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Climate Change Induced Socio-economic Vulnerability- A Case Study for Koyra Upazila, Khulna, Bangladesh

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ABSTRACT: The study intends to explore the socio-economic vulnerability of climate change in the coastal Koyra Upazila of Bangladesh. The present study is concerned with climate-induced disasters and associated vulnerabilities which adversely impact the social and economic aspects of coastal inhabitants of Bangladesh. The researchers selected four unions (Koyra, Amadi, Bagali, and Dakshin Bedkashi) among the seven unions of Koyra Upazila for this study. In this study, the socio-economic vulnerability of the community people at risk is assessed through the Socio-economic Vulnerability Index (SeVI). This research focused on a mixed-method strategy combining quantitative and qualitative data. By conducting systemic data analysis, the researchers tried to identify the socio-economic vulnerability of the people of selected communities by using the vulnerability index. This study reveals that the study area is highly exposed to climate-induced disasters and extremely sensitive towards the damages caused by these disasters. Moreover, due to the socio-economic vulnerability, the adaptation capacity of the marginalized households remains low. Among sample households, most are affected by the economic vulnerability which limits their capacity to cope with the changing climate and disaster situations. This study not only focuses on the socio-economic vulnerability but also it deals with social perception of the climate-induced disasters of the selected coastal areas of Bangladesh. This index-based assessment with social perception can be an integral part of the contingency planning of the disaster-prone coastal regions of Bangladesh.

Keywords: Climate Change; Disaster Risk; Coastal Vulnerability; Socio-Economic Vulnerability; Social Perception

INTRODUCTION

This research deals with the range of vulnerabilities induced by climate change in the coastal areas of Bangladesh. Du e to the unique geophysical structure, the coastal areas of Bangladesh are extremely vulnerable due to climate change. The severe impacts of climate change are evident on the life and livelihoods of all walks of people specially in the coastal areas of Bangladesh (Rakib et al., 2019). Poor and marginalized people are the worst victims in this case to be specific. However, due to this climate vulnerability, the vulnerable communities of the coastal areas have developed their own adaptation practices based on their indigenous coping mechanisms (Chowdhury et al., 2022). To study the socio-economic vulnerability of climate vulnerable coastal area is the key motivation as well as the objective of this study. The main aim of this study is to carry out a vulnerability assessment of the selected coastal at-risk communities.

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The lack of knowledge, technological innovation, exclusion of vulnerable social groups, policy constrains and systematic analysis on climate-induced vulnerability, livelihood disruption due to the frequency and intensity of disasters, coping with the vulnerability of climate change (such as: tidal regime, salinity in soil and water, cyclone and storm surge) with economic and social complexities, the coastal population remain barriers to sustainable adaptation strategies leading towards social and economic collapse (Islam and Nursey-Bray, 2017). These distinctive characteristics make these coastal inhabitants more vulnerable in terms of social, economic or financial, physical, demographic, health, and environmental domains. Also, these sort of vulnerabilities lead them to become more susceptible to calamities, distress, disruption, and increases tangible (in terms of monetary loss) & intangible loss (cultural damage and loss) (Otto et al., 2017).

Nowadays climate change is perhaps the most widely discussed issue among the recent global environmental crisis and several well-documented studies revealed that climate change creates an authentic link to natural disasters due to anthropogenic causes. That's why, little too intense alter in climatic variability affects the social

and economic wellbeing of populations (Minar, Hossain and Shamsuddin, 2013). Climate change has influence over various inter-connected issues of the nations of the world, such as: environmental, ecological, socio-economic, socio-political and so on (Abbass et al., 2022) . The ongoing threat of climate change imposes a severe impact on the lives and livelihood of coastal people, such as: physical infrastructure damage, lower level of health status, death of livestock, loss of income, physical injury, raising migration pattern, natural property damage and so on (Ahsan and Warner, 2014).

It is now well known to all of us that among other developing countries, Bangladesh is recognized as the most climate-vulnerable country in the world (Saier, 2007). The frequency and intensity of disasters such as floods, cyclones, droughts, and landslides have changed due to the impacts of climate change. Moreover, the coastal area of Bangladesh is also facing the severe impacts of sea-level rise and salinity intrusion due to climate change(Younus and Kabir, 2018). Over the last three consecutive decades, Bangladesh has experienced nearly $16 billion in GDP losses including property damage, livelihood disruption, communication destruction, infrastructure collapse, agricultural loss, and over thousands of death tolls due to about 200 climate-related disasters (Malakar and Mishra, 2017). Among the most climate vulnerable counties of the world, Bangladesh has ranked 7th most vulnerable country according to the IPCC 2021 report (ICCCAD, 2022). Because of the flat topography and low adaptation capacity, the coastal communities of Bangladesh are highly exposed various natural disasters, such as: cyclone, storm surges, coastal flooding, sea level rise, and so on (Uddin et al., 2019).

