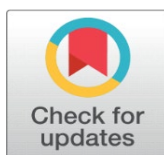


# CONSTITUTIONAL PROTECTIONS AND THE PLIGHT OF CLIMATE-INDUCED MIGRANTS IN THE SUNDARBAN DELTA: A LEGAL ANALYSIS

Chayan Chakraborty<sup>1</sup>✉, Dr. Arup Kumar Poddar<sup>2</sup>✉

<sup>1</sup>PhD Research Scholar, WBNUJS, Assistant Professor, Bikash Bharati Law College

<sup>2</sup>Supervisor, Professor (Law) WBNUJS, Kolkata, West Bengal



## Corresponding Author

Chayan Chakraborty,  
[c.chakraborty9830@gmail.com](mailto:c.chakraborty9830@gmail.com)

## DOI

[10.29121/shodhkosh.v5.i1.2024.2020](https://doi.org/10.29121/shodhkosh.v5.i1.2024.2020)

**Funding:** This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

**Copyright:** © 2024 The Author(s). This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

With the license CC-BY, authors retain the copyright, allowing anyone to download, reuse, re-print, modify, distribute, and/or copy their contribution. The work must be properly attributed to its author.



## ABSTRACT

Article 21 of the Indian Constitution guarantees the protection of life and liberty to all individuals. The term 'life' encompasses more than mere animal existence; it implies the inhibition against deprivation of limbs and the ability to appreciate life in its fullness. This provision prohibits the deprivation of life or any divine endowment, including growth and enjoyment, provided legal rulings uphold its efficacy. Life, as envisioned by Article 21, transcends mere physical survival; it embodies the outward expression of an imperceptible inner activity. A significant development in Indian constitutional jurisprudence is the recognition and enforcement of positive rights of life, stemming from the intersection of social justice, the rule of law, and principles of dignified human existence. These positive rights are supported by the language of Article 21. However, the climate migrants from the Sundarban delta remain excluded from the protections offered by 'life,' 'liberty,' 'social justice,' and 'positive rights.' The Sundarban region, with its unique ecosystem, has been severely impacted by catastrophic climate change-induced disasters. The inhabitants suffer from the adverse effects of recurrent natural disasters, yet they receive neither assistance nor compensation for their losses, necessitating their migration to safer areas. This paper examines the various causes of migration from the Sundarban due to climate change and analyzes how the rights of these migrants have been infringed upon.

**Keywords:** Climate change, Migrants, Ecology, Disasters, Right to life

## 1. INTRODUCTION

The constitutional frameworks of free democratic governments are designed to structure and manage power, safeguard human rights, balance the competing demands of social and private interests, and embody the national character and experience, serving as catalysts for progress and unity.<sup>1</sup> These frameworks inherently reflect the core and timeless principles of human rights, integrating them within their legal constructs.<sup>2</sup> Moreover, the convergence of human traits and justice claims represents a significant phenomenon.<sup>3</sup> Central to this is the principle of equal liberty, which profoundly

<sup>1</sup> P. Ishwara Bhat Fundamental Rights A Study of Their Interrelationship 1-3(Eastern Law House,Kolkata,2004)

<sup>2</sup> Ibid

<sup>3</sup> Ibid

impacts the concept of individual personhood developing in harmony with societal interests.<sup>4</sup> This ideal presupposes that every individual possesses an equal set of rights, free from oppression, tyranny, or exploitation by others or the state.<sup>5</sup> The notion that no individual's liberty surpasses another's serves as a perpetual countermeasure against arbitrary actions or the abuse of freedom.<sup>6</sup>

The pursuit of justice is particularly pertinent in the equitable distribution of life's goods, including liberty. Thus, the fundamental principle of equal liberty underpins constitutional efforts to protect human dignity and foster personality development. The interplay among fundamental rights is shaped by a complex formula of right and justice, encompassing various dimensions such as rationality, affirmative action, equality before the law, due process, and equal protection under the law. The Indian Constitution's primary aim of securing liberty, equality, fraternity, dignity, and justice for all citizens provides a theoretical foundation for this interplay of rights. The structural organization, phrasing, and arrangement of the fundamental rights enshrined in Part III of the Constitution underscore the primacy of justice, reasonableness, and the enhancement of human personhood in their interrelated framework.

The term "right" is inherently multifaceted, commonly defined by its criterion of permitted action within a specified domain. Engaging in debates over the morality of a given action is futile without a clear understanding of the context in question.<sup>7</sup>

In the Sundarbans, one prevalent means of livelihood is outmigration, with three-fourths of households having at least one member seeking employment elsewhere. Migration across states is preferred over internal movement within or between districts.<sup>8</sup> The primary driver of outmigration from the Sundarbans is the scarcity of livelihood opportunities.<sup>9</sup> The environmental context significantly influences migration patterns in the region, though the analytical framework necessary to elucidate the impact of environmental change on migration remains underdeveloped in the field of environmental migration studies.<sup>10</sup> Extreme weather events exacerbate immobility among the population, who possess limited assets. Migration is, therefore, a phenomenon with multifaceted causes.

