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Impact of Riverbank Erosion: A Case Study of Naria Upazila of Shariatpur District, Bangladesh

Al Artat Bin Ali¹, Sharmin Sultana Toa²

¹Lecturer, Department of Geography and Environment, University of Dhaka, Bangladesh ²Lecturer, Department of Environmental Science, Shaikh Burhanuddin Post Graduate College, Dhaka, Bangladesh Correspondence: <u>artat.ruhan@du.ac.bd</u>¹

ABSTRACT

Riverbank erosion is a common accepted marvel in Bangladesh. In terms of afflicted individuals and property damage, the impact of river bank erosion is the most notable. The goal of the study is to determine the socio-economic impact and consequences of riverbank erosion on Naria upazila in Shariatpur District which is a vulnerable area in terms of erosion of Padma river. A field survey has been conducted including interviews and FGDs for the purpose of primary data collection while secondary data has been composed from census, reports from national and international organizations, books, journals and relevant articles. The study discovered that erosion has a longstanding effect on living and has changed the living patterns of erosion-affected people in this area. People have lost their sources of revenue, homestead lands, agricultural lands, nourishment production and other living options. They are deprived of education, safe water, health care, sanitation and other basic human needs that triggers as the push factors of migration in this area. It is high time for the government and local organizations to take responsibility for reducing riverbank erosion's disastrous effects.

Keywords: Riverbank Erosion, Naria Upazila, Shariatpur, Bangladesh.

Introduction

"River bank erosion" is one of the most discussed problems in Bangladesh. It is one of the main natural disasters of our country and a long-standing issue, inflicting untold suffering to thousands of people who live along riverbanks. It has turned into a huge societal concern, displacing millions of people. As a result of riverbank erosion, people who live near rivers are compelled to alter their livelihoods and communities.

The Padma is one of Bangladesh's three major rivers and is architecturally quite active (CEGIS, 2010; Yeasmin, 2011). The Padma River originates in the Himalayan Gangotri Glacier, flows through India, and is known as Padma in Bangladesh (Sarifuzzaman *et al.* 2010). The Padma river's bed and banks are predominantly made up of alluvial materials (CEGIS. 2010), while the bank sediments are mostly finegrained and compact sands (Azuma *et al.*, 2007). The banks of the river are particularly unstable due to fine sand and silty sediments with occasional clay (Mclean et al. 2012), and a constant erosion-accretion process occurs often (Kammu *et al.* 2008). The Padma river is braided, and between the braiding channels, islands or chars emerge. These chars, many of which are populated, shift with the stream and

Article History

Received: October 26, 2021

Revised: December 16, 2021

Accepted: January 21, 2022

Published: February 02, 2022 are particularly sensitive to changes in river erosion and accretion (NPDM, 2006). According to a study, bank erosion along the Padma river totaled 66,457 hectares between 1967 and 2009 (CEGIS, 2005).

Riverbank erosion in the Padma river has become a severe issue, as the river has resulted in the destruction of a large number of farms and livelihoods. Human livelihoods near the river bank floodplain are being jeopardised by continuous erosion. River bank erosion, according to Haque (1985) and Islam (2000), has an immediate and severe influence on human population relocation, and flood and bank erosion are major contributors to landlessness and destitution of rural populations. Rapid riverbank erosion has direct social and economic impacts which are major constraints against development along the river banks.

Because of the high levels of bank erosion and channel migration caused by the Padma river's strong current, permanent structures on the river are difficult to construct. The protective structures designed to restrict the river's erosion effects, such as embankments and polders, frequently confront several challenges during and after construction. As a result, riverbank erosion has emerged as a common occurrence in Naria Upazila of Sariatpur district despite minimal previous investigation of this site. The goal of this study is to depict the sufferings of river erosed people who have been significantly impacted by river erosion. The socio-economic consequences of river erosion on the residents of Naria Upzaila, as well as the protective policies required for them are also highlighted in the study. People living near riverbanks, governments, and other non-governmental organizations can use the findings of this study to hold themselves accountable and take necessary efforts to improve existing livelihood and socioeconomic conditions in riverbank erosion-prone areas.

