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Evaluation of Agricultural Pattern and Socio-economic Conditions Due to Flooding in Tangail Region, Bangladesh

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Abstract: Nowadays, flooding is a serious problem in Bangladesh. Excess rainfall, poor drainage patterns, and the inability of the soil to store much water are the common causes of flooding and the Tangail is the most affected area. The purpose of this study is to find out the problems of agricultural patterns due to flooding and farmers socio-economic conditions. The study was conducted at Tangail Sadar, Nagarpur, Delduar, Bhuapur, Kalihati, Dhanbari, Gopalpur, Basail, and Mirzapur Upazilas in Tangail District. The investigation was based on primary data collection, field visits, secondary data sources, and conceptual methods. The study area was measured by interviews, group discussions, and survey methods. Data were collected by questionnaires with a sample size of 100. Flooding's detrimental effects on food grain and agricultural output values point to a threat to small and marginal farming households' ability to secure food. There is a significant change in the occupational pattern in the area due to flooding. Flooding is highly responsible for the changes in livelihood patterns and the economy. The effects of occupational change decrease income levels. About 84% of household members opined that they have changed their housing pattern due to flooding. Most of the land property (90%) was covered by flooding time. Due to flooding and diarrhea, typhoid, skin diseases, and viral diseases, the eye is an alarming health risk for helpless people. About 52% of tube wells were affected due to flooding. This research simply suggests that the development works associated with the flooding should be managed suitably and recommends that an Environmental Impact Assessment is a prerequisite for the development activities.

Keywords: Flooding; Agricultural pattern; Socio-economic; Drainage system; Land pattern.

INTRODUCTION

Bangladesh is one of the least developed countries in the world. There are 140.79 million people on the world as of 2011 (UNDP, 2011), and their number is increasing at a pace of 1.23 per year. 76.61% of them live in rural regions. A number of other problems also plague this developing country, including poverty, overcrowding, a complex socioeconomic structure, a vulnerability to natural disasters, a weak industrial base, inadequate institutional and infrastructure, a lack of skilled labor, etc. (Allaire, 2018). Bangladesh is one of the country's most susceptible to natural catastrophes globally. With 140.23 million inhabitants in a state vulnerable to natural calamities, Bangladesh could have the world's greatest population density. Numerous natural hazards pose a substantial threat to the majority of its people (Islam and Sultana, 2014). Various natural catastrophes affected different regions of Bangladesh. The flood is one of them. Floods are considered to be the most frequent and deadly issue in Bangladesh. Between 0 and 50 cm above sea level, over half of the land area is located (Islam and Sultana, 2014). Due to the country's high rainfall and the catchment areas, most of the country's rivers are in their ancient phases, and during the monsoon season, a sizable volume of floodwater flows (Bishnu and Pangali, 2018). In the northern part of

Bangladesh, flooding is a serious problem (Rahman, 2008). The flood would affect the biophysical environment, which would subsequently affect fish and paddy production, along with other socioeconomic factors (Alam, 2007). Salinity killed all vegetation, fruit trees wilted, flooding ruined tree roots, agriculture was drastically reduced, and even homestead vegetation and livestock grazing were made impossible (Unnayan, 2007).

Environmental disasters including salinity, river silting, and floods have grown commonplace in Bangladesh's north and are leading people to suffer unimaginable suffering (Ahmed *et al.,* 1999). As a result, agriculture and related occupations have been severely reduced. Static water causes pollution and the spread of water-borne diseases since there is nowhere in the region to dispose of human and other waste. Unemployment has expanded poverty, out-of-town migration, and slum overcrowding in urban areas, creating new problems (Parvin *et al.*, 2017). Land productivity is reduced by flooding, which is caused by rising groundwater levels at the soil's surface and in places where the water table rises above it. The high-water table in this region limits plant growth by making the soil wet and filling in the air spaces with water, which suffocates the roots of the plants since there is not enough oxygen in the soil. Farmland flooding has been identified as one of the eight primary worldwide causes of land degradation (Parvin *et al.,* 2017). Flooding provides concrete instruments for assessing the crops. Because of it, ground levels rise, which raises the salinity of the soil. The poisonous content of the topsoil increases as a result. Furthermore, it increases the possibility of manufactured substance penetration and exposure (Case and Fair, 2007). According to Scott and Batcher (1979), flooding occurs when water builds up on agricultural land. Heavy rains or unplanned irrigation might be the reason for this. Flooding may change the natural status of a region where development has been slow over a thousand years.

