The Dhaka University Journal of Earth and Environmental Sciences, Vol. 13 (2): 2024

Living In Haors: Coping and Mitigation Strategies to Poverty and Flooding in Dingapota Haor of Netrokona, Bangladesh

Nahid Rezwana*, Afrin Sharabony, Pollob Chandra Talukder and Pallab Chakraborty

Department of Geography and Environment, University of Dhaka, Dhaka 1000, Bangladesh

Manuscript received: 12 July 2024; accepted for publication: 04 December 2024

ABSTRACT: The present research aims to investigate the coping mechanisms adopted by local residents in the haor region of Bangladesh in response to poverty and flooding. The study was conducted in Galgali Mallikpur village of Mohonganj Upazila, Netrokona and employed observations, FGDs, household questionnaire surveys, and KIIs to collect data from the field. Mallikpur village is frequently flooded during the rainy season, impacting virtually all dwellings (95 percent). 43.2 percent of the households in this village use sandbags to protect their homes against floods, while 20.1 percent use a local bamboo fence, and 17.3 percent raise the level of their homesteads. Seasonal migration (43.2 percent), loans (82.7 percent), and alternative economic sources (29 percent) are the coping and mitigation strategies taken by the families to deal with flood induced poverty. However, these initiatives do not assist Mallikpur inhabitants break the cycle of poverty: 93.75 percent of the population lives below the poverty line and has limited access to healthcare and education.

Keywords: Floods; Haor Region; Coping Strategy; Migration; Local Level Community; Poverty

INTRODUCTION

Haors, located in northeastern Bangladesh, are seasonal floodplains distinguished by their vast, bowl-shaped depressions that become submerged for up to eight months each year (IUCN-Bangladesh, 2004; Bhattacharya & Suman, 2012; Kabir & Amin, 2007). Spanning 1.99 million hectares and home to approximately 19.37 million people, haors possess distinctive hydro-ecological characteristics (BHWDB, 2012). Haor area of Bangladesh consists 373 haors spans across the districts of Sylhet, Habiganj, Sunamganj, Maulvibazar, Kishoreganj, Netrakona and Brahmanbaria along Netrakona district, haor area comprises 79,345 hectares covered by 52 Haors (BHWDB, 2012). The Haor basin, being bordered by Indian mountain ranges with some of the world's wettest places nearby, experiences flash floods due to intense rainfall upstream in a short period of time, during the pre-monsoon season (Dey et al., 2021). Recently, the haor region has faced several flash floods within a few years: in 2017, 2019, 2020, and 2022. The ever-increasing frequency and intensity of these floods are taking a toll on the poor communities. During the flood in 2020, approximately 1.3 million households were affected, leaving hundreds of thousands stranded and resulting in the loss of many lives (Imtiaz, 2020). The floods resulted in 119 deaths, and 21,388 people were afflicted with diseases linked to the floods. On the other hand, due to heavy flooding in 2019, the emergency reserves were nearly depleted, and 204 community clinics were damaged (Warner & Afifi, 2014). During the 2017 flash flood, approximately 800,000 tons of harvested Boro and IRRI crops across about 160,170 hectares were damaged, leaving the farmers empty-handed (DAE, 2017; Abedin & Khatun, 2020; NIRAPAD, 2017). The adverse impact of the floods makes them a major climate risk to the poor farmers of northeastern Bangladesh (Kamruzzaman & Shaw, 2018). Subsequently, floods pose a grave threat to public health as community groups have recognized skin conditions, snakebites, and diarrhoea as common dangers (DDM, 2017). Recent floods had devastating consequences for schooling, as children were confined to their homes for months and schools were submerged, resulting in setbacks for the education system in the haor region (Farid et al., 2021; Reeve, 2017; Alam, 2018). However, the haor region has been recognized as

*Corresponding author: Nahid Rezwana

Email: nahid.rezwana@du.ac.bd

DOI: https://doi.org/10.3329/dujees.v13i2.79453

one of the most underprivileged areas due to isolation and developmental neglect, impacting the socio-economic status of local dwellers. Inhabitants endure pervasive poverty and exclusion due to remoteness and inaccessibility to basic needs (Barkat et al., 2019). During the recent years Bangladesh has witnessed a substantial reduction in the under-five mortality rate, meanwhile maternal mortality rates have plateaued in the haor region, remaining at 196 per 100,000 live births from 2010 to 2016 (NIPORT, 2016) due to the lack of access to adequate healthcare during pregnancy, childbirth, and the postnatal period (Chakraborty et al., 2020). Along with adverse geographical characteristics, factors such as poor sanitation, landlessness, ecological degradation, and limited access to health, education, and other basic services increase inhabitants' vulnerability to flash floods, mounting suffering for the people residing in the area (BHWDB, 2012; Azad et al., 2013). However, haor residents have been living in these regions with floods for centuries, surviving by applying local knowledge. Residents in flood-prone districts elevate their homesteads, build temporary platforms, and store dry food (Maxwell et al., 1999; Sheheli & Khan, 2015; Sultana & Raihan, 2012). They search for alternative sources of income and migrate for a season. In rural Bangladesh, migration and remittances serve as ways of dealing with disaster (Uddin & Firoj, 2013; IOM, 2009; Giannelli & Canessa, 2022). Nevertheless, these strategies are not enough, as the frequency of flash floods has increased in the region; the rural population is encountering unprecedented challenges in their daily lives, fueled by existing disparities and inequalities (Azad et al., 2013). The present research aims to comprehensively investigate the coping mechanisms adopted by local residents to combat poverty and flooding, along with the challenges and gaps created in the process. The objectives applied to reach the aim are 1) to understand the prevailing coping strategies for poverty and floods applied by the residents, 2) to identify the relation between socio-economic conditions and the selection of coping strategies applied to cope with floods and 3) to analyze the impacts of coping strategies in reducing poverty and flood effects.

It is expected that this research will present a detailed picture of a haor resident's life who are living with floods and poverty. It will be helpful to understand the knowledge gap and take actions to improve the conditions, which will lead to meeting the SDG goals, including SDG 1: No Poverty, SDG 3: Good Health & Well-being, and SDG 13: Climate Action.

MATERIALS AND METHODS

The Study Area

The present study has selected Galgali Mallikpur village due to its unique locational characteristics. According to the BBS, (2015), Galgali Mallikpur village is situated in Ward 42 of Maghan Siadhar Union, Mohonganj Upazila, within Netrokona District (Fig. 1), encompassing an expanse of 9,177 acres.

