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Sr. No	Title of the Article and Name of the Author	Page No.
1	The Socio-Economic Impact of Wireless Telecommunication Services in India- Dr. Basavaraj S. Kudachimath and Mr. Nikhil S. Ragashetti	1
2	New Challenges Faced by Construction Worker's of Marathwda Region in a Globalizing World - Ambulgekar Kailash Gangadhar	6
3	Article 370- Dr. Manjiri Karekar	16
4	Divyang Reservation Policy in India and its Impact for Divyang Persons. - Mr. Thakur Baldeep Singh Chatur Singh and Dr Dattatray Sopan Yadav	19
5	Issues and Challenges of Women Empowerment in India- Dr. Asha S. Patil,	26
6	Sociological Perspectives on Women's empowerment- Dr. Chandrakant D. Kamble	30
7	Analytical study of the dispute between the RBI and the government of India- Dr. Ghuge Sunil Balu	34
8	Human Security and Arms Race- Dr. Mohd.Yousuf Bhat	39
9	Debates on CAA & NRC- Dr. Pravin S. Sasane	50
10	A Critical Study of Reservation System in India- Dr. Rupesh Dhumaji Bansode	54
11	An Analytical Study of the Health of Indian Economy- Dr. Somnath Patil Prof. Keshav Ubale	62
12	Role of Central Bureau of Investigation in eradicating corruption in India -Dr.Wahida Shaikh,	66
13	“The Assessment of Environment impact on Pilgrimage Destination and changing Scenario of Globalization with special Reference to Dehu in Maharashtra”- Mr. Gandhile Ganesh Dattoba	70
14	Discourse of Nationalism and Role of the Indian State- Anand D. Jayshette	76
15	Mass Media Biasness and Affiliations - Prof. T. A. Inamdar and Prof. P. R. Gawade	80
16	Human Rights and Kashmir Issues: 370 Article.-Dr. Bidlan Jyoti Papa	83
17	Impact of Globalization on Environment- Prof. D. L. Khokale and Prof. H. A. Jadhav.	86
18	Concept of Gender Inequality - Dr. Mahesh Jaiwantrao Patil	89
19	Health of Indian Economy – Mr. Bhokse Umesh Chindhu and Dr. Mohan Kisanrao Choudhari	94
20	Gender Sensitization in Globalizing World - Mr. D. M. Bhise and Dr. Muktaja Mathakari	97
21	Portrayal of Mulk Raj Anand's Women Characters from 'Untouchable' and 'Gauri' with Reference to contemporary concept of Globalisation - Prof. Namrata Suresh Alhat	101
22	Constitutional Notion of Secularism - Padmashri Mudake	104
23	Impact of Affirmative Action on Tribal Education in India: Some Problems and Challenges - Mr. Pandurang Kashiram Bhoys	108
24	Current Situation of Poverty and Health of Indian Economy - Prof. Potdar Pravin Ramesh and Dr. Bhosale Meghana Madhukar	119

