



RESEARCH ARTICLE

RIVER BANK EROSION AND HUMAN DISPLACEMENT – A CASE STUDY OF THREE DECADES OF BHAGAWANGOLA-II BLOCK OF MURSHIDABAD DISTRICT, WEST BENGAL

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ARTICLE INFO

Article History:

Received 24th November, 2023

Received in revised form

27th December, 2023

Accepted 20th January, 2024

Published online 29th February, 2024

Key words:

River bank erosion, Environmental problem, Lower Gangetic Plain, Erosion victims, Insecurity, Holistic approach.

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ABSTRACT

In India, river bank erosion has become one of the most significant environmental problems. This is one of the critical public concerns in India at least in some states like West Bengal especially in the Lower Gangetic Plain. River bank erosion has a long-term consequence on human life. The victims are compelled to displace as they become destitute. In this paper, an attempt has been made to study about previous trends of riverbank erosion, its impact on riverine inhabitants and possible preventive and remedial measures required to solve such a complex and multi-dimensional problem along river Ganga of Bhagawangola II block, Murshidabad district. Analysis of data as obtained from the representative sample of erosion victims as well as the secondary sources of data clearly indicates that the hazard victims are to face socio-economic insecurity due to loss of agricultural land, become unemployed and that a holistic approach to save the erosion victims needs to be undertaken for a permanent solution of the problem.

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Citation: Mitra, P.K., Das, M. and Sarkhel, S. 2024. "River Bank Erosion and Human Displacement – A case study of three decades of Bhagawangola-II block of Murshidabad district, West Bengal". International Journal of Current Research, 16, (02), 27248-27255.

INTRODUCTION

River bank erosion, is the wearing away of bank materials of a river (Chatterjee et al. 2013). This is a common and unavoidable phenomenon of rivers, and it is characterized as a dynamic natural process that involves the removal of riverbank materials. The bank erosion will be occurred when the magnitude of flowing water exceeds the strength or shearing resistance of materials or sediments on the basal part of a river bank (Ghosh et al. 2018). Most of bank erosion occurs in meandering rivers. River shifting takes place in meandering rivers as a result of bank erosion and sediment deposition on the point bar. That's why a large number of rivers throughout the world are prone to meandering and bank erosion. Bank erosion in devastating nature is found in Ganga basin (Thakur et al. 2012). The Ganga River and its many tributaries flow through the states of Uttarakhand, Uttar Pradesh, Jharkhand, Bihar, Haryana, Himachal Pradesh, Rajasthan, Madhya Pradesh, and Delhi as well as the southern and central portions of West Bengal. However, the erosion issues are confined to a few places. In the lower Ganges region, especially in West Bengal, there are major issues with river bank erosion.

Near Rajmahal in the state of Jharkhand, the River Ganges enters West Bengal. Then it flows in a South-easterly direction within West Bengal (Das et al. 2014). It divides into two branches near Mithipur village in the Murshidabad district after flowing through the Malda district. One branch enters Bangladesh through the eastern portion of the Murshidabad district as the Padma, while the other flows through West Bengal as the Bhagirathi River and Hooghly River in the south. River bank erosion has numerous negative effects. The most significant effect is homelessness as a result of migration caused by land erosion. After then, they face social, economic, health, and political challenges occasionally. These migrant populations always experience identity crises because their belongingness to any particular district or state or country is often denied (Das et al. 2014). Such has been the case with the people living along the right banks of the Ganges in Murshidabad district. Since the third decade of the twentieth century, eleven community development blocks in the Murshidabad district have experienced serious river bank erosion (Chattopadhyay 2003). The study area covers river facing villages of Bhagawangola II block of Murshidabad district downstream Farakka barrage. The present channel of river Ganges has a tendency to shift laterally.

Thus, villages regularly experience significant bank erosion. Villagers are frequently displaced. Pre-flood and Post-flood erosion are two distinct phases of bank erosion that occur in the Ganges during the monsoon season (June to September). Unconsolidated sediments are removed from the base of the bank, which ultimately collapses, by the sudden, rapid flow of water during the rising stage of discharge. In the post flood period, erosion caused by groundwater effluent flow into rivers causes basal materials to liquefy and flow into the river (Rudra 2006). River bank erosion results in massive displacement of people and property loss, which ensures poverty (Chatterjee *et al.* 2013). More than 500,000 people have been displaced during the last four decades in the Murshidabad district (Mazumder 2000), downstream of the Farakka Barrage, where more than 500 km² of fertile agricultural land has been wiped away by river erosion. Prime agricultural land, populated villages, trade centers, and townships are all being lost in all the erosion-affected blocks (Das 2011).

