Progressive Agriculture 28 (2): 73-83, 2017 **ISSN: 1017 - 8139**

Progressive Agriculture
Journal homepage:http://www.banglajol.info/index.php/PA

Impacts of riverbank erosion hazards in the Brahmaputra floodplain areas of Mymensingh in Bangladesh

MA Islam*, S Parvin, MA Farukh

Department of Environmental Science, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

Abstract

The study was conducted to investigate the impacts of Brahmaputra riverbank erosion hazard on livelihood pattern of char people, agriculture and environment. Five villages of Mymensingh district near to the Brahmaputra River were selected. A semi-structured questionnaire, interview, secondary data sources, field observation and focus group discussion were utilized for this study. Result revealed that erosion has a great impact on livelihood, agriculture, environment and other sectors. Population displacement is a common phenomenon in the study area due to riverbank erosion. During the river erosion 73% people took temporary and 27% took permanent migration where 26% had chosen town as permanent migration. About 56% people loss 0 to 5 acres and 33% loss 6 to 10 acres of their land. Before riverbank erosion 61% people were involved in farming but after riverbank erosion it decreased into 24%. About 88% respondents used tube well as the main source of drinking water, which was smaller than that of the national rural rate 96.42% and some people used river water as drinking, bathing, washing clothes and household materials, and that was so unhygienic. The major diseases like diarrhea, dysentery, asthma, TB, typhoid, etc. were prevalence during flood and river erosion as well as medical facility was also poor. Only 9% people used medicine from consultant doctor. The study has explored a negative fact that without any organizational support, the people of the villages have to formulate and undertake various adaptation techniques in their own way. Finally, the study has recommended some suggestions for the policy planners and implementers for the future development of the riverbank erosion victims in Bangladesh. It emphasizes the importance of the government and non-governmental organizations to take their own responsibility to the devastating situation of the riverbank erosion.

Key words: Riverbank erosion, hazards, livelihood pattern, Brahmaputra floodplain

 ***Corresponding Author:** maislam@bau.edu.bd

Introduction

Riverbank erosion is one of the major natural disasters of Bangladesh and an issue of major concern. It causes undefined miseries to thousands of people every year living along the banks of rivers in Bangladesh. Only erosion has rendered millions of people homeless and has become a major social hazard. People, who live near riverbanks, become victim of erosion which forces them to change their livelihood and community. Most of the victims of riverbank erosion become slum dwellers in large urban and metropolitan cities and towns (Hutton and Haque, 2004). Since 1973 major rivers like the Jamuna, the Ganges and the Padma have eroded around 1,590 km^2 of floodplains making 1.6 million people became homeless. Not only the

floodplain dwellers, but the *char* land dwellers are also always vulnerable to river erosion (Islam, 2007). Change of climatic parameters is not the only cause for concern, the geographical location of Bangladesh also makes the country vulnerable to different natural disasters, especially flood.

The Brahmaputra river experiences high levels of bank erosion and channel migration caused by its strong current, lack of river bank vegetation, and loose sand and silt which compose its banks (Islam, 2007; Islam, 2009; Khan *et al.*, 2003). It is thus difficult to build permanent structures on the river, and protective structures designed to limit the river's erosion effects often face numerous issues during and after construction. Limited previous study of this site was carried out of the riverbank erosion in the study area. The study will also emphasis on the people in char areas with low socio-economic and environmental conditions, where more likely to fail to adapt some ability such as education, income, and occupation etc. The findings of our study can help the *char* land peoples, governments, and other non-governments organizations to take their own responsibilities and necessary steps for improving the livelihood and socio-economic condition of *char* land peoples. The objectives of the study to explore the status of riverbank erosion and to state the impacts of riverbank erosion on agriculture, environment and livelihood pattern of *char* area peoples.

Materials and Methods

Study area*:* Gauripur and Iswargonj upazilla of Mymensingh district along the river Brahmaputra are the most affected areas of recent decades, have been considered as the study area. Keeping in view the main objectives of the present study the five most affected villages namely Bhatipara, Bhangnamari, Gazariapara, and Kashiar *Char* under Bhangnamari union in Gauripur upazilla and Morichar *Char* under Uchakhila union in Iswargonj upazilla in Mymensingh were selected.

Preparation of a questionnaire*:* Questionnaire was developed to record the information needed based on objectives of the study. Care was taken in wording to ensure that they are easily understood to ensure cooperation from the respondents.

