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Household Migration and Intentions for Future Migration in the Climate Change Vulnerable Lower Meghna Estuary of Coastal Bangladesh

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Abstract: Coastal residents of Bangladesh are now confronted with the increased incidence, variability, and severity of weather-related hazards and disasters due to climate change-induced sea level rise (SLR). Many researchers hold the view that as a consequence residents of such area have either already migrated to inland locations or intend to so in the near future. We examine the migration of households following a flash flood event that took place in August 2020 and address intentions for future migration in the Lower Meghna Estuary of coastal Bangladesh. The data obtained for this study include 310 household surveys, field observations, and informal discussions with respondents and local people. Based on the analysis of the field data, this empirical research found one household migrated to other district within one year after the event. When the respondents were asked about their future migration intensions, only a tiny proportion, namely 21 (6.77%) households, likely will leave the study area to settle in other districts while the remaining 289 households likely will stay in the Lakshmipur district. This finding challenges the existing narratives about vulnerability to environmentally induced migration. Moreover, it provides evidence of non-migration, which is a new as well as thriving area of investigation in relation to coastal Bangladesh.

Keywords: household migration; flash flood; coastal vulnerability; bangladesh

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1. Introduction

With growing concern over global climate change, along with extreme climate variability, the environment-migration nexus has received extensive attention from researchers working in the field of environmental degradation and global climate change [1–4]. Many of these researchers hold the view that climate change deprives people, particularly residents of coastal areas, of their livelihood and force them to migrate to places with better environmental attributes and better income opportunity [5–11]. Many of them also consider migration an adaptation strategy for climate change [8,12–14].

This paper is about human migration or non-migration from coastal areas of Bangladesh, a country deemed a hotspot of global climate change and the second most vulnerable country (MVC) for climate change impacts after Chad [15–18]. The coastal areas of the country have already reported increased frequency, variability, and severity of weather and climate-related disasters [19–21]. As a consequence, many researchers [18,22–25] claim that people in Bangladesh's coastal areas have either already started to migrate from their ancestral homes to inland places that are perceived as safer or may migrate in the near future [18,22–25].Other researchers [26–29] question whether such migration really occurs. They argue that climate change and environmental pressure exert little to no effect on migration flows from coastal areas of Bangladesh.

In fact, some authors e.g., [30–32] claim that climate change and pressure actually reduce migration. Indeed, Bell et al. (2019) [33] project that migration from the interior to the Bangladesh coast may increase through 2100. Despite the conflicting findings from the empirical studies one thing is clear: migration decisions are highly complex and shaped by a wide range of economic, demographic, social, political, cultural, and ecological drivers [4,11,34–37]. Ultimately, whether coastal residents move or stay put is not entirely attributable to environmental degradation.

While contradictory evidence of out-migration from coastal Bangladesh has received relatively wide attention from researchers, little work has been done on the future migration intentions of residents in such areas. Living in areas which are already increased incidence and magnitude of weather and climatic hazards and disasters, it is most likely that a considerable number of households view post-disaster as an opportunity to migrate safer places. In hazards and disasters literature, this is called 'window of opportunity', which lasts about seven months immediately after a disaster [38,39]. Once the window closes, however, the opportunity may not come again until the next disaster. Thus, the interest of households' migration decision declines over time, and as recovery progresses from the event, the migration is either forgotten or sidelined until another disaster strikes a coastal area.

In this paper, we analyze actual household migration within about one year after a rapid onset disaster and residents' intentions for future migration from a vulnerable estuary area of coastal Bangladesh. In particular, we empirically investigate whether individual households in the lower Meghna estuary of Kamalnagar and Ramgati upazilas (sub-districts) in Lakshimpur district of Bangladesh migrated after a flash flood event in 2020. We are also interested in studying future migration intentions from the study area. Both the district and the upazila are administrative units in Bangladesh. Table 1 provides the basic characteristics of the administrative units, which are relevant to our discussion on migration in the next section.

Table 1. Administrative and social unit used in Bangladesh *.

Name	Administrative Hierarchy	Number	Characteristics
Village	Smallest territorial and social unit	68,038	Average households size: 232
Union	Lowest tier of administration	4571	Comprising of 15–30 villages
Upazila	Third lowest tier of administration	495	Comprising of 8–15 unions Population ranges between 0.05 and 1.5 million Area ranges between 220 and 1092 sq. miles (572–2829 sq. km)
District	Second lowest tier of administration	44	Comprising of 8–20 upazilas Average population 2.6 million Average area: 859 sq. miles (2306 sq. km)

* Compiled from various sources; last two columns differ from one source to another.

We treat post-event migration and intentions for future migration of an area most vulnerable to weather and climate change together because we believe that past migration will shape future migration. We test the null hypothesis that there is no effect of past migration on future migration intentions. While we have no mobility data prior to the flash flood event, logically, we expect out-migration from the study area would increase after the flash flood and associated riverbank erosion. We hope our study helps us better understand the migration of the residents in the lower Meghna estuary area of Bangladesh in response to climate change hazards.

The next two sections of this paper provide a review of definitions of migration in Bangladesh and a brief description of the August 2020 flash flood event in the study area.

Section 4 describes the materials and methods used in the study while Section 5 presents the empirical results. The final two sections consist of the discussion and conclusions of this study.

2. Issues Related to Migration and Non-Migration in Bangladesh: A Review

This section provides the essential background of the present study, and is divided into two sub-sections: migration definitions and how they promote understanding of migration and non-migration. Researchers who studied migration trajectories in Bangladesh have used varied definitions of migration, which poses considerable challenges to measuring the extent of the phenomenon and for government and international agencies devising policy measures to respond to population migration.

