

Exploring Gender, Ethnicity, and Livelihoods Nexus in Disaster-Prone Areas of Bangladesh

Abdul Alim Shaikh¹, Muhammad Ramzan Ali², Tushar Kanti Saha²,
Sk. Mohibullah³, Prapty Sarkar⁴, Palash Sarker⁵, Md. Kamruzzaman¹

¹Khulna University, Khulna, Bangladesh

²Christian Commission for Development in Bangladesh (CCDB), Dhaka, Bangladesh

³BRAC, Dhaka, Bangladesh

⁴Jagannath University, Dhaka, Bangladesh

⁵Practical Action, Dhaka, Bangladesh

Email: alim.shkh@gmail.com, muhammadramzanali.fes@gmail.com, sahatushar12@gmail.com, babu02ku@gmail.com, prapty56@gmail.com, ptlucky7@yahoo.co.in, mkzamanku@gmail.com

How to cite this paper: Shaikh, A. A., Ali, M. R., Saha, T. K., Mohibullah, S., Sarkar, P., Sarker, P., & Kamruzzaman, M. (2025). Exploring Gender, Ethnicity, and Livelihoods Nexus in Disaster-Prone Areas of Bangladesh. *American Journal of Climate Change*, 14, 544-564.

<https://doi.org/10.4236/ajcc.2025.143027>

Received: March 23, 2025

Accepted: August 5, 2025

Published: August 8, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Bangladesh, an emerging economy, is one of the most vulnerable countries to the impacts of climate change. Communities living in climate hotspots experience severe consequences, and different groups within these communities are vulnerable in distinct ways. Few studies have explored gender-based vulnerability and adaptive livelihoods among coastal communities in Bangladesh, often neglecting resilience in relation to gender, ethnicity, and social class. This study aims to fill that gap by identifying vulnerabilities, climate-smart livelihood options, and the challenges related to the inclusion of marginalized and ethnic minority groups. The study was conducted in Debhata Upazila, and Satkhira Sadar Upazila in the Satkhira district of Bangladesh, using a mixed-methods approach comprising both quantitative and qualitative assessments. A total of 140 household surveys, 14 focus group discussions (FGDs), and 14 key informant interviews (KIIs) were conducted. The analysis of socio-economic conditions—including factors such as education, family size, income, and occupation—revealed significant variations among rural, urban, and ethnic minority groups. The study shows that different groups in the area face disproportionate impacts of climate change. The severity of these impacts varies across the two areas, with soil salinity, heat stress, cyclones, and floods affecting them to different degrees. Saline-tolerant crop varieties and homestead gardening have emerged as common climate-smart practices. Women-led businesses, including poultry farming, tailoring, and cattle rearing, present diverse opportunities. Off-farm options such as handicrafts, technical skills, and small busi-

nesses offer potential avenues for economic diversification. Perceptions regarding the availability, access, and challenges of public services reveal regional disparities. Women's mobility also differs significantly across the two areas. Access to drinking water remains a critical issue, with challenges exacerbated by salinity intrusion, groundwater depletion, and the presence of arsenic. People from ethnic communities face limited access to resources, infrastructure, and social services, which hinders their ability to cope with climate-related shocks. The study highlights the importance of tailored training programs, the promotion of climate-resilient livelihoods, and equitable access to public services to improve the overall well-being of disadvantaged groups. Integrating these initiatives can foster a more inclusive approach to climate resilience, ensuring that no segment of the population is left behind.

Keywords

Climate Change, Gender, Livelihood, Resilience, Disaster

1. Introduction

Bangladesh, an emerging economy with an area of 148,460 km², a coastline of 580 km, and a population exceeding 165 million (Tiwari et al., 2024), is among the most vulnerable countries to the impacts of climate change (Bari et al., 2023; Mojid, 2020). According to the Global Climate Risk Index 2021, Bangladesh ranks as the 7th most climate-vulnerable country (Raihan et al., 2023; Islam et al., 2023). This vulnerability is exacerbated by a combination of geographic, environmental, and socio-economic factors, including its flat and low-lying topography, high population density, and weak socioeconomic structure (Roy et al., 2022). People living in climate hotspot areas suffer significantly due to frequent and extreme climatic events (Rahman & Rahman, 2015). The increasing intensity and frequency of floods, land erosion, heatwaves, tropical cyclones, intense rainfall, tornadoes, droughts, storm surges, and salinity intrusion make coastal communities particularly vulnerable (Ahmed & Kiester, 2021). The southwestern region of Bangladesh is especially climate-sensitive.

In the Global South, disparities in experiencing and managing the effects of climate change are deeply rooted in existing social and economic inequalities such as poverty, hunger, marginalization, unequal land ownership, and systemic injustice. These structural challenges heighten the vulnerability of poor and marginalized groups (Ahmed & Kiester, 2021). Satkhira, one of the most vulnerable districts in Bangladesh, has witnessed severe disruption in agricultural productivity due to salinity intrusion, particularly during the dry season (March–April), along with recurring droughts, floods, waterlogging, cyclones, and storm surges that undermine food security and livelihoods (Islamic Relief, 2020).

Gender is a critical dimension of vulnerability, influencing access to natural resources, knowledge, decision-making, and employment opportunities (Bari et al.,

2023). Participation from both men and women is essential for enhancing resilience through adaptive strategies (Bryan et al., 2021). In patriarchal societies, gender roles and expectations significantly affect access to resources such as land, food, climate information, and adaptation tools. In Bangladesh, as in many other developing nations, women often have limited access to these resources and minimal decision-making power. They typically bear the responsibility for household water collection, fuel gathering, and food security. Consequently, climate change disproportionately impacts women in coastal areas, whose labor roles are directly affected (Garai, 2016).

Bangladeshi women generally have lower educational attainment, limited access to financial resources, and own less than 10% of land. They also receive only 5% of agricultural extension services (Alston & Akhter, 2016). Equal access for women in agriculture could boost farm yields by 20% - 30% and potentially reduce global food insecurity by 12% - 17% (Ahmed & Kiester, 2021). Rising climate pressures and declining agricultural yields have driven male family members to migrate to urban areas for alternative livelihoods, leaving women with increased household and agricultural responsibilities (Ahmed et al., 2023).

Women's adaptive capacities are constrained by gendered expectations at both household and community levels, compounding the stress caused by shifting climatic conditions. Moreover, the inefficiency and inaccessibility of government support services hinder localized adaptation efforts (Ahmed & Kiester, 2021). Women also endure the consequences of salinized drinking water, often traveling long distances on foot to collect water for household use (Khalil et al., 2020). Restricted access to clean water, sanitation, health care, energy sources, and the burden of reproductive and caregiving responsibilities further amplify their vulnerability.

There is growing recognition of the importance of incorporating gender perspectives into climate change responses, acknowledging that men and women are affected differently due to existing societal inequalities in roles, responsibilities, and access to resources. Understanding gender-specific roles and challenges in climate adaptation is therefore essential for effective risk management. While some research has explored gender-based vulnerability and adaptive livelihoods, studies incorporating intersectionality—considering the combined influence of gender, ethnicity, social class, and other identity markers—are still limited. Furthermore, few studies address the vulnerabilities and adaptive challenges faced by marginalized and ethnic minority groups in this context. To fill this gap, the present study aims to investigate gender-based vulnerability and differences in adaptive livelihoods in disaster-prone areas through an intersectional lens, in order to better understand the strategic constraints faced by these communities.

