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GEOMORPHOLOGICAL STUDY OF RIVER WAINGANGA WATERSHED IN BHANDARA DISTRICT-AREAL ASPECT

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Abstract

Watershed Region is one of the most important landforms on Earth. Rainfall Drainage Density, stream frequency, Average slope, Absolute & Relative Relief etc. It plays an important role in the special distribution of elements. Morever all the characteristics of a watershed are related to the size of the watersheds. In the study and analysis of watershed between there is a relationship between circumferences and size of river basin, special aspects of watersheds refers to the geographic structure of watersheds, such as climate, vegetation cover, stream development as well as topographic features. The catchment area is demarcated on the basin of watersheds. In the real aspect of catchment areas are studied. The areal aspect of a watershed area is related to size of the streams flowing through it, Areal aspect of watershed can be used in water Conservation projects like collection, Conservation.

Keyword: Watershed, Areal aspect, Wainganga, shape, size, Elongation.

Study Area

The area selected for this short research paper is from the Bhandara Districts upper watershed of rivers Wainganga. This watershed area extends from 21^0 4’ 09” N to 21^0 35’ 42” N latitude, and 79^0 27’ 31” E to 79^0 55’ 49” E longitude. This watershed area covers the total area of Bhandara District (27.69%) covering an area of 1132.20 sq.km. This watershed area sq.km. is negligibly triangular in shape. The waingang is the major river in Bhandara is District.

Objectives

1. The objectives of the present short research paper are to study the right bank of river wainganga and its watershed.
2. Study the range of different flow system in watershed. (River Pattern)
3. Study the various main areal aspect of the watershed area and geomorphological elements.

Research methods and data collection

A base map making of the Wainganga river system and watershed arre Bhandara district through Indian topographical Map No. $55\frac{0}{6}$, $55\frac{0}{7}$, $55\frac{0}{8}$, $55\frac{0}{10}$, $55\frac{0}{11}$, $55\frac{0}{12}$, $55\frac{0}{14}$, $55\frac{0}{15}$ and watershed area is to be classified. It has been made to study geological feature of the area. Data collection, Sampling, Maps, Diagrams, Graphs, Measurements were used to display the data.

Introduction

Ariel Aspect

Watershed Region is one of the most important landforms on Earth. Rainfall Drainage Density, stream frequency, Average slope, Absolute & Relative Relief etc. It plays an important role in the special distribution of elements. Morever all the characteristics of a watershed are related to the size of the watersheds. In the study and analysis of watershed between there is a relationship between circumferences and size of river basin, special aspects of watersheds refers to the geographic structure of watersheds, such as climate, vegetation cover, stream development as well as topographic features. The catchment area is demarcated on the basin of watersheds. In the real aspect of catchment areas are studied. The areal aspect of a watershed area is related to size of the streams flowing through it, Areal aspect of watershed can be used in water Conservation projects like collection, Conservation.

Shape and form of watershed Region

Geometrical study of the watershed area of any river helps in comparative study of their different shaper. Circularity Index relates to the young, mature and old stages of watershed development respectively. Generally the ideal watershed shape is wide at the top and tapering at the bottom, however the shape of a watershed depends on its aerial extent, length of major river, circumference, etc is based on however, these elements are also the absolute relief, slope, geometric structure, Rock structure, etc. are influenced by related factors. Therefore it is natural to see of heterogeneity in the size of the watershed.

Three type of watershed shapes are generally considered -

1. Circular / Compact
2. Elongated
3. Jagged

Many researchers and geographers have used different scales to determine the size of watershed. Horton's 'Form Factor' (F) 1932, Stoddart's 'Eilipticity Index' (E) 1965, Miller's 'Circularity Index' (C) 1953, Schum's 'Elongation Ratio' (R) 1956 and 'Leminiscent Method' (K) 1957 by Chaule, Mime and Progeisky are famous.

The sub watershed boundaries within that watershed play and equally important role in shaping the right hand upper watershed of Wainganga river basin into a triangular specific catchment mainly the shape of presented study are in elongated.

1.1) Form of Watershed

Horton (1932) deviced a 'Form Factor' (F) diagram from watershed. Which mainly indicates the vertical index.

Formula:- $F = \frac{A}{L_2}$

F = Form Factor

A = Area of Watershed

L_2 = Lengh of Watershed

(Singh, Savindra 2003, Page No. 357)

1.2 Shape of Watershed

The shape is determined by the boundary of river basin. Shape controls watershed characteristics. Horton (1932) used the following formula to calculate the shape.

Shape of Watershed (s) = $\frac{Lb}{Bw}$

S = Shape of watershed area

Lb = Length of watershed area

Bw = Width of watershed area

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The shape ratio of Wainganga river basin is S = 1.16. Also 3 shape ratio of sub-watershed table No. 1.1 is shown in fig. The highest ratio value is 0.82 for Sur sub-watershed. 1.53 of Wakada Nala sub-watershed has come.

The value of F ranges from 0 to 1. The smaller value, indicator that the shape of watershed is more elongated and a higher value indicates that the shape of the watershed is circular.

Considering the context of the Wainganga river basin to in the present study area 'Form Factor' (F) is 0.85. Hence the shape of the Wainganga river watershed area is triangular comes out. Form Factor (F) of various sub-watersheds in Wainganga river basin is given in the table no. 1.1, Form Factor of the three sub-watersheds namely Chandrapur, Sur and Wakda is 0.73, 0.83 and 0.92 respectively. As this index ranger between 0 to 1, it is clear that the shape of all the three sub-watersheds is rectangular.

