

Environmental change of coastal Sundarbans: Impact on livelihood and standard of living status of indigenous people

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Abstract

There is overwhelming scientific consensus that environmental change is currently having ecological and socioeconomical impacts at the micro and macrolevel. Over the coming decades, the impact of development, climate change, and urbanization on the ecosystem is likely to become even more ruthless in the Sundarbans. Like many other ecologically sensitive areas, the Sundarbans of the Indian state of West Bengal and of Bangladesh are being stressed climatically to the extreme due to their geographical location. This study explores both the ways in which residents of communities in the West Bengal and Bangladesh Sundarbans perceive changes in the environment, as well as intergenerational changes in livelihoods to be driven in a large part by environmental changes. Persons from a total of 368 households were interviewed using a structured interview tool. As an example of differences in perception between residents of the two areas, survey respondents from communities of the Sundarbans of Bangladesh were more likely to perceive that rainfall amounts are changing than did the residents interviewed from the Sundarbans of West Bengal. From the sample data, it is shown that in the Sundarbans of Bangladesh, 59% of the respondents, as compared to 63% of the respondents in West Bengal, reported that they had chosen to enter their parents' occupations. From the multivariate logistic regression analysis, it was observed that, especially in Bangladesh when compared to West Bengal, the state of the environment plays a vital role in whether respondents adopt occupations other than those of their parents.

KEYWORDS

environmental change, environmental parameters, intergenerational change, livelihood, perception, Sundarbans

1 | INTRODUCTION AND BACKGROUND

Livelihood resilience is currently a pressing subject globally in critical disaster, hazard, and cultural studies (Bahadur, Ibrahim, & Tanner, 2013). Maritime delta provinces, such as the Sundarbans, are dwelling places to more than a half-billion people worldwide and constitute universal food baskets (Reddy, 2015; Szabo et al., 2016), yet they are risk prone and vulnerable to the impacts of environmental and climate change, including from various natural hazards (Tessler et al., 2015). Adverse events and hazards in low-income countries can place a drain on their economies and result in loss of social welfare (Kumar, Heath, & Heath, 2002; Mazumdar, Mazumdar, Kanjilal, & Singh, 2014; Pelling & Uitto, 2001). In the United States of America, economically disadvantaged people have been found to be more vulnerable than people having greater economic means in regard to natural hazard experiences.

This is due both to a lack of hazard preparation and to a reduced ability to recuperate from the loss of livelihoods (Björklund & Jäntti, 1999; Fothergill & Peek, 2004). Poor households often have limited access to income, water, and sanitation. Furthermore, many poor residents live in inadequately constructed houses made of flimsy materials, which make them more sensitive to extreme weather conditions and other direct and indirect impacts of natural hazards. In South Asia, these houses are often referred to a kutchas and are constructed of earth and grasses (Brouwer, Akter, Brander, & Haque, 2007; Majumder, 2010).

The Sundarbans are the world's largest halophytic, as well as riverine, delta, and the world's largest estuarine mangrove forest (Ekka & Pandit, 2012). Degradation within an ecosystem can result in a decline in its function, both ecologically and economically. The most significant decreases in ecosystem quality are caused by humans due to excessive use of natural resources for their own welfare (Linham &

Nicholls, 2010). Around the globe, a growing share of the destruction activated by “natural disasters” stem from ecologically destructive practices and from putting residents in harm’s way, especially in coastal regions. Many ecosystems have been fragmented to the point where they are no longer elastic and able to withstand natural disturbances, setting the stage for “unnatural disasters:” those made more frequent or more devastating due to human actions. As a result of anthropogenic activities, such as degrading forests, developing large water reservoirs through river engineering, the filling in of wetlands by various techniques, and destabilizing the atmosphere, we are unraveling the threads of a composite ecological safety net (Abramovitz, 2001).

