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RESEARCH ARTICLE

TRENDS OF CLIMATIC PARAMETERS AND RESILIENCE PRACTICES OF CLIMATE DISPLACED PEOPLE OF SOUTHERN COAST OF BANGLADESH

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ABSTRACT

Climate change is an extremely crucial issue in Bangladesh and is affecting people displacement in Bangladesh both sudden and gradual environmental change. To conduct the study, both the qualitative and quantitative approaches was adopted, the primary data are collected through participant observation, key informant interview (KII), Focus group discussion and Questionnaire methods. In total, 120 questionnaires were operated in 3 unions. In addition, estimate of Displacement hazard impact analysis, weight analysis, and effective adaptation analysis with various Ranking. The study prescribed 14 adaptation policies for resolving climate displacement problem, in which Incorporate climate Change in long term planning, Grass plantation, Multi crops cultivation in a land Promote awareness, Embankment construction, Salt production Using deep tube-well for pure drinking water, Livelihood skill development are highly effective adaptation policies. This study will help for resolving the displacement problem and overall adaptation goals.

KEYWORDS

Quantitative, Environmental Change, Displacement, Adaptation

1. INTRODUCTION

Recent years have seen a global catastrophe brought on by climate change. The ecosystem, people, and their economic situations have already been significantly impacted at a startling rate. Climate change-related issues are one of the main causes of today's large- and small-scale population displacement (Bilak et al., 2016). For instance, the Least Developed Countries (LDCs) are impacted differently by climate change and global warming. 600 people were died and more than 20 million people were homeless in 2004 due to the flood that was brought on by heavy rainfall (Parliamentary Office of Science and Technology, 2006). Because of direct and indirect, slow and rapid changes in the climate, such as cyclonic disasters, river erosion, extremely high temperatures, drought, and flooding, there is a risk of seasonal, yearly, and even permanent displacement (Raleigh et al., 2008). Along with 19.2 million new displaced people, 113 countries worldwide in all areas in 2015 saw calamitous catastrophes such river erosion, storms, earthquakes, volcanic eruptions, high temperatures, and avalanches (Bilak et al., 2016).

One of the most vulnerable nations to the effects of climate-related problems is Bangladesh, which could see up to 30 million people displaced there by the year 2100. Bangladesh is not yet sufficiently prepared to deal with the problem of relocating so many people who have been displaced by the effects of the climate, and it is unable to implement the preferred adaptation measures (Barua et al., 2016). In nations like Bangladesh, where climate change is expected to cause temperature changes, heavy rainfall, flooding, waterlogging, water pollution, river erosion, cyclones, and the impending threat of sea-level rise as well, these risks are multiplied by a significant amount (Ali et al., 1999). Numerous recent examples of climate disasters include the deadly tsunami that struck in 2004, hurricane Katrina in 2005, typhoon Sider in 2007, and Nargis in 2008, which killed millions of people in coastal areas 26 coastal and mainland districts in Bangladesh's 64 districts are already producing climate displacement (Parvin et al., 2008). It also discovered that about 60 lakh people had been uprooted from their homes and lands in Bangladesh as a result of climate change (Displacement Solutions, 2012).

Four climate hotspots in Bangladesh have caused about 46% of people to be temporarily displaced and 12% to be permanently displaced (CDMP-II, 2014). Similar environmental issues like river erosion, salinity intrusion, altered rainfall patterns, etc. affect the majority of coastal areas. These all contribute to a movement of people toward the closest cities. Political unrest, social unrest, and low productivity all contribute to internal and external migration toward developed cities in quest of managing other income prospects to better adapt (Rashid, 2013). Forced population displacement across Bangladesh as a result of people losing their homes, lands, possessions, and means of subsistence owing to the impact of climate change is one of the most dramatic effects. Different levels of salt affect 70% of the land in the Barisal and Khulna divisions, which lowers agricultural production (Rahman and Ahsan, 2001). Numerous studies on the effects of migration and climate change have been conducted globally (Faist and Schade, 2013; Myers, 2002; Singh, 2019).

They concentrate on climate-related migration from a socioeconomic perspective, taking into account the significance and value of exploiting the resources and sources of livelihood already accessible, as well as elements connected to adaptation and climate change vulnerability. According to a survey of the literature, there have been few or no comparable studies conducted on the coastal regions of Chattogram.

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Climate-induced migration has been studied in various ways in the coastal regions of Bangladesh (Rashid, 2013). This study was carried out in Bangladesh's Chattogram province's Banskhali Upazila (subdistrict). Additionally, this research will offer a baseline analysis of local residents' understanding of several topics, including climate change variables, their familiarity with the word, their information sources, etc. In order to combat climate change in Bangladesh's local areas, policymakers, local community representatives, and various government and non-government sectors will benefit from this research.

Therefore, it is crucial to examine the changing patterns of climatic parameters, identify the shifting patterns of displaced people's lives and livelihoods, and assess indigenous knowledge to determine how well adaptations work for climatic victims in the study area. People who are forced to leave their usual homes or choose to do so, either temporarily or permanently due to sudden or progressive changes in the environment brought on by climate change that negatively affect their lives or living conditions, are said to be climate change-induced displaced people. They may move both domestically and internationally (Kniveton et al., 2008).

People or groups of people who have been compelled to flee or leave their homes or places of habitual residence, particularly as a result of or to avoid the effects of armed conflict, situations of generalized violence, violations of human rights, or natural or man-made disasters, but who have not crossed an internationally recognized State border (Adelman, 2001). When people are uprooted from their familiar rural environs in Bangladesh, they typically first try to migrate inside their village context, then to adjacent villages, nearby embankments, or Char land, and finally move to urban areas when there are no other possibilities for a living there.

Bangladesh's fast urbanization can be attributed to rural-urban migration, with poor rural-urban migrants filling up more and more urban slums (Ishtiaq and Mahmud, 2011). In Bangladesh, climate related IDPs make up the majority of the population. These climate IDPs are another feature of Bangladesh's rural-urban migratory pattern (Rahman, 2012). In the context of converging non-climatic changes, adaptation encompasses change in social-ecological systems in response to actual and anticipated impacts of climate change. Aiming to address climate change, adaptation techniques and initiatives can range from short-term coping to long-term. Moser and Ekstrom Climate adaptation has been an increasingly important topic of scientific study, local to international policy and planning, as well as media and public awareness in the first decade of the twenty-first century.

For those without access to land, the government established Guccha Grams (clustered communities) in 1987. Numerous NGOs seized the chance to assist the government with the land distribution responsibilities. This partnership has persisted, and NGOs have helped the government with its Adarsha Gram (perfect villages) program, which aims to build homes for the underprivileged who are in need of comfort (Manzurul, 2013). NGOs also helped landless and displaced people get back on their feet by building Gucchagram (cluster villages), which they did by using donor money to buy land.. The NGOs of Bangladesh have been employing a variety of tactics and procedures to reclaim and distribute Khas land among the landless poor, including mobilization, identification and redistribution of Khas land, legal aid, lobbying and advocacy. This is in addition to the rehabilitation of displaced people through the establishment of cluster villages (Barkat et al., 2001). The goal of the study was to determine how displaced people's patterns of life and livelihood were changing, as well as to evaluate the performance and usefulness of indigenous knowledge in assisting climatic victims. In addition, to access the climatic parameter's changing pattern.

