



## Farmers' Perception of Climate Change and Adaptation Strategies in Dasmina Upazila, Patuakhali, Bangladesh

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### ABSTRACT

This study examines the perceptions of climate change among farmers and their adaptation strategies in Dasmina Upazila, Patuakhali, a coastal region of Bangladesh susceptible to environmental changes. The research employed a mixed-methods approach, utilizing both closed-ended and open-ended structured questionnaires to collect data from 300 coastal farmers between March and July 2024. Descriptive statistical analysis was conducted using SPSS software to interpret the findings. Results indicated that 95% of respondents exhibited a high level of awareness regarding climate change and its impacts on their lives and livelihoods. Farmers consistently reported observable changes over the past 22 years, including increased temperature, droughts, floods, cyclones, salinity levels, and decreased rainfall. The climate change risk perception index identified temperature as the highest perceived risk, while flooding ranked lowest. Additionally, the climate vulnerability index indicated substantial vulnerability in the study area, with a score of 0.482. Regarding adaptation strategies, the majority of farmers (82.50%) implemented medium-level adaptation measures, while 11.25% adopted high-level strategies and 6.25% employed low-level approaches, with an overall adaptation score of 39.43%. Among adaptation methods, changing crop varieties emerged as the most widely adopted strategy, whereas zero tillage was the least utilized. The problem-facing index identified pest incidence as the primary challenge hindering adaptation efforts, while prolonged crop harvesting ranked as the least significant obstacle. The findings highlight the necessity for targeted interventions and policy support to enhance the resilience of coastal farming communities in Bangladesh.

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## 1. Introduction

Bangladesh is recognized as one of the most climatic vulnerable countries globally, primarily due to its geophysical location in low lying delta with significant dependence on climate sensitive agriculture based economic activities and livelihoods, and the occurrences of high incidences of climate related disasters (Yonus and Harvey 2014; Hoque et al. 2019; Ahmed et al. 2021; Iqbal et al. 2025). With a population density higher than 936 people per km<sup>2</sup> and more than 31% of its inhabitants living below the poverty threshold made the region substantial pressure on its natural resources and livelihoods. Consequently, it is increasingly susceptible to climate related risks (GoB 2011; World Bank 2013).

Agriculture plays a major role in Bangladesh's economy, contributing significantly to food security, employment, and rural livelihoods, where a large proportion of the population directly depends on climate sensitive farming systems. Therefore, any alteration in climatic conditions has direct and profound consequences on agricultural

productivity and farmers' socioeconomic conditions. These climatic stressors have severe implications for agriculture, including reduced crop yields, soil fertility degradation, shifts in cropping patterns, increased pest and disease outbreaks, and loss of arable land due to salinity intrusion and waterlogging. The effects of climate change are acutely experienced, particularly in the heavily populated coastal areas where a large segment of the poor population lives. Extreme weather events, including floods, droughts, cyclonic storm surges, riverbank erosion, salinity intrusion, and waterlogging, are prevalent, resulting in significant loss of life, damage to infrastructure and economic assets, and severely compromising food, water, health, and energy security (Choudhury et al. 2005; Huq and Ayers 2008; Pouliotte et al. 2009; Thomas et al. 2013; Jordan 2015; Alam 2016; Alam et al. 2017).

Dasmina Upazila, located in the south-central coastal region of Bangladesh, is highly exposed to climate change induced hazards such as cyclones, storm surges, tidal flooding, and salinity intrusion. The area frequently experiences agricultural disruption due to saline water

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encroachment, erratic rainfall, and extreme weather events, which significantly affect crop production and farmers' livelihoods. In this fragile situation, the south-central coastal area of Patuakhali faces serious dangers experiencing floods, cyclones, storm surges, river erosion, and saline intrusion almost annually (Biswas et al. 2015; Iva et al. 2017).

The Bauphal and Dasmina Upazillas under Patuakhali district is very vulnerable where all parts and people are at a higher risk of disasters (Biswas et al. 2015; Iva et al. 2017; Biswas et al. 2016; Mukherjee et al. 2020). Agricultural productivity in riverine char land is remarkably affected by climate related shocks, manifesting as soil degradation and increased pest and disease infestations (Ahmed et al. 2021). Consequently, adaptation emerges as a critical and practical means for farmers to mitigate these adverse effects and safeguard their livelihoods (Füssel and Klein 2006). Adaptation to climate change, as defined by the IPCC (2007), involves adjustment in human or natural systems in response to actual or expected climatic stimuli or their effects to moderate harm or exploit beneficial opportunities.

While farm level adaptation is often autonomous, driven by farmers themselves, it frequently requires institutional support and is influenced by a complex interplay of factors (Semenza et al. 2008; Simane et al. 2016). Common strategies employed by smallholder farmers globally include adopting improved crop varieties, agroforestry, soil conservation, irrigation techniques, and adjusting planting dates (Deressa et al. 2009; Mideksa 2010). However, adaptation decisions are inherently location specific and shaped by socioeconomic, institutional, and environmental contexts.

At the farm level, the adaptation process is fundamentally comprised of two critical steps: the perception of climatic changes and the selection of an appropriate adaptation strategy (Asrat and Simone 2017a; Deressa et al. 2009). However, mere perception does not ensure adaptation. Farmers who acknowledge climate change may not necessarily adapt, or they may adopt varied strategies due to barriers associated with institutional, social, economic, and environmental factors (Mertz et al. 2008; Maharjan et al. 2011).

Despite the high vulnerability of coastal Bangladesh, particularly areas like Dasmina Upazila, existing studies have largely focused on broader regional assessments, with limited location specific empirical research addressing how climate change directly influences agricultural practices and farmers' adaptation behavior at the local level. It is therefore imperative to comprehend the factors influencing smallholder farmers' perceptions of climate change and their subsequent adaptation responses within specific geographical contexts.

