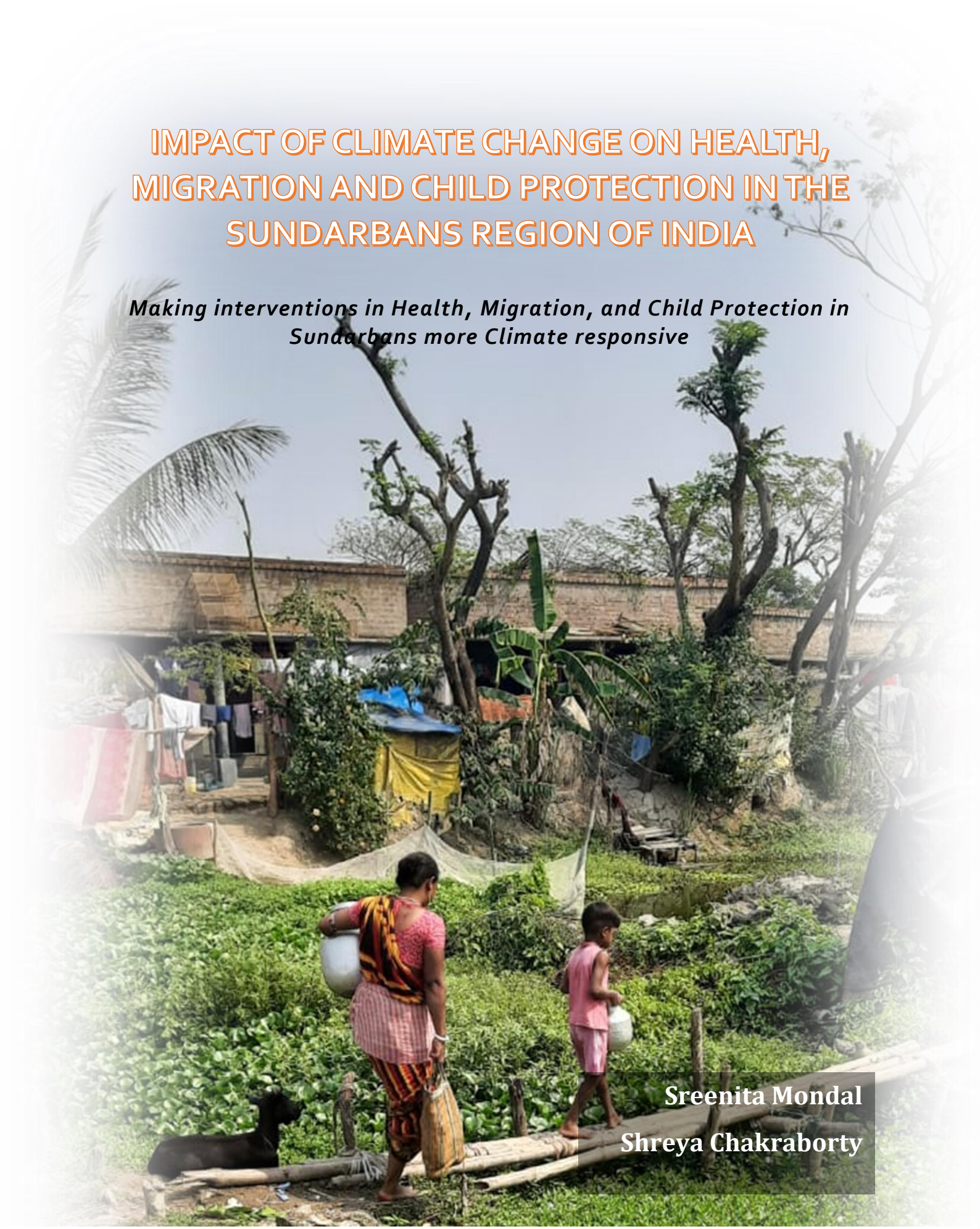
IMPACT OF CLIMATE CHANGE ON HEALTH, MIGRATION AND CHILD PROTECTION IN THE SUNDARBANS REGION OF INDIA

Making interventions in Health, Migration, and Child Protection in Sundarbans more Climate responsive



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Terre des hommes
Helping children worldwide.

Declaration: This report is based on an assessment carried out by South Asia Consortium for Interdisciplinary Water Resources Studies (SaciWATERs), Hyderabad, India and funded by Terre des hommes (Tdh).

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Special Mention:

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EXECUTIVE SUMMARY

The baseline study is an exploratory assessment conducted by SaciWATERs with funding support from Terre des hommes (Tdh) with an objective to identify some of the key child and youth-related vulnerabilities emerging from climate change impacts on the Indian Sundarbans region. The Sundarbans region, a tidally active lower deltaic region of the largest delta in the world, is considered one of the most vulnerable regions in the face of a rapidly changing climate and consequent environmental changes. Climate change is a long-term shift in weather patterns and eventually climatic patterns. Though it is a natural phenomenon, however, further aggravated by human interventions like- high population growth rate, inadequate infrastructure planning, and investment, unsustainable land-use decisions, increasing use of fossil fuel, etc. The Sundarbans region is not an exception. Home to dense mangrove forests, this region offers as the vanguard against the ravages of severe cyclonic storms and tidal surges for the larger Bengal delta and the megacity of Kolkata. A maze of rivers, rivulets, and creeks, this region is drained by 7 important rivers from Hoogly in the west to Harin-bhanga in the east, and the Bay of Bengal in the south. This biodiversity hotspot region with unique ecological and geophysical characteristics is extremely fragile and increases the vulnerability of the local population.

Children are found to be a particularly vulnerable group to climate change as children have a unique metabolism, behaviour, physiology, and development characteristics. The existing literature suggest that the impacts of climate change on children are not always straightforward and easily predictable. These impacts vary among individuals depending on context and many times facilitated by a host of other socio-cultural, economic, ecological, or political factors. Integration of social sciences with natural sciences to better understand the differences in the way that climate change affects children present a more holistic, nuanced picture of how climate change intersects with various other factors (such as social, cultural, institutional and technological) in different settings. In this context, drawing on multiple data sources, methods, and tools, the overarching goal of this study is to build an understanding of the impact of climate change in order to inform directions of Tdh interventions in the region to be more climate-responsive. Within a broader thematic focus on health, migration and child protection, the study aims to draw particular attention to child and youth-specific vulnerabilities through focal areas of maternal and child health, migration and trafficking as well as child protection. In this regard, a mixed-method approach can provide a distinctive lens to illuminate how local communities perceive, understand, value, and respond to the impacts of climate change. This knowledge will also be crucial for informing climate change adaptation initiatives and providing a stronger foundation for protective measures.

This study brought out 4 major climate change outcomes for the Sundarbans region – sea surface temperature changes, sea level rise and land erosion, salinity changes and biodiversity, and incidence of cyclonic storms. Each of these is closely linked to some tangible consequences for the socioeconomic and resource outcomes for the Sundarbans population. The cumulative impacts of climate change lead to a cascading set of consequences, including increasing poverty, reduced food production, the loss of livelihood security, negative impacts on health, large-scale migration, and increased economic and geopolitical tensions and instabilities. With the intensification of the climate crisis, there is an increasing concern among the island communities to sustain their lives

and livelihood in such a hostile environment. Climate change impacts on livelihoods, natural resources, infrastructure and services are found to be some of the key mediating processes that connect climate change with more underlying socioeconomic impacts on poverty, migration, spatial differences and inequalities, and social and gendered marginalities. Multiple pathways connect larger climate change variables and outcomes with socioeconomic vulnerabilities including intersections with anthropogenic and developmental activities, social structures, policy and governance, class structures and poverty, local geographic variations, and historical development of the region. These pathways link climate change to significantly more complex social outcomes of health, migration, and protection.

This research highlights the precarious health condition of the people of the Sundarbans region along with the poor health system. Sundarbans region shows a high prevalence of child marriage and adolescent pregnancy. Studies identified climate change as one of the determining factors for the health outcomes for this region. While the incidences of death, injury, and drowning resulting from the direct exposure to extreme weather events have declined massively in the last few years due to better preparedness and risk management strategies in the Indian Sundarbans region. Contrary to this, the disease burden among the children is still quite overwhelming followed by extreme weather events. Three types of health problems i.e. worm infestation, diarrhoea, and skin rashes/ infection among the children following cyclones and floods and also during the hot and humid summer period has been reported. There is a clear indication that with the increasing frequency of cyclones, floods, and drought events there are chances of increased incidences and epidemic outbreaks of infectious diseases. The increasing cases of anemia (low hemoglobin) among the reproductive age group women have been identified as another major public health problem post-disaster period in Indian Sundarbans region. Climate change also brings indirect health risks for children and mothers through impacts on ecosystems and human social systems or interaction of both. This is a complex process and follows multi-stepped, diffuse, and deferred causal paths. The indirect impacts of climate change on child and maternal health mediate through two pathways, i.e. through water insecurity caused by a disruption in freshwater services due to depletion of groundwater, increasing level of salinity in groundwater and surface water; and through food insecurity caused by the decrease in farm production, crop failure, the decline in fish production, etc. we also find that disruption in normal ways of life due to extreme weather events brings emotional trauma and disorders to the children. Extreme climatic events also create a lot of stress among pregnant mothers, especially for those who live in island villages surrounded by rivers.

With a geography susceptible to cyclonic storms, poor groundwater availability and access, lack of irrigation, and single cropping season, this region has long had processes of migration ingrained into its socioeconomic fabric. The blocks with high/very high climate exposure have high percentage of households (above 60% hhs) with migration while those with low exposure or have relatively lower (below 50% hhs) incidence of migration. Temporary cyclic migration was found to be the major form of migration in the region overall. Labour migration in the region is facilitated through highly informal processes by independent contractors, familial connections and social networks. An assessment of the reasons for migration as reported by households we find a close alignment with this aspiration overlapped with climate change related vulnerabilities as observed in the spatial correlation earlier. It is found that while the migration percentages among children are low, their early involvement in the labour market sets the stage for their migration for work in their early youth. The other significant form of migration in the region is

related to marriage migration. Given the prevalence of early marriage in the region this form of migration holds relevance for the youth, their capabilities and vulnerabilities. As child marriage has also been a prevalent age old practice in this region, the actual extent of marriage migration is not easy to ascertain since most households do not reveal cases of child marriage for a fear of administrative/punitive action. Child marriage was stated to have significant implications for child vulnerability both for boys and girls. Boys were compelled to provide an earning and livelihood for a family and pushed into a precarious labour market at a very young age. On the other hand girls marrying at that age were faced with problems of teenage pregnancies and associated health dangers, burdens of child rearing, at a very early age, pressures of domestic responsibilities, and consequent limitations on their mobility and educational aspirations. A high incidence of girl child trafficking is reported in the Sundarbans region by civil society and government stakeholders.

The increasing frequency and intensity of climate-related extreme events are likely to increase the protection risks to children in the form of increased child labour, child marriage, teenage pregnancy, abduction, recruitment into fighting forces, sexual violence and labour migration. Violence at home by parents/caregivers is the most common form of violence experienced by children of the Indian Sundarbans region. It is expected that stressors related to extreme climatic events, including concerns over the shelter, health, food security and income, could exacerbate this violence against children, both increasing the risk to children already in abusive and neglectful households, as well as increasing the potential for over-stressed parents/caregivers to become violent or abusive. A number of parent or caregiver factors potentially contributing to the maltreatment of the children were identified during the field study. These include lack of patience, the young age of a parent, absence of one parent, lack of education, household responsibility, and poverty. Of all the categories of child abuse, neglect and violence in the Sundarbans region, exploitative child marriage has received perhaps the greatest attention. It is reported that the tendency of underage marriage has massively increased in the last 10 years in the Sundarbans region. The survey found that child marriage has been found to increase a woman's chances of being abused. Child brides often show signs symptomatic of child sexual abuse and post-traumatic stress. Such symptoms include feelings of hopelessness, helplessness and severe depression. Exposure to the digital world has increased the likelihood of exploitation among children in Sundarbans region.

While children are most affected by natural disasters given their physical and psychosocial vulnerability, disruption of services, high dependency on parents or other caregivers, and limited scope of representation and voice. Children's views are not being asked for and they are rarely consulted and their opinions are not taken into consideration most of the time. It is found that there are no Disaster Risk Reduction (DRR) activities for the affected communities and specifically for children. There is limited scope for children to talk about disaster-related risks (physical as well as social) in the area and their collective voice is not heard in any action plans. Children's views can be meaningful when children have access to the right information about events that affect them, and are given the opportunity to express their experiences. This report reveals that the expression of children's views also depends on their cognitive ability based on their knowledge base and should not be based on their age, cultural background, and/or socioeconomic status. Stakeholders can achieve this through the provision of enough time to understand children's views, issues, and perceptions, and can make available child-friendly information on community-based DRR so children can act responsibly.

This report is the outcome of a 6 months long study through which we aimed to build an evidence base of the impact of climate change on child protection, rights and wellbeing and key factors that make children vulnerable to such impact. The report provides recommendations on the implementation of child-centric adaptation strategies, along with the integration of a child focus in the existing plans and policies at the national and sub-national level.

1 UNDERSTANDING THE LINKAGES

The Sundarbans region, a tidally active lower deltaic region of the largest delta in the world, is considered one of the most vulnerable regions in the face of a rapidly changing climate and consequent environmental changes. The Indian Sundarbans region comprises 102 islands, of which 48 islands are mangrove-dominated ecosystems demarcated as a Reserve Forest. 58 islands with embankments enable dense human habitations. Home to dense mangrove forests, this region offers as the vanguard against the ravages of severe cyclonic storms and tidal surges for the larger Bengal delta and the megacity of Kolkata. A maze of rivers, rivulets, and creeks, this region is drained by 7 important rivers from Hoogly in the west to Harin-bhanga in the east, and the Bay of Bengal in the south. This biodiversity hotspot region with unique ecological and geophysical characteristics is extremely fragile.

A significant body of emerging literature captures the changing climate and its environmental and resource implications for this region. However, the societal linkages and impacts of climate change in the region are understood and documented much lesser. Assessments of climate change impacts are rarely simplistic and linear. Climate change linkages with societal outcomes are complex and traverse through multiple sectors and pathways, varied geographical contexts and scales, underlying local socioeconomic structures, and layers of mediating direct and indirect outcomes. Therefore, understanding social vulnerability to climate change and making social initiatives climate-responsive requires an appreciation and knowledge of these linkages and pathways.

The present study aims at understanding these linkages and pathways for three focus areas – health, migration, and child protection – in the Indian Sundarbans region. The overarching goal of this study is to build an understanding of the impact of climate change in the Sundarbans which will inform Terre des hommes (Tdh) interventions in the areas of mother and child health, protective accompaniment of children and youth on the move as well as child protection to more climate-responsive. Various models and frameworks have been extended in the global literature to visualize these climate change impacts and responses. This section will scope the existing global literature to understand the nature of linkages between climate change and the three focus areas in order to identify the key building blocks of such frameworks. It will then look into the body of literature emerging from the Indian Sundarbans region to understand the processes and outcomes of this region. Together these sections will provide a base for creating an integrated framework of analysis for this study with a particular focus on women and children.

1.1 Climate change linkages with health

Centre for Disease Control[1] (CDC) extends a simple and relatively linear framework between climate change and health, building blocks of which incorporate climate factors leading to exposure pathways, which further create climate-sensitive health risks comprising high probability health outcomes. *Climate factors* include the direct climate outcomes of increased temperatures, extreme weather, sea-level rise, and CO_2 levels. *Exposure pathways* describe the ways in which these climate outcomes are experienced such as extreme heat, air and water quality, food and water supply, environmental degradation, disasters, and vector and allergen

[1]https://www.cdc.gov/climateandhealth/effects/default.htm

changes. This framework captures a variety of specific *health outcomes* and diseases including respiratory, cardiovascular, vector-borne diseases, injuries and fatalities, mental health-related, and food-water-related diseases. However, there is no focus on underlying contexts of vulnerability and resilience.

Machalaba et.al 2015[2] call instead for transcending disciplinary silos in responding to climate change impacts on health as they acknowledge the complexity of impact pathways. They find that health outcomes of climate change cannot be isolated from the *social and ecological contexts and determinants* of diseases. These complexities come both from overlapping drivers of climate change mixed with other anthropogenic pressures on ecosystems. Further climate change tends to multiply and intensify these sociopolitical processes and drivers such as land use changes, resource exploitation, biodiversity loss, food and water insecurity, livelihood insecurity, and conflicts. Due to these multidimensional causalities and pathways the influence of climate change on infectious diseases and their distribution are difficult to model robustly and are thus heavily debated (Machalaba et.al 2015).

The conceptual illustration of climate change impacts on health by the U.S. Global Change Research Program (USGCRP 2016)[3] contributes to the CDC framework acknowledging contextual factors – Environmental, Institutional, Social and Behavioral. *Environmental and institutional contexts* comprise factors influencing vulnerability at larger scales of natural and built environments. *Social and behavioral contexts* on the other hand include key factors that influence vulnerability for individuals such as age and gender, housing, poverty, education, discrimination, and biological conditions. This framing considers the fact that climate change not only impacts the exposure pathways but also the context factors. And these altered context factors further impact health outcomes either directly or indirectly through their influence on the exposure pathways.

Myers et.al[4] (2013) in their framework looking at ecosystem alterations and health impacts make significant contributions to climate change-health linkages recognizing that ecosystem deterioration, which is a key driver of negative health outcomes, is not only a function of climate change, but also other anthropogenic pressures such as resource decline and degeneration, and land use changes. The other contribution of this framework is to look at '*insulating layers*' that modulate negative health outcomes. These insulating layers are risk buffers that can have implications for the extent and depth of negative health impacts. Insulating layers can therefore reduce *climate-sensitivity* and increase *adaptive capacity* of the affected population.

Clayton et.al's (2014)[5] framework extends health outcomes to incorporate – *Physical health, Mental health, and Community Health*. Here community health refers to impacts emanating out of altered ways of social interaction and community relations – such as displacement, social

[2]Machalaba, C., Romanelli, C., Stoett, P., Baum, S. E., Bouley, T. A., Daszak, P., &Karesh, W. B. (2015). Climate change and health: Transcending silos to find solutions. Annals of Global Health, 81(3), 445-458.
[3]https://health2016.globalchange.gov/
[4]Myers, S. S., Gaffikin, L., Golden, C. D., Ostfeld, R. S., Redford, K. H., Ricketts, T. H., ... & Osofsky, S. A. (2013). Human health impacts of ecosystem alteration. Proceedings of the National Academy of Sciences, 110(47), 18753-18760.
[5]Clayton, S., C. M. Manning, and C. Hodge, 2014: Beyond Storms & Droughts: The Psychological Impacts of Climate Change. 51 pp., American Psychological Association and ecoAmerica, Washington, D.C.

instability, loss of public trust, violence and abuse. Curtis et.al (2017)[6] provide insights on extending health impacts to include *health and social care systems*, both in terms of climate change *vulnerability* as well as focal areas of *preparedness and adaptation*. Thomas et.al (2014)[7] further extends health outcomes to a larger concept of well being. In this extension, focus has been laid on impacts emerging not only from climate change but also general health *'co-benefits' and 'dis-benefits'* that would emanate from climate adaptation and mitigation measures.

Finally, an important contribution to these frameworks have been the emerging focus on a key mediating factor i*nequality leading to differentiated vulnerabilities.* Clayton et. al (2021)[8] introduces into a climate change-health framework three categories of inequality - *Social, Individual, and Physical inequalities.* Societal inequalities refer to economic inequalities and unequal access to services and basic needs across social structures. Individual inequalities refer to an individual's specific vulnerabilities emanating from one's pre-existing biological and health conditions, age, sex, and occupation. Physical inequalities emerge from one's locational, infrastructural, and geographic marginalization. WHO (2014)[9], Sorensen et.al (2018)[10] elaborates on the gendered impacts of climate change on health urging for an integration of gendered lenses into existing climate, development, and disaster risk reduction frameworks. Bennett and Friel (2014)[11] bring forth not only the specific vulnerabilities for children but contribute to the framework a need to look at inequalities among children with a disproportionate disadvantage for poorest and socially-disadvantaged children.

1.2 Climate change linkages with migration

Climate change linkages with migration, as in the case of health impacts, are mediated through numerous factors making environmental migration predictions complex. It is difficult to isolate climate change and environmental factors as the sole drivers behind migration (IOM 2014)[12]. One of the most prominent frameworks of migration used in the literature is adapted from Black et.al's (2011)[13] work on the drivers of migration. The study effectively frames the decision to migrate as a function of complex interlinkages between *social, environmental, economic, demographic, and political drivers* which are all influenced by *environmental changes*. These drivers together determine the context of individuals and communities within which costs and benefits of migration are assessed leading to decisions to move or stay. In addition to these drivers that provide the basis for individual vulnerability/capacity, the actual decision to migrate is also

[6]Curtis, S., Fair, A., Wistow, J., Val, D. V., & Oven, K. (2017). Impact of extreme weather events and climate change for health and social care systems. Environmental Health, 16(1), 23-32.

[7]Thomas, F., Sabel, C. E., Morton, K., Hiscock, R., &Depledge, M. H. (2014). Extended impacts of climate change on health and wellbeing. Environmental Science & Policy, 44, 271-278.

[8]Clayton, S., Manning, C. M., Speiser, M., & Hill, A. N. (2021). Mental Health and Our Changing Climate: Impacts, Inequities, Responses. Washington, D.C.: American Psychological Association, and ecoAmerica.