The coastal areas of the Bangladesh are regarded as the frontline of climate change which are severely affected by increased flooding, increased intensity of cyclones, salinity intrusion and temperature extremes (Huq and Ayers, 2007). Due to climate change the intensity and frequency of disasters increase and these climate induced disasters disrupt the social and economic well-being of populations specially in the coastal areas of Bangladesh (Parvin, Takahashi and Shaw, 2008). In this study, the researchers have chosen 4 unions (Koyra, Amadi, Bagali, and Dakshin Bedkashi) of a coastal upazila of southern Bangladesh namely Koyra Upazila under the Khulna District of Bangladesh. The coastal areas of Bangladesh are affected by the impact of climate change and the Koyra Upazila is a remarkable disaster-prone area where the impacts of these changes are notable and significant. This upazila is being frequently affected by cyclones and storm surges. This area was severely affected by the super cyclone Sidr and Aila (Ahsan, 2010). Moreover, research shows that in Koyra Upazial, salinity intrusion and waterlogging are the most common natural hazards (Sadik et al., 2018). In this area the people are vulnerable due to the repetition of disasters before overcoming the impacts of previous disasters. Gradually vulnerable people living here are losing their capacity of disaster management and being trapped by the cycle of poverty (Nazir Hossain, 2015). Therefore, this study focuses on the socio-economic vulnerability of the climate vulnerable Koyra Upazila.

Previously few studies have done about the vulnerability of southwest coastal areas of Bangladesh. Md. Nasif Ahsan and Jeroen Warner have done research about the socioeconomic vulnerability index in Koyra Upazila in the year 2014. But the present research has focused on the socio-economic vulnerability index and social perception of climate vulnerability by combining the insights of the theoretical framework of PAR Model. However, the data collection of the present research was done in 2022 where the situation has become worse than the previous mentioned research. So, this study also portrays the changes of vulnerability in the selected study area. The previous mentioned research developed the vulnerability index while this research has modified the vulnerability index by portraying the dynamic pressures of the households while dealing the root causes of the vulnerability. This research also has shown the social causation of disaster in the study area following the PAR model. After determining the social causation, the research has presented the vulnerability index. Therefore, the present study then portrays the social perception of the local people about their climate change induced vulnerability.

The objectives of this study are to explore the components and levels of vulnerability, explain the vulnerability scenario, and analyze the social perception of the climate-induced disasters of the selected coastal areas of southern Bangladesh. The present paper focuses on the socio-economic vulnerability of the selected coastal study areas of Bangladesh, and socio-economic impacts of climate induced disasters are also analyzed critically in this study.

Background and Significance of the Study

Climate-induced extrem force people to alter the course of life most of the time and ultimately engage tem in

diversified occupation patterns for maintaining their lives & livelihoods. The result of extreme weather events such as floods, droughts, cyclones, and other weather-associated phenomena affect the wellbeing of affected people through the destruction of physical, human as well as social capital. Due to climate variability, displacement (migration) is also a common phenomenon especially in coastal areas of Bangladesh (Islam and Hasan, 2016). Due to this sort of forced migration, the coastal residents become economically vulnerable (Kelman and Khan, 2013). This is one of the most distinguished forms of vulnerability experienced by many households in this research's selected study areas. Climate change leads to negative consequences on every sector of our surroundings. Especially people who live in coastal regions suffer an immense crisis. The livelihood of the poor and marginalized people are disproportionately vulnerable. In coastal Bangladesh, the multiple stressors related to climate change make the life of the people more vulnerable than the rest of the country(Momtaz and Md Shameem, 2016). Moreover, the study of vulnerability helps the authority to determine the actual condition of the communities and implement necessary plans for reducing the vulnerability.

In this study, the socio-economic vulnerability of the community people at risk is assessed through the Socio-economic Vulnerability Index (SeVI) using a Composite Indicator Framework method. According to IPCC, the interrelationship between vulnerability and climate change depends on three components: exposure, sensitivity and adaptive capacity (IPCC, 2007; Krishnamurthy et al., 2014). These dimensions are further divided into five domains: physical, social, economic, demographic, and exposure to hazards (Ahsan and Warner, 2014). In this present study, the researchers used this SeVI index to assess the socio-economic vulnerability of the study area with a specific focus on the social perception of the climate induced disasters. For the theoretical framework, this study used the PAR Model for developing the indicators for SeVI. The PAR model guided the researchers to determine the root causes and dynamic conditions of vulnerability.

The most familiar conceptual model of vulnerability to disasters includes the Pressure and Release Model (PAR Model) by Wisner. This Model emphasized vulnerability at micro-unit level. The PAR model shows the intersection of unsafe conditions and hazards which creates social vulnerability. According to this Model, disasters occur when vulnerable people are affected by hazards. The root causes of vulnerability are: social, economic and political conditions of community people. The vulnerable communities live under constant pressure due to their limited access to livelihood, education and healthcare, resulting in poor income and unsafe healthcare status and living conditions. To release this pressure, the vulnerability components of risk should be addressed properly by the concerned authorities (Wisner et al., 2003).

