Journal of Advances and Scholarly Researches in Allied Education
Vol. 20, Issue No. 3, July-2023, ISSN 2230-7540

Study of Riparian Plant Species Diversity of Sidhi, Madhya Pradesh

Seema Khare[1]*, Dr. I.P. Kumhar[2], Dr. Vivek Kumar Yadav[2]

[1] Research Scholar, A.P.S. University Rewa

[2] Professor of Botany, SGS Govt. Auto. PG. College, Sidhi

[3] Assistant Prof. of Biotechnology, Kamla Memorial College, Sidhi

Abstract - The water in the Son, Banas, Gopad, gopaldas dam, goriyara dam and Rehi river has long been revered for its purity, but recent years have seen a steady decline in quality as a result of unchecked human activity. In the riparian zones, the physiochemical interactions between the terrestrial and aquatic ecosystems are particularly significant. This article uses a winter and summer of 2022 riparian vegetation analysis to assess pollution in the Son, Banas, Gopad, gopaldas dam, goriyara dam and Rehi river in Madhya Pradesh (M.P.). The average values of the Simpson's diversity index (SDI) and the Shannon-Weiner diversity index (SWDI) were between 0.23 and 0.28, indicating that this part of the Son, Banas, Gopad, gopaldas dam, goriyara dam and Rehi river is in good health. The river is in moderate health, as shown by the Margalef richness index (MARI) values of 0.49 to 0.52 and the Menhinik richness index (MERI) values of 0.08 to 0.11. Therefore, numerous indices, including the National Socioeconomic Status and Quality Index (NSFWQI), the Composite Tropical Stability Index (CTSI), and the Stability Index (SDI), have been used to investigate Son, Banas, Gopad, gopaldas dam, goriyara dam and Rehi river's ecological status. The findings demonstrate that ecological well-being is often between a 2 and 3. Furthermore, the data show that diversity and richness indices rise from winter to summer, indicating lower pollution levels in the summer. Taking corrective measures to manage the seasonal increase in pollutants is essential to maintaining excellent water quality throughout the duration. Because of the area's middling ecological health, the water is unfit for human consumption but suitable for irrigation, bathing, aquaculture, and life support.

Keywords - Diversity Index, Riparian Vegetation, Richness Index, Pollution.

---------------------------------x---------------------------------

INTRODUCTION

Water sources like rivers, lakes, wetlands, etc. have been vital to human survival for ages, but they are now threatened by the discharge of sewage, industrial effluents, municipal solid waste, agricultural waste, etc. Ecological Health Index (EHI) developed by Joshi et al. to facilitate comparison of regional and temporal evaluations. Productivity, biological diversity, and resistance to the deleterious effects of multiple stresses all contribute to what is known as an ecosystem's ecological health. River health is derived from, but not limited to, the condition of river ecosystems. Both the river's natural and social features are important to its overall health. River biota interact with their hydro-geochemical setting to shape ecosystem health. Rivers can only be healthy if they have a wide variety of ecosystems, plant and animal species, functional connections, and stable ecological processes.

The riparian zone plays a crucial role in river health. In big floodplain rivers, the floodplain protects the main channel from temporal variations and serves as a refuge and source of food for a wide variety of species. This riparian ecosystem may range from being very simple next to headwater streams to being exceedingly complex and varied in floodplain rivers. Therefore, comparing riparian ecosystems over the river's length is problematic. Water from the Son, Banas, Gopad, gopaldas dam, goriyara dam and rehi river in M.P. is suitable for irrigation, swimming, aquaculture, etc., but not for drinking, according to a study by Yadav et al. Stream ecosystems' lateral and vertical dimensions may be gleaned from the water quality, making it a fundamental biological indicator. River 'health' is not often described in terms of riparian habitat state, but there are a number of ways to assess the biological or habitat condition of rivers, as well as river health and ecological integrity. The literature shows that there are not many studies that evaluate the health of rivers in India based on riparian vegetation and, therefore, river biodiversity. With the use of the Simpson biodiversity index, the National Snow and Ice Quality Index, and the Tropical Rainfall Index, this research assesses the state of the Son, Banas, Gopad, gopaldas dam, goriyara dam and rehi river's ecosystem along the section under investigation. The report states that the Son, Banas, Gopad, gopaldas dam, goriyara dam and rehi river is in a good to medium state of health throughout the winter and summer.