## **2. LIVING CONDITIONS AND MIGRATION IN THE SUNDARBANS**

### **2.1 ANTHROPOGENIC PRESSURES ON THE SUNDARBANS ECOSYSTEM**

For many years, anthropogenic pressures have severely impacted the Sundarbans, a fragile and unique ecosystem.<sup>11</sup> Rapid population growth has exacerbated these pressures, posing significant risks to the survival of this vital region. The scarcity of sufficient agricultural land compels the inhabitants to gather resources from the forests unsustainably, leading to the degradation of the biophysical characteristics of the forests and the deterioration of mangrove forests.<sup>12</sup> Additionally, overfishing, a reduction in forest cover, environmental degradation, and the extraction of various non-timber forest products contribute simultaneously to the ecosystem's decline.

### **2.2 ACCESSIBILITY AND MIGRATION DYNAMICS IN THE SUNDARBANS**

The Sundarbans region is primarily accessible via river routes, especially in the southern areas. Most transportation relies on country boats, often equipped with modified engines. Northern parts of the Sundarbans, closer to Kolkata, face somewhat different dynamics. The limited and often hazardous livelihood opportunities in the Sundarbans drive migration to Kolkata and its surroundings. This migration is crucial for supplementing inadequate household incomes and broadening subsistence options. Therefore, understanding migratory trends in conjunction with livelihood patterns and opportunities is essential for devising strategies to enhance the well-being of the Sundarbans' inhabitants and the sustainability of their environment.

### **2.3 TYPES OF MIGRATION IN THE SUNDARBANS**

<sup>4</sup> Ibid

<sup>5</sup> G.W.Paton A Textbook of Jurisprudence 284(Oxford University Press, New Delhi, 2018)

<sup>6</sup> Ibid

<sup>7</sup> Ibid

<sup>8</sup> S.Irudaya Rajan and R.B.Bhagat(eds), Climate Change, Vulnerability and Migration 148-149(Routledge, ,New York,2018)

<sup>9</sup> Ibid

<sup>10</sup> Ibid

<sup>11</sup> Action Aid Association(India),Troubles in the Sundarbans Astudy of Social and ecological issues in Hingalgang Block, North 24 Parganas, West Bengal(May, 2022)

<sup>12</sup> Samantak Das et.al, Shifting Lands, Moving People 64-67(Jadavpur University Press,Kolkata, 2023)

Extensive research on the Sundarbans has identified three distinct types of migration: internal migration within the Sundarbans, migration into the Sundarbans, and migration out of the Sundarbans.<sup>13</sup> A significant proportion of recent internal migrants within the Sundarbans have been driven by the impacts of climate change, including land loss, environmental degradation, and the loss of livelihoods due to both abrupt events (such as cyclones) and gradual changes (such as irregular monsoon patterns). These climate-induced migrants are typically forced migrants, relocating out of necessity rather than choice. Their deep-rooted connections to the Sundarbans often motivate them to remain within the region's boundaries rather than seeking permanent resettlement elsewhere.<sup>14</sup>

## 2.4 CHALLENGES OF INTERNAL MIGRATION TO SAGAR ISLAND

This internal migration frequently directs individuals to Sagar Island, where relocation efforts have proven largely ineffective and sometimes detrimental. Various studies highlight the government's inconsistent and fragmented approach to resettling these climate change-induced forced migrants on Sagar Island. As environmental challenges intensify, the number of these environmental refugees is expected to rise. Despite the increasing risks and uncertainties posed by climate change, all three types of migration are likely to continue to be prominent features of life in the Sundarbans.

## 2.5 SEASONAL AND PERMANENT OUT-MIGRATION

Significant out-migration from the Sundarbans occurs on a seasonal, occasional, or permanent basis. Temporary migration typically involves a family member moving away for a period ranging from a few days to a year to work, save money, and return home once their savings are depleted. This form of migration is a critical strategy for supplementing household incomes and coping with the limited livelihood opportunities within the Sundarbans.

Understanding these migration patterns, in conjunction with livelihood strategies and opportunities, is essential for developing effective policies to support the well-being of the Sundarbans' inhabitants and the sustainability of their environment.

## 2.6 EMPLOYMENT OPPORTUNITIES AND OUT-MIGRATION

An intriguing aspect of migration in the Sundarbans is the phenomenon where a segment of the population that temporarily or seasonally moves into the region frequently leaves in search of better employment opportunities.<sup>15</sup> Additionally, many long-term residents—whether from before or after the cyclone Aila—have migrated out of the region, often relinquishing their voter or ration cards, which still identify them as locals. Despite relocating, many of these migrants retain ties to the Sundarbans by holding onto whatever land and assets they may have, due to familial and relational connections.<sup>16</sup>

Most of the out-migration from the Sundarbans is directed towards Kolkata and its surrounding areas. This migration exacerbates the challenges faced by both the migrants and the already overburdened city. This trend indicates that improving agricultural productivity and broadening livelihood options in the Sundarbans could significantly reduce out-migration, thereby alleviating pressure on Kolkata.<sup>17</sup>

## 2.7 LIVELIHOODS IN THE SUNDARBANS: THE ROLE OF FISHING

A comprehensive discussion of livelihoods in the Sundarbans must include fishing. Since the beginning of habitation in the Sundarbans, fishing has been a predominant source of income, providing both sustenance and a crucial protein source for the islanders' diet. Traditionally, the Sundarbans' inhabitants have been fishermen by trade and culture. Currently, many fishermen have shifted towards crab fishing, a more hazardous and physically demanding activity due to the crabs' habitats within the interior of tiger reserve forests.

