International Journal of Scientific Research in Multidisciplinary Studies
Vol.5, Issue.9, pp.33-46, September (2019)

Research Paper
E-ISSN: 2454-9312
P-ISSN: 2454-6143

Geomorphological Analysis and Prioritization of Subwatershed of Raichur City Karnataka Using Weighted Sum Approach

Mohammed Badiuddin Parvez[1]*, M Inayathulla[2]

[1,2]Department of Civil Engineering, UVCE, Bangalore University, Bangalore, Karnataka, India

**Corresponding Author: parvezuvce@gmail.com_Tel.: +919060506390*

Available online at: www.isroset.org

Received: 26/Aug/2019, Accepted: 20/Sept/2019, Online: 30/Sept/2019

Abstract- Prioritization of watershed has picked up significance in watershed management. Morphometic analysis is been commonly applied to prioritize the watershed. In the present study two mini watersheds in Raichur city have been considered Mini-watershed 1 with an area of 519.32 km^2 with highest order stream of 6 Mini -Watershed 2 with an area of 360.97 km^2 with highest order stream of 5. There are Seven Subwatersheds in both the Mini-watersheds. Various morphometric parameters namely Bifurcation ratio(Rb), Drainage density(Dd), Stream frequency(Ns), Texture ratio(T), Form factor(Rf), Circularity ratio(Rc), Elongation Ratio(Re), length of overland flow, shape factor(Bs), compactness ratio (Cc) has been determined for each subwatershed and allotted position on premise of relationship as to arrive at a Compound value for final ranking of subwatershed. The morphometric parameters ranges between Rb (2.95-5.50), Dd (1.218-1.373), Ns (0.890-1.182), T (0.731-1.590), Rf (0.230-0.850), Rc (0.246-0.500), Re (0.55-1.04), Cc (1.40-1.83), Lof (0.364-0.411), and Bs (1.17-4.20). It is found that in Mini-watershed 1 50.87% of area falls under Very high Priority category 32.94% under high, 8.96% under medium and 7.23% under very low priority category and in Mini-watershed 2 20.34% of area falls under very high, 19.82% under high and 59.84% under medium priority category.

Keywords: GIS, DEM, Morphometric analysis, Subwatershed, Priority, Compound Factor.

I. INTRODUCTION

Morphometric analysis provides quantitative description of the basin geometry to understand initial slope or inequalities in the rock hardness, structural controls, recent diastrophism, geological and geomorphic history of drainage basin (Strahler, 1964). Morphometric analysis requires measurement of linear features, gradient of channel network and contributing ground slopes of the drainage basin. Morphometry is the measurement and mathematical analysis of the configuration of the earth's surface, shape and dimension of its landforms. A major emphasis 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). Drainage basin examination based on morphometric parameters is very fundamental for watershed planning since it gives an thought regarding the basin characteristics in terms of slope, topography, soil condition, runoff characteristics, surface water potential etc. Geographic Information System techniques strategies described by an exceptionally high exactness of mapping and measurement prove to be a tool in morphometric analysis. One of the advantages of quantitative analysis is that many of the basin parameters derived are in the form of ratios, and dimensionless numbers, thus providing an effective comparison irrespective of the scale (Krishnamurthy et al. 1996).

II. MATERIALS AND METHODS

2.1 Study Area

In this Study two Mini-watersheds have been considered Mini-watershed 1 is located between Latitude 16º9′52″ N to 16º22′24″ N Latitude and 77º2′59″ E to77º28′50″ E Longitude and Covers an area of 519.32 km^2, having maximum length of 38.42 km. The maximum and minimum elevation of the basin is 492 m and 335 m above MSL, respectively. It is divided into seven subwatersheds as (S1A, S1B, S1C, S1D,S1E, S1F and S1G) and Mini-watershed 2 is located between Latitude 15º57′58″ N to 16º11′25.6″ N Latitude and 77º18′1″ E to77º32′5.3″ E Longitude and covers area of 360.97 km2, having maximum length of 26.17 km. The maximum and minimum elevation of the basin is 533 m and 323 m above MSL respectively. It is divided into seven subwatersheds as (S2A, S2B, S12C, S2D, S2E, S2F and S2G) . Location of the study area is shown in figure 1. The average mean daily temperature varies from 22 to 41^0C respectively. The impact of climate change is likely to have serious influence on agriculture and water sector.

2.2 Methodology

By using SRTM DEM data, basin was delineated and the drainage network was extracted. Initially the sink or depression area in DEM is been filled to get rid of small uneveness in the data. Then on basis of relative slopes between pixels flow direction is determined. Flow accumulation grid has been prepared using this data. Stream order was generated using above data on the basis of drainage flow direction watershed was divided into seven subwatersheds designated as (S1A, S1B, S1C, S1D,S1E, S1F and S1G) and (S2A, S2B, S12C, S2D, S2E, S2F and S2G) for Mini waterhed 1 and 2 respectively as show in figure 2 and 3. Morphometric aspects such as Bifurcation ratio(Rb), Drainage density(Dd), Stream frequency(Ns), Texture ratio(T), Form factor(Rf), Circularity ratio(Rc), Elongation Ratio(Re), length of overland flow, shape factor(Bs), drainage texture, compactness ratio(Cc) is calculated using formulas shown in table.

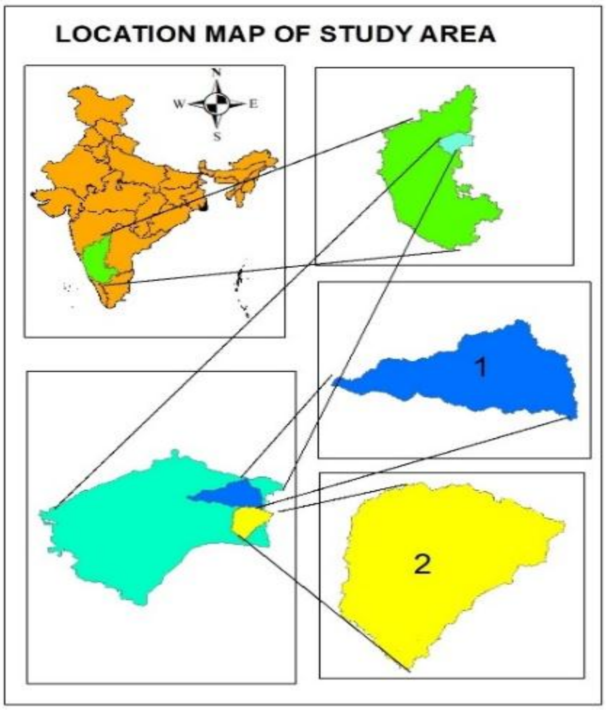


Figure 1 location map of study area

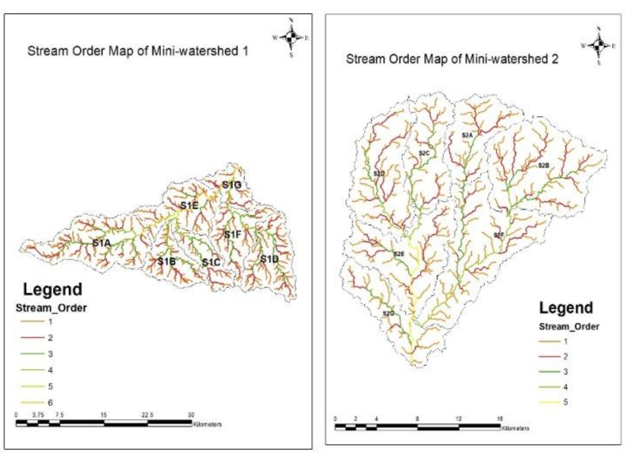


Figure 2 Stream order map

The total Area (A), Perimeter (P) of Seven subwatersheds of both is calculated using Arc GIS and values are tabulated in table 2.

