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MORPHOMETRIC ANALYSIS OF DADI WATERSHED OF PEDI RIVER BASIN AMRAVATI DISTRICT, MAHARASHTRA, USING GIS TECHNIQUES

KALBANDE AA

Research Student, Late. Narayanrao Amrutrao Deshamukh College, Chandur Bazar, Amravati.

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Abstract: The present study area of Dadi watershed comes under Padi river basin, situated in the western side of Amravati district, Maharashtra, for characterization of watershed the quantitative analysis of drainage system is an important aspect as well as to understand the various hydrological characters for a comprehensive water resource management plan. The areal extent of the study area is 61.80 km², The Morphometric analysis is mathematical calculation of the parameters like stream order, bifurcation ratio, and drainage density and so on. The drainage pattern of the study area is dendritic to sub dendritic with stream order V. The drainage density of the basin is 2.69 km/km², Strahler (1964) stream order method used for stream ordering.

Keywords: Watershed, Morphometry, Drainage pattern, GIS Technique

Corresponding Author: MR. ATUL A. KALBANDE



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INTRODUCTION

Morphometric studies in the field of hydrology were first initiated by Horton (1940) and Strahler (1950). Morphometric analysis requires measurement of linear features, aerial aspects and gradient of channel network of the drainage basin (Nautiyal,1994). Identification of drainage networks within basins or sub basins can be achieved using traditional methods such as field observations and topographic maps with advanced methods using remote sensing and GIS (Macka 2001; Sreedevi et al., 2009). The study morphometry analysis provides the useful parameter for the assessment of the groundwater potential, surface and groundwater resource management, runoff and geographic characteristics of the drainage system. Morphometry is the measurement and mathematical analysis of the configuration of the earth's surface, shape, dimension of its landforms (Clarke, 1966). The morphometry analysis includes the linear aspects and aerial aspects, in the linear aspects the stream ordering, stream length.

Study Area:

The Dadi watershed area selected for the present work is a part of Pedi river basin, Amravati district, Maharashtra state. The study area falls in survey of India Toposheet no 55G/16 and lies between latitudes $21^{\circ}00'$ and $21^{\circ}06'$ N and longitudes $77^{\circ}45'$ and $77^{\circ}55'$ E. The study area occupies an area of 61.80 km^2 . (Fig.1).

Objectives:

To understand the hydro geological aspects of the region, Morphometric analysis of Dadi watershed is carried out by using GIS Techniques.

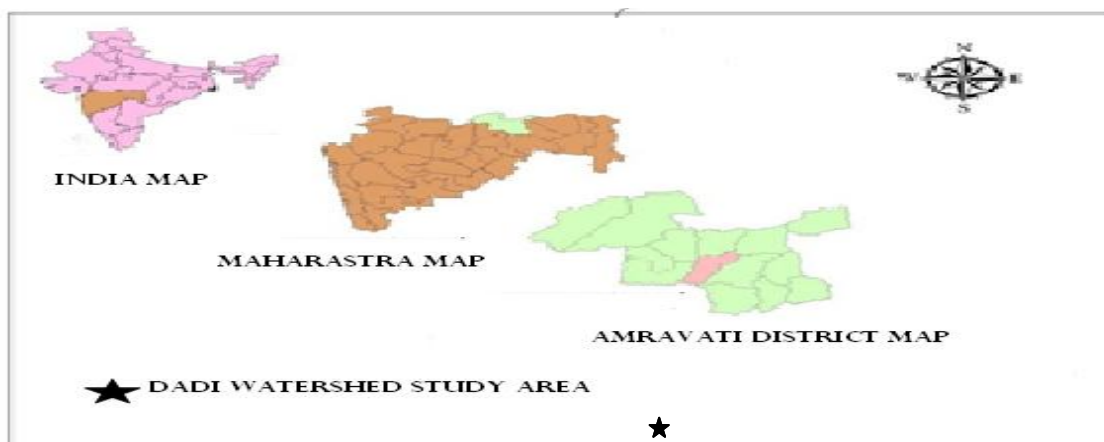


Figure 1 - Location Map of study area of Dadi watershed

METHODOLOGY:

The Survey of India Toposheet no. 55G/16 at the scale of 1:50000 used as base map for stream network digitized using Arc GIS 9.3.

Morphometric analysis

In geomorphology over the past several decades has been on the development of quantitative physiographic methods to describe the evolution and behavior of surface drainage networks (Horton, 1945; Leopold & Maddock, 1953; Abrahams, 1984). Morphometric is the mathematical analysis of the configuration of the earth's surface, shape and dimension of its landforms (Agarwal, 1998; Obi Reddy et al., 2002).

The total area of Dadi watershed is 61.80 sq.km. and perimeter is 35.83 km. The drainage pattern of the area is noticed mainly dendritic to sub dendritic (figure 2).