[9]World Health Organization. (2014). Gender, climate change and health. World Health Organization. https://apps.who.int/iris/handle/10665/144781

[10]Sorensen C, Murray V, Lemery J, Balbus J (2018) Climate change and women's health: Impacts and policy directions. PLoS Med 15(7): e1002603. https://doi.org/10.1371/journal. pmed.1002603

[11]Bennett, C. M., & Friel, S. (2014). Impacts of climate change on inequities in child health. Children, 1(3), 461-473.

[12] IOM. (2014). IOM outlook on migration, environment and climate change. International Organisation for Migration.

[13]Black, R., Adger, W. N., Arnell, N. W., Dercon, S., Geddes, A., & Thomas, D. (2011). The effect of environmental change on human migration. Global environmental change, 21, S3-S11.

impacted by *social and household capability* as well as *intervening external obstacles or facilitators* for migration.

UNDP (2017) frames a broader spectrum of migration, conceptualizing it as *mobility*. Firstly, under this concept of mobility a wider range of movements are considered including – *stay and adapt, long term migration, temporary cyclical migration, and displacement*. It further differentiates between responses to *slow-onset and sudden-onset* climate and environmental factors. Rise in natural disasters leads to more and more forced climate displacement. This form of migration however often happens unprepared and uninformed, resulting in a potential rise of risks and dangers all along the migratory routes. For children and youth specifically, vulnerabilities and specific child protection concerns tend also to increase. Therefore while migration is indeed for many an adaptative strategy and particularly in response to multiplying climated change induced threats, the mobility lens allows to look at migration from perspectives of both opportunities and challenges. While financial and livelihood benefits, access to education and employment may accrue as opportunities, disrupted social networks and potential for labour exploitation, trafficking as well as other protection concerns along the route in transit but also destination places where migrants have to start afresh and are often facing strong marginalization dynamics, provide as negative outcomes of mobility, and notably forced one.

1.3 Climate change linkages with child vulnerability and protection

Age and gender intersectionalities have been inbuilt into the varied frameworks of climate change impacts on health and migration. The aforementioned pathways of health and migration impacts therefore offer overarching building blocks for understanding child vulnerability as well. UNICEF (2021) further delineates the specific sectoral pathways that are most central to the context of children. These specific drivers of child vulnerability emanate from *lack of WASH, health and nutrition, education, social protection, conflict and fragility*. Lack of *recognition of children's voice, agency, and participation* is widely considered in literature as a source of child vulnerability. Climate change exposure pathways tend to exacerbate these vulnerabilities, which in turn exacerbate exposure to child protection concerns creating a vicious cycle and magnifying the effects.

The social-ecological framework for prevention developed by the Centre for Disease Control and Prevention offers a four-level social-ecological model to better understand risk and violence faced by children and the effect of potential prevention strategies. This model considers the *complex interplay between individual, relational, organizational, community, and policy factors*. It allows us to understand the range of factors that put children at risk of violence or protect them from experiencing or perpetrating violence in the context of climate change. The overlapping rings in the model illustrate how factors at one level influence factors at another level. Besides helping to clarify these factors, the model also suggests that in order to prevent violence, it is necessary to act across multiple levels of the model at the same time. The unique perspectives of children towards the environment, the need for building intergenerational climate justice, and push for basic human rights for all categories of population have been considerations for increasing child protection and *child participation* in climate policy, planning, preparedness, adaptation, and mitigation.

UNICEF (2019)[14] put forth an integrated framework for social protection across the life course which incorporated different *age-based vulnerabilities* and associated social protection programmes to address the varied needs of different population groups. "Such a life-course approach offers child-sensitive social protection in that it reaches children directly but also recognizes their connection with adults at different stages of their lives" – UNICEF 2019, pp 34. Such a framework integrating varied age-groups thus recognizes vulnerabilities and needs for protection ranging from maternity and child benefits, early education, childcare, education support, care work, skill development, access to employment and work across gender groups, parental leaves, insurance programmes and child-sensitive pensions and social care. Along with varied age groups, Bennett and Friel (2014) put forth a need to look at *inequalities among children* with a disproportionate disadvantage for poorest and socially-disadvantaged children.

1.4 Building Blocks for an Integrated Analytical Framework

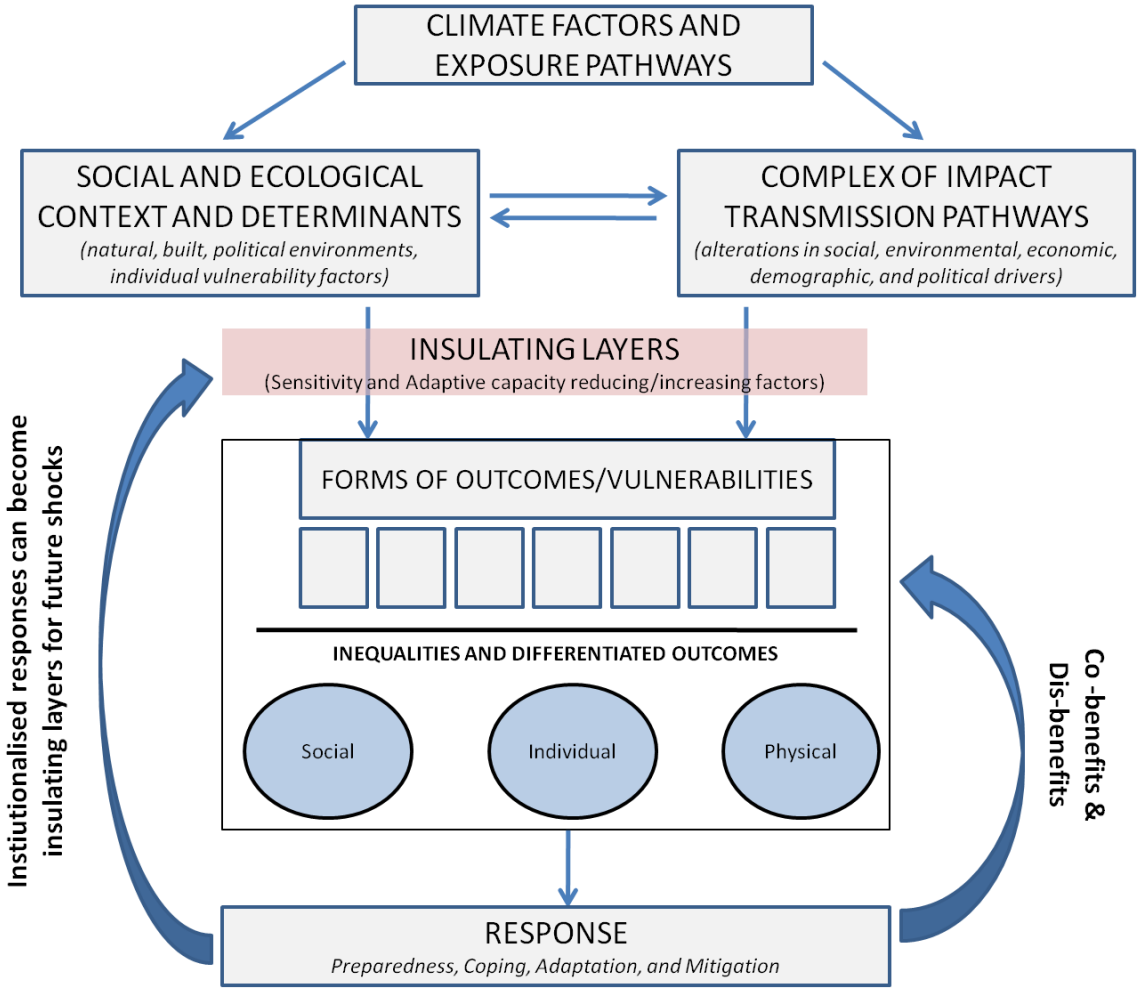
From the above discussion on climate change linkages and frameworks, we aim to identify some of the essential building blocks of a framework that would enable us to tie together the three interconnected focal areas of study through a lens of child and youth vulnerabilities. This integrated broader framing would also provide for an analytical framework for this study within which the conditions, processes, and pathways emerging from the Indian Sundarbans region may be located. We are able to identify, categorise, and structure the following building blocks required for an assessment of climate change impacts:

- Climate factors and exposure pathways
- Social and ecological contexts and determinants
- Impact transmission pathways (*social, environmental, economic, demographic, and political drivers)*
- Insulating layers – Sensitivity and Adaptive Capacity
    - *social and household capability*
    - *intervening external obstacles or facilitators (policy, local institutions, informal institutions)*
    - *complex interplay between various levels/scales: individual, relational, organizational, community, and policy factors*
- Forms of Outcomes/Vulnerability – e.g. Categorizations of health, migration, and child-related impacts/vulnerabilities
    - *Health: Physical health, Mental health, Community Health, Health and social care systems*
    - *Migration: stay and adapt, forced and voluntary, temporary and permanent, internal and international*
    - *Child vulnerabilities: Different vulnerabilities across life course*
- Inequality and differentiated outcomes
    - *Social (gender, class, caste),*
    - *Individual (age, biological, occupational)*
    - *Physical (infrastructural and geographical) inequalities*
- Response: Preparedness, Coping, Adaptation, and Mitigation

[14] UNICEF (2019): "UNICEF's Global Social Protection Programme Framework". Social Inclusion and Policy, United Nations Children's Fund, October 2019

- 'Co-benefits' and 'Dis-benefits': vulnerabilities or resilience emerging from response mechanisms

Figure 1.1: *Building Blocks and Framework for Climate change linkages*



Source: Conceptualized by the authors.

1.5 Questions addressed and Information base

In further pursuing the issue of the impact of climate change in the Sundarbans in the areas of mother and child health, tackling and preventing the risks and dangers linked to climate-induced migration and trafficking as well as strengthening child protection, a number of related questions arise, such as: is there any impact of increasing salinity in soil and land erosion among pregnant women and dietary diversity among children? What are the risks of current climate variability and change on health risks among mothers and newborn children in the Sundarbans region? Are the current institutional capacity of health and allied sectors good enough to manage the risks of climate-sensitive health outcomes in Sundarbans? how climatic conditions induce migration in Sundarbans, particularly among youth and children, and its relationship to other push and pull factors-social, political, economic, etc.? Assess how do climatic conditions exacerbate the factors

that shape vulnerability to human trafficking, especially girls in the Sundarband region? Are there any bottlenecks among government and non-governmental originations to respond effectively to the challenges posed by human trafficking and associated form of exploitation of the vulnerable population With a focus on children, and therefore formal and non formal child protection systems?

To answer the larger body of questions raised above we conducted a household survey in 20 villages spread across 5 blocks of Sundarbans. Data was collected from a total of 410 households using the PPS sampling method. This quantitative information has been supplemented by qualitative interviews with different stakeholders from the region. The details methodology is discussed in chapter 3.

1.6 Purpose of the report

The need assessment report is meant to present state of the art knowledge in order to guide Tdh's future interventions to mitigate climate change impacts on mother and child health, migration-related risks, and dangers such as trafficking of children and youth from the Sundarbans.

The study can also be used by the climate change and child protection researchers, practitioners, implementers, NGOs, academia, and the general public, with the purpose of preparing effective action plans on climate change in the context of Sundarbans and reducing the negative impact on child protection.

1.7 About the report

This report is divided into nine chapters. The introductory chapter is followed by eight chapters outlining the impacts of climate change on child health, migration, and protection in the Indian Sundarbans region. ***Chapter 2*** provides a background to the state of the art knowledge about the Sundarbans region and more specific indicators and inquiries for further development of the research method. ***Chapter 3*** focuses on the mixed-method approach used in this study to answer the research question. ***Chapter 4*** presents the socioeconomic and ecological contexts of the region as well as looks at mediating pathways through which climate change vulnerability for the region is founded. ***Chapter 5*** attempts to critically inquire into and understand the impact climate change factors will have on the child and maternal health conditions and the health systems. ***Chapter 6*** focuses on the general incidence of migration in the study area, reasons reported by households for migration, and considers some complex linkages that create unsafe migration and factors that have affected these. ***Chapter 7*** presents climate change impacts on the child protection vulnerabilities for girls and boys and enablers for a protective environment considering the Social-Ecological Framework and through a gender lens in the Indian Sundarbans region. ***Chapter 8*** focuses on the challenges and constraints girls, and boys are facing in the Sundarbans region to take part in discussions on climate change effects on their lives through a gender lens***. Chapter 9*** concludes this need assessment study by summarizing the key findings and the way forward.

2 LITERATURE AND FRAMEWORK FROM THE SUNDARBANS

Having integrated several building blocks for a climate change impact framework, we now aim to develop and nuance this framework for the specific context of the Indian Sundarbans based on the research and literature emerging from the region. The objective of this section is not only to provide a background to the state of the art knowledge about this region but also to provide this study with more specific indicators and inquiries for further development of the research method.

2.1 Climate Factors and Exposure Pathways

A significant and emerging body of scientific literature has studied climatic changes occurring here and their consequences for the region. The core indicators analysed are temperature shifts, sea-level rise, resultant land erosion and land loss, river and groundwater salinity, pattern and frequency of severe cyclonic storms, and biodiversity. Assessment of surface water temperature trends in the Indian Sundarbans between 1980-2007 revealed a gradual increase at the average rate of 0.5 degrees Celcius per decade – much higher than the global rate of 0.06 degrees per decade and the IPCC documented rate for the Indian ocean at 0.2 degrees (Mitra et.al, 2009)[15]. Not only is there an overall increase in sea surface temperature, Hazra et.al (2010) found that this rate of increase in recent years (2001-2009) has been higher than the rate of increase observed in the decade before implying that the climatic shifts are expected to occur faster now that seen before. Nandy and Mandal (2020) corroborated the increasing sea surface temperatures through their observation of excess warm water zooplanktons found in estuarine waters of the Indian Sundarbans[16].

The other important indicator of climate change impacts in the region studied pertains to sea-level change and the resulting consequence for land erosion. Pramanik (2016) analysed sea level data change from 1950 – 2014, and found an approximate rise in sea levels of 0.30m over this period[17]. Further, Hazra et.al (2010) found that the average annual rise in relative mean sea level was higher in the recent decade (17.8mm/yr in 1999-2008) than in earlier decades (3.14mm/yr). In addition to sea-level rise, the Bengal delta falls under the highly active seismic zone IV and is affected by tectonic subsidence, together causing higher relative sea-level changes (Chatterjee et.al, 2015). These two factors along with the active tidal and river regimes of the area have resulted in severe erosion of the deltaic landmass creating a significant land loss. While erosion rates have not been uniform temporally or spatially, Rahman (2012) found the average rate of coastal erosion to be around 14-15m/yr in the period 1970-2010 with Dasgupta et.al (2020) reporting linear retreat as high as 40m/yr for some islands. Temporally it is seen, from Rahman et. al's (2011) analysis between 1970-2010, that while both erosion and accretion rates (from

[15] Mitra, A., Gangopadhyay, A., Dube, A., Schmidt, A. C., & Banerjee, K. (2009). Observed changes in water mass properties in the Indian Sundarbans (northwestern Bay of Bengal) during 1980–2007. *Current Science*, 1445-1452.

[16] Nandy, T., & Mandal, S. (2020). Unravelling the spatio-temporal variation of zooplankton community from the river Matla in the Sundarbans Estuarine System, India. *Oceanologia*, *62*(3), 326-346.

[17] Pramanik, M. K. (2016). Assessment of the impacts of sea level rise on mangrove dynamics in the Indian part of Sundarbans using geospatial techniques. *Journal of Biodiversity, Bioprospecting and Development*, *3*(155), 2376-0214.

river deposits) have been changing over the decades since the 1990s erosion rates have exceeded the accretion rates significantly leading to net land loss in the region. In terms of land loss, Hazra et.al (2010) reported a net land loss of 44 sq.kms in the island system from 2001 to 2008. Chatterjee et.al (2015), from their analysis of the 13 most affected islands, found that the southern boundaries (sea-facing) and western boundaries of islands were most prone to erosion while accretion happened more on the northern and eastern boundaries. Sea level rise also appears to be linked with the increase in land use under water bodies and swamp areas (Hazra et.al 2010).

Directly linked to sea-level changes are the river salinity levels in the region which are not only an important indicator of climate change outcomes but also have important implications for local biodiversity. With the sea-level rise and tectonic subsidence saline, tidal waters flow deep into the river channels mixing with freshwater increasing salinity in the rivers for longer distances. The most notable observation emerging in the literature on river salinity was a clear regional variation found between the western sector and central/eastern sector of the Sundarbans (Banerjee et.al 2017, Mitra et.al 2009, Chakraborty et.al 2013, Zaman et.al 2018). The western sector is predominantly drained by the rivers Hoogly and Muriganga linked with the Ganga receiving perennial glacial meltwater. With climate change and resultant increase in glacial melting, the meltwater flowing into this sector has increased thereby reducing the river salinity levels in this sector. On the other hand the rivers draining the central (N24 PGNS district and Reserve Forest belt) have lost their connection with the Ganga river over years of shifting channels and have therefore faced increased siltation, drying or reduced freshwater flows. This has led to increase tidal flows into the river channels and therefore increased river salinization in the eastern sector.

A significant body of literature studying mangroves has found a direct impact of salinization on retreat of mangroves landwards and loss of salinity-sensitive species of mangroves thus changing the overall forest landuse and biodiversity (Pramanik 2016, Chowdhary 2016, Shams Uddin et.al 2013). The most dominant species of this region, *Heritiera Fomes*, commonly called the 'Sundari' tree (believed to be the origin of the name 'Sundarbans'), also a high value timber tree, is expected to be critically impacted due to this salinization. Salinity resistance varieties of mangroves are expected to increase in dominance at the cost of salinity-sensitive species in the coming years (Banerjee et.al 2017, Dasgupta et.al 2017). Similarly, salinization of rivers also impacts the aquatic biodiversity causing reduced productivity of freshwater fish (Dasgupta et.al 2020). The variations in salinization in the western and central/eastern sectors also overlap with variations in land use changes between the two sectors with the eastern sectors seeing more changes from agriculture to aquaculture, while in the western sector there has been a higher shift from agriculture to settlements (given also its proximity to Kolkata city) (Hazra et.al 2010).

Finally, a most significant climate change indicator and outcome studied is the frequency and patterns of cyclone incidence and vulnerability in the region. The frequency of severe cyclones has increased by 26 percent in the Bay of Bengal over the period 1975-2006 (Islam, 2014). Mishra (2014), from his analysis of cyclonic events from 1891-2013, found a trend of enhanced cyclogenesis during the months of May, October, November, December. Dasgupta et.al (2020), through their analysis of cyclones in the period 1877-2016, found that the median location of cyclones shifted eastward over time making the Sundarbans the highest impact zone. Severe cyclones cause rampant breach of embankments, tidal surges, flooding of settlements and agriculture land, and salinization of soils and ponds (Pramanik 2016, Mukherjee and Siddique

2021, Dasgupta et.al 2020). Almost 1000kms of embankments were damaged and breached in the Indian Sundarbans during the cyclonic storm *Aila* in 2009 (Hazra et.al 2010). Between 2005 and 2014 Danda et.al (2019) reported flooding of between 13 – 32 percent of agriculture land in 5 major islands – Sagar, Patharpratima, Basanti, Gosaba, Sandeshkhaali II.

2.2 Climate Change and Migration in Sundarbans

The widespread incidence of migration is not a new phenomenon in Sundarbans. Naturally prone to seasonal vagaries with geophysical constraints for resource and market access, migration has been a coping practice among households since the early periods of settling in the region. The patterns and causalities for migration present significant variations across regions and sections of the population in the region. The literature base on migration in Sundarbans can be found to cover varied mobilities and processes under the umbrella of migration. These include regular community migrations seeking livelihoods, disaster-induced displacement, and mobility, long-term erosion-induced permanent migration, and planned government-supported retreats. Each of these is connected to climate change to varying degrees and through different impact pathways.

Regular community migration occurs for varied causes; a combination of push and pull factors. There is a high percentage of households (almost 50%) in the region where at least one member of the household has migrated (Nguyen and Wodon, 2015). Reasons could include migration for marriage, education, or seeking livelihoods. This migration is predominantly done by male members of the household between the age of 15-35yrs. Mistry (2019) finds that majority of these migrants follow temporary circular migration patterns with at least once a year return frequency to the village which could be for seasonal agriculture work at home or any other seasonal work available in or near the village. Migrants are equally prone towards inter-district migration within the state and interstate migration. This migration is mostly enabled and directed through social networks, local agents, and even some illegal brokers who can enable illegal cross-boundary migration (Shewly and Nadiuzzaman 2017, Mistry 2019, Saha and Goswami 2020). Education levels, skills, and networks play a major role in determining migration decisions. Since these are facilitated by agents, migrants mostly adhere to contractual arrangements with employees and agents that determine the place of work, quality of work, flexibility, and frequency of payment, the abiltoy of return home, and duration of employment. With regard to linkage with climate change on this "planned migration", empirical studies by Nguyen and Wodon (2015) and Mistry (2019) since coping with climatic shocks, resource degradation and depleting livelihood options in Sundarbans has been a slow and age old practice in the region it is not considered as a primary reasoning for migration by households and a rather low percentage of households report reasons directly related to climate change. There are others however who have reported significant linkage between climate outcomes and reasons to migrate (Gunjal 2022, Guha and Roy 2016, Pramanik et.al 2021). In addition to that, there are sample data surveys on migration which are unable to capture the underlying exploitative or bonding nature of the employment contracts. Literature on trafficking highlight the exploitative conditions poor households, especially the most vulnerable social groups, for a lack of capital can often move into such exploitative contracts, especially women (Molinari 2017, Bettio and Nandi 2008, Pakrashi 2014). On the other hand many poor households, for a lack of capital, may not be able to afford to migrate at all and therefore get stuck in local poverty traps (Nguyen and Wodon, 2015). Further, under male selective migration, women's burdens and vulnerabilities are pushed to more critical levels as

they bear the load of declining agriculture, childcare and domestic duties (Mukherjee and Siddiqui 2019).

