

The Intersectionality of Water Crisis, Climate Change, and Gender: Impacts on Agri Community Women in Disaster-Prone Coastal Areas

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Abstract

The study explores the intersectionality of water crisis, climate change, and gender, focusing on the lived experiences and vulnerabilities of agricultural women in disaster-prone coastal areas of Bangladesh. Despite national progress in improving access to water, salinity intrusion, flooding, and climate-induced hazards continue to undermine water security, with disproportionate impacts on women. As primary collectors and managers of household water, women face physical strain, health risks, and emotional distress, while also balancing agricultural labor and domestic responsibilities. Using a mixed-methods approach, including household surveys, focus group discussions, key informant interviews, and in-depth interviews, data were collected from Koyra in Khulna and Moheshkhali in Cox's Bazar. Findings reveal that women in both regions endure a "triple vulnerability": climate-induced water scarcity directly threatens their health, intensifies their domestic workload, and reinforces gendered inequalities that restrict economic opportunities and decision-making power. While women in Koyra show greater participation in income generation and collective earning patterns, Moheshkhali households are more dependent on single male earners, leaving them highly vulnerable to livelihood shocks. The study also highlights the compounded risks of waterborne diseases, time poverty, economic strain linked to water scarcity. These dynamics underscore that water insecurity is not merely an environmental challenge but a deeply gendered social crisis. The research concludes that empowering women through inclusive adaptation strategies, livelihood diversification, and gender-sensitive water governance is critical to strengthening community resilience in climate-vulnerable coastal areas.

Keywords

Intersectionality, Water Crisis, Climate Change, Gender, Agri Community Women, Health Risks, Disaster-Prone Coastal Areas

1. Overview & Introduction

1.1 Introduction

In Bangladesh, water insecurity remains a pressing challenge despite notable progress in expanding access. While 97% of the population uses an improved water source, only 39% benefit from safely managed services, as water quality is frequently compromised by contamination, weak regulation, and vulnerability to climatic shocks [1]. Water security here is not merely a matter of infrastructure provision but is instead shaped by intersecting environmental, institutional, financial, and social risks [2]. Among these, salinity intrusion in coastal areas has emerged as one of the most critical threats, worsening under the influence of climate change and rising sea levels. The health implications of this crisis are profound: elevated salinity levels in drinking water have been strongly associated with preeclampsia and gestational hypertension, disproportionately affecting women, particularly during pregnancy, who are 1.3 times more likely to develop hypertension compared to men [3&4]. However, the burden of salinity intrusion extends beyond the clinical health dimension and reflects the deeply gendered dynamics of resource access.

As the primary water collectors within households, women are placed at the center of this crisis. They shoulder the physical labor of traveling long distances with heavy containers and endure emotional distress when negotiating access with those who control or own water sources [5]. Such responsibilities not only intensify women's time poverty but also limit their opportunities for education, income-generating activities, and social mobility. The intersectionality of the water crisis, climate change, and gender becomes most evident. Women in coastal agricultural communities face a triple vulnerability: firstly, they face climate-related salinity intrusion that directly threatens water security; secondly, they endure health repercussions that disproportionately affect their well-being; and thirdly, they are constrained by established gender norms that place the responsibility of water collection and management on them.

However, although there is a growing body of research on climate change and water governance in Bangladesh, there is still a lack of studies that highlight women's experiences in these areas and thoroughly examine how their overlapping vulnerabilities intersect to affect their resilience or lack thereof. Filling this research gap is essential because it not only

illuminates the gender-specific aspects of water and climate insecurity but also helps develop more inclusive and equitable adaptation strategies. As a result, this study aims to explore how women in disaster-prone coastal agricultural communities' experience and manage the intersections of water crisis, climate change, and gender, focusing on the physical, emotional, and socio-economic impacts that shape their daily lives.

1.2 Objective of the Study

Explore the intersectionality between Water Scarcity due to climate change & Women's Security Situation Analysis of Water Scarcity & Women's Empowerment Condition in the agriculture sector.

1.3 Study Locations and their Justification

The selection of Koyra in the Khulna district and Moheshkhali in the Cox's Bazar district as study areas is based on several key factors. Both areas are highly vulnerable to climate change due to their coastal locations, which face the brunt of rising sea levels, increased frequency of cyclones, and saltwater intrusion. Koyra, located in the southwestern part of Bangladesh, has been severely affected by flooding and coastal erosion, impacting agricultural livelihoods and local communities. Similarly, Moheshkhali, situated in the southeastern coastal region, has also experienced the adverse effects of climate change, including damage to infrastructure and livelihoods, particularly for women who are often more vulnerable in these settings.

Moreover, both districts are known for their reliance on agriculture, fishing, and aquaculture, which are directly impacted by climate change. These areas provide a critical opportunity to assess the intersection of climate resilience and gender, as women in these regions often face additional socio-economic barriers that hinder their ability to cope with environmental changes. By focusing on these regions, the study aims to explore the intersectionality between water scarcity due to climate change & women's security and situation analysis of water scarcity & women's empowerment condition. These areas thus represent a microcosm of broader challenges facing coastal Bangladesh, making them ideal study sites for devising actionable, localized solutions.

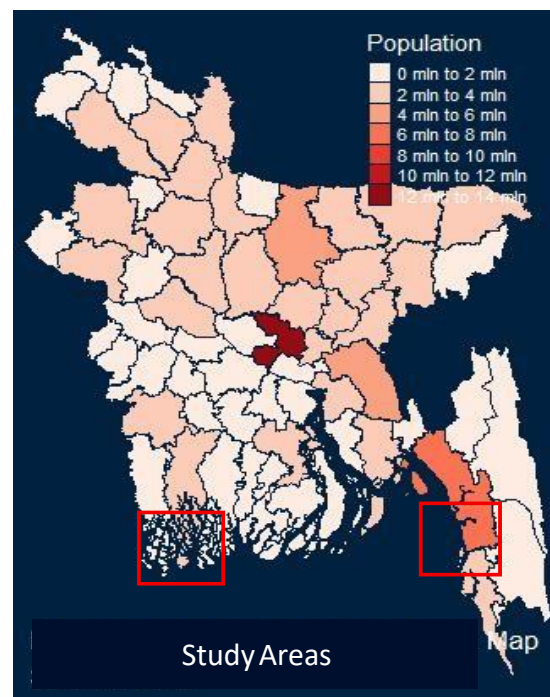


Figure 1. Study locations.

1.4 Limitations of the Study

1. Participants were dispersed across a wide area, requiring significant travel time for data collection.
2. Arranging participants for FGDs was time-consuming.
3. Adverse weather conditions, including frequent rain and poorly constructed roads, hindered data collection efforts.

1.5 Ethical Consideration

Selected study participants were fully informed about the purpose of the study, and permission was taken for discussions and interviews. Consents were taken from all participants before conducting the survey or interview. All possible safety measures were taken during the survey, FGDs, and KII, especially considering gender sensitivity. Security of personal and sensitive data at all stages of the study was kept confidential to maintain research ethics and respect the community perspective.