<sup>13</sup> Ibid

<sup>14</sup> Ibid

<sup>15</sup> [https://www.sundarbanaffairswb.in/home/page/sundarban\\_biosphere](https://www.sundarbanaffairswb.in/home/page/sundarban_biosphere) (Last visited on 12<sup>th</sup> March, 2024)

<sup>16</sup> Ibid

<sup>17</sup> Ibid

## 2.8 IMPACT OF MALE OUT-MIGRATION ON WOMEN

The out-migration of husbands creates additional financial and resource-related challenges for mothers seeking care. These women also become responsible for the processes that restore their household's livelihood, a role that was not previously as demanding. Women in the Sundarbans now bear triple responsibilities: domestic work, childcare, and elder care. Increasingly, they are joining the marginal labor force as unskilled workers in domestic assistance, handicrafts, and riskier industries such as crab catching. While both men and women can adapt to climate change through migration, most women migrate in response to the overall economic decline, resulting in significant income losses.

These migration patterns and the accompanying livelihood challenges underscore the need for comprehensive strategies to improve local employment opportunities, enhance agricultural productivity, and provide targeted support to the most vulnerable populations in the Sundarbans. Addressing these issues is crucial for reducing migration pressures and ensuring the sustainable development of the region.

## 2.9 HEALTH AND SOCIOECONOMIC CHALLENGES OF WOMEN IN THE SUNDARBANS

In 2010, the Indian Institute of Health Management Research in West Bengal conducted a comprehensive study on the healthcare system in the Indian Sundarbans.<sup>18</sup> The study revealed that women aged 15-59 reported a higher incidence of general ailments compared to men. These ailments included conditions such as asthma, arthritis, and vision problems.<sup>19</sup> Additionally, data on the body mass index of selected women indicated that nearly one-third were underweight, highlighting significant nutritional deficiencies.<sup>20</sup>

The study also uncovered a disproportionate impact of mental health issues on women. Analysis of clinical records from six government hospitals in the Sundarbans showed that women accounted for 65-77% of admissions for intentional self-harm and 67% of deaths from such incidents. This heightened vulnerability to mental illness is primarily attributed to the precarious socioeconomic status of women in the Sundarbans, exacerbated by poverty, domestic abuse, and societal indifference to their issues.

Women in the Sundarbans, particularly those from impoverished backgrounds, face disproportionate vulnerability due to several factors. These include their reliance on biofuels and water, the necessity to fetch water for household use, their role in securing food and fuel, their predominance in low-tech, rain-fed agriculture, and their increased exposure to climate hazards. The impacts of climate change and environmental degradation, such as water scarcity and shortages, especially following cyclones like Amphan, disproportionately affect low-income rural women. These women often lack access to locally sourced, renewable, and sustainable resources for their livelihood. As natural resources diminish, women must travel further to obtain essentials, increasing their risk of sexual assault.

Based on this analysis, targeted interventions are urgently needed to address the health and socioeconomic challenges women in the Sundarbans face. Improving access to healthcare, enhancing nutritional support, and ensuring the safety and security of women are critical steps towards mitigating the disproportionate impacts on this vulnerable population. Additionally, sustainable development initiatives that enhance local resources and resilience to climate change are essential for improving the overall well-being of women in the Sundarbans.

## 2.10 CONSTITUTIONAL MANDATE FOR PUBLIC HEALTH IN INDIA

The Indian Constitution does not explicitly enumerate the right to health as a fundamental right. However, the Constitution mandates the State to ensure social and economic justice, as articulated through the Directive Principles of State Policy (DPSP) under Part IV.<sup>21</sup> Article 38 of the Constitution requires the State to promote the welfare of the people by establishing a social order in which justice—social, economic, and political—shall inform all the institutions of national life. This implies that public health is a prerequisite for human welfare and societal well-being.

Several provisions within the DPSP indirectly address health-related issues. Article 39(e) concerns the protection of workers' health, while Article 41 obligates the State to provide public assistance, particularly for the sick and disabled. Article 42 mandates maternity benefits to protect the health of mothers and children. Furthermore, Article 47 designates

<sup>18</sup> Dr. Ishita Chatterjee, *Health Law 102-105* (Central Law Publications, Allahabad, 2019)

<sup>19</sup> Ibid

<sup>20</sup> Ibid

<sup>21</sup> Supra at 18.

the improvement of public health as one of the State's primary duties, emphasizing the importance of nutrition and living standards and advocating for the prohibition of harmful drugs and alcohol. Article 48A ensures the State's commitment to maintaining a pollution-free environment, essential for public health.

The DPSP provides guidelines to the State, which are non-justiciable, meaning individuals cannot legally enforce these provisions. However, the Supreme Court of India has interpreted the right to health as an integral part of the right to life under Article 21 of the Constitution. Article 21, which guarantees the protection of life and personal liberty, has been expansively interpreted to include a broad spectrum of rights connected to the dignity and quality of life. This judicial interpretation allows individuals to assert their right to health as part of their fundamental rights.

