

Exploring Disaster Threats and Adaptation in the Urir Char Union of Sandwip Island, Bangladesh

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Abstract: Being isolated from the mainland, *Urir Char* regularly faces numerous disaster threats. This study intends to explore the disaster threats and adaptation strategies of the island community of *Urir Char* union in Sandwip upazila, Chittagong. Field observations, focus group discussions, key informant interviews, and in-depth interviews were done to obtain primary data. Participatory Rural Appraisal (PRA) techniques such as hazard lists and seasonal hazard calendar aided in determining prevalent disaster threats and their severity based on local people's perspectives. Coastal erosion, cyclone, and storm surge were regarded as the most damaging hazards in the research area. Some sociodemographic factors exacerbated the risks that existed in the area before. Moreover, it has been tried to find out available local adaptation strategies using PARA (protect, accommodate, retreat or avoid) framework. The char dwellers practice a variety of adaptation strategies, including raising the pond boundary, constructing a levee in front of the house, plantation around houses, relocating to a new location, and so on. Approximately 60% of those who participated in the survey had been relocated at least four times from their place of birth. Considering a few criteria such as effectiveness, implementation ability, relevance to vulnerability, suitability for future climate instability, and financial feasibility, it has been assessed that local adaptation practices are inadequate for a sustainable hazard management strategy. Overall, government assistance is required for costly structural adaptation measures in addition to existing non-structured measures to protect the union.

Keywords: Threats, Coastal Erosion, Adaptation, Island, Urir Char.

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1. Introduction

As a low-lying deltaic floodplain in the Ganges–Brahmaputra–Meghna (GBM) river basin (Yang, 2014), Bangladesh faces one of the highest levels of sediment flux at a global scale (Datta et al. 1997). A substantial fraction of this sediment load contributes to the formation of numerous riverine *chars* (land surrounded by water and shaped by accretion in river course or estuary) and islands. It is assessed that several million people live on such fragile and tide-dominated lands. People living on the islands are regarded as victims of nature due to their high exposure to natural hazards and it seems that climate change has aggravated the problem in recent years. However, the island's dynamism plays a significant role in the lives of island dwellers and contributes to forming distinct cultures among them (Sarker, 2021).

Urir Char is a comparatively newer island that was first observed in satellite images of 1973 and people have been migrating towards the north since its development. More than 10 thousand people live on this ever-changing island despite being a pocket of poverty and victim to climate change. The existing disasters in Urir Char are cyclones, storm surge, flood, and coastal erosion. Being a detached union of an island upazila itself, there is scarce literature on the way people of Urir Char cope with the existing threats. This study intends to explore the existing disaster threats and available adaptation options for the dwellers with a view to highlighting the nature of this dynamic island union which needs proper attention.

Urir Char has a lot of dynamic and continual erosional and accretion features as well as it is located on a cyclone's path. As a result, the study area is considered a particularly vulnerable area to cyclones originating in the Bay of Bengal. Additionally, the union is a completely isolated landmass, detached from the main upazila by water bodies, which increases its cyclone vulnerability to a great extent. Therefore, this research is helpful to the academicians and practitioners in the field of disaster management who seek to assist marginalized coastal communities. Furthermore, this study investigates the adaptive ability and coping responses to natural catastrophes on a local level, as well as the shortcomings of these measures, which will open a broad window of opportunity for the academician to learn about the indigenous coping mechanism of local people and assist the researchers to rethink current action plans and policies.

Any sign, condition, or event that has the potential to result in the loss or damage of an asset is considered a threat (FEMA, 2018). At times, the terms hazard and threat are used interchangeably ('Difference between Threat and Hazard in Safety Management', no date). From the perspective of disaster, it is recognized as an event or component that has the capability to exploit livelihoods and assets. Disaster threat varies from place to place, thus its component and parameter. Barnett (2001) identified the events of tropical cyclone, high-velocity wind, flash flood, storm surge, erosion, volcanic eruption, earthquake, tsunami, drought, El Nino and La Nina events as threats for Island.

The IPCC (The Intergovernmental Panel on Climate Change) defines adaptation as an interconnection among ecological, social, or economic systems as a result of real or projected changes in climatic stimuli and their implications to reduce the negative effects of change or capitalize on new solutions in its third assessment report (IPCC, 2012). In

response to the climatic anomalies and physical vulnerabilities, islanders partake various adaptation methods. Regardless of their nature, adaptation responses are constrained at the local scale by local needs and contexts. These requirements for adaptive capacity can be classified as technical, economic, financial, or social in nature (Hinkel et al., 2018) to improve assets, flexibility, learning, and agency (Cinner et al., 2018). The sociocultural origins of island communities, their traditional knowledge systems, and their linkages to the natural coastal environment all affect their adaptation responses (McMillen et al., 2017).

The broad aim of the study is to explore the disaster threats and adaptation strategies of the island community of Urir Char Union. More specially, the following objectives will be dealt with in more depth: a) to identify the diverse hazards and portray the seasonality of different hazards in the study area; b) to elucidate the adaptation measures of the local people and identify the weakness of these measures.