2. Materials and Methods

The authors conducted the study at Banshkhali sub-district under Chittagong District which located southern coast of Bangladesh and mostly coastal areas that Sangu estuaries and Bay of Bengal covered the southern part of this sub-district. in the division of Chattogram. It is bounded by Anwara and Sangu on the North, Chakaria on the South and Lohagara and Satkania on the east, Kutubdia and Bay of Bengal on the west (Figure 1).

Banshkhali is surrounded by a chain of mountains in the east, located on the shore of the Bay of Bengal and on the bank of the Sangu River and situated 45 km southward of Chattogram City covering an area of 392 square kilometers. Total population is about 427,913. It has 14 union and a pourashava. (Upazila Statistics Office, Banshkhali). The livelihood status and activities of the villagers in the north depends on Sangu River and people of west depend on Bay of Bengal coast.

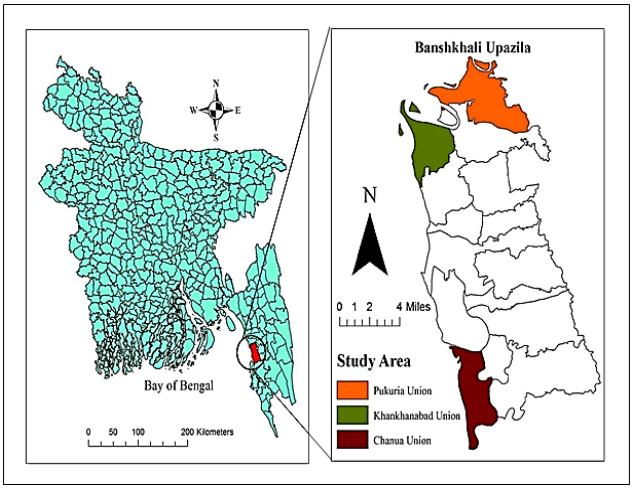

Figure 1: GIS map showing the study Area

Due to geographical settings study area is situated in the eastern side of the Bay of Bengal and natural calamities are common phenomena in this area (Figure 2).

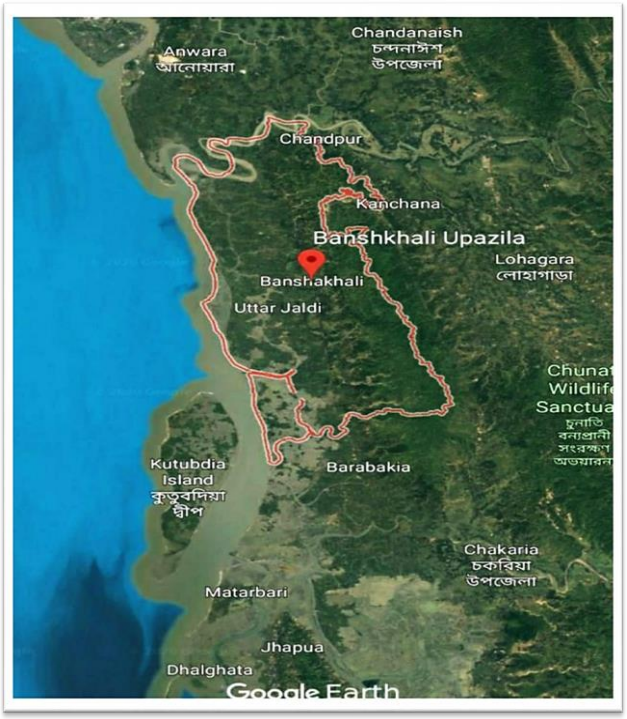

Figure 2: Landsat TM image showing the geographical location of Banshkhali

In order to conduct the study, participant observation, key informant interviews (KII), focus groups, and questionnaire methods were used to gather primary data on the effects, patterns of life and livelihood of displaced people, indigenous knowledge, coping mechanisms, displacement rate, and riverbank erosion. In three unions, a total of 100 surveys were used. The study mostly uses primary data for its investigation. besides additionally makes use of secondary data. Participant observation, key informant interviews, focus groups, and questionnaires are all used to gather primary data. Additionally, 3 unions of the Banshkhali Upazila conducted 120 questionnaires.The sample size were selected by the help of statistical representative formula (Islam, 2014) such as:

$$\text{Formula,} \quad n_0 = \left(\frac{z^2 pq}{d^2}\right)$$

Where n_0= desire sample size, z = standard normal deviate usually set at 1.96, which corresponds to the 95% confidence level (z = 1.96), p = assumes proportion in the target population estimated to have a particular characteristic (p = 0.5), q = proportion of the estimation of population (q = 1-p), d = allowable maximum error in estimating a population proportion (d = 0.05).

Moreover, Simple Random sampling technique was adopted for

successfully operating of 357 questionnaires at a household's level who are rearing the goat . Considering the representative sample size, the authors have distributed those samples on the statistical way with the help of following formula;

$$\text{Random sampling, } Nj = (\frac{n}{N})Ni$$

Where, Nj = represents the sample size, N = total population size, (N = ni + nii + niii +……+ nn), Ni = population size of study area, n= desired sample size.

Data of climate parameters (temperature, rainfall, humidity, wind speed) in Banskhali upazila were collected from the Bangladesh Meteorological Department (BMD) from 1995-2018. For statistical analysis of climate parameters, the researcher used average yearly data from the time series data which were conducted on the monthly average value for the last 23 years (1995-2018). The equation of a linear regression line is given as y = a + bx where y is the observation on the dependent variable x is the observation on the independent variable 'a' is the intercept of the line on the vertical axis, and 'b' is the slope of the line. The estimate of intercept 'a' and the regression coefficient 'b' by the least square method

$$\text{i.e.} \quad \hat{a} = \bar{y} - \hat{b}\bar{x}$$

$$\text{and} \quad \hat{b} = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

$$\text{Coefficient of determination,} \quad R^2 = (\text{SS due to Regression})/ (\text{Total SS}) = \frac{\sum (\hat{Y}_i - \bar{Y})^2}{\sum (Y_i - \bar{Y})^2}$$

The monthly averages of rainfall, humidity, temperature, and wind speed throughout the rainy season were plotted against time (the independent variable) in years in order to fit regression lines. The trends in rainfall were then determined by fitting linear regression lines. Microsoft Excel was used for the diagram creation and regression line fitting. The strength of the linear link between two variables is determined by the correlation coefficient. It always accepts a number between -1 and +1, with a perfect correlation of 1 or -1. (all points would lie along a straight line in this case and having a residual of zero). No association between the variables is indicated by a correlation coefficient that is close to or equal to zero.

The following formulas were used to determine the correlation coefficients between rainfall and time. The correlation coefficient is calculated using the pairs of variables (x1, y1), (x2, y2),.....(xn, yn), and the formula is given by Scatter diagrams were used to determine the regression equations and the coefficient of determination (R2) by examining two indices at a time (Alder and Roessler, 1964).

In order to estimate the number of Banshkhali residents who have been displaced by climate change in the three unions of Pukuria, Khankhanabad, and Chunua, the authors used the methodology proposed by who took into account the connection between displacement and resilience and provided the following formula (Schrepfer and Caterina, 2014):

Displacement = Hazards (causes + drivers) +vulnerability\ Capacity + innovation

The authors used the Likert scales approach to gauge how satisfied displaced people were with their current and previous living situations (Vagias, 2006). Using this methodology, a comparison scenario of the livelihood and status of displaced persons between before and after displacement has been discovered. The weighting of current and previous living conditions, home ownership, access to drinking water, sanitation facilities, occupation, housing condition, access to health care, women's security, social security, and capacity to deal with natural disasters has been determined. According to respondents' statements. The satisfaction level of weight is divided into three categories: 1. Extremely satisfied High Satisfaction 3. Not Quite Satisfied 4. Unsatisfied than other unions in the Banshkhali, these three unions—Pukuria, Chanua, and Khankhanabad—are closer to the coast. Additionally, interviews were conducted with 40 households from each of the 12 villages in the union, yielding a sample size of 120 households overall (Table 1).

