Case Study

Impacts and coping techniques to flood: the case study of two adjacent Char lands of Jamuna River in Sirajgonj District, Bangladesh

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Abstract
Sirajganj is a northern district that is considered as a highly flood prone district in Bangladesh. Most vulnerable regions of this district are mainly char lands. This survey was conducted in two adjacent char villages named as Brahmgangaon and Arkandi under Shahazadpur upazila of Sirajgonj District. The objectives were the sector specific impacts and coping techniques of flood affected people in the study area. Total 120 households were interviewed with a structured and semi structured questionnaire. Random sampling technique was applied to conduct the study. Agriculture, water source, sanitation and health were considered as target sector for the study. The study result revealed that agricultural (47.5%) sector was the most affected sector and followed by communication (19.17%) in the study area. Among them, crops (50%) and animal husbandry (37.5%) were the most affected part of agriculture. In health sector, children (38.33%) were the most affected group and followed by the aged people (17.5%). In char land, flood affected people suffered from different water borne diseases like diarrhea (44.17%), typhoid (28.83%) and dysentery (6.67%) for the crisis of pure drinking water as well as poor sanitation system. Considering long term health effects, malnutrition (53.33%) and hypertension (55.83%) were found as outbreak health events in post flood period at the study area. About 43% respondents were stored dry food during flood and 68% respondents don’t receive flood warning signals in the study area. Though, floods loss and damage of lives, livelihood and properties; people’s local knowledge and coping strategies may reduce their risk and vulnerability except any outer aid. Considering the coping techniques the result indicated that 39.17% respondents stayed at their own house (without taking any measures) for survive and followed by muchan (25.83 %), boat/embankment/roadside (12.5%), shelter center (9.17%) respectively. Introducing to pre-disaster warning system and consciousness, integrate local techniques with latest knowledge can be useful tools to reduce flood risk and vulnerability.

Keywords: Domestic, coping mechanism, rural, housing and livelihood.

Introduction
Bangladesh is a deltaic region with Ganges, Bramaputra and Meghna (GBM) river system\(^1\). The area is flood prone and is situated on the Ganges delta with many distributaries (from north to south) flowing into the Bay of Bengal\(^2\). It is also a colloidal damage to life and property as well as infrastructure almost every year. The major disasters are flood, tornado, riverbank erosion, cyclone and storm surge and so on which hit in this area every year. These extreme natural disasters adversely affect the whole physical and human environment and its infrastructures, shelters and necessary resources for their lives and livelihoods\(^3\). Floods are common disaster in underdeveloped, developing and also developed countries\(^4\). The World Health Organization (WHO) reported that during the last 30 years. Around 2,00,000 fatalities were created by flood and about 2.8 billion people were affected worldwide. The statistics showed that flooding is a global problem and is a uncross border issue\(^5\). Flood also impacts on socio-economic condition as well as agriculture, infrastructure, health, water and sanitation and so on. More than 55% of total areas of the country were flooded by severe flood\(^6\).

Floods cause mass fatalities and damage though people have tried to reduce the risks and impacts of flood for millions of years. Flood destruction may be increased for huge population and development of other infrastructures. For reducing flood impacts, flood risk and vulnerability management strategies/practices would be reconsidered\(^7\). The majority rural population of Bangladesh does not have access to proper food and nutrition, housing settlement and healthcare accessibility. Poverty situation is a problem that is deteriorated by natural disasters or hazards. Flood and riverbank erosion destroy agricultural yields massively, disrupts bridges, culverts, roads and infrastructure development of the country. For millions of years, people built their settlement near riverbanks for cultivate soils water for daily use and river as a communication ways\(^8\). In the past, human settlements were built on highlands and lowlands was used for cultivating agricultural crops. Riparian’s were profited from enriched soil. For short period, people lived
with floods simultaneously. According to Khalequzzaman monsoon rainfall, sediment deposition, compaction and silted of sediments, upstream deforestation, river damming, rapid urbanization, seismic tectonic activities, greenhouse effect were the main causes of flood.