Such understanding facilitates the formulation of targeted policy interventions that are attuned to local sensitivity, vulnerability, and the feasibility of available adaptation strategies (Asrat and Simane 2017b; Simane et al. 2016). Despite the acknowledged vulnerability of Bangladesh's coastal zones, significant knowledge gaps remain. There is a conspicuous lack of exploratory research aimed at identifying the most suitable adaptation strategies for saline prone coastal areas such as Dasmina Upazila and understanding how farmers specifically modify their

agricultural practices in response to extreme climate variability and events. Moreover, comprehensive scientific studies examining farmer perceptions of climate change and the socioeconomic factors influencing their adaptation decisions in Bangladesh are scarce (Rahman et al. 2018).

Therefore, Dasmina Upazila has been specifically selected as the study area due to its high exposure to climate induced risks, agricultural sensitivity to salinity and extreme events, and limited availability of localized empirical studies. This study directly addresses these critical gaps by pursuing three primary objectives: i) to assess the impact of climate change on agriculture in the coastal zone of Bangladesh, specifically Dasmina Upazila; ii) to determine the extent of adaptation measures implemented by farmers in the area; and iii) to identify the key socioeconomic factors influencing farmers' adaptation decisions.

## 2. Materials and Methods

### 2.1. Study area

The Dasmina upazila of Patuakhali district is among the most disaster prone areas in Bangladesh, with communities exposed to persistently high climatic risks while agricultural productivity in the surrounding riverine char lands is severely constrained by climate induced shocks, leading to soil degradation and heightened pest and disease outbreaks (Mukherjee et al. 2020; Ahmed et al. 2021). The seven unions of Dasmina upazila under Patuakhali district that comprised the study area were Rangopaldi, Alipur, Betagi Shankipur, Dashmina Sadar, Bahrapur, Bashbaria, and Char Bohranuddin. The Patuakhali district's Upazila unions were deliberately chosen (Figure 1). The chosen unions in this Patuakhali district's Upazila were situated in Bangladesh's southern coastline area.

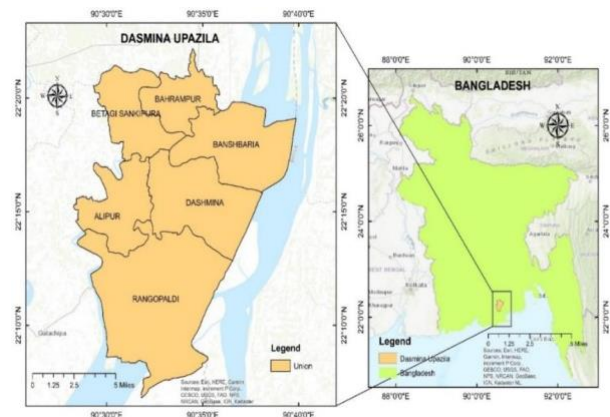


Figure 1. Map of the study area (Dasmina upazila of Patuakhali district)

### 2.2. Population and Sampling

The present study was conducted in the Patuakhali district of the southern coastal region of Bangladesh, specifically within seven unions of the Dasmina upazila (Table 1). This upazila comprises approximately 28,490 households and a population of 123,388, of which 67% are engaged in farming (BBS, 2015). Initially, 500 household heads were identified through a household census survey based on the criteria of being the head of the family and having an agricultural connection. Subsequently, 300 farmers were randomly selected from these 500 households, adhering

to the criteria of possessing more than 15 years of farming experience, being actively engaged in agriculture, and having agriculture as their primary occupation. This selection process was facilitated by a background survey and the guidance of local experts. The research utilized primary data sources, and data collection was executed using a simple random sampling technique.

**Table 1.** Name of the unions of the study area with sample size

Name of the Upazila	Name of the Union	Sample Size
Dasmina	Rangopaldi	43
	Alipur	43
	Betagi Shankipur	43
	Dashmina Sadar	43
	Bahrampur	43
	Bashbaria	43
	Char	42
	Bohranuddin	

### 2.3. Data Collection and Processing

Data were collected through face-to-face interviews conducted from March to July 2024. The investigator initially established a rapport with the participants and clarified the objectives of the study. Consequently, respondents provided accurate responses to the statements and questions without hesitation. The Sub Assistant Agricultural Officer (SAAO) assisted the researcher in each union. The residents and respondents in the research area demonstrated excellent cooperation, and no significant issues arose during the data collection process. The collected data were accurately labeled and transferred from the interview schedule to a master sheet to facilitate tabulation. Where necessary, qualitative data were converted into quantitative representations for appropriate scoring. The researcher's predefined categories served as the basis for tabulation and cross-tabulation. Data on temperature and precipitation were obtained from the Bangladesh Meteorological Department for the observation station nearest to the study area (BMD 2023).

### 2.4. Climate Change Risk Perception Index

In this study, we developed the Climate Change Risk Perception Index (CCRPI) to assess farmers' perceptions of climate change risk concerning eight specific climatic events, based on their personal experiences. Data on respondents' perceptions were collected using a four-point Likert scale, with the scale ranging from "no perception" to "high perception," and including intermediate levels of "low perception" and "medium perception." For analytical purposes, we assigned ascending values to the perception scale: 0 for no perception, 1 for low perception, 2 for medium perception, and 3 for high perception. The cumulative perception score of respondents was subsequently calculated. To further explore respondents' perceptions of the eight selected climatic events, participants were asked to evaluate their opinions on eight related statements. The Climate Change Risk Perception Score (CCRPS) was computed using the following equation (1) (Ahmed et al. 2021):

$$\text{Climate Change Risk Perception Score (CCRPS)} = \text{CCRPN} \times 0 + \text{CCRPI} \times 1 + \text{CCRPm} \times 2 + \text{CCRPh} \times 3 \dots \dots \dots (1)$$