Objectives

This research aims to explore the gender-based vulnerability and adaptive livelihood differences in disaster-prone areas from an intersectionality perspective. The specific objectives of the study are the following:

- To understand the present socio-economic and cultural context in the study area.
- To assess the climate change impact and vulnerabilities in the study area.
- To find out gender-responsive climate-smart livelihood opportunities in the study area.
- To explore the nature and accessibility of marginalized communities to essential public services.

2. Methods

The study area encompasses Debhata Upazila and Satkhira Sadar Upazila in the Satkhira district of Bangladesh, located in the southwestern coastal region of the country see **Figure 1**. Subarnabad and Ramnagar villages in Kulia Union of Debhata Upazila, along with Fingri and Jordia villages in Fingri Union of Satkhira Sadar Upazila, were selected based on their high vulnerability to climate change.

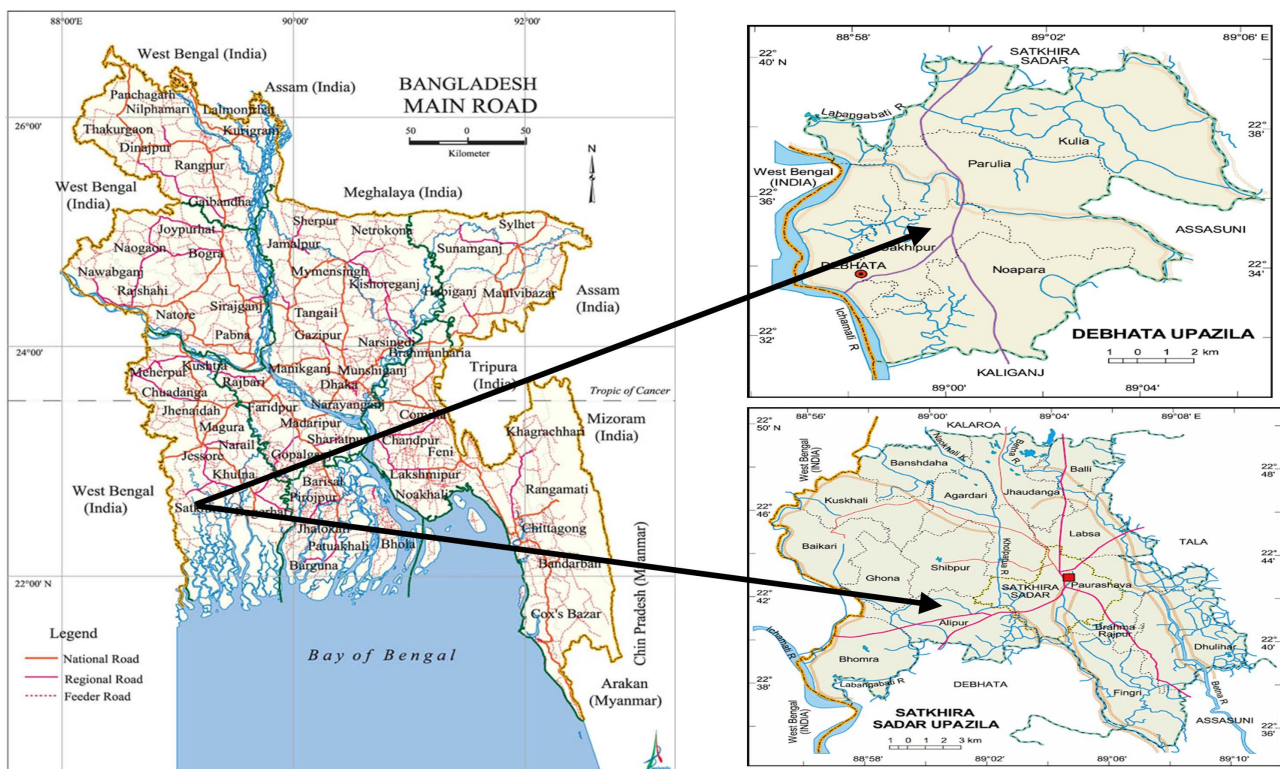


Figure 1. Map of Debhata Upazila and Satkhira Sadar Upazila of Satkhira Sadar district.

The study employed a mixed-methods approach, incorporating both qualitative and quantitative data collected from the selected locations. A random sampling technique was used to select households from each of the four villages. The respondent was selected based on their involvement in household decision making. One person from each household was selected for questionnaire survey. The study aimed to include approximately 50% female respondents among the total sample to ensure the representation of gender perspectives. Multiple data collection tools

were utilized to ensure comprehensive coverage, including semi-structured questionnaires, Focus Group Discussion (FGDs), and Key Informant Interviews (KIIs). Purposive sampling was employed to select key informants and Focus Group Discussion (FGD) participants. Primary data were collected directly from the field, while secondary data were obtained through an intensive review of relevant literature, including books, peer-reviewed journals, grey literature, and official websites. Based on a 90% confidence level and a 7% margin of error, the proposed sample size was 139. In total, 140 household surveys were conducted, with 50% from each Upazila. Additionally, 14 FGDs and 14 KIIs were conducted across the two study locations. The collected primary data were coded and entered into the Statistical Package for the Social Sciences (SPSS), Version 20.0. Data analysis was carried out using both SPSS and Microsoft Excel to ensure accuracy and rigor.

Table 1. Demographic information on the study area.

Characteristics (Measuring units)	Categories	Debhata Upazila %	Satkhira Sadar Upazila %
Sex	Male	57.14	51.6
	Female	42.86	48.4
Age (years)	20 - 30	35.7	30.6
	31 - 40	21.4	25.8
	41 - 50	18.6	25.8
	51 - 60	15.7	8.1
	>60	8.6	9.7
Level of Education (Total years of schooling)	Illiterate (0)	4.3	24.2
	Primary (1 - 5)	25.7	40.3
	Secondary (6 - 10)	52.9	29.0
	Higher secondary and above (>10)	17.1	6.5
Family size (No. of members)	Average	5.39	4.9
Monthly family income (BDT)	Average	10,094.3	11,976.29
Farm Size	Landless	1.4	3.2
	Marginal (0.002 - 0.02 ha)	22.9	51.6
	Small (0.021 - 0.99 ha)	74.3	40.3
	Medium (1 - 3 ha)	1.4	4.8
	Large (>3 ha)	0	0.0

3. Result and Discussion

3.1. Demographic Information

Table 1 presents the demographic and socio-economic characteristics of respond-

ents across the two study Upazilas. The proportion of female respondents was 42.86% in Debhata Upazila and 48.4% in Satkhira Sadar Upazila, while male respondents constituted 57.14% and 51.6%, respectively. Variations in average monthly household income were observed between the two areas, with Debhata reporting an average of BDT 10,094.30 and Satkhira Sadar BDT 11,976.29. The relatively higher average income in Satkhira Sadar is likely attributable to the availability of more diversified livelihood opportunities compared to Debhata.