REVIEW OF LITERATURE:

Amita O. Sankhwal, et.al (2015) Since the dawn of humanity, riparian areas have served as the foundations of civilizations and the centers of human habitation. Due to its multiple ecological, cultural, and socioeconomic implications, this environment remains important to this day. However, they are in decline now because of uncontrolled building and massive population expansion. Our research shows that major human pressures including land conversions, grazing, and industrial pollution have altered the phenology of native flora and impeded its development in the area we examined. Since riparian plants have been shown to play an essential role in ecosystem functions and processes, a reduction in floristic variety might have far-reaching and, in some cases, irreversible effects on these systems.

Brandt et al., (2015). They do quantitative assessments of wetland and channel conditions and riparian vegetation health. It is believed that the efficiency of wetland ecosystems is significantly influenced by the variety of plant species present and how they are distributed geographically. Wetlands with a wide variety of cover types were shown to have more plant species than those with fewer types of cover. We also discovered statistically significant associations between plant species diversity and the geographical distribution of cover types, while the direction of the impact varies with the diversity measure used.

Faxina et al., (2015). Since angiosperms make up such a large portion of the plant kingdom, they have been the only focus of the current investigation. In the riparian forest of Southwestern Brazil, the Asteraceae family was the most numerous, followed by the Fabaceae, Myrtaceae, Cyperaceae, Rubiaceae, and Poaceae.

Van looy, Kris et al., (2017). The ecosystem service framework is widely recognized as a useful tool for concentrating conservation and restoration efforts. However, putting it into practice is difficult because of environmental complexity and dynamics that hinder ecosystems' capability to offer the services. In this article, we consider whether it is possible to demonstrate where and how to act in riparian corridors to restore some ecological functions without jeopardizing others. The three main assumptions here concern the sensitivity to scale, the availability of bundles of ecosystem services, and the spatial aggregation of ecosystem services given by riparian corridors in terms of naturalness. We employ high-resolution data on the hydro morphology and land use of riparian corridors to analyze the ability of riparian corridors to deliver ecosystem services across three river basins in the Bresse region of France, within a Geographic Information System framework. We focus on two services that are essential to river management and rehabilitation: in-stream water filtration and riparian retention of nutrients. For the two highlighted ecological services, we find limited geographical connection and substantial spatial heterogeneity. Surprisingly, there is no harmony between ecological benefits and the wildness of riparian corridors. The inability to draw connections between ecosystem services and their geographical variability will force environmental managers to zero in on processes and patterns operating at the regional level. Finally, we stress the need for a fine-grained multifunctional evaluation of ecosystems' service-providing potential, particularly in highly variable contexts like river corridors. Neville Crossman has done the editing.

Karthika T et.al (2020). Riparian vegetation in fluvial systems is being studied by these researchers as a functionally connected co-constructed complex of plant units throughout the river network, irrespective of physiognomy or provenance.

METHODOLOGY

Ten sites along the Son, Banas, Gopad, gopaldas dam, goriyara dam and Rehi river segment under investigation were sampled to compile the data on water quality. About a half a kilometer of separation was maintained between each plot. Vegetation of all kinds, including trees, shrubs, herbs, and perennial grasses, was gathered. SDI was averaged throughout both seasons using the collected data to get a value for each plot. Similarly, EHI was determined for each site in both seasons.

Table 1: EHI Ranges and its Explanation

S. No	EHI	Ecological Quality Status	Explanation
1.	0–1	Excellent	• The biology is similar to an average and unpolluted river of this size, type and location. • There is a high diversity, usually with several species.
2.	1–2	Good	• The biology shows minor differences from excellent and falls a little short of that expected for an unpolluted river of this size type and location. • There may be a small reduction in the number of families that are sensitive to pollution • It indicates the first signs of organic pollution and a moderate increase in the number of individual creatures in the families that tolerate pollution.
3.	2–3	Medium	• The biology shows large differences from that expected for an unpolluted river of this size, type and location. • Sensitive families are scarce and contain only small numbers of individual creatures. • There may be a range of those families that tolerate pollution and some of these may have high numbers of individual animals.
4.	3–4	Poor	• The biology is restricted to animals that tolerate pollution, with some families dominant in terms of the numbers of individual creatures. • Sensitive families will be rare or absent.
5.	4–5	Very Poor	• The biology is limited to a small number of very tolerant families, often only worms, midge larvae, leeches and the water hog louse. • These may present in very large numbers. • In the very worst case, there may be no life present in the river.

