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CLIMATE CHANGE EFFECTS ON LIVELIHOOD RESILIENCE OF HAOR PEOPLE IN MONHANGANJ UPAZILLA

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ABSTRACT

Bangladesh is widely recognized as one of the most climate vulnerable countries in the world. The study analyzed the effects of climate change and explores prevailing adaptation strategies taken by haor famers at locale level. This study aims to document the impact of climate on the livelihood and food security of Haor farmers and identify relevant forces and factors contributing to it and identify appropriate adaptation policies and programs that support the most vulnerable and food insecure communities affecting the lives and livelihoods of Haor area Primary data were collected through field visit, questionnaire survey, FGD and KII. A purposive random sampling method was applied for selecting 60 from different households in 8 villages located in and around Diggaputa Haor at Mohonganj Upazilla. Data has been presented mostly in the tabular form, some statistical measures like average, percentage, ratios, and regression analysis calculated to arrive at expected findings. Home stead area is the highest (12.5%) in

Etniyakhalipur compared to others areas. Cultivated land and pond area is highest around 66.7% and 28.9% in Pabui. Also, the average farm size and annual income of Pabui respondent is greater than other respondents which is 143.3 decimal & 93% from agricultural crop production. Other respondents are affected by climatic hazards like flood plains, cyclones, drought etc. That's why, most of the respondents are dependent on various sources like livestock and poultry, fisheries, business, labour and others. It has been observed from interview data that flood (100%) is the major factor affecting agricultural productivities in the haor area whereas drought, cyclone and others is 80%, 80% and60% respectively. Also, perception of food consumption and food insecurity in terms of seasonal deficit especially dry lean periods is 100%. After natural disaster, the access of food is 100% and pure drinking water from tube-well (100%), Pond water (40%), Rain water (80%) which causes various kinds of water borne disease. According to case study, it has been observed that natural disasters have negative effects on their family income where around 60% said during the last five years natural disasters occurred 3 -5 times around the years. Compare to degree of suffering natural disasters, it has found that the degree of suffering before natural disaster in extreme and moderate level was 80% and 20% respectively and now the degree of suffering after natural disaster is extreme level (100%) which proves that climate change affects Haor people's livelihoods. In the perception level of flood as a phenomenon of climate change of the selected communities is 100% which cause 20% respondents to change in crop calendar and 40% population to switching their job. Due to flood, the selected community are affected by property loss, diseases and changing crop production pattern. The second perception level is cyclone and potable water crisis which is around 80%. Cyclone has devastating effect on the communities which make their lives more vulnerable along with floods. Due to cyclone, 60% respondent has repaired/reconstructed their house. Due to heavy rainfall sometimes, the poor people have to repair/reconstruct their house (40%) and most of the respondent follow the weather forecast around 60% as a adaptation strategies. It has been recorded that due to drought as a vulnerability context, the migration level is around 20%.

Keywords: climate change, livelihood, haor area, resilience

JEL classification: Q54

BACKGROUND OF THE STUDY

Due to its geographical position, high population density and poverty, low capacity for adaptation and mitigation, Bangladesh is the most susceptible country to climate change with other developing countries in South Asia (Mirza 2002; Dastagir 2015; Alam et al. 2018). Climate change may affect people differently based on their livelihoods and socioeconomic status (Kabir & Serrao- Neumann 2020). According to the World Risk Report 2012, Bangladesh ranked fifth out of 173 countries to natural hazards and the vulnerability of societies (Joarder & Miller 2013). Mostly the riverine households of Bangladesh are at high risk of negative impacts of climate change and experience extreme events such as drought, flood, tropical cyclones, and storm surges every year (Alam et al. 2017). These events have killed thousands of people and destroyed homes and livelihoods. The prolonged flood events push thousands of people to become homeless and they lose their homestead and croplands (Saha 2017). Also, in riverine areas of Bangladesh, frequent floods pose a different threat to food security by rice crop damage which ultimately impacts both the country's food security and economy.

Due to flash floods, crops are destroyed every year in the northeastern haor region. Although the riverine haor areas are much more fertile land for agricultural production, these areas are relatively poor compared to the rest of the country (Md. Shajahan, 2022, Md. Shajahan & Radović-Marković, 2023). There are many reasons attributed to it such as the production of the single crop throughout the year, seasonal unemployment, flood, other natural disasters, lack of communication and other infrastructure facilities, employment opportunities, lack of due attention on the part of the government, and other service providers (Nowreen et al. 2013).