Data from Focus Group Discussions (FGDs) and secondary literature indicate that, in Debhata Upazila, seven households belonging to the indigenous Munda community—comprising 21 males and 11 females—reside in Patakhali village under Parulia Union Parishad. The Munda population is also distributed across Shyamnagar, Debhata, and Tala Upazilas of the Satkhira district, located adjacent to the Sundarbans region. A substantial proportion (approximately 85%) of this community is engaged in agriculture for subsistence, with 50% reported as landless (Huda, 2021).

3.2. Occupation

The findings reveal that respondents are engaged in a diverse range of occupations, including farming, small business, day labor, healthcare services, van/rickshaw driving, fishing, poultry farming, teaching, handicraft production, garment work, and cattle rearing across the study areas, see **Figure 2**.

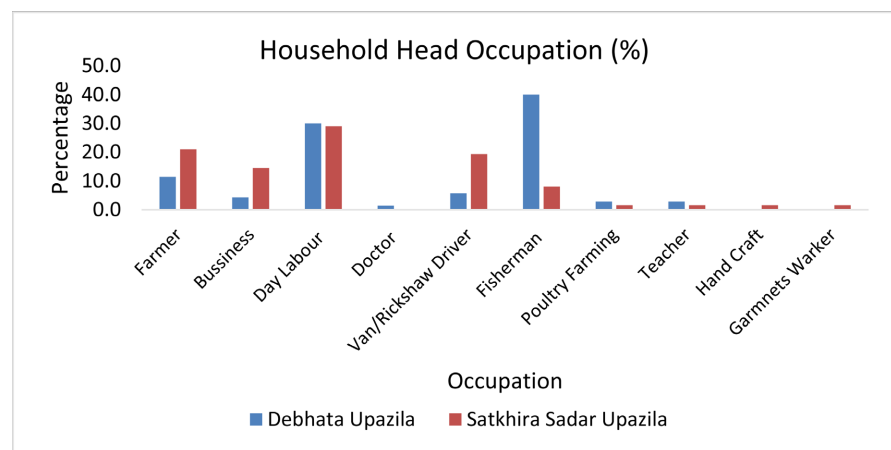


Figure 2. Household occupation.

The results showed that fishing is a significant occupation in Debhata Upazila (40%), while agricultural farming is more prominent in Satkhira Sadar Upazila (21%). Fishing plays a predominant role in Debhata due to the widespread presence of fish farms. However, respondents reported that fishing has become less profitable due to the low availability of quality fingerlings, increasing salinity, and the emergence of new aquatic diseases.

Day labor is a common occupation in both study areas. The majority of laborers work on other fish farms daily, performing tasks such as clearing weeds and earth-

works. A few women also work as day laborers alongside men. However, female laborers receive approximately half the wages of their male counterparts. In addition, some respondents mentioned suffering from skin diseases caused by prolonged exposure to saline water.

In Debhata Upazila, 11.4% of respondents were involved in agriculture, compared to 21% in Satkhira Sadar Upazila. Most farmers in both areas engage in homestead gardening, with some also cultivating rice, including saline-tolerant varieties. Observations revealed that agriculture on fish farm embankments is popular and profitable in neighboring villages; however, this practice is notably absent in the study areas. This absence can be attributed to the narrow width of the embankments and fragmented land ownership, which often leads to disagreements among multiple owners—some of whom support agricultural use while others oppose it.

Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) indicated that most women in Debhata Upazila are involved in livestock care and household-scale poultry farming, such as raising sheep, hens, ducks, and goats. Some women also engage in hand sewing. However, they reported that declining livelihood opportunities have led to a reduction in household income.

In Satkhira Sadar Upazila, where salinity levels are lower, people cultivate a variety of crops, including rice and vegetables. Women are also involved in agriculture—sometimes cultivating crops on their own land and at other times working as laborers on others' land. In addition, women participate in small-scale poultry farming. Respondents mentioned that they are engaged in various livelihood activities such as small businesses, shopkeeping, tailoring, and other trades. However, according to FGDs with a women's group in Fingri Village, participation in economic activities remains limited due to financial hardship and a lack of knowledge or technical skills. In both Debhata and Satkhira Sadar Upazilas, most women are responsible for fetching water and caring for family members.

According to FGDs, the Rishi Dalit community in Debhata Upazila is primarily engaged in day labor, leather-related work, handicrafts, and the production of clay-based materials. The livelihood of the Munda community depends largely on wages earned from working in shrimp and crab farms, paddy fields, or brick kilns. They are also involved in extracting forest resources from the Sundarbans, including tree felling, honey collection, and fishing. Many members of the Munda community live in poverty in Shyamnagar, with monthly incomes below US\$100. Approximately 70% of them rely on agriculture and fishing as their primary sources of income, supplemented by occasional daily wage labor (Rahman et al., 2023). Due to the gradual decline in available income-generating opportunities, dependency on day labor is increasing among these ethnic minority groups.

3.3. Climate Change Effects

Climate change-induced effects are prevalent both on land and in water throughout the coastal region of Bangladesh (Roy et al., 2022). Satkhira, a low-lying coastal

area, is especially vulnerable to climate change and natural disasters due to rising temperatures and sea levels. This vulnerability leads to increased salinity in soil and water, which affects agriculture and freshwater resources, along with changes in precipitation patterns, heat waves, and impacts on ecosystems.

The study identified several climate change effects experienced by the respondents, including soil and water salinity, hailstorms, riverbank erosion, heat stress, cyclones, floods, drought, waterlogging, the spread of diseases and pests, and storm surges. The findings highlighted the potential impacts of climate change and their variations across the study areas, see **Figure 3**.

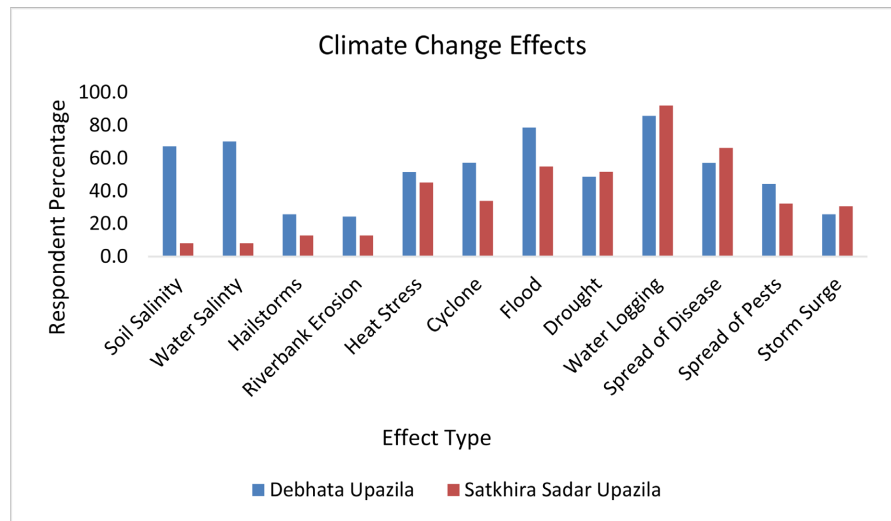


Figure 3. Climate change effects.

