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Exploring Gender and Climate Change Nexus, and Empowering Women in the South Western Coastal Region of Bangladesh for Adaptation and Mitigation

Ashrafuzzaman Md ^{1,2,3,4,5,*}, Carla Gomes ², João Miguel Dias ⁶  and Artemi Cerdà ³ ¹ Climate Change and Sustainable Development Policies, University of Lisbon, 1600-189 Lisbon, Portugal² Institute of Social Sciences, University of Lisbon, 1600-189 Lisbon, Portugal³ Department of Geography, University of Valencia, 28, 46010 Valencia, Spain⁴ Department of Anthropology, University of Chittagong, Chattogram 4331, Bangladesh⁵ Climate Change Department, University of East Anglia, Norwich Research Park, Norwich NR4 7TJ, UK⁶ Physics Department, CESAM, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal

* Correspondence: md.a@edu.ulisboa.pt; Tel.: +351-920573188

Abstract: This study has been conducted to identify vulnerabilities and effects of climate change on women in 12 unions in Shyamnagar upazila in the Satkhira district in the Southwestern Coastal Region of Bangladesh (SWCRB). Climate vulnerability and gender inequality may increase due to climate change. Women may, thus, face specific conditions of vulnerability in society and daily livelihood. This paper focuses on investigating factors that influence women's vulnerability from climate change, their adaptations, and the importance of women empowerment to reduce their inequality in SWCRB. This study also emphasizes gender inequality caused by climate change, and looks at accommodations for women to reduce hostile influences of climate change. From the 9 unions in SWCRB, a total of 320 household respondents were randomly selected to complete a questionnaire. The results of the statistical analysis showed that most of the survey's perimeter has significant. Interviews, case studies, focus group discussions, workshops, and key informant interviews were also conducted from 12 unions, and it was found that climate change impacts men and women differently, with women being more vulnerable than men. Through case study this paper investigated the main factors influencing the vulnerability of women. In terms of empowerment women may also be well positioned to lead adaptation efforts alongside men, as this analysis represent that gender inequalities are leading by social norms. Women being more vulnerable both in short-term i.e., major natural disasters, cyclones, flood, and long-term i.e., sea level rise, salinity intrusion in water and soil, land erosion, droughts, climatic events, as they enhance gender inequalities. Further, gender inequality is seen in illiteracy, food shortages and poor health conditions, traditional norms, religious taboos, and patriarchy. Moreover, gender-based economic opportunities, women's mobility, and income are changing, while household authority relations and gender-based socio-economic, cultural, and institutional constraints remain. This study examines the increased vulnerability of women in SWCRB to climate change, which can be mitigated through women empowerment; female involvement with environmentally friendly stoves, rural electrification and renewable energy development, microfinancing, and nakshikantha. (Nakshikantha is a special type of sewing art that is made by creating designs with different types of colored threads on plain stitches). Lastly, women may also lead adaptation efforts alongside men, make decisions, and promote their participation.

Keywords: gender; climate change & vulnerability; inequality; women empowerment; adaptation; Southwestern coastal region of Bangladesh



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1. Introduction

Most of Earth's coastal regions are threatened by climate change and sea level rise, natural calamities and meteorological turbulence originating from climate change [1]. On

a superficial level, climate change does not seem to have an impact on gender elements. However, changing environmental conditions continue to alter the impact on women. Women, adolescent girls, and female children are the most abandoned during natural catastrophes [2,3] representing more than 75% of displaced people [4]. Even during hurricane Katrina that affected USA, the most affected people were typically females, in particular those with Afro-American ethnicity [5,6]. Because of shortage of health care privileges in times of disaster, women are vulnerable to reproductive and sexual health problems, in addition to prevalent sexual and domestic abuse [7]. This illustrates the logic that equal socio-economic rights can make recovery and in starvation assistance more effective in terms of public health service, food and water accessibility. Moreover, while complex relations between gender and climate change are still under review, previous studies of natural disasters can show climate change adaptation strategies [8,9]. Understanding the social implications of climate change can be illuminating though regretfully, as Kabeer [10] shows, the logic that makes predictions is complex and may not always lead to the desired results. Many inhabitants of developing nations like the South Western Coastal Region of Bangladesh (SWCRB) are already socially marginalized; dependent on State resources and with limited financial resources, their security tends to be progressively compromised by climate change [11]. Frequent natural hazards from climate change increases the women vulnerability. Further, women's social positions are based on social institutions, ethnicity, gender identity, and not on personal abilities [2,10]. Thus, gender characteristics and patriarchal norms serve as social barriers that make it difficult for women. This is because they lack power to make decisions, such as whether to take shelter during disasters. As such, vulnerability traits are based on physical, social, economic, and environmental aspects that increase individual and community susceptibilities to hazards [11]. Women are more vulnerable in poor countries, like Bangladesh, as they play multiple roles in the family (i.e., providing food, water, collect fuel, and care for their loved ones).

It is important to investigate the effect of gender to understand the issue of adaptation in vulnerable areas (SWCRB). In post-calamity, women in the SWCRB do not receive appropriate sustenance from family, society or non-governmental associations but they find ways to adapt [12]. Because of damaged dwellings and possessions, women must adapt and resort to adaptation measures to improve their livelihoods. It is recently widely accepted that the potential of adaptation is strongly linked to gender [13]. To better understand this connection of gender with climate vulnerability, it is essential to consider the socioeconomic roles of men and women within (rural) households in SWCRB. Recently, in response to the challenge of climate change, much attention has been paid to gender perspectives and the inclusion of women in disaster adaptation. It is generally believed that climate change shapes men and women in different ways, because inequalities in their roles and responsibilities in society, access to resources, and power relations that may seriously affect the ability of genders to respond to climate hazards [14–16]. In SWCRB, Women participate in different income-generating activities to help other poor women in the community to ameliorate poverty, aid them in achieving independence, and solving the problem of empowerment [15]. Therefore, to a significant extent of women who help to respond and adapt to the expected changes in climatic conditions. At this point, gender starts to play a defining role. Besides, the majority of Earth's coastal regions women are threatened by rising sea levels, natural calamities, and meteorological turbulence originating from climate change [16]. The area examined in this study is the Shyamnagar Upazila region, adjacent to the Bay of Bengal. The Bay of Bengal has optimal conditions for the formation of tropical cyclones, with an average of 12 to 13 depressions, and 1 or 2 major cyclones affecting Bangladesh each year [17,18]. For example, cyclones Sidr and Aila and the latest cyclone Amphan, which occurred in May of 2020, devastated the SWCRB [19,20]. Moreover, the geophysical distinctiveness of the Bangladesh coast and the poor socioeconomic conditions of coastal residents contribute to the inhabitants' increased vulnerability to hurricanes and storms [21]. Most of the unions (Unions are the smallest rural administrative units, under Upazila level, and they can be taken analogously to counties in the western countries) in

Shyamnagar Upazila are inhabited by people with low Income that are unable to maintain their houses in a sustainable manner. As a result, they have to face various dangers. Respondent –46, age 51, a resident of the Gabura Union (Unions are the smallest rural administrative units, under Upazila level, and they can be taken analogously to counties in the western countries), said: “I have built a house with an installment of (Bangladeshi Currency) (Bangladeshi taka is the currency of the People’s Republic of Bangladesh) tk 5000 (\$45.04). If there is a big storm, there will be no house left.” This paper highlights the most salient issues regarding climate change, what women are facing in the SWCRB, how to mitigate the uncontrollable effects of climate change and how to adapt to an unpredictable but inevitable future.

Additionally, there is focus on the interactions between natural climate systems, social norms, religious taboo, and dominant patriarchy system that have gender inequality implications in areas such as the SWCRB during the time of catastrophes. This study, thus, aims to identify people’s perspectives on gender responses to disaster threats, women’s vulnerability, adversities, and inequality. The development of adaptive capacity can contribute to the well-being of social and ecological systems, requiring radical transformation and changes in the mainstream of our society [22]. The dominant development perspective widely supports the truism that integrating gender analysis into development methods and practices will be beneficial in addressing climate change in the SWCRB. The government of Bangladesh and NGOs are concentrating on climate change and are implementing adaptation and mitigation steps to reduce the severity of environmental, economic and social impacts on women, such as the National Adaptation Program of Action (NAPA), Bangladesh Climate Change Strategy and Action Plan (BCCSAP) [23,24].

This paper is divided into five main sections, starting by outlining the process of incorporation of a gender perspective into developmental theory, leading up to the mainstream approach that is favored today and focusing in the vulnerabilities existing between gender, specially analyzing existing trends in literature on the gender and climate change nexus. It reflects on why women are particularly vulnerable to climate variability and change (short and long term) and also play a key role in adaptation, in the SWCRB. The broader social implications of women’s vulnerability in rural areas, especially those generated by inequality, will also be addressed throughout the paper under the main perspectives raised from the 5th IPCC Assessment Report [22]. The second section presents the perceptions of local communities on women vulnerabilities and empowerment in the context of climate adaptation, bringing in critical stances with pressing policy implications. The third section reflects field survey analysis with social opinion regarding nexus of gender and climate change, the fourth section highlights four success cases of women empowerment with the potential to become contributors to adaptation in the SWCRB, And the final section that presents the discussion, comparison and conclusion.

The hypothesis is that climate exposure and events, as well as societal themes (i.e., increased illiteracy, food shortages, worsened health conditions, traditions, social systems and norms, patriarchy, and religious taboo), increase women’s vulnerability and gender inequality. Thus, women empowerment (in gender dimensions of climate change) improves climate induced vulnerability and gender inequality, as women serve as agents in SWCRB for climatic adaptation.

2. Literature Review

2.1. Vulnerability, Gender Dynamics of Climate Change

Gender dynamics is affected both material and non-material resources; it is likely that climate change will affect gender relations and gender equity. Developmental theory and practice aim to create and understand social change, alongside political and economic change [25]. Like all theories, developmental theory has revised and renewed itself, incorporating, refusing and re-assimilating criticism over time [25]. Part of its trajectory involved the inclusion of social analysis into research and practice, and gender equity [9]. Sen’s [26] assertion that humans are actors for whom the maintenance of fundamental freedoms is

an integral part of “what we have reason to preserve” questions and redirects the focus of what is to be sustained [26]. Amartya Sen [9] insists that people should be perceived as agents instead of as patients. People have the ability and capacity to act and value their surroundings are therefore should be given the capabilities to do so. Sen [9] states that prerequisites to enable people to become agents are the removal of unfreedoms, e.g., governmental oppression or starvation which curtails people’s abilities. Capabilities in turn refer to the ability of people to achieve or to do what they value in life e.g., individual freedom to choose for themselves between certain alternatives. This in turn, assumes that there are certain prerequisites to make choices and also that there are particular alternatives to choose from. Capabilities can only be realized if, for example, there is enough food to choose from, i.e., if you want to eat or not to eat. Thus, under certain climatic circumstances such as in the event of a deprivation, women’s potential capabilities may not be achieved [25]. Sen [9] further explains the concept of agency as a person who chooses to actively be an individual member of a society participating in social and political practices. Sen’s capability-approach enables people to control their own life through individual and free choices. Powerlessness and inequality will limit a person’s ability to choose freely. Empowerment can be acquired through availability of education or health care which in turn will enable people to access more alternatives and choices [9]. It is within this idea of mandate and expanding freedoms that we examine the logic of conventional gender analysis that has the potential to reduce gender inequity in SWCRB and tackle climate change through engaged and active participation of empowered women. This research is directed at utilizing gender insights to achieve sustainable development pathways. Amongst these, we highlight three implications of gender equitable analysis; (i) strengthening women’s rights and socio-economic status to better cope with the effects of climate change, (ii) building resilience through women empowerment, and (iii) enhancing empowerment and income through women-friendly, low-carbon renewable energy for reducing climate effect. Moreover, it is necessary to prioritize micro-finances for improvement of social status for women.

Gender discrimination may be intrinsic in harsh background conditions (higher illiteracy rates, shortage of food and calories consumption and inferior health conditions), traditions, social systems and patriarchy are also responsible among other things. These obstacles handicap women more than men by increasing effective responses to foresee continuous environmental changes such as coastal erosion, flooding and soil salinity [27,28]. Strengthening women’s rights and socio-economic status is to better deal with the effects of climate change. This suggests that there is a gendered vulnerability to climate change that largely ways in the favour of men [8,9,29–31]. The IPCC also recognizes that climate change plays a particular role in continuing gender inequality, such as in the SWCRB where men have larger access to land [22]. Existing gender inequality is highlighted as a result of weather events and disasters related to climate, which increases the abyss of social, economic, and cultural rights perpetuating vulnerabilities [3,29].

The construction of economically poor women as victims denies their agency [10,30] and emphasizes vulnerability as an intrinsic problem [10]. Less than 20% of global lands are owned by women, and their high vulnerability can be checked in terms of labor force. In South Asia, for instance, women comprise approximately 70% of the agricultural labor force [22]. Rural women are dependent on natural resources to sustain themselves more than men because they perform majority of the agricultural work [8,31,32]. In Bangladesh, women’s participation in the agricultural workforce increased from 25% during 2002–2003 to more than 34% during 2005–2006 [32,33] and recently, women account for more than 50% of the agricultural workforce and the participation rate is much higher, compared to 30% in India and Pakistan though they are small marginal farmers. Women’s vulnerability through overwork may worsen under climate change scenarios due to negative impact on crops, leading to a new gender division within the SWCRB [22]. Projections of climate change impacts indicate that women’s vulnerability will manifest more intensively in terms of restricted access to natural resources (especially land and water), credit and markets, knowledge and information [33,34].

Table 1 shows how extreme weather can affect men and women in rural areas disproportionately, situation that can be observed both in the developed and underdevelopment nations. The following table, sourced from the IPCC AR5WGII report, summarizes vulnerable conditions faced by women in the countryside of India and Australia.

Table 1. Gender climate experiences. Source: IPCC, 2014:808.