The availability of safe drinking water, particularly in Bangladesh's hard to reach areas such as haor area is expected to worsen as the country experiences the effects of climate change. About 28 million Bangladeshis, or just over 20% of the population, are living in harsh conditions in the "hard-to-reach areas" that make up a quarter of the country's landmass. People living in hard-to-reach areas are often vulnerable to natural calamities like flooding, riverbank erosion and siltation (WHO, 2010). Approximately 80% of communicable diseases in the world are water-borne. The availability of safe drinking water, particularly in Bangladesh's hard to reach areas, is expected to worsen as the country experiences the effects of climate change. As a result of climate change, drought in Bangladesh's haor areas during dry season has increased, causing a lack of sweet water. Women in haor areas need to go miles to collect a pitcher of safe drinking water (Rani et al, 2011).

Nowadays, most of the households have now become accustomed by taking some steps in different events like floods and heavy rainfall. Therefore, exploring adaptations associated with local-level knowledge is regarded as an important adaptation strategy for people to deal with an extreme climatic event. So far only a few studies have been conducted to identify the impacts of climatic events, the reason of happening such events, adaptation strategies especially adopted by local people, and how it can be mitigated through building local awareness. The future of the riverine haor people of

Bangladesh relies upon the improvement and disaster management policies of the responsible government and on the regional cooperation and international effort fighting climatic dangers. Therefore, climate change is followed by a significant unpredictability of the new local conditions and vital that initiatives for better climate adaptation.

Objectives of the Study

1. To investigate the factors behind which is responsible to change the patterns of livelihood strategies due to climate change
2. To assess climate change, risks and adaptations approaches among farmers in Haor region
3. To analyze climate change, risk, and adaptations, approaches in terms of gender issues

This finding will be useful for analyzing such vulnerabilities in future research work that will establish the climate change impacts interconnectedness. Clearly, identifying order of the impact constitutes an important component of climate world vulnerabilities analysis, because it can help in identifying the level of vulnerability, when it is showed from end point of consequence, considering vulnerability on a long-term basis is the best approach to developing the results of the local communities against climate, natural hazard, and the research with considered a positive window of opportunity, created by the climate impact, such as the creation of a new institutions, stronger social networks and other positive transformations, in its analytical framework.

LITERATURE REVIEW

Shamsur R et al. (2017) investigated the drinking water quality parameters from different sources (tube-wells and haor) and hygienic conditions of people living around the Dingaputha haor area of Netrokona District. It was found that the levels of DO, pH, EC, TDS, NO3- from both tube-well and haor water were within or near to standard level for drinking (ECR, 1997) and the levels of BOD, Phosphorous from both tube-well and haor water exceeded the standard level for drinking slightly. The Arsenic and Iron concentration of tube-well water exceeded the standard level for drinking extremely (WHO, 2003). The highest number of Escherichia coli bacteria was found in haor water due to open toilets nearby haor and the lowest number of Escherichia coli bacteria was found in tube-well water of Magan-Siader Union both of which exceeded the standard for drinking (EPA, 1996). It was also observed that about 82.5 % people had access to tube-well water for drinking and 17.5% people had no access to tube-well water for drinking. The hygienic condition of Digaputha haor area of Netrokona District was very poor. The distances between tube-well and toilet were very near to each other and the open hanging toilets nearby haor were also found. People using contaminated tube-well water for drinking and haor water for cooking were infected with various water borne diseases such as diarrhoea, cholera, typhoid, liver diseases (Cirrhosis, Cancer), skin disease etc.

Islam et al. (2020) found that 65% fishers were involved in permanent fishing activity and 35% fishers were temporarily involved in fishing with other occupation as daily labour, net making etc. A very few empirical research on the impacts of climate change in Kishoreganjhaor had been conducted, so researcher and policy makers could get information about the concern by that study and implement policy for the climate change induced affected people of the Kishoreganjhaor.

Raihan F & Hossain MM (2021) addressed the livelihood vulnerabilities and adaptation strategies in response to the climate change issues based on empirical evidence from wetland communities using the livelihood vulnerability index (LVI) in Tanguar haor, located in Sylhet, Bangladesh. The finding shows that people of the study area are switching their formal livelihood activities into alternative sources. Crop diversification, homestead gardening, erosion proofing, and cage aquaculture are commonly used by the studied communities to adapt to climate change impacts. The main driver of vulnerabilities was found to be lack of education, underdeveloped infrastructures, lack of advanced health facilities, and lack of alternative livelihoods during extreme events. Therefore, people living in and around the haor region need special consideration. Overall, the study suggested that policy or institutional arrangements are required to promote the better governance system for local communities to improve their living standard so that they can achieve resilience to the impacts of climate variability and change in this area.

