

## REPORT

Occupational challenges and coping strategies  
of women amid climatic hazards: A case study of  
Sagar Island, IndiaKanchan Paira<sup>1,2\*</sup>  and Moatula Ao<sup>1</sup> <sup>1</sup>Department of Population Studies, Fakir Mohan University, Vyasa Vihar, Balasore, Odisha, India<sup>2</sup>Department of Geography, Hijli College, Medinipur, West Bengal, India

## Abstract

Women's livelihoods, particularly those residing in coastal areas, are vulnerable due to their reliance on climate-sensitive occupations and limited adaptive capacities. Sagar Island in India is one such region, which is often affected by cyclonic storms, coastal flooding, and saltwater intrusion. This study explores the factors driving occupational changes and the coping strategies adopted by married women of reproductive age in Sagar Island. A cross-sectional survey design was employed to explore the occupational challenges and coping mechanisms among 420 purposely selected married women. Primary data were collected during June and July 2024. Bivariate and multivariate logistic regression models were employed for statistical analysis. Findings indicated that approximately 43% of the sampled women had been compelled to change their primary occupation over the past 3 years due to climate-related hazards. Among these women, those engaged in labor and cultivation are more likely to experience occupational shifts due to climatic hazards. Logistic regression revealed that their occupations were significantly affected by cyclonic storms, coastal flooding, and saltwater intrusion. In addition, factors such as social category, housing type, economic status, the wealth index, and husband's occupation were significantly associated with occupational shifts. The study showed that women resorted to adopting numerous coping strategies to address the challenges to their livelihoods. The study underscores the need to address socio-economic disparities to improve livelihood resilience. It also highlights the importance of targeted interventions for affected women to raise awareness about climate change, provide credit facilities for taking adaptative measures, and enhance women capacity in the face of climate change.

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## 1. Introduction

Environmental disruption due to the interaction between human activities and climate change has emerged as the biggest global threat of the 21<sup>st</sup> century (Qin *et al.*, 2022). Climate change poses a significant threat to livelihood security—particularly through

its adverse effects such as severe cyclones, embankment failures, coastal flooding, erosion, and increased salinity affecting crop productivity and access to natural resources (Guha & Roy, 2016; Intergovernmental Panel on Climate Change [IPCC], 2014; Sušnik *et al.*, 2015). In coastal areas, sea-level rise, coastal flooding, and increasing inland penetration as a result of tropical storm surges and coastal erosion threaten coastal livelihoods (Habiba *et al.*, 2015; Mehvar *et al.*, 2018). Although everyone is affected by climatic events, not all individuals experience the impacts equally. The level of impact is shaped by numerous factors, such as an individual's age, race, gender, culture, ethnicity and other socioeconomic determinants (Shamsuddoha *et al.*, 2024). Among these, the gendered perspective of climate change impacts is of major concern, as the types and degrees of vulnerability men and women face in response to climate change-induced natural hazards differ (Hai & Smyth, 2012). The United Nations Framework Convention on Climate Change (UNFCCC, 2017) notes that women bear a greater burden and face higher risks from climate change impacts. One of the immediate and more frequent impacts is on the economic livelihood of women, particularly those living in coastal areas (Hasan & Shah Shovon, 2019; Mandal, 2014).

Numerous studies have demonstrated that households living in coastal areas have limited income diversification (Alam *et al.*, 2018; Sarker *et al.*, 2020; Toufique & Yunus, 2013). However, the people are forced to diversify their income sources to combat the impacts of climate change (Kabir *et al.*, 2016a). As Ishtiaque and Ullah (2013) have pointed out that one of the key push factors in diversifying income sourcing activities is natural disasters. Recent literature indicates that diversification of income is an effective strategy for rural households to cope with disasters (Wan *et al.*, 2016). In addition, livelihood diversification and changes in agricultural practices are also vital adaptation strategies (Aryal *et al.*, 2020) which can lessen people's vulnerabilities to adverse impacts of climate hazards while promoting sustainability (Bhowmik *et al.*, 2021).

Sagar Island, a massive low-lying archipelago in India, lies on the Bay of Bengal's continental shelf and belongs to a highly vulnerable delta region (Mondal *et al.*, 2020). The island faces multiple climate-induced threats such as storm surges, rising sea level, shoreline changes, regular land loss, and cyclones that disrupt agriculture, damage infrastructure, and threaten the livelihoods of its inhabitants, particularly women (Bera *et al.*, 2021; Mondal *et al.*, 2020; Mukherjee *et al.*, 2019). In addition, coastal flooding also poses a serious threat to the island due to its impact on agricultural production, property damage, and the loss of livelihoods (Guha *et al.*, 2012).