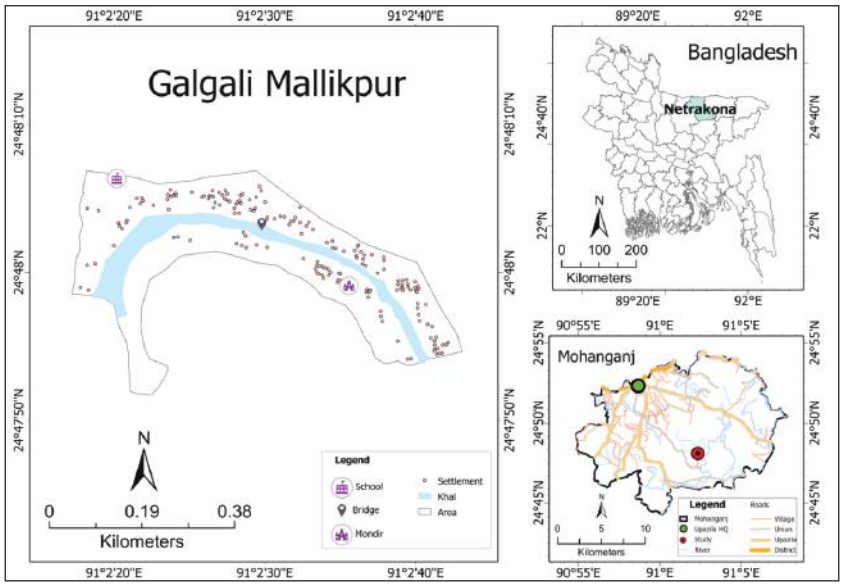

Figure 1: Map of the Study Area

The village is home to 213 households, with an average size of 4.5 individuals, contributing to a total population of 950. The crescent-shaped small village of Galgali Mallikpur is located in the middle of Dingapota Haor, which makes it susceptible to annual flooding. This village has one primary school and no healthcare centre except few numbers of drug stores.

Methods

The study employs a mixed-methods approach, collecting both qualitative and quantitative data to gather the necessary information from the study area (Fig. 2).

The study collected the data from Mallikpur by conducting a household survey in 139 houses out of a total population of 213. It considered one alternative household and semi-structured questionnaire for the survey. Using statistical methods at a 95 percent confidence level, with a margin of error of 5 percent and a response rate of 50 percent, the sample size 139 was calculated for the survey. Furthermore, to gain a deeper understanding of the devastating impacts of the flash flood in 2022, 2 case studies were conducted to illustrate the arduous experiences of the residents.

Five Key Informant Interviews (KIIs) were conducted to understand the situation and the strategies taken by the villagers. These interviews encompassed individuals from diverse occupations, including a primary school teacher, fisherman, housewife, graduate, and a member affiliated with a government body. The selection of school teachers and graduates aimed to gather insights into the challenges and the indigenous strategies adopted by the villagers. The farmer and fisherman were interviewed to assess the impact of floods on their livelihoods and to understand their coping strategies. Housewife was asked about her struggles to govern the household during the flood. Focus Group Discussion (FGD) (5 in number) were carried out with farmers and fishermen to cross check the assessment and given detailed information by the local residents. These qualitative methods were being applied until they reach the saturation points.

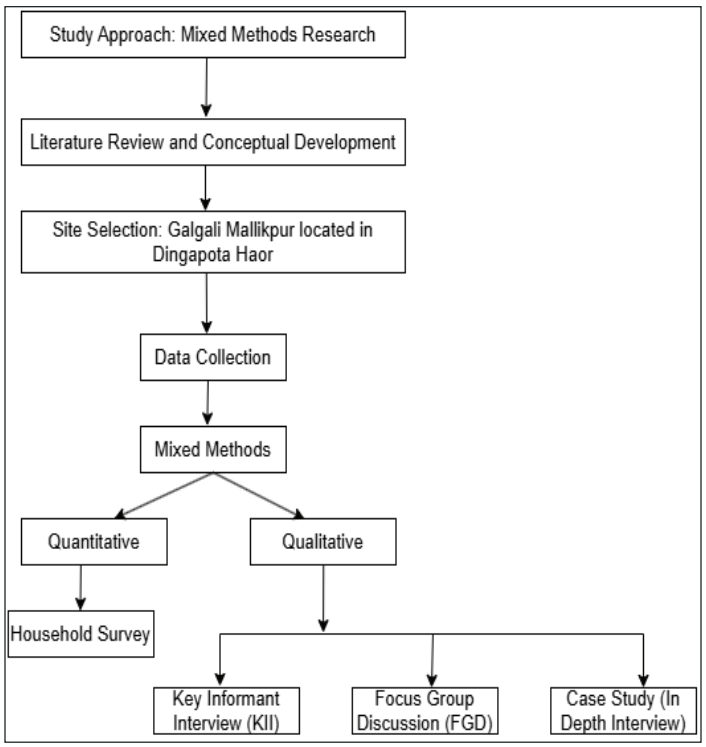

Figure 2: Methodology

The data was analyzed with SPSS and Excel software. Coding method was used to analyze qualitative data collected from KII and FGDs. Field visits and observation method helped to understand the real situations of daily life in poverty and floods in Mallikpur village which is located in a remote haor region of Bangladesh. However, due to limited time and lack of fund this study could not include another study area from the inland to present a comparative analysis.

RESULTS

Economic, Education and Health Impacts of Floods

Mallikpur is an agriculture-based village where 74.02 percent of the residents work in the agricultural sector, including farming, livestock rearing, and fishing. The second major occupation is service, with 17.32 percent of the residents working in shops, followed by day laborers, who make up 3.15 percent of the population. The unemployment rate stands at 5.51 percent, reflecting labor market and economic challenges such as job availability and workforce engagement. However, agriculture does not ensure solvency in this village, as a significant number of households (48.20 percent) do not own any cropland. Among those owning land, 50.70 percent have less than 100 decimals, and 23.94 percent own less than 200 decimals, with only 14.08 percent of households owning more than 400 decimals of land. Moreover, during the wet season and floods, a large number of farmers (65.93 percent) remain unemployed as the land stays underwater. Some of them engage in livestock rearing (12.59 percent), fishing (5.19 percent), or boat transportation (4.44 percent), respectively. However, these sectors are not sustainable and efficient for the locals, as only 41percent of the residents own a boat. Environmental disasters and poverty create a critical situation for the Mallikpur residents, as most of them (93.75 percent) living below 2.15 USD per day (World Bank Group 2022). Analyzing the income distribution, it has been revealed that the majority of the residents (48.12 percent) earn less than 10,000 BDT per month, while 40.60 percent have an income of 10,001-20,000 BDT per month (Table 1), and 10.52 percent earn more than 20,000 BDT monthly. About 59.56 percent of the families have one earning member, with other members economically dependent on him/her. According to the survey, 25 percent of the families have 1-3 members, 58.09 percent have 4-6 members, and 16.91 percent have more than 7-10 members, indicating economic dependency at the family level.