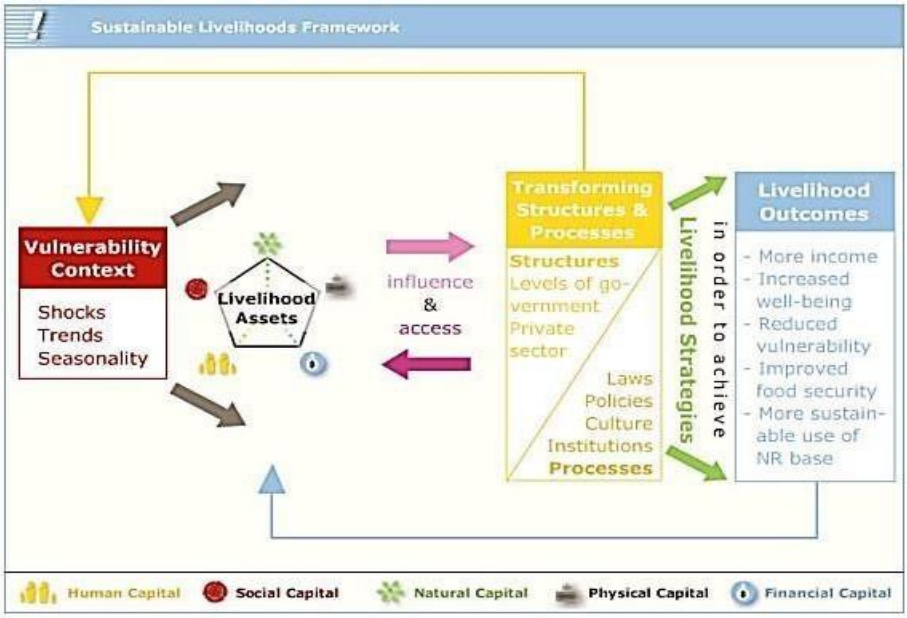
THEORETICAL FRAMEWORK

The concept of 'Sustainable Livelihoods' constitute the basis of different 'Sustainable Livelihood Approaches' (SLA) and has been adapted by different development agencies such as the British Department for International Development (DFID). The DFID has developed a 'Sustainable Livelihood Framework' (SLF) which is one of the most widely used livelihoods frameworks in development practice. The SLF was integrated in its program for development cooperation in 1997.

DFID adapts a version of Chambers Conway's definition of livelihoods: "A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base." (DFID, 2000) DFID has begun to make use of livelihoods approaches in project and program planning and in monitoring and review of existing activities.

A first step is to understand the livelihoods of the poor, namely conducting livelihood analysis. The livelihood analysis will be the basis for planning, prioritizing and eventual monitoring. There is no designed sequence for livelihood analysis, nor has DFID developed particular tools for such analysis. The stress is GLOPP, 2008 2 on using the best of existing tools for the given circumstances. There is, however, a distinct DFID SL framework (see below) that provides an organizing structure for analysis. The SLF is the core of the Sustainable Livelihoods Approach. The Framework used can be

understood as a tool or checklist to understand poverty in responding to poor people's views and their own understanding of poverty.
In a nutshell, the main elements of the SLF can be summarised as follows:
"…The framework depicts stakeholders as operating in a context of vulnerability, within which they have access to certain assets. Assets gain weight and value through the prevailing social, institutional and organizational environment (policies, institutions and processes). This context decisively shapes the livelihood strategies that are open to people in pursuit of their self-defined beneficial livelihood outcomes." (Kollmair et al., 2002).



Source: DFID (2000)

METHODS AND TECHNIQUES OF THE STUDY

A socioeconomic study usually requires selection of an area for collection of data in accordance with the objectives set for the study. Selection of the study area is an important step in such a study. To achieve the objectives of the present study, a preliminary survey was conducted in Haorarea of (Dinaggaputa Haor) Netrokona district to understand the broad socio-economic characteristics of the respondents.
In a sample survey, a subset of populations called sampling frame was prepared and required data was collected from the frame. Hoar agricultural and fish collector was selected as a sample unit under Netrakona district. Memory recall method was used. Population list was collected through district or up a zila office of haor farmers among

them, 5 case studies was done in Netrakona District.