2. Methodological Process

2.1 Methodology

This study employed a mixed-methods strategy, combining both qualitative and quantitative data. The primary data was collected through Key Informant Interviews (KIIs), Focus Group Discussions (FGDs), In-Depth Interviews (IDIs), and surveys using Kobo Toolbox. Secondary data was gathered through an extensive literature review.

Literature Review

Literature defining climate-induced water scarcity issues, with and without focusing on Gender Issues Table 1.

Table 1. Literature defining climate-induced water scarcity issues, with and without focusing on gender issues.

Different Perspectives	Definition	Key Theme	Feminist Lens	References
Holistic	A comprehensive, multifaceted approach that tackles the intricate and interrelated problems of water availability, quality, access, and governance in light of the effects of climate change.	-Climate-induced water hazards such as salinity intrusion -Local Government initiative and foreign aid for water scarcity mitigation -Low-cost, nature-based technology to reduce water scarcity on the coastal side of Bangladesh	-Women's vulnerabilities regarding water collection	United Nations Bangladesh (2022) [6]
Organizational	Coordinated efforts, policies, frameworks, and institutional mechanisms are used by government agencies, non-governmental organizations (NGOs), development partners, and community-based organizations to deal with the problems that climate change causes for water security.	-Difference between coverage and the availability of quality water -Access to safely managed water -Climate-induced water scarcity impact on agriculture	-Though the pictorial representation is present, descriptive information is missing	Wateraid (2022) [7]
Hydrological	The study and management of the country's water resources through the lens of hydrological science, focusing on how climate change affects the water cycle, including precipitation patterns, river flows, groundwater levels, and flood/drought frequency.	-Intersection of Climate change, water security, and health -Water Scarcity and Quality, Infrastructure challenges -Adaptation Strategy for Water Management Techniques	-N/A	Kumar et.al (2022) [8]
Political/Policy relevant	Political institutions, actors, and governance frameworks deal with and handle the problems that climate change causes for the country's water resources.	-Intersections between water, sanitation, and hygiene (WASH) services and climate change policies -Primarily focuses on policy and financing gaps	-Highlights: the lack of Gender-Responsive Policies in the WASH sector - Identify limited access to climate finance for women	Wateraid and ICCCAD [9]
Environmental	A strategic and integrated framework that puts the protection, restoration, and long-term management of natural ecosystems first to deal with the growing problems climate change is causing for water resources.	-Impact of Climate Change on Water Resources -Vulnerability of Bangladesh's Water Systems -Adaptation Strategies and Water Management	-Gendered Vulnerability to Climate Change and Water Stress	IUCN [10]

2.2 Quantitative Study Design

The sample is required to estimate a proportion with an approximate 95% confidence level and 5.15% margin of error. We will use W.G. Cochran's widely used formula to estimate the sample size.

$$\text{Sample Size: } n_0 = \frac{Z_{\alpha/2}^2 \times p(1-p)}{e^2} = \frac{1.96^2 \times 0.5(1-0.5)}{(0.0536)^2} = 362 \quad (1)$$

Where,

n_0	=	Sample size	362
$Z_{95\%}$	=	$Z_{\alpha/2}$ value for 95% confidence interval	1.96
p	=	The proportion of the population	0.5
e	=	The degree of precision (Margin of error: 5.15%)	0.0515

Considering 5% non-respondent participants, the total collected survey data was 381. The sample distribution is given below in table 2.

Table 2. Details of quantitative data collection.

Locations	Survey Participants (in numbers)		Survey Participants (in %)	
	Female	Male	Female	Male
Koyra	81	32	72%	28%
Moheshkhali	198	70	74%	26%

2.3 Qualitative Study Design

The Key Informant Interview (KII) participants included local leaders, some agricultural sector specialists, and others, while the Focus Group Discussion (FGD) participants were mostly arming community people, especially marginalized female farmers and their spouses. Note that, in the FGD, separate male and female groups were interviewed to reduce bias and ensure freedom of speech. A walkthrough observation was conducted in both areas to gather insights on the existing water sources and their condition.

3. Analysis of Socio-Economic Situation

3.1 a.Socio-Demographic Situation Analysis

Table 3. Details of Socio-Demographic Situation.

Catagories	Variables	Koyra		Moheshkhali	
		Female	Male	Female	Male
Education	No education	5%	1%	4%	16%
	Can sign only	28%	17%	47%	50%
	Primary School	32%	30%	27%	13%
	Secondary School	29%	39%	20%	19%
	Higher Secondary school	4%	7%	2%	3%
	University	2%	6%	0%	0%
Total Number of Household Members	1-3 members	14%	9%	20%	25%
	4-6 members	64%	73%	75%	59%
	6-8 members	22%	19%	5%	16%
Type of House	Tin shed	92%	91%	100%	100%
	Half wall	5%	3%	0%	0%
	Pucca	4%	6%	0%	0%
Kitchen Location/Facility	Outside of the house but within its own premises	73%	77%	79%	91%
	Cook in an open area outside of the house	2%	0%	1%	0%
	Situ kitchen facility	20%	16%	12%	0%
	Do not have their own kitchen in their dwellings	5%	7%	7%	9%

3.1 b. Economic Condition Analysis

Income versus Expenditure Condition: In this study, all female participants are involved in agriculture, whereas 80% of the male participants work in agriculture. The remaining male participants are engaged in small businesses, daily labor, work in small local hotels, shops, etc. The figure 3 below provides a snapshot of the monthly income and expenditure conditions of the households of the survey participants:

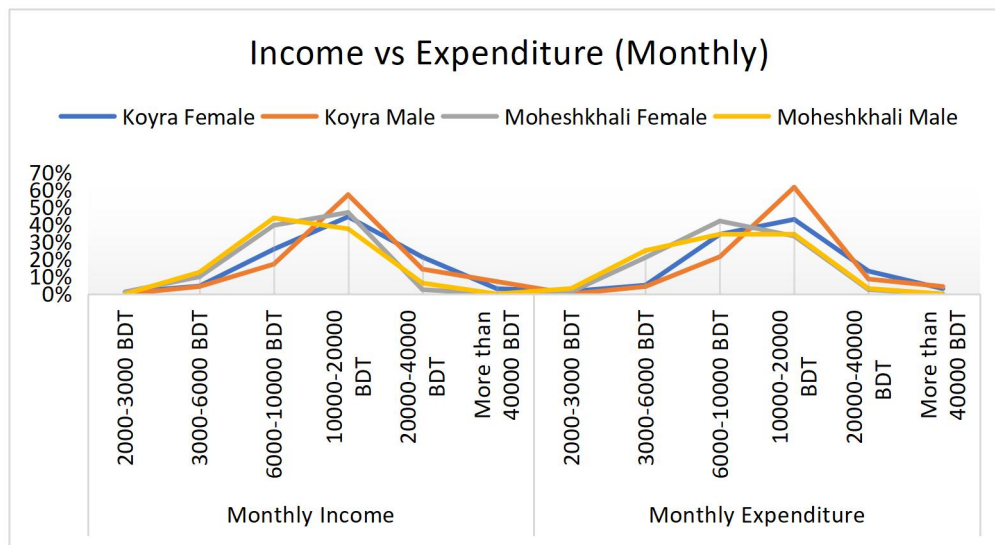


Figure 3. Monthly income and expenditure conditions of the households.