III. RESULTS AND DISCUSSIONS

3.1 Morphometric analysis

Designation of Stream order is the basic step in morphometric analysis of a drainage basin, based on the hierarchic making of streams proposed by Strahler (1964). The highest order stream in the study area is 6^{th} order. The morphometric parameters were calculated its shows that Bifurcation ratio (Rb) ranges from 2.95 to 5.50 S1G have low Rb whereas S2A have high Rb. Drainage density (Dd) is low in S1C and high in S2D its value ranges from 1.218 to 1.373. Stream frequency (Ns) varies from 0.890 to 1.182 with S2F having low and S1B has high value. Texture ratio (T) ranges from 0.731 to 1.590 with low in S2G and high in S1A. Form factor (Rf) is low in S2G and high in S2B it ranges from 0.230 to 0.850. Length of overland flow varies from 0.364 to 0.411 with low in S2D and high in S1C. Basin shape(Bs) is low in S2B and high in S2G it ranges from 1.17 to 4.20. Compactness coefficient(Cc) show wide variation across the subwatershed it is more in S2B and less in S1E it varies from 1.40 to 1.83. Elongation ratio(Re) varies from 0.55 to 1.04 with S2G has low and S2B has high value. Circularity ratio(Rc) of subwatersheds ranges from 0.246 to 0.500 with low in S2G and high in S2B. The Tabulated results are shown in Table 4. Linear morphometric characteristics is shown in table 3.

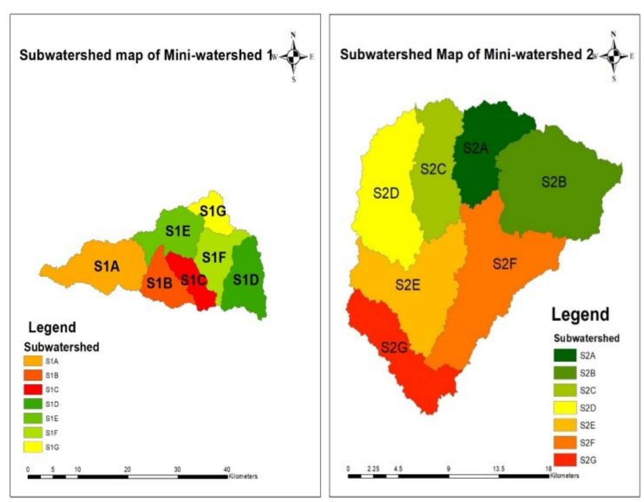


Figure 3 Subwatershed map

Table 1: Formula adopted for computation of morphometric parameters for the study area

Sl no	Morphometric parameters	Formula	Refrence
1	Stream order	Hierarchial rank	Strahler (1964)
2	Stream length (Lu)	Length of the stream	Horton (1945
3	Mean stream length (Lsm)	Lsm = ? Lu / Nu Where, Lsm = Mean stream length Lu = Total stream length of order 'u' Nu = Total no. of stream segments of order 'u'	Strahler (1964)
4	Stream length ratio (RL	RL = Lu / Lu – 1 Where, RL = Stream length ratio Lu = The total stream length of the order 'u' Lu – 1 = The total stream length of its next lower order	Horton (1945)
5	Bifurcation ratio (Rb)	Rb = Nu / Nu + 1 Where, Rb = Bifurcation ratio Nu = Total no. of stream segments of order 'u' Nu + 1 = Number of segments of the next higher order	Schumn (1956)
6	Relief ratio (Rh)	Rh = H / Lb Where, Rh = Relief ratio H = Total relief (Relative relief) of the basin (km) Lb = Basin length	Schumn (1956)
7	Drainage density (D)	D = Lu / A Where, D = Drainage density Lu = Total stream len gth of all orders A = Area of the basin (Sq km)	Horton (1932)
8	Stream frequency (Fs)	Fs = Nu / A Where, Fs = Stream frequency Ns = Total no. of streams segments A = Area of the basin (Sq km)	Horton (1932)
9	Form factor (Rf)	Rf = A / Lb Where, Rf = Form factor A = Area of the basin (Sq km) Lb = basin length	Horton (1932)
10	Circularity ratio (Rc)	$Rc = (4 * Pi * A)^{1/2} / P^2$ Where, Rc = Circularity ratio Pi = 'Pi' value i.e., 3.14 A = Area of the basin (Sq km) P^2 = Square of the perimeter (km)	Miller (1953)
11	Elongation ratio (Re)	Re = 2 (A/Pi)½ / Lb Where, Re = Elongation ratio A = Area of the basin (Sq km) Pi = 'Pi' value i.e., 3.14 and Lb = Basin length	Schumn (1956)

Table 2 : Subwatersheds of Cauvery Catchment

Subwatersheds	Area(km^2)	Perimeter(km)	Length(km)	Width(km)
S1A	131.66	71.41	21.49	7.35
S1B	60.05	44.97	12.31	6.42
S1C	46.57	42.58	12.37	5.04
S1D	87.63	51.88	13.10	7.88
S1E	83.4	59.2	13.25	6.85
S1F	72.47	54.75	12.42	6.63
S1G	37.55	36.71	8.05	6.97
S2A	34.83	33.72	8.90	4.50
S2B	72.6	42.73	9.24	10.25
S2C	38.18	38.48	11.3	3.98
S2D	52.96	42.38	12.7	4.95
S2E	55.53	51.5	11.2	8.28
S2F	71.51	59.54	15.08	6.21
S2G	35.22	42.39	12.17	3.24