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The mangrove ecosystem in the lower Gangetic plain is one of the most biologically prolific and taxonomically miscellaneous of the tropical region, but it is threatened by a number of stressors (Chowdhury, Sengupta, Saha, Islam, & Zaman, 2017). The coastal regions of the Sundarbans are a major climatic hotspot located at the southern end of Bangladesh and the state of West Bengal in India (Ghosh, Bose, & Bramhachari, 2018). The area is prone to storm-generated hazards. Such hazards have a direct effect on the landforms of the Sundarbans (O’Malley, 2009). Although this region is very important ecologically and wealthy in natural resources (fish, forest, fertile agricultural land), due to natural hazards the livelihoods of inhabitants have suffered. A study is needed into both the extension of natural hazards into the Sundarbans and their magnitude. It is also important to assess how people are living in these vulnerable areas. The objectives of this study are, first, to understand the residents’ perceptions of environment change in the Sundarbans and how this has influenced their livelihood choices, and, second, to identify the determinants of intergenerational occupation change. Empirical study or proof of the extent and reasons for intergenerational mobility is inadequate (Peters, 1992).

2 | DATA SOURCES AND METHODOLOGY

Primary data were collected from eight villages of the Sundarbans, four located in Bangladesh and four in West Bengal. The villages were selected by latitudinal extension, with four from the northern part and four from the southern part. In addition, two high-population-density villages and two low-population-density villages were selected from each part of the Sundarbans. A total of 368 households were surveyed; among them, 192 households were in the Sundarbans of West Bengal

and 176 households were in Bangladesh. The following formula was used to determine the number of samples needed for a statistically valid study:

$$n = \{(1.96) 2 * p * (1 - p) * (1 + R) * d_{\text{eff}}\} / d^2$$

where n is estimated sample size; α is the level of significance that was set at 0.05; Z_{α} is the Z value at 95% confidence level; d is margin of error (0.05); p is a percentage of household engaged in primary activities like, agriculture, aquaculture, and fishing (Bangladesh Census, 2011; Census of India, 2011); $q = 0.05 (1 - p)$; R is a nonresponse rate (10%); D is design effect (1.25) (Mundfrom, Shaw, and Ke 2005).

Some key, in-depth interviews and focus group discussions (in eight villages) were also performed. The perceptual context regarding environmental changes and impact, such as changes in temperature, rainfall, wind, coastal erosion, sea level rise, and the like, were also captured using a five-degree Likert scale. Principle component analysis was performed for multivariate logistic regression. The function (Tabaei & Herman, 2002) is

$$\text{logit} = [\pi(X)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p$$

where X represents the whole set of covariates X_1, X_2, \dots, X_p and

$$[\pi(X)] = \frac{[\exp(\beta_0 + \beta_i X_i)]}{[1 + \exp(\beta_0 + \beta_i X_i)]}$$

3 | RESULTS

3.1 | Perceptions of changes in the environment

As shown by the results in the table in **Exhibit 1**, the local inhabitants of the Bangladesh Sundarbans perceived that rainfall amounts or the spacing of rain events are changing (90%) over the period of time (since 2001), as compared to the inhabitants of the Sundarbans of West Bengal, where 78% said that rainfall amounts or spacing of events are changing. Among the people of Bangladesh who agreed that rainfall amounts are changing, as shown in **Exhibit 2**, 63% said that rainfall has decreased; whereas among the respondents of West Bengal, 57% perceived that rainfall amounts have decreased. Of the respondents who perceived that rainfall is changing, 59% in West Bengal and 54% in Bangladesh stated that they believed that the rainfall spacing is widening, and 50% in West Bengal and almost 60% in Bangladesh perceived that the rainfall season has shortened. In a statement from one of the key interviews conducted in Bangladesh and West Bengal, a farmer reported:

[The] last few years we had very less [in the way of] agricultural production due to lack of proper rainfall, [and] even [the] rainfall season also shortened. So, for the adequate and inappropriate water (rainfall), the harvesting cycle has suffered, and the quality and quantity of [the] food grain has become very poor. So, we are getting affected by scarcity and inadequacy of rainfall. (Interview conducted in February, 2016)