In Koyra, the income and expenditure patterns reflect a community where most households are concentrated in middle-income brackets. Among women, the largest proportion (44%) earns between 10,000 and 20,000 BDT, followed by 26% earning 6,000 to 10,000 BDT. Expenditure patterns among women reveal that 43% also spend within the 10,000 to 20,000 BDT bracket, while a significant 34% fall in the 6,000 to 10,000 BDT range. This alignment suggests that women's incomes are largely absorbed by essential expenses, leaving them with limited opportunities for savings or investment. Men show a similar distribution, with 57% earning and 61% spending in the 10,000 to 20,000 BDT category. Although a small portion of men (7%) earn more than 40,000 BDT, their expenditures remain relatively high, which points to a narrow financial margin. Overall, Koyra's income-expenditure profile highlights a community where livelihoods are modest, and most households operate with little surplus beyond basic needs.

In Moheshkhali, the situation presents both similarities and distinctions. Women concentrated in the middle-income ranges, with 47% earning 10,000 to 20,000 BDT and 40% earning 6,000 to 10,000 BDT. Unlike in Koyra, however, women in Moheshkhali display slightly more prudent spending patterns: 42% report expenditures of 6,000 to 10,000 BDT, and 33% fall in the 10,000 to 20,000 BDT range. This gap between income and expenditure suggests a greater capacity for savings, even if modest, and reflects more cautious financial management. Men in Moheshkhali, by contrast, earn predominantly in the 6,000 to 10,000 BDT (44%) and 10,000 to 20,000 BDT (38%) ranges, with expenditures closely mirroring their incomes. This indicates that male earnings are largely consumed, offering little scope for accumulation or long-term financial security.

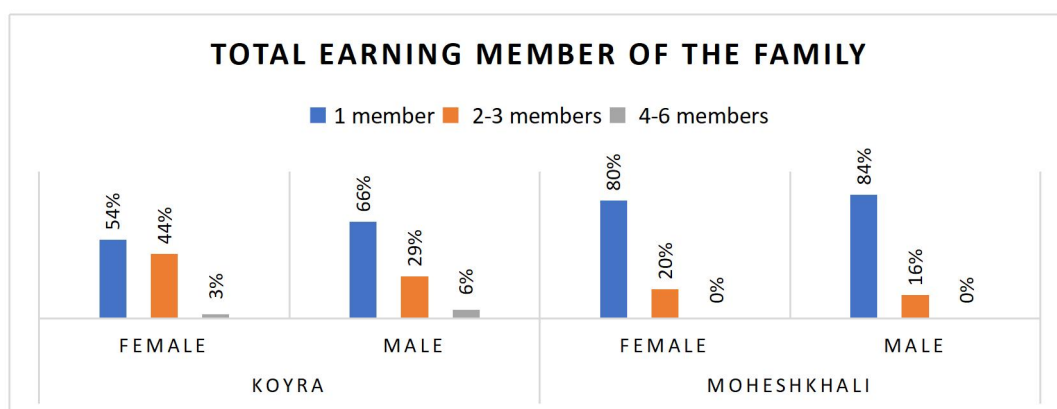


Figure 4. Overview of the earning members' situation at the household level.

When comparing the two locations, a broader narrative emerges. In Koyra, households across both genders spend nearly all they earn, reflecting a fragile balance between income and expenditure that leaves them vulnerable to economic shocks. In Moheshkhali, women, in particular, appear to demonstrate more cautious expenditure habits, resulting in a slightly stronger capacity for financial resilience compared to their counterparts in Koyra. Men, however, remain consistent across both communities, with expenditures closely tied to income and minimal prospects for savings.

Considering together, these patterns reveal gendered and locational variations in financial behavior, underscoring how community-level livelihoods are shaped not only by income levels but also by household expenditure practices.

Earning Members of the family: The distribution of earning members in households reflects not only the economic base of communities in Koyra and Moheshkhali but also deeper gender dynamics that shape household resilience. The graph below provides an overview of the earning members' situation at the household level:

In Koyra, women's participation in income generation appears to be more diversified, with 44% of female households reporting two to three earning members, compared to only 29% in male households. This suggests that where women are engaged in economic activity, there is often greater collective participation in livelihood contributions, possibly due to women mobilizing household members, such as children or spouses into supplementary income-generating roles. While a majority of both men and women still report households with only one earner, the relatively higher share of multiple earners in female households reflects the importance of women's agency in spreading financial responsibility. This distribution not only enhances household resilience but also reduces the risk associated with dependence on a single male income earner.

In Moheshkhali, however, the gendered picture is more constrained. An overwhelming majority of both women (80%) and men (84%) report only one earning member per household, with very few households reflecting multiple income earners. The absence of households with four to six contributors further underscores the narrowness of livelihood structures in the area. From a gender perspective, this indicates that women's economic participation is comparatively limited, and household reliance on single male earners remains dominant. This reinforces traditional gender norms where men shoulder the primary economic role, while women's engagement in income-generating activities remains minimal or secondary. Such a pattern not only places higher economic pressure on men but also limits women's potential contribution to strengthening household financial resilience.

The contrast between the two areas highlights the gendered implications of income distribution. In Koyra, women's greater involvement in earning roles appears to promote shared economic responsibility, which can cushion families against livelihood shocks and foster more adaptive household strategies. In Moheshkhali, by contrast, the persistence of male-dominated single-earner households reflects more rigid gender norms that hinder diversification of income sources, leaving families more vulnerable to poverty cycles. Overall, the data suggests that women's active participation in household income generation is not only a question of gender equality but also a critical factor in improving household economic security and resilience at the community level.

4. Key Findings

4.1 a. Water Crisis in Disaster-Prone Areas

The water crisis, especially in coastal and flood-prone areas, is a critical issue for women, worsened by the combined effects of climate change and natural disasters. According to FGD findings, women are primarily responsible for water collection in the study locations, making it difficult during extreme weather events such as floods, droughts, and cyclones. The figure 5 below illustrates survey participants' responses regarding water collection practices at the household level in the disaster-prone areas:

The figure 5 illustrates household water collection practices in disaster-prone areas, focusing on who collects water within households and the typical time for water collection. As per survey data, adult women (household heads' wives or women-headed households) overwhelmingly shoulder the responsibility of water collection in both regions. In Koyra, 91% of females and 83% of males reported adult women as the primary collectors, while in Moheshkhali, 89% of females and 84% of males confirmed the same. Daughters, particularly adolescent girls, also contribute to this task. In stark contrast, the household heads (typically adult males) rarely engage in water collection.