Where: CCRPN = the number of respondents with no perception, CCRPI = the number of respondents with low perception, CCRPm = the number of respondents with medium perception, CCRPh = the number of respondents with high perception of risk. Based on the responses of 300 participants, the CCRPS for a particular climatic event can range from 0 to 900, with 0 indicating the minimum level of risk perception and 900 representing the maximum level. For a more comprehensive analysis, the CCRPS was transformed into a standardized index using the following formula (Ahmed et al. 2021):

$$\text{Standardized Climate Change Risk Perception Index (SCCRPI)} = (\text{Total CCRPS Value}) / (\text{Respective Highest CCRPS Value}) \times 100 \dots \dots \dots (2)$$

The Respective Highest CCRPS Value was determined by dividing the total CCRPS value by the highest maximum boundary value and multiplying the result by 100. The Total CCRPS Value was calculated by multiplying the respective perception values with the total perception frequency for each climatic event. According to Akanda (2015) the SCCRPI provides a framework for categorizing and understanding perceptions of climate change risk. The SCCRPI value ranges from 0 to 100, where 0 signifies the lowest perceived risk of climate change and 100 indicates the highest perceived risk among the community's residents.

### 2.5. The Climate Vulnerability Index

Vulnerability is defined as the susceptibility to individual or collective stressors induced by climate change (Frank et al. 2011). According to the Intergovernmental Panel on Climate Change (2007) vulnerability is determined by three factors: exposure, sensitivity, and adaptive capacity. This study establishes a relationship between farmers' perceptions of vulnerability and the risks associated with climate change using the IPCC Climate Vulnerability Index (IPCC-CVI). The IPCC Climate Vulnerability Index (IPCC-CVI) was developed using the index values for exposure, sensitivity, and adaptive capacity (Eq. 3) (Ahmed et al. 2021).

$$\text{IPCC-CVI} = (\text{Exposure Index} - \text{Adaptive Capacity Index}) \times \text{Sensitivity Index} \dots \dots \dots (3)$$

The IPCC-CVI ranges from -1 to +1, where -1 indicates low vulnerability (adaptive capacity exceeds exposure), 0 denotes moderate vulnerability, and +1 represents extreme vulnerability (exposure exceeds adaptive capacity). In this study, the extent of agricultural adaptation to climate change was used as the dependent variable and measured using an Adaptation Strategies Index (ASI). Farmers' adaptation was assessed across ten prefixed determinants using a four-point scale from "high" to "not at all." Based on farmers' perceptions, the ASI was applied to rank key adaptation strategies, with their relative importance determined using Equation (4) (Ahmed et al. 2021).

$$\text{Adaptation Strategies Index} = \text{ASn} \times 0 + \text{ASI} \times 1 + \text{ASm} \times 2 + \text{ASh} \times 3 \dots \dots \dots (4)$$

Where;

ASI = adaptation strategy index; ASn = number of farmers who reported no agricultural adaptation to climate change; ASI = number of farmers who reported low agricultural adaptation to climate change; ASm = number of farmers who reported medium agricultural adaptation to climate change; ASh = number of farmers who reported high agricultural adaptation to climate change.

### 3. Results and Discussion

#### 3.1. Characteristics of the Respondents

Table 2 summarizes the economic, environmental, and personal characteristics of the respondents. Most farmers were older than 40 years (41–50 years: 27.2%; >50 years: 43.9%), while younger age groups were less represented (<30 years: 3.0%; 30–40 years: 25.6%). The sample was overwhelmingly male (96.3%) and married (94.7%). Farming experience was substantial, with more than two-thirds of respondents reporting over 20 years of experience (20–30 years: 34.9%; >30 years: 35.2%). The findings indicate that farmers possessed adequate awareness of the effects of weather and climate variability on agricultural decision-making and productivity. Consistent with earlier evidence, experienced farmers tend to respond more effectively to climate-related stresses, including changes in temperature and rainfall, as well as hazards such as floods, cyclones, droughts, and salinity intrusion (Uddin, 2012).

Farming constituted the primary source of household income (76.4%), while non-farm activities accounted for 23.6%. Similar patterns in household income among farmers were observed in studies by Arifullah et al. (2014) and Haq (2016).

The educational attainment among respondents was predominantly low, with approximately one-third being illiterate (31.9%). Primary and secondary education levels were represented in similar proportions (27.9% and 28.9%, respectively), while a smaller percentage had completed higher secondary education (8.3%) or achieved tertiary qualifications, including graduation (2.3%) and post-graduation (0.3%). Khan (2015) reported a comparable literacy rate among the farmers he surveyed. However, other research found a significant proportion of respondents (73.5%) were illiterate, particularly in Bangladesh's newly acquired territory, known locally as "char land" (Rahman and Devis, 2005). Irrigation practices were largely reliant on canal water (51.5%) and rainfall (32.2%), whereas dependence on rivers (13.6%), deep tube wells (0.7%), or combined deep tube-well and rain-fed systems (1.7%) was minimal. Information regarding climate variability was predominantly sourced from media outlets (57.5%), followed by friends and relatives (26.2%) and village elders (14.3%), with only a small fraction relying on personal observation (1.7%).

#### 3.2. Farmers' Perceptions on climate change events

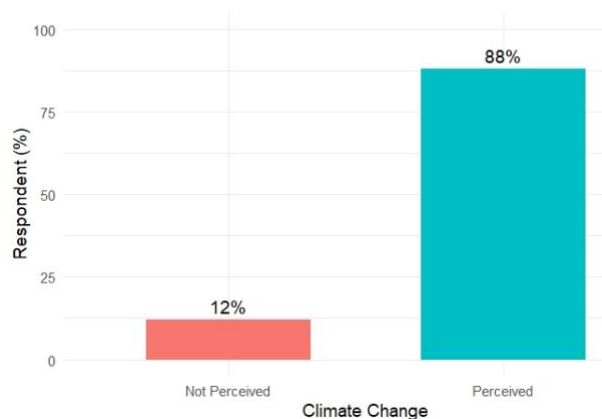
A binary ("yes/no" response) question was posed to the research participants to ascertain whether they have observed changes in the local climate over the past 30 years. Following their initial response, the farmers were further queried regarding their perceptions of various climatic phenomena that, according to the reviewed literature, are commonly associated with the impacts of global climate change in Dasmina Upazila, Bangladesh.

