

The effect of riverbank erosion on lives and livelihoods of rural people: a study on Nolian village, Khulna, Bangladesh

Bayezid Khan, Sadia Afrin Nabia and Md. Ashfikur Rahman

Development Studies Discipline, Khulna University, Khulna-9208, Bangladesh

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ABSTRACT

The effect and magnitude of river bank erosion are multiple because of its polygonal impact. It creates a great loss of physical and natural resources which makes the life of people more vulnerable. This study was an initiative to explore the effects of riverbank erosion on living and livelihood of rural people of Nolian village of Dacope Upazila, Khulna, Bangladesh. The current study applied survey method because the household heads were considered as the respondents. Applying face-to-face interview method author collected data through an interview schedule form 336 household head. Findings revealed that 94% of respondents were affected by river bank erosion up to 9 times during their lifetimes. The inferential statistics describes that after riverbank erosion income of the household declined, in addition, their expenditure decreased. (42.0%) strongly agreed that food cost and medical cost due to riverbank tremendously increased. Majority (32.70%) household lost more than (1 to 3) metric tons of rice, and another (29.20%) lost (4 to 6) metric tons of rice. This study also explored that (36%) people and households lost (1-5) bighas of land, while (35%) household lost (6-10) bighas of land and the rest 59(10.5%) household lost (above-10) bighas of plough lands and homestead. The river bank erosion problem is increasing in Bangladesh due to lack of proper initiatives. The prevalence of river bank erosion dares to question the initiatives which had already been taken and implemented in different times in Bangladesh. Adequate measures need to be taken for stopping this situation while this study would assist the interested researchers for taking further extensive researches on this issue.

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I. Introduction

Bangladesh possesses a sound environment which is blessed with many rivers. In Bangladesh, rivers have been playing an important role in the lives and livelihoods of the people. Millions of people especially the poor are solely depending on the resource of river. But rivers maintain a dynamic system

which continuously change their way in passing (Mollah and Ferdaush, 2015) and in its natural process, erosion and accretion is very common in the context of Bangladesh. Erosion may occur regular and irregular basis either floodplain or in common place. In a study Mollah and Ferdaush (2015) addressed that most often erosion exceeds accretion and causes great damage of lives and livelihoods, mostly the poor are likely to be affected become the worst casualty. But to some extent erosion can produce favorable outcomes such as the formation of productive floodplains and alluvial terraces. Further, Chatterjee and Mistri (2013) reaffirmed that in this dynamic process it affects the concave side of the bank while depositing sediments on the opposite side. The riverine and coastal districts in Bangladesh are Shatkhira, Bagerhat, Khulna, Manikganj, Netrokona, Kurigram, Sherpur, Gaibandha, Mymensingh, Tangail, Sirajganj, Rajshahi, Pabna, Kushtia, Comilla, Barisal, Noakhali, Patuakhali, Pirojpur, Bhola, Coax's Bazar are certainly vulnerable to riverbank erosion, and affected by this disaster several times. Mollah and Ferdaush (2015) asserted that riverbank erosion has serious impacts on Bangladesh that causes permanent displacement and impoverishment of many people in Bangladesh.

Hence thousands of inhabitants of Bangladesh have been threatened by massive river erosion. Iva *et al.* (2017) noted that most of the affected people are suffering a lot of problems, i.e., people loss their homestead area and house, facing economic problems, shifting their occupation also and migrated from one place to another place and a very large number of people are unable to get back to their homestead or even any new places. As Khulna is one of the coastal and riverine districts in Bangladesh therefore many Upazilas, unions, and villages are at great risk of riverbank erosion. But among them, Dacope Upazila and its all unions and villages are frequently and extremely susceptible areas due to riverbank erosion. Riverbank erosion has severe effects on the livelihoods of the affected people. In the coastal areas of Bangladesh, riverbank erosion has been creating a wide array of socio-economic problems extensively. In addition, this problem is amplifying the persistence poverty problem in rural areas of Bangladesh and to some extent it exacerbates the impoverishment. In this study village Nolian, the people are always fearful about the risk of it. So, the findings of the study will be important to display their status before the erosion and then assessing the losses and damages of their livelihood condition in the post-riverbank erosion. Therefore, the attention will impose on the pattern of livelihood condition of people of this village who are enormously suffering due to riverbank erosion of Shibsha and Nolian rivers.

Riverbank erosion has now become a common phenomenon and one of the major natural calamities of Bangladesh that takes place in almost every day, every year in fact at any time of riverine areas. The effects of this disaster are widespread in Bangladesh, especially in the riverine and coastal areas. Therefore, the objective of this study was determined to explore the effects of riverbank erosion on lives and livelihood of rural people of Nolian village, Khulna.

