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Research Article

Climate Change Adaptation Strategy of the Coastal Indigenous Community of Bangladesh

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Climate change has increasingly impacted developing and underdeveloped nations, with Bangladesh's coastal areas experiencing significant effects such as storm surges, salinity, cyclones, and droughts. These regions, heavily reliant on agriculture, face economic challenges exacerbated by climatic events, making adaptation to climate change a critical concern for coastal inhabitants. This study aims to understand the obstacles and adaptive mechanisms employed by the Munda indigenous people in southeastern coastal Bangladesh to protect their livelihoods. Employing both qualitative and quantitative methodologies, including focus group discussions (FGDs) and thematic analyses, we assessed the community's challenges and adaptation strategies. FGDs revealed that public life is frequently disrupted, salinity poses a major threat to agriculture and drinking water, and the cropping pattern, fish production, livestock, infrastructure, industry, biodiversity, health, and human settlement are adversely affected. Notably, there is a significant lack of adequate healthcare. Quantitative analysis using the χ^2 test showed that 33.2% of participants believe climate change affects their happiness, 85.1% stored 72 h of water and food, and 59.3% had hygiene and sanitation supplies. This research underscores the necessity of adaptive measures such as rainwater harvesting, organic fertilizer usage, community disaster preparedness education, effective communication systems, and social security implementation to mitigate climate change's adverse effects. The findings offer valuable insights for the government, nongovermental organizations (NGOs), policymakers, civil society, and stakeholders in developing suitable climate adaptation strategies to ensure sustainable livelihoods in coastal Bangladesh.

Keywords: Bangladesh; climate adaptation; coastal zone; emergency response; indigenous community; indigenous knowledge

1. Introduction

Climate change, which is intensifying day by day in emerging and impoverished countries, is defined as changes in trends over time in the average climate, including changes in average temperature [1]. Due to a scarcity of economic, social, technological, and institutional resources, Bangladesh is regarded as one of the world's most climate-vulnerable countries. This South Asian nation is low-lying, riverine, and has an active delta with a 700 km-long coastline on the northern littoral of the Bay of Bengal. Bangladesh's coastline region, located in the country's south, is an almost level clay environment that is expected to be severely impacted by changes in the climate in the coming decades [2]. Climate change adaptation has received increased attention in policy and research in recent decades. It involves making efforts to mitigate the adverse impacts of climatic events, such as floods and droughts, or to enhance the positive outcomes to mitigate the negative effects of climate change [3].

Adaptation, as described by the IPCC [4], refers to the changing of natural or human systems to respond to current or expected climate-related shocks or their effects, to reduce harm or to focus on beneficial opportunities [5]. Specifically, it involves implementing an integrated plan to improve the

capacity for surviving and hitting back from probable hazards and unanticipated issues, thus decreasing the likelihood of negative effects on the community [6]. The concept of "adaptive capacity" relates to the existence of several possibilities for adaptation, the community's capacity to carry out those choices, and the community's ability to prepare for, manage, and recover from the effects of climate change. By reducing the system's level of exposure and susceptibility, it effectively mitigates vulnerability, lessens the consequences, and enhances the overall resilience of the system to climatic calamities [7, 8].

Coastal areas are where goods and services with economic and social value are produced, and because of this, they also embody a very dynamic and potentially dangerous natural environment. Due to these risks, many people have relocated their families, and the majority of the internally displaced people caused by the climate are being relocated to char lands. Adaptation efforts should place a strong priority on coastal areas [9]. Indigenous adaption techniques and knowledge practices (ITKPs) are important elements for climate change adaptation in the world's developing countries.

The coastal dwellers, especially the indigenous community of Bangladesh have long been active in various adaptation methods to climate change. However, they are not aware of the future climate extremes that are anticipated in the coastal regions of Bangladesh [10]. It is crucial to assess their adaptation strategies for taking adequate measures to minimize their disaster risks and ensure sustainable adaptation. Bangladesh was one of the first nations to support community adaptation projects in coastal locations to deal with the effects of climate change. However, there are not many noteworthy studies exploring climate change adaptation strategies of indigenous communities in Koyra and Tala Upazila. To shed some light on this issue, the study will pay particular attention to Koyra Upazila in Khulna district and Tala Upazila of Satkhira District. The purpose of this paper is to examine the current socioeconomic status and social demographic characteristics of the indigenous Munda community residing in the study area to investigate the vulnerability of Bangladesh's coastal communities due to climate change. Additionally, this study seeks to understand the necessity of coastal communities adapting to climate change and the significance of indigenous coastal communities' alternative adaptation strategies based on their capacity to do so.

2. Literature Review

Bangladesh is widely recognized as a country that is highly susceptible to disasters and has a high level of vulnerability. This is primarily due to its frequent exposure to extreme climate events. Within this country, there are numerous tribes, including the indigenous (adivasi) Munda community in the Shyamnagar Upazilla (subdistrict) of Satkhira. The community has seen substantial difficulties in sustaining their livelihoods due to the enduring consequences of climate change, mostly due to their heavy reliance on the surrounding environment, namely, forest resources. Each year, this community grapples with climate phenomena such as cyclones (such as Sidar, Aila, Mohasen, Comen, Foni, Bulbul, Amphan, and Yash), floods, saline intrusion, starvation, and heat waves [11].

The Munda people, who are indigenous inhabitants, reside in remote areas that are very susceptible to the impacts of climate change. This susceptibility is mostly due to their placement in fragile and sensitive habitats, such as small islands, high-altitude regions, and rugged regions, with limited communication infrastructure. While Bangladesh is experiencing development across various sectors, the basic needs of the Munda people in Rangamati district remain unaddressed [12].

Nevertheless, the members of the community are not mere passive victims of extreme climate change. On the contrary, their extensive and firsthand knowledge enables them to be exceptional observers of environmental change and its consequences. They employ traditional knowledge and diverse adaptation tactics that are passed down through generations. This enables them to mitigate their susceptibility to the effects of climate change and thrive in an increasingly hostile environment [13].

According to research done in Kalinchi and Sundarbans forest, Munda community has long made a living by gathering honey, catching fish and crabs, and felling trees and timbers. This livelihood was seriously threatened by the powerful cyclone Aila on May 9. But they used a number of techniques, such as diversifying their sources of income by looking for second employment, growing a range of crops, such as vegetables on floating beds, saline-tolerant rice, and raising chickens and cattle for their own survival [14].

In another study conducted within the Munda community, indigenous women from the village expressed concerns about the detrimental effects of "rising salinity" and "altered weather patterns" on their quality of life, rendering them more susceptible. Furthermore, it was mentioned that amidst the flood, they experienced a complete loss of their possessions, including the unfortunate disappearance of their chickens and cattle. The coastal region also vividly remembers the destructive cyclones and tornadoes that resulted in their displacement. Their houses were destroyed, and the waves swept away their books. Consequently, the people were compelled to abandon their land and seek refuge elsewhere. This displacement has caused numerous challenges in terms of housing, land rights, employment, and access to freshwater [15].