2.1. Migration Definitions

Obviously, the magnitude of migration depends on its definition, and yet migration is difficult to define precisely; indeed, a universally-accepted definition is lacking. In general, it is defined as a move, either forced or voluntary that crosses a specified administrative or political boundary [40]. Specifically, however, in the context of climate change-induced migration from coastal Bangladesh, about half of more than two-dozen empirical studies did not define the term e.g., [41–47], while the other studies did not follow a common definition. More importantly, the term's definition differs considerably in both the temporal and spatial scales of migration. Furthermore, no available migration study from coastal areas employed either of the two official definitions provided by the Bangladesh government e.g., [19,24,47–50].

Regarding the first definition, in the 2011 Population and Housing Census, the Bangladesh Bureau of Statistics (BBS) of the Ministry of Planning defined migration as the movement of persons who change their place of residence for reasons other than marriage for a period of six months or more (temporal scale or dimension). Movement within a district (spatial scale or dimension) is not considered migration [51]. This first definition reflects inter-district domestic migration and includes both forced and voluntary migration. For the second definition, in another monograph, the BBS defined migration as that of people whose place of residence five years prior to the time of census is different from their current place of residence [52]. A limitation of this definition is that certain types of migration (e.g., temporary, seasonal, and return) are not identifiable because they are mixed with migrant or non-migrant populations. Note that a student who studies away from home is not considered a migrant because he or she either occasionally or frequently returns home from where the educational institution is located. Similarly, other short-term movements, such as travel for recreation and holiday, visits to friends and relatives, travel for business or, medical treatment, and religious pilgrimages are not considered migration.

Almost all researchers who have studied migration from coastal Bangladesh to inland used much smaller administrative units than does the formal definition provided by the BBS. They also used different time periods to determine stay at the destinations. For example, Bernzen et al. (2019) [19] suggest migration is "any move from the household in which the person no longer ate meals at the household table, including moves both within the same union and outside the union". They differentiate between temporary and permanent migration on the basis of months of absence: temporary $\leq$ 6 months of absence and permanent > 6 months of absence. On the other hand, Carrico and Donato [50] applied administrative units larger than the union, and they defined "a migrant trip as any trip outside of the upazila (sub-district) during which the migrant set up a household in the destination for three months or longer" (Table 2).

Table 2. Spatial and temporal scale used in defining migration in Bangladesh by selected study.

Source	Spatial Scale	Temporal Scale	Remarks
Bernzen et al. (2019) [19]	Within home union or outside the union	≤6 months for temporary migration and >6 months for permanent migration	
Best et al. (2020) [53]	Within own village	Not specified	Only mentioned movement type and drivers of migration
Call et al. (2017) [32]	Outside of the study area (upazila)	More >1 month for temporary migration	Only considered temporary migration irrespective of age
Carrico and Donato (2019) [50]	Outside own upazila	≥3 months	-
Chen and Mueller (2018) [24]	Not specified	Between one and 23 months	-
Gray and Mueller (2012) [30]	Local mobility within the district	Not specified	They provided two types of mobility, no mention of migration
	Long-distance mobility outside the home district	Not specified	
Mallick et al. (2020) [54]	Outside own village	Not specified	They mentioned movement type and drivers of migration
Rashid (2013) [17]	Not specified for traditional migration definition	Not specified	He provided two definitions of migration
	Outside own village for applied migration definition	Not specified	

Without mentioning any difference between temporally and permanently migration, Lu et al. (2016) [48] defined the term migration "to denote a change in residence lasting between one and twenty-three months." Similarly, Chen and Mueller (2018) [24] treated migration as that of any household members "who have been away for at least six months or have left because of household partition or marriage". In a study of migration from five coastal villages of Bangladesh, Rashid (2013) [17] provided two definitions of migration: traditional and applied. The former refers to "movement of people from one place to another, temporarily or permanently, in search of better life, livelihood, or, to avoid threat to life and livelihood". To him, seasonal migration refers to migration for one to four months based on seasonal work purpose. His applied definition is only for permanent migration, which he considers movement from the home village for those households that lose or sell their homesteads and do not live there anymore (Table 2).

Although Gary and Muller (2012), [30] did not directly provide a definition of migration, they seem to make no distinction between migration and movement. They instead address dichotomous population mobility and define "local mobility" as the residential moves within the district of origin, and "long-distance mobility" as moves outside one's district of origin. The latter is consistent with the definition used by the Bangladesh government, but neither local nor and long-distance mobility specified any temporal scale of migration.

Some researchers such as Mallick et al. (2020), [54] define migration in terms of movement type (temporary or permanent) and their driving forces (political, environmental, economic, or social). They imply that those people who moved from their own villages can be considered migrants. In contrast, one study [53] considered mobility within the home villages as temporary migration. Based on the reasons for temporary migration, this study classifies five types of migration: due to environmental, educational, health care, commerce/trading causes, and with the purpose of visiting relatives. Similarly, [32] considered temporary migration as the leave of absence from the study area for at least one month. Their study area was the Matlab Health and Demographic Surveillance System (MHDSS) area, which was established in 1966 and covers rural villages within an area of 71.04 sq. miles (184 sq. km). The system records births, deaths, migrations, marriages, and divorces of household members and is located 10 miles (16 km) north of Chandpur. Moreover, there are some other definitions of migration available from coastal or environ-

mentally challenged areas to other parts of Bangladesh, but most of them are not consistent with each other (Table 2).