**Table 2.** Salient features of the characteristics of the farmers (N=300)

Characteristic	Categories	Respondents	
		N	%
Age	Young <30	9	3.0
	Middle 30-40	77	25.6
	41-50	82	27.2
	Old >50	132	43.9
Gender	Male (1)	290	96.3
	Female (2)	10	3.3
Marital Status	Married (1)	285	94.7
	Single (2)	15	5.0
Education	Illiterate	96	31.9
	Primary (1-5)	84	27.9
	Secondary (6 -10)	87	28.9
	Higher Secondary (11 - 12)	25	8.3
	Graduation	7	2.3
	Post-graduation	1	.3
Income source	Farm (1)	229	76.1
	Non-Farm (2)	71	23.6
Irrigation sources	Canal	155	51.5
	Deep tube well	2	.7
	Rain fed	97	32.2
	Both deep tube-well & Rain-fed	5	1.7
	River	41	13.6
Source of Information of climate	Media	173	57.5
	Village elders	43	14.3
	Own view	5	1.7
	Friends and relatives	79	26.2

Source: author's field survey

Respondents could indicate whether they had observed an increase, decrease, no change, or were unaware of the phenomenon. The responses to the initial question are depicted in Figure 2, revealing that 88% of respondents reported experiencing climate change events in the last 22 years. The farmers' responses to specific climatic events are presented in Table 3.

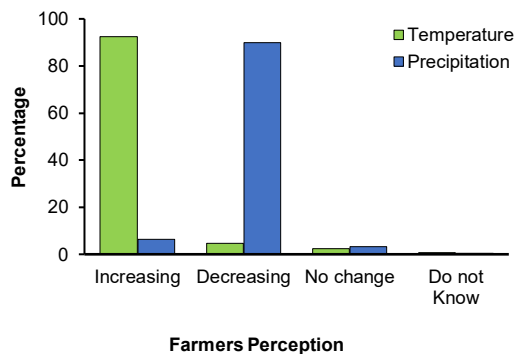


**Figure 2.** Percentage of participants based on their self-reported climate change experiences

**Table 3.** Percentage of the evolution of extreme weather events and climate factors (N = 300)

Climatic Events	% of respondents			
	Increasing	Decreasing	No change	Do not know
Temperature	92.3	4.7	2.3	7
Rainfall	6.3	90	3.3	0.3
Flood	74	20.7	5.0	0.3
Drought	88.7	7.3	3.3	0.7
Cyclone	91	4.7	4.0	0.3
Salinity	84.3	9.7	5.3	0.7
Crop pest/Diseases	92.7	2.3	4.0	1.0
Livestock pest/Diseases	91.7	3.3	5.0	0

All respondents reported experiencing cyclones, flooding, droughts, temperature increases, and soil salinity. A majority of respondents noted an increase in temperature (92.3%), drought (88.7%), cyclones (91%), salinity (84.3%), crop pests/diseases (92.7%), and livestock pests/diseases (91.7%). Additionally, 74% of respondents perceived an increase in flooding. However, regarding rainfall, 90% of respondents indicated a decrease, suggesting a reduction in its quantity over the years. A smaller percentage of respondents reported not observing any change or being unaware of such occurrences, with only 5% frequently responding "do not know." Some respondents may select "do not know" due to genuine uncertainty or lack of familiarity with the subject matter, which differs conceptually from inattentiveness but still signals limited engagement or information. The combination of rising temperatures and declining precipitation may exacerbate drought-induced water shortages, potentially impacting crop productivity. These findings may also indicate that Bangladesh's coastal regions are particularly vulnerable to the effects of climate change. A significant proportion of farmers believe that temperatures have increased while precipitation has decreased, as corroborated by research conducted by Uddin et al. (2017). Furthermore, increased temperature and reduced rainfall have been reported in studies conducted in Ethiopia, Nigeria and Chile over the same 20-year period (Legesse et al. 2013; Tambo and Abdoulaye 2012; Roco et al. 2014).



**Figure 3.** Farmer's Perceptions of the annual mean temperature and precipitation

Figure 3 illustrates the farmers' perceptions of changes in temperature and precipitation over time. The data indicate

that a significant majority of respondents, over 92.3%, have observed an increase in temperature, while 90% have reported a decrease in precipitation over the past 22 years. A small fraction of respondents, 0.7%, were unaware of the trends in temperature changes, and 0.3% were similarly uninformed about precipitation trends during this period.

### 3.3. Climate Change Risk Perception Index (SCCRPI)

The assessment of climate change risk perception is a complex process influenced by demographic, social, cultural, and economic factors (Cutter et al. 2012). Sjoberg (2000) consider that risk perception is a mental construct. Farmers' perceptions of climate change risks are unique in that they allow for a distinction between actual hazards, such as climate change, and their intuitive assessments of these threats (Cutter 1996; Rosa 2003). Several researchers have utilized Likert scales to measure individuals' perceptions of climate change risk based on personal experiences (Akanda and Howlader 2015; Alam et al. 2016; Sarker et al. 2020). Likert scales are frequently employed in behavioral research to develop relative perception scales. In our study, we employed a similar Likert scale to measure farmers' perceptions of climate change risk. The objectives of the CCRPS and SCCRPI were to enhance understanding of how char dwellers perceive climate change hazards. Using Eq. (1), we calculated the CCRPS for eight climatic events, with values ranging from 0 to 866. Upon examining the CCRPS value range, we cannot definitively determine whether farmers are generally sensitive to climate change risk; however, we conclude that farmers exhibit medium to high sensitivity to most climate events (values 852 to 858) and low to medium sensitivity to the remaining four events (values 805 to 833). Conversely, the SCCRPI indicates significant variation in values, ranging from 89.44 to 96.22, suggesting that farmers' perception categories are nearly uniform. Numerous studies have demonstrated that farmers are highly susceptible to environmental risks and uncertainties (Lahiri-Dutt and Samanta 2007; Roy et al. 2015). Due to their high susceptibility to environmental hazards, they are frequently affected by multiple climatic events, specifically the eight climatic events we have examined. Table 3 presents farmers' perceptions of the risk posed by climate change for eight predefined climatic events, along with their index values and scores.