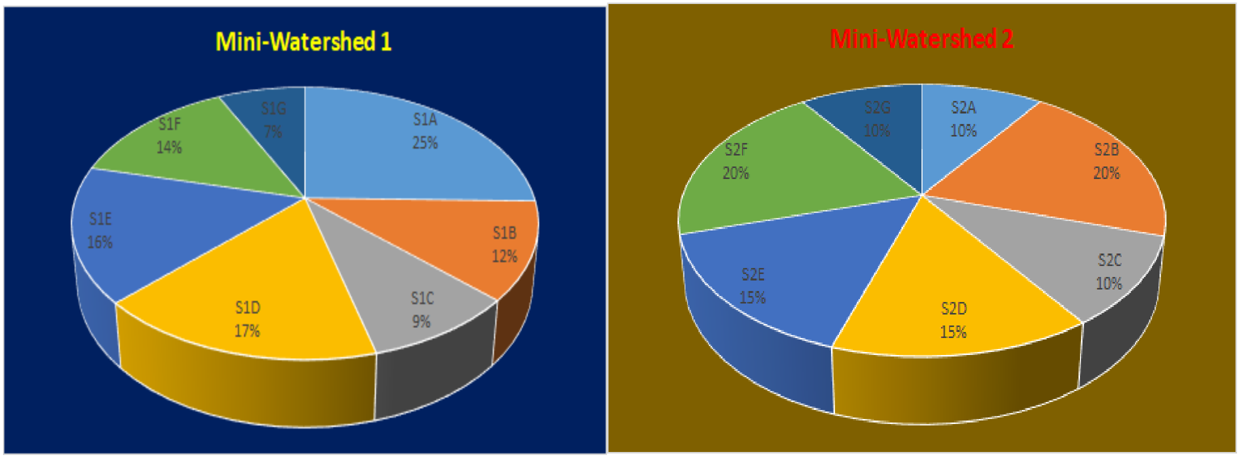


Figure 4 Percentage area distribution of Subwatershed

Table 3: Linear Morphometric Characteristics of Subwatersheds in Miniwatershed 1

Subwatershed	Stream order	No of Streams	Total length of Streams (km)	Cumulative Length(km)	Mean Stream Length(km)	Bifurcation Ratio	Length Ratio
S1A	1	114	88.78	88.78	0.78		
	2	25	34.75	123.53	1.39	4.56	1.78
	3	6	25.72	149.25	4.29	4.16	3.08
	4	2	9.24	158.49	4.62	3	1.08
	5	1	2.69	161.18	2.69	2	0.58
S1B	1	57	40.17	40.17	0.70		
	2	10	17.34	57.51	1.73	5.70	2.46
	3	3	11.39	68.90	3.80	3.333	2.19
	4	1	7.54	76.44	7.54	3	1.99
S1C	1	39	26.80	26.80	0.69		
	2	8	12.91	39.71	1.61	4.88	2.35
	3	2	12.39	52.10	6.20	4	3.84
	4	1	4.60	56.70	4.60	2	0.74
S1D	1	65	66.45	66.45	1.02		
	2	18	27.06	93.51	1.50	3.61	1.47
	3	4	22.10	115.61	5.53	4.5	3.68
	4	1	4.16	119.77	4.16	4	0.75
S1E	1	70	53.50	53.50	0.76		
	2	16	19.54	73.04	1.22	4.38	1.60
	3	2	6.64	79.68	3.32	8	2.72
	4	2	2.78	82.46	1.39	1	0.42
	5	2	7.83	90.29	3.92	1	2.82
	6	1	12.12	102.41	12.12	2	3.10
S1F	1	54	43.68	43.68	0.81		
	2	15	23.14	66.82	1.54	3.60	1.91
	3	2	14.58	81.40	7.29	7.5	4.73
	4	1	7.84	89.24	7.84	2	1.08
	1	30	19.63	19.63	0.65		
	2	8	14.22	33.85	1.78	3.75	2.72

S1G	3	1	0.52	34.37	0.52	8	0.29
	4	1	4.70	39.07	4.70	1	9.04
	5	0	0.00	39.07	-	-	-
	6	1	6.50	45.57	6.50	-	-

Table 4: Linear Morphometric Characteristics of Subwatersheds in Miniwatershed 2

Subwatershed	Stream order	No of Streams	Total length of Streams (km)	Cumulative Length(km)	Mean Stream Length(km)	Bifurcation Ratio	Length Ratio
S2A	1	28	24.08	24.08	0.86		
	2	4	14.13	38.21	3.53	7.00	4.11
	3	1	5.94	44.15	5.94	4	1.68
S2B	1	66	48.76	48.76	0.74		
	2	13	27.93	76.69	2.15	5.08	2.91
	3	3	12.49	89.18	4.16	4.333333333	1.94
	4	1	2.31	91.49	2.31	3	0.55
S2C	1	34	25.41	25.41	0.75		
	2	7	10.60	36.01	1.51	4.86	2.03
	3	2	12.14	48.15	6.07	3.5	4.01
	4	1	0.63	48.78	0.63	2	0.10
S2D	1	43	36.94	36.94	0.86		
	2	9	24.01	60.95	2.67	4.78	3.11
	3	2	7.22	68.17	3.61	4.5	1.35
	4	1	4.55	72.72	4.55	2	1.26
S2E	1	49	37.08	37.08	0.76		
	2	7	18.50	55.58	2.64	7.00	3.49
	3	1	5.30	60.88	5.30	7	2.01
	4	2	3.04	63.92	1.52	0.5	0.29
	5	1	9.01	72.93	9.01	2	5.93
S2F	1	53	53.03	53.03	1.00		
	2	9	17.15	70.18	1.91	5.89	1.90
	3	1	10.48	80.66	10.48	9	5.50
	4	1	17.23	97.89	17.23	1	1.64
S2G	1	31	25.64	25.64	0.83		
	2	5	5.97	31.61	1.19	6.20	1.44
	3	1	8.13	39.74	8.13	5	6.81
	4	1	0.28	40.02	0.28	1	0.03
	5	1	5.06	45.08	5.06	1	18.07

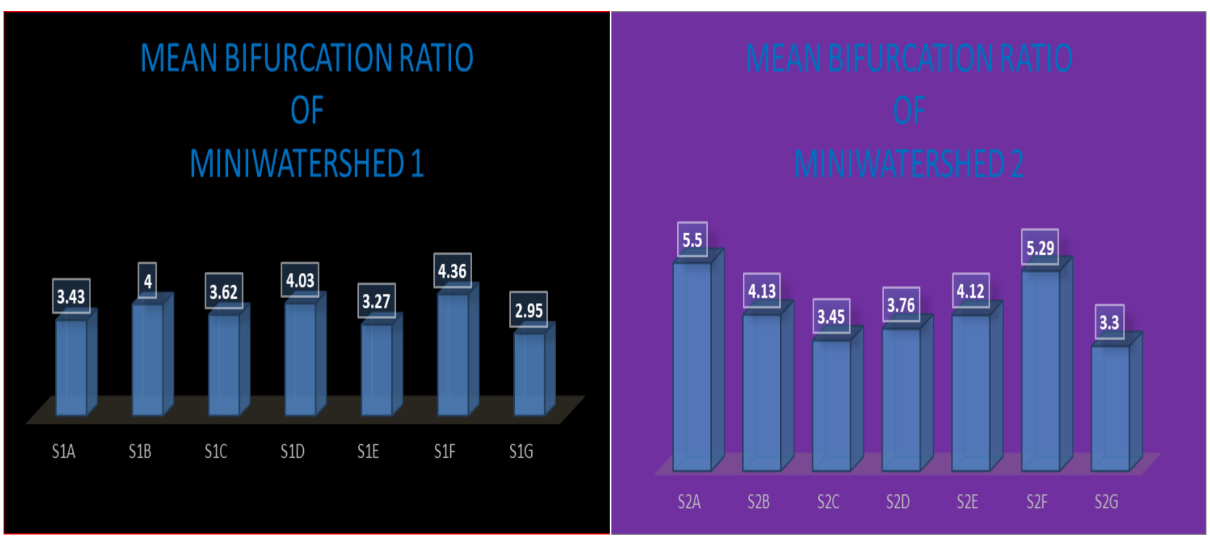


Figure 5 Bifurcation Ratio

3.2 Priortization of subwatersheds

Morphometric aspects such as Bifurcation ratio (Rb), Drainage density (Dd), Stream frequency (Ns), Texture ratio (T), Form factor (Rf), Circularity ratio (Rc), Elongation Ratio (Re), length of overland flow, Basin Shape (Bs), compactness ratio(Cc) are also termed as erosin risk assessment parameters and have been used for prioritizing subwatersheds (Biswas et al 1999). The preliminary priority ranking of sub-watersheds was done on the basis of morphological characteristics the parameters such as Bifurcation ratio(Rb), Stream frequency (Ns), Drainage density(Dd), Texture ratio(T), have a direct relationship with erodibility higher values of all these have been have been given rank 1 second largest is rated as rank 2 and so on with the least ranked last in each of the mini watersheds. Parameters such as Form factor (Rf), Circularity ratio (Rc), Elongation Ratio (Re), Basin Shape (Bs) have inverse relationship with the erodibility higher the value less is erosion lower the value high is erodibility. In this manner least estimations of this is appraised as rank 1 and second least been rated as rank 2 and so on and the highest values is given last rank. The final priority ranking and related categorization were made on the basis of the compound factor value, which was computed by multiplying the ranks from morphometric analysis and their weights obtained using cross-correlation analysis of these parameters to give compound factor for final prioritization of sub-watersheds. The compound factor is calculated using equation 1.

$CF = PPR_{mp} \times W_{mp}$ (1) Where CF is compound factor, PPR_{mp} is the preliminary priority rank based on morphometric parameter, and W_{mp} is the weight of morphometric parameter obtained using cross correlation analysis. Based on final value of compound factor Subwatershed with least rating was assigned highest rank next value was assigned second rank and so on and the subwatershed with highest compound value was assigned last rank.

