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Consequences of Riverbank Erosion among Rural Household along the River of Meghna in Bangladesh

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Abstract

Bangladesh, a riverine country, is suffering from acquit riverbank erosion which compels millions of her population to be displaced from their place of origin. Flood and riverbank erosion are dynamic and natural processes which have an adverse impact on livelihood. Our study focuses the socio-demographic profile of the victims of the study area. In our study we have a large number of the respondents receive the formal education that is also 60% of the respondents. Only 10% of respondents who finished the S.S.C. The damage caused by this disaster is a negative cause of illiteracy in the region. About 56% respondent says that river erosion has an impact on their child education. Most often after losing their home they have moved somewhere else therefore their child can't attend the same school. More than 2 times the people about 54.9% are facing riverbank erosion and 98.8% of them are migrated to another place. After migration 66.4% of them are facing economic crisis and 82.6% of them have changed their occupations due to this calamity. Accommodations, education, treatment, are one of the basic needs which are in great trouble for those areas. Even after so much, only 70% of the people didn't get any relief. Above all, 88% people believe that such kind of disasters can be solved by constructing embankments. There is a significant association between educational level and tackling erosion. In fact, caused riverbank erosion every year unemployment, landless and poverty are increasing which is responsible to country wide unstable condition.

Keywords: Riverbank • Consequences • Erosion • Household • Migration

Introduction

Riverbank erosion is considered one of the major natural disasters in Bangladesh, one of the adverse consequences of climate change. Riverbank erosion is a natural slow-onset hazard that upsets the balance of many fluvial and coastal environments of the world by wearing away the bank materials from a river's banks. This geomorphic process results in the shorelines' movement from its original position, affecting the lives of the people living nearby Islam and Rashid [1,2]. Bangladesh is a riverine country which is criss-crossed by more than 220 rivers, 57 of them are international, with a stretch of 2,400 kilometers (km) of bank-line [3]. All these rivers are divided into three major river systems *i.e*., the Ganges-Padma, the Brahmaputra-Jamuna and the Meghna. The catchment area of these major rivers is about 1.65 million km^2 of which only 7.5 percent lies within the border of Bangladesh that generates 1,200 km^3 of run-off annually, only 10 percent of which is generated within Bangladesh [4]. Bangladesh is susceptible to numerous natural disasters such as tropical cyclones, storm surges, coastal erosion, floods, droughts and riverbank erosion causes heavy loss of life and property. Furthermore, every year, natural calamities affect people's lives and livelihoods in some parts of this country. Due to climatic and non-climatic variability and change, life and livelihood of the general people of Bangladesh are heavily dependent on the local ecosystem; but their services are under immense pressure all over the country [5]. The Bangladesh is situated in the Bengal delta which was developed by three mighty rivers *i.e*., the Ganges, the Brahmaputra and the Meghna (GBM) [6]. The sediments deposited in the GBM basin is the highest in amount in the world [7]. factors that affect riverbank erosion are; decrease or increase in shear strength, changes of river course, characteristics of erosion prone bank and bed materials, pressure imbalance at the bank face, rapid drawdown, poor vegetation cover, obstacle in the streams, wind wave and boat wakes [8]. As such, 283 locations, 85 towns and growth centers, along with 2400 kilometers of riverbank line in Bangladesh are vulnerable to erosion. The union of this upazila is Char Falcon has 30,815 people who are suffering most due to river erosion. 'Internally Displaced Populations' (IDP) face many unavoidable problems at different stages of displacement. Displacement marginalized them in respect of livelihood patterns and psycho-physical troubles [9]. Erosion and accretion processes vary in a decade scale along the main rivers of Bangladesh, which can also be influenced by anthropogenic activities [10]. Storm surges, tidal ranges and wave action are the main

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reasons for erosion at the front of the Bay of Bengal in coastal Bangladesh. Erosion has significantly reduced many islands in Bangladesh over the past 100 years Riverbank erosion continues to create hardship and stress on the lives of people living in riverbank areas in Bangladesh [11,12]. Bangladesh, a riverine country, is suffering from acquit riverbank erosion which compels millions of her Population to be displaced from their place of origin. The Kamalnogorupazila of Laxmipur districts is the victim area of riverbank erosion of Meghna river. We have conducted our survey by primary data collection on 8 January, 2021 including 23 survey questions on the basis of their livelihood. In this area people have lost their home, land, hospital, educational institutions by the aggression of Meghna river. As such, 283 locations, 85 towns and growth centers, along with 2400 kilometers of riverbank line in Bangladesh are vulnerable to erosion. The union of this upazila is Char Falcon has 30,815 people who are suffering most due to river erosion. 'Internally Displaced Populations' (IDP) face many unavoidable problems at different stages of displacement. Displacement marginalized them in respect of livelihood patterns and psycho-physical troubles. Riverbank erosion, a factor which accounts for the largest losses in Bangladesh, occur gradually but has long-term impacts and is not recoverable naturally. Riverbank Erosion is an important geo-morphological phenomenon affecting changes in river channel courses in alluvial plains creating long-term impacts and is not recoverable Naturally. This erosion problem is a regular phenomenon in Bangladesh and about 15 to 20 million people are at risk from the effects of erosion in the country while about 1 million people living in 94 upazila are directly affected by riverbank erosion every year. Newly settled people along with the people who have recently lost their home are interviewed to find out the difficulties associated with rearrangements for them. Along with this problem of displacement, effects on their income, local crime rate, effects on their family relations, sufferings, government effects to prevent erosion are revealed in this paper. Moreover, there is no effective plan of action to resolve this problem in Bangladesh [13].