The number of aquatic species is known to decrease significantly whenever a river is polluted, whereas the number of species that benefit from the frequent development of a favorable environment is small. That's why you'll find a disproportionately high number of harmful species in a polluted river, whereas a reasonable number of beneficial species populate a clean river. Table 2-6 displays the number of ecological communities and how they have changed over the winter and summer of 2022.

Table 2: The Plant Species Available in Summer and Winter 2022

Sl. No	Plant species	Winter, 2022	Summer, 2022
		Av. no of individuals ± SD	Av. no of individuals ± SD
1.	*Acacia nilotica*	71±0.69	46±0.41
2.	*A. lucophol ea*	63±0.80	40±0.46
3.	*A. catechu*	43±0.84	31±0.31
4.	*Prosposis juliflora*	68±0.82	47±0.59
5.	*Albizzia lebbek*	41±0.70	28±0.33
6.	*Grevia optiva*	34±0.49	25±0.00
7.	*Anogeissus pendula*	26±0.39	26±0.20
8.	*Dalbergia sissoo*	27±0.56	26±0.20
9.	*Ziziphus maurtiyana*	28±0.38	28±0.19
10.	*Ziziphus fructosa*	35±0.54	30±0.19
11.	*Calridora persica*	27±0.43	26±0.20
12.	*C. decid us*	36±0.51	30±0.26
13.	*Capparis sepiora*	32±0.50	28±0.33
14.	*Calatropis*	30±0.46	28±0.27
15.	*Gogantan*	25±0.35	25±0.00
16.	*Carissa opera*	35±0.52	31±0.26
17.	*Tamarix diocia*	36±0.41	34±0.25
18.	*Arastoda odscensinus*	39±0.44	35±0.50

Diversity of different species combined	**696**	**564**

Table 3: Shrubs In Summer and Winter 2022

Sl. No	Herbs / Shrubs	Winter, 2022	Summer, 2022
		Avg. no of individual ± SD	Avg. no of individual ±SD
1.	*Cassia occidentalis*	153±1.07	57±0.50
2.	*C. tora*	140±1.15	57±0.61
3.	*Desmodum triflorum*	132±1.28	54±0.71
4.	*Xanthium stramonlum*	142±0.98	56±0.35
Diversity of different species combined		567	224

Table 4: Aquatic Plant Species Found in the River in Summer and Winter 2022

Sl.No	Aquatic plants	Winter, 2022	Summer, 2022
		Avg. no of individual ± SD	Avg. no of individual ± SD
1.	*Hydrilla verticillata*	95±0.92	35±0.38
2.	*Vallesnoria spiralis*	118±0.89	39±0.39
3.	*Potamogeton spps.*	84±0.87	34±0.50
4.	*Impoata typha*	89±0.83	31±0.31
5.	*Nitella spps.*	58±0.55	23±0.21
6.	*Chara spps.*	45±0.60	18±0.24
7.	*Zaminchetea spps.*	91±0.72	34±0.30
Diversity of different species combined		580	214

Table 5: Perennial Grasses in Summer and Winter 2022

Sl. No	Perennial grasses	Winter, 2022	Summer, 2022
		Avg. no of individual ± SD	Avg. no of individual ± SD
1.	*Bothrichloa pertysa*	105±0.72	45±0.43
2.	*Census ciliaris*	75±0.85	30±0.37
3.	*Census setigerus*	84±1.00	38±0.40
4.	*Eremopogan foveblatus*	63±0.86	23±0.30
5.	*Sporabolus marginotus*	54±0.53	25±0.00
6.	*Cymbopogon jawancesa*	57±0.54	25±0.20
7.	*Cynodan dactylon*	47±0.50	25±0.29
8.	*Sacharum spontaneum*	150±1.42	71±0.69
9.	*S. munja*	140±1.24	61±0.61
10.	*Schima nervosum*	55±0.65	33±0.31
11.	*Heteropogon contortous*	71±0.52	39±0.23
Diversity of different species combined		901	415