The Munda indigenous community's narrative is the driving force behind this research. Located in Bangladesh's southwestern region, they endure severe neglect and deprivation since they rely on their own amazing traditions and customs. Cyclones, salt, heat waves, droughts, and floods evidently have a significant impact on this Bangladeshi community. Adapting to the many negative consequences of climate change on coastal communities' lives and livelihoods is challenging, and improving adaptability in the face of these challenges is essential. Finding appropriate adaption solutions in the Munda community in Bangladesh is the reason of this study. Policymakers will be able to reevaluate their basic human rights and provide these people what they deserve with the help of this study. All of the suggestions also originated from Munda speakers, whose words are the focus of this article.

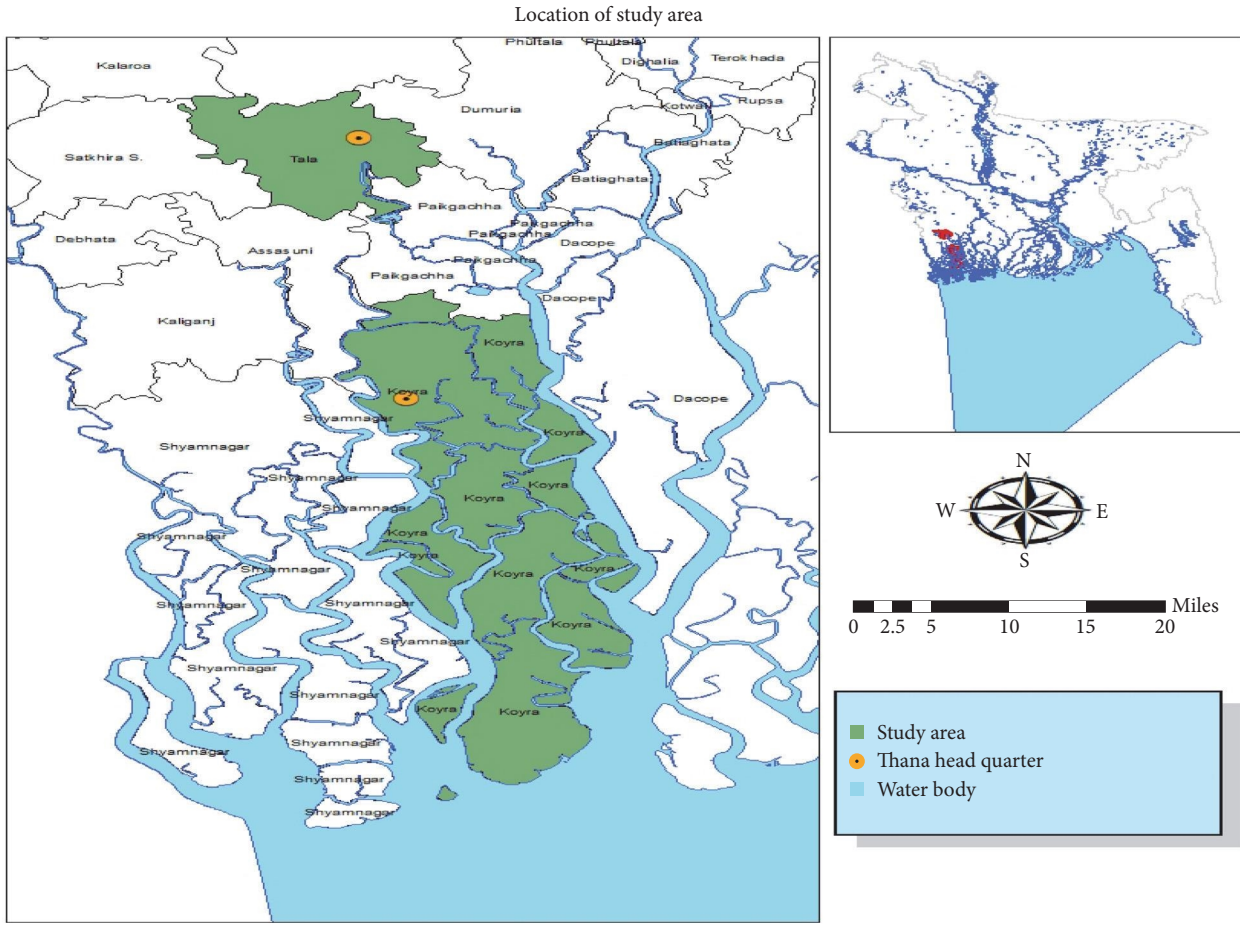

Figure 1: The geographical location of the study area.

In order to provide clarity on this matter, this paper seeks to accomplish three main goals:

- Analyze the present circumstances and various effects of climate change on the Munda indigenous people living in coastal Bangladesh.
- Assessing the community's self-initiated climate change adaption actions.
- Identify the obstacles faced by current adaption measures and gather the solutions put forward by indigenous people in the community.

3. Methodology

3.1. Study Area and Duration. Bangladesh is very susceptible to the impacts of climate change, particularly in its coastal region, which is at risk from both natural and human-driven disasters. The primary regions impacted by climate change are the southern coastal areas, such as Khulna. Hence, this specific region in Bangladesh was chosen for the purpose of this investigation. The study was conducted in Koyra Upazila and Tala Upazila, both located in the Khulna division of Bangladesh. The Koyra Police Station is situated at latitude 22° 21′ 02.54″ N and longitude 89° 17′ 06.05″ E, while the coordinates for Tala Upazila are latitude 22° 45′ 02.97″ N and longitude 89° 15′ 26.69″ E, as shown in Figure 1.

Both Koyra Upazila and Tala Upazila are situated in a vast coastal region that frequently encounters climate-induced calamities, including tropical cyclones, floods, river erosion, saline intrusion, and drought [16, 17]. The areas are vulnerable to a wide range of ongoing and constant weather-related risks, and they have been hit by cyclones in history [18]. Koyra is facing a severe issue with the availability of clean drinking water, particularly in the tube wells located in the upazila. In addition, the Munda people are the ethnic population residing in Koyra [19]. Tala Upazila in Satkhira district is prone to frequent flooding and waterlogging, which can have adverse effects on land use, biodiversity, and ecosystem services [20]. These locations were deliberately chosen and situated in the most susceptible area to extreme climatic events. The study was conducted from August to November 2023.

3.2. Study Design. This research has the potential to access a sizable population sample with minimal bias and participation hurdles because it was a cross-sectional study. The study employed a mixed-methods research design, incorporating both quantitative and qualitative approaches [21]. In order to

acquire a more comprehensive understanding of household perceptions, a quantitative survey was implemented. In addition, we conducted six focus group discussions (FGDs) as part of a qualitative inquiry to gain a deeper knowledge of the local perceptions and experiences of Munda persons in Koyra and Tala Upazilas.

3.3. Sample. The study involved surveying a total of 325 Munda individuals, with 225 people from Koyra Upazila and 100 participants from Tala Upazila. The sample comprised 210 males, accounting for 64.6% of the total, and 115 females, representing 35.4% of the total. The participants were chosen based on their availability using a convenience sample technique. Sample size was estimated by using the formula of Godden [22].