Following the determination of each climatic event's corresponding score and index value, we assigned grades ranging from 1 to 8 to facilitate comprehension and interpretation. According to the SCCRPI, the primary climate hazards perceived by farmers include extreme temperatures, livestock illnesses, crop diseases, and cyclones during both summer and winter seasons. Similar findings have been reported by other researchers (Lahiri-Dutt and Samanta 2007; Alam et al. 2016; Sarker et al. 2020).

### 3.4. Climate Vulnerability Index (IPCC-CVI)

Farmers' perceptions of vulnerability significantly influence the three dimensions of vulnerability exposure, sensitivity, and adaptive capacity and play a crucial role in shaping perceptions of climate change risk. The IPCC Climate Vulnerability Index (IPCC-CVI) study (Eq. (3)) has been employed to evaluate farmers' susceptibility to various climatic events and to ascertain whether a

correlation exists between their perceptions of climatic risk and their inherent vulnerability. The various aspects of vulnerability are presented in Table 4. According to the IPCC-CVI index value of 0.482 (Table 4), farmers are moderately to severely vulnerable. Ahmed et al. (2021) found that moderate to high vulnerability with IPCC-CVI value of 0.153 in the riverine char dwellers. The positive index value of 0.482 suggests that residents of study area experience vulnerability to climatic events and hazards

that exceeds their adaptive capacity to mitigate adverse environmental impacts. Bangladesh char communities typically show moderate vulnerability levels influenced by drivers such as limited access to food, health services, employment, and social networks alongside their physical exposure to environmental stresses like riverbank erosion and flooding (Al Mamun et al., 2022; Azam et al., 2019; Sarker et al., 2019).

**Table 3.** Farmers' perceptions of the risks associated with climate change in the study region

Climatic events	HP	MP	LP	NP	CCRPS	SCCRPI	Rank
Extreme Temperature	277	14	7	2	866	96.22	1 <sup>st</sup>
Livestock diseases	275	10	15	0	860	95.56	2 <sup>nd</sup>
Crop diseases	278	7	12	3	860	95.55	3 <sup>rd</sup>
Cyclone	273	14	12	1	859	95.44	4 <sup>th</sup>
Rainfall	270	19	10	1	858	95.33	5 <sup>th</sup>
Drought	266	22	10	2	852	94.67	6 <sup>th</sup>
Salinity	253	29	16	2	833	92.55	7 <sup>th</sup>
Flood	222	62	15	1	805	89.44	8 <sup>th</sup>

HP=High Perception, MP=Medium Perception, LP=Low Perception, NP=No Perce

**Table 4.** Climate vulnerability index of coastal farmers in study area

Vulnerability factors	Index Value
Exposure (Natural disaster and climate variability)	0.918
Sensitivity (Climate-related stimuli)	0.964
Adaptive capacity (Socio-economic characteristics)	0.418
IPCC-CVI	0.482

**Table 5.** Rank Order of the Major Adaptation Strategies Adopted by the Farm

Adaptation Strategies	High (3)	Medium (2)	Low (1)	Not at all (0)	ASI	Rank
Changed Crop Varieties	247 (82.1%)	37 (12.3%)	15 (5%)	1 (.3)	830	1 <sup>st</sup>
Used more organic fertilizers and pesticides	225 (74.8%)	52 (17.3%)	20 (6.6%)	3 (1%)	799	2 <sup>nd</sup>
Diversified crops	207 (68.8%)	53 (17.6%)	27 (9%)	13 (4.3%)	754	3 <sup>rd</sup>
Use of salinity tolerant varieties	158 (52.5%)	82 (27.2%)	47 (15.6%)	13 (4.3%)	685	4 <sup>th</sup>
Improved irrigation practices	19 (6.3%)	93 (30.9%)	145 (48.2%)	43 (14.3%)	678	5 <sup>th</sup>
Adopted other soil conservation practices	141 (46.8%)	100 (33.2%)	41 (13.6%)	18 (6%)	664	6 <sup>th</sup>
Changed planting and harvesting dates	155 (51.5%)	67 (22.3%)	54 (17.9%)	24 (8%)	653	7 <sup>th</sup>
Integrated farming system	90 (29.9%)	112 (37.2%)	75 (24.9%)	23 (7.6%)	569	8 <sup>th</sup>
Practicing intercropping	87 (28.9%)	122 (40.5%)	65 (21.6%)	26 (8.6%)	570	9 <sup>th</sup>
Zero Tillage	12 (4%)	28 (9.3%)	137 (45.5%)	123 (40.9%)	229	10 <sup>th</sup>

Source: author field survey 2024

### 3.5. Adaptation Strategies Index (ASI) Based on Farmer's Perception

The adverse effects of climate change such as droughts, floods and riverbank erosion have considerably reduced agricultural productivity. In this study, the farmers have employed multiple strategies to secure their livelihoods, a process referred to as livelihood resilience. The Adaptation Strategy Index (ASI) is employed to ascertain the ranking of adaptation strategies essential for farmers to sustain their agricultural activities. The findings indicate that among the ten adaptation strategies, "changed crop varieties" (830) is ranked first, signifying its popularity among farmers, as presented in Table 5. Key adaptation strategies include the adoption of new crop varieties in agricultural practices, adjustments in planting schedules, alterations in the size of cultivated land, the cultivation of short-duration varieties, and the implementation of crop rotation (Yadav et al., 2020; Shew et al., 2019).

