TRIBAL COMMUNITIES OF SUNDARBAN BIOSPHERE RESERVE (SBR) AND CLIMATE CHANGE

Thesis submitted for the degree of

Doctor of Philosophy (Ph.D.) in Science

of

Jadavpur University

Submitted by

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School of Oceanographic Studies

(Under the Faculty of Interdisciplinary Studies Law and Management)

Jadavpur University

2025

CERTIFICATE FROM THE SUPERVISOR

This is to certify that the thesis entitled "**TRIBAL COMMUNITIES OF SUNDARBAN BIOSPHERE RESERVE (SBR) AND CLIMATE CHANGE**" submitted by Mrs. Sudipa Pal who got her name registered on 03rd January, 2019 for the award of Ph.D. (Science) degree of Jadavpur University, is absolutely based upon her own work under the supervision of **Prof. (Dr.) Suchorita Chattopadhyay** that neither this thesis nor any part of it has been submitted for either any degree/diploma or any other academic award anywhere before.

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STATEMENT OF ORIGINALITY

I, **Sudipa Pal (D-7/ISLM/87/18)** registered on 03/01/2019 do hereby declare that this thesis entitled "**TRIBAL COMMUNITIES OF SUNDARBAN BIOSPHERE RESERVE (SBR) AND CLIMATE CHANGE**" contains literature survey and original research work done by the undersigned candidates as part of Doctoral studies.

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This work is dedicated to my Parents, Son, and Husband

Acknowledgement

The submission of this thesis brings me to the end of a wonderful journey that I have undertaken while pursuing my Ph.D. degree. I take great pleasure in thanking all those people who made this thesis possible and an unforgettable experience for me.

I would like to express my deepest gratitude to my supervisor, ***Prof. (Dr.) Suchorita Chattopadhyay****, for her exceptional guidance, encouragement, and support throughout my research. Her insightful advice and unwavering commitment to my academic development have been invaluable to the completion of this thesis. Without her support, this research would not have been possible. I consider myself incredibly fortunate to have had the opportunity to work under her mentorship.*

Additionally, I would like to express my sincere gratitude to my respected co-guide, ***Prof. (Dr.) Sugata Hazra****, Former Director, School of Oceanographic Studies, Jadavpur University, for his continuous support. His immense knowledge, patience, motivation and enthusiasm have helped me so much to carry out the research all the way through.*

I would like to express my sincere thanks to ***Prof. (Dr.) Tuhin Ghosh****, Director, School of Oceanographic Studies for his constant support and encouragement throughout my research. I am deeply grateful for the resources and opportunities provided by the department, which were essential to the completion of this thesis.*

I am highly indebted to "Swami Vivekananda Single Girl Child Fellowship in Social Sciences" awarded by the University Grants Commission (UGC), Government of India, for funding support for my research.

The would like to thank Asst. Prof. Dr. Abhra Chanda, and all my fellow research scholars and special thanks to Manjira Ghosal, Ankana Chatterjee, Madhusree Biswas, Shaberi Das, Samiran Khorat and Oindrila Basu, at the School of Oceanographic Studies, Jadavpur University, India, for their constant support during the study.

I would also extent my thanks to the "TASE" team for the data without which this research would not have been possible.

SUDIPA PAL

List of Publications from the Ph.D. Thesis

- Pal, S., Das, S., Samanta, S., Chattopadhyay, S., & Hazra, S. (2024). A preliminary appraisal of the mobility of tribal communities in the Sundarban Biosphere Reserve, India. SN Social Sciences, 4(3), 58.

- Pal, S., Ghosal, M., Biswas, M., Chatterjee, A., Mondal, P. P., & Hazra, S. (2024). Is Sundarban coming out of abject poverty as the government pursues Sustainable Development Goals? GeoJournal, 89(2), 77.

- Charlotte L.J. Marcinko *, Robert J. Nicholls, Tim M. Daw, Sugata Hazra, Craig W. Hutton, Chris T. Hill, Derek Clarke, Andrew Harfoot, Oindrila Basu, Isha Das, Sandip Giri, Sudipa Pal, Partho Mondal: A framework for the Integrated Assessment of SDG trade-offs in the Indian Bengal Delta, December,2020, Water

- Marcinko, Charlotte LJ, Sourav Samanta, Oindrila Basu, Andy Harfoot, Duncan D. Hornby, Craig W. Hutton, Sudipa Pal, and Gary R. Watmough. "Earth observation and geospatial data can predict the relative distribution of village level poverty in the Sundarban Biosphere Reserve, India." Journal of Environmental Management 313 (2022): 114950.

Conference abstract and Presentations

- Basu Oindrila, Das Isha, Pal Sudipa, Daw Tim, Shrinking Ecosystem Services in a Sinking Delta: Maintaining livelihoods in the Sundarbans Biosphere Reserve, India EGU General Assembly 2021 in session GM6.9
- Pal Sudipa, Hazra Sugata 2019; ‘Land under Water: Stories of experience, rights and privileges in the Anthropocene’ at the Indo-Canada Conference, at the School of Canadian Studies, Jadavpur University

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LIST OF ABBREVIATIONS

IBD	INDIAN BENGAL DELTA
SBR	SUNDARBAN BIOSPHERE RESERVE
GBM	GANGA BRAHMAPUTRA MEGHNA
ST	SCHEDULE TRIBE/TRIBAL PEOPLE
IPCC	INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE
GOI	GOVERNMENT OF INDIA
TCRM	TROPICAL CYCLONE RISK MODEL
UNESCO	UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION
FGD	FOCUS GROUP DISCUSSION
NDWI	NORMALISED DIFFERENCE WATER INDEX
ICDS	INTEGRATED CHILD DEVELOPMENT SERVICES
BPL	BELOW POVERTY LINE
MGNREGA	MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE ACT
TRIFED	INSTITUTIONAL SUPPORT FOR DEVELOPMENT AND MARKETING OF TRIBAL PRODUCTS
UNFCCC	UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE
SOVI	SOCIAL VULNERABILITY INDEX
MPI	MULTIDIMENSIONAL POVERTY INDEX
HDS	HOUSEHOLD DEPRIVATION SCORE
BLR	BINARY LOGISTIC REGRESSION MODEL
OR	ODDS RATIO
SECC	SOCIO-ECONOMIC CASTE CENSUS
CDB	COMMUNITY DEVELOPMENT BLOCK
MSH	MIGRANT SENDING HOUSEHOLD
NSH	NON-MIGRANT SENDING HOUSEHOLD
NTFP	NON-TIMBER FOREST PRODUCT
NCST	NATIONAL COMMISSION FOR SCHEDULED TRIBES
LAMPS	LARGE AREA MULTIPURPOSE SOCIETIES
EMRS	EKLAVYA MODEL RESIDENTIAL SCHOOLS

ABSTRACT

The Sundarbans Biosphere Reserve (SBR) is home to tribal communities that are not indigenous to the area. Early in the 19th century, they moved from the arid, rocky western region of the neighbouring Chotanagpur Plateau, which encompasses portions of Odisha and Jharkhand, or from neighbouring districts like Bankura, Birbhum, and Puruliya in West Bengal. This movement took place. When the colonial government, led by the East India Company, began land reclamation by mangrove deforestation in the western part of the Ganga-Brahmaputra Meghna (GBM) Delta. Socioeconomic deprivation affects the Scheduled Tribe (ST) communities that live in the Ganga Delta's Sundarban Biosphere Reserve in India.

Due to a variety of environmental and climatic hazards, such as sea level rise, more frequent and strong cyclones, salinization, erosion, and the retreat of mangrove forest cover, which exposes the coast to more extreme weather events, the tribal communities are the most socioeconomically vulnerable in the region. It has been difficult to evaluate the socioeconomic circumstances, migration patterns, and adaptation requirements of these communities due to a lack of caste-disaggregated reliable data and a number of gaps in policies and execution. The current work attempts to fill this gap by analyzing existing secondary data and literature, as well as conducting a primary survey of 600 tribal households and multi-hazard mapping at the village level. This research aims to provide, for the first time, an understanding of tribal mobility in the Indian Sundarbans in response to multiple climatic hazards in relation to their socioeconomic deprivation. It also identifies how the tribal people are coping or adapting to the impacts of climate change. It deals with the change in condition of tribal people in the Sundarbans since independence; furthermore, to what extent have policy interventions been successful in alleviating poverty and improving their overall living conditions is also investigated.

The objectives of the study are listed as: To identify and understand

- *The spatial distribution of the tribal population across the 19 Community Development Blocks (CDBs) in the Sundarbans Biosphere Reserve (SBR) study area, along with the decadal changes in their population from 2001 to 2011, is analyzed.*

- *The socio-economic status of the tribal population is compared with that of the non-tribal population in the SBR, considering factors such as agricultural landholding, employment type, and education levels.*

- *The social vulnerability (index) at the village level within the SBR using Census data from 2011.*

- *The Multidimensional Poverty Index (MPI) for the study area at the village level using both Census data (2011) and primary data (2021).*

- *The household-level deprivation (HDS) among the tribal population based on primary data.*

The current socio-economic conditions of the tribal population, including aspects such as landholding, livelihood patterns, ecosystem dependency, food security, access to safe water, and education, were examined through a detailed primary survey.

Additionally, changes in livelihood strategies among Scheduled Tribe (ST) households in response to climate change are explored, along with an evaluation of policy interventions aimed at addressing these challenges.

Secondary data on demography and socio-economic conditions in the study area were obtained from the Indian Census surveys of 2001 and 2011 (Census data 2001, 2011, Ministry of Home Affairs, Government of India), along with the Primary Census Abstract, Socio-Cultural Table, and Housing Data from the Census of India (2011). To develop the multi-hazard index at the village level, satellite imagery was sourced from online platforms. Primary survey data were collected from households (both tribal and non-tribal) across the 19 Community Development Blocks (CDBs) of the Sundarbans Biosphere Reserve (SBR) during 2020-2021. The household data for this study were gathered using a structured questionnaire. In total, 1,800 households were surveyed, out of which data from 600 tribal households were utilized for this research. The selection of villages and households followed a two-stage stratified sampling approach. Several indices, including the Multi-Hazard Index and the Multidimensional Poverty Index (MPI), were developed at the village level. To assess the level of hazard risk in the surveyed villages, a multi-hazard map of the study area was created using three key hazard layers: inundation (caused by storm surges and floods), cyclones (including storms and high-velocity winds), and erosion. Focus group discussions and stakeholder interviews revealed a link between environmental impacts and prevailing socio-economic conditions as key drivers influencing migration decisions at the household level in the SBR. Potential drivers of migration were identified through expert discussions, and the final migration determinants were analyzed using Binary Logistic Regression (BLR).

This method effectively examines the relationships between various independent variables (potential drivers of migration) and household migration decisions.

The percentage of the tribal population in the study area indicates greater spatial heterogeneity throughout the 19 community development blocks. Distress-driven, permanent migration of tribal people in the Sundarbans appears to be the cause of the observed depopulation trend from sea-facing or hazard-prone locations to areas perceived as safer. Over time, landlessness has become a significant hardship for the tribal people in the delta. Less than 0.5 hectares of land are owned by a sizable section of the indigenous community. In contrast to the reported and generally accepted agrarian livelihood pattern of the non-tribal populations, the primary livelihood pattern of tribal households in the SBR is primarily non-agrarian.

While disparities between the decadal growth rate of the ST population in the region might indicate their permanent displacement and internal migration, the research draws a few robust observations from the primary survey of the ST households under high and low deprivation categories to understand their seasonal migration behaviour from villages impacted by high, medium, and low levels of climatic hazards.

Binary logistic regression analysis was used to evaluate the likelihood of migration by taking into account household-level deprivation, household size, agricultural landholding, hazard occurrences, and access to mangrove ecosystem services. Owning agricultural land, Household level deprivation score, the village's hazard category, access to mangrove ecosystem services, and household size were found to have a significant ($p < 0.05$) role in migration. The Binary Logistic Regression analysis's findings showed that there were important variables affecting the SBR's tribal populations' migration choices. Significant push reasons for migration from the SBR include marginal or non-existent agricultural landholding, dwindling access to the mangrove forest habitat, larger families, and greater household level impoverishment.

Tribal communities in the SBR reside outside Scheduled Areas, limiting their access to Non-Timber Forest Products (NTFPs). Poverty, landlessness, and insufficient income from livelihoods push many to illegally enter the protected mangrove forests (governed by the Indian Forest Act of 1927 and 1978), putting their lives at risk due to man-animal conflicts. Dispersed nature of tribal settlements(<50% of the population) and absence of land records in their favour before the cut-off year of 1978 act as a major deterrent and obstacle for them

to access various Govt Schemes offered to the tribal communities in other scheduled areas or areas with tribal majority population

The socioeconomic circumstances of tribal populations in the SBR are not improving due to substantial shortcomings in policymaking and policy implementation, which are made worse by the frequency and severity of hazards. Poverty and migration are made worse by the loss of traditional means of subsistence and cultural customs, as well as by limited access to forest resources and insufficient legislative support. In order to support the sustainable development of the tribal groups in climate-impacted areas like the Sundarban Biosphere Reserve, the thesis aims to create new opportunities for future research into appropriate paths for in-situ adaptation, safe migratory patterns, and progressive policy changes.

CHAPTER 1

INTRODUCTION

1.1. CLIMATE CHANGE MANIFESTATION ON THE PEOPLE OF SUNDARBANS

The Indian Sundarbans have seen numerous cyclones in the last ten years, namely cyclone Sidr (2007), cyclone Aila (2009), and most recently, the super cyclonic storm Amphan in 2020. As a result, the region is particularly exposed to storm surges and cyclone dangers (Marcinko et al., 2022). According to Mukherjee & Siddique, 2019 some mouzas, like Baliara and Iswaripur mouza, are extremely sensitive to the atrocities of climate change, such as stronger storm surges, increased tidal ingression, severe coastal erosion (an average of over 10% during the time phase of 1977 to 2017), breaching of the embankment (>3.0 km stretch), and anomalies in rainfall and temperature.

According to findings from the examination of IBD's multi-hazard data (flooding, cyclone, and coastal erosion), coastal sub-districts including Sandeshkhali-II, Gosaba, Kultali, Basanti, Patharpratima, and Hingalganj are particularly vulnerable (Das et al., 2020). The lowest income group's classification was linked to moderate to high cyclone risk. This may be explained by the high cyclone hazard ratings for settlements in the SBR's central region, such as the northern Basanti blocks and Kultali (Marcinko et al., 2022).

One of the environmental risks in the Sundarbans is the lack of fresh water, both in the surface and subterranean water reserves. In the administrative blocks of Gosaba, Sagar, Namkhana, Kakdwip, Patharpratima, and Canning, the situation is dire (Nath et al., 2021). During the low rain spell, maximum blocks experience a deficit in water due to the growing population's increased demand for water. Because the shallow groundwater

in the south is salty, block-wise statistics show that the usage of tanks is more common in the southern blocks of Sundarbans (Hazra et al., 2019). Patharpratima, Kultali (2001), as well as Basanti for the years 2001 and 2011, are among the highly vulnerable blocks in the western part of the Ganga Brahmaputra Meghna delta (Das et al., 2021). According to the composite vulnerability index, Basanti is the second-most susceptible block (GoWB, 2009). Residents of Basanti are subjected to frequent storm surges and coastal flooding, live in perpetual poverty, and have low levels of both physical and socioeconomic resilience (Dasgupta et al., 2015). According to GoWB (2009), Kultali is the third most susceptible block in the South 24 Parganas composite vulnerability index. This block has regular coastal flooding, was flooded by a surge during Cyclone Aila, and has an arsenic pollution problem. Patharpratima is also vulnerable to erosion and flooding along the coast (Dasgupta et al., 2015). An increase in the sea level is an important indicator of climate change. The Sundarbans of India, which have an average elevation of around 2 m above mean sea level, are in danger of flooding and the ensuing loss of their wetlands (Paul & Chatterjee, 2019). At least more than 200 km^2 of the Indian portion of the Sundarbans shoreline, according to the Geological Survey of India, have deteriorated in recent decades (Hazra et al., 2016). Compared to the worldwide sea level rise of 1.88 mm per year on average, the local sea level rise of the Sagar islands in the Indian Sundarbans has been recorded to be more than 5 mm per year (Paul & Chatterjee, 2019). In pursuit of employment, many from this natural zone have moved to cities following the 2009 cyclone Aila, which devastated both sides of the Sundarbans (Paul & Chatterjee, 2019). If their dwellings are entirely submerged by rising sea levels, inhabitants of the Sundarbans are likely to relocate to higher land nearby. The consensus is that a sizable portion of the displaced population will relocate to cities (Guha & Roy, 2016).

According to an overall analysis of socioeconomic susceptibility to warming temperatures, flood and cyclone hazards significantly impacted most of the studied households in Sundarbans. According to the analysis, to reduce the level of vulnerability, Patharpratima, Kultali, Namkhana Gosaba, Sagar Basanti, Kakdwip, Sandeshkhali I and II, II, Hingalganj, Minakhan, and Hasnabad blocks need to be given urgent attention. With very little modification, the above mentioned blocks have shown a more susceptibility and sensitivity. These areas are located along the coast and have suffered significant damage from natural disasters. (Sahana et al., 2021). Sections of

Basanti, Canning, Gosaba, and Jaynagar were found to fall into extremely high susceptibility categories, per the study by Bera & Maiti, 2021. The study also noted that Basanti (66%), Canning-I (65%), Canning-II (59%), and Hingalganj (54%) residents face a very high-risk condition. The whole Sandeshkhali-I population and over ninety percent of the Sandeshkhali-II population belong to the high-risk class. The coastal blocks of Canning II, Kakdwip, Jaynagar II, and Mathurapur II, as well as Kultali, Basanti, Namkhana, Sagar, and Patharpratima, have the highest vulnerability, according to the composite vulnerability index analysis (Raha et al., 2013). As the blocks are close to the Bay of Bengal, the coastal blocks in the south are particularly vulnerable to cyclones, storm surges. The agricultural area frequently experiences embankment breaches and saline water inundation due to heavy tidal currents (Raha et al., 2013). There were coastal blocks with surge heights of more than 10 meters, including Gosaba, Sagar, Namkhana, Patharpratima, and Kultali. The inhabitants of the coastal blocks of Gosaba, Kultali, Sagar, Kakdwip, Patharpratima, and Namkhana revealed intensity of severe occurrences as well as the shifting patterns of climate factors (Ghosh & Mistri, 2021). It has been demonstrated that salinization has the biggest effect on the likelihood of losing land. For residents on Mousani Island, the likelihood of experiencing land loss is eleven times greater than that of households on Sagar Island (Hajra et al., 2017). According to Rani et al., 2018, there are even less opportunities for local farmers to compensate for the saline water intrusion on the surface during such episodic events and sustain agriculture, as the near surface aquifers in the Indian Sundarban are also vulnerable to saline water invasion. A statistically significant positive association was found by Hajra and Ghosh, 2018 between the extent of migration from the Indian Sundarbans and the loss in crop production. Females and households led by women face disproportionately more challenges to earning their livelihoods and conquering disasters due to a growing pattern of men leaving from the region. This is because females are expected to care for their families while also working in occupations where they are paid less than males (Banerjee et al., 2013). During a time period of 2019 to 2021, cyclones such as Fani, Bulbul, Amphan, and Yaas caused enough damage to validate the concern of an imminent disaster (Mondal et al., 2022). After hitting the coast along West Bengal near the Sundarbans, Bulbul devastated huge portions of the south of the state with winds as high as 137 km/h and copious amounts of rain. In West Bengal, the storm directly impacted about 3 million people, while storm-related accidents claimed the lives of over 10 individuals. Amphan caused severe damage to

the mangroves in the Sundarban region (Mondal et al., 2022). According to the study, by Sen & Gorai, 2019 over half of the settlements of the Sundarban Biosphere Reserve (SBR) lies in areas of low elevation that observe flooding very often. Yaas (2021) made landfall at the same time as the flood tide peaked, causing seven meters of surges at Sagar Island. Hazards including cyclones, storm surges, and severe rains generate substantial intermediate impacts, such as flooding of the coast and eventual salinization, when embankments breach (Mondal et al., 2022). These occurrences caused over 270 kilometers of the embankment in the southwest parts of Patharpratima, Kakdwip, Namkhana, and Sagar to sustain significant damage (Sen & Gorai, 2019).

Climate change is causing sea levels to rise in India's coastal regions and to increase in both the frequency and intensity of cyclonic activity (Paul & Ghosh, 2018). The Indian Sundarbans are difficult to inhabit because of flooding brought on by embankment collapse and surpassing, salinization of the water and soil, and other factors. Climate change's effects will only worsen matters (Sánchez-Triana et al., 2018). The sea level is rising by 3.24 mm per year, which frequently increases the risk of saltwater floods during the monsoon period and during cyclones that coincide with high tides. Researchers have found a link between land degradation and rising sea levels, with the latter being most noticeable in Sundarbans southern and southeast regions. The most affected blocks are Sagar, Kakdwip, Namkhana, and Pathar Pratima. These blocks are located in a geologically active zone (Bera, 2013).

Findings for West Bengal indicate that during Cyclone Aila, over 20% of households questioned relocated in pursuit of employment (Ortolano, 2016). According to Basu (2020), Cyclone Amphan devastated thousands of homes, toppled embankments, inundated a substantial portion of agricultural land with saline water, ruined crops, and severely disrupted livelihoods. Flooding during Amphan has led to the development of waterborne illnesses, such as cholera or potentially fatal diarrhoea brought on by contaminated water (Ortolano, 2016).

Indigenous people and their knowledge systems are pivotal for human-nature harmony in today’s era of Anthropocene (Inoue and Moreira 2016). The indigenous communities with around 370 million people globally manage at least 25% of world’s land surface. Over 4000 languages are spoken by them reflecting their diverse cultures, worldviews, and the strong connections to their "territories" culturally and spiritually with – their

lands, waters, and spiritual environments (Garnett et al. 2018). Their life, livelihoods, and customs are closely intertwined with nature. Indigenous people play a direct role in the conservation of highly bio-diverse global protected areas as 40 % of global protected area, 7.8 million km constitutes 20.7 % of the Indigenous communities' lands (Garnett et al., 2018). They are pioneers to nature-based solutions with their wide array of indigenous knowledge systems and traditional management practices (Ford et al., 2020). Although the indigenous communities are highly resilient to environmental changes, the fast pace of Anthropocene, loss of natural resources, climate change induced frequent hazards put them at high risk and vulnerability (ILO, 2017; Yohe et al., 2007).

1.2. TRIBAL COMMUNITIES OF SUNDARBANS

Historically, the Sundarbans were sparsely populated (Bhattacharya, 2011) and witnessed depopulation several times owing to earthquakes, floods, and attacks by the Portuguese and the Arakans (Sarkar, 2012). However, a series of legislations enacted by British Governor Generals in Bengal affected agricultural expansion into the region. Dampier and Hodges' survey to demarcate the outer boundaries of the Sundarbans forest in the year 1764 divided the region into 236 blocks spanning a land area of over 6880 km^2 (in the Ganga-Brahmaputra-Meghna Delta in undivided Bengal, comprising the Sundarbans islands in India and modern-day Bangladesh), giving the East India Company an image of the land area that had not yet been leased by the Government. The colonial administration saw economic potential in the rich alluvial land of the Delta, and proceeded to convert the 'wasteland' (Chakraborty, 2005; Dey, 2018) into paddy land. Large-scale mangrove destruction began in 1771 (Richards and Flint 1990) when the zamindari (landlordism) system prevalent in the mainland was extended to the islands. Mangrove clearance, settlement establishment, and revenue collection from agricultural production in the Delta continued even into the early decades of Indian Independence (Richards and Flint 1990). The tribal communities inhabiting the Sundarbans Biosphere Reserve (SBR) are not indigenous to the region but have migrated from the adjoining districts of Bankura, Birbhum, and Puruliya or the dry, rugged western part of the neighbouring Chotanagpur Plateau region comprising parts of the states of Odisha and Jharkhand in West Bengal, during the early 19th century,

when the East India Company-led colonial administration ordered land reclamation from mangrove deforestation in the Ganga-Brahmaputra Meghna (GBM) Delta. Thus began the large-scale clearance of the mangrove forest and the killing of the native Royal Bengal Tiger, for human settlement and cultivation (Richards and Flint, 1990; Bera, 2013a). The tribal people, initially brought in to reclaim the land, colonized in significant numbers, struggling to adapt to the warm, humid swamps (Mandal et al., 2010), and suffering the loss and corruption of their tribal heritage and rising effects of environmental as well as climatic changes. The retreating mangrove cover left the coast progressively exposed to extreme weather events like cyclones and storm surges (Hazra et al., 2021). Having settled outside a Scheduled Area, some of these tribal communities have adopted subsistence options that were not previously practised by them, such as settled agriculture. However, being predominantly forest-dependent and settled in a non-Scheduled Area where retreating mangrove cover, declining ecosystem health (Basu et al. 2021), and India's forest and wildlife protection legislations (in effect since 1972) severely limit their economic opportunities and worsen their socio-economic wellbeing. Tribal people from agrarian and fishing communities in the neighbouring districts and states were brought in for deforestation and timber extraction for the British railways (Danda, 2007). The enactment of the Permanent Settlement Act in 1793, which levied a fixed tax on landholders, and was intended to drive investment in agriculture, and alleviate famine and peasant distress, intensified land reclamation in the Sundarbans. This came as a consequence partly of landholders' interest to produce more and partly of the East India Company's ever-growing need for resources to maintain a standing army at a time when the Company's revenues were fixed but Britain was being pressed into a growing number of wars and armed conflict (Ghosh, 2020/2018). The tribal communities that had been brought in for land reclamation and timber extraction settled in the region (Dey, 2018), with only a few tribal households being given plots of land.

The Delta saw a massive migration of people from East Pakistan after India was divided, which gained momentum after the 1971 Bangladesh Liberation War (Ghosh et al., 2015). The tribal population was dispersed and increasingly marginalised with the arrival of non-indigenous, primarily Hindu and Muslim, ethnic groups. Extreme weather events and environmental and climate change has further disempowered these tribal minorities (Ghosh et al., 2015). Low adaptive capacity and little governmental

protection from environmental and socio-economic stressors are again displacing and putting these impoverished tribes on the move. Residence out Tribal Areas also robs these tribes settled in the SBR of the special protections. Constitutionally, guaranteed to tribal communities settled in tribal-dominated or Scheduled Areas. With the influx of non-tribal peoples who settled in the Delta for economic or political reasons and acquired land, the tribal population was dispersed and further marginalised. Endemic poverty, landlessness, illiteracy, poor health and morbidity, susceptibility to non-communicable (Jain et al., 2015) and emerging infectious diseases and exposure to a range of environmental and climate change-induced hazards contribute to low levels of societal and economic wellbeing of the tribal people of SBR. Environmental and climatic stressors, including accelerated sea level rise, increasingly frequent and intense cyclones, salinisation, erosion and subsidence are displacing populations in the region and exacerbating their socio-economic vulnerability (Das et al., 2021). Adverse environmental impacts, particularly those associated with climate change are likely to disproportionately affect the rural, poor, marginalised, disabled, elderly populations, further aggravating existing inequalities and vulnerabilities (Das et al., 2021; Islam & Winkel, 2017 and IPCC AR5 Ch13 p. 796). Vulnerable populations may be displaced as a result of these reasons to drive internal and international population migration, or increase the number of trapped populations (Adger et al. 2014, Das et al. 2021, Mortreaux et al., 2018). Though a broad array of tribal-specific legislations, such as Special Central Assistance to Tribals, scholarships for tribal students, Institutional Support for Development and Marketing of Tribal Products (TRIFED), and Development for Particularly Vulnerable Tribal Groups (PVTGs) (Ministry of Tribal Affairs, GoI), to name a few, exist alongside general schemes designed to uplift impoverished rural populations, such as Pradhan Mantri Gram Sadak Yojana, MGNREGA, One Nation, One Ration Card, Below Poverty Line (BPL) Card, Integrated Child Development (ICDS) etc. are operational for several decades in the country, tribes in India continue to suffer from endemic poverty, poor health, low socio-economic wellbeing and inadequate protection of their rights and interests. Tribal people are not traditional inhabitant of the Ganga delta. Even after independence of India, they could not receive a better deal than getting dispersed among the influx of non-tribal communities settling in the delta margin for political and economic reasons. Even now they are frequently getting displaced due to the rising sea, roving cyclones and salt water intrusion and retreating mangrove forest. Globally the survival of the

indigenous population is constantly threatened due to different environmental as well as climate change (Hanna 2007). Food availability, health and economic condition, culture of the indigenous population are highly dependent on the natural reserves (Smith et al. 2016). The traditional knowledge of the indigenous population is one of their major resources which with time is also getting affected under the constant changing environmental condition (UNFCCC Framework, 2011).Throughout the world the indigenous population are highly marginalised. Presently the climate change and different environmental changes are taking a huge toll on their lives making the scenario worse. The Schedule Tribes/tribal people (ST) are the indigenous/native population of India. The tribal people in the country are already highly marginalised in the society. They have high poverty, low education, and poor health condition.