3.4. Data Collection. In the quantitative study, the research team developed structured questionnaires and conducted face-to-face interviews. The questionnaire covered several subjects, including sociodemographic information, climate change information, catastrophe adaptation and risk reduction strategies of the Munda community, and the impact of climate change. A qualitative study was conducted through FGDs in the community courtyard that focused on the broad themes of the Munda community's current situation, adaptation strategy, and potential solutions to climate change. The interviews were meticulously documented through the use of both written notes and audio recordings, with the explicit consent of the individuals being interviewed. Subsequently, the recorded conversations were transcribed.

3.5. Statistical Analysis. The data were analyzed using the Statistical Package for the Social Sciences (SPSS), especially version 26.0. This analysis involved conducting logical and range checks on the data, which resulted in the generation of summary statistics and tables. The summary data were presented as averages with standard deviations (SDs) for continuous variables, or as percentages with 95% confidence intervals (CIs) for categorical variables. Frequency tables were used to summarize and illustrate sociodemographic variables. The χ^2 test was employed to compare discrete variables, with a significance level of $p < 0.05$. Logistic regression models were employed to identify any correlation between sociodemographic and socioeconomic factors and the influence of climate change. The data from the qualitative study was transcribed and analyzed based on the themes of the current situation, adaptation strategy, and future solutions to climate change. Content analysis was employed to examine the interview transcripts. This method involves categorizing the transcribed material by assigning codes to the interview data, which are then grouped into blocks that reflect either a shared subject or newly emerging themes derived from the interviewee's quotations [21].

3.6. Ethical Considerations. After providing a clear explanation of the purpose of the study to the participants, we received their explicit consent, both in writing and verbally, to disclose any pertinent information to the individuals participating in the study prior to conducting the interviews. Verbal consent was used by the few percent of respondents who were unable to read or write our survey. Furthermore, they were explicitly notified of their autonomy to discontinue their participation in the study at any given moment.

3.7. Sampling Procedures and Sample Size Determination. The sample size of the study was determined by using the formula of Godden [22]. According to the formula:

$$s = \frac{z^2 p(1-p)}{M^2},$$

$$s = \frac{1.96^2 \times 0.692(1-0.692)}{(0.05)^2},$$

$$s = \frac{0.81878}{(0.05)^2},$$

$$s = 327.5,$$

$$\cong 325 (\text{approximately}).$$

Here, s = sample size; z = standard normal deviation set 95% confidence level = 1.96; p = percentage of population picking a choice, expressed as decimal = 6. 92% = 0.692; M = margin of error = 0.05% = 0.050.

4. Results

Table 1 shows that our survey of 325 people found that 60% of community members are affected by climate change. The study finds significant correlations between several demographic and socioeconomic factors and perceived climate change impacts. There was a significant association between age group ($\chi^2 = 2.293$, $p = 0.318$) and gender ($\chi^2 = 4.452$, $p = 0.035$), with males and those aged 26–40 reporting higher impacts. Residential property type ($\chi^2 = 4.820$, $p = 0.020$) and drinking water source ($\chi^2 = 7.537$, $p < 0.001$) showed significant correlations to impact levels, with brick-built houses and pond water users showing higher impacts. Significant relationships were found between education level ($\chi^2 = 5.435$, $p = 0.050$) and occupation ($\chi^2 = 3.353$, $p = 0.004$), with primary education and farming occupations showing a significant impact. Monthly income ($\chi^2 = 5.509$, $p = 0.010$) had a significant association, with lower-income households expressing more impacts. Climate change-related damages ($\chi^2 = 5.730$, $p = 0.006$), especially family displacement, had a significant association with impact levels.

The timing of climate change impacts and community preparedness showed no significant associations ($\chi^2 = 3.884$, $p = 0.274$ and $\chi^2 = 0.077$, $p = 0.781$, respectively), but perceptions of climate change effects on lifestyle ($\chi^2 = 3.970$, $p < 0.001$) and impacts on drinking water sources ($\chi^2 = 14.349$, $p < 0.001$), notably salinity intrusion, demonstrated significant correlations. Anxiety, depression, post-traumatic stress disorder (PTSD), and attempted suicide were found to be significantly associated with reported climate change impacts ($\chi^2 = 5.352$, $p = 0.008$). Community preparedness measures, such as understanding community risks, communicating with disaster management experts,

Table 1: Frequency and association of factor categories with climate change impact.

Variables	Total (%)	Status of climate change impact		χ^2 value	*P* value
		Impact	Not impact		
Sociodemographic information					
Age group				2.293	0.318
Age ≤ 25	77 (23.7)	49 (63.6)	28 (36.4)	—	—
Age 26–40	141(43.4)	100 (70.9)	41 (29.1)	—	—
Age ≥ 41	107 (32.9)	79 (73.8)	28 (26.2)	—	—
Sex of the respondent				4.452	0.035
Male	210 (64.6)	139 (66.2)	71 (33.8)	—	—
Female	115 (35.4)	89 (77.4)	26 (22.6)	—	—
The residential property				4.820	0.020
Wooden/mud-built house (kaccha house)	225 (69.2)	150 (66.7)	75 (33.3)	—	—
Semi-furnished house (semi-pucca)	75 (23.1)	57 (76.0)	18 (24.0)	—	—
Brick-built house (Pacca)	25 (7.7)	21 (84.0)	4 (16.0)	—	—
Source of drinking water				7.537	<0.001
Tube well water	195 (60.0)	127 (65.1)	68 (34.90)	—	—
Rain water	57 (17.5)	43 (75.4)	14 (24.6)	—	—
Pond water	43 (13.2)	36 (83.7)	7 (16.3)	—	—
Supply water	30 (9.2)	22 (73.3)	8 (26.7)	—	—
The education level of the participant				5.435	0.050
No education	95 (29.2)	67 (70.5)	28 (29.5)	—	—
Primary	147 (45.2)	103 (70.1)	44 (29.9)	—	—
Secondary	64 (19.7)	45 (70.3)	19 (29.7)	—	—
Tertiary	19 (5.8)	13 (68.4)	6 (31.6)	—	—
Socioeconomic information					
Head of the household's occupation				3.353	0.004
Farmer	71 (21.8)	47 (66.2)	24 (33.8)	—	—
Self-employe	125 (38.5)	84 (67.2)	41 (32.8)	—	—
Government employment	30 (9.2)	23 (76.7)	7 (23.3)	—	—
NGOs employment	86 (26.5)	63 (73.3)	23 (26.7)	—	—
Unable to work	13 (4.0)	11 (84.6)	2 (15.4)	—	—
Monthly income of the household				5.509	0.010
Less than 5000	149 (45.8)	102 (68.5)	47 (31.5)	—	—
5000–6000	122 (37.5)	81 (66.4)	41 (33.6)	—	—
7000 and above	54 (16.6)	45 (83.3)	9 (16.7)	—	—
Climate change information					
Climate change related loss and damage				5.730	0.006
Disruption or loss of income	26 (8.0)	19 (73.1)	7 (26.9)	—	—
Displacement of families	192 (59.1)	137 (71.4)	55 (28.6)	—	—
Property damage	30 (9.2)	17 (56.7)	13 (43.3)	—	—
Infectious diseases	66 (20.3)	45 (68.2)	21 (31.8)	—	—
Minor injury	11 (3.4)	10 (90.9)	1 (9.1)	—	—
The community recently encountered climate change related impacts				3.884	0.274
Yes, 1–5 years ago	216 (66.5)	144 (66.7)	72 (33.3)	—	—
Yes, 6–10 years ago	58 (17.8)	44 (75.9)	14 (24.1)	—	—
Yes, this year	26 (8.0)	20 (76.9)	6 (23.1)	—	—
No	25 (7.7)	20 (80.0)	5 (20.0)	—	—
Climate change may have effects on your lifestyle				3.970	<0.001
Yes	279 (85.8)	190 (68.1)	89 (31.9)	—	—
No	46 (14.2)	38 (82.6)	8 (17.4)	—	—
Community climate change preparedness may save lives				0.077	0.781
Yes	228 (70.2)	161 (70.6)	67 (29.4)	—	—
No	97 (29.8)	67 (69.1)	30 (30.9)	—	—

Table 1: Continued.