For the study, the primary data was collected through personal interviews with selected farmers. Data were collected in August 2022. In order to obtain reliable data, the research team was stayed at Hoar area to observe the situation and livelihood Stahl true ethnographic observation.

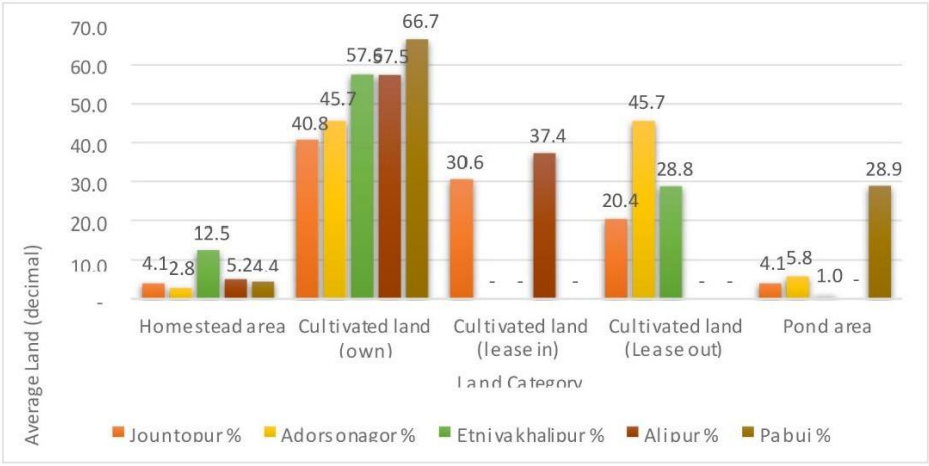
The service schedule was carefully prepared to record the record data on various aspect of the study. In conformity with the objectives of the study in draft survey schedule was prepared in a such way, that factors associated with climatic observations and livelihood of the farmers at whole area of selected District. In the pretest, survey attention was paid to inclusion of any new information, which was included in the draft schedule. The drop schedule was improved, rearranged and modified in the light of the actual and practical experiences. After making necessary adjustments and final survey schedule was developed in a logic sequence collection of Data:

The farmers were interviewed at their leisure time so that they could give accurate information in a cool mind. Before information regarding the nature and the purpose of the study was made to the farmers before actual interview. An introductory visit was made in which that aims and objectives of the study was explained to the sample farmers in order to ensure cooperation from the correspondent. Questions was asked systematically and explain was made whenever it was felt necessary. In order to minimize your data was collected in the local units and language. This was subsequently converted into appropriate standard limits. The secondary data was collected from the research documents.

All the collected data was checked and cross-checked before transferring to the master sheet. Therefore, this was classified delete it, and analyzed to accomplish a specific of the objectives of the study. The impact of the climate change on livelihood was examined by making before, and after experience of a natural disaster or climatic hazards. Data was presented mostly in a tabular form, some statistical measure like average, percentages was calculated to arrive at expected findings MS excel was used to analyze quantitative data. results and discussion:

Pattern of Land ownership and Income distribution of respondent household

Homestead area is the highest (12.5%) in Etniyakhalipur compared to others areas. Cultivated land and pond area is highest around 66.7% and 28.9% in Pabui. Also, the average farm size and annual income of Pabui respondent is greater than other respondents which is 143.3 decimal & 93% from agricultural crop production. Other respondents are affected by climatic hazards like flood plains, cyclones, drought etc. That's why, most of the respondents are dependent on various sources like livestock and poultry, fisheries, business, labour and others.