2. Materials and methods

2.1 Study Area

This study was conducted in the Urir Char union of the Sandwip upazila in Chittagong district. The GBM (Ganges-Brahmaputra-Meghna) river basin sediment formed this offshore island (Hussain et al., 2013). This small island lies in between 22°36'25" to 22°43'28" N and 91°18'55" to 91°23'15" E and surrounded by Sandwip channel in the east, Companyganj upazila is on the north, and Meghna estuary on the west (Alam et al., 2005).

Urir Char is considered a significantly exposed zone to the cyclone that originates in the Bay of Bengal (Alam et al., 2005). Cyclones of the year 1985 and 1991 have wreaked havoc on the union. Although the union is completely exposed to the sea, there is no protective embankment. Every year the landmass changes due to the erosion and accretion process of land (Hussain et al., 2013). So, the area has been chosen to explore as it is essential to portray the disaster threats of the island union and draw a link between seasonal variations and disaster events which help to look for better adaptation measures.

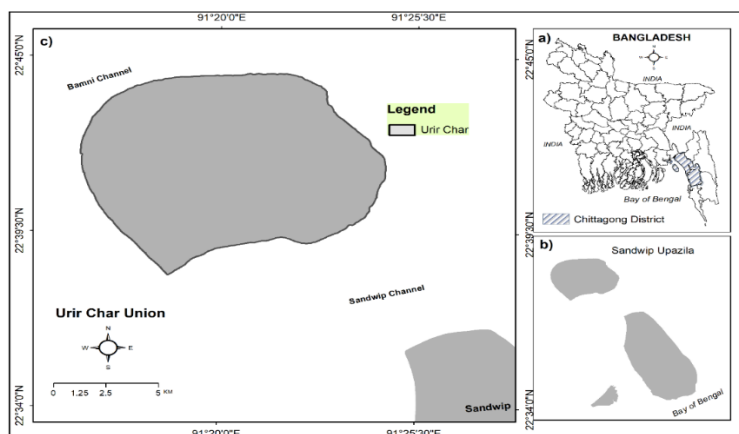


Figure 1: Location of Study area (c) Urirchar -an isolated union of (b) Sandwip upazila in (a) Chittagong district (Source: Compiled by Author, 2023)

2.1.1 Topographic characteristics

Agro-ecologically, this island is known as the Meghna Estuarine Charland (FAO-UNDP, 1988). The area's landmass was formed by the lower Meghna river's silts, which are a variety of sediments derived from the GBM river system.

2.1.2 Land Use

Urir Char union has three mouza and most of the land uses exists within the area for residential and agricultural uses. For Bangladesh Forest Department's coastal afforestation effort, more than 30% of the land has been brought under planting mangrove forest (Hussain et al., 2013).

2.1.3 Infrastructural pattern

The communication system is not well developed and most of the roadways are *Kacha* (unmade road), where people generally use local vans, rickshaws and motorcycle as the main mode of transportation. Besides, waterways are a vital part of the communication network. Most of the houses in this area are mainly *kacha* houses which are made of mud, bamboo, metal tin, wood, and straw of paddy. Communities aren't financially stable, nor are their homes.

2.1.4 Climatic Characteristics

The area has a humid tropical monsoon environment with an annual average rainfall of about 3000 mm and the area receives more than 90 percent of rainfall between March and October (SRDI, 1997).

2.1.5 Demographic Characteristics

Despite being an environmentally vulnerable union, most of the inhabitants came to this newly developed island for better economic opportunity from the nearest Sandwip island. According to Population and Housing Census Report 2011, the total population of this union is 13,323, and the total male and female populations are 6,425 and 5,498 respectively. The population density is 130/km². The literacy rate of this island is nearly 26.40% (Banglapedia, 2021). It has only one middle school and four government primary schools. There is no college here which is frustrating for the local people (Field Survey, 2023).

2.1.6 Occupation

The area evolved mainly as an environmentally dependent region and hence the major occupation of the dwellers is fishing, agriculture, and animal rearing. Thus, in Urirchar, farming is the primary source of income for most residents. They have cows, goats, and buffaloes as their property. Agricultural products from this region are supplied to Sandwip, Noakhali, and Chittagong (Field survey, 2023).

2.2 Research Design

This study was designed using a combination of primary and secondary data collection on the disaster threats of Urir Char. A survey-based technique was used to obtain data on the target groups' individual experiences. The acquired data were analyzed using a variety of approaches, and the data analysis assisted in determining the study's overall outcomes and

key findings. The study employed several qualitative approaches to elucidate personal experiences and adaptation strategies.