Given the diversity of climate-induced threats, a comprehensive assessment of coastal livelihoods is imperative in the face of climate change. This study explores the gendered impacts of climate change, particularly those on the women. Climate change gravely affects coastal women, exacerbating their existing struggles by damaging crops and livestock, disrupting fishing grounds and reducing fish stocks, ultimately impacting their income and food security (Hasan & Shah Shovon, 2019; Subramanian *et al.*, 2023). This research investigates the occupational shifts among coastal women in response to climate-induced disruptions and the coping strategies they adopt to secure their livelihoods. Despite existing studies on climate-related health impacts in India, limited research explores women's occupational adaptations and household-level responses in coastal areas—a gap this study aims to address. The study also seeks to contribute to Sustainable Development Goal 13, which emphasizes urgent action to combat climate change and its impacts, and Sustainable Development Goal 8, which promotes inclusive and sustainable economic growth and decent work for all (United Nations, 2015). By addressing coastal women's occupational challenges and resilience strategies, the study intends to inform policies and practices that support climate adaptation and equitable livelihood opportunities ensuring that these women are not left behind in the broader climate-development agenda. Accordingly, this study addresses three key questions: (1) How do climatological events influence the occupations of coastal women? (2) What socioeconomic and demographic (SED) factors affect their livelihoods? (3) What coping mechanisms do they adopt for survival? The findings will help identify key variables driving occupational change and support targeted policy strategies to address climate change impacts in coastal India.

## 2. Data and methods

### 2.1. Study area, sampling, and data collection

The study was conducted in Sagar Island (also known as Ganga Sagar) of West Bengal, India, during June–July 2024. This island occupies a total ground area of about 282.11 sq km extending between 21° 37'21"–21° 52'28" N and 88° 02' 17"–88° 10' 25" E. The Island is located in the mangrove-dominated Ganga delta and is more or less triangular in shape (Chakraborty and Saha, 2020). The average elevation of the island is 3.8 m from the mean sea level (DataWeb on Island Environment and Protection, 2018). It consists of 42 inhabited villages with a population of over 212,037, of which 109,468 (52%) were male and 102,569 (48%) were female, with a density of 751 persons/sq km (Census of India, 2011). The formation of this estuarine area is still incomplete due to the quaternary sediments deposited

principally by the Ganges, Brahmaputra, Meghna rivers, and their several distributaries (Mondal *et al.*, 2020). From the 42 inhabited villages, ten women from every village with one woman from one household were selected purposively, comprising a final sample of 420 women. The vulnerability of coastal married women is heightened by climate instability, adversely impacting their economic livelihoods, nutritional status, and access to reproductive health services, including antenatal and postnatal care (Azrimaidaliza, 2014; Hasan & Shah Shovon, 2019). In addition, the women of reproductive age contribute significantly to agricultural and coastal livelihoods; however, they are more exposed to health risks arising from climate-related disasters (UN Women, 2025). Moreover, occupations in non-service sectors are closely tied to climate variability, making them highly vulnerable to environmental changes (IPCC, 2023). Therefore, including women engaged in such sectors allows the study to capture the critical link between climate impact and livelihood. Furthermore, selecting the women who have directly experienced at least one climatic hazard ensures that the present study examines actual impacts rather than hypothetical vulnerabilities. Therefore, in the present study, women were included based on three criteria: they had to be married and within the reproductive age range (15–49 years), engaged in any form of economic activity other than services, and have experienced the impact of at least one climatic hazard in the course of their occupational activities.

## 2.2. Outcome variables

To determine the outcome variable, women in the study were first asked whether they had changed their occupation in the past 3 years. Those who reported a change were then asked if it was due to any of the following climate-related hazards: Coastal flooding, saltwater inundation, or cyclonic storms. Women who attributed their occupational change to any of these hazards were coded as “1,” while those who changed their occupation for other reasons were coded as “0.”

## 2.3. Predictor variables

Several independent variables were used to understand the association of occupational change with climate-induced hazards among the women.

At the individual level, variables such as age-group (coded as “1” = up to 25 years, “2” = 25–40 years, and “3” ≥ 40 years), educational attainment (coded as “1” ≤ secondary, “2” = secondary, and “3” ≥ secondary), and religion (coded as “1” = Hindu, and “2” = Muslim) were employed. Household characteristics such as economic status (coded as “1” = Antodaya, “2” = below poverty line [BPL], and “3” = above poverty line [APL]), ethnicity (coded as “1” = General, “2” = other backward class [OBC],

“3” = scheduled caste [SC], and “4” = scheduled tribe [ST]), type of house (coded as “1” = kutchha, “2” = semi-pucca, and “3” = pucca), family size (coded as “1” ≤ 3, “2” = 3–6, and “3” ≥ 6), wealth index (coded as “1” = poorest, “2” = poor, “3” = middle, “4” = richer, and “5” = richest), occupation of husband (nothing, labor, cultivation, business, and service) were used. Perception on climatic hazard-related phenomenon based on the adverse impacts experienced by the study women such as coastal flooding (coded as “1” = not dangerous, “2” = mildly dangerous, “3” = dangerous, “4” = very dangerous, and “5” = extremely dangerous), saltwater inundation (coded as “1” = not dangerous, “2” = mildly dangerous, “3” = dangerous, “4” = very dangerous, and “5” = extremely dangerous), and climatic storm (coded as “1” = not dangerous, “2” = mildly dangerous, “3” = dangerous, “4” = very dangerous, and “5” = extremely dangerous) were employed.