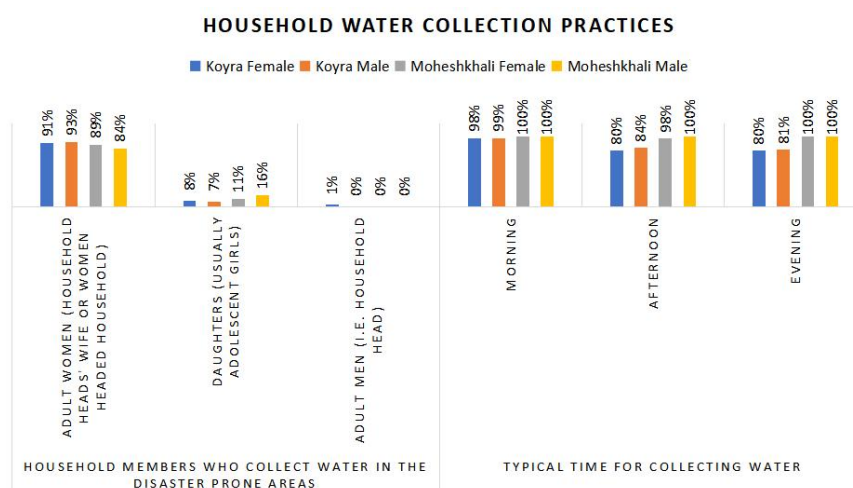


Figure 5. Household water collection practice.

Regarding the timing of water collection, mornings are the most common period, with participation rates nearly universal across genders and locations (98-100%). Afternoons are less popular in both Koyra and Moheshkhali. Evening collection is also frequent, especially in Moheshkhali, where 100% of males and 81% of females report doing it, compared to slightly lower rates in Koyra (80-86%). This indicates that in almost all households, family members usually collect water two to three times a day, and this demanding task often falls on the adult women or adolescent girls of the family. The findings also highlight a strong gendered division of labor in water collection in disaster-prone regions, with women and girls disproportionately responsible for this essential task. Adult men's involvement is negligible, reinforcing traditional gender roles. Additionally, water collection occurs throughout the day, but mornings dominate as the peak period, likely due to household needs and water availability patterns. This pattern underscores the significant physical and time burdens borne by women and girls in managing household water security in vulnerable areas.

As per FGD findings, the people of the study area experience unpredictable rainfall patterns, often leading to water shortages or waterlogging. This variability impacts both the availability and quality of water resources. When natural disasters, such as droughts or floods, strike, tube wells and other water sources that people depend on become contaminated or dry up. This forces women to travel longer distances in search of clean water, often making the journey multiple times a day. One female respondent noted that fetching water can take over an hour or longer, particularly if water sources are crowded with others or if water levels have receded.

'When men fetch water, they use bicycles or motorbikes, but women and girls walk with waterpots on their heads and waist. While younger girls may occasionally use bicycles, this is rare, but older women never use such modes of transport.'- *Mentioned by one of the male FGD participants*

In some areas, the only alternative sources are hand pumps or community wells, which may be overwhelmed by high demand. Women in these areas, especially those with children or elderly dependents, are forced to prioritize water collection over other essential activities, including health care and rest. The physical strain of carrying large containers of water for long distances takes a significant toll on their bodies, particularly during pregnancy or periods of illness. One of the female respondents shared how walking with water pots for long distances can be difficult:

"It is painful to carry water pots on our waists. The hand becomes numb, and the legs hurt. I think going and coming back with the water takes around an hour. Then again, if there are a lot of people in the line, it might even take 1.5 hours."

Qualitative findings also highlight that when the stock of water in their household is about to finish, people sometimes borrow from their neighbors. They also rely heavily on rainwater collection during monsoon months, which they use for many purposes. However, rainwater for drinking is not suitable for everyone due to health reasons. Women also tend to drink less and prioritize their husbands if there is not enough water. One woman explained:

"Right now, we are drinking rainwater. But my man gets allergies when he drinks rainwater, so I drink it. If there is no rainwater, then I have tap water. You know, women can bear a lot of discomfort, but men cannot bear the same discomfort in many cases."

This indicates that the water crisis in disaster-prone areas worsens gender inequality, placing a heavier burden on women as the crisis deepens.

4.2 b. Climate-Induced Changes & Women's Health Due to Water Scarcity:

The study findings highlight that water scarcity is intricately linked to women's health, particularly in regions severely affected by climate change. Changes in weather patterns, such as longer dry spells followed by intense rainfall or floods, impact both the availability and the quality of drinking water. In areas affected by salinity intrusion, the contamination of drinking water sources with salt significantly compromises public health. Women, often responsible for maintaining family health, experience a heightened burden of managing the health of their families during such times. The impacts on women's health are direct and indirect. Directly, women are more likely to suffer from diseases caused by contaminated water, such as diarrhea, dysentery, and cholera. The risk of waterborne diseases is exacerbated by the lack of safe drinking water, especially during times of flood or drought. Many women are forced to rely on contaminated sources, such as pond water, which is further polluted by the chemicals used in agricultural runoff or saline intrusion. This exposure often leads to chronic health issues, including skin diseases, urinary infections, and digestive problems.

The table 4 below illustrates female survey participants' responses regarding their suffering from waterborne diseases within the last 6 months:

Table 4. Female survey participants' responses regarding their suffering from waterborne diseases within the last 6 months

Locations	Types Of Water-Borne Diseases Women And Their Families Suffer								
	Diarrhea Only	Diarrhea and Typhoid Fever	Diarrhea and Jaundice	Skin Disease	Only Typhoid Fever	Typhoid Fever and Worms	Only Jaundice	Jaundice and Worms	Dysentery and Itching-Enteritis
Koyra	68%	2%	9%	19%	9%	2%	2%	2%	68%
Moheshkhali	23%	8%	0%	8%	15%	2%	0%	5%	92%

According to the 24% of the females from Koyra and 16% female participants from Moheshkhali stated that female and their family members suffered from water-borne diseases during the last 6 months. As per the table above, in Koyra, the most widespread issue reported was diarrhea, with 68% of women indicating that their families suffered from it in the last six months. Alarming, an equally high percentage (68%) reported cases of dysentery and itching-enteritis, reflecting a dual burden of gastrointestinal and skin-related illnesses. Other notable health problems included skin diseases (19%) and combinations such as diarrhea and jaundice (9%), as well as only typhoid fever (9%). Less common, but still present, were combinations like diarrhea with typhoid fever, typhoid fever and worms, and only jaundice, each affecting 2% of families. These results suggest that Koyra households face a diverse range of waterborne illnesses, with diarrhea and dysentery dominating the health burden.

In contrast, Moheshkhali participants reported a slightly different pattern. The most prevalent condition was dysentery and itching-enteritis, affecting an overwhelming 92% of families, substantially higher than in Koyra. Diarrhea alone was reported by 23%, which is much lower than Koyra. Other illnesses, while less frequent, included only typhoid fever (15%), diarrhea and typhoid fever (8%), skin disease (8%), and jaundice with worms (5%). A small proportion also reported typhoid fever with worms (2%). Interestingly, no cases of diarrhea and jaundice or only jaundice were recorded in Moheshkhali, pointing to a narrower, though more concentrated, disease profile compared to Koyra.