Objective

- To study the social life of people affected by riverbank erosion.
- To study the impact of riverbank erosion and its effect on the people include not only income and expenditure poverty but also damage to other aspects of human socioeconomic development like, health, education, living conditions, and security.
- To determine the migration and resettlement patterns of Bangladesh.

This study took place in Chor Falkan union of Ramgati Upazila, Lakshmipur, Bangladesh. The study area was selected through field observation because the coastal area of Bangladesh is at great risk for its geographical uniqueness to be affected by riverbank erosion. A number of villages in Ramgati upazila of the district have already been devoured by the Meghna river. The erosion-hit villages are Aslipara, Ramgati Bazar and Ramdayal under Ramgati upazila and Nasirganj, Hajiganj of Charkalkini union, Kadir Panditerhat of Saheberhat union, Ludhua Folkon of Char Folkon union and Dakshin Folkon of Patarihat union in Kamalnagar upazila Lands are disappearing as erosion continues. Some 16,000 acres of crop lands, 15 educational institutions, cyclone shelter centers, four colonies of Ashrayan project, a stretch of 20 kilometer cross dam, roads, mosques and various structures have been devoured by the Meghna river in the last 40 years (locals informed). In this research method, individual's information was collected through using a questionnaire where the respondents are asked questions and collected information. The data were collected through applying face-to-face interview techniques. Based on the Yamane sampling formula; where 95% confidence level and the margin of error (.05) were accepted. Altogether 81 samples were taken from 2691 households. And then adapting purposive sampling, the household heads were selected for interviews.

Statistical analysis

We perform descriptive analysis and graphical presentation, mean, standard deviation, Cramer's V value *chi-square* test and meta analysis were used on socio-demographic factors to find out the association between various nominal and categorical variables. The t-test was applied to test the significance of the study variables. Finally, Binary Logistic Regression used to find out the individual expectation on dependent variables. We use the SPSS-25 version, MS Excel and MS-Word for performing analysis.

Literature Review

Md. Shohel Rana and Ayesha Meherun Nessa discussed in their study the impact of riverbank erosion on population migration and resettlement of Bangladesh. From this study it was observed that every year thousands of hectares of land were washed away by the aggressive rivers e.g., the Jamuna, the Padma, the Meghna. As a result thousands of people landless, homeless and lose their resources every year. In the study area some landless people leave without shelter and food to their own safe destination. Therefore to get out of this problem, some changes are needed such as honest political leaders, initiatives of institutions and service organizations that will work tirelessly for the victims of riverbank erosion [14].

Tanjinul Hoque Mollah and Jannatul Ferdaush defined migration as a significant part of human history as the movement of people over some distance and from one usual place of residence to another due to search of food, shelter or civilizing living conditions. Migration occurs both temporary and permanently. Temporary migration is migration to an area that is not intended to be permanent, for a specified and limited period of time, and usually undertaken for a specific purpose due to climate stress. Permanent migration occurs when the people landless, homeless and lose their resources [15].

Due to riverbank erosion millions of people are affected and the result is loss of housing, crops, cattle and also farmland. Bangladesh Water Development Board (BWDB) said the districts which are most in risk are Bogra, Sirajgonj, Kurigram, Lalmonirhat, Rangpur and Gaibandha [16]. Abdus Sattar Paloan convener of the organization said "Almost 50%of the kamalnagar and Rangamatiupazilas were washed away in twenty years. If emergency measures are not taken along with the dam construction, the very existence of Kamalganjupazila will be compromised [17]." BWDB Engineer of Laxmipur Md Arifur Hossain said: "We conducted a survey over a 15.5 kilometer area as part of the second phase. When we get the survey results, a design will be proposed to the authority, and the

construction will begin soon after [18]." Usually migration occurred from rural to urban area in search of livelihood but there is occurred internal migration to and fro because of riverbank erosion. Thousands acres fertile land, 35 schools, 15 markets outspent in Meghna river. Three major rivers (the Ganges, the Brahmaputra-Jamuna, the Meghna) are in Bangladesh 1.1 million acre feet are running in Bangladesh which occurred flooding, riverbank erosion, and house displacement. That's why poverty, landlessness lag behind the rural people. The people who migrated to another area from the riverbank erosion area have suffered socially and economically in their current place.

Results and Discussion

The demographic data of the respondents show that there is a difference between the age of the respondents. We have 44% respondents between the ages of 15-35. Which means that the respondent is mostly young. We have some older respondents too. Though the number of the older respondents is only around 15%. Education which is one of the basic necessities of life can also promote the overall development of a society. In our study we have a large number of the respondents receive the formal education that is also 60% of the respondents. But only 10% of respondents who finished the S.S.C. We also found that the families mostly have 4-6 members. But there are also some families which have more than 7 members (Table 1).

Variable	Category	Frequency	Percentage (%)
Age of the people	15-35	36	43.9
	36-55	33	40.2
	56-75	13	15.9
		Total=82	Total=100%
Number of the family member	1-3	5	6.1
	4-6	46	56.1
	7-9	30	36.6
	>9	1	1.2
		Total=82	Total=100%
Education Level	Primary	47	57.3
	Under S.S.C	27	32.9
	Under H.S.C	8	9.8
		Total=82	Total=100%

Table 1. The demographic profile of the respondents.

Comment: Illustrates that 43.9% people ages between 15 to 35 years and 56.1% family have the number of family member are 4 to 6. The education level of 57.3% people is primary (Table 2).