## 2.4. Statistical analysis

The Statistical Package for the Social Sciences (SPSS21.0 IBM, United States) was used for statistical analyses of the quantitative data. Quantitative data management involves the use of both descriptive statistics (*summaries of the variables in a data set*) and inferential statistics (*links between variables and making inferences*) (Kotronoulas *et al.*, 2023). This study employed both descriptive and inferential statistics to address its objectives, thereby aligning the research design with an explanatory quantitative approach. Descriptive statistics such as percentage distribution and cross-tabulation were used for addressing the research questions (1) and (3). Subsequently, cross-tabulation and Chi-square tests ( $\chi^2$ ) were applied to investigate whether there were any associations between outcome and predictor variables. Multivariable logistic regression model following Ebrahimi Kalan *et al.* (2021) was used to comprehend the coefficients associated with the occupational change considering the selected background characteristics and climatic hazard related phenomena. Model 1 of the multivariable logistic regression was employed to investigate the relationship between occupational change and different climatic hazards, while model 2 investigates the relationship of occupational change with different climatic hazards after controlling for other predictor variables.

## 3. Results

### 3.1. Sample characteristics

Among the women surveyed, two-thirds were between the ages of 25 and 40. In terms of educational attainment, approximately 47% had less than a secondary-level education, 37% had completed secondary education, and only 16% had education beyond the secondary level.

Regarding economic status, half of the women belonged to the APL category, followed by BPL (48.57%) and Antodaya (1.43%). The vast majority of participants were Hindu (93%), followed by a minority of Muslim women. In terms of caste, 50.24% identified as General, 29.53% as SC, 19.28% as OBC, and 0.96% as ST. With respect to housing, around 50% of households lived in kutcha houses, 38% in semi-pucca, and 12% in pucca houses. The study also found that about two-thirds of the women came from households with a family size of 3–6 members. One-third had fewer than three family members, and only 3% belonged to large families with more than six members. According to the wealth index, about 60% of the women fell into the “middle,” “richer,” or “richest” categories, while the remaining 40% were in the “poor” or “poor” groups. Most of the women’s husbands were engaged in either labor (44.76%) or cultivation (44.28%), while a smaller percentage worked in business (6.91%) or the service sector (2.62%) (Table 1).

### 3.2. Status of occupational change and impact of climatic hazard

The study found that approximately 48.1% of the women had been compelled to change their primary occupation. Among those who experienced a change, 43.4% ( $n = 183$ ) reported that it was due to climatic hazards (Figure 1).

In this study, “parent occupation” specifically refers to the occupation that the women participants were engaged in before they were compelled to shift to a different occupation due to the impact of climatic hazards. The study found that among the 43.4% of the women who were compelled to shift their parent occupation due to different climatic hazards, 26.19% of them were engaged in different economic activities such as labor. About 14.52% of them were engaged in cultivation (including horticulture—betel and paddy cultivation). Approximately 1.90% of them were engaged in small business activities and about 0.95% were engaged in fishing. Overall, the findings indicate that the women who engaged in labor and cultivation are more likely to experience occupational shift due to climatic hazards, whereas those in business and fishing show relatively low transitions (Figure 1).

### 3.3. Occupational change by different background characteristics

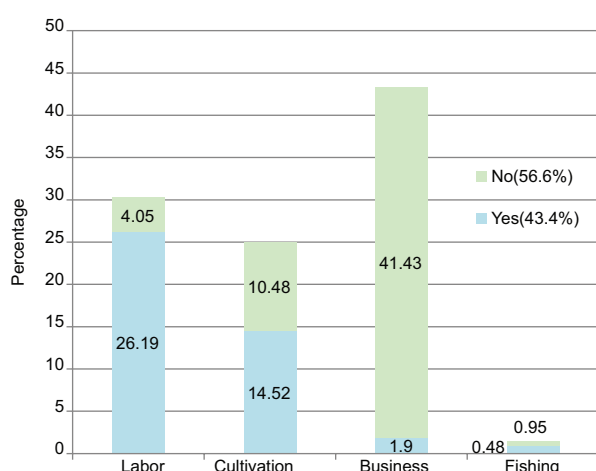
Table 2 presents the bivariate analysis of occupational change by different background characteristics of the women and their perceptions on the impact of various climatic hazards. The study found that by age group, the proportion of occupational change was higher among the 25–40 age groups. By educational attainment, the finding shows that the occupational change took place