“During their periods, women have to wash their rags with salty water, which is why they get several diseases like urine infection”. - An NGO female worker who works with women in the communities revealed

FGD among female participants highlights that, in case of the indirect impact of the lack of clean water includes women's ability to manage personal hygiene, particularly during menstruation. Due to limited water resources, many women use rags instead of sanitary pads. These rags are often washed in saline or contaminated water, increasing the likelihood of infections. Furthermore, KII findings indicate that women in these areas are exposed to increased stress and mental health issues due to the ongoing threat of climate change. The inability to access clean water, combined with the pressure of managing household duties during extreme weather events, leads to anxiety, depression, and exhaustion. Some key informants who work with these local communities regularly also explained that the impacts of climate change affect women negatively. For example, nutritional deficiencies affect girls' periods and make them irregular. Issues like this can lead to fertility problems and divorce later on. Moreover, the effects of living in areas where salinity is high in the water and air on women's physical health can have many other indirect impacts. As an example, *a key informant associated with an NGO working with women's issues in the area shared:*

“We get skin diseases; we get a darker skin tone, and our hair falls off because of the salt. Women suffer from itching, period issues, and high blood pressure, leading to more miscarriages and venereal diseases.”

4.3 c. Intersectionality Between Climate-Induced Natural Hazards & Power Situation of Women:

The study findings highlight that the power dynamics within households and communities become more pronounced during climate-induced disasters. In times of crisis, such as during a cyclone, women are often expected to perform roles that are seen as “traditional” in the household, caring for children, the elderly, and other vulnerable family members, while men are more likely to engage in external recovery or evacuation efforts. Women, who are largely responsible for water collection, food preparation, and caregiving, have limited decision-making power in both household and community settings intensifies their vulnerability during climate events. The female survey participants' responses regarding their household responsibilities are given below:

As per the figure 6, Koyra women report higher responsibility for cooking & cleaning (75%) and fetching water (69%). Moheshkhali women show relatively less emphasis on these but significantly more on washing clothes (48%) compared to Koyra (24%). In both regions, only a small share of women report responsibility for taking care of children and the elderly (7-9%). This highlights that women in both Koyra and Moheshkhali bear the brunt of household labor, with the heaviest burdens revolving around cooking, cleaning, and water collection. However, differences emerge between the two regions: Koyra women are more engaged in cooking/cleaning and water fetching, while Moheshkhali women report a stronger role in washing clothes in addition to these tasks. Despite these variations, caregiving responsibilities (children and elderly) are reported as relatively low in both areas, suggesting that women's labor is viewed primarily in terms of maintaining household survival needs rather than caregiving. These findings indicate that the persistent gendered nature of household responsibilities, where women disproportionately carry out physically demanding and time-consuming work, exacerbates their vulnerability in disaster-prone environments.

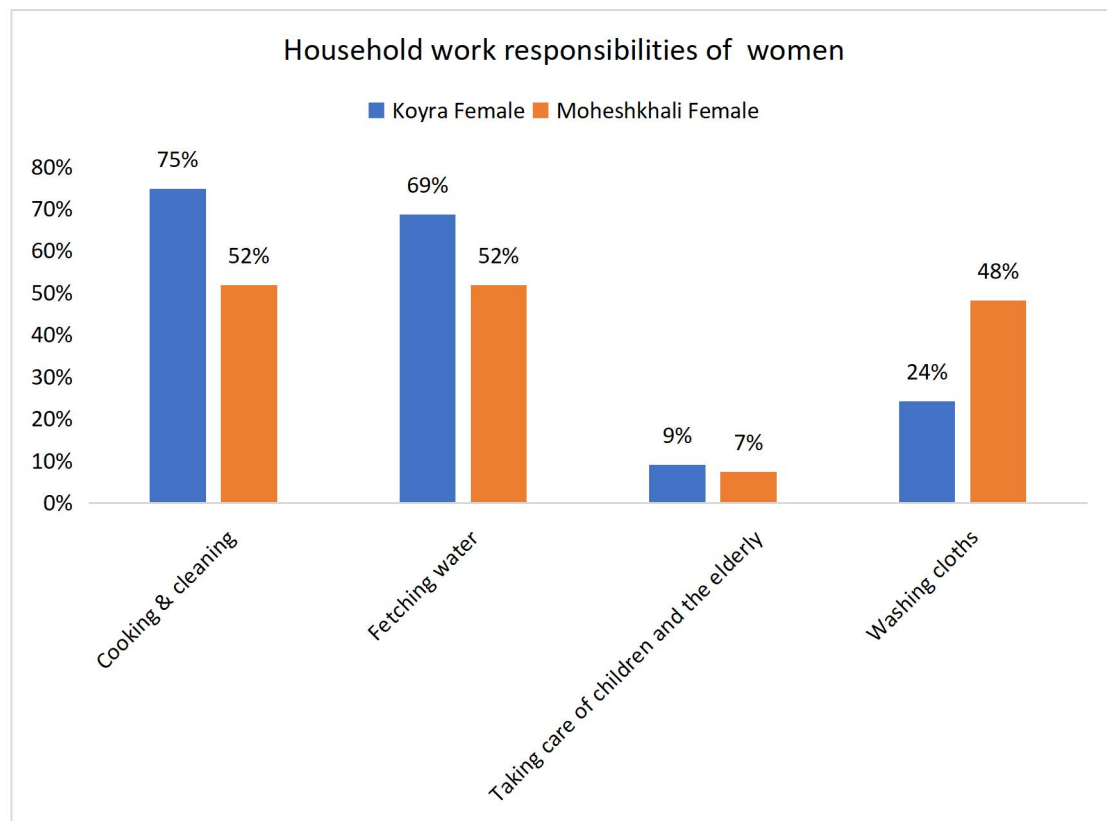


Figure 6. Female survey participants' responses regarding their household responsibilities.

In terms of access to resources, the unequal distribution of power between genders is stark. Qualitative findings highlight that the women in many disaster-prone areas are expected to prioritize the needs of their husbands and children, sometimes at the cost of their own well-being. One female participant shared how, during a drought, she would give the last bit of water to her husband or the elderly male member of the family, i.e., her father-in-law, even though she knew it might cause her health to deteriorate. This priority placed on male household members during times of scarcity underscores the gendered nature of survival strategies in many communities.

This power imbalance is further magnified in community decision-making processes. When communities face disaster preparedness and recovery planning, women often have little to no say in the decisions that affect their lives. FGD participants mentioned that the lack of agency in decisions regarding water resources, shelter, and post-disaster recovery further isolates women, reducing their ability to effectively respond to and recover from climate-induced hazards.

4.4 d. Intersectionality Between Climate-Induced Natural Hazards & Domestic Workload of Women:

Qualitative finding shows that climate-induced natural hazards, such as floods and droughts, increase the domestic workload of women, who are expected to continue their household duties while simultaneously dealing with the aftermath of a disaster. The already heavy burden of managing the home, caring for children and elderly relatives, and participating in economic activities increases when water becomes scarce.