Respondents from Debhata Upazila reported that soil and water salinity, cyclones, excessive rainfall, floods, drought, waterlogging, and the spread of diseases and pests are the most pressing climate change effects in their area. Meanwhile, respondents from Satkhira Sadar Upazila identified floods, waterlogging, drought, heat stress, and the spread of diseases and pests as the major climate change challenges they face. According to key informant interviews (KII) and focus group discussions (FGD), the presence of arsenic in drinking water is a significant threat in the study area. The study also found that the Munda community was severely affected by the destructive impact of Super Cyclone Amphan in 2020. Their lives and livelihoods have been adversely impacted by cyclones, salinity, riverbank erosion, and heat stress. Since they are primarily involved in agriculture and day labor, such hazards affect them profoundly. Additionally, Dalit communities are among the most vulnerable due to the impacts of climate change.

3.4. Extent of the Severity of Climate Change Effects

The figure illustrates the perceived severity of climate change effects in terms of high, medium, and low impact categories for various climate change impact types across Debhata Upazila, and Satkhira Sadar Upazila. In Debhata Upazila, re-

spondents perceive high severity for water salinity (54.3%) followed and soil salinity (50.0%), emphasizing the significant impact of salinization. Most of the areas of Debhata are covered by shrimp farming. In Debhata Upazila, the respondents also mentioned: heat stress (45.7%), cyclone (37.1%), and flood (31.4%) are significant climate change effects in the area. The respondent of Satkhira Sadar Upazila reported moderate to low severity for soil salinity, see **Figure 4**.

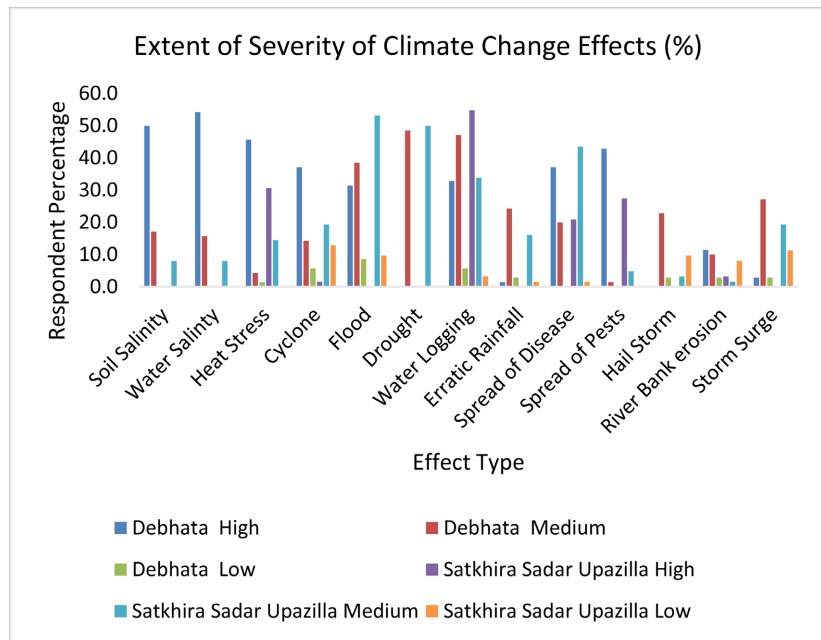


Figure 4. Extent of severity of climate change effects.

Water logging is considered highly severe at Satkhira Sadar Upazila (54.8% of respondents reported), followed by floods (51.5%). Erratic rainfall is noted with varying severity levels all over both areas of Satkhira.

3.5. Climate Change Impact and Vulnerability

The impacts of climate change in both Satkhira Sadar, and Debhata Upazila have been illustrated here based on Household Survey, FGD, and KII.

3.5.1. Water and Sanitation

People in both study areas face an acute safe drinking water crisis. They lack access to safe drinking water, hygienic toilets, and adequate hygiene facilities. About 54% of respondents from Debhata Upazila and 37% from Satkhira Sadar Upazila reported a serious shortage of safe water in their areas due to salinity. Increasing surface water salinity limits the availability of freshwater, creating a severe potable water crisis. This forces people to consume saline water, which leads to various health problems (Nasreen, 2022).

In Debhata Upazila, the primary source of drinking water is deep tube wells; however, their number is minimal and insufficient to meet local demand. Among the existing tube wells, 50% - 60% are unusable due to non-functionality, unpleas-

ant odor and taste, and the presence of arsenic. People experience severe drinking water shortages starting three months before the monsoon season due to shrinking water sources and prolonged dry spells, resulting in reduced water consumption during the dry season. During cyclones and associated storm surges, drinking water becomes scarce due to contamination, damage to water sources, and saline water intrusion into ponds. Additionally, people—mainly women—spend over two hours daily fetching potable water from distances ranging between 0.5 to 2 kilometers. They often stand in queues for hours under the scorching sun, just to obtain a single pitcher of water.

The study also found that health risks in the study areas have increased by 40% due to climate change. According to key informant interviews (KII) with health experts, consuming saline-contaminated water and using saline water for daily household activities cause various health complications, including hypertension, skin diseases, cholera, diarrhea, anemia, premature deliveries, miscarriages, and other reproductive health issues in women. Experts also reported high levels of iron and arsenic in the water of Satkhira Sadar and Debhata, which contribute to frequent illnesses in these areas.

About 58% of respondents lack proper sanitation facilities, with only 42% of households having access to adequate sanitation. Poor hygiene practices prevail due to a lack of awareness, insufficient facilities, and economic constraints. Open defecation contaminates surface water, increasing the risk of fatal waterborne diseases. The chief engineer of the Department of Public Health Engineering (DPHE) acknowledged witnessing the harsh realities and challenges people face in accessing safe drinking water and proper sanitation. He emphasized the need for proper planning, program design, and effective implementation to address water and sanitation issues.

Key informant interviews with a Dalit NGO revealed that about 4000 people from the Dalit community across 13 villages in three unions of Satkhira Sadar Upazila are deprived of potable water. Among the 731 families in these villages, 390 have access to potable water, while the remaining 341 are forced to consume water contaminated with arsenic and iron. According to the Satkhira District Department of Public Health Engineering, salinity levels in most coastal district areas reach 4400 milligrams per liter (mg/L), far exceeding the permissible threshold of 1000 mg/L.

3.5.2. Agriculture Sector

The agricultural sector is facing severe challenges due to the impacts of climate change, particularly salinity (Roy et al., 2022). According to the study, 25.7% of respondents from Debhata Upazila reported a significant decrease in irrigation water availability, while 20% noted a moderate decrease. About 28.6% of respondents in Debhata Upazila and 12.9% in Satkhira Sadar Upazila stated that cultivable land is shrinking as a result of climate change. Additionally, over one million hectares of arable land in the region have been affected by saltwater intrusion (Roy et al., 2022). Crop production has also moderately declined, as reported by 24.1% of

respondents in Debhata and 21% in Satkhira Sadar Upazila. Respondents from Satkhira Sadar Upazila mentioned that irrigation water availability is rapidly decreasing due to the falling groundwater table. The Additional Agriculture Officer of Satkhira Sadar noted that during the Boro season (summer), the groundwater level drops significantly, preventing farmers from properly irrigating Boro rice fields, which in turn reduces crop yields.

Focus Group Discussions (FGDs) revealed that cyclones have consistently damaged both field crops and homestead gardens. Such cyclones occur almost every year in the study areas. Boro rice crops are sometimes affected by Kalboishaki (nor'westers). In both Satkhira Sadar and Debhata Upazilas, the primary causes of waterlogging are river siltation, excessive rainfall, and tidal surges. According to the Additional Agriculture Officer of Satkhira Sadar, approximately 200 hectares of cultivable land are currently waterlogged due to these factors.