3.2.1 Prioritization of sub-watershed based on weighted sum approach

The cross-correlation analysis among various morphometric parameters (Table 6 and 7) was performed and tested at 5% level of significance. The priority ranks of sub-watersheds were determined on the basis of compound factor (Table 6), which was calculated using Eq.1.The value of weights assigned to a morphometric parameter was calculated by dividing the sum of correlation coefficient of each parameter by the grand total of correlations (Table 6 and 7). By assigning the weights to different parameters, a model was formulated to assess the final priority ranking. The compound factor form mini- watershed 1 prioritization was computed as follows:

Compound factor =(0.2088*PPR of Rbm)+(0.4209*PPR of Dd)-(0.432*PPR of LOF)- (0.3445*PPR of Cc)+(0.3617*PPR of Rc)+(0.1195*PPR of Ns)+(0.1508*PPR of Rf)-(0.2329*PPR of Bs)+(0.2296*PPR of Re)+(0.5188*PPR of T) .

The final priority ranking was made in such a way that the lowest value of compound factor was given the priority rank of 1, the next lower value was given priority rank of 2, and so on for all the sub-watersheds. Figure 10 shows the final priority ranking map of 14 sub-watersheds under study.

Based on the compound factor value, all the subwatersheds of both Mini-watersheds were classified into five priority categories such as (i) very high (0 to 2.5), (ii) high (2.5 to 5.0), (iii) medium (5.0 to 7.5), (iv) low (7.5 to 10.0), and (v) very low (>10.0) as given in Table 11 and 12. It was observed from Table 11 that the three sub-watersheds (S1A, S1B and S1F) were under very high category, two sub-watersheds (S1D and S1E) under high category, one sub-watersheds (S1C) under medium, and one sub-watershed (S1G) was under very low category. And from Table 12 that the two sub-watersheds (S2C and S2G) were under very high category, one sub-watersheds (S2F) under high category, four sub-watersheds (S2A, S2B, S2D and S2E) under medium.

Table 5 Morphometric Parameters of Subwatersheds

Sub Watershed	Bifurcation Ratio Mean	Drainage Density	Length Of Overland Flow	Compactness Coefficient	Circularity Ratio	Stream Frequency	Form Factor	Elongation Ratio	Shape Factor	Texture Ratio
S1A	3.43	1.224	0.408	1.761	0.325	1.124	0.285	0.602	3.508	1.59
S1B	4	1.273	0.393	1.640	0.374	1.182	0.396	0.711	2.523	1.26
S1C	3.62	1.218	0.411	1.760	0.323	1.074	0.304	0.622	3.286	0.91
S1D	4.03	1.367	0.366	1.560	0.41	1.004	0.511	0.866	1.958	1.25
S1E	3.27	1.228	0.407	1.830	0.299	1.115	0.475	0.777	2.103	1.18
S1F	4.36	1.231	0.406	1.810	0.304	0.994	0.47	0.773	2.129	0.96
S1G	2.95	1.222	0.409	1.690	0.351	1.119	0.579	0.858	1.726	0.82
S2A	5.5	1.268	0.394	1.61	0.385	0.95	0.44	0.748	2.27	0.83
S2B	4.13	1.26	0.396	1.41	0.5	1.14	0.85	1.04	1.17	1.544

S2C	3.45	1.277	0.391	1.76	0.324	1.15	0.299	0.616	3.34	0.883
S2D	3.76	1.373	0.364	1.64	0.37	1.03	0.328	0.646	3.04	1.014
S2E	4.12	1.313	0.38	1.95	0.263	1.08	0.442	0.75	2.26	0.951
S2F	5.29	1.368	0.365	1.99	0.253	0.89	0.314	0.632	3.18	0.89
S2G	3.3	1.28	0.39	2.01	0.246	1.1	0.23	0.55	4.2	0.731

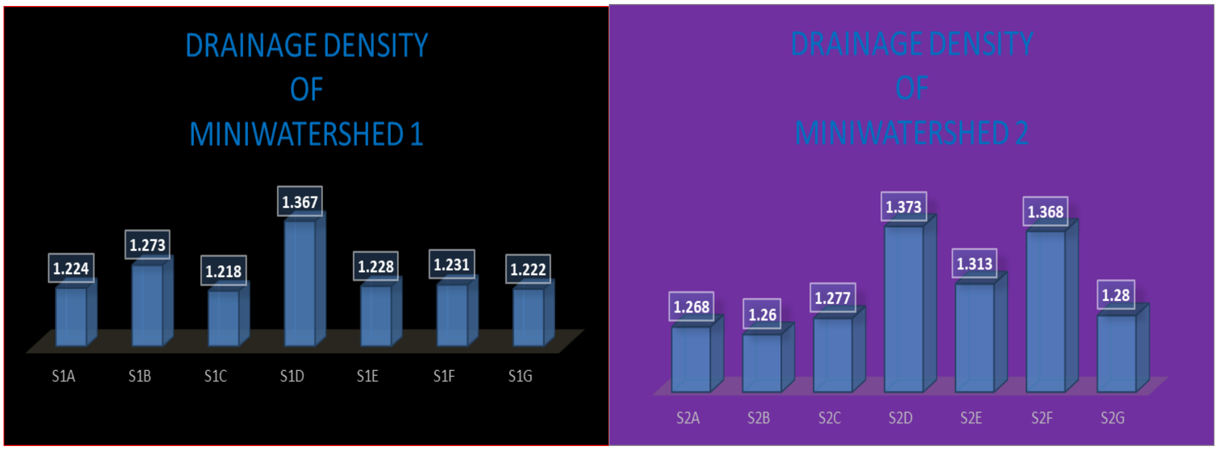
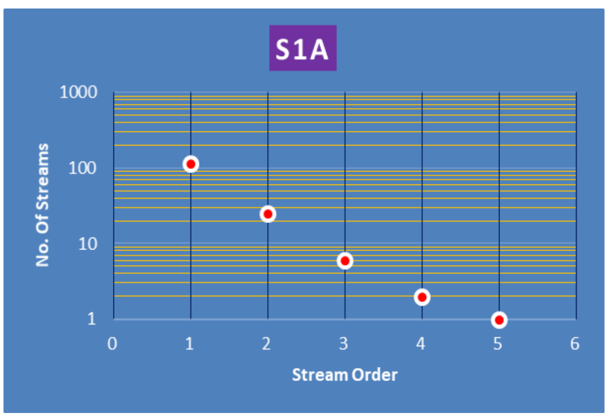
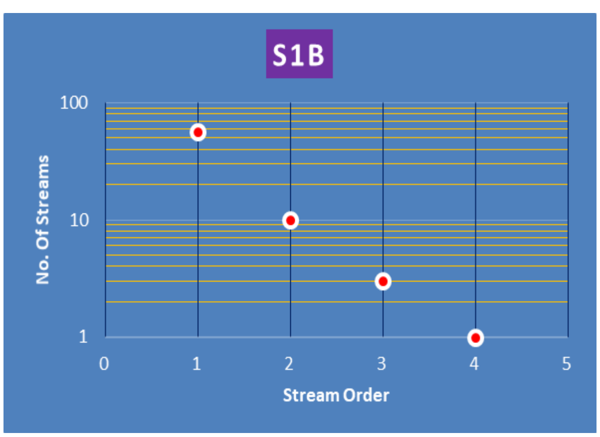
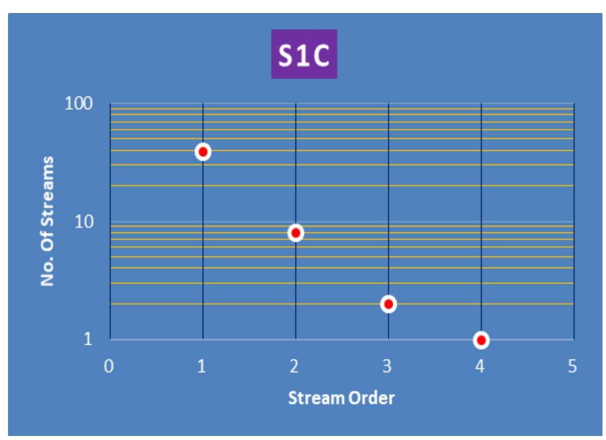
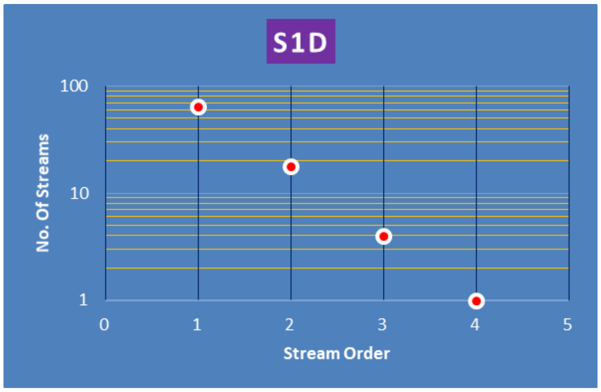