Based on the foregoing discussion, two important points need to be mentioned. First, neither migration researchers nor the Bangladesh government use a uniform definition of migration in terms of spatial and temporal scales, and it seems that the definitions employed were developed by the researchers for their own purposes. Another point is that (spatial) mobility and migration should not be used interchangeably in Bangladesh or elsewhere. Mobility of individuals or groups is a more general term covering all types of geographic moves (e.g., circular and seasonal), and while movement is essential for migration, not all movements are migration. The latter term is reserved for crossing of a selected administrative unit (e.g., outside home district in Bangladesh and outside home county in the United States). In terms of spatial scale, Figure 1 illustrates the distinction between movement and migration in Bangladesh.

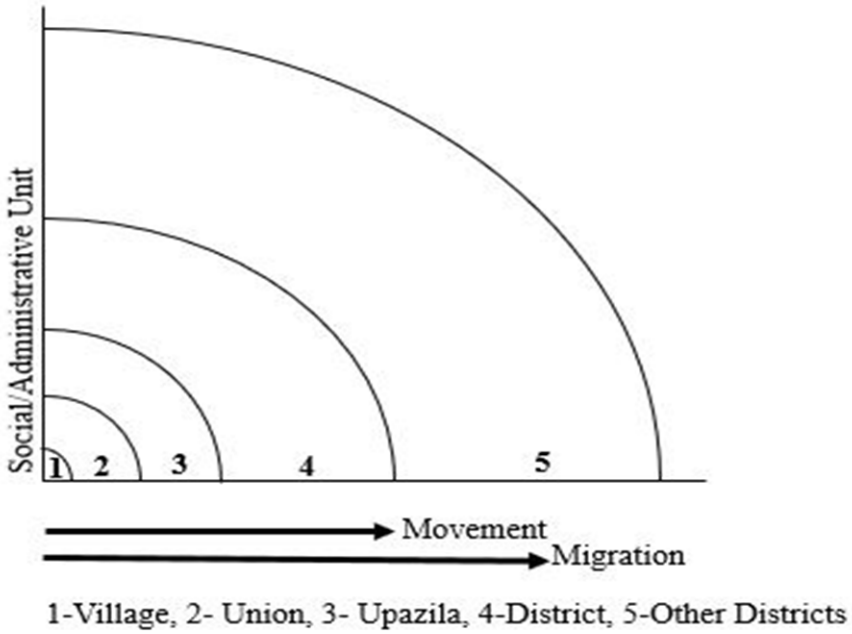

Figure 1. Social/Administrate unit in Bangladesh.

2.2. Migration and Non-Migration

There is an increasing amount of evidence that people are not moving from environmentally challenged areas, especially coastal zones, in Bangladesh e.g., [29,55]. Keeping in mind that generally, the terms migration and non-migration are complementary to each other, the BBS (2015), [52] defines non-migration as that of "people whose place of residence 5 years prior to the time of census is their current place of residence". Thus, each group of migrants has an associated group of non-migrants. In environmental migration studies, non-migration is often considered as the default state when migration is not possible e.g., [47,56,57].

Some migration researchers Castles 2009 and Black et al. 203, [35,58] emphasize that the cost of movement acts as a major intervening obstacle for non-migrants and they treat them as "trapped" populations, i.e., those who stay back in coastal areas despite imminent or actual exposure to climatic and environmental risks [11,36,43,47,56,58–61]. The trapped populations are described as those people who would have migrated but for the lack of resources to do so. This means that the poor are less likely to move [28,30]. They are thus treated as members of forced non-migration or "voluntary sedentarism" [47,60,62]. Etzold and Mallick (2016) [44] maintain that, for non-migrants, immobility is a particular source of their vulnerability.

That non-migrants seem to be the poor contradicts a key finding of [44], who claim that most migrants have little to no land to cultivate. Moreover, other non-migrants have resources to migrate but choose to stay in vulnerable coastal Bangladesh for various reasons. However, there is no empirical evidence about whether the trapped populations are intentionally staying or forced to remain at the point of origin as trapped non-migrants. Empirical study is also absent about the proportion of these two types of non-migrants. In fact, there is no conclusive evidence showing whether the poor or the rich relocate from coastal Bangladesh see [63].

Paul and his colleagues (2020) [29] explain such non-migration from the lower Meghna estuary in terms of the existence of adequate community (built, financial, political, social, human, cultural, and natural) capital, and strong social ties and place attachments [60,64,65]. Gray and Mueller [30] argue that natural disasters actually increase the demand for labor in the area impacted, and that this creates employment opportunities, which reduces the mobility of people who might have migrated elsewhere. In contrast, Paul and Bhuiyan (2010) [66] reported that instead of out-migration, people migrated to the disaster-affected areas from non-affected areas access to public and private emergency assistance. Most economic and other theories of migration suggest a host of problems abound in living in the place of origin, while the destination offers a panacea of opportunities, which ignores negative forces in the latter. Drawing on empirical research amongst migrants in Bangladesh, Ahsan et al. (2014) [23] listed these forces as feeling lonely and alone, being separate from local people, experiencing unknown destination life style, and socially not being honored as opposed to the more positive experiences reported by sources in coastal areas (also see [29]).