The other form of migration and displacement found are by households in villages living close to embankments which are the first to lose land and livelihoods following severe cyclonic disasters, embankment breach, and heavy flooding which may persist for months or years as rebuilding of embankments by government support is often a slow delayed process. It is seen that while households move to other villages, they prefer to not move far away from their affected lands because of livelihood and familial roots that they are often not easily willing to sever (Bera 2013). This is especially true for fishing households that depend on the proximity to river or sea for their livelihoods. Households are also not willing to permanently move without their kin as they are not willing to lose their social networks and often delay migration until they can find or afford sufficient land for the entire family. Men from villages at the island boundaries are found to prefer marriage ties to women from villages in the interiors of the island and seek land in these interior villages as dowry to then settle their kin. Villages in the interiors of islands have high land values and because of high immigration tend to get crowded further disincentivising displaced village communities to find space here. Some households may also migrate to resettlement colonies provided by governments, but for many these are not lucrative since these are generally based in areas of dried estuaries and saline land with limited livelihood options.

A third form of displacement and migration is more permanent migration between islands that is taken on by households permanently due to long term sea level changes and complete land loss (Das and Hazra, 2020, Bera et.al 2021). This is seen specifically in islands that have partially or completely disappeared over the past decades. Permanent migration to safer islands is done in addition to temporary migration taken on for providing income and livelihood to the household. This shift often requires capital and therefore impacts those who are least able to afford it as they are either locationally stuck on their eroding islands or are significantly impoverished in their new destinations. Example of such migration is seen in Ghoramara island where many households moved to Sagar island. Such migration is often enabled and eased by close social networks or kin who may have already migrated earlier and can provide support to newly migrating individuals and families. Government supported and planned retreat or resettlement has also been seen in this region for such permanent land loss wherein (as in the case of Ghoramara) the government facilitated capital access and settlement for affected populace enabling such migration (Danda et.al 2019). However that scheme was practiced earlier and is no longer active.

And while many must evacuate to safer grounds, children deprived of liberty held in detention centres cannot.

The covid-19 pandemic, extreme weather conditions, political and armed conflicts and supply disruptions are the ultimate formula for the 'perfect storm'[18]. Heat waves, deterioration of water quality, Air pollution, and rising sea levels will directly affect justice system infrastructures, causing severe flooding as well as rising air temperature and humidity inside buildings.

[18] 2021. *Global Prison Trends 2021*. [online] Penal Reform International, Thailand Institute of Justice. Available at: <https://cdn.penalreform.org/wp-content/uploads/2021/05/Global-prison-trends-2021.pdf> [Accessed 14 June 2022].

Children in detention are among those hardest impacted by these effects. Therefore, it is fundamental to raise awareness of what can be done to prevent them from suffering the impacts of climate change on deprivation of liberty and to advocate for more community based and other alternatives measures. Evacuation and shelter plans should be in place for immediate emergency response and to alleviate other possible harmful consequences. In this specific context, it is clearly imperative to maintain good communication channels with the families of detained children, ensure continuity of medical care and develop a safeguarding plan.

Migration is therefore a highly nuanced process and in this region is a traditionally practiced coping strategy for most households. After Aila temporary migration rates for employment increased drastically showing that climate induced disasters do indeed impact migration. However, since much of this is temporary movement, one may not see these cases in line with the arguments for climate-refugees. The impoverishment and resource degradation faced by communities are indeed underlying factors that create relative incentives for moving out, as a normalised fact of this region these are often not seen as the primary overt reasons to migrate (Hazra and Ghosh 2018). Case studies, qualitative narratives, and media stories often identify the ways in which the climate change induced impoverisation as well as capital labour markets that draw cheap labour from such resource starved regions through similar employment contracts but exploitative in nature with poor work conditions, low pay, and bonded under the employer through debt cycles.

2.3 Climate change and trafficking in Sundarbans

Children and women of Indian Sundarbans region are highly vulnerable to trafficking (Molinari, 2017; Biswas and Chatterjee, 2021). Das (2017) notes that the girls aged 15 to 20 are trafficked more owing to their high demands in the sex trade. The climate change and human security literature tried finding connections between climate change, intensifying vulnerabilities, and human trafficking. Milonari (2017) reports that factors like- lack of social or educational infrastructure, inequities based on gender, caste, class, religion and indigeneity, high rates of gender-based violence, major disruptions within households, landlessness and lack or loss of livelihoods, food insecurity and hunger, severe poverty and indebtedness, natural disasters and environmental degradation, and displacement or forced out-migration contributed to peoples' vulnerability to trafficking. These factors make people specifically young women and minor girls vulnerable to human trafficking on the one hand and create room for expanding organized criminal rackets in this region on the other. Although these contexts are augmented by climate change, the impact of climate change has not been recognised as a direct evidence of vulnerability to trafficking. Instead, evidence of the relationship between climate change impacts and vulnerability to human trafficking emerged as an additional issue of climate change research in the region (Milonari, 2017).

Milonari (2017) finds that the combined effects of climate change, erosion, flood, seawater inundation and extreme poverty, make it relatively easier for traffickers to trap women and children into forced prostitution, marriage and child labour. Das (2017) reports, that the year 2009 had the highest number of women trafficking cases to its credit and tried linking the situation with cyclone Aila that struck the coast of West Bengal on 25th May 2009. She finds that disasters destroy the houses and leave people in utter deprivation. This caused people to stay on the embankments by raising temporary makeshift huts. With increasing insecurity of life, girls

get trafficked easily. A more recent report by Indian Express reports that the incidence of child marriages have increased drastically under the impact of the COVID-19 pandemic and natural hazards, like- cyclone Amphan[19].

Studies also find a direct relation between male out migration and human trafficking. Men often migrate out from the region to earn a living and using this as an opportunity, middlemen trap the women of the house (those who stay behind) in the sex trade. According to Das's (2017) findings, tourism has increased this business of middlemen taking women off to the tourists for the sex trade. It also finds that the problem of trafficking does not end with the rescue of the victim. Even after the victim is rescued her rehabilitation in society faces a huge crisis. Owing to the absence of a complete rehabilitation mechanism in society, the victim again gets ensnared in the trap of traffickers. Often the victims fail to stay with their own families.

2.4 Maternal and Child Health in Sundarbans and climate change impacts

The underlying vulnerabilities of women and children in the region emanating from loss of livelihoods, and impoverished conditions of households leading to exploitation and trafficking create cumulative vulnerabilities along with health status and access in the region. This section will delve into the critical health systems in Sundarbans with a focus on child and maternal health.

IIHMR's long term research on the health of the Sundarbans people under the Future Health System Research Programme Consortium has documented numerous issues related to maternal and child health. The FSH-IIHMR (2010) study shows that more than one-third of the children are chronically malnourished. The incidence of malnutrition is especially high among the girl children aged 13-36 months belong to poorer households. Children from the deltaic region are more nourished than those of the non-deltaic region, though the reasons are not mentioned clearly in the study. It further notes that child nutritional status is positively linked to the health of the mothers. Mothers of children with SAM and MAM are more malnourished than mothers having children of normal weight. Apart from malnutrition, children in the Sundarbans also face a higher rate of hospitalization due to low immunity and the prevalence of respiratory infection or gastrointestinal disorders and face an extra burden of morbidity. The absence of proper sanitation and hygiene is evident in the villages of Sundarbans, which further increases during floods (Kanjilal et al., 2010). In a more recent study, Panda et al. (2016) also come across similar findings that Children of Sundarbans are most vulnerable due to unacceptable levels of under-nutrition and high prevalence of common communicable diseases. The most common diseases prevalent among children are respiratory ailments (fever, cough), gastrointestinal disorders (diarrhoea, watery stool) and skin problems (irritation, rash).

Local perceptions on child health in the Indian Sundarbans region are interesting to note. Through their survey in three blocks in Sundarbans, Bose et. al (2016) find that when asked about health issues, the mothers of the children identified health issues like- disabilities, mental health and non-communicable as well communicable diseases among their children. Studies note that children are susceptible to diseases due to their rapid growth and physiological and cognitive development.

[19]https://www.newindianexpress.com/nation/2021/sep/26/covid-climate-crisis-leads-to-sharp-rise-in-child-marriages-in-sundarbans-2363991.html

The maternal health status is equally poor in the Indian Sundarbans region. For instance, Biswas (2013) reported that high fertility, high infant mortality, low birth rate and miscarriages are the most common health problems among women in the Indian Sundarbans region. In many areas in Sundarbans, Anemia and Preeclampsia[20] are the two main problems persistent among pregnant women (Biswas, 2013). The FSH-IIHMR study finds that mother's of young children require more care regarding nutritional intake. This study also comes across the finding that while the level of antenatal care (ANC) given to mothers is satisfactory and immunisation level is also high, however, it records negligence in neonatal care and lacking institutional delivery. It reported that 35% of the children are born at home and only five per cent of these home deliveries were assisted by qualified medical professionals. A quarter of the children aged 0-12 months took birth and spent the first week of their lives without any medical supervision from any health worker. Timeliness of immunisation and immunisation of home-delivered children remains a cause of concern in the Indian Sundarbans region. As per the study, child feeding practice is another area of concern. About 60% of the children do not receive breast milk immediately after birth and there is also a lack of exclusive breastfeeding for the first six months. The study reports huge demand for health care services including institutional facilities, OPD treatment, accessibility to PHCs and quality treatment from qualified medical practitioners as almost all ailing children sought medical care. However, 85 per cent of the OPD treatment for ailing children is provided by the Rural Medical Practitioners (who are neither qualified, nor trained, nor licensed to provide medical care and yet practice medicine without supervision) by using herbal medicinal supplements from forest resources of questionable quality. It further finds that in few places where private health care services are available, charging prohibitively exorbitant prices is not affordable by the people of the poor populations in the Indian Sundarbans.

There is evidence that both child and maternal health conditions are poor in the Indian Sundarbans region while the public health system is extremely fragile and inadequate. It is neither dependable nor accessible leading to extreme severity to the health scenario. Under these baseline conditions, it is critical to inquire into and understand the impact climate change factors will have on these conditions and systems.

Climate change is one of the determinants of child and maternal health (Bose et al. 2016) and it affects in the form of mortality and other physical and psychological disorders. This review draws on numerous studies (Helldén et al., 2021) and clinical trials that recognise that climate change-induced threats i.e. frequent storm surge, inundation and salinization (Dasgupta et al., 2020) act through multiple pathways to negatively affect reproductive and child health, mental health, rights and wellbeing.

Increasing frequency and exposure to tropical cyclones have adverse health outcomes- such as cardiovascular diseases, water-borne diseases, respiratory diseases, dialysis, and injury-related hospitalizations. A community-based survey conducted by the George Institute in collaboration with the Child in Need Institute (CINI) highlights that flooding also increases the chances of drowning deaths among children aged 1-9 years[21]. Kanjilal et al. (2010) examined the effects of

[20]A potentially dangerous pregnancy complication characterised by high blood pressure.

[21]https://www.georgeinstitute.org.in/media-releases/drowning-biggest-killer-of-children-in-the-indian-sundarbans.

the 2009 Cyclone Aila in Indian Sundarbans and explain that Cyclone Aila created some measurable health hazards in the short term, the most significant of which were water-borne diseases. Liebarman (2020) also reports how significant storm surge during Cyclone Amphan (2020) and salinization of land gave way to a rise in eye infections in children. Illness due to snakebite is quite rampant in Sundarban, especially after cyclonic events (Chowdhury and Jadhav, 2012).

The findings suggest that these health issues gradually become less visible with time, however, the impacts persist in the long run in the form of malnutrition. The FSH study (2010) reports that climate change-induced food system alteration has a moderate to severe impact on the nutritional status of the children of Indian Sundarbans though not well reflected due to a range of short-term coping strategies taken by parents. The existing social vulnerabilities like caste, religion or geographical position of the households intensify the complexities. Lack of adaptive mechanisms and planning for sustainably addressing the changing situation worsens the situation further. Studies also note tropical cyclones disrupt the already fragile health care delivery system in the Sundarbans and are also unable to provide required timely services immediately after a cyclone hit.

There is growing concern regarding the health crises among women and children with increasing water insecurity in the Sundarbans regions. For instance, a recent World Bank study by Dasgupta et al. (2020) reports that progressive salinization of rivers and groundwater has resulted in the decline of available fresh drinking water in the deltaic region. It further suggests that persisting mother-child health issues in Sundarbans, including dehydration, hypertension, prenatal complications, increased infant mortality, preeclampsia have a strong relation with higher salt intake through drinking water. In some areas, women spend long hours in saline water to catch shrimp larva and crabs which creates severe health problems, especially skin ailments and discolouration (Chakraborty, S., 2020; Dasgupta et al., 2020).

The increasing frequency of natural hazards not only jeopardises physiological health of the islanders, but also the mental health of the islanders including children. For instance, Chowdhury and Jadhav (2012) reports that the ecospecificity of the region is intimately linked to mental health of the population as with increasing of tropical cyclone and related flooding people become more anxious and emotionally distressed. The cases of Deliberate Self Harm (DSH) attempts are approximately 1800 per year in the Indian Sundarbans region and are especially high among the women. While, as per the NCRB report, West Bengal has reported 13103 cases of Suisides in the year 2020.

In sum, only a few studies that have empirically tested the differential impacts of climate change on child and maternal health has majorly given importance to three issues, i.e. first is the rise in water and vector-borne diseases after each episode of flooding caused by tropical cyclones, excessive rainfall along with tidal surge (Bose et al, 2018; Kanjilal et al., 2013). Secondly, there are increasing levels of malnutrition among children and the prevalence of anaemia among pregnant women and mothers of small children (Panda et al., 2016) due to increasing food insecurity (Dasgupta et al., 2020). Increasing frequency of flood in the cyclone-prone region along with high salinity resulted in declining affordability and accessibility of nutritious food viz. wild freshwater fish, vegetables, rice etc. (Dasgupta et al., 2020) and third, the impact of sudden climatic events on the existing poor health care infrastructure. The health infrastructure is

already a weak system and climatic shocks like cyclones, make it more inaccessible to the local population and lead to deprivation of the affected islanders of quality-assured medical attention (Kanjilal et al. 2013, Bose et al. 2018). It is reported that cyclone Amphan that hit Indian Sundarbans region in 2020 damaged more than 563 primary health care centres of West Bengal. As an impact of this access to routine health and vision care services dropped immediately[22].

Given the fairly recent interest in the topic of climate change impacts on child and maternal health, limited empirical evidence is available in the context of Indian Sundarbans. A pool of the available information comes from various reports published by international organisations, as well as aid and disaster relief organisations (UK Aid). The number of academic literature is small and scattered started emerging around a decade back, however, growing gradually. While some provide a broad overview of the issues in general, a few among them provides case studies specific to the context. Many times the studies are not supported by concrete evidence, rather based on assumptions, projections, or speculations. Only a few studies (Majumdar et al., 2014; Ghosh et al., 2018; Mukherjee, M., 2016) have empirically tested the differential impacts of climate change on the physical health of the population, and most have been conducted after the incidence of Aila (a tropical cyclone occurred in 2009). It has been mentioned in the literature (Ghosh et al., 2018) that the increasing threats to the health and wellbeing of the islanders posed by climate change are not well recognised among researchers.

What is not clear is that despite the significant advancement of scientists' understanding of the multiple ways that climate change increases risks to human health in recent years, which factors lead to low recognition of climate change impacts on health conditions for the Indian Sundarbans region. Is it limited because there is hardly any evidence of associated outbreaks of epidemics or visible health outcomes directly with natural disasters (Majumdar et al., 2014; Ghosh et al, 2018)? Or is it because the impacts are slowly being shown over time by the social determinants of health such as poverty, water and sanitation, food production systems and socio-cultural patterns of the society (Majumdar et al, 2014)?

2.5 Protective Mechanisms

To protect the children from these vulnerabilities several protective mechanisms have been adopted at the regional level. At present, literature on specific protective measures for children in the Indian Sundarbans is limited. Xu et al. (2012) suggest the reduction of poverty and disparity, providing the children with their basic rights. Like- improved health services, food security and education are fundamentally the best forms of protective mechanisms to the impacts of climate change. They further mention that in the context of tackling natural disasters, effective awareness programmes in schools, homes and communities can contribute to the capacity of the communities where resources are limited to help children during disasters. The government along with donor agencies and civil society organisations adopted several programmes to protect the children from problems like - early marriage, trafficking and critical reproductive health hazards in the Sundarbans. For instance, Since 2014 Digambarpur Angikar is running Government aided residential shelter home [Two units] for 100 CNCP & CWSN girls under

[22] Amy Lieberman // 08 October 2020, "In India's Sundarbans Region, Natural Disasters Will Continue to Complicate Vision, Health Care," Devex, October 8, 2020, https://www.devex.com/news/sponsored/in-india-s-sundarbans-region-natural-disasters-will-continue-to-complicate-vision-health-care-98268.

Juvenile Justice Act in order to restore childhood and imbibing them with social values through education & equipping them with decision making power to become a responsible citizen[23]. Similarly, CINI along with the George Institute of Global Health implemented drowning prevention interventions for the children of the Sundarbans. The national programme -Childline 1098 is considered a useful children-protective measure in handling Child Marriage, Child trafficking, Child labour, Child Rights and incidents of Child missing. Childhood immunization programmes, drinking water disinfection, source water protection and sanitation are all necessary actions that protect children from possible adverse impacts of ecological change. What is still not clear is that while children are one of the most vulnerable groups to disasters, why children are often excluded from disaster risk reduction (DRR) activities? It is important to mention here that Caritas India in 2016, initiated a programme called CLDRR (Child Led Disaster Risk Reduction) in the Sundarbans region to understand hazards, risks, and vulnerabilities from children's point of view and found that children's participation in DRR and their contribution to the programme can strengthen community resilience.

In examining the literature across the impact areas i.e. maternal and child health, trafficking, migration, child protection, several observations can be made on how climate change is influencing and will increasingly affect children's health. Evidence is inadequate, sparse, varied, and highly contextual. The nature of the literature makes it challenging to draw any strong conclusions, and to effectively compare and contrast between case studies. Children are already known as a particularly vulnerable group to climate change as children have unique metabolism, behaviour, physiology, and development characteristics. Several socio-cultural measures are already in place that is protecting the children (e.g., caregiving, education, skill development, etc.). However, the effectiveness of those measures and what else can be done to protect children in the context of climate change? is still not clearly mentioned in the literature.

Even though the general finding is that children are negatively affected by the impacts of climate change, however, not all of them are equally at the same risk as they are heterogeneous both physiologically and behaviourally. For instance, children under the age group of 0-6 are likely to be more prone to malnutrition and Children aged 1-9 years are more vulnerable to drowning mortality.

These studies indicate that the impacts of climate change on children are not always straightforward and easily predictable. These impacts vary among individuals depending on context and many times facilitated by a host of other socio-cultural, economic, ecological, or political factors. Integration of social sciences with natural sciences to better understand the differences in the way that climate change affects children present a more holistic, nuanced picture of how climate change intersects with various other factors (such as social, cultural, institutional, technological factors) in different settings. In this regard, a mixed-method approach can provide a distinctive lens to illuminate how local communities perceive, understand, value, and respond to the impacts of climate change. This knowledge will also be crucial for informing climate change adaptation initiatives and providing a stronger foundation for protective measures.

[23]http://angikar.in/project.php?id=1368%20&%20category=childcare%20and%20protection

3 METHODS AND TOOLS

This study provides an exploratory assessment with an objective to identify some of the key child and youth-related vulnerabilities emerging from climate change impacts on the Indian Sundarbans region. Drawing on multiple data sources, methods, and tools, the overarching goal of this study is to build an understanding of the impact of climate change in order to inform directions of Tdh interventions in the region to be more climate-responsive. Within a broader thematic focus on health, migration and child protection, the study will draw particular attention to child and youth-specific vulnerabilities through focal areas of maternal and child health, migration and trafficking as well as child protection.

3.1 Objectives:

- To understand the risks of current climate variability and change on human health in Sundarbans and identify climate related risks for maternal and child health
- To assess the migration behaviour and practices of rural population in Sundarbans as one of the world's most climate-stressed regions
- To focus on the range of factors (risk factors) those put children at risk and also on the factors (preventive factor) those decrease the likelihood of risks in the context of climate change in Sundarbans using a social-ecological framework through gender lens.
- To examine the nature, effectiveness, and gaps in the responses and preventive mechanisms adopted by the government and non-governmental institutions so far in reducing risks

3.2 Methodology

3.2.1 Mapping existing knowledge resources:

An in-depth review of literature was conducted (Chapter 2) by the research team of SaciWATERs in order to have a broad understanding of the emerging issues on the impact of climate change in the Sundarbans with specific reference to mother and child health, Migration related risks, trafficking and issues related to the protection of children in the region. The overall objective here was to delineate important research gaps and develop a framework of study for the regional context of the Sundarbans.
This review of literature focussed on five major areas:

- The evolution of climate change in the Indian Sundarbans region and the pathways of impact emerging from this change
- Documentation of various climate change impacts (direct and indirect) on maternal and child health identified by various scholars of this field.
- Identifying varied types and divergent trends of migration from the study region, and identifying factors influencing the decision making, purpose of migration, destination and occupation
- A comprehensive view of children's exposure and vulnerability to the impacts of climate change (a water crisis, a health crisis, an education crisis, a protection crisis and a participation crisis)
- Explore links - if any - that have already been established between climate change and each of these programmatic areas globally (Chapter 1)

The literature survey also provided secondary data for some important quantitative and qualitative insights and indicators that would otherwise be beyond the temporal and methodological scope of this study.