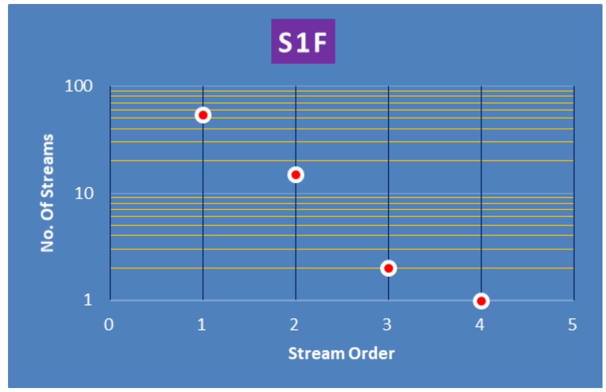
Figure 6 Drainage density

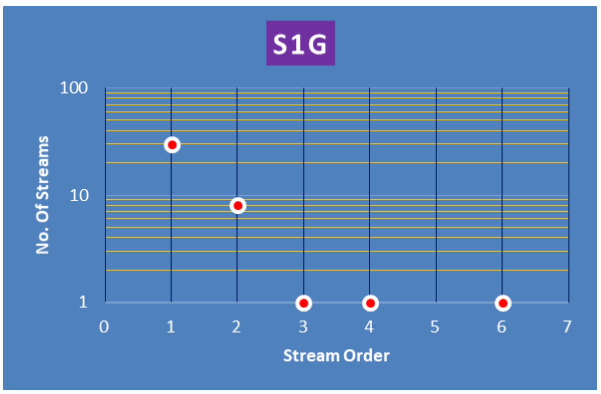


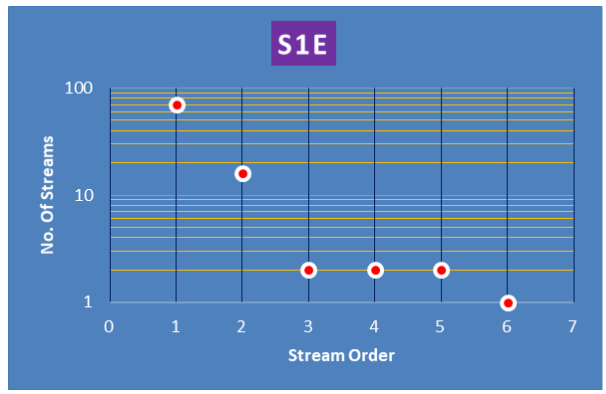


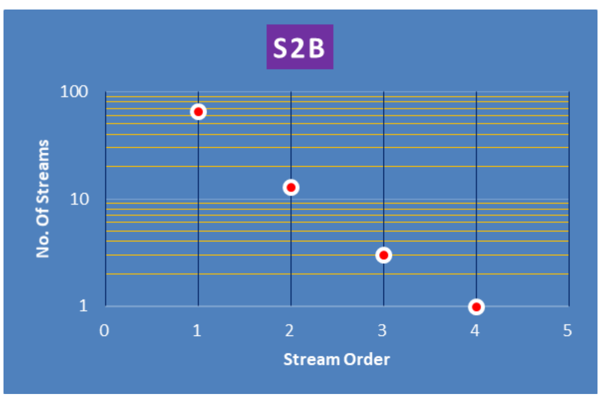


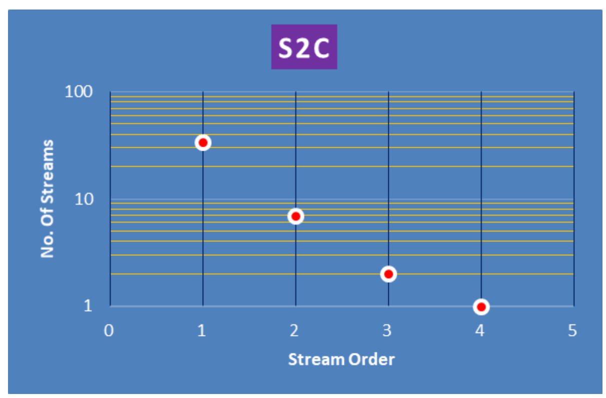

S1D
100
10
1
No. Of Streams
0 1 2 3 4 5
Stream Order

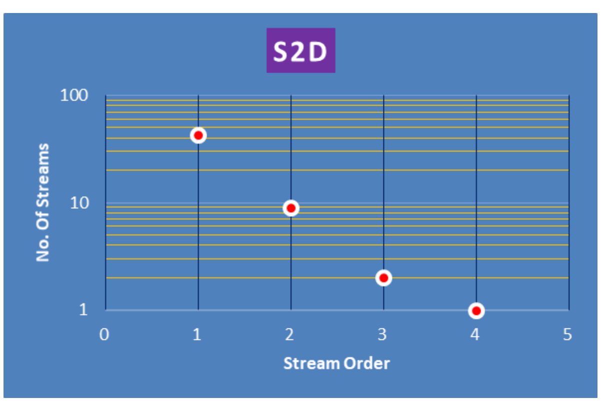

S1F
100
10
1
No. Of Streams
0 1 2 3 4 5
Stream Order

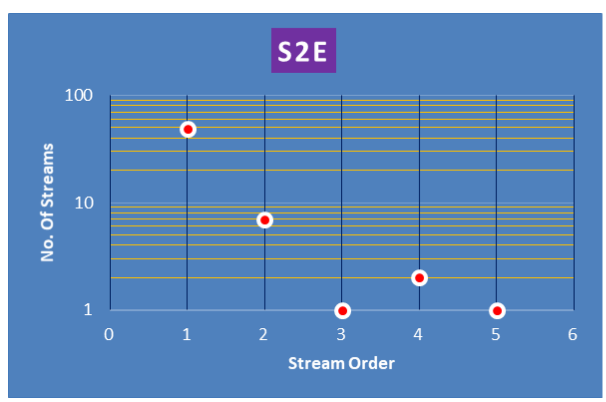