The second-ranked adaptive strategy is "used more organic fertilizers and pesticides" (799), which aids farmers in maintaining soil fertility, reducing the cost of expensive fertilizers, and enhancing crop productivity. Uddin et al. (2017) assert that the use of organic fertilizers and pesticides constitutes a more efficient adaptation strategy. "Diversified crops" (754) is ranked third and is favored by farmers because it minimizes the risk of crop failure and increases crop yield, thereby expanding opportunities for farm expansion. Approximately 57.9% of Indian farmers (Loria and Bhardwaj 2016) and 61% of Kenyan farmers (Judith et al. 2017) consider crop diversification at the farm level a viable adaptation option to address climate change. Other researchers have identified similar adaptation measures (Tripathi and Mishra 2017; Mamun et al. 2021; Alam et al. 2017a; Ahmed et al. 2021; Kabir et al. 2021). Overall, while certain approaches are highly effective, there remains potential for improvement and a possible need for more innovative, context-specific strategies to enhance farmers' capacity to adapt to climate change on their farms

### 4. Conclusions

This study investigates farmers' perceptions of the effects of climate change on coastal agriculture. The findings indicate that a majority (95%) of farmers in the study area have perceived changes in climatic conditions, while only 5% have not. Nearly all farmers reported increases in temperature, droughts, floods, cyclones, and salinity levels, alongside a decrease in rainfall over the past two decades. The rising temperatures, coupled with declining precipitation, may intensify water scarcity thereby affecting crop production. The Climate Vulnerability Index (IPCC-CVI) was calculated to assess the level of vulnerability among farmers in Dasmina Upazila, revealing that they are highly susceptible to climate change. Various adaptation strategies have been employed by farmers in response to the altered farming conditions resulting from environmental degradation associated with climate change. Adaptation Strategy Index (ASI), showing farmers applied favourite strategies were changes in crop varieties identified as the most significant farm adaptation strategy, while zero tillage was observed the least important. The study recommends implementing training, warning systems, and credit facilities to enhance farmers' climate resilience.

### References

- Ahmed Z, Guha GS, Shew AM, Alam GM. 2021. Climate change risk perceptions and agricultural adaptation strategies in vulnerable riverine char islands of Bangladesh. *Land use policy*, 103, 105295. <https://doi.org/10.1016/j.landusepol.2021.105295>
- Akanda MGR, Howlader MS 2015: Coastal Farmers' Perception of Climate Change Effects on Agriculture at Galachipa Upazila under Patuakhali District of Bangladesh. *Global Journals of Science Frontier Research: Agriculture and Veterinary*, 15(4), 31-39.
- Al Mamun A, Islam ARMT, Alam GMM, Sarker MNI, Erdiaw-Kwasie MO, Bhandari H, Mallick J. 2022. Livelihood vulnerability of char land communities to climate change and natural hazards in Bangladesh: an application of livelihood vulnerability index. *Natural Hazards*, 115(2), 1411–1437. <https://doi.org/10.1007/s11069-022-05599-y>
- Alam GM, Alam K, Mushtaq S 2017. Climate change perceptions and local adaptation strategies of hazard-prone rural households in Bangladesh. *Climate risk management*, 17, 52-63. <https://doi.org/10.1016/j.crm.2017.06.006>
- Alam GM, Alam K, Mushtaq S, Clarke ML. 2016. Vulnerability to climatic change in riparian char and river-bank households in Bangladesh: Implication for policy, livelihoods and social development. *Ecological Indicators*, 72, 23-32. <https://doi.org/10.1016/j.ecolind.2016.06.045>
- Alam GMM, 2016. An assessment of the livelihood vulnerability of the riverbank erosion hazard and its impact on food security for rural households in Bangladesh. PhD thesis, School of Commerce, University of Southern Queensland, Australia.
- Arifullah M, Zahan A, Rana MM, Adil M, Shamsunnaher S. 2014. Attitude of the Rural Elite Farmers towards Extension Activities Performed by Personnel of Department of Agricultural Extension. *The Agriculturists*, 12, 96-102. <https://doi.org/10.3329/agric.v12i1.19586>
- Asrat P, Simane B. 2017a. Adaptation benefits of climate-smart agricultural practices in the Blue Nile Basin: empirical evidence from North-West Ethiopia. *Climate change adaptation in Africa: fostering resilience and capacity to adapt*, 45-59. [https://doi.org/10.1007/978-3-319-49520-0\\_4](https://doi.org/10.1007/978-3-319-49520-0_4)
- Asrat P, Simane B. 2017b. Characterizing vulnerability of crop-based rural systems to climate change and variability: agro-ecology specific empirical evidence from the Dabus watershed, north-West Ethiopia. *American Journal of Climate Change*, 6(4), 643-667. <https://doi.org/10.4236/ajcc.2017.64033>
- Azam G, Huda ME, Bhuiyan MAH, Mohinuzzaman M, Bodrud-Doza M, Islam SMD-U. 2019. Climate change and natural hazards vulnerability of char land (bar land) communities of Bangladesh: application of the livelihood vulnerability index (LVI). *Global Social Welfare*, 8(1), 93–105. <https://doi.org/10.1007/s40609-019-00148-1>
- Bangladesh Bureau of Statistics (BBS). 2015. Bangladesh Population and Housing Census 2011 Zila Report – Patuakhali"
- BBS, 2012. Yearbook of Agricultural Statistics. Bangladesh Bureau of Statistics, Dhaka.
- Biswas A, Sonia N, Nahar L, Hossain M, Faisal M. 2016. Women's Vulnerabilities to Climate Induced Hazards and Their Coping Strategies in Chandradip Union of Southern Bangladesh. *British Journal of Education, Society & Behavioural Science*, 14(1), 1-15. <https://doi.org/10.9734/BJESBS/2016/22763>
- Biswas AKMAA, Sattar MA, Hossain MA, Faisal M, Islam MR. 2015. An internal environmental displacement and livelihood security in Uttar Bedkashi Union of Bangladesh. *Applied Ecology and Environmental Sciences*, 3(6), 163-175.
- Cangüzel A, Coşkun Hepcan Ç. 2024. Climate change vulnerability assessment of Karşıyaka, İzmir. *Natural Hazards*, 120(15), 14869–14888. <https://doi.org/10.1007/s11069-024-06798-5>
- Choudhury AM, Neelormi S, Quadir DA, Mallick S, Ahmed AU. 2005. Socio-economic and physical perspectives of water related vulnerability to climate change: results of field study in Bangladesh. *Science and Culture*, 71(7/8), 225.
- Cutter LS, 1996. Vulnerability to environmental hazards. *Prog. Hum. Geogr.* 20 (4), 529-539. <https://doi.org/10.1177/030913259602000407>
- Cutter S, Osman-Elasha B, Campbell J, Cheong SM, McCormick S, Pulwarty R, Rist S. 2012. Managing the risks from climate extremes at the local level. <https://doi.org/10.1017/CBO9781139177245.008>
- Deressa TT, Hassan RM, Ringler C, Alemu T, Yesuf M. 2009. Determinants of farmers' choice of adaptation methods to climate change

