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MORPHOMETRIC ANALYSIS OF SUB-BASINS IN JAISAMAND CATCHMENT USING GEOGRAPHICAL INFORMATION SYSTEM

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ABSTRACT

In the present paper, an attempt has been made to study the detail morphometric characteristics of Jaisamand catchment. The parameters computed in the present study includes stream order, stream length, stream frequency, bifurcation ratio, drainage density, stream frequency, form factor, circulatory ratio, elongation ratio, relief ratio and ruggedness number by standard methods and formulae. The total length of stream segments is maximum in first order streams and decreases as the stream order increases. The total stream length in the Jaisamand catchment is 7351.83 km. The values of the stream length ratio vary from 2.31 to 6.29 for the whole Jaisamand catchment. The average relief of the catchment is 413 m and it varies from 83 m to 413 m in the sub-basins of the study area. The catchment displays the ruggedness number 1.74, indicates that the area is extremely rugged with high relief and high stream density.

KEYWORDS: Jaisamand Catchment, Morphometric Analysis, Prioritization

INTRODUCTION

Morphometry represents the topographical expression of land by way of area, slope, shape, length, etc. These parameters affect catchment stream flow pattern through their influence on concentration time (Jones, 1999). The morphological parameters directly or indirectly reflect the entire watershed based causative factors affecting runoff and sediment loss. Morphometry is the measurement and mathematical analysis of the earth’s surface, shape and dimension of its landforms and this analysis could be achieved through measurement of linear, aerial and relief aspects of basin and slope contributions (Nag and Chakraborty, 2003; Putty, 2007).

The parameters have been conveniently worked out from the toposheet using GIS tools. Drainage basins are the fundamental units to understand geometric characteristics of fluvial landscape, such as topology of stream networks, and quantitative description of drainage texture, pattern, shape and relief characteristics (Reddy *et al.,* 2004; Subba, Rao, 2009). Morphometric analysis is an important technique to evaluate and understand the behaviour of hydrological system. It provides quantitative specification of basin geometry to understand initial slope or inconsistencies in rock hardness, structural controls, recent diastrophism, geological and geomorphic history of drainage basin (Strahler 1964; Esper, Angillieri, 2008). Morphometric studies of a river basin comprise discrete morphologic region and have special relevance to drainage pattern and geomorphology (Strahler 1957; Dornkamp and King, 1971).

Morphometric analysis is useful for the prioritization of basins. Prioritization is very important to prepare a comprehensive basin management and conservation plan. A study by Mesa (2006) reveals that geology, relief and climate are the primary causes of running water ecosystems at the basin scale. Subba, Rao (2009) has attempted to define how the numerical scheme is helpful in watershed development planning programmes.

MATERIALS AND METHODS

Study Area

The Jaisamand lake catchment is located in the Udaipur district which falls semi-arid region of Rajasthan bounded by Longitude $73^0$45' E to $74^0$25'E and Latitude $24^0$10' N to $24^0$35' N (Figure 1).The study area falls in Survey of India (SOI) toposheets of 45H-14,15,16, 45L-2,3,4,6,7,8 of 1:50,000 scale. The lake is also a prime source supply of drinking water for the city of Udaipur located at a distance of about 52 km from the lake. The Jaisamand lake with a gross capacity of 414.6 Mm^3 and live storage of 296.14 Mm^3, is Asia's second largest artificial water storage reservoir built across the Gomati river. Jaisamand is a prominent medium irrigation project with a cultivable command area of 160 km^2 downstream of the lake.

The total catchments area of Jaisamand Lake 1,857.87 km^2 with highest elevation is 693 above mean sea level, located in sanctuary area very nears to bund. In Jaisamand catchment Gomati, Thavari, Siroli, Vagurwa, Jhamri, Sukhali, Godi, Makreri and Bhangad are the major rivers. There is serious threat to environment in the catchment due to admixture of land degradation, severe erosion, declining water table and biodiversity reduction in whole catchments due to lack of sustainable water resources management. The area has humid climate with an average rainfall of 650.30 mm per year. The area has mild winters and mild summers. The humidity is high and all these factors putting together support good vegetation growth.

Geomorphological Analysis

Geomorphological analysis is the systematic description of watershed's geometry and its stream channel system to measure the linear aspects of drainage network, aerial aspects of watershed and relief aspects of channel network. The morphological parameters directly or indirectly reflect the entire watershed based causative factors affecting runoff and sediment loss. The parameters have been conveniently worked out from the toposheet using GIS tools. The geomorphological parameters were determined by using different formulae as shown in Table 1.

RESULTS AND DISCUSSIONS

The study was undertaken to determine the morphometric parameters of sub-basin in Jaisamand catchment by using Arc-GIS software. For this study different formulae were used for computation of morphometric parameters. The results obtained during research work discussed below.