Table 1: Demography of the Surveyed Residents at Galgali Mallikpur Village

Demographic Aspects	Features
Male-Female ratio	44:56
Age distribution	1-15 years: 0.72 %, 16-25 years: 5.76%, 26-50: 55.40%, Above 51 years: 38.125%
Marriage status	Married: 93.53 %, unmarried: 5.76%, widow: 0.71%
Family size	1-3: 25%, 4-6: 58.09%, 7-10: 16.91%
Education level	No schooling: 41.70%, Primary: 32.40%, Secondary: 15.10%, College: 6.50%, under graduation: 4.30%
Occupation (Main income source)	Agriculture: 74.02 percent, Service holder (informal sector): 17.32%, labor: 3.15%and unemployed: 5.51%
Monthly income	Below 10000 BDT: 48.12%, 10,000-20,000 BDT: 40.60%, 20,001-30,000 BDT: 9.02 %, 30,000-40,000 BDT: 1.5 %
Poverty	Living below 2.15 USD per day: 93.75%

Source: Field survey 2023

The housing conditions of the villagers reveal a lack of adequate living standards and high vulnerability to floods. A significant percentage of houses are katcha (84.89 percent): made of crude structures such as mud, thatch, or other less durable materials, with Jhupri accounting for 24.46 percent (Fig. 3). Only 12.95 percent of the houses are semi-pucca, and 2.16 percent are pucca houses made of sturdy, long-lasting materials. Alarmingly, most houses in this village were affected by flooding; for example, nearly 95 percent of the households were submerged by floodwater at different levels during the 2022 flood. About 65.55 percent of the homesteads *(Vita)* went underwater, 13.45 percent of the residents experienced floodwater up to their bed level and floodwater entered the courtyards of 21 percent of the households. They had to move things and live on the beds during the 2022 flood. Due to the submergence of houses, 27.94 percent of households moved their belongings to higher places in the house. More than half of the household members (54.67

percent) were relocated to other places, among which 85.53 percent took shelter in the primary school. However, the living condition in the shelter was very poor, as five or six families (nearly 36 people) stayed in one room. This situation disrupts children's health, education and affects their wellbeing. Residents also experience different types of diseases. Fever and cold are the most common diseases during floods, affecting 89.47 percent of the families, and waterborne diseases affect 10.53 percent of the families. The data shows that most households (78.40 percent) use kutcha toilets, indicating a deficiency of adequate sanitary facilities. Only a few households (4.30 percent) have pucca toilets with better hygienic conditions. More importantly, 7.90 percent of households do not have access to sanitary facilities at all. However, 89.23 percent of the sanitation facilities available during non-disaster periods were damaged by floodwater in 2022. Besides, 62 percent of the households collect their drinking water from tube wells, and the rest from ponds and haors. In most cases, these water sources were damaged during the floods. Only 26 percent of the households used water purification tablets during the 2022 flood. These factors increased the risk of infections and diseases among the villagers.

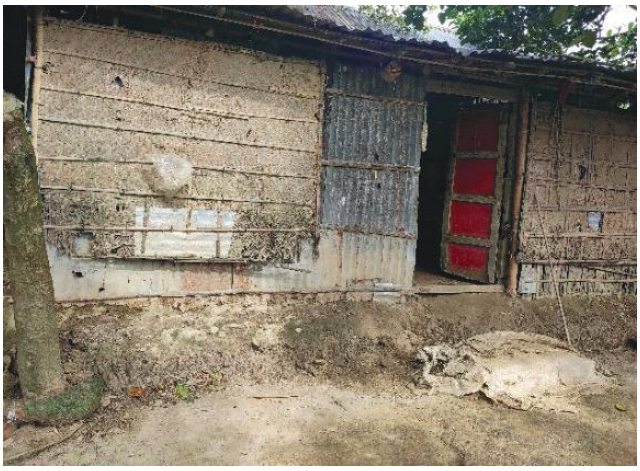

Figure 3: A House in Mallikpur (2023)

Coping and Mitigation Strategies Against Floods

Galgali Mallikpur village does not have any flood management structures except for a flood wall, which protects only a few houses (4.03 percent) of the village. Residents apply local knowledge and experiences to protect their houses from the floodwater and take several strategies to cope with the socio-economic effects of flooding, which are presented in the following points.

Mitigation Strategies Against Floods

Protecting Houses

As flood events are regular in the study area, households in vulnerable regions have developed a range of mitigation strategies to protect their homes and ensure their survival during such crises. A notable 47.24 percent of these households rely on the use of sandbags (Fig. 4), which protect their homesteads against rising water levels. This approach not only signifies a practical and low-cost solution but also reflects significant reliance on available flood coping mechanisms. Additionally, 22.05 percent of households implement local fencing: plant's local name *Ujagori* (Fig. 5) as a barrier against wave effects during floods, while 18.90 percent take measures to elevate their house levels, thereby reducing the risk of water intrusion. These strategies underscore the community's ingenuity in utilizing available resources and techniques to fortify their living spaces against flooding. However, it s concerning that 11.81 percent of households remain unprotected, lacking any form of precautionary measures to shield themselves from the impending danger of floods.

Figure 4: Sandbags to Protect Houses (2023)

Figure 5: Local Fence (2023)

Storing Local Dry Food and Rainwater Harvesting

In terms of food security and water safety, half of the families (48.20 percent) proactively store local dry food supplies, such as flattened rice, puffed rice, and jaggery, to sustain themselves through the flood period. However, the rest do not store any food for emergency periods. A small yet significant portion of the community (38.80 percent) adopts rainwater harvesting during the flood season, utilizing it for daily activities like cooking and washing utensils. However, this water is not sufficient for them. Collecting safe water is one of the challenges that all the residents face during the floods.