25	Impact of Gender Inequality in Education on Economic Development- Miss Sangita Sahebrao Borse	126
26	Impact of Globalization on the living Standard of Scheduled Tribes in villages of Maharashtra - Dr. Savita Kulkarni and Mrs.Shital Gaikwad	132
27	Question of Gender in Globalizing world and Indian English Fiction- Miss. Shashikala Walmiki	136
28	A Case Study of Identity Crisis of Dalit Women especially with Reference to the Participation in Political Arena- Shishupal Naresh Bhikaji	143
29	Environmental Impact and Tourism Potential of Forts in Pune District- Dr. Shivaji B. Shinde	146
30	Health of Indian Economy- Dr. Sunil J. Kavade	152
31	The health of Indian economy: The Pros and Cons- Mr. S. N. Waghmare	155
32	Environmental Implications of Globalization- Dr.Suresh S. Muluk	160
33	Kashmir Issue and Article 370- Dr. Tanpure Sambhaji Shamrao,	165
34	Morphometric Analysis of Ram Odha Sub Basin of River Nira - A.S. Bhosale and Dr. Vinod Veer	168
35	Reservation Policy and its Impact: Rights of Tribal- Dr. Vilas Awari	176
36	The Study of Business Environment- Santosh Marutirao Waghmare	180
37	An Assessment of Pilgrims Views Regarding Infrastructure Facility at Pilgrim Destination in Pune District of Maharashtra- Ganesh D. Gandhile and Dr.Jotiram C. More	185
38	निवडणूक राजकारणाच्या चक्रव्यूहात अडकलेले आरक्षण धोरण.- राहुल नरंगलकर	198
39	पारदर्शक निवडणूक आयोग : लोकशाही व्यवस्थेचा आधारस्तंभ - डॉ. इंद्रजीत जाधव	204
40	जागतिकीकरण, लिंगभाव आणि स्त्रिया - शीतल गायकवाड	206
41	जागतिकीकरणाचा पर्यावरणीय परिणाम - डॉ.मारुती घंटेवाड	214
42	भारतीय अर्थव्यवस्था का स्वास्थ्य - प्रो.स्नेहा प्रदीप हिंगमिरे	219
43	भारतीय राज्यघटना 370 कलम आणि 35(A) वास्तव परस्थिती - डॉ. जे. टी. कांबळे	223
44	नागरिकत्व दुरुस्ती कायदा २०१९ आणि त्याचे वास्तव - किर्ती विजय करंजावणे	226
45	काश्मीर प्रश्न आणि कलम 370 - मिलिंद खांदवे	232
46	काश्मीर मुद्दा आणि अनुच्छेद ३७० - सतीश उढाण	235
47	भारतातील आरक्षण धोरण आणि त्याचे परिणाम - प्रा. सूर्यवंशी अंकुश गंगाराम	237
48	महाराष्ट्रातील बदलत्या राजकीय आघाड्या व राज्यपालांच्या भूमेकेचे वादंग (अनुच्छेद २५६) - खुशाल अच्युतराव तांगडे, डॉ.अनंत अवटी आणि राहुल नरंगलकर	241
49	कलम 370: घटनात्मक तरतुदी - डॉ.सुधीर वाडेकर	245
50	कश्मीर मुद्दा और धारा 370 - डॉ.राजेश रसाल	250
51	जम्मू काश्मीर आणि कलम 370 - युवराज महाडीक आणि गया नवले	254
52	काश्मीर प्रश्न आणि कलम ३७० - डॉ. बी. डी. तोडकर	257
53	कलम ३७० रद्द करणे आणि राष्ट्रीय सुरक्षा - डॉ. सुभान तुळशीराम जाधव	261

54	स्त्रियांच्या चळवळीचा ऐतिहासिक काढावा: एक अभ्यास - डॉ. धनंजय नागोराव मोगले	267
55	भारतातील लिंगभाव समानतेचे वास्तव - प्रा. एच. टी. वाघमारे	270
56	शरद पवार यांचे देशाच्या कृषी विकासातील योगदान - प्रा. नितीन लगड	276
57	कलम ३७० व नव्या जम्मू-काश्मीर पुढील आव्हाने - बाबुराव भीमराव जाधव	279
58	आरक्षण धोरणाचे परिणाम - अजित नानासाहेब भुसनुर	281
59	स्वातंत्र्योत्तर काळातील प्रमुख चळवळी - सागर मा.कांबळे	286
60	मुस्लीम आरक्षणाचे चर्चाविश्व - मालेगावकर मो.अलीसाब	292
61	मातंग जातीचा सामाजिक आणि राजकीय अविष्कार - राहुल नरंगलकर	299
62	"एकोणिसाव्या व विसाव्या शतकातील महाराष्ट्रातील राजकीय विचार" - डॉ. गिरीश महादेव कुलकर्णी आणि प्रमोद राजेंद्र तांबे	303