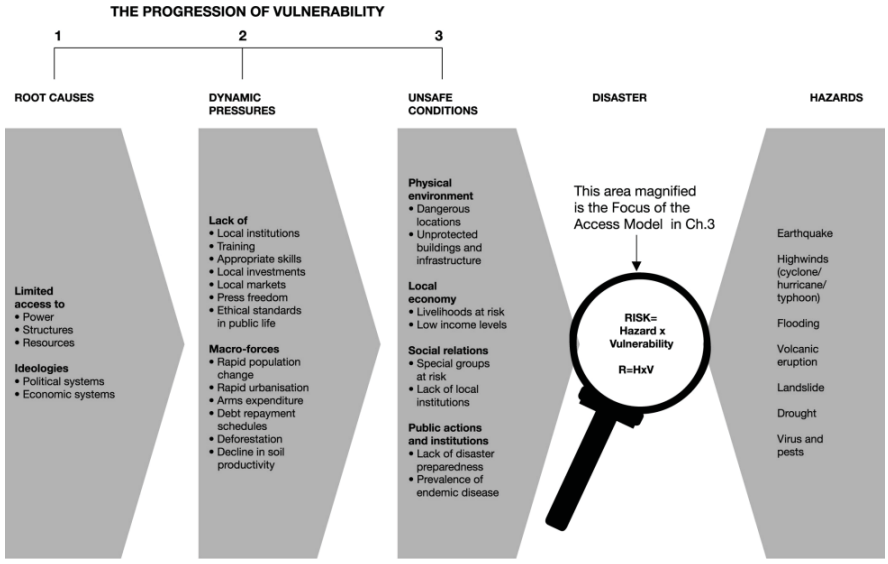

Figure 1: Pressure and Release (PAR) Model of Vulnerability (Wisner et al., 2003)

The use of PAR Model to determine the indicators (indicators of dimensions: Social, Economic, Demographic, Physical and Exposure to Hazard) of Vulnerability Index makes the theoretical concept operational. As vulnerability is a multidimensional concept, the SeVI consists of five dimensions comprised of the contributing variables. The researchers used context specific indicators in this study. The results are presented through the scores of individual dimensions.

The study is about the assessment of socio-economic vulnerability of the people living in coastal Bangladesh (Koyra Upazila). This study not only focuses on the socio-economic vulnerability but also it deals with social perception of the climate induced disasters of the selected coastal areas of Bangladesh. This index-based assessment with social perception can be an integral part of the contingency planning of the disaster-prone coastal areas of Bangladesh. Through qualitative and quantitative approaches, this study determines the changes of the holistic lifestyle of the community people at risk due to climate change. This study shows that the frequent climate change induced disasters have always been detrimental to the local vulnerable coastal communities. The socio-economic vulnerability assessment is imperative for recognizing the impacts of climate induced disasters and formulating effective contingency plan. The vulnerability analysis by using the SeVI can be useful for assessing the coastal vulnerability of Bangladesh and identifying the priority areas for implementation of action-oriented community-based resilience planning for lessening the effects of climate change.

METHODOLOGY

Selection of the Study Area

This Koyra Upazila is highly fragile and vulnerable in terms of climate change induced disasters. The available demographic sources reveal that about 13.3 million population may likely be homeless in the name of climate refugees as the victim of climate extremes in the southern coastal part of Bangladesh by 2050 (Mcdonnell, 2019). Koyra is a coastal upazila under the Khulna District of Bangladesh. It is about 100 km by road from Khulna City and located at the border of Sundarban Mangrove Forest. In 2009, Cyclone Aila created a huge damage and loss in Koyra and affected nearly a population of 152,496 over there. After this damage and loss, the government of Bangladesh and the relevant development partners regard this area as a priority for recovery and reconstruction (Sadik et al., 2018). The Upazila is occupying an area of around 1800 km^2. This area belongs to the immature delta slope which his hardly above the sea level. For this coastal location, the Koyra Upazila is susceptible to different disasters, such as: cyclone, flood, storm surges, salinity intrusion and water logging. The damage and loss scenario after the super cyclones (Sidr in 2007 and Aila in 2009) reveals that the community people living in the study area are the worst sufferer of socio-economic vulnerable conditions (Ahsan and Warner, 2014). The researchers selected four unions (Koyra, Amadi, Bagali, and Dakshin Bedkashi) among the seven unions of Koyra Upazila for this study. In this study, the primary data reveal the underlying and overlying causes of vulnerability in the study area. The data show the most vulnerable groups within these communities, such as: women, minor groups, low-income households, disable people, old-age people, displaced people etc. The researchers have chosen the four unions and tried to figure out the factors which are responsible for emerging crises. This study tried to reveal the socio-economic vulnerability perspectives of the concerned unions under Koyra Upazila.