Involvements	Male Farmers	Female Farmers
Rise in workload	Feeding livestock, drawing water (A)	Additional income by carrying out farm tasks (A)
	Increased migration for wages (I)	Collection of firewood, waging in neighboring villages (I)
Communal relations, remoteness, and misuse	Unable to migrate from farms, political powerlessness (A)	Increased interactions and responsibility of caregiving, negligence of health (A)
	Exploitation by contractors providing labor (I)	Disadvantage in accessing institutional support (I)
Physical and psychological toll	Increased stress, depression, suicidal tendency (A)	Indefinite support, increase in stress (A)
	Increased anxiety to escape indebtedness, domestic violence, suicidal tendency (I)	Increased pressure to provide for family, increase in domestic violence (I)

(A) Australia (ten-year drought, 2003–2012). based on Alston (2011); (I) India (climate variability and changing climatic trends), based on Lambrou and Nelson (2013).

In the context of climate change, it was observed in this research that in the SWCRB, women have less access to climate and disaster-related information compared to men. This includes emergency information and training programs to administrative processes at domestic and public levels to financial resources, including economic means to land ownership and to activities inside and outside the villages.

2.2. Capacities

All over the world, the ability of communities and individuals to deal with climate change involves a number of capacities [9]. The enlargement of women's social and economic freedoms, including their empowerment through involvement in decision making, is viewed as a means to formulate more effective response to climate change's effects, as well as contributing to social transformation through public discussion [9]. The impetus for socio-economically empowering women is strong because it expands their capabilities, entitlements, choices, and the overall effects [9,15]. Human security has been taken under risk in the context of climate change and preserving it plays an important role to protect life, as such as freedom and capacity to live worthily [22]. It's a challenge to keep such principles considering the weakness presented by the majority of institutions at national level to conduct effective adaptation efforts, risen human insecurity [3,9]. This sparks the logic that equal socio-economic rights can make recovery and response assistance more effective. Moreover, while the complex relations between gender and climate change are still being grappled with, previous studies of natural disasters can inform climate change adaptation strategies [8,9]. Understanding the social implications of climate change can be illuminating though regretfully, as Kabeer [10] shows, the logic which renders general and predictable that which is complex and particular may not always lead to expected outcomes. Many inhabitants of developing nations like SWCRB are already socially marginalized, state dependent of resource and with limited financial resources, therefore, their security tend to be progressively damaged due to climate change [22]. Though not relating to gender specifically, this is in line with Sen's [8,9] argument about famines. He states that hunger is caused by 'entitlement', ownership and command over enough food deprivation

which relates to ‘endowments’, or ownership over productive resources (land and labor) as well as wealth. [8,9]. As it is stressed by Escobar [35], the economy is not only, or even principally, a material entity, but above all, it is a cultural production, a way of producing human subjects and social orders of a certain kind.

Climate shifts can affect areas that are considered profitable and cause people to lose their occupations, and droughts or floods can drive down the price of high value foods relative to food grains, which can have serious consequences for those who make a living from the sale of these foods [9]. If the SWCRB women have unequal chances to an alternative income, or lack land rights and lose their spouse, then it is likely that they will suffer most, as will economic development. Furthermore, small-scale women farmers often play a critical role in the food security of their communities. Gender equitable understanding of climate change impacts and related gendered risks/needs can contribute to the development of effective adaptation policies and lead to wide-ranging social impacts [36]. As climate change usually impacts livelihoods and income in the SWCRB for two main reasons: extreme events impacts on agriculture crops (SLR, riverbank erosion, floods, tropical storms and severe droughts) and loss of ecosystems on which coastal people depend [3], poverty and starvation tend to worsen with the increase of the price of food, restricted mobility, and discrimination [3].

Gender equitable understanding of climate change impacts and related gender risks and needs can contribute to the development of effective adaptation policies and lead to wide-ranging social impacts. Climate change impacts livelihoods and income in the SWCRB in significant ways. Sen [9] sees women are active agents of change, able to promote the required social transformation to alter the lives of women and men [36].

3. Adaptations and Women Empowerment

Adaptation is an important measure to reduce stress in developmental processes, especially in the SWCRB, where it can help promote and support sustainable development. Adaptation planning stimulates participatory social processes, including equity and legitimacy, and it can encourage women to think more clearly about broader sustainable development goals, options and pathways [22]. There is a great deal of confidence that public decision making for adaptation can be strengthened by understanding the participation of the people in the SWCRB [22]. In this sense, women empowerment is considered valuable in this research because it contributes to favorable environmental governance and builds climate resilience. As opposed to the previous focus on women’s vulnerability, when it comes to adaptation, women are seen as powerful agents of change [37] endowed with indigenous knowledge of agriculture and water management, which also constitutes the SWCRB’s [8] livelihoods and is intrinsic to effective adaptation and social change [9]. Women also wrap tubes with plastic to prevent saltwater infiltration and from time to time excavate clay openings to put in their jewelry and important documents underneath the soil. In addition, women also have distinctive culture and reflex actions before, during and after calamity phases. Currently, women’s adversity groundwork methods have undergone change to a substantial level with knowledge obtained from cyclones Sidr, Aila, Bulbul, Foni and Amphan and calamity watchfulness guidance obtained from local stakeholders like Union Digester Management Committee.

The lack of financial resources (credit), physical resources (water and land), access to technologies and infrastructure (markets) are major factors inhibiting adaptation for farmers in Asia [3,22]. Albeit accessing such resources has become a barrier, knowledge is even more important because adaptation strategies involve dealing with uncertainty, and accurate information is crucial for perceive and decide how to adapt [22]. The fact that rural women are integral to food security yet make up a disproportionate number of those considered hungry [36] strengthens the case for eliminating gender specific barriers to livelihood adaptation in the face of climate change. Including women’s voices in decisions on climate adaptation strategies makes sense because their livelihoods are different to those of men, as are their experiences, needs and perhaps perceptions of risks [8]. The

World Bank Group illustrates the foundation of women's empowerment with projects where women have better dealt with drought risks through support for women's loans and savings groups, where women were given key roles [37]. The results show great success in facilitating income generation, saving assets, positively influencing food security and building social capital [36]. Yet, the term agent refers to acting on behalf of, rather than as, a voluntary and independent agent according to own values and objectives, envisioned by Sen [9]. Appropriation of the term 'agent' in instrumental form makes empowerment conditional and fragile; effective use of funds will strengthen the receiver's status while the opposite will produce additional indebtedness, a narrowing of choices and the loss of 'real' agency [9,36] (Agency here refers to Sen's (1999) notion of an independent actor who works on the basis of personal values and objectives). This instrumental 'take' is most explicit in the Bolivian study [9] which bases the benefits of women's empowerment on their more efficient use of resources in innovative climate change adaptation strategies with their knowledge; women can develop adaptable methods for the vulnerable SWCRB. Besides [22], observed that in Bangladesh, women are required to be self-assured and use association expertise to improve recovery capacity. Similarly, males are required to be familiar with gender-specific characteristics of disasters to be socially prepared to deal with any disaster.

On the other hand, the term empowerment first appeared in gender and development debates during the late 80s and early 90s, [38,39] and addressed the concern many feminists felt over global inequality. This global inequality would, according to the feminists inhibit women's ability to develop. It was during the mid 1990s that agencies began to adopt the concept of empowerment [38]. There are many different views of what the empowerment of women is. However, there are four aspects which are generally accepted in terms of defining the empowerment of women [39]. The first aspect is that the woman is powerless in various aspects of life. The second aspect is that women are not given empowerment, but they must claim it; "Canadian International Development Agency" (CIDA), 2012 [40], also emphasizes that outsiders can't empower women. Aspect three is that empowerment is usually seen as the ability to make independent decisions. The fourth aspect is that empowerment of women is a process of development [39]. Institutions and agencies can support women through processes that increase their confidence and develop their self-reliance [40]. Development goals such as Climate Action can be seen as a sign of female empowerment, because these goals often give rise to empowerment [39].

3.1. Empowerment for Efficiency

A major motivation for the adoption of gender-sensitive analysis and socio-economic empowerment is to improve and enhance economic activity for women and their families [25]. Women empowerment does not appear to be supported by a desire for gender justice per se, but rather to make coping strategies more effective. Such measures can still have positive social effects although the instrumentalization of women empowerment may mask the visibility and possibility of constructive results [41–43]. Furthermore, there needs to be a critical analysis on how the local processes of empowerment and inequality are situated within the global economic and political arena.

Gender equality means that women and men are treated equally [25]. This implies that women and men have equal status and opportunity to contribute to social, economic, political, and cultural development [38,39]. Women empowerment can vary depending on factors like social class, ethnicity, and family position [39]. In many developing countries, religious and cultural values and upbringing have a profound influence on women's roles in society [39]. In Bangladesh, mobility restrictions make women more vulnerable in their homes during disasters [3,22]. In addition, women take extra responsibilities before and after disasters, such as storing food and water and taking care of the children and the elderly [22]. A case in point, in 1991, Bangladesh was hit by a devastating cyclone and floods killed lots of people. Since men could move and communicate freely, they warned each other of the calamity. But a great number of women were not informed of the coming

danger. The mortality rate for women was five times higher than that for men. There are two main reasons for the high mortality rate among women during the 1991 cyclone. Firstly, they waited for their male companions to migrate to a safer place. Secondly, in many Asian countries, along with Bangladesh, most women do not learn how to swim. Women have the responsibility to supply clean water for the whole family [31,42].

3.2. Women Empowerment Rendered Technical

Tania Murray Li [43] has described a process which she calls ‘rendering technical’. In this process, an issue is formulated in technical terms, with specifiable limits and particular characteristics. It involves the definition of boundaries, rendering that within them visible, gathering information and devising techniques to mobilize the revealed forces and entities. The identification of a problem is intimately linked to the availability of a solution, according to Murray. A second dimension of rendering technical is that it simultaneously renders an issue nonpolitical. Experts who are working with development tend to focus more on the capacities of the poor than on the practices through which one social group impoverishes another, Murray Li argues [43]. Integrated approaches in development frequently face the issue of how to, or indeed if it is possible to, measure results for all parties involved [10,36,39]. This is certainly the case when we consider the possibility of measuring empowerment.

Many feminist scholars believe the vagueness of the definition of women’s empowerment to be an asset that makes it malleable to specific contexts and that empowerment is a process which eludes measurement [10,43]. Yet, for developmental organizations, the ability to measure and show quantifiable outcomes is intrinsic to the implementation and evaluation of policies [43]. This can be seen as part of the process of “rendering technical” [43]. Through defining a field of action which is intelligible, has specific limits and characteristics, experts create a boundary between them and their ‘subjects’, and can offer a solution within their repertoire. Regretfully, such delimitation in methodology and practice often results in ineffective programmes which miss the complex reality beyond that which they define. Integrating gender analysis into developmental methods and practices will be beneficial in addressing gender and climate change in the SWCRB.

4. Research Methodology & Study Area

4.1. Study Area

Shyamnagar Upazila (Upazila is the administrative tier under District level) (Satkhira District) (Bangladesh is divided into 8 geographical regions called Divisions, and these are separated into 64 Districts. The Districts are the first administrative level after Central Government) covers an area of 1968.24 square kilometers. It is a large uplift close to southwestern Bangladesh as can be seen in Figure 1. The border between Bangladesh and India, close to Sundarbans and the Bay of Bengal, has a total population of approximately 318,254 people, which equates to 46,500 households [44,45]. The annual average maximum temperature reaches 35.5 °C (Celsius)(95.9 °F) (Fahrenheit); the lowest temperature is 12.5 °C (Celsius) (54.5 °F) (Fahrenheit). The annual rainfall is 1710 mm (67 inches). Southwestern Bangladesh is highly exposed to various climatic factors, including temperature changes, erratic rainfall and sunlight, sea level rise, and cyclone events [46]. Climate change-induced sea level rise and cyclone events have led to an increase in natural disasters in coastal areas, which impacts the vulnerability of women [12].

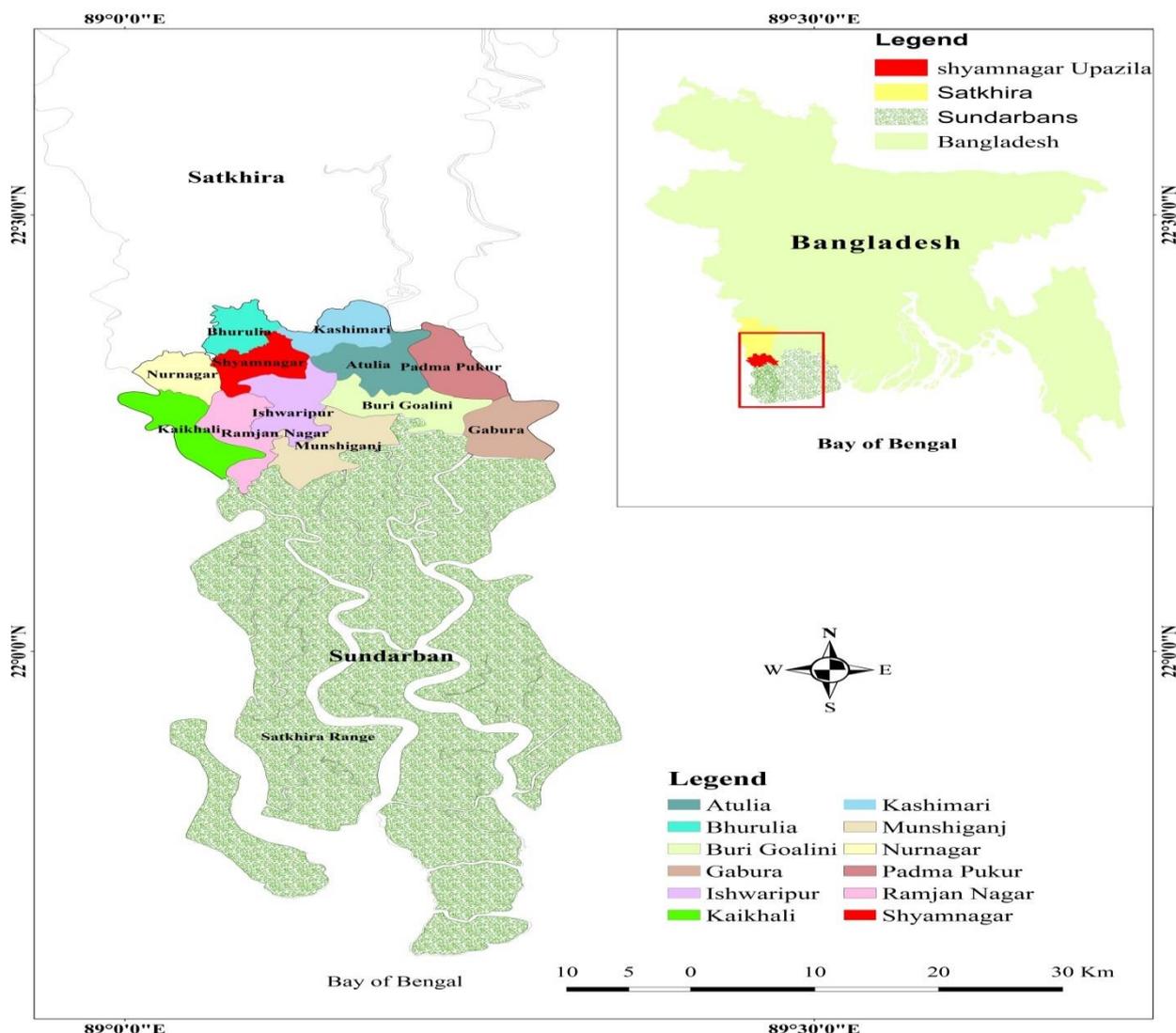


Figure 1. 12 Unions under Shyamnagar Upazila, adjacent to the Bay of Bengal.