Table 1: Source of Primary Data

Data Types	Methods	Source	Level
Qualitative	Participant Observation	Field Based	Climate induced Displaced Communities
	Key Informant Interviews (KII)	Field Based	Total 6 KII were conducted with the expert
	Photography	Field Based	At whole study area
	Focus Group Discussion (FGD)	Field Based	Total 04 FGDs were done in both origin and destination areas of climatic displaced people
Quantitative	Questionnaire Survey	Field Based	Total120 displaced person interviewed at the household level

Source: Compile by Researcher, 2020

In order to further the goal of this research effort, a total of five key informant interviews were also performed with Word members, an Upazilla disaster management and reliance officer, community leaders, bazar leaders, fishermen leaders, a Madrasah teacher, NGO workers, and government employees. These specialists were closely connected with the initiatives and duty bearers in Bangladesh's coastal regions. Each expert who participated in the KII survey was subjected to a total of nine (09) questions during the interview procedure (Appendix-I). The following table provides comprehensive details on 6 KIIs. Focus Group Discussions have been held in the communities to learn how others see things. A total of 10–12 respondents took part in each FGD, with equal representation of women.

The FGD covered various socioeconomic issues, shifting livelihood patterns, the causes and effects of the climate catastrophe, including displacement, adaption measures they made, re-habitation plans, etc. The results of FGDs were used to fully comprehend respondents' perceptions and to recognize the concepts that flowed from their knowledge and experiences. A questionnaire survey was used to gather quantitative data. Prior to conducting the questionnaire survey, the researcher took into account a few key factors for conducting the survey successfully in both study locations. Techniques for sampling, determining sample sizes, and questionnaire design were among these fundamentals. Before entering the study location, a questionnaire was created. However, after reading the literature, I reorganized the questionnaire in accordance with each supervisor's concerns.

A questionnaire was initially created in English. But when a household-level survey was being conducted, it was translated into Bengali for the respondents' benefit. After gathering data on the entire population in the two research areas, a sampling frame was created. The sample frame was useful in helping to decide on the sampling method to use for the current investigation. In accordance with the statistical formula published by Islam in 2014, the sample size was determined. The Hazard ranking for relocation in the study region is determined using the following table. Utilizing techniques encouraged by FEMA's hazard mitigation planning advice and the HAZUS-MH risk assessment tool, estimates of risk for the study region were created (FEMA, 2004). It is assisting those who must adapt to and gain knowledge from prior experiences in order to deal with past and present climatic unpredictability (Table 2).

Table 2: Probability of Occurrence Rating Factors

Rating	Probability	Definition
1	Rare	Hazard event is not likely to occur within 100 years (>1% chance of occurrence in any given year)
2	Occasional	Hazard event is likely to occur within 100 years (1% chance of Occurrence in any given year)
3	Frequent	Hazard event is likely to occur within 25 years. (4% chance of Occurrence in any given year)

Review papers, journals, books, magazines, newspapers, and other recent publications, as well as pertinent Internet sources, were used to compile relevant secondary data. These sources included the local government, university library, government and non-government organizations, and some renowned research cells. A great deal of consideration was given to the relevance, dependability, and authenticity of the data that was gathered. After the collections of both qualitative and quantitative data from primary and secondary sources were edited, coded, classified and tabulated the sequential manner.

2.1 Vulnerability Analysis for Displaced People

The IPCC suggests that vulnerability is characterized as a function of three dimensions—exposures, sensitivity and adaptive capacity, as follows (IPCC, 2007):

Vulnerability = f (Exposure; sensitivity; adaptive capacity).

Vulnerability is a positive function of the system's exposure and sensitivity and a negative function of the adaptive capability (Ford and Smit, 2004). The authors used the Climate Vulnerability Index and the Livelihood Venerability Index to measure and compare livelihood vulnerability in the context of the living conditions of coastal area residents (Pandey and Jha, 2012; Hahn et al., 2009). The Sustainable Livelihood Approach, created by Chambers and Conway in 1992, was preferred over the LVI approach because the latter only took into account five categories of household assets—natural, social, financial, physical, and human capital—and neglected to take into account climate change sensitivity and adaptive capacity. In order to calculate the, the current study develops a weighted-balance integrated approach that takes into account local and indigenous knowledge when choosing the indicators.

3. Results and Discussion

Temperature, Rainfall, Pressure, and Wind Speed are the measurable variables that have a significant impact on the characteristics of this Climate system. It illustrates the direction in which the local climate in Banshkhali is changing. Along with offering the essential hints regarding what might occur in the future. Major climate variables have undergone trends over various time series. This demonstrates that the temperature has risen periodically. Most regions have experienced colder winters and hotter monsoon seasons. Everywhere in the region, the wind speed has drastically diminished. In winter, less rain or undesirable rain falls as a result of rising temperatures and lowering wind speeds. According to Figure 3 by the authors, rainfall rates climbed from 1995 to 2000, increased moderately from 2000 to 2010, and then sharply increased from 2010 through 2016. (Figure 3).

The annual mean rainfall pattern in Banskhali Upazila is shown in Figure 3. Here, y = 0.8572x - 1451.2 and R2 = 0.0342 represented the fixed linear regression model. Where x is the independent variable, rainfall, and y is the year. Here, the intercept term 1451.2 denotes that the maximum rainfall in the Banskhali region was 1451.2 every year. The regression co-efficient of 0.8572 indicates that the rainfall rose by 0.8572 times annually, or over 1%, from its prior equivalent (Figure 3). The time series data analysis approach for counting climatic years has been applied. The average annual rainfall during the past 23 years, from 1995 to 2018, is +36.00 mm. Figure 3 illustrates the main conclusions of the analysis, which state that rainfall is increasing at a rate of (+) 36.00 mm per 23 years.

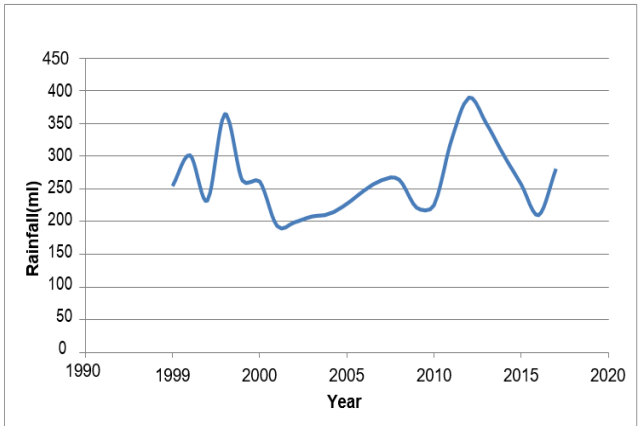

Figure 3: Rainfall rate of Banshkhali area since 1995-2018

The authors discovered data on the research area's wind speeds from 1995 to 2018 in figure 4. 2009 to 2016 saw an increase in wind speed due to Cyclones Sider and Ayla. That harms the Banskhali region greatly (Figure 4). R2 = 0.627 and the fixed linear regression model in this case was y = 0.0643x -125.43. where x is an independent variable and y is the current year. In this case, the intercept term 125.43 indicates that the research area's average annual maximum wind speed was 125.43. The wind speed rose 0.0643 times annually, or roughly 0.0643 percent, from its previous counterpart, according to the regression co-efficient of 0.0643 (Figure 4). The time series data analysis approach for counting climatic years has been applied. Over the past 23 years, the wind speed rate has been (+) 2.70 m/s. The main conclusions of the investigation indicate that the rate of growth in wind speed is (+) 2.70 m/s every 23 years.