Numerous environmental changes, including rise in the sea level, subsidence of land, population pressure, erosion of the coast, flood induced loss of land, salt water invasion, soil salinization, various developmental activities, together with the effects of climate change, have a significant impact on the Sundarban delta. (Szabo et al. 2015a; Tessler at al. 2015, Hajra et al. 2017, Hazra et al. 2002, Bera 2013). The islands of Lohachara, Bedfort, and Suparibhanga have already disappeared, according to a study on the gradual change in the morphology of the southern islands in the Indian Sundarbans region. In this unique delta and its prevalent environmental stressful condition, the tribal population there are becoming more and more marginalised. This unique tribal population is already displaced from their native place. In this delta region they are not resettled. Over 200 thousand tribal people live in this delta (Indian part). Very few of the tribal populations got small landholdings when they came from their native place. Under such scenario how these tribal people are able to maintain their livelihood and sustain life requires a detailed study. With such a backdrop this research tries to assess the present societal and economic condition tribal people living in the Indian Sundarban deltaic region. In the 8^{th} century, the hostile as well as fertile Sundarbans was sparsely populated. It was during the British colonial period from 19^{th} century to 20^{th} century that humans again started to settle in the Sundarbans region. In 1771, then Collector General, Clod Russell started dividing the forest land into plots. These plots were later given to the Zaminders under lease. Forest clearing started around 1781 mainly in the northern part. Initially by 1873 the blocks namely Hasnabad, Bhangar, Haroa, Hingalgunj, Minakhan, Canning, Joynagar, Mathurapur and Sagar started settling. Till

1939 blocks in the further south namely Sandeshkhali, Kakdwip, Patharpratima, Basanti, Kultali and Gosaba started having human settlements. The Zaminders engaged labours mostly for building embankments and clearing the forest. It was at this time that many tribal people were brought from Ranchi, Chottanagpur, Hazaribagh, Mayurbhanj districts of Orissa along with others districts of West Bengal namely Puruliya, Medinipur for clearing the forest. These tribal people were poor farming communities who were brought in by the Zaminders to the Sundarbans. They constructed the embankment, cleared the forest, reclaimed the land and finally settled in the Sundarbans. The Santhals started settling in the year 1830 (Eaton 1990; Dasgupta 1984, Iqbal 2011, O'Donnell and Wooden 2015, Ghosh et al., 2015). The present Santhal tribal people in Sundarban are mostly migrated from Mayurbhanj district of Orissa. The Munda tribal people of Sundarban have their root or origin in the Chotanagpur- Bihar region. The Oraon tribal people of Sundarbans once due to high economic pressure migrated from Bihar which was their original homeland and came to Sundarbans for reclamation works. The tribal population of Sundarbans are the displaced population from their homelands (Reports available from Cultural Research Institute, Schedule Caste and Tribes Welfare Department, West Bengal). In Sundarbans some of them have little land of their own whereas most of them are landless. Landless conditions of the tribal population in the delta are making them highly marginalised. Their apparent invisibility in official data and the absence of disaggregated data on ethnicity makes assessment of the existing inequalities among the tribal people and the people other than the tribal community, and between the different tribes in India difficult (SDG Knowledge Hub, IISD September 2019). As a result, we must either adopt an aggregative approach to studying ST populations, like we did in this study, or rely on regional surveys conducted by researchers and non-governmental agencies to give us disaggregated information on the specific concerns facing each tribe/ethnic group. This further disenfranchises tribal communities by leaving their special needs under-represented and unmet. This research discusses the socio-economic conditions of the ST communities in the SBR, and highlights need for future research to identify gaps in policy designed to secure their protection and socio-economic up-liftment.

1.3. CONTEMPORARY CONTEXT

Scheduled Tribe communities (interchangeably referred to as tribal communities in this research) in the SBR suffer endemic socioeconomic deprivation, including landlessness, illiteracy, poor health and housing, and inadequate economic prospects. This makes the communities the most socioeconomically vulnerable in the region, even as exposure to a range of environmental and climatic hazards like sea level rise, increasingly frequent and intense cyclones, salinisation, and erosion with retreating mangrove forest cover that leaves the coast progressively exposed to extreme weather events, exacerbates vulnerability (Samanta et al., 2021; Das et al., 2021). Adverse environmental impacts, particularly those associated with climate change, are likely to disproportionately affect rural, poor, marginalised, and ethnic/religious/socioeconomic minorities, further aggravating existing inequalities and vulnerabilities and driving migration (Das et al., 2021; Mortreaux et al., 2018; Islam and Winkel, 2017; IPCC 2014; Adger et al., 2014). In the SBR, these factors combine with low adaptive capacity to further disempower and marginalise deprived populations, putting them on the move to secure their lives and livelihoods. Owing to the dearth of disaggregated secondary data on ST communities in the SBR, there is a significant gap in academic understanding of the material conditions of these communities, and researchers interested in studying this population must adopt an aggregative approach or design independent surveys to collect primary data. The present research seeks to address this research gap by conducting a primary survey to assess the socioeconomic conditions of these ST communities and their likelihood to migrate in response to different stressors (due to climate or not due to climatic conditions) along with the inadequate in-situ adaptive capacity – either temporarily for work (seasonal/cyclical migration) or permanently (displacement-induced involuntary migration). Permanent migrants are people who leave their place of residence permanently to relocate to a different, receiving area while temporary/seasonal migrants are those who migrate for short durations or seasonally (usually during the lean season) for work or other reasons but eventually return to their place of residence. This is the first attempt to quantify and analyse the socioeconomic conditions of these communities in terms of their ecosystem dependence and mobility in the face of their exposure to climatic and environmental hazards.

1.4. THE STUDY AREA

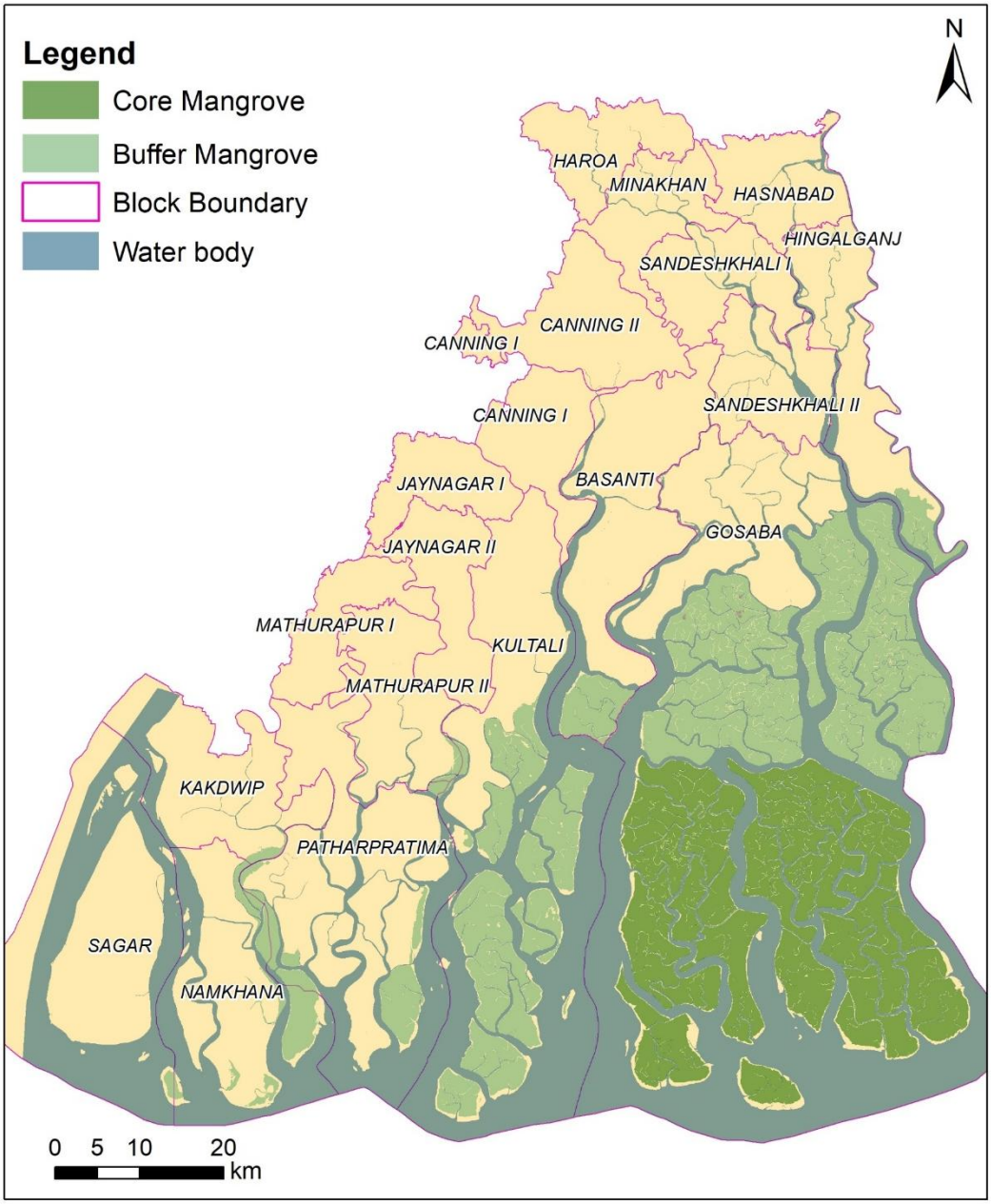
The GBM Delta, which spans throughout most of Bangladesh and portions of the Indian state of West Bengal, is one of the most active deltas in the world. (Ericson et al. 2006; Nicholls et al. 2016 and Woodroffe et al. 2006). The western part of the lower region of the GBM Delta is designated the Sundarban Biosphere Reserve (SBR) (UNESCO, Sundarban Biosphere Reserve, Govt. of WB). A UNESCO World Heritage site since 1987 for being the biggest mangrove forest globally – the only with a tiger population (the endangered Royal Bengal Tiger) (UNESCO) – is a rich biodiversity and climate hotspot (Ghosh et al. 2018, WWF India, World Bank Group 2020). The Indian part of the GBM Delta comprises 102 geologically young islands, only 54 of which are inhabited (Banerjee, 1998). Densely populated, with nearly 4.5 million people inhabiting an area of 5400 km^2 out of the total 9600 km^2 land area that comprises human settlements, farms, and protected mangrove forests of the Divisional Forest area, the Sundarban Tiger Reserve and the Sundarban National Park (Sánchez-Triana et al., 2014), the SBR is also home to 0.2 million tribal people (Census of India, 2011) who, unlike other tribals in protected areas, are not aboriginals (Census of India 2011, Strategy Report, World Bank 2014).

The SBR comprises Nineteen (19) Development Blocks (CDB; which are the legislative and operational units) under the jurisdiction of two districts of West Bengal, the North Twenty-four Parganas and the South Twenty-four Parganas. These 19 CDBs form the study area (Table 1) for this research.

Table 1: Community Development Blocks of the SBR

District	Community Development Block
North 24 Parganas	Hingalganj, Hasnabad, Sandeshkhali I, Sandeshkhali II, Haroa, Minakhan
South 24 Parganas	Sagar, Namkhana, Kakdwip, Patharpratima, Mathurapur-I, Mathurapur-II, Kultali, Joynagar I, Joynagar II, Canning I, Canning II, Basanti, Gosaba

Figure 1: Location Map of the SBR



The tribal population present in these CDBs are comprised of 10 Scheduled Tribes (STs), namely Munda, Oraon, Bhumij, Santhal, Ho, Lodha/Sabar, Koramudi/Mudi, Mahato, Bedia, Khasi, as revealed in stakeholder consultations conducted by the authors.The SBR is extremely fertile and abundant in natural resources, with a unique ecosystem and indigenous flora and fauna specimens, but remarkably inhospitable. The region is vulnerable to the accelerating impacts of development-induced degradation and climate change, demonstrated by changes in sea level, coastal erosion, inundation, loss of land, salinisation addendum to frequent extreme weather events (Bera, 2013; Hajra et al., 2017 and Hazra et al., 2002).

Mangrove clearance, settlement establishment and revenue collection from agricultural production in the Delta continued even into the early decades of Indian Independence (Richards and Flint 1990). The tribal communities that had been brought in for land reclamation and timber extraction settled in the region (Dey 2018), with only a few tribal households being given plots of land.

The tribal population was dispersed and increasingly marginalised with the arrival of non-indigenous, primarily Hindu and Muslim, ethnic groups. Extreme weather events and environmental and climate change have further disempowered these tribal minorities (Ghosh et al., 2015). Low adaptive capacity and little governmental protection from environmental and socio-economic stressors are again displacing and putting these impoverished tribes on the move.

1.5. RESEARCH QUESTIONS

1. What is the post-independence and present situation of the tribal people in the Sundarbans?
2. How are the increased events of climate change impacting the tribes of Sundarbans?
3. How are the tribal people coping to the effects of climate change? Are policy interventions successful in alleviating poverty?

1.6. AIM, OBJECTIVES AND SIGNIFICANCE OF THE STUDY

The educational, economic, social and political interests and rights of tribal peoples in India are Constitutionally safeguarded (Part I Arts. 342 and 366; Part II.B Arts. 15, 16, 19, 46, 335; Part II.C Arts. 330, 332, 334, 243D, 243T; Part II.D Art. 338A of The Constitution of India), committing the Government to the affirmation and uplift of "such tribes or tribal communities or parts of or groups within such tribes or tribal communities as are deemed under Article 342 to be Scheduled Tribes for this constitution" (Art. 366(25), The Constitution of India) (Ministry of Law and Justice, GoI 2015).The criteria used to define a tribal community as a Scheduled Tribe (ST) include indicators such as primitive traits, distinct culture, geographic isolation, reluctance to interact with the broader community, and backwardness. While not explicitly stated in The Constitution, these criteria reflect the definitions outlined in the 1931 Census of India, the reports of the first Backward Classes Commission (1955), the Kalelkar Advisory Commission (1953), the Lokur Committee on the Revision of the Lists of Scheduled Castes and Scheduled Tribes, and the Chanda Committee (or Joint Committee of Parliament) on the Scheduled Castes and Scheduled Tribes Orders (Amendment) Bill of 1967. (Tribal Welfare Department, Govt. of AP). Despite these safeguards, ST communities in the country are routinely marginalized, exploited, oppressed, and their cultural, bodily and economic integrity repeatedly rejected and violated, with the use of a variety of socio-economic and political weapons like development-induced deforestation and displacement (IWGIA) and systemic abuse. Tribal concerns receive little social, administrative and judicial justice in India. Though a range of pro-tribal legislations exist in India, certain lacunae in policy (e.g., pro-tribal schemes designed to uplift tribal communities inhabiting only tribal-dominant areas), and widespread ignorance, superstition and apathy towards tribal cultures and religions lead to the alienation of a significant number of tribal concerns.

This research was conceptualized as an acknowledgement of the need for more study and evidence to identify tribal concerns and promote remedies to the disempowerment, displacement and systemic erasure that threatens their livelihoods,

cultures and wellbeing. It is the first attempt to quantify and analyze the socio-economic conditions of the ST people living in the SBR.

A thorough understanding of the current socioeconomic conditions of tribal occupants is necessary to secure the minimal conditions of wellbeing, as measured by the achievement of the Sustainable Development Goals (SDGs) of "No Poverty" (Goal 1), "Zero Hunger" (Goal 2), "Quality Education" (Goal 4), and "Reduced Inequality" (Goal 10) (Dept. of Economic and Social Affairs, UN 2015).

1.7. OBJECTIVES OF THIS THESIS ARE TO DEMONSTRATE

- The spatial distribution of the tribal population across the study area and the change over the last decade (2001-2011).
- The socio-economic status of the tribal population as well as the non-tribal, measured by agricultural landholding, employment type and level of education in the study area.
- A social vulnerability index at the village level of the SBR is developed using Census data (2011).
- Multidimensional Poverty Index at the village level is developed using both Census data (2011) and primary data (2021) is analysed.
- A study of the household deprivation of the tribal people from the primary data.
- What is the socio-economic status of the tribal people including landholding, livelihood pattern, ecosystem dependency, food availability and safe water source, education in the present scenario and how is it varying is analysed from detailed primary survey. Coupled with that the study of the livelihood pattern will also indicate change in the livelihood if ant the ST/tribal households undergoing to counter the climate change and acclimate to the present condition. Policy interventions are also studied.

A BRIEF OUTLINE OF THE CHAPTERS

- **Chapter 1:** ***Introduction***

- **Chapter 2:** ***Data and Methodology***

- **Chapter 3:** ***Demographic profile of the Tribal communities in the study area***

- **Chapter 4:** ***Livelihood pattern and the Multidimensional Poverty of the Tribal communities in the study area***

- **Chapter 5:** ***Drivers of migration of Tribal communities in the study area***

- **Chapter 6:** ***Policy towards sustainable development of the Tribal communities***

- **Chapter 7:** ***Conclusion***

Chapter 2

DATA AND METHODOLOGY

2. Data Source

2.1. Secondary data

Secondary data on the demography and socioeconomic conditions were obtained from Indian Census surveys of 2001 and 2011 (Census data 2001, 2011, Ministry of Home Affairs, GoI), Primary Census Abstract, Socio-Cultural Table, and Housing Data from Census of India (2011; Ministry of Home Affairs, GoI 2011). Agricultural landholding (Dhargupta et al., 2009, Agriculture Census 2011 and SECC 2011), and engagement in agricultural and casual labour (Census of India 2011) were used as proxy indicators for the economic condition and illiteracy rate and salaried employment as proxy indicators for the social condition. For developing a multi-hazard index at the village level, several satellite imageries were obtained from online sources. Landsat-TM data (pre and post Aila, 24 April 2009 and 26 May 2009) and Tropical cyclone risk model (TCRM) (Arthur et al., 2008) were also analyzed. A review of relevant literature and content about the concerns has been conducted and the findings analysed and synthesised to enhance our understanding of the realities of indigenous living and livelihoods. The only reliable source of secondary data of population as well as satellite imageries in the country is provided by the Government which are believed and used by several national and international agencies.

2.2. Selection and Distribution of the Sample

Survey data was collected from a survey of households (tribal and non-tribal) across the 19 CDBs of the SBR in 2020-2021. The data collected from the survey of the households for this study was collected using a scheduled questionnaire. A dual-step stratified sampling method was applied to select the surveyed villages and households. The entire survey was carried out during the COVID-19 period (June 2020 to October 2021), which imposed additional constraints on the approachability of the villages for the survey. To ensure the anonymity of the survey participants, their names and the coordinates of their households were not recorded. All the interviews were conducted with prior informed consent of the respondents. At the beginning of each household survey, each respondent was briefed about the purpose of the interview and the study objective and informed that they could choose not to answer a certain question or even discontinue the interview at any point. As the survey was conducted in several phases between September 2020 and October 2021, all COVID-19 protocols were maintained during the survey. During the interview, very short and specific questions were asked, both closed-ended and open-ended, regarding respondents' livelihood practices, landholding, education, caste and ethnicity, hazard experiences, health, and housing. While open-ended questions help to know the perceived impact of environmental change on respondents' livelihoods and socioeconomic wellbeing, closed-ended questions sought to gain specific information such as the details of members within the surveyed inhabitants, different occupation types including circular migration, and the percentage of income from these occupations, etc.

2.3. Methods of Data Collection (Sampling Strategy) Multidimensional Poverty Index (MPI) of the study area (village)

Data was collected through household surveys using a scheduled questionnaire. For primary survey, a two-tier stratified sample approach was used, with villages grouped in the first tier and houses surveyed in the second. The survey villages were selected based on the MPI calculated by Marcinko et al., (2022). Out of the 50 villages selected, nearly half (25 villages) were targeted to survey among the classified poor villages given the 2011 MPI, and 10 villages with low 2011 MPI values. The remaining 15 villages were targeted from the moderately poor villages. The villages selected for the survey cover the entire range of high, moderate, and low MPI in 2011. Under such a constrained situation, the 5:3:2 ratio for selected villages could not be strictly maintained. On the second level, 50 households were surveyed within each village. The random selection could not be carried out for the households due to the vast variation of the range of households per village, according to the Census data. Therefore, judgmental sampling was done to select the households. It is assumed that compromising on the statistical significance of the survey result, the pilot investigation would be able to identify the general pattern of change of the MPI in the village context on a decadal scale.

Dwellings were chosen inland beyond a buffer zone of 500 meters from the creek or the boundary of the village. Alternatively, the overall number of households sampled (2500) is significantly more than the required minimum number (Krejcie and Morgan (1970)) of households (384) to be surveyed in the SBR having little over 75000 households. To ensure the anonymity of the respondents, the name and coordinates of the households were not recorded. During the interview, very short and specific questions, both closed and open-ended, were asked regarding their livelihood practice,

landholding, education, caste, ethnicity, the standard of living, health, hazard experience, benefits from government policies, etc. All COVID-19 protocols were maintained throughout the survey process.

2.4. Livelihood Profile and Probable drivers of migration identification of the tribal households within the research area

Primary information was gathered from a survey of 1800 dwelling units (tribal and non-tribal) across 19 CDBs of the SBR in 2020-2021. Out of this survey data, only data about tribal households (n = 600) was used for research. A questionnaire was used to perform a household sample survey to gather primary information. The villages and homes that were surveyed were chosen using a two-step layered sample procedure.

According to Census 2011 data, the 19 CDBs of the SBR consist of approximately 1032 villages. Jayanagar I CDB was left out of the primary survey owing to its very small tribal population in 2021, the same as in 2011. However, nearly 500 of these 1032 villages have no tribal population. Census data from 2011 revealed that only 178 villages in the SBR have a tribal population, which is at least 10% of the total village population. The present study sought to cover at least 20% of such villages, selecting 36 villages across the 18 CDBs based on their respective rankings in the multi-hazard (cyclone, inundation, erosion) index constructed according to the methodology detailed and their accessibility by COVID-19 protocols. Within each village, 50 households were chosen at random. Out of the 1800 households surveyed, 600 were of tribal origin. Hence, the survey data of only these 600 tribal households were used for this analysis. Random selection of households was conducted due to the vast variation of the range of households per village based on the enumeration data 2011

shared by the Government of India. Additionally, the cumulative household figure sampled (1800) is significantly higher than the required minimum number (Krejcie and Morgan, 1970) of units (384) to be surveyed in the study area, and the data of 600 tribal households purposively selected from the sample of 1800. It was assumed that this pilot investigation would succeed in identifying the general pattern of migration in the SBR despite making a small compromise on the statistical significance of the survey result.

2.5. Methodology

2.5.1. Social Vulnerability Index **(SoVI)** *at the village level for the study area*

The susceptibility of people (individuals or communities) to environmental hazards and change is shaped by their inherent social fabric and inequalities (Cutter et al., 2003). Social vulnerability is an intrinsic characteristic of a system arising from its core quality (Adger and Kelly 1999)) and determined by factors such as impoverishment and imbalance, disempowerment, nutritional assistance, access to coverage and housing conditions ((Wisner et al., 1994); (Adger and Kelly 1999); Cross, 2001). Social Vulnerability Analysis is done using Secondary data to differentiate the 1032 villages based on Social Vulnerability Index (SoVI). Creation of a socioeconomic index that can distinguish between underprivileged areas and more affluent ones in a multivariate setting. Principal Component Analysis (PCA) using SPSS software was carried out. 16 variables (as listed below) were selected based on the literature review and available common data sets in West Bengal (Village level).The survey count (study sample) has satisfied both the cases-to-variables ratio and the rule of 10, rule of 100 and rule of 150, as affirmed by (Das et al., 2021; OECD Handbook 2008). The test of normality has been done by inspecting

the Kolmogorov-Smirnov statistic and the result (sig. = 0.00) suggests no violation of the assumption of normality. The existence of outliers, or values that are significantly lower or higher than the other values in the data set, might influence correlations and hence distort factor analysis, as is the case with most statistical approaches. Before doing factor analysis and Principal Component Analysis (PCA), outliers were identified in every variable and eliminated. Furthermore, the type of distribution was identified using descriptive statistics like kurtosis, which measures "peakedness," and skewness, which measures symmetry. To determine whether it was appropriate to perform a factor analysis, multi-collinearity in the data was identified using the Kaiser-Meyer-Olkin (KMO), a Measure of Sampling Adequacy (MSA) (Kaiser 1970; Field 2009; Das et al., 2021). More precisely, using correlations and partial correlations, sampling adequacy forecasts whether data will likely factor well. KMO can have a maximum value of 1.0; 0.9 is regarded as "marvelous," 0.80 as "meritorious," 0.70 as "middling," 0.60 as "mediocre," 0.50 as "miserable," and so on. To determine whether using PCA was acceptable, multi-collinearity in the data was identified using the Kaiser-Meyer-Olkin (KMO), a Measure of Sampling Adequacy (MSA). The Bartlett's (1954) Test of Sphericity was used to assess the degree of correlation between the variables. The null hypothesis that the variables in the population correlation matrix are 14 uncorrelated is tested using the Bartlett's Test of Sphericity (Krishnan 2010). Kaiser Normalization and Varimax rotation methods were employed to extract components. Components with eigenvalues exceeding 1.0 were selected. The user can specify how many factors should be extracted, and SPSS offers methods to assist in determining the number of factors. Kaiser's criterion, often known as the eigenvalue rule, is one of the most popular methods. Only factors that have an eigenvalue (the variances that the factors

extract) of 1.0 or above are kept under this criteria. Since the variables are not normalized, the principle components have been extracted using the correlation matrix as an input to PCA. Kaiser developed the "eigenvalue-greater-than-one" rule, which states that only components with an eigenvalue greater than 1.0 have been kept. To make components easier to understand, the varimax (orthogonal) rotation has been chosen (Kaiser 1960). A non-standardized index was created by applying the proportion of variance as weights to the component scores.

Kaiser Normalization and Varimax rotation methods were employed to extract components. Components with eigenvalues greater than 1.0 were extracted. The number of factors extracted can be defined by the user, and there are techniques available in SPSS that can be used to help decide the number of factors. One of the most used techniques is Kaiser's criterion, or the eigenvalue rule. Using the proportion of variance as weights on the component score, a non-standardized index has been developed. Using the proportion of these percentages as weights on the factor score coefficients, a Non- standardized Index (NSI) was developed for each village, using the formula: NSI = $\sum$ (Fi /TV) *FSi (adopted from Das et al., 2021) where Fi means variance percentage for each component, TV means the total variance explained and FSi refers to the individual component score. The value of the index can be positive or negative, making it difficult to interpret. Finally, Standardization has been done to get the final standardized value of SoVI using the formula of 'Z-score': (Actual – Mean)/Standard Deviation (Das et al., 2020). This index measures the socioeconomic status of one village relative to the other on a linear scale (Das et al., 2020; Guha & Hazra 2024). Finally, Standardization has been done to get the final standardized value of SoVI using the formula of 'Z-score': (Actual – Mean)/Standard Deviation (Das et al., 2020; Das et al., 2021; Guha &

Hazra 2024). The variables used for developing the village-level Social Vulnerability Index are as below: (Data Source: Primary Census Abstract, Socio-Cultural Table, District Census Handbook, Housing Data, Census of India, 2011; District Human Development Report, 2009-10):

Table 2: Variables considered for Social Vulnerability Index

Sl. No.	Name of Variable
1.	Household size
2.	Percentage of female population
3.	Percentage of the population under the age of 6 years
4.	SC/ST population
5.	Percent illiterates
6.	Percent of population dependent on agriculture
7.	Percentage of Marginal workers
8.	Percentage of non-workers
9.	Percentage of population with no asset
10.	Percentage of the population living in temporary houses
11.	Percentage of the population living in houses having no exclusive room
12.	Percentage of the population having no house ownership
13.	Percentage of households having drinking water sources away
14.	Percentage of households having no electricity
15.	Percentage of households having no sanitation
16.	Percentage of households using fuel wood

On a linear scale, this score compares the socioeconomic standing of villages. The index's value can be either positive or negative, which makes interpretation challenging. Consequently, a Standardized Index (SI) was created using the "Z-score" formula, which is (Actual – Mean)/Standard Deviation.

2.5.2. Multi-hazard index at the village level

To understand the level of hazard risk in the surveyed villages, a multi-hazard map of the study area was generated using the three hazard layers: inundation (storm surge and floods), cyclone (storm and cyclonic wind), and erosion. After severe cyclone Aila, an inundation layer was developed using pre-cyclone (24.04.2009) and post-cyclone Landsat-TM data (26.05.2009). The storm surge caused extensive flooding of 2 to 3 meters above the high tide level. The "Envi Flash" tool was used to correct atmospheric interference in the satellite data, which was then clipped by the study area outline. The water portion was extracted from a clipped image using NDWI indices, and a binary raster representing the water area was transformed into a polygon vector layer. To eliminate perennial water bodies, the vector layer was clipped using the river polygon from the previous month, creating the surge inundation layer. The layer was then subjected to post-editing to improve its accuracy. Hazard due to cyclonic wind was modelled with the help of TCRM. The data used were obtained from the Indian Meteorological Department. This model provided output in the form of wind speed of various return periods for the study area. To generate the erosion layer, a time series analysis of Landsat data spanning a decade was conducted. Radiometric and atmospheric corrections were carried out on the Landsat data of 2001 and 2011 using ENVI software. The land-water boundary was determined by differentiating the NDWI index and binarizing the NDWI layer. The resulting binary images were then vectorized to extract the boundaries of the islands. To estimate erosion, the island boundaries from the years 2001 and 2011 were overlapped. This method allowed for the detection and mapping of the changes

in the island's shape and size over time. To compute the composite multi-hazard index, all data were normalized using the dimension index formula. The normalized hazard values were then averaged using the simple arithmetic mean method. This process allowed for the computation of a single index that represents the combined level of hazard for each village. The threshold values considered for the multi-hazard indices analysis are 0-0.25 (low); 0.25-0.50 (moderate) and 0.50-1.0 (high). The multi-hazard (for cyclone, inundation, and coastal erosion) index at the village level was constructed following the methodology described in Das et al. (2020) and detailed further with output from Marcinko et al., (2022). The maps and graphs depicting demographic and socio-economic variables for visual analysis were prepared on ArcGIS using data from remote sensing and literature review.

2.6. Primary data analysis

Several indices like the Multi-hazard index and Multidimensional Poverty Index (MPI) have been developed at the grassroots level. Probable drivers of migration were identified from focused group discussions and expert interviews and finally, the drivers of migration are predicted using the Binary logistic regression analysis.

2.6.1. Multidimensional Poverty Index (MPI) (Village)

This is calculated following the Alkire-Foster method. The MPI is a gauge used to quantify extreme poverty. Multiple deprivation sufferers are measured by MPI. The incidence of poverty, or the percentage of individuals (within a given population) who experience numerous deprivations, and the intensity of their deprivation, or the average proportion of (weighted) deprivations they encounter, are two important pieces of data that are used by the MPI to assess acute poverty. When measuring poverty, both the frequency and severity of these deprivations are extremely important pieces of data. Alkire-Foster method (AF) is adopted (2011) (Alkire et al., 2011).