Morphometric Analysis of Ram Odha Sub Basin of River Nira

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ABSTRACT

Ram Odha originates near Yeroli village and meets River Nira in the north eastern side of Bhor city in Pune district, Maharashtra state. Ram Odha sub basin of River Nira covers 51.48 Sq.km area. Tropical evergreen forest is found in this sub basin. To achieve the Morphometric analysis characteristics Survey of India (SOI) Toposheet No. 47F/16 in scale 1:50,000 was used and base map, thematic maps and drainage maps were prepared with the help of Arc GIS Software. In the present study linear and areal parameters were consider for the morphometric analysis. A. N. Strahler stream ordering method was used for identification of drainage pattern and morphometric characteristics of Ram Odha sub basin of River Nira. 255 streams were recorded in this sub basin and total stream length is 198.91 km.

Key Words: Morphometric Analysis, Toposheet, GIS.

Water is essential for the existence of all plants, animals and human being. Hydrological cycle plays vital role to provide water for the earth surface. Morphometric analysis provides the beneficial parameter for the assessment of the potential ground water region, identification of suitable site for watershed management and treatment, identification of water runoff and geographic characteristic of the drainage system. In the present study GIS is used as a tool for creation of digital data base. Arc GIS a powerful software of the analysis of geographic features was used for the Morphometric Analysis.

Study Area

Ram Odha originates near Yeroli village at the height of 1377 meter above mean sea level. This odha is one of the important streams of River Nira. *Ram Odha* stream meets River Nira near Bhor city in Bhor taluka. *Ram Odha* sub basin of River Nira covers 51.48 Sq. km. area. *Ram Odha* sub basin lies between 18° 0' north to 18° 10' north latitude and 73° 47' east to 73° 54' east longitude. The study area receives average annual rainfall above 1065 mm (Fig.1).

Objectives

1. To access digital database of *Ram Odha* sub basin of River Nira.
2. To study the morphometric characteristic of *Ram Odha* sub basin of River Nira.

Database and Methodology

The present study based on the Secondary data. Maps were created with the help of Arc GIS software using SOI Toposheet No. 47F/16. A. N. Strahler's Method was used for stream ordering. Mathematical methods were used for calculating Bifurcation Ratio, Drainage Density and Creation.