Table No. 1.1

Right Upper Watershed Area of Wainganga River Basin in Bhandara District

Form and Shape

Sr. No.	Watershed area	Form Factor (F)	Size (S)
01	Chandrapur sub-watershed	0.73	0.82
02	Sur sub-watershed	0.83	1.78
03	Wakda sub-watershed	0.92	1.53
04	Mili, Micro and Mini watershed	0.85	1.16

Source:

2) Circularity Index

Circularity index are related to the structure of rock and soil of a river watershed Strahler (1964) and Miller (1953) have introduced the concept of circularity index. The circularity index is the ratio of watershed area and perimeter of the river basin.

Formula:

Circularity Index (RC) = $\frac{4\pi A}{P^2}$

RC = Circularity Index

A = Area of the Watershed

P^2 = Perimeter of the Basin

4 = Content

$\pi = 3.14 / \frac{22}{7}$

Table No. 1.2

Circularity Index

Sr. No.	Watershed Area	Circularity Index (RC)	Elongation Ratio (Re)
01	Chandrapur	0.68	0.76
02	Sur	0.44	1.83
03	Wakda	0.31	0.92
	Total Watershed Area	0.41	0.85

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Source:

Table No. as given in 1.2 the circularity index for the wainganga river basin is 10.41 from that it is clear that the shape of this catchment area is not circular. Also the circularity index of other sub-watershed is 0.68, 0.44, 0.31 for Chandrapur, Sur and Wakda sab-watershed respectively. It is clear that their shape is also not very circular.

The circularity index indicates the intermediate stage of the river.

3) Elongation Ratio

This method was firstly used by schamm in 1956 for the ratio of area to maximum length of any river basin or watershed. According to strahler (1964) a ratio between 0.6 and 1.0 indicates a variety of climate and geology. So if the value is close to 1.0 then how rise and 0.6 to 0.8 indicates high slope and steep slope. This index is calculated by the following formula.

Formula:

Elongation Ratio (Re) = $\sqrt[2]{\frac{A}{\pi / l}}$

Re = Elongation Ratio

A = Area of Watershed

L = Maximum Length of Watershed

2 = Constant (Singh, Savindra 2003, Page No. 357)

The Elongation ratio of is 0.85 for the watershed area of wainganga river. The Elongation types are classified on the basis of the following respect ratio.

1. Length ratio valuar range from 0.01 to 1.00
2. Oval shape - 0.8 to 0.9
3. Less perpendicular 0.7 to 0.8
4. Oblong 0.5 to 0.7
5. Excessive perpendicularity 0.01 to 0.5

The Elongation ratio of wainganga river watershed area is 0.85 is found. According to this ratio the shape of the catchment area should be oval.

4) Drainage Density (Dd) (per. Sq. km.)

Drainage Density per sq.km. reflects the climate and geographical conditions of the river basin. (Kenny 1991). The length of all streams each called the drainage density. Horton used the following formula to calculate Drainage Density.

Formula:

Drainage Density (Dd) = $\frac{\in LK}{AK}$

LK = Length of all streams in the watershed area.

AK = Total area of watershed (sq. km.) (Singh, Savindra 2003, Page No. 361)

Table No. 1.3

Drainage Density

Sr. No.	Watershed	Areas (sq.km.)	Length (k.m.)	Drainage Density (sq.km.)
01	Chandrapur	384.00	503.00	1.31

02	Sur	474.00	569.00	1.19
03	Wakada	101.00	109.00	1.08
04	Mili, Micro and Mini	173.00	140.00	0.80
	Total	1132.00	1321.00	1.17

Source: Researcher Themselves

A study of Drainage Density of Wainganga river watershed is 1.17. The Drainage Density of this watershed is moderate. That is the length of the stream in the watershed is moderate in comparison to the area.

Also when studying the sub-watershed area in the Wainganga watershed, it is seen, that the highest flow density in Chandrapur (1.31) sub-watershed and it is of high quality. Sur sub-watershed has moderate drainage density (1.19) while Wakada Nala sub-watershed has low drainage density (1.08) is found. The drainage density of Mili, Micro and Mini watershed is found to be very low (0.80). From this it is clear that the length of the streams following through this water said area is less as compared to its area.

5) Drainage Determination Constant (CCM)

Schumm (1956) explained the inverse relationship between rainage density and drainage determination constant.

The drainage determination constant in wainganga river watershed is calculated based on the total area of the watershed and the length of the streams in that area as well as the drainage density.

Formula:

$$\text{CCM} = \frac{1}{\text{Dd}} = \frac{\text{AU}}{\text{LU}}$$

Dd = Drainage Density

AU = Total area of watershed

LU = Total length of the stream

Table No. 1

Drainage Determination Constant (CCM)

Sr. No.	Watershed	CCM
01	Chandrapur	0.76
02	Sur	0.84
03	Wakada	0.92
04	Mili, Mini, Micro	1.23
	Total	0.85

Source:

It can be seen that the lowest drainage determination constant is 0.76 which belongs to Chandrapur sub-watershed. Whereas Wakda and Sur sub-watershed have the smallest areas respectively per sq.km. is 0.92 and 0.84. The highest drainage determination constant is for the mili, micro and mini watersheds. This drainage determination constant is the rate per square. The wainganga river is watershed drainage determination constant is found to be 0.85.

Conclusion

In order to study the factors in the regional aspects of the upper basin of the wainganga river, the shape and size of watershed, relative flow capacity, flow determination Constant, Catchment area mean, flow frequency etc. have been studied in this aspect. When studying the shape and figure according to regional aspect, it can seen that the shape of the present catchment area is triangular and this catchment area is marked towords the north and tapering towards the south. A flow analysis of the present catchment area shows that the overall river flow density here is moderate, and as the height of the watershed area has increased. It is also seen that the river flow has increased. Similarly, an inverse relationship is observed between the relative flow determination constants in this watershed.

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