II. Materials and Methods

This study was taken place in Nolian village of Dacope Upazila, Khulna, Bangladesh. The study area was selected through field observation because the south-west coastal area of Bangladesh is at great risk for its geographical uniqueness to be affected by riverbank erosion. This study followed survey method since the respondents were fixed as the household heads because survey method is appropriate when an individual unit from a large population is considered. In addition, in this research method, individual's information were collected through using a predefined individual interview schedule where the respondents are asked one or more questions that may or may not be answered. The data were collected through applying face-to-face interview technique. Based on the Yamane (1963) sampling formula; where 95% confidence level and the margin of error (.05) were accepted. Altogether 336 samples were taken from 2,100 households (BBS, 2011). And then adapting systematic random sampling, the household heads were selected for interviews. Frequency, mean, Std. Deviation, Cramer's V value was used on socio-demographic factors to find out the association between various nominal and categorical variables. T-test was run to evaluate the income differences among the respondents.

III. Results and Discussion

The demographic characteristics of the respondents showed that most of them (79.2%) were male; it means most of the families were male-headed while only a very number (20.8%) were female headed. The seven-age category shows the age difference among the respondents. It is seen from the [Table 01](#) that majority of the respondents were from 31 to 60, and around two third of the total respondents participated from this age. A few numbers of respondents were above 60 years of age. Education is considered the most basic necessities for a human being also it can promote the overall development. But the study found that a large number (35.4%) didn't have formal education and the next (26.2%) only knew how to sign. And only (12.5%) finished class 6 to 10. Further, most of the respondents (87.3%) lived in the joint family while 12.7% were in the nuclear family ([Table 01](#)).

Table 01. The demographic profile of the respondents

Variables	Frequency	Percentage
Sex		
i. Male	266	79.2%
ii. Female	70	20.8%
Age		
i. 25-30	29	8.6%
ii. 31-36	52	15.5%
iii. 37-42	67	19.9%
iv. 43-48	55	16.4%
v. 49-54	46	13.7%
vi. 55-60	64	19.0%
vii. 60+	23	6.8%
Level of education		
i. Illiterate	119	35.4%
ii. Literate (Only Signature)	88	26.2%
iii. Primary (I - V)	70	20.8%
iv. Secondary (VI - IX)	42	12.5%
v. Secondary (X \geq)	17	5.1%
Family type		
i. Nuclear	71	12.7%
ii. Joint	265	87.3%

This study was primarily hypothesized that “there were no association between years of living and number of losses of livelihood”. But the study found that about (94%) household faced river erosion problems and it was above once to nine times depending the year of living. The household members who have been living since by born and above 60 years, they lost their livelihood 7 to 9 times. Based on the 95% confidence level the Pearson chi-square obtained (282.556a) and the p-value is less than ($p < .05$) which means there were highest probability of being affected by river bank erosion, who have been living since many years. So, the study intended to reject the null hypothesis.

This study was also hypothesized that “there were no association between the river bank erosion and change the amount of monthly income of the respondents”. The aforementioned descriptive statistics ([Table 02](#)) represents the average income of the respondents. This indicates clear difference between the amounts of average income. Before river erosion the mean income was (5924.40) while after river erosion the income decreased about (2718 BDT). Later the [Table 04](#) inferential statistics shows the statistical significance that after river erosion the income declined. Further, after river erosion there is a probability of declining (2718.155) quantity of income and based on the 95% confidence interval the difference would be (2452.0085-2984.225) amount of income.

Table 2. Loss of livelihood due to the effect of riverbank erosion

Years of Living	Loss of Livelihood				Total
	Never	1-3 Times	4-6 Times	7-9 Times	
By born	0	6	51	63	120
10-20	13	15	0	0	28
20-30	6	31	3	0	40
30-40	0	11	2	0	13
40-50	1	13	15	6	35
50-60	0	7	35	9	51
Above 60 Years	0	5	28	16	49
Total	20 (5.9%)	88 (26.4%)	134 (39.9%)	94 (27.98%)	336

Table 03. Descriptive statistics: respondent's income difference

Monthly Income	Mean	N	Std. Deviation	Std. Error Mean
Before River Erosion	5924.40	336	2399.900	130.925
After River Erosion	3206.25	336	792.195	43.218

Table 04. Inferential statistics: respondent's income difference

Paired Samples t-Test								
Monthly Income	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Before*After	2718.155	2479.395	135.262	2452.085	2984.225	20.095	335	.000

Table 05. Descriptive statistics: family expenditure difference

Monthly Expenditure	Mean	N	Std. Deviation	Std. Error Mean
Before Erosion	7203.87	336	2177.075	118.769
After Erosion	6702.38	336	2409.706	131.460