EXHIBIT 1 Changes in perceptions of environmental components in the Sundarbans

| Component | Category (yes or no) | Percent (%) of study respondents in West Bengal | Percent (%) of study respondents in Bangladesh |
|----------------------|----------------------|---|--|
| Rainfall change | No | 21.88 | 9.09 |
| | Yes | 78.12 | 90.91 |
| Temperature change | No | 14.06 | 2.84 |
| | Yes | 85.94 | 97.16 |
| Wind—unusual changes | No | 43.23 | 40.34 |
| | Yes | 56.77 | 59.66 |
| Sea coast erosion | No | 67.71 | 53.41 |
| | Yes | 32.29 | 46.59 |
| Water level rise | No | 48.96 | 18.18 |
| | Yes | 51.04 | 81.82 |
| River coast erosion | No | 11.46 | 7.95 |
| | Yes | 88.54 | 92.05 |
| Summer heat increase | No | 27.08 | 5.11 |
| | Yes | 72.92 | 94.89 |
| Winter cold increase | No | 72.4 | 82.95 |
| | Yes | 27.6 | 17.05 |

Source: Data collected during field work by the author in Sundarbans (2016).

Among the respondents of the Sundarbans of Bangladesh, 97% stated that they felt that the temperature has changed over time, and 84% perceived that the temperature is increasing. The remaining respondents who were surveyed felt that the temperature varies continuously or has stayed the same. However, in West Bengal, 86% of respondents reported that they perceived that the temperature is changing, and approximately 84% perceived that the temperature has increased. The following comment was characteristic of those made during focus group discussions in Bangladesh and West Bengal:

Coastal Bengal is [the] most vulnerable area due to 'global warming.' As a result of that the temperature has increased in both surface and water bodies, and the consequence is drought is happening. So, the farmers are affected most, and also the fishermen are not getting [the] expected fish and other oceanic products. (Focus group discussion conducted in March, 2016)

A study from 1990 to 2000 tracks temperature changes in the Sundarbans from 1965 to 2000. The study found that there was a rise in temperature over the land as well as over the sea. The observed rise in temperature was 0.019 degrees Celsius (°C) per year over the Bay of Bengal, and same was observed over all of the Sundarbans. According to a study, from 2000 to 2050, the temperature will increase up to 1°C by 2050 (Danda, 2010).

Almost 60% of the inhabitants of the Sundarbans perceived unusual changes in the wind. In the Sundarbans of Bangladesh, roughly 55% of

EXHIBIT 2 Changes in perceptions of environmental parameters in the Sundarbans

| Parameter | Category | Percent (%) of study respondents in West Bengal | Percent (%) of study respondents in Bangladesh |
|--------------------------------|---------------------|---|--|
| Types of rainfall change | Increased | 30 | 27.5 |
| | Decreased | 57.33 | 63.13 |
| | Varies continuously | 12.67 | 9.38 |
| Rainfall amount changing | Increased | 31.33 | 23.13 |
| | Decreased | 57.33 | 63.13 |
| | Varies continuously | 11.33 | 13.74 |
| Rainfall spacing changing | Widened | 59.33 | 54.38 |
| | Narrowed | 34.67 | 22.5 |
| | Same | 15.33 | 23.12 |
| Rainfall season changing | Shortened | 50 | 59.38 |
| | Extended | 34.67 | 23.75 |
| | Same | 15.33 | 16.88 |
| Types of temperature change | Increasing | 83.64 | 84.8 |
| | Varies continuously | 16.36 | 15.2 |
| Types of wind direction change | Yearly | 41.28 | 55.24 |
| | Seasonally | 54.13 | 39.05 |
| | Daily | 4.59 | 5.71 |
| Wind speed change | Increasing | 55.96 | 54.29 |
| | Decreasing | 3.67 | 0 |
| | Unpredictable | 40.37 | 45.71 |

Source: Data collected during field work by the author in Sundarbans (2016).

the respondents observed yearly wind direction changes; whereas in West Bengal, approximately 54% of the respondents reported observing seasonal wind change. Furthermore, 55% of all respondents from the Sundarbans believed that the wind speed is increasing from day to day because of the decrease in the extent of the mangrove forest, which disrupts and helps slow the wind speed.