**Table 1. Characteristics of study participants ( $n=420$ )**

Variables	Category	<i>n</i> (%)
Age group (years)	<25	79 (18.81)
	25–40	279 (66.43)
	>40	62 (14.76)
Educational attainment	<Secondary	196 (46.67)
	Secondary	157 (37.38)
	>Secondary	67 (15.95)
Economic status	Antodaya	6 (1.43)
	Below poverty line (BPL)	204 (48.57)
	Above poverty line (APL)	210 (50)
Religion	Hindu	392 (93.34)
	Muslim	28 (6.67)
Social category	General	211 (50.24)
	Other backward class (OBC)	81 (19.28)
	Schedule caste (SC)	124 (29.53)
	Schedule tribe (ST)	4 (0.96)
Type of house	Kutcha	212 (50.47)
	Semi-pucca	159 (37.86)
	Pucca	49 (11.66)
Family size (persons)	<3	138 (32.86)
	3–6	268 (63.81)
	>6	14 (3.33)
Wealth index	Poorest	81 (19.28)
	Poor	87 (20.72)
	Middle	83 (19.76)
	Richer	84 (20)
	Richest	85 (20.24)
Occupation of husband	Nothing	6 (1.42)
	Labor	188 (44.76)
	Cultivation	186 (44.28)
	Business	29 (6.91)
	Service	11 (2.62)
Coastal flooding	Not dangerous	18 (4.28)
	Mildly dangerous	48 (11.42)
	Dangerous	43 (10.23)
	Very dangerous	95 (22.64)
	Extremely dangerous	216 (51.43)
Saltwater inundation	Not dangerous	31 (7.37)
	Mildly dangerous	56 (13.33)
	Dangerous	84 (20)
	Very dangerous	111 (26.44)
	Extremely dangerous	138 (32.86)
Cyclonic storm	Not dangerous	47 (11.19)
	Mildly dangerous	35 (8.34)
	Dangerous	94 (22.38)
	Very dangerous	110 (26.19)
	Extremely dangerous	134 (31.9)

Data source: Field survey, 2024.





**Figure 1.** Parent occupation of women who compelled to change occupation in response to climatic hazards

more among the women with lower education compared to the higher-educated women. Economic status shows that the occupational change was high among BPL women compared to those in the APL category ( $p < 0.01$ ). By religion, it is quite evident that women belonging to Hindu showed higher proportion of occupational change followed by Muslims. By social category, it is clear that households belonging to the general category show higher proportion of occupational change followed by SC, OBC, and ST ( $p < 0.01$ ). Our study found that housing conditions replicate the economic status of a person. Women living in kutcha houses showed higher change of occupation compared to the women residing in semi-pucca and pucca houses. Size of the household also matters in opting an occupation as the study revealed that the change of occupation by women is highest among households with 3–6 persons followed by <3 persons and >6 persons ( $p < 0.05$ ). According to wealth index, women in the richest and richer class had higher proportion of occupational change ( $p < 0.05$ ). Occupation of the husband is a significant predictor ( $p < 0.01$ ) as our study showed that the proportion of occupational change was higher among women with their husband engaged in labor and cultivation activities compared to those who engaged in business and service.

By the perception on coastal flooding, women who expressed the impact as extremely dangerous and very dangerous had higher proportion of occupational change ( $p < 0.01$ ). The distribution of proportions is quite analogous to those in the contexts of saltwater inundation ( $p < 0.01$ ) and coastal storm ( $p < 0.01$ ).

### 3.4. Factors associated with occupational change

Table 3 lists the correlates of occupational change by the women in the study, including the impact of different

**Table 2.** Bivariate analysis of occupational change by different background variables

Variables	Category	Percentage of women forced to change occupation due to climatic hazard	$\chi^2$ statistic
Age group (years)	<25	7.38	1.19
	25–40	29.05	
	>40	7.14	
Educational attainment	<Secondary	21.19	0.57
	Secondary	15.48	
	>Secondary	6.90	
Economic status	Antodaya	0.95	15.21***
	Below poverty line	25.48	
	Above poverty line	17.14	
Religion	Hindu	41.43	1.23
	Muslim	2.14	
Social category	General	18.57	11.95***
	Other backward class	11.43	
	Schedule caste	13.10	
Type of house	Schedule tribe	0.48	2.05
	Kutcha	21.19	
	Semi-pucca	16.19	
Family size (person)	Pucca	6.19	6.88**
	<3	15.71	
	3–6	25.48	
Wealth index	>6	2.38	22.80***
	Poorest	5.95	
	Poor	6.19	
Occupation of husband	Middle	9.05	56.41***
	Richer	10.48	
	Richest	14.29	
Coastal flooding	Nothing	0.71	51.23***
	Labor	27.62	
	Cultivation	10.71	
Saltwater inundation	Business	3.81	27.01***
	Service	0.71	
	Not dangerous	2.38	
	Mildly dangerous	6.90	
	Dangerous	8.81	
	Very dangerous	9.29	
	Extremely dangerous	16.19	
	Not dangerous	1.67	

(Cont'd...)