Limitations of the Study

The limitations of the study were identified as following:

- Time and budget constrains has been the major limitation of this study.
- The field work has been pros ponded several times due to Covid-19 pandemic situation.
- Lack of secondary materials as limited research works have been conducted on this area.

Study Area

The research region is Naria Upazila in Shariatpur district, which is located along the river Padma and has been one of the most devastated places in recent decades due to river bank erosion. Naria Upazila has a total area of 203.58 square kilometres (78.60 sq mi) (BBS, 2011). It is bordered on the west and north by Zajira Upazila, the north by Munshiganj District, the east and south by Bhedarganj Upazila, and the west by Shariatpur Sadar Upazila. The Padma River runs through the upazila's northern section, while the Kirtinasha River runs through it as well (Rahman, 2012).

Bhumkhara, Bijhari, Bhojeshwar, Dingamanik, Chamta, Char Atra, Fateh Jangapur, Japsa, Kedarpur, Gharisar, Muktarer Char, Noapara, Nasason, and Rajnagar are the 14 union parishads of Naria Upazila. There are 146 mauzas and 189 villages in the union parishads. The municipality of Naria is divided into nine wards and twenty-seven mahallas (BBS, 2011).

Naria Upazila had 49,615 houses and a population of 231,644 people according to the 2011 Bangladesh census. The main sources of income in this Upazila include agriculture (47.63%), non-agricultural laborer (2.47%), industry (1.44%), commerce (20.23%), transportation and communication (3.25%), service (7.59%), construction (1.23%), religious service (0.29%), rent and remittance (6.73%), and others (9.14%) (BBS, 2011). There were 10.3 percent of the population under the age of five. The literacy rate (for those aged seven and up) had been 51.8 percent (Male 51.7 percent and Female 51.8 percent) (BBS, 2011). The steady erosion of the river bank in recent years, resulting in land loss and significant changes in the socio-economic pattern, reflects the Padma river's retroactive scenario in Naria Upzaila. Following Figure 1 shows the research area's location in Bangladesh:



Figure 1: Study Area Map (Naria Upazila, Shariatpur District).

Materials and Methods

Primary Data Collection: Personal interviews with random local residents have been conducted for collecting data and to understand their perceptions as part of the reconnaissance and field survey for this research. All reasonable attempts have been made to explain the goal of the study to the respondents in order to obtain the actual scenario of the study sites. Some interviews have been conducted over telephone as the extensive field work has been hampered due to the emergency situation aroused from Covid-19. A total number of 100 individuals were interviewed for the purpose of gathering primary data, and they were asked about the trend of river bank erosion over the last two decades, the causes of the erosion, and socio-economic impacts on the local community, such as occupational migration, land loss, infrastructure damage, and the impact on education and health facilities, among other things. Following each interview, the completed schedules have been double-checked for accuracy and accurate recording of each item. Local residents, village leaders, teachers, and the Imam, among others, participated in a focus group discussion to address issues and concerns.

Secondary Data Collection: This study employed an exploratory research approach, and the data has been acquired from a variety of secondary sources based on the study's needs, including census data, reports from national and international organizations, books, journals, and pertinent articles. Secondary data has been collected from the union parishad office, the BWDB (Bangladesh Water Development Board), and other sources. In addition, all accessible supporting data and resources have been obtained

from the internet. For further analysis and synthesis, the data acquired for the study has been subjected to appropriate statistical and graphical treatments.

Processing and Analysis of Data: This study employs descriptive statistics, and the respondents' sociodemographic variables were offered as the starting point for data analysis. On socio-demographic characteristics, frequency, mean, standard deviation, and Cramer's V value were used to determine the relationship between various nominal and categorical variables. Various statistical techniques and tools, such as SPSS and Microsoft Excel, Microsoft Word, and others, were used to computerize, process, and analyze the data, which was then presented in text format with the relevant graphics, figures, and so on.

Status of Riverbank Erosion: Padma River flows through the northern part of Naria Upazila, Shariatpur. Delineation and analysis of the bank line over the past four decades (1980 - 2019) have shown that, erosion at downstream is more prominent rather than the upstream of the selected reach. During this period total erosion was occurred at downstream side (Naria Upazila) 2823 meter by length (4456 ha by area) where the maximum erosion was happened 2159 meter in between the year 1988 – 1990 (Alom, 2020). If the present trend of river bank shifting continues, the Naria Upzila will disappear within a very short period of time.