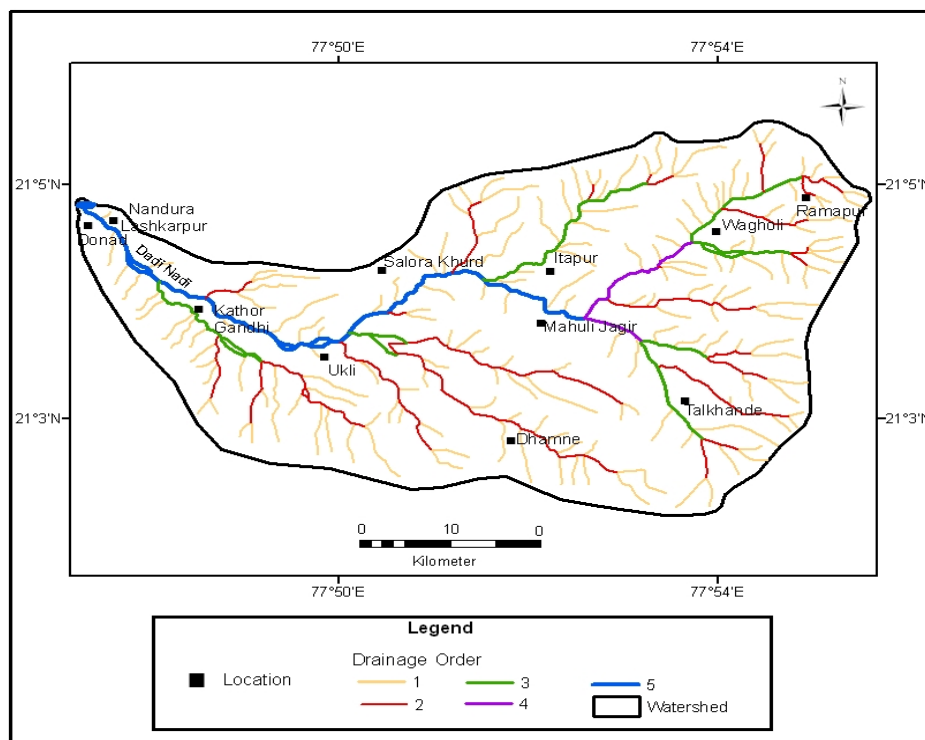


Figure 2 Drainage map of Study Area

The linear and areal aspects of Dadi watershed study area are listed in Table 1 and table 2.

Table 1. - Linear aspects of the Dadi Watershed.

Sr. No.	Morphometric Parameter	Symbols/Formula	Result					Total
			I st	II nd	III rd	IV th	V th	
1	Stream order	u						
2	Stream Number	Nu	176	25	7	2	1	211
3	Stream Length(Km)	Lu	103.25	33.78	15.47	3.53	10.73	166.77
4	Bifurcation Ratio	Rb	7.04	3.57	3.50	2.00		
5	Mean Bifurcation Ratio	Rbm	4.03					
6	Mean Stream Length(Km)	Lsm = Lu / Nu	0.59	1.35	2.21	1.77	10.73	0.79
7	Main Channel Length	Cl	16.86 km					
8	Length of Overland Flow (Lg)	Lg= A/2*Lu	0.18					

Table- 2 Areal aspect of Dadi watershed.

Sr. No.	Morphometric Parameter	Symbols/Formula	Result
9	Basin Area (sq.Km)	A	61.80
10	Basin Length (Km)	Lb	14.18
11	Basin Perimeter(Km)	P	35.83
12	Drainage Density	Dd= $\Sigma Lu / A$	2.69
13	Drainage Texture	Dt = $\Sigma Nu/P$	5.88

14	Stream Frequency	$F_s = \Sigma Nu / A$	3.41
15	Circularity Ratio	$R_c = 4\pi A / P^2$	0.60
16	Elongation ratio	$Re = \frac{2\sqrt{(A/\pi)}}{Lb}$	0.62
17	Form Factor	$F_f = A/Lb^2$	0.30
18	Fitness ratio (Rf)	$R_f = Cl/P$	0.47
19	Infiltration number (If)	$I_f = Dd * F_s$	9.17

SUMMARY AND CONCLUSION:

The morphometric analysis carried out in the Dadi watershed shows low relief of the terrain. Drainage network of the watershed exhibits as mainly dendritic to sub dendritic type, presence of homogeneity in texture and lack of structural control. . The Morphometric parameters such as drainage density, stream frequency and bifurcation ratio are important for the integrated decision making process in flood management, soil erosion assessment and water resource management. The study area is underlined by Deccan trap consist of hard and compact basalts, occasionally weathered basalts. The basin Bifurcation ratio is 4.03 which indicate dendritic to sub dendritic drainage type. The drainage density, 2.69 indicates that the basin has porous in nature and medium to coarse grained texture and the region has highly permeable subsoil materials, The Dadi watershed basin elongation ratio (0.62) indicates that the basin is elongated shape. Based on this study, various groundwater potential zones can be identified for the sustainable development of the region.

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