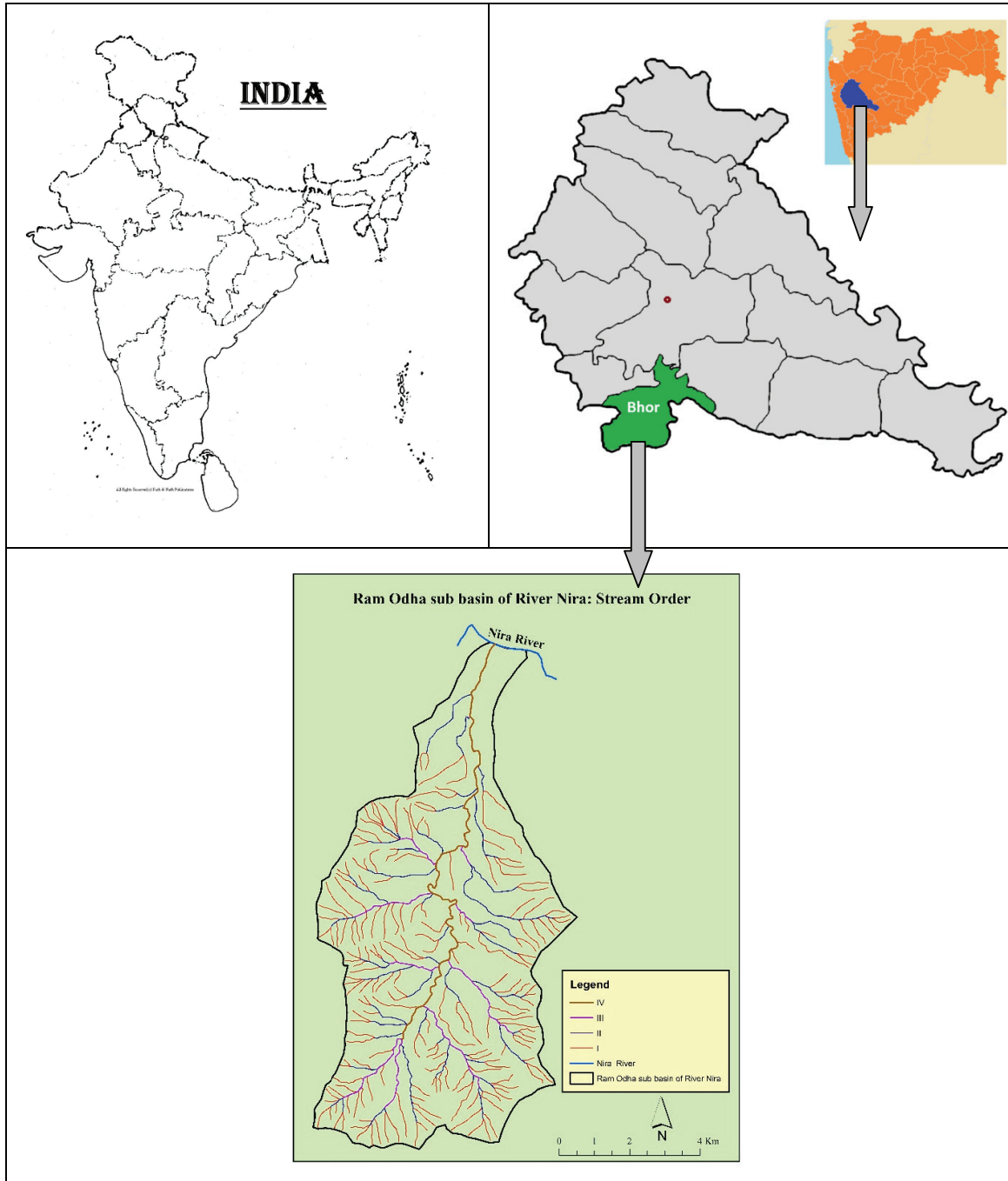
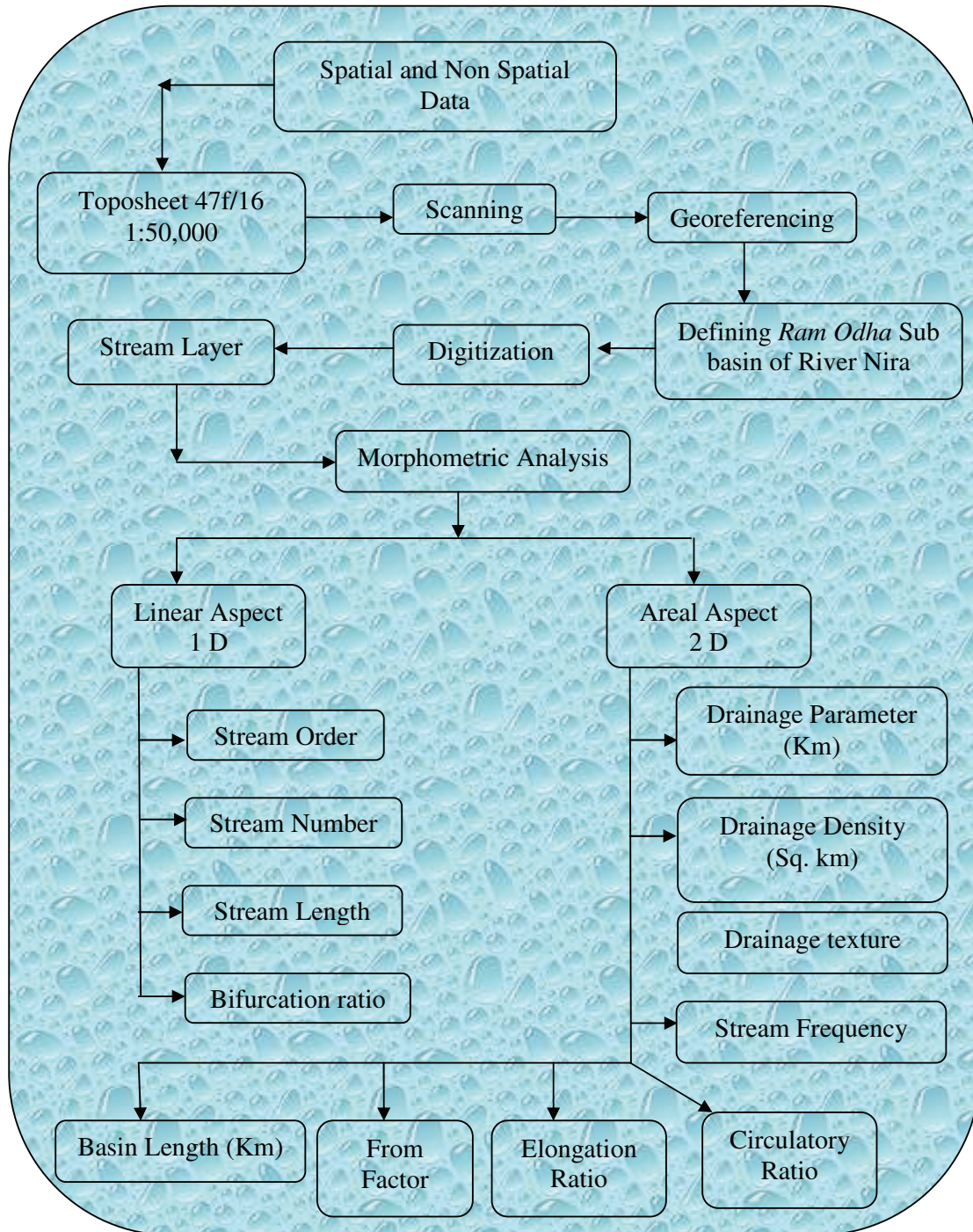