3.2.2 *Quantitative Household Survey*

The study adopts a three-stage sampling design. The sample size is governed by several considerations, including the magnitude of the key indicators, the subgroups for which the indicators are required, the desired level of precision of the estimates, the availability of resources, and logistical considerations.

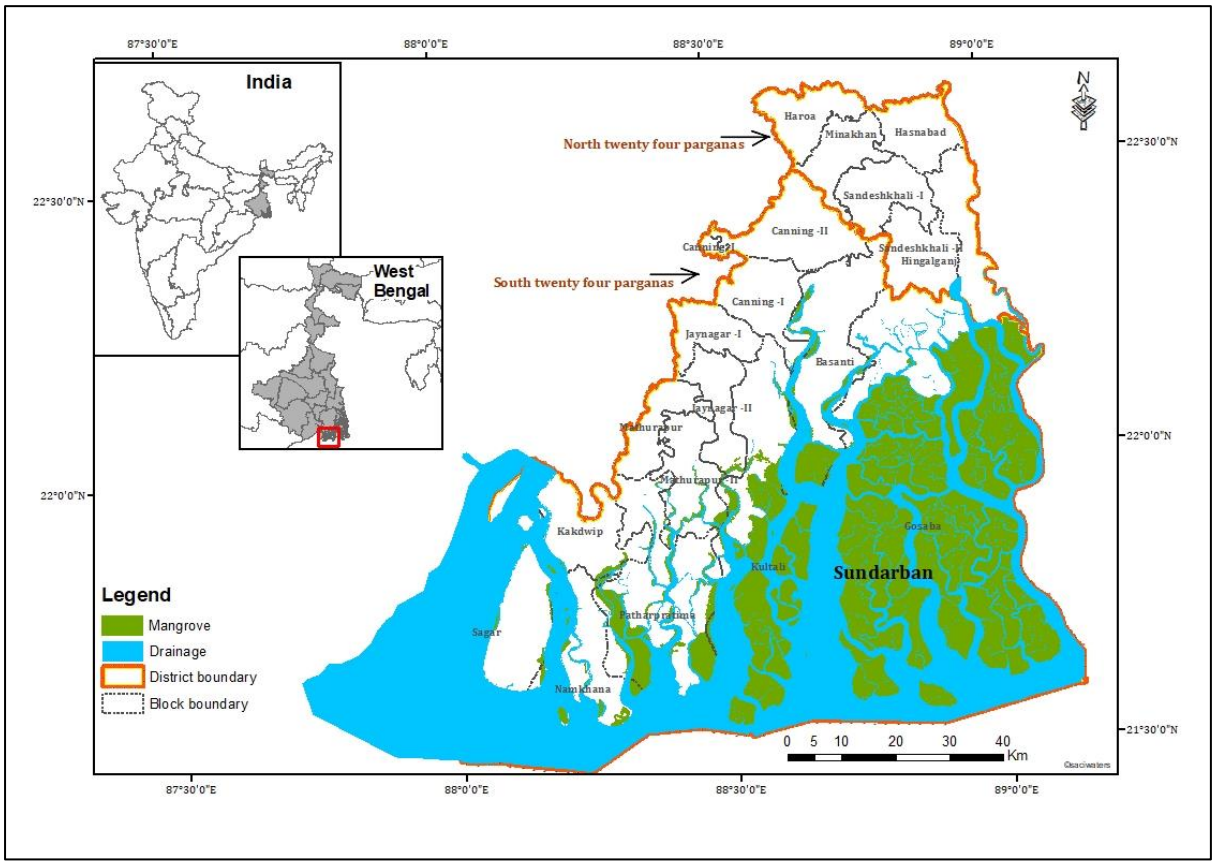
A. <u>Universe of the survey and geographical Coverage</u>

To carry out a survey it was important to define the extent of the geographical areas to be covered under the survey and the target population. The study geography is Sundarbans in West Bengal which comprises 19 blocks.

Table 3.1: demographic profile of the region

Blocks	Total Households	Total Population	Males	Females	% Scheduled Caste/Tribe	Literacy	Working Population
19	955040	4426259	2264133	2162126	40.35	64.30	37.55

***Figure 3.1:** Study Area Map*



Source: SaciWATERs, 2022

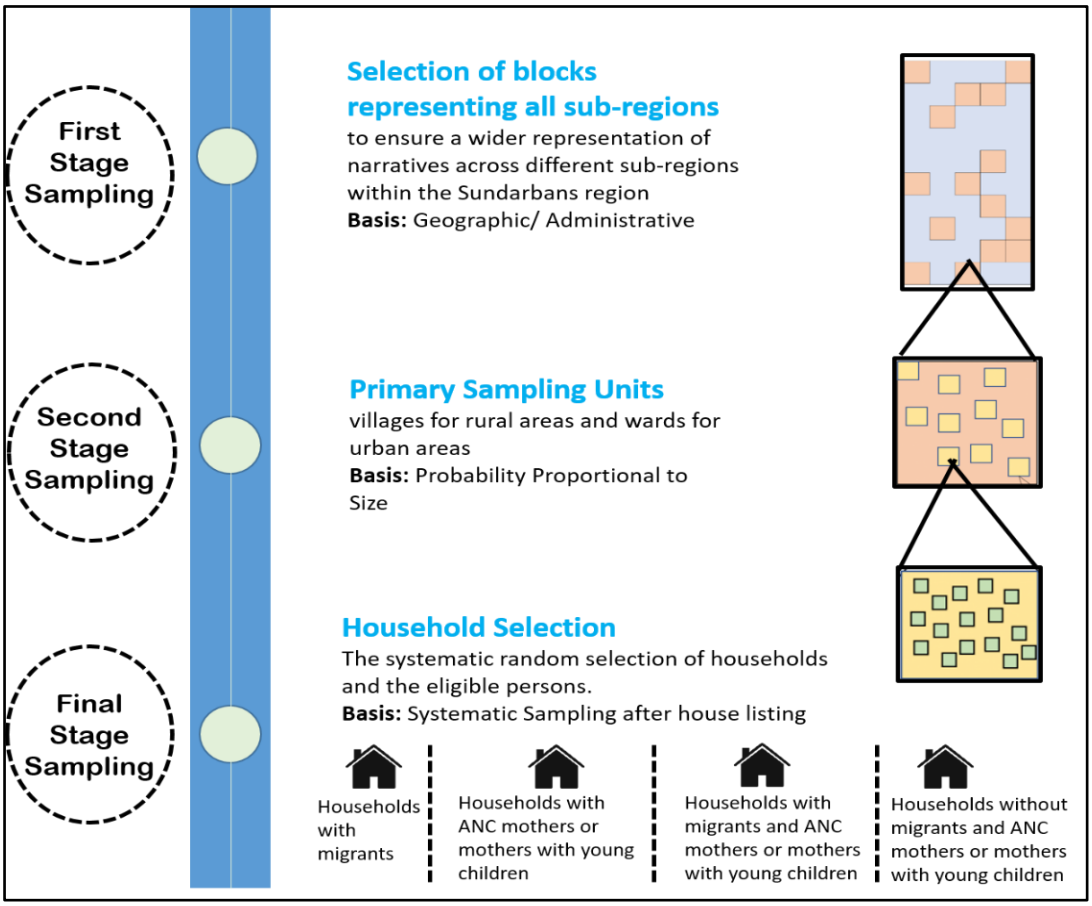
Table 3.2: Administrative setup of the Sundarban area

District	Sub-Division	Police Stations	Blocks / Panchayat Samitee
24-Parganas (South)	Kakdwip	Sagar, Namkhana, Kakdwip, Patharpratima	Sagar, Namkhana, Kakdwip, Patharpratima
	Diamond Harbour	Mathurapur, Roydighi	Mathurapur-I, Mathurapur-II
	Baruipur	Kultali, Joynagar	Kultali, Joynagar-I, Joynagar-II
	Canning	Canning, Basanti, Gosaba	Canning-I, Canning-II, Basanti, Gosaba
24-Parganas (North)	Bashirhat	Hingalganj, Hasnabad, Sandeshkhali, Haroa, Minakhan	Hingalganj, Hasnabad, Sandeshkhali-I, Sandeshkhali-II, Haroa, Minakhan.

B. Sampling Frame

The overarching sampling strategy used for the study is presented in Figure 3.2. It shows the three stages of sampling design.

***Figure 3.2:** Three stage sampling design*

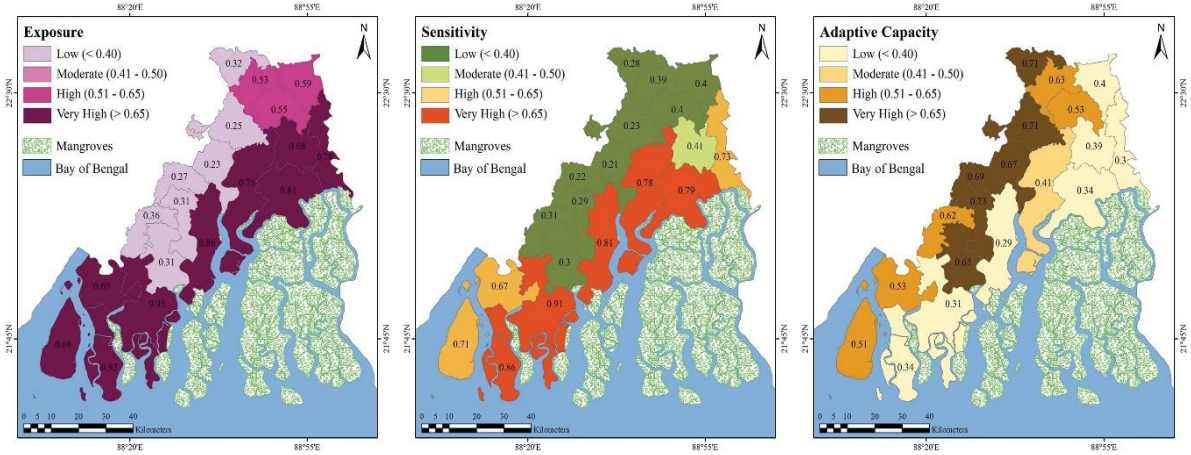


I. First Stage Sampling

The first stage of sample selection involved the selection of blocks representing all sub-regions. A recent study by Sahana et al. (2021) divided the Indian Sundarbans region into different sub-regions based on its exposure to natural hazards, sensitivity and adaptive capacity among the

population. The present study follows the regionalisation as mentioned in the research paper by Sahana et al. (2021)[24].

Figure 3.3: *Vulnerability regionalisation of Sundarbans*



Source: Sahana et al. (2021)

Total 5 blocks are selected (at least one from each sub-regions) to ensure a wider representation of narratives across different sub-regions within the Sundarbans region given the geo-climatic vulnerability of the region.

Table 3.3: *Block selection Criteria*

Levels of Vulnerability	Exposure	Sensitivity	Adaptive Capacity	Selected Blocks	Justification
Low	Mathurapur I, Mathurapur II, Haroa, Jaynagar I, Jaynagar II, Canning I, and Canning II	Minakhan, Mathurapur I, Mathurapur II, Jaynagar II, Haroa, Canning II, Jaynagar I, and Canning I	Hasnabad, Sandeshkhali II, Namkhana, Gosaba, Patharpratima, Hingalganj, and Kultali	**Canning I**	Less vulnerable and connected to the mainland
Moderate	Sandeshkhali I and Minakhan	Sandeshkhali II, Hasnabad, and Sandeshkhali I	Sagar and Basanti	**Sandeshkhali I**	Moderrately Vulnerable
High	Basanti, Kakdwip, Sagar, Sandeshkhali II, and Hasnabad	Hingalganj, Sagar, and Kakdwip	Minakhan, Mathurapur I, Kakdwip, and Sandeshkhali I	**Sagar**	High exposure and sensitivity with high adaptive capacity
Very High	Patharpratima, Namkhana, Kultali, and Gosaba	Patharpratima, Namkhana, Kultali, Gosaba, and Basanti	Jaynagar II, Haroa, Canning II, Jaynagar I, Canning I, and Mathurapur II	**Patherpratima, Gosaba**	High exposure and sensitivity with low adaptive capacity. Two blocks are picked from

[24]Sahana, M., Rehman, S., Paul, A. K., &Sajjad, H. (2021). Assessing socio-economic vulnerability to climate change-induced disasters: Evidence from Sundarban Biosphere Reserve, India. Geology, Ecology, and Landscapes, 5(1), 40–52. https://doi.org/10.1080/24749508.2019.1700670

	this category based on their location (one from east and one from West)

Source: *Sahana et al. (2021)*

II. Sampling frame at the Second Stage (Primary Sampling Units)

The second stage involved the selection of primary sampling units, which were villages for rural areas and census towns/wards for urban areas. From each subregion/ stratum, PSUs were selected using the probability proportional to population size (PPS) sampling[25] method. Census 2011 household numbers and population of villages/ census towns are considered for selection of the PSUs.

Steps in applying Probability Proportional to Size (PPS) and calculating Basic Probability Weights were:

1. Prepare a list of the primary sampling units (Villages/ census towns/urban wards) and their population sizes. Each village/ census towns/ wards (cluster) has its Cluster Population Size (a).
2. Calculation of the cumulative sum of the population sizes (Column C). The Total Population (b) is the last figure in Column C.
3. Determine the Number of Clusters/ PSUs (d) that will be sampled in each stratum/ Blocks. This study includes **4 clusters from each selected stratum/block**.
4. In order to ensure that all households in the cluster have the same probability of selection irrespective of the size of the PSUs, the same number of households has to be sampled from each PSU. The Number of **sample households** has been decided as **20 from each cluster**.
5. Divide the total households by the number of PSUs to be sampled, to get the Sampling Interval (SI).
6. Choose a random number between 1 and the SI. This is the Random Start (RS). The first cluster to be sampled contains these cumulative households (Column C). [Excel command =rand()*SI]
7. Calculate the following series: RS; RS + SI; RS + 2SI; …. RS+(d-1)*SI.
8. The clusters selected are those for which the cumulative households (Column C) contain one of the serial numbers calculated in item 6. Depending on the household numbers of the cluster, big clusters may be sampled more than once. Mark the sampled PSUs in another column.
9. Calculate for each of the sampled clusters the Probability of Each Cluster Being Sampled (Prob 1)
   Prob 1= (a x d) ÷ b
   [a= Cluster household number b= Total household number of the stratum/block d= Number of Clusters]
10. Calculate for each of the sampled clusters the Probability of each household being sampled in each cluster (Prob 2) (Column G).

[25] larger villages have bigger probability of being sampled

Prob 2= c / a

[a= Cluster household number c= Number of households to be sampled in each cluster]

11. Calculate the overall basic weight of a household being sampled. The basic weight is the inverse of the probability of selection.
    BW=1/(prob 1 * prob 2)

***Table 3.4:** Selected villages for the study*

Block	Town/Village code	Level	Name	No_HH	TOT_P	TOT_M	TOT_F
Sandeshkhali I	323853	Village	Bayarmari	912	3998	2035	1963
	323859	Village	Natkora	1134	5081	2590	2491
	323865	Village	Bayar Mari Abad	2443	11030	5635	5395
	323872	Village	Raypur	652	2630	1385	1245
Patharpratima	335331	Village	Taranagar	937	4425	2259	2166
	335360	Village	Durbachati	782	3830	1936	1894
	335382	Village	Achintya Nagar	1323	6181	3090	3091
	335400	Village	Rakshaskhali	936	4729	2438	2291
Sagar	335243	Village	Muri Ganga	621	2725	1387	1338
	335256	Village	Haradhanpur	1753	8998	4660	4338
	335265	Village	Krishnanagar	1624	8105	4200	3905
	335277	Village	Purrusottampur	1467	6753	3534	3219
Canning I	333759	Village	Khas Kumarkhali	1415	7227	3746	3481
	333773	Village	Marapia	372	1999	1098	901
	333797	Village	Poramura	337	1656	873	783
	333814	Town	Banshra (CT)	6607	29521	14814	14707
Gosaba	335124	Village	Puinjali	1323	5455	2830	2625
	335136	Village	Jhaukhali	398	1502	770	732
	335151	Village	Bally	1476	6234	3189	3045
	335163	Village	Dayapur	1215	4972	2570	2402

Note: *The details of the sample calculation method for the study region is given in the annexure- Probability Proportional to Size (PPS) and calculating Basic Probability Weights*

III. Ultimate Stage (Selection of households)

The final stage involved the systematic random selection of households and the eligible persons. A household listing operation was carried out in each sampled PSU to identify households with migrants and children of three age groups (0-6yrs / 7-13yrs / 14-18yrs) to provide the necessary frame for selecting households. Listing all households in large villages with 500 or more households is a huge task, potentially prone to errors of omission or duplication. Hence, large villages with about 500 or more households were segmented into three or more habitations (depending on village size). One segment/habitation with an approximate 100 population size was selected based on PRA methods for a house listing. In all such large villages, the sampling design became a four-stage design.

The selection of the required number of households was done using systematic proportionate sampling. Households that do not have any children were excluded from the sample. For the logistical convenience of the fieldwork and to minimize refusals, all listed households in the house listing exercise were divided into categories of households with different age-group children, overlapped with a category of with/without at least one migrant member (Table 3.5). This offered multiple alternatives for respondent households without compromising on the sampling design and sample size.

A total of 3638 household data were collected in the first stage and 410 household level data were collected in the second stage (Table 3.6).

Table 3.5: *Systemic sampling categories*

	<6yrs	6 to 12yrs	13 to 17yrs	<6, 6-12	6-12, 13-17	<6, 13-17	<6, 6-12, 13-17
HH with child + migrants							
HH with a child but without Migrant							

Table 3.6: *Sample size of household survey*

Block	Village Name	House Listing	Household Survey
Sandeshkhali I	Bayarmari	151 HH	20HH
	Nalkora	206 HH	20 HH
	Bayar Mari Abad	202 HH	20 HH
	Raypur	206 HH	20 HH
Patharpratima	Taranagar	171 HH	20 HH
	Durbachati	157 HH	20 HH
	Achintya Nagar	160 HH	20 HH
	Rakshaskhali	200 HH	20 HH
Sagar	Muri Ganga	200 HH	20 HH
	Haradhanpur	191 HH	20 HH
	Krishnanagar	158 HH	20 HH
	Purrusottampur	151 HH	20 HH
Canning I	Khas Kumarkhali	169 HH	20 HH
	Marapia	149 HH	20 HH
	Poramura	166 HH	20 HH
	Hero Bhanga	205 HH	20 HH
Gosaba	Puinjali	203 HH	20 HH
	Jhaukhali	201 HH	20 HH
	Bally	191 HH	20 HH
	Dayapur	201 HH	20 HH

3.2.3 Qualitative indepth stakeholder interviews

Apart from the quantitative household survey the research also used a wide base of purposive qualitative interview methods across multiple stakeholders to understand:

- policy development, implementation, and gaps
- contextual challenges of frontline workers
- experience, methods, and challenges from initiatives of the civil society and development sector
- village development and climate change experiences from the community
- Child participatory assessments

The following groups of stakeholders were interviewed for qualitative insights:

- ASHA workers
- ICDS workers

- Rural Health Practitioners
- Panchayat members
- Key Person Community members
- School teachers
- Community workers from NGOs
- Child Protection Committee member
- Child and Youth groups

The questionnaire tools are provided in the annexure.

3.2.4 Limitations

This study is exploratory in nature particularly since linkages with climate change being highly complex mediated through multidimensional pathways. As such the study acknowledges the following limitations in data and methods:

- ***Attribution*:** Given the nuanced nature of climate change linkages as well as the multiplicity of external determinants the clear attribution of the societal outcomes under inquiry here to climate change alone is difficult. This challenge of attribution has been acknowledged in most studies and secondary literature delving on climate change linkages. The study attempts to draw closer linkages through qualitative assigning of causality, stepwise linkages through pathways, and spatial sampling techniques.

- ***Spatial and Temporal scope*:** Climate change exposure outcomes tend to have wide geographical and temporal scales. Gradual shifts are seen over decades and over some spaces that are more vulnerable than others at different points of time to different climatic exposures. Short duration lenses or slices of time and geographies can have limitations therefore for exhaustively capturing climate change impacts. More focussed scientific literature and wide based secondary data have therefore been used to supplement the field research.

- ***Access to government data*:** Much of the time scale data across the wider geography of the Sundarbans are largely collected by government surveys and monitoring databases. Many government databases are however not easily made available to the public and therefore not accessible for wider analysis. Attempts have been made to collect open access secondary data from government databases wherever possible and relevant for the study.