3. The August 2020 Flash Flood Event

The Meghna estuary study area experiences multiple hazards such as tropical cyclones and associated storm surges, riverbank erosion, flash and riverine floods, water logging, lightning, and tornadoes. It is also highly vulnerable to climate change and associated sea-level rise [67,68]. However, information collected from the study area reveals that flash flooding occurs more frequently than other extreme events. It generally occurs in coastal Bangladesh when regular high tides coincide with a full moon and/or is accompanied by strong winds and waves, locally called "jaluustus" (tidal bore) [67]. Water rushes from the estuary through canals and small rivers as quickly as 25 miles (40 km) per hour, eroding riverbanks and inundating adjacent settlements and crop lands for about three to seven days.

The 2020 flash flood occurred in the study area on August 5 and lasted for one week. In some water logged portions of the area, it stayed even longer. A considerable number of elderly residents reported that they had never seen such a volume of water before in their lifetime. The tidal bore brought 7 feet (2.13 m) of high water from the estuary. The respondents were really shocked when the surge started flooding almost everything from croplands to homes and infrastructure. The study area also experienced tidal surge-induced flash floods in the first week of September, 2020 and in August of 2021, providing evidence that flash flooding occurs more frequently than other natural disasters.

Riverbank erosion and flash flooding occurred simultaneously and were caused by tidal bore in both instances. The former event not only washed away adjacent homestead lands, but also ceded croplands to the river. The latter event submerged the entire study area with saline water, destroying or damaging homes, field crops (rice, soybean, peanut, pepper, maize, pulses, and summer vegetables), and roads (made of both earth and asphalt) (Figure 2). Three hundred and five respondents provided information about the damage status of their main dwellings. Of them, 52 (17%) reported that their main dwellings were completely damaged, including 16 respondents who lost their homes to the Meghna River. Additionally, 241 (79%) respondents had partial damage to their houses while the remaining 12 (4%) respondents did not experience any damage to their main dwellings. Flood also damaged shops, owned by respondents.

Two hundred and six (66%) of the 310 respondents experienced crops and vegetable damaged either partially or completely due to salt water intrusion, and many roads were so damaged that they were not usable for weeks. Further, many trees were uprooted and fish escaped from ponds, causing considerable loss of earnings to 77 respondents. The flash flood affected people reduced the impact of the event by adopting various coping strategies, such as borrowing money, spending savings, selling land, and or livestock, and household goods. They received little if any emergency assistance from government and non-governmental organizations (GO and NGOs), which is not unusual in the lower Meghna estuary see [29]. However, they received generous help from members of their social networks (e.g., friends, neighbors, and relatives). Irrespective of their own damage and losses, local people, particularly those who were not heavily affected, also provided flash flood survivors with food, clothing, and other necessary items.

Figure 2. 2020 Flash flood in the study area. Curtsey: Junayed Al Habib.

4. Materials and Methods

4.1. Study Area and Sources of Data

The study area (Figure 3), comprising 12 unions and 26 villages, is located in Kamalnagar and Ramgati upazilas, in the Lakshimpur district in Bangladesh. It covers 30 square miles (78 sq. km), and according to the 2011 population census of Bangladesh contains approximately 93,000 people. Situated along the eastern bank of the lower Meghna River in Bangladesh, the study area consists of low-lying flat land that is part of the central coastal zone. It has been experiencing rapid and dynamic geomorphological changes, meaning it is exposed to recurrent erosion and sediment depositions [69]. Riverbank erosion and flash floods are persistent problems in the study area but other natural hazards and disasters such as tropical cyclones and associated storm surges, tornadoes, and river floods occur infrequently. Like in other coastal zones of Bangladesh, the poverty rate in the study area is at least 40% higher than the national average [69].

Apart from experiencing the flash flood in 2020 (Figure 4), the study site was also chosen to facilitate a comparison with our previous study conducted in 2018 just south of the current study area, which analyzed migration and non-migration patterns of people due to riverbank erosion. Moreover, this particular study area provides additional understanding regarding migration in this estuary region.

During May and June 2021, an empirical study was conducted in the selected villages. The field study included a structural household survey, field observation, and informal discussions with respondents, village leaders, school teachers, and other local professionals. A total of 310 household heads (if absent, other adult members) participated in the questionnaire survey through spatial random selection using the ArcGIS Pro tool. The survey contained 66 questions-some were open-ended and others closed-and required

approximately one hour to complete. In addition to migration after the flash flood and migration intention in the near/distant future, the survey collected data related to households' socio-economic and demographic characteristics, damage caused by the flash flood, emergency assistance received, coping measures used to reduce the impact of the event, and so on. Three data collectors were trained to conduct the field survey who had prior experience with field surveying. The data was then coded and stored in an excel file. The questionnaire was approved by the Institutional Review Board (IRB) of Southern Georgia University, and all IRB guidelines were strictly followed.