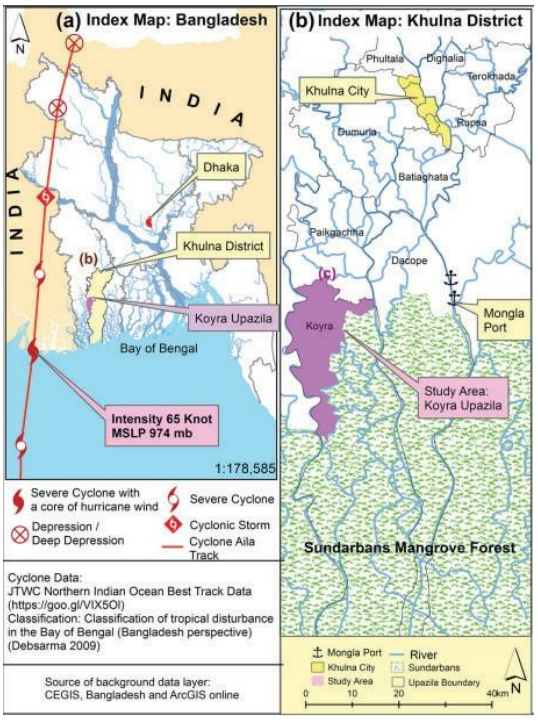

Figure 2: Koyra Upazila, Khulna District, Bangladesh (Sadik et al., 2018)

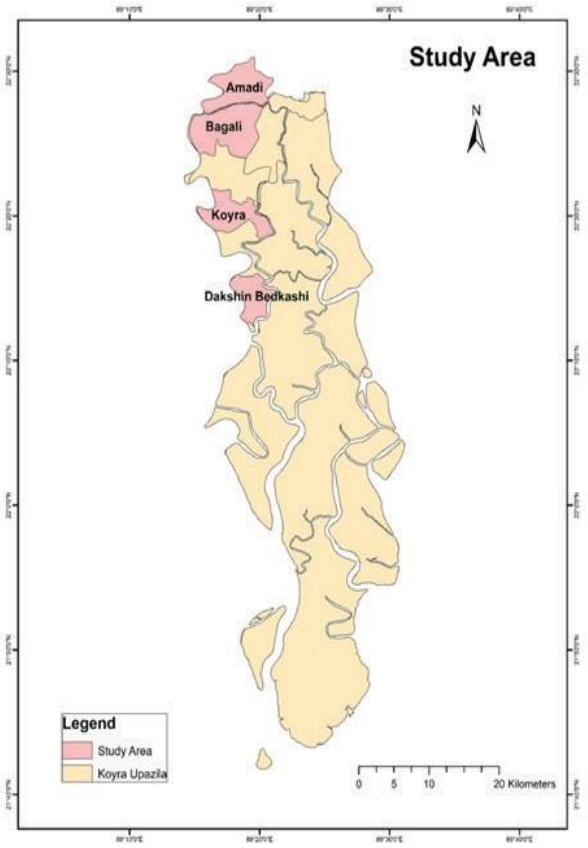

Figure 3: Map of the Study Area

Data Collection

This research focused on a mixed-metho strategy by combining both quantitative and qualitative data. The researchers collected primary data conducting Key Informant Interviews (KII), Focused Group Discussions (FGD), Questionnaire Survey and secondary data was collected through extensive literature review. By conducting systemic data analysis, the researchers tried to identify the socio-economic vulnerability of the people of selected communities by using the vulnerability index. Moreover, the researchers have also explored the adaptation strategies of the vulnerable frontline people by focusing on their livelihood patterns.

The researchers have followed the non-probabilistic sampling method in this study. To have detailed insights into the life and livelihood of the climate vulnerable people, the researchers have selected 200 households (50 households from each union) on the basis of their climate-vulnerable situation.

By conducting several FGDs with community people, the researchers have tried to collect data related to socioeconomic status of the households. To have detailed insights of the community lives and livelihood, the researchers have chosen some key informants from the selected study area with whom they maintained constant contact throughout out the fieldwork period. Moreover, some experts from the selected field of research interest were chosen for their valuable advice and opinions. Through Key Informant Interviews, the researchers tried to capture clear emic insights of the key informants form the study area for defining the socioeconomic vulnerability situation. Through questionnaire survey, the researchers tried to identify the nature of relationship between vulnerability and major socio-economic indicators. By combining the findings from FGDs, KII and Questionnaire Survey, the researchers tried to generate a comprehensive analysis of the socio-economic vulnerable situation of the community people at risk.

Researchers collected the secondary data by reviewing the relevant literature. Based on extensive literature review**,** the researchers prepared questionnaire and conducted the survey among local inhabitants. In the questionnaire, there were questions regarding the demographic information of the households, household profile, exposure to risk environment, economic indicators, social parameters, safe drinking water and sanitation, literacy rate, food security, health care facilities, and other infrastructural indicators. The questionnaire survey among the local households helped the researchers to extract the type of data which showed households' exposure, sensitivity and adaptive capacity towards disaster risks and climate vulnerability.

Data Analysis

After the data collection, the data was analyzed systematically in SPSS and Microsoft Excel for quantification. Furthermore, the qualitative data were analyzed thematically by chunking and coding.

The researchers determined the indicators for vulnerability indicators by following the PAR Model. To determine the domain-wise vulnerability score, the researchers summed up the findings and organized each value according to the indicators of the vulnerability index: physical, social, economic, demographic and

exposure to natural hazards (Ahsan and Warner, 2014; Krishnamurthy et al., 2014; Tonmoy et al., 2014).