2.2.1 PARA framework

The first IPCC Climate Change Assessment Report of 1990 delineated three approaches (protect, accommodate, retreat) that could be used for coastal communities in the preparation of climate change-related sea-level rise (Dronkers et al., 1990), and fourth 'avoid' option included by experts and researchers of this area (Middle, 2018). These are stated as the 'PARA framework' which consists of four major techniques. *Protect* approaches refer to the engineered structures and systems used to protect against threats. For instance- dikes, floodwalls, diversion structures, etc.. *Accommodate* methods are those adaptive solutions that are aimed to enable ongoing use of flood-prone locations by enhancing the resilience of communities or valuable services to occasional flooding, or by reducing damage in these areas. For instance- raised structures, flood proofing foundations, etc.. *Retreat* approaches involve when houses, communities, buildings, and infrastructure that have been subjected to repeated flooding or inundation are moved permanently to safer places, this is called a retreat strategy. For example- building setbacks, relocation. Strategies that try to prevent new dwellings, communities, facilities, or infrastructure from being built in flood-prone areas in the first place by taking proactive measures to prevent them from being built are known as *avoid* methods. This framework has been explored by several research (Bott & Braun, 2019; Benioff et al., 1996) to figure out and improve hazard mitigation approaches for various communities. In this study, we also used this framework to explore the adaptation strategies of the local.

2.3 Primary and Secondary Data

2.3.1 Primary Data

A 7-day field visit to the study area Urir Char was conducted to gather primary data. A local respondent helped the researchers to conduct this study throughout their stay in the island. Primary data was gathered using field observation, key informant interviews, focused group discussions, and in-depth interviews. People who have been living on Urir Char Island for at least 20 years were targeted for in-depth interviews, and around 40 respondents with a history of exposures were interviewed individually in the study area using the snowball survey approach.

2.3.1.1 Direct Observation

The researcher of the study directly collected data through visiting the area while observing, asking, seeking problems and solutions. For the study purpose, researchers visited the selected places recommended by local people which are more vulnerable to coastal erosion and storm surges. Besides, some governmental and non-governmental offices who directly provide services to the affected people were also communicated to gather information.

2.3.1.2 Key Informant Interview (KII)

Data were also collected from some key persons who are specialized and directly or

indirectly affected by several hazard events. They were local school teachers, religious representatives, local union parishad chairman (both male and female). The key informants were interviewed face to face to validate the survey findings and their comments are also taken into consideration for analysis.

2.3.1.3 Focus Group Discussion (FGD)

For our study total 3 focus group discussions have been conducted where people from similar experiences were gathered. The average number of participants in the focus group was 6 to 8. Both male and female participants were part of the focus group discussion. Different occupations like farmer, fishermen, businessman, homemakers etc. were respondents in the FGD.

2.3.1.4 In-depth interview

To get individual response, in-depth interview has been carried out following a semi-structured questionnaire pattern. The number of the sample population was 40 (male 26, female 14). Interviews were done in a variety of settings, including people's houses, open places, tea stalls, bazar area and while roaming around the village.

2.3.2 Secondary Data

A review of related literature provides concrete information on history, physical features, existing environmental risks, undertaken policies related to the study area. An extensive literature review was carried out through studying different peer-reviewed journals, newspaper articles, books as well as published official reports of government and non-government and international organizations.

2.4 Data Analysis

In analyzing phase, at first, the collected field data were reviewed thoroughly to check the relevance with the research aim and objectives and filtered thereafter. The sorted data were analyzed afterward with mixed analysis.

2.4.1 Quantitative Analysis

Quantitative analysis was also performed in microsoft excel to determine the percentage of the answers given by the sample population in response to the questionnaire.

2.4.2 Qualitative Analysis

2.4.2.1 Narrative Analysis

To obtain the raw sense of the miseries of the Urir Char dwellers, individual interview records were taken with prior permission to understand their personal experiences. People in the area conveyed their feelings in their local dialect, "Sandwipi," a Chittagonian dialect. Since the author is also from Chittagong, she transcribed and translated those into English, then double-checked the accuracy beside the audio recordings.

2.4.2.2 PRA analysis

Several PRA (participatory rural appraisal) tools like hazard profile, seasonal hazard calendar etc. were used to focus attention on community people, prevailing threats, and their experiences.

3. Result and Discussion

3.1 Vulnerability and exposure to natural hazards in the study area

3.1.1 Geographical conditions that intensified the threats

3.1.1.1 Active erosion process

Urir Char is situated near the mouth of the Meghna estuary, which is well known for its strong geomorphic activity. As a result, both erosion and accretion may be seen on this island. All of the people who took part in our survey said that they had to move at least twice in their lives because their homes were washed away by erosion. Despite the erosion, there is also seen accretion in other parts. Though those lands have not been stabilized for human habitation. Locally strong political figures, on the other hand, use such territories for their personal gain.