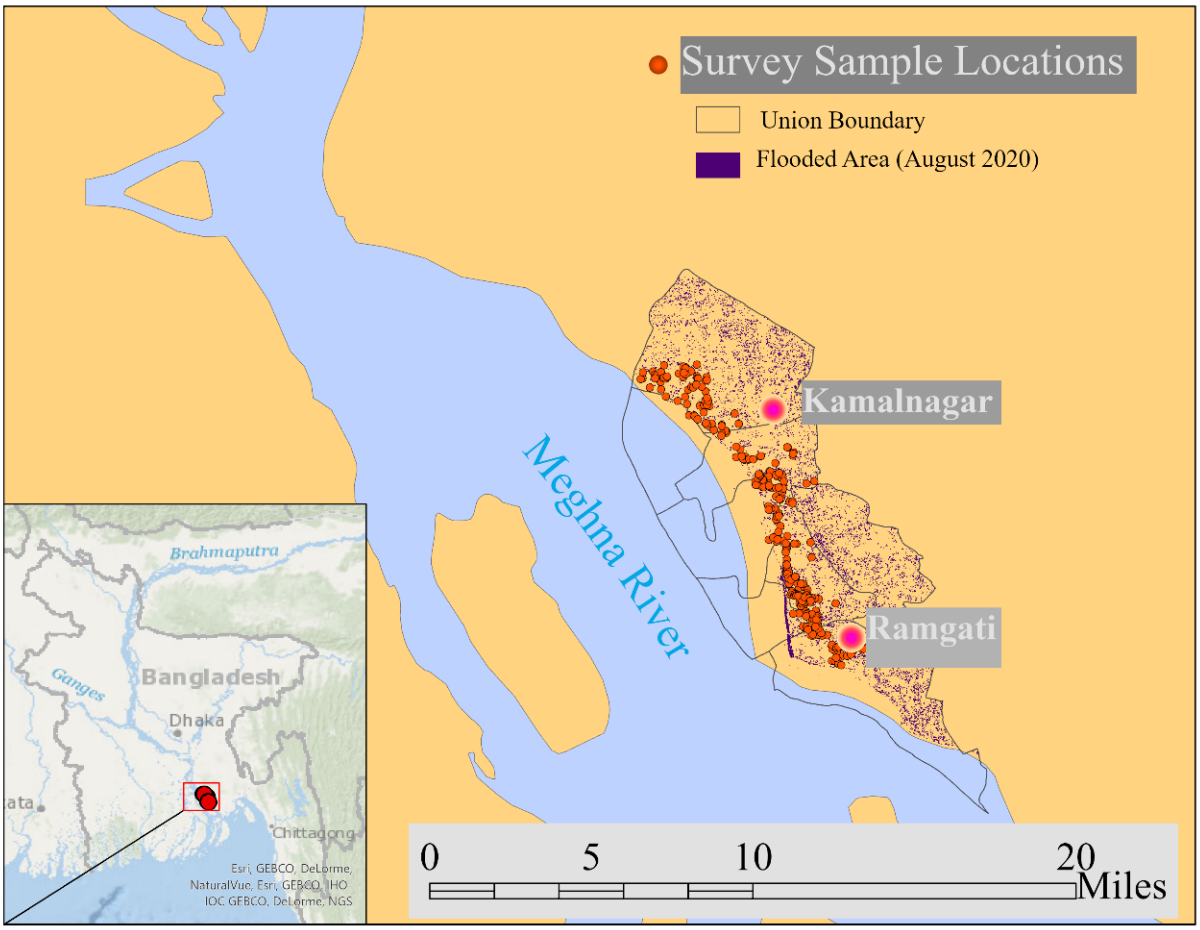

Figure 3. Study area.

4.2. Statistical Technique

To examine whether actual movement of households after the August 2020 flash flood in the study area are different from intended future moves, we used the Mann–Whitney U test. This nonparametric test is appropriate for three reasons: (1) options to move are restricted to five categories, (2) these categories are unequal (one group is four and another group is six), and (3) the comparison is between two groups/samples (one represents actual movement after the 2020 flash flood and another sample refers to intention to migrate). The following formula was used to perform the U test:

$$U1 = n1n2 + \{(n1 + 1)/2\} - R1 \quad (1)$$

$$U2 = n1n2 + \{(n2 + 1)/2\} - R2 \quad (2)$$

or

$$U2 = n1n2 - U1 \quad (3)$$

where U1 and U2 are the Mann–Whitney U test for Groups 1 and 2, respectively; n1 = sample size 1, n2 = sample size 2; and R1 and R2 are total ranks of the sample sizes 1 and 2. To accept or reject the null hypothesis, we have to use the smaller of U1 and U2.