In this research work some selected mouzas like Hasanpur, Nasipur, Giridharipur, Munsarpur, Khamar Diar, Jazira Char Dhumuria, Uttar Purba Nirmal Char and Dakshin Purba Nirmal Char are studied to show impact of bank erosion on the riverine people. The inhabitants of these villages have relocated numerous times after losing their residences. The loss of arable land has also had a significant impact on their agrarian economy. Affected people are consequently compelled to shift to Khamar Diar Village and the area surrounding Bhagawangola Railway Station. The current paper deals with the issue of bank failure in Bhagawangola II Block along the Ganga River and the situation of erosion victims. The Ganga River System now has certain distinctive characteristics, including varying flows, sediment load, tidal intrusion at the mouth, decreasing water flow from the western tributaries, decreasing slope of the thalweg, and new tectonic features of the delta (Rudra 2004). As a result, as fluvial dynamics alter, the geomorphic features of the area experience changing occurrences. The research area is becoming increasingly prone to severe riverbank erosion as a result of these changes.

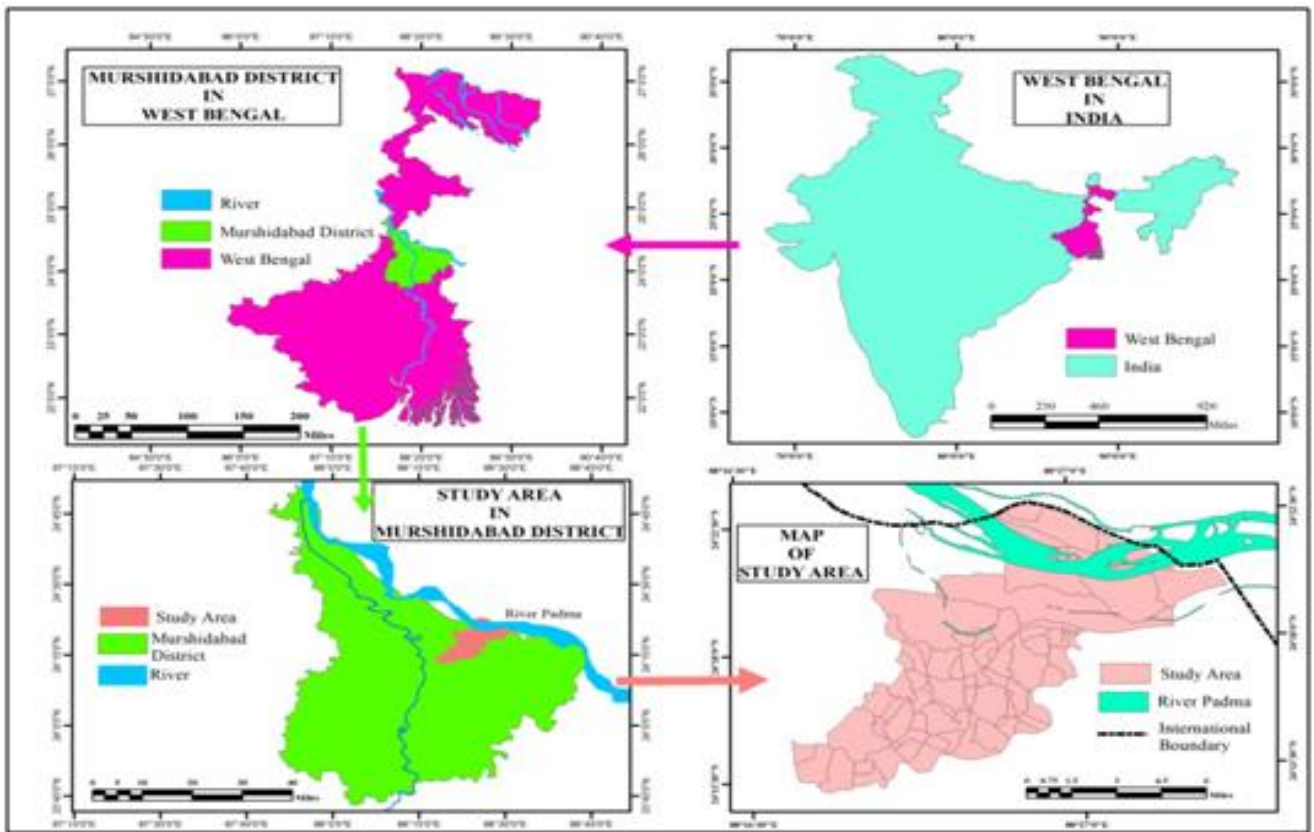
This paper mainly discusses the issue of riverbank erosion from the perspective of erosion victims of the study area. Through field research and the use of secondary data sources, the geomorphologic properties of the study area, the history and present characteristics of the magnitude of erosion, and the spatio-temporal distribution of erosion hazards have all been identified for the purposes of the current study. Through an extensive door-to-door field study and the use of secondary sources of information, the suffering of the displaced riverine people has been studied.

Objective of the study: The river Ganga is engulfing new areas in its regime of erosion, thus the authors of this study desires to seek out and explain the many sectoral views regarding the magnitude of erosion and its effects on human settlement. Geomorphological characteristics enhancing erosion hazard and their spatio-temporal distributions have been determined for this purpose. The main objective of the study is to analyze and assess the three decades trend in river bank erosion in the study area and its effects on the surrounding settlements. In more precise words, the major focus is to show how bank erosion hazards has caused human settlement to be displaced and how this has impacted the local livelihood of Bhagawangola-II block of Murshidabad district, West Bengal.