Thus, while the Indian Constitution does not explicitly list the right to health as a fundamental right, it provides a robust framework for its protection through the interplay of the DPSP and the judicial interpretation of Article 21. This ensures that the right to health is safeguarded alongside other civil, political, and economic rights, reflecting a comprehensive approach to individual and public welfare.

## **2.11 JUDICIAL INTERPRETATION OF THE RIGHT TO HEALTH**

In 1995, the Supreme Court of India ruled that access to healthcare and medical treatment is a fundamental right protected under Article 21 of the Constitution. This landmark decision emphasized that workers' lives must be meaningful, purposeful, and compatible with human dignity to maintain their health. Article 21 mandates the State to protect each individual's right to life, underscoring the paramount importance of safeguarding human life.

## **2.12 ADDRESSING HEALTH RIGHTS THROUGH JUDICIAL INTERPRETATION**

In the case of *Parmanand Katara v. Union of India* (AIR 1989 SC 2039), the Supreme Court asserted that individuals responsible for community health have a duty to protect life, regardless of whether the patient is an innocent party or a criminal facing legal consequences. This ruling further solidifies the interpretation of the right to health as an essential component of the right to life under Article 21.

## **2.13 HEALTH RIGHTS AND HUMAN TRAFFICKING**

Health rights also intersect with Article 23, which prohibits human trafficking. Article 23(1) explicitly forbids the trafficking of persons, addressing a critical issue linked to public health. Human trafficking is widely recognized as a significant factor contributing to the spread of diseases, including AIDS, particularly through the forced prostitution of trafficked women.

These judicial interpretations demonstrate the comprehensive approach taken by the Indian judiciary to integrate health rights within the broader framework of fundamental rights. By interpreting Article 21 to include access to healthcare and recognizing the public health implications of human trafficking under Article 23, the Supreme Court has reinforced the constitutional commitment to protecting and promoting health as a vital aspect of human dignity and life.

## **3. METHODOLOGY**

The survey data were collected from ten distinct locations within the Sundarbans area, specifically from Lahiripur, Anandapur, Emilybari, Mitrabari, Sukumari, Saatjelia, Sudhangsupur, Shantigachi, Dayapur, and Sagar. A total of 101 participants from these locations provided their responses, ensuring a comprehensive representation of the region's population. The distribution of the participants in different locations is depicted in Figure 1. The diverse geographical coverage and the substantial number of respondents enhance the reliability and validity of the findings related to climate adaptation strategies and the experiences of climate refugees and migrants in the Sundarbans.

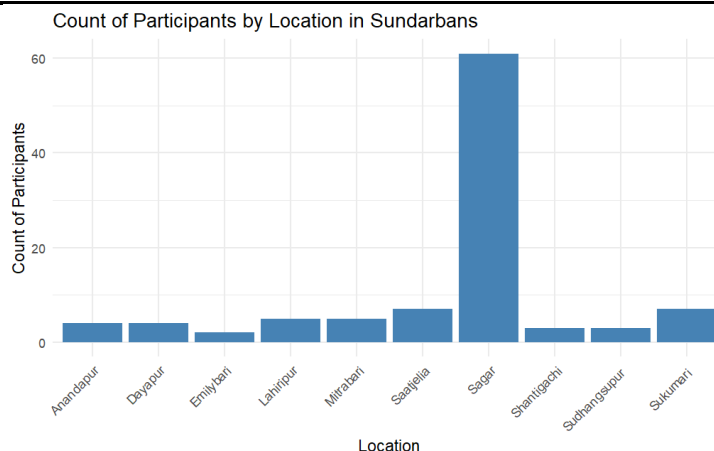


Figure 1: Participants in ten different locations

### 3.1 SURVEY DESIGN AND DATA COLLECTION

In 2023, a structured survey was conducted to gather data on perceptions and experiences related to climate adaptation strategies in the Sundarbans. The survey consisted of ten questions designed to elicit responses on various aspects of climate change and its impact on the local population, particularly focusing on climate refugees and migrants.

### 3.2 SURVEY QUESTIONS

The survey questions were meticulously designed to capture a comprehensive understanding of the perceptions and experiences of residents in the Sundarbans concerning climate refugees and migration due to climate-related events. Each question serves a specific purpose and collectively, they provide valuable insights into various aspects of climate adaptation strategies, community involvement, and policy awareness.

**Q01: Are you aware of any official policies aimed at protecting climate refugees/migrants in the Sundarbans?**

**Justification:** This question assesses the awareness level of residents about existing governmental policies. Awareness is crucial for policy effectiveness, as it determines how well the policies are being communicated and implemented among the affected populations.

**Q02: Have you or anyone you know been displaced due to climate-related events in the Sundarbans?**

**Justification:** Understanding the extent of displacement helps in gauging the direct impact of climate change on the community. This question aims to quantify the prevalence of displacement and identify the proportion of the population directly affected by climate events.

**Q03: Do you believe that the current efforts to protect climate refugees/migrants in the Sundarbans are adequate?**

**Justification:** Evaluating the perceived adequacy of protection efforts provides insight into the effectiveness of current measures. It highlights areas where residents feel improvements are needed and can guide future policy adjustments.

