

**DETERMINANTS AND GENDER CONSIDERATIONS FOR
SURVIVAL STRATEGIES DUE TO RIVERBANK EROSION: A CASE
STUDY AT DEWANGANJ, JAMALPUR**

Sahika Ahmed

MASTER OF SCIENCE IN WATER RESOURCES DEVELOPMENT



**INSTITUTE OF WATER AND FLOOD MANAGEMENT (IWFM)
BANGLADESH UNIVERSITY OF ENGINEERING AND
TECHNOLOGY**

November, 2022

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

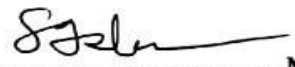
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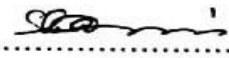
The thesis titled ‘Determinants and Gender Considerations for Survival Strategies due to Riverbank Erosion: a Case Study at Dewanganj, Jamalpur’ submitted by Sahika Ahmed, Roll No. 0419282006, Session: April 2019, has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Master of Science in Water Resources Development on November 23, 2022

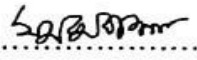
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(Sahika Ahmed)

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Session: April 2019

Dedicated to

My beloved husband, MD. Sultan Ahmed Sajib

ACKNOWLEDGEMENT

At first, I would like to express my endless regards and devotion to the Almighty Allah's continual mercy for giving me the ability to complete this research. I consider myself extremely fortunate to be able to study and work in the welcoming atmosphere of the institution (IWFM) which not only has played a key role in this research work, but also polished my potential as a researcher.

I would like to express my sincere and heartfelt gratitude towards my honorable supervisor Dr. Sonia Binte Murshed, Associate Professor, Institute of Water and Flood Management, BUET, Dhaka for her constant supervision, cordial cooperation, and encouragement throughout the research work. Her constructive comments, keen interest, and expertise helped me to understand better and broaden my knowledge, research capacity and writing skill.

I am extremely grateful to Dr. Mohammad Shahjahan Mondal, Professor, IWFM, BUET, and Dr. Sara Nowreen, Associate Professor, IWFM, BUET, for their kind advices, comments and valuable suggestions, without which the successful completion of the thesis was not possible. I express gratefulness to Dr. A. K. M. Saiful Islam, honorable Director and Professor of the institution, Dr. Sujit Kumar Bala and Dr. Asma Begum for helping me to improve the quality of this work. .

Special thanks go to Kazi Mushfique Mohib, a former student of the Department of Water Resources Engineering, BUET and Sujit Kumar Roy current student of IWFM, BUET, for accompanying me with their wise advices and enormous supports.

I would like to thank my two other fellows Sumaiya Binte Islam and Khadizatul kubra, current students of IWFM, BUET, for their cordial support, inspiration and exchanging required information.

This study was funded by International Development Research Center Canada (IDRC) as part of the 'South Asian Water (SAWA) Leadership program on Climate Change'. I gratefully express my gratitude to the project team, especially SaciWATERS, India for continuous guidance, training and assistance which encouraged me to complete this degree.

Special thanks to Md. Ashab Uddin, Md. M. S. Alam Masum, Mst. Masuda Begum, Md. Shadhin Miah, Zeal Bangla Sugar Mills Ltd. authority and staff for providing valuable information and comments during the field surveys. I would also like to thank all local people in the study area who gave me their valuable time and effort during focus group discussions (FGD) and questionnaire surveys as well as support in every step in the study area during the field survey.

I would love to take this opportunity to express my heartfelt thanks to my family members Ayub Ahmed, Afia Khatun, Syed Marzan-ul Hasan, Anika Ahmed, Fakeha Ahmed and my precious Syed Afnaan-ul Hasan for their inspiration during this study. I am indebted to many other individuals without whose assistance, this research could not have been completed in time. I want to thank everyone who has helped me along the way.

Finally, my most special gratitude and thanks to my husband, Md. Sultan Ahmed Sajib for his patience, sacrifice, mental support, and continuous encouragement during this work.

ABSTRACT

This study focuses on the survival strategies of riverbank erosion victims of Dewanganj, Jamalpur. Coping and adaptation strategies, determinants of destination choice and gendered considerations are the key factors here. The Brahmaputra river, braided in nature, is very much prone to riverbank erosion. The most devastating phenomenon here is that the victims are bound to move or displace to another location due to the loss of homestead land. This incident severely impacts the victim's everyday life and the socio-economic conditions of a whole community. In the study area, Dewanganj, the erosion rate is very high; almost every year, erosion happens. So giving proper attention and outreach to this condition is necessary. The study area has different types of communities where people have different requirements. However, displacing in nearby areas is a common tendency of these people. This displacement processes require different types of survival strategies for the victims of different areas. Also, some gender discriminative conditions among the inhabitants make the situation worse from some perspectives. It is important to know their requirements and needs to plan policies for these erosion victims and make them sustainable. So, the study area is divided into five principal land types: Island Char, Attached Char, GOVT Land, Gucchogram and the Mainland. The erosion pattern of the study area was assessed, which showed the erosion accretion severity of the site from 2000 to 2020. From this analysis, it is clear that the amount of eroded area (15.84 sq. km) is nearly double of the amount of accreted area (9.23 sq. km). It shows the necessity of the planned displacement process. The information related to the inhabitants living conditions and strategies was collected through household surveys, Focused Group Discussions (FGDs) and Key Informant Interviews (KIIs). It helped to identify the key survival strategies divided into coping and adaptation strategies. Through SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis, the suitability of these strategies were analyzed for the five different zones. This analysis indicated the differences in the requirements to stay or to move to any new place. Both the positive and negative influence of a zone is being cleared through this analysis. The preferred requirements to choose any new place to move and all the factors influencing their decision-making in destination choice were then ranked based on their importance or preference. From this ranking, we get to see the differences in the expectations of people from different zones. Gender considerations related to these factors were also identified to understand the participation of different genders and their influence in decision-making. Harvard Analytical Framework is used to represent the participation in different sectors based on gender classification which showed women as the most vulnerable gender group with almost no opportunity to participate in decision-making. These gendered conditions, ranking of destination choices and suitability analysis present the expectations, requirements and exact conditions during the erosion, displacement and post-displacement periods.

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Chapter One

INTRODUCTION

1.1 Background and Rationale of the Study

Bangladesh is a land of rivers. The Brahmaputra River is one of Bangladesh's three main rivers (Ganges, Brahmaputra and Meghna). This river originates in Tibet as the Yarlung Tsangpo, flowing into India and southwest into Bangladesh (Rampini 2021). At the mature stage (as in the case of the three major rivers, Ganges, Brahmaputra and Meghna), rivers become sluggish and meander or braid (Hasanuzzaman and Mandal 2020). These oscillations are the cause of massive riverbank erosion. Every year, millions of people become affected by erosion that destroys standing crops, farmland and homestead land (Alam et al. 2020). It is estimated that about 5% of the total floodplain of Bangladesh is directly affected by erosion (M. S. Rahman and Gain 2020a). Riverbank erosion is taking place in about 94 out of 489 Upazilas of the country (Rezaul Islam 2021).

Some rivers cause erosion on a large scale and high frequency due to their unstable bank line Character. These rivers have braided patterns consisting of several channels separated by small Islands in their courses. These are called the braided river. Brahmaputra river has braided nature with bank materials that are highly susceptible to erosion. River channel migration due to erosion has emerged as a severe environmental issue. The victims lose their shelters, cultivable lands, and other properties. Erosion force the victims to be evacuated from their land. Poor peoples are the most vulnerable to this situation. Education, electricity, health security, and many other facilities are not yet sufficient in erosion-prone regions. Riverbank erosion is a destructive hazard in Bangladesh that permanently displaces and impoverishes people. The Brahmaputra river floodplain covers most of the northern portion of Bangladesh. Brahmaputra river channels have intermittently and impulsively wandered across the land, eroding banks, destroying everything in their paths, and accreting land elsewhere.

Compared economically, riverbank erosion is the most disastrous as it takes everything away from the victims. It is the reason for extreme poverty and the uncertain socio-economic

condition of the victims (Baki and Gan 2012). The population's degree of economic loss and vulnerability due to bank erosion has dramatically increased in recent years. Land loss primarily involves the loss of homestead land, housing structures, crops, livestock, trees and household utensils. Loss of homesteads forces people to move to new places without any option and puts them in disastrous situations. About one million people are directly affected each year by bank erosion in the country (M. S. Rahman and Gain 2020a). The total monetary loss is estimated to be approximately US\$500 million annually (M. F. Islam and Hossain 2020). An estimated 300,000 displaced persons usually take shelter on roads, embankments and government-requisitioned lands (M. F. Islam and Rashid 1970).

This land erosion peaks during June-to-October, after heavy monsoon rain and high discharge in the rivers. In 2021, erosion destroyed the homes of at least 8,000 people in Bangladesh's northern districts during heavy July floods that swept through the region and displaced at least 300,000 people across the country (Ali et al. 2021, Quader 2021). Hundreds more households have been stranded in recent days. About two million people face displacement each year due to landlessness, river erosion, floods and other natural calamities (Martin et al. 2014).

Displacement is the immediate impact of riverbank erosion. The displaced usually move to nearby areas, but migrations to distant places are not uncommon. In erosion-prone areas, most families have witnessed displacement in their lifetime. This involuntary movement can go up to 10 times or even more. The displacement caused by erosion mostly involves the displacement of whole families. A large proportion of the victims remain unemployed due to a lack of work opportunities after displacement.

The places which are being mainly chosen by the internal displacees of Bangladesh are riverine Island Chars, Attached Chars (Karim and Thiel 2017), Government Lands (Khas Jomi), Gucchograms (rehabilitation program by the Government of Bangladesh) and Mainlands. The riverine Island Chars are the extremely isolated and most climate vulnerable areas of Bangladesh (M. N. I. Sarker et al. 2020). Floods and erosions affect this area the most. The Attached Chars are connected to the Mainland, making the place more communicable than Island Chars. Government Lands are owned by the Government of Bangladesh but living here without permission is illegal. Gucchograms are planned projects

by the Government of Bangladesh where people get housing, sanitation and water facilities from the government. Mainland is distant place from riverbanks where the erosion rate and possibility is minimum.

It is obvious that the people of Bangladesh generally are very adaptable and resilient to changing environmental conditions (Siddiqui 2008). Adaptation and coping are two types of survival strategies for riverbank erosion-induced displaced. These strategies are taken by the victims, communities, and the government. The short-term immediate responses to coping with new situations are called coping strategies and the long-term planned policies and preparations to mitigate the loss are called adaptation strategies. The victims themselves take coping strategies. Sometimes they get help from communities and government or non-government organizations. Adaptation strategies are mainly planned policies by government and non-government organizations. When the victims also have a long-term plan and understanding of the mitigation and response to the phenomena that can also be called adaptation strategies. The internal displacement process is the most common adaptation strategy taken by the victims (M. N. I. Sarker et al. 2019). Adaptation strategies provide sustainable solutions and development, which are evaluated by the technical, social and financial conditions of the area (Thoai et al. 2018). These strategies are different for different areas (Khan et al. 2020). The suitability and accessibility of a place are depended on the conditions of these strategies.

Several factors are working behind the choice of place for rehabilitation (Bernzen, Jenkins, and Braun 2019a). Push and pull factors are the two types of factors, one of which attracts people to a new place and another makes people bound to leave the place he lives. That is why analyzing these factors and their importance is very fruitful in understanding their requirements and abilities. These factors reveal the requirements and expectations of the victims which should be followed while making plans for their rehabilitation.

There is another issue to be focused on while talking about decision-making. Common social and family norms are not familiar with gender equality in these areas. Equal participation in decision-making and equal opportunities are must to ensure equality in gender groups. Lack of involvement in decision-making, education and other advantages makes the female part of the population more vulnerable (De Jong 2000). Moreover, extra responsibilities are given

to them during disasters. Women do all the household chores. Also, she is the one to take care of all members. For this, during internal displacement due to erosion, women are the worst victims. The overall stress on them is immense.

Describing men and women in terms of gender is sometimes misleading as it focuses on the biological difference or sexual difference which is not covering the overall concept of gender. But if the work includes differences mostly induced by social, cultural and behavioral patterns, then it is not just focusing on biological differences but the broader concepts of gender (Wylie et al. 1986). Even though the classification is based on sexual identity, including every type of orientation (i.e., third gender, transgender etc.) in the study increases the acceptability of the research (Pryzgodna and Chrisler 2000). In this study, men and women groups are being given priority as they represent a huge difference in demands, needs, opportunities, responsibilities, decision-making, and sufferings in this area.

This study attempts to assess the erosion pattern of the study area, the survival strategies taken by or for the victims, and the suitability of the strategies. In addition, the ranking of the decision-making factors of destination choice and gender influence on them are being investigated in this study.

1.2 Objectives of the Study

The overall objectives of this study are to represent the erosion pattern of the Brahmaputra riverbank, erosion-induced displacements and the survival strategies of the victims. Also, the suitability of the strategies, destination choice for rehabilitation and gender influences on this are being assessed. The specific objectives are:

1. To identify the erosion patterns of the Brahmaputra in Dewanganj, Jamalpur.
2. To assess the suitability of the existing coping and adaptation practices of the inhabitants and
3. To analyze the survival strategies by identifying the decision-making factors related to internal displacement and gender influence in destination choices

1.3 Scope and Limitations of the Study

This study will enlighten the understanding of riverbank erosion extent and its impact on the displaced victims. The previous studies on survival strategies and destination choices did not have land type difference-based analysis (Tanvir Rahman, Islam, and Rahman 2015, Hutton

and Haque 2004, M. Z. Mamun 1996, Regmi, Paudel, and Bhattarai 2020). In this study, the total analysis has a perspective from different land types and their influence on decisions and adjustments. The suitability of adaptation and coping strategies and pointing out the gender issues and decision-making factor's ranking will help the policymakers to ensure rehabilitation with enough facilities and gender friendly environment after a disaster. These also can help in achieving a sustainable solution for the coping and adaptation strategies in order to mitigate the loss of the victims. The Government of Bangladesh has already taken many steps to rehabilitate the erosion displacees and the landless peoples. Project of making Gucchograms is one of them. This study will also help in making these rehabilitation plans and policies more fruitful for the displacees.

Incorporating quantitative elements in qualitative analysis is a famous research option nowadays (Grim, Harmon, and Gromis 2015). However, it is not possible to quantify each qualitative information as it will change the main purpose of the research. As qualitative analysis is interpretive in nature, there are possibilities of insufficient or unrepresentative information being focused on. Also, if the sample size was more, the validity of this study would increase. So these are the limitations of this study

1.4 Organization of the Thesis

This thesis is organized into six chapters which are described in the following:

Chapter 1 provides the background and present state of the problems. It also draws attention to the objectives, scope and outcome of the study. **Chapter 2** illustrates the literature review of various research works related to the specific fields. **Chapter 3** briefly overviews the study area with information on the different land types. **Chapter 4** explains the details of the methodology, data collection procedure and data types. **Chapter 5** describes the analysis results to evaluate and discuss these results. **Chapter 6** draws a conclusion from this study and also gives some recommendations for further study.

Chapter Two

LITERATURE REVIEW

2.1 Riverbank Erosion in Bangladesh

Bangladesh is a riverine country with low lying land area. Rivers continuously change their pathways; thus, erosion and accretion happen naturally (Mollah and Ferdaush 2015). However, it can be controlled to some extent. The alluvial nature of Bangladeshi Rivers is the main hindrance behind controlling riverbank erosion. This land is made of alluvial deposits. Also, the rivers of this country are shifting their channels continuously. That is why riverbank erosion is so common here (Nath, Naznin, and Alak 2013).

Loss due to riverbank erosion is beyond calculation. People lose their ancestral properties and, with that, all the memories which are irreplaceable with money. Also, they suffer mental and emotional damage too. Riverbank erosion increases the social, economic and psychological distress of people (M. S. Rahman and Gain 2020b). The degree of loss has risen dramatically in recent years. These victims are deprived of a well and healthy social and economic life due to this natural hazard (M. S. Rahman and Gain 2020b).

Local people have their comments on how to stop riverbank erosion. A study was conducted in Shibalaya, Manikganj (Shohel Rana 2017) and this research shows us how the local people are thinking about preventing riverbank erosion. The result is given below.

Table 1: Perception of people on preventing riverbank erosion (source: Shohel Rana 2017)

Perceptions	Frequency	Percent	Valid Percent	Cumulative Percent
Construction of embankment	28	56.0	56.0	56.0
The channel bed	13	26.0	26.0	82.0
Setting blocks	2	4.0	4.0	86.0
Impossible to check erosion	3	6.0	6.0	92.0
Non response	4	8.0	8.0	100.0
Total	50	100.0	100.0	

Though most people choose embankments as the solution to riverbank erosion, it is not possible to build embankments along the riverbank of a whole river. Also, building embankments on one side can cause devastating erosion on the other side. The embankment project needs a large amount of riverbank area to be evacuated, so there will be the problem of relocating many people, which is not always beneficial (M. Rahman 2013).

According to the requirements of the present riverbank condition in Bangladesh, it is more important to adapt than prevent it. Decreasing the loss due to riverbank erosion and planned rehabilitation of victims will be the most convenient solution to this problem.

2.2 Riverbank Erosion in Brahmaputra

Flood and riverbank erosion are common natural hazards along the Brahmaputra river floodplain (S. Islam 2017). People living in these areas face floods and erosion almost every year. Riverbank erosion is considered one of the main factors behind our national poverty (G M Monirul Alam 2016). The amount of loss due to erosion is not comparable to the loss due to other natural hazards. Riverbank erosion snatches homestead and agricultural land from the victims (Aktar and Nazneen Aktar 2013). They do not have any other way without being evacuated. Riverbank erosion induces migration or displacement. Almost half a percentage of all homeless people in our country have suffered riverbank erosion and are unable to rebuild their houses (A. Al Mamun et al. 2022).

The impact of riverbank erosion-induced displacement mainly hampers the victims' socioeconomic condition and livelihood (A. Al Mamun et al. 2022). It is essential to understand people's decisions on migration to know in which situation they tend to move (Adams and Kay 2019). In the context of Bangladesh, people are forced to migrate on a permanent basis (Bernzen, Jenkins, and Braun 2019b) within their place of origin, which is quite common to observe along the Brahmaputra river floodplain. This type of migration is also known as internal displacement (Wilkinson et al. 2016). There are different types of strategies to overcome the forced changes in the life of erosion victims. The suitability of these strategies is vital for further modification in the policies related to the rehabilitation of these people.

Also, the gender influence of the strategies is an important thing to focus on. Usually, most of the activities of women in these erosion-prone areas depend on the surrounding

environment (Akter, Dey, and Hasan 2019). As a result, displacement due to erosion affects them severely. It increases their responsibilities and liabilities (Akter, Dey, and Hasan 2019). Moreover, the dominant patriarchal practices and norms are increasing the discrimination between men and women in almost every step of living (Ferdous and Mallick 2019).

2.3 Application of Satellite Image on Erosion Analysis

To calculate the riverbank erosion and accretion, the riverbank shifting can be shown using remote sensing and Geographic Information System (GIS) techniques (Ophra et al. 2018). Only secondary data is needed for monitoring this change. Selected pictures of the specific timeline are used for further analysis. Images should be cloud free for the accuracy of the analysis.

Google Earth Pro (GEP) is providing available high-resolution imageries (Landsat 7) for recent years (2000-2020) (Calva et al. 2019). Extracted layers from satellite images can be transformed into GIS layers (Mallick and Schanze 2020). Image overlay is the process of superimposing multiple datasets to identify the relationships between them. Polygon features of these images create areas of erosion and accretion by intersecting the riverbank lines; thus, the areas can be extracted. The calculation of these areas can be done using the GIS calculate geometry tool.

2.4 Internal Displacement due to Erosion

There are different types of displacement and migration based on their Characteristics. Internal displacement is one of the immobility-based movements where people typically do not want to go far from the lands of their ancestors. This is also called mobility instead of migration, as migration means crossing the boundary or border, but in mobility, people remain within their own boundaries (Myers 1997). This mobility may require a new lifestyle and behavior pattern.

Riverbank erosion forces people to displace, that's why it is also called forced displacement. Displacement due to riverbank erosion is a traumatic experience for the victims. This refers to a situation where the victims are forced to leave their habitual residence with intensive risk. Mostly the primary driver is the occurrence of a disaster (Krishnan 2022). They do not have suitable and sufficient transportation services to move in most floodplain areas. (A. Al Mamun et al. 2022).

The transition period between displacement and permanent resettlement is the most critical phase (Thukral 1996). A place for permanent settlement is not easy to manage. Sometimes the victims need some time to make the new place livable. That is why they take shelter in any temporary place; this phase is called the transition period. During this period, managing basic needs is not possible due to various complexities sometimes.

2.5 PRA Tools for Understanding the Situation

The principles of Participatory Rural Appraisal (PRA) tools include but are not limited to direct learning from local people, concern about the behavior of outsiders, facilitating analysis by local people, practicing critical self-awareness and responsibility, offsetting biases, optimizing tradeoffs, and triangulating and seeking diversity (Chambers 1994). These tools give the scope of the analysis to be owned and shared by local people. There are many studies on riverbank erosion and its victims where PRA tools were used (Iva et al. 2017, Monirul Alam et al. 2017, Mollah and Ferdaush 2015).

The scope of information sharing is high in PRA tools. Different types of sharing make this process a successful one. Information sharing can be of three types, sharing between local peoples, sharing information from the local people to the outsiders, and sharing between outsiders (Chambers 1994). One of the most used processes of PRA tools is field learning. It helps a lot to extract the exact information. Matrix ranking and analytical diagraming are some PRA tools that ensure the complete participation of local people. These are open-ended processes. PRA tools help collect and quantify the information for qualitative analysis.

2.6 Adaptation and Coping Strategies

To overcome the loss due to riverbank erosion, people follow some strategies which help them to come back to their normal life. The erosion victims are bound to be displaced and continue to try to live comfortably in the new place of resettlement. So to overcome the loss and also to ensure better protection in the future, there are mainly two types of strategies: Coping strategies and Adaptation strategies. The strategies having a short-term vision of response are called coping strategies. It is the method to meet various needs temporarily with existing resources (Wisner et al. 1993). Seeking support from relatives, friends and neighbors is also considered a coping strategy (Akter, Dey, and Hasan 2019). The strategies for a long-

run sustainable solution are called adaptation strategies. It helps to moderate and take advantage of the consequences of hazards.

2.7 SWOT Analysis for Analyzing Suitability

SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis is a well-known strategic management tool. It is known for its simplicity and practicality (Pickton and Wright 1998). It is shown as a 2x2 matrix, mainly listing or categorizing factors. This categorization is done under four headlines Strengths, Weaknesses, Opportunities and Threats. It helps to focus the key issues of any effective process with the help of related factors. SWOT analysis is mainly popular among business researchers. It is also used in strategic planning and formulating policies (GÜREL 2017).

Strengths and Weaknesses are mainly based on the existing condition of management, where Opportunities and Threats are possibilities for future conditions. Strength defines the internal capacity and positive factors, while weakness defines internal factors that hinder purposes (Namugenyi, Nimmagadda, and Reiners 2019). Opportunities are the factors that can favour or facilitate the purposes and threats are just the opposite of opportunities.

Though this analysis is most commonly used for business management analysis, it is also suitable for environmental management analysis (Nikolaou and Evangelinos 2010, Rachid and El Fadel 2013).

2.8 Internal Displacement Destinations

Generally, people in the floodplain are more interested in the blessings of floodplain soil for agriculture (Ruknul Ferdous et al. 2018), despite that situation forcing them to decide their mobility or immobility.

After being landless, the first step is to survive anyhow. People usually go to nearby highways, bridges, marketplaces and school grounds with household materials and try to manage food first. After a few days, they seek permanent resettlement for which a certain amount of land is required. In which area they should go, in which way they will get land and be rehabilitated is the main challenge of internal displacement. Choosing the destination is one of the adaptation techniques the victims took themselves. Economic conditions

influence the decision-making process the most, as the land required for resettlement cannot be found without money commonly (Haug 2008).

2.9 Factors Behind Destination Choice

There are many factors working behind the choice of destination. These factors influence their decisions and determine their way of thinking and standard of living (De Jong 2000). Some factors make them attracted to any place, which are called pull factors. Some factors make them leave their old habitual residence, which are push factors.

As riverbank erosion is a natural hazard that does not have any warning system, it is hard to have prior preparation for it (M. S. Rahman and Gain 2020b). People have to make quick decisions, a common thing these victims practice, as they all faced erosion several times before.

2.10 Ranking of Factors According to Preference

Matrix Ranking is a very effective PRA (Participatory Rural Appraisal) tool to assess the preferences and priorities of any system. Specific criteria of factors are needed for this ranking. Different factors are working behind the decision-making of displacement. Most of them are related to the decision of where to go for rehabilitation. There are two types of factors behind this. Some are push factors that provoke people to leave any place to avoid the inconveniences that exist. Others are pull factors that attract people to move to a new place to achieve more opportunities for a living (Ferro 2006). For identifying the importance of one factor to another, matrix ranking is used. It is a very simple but clear method to discover the reasons behind preferences (Swathi lekshmi et al. 2017).

The decision to displace is mainly a one-person decision where the family head influences others (Stark and Taylor 1991). Though society focuses on push factors more, there are also many strong pull factors which make people interested and sometimes force to displace in the same type of areas. This phenomenon is also known as immobility (Ferro 2006).

2.11 Gender Influence

Sometimes the word gender is used for explaining behavioral differences between men and women, but it actually has a broader explanation and uses in research fields. There are controversies between traditional ideology and modern gender theory (Pryzgoda and Chrisler

2000). Many researches refer that gender is the different roles, socially constructed identities and responsibilities of men and women conducts in historically and socially determined unequal power structures (Llácer et al. 2007, Reeves and Baden 2000, Zwartveen 2008). Such as women in the South Asian continent face a huge burden of domestic work which is determined and common phenomena (Krishnan 2022).

Gender vulnerability is a widespread phenomenon, while it is the question of people's ability to cope with and adapt to different hazards (Ferdous and Mallick 2019). Asymmetrical gender division is the main reason why women are lagging behind. In South Asia, social, economic and political barriers limit the coping capacities of women where cultural norms and scarcity of resources increase their vulnerabilities (Krishnan 2022). Moreover, disasters increase gender inequality making bad situations worse for women (M. S. Rahman 2013). Women are the most vulnerable among all the gender-vulnerable groups (Ferdous and Mallick 2019).