4.2. Methodology

The data was collected in this research through qualitative and quantitative methods. Qualitative data collection techniques, such as focus group discussions (FGDs), case studies, questionnaires, workshops, in-depth interviews, and field inspections were used. The quantitative data collection technique included 320 household surveys. Both methods of data collection took place during various time frames between 2017 and 2019. Statistical Analysis was done by Cross tabulation, Chi-square test and symmetric measures were calculated by using SPSS software to determine the level of significance. The data obtained was sorted and reviewed using MS Excel-365 and SPSS (Statistical Package for Social Sciences, Version-25). QDA software is also used in the analysis process.

Before making a decision, different variables were verified and cross-checked, and then classified statistics were analyzed in terms of quality and quantity. Quantitative method indicators and questions were designed within the frame of Sen’s “Capability approach” [9], Kabeer’s “Resources, agency, achievements” [10] with “The Power of Relationships” [47] theories, Terry’s, “No climate justice without gender justice” [8], IPCC’s “Fifth Assessment Report “ [22], and the collected and analyzed data were suitable to test the validity of the theories by Lama, and Wester’s “Women as agents of change?” and Murray, L.T.’s “The will to improve” [43], in association with women empowerment. The study of the relation between gender, climate change, and other constituents (through Chi-square,

Cramér's V interpretation and SPSS analyses) is a central element of the quantitative data analysis [48,49].

An observation guide was used to collect data during the case study, FGDs, KIIs, IDIs, and workshops. The data was recorded in field notes, audiotapes, and transcribed. The data analysis was consistent as it entailed two parts: First, reading the recorded field notes to reinforce hypotheses or themes developed during the data collection phase and to generate new hypotheses or themes [50,51]. This first step is referred to as initial coding or open coding [52,53]. The second part is to notice and systematically create records of patterns in the conversations and activities of people depicted in the notes or create coding frames. The initial coding of the collected data material guidelines for coding [52] was applied to ensure credibility, transferability, and dependability.

The theoretical and conceptual frameworks consisted of content analysis. This analysis method corresponds with the abductive approach of the research, as it is based on analytic codes and categories from existing theories and explanations relevant to the overarching research question [49,50,53]. In other words, in the directed content analysis, the researcher analyses the data from the predefined categories, e.g., climate change and gender, and the gender categories that emerge from the data itself [49]. Hence, the observation and interview guide serves as a data collection tool and an analytical tool, as it will be used to categorize the data material. It is challenging to understand the beliefs, norms, and values of local people on a primary level. However, for qualitative analysis to know the gender vulnerability and the status of female empowerment, it was necessary to obtain most of the cases from female respondents. In this research, a local female was included as a monitoring mediator (trained was done two days, on the 4th and 5th of October 2017, discussion was done how to collect data and describing meaning of each question) to include female respondents. This study exclusively focused on qualitative analysis on female vulnerability issues and concerns such as tiger widows (Tiger widow is a term used to refer to women who have lost their husbands to tiger attacks while working. Every village located near the forest has many widows trying to eke out a meager living after losing their husbands), sufferers from salinity, water crisis, and inequality. Women working in agriculture, small shopkeepers, honey cultivators and other occupations were also considered for in-depth interviews. Most of respondents name were not included in our research as we used Respondent/Participant-1, 2, 3, 4 ... or A, B, C ... X, Y and Z because of qualitative research ethics. A few names were used because she/he did not currently face social challenges, and his/her name was useful to reduce climate change challenges for the many people [49–53].

Household surveys were carried out through close-ended questionnaires to capture responses from respective respondents for capturing the nexus of climate change and gender [50] (Table 2).

Table 2. Gender and climate change analysis questionnaire.

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- (1) Do you think the oldest, disabled, children, and women are most vulnerable at the time of disaster?
 (2) Do you think women are the most vulnerable due to climate shifting pattern?
 (3) If yes, what type of vulnerability do they usually face?
- (4) Is there climate change associated impact on a specific gender? (a) Physical and social settings of women (b) Link between climate change, livelihoods, etc. (c) Impact of climate change on women's triple role (Reproductive, Productive, Community Management).
- (5) Do you think adaptation measures impact on men and women differently?
 (6) Is it possible to achieve women-friendly adaptation and mitigation in coastal region?
-

In-depth interviews were conducted with selected respondents such as teachers, community leaders, farmers, non-governmental organization representatives, fishermen, farmers, honey collectors, and gender practitioners with guidelines prepared separately for each type of respondent specifically on climate shocks and vulnerability. These were conducted through field work, skype, messenger, telephonic interactions or interaction with

respondents. The close-ended questionnaire consisted of household survey data collection from household heads together with interviews of family members (where permissible) (Table 2). During the close ended questionnaire surveys, interviews were focused on male and female respondents from each household. However, the women were generally due to religious taboo and traditional norms they are hesitant to give interviews with male researchers. To realize such a comprehensive understanding of the relationship between gender and climate change, it is essential to characterize these notions from both scientific and SWCRB people perspectives. Moreover, women felt reluctant to express themselves in front of researchers. During this household research survey, 31% of the female respondents willingly responded to the close-ended questionnaires. A total of 320 household head surveys, 26 FGDs, case studies, observations, interviews, and several public discussions were conducted. Investigations were conducted between July 2017 and October 2019 in the Shyamnagar Upazila, SWCRB. The survey covered a total of 320 households from respective 9- union of the Shyamnagar sub-district. The respondent size was distributed proportionally depending on population size in the respective area using simple random sampling [49–53].

FGD: In this research, the locals got together to discuss on climate change, sea level rise, gender issues, vulnerability of women, empowerment, and were guided by a male and a female moderator. The group was called a focus group, and the discussions were tape-recorded, transcribed, and analyzed. We carefully evaluated and analyzed the interactions and discussions among the people [53]. The study organized 26 FGDs with different groups of pre-selected respondents of homogenous nature with semi-structured guideline and the use of participatory exercises.

Guidelines were prepared for each group of respondents to purposely draw out specific information related to the research objectives. Each FGD consisted of 8–12 participants including doctors, teachers, and stakeholders from government and non-government organizations, women, men, youth, elders, people with disabilities, and others. FGDs captured the data related to climate shocks and vulnerabilities, opportunities such as disaster- and climate-resilient practices (disaster risk reduction, climate change adaptation and mitigation) [49,50].

This research is a series-based analysis to assess climate change, sea level rise, the extent of impacts, vulnerability, and risk adaptation. The FGDs consisted primarily of mixed male and female respondents. Specifically, to identify vulnerability of women and the importance of female empowerment in the climate adaptation process in each union of the study area, there was an arrangement of the FGD session, solely consist of female participants. All other essential information was collected through face-to-face FGD sessions. Since patriarchy shapes women's status to remain in obscurity, and discourage women from expressing their concerns in the presence of men, focus groups exclusively targeting women were very effective of Bangladesh. Gathering information through FGDs and informant interviews were conducted for females in the age range of 1947–2017 years. Considering the need to have participants with exposure to climate aspects and long-term trends, the focus group interactions focused on 8 to 10 individuals. To ensuring that research participants were aware of long-term scenarios, a minimum age-limit was set. The information provided from rural inhabitants was important, as they had a limited academic background, and were more aware about the neighborhood [53].

Case studies: Case study is used for in-depth investigation. It is an ideal method that can run a holistic investigation [51]. Since case study spans its focus on an analytical domain in a comprehensive sense, such an approach is optimum for qualitative research within a short duration of a study. As life is not conducive in any aspect for these women, it is essential to understand how they could survive, and what their voice is in the SWCRB against the climate change debacle. They have limited alternatives to migrate elsewhere despite worsening circumstances. Thus, it is necessary to note if they will be able to adapt to the change. The case studies in our research were designed based on our research question [53]. For example, primarily, a list of women facing vulnerability due to climate

change was generated, and their extent of vulnerability was discussed with the participants. If the participant was indeed vulnerable, an appointment was made, and the participant was briefed on the further design of the case study. Then the case study was analyzed and the interviewee was mentioned in the research [51]. They were briefed regarding the importance of our study topic during data collection and while concluding the study. They were also shown what was written and recorded during the case study, and their permission was obtained to use their responses in our research. Short cases and case studies on climate change and gender, gender vulnerability of coastal communities, social inequality, economic activities, climate justice, community-based adaptation, empowerment, food security, shrimp farming, drinking water, livelihood, adaptation etc. from the community were recorded. This research was facilitated with the knowledge of understanding the survival mechanism for vulnerability of women and their adaptation in the SWCRB.

Workshops: In this research, 9-meetings were organized with school, college students, and a mixed group of participants (local government officials, journalists, and representatives from non-governmental organizations). Workshop guidelines were prepared to sort out climate shocks and vulnerability, and benefit from their experience and knowledge [50,53].

Attempts to characterize people's perspectives on climate change in SWCRB have focused predominantly on observations of change. When attempting to characterize the relationship between gender and climate change it is common for SWCRB people to communicate the perceived influence of climate change on their: (i) Vulnerability, gender dynamics of climate change; (ii) how extreme weather can affect men and women in rural areas disproportionately; (iii) women's social and economic status; (iv) Social construction is that women are not able to deal with the effect of climate change but, when societies comes to adaptation question, women are seen as powerful agents of change in SWCRB; (v) In SWCRB, religious, individual movement from one place to another place, social values, and upbringing have a profound influence on women's roles in society (ex. during cyclones, women are more vulnerable); (vi) Types of vulnerability typically faced by women; (vii) Adaptation mechanism of women before, during, and after catastrophes; (viii) Differences in catastrophe adaptation measures between men and women; (ix) Women's capabilities in the SWCRB and challenges; (x) Empowerment are improving family and society. Because gender dynamics affect various aspects of SWCRB adaptation, it is difficult to isolate SWCRB people's perception of the relationship between gender and climate change alone. As such, it may not only be the process of climate change itself that characterizes socio-economic norms. It seems that it is the manifestation related to social norms that are enhancing social inequalities of women in SWCRB.

As a result, it may be interpreted that, to the perspectives and awareness based on this research field survey of, and experiences with, gender (and all related driving forces) a conceptual link between climate change and gender inequalities may that a be identified. Participants were asked to describe what they thought would be key characteristics of climate from their perspectives (i.e., climate/environmental changes that they were starting to face). From the respondent key characteristics identified were climate change, sea level rise, cyclone, flood, and higher soil and water salinity in SWCRB.

During the interviews, FGDs, Case studies, workshops and questioner survey when we asked the questions to the respondents, we observed their eyes, body language and their conversation, we try to understand their motivation and information whether it is truthful or not. We also cross checked respondents answers with each and other (for the same questions) for reliability and validation of information [49–53].

4.3. Sample Size

Quantitative sample size determination:

For collecting primary data and information, the Shyamnagar sub-district under Satkhira district was chosen using purposive sampling as the most climate vulnerable area including the banks of Bay of Bengal. In the respective sub-districts, qualitative data

and information were collected from 12 (100%) unions namely Gabura, Ramjan Nagar, Kaikhali, Atulia, Ishwaripur, Munshiganj, Kashimari, Nurnagar, Poddo pukur, Buri Goalini, Shyamnagar, and Bhurulia. Quantitative data were collected from different respondents from different places in 9 unions under respective sub-districts for this research focusing on social vulnerability.

A representative sampling approach was executed in this study. The sampling was undertaken by means of a non-probability sampling—a technique where the examination is permissible to opt individuals in accordance with a precise trait [49,52]. The targeted respondents were identified using probability sampling technique such as systematic, simple random, and stratified random sampling techniques to represent the target population with study coverage. Respondents were selected as per ratio of gender, age, and people with disabilities, ethnicity/minorities, and economic segregation status. An extra sampling method known as snow-ball sampling was also employed. Snow-ball sampling highlights the exploit of preliminary participants who assist in recommending other participants for this research [52]. For this study, communications was established with a local guide and a journalist for a local newspaper to locate potential individuals for interviews.

Table 3. The sample was considered at a 95% confidence level, with an accuracy rate or amount of admissible error margin of ±5% considering the exact beneficiary count and to sample the representative equally for Shyamnagar Upazila (Satkhira District) and distribute proportionately in accordance with population size. The following sampling approach and statistical formula has been applied for the sample design:

$$n = \frac{z^2 \cdot p \cdot q \cdot N}{z^2 \cdot p \cdot q + (N - 1)e^2} \tag{1}$$

where,

n = Sample size

N = Target population size

e = Admissible error in the estimate

p = Proportion of defectiveness or success for the indicator

$q = 1 - p$

z = Standard normal variable at the given level of significance

Sample size distribution through stratified random sampling was as shown in Table 3.

Table 3. Detail of quantitative sample size distribution.

Type of respondents:		N = Total	e = Admissible error in the				
Social and gender vulnerability	Unions: 09	population: 242,392	estimate: 5.5% admissible error margin	Sample size = n: 320	Female 98	Male 222	Youth 25.5%

In this study, exclusive purposive sampling was employed to select the respondents. Gender: The gender of respondents is presented in Figure 2. Most respondents (69.4%) were male while 30.6% of the total respondents were female.

