

Channel Migration and Fear of Displacement: A Spatio-Temporal Study of Nirmal Char, in Murshidabad District, West Bengal

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Abstract

The enduring and often challenging relationship between the river and human habitation finds a poignant example in nirmal char. This paper analyzes the trends of channel migration and lateral erosion of the Padma river on the lives, livelihoods, and settlements of the inhabitants of this unique riverine island in west bengal.

The conventional perception that char areas are too impoverished or structurally unstable for development, while often true, is an incomplete picture for Nirmal Char. The core issue here isn't merely the lack of development inputs, but rather the pervasive instability and the fear of displacement that this fluvial dynamism engenders. The primary objective of this study is to highlight the intricate link between river course changes, resulting land loss, and the ever-present anxiety of losing one's homestead among the local populace.

The methodology for this research primarily employs a Descriptive Statistical Method. Since a large number of the inhabitants belong to a homogeneous socio-economic class, both Simple Random Sampling and Stratified Random Sampling techniques were utilized for data collection. The findings clearly illuminate the destructive relationship between river dynamics and human settlement, underscoring the urgent need for intervention in this fragile ecosystem to mitigate the deep-rooted fear and ensure basic stability.

Keywords: River Bank Erosion, Flood, River Migration.

INTRODUCTION

People displaced from one place to another place either push factors or pull factors. The shock factors include population displacement due to natural disasters, war, and development activities. A forced migrant is a person who is forced by adverse circumstances to migrate, but does not cross a border. River erosion and floods are two environmental disasters that occur almost regularly in Murshidabad district. Between these two types of disasters, while damage due to flooding is temporary, land loss due to river erosion is permanent and has long-term effects on the economy. At times, habitable and fertile lands have been destroyed due to river erosion.

We lived in a place in India that was called holy because of the Ganges. The Ganga River originates from Gomukha at the top of the Gangotri Glacier in the Himalayas. The fresh water of Bhagirathi River is created by the melting of the ice of this glacier. Flowing through the Himalayas, the Bhagirathi River joins the Alkananda River, officially becoming the Ganges River. The Ganges basin is sometimes con-

sidered part of a larger basin that includes the nearby Brahmaputra and Meghna rivers. It is known as the Ganges-Brahmaputra-Meghna basin and is one of the largest river basins in the world.

The Ganga flows through the states of Uttarakhand, Uttar Pradesh, Delhi, Bihar, Jharkhand and West Bengal. It reached Dhuliana in Murshidabad region, where the stream split into two – Padma and Bhagirathi. We lived in Murshidabad, a river district where the Ganga and Padma flow. It is believed that the river Ganges flowed slowly through Gaur, the capital of Bengal. According to Rennell (1788), Gaur, the ancient capital of Bengal, was situated on the old banks of the Ganges, and Chhota Bhagirathi etc. is evidence of the past. The main responsibility for the construction of Farakka Dam rests on him. These dams disrupt the normal flow of the river. During the British rule, the Farakka Dam was constructed to expand trade through the Calcutta port and supply water to the Bhagirathi-Hooghly rivers throughout the year. Despite the tilt of the Bengal delta, the Ganges River changes its course. Bhagirathi Patale Ganges stream is known as Padma.

Every day the banks of the river Padma are being eroded and its course is changing. Fluvial migration is a geologic process that involves the lateral migration of a river of sediment across a floodplain. This process is mainly driven by coastal erosion and the accumulation of point bars over time (Wikipedia). The Rajmahal was on the banks of the river, but in 1870 the river shifted from east to west of the Rajmahal and threatened to cross the Kalindri River due to the changing course of the Ganga-Padma. Presently, Padma flows through Bhagbangola-II block, a river that flowed through this block in 1776. In 1988-1989, residents fled their settlements due to the Aheriganj landslide on the banks of the Bhagbangol-II river. Displaced people are also called “environmental refugees”

Study Area

Nirmal Char is a rural village area of community developed block Bhagawangola-II of Murshidabad District in situated west Bengal. This village area located in between 24° 24' 0" N to 24° 18' 30" N latitude and 88° 22' 34" E to 88° 38' 39" longitudes, Nirmal Charis situated the flooded bank of Padma River and western international boundary of Bangladesh, Raninagar-I and II situated on the south-east and the southern part of the Bhagawangola-II, Murshidabad-Jiaganj situated on the south-west part, Bhagawangola-I is situated on the North-west part and western part of the village. And Akheriganja is the village panchayat of one of the village Jazira Char Dumuria situated in Nirmal Char.