S1G
100
10
1
No. Of Streams
0 1 2 3 4 5 6 7
Stream Order


S1E
100
10
1
No. Of Streams
0 1 2 3 4 5 6 7
Stream Order


S2B
100
10
1
No. Of Streams
0 1 2 3 4 5
Stream Order


S2C
100
10
1
No. Of Streams
0 1 2 3 4 5
Stream Order


S2D
100
10
1
No. Of Streams
0 1 2 3 4 5
Stream Order


S2E
100
10
1
No. Of Streams
0 1 2 3 4 5 6
Stream Order

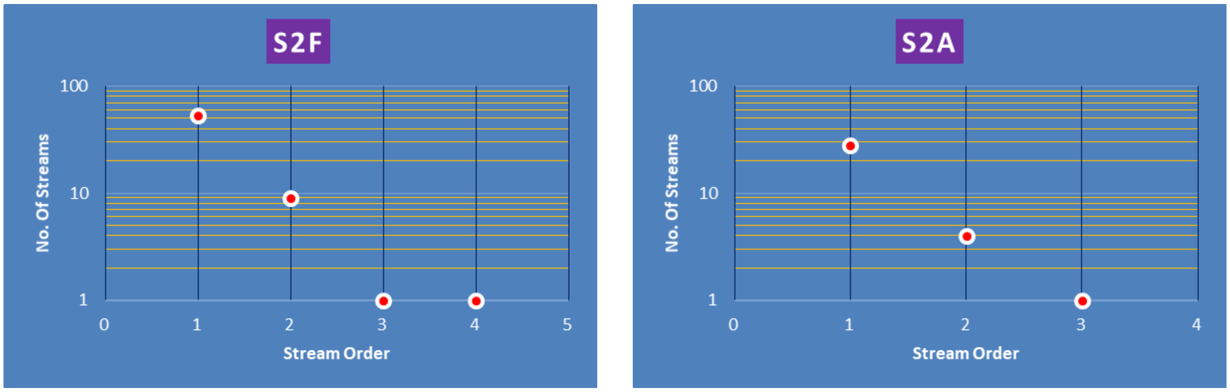
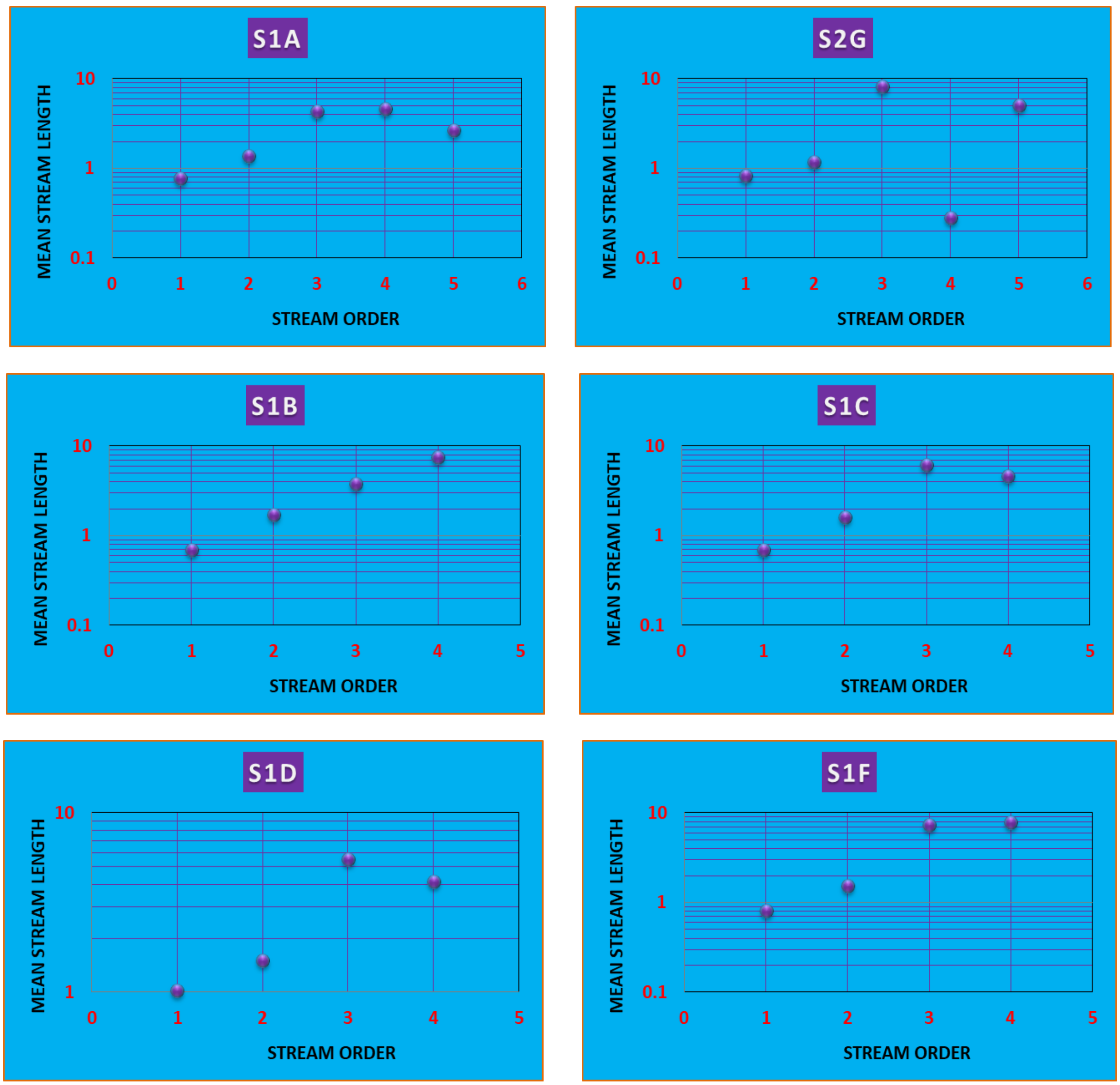