Although riverbank erosion and displacement affect all the family members, such as men, women, aged persons, and kids, the suffering of women goes to the highest due to their extra duties and responsibilities (Goodrich, Mehta, and Bisht 2017). There are certain policies and development strategies for displaced people, but women have less access to these benefits (Thukral 1996). It is mainly because of the existing intra-household inequalities. Women's ability is also restricted because of their responsibilities to their children and their extreme love for their families (M. S. Rahman 2013). There are some social and cultural norms which are also discriminating against women. The effect of displacement on the social security and dignity of women is more severe than that of men (Akter, Dey, and Hasan 2019). It affect the women portion negatively and decrease their status in a new place. Also, women have limitations in decision-making and choices. They cannot choose places based on their preferences most of the time.

After the displacement to a new place, collection of fuel and water is not an easy task. But like any other time, the female members have to do it. Also, in new places, sometimes they do not have a proper sanitation system, making them uncomfortable and more vulnerable to unpleasant situations. Sometimes the male members go to other areas or cities searching for income sources. This time increases the burden on the female members. They have to take

care of the family from every perspective. These unequal workload divisions result in gender vulnerabilities. To indicate the influence of gender and participation in different sectors the participation of different gender groups should be analyzed. Harvard Analytical Framework tools have been used in many previous research works for this purpose (Wiebe 1997, Sita and Herawati 2017).

2.12 Closure of Review

Riverbank erosion and its impact on riverbank dwellers differ from different perspectives. The Char surrounding area's Characteristics, economic condition, education, and availability of other facilities influence the ability to adapt or cope with this hazard. From the review, we can see an absence of analysis focusing on these factors. Also, the preference ranking based on the victims' opinions is not a commonly studied topic regarding erosion-induced displacement. So addressing these gaps is the primary purpose of this study.

Chapter Three

STUDY AREA

3.1 Introduction

The Study area is located in the middle northern part of Bangladesh. The site was selected after observing the severity of flood and erosion through existing literature studies and secondary data. It is the part of Dewanganj under Jamalpur district and situated near the downstream course of the Brahmaputra, which shifted in this location after the catastrophic flood and earthquake in 1787. The average channel width is 11 km (M. H. Sarker, Koudstaal, and Alam 2003). Dewanganj is located between 25°06' and 25°26' north latitudes and between 89°40' and 89°51' east longitudes. The study area is just downstream of Bahadurabad station. The water and sediment discharge of the Brahmaputra river is dominated by the annual Monsoon rainfall (Ashworth et al. 2000), as more than 80% of the river basin's yearly precipitation occurs during this season. Bank materials of the Brahmaputra River consist of loosely packed silt and fine sand with less than 1% clay, so they are highly susceptible to erosion. The bank erosion rate is as high as 1 km per year (Klaassen, Mosselman, and Brühl 1993). The loss of agricultural land and homestead area due to riverbank erosion is very high. Due to this, the area and its people suffer a lot every year. This area is also prone to riverine monsoon floods. The socio-economic condition thus is destroyed due to repeated natural hazards.

3.2 Physical Setting

Brahmaputra river originates from the southern slope of the Himalayas and runs over three countries named China, India, and Bangladesh, with a length of approximately 2900 km. The lower part of this river is situated in Bangladesh. The average channel width is 11 km (M. H. Sarker, Koudstaal, and Alam 2003). The water and sediment discharge of the Brahmaputra river is dominated by the annual Monsoon (Ashworth et al. 2000). Bank materials of the Brahmaputra river consist of loosely packed silt and fine sand with less than 1% clay. So they are highly susceptible to erosion (Gerrit Klaassen 2013). The bank erosion rate is as high as 1 km per year (Klaassen, Mosselman, and Brühl 1993). The erosion-accretion process of the Brahmaputra River develops several small and large sand bars known as chars". Chars that

are connected to the Mainland are known as "Attached Chars," whereas the chars without any connection to their surrounding area are known as "Island Chars". These are actually low-lying areas at the floodplain of the Brahmaputra River.

The location map of the study area is presented in the figure below.

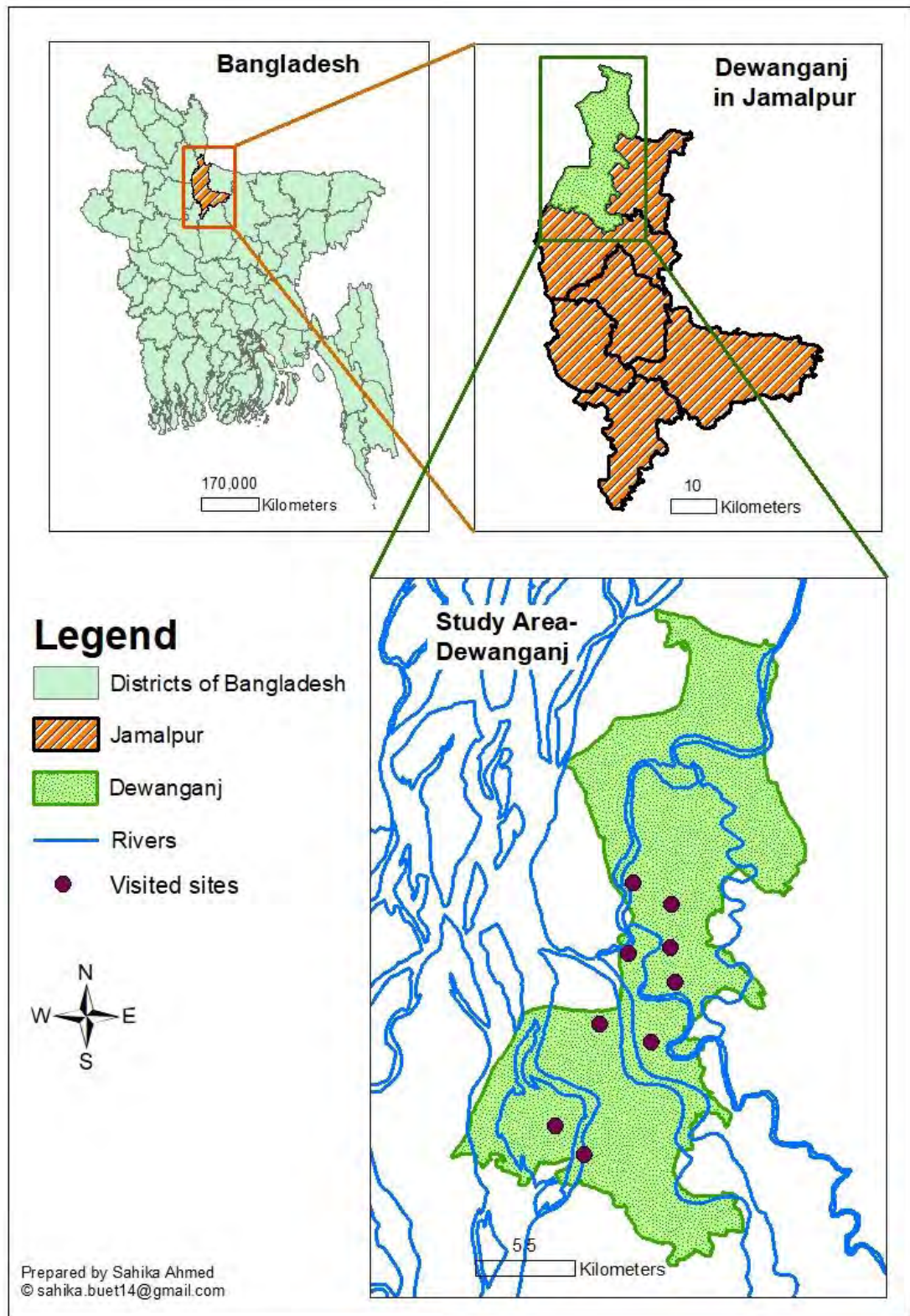


Figure 1: Map of the study area

3.3 Climate

The mean monthly temperature varies from 12° Celsius in January to 35.8° Celsius in July. The average annual temperature is 31° Celsius. The humidity in this area is high and is the highest in the Monsoon period from June to October. The duration of the wet season in Dewanganj is from April to October and the minimum daily precipitation during this time is 12.7mm. There is about 1193mm of rainfall in a year. The average humidity is 66% and the UV index is 7 (Weather Atlas).

3.4 Demography

The total population of Dewanganj Upazila in 2011 was 258133 of which 1,26,623 were male and 131510 were female. The total area of Dewanganj is 267.51 sq. km. According to the BBS report of 2011, the population density was 965 per sq. km. The economic status of the inhabitants varies from place to place. In the town area, people from the middle class to the higher middle class are living. However, in the areas nearer to the river, the lower middle class lives in, the poorer section of society. The literacy rate of Dewanganj was 32.5% (BBS 2014).

3.5 Erosion Condition

The erosion that occurred from 2016 to 2019 has nearly destroyed a whole union with government buildings, pakka houses, schools, mosques, and concrete roads. Ten years ago Harindhara embankment was eroded, and since then, this area does not have any concreted embankment. People here also suffered a record flood before this. On the Mainland, they can go to the school buildings during the flood, but in Char lands, there are no flood shelters like these. Also, in Mainland areas, the schools are not properly managed to use as a shelter.

3.6 Infrastructures

Riverbanks are protected by geo bags dumped by Bangladesh Water Development Board (BWDB). Some official buildings like 'Nouproshason Bhaban', Thana, UNO (Upazila Nirbahi Officer) office etc., are located in this area. There are also three school buildings, which are used as flood shelters too. There is also a college and a madrasa building. Though this area is not industrially developed, there is a sugar mill named Zeal-Bangla Sugar Mill, which is the income source for many people in this area. The Local Government Engineering

Department (LGED) constructed local roads at study area, where most roads in Attached Char areas have already been eroded.

3.7 Livelihood

People here are mainly involved in agricultural work. Mainly they cultivate others' land by sharecropping. Some of them earn by van and rickshaw pulling. Very few people have the opportunity of a Government job. There are some seasonal works for the sugar industry. Women are mostly earned by animal husbandry. They got the opportunity to work in the field during harvesting only. Very few are engaged in government offices and private sectors as garments.

3.8 Agriculture

As the soil of this area remains under river water for a specific time every year, this is enriched with different nutrients. That is why cultivation is the best choice here. Paddy, wheat, jute and sugarcane are mainly cultivated here. Besides, mustard, chili, peanut, and different types of vegetables are also produced here.

3.9 Housing Pattern

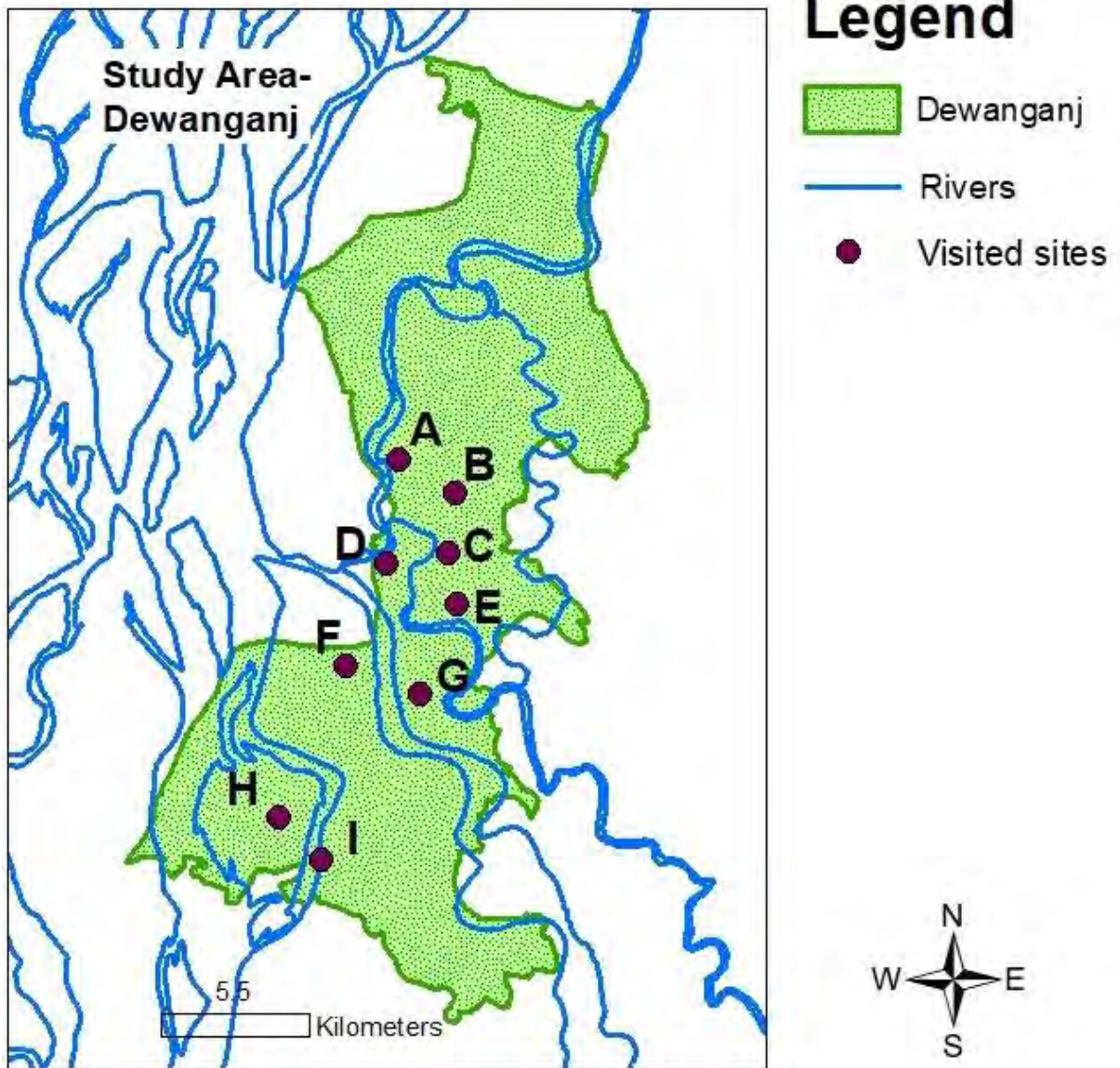
In the Chars and GOVT Lands, the houses are made of straws, bamboo, mud and tin. These are kacha houses that are temporarily made as they have to shift frequently. In the Gucchogram, GOVT provided semi-pacca houses to the inhabitants made of concrete, wood and tin. On the Mainland, the houses are pacca and made of concrete.

3.10 Land Types

The study area comprises of five low-lying lands: Island Char, Attached Char, GOVT Land, Gucchogram, and Mainland. Sites under these five categories were visited. These areas are given below.

Table 2: Visited areas of all selected categories

Selected Category	Areas
Island Char	Tiner Char
Attached Char	Kholabari, Charmaguri hat
GOVT Land	Chulkani bil railline para, Gujimari railline
Gucchogram	Adorsho gram, Gujimari Gucchogram
Mainland	Bazaripara, Badeshshariabari



Prepared by Sahika Ahmed
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Figure 2: Visited sites in location map (A. Chulkani bil railline para; B. Gujimari railline; C. Gujimari Gucchogram; D. Kholabari; E. Badeshshariabari; F. Charmaguri hat; G. Bazaripara; H. Adorsho gram; I. Tiner Char)

3.10.1 Island Char

Island Chars or bars are situated in the river without a physical connection to the Mainland. The income sources here are crop cultivation and animal husbandry. People here face very poor basic facilities like health services and education. These Chars are the most unstable place to live. However, soil fertility is the most useful thing in this area. The only transportation within Char is horse-drawn carriages. They use boats to communicate with the Mainland.

3.10.2 Attached Char

These types of Chars or bars are situated on the bank of a river. These areas are very prone to erosion. The fertility is not as well as Island Chars. As this area is connected to the Mainland, people living here are getting most of the facilities people get on the Mainland. The income sources of these people are crop cultivation, day labour, rickshaw pulling, and official jobs. Most people here are the owner of lands eroded in the river.

3.10.3 GOVT Land

There are mainly lands under the government's control. People are living here illegally, possessing the land and building houses. That's why they are always afraid of eviction. These are mainly elevated lands previously used as road or rail lines. For this, these areas are the lowest prone to erosion or floods. The income sources are mainly sharecropping, fishing, day labour and tailoring. Education and health services are comparatively available here. People living here are the worst victims of erosion and cannot pay for living land anywhere.

3.10.4 Gucchogram

The government of Bangladesh gives these lands with housing, sanitation and drinking water facilities. One of the Gucchograms is situated on the Island Char and another on the Mainland. The primary income sources of these people are sharecropping and day labour. Education and health services are comparatively available here. These are pretty stable places and people living here got the ownership of their lands. These people were basically landless, which is why they got this land from the government.

3.10.5 Mainland

All of the offices, academic buildings and industries are situated here. This area is free from erosion but prone to flood and waterlogging. The living and financial condition is far better

here and all the facilities are available. The income sources are auto driving, business and official jobs.

Chapter Four

METHODOLOGY

4.1 Conceptual Framework

Riverbank erosion is one of the most disastrous natural calamities expected in a braided river like Brahmaputra. It takes everything away from the victims and permanently displaces them. So, it is necessary to analyze how the erosion victims are being rehabilitated and how they overcome its impacts. In this study, erosion accretion is calculated for the reach of the Brahmaputra near Dewanganj. The survival strategies are also assessed. Moreover, the destination choices are ranked, and gender perspectives in choosing destinations are analyzed.

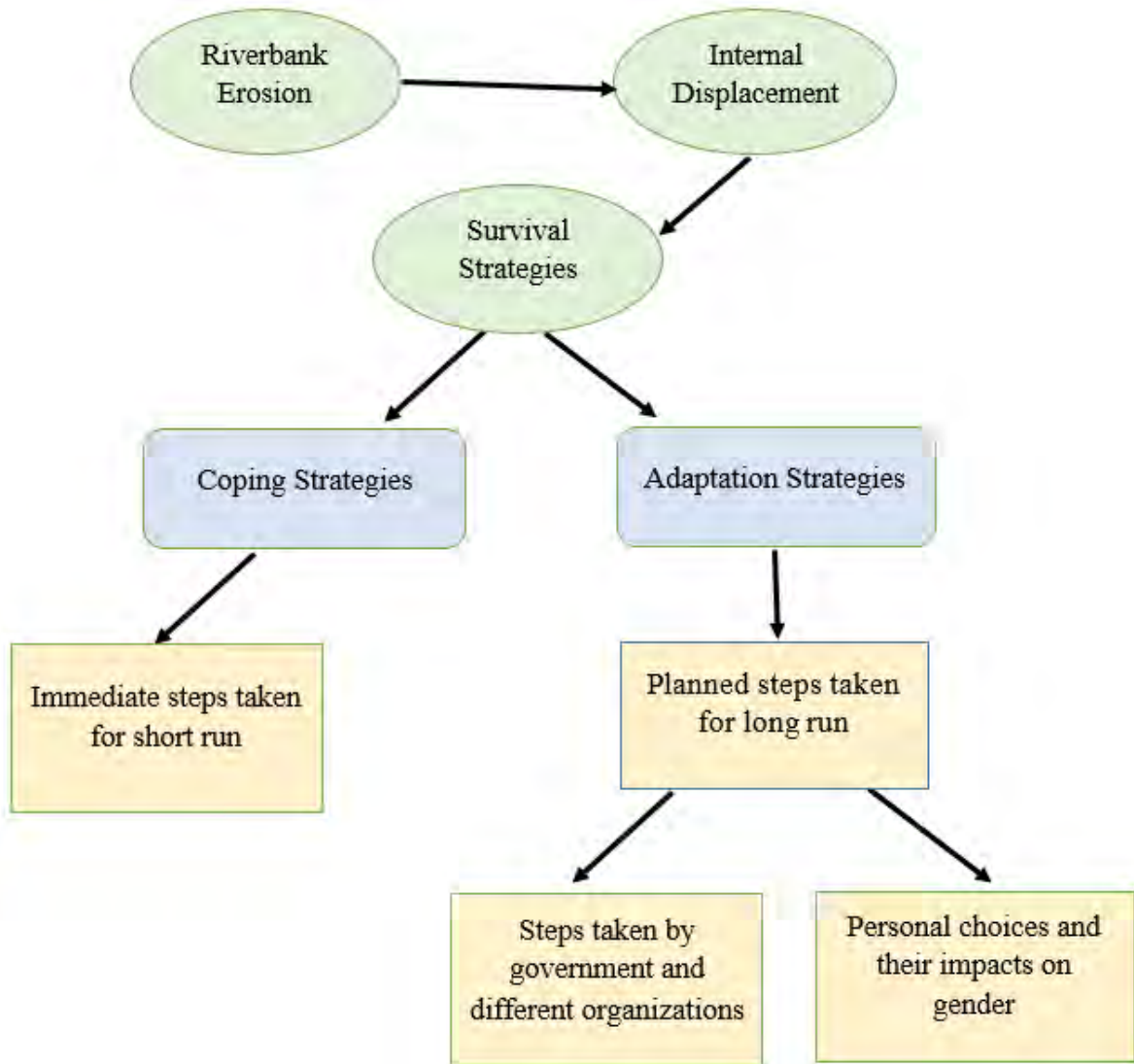


Figure 3: Conceptual framework of the study

Every year, due to riverbank erosion, a significant number of people lose their lands. Many of these people do not usually migrate to any distant place from their origin. They prefer internal displacement as it keeps them near their places of origin. After displacement, they follow survival strategies to cope in the new place. Also, some adaptation strategies make them more adaptive to this natural hazard.

According to land types, the area was classified into five zones. These different zones require different types of coping and adaptation strategies. Also, these zones' economic and social status plays a significant role on the living conditions. To differentiate these SWOT analyses of these strategies are done differently for the five zones.

Most of the time, male family members make strategies and decisions as the society is patriarchal. Sometimes, these create difficult situations for female members. Mainly in the case of choosing the destination for displacement, many factors are not gender-friendly. All of these factors were ranked according to their importance. Therefore, this study included the gender influence on destination choices, erosion patterns, and survival strategies after internal displacements.

4.2 Research Design

The qualitative data sets and analysis take up more space in this research than their quantitative counterparts. The qualitative method appeared to be the most appropriate and suitable option for this research. The data collection methodology was based on field surveys, excluding the required data for erosion accretion calculation. Generally, the study was conducted in three phases. First, the erosion accretion situation of the study area was analyzed by calculating the total eroded and accreted land using satellite images and ArcMap. Second, the survival strategies were assessed and the suitability was analyzed with the SWOT analysis. Finally, the destination-choosing factors were identified and ranked based on importance. Gender influence was also identified at this stage. These phases are described below.

The overall methodology of this study is represented through a schematic diagram shown in Figure 4.

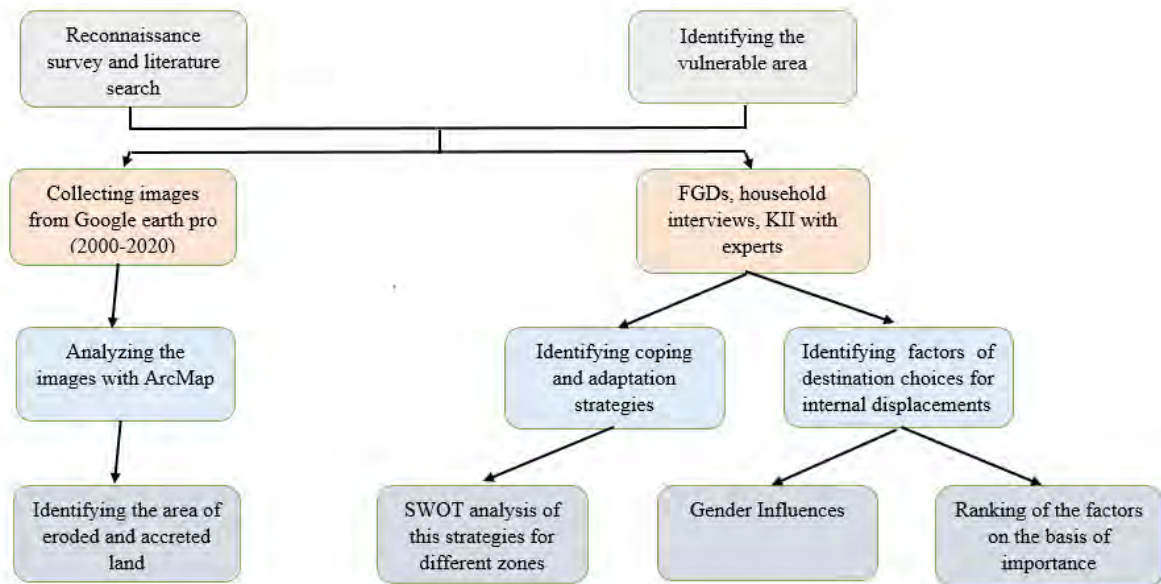


Figure 4: Schematic diagram of the methodology

4.3 Reconnaissance Survey

A reconnaissance survey is helpful to get preliminary ideas, issues, and challenges about a study. Direct observation and understanding are needed to clarify the whole situation to the researcher. It helps to set an outline of the overall purpose of the study.

In this study, the reconnaissance survey was done by visiting several erosion-prone areas of Dewanganj. Systematic literature reviews (i.e., relevant articles, research papers and newspapers) were carried out before the field trip. The site was preliminary selected based on its severity caused by recent floods and riverbank erosion. During the first field visit, we met and consulted with several knowledgeable persons to understand the overall condition of the area. Also, visiting different zones and talking with the inhabitants greatly helped this purpose.

4.4 Data Collection

The data collection process consists of two aspects: social and technical. Both primary and secondary data were required for social and technical analysis.

4.4.1 Primary data collection

Most of the information was collected from the field surveys. A total of 51 Household surveys, 33 FGDs (Focused Group Discussions) and 9 KIIs (Key Informant Interviews) were conducted. The KIIs were with the UNOs (Upazila Nirbahi Officer), TNO (Thana Nirbahi Officer), Chairman, Members and other government and non-government officials. We applied Participatory Rural Appraisal (PRA) methods to gather field information. Direct observations are another important primary data source for this study.