A similar method is used by the UNDP and OPHI in developing the MPI at a worldwide scale, and also used by several countries to develop national MPIs (OPHI-UNDP Handbook 2019). Making a deprivation profile for every person (or household) is the first step in applying the AF technique. The individual's achievement is compared to the corresponding deprivation cut-off for each of the MPI's metrics, and they are categorized as either deprived or non-deprived (Alkire et al., 2011). The list of indicators used is context-specific and accepts revisions to the context in which poverty is calculated (Alkire et al., 2020). Each deprivation is assigned a weight, which must equal one, or 100 percent, and the weighted proportion of deprivations that each person experiences is determined by adding together all of the deprivations. If the weighted sum of a person's deprivations exceeds or equals the poverty cut-off, which could be, for instance, 20 percent, 33 percent, or 50 percent, that person is then classified as multi-dimensionally poor (Alkire et al., 2011). Following the classification of each individual as poor or not, the data is combined to create two cognitive indices (Alkire et al., 2011). The percentage of persons classified as multi-dimensionally poor is known as the "headcount ratio," or incidence of poverty (H). The proportion of the population whose weighted deprivation score is higher than or equal to the poverty cut-off is known as this (Alkire et al., 2011). The average percentage of indicators in which the poor are deprived—the average deprivation score for all the poor—is the intensity of poverty (A). These two elements are multiplied to determine the MPI [MPI = H x A]. This approach not only determines who is impoverished, but it also innovates by taking into account how severe or severe multidimensional poverty is for the impoverished (Alkire et al., 2011). The next stage is to specify the weights that each indication will have in the measure after the indicators and their matching cut-offs have been chosen. Each of the three dimensions

in the MPI is given a 1/3 weight because they are all equally weighted (Alkire et al., 2011). The deprivations in the component indicators are then used to determine each person's deprivation score. Each person's deprivation score is determined by adding together all of their deprivations in a weighted manner, so that it falls between 0 and 1. When an individual is deprived in every component indicator, the score rises as their number of deprivations rises and reaches its maximum of 1. A score of 0 is given to someone who is not deficient in any way (Alkire et al., 2011). To determine who is multi-dimensionally poor, a second cut-off, referred to as the poverty cut-off in the Alkire-Foster technique, is employed. Accordingly, if a person's deprivation score is equal to or higher than the poverty cut-off, she is deemed impoverished (Alkire et al., 2011). Lastly, if ci > the specified poverty cut-off, then someone is poor. The MPI integrates two essential pieces of information, as stated in the overview: (1) the percentage or frequency of individuals (in a particular group) who suffer from more than one deprivation, and (2) the severity of that deprivation, or the average percentage of (weighted) deprivations they encounter. The multidimensional headcount ratio (H) is the formal name for the first component (Alkire et al., 2011):

Here q is the measure of multi-dimensionally poor people, and n denotes the total population. The other component namely intensity (or breadth) of poverty is denoted as A. (Alkire et al., 2011):

A is the censored deprivation score of ith individual, and q is the number of people multi-dimensionally poor. Finally MPI is multiplication of both H and A: MPI = H × A.

Village-level MPI was calculated using the primary survey data as per AF methodology (Alkire & Foster, 2011) across the surveyed villages. MPI was computed

using data from eight metrics, categorized into the three equally weighted aspects of living standards, education, and health. Indicators used for the MPI calculation of 2021 were adopted from Marcinko et al., (2022) while the education dimension was further modified for better analysis of the education system. The indicator used by Marcinko et al., (2022) to assess the education dimension was the percentage of illiterates. But for the MPI calculation using primary survey data in this paper, two new indicators to assess the education dimension, namely, "Years of Schooling" and "School Attendance" were adopted from Niti Aayog Report 2021(MPI Report, Niti Aayog, 2021). MPI represents a picture of both incidence (H) and intensity (A) of poverty. Generic MPI values lie between 0 to1. MPI values close to 0 signify is the villages are less poverty-stricken while those on the higher end i.e., 1 signify the villages are highly poverty-stricken. The severity of poverty answers the question: How impoverished are the poor? The incidence of poverty is the headcount ratio that has been expressed in percentages. A detailed description of the indicators, along with their weights, is presented in **Table 3** (Adopted from Marcinko et al., (2022) and Niti Ayog Multidimensional Poverty Index Baseline Report 2021).

Table 3: Dimensions and Indicators used for MPI 2021

Dimensions	**Indicators**	**Descriptions**	**Weightage**	**Justification for taking Indicators**
Health	Access to safe drinking water	Households with no access to drinking water	1/9	Access to safe water is essential for optimum health, and there is a link between low-income homes and the

Dimensions	Indicators	Descriptions	Weightage	Justification for taking Indicators
				occurrence of sickness caused by contaminated water (Bedi et al., 2015, Marcinko et al. 2022).
	No proper sanitation	Households using the exposed latrine	1/9	No proper sanitation has been associated with a higher incidence of diarrhoea in children under the age of five (Marcinko et al. 2022).
	Use of unsafe cooking fuel	Household use fuelwood, and cow dung as the primary fuel	1/9	Solid fuel consumption subjects people to smoke and toxins for longer periods, which can contribute to respiratory illnesses and fatal mortality (Marcinko et al. 2022, World Health Statistics, 2018).
Education	School	If any school-	1/6	The members of the

Dimensions	Indicators	Descriptions	Weightage	Justification for taking Indicators
	attendance	aged youngster does not visit the school until the age at which he or she would finish class 8, the household is deprived.		family will be devoid of the societal benefits that come with having a properly educated person in the family if the child does not attend school (Niti Ayog Multidimensional Poverty Index Baseline Report, 2021).
	Years of Schooling	If nobody in the family, aged ten or older, has finished 6 years of education, the household is considered deprived.	1/6	If one of the members has completed more than 6 years of education, this has a beneficial influence. Education is shared between all people of the home, whether it is to better economic prospects such as the capacity to join high-paying jobs or to

Dimensions	Indicators	Descriptions	Weightage	Justification for taking Indicators
				promote social position (Niti Ayog Multidimensional Poverty Index Baseline Report, 2021).
Standard of Living	Absence of electricity	Households with no electricity	1/12	The availability of residential electricity has a significant effect on every household (Niti Ayog Multidimensional Poverty Index Baseline Report, 2021).
	Presence of mud floor	Households with floors made of mud	1/12	Mud is regarded as a primitive/natural material that is more prone to damage (Niti Ayog Multidimensional Poverty Index Baseline Report, 2021).
	Presence or absence of	Homes without a separate	1/12	According to studies, it is a sign of a lack of

Dimensions	Indicators	Descriptions	Weightage	Justification for taking Indicators
	a separate kitchen	kitchen		income (Marcinko et al. 2022, Mohanty, 2011) In addition, the lack of a separate kitchen has a significant effect on influencing the quality of indoor air superiority (Marcinko et al. 2022, Duflo et al., 2008).
	Asset possession	Households that have only one asset	1/12	A household is considered deficient if it lacks at least one of the following assets: radio, television, phone, computer, livestock cart, bicycle, motorcycle, or fridge, as well as a vehicle (Marcinko et al. 2022, Niti Ayog Multidimensional Poverty Index Baseline

Dimensions	Indicators	Descriptions	Weightage	Justification for taking Indicators
				Report, 2021).

(*Adopted from Marcinko et al., 2022 and Niti Ayog Multidimensional Poverty Index Baseline Report, 2021*)

Censored Headcount Ratio and Uncensored Headcount Ratio

The ratio of the number of impoverished families surveyed to the total number of households deprived in any given metric is known as the censored headcount ratio. However, regardless of whether a household is impoverished or not, the uncensored headcount shows the proportion of households deficient in any indication to all families polled (Niti Ayog Multidimensional Poverty Index Baseline Report, 2021). By observing the contribution of indicators toward the village-level MPI, a comparable perception of deprivation in an indicator based on its weightage was attempted. A wholesome analysis and explanation of the censored headcount ratio, and involvement of indicators gave a true and representative picture of the MPI of a village. Lastly, the percentage contribution of an indicator, inclusive of its weightage was considered to find the deprivation of the particular village in a particular indicator. The contribution of an indicator towards the village-level MPI was calculated in accordance to the Niti Ayog Multidimensional Poverty Index Baseline Report, 2021. The contribution of an indicator was calculated by multiplying the censored headcount ratio for the particular indicator by its weightage and then dividing the product by the MPI of the village. The contribution of a particular indicator was expressed in percentage (Niti Ayog Multidimensional Poverty Index Baseline Report, 2021). The

censored headcount ratio depicts the very earliest priorities required for the benefit of the multi-dimensionally poor population, and the contribution outlines where interventions due to policies or schemes could result in a decrease in the overall MPI.

2.6.2. Household deprivation score (HDS) for the tribal households (600 nos.)

The HDS was computed from primary data of the 600 tribal households surveyed using the Alkire Foster (AF) method. A standard set of indicators under three dimensions and weightages (health, standard of living and education) was used (**Table 3**). Each household's deprivation profile was produced using the AF approach. Equal weightage was given to each of the three deprivation dimensions, which were then summed up to 1. Each household was finally identified as poor or not-so-impoverished if the weighted total of their hardships exceeded or was equivalent to the poverty threshold. (0.33) (Alkire et al., 2010, 2011; OPHI-UNDP Handbook, 2019; Niti Aayog, 2021; Marcinko et al., 2022). Poverty scores lower than 0.33 indicated higher wellbeing of the households while scores higher than 0.33 indicated lower wellbeing of the households.

2.6.3. Binary logistic regression (BLR) model

BLR is a suitable method to analyse the interconnections between potential drivers of migration (independent variables) and migration decisions (dependent variables; indicated as “Yes” or “No”) (Hutcheson and Sofroniou 1999; Niedomysl 2011; Jha et al., 2018; Akhtar & Jariko 2018). For the purpose of this analysis, the model was run in IBM SPSS Statistical 22 (Statistical Analysis Software Package) to understand the relationship between the independent variables (multi-hazard category, household

size, agricultural land holding, HDS, and ecosystem dependence) and migration. The validity of the model was tested using the goodness of fit (Pituch & Stevens 2016). The quality of the input data was verified before further processing the model. Finally, the variables whose significance value was less than 0.05 were considered for the discussion of the findings of the study. The OR or probability of any event happening to not happening was used to make sense of the interpretation (Tabachnick & Fidell, 2007). The limitations of the secondary data used is the resolution up to which data is made available by the Government and the limitation of the primary data is to some extent due to the inaccessibility of the villages in the SBR region. The entire survey was carried out during the COVID-19 period (June 2020 to October 2021) which imposed additional constraints on the approachability of the villages for the survey. Under such a constrained situation choice of the selected villages was restricted. This could generate some bias but since the sample size is adequate according to Krejcie and Morgan, 1970 it avoids much bias in data and analysis.

2.6.4. Conceptual framework of the study

From the focused group discussion and different stakeholders' interviews, a link was found between the environmental impact and well present socio-economic conditions acting as drivers for the migration decision at the household level in the SBR. With the aid of the suggested conceptual framework, the most significant connections between drivers and their primary and secondary socioeconomic conditions can be identified. The drivers pointed out by participants were external system drivers, internal dynamics of the area, and to some extent policy drivers or actions of government or civil society. Environmental impacts of hazard incidences like coastal erosion, frequent cyclones, and flooding are commonly identified as having effects on the decision to migrate. Social variables commonly mentioned as causing outmigration are fragmentation of small land holdings, poor educational status, and high household-level deprivation. Thus, drivers of migration, particularly in the SBR, have been conceptualised after a series of focus group discussions in the field to be dependent on a multitude of climatic hazards and the livelihood pattern of the tribal community. The questionnaire has been developed to test the following simple conceptual framework (**Figure 2**).

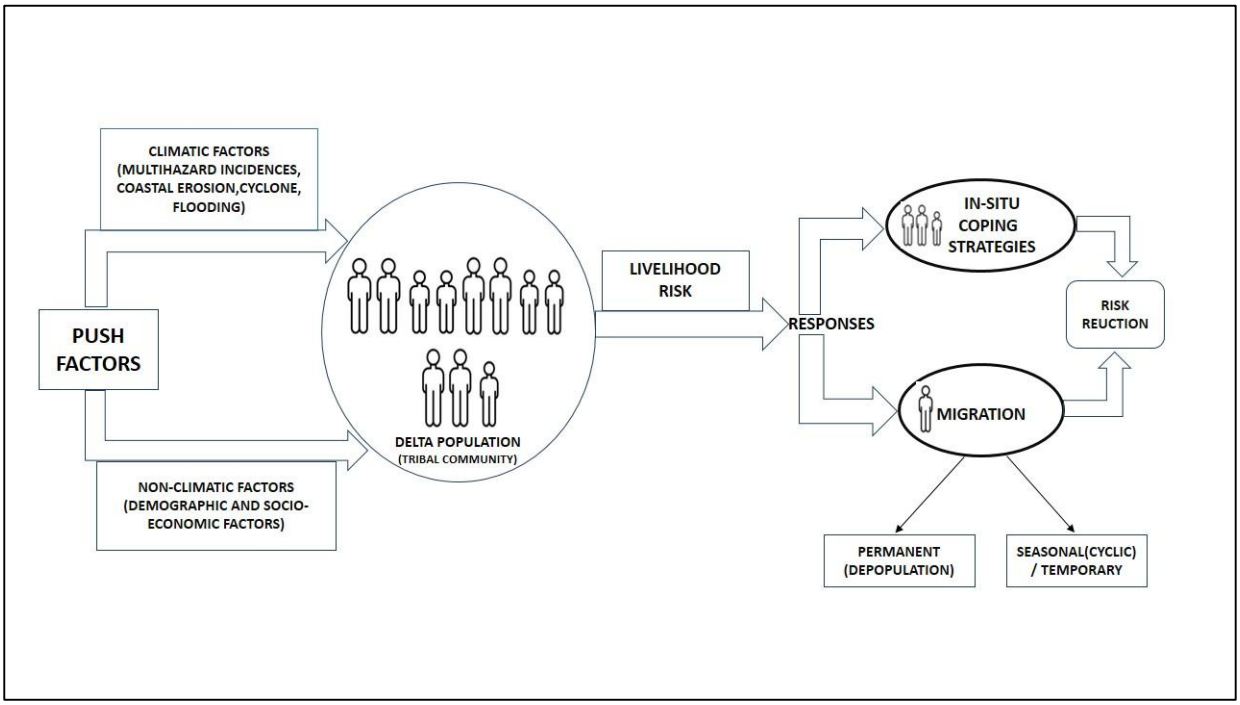


Figure 2: Conceptual Framework

2.6.5. Conclusion

The methodology listed here would be applied in an iterative method with results coming out of the application and appropriately changing the methodology to arrive at optimum results confirmatory to the existing knowledge and theory.

CHAPTER 3

DEMOGRAPHIC PROFILE OF THE TRIBAL COMMUNITIES IN THE STUDY AREA

RESULTS AND DISCUSSION

3. Introduction

The study mainly used the enumerated data from the Census India (2001, 2011), Socio-Economic Caste Census, 2011, and Agriculture Census 2011. Secondary data on the demography and socioeconomic conditions in the research area were obtained from Indian Census surveys of 2001 and 2011 (Census, Ministry of Home Affairs, GoI, 2001, 2011), Primary Census Abstract, Socio-Cultural Table, and Housing Data from Census of India (Census, Ministry of Home Affairs, GoI 2011). In the research area, the decadal growth rate as well as the tribal population's spatial distribution are mapped. Initially using the secondary data, the socio-economic condition of the tribes is assessed.

3.1. Results and Discussion

3.1.1. Spatial Distribution

The total tribal population of West Bengal in 2011 was estimated to be 5 million (approximately 5.8% of the total population) (Ministry of Home Affairs, GoI 2011) and of this, 0.2 million inhabit the 19 CDBs in SBR (Ministry of Home Affairs, GoI 2011). Tribal population percentage (2011) indicates great spatial variability, as shown in **Figure 3** .

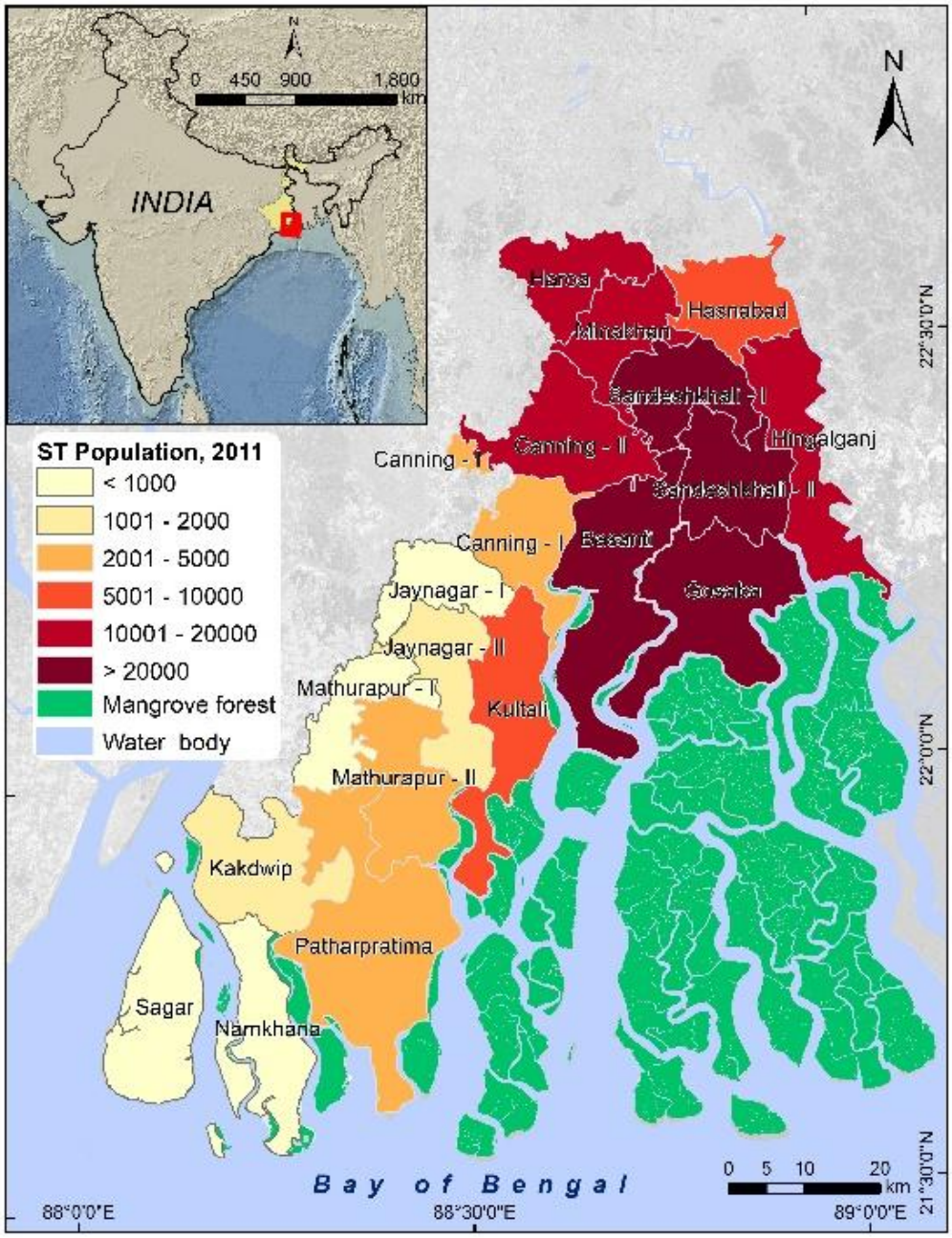


Figure 3: Block-wise spatial distribution of the ST population in the SBR

3.1.2. Growth and decline of tribal population in SBR in the 21st century

Currently, two districts, South and North 24 Parganas, are home to many Scheduled Tribes, with varying population densities. Out of all the Scheduled Tribes in West Bengal, this group makes up 4.07% of the total. About a century ago, the tribal people were first brought to the Sundarbans to work as labourers to clean up the virgin forests. After obtaining arable land, they eventually made their homes and began farming. Even now, a large number of them own land and work in agriculture. Those who were and are landless or marginal landowners continue to work as day or agricultural labourers. A few of them also work as sharecroppers. Some of them now have the opportunity to work in various public and/or private sectors, as teachers in schools, or modest businesses, thanks to modern education. According to the Census 2011, the overall tribal population of West Bengal is 5296963 (5.8% of the entire population). For the research area, the tribal population is 0.2 million (Census 2011). The proportion of the tribal population indicates high spatial variability throughout the 19 community development blocks. While the ST population in India grew by 23.66 per cent and the rural population as a whole by 12.18% between 2001 and 2011, the state recorded a decadal growth of 15.7% for the ST population in 1991–2001 and 20.20 per cent for the ST population in 2001–2011. Within the study area, for the ST population, it is observed that blocks, namely Namkhana (4.37%), Minakhan (5.80%), and Jaynagar-II (7.39%) show a growth rate (0.0 – 10.0 %), much lower than mean growth trend for tribal population in West Bengal during 2001 to 2011. The tribal population of the blocks, namely Patharpratima, Kakdwip, Jaynagar-I and Mathurapur-I show a negative growth rate (<-20.0% to 0%). In contrast, blocks like Mathurapur-II, Canning-I, Canning-II and Hasnabad show a much higher growth rate (20.1% to 41%). The rate of population growth of tribal communities within the 19 CBDs of the SBR was assessed with the help of secondary data from the GoI's Census surveys in 1991, 2001, and 2011. Out of the 19 CDBs considered for the study, four CBDs in the southwestern part, including Patharpratima, Kakdwip, Jaynagar I, and Mathurapur I, showed a negative growth rate (<-20.0% to 0%). Three other CBDs in the southwestern part, namely Namkhana, Minakhan, and Jaynagar II, show a growth rate which is significantly less than the mean typical intrinsic growth rate for the tribal

population in West Bengal during 2001-2011 (20.20%) or even the SBR. The population movement, in cases where people's households living on vested land without personal landholding, might be due to social and economic push factors like the expansion of aquaculture farms by non-ST communities as well as peri-urban growth of urban facilities like bridges and markets, as observed in Jaynagar I and II, Canning I. But for ST households in Patharpratima, Kakdwip, Mathurapur and Namkhana, which are sea-facing CDBS, population movement can be attributed mostly to climatic catastrophes like Cyclone Aila (2009) and land loss to the sea. However, such an assertion must be validated in future studies by also tracing migrants' pathways from sending areas to receiving areas. Such depopulation might indicate distress-driven permanent migration of the tribal people from sea-facing or hazard-prone areas to areas they perceive to be safer. In contrast, Mathurapur II, Canning I, Canning II, and Hasnabad, considered 'receiving areas' farther away from the coast, demonstrated a much higher growth rate (20.1% to 41%) of tribal population, pointing to permanent population movement within the Delta. CDBs with a dominantly tribal population, namely Sandeshkhali I, Sandeshkhali II, and Gosaba, which are closer to the mangrove forest, had a consistent growth rate of 20.20%, which was the same as that for ST communities in West Bengal. As there was hardly any fresh influx of tribal peoples from adjoining districts, states or countries, the disparity in the growth rates might indicate the internal mobility of tribal peoples. **Table 4** indicates the change over 10 years for the tribal population in the 19 CDBs of the SBR, and their decadal growth rate (2001-2011) (**Figure 4**).

Table 4: Decadal Change in tribal population in the 19 CDBs of SBR

District	Blocks	Tribal Population (2001)	Tribal Population (2011)	Growth Rate
South 24 Parganas	Mathurapur II	3308	4643	40.36
South 24 Parganas	Canning II	11654	14910	27.94
North 24 Parganas	Sandeshkhali II	30214	37695	24.76

District	Blocks	Tribal Population (2001)	Tribal Population (2011)	Growth Rate
North 24 Parganas	Hasnabad	6012	7487	24.53
South 24 Parganas	Sagar	691	854	23.59
North 24 Parganas	Hingalgunj	10419	12504	20.01
South 24 Parganas	Kultali	4844	5672	17.09
North 24 Parganas	Sandeshkhali I	36488	42674	16.95
North 24 Parganas	Haroa	10962	12728	16.11
South 24 Parganas	Basanti	17462	19963	14.32
South 24 Parganas	Gosaba	20560	23343	13.54
South 24 Parganas	Jaynagar II	974	1044	7.19
South 24 Parganas	Canning I	3075	3264	6.15
South 24 Parganas	Namkhana	710	740	4.23
North 24 Parganas	Minakhan	17547	18019	2.69
South 24 Parganas	Kakdwip	1941	1836	-5.41
South 24 Parganas	Patharpratima	2834	2640	-6.85
South 24 Parganas	Mathurapur I	589	495	-15.96
South 24 Parganas	Jaynagar I	145	53	-63.45

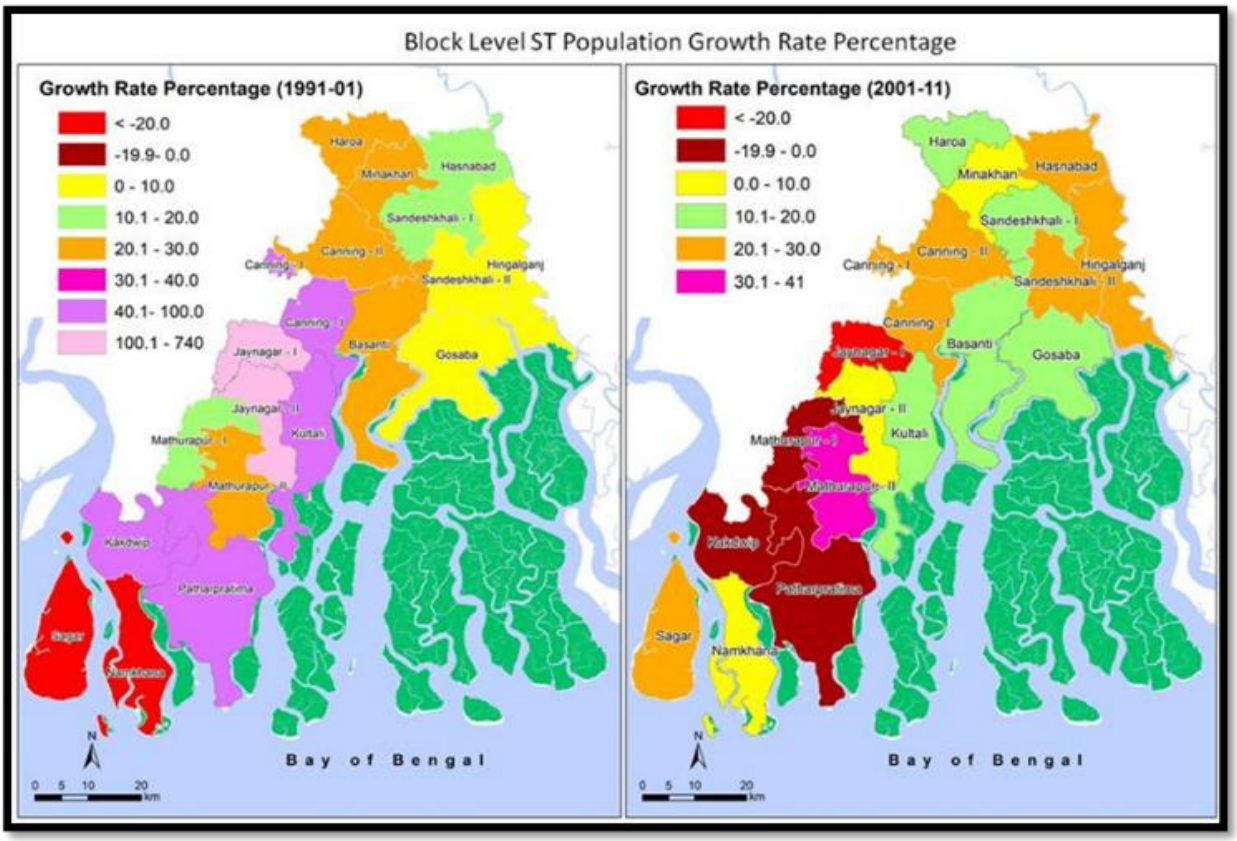


Figure 4: Decadal growth rate (1991-2001; 2001-2011) of the ST population in the study area

3.1.3. Socio-economic condition of the tribal people

An understanding on the economic circumstances of the tribals in the study area is important. Several economic parameters help to understand the conditions of a community. Since in the SBR Delta, people are agriculturists as their major source of income alongside fishing along with aquaculture; agricultural landholding is one of the important parameters to understand the economic condition of a family (Dhargupta et al., 2009). Agricultural landholding (Source: Agriculture Census 2011 and SECC 2011), and number of agricultural and casual labourers (Source: Census of India 2011) are used as proxy indicators for the economic status of the tribal community. Analysis from data on agricultural landholding shows that the tribal people throughout the study area have very low agricultural landholding (<0.5 ha), particularly in Basanti, Gosaba, Minakhan, Sandeshkhali-I and Sandeshkhali-II. Individual landholding ranges

between 0 and 0.5 hectares, whereas the non-tribal agricultural landholding is much higher. The percentage of landholding of the ST population ranged mostly between 0 and 0.5 ha in 2001, while that of the non-ST population was mostly above 0.5 ha. However, within a decade (2001-2011), marked by the incidence of Cyclone Aila, which caused significant damage to assets in the SBR, ST households appeared to have lost most of their already meagre landholding owing to distress and population movement. A comparative decadal study of higher (1-2 ha) agricultural landholding reveals a similar trend: a significant drop in landholding is observed in the western CDBs, like Canning I, Canning II, and Sagar, and the northern CDBs, like Haroa, Basanti, and Sandeshkhali II.

Only a few tribal households in Basanti, Canning-II, Gosaba, Sandeshkhali-I and Sandeshkhali-II have average agricultural landholdings ranging between 0.5 hectares and 1.0 hectares. The above observation indicates the landlessness of tribal people. As decades passed by, the landlessness of the tribal people became their curse in the delta, where cultivation is one of the main sources of livelihood. Slowly, they learnt the art of agriculture and started working as agricultural labourers in the cultivable lands of the non-tribal people.