Figure 7 Regression of stream order vs No of Streams



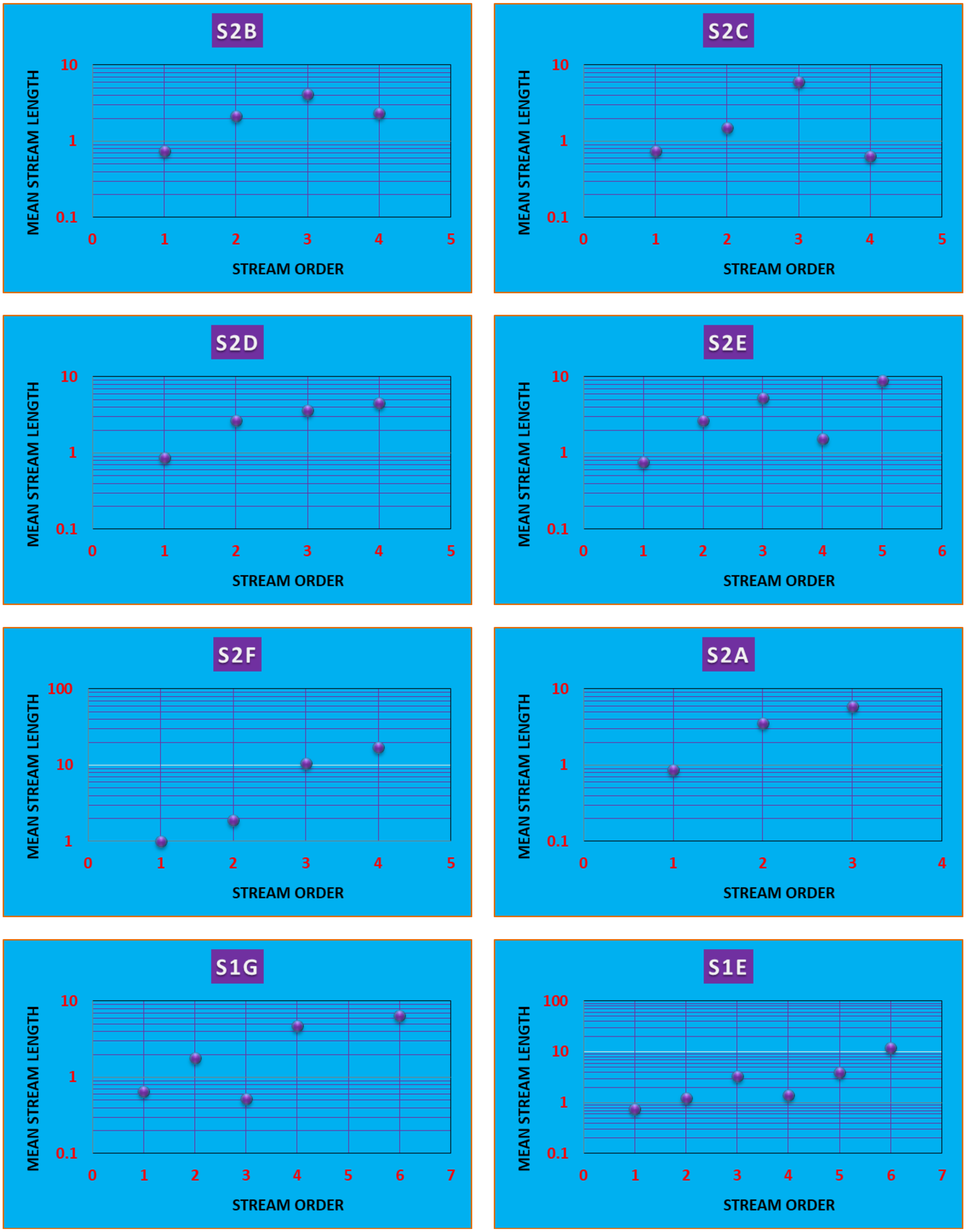


Figure 8 Regression of stream order vs mean stream length

Table 6: Preliminary priority ranking of Mini-watershed 1

Subwatershed	Bifurcation Ratio Mean	DRAINAGE DENSITY	LENGTH OF OVERLAND FLOW	COMPACTNESS COEFFICIENT	CIRCULARITY RATIO	Stream Frequency	Form Factor	ELONGATION RATIO	Shape Factor	Texture Ratio
S1A	1	6	2	2	6	6	5	5	3	6
S1B	3	7	1	1	7	2	7	7	1	1
S1C	6	5	3	4	4	1	2	2	6	5
S1D	5	1	7	3	5	5	4	4	4	2
S1E	4	3	5	5	3	4	6	6	2	3
S1F	2	2	6	6	2	7	3	3	5	4
S1G	7	4	4	7	1	3	1	1	7	7

Table 7: Preliminary priority ranking of Mini-watershed 2

Subwatershed	Bifurcation Ratio Mean	DRAINAGE DENSITY	LENGTH OF OVERLAND FLOW	COMPACTNESS COEFFICIENT	CIRCULARITY RATIO	Stream Frequency	Form Factor	ELONGATION RATIO	Shape Factor	Texture Ratio
S2A	1	6	2	2	6	6	5	5	3	6
S2B	3	7	1	1	7	2	7	7	1	1
S2C	6	5	3	4	4	1	2	2	6	5
S2D	5	1	7	3	5	5	4	4	4	2
S2E	4	3	5	5	3	4	6	6	2	3
S2F	2	2	6	6	2	7	3	3	5	4
S2G	7	4	4	7	1	3	1	1	7	7

Table 8: Cross-correlation matrix between various parameters of mini watershed 1

	Rbm	Dd	LOF	Cc	Rc	Ns	Rf	Re	Bf	T
Rbm	1.0000	0.4332	-0.4402	-0.1644	0.1769	-0.4973	-0.3141	-0.1696	0.1903	0.3935
Dd	0.4332	1.0000	-0.9995	-0.8282	0.8541	-0.3170	0.2110	0.4530	-0.2648	0.6843
LOF	-0.4402	-0.9995	1.0000	0.8277	-0.8538	0.3033	-0.2194	-0.4591	0.2777	-0.6973
Cc	-0.1644	-0.8282	0.8277	1.0000	-0.9986	-0.0332	-0.2094	-0.3791	0.1939	-0.4121
Rc	0.1769	0.8541	-0.8538	-0.9986	1.0000	0.0199	0.2166	0.3939	-0.2079	0.4527
Ns	-0.4973	-0.3170	0.3033	-0.0332	0.0199	1.0000	-0.1483	-0.2690	0.1409	0.1490
Rf	-0.3141	0.2110	-0.2194	-0.2094	0.2166	-0.1483	1.0000	0.9645	-0.9801	-0.0816

Re	-0.1696	0.4530	-0.4591	-0.3791	0.3939	-0.2690	0.9645	1.0000	-0.9585	0.0926
Bf	0.1903	-0.2648	0.2777	0.1939	-0.2079	0.1409	-0.9801	-0.9585	1.0000	-0.0699
T	0.3935	0.6843	-0.6973	-0.4121	0.4527	0.1490	-0.0816	0.0926	-0.0699	1.0000
Sum	0.6083	1.2261	-1.2607	-1.0036	1.0538	0.3482	0.4393	0.6688	-0.6784	1.5112
Grand Total	2.9130	2.9130	2.9130	2.9130	2.9130	2.9130	2.9130	2.9130	2.9130	2.9130
Weight	0.2088	0.4209	-0.4328	-0.3445	0.3617	0.1195	0.1508	0.2296	-0.2329	0.5188

Table 9: Cross-correlation matrix between various parameters of mini watershed 2

	Rbm	**Dd**	**LOF**	**Cc**	**Rc**	**Ns**	**Rf**	**Re**	**Bf**	**T**
Rbm	1.0000	0.5342	-0.5390	0.1490	-0.0933	-0.8084	0.1785	0.2012	-0.3039	0.1713
Dd	0.5342	1.0000	-0.9996	0.2771	-0.3315	-0.8530	-0.4294	-0.3970	0.2242	-0.3059
LOF	-0.5390	-0.9996	1.0000	-0.2949	0.3484	0.8554	0.4341	0.4006	-0.2246	0.3160
Cc	0.1490	0.2771	-0.2949	1.0000	-0.9893	-0.4446	-0.7654	-0.7527	0.7016	-0.8806
Rc	-0.0933	-0.3315	0.3484	-0.9893	1.0000	0.4332	0.8370	0.8212	-0.7484	0.9295
Ns	-0.8084	-0.8530	0.8554	-0.4446	0.4332	1.0000	0.3447	0.3269	-0.2215	0.2917
Rf	0.1785	-0.4294	0.4341	-0.7654	0.8370	0.3447	1.0000	0.9977	-0.9413	0.9698
Re	0.2012	-0.3970	0.4006	-0.7527	0.8212	0.3269	0.9977	1.0000	-0.9613	0.9652
Bf	-0.3039	0.2242	-0.2246	0.7016	-0.7484	-0.2215	-0.9413	-0.9613	1.0000	-0.9171
T	0.1713	-0.3059	0.3160	-0.8806	0.9295	0.2917	0.9698	0.9652	-0.9171	1.0000
Sum	0.4896	-1.2809	1.2963	-1.9999	2.2068	0.9244	2.6258	2.6018	-2.3923	2.5399
Grand Total	7.0114	7.0114	7.0114	7.0114	7.0114	7.0114	7.0114	7.0114	7.0114	7.0114
Weight	0.0698	-0.1827	0.1849	-0.2852	0.3147	0.1318	0.3745	0.3711	-0.3412	0.3623

Table 10 : Final Priority Ranking

Subwatersheds Name	Compound factor	Rank	Subwatersheds Name	Compound factor	Rank
S1A	1.0853	1	S2A	6.32865	6
S1B	1.4874	2	S2B	6.53433	7
S1C	6.1268	6	S2C	1.55998	2
S1D	4.3134	5	S2D	5.17446	4
S1E	2.9078	4	S2E	5.57464	5
S1F	1.9841	3	S2F	2.70167	3
S1G	10.0756	7	S2G	0.09799	1

