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# Morphometric Study of Area Drainage Basin on Pravara Drainage Basin using Geospatial techniques

**R. K. Kadam**

***Abstract***

*Basin morphometry is a method or a measurement of various attributes of a basin in a form of a number. The morphometric analysis is quite common in observing how a watershed drains, to assist in the river basin development and management schemes. The morphometric parameters have the ability to examine linear, areal and relief. In this research we selected Pravara basin since it is a highly relief ratio basin and in terms of area occupies 3474.4 square kilometers. The current work paper primarily examines parameters that are contained in the areal morphometrics which are basin area, drainage density, frequency of streams, texture ratio, elongation ratio, circularity ratio and the form factor ratio. Morphometric analysis on GIS is used in this study. The current study is quite helpful in planning and managing a drainage basin. The areal morphometric parameters are significant in the aggregate decisions in flood management, soil erosion determination and water resource management in the localized scale.*

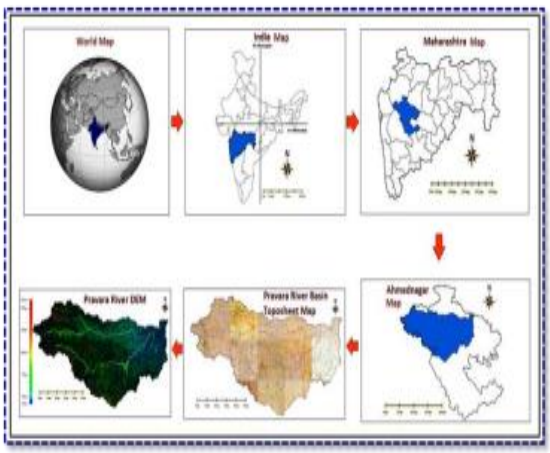
***Keywords:*** *land forms, area, water runoff, geographic information system (GIS).*

## Introduction

The morphometry is a significant method to investigate the form and magnitude of territory in a given locale. It refers to the determination of the shape of the earth surface and its topographies (Clarke, 1966). Morphometry is a word derived through the measurement of shapes; the term landforms was firstly used by Horton with the help of numbers. GIS can be used to study the morphometry of drainage. In order to measure these measurements we consider numerous drainage features including the arrangement of streams, the size and shape of the basin, drainage channels length, channel density, frequency of appearance of streams, branch ratio, basin relief and ruggedness. Through the GIS, this paper has computed most of these parameters of the Pravara basin area. Investigating the basin will enable us to know the size and power of the waterways in the stream network and this is important in managing water resources. Identifying the areal drainage of the basin and to explain the overall basin condition constitute the main aim of morphometric analysis. The data we generated and tabulated in this work included the number of streams, stream order, stream frequency, drainage density, circularity ratio, the elongation ratio and form factor according to drainage channel area, using the GIS information in the topography maps. These researches prove quite handy in planning and management of drainage basins. The areal morphometric parameters are significant to the decisions that are made based on flood management, soil erosion assessment, and flood waters at the local level.

## Study Area:

The Pravara River originates at Ratangarh 1100 meters above Sea level and in the northwest corner of Ahmednagar district and Maharashtra. It is flowing towards the eastern direction of the western Ghats in Maharashtra. The tributaries of the Pravara River are Mula, Adula, Mhalungi and Krushanavanti. The tahsil areas of the Akole, Sangamner, Rahta, Shrirampur, Newasa, Parner, Rahuri, Nagar and Pathardi of Ahmednagar district, Sinnar of Nasik district and Junnar of Pune district are also covered by this river.



**Map No:** Study Area

The region of the study has a latitude of $19^0 13' 8"$N to $19^0 45' 18"$N and a longitude of $73^0 37' 34"$ E to $75^0 01' 24"$E providing it an area of 3472.4 square kilometers. The peak of the basin is Kalsuabi Peak with a height of 1646 meters and the lowest point is approximately 470 meters close to Pravarasangam.

**Objectives:**

1. To delimit and trace the borders of the Pravara river basin with the GIS tools.
2. To identify the order of the stream through Strahler method and GIS product.
3. To investigate the shape and size characteristics of Pravara river basin.