Primary data collection*:* The field observation study was carried out through by personal interview with local people for data collection during the period of 10^{th} March to 10^{th} September, 2016. Fifty (50) respondents were selected randomly from each village. All possible efforts were made to explain the purpose of the study to the respondents in order to get actual picture of the study sites. After each interview, the filled schedules were checked with regard to every item so that these were correct and properly recorded.

Secondary data collection: Secondary data were collected from different sources according to requirement of the study. Different kinds of data like the total area of the study sites, population of the area, cultivable land of the site, past data on flooding and the river erosion etc. were collected from the union parishad Office, BWDB (Bangladesh Water Development Board) etc. The data related to the settlement pattern of the respondents, land use patterns, population, land area were collected from BBS, BWDB, Settlement Office, union parishad office etc. Besides, supporting data and related materials were collected from different sources, like internet, previous research and survey reports. The data collected for this study underwent appropriate statistical and cartographic treatments for further analysis and synthesis.

Focus group discussion: Focus group discussion was conducted on the local peoples, village leaders (*Gram sarkar*), school teachers, etc. to discuss issues and concerns based on a list of key themes.

Processing and analysis of data: After completion of the field survey all the interview schedules were set for its data tabulation for coding and recording. All data collected from the primary and secondary sources which were analyzed by using Microsoft Office word

2010 and Microsoft Office Excel 2010. Finally the analyzed data have been integrated and presented accordingly.

Results and Discussion

Status of riverbank erosion: Gauripur and Iswarganj upazila in Mymensingh district are located at the confluence of the major river namely Old Brahmaputra. There are ten unions in Gauripur upazila among which Bhangnamari union is mostly collapsed by the riverbank erosion since 1988-2015. Bhatipara, Bhangnamari, Gazariapara, and Kashiar *Char* villages under Bhangnamari union in Gauripur upazilla are mostly affected by recent riverbank erosion. There are eleven unions in Iswargonj upazila among which Uchakhila is partially eroded by old Brahmaputra. The village namely Morichar *Char* under Uchakhila union in Iswargonj upazilla was mostly affected by recent river bank erosion (Table 1). These areas experience severe to moderate level of flood almost every year. River bank erosion is a common problem for the inhabitants of these areas throughout the year. Siltation of river-bed, high velocity of river current cuts the base of the river-bank causing erosion but the erosion occurs most by at the end of monsoon. However, it has been observed that riverbank erosion takes place just before monsoon set in.

Table 1. Erosion Status in Iswargonj and Gauripur upazila in Mymensingh (1988-2015).

Village	Total area (ha)	Eroded area (ha)	Percent Eroded
Bhatipara	1800	680	37.78
Bhangnamari	7698	1733	22.51
Gazariapara	2188	889	40.63
Kashiar *Char*	2956	1080	36.53
Morichar *Char*	2596	1308	50.38

Source: UNO Office, Iswargonj and Gauripur Upazila, Mymensingh, 2016.

The *char* land Bhatipara, Bhangnamari, Gazaria para, Kashiar *Char*, and Morichar *Char* are extremely vulnerable to both erosion and flood hazards. These *Char* land peoples of the study area identified riverbank erosion is an environmental disaster as it affected their lives and properties such as land loss, devastating loss in agricultural production, deteriorate the drinking water quality and population displacement. It displaced *char* resident from their original homestead where they used to live from long time ago. Khan *et al*. (2003) described that there was a significant evidence of frequent and rapid erosion rate along the river Brahmaputra-Jamuna within Bangladesh shows that it was 160 m year^{-1} between 1973 and 1992 and 50 m year^{-1} during the period of 1830-1992. In 1830, the river had an average width of 6.2 km, but by 1992 the average width had increase to 10.6 km. The channel has widened at an average rate of 27 m year^{-1} during 1830-1914.

Brahmaputra is the seventh largest river in the World and has created a thick extensive valley in Mymensingh district. The dynamic nature of Brahmaputra and its tributaries modifies the floodplains frequently, at times to an undesired magnitude. The upper Brahmaputra plain is one of the worst flood-affected areas and regularly inundates and erodes the floodplains damaging land and standing crops. The Figure 1 showed the eroded areas in the Brahmaputra in last twenty years. In the year of 1995-2000 the erosion rates in the left bank is 1500 hectares and right bank is 1200 hectares. In the year of 2001-2005 the erosion rates in the left bank is 1000 hectares and right bank is 800 hectares. Similarly in the year of 2006-2010 the erosion rates in the left bank is 1100 hectares and right bank is 900 hectares and in the year of 2006-2010 the erosion rates in the left bank is 1050 hectares and right bank is 850 hectares.