- ***Not a clinical study*:** Being exploratory in nature, the health analysis for the study has been based on observations and experiences of key stakeholders in health practice and policy, and not on actual clinical assessments. The information presented therefore is more experiential and provides a more real lens into community and ground practitioners' perceptions and understanding of health problems. The analysis may vary from the outcomes of clinical studies on complex health issues in the region. However, this experiential nature of the problem is important and adds value to the study as community responses to these problems are a stronger function of their understanding and perception.

- ***Sensitive issues*:** Some queries of this study related to child marriage, trafficking, child labour, etc were considered culturally sensitive. With increasing political focus and awareness building around these issues, a sense of discreetness and political correctness has seeped into communities around voicing/reporting on these issues. Therefore, direct survey questions could not be designed on these issues and had to be dealt with through indirect proxies and indepth qualitative interviews leaving a gap for data to ascertain the actual incidence and extent of these outcomes quantitatively.

- ***Plural thematic inquiries*:** The study, keeping child and youth vulnerabilities at its centre, analyses a variety of themes – migration, WASH, health, child protection, DRR. Further, the issues also required inquiry across different age groups and social categories of the population. Ideally, such disparate themes demand distinct methodologies, questionnaires, and respondent/household sampling techniques, to robustly analyse specific issues. Each thematic area also requires a different set of samples to provide adequate data for quantitative modelling, causality determination, and indepth assessments for each theme. The need for the study to integrate these varied themes under the scope of a single study created an immense challenge for developing a methodological and sampling design to make space for all diverse themes and sub-themes. The widely accommodating design of the methodology, therefore, provides significant thematic coverage. However, it is limited by the depth of assessment for sub-themes that will entail further focussed research studies.

4 SUNDARBANS: CONTEXT AND PATHWAYS

The literature base presented in Chapter 2 has brought out the climate factors and exposure pathways emerging in the Indian Sundarbans. In this section, drawing from that literature, we build the socioeconomic and ecological contexts of the region as well as look at mediating pathways through which climate change vulnerability for the region is founded.

4.1 Social and ecological contexts and determinants

Chapter 1 and 2 drew non-linear linkages between climate change outcomes and its societal impacts. However, it is also important to move past simplistic naturalisation of these socioeconomic crises and also identify role of the local ecological context as well anthropogenic processes that intersect with climate change impacts to create the observed outcomes. Ecological contexts include the geographical realities of the region. Anthropogenic causes include high concentration of population in the island areas, infrastructure planning and investment, huge discharges of untreated domestic and industrial effluents carried by tributary rivers as well as the disposal of contaminated mud from harbour dredging, unsustainable land-use decisions which increase risk and sensitivity aspects of vulnerability. Further the colonial history of settlement of the Sundarbans reveals insights about the impoverished nature of the local communities and processes that pushed human settlements to grow in high disaster exposure regions through infrastructural support of embankments for purposes of increasing colonial revenues from land taxes from the peasantry. As forest management and conservation discourses emerged, investments in conservation assumed predominance over social and developmental investments (Martin et.al 2015).

In order to understand the vulnerability of this region in a holistic way, we identify here, from our field study, some ecological and socioeconomic processes and developments in the Sundarbans region that are external to climate change impact pathways. However these factors either provide a base condition for climate change impacts or exacerbate them, and in the process playing a role in the societal outcomes for child and youth vulnerability in the region.

4.1.1Ecological context

As a low lying deltaic region at the edge of the Bay of Bengal, the Sundarbans region has historically and geographically been a cyclone affected region. It was entirely forested with dense mangrove vegetation that stands as a barrier to these cyclonic storms holding the soils preventing the landmass from sea and river erosion. However as the Sundarbans region got settled through policies of the colonial government to increase land revenues, widespread deforestation and building of embankments was carried out to enable this (Martin et.al 2015). The region is geographically low lying with most of the landmass merely a few meters elevation above sea level and some even below. Saline estuarine rivers and rivulets affected by diurnal tides intricately dissects the entire landmass. Tidal action on the rivers makes the islands further prone to flooding and inundation by saline river waters, which is only held back by embankments. Embankment systems are largely low earth embankments which are highly vulnerable to intensified climatic impacts. The hydrogeological context of the delta also impacts resource availability for the population of this region. Clayey and Loamy soils do not create rich shallow freshwater aquifers

here. The shallow layers are largely saline with low capacity groundwater holding aquifer layers. Freshwater aquifers are available predominantly in the deep aquifer layers. All these geographical contexts of the Sundarbans region affects resource availability and in turn livelihood potential of the region determining sensitivity of this region to climatic changes and shocks.

4.1.2. High incidence of landlessness and dependence on rainfed agriculture

The Indian Sundarbans region was historically settled as a result of land tenure interests of the colonial government under the zamindari system. The region was largely therefore under tenancy regimes with sharecropping as the mainstay of the agriculture system. After land reforms post-Independence the redistribution of land created predominantly marginal landholdings. There is also a high incidence of landlessness in the region largely dependent on wage labour for livelihood. Due to the hydrological regime, salinity of deltaic rivers, and general impoverishment of the peasantry, irrigation is not widely accessed for agriculture in the region. Climate change exposure led salinity and drought conditions further exacerbate this availability of irrigation water. This enables only single season agriculture for much of the region. This creates further impoverishment and livelihood insecurity for the region. Climate change led agriculture decline further exacerbates this livelihood insecurity.

Figure 4.1: Type of land owned and incidence of landlessness in the study area

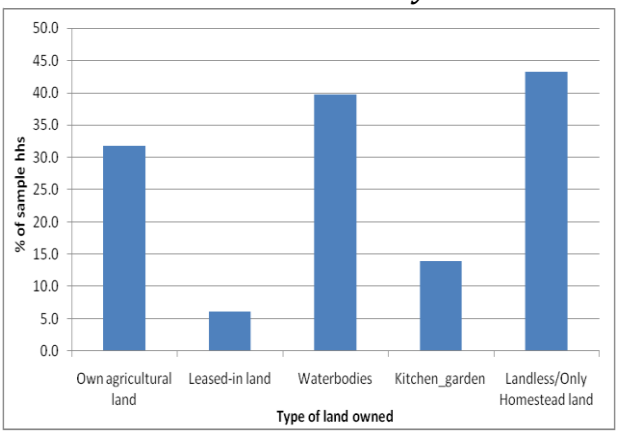
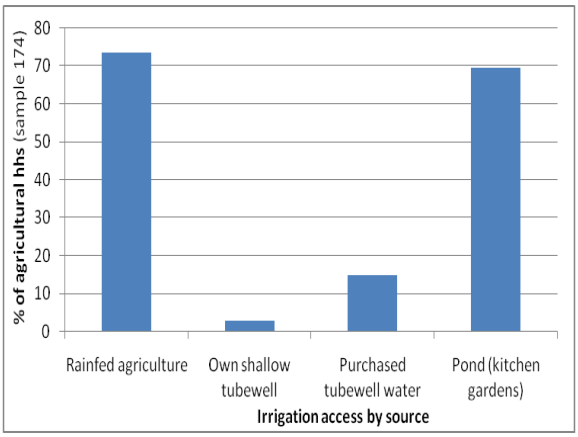


Figure 4.2: Access to irrigation for agricultural households

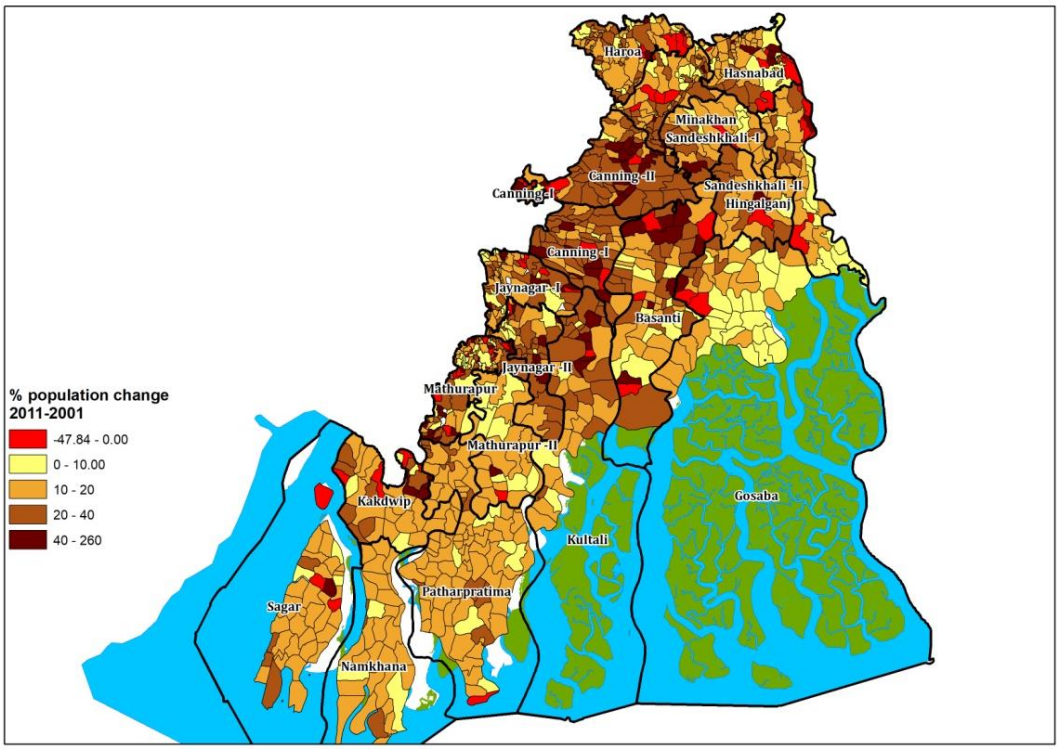


4.1.3. Urbanisation, Tourism, and population growth

Due to its proximity to Kolkata city and a developing tourism area the Sundarbans region has seen population growth and increased land use for settlements. The northern blocks of the Sundarbans region which are proximate to Kolkata city have seen high population growth around the growing peri-urban towns of Canning, Joynagar, and Baruipur. The western sector there has seen a high shift from agriculture to settlements given its proximity to Kolkata city and an increased religious and recreational tourism (Hazra et.al 2010). Sagar island and Namkhana in the west have seen higher growth in this regard. In the east the Gosaba and Basanti block have seen development of eco-tourism in the Sundarbans Reserve Forest region. Tourism development has also led to significant improvements in transport infrastructure with two major highways being connected through Namkhana block in the west and Basanti block in the east till the seaward limits of the islands. Development of resorts, homestays, cruises and tours have all created livelihood alternatives and connectivity with Kolkata city and ease of road and rail transport routes from

the region. However, with higher settlement and population density it has also increased the sensitivity of this region to disasters and resource scarcities increasing the climate change vulnerability of the region.

Figure 4.3: Population growth rate (2001-2011 Census of India)



Source: Prepared by SaciWATERs Team

4.1.4. Conversion to aquaculture

Conversion of agricultural and forest lands into brackishwater aquaculture tanks (*bheris*) is another socioeconomic process active across the Sundarbans. Being a highly remunerative business, rich local farmers as well as commercial interest groups from other parts of West Bengal and India, have invested in this widespread conversion of lands. For commercial interests and profits, this aquaculture is done at vast scales involving purchase/leasing in of surrounding agriculture lands or illegal felling of reserve forest areas. This process of conversion to brackishwater aquaculture entails channelling in of saline river water inland to fill the tanks wherein shrimp and tiger prawns farming takes place. This process and the increasing spread across the region are another determinant of vulnerability as it increases the risk of saline water inundation. Even freshwater floods due to heavy rains can cause these tanks to overflow and cause saline water inundation in neighbouring lands and ponds. Holding of saline water in these tanks increases soil salinity in the shallow aquifers and adjacent agriculture lands making them unproductive. This creates conditions that ease the buying and accumulation of more lands into the aquaculture system allowing commercial fisheries to grow at the cost of marginal farmers. Also, since aquaculture barely required any labour, it does not create alternate livelihoods for the displaced farmers. Commercial fisheries are also growing at the cost of illegal deforestation of protected reserved mangrove forests in many areas. Saline water ingress from increasing cyclone incidence has further facilitated the conversions of agriculture farms to aquaculture. This process thus increases resource and livelihood insecurity making the region more sensitive to climate change impacts of poverty and resource scarcity.

Photo 4.1: Conversion of mangrove forest belts into aquaculture tanks on deltaic islands

Photo 4.2: Conversion of mangrove forest belts into aquaculture tanks on deltaic islands

Photo 4.3: Conversion of agriculture areas into aquaculture tanks in Sandeshkhaali block

Source: Google Map

4.1.1 4.1.5. Seed prawn collection and overfishing

The aquaculture conversions and livelihood insecurity from storms and salinity plaguing the Sundarbans region create conditions wherein many households turn to depend on seed prawn (*meen*) collection from the saline river. These seeds and fishlings draw good remuneration from sale to aquaculture farms in the region as well as for export. However, it has led to overfishing and reduced availability of saline water fish in the rivers. Landless farming households are often pushed into these livelihoods for a lack of alternatives. 4.6% of households among our sample households were found to be involved in this seed prawn collection. Further, the increase of commercial trawlers by external commercial interest groups has led to overfishing and a decline in the fish catch for the local communities. Landless or impoverished marginal farmers and fishermen, for a lack of traditional livelihoods, tend to work as wage labour for these commercial trawlers. Women and girl children are often involved in seed prawn collection. It requires

extended hours of wading in saline river waters which creates health vulnerabilities (Dasgupta et.al 2020). Therefore, these socio-political processes leading to livelihood insecurity, which is further exacerbated by climate change-led salinity ingress, create a firm base of health and employment vulnerabilities for the communities of Sundarbans.

Photo 4.4: Seed prawn collection by women in saline river water

Photo 4.5: Separation of tiger prawn seedlings for sale

Source: Fieldwork, 2022

4.1.6 River Pollution and Brick Kilns

There are other external ecological and economic processes that drive vulnerability in this region. One such observed driver was the impact of industrial activity on river pollution which affected the productivity of aquaculture that uses this river water for production. This is seen in Sandeshkhali block particularly where the Bidyadhari river receives downstream pollutants from the Calcutta Leather Complex which has reduced productivity of aquaculture farms in the region, according to the local community. As soil productivity has gradually declined with increase aquaculture in the region, vast stretches of brick kilns have come up in the region further causing irretrievable damage to the top soil of the region. Nexus between commercial bheri owners and brick-kiln owners has also led to conversion of aquaculture farms to brick-kilns. Brick-kilns provide employment to migrants from various blocks across the Sundarbans, both men and women. Brick-kilns are therefore important destinations of temporary migration for families (with young children). However, the ecological damage to soil productivity of this region by aquaculture and brick-kilns is extensive and makes this region highly fragile and sensitive to any climatic shocks.

Photo 4.6: Extensive linear stretches of brick kilns along river channels in Sandeshkhali block

Source: Google Map

4.1.7. Government forest license and conservation-livelihood conflict

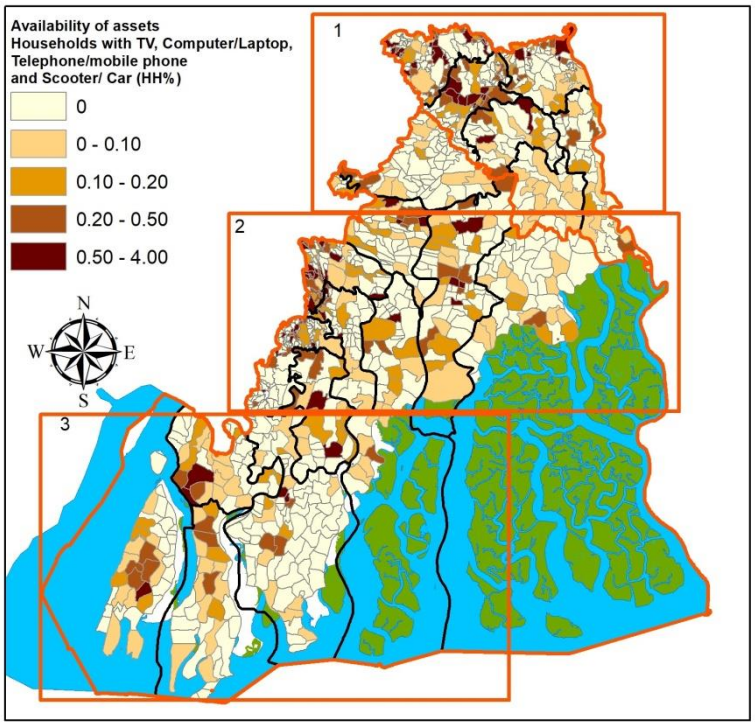
Government policies form important institutional drivers of livelihoods and resource conditions of the region. In Gosaba block, adjacent to the Sundarbans Reserve Forest, fishing communities are dependent on entry into the reserve forest area for their traditional livelihoods. This is also the case for honey-collectors. However, access to this forest region is restricted and regulated by the state forest department which issues boat licenses to fishermen to allow access to the forest area. Boat licenses are extremely limited and during the COVID lockdown entry into the forest areas were completely denied for over 2 years. This has affected the livelihoods and income of the fishing community in the Gosaba block. A conservation-livelihood conflict is thus an important external driver that is not a direct climate change impact but drives sensitivity of this region to climatic changes and shocks.

4.1.8. Infrastructure and transport

The Sundarbans region is heavily dissected by rivers and rivulets through its entire landmass which makes transportation one of the most important external drivers that drive sensitivity to climate change. This remote nature of many islands makes access to schools, hospitals, centres of governance, and other basic services difficult. Dinghies, motor boats, and ferries are the main sources of transport in this region, and their availability is further regulated by river tides. In the

last few years, transport infrastructure has improved in some areas due to the development of tourism. Major highways have been brought to Namkhana block in the west and Basanti block in the east. Bridges across islands are also important infrastructure that can determine climate change response and adaptation for communities by enabling better access to resources. Embankment raising and strengthening is another government infrastructure investment that can impact climate change sensitivity for this region. Road connectivity, tourism development, and urbanisation also have an impact on income prosperity of the community.

Figure 4.4: Spatial pattern of Asset ownership-based wealth indicator in Sundarbans (Census 2011)



Source: Prepared by SaciWATERs Team

Figure 4.4 here shows the asset ownership of households in the Sundarbans spatially across villages. This proxy variable firstly shows the general poverty in the region with an extremely low percentage of population with access to wealth assets. Secondly, we find a close alignment of relatively higher percentage households with assets along major highways, tourism areas, and urban centres in the region. Income prosperity is an important factor that can improve adaptive capacity among household thereby reducing climate change vulnerability.

In addition, government policies can also drive improved resource access through programmes for drinking water supply, provision of or subsidies on fish feed, subsidised seeds for farmers, PDS distribution of food rations, government disaster relief, and crop procurement policies such Minimum Support Prices.

4.1.9 Modernising Agriculture

While various contextual factors and development processes affect livelihood sustainability, community respondents also identified modernising agriculture as impacting agriculture outcomes negatively in the region. This is primarily with regard to the heavy use of chemical fertilisers and use of high-yielding variety low height crops. Chemical fertilisers have led to declining soil quality which has affected crop productivity. Further high-yielding variety seeds and crop varieties have gradually replaced traditional flood-resistant crop varieties. While this

agriculture development is policy-led and generally intended for pushing agriculture production and incomes in the region, these developments have also increased the susceptibility of agriculture and agrarian communities of the region to flood and salinity damage.
30.5% of agricultural households in the sample household survey of the study have reported declining agricultural productivity due to the use of chemical fertilisers.
Comprised of more than 54 inhabited islands, the Sundarbans region is not homogeneous throughout the inhabited part. There is differentiation due to geophysical settings, population composition and their background, access to different sets of resources and subsequent occupational specialisation, and the non-uniform pace of socio-economic transformation through the region. Several studies have divided the region into a deltaic and non-deltaic regions based on the geophysical characteristics, western and eastern-based on river regimes, and core and buffer based on conservation frameworks. It has been mentioned in the literature that the vulnerability to the process of climate change is not the same for all. A critical area to address will be the differential vulnerability of subpopulations. There found a wide range of differences across the subpopulation, while the socio-economic-cultural variation, and gender relations further intensify the complexities (Chowdhury and Jadhav, 2012; Biswas, 2013).

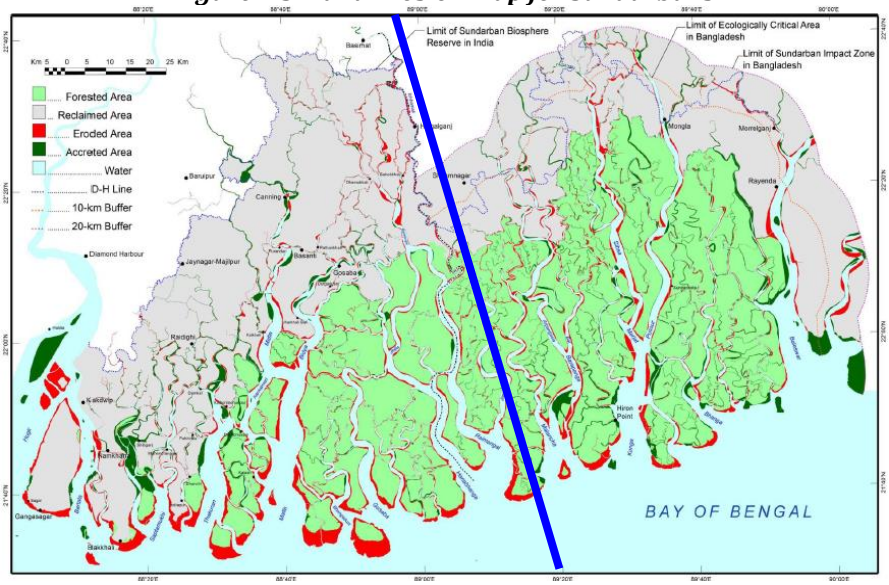
4.2 Climate change impact transmission pathways

Chapter 2 brought out 4 major climate change outcomes for the Sundarbans region – sea surface temperature changes, sea level rise and land erosion, salinity changes and biodiversity, and incidence of cyclonic storms. Each of these is closely linked to some tangible consequences for the socioeconomic and resource outcomes for the Sundarbans population.