**Q04: Have you participated in any community-led initiatives aimed at supporting climate refugees/migrants in the Sundarbans?**

**Justification:** Community involvement is a key factor in the success of adaptation strategies. This question aims to measure the level of grassroots participation and the role of local initiatives in supporting climate refugees.

**Q05: Is there sufficient access to safe housing for climate refugees/migrants in the Sundarbans?**

**Justification:** Safe housing is a fundamental need for displaced individuals. This question assesses the availability and adequacy of housing solutions, which is critical for the well-being and stability of climate refugees.

**Q06: Do you think that climate change is a major factor contributing to migration in the Sundarbans?**

**Justification:** Understanding the perception of climate change as a driver of migration helps in recognizing the root causes of displacement. This question seeks to establish a direct link between climate change and migration patterns in the region.

**Q07: Are local authorities actively involved in creating solutions for climate refugees/migrants in the Sundarbans?**

**Justification:** The involvement of local authorities is essential for the development and implementation of effective adaptation strategies. This question evaluates the perceived commitment and actions of local governance bodies in addressing climate-related issues.

**Q08: Have you received any form of education or training on how to adapt to the impacts of climate change in the Sundarbans?**

**Justification:** Education and training are vital for building resilience and preparedness. This question measures the availability and accessibility of educational programs aimed at equipping residents with the knowledge and skills needed to adapt to climate change impacts.

**Q09: Do you believe that the international community should play a larger role in supporting climate refugees/migrants in the Sundarbans?**

**Justification:** International support can significantly enhance local adaptation efforts. This question assesses the perception of the need for greater involvement from the global community in providing financial, technical, and policy support.

**Q10: Are climate refugees/migrants included in the decision-making processes regarding climate adaptation strategies in the Sundarbans?**

**Justification:** Inclusive decision-making ensures that the voices of the most affected individuals are heard and considered. This question evaluates the extent to which climate refugees are involved in the formulation and implementation of adaptation strategies, which is crucial for the development of effective and equitable policies.

Collectively, these questions aim to provide a holistic view of the challenges, perceptions, and needs related to climate adaptation in the Sundarbans, thereby informing policymakers, researchers, and community leaders in their efforts to develop more effective and inclusive adaptation strategies.

### 3.3 DATA COLLECTION PROCEDURE

The survey was meticulously designed and administered to gather comprehensive data on the perceptions and experiences of residents in the Sundarbans regarding climate refugees and the impacts of climate change. The following steps outline the detailed data collection procedure:

#### SURVEY DESIGN

**Question Development:** The survey included ten questions focused on awareness of policies, personal experiences of displacement, perceived adequacy of protection efforts, community involvement, housing access, education and training on climate adaptation, and the roles of local authorities and the international community.

**Pilot Testing:** The survey was pilot tested with a small group to ensure clarity and relevance of questions, and adjustments were made based on feedback.

#### SELECTION OF SURVEY LOCATIONS

**Geographic Representation:** The survey was conducted across ten distinct locations within the Sundarbans region: Lahiripur, Anandapur, Emilybari, Mitrabari, Sukumari, Saatjelia, Sudhangsupur, Shantigachi, Dayapur, and Sagar. These locations were chosen to provide a representative sample of the diverse geographic and demographic characteristics of the Sundarbans.

**Stratified Sampling:** A stratified sampling method was employed to ensure that each location was proportionately represented in the survey. This approach helped capture the unique experiences and perspectives of residents from different parts of the region.

#### PARTICIPANT SELECTION

**Random Sampling:** Within each selected location, participants were randomly chosen to participate in the survey. This randomness aimed to minimize selection bias and ensure that the sample was representative of the broader population.

**Demographic Diversity:** Efforts were made to include participants from various age groups, genders, socio-economic backgrounds, and occupations to capture a wide range of experiences and views related to climate change and migration.

## **SURVEY ADMINISTRATION**

**Mode of Survey:** The survey was administered through face-to-face interviews, ensuring that participants fully understood the questions and could provide thoughtful responses. This method also allowed the surveyors to clarify any doubts or ambiguities in real-time.

**Informed Consent:** Prior to administering the survey, participants were informed about the purpose of the study, the nature of the questions, and their rights as respondents, including the right to withdraw from the survey at any time. Informed consent was obtained from all participants.

**Language and Accessibility:** The survey was conducted in the local language to ensure that all participants could understand and respond accurately. Surveyors were trained to accommodate any special needs of the participants, such as those with limited literacy or physical disabilities.

## **DATA COLLECTION AND MANAGEMENT**

**Data Recording:** Responses were recorded systematically using digital tablets to ensure accuracy and facilitate easy data management. This method also helped reduce the risk of data loss or misinterpretation.

**Quality Control:** Regular checks were conducted to ensure the quality and consistency of the collected data. Any discrepancies or incomplete responses were addressed promptly by revisiting the participants if necessary.

## **ETHICAL CONSIDERATIONS**

**Confidentiality:** Participants' responses were kept confidential, and data were anonymized to protect their privacy. Personal identifiers were not included in the final dataset.

By following this comprehensive and systematic data collection procedure, the survey aimed to gather reliable and representative data on the experiences and perceptions of residents in the Sundarbans regarding climate adaptation and migration. This data is crucial for informing effective policies and interventions to support climate refugees and enhance resilience in the region.