Thompson (2000) found that the course of the Brahmaputra river has changed dramatically over the past 250 years, with evidence of large-scale avulsion, in the period 1776-1850, of 80 km from east of the

Madhupur tract to the west of it. The banks of the river are mostly made from loose sand which erodes away easily. Though the river's erosion rate has decreased to 30m per year as compared to 150m per year from 1973 to 1992, this erosion has destroyed so much land that it has caused 0.7 million people to become homeless due to becoming landless. Together with the slow migration of the river, the left bank is being eroded away faster than the right bank.

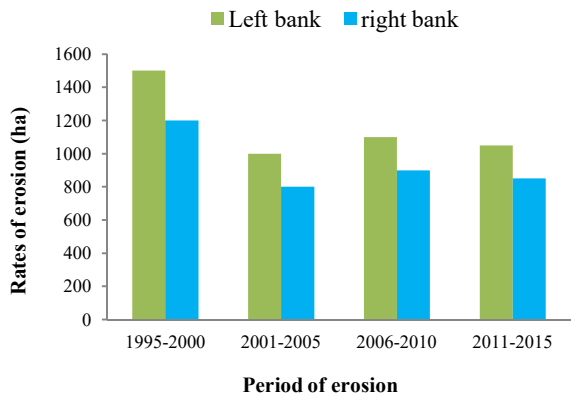

Figure 1. Erosion rates of Brahmaputra River in last twenty years (From 1995 to 2015) (Source: Rahman, 2016).

***Socio economic condition of the affected people*:** A closer look at the socio-economic aspects of the displaces is relevant to understand more clearly their perception and process of adjustment to erosion hazard. But the socio economic conditions of the displaced population were not all alike from people of rest of the Bangladesh and therefore it needs to be understood within their own context. Sarker and Thome (2003) found that the riverbank erosion demonstrate extreme problem of land loss, damage of crops, livestock and ether assets. The Socio-economic background of households, nature and magnitude of the problems caused by erosion is very unpleasant and their survival strategy is also very poor.

Family size of the respondents*:* On the basis of the family size the respondents were classified into three following categories as shown in Table 2. Hutton and Haque (2004) find out that the most of the char land people in Bangladesh were poor and their family size was large. Maximum people in the affected area by Jamauna and Brahmaputra river erosion have large family size having more than six family members and their life style is so poor. According to his research more than 48% people live below poverty line in the char land areas.

Table 2. Distribution of respondents according to their family size in the study area.

Types of family	Frequency of respondents	Percentage (%)
Small (up to 4)	68	27
Medium (5 to 6)	104	42
Large (More than 6)	78	31
Total	**250**	**100**

Age and sex structure of the respondents*:* On the basis of age and sex the respondents were classified into five categories as shown in Table 3.

Table 3. Distribution of respondents according to their age and sex in the study area.

Age group	Frequency of Respondents		Average percentage (%)
	Male	Female	
10 to 20	22	20	16.80
21 to 30	47	53	40.00
31 to 40	38	43	32.40
41 to 50	12	10	8.80
More than 50	-	5	2.00
Total	119	131	250

Hutton and Haque (2004) determined the gender, age and other critical socioeconomic variables related to the processes of hazards-induced to determine the effects of floods and their associated displacements, specifically in relation to the impoverishment and marginalization of the rural poor. It has rarely examined the effects of bank erosion on livelihood that enhance hunger and landlessness. An attempt has been

made in this study to find out the process of marginalization of the poor people in the paradigm of riverbank erosion.

Education of the respondents: Results indicated that majority of the respondents (56%) had no educational qualification i.e. they were fully illiterate. Only 22% respondents had primary education, 12% had secondary education, 7% had higher secondary education and 3% had more than higher secondary education in the study area. The literacy rates of the respondents were 44% which was smaller than that of the national level 47.68% (BBS, 2014) and 62.3% (BDER, 2015). Das and Saraf (2007) described the socio-economic research where about 44% people in the char land area were illiterate. It was discussed that these huge illiterate people increase the unemployment status in Bangladesh. Due to their high illiteracy rate they were suffering from lack of knowledge about hazards and its environmental impact, health impacts, agricultural impacts etc.