Linear Aspects

The linear aspects of the basin such as stream order (N_u), stream length (L_u) and bifurcation ratio (R_b) were determined and results have been given in Table 2 (a & b). In the present study ranking of streams has been carried out based on the method proposed by Strahler (1964). Out of these fourteen sub-basins, sub-basin 1, 8, 9 and 10 are sixth order basin (Figure 4). Table 3 also shows that the maximum stream frequency was found in case of first order streams and there is a decrease in stream frequency as the stream order increases. The order wise total number of stream segment is known as the stream number. Horton's (1945) law of stream numbers states that number of stream segments of each order form an inverse geometric sequence with order number. Most drainage networks show linear relationship, with small deviation. The logarithmic plotting position of number of streams against stream order is given in (Fig.2), shows the number of streams usually decreases in geometric progression as the stream order increases.

The stream lengths for all sub-basins of various orders were measured on digitized map with the help of GIS. The total length of stream segments is maximum in first order streams and decreases as the stream order increases. The total stream length in the Jaisamand catchment is 7351.83 km and that of the fourteen sub-basins are 857.33 km, 71.39 km, 422.09 km, 418.44 km, 191.53 km, 364.71 km, and 533 km, 336.44 km, 1338.35 km, 341.3 km, 1013.22 km, 840.63 km, 437.53 km and167.87 km respectively (Table 2-a).

The stream length ratios (R_L) are changing haphazardly at the basin and sub-basins level. The values of the stream length ratio (R_L) vary from 0.08 to 58.93 for sub-basins, while it ranges from 2.31 to 6.29 for the whole Jaisamand catchment (Table 2- b). It is noticed that the R_L between successive stream orders of the basin vary due to differences in slope and topographic conditions (Sreedevi *et al.*, 2005). The Stream Length Ratio (R_L) has an important relationship with the surface flow discharge and erosional stage of the basin.

In the present study, it was observed that the plot of logarithm of the cumulative stream length as ordinate vs. stream order as abscissa is almost a straight line fit. The straight-line fit indicates that the ratio between cumulative length and order is constant throughout the successive orders of a basin (Figure 3).

The mean bifurcation ratio values range between 3.71 to 5.73 for the basins of the study area indicating that all the basins are falling under normal basin category (Strahler, 1957). The bifurcation ratio is also an indicative tool of the shape of the basin. Elongated basins have low R_b value, while circular basins have high R_b value (Morisawa, 1985). In this study area, the higher value of R_b indicates a strong structural control in the drainage pattern whereas the lower value indicates that the sub-basins are less affected by structural disturbances (Strahler, 1964, Vittala *et al.*, 2004 and Chopra *et al.*, 2005).

Aerial Aspects

The aerial aspects of the basin like drainage density (D_d), stream frequency (F_s) elongation ratio (R_e), circularity ratio (R_c), form factor (R_f), were calculated and results have been presented in Table 3. The drainage density in the whole basin and sub-basins of the study area shows variation from 2.33 to11.50 km per km^2 suggesting high drainage density. It indicates that the region is composed of weak or impermeable subsurface materials; sparse vegetation, mountainous relief and fine drainage texture (Reddy *et al.*, 2004). The stream frequency (F_s) mainly depends on the lithology of the basin and reflects the texture of the drainage network. The stream frequency (F_s) values of the basin and sub-basins of the study area are varying from 4.04 to 11.83.

It is also seen that the drainage density values of the sub-basins exhibits positive correlation with the stream frequency, suggesting that there is an increase in stream population with respect to increasing drainage density. Generally, High value of stream frequency (F_s) is related to impermeable sub-surface material, sparse vegetation, high relief conditions and low infiltration capacity (Reddy *et al.*, 2004).

Form Factor (R_f) proposed by Horton (1945) to predict the flow intensity of basin of a defined area. The index of R_f shows the inverse relationship with the square of the axial length and a direct relationship with peak discharge. The value of form factor would always be greater than 0.78 for a perfectly circular basin. Smaller the value of form factor, more elongated will be the basin. Form Factor (R_f) values of whole basin and sub-basins of the study area vary from 0.12 to 0.35, which indicate that they are sub-circular and elongated in shape. The elongated basin with low form factor indicates that the basin will have a flatter peak of flow for longer duration. Flood flows of such elongated basins are easier to manage than of the circular basin (Nautiyal, 1994).

The circularity ratio (R_c) is affected by the lithological character of the basin. Its values approaching one indicates that the basin shapes are like circular and as a result, it gets scope for uniform infiltration and takes long time to reach excess water at basin outlet, which further depends on the prevalent geology, slope and land cover. The ratio is more influenced by length, frequency (F_s) and gradient of various orders rather than slope conditions and drainage pattern of the basin. The R_c of the whole basin and sub-basins of the study area vary from 0.27 to 0.54, which indicates the dentritic stage of a basin.

