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ECOLOGICAL QUALITY OF RIPARIAN HABITAT OF STREAMS AT BARNA STREAM NETWORK OF NARMADA RIVER BASIN

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ABSTRACT

The goal of the current study was to use the QBR index to evaluate the ecological health of the riparian habitat along streams in the Narmada river basin. The Barna & its tributaries riparian habitat quality is assessed using the QBR index.

The left and right banks of the streams were used for the quick survey. The results showed that Palakmati had poor riparian quality due to anthropogenic pressure and fewer vegetation along the banks, degrading the quality of riparian habitat, while Barna, Narheri stream had good riparian quality due to the presence of a considerable number of trees on both sides.

Keywords - Qbr Index , Riparian Habitat, Anthropgenic Pressure And Physicochemical properties

Introduction

Over 70% of the Earth's surface is covered by water. In spite of this, just 1% of the world's water is actually fresh and potable. Given India's sparse surface water supplies and its large population, it is essential to utilise water resources wisely for residential and drinking water needs [1]

. However, as our enormous but limited water resources are strained, water contamination and health problems arise. These factors include increasing population, fast industrialization, intensification of agriculture, and urbanisation. The World Health Organization estimates that almost 80% of all human diseases are caused by water. 3 As a result, managing and protecting surface water quality is always necessary and important. The Barna Stream is located in Tehsil Bari, Raisen District, about 2.5 kilometres northwest of Barikhurd town. The project's distance from Bari National Highway (Jabalpur, Jaipur)) is 8 kilometres. Obedullaganj on the Central Railway is 66 kilometres away from the Dam's location and is the closest station. The project is situated between 100 and 200 kilometres from Bhopal, the nation's capital [2] Water is provided by the Barna stream network for use in agriculture and for a number of other things. The network of streams in Barna also provides a habitat for a variety of ecological species and hydrates the river Narmada, which is crucial to India's way of life. Although the reservoir in the river's main portion keeps some water in it all year long, the stream's main portion lacks any viable sources of water throughout the summer.

Through changes in land use (including urbanisation, forest-agricultural transitions, or other consequences), humans also influence the hydrology of streams and rivers. Water balance elements (such as surface runoff, infiltration/groundwater runoff, and evapotranspiration), potential water shortages, and riverbank erosion are some effects on water

resources and water catchment management. Urban floods and hydrological changes [3][4][5][6]

A base for ecological health and growth, the Barna stream network is made up of various streams that flow through hilly areas, forests, agricultural fields, and towns. However, there are some areas where human intervention has polluted the water to a lesser extent and can be controlled with better management and solution practises with community involvement and awareness.

The Latin term "riparius," which refers to land near a body of water, is the source of the English word "riparian" [7]. The term "riparian zone" refers to the area that exists between these rivers and the surrounding land. Because they serve as transitional zones between the terrestrial and aquatic ecosystems and as functional interfaces mediating energy and matter between these two ecosystems, these riparian habitats are regarded as one of the biodiversity-rich ecosystems [8]. One of the most important ecological components of river systems is the riparian zone. They sustain high levels of biological productivity and diversity, and they offer diverse habitats for many species [9]

They also offer a wide range of additional ecological, social, and ecosystem functions. The physical habitat characteristics and functions of riverine ecosystems are influenced by the riparian zone, which is a crucial component of the aquatic ecosystem [10]. Riparian forests have been reduced and altered, which has caused habitat fragmentation and the elimination of diverse habitat in the river system [11]. The goal of the current study was to use the QBR Index to evaluate the health of the riparian habitat along the Barna and Jamner streams.