Variables	Total (%)	Status of climate change impact		χ^2 value	*P* value
		Impact	Not impact		
The biggest climate-induced impacts on drinking water sources				14.349	<0.001
Salinity intrusion in soil and water	209 (64.3)	132 (63.2)	77 (36.8)	—	—
Water logging	52 (16.0)	45 (86.5)	7 (13.5)	—	—
Erratic rainfall	55 (16.9)	44 (80.0)	11 (20.0)	—	—
Cyclone	9 (2.8)	7 (77.8)	2 (22.2)	—	—
Climate change related mental health problems				5.352	0.008
Anxiety	58 (17.8)	35 (60.3)	23 (39.7)	—	—
Depression	89 (27.4)	62 (69.7)	27 (30.3)	—	—
Post-traumatic stress disorder	157 (48.3)	113 (72.0)	44 (28.0)	—	—
Attempt to suicide	21 (6.5)	18 (85.7)	3 (14.3)	—	—
Preparation for dealing with future climate change				0.412	0.981
Better understanding of risks to my community	97 (29.8)	66 (68.0)	31 (32.0)	—	—
Spoken to disaster management representatives in my area	82 (25.2)	59 (72.0)	23 (28.0)	—	—
Prepared a family emergency plan	19 (5.8)	13 (68.4)	6 (31.6)	—	—
Better understanding of the disaster response system	95 (29.2)	67 (70.5)	28 (29.5)	—	—
Trained other members of the community	32 (9.8)	23 (71.9)	9 (28.1)	—	—
Warn before climate change				1.255	0.534
NGOs	86 (26.5)	57 (66.3)	29 (33.7)	—	—
Community people	85 (26.2)	63 (74.1)	22 (25.9)	—	—
Government	154 (47.4)	108 (70.1)	46 (29.9)	—	—
Rainfall irregularities				7.574	0.005
Yes	131 (40.3)	93 (71.0)	38 (29.0)	—	—
No	194 (59.7)	135 (69.6)	59 (30.4)	—	—
Increasing temperature				1.841	0.002
Yes	188 (57.8)	127 (67.6)	61 (32.4)	—	—
No	137 (42.2)	101 (73.7)	36 (26.3)	—	—
Rising floods				0.089	0.765
Yes	128 (39.4)	91 (71.1)	37 (28.9)	—	—
No	197 (60.6)	137 (69.5)	60 (30.5)	—	—
River and stream drying				4.635	0.005
Yes	236 (72.6)	62 (69.7)	27 (30.3)	—	—
No	89 (27.4)	166 (70.3)	70 (29.7)	—	—
Climate change could threaten Bangladesh's development				4.770	0.009
Effects on the quality of water	123 (37.8)	87 (70.7)	36 (29.3)	—	—
Heat troke or heat exhaustion	156 (48.0)	103 (66.0)	53 (34.0)	—	—
Respiratory problems	31 (9.5)	26 (83.9)	5 (16.1)	—	—
Effects of air quality	15 (4.6)	12 (80.0)	3 (20.0)	—	—
The effects of climate change on human life of threats				2.243	0.034
Yes	305 (93.8)	211 (69.2)	94 (30.8)	—	—
No	20 (6.2)	17 (85.0)	3 (15.0)	—	—
Climate change is caused by cyclones				0.713	0.398
Yes	176 (54.2)	120 (68.2)	56 (31.8)	—	—
No	149 (45.8)	108 (72.5)	41 (27.5)	—	—
River erosion is a contributing factor to climate change				1.386	0.239
Yes	202 (62.2)	137 (67.8)	65 (32.2)	—	—
No	123 (37.8)	91 (74.0)	32 (26.0)	—	—

Table 1: Continued.

Variables	Total (%)	Status of climate change impact		χ^2 value	*P* value
		Impact	Not impact		
One of the factors causing climate change is less rainfall				2.256	0.003
Yes	229 (70.5)	155 (67.7)	74 (32.3)	—	—
No	96 (29.5)	73 (76.0)	23 (24.0)	—	—
Drought is one of the causes contributing to climate change				4.533	0.005
Yes	254 (78.2)	178 (70.1)	76 (29.9)	—	—
No	71 (21.8)	50 (70.4)	21 (29.6)	—	—
Water logging contributes to climate change				9.158	0.002
Yes	230 (70.8)	150 (65.2)	80 (34.8)	—	—
No	95 (29.2)	78 (82.1)	17 (17.9)	—	—
Salinity effects cause prevent crop production				9.547	<0.001
Yes	232 (71.4)	160 (69.0)	72 (31.0)	—	—
No	93 (28.6)	68 (73.1)	25 (26.9)	—	—

and completing family emergency plans, did not significantly correlate with reported consequences ($\chi^2 = 0.412$, $p = 0.981$).

Respondents who perceived climate change as a threat to Bangladesh's development, affecting water quality, heat stroke or exhaustion, respiratory problems, and human life were more likely to report its impact ($\chi^2 = 4.770$, $p = 0.009$; $\chi^2 = 0.841$, $p = 0.012$; $\chi^2 = 3.651$, $p = 0.056$; $\chi^2 = 2.743$, $p = 0.098$; $\chi^2 = 2.243$, $p = 0.034$, respectively). However, assigning particular climate change causes such as cyclones, river erosion, reduced rainfall, drought, water logging, or salinity effects on crop output did not significantly correlate with reported consequences ($p > 0.05$ for all variables). Environmental changes, such as irregular rainfall, rising temperatures, river and stream drying, attributing drought, water logging, or salinity effects to climate change, significantly increased the likelihood of reporting impacts ($\chi^2 = 7.574$, $p = 0.005$; $\chi^2 = 1.841$, $p = 0.002$; $\chi^2 = 4.635$, $p = 0.005$; $\chi^2 = 4.533$, $p = 0.005$; $\chi^2 = 9.158$, $p = 0.002$; $\chi^2 = 9.547$, $p < 0.001$, respectively).

Table 2 shows that the logistic regression analysis investigated how sociodemographic and socioeconomic characteristics relationship to climate change impact. The adjusted odds ratios (ORs) and 95% CIs were used to evaluate these associations. After adjustments, male displayed a nonsignificant decrease in climate change impact odds compared to female (adjusted OR = 0.82, 95% CI = 0.46–1.51, $p = 0.441$). Individuals with primary and secondary education had significantly less likely to be impacted by climate change than those with tertiary education (adjusted ORs: 0.38, 95% CI = 0.06–1.99, $p = 0.231$ and 0.37, 95% CI = 0.06–2.35, $p = 0.002$, respectively).