The elongation ratio (R_e) is a very significant index in the analysis of basin shape, which helps to give an idea about the hydrological character of a drainage basin. Elongation ratio (R_e) for the study area varied from 0.39 to 0.67 as shown in Table 3. The value near 1 is typical of regions of very low relief, whereas values in the range of 0.6 to 0.8 are generally associated with strong relief and steep ground slopes (Strahler, 1968).

Schumm (1956) used the inverse of drainage density as a property known as the constant of channel maintenance (C). It is the area of basin surface needed to sustain a unit length of stream channel and is depends on the rock type, permeability, climatic regime, vegetation cover as well as duration of erosion. In areas of close dissection, its value will be very low. The value of constant channel maintenance (C) of the study area varied from 0.09 to 0.43, which indicates that these basin and sub-basins are under the influence of high structural disturbance, low permeability, steeps to very steep slopes and high surface runoff.

The length of overland flow (L_g) is the length of water over the ground before it gets concentrated into definite stream channels. It is approximately equals to half of the reciprocal of drainage density (Horton, 1945). This factor relates inversely to the average slope of the channel and is synonymous with the length of the sheet flow to the large degree. The length of overland flow (L_g) is one of the most important independent variables, affecting both the hydrological and physiographical development of the drainage basins (Horton, 1945). The computed value of L_g for all sub-basins and basin varies from 0.04 to 0.21 km^2/km. The low L_g values of basin and sub-basins indicate to short flow paths, with steep ground slopes, reflecting the areas associated with more runoff and less infiltration.

Relief Aspects

Relief aspect of the watershed plays an important role in drainage development, surface and sub-surface water flow, permeability, landform development and associated features of the terrain. Relief is the maximum vertical distance between the lowest and the highest points of a basin. The maximum height of the Jaisamand catchment is 693 m and the lowest is 280 m. Therefore, the relief of the basin is 413 m (Figure 5).

The relief of sub-basins of the study area is varying from 83 m to 413 m. The high relief value indicates the gravity of water flow, low infiltration and high runoff conditions of the study area. Relief ratio has direct relationship between the relief and channel gradient. The relief ratio normally increases with decreasing drainage area and size of the watersheds of a given drainage basin. The relief ratio of the Jaisamand catchment is 0.00123, while that of the fourteen sub-basins vary from 0 to 0.02 as given in Table 4. The relief ratio of the basin as well as the sub-basins of the study area are low which are characteristic features of less resistant rocks of the area (Sreedevi, 1999).

Ruggedness number, R_N is the product of relief and drainage density in order to define the slope steepness and length. It is a dimensionless term and indicates the structural complexity of the terrain. The Jaisamand catchment displays the ruggedness number as 1.74 and indicate that the area is extremely rugged with high relief and high stream density. The ruggedness number of sub–basins varies from 0.19 to 4.75 as given in Table 4.

Table1: The Formulae Used for the Computation of Different Morphometric Parameters

Morphometric Parameters	Formula	Reference
Linear Parameters		
Length (L)	$L= 1.31*2A^{0.568}$ where L=Basin length (km) A=Area of the basin (km^2)	Nookaratnam et al. (2005)
Stream order (u)	Hierarchical rank	Strahler (1964)
Stream length (L_u)	Length of the stream	Horton (1945)
Mean stream length (L_{sm})	$L_{sm} =L_u/N_u$ where L_{sm}=Mean stream length L_u=Total stream length of order ‘u’ N_u=Total no. of stream segments of order ‘u’	Strahler (1964)
Stream length ratio (R_L)	$R=L_u/L_{u-1}$ where R_L=Stream length ratio L_u=Total stream length of order ‘u’ L_{u-1}=The total stream length of its next lower order	Horton (1945)
Bifurcation ratio (R_b)	$R_b=N_u/N_{u+1}$ where R_b=Bifurcation ratio N_u=Total no. of stream segments of order ‘u’ N_{u+1}=Number of segments of the next higher order	Schumm (1956)
Mean bifurcation ratio (R_{bm})	R_{bm}=Average of bifurcation ratios of all orders	Strahler (1957)
Areal Parameters		
Form factor (F_f)	$F_f =A/L^2$ where F_f=Form factor A=Area of the basin (km^2) L=Basin length (km)	Horton (1932, 1945)
Elongation ratio (R_e)	$R_e =1.128\sqrt{A/L}$ where Re=Elongation ratio A=Area of the basin (km^2) L=Basin length (km)	Schumm (1956)
Circularity ratio (R_c)	$R_c =4\pi A/P^2$ where R_c =Circularity ratio π=3.14 A=Area of the basin (km^2) P=Perimeter (km)	Miller (1953), Strahler (1964)