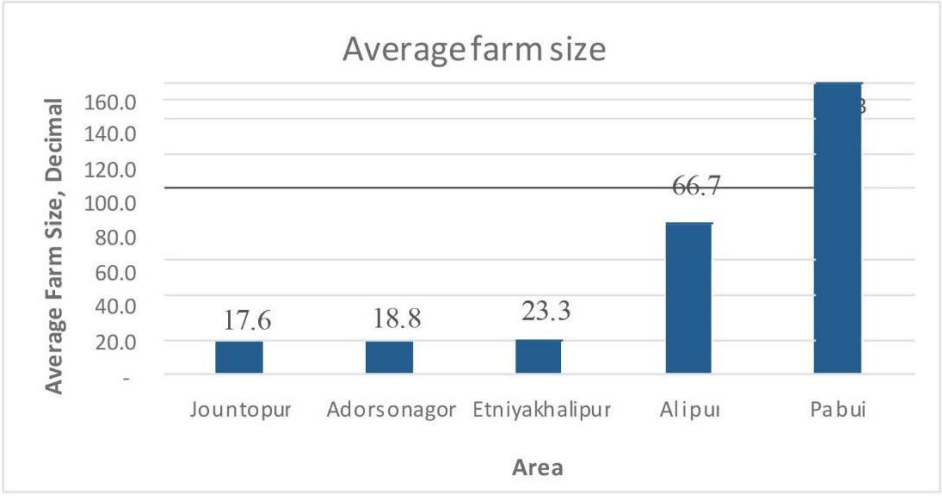


Figure 1: *Pattern of land ownership*

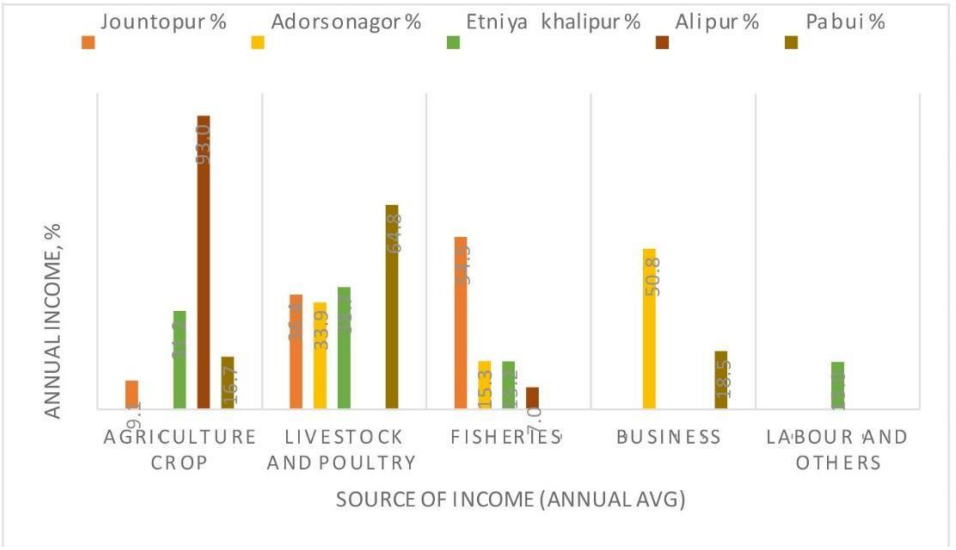


Figure 2: *Income distribution of respondent household*

CLIMATE CHANGE AND FOOD INSECURITY OF HAOR PEOPLE

It has been observed from interview data that flood (100%) is the major factor affecting agricultural productivities in the haor area whereas drought, cyclone and others is 80%, 80% and 60% respectively. Also, perception of food consumption and food insecurity in terms of seasonal deficit especially dry lean periods is 100% as per data shown in table 1. After natural disaster, the access of food is 100% and pure drinking water from tube-well (100%), Pond water (40%), Rain water (80%) which causes various kinds of water borne disease.

Table 1: *Climate Change and food insecurity of haor people*

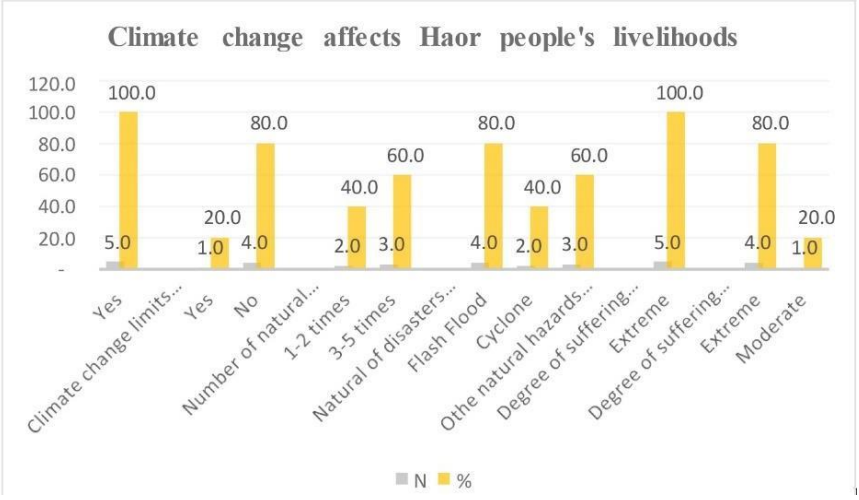
Climate change affects agricultural productivities	N	%
Problems of crop productivities		
Yes	60.0	100.0
No	-	-
Factors affecting agricultural productivities		
Soil Erosion	-	-
Drought	45.0	75.0
Flood	60.0	100.0
Cyclone	40.0	67.0
Others	30.0	50.0
Perception of food consumption and food insecurity		
Deficit of food through whole year	42.0	70.0
Seasonal deficit especially dry lean periods	60.0	100.0
During disaster periods	30.0	50.0
Neither deficit nor surplus	30.0	50.0
Surplus	10.0	17.0
Access of food immediately after natural disasters		
Yes	-	-
No	60.0	100.0
Access of pure drinking water after natural disasters		
Deep tube-well water	60.0	100.0
Pond water	20.0	34.0
Rain water	40.0	67.0