Changes of the income source due to river bank erosion: On the basis of change in the income sources, the respondents were classified into four categories as shown in Figure 2. Data indicated that before riverbank erosion 61% of the respondents were involved in farming activities but after affecting by river erosion it decreased and then only 24% of the respondents were involved in farming activities. It also revealed that riverbank erosion increased the percent of day labors and unemployed in the study area. After bank erosion 39% of the respondents were day labor while it was only 8% before the bank erosion and 16% respondents were unemployed while it was only 5% before the river bank erosion. Before riverbank erosion 26% respondents were related with non-farming activities but after erosion hazard it decreased and it stood for 21%. It is clear that riverbank erosion decreases the employment status of the affected people. Das and Saraf (2007) determined that due to river bank erosion occupation pattern changes and after river bank erosion most people loss their agricultural land and become landless and homeless. So non-farming activity, day labour and unemployment arise day by day in the study area.

Causes of riverbank erosion: Riverbank erosion occurs both naturally and through human activities. Rivers and streams are dynamic systems as they are constantly changing. The report revealed that the causes of riverbank erosion in the study area were: excessive flood, excessive rainfall, heavy rainfall in the upstream, increase flow of water with high wind, and poor land cover along with the line. Hutton and Haque (2004) explained that Bangladesh is highly vulnerable to the riverbank erosion.

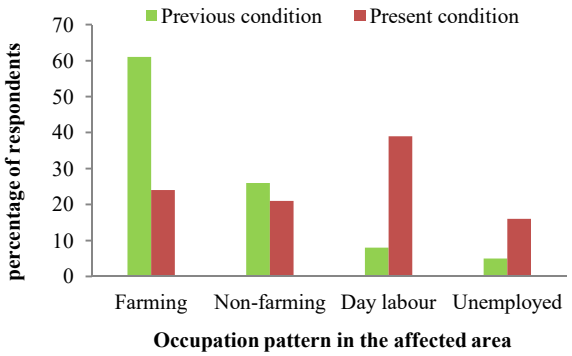

Figure 2. Graphical representation of occupation pattern of the respondents in the study area.

It is one of the most unpredictable and critical type of disasters that takes into the country because of quantity of rainfall, soil structure, river morphology, topography of river and adjacent areas, and floods. Geographically, Bangladesh situated in a region where the constant threat of flood and riverbank erosion was contributed to a substantial disaster subculture in the riverine zone of Bangladesh. Kotoky *et al.* (2005) found that the mechanisms involved and responsible for Brahmaputra riverbank erosion were basically related to aqueous flow of sediments (liquefaction) enhanced by the in homogeneity in the bank materials, over steepening and associated sub-aerial processes of weathering and weakening in relation to soil moisture content. It revealed that the extent of erosion and deposition in not

same for the period 1914-75 and 1975-98. BDER (2015) reported that the Brahmaputra river experiences high levels of bank erosion and channel migration caused by its strong current, lack of river bank vegetation, and loose sand and silt which compose its banks.

***Impact of riverbank erosion hazard*:** Impacts of river bank erosion are multifarious: social, economic, health, education and sometimes political. The first and foremost impact is social, i.e. homelessness due to land erosion which compels people to migrate. After forced migration they suffer from economic crisis, namely loss of occupation and loss of property, and they are at the risk of poverty and sometimes involvement in criminal activities (Iqbal, 2010). In the study area the river bank erosion impacts were classified into three categories as socio-economic impact, environmental impact, and others. The socio-economic impacts include homelessness, migration, loss of land and productive land, loss of occupation, risk of poverty, etc.; the environmental impacts include loss of drinking water quality, lack of proper sanitation facility, poor management of soil and agricultural land, etc. and also others impact arise like improper care of health, lack of education attainment, criminal activities, etc. Reuveny (2007) identified that the extensive bank erosion has numerous social and economic consequences loss of agricultural land (loss of livelihood), loss of housing and other essential infrastructures, displacement and involuntary migration promoting native-migrant contest over limited resources, ethnic tensions, distrust and political instability and civil strife in the basin.