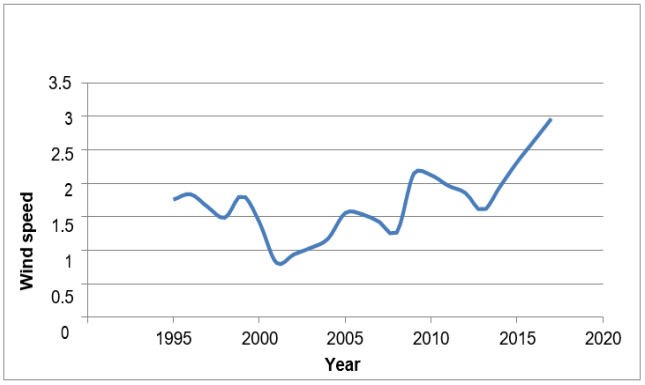

Figure 4: Wind speed pattern of Banshkhali since 1995 to 2017

The authors conclude from Figure 5 that the average temperature (0 C) in the research area increased significantly between 1995 and 2017, leading to high humidity levels and more frequent storm breakouts in coastal areas. Here, y = 0.0444x - 58.595 and R2 = 0.6605 represented the fixed linear regression model. where x is the independent variable, temperature, and y is the year. Here, the intercept term of 58.595 indicates that the research area's average annual maximum temperature was 58.595. The temperature grew by over 0.044 percent from its previous equivalent, or 0.044 times each year, according to the regression co-efficient of 0.044. (Figure 6). The time series data analysis method for counting climatic years has been employed. The rate of change in temperature during the past 40 years, from 1977 to 2017, is +1.85 0C. The analysis's main findings indicate that temperatures are rising at a rate of (+) 1.85 0C per 23 years.

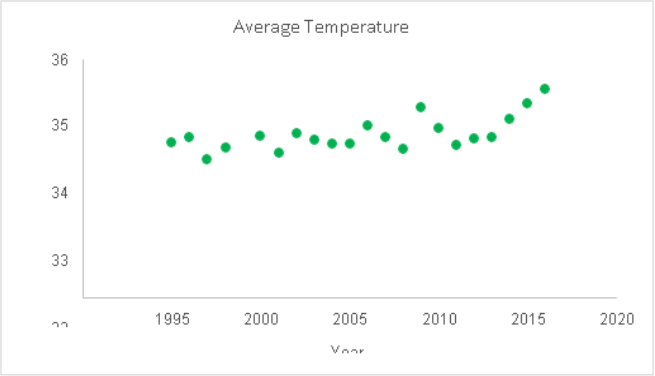

Figure 5: Average temperature pattern of Banshkhali up to (1995-2017)

The authors demonstrate in Figure 6 that rather than showing a diminishing tendency between 1995 and 2000, relative humidity slightly increased over that time. However, the Banshkhali region showed a steeply dropping pattern in 2010 and an increasing tendency from 2010 to 2017. Climate changes brought on by this parameter shift usually result in cyclones, strom surges, salinity intrusion, coastal erosion, river erosion, and other phenomena. The fixed linear regression model is shown in Figure 7 as y = 0.07x - 67.576 and R2 = 0.2066. Where x is the independent variable, humidity, and y is the year. The intercept word in this case, 67.576, indicates that the highest humidity in the research area was 67.576 every year. The humidity grew 0.07 times annually, or roughly 0.07 percent, from its previous equivalent, according to the regression coefficient of 0.07. The last 23 years' average humidity rate is (+) 2.94 percent. The analysis's main findings indicate that humidity is rising at a rate of (+) 2.94 percent every 23 years.

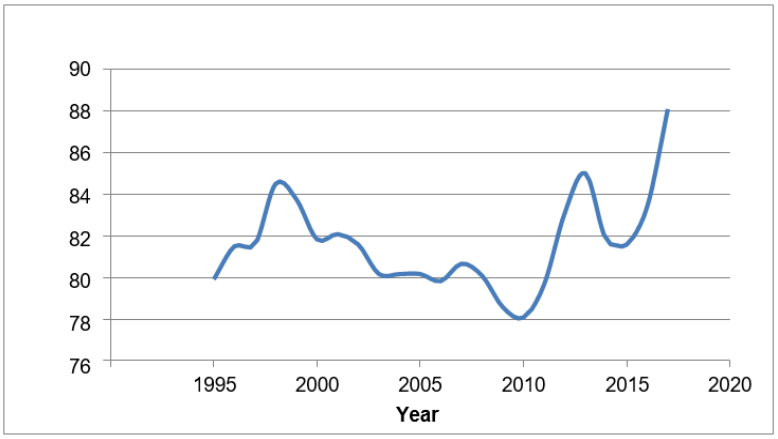

Figure 6: Relative Humidity Pattern in the study area

3.1 Demographic Profile

The authors found that climate displaced communities mostly are fishermen (18.33%) followed by day labour (16.67%), agriculture activities (8.33%) and others (Table 3).

Table 3: Occupational Status

Occupational Status	Frequency	Percentage
Agriculture	10	8.33
Fisherman	22	18.33
Fry Collector	1	0.83
Day Labor	20	16.67
CNG driver & Easy Bick Driver	3	2.51
Garments Worker	1	0.83
Salt Cultivator	9	7.52
Small Business Man	8	6.67
Dry Fish Labor	4	3.33
Boatman	10	8.34
Housewife	15	12.5
Unemployed Person	5	4.17
Fry Collection and Salt Cultivation	4	3.33
Service	1	0.83
Fish Isolation	1	0.83
Teaching	3	2.5
Homemade Tailor (Cloth Made)	1	0.83
Rural Doctor (Non-Registered)	1	0.83
Imam at Mosque	1	0.83
Total	120	100.0

The respondents' primary socioeconomic indicator is their monthly income. It does more than only illustrate the family's financial stability. The respondents' average monthly income in the research locations. The majority of respondents have roughly the same monthly income and are members of our society's lowest economic class. According to Islam (1990), Bangladesh's rural areas have three different income groups for households: the highest income group (above 20,000), the intermediate income group (5,000 to 20,000), and the lowest income group (less than 5,000 tk.). The majority of the respondents' income ranged from Tk. 3001 to 5000. and a 26 percent monthly income of Tk. 1000–3000 and Tk. 3001–5000.

3.2 Housing Pattern

According to the survey, the most common types of homes were Katcha and straw-roofed houses with polythin structures. These homes accounted for 31.67 percent, 20.83 percent, and 8.33 percent of all homes, respectively. Focusing respondents lost their source of income. For a means of subsistence after being displaced, people-built homes wherever they could. The ownership structure of displaced people's homes in the research areas is shown in Table 14). Here, 38.3 percent of respondents sought refuge on government-owned territory (mainly by the sides of the road without formal authorization), 16.67 percent did so on government property, 11.67 percent did so on their own land, and 5 percent did so on an embankment (Table 4).