4.4.2 Secondary data collection

For the purpose of erosion analysis, Google Earth Pro and ArcMap software were used. The Landsat 7 satellite images were taken from Google Earth Pro for the years 2000, 2003, 2006, 2009, 2012, 2015, 2018 and 2020. These images were taken during the winter season of these selected years as this prevents unnecessary substances in the environment and helps to get a clear view. Google earth pro also provides Landsat 8, Landsat 5 and Landsat 3 images. But Landsat 8 images are only available from the year 2008. Landsat 7 images are available from the year of 1997. To maintain the similar quality of the image analysis, here only Landsat 7 images were used. Also, the images were analyzed from 2000 as the main focus of this part was to show the severity of erosion and land type change (such as attached char to island char) for which images from the year 2000 are analyzed here.

4.5 Analysis of Erosion-Accretion

For the first objective, earth observation data, i.e., satellite images (Landsat 7 data) for the years 2000-2020, were analyzed to quantify the land loss and gain. The amount of eroded and accreted land was calculated by analyzing the shifting nature of the river bank.

Satellite images were taken from Google Earth Pro and then projected on ArcMap using the WGS 1984 UTM Zone 45N coordination system. Images of two consecutive years were projected, and the riverbank line along with the Island Char borders was used as the main calculating objects. The bank lines were drawn and after exporting these lines, they were superimposed and created areas by intersecting each other. Thus the polygons were created using polygon features, and the areas created on both sides of these lines indicated the eroded and accreted lands. Eroded and accreted lands were then classified in the attribute table by name. Then the measurements were taken in square kilometers for each section of areas and

after calculating all the areas of same type, the eroded, accreted and unchanged land areas wereshown as maps and graphs.

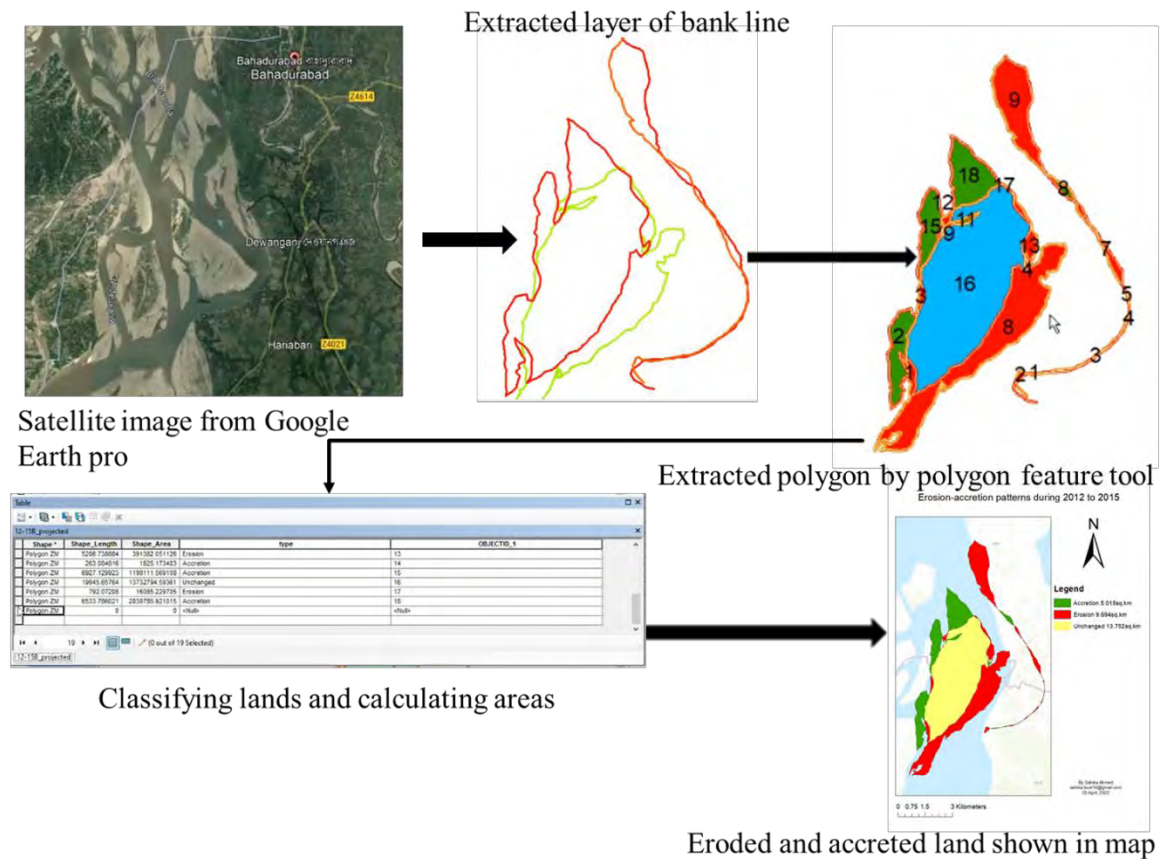


Figure 5: Different stages of the erosion-accretion analysis process

4.6 Analysis of Survival Strategies

The survival strategies are mainly classified as coping strategies and adaptation strategies. These strategies were analyzed with the combined use of qualitative and quantitative methods. At first, the present conditions of these five zones were identified to assess the different strategies for different zones. The living condition is mainly used as an indicator of the requirements one needs to rehabilitate or displace to a new zone. Also, the losses of the erosion victims were observed.

4.7 Statistical Population, Sample Size, and PRA Tools

The statistical population included all the inhabitants of the study area who faced riverbank erosion in their lifetime. The simple Random sampling method of probability sampling (Hameed 2016) was used to select representative samples. Because every singular person in

the population has an equal chance of being included in the sample (Ghauri, Grønhaug, and Strange 2020). Most of the desired data were collected at the individual level based on the opinions of all household members. The selected samples were well distributed across the zone and large enough to cover the entire location spatially. All field surveys were conducted from 18th September 2019 to 4th December 2021. A total of 51 household surveys, 33 FGDs and 9 KIIs were conducted for this study. From the 33 FGDs, 20 FGDs were done with female participants and 13 FGDs were done with male participants. FGD is a qualitative method where researchers interactively question a homogenous group of participants. During these FGDs, the preference ranking tool was also used to rank the factors influencing destination choices.

4.8 SWOT Analysis

Analysis of SWOT is an effective technique for identifying issues or current situations, if it is suitable or not (GÜREL 2017). Strengths in a SWOT analysis are existing positive capabilities and characteristics that lead to sustenance (Solangi et al. 2019). Weaknesses are the Characteristics that prevent the issues of conditions from reaching their optimal level and need to be improved to continue the process. Additionally, opportunities refer to favorable external factors or advantages, and threats refer to the factors that can harm or reverse sustainability (Shakerian, Dehnavi, and Ghanad 2016). Overall, the SWOT analysis is useful for identifying strategic positions in making decisions (Bouraima et al. 2020). Various studies have used SWOT tools to identify and rank livelihood sustainability strategies around the world (GÜREL 2017, Ghazinoory, Abdi, and Azadegan-Mehr 2011).

In this study, all of the survival strategies were identified from the primary data analysis. These strategies were analyzed from a qualitative perspective. Again, the results of primary data analysis were assessed by the SWOT. The SWOT analysis was done differently for all five zones, as the strategies are not the same for all the zones.

4.9 Ranking of Factors Behind Destination Choice

Several factors work to make people willing to displace or avoid it. The factors forcing people to leave any place are push factors and the factors of a place attracting people to move there are pull factors. These factors work differently for different zones. Also, these factors have

different values of importance for any specific zone. A ranking of the factors identifies these differences. Also, in the decision-making process, gender is not considered all the time.

4.10 Matrix Ranking

Matrix ranking is also an important PRA tool to assess and study the preferences of people on any particular issue. On the field visits, semi-structured interviews were conducted to ease the interaction with the inhabitants and to get the information without making any bias. Then the factors working behind their choice of destination were identified. A total of 14 factors were there and classified as push and pull factors. After categorizing the factors as push and pull factors for the five different zones, another semi-structured interview was conducted for a direct matrix ranking of the factors according to their preferences. Separate matrix rankings were made differently for the five zones' push and pull factors. Scoring was done for the ranks so that the first rank for a factor got the highest score and the last rank got the lowest score.

4.11 Gender Influence on Destination Choice

The inequalities in gender roles are very common while choosing the destination place. This results from patriarchal practices existing in society for a long time. There are some problems and inconveniences faced mainly by female inhabitants of these areas. From the Open Questionnaire interview and FGDs, some of these were identified. These findings were shown for the five different zones. Harvard Analytical Framework has been used to represent gender participation in different sectors and thus to assume gender influence in destination choices

4.12 Harvard Analytical Framework

Harvard institute for international development published the Harvard Analytical Framework (HAF) in 1986 as one of the first gender analysis frameworks (March, Smyth, and Mukhopadhyay 1999). There are four types of tools in this framework. In this study, the first and second tool, activity profile and access and control profile have been used. To analyze the activity profile, the activities are classified as productive, reproductive and community management activities according to the collected field data. For the access and control profile, resources and benefits were analyzed. Productive works are the type of works that have a monetary value. Reproductive works are the opposites where community management

activities represent participation at community levels. The access and control profile indicates who has access to resources, and who has more control over these resources and benefits. As the participation is not the same for all five zones, the collected data were presented as the percentage between men and women.

Chapter Five

RESULTS AND DISCUSSIONS

5.1 Introduction

This chapter includes the results and discussions relating to the riverbank erosion of the Brahmaputra river near Dewanganj, the suitability of survival strategies, determinants of destination choices, and gender considerations. It contains the presentation of erosion-accretion analysis with the help of GIS and SWOT analysis of different strategies of the erosion victims. It also discusses the ranking determinant factors for choosing the destination and participation in destination choice from gender perspectives.

The five different categories of study area discussed previously are Island Chars, Attached Chars, GOVT Land, Gucchograms and Mainland. This categorization is mainly based on the difference in livelihood standards and the impact of hazards. 50 Household surveys and 27 FGDs were conducted in these areas. Names and categories of these areas and data collection information is given in Table no 3

Table 3: Primary data collection information

Category	Name of the Area	Number of HH Surveys	Number of FGDs (Age group 25-45)
Island Char	Tiner Char	10	2 Female, 2 Male
Attached Char	Chikajani, Kholabari, 1 no ward	5	2 Female, 1 Male
	Charmaguri Hat	8	2 Female, 2 Male
GOVT Land	Chulkani bil, railline para	3	3 Female, 1 Male
	Gujimari Railline, 5 no union	3	2 Female, 2 Male
Gucchogram	Adorsho gram	5	3 Female, 2 Male
	Gujimari Gucchogram	6	2 Female, 1 Male
Mainland	Bajaripara	5	2 Female, 1 Male
	Badeshshariabari	6	2 Female, 1 Male

5.2 Erosion-Accretion Patterns in the Study Area

The people of Dewanganj face riverbank erosion almost every year. This kind of natural hazard forces people to move or get displaced from their living places. The loss due to riverbank erosion is not easy to recover. Many government infrastructures have already been eroded in Dewanganj in recent years. Local inhabitants demand concreted embankment though it is not a permanent solution to the riverbank erosion problem. Many inhabitants shared the incident about the Harindhara embankment, which was eroded ten years ago. Since then, this area does not have any concrete embankment (Figure 6). That's why people here have been suffering more severe erosion in recent years as the right bank is highly protected downstream.

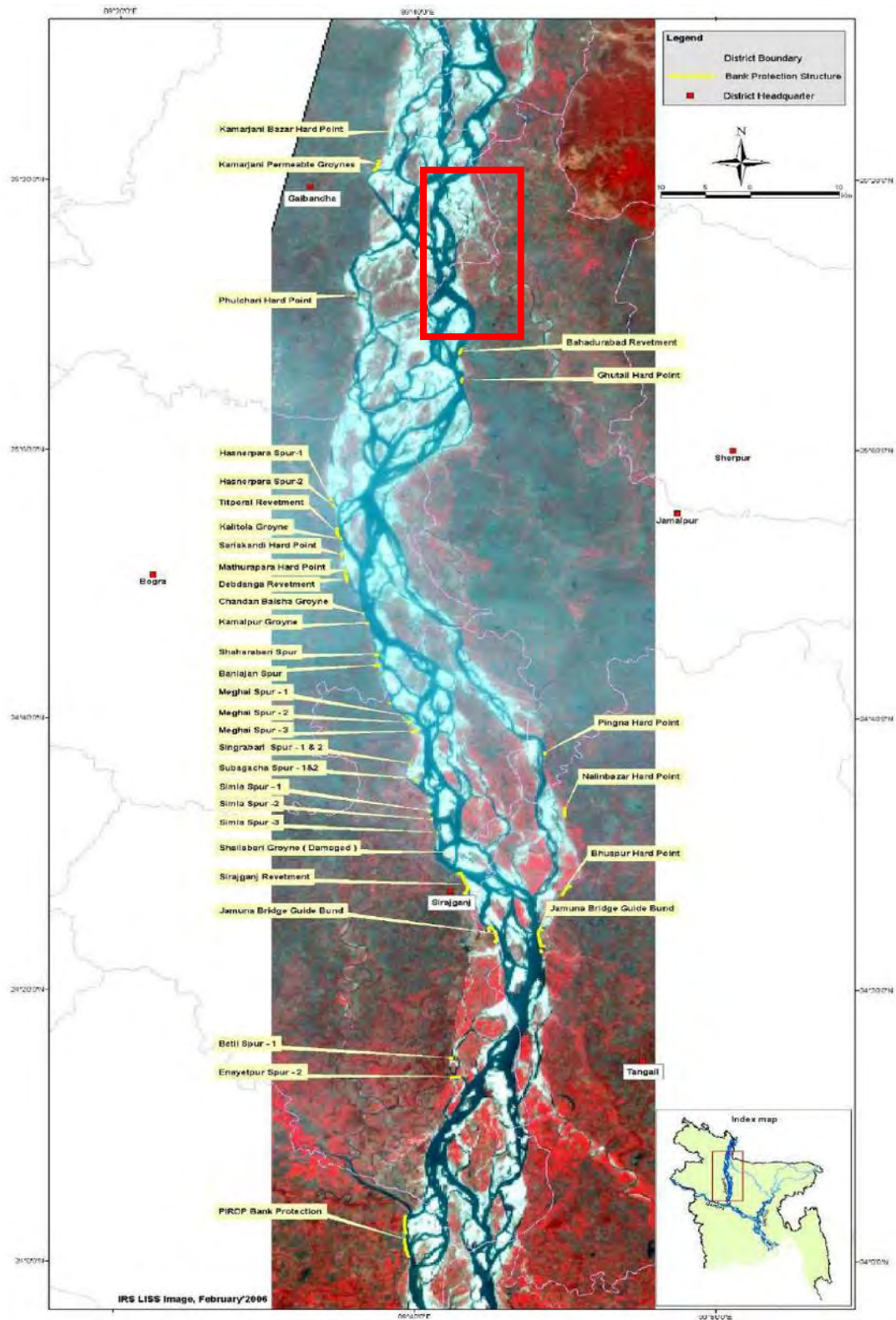


Figure 6: Bank protection along the Brahmaputra river (Source: IRS LISS image) study area in the red marked rectangle

The extent of river bank erosion has been shown here at three years intervals from 2000 to 2020. Satellite images from Google earth pro were collected in 2000, 2003, 2006, 2009, 2012, 2015, 2018 and 2020. This has shown the severity of erosion in this area. Another significant phenomenon here is the accretion of land. These new lands also work as one of the primary resources for rehabilitation. So the accretion and unchanged land in the Char area has also been calculated.

The following maps show the eroded, accreted, and unchanged area in square kilometers. The upper point of this calculated area is the Bahadurabad station and the lower point is the initial point of Sasaribari. The precision of these calculated areas is .001 square kilometers.

5.2.1 Erosion Accretion Patterns from 2000 to 2003

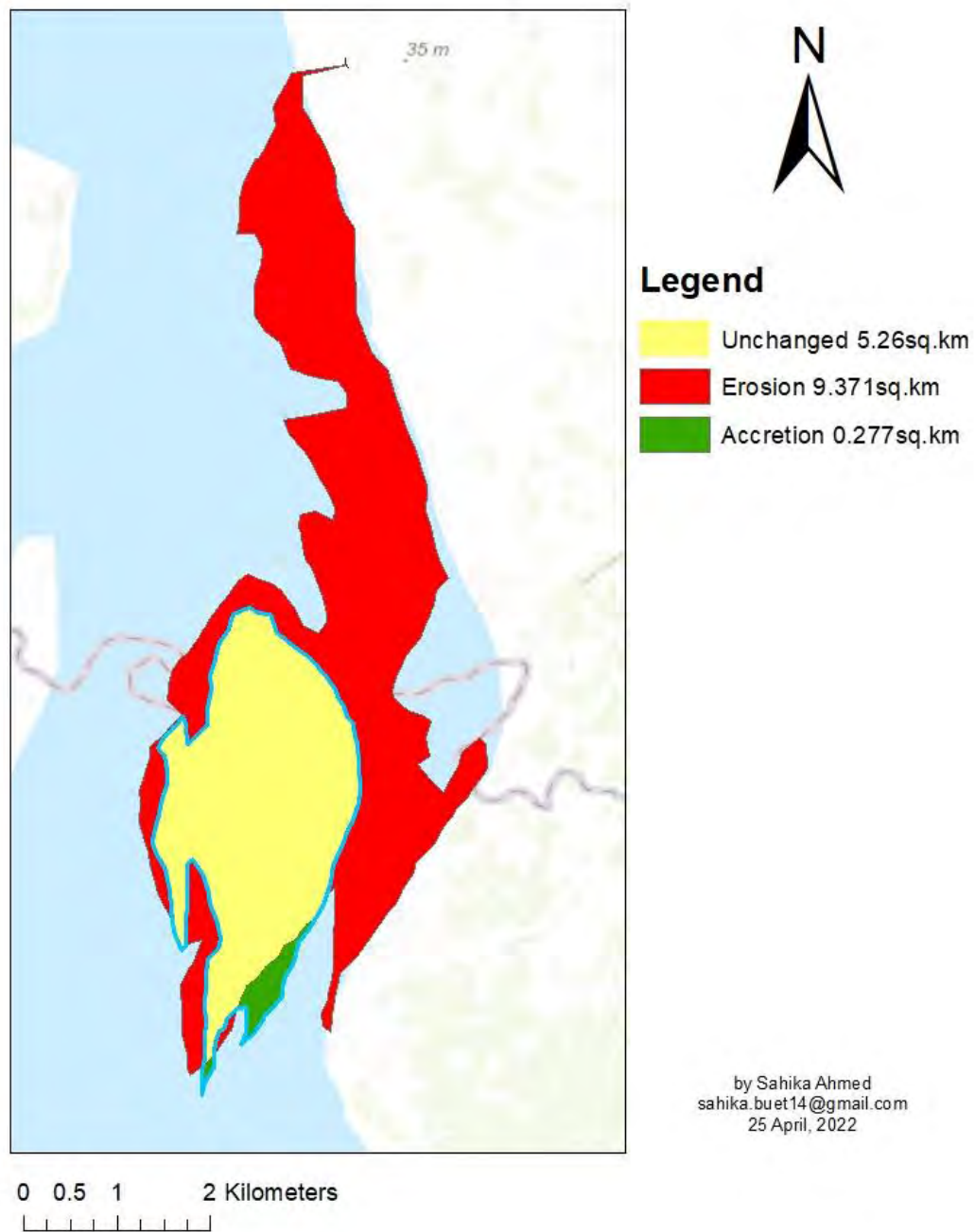


Figure 7: Erosion-Accretion patterns from 2000 to 2003

Figure 7 shows the transformation of an Attached Char into Island Char. The amount of accretion is very low in these three years while the amount of erosion is relatively very high.

5.2.2 Erosion Accretion Patterns from 2003 to 2006

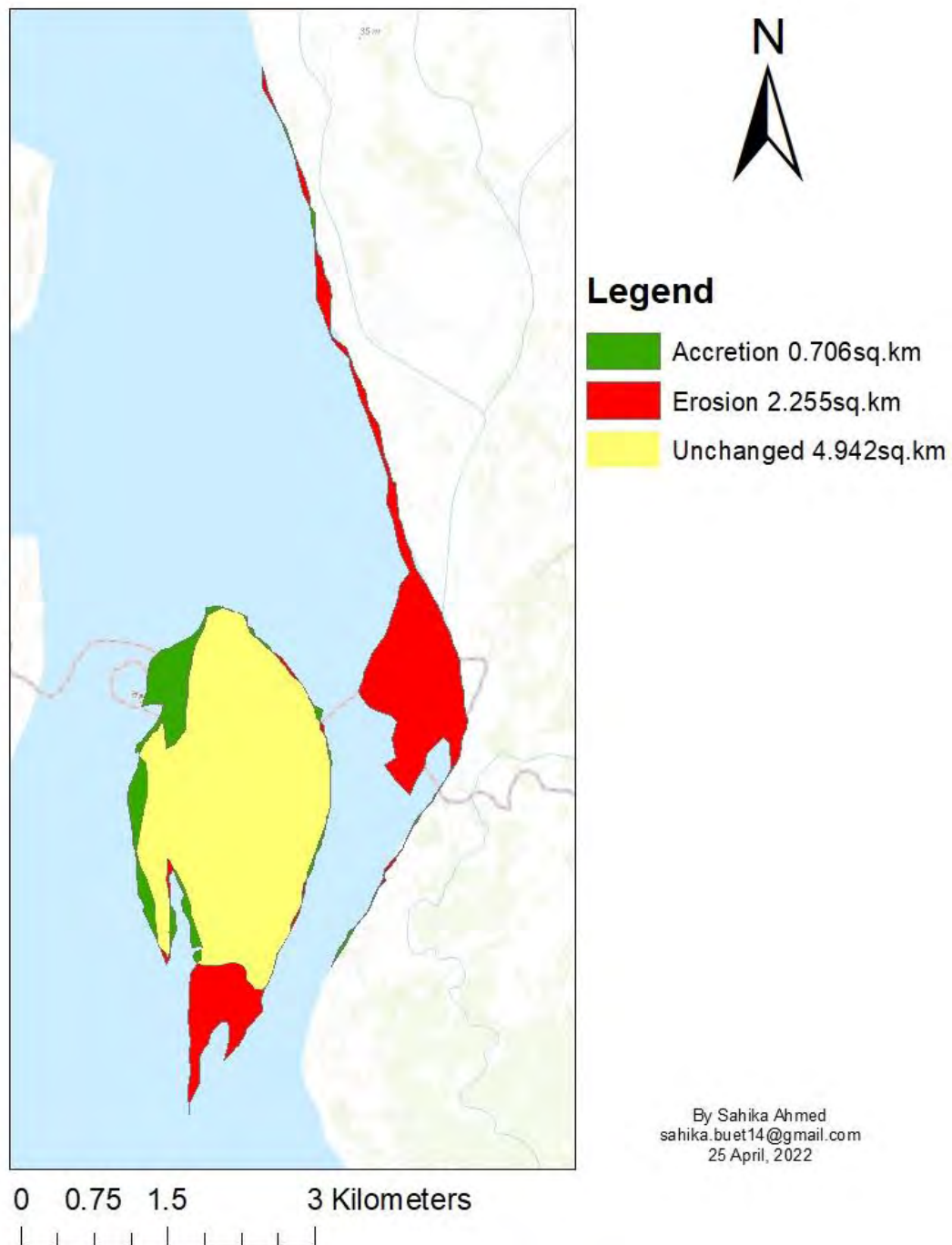


Figure 8: Erosion-Accretion patterns from 2003 to 2006

Figure 8 shows that the erosion rate is relatively low than in the previous 3 years. The Attached Char faced more erosion than the Island Char in these 3 years.

5.2.3 Erosion Accretion Patterns from 2006 to 2009

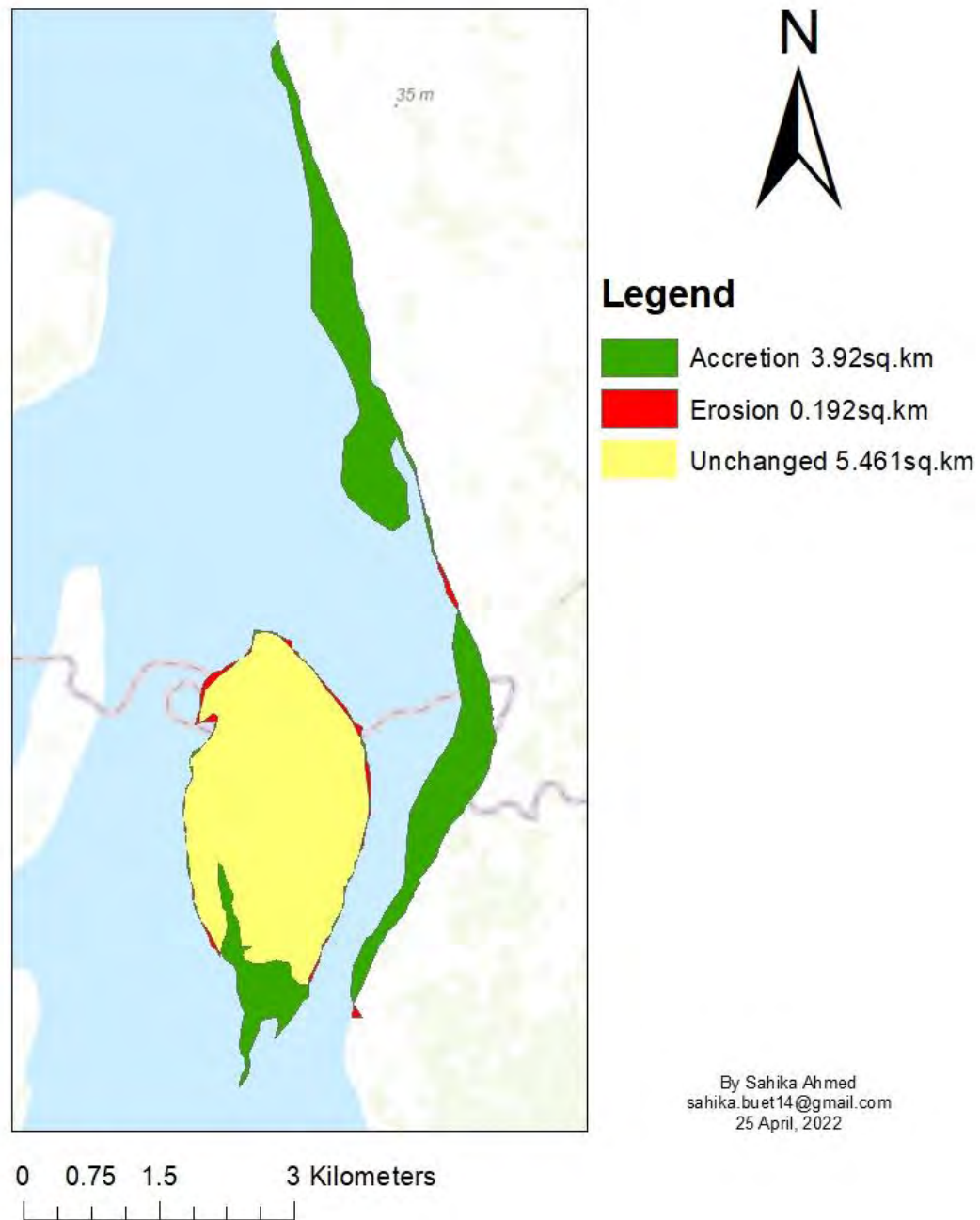


Figure 9: Erosion-Accretion patterns from 2006 to 2009

From figure 9, it is obvious that the amount of erosion is negligible to the amount of accretion in these three years. Both Attached Char and Island Char faced accretion in these years.