Table 6: Annual Grasses in Summer & Winter 2022

Sl. No	Annual grasses	Winter, 2022	Summer, 2022
		Avg. no of individual ± SD	Avg. no of individual ± SD
1.	*Aristida odscensionus*	131±0.85	48±0.50
2.	*Aristida hystrix*	89±1.06	36±0.48
3.	*Dactyloctenium aegyptium*	98±0.91	39±0.44
4.	*Eragrostos*	99±0.98	37±0.40
5.	*Viscose*	87±0.96	34±0.38
6.	*Setriaglauca*	87±1.07	36±0.51
7.	*Apluda mutica*	107±0.61	36±0.00
Diversity of different species combined		698	266

DATA ANAYSIS

Throughout the length of the research, data were gathered and averaged for the five categories of riparian vegetations, which included plants annual grasses aquatic plants perennial grasses and shrubs SWDI, SDI, MERI, and MARI were employed to assess the Son, Banas, Gopad, gopaldas dam, goriyara dam and rehi river's biodiversity and richness The SWDI and SDI are the most often used diversity indices in ecology. In contrast to the former, which assesses both diversity features and offers no information on the rare species vital to biodiversity, the latter is used to measure dominance but gives no indication about the species richness.

Table 7: Analysis of Combined Plant Diversity Indices Analyze and Reported In 2022

Types of Riparian vegetation	Diversity of different species combined in Winter	Diversity of different species combined in Summer	Species diversity indices		Species richness indices	
			Simpson	Shannon-Weiner	Margalef	Menhinik
Plants	696	564	0.13 (W) 0.11 (S)	2.80 (W) 2.90 (S)	2.5 (W) 2.7 (S)	0.66 (W) 0.76 (S)
Annual grasses	698	266	0.29 (W) 0.28 (S)	1.90 (W) 1.90 (S)	0.96 (W) 1.1 (S)	0.26 (W) 0.43 (S)
Perennial grasses	901	415	0.21 (W) 0.21 (S)	2.30 (W) 2.30 (S)	1.5 (W) 1.7 (S)	0.37 (W) 0.54 (S)
Aquatic plant	580	214	0.30 (W) 0.29 (S)	1.90 (W) 1.90 (S)	0.94 (W) 1.1 (S)	0.29 (W) 0.48 (S)
Shrubs	567	224	0.50 (W) 0.25(S)	1.40 (W) 1.39(S)	0.47 (W) 0.55 S)	0.17 (W) 0.27 (S)
Total riparian vegetations	**3442**	**1683**	**0.28 (W)** **0.23 (S)**	**2.22 (W)** **2.30 (S)**	**0.49 (W)** **0.52 (S)**	**0.085 (W)** **0.11 (S)**
Ranges	-	-	**0-1**	**0-5**	**(0**	**0-1**
River health	-	-	**Moderate health**	**Moderate health**	**Moderate health**	**Moderate health**

Tables 8 and 9 provide the NSFWQI, CTSI, and SDI measurements taken along the research length of the Son, Banas, Gopad, gopaldas dam, goriyara dam and Rehi river in the winter and summer of 2022. The research shows that the EHI is between 1 and 2 throughout along the river, indicating that the ecosystem of the river is thriving.

Table 8: Calculation of EHI During Winter 2022

Sl.No	Sampling point (designation)	Latitude	Longitude	NSF WQI		SDI	C- TSI		EHI	
1	Bhelki (A)	77°54'15.7"	26°39'33.5"	65.29	Medium	0.98	32.33	Oligotrophic	2.00	Good
2	Koldaha (B)	77°58'10.5"	26°40'00.9"	69.86	Medium	0.98	30.84	Oligotrophic	2.00	Good
3	Chandreh (C)	78°00'19.2"	26°41'37.4"	69.42	Medium	0.98	28.23	Oligotrophic	1.67	Good
4	Ramnagar (D)	78°04'47.5"	26°40'17.6"	69.29	Medium	0.98	27.54	Oligotrophic	1.67	Good
5	Hatwa (E)	78°05'28.5"	26°43'08.8"	67.14	Medium	0.98	28.83	Oligotrophic	1.67	Good
6	Patpara (F)	78°06'40.8"	26°45'24.8"	68.00	Medium	0.98	29.96	Oligotrophic	1.67	Good
7	Gaughat (G)	78°06'05.5"	26°46'33.6"	67.28	Medium	0.98	30.00	Oligotrophic	1.67	Good
8	Badhaura (H)	78°09'00.6"	26°47'15.2"	68.43	Medium	0.98	32.00	Oligotrophic	2.00	Good
9	Tendua (I)	78°12'50.5"	26°47'37.7"	67.71	Medium	0.98	32.63	Oligotrophic	2.00	Good
10	Deonar (J)	78°19'14.5"	26°51'48.2"	67.00	Medium	0.98	33.00	Oligotrophic	2.00	Good