Year	Erosion (m)	Deposition (m)
1980 - 1988	-	1787
1988 - 1990	2159	-
1990 – 1995	-	541
1995 - 2000	1198	-
2000 - 2005	75	-
2005 - 2010	406	-
2010 - 2015	180	-
2015 - 2019	1118	-

Table 1: Erosion/Deposition with fixed time Interval in Naria Upazila.

Source: Alom, M.M. (2020)

More than 5,000 people in Naria Upazila have been homeless as a result of the Padma river's erosion in 2018. On the banks of the Padma in Shariatpur district, there is serious erosion in at least 10 points totaling 7 kilometres, including Naria Pourashava, Kedarpur Union, Moktarer Char Union, Nawa Para Union, Charatra Union, and Gharisara Union (BDNews24, 2018). In addition to residences, the river has drowned all of the area's roads, bridges, culverts, and other important infrastructure. At least 200 enterprises in Sadhur Bazar and 200 shops in Wapda Bazar have also been washed away in the river. (BDNews24, 2018). People have become terrified as the erosion has reached the densely populated and important business locations.

Vulnerable Areas of Naria Upazila

The discussion with local people has revealed that, 6 unions are at high risk of river bank erosion among total 14 unions in Naria Upazila and it is because of their geographical location. These 6 unions are as following:

- 1. Kedarpur Union
- 2. Moktarer Char Union
- 3. Gharishar Union
- 4. Noapara Union
- 5. Char Atra Union
- 6. Naria Paurashava

Among those 6 unions Noapara Union and Char Atra Union are situated in char lands of Padma River. The secondary data collected from different sources has justified the perception of the respondents. The following represents the most vulnerable areas of Naria Upazila:





Table 2: Vulnerable areas of Naria Upazila.

Name of Union	Name of Villages	Affected Household	Affected Population
Kedarpur	Char Juzira, Char Naria, Kedarpur,	3045	11373
	Panchgaon, Saheber Char		
Mokterer Char	Cherag ali, Bepari Kandi, Sheher Ali,	1235	5681
	Matbarer Kandi, Ishwar Kathi		
Char Atra	Basar Char, Char Atra, Sreepur	215	989
Noapara	Dewan kandi, Munshikandi, Mijhi Kandi	155	713
Gharisar	Shurashwatr, Adam monirabad, Haloisar,	36	166
	Kroki monirabad		
Naria Paurashava	4 No ward	400	1159
		5086	20081

Source: Upazila administration (UNO) Naria and Media report. (Start Fund Bangladesh, 2018)

Results and Discussion

Socio-Economic Impacts of River Bank Erosion

The impact of riverbank erosion in Naria Upazila of Shariatpur has created numerous catastrophic socioeconomic effects. The majority of those impacted people see riverbank erosion as a natural occurrence, and many feel that erosion is the 'will of God.' Riverbank erosion, on the other hand, is now considered one of the key drivers of national poverty. (Rahman, 2010).

Loss of Land and Households: Because of the ongoing erosion of the riverbank of the Padma River, the respondents in the research region have lost a significant quantity of land. Households, homestead lands, agricultural lands, agricultural productions, crops, and trees are all affected by land loss in Naria Upzila.

The immediate impact of river bank erosion is displacement, which occurs as a result of the loss of dwellings, rendering the inhabitants unable to live a decent life. According the respondents, the impact has been prominent in Char Juzira, Char Naria, Kedarpur, Panchgaon, Saheber Char villages of Kedarpur Union. According to the information provided by Shariatpur Development Society (SDS) – a local NGO that involved in this crisis, four wards of Kedarpur union (1, 2, 3 and 4) have been destroyed; two more wards (6 and 7) have been 30% demolished as of August 2018. Naria Paurasava's ward 4 has also been completely wiped. Every day, between 70 and 100 buildings fall into the river in these highly populated neighbourhoods, forcing residents to flee. (SDS, 2018). The percentage of households destroyed by erosion in six unions of the study area is shown in Figure 1:



Figure 1: Percentage of Household Damage in Naria Upazila.