Table 4: Ownership Pattern of House

House Ownership	Frequency	Percentage
Own Land	14	11.67
Government Khas Land	46	38.33
Rent	3	2.5
Relative House	5	4.16
Neighbor Land (Rent Free)	8	6.67
Government Khas Land (Without Permission)	16	13.33
On The Embankment (Barry Baad)	6	5
Government Land (Ownership Got from Second Parties)	20	16.67
By Capturing	2	1.67
Total	**120**	**100.0**

The researchers discovered that the majority of respondents (35%) lived in this area for five to ten years, 29.16% for less than five years, and 21.67% for eleven to fifteen years. This study considered it significant that no one was still residing in their birthplace in the studied area (Table 5). After a typhoon and storm surge in 1991, the majority of them relocated. Five thousand (5,000) persons from three unions were relocated during cyclone Aila in 2009, and some of them are still living on embankments or on a temporary basis.

Table 5: Duration of Living

	Frequency	Percentage (%)
Less 5 Years	35	29.16
5-10 Years	42	35
11-15 Years	26	21.67
16-20 Years	10	8.33
20-30 Years	5	4.17
Above 30 Years	2	1.67
Total		

3.3 Climate Displacement Scenario

The authors found that 28% of respondents to the research lost their homestead for the first time, 35 % of participants lost their homestead twice, and 12 % claimed to have lost their homestead more than five times (Figure 8). Those who moved to a nearby Upazila or elsewhere in Banshkhali only occasionally experienced homestead loss, but they were unable to move and remained essentially in the same place. Residents of the Khankhanabad union said during the FGD that they had lost their homes more than five times, making these regions more susceptible to cyclones and coastal bank erosion. Additionally, the Sangu River's eroding riverbed has forced more than five times as many Pukuria union villagers to leave their homes.

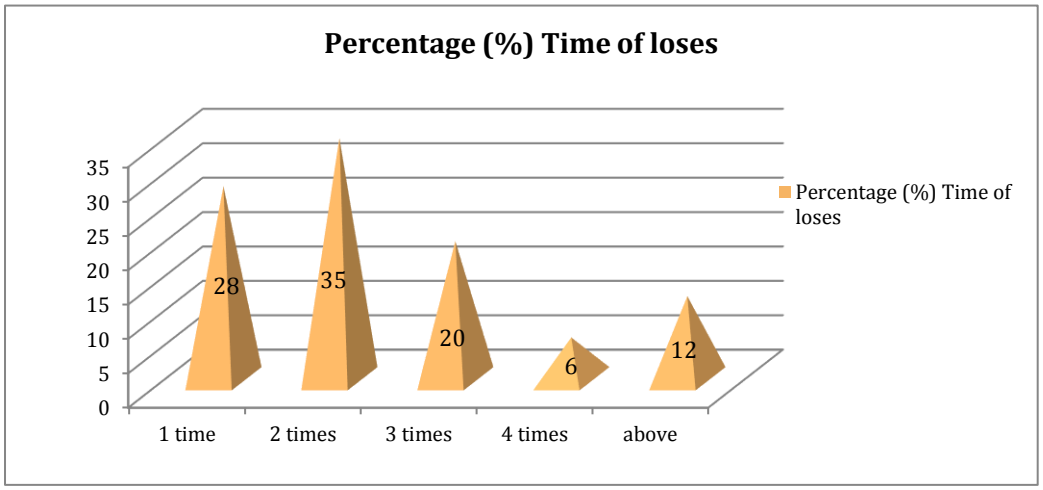

Figure 7: Times of losing homestead

People who had been displaced by the climate tried to stay in their own community, especially if they had no other options for moving and had access to alternative land and sources of income. According to the survey, 63.34 percent of respondents stayed in their original villages after being uprooted, while 20 percent relocated outside of their original villages (Figure 9). Even though they have few options for a living after being uprooted, most people stay in their own villages for a variety of reasons, including the government's own and many other groups conducting various forms of relief efforts in this region following Sidr and Aila.

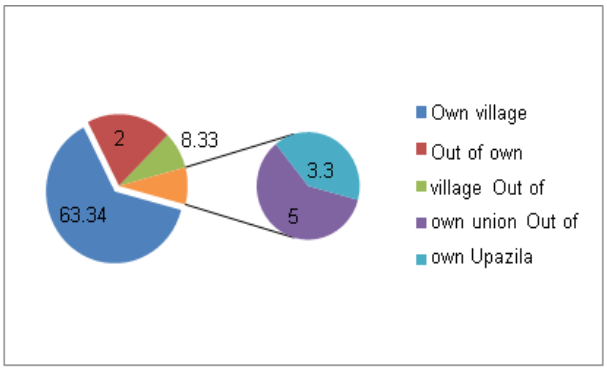

Figure 8: Pattern of displacement

The authors discovered that 38.3% of respondents lived on Government Khas land (mainly by the side of the road without formal permission), 16.67% lived on Government land (with temporary ownership from second parties), 11.67% lived on their own land, and 5% took refuge on an embankment.

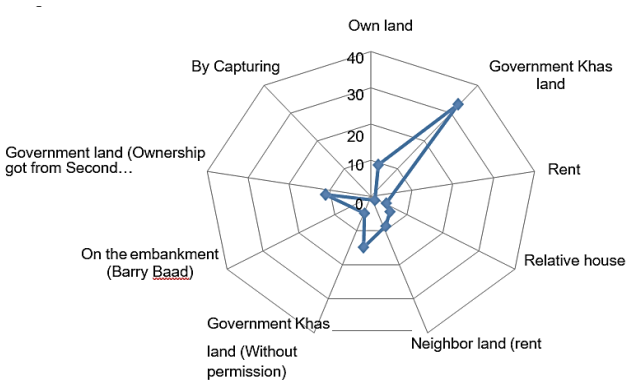

Figure 9: Spider diagram showing pattern of Housing in the study area

3.4 Livelihood Vulnerability Index

According to the results of the current study, households in the study area are vulnerable to the effects of climate change. However, the coastal island's overall LVI of 0.540 was slightly higher than that of mainland households (0.490). (Table 6). This suggests that island residents' livelihoods are more precarious than those of households on the mainland. This occurred as a result of the lengthy history of coastal erosion and displacement issues in Banskhali Upazila. The estimated index value for various socio-demographic profiles for the study sites showed a slight variation, according to the study. The index values for "livelihood strategies" and "social network," which were 0.410 and 0.370 for study areas, did not significantly differ between sites. However, mainland residents rather than islanders had the greatest index values for "food," "water," and "health." On the other side, the study areas had the highest index values for "natural disasters" and climate variability. Due to their low-lying geography and susceptibility to flooding, char dwellers had the highest index value for natural disasters, however both communities were determined to be similarly impacted by climatic variability.

The contribution of "food" to the livelihood vulnerability of the study area demonstrates how difficult it is for these households to meet their food needs. Crop cultivation on sand bars is constrained by the poor soil quality, and during the rainy season, these households frequently relocate to a location that is less vulnerable to flooding, such as an adjacent embankment. Due to the risky nature of farming in these unstable situations, livestock's contribution to food is similarly modest. In the island regions, the factor "water" had an even greater impact on vulnerability. Although a few tube wells had been erected, the majority of them were discovered to be contaminated with arsenic, and households in these areas rely on the river for unsanitary drinking water. Although drinking water poisoned with arsenic can be dangerous, there are sometimes no other options available. Communities compete with one another for water, which frequently results in confrontations.

People who have been displaced by the effects of climate change typically travel in similar ways to other migrants, but this type of migration is accelerating and becoming more widespread. The effects of climate change are more likely to exacerbate and stress current patterns of displacement in the future than they are to produce new migratory destinations, flows, or behaviors. Therefore, current tendencies serve as a general indicator of how helpless people will behave in the future, albeit this may differ depending on how climate change manifests itself in certain regions. (Hugo, 2010). Global climate change will result in transitory relocations rather than long-term ones in the near future. Others will move internally to nearby geographies, while those with wealth may opt to travel globally. Temporary relocation presents unique job challenges.