Farmers and self-employed individuals were more likely to be impacted by climate change than those who were unable to work (adjusted ORs: 1.27, 95% CI = 0.17–9.43, $p = 0.004$ and 1.50, 95% CI = 0.21–10.61, $p = 0.020$, respectively). Households with incomes less than 5000 and between 5000 and 6000 were more likely to be impacted by climate change than those with incomes of 7000 or more (adjusted ORs: 1.57, 95% CI = 0.44–5.63, $p = 0.008$ and 1.92, 95% CI = 0.58–6.32, $p = 0.005$, respectively). Participants suffering disturbance or loss of income displayed a higher risk of climate change impact (adjusted OR = 2.55, 95% CI = 0.19–35.24, $p = 0.084$). Family displacement was associated with a significantly increased risk of climate change impact (adjusted OR = 3.77, 95% CI = 0.31–46.57, $p < 0.001$). Climate change had a major effect on property damage (adjusted OR = 14.67, 95% CI = 1.09–20.06, $p = 0.003$) and infectious diseases (adjusted OR = 16.31, 95% CI = 1.29–21.16, $p = 0.031$).

Respondents who expected lifestyle changes due to climate change had considerably higher probabilities of suffering from the impact (adjusted OR = 2.78, 95% CI = 0.10–81.50, $p < 0.001$). Climate change impact was significantly associated with salinity intrusion in soil and water (adjusted OR = 7.48, 95% CI = 0.96–58.38, $p < 0.001$), water logging (adjusted OR = 3.35, 95% CI = 0.41–27.21, $p = 0.028$), and erratic rainfall (adjusted OR = 3.31, 95% CI = 0.40–27.70, $p = 0.009$). However, resulting from corrections, characteristics such as air and water quality did not significantly contribute to climate change impact (adjusted OR = 0.70, 95% CI = 0.07–6.92, $p = 0.020$ and adjusted OR = 0.79, 95% CI = 0.59–1.06, $p = 0.016$, respectively). Heat stroke or heat exhaustion had a significant connection (adjusted OR = 0.71, 95% CI = 0.03–15.64, $p = 0.830$), while respiratory difficulties did not (adjusted OR = 1.17, 95% CI = 0.07–20.71, $p = 0.913$).

Climate-related hazards to human life had a significant impact on climate change (adjusted OR = 1.29, 95% CI = 0.8–0.27, $p < 0.001$). River erosion was significantly associated with climate change impact (adjusted OR = 2.18, 95% CI = 1.19–3.10, $p = 0.011$), as were drought (adjusted OR = 1.74, 95% CI = 0.78–3.88, $p = 0.015$), water logging (adjusted OR = 2.18, 95% CI = 1.07–4.43, $p = 0.032$), and salinity effects on crop production (adjusted OR = 0.96, 95% CI = 0.49–1.88, $p = 0.005$). These findings highlight the importance of addressing environmental issues in order to mitigate negative outcomes.

4.1. Table 3: Results. Table 3 highlights the distribution percentages, mean scores, and SDs of the Munda community's views on disaster adaptation and risk reduction effectiveness. Participant differences are clear, with 47.4% rating flood

Table 2: Logistic regression analysis of risk factors for climate change impact yields odds ratios and 95% confidence intervals.

Variable	Adjusted (95% CI)	Sig	Unadjusted (95% CI)	Sig
Sociodemographic information				
Sex				
Female	1	—	1	—
Male	0.82 (0.46–1.51)	0 0.441	1.14 (0.72–1.82)	0.578
The education level of the participant				
Tertiary	1	—	1	—
No education	0.44 (0.08–2.56)	0.358	1.14 (0.41–3.17)	0.797
Primary	0.38 (0.06–1.99)	0.231	1.22 (0.45–3.27)	0.005
Secondary	0.37 (0.06–2.35)	0.002	1.10 (0.38–3.17)	<0.001
Socioeconomic information				
Head of the household's occupation				
Unable to work	1	—	1	—
Farmer	1.27 (0.17–9.43)	0.004	2.74 (0.69–10.79)	<0.001
Self-employe	1.50 (0.21 −10.61)	0.020	2.54 (0.67–9.66)	0.003
Government employment	0.84 (0.10–7.27)	0.872	1.43 (0.32–6.46)	0.643
NGOs employment	0.85 (0.12–6.26)	0.875	2.08 (0.53–8.10)	0.293
Monthly income of the household				
7000 and above	1	—	1	—
Less than 5000	1.57 (0.44–5.63)	0 .008	1.89 (0.97–3.68	0.002
5000–6000	1.92 (0.58–6.32)	0 .005	1.59 (0.80–3.17)	0.018
Climate change information				
Climate change related loss and damage				
Minor injury	1	—	1	—
Disruption or loss of income	2.55 (0.19–35.24)	0.084	4.44 (0.48–40.84)	0.017
Displacement of families	3.77 (0.31–46.57)	<0.001	6.41 (0.80–51.10)	0.009
Property damage	14.67 (1.09 −20.06)	0.003	11.43 (1.30–10.82)	0.028
Infectious diseases	16.31 (1.29–21.16)	0.031	8.86 (1.07–73.18)	0.043
Climate change may have effects on your lifestyle				
No	1	—	1	—
Yes	2.78 (0.10–81.50)	<0.001	0.42 (0.20 – 0.85)	0.017
Community climate change preparedness may save lives				
No	1	—	1	—
Yes	0.92 (0.40–2.14)	0.847	1.07 (0.66–1.74)	0.786
The biggest climate-induced impacts on drinking water sources				
Cyclone	1	—	1	—
Salinity intrusion in soil and water	7.48 (0.96–58.38)	<0.001	3.09 (0.63–15.23)	0.066
Water logging	3.35 (0.41–27.21)	0.028	1.56 (0.29–8.33)	0.006
Erratic rainfall	3.31 (0.40–27.70)	0.009	1.31 (0.25–7.04)	0.051
Rainfall irregularities				
No	1	—	1	—
Yes	0.63 (0.03–15.41)	0.778	1.01 (0.64–1.59)	0.964
Increasing temperature				
No	1	—	1	—
Yes	1.21 (0.68–2.17)	0.521	1.47 (0.93–2.31)	0.099
Rising floods				
No	1	—	1	—
Yes	2.17 (0.04–11.24)	0.700	1.02 (0.65–1.61)	0.925
River and stream drying				
No	1	—	1	—
Yes	0.66 (0.32–1.34)	0.248	0.78 (0.47–1.29)	0.326
Climate change could threaten Bangladesh's development				
Effects of air quality	1	—	1	—
Effects on the quality of water	0.70 (0.07–6.92)	0.020	0.79 (0.59–1.06)	0.016

Table 2: Continued.