5.2.4 Erosion Accretion Patterns from 2009 to 2012

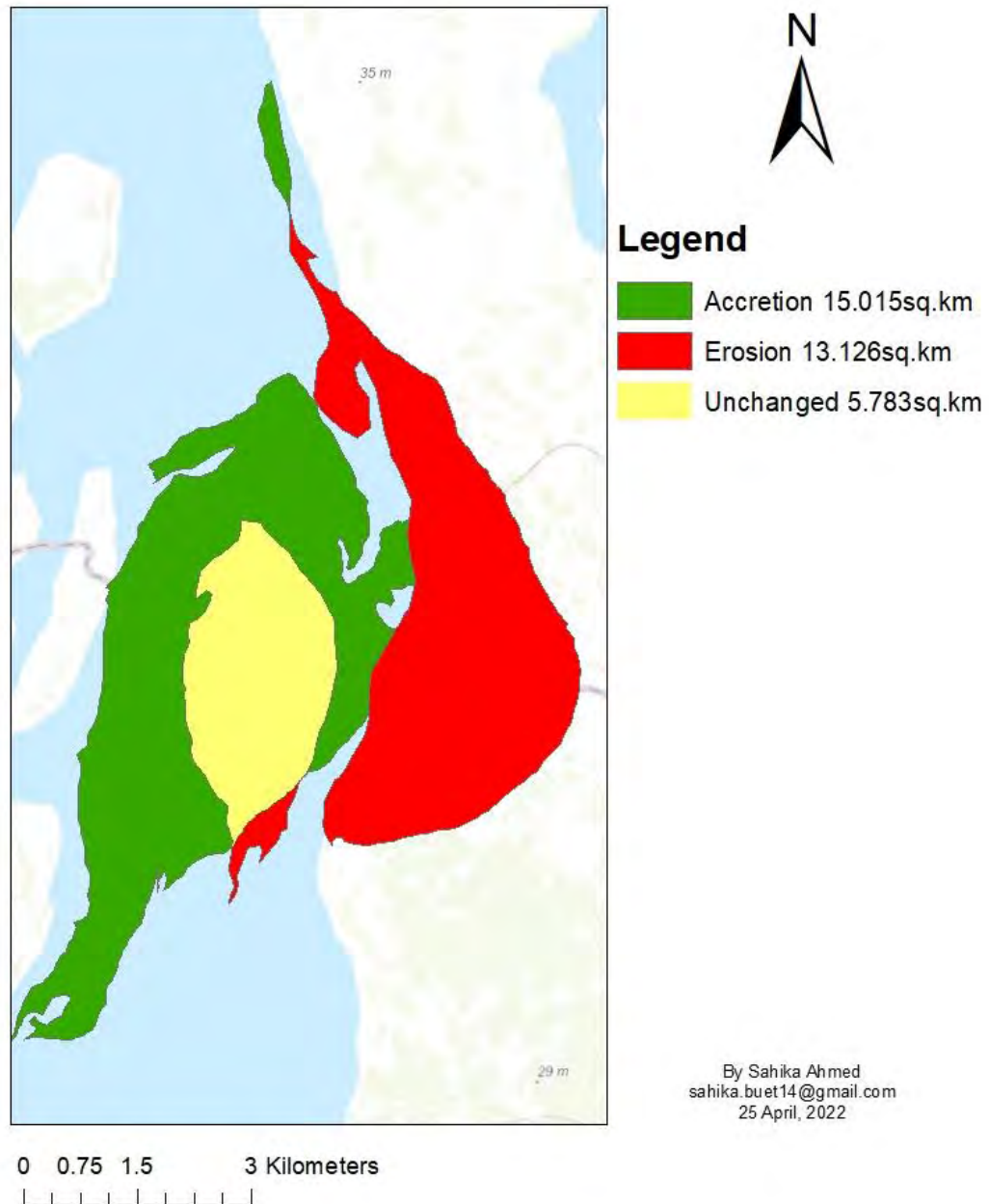


Figure 10: Erosion-Accretion patterns from 2009 to 2012

From figure 10, erosion and accretion seem very high in the years from 2009 to 2012. The Attached Char faced a massive erosion, while the Island Char faced a huge accretion.

5.2.5 Erosion Accretion Patterns from 2012 to 2015

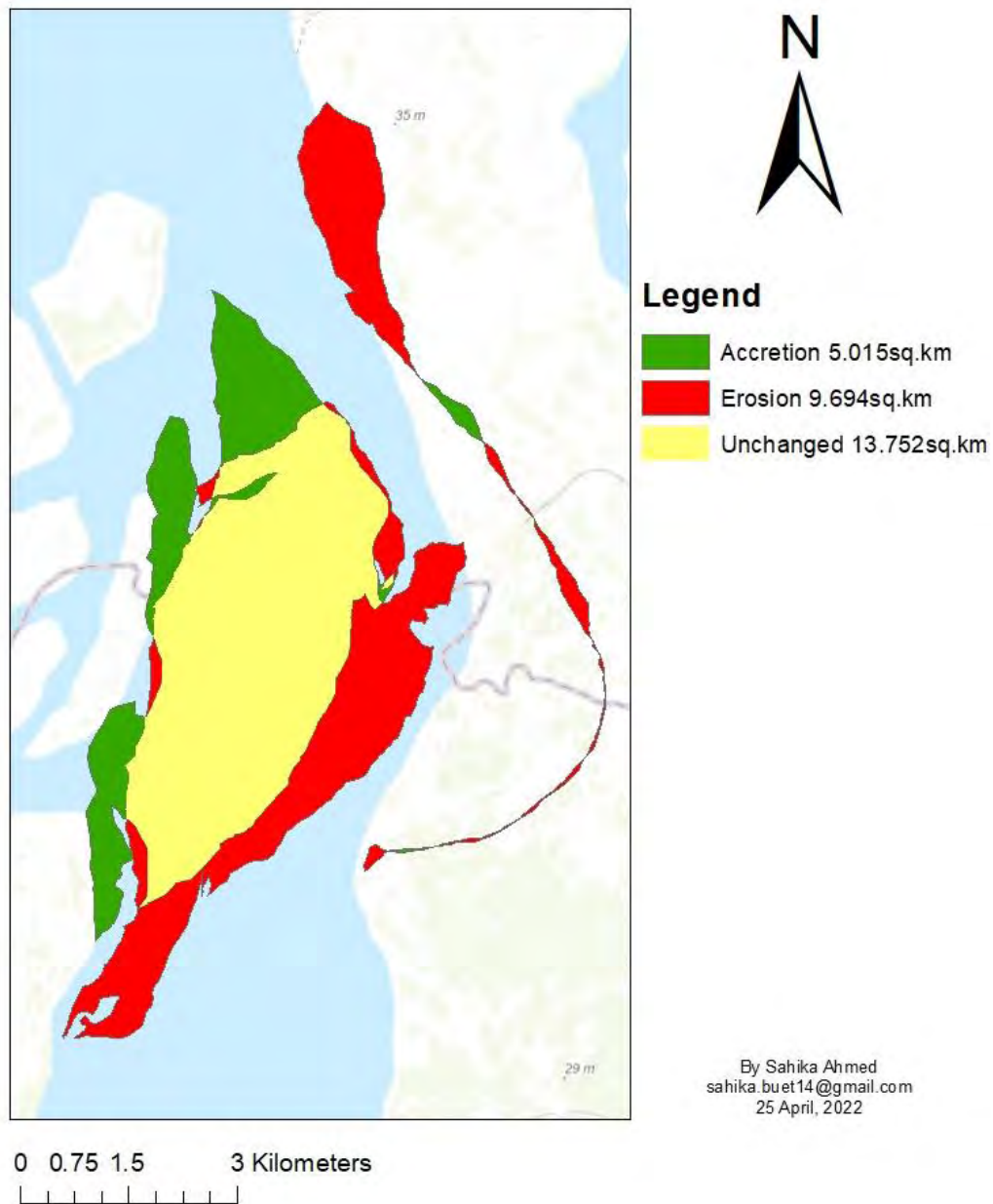


Figure 11: Erosion-Accretion patterns from 2012 to 2015

From 2012 to 2015, one side of the Island Char faced erosion while the other side faced accretion. The Attached Chars, situated on the northern side of the study area, faced erosion, while other parts of the Attached area were unchanged.

5.2.6 Erosion Accretion Patterns from 2015 to 2018

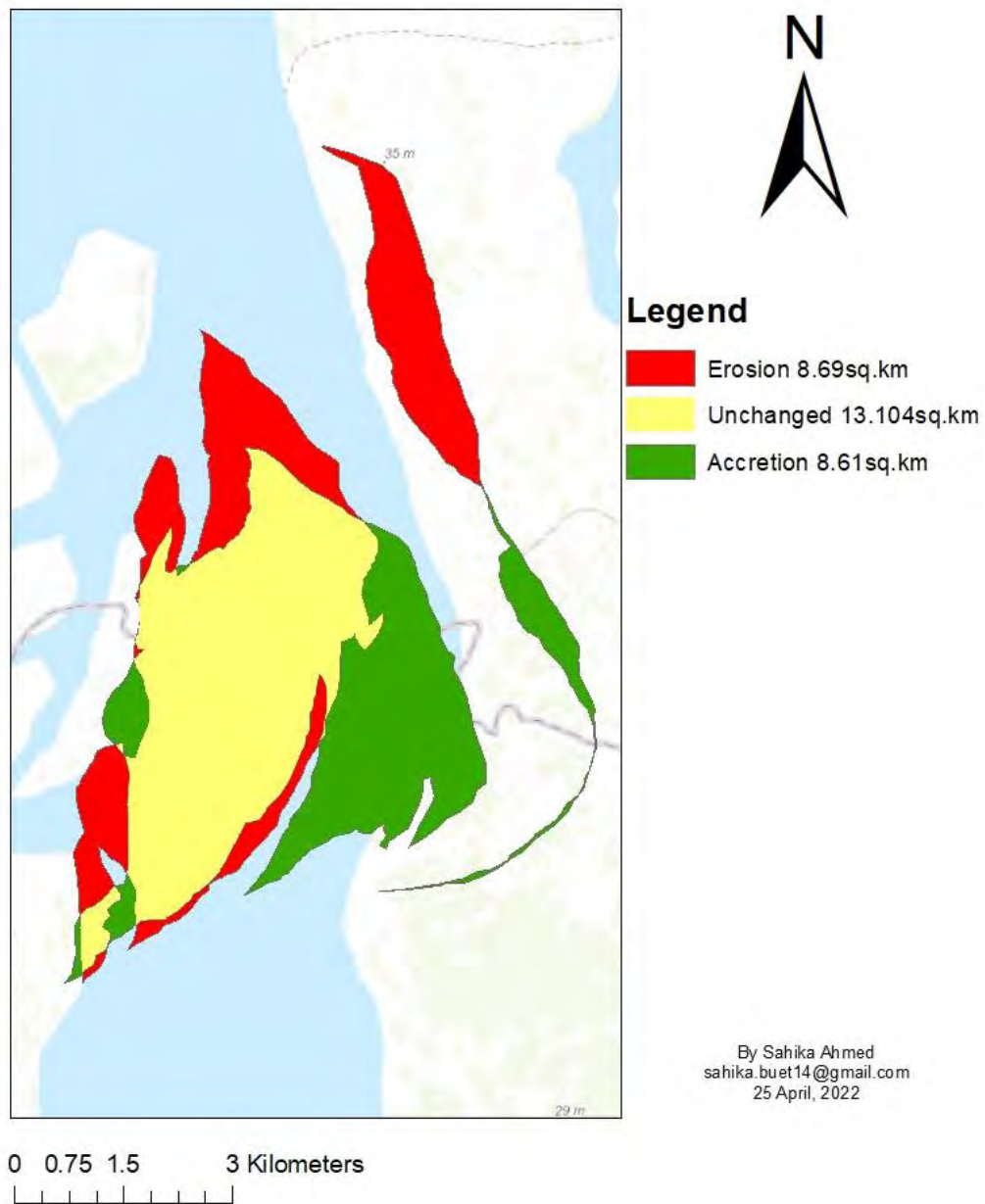


Figure 12: Erosion-Accretion patterns from 2015 to 2018

From 2015 to 2018, both Island Chars and Attached Chars faced erosion as well as accretion.

5.2.7 Erosion Accretion Patterns from 2018 to 2020

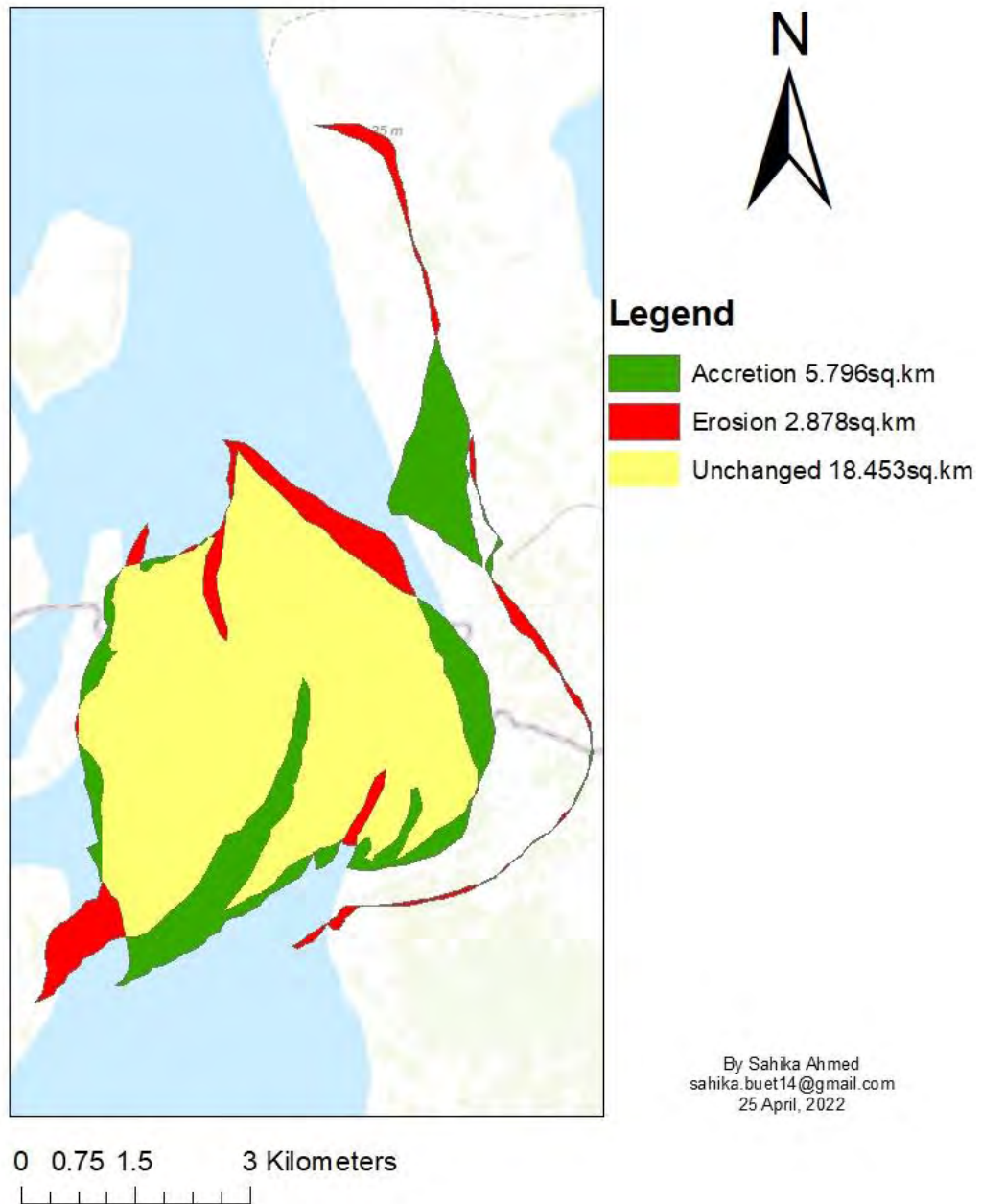


Figure 13: Erosion-Accretion patterns from 2018 to 2020

In these two years, both Island Char and Attached Chars faced a negligible amount of erosion and accretion.

5.2.8 Erosion Accretion Patterns from 2000 to 2020

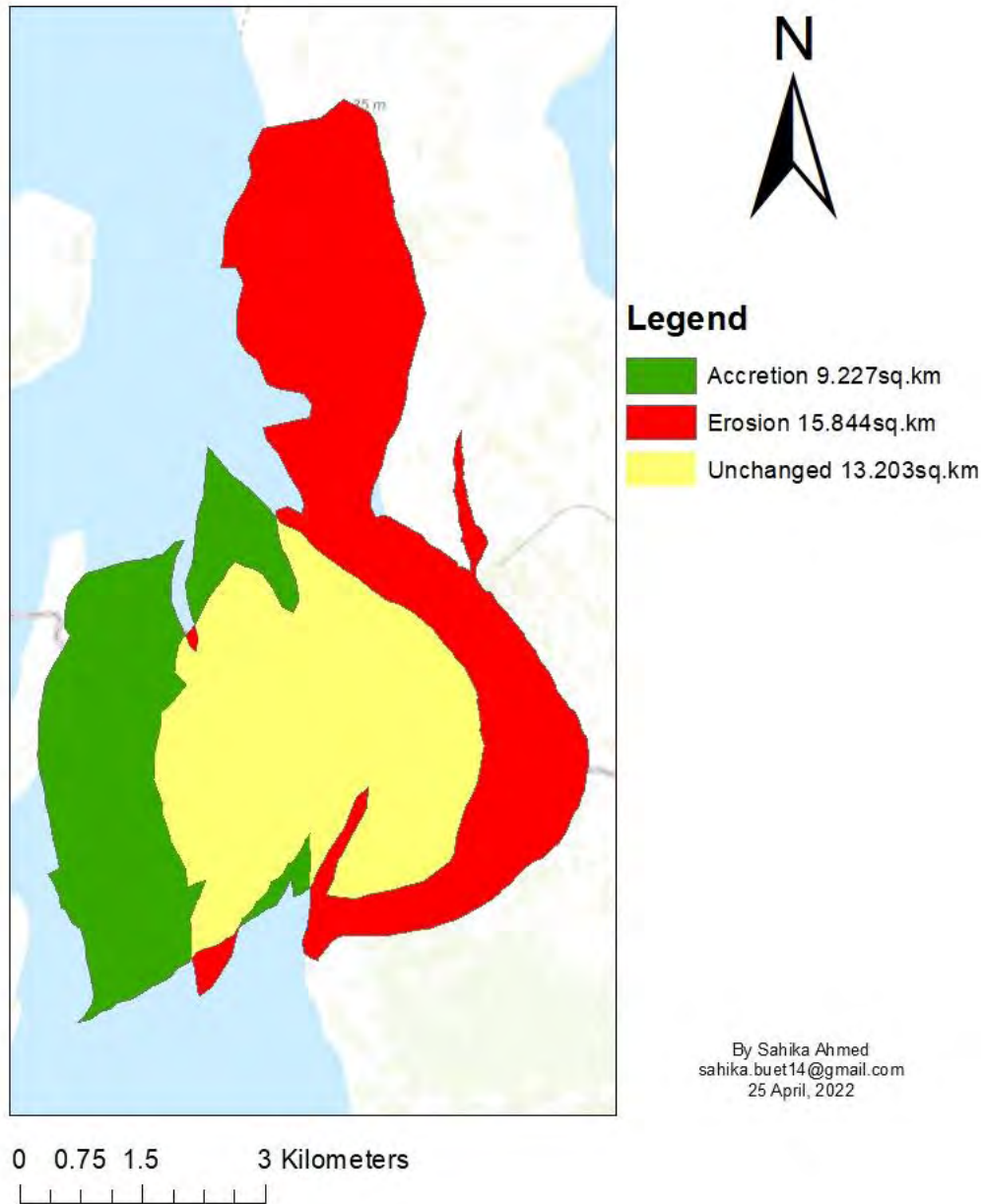


Figure 14: Erosion-Accretion patterns from 2000 to 2020

Figures (7-14) show that the selected area is prone to erosion. The analysis for the entire 20 years shows this area's massive amount of eroded and accreted land. For convenience the patterns from 2000 to 2020 in given as a combined map in Figure 15.

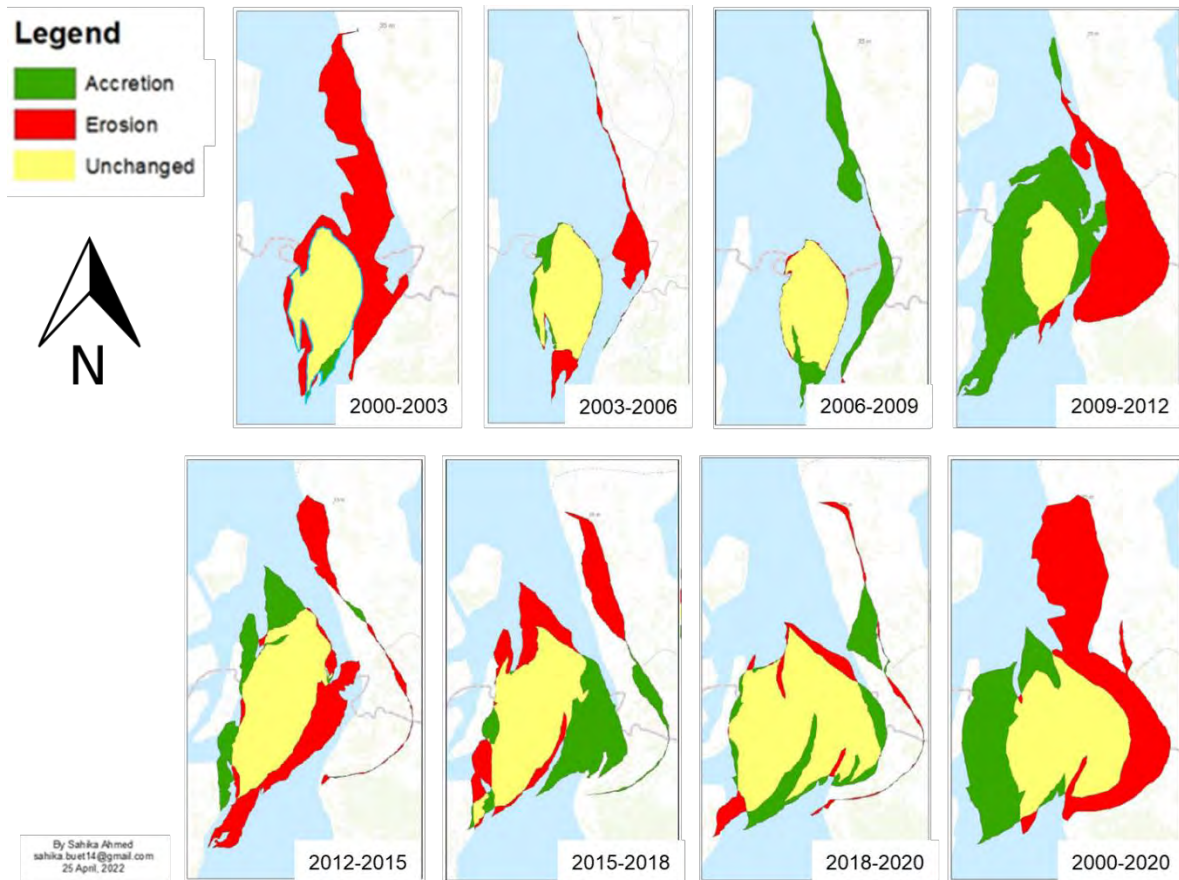


Figure 15: Combined map of Erosion-Accretion patterns from 2000 to 2020

Another important point of accreted lands is that those lands are not immediately mature (in terms of land depth and stability) enough for settlement. So, even if the amount of accreted land is huge, people don't displace to these places.

The effect of erosion cannot be neglected, and the most significant impact of this hazard is the displacement of people. From figure 8, the total eroded area from 2000 to 2020 is nearly double the area accreted. So it is clear that the policies of processes of displacement of erosion victims are very complex as the amount of land has decreased. There are many different strategies and decision-making processes that they follow to survive. These strategies are discussed in the next part of this research.