Figure 5: Changes in the percentage of ST population with marginal agricultural landholding (< 0.5 ha)

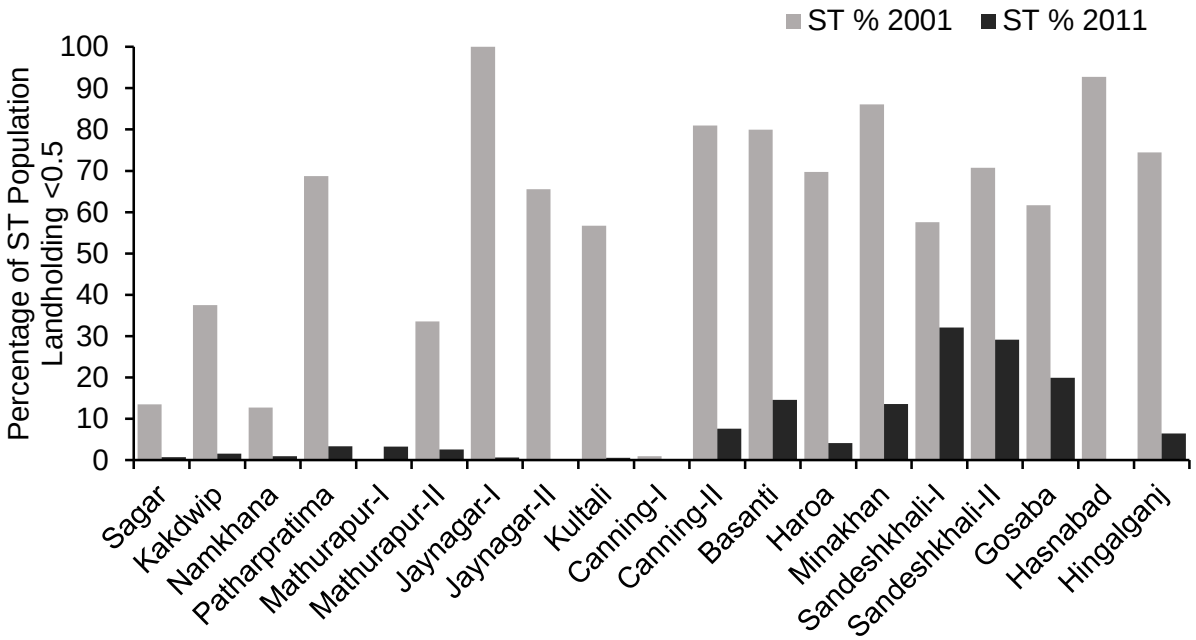
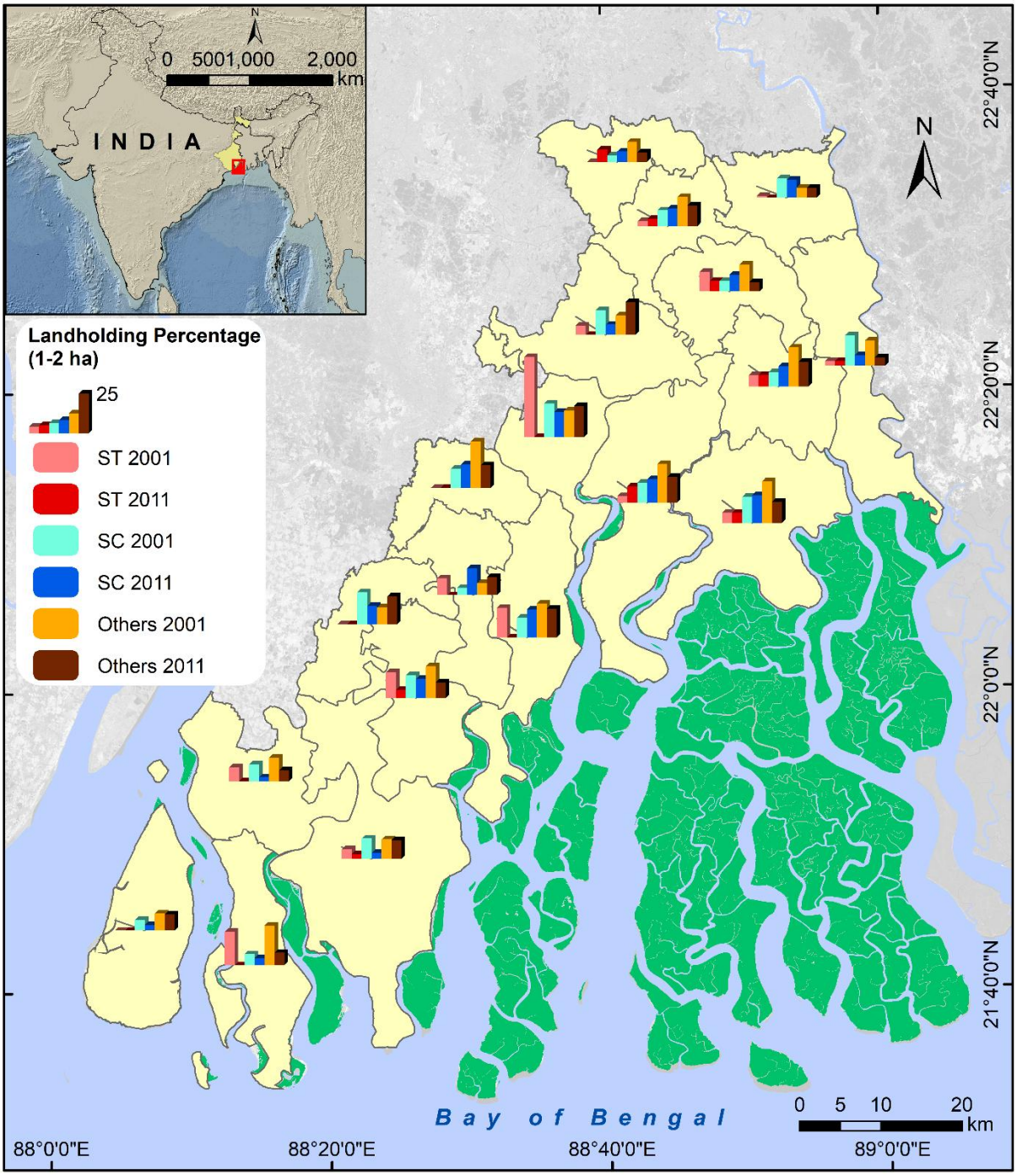


Figure 6: Changes in agricultural landholding of different communities (ST, SC, Others) in the SBR



It is observed in the SECC 2011 data that in 12 blocks within the study area, the percentage of landless tribal households deriving most of their income from manual casual labour is the highest. These blocks are Mathurapur-I, Haroa, Sandeshkhali-I, Hasnabad, Hingalganj, Minakhan, Kultali, Jaynagar-I, along with Canning-II. Sandeshkhali-I and Sandeshkhali-II have a high percentage of tribal population (nearly 23%) as well as a high percentage of landless tribal households engaged in manual casual labour. 0.5 hectares of agricultural land holding is a very meagre landholding size. In blocks like Jaynagar-I (100%), Mathurapur-I (58%), Patharpratima (41%), Namkhana(29%), and Basanti (19%) a sizeable population among the tribal people have individual landholding less than 0.5 hectares (SECC 2011). Haroa and Mathurapur-I have a low tribal population, but also the highest percentage of landless tribal households engaged in manual casual labour. The analysis also shows that the tribal households in the blocks like Mathurapur-I, Kultali, Basanti, Gosaba, Mathurapur-II, Haroa, Minakhan, Sandeshkhali-I, Sandeshkhali-II, Hasnabad, Hingalganj derive lion's share of their monetary income from casual manual daily labour. Throughout the study area, the percentage of agricultural labourers from the tribes is high. This can indicate that most of the study population in the research area is landless or are mainly involved as wage labourers.

Figure 7: Percentage of ST, SC and Others households in the SBR engaged in casual manual labour (2011)

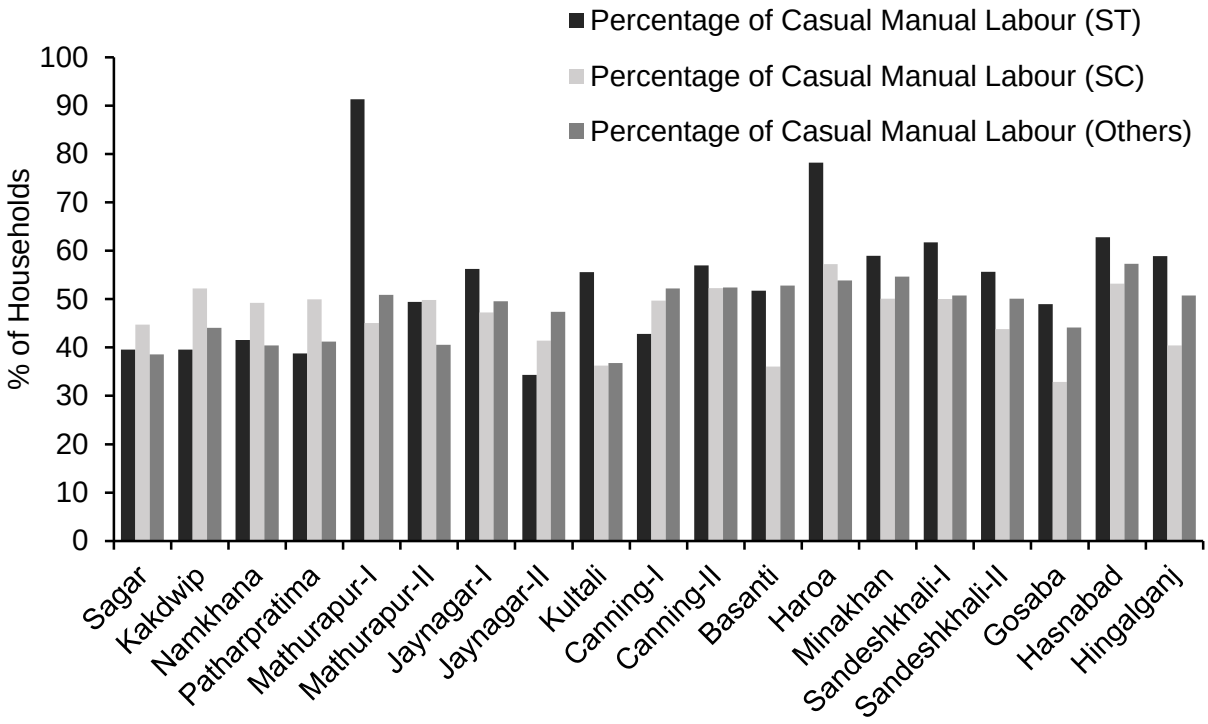
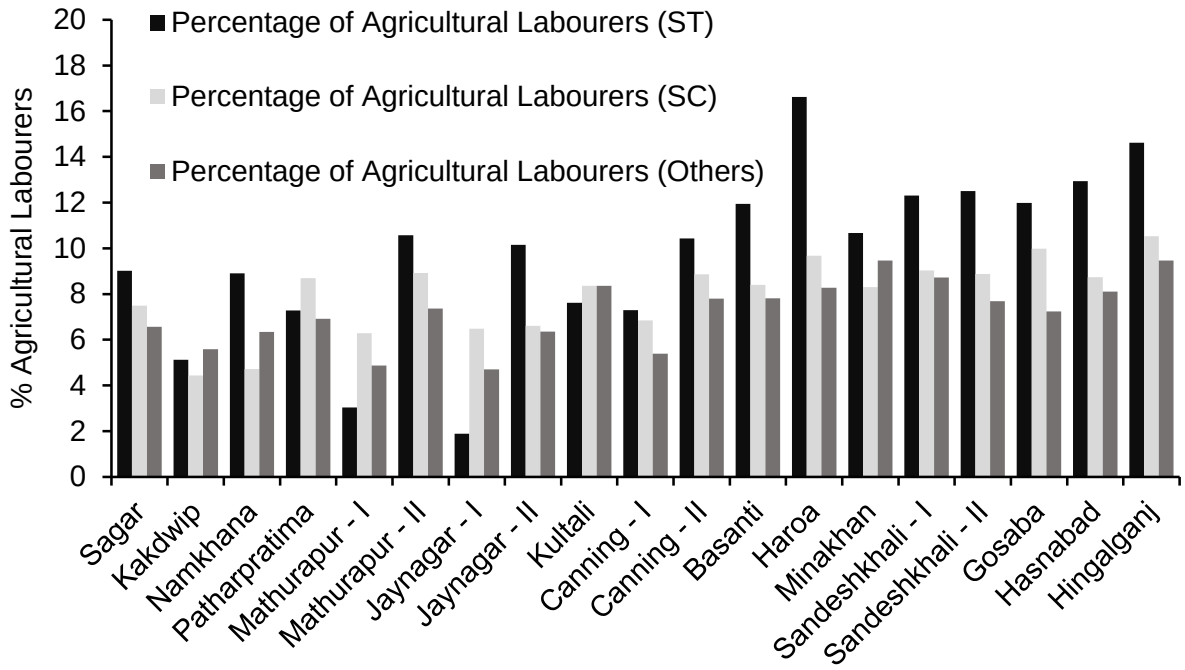


Figure 8: Percentage of ST, SC and Others populations in the SBR engaged in agricultural labour (2011)



The rate of illiteracy and the percentage of the population having salaried jobs are considered proxy indicators to represent the educational and work-participation situation for the tribal population in the study area. The average percentage of literates amongst the tribal population in the state is 57.9 percent. The percentage of illiteracy is highest among the tribal population in the study area. High illiteracy contributes to the increased social vulnerability of a community by decreasing its resilience to any environmental change (Ahsan and Warner 2014). Jaynagar-I (58.49%) and Canning-II (57.57%) have the highest rate of illiteracy among the tribal population, while that of non-tribal in the same blocks is low. The percentage of households having a salaried job among the tribal population is very low in the study area. Households having salaried jobs are less vulnerable to any environmental change, which mostly affects the population dependent on agriculture. Thus, as the variable grows, the social vulnerability of the community decreases.

According to SECC 2011, the average literacy rate among STs in West Bengal is 57.9%. The ST population in the SBR have lower literacy rate. The highest rates of tribal illiteracy in the study are found in Jaynagar I (58.49%) and Canning II (57.57%), where non-tribal illiteracy is low. Salaried employment among STs in the study area is extremely rare, ranging from 0.0 to 0.1%.

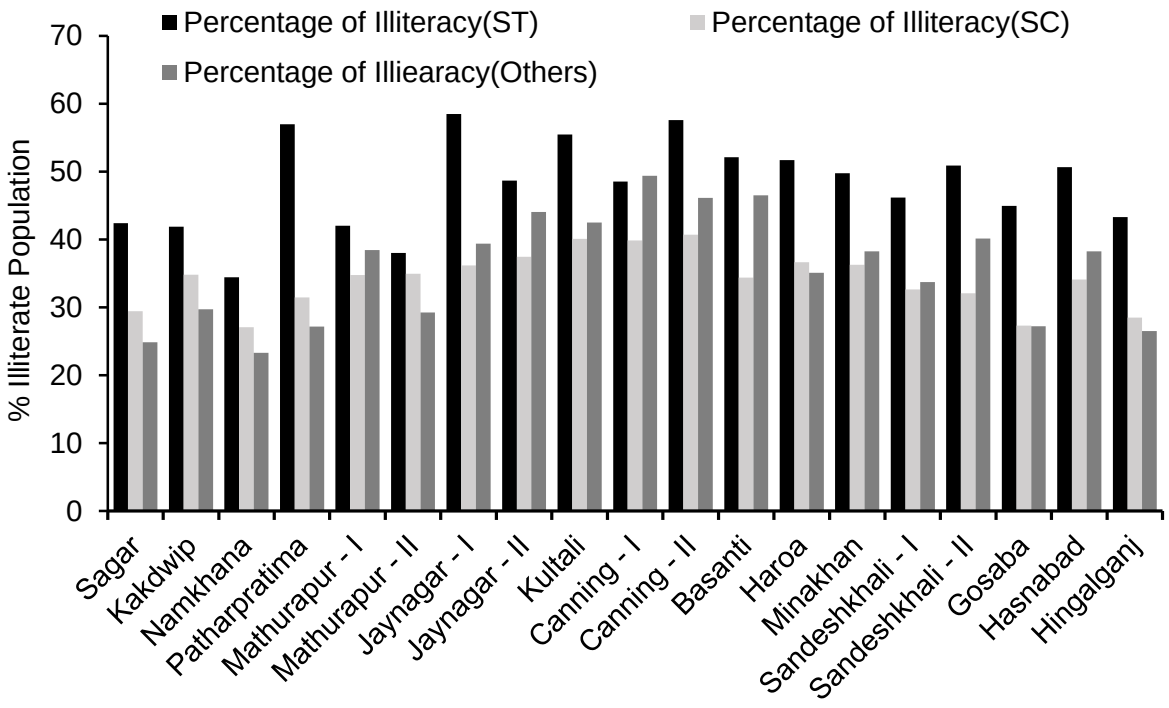
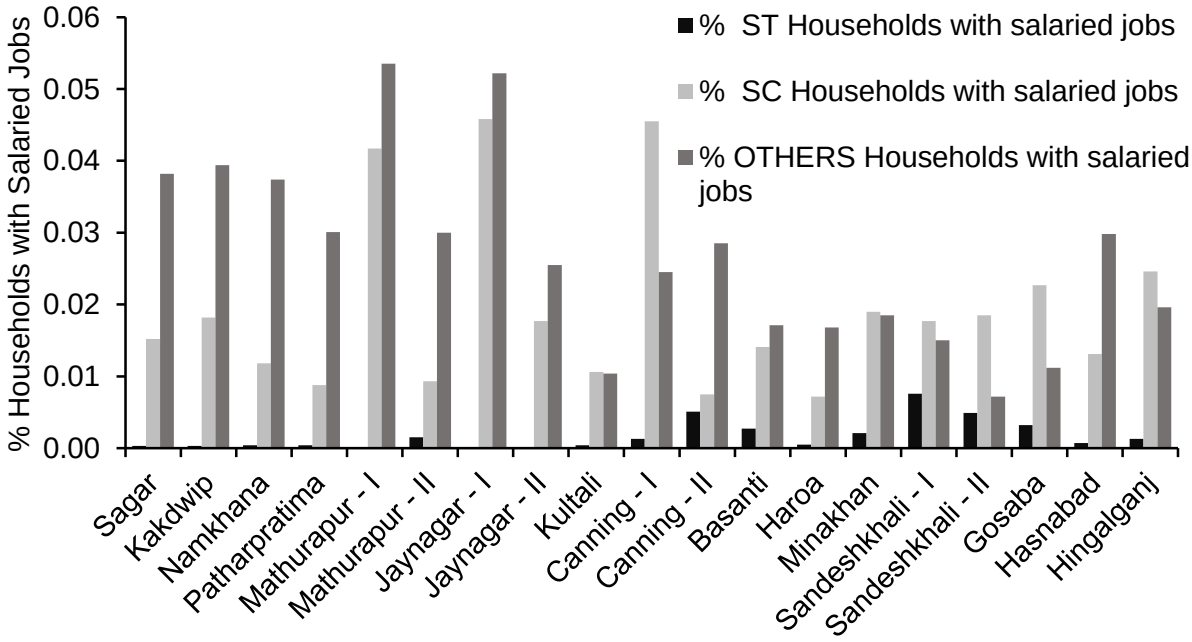


Figure 9: Percentage of illiteracy STs, SCs and Others in the study area

Figure 10: Percentage of Salaried Households among ST population



3.1.4. Social Vulnerability Index (Village level)

The susceptibility of people (individuals or communities) to environmental hazards and change is shaped by their inherent social fabric and inequalities (Cutter, 2003). Social vulnerability is an intrinsic state of a system arising from its system characteristics (Adger & Kelly 1999) and is assessed by indicators like poverty and inequality, marginalisation, food entitlements, access to insurance, and housing quality (Wisner et al., 1994); (Adger & Kelly 1999); Cross, 2001).

The analysis's findings revealed a significance level of 0.00, which is a number small enough to reject the hypothesis (the null hypothesis should be rejected with a probability of less than 0.05). Components with Eigen values greater than 1.0 are extracted. On a linear scale, this score compares the socioeconomic standing of villages. It is challenging to interpret the index because its value might be either positive or negative. Thus, the "Z-score" formula—(Actual – Mean)/Standard Deviation—was used to create a Standardized Index (SI).

The value of the Kaiser-Meyer-Olkin (KMO-test) is 0.7910 for this analysis which suggests that the sample is adequate for the analysis. Under the Eigen rule, only those factors with an eigenvalue (the variances extracted by the factors) of 1.0 or more are retained. Four components were found in the data using this criterion. Components were retained considering the Eigen value larger than 1 (Guttman-Kaiser rule) and the Scree plot (Field 2009; Krishnan 2010).

The four factors explained 58.585 % of the total variation, with the first, second, third and fourth components, explaining 28.13 %, 15.39 %, 8.24 %, and 6.818 % respectively. Non-Standardised Index (NSI) = (28.13/58.585) (Factor 1 score) + (15.39/58.585) (Factor 2 score) + (8.24/58.585) (Factor 3score) + (6.818/58.585) (Factor 4 score). Finally, the NSI is standardised for interpretation. The higher value of SoVI interprets that the village has high Social Vulnerability while a low SoVI indicates that the village is having a low score of Social Vulnerability. A negative loading indicates that the results should be interpreted in the opposite direction of how they are phrased.

The four factors explained 58.585 percent of the total variation, with the first, second, third, and fourth components, explaining 28.13per cent, 15.39 percent, 8.24 percent, and 6.818 percent respectively. Using the proportion of these percentages as weights on the factor score coefficients, a Non- standardized Index (NSI) was developed for each village, using the formula:

NSI = (28.13/58.585) (Factor 1 score) + (15.39/58.585) (Factor 2 score) + (8.24/58.585) (Factor 3score) + (6.818/58.585) (Factor 4 score)

The entire range of SoVI is divided quantitatively into five equal categories (Das et al., 2021). The 1032 villages spread across 19 blocks of the SBR are ranked as very low, low, moderate, high, and very high categories of the Social Vulnerability Index (SoVI). The choropleth map of the village-level SoVI is prepared using the ARC GIS platform.

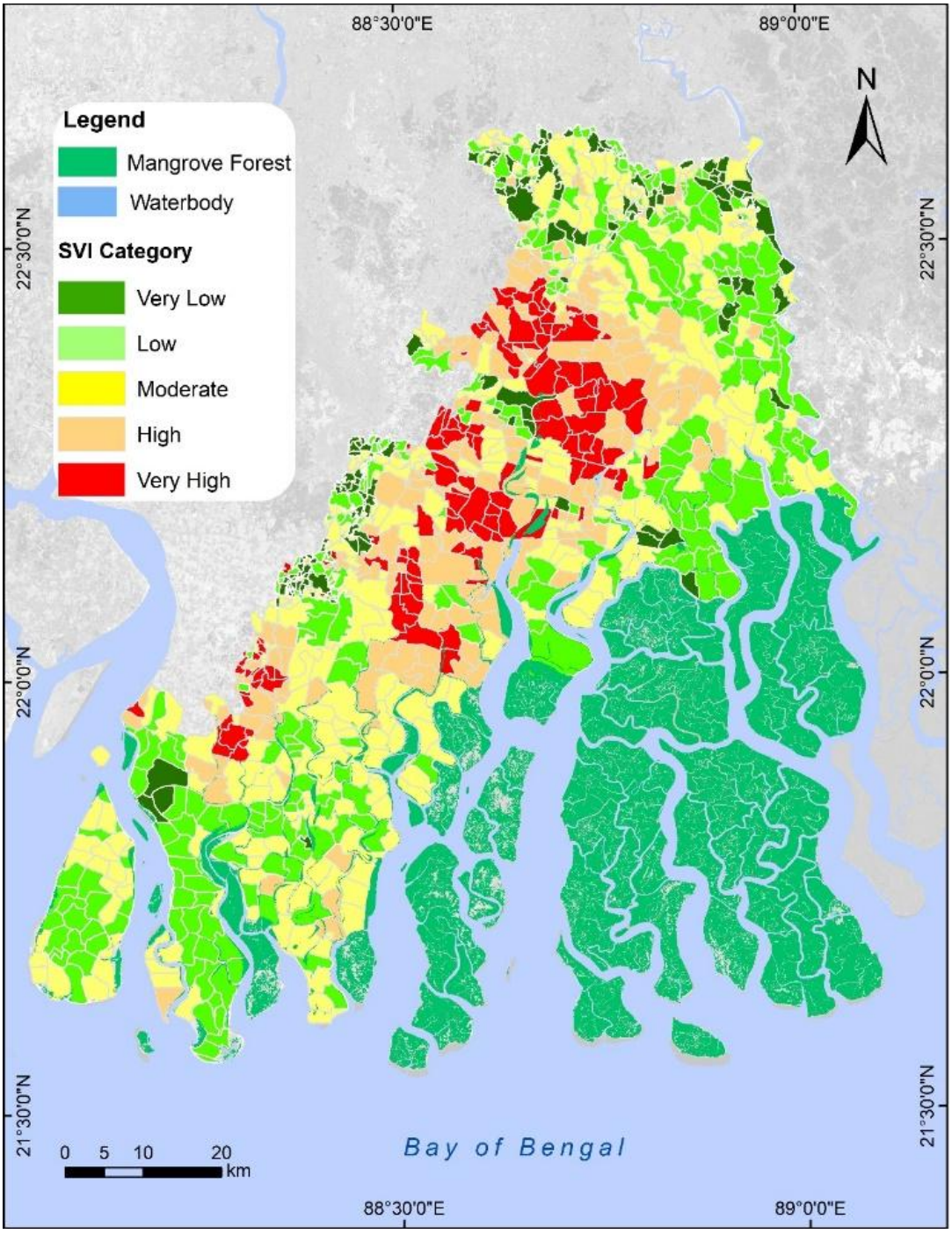


Figure 11: Social Vulnerability of SBR at the village level (2011)

Table 5: Sample Adequacy for SoVI

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.791
Bartlett's Test of Sphericity	Approx. Chi-Square	6283.710
	df	120
	Sig.	0.000

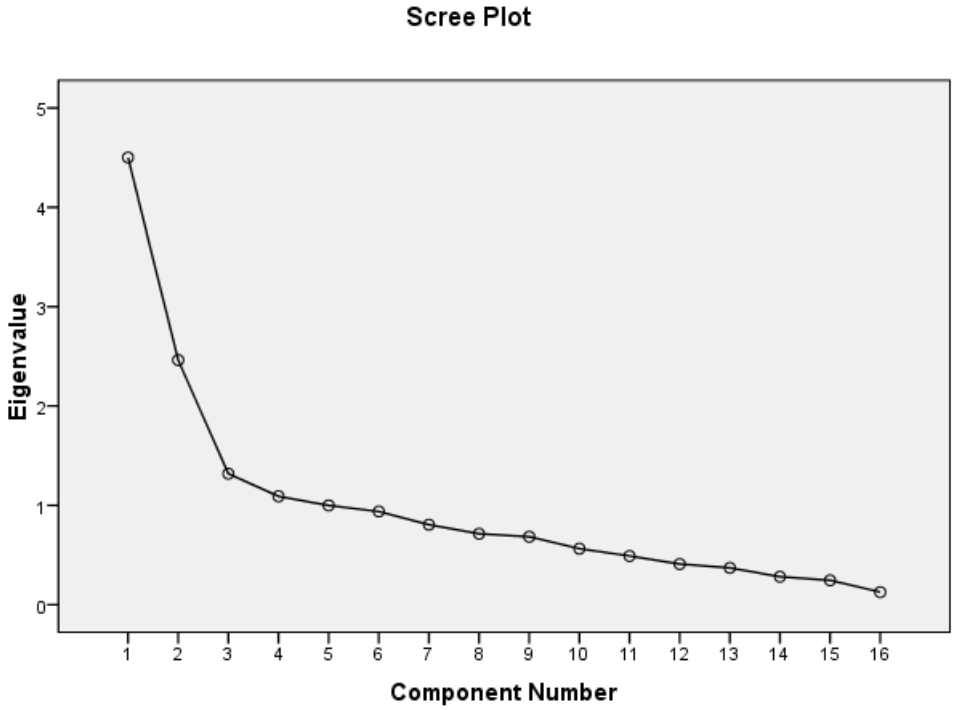


Figure 12: Scree Plot

Table 6: Rotated Component Matrix

Rotated Component Matrix				
	Component			
	1	2	3	4
HHS	.833	.267	-.044	.054
FEM	.146	.009	.100	.680
CHILD	.839	.200	.274	.186
SCST	-.429	-.019	.562	-.513
ILL	.709	-.007	.483	.044
AGDEP	-.022	.718	-.017	-.204
MARG	-.036	.728	.192	.075
NONWR	.759	-.233	.000	-.047
NOASST	.194	.287	.716	.040
HTEMP	.104	.645	.580	-.055
NORM	-.012	.102	.383	.193
NOOWN	-.302	-.367	.204	.559
DWA	.073	.163	.421	.130
NOEL	.054	.655	.401	.066
NOSAN	.435	.154	.586	-.211
FWOOD	-.182	-.537	-.269	.018
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 14 iterations.				

- Component 1, the variables having the highest positive loading are the Household size, Percentage of child population, Percentage of illiterates and Percentage of non-worker population.
- Component 2, the variables having the highest positive loading are the Percentage of the population dependent on agriculture, the Percentage of marginal workers, the Percentage of households which are temporary structures and the Percentage of households having no electricity.
- Component 3, the Percentage of households having no assets, the Percentage of households having inadequate sanitation and the Percentage of households which are temporary structures have the highest positive loading.
- Component 4, the Percentage of females and the Percentage of households with no ownership have the highest positive loading.

The Sundarbans are unique due to their physical vulnerability, which affects not just survival and livelihoods but also health and the region's healthcare system. Previous research indicates that residents of the Sundarbans experience greater health challenges and risks compared to those living in the same district. The combination of poverty and harsh geographical and climatic conditions increases their susceptibility to health shocks caused by environmental and climate changes (Kanjilal et al., 2013). Given this context, the healthcare system in the Sundarbans is far from ideal or optimal from a societal perspective. Due to a shortage of staff and inadequate facilities, public healthcare institutions in the most vulnerable areas are either absent or inactive. The following scenario of the health status of Sundarbans has been observed through a literature review:

- Climate threats in Sundarban, such as increase in sea level, rising temperatures, also repeated cyclonic storms along with floods, have significantly increased the vulnerability of health and wellbeing in low-lying deltaic zones (Kanjilal et al., 2013).
- Findings imply that experiencing either climate or health shock raises multiple risks to a considerably smaller level (Kanjilal et al., 2013).
- The implementation of new health schemes by Govt. is not effective enough as there is still an unavailability of doctors and hospital beds (Kanjilal et al., 2013).

3.1.5. Conclusion

The degree of socioeconomic poverty and degradation experienced by the ST population in the SBR has been made clear by an analysis of decadal (1991-2001, 2011) changes in population, spatial distribution, and social vulnerability. According to this analysis, the vulnerable and socially marginalized groups are primarily located around the delta's seaward edge. Furthermore, compared to the western and central sections, the east part of the delta seems relatively more socioeconomically vulnerable. Significant lingering effects of storm Aila in 2009, especially in the said region, are consistent with negative changes in societal vulnerability in several regions of the delta between 2001 and 2011. Due to their potential to cause significant damage and impede development, flooding and especially storm landfall continue to be serious problems for the delta. Poorer socio-economic conditions and marginalised status of tribal communities compared to non-tribals disproportionately affect their adaptive capacity, limit resettlement options and further disempower them. This has disastrous consequences for these minorities in the SBR where the impacts of fast and slow-onset environmental and climate change, limited options for livelihood diversification and protection from bio-physical hazards, and inadequate healthcare service delivery plague even non-tribal populations.