Variable	Adjusted (95% CI)	Sig	Unadjusted (95% CI)	Sig
Heat stroke or heat exhaustion	0.71 (0.03–15.64)	0.830	0.54 (1.24–2.04)	0.005
Respiratory problems	1.17 (0.07–20.71)	0.913	1.08 (2.10–1.42)	0.050
The effects of climate change on human life of threats				
No	1	—	1	—
Yes	1.29 (0.8–0.27)	<0.001	2.85 (0.93–8.74)	0.006
Climate change is caused by cyclones				
No	1	—	1	—
Yes	1.60 (0.87–2.96)	0.134	1.11 (0.71–1.74)	0.640
River erosion is a contributing factor to climate change				
No	1	—	1	—
Yes	2.18 (1.19–3.10)	0.011	1.36 (0.86–2.16)	0.194
One of the factors causing climate change is less rainfall				
No	1	—	1	—
Yes	0.81 (0.39–1.69)	0.580	1.34 (0.82–2.20)	0.245
Drought is one of the causes contributing to climate change				
No	1	—	1	—
Yes	1.74 (0.78–3.88)	0.015	0.82 (0.48–1.41)	0.074
Water logging contributes to climate change				
No	1	—	1	—
Yes	2.18 (1.07–4.43)	0.032	1.81 (1.09–3.02)	0.022
Salinity effects cause prevent crop production				
No	1	—	1	—
Yes	0.96 (0.49–1.88)	0.005	1.25 (0.76–2.05)	<0.001

Table 3: Munda community disaster adaptation and risk reduction strategy.

Statement	Distribution (%)					Mean	SD
	Not effective at all	Slightly effective	Moderately effective	Very effective	Extremely effective		
Creating flood warning systems	9.5	22.5	14.2	47.4	6.5	2.19	1.143
Constructing earthquake-resistant and robust buildings	5.5	7.7	19.1	18.8	48.9	2.98	1.221
Community calamity preparedness and response education	5.5	15.4	22.5	30.5	26.2	2.56	1.189
Create community disaster management committees	5.5	16.0	19.7	24.9	33.8	2.66	1.249
Promoting agroforestry to mitigate droughts	7.4	14.8	17.5	29.8	30.5	2.61	1.261
Using rainwater collection	6.8	18.5	14.8	24.9	35.1	2.63	1.310
Formulating evacuation strategies for populations at risk	7.1	15.7	19.1	26.8	31.4	2.60	1.270
Creating alternative means of subsistence to decrease reliance on vulnerable sectors	4.3	20.3	14.5	28.3	32.6	2.65	1.245
For disaster resistance, bolstering existing infrastructure such as roads and bridges	5.2	16.9	15.4	27.4	35.1	2.70	1.252
Implementing everyday risk assessments and mitigation strategies for disasters	5.2	18.8	18.5	32.9	24.6	2.53	1.198

warning system development as "highly effective," 6.5% as "exceptionally effective," and 9.5% as "absolutely ineffective." Earthquake-resistant building was rated "extremely effective" by 48.9%, with a mean score of 2.98 and high variance (SD of 1.221). Community disaster education had mixed feedback, with 30.5% ranking it as "very effective" (mean score = 2.61, SD = 1.261). Community disaster management committees had an average rating of 2.66, indicating modest

Table 4: Impact of climate change on Munda community mitigation and adaptation strategies.

Statement	Not serious	Less serious	Undecided	Serious	Very serious	Mean	SD
Realize how seriously climate change is affecting human lives	9.8	40.3	10.8	35.7	3.4	1.82	1.124
Effects on physical health	4.6	19.1	21.5	22.2	32.6	2.59	1.248
Source of income and its effects	6.8	15.4	24.3	31.1	22.5	2.47	1.190
Real property (residence, land)	7.1	25.8	17.8	28.3	20.9	2.30	1.255
Effects on the productivity and production of crops and animals	6.5	23.7	21.2	28.6	20.0	2.32	1.218
Effect on the overall well-being of human existence	2.8	24.3	20.6	33.2	19.1	2.42	1.132
Effects on property creation	6.5	21.2	15.1	28.9	28.3	2.51	1.278

efficacy SD = 1.249). Agroforestry for drought mitigation was rated as "very effective" by 30.5%, with a mean score of 2.61 (SD = 1.261). Rainwater collection received mixed reviews, with 35.1% describing it as "extremely effective" (mean score = 2.63, SD = 1.310). Evacuation preparations obtained an average score of 2.60, indicating modest efficacy (SD = 1.270). Alternative subsistence strategies received a 32.6% rating of "very effective" (mean score = 2.65, SD = 1.245). Infrastructure improvements were deemed "extremely effective" by 35.1%, with a mean score of 2.70 (SD = 1.252). Routine catastrophe evaluations were rated "very effective" by 32.9%, with a mean score of 2.53 (SD = 1.198).

4.2. Table 4: Results. The Munda community's varying perceptions of climate change, along with their distinct mitigation and adaptation methods, are shown in Table 4, according to the survey results. 40.3% agree climate change is "less serious," while 35.7% think it is "serious." Keep in mind that 10.8% consider it "not serious," and 3.4% consider it "very serious," with a mean score of 1.82 and a SD of 1.124 indicating moderate severity. For physical health, 32.6% think climate change has "very serious" implications, with a mean score of 2.59 and a SD of 1.248 indicating moderate impact and various opinions. The mean score of 2.47 and SD of 1.190 indicate moderate perceived influence and different perspectives, while 31.1% expect a "serious" impact on income sources. 28.3% of respondents consider actual assets like homes and land "serious" with a mean score of 2.30 and a SD of 1.255, indicating moderate influence and different perspectives. 28.6% consider climate change's impact on agricultural and animal productivity "serious" with a mean score of 2.32 and a SD of 1.218, indicating modest influence and various viewpoints. Most (33.2%) saw a "serious" impact on happiness, with a mean score of 2.42 and a SD of 1.132 indicating moderate perception and various opinions. 28.9% consider property creation "serious," with a mean score of 2.51 and a SD of 1.278 indicating moderate influence and multiple perspectives.

4.3. Table 5: Results. Table 5 illustrates the environmental challenges faced by the Munda community, including salinity intrusion (28.4%), flooding (19.8%), cyclones (20.8%), and riverbank erosion (24.3%). Droughts affect a smaller proportion (3.6%), with 3.2% reporting unspecified hazards. It also highlights emergency preparedness measures, which include provisions for nonelectrical communication (35.0%), flashlights (8.2%), first aid supplies (21.5%), and hygiene products (24.4%), ensuring at least 72 h worth of food and water. Vulnerable groups include the disabled (31.2%), elderly (29.0%), children (17.9%), and women (8.2%). Barriers to disaster adaptation include inadequate marketing facilities (7.8%), awareness (20.1%), education access (15.7%), water for irrigation (8.8%), education (26.0%), and agriculture extension services (15.4%). Recovery assistance emphasizes short-term (24.8%) and long-term (21.9%) mental health services, postdisaster risk mitigation (20.3%), survivor support groups (13.2%), and assistance with financial claims (19.9%).