METHODOLOGY

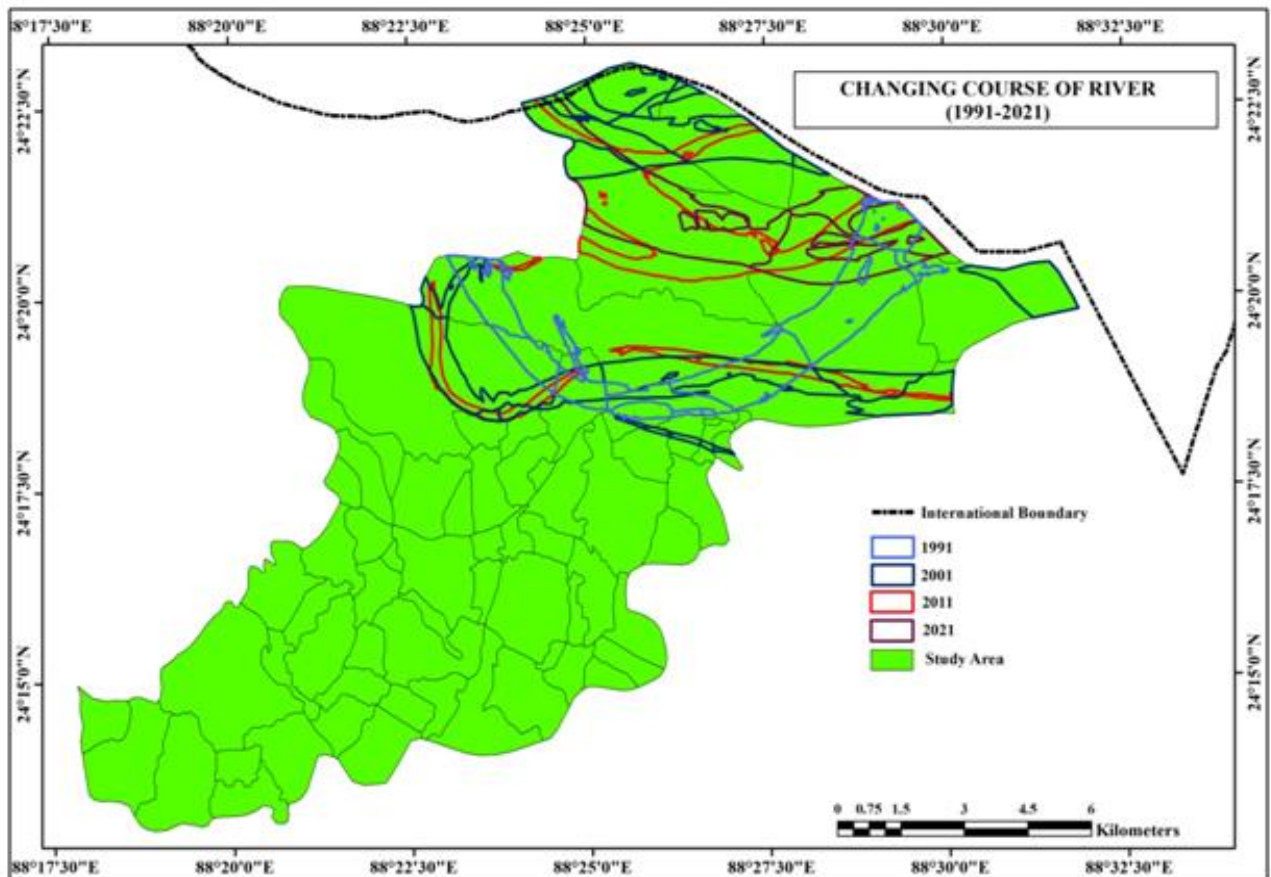
The methodology includes a number of steps to achieve the study's stated objectives, including identification of the research problems, research issues, and the study area; conducting a pilot survey of the study area; designing a questionnaire; choosing representative samples using stratified random sampling; conducting a household survey; statistically analyzing the data collected; and analyzing the findings. Both primary and secondary sources were used to gather the data for the present study. The primary data was collected by fieldwork and household surveys with the help of a questionnaire that included open-ended, closed-ended, and multiple-choice questions on a few topics related to the problem of riverbank erosion at the study area. The field work has been carried out at Hasanpur, Nasipur, Giridharipur, Munsarpur, Khamar Diar, Jazira Char Dhumuria, Uttar Purba Nirmal Char and Dakshin Purba Nirmal Char villages of Bhagawangola-II block of Murshidabad district, West Bengal. Stratified random sampling has been used to select samples for a household survey. The interviewees were divided into two groups based on their geographic locations for stratified random sampling; one group included people who lived along riverbanks that are prone to erosion and had a sample size of 133; the other included people who had to relocate due to bank erosion and now reside in Khamar Diar Village and the area surrounding Bhagawangola Railway Station and had a sample size of 67. The rationale behind such a selection of two different types of samples is to get responses from both directly affected or may be affected directly in future and already become refugee due to bank erosion. Almost all of the samples are collected from areas where there is a high risk of riverbank erosion because those who are represented there are frequently immediately and negatively impacted by these hazards. Moreover, the people chosen for the survey represent most of the working population in the study area, are directly affected by riverbank erosion, and must take action to ensure their own survival.