FGD participants mentioned that during extreme weather events, women often face the difficult task of managing domestic responsibilities, such as cooking, cleaning, and childcare, while also taking on the additional duty of collecting water from distant sources. As one respondent described, she would spend up to two hours a day fetching water, which left her little time to focus on other essential tasks. When women are forced to travel long distances to collect water, they face a risk of injury, health issues, and sometimes even harassment. One woman described an incident where,

while out fetching water, her young son drowned because she was not at home to supervise him. The table 5 below illustrates survey participants' responses regarding water source distance and its impact on women:

Table 5. Survey participants' responses regarding water source distance and its impact on women.

		Distance Of Water Source from Home		Frequency of Collecting Water Daily					Time Spent on Collecting Water					
Locations	Gender of the respondents	1-3 k.m	3-6 k.m	More than 6 k.m	1 time	2-3 times	4-6 times	6-10 times	More than 10 times	15 Min-utes	Half an hour	1 hour	2-3 hours	More than 3hrs
Koyra	Female	84%	7%	9%	0%	36%	24%	6%	34%	8%	49%	33%	9%	1%
	Male	86%	7%	7%	3%	20%	14%	13%	49%	10%	56%	26%	7%	1%
Mohesh-khali	Female	79%	13%	9%	0%	27%	10%	1%	62%	2%	57%	10%	28%	2%
	Male	81%	16%	3%	0%	31%	6%	6%	56%	6%	56%	19%	13%	6%

The data demonstrates that women in both locations bear the overwhelming responsibility for water collection, with Moheshkhali showing particularly intense demands. The distances may seem moderate (mostly within 1-3 km), but the high frequency of trips and cumulative hours spent daily transform water collection into a physically exhausting and time-consuming task. This reinforces gender inequality, as men participate less frequently and spend comparatively less time, while women's health, safety, and opportunities for education or livelihood are compromised.

The findings also show that inadequate access to nearby, reliable water sources perpetuate cycles of female labor exploitation and time poverty. The finding also indicates that the burden of water collection on women in Koyra and Moheshkhali produces far-reaching negative externalities: deteriorating women's health, reinforcing time poverty and economic inequality, exposing them to safety risks, and amplifying community-level health vulnerabilities. The table 6 below illustrates the qualitative findings regarding intersectionality between climate-induced natural hazards & domestic workload of women:

Table 6. Qualitative findings regarding intersectionality between climate-induced natural hazards & the domestic workload of women

Impacted Areas	Negative Externalities	Implications
Health	Physical strain, musculoskeletal injuries, fatigue, reproductive health issues, and a high risk of waterborne diseases	Increased dependency on healthcare, reduced productivity, and long-term health costs
Time Poverty	Women and girls spend 2-3 hours daily fetching water, often >10 trips per day	Loss of education and income opportunities reinforces gender inequality
Community & Environmental Health	Reliance on unsafe/distant water sources causes contamination and spreads diseases	Higher prevalence of diseases, reduced community productivity, and strain on local health systems

As per the findings from the above table, marginalized women face significant challenges due to limited access to safe water, resulting in multiple negative externalities. Physically, they endure musculoskeletal strain, fatigue, reproductive health issues, and higher susceptibility to waterborne diseases, leading to increased healthcare dependency and longterm productivity losses. Time poverty is severe, as women and girls often spend 2-3 hours daily, sometimes making over ten trips, fetching water, which limits educational and income opportunities and perpetuates gender inequality. At the community level, reliance on unsafe or distant water sources contributes to contamination and disease spread, lowering overall productivity and putting additional strain on local health systems. Collectively, these challenges exacerbate systemic inequalities and hinder both individual and community well-being.

In summary, climate-induced hazards intensify women's domestic burdens, as they must care for displaced family members, manage shelter needs, and rebuild damaged homes. Their roles as primary caregivers and household managers often result in them being the last to receive aid, increasing their vulnerability during crises.

4.5 Impact of Water Scarcity on Women's Access to Economic Activity

Walkthrough observation identified that water scarcity significantly affects women's access to economic activities, particularly in rural and coastal areas where agriculture and fishing are primary sources of livelihood. Women play a crucial role in these economic activities, whether it's through fishing, crab collection, or working in shrimp farming.

However, the impacts of climate change on water resources, such as saline intrusion, droughts, and flooding, directly affect the success of these industries.

In regions where women rely on fishing, the salinity levels of water sources have increased, affecting the quality and availability of fish and shrimp. This disruption in local industries forces women to seek alternative sources of income. However, the lack of access to reliable water resources to clean, store, or process their catch creates a further barrier to economic stability. The figure 7 below illustrates surveyed female participants' responses regarding water scarcity's impact on rural women's economic activities:

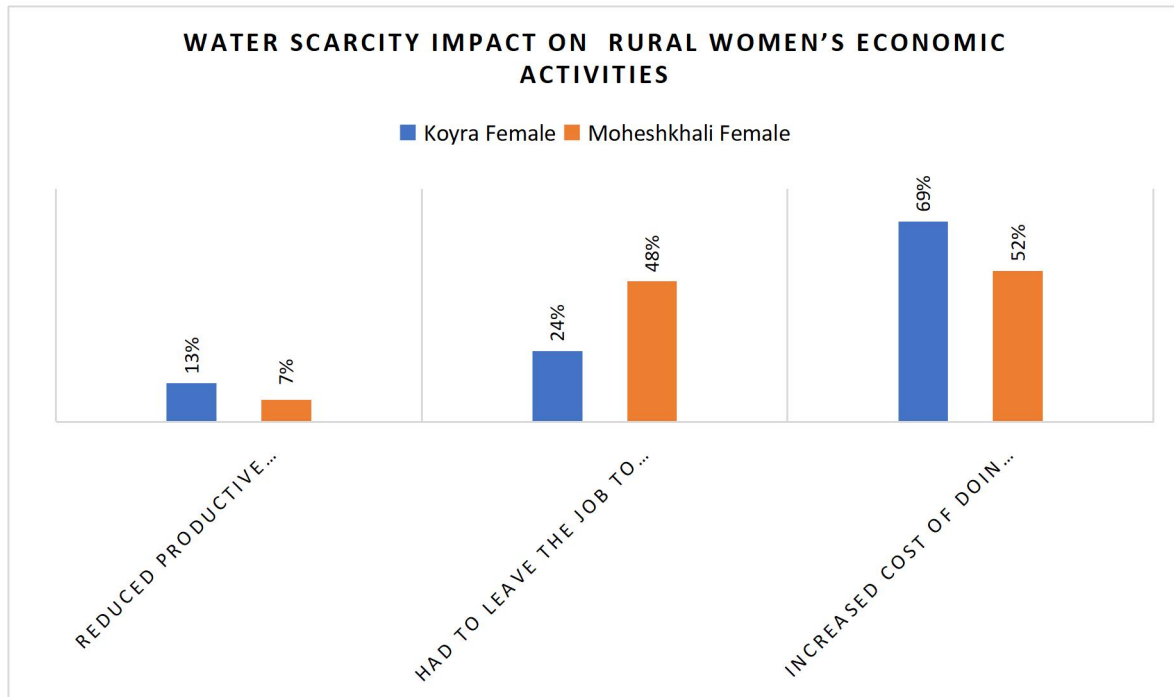


Figure 7. Surveyed female participants' responses regarding water scarcity's impact on rural women's economic activities.