Coping Strategies Against Floods

Taking Loans

The study found that 91.37 percent of households in Galgali Mallikpur village have debt, ranging from below 10,000 to more than 100,000 BDT. 39.64 percent of them took loans ranging from 10,001 to 50,000 BDT, 23.42 percent of the households have loans ranging from 50,001 to 100,000 BDT, and 30.63 percent have loans exceeding 100,000 BDT. The data demonstrate that a large proportion of the village's residents are suffering from considerably greater levels of indebtedness. Taking out loans is one of their coping strategies during floods, as many of them cannot work due to this natural catastrophe. According to the present study, 71 percent of the residents who cannot work during the floods find themselves without work for two to four months (42.86 percent), two months (34.29 percent), and more than four to six months (22.85 percent). Consequently, they have to take loans to survive. However, while taking loans offers short-term relief, it ultimately leads the residents into a vicious cycle of poverty due to high interest rates (Fig. 6). They tend to borrow mostly from moneylenders (61.59 percent), NGOs (51.80 percent), and banks (only 8.63 percent borrow from banks). Although banks offer lower interest rates, the residents prefer to avoid them due to the stringent rules and difficulties in obtaining money.

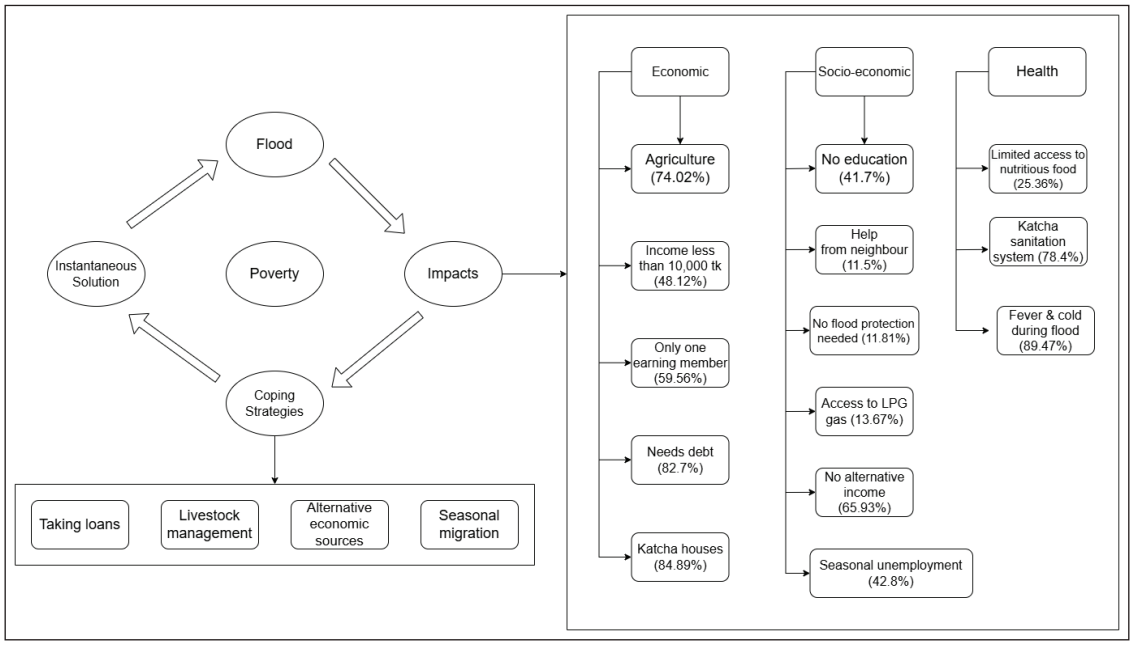

Figure 6: Cycle of Poverty in Haors (Field survey 2023)

Livestock Management

Managing livestock plays a crucial role for households during floods. An overwhelming 71.20 percent of these households possess at least one type of livestock, including cow (65.69 percent) and hen rearing (11.51 percent) being the most common practices. This reliance on livestock not only underscores the agricultural backbone of these communities but also highlights their vulnerability to natural disasters such as floods. In response to the imminent threat of flooding, a significant proportion of these households adopt proactive measures to safeguard their valuable livestock assets. Notably, nearly half of them (48.19 percent)

relocate their animals to higher ground, a practice that demonstrates a pragmatic approach to minimizing loss and ensuring the survival of their livestock. This strategy not only protects the animals from the immediate dangers of flooding but also secures a vital source of income and sustenance for the households during and after the disaster. Furthermore, a substantial number of households (31.33 percent) resort to selling their livestock as a means to mitigate the financial shock brought on by the floods. This decision, while difficult, provides immediate liquidity and is a testament to the adaptive strategies employed by these communities to navigate the economic challenges posed by floods. Selling livestock serves as a crucial financial lifeline, enabling households to cover essential expenses, repair damages, and possibly invest in post-disaster recovery efforts.

Alternative Economic Sources

Though unemployment increases among the flood affected residents during the flood periods, some of them (29 percent) try to get alternative economic sources. 44.74 percent of them, who search for employment, get involved in livestock rearing, 18.42 percent of them catch fish, 15.79 percent become boatman, 10.52 percent do small business and 10.53 percent of them move to other areas for a short time.

Seasonal Migration

According to the present study, 44.12 percent of the residents decided to move out of the village because of the flood, while 55.88 percent stayed in the village despite the socio-economic effects of floods. Of the people who left the village after floods, 51.72 percent were sons, 41.38 percent were fathers, and 6.90 percent were daughters, all seeking better economic opportunities in the cities driven by the desperate hope of finding a sustainable livelihood. This indicates that sons were the most likely to move out as they are considered the breadwinners of the family. The survey found that 31.14 percent of people moved to Dhaka, followed by 21.31 percent who moved to Chittagong, 18.03 percent to Feni, 11.47 percent to Netrokona, 9.83 percent to Mymensingh, 6.56 percent to Gazipur in search of their livelihoods. Barishal was the least popular destination, with only 1.65 percent of respondents considering it as their desired destination. Notably, 28.85 percent of the participants were involved in agricultural activities at their migration destination. Closely following, 26.92 percent contributed to the garment industry, while 23.08 percent found employment in the informal service sector. Additionally, 21.15 percent of the migrants were engaged in labor-intensive work. Due to the lack of education, skills, and training, these individuals cannot get employed in service sectors, resulting in low wages and fewer work facilities, which can only help them survive the hardship.

The data reveals that a significant majority (78.05 percent) of the migrants exhibited short-term migration, lasting between 1 and 5 months, suggesting a dominant pattern of rapid return to their original villages. In contrast, a small proportion (14.63 percent) prolonged their migration for 6 to 10 months, while an even smaller fraction (7.32 percent) maintained long-term migration, ranging from 11 to 15 months. Due to the hardships caused by frequent floods, villagers always need financial support, which they cannot properly obtain in the study area. As a result, every year the labor force tends to move to other destinations in the country, where they can find livelihoods to support their families during the emergencies.