Variable	Category	Frequency	Percentage (%)
Time erosion faced	1	21	25.6
	2	16	19.5
	>2	45	54.9
		Total=82	Total=100%
Losing home	Yes	81	98.8
	No	1	1.2
		Total=82	Total=100%
Migrate after river erosion	Yes	81	98.8
	No	1	1.2

		Total=82	Total=100%
Where migrated	Rural area	50	61
	Semi urban area	30	36.6
	Urban area	2	2.4
		Total=82	Total=100%
Changing occupation	Yes	16	19.5
	No	66	80.5
		Total=82	Total=100%
Impact on income	Yes	74	90.2
	No	8	9.8
		Total=82	Total=100%
Impact on education	Yes	46	56.9
	No	36	43.1
		Total=82	Total=100%
Face economic crisis	Yes	69	84.1
	No	13	15.9
		Total=82	Total=100%
Face identity crisis	Yes	50	61
	No	32	39
		Total=82	Total=100%
Get any relief	Yes	25	30.5
	No	57	69.5
		Total=82	Total=100%
Feel insecure	Yes	41	50
	No	41	50
		Total=82	Total=100%
Government take preventing steps to reduce erosion	Yes	37	45.1
	No	45	54.9
		Total=82	Total=100%
Cause of river erosion	Absence of embankment	72	87.8
	Abnormal flood	10	12.2
		Total=82	Total=100%
How to tackle erosion	Construct embankment	38	46.3
	Need honest political leader	38	46.3
	Need to consult local people	1	1.2
	Need regular river dredging	5	6.1
		Total=82	Total=100%

Table 2. Impact on subsistence due to the effect of riverbank erosion.

This table represents the frequency and the percentage of all questionnaire variables according to their classification.

Comment: Illustrates that about 54.9% people have faced the river erosion more than 2 times that's why 98.8% people loss their home and migrated to another place. 80.5% people haven't change their occupation but there occurs impact of income on 90.2% people and 84.1% people face economic crisis also 61% people face identity crisis.50% people feel insecure and 69% people don't get any relief.

87.8% people thinks that the cause of this river erosion is absence of embankment but 54.9% people have said government don't take any preventive steps to reduce erosion. To tackle this erosion 46.3%people have said they need honest political leaders and construct embankments (Table 3).

Descriptive statistics

	N	Minimum	Maximum	Mean	Std. deviation	Variance
Age of people	82	1	3	1.7195	0.72477	0.525
Number of family member	82	1	4	2.3293	0.60969	0.372
Times of face erosion	82	1	3	2.2927	0.85328	0.728
Migrate after river erosion	82	0	1	0.0122	0.11043	0.012

Table 3. Descriptive statistics.

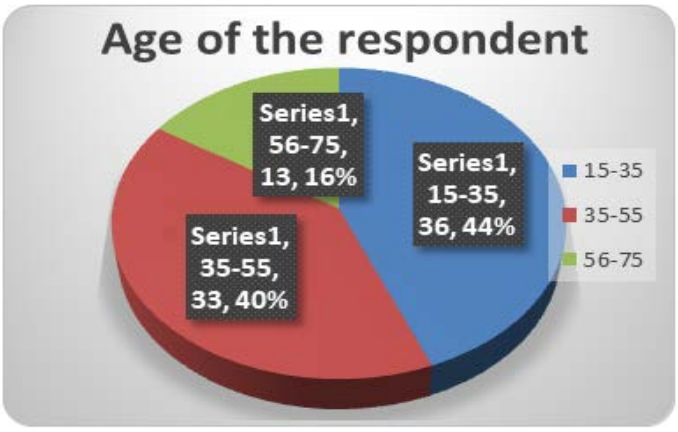

Figure 1. Age of the 44 respondents.

Above Figure 1 shows that, age of the 44% respondents between 15-35, 40% and 16% respondents are between (35-55) and (56-75) respectively. In total, we have 84% of respondents who are aged between 15 and 55. So, we can say that most of the respondents are young.

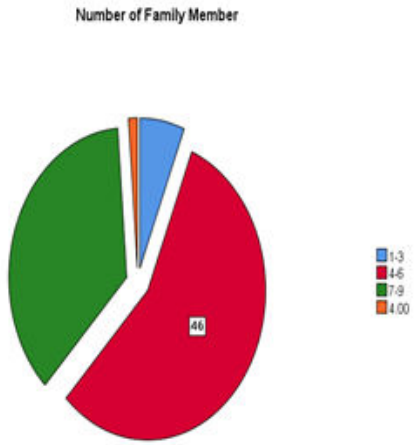

Figure 2. Number of family members.

This Figure 2 shows 46% of respondents who belong to (4-6) members families. More family members are a hindrance to the livelihood of the afflicted people, so they have to go out on the path of earning without education.

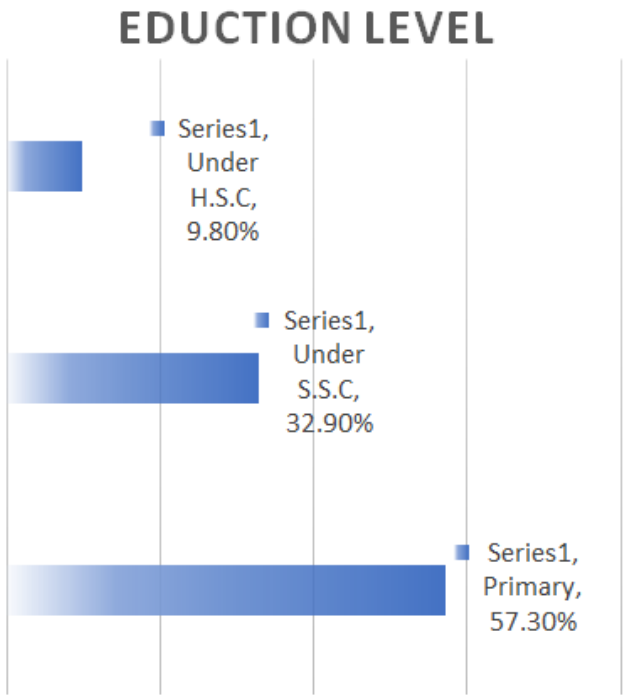

Figure 3. Education level.