Table No.1: General Information About Study Area General information

Name of the state	West Bengal
Name of the district	Murshidabad
Name of the cd block	Bhagwangola II
Latitude	24°18' 35" n to 24°21'08" n
Longitude	88°27' 09" e to 88°29'55" e
Area	35 km ²
Hazard	Flood, Erosion
Panchayat	Akheriganja

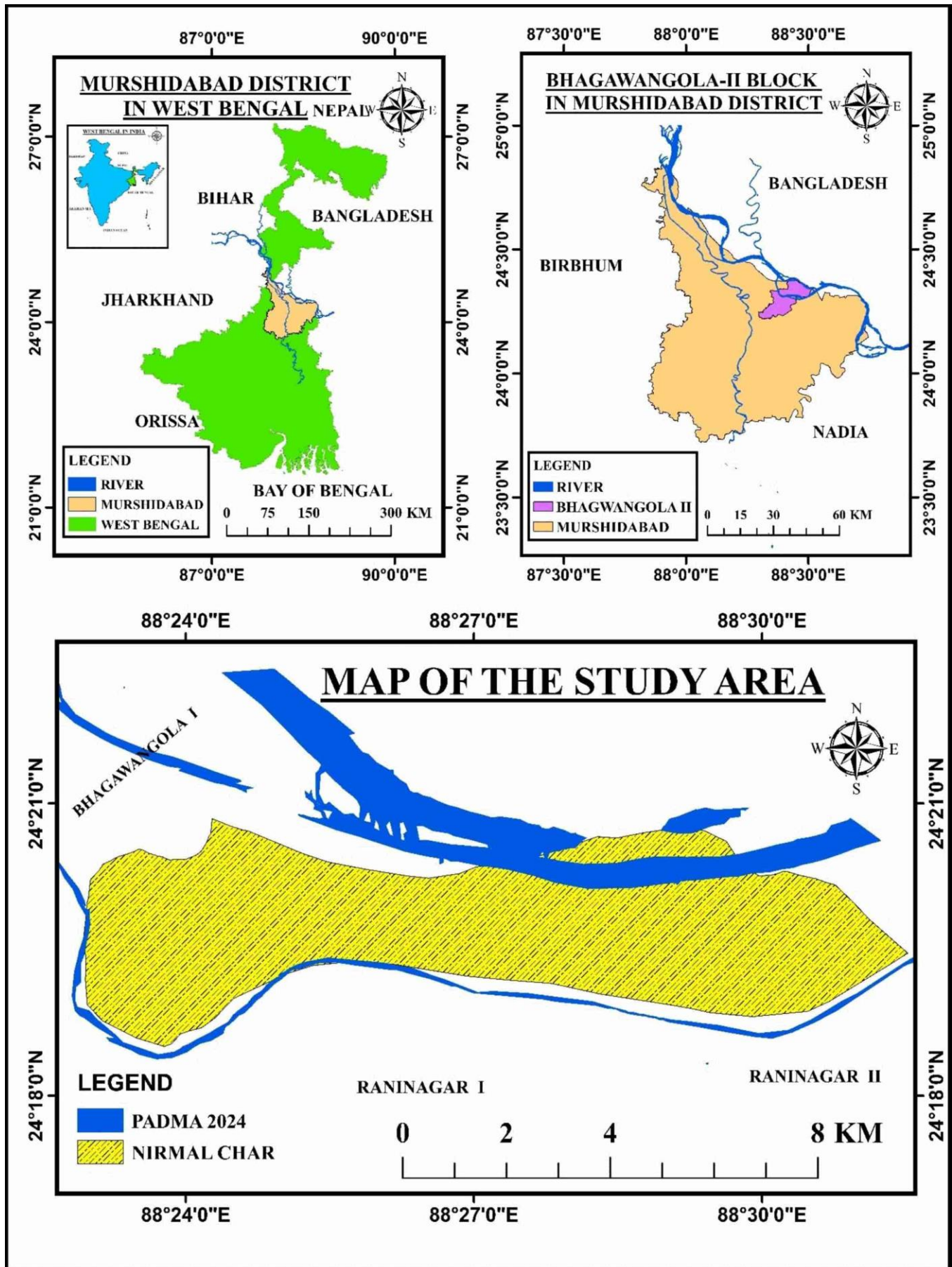


Figure 1: Study Area Map

Discussion

The southeastern Bengal Delta's subsidence caused the Ganga River to divert into the Padma channel, moving away from the Bhagirathi. Historical evidence (Rennel's Map, 1776) shows channel migration near Bhagbangola-I (India) and South Bhatpara Arazi (Bangladesh), affecting the Bhairab River course. Analysis from 1999 to 2024 shows significant Lalgola channel changes around Nirmal Char. By 1993, the Padma flowed into Narukhaki, pushing charkatis eastward. Silt accumulation later shifted the main channel towards Bangladesh (near Patapara, Godagari). This movement created complex flows around South Jazira and Char Dhumuria, with one branch re-entering Bangladesh near Charghar.