The fluctuation of climatic parameters leads to change the abnormalities and uncertainties of flood. Around 40–70% landmasses were submerged under water due to devastating floods in this country almost every year. It is cleared that about 80% landmass were plain as well as low-lying in Bangladesh. Therefore, Bangladesh is more risky for recurrent floods. Change of stream line is another cause for flood. The river channel is not access to bear the water capacity at wet season or heavy rainfall period. It is another major cause for disaster intensification at the char inhabitants. However, the char is risky for the char people. But a huge inhabitants are now holding in newly accreted and existing char land.

It is cleared that floods have some negative impacts as well as some positive impacts. Riverine floods deposited sediments with lot of nutrients which is capable to intensive agricultural production for farmers living downstream areas. It also spreads sediment containing beneficial nutrients to topsoil which develops fertility. These enriched fertile soil benefits for cultivation. This natural system provides food security. Flooding cannot be prevented but some controlling measures and strategies can be adopted to mitigate the damage than prevention. The inhabitants of chars are facing different problems regarding to sanitation, permanent accommodation, food accessibility and become refugees in flood period. Normally the flood intensified in July-August and that time the serious problems are faced for food deficiency, damage crops and infrastructures.

The char lands and riverine islands are formed by disintegration and decomposition in the main rivers of the country. Temporary/permanent displacement and household movement is common in char areas. More than 68% areas of Bangladesh was seriously affected by flood. Around 5% land are char land of the country. Considering the above mentioned circumstances, a detailed sector specific impacts and coping techniques is very crucial to elucidate in the char land.

Indigenous knowledge and strategies were used to adapt or cope with these adverse situations. So, it is essential to development the indigenous knowledge to adapt with char environment. Mitigation measures should be taken before or immediate after the flood. Different engineering (embankment, dam, barrage, levee and polder) and non-engineering actions have introduced for flood prevention or mitigation. Thus, local coping techniques are needed to be address to cope with flood and minimizing sector specific impacts. The findings of this research can help government and non-government organizations to formulate policies, implementing rules and regulations and improving the livelihood of char people. The char people faced more difficulties than mainland inhabitants. Flood is a vital natural disaster faced by char inhabitants in recent years. About 10% of houses were not flooded in 1988 and 67% in 1991. Monsoon flood in the char area tends to be stay for weeks to months frequently.

Char land is a unique creation of sediment deposition. Char lands are the habitat for marginalized people. The poorer are in always environmental hazards like flash flood, storm surge, river bank erosion, etc. Limited livelihood options make life harder in many folds. Considering livelihood and vulnerability in char land, the objectives were to introduce sector specific impacts and to identify coping strategies or techniques on two adjacent char villages in the study area. Once a char land is formed landless, river eroded and marginalized people migrate there in search of livelihood. Char land offer newly accreted land with extremely limited livelihood options impacted by seasonal variation. Migration, remotesness and isolation from main land forced people to choose vibrant livelihood. Brahmangaon and Arkandi are two integrated remote char lands where many unresolved sector specific flood impacts and their coping techniques needed to be prioritized. Therefore, present study was undertaken in the above mentioned chars to identify the sector specific flood consequences and their coping techniques for improving the livelihood status. This study will provide baseline information for policy maker to formulate appropriate policy for remedial measures. Apart from the above mentions impacts, migration, socio-economic, cultural and land related issues are very important for detail analysis of flood impacts. Considering the time constraints, remoteness and fund availability present study cannot address this issue.

Methodology

Study area: The study adjacent villages are low-lying area situated beside the Jamuna river. The villages are in the Sirajgonj district under Shazadpur Upazila. The Shazadpur upazila occupies an area of 324.15km² which lies between 24°04′ and 24°16′N latitudes and between 89°31′ and 89°46′E longitudes and bounded on the north by Ullahpara and Belkuchi Upazila of Sirajgonj, east by Nagarpur upazila of Tangail Zila and Chowhali Upazila, south by Bera Upazila of Pabna Zila and Daulatpur Upazila of Manikganj Zila and west by Faridpur and Santhia Upazila of Pabna Zila.