Above Figure 3 shows, most of the respondents (57.30%) who at least go to primary school. The damage caused by this disaster is a negative cause of illiteracy in the region (Figure 4).

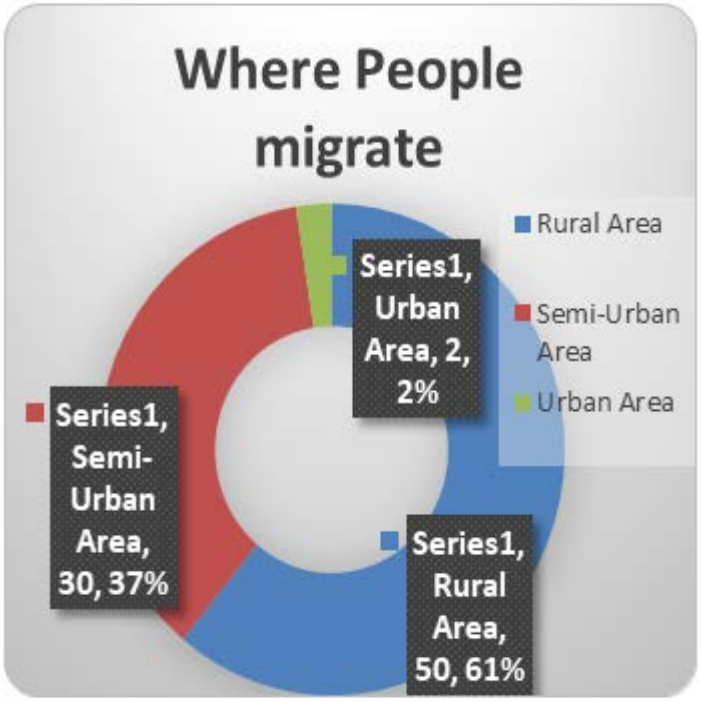

Figure 4. Where people migrate.

From the above doughnut chart we saw that 61% of the respondent people who have lost their house due to river erosion migrated to the rural area (Figure 5).

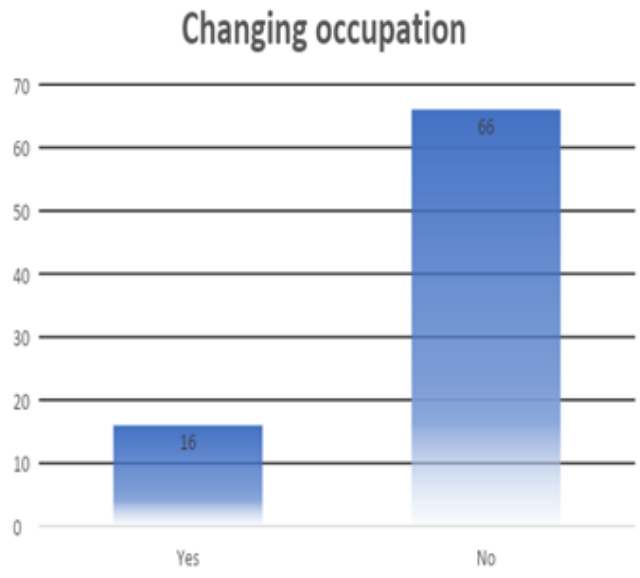

Figure 5. Changing occupation.

From the graph we saw that 66 respondents out of 82 said that they have changed their occupation due to the river erosion (Figure 6).

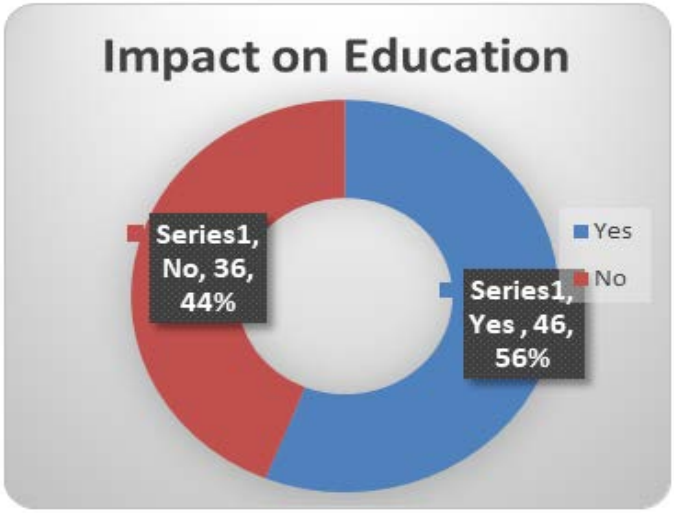

Figure 6. Impact on education.

From the Figure indicate that 56% respondent says that river erosion has an impact on their child education. Most often after losing their home they have moved somewhere else so that their child can't attend the same school (Figure 7).