Here, the researchers took the score which varies between 0 to 1, where 0 means No Vulnerability and 1 means Extreme Vulnerability. In between 0 to 1, the researchers categorized the different levels of vulnerability including severe, moderate, partial, and fully vulnerable. The sub-components of vulnerability were standardized again between 0 and 1. Each sub-component has an equal contribution to the SeVI index. A balanced weighted approach were used for calculating the SeVI (Hahn et al., 2009):

Weighted index score (WIS)k = (component index score) × (average index score)

The domain-wise vulnerability score was then calculated by averaging the weighted score of all sub-components for each domain category:

$$COV_i = \frac{\sum_{k=1}^{n} (WIS)_k}{\sum_{k=1}^{n} (average\ weight)_k}$$

Source: Sahana et al., 2021

RESULT

The Nature of Climate-Induced Vulnerability in the Study Area

For understanding and measuring the vulnerability of the selected coastal areas, the researchers have used the pressure and release (PAR) model. In this research, the researchers have taken the livelihood pattern as an important indication along with other indicators, such as: Calorie intake, Life Style, Income, Expenditure, Savings, Debt, Housing Pattern, Literacy Rate, Access to Technology, Health Condition, Social Capital, Community Participation, Dependency on Relief and so on.

According to the PAR Model, the social, economic and political situations make some people more vulnerable to natural disasters. Root causes, dynamic pressures and unsafe conditions makes the vulnerable population more sensitive to natural hazards. The Figure 3 shows the rooted character of vulnerability of the people who have limited opportunity as well as limited access to resources.

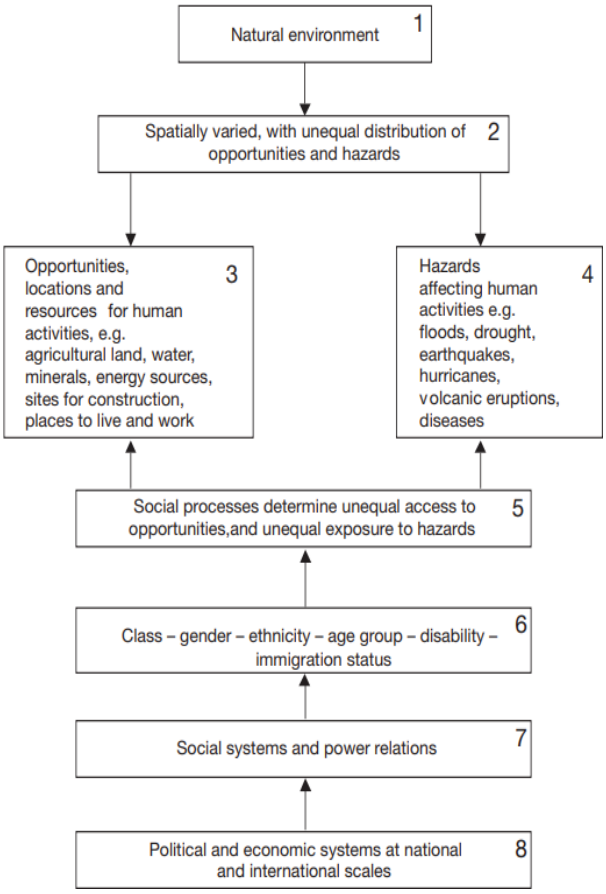

Figure 4: The Social Causation of Disaster (Wisner et al., 2003)

As per the PAR Model, the researchers have considered the vulnerability situation of the study area by combining two opposite forces: the mechanism of the progression of vulnerability and the occurrence of a hazard. The vulnerable situation of the community people is generated without the impacts of hazards initially then the occurrence of hazards creates stress in their life and complicates their situation (As the Figure 3 shows). In the selected unions of the Koyra Upazila, the researchers have found that the climate induced disaster situations usually intensify the vulnerable situation of the community people. This situation gets more intense for the households who faces political, social and economic inequality. Researchers found that, the underlying economic and social problems of low-income households and socially marginalized groups (such as: women, disable and old- age people) affect livelihood opportunities and this situation gets worse during and after disasters. Moreover, the

climate change situation exacerbates the damage and loss and the situation of the community people becomes more vulnerable. To have the insights about the vulnerability of the selected households of study areas, the researchers considered Community Based Disaster Risk Index and also took into account the number of dependent and independent variables based on **Sensitivity** (Indicate the area of the extent to which a domain can be affected by existing socioeconomic irregularities), **Exposure** (the degree, depth, and nature to which a domain is exposed to climate-induced extremes and socioeconomic shock) and **Capacity** (Existing socioeconomic capability to cope climate extremes).

In this study, the index is comprised of relevant indicators which summarizes the overall climate vulnerability situation of the study area. Table 1 shows the domain wise vulnerability indicators and the associated general remarks on the findings. The level of vulnerability of each indicator is presented here with + and – signs (+ denotes increase; - denotes decrease). With these signs, the researchers were able to present the overall vulnerability of the selected households rapidly. The nature of vulnerability here is presented on the basis of the increase and decrease of the factors associated with the indicators.