In almost every household survey, key informant interview, or focus group discussion, the inhabitants of the Sundarbans stated that the rising sea has persistently thwarted every attempt at keeping it out of the fields and farmlands. Almost 90% of Sundarbans inhabitants are being affected by coastal erosion. Also, 95% of the respondents from the Sundarbans of Bangladesh perceived that the summer heat has increased, but only 17% believed that winter cold has increased. The respondents in West Bengal showed some deviation from these

EXHIBIT 3 Monthly average temperature and rainfall in the Sundarbans

| Year | Temperature in degrees Celsius | | Rainfall in millimeters (mm) | |
|-----------|---------------------------------|-------|---------------------------------|--------|
| | South 24 Parganas (West Bengal) | | South 24 Parganas (West Bengal) | |
| | Khulna (Bangladesh) | | Khulna (Bangladesh) | |
| 1901–1930 | 26.37 | 24.85 | 140.9 | 212.2 |
| 1931–1960 | 26.53 | 25.08 | 139.9 | 208.18 |
| 1961–1990 | 26.62 | 25.1 | 140 | 199.91 |
| 1991–2015 | 26.85 | 25.28 | 137.4 | 186.68 |

Source: The World Bank Group, 2015.

perceptions, with only 73% indicating that they believed that the summer heat has increased, and almost 28% stating that the winter cold has increased.

From the table in **Exhibit 3**, we observed that from 1901 to 2015, the temperature has increased significantly. In the time period from 1901 to 1930, the average monthly temperature was 26.37°C in South 24 Parganas—a district of West Bengal that includes the Sundarbans of West Bengal—and 24.85 °C in Khulna, the district in Bangladesh that includes the Sundarbans in that country. In the time period from 1991 to 2015, the average monthly temperature was 26.85 and 25.28°C in South 24 Parganas and Khulna, respectively. In the Sundarbans, the monthly average temperature rose more than 0.4°C in this same time period. Thus, the increase of temperature is evidence of global warming in the Sundarbans. Furthermore, it has been observed that in the Sundarbans of Bangladesh, the amount of rainfall has shown a drastic, though gradual, reduction from 1901 to 2015, with a monthly average reduction in rainfall amounts of approximately 26 millimeters (mm). In South 24 Parganas, however, reductions in the average monthly rainfall amounts have been nominal from 1901 to 2015 (3.5 mm), but the amounts of rain fluctuated.

3.2 | Livelihood patterns and intergenerational change

The livelihood patterns in the Sundarbans are dependent on both the climate and the natural setting. The fertile Sundarbans wield substantial influence on its living organisms and on residents' livelihoods. As the table in **Exhibit 4** shows, according to our study, the majority of the working populations in the Sundarbans are involved in primary activities, such as agriculture or fishing and forestry, although the people in the Sundarbans of West Bengal were more likely to be involved in agriculture (57.29%) as compared to the people in Bangladesh (37.5%). In Bangladesh, more of the respondents were involved in forestry and fishing (26.14%) as compared to the respondents in West Bengal (14.58%).

This research found that intergenerational views of environmental changes were common in the Sundarbans. In the Sundarbans, the living standard has generally improved from the older to the younger generations. However, the number of houses made with mud has increased

EXHIBIT 4 Intergenerational occupational mobility in the Sundarbans

| | Intergenerational occupation changes in percent | |
|-------------------|---|------------|
| | West Bengal | Bangladesh |
| Same occupation | 59.06 | 63.33 |
| Farmer to other | 21.26 | 18.33 |
| Fishing to other | 6.3 | 1.67 |
| Forestry to other | 1.57 | 4.17 |
| Other to other | 11.81 | 12.5 |

Source: Data collected during field work by the author in Sundarbans (2016).

in Bangladesh over the past generation. The houses constructed of brick were also less likely to be found in the Sundarbans of Bangladesh. Based on our analysis, it can be observed that agriculture is the main occupation in the Sundarbans. Also, based on our intergenerational occupational change data, in West Bengal, agriculture as an occupation has increased marginally, from 52% to 57%. However, in Bangladesh, the younger generation is less likely to follow their parents' occupation; it has decreased from 46% to 36%.