Table 06. Inferential statistics: family expenditure difference

Paired Samples t-Test								
Monthly Expenditure	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Before and - after River erosion	501.488	1198.568	65.387	372.867	630.109	7.670	335	.000

Above mentioned tables (Table 05 and 06) describe the monthly household expenditure difference in the period of pre and post riverbank erosion. As the aforementioned (Table 03 and 04) explored that river erosion forced to alleviate monthly income of the household, consequently, monthly family expenditure obliged to decrease. The two tables (Table 05 and 06) illustrate the decreasing trend of average monthly family expenditure which is statistically proved. The obtained p-value is less than ($P < .05$) which indicates that after river erosion the monthly income has decreased at mean (501.488) and based on (95% CI) the difference would be within (372.867-630.109).

The (Table 07) shows the association between socio-demographic variables and probability of being life endangered due to river erosion. Though the Cramer's V shows the lower value but except two all variables achieved positive value. So it can be said that the risk of life was being frequently endangered by river bank erosion.

Table 07. Chi-Squire and Cramer's V value on Socio-demographic factors and life endangered

Variables	Chi-square	df	Cramer's V value	Sig.
Age	$X^2=14.174^a$	6	.205	.028
Type of Family	$X^2=2.535^a$	1	.087	.111
Number of Family Member	$X^2=19.654^a$	14	.242	.242
Family Headed	$X^2=4.441^a$	1	.115	.035
Education	$X^2=2.786^a$	4	.091	.594

Table 08. People's perception about the cost of life

Statement	Cost of Education		Food and Medical Cost		Cost of House Repairing	
	Number	Percentage	Number	Percentage	Number	Percentage
Strongly Agree	67	19.9%	141	42.0%	113	33.6%
Agree	174	51.8%	115	34.2%	105	31.3%
Neutral	62	18.5%	49	14.6%	86	25.6%
Disagree	23	6.8%	25	7.4%	18	5.4%
Strongly Disagree	10	3.0%	6	1.8%	14	4.2%

Above the (Table 08) contains the perception of respondents on different issues. Due to river erosion the cost of living increased comparing to past. The five-point Likert scale was employed to measure the people's perception. It has clearly been seen from the table that frequent river erosion increased the cost of living. In these cases, (51.8%) household head agreed that education cost increased while (42.0%) strongly agreed and (34.2%) agreed that food cost and medical cost tremendously increased. To some extent they lost their arable land which gave them food but after river erosion they didn't have land for cultivation. As a result, the expenses increased comparing to past. A good number of (33.6% & 31.3%) household heads strongly agreed and the rest agreed that the cost of house repairing increased due to continuous river erosion.

Table 09. Loss of properties and assets due to riverbank erosion

Name of properties	Responses	
	N	Percent
1. Transport and Communication System	281	83.6%
2. Water Bodies	118	35.1%
3. Homestead	199	59.2%
4. Machinery and Other Equipments	200	59.5%
5. Hatchery	129	38.4%
6. Livestock	200	59.5%
7. Poultry Farm	153	45.5%
8. Crops	235	69.9%
9. Agricultural Land	297	88.4%
10. Trees	235	69.9%
11. Home Appliances	282	83.9%

a. Dichotomy group tabulated at value 1(Yes).

Aforementioned table (Table 09) illustrates the loss of physical capital and assets due to riverbank erosion. The multiple questions illustrate that on account of river erosion, they lost their numerous resources. The answer of the respondents belong to almost above 50% negative that they lost their assets due to river bank erosion for several times. Among them 88.4% answered that they lost their arable lands, while 84.9% lost home appliances and 59.2% lost their homestead.