The questionnaire was prepared with a number of issues in mind, based on useful data gathered through the outcome of a preliminary qualitative interview with the relevant individuals and groups. Regarding the types of information sought, the respondents are asked two different types of questions: the first type seeks factual information about the frequency of certain events, such as shifting homesteads, and the second type seeks their perceptions on a variety of issues, such as types of hazards experienced, causes of riverbank erosion, types of preventive and remedial measures necessary for controlling riverbank erosion, and types of interventions by the local government. Books, articles, published papers and reports, district gazetteers, MNDWI method, different satellite images from USGS earth explorer and the District Census Handbook of Murshidabad districts were consulted for secondary data collection for a variety of reasons, including to trace out the history and current status of riverbank erosion hazard as reported and documented for the study area, to understand spatio-temporal distribution of erosion hazard, and to understand about the erosion affected people who are displaced as a result of this hazard. These data sets show the magnitude and severity of the erosion hazard issue.



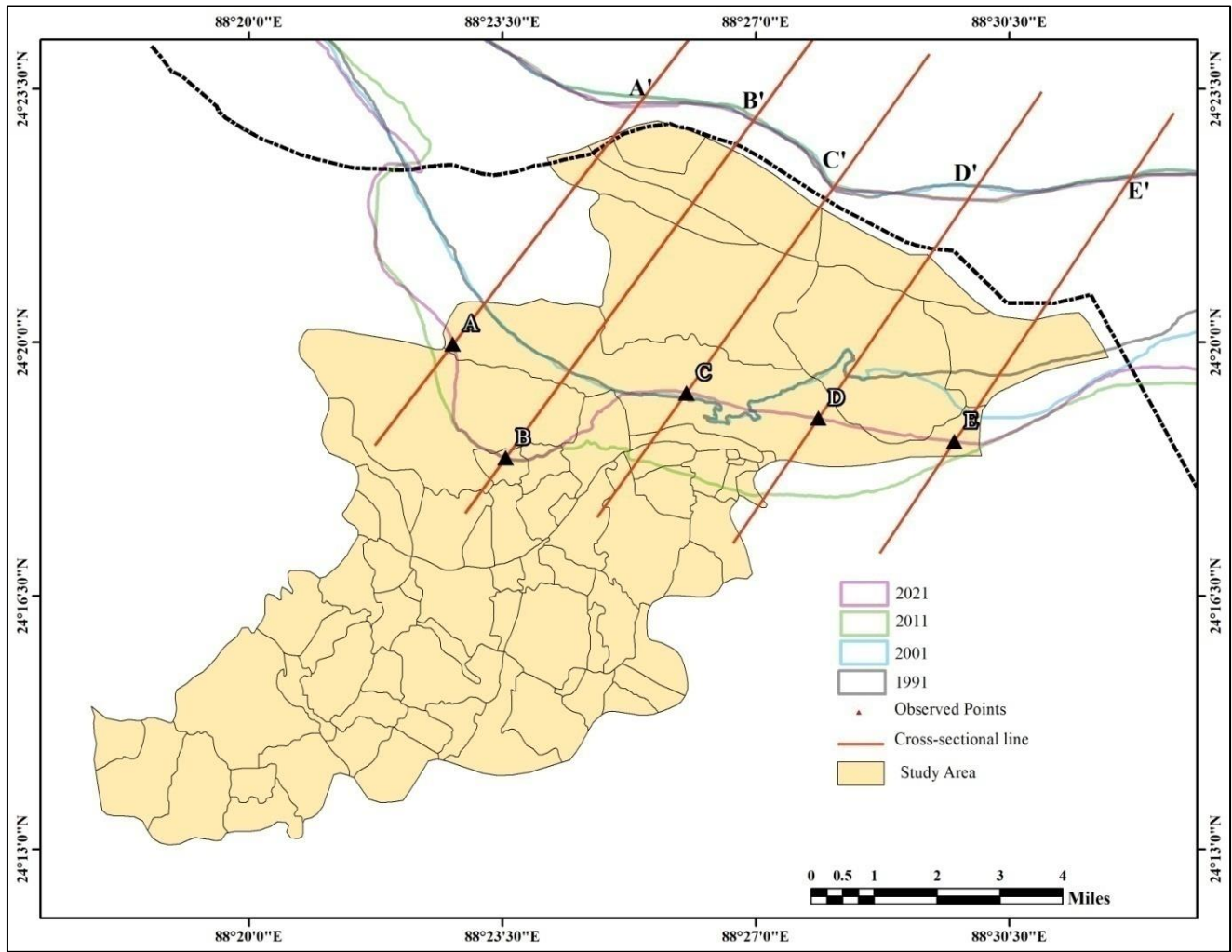
Source SEDAC & Arc Map 10.5

Fig. 1. Location map of Bhagawangola II block



Source SEDAC, Landsat 5,8 & Arc Map 10.5

Fig. 2. Changes of River course in last three decades



Source Google Earth Pro

Fig. 3. Cross section of river courses

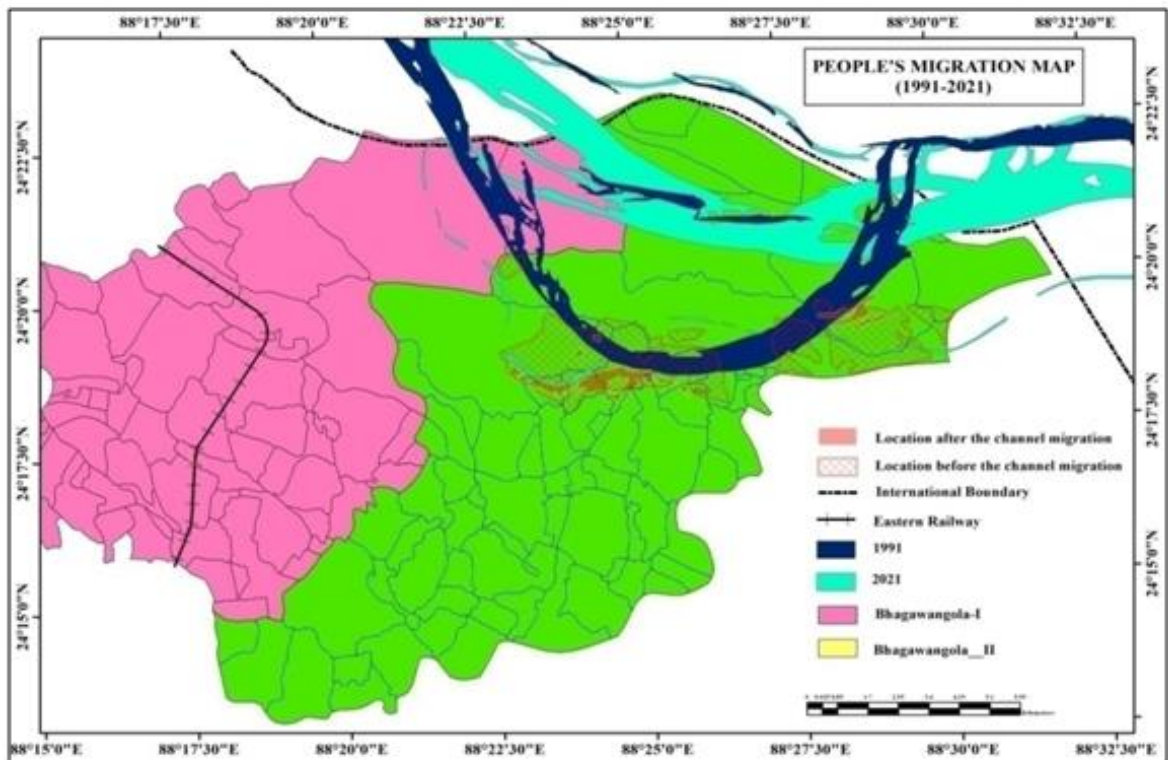


Fig. 4. Displacement of settlement and their present location missing Source

Table 1. Shifting of river courses in last three decades of the study area

Observed Point	Year	Shifting Direction and rate (in metre)		Bank
		West	East	
A (KhamarDiar)	1991-2001	-	19.6	Right
	2001-2011	2000	-	
	2011-2021	-	734	
	1991-2001	-	199	Left
	2001-2011	4.34	-	
	2011-2021	297	-	
B (Sankarpur)	1991-2001	32.9	-	Right
	2001-2011	2660	-	
	2011-2021	-	15.2	
	1991-2001	-	75.7	Left
	2001-2011	-	36.3	
	2011-2021	113	-	
C (Khamar Diar)	1991-2001	-	50.6	Right
	2001-2011	1970	-	
	2011-2021	2.08	-	
	1991-2001	-	63.3	Left
	2001-2011	-	62.9	
	2011-2021	79.9	-	
D (KhamarDiar)	1991-2001	-	63.8	Right
	2001-2011	3600	-	
	2011-2021	-	2300	
	1991-2001	-	4.44	Left
	2001-2011	400	-	
	2011-2021	7.92	-	
E (KhamarDiar)	1991-2001	1130	-	Right
	2001-2011	1560	-	
	2011-2021	-	715	
	1991-2001	-	37.3	Left
	2001-2011	27.5	-	
	2011-2021	44.8	-	