In the Sundarbans, fishing and forest-based collection activities are showing a reduction in the number of people involved in these occupations, a trend that is similar in both of the Sundarbans. In today's world, people of the Sundarbans are looking for diversified occupations. They are looking for high incomes and shifting their professional aspirations away from what their parents used to do. The main reason for this is that both agriculture and fishing are yielding less income, and both the Bangladesh and West Bengal governments are restricting residents from forest-based occupations, such as the collection of honey, wax, fruit, tree branches, and other forest-based goods. At the time of the older generation, there were no such government rules or regulations that prevented residents from going into the forest and collecting forest-based products. Usually, at that time, residents collected massive amounts of wood from the jungle for cooking and other household purpose. This situation has changed with the increasing population densities in the Sundarbans. Government actions have reduced the forest-related activities in which residents can engage. During earlier times, the forest was very dense, but the current generation has reported that the forest density has decreased.

Also, during earlier times, fishing activity was pervasive in the Sundarbans. Now, fishing activity has declined significantly. The reasons for this decline reported by the respondents include contamination of the water and a degradation of the quality of the fish caused by anthropogenic activities on the coastline. Natural calamities were also cited, including cyclones and low-pressure-like weather aberrations, which have threatened the lives of a large number of those persons engaged in fishing in the Sundarbans. Thus, the problems with marine and estuarine fishing in the Sundarbans can be classified in two ways: One is associated with decreased biodiversity, and the other, sustainability and livelihood changes, indicates societal damage, such as changes in occupational structure and economic deterioration.

EXHIBIT 5 Determinants of intergenerational occupation change showing relative risk ratio (RRR) and standard error (SE)

| | | | West Bengal | | Bangladesh | |
|----------------------------|---|---------------------|---------------------|-------------------|---------------------|------|
| | | | RRR | SE | RRR | SE |
| Farmer to others | Environmental role in occupation change | No | | | | |
| | | Yes | 1.46 ^{***} | 0.95 | 1.8 ^{**} | 0.38 |
| | Religion | Hindu | | | | |
| | | Muslim | 1.06 | 0.23 | 1.59 ^{**} | 0.26 |
| | | Others | 1.52 | 0.4 | 0.98 | 0.38 |
| | Literacy | Illiterate | | | | |
| | | Up to 5 | 0.55 [*] | 0.14 | 1.01 | 0.19 |
| | | Above 5 | 1.58 ^{**} | 0.41 | 2.98 [*] | 0.03 |
| | Current living Standard | Low | | | | |
| | | Medium | 0.6 ^{***} | 0.12 | 0.27 ^{***} | 0.08 |
| | | High | 1.19 | 0.3 | 0.78 | 0.26 |
| | Wealth Index | Poor | | | | |
| Middle | | 0.41 [*] | 0.115 | 2.47 | 1.16 | |
| Rich | | 1.82 [*] | 0.51 | 3.76 [*] | 2.59 | |
| Forest-fisheries to others | Environmental role in occupation change | No | | | | |
| | | Yes | 3.58 ^{***} | 1.78 | 2.96 ^{***} | 0.99 |
| | Religion | Hindu | | | | |
| | | Muslim | 1.06 | 0.4 | 2.87 [*] | 1.38 |
| | | Others | 2.4 [*] | 0.96 | 2.35 | 0.05 |
| | Literacy | Illiterate | | | | |
| | | Up to 5 | 1.9 [*] | 0.57 | 0.5 [*] | 1.85 |
| | | Above 5 | 2.02 | 0.002 | 1.34 | 0.53 |
| | Current living Standard | Low | | | | |
| | | Medium | 0.62 | 0.2 | 3.97 | 0.05 |
| | | High | 1.13 | 0.48 | 1.29 | 0.02 |
| | Wealth Index | Poor | | | | |
| Middle | | 0.22 ^{**} | 0.08 | 0.91 | 0.37 | |
| Rich | | 0.57 | 0.21 | 3.59 | 0.04 | |
| Other to others | Environmental role in occupation change | No | | | | |
| | | Yes | 2.66 ^{***} | 1.2 | 1.68 ^{***} | 0.33 |
| | Religion | Hindu | | | | |
| | | Muslim | 0.83 | 0.24 | 3.78 ^{***} | 1.1 |
| | | Others | 3.92 ^{***} | 1.15 | 2.09 | 0.04 |
| | Literacy | Illiterate | | | | |
| | | Up to 5 | 1.62 [*] | 0.39 | 0.4 ^{**} | 0.14 |
| | | Above 5 | 2.42 | 0.005 | 3.04 ^{**} | 0.88 |
| | Current living Standard | Low | | | | |
| | | Medium | 0.07 | 0.02 | 1.17 | 0.45 |
| | | High | 0.42 ^{**} | 0.13 | 3.92 | 0.25 |
| | Wealth Index | Poor | | | | |
| Middle | | 0.67 | 0.21 | 2.52 | 0.25 | |
| Rich | | 2.73 ^{***} | 0.89 | 1.59 [*] | 0.14 | |