Table 4: Calculated areas of eroded and accreted lands

Year of incident	Erosion (sq km)	Accretion (sq km)	Unchanged (sq km)
2000-2003	9.37	0.28	5.26
2003-2006	2.26	0.71	4.94
2006-2009	0.19	3.92	5.46
2009-2012	13.13	15.02	5.78
2012-2015	9.69	5.02	13.75
2015-2018	8.69	8.61	13.10
2018-2020	2.88	5.8	18.45
2000-2020	15.84	9.23	13.20

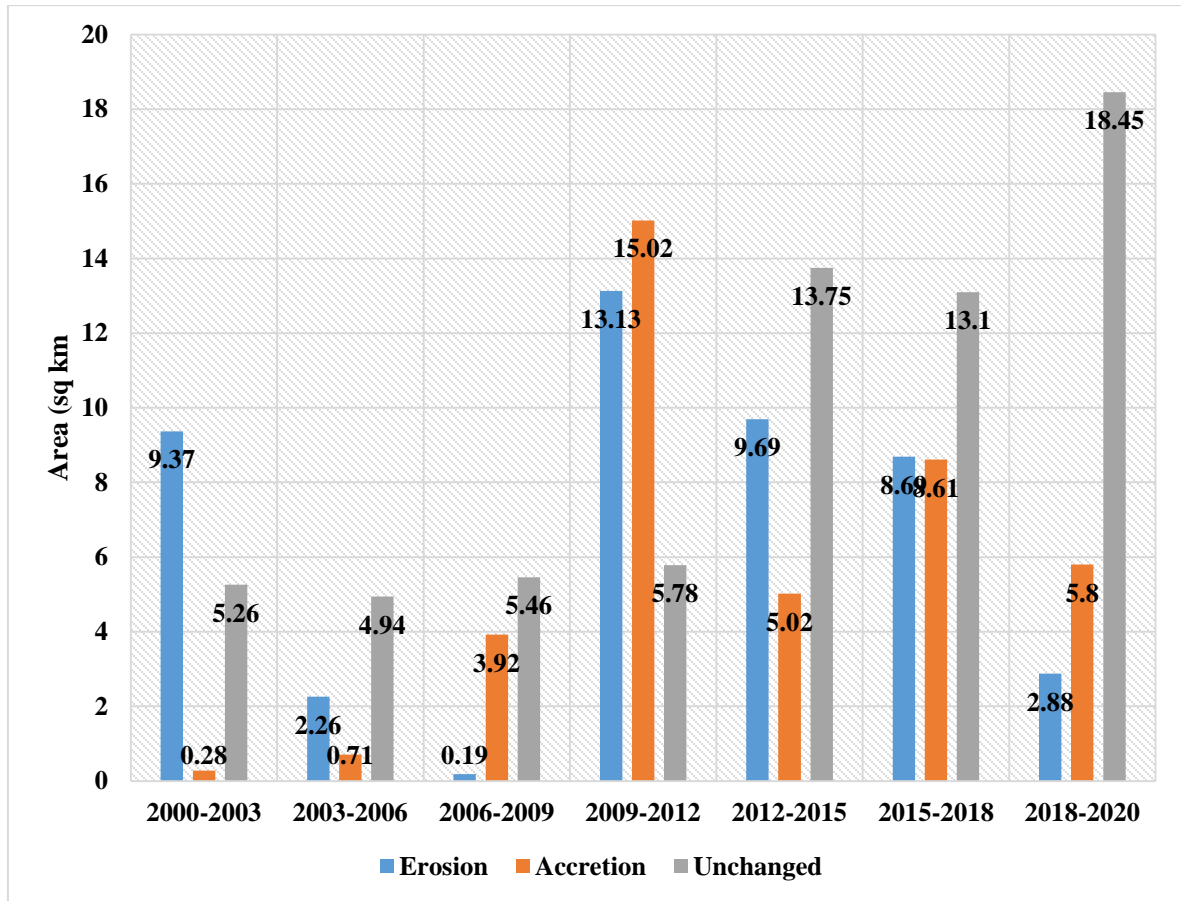


Figure 16: Eroded, Accreted and Unchanged Lands in Different Years

From the above table and bar Chart, the minimum erosion happened during 2006-2009 and the maximum erosion occurred during 2009-2012. Minimum accretion happened in 2000-2003 while maximum accretion happened in 2009-2012. So, maximum erosion and accretion occurred during the same time frame.

5.3 Adaptation and Coping Strategies

Due to erosion, the affected inhabitants are forced to settle in new locations. Displacements become a common phenomenon as erosion occurs almost every year. The extent of erosion is also unpredictable. So there are specific coping and adaptation mechanisms to adjust to this hazard. As the victims of river bank erosion are bound to lose their homestead lands and farmlands, they follow some survival strategies. over These are the shorter-term concept of responding. The strategies which help to create a sustainable solution, in the long run, are called adaptation strategies. These are the longer-term adjustments. So to understand these

strategies, the present impacts of riverbank erosion and the simultaneous occurrence of riverine flood on the victims and livelihood conditions are to be analyzed first.

5.3.1 Effects of natural hazards

Dewanganj is a highly flood-prone and erosion-prone area. Riverbank erosion, often an aftereffect of devastating floods, mainly occurs in alluvial floodplains. In this study, the area is divided into five categories and the analysis is done differently for each type of area. A comparison of different phenomena and factors is shown in the graphs below.

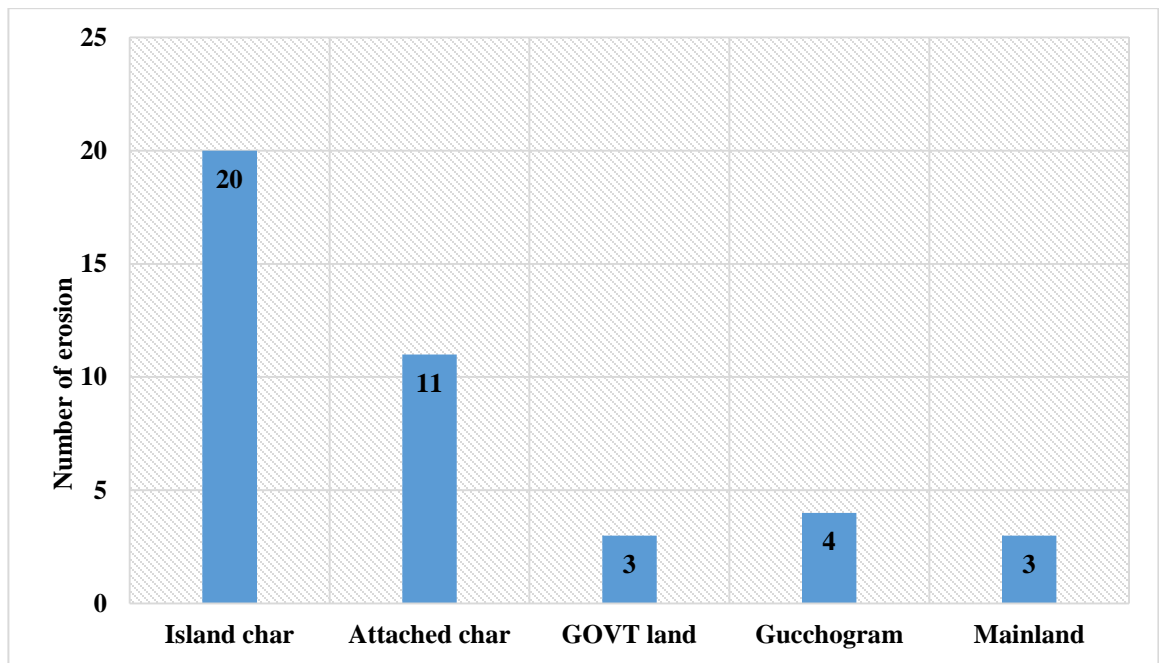


Figure 17: Number of erosion faced by residences from 2000 to 2020

So from this graph, the most erosion-prone area of Dewanganj is the Island Char and the least eroded areas are Mainland and GOVT Land. These two areas are at a larger distance from the river, people living here are not facing erosion in recent years, but they faced erosion before moving to these places. As Island Chars and Attached Chars have the lowest land elevation, these areas face devastating floods. Moreover, erosion is very typical in these areas.

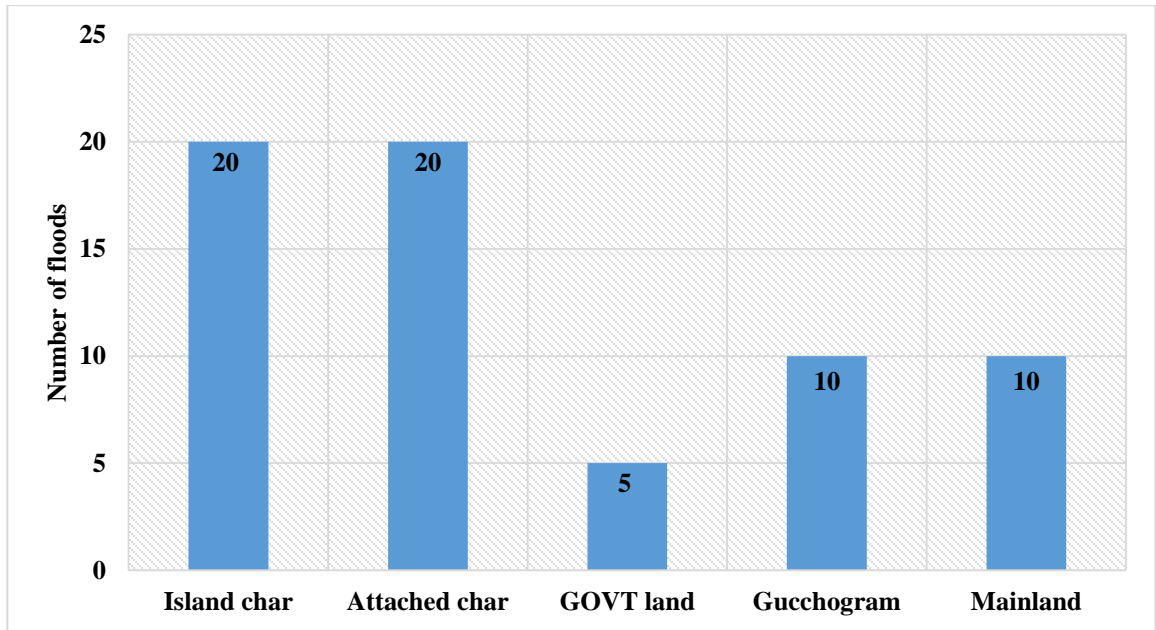


Figure 18: Number of floods faced from 2000 to 2020

The above figure shows that most flood-prone areas are the same as erosion-prone ones. As said previously, these areas are low-lying. In Guchogram and the Mainland, water logging problems in monsoons are prevalent due to elevation differences in some areas. As GOVT Lands, such as rail lines, are situated at high elevations, these areas are hardly affected by floods.

The effect of riverbank erosion and riverine floods on the inhabitants of the study area is being analyzed. There are mainly three types of losses due to these hazards: Economic, social, and personal. In the FGDs, the examples of these three kinds of losses were discussed. The principle concept about these losses was almost the same for all these five types of zones.

Economic losses are mainly any kind of losses presentable in monetary terms. Loss of income sources, farmlands, homestead lands and livestock are some examples of financial hardships. Social losses mainly affect social status at present and in the future. In the study area, inhabitants' social status primarily depends on their land resources. Also, many students drop out from educational institutes due to riverbank erosion. It is unfortunate and threatens their future. The decrease in social security and the increase in forced child marriage are also examples of social loss. In personal losses, there is the loss of something precious which cannot be expressed in monetary terms. Such as the grave of family members, ancestors'

houses, mental condition and security, and many other things which usually are not common for all victims.

Strategies to overcome these losses are different in different zones. This is because the living condition is different in different zones. The household surveys and FGDs show the relation among present living conditions in different areas.

5.3.2 Present living conditions

The living conditions of different areas reveal much about the requirements and strategies to live there. One of the most important things is the cost required for the land.

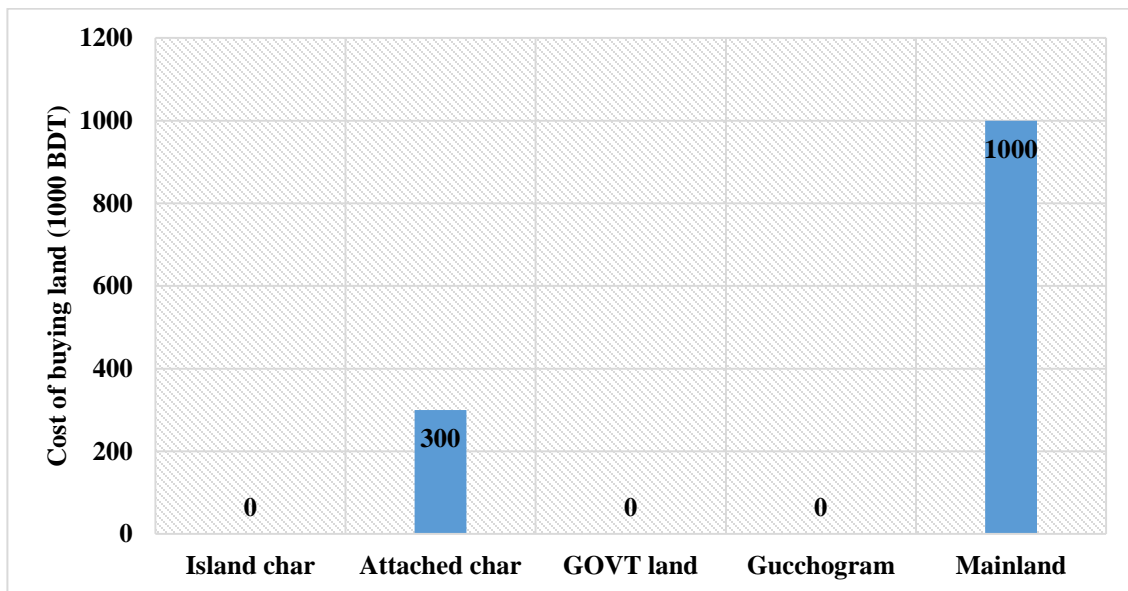


Figure 19: Cost of land buying in different zones (per year)

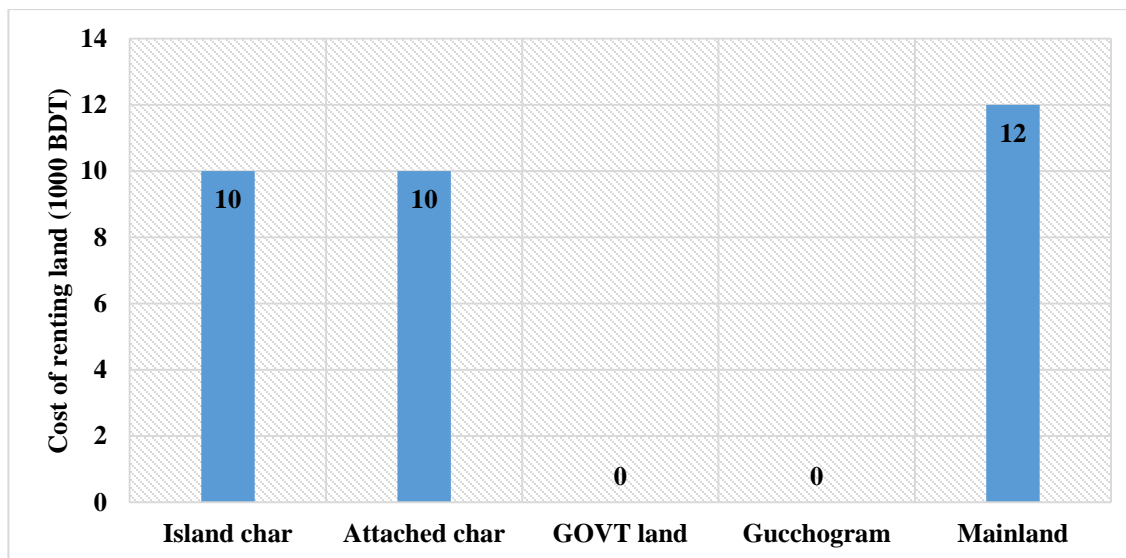


Figure 20: Cost of renting land in different zones (per year)

So from the above figure, the highest land buying and renting cost is in the Mainland while the lowest cost of land buying is in the Attached Char. In Island Char, GOVT Land and Gucchogram, people usually do not buy land to live there. They usually either get land with legal government procedure in Gucchogram or illegally in GOVT Land. In Island Char, they either settle in their relatives' land or acquire land for rent. The lowest land renting cost is in Island Char and Attached Char.

People in Mainland areas are mainly from the higher middle class and higher class. They have the capability to buy or rent land or house for residence. The minimum expense for renting a house is around 1000 BDT per month on the Mainland which means around 12,000 BDT per year. Anyone buying land on the Mainland must pay around 10 lakh BDT per Katha (1 katha= 720 square feet). At the same time, land in GOVT areas and Gucchogram is free of cost. As Gucchograms are projects of the government of Bangladesh to rehabilitate landless people, these people get land, one house, one toilet, and one tubewell free of cost. But habitation is prohibited in GOVT areas, like beside the rail lines and roads, on the bridge, and in other places like parks and fields. But people who do not get lands in Gucchograms and do not have any option to settle in other areas are bound to choose GOVT Land for habitation.

Another important thing about these areas is the amount of usable natural resources. These include soil fertility, availability of foods, housing materials, fuel and water. Dependency on natural resources is calculated as the number of sectors for which the inhabitants are dependent on natural resources.

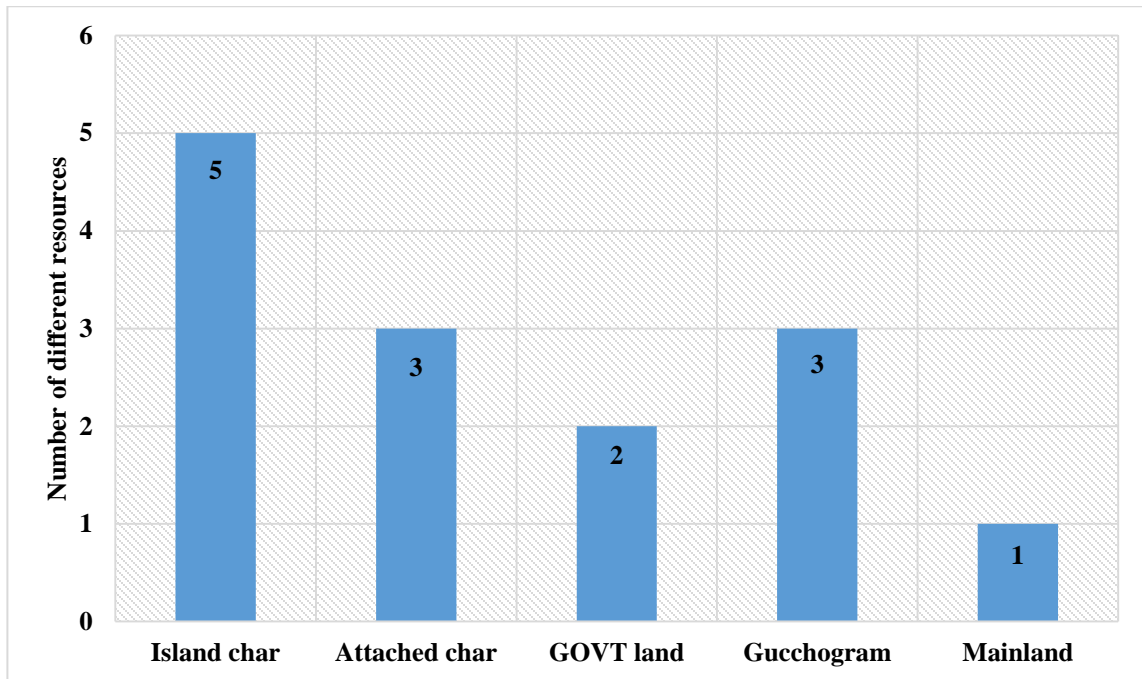


Figure 21: Dependency on natural resources in different zones

In Mainland areas, only water is available as a natural resource. The amount of cultivable land is very negligible here. That is why they have fewer opportunities to grow food. Also, the housing materials and fuel are to be bought here. In GOVT Lands, water and fuel are the only natural resources available. Water, food, and fuel are available in the Attached Chars and Gucchograms. All five types of natural resources are available in Island Chars. They use natural materials to build houses, and land fertility provides enough food for them and their cattle. Fuel and water are also available in these areas.

The condition of health facilities in an area can be explained by the availability of the services and the satisfaction of the inhabitants. So in this study, the availability is presented as the required time to reach the nearest health center, like hospitals or clinics. Satisfaction with health services is analyzed from different gender perspectives.

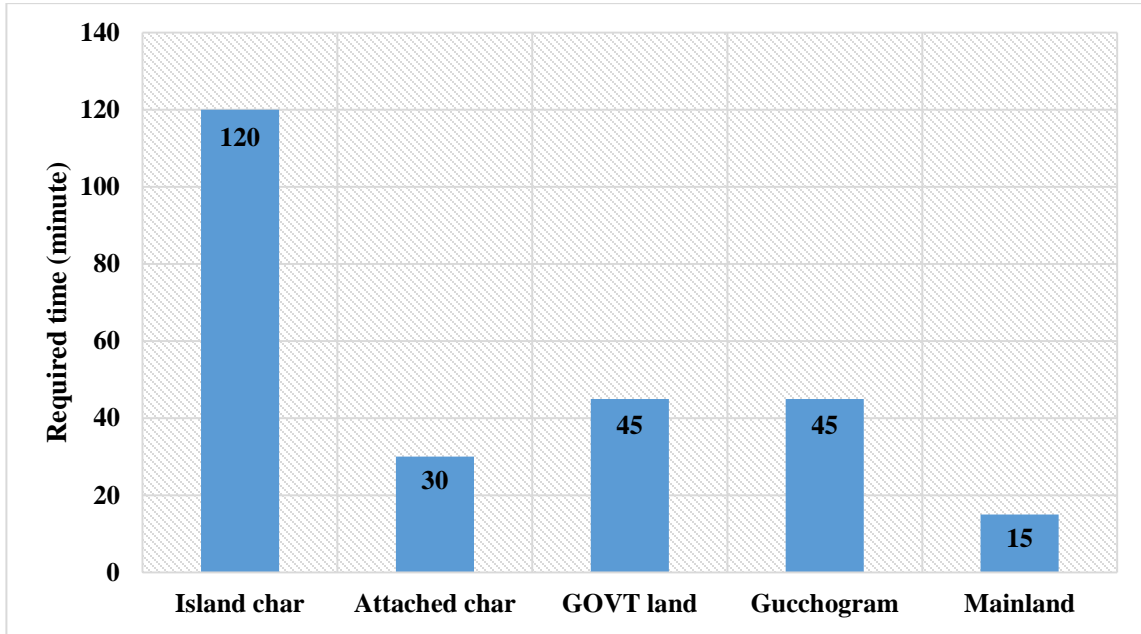


Figure 22: Required time to reach the nearest health center

In Island Char, there is no health center there. They must go to the riverbank areas by boat and then take another transportation service to reach the nearest health center. This is very time-consuming and also risky. It takes a minimum of 2 hours which sometimes becomes the reason for unexpected death without treatment and life risks of pregnant women and newborn babies. In the Attached Char, they have a clinic nearby, but due to poor communication and transportation, it takes almost 30 minutes to reach there. GOVT Land and Gucchograms are a bit far from both the clinic and hospital. It takes nearly 45 minutes to arrive at hospitals/clinics premises. The only government hospital is situated on the Mainland, and the communication and transportation system is also available. That is why it takes less time (15 minutes) than others.

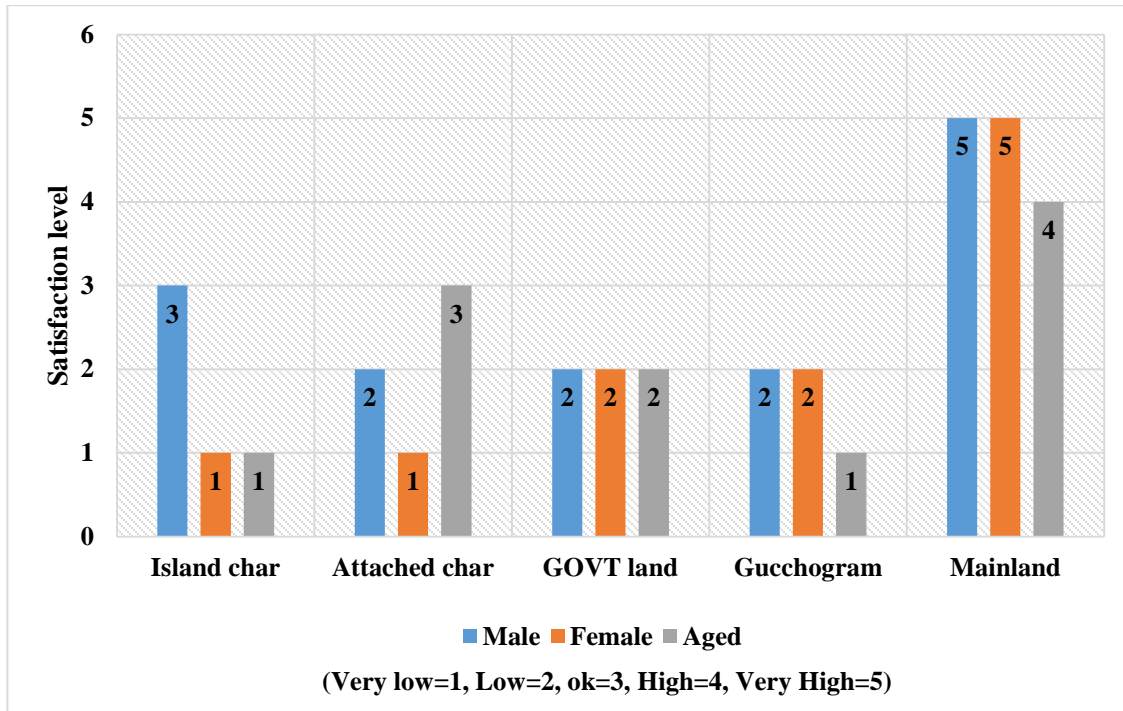


Figure 23: Satisfaction with health facilities

The above figure shows the response of different gender groups (Male, Female and Aged group) about their satisfaction with health facilities. These mainly depend on the treatments they get from the health centers, the time to get treatment, the behavior of health workers, the price and type of medications, etc. In Island Char, women and aged groups are very disappointed with their health facilities, but men have no complaints about that. As the sufferings of women and aged groups are more in the Island Char and they need more frequent treatments than men, it is tough for them to cope with the situation. In the Attached Char, women and men are disappointed when the aged group has no complaints about health services. Most of the aged persons here are mainly displaced from Island Chars, so they are satisfied compared to their previous experience with healthcare in island chars. But others normally compare the existing situation with that of the mainland and this makes them feel unsatisfied. In GOVT Land, all of them have low satisfaction with it mainly because of the unavailability of necessary medicines and treatments. In Gucchograms, men and women groups have low satisfaction, but the aged group is very disappointed as most of them are from distant places where they got better facilities. People on the Mainland are satisfied with

health facilities, but the aged group has complaints about artificial medications as they believe on the ancient kabiraji treatment.