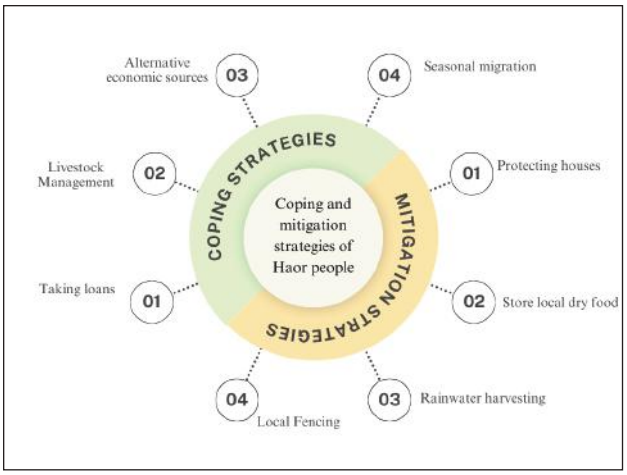

Figure 7: Coping and Mitigation Strategies Taken by Local People

Cross-Sectional Analysis: Floods and Poverty

Floods and Poverty in Mallikpur Village

The study reveals that 93.75 percent of the residents of Mallikpur village live below the poverty line (calculated

following World Bank Group 2022), and 82.7 percent of them are in debt. About 29 percent of them take on alternative jobs during the floods, as 71 percent remain unemployed. Approximately 47.95 percent of the residents consume less food during the floods to cope with reduced income (Oskorouchi & Sousa-Poza, 2021), and 27.4 percent sell their livestock in exchange for money during the crisis due to a lack of straw and safer places to keep them (Islam, 2018). Additionally, 4.10 percent of them seek help from others to continue their daily life. Analyzing the relationship between major occupations and alternative jobs during the floods reveal that a large number of service holders (75 percent) who are involved in informal sectors become unemployed during the floods, with 69 percent of farmers and 50 percent of laborers also being out of work. Among the residents who switch jobs, farmers are the highest in number (77.78 percent), followed by service holders and daily laborers at 11.11 percent each. It shows that farmers try to involve themselves in other sectors like fishing, livestock rearing, and boat transportation (boatman) as also Parvin found in her study 2016, where job holders do not have these opportunities and specific skills. Instead, they choose migration far more often (63 percent) in comparison to farmers (38.46 percent). Additionally, debt held by farmers usually resides in a higher range, spanning from 10,000 to 100,000 BDT (described in section 3.2). It should be noted that all of the haor is under private lease, and fishing is not permitted for all. As a result, residents are unable to catch fish from the haor, which is critical during flooding.

In regard to income and debt, all occupations, except service holders, earn less than 20,000 BDT monthly, which makes evident the reason behind the existing poverty in this village. However, only 4.77 percent of the service holders earn more than 30,000 BDT monthly. People from all occupations are in debt of varying amounts. During the wet seasons, when people lose their employment and their earnings fall, they accumulate more debt (Balgah et al., 2019). Some families migrate to other areas to cope with the economic effects of floods. Migration is found to be higher among the income group of 10,000-20,000 BDT (50 percent) and then among the income group of less than 10,000 BDT monthly (39 percent), and with the income group of 20,000-30,000 BDT being the lowest with a percentage of 25. The poorest of the poor cannot leave the area due to lack of money, skill, and information (Lwanga-Ntale & McClean, 2004).

No Education in Poverty and Floods

Regarding education, 41.70 percent of Mallikpur residents have no formal education, 32.40 percent attended elementary/primary school, 15.10 percent completed secondary school education, and only 10.80 percent studied beyond the HSC level. The lack of educational institutions in nearby locations, a difficult transport system, and a lack of money are the main reasons for illiteracy in this village (Kaiser, 2023). According to the survey, 93 percent of the families who answered the education related question mentioned that children from their families have stopped going to school. Of the children who left school, most stay at home (76.25 percent of them), 22.5 percent work at others' shops or houses, and 1.25 percent do tuitions to earn money for the family. However, as they grow up, the absence of schooling leads to choosing locally available jobs or taking up the family job, such as farming. 80.4 percent of the farmers do not have any formal education; Ferdushi and her team also revealed similar situation in her research (Ferdushi & Kamil, 2019). The migration rate is higher among the people who are poor and have studied only primary school level compared to those with no education (54.8 percent and 37.9 percent respectively). However, the rate of leaving school is very high among the residents of Mallikpur village.

Flood Coping and Mitigation Strategies in Economic and Spatial Disparity

Family income status and types of coping strategies adopted against flooding are interrelated (Mondal et al., 2020). Analyzing the data, it has been revealed that the number of residents (27.5 percent) from lower income groups (monthly income below 10,000-20,000 BDT) reduce their food consumption to manage their monthly expenses during the floods is significantly larger than their counterparts despite being the higher income group (monthly income more than 20,000 BDT), which is 8.33 percent. The poorer groups do not have enough savings to manage emergencies, so they sell their livestock, whereas comparatively higher income groups spend from their savings during the emergency periods of floods (Mondal et al., 2020; Oskorouchi & Sousa-Poza, 2021; Del Ninno, 2001). However, feeling helpless during floods is common among all income groups.

Mallikpur village has a spatial disparity involving the placement and number of regarding flood protection walls and inundation caused by floodwater. It has been revealed that the houses located near the wall are protected from the floodwater, though the percentage is not very high, at only 4.03 percent, and richer residents live in this part of the village. However, the rest (95.97 percent) of the houses in the village face floodwater. They take several mitigation measures (described in section 3.2), which also vary according to income level. Cross-sectional analysis presents that applying sandbags, local fences, and uplifting the house level are measures mostly common amongst the lower income groups, whereas uplifting the house level is most common among the poorest of the poor income group (monthly income below 20,000 BDT); the percentage being at 96. This is the easiest and least expensive mitigation measure for them as the houses are made of light materials like bamboo, tin, and wood.

Disability and Healthcare Access in Floods and Poverty

The present study reveals that healthcare access is very poor for the residents of Mallikpur village. They do not visit any healthcare centres in most cases, especially during floods as the transportation becomes difficult and costly (see Rezwana, 2018). Instead, Mallikpur residents apply several indigenous treatment methods to cure illness during floods such as Centella asiatica leaves and juice from Malabar and Bermuda grass or buy medicine from the nearby drug stores. The case 1 presented below exhibits how a resident was left in a helpless situation when her husband died in Dhaka and could not bring his dead body to the village timely due to severe flood conditions.