### **3.4 SURVEY DATA ANALYSIS**

The methodology for analyzing the survey data involved several systematic steps to ensure accurate, reliable, and insightful results. The process utilized both Microsoft Excel for initial dataset preparation and the R statistical programming language for comprehensive data analysis and visualization. Below is a detailed description of each step in the methodology:

#### **DATASET PREPARATION**

**Data Entry:** The raw survey data collected from participants were initially entered into Microsoft Excel. This step involved transcribing responses from survey forms into a digital format to facilitate further analysis.

**Data Cleaning:** In Excel, the dataset was meticulously cleaned to ensure accuracy and consistency. This included checking for and correcting any data entry errors, handling missing values, and standardizing response formats.

**Data Transformation:** The responses were coded into numerical values where necessary (e.g., Yes/No responses were converted to binary values) to prepare the data for statistical analysis. Additionally, categorical variables were appropriately labeled to maintain clarity.

#### **DATA IMPORTATION AND MANAGEMENT**

**Data Import:** The cleaned and prepared dataset was imported into R, a powerful statistical programming language, for detailed analysis.

**Data Structuring:** In R, the dataset was structured into a data frame, facilitating efficient manipulation and analysis.

#### **DESCRIPTIVE STATISTICS**

**Summary Statistics:** Descriptive statistics were computed to provide an overview of the data. This included calculating frequencies, percentages, means, and standard deviations for each survey question. The `summary()` function in R was used to generate these statistics.

Exploratory Data Analysis (EDA): Exploratory techniques, such as cross-tabulations and correlation matrices, were applied to identify patterns and relationships within the data. Visualization tools, including histograms and box plots, were used to explore the distribution of responses.

## DATA VISUALIZATION

Chart Preparation: Various charts and graphs were created to visually represent the survey findings. Column charts and Likert scales were used to depict the distribution of responses for each question and to understand the responses.

Location-Specific Analysis: To analyze responses by location, the data were grouped and summarized based on geographic regions. Location-specific column charts were prepared to highlight differences and similarities across the surveyed locations.

## REPORTING AND INTERPRETATION:

Result Interpretation: The statistical results and visualizations were interpreted to draw meaningful insights about the perceptions and experiences of residents regarding climate adaptation and migration in the Sundarbans.

Documentation: The entire analysis process, including code scripts and outputs, was thoroughly documented to ensure reproducibility and transparency. The findings were compiled into a comprehensive report, detailing the methodology, results, and recommendations.

By employing this rigorous and systematic approach to data analysis, the study aimed to provide robust and actionable insights into the challenges and opportunities related to climate adaptation strategies in the Sundarbans. This methodological rigor ensures that the conclusions drawn are based on sound statistical principles and reliable data.

## 4 RESULTS

Figure 2 summarizes survey responses to ten questions regarding the involvement of climate refugees and migrants in climate adaptation strategies in the Sundarbans. The percentages reflect the proportions of respondents who answered "No" or "Yes" to each question.

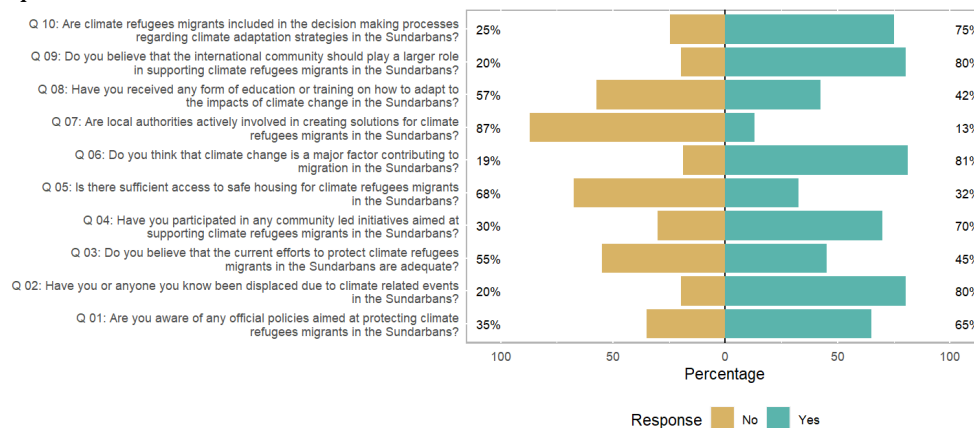


Figure 2: Summary of survey data on climate adaptation strategies in the Sundarbans

### 4.1 KEY FINDINGS:

**AWARENESS OF POLICIES (Q01):** 65% of respondents are aware of official policies aimed at protecting climate refugees and migrants in the Sundarbans, while 35% are not.

**DISPLACEMENT EXPERIENCE (Q02):** 80.20% of respondents have either been displaced or know someone who has been displaced due to climate-related events in the Sundarbans, highlighting the prevalence of climate-induced displacement.

**ADEQUACY OF CURRENT EFFORTS (Q03):** Only 45% believe that the current efforts to protect climate refugees and migrants are adequate, suggesting a need for improved measures, as 55% do not find the efforts sufficient.