4.1.1 Erosion and land loss:

Sea level rise and resultant land erosion leads to loss of agriculture land for villages and communities settled in erosion prone boundaries of islands and therefore leads to landlessness for these communities on the physical margins of the vulnerable islands (Gunjal 2021, Bera et.al 2021). Figure 4.5 is drawn from Bandopadhyay (2019) which shows the river/sea erosion in the integrated Sundarbans region from India and Bangladesh provides a spatial visualisation of the extent of land erosion in various blocks of (Indian) Sundarbans.

Figure 4.5: Land Erosion Map for Sundarbans



Source: Bandopadhyay(2019)

Note: blue dividing line added to the original image to show rough delineation of Indian (left) and Bangladesh (right) Sundarbans

Sea facing blocks and islands are most affected by erosion. The larger Hoogly river carrying meltwater also creates significant land erosion. The mapping is further corroborated by the field sample data where in the sea facing blocks (as well as those fed by the large Hoogly river carrying perennial meltwater) are most affected by erosion. According to the household sample survey, as interior blocks and drained mostly by tidal rivers, Canning 1 and Sandeshkhali 1 show low percentage of households reporting river erosion as a major long term change. Gosaba block while significant in reporting the same is relatively protected from large scale erosion by the adjacent extensive mangrove reserve forests. On the other hand, in the sea facing blocks of Sagar and Patharpratima, and drained by the perennial Hoogly, land erosion as a long term change is reported by over 95% households.

Table 4.1: Erosion as a major perceived/observed change over past 10-20 years by sample households

Study Block	% hhs reporting river erosion as a perceived/observed change over past 10-20 years
Canning 1	2.50
Gosaba	49.44
Patharpratima	98.75
Sagar	95.06
Sandeshkhali 1	32.50
Total for study blocks	55.6

Source : Fieldwork, 2022

Photo 4.7: Ring embankment constructed after embankment breach and land erosion/loss on Sagar island, Muriganaga village

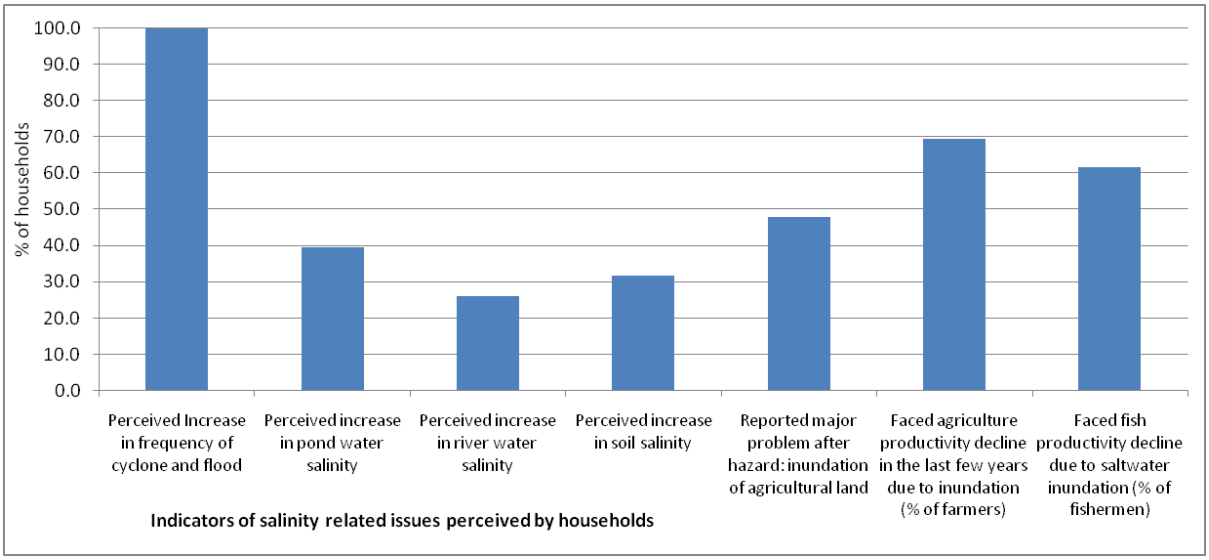
Source: Authors' fieldwork Feb 2022

4.2.2 Embankment breach and salinisation

Impacts of embankment breach, flooding, and salinization are some of most widely studied issues in relation to climate change, disasters, and their socioeconomic consequences in the Sundarbans. Repeated and prolonged inundation of agriculture lands, delayed repairs and reconstruction of embankments, mixing of saline flood waters with freshwater in ponds lead to declining productivity of agriculture lands and freshwater fish in ponds (Dasgupta et.al 2020, Nguyen and Wodon 2015). Declining produce of paddy and complete loss/unsuitability of saline soils for leafy vegetables, affect access to nutrition for affected communities.

Observations from the household survey for this study align with this literature in explaining this pathway. We find in our study areas wide reporting of salinity issues by households. Not only is there a general perception/observation by households of increase in salinity but also reporting by farmers of productivity declines of agriculture and fishing. Many community narratives referred to saline water ingression as the "poison" of the Sundarbans. Once inundated agriculture lands can become unproductive for 3-5 years. Saline ponds have to be pumped out with motor pumps and are filled during the succeeding monsoon season. Salinization of rivers and ponds also lead to decline in freshwater fish catch for both subsistence and market purposes.

Figure 4.6: Reporting of changes in various salinity related exposure and issues over the past 10-20 yrs in the study area



Source: Field data, 2022

Table 4.2: Percentage sample households reporting salinity issues in the study area

Salinity related indicators	**% of total hhs reporting*(sample 410 hhs)***
Perceived Increase in frequency of cyclone and flood	99.8
Perceived increase in pond water salinity	39.5
Perceived increase in river water salinity	26.1
Perceived increase in soil salinity	31.7

Reported major problem after hazard: inundation of agricultural land	48
Faced agriculture productivity decline in the last few years due to inundation ***(% of farmers–sub-sample 174hhs)***	69.5
Faced fish productivity decline due to saltwater inundation ***(% of fishermen–sub-sample 284hhs)***	61.6

Source: Field data, 2022

Inundation and salinisation of lands and water bodies are linked with increasing incidence of cyclonic storms over the region. While cyclonic storms are not considered a new phenomenon for this region, occurrence of severe storms was not considered an annual hazard. Since 2018 communities in the study areas have observed that major cyclones have become a regular annual feature of this region. One respondent animatedly referred to it as – "Ekhon toh jhor-brishti Durga pujor moton hoyegechhe, proti bocchor hoye" (*Cyclones/storms have now become an annual event like Durga Puja*). In the past few years the region has seen major storms such as Bulbul, Fani, Yaas, and Amphan.

Photo 4.8: Vast stretches of fallow lands left uncultivated post inundation after cyclone Yaas in Gosaba block

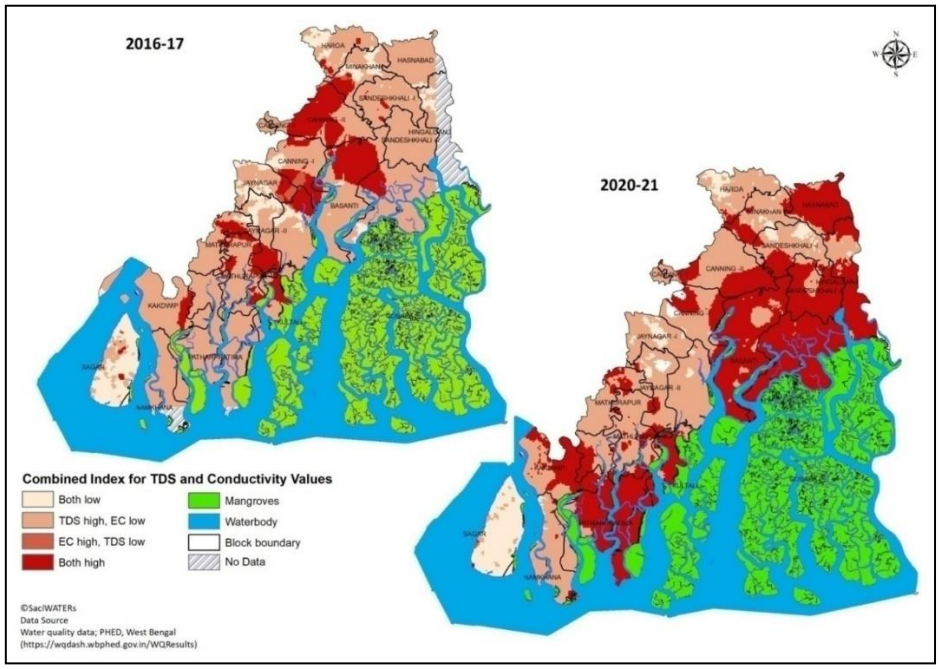
However, field narratives and expert stakeholder interviews from this study explained that river water ingress and saline water inundation was not uniformly associated with cyclone incidence. It is highly dependent on the time of the storm and its alignment with the tide. The Sundarbans islands are low lands with large areas merely 2-5 meters above sea level and many areas at or below sea level. Embankments thus enable human settlement on these islands. During high tides, the islands are a few meters below the level of the river surface water. As rivers face increasing siltation the river water levels have further risen bring the high tide water levels dangerously close to the embankment limit. Thus cyclonic storms that align with the high tide easily breach embankments inundating vast extents of the islands.

Photo 4.9: Damaged farm lands from saline water ingress after embankment breach in Sagar island

However such a breach may not occur if the storm aligns with low tides as water levels in the river are lower which embankments are able to hold against. This explained the observation that the 2020 cyclone Amphan, while being a severe cyclone, caused enormous damage to property but did not cause saline river water ingress and inundation. On the other hand the cyclone Yaas of the following year was considered more damaging as it caused saline water ingress leading to vast stretches of fallow lands and saline ponds during the fieldwork period of this study almost a year after.

Land is not the only resource that is affected by salinity in the Sundarbans. Surface and groundwater sources are equally damaged by saline water ingress both through surface inundation as well as aquifer level saltwater intrusion. Figure 4.7 below shows uses temporal water quality data of groundwater and surface water sources from PHED[26] West Bengal to map salinity indicators across two periods – 2016-17 and 2020-21. It maps indicators of Total Dissolved Solids (TDS) and Electrical Conductivity (EC) together. Areas where EC occurs with high TDS are the most salinity affected regions. Further, water salinity can exacerbate land salinity as these water sources are also used for irrigation. Since the past 4 years have seen annual cyclonic storm events unlike earlier periods, this map is effective in visually presenting the significant increase in water resource salinity across the Sundarbans region aligned with increasing incidence of cyclones.

Figure 4.7: Mapping of water quality (salinity indicators) in Indian Sundarbans region



Source: SaciWATERs, 2022

[26] Public Health and Engineering Department

Shallow aquifer layers are turned saline due to prolonged inundation and infiltration of flood waters. This causes scarcity of drinking water compelling women to walk long distances for common potable water. For domestic purposes women spend prolonged durations in saline pond water making them more susceptible to skin infections (Mukherjee and Siddiqui 2021). Through the household survey in this study we find that 47.8% households in the study area have reported perceiving/observing major changes in drinking water salinity over the past 10-20 years.Table 4.3 below lists out the nature of problems faced by households with regard to drinking and cooking water and percentage of total sample households that have reported facing these problems.

Table 4.3: Problems with regard to access to drinking and cooking water (during summers and floods)

Problems reported with regard to access to drinking and cooking water	**% of total hhs** ***(sample 410 hhs)***
travel long distances for alternate water source	70.9
use polluted water	40.8
Increased salinity in water used	28.1
Scarcity of water	74.6
Time spent on water collection	39.1
Need to purchase water	12.0
No problems faced	10.8

4.2.3 Droughts and untimely rainfall

Qualitative indepth interviews with key persons from the village community revealed that while Sundarbans is most often discussed with regard to cyclonic storms and floods, communities were now regularly facing severe drinking and irrigation water shortages during summers. The upper layers (200-300ft) of the aquifer of Sundarbans are largely saline and are therefore not suitable for drinking. This layer is largely used for irrigation water. In many areas there is no shallow water layer. The soils of this region are largely clayey loam which holds water but does allow surface water to permeate to deeper layers. Drinking water in the region is therefore accessed through deep tubewells (depth 1000-1200ft) installed by the PHED at various common points across the villages. Over the past 4-5 years communities have been facing acute drinking water shortage even at these deeper layers.

It may appear counter-intuitive for a deltaic flood-prone region to depend on deep groundwater layers and face groundwater shortages. However, expert stakeholder engagement on this issue for the study revealed that the aquifer structure of the region offers an explanation for such resource scarcity. As explained earlier, the deeper aquifer layers of the region are not fed by the precipitation and surface runoff within the region. These deep aquifer layers of the Sundarbans region are recharged by rainfall and surface drainage in districts north of the Sundarbans region. Rainfall conditions in these regions can therefore affect potable groundwater availability in the Sundarbans region creating drought-like impacts. Additionally with increasing pond water salinity conditions under increased incidence of cyclones there is a lack of alternative drinking water sources.

With lack of groundwater (shallow and deep), the Sundarbans region is also challenged by low access to irrigation water, mostly depending on rainfed agriculture. 73.6% of the farming households sample from this study reported depending on rainfed agriculture and merely 2.95% of farming households owned irrigation tubewells. 14.9% farming households purchased

tubewell water from others for irrigation. This resource access issues can be easily exacerbated by fluctuations in rainfall. They further impact agriculture during the winter and summer cropping seasons. While on the one hand the study region is facing drought-like conditions, it also faces cyclonic storms and frequent flooding (both from rain and river ingress). Rainfall conditions in the region, through its interaction with an already fragile water ecology, can have significant outcomes for resource access in the region. Table 4.4 and Figure 4.8below present the extent of issues of resource access faced by respondent households during and due to various hydrological hazards in the region.

Figure 4.8: Resource access issues reported by households during hazards

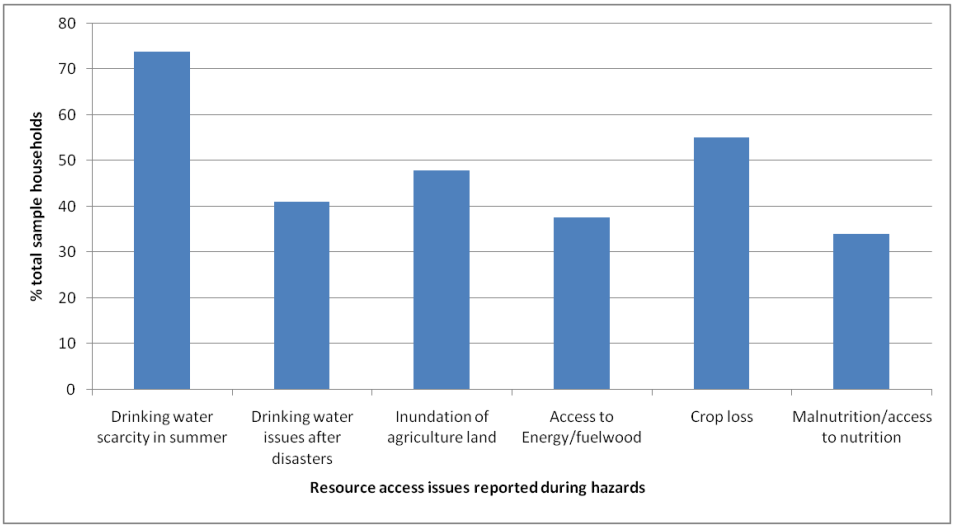


Table 4.4: Resource access issues reported by households during hazards (supporting table)

Resource access issues reported during hazards	**% of total hhs** ***(sample 410 hhs)***
Drinking water scarcity in summer	73.9
Drinking water issues after disasters	41
Inundation of agriculture land	48
Access to Energy/fuelwood	37.6
Crop loss	55.1
Malnutrition/access to nutrition	34.1

Finally, local infrastructure such as houses, roads, schools, and access to transport and medical infrastructure are inundated and damaged under severe storms and resulting saline water flooding conditions (Nguyen and Wodon 2015).

4.1.4 Cyclonic storms and damage to property

An important resource and livelihood impact of climate change pertains to the damage to property caused by cyclonic storms. With increasing intensity of storms the frequent damage to houses, roads, electricity supply, and other infrastructure creates heavy cost burdens of maintenance and reconstruction for the community and local governments.

Table 4.5: Vulnerability of housing infrastructure among sample households

Indicators showing vulnerability of housing infrastructure	% of total sample hhs
%hhs with kuccha houses	41.2
%hhs with semi-kuchha houses	45.1
%hhs who have to move to other shelters (away from their houses) during floods	72.9
%hhs reporting poor living/housing condition after hazards	47.8

With repeated cyclones and floods, kuccha houses and semi-kuchha houses are easily damaged. Houses in the region are predominantly mud houses with tin sheet/straw roof. Households, already affected by losses in income from crop and fish produce loss, are further burdened with the costs of repeatedly rebuilding houses. Damage to electric polls, wiring, and village roads also creates risks during storms and floods.

Photo 4.10: Kuchha mud housing with straw roof adjacent to earth embankment in Gosaba block

Photo 4.11: Damage of elevated village roads from flooding

4.1.5 River salinity and biodiversity

Landward retreat of mangroves as river salinity increases augments potential for honey production with proximity and easier access to forests. However, the literature also connects this retreat to increased human-wildlife conflict and threats (Ghosh and Roy 2022).. On the other hand, retreat of mangroves and shifting species of mangroves due to salinization tend to lead to reduction in land use area under mangroves and reduction in high timber value species such as *Heritiera Fomes,* which affect livelihoods based on timber and other forest produce (Ghosh and Roy 2022). Changes in mangrove species also impact the livelihoods based on honey production as honey derived from certain species of mangroves, now dwindling, draw high rates in the

national and international markets and shift in species can thus affect the quality of honey produced and market prices received (Dasgupta et.al 2017).

These cumulative impacts of climate change thus lead to a cascading set of consequences, including increasing poverty, reduced food production, the loss of livelihood security, negative impacts on health, large-scale migration, and increased economic and geopolitical tensions and instabilities (Abedin et al., 2014). With the intensification of the climate crisis, there is an increasing concern among the island communities to sustain their lives and livelihood in such a hostile environment. Climate change impacts on livelihoods, natural resources, infrastructure and services are found to be some of the key mediating processes that connect climate change with more underlying socioeconomic impacts on poverty, migration, spatial differences and inequalities, and social and gendered marginalities.

Multiple pathways connect larger climate change variables and outcomes with socioeconomic vulnerabilities including intersections with anthropogenic and developmental activities, social structures, policy and governance, class structures and poverty, local geographic variations, and historical development of the region. These pathways link climate change to significantly more complex social outcomes of health, migration, and protection.

5 CLIMATE CHANGE IMPACTS ON CHILD AND MATERNAL HEALTH

In chapter 2, we have seen that there is evidence that both child and maternal health conditions are poor in the Indian Sundarbans region while the public health system is extremely fragile and inadequate. It is neither dependable nor easily accessible leading to extreme severity in the health scenario. Chapter 4 presents how the changing climate interacts with other environmental factors and social determinants of health and could cause important impacts on human health. It is under these baseline conditions, that this chapter attempts to critically inquire into and understand the impact climate change factors will have on the health conditions and systems.
Climate change is one of the determinants of child and maternal health (Bose et al. 2016, Ghosh, 2019) and it affects in the form of mortality and other physical and psychological disorders. Numerous studies (Helldén et al., 2021) and clinical trials recognize that climate change-induced threats i.e. frequent storm surges, inundation, and salinization (Dasgupta et al., 2020) act through multiple pathways to negatively affect reproductive and child health, mental health, rights, and wellbeing. A few studies that have empirically tested the differential impacts of climate change on child and maternal health have majorly given importance to three issues, i.e. first is the rise in water and vector-borne diseases after each episode of flooding caused by tropical cyclones, excessive rainfall with tidal surge (Bose et al, 2018; Kanjilal et al., 2013). Second, increasing levels of malnutrition among children and the prevalence of anaemia among pregnant women and mothers of small children (Panda et al., 2016) are due to increasing food insecurity (Dasgupta et al., 2020). Increasing frequency of floods in the cyclone-prone region along with high salinity resulted in declining affordability and accessibility of nutritious food viz. wild freshwater fish, vegetables, rice, etc. (Dasgupta et al., 2020), and third, the impact of sudden climatic events on the existing poor health care infrastructure. The health infrastructure is already a weak system in the remote villages of Sundarbans and climatic shocks like cyclones and floods, make it more inaccessible to the local population and lead to deprivation of the affected islanders of quality-assured medical attention (Kanjilal et al. 2013, Bose et al. 2018).

This chapter focuses on three specific issues: ***first,*** it assesses the risks of current climate variability and change on human health in the Sundarbans and identifies climate-related health risks among mothers and new-born children; ***second,*** it explores the current institutional capacity of health and allied sectors (insulating layers) to manage the risks of climate-sensitive health outcomes in Sundarbans; and ***third,*** it tries to understand the gaps in dealing with climate-induced health issues and suggests recommendations.