Table 2. Erosion affected villages

Sl. No.	Name of the Area	Year of destruction
1.	AkhrikanjMouza (fully destroyed)	1940-42
2.	Patmari (fully destroyed)	1982-84
3.	Krishnapur (fully destroyed)	1982-84
4.	Mastanapara (fully destroyed)	1982-84
5.	Ghoshpara (fully destroyed)	1982-84
6.	Alaipur (partly destroyed)	1989
7.	Khoribona (partly destroyed)	1989
8.	Sankarpur (partly destroyed)	1989
9.	Girdharipur (fully destroyed)	1988
10.	Munsarpur (fully destroyed)	1989
11.	Hasanpur (partly destroyed)	1989
12.	Sibnagar (partly destroyed)	1989

Source Field survey,2023

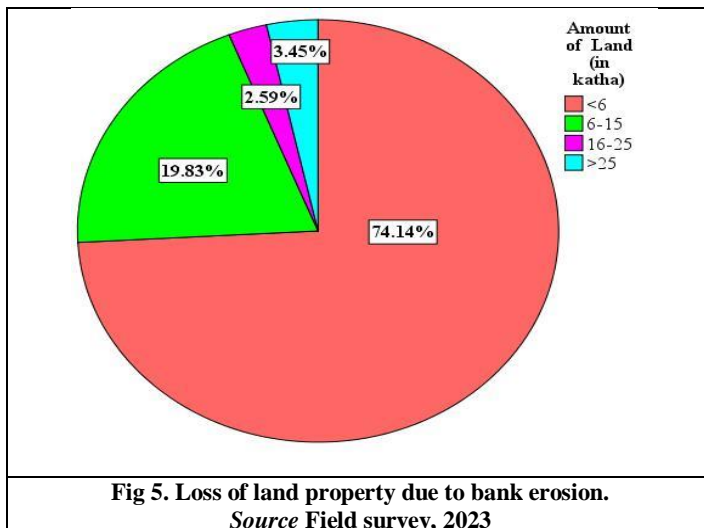


Fig 5. Loss of land property due to bank erosion.
Source Field survey, 2023

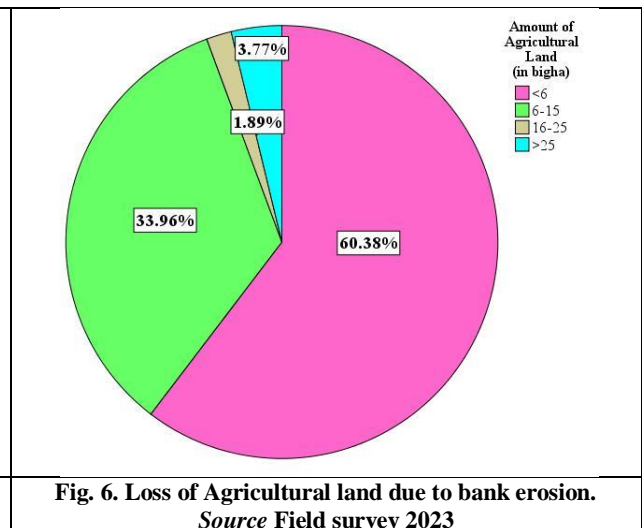


Fig. 6. Loss of Agricultural land due to bank erosion.
Source Field survey 2023

Table 3. Amount of submerged land property

Amount of Land (in katha)	No. of Family
<6	86
6-15	23
16-25	3
>25	4

Source Field survey,2023

Table 4. Amount of submerged agricultural land

Amount of Agricultural Land (in bigha)	No. of Family
<6	32
6-15	18
16-25	1
>25	2

Source Field survey,2023

Perception of river bank erosion induced human displacement:

Before assessing the perspective of human relocation as a result of bank erosion in relation to the study area, a brief introduction to that concept is absolutely necessary. People can move from one place to another for a variety of reasons, including economic, social, political, and environmental ones (Black *et al.* 2011). But in recent decades, forced migration has become a widespread occurrence. Forced migration that caused by environmental crisis or natural disasters is termed as an environmental refugee (Warner 2010). Among the various types of natural disasters Riverbank erosion becomes an endemic disaster with long term effect. As a result, it becomes a significant factor in the migration from riverine areas.

Riverbank erosion causes many forms of socioeconomic problems and poverty in some parts of India, making it a serious natural disaster that leads to forced migration (Das *et al.* 2014). According to the National Disaster Management Authority (NDMA 2014), Bihar and Assam are two of India's most severely afflicted states by flooding and erosion. Greater severity was also felt in riverine areas of West Bengal. Many riverfront residents along the Ganges in West Bengal fall victim to poverty and migrate to nearby, non-eroding areas as well as outside the district (Das *et al.* 2017). In any channel of the deltaic tract, bank erosion is a frequent occurrence. The River Ganges in West Bengal, however, presents a quite distinct set of conditions. The river has to change its course since the river channel is so filled with sediments. In the lower Ganges region, especially in the Murshidabad district of West Bengal, major erosion issues exist (Das *et al.* 2014).