- in the Nile Basin of Ethiopia. *Global environmental change*, 19(2), 248-255. <https://doi.org/10.1016/j.gloenvcha.2009.01.002>
- Frank E, Eakin H, Lopez-Carr D. 2011. Social identity, perception and motivation in adaptation to climate risk in the coffee sector of Chiapas, Mexico. *Glob. Environ. Chang.* 21 (1), 66-76. <https://doi.org/10.1016/j.gloenvcha.2010.11.001>
- Füssel HM, Klein RJ, 2006. Climate change vulnerability assessments: an evolution of conceptual thinking. *Climatic change*, 75(3), 301-329. <https://doi.org/10.1007/s10584-006-0329-3>
- Gbetibouo GA, Ringler C, Hassan R. 2010. Vulnerability of the South African farming sector to climate change and variability: an indicator approach. *Natural Resources Forum*, 34(3), 175-187. <https://doi.org/10.1111/j.1477-8947.2010.01302.x>
- GoB, 2011. The Sixth Five-year Plan, 2011-2015. Ministry of Planning, Govt. of Bangladesh, Dhaka.
- Haq AZM, 2016. Agricultural Extension Contact and Farmer's Income in Bangladesh. *Turkish Journal of Agriculture-Food Science and Technology*, 4, 787-792. <https://doi.org/10.24925/turjaf.v4i9.787-792.697>
- Hoque M, Cui S, Li X, Islam I, Tang J, Ding S. 2019. Assessing agricultural livelihood vulnerability to climate change in coastal Bangladesh. *International Journal of Environmental Research and Public Health*, 16(22), 4552. <https://doi.org/10.3390/ijerph16224552>
- Huq S, Ayers JM, 2008. Climate change impacts and responses in Bangladesh. Briefing note prepared for the European Parliament. International Institute for Environment and Development, London; and Policy Department Economic and Scientific Policy, DG Internal Policies of the Union, Brussels.
- IPCC 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge UK.
- Iqbal A, Haque S, Murshed SB, Islam AS, Hussain M. 2025. Climate vulnerability and risk assessment in low-lying coastal cities of Bangladesh using analytic hierarchy process (AHP) approach. *Journal of Water and Climate Change*. <https://doi.org/10.2166/wcc.2025.744>
- Iva TT, Hazra P, Faisal M, Saha S, Hossain, S. 2017. River bank erosion and its impact on population displacement in Bauphalupazila under Patuakhali district. Bangladesh. *Journal of Science, Technology and Environment Informatics*, 5(02), 371-381. <https://doi.org/10.18801/jstet.050217.39>
- Jordan JC. 2015. Swimming alone? The role of social capital in enhancing local resilience to climate stress: a case study from Bangladesh. *Clim. Dev.* 7 (2), 110-123. <https://doi.org/10.1080/17565529.2014.934771>
- Kabir A, Amin MN, Roy K, Hossain MS. 2021. Determinants of climate change adaptation strategies in the coastal zone of Bangladesh: implications for adaptation to climate change in developing countries. *Mitigation and Adaptation Strategies for Global Change*, 26(7), 30. <https://doi.org/10.1007/s11027-021-09968-z>
- Khan AR. 2015. Domestic Violence against Women in Bangladesh: A Review of the Literature and the Gaps to Fill-In by Future Intervention. *Khazar Journal of Humanities and Social Sciences*, 18, 57- 80.
- Lahiri-Dutt K, Samanta G. 2007. "Like the drifting grains of sand": vulnerability, security and adjustment by communities in the Charlands of the Damodar River, India. *South Asia: J. South Asia Studies* 30 (2), 327-350. <https://doi.org/10.1080/00856400701499268>
- Legesse B, Ayele Y, Bewket W. 2013. Smallholder Farmers' Perceptions and Adaptation to Climate Variability and Climate Change in Doba District, West Hararghe, Ethiopia. *Asian Journal of Empirical Research*, 3, 251-265.
- Mac VVT, McCauley LA. 2017. Farmworker vulnerability to heat hazards: a conceptual framework. *Journal of Nursing Scholarship*, 49(6), 617-624. <https://doi.org/10.1111/jnu.12327>
- Maharjan SK, Sigdel ER, Sthapit BR, Regmi BR. 2011. Tharu community's perception on climate changes and their adaptive initiations to withstand its impacts in Western Terai of Nepal. *International NGO Journal*. 6(2), 035-042. <https://doi.org/10.5897/NGO10.003>
- Mamun AA, Roy S, Islam ARMT, Alam GM, Alam E, Chandra Pal S, Mallick J. 2021. Smallholder farmers' perceived climate-related risk, impact, and their choices of sustainable adaptation strategies. *Sustainability*, 13(21), 11922. <https://doi.org/10.3390/su132111922>
- Mertz O, Mbow C, Reenberg A, Diouf A. 2008. Farmers' perceptions of climate change and agricultural adaptation strategies in rural Sahel. *Environmental management*, 43 (5), 804-816. <https://doi.org/10.1007/s00267-008-9197-0>
- Mideksa TK. 2010. Economic and distributional impacts of climate change: The case of Ethiopia. *Global Environmental Change*, 20(2), 278-286. <https://doi.org/10.1016/j.gloenvcha.2009.11.007>