3.1.1.2 Being A Detached Union of an Island

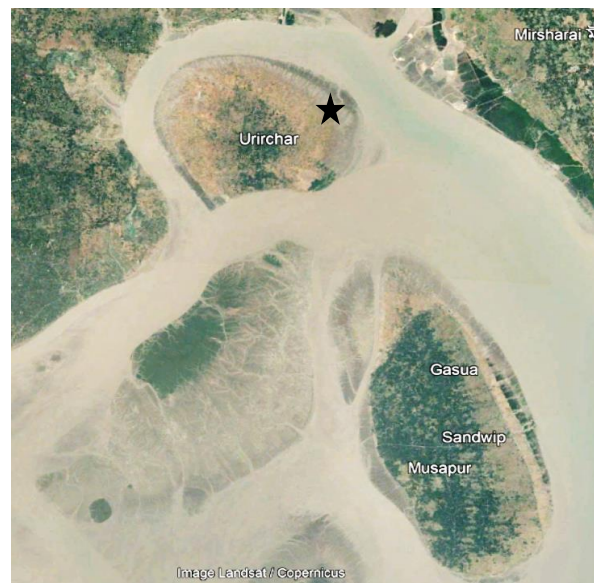


Figure 2: Urir Char, a detached union of Sandwip upazila

(Source: Google Earth image, 2023)

According to local people, due to the island's geographical distance from its higher administrative unit, development activities on Urir Char are often delayed. During a catastrophe, the situation worsens. Because of the island's remoteness and lack of transportation, affected locals get disaster relief materials much later than those in other neighboring unions. The absence of timely assistance supplies increased the vulnerability

of the affected community. In the FGDs, a respondent indicated the inadequate transport system as:

“It is impossible for us to transport an emergency patient to district or upazila hospital for better treatment during crisis moment.”

It experiences locational biases from non-government organizations and humanitarian workers as a disconnected union. As a result, island inhabitants only see red cross volunteers during catastrophe relief efforts.

3.1.1.3 Socio-demographic conditions that intensified the threats

i. Family size:

Poor socio-economic conditions that were likely to affect the coping capacity of the respondents include household size, housing patterns and livelihood capitals, contributing to disaster susceptibility. The results of the study show that most families have more than five members (figure 3). Thus, the breadwinner of the family has to ensure not only daily necessities but also socio-economic stability for each family member throughout the year.

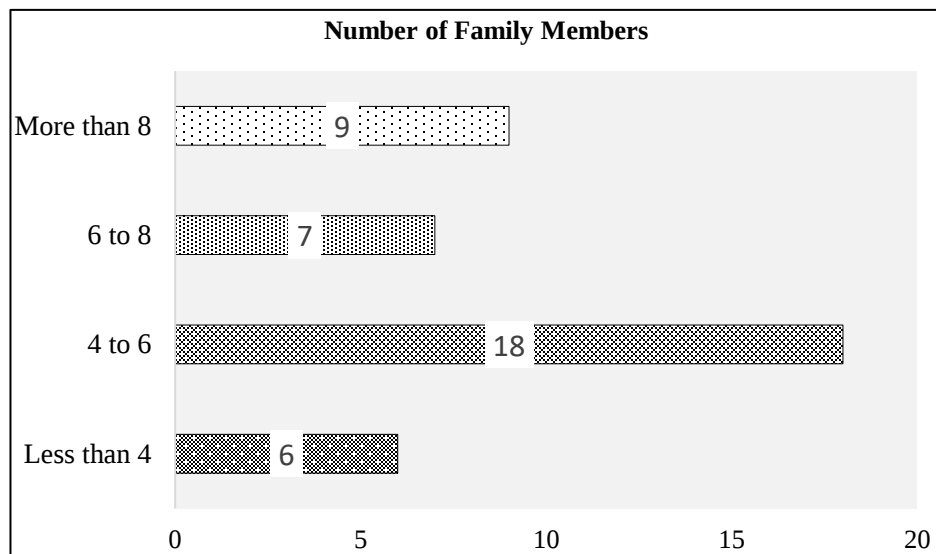


Figure 3: Number of family members (Source: Field survey, 2023)

ii. Housing type

Locally accessible materials such as mud, straw, bamboo, and tin sheets were used to construct houses and settlements in the study area, with skilled labor but having limited knowledge on disaster response. Based on the survey data, the study classified housing patterns into three categories: Kacha (82%), Pucca (10%) and Jhupri (8%). These houses are not able to endure the high-velocity wind of cyclones nor able to withstand coastal flooding. As a result, each household invests in restoring their homes to livable standards every year, resulting in an additional burden. A survey participant stated the condition as:

“I used to live in a semi-pucca house with my family. After losing it because of erosion, I along with my son build a kacha house in another land. Every summer, we have to reinforce it to withstand coming hazards. But flood events damage it mostly. It’s tough for my family to reconstruct or repair it after every hazardous event with our small family earning.”

iii. Displacement frequency and type

Because of the severe consequences of coastal erosion, the majority of the respondents (60%) have relocated their houses more than four times in their lifetime, while the rest shifted two or three times. In addition, the most prevalent sort of displacement was from one community to another (67%) or neighboring villages, and some of the respondents (31%) shifted within their own community. Only a few (2%) of them left the island and settled in the nearest area. On the other hand, new land acquired because of the accretion process provides no benefit to the local population. Furthermore, the study found power dynamics in land allocation and acquisition.