Education is one of the most critical factors in understanding the development status of an area. The present condition of education level is shown in the figure below.

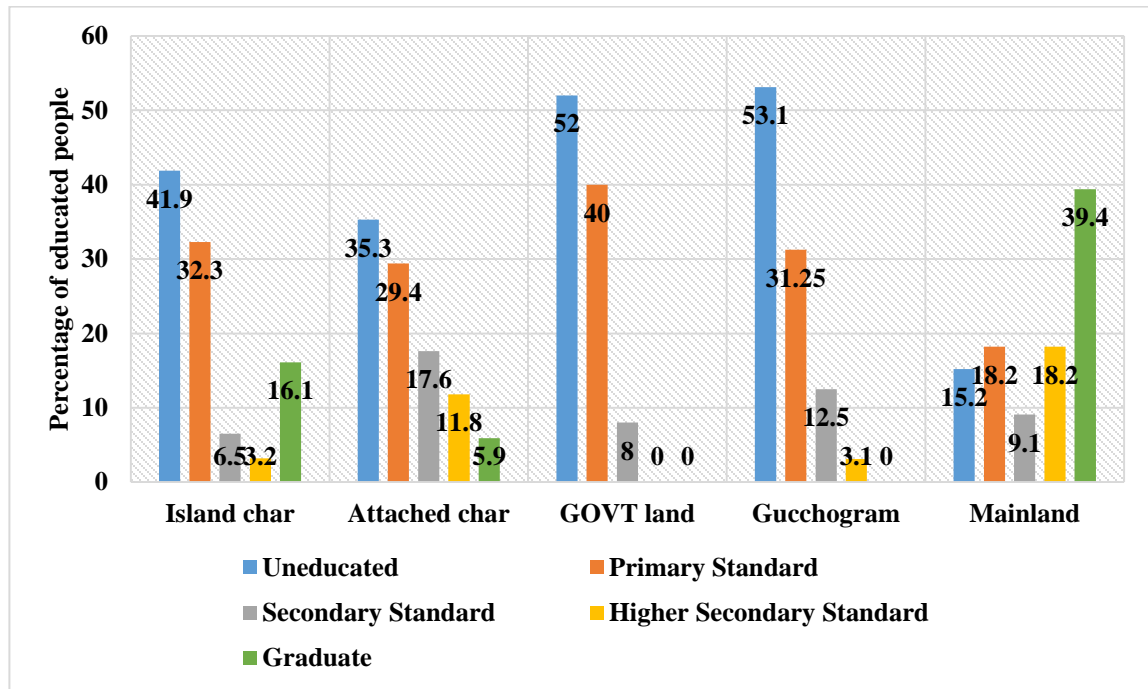


Figure 24: Education level in different zones (%)

From the above figure, in Island Char, 41.9% of people are uneducated and 32.3% have passed the primary level of education. Due to the lack of colleges and high schools in this area, the percentage of graduated people in secondary and higher secondary levels is very low, which are 6.5% and 3.2%. Some people on the Island have the facilities to send their sons and daughters to other areas to their relatives after passing the higher secondary level. Thus we get some college graduates in this area, and the percentage is 16.1%. In the Attached Char, the percentage of uneducated people is 35.3%. However, 29.4% of people have passed the primary level, 17.6% have passed the secondary level, 11.8% have passed the higher secondary level and only 5.9% have graduated from college/universities. In GOVT Land, more than half of the people (52%) were uneducated, and 40% of people have passed the primary level. Only 8% of them passed secondary standards, but no people had passed higher secondary and graduation levels. In Gucchogram, the situation is quite similar to that in

GOVT Land. 53.1% of them are uneducated and 31.25% of them have passed the primary level. 12.5% have passed the secondary level and 3.1% have passed the higher secondary level. No one graduated here. In GOVT Land and Guchohograms, people living here are mainly landless. People who do not have any other place to go or any help from relatives, come to stay in GOVT Lands and Guchohograms. That is a cause of negligence toward education as they have less support and worst financial conditions decreasing their ability to afford it. On the Mainland, only 15.2% of people are uneducated, 18.2% have passed the primary level, 9.1% have passed the secondary level, 18.2% have passed the higher secondary level, and 39.4% have graduated.

Daily expense reveals a place as if it is expensive to bear the minimum costs or cheap. This factor affects people the most. People mainly depend on this factor for deciding whether to leave or remain in the same place after facing natural hazards.

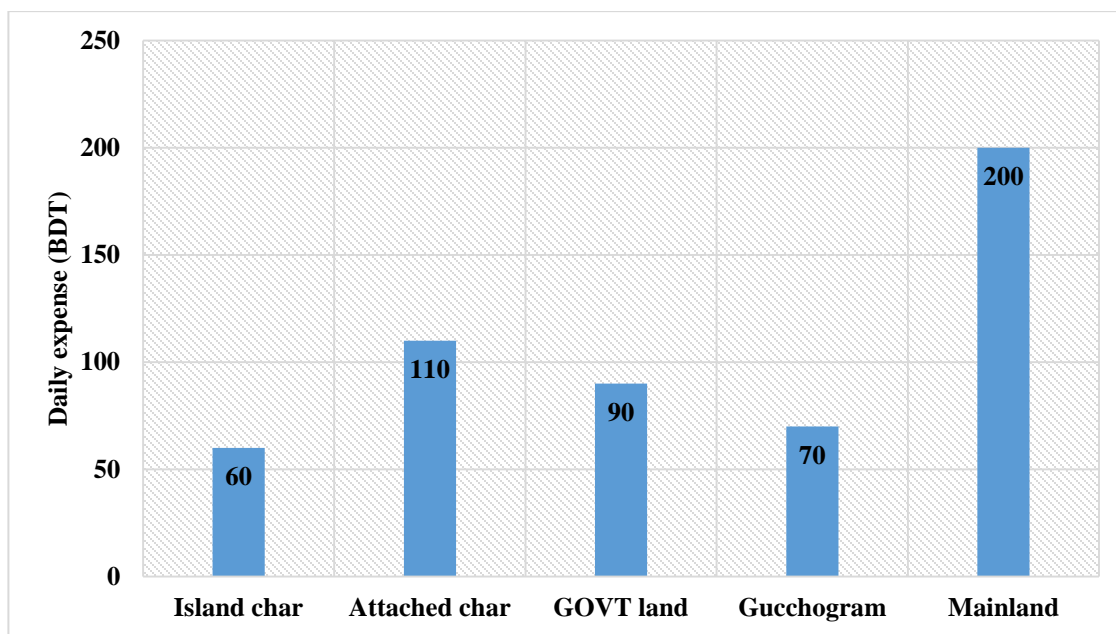


Figure 25: Daily Expense per person (BDT) avg in different zones

Figure 25 shows the average daily expense for one person for different zones. The lowest daily expense is found on Island Char and the highest daily expense is found on the Mainland. On the Island Char, the expense is around 60 BDT, whereas, on the Mainland, the amount is more than three times of that on Island Char. Around 200 BDT is the average daily

expenditure per person on the Mainland. In Gucchogram, GOVT Land, and Attached Char, the expense is around 70, 90, and 110 BDT accordingly.

The variety of available income sources is also a great indicator of the present condition of any area. The figure below shows this variation for both male and female persons.

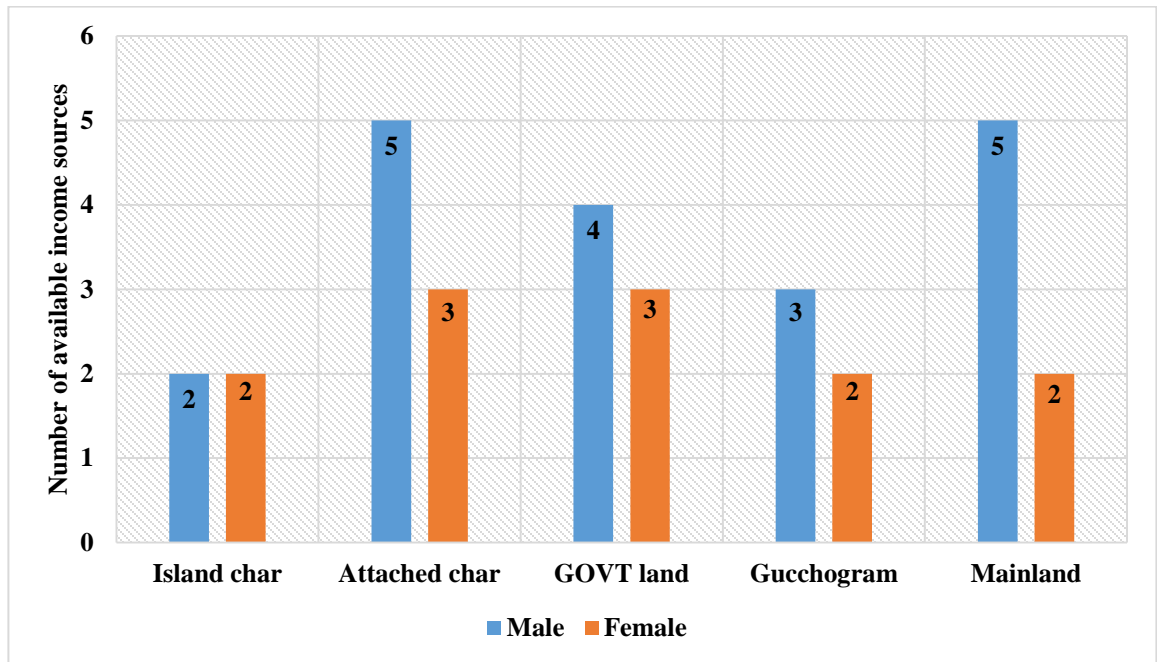


Figure 26: Variety of Income Sources

This study examined various income sources with respect to spatial variation. In the different areas, the number of available income sources is presented. In Island Char, male persons only have opportunities to cultivate others' land or sharecropping and work as construction labourers in other towns. Female persons work in the field during harvesting and other times, they do animal husbandry. In the Attached Char, male persons are involved in sharecropping, rickshaw pulling, construction labour, politics and different types of businesses. Female members are engaged in crop harvesting, animal husbandry and GOVT jobs. In GOVT Land, sharecropping, rickshaw pulling, construction labour and fishing are the available works for the male person and animal husbandry, tailoring and working as a housemaid are common for a female person. In Gucchogram, male members have the opportunity of sharecropping, rickshaw pulling and working as construction labour while female members have opportunities of sharecropping and tailoring. On the Mainland, male persons do various kinds

of work like GOVT jobs, businesses, NGO (non-governmental organization) works, politics and driving automobiles. Female persons are involved in GOVT jobs and tailoring.

Although the above factors affect living choices, personal understandings and preferences also influence local peoples' preferences. In the figure 23, preferable areas for living are presented by the percentage of people who prefers it.

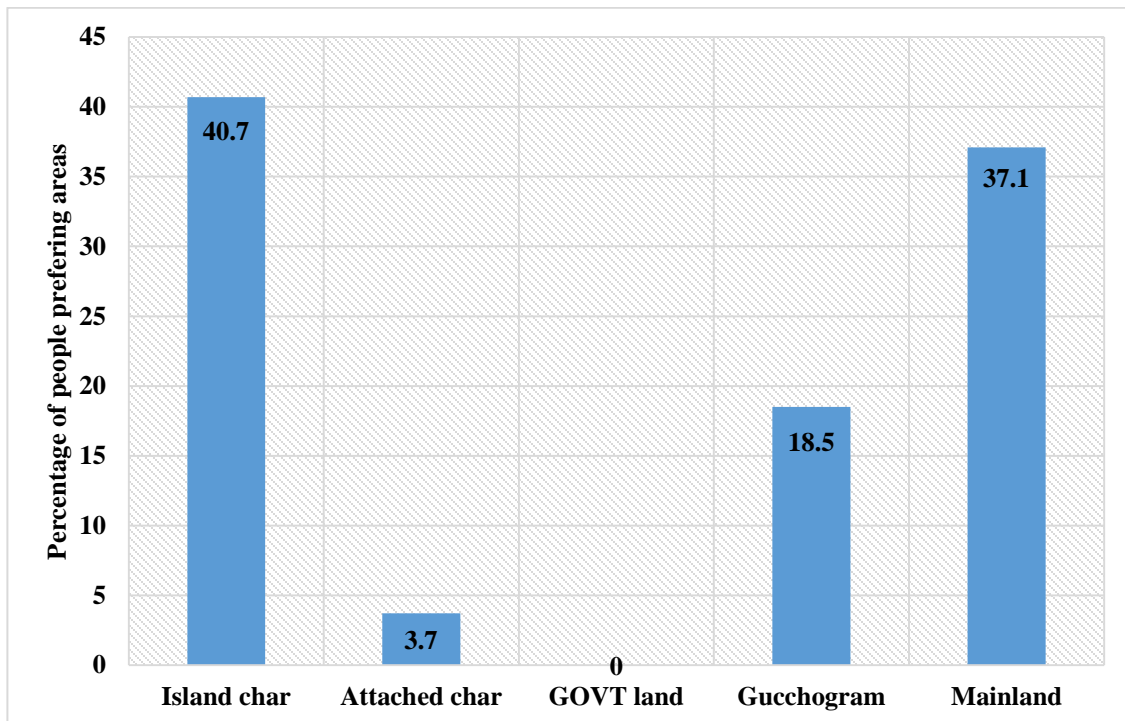


Figure 27: People's preference for living place

Island Char is most preferable for living than any of the other places. 40.7% of people prefer it as the best place to live. The reason behind this is the cheapest living condition and very fertile land. Cultivating in Island Char is very profitable and the price of land, food, and other essentials are very low here. The Attached Char is not that much preferable too. Only 5.7% of people preferred it. This is because the land is not fertile and this place is very prone to flooding and riverbank erosion. No one in the study areas chose GOVT Land for settlement, as the fear of eviction is apparent here. 18.5% of people prefer Gucchogram. Though this place provides free housing, sanitation, water and other facilities, people face social humiliation as they own nothing and the government gives all. It is considered as giving Charity to beggars. 37.1% of people prefer the Mainland as it is not that much affected by

natural hazards and people living here enjoy more facilities. However, the expense of living here is relatively very high.

5.3.3 Coping strategies

After facing disaster due to riverbank erosion, people lose their homesteads, cultivable lands and many more things. These people are bound to displace to a new area for their habitation. In the study area, the erosion victims do not want to leave their known environment easily. Also, there are some financial and emotional issues. Their financial condition does not always support them to move to a safer place far from their origin. Also, they hope that the eroded lands will be recovered as charlands after some years. That's why they seek places for rehabilitation near their origins in Dewanganj.

After rehabilitation, their first step to returning to normal life is coping with it. As coping is the immediate solution that can help in the short run, this process mainly depends on individuals, families, or areas. In this study, the coping strategy is shown based on different areas. The five types of land areas differ in their coping strategies.

5.3.3.1 Island Char

Island Char is preferable for people living in GOVT Land, Attached Char and Gucchograms. This is mainly because of the availability of natural resources here; people with lower income status try to settle here. The land is also very cheap. But to get land here, one should have a connection with the land owner or local political parties. Otherwise, due to the high demand for Island Char, it is tough to get a chance to accommodate here. So, first of all, to cope here, one should contact the landowner as soon as possible.

The education facilities are not available here. So it is another challenge whether to continue studying or drop out. Due to financial bindings, most families do not have any other way to continue their children's studies. Some of the families send their children to boarding schools (e.g., Madrasa) or any relative's place to continue studying staying in their house. Same situation for health facilities too. The unavailability of health services makes the inhabitants aware of coping with any emergency need. They have boats for the immediate need of transportation.

Crop cultivation is the most common income source here. People do sharecropping with the landowners. In addition, the landowners do not dwell in Char. They pay for cultivating their lands. So to cope, one must find work from the landowners. However, the income is not high, only around 300/400 BDT per day. People do not have any problem with this low income as the daily expense is also very low. So coping from this perspective is not hard.

The main threat to Island Chars is the natural hazards. The rate of both flood and erosion is high here. To cope with these, the dwellers make some modifications/adjustments in their houses. There is a place to tie wooden cots from the roof so that they can stay there during the flood and they have to stock fuel, dry food and other important things for use during floods. Also, erosion is very common, so they do not build their houses with permanent structures (e.g., brick-built structures). Instead, they build houses in a way that can be transferred or moved easily. Despite these strategies still, they are the worst victims of floods and erosion. During these hazards, they get medicines, dry foods and rice as relief from the government.

From the above discussions, the key coping strategies for living in Island Chars are

- Connection with landowners
- Availing facilities under political Influences
- Making temporary Kacha houses
- Managing land for sharecropping
- Accepting children's dropping out of school
- Sending the children to any boarding school or relatives' places in town if they have the ability to continue their children's education
- Arranging boats and learning to drive boats for emergency cases
- Getting used to with natural remedies due to the lack of other health services
- Learning to store fuels and foods for the Monsoon season

5.3.3.2 Attached Char

The Attached Char has some issues and challenges to be chosen as a living area for displaced people. Few people think living in Attached Char in their ancestor's land is a matter of self-respect. Attached Char The area often faces the severity of natural hazards and it also has a

lack of facilities. The land cost is not high, but most people live here by taking ownership of a certain amount of land for a limited period. So to settle in this area, it is important to have a minimum amount of money which is at least 10 thousand BDT. This type of ownership is cheaper than the ownership of other areas. Also, living here is more beneficial for people who value education and health facilities as essential requirements. Due to the direct connection with the Mainland, these areas are also developed, having different clinics, medical stores, thanas, schools and colleges. This area has various income facilities due to its connection with the Mainland. So to cope up here is relatively easy after getting these facilities.

This land is less fertile than the land of Island Chars due to the higher portion of sand. Also as the land price is higher than in Island Chars, most people can afford land only for accommodation, not for cultivation. As a result, people do not get food, fuel, or necessary materials for housing from this land. Buying these things makes the daily expense higher in this area.

The flood rate is also high in this area. This area got flooded almost every year. They chose to go to any elevated building during the flood. So, they have to stock fuel, dry food and other important things during floods. Also, during the flood, they get medicines, dry foods and rice as relief from the government. Another natural hazard, riverbank erosion, is very sudden here. The nature of erosion is more unpredictable than Island Chars. Also, the extent of erosion is high. They have to transfer their houses very quickly due to the unpredictable nature of riverbank erosion.

From the above discussions, the key coping strategies for living in Attached Chars are

- Buying or renting land
- Building easily transferable houses
- Managing new income source
- Being capable of buying foods, fuels and other necessities
- Learning to store fuels and foods for the Monsoon season

5.3.3.3 GOVT Land

GOVT Lands are mainly abandoned rail lines, roadside areas, bridges, and surrounding areas of GOVT buildings. These areas are elevated lands situated inside of the Mainland areas. That's why the erosion rate is lower here. Also, the flood depth is not high here due to the higher elevation. As these lands are under the ownership of the government, living in these lands is not legal. There is no system to buy or sell these lands for settlement. People who settle here are mainly the most helpless and do not have enough money or a place to settle. They do not have to pay for living on these lands. However, sometimes eviction is needed, which is the greatest obstacle to live here. Local political persons help these people, if it is possible, by saving them from eviction.

People here do not own any cultivable land, so they have to buy food, housing materials and other necessary things. As these areas are on the Mainland, education and health facilities are available here. So from this perspective, coping in this area is more manageable.

From the above discussions, the key coping strategies for living in GOVT Lands are

- Finding settlements with a group of people belonging to the same area
- Building easily transferable house
- Managing new income source
- Being capable of buying food, fuel and other necessities
- Getting political Influences

5.3.3.4 Gucchogram

Gucchogram is a project led by the government of Bangladesh to rehabilitate the victims of natural hazards and landless people. The government created some residential areas where one family gets one house, one latrine and one tubewell from the government. They have legal ownership of these things. That is why living here ensures a secure social status.

These Gucchograms are built in the inner part of the Island or Mainlands. Hence they are less prone to erosion. So most houses are semi pacca and there is no need to transfer house. Even if their houses are eroded or damaged, they get another place to live or the government of Bangladesh repair that home. Even sometimes, they get work opportunities in government-led projects as day labourers.

In Gucchograms, according to the dwellers, the designed height is not provided everywhere due to different issues. That is why these areas are flood-prone and people must move to any elevated place during a flood. So, they have to stock fuel, dry food and other important things during floods.

Despite various opportunities, people normally do not want to live in Gucchograms as it is seen as a disgrace and their social status becomes lower. The inhabitants of the other four zones look down on the dwellers of Gucchograms. They do not want to get their sons or daughters married to anyone living in the Gucchogram. The cause is that though they are not the legal owner of the land they live on, they have no right to sell or hand over this property as it is a government order. So, the dwellers of Gucchograms are treated as landless and helpless people by others.

From the above discussions, the key coping strategies for living in Gucchograms are

- Going through legal procedures to get land
- Learning to store fuels and foods for the Monsoon season
- Accepting the degradation of social status
- Managing new income source
- Being capable of buying food, fuel and other necessities

5.3.3.5 Mainland

Living standards and facilities are far better on the Mainland than in the other four zones. The educational institutions and health centers are at the nearest distance. Also, the chance of riverbank erosion is less here. That is why people can ensure permanent settlement, education, and health facilities in this area. However, the main obstacle to living here is the higher price of land. Even if anyone wants to rent accommodation on a monthly or yearly basis, they have to pay at least 12 thousand per year for a one-room house. So to cope here, one should have a stable financial condition.

The daily expense is relatively high here as they do not get any basic needs from their lands. Only water is collected from the own tubewells or pumps. They need to buy food, fuel and other necessities for their living.

The income facility here is much better and more available. Government and NGO offices, markets, and other types of development projects are based on the Mainland. That is why getting a source of income is easier.

Most of the houses here are *pacca* (concreted) and one-storied. Due to flood occurrences, these houses are built at least 6 to 7 feet above the road level. But due to the increase in flood height every year, this place has also been victims of losses. Water logging is also expected due to the nature of the land here. The loss due to flood and water logging is higher than in other zones here. That is why it requires a certain amount of financial support to cope with these losses every year.

From the above discussions, the key coping strategies for living in Mainland are

- Buying or rent land or house
- Building house on elevated base
- Managing new income source
- Being capable to buy foods, fuels and other necessities

5.3.4 Adaptation strategies

Adaptation strategies are steps that solve a problem in the long run. These can not be obtained suddenly. These are mainly planned ways through which one problem can be solved day by day.

In this study, two types of adaptation strategies are found. One is the strategies made by the government, NGOs and other supportive parties who have plans to make this area much more stable by controlling the losses due to hazards. Another is the strategies the inhabitants follow to adapt to this unavoidable situation, which includes their displacement plans and the dependent variables behind this. Due to the complexities of these conceptions, this part is discussed differently in the 3rd part of this research.

This section shows the adaptation strategies taken by the government, NGOs and other supportive parties. As these zones are financially underdeveloped, the government project 'Ekti Bari Ekti Khamar' (One house, One farm) includes people of island chars, attached chars and GOVT lands. These people are given loans and training under these projects. There is

another project from the government named 'KABIKHA' (food in exchange for work). People also get work under this project.

On island chars, the government of Bangladesh has constructed primary schools, thana, mosques and required roads for the betterment of the char inhabitants. The Bangladesh water development board has several projects in the attached chars to protect the riverbank. Also, there are some pacca roads and office buildings by LGED in the attached chars. Gucchograms are the main rehabilitation program for landless people by the government of Bangladesh. Basic needs like a house, tubewell and latrine are provided for each family. Enough solar panel is given in island chars, attached chars and gucchograms.

Different NGOs also have financial plans. During flood and erosion, Red Crescent Society gives financial helps to the inhabitants of attached chars. There are different types of loan systems and training for developing skills for the inhabitants of attached chars, GOVT lands and gucchograms. Cow owners of this area also get loans under beef fattening projects. Also, the banks have different types of loan systems to encourage some development projects.

NGOs provided some elevated houses in attached chars. Also, in island char, NGOs worked on some lands to increase elevation by landfilling. They also gave tubewells and latrines on the elevated lands in island chars and attached chars under the CLP project. Many inhabitants also get cows under this same project. Despite these, there are different types of training for skill development provided by these NGOs.

Local political leaders also help during hazards to transport the household staff. They arrange boats, vans and food for immediate help. Also, sometimes, they give cows and sewing machines to helpless women to make them financially independent.

5.3.5 SWOT analysis for different areas

The above analysis of coping and adaptation strategies clearly shows that the strategies are not same in different zones. For that, the benefits and difficulties are also different. So here is the final SWOT analysis presentation for the strategies of different areas from which we can understand the difference between different zones. Strength and weakness represent the immediate strategies to cope up with and opportunities and threats represent the strategies for near future.