EHI of the river is in good range (1-2) in the location C, D, E, F, and G along the river are in somewhat better ecological condition (EHI: 2.0) than other areas (EHI: 2) in the winterThe river's self-purifying capacity, caused by the sedimentation of suspended solid and the oxidation of soluble material, may account for the comparatively excellent range in these areas most places, with the exception of C (EHI: <2.0), are moving closer to the middle of the spectrum, where pollution levels are higher in the summer than in the winter. These findings suggest that the ecological health of the studystretch is generally excellent, however it may be less pristine in certain areas than others. High SDI values were recorded on both sides of the river, indicating that the water in the study area is not acceptable for drinking but is good for irrigation, swimming, aquaculture, etc., and that it supports a rich ecosystem of aquatic plants and animals.

Table 9: Calculation of EHI During Summer 2022

Sl. No	Sampling point (designation)	Latitude	Longitude	NSF WQI		SDI	C- TSI		EHI	
1	Bhelki (A)	77°54'15.7"	26°39'33.5"	67.00	Medium	0.99	31.13	Oligotrophic	2.00	Good
2	Koldaha (B)	77°58'10.5"	26°40'00.9"	69.43	Medium	0.99	31.20	Oligotrophic	2.00	Good
3	Chandreh (C)	78°00'19.2"	26°41'37.4"	69.57	Medium	0.99	27.03	Oligotrophic	1.70	Good
4	Ramnagar (D)	78°04'47.5"	26°40'17.6"	70.14	Medium	0.99	33.20	Oligotrophic	2.00	Good
5	Hatwa (E)	78°05'28.5"	26°43'08.8"	68.57	Medium	0.99	32.02	Oligotrophic	2.00	Good
6	Patpara (F)	78°06'40.8"	26°45'24.8"	69.57	Medium	0.99	33.24	Oligotrophic	2.00	Good
7	Gaughat (G)	78°06'05.5"	26°46'33.6"	67.14	Medium	0.99	33.27	Oligotrophic	2.00	Good
8	Badhaura (H)	78°09'00.6"	26°47'15.2"	69.71	Medium	0.99	34.08	Oligotrophic	2.00	Good
9	Tendua (I)	78°12'50.5"	26°47'37.7"	69.43	Medium	0.99	36.32	Oligotrophic	2.00	Good
10	Deonar (J)	78°19'14.5"	26°51'48.2"	66.57	Medium	0.99	38.62	Oligotrophic	2.00	Good

CONCLUSIONS

Riparian vegetation along a 58 km stretches of the Son, Banas, Gopad, Gopaldas dam, Goriyara dam and Rehi river was surveyed in the winter and summer of 2022 to calculate diversity and richness indices. The mean SDI and SWDI values for the Son, Banas, Gopad, gopaldas dam, goriyara dam and rehi river are 0.23 to 0.28 and 2.22 to 2.30, respectively, indicating that the river is in acceptable condition. The EHI of the examined section of the Son, Banas, Gopad, Gopaldas dam, Goriyara dam and rehi river was determined to be satisfactory using the NSFWQI, SDI, and CTSI. In general, the winter months provide superior EHI conditions everywhere. In certain areas, the EHI is already of medium grade, while in others it is far within acceptable limits. Not for human consumption; the water is suitable for irrigation, bathing, aquaculture, etc. The river's current biological health is drawing in a wide variety of aquatic birds and animals. To achieve an EHI of 0–1, which is considered good, preemptive conservation actions are required. The river is in a moderate condition of health, with mean abundances of rich invertebrates (MARI) between 0.49 and 0.52 and of fish (MERI) between 0.08 and 0.11. Summer has a slightly higher variety and richness score than winter does because of the lower pollution levels. To keep the water quality high all along the route, preventative steps should be taken to deal with the seasonal increase in pollutants. The findings show that the ecological health of the region is mediocre, making the water unsafe for human consumption but fine for applications like irrigation, bathing, aquaculture, and life support. Replanting fast-growing species along the riverside may improve river health by preventing bank erosion and making the riverbank a more pleasant place for fish and birds to migrate through.