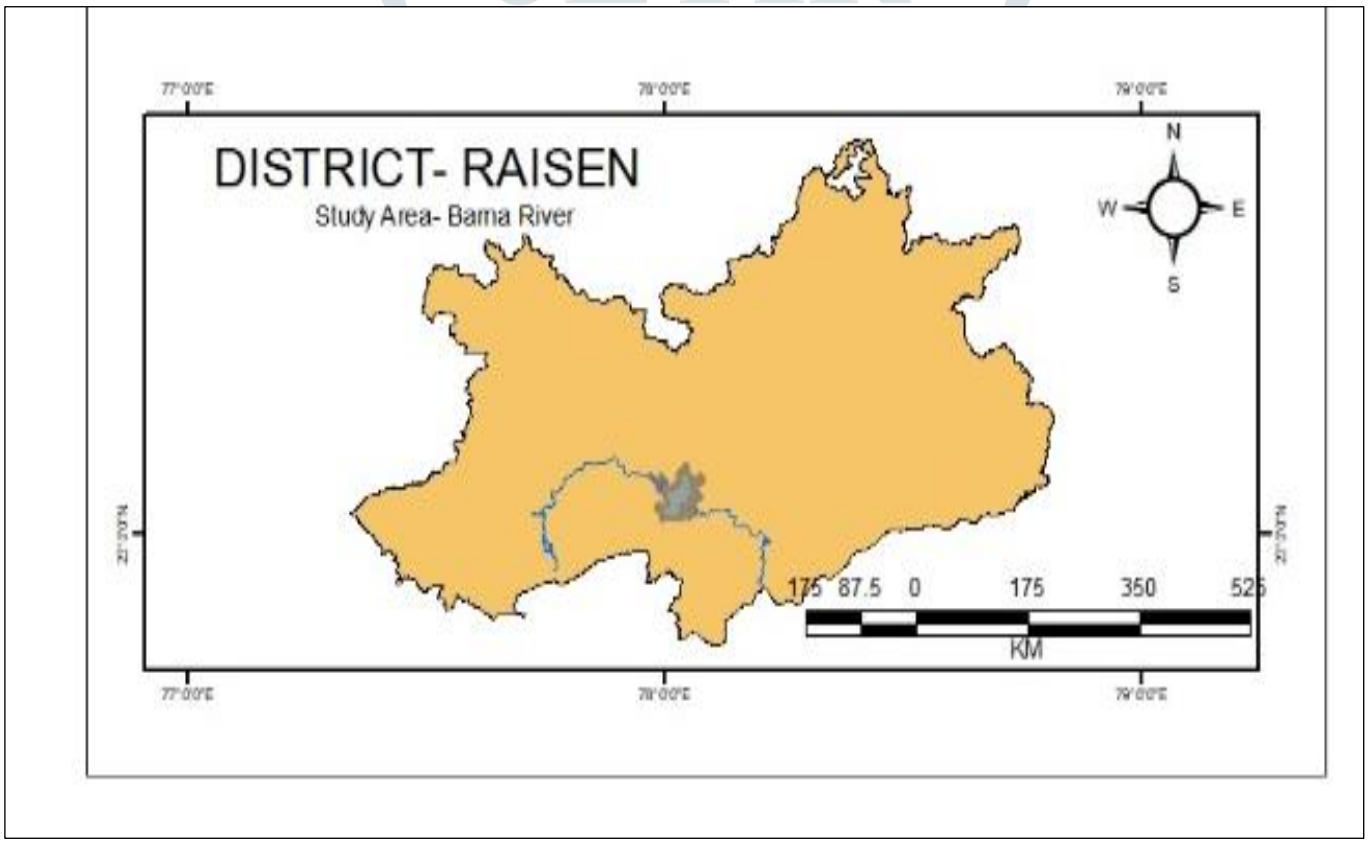

Fig A – Showing Barna river in Raisen district

Materials And Methodology

The current study was carried out on the Barna stream network, which is situated at 23° 4'26.21"N latitude and 77°45'43.34"E longitude, throughout the winter, summer, and monsoon seasons in (2020-2021).