**COMMUNITY-LED INITIATIVES (Q04):** 70% of respondents have participated in community-led initiatives to support climate refugees and migrants, indicating strong community engagement in adaptation efforts.

**ACCESS TO SAFE HOUSING (Q05):** A significant 67.50% of respondents believe there is insufficient access to safe housing for climate refugees and migrants, pointing to a critical area for improvement.

**IMPACT OF CLIMATE CHANGE ON MIGRATION (Q06):** 81.19% recognize climate change as a major factor contributing to migration in the Sundarbans, underlining the urgent need for climate action.

**LOCAL AUTHORITIES' INVOLVEMENT (Q07):** Only 12.87% believe that local authorities are actively involved in creating solutions for climate refugees and migrants, suggesting a perceived lack of local governmental action.

**EDUCATION AND TRAINING (Q08):** 42.50% of respondents have received education or training on adapting to climate change impacts, highlighting the importance of educational initiatives.

**INTERNATIONAL COMMUNITY'S ROLE (Q09):** 80.20% believe that the international community should play a larger role in supporting climate refugees and migrants, indicating a call for increased global cooperation and support.

**INCLUSION IN DECISION-MAKING (Q10):** 75.25% believe that climate refugees and migrants are included in decision-making processes regarding climate adaptation strategies, suggesting a relatively high level of participatory governance.

This analysis provides valuable insights into the perceptions of residents in the Sundarbans regarding climate adaptation strategies and the involvement of climate refugees and migrants. The data highlights areas of both strength and concern, such as high community engagement and the recognized impact of climate change on migration, contrasted with perceived inadequacies in local authority involvement and access to safe housing. These findings can inform policymakers and researchers in developing more effective and inclusive climate adaptation strategies in the Sundarbans.

## 5 POLICIES AND RECOMMENDATIONS

In December 1878, the colonial government designated the Sundarbans Forest as a "Protected Forest." To prevent further land conversion, the remaining areas of the protected forest were designated as "Reserved" by May 1943. Today, the Divisional Forest Officer of the 24 Parganas (South) Forest Division and the Field Director of the Sundarban Tiger Reserve, established by notification in December 1973, report to the Director of the Sundarban Biosphere Reserve (SBR) regarding the forested portion of the Indian Sundarbans Delta (ISD).

The National Forest Policy was revised in 1988 to enhance awareness of environmental sustainability, conservation, and the socio-economic benefits of forests. This revision led to the Joint Forest Management Resolution of 1990, which has significantly influenced forest management practices in the Sundarbans. Additionally, the West Bengal government issued two specific guidelines in 1991 and 1996, impacting the management of the Sundarbans' national parks, sanctuaries, and mangrove forest regions. The Sundarban Affairs Department (SAD) was established in 1994 to oversee these efforts.<sup>22</sup>

The West Bengal State Action Plan on Climate Change identifies the Sundarbans as a priority region, emphasizing its vulnerability and the need for targeted climate adaptation strategies. However, the Sundarbans are notably absent from the priority areas listed in the National Action Plan on Climate Change, which outlines eight national-level missions to prepare adaptation plans for various regions.

These developments reflect the evolving approach to forest management and environmental policy in the Sundarbans, highlighting the need for continued focus on sustainability and conservation to protect this critical ecosystem.

## RECOMMENDATIONS FOR IMPROVING CLIMATE ADAPTATION STRATEGIES IN THE SUNDARBANS

Based on the survey findings on climate adaptation strategies in the Sundarbans, the following recommendations are proposed to address the highlighted areas of concern and enhance the overall effectiveness of adaptation efforts:

**Enhance Awareness and Dissemination of Policies:** To increase awareness of official policies aimed at protecting climate refugees and migrants, targeted awareness campaigns should be conducted. These campaigns can be implemented through community meetings, local media outreach, and educational programs, ensuring a broader dissemination of information. This multifaceted approach will help to inform more residents about existing policies and their associated benefits, fostering greater understanding and engagement within the community.

<sup>22</sup> <https://www.sundarbanaffairswb.in> (Last visited on 17<sup>th</sup> March, 2024)

**Strengthen Support for Displaced Individuals:** To provide better support for individuals displaced by climate-related events, it is essential to establish dedicated support centers offering comprehensive assistance. These centers should provide legal, psychological, and logistical support to displaced individuals. Additionally, developing comprehensive resettlement programs that include access to employment opportunities and education will ensure a holistic approach to aiding displaced individuals, facilitating their integration and stability in new environments.

**Improve the Adequacy of Protection Efforts:** To enhance the perceived adequacy of current efforts to protect climate refugees and migrants, it is crucial to review and update existing protection measures in consultation with affected communities. This participatory approach ensures that the measures are relevant and effective. Additionally, increasing funding and resources to strengthen infrastructure and services will bolster support systems for climate refugees, thereby improving their overall protection and well-being.

**Increase Access to Safe Housing:** To ensure sufficient access to safe and resilient housing for climate refugees and migrants, it is essential to invest in the construction and maintenance of climate-resilient housing. Implementing housing programs that prioritize the needs of the most vulnerable populations and actively involve community participation in both planning and execution will help create sustainable and secure living environments. This approach ensures that housing solutions are both appropriate and supported by the communities they serve.