Chapter 4

LIVELIHOOD PATTERN AND MULTIDIMENSIONAL POVERTY OF THE TRIBAL COMMUNITIES IN THE STUDY AREA

4. Introduction

There is difficulty in explaining what livelihood means? ' and people would have difficulty to reply 'making a living', 'supporting a family', or 'my job'. The term is widely recognized, as humans naturally create and apply strategies to secure their survival. The hidden complexity of the term arises when governments, civil society, and external organizations try to assist individuals whose livelihoods are at risk, harmed, or destroyed. (UNDP, 2010). Livelihoods are usually determined by the access to rights and assets people have. Assets can be characterized as physical, natural, human, social, or financial. The collective or opportunity set of skills, resources, and activities required to earn a living is expected to constitute livelihoods. (Ellis et al., 2003; Chambers and Conway, 1992).

They rely on the availability of natural, physical, human, social, financial, and cultural capital (assets), the social connections people make to pool, refine, and increase their assets, and how people use and improve their capacities to act and give their lives purpose (Bebbington, 1999; Scoones, 1998).

People's livelihoods are dynamic, and they evolve and adapt to both internal and external influences. Successful livelihoods eventually convert assets into revenue, self-respect, and agency to improve living situations, all of which are necessary to reduce poverty (Sen, 1981). In order for families to maintain themselves materially, emotionally, spiritually, and socially, livelihoods entail a number of intricate variables (WRI, 2005). For millions of people who rely on forests for their livelihoods, the diminishing productivity and degradation of forest ecosystems are major concerns. Because of the effects of climate change, ecosystem services' capacity to maintain agricultural output and raise farmers' incomes and food security is becoming more and

more limited in developing nations. In particular, forest ecosystems give impoverished communities safety nets in terms of income production, food security, and the enhancement of livelihoods and well-being. Local communities' quality of life, livelihood options, and access to food would all suffer from the degradation of these ecosystem services. The deterioration of forest ecosystems has frequently resulted in recurring episodes of famine and malnutrition since many developing nations lack supportive networks for obtaining necessities of life. (WRI, 2005; Boon & Ahenkan, 2012).

4.1. Livelihood

The livelihood pattern of the 600 ST households was analysed to determine their dominant economic activities. Households were assigned a household type depending on dominant (above 50% economic activity) in the last 365 days (National Sample Survey Round 64, 2007-2008). Analysis of the survey data revealed that daily wage work was the primary occupation of 24% of the ST households while, for 32% of the ST households, the dominant occupation was work in the unorganised sector in peri-urban or urban areas through temporary or cyclical migration. This indicated a dominant departure from the prevalent perception that the delta-dwelling communities predominantly depend on agriculture and fishing for their livelihood (Mistri, 2013), revealing that 8% of the tribal households were primarily forest-dependent and mangrove ecosystem services to sustain their life and for their earnings, and 20% on farm activities like cultivation (10%) and agricultural labour (10%). This pointed to a high level of diversification of livelihoods among these communities to improve their economic condition and standard of living.

The term "livelihood diversification" describes efforts made by people and families to discover alternative means of increasing incomes and lowering environmental risk; these efforts vary greatly depending on the degree of choice (whether to diversify or not) and the outcome's reversibility (Ahmed et al., 2018; Ellis, 1998; Khatun & Roy, 2012; Roy & Basu, 2020). With or without agriculture-related earning, the surveyed ST households depended on daily wage work, forest and ecosystem collection and other marginal livelihoods.

These results (**Table 7**) were significantly different from the reported occupation pattern of the delta-dwellers as being dominantly agriculturists (Dhargupta et al.,

2009). Moreover, dependence on forest and ecosystem services did not come up as the primary livelihood strategy for the tribal households as commonly believed. One of the causes for this, as cited by many respondents, was stricter restrictions imposed by the Forest Department on entry into the protected forest area for economic activities like the collection of fuel-wood, fish, prawn, crab, etc. (Mahato & Mondal, 2019). However, the scope of MGNREGA and daily wage activities did improve post-Aila i.e., from 2011 onwards.

Table 7: Primary occupations of the surveyed ST households

Household Type (Primary Occupation contributing to the household income equal or more than 50 percent)	**Count of ST Household to Total Respondents (n=600)**	**Percentage of ST Household to Total Respondents**
Migration	195	32
Daily Wage Labour	147	24
Harvesting from Forest	51	8
Artisanal fishery	10	2
Cultivation	59	10
Agricultural labour	60	10
Small Business	28	5
Transport Services	22	4
Aquaculture	10	2
Service Sector	10	2
Fishing	4	1
Livestock	2	-
Aquaculture (Fresh Water)	2	-
Total	600	100

Source: Primary Survey, 2021

Temporary migration from the SBR can be divided into two predominant types, depending on the nature of the drivers, as indicated by interview respondents who migrate: migration induced by fast-onset climatic hazards such as cyclones and storm surges (which cause lasting damage to property and disrupt livelihoods) and migration induced by slow-onset incremental changes to the climate (which cause an incremental increase in livelihood insecurity).

The condition of agricultural landholding by ST families is grim, with the majority owning less than 0.5 hectare. According to Census data (2011), the number of agricultural labourers is highest among the tribal population in the SBR. In subsequent years, with rise in the occurrences and intensity of natural hazards (cyclones, rise in sea level, erosion, soil salinisation, and delayed monsoon) cultivation was also highly impacted. To sustain themselves in such adversities, ST households with or without landholding showed a high affinity for out-migration.

4.2. Migrant-sending households (MSHs)

44.8% of the surveyed ST households, in the absence of a more stable source of income, sent a minimum of one migrant to labour outdoors SBR (**Table 8**). Among them, 24% earned 40% to 60% of their livelihood share from remittance income while 27% earned 61% to 100%. The survey participants opined that migration remittances contributed to the well-being of the household by meeting the families' health expenses, educational expenses, expenses to modify homesteads by making them flood-proof, and even contributed towards the creation of small savings for future needs. Thus, remittances also contributed to the local economy through spending and investment in animal husbandry, backyard fishery and acquisition of household assets like electronic gadgets, motorcycles, etc.

***Table 8:* Livelihood share from migration (remittance income)**

Percentage of Total Livelihood Share from Migration	Number of ST Households (Respondent) (total = 600)	Percentage of ST Households (Respondent)
1 to 20	42	15.6
21 to 40	91	33.7
41 to 60	65	24.1
61 to 80	41	15.2
81 to 100	31	11.5
Total	270	100.0

Source: Primary Survey, 2021

4.3. Agricultural landholding

Nearly 89% of MSHs and 75.6% of NSHs were found to be landless i.e., they had no substantial agricultural landholding. 9.7% of MSHs and 22.9% of NSHs owned 1 to 3 bighas (0.10 to 0.30 hectare) of agricultural land. The BLR analysis indicated that

landholding equal to, or greater than, 0.10 hectare was one of the threshold values to determine whether a household sent at least one migrant to work in the past or might do so in the future (**Table 9**). While most ST households, whether MSH or NSH, owned less than 0.5 hectare of land, consecutive disasters like cyclones Bulbul (2019), Amphan (2020), Yaas (2021), and Asani (2022), and concomitant saline surges, which breached embankments and affected cropland made even the limited returns from agriculture uncertain. Thus, poor landholding and crop failure may have been push factors of migration from tribal households. The results then indicated that the lower the landholding of a tribal family, the greater the probability of migration.

Table 9: Agricultural landholding of migrant-sending and non-migrant-sending ST households

Agricultural Landholding (Hectare)	Percentage of Migrant-sending ST Household	Percentage of Non-Migrant-sending ST Household
Zero (Landless)	45.4	59.6
< 0.133 hectare	15.2	8.1
0.13- 0.26 hectare	24.5	21.4
0.28 – 0.40 hectare	7.1	5.4
0.41 – 0.53 hectare	3.0	2.1
0.54 – 0.67 hectare	4.5	1.5
> 0.68 hectare	0.4	1.8
Total	100.0	100.0

Landless NSHs earned a very small share of their income from agricultural labour. Their livelihoods were diversified, including non-farm-based activities like transport, small business, and daily wage work under MGNREGA. Despite their landlessness, they showed a high level of satisfaction with their in-situ coping strategies and might have also had smaller families and more income input from provisioning services of the ecosystem. However, tribal households with moderate landholding and livelihoods that, though highly diversified, were sensitive to environmental shocks, were forced to migrate. These farm and ecosystem-based income opportunities were highly impacted by climate change impacts and led to economic instability. Thus, to ensure household sustenance and wellbeing, those households opted to migrate out of the

delta, making remittances the major contributor to their household income.ST households owning more than 0.5 hectare of land could survive without migrating as they were able to generate a sustainable income from agricultural production to offset the economic implications of rapid-onset climatic hazards like cyclones and surges. MSHs with agricultural landholding above 1 hectare were rarely found, comprising a mere 3% of the surveyed ST households. The productivity of their land was affected by a multitude of climate change impacts like higher winter temperatures, delayed monsoon, irregular rainfall patterns, frequent cyclones, and sea level rise.

While high livelihood diversification among NSHs indicated (23%) successful in-situ coping, the decision to migrate or not migrate must be perceived as a complex web where social vulnerability is intensified by hazard incidence and mediated by livelihood choices and the percentage of livelihood income from the available livelihood opportunities. The relationship between these factors has been discussed in greater detail in the section on BLR analysis.

4.4. Household size

Primary data analysis indicated that the smaller the size of the ST household, the lower is the probability of migration (**Table 10**). 64.8% of NSHs had 4 or fewer members compared to 52% of MSHs with the same household size. 26% of MSHs had a substantially large household size (6 and above) while only 15% for NSHs had a similar household size. It must be noted that household size includes both able-bodied adults and dependents (children and elderly and disabled members), denoting that larger households do not necessarily have a higher share of members contributing to the household income. Moreover, women members in most households in the SBR perform significant unpaid caregiving and other household duties, which do not reflect on the household income. Migrants from MSHs were found to occupy the age range of 18 to 50 years. Naturally, a higher number of remittance-sending members contributed more towards the household income, helping them to cope/adapt to climatic changes and hazards.

Table 10: Household sizes of migrant-sending and non-migrant-sending ST households

Household size	Percentage of migrant-sending ST Household	Percentage of non-migrant-sending ST Household
< 4	19.2	34.8
4	31.8	30.3
5	23.7	19.3
6	10.7	8.4
>6	14	7.5
Total	100	100

4.5. Forest access and ecosystem dependence

Mangroves in the SBR provide the local people with numerous direct benefits in the form of 'provisioning' services. NTFPs from the mangrove forest ecosystem in the SBR constitutes the mainstay of many of the ST families. NTFPs collected from the mangrove forests include honey, fuel-wood, fishes, prawn, crabs, and shrimps. 25% of the surveyed ST households were found to be in some way dependent on these ecosystem services. Among them, households with at least one migrant member demonstrated lower forest dependence for their sustenance compared to households with no migrant member (**Table 11**). The level of mangrove ecosystem dependence was calculated based on contribution of NTFPs towards annual household income, and subsequently, categorised into three classes (Singh et al., 2010), viz., (i) High Dependence, where NTFPs contributed more than 60% to annual household income; (ii) Moderate Dependence, where NTFPs contributed 40 to 60% to annual household income; and (iii) Low Dependence, where NTFPs contributed less than 40% to annual household income. It was apparent that 100% of MSHs demonstrated low dependence on the mangrove forest ecosystem services vis-vis only 48% of NSHs (**Table 11**). Nearly 52% of NSHs demonstrated high or moderate dependence on the ecosystem

services for their sustenance. Higher dependence on ecosystem services for livelihood might have also deterred these households from migrating.

Table 11: Levels of dependence on Ecosystem services of migrant-sending and non-migrant-sending ST households

Dependence on Ecosystem services	Number of Migrant-sending ST Households Dependent on Ecosystem services	Percentage of Migrant-sending ST Households Dependent on Ecosystem services	Number of Non-migrant-sending ST Households Dependent on Ecosystem services	Percentage of non-migrant-sending ST Households Dependent on Ecosystem services
Low Dependency	63	100	41	48
Moderate Dependency	0	0	18	21
High Dependency	0	0	26	31
Total	**63**	100	**85**	100

Conversely, tribal communities without sufficient landholding to sustain the whole family, when denied access to the mangrove forest for NTFP collection, were left with no other option but to send migrants for the families' sustenance. Moreover, dominant or secondary dependence on the provisioning services of the mangrove ecosystem also contributed to heightened income insecurity by making the household vulnerable to climatic changes and hazards that affect the availability and accessibility of NTFPs, thus increasing the potential for migration from these households.

A trend can be evidenced from the primary survey, suggesting that the dependence of ST households on ecosystem services decreased with greater involvement in non-ecosystem-based work i.e., daily wage work. Marginal or no agricultural landholding as well as decreasing access to the mangrove forest ecosystem acted as important push factors for cyclical migration from the SBR as households sought to diversify their livelihoods for risk reduction. In the absence of land records, ST communities in the SBR are deprived of their forest rights, which restricts their access to NTFPs.

However, even forest dependence is not without serious risks. Landlessness and inadequate returns from daily wage work force many ST households to increasingly rely on dangerous occupations, like illegally collecting crabs, fish and honey from Protected Areas (regulated by the Indian Forest Act, 1927, 1978, 2006), where the indigenous population of tigers, poisonous snakes, and crocodiles pose serious threats to their lives. Forest dependence being stringently curbed by the Forest Department, and capture by officials entails heavy fines and even imprisonment. Loss of life in man-animal conflicts within the Reserved Forest entails no monetary compensation for the family owing to the illegitimacy of venturing into, and profiting, from reserved areas (MoEFCC, GoI).

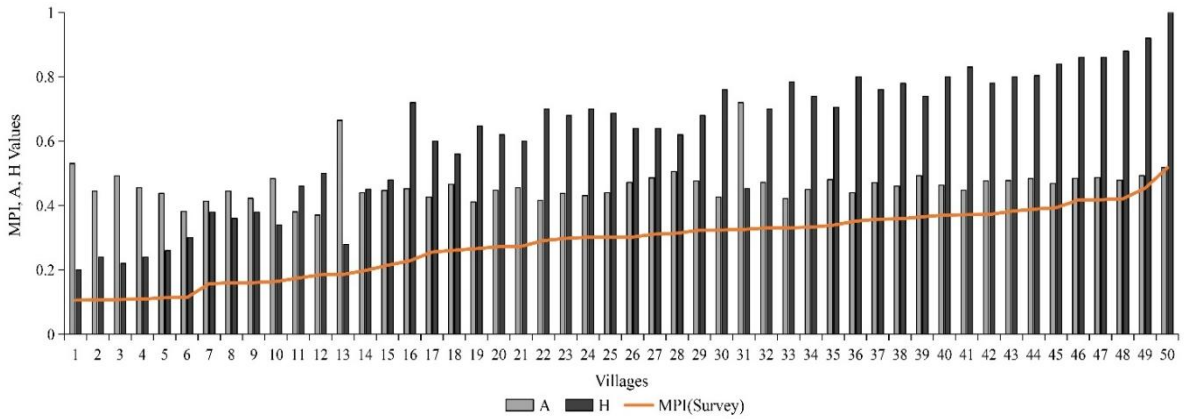
4.6. Multidimensional Poverty Index (MPI)

The representative surveyed villages have been divided into five classes according to their MPI values. The five classes are Very High (poor village; MPI values span from 0.747 to 0.906), High (poor village; MPI values range from 0.587 to 0.746), Moderate (moderately poor village; MPI values vary from 0.427 to 0.586), Low (not-so-poor village; MPI values extends from 0.267 to 0.426) and very low (not-so-poor village; MPI values falls between from 0.106 to 0.266). The MPI values of the 50 surveyed villages for the years 2011 and 2021 lie between 0.338 to 0.877 and 0.106 to 0.518 respectively. It was observed that in 2011 only 2 villages had very high MPI values. More than 50% of the villages had high MPI values that were spread throughout the study area in 2011. However, in 2021 none of the surveyed villages fell in the category of Very High and High MPI. In 2011, 18 villages across the northern and southern zones within SBR had moderate MPI values. On the other hand, only 2 villages across the northern and southern parts of the SBR had moderate MPI values in 2021. The most significant change that was observed in 2011 and 2021 is that only 2 villages had low MPI values in 2011. None of the surveyed villages fell in the category of Very Low MPI in the year 2011. Whereas, for 2021, 19 villages had very low MPI values distributed as isolated pockets. More than 58% of villages had a low MPI spread throughout the area, indicating that those villages are not so poor. This, itself signifies a considerable reduction of poverty in the area of interest.

Table 12: Improvement in MPI from 2011-2021 (in percentage)

Improvement in MPI from 2011-2021	Improvement in MPI	Number of villages	Percentage of villages
10.0 - 40.0	**Low Improvement**	15	30
40.1 - 60.0	**Medium Improvement**	19	38
60.1 - 100.0	**High Improvement**	16	32

The higher value of the headcount ratio is 1, while the lower value is 0.2. A moderate incidence of poverty was recorded in 32 villages out of the 50 villages surveyed. 18 villages showed a low value of the incidence of poverty. The villages having a high intensity of poverty, however, showed low, moderate, and high incidences of poverty. Both the moderate intensities as well as the incidence of poverty were found in 18% of the villages. On the other hand, the spatial extent of poverty through the headcount ratio was quite significant. Most of the villages had higher values of H (Figure 3b). This reflects that, although the severity of poverty is moderate in 2021, many of the villages still have a high number of poor households.



(1.Jamtala, 2. Sandelerbil, 3. Nazarnagar, 4. Boromollakhali, 5. Ramganga, 6. Kachukhali, 7. Namkhana, 8. Ambikanagar, 9. Lebukhali, 10. Satyadaspur G-Plot, 11. Khari, 12. Madhukhali, 13. Godkhali, 14. Khakurdaha, 15. Ichhapur, 16. Hatgachi, 17. Ghoradal, 18. Parandar, 19. Ganti, 20. Harekrishnapur, 21. Khulna, 22. Jhupkhali, 23. Rampur, 24. Kakdwip, 25. Jamberiabad, 26. Dwarir Jangal, 27. Pathankali, 28. Bhangatushkhali, 29. Bara Sehara, 30. Chemagari, 31. Poila Bhagbanpur, 32. Gazalia, 33. Gilarchat, 34. Baliara, 35. Maukhali- Kumarkhali, 36. Tilpi, 37. Chandipur, 38. Amadpur, 39. Kankandighi, 40. Chuprijhara, 41. Gopalnagar, 42. Banstala Boroghari, 43. Maukhali, 44. Paschim Jatar Deul, 45. Telenipara, 46. Amtali, 47. Ful Malancha, 48. Baunia Abad, 49. Manmathapur, 50. Debitala)

Figure 13: Distribution of A, H and MPI

4.7. Contribution of Indicators and Dimensions towards the village-level MPI

Under the education dimension, the deprivation ratio for school attendance was less throughout all the categories (moderate, low, and very low MPI). The villages having a moderate MPI were found to be highly deprived in the health dimension with an overall low-to-moderate deprivation in schooling and living standards. Among the benchmarks (criteria) used under health aspect, accessibility to safe drinking water showed least deprivation. Though the moderately poor villages show moderate deprivation in the aspect of living standards and education but they were particularly highly deprived of sanitation as well as cooking fuel. (**Table 13**). All the villages ranged from very low to moderate and were the least deprived of electricity.

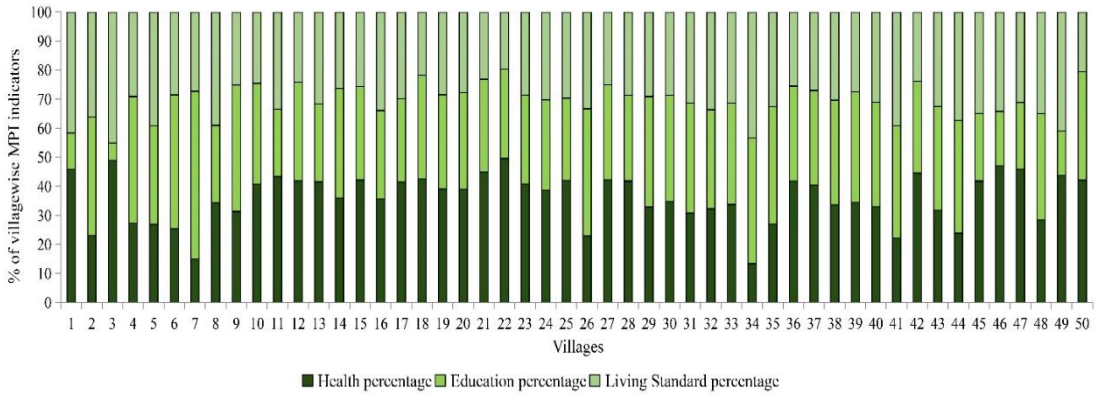
Table 13: Indicator-wise censored headcount ratio towards MPI

			MPI (2021)				
			Very Low	**Low**	**Moderate**	**High**	**Very High**
Range of censored Headcount ratio	**Health Dimension**	**Unsafe Drinking Water**	0 to 0.47	0 to 0.58	0 to 0.3	0	0
		No adequate Sanitation	0 to 0.83	0.02 to 0.96	0.68 to 0.98	0	0
		Unsafe Cooking Fuel	0.15 to 1	0.6 to 1	0.98 to 1	0	0
	Education Dimension	**School Attendance**	0 to 0.45	0 to 0.32	0 to 0.24	0	0
		Year of schooling	0.17 to 1	0.13 to 0.97	0.92 to 0.93	0	0
	Standard of	**No Electricity**	0 to 0.35	0 to 0.14	0.02 to 0.02	0	0

			MPI (2021)				
			Very Low	**Low**	**Moderate**	**High**	**Very High**
	Living Dimension	**No Separate Kitchen**	0.2 to 0.83	0.21 to 0.82	0.2 to 0.37	0	0
		Mud Floor	0.61 to 1	0.78 to 1	0.87 to 0.96	0	0
		No Asset possession	0 to 0.83	0 to 0.54	0.1 to 0.15	0	0

The scenario for the not-so-poor villages having low and very low MPI values was quite different. Poor hygiene and the use of harmful cooking fuel contributed most to MPI values. Households from low MPI villages showed very less deprivation n safe drinking water. However, there was a large diversity of variation in the censored ratio of deprived households for the indicator of the year of schooling. The absence of a separate kitchen and the presence of mud floors were found to contribute more in the low to very-low-MPI villages. The absence of electricity contributed very little to the MPI of the not-so-poor villages.

Overall, it could be understood that the presence of inadequate sanitation, use of unsafe cooking fuel, less number of years of schooling, absence of a separate kitchen, and presence of mud floor within the house contributed to the deprivation of all the villages from the five categories of MPI. Thus, multidimensional poverty is somewhat guided or controlled by deprivation in the above-mentioned indicators within a household.



Ambikanagar, 2. Jamtala, 3. Harekrishnapur, 4. Kachu khali, 5. Namkhana, 6. Baliara, 7. Ramganga, 8. Satyadaspur-Gplot, 9. Nazarnagar, 10. Telenipara, 11. Amadpur, 12. Bara Sehara, 13. Khulna, 14. Jhupkhali, 15. Pathankali, 16. Amtali, 17. Ful Malancha, 18. Parandar 19. Baunia_Abad, 20. Gazalia, 21. Dwarir Jangal, 22. Bhangatushkhali, 23. Gilarchat 24. Paschim Jatar Deul, 25. Kankandighi, 26. Khari, 27. Poila Bhagbanpur, 28. Banstala Boroghari, 29. Rampur, 30. Ghoradal, 31. Khakurdaha, 32. Tilpi, 33. Maukhali, 34. Madhukhali, 35. Ganti, 36. Maukhali-Kumarkhali, 37. Chandipur, 38. Chemagari, 39. Gopalnagar, 40. Chuprijhara, 41. Kakdwip, 42. Manmathapur, 43. Jamberiabad, 44. Ichhapur, 45. Godkhali, 46. Lebukhali, 47. Sandelerbil, 48. Boromollakhali, 49. Hatgachi, 50. Debitala

Figure 14: Contribution of Indicators towards MPI

Overall, the major contributor to the MPI is the health dimension which contributed 8% to 60% to the village-level MPI (Fig. 5). Villages like Sandelerbil, Nazarnagar, Harekrishnapur, etc. ranked poorly in the health dimension. The standard of living contributed 19.72% to 49% of the MPI among the surveyed villages. Kakdwip, Ramganga, and Satyadaspur G-Plot demonstrate higher contributions of the standard of living to the village-level MPI. Education contributed 1.22% to 42.74% to the MPI (Fig. 5). The lower limit of educational parameters also proved that, within all three major divisions, education had improved and contributed to lowering the MPI value of a village. In exception, only three villages, Khari, Kakurdaha, and Madhukhali showed the highest contribution of education to the MPI among the surveyed villages.

Primary data analysis indicated that a greater number of poor tribal households with high HDS opted for migration. Whereas, very few not-so-poor households with low

HDS opted for migration. Nearly 81% of tribal households experiencing a high level of deprivation sent minimum one family member outside SBR for work. (**Table 14**).

Table 14: Household deprivation status and Migration of the surveyed ST Households

	Migrating Household	**Non-Migrating household**
Not-so-Poor (< 0.33)	47 (19%)	79 (25%)
Poor (>0.33)	193(81%)	231 (74%)
Total (n=550)	240 (100%)	310 (100%)

This demonstrated that socioeconomic deprivation was a dominant driver of migration in the face of climatic hazards in the Delta. From all three categories of hazard-impacted zones, migration from the poor section was observed to be higher than that from the not-so-poor section.

Table 15: Relationship between Hazard, Household deprivation and Migration of the surveyed ST households

Hazard category	Household Deprivation score	Migrant sending household (%)	Non-migrant sending household (%)
High Hazard	Not so poor	37.2	62.8
High Hazard	Poor	60.1	39.9
Moderate Hazard	Not so poor	18.0	82
Moderate Hazard	Poor	33.8	66.2
Low Hazard	Not so poor	20.0	80.0
Low Hazard	Poor	24.2	75.8

4.8. Discussion

Policymakers can learn how these deprivations change over time by using the MPI, which highlights overlapping deprivations across and within groups in various regions.

There was little variation over the whole poverty intensity spectrum. The incidence and severity of poverty were found to be correlated, and while the severity of poverty had declined, the majority of the villages still had a significant proportion of impoverished households. The MPI of the SBR in 2021 was significantly impacted by the indicators for each dimension. The deprivation of all the villages under the five categories of MPI is caused by poor sanitation, the use of unsafe cooking fuel, the smaller number of years of schooling, the absence of a separate kitchen, and the presence of mud floors in the house. Lastly, it can be said that the enaction of numerous government initiatives and programs aimed at achieving the SDGs and emphasizing diverse facets of society should be credited with this positive shift. None of the surveyed households faced starvation or partial starvation because of the implementation of different government schemes for the free distribution of cereals (rice, wheat, etc.) through PDS and mid-day meals for school-going children.

The Public Distribution Schemes (PDS) are strongly active in Sundarbans. 99.76% of households are ration cardholders. The PDS scheme in West Bengal is further regenerated as the ‘Khadya Sathi’ scheme. The Khadya Sathi Scheme has also been

introduced to make sure that the underprivileged can purchase the food items they want (Department of Food & Supplies Government of West Bengal). Giving subsidies to those who are below the poverty line is one of the Scheme's objectives. Under this scheme, five types of ration cards are allocated according to people's income levels.. AAY, SPHH, and PHH cards are given to the people as per the National Food Security Act. On the other hand, RKSY 1 and 2 cards are given to the people as per the State food security scheme (Department of Food & Supplies Government of West Bengal). Most of the households (49.62%) are SPHH (State Priority Households) cardholders. The percentage share for the PHH ration card is 23.14%. Both cards fall under the BPL (Below Poverty Level) category that has assured food security to the backward and economically poor section. There are also RKSY 1 (15.03%) and 2 (4.17%) cardholders who receive a monthly allowance of 2kg rice/ head/family and 3 kg wheat/head/family. As for RKSY 2 cardholders, they receive 1 kg rice and wheat with a price of Rs. 9 and 13 respectively. The percentage share for AAY (Antyodya Anna Yojana) is little (7.79%) it ensures that the poverty level is decreasing as AAY Cards are for persons who cannot eat 2 meals every day in a consistent manner year-round.

One such significant government involvement in the rural labor market is the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), which was implemented in 2005, nearly five years after economic liberalization. The primary goals of MGNREGA are to create long-lasting assets to bolster the rural livelihood resource base and to give rural households 100 days of guaranteed employment annually on a demand basis. Empirical studies show inconsistent results in terms of creating jobs and the longevity and use of the assets produced (Sarkar et al., 2011; Sarkhel 2013; Dey 2016).

According to a study, 47 percent of the households of West Bengal participated in MGNREGA in the year 2013-14 (Sarkar et al., 2011). Following 2008, for specifically Bengal, there is a huge jump in the year 2011-12 in the beneficiaries of MGNREGA particularly for South and North 24 Parganas in West Bengal, there has been a rise and fall in employment availability through MGNREGA from the year 2007-2008 to 2013-2014 (Sarkar et al., 2011; Sarkhel, 2013). The Mahatma Gandhi Rural Development Act (MNREGA) is present in Sundarban but only 32.4% of residents among the present surveyed villages get benefitted from it. Therefore, it can be concluded that MNREGA is helping to uplift the poverty condition of the people in

Sundarban. But on the contrary, many of the respondents complained about this scheme for not getting paid properly after work or delayed payment. The micro-credit schemes of West Bengal were active since 2010. The observation of this study reveals that only 22.02% of households took the benefits of SHGs. It depends on people's needs, awareness, and ability to pay back the loan they have taken from SHGs. It can be stated that they are indirectly contributing to reducing the MPI of Sundarbans in 2021. However, it needs to be more spread out among households so that more people can get the facilities.

School dropout has gradually decreased with time due to several government initiatives and schemes. Apart from the mid-day meal at school the most beneficial scheme for the improvement of education is SC/ST scholarship and Kanyashree. Additionally, the Swami Vivekananda Scholarship provides scholarships at different levels of higher studies.

4.9. Conclusion

From the present study, after analysing the multi-dimensional poverty in Sundarbans, it can be concluded that it has reduced from 2011 to 2021. However, the rate of reduction varies from village to village. Apart from the availability of free cereals through PDS, the major contributing factors that help to improve poverty conditions are the availability of pure water for drinking purposes and electricity to most households. But lack of proper sanitation, proper houses, and use of fuel-wood to a large extent by the people as the primary cooking fuel contributes to poor performance in the health dimension of MPI. Years of schooling played an active role in the multidimensional poverty alleviation in the SBR. Several government policies have been operative in the study area, but there is a gap between their modes and tempo of implementation and their targeted beneficiaries. However, this gap can be reduced if policymakers consider village-level MPI as a guiding factor while implementing new policies. For a better assessment of the condition of poverty in the SBR, all of the 1032 villages in the biosphere region need to be considered in the future.