RESULTS AND DISCUSSION

Trend of bank erosion: People from different religious, caste, and occupational backgrounds live in the study area. However, there is one issue where all of the inhabitants' concern that namely the vulnerability of the river bank to erosion. Bank erosion has been a problem in this area for many years. The river's flow pattern, the nature of sedimentation, the Farakka barrage construction, the soil composition of the river bank, along with other factors are all contributing to an increase in bank erosion (Rudra, 2014). The fig. 2 shows that the course of the river has changed drastically in the last three decades. A number of points have been selected from our study area to understand the nature of changes in river flow pattern. River in its normal course has eroded sometimes along the left bank and sometimes along the right bank.

The five-points mentioned in the table no. 1 show that the river has eroded more towards the west along the right bank. In other words, it can be said that erosion has increased along the Bhagawangola II block of Murshidabad district in the last three decades. However, the severity of the bank erosion has decreased to a great extent in the last two decades.

Impact of riverbank erosion on social life: River bank erosion has a wide range of negative effects, including social, economic, health, educational, and occasionally political ones as well. The most significant social effect is homelessness brought on by land erosion, which forces people to migrate. Following forced migration, they experience an economic crisis, including job loss and property loss, and they face the risk of falling into poverty and occasionally getting involved in criminal activity. Identity crisis is inevitable to these migrated people as their belongingness to any particular district or state or country is often denied (Das *et al.* 2017).

Displacement of population due to bank erosion: The river had gradually displaced several of the settlements in the study area (Table 2). The settlement was being engulfed by the river, so residents were constantly moving inward. Population of that villages shifted several times in last few decades till the date of survey (Fig.4). Akheriganj, Honumantapur, Tiklichar, Char Krishnapur, Chilmari, Hasanpur, Giridharipur, Rajapur villages along the river either partially or completely engulfed by the bank erosion. Now the people are relocated to about 2 to 16 kms west of the river. Many of them have settled in the Nirmal Char, Khamar diar village and near Bhagawangola station (Fig. 4). Those who are financially able have built shelters away from the river. Many villagers have migrated permanently in the other states.

Loss of property due to bank erosion: According to the study, a large amount of property, such as homes and multiple-cropped land, disappears by the river almost every year. The result was the emergence of the proletariat. Fig. No.5 shows that 74.14% of the people who were surveyed lost less than 6 katha of land. They were all marginal farmers, in other words. Later, they migrated. 3.45% of the villagers who have lost land more than 25 kathas due to riverbank erosion. Similarly, fig.6 shows that 60.38% of the surveyed people lost less than 6 bigha of agricultural land and 3.77% of peoples lost more than 25 bigha agricultural land due to river bank erosion. The erosion of the riverbank has had some impact on each of the local people. A large amount of government property was destroyed due to erosion. School, hospital, BSF camp, government offices, religious centers have been repeatedly affected by the bank erosion which has affected local residents (Table 5).

Occupational shifting due to riverbank erosion: Almost all of the inhabitants in our study area are farmers. The population of this region depends mainly on agriculture, fishing, small cottage industries, small businesses, etc. for their livelihood. But they have frequently lost their livelihood to river erosion. The erosion of the riverbank has affected a family several times. They are now jobless and have lost their land. Many people have migrated as a result, while many more have been compelled to change their occupation. Fig.7 shows people choose many alternatives as occupation but most of the inhabitants who were cultivators now become migratory labours. They are working in different sectors in different parts of the country even abroad.

Table 5. Affected Government properties due to bank erosion

Name of the area	Affected Administrative properties									
	School	Hospital	Temple	Mosque	BSF Camp	Bank	Panchayat	Post Office	Market	Indigo factory
Hasanpur	3	-	1	1	-	-	-	-	-	-
Rajapur	3	-	3	-	1	-	1	1	-	1
Krishnapur	1	-	1	1	-	-	-	-	-	-
Patmari	1	-	-	2	-	-	-	-	-	-
Munsarpur	1	-	2	2	1	1	1	1	1	-
Giridharipur	2	1	-	2	-	-	-	-	1	-
Alaipur	1	-	1	1	-	-	1	1	1	-
Sankarpur	1	-	1	-	-	-	-	-	-	-
Sibnagar	1	-	-	-	-	-	-	-	-	-
Khoribona	1	-	1	1	-	-	1	1	1	1