Table A : Showing coordinates of the study area and different streams

S.NO	SUBSTREAMS	LATITUDE	LONGITUDE
1	BARNA	23° 4'26.21"N	77°45'43.34"E
2	SATDHAR	23° 6'8.64"N	77°55'21.17"E
3	JAMNER	23° 4'19.52"N	77°57'39.08"E
4	PALAKMATI	23° 8'6.98"N	77°55'58.83"E
5	CHAMARSIL	23° 9'59.79"N	77°57'43.98"E
6	NARHERI	23°11'35.70"N	78° 4'10.10"E

Along with five other important tributaries, Barna is one among the Narmada's primary tributaries. The Barna stream network is made up of Barna and its numerous other substreams, including Jamner, Satdhar, Palakmati, Chamarsil, and Narheri. The Barna Reservoir, also known as the Barna Irrigation Reservoir, was built on the Barna River and is located near Bari at 23° 2'11.13"N latitude and 78° 1'34.46"E longitude. A designated wetland under the National Wetland Conservation Program is Barna Reservoir. The river's source is the Vindhya Mountains, which are located in the Raisen District to the east of Barkhera. At 22 55' N latitude and 77 44' E longitude, the elevation is 450 metres ASL [12]. The basin has a total size of 1787 square kilometres. The Narmada River's union with Barna is 60.0 kilometres away from its source[12].

The Barna sub-basin of the Narmada River basin's Barna streams' riparian habitat quality was evaluated in the current inquiry utilising the QBR Index [13]. The QBR index, also known as riparian forest quality or "qualitat del bosc de ribera," is a simple field technique for evaluating the ecological quality of riparian habitat. The four riparian habitat characteristics of vegetation cover, cover structure, cover quality, and channel changes form the basis of the QBR index. Numerous attributes are included in each category. The scores for each category vary from 0 to 25, with 100 being the highest possible overall score given to the category with the best quality and five classes (Table 1).

Table – B: Showing the Riparian habitat quality levels and their scores

SN	Riparian Habitat Quality Class	QBR	Colour
1	Riparian zone habitat in natural condition	>95	
2	less disturbance, good quality	75–90	
3	increased Disturbance , fair quality	55–70	
4	Strong alteration, poor quality	30–50	
5	Extreme disturbances /degradation, bad quality	<25	

The four primary riparian zone characteristics that make up the QBR index, a score-based indicator, are Total Riparian Cover (TRC), Cover Structure (CS), Cover Quality (CQ), and Channel Alteration (CA). The index is utilised to contrast sites, evaluate sites for riparian zone/area restoration, and compare locations with the best circumstances. The QBR index was established by the F.E.M (Freshwater Ecology and Management) research team at the Universitat De Barcelona for use in Spanish Mediterranean streams [13].

Results and Discussion

Table-C: Showing WQI at Barna and its tributaries in different seasons (20-21)										
Stations	Summer		pre-monsoon		Monsoon		Post Monsoon		Winter	
	WQI	Status	WQI	Status	WQI	Status	WQI	Status	WQI	Status
B1	44	Good	39.8	Good	31.8	Good	33.1	Good	22.4	Good
B2	57	poor	60.6	poor	47.5	Good	54.5	poor	47.2	Good
B3	32.5	Good	35.1	Good	26.5	Good	31.7	Good	29.4	Good
B4	64.5	poor	67	Good	60.9	poor	64	poor	55	poor
B5	48.5	poor	51.5	Good	31.7	poor	31	Good	32.5	Good
B6	41.6	Good	41.5	Good	31.6	Good	22.2	Good	26.6	Good
B1- Barna, B2-Satdhar, B3- Jamner, B4-Palakmati, B5- Chamarsil, B6 -Narheri										

Overall water quality of all the tributaries observed during the year 2020-2021 was found under good condition except at some sites B4- Palakmati , B2-Satdhar which showed some signs of anthropogenic acticities and urbanization near the bank of the river . The Palakmati river was affected mainly due to sewerage load being discharged into the stream at Sultanpur town and also affected by agricultural activities upside the stream. The Satdhar and Chamarsil showed agricultural activities which impacted the water besides Jamner also showed some signs of fishing activities alongwith the agricultural activies.