However, poverty and lack of healthcare facilities during floods and inundations bring immense sufferings for those older and disabled (Case 1 and Case 2). Study found that 8.7 percent of the Mallikpur village residents are facing different types of disabilities. Old age, paralysis, blindness, physical disability, and autism are the major forms of disability experienced amongst the residents. These residents need different forms of assistance during daily routine works. Case 3 discusses the creation of a situation that is so severely difficult to withstand for the people with special needs during floods and poverty.

Here it should be mentioned that the present research has revealed that Mallikpur village did not get any financial help during the flooding. There were few numbers of volunteer organizations who helped flood victims to take refuge during the flood periods and distributed water purification tablets (Potassium Aluminium Sulfate) but this relief available was never enough.

Case 1

Rakhal Majumder (89 years old) is an elderly resident of Galgali Mallikpur. Upon entering his humble house, it was noticed that he was taking medicine sitting on a mora (a tool made of wood) and as he explained the condition, “I have heart disease as you can see, I’m taking my prescribed medicine. There is no one in my family except my ill wife (78 years old) who is suffering from kidney diseases.” The elderly couple receive economic support from their daughter and sons-in-law. While mentioning about the devastating flood of 2022, Rakhal took a long harrowing breathe and was silent for a moment. The isolation resulting from the flooding subjected the couple to immense misery, as both required medical attention and support from the neighbors. Rakhal normally faces difficulty to move and daily activities like preparing food, bathing, washing clothes, using washroom. This flood made his activities challenging to perform, “the water reached at our bed and we two people were literally stuck at bed. At the beginning, we starved for a couple of days because all the nearby people went to the shelter-house. There was nothing to eat in this house even our regular medicine was stocked out. My wife and I suffered from chest pain at that time. We were praying for humanitarian help; however, we didn’t receive any support from officials or organizations.” After few days of starvation, a neighbor extended an offer of help, as she gave them some dry food (puffed rice, dried chili, biscuits) to survive the crisis. As he was howling and picturing the trials that they faced during the flood, he explained, “The flood was so horrific that we were praying to Gods for death as living our lives became unbearable!”

Case 2

Hira Sarker, a middle-aged woman suffering from paralysis, relies on the support of her distant cousin, Harshi Sarder. Harshi began to share her experience of floods, "my sister (Hira Sarker) cannot move without my help and is entirely dependent on me. During the flood, the water started to rise quickly, and all we could do was pray for help. The network system was cut off within a few hours and we couldn't contact anyone for help. As the water began to engulf our bed and belongings, I sought humanitarian help nearby." To her shock, the entire neighborhood was inundated, with everyone trying to escape the area.

Harshi continued, "By all means, I carried my sister on my back and we sought refuge on the tin roof of our house. We were forced to go without food for days." The misery was compounded by non-stop rain, forcing them to remain wet day and night. After a pause, Harshi added, "Before the flood, Hira could speak. Despite her paralysis, she remained cheerful. During the flood, due to our hardships, Hira fell ill and became unconscious multiple times. When the flood peaked and heavy rainfall continued, she was unconscious for hours. At that time, I thought I had lost my sister." Amidst their struggles, a volunteer organization helped the two to escape the flood-stricken area. Although Hira was taken to a health clinic, her condition remained critical for weeks. After the flood, she lost her ability to speak. While discussing Hira's health condition, Harshi wept and said, "By the grace of God, we survived the 2022 flood. But my sister has become so weak that she is practically counting her last days."

DISCUSSION

According to the present study, an insufficient number of healthcare centers, educational institutes, and employment opportunities have created difficult living conditions for the residents of Mallikpur village. Floods and inundations increase insecurity to earning and food availability in this village during the wet season. Similar impacts of floods were presented in Bubeck's paper in 2017 whereas Ahmed explained this situation created by floods applying food insecurity experience scale in 2024. Again, in the present study, 47.10 percent of the residents answered that they feel helpless during floods because the coping and mitigation strategies they adopt are insufficient to protect them from the socio-economic effects of floods (Dewan, 2015). These local mitigation strategies are also practiced in the flood affected rural areas of Bangladesh which have been mentioned in Shafie and Rahman's paper in 2009 Paul & Routray in 2010 and Sheheli & Khan's paper in 2015.

Floods have always intensified the factors that compel people to leave their homes. The present study as well as studies from all other flood-affected countries shows that while facing unpredictable income and seasonal shocks, migration has been accredited as a significant strategy for rural people (Chumky et al., 2022; Rapoport, 2014; Yang, 2011, Warner & Afifi, 2014; Giannelli & Canesa, 2022; Gemenne & Blocher, 2017; Warner & Afifi, 2014). However, alternate jobs and migration do not assist the residents of Mallikpur village in breaking free from the poverty cycle; instead, lower income, unemployment, taking loans, and flood damage leave them trapped year after year, resulting in chronic poverty in this remote area (Kaiser, 2023; Abedin & Khatun, 2020). They remain in a vicious cycle of poverty. A similar result is found in Abedin and Khatun's study on the impacts of flash floods in Tanguar Haor of Bangladesh (Abedin & Khatun, 2020) and in Kaiser's study on riverbank erosion victims (Kaiser, 2023).

The above discussion encompasses the significant effects of geographical location, spatial and regional disparities on socio-economic development in a disaster prone village in the Haor region of Bangladesh which is also supported by the research conducted by Rice and Venables in 2003, Kanbur and Venables in 2007 and Touitou et al., 2020. Rice and Venables worked on the relationship between spatial disparities and unequal economic development in Great Britain whereas Kanbur and Venables addressed at the global level. Not only the economic conditions, Touitou and his team (2020) have explained the impacts of spatial disparities on the uneven distribution of education facilities in Algeria.

CONCLUSIONS

The phenomenon of annual flooding dramatically transforms the landscape of Mallikpur village, resulting in the area becoming temporarily isolated from the rest of the country for several months. The economic loss due to crop damage and unemployment during the flooding leads to a gradual descent into deeper poverty. The absence of educational opportunities in the village compounds these challenges. Education is a critical pathway out of poverty, offering individuals the

chance to improve their circumstances and contribute to society. However, the recurrent floods and resulting isolation deprive the villagers of this vital resource. Consequently, without any external help and sufficient means to recover, the community remains entrenched in a cycle of poverty and backwardness, unable to progress or break free from their disadvantaged status. According to Khayyam (2020) and Hallegatte et al., (2020) the devastating disaster impact on vulnerable populations becomes more long-lasting due to exacerbating existing socioeconomic disparities.