4.4. Indigenous Community Socioeconomic Conditions. Age: 15, occupation: student, FGD no: 01, Tala Upazila, **one responded said:** *"In our country, they are socialized differently in terms of behavior, language, education, eating habits, and shortage of modern equipment and cash to play games. Therefore, they believe the government should assist Tala Upazila residents more. Additionally, the youth wish to obtain employment outside their society and avoid poverty."*

Age: 17, occupation: student, FGD no: 02, Koyra Upazila, **another respondent expressed:** *"We are a backward community, we don't have a good learning environment, we do not have a playground, I do not eat properly, I can not focus on studies, sometimes I go to work with my father but I do not get proper work, I do not go to school, I sit at home, we can not study so can not get a good job, if the government helps us specially then we will not be left behind."*

Age: 41, occupation: farmer, FGD no: 03, Koyra Upazila, **one responded said:** *"The majority of participants in focus groups were illiterate and subsisted on agriculture. Field workers earned between 150 and 200 takas per day, a pittance compared to family support. Due to illiteracy, unemployment, and ethnicity, this population has poor social status and limited access to contemporary technology."*

Age: 35, occupation: vanpooler, FGD no: 04, Tala Upazila, **another respondent expressed:** *"Most of the people in our neighborhood are uneducated, we make a living by farming and driving vans. Our daily wage is 200–250 takas, it becomes very difficult to run our family with this money. Can not get proper treatment, we have no good means of communication. There is no hospital in our neighborhood,*

Table 5: Munda community natural disaster adaptation and mitigation.

Statement	Variable	Frequency	Percentage (%)
The community is exposed to natural risks and has already experienced natural disasters	Floods	175	19.8
	Droughts	32	3.6
	Cyclone	184	20.8
	River bank erosion	215	24.3
	Salinity intrusion	252	28.4
	Other	28	3.2
Planned for the following, in the event of a natural disaster or emergency	A minimum of 72 h of water supply and food supply	274	35.0
	A mode of communication which is not dependent on electricity	86	11.0
	Enough flashlights or light sources	64	8.2
	Enough first aid kits	168	21.5
	Necessary hygiene and sanitation products	191	24.4
Certain groups in the community experience a greater impact compared to others, based on your observations	Older person	192	29.0
	Disabled person	206	31.2
	Children	118	17.9
	Women	54	8.2
	Others	13	2.0
Community disaster recovery challenges; perceived adaptation barriers	Lack of information on weather	206	26.0
	Lack of knowledge concerning appropriate adaptation	159	20.1
	Lack of marketing facilities	62	7.8
	High cost of improved crop varieties	49	6.2
	Lack of education	124	15.7
	Lack of water for irrigation	70	8.8
	Poor agriculture extension services	122	15.4
Assistance was provided to aid in your recovery from calamities	Short-term mental health services	182	24.8
	Long-term mental health services	161	21.9
	Disaster survivor's support groups	97	13.2
	Help reduce postdisaster risks	149	20.3
	Help with processing postdisaster financial claims	146	19.9

the dirt roads are very difficult when it rains. Can not send children to school due to lack, can not get enough food for three meals a day, sometimes have to go without food."

Age: 25, occupation: housewife, FGD no: 05, Koyra Upazila, **one responded said:** *"They confront natural disasters, unemployment, and healthcare. Women have fewer opportunities to earn 100–120 taka per day. There were no social security benefits from the government. Thus, they are combating several fatal maladies and have recently begun family planning"*

Age: 30, occupation: homemaker, FGD no: 06, Tala Upazila, **another respondent expressed:** *"Most of our women earn by doing agricultural work besides housework, our daily wage is 120–150 takas, women are discriminated in various ways. We do not have a good health care system; we have to face various adversities."*

4.5. The Impacts of Climate Change in Indigenous Community. Age: 47, occupation: farmer, FGD no: 07, Tala Upazila, **one responded said:** *"Due to climate change, our public life is constantly disrupted, temperature is increasing due to climate change, rainfall irregularity in summer, heavy rain in winter, cyclones are increasing due to natural disasters, extreme temperature, floods, salinity, river erosion are appearing. Due to presence of deep tube well water and increasing salinity we cannot drink deep tube well water. Water from deep tube wells should be heated and consumed."*

Age: 34, occupation: farmer, FGD no: 08, Koyra Upazila, **another respondent expressed:** *"Due to climate change, the cropping pattern is greatly affected, saline water enters the river and crops are not as good as before, fish production is not good, saline water is going underground, for which food water is becoming unfit for consumption. We are not getting fresh water; salt water is entering the river. Especially salinity is causing more crop damage during dry season. Due to salinity, the quality of crops is decreasing, due to low salinity during monsoon, the best time to grow crops in Koira upazila is June to October. Dry session (November to May) is suitable time to cultivate only Robin crops."*

Age: 50, occupation: housewife, FGD no: 09, Koyra Upazila, **one responded said:** *"The effects of climate change include rising temperatures, variable rainfall and extreme weather events such as floods, droughts, cyclones, sea level rise, salinity, and soil erosion. Climate change affects various sectors including crop agriculture, fisheries, livestock, infrastructure, industry, biodiversity, health, human settlement."*

Age: 38, occupation: homemaker, FGD no: 10, Tala Upazila, **another respondent expressed:** *"Farmers or agriculture sector is the most vulnerable due to climate change, we have two crops a year, aman, buro paddy, now due to salinity. The harvest is not good."*

Koyra and Tala Upazila residents adapted by changing their cropping patterns, introducing a mix cropping system, crab farming, improving household structure, increasing tree plantation, buffalo farming, improving educational and transportation systems, increasing women participation in business, changing professions, and establishing new educational institutions.

In our study, we discovered that women and older adults are more susceptible to the effects of climate change, which is consistent with other research indicating that while everyone is susceptible to the effects of natural disasters and climate change, women, children, and senior adults are more susceptible than others [19]. The results of the focus groups revealed that the socialization of the community is distinct from that of the rest of the population in our country in terms of behavior, language, educational system, and dietary customs, among other aspects. This behavior holds them back and prevents them from receiving the assistance they need from others in our country. Only 5% of the population is literate, a minuscule fraction of experienced individuals can compose written documents, and the majority of people are unaware of family planning. Therefore, it was challenging for them to support themselves. Their ability to better prepare has been significantly hampered by a lack of financial resources, which has impacted their social standing, access to modern technologies, and their desire to vote. In this regard, we also observed that women were in a vulnerable position. We also determined that they did not receive any social security benefits from the government. Many communities struggle with social status and educational attainment-related issues. During the FDGs with community members, the inadequacies of the current system were mentioned, but it was far more important to concentrate on how things could be improved. It should be emphasized that several initiatives for the improvement of the overall communal conditions in the region were identified. During discussions with local policymakers, measures that address or intend to address community issues were identified. Where new actions are required, the local policymakers have acknowledged their necessity.

