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IMPACT OF NATURAL DISASTER ON PEOPLE'S LIVELIHOOD AND THEIR ADAPTATION STRATEGIES IN SELECTED AREAS OF BARISHAL DISTRICT

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Abstract

Bangladesh is highly vulnerable to different natural disasters mainly due to its geo-physical setting and socio-economic conditions. Disasters, such as floods, river bank erosion, cyclone, heavy rainfall, water logging, salinity intrusion, etc., are gradually intensifying by climate change and composing risks for the coastal people in Bangladesh. The present study is aimed at exploring the impacts of natural disasters on people's livelihoods of Dehergati union at Babuganj upazila of Barishal district along with to find out the existing adaptation strategies as well. Both primary (household questionnaire survey, focus group discussion, key informants interview) and secondary data (newspapers, journals, books, online articles, web site, and Government office data) were collected accordingly. Results revealed that the intensity, frequency and damaging impact are high for cyclone, river bank erosion and flood in the study area. Findings also stated that natural disasters have affected the livelihoods of the study area in many folds including scarcity of pure drinking water, malnutrition, extreme poverty, health problems and livelihoods impacts such as losses and damage in crop cultivation, fisheries, poultry, vegetables garden, etc. Disasters driven consequences have created a state of unemployment among the community people. To overcome the livelihoods impacts people are adopting both major (i.e. changes of crop pattern, raising agriculture land, mulching system, crop combination, preservation of seed, raising pond bank, etc.) and minor (i.e. raising homestead plinth, storage of fuel wood and dry food, making handicrafts, etc.) livelihood adaptation strategies.

Key Words: Adaptation, Impacts, Livelihoods, Natural Disasters, Strategy.

Introduction

Bangladesh is currently ranked as one of the world's most disaster-prone countries in the world (Choudhury, 2002; Shimi *et al*., 2010; World Bank, 2005). Bangladesh experiences numerous natural disasters each and every year with various magnitude and intensity. The frequently occurring natural disasters, such as cyclone, storm surge, flood, drought, tornado, riverbank erosion, earthquake, arsenic contamination of groundwater and landslide account for significant losses in human lives, livelihoods and physical assets while effects are further reflected in social settings, ecosystems and the economic well-being of the country (Choudhury, 2002; Khan, 2008). People's extreme vulnerability to natural disasters which cause loss of life, damage of infrastructure and economic assets, and adversely affect the livelihoods, especially the poor, vulnerable and destitute living in environmentally fragile areas in particular the southern coastal region of Bangladesh (Kulatunga *et al*., 2014). Moreover, as a developing nation Bangladesh faces variety of problems ranging

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from low income; lack of assets, such as land and permanent housing to accommodate the people; shortages of clean water and adequate food; inability to participate in commercial activity; high population density, human health and illiteracy, etc. (Maxwell, 1999 cited in Mclean and Moore, 2005; Ali, 1999). All these long-lasting problems have been further exaggerated due to frequent natural disasters in the country and also have resulted in turning natural hazards into disastrous situations (Ali, 1999). In the face of climate change and variability, the frequency and intensity of these disasters have been increasing which damages resources and livelihood significantly (Sadeka *et al.*, 2011). In Bangladesh, most of the people are greatly affected by natural disasters and face a greater challenge in their livelihood (Kulatunga *et al.*, 2014). In coastal region of Bangladesh, most of the people are depended on the natural resources base for their livelihood and due to high susceptibility of those natural resources to various climatic shocks and stresses, the overall livelihoods are becoming threatened in coastal region (IFAD, 2009). As a result, the affected people are losing their means of livelihoods and forced to take several alternative means of livelihoods to cope with the adverse impact of climate change related disasters (Nasreen *et al.*, 2013). Due to livelihood impacts and maintenance of livelihood sectors, rural people learned how to adapt with their livelihood impacts. In rural area, adaptation practice is highly noticeable. Adaptation strategy refers to the adjustment of natural or human systems in response to actual or expected climatic stimuli or their effects in order to moderate harms or exploit beneficial opportunities (Perry *et al.*, 2007). People contribute to rural production activities include raising seedlings, gathering seeds, post-harvesting, changing crop pattern, cow fattening and milking, goat farming, backyard poultry rearing, raising homestead plinth, food processing, cane and bamboo works, handloom weaving, homestead gardening, fishnet making, coir production and handicrafts, etc. Meanwhile, several studies have been conducted on various natural disasters impacts on socio-economic, physical, environmental sector in coastal community (Choudhury, 2001; Islam, 2010), recovery needs (Mallick *et al.*, 2011), changes of income after recovery (Abdullah *et al.*, 2016), individual recovery strategy (Parvin and Shaw, 2013), housing recovery initiatives (Mallick and Islam, 2014), and resilience building (Ahmed *et al.*, 2016). So far, the overall impact of various natural disasters on livelihood sector particularly in the small geographical scale is still under-investigated. In-depth research on natural disasters impacts from livelihood perspective of interior coastal area is still needed (Sadik *et al.*, 2018). Accordingly, this study explores the impacts of natural disasters on livelihoods and adaptation strategies in Dehergati union community in Babuganj upazila of Barishal. The study area is situated in a low lying, severely disaster prone area. Most of the communities in the area are located along river side named Sugondha river and Sondha river. Moreover, most of the people of the study area are still remaining so poor which also exaggerated vulnerable condition from natural hazards and the socio-economic conditions not so viable to lead decent living.