Table 1: The Nature of Vulnerability in the Study Area

Area of Concern	Indicators and Level of vulnerability [Decrease (-) / Increase (+)]	Findings
Physical	1. Condition of housing (+) 2. Availability of community utility Services (+) 3. Number of Physical utility services per households (+)	Due to excessive heat, the ground water table are lowering day by day and salinity increases. That's why people not getting drinking water in near hand. In such situation amplify their miserable living standards.
Financial or Economic	1. Number of employees per households (+) 2. Sate of insurance debt or loan (+) 3. Availability of Lands (+)	Due to frequent climatic condition vulnerable coastal people loss their formal jobs and a vast majority of people are going under the poverty line (Per day income less than 1.9 USD).
Social	1. State of existing literacy rate (+) 2. People attitude towards psychological trauma during disasters (-) 3. Number of marginalized people (+, -) 4. State of vulnerable people access to Community decision making approach (-) 5. Social Capitals (+, -)	Majority of people loss social capital and being marginalized. Due to economic instability the holistic peace and stability in society are largely disrupted. Also, Social status created one type of caste system (in terms of economy) which is one of the most emerging issues for social transition of population.
Demographic	1. Population Density (+) 2. Rate of migration towards urban area (+) 3. State of occupational pattern change (+)	Large portion of vulnerable people are migrating towards urban area for managing their livelihoods.
Exposure to Natural Hazard	1. Not having shelter in cyclone centers (-) 2. Willing to go to cyclone shelters (+) 3. Understanding National Waring System (+) 4. Number of cyclones in last 10 years (+) 5. Number of floods in last 10 years (+)	People usually go to shelters homes during cyclones. Not all of them are willing to go to cyclone shelters but the ratio of willingness has increased after Aila.

Vulnerability Scenario in Study Area

The results of the study shows that most of the households of the study area are vulnerable. The degree of exposure and sensitivity are high, and low adaptive capacity contributes to the high level of vulnerability. The physical, economic, social, demographic and exposure to natural hazards domains have contributed

to different degrees of vulnerability (such as: extreme, very high, high and low). The selected households are found more exposed to coastal disasters and sensitive towards damages created by the disasters. Moreover, the low level of adaptive capacity of these households makes them more vulnerable. Most of the sampled households of the study area affected by the asset loss and home damages. The socio-economic vulnerability situation exposes their low access to healthcare services, less access to food and safe water, limited livelihood facilities, low economic condition and inadequate provision of infrastructure. The domains of SeVI are presented in Table 2.

The researchers have also presented the domain wise (Physical, Economic, Social, Demographic and Exposure to Natural Hazards) vulnerability scenario of the study area.

The researchers analyzed the areas (Table 2: physical, social, economic, demographic and exposure to natural hazards) of vulnerability in terms of exposure, sensitivity and capacity and categorized the unions on the basis of the category of (Table 3 - category of vulnerability: extreme, high, moderate, and low) of vulnerability.

Table 2: Combined Socio-economic Vulnerability Index (SeVI) of the Sampled Households

Name of Union of the Study Area	Physical Vulnerability (Value of Index)	Economic Vulnerability (Value of Index)	Social vulnerability (Value of Index)	Demographic vulnerability (Value of Index)	Exposure to Natural Hazard (Value of Index)
Koyra	0.49 (49 %)	0.88 (88%)	0.31 (31%)	0.30 (40%)	0.52 (52%)
Bagali	0.88 (88%)	0.71 (71%)	0.62 (62%)	0.34 (34%)	0.60 (60%)
Amadi	0.50 (50%)	0.73 (73%)	0.23 (23%)	0.31 (31%)	0.53 (53%)
Dakshin Bedkashi	0.56 (56%)	0.75 (75%)	0.38 (38%)	0.52 (52%)	0.59 (59%)

Table 3: Average Socio-economic Vulnerability of the Sampled Households in the Study Area

Serial No.	Name of Union	Socio-Economic Vulnerability	Percentage	Category of Vulnerability
1	**Bagali**	**0.63**	**63%**	**Extreme Vulnerable**
2	**Dakshin Bedkashi**	**0.56**	**56%**	**Very High**
3	**Koyra**	**0.50**	**50%**	**High**
4	**Amadi**	**0.46**	**46%**	**Moderate**

The overall vulnerability scenario reveals that, among the selected unions of Koyra Upazia, the Bagali union is extremely vulnerable. Lack of early warning dissemination, less socio-economic opportunities and increased disasters are responsible for the extreme vulnerability of this union.

According to this research, increased rate of poverty, loss in agricultural production, unemployment rate, decreasing health condition, loss of formal economy, scarcity of safe drinking water and rise of the communicable diseases are the reason behind the socioeconomic vulnerability of local inhabitants of in Koyra Upazila. The climate induced disasters buffer this situation which lead towards inadequate capacity. So, the risk of the climatic situations remains high in this coastal area.