Fig: 1 Location Map

Methodology for Morphometric Analysis



Result and Discussion

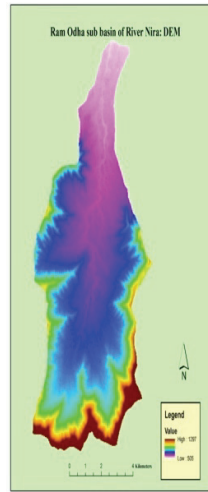


Fig: 2

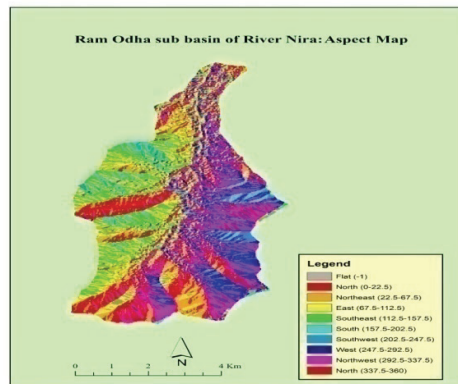


Fig: 3

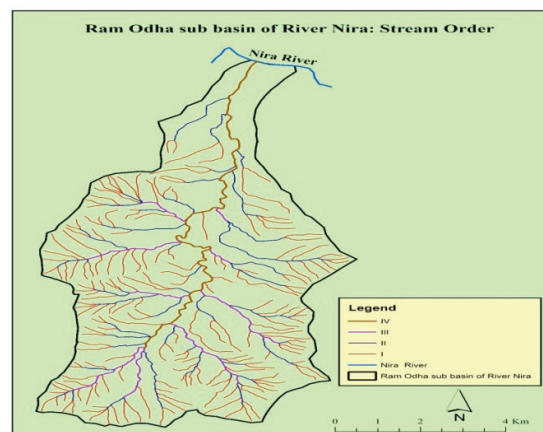


Fig: 4

Table: 1 Stream Order and Number of Stream in *Ram Odha* sub basin of River Nira

Stream order	No. of Stream	In %
I	194	76.08
II	51	20.00
III	9	3.53
IV	1	0.39
Total	255	100