**Methodology:**

This paper is based on GIS to examine the shape of the basin. Satellite images were aligned with Survey of India maps (scale 1: 50,000) and a marking of the watershed area was done. We applied the Strahler method to place an order of a stream per river. The drainage layer provided important information which we retrieved, namely, stream length, area, perimeter, streams number, and basin length. The values of morphometric parameters namely stream length, drainage density, stream frequency, form factor, texture ratio, elongation ratio and circularity ratio are calculated based on the formulae suggested by Horton (1945), Miller (1953), Schumn (1956), Strahler(1964), Nookaratm (2005).

**Findings and discussion of results: Drainage basin land areas:**

| Morphometric parameters | Symbol/ formula | Result | Morphometric parameters | Symbol/ formula | Result |
|---|---|---|---|---|---|
| Area (Sq.Km) | A | 3472.4 | Texture ratio | T= N1/p | 13.7201 |
| Perimeter(Km) | P | 474.63 | Elongation ratio | $Re=\frac{2\sqrt{A/\pi}}{Lb}$ | 0.4554 |
| Basin length (Km) | Lb | 146.06 | Circularity ratio | $Rc= 4\pi Au/P^2$ | 0.1936 |
| Drainage density (Dd) | $Dd= \sum Lu/A$ | 2.1487 | Form factor ratio | $Rf= A/Lb^2$ | 0.1628 |
| Stream Frequency | $Fs= \sum N\mu/A$ | 2.4605 | - | - | - |

**Table No 1:** Areal Aspects of Drainage Basin


**Map No 2:** Strahler's stream ordering classification

**Basin Area and Basin Length:** The Pravara basin is a 7th -order basin with an area of 3,472.4 square kilometres. It comprises the Akole, Sangamner, Rahta, Rahuri, Shrirampur, Newasa, Parner, Nagar, Pathardi, areas of Ahmednagar and Sinnar area of Nasik and Junner of the Pune district. The Pravara basin length measures 146.06 km in length.

**Basin Perimeter (P):** The outer rim of the watershed that covers the area of the watershed is called the basin perimeter. The basin has a perimeter (P) of 474.63 km. The basin shape is elongated.

**Drainage Density (Dd):** Drainage density refers to the amount of time all the streams within a given area have in relation to the size of the area (Horton, 1932). The drainage density in this catchment is 2.1486 km/ sq km and this is attributed to the unfavorable layers of rock and minimization of vegetation. This causes further water to flow off the ground and in the process may lose the rock and carry off the topsoil. The watershed is very coarse, as it has been described. There is low drainage density at the study area and thus the ground beneath is either very resistant or very porous.

**Stream frequency (Fs):** Frequency of a stream The sum of the number of stream segments of any order divides the basin area. The greater the density of the drainage and the frequency of streams, the greater will be the amount of runoff generated on the basin; vice versa. The channel or drainage frequency (Fs) of the entire basin is 2.46 quite literally sq. km. This figure demonstrates the various phases of the landscape development. The frequency of streams is due to the type of the rock, the soil content of water that can penetrate the earth, the vegetation amount or the vegetation level, the elevation of hills, the received types and quantity of rainfall, and the water penetration of the earth stratum. Pravara basin has a stream frequency of 2.46 2. nr. sq. km that denotes rich vegetation in upper catchment, middle hills, dense water infiltration, and high peak run offs that occur later due to low run offs. The stream frequency of this region has a positive relationship with the drainage density, that is, the more so many streams are seen with increase in the drainage density**.**

**Form Factor:** The area of a basin divided by the square of the basin length is called form factor (Horton, 1932). It ought to never exceed 0.7854 which is the value of a perfect circle. When the value is near to zero, it indicates that the basin is long and narrow whereas when this value is nearly one, it indicates that the basin is round. This section of study has a form factor of (o.1628) which represents a long basin whose peak flow is flatter and longer, Flood flows of such elongated basins are easier to manage than of the circular basin. (Christopher et al., 2010).

**Circularity ratio (RC):** The circularity ratio depends on the number of streams that are long and numerous, the geology, land use and land cover, climate, and slope of the basin. The ratio of this study field is 0.1936 and indicates that the basin is very long. The Pravara basin is relatively young and is also at the same 0.1936 ratio. The shape is long and thin with a ratio of less than 0.5 as indicated by Miller (1953). The circulation ratio assists in identifying a dendritic watershed, largely due to the fact that the basin slopes and relief are not consistent.