In terms of the severity and prevalence of poverty, the inhabitants in the Indian SBR eco-region are still impoverished. The implementation of government initiatives to regularly fulfill SDG objectives 1, 2, 3, 4, 5, and 6 has allowed for a significant decrease in poverty during the past ten years. This study's evaluation of MPI aims to

support both the achievement of the SDGs and the effectiveness of the current sub-district plans.

The livelihood pattern of tribal households in the SBR is dominantly non-agrarian, which contrasts with the agrarian livelihood pattern prevalent for the rest of the islanders. Landlessness condition for the tribal islanders is responsible for their strong reliance on casual manual labour and agricultural labour, which provide meagre compensation. Tribal communities in the SBR are additionally dependent on the mangrove ecosystem for their livelihood (Bandyopadhyay & Guha, 2016). In the present analysis, primary survey data indicate that around 31% of the surveyed tribal population is dependent on the ecosystem services of the forest in some way. However, a decline in mangrove forest cover and ecosystem goods like timber, fruits, honey, crab, fish, and molluscs in the SBR (Samanta et al., 2021) resulted in the assimilation of dominant socioeconomic practices of non-tribals, like agriculture, fishing, and aquaculture, for instance, by ST communities for their sustenance, leading to a loss of cultural identity. In addition, stringent forest regulation and the risk of man-animal conflict induce them to reduce their dependence on the mangrove forest ecosystem in favour of remittance income from migration. A trend can be evidenced from the primary survey, suggesting that the dependence of ST households on ecosystem services is lower with greater involvement in non-ecosystem-based labour, viz., daily wage work. Marginal or no agricultural landholding, as well as decreasing access to the mangrove forest ecosystem, act as important push factors for migration from the SBR, as diversification of their livelihood for risk reduction. While a sizeable section of the tribal population in the SBR now send at least one migrant from each household, NSHs are predominantly dependent on daily wage work in different non-farm activities like work under the MGNREGA, in brick kilns, aquaculture farms, industries or masonry within the SBR or in emerging urban centres in the Delta.

The historic shift from a predominantly forest-dependent livelihood of the dominantly Munda-Oraon community to increased reliance on settled agriculture as well as relocation to the Delta led to a gradual loss of tribal identity, customs, and languages. Being in touch with tribal traditions, including the worship of nature, and art, music, performance, and practices that encourage sustainable management of natural resources and environmental risks – such as promoting Joint Forest Management and issuing carbon credits to these communities, is central to effective and holistic in-situ

adaptation of tribal communities. It has been observed, for instance, that cultural revival within the Santhali tribal community in hazard-prone areas of West Bengal, and the introduction of Santhali language training up to the postgraduate level, has significantly improved the socioeconomic status and climate resilience of this community. Such facilities are, however, unavailable for the dominantly Mundari tribes of the SBR.

Tribal communities in the SBR live outside Scheduled Areas, which restricts their access to NTFPs. Poverty, landlessness, and inadequate returns from livelihoods force many to sneak into the protected mangrove forest areas (regulated by the Indian Forest Act, 1927 and 1978), and risk their lives in man-animal conflict. Forest-gathering is recently also being discouraged by the Forest Department, with heavy fines and even imprisonment for violation. The absence of forest rights of ST communities in the SBR also contributes to cyclical migration.

Other major lacunae in policymaking and policy implementation also contribute to the lack of improvement in the socioeconomic conditions – which are worsened by increasing hazard frequency and intensity – of tribal communities in the SBR. While healthcare infrastructure and water, sanitation, and health (WaSH) facilities in the SBR are weak, certain specialised and culturally-sensitive educational support for STs, such as the EMRS scheme remains inaccessible to these communities as it is applicable only for administrative blocks with at least 50% and 20,000 tribal inhabitants, which cannot be applied in the SBR where tribal hamlets are sporadically distributed. This contributes to the burgeoning social inequality and social vulnerability of ST communities' vis-à-vis non-ST communities in the SBR. Systematic redesigning of such policies and removing bottlenecks in implementation are key to delivering the best safeguards available with the government to these vulnerable tribal communities in the SBR and in other hazard-prone areas within India. National as well as international NGOs have an important responsibility in advocating for such measures, and in handholding the communities in non-farm skills training, climate-resilient farming practices like natural farming and nutrition gardening with indigenous seeds and water harvesting, and improving access to relevant government provisions and safe migration practices through information hubs.

Chapter 5

Drivers of migration of Tribal communities in the study area

5. Introduction

Migration is one of the major concerns from the global to local scales. IOM (International Organization for Migration Glossary, 2011) defined

Migration can include any type of movement of people of any length, composition, and cause, including economic migrants, displaced people, and people moving for other reasons, such as family reunification. Migration is defined as the movement of an individual or a group of people across an international border or within a state.

Eisenstadt (1953)

Migration is the physical movement of a person or group of people from one society to another, leaving behind the entire social life of the previous residential area and establishing a new social life in the new or subsequent area where they have chosen to live (Eisenstadt, 1953; Ibiloye, 2011).

Lee (1966) describes migration as a permanent or semi-permanent change of residence, where each act of migration consists of an origin, a destination, and a series of barriers that must be overcome along the way, regardless of how short or lengthy, simple or complex, the migration is. Additionally, he lists four migration-related elements that influence migration decisions and procedures, as follows:

1. Factors associated at origin
2. Factors associated at destination
3. Intervening obstacles
4. Personal factors

Trewartha (1969) defines migration as a short-distance movement that leads to a change in permanent residence, specifically leaving out other forms of human mobility such as daily commuters, seasonal migrants, tourists, and pastoral nomads. (Trewartha, 1969; Graham, 2004).

On a broader aspect Demko et al. (1970), includes a variety of elements in their typology to define migration, including the shift in residence, the commute to work, boundary kinds, and many more.

The United Nation (United Nation, 1970) defined,

Non-migrants are those who were counted in their birthplace, while migrants are those who were counted in a location other than their birthplace. They also suggested migration as a planned length of time, where a person who enters the country for work and receives compensation from domestic sources stays for more than a year as a permanent migrant and for less than a year as a temporary migrant.

Zelinsky (1971), the famous researcher of population and migration, also propounded the theory of migration as Mobility Transition Model. He proposed that the changes in migration behaviour have been similar or paralleled by the five stages of the Demographic Transition Model at four different scales:

1. International
2. Regional
3. Rural to Urban
4. Urban to Urban including intra-urban

Goldscheider (1971) defines migration as any permanent change in residence that involves separating activities from one location and relocating them to another. Darsky (1978) describes migration as a movement of people, either permanent or temporary, from one territorial unit to another. Mishra (1981) explains migration as the flow of people into and out of a specific region for permanent or semi-permanent settlement. Ross (1982) characterizes migration as geographic mobility that involves a change in residence across defined political, statistical, or geographic boundaries, considering both duration and purpose. Shrivastava (1983) sees migration as a departure from a place for a permanent or extended period, beyond a nearby location, with a migrant being someone who no longer resides in their birthplace. Newman and Matzke (1984) reviewed various definitions, noting that most focus on permanent or semi-permanent residence changes, distinguishing migration from circulation, which does not involve a change in residence and includes activities like daily commuting, shopping, or vacations. Population mobility encompasses both migration and circulation, as defined by Newman and Matzke (1984).

In his multifaceted perspective, Ghosh (1985) views migration as a long-term shift in residence that frequently involves crossing a political boundary, albeit he makes no explicit reference of how long a person must stay in a new place, whether permanently or temporarily. According to Weeks (1986) and Goldscheider (1971), the act of relocating and shifting the entirety of social activity from one location to another can be regarded as migration. In 1990, Rubenstein and Bacon made a distinction between migration and the more broad word "mobility."

They define migration as the permanent relocation of individuals to a new location, which could be anywhere in the same country or another. According to Johnston (1994), migration is the permanent or semi-permanent relocation of an individual or group of individuals inside a boundary of some kind, followed by a specific period of time spent in a new place of residence.

Chandna (1998) defined migration as a movement including a permanent or semi-permanent shift of residence from one settlement to another, taking into account physical distance and residential change. He stated that it is challenging to conceive migration because it involves a social and physical transaction. Residential shift, travel distance, birthplace, kind of border crossed, planned to remain, and duration of stay in a new location are common factors among different definitions of migration, according to Sinha (2005). He also comes to the conclusion that the concept of migration is still ambiguous because there are now no widely recognized standard criteria for defining it.

5.1.Characteristics

Lee (1966) characterized migration into seven ways; *1. Migration is selective*; which means migration is a non- random sample of the population at the base. Instead, it involves sets of positive and negative causes or drivers at origin as well as at the place of arrival which have capacities to navigate the obstacles in between. *2. People migrating due to pull factors are positively selected towards the place of destination;* which describe that there is some advantage in destination and disadvantage in origin leading people to choose the better opportunities at the destination. *3. Migrants reacting majorly to negative pull factors at the native place are selected due to negative reasons;* where the push factors act on the whole population but they act in a differentiate manner. *4. Overall, the J-shaped or U-shaped curve of the continuum*

ranging represents the characteristic that is either occupational class or education. Migrant selection is typically bimodal. 5. The strength of positive selection grows with the complexity of the obstructive barrier. 6. Certain life stages increase the likelihood of migration, which is significant when choosing migrants. The marital status of the female also encourages the migration of specific age group. *7. A paradox of migration is that the movement of people may tend to lower the quality of the population, as expressed in terms of a particular characteristic, at both origin and destination. The characteristics of migrants are typically intermediate between those of the population at origin and the population at destination.*

Ravenstein (1885 and 1889) illustrated migration in his theory of the "laws of migration", which summarized the characterization of migration in a simple way: *1. Short-distance migration is most common:* Majorly migrants prefer to travel short distance and neighbouring areas are most preferred for displacement. Long distance migration happens for specific reasons like affinity to large centres of financial importance for a specialised job, technical or adventure etc. which is not locally available. The whole family rarely moves over a long distance. *2. Migration progress in a series of steps;* For example, when a town experiences rapid growth, the surrounding people gather to the town and then people from interior place fill the gaps in these places. *3. Rural people migrate more than urban people;* Migration from rural areas is more common than from urban areas. *4. Men tend to migrate longer distances than women;* While males are more likely to move far from their origin, females typically migrate shorter distances. *5. Every migration flow generates a counter-flow;* for every migration current has compensating counter currents. *6. Migration typically flows from agricultural to industrial regions;* the incidence of migration increases due to expansion of improved and expanded trading and infrastructural facility. *7. The direction of migration mainly happens from agrarian scenario to non-agrarian regions. 8. Economic factors are the major cause of migration.*

5.2. Types of Migration

Typologies are helpful in comprehending the various aspects of migration. Economic migrants, environmental migrants, refugees, seasonal migrants, temporary migrants, rural-urban migrants, and internal migrants are only a few of the many types of migration that are utilized in academic literature, politics, and the media, according to

Kallio (2016). These typologies were separated into three groups by her: 1) temporal migrant types, 2) spatial migrant types, and 3) descriptive migrant types. While temporal migrant types are based on the length of time that migrants dwell in their destination places, descriptive migrant types are based on a variety of migration reasons. Finally, spatial migrant types classify migrants according to their origin and destination areas.

Table 16: Types of human migration

Types	Definition
Descriptive migrant types	
Conservation refugees	Forced to leave their habitual homes due to the establishment of protected areas
Economic migrants	Leave their areas of origin in order to improve their quality of life, typically through employment; these include temporary labour migrants, highly skilled migrants and illegal immigrants
Environmental migrants, also environmental refugees	Obliged to leave their habitual homes due to rapid or slow changes in the environment that adversely affect their lives or living conditions
Family reunification migrants	Migrate to regroup with their family in an area other than that of their origin
Internally displaced persons	Forced or obliged to leave their homes typically due to armed conflict, situations of violence human rights violations, natural or man-made disasters but do not cross

Types	Definition
	an internationally recognized state border
Return migrants	Return to their areas of origin after a period away
Seasonal migrants	Move regularly according to the seasons in search for opportunities such as labour, education or production opportunities
Transient migrants	Do not have a fixed place of usual residence; these include nomads and wanderers
Refugees and asylum seekers	Forced or obliged to leave their homes typically due to armed conflict, situations of violence human rights violations, natural or man-made disasters crossing an internationally recognized state border
Temporal migrant types	
Circulation	Refers to a variety of short-term, repetitive or cyclical movements of human populations such as seasonal or transient migration; lacking the intention of permanent or long-lasting change in residence
Long-term migrants	Change their residence for a longer period of time; usually defined as a period of 12 months or more

Types	Definition
Temporary migrants	Move for short periods of time, not changing their primary residence
Spatial migrant types	
Internal migrants	Move from one area to another within an internationally recognized state border
International migrants	Move from one area to another crossing an internationally recognized state border
Rural-urban migrants	Move from rural to urban areas
Rural-rural migrants	Move from rural-to-rural areas
Urban-rural migrants	Move from urban to rural areas
Urban-urban migrants	Move from urban-to-urban areas

Source: Oglethorpe et al. 2007; Castles, 2000; Zelinsky, 1971; Kallio, 2016

5.3. Theories of Migration

There are multiple theories of migration observed from the late 18th century.

The economic and social facets of migration are the primary emphasis of these ideas. An outline of the main types of theories about human migration is provided by Kallio (2016). She separated these theories into the following five groups: 1) Functional theories: these comprise the post-industrial neoclassical theories that contend that economic incentives and unequal opportunities drove migration; 2) Historical-structural theories: these are the theories that challenged the functional theories during the globalization era. They contend that because capitalism countries use political and economic structures to impose structural forces that influence migration, migrants have little control over their decisions. 3) theories on migration networks, 4) theories of migration systems, and 5) theories of migration transition.

The study's most pertinent hypothesis is Lee's (1966) "Push-Pull" theory, which is especially important to this thesis. Every place has both positive and negative aspects, according to Lee, with the former drawing people from other places and the latter repelling them. Lee adds that there is always a component of ignorance and uncertainty about how migrants would react in the new location. According to him, the distinction between origin and destination is comparable to a stage in a person's life cycle. Individual differences in inherent inertia and intervening obstacles determine the ultimate decision to move (Lee, 1966; Willekens, 1978).

Furthermore, a person does not necessarily decide to migrate on their own. The family, not the wife and kids, decides whether or not to move. Lee develops a series of theories on the number of migrants, as well as their streams and counter-streams. The following is the hypothesis that Lee (1966) put forth: 1. The variety of a chosen region differs from the volume of migration within that region. 2. The diversity of the population in that area determines the volume of migration. 3. The complexity of overcoming the intervening hurdles is correlated with the amount of migration; the more obstacles that need to be overcome, the lower the volume of migration. 4. The volume of migration is impacted by economic fluctuations. 5. In the absence of strict controls, both the volume and the rate of migration tend to rise with time. 6. The amount of migration fluctuates according to the nation's or the region's level of development.

5.4. Generic Drivers

Migration is a complex process guided by various factors, affecting the decision to stay or leave. Black et al. (2011), Foresight (2011) and UE report (Science for Environment Policy, 2015) proposed a framework to identify the drives of migration which affect the decision: economic, political, social, demographic, and environmental. These drivers defined as;

- *economic:* the employment opportunities cost of living and income
- *social:* educational opportunities or obligation to kin,
- *political:* discrimination or persecution, conflict, levels of security and policy incentives,

- *demographic:* density of population, and structure and risk of disease, and
- *environmental:* natural hazards, loss in productivity and habitability.

In every geographical measure of population change, migration is as important as fertility and mortality (Bilsborrow, 2002). According to the International Organization for Migration (2013), migration is the movement of people within a state or across international borders. This movement involves refugees, displaced people, economic migrants, and those traveling for other reasons, like family reunification. It also includes any type of migration, regardless of its duration, makeup, or causes. According to the International Organization for Migration (2013), there were an estimated 28 million internal migrants worldwide in 2018.

Both the location of origin and the destination have an impact on the reasons behind migration. Factors that either promote (allow) or reject (neither support nor oppose) migration are characteristics of both the origin and the destination. Pull factors are the positive aspects of a place that draw people in. The push factors that motivate someone to relocate are the unfavourable characteristics present at a place (Lee, 1966; Bansal et al., 2005; Moon, 1995). Some people migrate because they have to, but many people travel deliberately.

As of June 2018, the UNHCR estimates that there are over 68.5 million people who have been forcibly displaced, including over 40 million internally displaced people, over 25.4 million refugees, and 3.1 million asylum seekers (Warner et al., 2009). Of them, more people are displaced by natural disasters than by conflict and violence. 10.8 million people were displaced by conflict and violence at the end of 2018, whereas 17.2 million people were affected by catastrophes (Internal Displacement Monitoring Center, 2018).

Over the past 20 years, the frequency of weather-related disasters, including storms, hurricanes, floods, heat waves, and droughts, has more than doubled. Almost 90 million people need emergency aid as a result of the more than 400 weather-related disasters that occur each year; estimates indicate that number might reach 350 million by 2030 (Global Humanitarian Forum, 2009). In addition to conflict and violence, environmental degradation, including climate change, natural catastrophes, and persistent poverty are posing a threat to the lives of millions of people. In summary, the goal of this review is to determine how migration and environmental issues, both

short-term and long-term, are related. It demonstrates how climate change and environmental deterioration significantly contribute to the human migration.

The concept of environmental migration is relatively new, but several studies show that a significant number of people are already being displaced due to environmental disruptions. As early as 1985, EL Hinnawi (El-Hinnawi, 1985) defined “environmental refugees” as individuals forced to leave their homes, either temporarily or permanently, due to environmental hazards. In 1994, Hutton introduced the term "climate refugee" for the first time. However, the terms "environmental" or "climate refugee" are not globally accepted. For instance, the 1951 UNHCR convention did not recognize environmental factors as a cause for migration (Office of the United Nations High Commissioner for Refugees, 1979). In the absence of international agreement, the International Organization for Migration (IOM) has proposed a working definition of "environmental migrants." This definition refers to individuals or groups who are compelled to leave their habitual homes, either temporarily or permanently, due to sudden or gradual environmental changes that negatively impact their lives or living conditions. These individuals may move within their country or abroad (Laczko & Aghazarm, 2009). The definition encompasses those displaced by natural disasters and those who choose to migrate due to worsening environmental conditions.

Globally, people are being displaced on a vast scale due to the effects of climate change. The immediate human cost was addressed by natural disasters and gradual environmental changes, such as the climate refugees and migrants brought on by climate change. Many residents of coastal regions and small islands have been and will soon be forcibly migrating because the most vulnerable groups in developing nations are poor due to poor adaptive capacity, which includes high levels of poverty, a lack of education, health care, and sustainable livelihood. According to the Internal Displacement Monitoring Center in Geneva, there were 19.3 million displaced people worldwide in 2014; by 2050, that number might rise to one billion.

As the largest nation in the region, India is the destination for migrants displaced by floods, storm surges, salt water intrusion, droughts, earthquakes, cyclones, and sea level rise. The geographically diverse Indian subcontinent is especially vulnerable to a wide range of natural disasters. Furthermore, these migrating groups are more

vulnerable than only the actual danger of the calamity. Additionally, there are cultural, social, and economic repercussions that necessitate more comprehensive adaptation plans and efficient management practices.

5.5. Conceptual Connections among Migration, Adaptation, and Climate Change

Across spatiotemporal scales, migration is a crucial livelihood strategy that might involve anything from short-term displacement to long-term relocation (Hugo, 1996). Depending on their contextual location, demographic makeup, and socioeconomic and cultural traits, individuals and households react differently to the many drivers of migration (Black et al., 2011). According to early studies, the goal of maximizing personal gain and minimizing household income loss as a result of crop failure, market instability, or economic downturns drove migration decisions (Stark & Bloom, 1985). More recent research, however, has refined this model, emphasizing that household capabilities (such as composition, education, and social networks), assets, individual goals, and outside variables like increased climate variability, employment opportunities, and town accessibility all interact intricately to influence migration decisions (Chapagain & Gentle, 2015; Dallmann & Millock, 2017; Patel & Giri, 2019; Singh & Basu, 2020; Tacoli, 2009).

South Asia's current migration patterns continue to point to the predominance of economic considerations in migration. The relationship between population movement and the degree of exposure to and impact of hazards on livelihoods has been examined in research on migration related to environmental drivers. This research has shown how migration decisions and outcomes differ among households and communities (Gray & Mueller, 2012; Hunter et al., 2015; Martin et al., 2014). Beyond direct causative variables like sudden disasters that result in displacement, this empirical work has made great progress in understanding the relationship between migration and climate change. It is acknowledged that migration linked to slow environmental changes over time is a complex process that is difficult to separate. Economic, social, and political developments can coexist with slow-onset events, making it challenging to assign migration solely to climate change (Mortreux & Barnett, 2009).

As the effects of climate change gain broader recognition, researchers are increasingly exploring how migration can be a strategy for adapting to climate change (Adger et al., 2013; Singh & Basu, 2020; Upadhyay et al., 2015), regardless of the original reasons for migration. In the context of climate change, adaptation is defined as the process of adjusting to actual or anticipated climate changes and their effects, aiming to reduce harm or take advantage of beneficial opportunities (Pachauri et al., 2014). Adaptation can be either autonomous or planned. Autonomous adaptation refers to "natural or spontaneous adjustments to a changing climate" (Carter et al., 1994), while planned adaptation involves deliberate intervention (Fankhauser et al., 1999). The IPCC's Fifth Assessment Report emphasizes that migration can reduce the vulnerability of populations exposed to extreme events and long-term climate change (Adger et al., 2014). Migration is often seen as an effective adaptation strategy, such as spreading risk and diversifying incomes (Gemenne & Blocher, 2017; Tacoli, 2011; Warner & Afifi, 2013). Conversely, it has been described as a failure to adapt when populations are unable to respond to risks and migrate as a last resort (Adger et al., 2014). Between these two extremes, there are perspectives suggesting that migration can be a form of adaptation in certain circumstances and for particular individuals, while for others, it represents a failure to adapt (Dandy et al., 2019; Singh & Basu, 2020; Singh et al., 2019; Warner, 2009). In vulnerable environments, migration is a common response to both slow- and rapid-onset events (Nawrotzki et al., 2013; Warner & Afifi, 2013). According to Gemenne and Blocher (2017), there are three different ways that migration might impact adaptation: for the migrants themselves, the community of origin, the community of destination, and the communities of origin and destination combined. Our research centres on the perspective of migrants, looking at their traits as well as the social and cultural elements that influence migration. Remittances are the main way that migration can help households adjust; it can also disperse risk, diversify income sources to lessen vulnerabilities, and improve individuals' and households' current resource bases. (Gemenne & Blocher, 2017; Tacoli, 2011; Warner & Afifi, 2013). Emerging research suggests that remittances, along with skill acquisition and transfer, play a crucial role in household adaptation (Afifi et al., 2016; Mortreux & Barnett, 2009).

Migration and the remittances that follow can help households in vulnerable areas become more adapted, particularly when adaptation techniques call for financial

investment (Karanja Ng'ang'a et al., 2016). Additionally, research suggests that migration may improve a household's resilience to shocks (Gioli et al., 2014; Tebboth et al., 2019).

5.6. Result and Discussion

5.6.1. Climatic hazards and migration

The 36 surveyed villages have a varied tribal population, which is reflected in the sampled household data. **Table 17** presents the hazard rankings obtained from the village-level hazard index map (**Figure 15**) of the surveyed tribal villages as well as the numbers of MSHs and NSHs in each village recorded from the primary survey. An interesting correlation between multi-hazard incidence in the village and the number of MSHs was observed. Out of the 16 villages with high hazard incidence, 11 villages have a higher number of MSHs than NSHs. The value for Pearson's correlation coefficient between the multi-hazard index value of the village and the number of MSHs of the same village was 0.550. (

Table 18).

Table 17: Surveyed villages with their multi-hazard rank and migration

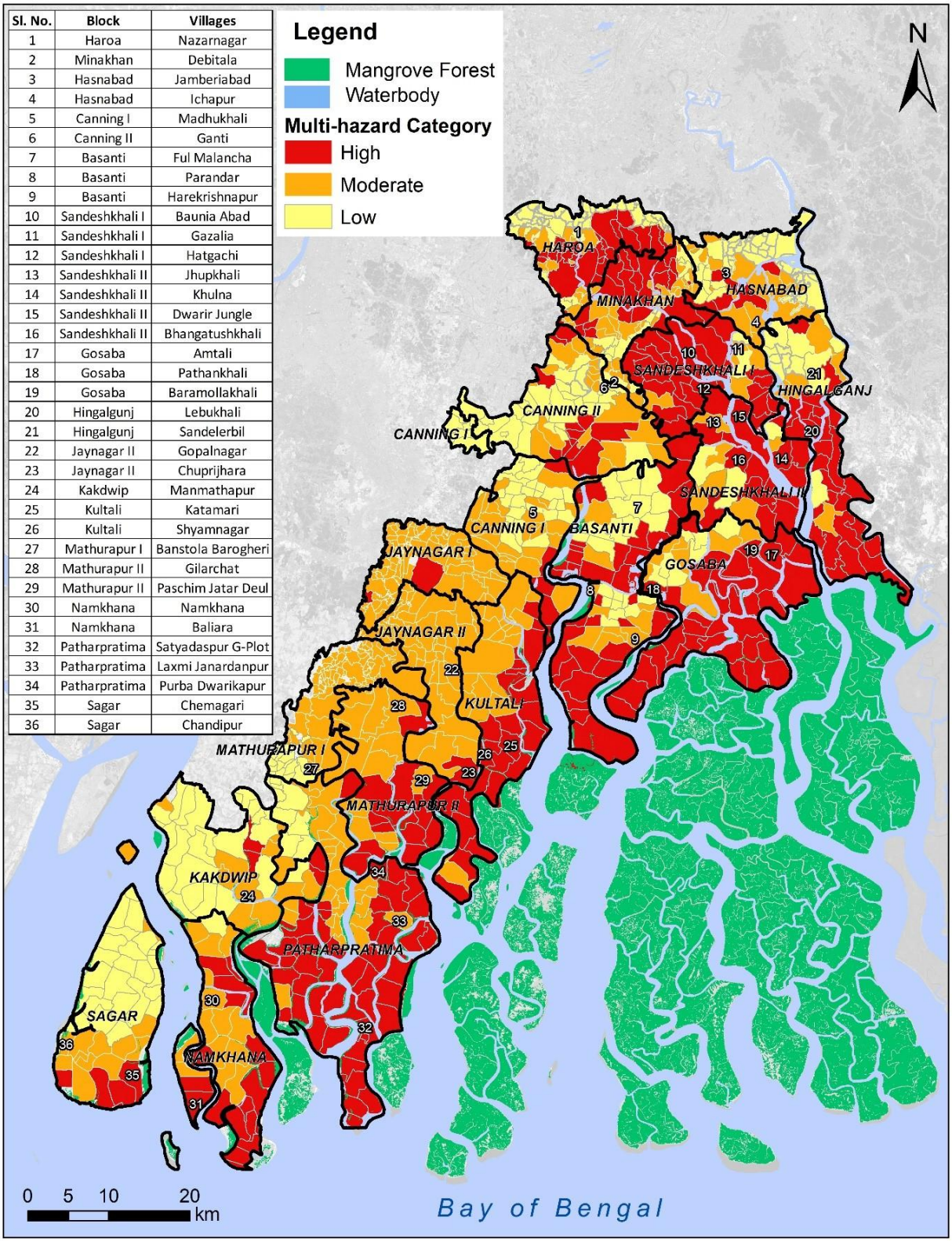
Sl. No.	Block	Villages	Hazard	Migrant-sending ST Households (nos.)	Non-migrant-sending ST Households (nos.)
1	Haroa	Nazarnagar	Low	0	1
2	Minakhan	Debitala	Low	1	5
3	Hasnabad	Jamberiabad	Moderate	0	3
4	Hasnabad	Ichapur	Moderate	1	1
5	Canning I	Madhukhali	Moderate	1	4
6	Canning II	Ganti	Low	1	2
7	Basanti	Ful Malancha	Low	4	21
8	Basanti	Parandar	Moderate	5	6
9	Basanti	Harekrishnapur	Moderate	1	2
10	Sandeshkhali I	Baunia Abad	High	2	22
11	Sandeshkhali I	Gazalia	Moderate	2	22
12	Sandeshkhali I	Hatgachi	High	9	4
13	Sandeshkhali II	Jhupkhali	Moderate	6	6
14	Sandeshkhali II	Khulna	High	13	1
15	Sandeshkhali II	Dwarir Jungle	High	10	9
16	Sandeshkhali II	Bhangatushkhali	High	11	9
17	Gosaba	Amtali	High	11	9
18	Gosaba	Pathankhali	High	16	12
19	Gosaba	Baramollakhali	High	6	4
20	Hingalgunj	Lebukhali	High	6	30
21	Hingalgunj	Sandelerbil	Low	3	1
22	Jaynagar II	Gopalnagar	Moderate	1	1
23	Jaynagar II	Chuprijhara	High	0	2
24	Kakdwip	Manmathapur	Moderate	3	8
25	Kultali	Katamari	High	32	12
26	Kultali	Shyamnagar	High	37	9
27	Mathurapur I	Banstola Barogheri	Moderate	5	17
28	Mathurapur II	Gilarchat	Moderate	4	12
29	Mathurapur II	Paschim Jatar Deul	Moderate	4	17
30	Namkhana	Namkhana	Moderate	10	20
31	Namkhana	Baliara	High	16	11
32	Patharpratima	Satyadaspur G-Plot	High	2	9
33	Patharpratima	Laxmi Janardanpur	Moderate	9	11

34	Patharpratima	Purba Dwarikapur	High	19	11
35	Sagar	Chemagari	High	0	7
36	Sagar	Chandipur	Moderate	1	6

Table 18: Correlation between Hazard index and Migration

Multi hazard index	Pearson Correlation	1	.550
	Sig. (1-tailed)		.000
	N	36	36
Migrant-sending ST Households (nos.)	Pearson Correlation	.550	1
	Sig. (1-tailed)	.000	
	N	36	36

Figure 15: Multi-hazard Index Map



Sl. No.	Block	Villages
1	Haroa	Nazarnagar
2	Minakhan	Debitala
3	Hasnabad	Jamberiabad
4	Hasnabad	Ichapur
5	Canning I	Madhukhali
6	Canning II	Ganti
7	Basanti	Ful Malancha
8	Basanti	Parandar
9	Basanti	Harekrishnapur
10	Sandeshkhali I	Baunia Abad
11	Sandeshkhali I	Gazalia
12	Sandeshkhali I	Hatgachi
13	Sandeshkhali II	Jhupkhali
14	Sandeshkhali II	Khulna
15	Sandeshkhali II	Dwarir Jungle
16	Sandeshkhali II	Bhangatushkhali
17	Gosaba	Amtali
18	Gosaba	Pathankhali
19	Gosaba	Baramollakhali
20	Hingalgunj	Lebukhali
21	Hingalgunj	Sandelerbil
22	Jaynagar II	Gopalnagar
23	Jaynagar II	Chuprijhara
24	Kakdwip	Manmathapur
25	Kultali	Katamari
26	Kultali	Shyamnagar
27	Mathurapur I	Banstola Barogheri
28	Mathurapur II	Gilarchat
29	Mathurapur II	Paschim Jatar Deul
30	Namkhana	Namkhana
31	Namkhana	Baliara
32	Patharpratima	Satyadaspur G-Plot
33	Patharpratima	Laxmi Janardanpur
34	Patharpratima	Purba Dwarikapur
35	Sagar	Chemagari
36	Sagar	Chandipur

However, exceptions to this simple relationship between hazard and migration were observed in the villages that are situated in more urbanised CDBs like Canning I, Canning II, Jaynagar II, and Sagar, which have good connectivity to urban centres and/or greater proximity to non-farm livelihood opportunities (e.g., religious tourism in Sagar). A very exceptional case is the remote Satyadaspur village in Patharpratima CDB, where MSHs is less than that of NSHs despite high multi-hazard incidence. This may be due to the high percentage of forest ecosystem dependence of the Lodha-Sabar community (a group identified as "particularly vulnerable tribal group or PVTG" by the Government of India), which inhabits this village. The hunter-gatherer Lodha-Sabars of Satyadaspur are yet to adapt to settled agriculture or even to manual work in the Delta, and prefer to stay within close proximity to the forest. Conversely, there were few-to-no MSHs from the surveyed villages with low hazard ranking. While the data indicated that multiple incidences of climatic hazards may be a driver of migration in the tribal hamlets, there might potentially be other drivers of migration (like loss of ecosystem dependence) from tribal communities, which have been discussed in subsequent sections.