On the basis of erosion affects, the respondents are classified into four categories as shown in the following graph (Figure 3) as high, medium, low and not ever. Data presenting in the figure showed that the majority of the respondents 46% are highly affected, 29% are moderately affected, 14% are less affected and 11% respondents were not ever affected by riverbank erosion attack in the study area. Ahamed (2001) described that the riverbank erosion is a constant and old disaster that has rendered the formation of the char land of Bangladesh. Erosion is a continuous process for which the disaster fails to generate concern that other forms of disaster are capable of creating. It causes enormous loss of lives and properties. According to the satellite data the river consumes about 8700 hectors of arable land every year and about 1000000 peoples were affected. In 1998, 600000 households and about 50000000 peoples were directly affected by the riverbank erosion. Viswanathan and Ravi (2007) also revealed that in 2007 nearly 14 Million people (10% of the population) in more than 20 districts were affected by the floods limited to the Brahmaputra river. The flood damages are counted by the billions considering the extreme population density of more than 1000 persons per km^2.

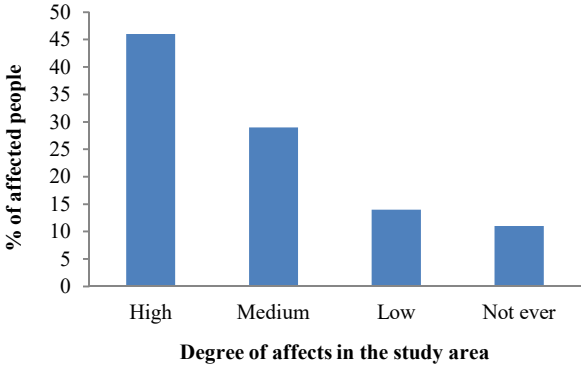

Figure 3. Percentage of affected people in the study area.

Population displacement-conceptual consideration: In this study it has been made to examine the fact of population displacement within the context of riverbank erosion. Erosion is a natural event and as it occurs, there is gradual or sudden inconsequence affecting human habitat in a given area that often leads to a dislocation of a well-established life. Kar and Hossain (2001) determined that from 1981 to 1992 an estimated average of 36,220 people were displaced by erosion of mainland and attached chars every year and it results more households being displaced 90% of the within-bank area during the period 1973-1992, with the consequence that the majority of char dwellers are

likely to have been forced to move at least once during this period due to erosion. Hutton and Haque (2004) found that the constant threat of riverbank erosion was contributed to a substantial disaster subculture in the riverbank zones of Bangladesh which forced large people to displace.

Types of migration: The displacement caused by erosion, mostly involve displacement of whole families. According to their types of migration the respondents divided into two categories such as temporary migration and permanent migration but maximum respondents are chose temporary migration because of their financial problem. The opinion of the respondents illustrated that 27% affected people took temporary migration and 73% took permanent migration due to loss of their assets and properties as well as lands for cultivation. Rahman (2010) described in a study where migration is a common factor due to river erosion. Though most people's occupation is related with river and agricultural land people like to choose temporary migration but when extreme impact occurs most people migrate themselves as permanent migrant.

Choice of place for further migration: After displacement, the displacees of char villages located in the Brahmaputra River moved to safer part like different riparian villages or in the other safe char land. They found shelter on the embankment of the river, on neighbors land, nearby char village, towns or elsewhere. On the basis of choice of place for further migration, the respondents were classified into four categories as shown in Figure 4. Data indicated that 22% of the affected people were resettled in neighboring villages and 35% were sheltered in nearby char land. They were suffered from the lack of drinking water and food, sanitation facilities, emergency health care services, and lack of employment. A few number of people or the displacees took shelter in the embankment of the river which is actually *Khash l* and (Government own land). Some people (26%) had chosen town as permanent migration for better employment facility or shifting their nature of works. Rahman (2010) described that due to riverbank erosion people migrated themselves into different location such as shelter on the embankment of the river, neighboring villages, neighbors land, nearby char village, towns or other location. Though river bank erosion is a continuous process, most people choose nearby *char* land for future resettlement in previous or new area of the surroundings with new dreams.

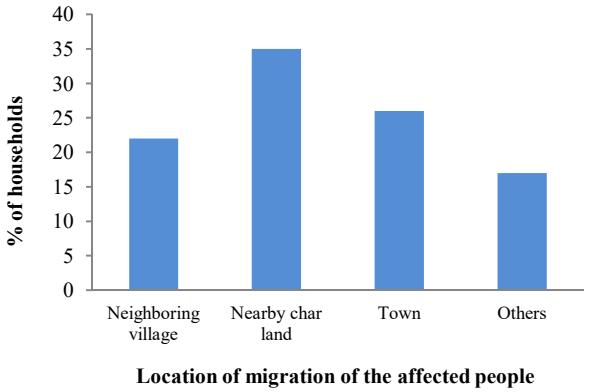

Figure 4. Choice of places for further migration in the study area.