- Mukherjee A, Faisal M, Saha MK. 2020. Measuring Resilience of Urban Slum to Climate Induced Disasters: A Study on Barishal City Corporation, Bangladesh. *International Journal of Disaster Management*, 3(2), 34-47. <https://doi.org/10.24815/ijdm.v3i2.17815>
- Pouliotte J, Smit B, Westerhoff , 2009. Adaptation and development: livelihoods and climate change in Subarnabad, Bangladesh. *Clim. Dev.* 1, 31-46. <https://doi.org/10.3763/cdev.2009.0001>
- Rahman S and Davis J. 2005. A Survey of Rural Livelihood and Enterprise Development Opportunities in the Chars, Bangladesh: DFID Poverty Oriented Research Programme R8369 (NRI: C1731).
- Rahman THM, Hickey GM, Ford JD Egan MA. 2018. Climate change research in Bangladesh: research gaps and implications for adaptation-related decision-making. *Regional Environmental Change*, 18, 1535-1553. <https://doi.org/10.1007/s10113-017-1271-9>
- Roco L, Engler A, Bravo-Ureta B and Jara-Rojas R. 2014. Farmers' Perception of Climate Change in Mediterranean Chile. *Regional Environmental Change*, 15, 1- 13. <https://doi.org/10.1007/s10113-014-0669-x>
- Rosa E.A. 2003. The logical structure of the social amplification of risk framework (SARF): metatheoretical foundations and policy implications. In: Pidgeon, N.F., Kasperson, R.E., Slovic, P. (Eds.), *The Social Amplification of Risk*. Cambridge University Press, Cambridge, pp. 47-79. Retrieved from: <https://trove.nla.gov.au/work/28268203>
- Roy B, Ullah M, Rahman M. 2015. Climate change impact in Char lands in central area of Bangladesh: assessing vulnerability and adaptation by the farming communities. *J. Environ. Sci. Nat. Resour.* 7 (2), 59-63. <https://doi.org/10.3329/jesnr.v7i2.22205>
- Sarker MNI, Wu M, Alam GMM, Shouse R.C. 2020. Life in riverine islands in Bangladesh: local adaptation strategies of climate vulnerable riverine island dwellers for livelihood resilience. *Land Use Policy* 94, 1-7. <https://doi.org/10.1016/j.landusepol.2020.104574>
- Sarker, M. N. I., Wu, M., Alam, G. M. M., & Shouse, R. C. (2019). Livelihood Vulnerability of Riverine-Island Dwellers in the Face of Natural Disasters in Bangladesh. *Sustainability*, 11(6), 1623. <https://doi.org/10.3390/su11061623>
- Semenza JC, Hall D. E, Wilson DJ, Bontempo BD, Sailor DJ, George LA. 2008. Public perception of climate change: voluntary mitigation and barriers to behavior change. *American journal of preventive medicine*, 35(5), 479-487. <https://doi.org/10.1016/j.amepre.2008.08.020>
- Shew MA, Morat DA, Putman B, Nalley LL, Ghosh A. 2019. Rice intensification in Bangladesh improves economic and environmental welfare. *Environmental Science & Policy*, 95, 46-57. <https://doi.org/10.1016/j.envsci.2019.02.004>
- Simane B, Zaitchik BF Foltz JD. 2016. Agroecosystem specific climate vulnerability analysis: application of the livelihood vulnerability index to a tropical highland region. *Mitigation and Adaptation Strategies for Global Change*, 21, 39-65. <https://doi.org/10.1007/s11027-014-9568-1>
- Sjoberg L. 2000. The methodology of risk perception research. *Qual. Quant.* 34 (4), 407-418. <https://doi.org/10.1023/A:1004838806793>
- Tambo J and Abdoulaye T. 2012. Smallholder Farmers' Perceptions of and Adaptations to Climate Change in the Nigerian Savanna. *Regional Environmental Change*, 13, 375-388. <https://doi.org/10.1007/s10113-012-0351-0>
- Thomas TS, Mainuddin K, Chiang C, Rahman A, Haque A, Islam N, Sun Y. 2013. Agriculture and adaptation in Bangladesh: current and projected impacts of climate change, International Food Policy Research Institute (IFPRI), Discussion Paper 01281, USA. <https://doi.org/10.2139/ssrn.2310087>
- Tripathi A, Mishra AK. 2017. Knowledge and passive adaptation to climate change: An example from Indian farmers. *Climate Risk Management*, 16, 195-207. <https://doi.org/10.1016/j.crm.2016.11.002>
- Uddin M, Bokelmann W, Dunn E. 2017. Determinants of farmers' perception of climate change: a case study from the coastal region of Bangladesh. *American Journal of Climate Change*, 6, 151-165. <https://doi.org/10.4236/ajcc.2017.61009>

Uddin MN. 2012. An Analysis of Farmers' Perception and Adaptation Strategies of Climate Change in Bangladesh. Master's Thesis, Humboldt University of Berlin, Berlin.

World Bank. 2013. Bangladesh disaster risk and climate resilience program. World Bank. <https://www.worldbank.org/en/country/bangladesh/brief/bangladesh-disaster-risk-climate-change-program>

Yadav S, Mondal MK, Shew A, et al. 2020. Community water management to intensify agricultural productivity in the polders of the coastal zone of

Bangladesh. Paddy and Water Environment, 18, 331–343. <https://doi.org/10.1007/s10333-019-00785-4>

Younus MAF and Harvey N. 2014. Economic Consequences of Failed Autonomous Adaptation to Extreme Floods: A Case Study from Bangladesh. Local Economy, 29, 22-37. <https://doi.org/10.1177/0269094213515175>