Source: Field Study, 2020 and Secondary data.

Figure 1 show that about 60% of households in Kedarpur Union have been diminished, and nearly 25% of households in Cherag Ali, Bepari Kandi, Sheher Ali, Matbarer Kandi, and Ishwar Kathi villages of Mokter char have been entirely damaged, out of the total damaged households in this Upzila.

People, according to the respondents, have no choice but to bear the losses when riverbank erosion occurs. They are unable to abandon their houses and farms before the erosion occurs in that area. The main reason for such actions is that their meager earnings prevent them from relocating their homesteads before they completely collapse.

Due to bank erosion, a large tract of agricultural land in Naria upzila has been lost to the river. Agricultural land is seen as a valuable resource for Bangladeshis who live in villages or rural areas. The majority of respondents in the study area are both directly and indirectly reliant on agricultural land. If there is a small loss of arable land, it may leave the poor people in a more vulnerable position. The following figure 2 depicts the respondents' loss of agricultural land in the research area:

Figure 2: Loss of Agricultural Land of the Respondents in Naria Upazila.



Source: Field Study, 2020

According to the survey, nearly 53% of respondents in the study area had lost less than 5 acres of agricultural land, while roughly 18% have lost 5-10 acres of agricultural land. According to empirical data, 21% of respondents in the research area have lost 10-15 acres of agricultural land due to riverbank erosion, while only 8% have suffered more than 15 acres of farm land. People who have lost their agricultural land have been forced to use their savings and frequently fall farther into debt, making their lives precarious.

Impact on Livelihood

Any type of displacement has a direct influence on the displaced population's normal sources of income and money-generating activities. They are forced to live in substandard conditions as a result of their loss of income, and they are unable to continue living in the same manner as before they were displaced. In new settlement locations, they are having difficulty finding new sources of income. The respondents have been divided into five categories based on changes in their income sources, as illustrated in figure 3 below:



Figure 3: Change of Occupation pattern in Naria Upzila.

Source: Field Study, 2020

Figure 3 shows that prior to riverbank erosion, about 53% of respondents have been engaged in farming activities, but this has fallen as a result of riverbank erosion, with only about 33% of respondents engaged in farming activities. Riverbank erosion has increased the percentage of day laborers and unemployment in the research area, according to the findings. Following bank erosion, 13% respondents have worked as day laborers, compared to just 9% prior to the bank erosion, and 17% respondents have been unemployed, compared to only 12% prior to the river bank erosion. Before riverbank erosion, 18% of respondents have been involved in non-farming primary activities, but this increased following erosion hazard, reaching almost 27%. There has been a little variation in the percentage of other activities, though. As a result, it is clear that riverbank erosion affects the employment status of those who have been affected.

According to Das and Saraf (2007), most people lose their agricultural land and become landless and homeless as a result of river bank erosion, and their occupation patterns alter. As non-farming activities, day laborers, and unemployment have increased day by day in the research area, this has been the situation. People who have worked in agricultural sector have completely lost their source of income. They have been struggling to cope with the loss of their livelihood as well as their home. They have turned to fishing and non-farming activities as their principal source of income because they have no other options. Erosion refugees also work as day laborers or rickshaw pullers. Rickshaws and other vehicular operations have become obsolete as a result of the destruction of roadways. Due to the harsh condition, the majority of the erosion displaced individuals have temporarily relocated to neighboring towns or cities and engaged in dangerous income-generating activities.

Impact on Nutrition and Health Care Facilities

Health is regarded as the most important aspect in living a quality life and carrying out economic activities effectively. However, individuals in Naria upzila have been dealing with a variety of health issues, and the erosion-affected population's public health demands are anticipated to grow. People who have been displaced may find themselves living beneath the stars with no access to safe drinking water or proper sanitation.

The health care facility for the local people has been greatly threatened due to extensive erosion. Recently the main building of the 50-bed Government health complex of Naria upazila has been disappeared in the

river. The erosion has also affected 25 pharmacies in front of the Upazila Health Complex, and two private clinics (The Daily, 2018). The absence of a Government Health facility and other private clinics, may overwhelm the services of the remaining health centers.