Objectives of the study

General objectives: The broad objective of the study is to explore natural disaster impacts on people's livelihood and their adaptation strategy. This study is conducted at Dehergati Union at Babuganj upazila in the district of Barishal in Bangladesh.

Specific Objectives

- To identify the existing frequently occurring natural disasters that affect livelihood of the community people;
- To find out the impacts of those identified natural disasters on livelihoods of inhabitants of study area; and
- To identify the adaptation strategies practiced by community people.

Methodology

Selection of the study area

The Dehergati union is only 2.5 km from Babuganj Upazila Sadar. The study area is surrounded by Kedarpur union at west, Rahmatpur union at south and Sugondha river in the west and Sondha river in the east. The area is highly vulnerable to a range of natural disasters and the study area was one of the hardest hit by the 2007 super cyclone SIDR (MoFDM, 2010, Government of Bangladesh, 2008). The Dehergati union was selected for the study due to its significant vulnerability to various devastating natural disasters viz., the cyclones, the floods, riverbank erosion, etc. It was thought that previous experiences of disaster events would allow the local communities to provide useful insights into the issues being investigated, while the findings of the study would be of practical importance for policy making and practice in disaster risk reduction initiatives in the region. The reasons for selecting this study location is the intensity of high disaster risk in the area, as well as the fact that no scientific research has been done yet to find out the causal driving factors of livelihood impacts of natural disasters and adaptation strategies in this area.

Data collection and analysis

Acknowledging community participation toward effective and efficient disaster reduction activities, a bottom-up research approach is adopted for the study, whereby the local community was consulted for their viewpoints and these, in turn, were fed back to local policy makers for their consideration (Kulatunga *et al.*, 2014) To ensure appropriate coverage of views from different community groups and social categories, both men and women representing different age groups and livelihoods, such as farming, fishing, small businessmen, education, religious leaders, etc. were selected as respondents. The study was required to explore the impacts of natural disasters on community livelihoods and to find out the currently practiced adaptation strategies to reduce or prevent the disaster related shocks and stresses in livelihoods. Therefore, a qualitative research strand was selected for this research as it enabled investigation of the phenomenon in a natural setting and attempted to make sense of,

or interpret, those views by considering the meanings people brought to them (Denzin and Lincoln, 1994). Since, there is no specific rule or pattern for selecting population and sample size for conducting social research, either quantitative or qualitative. Sampling primarily depends on the research aim, achieving theoretical saturation, available time, and surveying cost (Bryman, 2016). After consultation with local disaster management experts in public organizations, academics, and professionals, the study areas were finalized. Four highly disaster-affected communities locally known as Dehergati, Rakudia, Idilkati, Bahir Char Khudrokati were selected for the research (Table 1).

Accordingly, within the qualitative research strand, Fifty (n=50) structured interviews and five focus group interviews (Table 1) and six key informants interview (Table 1) were used as the data collection methods. Respondents previously affected by natural disasters were purposively selected for the interviews. Respondents of farmers, fishermen, day-laborer, women and aged people group were selected for focus group discussion. People from various corners of society who had practical experience with disaster management in the study area were being selected as the participants of key informant's interview.