Table 2. (Continued)

Variables	Category	Percentage of women forced to change occupation due to climatic hazard	$\chi^2$ statistic
Cyclonic storm	Mildly dangerous	3.57	15.41***
	Dangerous	12.86	
	Very dangerous	11.90	
	Extremely dangerous	13.57	
	Not dangerous	2.62	
	Mildly dangerous	4.29	
	Dangerous	12.62	
	Very dangerous	10.71	
	Extremely dangerous	13.33	

Notes: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

Data source: Field survey, 2024.

climatic hazards and socioeconomic characteristics. In the analysis, model 1 shows the relationship of occupational change with climatic hazards affecting occupational change, while model 2 shows the relationship of climatic hazards with occupational change after controlling for other independent variables.

In model 1, it is evident from the analysis that women affected dangerously by coastal flooding were more likely to be forced to change their occupation ( $p < 0.05$ ) compared to the women who were affected in a minor way by coastal flooding, but model 2 did not find a significant relationship after controlling for the SED characteristics. The result of salt water inundation exhibits significant relationship as our study showed that women affected dangerously were more likely to be forced to change their occupation ( $p < 0.01$ ) compared to the reference category. The study also found that climatic storm is a significant factor as the women who were affected both mildly and dangerously ( $p < 0.01$ ), as well as very dangerously and extreme dangerously ( $p < 0.05$ ) by coastal storm, were more likely to change their occupation compared to the women who were not affected by it.

Model 2 shows significant association between salt water inundation and occupational change after controlling for the SED characteristics. The model depicted that women affected dangerously by salt water inundation were more likely to change their occupation ( $p < 0.01$ ). The association between cyclonic storm and occupational change was found to be significant after controlling for the SED characteristics. The model establishes that women affected both mildly and dangerously ( $p < 0.05$ ) by coastal storm were

Table 3. Logistic regression estimates of occupational change by different background variables

Variables	Category	Model 1			Model 2		
		Exp (B)	95% CI		Exp (B)	95% CI	
		Lower	Upper		Lower	Upper	
Coastal flooding	Not dangerous (reference)						
	Mildly dangerous	1.36	0.41	4.50	1.16	0.28	4.70
	Dangerous	4.47**	1.15	17.31	3.55	0.77	16.36
	Very dangerous	0.52	0.17	1.55	0.36	0.10	1.33
	Extremely dangerous	0.36	0.12	1.04	0.36	0.10	1.24
Salt water inundation	Not dangerous (reference)						
	Mildly dangerous	0.90	0.30	2.71	1.50	0.41	5.41
	Dangerous	5.02***	1.80	13.98	4.95***	1.45	16.87
	Very dangerous	2.55	0.95	6.83	2.79	0.86	8.99
	Extremely dangerous	2.20	0.83	5.84	2.45	0.76	7.92
Cyclonic storm	Not dangerous (reference)						
	Mildly dangerous	4.45***	1.60	12.38	4.90**	1.42	16.83
	Dangerous	3.55***	1.48	8.50	3.55**	1.23	10.18
	Very dangerous	2.29**	0.99	5.33	2.25	0.82	6.22
	Extremely dangerous	2.37**	1.03	5.46	2.19	0.81	5.97
Age group (years)	<25 (reference)						
	25–40				1.51	0.74	3.09
	>40				1.38	0.53	3.55
Educational attainment	<Secondary (reference)						
	Secondary				0.80	0.44	1.44
	>Secondary				0.64	0.27	1.51
Religion	Hindu (reference)						
	Muslim				0.35	0.11	1.15
Social category	General (reference)						
	Other backward class				2.64**	1.16	5.97
	Schedule caste				1.16	0.63	2.12
Type of house	Schedule tribe				1.59	0.16	15.27
	Kutchia (reference)						
	Semi-pucca				1.17	0.65	2.10
	Pucca				3.38***	1.32	8.64

(Cont'd...)

Table 3. (Continued)

Variables	Category	Model 1		Model 2	
		Exp (B)	95% CI Lower Upper	Exp (B)	95% CI Lower Upper
Economic status	Antodaya (reference)				
	Below poverty line	0.22	0.02 1.90		
	Above poverty line	0.10**	0.01 0.89		
Family size (persons)	<3 (reference)				
	3–6	0.76	0.43 1.32		
	>6	3.99	0.74 21.28		
Wealth index	Poorest (reference)				
	Poor	1.01	0.43 2.35		
	Middle	1.52	0.64 3.56		
	Richer	3.01***	1.27 7.07		
	Richest	3.44***	1.45 8.14		
Occupation of husband	Labor (reference)				
	Cultivation	0.23***	0.13 0.41		
	Business	0.98	0.37 2.59		
	Service	0.12**	0.02 0.77		

Notes: \* $p<0.1$ ; \*\* $p<0.05$ ; \*\*\* $p<0.01$ .

Data source: Field survey, 2024.