The survey responses highlight that water scarcity severely constrains rural women's economic activities, primarily by reducing agricultural output, increasing time burdens, and triggering conflicts over limited resources. Women's dual responsibilities in agriculture and household water management exacerbate their vulnerability, as lost productivity and income directly affect household livelihoods. The patterns observed between the two locations suggest that while the severity of impacts varies, the overarching consequences, such as economic strain, social tension, and additional labor burdens, remain consistent and emphasize the urgent need for interventions that improve water access and reduce gendered inequalities in rural communities.

The survey data also identified that, in Koyra, a significant proportion of women (75%) reported crop failure due to water shortages, while 69% indicated a loss of income, highlighting the direct economic consequences of limited water availability. Reduced crop production affected 24% of women, and conflict over water sources was a major concern for 69% of respondents, suggesting that competition for scarce water resources not only impacts productivity but also creates social tension. Additionally, women in Koyra spend considerable time fetching water (9%), which further limits their capacity to engage in income-generating activities or other productive tasks. Livestock health issues were less commonly reported (9%), though they remain a contributing factor to overall economic vulnerability.

In Moheshkhali, the effects of water scarcity show a somewhat different pattern. Nearly half of the female respondents (48%) experienced reduced crop production, which aligns with an equivalent proportion (52%) reporting crop failure and loss of income. This indicates that water scarcity directly undermines agricultural productivity and the economic stability of households. Conflict over water sources affected 52% of women, reflecting significant social strain but slightly lower than in Koyra. Time spent fetching water was reported by 7% of respondents, suggesting that in Moheshkhali, the labor burden of water collection is slightly less intense than in Koyra but still impacts women's daily routines and opportunity for economic engagement. Livestock health issues were minimal (7%), indicating that while water scarcity primarily affects crop production and income, secondary effects on livestock are comparatively limited.

Overall, the survey responses highlight that water scarcity severely constrains rural women's economic activities, primarily by reducing agricultural output, increasing time burdens, and triggering conflicts over limited resources. Women's dual responsibilities in agriculture and household water management exacerbate their vulnerability, as lost productivity and income directly affect household livelihoods. The patterns observed between the two locations suggest that while the severity of impacts varies, the overarching consequences, i.e., economic strain, social tension, and additional labor burdens, remain consistent, emphasizing the urgent need for interventions that improve water access

and reduce gendered inequalities in rural communities. The table 7 below illustrates qualitative findings regarding the impact of water scarcity on women's access to economic activity:

Table 7. Qualitative findings regarding the impact of water scarcity on women's access to economic activity

Impact Area	Key Findings from FGDs/KII	Implications for Women
Livelihood Exposure & Health Risks	Women engage in crab collection, fishing, clearing algae from ponds, and shrimp enclosures. Work involves standing in water for hours, handling dirty or salty water directly.	High risk of skin diseases, itchiness, urinary infections, complications during menstruation, leading to frequent doctor visits. Health risks force women to weigh livelihood against personal well-being.
Income & Household Contribution	Women pursue these activities as additional income sources to cope with the financial impacts of climate change and household expenses. Men typically fish in groups with bigger nets.	Women often take on labor-intensive, high-risk work for smaller returns. Income insecurity persists despite physical risks.
Agriculture & Livestock Challenges	Climate impacts reduce fodder availability and make livestock vulnerable (diarrhea from saline water, heat/storm-related deaths, mosquito-borne illnesses).	Women, especially widows, single mothers, and minorities, bear primary responsibility for livestock rearing, facing increased costs for water and fodder, which jeopardizes household income.
Climate-Induced Livelihood Shifts	Unstable weather reduces agricultural productivity; coastal populations shift to shrimp farming and day labor.	Women move toward less stable but comparatively safer income streams. Livelihood diversification is necessary but does not fully offset economic vulnerability.
Economic Vulnerability & Gendered Burden	Women's labor-intensive roles in high-risk environments are exacerbated by climate impacts on traditional agriculture.	Persistent economic vulnerability, physical strain, and health risks reinforce gender inequalities, limiting women's access to safer or higher-income economic activities.

Additionally, walkthrough observation highlights that women involved in agricultural labor or shrimp farming are exposed to contaminated water, which can cause skin diseases, urinary infections, and other health issues. One of the FGD respondents explained,

“Our skin itches, there are infections, white discharge, and we experience burning in those areas. During periods, we try not to go, but if we do, we remove the period clothes (rags) and then go directly into the water”.

All the participants agreed with this information, with some of them saying they had to visit the doctor. One of the respondents said,

“The doctors tell us not to do this kind of work and that we are getting infections because of it. But if we don't do this work, how will we eat?”

As women have limited access to health care, these issues further restrict their ability to participate in economic activities. In some cases, the stress of balancing domestic chores with income-generating work, combined with health problems from contaminated water, results in absenteeism from work and lower overall productivity. The figure 8 below illustrates female participants' responses regarding the intersectionality between the water crisis and rural agricultural women's vulnerabilities:

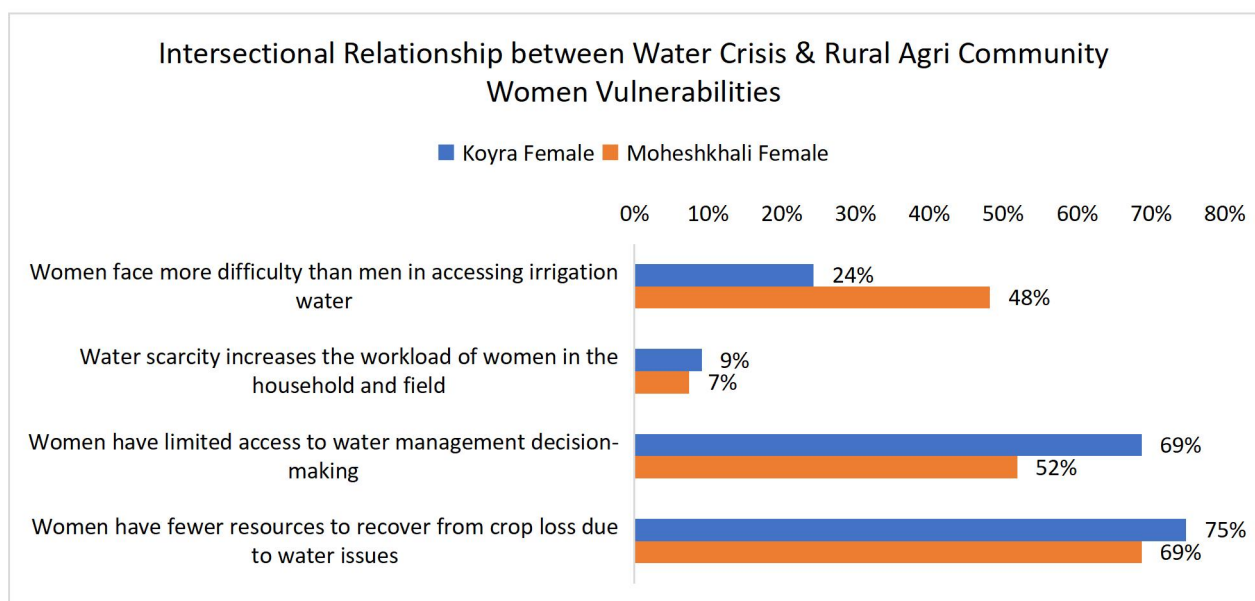


Figure 8. Intersectional relation between the water crisis and rural agricultural women's vulnerabilities.