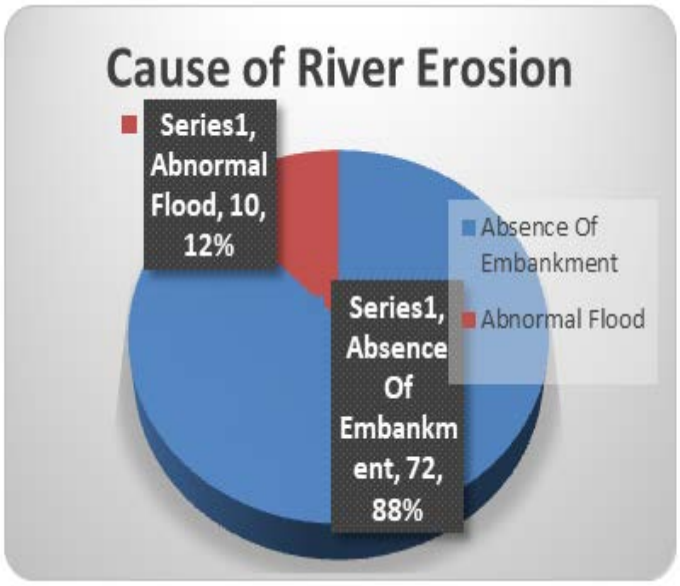

Figure 7. Cause of river erosion.

It has been found about 88% of the coastal people believe that, absence of the embankment is the main cause of the river erosion (Figure 8).

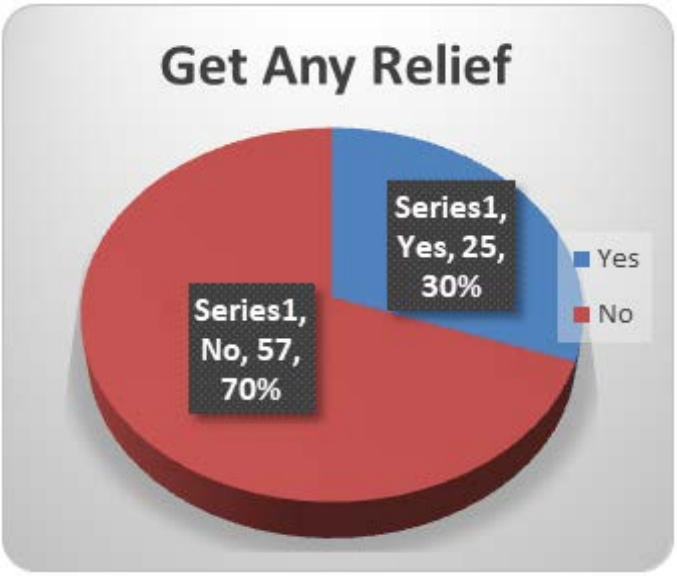

Figure 8. Get any relief.

It has been found about 70% of the affected people didn't get any relief (Figure 8).

Study area

The Kamalnogor upazila of Laxmipur districts is the victim area of riverbank erosion of Meghna river. The union of this upazila is Char Falcon has 30,815 people who have suffered most due to river erosion (Figure 9). 'Internally Displaced Populations' (IDP) face many unavoidable problems at different stages of displacement. Displacement marginalized them in respect of livelihood patterns and psycho-physical troubles (Table 4).

Figure 9. Spot map of riverbank erosion.

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I for EXP (B)	
								Lower	Upper
Steps 1a	Times of face erosion			0.233	2	0.89			
	Times of face erosion (1)	-0.028	1.121	0.001	1	0.98	0.973	0.108	8.758
	Times of face erosion (2)	-0.37	0.883	0.176	1	0.675	0.691	0.122	3.898
	Losing home (1)	-20.426	40192.97	0	1	1	0	0	
	Migrate after river erosion (1)	-19.366	40192.97	0	1	1	0	0	
	Where migrate			0.141	2	0.932			
	Where migrate (1)	-0.302	0.805	0.141	1	0.707	0.739	0.153	3.58
	Where migrate (2)	-18.961	28224.04	0	1	0.999	0	0	.
	Changing occupation (1)	0.602	1.224	0.242	1	0.623	1.826	0.166	20.101
	Impact on income (1)	-18.676	13971.28	0	1	0.999	0	0	
	Effect on education (1)	-0.198	0.792	0.063	1	0.802	0.82	0.174	3.869
	Face economic crisis (1)	0.509	0.965	0.279	1	0.598	1.664	0.251	11.036
	Face identity crisis (1)	0.983	0.774	1.614	1	0.204	2.673	0.587	12.182
	Feel insecure (1)	1.06	0.828	1.639	1	0.2	2.888	0.57	14.637

Govt take preventing step to reduce erosion (1)	-0.591	0.791	0.558	1	0.455	0.554	0.117	2.612
Constant	-2.832	1.421	3.972	1	0.046	0.059		

Table 4. Logistic regression–cause of river erosion.

Variable (s) entered on step 1: Times of face erosion, losing home, migration after river erosion, where migration, changing occupation, impact on income, effect on education, face economic crisis, face identity crisis, feel insecure, govt take preventative steps to reduce erosion.

Above Table illustrates that 97% of the people are facing river erosion 2 times due to riverbank erosion which occurs for absence of embankment and 73% people migrated to semi-urban area.82% people have changed their occupation and have harmful educational effects. 66% people face insecure after riverbank erosion which occurs for absence of embankment. 55% think that the govt. do not take preventive measure to reduce riverbank erosion which occurs for absence of embankment. Table 04 illustrates that 66.4% of the people who are affected by the riverbank erosion have faced economic crisis and 82.6% people have changed their occupation after migration (Table 5).

One sample t-test	N	Mean	Std. deviation	Std.error mean	Test value	95% Confidence interval of the difference upper	lower	t	Mean difference	df	Sig. (2-tailed)
Times of face erosion	82	2.2927	0.85328	0.09423	1.98	0.5002	0.1252	3.318	0.31268	81	0.001

Table 5. One sample t-test times of facing river erosion.

The significant value 0.001 which is less than 0.05 (p-value) so the sample is unlike population (Table 6).