Climate change affects Haor people's livelihoods:

According to case study, it has been observed that natural disasters have negative effects on their family income where around 60% said during the last five years natural disasters occurred 3-5 times around the years. Compare to degree of suffering natural disasters, it has found that the degree of suffering before natural disaster in extreme and moderate level was 80% and 20% respectively and now the degree of suffering after natural disaster is extreme level (100%) which proves that climate change affects Haor people's livelihoods.

Table 2: *Climate Change effects on the livelihoods of haor people*

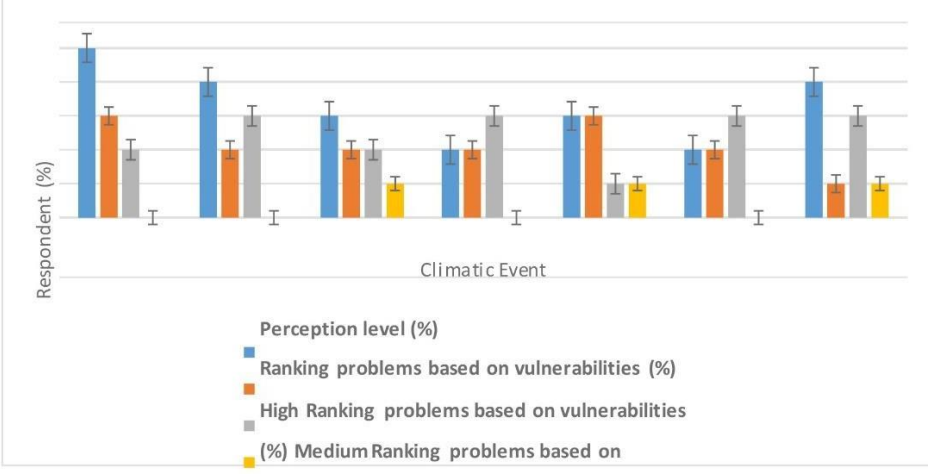
Climate change affects Haor people's livelihoods	N	%
Yes	60	100.0
Climate change limits woman's economic activity		
Yes	50	80.0
No	40	80.0
Number of natural disasters occurred during the last five years		
1-2 times	20	40.0
3-5 times	30	60.0
Natural of disasters occurred in the locality		
Flash Flood	40	80.0
Cyclone	20	40.0
Other natural hazards	30	50.0
Degree of suffering after natural disasters		
Extreme	60	100.0
Degree of suffering before natural disasters		
Extreme	40	80.0
Moderate	10	20.0



Perception level about different climate problems in Mohanganj haor area: It is inevitable for the study about climatic problems to cope with the climatic disruption by measuring people's perception level. It has been observed the various climatic changes that affect the overall livelihood pattern of the selected communities. The perception level about different climatic problems in Dinggaputa Haor are shown in Table -3.