Abbreviation: CI: Confidence interval.

more likely to change their occupation. Model 2 exhibits that the women belonging to OBC category ( $p<0.05$ ) and residing in pucca houses ( $p<0.01$ ) were more likely to be associated with occupational change. The analysis revealed that the women belonging to APL categories ( $p<0.05$ ) were less likely to be associated with occupational change. Based on model 2, the women placed in the richer and richest class ( $p<0.01$ ) in the wealth index were more likely to change their occupation. It was also found that women with a husband who engaged in cultivation ( $p<0.01$ ) and service ( $p<0.05$ ) were less likely to be forced to change their occupation.

### 3.5. Coping mechanisms

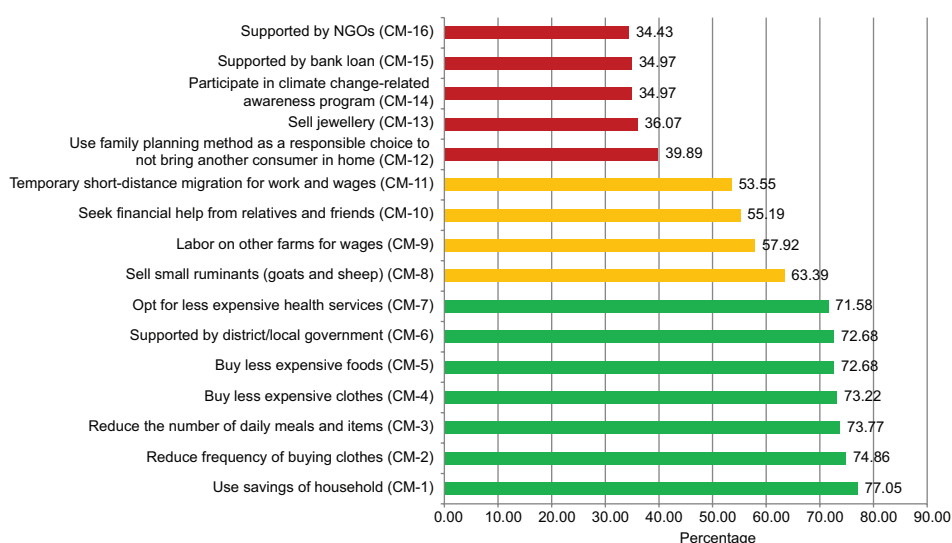
Figure 2 presents the 16 coping mechanisms adopted by women to manage livelihood challenges. The most common strategies included spending personal savings (77%), reducing the purchase of new clothes (75%), cutting down on daily food and meals (74%), and buying cheaper clothing (73%) and food (73%). About 73% received support from the local government, and 72% opted for lower-cost healthcare. Other coping strategies included selling ruminants (63%), working as laborers on other

farms (57%), and seeking financial help from friends and relatives (55%). In addition, 54% migrated to other villages for work, 40% used family planning methods, and 36% sold jewelry. Participation in climate change awareness programs was reported by 34%, while 35% received bank loans and 34% were supported by non-governmental organizations (NGOs).

## 4. Discussion

This research was undertaken to explore the occupational challenges of coastal reproductive married women, to identify the different climate-induced factors and various socioeconomic characteristics underlying these challenges that they face. The analysis was also intended to identify the coping mechanisms adopted by these women to ameliorate the livelihood struggle. To accomplish this, the study first assessed the occupational struggle the women face due to climate-induced hazards and the impact of these hazards on their income.

The findings of the study exhibit the significant impact of climate change-induced natural hazards on the occupation of women residing in Sagar Island, considering the increasing intensity and frequency of climate change-induced natural hazards as reported by the IPCC (2023; Shamsuddoha *et al.*, 2024; Vineis *et al.*, 2011). Our research showed that about 48% of the women were forced to change their occupation due to various reasons, of which almost 43% were due to climatic hazards such as coastal flooding, saltwater inundation, and climatic storm. Understanding these difficulties of the coastal women can assist in formulating better policies that not only effectively address this issue but also help in achieving the 13<sup>th</sup> SDG of “Climate action” and the 8<sup>th</sup> SDG of “Decent work and economic growth.” Agriculture as an occupation is particularly vulnerable to climate change due to its high dependency on weather and climate (Dev, 2011). Our findings revealed that women engaged in cultivation (mainly paddy and horticulture) and labor activities (mainly agricultural labor, fish processing including drying fish, betel leaf collection) were mostly affected by the climatic hazards. Our study is corroborated by previous reports that the people of Sagar Island are extremely vulnerable to livelihood disruptions due to their exposure to frequent climatic hazards and limited adaptive capacities (Guha & Roy, 2016; Mondal *et al.*, 2020). Women are vital for developing sustainable adaptation options due to their knowledge, responsibilities, and roles in productive areas including all sectors from agriculture, to households, income-generation and livelihoods (Nellemann *et al.*, 2011). Our study found that about one-thirds of the women were harshly affected in regard to losing their average annual income due to climatic hazards affecting



**Figure 2.** Coping mechanisms adopted by women to manage livelihood challenges  
Abbreviation: NGOs: Non-governmental organizations.

this highly vulnerable island. Loss of income due to such environmental stressors directly reinforces gendered power imbalances between men and women (UN Women, 2025) and limits essential services particularly reproductive and maternal healthcare (Neumayer & Plümper, 2007; Rahman, 2013; Shammi *et al.*, 2019). Moreover, the loss of women's income affects children's education, family health investments, and community development, as women are more likely than men to reinvest a greater portion of their earnings into their families (OECD, 2020).