This chapter uses both primary and secondary data for the analysis. SaciWATERs research team carried out a household study in the five blocks of the Sundarbans region from February-March 2022. The household survey was carried out by two-stage stratified purposive random sampling using structured questionnaires. A total of 410 households in 20 villages (at least 20 HHs per village) were surveyed (Chapter 3). The quantitative information has been supplemented by indepth qualitative interviews with front-line workers, like- Doctors, ASHA, ANM, ICDS, and community members. Secondary data was taken essentially from two sources, i.e. Health statistics of West Bengal published by the Health and Family Welfare Department and the Monthly progress report (MRP) published by the Directorate of Integrated Child Development Service, Department of Women and Child Development and Social Welfare, Government of West Bengal.

5.1 Health status of children and mothers in Indian Sundarbans regions (Baseline situation)

Previous research on the Sundarbans highlights the precarious health condition of the people of the Sundarbans region along with the poor health system. These studies are mostly a decade old and therefore primarily it is important to understand the baseline condition and the magnitude of the problem of the region in terms of its health status in the present context. Here we tried to take a broad perspective i.e. RMNCH+A (MOHFW, 2013) on maternal and child health and place it in a wider context. RMNCH+A approach encompasses health issues across the life course from adolescent girls and women before and during pregnancy and delivery to newborns and children. This framework focuses on two basic issues; ***first,*** the child and maternal health mutually influence one another during childhood and adolescence, and therefore, the need for health services across the stages of the life course as it cannot be addressed in isolation; ***second*** is the delivery of integrated preventive and therapeutic health interventions through varied service platform, like-community health workers, primary health centers and the hospitals.
In order to understand the baseline situation, we have taken a few health indicators (Table 5.1) for various life stages and tried to link them.

Table 5.1: Health Indicators (RMNCH+A Approach)

Life Stage	Indicators	Relation with health outcomes
Adolescent	Malnutrition	The nutritional status of adolescent girls and young women is inextricably linked to the birth weight of their children and subsequently to child survival.
	Menstrual Hygiene	Poor genital hygiene negatively affects adolescents' health.
Pregnancy	Age at birth	Early childbearing can increase risks for newborns as well as young mothers.
	Antenatal Check-up	Lack of antenatal reduces the opportunities to deal with recurrent problems.
	Pregnancy-related complications	Indicative of a potential need for health care during pregnancy
Delivery	Institutional Delivery	Institutional delivery with skilled birth attendants could reduce the complications during delivery
	Skilled birth attendant	
Post Natal	Postnatal Check-up	Lack of postnatal check-ups reduces the opportunities to deal with recurrent problems of mother and newborn child
Neonatal	Breastfeeding	Appropriate for infant nutrition and reduced health complications and hospital admissions
	Health problems in the newborn	Indicative of potential need for health care for the newborns
Infancy	Immunisation	Decreases the health risks
	Registration with community health care services	Registration with ASHA, ANM, and ICDS could reduce the health risks by generating awareness for immunization
	Food through ICDS Scheme	Food provided through ICDS could reduce malnutrition among the children

Figure 5.1: Current Status of RMNCH+A in the Sundarbans region

Source: Calculated from the field data, SaciWATERs, 2022.

Table 5.2: correlation between health complications reported during pregnancy and in the newborn

Correlations		Complications reported during pregnancy	Complications reported in the newborn
Complications reported during pregnancy	Pearson Correlation	1	.392**
	Sig. (2-tailed)		.000
	N	187	187

****. Correlation is significant at the 0.01 level (2-tailed).**

Source: Calculated from the field data, SaciWATERs, 2022.

The health of an adolescent girl impacts pregnancy while the health of a pregnant woman impacts the health of the newborn and the child. Access to proper sanitary products during menstruation

is an important factor that influences menstrual and reproductive health. It is found that cloth is often not recommended for menstrual hygiene management as their use has been associated with abnormal vaginal discharge, skin irritations, and urogenital infections in the long run[27]. During an interview with a doctor at a rural hospital in Sagar Island, we find that abnormal vaginal discharge of a mother can have a negative impact on a newborn child. It has been reported in the household survey that 51.6 percent of adolescent girls do not have access to sanitary pads and they are still dependent on clothes for menstrual management, which is quite high in comparison to the state average. As per the NFHS 5 report, around 79.7 percent of the rural population aged between 15-24 use hygenic method of protection during their menstrual period. On the other hand, adolescent undernutrition can have a potential impact on growth and reproductive health, although these are likely consequences of chronic malnutrition in infancy and childhood[28].

Though maternal mortality is a key indicator of maternal health, however, due to the scantiness of data we have considered a couple of proxy indicators. We consider health outcomes beyond mortality, in particular, we have considered the health complications during pregnancy and tried to make links to a range of survival initiatives, particularly for neonatal and antenatal. It has been reported that a large proportion of women suffer pregnancy-related illnesses, near-miss events, and other potentially devastating consequences post-birth. The long-term consequences are not only physical, but are also psychological, social, and economic. This study uses self-reported ill-health information in pregnancy. The common symptoms reported by the women include fever, swollen feet, tiredness, and weakness. A doctor at the rural health centre reports that

> *"Swollen foot is a common symptom found among pregnant mothers during the advanced stages of the pregnancy. In the villages of Sundarbans, many families still prefer normal delivery and like to wait till the expected delivery date. Due to this, sometimes the weight of the baby increases or fluid volume decrease, which could cause symptoms like swollen feet. This all happening due to lack of knowledge among the family members."*

Apart from that, a number of women have also reported that they suffered due to iron deficiency and anaemia during their last pregnancy. Two ASHA workers of Patharpratima block confirm that a health camp organized in Durbachati village of Patharpratima block a few months back recorded low hemoglobin (below 11 gm/dL) in 80 percent of the mothers, which is quite high in comparison to the state average for rural areas i.e. 63.0 percent (NFHS-5, 2019-20).

The institutional delivery with skilled health attendants, and antenatal and postnatal care, immunisation has improved massively due to high coverage of the government intervention and strict implementation of the government policies. Contrary to this, it is also found that early marriage and childbirth at a very young age is still persisting in this region. The survey result shows that around 37.4 percent women below 20 years of age were already mothers or pregnant at the time of the survey, which is almost 20 percent high than the state rural average i.e. 19.6 percent (NFHS 5, 2019-20). It could increase the health risks for mothers and children.

[27] https://www.unicef.org/media/91346/file/UNICEF-Guide-menstrual-hygiene-materials-2019.pdf

[28] Aparajita Dasgupta et al., "Assessment of Malnutrition Among Adolescents:Can BMI Be Replaced by MUAC," *Indian Journal of Community Medicine : Official Publication of Indian Association of Preventive & Social Medicine* 35, no. 2 (April 2010): 276–79, https://doi.org/10.4103/0970-0218.66892.

The key observations from the situational Analysis are:

1. Ante-natal and post-natal services are satisfactory, yet have not reached 100 percent coverage.
2. High prevalence of child marriage and adolescent pregnancy.
3. Adolescents' nutrition intake requires greater care.

5.1.1 Spatial Variation

There are also vast spatial and socioeconomic inequalities within the Sundarbans region which has impacts on the child and maternal health outcomes.

Table 5.3: Exposure to climate shocks and Current Status of RMNCH+A

STAGES	INDICATORS	HIGH EXPOSURE TO CLIMATIC SHOCKS	LOW TO MODERATE EXPOSURE TO CLIMATIC SHOCKS
ADOLESCENT	Using clothes during the menstrual period	32.3%	71.0%
	Malnutrition	35.1%	37.3%
PREGNANCY	Age of mother at last birth (Below 20)	38.9%	35.4%
	Received 4 ANC checkups	82.4%	78.5%
	High blood pressure during last pregnancy	6.5%	11.4%
	Low blood pressure during last pregnancy	13.0%	15.2%
	High bleeding during last pregnancy	1.9%	3.8%
	Abdomen pain during last pregnancy	15.7%	24.1%
	Weakness during last pregnancy	72.2%	75.9%
	Breathlessness during last pregnancy	2.8%	8.9%
	Swelling of legs during last pregnancy	16.7%	13.9%
	Convulsions during last pregnancy	.9%	1.3%
	Fever during last pregnancy	11.1%	8.9%
	Poor vision during the daytime during last pregnancy	2.8%	0
DELIVERY	Home delivery	2.8%	5.1%
POST-NATAL SERVICES FROM ASHA, ANM	Vitamin supplement	72.2%	97.5%
	Advice on family planning	75.9%	62.0%
	Advice on nutritional food	88.9%	88.6%
	Advice on breastfeeding	86.1%	77.2%
NEONATAL (PROBLEMS IN NEWBORN)	Difficulty in breathing	14.8%	19.0%
	Inability to pass urine and stools	7.4%	1.3%
	Jaundice	3.7%	3.8%
	Fever	29.6%	20.3%
	Diarrhoea	13.9%	0
	Dull and lethargic baby	9.3%	1.3%
	Eyes are red or infected	6.5%	0
INFANCY	Immunization	95.4%	100.0%
	Malnutrition among the children < 6	18.8%	15.6%

The field data (Table 5.3) shows that it is not always true that the population living in the most vulnerable areas to climate change has poorer health outcomes than those living in less vulnerable regions. There are several socio-economic and cultural factors having an impact on health outcomes. For example, it is reported that 71 percent of adolescent girls from less vulnerable areas use clothes during their menstrual period in comparison to 32.3 percent from the more vulnerable areas. As reported by an ICDS worker of Sandeshkhali I block, *"one of the major problems of our area is girls use cotton clothes during their menstrual period. Napkins are also not available so easily in our area. Now they are not having any problems, however with aging, they will have to face many problems. Chances of getting infections are very high. Napkins are not even available in the public health centres and sub-centres. In some cases, they cannot purchase it due to poor economic conditions of the family, sometimes girls feel very shy to purchase it from medical stores as the storekeeper is a man."* There are a number of socio-cultural factors acting behind this scenario. Fertility rates are high in some pockets of the Sundarbans region. ICDS worker of Boyarmari village of Sandeshkhali I reports that fertility rate is quite high in some villages of Minakhan I and Sandeshkhali I block, especially those having dominance of Muslim population. These are the places with low literacy rates and with a high prevalence of poverty. While these areas record high fertility rates, only 62 percent of the mothers reported that they received advices on family planning.

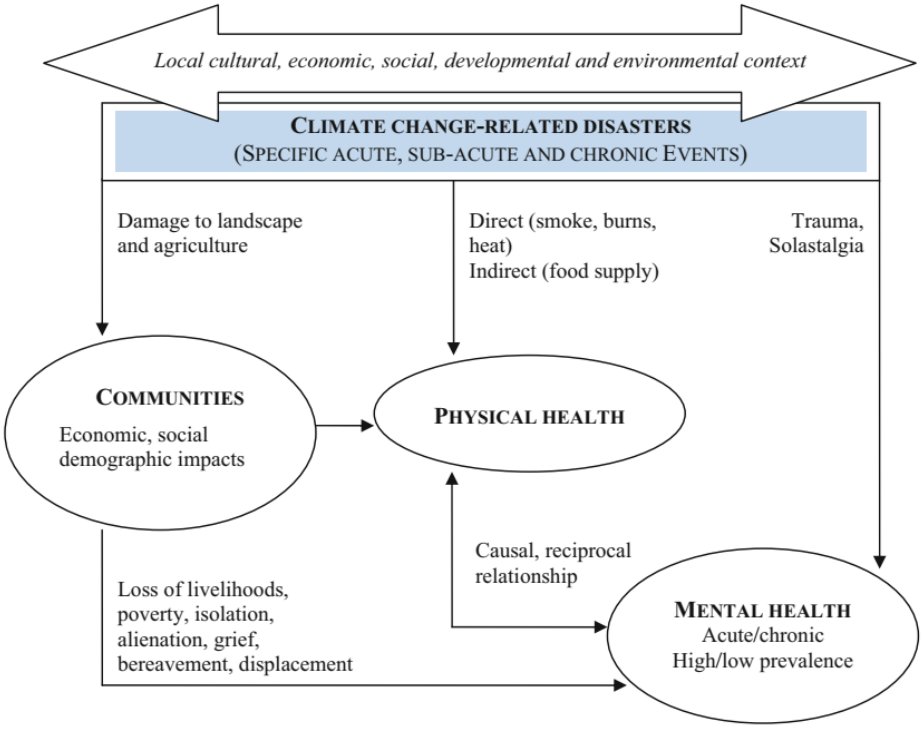
The data further shows that the health problems among the newborns are found to be more pronounced in areas with high exposure to extreme climatic events. The rate of infectious diseases, like- diarrhoea, eye infections are especially high in this region. Similarly, prevalencee of malnutrition is relatively more among the children in high exposure region.

Moreover, it is also recorded that health inequalities in some regions are being further exacerbated over time, with those at the bottom of the socioeconomic scale facing more health-related complications due to pre-existing inequalities.

5.2 Climate-related health risks

Studies identified climate change as one of the determining factors for the health outcomes for this region and therefore, against the above backdrop, it is important to find out the linkages between climate-related factors and health risks among mothers and newborn children. To examine the particular impacts of climate change on child and maternal health, we identified several frameworks mentioned in the literature. Studies suggest that climate change is directly linked to extreme weather events as climate change increases the frequency, intensity, and impacts of some types of extreme weather events, like – cyclones, floods, drought, etc. Extreme weather events have direct impacts on health outcomes in the form of death, injury, diseases, and trauma. On the other hand, indirect impacts such as infections or chronic disease complications in the context of climate change in general and extreme weather events, in particular, are less well-understood, in part due to the complex nature of the ecosystem, social, and biophysical interactions. It is also noted that all the uneven implications of climate change for children and women get intensified with poverty, poor access to resources, and poor adaptive capacities.

Figure 5.2: Framework showing causal pathways linking climate change and health



Source: Berry et al. 2010

The health impacts of climate change on children and maternal health are divided into three interrelated categories in this chapter for detailed discussion:

(1) Death, injury, and disease resulting from the direct impact of extreme weather events (e.g., triggered by an extreme heat event, extreme precipitation, cyclone, flood, increased air, and water contaminants accompanying such events);
(2) Death and disease brought on indirectly following cyclone/ flood due to loss of ecosystem functions, services, and goods (including more pervasive pathogens and altered disease transmission patterns) or due to disruption of normal lives and livelihoods and subsequent breakdown of social systems (including housing, infrastructure, food, and water supply); and
(3) Mental health impacts brought on directly or indirectly by extreme weather events.

5.2.1 Direct Health impacts brought by extreme weather events

Different types of extreme weather events lead to different direct physical health risks to children and women. Impacts on children in the immediate aftermath of an extreme weather event such as a cyclone, storm surge, or flooding are overwhelmingly due to the direct effects of trauma, crush-related injuries, and drowning incidences. Similarly, extreme heat events may also be particularly devastating for young children. Skin, respiratory, and digestive infections are a risk for children in all extreme weather events. It is reported in the literature that children can be more vulnerable to extreme temperatures as the child's higher body surface area-to-mass ratio means the temperature transfer between his or her environment and body will be greater than in an adult. Children are more sensitive to temperature due to a higher metabolic rate in them.

They also create somewhat lower cardiac output values than adults, spend more time outdoors, and do more vigorous activities, leading to the potential for longer exposure to extreme temperatures because of lower awareness of their deleterious effects than adults may have.

It is found during the interviews with children and their parents that the incidences of death, injury, and drowning resulting from the direct exposure to extreme weather events have declined massively in the last few years due to better preparedness and risk management strategies in the Indian Sundarbans region. Drowning deaths caused by extreme weather events like-flood are can be prevented through building physical skills among the children such as swimming.

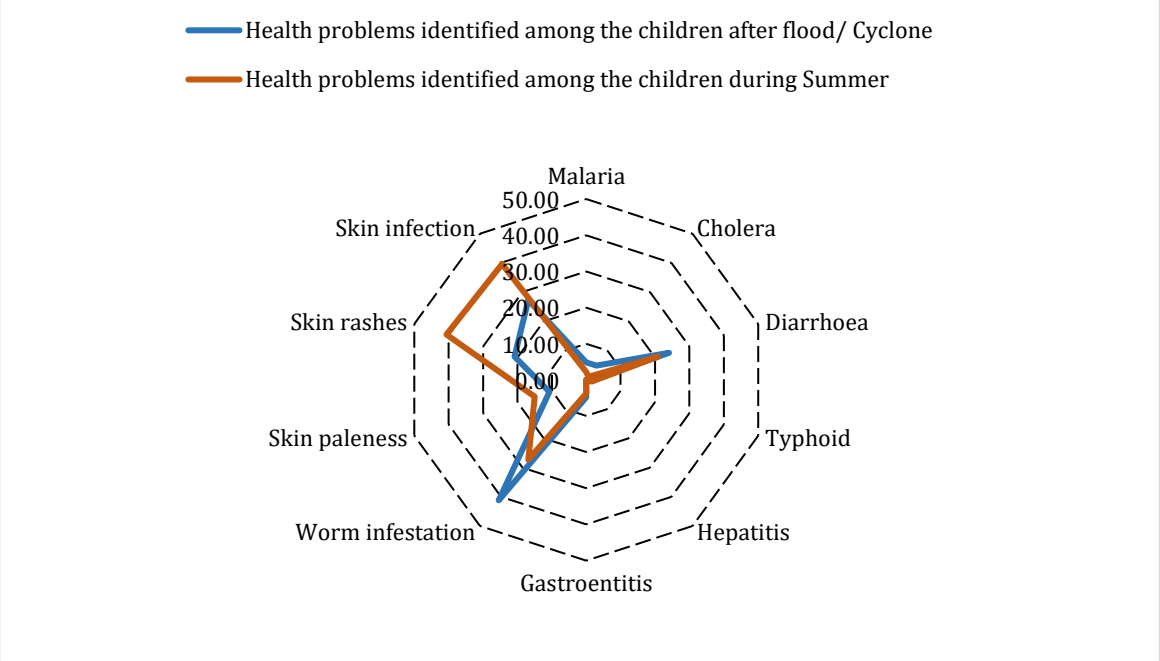
> *'They all know how to swim. If they get stuck in floodwater, they will be able to escape as they can swim. All those who have been born and brought up in this region have learned to swim." (FGD, Mahendranagar, Patharpratima)*

Contrary to this, the disease burden among the children is still quite overwhelming followed by extreme weather events.

a. Impact on child health

The mothers of the small children reported that they have primarily noticed three types of health problems i.e. worm infestation, diarrhoea, and skin rashes/ infection among the children following cyclones and floods and also during the hot and humid summer period. These are all infectious diseases transmitted to the human body through food, water, and vectors. Figure 5.3 presents the child's health issues reported by the parents following the extreme weather events.

Figure 5.3: Health problems reported for the children after cyclone/ flood and during summer



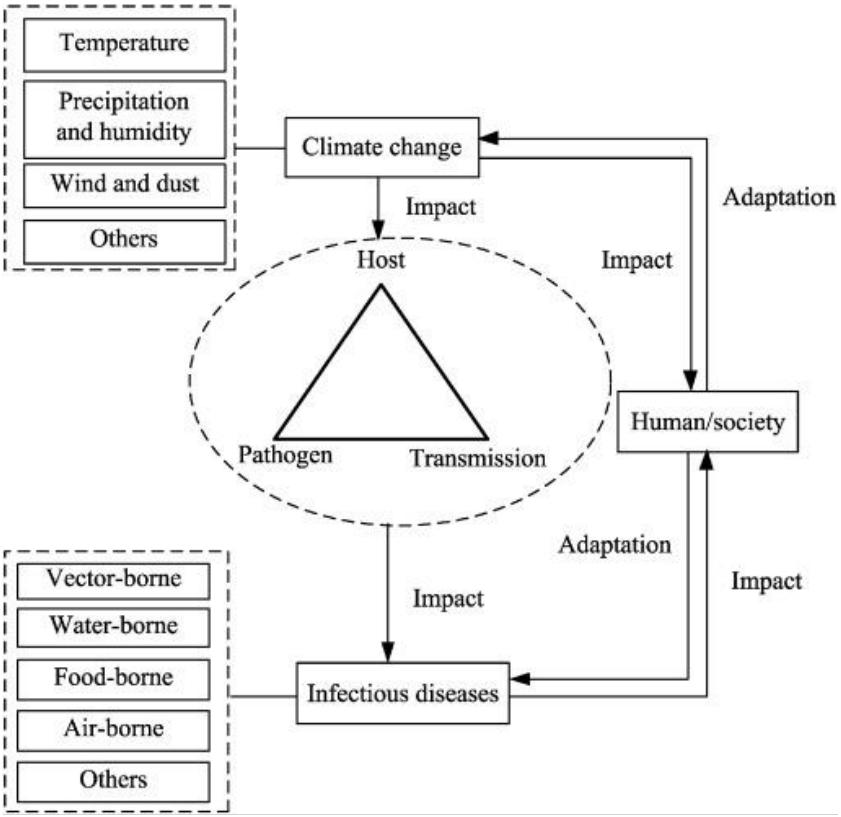
Source: field data, SaciWATERs, 2022.