A structured questionnaire was developed, piloted, and then used for collecting household information on hazard profile, livelihood related information and adaptation strategy. The purposive sampling technique was adopted for selecting participants for the structured interviews and focus group discussions. According to Saunders *et al.* (2009), purposive sampling enables researchers to use their own judgment in selecting participants in a way that best enables answering of the research questions and accomplishing the research objectives. Yin (2011) recognized that purposive sampling is likely to be used in qualitative research where samples are selected in a deliberate manner. Yin (2011) further commented that the reasoning behind the use of purposive sampling is to select the cases that could provide the most relevant and rich data. Accordingly, participants were selected to suit the research questions at hand and to achieve the objectives of the study while representing the major stakeholders within the local communities studied (including vulnerable groups, such as women and the elderly and different age groups). The purposive sampling technique adopted enabled the researchers to capture the perspectives of different stakeholder groups present within a local community in the study area.

Table 1. Details of the Respondents of the study

Sl No.	Data sources Category	Descriptions	Additional information
01.	Name of the villages and sample taken (n=50)	a. Dehergati (n=13) b. Rakudia (n=14) c. Idilkati (n=11) d. Bahir Char Khudrokati (n=12)	Villages were selected based on its disaster vulnerability after consultation with the local disaster experts
02.	Participants Groups of FGD (5 FGDs)	a. Farmers (FGD1) b. Fishermen (FGD2) c. Day-laborer (FGD3) d. Housewives (FGD4) e. Aged people (FGD5)	On an average 10-12 respondents were participated in each FGD
03.	Participants of KIIs (6 KIIs)	a. Chairman of Dehergati union (KII1) b. School Head teacher (KII2) c. Block supervisor (KII3) d. Upazila Livestock officer (KII4) e. Upazila Agricultural officer (KII5) f. Project Implementation officer (KII6)	Participants in KII were selected who had previous experience in disaster management in the study area

Results and Discussion

Socio-economic status

Most of the household of respondents of this study mentioned that they are mostly vulnerable to natural disasters, such as flood, river bank erosion, heavy and late rainfall, cyclone, changing temperature, water logging, etc. Out of the total respondents about 56.35% houses located near the river side and remaining 43.65% houses located away from the river sides which make them more vulnerable to natural disaster particularly for cyclone, storm surges, riverbank erosion, tidal flooding, etc. These sorts of physical locations of houses make people and their property more vulnerable to natural disasters. Due to natural disasters' impact, the living condition and livelihood system of community are affected and thus for their livelihood pattern are changed and create a great economic problem. Due to this economic problem, the life style of community is disrupted. Figure 1 represents the livelihood pattern of the study area.

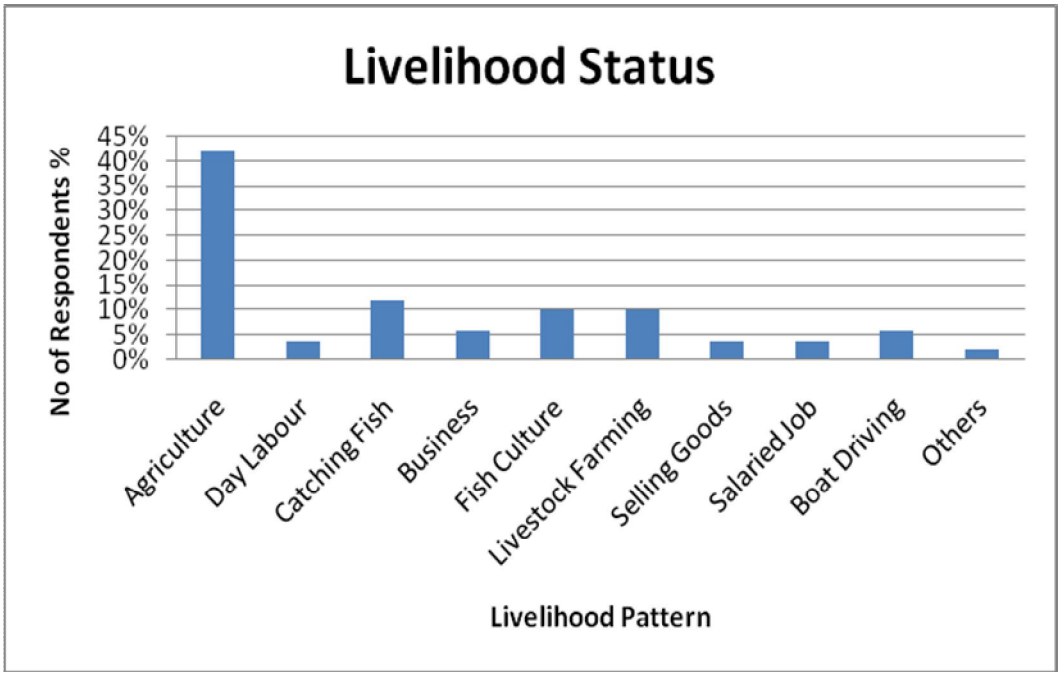

Figure 1. Livelihood status of the study area (Source: Field survey, 2017)

