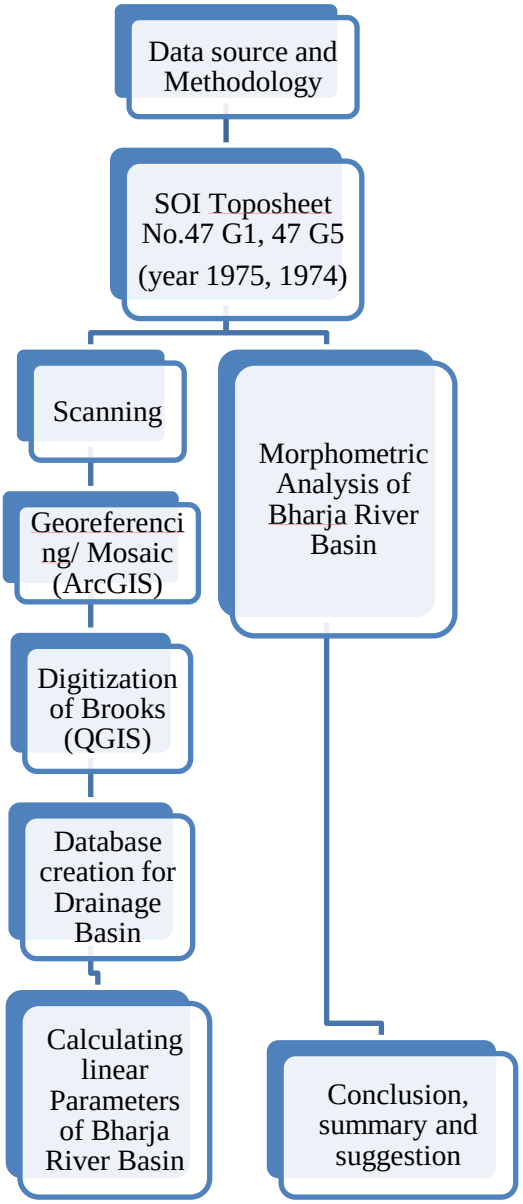
(fig2.1)

3) Data Source and Methodology:

For the present analysis Secondary data observation method has been used. The analysis of the Bharja River Basin is based on topographical maps published by the Survey of India. The scale of Topographical maps that are used for the schoolwork is 1:50000. The toposheets which have stood cast-off for the present-day study are 47G1 and 47 G5. These toposheets were surveyed in 1975 and 1974 respectively. District Planning Map Series of 1:250000 has been used for the present study. ArcGIS and QGIS software geo-

reference and mosaic topographical maps. Digitization of the brook network of the Bharja River Washbasin has stood done by this software.

A detailed Flow chart of Methodology has been displayed below.



4) Finding and Discussion:

Linear aspects

The analysis oflinear aspects of any drainage network include computation all linear parameter. They are brook order, torrent length, mean river length, river length ratio bifurcation percentage, Unkind bifurcation proportion, and Weighted bifurcation ratio.

4.1 Brook Order: Brook ordering is the first step analysis**.** The brook ordering method was first invented by Horton in 1945, but later on, in 1952 Strahler modified the brook ordering method and published it. Three methods of brook present analysis. They are Horton 1945, Strahler's 1952, and L. Shreve 1967 respectively.

4.1.1 Horton's Classification of Brook ordering: According to Horton's classification of brook order, 817 brooks were counted. Out of which 628 are the first-order brooks, 148 are the 2nd order brooks, 33 are the 3rd order brooks, 7 are the 4thorder brooks, and 1 is in the 5thorder brooks. (Table 4.1)

Table 4.1: Horton's Classification of Brook Order

Brook order	**Brook Number**	**Bifurcation Ratio**
1	628	4.24
2	148	4.48
3	33	4.71
4	7	7.00
5	1	
Total	**817**	20.44
Mean Bifurcation Ratio= 5.11		
Weighted Bifurcation Ratio=5.32		

Source: Computed by a researcher.