Note: *p* value * *p* < .1, ** *p* < .05, *** *p* < .01; RRR, relative risk ratio; SE, standard error.

Source: Data collected during field work by the author in Sundarbans (2016).

EXHIBIT 6 Determinants of intergenerational change in standard of living showing relative risk ratio (RRR) and standard error (SE)

| | | | West Bengal | | Bangladesh | |
|----------------------------|--|-----------------------------|-------------|------|------------|------|
| | | | RRR | SE | RRR | SE |
| Living standard declining | Intergenerational occupation change | Same | | | | |
| | | Farmer to others | 1.51*** | 0.46 | 0.91* | 0.15 |
| | | Fishery, forestry to other | 0.99 | 0.24 | 3.41*** | 0.69 |
| | | Other to other | 2.5*** | 0.55 | 1.48* | 0.09 |
| | Intergenerational working time | Same | | | | |
| | | <10 hour | 0.93 | 0.3 | 2.95* | 0.96 |
| | | >10 hour | 0.32* | 0.07 | 0.59* | 0.13 |
| | Intergenerational housing type | Same | | | | |
| | | Mud to other | 0.7 | 0.1 | 0.9* | 0.05 |
| | | Brick to mud | 1.9 | 0.52 | 1.74 | 0.14 |
| | | Brick to concrete | 0.6 | 0.57 | 0.89 | 0.44 |
| | Intergenerational agricultural land | Same | | | | |
| | | Agricultural land increased | 0.91*** | 0.39 | 0.93 | 0.46 |
| | | Agricultural land decreased | 2.7 | 0.08 | 1.24*** | 0.1 |
| | Intergenerational women economic activity | Same | | | | |
| | | Yes to no | 1.17** | 0.28 | 1.21* | 0.22 |
| | | No to yes | 0.95** | 0.15 | 1.01 | 0.85 |
| Living standard increasing | Intergenerational occupation change | Same | | | | |
| | | Farmer to others | 0.86 | 0.18 | 0.47*** | 0.1 |
| | | Fishery, forestry to other | 1.15 | 0.19 | 0.74 | 0.13 |
| | | Other to other | 0.48* | 0.23 | 0.39* | 0.15 |
| | Intergenerational working time | Same | | | | |
| | | <10 hour | 0.7* | 0.16 | 0.97* | 0.7 |
| | | >10 hour | 1.03 | 0.16 | 1.99* | 0.35 |
| | Intergenerational housing type | Same | | | | |
| | | Mud to other | 3.22 | 0.55 | 5.81 | 0.38 |
| | | Brick to mud | 0.81* | 0.7 | 0.55** | 0.09 |
| | | Brick to concrete | 1.91* | 0.7 | 1.44* | 0.49 |
| | Intergenerational agricultural land | Same | | | | |
| | | Agricultural land increased | 1.57* | 0.33 | 3.82* | 0.03 |
| | | Agricultural land decreased | 1.01* | 0.34 | 0.84 | 0.29 |
| | Intergenerational women in economic activity | Same | | | | |
| | | Yes to no | 1.1* | 0.18 | 0.87* | 0.26 |
| | | No to yes | 1.8 | 0.1 | 1.55** | 0.81 |

Note: *p*-value **p* < .1, ***p* < .05, ****p* < .01; RRR, relative risk ratio; SE, standard error.