In the flood area, the situation affects agriculture output, biodiversity, people, and other types of variety. High rainfall causes transitory flooding in certain parts of Bangladesh, while excessive precipitation or water running over mountainside barriers—natural or man-made—cause persistent floods in other locations. Rapid siltation at the downstream regulators and poor switch gate control blocked the drainage channels, causing flooding (Mostafizur and Karim, 1995). Beginning in early August 2011, floods struck 13 of Bangladesh's 64 districts. Jessore, Satkhira, and Khulna in the southwest coastal region; Faridpur, Madaripur, Shoriotpur, Rajbari, Munshiganj, and Manikganj in the south-central region; Bandarban and Cox's Bazar in the southeast; and Sherpur, Netrokona, and Tangail in the north are the districts that are impacted. Because these risks—such as floods, water logging, and water salinity—occur regularly in Tangail districts, there are regions that are particularly exposed to a range of dangers (Parvin *et al.,* 2017). The real world, however, is more complex and arises from the interaction of several factors. Inadequate drainage, poor management and maintenance of dams built along rivers in the 1960s, increased sediment load and river siltation, the ongoing monsoonal rains that have been occurring since late July, and barriers like the Durgapur/Damodar barrage and the Farakkah barrage have all contributed to the current dire situation. Water logging that started in late July is having unfathomable repercussions on the persons involved (Hossain *et al.,* 2013). Because of the constant rain, the areas are now facing a severe and pervasive high level of inhumanity. In the affected communities, cattle, field crops, homesteads, and other valuables were flooded. At least 25% of the homes in the impacted regions were flooded or swamped since they still had little to no support and were forced to rely on outsiders to help them recover. The locals thus sought cover from the sun on the roadways, school property, and other elevated locations. As a result, many kinds of crops flourish. Studies have examined how flooding has affected socioeconomic and agricultural trends in Bangladesh's north-central areas (BBS, 2011). This article's goals were to analyze the livelihood circumstances caused by flooding in the study region, identify the issue and assess the drainage system's flaw that caused flooding in the study area, and observe the agricultural pattern due to flood occurring.

MATERIALS AND METHODS

The study was conducted in Tangail Sadar, Nagarpur, Delduar, Bhuapur, Kalihati, Dhanbari, Gopalpur, Basail, and Mirzapur upazilas under Tangail District which falls in a flood-prone area of the country. These upazilas were primarily selected as a suitable area for the study because they are situated near the bank of the Jamuna which comes under regular flood and is highly vulnerable to flood damage (Figure 1). Bangladesh's center area is known as Tangail district. About 3.8 million people live in the Tangail district which has a total size of 3,414.28 square kilometers (1,318.26 sq. mi). These settlements experience flooding almost annually which harms agriculture, cattle, fisheries, and other resources in addition to causing human suffering. We randomly collected data by questionnaires with a sample size of 100.

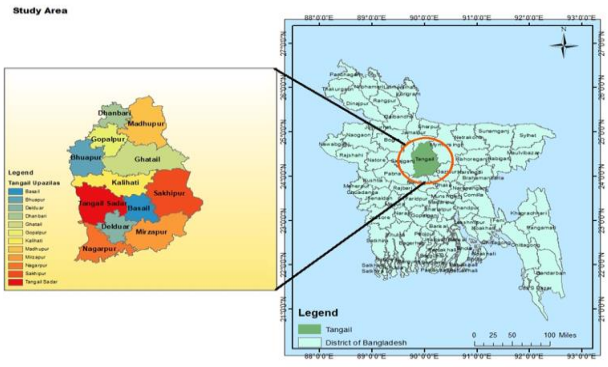

Figure 1. Study area (Tangail)