Soil and water salinity levels are rising alarmingly in the study area, making it increasingly difficult for farmers to grow rice seedlings during the Boro season. Farmers rely on deep groundwater for irrigation, a practice that may lead to long-term environmental degradation. Furthermore, insect pest infestations have increased in the area. Notably, BRRI dhan28 is now at risk of extinction in Satkhira Sadar due to a widespread blast disease infestation.

3.5.3. Fisheries Sector

The fisheries sector is significantly affected by climate change, facing numerous challenges that threaten its sustainability. During cyclones, fish farms suffer severe losses due to the breaching of dikes. Waterlogging also causes some farms to become submerged, resulting in the loss of fish stocks (Roy et al., 2022). In the rainy season, many fish farms are inundated, leading to further production losses.

Local residents reported experiencing unusually high temperatures between April and July in recent years. Rising temperatures have negatively impacted fish fingerlings, which are not growing properly. The mortality rate of fingerlings is increasing, and bacterial growth is accelerating in the warmer water. Consequently, bacterial diseases among fish are becoming more prevalent under these conditions.

Fishing is highly dependent on seasonality; however, erratic rainfall patterns have disrupted farming cycles. Farmers are often unable to begin fish farming at the appropriate time due to the lack of timely water availability and declining water quality—particularly for shrimp farming. Erratic rainfall also causes fluctuations in salinity levels in both river and farm waters, which hampers fish growth and, in some cases, leads to fish mortality.

3.5.4. Livestock Sector

Climate change also significantly affects livestock in the study area. Cyclones often destroy cattle and poultry shelters, and in some cases, cattle, goats, and poultry die during these events (Roy et al., 2022). During periods of waterlogging, livestock face greater difficulties due to the lack of feed and grazing land. Disease out-

breaks among livestock are also on the rise.

Saline water has harmful effects on livestock health. Cattle and goats frequently suffer from diarrhea and other illnesses caused by the consumption of saline water. Md. Emdadul Haque, a village livestock doctor in Fingri village, noted that livestock often develop diarrhea after grazing in areas where they ingest saline water. Additionally, saline water degrades grazing land, further limiting access to fodder.

Lumpy Skin Disease (LSD) is increasingly affecting the livestock population in the community. Vector-borne diseases are also becoming more prevalent, further compromising animal health. The rise in salinity has led to a significant decline in fodder production and a scarcity of freshwater for livestock, exacerbating their vulnerability.

3.5.5. Women

Climate change has had a particularly severe impact on women in the study areas, with 90% of women reporting significant disruptions to their lives and sources of income. Additionally, 84% of women faced challenges in cooking due to the scarcity of fuelwood, especially during and after flooding events (Nasreen, 2022). Many women are engaged in fishing activities, which require them to stay in saline water—posing serious health risks, particularly to their reproductive health. Prolonged exposure often results in skin diseases, limiting their ability to engage in horticulture, livestock rearing, and other income-generating activities. As fish production continues to decline, women's work opportunities in this sector are also diminishing. Consequently, many have shifted to alternative livelihoods such as livestock rearing, poultry farming, and sewing.

Climate change and related disasters have also intensified social vulnerabilities. Economic hardship compels some families to marry off their underage daughters to reduce the number of dependents. The study found that the early marriage rate has risen to approximately 45% in the area. Women bear the primary responsibility for collecting potable water from distant sources, which exposes them to risks of harassment, assault, and physical illness. Waterborne diseases are also prevalent during disasters and periods of high salinity, affecting women disproportionately with health issues such as irregular menstruation, gestational hypertension, preeclampsia, miscarriages, and diarrhea (Nasreen, 2022). Furthermore, the study indicates a moderate rise in domestic violence in the study areas, with a reported increase of 19%.

3.5.6. Ethnic Minor Community

Ethnic minority communities often bear a disproportionate burden of climate change impacts due to pre-existing social and economic vulnerabilities. Climate-induced events—such as floods, droughts, and storms—exacerbate existing inequalities, displace communities, and disrupt traditional ways of life. Limited access to resources, infrastructure, and social services hinders these communities' capacity to cope with and recover from climate-related shocks. A 51-year-

old van driver from the Rishi community lamented, “We have no income opportunity here; every day, my family faces challenges, and nobody cares that we are dying.”

The Munda community in the study area is particularly affected by climatic hazards such as salinity intrusion, floods, and droughts. They suffer from an acute scarcity of safe drinking water and a lack of hygiene awareness and access to clean water sources (Rahman et al., 2023). In the absence of proper facilities, they often rely on unsafe and unhygienic pond water, which significantly increases the risk of waterborne diseases, including diarrhea, scabies, dengue, and other infections. Diarrhea is especially prevalent, resulting from exposure to germs and worms found in contaminated water. Prolonged consumption of such water has also led to inflammatory conditions, eye infections, and kidney damage. The community’s only available safe drinking water sources are located at great distances, requiring either travel or purchase. While a portion of the Munda population has received support from local NGOs in the form of purified water, the supply remains insufficient to meet the needs of the entire community.

In the Dalit community, one of the most pressing challenges is the loss of income and employment following climate-related disasters. Many members engage in traditional occupations that are now threatened due to outdated techniques, rising heat stress, and declining work hours. Consequently, Dalit households are increasingly dependent on agriculture and day labor, but these opportunities are also shrinking due to waterlogging and reduced rice production. Cyclones frequently damage their homes and household assets, exacerbated by inadequate infrastructure and poor housing conditions.

According to existing literature, 341 Dalit families in Agardi, Balli, and Zhaodanga unions of Satkhira Sadar Upazila are forced to drink arsenic- and iron-contaminated water. These communities also struggle with limited access to hygienic sanitation facilities. On average, 5 - 10 families rely on a single tubewell, intensifying the water crisis. Poor drainage infrastructure further increases health risks. Dalit women are particularly affected, as they bear the burden of collecting water. Many suffer from diseases such as diarrhea, scabies, and dengue, and face serious sanitation-related challenges. Women and children in villages like Babulia Rishipara, Indira Goldarpara, Chuparia Rishipara, Ramdanga Bhagwanipara, and Kasimpur Hajampara in Agardari Union lack access to safe drinking water, hygienic toilets, and basic hygiene facilities. Similarly, residents of Kathaltala, Rishipara, Mukundpur, Karkarpara, and Raipur Bhagawanipara in Bolli Union suffer from various diseases due to the absence of safe water and sanitation services.

3.5.7. Youth Group

Climate change poses distinct and growing challenges for youth, severely affecting both their present circumstances and future opportunities in the study areas. Changing climatic conditions disrupt educational systems, particularly through extreme weather events that damage school infrastructure and limit access. A 16-year-old girl from Debhata expressed her concerns, stating, “My father’s economic

conditions are getting worse day by day, and it is hampering my overall life; I do not know how many days I will continue my studies.” Students increasingly struggle to attend school due to frequent heatwaves and suffer from waterborne and skin diseases resulting from the consumption of saline water. The effects of climate change—such as household income loss, educational disruption, early marriage, and increased school dropout rates—are becoming more pronounced among youth (Nasreen, 2022).