Despite these adversities, the region in which Galgali Mallikpur is situated holds considerable importance for the national economy of Bangladesh. This region accounts for nearly one-fifth of Bangladesh's total paddy output (Rabby et al., 2011 & Rahaman et al., 2022). This substantial contribution highlights the area's potential and underscores the necessity of addressing the hardships faced by its inhabitants. While the nation is trying to achieve the Sustainable Development Goals (SDGs) within the timeframe set, it is essential to examine haor regions with special development plans. Reducing poverty, spatial and regional disparity, and implementing comprehensive disaster management plans are suggested to improve the lives and wellbeing of the inhabitant in this region.

REFERENCES

Abedin, J., Khatun, H., 2020. Impacts of flash flood on livelihood and adaptation strategies of the haor inhabitants: A study in Tanguar haor of Sunamganj, Bangladesh. The Dhaka University Journal of Earth and Environmental Sciences 8(1), 41–51. https://doi.org/10.3329/dujees.v8i1.50757

Ahmed, M. R., 2024. Climate shocks' impact on agricultural income and household food security in Bangladesh: An implication of the food insecurity experience scale. Heliyon 10(4), e25687. https://doi.org/10.1016/j.heliyon.2024.e25687

Alam, M., 2018. Inequalities in access to primary education: An investigation on "haor"(wetland) areas in Bangladesh. World Voices Nexus; WCCES: Ithaka, NY, USA, accessed on03/07/2024, www.worldcces.org/article-1-by-alam/inequalities-in-access-to-primary-education-an- nvestigation-on-haor-wetland-areas-in-bangladesh

Azad, A. K., Hossain, K. M., Nasreen, M., 2013. Flood-induced vulnerabilities and problems encountered by women in northern Bangladesh. International Journal of Disaster Risk Science 4(4), 190–199. https://doi.org/10.1007/s13753-013-0020-z

Balgah, R. A., Bang, H. N., Fondo, S. A., 2019. Drivers for coping with flood hazards: Beyond the analysis of single cases. Jàmbá Journal of Disaster Risk Studies 11(1), Article 1. https://doi.org/10.4102/jamba.v11i1.678

IUCN- Bangladesh, 2004. Introduction to community-based haor and floodplain resource management. IUCN Bangladesh Country Office, Dhaka, Bangladesh, 42.

Barkat, A., Suhrawardy, G. M., Rahman, M. I., 2019. A study on haor governance and haor dwellers' rights in Bangladesh. Human Development Research Center, Dhaka, Bangladesh.

BBS, 2015. Population & housing census 2011, Community report: Netrokona (pp. 1–1033) [Government]. Bangladesh Bureau of Statistics (BBS), Statistics and Informatics Divisiion (SID), Ministry of Planning. http://203.112.218.65:8008/WebTestApplication/userfiles/Image/PopCenZilz2011/Netrokona.pdf

Bhattacharya, B., Suman, A., 2012. Flash flood characterisation of the haor area of Bangladesh. In EGU General Assembly Conference Abstracts (p. 11287).

BHWDB, 2012. Master plan of haor area (pp. 1–82). Haor and wetland development board, Ministry of Water Resources, Bangladesh. https://dbhwd.portal.gov.bd/sites/default/files/files/dbhwd.portal.gov.bd/publications/baf5341d_f248_4e19_8e6d_e7ab44f7ab65/Haorpercent20Masterpercent20Planpercent20Volumepercent201.pdf

Bubeck, P., Otto, A., Weichselgartner, J., 2017. Societal impacts of flood hazards. In P. Bubeck, A. Otto, & J. Weichselgartner, Oxford Research Encyclopedia of Natural Hazard Science. Oxford University Press. https://doi.org/10.1093/acrefore/9780199389407.013.281

Chakraborty, B., Darak, S., Haisma, H., 2020. Maternal and child survival in haor region in Bangladesh. An analysis of fathers' capabilities to save the future. International Journal of Environmental Re-

search and Public Health 17(16), 5781. https://doi.org/10.3390/ijerph17165781

Chumky, T., Basu, M., Onitsuka, K., Parvin, G. A., Hoshino, S., 2022. Disaster-induced migration types and patterns, drivers, and impact: A union-level study in Bangladesh. World Development Sustainability 1, 100013. https://doi.org/10.1016/j.wds.2022.100013

DAE, (2017). Report on damage of Boro crops due to excessive rain, flash flood and embankment collapse. Department of Agricultural Expansion, Ministry of Agriculture, Bangladesh.

DDM, (2017). Floods in northeast (haor) areas of Bangladesh. Department of Disaster Management. Ministry of Disaster Management and Relief, Bangladesh.

Del Ninno, C., 2001. The 1998 floods in Bangladesh: Disaster impacts, household coping strategies, and response. Research Report Vol. 122, International Food Policy Research Institute, Washington D.C.,USA.

Dewan, T. H., 2015. Societal impacts and vulnerability to floods in Bangladesh and Nepal. Weather and Climate Extremes 7, 36–42. https://doi.org/10.1016/j.wace.2014.11.001

Dey, N. C., Parvez, M., Islam, M. R., 2021. A study on the impact of the 2017 early monsoon flash flood: Potential measures to safeguard livelihoods from extreme climate events in the haor area of Bangladesh. International Journal of Disaster Risk Reduction 59, 102247. https://doi.org/10.1016/j.ijdrr.2021.102247

Ferdushi, K. F., Ismail, M. T., Kamil, A. A., 2019. Perceptions, knowledge and adaptation about climate change: A study on farmers of haor areas after a flash flood in Bangladesh. Climate 7(7), 85. https://doi.org/10.3390/cli7070085

Gemenne, F., & Blocher, J. (2017). How can migration serve adaptation to climate change? Challenges to fleshing out a policy ideal. The Geographical Journal, 183(4), 336–347. https://doi.org/10.1111/geoj.12205

Giannelli, G. C., Canessa, E., 2022. After the flood: Migration and remittances as coping strategies of rural Bangladeshi households. Economic Development and Cultural Change 70(3), Article 3. https://doi.org/10.1086/713939

Hallegatte, S., Vogt-Schilb, A., Rozenberg, J., Bangalore, M., Beaudet, C., 2020. From poverty to disaster and back: A review of the literature. Economics of Disasters and Climate Change 4(1), 223–247. https://doi.org/10.1007/s41885-020-00060-5

Ibn Farid, Z., Ibn Farid, S., Awfa Islam, M., Jerin, T., 2021. Education in emergency: Exploring the issues and options for continuing education during flash flood in the haor regions of Bangladesh. International Journal of Research and Innovation in Applied Science 06(04), Article 04. https://doi.org/10.51584/IJRIAS.2021.6406

Imtiaz, A., 2020. The nation learning to embrace flooding. BBC. https://www.bbc.com/future/article/20201201-bangladesh-the-devastating-floods-essential-for-life, accessed on 03/07/2024.