In Bangladesh, women’s activities have traditionally been restricted. Even when they go out, Muslims generally abide by SWCRB by following the Muslim custom of wearing a veil and segregating women, and limiting their movements since they take care of their children. There is also an increased fear of sexual and physical abuse for women outside the home [54]. Still, social and religious barriers prevent them from leaving their homes. In this context, male respondents outnumber female respondents in this survey. It is clear that females are more vulnerable during disaster periods than males in the study area [54,55]. Females are less conscious as well as less concerned about the impact of climate change, rising sea level, pure drinking water and sanitation. They don’t even know how to cope with disaster or to mitigate their situation of vulnerability [55]. On that ground,

this study included limited female respondents for collecting answer of the close ended questioner survey but we overcame this limitation through qualitative method like case studies, FGDs, workshops and interviews under 12 Unions.

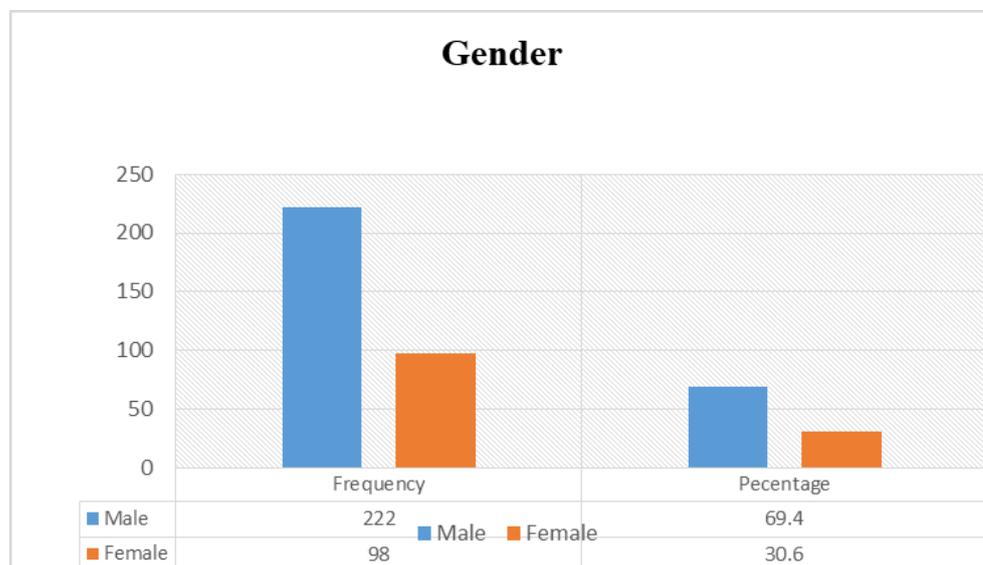


Figure 2. Gender of the Respondents; Source: Field Survey, 2017–2019.

4.4. Respondents Occupation and Income

Key bases of earnings: Shyamnagar inhabitants have an extensive variety of professions, for example, day labor, farming employment, fish farming, crab farming, poultry farming, rickshaw-van pulling, auto bike-taxi driving, mechanics, fishing, grocery shopping, fishing [56]. There are individuals of numerous occupations comprising cutting leaves, collecting honey, providing labor in shrimp farms, teaching, temporary labor, but maximum of the individuals of the Shyamnagar Upazila are engaged in fish farming. From the key basis of earning, maximum of the people of Shyamnagar make an income usual of tk 5000–10,000 (\$45.04–90.09) each month. Overall earning: Those who have a basis of incidental earning make around 10,000–12,000 tk (\$90.09–108.10) a month. In the instance of those who do not have incidental earning, it is 5000–6000 tk(\$45.04–54.05) with which the individuals of the locality devote half a day in starvation [56].

5. Field Survey Analysis and Results

This section presents the results of the questionnaire survey conducted from 2017 to 2019. It examines the perspectives and level of awareness of those impacted by climate change events. Furthermore, it presents the respondents thoughts and ideas regarding types of vulnerability, adaptation measures as well as cultural frameworks.

Many respondents (87%) believe that women, children, elderly, and disabled people are the most vulnerable to shifting climate patterns. A total of 12% of the respondents stated that they are not aware about the issue, which means that the respondents, especially women are not conscious about their vulnerability to climate change (Figure 3). Comparison of the mean values of the male and female respondent's women, children, elderly, and disabled people are the most vulnerable to shifting climate patterns represents a significant value among them. The respondents also pointed out that gender inequality as well as gender differentiation is caused by climate shifting pattern, and women are more vulnerable than men to climate change due to their poverty, social and cultural norms and religious restrictions. One of respondent, B, age 43, from Ramjan Nagar union said that the lives of children, elderly people, women, and disabled become more vulnerable at the time of disaster because they cannot move easily or run fast. They cannot take shelter anywhere during this disastrous period, as they cannot say anything. The restricted movement of

women makes them more vulnerable to the effects of climate change. Moreover, during disasters sanitation systems are disrupted as well as damaged. Under these circumstances, women feel insecure and ashamed to carry out their biological needs outside. Many elderly people have lost their memory, terrified by fear, and many of them have suffered strokes. Pregnant women are more affected by various diseases due to climate change. The locals have asked several times to build shelters nearby for the benefit of these women and elderly people but no action has been taken.

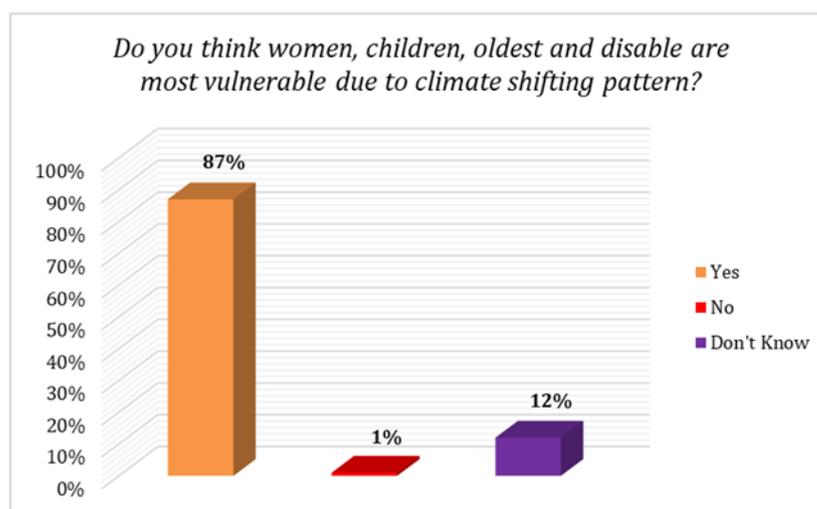


Figure 3. Vulnerability of population type to shifting climate patterns; Source: Field Survey, 2017–2019 [Whereas, yes (male 60.36%, female 26.64%); No (male 0.69%, female 0.31%); Don't know (male 8.32%, female 3.68%)].

A total of 12% of the respondents mentioned that they were not aware of it, which means the respondents, especially women are not aware about their vulnerability due to climate change. Gender equality means that women and men are treated equally [47,57] and that women and men have equal status and opportunity to contribute to social, economic, political, and cultural development. According to Kabeer [57], there is a distinction between men and women, because they are not treated the same. Many women, for example, receive lower wages for the same job in the context of the SWCRB [42,47]. Women empowerment can vary depending on factors like social class, ethnicity, and family position [41]. In many developing countries, religious and cultural values and upbringing have had a profound influence on women's role in society [29]. There is very high expectation in many developing countries that girls take on family responsibilities at a young age to be able to help around with domestic and other duties [11,25,37,57]. In countries such as Bangladesh, India and Indonesia, young girls have limited mobility and are not allowed to go far from the house as they are expected to perform domestic duties [22,54,57].

The Climate Change Cell of Bangladesh noted that women are further more exposed as they are often not allowed to partake in the community arena, and consequently, less likely to obtain decisive data for consideration of emergencies [58]. Furthermore, the majority of climate change, sea level rise, and adversity questions, planning, and agenda are not gender neutral [59,60]. As women do not have enough opportunities to earn income, they are dependent on men's choices and interests. Participant-47, age-19, mentioned that the women of the Gabura union in the SWCRB are more vulnerable to health risk because in such areas, they have to travel a long distance to collect water and such hard work is detrimental to their health. The women of the SWCRB suffer more than women of any other area of Bangladesh because this region is prone to natural disasters, and clean water is rare.

According to Table 4, 43.75% of the total respondents stated without hesitation that women face shortage of food and clean water. Approximately 55% of the respondents

stated that the distance between the cyclone shelter and their home is far. The respondents pointed out that during climatic hazards, they become nervous and worried because the weather forecasting and warning system of the study area do not work well and they do not receive updates on climate hazards. Moreover, the respondents especially women, children, and disabled people cannot connect with local institutions due to poor road condition and communication systems. A total of 20% of the respondents have mentioned that they feel helpless. Women's specific physiological needs add additional challenges to their already existing vulnerability in terms of climatic conditions in the SWCRB. Approximately 25% of the total respondents pointed out that there are limited high areas in the coastal area. As a result, during flood or cyclone, water enters the homes and the inhabitants suffer from various problems.

Table 4. Types of vulnerability typically faced by women.

Types of Vulnerability	Respondents	Percentage of Responses	Male (222)	Female (98)
Women that don't know how to swim	112	35%	24.28%	10.72%
Water and food issues	140	43.75%	30.35%	13.40%
Cyclone shelter is far from home	176	55%	38.16%	16.84%
Lack of high places to build homes	80	25%	17.34%	7.66%
Physical weakness	88	27.5%	19.09%	8.42%
Helplessness	64	20%	13.89%	6.13%
Nervousness & Fear	96	30%	20.81%	9.19%

Multiple Responses: N = 320; Source: Field Survey, 2017–2019.

Approximately 27.5% to 35% of the total respondents respectively mentioned that women living in the study area face a very dangerous situation due to their physical weakness during the disaster. In addition, many of the women do not know how to swim as they have never tried to learn swimming because of religious and cultural norms (Table 4). As a result, they are not able to cope with hazards. Long-term climate change effects like Sea level rise, droughts or flooding are likely to affect women more negatively than men in situations where their means, capacities, and opportunities are unequal [58–61].

According to Table 5, more than 43.75% of the total respondents have mentioned that women are affected differently by physical and social setting for women/health issues. A total of 35% and 38.1% of the total respondents respectively registered that women's economic condition are adversely affected by the worsening effects of climate change. A total of 46% of the respondents admitted that women are not sufficiently involved in decision-making or in planning climate change adaptation or mitigation strategies. This traditional thought restricts to flourish women's decision-making power (Table 5). According to total respondents 40.6% in SWCRB women's undertake triple role in the family and society (Reproductive, Productive, and Community Management). Women's reproductive roles include the physical and connected to the labor of the household such as maternal duties and care and maintenance of household chores. The productive role of women relates to agricultural production, informal production, household production and livelihood. Women's community management roles include caregiving and unpaid work, and water collection, health care, natural resource management, etc. In Bangladesh, mobility restrictions make women more vulnerable in their houses during floods [3]. The case of the cyclone is a prime example of the dramatic gender disparities during floods [22]. Other differences may be exacerbated during extreme events of cyclone, drought or flooding because women take on extra responsibilities before and after disasters, like storing food and water and taking care of the children and the elderly [22]. Inadequacy of shelter capacity

during and after climate events affects every sector e.g., human trafficking. From the total respondents 27.5 % have mentioned that women are affected differently in connecting to Inadequacy of shelter capacity (Table 5).

Table 5. The impacts of climate change on gender in particular.

Impacts	Respondents	Percentage of Responses	Male (222)	Female (98)
Physical and social setting for women/health issues	140	43.75%	30.35%	13.40%
Women's triple role (Reproductive, Productive, Community Management)	130	40.6%	28.16%	12.43%
Women's economic livelihood/poverty	112	35%	24.28%	10.72%
After hazards, income and occupation challenges for women	122	38.1%	26.43%	11.67%
Inadequacy of shelter capacity	88	27.5%	19.07%	8.42%
Women's participation in decision making	150	46.9%	32.54%	14.36%

Multiple Responses: N = 320; Source: Field Survey, 2017–2019.

One of the participant-48, age-38, said that food and water are the main concerns of women in the SWCRB, for those of whom the partners have migrated because of climate change. Food is vital in people's everyday lives. Women are part of the food supply chain from the beginning, as gatherers of seeds, leaves and eggs; growing plants in gardens and raising animals for family and income; cooking, and collecting fuel [61]. However, although women contribute to half of the world's food production, they face more obstacles than men to reach resources such as land, credit, and agricultural inputs and services [60,62].

In coastal region, most of the women mainly depend on natural resources for earning money as well as managing their livelihoods. The respondents said that women living in the study area earn money through performing agro based activities (like transplanting, harvesting crops, boiling and drying cereals), collecting fish & prawns in the river, raising hens and goats. The findings of the study indicated that different natural disasters contribute to the reduction of the source of income, especially those of women. During disaster periods, women cannot find agro-based jobs because natural disasters damage crop production. Moreover, natural disasters hamper the reproductive capacity of fish and prawns. Additionally, women are unable to travel or move to another location to look for work because of their social attributes and religious restrictions, whereas men can easily migrate to another region to earn a living without facing any social or religious restrictions.

The following (Table 6) shows the operating framework of women namely, culture and conditions, during and after extreme climate events.

According to the World Bank Group's report, women's lesser involvement in shaping of policies that affect flow of finances, or reduced access to assets, services, and voice [37] make them more vulnerable to climate change. In the context of climate change in the SWCRB, gender analysis promotes an understanding of the ways that men and women are differently impacted by climate related hazards and the adoption of adaptation strategies. In Bangladesh, gender inequality prevails in various social, economic, and political institutions. Natural disasters and climate play an important role here, and women suffer more than men from gender disparity. All the important elements of life such as income, property, access to credit, decision-making and source of food are controlled by men in the Bangladeshi society. Women's movement is limited and restricted and so they can hardly access information and natural resources. In the same way, they are not authorized to run monetary events [62,63].

However, when women were involved in the community enlistment and participation with the local disaster management before the 2007 cyclone, deaths decreased substantially [37].