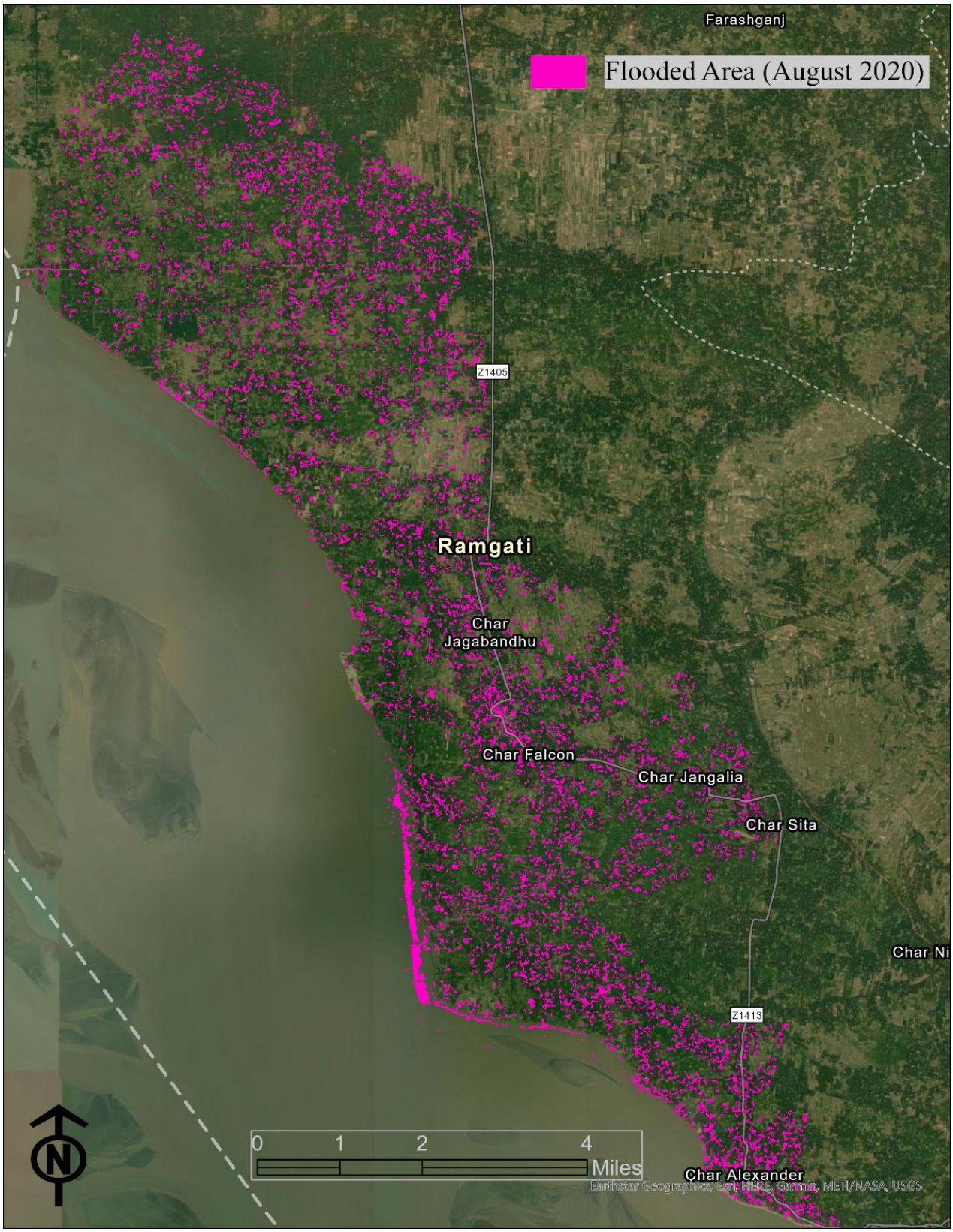

Figure 4. Flooded area during the August 2020 Event.

5. Results

Before presenting the major findings of this study, a profile of the respondents with respect to their socio-economic status is discussed first. Four indicators (primary occupation, agricultural land owned, annual household income, and educational level) duly reflect the socio-economic conditions of the respondents. Slightly more than two-thirds of the head of the households in the study area are employed in agricultural, fishery, or both sectors. Other primary occupations in descending order are service holders, small business owners, and laborers (Table 3). Similar to the situation with occupations, almost the same proportion of households has no agricultural land. They make a living either as tenant farmers or entirely in the fishing sector. More than two-thirds earned less than Tk. 100,000 (US $1200) per year (Table 3). They are considered to be poor. The study area has an illiteracy rate higher than the national average. Clearly, all these indicators reveal that socio-economically the study area is lower than the national average. (Table 3).

Table 3. Indicators of socio-economic status of the respondents.

Indicator	Number	Percentage
Primary Occupation (N = 293)		
Farmers	83	28.33
Fishing	83	28.33
Both Farmers and Fishers	23	7.85
Service Holders	40	13.65
Small Businesses	26	8.87
Laborers	18	6.14
Others, including Home Makers	20	6.83
Agricultural Land Owned (in decimal) (N = 310)		
Landless	190	61.29
Under 100	81	26.13
≥100	39	12.58
Annual Household Income (in Takas) (N = 310)		
<100,000	199	64.19
100,000–250,000	105	33.87
>250,000	6	1.94
Educational Level (Years of Schooling) (N = 310)		
Illiterate	80	25.81
1–5	214	69.35
>5	16	5.16

The survey data revealed that of the 310 respondent households, 16 or 5.16% of them in the study area moved after the August 2020 flash flood. Eleven of the 16 households moved or built houses within the same village to replace houses washed away due to flash flood-induced riverbank erosion. Four other households built houses within the same union but not in the same villages. They felt that their houses would be destroyed by similar hazards in the near future so they moved to other nearby villages. Lastly, one household with three members moved to another district. If we apply either of the two official migration definitions of the Bangladesh government, this household can be considered as migrant, which means the assessment yielded a migration rate of 0.32%. Ultimately, 294 of the 310 households opted to stay as non-migrants in their current villages (Table 4).

Further analysis reveals that one or two members of three households moved from their current village, two within the union, but not in the current village, for marriage reasons. Receiving a job, one person household moved to another village but not in current upazila. Finally, one member of the third household migrated abroad. That member decided to migrate before the flash floods, but due to COVID-19, he delayed his departure. However, because the study unit for this research is the household, an adaptation of the official definition, only a household can be considered as migrant.

Table 4. Actual and future movement by number of households in the study area (N = 310).

Non-Mover	Mover					Total
	Current village	In union but not on current village	Other village in current upazila outside current union	Other village but not in current upazila	Other district	
294 *	11	4	-	-	1	310
90 **	6	38	117	38	21	310

* Actual movement after the 2020 flash flood, ** Intention to move in near future.