According to household survey, this chart represents the livelihood status of the inhabitants. The main livelihood source of this area is mainly based on agriculture 42%, day laborer 4%, catching fish 12%, businessman 6%, fish culture 10%, livestock farming 10%, selling goods 4%, salaried job 4%, boat driving 6%, and others 2%. But agriculture is the main income source among most of the people. Most of the respondents of the study area are small farmers with having agricultural land. Many have no agricultural land at all. They are tenant farmers and work as a share cropper on other's field. Since, most of the people depends on agriculture, their income source fully depend on crop production. However, due to the occurrence of frequent natural disasters, the agricultural production of the study area have seriously affected and damaged. It is noticeable that most of the agricultural land is beside the rivers, and therefore, these lands are more prone to natural disasters like flood, salinity intrusion, tidal flooding, river bank erosion and water logging, etc. The average monthly income of the different livelihoods groups are shown in Table 2.

Table 2. Average monthly income of respondents

Sl. No.	Livelihood sources	Average monthly income (BDT)	Frequency (f)	Percentage (%)
01.	Agriculture	4000-5000	21	42
02.	Day labor	3000-4000	2	4
03.	Catching Fish	4000-5000	6	12
04.	Fish Culture	3000-4000	3	6

05.	Business	5000-6000	5	10
06.	Livestock Farming	2000-3000	5	10
07.	Selling Goods	3000-4000	2	4
08.	Salaried Job	10,000-12,000	2	4
09.	Boat Driving	2000-3000	3	6
10.	Others (Home Gardening, Rickshaw pulling etc.)	1000-2000	1	2

Data source: Field survey, 2017

From the Table 2, it is found that most of the families' average monthly income was between 2000 to 4000 BDT. Only few families earn more than 5000 BDT. From this low monthly income, it is clear that the living conditions of inhabitants are so poor and this low income status undermine the overall employment opportunity in the study area. One of the most important aspects regarding the study area is that the average family size is 4. So family have only one income earning person most of the cases. Therefore, families having only one earning person are highly vulnerable to economic shocks and stresses when they are unable to work during and after disasters and hence create a major economic problem. The following chart represents the earning person status of the study area.

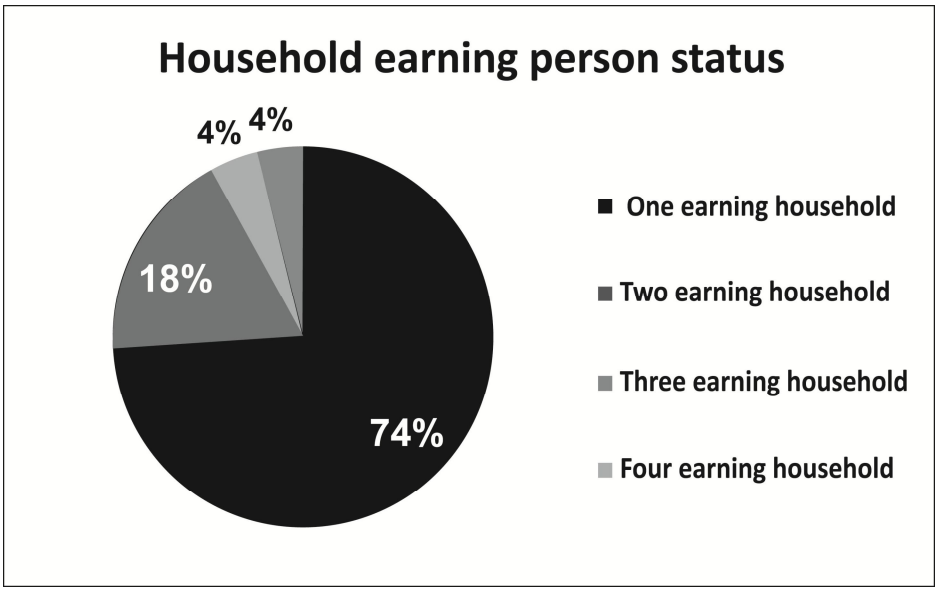

Figure 2. Earning person status (Source: Field survey, 2017)