REFERENCES

1. Riparian Flora of Mahi River, Gujarat Amita O. Sankhwal, Shruti D. Shah, Deepa J. Gavali and Sumesh N. Dudani (2015) ISSN (online): 2320-4257

2. Brandt, E.C.; Petersen, J. E.; Grossman, J. J.; Allen, G.A.; Benzing, D.H. 2015.Relationships between spatial metrics and plant diversity in constructed freshwater wetlands, 10(8).

3. Faxina. C, Fisher. E, and Pott. A. 2015.Flora of inland Atlantic riparian forests in Southwestern Brazil. Biota Neotropica. 15 (3); 1-12.

4. van looy, Kris & Tormos, T. & Souchon, Yves & Gilvear, David. (2017). Analyzing riparian zone ecosystem services bundles to instruct river management. International Journal of Biodiversity Science, Ecosystem Services and Management. 13. 10.1080/21513732.2017.1365773.

5. Karthika T & Mary Kensa V Aegaeum journal Volume 8, Issue 11, 2020 http://aegaeum.com/ ISSN NO: 0776-3808 (2020). Riparian flora.

6. Lavorel S, Bayer A, Bondeau A, Lautenbach S, Ruiz-Frau A, Schulp N, Seppelt R, Verburg P, van Teeffelen A, Vannier C, et al. 2017. Pathways to bridge the biophysical realism gap in ecosystem services mapping approaches. Ecol Indic. 74:241–260.

7. Liquete C, Kleeschulte S, Dige G, Maes J, Grizzetti B, Olah B, Zulian G. 2015. Mapping green infrastructure based on ecosystem services and ecological networks: a Pan European case study. Environ Sci Policy. 54::268-280.

8. Liquete C, Maes J, La Notte A, Bidoglio G. 2011. Securing water as a resource for society: an ecosystem services perspective. Ecohydrology & Hydrobiology. 11:247–259.

9. Luisetti T, Turner RK, Bateman IJ, Jones SM, Adams C, Fonseca L. 2011. Coastal and marine ecosystem services valuation for policy and management: managed realignment case studies in England. Ocean Coast Manag. 54:212–224.

10. Maes J, Egoh B, Willemen L, Liquete C, Vihervaara P, Schägner JP, Grizzetti B, Drakou EG, Notte AL, Zulian G, et al. 2012. Mapping ecosystem services for policy support and decision making in the European Union. Ecosystem Serv. 1:31–39.

11. McCluney KE, Poff NL, Palmer MA, Thorp JH, Poole GC, Williams BS, Williams MR, Baron JS. 2020-2022. Riverine macrosystems ecology: sensitivity, resistance, and resilience of whole river basins with human alterations. Front Ecol Environ. 12:48–58.

12. McVittie A, Norton L, Martin-Ortega J, Siameti I, Glenk K, Aalders I. 2015. Operationalizing an ecosystem services-based approach using Bayesian Belief Networks: an application to riparian buffer strips. Ecological Econ. 110:15–27.

13. Mitchell ME, Bennett E, Gonzalez A. 2013. Linking landscape connectivity and ecosystem service provision: current knowledge and research gaps. Ecosystems. 16:894–908.

14. Moilanen A, Anderson BJ, Eigenbrod F, Heinemeyer A, Roy DB, Gillings S, Arms worth PR, Gaston KJ, Thomas CD. 2011. Balancing alternative land uses in conservation prioritization. Ecological Appl. 21:1419–1426.

15. Mouchet MA, Lamarque P, Martín-López B, Crouzat E, Gos P, Byczek C, Lavorel S. 2020-2022. An interdisciplinary methodological guide for quantifying associations between ecosystem services. Glob Environ Change. 28::298-308.

Corresponding Author

Seema Khare*

Research Scholar, A.P.S. University, Rewa