When we asked the respondents about their intention to migrate from their current location in the future, only 21 (7%) households said they would likely leave to settle in other districts. This means, only very few number of households wanted to take advantage of the window of opportunity in the post-disaster situation. The remaining 289 households indicated they would stay in the Lakhmipur district (Table 4). Of those, six respondent households indicated they would move within the current village, and 38 or 12% respondents said they would likely move to another village within the union. Approximately 38% of the respondents said they would move to a village within the same upazila, but outside the current union, and another 12% said they would move to another upazila but remain in the same district. As noted earlier, to test the main hypothesis that there is no difference between actual migration due to flash flooding and the respondents' intentions for future migration from the study area, the U test was performed. Our calculations show the smaller U value is 7, much higher than the critical value of 2, and where n1 equals 4 and n2 equals 6. Therefore, we accept our null hypothesis, which implies that the actual and future moves of households do not differ statistically. This, in turn, implies that past migration determines future migration.

This finding of actual and intended migration is not unexpected for the left bank zone of the lower Meghna River. A study conducted immediately south of the present sites in Ramgati upazila, Lakhmipur district reported a similar finding Paul et al. (2020) [29]. That study examined riverbank erosion and its impact on migration based on the data from a structured questionnaire survey covering 407 randomly selected households from April–May, 2018. The study area comprised 15 villages in four unions (Char Alexander, Char Algi, Char Badam, and Char Ramiz) of Ramgati Upazila in the Lakshmipur district. It is also located along an approximately 20 km stretch of the eastern bank of the lower Meghna River in Bangladesh that has experienced significant erosion since 2008. But none of those households migrated outside the Lakshmipur district.

A similar finding was also reported by Rahman et al. (2015) [67] who conducted an empirical study in Kutubdia Island after it experienced a flash flood in August 2012. That island is located in the eastern coastal zone of Bangladesh and bounded by the Bay of Bengal on the north, west, and south and the Kutubdia channel on the east. With an average width of about two miles (3.2 km), the channel separates the island from the mainland. The flood was caused by tidal waves, storms, and continuously heavy rainfall for two days. The study found that no survivors of flash flood moved to other districts. Most residents whose houses were lost by the sea, destroyed, or damaged by the event were relocated to the inland of the island [67]. The study did not collect information about future migration intensions.

Empirical studies (e.g., Mortreux and Barnett 2009; Bradsley and Hugo 2010; Kelman et al. 2019; Berlemann and Tran 2020 and 2021) [6,70–73] conducted in other tropical countries found no effect of disasters on migration flows from the coast to inland areas. They explained this in terms of both short- and long-term in situ adaptations that reduce their exposure and vulnerability to the problems. As such, they are unlikely to opt for migration as their first and preferred strategy.

Although we did not ask any questions in the household survey about reasons for migration after the 2020 flash flood and intention to migrate in the near future, conversations with the adult members of sampled households and local people gave us some idea why these residents do not want to migrate. First, they have experienced weather and climatic disasters since their childhood and are mostly used to coping with them because of local strong social and community bonds also see [29,42]. The robust social networks in the area are not only expressed in terms of enormous support received by most survivors of flash flood, but also specifically in terms of wealthy people and members of the same kinship helping build houses for those who were displaced by riverbank erosion. As indicated, 16 households were displaced from their ancestral homes due to the flash flood event in 2020. Of them, five households built their homes temporarily on the lands of their relatives and a neighbor with rent free for up to five years. The remaining 11 households rebuilt their houses and local people helped them with free labor and building materials.

Residents of the study area were heavily dependent on abundant natural resources, which is another reason behind non-migration. They desire to live close to the Meghna River because the river provides many employment opportunities, and the people of the study area widely consider the river an important natural resource. Another important reason to stay nearby is the hope that land may accrete along the river so that locals can reclaim it. This hope has also been reported by people who were displaced from inland char (riverine bar and small island) areas and along the inland riverbank e.g., [25,74,75]. The study results clearly show that residents of all socio-economic conditions are reluctant to migrate from the study area. Even landless displaced people did not leave the area in search of alternative employment opportunities. People who own land believe that if they migrate to other areas, they will have nobody to guard their land, and subsequently decide not to migrate also see [49]. Yet another reason is the emotional bond between residents and the place they live in, which is termed 'place attachment' [29,49]. These factors tend to inhibit movement far away from the study area.

To enrich the study, we conduct a comparative analysis of socio-economic characteristics of household heads, specifically those who intend to move and those who do not. We label the former group movers and the latter non-movers. Also, the movers relocate from their main dwelling from current location, but often within or beyond their current village, union, upazila, or district (Tables 4 and 5). The survey data reveals that movers accounted for nearly 71% of the respondent households. The remaining 29% are non-movers or those who do not relocate (Table 5). Information presented in Table 5 clearly shows that the majority of movers are landless and their annual income, therefore, make up the lowest income category (less than Tk. 100,000). But they are more literate than their counterpart non-movers. In contrast, more than three-fourths of the non-movers are employed in farming and/or fishing. It should also be noted that all movers are not migrants. In fact, according to the definitions supplied by the government of Bangladesh, a little over 90% of the movers are not migrants.

Table 5. Socio-economic status by movers vs. non-movers.