Variation in riparian zone (QBR) at Barna stream network

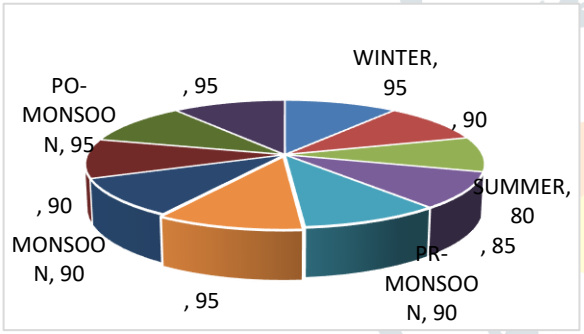

Fig B1 Variation in riparian zone (QBR) score at B1 site

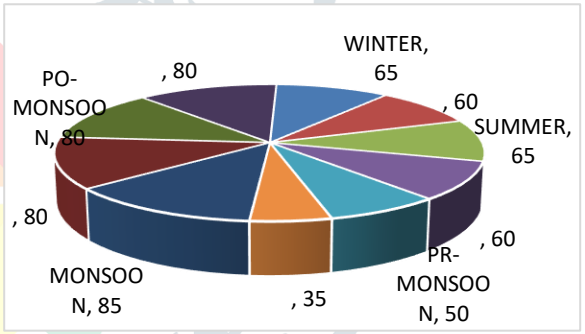

Fig B2 Variation in riparian zone (QBR)score at B2 site

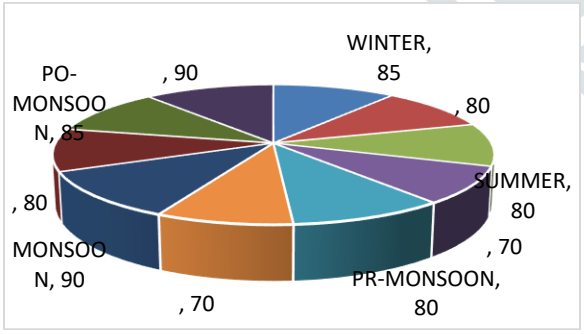

Fig B3 Variation in riparian zone (QBR) score at B3 site

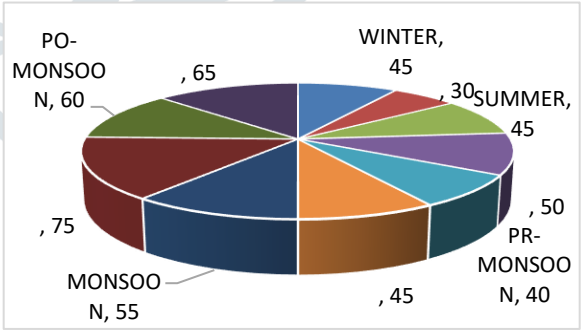

Fig B4 Variation in riparian zone (QBR) score at B4 site

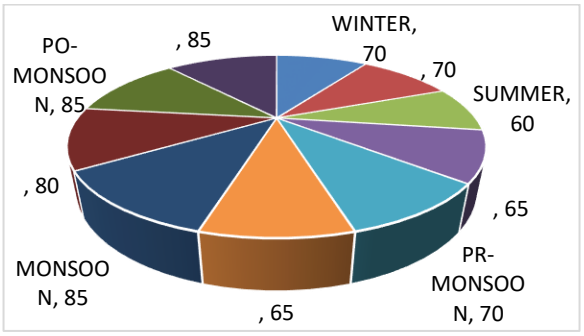

Fig B5 Variation in riparian zone (QBR) score at B5 site

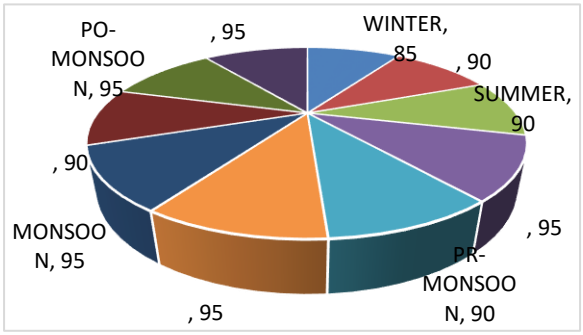

Fig B6 Variation in riparian zone (QBR) score at B6 site

Table D: Quality of Riparian zone & score with category from poor to excellent

STATION	SEASONS										AVERAGE	QUALITY CATEGORY
	WINTER		*SUMMER*		*PR-MONSOON*		*MONSOON*		*PO-MONSOON*			
B1	94	89	79	84	89	94	89	89	94	94	89.5	**Excellent**
B2	64	59	64	59	49	34	84	79	79	79	65	**Fair**
B3	84	79	79	69	79	69	89	79	84	89	80	**Excellent**
B4	44	29	44	49	39	44	54	74	59	64	50	**Poor Quality, Strong Alter**
B5	69	69	59	64	69	64	84	79	84	84	72.5	**Fair**
B6	84	89	89	94	89	94	94	89	94	94	91	**Excellent**