Data Collection and Analysis

In the study, both primary and secondary data were needed. All the necessary data has been collected from

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various sources. We gathered a variety of data from the Union Parishad Office, BWDB, and other sources, including the area of the investigated region, its population, and cultivable land. Secondary data on land usage, population, and land area was gathered from review articles, BBS, and BWDB, among other sources. A questionnaire survey, a field survey, and key informant interviews were used to gather socioeconomic data on the population's characteristics, occupation, source of income, everyday activities, flooding issues, adaption strategies, and agricultural patterns. Random interviews and open discussions were held with locals and Union Parishad officials. We randomly selected 100 sample sizes with different age groups, sexes, and religions during the field survey.

Data were collected from June 2022 to May 2023. After the field visit, we collected some information for data analysis from these study areas. We observed the pattern of agriculture and socio-economic conditions and about 70% of these areas people opined. ARC GIS 10.8, SPSS and Microsoft Office Excel were used to analyze the data.

RESULTS AND DISCUSSION

Characteristics of the study areas people

We interviewed 100 people, of whom 95% the men. The average age of the population was 40.1 years, and their average agricultural experience was 33 years. On average, the farmers had six family members who owned land in 55.95% of cases and were landless in 44.05% of cases. They produced 81% of the rice and 14% of the other crops, so they had adequate food for the entire year (85%). Flooding affects over 66% of the average amount of agricultural land. various landscapes have various meanings for different individuals (Figure 2).

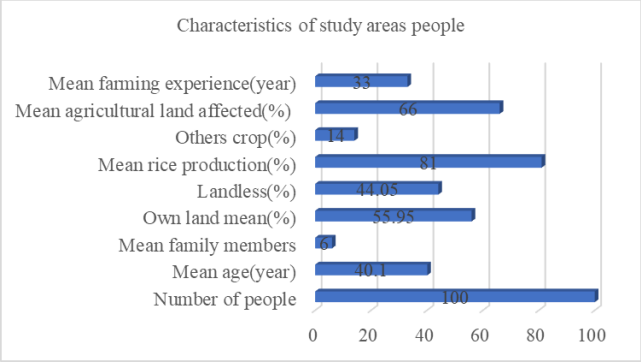

Figure 2. Characteristics of the study areas people

Occupational status and causes of flooding

Flooding is the result of several factors. About 71% of respondents stated that low land in the study region was the primary cause of floods, which was the largest percentage. This was followed by 27% who stated that upstream water was also to blame. However, just 2% of respondents claimed that floods, which worsened their socioeconomic situation, was also caused by an inadequate management system. They believed that their income sources were likewise impacted by their employment position (Table 1).

About half (50%) of the population worked as day laborers, followed by unemployment and others, at 5% and 3%, respectively. The number of workers in agriculture and non-agriculture was around 36% and 6.66%, respectively. Because industrialization was not absent, the majority of people were involved in primary activities including transportation, construction, commerce, and other services.

Table 1. Occupational status of respondents in the study area

Category	Number of respondents	Percentage
Day laborer	70	50%
Agriculture laborer	50	36%
Non-agricultural laborer	10	6.66%
Industry	15	11.91%
Commerce	20	19.9%
Transport and communication	10	7.15%
Service	25	12.18%
Constructions	15	15%
Unemployment	10	5%
Others	20	3%

Source: Field survey

Problems faced during the flood

Humans encounter several issues during floods, which are the subject of our study. According to the survey (Figure 3), 70% of participants stated that the most frequent issue was the scarcity of food during floods. According to 35.33% of the responders, there were communication issues throughout the disaster. Health service issues that arose during a flood in the research region accounted for 6.5% of the respondents and were also the cause of the socioeconomic situation.