Figure 2 states that most of the families have one earning person (74%) and a very few have two earning persons (18%), three earning persons (4%), and four earning person (4%). From the aforementioned statistics, it is clearly perceived that the overall family welfare depended on one person's income. From disaster management perspective, it is well comprehended that those families are more vulnerable to the natural disasters impact during and after a natural disaster.

From the Figure 1, it was found that most of respondents' income sources rely on agriculture (42%). So, it is worth mentioning that most of the respondents are somehow engaged with agricultural activities. But there are also small farmers who worked on other's land as share cropper. This share cropping system also fully depends on agricultural land. For this cause, the share cropping respondents have not their own agricultural land without their habitat land. Some farmers have also fallow land which is only used for grazing purpose, due to natural disasters like flood, salinity intrusion and water logging this land is affected every year and loses its fertility.

Disaster information

The noticeable disasters of the study area (Table 3) are listed below according to responses and reviewing different literatures as follows:

Table 3. Most frequently occurring natural disasters (respondents could select more than one answer)

SI No.	Name of natural disaster	Frequency (f)	Rank
01.	Riverbank Erosion	35	1st
02.	Heavy Rainfall	30	2nd
03.	Cyclone	27	3rd
04.	Flood	25	4th
05.	Water logging	22	5th
06.	Salinity	22	5th

Data source: Field survey, 2017

Ttable 4 shows the adverse effects of natural disasters according to intensity, frequency, and damage occurrence.

Table 4. Adverse effects of natural disasters according to intensity, frequency and damage occurrence (author's field survey 2017)

Natural disaster	Intensity	Frequency	Damage
Riverbank Erosion	8	6	10
Heavy rainfall	8	5	8
Cyclone	7	6	8
Flood	3	4	7
Water logging	3	4	6
Salinity intrusion	2	3	5

[Note: Scale assigned after the expert consultation as (1-3) = Low (intensity, frequency and Damage), scale (4-6) =Medium (intensity, frequency and Damage) and level (7-10) =High (intensity, frequency and Damage)].

From the Table 4, it is noticeable that respondent's identified the intensity of river bank erosion as very high, frequency as medium and damage as so high. Because the respondents of the study area are living near the river side, and every year, the riverbank erosion is occurred frequently. So, they face a greater challenge in their living condition with riverbank erosion. The intensity and damage of heavy rainfall

and cyclone are high and frequencies are medium. From this point, it is clear that the adverse effects of heavy rainfall and cyclone are so high. Predated, the damaging impact of flood is high but intensity and frequency are low and medium level, respectively. The effects of water logging and salinity intrusion are considered as medium because during high tide, sometimes salinity level of water increases than its normal level and create a great water logging problem during rainy season.

Livelihood information

Major sources of livelihood of the study area are given below in the art tools:
From the socio-economic status of the study area, it was found that the main livelihood source of the area is agriculture.