Case processing summary

education level* how to tackle erosion	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
	82	97.60%	2	2.40%	84	100.00%

Education level*how to tackle erosion cross tabulation

			how to tackle erosion				Total
			Construction embankment	Needed honest political leader	Needed to consult local people	needed regular river dredging	
Education level	Primary	Count	19	26	0	2	47
		Expected count	21.8	21.8	0.6	2.9	47
		% within education level	40.40%	55.30%	0.00%	4.30%	100.00%
		% within how to tackle erosion	50.00%	68.40%	0.00%	40.00%	57.30%
	Under ssc	Count	14	12	0	1	27
		Expected count	12.5	12.5	0.3	1.6	27
		% within education level	51.90%	44.40%	0.00%	3.70%	100.00%
		% within how to tackle erosion	36.80%	31.60%	0.00%	20.00%	32.90%
	Under hsc	Count	5	0	1	2	8

	Expected count	3.7	3.7	0.1	0.5	8
	% within education level	62.50%	0.00%	12.50%	25.00%	100.00%
	% within how to tackle erosion	13.20%	0.00%	100.00%	40.00%	9.80%
Total	Count	38	38	1	5	82
	Expected count	38	38	1	5	82
	% within education level	46.30%	46.30%	1.20%	6.10%	100.00%
	% within how to tackle erosion	100.00%	100.00%	100.00%	100.00%	100.00%

Chi-Square tests

	Value	df	Asymptotic significance (2-sided)
Pearson *Chi-Square*	19.981[a]	6	0.003
Likelihood ratio	17.015	6	0.009
Linear-by-Linear association	0.207	1	0.649
N of valid cases	82		

8 cells (66.7%) are expected to count less than 5. The minimum expected count is 0.10.

Table 6. Cross tab and chi square test.

Here, p value (0.003) <level of significance(0.05), so educational level and erosion tackle efficiency significantly related. We conclude that there is significant association between educational level and tackle erosion (Table 7).

Case processing summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Times of face erosion*get any relief	82	97.60%	2	2.40%	84	100.00%

Times of face erosion*get any relief crosstabulation

			Get any relief		Total
			yes	no	
Times of face erosion	1	Count	12	9	21
		Expected count	6.4	14.6	21
		% within times of face erosion	57.10%	42.90%	100.00%
		% within get any relief	48.00%	15.80%	25.60%
	2	Count	2	14	16
		Expected count	4.9	11.1	16
		% within times of face erosion	12.50%	87.50%	100.00%
		% within get any relief	8.00%	24.60%	19.50%
	>2	Count	11	34	45

		Expected count	13.7	31.3	45
		% within times of face erosion	24.40%	75.60%	100.00%
		% within get any relief	44.00%	59.60%	54.90%
Total		Count	25	57	82
		Expected count	25	57	82
		% within times of face erosion	30.50%	69.50%	100.00%
		% within get any relief	100.00%	100.00%	100.00%

Chi-Square tests

	Value	df	Asymptotic Significance (2-sided)
Pearson *Chi-Square*	10.259a	2	0.006
Likelihood ratio	10.058	2	0.007
Linear-by-Linear association	5.467	1	0.019
N of valid cases	82		

1 cell (16.7%) have expected count less than 5. The minimum expected count is 4.88.

Table 7. Time of face erosion*get relief.

Here, p value (0.006)<level of significance (0.05), so time of face erosion and getting any relief significantly related. we conclude that there is significant association between time of face erosion and getting any relief (Table 8).

Case processing summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
where migrate*changing occupation	82	97.60%	2	2.40%	84	100.00%

where migrate*changing occupation cross tabulation

			Changing occupation		Total
			yes	no	
Where migrate	Rural area	Count	15	35	50
		Expected count	9.8	40.2	50
		% within where migrate	30.00%	70.00%	100.00%
		% within changing occupation	93.80%	53.00%	61.00%
	Semi urban area	Count	1	29	30
		Expected count	5.9	24.1	30
		% within where migrate	3.30%	96.70%	100.00%
		% within changing occupation	6.30%	43.90%	36.60%
	Urban area	Count	0	2	2

		Expected count	0.4	1.6	2
		% within where migrate	0.00%	100.00%	100.00%
		% within changing occupation	0.00%	3.00%	2.40%
Total		Count	16	66	82
		Expected count	16	66	82
		% within where migrate	19.50%	80.50%	100.00%
		% within changing occupation	100.00%	100.00%	100.00%

Chi-Square tests

	Value	df	Asymptotic significance (2-sided)
Pearson *Chi-Square*	8.987a	2	0.011
Likelihood ratio	11.09	2	0.004
Linear-by-Linear association	8.353	1	0.004
N of valid cases	82		

2 cells (33.3%) have expected count less than 5. The minimum expected count is 0.39.

Table 8. Place of migration*changing occupation.

Here, p value (0.011) <level of significance (0.05), so place of migration and changing occupation significantly related.we conclude that there is significant association between place of migration and changing occupation (Table 9).

Case processing summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Where migrate*get any relief	82	97.60%	2	2.40%	84	100.00%

Where migrate*get any relief Crosstabulation

			get any relief		Total
			yes	no	
Where migrate	Rural area	Count	21	29	50
		Expected count	15.2	34.8	50
		% within where migrate	42.00%	58.00%	100.00%
		% within get any relief	84.00%	50.90%	61.00%
	Semi urban area	Count	4	26	30
		Expected count	9.1	20.9	30
		% within where migrate	13.30%	86.70%	100.00%
		% within get any relief	16.00%	45.60%	36.60%
	Urban area	Count	0	2	2
		Expected count	0.6	1.4	2

	% within where migrate	0.00%	100.00%	100.00%
	% within get any relief	0.00%	3.50%	2.40%
Total	Count	25	57	82
	Expected count	25	57	82
	% within where migrate	30.50%	69.50%	100.00%
	% within get any relief	100.00%	100.00%	100.00%

Chi-Square tests

	Value	df	Asymptotic significance (2-sided)
Pearson *Chi-Square*	8.170a	2	0.017
Likelihood ratio	9.261	2	0.01
Linear-by-Linear association	7.902	1	0.005
N of valid cases	82		

2 cells (33.3%) have expected count less than 5. The minimum expected count is 0.61.