For the present study, Char Brahmangaon and char arkandi were selected among the villages. Both char lands are considered as serious flood prone areas that are located in the west bank of the Jamuna River. The latitude and longitudes of these char villages are 24°13′9.1″ (24.2192°) to 24°13′33.5″ (24.226°) north latitudes and 89°41′41.7″ (89.6949°) to 89°39′41.4″ (89.6615°) east longitudes, respectively.

Sample size and data collection: The study was conducted within the population of Brahmangaon and Arkandir char village under the Khukhi union of Shahzadpur upazila in
Sirajganj district. A total of 120 respondents (60 from each) were selected for the present study. Respondents were selected randomly and head of household (HH) or immediate adult person (in absence of HH) were interviewed for the study. To identify the impacts of flood and coping techniques of the study area, a self-exploratory questionnaire were used for the present survey. Both primary and secondary data/information was collected to conduct the study. The empirical data presented here were collected from the *char*. A structured and semi structured questionnaire survey was conducted to assess the affected populations flood impacts on livelihood and their coping techniques of the selected *char* villages. During the survey some inclusion criteria were selected for collecting sample from population. People who were affected by flood and suffer associated factors of flood are considered as respondent. Every households head minimum of 18 years old was interviewed as respondent. Focus Group Discussion (FGD) was conducted for collecting qualitative information involving all stakeholders. Basically elderly young men and women, farmers and others occupational people were participated in FGD. Observation was an important phase during primary data collection. Secondary information was collected from articles, books, journals and different organization such as Bangladesh Bureau of Statistics (BBS), Economic Review of Bangladesh, Bangladesh Water Development Board (BWDB). The raw data were tabulated through Microsoft excel software. Different bar chart, pie chart and tables were also drawn by MS-Excel. Maps were reproduced by using Arc-GIS (version 10.0) software.

**Results**

**Demographic profiles:** The study area Brahmangaon and Arkandic *hars* were the village of Khukni union of Shahzadpur Upazila in Sirajganj District. Shazadpur Upazila is the largest upazila of Sirajganj District in respect of both area and population. According to the report of BBS 2011, the total population of this upazila is 5,61,076 in which Khukni union is 60,438 and the population of Brahmangaon and Arkandi were 1456 and 3401 respectively. The survey result showed that 44% of respondents were male of the total respondents and 56% were female in the study area (Figure-2a).

A total of 120 respondents were surveyed in different age classes and minimum age of respondent was 18 years. The respondent were classified into five categories such as 18-30, 30-40, 40-50, 50-60 and >60 years respectively. The survey result showed that the major respondents were in 40-50 age class and this percentage is 30.83. The others were 15.83%, 20%, 24.17% and 9.17% respectively (Figure-3a).

![Figure-1: Location map of the study area](image1.png)

![Figure-2: (a) gender distribution (b) educational status of the respondents.](image2.png)
**Education and occupation:** The literacy rate of the study area was poor due to lack of sufficient number of educational institutions. The survey result showed that 51.67% of the respondent had primary education. Followed by secondary and tertiary education were 44.17% and 4.17% respectively (Figure-2b). Agriculture is the main occupation in char land. In the studied char land area occupation varies with different season. Farming occupation includes owner cultivation as well as share cropping, livestock rearing; manual labor forces and farming were the major sources of income. Besides these char people are engaged in fishing, small business etc. The results revealed that day labor was found as the main occupation in char land (38.33%), followed by farmers (23.33%), student (11.67%), small business (10.83%), fishing (5.83%) and others were 10% respectively (Figure-3b).

**Causes of flooding:** Generally flooding in any area varies regarding the changing the base level of river elevation. The study area was a char land which is situated in the bank of Jamuna River. So, every year flood is occurred in the study area. The survey results that there were found as many factors responsible for causing flood in the study area. The study results indicated that low land (40.83%) was the main cause of flood. Followed by the respondents said that increase of river water height (33.33%), excessive rainfall (14.17%), lack of water management system (7.5%) and Farakka barrage (4.17%) were also responsible for flood in the surveyed region.