4.1.2 Strahler's Classification of Brook ordering: According to the Strahler's method, first-order brooks have no tributaries because they are the furthest upbrook channels. A brook that joins another brook reach is known as a tributary. When two 1st order brooks join, they form a 2ndorder brook. In the same manner, when two 2ndorder brooks join a 3rd order brook is formed, and so on. The main reason behind this brook ordering system is that the mean discharge capacity is doubled when two similar order brooks join to generate am. The present area shows a 5thorder brook. The total 1142number of Brookshas been counted in the Bharja river basin. Out of which 898 are the 1storder brooks, 192 are the 2nd order brooks, 43 are the 3rd

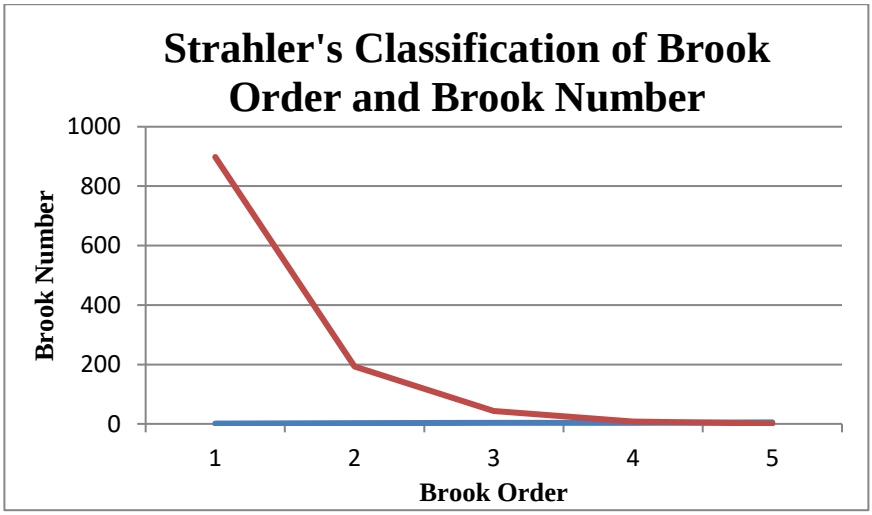
order brooks, 8 are the 4thorder brooks, and 1 is the 5thorder brooks (Table-4.2 and fig.-4.3). basin area brook formed and it shows the brook numbers decreases by increasing brook order. The brook order and Brook quantity are shown in fig-4.1

Table 4.2 Brook Quantity and Brook Length

Brook Order (u)	Brook Number(Nu)	Brook length (Lu) in km
1	898	493.40
2	192	135.22
3	43	66.74
4	8	21.32
5	1	42.49

Source: Computed by a researcher.

Fig-4.1 Brook Quantity and Brook Order



4.1.3. L. Shreve Method of Brook ordering: In the contemporary Training according to Shreve method **821** number of brook are calculated.

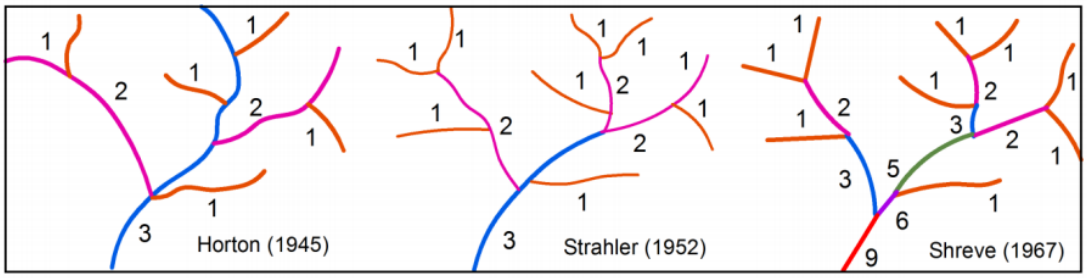


Figure 4.2 Methods of ordering brooks within a drainage washbasin

Sources: Shodhganga

4.2 Brook Length (Lu):

The brook length is measured from the farthest drainage divide to the mouth of a river, based on the law planned by Horton (1945). It has been measured in QGIS Software. The Brook length is ace of the essential characteristics of the any drainage area because it reveals characteristics of surface run-off. The length of small brook depict that the area is having high steep slopes while longer length of brook shows a gentle gradient. The brook length of the present area is shown in (Table 4.2). Brookfirst order brook of the Bharja river basin is 493.40 km, the 2ndorder length is 135.22 km, the 3rdorder length is 66.74 km, the 4thorder length is 21.32 km and brook5thorder is 42.49 km. All the figure and numbers of Brook length for various brook order in the training area shows that length is highestfor 1storder brook and it decreases by increasingbrook order. It indicates the terrain consists of high relief, moderately steeper slope in the Bharja river basin.