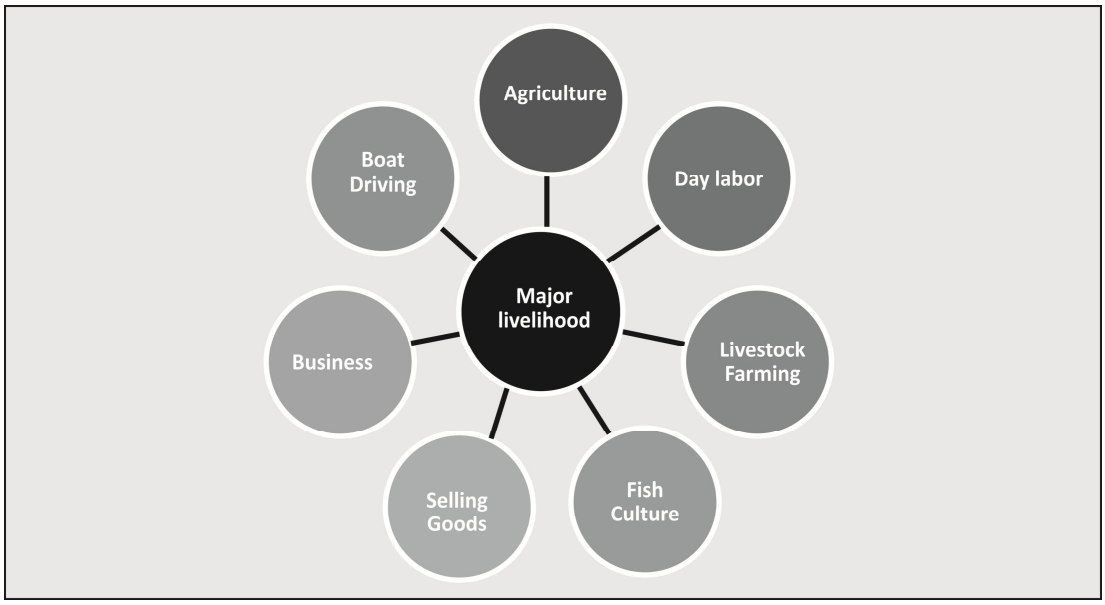

Figure 3. Major livelihood sources in the study area (Sources: author's field survey 2017)

About 42% respondents of the area are fully or partially depended on agriculture. As a result, disruption of the agriculture through any causes either climate induced natural disasters or any other makes their livelihood in a great challenge. Sometimes, the major livelihood sources of the study area have been affected due to different devastating disasters (Figure 3). Owing to these natural phenomena, the respondents cannot maintain their livelihood sources. During the rainy season (June and July), due to heavy rainfall and rain flood, farmers cannot cultivate their crops properly. Sometimes, they have to plant late season crop for this problem.

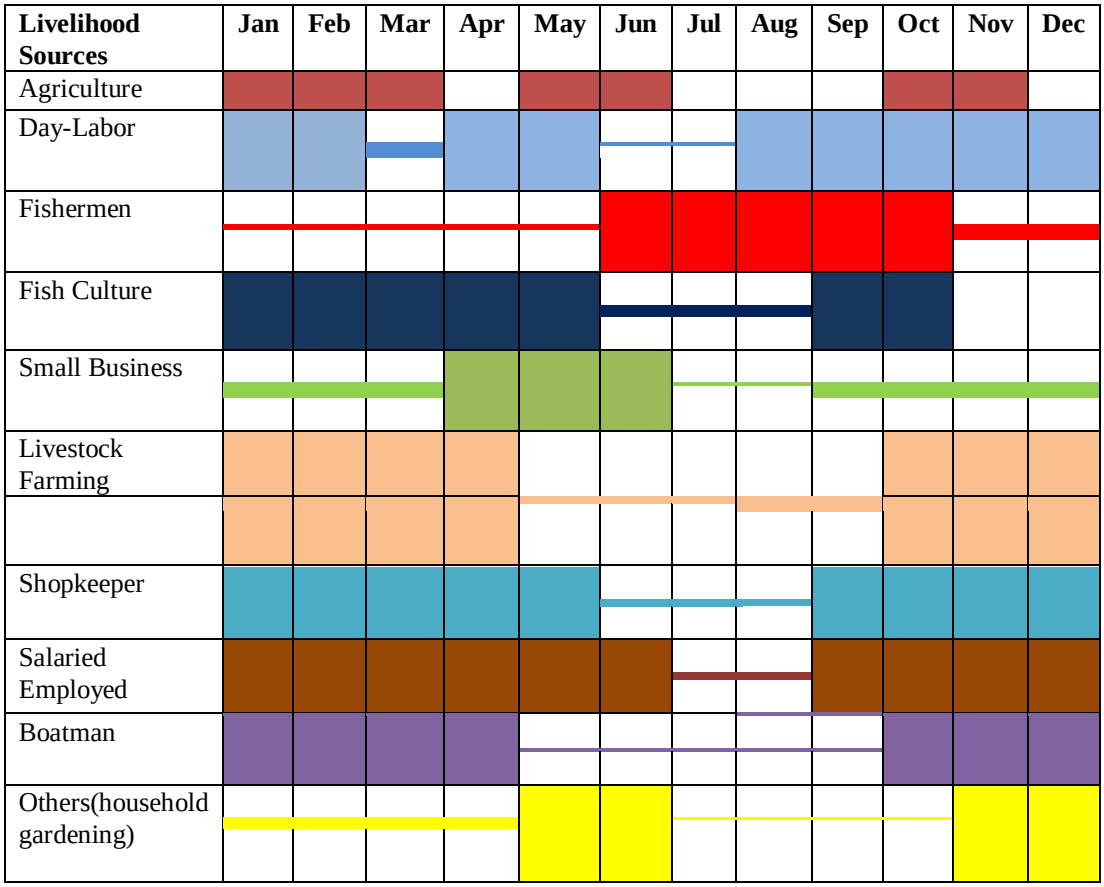

Figure 4. Livelihood seasonal calendar (Author's field survey 2017)