Source Field survey,2023

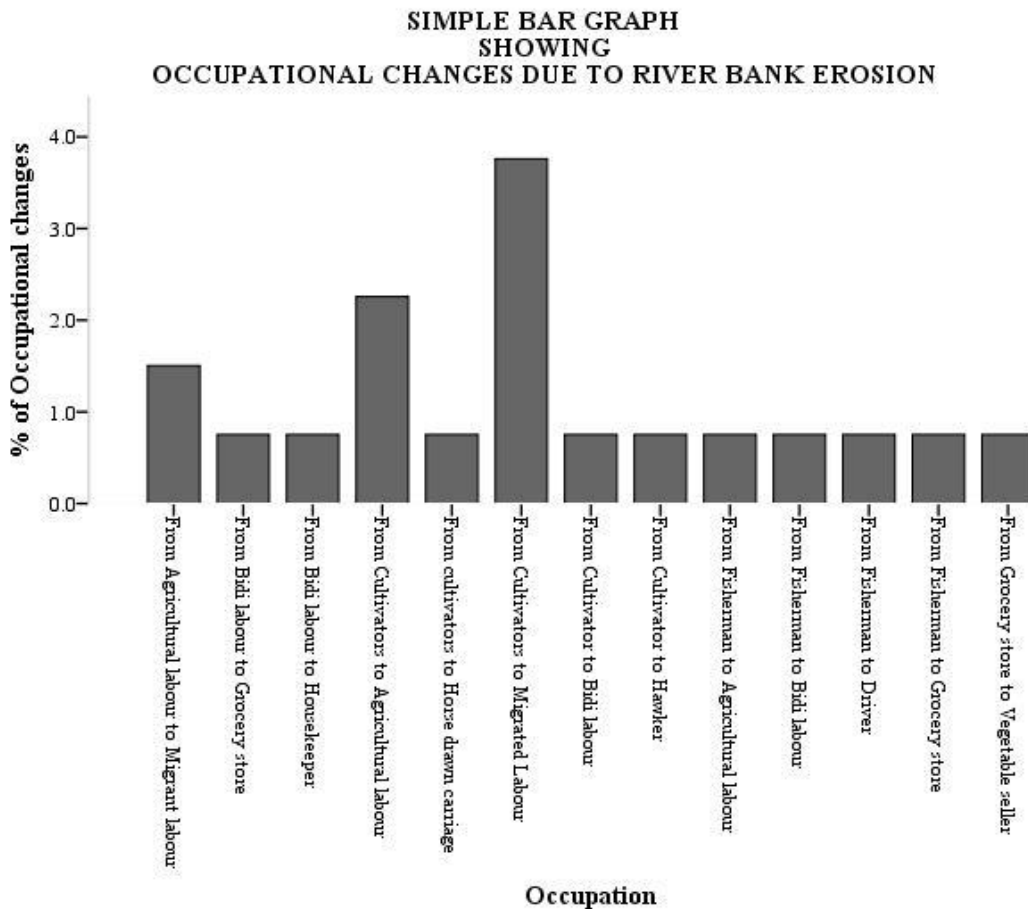


Fig. 7 Occupational changes due to river bank erosion Source Field survey, 2023

However, since it is an international border area, few people have become involved in smuggling and illegal activities due to lack of job opportunities. Overall, the occupational pattern of the river bank erosion affected areas is changing very rapidly.

Findings and Recommendations

Different bank erosion processes take place from the upper reaches to the lower reaches of the river network. It mostly erodes downward in the upper reach, close to its source. However, the river has almost reached its base level as it enters the lower course and is getting close to the sea, therefore most of its erosive force concentrates on cutting laterally. Therefore, bank erosion is a comparatively regular occurrence in the lower course of the River Ganga. This area includes the study area. Bank erosion has long been an issue in the Murshidabad district(Rudra 2014). To stop bank erosion, the administration has used several strategies at various points in time.

But they generally do not get success. Residents of the area are compelled to accept their fate. They are aware that there is always a risk of erosion when living beside a river's banks. As a result, a number of residents along the river banks were compelled to relocate. Yet another group of people continuously struggle through generations but they never leave their native place. Staying together is the only way to cope with this environmental problem since it has made them stronger and united in their struggle for survival against the mighty Ganges. The government is taking numerous actions to slow the rate of erosion. Numerous strategies, including the effective use of sandbags on concave slopes and the concretization of river banks, are used to combat erosion. However, they were not entirely successful. It has been noted that when a river erodes its banks, no precautions can totally prevent bank erosion. Only the severity of the bank erosion is minimized. For instance, in the 1990s, there was considerable bank erosion in our study area, and there was no way to stop it.

Since the main course of river now flows through eastern side of Nirmal Char and towards Bangladesh, the rate of erosion along our research area has decreased. Thus, river erosion is a basically phenomenon that is out of our control. However, damage can be reduced. For this, the measures listed below can be used.

- First of all, the erosion prone area along the river bank should be identified.
- Then gradually the permanent residents should be shifted from this area to safer places.
- Proper rehabilitation should be done for those already affected by the bank erosion.
- Government office, school building, health centers, road etc. cannot be built along the river banks.
- It should be ensured that the flow of the river is not obstructed in any way by any human activities.

CONCLUSION

The research work presented in this paper reveals a significant perception about the river bank erosion and its impact on human life. The government has implemented a number of measures to solve this problem because it has persisted for a long time, including the construction of spurs and embankments. However, these measures did not always work. Therefore, river bank erosion and its effects are quite upsetting. Thus, riverbank erosion always has an adverse impact on human life. Economic insecurity resulting from unemployment, social insecurity resulting from loss of civic rights, health insecurity resulting from a lack of essential infrastructure, etc. are the uncertainties that the erosion victims must deal with. All of these problems brought on by forced migration result in family struggle, destituteness, fragility, and increased vulnerability. This study suggests a holistic approach to deal with the issue and protect the riparian people from social vulnerability.

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