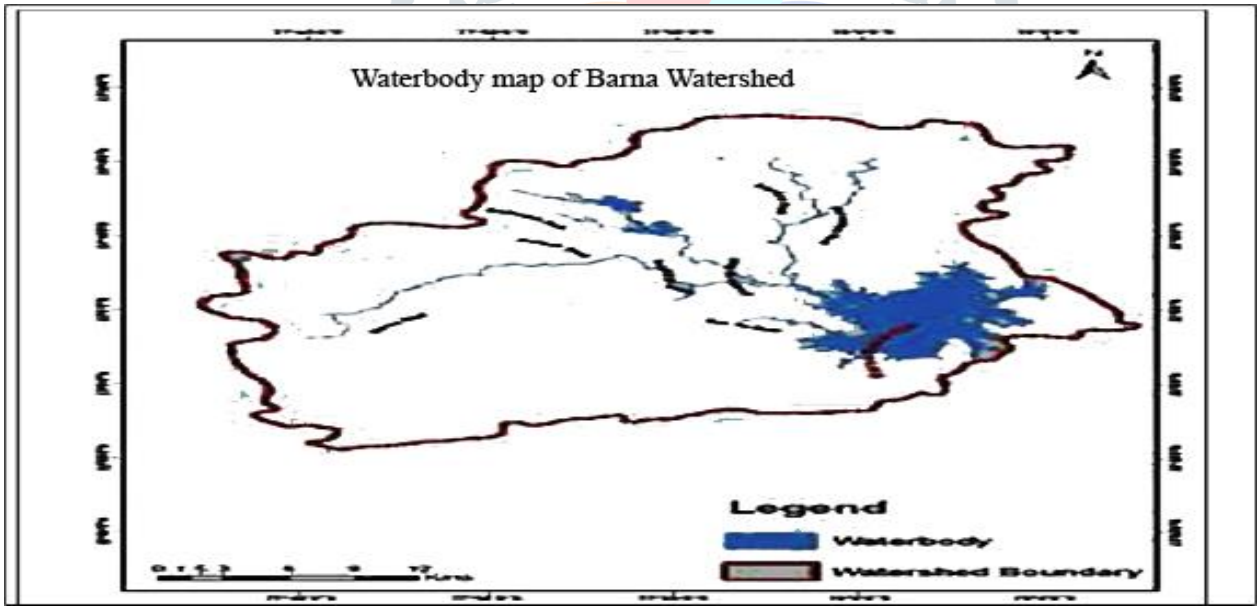

Figure C – Showing Barna river and its tributaries

Table E - Positive and negative impacts of certain factors observed

Site	Barna	Satdhar	Jamner	Palakmati	Chamarsil	Narheri
MINING ACTIVITIES	+ (ve)	- (ve)	- (ve)	- (ve)	+ (ve)	- (ve)
TOURIST ACTIVITIES AND TYPES	+ (ve)	+ (ve)	+ (ve)	- (ve)	- (ve)	+ (ve)
BATHING AND WASING	- (ve)	+ (ve)	+ (ve)	- (ve)	- (ve)	- (ve)
POINT AND NON POINT SOURCES	- (ve)	- (ve)	- (ve)	+ (ve)	- (ve)	- (ve)
EROSIONAL & LANDSLIDES	- (ve)	+ (ve)	- (ve)	- (ve)	- (ve)	- (ve)
GRAZING & AGRI ACT	- (ve)	- (ve)	+ (ve)	+ (ve)	+ (ve)	- (ve)
SAND MINING	- (ve)	- (ve)	- (ve)	- (ve)	- (ve)	- (ve)
URBANIZED	- (ve)	- (ve)	- (ve)	+ (ve)	+ (ve)	- (ve)
CLEAN WATER	+ (ve)	- (ve)	+ (ve)	- (ve)	- (ve)	+ (ve)
WATER AVAILABILITY	+ (ve)	- (ve)	+ (ve)	+ (ve)	- (ve)	+ (ve)
CREMATION	- (ve)	- (ve)	- (ve)	- (ve)	- (ve)	- (ve)
POLLUTION	- (ve)	+ (ve)	- (ve)	+ (ve)	+ (ve)	- (ve)
FISHING	+ (ve)	- (ve)	+ (ve)	- (ve)	+ (ve)	- (ve)
STOP DAM	+ (ve)	+ (ve)	- (ve)	+ (ve)	+ (ve)	- (ve)
FOREST COVER	+ (ve)	+ (ve)	+ (ve)	- (ve)	- (ve)	+ (ve)
BIODIVERSITY	+ (ve)	- (ve)	+ (ve)	- (ve)	+ (ve)	+ (ve)

It was observed during the study period from 2020-2021 in Barna stream network , overall riparian quality was found in good condition except at some stretch in some streams namely Sathdar, Chamarsil and Palakmati. The satdhar and Chamarsil were under fair conditions and Palakmati at some stretch was under poor condition .

The scores for **TRC** over the years 2020–21 are B1 (Barna), B3 (Jamner), and B6 (Narheri), with general natural conditions and vegetation along the flow. The majority of the riparian region is made up of forests, although there are also some private agricultural fields along some of the river's banks. Agriculture was visible in Semri Khurd at B3, but the riparian zone's total plant cover received a decent grade.