By 2001, a river-bed bar led to the Padma splitting into two major channels near Bhagbangola and Kanthalbari. One stream flowed through Indian villages (Khamar Diar, Nasipur, etc.), while the other encircled parts of Nirmal Char and South Jazira Char Dhumuria. In 2011 Padma river make unpredictable turn.

The 2024 view confirms the dominant eastward shift of the left bank (Patapara to Bhatpara). The river is actively eroding eastward near West Durlabpur and Kodalkati, though bank erosion near Rajshahi shows a westward shift. The net effect is the isolation of Nirmal Char, which now exists as a surrounded bar with a completely diverted original course, constantly threatened by the main river and its separate flows.

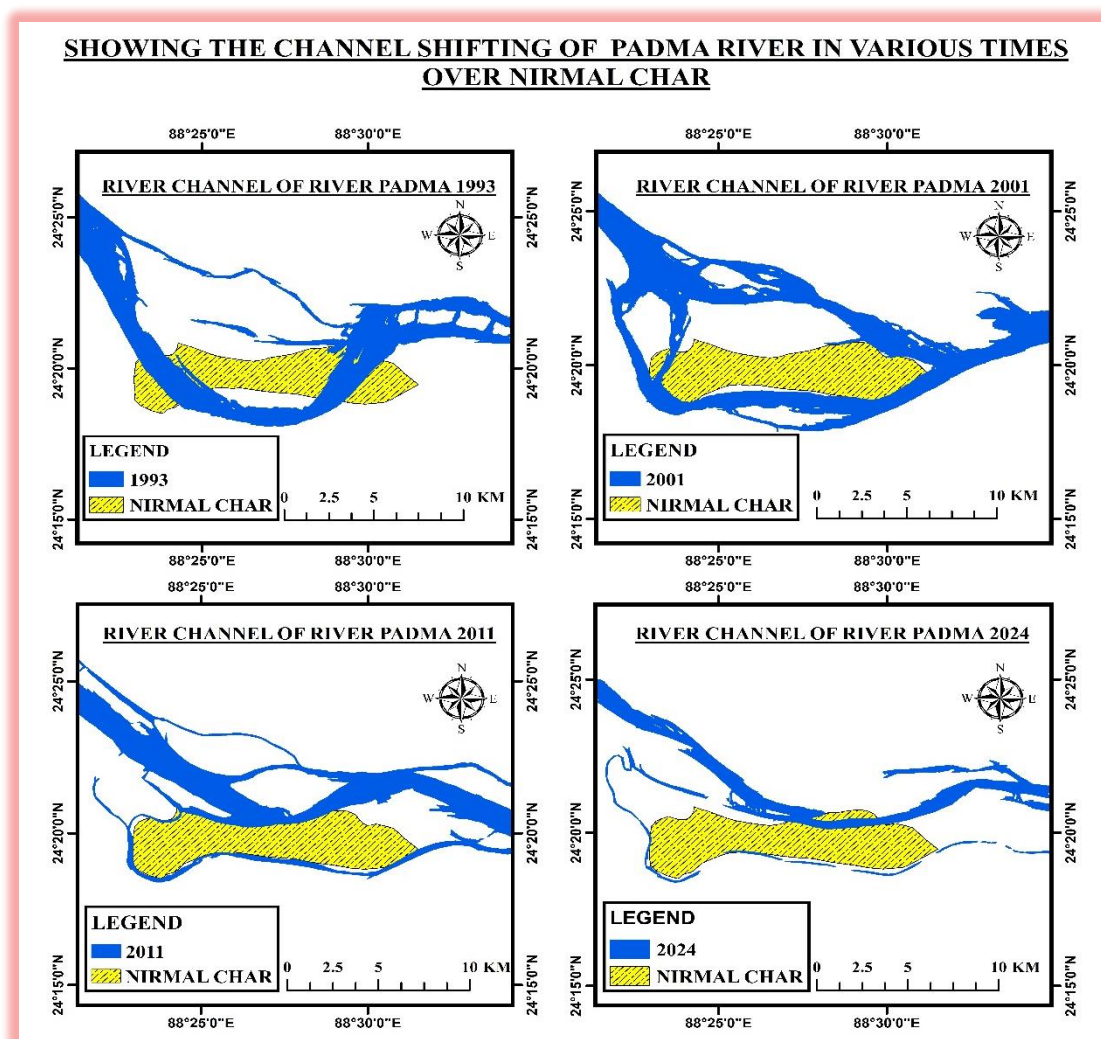


Figure 2: River Shifting From 1993 to 2024

Sinuosity Index: The Sinuosity Index of the Padma River has shown a decreasing trend from 1993 to 2024. In 1993, the river had a relatively high sinuosity index of 1.43, indicating significant meandering. This increased to 1.46 in 2001, suggesting even more winding. However, by 2011, the index dropped to 1.24, reflecting a reduction in meandering. The trend continued with the index further decreasing to 1.21 in 2024, indicating that the river's path has become progressively straighter over time.