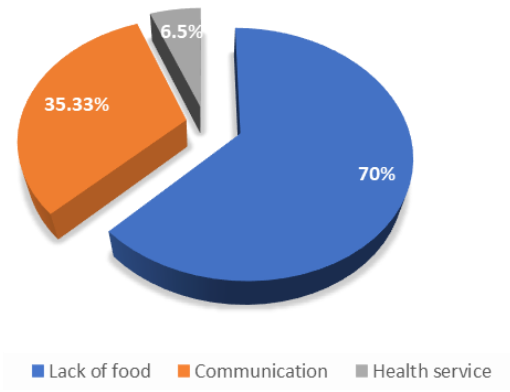

Figure 3. Problems of occurring flood

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Sectors affected during the flood

Where we researched, several sectors suffered damage during a flood, and property loss occurred, which had an impact on farmers' agricultural pattern (Figure 4) . The study revealed that 30.66% of respondents stated that their properties were impacted by the storm, while 55.33% of respondents stated that agriculture was the most often impacted sector. A sizable portion of respondents (20.1% and 5%, respectively) said that the flood had an impact on their socioeconomic status and their livestock and health.

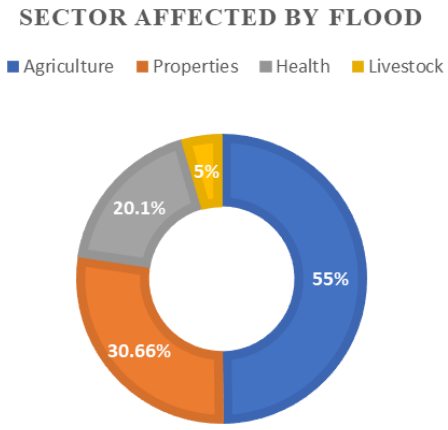

Figure 4. Affected sector

Housing conditions

Nonetheless, a prevailing pattern of the entire scenario could be recognized among the five circumstances of the dwelling. The housing situation is becoming better every day. According to the study, 35% of homes were paved, 55% were semi-paved, 5% were tin houses, 4% were destroyed, and the remaining 1% were others (Table 2).

Table 2. Housing conditions of the study area

Category	Number of respondents	Percentage
Paved house	40	35%
Semi-paved house	60	55%
Tin house	15	5%
Destroy	5	4%
Others	3	1%

Source: Field survey

Diseases that occur during/after the flood

Floods affect both the environment and people in a variety of ways. Numerous infectious diseases, including watery illnesses like cholera, hepatitis B, diarrhea, dysentery, and typhoid, harm people. According to the survey, 70% of respondents claimed that diarrhea was the most prevalent illness during and after the flood, which had a detrimental effect on their socioeconomic standing.

Damage caused during the flood

The study revealed that the majority of respondents (77.77%) said that the flood had ruined their crops, while 26.66% claimed that the flood had also damaged their homes, which was the cause of their current financial situation. The percentages of respondents who said that the flood had harmed their land and domestic animals were 15.33% and 5%, respectively. Because of the research area's inadequate drainage infrastructure, flooding is happening. Fixing the drainage pattern in this area is crucial, though. Significant levels of suspended sediments are present in the majority of river streams (Rahman, 2008).

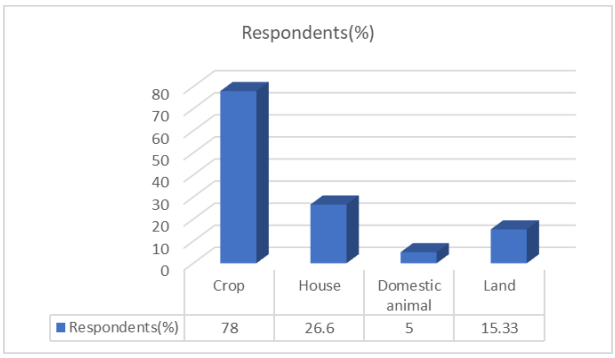

Figure 5. Damaged things during the flood

Besides, in this research, river water accounted for 3% and tube wells for 65% of the drinking water. The majority of people in the research area utilize tube well water for drinking, whereas the other individuals use other water sources since they are unable to access tube wells and about 52% of tube wells were affected due to flooding. Otherwise, field survey participants stated that some of them utilize pond water for drinking as well as domestic tasks. They therefore have various forms of diarrheal illnesses and food poisoning.