During the assessment, it was discovered that the quality of the **vegetation cover structure** ranged from very low to moderate. The structure of the vegetation cover was judged to be considerable in its natural state (good at B1 and B6). In the substreams of Barna B3, B5, B2 is generally in fair shape with occasional disturbances, while B4 is in very bad shape with significant modifications. Lakhera demonstrated similar outcomes (2021).

With **vegetation cover and riparian cover** taken into account, cover quality was discovered to be in outstanding natural condition at B1 and B6. In the substreams of Barna B3, B5, and B2, B4 is in extremely bad condition with significant modifications while B2 is generally in fair condition with some disturbances.The study was found in concordance with Lakhera.,2021 & Tembhare (2018) [14] [15].

Throughout the study period, all of the rivers were discovered in their natural state at B1, a bridge is constructed on the Barna river replacing the old one with raising the height of the new bridge above the high flood level. Although it did not significantly affect the river ecosystem, the construction's remnants did cause some problems. B1, B3, and B6 had good/excellent scores in their natural state, whereas B2, B5 received fair scores with some anthropogenic disturbances found in the river zones. The substream B4 was significantly modified, negatively affected, and falls in unfavourable circumstances.

Conclusion and recommendation

Out of the six stations in the study area, three stations, B1, B3, and B6, were observed in good/excellent condition with lowest signs of disturbance, two stations B2 and B5 observed in fair condition with some significant disturbances and station B4 was observed in bad condition, according to all four components of the QBR index (TVC, VCS, CQ, and RCA). Numerous anthropogenic disturbances dating back to some years that led to the natural river's degradation were to blame for the bad or poor condition.

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