$$\text{Formula for Sinuosity Index} = \left(\frac{\text{Observed Length}}{\text{Expected Length}} \right)$$

Table No.2: Sinuosity Index of the Padma River

Year	Observed Length Km	Expected Length Km	Si
1993	110	76.9	1.43
2001	112	76.8	1.46
2011	93.9	75.6	1.24
2024	91.9	75.7	1.21

Table No.3: Sinuosity Measure

Classes Of Sinuosity	Nature
<1.05	almost straight
1.05-1.25	winding
1.25 -1.50	twisty
1.50 ≤	meandering

Figure 3: Sinuosity Index

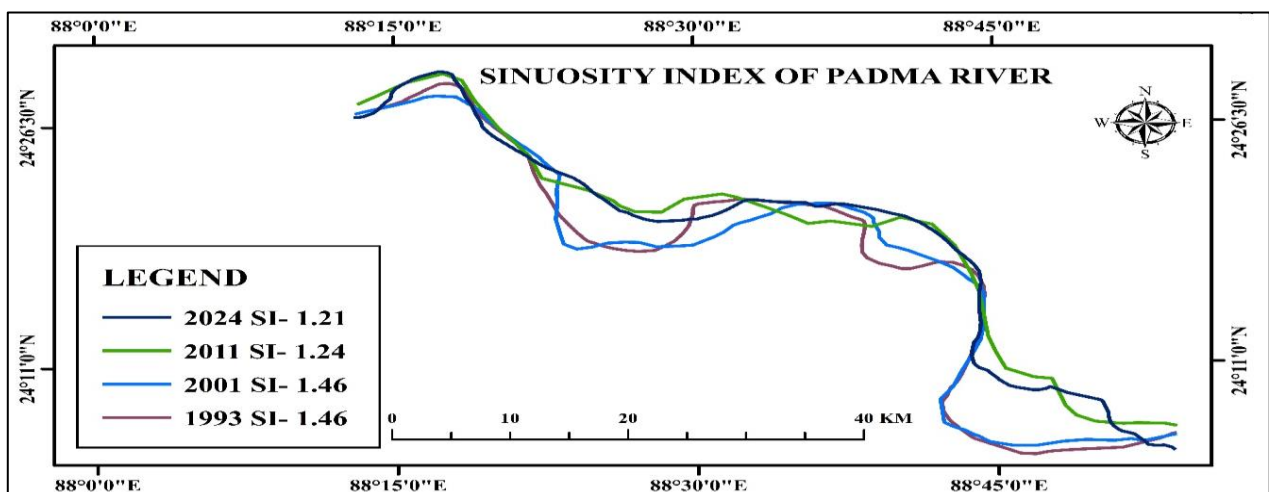
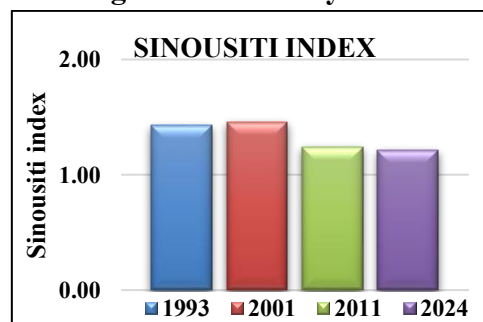


Figure 4: Sinuosity Index

Braiding Index (BI): The Braiding Index (BI) quantifies the extent of a river's braiding, which is the division of its flow into multiple interweaving channels. A low Braiding Index in 2024 indicates a relatively simple river system with a single, dominant channel and minimal braiding. A moderate Braiding Index in 1993 to 2001 reflects Padma River with several visible channels and bars, showing noticeable but manageable braiding. A high Braiding Index in 2011 signifies a highly braided and complex river system with numerous interwoven channels and frequent changes in the riverbed.