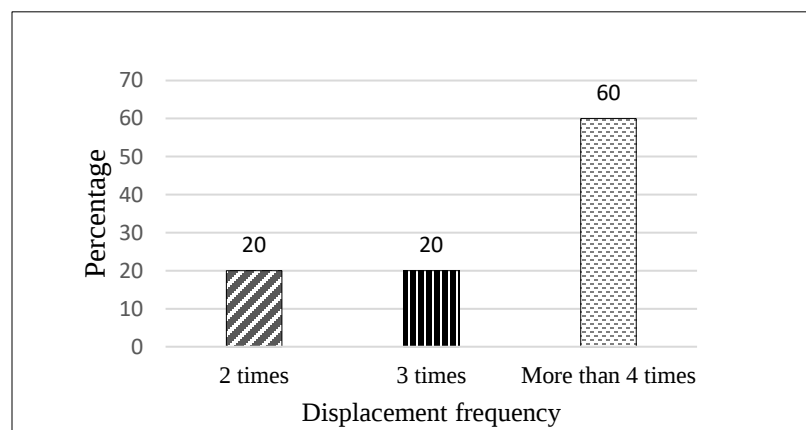


Figure 4: Displacement frequency of the respondents (Source: Field survey, 2023)

iv. Knowledge of disaster risk

Poverty and inaccessible communication pathways hamper access to essential services. Most of the respondents are illiterate (63%), and only a small percentage of them received primary (24%) or secondary (10%) education in their locality. Only a handful of individuals managed to complete their graduation from the closest cities. In addition, the illiteracy rate is higher in the female. There is no college in the area, and male students are forced to migrate to the Sandwip town area to obtain educational facilities, which is not always feasible for female students. As a result, early marriage is also common in this locality.

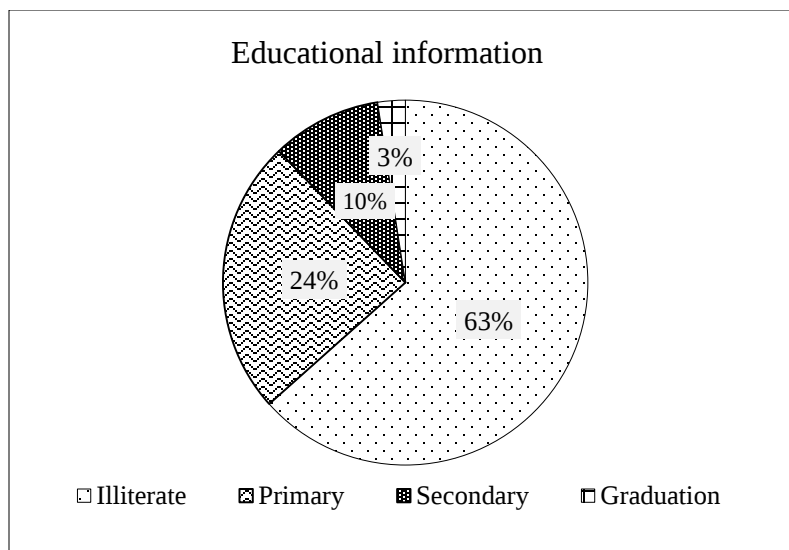


Figure 5: Educational qualification of the respondents (Source: Field survey, 2023)

Therefore, a substantial percentage of the respondents have no knowledge about the adverse effects of climate change and global warming, and almost half of the participants were unaware of the early warning and forecasting system. The lack of awareness about preparedness and mitigation within the locality increases the vulnerability of habitats in response to coastal disasters. A participant explains the present situation of cyclone preparedness as:

" We receive early warning information mostly from the volunteers of Red Crescent society. There are 5 to 6 teams of red crescent working in this area. It's tough for them to cover the entire region before a coming cyclone."

v. Administrative infrastructure in the post-disaster period

The people of this island experience bias from non-governmental or non-profit organizations. From the survey, the study found that the only volunteers from the Red Crescent Society usually work during the post-disaster period for relief distribution. Maximum participants (95%) from the FGDs and questionnaire survey mentioned that relief distribution lacks in maintaining equity. Several variables like bad weather and poor transportation made the situation more difficult. Moreover, the provision of emergency medical services is not adequate in the study area. Most of the participants (97%) stated that they did not get any emergency medical care which increased their exposure to a secondary health hazard or a disease outbreak such as cholera, diarrhea in previous times.