Loss of land in the study area: It was found that the land lost is much more than the land that rises out of riverbed through accretion. The affected people lose their assets and are forced to draw on savings and often fall into further debt. The impact of land loss involves primarily the loss of homestead land, housing structures, crops, cattle, trees and household utensils. Loss of homesteads forces people to move to new places without any option and puts them in disastrous situations (Rahman, 2010). In the study area respondents lost huge amount of land due to Brahmaputra riverbank erosion. Amount of losses of land in the study area were classified in three categories as- majority of the respondents about 56% lost 0-5 acre land, 33% lost 6-10 acre land and 11% people did not loss any land. Talukdar (2012) reported that Brahmaputra river bank erosion causes poverty, has a long term impact and there is no compensation mechanism. It has mentioned that Brahmaputra bank erosion has wiped out a large area including human

settlements, productive crop land and reserve forest area Rahman (2010).

Riverbank erosion has a great impact on agriculture. Rice growing fertile cultivable land is becoming unsuitable for rice cultivation due to sand deposition. The fertility of the land is reduced as a result of erosion and sand deposition; the yield of the land is declined. The information taken from the respondents, people losses their cultivable lands divided into three categories like- the majority of the respondents, 62% in Bhatipara, 54% in Bhangnamari, 75% in Gazariapara, 69% in Kashiar *char* and 72% in Morichar *char* loss their land 0-5 acres. It also found that 27% in Bhatipara, 28% in Bhangnamari, 22% in Gazariapara, 24% in Kashiar *char* and 20% in Morichar *char* loss their land 6-10 acres. Within these losses the crop production became vulnerable and reduces the productivity. Again another proportion shows that 11% in Bhatipara, 18% in Bhangnamari, 03% in Gazariapara, 07% in Kashiar *char* and 08% in Morichar *char* loss no land. On average 66.4% people loss maximum amount of land that is too much negative effect for char land people. Pahuja and Goswami (2006) reported that the Brahmaputra River has destroyed nearly 4000 km^2 of agricultural land. Sarker *et al.* (2003) revealed that in Bangladesh most of the char land is fertile cultivable land and huge amount of these are eroded by only Jamuna River.

Environmental impact: The key environmental issues identified in the basin were river bank erosion, flooding and droughts. River bank erosion and its impacts were clear during field observations. The residents reported that flooding is an annual occurrence, while droughts are more erratic. The environmental hazard experienced by affected people in the study area in last during last ten years as shown in Table 4. Kabir (2006) described that chars are areas of new land formed through the continual process of erosion and deposition in the major rivers and coastal areas. Chars land areas irrespective of their geographic attachment to the mainland and distance from the growth centers are particularly vulnerable to floods, drought and river erosion. They suffer much from extreme attack of insects and pests during flood and river erosion. It causes substantial illness and premature death, especially in younger age groups. In this study area maximum respondents had chosen empty space or river bank as their natural sanitation. So it has great impacts on soil, air and water pollution problem in study areas as well as in our country.

Table 4. The environmental hazard experienced by affected peoples in the study area.

Name of the Hazards	**Extent of damage**			
	High	Medium	Low	Not ever
Flood	√	-	-	
River erosion	√	-	-	
Drought	-	√	-	
Cyclone	-	-	-	√
Spread of pest	-	√	-	

Other impacts

Health impact: Poverty and illiteracy people were not aware about health and malnutrition of the children and women was a common problem in the study area. Existing medical centers in the previously eroded settlement were badly affected due to river bank erosion. The major diseases prevalence in the affected area were diarrhea, dysentery, asthma, T.B, typhoid, etc. during flood and river erosion. Though the socio-economic conditions of the respondents were poor, so the medical facility of these areas was also very poor. Improper healthcare facility, lack of education, lack of pure drinking water, unhygienic sanitation, etc. were the main causes of different diseases.

Increase of population in the city: In this study area most people choose city as permanent migration having more income sources. About 70% people selected Dhaka city for permanent migration. Uddin (2012) described that if river bank erosion increase, the

number of population of a city increase & the number of rural employment decrease. Nazneen (2013) stated that most of the victims of riverbank erosion become slum dwellers in large urban and metropolitan cities and towns. Since 1973 major rivers like the Jamuna, the Ganges and the Padma have eroded around 1,590 sq. km of floodplains making 1.6 million people homeless. In the erosion prone area lands are resulted without involving government authorities and are managed by local *matbars* (local leader) and *amins* (Surveyors). Nazneen (2013) also mentioned that the land lost is higher than land emerged and it also creates crisis among char people.