According to a focus group discussion (FGD) with local youth, frequent waterlogging prevents many students from attending school regularly, contributing to growing levels of depression and psychological stress among students (Roy et al., 2022). Boys, in particular, are reportedly more vulnerable to developing addictions to drugs and online gaming as coping mechanisms. This has led to a gradual erosion of interest in formal education among both boys and girls. Economic hardship often compels children to engage in manual labor or become subject to early marriages. In parallel, the overall quality of their nutrition is declining, affecting their physical and cognitive development. Furthermore, during prolonged waterlogging, fear of snake encounters adds to the physical and psychological stress experienced by young people.

3.5.8. Disaster Management Committees (DMCs)

The Union Disaster Management Committee (UDMC) is the lowest administrative tier of government mandated to manage and coordinate disaster preparedness and response efforts at the local level. Both UDMCs and Municipal Disaster Management Committees (MDMCs) are tasked with implementing a range of community-focused initiatives, including the establishment of early warning systems, formulation of evacuation plans, execution of mock drills, and preparation of pre- and post-disaster management strategies. These efforts are often carried out in collaboration with NGOs and local communities to raise awareness and ensure inclusive participation in disaster risk reduction.

However, findings from Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) with the Kulia UDMC of Debhata Upazila suggest that the operational effectiveness of these committees remains inadequate. The selection process for committee members is often influenced by favoritism and political bias, undermining representativeness and legitimacy. A prevailing lack of volunteer spirit among members further weakens committee engagement. Many members have limited understanding of their roles and responsibilities, and regular bi-monthly meetings are seldom held unless prompted by NGOs. The committees also face a shortage of essential disaster response equipment, such as hand microphones, first aid kits, and identification vests. Notably, youth participation in these committees is minimal, which limits intergenerational engagement and the integration of innovative perspectives in disaster governance.

3.6. Climate-Smart Agriculture in the Study Area

Implementing Climate-Smart Agriculture (CSA) practices offers considerable

promise for enhancing food security by boosting agricultural productivity, increasing household incomes, and raising per capita food expenditure. However, adoption levels among farmers differ, largely shaped by their perceptions of the complexity, feasibility, and benefits associated with these practices (Hasan et al., 2018). Household survey findings reveal that a significant majority of respondents (61.4%) have adopted saline-tolerant rice varieties as a strategic response to salinity intrusion, see **Figure 5**. These varieties—such as BINA-8, BRRI Dhan-50, and BRRI Dhan-38—have proven effective in increasing yields and expanding cultivation areas in saline-prone zones (Roy et al., 2022).

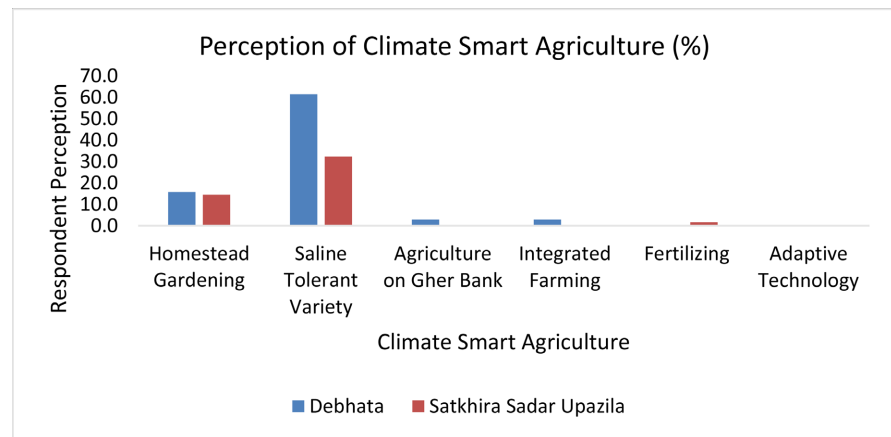


Figure 5. Climate smart agriculture in the study area.

Homestead gardening emerged as another vital adaptive strategy, particularly among women, who often face restricted access to formal income-generating opportunities. Female respondents emphasized that homestead gardening enables them to contribute to family nutrition and income with relatively low labor and resource input. Additionally, several respondents noted the potential of cultivating vegetables along the embankments of fish farms—areas that experience reduced salinity during the monsoon—as an alternative livelihood strategy. Crops such as pumpkin, okra, cucumber, and tomatoes were identified as highly suitable for such environments (Roy et al., 2022).

Integrated farming systems were also cited as promising CSA approaches, allowing farmers to diversify production and enhance resource efficiency. The adoption of these practices is often facilitated when they are aligned with local needs, environmentally appropriate, and supported by institutional frameworks and capacity-building initiatives (Hasan et al., 2018).

3.7. Women-Led Business Opportunities

Women-led businesses make substantial contributions to the global economy, with their numbers steadily increasing. In both developed and developing countries, women-led enterprises account for over 50 percent of Gross Domestic Product (GDP). Recognizing women's participation in business not only as a significant economic driver but also as a powerful social catalyst is crucial for promoting

inclusive and sustainable economic growth. The potential for women-led businesses in the study area is shown in **Figure 6**.

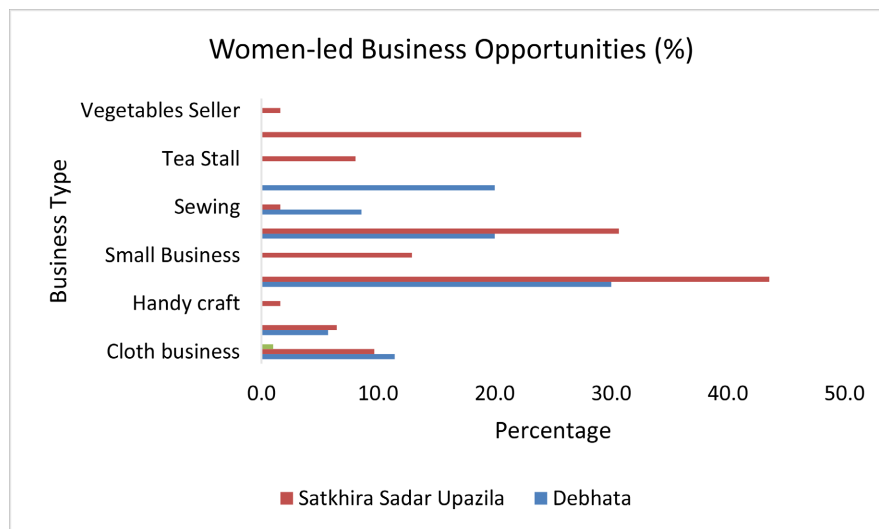


Figure 6. Women-led business opportunities.

In disaster-prone areas, women engage in various profitable income-generating activities, including floating vegetable production, vermicomposting, homestead gardening, fish farming, livestock care, fishing, and crop cultivation (Nasreen, 2022). Poultry farming stands out as a prominent opportunity, particularly in Satkhira Sadar Upazila, where a substantial number of respondents identified it as a key income source, followed closely by Debhata. However, many women reported limited financial capacity to expand their farming activities. Tailoring is another common enterprise, with 30.6% of respondents in Satkhira Sadar Upazila and a significant portion in Debhata involved in or interested in this trade. They emphasized the need for training and improved market linkages to enhance their engagement in tailoring. Additionally, cattle rearing in Satkhira Sadar Upazila presents a promising avenue for women-led businesses, provided they receive adequate training and financial support. Opportunities also exist in handicrafts, such as paper bag making and producing bamboo or jute products. This diverse range of women-led businesses highlights the importance of tailored support and interventions to promote economic empowerment, considering the unique preferences and resource availability in each area.