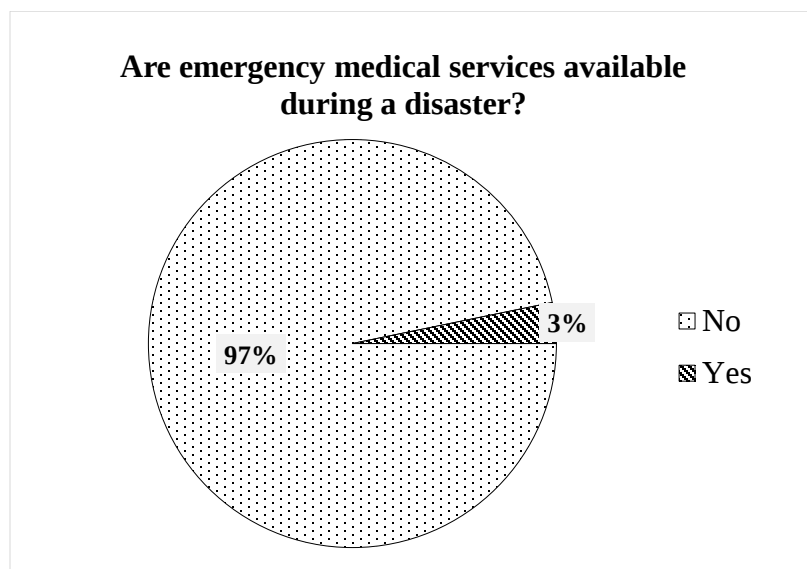


Figure 6: Respondent's view on the provision of emergency medical services (Source: Field survey, 2023)

3. 2 Hazards profile of the study area

Within relatively small geographic distances, threats vary considerably, and not all hazards pose significant threats to each community. As a result, it is necessary to define hazards in order to conduct further assessment and categorization (Jane Preuss, 2006).

This study obtained the hazard concern for this area from the focus group discussion. Respondents listed prevailing hazards in their village based on their experience, which was also cross-checked during the KII.

Table 1: Hazards Profile of Urir Char

Sl no.	Hazard / Threat	Frequency	Severity	Time frame	Rank (result obtained from FGD)
1.	Cyclone	High	High	Annual	1
2.	Storm Surge	High	High	Annual	1
3.	Coastal Flooding	High	Moderate	Annual	2
4.	Coastal Erosion	High	Moderate	Annual	1
5.	Drought	Moderate	Low	Annual	3

(Source: Compiled by author from field survey, 2023)

Table 1 illustrates local people's perception regarding hazard-specific occurrence, impact and ranking. Author followed suggested indicators for severity and frequency analysis (Malakar and Bhandari, 2012) to create a hazard profile of the study area based on collected information provided by FGD respondents.

Due to the high occurrence and impact of cyclone, storm surge and coastal erosion, local peoples ranked these as number 1. Coastal flooding ranked second with high occurrence but moderate severity and impact level. Drought ranked third due to its moderate probability of occurrence and low impact.



Figure 7: Land erosion scenario of the study area (Source: Field survey, 2023)

While conducting the in-depth interview, coastal erosion and coastal flooding are regarded as the most catastrophic phenomenon in the study area. According to a survey participant,

“Coastal floods, it destroys everything. There is no development work. Even in a short duration flood, our villages and roads get damaged.”

The continuous erosion of this offshore island forced people to relocate the house and damaged local livelihood capital. A participant elaborated on the intensity of the present erosion condition as:

“The erosion destroys our home. It destroys everything. Occurs mostly in June July. There is no specific time for river erosion nowadays. It didn't occur in Winter before. But recent sand extraction from rivers exacerbates the intensity of river erosion.”

Besides natural calamities like coastal flood and erosion, cyclone, storm surge and drought are also prevalent in the study area and make their living condition more miserable. One respondent said that,

“We're living with disasters. Even a small tide can cause a flood here. We have every kind of disaster in our area - cyclone, erosion, drought, salinity, flood. The southern part is most vulnerable to disaster.”

3.3 The Seasonality of Different hazards

The geographical location of the Urir Char made the area more vulnerable to coastal hazards. Every cyclone that developed in the Bay of Bengal hits this locality, whether it's a severe cyclone or moderate, it always has an impact on the infrastructure and livelihood. On the other hand, locating in the Meghna River Estuary exposes it to high magnitude coastal erosion. The seasonal high amount of water flows in the Meghna estuary results in such coastal erosion for a long period. Throughout the year, the people of this area have to deal with such weather and climatic anomalies.

Hazards have a time-space geography, with varying chances of producing harm of various magnitudes in different parts of the world (Wisner et al. 2004). The seasonal calendar technique is useful for keeping note of regular cyclical periods (seasonal) and noteworthy events that occur throughout the year and have an impact on the community's life (Tripp and Woolley, 1989; IIRR, 1998).

Table 2: Seasonal Hazard Calendar of the Urir Char

	Jan	Feb	March	April	May	June	July	August	Sept	Nov	Dec
Coastal Erosion											
Strom Surge											
Coastal Flooding											
Drought											
Cyclone											

Moderate
 High

(Source: Compiled by author from field survey, 2023)

The seasonal hazard calendar depicts the season-wise extreme environmental calamities of the Urir Char Island. From FGD, it has been found that the presence of coastal erosion was observed in this island throughout the year, although the intensity of coastal erosion is particularly strong from April to August. Respondents of KII said that, previously, it was minimal during the winter, but it now occurs throughout the year. From April to August, the region witnesses environmental stress of both storm surges and coastal flooding. On the other hand, the island dwellers observe the occurrence of drought from May to July. Cyclonic events are common from April to August.