Temporary migration from the SBR can be divided into two predominant types, depending on the nature of the drivers, as indicated by interview respondents who migrate: migration induced by fast-onset climatic hazards such as cyclones and storm surges (which cause lasting damage to property and disrupt livelihoods) and migration induced by slow-onset incremental changes to the climate (which cause an incremental increase in livelihood insecurity).

The condition of agricultural landholding by ST families is grim, with the majority owning less than 0.5 hectares. According to Census data (2011), the number of agricultural labourers is highest among the tribal population in the SBR. In subsequent years, with a rise in the occurrences and strength/vigour of natural hazards (cyclones, rise of sea level, erosion, soil salinisation, and delayed monsoon), cultivation was also highly impacted. To sustain themselves in such adversities, ST households with or without landholding showed a high affinity for out-migration.

5.6.2. Migrant-sending households (MSHs)

44.8% of the surveyed ST households, in the absence of a more stable source of income, sent at least one migrant to work outside the SBR (**Table 8**). Among them, 24% earned 40% to 60% of their livelihood share from remittance income while 27% earned 61% to 100%.

The survey participants opined that migration remittances contributed to the wellbeing of the household by meeting the families' health expenses, educational expenses, expenses to modify homesteads by making them flood-proof, and even contributed towards the creation of small savings for future need. Thus, remittances also contributed to the local economy through spending and investment in animal husbandry, backyard fishery and acquisition of household assets like electronic gadgets, motorcycles etc.

5.7. Binary logistic regression (BLR) model analysis

Results from the BLR analysis were indicative of the dominant factors affecting migration decisions of tribal communities in the SBR. Moderate and high climatic hazard risk were observed to affect the greatest number of households with high HDS and large household size. NSHs, on the other hand, demonstrated higher agricultural landholding and greater dependence on provisioning services of the mangrove ecosystem. The accuracy for the model was nearly 69.2%**.** It was also observed that five variables, namely own agricultural landholding, HDS, hazard category of the village, accessibility of the tribal household to mangrove ecosystem services, and household size, had a significant impact ($p<0.05$) on migration at a 95% level of confidence. Poor households (high HDS) were statistically significant to the model, with OR > 1 (1.927) indicating that households with high HDS have an increased tendency to migrate than households with less HDS. Households in the high hazard category showed a greater propensity to migrate than households in the low hazard category.

Owning agricultural land has been shown to correspond to a decrease in the tendency to migrate. Mangrove ecosystem dependence (harvesting from the forest) was a moderate predictor of the probability of a tribal household to migrate. The OR for harvesting from the forest (percentage of livelihood from forest) was 0.988, signifying

that the intensity of a household opting for migration decreased with an increase in Forest-dependence.

Table 19: Result of binary logistic regression

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	19.935	8	0.011

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	729.467[a]	0.149	0.2

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	97.08	9	0
	Block	97.08	9	0
	Model	97.08	9	0

Table 20: Drivers/Predictors of Migration for the ST communities in SBR

		B	Significance	Exp(B) i.e Odds Ratio	95% C.I.for EXP(B)	
					Lower	Upper
Step 1[a]	Agricultural landholding (Zero)		.001			
	Agricultural land (Own)	-1.016	**.000***	**.362**	.221	.593
	Agricultural land (Barga)	-.907	.109	.404	.133	1.226
	Agricultural land (Khas)	-.446	.632	.640	.103	3.970
	Agricultural land (Lease)	-20.350	.999	.000	0.000	
	Dependency on Forest (Ecosystem Dependency)	-.012	**.010***	**.988**	.979	.997
	Household Size	.200	**.001***	**1.222**	1.090	1.370
	Household Deprivation (Poor)	.656	**.002***	**1.927**	1.268	2.927
	Hazard Category (Low)		.000			
	Hazard Category (Moderate)	.570	.184	1.767	.763	4.091
	Hazard Category (High)	1.481	**.000***	**4.395**	1.974	9.785
	Constant	-2.413	.000	.090		

5.8. Conclusion

The livelihood patterns of tribal households in the Sundarbans Biosphere Reserve (SBR) are primarily non-agrarian, which contrasts with the agrarian livelihoods of non-tribal communities. Landlessness among the tribal population in the area is responsible for their strong reliance on casual manual labour and agricultural labour, which provide meagre compensation. Tribal communities in the SBR are additionally dependent on the mangrove ecosystem for their livelihood (Bandyopadhyay & Guha, 2016). According to data from a primary survey, around 31% of the surveyed tribal population relies on the mangrove forest for ecosystem goods in some capacity. However, the decline in mangrove forest cover and resources such as timber, fruits, honey, crabs, fish, and molluscs (Samanta et al., 2021) has driven these communities to adopt the dominant socioeconomic practices of non-tribals—such as agriculture, fishing, and aquaculture—for their sustenance, which in turn leads to a loss of cultural identity. In addition, stringent forest regulation and the risk of man-animal conflict

induces them to reduce their dependence on the mangrove forest ecosystem in favour of remittance income from migration. A trend can be evidenced from the primary survey, suggesting that the dependence of ST households on the ecosystem services is lower with greater involvement in non-ecosystem-based labour, viz. daily wage work. Marginal or no agricultural landholding as well as decreasing access to the mangrove forest ecosystem act as important push factors for migration from the SBR as diversification of their livelihood for risk reduction. While a sizeable section of the tribal population in the SBR now send at least one migrant from each household, NSHs are predominantly dependent on daily wage work in different non-farm activities like work under the MGNREGA, in brick kilns, aquaculture farms, industries or masonry within the SBR or in emerging urban centres in the Delta.

The historic shift from a predominantly forest-dependent livelihood of the dominantly Munda-Oraon community to increased reliance on settled agriculture as well as relocation to the Delta led to a gradual loss of tribal identity, customs, and languages. Being in touch with tribal traditions, including the worship of nature, and art, music, performance, and practices that encourage sustainable management of natural resources and environmental risks – such as promoting Joint Forest Management and issuing carbon credits to these communities, is central to effective and holistic in-situ adaptation of tribal communities. It has been observed, for instance, that cultural revival within the Santhali tribal community in hazard-prone areas of West Bengal, and the introduction of Santhali language training up to the postgraduate level, has significantly improved the socioeconomic status and climate resilience of this community. Such facilities are, however, unavailable for the dominantly Mundari tribes of the SBR.

Tribal communities in the SBR live outside Scheduled Areas, which restricts their access to NTFPs. Faced with poverty, landlessness, and insufficient livelihood returns, many are compelled to illegally enter the protected mangrove forest areas—governed by the Indian Forest Act of 1927 and 1978—risking their lives in man-animal conflicts. The Forest Department has recently intensified its discouragement of forest gathering, imposing heavy fines and even imprisonment for violations. The lack of forest rights for Scheduled Tribe (ST) communities in the SBR further contributes to their cyclical migration.

CHAPTER 6

POLICY TOWARDS SUSTAINABLE DEVELOPMENT OF TRIBAL COMMUNITIES

6. Introduction

As demonstrated by the 2015 Paris Agreement, which compelled countries to keep global mean warming below 2 °C relative to pre-industrial levels and create more robust action plans for indigenous people, international efforts are concentrated on reducing the effects of climate change on people (Ford et al., 2020). Similar to this, the 17 Sustainable Development Goals (SDGs) established by the UN recognize that an evaluation of the degree of development that does not negatively impact the environment is necessary because human activities are not totally exclusive and tend to affect their natural surroundings (Lusseau and Mancini, 2019). Additionally, the seriousness with which world leaders and policymakers address the issue of climate change effects on the planet is communicated by SDG 13 (take immediate action to combat climate change and its impact) (Priyadarshini and Abhilash, 2019a, 2019b). Known by many names in different parts of the world, indigenous populations make up around 5% (370 million) of the overall population, with nearly 15% of them classified as "extremely poor" (www.worldbank.org). These groups have a distinct ethno-linguistic identity and have a close bond with the land they live on and the natural resources they use (Senanayake, 2006).

Tribal well-being policies are found all over the world. To propose policy measures for aligning the traditional knowledge of scheduled tribes (ST) with the SDGs, the IUCN's drafted documents on Free and Prior Informed Consent (FPIC) and Nature Based Solutions (NBS) as well as the draft National Tribal Policy of India were examined (FAO, 2010; IUCN, 2019; The National Tribal Policy, 2006; National Policy on Tribals (Draft), 2007). Accordingly, the significance of policy rules for tribal people in terms of international policy initiatives has occasionally been covered in a variety of assessments (Mauro & Hardison, 2000).

6.1. Tribal Welfare in the Pre-Independence Period

For nearly 200 years, the British had dominated India. A variety of policies were developed and put into effect by the British during the colonial era to maintain administrative control over India, a nation with a diverse population in terms of social, economic, and cultural aspects. Tribal communities were an essential component of Indian society and lived more apart from the general population than they do now, primarily in forested and hilly areas. Three distinct approaches to tribe development—the isolationist, assimilationist, and integrationist approaches—can be used to understand the various policies that the British government developed in the form of acts.

According to India's history of forest policies, the pre-British teak forest reservation in Malabar in 1806 marked the earliest indication of forestry interest. During the conflict with Napoleon, it was done to provide England with lumber for the royal navy and other purposes. In order to give the state exclusive rights over forests, the Indian Forest Act of 1865 and the subsequent Act of 1878 were designed to prevent deforestation and other forest-related issues. The fact that tribal people's rights over

natural resources had been violated and that they could only enter the forest at the whim of British authorities had an impact on both tribal people and non-tribal people.

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It gave rise to revolts in tribal areas and the people didn't cooperate with the activities of the Forest Department (Pati & Dash, 2002).

The challenges of managing the nation's widely dispersed tribal regions were recognized by the British government at the time. In order to maintain effective administrative control over tribal territories and to safeguard tribal life and culture from the exploitation and aggregation of the more developed communities from the outside world, they also chose the isolation or segregation method. The Scheduled District Act of 1875, which barred tribal districts from the country's common laws, was created by the British government at the time to place tribal people under special administrative supervision. Under the Government of India Act 1919, the tribal territories were once more separated into "wholly excluded areas and areas of modified exclusion" (Shukla 2017).

6.2. *Tribal Development in Post-Independence Era*

Soon after gaining independence, the Indian government prioritized the nation's general growth, focusing on mining, large dams, industries, and other projects to strengthen the economy through five-year plans. In addition, the government developed many policies and programs for the development of the tribal community as a whole since it was deeply concerned about issues pertaining to tribal people. In order to create a foundation for progress for India's oppressed people, the constitution's drafters recognized the need for specific treatment for the scheduled tribes. In 1999, the "Ministry of Tribal Affairs," a tribal ministry, was established to handle all matters pertaining to Scheduled Tribes in India. The government took various steps for tribal development, from making of special provision of Scheduled Areas to formation of various constitutional bodies like National Commission for Scheduled Tribes (NCST).

The NCST is a constitutional body that was established to address the several issues that the tribal population faces and to listen to their complaints. Article 338 of the Indian Constitution previously established a single commission for ST and SC. It wasn't until 2004 that the 89th Amendment Act of 2003, which added a new article 388A, split NCST from NCSC. Additionally, certain clauses under several articles of the Indian constitution support social, economic, and educational advancement as well as the preservation of the language, culture, traditions, and customs of the country's tribal tribes.

6.3. Policy Interventions for the Tribal Communities (National Level)

To provide education to the tribal populations and financial support to organizations that serve them, the Indian government, acting through the Tribal Affairs ministry, has started several programs and initiatives. These include Vocational Training in Tribal Areas, the Post-Matric Scholarship Scheme (PMS) for tertiary education (ST students pursuing various professional courses), the Pre-Matric Scholarship for ST students at the higher school education stage (standards IX and X), and grants-in-aid to non-governmental organizations (NGOs) and voluntary organizations (VO) that promote the safety and well-being of ST (MOTA, GoI, 2018; MOTA, GoI, 2008).

The government also passed the Right to Fair Compensation and Transparency in Land Purchase, Rehabilitation & Resettlement (LARR) Act in 2013, which included particular measures for land purchase in areas with a tribal preponderance, acknowledging the connection these communities have with their land (GoI, 2013). Loopholes still exist, nevertheless, as the Forest Rights Act of 2006, which established provisions for ST's forest rights, has been poorly implemented, with tribal land alienation playing a significant role in the increased exploitation of tribal populations (The National Tribal Policy, 2006). Additionally, the nation lacks an operational National Tribal Policy, despite several versions being suggested for the same, and has not yet ratified International Labour Organization (ILO) Convention 169 addressing "Indigenous and Tribal Peoples in Independent Countries." (PIB, 2016; UN-HRC, 2017).

Even though STs are below the national average in all of these areas, states with large tribal populations do not have the worst rates of poverty; in fact, the majority of North-Eastern states with large tribal communities have poverty incidences below 20%,

according to a close examination of wealth quintiles, ST populations below national poverty lines, and literacy rates (MOTA, GoI, 2013; The National Tribal Policy, 2006; National Policy on Tribals (Draft), 2007).

The effective transfer of traditional knowledge gathered from tribal women and community elders to the children of their community is another crucial component of tribal education; the rapidly expanding industrial sector's opportunities are gradually causing a loss of intergenerational knowledge transfer. The implementation of tribal welfare policies through government agencies and their alignment with the SDGs would be greatly aided by NITI Aayog, the main government-based organization devoted to the cause of sustainability. Additionally, it would greatly improve data availability and capacity building if NITI and MOSPI regularly monitored the number of STs receiving benefits from the government's current Centrally Sponsored Schemes related to farmer welfare (Targeted Public Distribution Scheme), health and nutritional improvement (Integrated Child Development Services), universal education attainment (National Education Mission), and employment generation (Pradhan Mantri Kaushal Vikas Yojana). (GoI, NITI Aayog, 2017). The government's Direct Benefit Transfer, 2019 (DBT) program, which entails money payments straight to different schemes, has been a significant step in this direction.

The MGNREGA scheme is considered a successful case study within this mission (www.dbtbharat.gov.in). The effective and timely implementation of existing policies, proper distribution and utilization of funds, along with increased participation of Tribal Research Institutes (TRIs) and educational institutions, not only improve the socio-economic conditions of tribal communities but also better align their development with Sustainable Development Goal (SDG) targets. The National Portal of India Tribal Affairs (2020) features various initiatives aimed at improving

educational opportunities for tribal students. These programs provide primary and secondary education as well as scholarships, contributing to the achievement of SDG 4 targets such as 4.1, 4.2, 4.5, 4.6, and 4.b. Programs like the Rajiv Gandhi National Fellowship for Scheduled Tribe students assist those with disabilities or in vulnerable situations, promoting quality education (positive impact on Target 4.5). The 'Van Dhan Vikas Karyakram' is an initiative focused on generating livelihoods for the tribal population by utilizing forest resources. This program aims to combine the traditional knowledge and skills of tribal people with technological services to improve output at every stage, turning their wisdom into a profitable economic activity (Government of India Ministry of Tribal Affairs, 2019). These types of initiatives align with SDG 4 targets such as 4.3 and 4.4. The Tribal Co-operative Marketing Development Federation of India (TRIFED), under the Ministry of Tribal Affairs, plays an active role in capacity building for tribal communities by providing training and creating Self Help Groups. TRIFED helps tribal groups become effective entrepreneurs by providing knowledge and tools to improve their operations scientifically and systematically, and also assists them in developing their marketing strategies (TRIFED Tribal Co-operative Marketing Development Federation of India, 2020). Such programs are crucial for the socio-economic development of tribal communities in India, as they contribute significantly to marketing tribal products that are central to their livelihoods, with these groups spending a large portion of their time and income on such activities (Dandabathula et al., 2021).

Cooperative societies were designed to protect the weak, and one of the primary goals of cooperative reform initiatives has been to ensure that the advantages of the cooperative system increasingly reach the Scheduled Tribes and other marginalized groups. The cooperative has worked to accomplish this by increasing the number of

members from the weaker segments of the current PACS and making sure that they receive a greater flow of finances and services. In this context, specific and useful cooperatives for fisheries, dairy, and poultry farming have been established. Forest labour corporations have been established to handle forest labour. Similarly, rural artisans have also formed cooperatives and labour contract associations. States like Madhya Pradesh have seen a significant increase in the number of tribal people.

(Subashchandirabose & Nagarajan 2018).

The Objectives of LAMPS are as follows:

1. Promoting a subsidy-cum-loan production plan in sectors such as agriculture, horticulture, animal husbandry, irrigation, forestry, and rural cottage industries.
2. Freeing tribals from the influence of money lenders by providing production and consumption credit.
3. Purchasing additional agricultural and forest products from tribal communities.
4. Supplying essential goods and agricultural inputs to tribal people. The primary function of Large-sized Adivasi Multipurpose Cooperative Societies (LAMPS) should be to collect and distribute minor forest produce (MFP). These MFPs typically include items such as honey, tamarind, amla, treemass, soapnut, dalchinni, antwala (Sapindus emarginatus), gum, and grassstick. The collection and marketing of minor forest produce are the main income-generating activities undertaken by LAMPS. While the activities of LAMPS have expanded in recent years, their initial goal was to gather unique minor forest products from tribal communities and market them as a commercial venture.

6.4. Education of Tribal Communities

The foundation of development is the expansion and optimization of human potential, which is made possible by education since it serves as a conduit for information. Education has a lasting effect on many facets of society and has been acknowledged as a tool for socio-political mobility. As a result, education has been recognized as a fundamental human right and the cornerstone upon which growth and peace can be maintained and equalized (UNESCO, 2017). Tribal people have more options thanks to education, which not only raises awareness but also helps students develop their skills. The basic characteristics of traditional societies, such as tribal communities, are always in favour of preserving their sociocultural traditions (Hina, 2010). For administrators, social workers, and policymakers, tribal development becomes a significant concern. The government has launched several developmental programs, including the Integrated Tribal Development Programme (ITDP), and allocated specific funding for the upliftment of tribal communities to put them on par with non-tribal groups. However, there was still a great deal of variance in their standards of living. Tribal communities' use of rural credit was unequal and low in the majority of the tribal belts, even though rural credit institutions have become catalysts for the provision of credit for the economic improvement of tribal people.

6.4.1. Eklavya Model Residential Schools (EMRSs)

Eklavya Model Residential Schools (EMRS) are established to provide quality education to Scheduled Tribe (ST) students in remote areas of the country. The goal is not only to empower these students to access reservations in higher education and professional studies but also to enable them to compete for employment opportunities in both the government and private sectors alongside the non-ST population. EMRS is one of the prominent institutions, alongside Jawahar Navodaya Vidyalayas, Kasturba Gandhi Balika Vidyalayas, and Kendriya Vidyalayas. These schools are set up in various states and Union Territories with funding under Article 275(1) of the Indian Constitution. Admissions to EMRS are conducted through a rigorous selection process or open competition, with preference given to tribal students from Particularly Vulnerable Tribal Groups (PVTGs) and first-generation learners. The Ministry of Tribal Affairs ensures the implementation and administration of the scheme, with regular reviews.

Establishment of Ashram Schools in Tribal Sub-Plan Areas:

The objective of the scheme is to promote education among Scheduled Tribes, including Particularly Vulnerable Tribal Groups (PVTGs). Ashram Schools provide education along with residential facilities, creating a supportive environment for learning. This initiative has been operational since the 1990-91 academic year, and it is implemented in the Tribal Sub-Plan (TSP) areas and Union Territories (UTs). The scheme offers funding for the construction of Ashram Schools at the Primary, Secondary, and Senior Secondary education levels, as well as for the upgrading of

existing schools for both tribal boys and girls, including PVTGs. The government fully finances the construction of essential infrastructure for Ashram Schools, such as school buildings, shelters, kitchens, and staff areas for girls in TSP areas. For other non-recurring items, the funding for Ashram Schools in TSP areas is shared on a 50:50 basis. However, in areas identified as naxal-affected, 100% of the funding, including both recurring and non-recurring expenses, is provided for the establishment of Ashram Schools. The implementing agencies closely monitor the progress and submit quarterly reports to the Ministry of Tribal Affairs (GoI 2008).

Centrally Sponsored Scheme of Hostels for ST Boys and ST Girls:

The purpose of the scheme is to provide hostel accommodations for boys and girls from Scheduled Tribes in schools, colleges, and universities under the central, state, or Union Territory administration. Article 16 of the Indian Constitution mandates the creation of special provisions for the socio-economic advancement of disadvantaged sections of society. Education is a key priority of the government, as it is essential for empowering vulnerable groups, which is why hostel facilities need to be strengthened to support tribal students in accessing education. This scheme plays a crucial role in reducing the literacy gap and preventing dropouts among tribal students. The central government sanctions grants to build hostels, which are implemented by the states and Union Territories. The hostels are constructed at various levels, including middle school, secondary school, college, university, and vocational training centers. Hostel facilities for girls are fully funded by the central government, while a 50:50 funding formula is applied for boys. The implementing agency submits quarterly progress reports to the Ministry of Tribal Affairs until the project is completed (GoI 2020).

The Pre-Matric (Class IX and X) and Post-Matric Scholarship (PMS) schemes are aligned with the Directive Principles of State Policy in Part IV of the Constitution, particularly Article 46, which advocates for the promotion of education and economic welfare of weaker sections, especially Scheduled Castes and Scheduled Tribes. Article 38(2) calls for the reduction of income inequality and the elimination of disparities in state facilities and opportunities among different groups or regions. This scheme is designed to fulfill the objectives outlined in these constitutional provisions. The Pre-Matric Scholarship Scheme benefits students studying in classes IX and X.

National Scholarship for Higher Education of ST Students:

The program was launched in the 2007–08 academic year to encourage deserving ST students to enroll in graduate or postgraduate courses at reputable public and private universities that specialize in professional fields like management, medicine, engineering, information technology, law, etc. The program was once known as the "Top Class Scholarship." The program has identified 127 institutions in the public and private sectors that offer courses in management, medical, engineering, law, and commerce. (GoI 2017)

National Fellowship for Higher Education of ST Students:

With the help of fellowships, the program aims to encourage ST students—a segment of the population with the lowest literacy rates in the nation—to pursue M.Phil and Ph.D programs. Introduced in 2005–06, the Rajiv Gandhi National Fellowship (RGNF) program for Scheduled Tribes is currently known as the National Fellowship for Higher Education of ST Students and is supported by the Indian government through the Ministry of Tribal Affairs. Candidates from the Scheduled Tribe are given the chance to pursue higher education under the program, including conventional, full-

time M. Phil and Ph.D. candidates in the sciences, humanities, social sciences, and engineering and technology. Through the Indian Ministry of External Affairs, the grant is disbursed. (GoI 2018).

Institutional Support for Development & Marketing of Tribal Products/Produce:

The Tribal Cooperative Marketing Development Federation of India Ltd. (TRIFED), a multi-state cooperative under the Indian Tribal Ministry, and State Tribal Development Cooperative Corporations (STDCCs) both receive help from the Indian government. The goal of this project is to promote tribal forest and agricultural goods, produce, develop, and preserve traditional heritage, and offer all-encompassing assistance to members of different tribes in the area. To ensure a fair pricing system, funds are used to support institutions in carrying out the aforementioned activities, including better infrastructure, design development, product procurement, pricing information dissemination, and government agency support for sustainable marketing (GoI 2014).

Support to Tribal Research Institutes (TRI):

Through the Ministry of Tribal Affairs, the Indian government offers Tribal Research Institutes (TRI) all the assistance they require, including periodic interventions and updated financial guidelines.

Vocational Training in Tribal Areas:

The goal of the program is to empower the most marginalized segment of society, the tribal people. More job and revenue-generating possibilities were urgently needed to support the socioeconomic growth of tribal people. In order to help tribal kids find suitable jobs or start their own businesses, they aim to enhance their abilities in a range

of traditional and modern occupations, based on their educational background, market potential, and current economic trends (GoI 2009).

6.5. Policy Interventions for Tribal People in West Bengal

The framers of the Indian Constitution recognized the significance of preserving the sociocultural integrity of tribal communities and their contributions to nation-building, which is why they included provisions to protect and promote the interests of Scheduled Tribes. These provisions focus on safeguarding their educational rights, ensuring economic security, preserving their language and cultural heritage, and facilitating political representation (Press Information Bureau, GOI, 2023). Articles 16(4), 320(4), and 335 of the Indian Constitution provide safeguards for Scheduled Castes and Scheduled Tribes (SCs and STs) in government services and employment, ensuring their fair representation in public sector positions (Prakash, 2020). Article 46 of Part IV ("Directive Principles of State Policy") directs the State to prioritize the educational and economic advancement of disadvantaged groups, particularly the Scheduled Castes and Scheduled Tribes (Ministry of Tribal Affairs, GOI, 2019).

As "Public Health and Hospitals" fall under State jurisdiction, it is the responsibility of individual State Governments to ensure that mothers and children from the SC/ST communities receive quality healthcare in public healthcare facilities (Press Information Bureau, GOI, 2019). Introduced in 2005 as part of the National Rural Health Mission, the Janani Suraksha Yojana (JSY) seeks to reduce maternal mortality by promoting institutional deliveries and offering conditional cash transfers to women from low-income families. This initiative has also been beneficial for ST women in India. Other centrally supported programs, such as Janani Shishu Suraksha

Karyakram, Pradhan Mantri Matritva Vandana Yojana, and Pradhan Mantri Surakshit Matritva Abhiyan, further support maternal and child health (Bhatia et al., 2021). According to the Socio-Economic Caste Census (SECC), SC/ST families are eligible for health coverage up to Rs. 5 lakh per family annually under the Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB-PMJAY) (Press Information Bureau, GOI, 2019). Given that SC and ST communities are among the most vulnerable in India, they are qualified for PMJAY benefits (Dubey et al., 2023). Additionally, as health is a state responsibility, several states have introduced financial incentive programs to improve maternal health outcomes (Bhatia et al., 2021). For instance, West Bengal has implemented a universal health coverage system, offering basic health coverage of up to Rs. 5 lakh annually per family, irrespective of occupation, caste, or religion (Government of West Bengal, 2016).

The Pradhan Mantri Ujjwala Yojana, often known as a social welfare program, aims to improve access, eliminate indoor pollution, and promote women's advancement throughout time. In 2016, this program was introduced. By providing them with clean cooking fuel, such LPG, it aims to protect the health of women and children by removing the need for them to cook in smoke-filled homes or to forage for firewood in hazardous areas. The initiative gives preference to SC, ST, BPL households, and landless labourers while acknowledging the existing imbalances (Patnaik & Jha 2020). Through State Societies or NGOs, the Ministry of Tribal Affairs implements the following programs to assist government efforts for the social, economic, and educational advancement of STs.

For the advantage of ST, these central policies are also in effect in West Bengal. The state government of West Bengal is carrying out a number of state-funded programs for the welfare and development of the Scheduled Tribe group. The relevant government initiatives and programs for West Bengal's ST population are listed below.

Table 21: List of existing policies exclusively for ST population in West Bengal

Existing Policies	Benefits
Jai Johar	The state government initiated the programme to provide a monthly stipend to elderly members of the Scheduled Caste community.
The Special Component Plan	Economic improvement and increasing the SC/ST population's income in West Bengal through microfinance.
Pandit Raghunath Murmu Abasik School	Government-sponsored schools for tribal students.
Swastho Sathi	Basic medical coverage up to Rs 1.5 lakh for secondary and tertiary care annually through insurance mode, and up to Rs 5 Lakh annually through assurance mode for critical

Existing Policies	Benefits
	illnesses like as cancer, neurosurgeries, cardiothoracic surgeries, liver ailments, blood problems, etc.