3.8. Access to Public Services in the Study Area

Social safety nets are vital for vulnerable populations during climate shocks (UNSSC, 2023). The data on public service perceptions in Debhata Upazila and Satkhira Sadar Upazila provide important insights into how the local population views the accessibility and availability of various social welfare programs. The percentages represent the proportion of respondents who recognize the presence of these services, see **Figure 7**.

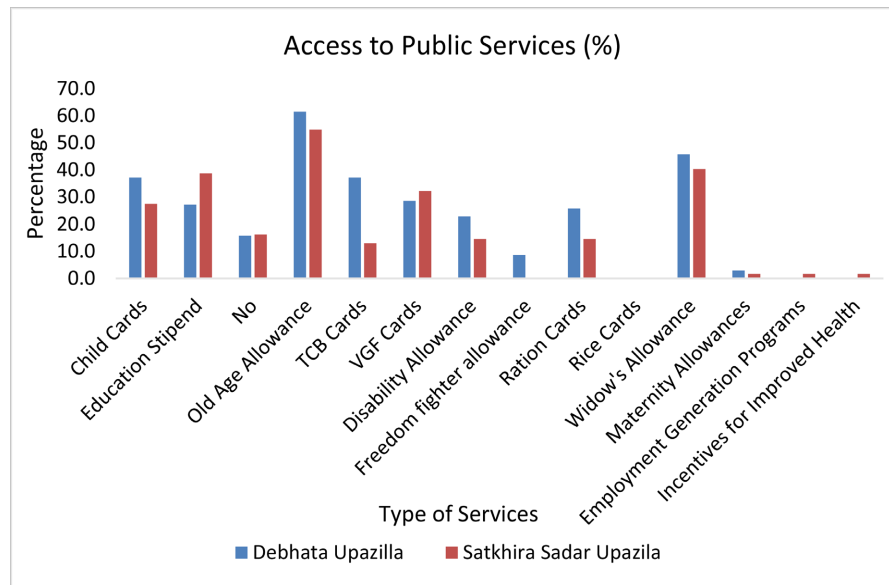


Figure 7. Access to public service in the study area.

There is a significant gap in employment generation programs in Debhata Upazilla. According to a household survey, only 47.1% of respondents in Debhata reported access to public services. In contrast, Satkhira Sadar Upazilla shows a higher percentage, with 53.0% of people having access to these services, indicating relatively better accessibility in Satkhira Sadar. While the findings suggest that people in the study areas are generally aware of the availability of public services, survey respondents and participants in FGDs and KIIs reported several challenges in accessing them. The most commonly mentioned issue is the lengthy process of obtaining services from the Union Parishad (UP), which often requires multiple visits and contacting UP members. There are also concerns about the fairness of beneficiary selection, with some UP members reportedly demanding illegal payments in exchange for services. Additionally, the limited number of available service cards does not meet the actual demand. Due to lack of awareness, particularly women are vulnerable to fraud related to mobile money withdrawals via Bkash or Nagad. Furthermore, poor women's access to relief in post-disaster situations has not received adequate attention (Nasreen, 2022).

The Munda Community has long experienced hardship due to unjust power dynamics, unequal access to resources, and unfair challenges. Being an ethnic minority is linked to less access to current information on hazards and less financing for related assistance. It may be brought on by unequal and limited access to resources and public services, cultural differences, and the marginalization frequently connected to racial inequities in social, economic, and political contexts (Rahman et al., 2023). Access to public services becomes more challenging due to the lack of representatives in local government bodies. To ensure that an individual is fit for service, numerous procedures must be upheld. They are financially disadvantaged to the extent that they cannot remit any funds necessary for public services.

3.9. Improving Access to Drinking Water

This study shows that access to drinking water in Satkhira remains a critical concern, particularly in rural areas and vulnerable communities. The district faces challenges such as salinity intrusion, groundwater depletion, arsenic, and inadequate infrastructure, impacting the availability of clean and safe water sources. Climate change-induced events, including cyclones and floods, further exacerbate the issue by disrupting existing water sources and contaminating supplies.

The majority of respondents use a common deep well for drinking water. According to FGD, few members of the community store rainwater for cooking purposes. They also mentioned that sometimes they face problems when the tube well becomes dysfunctional and need to travel long distance to collect water. The arsenic problem is also severe in the study area. Most of the respondent mentioned that they had to travel kilometers to collect drinking water, see **Figure 8**.

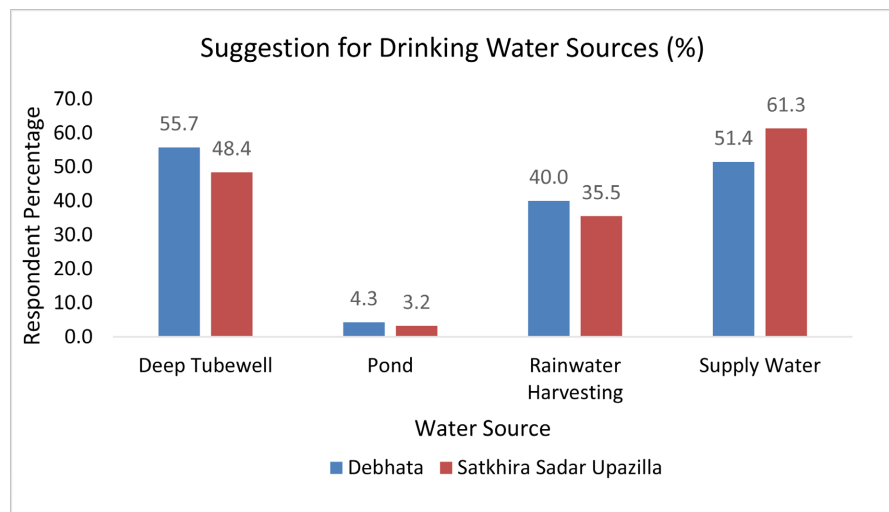


Figure 8. Drinking water sources.

FGD participants of Satkhira Sadar Upazila mentioned that they are collecting drinking water from common sources installed at the Union parishad premises by DPHE. In Debhata Upazila, 55.7% of respondents mentioned that adequate deep tube wells would be the potential water source to reduce the current drinking water crises. Rainwater harvesting (40%) and supplying water from a water plant (51.4%) also potentially reduce the problems. In Satkhira Sadar Upazila, the respondents mentioned suitable drinking water sources such as deep tube wells (48.4%), rainwater harvesting (35.5%), and supply water (61.3%). They need diverse sources for water sustainability and reducing the problem (Roy et al., 2022).

Socioeconomic disparities contribute to differential access, with marginalized groups often facing greater obstacles. Contamination from pollutants, limited awareness about water purification, and insufficient government initiatives also contribute to the overall precarious status of drinking water access in the study areas.