5. Discussion

Due to its highly flat geography and status as a developing nation, Bangladesh is among the most vulnerable nations in the world to climate change. People who live along the coast employ a variety of climate change adaptation tactics to survive because the coastal districts are even more low-lying and susceptible to natural disasters. This section explains in great detail the climate change adaptation measures that the indigenous community has adopted. Following the age distribution, 43.4% of participants were between the ages of 26 and 40, which is less than in a previous study that had a similar focus on the Munda community [23]. This result conflicts with research by Bandyopadhyay et al. [24] and Kabir et al. [25], which indicated that 83.76% of the population was between the ages of 0 and 49. In our studies, the rate of schooling increased from the prior study. 45.2% of people were in elementary education and 5.8% were in secondary education [23, 26]. The study focused on the indigenous community, which had a 64.6% male to 35.45% female gender ratio, which is remarkably close to another study [1]. According to another survey, the majority of respondents live in kaccha houses, while the minority live in pacca houses [23]. In our study, participants were self-employed this finding is inconsistent with [23, 26, 27], where they found a significant number of the respondent Munda are day laborers and farmers. In 122 households, the monthly income ranged from 5000 to 6000 taka, which is similar to a prior survey [26]. The results were inconsistent with those of another study [25]. 17.5% of the population in the research region uses rainwater reservoirs, while the remainder population uses tube wells, which is comparable to the study [28]. Health services, energy, drinking water quality, cyclone shelter, et cetera, all have a significant impact on adaptive capability, but the availability of safe drinking water has the most concerned issue. 64.3% reported safe drinking water was scarce in the study area which is similar to a previous study [1]. The primary illnesses, according to the study's respondents, were diarrhea, chicken pox, waterborne illnesses, et cetera. They received their treatment at community clinics [25, 29]. There is evidence that mental disorders like depression, PTSD, and suicide attempts are strongly correlated with climate change. The results of this study demonstrate that there is a high risk of PTSD in people who have been exposed to life-threatening situations and many interviewees claimed to have mental health problems [30–32]. According to our findings, 70.5% of respondents felt somewhat prepared, compared to 16.3% who felt somewhat unprepared. Additionally, respondents said that both the local government and a Non-Government Organizations (NGOs) had developed a community disaster plan, which is consistent with previous studies [33, 34]. Findings indicated that the top three hazards in this region are cyclones, precipitation, and river erosion. Every year, there is significant damage to livelihood, crop output, lifestyle, disturbance of immovable infrastructure, and fatalities as a result of river erosion and cyclones. Similar outcomes were discovered in the research of Faisal et al. [29] and Hossain [35]. However, individuals who received assistance from Government Organizations (GOs) and NGOs reported feeling more assured in their managerial abilities, and the early warning system in the community was effective. The communities understood that the effects of climate change on human existence were very serious, having an impact on physical health, revenue sources, tangible assets, crop and animal output, productivity, and the creation of real estate, which is similar to the research of Faisal et al. [29]. Lack of information on weather and lack of knowledge concerning

appropriate adaptation are barriers to climate change adaptation [2].

Our study reveals that the indigenous community has distinct socialization patterns in terms of behavior, language (Mundari), education, eating habits (specifically the consumption of a local drink called Haria), and cultural performances (including singing, dancing, worship, caste system, marriage, drama, and clothing), as well as limited access to modern equipment and cash for playing games, which aligns with previous research finding [36].

The state of the Munda people is exceedingly delicate. This community experiences low social status and limited access to modern technologies due to factors such as illiteracy, unemployment, and ethnicity. However, the findings of this study indicate that the majority of participants in the focus groups relied on agriculture for their sustenance. Parallel results were found in the investigation of Huda [11]. Our study found that climate change has an impact on multiple sectors, such as crop agriculture, fisheries, livestock, infrastructure, industry, biodiversity, health, and human settlement. In line with previous research, the community has indicated that the erosion of livelihoods is caused by rising sea levels, extreme weather events (such as heavy rainfall, droughts, cyclones, and tornadoes), and shifting environmental patterns. These factors disrupt traditional economic activities like agriculture and fishing [15].

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Our findings corroborate a prior investigation, suggesting that the populace lacks a resilient healthcare infrastructure and is inadequately provided with healthcare services. The coastal regions of Bangladesh are susceptible to cyclones, droughts, extreme weather events, and particularly, salt. These calamities present a substantial peril to the native inhabitants residing in these regions, who are susceptible to a range of illnesses. Regrettably, these regions suffer from an insufficient healthcare infrastructure, characterized by a dearth of medical professionals and the remote location of hospitals. Consequently, the impacted persons are unable to obtain the essential medical care [14].

6. Strengths and Limitations

It is important to recognize several constraints of the present study. First, being a cross-sectional study, it collected information at a certain moment, which restricted its capacity to establish causal linkages. Furthermore, the study utilized a field survey method, which may have introduced sample problems due to its exclusive reliance on respondents who were interviewed in person by random selection. Consequently, the group of people might not accurately represent the entirety of Bangladesh's population. In addition, the study did not include an evaluation of the effectiveness of disaster adaption strategies and the level of risk involved, which could have provided more extensive findings. By establishing a uniform diagnostic threshold for disaster adaption strategy and risk quality, it becomes more feasible to accurately evaluate disaster risk. Moreover, the information was collected from individuals in two distinct areas, presenting challenges in estimating the findings to the broader community. Similarly, a significant limitation is the inherently limited sample size, which may limit the ability to generalize the findings to other locations due to contextual factors. Nevertheless, relying on the collected data, we are certain that this study provides an in-depth understanding of the elements that contribute to differences in the Munda community concerning the climate change adaptation strategy of the coastal indigenous population of Bangladesh.

7. Recommendations

The results of this study indicate that the current method for coordinating GOs and NGOs does not effectively facilitate coordination at the Upazila level during the post-disaster recovery phase. This underscores the necessity for a comprehensive and efficient coordination structure at the Upazila level. Consequently, this research proposes sustainable long-term strategies to eradicate these primary causes of vulnerabilities. There is a need to enhance the connection between the field of climate change science, climatic scenarios, and the utilization of knowledge. This relationship can facilitate

the development of adaptation plans that are grounded in the accurate understanding of climate change at both national and local levels.

8. Conclusion

The significance of indigenous methods and practices for climate change adaptation in Bangladesh's southern coastal regions has been investigated in this study. Few studies concurrently assessed the state of indigenous communities and practices for adaptation, although the fact that climate-induced disasters are common in developing countries like Bangladesh. Our analysis revealed that the two most important threats in the study area were cyclones, salinity intrusion, and riverbank erosion. Results also showed that this region is affected by diarrhea, chickenpox, and other waterborne diseases, with disabled people in the community being more affected than others. Additionally, it was found that locals are less equipped to handle disasters. The development of community-oriented health care centers, weather communication system improvements, alternative livelihood alternatives, and increased construction of cyclone shelters are the most crucial steps in the recovery process from disasters. Following the completion of this research, in-depth analyses of each coastal disaster can be conducted. This will allow researchers to fully comprehend the various scenarios and develop appropriate adaptation plans for underprivileged communities.

Data Availability Statement

Data were collected through face-to-face interviews and preserved by the corresponding author.

Conflicts of Interest

The authors declare no conflicts of interest.

Author Contributions

H.R. supported the search for relevant literature, collecting data, analyzing data, making figures and tables, and writing the first draft of the manuscript. N.F. and M.J.I. assisted with planning, writing, and editing the draft of the manuscript. MA. contributed to planning and writing the first draft of the manuscript. A.A.E. and M.J.I. helped write the research method. The version that was going to be distributed was finalized by all the authors. H.R. confirms that all of the mentioned authors meet the requirements for authorship.

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