Table 6. Culture and condition induced tackling mechanism of women before, during, and after catastrophes.

Circumstances	Culture Triggered Manners	Condition-Induced Approach	Informer-Respondents of 12 Unions from SWCRB
Before calamity	Women usually overlook the cyclone indicator or continue to be oblivious about it.	Cautiously judge every cyclone sign	Respondents 1 Respondent 2 Burigoalini union
	Male individuals are not concerned to bring along women to cyclone-safe haven because of insecurity and lack of space to themselves within the atmosphere.	Get themselves ready to set off for cyclone-safe homes with other family members	Respondents 3, Respondent 4 Munshiganj union
	Because of insufficient or no facts available, they have slight/no alternative to communicate with the neighbors about the imminent calamity.	Share and communicate with the people in the community about the imminent catastrophe	Respondents 5 Respondent 6 Gaura union
	Attempt to bond and take care of their children and elderly family members collectively.	Maintain their children in close proximity, along with ailing and elderly family members	Respondents 7 Respondent 8 Ramjan Nagar
	Release livestock within the domestic setting	Look for secure positions, such as dam and cyclone sanctuaries for livestock.	
	Attempt to salvage jewelry and important documents.	Strive for their greatest level to guard their possessions to a considerable extent.	Respondents 9 Respondent 10 Koikhali
Circumstances throughout catastrophe	To follow their male partner	Caregiving responsibilities may save lives	Respondents 11 Respondent 12 Nurnagar
	Be present with teenager girls at house and periodically go to a cyclone protection center with men in the family	They cautiously regard every cyclone indicator and prepare themselves with family members to take refuge at protection in the cyclone safe haven	Respondents 13 Respondent 14 Bhurulia
After calamity	Women's work in agriculture is often seen as an extension of their family responsibilities.	Ensuring the safety of food, water, and fuel is the main concern	Respondents 15 Respondent 16 Kashimari
	Assist male members in tasks inside the house	Assist male members in resettling undertaking; doing work out of home for bringing in ready money, for example, in farming ground, ready money for labor vocation and so on.	Respondents 17 Respondent 18 Atulia
	Fixing fishing nets	Relating them in gathering of fish fingerlings, fish processing and drying undertaking.	Respondents 19 Respondent 20 Shyamnagar
	Fetch water from pond within proximity and tube well	Arrange secure drinking and potable water from distant source.	Respondents 21 Respondent 22 Ishwaripur
	Put aside money and other belongings for the coming days.	Strive to get more cash from farmhouse vegetable farming, betel leaf farming and tree plantation in farmstead and roadside	Respondents 23 Respondent 24 Padma Pukur

Source: FGD, Interview, workshops, women from 12 unions in 2017–2019 (Skye, Messenger, 2020–2021).

The following figure shows how adaptation measures affect men and women differently. When respondents were asked if they think that adaptation measures affect men and women differently, 80% responded positively. This means that gender inequality is a factor in preparing adaptation and mitigation measures (Figure 4). Comparison of the mean values of the male and female respondent's adaptation measures affect men and a woman differently represents a significant value among them. Introducing adaptation measures that include women will not only empower them and enhance their role in society, but it will also help women to learn and understand climate challenges and ways to cope with extreme events.

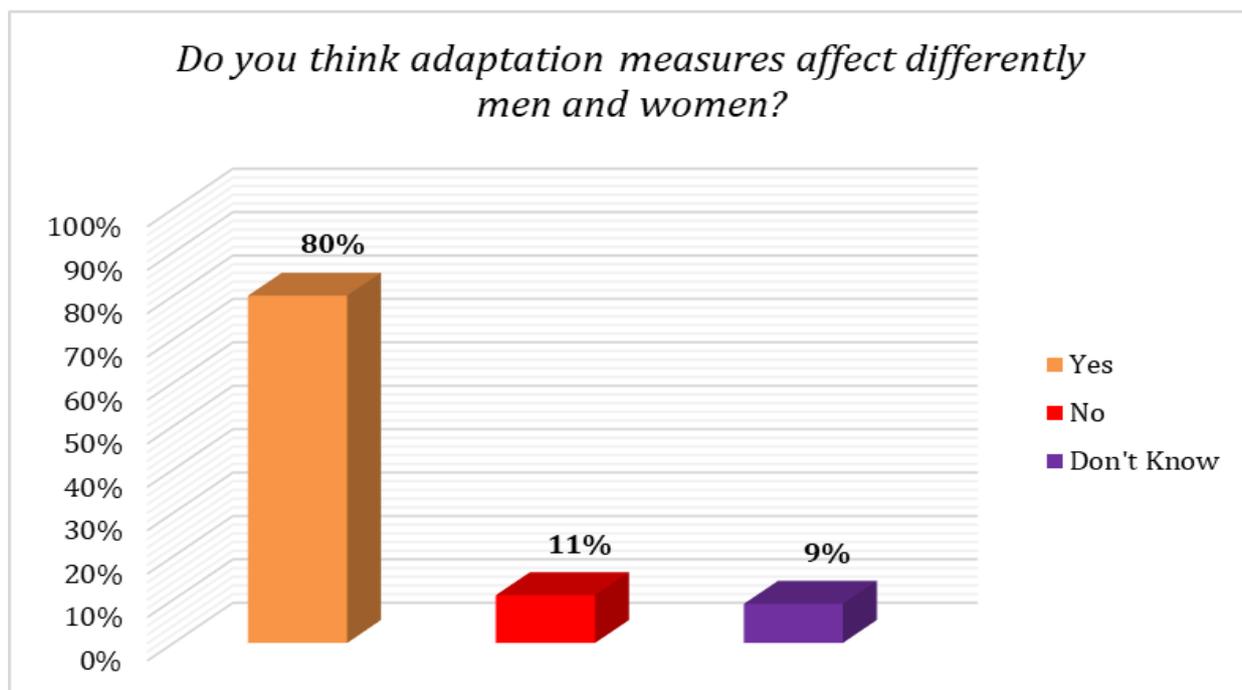


Figure 4. Affects of adaptation measures on men and women; Source: Field Survey, 2017–2019. [Whereas, Yes (male 55.5%, female 24.5%); No (male 7.63%, female 33.7%); don't know (male 6.24%, female 2.76%).

It has been reported in IPCC [22] that in Bangladesh, women are required to be self-assured and use association expertise to improve recovery capacity. Similarly, males are required to be familiar with gender-specific characteristics of disasters to be socially prepared to deal with any disaster (Table 7).

Table 7. represents women-centered adaptation measures in the SWCRB.

Adaptation Measures	Respondents	Percentage of Responses	Male (222)	Female (98)
Female empowerment through employment with land rights	150	46.9%	32.54%	14.36%
Women friendly agriculture	64	20%	13.88%	6.13%
Female education and building awareness	120	37.5%	26.02%	11.48%
Micro-finance	160	50%	34.68%	15.31%
Policy formation regarding gender equality	50	15.6%	10.82%	4.78%
Ensuring women's participation in idea development	92	28.8%	19.98%	8.82%
Organization of stakeholders with equal access and involvement of women	138	43.1%	29.90%	13.19%
Integrate climate change information in academic curriculum	52	16.3%	11.31%	4.99%

Multiple responses: N = 320; Source: Field Survey, 2017–2019.

Women in SWCRBs are certainly the most vulnerable to the impacts of climate change, and adaptation is a process that builds and enhances their resilience. How women in SWCRB are particularly vulnerable to the impacts of climate change, and what adaptation processes occur in SWCRB by which women can avoid harm from climate change impacts (Table 8).

Table 8. Women’s vulnerability and recovery capacities in the SWCRB.

SWCRB Women Vulnerability	Women-Focused Adaptation Capacity	Name of Union
Livelihood	By women/stakeholders	Women participant/informer name
Losing farmstead land and structure	Several women received help from government and non-government organizations while some were reconstructed by their selves with family members	Respondents 25 Gabura
Damage of farming yield	Obtained credit and instruction from non-government organizations for farming of season-based vegetables and substitute agricultural work	Respondents 26 Gabura
Shortcoming in essential needs like schooling, wellbeing, secure intake of water, refuge, sanitation, power supply, and communicative privilege	Government and non-government organizations make fundamental facilities available where women are dynamically involved	Respondents 27 Burigoalini
Uncertain sources of income	Probing for more varied origin of living instead of conventional ones	Respondents 28 Burigoalini
Deficiency in right of entry to and power over production like land, farm contribution, animal resource, and assets	Received credit from non-government organizations for agricultural purpose, farm animals rearing and purchasing fishing boat and farming tools	Respondents 29 Munshiganj
Reliance on money lending sources, usurious sources	Involved with uphill struggle comprising outer periphery of home for repayment of the borrowed cash timely	Respondents 30 Padma Pukur
Sharp or continual food scarcity	Farm animals rising, sowing seeds of fruit trees, season-based vegetable farming, and substitute agricultural undertaking	Respondents 31 Ramjan Nagar
Soaring death rate, undernourishment and illness	Seek advice from with the neighborhood medical doctors, herbal practitioner and visit neighborhood clinic	Respondents 32 Kaikhali
Overexploitation of natural reserves	Quit misuse of natural reserves if earning making encouragement is provided augmented by women’s economic involvement by means of self-employment	Respondents 33 Nurnagar
Escalating household violent behavior and neighborhood clash because of mental trauma	Through self-employment to decrease the mental pressure triggered from adversity	Respondents 34 Bhurulia
At Society/organization level	Through women participation	Women participant/informer name
Fragile family/relationship configuration owing to losing male adult in family unit	Improved local job openings for the women learned and working women making better contribution to reduce these troubles	Respondents 35 Shyamnagar
Shortcoming in guidance, enterprise, managerial composition to resolve troubles or disagreement	Majority of the girls are presently attending school, optimistically they will experience lesser troubles	Respondents 36 Ishwaripur
Disproportionate involvement of women in society interaction	Learning and job opening of women can diminish these gaps, consequently, decrease hostility towards women	Respondents 37 Atulia

Table 8. Cont.

SWCRB Women Vulnerability	Women-Focused Adaptation Capacity	Name of Union
Unfairness and deficiency of admission to political practices	Learning, job opening and creation of women group can diminish the social misery Calamity awareness instruction and schooling can organize women better against calamity	Respondents 38 Kashimari
Social pestering	Instruction on calamity can develop the understanding on reasons and cost of it Alertness and calamity supervision-associated instruction develop understanding about perils and costs	Respondents 39 Munshiganj
Unpleasant inferior situation in the society	Gender-responsive planning and homework for early caution or reaction to a calamity can decrease fair allocation of crisis relief easy, avail protection situation in refuge houses better, and advance alleviation	Respondents 40 Munshiganj
Attitude related issues	Women take it as a challenge	Women participant/informer name
Negative outlook towards transformation and no combating fortitude	Improved local job openings for the educated women and working women making better contribution to reduce these troubles	Respondents 41 Padma Pukur
Negative viewpoint/bigotry	Majority of the girls are at present attending school; optimistically they will experience lesser troubles	Respondents 42 Atulia
Ignorance about perils and cost	Learning and job opening of women can diminish these gaps, consequently, decrease hostility towards women	Respondents 43 Bhurulia
Reliance on outside endorsement	Learning, job opening and creation of women group can diminish the social misery. Calamity awareness instruction and schooling can organize women better against calamity	Respondents 44 Ramjan Nagar
Dispensing attitude, recuperation competence	Instruction on calamity can develop the understanding on reasons and cost of it. Relating themselves in diverse off-farm and on-farm earning creation actions	Respondents 45 Nurnagar

Source: Interview; workshops; FGD 2017–2019 (Skye, Messenger, 2020–2021).

6. Case Studies

6.1. Climate-Induced Challenges

Participant-49, age-50, of Padma Pukur union informs us that she barely maintains her family by putting entrapment on river. She also informs she has been affected during different natural catastrophes. Her house got destroyed due to the assault of hurricane Fani in 2019. Their health vulnerability is increasing due to food shortage. They cannot create and maintain gardens due to salinity. Potable water crisis is at its peak now. Various types of waterborne illnesses are surfacing due to saline water use. Pure water is becoming scarce. Fish are also dying due to salinity. A number of concerns emerge because of salinity. Participant-50, age-45 from Kashimari union is surviving within such hundreds of obstacles. Existing gender inequality is highlighted as a result of weather events and disasters related to climate, which increases the abyss of social, economic, and cultural rights perpetuating vulnerabilities. Though increasing attention is given to this topic in developed countries, it is still widely discussed in the context of developing countries, in particular with regard to ocean-related risks and sea level rise [63]. For instance, the recent surveys focusing on the southern coastal Bangladesh show that women attach less importance than men to climate and disaster-related information (both emergency information and training programs), to administrative processes at domestic and public levels, to financial resources including

economic means such as micro-credit, to the ownership of land and to activity inside and outside the villages [53].

Participant-51, age-60, mentions that they are dying without water or money. They cannot afford to go to Nowabecki every day to fetch water due to their poverty. They desperately request for the water supply facility. The widow from Borkupot village informed us further that since the only son R, and her daughter-in-law 'S' went for day-labor job, she, along with her grandchild 'M', went to Atlia Union Porishod area to fetch water but as the water was not supplied to the pipe connected to a source 2 km away, they returned empty handed. Participant-52, age-60, a peer of Participant-51, following the latter, informed us that she has to stay with the foster son since her husband is paralyzed. Since her daughter-in-law is ill, in a five-member family, she had to go to fetch water at noon and had to walk for an hour but could not obtain water. She would borrow water from the preserved rainwater of her neighbor to meet the demand for the noon; she would return the favor in the afternoon or evening. People from the villages of Napitkhali, Chandnimukha, Talbaria of Upazila have not water in proximity to their home; however, they would have to walk miles to fetch potable water. They claimed that even the day laborers have to buy water after cyclone Aila hit the waterbodies in the neighborhood rendering it saline. The water crisis worsened daily, the housewives informed that it is possible to survive without food but not without water. Without having the capability to buy water from the vendors, they are going through excruciating sufferings for days.