According to the field investigation, the majority of respondents (about 65%) cannot afford to spend more than 500 BDT on health care. Only approximately a quarter of them (about 23%) can afford to spend 500-1000 BDT per month on this purpose and only about 12% of the total respondents have been able to spend more than 1000 BDT for health care facilities. Due to the destruction of government health complexes, private clinics, and other medical centers, health-care expenditures may rise, leaving the majority of the population without adequate healthcare.

According to the respondents, due to destruction of farmlands, food crops have been damaged resulting in limited availability to various healthy food. As a result of the scarcity of food, the majority of them have been malnourished. Erosion may not have a direct impact on nutrition, but it has created situations that increased vulnerability and led to an increase in malnutrition, which has been exacerbated by factors like poor hygiene, a lack of private and safe spaces for women to breastfeed or feed children, and a lack of access and availability of nutritious food.

Impact on Education

Education is regarded as one of the most fundamental requirements for a human being's complete growth. It is a form of human capital, and contributes to the welfare of individuals, households and society (BBS, 2016). According to BBS 2011, in Naria Upzila 75 Government primary school, 35 registered primary school, 3 Non-govt. primary school, 38 kindergarten school, 23 Non-govt. secondary school, 1 Government college, 2 Non-govt. college, 6 Madrasha, 4 Kawmi madrasah and 2 technical and vocational institutions are located (BBS, 2011).

According to the respondents, depending on location, riverbank erosion has led damage to school buildings and other educational institutions as well as consequent a loss of the learning materials. Already many of the educational institutions have been demolished by the river. The field investigation has found that more than two-thirds of respondents have not completed more than high school. The school going children of this area have been facing difficulty to continue their study. In some cases, landless people who have lost their shelter due to the river bank erosion take shelter in school or college buildings leaving students no option to continue the classes. Thus erosion enhances the risk of eventual dropout of students preventing children from going to school.

Impact on Infrastructure

According to the findings of this study, key infrastructure in the Naria Upazila is endangered owing to river bank erosion. According to the replies of the respondents, about three kilometers of pucca road from Bashtala to Mulfatganj Bazar was lost in just three days during the riverbank erosion in 2018. In this upzila, six bridges have collapsed into the river. At that time, all communication systems, including the Sureswar-Naria road, had failed.

According to a Start Fund Bangladesh Briefing Note, the river has destroyed around 80 kilometers of kucha and pucca road in the upazila in less than two years. At the same time, seven religious institutions (including a mosque and a mondir) had toppled into the river. Naria upazila's Mullafatganj Bazar has also partially fallen. In just one week, at least 320 businesses have been dissolved. The erosion has destroyed 600 shops and businesses in the Naria municipality and the Kedarpur region (Start Fund Bangladesh, 2018).

Erosion Induced Migration

River bank erosion adds significantly to the marginalisation of a huge number of people in the country by displacing homes and negatively affecting their social and economic circumstances, resulting in migration and increased urban poverty (Barua, 2019). People in Naria Upzila who have been afflicted by erosion

have been uprooted from their birthplaces, cutting them off from their sources of income, homestead lands, agricultural fields, food production, and other livelihood possibilities. Their children's education has been seriously affected. Local communities have been denied of adequate drinking water, health care, sanitation, and other fundamental human necessities, which operate as the push factors of migration in this region.

In the research area, both temporary and permanent migration has occurred. Because of their financial difficulties, most displaced people have chosen temporary migration over permanent migration, according to the respondents. In order to save their lives, a considerable number of erosion refugees have recently fled from their places of origin to various destinations. Most of the affected people of Char Juzira, Char Naria, Kedarpur, Panchgaon, Saheber Char, Cherag ali, Bepari Kandi, Sheher Ali, Matbarer Kandi, Ishwar Kathi, Char Atra, Sreepur, Dewan kandi, Munshikandi and Mijhi Kandi villages have relocated themselves nearly to their destroyed homestead, though only small number of people have migrated from their own living places. When erosion happens, people instantly transfer their homestead to a neighboring place, but when an extreme occurrence occurs, the majority of people migrate permanently. The location of the impacted people's migration is depicted in Figure 4:

Figure 4: Choice of places for migration in Naria Upazila.