It is challenging to integrate employees into the market in host locations when livelihoods are disrupted in their places of origin because it is unclear how long the disruption will endure. Such transient workers have little choice but to accept temporary jobs that are frequently hazardous. Internal migrants are more likely to be inexperienced and underprivileged, making them particularly vulnerable to employment exploitation. This study aims to evaluate the Livelihood Vulnerability Index, taking into account the displaced residents of the study areas' patterns of livelihood change between their original homes and new residences. Through its many initiatives, the government offers emergency aid to climatic victims as well as rehabilitation for those who have been displaced. Mostly, displaced people have received one of two sorts of government help. such as assistance in times of need, alleviation, and ongoing support or inclusion in rehabilitation programs. The aid received by the displaced residents of Banshkhali Upazila is shown in Table 7 below.

Table 6: Indexed Value of Major Components and Sub-Components Comprising the Livelihood Vulnerability Index

Major Component	Indexed Value of Each Component	Sub-Components or Indicator	Indexed Value for Each Subcomponent (Indicator)
Socio-Demographic Profile	0.390	Percent of female-headed HHs	1.20
		Dependency ratio	0.165
		Percent of HHs where head of the HHs has not attended school	0.214
		Average number of family members in the HHs	0.403
		Percent of HHs where women family members are not allowed to work outside	0.250
		Percent of HHs where household head is the only earning members	0.465
Livelihood Strategies	0.425	Average livelihood diversification index	0.120
		Percent of HHs where family members migrate to work in a different community	0.323
		Percent of HHs solely dependent on agriculture and livestock as a source of income	0.540
		Ratio of agricultural income to total income	0.870
Social Network	0.340	Percent of HHs who receive assistance from social networks	0.320
		Percent of HHs who have provided assistance to others	0.150
		Percent of HHs borrowing money from others	0.360
		Percent of HHs lending money to others	0.350
		Percent of HHs receiving assistance/aid from Government and NGOs	0.250
		Percent of HHs under social safety network	0.190
		Percent of HHs not using mobile phone for communication	0.13
Health	0.425	Average time to health facility (at least with qualified doctor)	0.402
		Percent of HHs with family members who are chronic ill	0.340
		Percent of HHs who do not attend a local doctor during illness	0.498
		Percent of HHs without sanitary latrine	0.323
		Percent of HHs where a family member missed work or school due to illness in the past 2 weeks	0.180
Food	0.620	Average number of months HHs struggle to find food	0.190
		Average crop diversity index	0.320
		Percent of HHs that do not get food from the family farm	0.180
		Percent of HHs losing their agricultural land	1.121
		Percent of HHs who do not practice homestead gardening	0.980
Water	0.580	Percent of HHs reporting water conflicts	1.125
		Percent of HHs using unsafe drinking water (river, pond, water hole, arsenic contaminated water)	1.209
		Average time to get safe drinking water source	1.45
Natural Disaster and Climate Variability	0.430	Average number of reported flood, drought, and cyclone events in the past 10 years	0.432
		Percent of HHs with an injury or death as a result of natural disasters in the last 10 years	0.190
		Percent of HHs with an injury or death to their livestock as a result of natural disasters in the last 10 years	0.435
		Percent of HHs with losses of physical assets (homestead/agricultural equipment and machinery) due to riverbank erosion and other disasters	0.870
		Percent of HHs that do not receive a warning before a natural disaster	0.320
Climatic Variability	0.540	Perception index of summer temperature	0.60
		Perception index winter temperature	0.58
		Total rainfall perception index	0.68
		Perception index of monsoon rainfall	0.62
		Perception index of winter months rainfall	0.54
		Perception index of frequency of floods	0.70
LVI			0.490

Table 7: Displaced People Receiving Assistances From Governmental Organization		
	Frequency	**Percentage (%)**
Giving Housing Materials	10	8.33
Building House	9	7.5
Abason	4	3.33
Giving Food Items	24	20
Giving Food Items and Clothes	8	6.67
Giving VGF Card	7	5.83
Payment (20,000)	55	45.84
Payment (20,000) With Food Items	-	
Payment (23,000)	-	
Camp (Tent) and Food Items	-	
Cash Payment	-	
Not Applicable (Nobody Didn't Work Here)	3	2.5
Total	120	100

In an effort to assist the 19.16 percent of the population who had been evacuated, the government-built homes, provided housing supplies, and established Abbason in the study area. In the research area, over 32.5 percent of those who were relocated received assistance from a government organization, mostly in the form of food, clothing, and VGF cards. Most of the 45.84 percent received cash compensation (20,000 tk.). 2.5% claimed that neither the government nor any other organization was in charge of them. Human displacement is common in the Banshkhali region as a result of climate change-related disasters. The purpose of the following table was to examine the relationship between the patterns of life and livelihood of displaced persons in the research region both before and after their displacement.

Table 8: Level of Satisfaction of climatic displaced people								
Livelihood indicator	**5**	**4**	**3**	**2**	**1**	**Total Calculation**	**Weight**	**Remarks**
Family Income	8	18	7	26	8	100	0.67	Satisfied
Occupation	4	2	10	45	6	105	1.56	Strongly Dissatisfied
Ownership of House	0	2	6	54	5	110	1.64	Strongly Dissatisfied
Source of Drinking Water	0	1	3	50	13	119	1.77	Strongly Dissatisfied
Sanitation Facilities	8	7	5	32	15	117	1.74	Strongly Dissatisfied
Health Care Facilities	3	10	8	50	9	100	1.49	Strongly Dissatisfied
Women Securities	2	4	8	40	14	114	1.70	Strongly Dissatisfied
Social Securities	0	0	5	42	20	120	1.79	Strongly Dissatisfied
Coping with Natural Disaster	0	0	8	50	9	112	1.67	Strongly Dissatisfied

The table 8 illustrates that all most 80% people strongly dissatisfied about their displaced placed places and 20% people satisfied about their new displaced place.

3.5 Relation Between Climate Change and Coastal People Displacement

Floods in 1988, cyclones in 1991, 1997, 2015, and finally storm Roanu in 2016 all had a huge impact on Banskhali Upazila. During these periods, everyone was temporarily displaced, and a sizable part moved permanently. In addition, this island's size is decreasing every year due to coastal erosion, which also frequently uproots residents. The following Table-9 aimed to investigate the connection between climate change and displaced coastal residents in the studied locations. An effort has been made to statistically assess the association between climate change and coastal population displacement in both research areas in order to more thoroughly analyze the data.