Shape factor (S_b)	$S_b = L^2/A$ where S_b =Shape factor L=Basin length (km) A=Area of the basin (km^2)	Horton (1932)
Compactness coefficient (C_c)	$C_c = 0.2821* P/A^{0.5}$ where Cc =Compactness coefficient P=Perimeter (km) A=Area of the basin (km^2)	Gravelius (1914)
Drainage density (D_d)	$D_d = L_u/A$ where D_d =Drainage density L_u =Total stream length of all orders A= Area of the basin (km^2)	Horton (1932, 1945)
Stream frequency (F_s)	$Fs = \sum N_u/A$ where F_s =Stream frequency $\sum N_u$ =Total no. of streams of all orders A=Area of the Basin (km^2)	Horton (1932, 1945)
Drainage texture (T)	$T = D_d * F_s$ where T=Drainage texture D_d =Drainage density F_s =Stream frequency	Horton (1945)
Texture ratio (T_r)	$T_r = N_1/P$ N_1= Total number of first order streams P =Perimeter of watershed	Horton (1945)
Constant of channel maintenance (C)	$C=1/D_d$ where C=Constant of channel maintenance D_d=Drainage density	Schumm (1956)
Length of overland flow (L_g)	$L_g = 1/2D_d$ where L_g =Length of overland flow D_d=Drainage density	Horton (1945)
Relief Parameters		
Basin relief (R)	R =H-h where R=Basin relief H=Maximum elevation in meter H=Minimum elevation in meter	Hadley and Schumm (1961)
Relief ratio (R_r)	$R_r = R/L$ where R_r =Relief ratio R=Basin relief L=Longest axis in kilometre	Schumm (1956)
Ruggedness number (R_n)	$R_n = H*D_d$ where R_n =Ruggedness number H=Basin relief D_d =Drainage density	Schumm (1956)

Table 2a: Linear Aspects of Jaisamand Catchment Sub-Basins

Basin/ Sub-Basin	Area (Km^2)	Peri-Meter (Km)	Stream Number of Different Orders							Order Wise Total Stream Length (Km)						
			1	2	3	4	5	6	Total	1	2	3	4	5	6	Total
1	179.32	64.80	1683	344	73	14	5	2	**2121**	527.54	159.71	94.08	36.11	22.32	35.57	**875.33**
2	15.031	18.79	126	24	7	1	1		**159**	42.028	16.852	7.37	0.0859	5.06		**71.39**
3	92.04	47.21	695	132	33	5	1		**866**	270.56	74.96	43.97	21.79	10.81		**422.09**
4	11 8.87	57.01	734	138	27	8	2		**909**	256.41	78.28	40.58	26.28	16.89		**418.44**
5	38.79	38.32	337	71	16	2			**426**	117.72	43.98	15.52	14.31			**191.53**
6	89.42	53.23	611	124	23	4	1		**763**	222.16	70.91	27.36	28.51	15.77		**364.71**
7	143.75	59.51	921	166	33	7	3		**1130**	332.96	90.08	62.21	28.38	19.37		**533.00**
8	119.43	58.32	486	99	19	2	2	1	**609**	198.73	65.40	34.03	11.12	23.45	3.71	**336.44**
9	116.41	56.69	987	188	45	10	4	1	**1235**	339.50	899.97	50.04	34.29	9.41	5.14	**1338.35**
10	109.16	61.18	443	89	17	6	4	1	**560**	196.06	62.96	45.91	11.89	13.73	10.75	**341.30**
11	350.56	101.75	1556	262	60	17	5		**1900**	630.38	189.29	104.19	66.42	22.94		**1013.22**
12	240.65	80.35	1383	240	54	14	2		**1693**	494.30	163.61	98.99	59.26	24.48		**840.63**
13	172.43	89.79	639	106	25	8	1		**779**	280.58	76.89	42.87	27.45	9.74		**437.53**
14	71.95	48.28	237	39	11	3	1		**291**	129.81	20.44	10.32	5.77	1.53		**167.87**
Catchment	**1857.87**	**835.23**	**10838**	**2022**	**443**	**101**	**32**	**5**	**13441**	**4038.73**	**2013.33**	**677.44**	**371.66**	**195.50**	**55.17**	**7351.83**