Participant-53, age-52, from Atlia village, and Participant-54, age 47, from Chandipur village, claimed that apart from themselves, in order to provide water to the domestic cattle, they have to cross 2–6.0 km approximately four times per day. The pond water is not potable, and hence, they have to fetch water for cooking from outside. All the inhabitants of Shyamnagar Upazila are in desperate need for potable water despite being in proximity of water. In the coming summer days, the situation is assumed to worsen. Participant-55, age 28, of Manikkhali said, "I was not married in 2009. I was studying. The sky was normal on Saturday night. Then, on Sunday evening, the weather got worse. The signal (The Bangladesh Meteorological Department (BMD or Met) uses 11 warning signals during cyclones to warn people, and these signals are announced based on the intensity of the cyclone and the wind speed measurement mode) was No. 8 in the morning, No. 6 in the afternoon, No. 10 in the evening.

The storm started with the sound of breaking trees. It was like a horrible scene beyond imagination." She added, "I was swept away in the waters of the cyclone Aila, and never imagined that I would survive the onslaught of floodwaters." With the water, the house was washed away, chickens, goats, cows all died, and we became destitute. It struck the coastal area at 11 a.m. on Monday, 25 May 2009, flooding vast coastal areas. It had been raining heavily since morning, darkness all around; most of the abadas (embankments) were broken. Waves rose from river and descended on the land. The river looked like it was going to overflow. Then the floods came. The water was like poisonous water. There was no way to calculate the number of lives lost during that time. It doesn't matter how many things I had in my house that day. Everything including our family dreams was washed away in the flood waters. We had no money to build a new house. We lost everything in this disaster. Crops are not like before. There is no more fresh water in the pond. The plants died. This water would have killed cows and goats and we would get infected with various diseases and still now".

In 2009, the cyclone "Aila" hit the Southern part of Satkhira during the day and those who had mud houses died after being pressing away by the mud. If it hit at night, the amount of damage would increase. Then, the cyclone centers were not near from the remote area for stay there. Some people went to the cyclone center during the cyclone Aila but most of the people interviewed did not. Participant-56, age-54, said that cyclone center authority usually separates family members from their families, and same family member have to worried for others family members, for that cause people did not went to

Cyclone Center e.g., the inhabitants who is living near of the Lakshikhali Cyclone Center, in Gabura Union.

One of Catholic Father stated that there is no equality among Muslims and Hindus. There is a caste system among Hindus. Until the caste system is eradicated, there will be inequality in society. The idea of equality does not exist in the Indian subcontinent, the poet Nazrul spoke of communism. When it comes to equality, people will say that social inequality will always persist because in hand five fingers are not same. For example, during catastrophe periods, Hindus or Muslims, Mosques or temples are not open to everybody because of religious differences, those places are well-built and are safe places to take shelter during a cyclone. In SWCRB look down on the rich people, who do not want to give shelter the poor in their homes during the catastrophe.

Participant-57, age-46 a resident of 9 No Sora in Gabura Union, said: 'We have suffered a lot due to the breach of the dam. The house is ruined. Houses have been destroyed as well as crops due to the demolition of embankments. There is no income at this time. The water was contaminated due to saltwater infiltration into the pond and has become unsafe for consumption. Poultry food has been wasted. The vegetables in the field are spoiled, plants are dead. You have to build a house with a loan. In the coming days, if we build big embankments, are provided with drinking water and financial assistance, our misery will be lessened'.

Participant-58, age-45, said, "I have no land. I live on government khas land (Government land). I used to sell firewood in the past. There are 6 people in my family, 2 have income. Earlier, my occupations were fishermen and collecting/cutting firewood from the forest. I used to catch fish or gather firewood from the Sundarbans by boat. We had to go deep into the forest to cut. I am poor. I didn't have permission to go to the Sundarbans Forest, but I went there anyways. When I collected 40 kg of firewood for cooking, market price was 130 tk (US \$1.5). Now firewood cutting is totally forbidden by the government in this region and market price is 200 tk (US \$3). Previously, when I collected firewood for cooking, I used to cut Bain, Garan, Sundari, Keora, Golpata trees. The government has stopped going into the forest because of river erosion and deforestation. Thanks to the Sundarbans Forest, she saves us from North-wester (Kalavaishakhi) storms, tornadoes, cyclones, and floods. I convert my occupation as a small egg business woman because of uncertain climatic pattern, and don't have my own shop. I go to Burigoalini bazar to buy whole sell price eggs, at 11 tk per egg. I buy 1200 to 1400 eggs per day. I earn 3000 to 4000 tk (US \$35 to 45) per month. While my family's finances are generally good now, before this small business, I used to spend my days in trouble. Yet the present is better than my past.

Participant-59, age-48, a small trader. I have a grocery store. I don't have a husband. The government gave me a house made of brick I couldn't run a shop because my husband died. I have tried to run on our business even though the capital is low and have succeeded today with government and private financial help. NGO Caritas helped with 18,000 tk (\$205). At present I am able to educate boys and girls through my small entrepreneurship. From the river collect young fish then I sell it to local market. I am playing a role in meeting the family food needs and conserving the environment by cultivating vegetables organically in homestead. Through my income involvement in family decision-making processes and social status has increased.

6.2. Climate-Induced Health Problems

The area has seen a rapid increase in illness due to polluted water and water-borne diseases in the last six months. The sea level has risen due to climate change, resulting in a rise in water level in the river, eventually leading to flooding and inundation of the coastal areas. Due to this, salinity level in the water of ponds, canals, lakes rise, and the water gets polluted. Participant-60, age-30, of ward no. 9 of Gabura union informed us about this issue. She also said that after Aila, pathogens have increased due to water and soil level salinity; diarrhea, jaundice, cholera, abscess, sore in different parts of the body. Participant-61, 41, from Dumuria Village of Gabura Union tells us that there is a

sharp rise in the number of illnesses due to climate change. Due to unfavorable weather conditions, children are suffering from pneumonia, measles, pox, clod, fever, and other illnesses. Pregnant women are suffering from anemia, lack of nutritional balance, headache, vomiting, and other problems. Waterborne illnesses such as diarrhea are on the increase. Skin problem, like soreness, abscess, and intensity of allergy is increasing. Participant-62, age 43, of the same Union informs us that she and her daughter had been suffering from different types of skin problems since the last few weeks.

Participant-63, age-38, from union Jelakhali, Munshigonj, is a doctor by profession. She informs that teenage girl's aged 12–16 years suffer from white inflammation. As high as 80% of the problems are due to lack of nutrition—iron, calcium deficiency. Women suffer from depression due to irregular menstruation. Anemia, headache, fever occur frequently. Allergy incidents increase due to saline water intrusion as exposure to saline water causes soreness, scabies, eczema, and other skin problems. It also leads to disability infertility among women. Under aged girls prematurely deliver at the age of 13–15 years. Many early marriages are as a result of extreme poverty here, which causes problems in conception. Cases of high and low blood pressure become frequent, weight loss occurs, and anemia becomes pervasive. Many people suffer from soreness, scabies, and allergy problems due to the polluted water in the locality. Diarrhea, dysentery, acidity, iron, calcium, mineral, protein problems are also common. Even after six months of child delivery, this deficiency is not recovered through regular intake of supplementary vitamins. Saline water also leads to loss and greying of hair, for which men are the prominent sufferers. Girls experience menstruation at an early age—even at 10 years of age, when they study at class IV–V, girls gradually become physically weak. Several women suffer from breast tumors, which turn to breast cancer eventually. Among the 40-year-old women, breast pain is a common complaint. Women start lactating even without bearing children. Several children are malnourished. Women aged 25–35 years suffer from anemia; their hands and feet become numb. Homeopathic and ayurvedic medicines are used to combat such problems, which help to some extent. Besides, some people fight against gastric inflammation by consuming energy drinks. Availability of fish to supplement calcium in the body is limited. Consequently, the children born are mentally retarded. Infants do not get enough breast milk from their mothers due to poor availability of nutritious vegetables. Thus, the people believe that if food scarcity is met, most of the problems will be resolved.

Participant-64, age 37, from ward no. 9 of Gabura union tells us that climate change is triggering flooding, eventually creating pressure on river water leading to the damage of houses. Every year they have to raise the soil level in their house courtyard. The saline water mixes with the river water and makes the latter saline. Eventually, the coastal croplands experience salinity, and cultivable lands do not produce much crop. The weather has undergone drastic change; storms, floods are occurring frequently. The water level is swollen and causing siltation on the river, eventually causing flooding. For these reasons, there is an indirect or direct impact on the health of the inhabitants of the Shyamnagar Upazila.

The cyclone Aila took the father-in-law of Participant-64, age 56, besides her losing five ducks, six hens, 14 goats. Her house also got damaged. After Aila, contrary to her expectation, she did not receive any help. However, Participant-65, age-51, her next-door neighbor, got a tin-built house. She built her own house, and she had to make use of pond water for cooking and river water for bathing. Participant-66, age-57, saw her house being destroyed due to Aila in addition to ducks and hens. She had to take shelter on the roof of the house during the storm for 2–3 h. She did not have the time to go to the cyclone centers. She also said that vulnerability to climate change effects has different implications for both men and women, and its response efforts to natural disasters can compound existing gender inequalities. In addition, some of the issues she stated are incidences of women being raped in disaster shelters or losing their homes and means of earning a living and still 98% lands are owned by males. Two sons, had heart attack on the aftermath of cyclone Aila.

Participant-67, age-49, makes a living from farming although she does not own land. She said that because of the salinity of the water, and lack of self-awareness, women are easily affected by a variety of water-borne diseases, such as skin problems, itching, scabies, sores, worms.

6.3. Climate Change Driven Tiger Widows

Crop productivity has been declining in SWCRB due to climatic shocks like cyclones, sea level rise, salinity caused by long-term commercial shrimp farming for that cause the livelihoods of people who reside near the Sundarbans, the world's largest mangrove forest, depend mostly on the forest because of the availability of a variety of resources both from the forest. Their economic dependence on forests has led to many deaths from tiger attacks, an event that has long plagued people here.

In the villages attached the Sundarbans, women who lost their husbands to tiger attacks are known as tiger widows. Due to prejudice, these women are considered to bring bad luck and misfortune to their husbands. They have to live in one house. There are 1165 such women in the Shyamnagar upazila. Due to the employment crisis in the coastal areas, the only earning member of the family depends on the Sundarbans as an alternative occupation. Increased salinity is destroying the agricultural system of the coastal region and saltwater shrimp farming reduced human employment. Thousands of agricultural workers became unemployed. Since people depend on the Sundarbans as an alternative occupation, they are being attacked by tigers. The asceticism of their wives begins when they enter the Sundarbans. Their hair cannot be combed or tied back, they cannot talk loudly, or walk in front of strangers, or fry dried salt. The lives of such women are trapped in a world of unjustified rules. If unfortunately, a husband loses his life in a tiger attack, the tiger widow is blamed and named indecently. They also need permission to attend social events such as birthdays and weddings. Many are also evicted from their own homes. Most of the tiger widows have left their husband's house, and their father's house or khas (government land) place is their last resort. In these difficult times, natural calamities such as cyclone Aila, Bulbul, Foni, Amphan have left their mark in the coastal region. In the struggle to survive, many people have lost their small slum houses.

Expressing her opinion that widows are still active in their husband's profession in the Sundarbans, one of, a tiger widow Participant-68, said "I have not received any compensation for the last 20 years. She used to make a living by fishing in the forest. She said he was tired of throwing nets in the Sundarbans and was resting under a tree. At that moment, the tiger came and jumped on her. She jumped into the trap to save his life and screamed. Sailors came to the rescue. There are still big scars on her head, back and hands. Since the attack, she has lost many of her abilities. Her head hurts a lot. Officially, she got a special place as settlement, where we stay." Participant-68's family currently survives by begging and through human donations.

Participant-69, is another tiger widow from Sora No. 9 of Gabura union. When her husband went fishing in the forest and was killed by a tiger, she was three months pregnant. Her child now goes into the forest for earning a livelihood. She has been married for two years. She has a scarcely spaced house on government khas land, which she was not able to fence. Yet, she claims that she is fine.

Participant-70, another tiger widow, from Nakipur Malopara, got married at a very young age in the Munshiganj union. Lost her husband, which indicated the beginning of a life of extreme misery. Society continues to place a heavy burden of stigma on her. This cursed life lasted for several years. Now, she is happily married again to her husband's younger brother. A few years later, she had two more sons and daughters. But this happiness did not last for long. Once again, the tiger attacked her second husband to which he perished. This time she suffered from extreme harassment, humiliation and misery. She has been stuck in the house for years and occasionally even considered suicide; however, she did not act on the thought due to her religious belief that suicide is a great sin.

7. Importance of Empowering Women in the SWCRB

This section explores specific case studies of women's empowerment in response to climate change in the SWCRB. Based on this research, empowering rural women is an important measure for adapting and mitigating to climate change. Through the case studies, it was revealed that the local women possess unique level of resilience, in terms of climate change, women may also be well positioned to lead adaptation efforts alongside men, and it is important to include women in decision-making and their participation.

7.1. Environmentally-Friendly Stoves

Bangladesh lacks a modern energy infrastructure for a large portion of its population. Eco-friendly stoves provide an innovative energy alternative in addition to reducing the workload of women and reducing deforestation in the region. Moyna Rani, age-55, of Shyamnagar was awarded the Best Jayita Award for her development of eco-friendly stoves. She used her knowledge of technology to respond to the energy crisis and reduce the impact of climate change, global warming, harmful carbon emissions and aided in the protection of women and children's health. She has produced these stoves in the coastal regions of Shyamnagar, Kaliganj, Asashuni, Debhata, Satkhira Sadar, and Koyra Upazilas of divisional Khulna district for approximately 7000 families and more than 50 hotels for the past 15 years. She has also trained countless local women in the construction and use of eco-friendly hand stoves (Source: field work: 2019).

As Bangladesh has not yet afforded modern energy for large parts of its population, more than 60% of the total population still heavily relies on fuel wood, dung, and crop residues for their cooking needs, the eco-friendly stove help to reduce the deforestation, and drudgery of SWCRB women. As a positive outcome from the initiative, eco-friendly stove provides a direct benefit, especially to rural women, as a result of the reduction of the workload moreover reduce deforestation. Going further on women benefits, ecofriendly stove enables to save approximately 1 h 30 min time per day per family. This saved time can be used for childcare, income generating activities, education, recreation and other social works.