(Source: West Bengal Tribal Development (https://adibasikalyan.gov.in/); Government of West Bengal (https://ds.wb.gov.in/))

Table -22: List of Policies showing impact in the SBR

Sl. No.	Policy	Objective	Date of Enactment	Impact in the SBR	Effectiveness	SDG Alignment
National Level Schemes						
1	Indira Awas Yojana (IAY)	Financial assistance for constructing permanent houses for BPL families	1985 (Revised in 2016 as Pradhan Mantri Awas Yojana/ PMAY)	Some success, but many still live in temporary housing due to funding gaps	Partially effective	SDG 11
2	Mid-Day Meal Scheme (MDMS)	Provide nutritious meals to school children to enhance enrolment and retention	1995	Improved child nutrition and increased school enrolment, though quality varies	Effective	SDG 2, 4
3	Sarva Shiksha Abhiyan (SSA)	Universalize elementary education and improve education quality	2001	Increased enrolment, but quality of education and infrastructure issues remain	Partially effective	SDG 4
4	Mahatma Gandhi National Rural Employment Guarantee Act	Provide 100 days of guaranteed employment per year to rural households	2005	Helped reduce poverty, but implementation issues (payment delays, etc.) limit impact	Effective, but has implementation challenges	SDG 1

Sl. No.	Policy	Objective	Date of Enactment	Impact in the SBR	Effectiveness	SDG Alignment
	(MGNREGA)					
5	Coastal Aquaculture Authority Act	Regulate and promote sustainable coastal aquaculture practices	2005	Aimed at protecting coastal ecosystems while promoting aquaculture development	Partially effective	SDG 14, 8
6	Deendayal Antyodaya Yojana - National Rural Livelihood Mission (DAY-NRLM)	Promote self-employment and organize the poor into SHGs	2011	Empowered women, but limited by low participation and repayment issues	Partially effective	SDG 10, 1
7	Pradhan Mantri Jan-Dhan Yojana (PMJDY)	Financial inclusion through bank accounts for every household	2014	Improved financial inclusion, but without income growth, it does little to alleviate poverty	Effective, but limited impact on poverty	SDG 10
8	Swachh Bharat Mission (SBM)/Mission Nirmal Bangla	Eliminate open defecation and improve sanitation	2014	Improved sanitation but cultural barriers and lack of awareness limit effectiveness	Partially effective	SDG 6
9	Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) & Pradhan Mantri Suraksha Bima Yojana (PMSBY)	Provide affordable life and accident insurance to the poor	2015	Limited impact due to low awareness and enrolment	Ineffective	SDG 13
10	Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)	Ensure access to irrigation facilities for farmers	2015	Expanded irrigation in several districts, but challenges in water resource	Partially effective	SDG 6

Sl. No.	Policy	Objective	Date of Enactment	Impact in the SBR	Effectiveness	SDG Alignment
				management remain		
11	National Cyclone Risk Mitigation Project (NCRMP)	Reduce vulnerability to cyclones and other hydro-met hazards	2015	Strengthened disaster preparedness, but shelters are few compared to people and livestock	Partially effective	SDG 13
12	Pradhan Mantri Ujjwala Yojana (PMUY)	Provide free LPG connections to BPL households for clean cooking	2016	High refill costs lead to continued use of biomass, reducing effectiveness	Ineffective due to high price	SDG 7
13	Jal Jeevan Mission (JJM)	Provide safe and adequate drinking water to rural households	2019	Limited coverage in remote areas, though some success in improving access to drinking water	Partially effective	SDG 6
14	National Clean Air Programme (NCAP)	Combat air pollution across sectors	2019	Early-stage results; needs targeted implementation in Sundarbans for indoor pollution control	Potentially effective, but too early to evaluate fully	SDG 13
15	Mission Brackish Water/Saline Aquaculture (MBSA)	Promote sustainable brackish water aquaculture to support blue economy	2022	Potential to boost local livelihoods, but concerns over ecosystem impacts	Potentially effective	SDG 8, 1
State Level Schemes						
1	Swami Vivekananda Merit-cum-Means Scholarship	Support economically weaker students to pursue higher education	2011	Helped many poor students access higher education	Effective	SDG 4
2	Jal Dharo Jal Bharo	Large-scale rainwater harvesting and artificial	2011	Created/renovated 314,522 water bodies, crucial for addressing water stress	Partially effective	SDG 6, 2

Sl. No.	Policy	Objective	Date of Enactment	Impact in the SBR	Effectiveness	SDG Alignment
		groundwater recharge				
3	Kanyashree Prakalpa	Promote higher education and prevent child marriage among girls	2013	Highly successful in reducing child marriage and improving education for girls	Highly effective	SDG 5
4	West Bengal State Action Plan on Climate Change (SAPCC)	Focus on mitigation and adaptation strategies across sectors	2011, 2017, 2021-2030 (upcoming)	Provides a robust framework for addressing climate vulnerability	Potentially effective, but has budget and implementation issues	SDG 13, 14
5	Khadya Sathi Scheme	Provide subsidized food grains to the poor	2016	Ensured almost universal coverage of food security in the SBR	Highly effective	SDG 2
6	Usharmukti / Deepanjali Programme	Watershed management and ensuring sustainable livelihoods	2016	Addressed water-related livelihood challenges; scaling gaps exist	Partially effective	SDG 6, 1
7	Lakshmir Bhandar Scheme	Financial assistance for women to promote empowerment and reduce poverty	2021	Aims to enhance financial independence, poverty alleviation, reach is limited	Effective, but more outreach needed	SDG 5, 1
8	Bangla Krishi Sech Yojana	Promote water-efficient farming through micro-irrigation	2019	Covered over 41,000 farmers but lacks widespread implementation	Partially effective	SDG 6, 2
9	Matir Srishti	Convert barren land to green cover and create employment	2020	Generated employment, converted barren land to vegetation, limited in Sundarbans	Effective, but ineffective in Sundarbans	SDG 1, 15
10	Sabujayan	Prevent soil erosion by planting Vetiver grass along embankments	2017	Significant success in covering 300 km of embankments, less effective in saline area	Effective, but not in saline ecosystem	SDG 15

Sl. No.	Policy	Objective	Date of Enactment	Impact in the SBR	Effectiveness	SDG Alignment
11	West Bengal Forest Development Project	Promote afforestation and strengthen forest ecosystems	Ongoing	Mangrove conservation with community participation through Joint Forest Management	Effective	SDG 15
12	West Bengal Major Irrigation and Flood Management Project	Improve irrigation and flood management infrastructure	2020	Strengthened flood management, needs localized adaptation strategies	Effective, with limited success	SDG 13

6.6. Gaps of Policy Interventions

Since independence, several programs and policies have been developed to address tribal issues. However, it appears to be insufficient to improve the lot of tribal people, who have been living under the shadow of underdevelopment for decades. Due to a lack of knowledge and development, the tribal group has long been unable to reach its full potential. The quality of social life, political engagement, demographic shift, and economic prosperity of tribes are all positively impacted by education. Children's involvement in school has been found to be positively impacted by the development of rural villages. It has been discovered that education supports tribe growth in a number of ways, including economic and social, cultural preservation and prejudice eradication, demographic shifts, and the exercise of freedom through democratic processes. Furthermore, it has been discovered that social dogmas, prejudices, poverty, illiteracy, and ignorance all negatively impact tribal education.

Lack of educational facilities close to their homes and difficult access to schools for higher education are the main issues and barriers to education and development. Despite the prevalence of various pro-tribal policies at the national and state levels

since Indian Independence, the welfare of the country's tribal population still suffers from gaps in data, policy design, and the mode and pace of policy implementation not matching the intended benefits. A number of state governments have recently embraced the outstanding practice of the GOI's Socio-Economic and Caste Census (2015). By generating disaggregated data on the socioeconomic and demographic traits of underprivileged groups, including Scheduled Castes, Scheduled Tribes, and Other Backward Classes, it fills the data gap. Many homes in the Sundarbans no longer suffer from full or partial hunger as a result of the implementation of several government programs for the free distribution of grains (rice, wheat, etc.) through PDS and midday meals for school-age children.

The state government's "Swastha Sathi" scheme and GoI's "Ayushman Bharat"; better housing and sanitation, like the West Bengal Government's "Nirmal Bangla" scheme and GoI's "Swachh Bharat" program and "Pradhan Mantri Awas Yojna"; health; and education, like GoI's "Sarva Siksha Abhiyan" and "Mid-day Meal Scheme" (to reduce school dropout) improved the overall deprivation of ST population a little bit in Sundarbans. The government's efforts to build tube wells and provide piped water supplies and taps are seen in the rise in the consumption of safe drinking water. Even programs like the Indira Gandhi Awas Yojana, not all candidates had yet to receive its benefits. Many of the villages now have access to electricity to Sarba Griha Deep Prakalpa of the state government and Pradhan Mantri Sahaj Bijli Har Ghar Yojana of the central government. Beyond the state of the economy, caste also affects LPG use. The way that different caste groups use LPG as their main cooking fuel differs greatly even within the same asset ownership category. Despite belonging to the same class category, we find that a smaller percentage of ST’s households utilize LPG as their major cooking fuel across asset quintiles. The people turned to biomass fuel as their

main source of cooking fuel after becoming dissatisfied with the high cost of liquefied petroleum gas (LPG). Even though a number of programs and policies have been adopted, their accessibility and implementation are still inconsistent and subpar. This is especially true in several critical areas, such as supply and utilization equity, serving vulnerable populations, or the ST population. The most vulnerable populations are impacted by unequal supply and consumption. It could start a vicious cycle where the most disadvantaged groups become even more impoverished. Illiteracy and low levels of educational attainment, combined with lack of formal employment opportunities and geographical remoteness, contribute to poor socioeconomic wellbeing and development in the region. The absence of schools that teach in tribal languages and observe tribal values and holidays, and caps on the minimum population for the establishment of EMRS makes it difficult for tribal children to want or be able to attend school. Thus, thoughtful and culturally sensitive policy implementation alongside efforts to handhold tribal households in raising their awareness of Reservation policies, and access to caste certification (ST cards) designed to enhance their benefits from generalised welfare schemes, must support policymaking to strengthen resilience to climate change. The authors acknowledge that it is the latter, i.e., adaptation to climate change, which has received the least legislative attention in India. To that end, it is recommended that the government ensure safe housing against climatic shocks (cyclone and surge impact etc.), protective embankments to resist erosion, sustainable use of mangrove ecosystem services, access to culturally-sensitive and relevant education and healthcare facilities, stronger implementation of the pro-tribal LAMPS scheme, and adequate in-situ adaptation to reduce distress-driven migration and promote a sustainable future for poor communities in vulnerable areas, such as the ST communities in the SBR. While several schemes, such as ‘One

Nation One Ration Card' (to ensure food security of migrant workers and families), registration of migrants through the state Panchayats, state-level Departments of Rural Development, and GoI's eShram portal and National Tribal Migration Support Portal, are operational, tribal communities in the SBR migrating under distress may benefit significantly from access to these measures through awareness and handholding activities. Additionally, appropriately modifying the Forest Rights Act, 2006, and generating land records ensure that settler tribal communities which, though non-aboriginal to the area, have inhabited the area for several centuries since colonial times, are bequeathed forest rights which promote legal and sustainable forest use and management.

6.7. Policy Recommendations

A state's principal duty is to formulate and implement equitable policies that provide justice to the most vulnerable members of society. The Indian tribal population has been battling for the fundamental essentials of everyday living, which are readily available to others, and dealing with a variety of problems in their daily lives. The government of both the union and the states has always been very concerned about tribal development. The administration asserts that it has worked tirelessly to close the gap and move the tribal community as a whole toward sustainable growth and development. Tribes must be prepared to deal with their varied subcultures while also sharing a shared heritage in mainstream society under the main streaming scenario (Panigrahi, 2002).In order to support the sustainable development of the tribes, efforts have been made to incorporate elements into their schooling. Education policies, programs, and curriculum must be re-examined and redesigned in order to strengthen the body of evidence supporting their contribution to high-quality education and to

achieving sustainable development goals. Education for sustainable development gives people the values, information, and abilities they need to address the social, environmental, and economic issues facing many targeted groups, including tribes. Policymakers and education planners need to focus on developing targeted policies for tribal villages and regions. Specific provisions and incentives should be identified and implemented to support the education of tribal children and communities. Administrators, program implementers, and monitoring authorities must ensure the effective implementation of various education schemes and incentives aimed at the tribal population. NGOs should prioritize tribal communities and regions in their interventions, offering support for the education of tribal groups. Education officials and teachers must take a proactive role, demonstrating the willingness and commitment to accepting, educating, and empowering tribal communities and their children to access education. Tribal communities themselves should actively participate in advancing their educational agenda, raising concerns about the quality of education at Grama Sabhas, SHGs, and School Management Committees. They should also engage with teachers and education officials about the progress of schools and the education of their children.

It is not difficult to raise awareness of various development schemes and programs because nearly all of the population has completed formal education, and by successfully implementing these programs, the tribal community can be led to improve their quality of life. Policymakers and administrators ought to implement development programs that are tailored to the needs of individual tribes and regions. The correct execution of initiatives for tribal development with respect to tribal culture should be a priority for the program implementers and monitoring agencies. NGOs

should focus on improving the quality of life by raising awareness of the many programs implemented for tribal development.

Education officials and teachers can play a vital role in raising awareness about the various schemes and programs designed for the development of tribal communities. Members of the tribal community should actively participate in awareness programs aimed at their development and advocate for the organization of interaction sessions with developmental field workers and educators to better understand the initiatives available to them. Seasonal migration practices, driven by limited income-generating opportunities, low involvement in agriculture, and lack of local markets for agricultural and forest products, need to be addressed. To improve the economic situation of tribal communities, the government should establish agro-based small-scale industries that align with the educational backgrounds and skills of the people. Policymakers and administrators should also consider setting up skill-based training institutions focused on areas like woodcraft, food processing, and improving road connectivity for better transportation. Program implementers and monitoring authorities should prioritize these initiatives and work to implement them without delay. NGOs should take the lead in providing vocational training, while the tribal community must actively engage in these skill development programs and collaborate with government agencies and non-governmental organizations.

The school environment should be enriched with resources that enhance children's engagement in the educational process, making the curriculum and teaching methods more student-friendly. The current primary-level curriculum should be updated to reflect the changing socio-economic landscape, incorporating concepts like Aadhar utilization, Swachh Bharat and its practices at both school and village levels, digital literacy, and the use of smartphones and various educational and utility-driven

software applications in daily life. This broad range of activities will transform the education of tribal children, and as these children grow, they will contribute to educating their communities, fostering sustainable development across various tribal regions. However, it remains challenging for tribal children to attend school, as there are no institutions that offer education in their native languages, recognize their cultural values and holidays, and meet the population criteria necessary for establishing Eklavya Model Residential Schools (EMRS).

Tribal children in schools face significant challenges due to the lack of textbooks in their native languages and a shortage of language teachers. Despite the importance of tribal languages for their development, little progress has been made to incorporate these languages in primary education, which could greatly benefit these children. Research has shown that tribal children, like the Bodo tribe, perform better when taught in their mother tongue alongside the state language. However, challenges arise when teaching children from oral traditions, as they transition from speaking to reading and writing in a new language. This language barrier often leads to ineffective learning, as children struggle to comprehend what is being taught.

To address these issues, a clear language policy is needed, particularly for Scheduled Tribes. This policy should include identifying dominant tribal languages with scripts, designing relevant curricula, and developing primers and teaching materials that reflect tribal culture. Teachers must be either fluent in the tribal languages or trained adequately in them. Teacher handbooks and workbooks filled with activities, visual aids, and depictions of tribal culture will support both educators and students. Additionally, training centers should be established to teach tribal languages, and classroom activities should go beyond rote learning to engage students in understanding and applying what they learn. Many states are already working on

improving education in tribal areas, recognizing that language differences between home and school are a major barrier to learning.

Policymaking to strengthen resilience to climate change must therefore be supported by careful and culturally sensitive policy implementation as well as initiatives to assist tribal households in increasing their awareness of reservation policies and access to caste certification (ST cards), which are intended to enhance their benefits from generalized welfare schemes. The authors concede that in India, the latter—that is, climate change adaptation—has gotten the least amount of legislative attention. In order to achieve this, it is advised that the government provide safe housing against climate shocks (such as those caused by cyclones and surges), protective embankments to prevent erosion, sustainable use of the services provided by the mangrove ecosystem, access to culturally appropriate and relevant healthcare and education facilities, stronger implementation of the pro-tribal LAMPS scheme, and sufficient in-situ adaptation to lessen distress-driven migration and support a sustainable future for underprivileged communities in vulnerable areas, like the ST communities in the SBR. While a number of programs are in place, including the "One Nation One Ration Card" (which guarantees the food security of migrant workers and their families), registration of migrants through state Panchayats, Departments of Rural Development at the state level, and the GoI's eShram portal and National Tribal Migration Support Portal, tribal communities in the SBR that are experiencing hardship may significantly benefit from access to these measures through awareness and handholding activities. In order to guarantee that settler tribal communities—who, despite not being native to the region, have lived there for several centuries since colonial times—are bequeathed forest rights that promote lawful and sustainable

forest use and management, it is also necessary to appropriately modify the Forest Rights Act, 2006 and create land records.

The integrated Tribal Development strategy has not yielded the expected outcomes, particularly in remote tribal areas, due to issues at the implementation level. The tribals struggle to develop their communities due to a lack of resources in their regions. Agriculture and forestry sectors still need significant improvement, including soil conservation strategies. Exploitation of the tribals persists, driven by their innocence, illiteracy, and lack of awareness. To address this, education programs must be intensified and effectively implemented, as education is key to human development. The quality of teaching in tribal schools should be improved, and adult education programs should be reintroduced to enhance literacy rates. Tribals, particularly women, are often exploited by non-tribal moneylenders and traders. Strengthening the public distribution system to provide essential food and other local needs is crucial.

Empowering tribals, especially women, is essential for their participation in development programs and decision-making processes. Tribal women contribute significantly to family incomes, work longer hours, and possess valuable knowledge in forest produce collection and home garden maintenance. Empowering them through initiatives like Self-Help Groups (SHGs) boosts their economic status and helps the community. Health and nutrition programs should be strengthened to address issues like malnutrition and child deaths. Health plays a vital role in economic progress and well-being, and improving health services, including mobile clinics and integrating tribal medical systems into government health centers, is essential. Additionally, irrigation development, water conservation, and improved sanitation facilities are critical to addressing waterborne diseases and improving living conditions. Strengthening infrastructure and poverty alleviation programs in tribal areas,

especially for primitive tribes, should be prioritized. Participatory action research and intervention strategies should be adopted to address tribal issues at the community level. Tribals must be motivated to actively participate in development programs, and awareness campaigns should be conducted using local media to generate a positive response.

6.8. Sustainable Development of the Tribal Community

When we talk about sustainable development, we mean development that lasts. It is the developmental route that allows one to increase consumption without lowering its supply for subsequent generations. Therefore, it is a long-term phenomenon rather than a short-term one. Having sufficient and long-term access to resources and revenue to cover essential expenses is known as livelihood development. The set of actions people decide to do in order to reach their livelihood objectives is known as a livelihood strategy. The preservation of biodiversity is essential to the survival of the century-old culture of the indigenous people who lived in isolated areas. Tribals feel at home in their natural environment. Tribes depend heavily on their sustainable means of subsistence since they can readily engage with their natural surroundings. For the benefit of the tribal people's welfare as well as the preservation of the environment and tribal culture, many initiatives should be implemented. They should be given employment opportunities for their well-being. If various governmental and non-governmental initiatives highlight the various handicrafts and medicinal plant knowledge that tribal people possess, it will undoubtedly improve their economic situation and promote sustainable development among them.

Many rural poor people, particularly the tribal population, who make up a sizable portion of the population, remain outside the formal banking system despite the country's extensive network of rural banks and the adoption of credit-linked poverty alleviation programs. According to a number of studies, the requirements of the hard-core and asset-less poor were frequently not met by the policies, structures, and procedures in place. The largest obstacle to the Tribal community's sustainable development is their ignorance of the policies and programs designed for them, which must be strengthened and can only be achieved by raising the literacy rate among Tribals. According to government data, the 2011 census indicates that 59% of tribal people are literate. However, it is a cruel fact that many of these literary tribes are merely literate for the sake of being literate. They did not receive their education at an early age, and they are not aware of their rights or the rules and programs that have been put in place for them. In this age of globalization, the tribal group urgently needs certain regulations to safeguard and maintain its culture and identity. Development is pointless if it means jeopardizing the scheduled tribes' true identity. Positive changes, such as an increase in literacy, social status, social equality, financial security in old age, a decrease in the child mortality rate, better sanitary facilities, guaranteed food security, a decrease in urban migration, and increased participation by women, are linked to the successful implementation of developmental schemes. Positive changes including greater literacy, social standing, equality, financial stability, lower child mortality, better sanitary facilities, guaranteed food security, and increasing women's participation also demonstrate the sociological influence of developmental plans. The study also highlights how crucial it is to take into account the viewpoints of various recipient groups and economic levels in order to maximize the efficacy of developmental programs. Traditional tribal community organizations have developed

distinctive methods for managing and preserving natural ecosystems and shared property resources, which are now regarded as potentially revolutionary for creating mitigation and adaptation plans for climate change, guaranteeing food security, and achieving the Sustainable Development Goals. Tribal communities' sustainable development is important on a regional, national, and international level. (Strategies for Tribal Development That Are Sustainable)

Sustainable tribal development is crucial for improving the Human Development Index (HDI) within the framework of the Sustainable Development Goals (SDGs). Converging sectoral services can address policy conflicts related to land use, especially in areas like forestry, agriculture, water management, and non-timber forest products (NTFPs), ensuring sustainable livelihoods for tribes. However, without coordinated efforts among public sectors responsible for land-use management and timely provision of need-based funds, achieving a balance between conservation and economic development will be difficult.

Historically, tribal communities lived in a self-sufficient, subsistence economy, relying on activities like hunting, food gathering, and the collection of forest products for their livelihood. Forests played a key role in their socio-economic development. However, the lack of recognition for indigenous knowledge and practices has led to their exploitation. As a result, many tribal members have had to leave their forests and seek work as laborers, losing their cultural identity in the process. This shift from traditional to modern living has led to the erosion of their customs and way of life.

To protect and preserve tribal culture, development policies should prioritize not only their economic growth but also the sustainability of their traditions, language, and identity. In an era of globalization, specific policies are needed to safeguard the

cultural heritage of scheduled tribes. Efforts to improve access to education and development programs, facilitated by NGOs and government officials, are essential to enhance the well-being of rural tribal populations. The low socioeconomic development of these communities is rooted in factors like illiteracy, limited educational opportunities, lack of formal employment, and geographic isolation.

Chapter 7

Conclusion

The tribal communities living in the Sundarbans Biosphere Reserve (SBR) are not indigenous to the area. They originally migrated from nearby districts such as Bankura, Birbhum, and Puruliya, as well as from the arid and hilly western regions of the Chotanagpur Plateau—spanning parts of present-day Odisha and Jharkhand in West Bengal. This migration took place in the early 19th century, following land reclamation initiatives led by the colonial administration under the East India Company, which involved clearing mangrove forests in the Ganga-Brahmaputra-Meghna (GBM) Delta. The tribal communities brought in for land reclamation and timber extraction eventually settled in the area although only a small number of tribal households were allocated land plots. Due to a lack of disaggregated secondary data on ST communities in the SBR, researchers who want to examine this community either create their own independent primary survey or use an aggregative approach. This particular research is done by performing a primary survey to evaluate the socioeconomic circumstances of these ST communities and their propensity to migrate in response to various stressors. The study uses primary data and the limited amount of secondary data that is available. The research tries to identify the vulnerabilities of the tribal communities in the Sundarbans and how they are coping with the effects of climate change.

The growth rate analysis of the ST population in the SBR from the secondary data indicated a population movement. This phenomenon from the sea-facing CDBs can be caused by climatic catastrophes and land loss to the sea. This depopulation may be a sign of the tribal people's constant migration from locations that face the sea or are dangerous to areas they believe to be safer. Overall, the disparity in the growth rates indicates an internal mobility of tribal peoples in the SBR.

In Sundarbans some of them have little land of their own whereas most of them are landless. Landless conditions of the tribal population in the delta are making them highly marginalised.

A correlation between multi-hazard incidence in the village and the number of migrant sending households was observed however, the relationship is not linear. There are exceptions to the relationship between hazard and migration. A major exceptional case is the Satyadaspur village in Patharpratima, where the non-migrant sending households are more. The hunter-gatherer Lodha-Sabars of Satyadaspur are yet to adapt to settled agriculture or even to manual work in the Delta, and prefer to stay within proximity to the forest. Conversely, there were few migrant-sending households from the surveyed villages with low hazard ranking.

Thus, it is understood that numerous occurrences of climate hazards may be one of the reasons for migration in the tribal hamlets, but there may be other reasons as well, such as the loss of livelihood or reliance on ecosystems, which need in-depth investigation.

The primary economic activities of the tribal households were identified by analyzing their patterns of livelihood. The reported occupation pattern of the tribal population is substantially different from the general pattern for the delta dwellers. Contrary to popular belief, the ST households' main source of income was not reliance on forest and ecosystem services. The most common occupation among the tribal groups was temporary migration from the SBR. A trend can be evidenced from the primary survey, suggesting that the dependence of ST households on the ecosystem services is lower with greater involvement in non-ecosystem-based labour, viz. daily wage work.

The overall livelihood spectrum showed diversification. Their reliance on the forest is being negatively impacted by the Forest Department's tighter regulations on access to the protected forest region for commercial purposes such as gathering fuel wood, fish, prawns, crabs, etc. Additionally, tribal communities outside Scheduled Areas face restricted access to non-timber forest products (NTFPs).

Though the overall multidimensional poverty decreased for the SBR region but it is variable throughout the study area. Improvements in poverty conditions are largely due to the availability of free cereals through the PDS, safe drinking water, and electricity. However, issues like inadequate sanitation, poor housing, and heavy reliance on fuel-wood for cooking negatively impact health outcomes. Increased schooling has contributed substantially to poverty reduction. Primary data analysis

indicated that a greater number of poor tribal households with high HDS opted for migration. Whereas, very few not-so-poor households with low HDS opted for migration. Thus poor households (high HDS) indicating that households with high HDS are inclined more to migrate than households with low HDS.

From the focused group discussion and different stakeholders' interview, a link was found between the environmental impact as well present socio-economic conditions acting as drivers guiding migration decision at the dwelling level. Identification of the most important links present between drivers and their primary and secondary socio-economic conditions was used to develop the conceptual framework proposed.

Households in the high hazard category showed a greater propensity to migrate than households in the low hazard category. Owning agricultural land has been shown to correspond to a decrease in the tendency to migrate. Mangrove ecosystem dependence (harvesting from the forest) was a moderate predictor of the probability of a tribal household migrating. The intensity of a household opting for migration decreased with an increase in forest dependence.

Marginal or no agricultural landholding, as well as decreasing access to the mangrove forest ecosystem, act as important push factors for migration from the SBR, as diversification of their livelihood for risk reduction. While a sizeable section of the tribal population in the SBR now send at least one migrant from each household, non-migrant sending households are predominantly dependent on daily wage work in different non-farm activities like work under the MGNREGA, in brick kilns, aquaculture farms, industries, or masonry within the SBR or in emerging urban centres in the Delta.

Many programs and policies have been created to address tribal issues since independence, yet progress in improving the lives of tribal communities remains insufficient. Persistent underdevelopment, low education levels, and limited development opportunities continue to hinder their potential. Education has been shown to positively impact tribal communities by enhancing their social life, political participation, economic development, and cultural preservation. Improved rural development has been linked to increased school participation among children. However, poverty, illiteracy, social prejudices, and inadequate educational facilities near tribal areas remain major barriers. Other major lacunae in policymaking and

policy implementation also contribute to lack of improvement in the socioeconomic conditions—which are worsened by increasing hazard frequency and intensity—of tribal communities in the SBR.

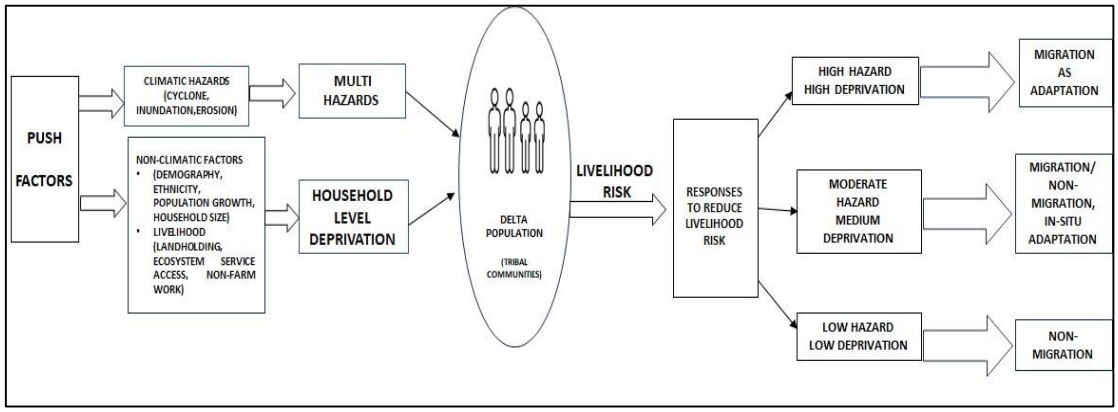
Overall, sustainable development for tribal communities requires a comprehensive approach that respects and integrates their unique cultures while addressing economic and social challenges. Collaboration between government agencies, NGOs, and tribal communities is essential to achieving meaningful and lasting development.

Despite the prevalence of various pro-tribal policies both at the national and local levels since Indian Independence, the welfare of the tribal people nationally continues to suffer from lacunae in data, policy design and gaps between the mode and tempo of policy implementation and the intended beneficiaries.

Addressing the data gap by producing disaggregated data on the demographic and socioeconomic conditions of marginalized populations, such as Scheduled Castes, Scheduled Tribes, and Other Backward Classes, is a good practice like the GoI's Socio Economic and Caste Census (2015), which is currently being adopted by various state governments.

This pioneering study has mapped out the patterns of permanent and seasonal migration among tribal communities in the Sundarban Biosphere Reserve (SBR), India, as a response to escalating climatic hazards exacerbated by severe socio-economic hardship. It found that, due to the frequent occurrence of multiple climate-related hazards and the depletion of available adaptation options, 60% of multi-dimensionally deprived tribal households chose to send at least one family member outside the Delta for livelihood support. The study illustrated the link between the intensity of hazard impacts (high, medium, or low), the level of deprivation (poor or less deprived), and the prevalence of short-term seasonal migration among tribal households in the SBR (**Figure 16**).

Figure 16: Validating Conceptual Model elaborating the relationship between hazard, deprivation and migration



The research emphasizes the importance of in-situ adaptation through the effective implementation of existing policies on food security, safe housing, education, health, and mangrove ecosystem services. It also advocates for a renewed policy perspective to facilitate safe and informed migration decisions, recognizing migration as an adaptive strategy to climate change. Furthermore, initiatives such as the 'One Nation One Ration Card' (ensuring food security for migrant workers and their families) and the registration of migrants via state Panchayats, state-level Rural Development Departments, and the GoI's eShram portal and National Tribal Migration Support Portal, should be consistently implemented, with dedicated support for tribal communities migrating under distress from the SBR and other hazard-prone regions. This research lays the groundwork for further studies on migration, aiming to develop comprehensive frameworks for: 1) Assessing land rights for Scheduled Tribes (ST) communities; 2) In-situ adaptation in global climate hotspots; and 3) Ensuring safe migration and providing support for migrants during transit and upon arrival, by monitoring migration routes at local, regional, and global scales in the context of climate-induced migration.

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