Day laborer cannot go outside due to heavy rainfall in the months of June and July. That's why, their daily income gradually reduced and create major economic problem. Fishermen mostly go to river for catching fish from July to October since it is the peak season for catching fish. The respondents who are related with fish culture, mainly culture fishes during January to May and September to October since natural disasters are less frequent this time. In livestock farming, the dry season is more preferable than rainy season (May to July) and after rainy season (July to September). Boatmen can easily move their boat when the wind remains calm and favorable with boat moving direction. From October to April, they can easily drive their boat but during June to September, it is getting challenging cause the velocity of wind and wave more unfavorable to drive boat in the river.

Adverse impacts of natural disaster on livelihoods

Table 5. Natural disasters impact (direct and indirect) on livelihoods

Sl. No.	Name of the natural disaster	Impacts on Livelihoods (Direct/indirect)	Reference FGD and KII
01.	Heavy Rainfall	During rainy season, small businessmen cannot operate their business and hence become financially loser; loss of agricultural production, damage of standing crops and cash crops; agricultural production damage due to irregular pattern of heavy rainfall; scarcity of animal feeds and fodder and safe water; lack of livestock shelter increasing in livelihood vulnerability of rural and peri-urban livestock keepers	FGD2, FGD4 and FGD3; KII1, KII2 and KII4
02.	Flood	Loss of agricultural production; disruption of livelihood system; damage of cash crops and standing crops; during rainy season, most of the ponds are flooded due to heavy rainfall and the fishes of pond go outside with flooding water; tidal flooding and rain fed flood damage agricultural crops, land and reduce the availability of seasonal employment opportunities for rural poor; during flooding season women faces great difficulties with their domestic livestock farming; scarcity of cash money for buying inputs by the farmers; due to shortage of cash money peoples force to sell their animals with very low price for their livelihood; scarcity of livestock fodder and feeder reduce the animal productivity	FGD1, FGD4 and FGD5; KII3, KII4 and KII5
03.	Cyclone	Loss of agricultural production; disruption of communication and livelihood system; destruction of subsistence and cash crops; destruction of water vessels like boat, trawler and reduction of livelihood income sources; fishermen cannot go to river to catch fish due to high wind, heavy rainfall and storm surges, which create pressure on livelihoods; total failure of agricultural production from severe natural disasters (e.g.-Sidr 2007 and Aila 2009) seriously hampered the agriculture based livelihoods; scarcity of cash money for buying inputs by the farmers	FGD1, FGD2 and FGD5; KII1, KII2 and KII6

Table 5. Cont'd.

04.	Salinity intrusion	Reduction of fresh water fish catching due to saline water intrusion in fresh water bodies and hence reduce fishery based livelihoods; saline water damages the crops and local crops cannot adapt or to tolerate saline water; saline water intrusion and prolong water logging in agriculture land reduce agriculture productivity and hence agriculture based livelihoods as well; decreased productivity of livestock reduce the income; direct loss of animal stock reduce the household capital; reduction of fresh water fish production	FGD1, FGD2, FGD4 and FGD5; KII4, KII5 and KII6

Data source: Field survey, 2017

Adaptation Strategy

The inhabitants of the study area are practicing various adaption strategies to cope with the adverse impacts of natural disasters on livelihood sector. According to field observation, structured household interviews, FGDs and KIIs in the study area following adaptation strategies identified:

Table 6. Adaptation strategies

Adaptation category	Sectors	Adaptation strategies
Major Adaptation	**Agriculture**	**1. Changing of crop pattern-**to adapt with saline water ingression and prolong water logging conditions farmers planting saline tolerant, submergence tolerant crop varieties. **2. Development of irrigation systems-**to reduce salinity problem farmers uses deep irrigation system through deep tube-well and water pump. **3. Drainage system-** to remove excess rain water or flood water, farmers uses this system during rainy season. **4. Raising agricultural land-** different crops such as *sugarcane, mung bean, pumpkin, cucumber, chilly plants, papaya, potatoes* etc. which cannot survive in excess water or moisture, are planted in raised agricultural land. **5. Mulching system-** to reduce soil erosion, suppress weeds, improve soil fertility and conserve moisture, farmers use this technique with straw, dry leaves, hyacinth root or dry grasses. **6. Preservation of seeds-** farmers particularly women preserve seeds so that this seed can be planted in next planting period.