Source: Compiled by Researcher

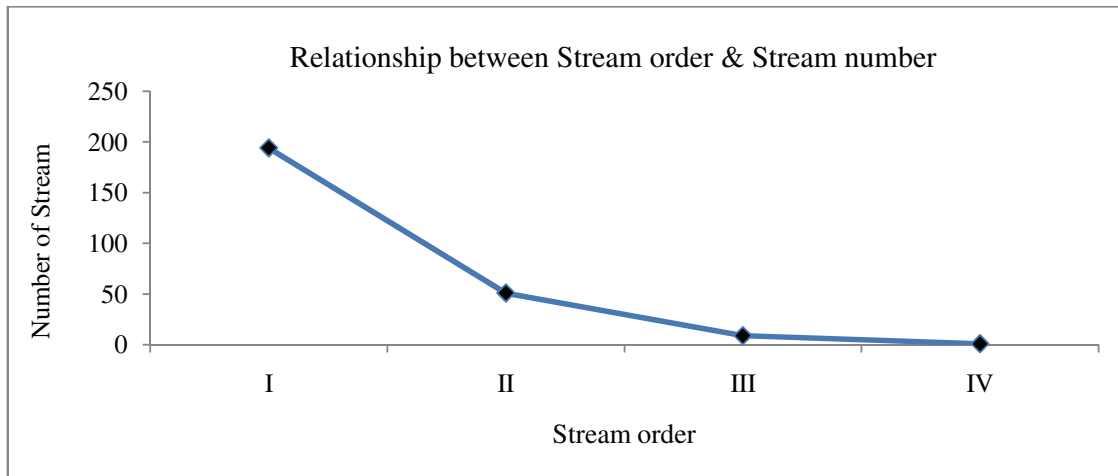


Fig: 5

The above table 1 shows the distribution of stream order and stream numbers in *Ram Odha* sub basin of River Nira. Fourth order is a last stream order in this sub basin. Total 255 streams have been observed. Among them 194 streams are of first order. Total number of second, third and fourth order streams are 61. Stream order analysis reveals that there is negative correlation between stream order and stream number (Fig.2).

Table: 2 Stream Order and Stream Length of *Ram Odha* sub basin of River Nira

Stream order	Stream Length in km	In %
I	126.67	63.68
II	42.52	21.38
III	15.95	8.02
IV	13.77	6.92
Total	198.91	100.00

Source: Compiled by Research Student

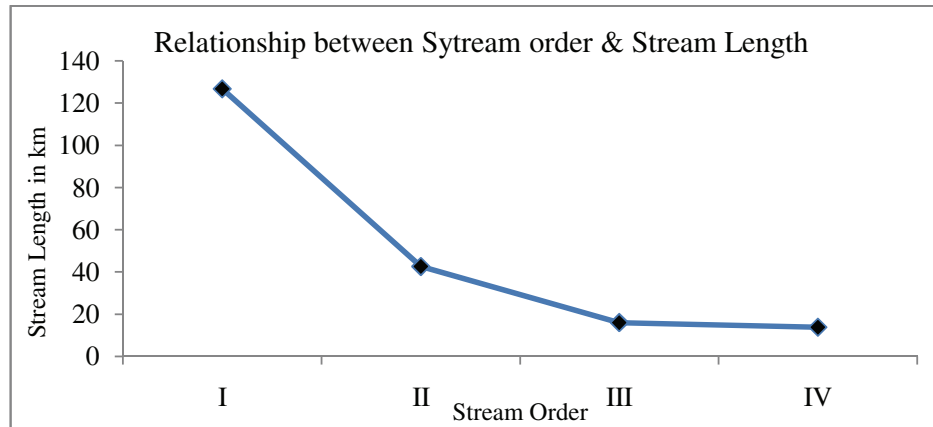


Fig: 6

The above table 2 represents the total length of streams of different orders. The total length of streams in *Ram Odha* sub basin of River Nira is 198.91 km. Out of this 126.67 km length is of first order stream. Total second order stream length is 42.52 km. Third and fourth order stream length in study region is 15.95 km and 13.77 km respectively. Stream order and stream length analysis reveals that there is negative correlation between stream order and stream length.