Social Perception about Climate induced Disasters

The selected four unions (Amadi, Bagali, Koyra, and Dakshin Bedkashi) are more disaster-prone areas among other remaining unions of Koyra Upazila. The residents of this area undergo a severe climate crisis. The extreme weather events (like: excessive temperature, unwanted rainfall, irregular precipitation pattern, raise in sea level, frequency of cyclone and storm surge, etc.) due to climate change pose a great challenge towards their lives and livelihoods,

During the field survey, the researchers asked local responders about existing weather patterns and rank the event that they faced in the last five years.

Based on the emic perception of the local respondents, the disasters to which they are being exposed regularly are given below (Fig. 7)

Table 4: Ranking of the Extreme Weather Events in the Study Area (According to the Respondents)

Climate Change Impacts	Rank based on Respondents	Average (% of households impacted by the mentioned changes in the climate)
Increased Intensity and Frequency of Cyclones	1	88%
Increased Flooding	2	75%
Rise in Temperature	3	72%
Drought	4	69%
Salinity Intrusion	5	64%
Water Logging	6	61%
Change in Rainfall Pattern	7	57%

The above-mentioned ranking is constructed based on the data collected from Questionnaire Survey, FGDs and KIIs. From this table, we can see that cyclone is the most common and devastating extreme weather event. According to the respondents, almost every year the local people of the four unions face climate-induced disastrous events which are being more intense and frequent. Historical trend of these events reveals several factors behind this irregularity, such as: raising of the average annual temperature (approximately 0.4 0C), uneven rate of rainfall pattern, gradually rising sea level, skyrocketed rate of deforestation, etc. These factors are a direct result of climate change. Due to ongoing climate change, the coastal communities are witnessing such climatic anomalies.

Therefore, almost a large section (about 88%) of the respondents said that cyclonic events make their vulnerable situation worse and these events are most responsible for civics distress and the researchers tried to figure out the recent (last 6) devastating cyclone in concern unions in the following figure (Table 4).

Table 5: Recent Cyclones in the Coastal Areas of Bangladesh

Name of Cyclone	Year	Impacted Domain
Alia	2009	Physical
Roanu	2016	Economic
Fani	2019	
Bulbul	2019	Environmental
Amphan	2020	
Yass	2021	Health

It is well apparent from social vulnerability analysis that the Koyra Upazila is much more fragile in terms of social perspective, such as: in terms of poverty rate, availability, number of healthcare institutions, safe drinking water supply, rate of literacy, female participation on policy making perspective and so on.

The community members do have their own socio-economic and religious factors in this case which shape up their own perception about the climate-induced disasters. In their opinions, the frequency of disasters has increased in the recent past years and their direct and indirect experience within these situations have formatted their experiences regarding risk perception. Households which have socio-economic differences, do perceive the disaster risk differently. Some prefer to migrate from their community to near-by cities to find better options. To these households, migration is an adaptation strategy. However, the households which are economically vulnerable, are being trapped in their communities and cannot migrate due to their socio-economic dynamics. In addition to this, the male and female victims consider their situation differently due to their gender specific exposure and ethos. Female respondents consider the disastrous situations to carry more risks because they are more exposed their domestic roles and actives rather than their male counterparts. The respondents are less aware about the anthropogenic activities which leads the climate to change faster. Rather, they perceive these disasters according to local values, religious beliefs and cultural

factors. Moreover, the community members do poses traditional strong family and social community values and during and after disasters they do play the roles of volunteer for communal wellbeing.

As per the PAR Model, the socio-economic situation of a community determines their adaptive capacity towards disasters. The socio-economic development shapes a community's resilience capacity which sometimes depends on the non-structural mitigation measures. The social perception of a community provides us the overall mindset and social situation of local inhabitants. This study provides both the socio-economic vulnerability scenario and social perceptions of respondents about disasters. From this perspective, the policy makers and concerned authorities should take appropriate initiatives of awareness raising campaigns amid the community people. This sort of initiative will reshape their social perception about every stage of disaster cycle and it will have a positive impact on their socio-economic vulnerable situation.

DISCUSSION

Due to the unique geophysical characteristics of the coastal areas of Bangladesh, it is event from this research that, almost every year the entire study area is exposed to the increased frequency of extreme climatic events. Consequently, the households in this area are likely to become socioeconomically more vulnerable, butut the range of vulnerability varies between these unions. That's why the researchers have tried to calculate the index value of each domain from the perspectives of exposure, sensitivity and capacity. Based on SeVI index, each domain scores with a different value of vulnerability. The researchers tried explore the socio-economic vulnerability by studying the major components of the physical, social, economic, health and demographic (based on selected indicators).

From the perspective of average socio-economic vulnerability (physical, demographic, social, and economic context), this study reveals that, among the selected unions, Bagali union is the most vulnerable from the perspective of almost all the domains of vulnerability index. During the fieldwork, it was quite clear that the reasons for which they are going through miserable conditions. The researchers tried to incorporate the social perception of community people about natural disasters to analyze the social process of the community. However, the other three unions are also vulnerable due to the climate change induced weather extremes.