![Figure-3: (a) age class distribution (b) occupation of the respondents.](image)

![Figure-4: Causes of flooding in the study area.](image)
Impacts on different sectors: Flood changes the usual life, homestead, economic structure, agricultural crops, water system and sanitation status. Flood adversely affect on every sector of char community’s life where frequency varies on different sectors due to availability on the char area. Along with various vulnerabilities related to agriculture, communication, economic, housing and water system become dangerous. During flood period, agriculture, communication, water system and sanitation status are most affected. The study result revealed that during flood period, various sector had been destroyed or damaged and property loss happened. It showed that 47.5% of respondents told that agricultural sector was commonly affected sector during flood. Followed by communication systems (19.17%), housing (15.83%), health sector (10.83%) and water supply (6.67%) were affected during flood period (Figure-5a).

Agriculture sector: In spite of rapidly emerging of industry, Bangladesh’s economy has remained an agriculture based economy still providing vital shares in Gross Domestic Product. The country is trying to remove unemployment problem from the country.

As the economy depend on agriculture in Bangladesh, the livelihood and life style of char dwellers are also depend on different agricultural activities such production of crops, animal husbandry, aquaculture, homestead gardening and others on. In every char land in Bangladesh, there have huge fertile land to produce crops such as rice, potatoes, nuts, pumpkins, watermelons, vegetables and so on. But every year it affected by flood time and damages. The survey results showed that, majority of the respondents told that various crops (50%) was damaged by flood; followed by animal husbandry (37.5%), homestead gardening (7.5%) and aquaculture (5%) were also damaged by the flood time in the study area (Figure-5b).

Health sector: Diseases occur during flood: With reason of floodwater, various waterborne diseases are spread sporadically among the flood affected people during flood time. The affected people suffered from different communicable diseases like diarrhea, dysentery, fever and cold, typhoid, skin diseases, eye infection etc. As the flood water is receded, different waterborne diseases are spread fast among the flood affected people. Acute shortage of pure drinking water, lack of sanitation arrangements, lack of awareness among the flood victims are main responsible for the waterborne diseases in the flood affected area, because most of the householders use water without applying purification methods. Figure-6a showed that, flood had many negative impacts on human livelihood and their life style and also on physical and human environment. The study result revealed that, about 44.17% respondent replied that diarrhea was common in the study area in flood time. Another the most common disease in the study area was typhoid (28.33%), followed by cold and fever (10.83%) various skin diseases (10%) and dysentery (6.67%) occur during flood in the surveyed area (Figure-6a).

![Figure-5: Impacts of flood on (a) different sectors (b) agricultural sectors.](image-url)
Long term health problem in post flood period: Flooding has a negative health impacts on the immediate biological and physical impact such as injuries and drowning. An increasing alarming is that following extreme events (secondary stressors) which are directly or indirectly interrelated to the event can seriously prolong and intensify the health impacts on affected communities. These stressors may be caused by shortage of food, loss their income source, reducing income, disruption to livelihood, damage of property etc. It can cause long term health effects in flood affected area. From the study result, it showed that there were some long term health impacts due to flood in the study area. The problem was great in malnutrition; hypertension and this frequency were 53.33% and 55.83%. A major part of respondent were agreed about those problem and said that they harmed by malnutrition due to unavailability of food, lack of health care etc. There were also some long term health impacts by flood such a various chronic diseases (29.17%), mental problem (25.83%) and physical problem (15%) such as physical disability by different type of accident etc.

Flood impacts on Water and Sanitation sector: Impacts on Sanitation status: It is said that well sanitation facilities were essential in flooded area for hygienic livelihood. The study areas were one of the poor sanitation condition areas. In this area there are a few household uses hygiene latrines. Most of latrines in the study area are semi paka and katcha toilets. In the study area, it was observed that char land communities in Jamuna River were very poor sanitary conditions. About 50% householders used semi paka, 26% used paka toilets, and rest of them used katcha toilets respectively. According to the householders perception, during previous flood about 64% of the toilets were unused and 36% toilets were partially used. 36% toilet was used by the following measures: i. higher or upward the base of toilet ii. using more sanitary ring to increase the base that raise the height of the toilet.