Table 9: Relationship between Climate Change and Peoples Displaced From the Study Areas						
1st Variable	**2nd Variable**	**Study Area**				
		Chi-square (χ^2)				
		Cal value	Tab value	Result	Df	Sig.*
Displacement of Local People	Flood	1.8342	9.488	-7.653	4	NS
	Cyclone or Storm surge	79.1562	9.488	66.69	4	S
	Bank Erosion (river and sea)	93.805	9.488	84.317	4	S
	Salinization	1.5222	9.488	-7.965	4	NS
	Governmental development Activities	Required response didn't detect				
	Tidal Fluctuation	1.6252	9.488	-7.862	4	NS
	Sea Level Rise (SLR)	1.6252	9.488	-7.862	4	NS
	Increase Temperature	Required response didn't detect				
	Changing pattern of Temperature	Required response didn't detect				
	Land captured by local powerful man	Required response didn't detect				

*S= Significant, *NS = Not Significant, df = degree of freedom, significance at the level of 0.05

3.6 Knowledge Analysis of Climate Change Adaptation and Effectiveness

The authors found that 31.67% people have clear knowledge about Climate Change Adaptation and 55.83% have medium knowledge ,12.5% have not clear knowledge but using adaptation techniques in the study area (Figure 10)

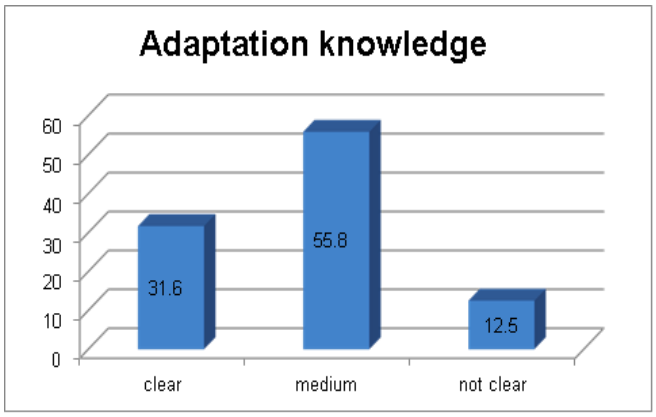

Figure 10: Showing Knowledge of Local people about climate change adaptation

The authors discovered that the coastal populations in the research area practice various indigenous adaptation strategies for their survival, which are planting of grass, cultivation of multiple crops on one land raise consciousness, Building of embankments and generation of salt deep tubewell used to provide pure drinking water, Development of livelihood skills is a highly successful adaption strategy. constructing a lofty, Rope protection for the home Mangrove plantations are only moderately to poorly successful at mitigating climate change (Table 9).

Table 9: The Adaptation Policies and Effectiveness

Adaptation Policies	High	Medium	Low	Remarks
Incorporate Climate Change in Long Term Plannimg	34	20	6	Highly Effective
Promote Awareness	40	15	5	Highly Effective
Using Semi Paccka House	25	27	9	Medium Effective
Grass Plantation	43	10	7	Highly Effective
Embankment	33	18	9	Highly Effective
Making House at High	20	26	14	Medium Effective
Protect House Through Rope	18	20	22	Low Effective
Using Deep Tubewell For Pure Drinking Water	34	15	11	Highly Effective
Multi Crops Cultivation in A Land	44	6	10	Highly Effective
Salt Production	28	21	11	Highly Effective
Mangrove Plantation	20	26	14	Medium Effective
Livelihood Skill Development	25	19	16	Highly Effective
Livestock Based Training	40	9	11	Highly Effective
Control Pollution	37	14	9	Highly Effective

This study serves as a springboard for understanding the crucial aspects of rural life in Bangladesh's coastal region that give households the flexibility to alter their way of life in the face of climate variability and change. The findings contribute to a preliminary knowledge of the empirically untested aspects of food sovereignty and extend the current theories on livelihood adaptation. The study's initial contribution is to give theories on development corridors and chains an empirical foundation, admitting their critical influence on micro-level adaptability. There can be no generalization of results because of the study's qualitative foundation and limited sample size. Additionally, due to time constraints, a longer-term study of livelihood adaptability was not possible.

The researcher finally came to the conclusion that more time with the homes was required in order to establish a relationship that could have produced more detailed and in-depth findings.

The authors discovered that the study areas and coastal areas of Bangladesh face the following obstacles to successfully implementing indigenous knowledge systems for adaptation practices:

i) Crop yields in coastal areas will decline due to extreme temperature and salinity intrusion;

ii) Changes in rainfall have already had an impact on the nation's crop production. Therefore, the altered weather due to climate change would have an impact on the indigenous coping mechanisms.

- ✓ Through an increase in the frequency of natural catastrophes, salinity intrusion in coastal land would have an impact on the rice production in these areas as well as other means of subsistence.
- ✓ As we can see, the climate trends are causing changes in the diversity of Bangladesh's six seasons, which means that the locals will have difficulty using their tactics for early warning of storms.

The fishing industries would face difficulties as a result of increased salinity and a lack of fresh water (like: shrimp cultivation).

- ✓ The coastal regions of the nation would experience a substantial influx of climate refugees as a result of sea level rise. Local communities' marine resources, biodiversity, and human health will all suffer as a result.
- ✓ Indigenous coping mechanisms would be severely impacted since the climatic pattern is drastically altering its scenario, endangering the local capacity for resilience in the near future.
- ✓ Climate change is anticipated to have a direct influence on the poor's way of life in coastal areas in a number of ways, including by increasing food insecurity, water stress, and health issues.
- ✓ Climate change would have an impact on public property like mangrove forests, which support the livelihoods of many low-income people in coastal communities.

4. Conclusion

The study's author hypothesized that increasing coastal residents' awareness of climate change through observation and widespread media coverage would allow policymakers to put adaptation methods into action and make it easier for coastal residents to plan for future mitigation measures. Using research findings from Bangladesh's southeast coast, this manuscript offers local level adaptation solutions based on indigenous knowledge in connection to hazard-prone, resource-poor rural households' perceptions of climate change and climatic hazards. Although many different types of climate-induced disasters have been happening in the study areas, the cyclone/storm surge, coastal bank erosion, and saline water intrusion are the most significant and recurrent nature in the study area. As a result, hundreds of thousands of people have been forced to leave their homes in coastal areas of Bangladesh. In this region, a person's life and means of support are more at risk.

The study discovered that 20 percent of respondents relocated outside of their own village, whereas 63.34 percent of respondents stayed in their own villages(Max) but in other locations. The majority of respondents (35%) have lived in this area for five to ten years, followed by less than five years (29.16%) and between ten and fifteen years (21.67%) respectively. No one is living in their place of birth in the study area, which is an important finding from this study. The majority of displaced persons are reported to be illiterate or only somewhat literate (signature). The majority of them work in agriculture, fishing, and salt production in their home regions, but they are quite unsatisfied with the day labor and small businesses they must participate in to make a living in their new locations. There are a lot of people who make less than $5,000 per month in the poor income bracket. The most common types of housing were katcha and straw buildings, thin structures, and katcha (earthen walls with straw roofs) (earthen wall with tin roof).

People are either residing on privately owned land, government property, or a majority of embankments. The absence of frequent calamities, unstable living conditions, losses of homes, lands, and other properties, and a constrained range of possibilities for a living are seen to be the main push factors. The majority of adaptation knowledge is now recognised as being essential for adjusting to this changing environment. According to

the results of the current study, only a small number of individuals are aware of climate change adaptation measures, but because their vulnerability is growing, they are using coping mechanisms. The development of livelihood skills, the planting of grass, the cultivation of multiple crops on one piece of land, raising awareness, the building of embankments, the production of salt, and the incorporation of climate change into long-term planning are all examples of highly effective adaptation strategies. By providing funds or habitation programs, the government and NGOs can make it possible for the displaced community to participate in catastrophe risk reduction, be used in policy making, or both.

The extent to which risks cause a disaster in an indigenous society when they are activated is a measure of that community's environmental adaptation or maladaptation. Here, the breadth of socio-cultural intervention comes into play, and the function of disasters as mobilizing forces of cultural change is largely understudied. Disasters in local communities often reveal the social structure, spark conflict between opposing social groups, and promote social cohesiveness and unity. The relationship between the little community and the larger society is also made clear. In order to bring the research back to the fourfold essence of the disciplinary specialization, socio-cultural research on natural catastrophes and climate change might integrate the platforms of assay of the social sciences.