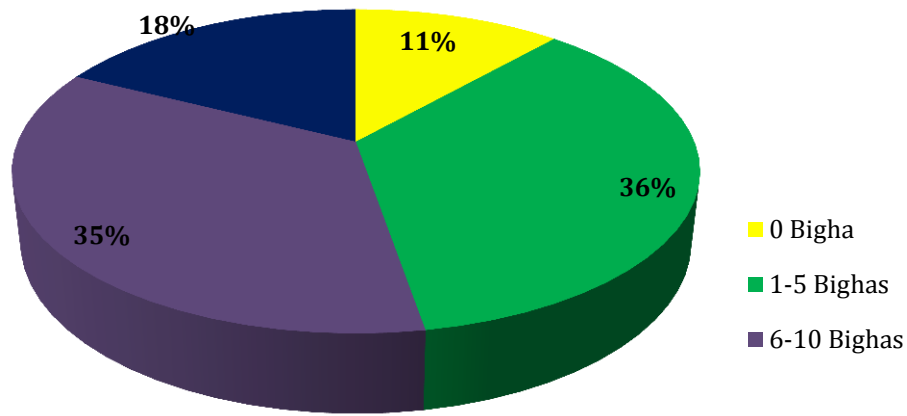


Figure 01. Loss of arable land due to riverbank erosion

Figure 01 describes the volume of land which the households loose several times. It is clearly realized from the graph that majority people lost their own homestead and plough lands. In this case, it is identified that 120 (36%) households lost (1-5) bighas of land, while 118 (35%) household lost (6-10) bighas of land and the rest 59 (10.5%) household lost (above-10) bighas of plough lands and homestead. The amount of lost land calculated based on information of the household who have been in Nolian village by born or above 60 years or 30 to 60 years.

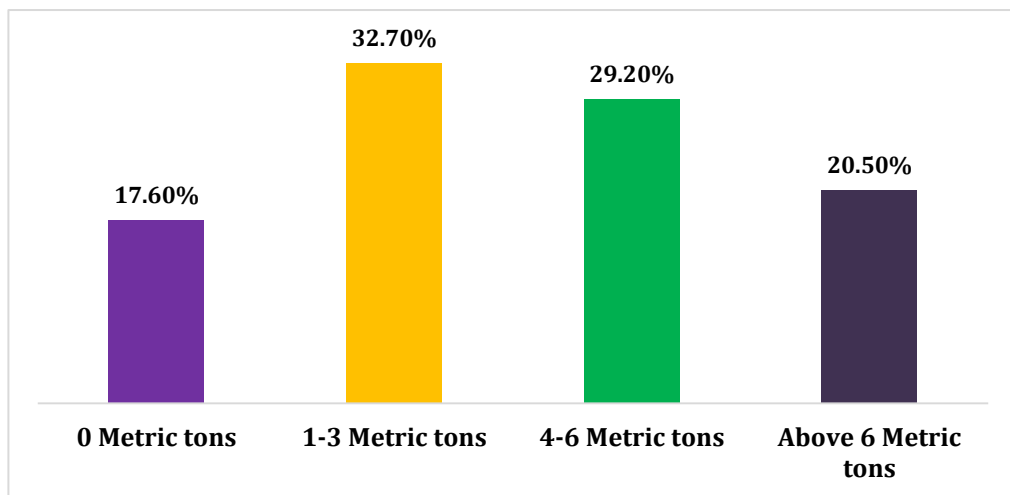


Figure 02. Loss of crops in metric tons due to riverbank erosion

The bar chart shows the amount of crop which the household lost in the last riverbank erosion. Majority 110 (32.70%) household lost more than (1 to 3) metric tons of rice, while 98 (29.20%) lost (4 to 6) metric tons of rice and the rest 59 (above 6) metric tons of rice. But a large number of people didn't lose any quantity of crops as they didn't cultivate any crops due to lack of cultivable land. Also, a large number stressed out that they already lost their last volume of land (Figure 02).

Table 10. Types of house before and after erosion

Types	Before		After	
	Frequency	Percentage	Frequency	Percentage
Hut	7	2.1%	114	33.9%
Conventional (<i>Katcha</i>)	44	13.1%	136	40.5%
Tina and wood	94	28.0%	54	16.1%
Semi-Pucca	97	28.9%	31	9.2%
Pucca	94	28.0%	1	.3%

Table 10 describes the types of the house where the respondents live. It is clearly observed that before erosion majority lived in i.e. (Tin and wood, Semi-Pucca, Pucca) house. But after being affected by river

erosion they bound to live in conventional (*Katcha*) house and a large number of households were confined to live 114(33.9%) hut (*Khupri Ghor*).

IV. Conclusion

Any type of disaster is detrimental to both human and environment. The effect and magnitude of riverbank erosion are many because of its multifaceted impact. It brings a heavy loss of physical and natural resources which make the life of people more vulnerable. The whole paper attempted to assess the livelihood status along with the socio-economic conditions of the people who are affected and lost their properties due to riverbank erosion time to time. Numerous vulnerabilities have been associating due to this problem i.e., loss of homestead area and house, economic loss, shifting occupation and migration from one place to another place. A large number of people are becoming unable to get back to their homestead and so they are obliged to start either migrating or living to new places around. Though various embankments have been built by the Government of Bangladesh (GoB) with the help of World Bank (WB), they are inadequate for the area coverage and according to the respondents to some extent inappropriate. Consequently, every year especially in rainy seasons, the amount of losses and damages outrageously turns into extensive and outreached. Hence, necessary measures must be taken and implemented to prevent further riverbank erosion in this particular area, as well as in the entire country.

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Conflict of Interest

The authors declare that no conflict of interest exists.

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