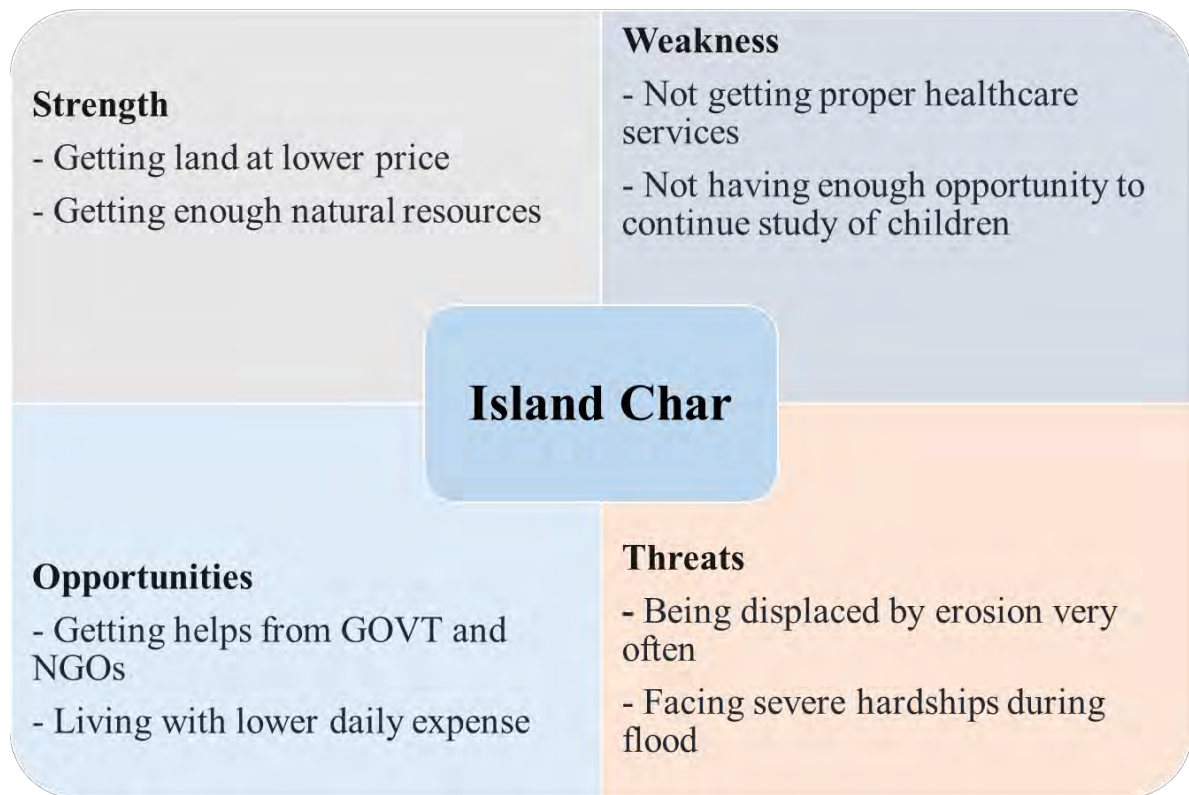


Figure 28: SWOT analysis of survival strategies in the Island Char

It shows the availability of land and natural resources in island chars helping the migrated people to manage new settlements easily. Also, the daily expense is very low due to enough natural resources. Often people get help from different government and NGO projects. But due to being a disconnected land, island chars are not provided with health and education facilities. That's why people are often bound to stop their children's studies and compromise with different health conditions. Island chars are actually a running process of land erosion and accretion. That's why displacing within the char is common. During floods, they are the worst victims of being in the middle of the river, having no elevated place near to go.

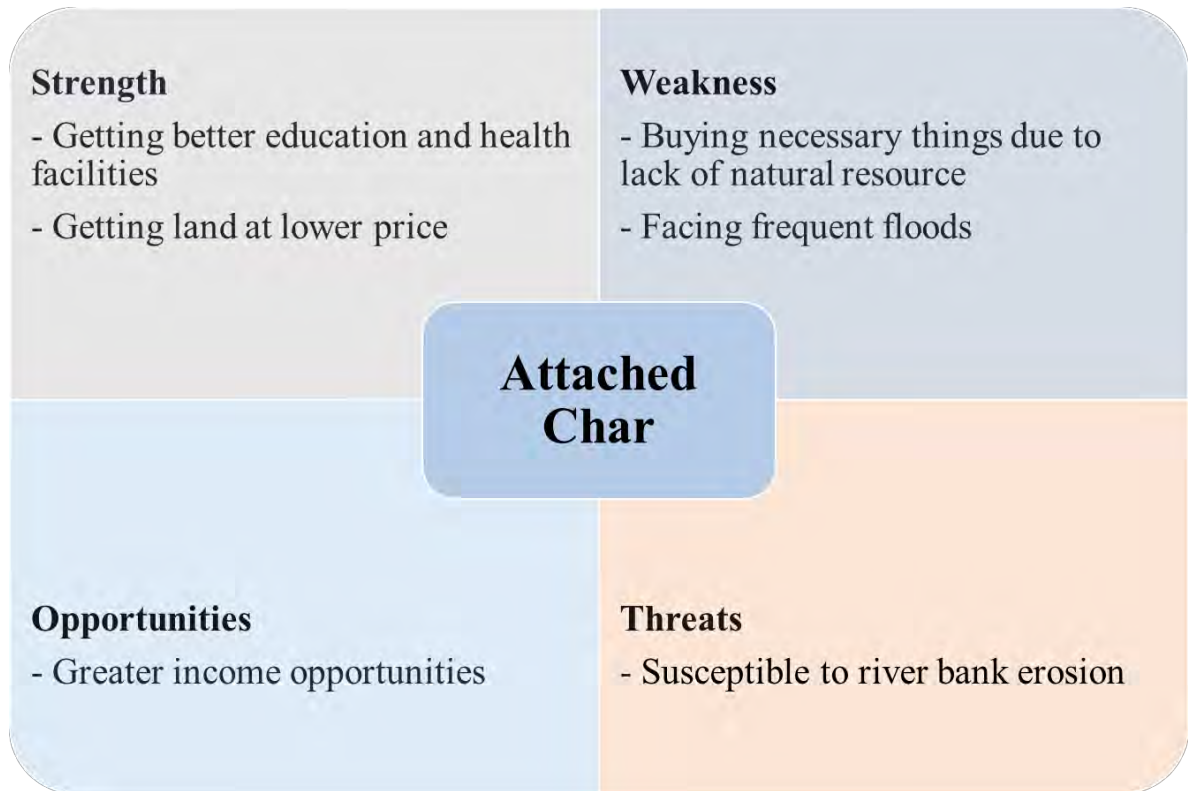


Figure 29: SWOT analysis of survival strategies in the Attached Char

From the above figure, the lower land price is very beneficial for the migrated people to settle here easily. Also, due to the connection to the Mainland, education and health facilities are available here. This is also the reason behind various income opportunities in this area. But the lack of natural resources makes people buy their necessary things for daily consumption. Being located at the bank of the river and having a lower elevation, this area gets flooded almost every year. Moreover, this location faces the most severe riverbank erosions.



Figure 30: SWOT analysis of survival strategies in GOVT land

So here, the displaced people settled on land without any cost, which is considered illegal rehabilitation. Due to the high elevation, these areas are not affected by floods that much. Also, the location of these areas is far from the riverbank in Mainland areas. They do not face erosion for this reason. Being on the Mainland, they get enough education facilities. Also, they can participate in many work opportunities, training and workshops led by the government and different NGOs like BRAC and others. Lack of natural resources forces them to buy all necessities. Though the local government supports these people, evacuation from illegal settlements is also very common.

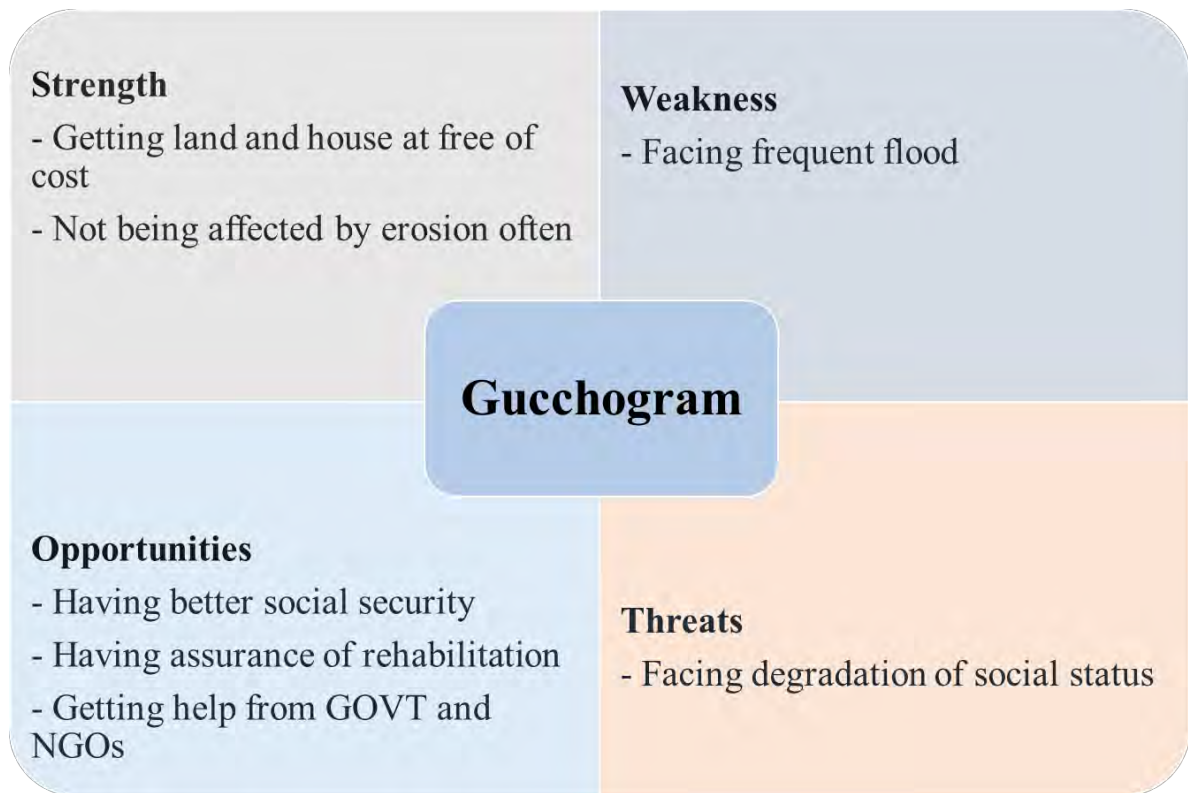


Figure 31: SWOT analysis of survival strategies in Guichogram

It shows that people get free land and housing here, which is the main requirement for rehabilitation. Also, due to the inland position of these areas, they are less prone to erosion. As it is a project of the Bangladesh government, the inhabitants get enough social security and assurance of rehabilitation from the government. Also, they can participate in many work opportunities, training, and workshops led by the government and NGOs. But the monsoon flood is a threat to this place. Also, living here indicates that the inhabitants have no other places to go and they own nothing without this land. This often creates class differences with inhabitants of other areas.

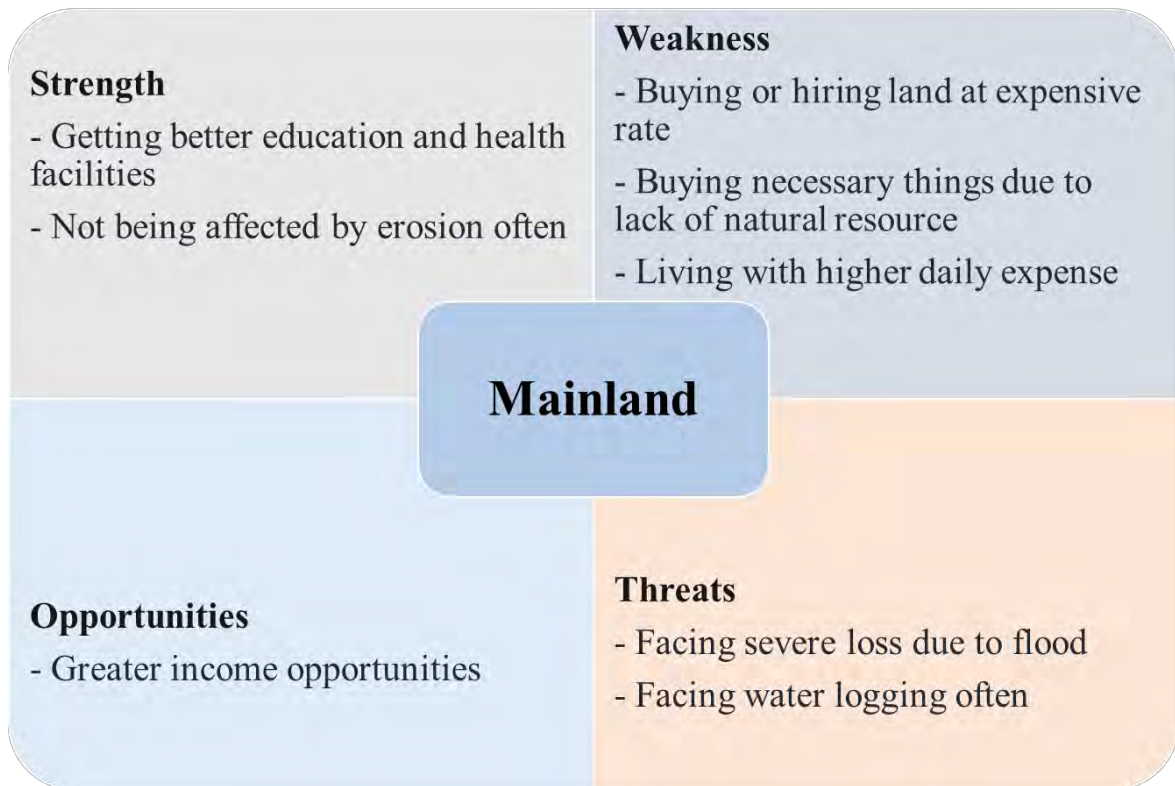


Figure 32: SWOT analysis of survival strategies in Mainland

From the above figure, it is obvious that the Mainland has available education and health facilities. Also, the physical location protects this area from erosion. Various types of income facilities are also an obvious characteristic of this area. The land price, daily expenses, and other facilities are expensive in this area. For this, living here requires a higher income ability. Flood and water logging are common here and due to the high expenses of everything here, the loss due to these hazards is also higher.

5.4 Decision-Making Factors of Internal Displacement

Riverbank erosion is so common in the study area that people have adapted by using their age-old knowledge and concepts. These adaptation strategies are quite planned and preferred by them based on their economic and social standard. The most important of these adaptation strategies is choosing the destination after losing land to erosion. The factors behind their choices ranking according to the importance of different zones are shown here. The author's previous works regarding this result has already been published in the proceedings of the 8th International Conference on Water and Flood Management by Springer Nature Switzerland AG (Ahmed and Murshed 2022).

5.4.1 Factors behind destination choice

Choosing the destination of displacement is not easy as there are lots of uncertainties involved in this process. A total of 15 factors were identified as push and pull factors from the FGDs, household interviews, and Key Informant Interviews (KIIs). Push factors force people to move away from their inhabitation, whereas pull factors motivate people to move into a new location for different socio-economic reasons. These 15 factors act differently for people of different zones. The factors are given in Table.

Table 5: Factors identified from FGDs

Study Zone	Push Factors	Pull Factors
Island Char	Erosion Lower-income facilities Lower land Elevation Marital Status Distance from origin Poor education facilities Inferior living condition Manpower	Surplus of resources Daily expenses Pastureland Relative's Land Land cost Political influence Government help or NGO help
Attached Char	Lower-income facilities Erosion Daily expenses Lower land Elevation Distance from Origin Scarcity of resources Manpower Political influence Marital Status	Government help or NGO help Relative's Land Better education facilities Land Cost Pastureland Better living condition
GOVT Land	Lower-income facilities Manpower Distance from Origin Erosion Relative's Land Marital Status Scarcity of resources Inferior living condition Barren land Daily expenses	Government help or NGO help Political influence Land cost Higher land elevation Better education facilities
Guchogram	Lower land Elevation Marital Status Erosion Relative's Land	Land Cost Government help or NGO help Political influence

	Barren land Lower-income facilities Manpower Poor education facilities Distance from Origin Daily expenses	Better living condition Surplus of resources
Mainland	Erosion Lower-income facilities Poor education facilities Land Cost Daily expenses Barren land Scarcity of resources	Better living condition Distance from origin Higher land elevation

*Factors playing as both push and pull factors are highlighted with same color in the table

5.4.2 Ranking of the determinants (push and pull factors)

Another key focus of our study is to understand the spatial variation among the push and pull factors. It will present the differences in thinking and understanding the displacement opportunities of people from different zones. The preference ranking tool helped to prioritize the identified 15 key factors. Tables 6 and 7 show the preference ranking of push and pull factors, respectively.

Table 6: Ranking of push factors across five zones of Dewanganj Upazila

Ranking of push factors of different places	Island Char	Attached Char	GOVT Land	Guchogram	Mainland
1	Erosion	Lower-income facilities	Lower-income facilities	Lower land Elevation	Erosion
2	Lower-income facilities	Erosion	Manpower	Marital Status	Lower-income facilities
3	Lower land elevation	Daily expenses	Distance from Origin	Erosion	Poor education facilities
4	Marital Status	Lower land elevation	Erosion	Relative's Land	Land cost
5	Distance from origin	Distance from Origin	Relative's Land	Barren land	Daily expenses
6	Poor education facilities	Scarcity of resources	Marital Status	Lower-income facilities	Barren land
7	Inferior living condition	Manpower	Scarcity of resources	Manpower	Scarcity of resources
8	Manpower	Political Influence	Inferior living condition	Poor education facilities	N/A
9	N/A	Marital Status	Barren land	Distance from Origin	N/A
10	N/A	N/A	Daily expenses	Daily expenses	N/A

Table 7: Ranking of pull factors across five zones of Dewanganj Upazila

Ranking of pull factors of different places	Island Char	Attached Char	GOVT Land	Gucchogram	Mainland
1	Surplus of resources	Government help or NGO help	Government help or NGO help	Land Cost	Better Living Condition
2	Daily expenses	Relative's Land	Political Influence	Government help or NGO help	Distance from Origin
3	Pastureland	Better education facilities	Land Cost	Political Influence	Higher land Elevation
4	Relative's Land	Land Cost	Higher land Elevation	Better living condition	N/A
5	Land Cost	Pastureland	Education	Surplus of resources	N/A
6	Political Influence	Better living condition	N/A	N/A	N/A
7	Government help or NGO help	N/A	N/A	N/A	N/A

The above results show the local inhabitants' different acceptance levels of push and pull factors. Our findings also depict that the major push factors are most common in these areas.

Due to riverbank erosions, the inhabitants of these areas become vulnerable from different perspectives, like they do not have any long-term plans or security of education, income

facilities and health. They face various inconveniences every day and everywhere when they become homeless. The unstable and unplanned condition of their life creates various other reasons to displace rather than riverbank erosion. This study shows that other factors, excluding erosion, sometimes become the main reason for the displacement of people in a particular area. Also, the different zones have different types of benefits. Local people usually take benefits from the surrounding environment and have become accustomed to it. That is a significant reason for people's non-migration behavior. They prefer to displace to nearer places to their origins.

Push factors were identified as the factors which make them compelled or interested in going into new habitation. Displaced households were interviewed to understand the local push factors. The ranking tables show that erosion, one of the topmost push factors, is common across the five different zones. These devastating phenomena compelled them to find new accommodations. Though it is supposed to be ranked top of all the factors, it is noticeable that the need for income facilities is not beatable. With the development of education and living style, more and more people are searching for earning sources beyond their living places. Besides, the opportunity for different types of jobs is rare in these locations. Most people earn their livelihood by cultivation, fishing, and temporary work on GOVT projects. There are also some facilities for academic work in Mainland, but that is not enough for all the educated and skilled people in these areas. Also, women do not have many facilities over there. For survival, many women are forced to move into city areas to work in the garment and domestic sectors. So, lack of income facilities is found to be one of the primary reasons for permanent migration.

Due to the occurrence of devastating floods every year, land elevation is also an essential factor here. Naturally, Island Chars are not permanent. These locations face erosion and deposition more frequently than any other zones. Subduction of soil is also very common. So, these people who live on less elevated land suffer the most during flooding events. Hence, elevated land is desirable and often gets prioritized as migrated destinations. Also, local inhabitants in Gucchograms and Attached Chars do not lose any chance to migrate or displace in higher elevated locations.

In addition, the erosion victims want to migrate to safer locations immediately after losing their homesteads. In those cases, the distance of migrated destinations is not an issue. Nevertheless, they always plan to return to their origin, near their lost household, after settling. However, sometimes, the opposite case happens. If the number of adults and earning members is high in a family, they usually migrate to cities and do not plan to return.

Usually, families want to settle their daughters (after marriage) at distant places of origin to keep them free from the suffering of erosion. Also, recently, male and female inhabitants who are not married have moved to towns by themselves and stayed there permanently by marrying there.

The facility of education and health service is very inferior in Island Chars. In Island Char areas, very few families consider poor education opportunities as the push factors for choosing their migrated destinations. The exception is Mainland, where the migration rate due to education facilities is relatively higher.

In the Island Chars, the daily expense is very low as the amount of natural resources is very high. They do not have to pay much for their food and fuel as the Island Char areas are productive enough to supply these demands at a meager or no cost. Besides, the living standard of local inhabitants of Island Char is very low. Therefore many families with lower income facilities prefer Island Char while displacing after erosion. Getting help from relatives is another critical factor in choosing new destinations. Many people chose to shift close to relatives immediately after displacement. Moreover, if anyone has any professional or family links with political persons, it is easier to get land on Island Char. The amount of cultivable land and pasture is abundant in Island Chars, which is a pull factor for the people with lower income from the other three zones, excluding Mainland.

The vast amount of natural resources is the main pull factor of Island Chars which influences them not to choose other locations except another Island Char. Also, the land cost is relatively very low here. However, the reliefs from GOVT or NGOs seldom reach the Island Chars. The people in Attached Chars, GOVT Lands, and Gucchograms are more likely to benefit from relief services. Hence, these places' access to relief services is a pull factor.

The displaced people illegally residing in GOVT Lands seek help from political persons as they are afraid of eviction. That is why political influence is a pull factor for the area. Elevated land is also a pull factor here as it saves them from the severity of floods. The education system and the developed medical facilities are the pull factors for all the areas, excluding Island Char. In Gucho Grams, the land is given by the government of Bangladesh. As it is free of cost people living here do not want to be displaced easily.

Though these ranking positions seem much different in different seasons according to their existing situation (such as during the season of riverbank erosion, it is the leading and top-ranking push factor, but in the dry season, they may focus on income facilities or other factors), this study has focused on the overall sufferings and preferences of the inhabitants. This study is done in wet and dry seasons and the final output is the merged conclusion of their overall condition.

These two tables introduce the ranking of the factors. Nevertheless, if we can understand the reason behind these rankings, it will be easy to identify the needs and sufferings of these people. It will help to design and plan for a better habitation for them. To develop the condition of these people, a better adaptation strategy to natural hazards is a must. Moreover, a further study on the driving factors will be helpful in this matter.

5.4.3 Gender influence on destination choices

The presented factors of destination choice are most of the time gender biased. In this analysis, mainly differences between gender relationships got in the way of power practicing, decision making and thinking. These differences are presented in this section through linking influencing factors to gender relations and gender analysis.

5.4.3.1 Link with influencing factors

The number of female household heads in the study area was very low. In households where the female is the head, the household head is the eldest person and the mother of the eldest male person. That is why she somehow gets the opportunity to give her own opinion on some issues.

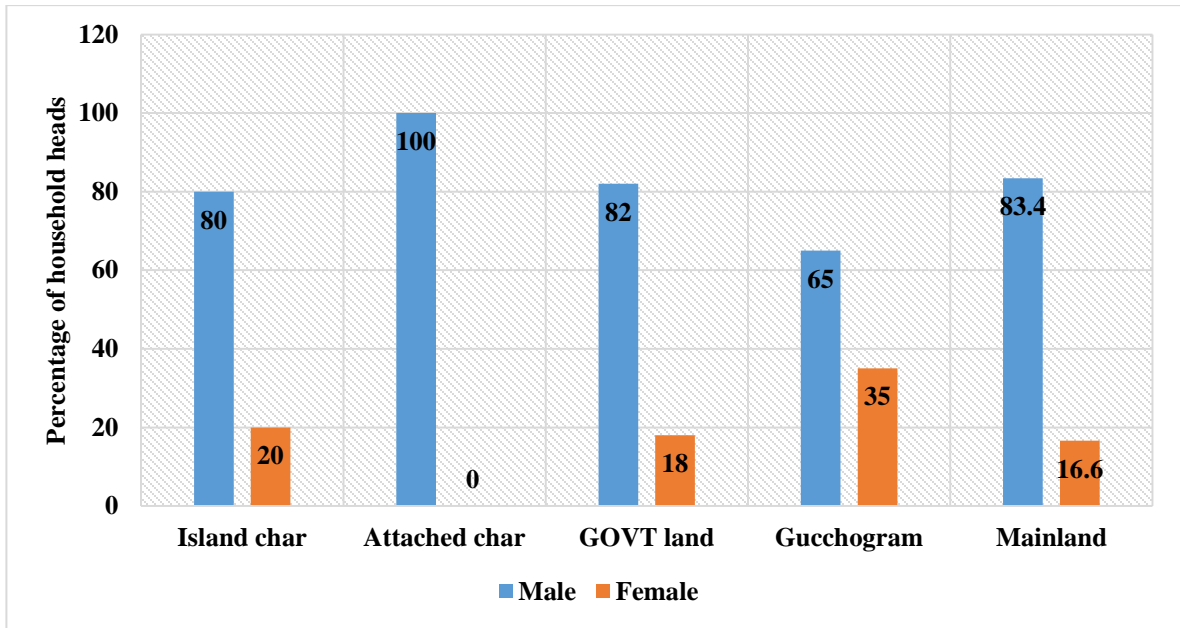


Figure 33; Percentage of male and female household head

Participation in destination choice-making is also different for male and female members. In the Chart below, the percentage is shown for five different zones.