**Elongation Ratio (Re):** Schumns1956 proposed an elongation ratio (Re) which was defined as the diameter of a circle that had all the same area as a basin divided by the maximum length of the basin. Re takes the value of 0 corresponding to a very elongated basin up to 1.0, which corresponds to a perfectly circular basin. The values of 1.0 are common to tropical areas that have very small reliefs whereas 0.6-0.8 values occur more often in high reliefs and steep slopes (Strahler, 1964). The elongation ratio of 0.4554 is a very steep slope which has steep slopes, big level of run off, and is long.

**Texture ratio (T)/Drainage Texture ratio:** The total amount of stream segments of various sizes perimeter of the area divided is called the drainage texture ratio (T) (Horton, 1945). It relies on a number of things that happen naturally such as the climatic conditions, precipitation and the level of development of the region. The geomorphic concept of most importance is a concept known as texture which is the relative distance between drainage lines (Smith, 1950). In the same measure, Horton (1945) came up with a definition of drainage texture using the frequency of a stream within a basin. The value of drainage texture in this study in relation to the Pravara basin is 13.72016 which indicates that the drainage pattern of the basin is very fine.

**Conclusion:**

The drainage basin is frequently selected due to morphmetric analysis determination because the shape and water flow of the drainage basin are uniform. In this study, the calculation of the morphometric parameters and analysis was simplified by using GIS. Morphometric analysis of the Pravara River indicates that the basin of the river is of the seventh order. The drainage pattern in the basin is dendritic. The most useful measures that can be used to classify the drainage basins are Dd and Fs, which govern the manner in which water will flow, the amount of sediment transported, and other aspects which affect water. The development of stream segments in the basin is dependent on rain, as well as groundwater discharge. The values of drainage density, texture ratio, circulatory ratio and elongation ratio reveal that the basin has a moderate texture and its shape is nearly elongated. Frequency of streams: there are increasing streams in the watershed as the degree of drainage density escalates. The greater density of drainage and high frequency of stream implies an increase in runoff of the basin. Stream frequency denotes the various levels of landscape change. The ratio of form factors of 0.1628 implies that the basin is long and with lower peak flows which take longer durations than average. The basin is also elongated as indicated by a shape factor of 6.14. Pravara basin is still in youthful level of development with a ratio of circularity at 0.1936. A ratio of 0.4554 on elongation shows that it is steeply sloping, with relief being high, and runoff being high with a long shape of its catchment. The catchment value (0.4654) gives an indication of low permeability, moderate to steep slopes and great surface runoff. Such studies are used to plan and manage drainage basins. The areal morphometric parameters are critical in the flood management, soil erosion evaluation, and small-scale water resource decision-making.

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**Conflicts of interest**

The authors declare that there are no conflicts of interest regarding the publication of this paper.

**References:**

1. A. N. Strahler, and A. H. Strahler, (2002), A text book of physical geography, John Wiley & Sons, New York.
2. S. Singh., (1998), Physical Geography, Prayag Pustak Bhawan, Allahabad, India.
3. S. Singh., (2000), Geomorphology, Prayag Pustak Bhawan, Allahabad.
4. Ramu, B.Mahalingam, P. Jayashree, (2013) "Morphometric analysis of Tungabhadra drainage basin in Karnataka using GIS" journal of engineering, computers & applied science, vol 2, no.7,.
5. Nag, S. K., (1998), Morphometric analysis using remote sensing techniques in the Chaka sub-basin, Puruliadistrict, West Bengal, Journal of the Indian society of remote sensing, 26(l&2), pp 69-76.
6. R.E. Horton., (1932), Drainage basin characteristics, Trans. Amer. Geophys. Union, 13, pp 350-361.
7. Agarwal, C. S (1998), study of Drainage pattern through Aerial Data in Naugarh area of Varanasi district, U.P. Journal of Indian Society of remote Sensing, 26 (4), pp 169175.
8. Geena.G.B, Ballukraya.P.N,"Morphometric analysis of Korattalaiyar River basin, Tamil Nadu, India: A GIS approach", International Journal of Geomatics and Geoscience, Volume 2, No. 2, 2011, pp 383-391.