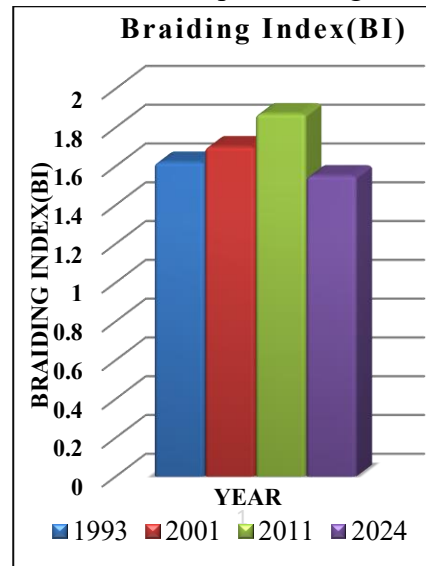


Figure 5: Braiding Index

Formula for Braiding Index (BI):

$$= \left(\frac{2 \times \text{Summation of all islands and bars in the reach}}{\text{Length of the reach measured}} \right)$$

Table No.4: Braiding Index Of Padma River

Year	1993	2001	2011	2024
sum of Islands and bars in Reach	7805	8132	6954	5729
Length of Reach	9629	9553	7438	7398
Braiding Index(BI)	1.62	1.70	1.87	1.55

Spatial Changes In Various Times: The total volume of Nirmal Char has changed many times. We can observe in the given table where the total area of Nirmal Char in 1993 was 26 square kilometers. Later, between 1993 and 2001, the area became 34 square kilometers due to the impoundment of the Padma River. In the same form, in 2001 to 2011, its level increased to 37 square kilometers. But from 2011 to 2024, the area has decreased by 35 square kilometers. From this we understand that this region has reached its present location through erosion and accumulation many times.

Table No.5: Shape Changes In Various Times

Year	Shape of Area(sq k.m.)
1993	26
1993-2001	34
2001-2011	37

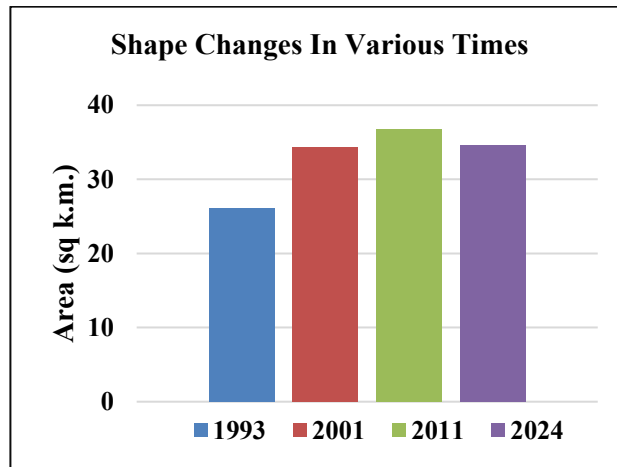


Figure 5: Shape Changes In Various Times

Conclusion

Nirmal Char being a flood prone area always creates a fear of resettlement among the inhabitants in this area. The population of this region has already been displaced from other floodprone areas like Patibna (partly destroyed), Akhrganj Mouza (fully destroyed) Khoribona (partly destroyed) Sankarpur (partly destroyed) Munsarpur (fully destroyed) Hasanpur (partly destroyed) and settled in Nirmal Char. Some of the residents living in Nirmal Char have been from 5 years, some from 8 years and some from more than 25 years. As these people have suffered previous terrible floods and lost everything to settle anew in this serene settlement, an earlier fear is still active among them. Among them, the fear of loss of their homesteads, destruction of agricultural land, economic weakness, disease and above all the fear of life. As most of the population in this region is engaged in agriculture, their economic condition is not very good. As it is a very remote rural area, the region has little to no advanced education facilities and no industrial or workplace facilities. Therefore, they are forced to engage in agricultural activities, or join the work as migrant workers. In this situation, the fear of inundation of their own cultivable agricultural land is always active.

Findings Of The Study

1. River movement displace communities living in this flood-prone area. When the rivers changes her course, homes, farmland and infrastructure can be destroyed or their lives made unsafe.
2. River shifting's are often the result of natural processes such as erosion, sedimentation and changes in water flow. Human activities such as deforestation, and land abuse can exacerbate these changes.
3. Although the amount of sediment removed from the riverbed each year is low amount, but a large amount of sediment stored in the riverbed, which reduces the river's carrying capacity. And people living on the banks are in trouble.

Problems

1. Rivers in this region often see floods. As a result of which the people here are constantly being displaced abnormally.
2. Due to the unusual course changes and breaks of the river, the inhabitants of the region are often

forced to displaced from one place to another.

3. The education rate of this region is very low as there are no prominent educational institutions in this region.
4. There are no permanent job opportunities here.

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