Source: Data collected during field work by the author in Sundarbans (2016)

According to our survey, in the Sundarbans of West Bengal, about 55% people of younger generation changed their occupation from those practiced by previous generations of their families, whereas in the Bangladesh Sundarbans, the number shows a change of about 59%. The maximum change is found in the forestry and fishing occupation (a decline of about 30%). Intergenerational forestry and farming occupational changes are observed as more prevalent in West Bengal than in Bangladesh. From the table shown in **Exhibit 5**, it can be observed that the environment plays a significant role in the shift-

ing of occupations by the younger generation away from those practiced by the older generation. Respondents perceived that the environmental factor is more likely to change their occupation from their previous generations' occupations. Parents may be engaged in primary activities, such as agriculture or fishing and forestry activities, but the next generation is more likely to change occupations, and these results are highly significant. Education does play a vital role in shifting intergenerational occupations, especially as shown in the very high shift from farmer to the "other" occupational category (see Exhibit 4).

In the Sundarbans of Bangladesh, it has been observed that Muslims are more likely to change intergenerational occupations when compared to respondents of other religions (see Exhibit 5). Furthermore, as shown in the table in **Exhibit 6**, those who enjoy high standards of living do not prefer to change intergenerational occupations, as the people within the high standard of living category are typically maintaining good agricultural land and already enjoy better economic conditions than other residents. Residents with low standards of living are more prone to change intergenerational occupations.

Along with increasing incomes, standards of living in households also increase. In West Bengal, it has been seen that people improved their living standards compared to the previous generations by 53%. In Bangladesh, it is 42%. The survey also indicated that people who are not continuing to work in their parent's occupations—especially in agriculture—reported a decline in their living standard in West Bengal, and in Bangladesh, those who changed occupations from forestry and fishing to other categories of occupation, are also experiencing significant declines in their living standards. The older people who were involved in forestry and fishing activities earned good incomes when they were younger. Nowadays, however, the younger generation is not satisfied with these occupations. After changing occupations, their living standards are likely to be lower than their parents' living standards. Furthermore, in the past, households in which older-generation women were engaged in income-generating activities when they were young had better standards of living than in households where women did not work. Now, in households in which women of the younger generation are not engaged in income-producing activities, the likelihood is increasing that their households will experience low standards of living.

It has also been observed that people who are not engaging in intergenerational occupational changes experience high living standards. People of the current generations who are working for hourly wages and working long hours are achieving higher standards of living than was the case with the older generations, whose members worked very long hours, but were not satisfied with their standards of living. The type of housing people live in reflect their living standards, and people who are living in pucca or semipucca homes, meaning houses constructed of sturdy materials, such as brick, stone, concrete, or timber, as opposed to the flimsily constructed kutcha homes made of grasses and mud, have high standards of living.

4 | DISCUSSION

The current study has discussed one of the deciding factors of an individual's choice of profession while living in the Sundarbans. One's profession level determines the kind of life that a person will live. The livelihood patterns within the Sundarbans are widely dependent on climate and natural settings. The inhabitants of the Sundarbans generally report feeling that environmental parameters, such as rainfall, temperature, sea level, wind direction, and the like, are changing from day to day; thus, according to their perceptions, the climate is gradually changing. It is very difficult to cope with such extreme events,

especially if people have very limited resources, their livelihoods are affected, and they have no alternative employment to which they can turn. The area is highly rich in natural resources, like fertile land, water resources, and unique forest resources. Primary economic activities have been the main livelihoods in the Sundarbans, but this sector—agriculture, fishing, and the collecting of forest resources—have been seriously affected by natural calamities, and the situation is worsening day by day. Climate change or natural hazards are believed to have had, or will have, severe impacts on the livelihoods of many Sundarbans households in the short, medium, and long term. Many people who live in the Sundarbans have lost their livelihoods due to the loss of agricultural fields from river erosion or floods, which have destroyed the fertility of this land. As a result, a significant number of people in these areas are shifting away from the traditional occupations of their parents. Currently, the Sundarbans have undergone severe threats to the livelihoods of their residents due to the long-term effects of climatic hazards. Both West Bengal and Bangladesh Sundarbans are facing severe environmental change, and therefore, inhabitants are shifting from their traditional occupations. As a result of this, the normal standard of living has become much lower than it was before. People from the current generation who engage in farming activities and belong to the high-income category are the ones who are most likely to change occupation from their parental occupation (such as forestry and fishing), and such intergenerational occupation change is more pronounced in the Sundarbans of Bangladesh.

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