3.4 Adaptation Scenarios of the Study Area

Local consensus on adaptation decisions is difficult to achieve because people in communities differ in their awareness of climate change threats, preferences for the sharing of benefits and costs of action and inaction, emotions and attachments to locations, and future expectations (Barnett *et al.*, 2014). When asked locals about their reaction to any threats, they frequently said, "*There is nothing to do against nature*" and '*Do nothing*'. These statements exemplify their helplessness. Nur Nabi (age 23) a student stated that '*local people tried to grab the attention of the concerned authority, political leaders about their problem but no one has taken any effective decision yet. they knew and informed about people's sufferings but somehow ignore them and this has made them more marginalized*'. This study followed PARA (protect, accommodate, retreat, avoid) framework of IPCC, to identify available adaptation measures of the local.

Protect	Accommodate	Retreat	Avoid
• Absence of any hard structure like any embankment or sea wall • No action (do nothing)	• Elevated the plinths to protect from flood water and others • Plantation to reduce the impact of storm surge • Raise pond boundary to save water from flooding • Construct levee like structure in front of the house	• Relocate house to comparatively safer location • Moved permanently to nearby places particularly in the northern areas of the union	• Avoid to make new establishment along the coast

Figure 8: Available adaptation options in the study area (Source: compiled by author, 2023)

3.4.1 Protect

The absence of any embankment makes them more helpless in the face of a cyclone, flooding, or erosion hazard. Local people and local organizations made several human chains to seek assistance from the authority for effective measures against erosion. Respondents said that the government of Bangladesh's proposal to construct a cross dam, a block dam, or an embankment to safeguard the land of Urir Char from river erosion has made little headway so far ('Tk 636 crore cross dam project to connect Urir Char with Noakhali - The Business Post', 2021).

One respondent expressed his helplessness by saying that '*There is nothing to do against erosion, it's not possible for us alone to take any step. Thus, we do nothing but pray. In any hazardous event, we arrange a Dua Mahfil for protection from erosion.*'

3.4.2 Accommodate

People move structures to a higher elevation to safeguard important infrastructures, such as cyclone shelters, hospitals, schools, and homes, from coastal floods or cyclones. Before the monsoon, people usually repair their houses which is quite common in the area. The residents also construct a levee in front of their homes to safeguard them against coastal flooding. The material of the levee, which can be either earth or cement, is determined by the socio-economic level of the population. Moreover, planting trees around the house is a traditional approach that gives people faith that they will reduce the impact of cyclonic storm. Apart from that, to reduce the impact of flooding and other associated hazards, the locals developed an adaptation strategy that included building an earthen mound around the pond to keep the freshwater from being contaminated by saltwater.

3.4.3 Retreat

Approximately 60% of those who participated in the survey had been relocated at least four times from their place of birth. As a result, residents relocated to the Sandwip, Sitakund, etc. Relocation is occasionally observed within the Urir Char union particularly towards the north as the erosion is approaching from the south. In that circumstance, people are more likely to choose a safer location that is less subject to erosion.

3.4.4 Avoid

Local people have identified specific sites that are more prone to erosion than the rest of the area, with the help of several non-governmental organizations and government experts. These areas have been labeled as "vulnerable." Residents in the study area are discouraged from building new homes. Some people, however, have no choice but to remain in the danger zone until the very last moment.

3.5 Evaluation of Adaptation Measures

Even if the PARA framework is beneficial to coastal communities' adaptation, not all the measures are sustainable across all criteria (Table 3). Based on literature review and KII interview, practiced adaptation options has been tried to evaluate based on several criteria.

Table 3: Evaluation of the adaptation measures

adaptation options Criteria	Raising the structure to a higher elevation	Constructing a levee	Plantation around home	Building an earthen mound around the pond	Relocation to comparatively Safer Place	Avoidance
Effective for adaptation	High	Moderate	Moderate	Low	High	High
Implement ability	Moderate	High	High	High	Low	Moderate
Feasibility	Moderate	High	High	High	Moderate	low
Relevance to the vulnerability	High	Low	Moderate	Low	High	High
Suitability for future climate crisis	High	Low	Moderate	Low	High	High
Economic viability	Low	High	High	High	Low	High

(Source: compiled by author, 2023)