Figure 4 shows that 37% of those displaced people have resettled to their neighborhoods, while 29% have sought refuge in adjacent villages. Around 18% of those impacted have relocated to surrounding districts, and about 16% have relocated to nearby cities in search of better employment opportunities or to change their work type. Despite the fact that river bank erosion is a continual process, the majority of those impacted have chosen temporary migration with the hopes of resettling in a prior or new location of that surrounding area in the future.

Conclusion and Recommendation

Naria Upazila is one of the most vulnerable places in terms of riverbank erosion, according to the analysis and findings of this study. The Padma river engulfs a significant amount of land every year making people homeless, landless and workless. So, riverbank erosion has catastrophic and multidimensional effect on social, economic, psychological, and cultural behavior of the survivors of this area.

The impact of riverbank erosion in Naria Upazia is most noticeable among those whose primary source of income is agriculture. Small, marginal, and landless farmers with small plots of land are disproportionately affected, as their only source of income has been destroyed by bank erosion. They have been challenged with the ambiguity of surviving in an unpredictable and volatile environment after losing

their main economic pursuits on which their livelihood is based. This has resulted in a major unemployment problem, particularly among those who rely highly on agriculture. The majorities of people have relocated to new locations and have been compelled to adjust their occupations and lifestyles in response to the severity and frequency of erosion occurrences.

It is high time to take the required steps to stem river erosion before the situation spirals out of control, in order to ensure sustainable livelihood management and a higher standard of life for the victims. In Bangladesh, there is a significant lack of cooperation across government agencies, as well as between government and non-government activities, when it comes to river bank erosion. The government program focuses primarily on subsidy programmes such as relief distribution, Vulnerable Group Feeding (VGF), Vulnerable Group Development (VGD), and so on; however, these programmes are frequently insufficient, disorganised, politicised, ad-hoc, and ineffective; thus, government initiatives can be improved (The Daily, 2014). Close collaboration between different local government agencies is essential to alleviate the situation. In contrast, despite their tremendous efforts to address other natural and manmade disasters, few NGOs have specialised programmes directed at persons affected by river bank erosion in Naria Upazila.

The government of Bangladesh should include the calamity of river bank erosion in its five-year plans, and a clear strategy for dealing with it should be established. To determine the extent of river bank erosion and the number of persons impacted, a data base is necessary. A national habitat policy should be developed to meet the needs of the thousands of individuals who are displaced each year. Local government agencies should take the lead in all of these phases, and they should have statistics on potential impacted persons who reside on the river's danger side. Local government agencies should also be decentralized and equipped with the necessary capacity and accountability mechanisms in order to reduce vulnerability and respond swiftly and efficiently. Aside from these significant matters, some actions in river bank erosion-prone regions should be executed, such as establishing detection systems in all critical areas and tracking during critical times using local knowledge; establishing embankments or spurs in erosion-affected areas; developing alternative employment opportunities in fishing and industry; and taking initiatives to distribute 'khas' land to the most vulnerable people. This proposal to distribute land among the 'khas' could assist to reduce migration to cities.

During the rehabilitation of the afflicted population in the erosion-prone areas of Naria Upzaia, a relocation plan for income-generating activities, as well as the establishment of health care facilities, services, and education, should be implemented. NGOs may be able to provide impacted individuals flexible financing arrangements so that they can restart their income-generating activities as soon as feasible. As part of their basic human rights, NGOs can advocate for rights-based advocacy campaigns to urge impacted individuals to seek access to education, health care, water, sanitation, and job opportunities. Given the magnitude and severity of the problem, national-level measures to properly respond to riverbank erosion disasters are long overdue. We may not be able to combat nature's powers, but we may devise tactics to counteract the results.

Acknowledgment

I would like to show my sincere gratitude to Disaster Research Training and management Centre (DRTMC), University of Dhaka for the sponsorship of the research grant.

Conflicts of Interest

The authors declare no conflict of interest.

Funding Source

Disaster Research Training and management Centre (DRTMC), University of Dhaka, Bangladesh

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