Table 9. Place of migration*get any relief.

Here, p value (.017) <level of significance (0.05), so place of migration and getting any relief significantly related. We conclude that there is significant association between place of migration and get ant relief (Table 10).

Where migrate*number of family member cross tabulation

			Number of family member				
			01-03	04-06	07-09	4	Total
Where migrate	Rural area	Count	3	33	13	1	50
		Expected count	3	28	18.3	0.6	50
		% within where migrate	6.00%	66.00%	26.00%	2.00%	100.00%
		% within number of family member	60.00%	71.70%	43.30%	100.00%	61.00%
	Semi urban area	Count	1	12	17	0	30
		Expected count	1.8	16.8	11	0.4	30
		% within where migrate	3.30%	40.00%	56.70%	0.00%	100.00%
		% within number of family member	20.00%	26.10%	56.70%	0.00%	36.60%
	Urban area	Count	1	1	0	0	2
		Expected count	0.1	1.1	0.7	0	2

	% within where migrate	50.00%	50.00%	0.00%	0.00%	100.00%
	% within number of family member	20.00%	2.20%	0.00%	0.00%	2.40%
Total	Count	5	46	30	1	82
	Expected count	5	46	30	1	82
	% within where migrate	6.10%	56.10%	36.60%	1.20%	100.00%
	% within number of family member	100.00%	100.00%	100.00%	100.00%	100.00%

Case processing summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Where migrate *number of family member	82	97.60%	2	2.40%	84	100.00%

Chi-Square tests

Pearson *Chi-Square*	Value	df	Asymptotic Significance (2-sided)
Likelihood ratio	15.181a	6	0.019
Linear-by-Linear association	12.271	6	0.056
N of valid cases	0.885	1	0.347
Pearson *Chi-Square*	82		

8 cells (66.7%) have expected to count less than 5. The minimum expected count is .02.

Table 10. Place of migration*get any relief.

Here, p value (.019) <level of significance (0.05), so place of migration and number of family members significantly related. We conclude that there is significant association between place of migration and number of family members (Table 11).

Case processing summary

	Cases					
	Valid		**Missing**		**Total**	
	N	**Percent**	**N**	**Percent**	**N**	**Percent**
Changing occupation* effect on education	82	97.60%	2	2.40%	84	100.00%

Changing occupation*effect on education crosstabulation

		Effect on education		**Total**
		yes	**no**	

Changing occupation	Yes	Count	13	3	16
		Expected count	9	7	16
		% within changing occupation	81.30%	18.80%	100.00%
		% within effect on education	28.30%	8.30%	19.50%
	No	Count	33	33	66
		Expected count	37	29	66
		% within changing occupation	50.00%	50.00%	100.00%
		% within effect on education	71.70%	91.70%	80.50%
Total		Count	46	36	82
		Expected count	46	36	82
		% within changing occupation	56.10%	43.90%	100.00%
		% within effect on education	100.00%	100.00%	100.00%

Chi-Square tests

	Value	df	Asymptotic significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson *Chi-Square*	5.106a	1	0.024		
Continuity correction	3.916	1	0.048		
Likelihood ratio	5.516	1	0.019		
Fisher's exact test				0.027	0.021
Linear-by-Linear association	5.044	1	0.025		
N of valid cases	82				

0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.02.

Table 11. Place of migration* number of family members.

Here, p value (.009) <level of significance (0.05), so face economic crisis and get any relief significantly related. We conclude that there is significant association between economical crisis and get any relief (Tables 12 and 13).

Case processing summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
changing occupation*get any relief	82	97.60%	2	2.40%	84	100.00%

changing occupation* get any relief crosstabulation

			get any relief		Total
			yes	no	
changing occupation	Yes	Count	12	4	16
		Expected count	4.9	11.1	16

			% within changing occupation	75.00%	25.00%	100.00%
			% within get any relief	48.00%	7.00%	19.50%
	No		Count	13	53	66
			Expected count	20.1	45.9	66
			% within changing occupation	19.70%	80.30%	100.00%
			% within get any relief	52.00%	93.00%	80.50%
Total			Count	25	57	82
			Expected count	25	57	82
			% within changing occupation	30.50%	69.50%	100.00%
			% within get any relief	100.00%	100.00%	100.00%

Chi-Square tests					
	Value	df	Asymptotic significance (2-sided)	Exact sig. (2-sided)	Exact sig. (1-sided)
Pearson Chi-Square	6.776a	1	0.009		
Continuity correction	5.174	1	0.023		
Likelihood ratio	10.496	1	0.001		
Fisher's exact test				0.008	0.005
Linear-by-Linear association	6.693	1	0.01		
N of valid cases	82				

1 cell (25.0%) have expected count less than 5. The minimum expected count is 3.96.

Computed only for a 2 x 2 table

Table 12. Changing occupation* effect on education.

Here, p value (.009) <level of significance (0.05), so face economic crisis and get any relief significantly related. We conclude that there is significant association between economical crisis and get any relief.