Table 2b: Linear Aspects of Jaisamand Catchment Sub-Basins

Basin/ Sub-basin	Average stream length (km)							Stream length ratio(R_L)						Bifurcation ratio(R_b)					
	1	2	3	4	5	6	Total	2/1	3/2	4/3	5/4	6/5	Mean R_L	R_b 1	R_b 2	R_b 3	R_b 4	R_b 5	Mean R_b
1	0.31	0.46	1.29	2.58	4.46	17.79	**26.89**	1.48	2.78	2.00	1.73	3.98	**2.39**	4.89	4.71	5.21	2.80	2.50	**4.02**
2	0.33	0.70	1.05	0.09	5.06		**7.23**	2.11	1.50	0.08	58.93		**15.65**	5.25	3.43	7.00	1.00		**4.17**
3	0.39	0.57	1.33	4.36	10.82		**17.47**	1.46	2.35	3.27	2.48		**2.39**	5.27	4.00	6.60	5.00		**5.22**
4	0.35	0.57	1.50	3.29	8.45		**14.16**	1.62	2.65	2.19	2.57		**2.26**	5.32	5.11	3.38	4.00		**4.45**
5	0.35	0.62	0.97	7.16			**9.1**	1.77	1.57	7.38			**3.57**	4.75	4.44	8.00			**5.73**
6	0.36	0.57	1.19	7.13	15.77		**25.02**	1.57	2.08	5.99	2.21		**2.96**	4.93	5.39	5.75	4.00		**5.02**
7	0.36	0.54	1.89	4.06	6.46		**13.31**	1.50	3.47	2.15	1.59		**2.18**	5.55	5.03	4.71	2.33		**4.41**
8	0.41	0.66	1.79	5.56	11.73	3.71	**23.86**	1.62	2.71	3.11	2.11	0.32	**1.97**	4.91	5.21	9.50	1.00	2.00	**4.52**
9	0.34	4.79	1.11	3.43	2.35	5.14	**17.16**	13.92	0.23	3.08	0.69	2.18	**4.02**	5.25	4.18	4.50	2.50	4.00	**4.09**
10	0.44	0.71	2.70	1.98	3.43	10.75	**20.01**	1.60	3.82	0.73	1.73	3.13	**2.20**	4.98	5.24	2.83	1.50	4.00	**3.71**
11	0.41	0.72	1.74	3.91	4.59		**11.37**	1.78	2.40	2.25	1.17		**1.90**	5.94	4.37	3.53	3.40		**4.31**
12	0.36	0.68	1.83	4.23	12.24		**19.34**	1.91	2.69	2.31	2.89		**2.45**	5.76	4.44	3.86	7.00		**5.27**
13	0.44	0.73	1.71	3.43	9.75		**16.06**	1.65	2.36	2.00	2.84		**2.21**	6.03	4.24	3.13	8.00		**5.35**
14	0.55	0.52	0.94	1.93	1.53		**5.47**	0.96	1.79	2.05	0.79		**1.40**	6.08	3.55	3.67	3.00		**4.07**
Catchment	**5.4**	**12.84**	**21.04**	**53.14**	**96.64**	**37.39**	**226.45**	**2.50**	**2.31**	**2.76**	**6.29**	**2.40**	**3.25**	**5.35**	**4.52**	**5.12**	**3.50**	**3.13**	**4.32**

Table 3: Aerial Aspects of Jaisamand Sub-Basins

Basin/ Sub-basin	Form factor	Shape factor	Circulatory ratio	Elongation ratio	Texture Ratio	Compactness Constant	Drainage density (km/km^2)	Stream frequency	Constant of channel maintenance	Length of overland flow (km^2/km)
1	0.12	8.58	0.54	0.39	25.97	1.37	4.88	11.83	0.20	0.10
2	0.24	4.17	0.53	0.55	6.71	1.38	4.75	10.58	0.21	0.11
3	0.17	5.72	0.52	0.47	14.72	1.40	4.59	9.41	0.22	0.11
4	0.29	3.47	0.46	0.61	12.87	1.49	3.52	7.65	0.28	0.14
5	0.13	7.42	0.33	0.41	8.79	1.75	4.94	10.98	0.20	0.10
6	0.15	6.77	0.40	0.43	11.48	1.60	4.08	8.53	0.25	0.12
7	0.31	3.19	0.51	0.63	15.48	1.41	3.71	7.86	0.27	0.13
8	0.22	4.60	0.44	0.53	8.33	1.52	2.82	5.10	0.35	0.18
9	0.31	3.23	0.46	0.63	17.41	1.49	11.50	10.61	0.09	0.04
10	0.14	7.14	0.37	0.42	7.24	1.66	3.13	5.13	0.32	0.16
11	0.20	5.03	0.43	0.50	15.29	1.54	2.89	5.42	0.35	0.17
12	0.25	4.00	0.47	0.56	17.21	1.47	3.49	7.03	0.29	0.14
13	0.35	2.86	0.27	0.67	7.12	1.94	2.54	4.52	0.39	0.20
14	0.34	2.95	0.39	0.66	4.91	1.62	2.33	4.04	0.43	0.21
Catchment	**0.23**	**4.94**	**0.44**	**0.53**	**12.40**	**1.55**	**4.23**	**7.76**	**0.28**	**0.14**