Understanding and analyzing the correlates of occupational struggles of the women is very crucial for policy makers who can address these challenges. Moreover, such micro-level studies provide insights to alleviate livelihood problems such as loss of agricultural productivity, lack of income diversification, depletion of fisheries, and gender-based livelihood challenges as women often bear the consequence of climate impacts, with reduced opportunities and increased caregiving responsibilities (UNCC, 2023). Our study shows that climate-induced events such as coastal storm, flood, and salt water inundation severely affect the occupation of the women and worsen their means of earning a livelihood by eliminating the primary source of their income. Our findings align with earlier research on the impact of severe cyclonic storms over the Bay of Bengal spanning the last 120 years (Singh, 2007). These cyclones bring in heavy rain, storm surges, flood, and devastating saline water inundation to the island (Chittibabu *et al.*, 2004; Indian Meteorological Department, 2008), which led to extensive damage of houses, cultivable lands and ponds, and decimation of domestic animals (Mondal *et al.*, 2020).

Moreover, another study found high possibility of saline water inundation as about one-fourth of the man-made embankments of the coastal Sundarbans are still vulnerable to breach during high-intensity climatic events (Mondal & Bandyopadhyay, 2014). Therefore, during cyclonic and storm surges, the river water rushes into the island, leading to an irreversible loss of lives, livelihoods, and assets (Mondal *et al.*, 2020). Our study identified irregular storms as a major factor contributing to difficulties in agricultural livelihoods, making it challenging for people to pursue cultivation as a stable occupation. In particular, when a super cyclone strikes before the monsoon season, saltwater intrusion caused by flooding often contaminates agricultural land. Hence, the excessive salinity in various soil layers renders the land unfit for cultivation for approximately 2–3 years. During this period, affected individuals are compelled to seek alternative sources of livelihood. A woman's occupation is often determined by their age, educational attainment, and family size (Alemu *et al.*, 2022; Onyebu, 2016). Unlike these studies, our study did not find any significant association between these factors and occupational change. In India, caste plays a significant role in socioeconomic disparities. The Government of India classifies Indian society into four main caste categories: forward castes (also referred to as upper castes), STs, SCs, and OBC (Starr & Sahgal, 2021). In contrast to upper-caste groups, lower-caste communities in India often face extreme form of marginalization and social disadvantage (Paira & Ao, 2024). Further, these groups are more vulnerable to climatic disasters due to their limited access to resources and opportunities (Youth4 Nature, 2021). Other studies in India found an association between



caste and climatic inequalities in the light of occupational exposure (Shah *et al.*, 2025). Aligning with these studies, our study also found the occupational struggle among the OBC women due to climate-induced causes. Our findings indicate that approximately 70% of these women were involved in cultivation and agricultural labor activities that are the most vulnerable to climatic hazards.

Interestingly, our findings revealed that occupational struggle of the women residing in pucca houses tend to increase with climatic hazards. Earlier research has shown that coastal inhabitants residing in pucca houses are often forced to change their occupations due to climate-induced sea level rise, saltwater intrusion, and intense cyclonic storm (IPCC, 2014). Our analysis found that occupational struggle of the APL women tended to decrease significantly with climatic hazards compared to women belonging to Antodaya. Earlier research suggests that poor people are often more exposed and vulnerable to climate induced extreme events due to lack of resources to cope and recover (Birkmann *et al.*, 2022; Lankes *et al.*, 2024).

Significantly, our research identified more occupational change among the richer and richest class women. As noted in Figure 1, analysis revealed that most of the women were engaged in cultivation and different labor activities which are the most susceptible to climate-induced disastrous events. However, these women have better access to education, resources, and mobility to switch to an alternative occupation (UNCC, 2023). In our study, the proportion of upper-middle and richest class women with higher educational attainment was nearly about 62%, suggesting a higher potential decision-making power and ability to switch to alternative occupations (Dankelman, 2010). Previous research reported that a husband's occupation significantly influenced the livelihood choices of women (Alemu *et al.*, 2022). Our study analyzed the association between husband's occupation and the occupational change of women. Findings suggest that the occupational change was significantly less among women with their husband engaged in service and cultivation sectors compared to those engaged in labor activities. Therefore, it is a significant challenge for such households to achieve food security, particularly in generating adequate food, as cultivation is more vulnerable to climatic hazards (Dev, 2011).