Figure 5: Agricultural Land of Bagali Union affected by Drought (Fieldwork Image)

Figure 6: Inundation in Bagali Union due to Flooding (Fieldwork Image)

From the data analysis, it is evident that the selected four unions have high exposure to the climate vulnerability are at high risk of increased frequency of the disasters. This situation of exposure and sensitivity is rising the poverty rate and the living standard of the affected people is becoming low. During the fieldwork, the researchers have found some cases of child malnutrition, failure to repay debt, maternal and child motility, dropout from school, child labor and gender discrimination.

The study area (Koyra Upazila) is highly exposed to climate induced disasters and extremely sensitive towards the damages caused by these disasters (such as: cyclones, flood and drought). Moreover, due to the socio-economic vulnerability the adaptation capacity of the marginalized households remains low. Among sample households, most of the households are affected by the economic vulnerability which limit their capacity to cope with the changing climate and disaster situations. So, these marginalized people are being trapped in the cycle of poverty. During the disasters, the damage and loss of their limited property exacerbate their situation and they become more sensitive to the extreme climatic

events. Climate induced disasters also pose constant threat to the health of the vulnerable population living in the Upazila. Loss of agricultural productivity creates food insecurity and the salinity intrusion and drought in the dry season compel the safe drinking water to become scarce. The overall vulnerability scenario of the selected study area reveals the high socio-economic vulnerability among the communities of Koyra Upazila in terms of: low income, crop failure, vulnerable health status, scarce safe drinking water, inadequate infrastructure and so on.

Moreover, the social perception of the respondents reveals the social systems and power relation of the communities. This social setup affects their adaptive capacity. The study shows that the social perception of community members is derived from the social processes which ultimately determine their access to opportunities and exposure to natural hazards. Also, the study shows that, during disasters, the local network of transportation becomes disrupted which leads towards a long-term communication disruption. Both the primary and secondary data sources also reveal that there is low level of literacy among the local people of selected unions. Moreover, the displacement during disasters also exacerbates the prevailing vulnerable situation of the sufferer households. Inadequate capacity and lack of amenities pose devastating impact on the lives and livelihoods of the local inhabitants and this situation is becoming more vulnerable due to the increased change in the climate. Those households who are at risk becoming marginalized and they require effective adaptation and mitigation measures to cope with this changing climate.

CONCLUSIONS

In this research, the researchers have tried to explore the existing vulnerability situation of the local communities of the southern coastal part of Bangladesh by assessing different domains of socio-economic perspectives which will be an important account for developing a contingency plan for the resilience of these localities. Moreover, the researchers also had some limitations while conducting the fieldwork, such as: time and fund constrains which restricted them to have the holistic vulnerable situation of more local people and emic insights of their way of life, their coping mechanisms and their real-life challenges during crisis events. However, the findings indicate that, the socio-economic vulnerability of the sampled households increases the poverty rate. The domains which the researchers selected in this research to study vulnerability have direct link with the disrupted livelihood and living standard of the local people. Due to the frequent climate extreme events, the damage and loss of the property, infrastructure and social capital make the inhabitants of the vulnerable coastal areas marginalized and they are constantly being deprived because of the climate injustice. Also, the findings of the study reveal that, in marginal households, the gender inequality persists and this often leads to gender-based violence so the women living these vulnerable unions are more vulnerable than their male counterparts. Though the vulnerable households sometimes perceive migration as an adaptation strategy but not all migration bring positive changes in the lives of the migrated households. Situation of the forced displaced households are far worst here. So, in conclusion it can be said that, the sampled households of the selected coastal areas are extremely exposed to climate change impacts and due to the lack of capacity they are sensitive towards the climate induced disasters. The selected unions of the Koyra Upazila are suffering from excessive socio-economic vulnerability because of the disrupted livelihood, low income, economic insecurity, physical vulnerability, low literacy rate, gender inequality, low health status, food insecurity, and problems regarding infrastructure, water and sanitation. These vulnerable coastal areas require efficient disaster risk reduction strategies, contingency plans, policy measures and implementation for resilience. Formulation of holistic vulnerability assessment framework and effective coastal risk management will be helpful in lessening the impacts of climate change. Engaging local community people in community-based risk assessment, initiating structural and non-structural mitigation measures, and promoting indigenous adaptive strategies are highly recommended by the researchers. To lessen the impact of vulnerability, the researchers suggest more cost-effective solutions, awareness raising initiatives, capacity building programs, increased social security services, effective disaster response and increased coordination among stakeholders and community people. Moreover, strengthening the social system with increased economic opportunities is also an essential step. In this regard, the use of a comprehensive vulnerability index will escalate the feasibility of climate change induced vulnerability assessment. These provisions will be very much helpful for the frontline vulnerable people who requires immediate attention. Social safety net assistance can play an important role is this regard and the proper disaster risk management formwork will be necessary

for reducing the vulnerability of the frontline people of the coastal areas.

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