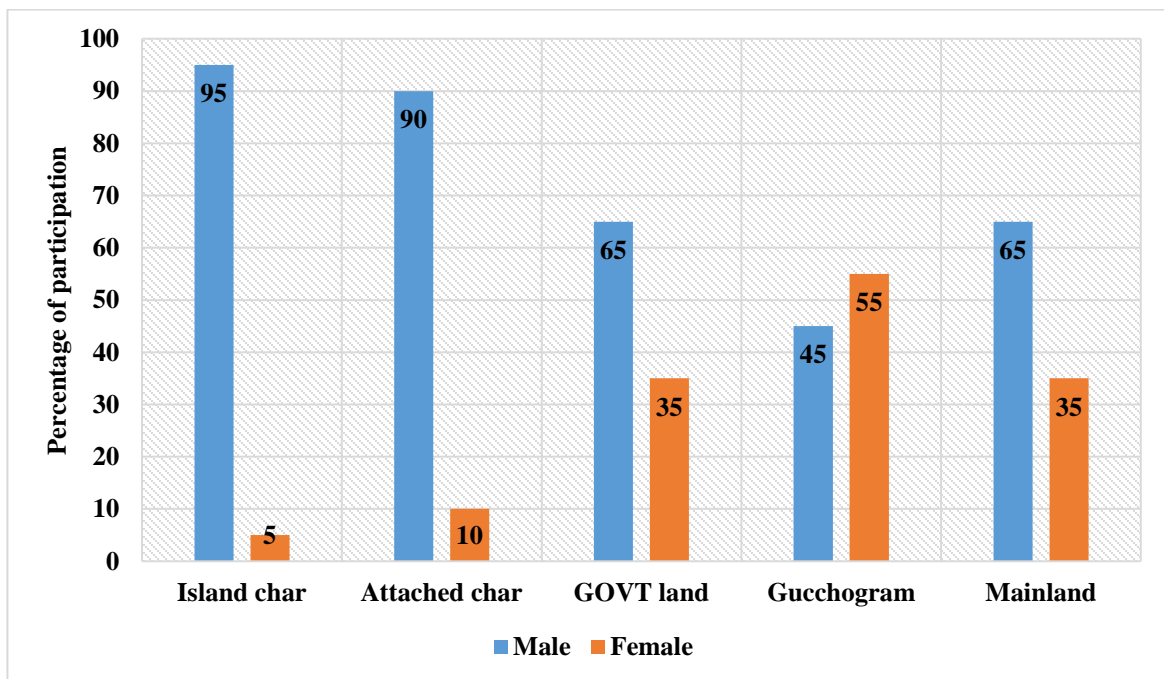


Figure 34; Percentage of male and female participation in destination choice

From these Charts, it is shown that the participation of female members in Island Char and Attached Char is very low. This is because of the financial and educational lacking in these areas. In GOVT Land and the Mainland, the participation of female members is much higher as these areas are much more developed than the Island and Attached Chars. In Gucchograms, female members got an essential role in destination choice-making as they get more benefits as an applicant for land from the government. Nevertheless, overall, the decision-making power of women is negligible to men.

Living condition existing in a place is a factor behind destination choice, which is very much neglected. However, this factor has a positive influence on women members. Water, fuel and food, the three important requirements of human life, are mostly actively or passively arranged by women. Women collect drinking water regardless of whether the collection source is near or far away from the area they settled in. In some households, they also collect water for bathing older persons. This is very time-consuming and hard work. Also, they have to face humiliation if they depend on water sources owned by other households. In the Gucchogram and Mainland, almost every household have a tubewell and they do not have to struggle much about water. But in Island Char and Attached Char, nearly 70% of households do not have their own water sources. In GOVT Land areas, there are 2/3 tubewells for a whole community and the availability is very low. They have to stand in a long queue to collect water.

Fuel collection and storing for flood seasons are only done by the women members. During harvesting, they work in the fields and collect the straws after harvesting. Drying and storing them in a high place and using them during a disaster are done by them. Also, cooking and feeding all the family members is the duty of female members. During normal days or disasters, they have to ensure cooked food. Male members earn and buy the necessary things; in these areas, male members are the main earning persons in the family. However, if we calculate the total workload of men and women to ensure these basic needs, women are obviously taking more workload than men. Men do not bother about drinking water or fuel usually.

Income facilities are another factor behind the choice of destination. Here they keep the focus on income facilities for male members only. The scope of female members to earn money is

far less than men in these areas. Also, due to some social and religious norms, it is not accepted by all to let female members earn money by doing any work. Working women are the victim of humiliation and blame for their Characters. Also, females do not have the options to choose any income source as there are very few options for them. Moreover, they have to choose from available options of earning in the place where the male members decide to live.

Marriage is another factor where it is important to arrange their unmarried daughters' marriage if they are over 12. This should be done before the displacement or as soon as possible just after the displacement. They consider new places unsafe for unmarried girls. So this increases child marriage, which is a significant burden in a girl's life. They must drop out of their schools and colleges and start a new life. Some of them face domestic violence due to dowry. Also, childbirth at an early age makes girls physically and mentally unstable.

Though education is not taken as an important factor by most of the inhabitants in this area, even if they try to give one of their children an education, it will be a boy. A girl's education is not considered necessary. Also, they think going to school and college is unsafe for girls. It will make them forget family values. Also, the distances and transportation systems are not suitable for girl students always.

During disasters, pregnant women and girls having periods are the worst victims. They face it very difficult to maintain hygiene at this time. Moreover, they have some skin diseases from wearing wet and dirty clothes for a long period. They have to stand in the water more than male members to do all the household chores. That is why if the land elevation is not high, women face more sufferings than men.

5.4.3.2 Gender analysis

Though the above factors are directly connected to destination choices, there are some other perspectives which clarify the condition of gender relationships. If the participation of men and women in different sectors is being analyzed, the present scenario helps to understand gender influences.

The Harvard Analytical Framework for gender analysis has this opportunity to analyze the participation of gender groups in activities, access, and controlling different resources and benefits. Here the activity profile is done for productive works which means works with monetary value or profit. In the Table below, we can see that women and men have different types of participation in different types of activities.

Table 8: Gender participation in productive works

Activity Profile - Productive Works		
Activities	Women	Men
Land preparation (for cultivation)	0%	100%
Cultivation or sharecropping	0%	100%
Harvesting	40%	60%
Post harvesting activities	55%	45%
Business	22%	88%
Driving (Rickshaw, van, battery bikes etc.)	0%	100%
Day labour	0%	100%
Fishing	0%	100%
Participating in LGED projects	29%	71%
Storing crops, fruits and vegetables	66%	34%
Selling crops, fruits and vegetables	17%	83%
Tailoring	100%	0%
Katha stitching	100%	0%
Working as housemaid	100%	0%
Animal husbandry	90%	10%
Homestead gardening	100%	0%
Working as service-holder	40%	60%
Working as shopkeeper	0%	100%

Works requiring hard labours like the cultivation process are totally done by men in this area. Women can participate in only harvesting activities. Also works with regular profits are done by male members. Women's participation is prominent in works like stitching, tailoring, homestead gardening and household work services where the profit is irregular. The most profitable work in this section done by women is animal husbandry where the participation of male members is negligible. Female participation in animal husbandry is increasing day by day as there are different projects from the government and NGOs which ensure proper training on livestock management and loan systems to make this sector more profitable.

So from this, it can be said that the participation of women is not negligible though there exists an unequal scenario to some extent.

The reproductive works, which don't provide monetary profit are being listed in the table below.

Table 9: Gender participation in reproductive works

Activity Profile - Reproductive Works		
Activities	Women	Men
Child rearing	100%	0%
Cooking and serving	100%	0%
Taking care of old members	90%	10%
Household cleaning	83%	17%
Construction and household repairing	10%	90%
Shopping	30%	70%
Collection of fuel	86%	14%
Storing of fuel	100%	0%
Collection of water	80%	20%
Livestock care and management	60%	40%
Collection of natural medicines	70%	30%
Seed preservation	72%	28%

In this section, we can see that the participation of men is very negligible except in the works of household repairing, shopping and livestock management. From the field data, it was identified that repairing of the house needs hard labour; shopping and food collection for livestock in some parts of the study area needs a longer journey. Due to social constraints, women's participation is less here. Otherwise, all the work in this list is mostly done by female members which increases the work burden of women a lot. These works require continuous concentration and presence which restrict the mobility of women as well as limits the scope of focusing on personal conveniences.

The after-effect of the result got from the table no 9 is obvious in the table no 10.

Table 10: Gender participation in community management

Activity Profile – Community Management		
Activities	Women	Men
Attending ceremonies	50%	50%
Participating in NGO workshops	50%	50%
Participating in village meetings	0%	100%
Participating in local politics	8%	92%

Women's participation is also lower in most important community management activities. Though NGOs are developing these situations by providing equal opportunities in various workshops, still here is the discrimination visible in this sector which further results in less participation in decision-making.

After analyzing the activities, the access and control over resources and benefits help to clarify the gendered condition more.

Table 11: Gender access and control over resources

Access and Control Profile - (Resources)				
Resources	Access		Control	
	Women	Men	Women	Men
Land	30%	70%	20%	80%
Cultivating equipment	30%	70%	0%	100%
Cash	30%	70%	20%	80%
Education	40%	60%	20%	80%
Training	55%	45%	50%	50%
Water sources	50%	50%	50%	50%

From the table above, it can be said that access and control over resources are also not equal for men and women. In recent days, due to government and NGO projects the participation of women in different trainings is increasing which is making them self-dependent. Also, the number of female students is increasing but there are various obstacles that they cannot

control always. Most of the resources are owned and controlled by the male members of the house which makes them more opinionated and powerful in decision-making.

Table 12: Gender access and control over benefits

Access and Control Profile - (Benefits)				
Benefits	Access		Control	
	Women	Men	Women	Men
Income sources	20%	80%	10%	90%
Asset ownership	20%	80%	20%	80%
Food	40%	60%	20%	80%
Cloth	50%	50%	50%	50%
House	50%	50%	30%	70%
Healthcare	40%	60%	10%	90%
Political power	8%	92%	0%	100%
Social status	30%	70%	20%	80%
Loan programs	70%	30%	0%	0%
Trainings	50%	50%	0%	0%

This table is showing the existing poor condition of women in a society where they have negligible access to most of the benefits except some of the basic needs like food, cloth, housing, healthcare etc. But the control of these needs is mostly done by male members. That is why women are being neglected while making decisions or in some cases, they do not even dare to take any decision in this existing discriminating system.

These things show the gender conditions of the study area being severely unequal. There is no such factor or sector that can be beneficial to the women of these areas. All these things bound female participation in destination choice to a limit. That is why a displacement, new settlement and other works after displacements always create a situation of discrimination between genders

Chapter Six

CONCLUSIONS AND RECOMMENDATION

6.1 Conclusions

Due to the geomorphological Characteristic of Bangladesh, riverbanks cannot be protected from erosion everywhere. Also, a huge number of people living in the floodplain of the rivers cannot rehabilitate due to land shortages and other limitations. Therefore, to eradicate or mitigate the sufferings of erosion victims, it is necessary to know about their choices, survival strategies, requirements and present condition. This study has shown the riverbank erosion and its severity in the study area. The division of study area according to its Characteristics helps to differentiate the effects of different factors on the inhabitants and thus ensures the most effective way to survive. Also, the present living condition and gender influences reveal the development phase of the specific area. The destination choices of the inhabitants will help to plan a rehabilitation policy that will ensure the contentment of the inhabitants themselves. From the data analysis and discussions, it can be concluded that:

1. Riverbank erosion is very unpredictable in nature, especially for an alluvial braided river like Brahmaputra. That is why there is no warning system for this hazard. Loss due to this hazard is more than other natural hazards because people do not get time to be prepared to move to a safer place. Studying erosion victims' responses to this hazard has a significant role in planning policies for erosion victims. Analysis of erosion-accretion patterns help to understand the extent of it in the life of erosion victims. The findings show that this area is very prone to erosion. The total amount of eroded land is around 15.84 sq. km and accreted land is around 9.23 sq. km within the last twenty years. (2000 – 2020). In many cases, the newly accreted lands are not mature and stable enough for the people to live in. GIS analysis of riverbank erosion helps to understand the condition and necessity of internal displacement as the amount of eroded, newly formed and accreted livable land is known by it.
2. Spatial variation of the study area was based on the differences in social, economic and developmental factors. It reveals the necessity of a detailed survey at the field level, where the information vary from one type of place to another. Communication

- systems, daily expenses, land cost, education and health facilities are some of the factors where the responses of the inhabitants vary from one another to a great extent.
3. The qualitative nature of this study made it more open to predicting the diversity of the different areas based on various factors. Most of the information in this study cannot be revealed as quantitative. These qualitative data work like a mirror of the inhabitants' lives to present the proper current conditions.
 4. A major outcome of this study is the coping and adaptation strategy of the erosion victims of the study area. As riverbank erosion is very common in this area and most of the people face it several times in their lifetime, inhabitants have built up self-made survival strategies, and the administration also has plans for their adjustments. People use their indigenous knowledge to cope with the after-erosion effects. Also, they have some planned ways to choose where, why and how to go, and what to do, which gives them a backup while adapting to the situation.
 5. The government of Bangladesh has had a rehabilitation program called 'Gucchogram' or cluster village since 1972. This program rehabilitates the landless, distressed and river erosion-affected people. Though it is a government-led program, many people have issues with it. It is said that people feel ashamed of being helpless and taking help which decreases their social status. However, the facilities of Guccograms are much high, which attracts them to apply for land in Guccograms.
 6. The economic condition of the inhabitants influences their adaptation strategies as well as mobility to another place. Choosing a new place to rehabilitate is mainly based on some factors, almost all of which are economic or related. It also depends on the income opportunities and availability of a place. Also, economic conditions change a person's conception of rights, necessities and facilities.
 7. Flood is also a common hazard in this area. Due to the heavy sedimentation of the Brahmaputra river, the river bed is rising daily, increasing the flood height every year. Two consecutive natural hazards, flood and erosion, prevent these people from becoming economically solvent and conscious about their other basic needs. Surviving is the primary goal of these people.
 8. Lack of knowledge, awareness, security, education and other facilities are the main reasons for gender vulnerability in this area. Due to the continuous effect of disasters,

people cannot ensure proper social security for their family members. Also, many superstitions increase the misconception about gender relationships. Education and other facilities are not always available here. That is why in many cases, female members are considered as drawbacks. They are the victims of child marriage and forced marriage. They are also deprived of proper education, hygiene and health facilities. Hence, they are considered a burden to their families. In power practice and decision-making, women have very low participation. Only a few female members got a chance to be educated, and thus, they became aware of their rights and participated in family issues.

9. To ensure a fair influence from all gender groups in the decision-making process, at first, equal participation in the other sectors is needed. When men and women will get the same workload divisions, same access and same control over different sectors it will be easier to participate in the decision-making process and choices.

6.2 Recommendations

From the experience of this study, the following recommendations can be suggested:

1. In recent years, the government of Bangladesh as well as many NGOs, have initiated different loan systems, training programs, and work opportunities. The effect of these should have a significant role in the life of the inhabitants. The aftereffect of these initiatives can be studied in further research.
2. Riverbank erosion protection structures were not a part of this study. However, including this in the study can find more new ways to adapt and mitigate the disaster. Findings on the required protection system or river management can be a solution from another perspective.
3. A well-planned sustainable rehabilitation program with ensured facilities can improve the backward situation of this area. A sustainable rehabilitation program should ensure the lowest loss due to flood and erosion. Education and health facilities should be available and the scope of income should be increased significantly for female persons. Also, the superstitions and social practices hampering the gender relationship should be controlled strictly. This study may help in planning such a rehabilitation program

4. The results and procedures of this study can be followed in further studies along the Brahmaputra riverbank or other erosion-prone riverbanks.

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**APPENDIX A: RANKING OF DESTINATION CHOICE
INFLUENCING FACTORS**

	1	2	3	4	5	6	7	8		
1	×	1	1	1	1	1	1	1	1	Erosion
2		×	3	4	5	2	7	8	2	Inferior living condition
3			×	3	3	×	3	3	3	Lower income facilities
4				×	5	4	7	8	4	Poor education facilities
5					×	5	5	5	5	Lower land Elevation
6						×	7	8	6	Manpower
7							×	7	7	Marital Status
8								×	8	Distance from origin
1>3>5>7>8>4>2>6										

Figure A 1: Ranking of push factors for Island Char

	1	2	3	4	5	6	7	8	9		
1	×	1	3	1	1	1	1	1	1	1	Erosion
2		×	3	2	5	2	2	8	9	2	Scarcity of resources
3			×	3	3	3	3	3	3	3	Lower income facilities
4				×	5	6	4	8	9	4	Political influence
5					×	5	5	5	9	5	Lower land Elevation
6						×	6	8	9	6	Manpower
7							×	8	9	7	Marital Status
8								×	9	8	Distance from Origin
9									×	9	Daily expenses
3>1>9>5>8>2>6>4>7											

Figure A 2: Ranking of push factors for Attached Char

	1	2	3	4	5	6	7	8	9	10		
1	×	1	3	1	1	6	7	1	1	1	1	Erosion
2		×	3	4	2	6	7	8	9	2	2	Inferior living condition
3			×	3	3	6	7	8	9	3	3	Relative's Land
4				×	4	6	7	8	9	4	4	Scarcity of resources
5					×	6	7	8	9	5	5	Barren land
6						×	6	6	6	6	6	Lower income facilities
7							×	7	9	7	7	Manpower
8								×	9	8	8	Marital Status
9									×	9	9	Distance from Origin
10										×	10	Daily expenses
6>7>9>1>3>8>4>2>5>10												

Figure A 3: Ranking of push factors for GOVT Land

	1	2	3	4	5	6	7	8	9	10		
1	×	1	1	4	1	6	1	8	1	1	1	Erosion
2		×	2	2	2	6	2	8	2	2	2	Relative's Land
3			×	3	3	6	3	8	3	3	3	Barren land
4				×	4	6	4	8	4	4	4	Lower income facilities
5					×	6	7	8	5	6	5	Poor education facilities
6						×	6	6	6	6	6	Lower land Elevation
7							×	8	7	8	7	Manpower
8								×	8	8	8	Marital Status
9									×	9	9	Distance from Origin
10										×	10	Daily expenses
6>8>1>2>3>4>7>5>9>10												

Figure A 4: Ranking of push factors for Guchoqram

	1	2	3	4	5	6	7		
1	×	1	1	1	1	1	1	1	Erosion
2		×	2	2	5	6	2	2	Land Cost
3			×	4	5	6	7	3	Scarcity of resources
4				×	5	6	7	4	Barren land
5					×	5	5	5	Lower income facilities
6						×	6	6	Poor education facilities
7							×	7	Daily expenses
1>5>6>2>7>4>3									

Figure A 5: Ranking of push factors for Mainland

	1	2	3	4	5	6	7		
1	×	1	3	4	1	1	7	1	Relative's Land
2		×	3	4	2	2	7	2	Land Cost
3			×	3	3	3	3	3	Surplus of resources
4				×	4	4	7	4	Pastureland
5					×	6	7	5	Government help or NGO's help
6						×	7	6	Link with political person
7							×	7	Daily expenses
3>7>4>1>2>6>5									

Figure A 6: Ranking of pull factors for Island Char

	1	2	3	4	5	6	7		
1	×	2	3	4	5	6	1	1	Better living condition
2		×	2	2	2	6	2	2	Relative's Land
3			×	3	5	6	3	3	Land Cost
4				×	5	6	4	4	Pastureland
5					×	6	5	5	Better education facilities
6						×	6	6	Government help or NGO's help
7							×	7	Link with political person
6>2>5>3>4>1>7									

Figure A 7: Ranking of pull factors for Attached Char

	1	2	3	4	5		
1	×	1	3	4	1	1	Land Cost
2		×	3	4	5	2	Better education facilities
3			×	3	3	3	Government help or NGO's help
4				×	4	4	Link with political person
5					×	5	Higher land Elevation
3>4>1>5>2							

Figure A 8: Ranking of pull factors for GOVT Land

	1	2	3	4	5		
1	×	2	1	4	5	1	Better living condition
2		×	2	2	2	2	Land Cost
3			×	4	5	3	Surplus of resources
4				×	4	4	Government help or NGO's help
5					×	5	Link with political person
2>4>5>1>3							

Figure A 9: Ranking of pull factors for Gucchogram

	1	2	3		
1	×	1	1	1	Better living condition
2		×	3	2	Higher land Elevation
3			×	3	Distance from Origin
1>3>2					

Figure A 10: Ranking of pull factors for Mainland

APPENDIX B: PRIMARY DATA COLLECTION FORMS

To collect the primary data and get a better understanding of the social, economic conditions, survival strategies, personal choices and gender roles and relationships and policy gaps, FGDs, Household surveys and KIIs were conducted. Following charts have been developed and used based on the preliminary field observations and interviews.

Questionnaires for household surveys and KIIs (Dewanganj, Jamalpur)

Name of Interviewer: Sahika Ahmed

Date of Interview:

Site name:

Household No:

Section 01: Socio- Economic and Demographic Information

1) Respondent details:

a. Household head

b. If not, then what relation with household head _____

Age: _____ Gender: M/F Education: _____

Occupation _____ Annual Income _____

2) Number of domicile family members in the household: _____

3) Information about other domicile members of the family besides the household head

Relation with respondent	Age (years)	Gender (M=1, F=0)	Marital Status (Married=1, Unmarried=0)	Education level (0=Uneducated, 1=Primary, 2=Secondary, 3 = Graduate, 4= Above graduate)

Section 02: Factor wise Analysis

A. Erosion and Displacement

1. Migration Process		Time	Vehicle (Transportation mode)	Destination
	Male			
	Female			
	Aged persons			
	Disable group			
2. Extra workloads during disasters		Erosion		Flood
	Male			
	Female			
	Aged persons			
	Disable group			

<p>3. Which is preferable? Why? Internal displacement=1 Permanent migration=2</p>		preference	Reasons
	Male		
	Female		
	Aged persons		
	Disable group		
<p>4. Who chooses the place to displace? why</p>		Reasons	
	Male		
	Female		

B. Living Condition

1. Which place is more preferable?		Male	Female	Aged	Disable group	
	Island char					
	Attached char					
	GOVT land					
	Gucchogram					
	Dewanganj city					
2. Satisfaction about health facility		Very high	High	ok	low	Very low
	Male					
	Female					
	Aged persons					
	Disable group					
<p>Very high = available at any moment</p> <p>High = Available at specific moments</p> <p>Ok = Available just when necessary</p> <p>Low= Not available also low access</p> <p>Very low = Not available also no access</p>						

3. Sanitation facilities	Pacca		Available			
	Semi-pacca		Not available			
	Kacha		Gender Friendly (Menstrual hygiene) (disable or aged friendly)			
4. Drinking Water facility	Source	Distance	Availability			
	Tubewell	Near	High			
	River water	Far	Medium			
	Groundwater	Very far	Low			
	others					
5. Satisfaction on living condition		Very high	High	ok	low	Very low
	Male					
	Female					
	Aged persons					

	Disable group						

C. Income Facilities

1. Employment		Present		Previous	
	Male				
	Female				
2. Change of earning source	Time	1	2	3	>3
	Male				
	Female				
3. Facilities of Income for non-earning persons in future		Male	Female	Aged	Disable group
	GOVT				
	NGO				
	Agriculture				
	Labour				
	Business				
	Others				

D. Manpower

1. Opportunities to work outside		High	Medium	Low
	Male			
	Female			
<p>High= encouraged to work</p> <p>Medium= No encouragement of</p> <p>Low= Forbidden due to social or other norms</p>				

E. Education

1. How many functioning primary schools are nearby from your locality?	
2. How far is the primary school located from your locality?	<ul style="list-style-type: none"> i. It is in the locality ii. within 1 km iii. 2-3 km iv. 4-5 km v. >5 km
3. How many high schools and colleges are nearby from your locality?	
4. Is there any other learning programs (i.e. vocational, creative learning) in your locality? If yes then specify.	<ul style="list-style-type: none"> i. Yes _____ ii. No

5. Is there any special learning program for women? What is it?	i. Yes _____ ii. No _____		
6. Drop out cases and reasons		No.	Reasons
	Male		
	Female		
	Aged persons		
	Disable group		

F. GOVT and NGO help

1. Type of help		Allowance	Work	Relief
	Male			
	Female			
	Aged persons			
	Disable group			

G. Marriage and Household activities

1. Decisions taken by		Education	Health	Expense	Marriage	Others
	Male					
	Female					
2. Unexpected events		Child marriage		Forced marriage		Violence in home
	Male					
	Female					
3. Effect of marriage		Education		Income		
	Male					
	Female					

Section 03: Coping Strategies

A. Basic needs during disasters

Gender Issues	During Erosion (Temporary displacement phase)	During Flood
Sanitation		
Drinking Water		
Firewood		

Health care		
Gender sensitive issues		
Others		

B. GOVT, NGO and other supports just after erosion

	Food	Money	Land	Others
GOVT				
NGO				
Political persons				
Relatives				

Checklist for KII

Local administration, NGOs and GOVT	<p>Available loan systems in each area</p> <ul style="list-style-type: none"> • Access conditions of loan systems • Maximum and minimum provided amount of loan systems • Interest rate • Installment flexibilities
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	<ol style="list-style-type: none">1. Policies and practices after losing the land and house in river bank erosion.2. Bank protection strategies.3. Impact on educational institutions due to flood and erosion.4. Condition of utility system during and after flood.5. Market price.
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APPENDIX C: FIELD VISIT IMAGES

The location of our study was very dynamic, and underwent many changes within the study period. Photographs captured during different times of field visits that captures the conditions, events and data collection processes.

Field visit 1



Figure C 1: Immediate temporary settlement beside roads and on bridges just after losing household due to erosion



Figure C 2: Temporary settlement beside roads immediately after erosion



Figure C 3: FGD with female persons of Island Char



Figure C 4: FGD with female persons of Island Char (in front of the only one school of island char)



Figure C 5: FGD with male persons of Island Char



Figure C 6: Post harvesting procedure for jute production in Island Char



Figure C 7: KII on the way to Island Char



Figure C 8: Eroded LGED road in Attached Char



Figure C 9: Ongoing geo bag dumping project of BWDB in Attached Char



Figure C 10: Settlement of displaced people beside the abandoned rail line



Figure C 11: FGD with female dwellers in Railline slum



Figure C 12: Sanitation facility in Railline slum



Figure C 13: Railline slum dwellers



Figure C 14: Primary school in Mainland



Figure C 15: KII at UNO office

Field visit 2



Figure C 16: ‘Gucchogram’ the rehabilitation project of Government of Bangladesh



Figure C 17: Temporary thana for security purpose in Island Char



Figure C 18: Household survey in Island Char



Figure C 19: Storing fuel for Monsoon season



Figure C 20: Only transportation system within Island Char



Figure C 21: Deforestation for accommodation in Attached Char



Figure C 22: Primary school in Attached Char



Figure C 23: Drinking water source in Rail line slum

Field visit 3



Figure C 24: KII with NGO officers



Figure C 25: FGD with male persons in Island Char



Figure C 26: FGD with female persons in Island Char



Figure C 27: FGD with male persons in Attached Char



Figure C 28: FGD with female persons in Attached Char