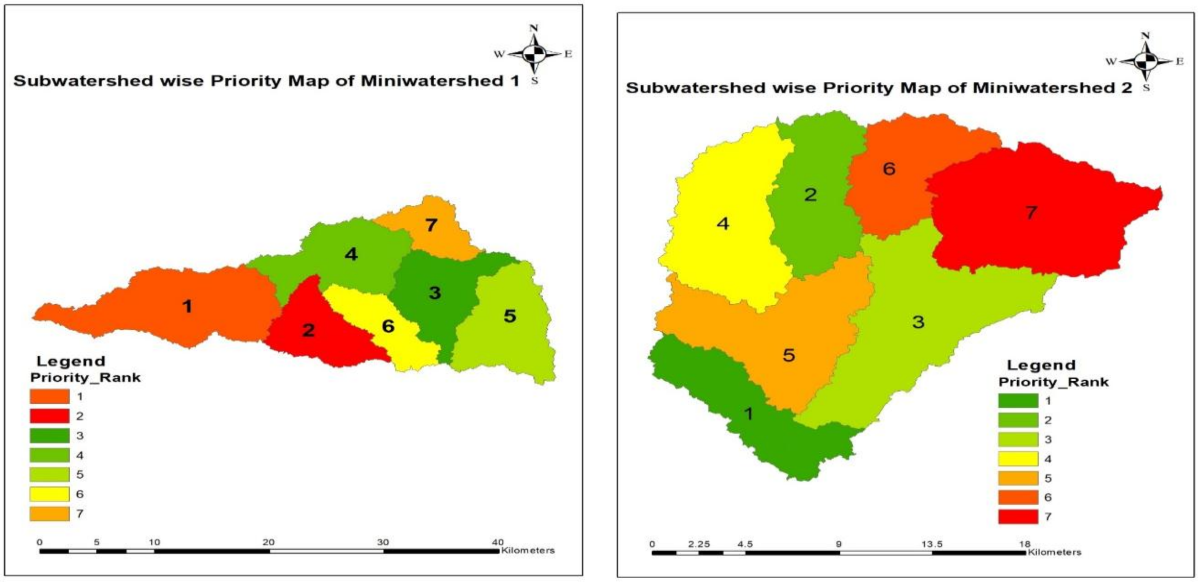


Figure 9 Priority Map

Table 11: Priority category based on compound factor for mini-watershed 1				
Sl No	Priority Level	Priority Category	Subwatershed name	% Area
1	0.0-2.5	Very High	S1A, S1B,S1F	50.87
2	2.5-5.0	High	S1D, S1E	32.94
3	5.0-7.5	Medium	S1C	8.96
4	7.5-10.0	Low	-	-
5	>10.0	Very Low	S1G	7.23

Table 12: Priority category based on compound factor for mini-watershed 2				
Sl No	Priority Level	Priority Category	Subwatershed name	% Area
1	0.0-2.5	Very High	S2C, S2G	20.34
2	2.5-5.0	High	S2F	19.82
3	5.0-7.5	Medium	S2A, S2B,S2D,S2E	59.84
4	7.5-10.0	Low	-	-
5	>10.0	Very Low	-	-

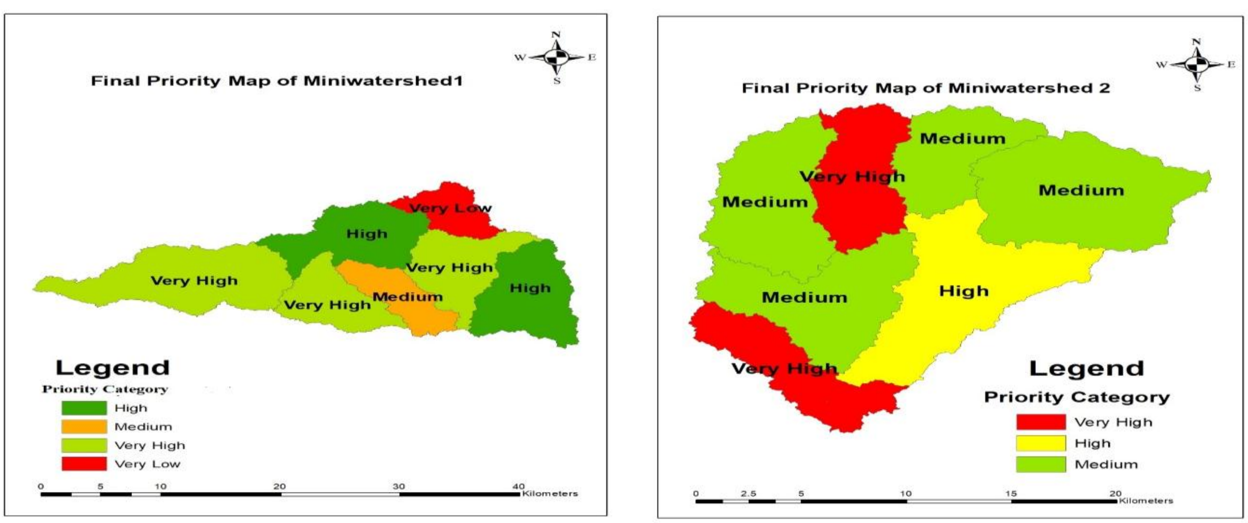


Figure 10 Final priority category map

IV. CONCLUSIONS

The length of overland flow (lof) for majority of the subwatersheds in the present study is more than 0.30 hence they have longer flow paths associated with more infiltration and reduced runoff. Stream frequency (Ns) for present study is low demonstrating relatively a low runoff. Higher value of form factor (Rf) indicates wider basin and lower value indicates narrow basin. Drainage density varies from1.222 km/km^2 to 1.373 km/km^2 indicating subwatersheds fall under coarse and very coarse texture. From table 11 and 12 it can be found that the 50.87 % of area of mini-watershed 1 falls under very high priority category where as 20.34% of area of mini-watershed falls under this category. 8.96 % of area of mini-watershed 1 falls under Medium priority category where as 59.84 % of area of mini-watershed falls under this category. We can also conclude that in case of unavailability of soil maps this type of study could be used in selecting area for soil conservation measure.

REFERENCES

[1]. Horton R.E.(1945). Erosional Development of streams and their drainage basins, Hydro physical approach to quantitative morphology. Geological Society of American Bulletin. 56: 275-370.

[2]. Mohammed Badiuddin Parvez, M Inayathulla "Prioritization Of Subwatersheds of Cauvery Region Based on Morphometric Analysis Using GIS", International Journal for Research in Engineering Application & Management (IJREAM), Volume: 05 Issue: 01, April -2019.

[3]. Mohammed Badiuddin Parvez, M Inayathulla "Modelling of Short Duration Isopluvial Map For Raichur District Karnataka", International Journal for Science and Advance Research in Technology (IJSART), Volume: 05 Issue: 4, April -2019.

[4]. Mohammed Badiuddin Parvez, and M .Inayathulla. "Morphometry, Hypsometry Analysis and Runoff Estimation of Aam Talab Watershed Raichur, Karnataka" International Journal Of Advance Research And Innovative Ideas In Education Volume 5 Issue 3 2019 Page 1713-1727

[5]. Mohammed Badiuddin Parvez, M Inayathulla, "Development of S Curve for Mini-Watershed of Raichur City Karnataka", International Journal of Scientific Research in Multidisciplinary Studies , Vol.5, Issue.8, pp.1-11, 2019.

[6]. Vijith, H and Sateesh, R. (2006). GIS based morphometric analysis of two major upland Sub-watershed of Meenachil river in Kerala. Journal of Indian society of Remote Sensing. 34(2): 181-185.

Authors Profile

Mohammed Badiuddin Parvez Is a life member of Indian Water Resources Society, ASCE Born in Gangavathi, Obtained his BE in Civil Engineering in the year 2009-2013 from UVCE, Banagalore and M.E with specialization on Water Resources Engineering during 2013-2015 from UVCE, Bangalore University and Pursuing Ph.D from Bangalore University. And has 3 years of teaching experience. Till date, has presented and published several technical papers in many National and International seminars, Journals and conferences.

Dr M Inayathulla Is a life member of Environmental and Water Resources Engineering (EWRI), ASCE, WWI, ASTEE, ASFPM. Born in Karnataka, Obtained his BE in Civil Engineering in the year 1987-1991 from UBDT, Davanagere and M.E with specialization on Water Resources Engineering during 1992-1994 from UVCE, Bangalore University and got Doctorate from Bangalore University in the year 1990-1995. Presently working as Professor at UVCE, Bangalore University, India. And has more than 25 years of teaching experience. Till date, has presented and published several technical papers in many National and International seminars and conferences.