Table 3: *Perception level about different climate problems in Dinngaputa Haor*

Climatic Problem	Frequency of occurrence/year	Perception level (%)	Ranking problems basedon vulnerabilities (%)		
			High	Medium	Low
Flash Flood	1~2 times	100	60	40	0
Cyclone	1~2 times	80	40	60	0
Heavy Rainfall	3~5 times	60	40	40	20
Strom surge	Throughout the year	40	40	60	0
Drought	1~2 times	60	60	20	20
Water Borne Disease	Throughout the year	40	40	60	0
Potable water crisis	Throughout the year	80	20	60	20

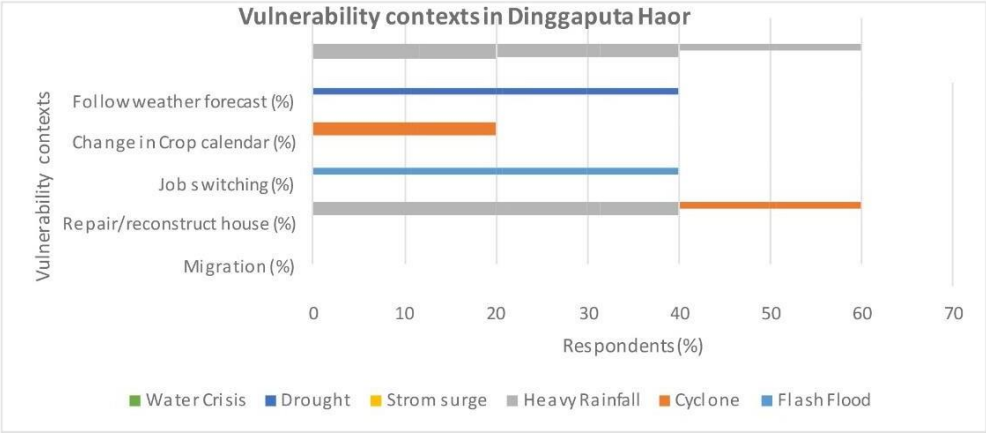


In the perception level of flood as a phenomenon of climate change of the selected communities is 100% which cause 20% respondents to change in crop calendar and 40% population to switching their job in Table- 4. Due to flood, the selected community are affected by property loss, diseases and changing crop production pattern.
The second perception level is cyclone and potable water crisis which is around 80%. Cyclone has devastating effect on the communities which make their lives more vulnerable along with floods. Due to cyclone, 60% respondent has repaired/reconstructed their house. The hygiene condition of Dinggaputa haor is very poor. It has been reported that people using contaminated tube well water for drinking and haor water for cooking were infected with various water borne diseases such as diarrhoea, cholera, typhoid, liver diseases (Cirrhosis, Cancer), skin disease etc. where water borne illness causes 40% perception level.
The frequency of heavy rainfall is 3~5 times over the study area and the perception level is about 60% which is equal to drought, one of the climatic events effects on the selected communities. Due to heavy rainfall sometimes, the poor people have to repair/reconstruct their house (40%) and most of the respondent follow the weather forecast around 60% as an adaptation strategy. It has been recorded that due to drought as a vulnerability context, the migration level is around 20%.

Adaptation Strategies to climate change:

In this study, the perception levels of different climatic problems have been recorded on Table-4 The adaptation strategies to cope up with these climatic events are migration, repair/reconstruct house, job switching, changes in crop calendar, following weather forecast which is shown in Table-4.
Generally, adaptations are felt by the impacted individual, household and community from the needs of adjustments. To avoid food insecurity, adaptation of agricultural sector to climate change is crucial. Farmers may use drought-tolerant crop and implement water saving technologies to cope with climate change as an adaptation strategy.
In a word, needs of adjustments are largely characterized by extent of adverse impacts.
It is necessary to understand that most of the climate change induced problems are likely to be exhibited in the form of water-related problems. Since climate change will have severe adverse impacts on agriculture and livelihoods and well-being of the poor will most likely be at risk, a holistic policy approach should be considered.

Vulnerability contexts	Migration (%)	Repair/reconstruct house (%)	Job switching (%)	Change in Crop calendar (%)	Follow weather forecast (%)
Flash Flood			40	20	20
Cyclone		60		20	40
Heavy Rainfall		40			60
Strom surge	20				
Drought	20			40	
Water Crisis	20				



CONCLUSION

The community has become more vulnerable to climate change due to various factors, such as geographical isolation, lack of education, underdeveloped infrastructures, lack of advanced health facilities, lack of awareness, lack of support from local government, and lack of alternative livelihood (Radović Marković, & Grozdanić, 2013). Strengthening and improving the indicator could help to reduce the livelihood vulnerability of these community. Government and nongovernment organizations should take several initiatives like training for income-generating activities, credit or loan facilities should be provided with ease or at a lower rate of interest that can help them to establish various agro-based industries, fisheries, and other sectors for the diversification of their livelihood options.

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