**Facilitate Climate Change Education and Training:** To provide comprehensive education and training on climate change adaptation, it is crucial to develop and integrate climate change adaptation curricula into local schools and community centers. Regular workshops and training sessions on sustainable practices and disaster preparedness should be offered to ensure that residents are equipped with the knowledge and skills necessary to effectively respond to and mitigate the impacts of climate change. This approach fosters a well-informed and resilient community capable of adapting to environmental challenges.

**Enhance Local Authority Involvement:** To increase the active involvement of local authorities in creating solutions for climate refugees and migrants, it is essential to establish task forces within local governments dedicated to addressing climate adaptation. These task forces should encourage collaboration between local authorities, NGOs, and community leaders to develop and implement effective adaptation strategies. This coordinated effort ensures that the needs of climate refugees are met through comprehensive and community-supported solutions.

**Foster International Cooperation:** To fortify the role of the international community in supporting climate refugees and migrants, it is essential to advocate for augmented international funding and technical assistance through global platforms and bilateral agreements. Additionally, active participation in international forums should be pursued to exchange best practices and obtain valuable insights from regions facing comparable challenges. This approach will enhance collaborative efforts and leverage global expertise in addressing the needs of climate refugees and migrants.

**Promote Inclusive Decision-Making Processes:** To ensure the inclusion of climate refugees and migrants in decision-making processes, it is imperative to establish participatory governance frameworks that integrate these individuals into policy formulation and implementation. This can be achieved by creating platforms for continuous dialogue between policymakers and affected communities, thereby ensuring that the perspectives and needs of climate refugees and migrants are effectively represented and addressed in policy decisions.

**Support Community-Led Initiatives:** To foster and support community-led initiatives focused on climate adaptation, it is essential to allocate grants and resources to local groups spearheading adaptation projects. Additionally, facilitating knowledge sharing and capacity-building activities will empower these communities, enabling them to devise and execute their own climate adaptation solutions effectively.

**Monitor and Evaluate Adaptation Strategies:** To ensure the ongoing effectiveness of climate adaptation strategies, it is crucial to establish comprehensive monitoring and evaluation frameworks. These frameworks should systematically assess the impact of adaptation measures and utilize feedback to inform necessary adjustments and improvements to policies and programs.

Implementing these recommendations will require a coordinated effort involving local authorities, community leaders, NGOs, and the international community. By addressing the identified gaps and building on existing strengths, the Sundarbans can develop more effective and inclusive climate adaptation strategies, ultimately improving the resilience and well-being of its residents.

## 6 CONCLUSION

The Sundarbans region has been subjected to an alarming frequency of natural disasters, with their intensity increasing annually. This study reveals that a confluence of environmental factors, including rising sea levels, floods, soil salinity, and cyclones, significantly influences human migration patterns in the region. Consequently, pinpointing a single cause for population safety issues is impractical. The rising sea level has already submerged Lohachara Island, with Ghoramara facing a similar fate.

Given these pressing challenges, it is imperative for the government to implement stringent regulations to protect the inhabitants of the Sundarbans. Ensuring the safety and well-being of these residents aligns with the constitutional guarantee of the right to life under Article 21. Proactive measures are essential to mitigate the impact of environmental changes and safeguard the future of this vulnerable region.

## CONFLICT OF INTERESTS

None

## ACKNOWLEDGMENTS

None

## REFERENCES

- Bhat, P. I. (2004). *Fundamental Rights: A Study of Their Interrelationship* (pp. 1-3). Kolkata: Eastern Law House.
- Paton, G. W. (2018). *A Textbook of Jurisprudence* (p. 284). New Delhi: Oxford University Press.
- Rajan, S. I., & Bhagat, R. B. (Eds.). (2018). *Climate Change, Vulnerability and Migration* (pp. 148-149). New York: Routledge.
- Action Aid Association (India). (2022). *Troubles in the Sundarbans: A Study of Social and Ecological Issues in Hingalgang Block, North 24 Parganas, West Bengal*.
- Das, S., et al. (2023). *Shifting Lands, Moving People* (pp. 64-67). Kolkata: Jadavpur University Press.
- Chatterjee, I. (2019). *Health Law* (pp. 102-105). Allahabad: Central Law Publications.
- Sundarban Biosphere Reserve. (2024). Retrieved March 12, 2024, from [https://www.sundarbanaffairswb.in/home/page/sundarban\\_biosphere](https://www.sundarbanaffairswb.in/home/page/sundarban_biosphere)
- National Forest Policy. (2024). Retrieved March 10, 2024, from [https://mpforest.gov.in/img/files/Policy\\_NFP.pdf](https://mpforest.gov.in/img/files/Policy_NFP.pdf)
- Sundarban Affairs Department. (2024). Retrieved March 17, 2024, from <https://www.sundarbanaffairswb.in>
- State Action Plan on Climate Change. (2024). Retrieved March 18, 2024, from <https://moef.gov.in/moef/division/environment-divisions/climate-changecc-2/state-action-plan-on-climate-change/index.html>
- Ministry of Environment, Forest and Climate Change. (2024). Retrieved March 13, 2024, <https://dx.doi.org/10.29121/shodhkosh.v5.i1.2024.2020>