Table: 3 Bifurcation Ratios of *Ram Odha* sub basin of River Nira

Stream order	No. of Stream	Bifurcation Ratio
I	194	3.80
II	51	5.67
III	9	9
IV	1	-
Mean Bifurcation Ratio		4.62

Source: Compiled by Researcher

Horton (1945) defines bifurcation ratio as the ratio between the numbers of stream of any given order to the number in the next lower order. The above table 2 shows the bifurcation ratio of *Ram Odha* sub basin of River Nira. In *Ram Odha* sub basin of River Nira mean bifurcation ratio is 4.62.

Table: 4 Areal Aspect of *Ram Odha* sub basin of River Nira

Area in Sq. Km	Drainage Density in Sq.km	Perimeter in Km	Stream Frequency	Drainage Texture	Circulatory Ratio	Basin Length in Km	Elongation Ratio	Form Factor	Compactness Coefficient
51.48	3.86	36.98	4.95	6.89	0.47	13.17	0.31	0.29	0.14

Source: Compiled by Researcher

Table: 5 Methods used for Morphometric Analysis

Morphometric Parameters	Formula	Reference
1.Linear aspect		
Stream Order (U)	Hierarchical order	Strahler (1964)
Stream Length (Lu)	Length of the stream	Horton (1945)
Bifurcation Ratio (Rb)	Rb = Nu/Nu+1 Where, Nu = Total number of stream segment of order 'U'; Nu+1 = Number of segment of next higher order	Schumn (1956)
2.Areal Aspect		
Drainage Density (Dd)	Dd = L/A Where, L = Total length of streams of all orders A = Area of the basin (km ²)	Horton (1945)
Stream Frequency (Fs)	Fs = N/A Where, N = Total number of stream. A = Areas of the basin (km ²)	Horton (1945)
Drainage Texture (Rt)	Rt = Nu/P Where, Nu = Total number of streams of all orders P = Perimeter of the basin (km)	Horton (1945)
Circulatory Ratio (Rc)	Rc = 4πA/Lp ² Where, A=Area of the basin Lp=Perimeter of the basin	Miller (1953)
Elongation Ratio (Re)	Re=(2 × (A / π) ^{0.5}) / Lb Where, A=Area of watershed, π=3.14, Lb=Basin length	Schumn (1956)
Form Factor(Ff)	Ff = A / Lb ²	Horton (1932)
Compactness Coefficients (Cc)	Cc = 0.2821 P/A ^{0.5} , A = areas of basin (km ²), P = basin perimeter (km)	Horton (1945)

Conclusion

Total 255 streams have been observed in *Ram Odha* sub basin of River Nira. Among them 194 streams are of first order. Total Numbers of second, third and fourth order streams are 61. The total length of stream in *Ram Odha* sub basin of River Nira is 198.91 km. Out of this 126.67 km length is of first order stream. Total second order stream length is 42.52 km. Third and fourth order stream length in study region is 15.95 km and 13.77 km.

The drainage density of *Ram Odha* sub basin of River Nira is 3.86 km². Basin perimeter is 36.98 km. Maximum stream frequency indicates the large number of streams availability. The stream frequency of *Ram Odha* sub basin of River Nira is recorded 4.95. In *Ram Odha* sub basin of River Nira very fine type of Drainage texture has been observed. The higher the value of "C" more the circular shape of the basin and vice versa. Basin length is the longest dimension of a basin to its main drainage channel. Basin length in study region is 13.17 km. Elongation ratio of this watershed is 0.31 indicates a wide variation of climatic condition as well as geological formation and high relief steep ground slope. The form factor values of *Ram Odha* sub basin of River Nira is 0.29.

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