4.3 Mean brook length (Lsm): The values of mean brook length(Lsm) has been determinedafter It has been pragmatic that the range of Lsmvalues varies from 0.55 to 42.49. This divergence English hawthorn be due to dynamic changes in terrain elevation and relief of the basin.

Table 4.3 Morphometric Analysis- Linear Aspect of Bharja River Basin

Brook Order (u)	Brook Number(Nu)	Brook length (Lu) in km	Bifurcation Ratio(Rb)	Mean River Length (Lsm)	Brook Length Ratio(RI)
1	898	493.40	4.68	0.55	
2	192	135.22	4.47	0.70	0.27
3	43	66.74	5.38	1.55	0.49

4	8	21.32	8.00	2.66	0.32
5	1	42.49		42.49	1.99
Total	**1142**	**759.18**	**22.52**	**47.96**	3.08
Mean Bifurcation Ratio(Rb) = 5.63					
weighted Bifurcation Ratio(Rb)= 5.68					

Source: Computed by a researcher.

4.4 **Brook Span Ratio (RI):** The brook length ratio of the Bhajra river basin is determined after dividing the mean brook distance of one directive to the succeeding higher order. The values obtained for different orders of the Bhajra river basin is expressed in(Table 4.3). The values of brook span ratio in the river basin varies between 0.27 and 1.99. It has been clearly seen that there is direct association among brook order and brook length ratio. If the order of the brook increases the brook length ratio will also increase. The total brook length percentage of the schoolwork area is 3.08.It shows the youth or mountain stage of the Bharja river basin for geomorphic development.

4.5 Junction Ratio (Rb): Junction ratio explains the proportion of the brook number of any specified order to the quantity in the next subordinate order of brook (Horton 1932). It has been experimental that there is irregularity in Bifurcation ratio it means that the Bifurcation Ration (Rb) will not be uniform after one command to the next. This non uniformity depend upon the topographical, geological, relief and geomorphologicaldevelopment of the waterway basin (Strahler 1964). In the contemporary study area, „Rb" ranges from 4.68 to 8. Which indicates lithological and structurally controlled terrain conditions (Table 4.4).