Adaptation techniques of indigenous people to cope up with losses

Adaptation technique to cope with loss of cultivable land: Losses occurred from cultivable land is quite expensive which hinders the respondents to bear the spending. In such a condition, they have to rely on relatives, moneylender, neighborhood etc. It is evident that to cope up with the losses of cultivable land, majority (48%) of them rely on moneylender and 31% affected people received money or taken help from relatives and money lenders (Figure 5). Islam (2000) stated that the alternative adjustment strategies to natural hazards and their implications for Bangladesh were identified. In that methodology, it identified the stage as well as the possible types of adjustments for the flood damage reduction plan. People try to reduce their losses personally, or by using other help strategy. They receive money as loan from relatives, moneylender, neighborhood, etc. to cope with their losses.

***Loss reduction techniques of displaces during riverbank erosion*:** During riverbank erosion people try to protect the losses in their own adaptation techniques. They tried their indigenous techniques besides different community programme. Govt. and NGO both has also taken their own responsibility in minimizing the optimum losses. Figure 6 shows that majority of the people used piled sand bag for the protection and reduction of losses which was 48%, about 24% of the respondents used zeo soil bag as a loss reduction techniques, and brick pieces also used in a few cases that was about 19% of the respondents.

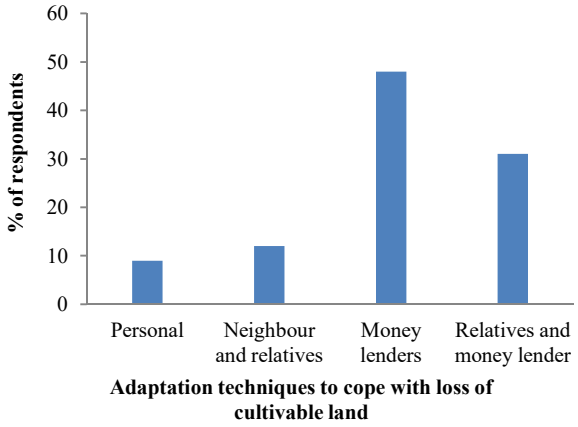

Figure 5. Adaptation techniques to cope with loss of cultivable land in the study area**.**

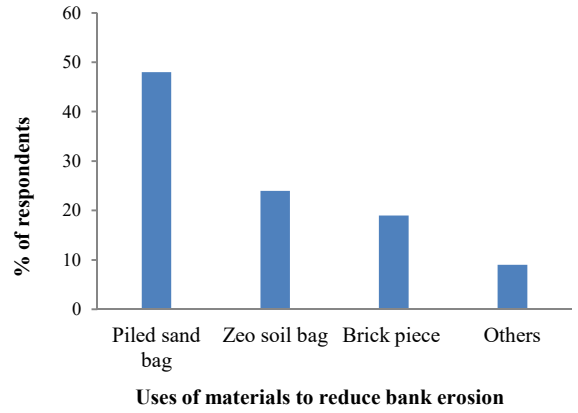

Figure 6. Loss reduction techniques during riverbank erosion in the study area.

Bangladesh water development board and also other government authority had tried to protect the losses of affected people in the study area and they used brick piece as protection of river bank erosion. Hossain *et al.* (2002) described that the design aspects of river embankments conducted by the Bangladesh Water Development Board (BWDB) during the last twenty years. A protection was designed using geo textiles and

cubic concrete blocks were used to reduce the loss caused by riverbank erosion, usually managed by Government authorities.

Conclusion

It is evident from the present study that erosion has a great impact on livelihood, agriculture, environment and other sectors. The major diseases like diarrhea, dysentery, asthma, TB, typhoid, etc. were prevalence during flood and river erosion and medical facility was also very poor. The effects of river erosion are long term and it takes a few decades to make up the losses, which a family has incurred by river erosion. This study confirms that although riverbank erosion in Bangladesh always generates socioeconomic and health related hazards and environmental and infrastructural damages, people's indigenous coping strategies can significantly reduce their vulnerability to disaster. The people of our country are very much optimistic. Despite losing everything by river erosion they start their lives newly every time. Only limited number of people used medicine from consultant doctor. It emphasizes the importance of the government and non-governmental organizations to take their own responsibility to the devastating situation of the riverbank erosion.