Land Property

Most of the land property (90%) was covered by flooding time (according field survey). In the study area, the way that land is used and its level of flooding determines its classification as follows that agricultural land, household purposes, high-medium and low land, unused land as well.

Effects of the flood on agricultural land

According to this study, during a flood that lasts one to four months, 94% of agricultural land is submerged under water. About 3,386.53 km^2 (1,307.55 sq mi) of Tangail District's total land area is cultivable. Flooding has reduced the amount of arable land over time, which has also reduced their socioeconomic standing.

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Conditions of crop production during the flood

Flood is a common natural disaster and also very common in many places and it can cover the agricultural land surface with overwater. Result showed that crop production increased by 40 percent approximately after flood in low land area which are affected during flood, and production of crop damaged by the long-term flooding in low areas in Tangail which is approximately 65 percent (Figure 6). So, crop production is seriously decreased due to flooding conditions in several areas of this part.

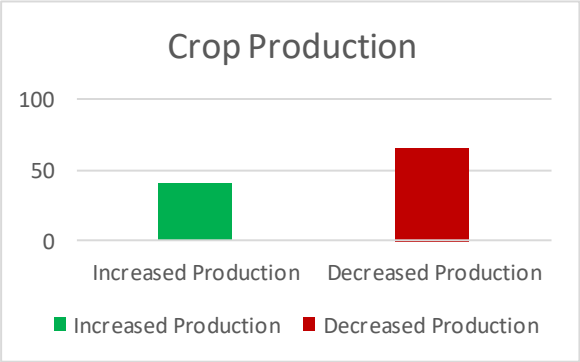

Figure 6. Crop production during the flood

Current production of crops

Table 3 showed that production of crops. About 90% of rice and 70% of sugarcane were produced, with the latter declining during the flood season. Flooding reduced the output of the other crops by 3%.

Table 3. Production of crops in the study area

Category	Percentage
Rice	70%
Paddy	30%
Sugarcane	90%
Jute	7%
Potato	5%
Wheat	25%
Vegetables	50%
Others	3%

Allaire (2018) found that floods were badly damaged farmers crop productions. Ahmed *et al.* (2007) found that 50% crops were damaged during the flood and impacts on economic conditions. Hossain *et al.* (2013) found that different types of crop productions after the flood. In this study, we also found that 65% people were able to cultivate Boro Rice, 25% were able to cultivate Amon Rice, and 15% were able to cultivate Aus Rice without flood season but during flood season it was decreased which was their economic sources of livelihood.

CONCLUSIONS

Flooding is primarily to blame for the shift in the economic and living patterns. Prior to and during the implementation of the irrigation plan in Tangail district, the socioeconomic characteristics of the families are compared. The second portion focuses on the examination of qualitative data from focus groups, interviews, and qualitative household surveys. Flooding is primarily to blame for the shift in the economic and living patterns. The following topics are covered in detail: severe acute disease, various social issues, household category, occupation, income, income person in a family, age, education, and the agricultural sector, which includes the primary water source for irrigation, cropping pattern, crop production, drainage system, home reconstruction, and other schemes. Tidal flooding and drainage system flaws are Bangladesh's two biggest problems. To address these problems, the Bangladesh Water Development Board constructed a large number of polders, embankments, and sluice gates. This long-term stressed environmental situation has limited the availability and accessibility of land and water, the two most important components of livelihood patterns and socioeconomic circumstances. Climate change has been exacerbating flood conditions by increasing sedimentation from increased flow during the dry season and increased rainfall during the monsoon season. Due to a lack of access to sanitary facilities and clean drinking water, people in the flood zone suffered from a number of waterborne ailments. People who lived in flood-prone locations were more likely to suffer from cholera, dysentery, diarrhea, colds, fevers, pneumonia, scabies, skin disorders, and malnourishment. The government and development organizations in Bangladesh are collaborating to adjust to the increasing flood risks and mitigate the adverse effects. Traditional flood prevention strategies have centered on constructing polders and embankments as well as enhancing drainage.

Conflict of Interest

There are no conflicts of interest declared by the authors.

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