Table4.4: Bifurcation ratio and terrain conditions

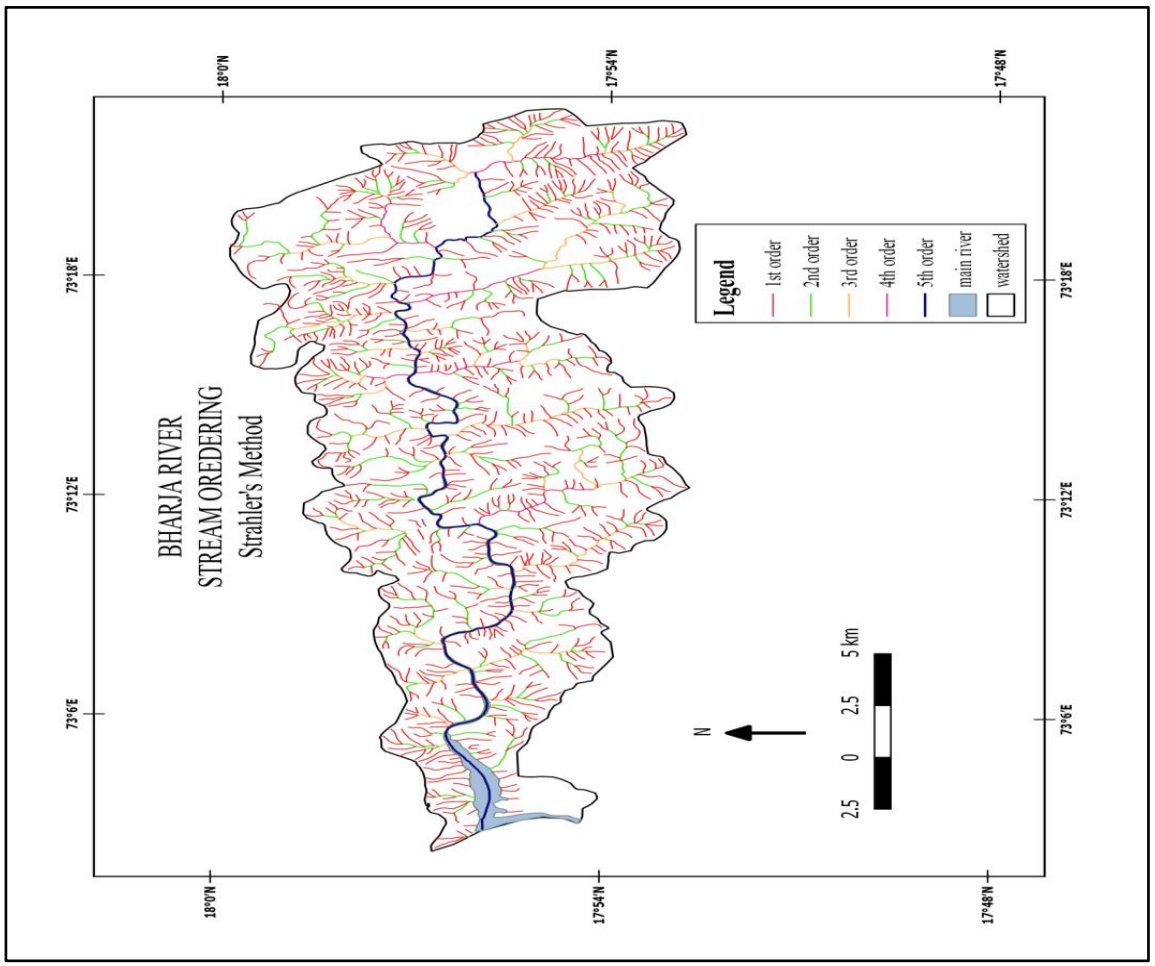
Bifurcation Ratio(Rb)	**Inferences**	**References**
<3	Flat region	Horton (1945)
03 to 5	geological structures that do not twist the drainage decoration	Chow(1964), Nautiyal (1994)
>5	Lithological and structurally control	Strahler (1964)

4.6 Mean Bifurcation Ratio(Rbm): Unkind Bifurcation Proportion (Rbm) is computed as the Arithmetic Mean Bifurcation Ratio and the fallouts are accessible in (Table 4.3). The values of mean Bifurcation Ratio differs from 2.0 to 4.0. The value 2.0 or less than shows flat or rolling basin while value 3.0-4.0 or greater than this shows a mountainous, hilly dissected washbasin (Horton, 1945). The average Bifurcation Ratio of all orders, is 5.63. Thus the outcome expressions that positioned in a dismembered or hilly area. .

4.7 Weighted Bifurcation Ratio (Rbwm):

In the present work, the method of Strahler (1953) has been used to calculate the weighted Bifurcation Ratio This ratio is obtained by multiplying the bifurcation ratio for each pair of brook orders by the total numbers of brooks involved in the ratio and taking the average of the sum of these values. The value of weighted Bifurcation Ratio of the Bhraja River Basin is 5.67 which is very close to the value of average bifurcation ratio of the basin that is 5.63.

Fig. 4.3 Brook Order Map of the Bharja River



5. Conclusion: The present work is fully based on secondary data observation and the data has been collected through toposheets. This study demonstrated that the GIS method used in the contemporary work is an essential tool for the calculation and analysis of various morphometric limitations of the any river basin. Present work has been done through the size of line characteristics of the washbowl. The analysis shows that Bharja River is a 5th order brook or it also shows variation in brook number by a different method.

According to Strahler's method, 1143 brooks have been counted. Horton's method 817 brooks have been counted. While according to Shreve 821 brooks were generated. The Occurrence of more quantity of 1storder brooks specifies that the washbowl is subjected to more erosion. In the schoolwork area, the drainage basin area brook formed a dendritic drainage decoration, and it shows inverse relationship between brook sum and river order as brook number decreases with increasing brook order. According to the present analysis, the Bifurcation Ratio ranges from 4.68 to 8. Which indicates Lithological and structurally controlled terrain conditions. Thus the outcome shows that is set in a dissected or undulating area. It has been pragmatic that the values of Lsm exhibit ranges from 0.55 to 42.49. This variation Crataegus laevigata be due to dynamic changes in geomorphological elevation and reprieve of the washbasin.

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