Impacts on water sources: During flood, most of the water sources and tube-well become submerged in polluted water; as a result, fresh drinking and cooking water become scarce. Different pollutants pollute water. Normally, all householders used pure drinking water and household chores from tube-well. These were situated near to the household. Almost all the tube-wells were sunk partially or fully during the flood and become unusable to use for entering the polluted water enter into the submerged tub-well.

In our survey, every households (100%) use tube wells water for their daily activities. During the last flood people claimed that pre and during flood 37% householders used one water source. According to survey results, 19.54% of respondent households use water by purification by potassium alum where as 49.43% of households use direct water during the flood period in the study area. Here a part of households use water purification by boiling and proportion is 31.03% (Figure-7). This was also a good proportion who used usable water by boiling in the study area.

Coping techniques in the study area: Capturing flood forecasting information: Early flood warning system can reduce the loss. Here education is very important phenomena raising awareness to the victims of flood. The findings show that almost all household heads are illiterate and not aware about the flood forecasting system.

According to survey result 68% of households in the study area didn’t capture flood forecasting due to their lacking of awareness. So this majority portion of households can’t prepare themselves against by flood vulnerability. Where 32% of the households able to capture flood forecasting by anyhow and they can prepare themselves against flood vulnerability that occurred every year in the study area.

Figure-6: (a) Diseases occur during flood(b) long term health effect in post flood period.
Accommodation status during flood period: Previous research suggested that affected communities, cope with consciousness due to save their livelihood and surroundings. They raise their base level of the ground flood. The study result revealed that char householders used muchan, some of them go to shelter center, some displace to another place (relatives house) and some stay at boats or embankment of the roads to save their lives during flood period time in the study area. During this critical situation of flooding period of household still stay at their own house. The study result showed that a major part of respondent (39.17%) said, they stayed at their home during the flood period time in the study area. That means they don’t take any measures during flood period time. 25.83% of respondents said that they also stayed at their own house by using muchan in flood period. 9.17% claimed that they went to any nearest shelter center to save their lives. A good portion respondent said they displaced to another place e.g relatives house from their own house during flood period. 12.5% of respondents stayed boat and embankment of nearest roadside during flood period (Figure-8).

Storage of food during flood period: Foods are not available during flood and householders suffered for shortage of food due to reduce income. Food price are increased thus food habits fluctuates consumption categories for chars population and leads to shortage of nutrients and health problem. So it needs to store of food to the local people to adapt them during the flood period. Storage of food increases the strength of local flood affected people to cope in the flood time. It is said by the respondent that during most of the previous floods for the householders the food storage capacity was changed. According to the survey result 57% of respondents said that they didn’t store food during flood period and also they had no good ability to adapt them for facing food scarcity during flood period time. 43% of respondent said that they stored food for facing the challenge of food crisis during flood period in the study area.
Generally in every locality of char area householders stored dryfood. These were chira, muri, gur, biscuits, etc. 32.5% respondents of the surveyed area told that they stored dry food (chira, muri, gur) during the flood time. 55% respondents claimed that they didn’t store any dry food but they store common foods such as chal, dal, salt, etc. which they used regularly before the flood in the study area. There were some respondents whose stored both of foods during flood period time and this was 12.5% (Figure-9).

**Conclusion**

In Bangladesh, floods have a damaged impact on human livelihood, agricultural sectors (crops, agricultural inputs, animal husbandry) and other assets (land and infrastructure). The study area is the most vulnerable areas for flooding as a natural phenomenon that cannot be prevented. As discussed under sector specific, it is cleared that floods have negative impacts on social and economic change of livelihoods and life style of people in Brahmanagon and Arkandi char village communities. The most of the inhabitants are ready to live for their various reasons. This is correct that the poor householders live with struggling against flood by their indigenous coping knowledge and techniques. It has been claimed that most of the householders take partial measures or techniques regarding water system to adapt with floods. Householders of the char lands just tried passing out the days and not to adopt any structural and non-structural measures that will prevent them for upcoming flood. Though some small coping techniques, the householders can live but not upward and sometimes these small coping techniques go in vain for frequent flood events.

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**References**