Case processing summary						
	Cases					
	Valid		**Missing**		**Total**	
	N	**Percent**	**N**	**Percent**	**N**	**Percent**
Number of family member*get any relief	82	97.60%	2	2.40%	84	100.00%

Number of family member* get any relief crosstabulation					
		Get any relief		**Total**	
		Yes	**No**		
Number of family member	1-3	Count	1	4	5
		Expected count	1.5	3.5	5

		% within number of family member	20.00%	80.00%	100.00%
		% within get any relief	4.00%	7.00%	6.10%
	4-6	Count	20	26	46
		Expected count	14	32	46
		% within number of family member	43.50%	56.50%	100.00%
		% within get any relief	80.00%	45.60%	56.10%
	7-9	Count	3	27	30
		Expected count	9.1	20.9	30
		% within number of family member	10.00%	90.00%	100.00%
		% within get any relief	12.00%	47.40%	36.60%
	4.00	Count	1	0	1
		Expected count	0.3	0.7	1.0
		% within number of family member	100.00%	0.00%	100.00%
		% within get any relief	4.00%	0.00%	1.20%
Total	Count		25	57	82
	Expected count		25	57	82
	% within number of family member		30.50%	69.50%	100.00%
	% within get any relief		100.00%	100.00%	100.00%

Chi-Square tests

	Value	**df**	**Asymptotic significance (2-sided)**
Pearson *Chi-Square*	12.144[a]	3	0.007
Likelihood ratio	13.357	3	0.004
Linear-by-Linear association	2.772	1	0.096
N of valid case	82		

4 cells (50.0%) have expected count less than 5. The minimum expected count is .30

Table 13. Get any relief * number of family members.

Here, p value (.007) <level of significance (0.05), so number of family members and get any relief significantly related. We conclude that there is significant association between family members and get any relief (Table 14).

		Education level	**How to tackle erosion**
Education level	Pearson correlation	1	0.051
	Sig. (2-tailed)		0.652
	N	82	82
How to tackle erosion	Pearson correlation	0.051	1
	Sig. (2-tailed)	0.652	
	N	82	82

Correlations

		Get any relief	Times of face erosion
Get any relief	Pearson correlation	1	0.260*
	Sig. (2-tailed)		0.018
	N	82	82
Times of face erosion	Pearson correlation	0.260*	1
	Sig. (2-tailed)	0.018	
	N	82	82

*Correlation is significant at the 0.05 level (2-tailed).

Correlations

		Where migrate	Changing occupation
Where migrate	Pearson correlation	1	0.321**
	Sig. (2-tailed)		0.003
	N	82	82
Changing occupation	Pearson correlation	0.321**	1
	Sig. (2-tailed)	0.003	
	N	82	82

**Correlation is significant at the 0.01 level (2-tailed).

Where r=0.051, which implies that educational level of respondents and tackle erosion weekly related to each other with positive slope. Highly educated people contribute more to tackling other natural disasters including riverbank erosion than less educated people.

Where r=0.260, which implies that time of erosion and get any relief weekly related to each other with positive slope. So we conclude that people get any relief increase gradually due to the number of times that erosion occurs.

Where r=0.321, which implies that place of migration and changing occupation weekly related to each other with positive slope. So we conclude that people with disabilities choose different professions due to relocation.

Meta-analysis

Let us consider,

H_0: Facing river erosion is independent of migration after erosion and education level.

H_1: Facing river erosion depends on migration after erosion and education level.

We conduct the test at 5% level of significance (Table 15).

Test statistic

x^2=oij^2/Eij-n

Now the table of expected frequency is given below:

	Migrate after erosion						
	yes				no		
	Face erosion						
Education level	1 times	2 times	>2 times	Total	1 times	2 times	total
Primary	11.05	8.84	22.11	42	0.52	0.48	1
Under SSC	6.84	5.47	13.68	26	11.96	11.04	23
Under HSC	2.11	1.68	4.21	8	0.52	0.48	1
Total	20	16	40	76	13	12	25

Table 15. Migrate after erosion.

For migrate after erosion:

x_1^2=12^2/11.05+9^2/8.84+21^2/22.11+7^2/6,84+4^2/5.47+15^2/13.68 +1^2 /2.11+3^2/1.68+4^2/4.21- 76

=78.308-76

=2.308 (P value, P_1= 0.679313) The

result is not significance at P<0.05

As P_1=0.679313>0.05 so H_0 is accepted.

For not migrate after erosion:

$x_2^2=1^2/0.52+0^2/0.48+11^2/11.96+ 12^2/11.04+1^2/0.52+0^2/0.48-25$

=2.006 (P value, P_2=0.366777)

The result is not significance at P<0.05

AS P_2=0.366777>0.05 so accept H_0.

For conclusion using data of all migrate or not migrate meta analysis can be performed by combining the P values of x^2 where combined P value is given by

-2ln P=-2ln (P_1+P_2)

=-2ln (0.679313*0.366777)

=-2ln (0.2491563842)

=2.779349061

Thus -2lnP is distributed as x^2 with 2K=(2*2) (K=2) df. The tabulated value of x^2 at 5% level of significance with 4 df is 9.49 which is greater than x^2 (-2ln P). So that, H_0 is accepted.

The calculation can also be done by combining the values of calculated for migrate and not migrate where combined x^2 is

$x^2=x_1^2+x_2^2$

=2.308+ 2.006

=4.314

This x^2 has (4+2)=6 df. The tabulated value at 5% level of significance is 12.59 which are greater than combined x^2. So that, H_0 is accepted.

So this indicates that facing erosion is independent of migration after erosion and education level.

Conclusion

Our study focuses the socio-demographic profile of the victims of the study area. In our study we have a large number of the respondents receive the formal education that is also 60% of the respondents. Riverbank Erosion is an important geo-morphological phenomenon affecting changes in river channel courses in alluvial plains creating long-term impacts and is not recoverable Naturally.

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