IOM, 2009. Climate change and displacement in Banglaesh-a silent crisis? International organization for migration, https://www.iom.int/migrant-stories/climate-change-and-displacement-bangladesh-silent-crisis, accessed on 3/7/2024.

Islam, M. N., 2018. Community-based responses to flood and river erosion hazards in the active Ganges floodplain of Bangladesh. In Science and Technology in Disaster Risk Reduction in Asia, Elsevier 301–325. https://doi.org/10.1016/B978-0-12-812711-7.00018-3

Kabir, M. H., & Amin, S. (2007). Tanguar Haor, a diversified freshwater wetland. Academic Press and Publishers Library, Dhaka, Bangladesh.

Kaiser, Z. R. M. A., 2023. Analysis of the livelihood and health of internally displaced persons due to riverbank erosion in Bangladesh. Journal of Migration and Health 7, 100157. https://doi.org/10.1016/j.jmh.2023.100157

Kanbur, R., Venables, A. J., 2007. Spatial disparities and economic development. In global inequality: Patterns and explanation, edited by David Held and Ayse Kaya ,Chapter 9, 204-215, Polity Press, Cambridge, UK.

Kamruzzaman, M., Shaw, R., 2018. Flood and sustainable agriculture in the haor basin of Bangla-

desh: A review paper. Universal Journal of Agricultural Research 6(1), Article 1. DOI: 10.13189/ujar.2018.060106.

Khayyam, U., 2020. Floods: Impacts on livelihood, economic status and poverty in the north-west region of Pakistan. Natural Hazards 102(3), 1033–1056. https://doi.org/10.1007/s11069-020-03944-7

Lwanga-Ntale, C., McClean, K., 2004. The face of chronic poverty in Uganda from the poor's perspective: Constraints and opportunities. Journal of Human Development 5(2), 177–194. https://doi.org/10.1080/1464988042000225113

Maxwell, D., Ahiadeke, C., Levin, C., Armar-Klemesu, M., Zakariah, S., Lamptey, G. M., 1999. Alternative food-security indicators: Revisiting the frequency and severity ofcoping strategies'. Food Policy 24(4), Article 4.

Mondal, M. S. H., Murayama, T., Nishikizawa, S., 2020. Determinants of household-level coping strategies and recoveries from riverine flood disasters: Empirical evidence from the right bank of Teesta River, Bangladesh. Climate 9(1), Article 1. https://doi.org/10.3390/cli9010004.

NIPORT, 2016. Bangladesh demographic and health survey, 2014. Ministry of Health and Family Welfare, Bangladesh.

NIRAPAD, 2017. Flash flood situation May 03, 2017, http://www.nirapad.org.bd

Oskorouchi, H. R., Sousa-Poza, A., 2021. Floods, food security, and coping strategies: Evidence from Afghanistan. Agricultural Economics 52(1), Article 1. https://doi.org/10.1111/agec.12610

Parvin, G., Shimi, A., Shaw, R., Biswas, C., 2016. Flood in a changing climate: The impact on livelihood and how the rural poor cope in Bangladesh. Climate 4(4), 60. https://doi.org/10.3390/cli4040060

Paul, S. K., Routray, J. K., 2010. Flood proneness and coping strategies: The experiences of two villages in Bangladesh. Disasters 34(2), Article 2. https://doi.org/10.1111/j.1467-7717.2009.01139.x

Rabby, T. G., Alam, G. M., Mishra, P. K., Hoque, K. E., Nair, S., 2011. Different economic and policy perspectives in micro population for sustainable development: A study of the Haor livelihood in Bangladesh. African Journal of Business Management 5(6), 2475-2492. + https://doi.org/10.5897/AJBM11.224

Rahaman, M. S., Sarkar, M. A. R., Rahman, M. C., Deb, L., Rashid, M. M., Reza, M. S., Siddique, M. A. B., 2022. Profitability analysis of paddy production in different seasons in Bangladesh: Insights from the haor. International Journal of Agriculture, Environment and Food Sciences 6(3), 327-339. https://doi.org/10.31015/jaefs.2022.3.1

Rapoport, H, D. F., 2014. The economics of migrants' remittances. Handbook of the economics of giving, Altruism and Reciprocity 2(3), 1135–1198. https://doi.org/10.1007/s11150-014-9259-4

Reeve S., 2017. Children and the changing climate: Taking actions to save lives. UNICEF, UK, 1–39. https://downloads.unicef.org.uk/wpcontent/uploads/2015/11/Unicef_2015childrenandclimatechange.pdf

Rezwana, N., 2018. Disasters, gender and access to healthcare: Women in coastal Bangladesh. Routledge, UK.

Rice, P., Venables, A., 2003. Equilibrium regional disparities: theory and British evidence. Regional Studies 37(6-7), 675-686. http://dx.doi.org/10.1080/0034340032000108769.

Shafie, H., Rahman, S., 2009. Traditional coping strategies of rural people living in flood-prone areas in North-West Bangladesh. Dhaka: Rangpur Dinajpur Rural Service (RDRS).

Sheheli, S., Khan, M., 2015. Coping strategies of women in flood prone areas of Bangladesh. Progressive Agriculture 26(2), Article 2.

Sultana, N., Rayhan, M. I., 2012. Coping strategies with floods in Bangladesh: An empirical study. Natural Hazards 64(2), Article 2. https://doi.org/10.1007/s11069-012-0291-5

Touitou, M., Yacine, L., Ahmed, B., 2020. Spatial disparity and inequality of education domain in Algeria: a spatial econometric approach. International Journal of Social Economics 47(9), 1161-1180. DOI 10.1108/IJSE-11-2019-0699.

Uddin, M. N., Firoj, M., 2013. Causes and consequences of rural-urban migration in Bangladesh: An empirical study in Chittagong city. International Journal of Ethics in Social Sciences 1(1), 1–16. http://dspace.iiuc.ac.bd:8080/xmlui/handle/88203/247

Warner, K., Afifi, T., 2014. Where the rain falls: Evidence from 8 countries on how vulnerable households use migration to manage the risk of rainfall variability and food insecurity. Climate and Development 6(1), 1–17. https://doi.org/10.1080/17565529.2013.835707

World Bank Group, 2022. Fact sheet: An adjustment to global poverty lines. World Bank. https://www.worldbank.org/en/news/factsheet/2022/05/02/fact-sheet-an-adjustment-to-global-poverty-lines , accessed 02/03/2024.

Yang, D, 2011. Migrant remittances. Journal of Economic Perspectives 25(3), 129–152. https://doi.org/10.1257/jep.25.3.129