4. Conclusion

This study offers a nuanced understanding of the socioeconomic and climate-related complexities faced by the communities in the studied areas. It underscores the critical need for tailored interventions, region-specific strategies, and gender-responsive approaches to effectively address challenges, enhance economic resilience, and safeguard community well-being amid climate change impacts. The escalating severity of climate-induced effects—such as soil and water salinity, increased frequency of cyclones and floods, waterlogging, and the spread of diseases and pests—demands a holistic, localized approach to building resilience. Key adaptive measures include promoting saline-tolerant crop varieties, advancing climate-smart livelihood options, strengthening infrastructure to withstand natural disasters, and improving extension services. Solutions must be customized to the distinct challenges and opportunities within each region, ensuring relevance and effectiveness.

The research highlights the pivotal role of women in climate-smart agriculture and local economic activities. Women-led enterprises—such as poultry farming, tailoring, and cattle rearing—serve not only to diversify income sources but also to fortify community resilience against climate shocks. Future initiatives must prioritize the empowerment of women by amplifying their participation in decision-making and recognizing their contributions to sustainable livelihoods. Additionally, disparities in awareness and access to public services, especially social welfare programs, point to the urgent need for targeted interventions to bridge these gaps. Ensuring reliable access to safe drinking water and adequate WASH facilities is essential. A concerted effort to provide equitable access to vital services will help mitigate the compounded vulnerabilities exacerbated by climate change.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- (2020). *Islamic Relief*.
<https://islamic-relief.org/news/people-in-satkhira-bangladesh-cultivate-thriving-livelihoods-despite-climate-change-challenges>
- Ahmed, S., & Kiester, E. (2021). Do Gender Differences Lead to Unequal Access to Climate Adaptation Strategies in an Agrarian Context? Perceptions from Coastal Bangladesh. *Local Environment*, 26, 650-665. <https://doi.org/10.1080/13549839.2021.1916901>
- Ahmed, S., Eklund, E., & Kiester, E. (2023). Adaptation Outcomes in Climate-Vulnerable Locations: Understanding How Short-Term Climate Actions Exacerbated Existing Gender Inequities in Coastal Bangladesh. *Journal of Environmental Planning and Management*, 66, 2691-2712. <https://doi.org/10.1080/09640568.2022.2082928>
- Alston, M., & Akhter, B. (2016). Gender and Food Security in Bangladesh: The Impact of Climate Change. *Gender, Place & Culture*, 23, 1450-1464. <https://doi.org/10.1080/0966369x.2016.1204997>
- Bari, A. B. M. M., Intesar, A., Mamun, A. A., Debnath, B., Islam, A. R. M. T., Alam, G. M.

- M. et al. (2023). Gender-Based Vulnerability and Adaptive Capacity in the Disaster-Prone Coastal Areas from an Intersectionality Perspective. *Climate Risk Management*, 43, Article ID: 100581. <https://doi.org/10.1016/j.crm.2023.100581>
- Bryan, E., Kato, E., & Bernier, Q. (2021). Gender Differences in Awareness and Adoption of Climate-Smart Agriculture Practices in Bangladesh. In J. Eastin, & K. Dupuy (Eds.), *Gender, climate change and livelihoods: vulnerabilities and adaptations* (pp. 123-142). CABI. <https://doi.org/10.1079/9781789247053.0010>
- Garai, J. (2016). Gender Specific Vulnerability in Climate Change and Possible Sustainable Livelihoods of Coastal People. A Case from Bangladesh. *Revista de Gestão Costeira Integrada*, 16, 79-88. <https://doi.org/10.5894/rgci656>
- Hasan, M. K., Desiere, S., D'Haese, M., & Kumar, L. (2018). Impact of Climate-Smart Agriculture Adoption on the Food Security of Coastal Farmers in Bangladesh. *Food Security*, 10, 1073-1088. <https://doi.org/10.1007/s12571-018-0824-1>
- Huda, M. S. (2021). *The Mundas: An Ethnic Community in the South-West Coastal Region of Bangladesh (Buno/Kuli/Sarna/Horoko, Indigenous People during the British Period Coming from Ranchi)*. Cambridge University Press. <https://doi.org/10.33774/coe-2021-m0qws>
- Islam, R., Ahmed, R., Dey, B., Haque, M. S., Aktar, S., Bhuiyan, M. S. et al. (2023). Salinity Hazard Drives the Alteration of Occupation, Land Use and Ecosystem Service in the Coastal Areas: Evidence from the South-Western Coastal Region of Bangladesh. *Heliyon*, 9, e18512. <https://doi.org/10.1016/j.heliyon.2023.e18512>
- Khalil, M. B., Jacobs, B. C., McKenna, K., & Kuruppu, N. (2020). Female Contribution to Grassroots Innovation for Climate Change Adaptation in Bangladesh. *Climate and Development*, 12, 664-676. <https://doi.org/10.1080/17565529.2019.1676188>
- Mojid, M. A. (2020). Climate Change-Induced Challenges to Sustainable Development in Bangladesh. *IOP Conference Series: Earth and Environmental Science*, 423, Article ID: 012001. <https://doi.org/10.1088/1755-1315/423/1/012001>
- Nasreen, M. (2022). *Gender and Disaster in Bangladesh*. Oxford Research Encyclopedia of Natural Hazard Science. <https://doi.org/10.1093/acrefore/9780199389407.013.380>
- Rahman, M. M., Tasnim, F., Uddin, A., Chayan, M. S. I., Arif, M. S. I., Asikunnaby, et al. (2023). Assessing Vulnerability in Ethnic Munda Community: A Study on a Cyclone-Prone Area of Bangladesh. *International Journal of Disaster Risk Reduction*, 95, Article ID: 103884. <https://doi.org/10.1016/j.ijdrr.2023.103884>
- Rahman, S., & Rahman, M. A. (2015). Climate Extremes and Challenges to Infrastructure Development in Coastal Cities in Bangladesh. *Weather and Climate Extremes*, 7, 96-108. <https://doi.org/10.1016/j.wace.2014.07.004>
- Raihan, A., Muhtasim, D. A., Farhana, S., Pavel, M. I., Faruk, O., Rahman, M. et al. (2023). Nexus between Carbon Emissions, Economic Growth, Renewable Energy Use, Urbanization, Industrialization, Technological Innovation, and Forest Area Towards Achieving Environmental Sustainability in Bangladesh. *Energy and Climate Change*, 3, Article ID: 100080. <https://doi.org/10.1016/j.egycc.2022.100080>
- Roy, S., Tandukar, S., & Bhattarai, U. (2022). Gender, Climate Change Adaptation, and Cultural Sustainability: Insights from Bangladesh. *Frontiers in Climate*, 4, Article 841488. <https://doi.org/10.3389/fclim.2022.841488>
- Tiwari, V., Thorp, K., Tulbure, M. G., Gray, J., Kamruzzaman, M., Krupnik, T. J. et al. (2024). Advancing Food Security: Rice Yield Estimation Framework Using Time-Series Satellite Data & Machine Learning. *PLOS ONE*, 19, e0309982. <https://doi.org/10.1371/journal.pone.0309982>

United Nations System Staff College (UNSSC) (2023). *Building Resilient Communities: The Role of Social Protection in Climate Adaptation*.
https://www.unssc.org/news-and-insights/blog/building-resilient-communities-role-social-protection-climate-adaptation?utm_source=chatgpt.com