Socio-Economic Status	No. of Mover (%)	No. of Non-Mover (%)	Total (%)
Primary Occupation			
Farming, Fishing, and Both *	121 (59.61)	68 (75.56)	189 (64.51)
Service Holders	35 (17.24)	5 (5.56)	40 (13.65)
Small Businesses	21 (10.34)	5 (5.56)	26 (8.87)
Laborers	10 (4.93)	8 (8.88)	18 (6.14)
Others	16 (7.88)	4 (4.44)	20 (6.83)
Total	203 (100.00)	90 (100.00)	293 (100.00)

Table 5. *Cont.*

Socio-Economic Status	No. of Mover (%)	No. of Non-Mover (%)	Total (%)
Agricultural Land Owned			
Landless	140 (63.64)	50 (55.56)	190 (61.29)
Under 100 decimal	59 (26.81)	22 (24.44)	81 (26.13)
≤100 decimal	21 (9.55)	18 (20.00)	39 (12.58)
Total	220 (100.00)	90 (100.00)	310 (100.00)
Annual Household Income			
<100,000 Tk.	158 (71.82)	41 (45.56)	199 (64.19)
100,000–250,000 Tk.	56 (25.45)	49 (54.44)	105 (33.87)
>250,000 Tk.	6 (2.73)	-	6 (1.94)
Total	220 (100.00)	90 (100.00)	310 (100.00)
Educational Level			
Illiterate	48 (21.82)	32 (35.56)	80 (25.81)
1–5 Years of Schooling	158 (71.82)	56 (62.22)	214 (69.03)
>5 Years of Schooling	14 (6.36)	2 (2.22)	16 (5.16)
Total	220 (100.00)	90 (100.00)	310 (100.00)

* These occupations combined because they are based extraction of natural resources.

6. Discussion

Like this study, a substantial number of studies e.g., [19,28,30,49,76] claim that the percentage of out-migration households from coastal Bangladesh to interior is negligible. For example, in a study of five villages located in the southwestern coastal region of Bangladesh, Mallick [49] found that less than 1% of the 4740 people had migrated from the sampled villages during the previous five years. He further noted that those who did migrated primarily because they were involved in local political conflicts and were troubled by legal actions. Therefore, they were forced to flee their place of origin to evade political leaders and law enforcement authorities, not because of the impacts of anticipated climate change. Findings by Mallick (2019), [49] also indicated that only five persons would like to migrate in the near future.

Thus, despite vulnerable locale and challenging circumstances, residents of the study area did not relocate to distant places. One can argue that a household migration decision would be weaker for a single event than for cumulative impacts of multiple events over the years. But this study clearly shows that those canvassed do not intend to migrate to other districts, even after the study area experienced three events (August 2020 flash flood, 2020 flood, and July 2021 flash flood) in a year and the residents of the area constantly face threats from different types of weather and climate-related hazards and disasters. Also, people of the study area indicate that they prefer to live close to their relatives, friends, neighbors, and other people they know and trust see [25,77]. Along with place attachment, these social networks encourage people to work together and promote commitment and loyalty to the community. Ultimately, social protection further strengthens their unwillingness to migrate.

This study of migration and non-migration points to an important finding that has not been reported so far. Movement within the vicinity of the study area and intention to migrate to distant locations in the future tend to involve all members of the concerned households. This differs from the usual view that households encourage one or more members to move to improve overall family economic conditions [23,47,78]. Such theories suggest that one or more members may migrate temporarily, seasonally, or permanently to benefit the household members who remain in place through the sending of remittances and/or help in diversifying income [50,79]. Such migration also guarantees at least some income flow to such households in difficult times. Yet this finding has not been verified in the study area.

This study also found no statistical difference between migrations one year after the 2020 flash flooding and intention to migrate from the study area in the future. This means

that past migration patterns also dictate future migration. In other words, past migration is a strong indicator of future migration in the climate vulnerable study area.

Given the widespread unwillingness of most coastal residents to migrate from the place of origin, the Bangladesh government takes this opportunity to further improve disaster vulnerable places because Bangladesh is already a very densely populated country. Therefore, the government promotes and implements sustainable development programs, including measures to prevent riverbank erosion, flash flooding, and other natural hazards in the study area. Informal conversation with the respondents clearly indicates that construction of the embankment along the east bank of the Meghna River is the most effective way to prevent riverbank erosion and flash flooding in this area. In fact, the Executive Committee of National Economic Council (ECNEC) of the Bangladesh government approved a plan in June 2021 to construct a 20 miles (31 km) long embankment in the study area for which the prime minister of Bangladesh has already allocated US $3.6 billion. Along with construction of an embankment, the government plans to dredge the river to prevent or reduce erosion, implement measures to sustain the integrity of the future embankment, and direct the river current downstream to prevent formation of char lands in the river.

Additionally, government programs should encourage adaptations by removing barriers to such actions, creating alternative livelihoods and more new jobs, increasing in situ household adaptations and resilience, and protecting coastal infrastructure. Many believe that disaster survivors should receive emergency assistance from local and national governments with some arguing that at least they should be given public loans at low interest rates and other buffers (e.g., crop insurance) for recovery from the impacts of extreme natural events.

7. Conclusions

Like most migration studies about the coastal area of Bangladesh, this empirical research also found that only a tiny proportion of people left or intend to leave either permanently or temporarily, which challenges current narratives about climate change-induced migration from coastal Bangladesh. It is worth noting that as a case study, our findings are not representative of all coastal areas in Bangladesh. They may not even apply to the whole central coastal zone.

A key study finding of our study is that the overwhelming majority of residents of the study area stay put as non-migrants despite constant potential, and actual, threat of SLR and other climatic events. Ultimately, this study provides evidence of non-migration, which is a new and thriving area of investigation concerning coastal Bangladesh. One shortcoming of this study, however, is that no time dimension was set to discover respondents' intentions for future migration for instance after 10 years or 20 years. Also, this research represents a case study and is therefore not representative of all coastal areas of Bangladesh. Clearly, future work should continue to focus on other coastal Bangladesh and environmentally challenged areas within the country to provide continuing evidence of a strong consistency between past and future migration as was the finding of this study.

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