References

Ahamed RU (2001). Impact of Bank Erosion of the Jamuna River on selected towns in the Northern Region of Bangladesh. *PhD Report,* Department of Geography and Environment, Jahangirnagar University, Savar, Dhaka.

BDER (Bangladesh Disaster and Emergency Sub Group) (2015). *Post Flood Needs Assessment Summary Report,* Dhaka, Bangladesh. 23 P.

BBS (2014). Statistical yearbook of Bangladesh, Bangladesh Bureau of Statistics, Government of People's Republic of Bangladesh.

Das JD, Saraf AK (2007). Remote sensing in the mapping of the Brahmaputra-Jamuna river channel patterns and its relation to various landforms and tectonic environment. *Int. J. of remote sensing,* 28(15/16):3619-3631.

Finnegan NJ, Hallet B, Montgomery DR, Zeitler PK, Stone JO, Anders AM, Yuping L (2008). Coupling of rock uplift and river incision in the Namche Barwa-Gyala Peri massif, Tibet. *Geological Society of America Bulletin,*120(1): 142-155.

Hossain MM, Islam MR, Ali A (2002). On design aspects of embankment in the coastal zone of Bangladesh. Department of Water Resources Engineering, Bangladesh University of Engineering and Technology, Dhaka, 119-125.

Hutton D, Haque CE (2004). Patterns of Coping and adaptation Among Erosion Induced Displaces in Bangladesh: Implications for Hazard Analysis and Mitigation. *Natural Hazards*, 29(3): 405-421.

Iqbal S (2010). Flood and Erosion Induced Population Displacements:A Socioeconomic Case Study in the Gangetic Riverine Tract at Maldah District, West Bengal, India. *Journal of Human Ecology*, 30(3): 201–211.

Islam MA (2007). Land degradation due to riverbank erosion and its socioeconomic impact at Gangachara, Rangpur. *M.S. Dissertation,* Department of Environmental Science, BAU, Mymensingh, P. 58.

Islam MZ (2000). Hazards in Bangladesh: A Case Study on the Meghna River. *Journal of Science, Technology and Development*, 1(1): 5-48.

Islam MZA (2009). Indigenous Adaptation Strategies of the Riverbank Erosion Displaces in Bangladesh: A Study of Two Northwestern Riparian Villages. *Journal of Science, Technology and Development*, 1(3): 15-35.

Kabir RD (2006). The state of char education in Bangladesh: focus on selected chars of Gaibandha District. *Asian Affairs*, 28(3): 5-24.

Kar K, Hossain,F. 2001. Mobility of the People of Chars and Riverbanks of Bangladesh: A study of Gaibandha. DFID-B, Dhaka.

Khan NI, Islam A, Ritchie JC, Walling DE, Peters NE (2003). Quantification of erosion patterns in the Brahmaputra-Jamuna River using geographical information system and remote sensing techniques. Department of Geography and Environment, University of Dhaka, Bangladesh, 17(5): 959-966.

Koelle K, Rodo X, Pascual M, Yunus M, Mostafa G (2005). Refractory periods and climate forcing in cholera dynamics. *Nature London*, 436 (7051): 696-700.

Kotoky P, Bezbaruah D, Baruah J, Sarma, JN (2005). Nature of bank erosion along the Brahmaputra river channel, Assam, India. *Current Science*, 88 (4): 634-640.

Nazneen A (2013). Impact of Climate Change on Riverbank Erosion. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, 23(2): 123-130.

Pahuja S, Goswami DC (2006). A fluvial geomorphology perspective on the knowledge base of the Brahmaputra. Retrieved from http://northeast.nic.in/writereaddata/sublink3 images/13.pdf

Rahman MR (2010). Impact of riverbank erosion hazard in the Jamuna floodplain areas in Bangladesh. *J. Sci. Foundation*, 8(1&2): 55-65.

Reuveny R (2007). Climate change-induced migration and violent conflict. *Political Geography,* 26:656-673.

Sarker HM, Haque I, Alam M (2003). Rivers chars and chars dwellers of Bangladesh. *River Basin Management*, 1(1): 61-80.

Talukdar B (2012). River Bank Erosion: A Perspective, conference paper. Retrieved fromhttp:// www.iitg.ernet.in/coeiitg/31.pdf.

Thompson PM (2000). Bangladesh Char Lands a review of assets and change, DFID.

Viswanathan S, Ravi S (2007). Learning from the Poor: Findings from Participatory Poverty Assessments in India. Manila: Asian Development Bank.