Table 4: Relief Aspects of Jaisamand Sub-Basins

Basin/ Sub-basin	Elevation (m)		Relief (m)	Relief ratio	Ruggedness number
	Max.	Min.			
Sub-basin-1	558.00	335.00	223.00	0.01	1.09
Sub-basin-2	503.00	334.00	169.00	0.02	0.80
Sub-basin-3	610.00	353.00	257.00	0.01	1.18
Sub-basin-4	493.00	355.00	138.00	0.01	0.49
Sub-basin-5	404.00	308.00	96.00	0.01	0.47
Sub-basin-6	476.00	305.00	171.00	0.01	0.70
Sub-basin-7	485.00	346.00	139.00	0.01	0.52
Sub-basin-8	434.00	284.00	150.00	0.01	0.42
Sub-basin-9	693.00	280.00	413.00	0.02	4.75
Sub-basin-10	441.00	288.00	153.00	0.01	0.48
Sub-basin-11	509.00	326.00	183.00	0.00	0.53
Sub-basin-12	490.00	317.00	173.00	0.01	0.60
Sub-basin-13	487.00	283.00	204.00	0.01	0.52
Sub-basin-14	369.00	286.00	83.00	0.01	0.19
Jaisamand catchment	**693**	**280**	**413**	**0.00123**	**1.74**