It is useful in the study area for hazard adaptation to raise structures such as roads, housing, and schools to a higher elevation, which makes them more resistant to future climate extremes. The problem is that it isn't cost-effective rather expensive. The implementation of this strategy will be uneconomical and will only have a moderate level of implementation capability. Again, the houses of the study area become submerged during

floods and cyclone-induced storm surge. Levees are built in front of the houses to protect them from flooding. The water level can sometimes rise over the height of the levee, leaving it ineffective of protecting against flooding. It is economically viable and feasible to deploy because it is composed of both soil and cement. Many locals are skeptical that it will be capable of withstanding the terrible weather conditions in the future. On the other hand, the homestead plantation is great at reducing the impact of storms. Previous hazard incidents have led them to believe in this strategy, even though it may pose a secondary risk by toppling on houses during a severe cyclonic storm. About Earthen ridges, they cannot operate efficiently since they are formed of earth, making them less effective as a means of adaptation. Because of this, it is not well-suited to withstand any future climate-related extreme event. During normal flooding, earthen embankments have a high level of feasibility and economic viability because the material needed to construct them can be obtained from nature. In order to relocate after losing a home to erosion, one must have substantial financial resources and occupy a significant quantity of land. Those who have both land and money can relocate in a planned way. Concerning climate change, it is a good fit for the future.

Nur nabi (age 23) stated that *‘I have no memories of my grandfather. He passed away while residing in his previous home. We came here in 1980 from Dhirgapar, Sandwip after being displaced due to erosion. Since then, we displaced for 4th time. Following the grandfather's death, the grandma takes charge of the family. We and our uncles lived in that family under grandmother's care. However, I have not observed any of these. My father and uncle, each has a separate home in a different location now. The joint family separated due to river erosion. However, today my father has returned to my uncle's house after nearly two decades. Due to the river's proximity, we're constructing another new house to the north. That is why, today, our house has been demolished, and we are staying at uncle's house for a few days. My father yearned for his old house often’.*

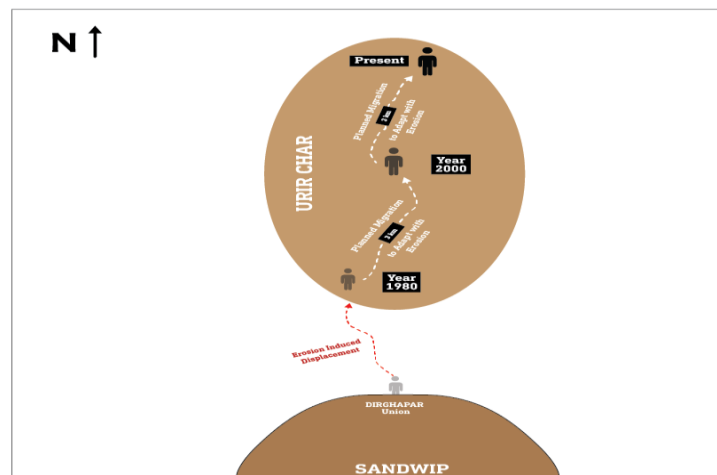


Figure 9: Displacement scenario of the respondent ‘ Nur Nabi’ depicted in the illustration to show his mobility pattern through planned relocation of his family (source: Compiled by author from Field survey, 2023).

As the erosion is approaching from the south, they relocated to the north a few days ago. They are tensed about their future, as there will be no further place for relocation. In our survey, we found some people who are unable to plan ahead of time and wait until the last day to relocate. Many people cannot afford to relocate because it is so costly. Thus, they lead a compromised livelihood throughout their life being trapped on an isolated island.

A 45-year-old fisherman and his family lived together having six members. He is, however, terrified, as his house is on the verge of disappearing into the sea. According to him,

“I do not know what to say but I never ask for any help before. I had been displaced seven times since 1985 when I arrived from Sandwip. But I am helpless now with my large family. I have no other land, savings or any relative who can help. I cannot sleep at night and only pray so that the coastal erosion takes delay so that I can stay here a few more months.”

Regulation and zonation are relatively more technical than the other adaptation strategies in that they require specific knowledge and expertise. It is efficient for adaptation but as the land is reducing due to erosion, people are left with fewer choices.

4. Conclusion

Despite significant advances in the government of Bangladesh's comprehensive disaster management policy, localized vulnerability factors were only partially considered. The data presented in this study illustrated that Urir Char is facing significant challenges in managing extreme climatic events. Coastal erosion is the most distressing issue to which people are utterly helpless to respond from their individual perspectives. Many responders choose the retreat option to adapt to the continuous erosion. Leaving their former home is heartbreaking and costly sometimes. Most households developed manual adaptive responses based on their prior experiences in response to other coastal threats. To reduce the disaster vulnerability of the community of Urir Char, capacity development programs and training should be run at the village level to enrich the understanding of disasters and adaptation capacities. Each hour, the land loses landmass, making life more difficult for the char. Climate change will pose a serious threat to char dwellers, and it should be addressed. Along with prevailing non-structured measures, government help is required for costly structural adaptation measures. Thus, this research tried to elicit information concerning local knowledge about existing natural hazards, as well as their adaptation to the current circumstances. This study explained that local solutions to existing hazards are inadequate for sustainable hazard management.

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