The survey responses from female participants highlight the intersectionality between water scarcity and the vulnerabilities of rural agricultural women, identifying both structural and practical inequalities. A substantial proportion of women reported facing more difficulty than men in accessing irrigation water. 24% in Koyra and 48% in Moheshkhali, indicating that women's ability to engage in agricultural activities is directly constrained by unequal access to essential resources. Water scarcity also increases women's workload in both household and field activities, though reported by a smaller proportion (9% in Koyra, 7% in Moheshkhali), reflecting the added time and labor burden imposed by limited water availability.

Structural inequalities are evident in women's limited participation in water management decision-making, reported by 69% in Koyra and 52% in Moheshkhali. The lack of agency restricts their ability to influence water allocation and irrigation practices, perpetuating gendered disparities in resource control. Furthermore, the inability to access financial and material resources to recover from crop loss due to water scarcity, reported by 75% in Koyra and 69% in Moheshkhali. This underscores that rural agricultural women experience compounded risks: they are disproportionately affected by water scarcity, bear increased labor demands, have limited decision-making power, and face significant barriers to economic recovery, emphasizing the need for gender-sensitive interventions in water and agricultural management.

4.6 Gender-Responsive Strategies to Improve Women's Access to Water in Climate-Vulnerable Coastal Bangladesh

Enhancing women's access to water in disaster-prone coastal areas of Bangladesh necessitates an integrated, gender-responsive framework that addresses the overlapping challenges of climate change, water insecurity, and entrenched social inequalities. As the study demonstrates, women in regions such as Koyra and Moheshkhali carry the principal responsibility for household water management, rendering them disproportionately vulnerable to the compounded effects of salinity intrusion, flooding, and resource scarcity. Their burdens manifest not only through the physical strain of traveling long distances and transporting heavy containers but also in heightened exposure to waterborne diseases, reproductive health complications, time poverty. Addressing these systemic challenges requires prioritizing climate-resilient and locally appropriate water infrastructure, including community-based rainwater harvesting systems, low-cost desalination technologies, and elevated tube wells designed to withstand flooding.

These interventions, however, must be coupled with inclusive governance mechanisms that ensure women's participation in water user committees, disaster management bodies, and irrigation planning processes, thereby strengthening their agency and disrupting entrenched gender norms that limit their decision-making power. Health-focused interventions are equally vital, given that contaminated water sources exacerbate women's vulnerability to chronic illnesses, urinary tract infections, and maternal health risks. Expanding affordable and accessible gender-sensitive healthcare services, particularly through mobile clinics, reproductive health programs, and menstrual hygiene initiatives, would mitigate these adverse outcomes. Reducing women's time poverty is another critical priority; piped water networks, community-managed distribution systems, and women's cooperatives for water collection can substantially decrease the hours spent on unpaid domestic labor and enable greater participation in education and income-generating activities.

Diversification of livelihoods further strengthens resilience, as dependence on saline-prone agriculture perpetuates economic precarity. Providing women with training, access to microfinance, and opportunities in aquaculture, handicrafts, and small enterprises fosters financial independence while reducing vulnerability to climate-induced livelihood shocks. Securely located and well-lit community water points, group-based collection practices, and strengthened accountability measures are essential to safeguarding women's dignity and mobility.

At the policy level, water governance and climate adaptation frameworks must integrate gender as a core consideration, guaranteeing women's equitable access to resources, climate finance, and institutional support. Equally, social transformations must be encouraged through the redistribution of domestic labor, with men actively sharing responsibilities for water collection and caregiving. Such measures not only reduce the gendered labor imbalance but also contribute to reshaping societal norms that perpetuate women's marginalization. In sum, improving women's access to water in coastal Bangladesh cannot be addressed solely through technical interventions but requires a comprehensive strategy that simultaneously advances infrastructural resilience, inclusive governance, health and safety measures, economic empowerment, and gender equality. By tackling these interlinked dimensions, women's "triple vulnerability" to environmental hazards, health burdens, and social inequities can be mitigated, enabling them to play a central role in fostering resilient households and communities under intensifying climate and water insecurity.

5. Concluding Remarks

5.1 Conclusion

The study demonstrates that the intersection of water scarcity, climate change, and entrenched gender norms creates layered vulnerabilities for women in disaster-prone coastal areas of Bangladesh. In both Koyra and Moheshkhali, women bear a disproportionate share of the burden of water collection, domestic responsibilities, and agricultural labor, which exposes them to physical strain, health risks. The findings reveal that while Koyra households show slightly

greater diversification of income sources and women's engagement in economic roles, Moheshkhali households remain overwhelmingly dependent on single male earners, reflecting rigid gender divisions and heightened economic fragility.

The evidence further highlights how water scarcity directly undermines women's health, productivity, and dignity, with impacts extending to household food security and community well-being. Women's resilience is constrained by limited decision-making power, inadequate access to resources, and pervasive social vulnerabilities. Yet, the study also shows that where women participate more actively in earning roles, as in Koyra, households demonstrate greater adaptive capacity and economic resilience.

In conclusion, tackling the water crisis and climate vulnerabilities in coastal Bangladesh is inseparable from addressing gender inequality. Improving women's agency, creating multiple earning opportunities within households, and ensuring safe, reliable water access are essential steps toward building resilient communities. Gender-responsive adaptation strategies that focus on women's voices, needs, and contributions must, therefore, be prioritized in policy and practice to break cycles of vulnerability and work toward a more equitable and sustainable future.

5.2 Conflict of Interest Statement

The authors declare that there are no financial, personal, or professional conflicts of interest that could have influenced the design, execution, or interpretation of this study. All stages of the study, including data collection, analysis, and reporting, were conducted independently, without external influence from funding agencies, governmental institutions, or private organizations. The findings presented reflect the perspectives of the study participants and the analysis of the study team, with no competing interests affecting the outcomes.

5.3 Data Access Statement

The data supporting the findings of this study were collected through household surveys, focus group discussions (FGDs), key informant interviews (KIIs), and in-depth interviews (IDIs) in Koyra (Khulna) and Moheshkhali (Cox's Bazar). To protect the privacy and confidentiality of participants, the raw data, particularly survey responses and interview transcripts, are not publicly available. However, anonymized datasets or summary statistics that do not compromise participant confidentiality may be made available upon reasonable request to the corresponding author.

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