The use of energy-efficient stoves could help reduce unwanted emissions and improve the climatic situation, especially since the stoves reduce the amount of biomass while needed its reducing cooking time and increase their distribution by reducing costs and allowing access to cleaner, safer, faster, and cheaper energy [64,65]. Other than energy proficient stoves, it is particularly important for SWCRB because in the remote area did not have access to electricity, like Gabura Union power created by private renewable energy source. At the end of the day, energy-efficient stoves that allow women and man to be more efficient while reducing their workload.

7.2. Electrification of the SWCRB and Women Empowerment

An example of rural women's empowerment and social inclusion in Bangladesh is a program run by the World Bank, in partnership with the national government (Bangladesh Bank's Non-Bank Financial Institution (NBFI) in January 1998 to bridge the gap in medium to large development funds, playing an important role in Bangladesh's large-scale infrastructure and renewable energy projects.) and grant donors (US Agency for International Development (USAID), and multi-donor trust fund Global Partnership for Output Based Aid (GPOBA), named Rural Electrification and Renewable Energy Development (RERED). Partners of solar projects aim to train women as solar technicians and improve their social status and enhance sustainable energy sources [66,67]. An example of women's involvement in low-carbon emissions development paths such as solar power is that of F age 47 owns a tea stand and a small restaurant in East Buri Goalini. She makes stoles with her husband and serves local snacks to her customers. In the restaurant, two white light bulbs are suspended, which are powered by electric energy generated by solar panels. She bought the solar home system (SHS) for 20,000 TK (approximately US\$ 181). Participant-71,

age-47, stated, “I can now keep my small restaurant open even at night. My business is booming, and the increase in income makes my family much more comfortable”.

Participant-72 stated that “The SHS is an alternative solution to meet the needs of home lighting. (Source: field work: 2019). The use of SHS units can provide a convenient and sustainable way to obtain high-quality, clean, and environmentally-friendly energy services. Furthermore, operating SHS services in coastal villages can bring positive socio-economic benefits, including high-quality home lighting, extended education hours, and increase women’s health awareness through TV programs and income-generating opportunities.” Although access to these resources has become a barrier, knowledge is even more important because adaptation strategies involve dealing with uncertainty, and accurate information is crucial [36].

The fact that rural women are a key component to food security while representing a disproportionate number of those considered hungry [55], reinforces the case for eliminating gender-specific barriers to livelihood adaptation to climate change. Including women’s opinions in decisions on climate adaptation strategies makes sense because their livelihoods are different to those of men, as are their experiences, needs, and perhaps perceptions of risks [8,68]. Women can thus acquire knowledge, broaden decision-making, and generate economic independence, which is crucial in terms of climate change adaptation in the SWCRB [68].

Participant-73, age 28, Participant-74, age 31, of Dumuria in the Gabura union, and Participant-75, 28, from Sora No. 9, Gabura union, Participant-76, 30, from Padmapukur Union, Ward-1 said that they use solar power as well as a few families close to home. She mentioned that empowerment of women is growing in the coastal areas of Bangladesh. In addition to daily work, they also maintain income-generating activities at home and make money to meet their personal needs. In addition, the SHS is an alternative solution to meet the needs of home lighting. The use of SHS units can provide a convenient and sustainable way to obtain high-quality, clean and environmentally friendly energy services. In addition, operating SHS services in coastal villages can bring positive socio-economic benefits, including high-quality home lighting, extended education hours, and increased women’s health awareness through television programs and income-generating opportunities.

Figure 5, taken from IPCC’s AR5WGII report, shows positive results in terms of food security through women’s education. Women’s empowerment, mainly at local levels due to cultural change will improve livelihoods, and in addition, bring extra benefits [22].

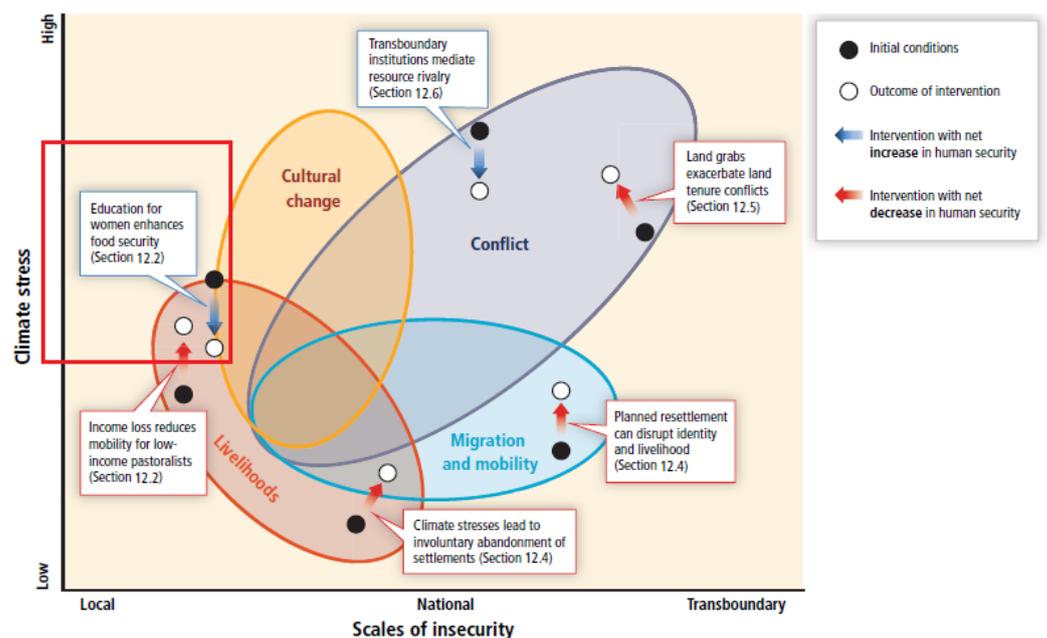


Figure 5. Women’s education strengthens livelihoods and promotes cultural changes [22].

In terms of dealing with adaptation to climate events, interventions and strategies can reduce risks to human security, mainly by providing women income alternatives in agriculture and education [22].

7.3. *Nakshikantha*

Chandrika Banerjee has always had a passion for helping women. In 1993, she started a small sewing business in her home with six other women to help alleviate the poverty of women in Satkhira, a coastal town near the Sundarbans. Her business expanded into an organization involving many more women. Hundreds of stories of rural women's happiness, sorrow and suffering are woven in each Nakshi kantha (Bangladeshi "Nakshi Kantha" is the most popular traditional handicraft in the world. "Nakshi Kantha", a type of embroidered quilt, is a centuries-old Bengali art tradition of the Bengal region, notable in Bangladesh. It usually uses this product to cover itself and protect itself from the cold at the beginning of winter. Especially rural women make their art and enhance all the traditional activities when they make a handicraft item) (a type of embroidered quilt), so she named her organization Nakshikantha. Thousands of women have become self-sufficient by working on more than 30 projects within her organization. One of her projects is to dig freshwater ponds in the saline area adjacent to the Sundarbans and help in the construction of farms with training on growing vegetables, raising cattle, goats, sheep, ducks, and chicken and constructing biogas plants and fish farms with their feces.

To date, Nakshikantha has built 60 tanks to conserve fresh water, provided 350 women with tailoring training and thousands more women and men with computer literacy. Other projects that assist in self-sufficiency include green forestry, training of farmers, and education of underprivileged children, construction of rural sanitation, granting of interest-free loans, production of organic and vermicomposting manure. The majority of respondents in the research area believe that her efforts are very successful. This organization has shown that men, women, and children can work together to build a Bangladesh free from hunger and poverty (Source: field work: 2019).

The people of Satkhira think that her efforts are very successful. Besides running the household, they also educate the boys and girls. Many have become self-sufficient by raising goats, sheep and chickens. Disabled Participant-77 started a business with a small loan from her organization. Widow Purnima Rani Pal learned how to sew with a sewing machine.

Sen [8] states that hunger is caused by entitlement, ownership and command over enough food deprivation which relates to endowments or ownership over productive resources (land and labor) as well as wealth [36]. Climate shifts can affect areas that are considered profitable and cause people to lose their occupations, and droughts or floods can drive down the price of high value foods relative to food grains, which can have serious consequences for those who make a living from the sale of these foods [25,47]. If the women in SWCRB have unequal chances to an alternative income, or lack land rights and lose their spouse, then it is likely that they will suffer the most, as will economic development. Furthermore, as McMahan and Johra [34] pointed out those small-scale women farmers often play a critical role in the food security of their communities.

Gender-equitable understanding of climate change impacts and related gendered risks/needs can contribute to the development of effective adaptation policies and lead to wide-ranging social impacts. As climate change usually impacts livelihoods and income in the SWCRB for two main reasons: extreme events impact on agriculture crops (sea level rise, riverbank erosion, floods, tropical storms, and severe droughts) and loss of ecosystems on which coastal people depend [3,25], poverty and starvation tend to worsen with the increase in the price of food, restricted mobility, and discrimination [57].

7.4. *Micro-Finance*

Micro-finance is a form of low interest lending which can enable women to start live-stock farming, homestead gardening, tailoring or any other home business. It is a solution

that could reduce economic inequalities between men and women and increase women's economic independence. Micro-finance plays an important role when it comes to the maintenance of economic growth and poverty reduction. Micro-loans enable women to educate themselves and gain their own income, which promotes their empowerment [69–72]. Micro-loans can, for example, be utilized by a group of women planning joint projects, where they share all purchases and profits. Micro-loans empower women and create independent income, ensuring their independence from men, and they can have repercussions in other areas such as the political sphere in the form of voting and participation in protests [70]. Bolivia is an example of a country where women have been able to improve their economic situation through micro-loans provided by UNDP (United Nations Development Programme) [71,72]. With micro-loans, women have been able to increase their income more than 53%, reducing their poverty, allowing women to buy tools to create jewelry, craft leather or weave, produce handmade pastries, cheese, yogurt, ice cream, honey and soda or raise pigs, chickens, and hens.

Participant-77, said, "I have been working as a tailor for almost 16 years. Although I don't have a shop, I started a business at home. I had a machine. Since Aila, several disasters left us destitute. Sometimes, houses were washed away by river erosion. The NGO BRAC helped us by paying tk 16,000 (\$145) for the purchase of the shop. However, we have to reimburse in installments. I earn more money during worship or ceremonies. I have trained six people, each women paid me tk 4000 (\$36). Through this micro loan now I'm self-sufficient.

8. Discussion and Comparison

As opposed to the previous focus on women's vulnerability, when it comes to adaptation, women are seen as powerful agents of change [36] (Tables 6 and 8). Developmental theory is a specific concept in this regard that involves the inclusion of social analysis into research and practice [9], and much later, gender equity [25,73,74]. As described by Carothers and Gramont [73] with respect to politics mainstreaming, conflict over gender mainstreaming arises because it can mask feminist goals of challenging power structures and distort the essence of empowerment once again in favor of economic goals and maintaining gender differences.

Decreasing the gender gap is not just about increased education and access to employment but also on the values attributed to girls and women in family and society. In societies of extreme patriarchy, boys are often favored over girls [68,73]. Sen believes there is a positive correlation between women empowerment and employment, because job opportunities outside the home will provide women with independent salary [74]. Women empowerment through employment can in turn influence decisions regarding climate adaptation, improving social status of women in society (Tables 6 and 8). Women are active agents of change, able to promote the required social transformation in order to alter the lives of women and men (Tables 6 and 8). Above the case of environmentally friendly stoves, electrification of the SWCRB and women empowerment, nakshikantha, micro-finance, are mentionable example women can have a greater influence in the distribution of income in the household moreover women get empowered, through education or employment. Furthermore, women's education is directly linked to their children's, especially by reducing the gender bias. In addition, mothers are concerned about the well-being of their children. Improving the mother's position can have an impact on child mortality. In this discussion part, we are referring back to field surveyed (Figures 3 and 4 and Tables 1 and 4–6), from the statistical analysis, to see whether it is significant or not according to the respondents answer.

Chi-square interpretation: According to the total respondent $n = 0.05$ (95% confidence level) indicates that the p -value less than or more than 0.05 (95% confidence level), that indicates the variables are not independent of each other and there is a statistically significant relationship between the categorical variables.

Cramér's V interpretation:

Estimated Values, Interpretation of Association

- 0.00–0.10, Negligible
- 0.10–0.20, Weak
- 0.20–0.40, Moderate
- 0.40–0.60, Relatively Strong
- 0.60–0.80, Strong
- 0.80–1.00, Very Strong

Statistical analysis shows that the Pearson Chi-square value is 0.994. Since this value is much higher than our chosen significance level $n = 0.05$ (95% confidence level) it can be said that the result is non-significant and according to Cramér’s V value, there is no significant association between male and female respondents opinion. Whether, the women, children, the elderly and the disabled are most vulnerable to climate change (Table 9). (Calculation, see the supplementary Material Section).

Table 9. refer back to Figure 3. Gender * Vulnerability to_ women, children, the elderly and the disabled are most vulnerable to climate change -Cross tabulation.

Yes (87%)		No (1%)		Don’t Know (12%)		Pearson Chi-Square	Cramér’s V
Male	Female	Male	Female	Male	Female		
60.36%	26.64%	0.69%	0.31%	8.00%	3.00%	0.994	0.006

Statistical analysis shows that the Pearson Chi-square value is 0.001. Since this value is less than our chosen significance level $n = 0.05$ (95% confidence level) it can be said that the result is significant and according to Cramér’s V value, there is strong association between sample size frequency and respondents opinion whether, the adaptation measures affect men and women differently (Table 10). (Calculation, see the Supplementary Material Section).

Table 10. refer back to Figure 3. Frequency * Vulnerability to_ women, children, the elderly and the disabled are most vulnerable to climate change- Cross tabulation.

Frequency			Pearson Chi-Square	Cramér’s V
Yes (87%)	No (1%)	Don’t know (12%)		
			0.001	1.00

Since the p -value is less than our chosen significance level of $n = 0.05$ (95% confidence level), we can reject the null hypothesis and conclude that there is a significant association between this adaptation measure and gender except for the two variables. Policy formulation related to gender equality and integration of climate change information into academic curricula showed different results than other variables. For these two variables, the Pearson chi square value is greater than our chosen significance level $n = 0.05$ (95% confidence level), so our null hypothesis is accepted and we can explain that there is no significant relationship between these two variables (policy regarding gender equality structure and integrating climate change information into academic curricula) and gender (Table 11). (Calculation, see the Supplementary Material Section).