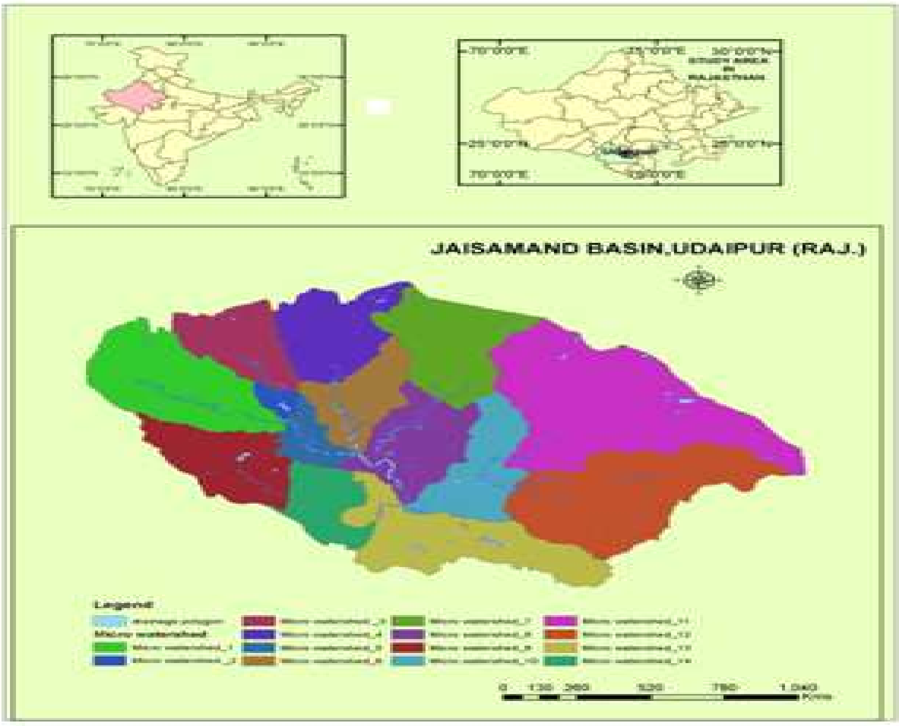

Figure 1: Location Map of Study Area

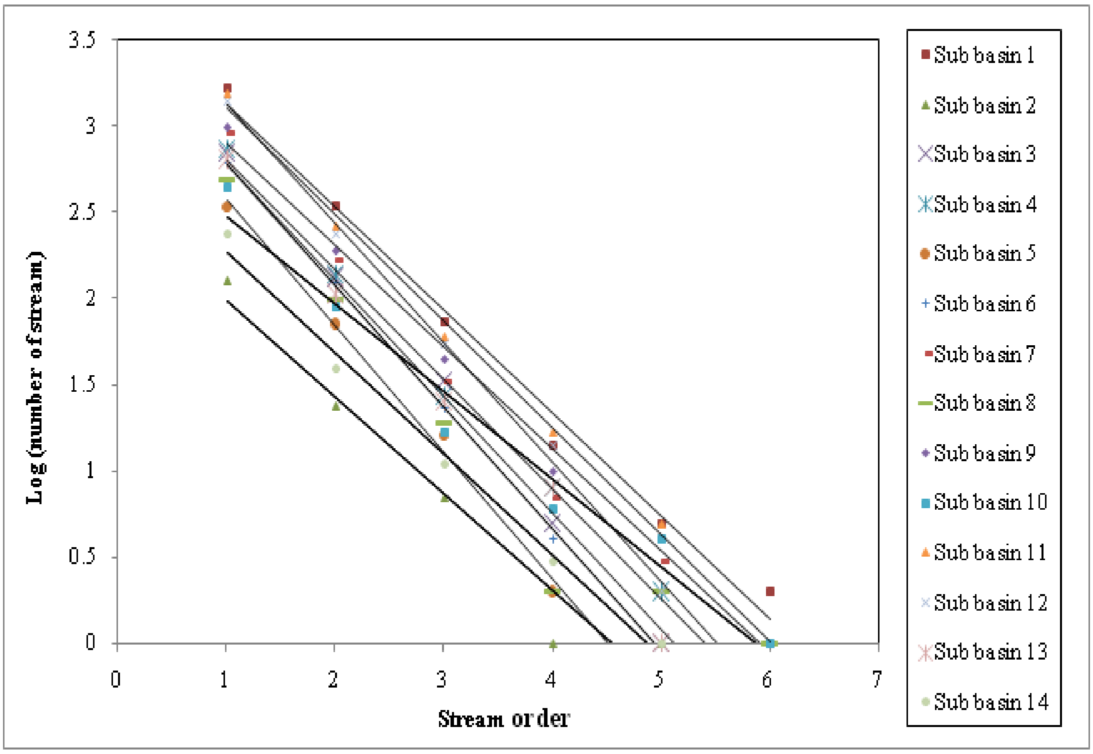

Figure 2: Relationship between Log (Number of Stream) and Stream Order

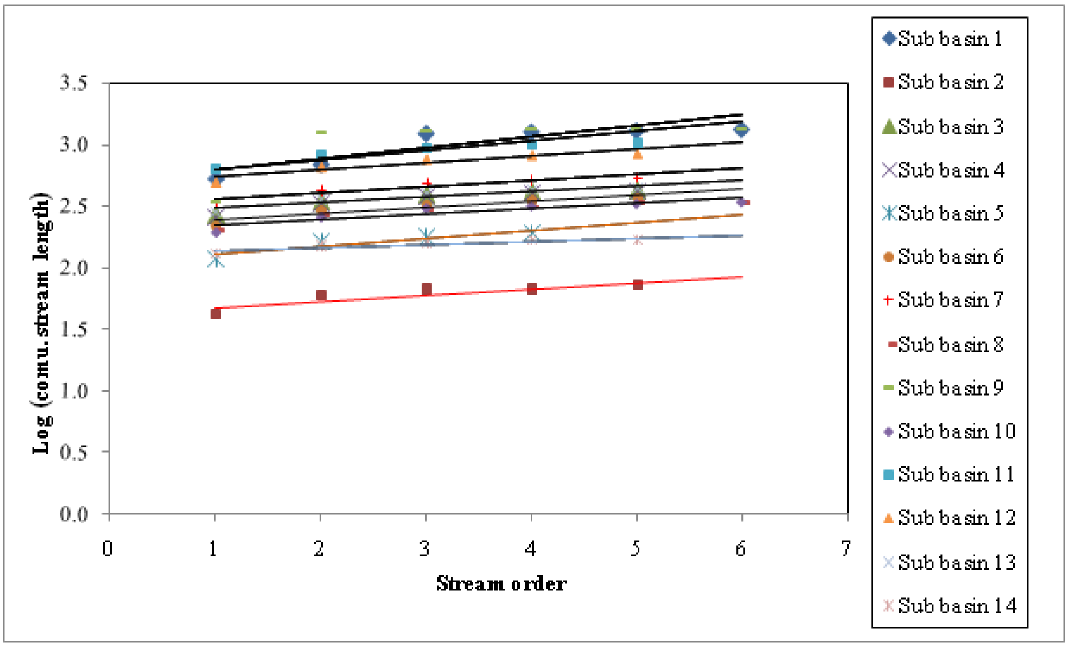

Figure 3: Relationship between Logs (Comu. Stream Length) and Stream Order

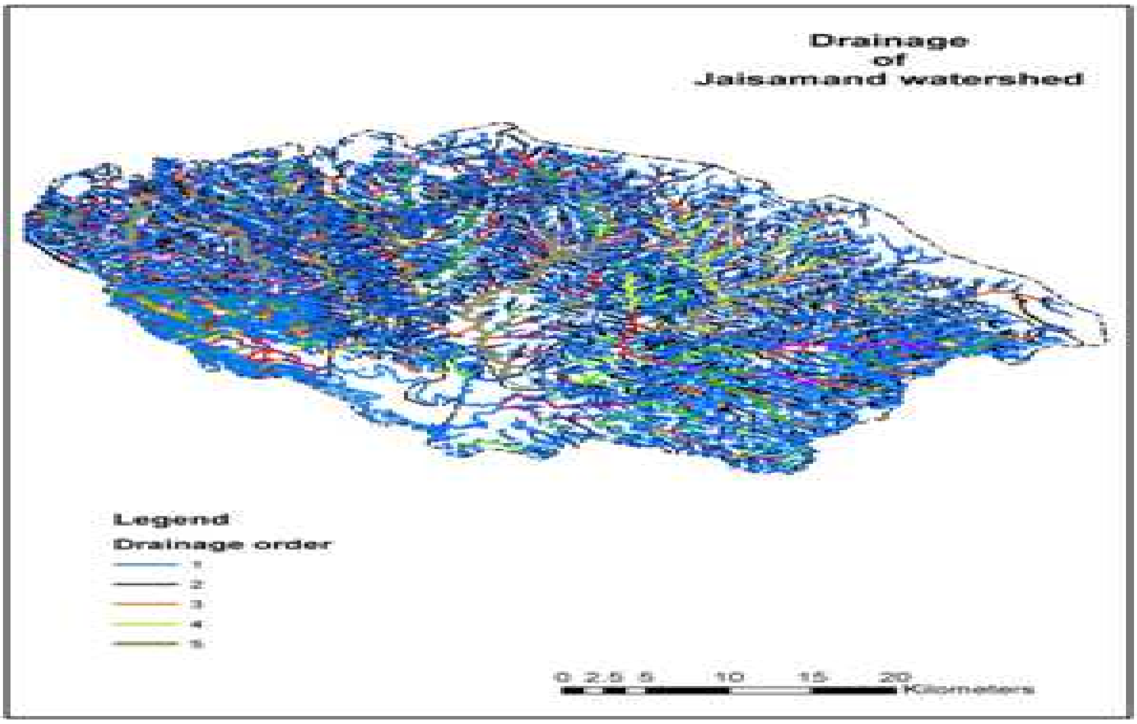

Figure 4: Drainage Map of Jaisamand Catchment

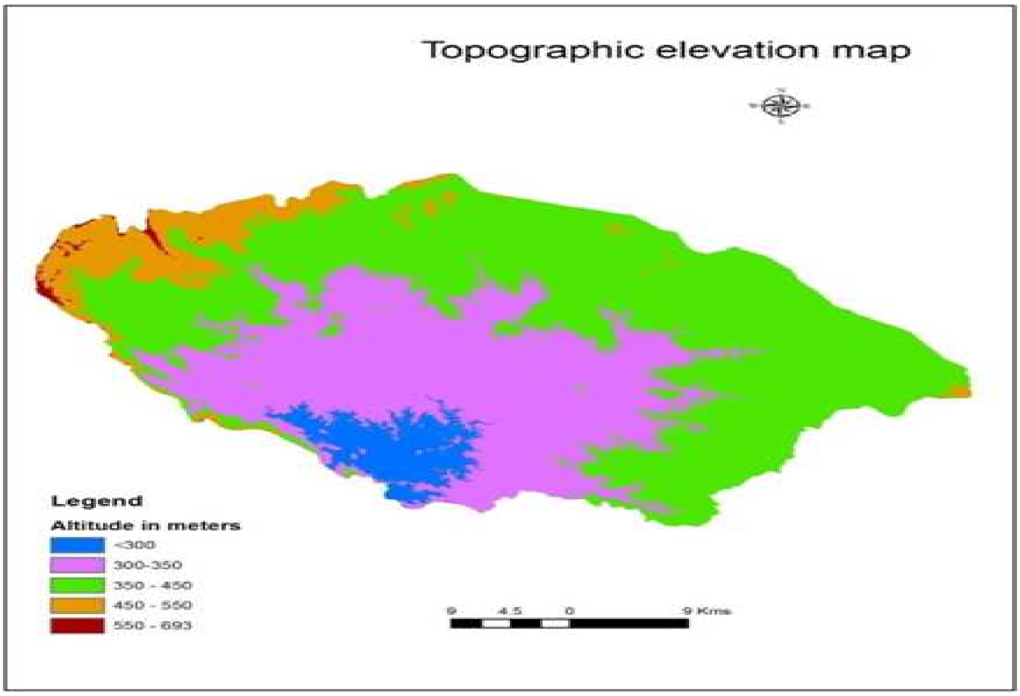

Figure 5: Topographic Elevation Map of Study Area

CONCLUSIONS

The present study demonstrates the usefulness of GIS for morphometric analysis of the sub-basins in the Jaisamand catchment of Rajasthan, India. The morphometric characteristics of different sub-basins show their relative characteristics with respect to hydrologic response of the watershed. Results of morphometric analysis shows that the plot of logarithm of the cumulative stream length as ordinate vs. stream orders as abscissa is almost a straight line fit. The straight-line fit indicates that the ratio between cumulative length and order is constant throughout the successive orders of a basin. The study area extremely rugged with high relief and high stream density. Catchment is under the influence of high structural disturbance, low permeability, steeps to very steep slopes and high surface runoff.

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