- Socio-cultural research can offer insightful socio-cultural data and viewpoints that can aid in disaster management and recovery.
- Through the established study approach, socio-cultural interventions can offer more comprehensive perspectives on the vulnerability of frontline workers.
- A skilled social researcher can help reorient the locally developed disaster management models so that they are more able to incorporate local resources.- In order to adapt to the severe effects of climate change, locals must develop alternate means of subsistence through the right application of indigenous knowledge.
- Coastal area women should be included in some livelihood methods, such as duck rearing, so they can support their families financially.
- The poor in coastal areas can simply undertake farming as a means of subsistence in their smallest household.
- GO-NGOs might have stepped forward to encourage the growing of regionally unique crops and to offer high-yielding seeds and technology to the far-flung coastal areas.
- GO should step up and take the effort to purify the pond water utilizing various inventive methods.
- Supplying clean drinking water using ring tube wells should be considered a campaign to raise awareness among nearby coastal communities.
- The government should pay attention to shrimp farming and tending to prawn renu as two of the finest coping mechanisms for the rising salinity.
- The government might launch pro-active programs for crab farming.
- By increasing the techniques to build "Pusher Bari" in the coastal areas, the loss of homes and other properties during cyclones and storm surges can be reduced.

The homestead's increased plant and tree cover should be replicable in areas of the nation that are vulnerable to natural disasters.GO-NGOs may step forward to share these native coping mechanisms with the frontline members of the vulnerable communities through a variety of activities. Their initiative can be beneficial in overcoming the difficulties of climate change by enhancing their traditional knowledge and coping mechanisms. Here, sociocultural interventions made through a variety of research projects may be crucial. This study looks at how adaptation strategies can lessen households' susceptibility to both gradual and abrupt climatic changes.

The literature on climate change was mined for a wide range of variables that come under social adaptation, economic adaptation, and physical adaptation to see whether and how any of these are connected to the vulnerability of the households. OLR (ordinal logistic regression) is used in this process, and the results of the regression models are reliable. Through the advancement of odds ratio analysis, it also elicits the adaptation differential among various vulnerable groups, with the outcome being that very vulnerable households have specific adaptation techniques used more frequently than the sum of moderate and low vulnerable households. It also provides an idea/clue about the co-existence of vulnerability and resilience in the context of climate change.

REFERENCES

Adelman, H., 2001. From refugees to forced migration: The UNHCR and human security. International Migration Review, 35 (1), Pp. 7-32.

Ali, A., 1999. Climate change impacts and adaptation assessment in Bangladesh. Climate research, 12 (2-3), Pp. 109-116.

Alam, G.M., 2016. Determinants of and Barrier to Adaptation: Evidence from hazard-prone rural households in Bangladesh.

Barkat, A., Zaman, S., Raihan, S., 2001. Political Economy of Khas Land in Bangladesh, Association for Land Reform and Development (ALRD), Dhaka.

Barua, P., Rahman, S.H., 2017. Indigenous Knowledge practices for Climate change adaptation in the southern coast of Bangladesh, IUP Journal of Knowledge Management, 15 (1), Pp. 45-55.

Barua, P., Rahman, S.H., 2018. Socioeconomic crisis and rehabilitation reality for climate displaced people in the southeastern coast of Bangladesh. Australian Journal of Science and Technology, 2 (4).

Barua, P., Rahman, S.H., Molla, M.H., 2019. Impact of river erosion on livelihood and coping strategies of displaced people in South-Eastern Bangladesh. International Journal of Migration and Residential Mobility, 2 (1), Pp. 34–55.

Barua, P., Rahman, S.H., 2016. Sustainable Adaptation for resolving Climate displacement issues of southeastern islands in Bangladesh, international journal of Climate Change Strategies and Management, 9 (1), Pp. 42-45.

BBS. 2001. Statistical Yearbook of Bangladesh 2001, Bangladesh Bureau of Statistics, Statistics & Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh, www.bbs.gov.bd.

Bilak, A., Cardona-fox, G., Ginnetti, J., Rushing, E.J., Scherer, I., Swain, M., Walick, N., Yonetani, M., 2016. Global report on internal displacement grid. Interal Displacement Monitoring Centre.

CDMP, I., 2014. Trend and Impact analysis of Internal Displacement due to the Impacts of Disaster and Climate Change. Ministry of Disaster Management and Relief, Dhaka, Bangladesh.

Faist, T., Schade, J., 2013. Disentangling Migration and Climate Change: Toward an Analysis of Methodologies. Faist T(Ed). Springer, Pp. 3-25.

FEMA. 2004. Using HAZUS-MH for risk assessment how-to guide. HAZUS® -MH Risk Assessment and User Group Series 433, Department of Homeland Security, FEMA Mitigation Division, Washington, D.C., Pp. 126.

Ishtiaq, A., Mahmud, M.S., 2011. Migration objectives and their fulfillment: A Micro study of the rural-urban migrants of the slums of Dhaka city, GEOGRAFIA Online TM, Malaysia Journal of Society and Space, 7 (4), Pp. 24-29.

Islam, N., 2014. An Introduction to Research Methodology, 3rd Ed., University Press Limited, Dhaka, Pp. 50.

Kniveton, D., Schmidt-Verkerk, K., Smith, C., and Black, R., 2008. Climate Change and Migration: Improving Methodologies to Estimate Flows. Geneva: International Organization for Migration, 12 (6), Pp. 47.

Manzurul, M., 2013. South Asia's Experience in Land Reform: The Role of NGOs, the State and Donors, Independent University Bangladesh, Dhaka.

Moser, S.C., Ekstrom, J.A., 2010. A framework to diagnose barriers to climate change adaptation. Proceedings of the national academy of sciences, 107 (5), Pp. 22026-22031.

Parliament, U.K., 2006. Parliamentary Office of Science and Technology. Carbon Footprint of Electricity Generation, 20 (3), Pp. 70-95.

Parvin, G.A., Takahashi, F., Shaw, R., 2008. Coastal hazards and community-coping methods in Bangladesh. Journal of Coastal Conservation, 12, Pp. 181-193.

Raleigh, C., 2008. Assessing the impact of Climate Change on Migration and Conflict. Social Values, 16 (1), Pp. 42-50.

Rahman, M.M., Ahsan, M., 2001. Salinity constraints and agricultural productivity in coastal Saline area of Bangladesh. Soil Resources in Bangladesh: Assessment and Utilization, 2 (3), Pp. 34-37.

Rahman, M.S., 2012. The Internally Displaced People of Bangladesh: A Background Paper, South Asian for Human Rights (SAHR) http://www.southasianrights.org.(accessed 20/10/20)

Rashid, A.Z.M., 2013. A journey towards shared governance: Status and prospects for collaborative management in the protected areas of Bangladesh. Journal of Forestry Research, 24 (3), Pp. 599-605.

Smith, J.B., Lenhart J., 2011. Adaptation, adaptive capacity, and vulnerability. Mitigation Adaptation strategies Global Change, 16, Pp. 282-292.

Vagias, W.M., 2006. Likert-type scale response anchors", Clemson International Institute for Tourism & Research Development, Recreation and Tourism Management, Clemson University Press, South Carolina, Pp. 80.

YPSA and DS. 2015. Guidance Note: New Land for Climate Displaced Persons in Bangladesh, YPSA and Displacement Solutions, 6 (2), Pp. 20.