Table 6. Cont'd.

	Fish Culture and trading	**1. Indigenous (local) species of fish cultivation-** local fish species such as *Koi, Magur, Sing, Taki, Shol* etc. are being cultivated by the respondents to address natural disasters impacts on livelihood. **2. Cultivation of fish in mini pond-** respondents cultivates fish in their mini pond in order to enhance their livelihood diversity and increase capacity. **3. Raising pond bank-** respondents are planting trees to maintain banks stability which effective against tidal surges and saline water intrusion **4. Making fish nets-** men and women making fishnet beside their household works which increase their adaptive capacity and facilitate alternative livelihood sources.
	Livestock farming	**1. Storage of crop residue-** Storage of crop residue is a common adaptation practice in livestock farming. During rainy season, when there is fodder scarcity then they can use them. **2. Using fallow land-** respondents use their fallow land for grazing livestock during disaster period. **3. Raising the plinth of livestock houses-** respondents raise the plinth level of livestock shelter so that rain water cannot enter during disaster period.
Minor adaptation	**1. Raising homestead plinth/ homestead gardening-** to reduce rain water intrusion or flood water intrusion, women raise the plinth of homestead land. Women plant sapling or trees, vegetables on the raised platform around homestead. **2. Storage of fuel wood and dry food-** storage of fuel wood is a common adaptation practices among the women. During dry season, they store fuel wood for their cooking which can be used during rainy season. **3. Making handicrafts-** women also help their male counterparts in making handicrafts such as mats or fishing traps, nets and baskets, handloom weaving which act as additional income source option. **4. Storages of manure for making fertilizer-** respondents store manure in a hole for a long periods of time. When this manure turns into dry condition or organic fertilizer, they use it in agricultural land for crop cultivation.	

(Data source: Field survey, 2017)

Alternative livelihoods

Since most of the respondents in the study area face greater challenges due to natural disasters impact, they adapt additional alternative livelihood as a source of income. According to socio-economic condition and household survey of the study area, it is well comprehended that the area is already under tremendous pressure from livelihood perspective. It is found that to reduce the livelihood related shocks and stresses, inhabitants practice various alternative livelihoods as their source of additional income. The following alternative livelihood sources are found in the study area:

Table 7. Alternative livelihood sources (respondents could select more than one answer)

SI No.	Alternative livelihood	Frequency	Rank
01.	Share cropping	39	2nd
02.	Fish trading	44	1st
03.	Fish culture in mini pond	28	6th
04.	Poultry farming	22	7th
05.	Livestock rearing	34	4th
06.	Boiling paddy and processing	12	8th
07.	Craft manufacturing	28	6th
08.	Harvesting crops	32	5th
09.	Homestead gardening	37	3rd
10.	Selling labor	22	7th
11.	Timber Sawing	12	8th

Data source: Developed for this research by Author, 2017

Conclusion

The findings of the study provide a detail overview of the existing natural disasters, their impacts on people's livelihoods and currently practiced adaptation strategies. 1. Riverbank erosion, heavy rainfall, cyclone, flood, persistent water logging and saline water intrusion are the frequent occurring natural disasters in the study area. 2. The inhabitants of the study area have taken various alternative livelihoods activities, such as share cropping, fish trading, poultry farming, livestock rearing, craft manufacturing, harvesting crops, homestead gardening, selling labor, timber sawing, etc. to reduce the shocks and stresses of natural disasters on livelihoods. 3. Various adaptation strategies like changes of crop pattern, development of irrigation and drainage system, raising agriculture land, mulching system, crop combination, preservation of seed, raising pond bank, etc. as major and raising homestead plinth, storage of fuel wood and dry food, making handicrafts, etc. as minor livelihood adaptation strategies could be practiced by community people.

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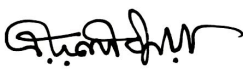

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