At our chosen significance level $n = 0.05$ (95% confidence level) the null hypothesis is rejected in all the variables and we can conclude that there is a significant association between this type of vulnerability and gender. In other words, there is evidence that vulnerability type and gender are related. For the variable (cyclone shelter is far from home) the statistical test is highly significant compared to others. This means variable (cyclone shelter is far from home) and gender have a strong correlation (Table 12). (Calculation, see the Supplementary Material Section).

Table 11. refer back to Table 4. types of vulnerability typically faced by women.

Adaptation Measures	Male (222)	Female (98)	Pearson Chi-Square	Cramér's V
Female empowerment through employment with land rights	32.54%	14.36%	0.001	0.189
Women friendly agriculture	13.88%	6.13%	0.043	0.113
Female education and building awareness	26.02%	11.48%	0.003	0.167
Micro-finance	34.68%	15.31%	0.001	0.197
Policy formation regarding gender equality	10.82%	4.78%	0.101	0.092
Ensuring women's participation in idea development	19.98%	8.82%	0.018	0.132
Organization of stakeholders with equal access and involvement of women	29.90%	13.19%	0.002	0.176
Integrate climate change information in academic curriculum	11.31%	4.99%	0.081	0.097

Table 12. Refer back to Table 5. the impacts of climate change on gender in particular.

Types of Vulnerability	Male (222)	Female (98)	Pearson Chi-Square	Cramér's V
Women that don't know how to swim	24.28%	10.72%	0.007	0.150
Water and food issues	30.35%	13.40%	0.001	0.180
Cyclone shelter is far from home	38.16%	16.84%	0.001	0.207
Lack of high places to build homes	17.34%	7.66%	0.035	0.118
Physical weakness	19.09%	8.42%	0.015	0.137
Helplessness	13.89%	6.13%	0.043	0.113
Nervousness & Fear	20.81%	9.19%	0.012	0.141

Statistical analysis shows that the Pearson Chi-square value is 0.992. Since this value is much higher than 0.05 it can be said that the result is non-significant and according to Cramér's V value, there is no significant relationship between male and female respondents opinion whether, adaptation measures affect males and females differently (Table 13). (Calculation, see the Supplementary Material Section).

Table 13. refer back to Figure 4. Gender adaptation_measures_affect_differently_men_and_women Crosstabulation.

Yes (80%)		No (11%)		Don't Know (9%)		Pearson Chi-Square	Cramér's V
Male	Female	Male	Female	Male	Female		
55.5%	24.5%	7.63%	3.37%	6.24%	2.76%	0.992	0.007

Statistical analysis shows that the Pearson Chi-square value is 0.001. Since this value is less than our chosen significance level $\alpha = 0.05$ (95% confidence level) it can be said that the result is significant and according to Cramér's V value, there is strong association between sample size frequency and respondents opinion whether the adaptation measures affect men and women differently (Table 14). (Calculation, see the Supplementary Material Section).

Table 14. refer back to Figure 4. Frequency adaptation_measures_affect_differently_men_and_women Crosstabulation.

Frequency			Pearson Chi-Square	Cramér's V
Yes (80%)	No (11%)	Don't know (9%)	0.001	1.00

By applying statistical analysis tool (chi-square test) we tried to find out if there is any relationship between effect and gender. Since the n-values are less than our chosen significance level $n = 0.05$ (95% confidence level), we can reject the null hypothesis and conclude that there is a significant association between effect and gender. The statistical test for variable (women's participation in decision-making) is highly significant as compared to others. It has a strong correlation with meaning variable (women's participation in decision-making) and gender (Table 15). (Calculation, see the Supplementary Material Section).

Table 15. refer back to Table 7. represents women-centered adaptation measures in the SWCRB.

Impacts	Male (222)	Female (98)	Pearson Chi-Square	Cramér's V
Physical and social setting of women/health issues	30.35%	13.40%	0.001	0.180
Women's triple role (Reproductive, Productive, Community Management)	28.16%	12.43%	0.002	0.176
Women's economic livelihood/poverty	24.28%	10.72%	0.007	0.150
After hazards, income and occupation challenges for women	26.43%	11.67%	0.002	0.171
Inadequacy of shelter capacity	19.07%	8.42%	0.015	0.137
Women's participation in decision making	32.54%	14.36%	0.001	0.189

Moreover, according to interviewed respondents from SWCRB, women are the biggest victims of natural disasters caused by climate change (Tables 1 and 9–15). Due to the impact of natural disasters, most of the time, the male members of the family will work in different parts of the country to earn money for survival. As a result, all the responsibilities of a parentless family fall on women. Most of the time, women cannot communicate regularly with their husbands who are out looking for work. As a result, their family ties eventually weaken. Moreover, many men cannot send money on time to support household expenses. Because of this, the woman at home has to work hard to take care of the family. Again, many widows have no one to turn to for help. The responsibility of a woman is not limited to managing the family, but earning money for the livelihood of other members of the family including her children. As a result, women's livelihood is increasingly threatened (Tables 4, 5, 7 and 9–15). After many efforts by feminists to highlight the relevance of gender equity in political dialogue on climate change, today, gender dimension analysis on climate change is widely included in policy documents of development institutions. Supported by qualitative and quantitative data from the SWCRB indicating the gender-specific vulnerability to climate change and the capacity to adapt to it [9,37], this research is directed at utilizing gender insights to achieve sustainable development pathways (Tables 6 and 8).

The ability of women in SWCRB to cope with climate change involves a number of means. The expansion of women's social and economic freedom, including their empowerment through involvement in decision making, is viewed as a means to an effective response to the effects of climate change, as well as contribution to social transformation through public discussions [9]. The impetus for socio-economically empowering women is

strong because it expands their capabilities, entitlements, and choices, and the effects will be felt by all. As per the results of this study, proper adaptation and mitigation measures are required to reduce vulnerability that respondents, especially women, face during disaster periods and, abolish gender inequality (Tables 1, 4, 5 and 7). The adaptation measures affect both genders differently as observed in this study.

Furthermore, according to respondents' interviews, workshops, and FGDs of the local population of SWCRB, women vary from their male partners in the preparation of strategies. Considering possible nuisances during the catastrophe, women are accustomed to creating moveable stoves, stack firewood, amass dry provisions, namely Chira, Muri, and Khoi (derived from paddy), molasses and biscuits, essential medicines, save money wherever possible, place Chhikas (jute derived bag that can hang from wall or ceiling) so that utensils can be suspended above the floor throughout the deluge. They also plant various trees and plants such as banana (Musaceae) and pink morning glory (*Ipomoea carnea*) around their dwelling as a step-in disaster risk reduction strategy (Tables 6 and 8). Besides, few women survive through engagement with various sectors in SWCRB.

Moreover, gender dimension analysis on climate change is widely included in policy documents of development institutions. National Adaptation Program of Action (NAPA) is an important catalyst for activating climate change and adaptation policies in Bangladesh, and thus, consideration must be given to the main systems that ensure gender inclusion in widely implemented transformational programs [75,76]. Through NAPA, the UNFCCC believes that men and women play different roles in obtaining livelihoods. The Adaptation Fund supports provably gender-sensitive activities and checks subsidy proposals to ensure they support participation cycles and observations in projects/programs that disaggregate clearly marked information by gender [24,77]. In Bangladesh, climate change adaptation is integrated into broad multisector strategic development and poverty reduction policies. Therefore, the Sixth Five-Year Plan, Annual Development Plan (2011–2015) and Poverty Reduction Strategy Paper (PRSP) (2005) were explored to assess gender responsiveness. Bangladesh prepared the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) (2010), National Environment Policy (1992), National Disaster Management Plan 2010–2015 (2010), Health Policy (2011), National Women's Development Policy (2011) and Bangladesh National Maternal Health Strategy (2001) [24,78].

Also, the strategies have a very explicit tendency towards floods, with generally little spotlight on miniature level preparation at villages or Upazilas (sub-locales) [63]. Ultimately, BCCSAP and NAPAs show reflexivity for reconciliation with other sectoral strategies. The BCCSAP and NAPAs are center around areas like agribusiness, water (metropolitan and industry), foundation, lodging, wellbeing, food security, disasters, and energy, stressing the part of reflexivity with other sectoral approaches [76,77]. For this, they have included transformation for the yearly advancement plans (sixth and seventh long term plans) for making vigorous and target-based interlinkages between areas. Furthermore, Bangladesh has considered the environmental change gender activity plan, specifying out the interlinkages between gender viewpoints, and environment-impacted areas considering these referenced approach drives reflexivity is supposed to expand soon [24,77,78].

But it is not be found that the environmental change and segregated gender impacts are not perceived. Strategy targets connected with climate change and gender are by and large resolved as fundamentally unrelated issues; existing arrangements do not consider gender explicit functional exercises. The main approach that incorporates gender-based contemplations for climate adaptation is the Poverty Reduction Strategy Paper (2005), but functional exercises under this arrangement have not yet satisfied these targets [76–78]. Environmental change approaches by and large perceive women as vulnerable, yet functional reactions are not established. In arrangements connected with gender and conceptive wellbeing, the effect of climate change is not considered, except for the National Women Development Policy, which momentarily advances women's part in ecological administration and the significance of guaranteeing offices for and the security of pregnant women in case of catastrophic events [76].

The National Forest Policy (1994) states that women will be encouraged to take an interest in residence and farm gardening, and participatory afforestation programs; nevertheless, it does not give explicit instructions to accomplish the expressed objective or put forth other gender explicit objectives (e.g., decision-making related to forests and forest resources) [78]. In approaches connected with gender and conceptive wellbeing, the effect of environmental change is not considered aside from the National Women Development Policy 2011 [6,24,78].

Despite the fact that women are involved in adaptation discourse, gender explicit contemplations are evidently not advanced. Multi-sectoral reactions and coordinated efforts to address environmental change, and approaches connected with catastrophe preparedness and reaction, jobs and medical services might consider the combination of gender issues into needs [23,24,75,78]. Besides, the speculation of women is another significant gap in both national and international policy papers. The current approaches frequently highlight women as being casualties of climate change and disregard their efforts as dynamic supporters of adaptation procedures in changing natural realities.

Globally, the ability of communities and individuals to cope with climate change involves a number of means [3,9,22]. The expansion of women's social and economic freedom, including their empowerment through involvement in decision making, is viewed as a means to more effective response to the effects of climate change, as well as contributing to social transformation through public discussions [8–10,25,43,57,68,74]. The impetus for socio-economically empowering women is strong because it expands their capabilities, entitlements and choices and the effects will be felt by all [36,57,60]. Human security has been jeopardized in the context of climate change and its preservation plays an important role in protecting life. It is a challenge to maintain these principles, given the difficulty for the majority of institutions at the national level to carry out effective adaptation efforts [3,25,26,34].

9. Conclusions

The results of this study indicate that women are most affected by climate change and natural disasters. Conditions, such as lack of water and food, distance from home to cyclone shelter, absence of Women's participation in decision making, unfavorable physical and social settings for women, women's triple role in the family, poverty, limited resources, and loss of homes make women vulnerable in this region. Even in such unfavorable conditions, women are capable of working with agriculture and water collection, which contributes to the SWCRB people's livelihoods [9], and is an intrinsic to effective adaptation and social improvement [9]. The inclusion of gender analysis in development policies on climate change has the potential to have far-reaching positive effects in mitigating and adapting to climate change, as well as contributing to gender-equity. The arguments in favor of empowering women as part of this process are persuasive in the sense that the 'odds' often sway in the favor of men and puts the role of adapting to climate change on women. Definitions of empowerment matter when it comes to policy and practice, and that there is still much work to be done in finding adequacy between competing agendas. Measurement and 'rendering technical' [43] are salient issues here. To implement climate friendly, women policies at the local level from governmental agents (i.e., NAPA, PRSP, and BCCSAP) there must be more focus and prioritization. While national policy makers need to weigh out the benefits, costs, and potential losses of new initiatives, they face failure in achieving meaningful or wanted results through this process. Deep and flexible analysis and a long term dedication to deciphering processes of inequality and empowerment are of the utmost importance in meeting the interests of feminists and development practitioners alike. Yet without situating the local processes of inequality within the 'larger forces' and discourses that cause inequality, it is questionable how much transformation can occur because women have not received their land rights. Regretfully, equality and reducing women's vulnerability may not be in everyone's interests. Based on the field surveys, case studies, FGDs, workshops, and interviews findings show that empowerment initiatives in

the SWCRB have already had a positive impact on women's role in the community, one that is recognized by its members. Thus, the outline of adaptation and mitigation measures has proven that the gender gap can be reduced, and vulnerability levels can be successfully addressed. Empowered women will strengthen the society, and the economy will be enhanced which helps SWCRB to reduce climatic effects. Further, women involvement in Bangladesh shows us that the challenge of climate change adaptation and mitigation is possible through female empowerment.

The existing adaptation measures have already proven their positive impact on the local community, and both genders recognized the promising outcomes. Climate change will worsen the current situation. Sen [9] argues that the expansion of women's social and economic freedoms, including their empowerment through involvement in decision making, is viewed as a more effective response to the impacts of climate change, as well as contributing to social transformation through public discussions. If every member of society becomes aware of the challenges they face and receives proper education and support, the local population will be strengthened against the threats and will have the opportunity to develop towards a brighter future. Women of coastal areas of Bangladesh suffer the most in disasters. Government and some local and international non-governmental organizations attempt to reduce the vulnerability of people in coastal areas. It is recognized that customized policies, planning, and good governance can also reduce hazards and increase the socio-economic situation by different micro-credit schemes through mutual collaborations. In this regard, the following recommendations can be provided for mitigating and reducing suffering of the coastal people: 1. Women should be prioritized in all policies, planning, and programs related to disaster management. 2. It is essential to modernize the meteorological and hydrological networks for forecasting and warning systems. 3. Emergency response systems and supporting livelihood strategies should be optimized based on local conditions, especially for women and children. Finally, this article proposes that, in order to reduce female vulnerability in SWCRB, women as stakeholders and agents of change must be encouraged and integrated into mitigation measures and adaptation plans.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/cli10110172/s1>, Tables S1–S100 are cited in the supplementary materials file.

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