The adoption of coping strategies is conditional upon the perceived changes in climate (Gbetibouo, 2009). In addition, coping strategies are different for those who do not perceive the impact of climate change (Batool *et al.*, 2018). The present study analyzed the coping strategies adopted by the women who perceived climate-induced

hazards. The coping strategies adopted by coastal women in response to occupational change-induced livelihood uncertainty included use of household savings, reducing expenditures by minimizing the frequency of buying clothes, reducing the proportion of daily meals and other items of consumption, buying less expensive clothes and food items, obtaining support from the local government, opting for less expensive healthcare services, selling large and small ruminants, working as labor on other farm for wages, and seeking financial assistance from relatives and friends, along with temporary short distance migration for wages. The least adopted coping strategies among coastal women in Sagar Island included opting for family planning as a long-term choice to limit size of households, selling jewelry, participating in awareness program on climate change, and obtaining support from banks and NGOs. The cross-tabulation between women's educational attainment and their coping strategies indicates that education plays a crucial role in how women respond to the severe impacts of climate change-induced disasters in Sagar Island.

Despite the findings, this study has a few limitations. First, the study was limited geographically to Sagar Island, which hinders the generalization of the findings to other coastal areas that may experience different climatic, cultural, and socio-economic factors. Second, the data were derived from women's self-reported perceptions and experiences, which may be susceptible to recall bias and be influenced by personal interpretation. Third, while the study illustrated occupational struggles and coping strategies, it did not capture livelihoods in terms of long-term trajectories or inter-generational implications. Finally, while the analysis did not include details of quantitative evaluations of climatic variables or broader policy interventions, these factors could have strengthened the understanding of how climate hazards affect women's occupational vulnerability even more comprehensively.

The present study underscores the significance of integrating gender considerations into climate adaptation policies and practices, as climatic hazards disproportionately disrupt the livelihoods of coastal women. Almost half the women in the study were forced to change livelihoods, which necessitates urgent resilience measures including the adoption of climate-resilient crops and alternative livelihoods. The impact on these women's income loss extends to amplified risks to the healthcare and family welfare. The study, thus, addresses the need to link women's economic empowerment with broader social protection. In addition, women's coping strategies, despite a demonstration of resilience, indicates very limited agency and therefore points to a larger need for legitimate institutional or community-based support.

## 5. Conclusion

The present study involved a concerted effort to understand the determinants of occupational challenges resulting from climate-induced hazards, as well as the coping mechanisms adopted by the married women of reproductive age. Bivariate results indicate that the majority of the women were forced to change their occupation due to climatic hazard-induced causes, particularly cyclonic storm, coastal flooding, and salt-water intrusion. The results of the multiple logistic regression models demonstrate a significant association between occupational struggles and women's perceptions of the impacts of these climatic phenomena. Further findings from the outcome model revealed that social category, type of house, economic status, wealth index, and husband's occupation are key determinants of women's occupational hardships. In Sagar Island, women play a crucial role in ensuring household food security; however, environmental disruptions caused by climatic hazards hinder their employment opportunities by limiting the agricultural inputs and disrupting supply chains.

Several coping strategies were adopted by these women to alleviate the influence of climate-induced effects, and overcome the occupational challenges. However, the study consistently identified the harsh impacts of climate change-induced natural hazards reported by the respondents.

The local government in the area primarily focuses on empowering women through skill development and alternative livelihoods. However, there is a need for effective climate change-induced natural disaster management and preparedness measures. In addition, there is a dire need to raise awareness about climate change among these women, provide credit facilities for undertaking adaptation measures, address the importance of socio-economic disparities, foster effective hazard management and preparedness measures, and enhance women capacity to adapt to climate change. The present study offers valuable insights that can assist policymakers and the local government in understanding the real circumstances of these women during and after the climatic hazards, thereby informing the development of fruitful policies intended at improving occupational opportunities and resilience among women facing climate-induced adversity.

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## Conflict of interest

The authors declare that they have no competing interests.

## Author contributions

*Conceptualization:* All authors

*Formal analysis:* KanchanPaira

*Investigation:* KanchanPaira

*Methodology:* All authors

*Writing-original draft:* KanchanPaira

*Writing-review & editing:* All authors

## Ethics approval and consent to participate

The present study was approved by the Departmental Ethics Committee (DEC) of Fakir Mohan University (approval letter no: FMU/PS/83A<sup>(9)</sup>/2024, dated March 01, 2024). The authors also attest and affirm that verbal informed consent had been obtained from the participants in the study and they were properly made aware and informed about the study purpose, risks, and benefits. The participants have also been informed that their personal information shall be kept confidential and the data will be published for academic purpose only. They were also informed that they are free to withdraw their participation at any time during the survey.

## Consent for publication

Not applicable.

## Availability of data

The data that support the findings of this study are available from the corresponding author on reasonable request and with the permission of P.G. Department of Population Studies, Fakir Mohan University (through <https://fmuniversity.nic.in/populationstudies> or mail to [population\\_fmu@rediffmail.com](mailto:population_fmu@rediffmail.com)).

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