Though the presence of disease pathogens is the main reason behind these health risks, however, the manifestations of the disease are further linked to multiple factors. Epidemiological studies suggest that there are three components that need to interact with each other for any kind of

disease to occur. The increasing incidence of infectious diseases among children can be better understood using the causation model used in epidemiological studies, also known as 'epidemiological triads' (Figure 5.4). In the case of infectious diseases (diarrhoea, cholera, typhoid, malaria), pathogens are the prime factors acting as agents for the development of the disease. It is important to mention here that the rate of infection depends on a number of factors, - such as its survival, reproduction, and transmission. Exposure to these disease pathogens over a long time leads to infections. However, susceptibility to developing infectious diseases varies across communities with a similar level of exposure due to differences in immune systems, nutrition status, age, etc. There are environmental factors that allow the diseases to be transmitted to the human body. Pathogens may enter the human body via different sources: vector, water, food, air, etc. In addition to these, the transmission pathways between each of these components allow the spread of the disease.

Climate changes lead to alternations in one or more climate variables including temperature, precipitation, humidity, wind, and sunshine. These changes may impact the survival, reproduction, or distribution of disease pathogens and hosts, as well as the availability and means of their transmission environment. The health effects of such impacts tend to reveal as shifts in the geographic and seasonal patterns of human infectious diseases, and as changes in their outbreak frequency and severity[29].

Figure 5.4: Climate change impacts on infectious diseases (Epidemiological Triad)



Source: Wu et al., 2016

[29] Xiaoxu Wu et al., "Impact of Climate Change on Human Infectious Diseases: Empirical Evidence and Human Adaptation," *Environment International* 86 (January 1, 2016): 14–23, https://doi.org/10.1016/j.envint.2015.09.007.

There is a clear indication that with the increasing frequency of cyclones, floods, and drought events there are chances of increased incidences and epidemic outbreaks of infectious diseases[30]. Climate factors influence each component of the epidemiological triad of the host, agent (pathogen), and environment, which intersect to produce infectious disease[31].

b. Impact on pregnant women

Along with the children, pregnant women are at high risk during and after extreme weather events, like- floods and cyclones due to their special conditions and suffer from health problems. Almost 36 percent of mothers reported that they experienced cyclones and floods while they were pregnant (Figure 5.5). Of those who experienced cyclone events, almost 95 percent of them reported that they had to face problems during and after cyclone/ flood events. Increased physiological stress, psychological stress (fear), lack of access to health centers, interruption of prenatal care, lack of nutritious food, and lack of access to WASH facilities are some of the risk factors identified by pregnant women in disasters (Figure 5.6). It is found from the literature that these risk factors increase the rate of pregnancy-related illnesses among the women in the form of complications including preterm birth, low birth weight of the child, small for gestational age (SGA), stillbirth, spontaneous abortion, etc.[32]. Post-flood a large number of women and children visit local rural health centres with skin diseases. According to a doctor at the rural hospital, the increasing level of PH in the river water causes fungal skin infection and sometimes continues for 3 to 6 months. The increasing cases of anemia (low hemoglobin) among the reproductive age group women have been identified as another major public health problem post-disaster period in both Sagar Island and Patharpratima (Table 5.4).

> *"In the last two years, we have recorded a maximum number of anemia cases among the mothers. We have never seen such high numbers earlier." (Surifa Bibi, Durbachati No 1 subcentre, ASHA Worker)*

[30] Anthony J McMichael, "Extreme Weather Events and Infectious Disease Outbreaks," *Virulence* 6, no. 6 (July 13, 2015): 543–47, https://doi.org/10.4161/21505594.2014.975022.

[31] Institute of Medicine (US) Forum on Microbial Threats, *Summary and Assessment*, *Global Climate Change and Extreme Weather Events: Understanding the Contributions to Infectious Disease Emergence: Workshop Summary* (National Academies Press (US), 2008), https://www.ncbi.nlm.nih.gov/books/NBK45737/.

[32] Nasim Partash et al., "The Impact of Flood on Pregnancy Outcomes: A Review Article," *Taiwanese Journal of Obstetrics and Gynecology* 61, no. 1 (January 1, 2022): 10–14, https://doi.org/10.1016/j.tjog.2021.11.005.

Figure 5.5: Incidence of flood/ cyclone during the last pregnancy of the mother (last 5 years)

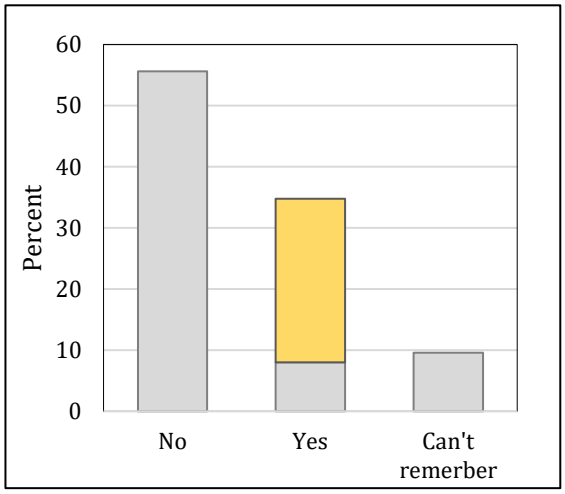
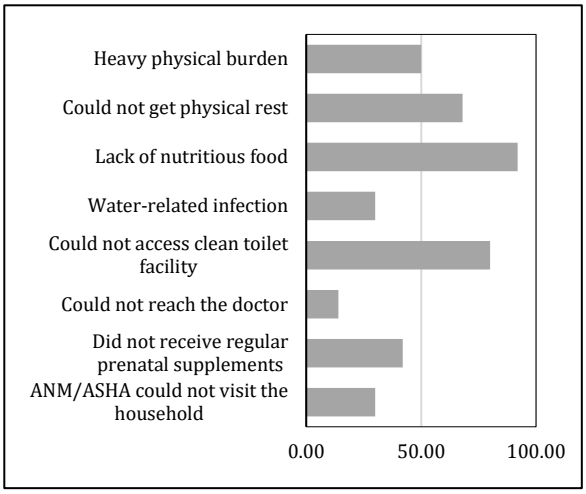


Figure 5.6: Nature of problems reported by the mothers



Source: Field data, SaciWATERs, 2022.

Table 5.4: Health problems identified by Health professionals

Respondents	*Maternal Health problems*		*Child Health Problems*	
	General problems	Post-disaster	General problems	Post-disaster
Doctor, Sagar Island	Skin Disease,	Iron deficiency, Skin disease	Skin disease	Waterborne diseases, Skin disease
ASHA, Patharpratima	Low Hemoglobin	Low Hemoglobin, Anemia	Malnutrition	Diarrhoea, Skin disease
ANM, Patharpratima	White Discharge	--	Diarrhea due to Rotavirus, Pneumonia,	Diarrhea
ICDS Group Discussion, Gosaba		Diarrhoea	Malnutrition, Seasonal cold and cough, Low weight,	Diarrhoea
ICDS Worker, Boyarmari, Sandeshkhali I	White discharge, vaginal infections	Vaginal infection, Skin rashes	Malnutrition	Diarrhoea

C. Impact on adolescent health

During floods, the challenges faced by women and adolescent girls, pertaining to their menstrual health needs are magnified. Given the lack of space, WASH facilities, and basic necessities, women are unable to manage monthly menstruation in a safe, private, and dignified manner. It is reported by 97 percent of women that menstrual hygiene practices were often compromised by adolescent girls and women during floods (Figure 5.7). Difficulty in accessing clean washrooms, adequate water, sanitary napkins, and clean clothes is some of the risk factors identified by the women (Figure 5.8). Lack of menstrual hygiene and inaccessibility to proper sanitation facilities lead to various health problems including dermatitis, urinary tract infections, genital tract infections,

alteration in the pH balance of vaginal secretions, and bacterial infection, all leading to increased susceptibility to cervical cancer in the long run.

Figure 5.7: Menstrual Health problems reported by women during cyclones and flood

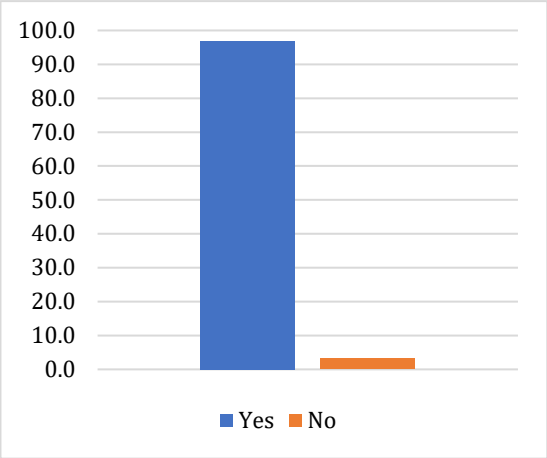
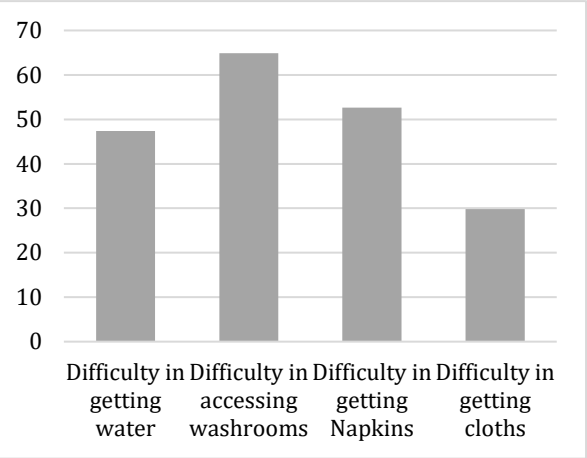


Figure 5.8: Risk factors reported by women related to menstrual health and hygiene



Source: Field data, SaciWATERs, 2022.

5.2.2 Indirect physical health effects mediated through Ecosystems and Social Systems

Climate change also brings indirect health risks for children and mothers through impacts on ecosystems and human social systems or interaction of both. This is a complex process and follows multi-stepped, diffuse, and deferred causal paths[33].

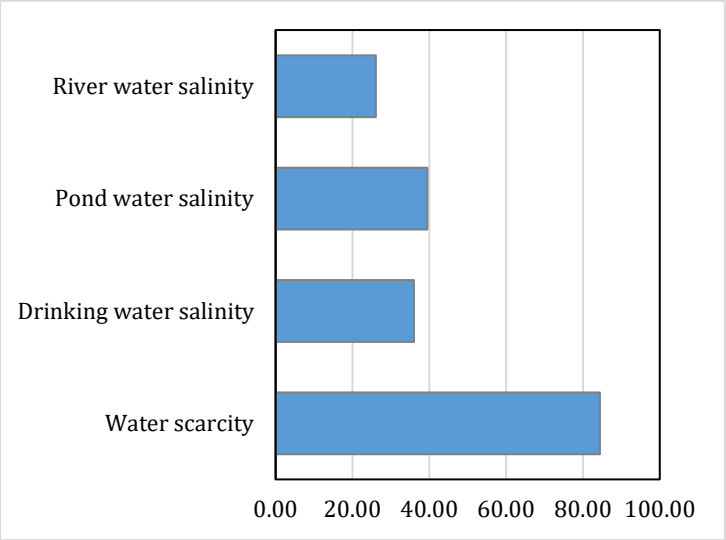
The indirect impacts of climate change on child and maternal health mediate through two pathways, i.e. through water insecurity caused by a disruption in freshwater services due to depletion of groundwater, increasing level of salinity in groundwater and surface water; and through food insecurity caused by the decrease in farm production, crop failure, the decline in fish production, etc. It is important to mention here that both water and food are essential to health and survival.

5.2.2.1 Water Insecurity

Higher temperatures, extremes of precipitation, frequent cyclonic events, and sea-level rise are contributing to water insecurities in this region. With the intensification of the climate crisis, there is an increasing concern about the availability of fresh water. This region has experienced a variety of problems with water (Chapter 4). We find in our study that households reported four types of water-related problems (Figure 5.9). In the Sundarbans region, groundwater is the primary source of freshwater used for drinking, cooking, and domestic as well as agricultural purposes. Due to increasing dependency on groundwater for daily use and rainfall variation, freshwater sources are being depleted. It is especially difficult to get adequate water during the dry seasons. Declining groundwater levels is causing saltwater from the sea to find its way into local aquifers through a process called seawater intrusion. Both lowering of the groundwater

[33] A. J. McMichael and E. Lindgren, "Climate Change: Present and Future Risks to Health, and Necessary Responses," *Journal of Internal Medicine* 270, no. 5 (2011): 401–13, https://doi.org/10.1111/j.1365-2796.2011.02415.x.

Figure 5.9: Major changes noticed in the past 10-20 years



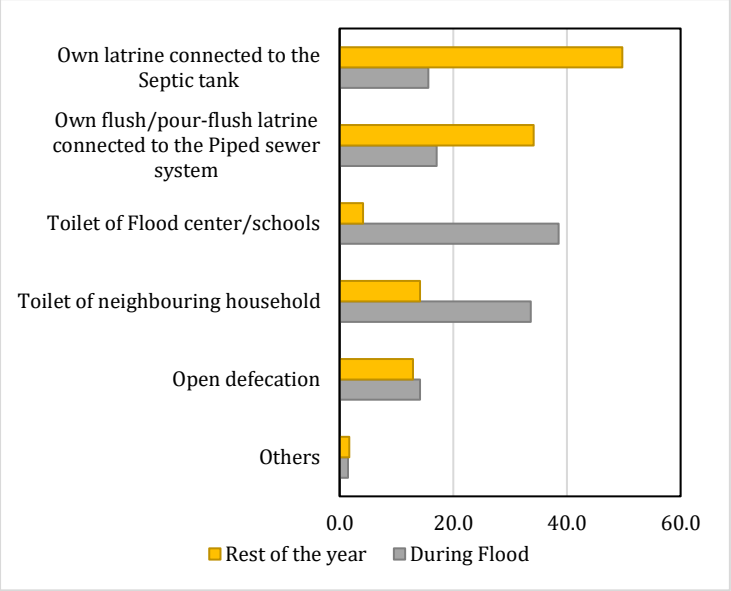
Source: Field work, SaciWATERs, 2022

layers and salinization of the shallow aquifer layers cause scarcity of water in the Sundarbans region. Similarly, ingression of saline river water during flood leads to salinization of the pond water (Chapter 4). We also find that 26.1 percent of the households reported an increasing level of salinity even in the river water and it has an impact on the fish productivity. These water-related issues have important implications on child and reproductive health. Children, in particular, pay a very high price for water-related insecurities. The UNCRC also clearly relates the right to water with one of the key principles of child rights, i.e., the right to survival and development (Article 6).

a. Poor WASH condition in communities and health impacts

Water scarcity jeopardises domestic and communal hygiene and can increase waterborne infectious diseases (cholera, other diarrhoeal organisms, cryptosporidium, etc.) with inevitable adverse health consequences. Extreme weather events threaten sanitation systems. It is reported by the households that toilets get inundated during floods and they use public toilets in the flood centres and schools (Figure 5.10). In absence of adequate clean water and crowded and unhygienic settings, infectious diseases are lurking in the background as the most feared source of an outbreak of diarrheal disease. Apart from that open defecation leads to faecal contamination of drinking water often occurs.

Figure 5.10: Use of latrine during flood and other times of the years



Source: Field work, SaciWATERs, 2022

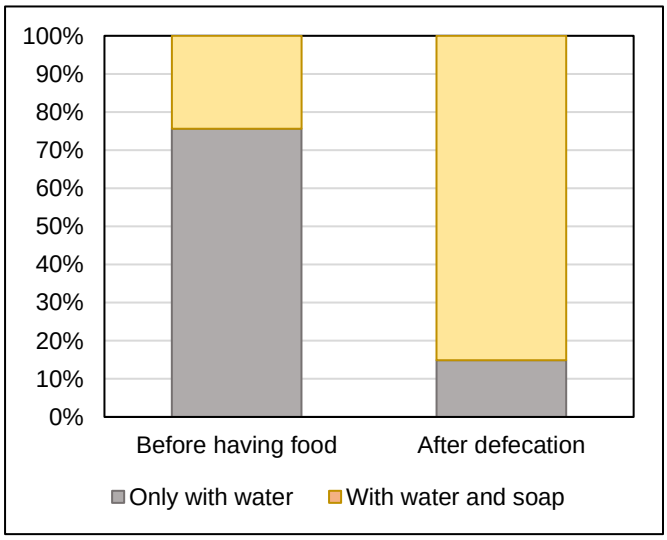
"It is impossible to access a latrine and bathroom during a flood. Either we defecate near the river or make some temporary arrangements. That situation persists for months. We face a lot of problems." (Villagers, Muriganga Village, Sagar Block)

Existing research studies note that Open defecation and using a shared latrine within a building or compound were also associated with higher chances of low birth weight and preterm birth, respectively, compared to having a private household toilet.

b. Hand hygiene practices and health impacts

With increasing water scarcity due to different climate change factors, proper hand hygiene become more difficult to maintain. In our study, we find reporting of poor hand hygiene practices by the community (Figure 5.11). Poor hand hygiene practices among children increase the health risks of different infectious diseases, like- diarrheoa, cholera, respiratory diseases, etc.

Figure 5.11: Hand Hygiene practices by households



Source: Field work, SaciWATERs, 2022

(c) Drinking water problem and impacts on health

Climate change impacts on drinking water quantity and safety have important implications for waterborne diseases. Drinking, bathing, washing utensils, or eating food exposed to contaminated water can result in waterborne diseases and sometimes cause life-threatening illnesses among children (Photo 5.2). Climate change is anticipated to exacerbate an already high burden of waterborne disease in the Sundarbans region (Figure 5.2).

Photo 5.1: Women fetching water from long distance

Source: Field work, (Left: Khas Kumarkhali village, Canning I; Right: Durbachati Village, Pathar Pratima) SaciWATERs, 2022

Most of the water used for drinking and cooking purposes is collected either from Panchayet tube wells or from the panchayet taps (which can be collected at a particular time in the day. Sometimes women need to travel a long distance to fetch water, especially during the summer

season when the water level goes down and is not available from the nearby tube wells/ taps. Therefore, getting water takes up a lot of time and energy (Photo 5.1). Usually, water has to be carried a long way by women and young girls and this traveling especially increases during the dry season (Table 4.3). Carrying such loads over long distances can result in strained backs, shoulders, and necks, and other injuries if women have to walk over uneven and steep terrain or on busy roads. Studies show that increased time daily spent fetching household water increased women's risk of delivering a low-birth-weight baby.

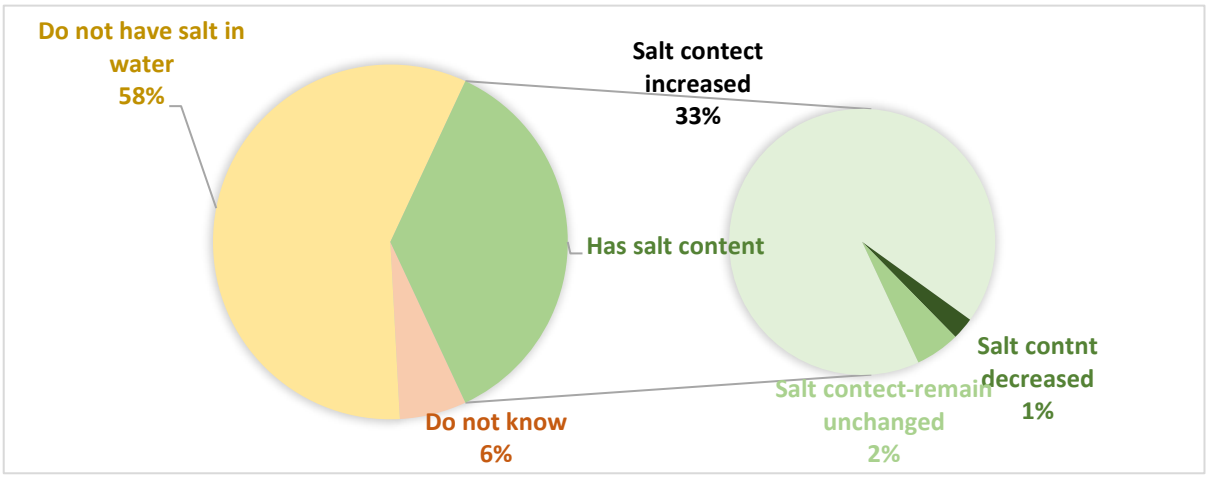
Photo 5.2: Women collecting dirty pond water for domestic use

Source: Fieldwork, Khas Kumarkhali village, Canning I Block, 2022

Many women who are unable to get fresh water due to distant water sources, resort to drinking saline water on a regular basis. In the case of pregnant women, it can increase the risk factors for high blood pressure, gestational hypertension, and (pre)eclampsia among pregnant women. 36 percent of households reported the presence of salt in their drinking water and it has increased in the last 10 years (Figure 5.12).

This acute drinking water problem further intensifies under flooding situations given the fact that underground water also becomes saline due to leaching and seepage. Even after the floodwater recedes, the tube well water remains undrinkable. Post-Aila most deep tubewells were elevated at the height of 2-3 feet above flood level so that the community can have access to safe drinking water.

Figure 5.11: Increased salt content in drinking water



Source: Source: Fieldwork, SaciWATERs, 2022

(d) Salinization of pond water and health impacts

Traditionally in the villages of the Sundarbans region most of the households has a pond where they raise freshwater fish, use for bathing, washing clothes and dishes, and use it for toilets. We find in the household survey that almost 75 percent of households use pond water for the purpose of bathing.

Figure 5.12: Place of taking bath

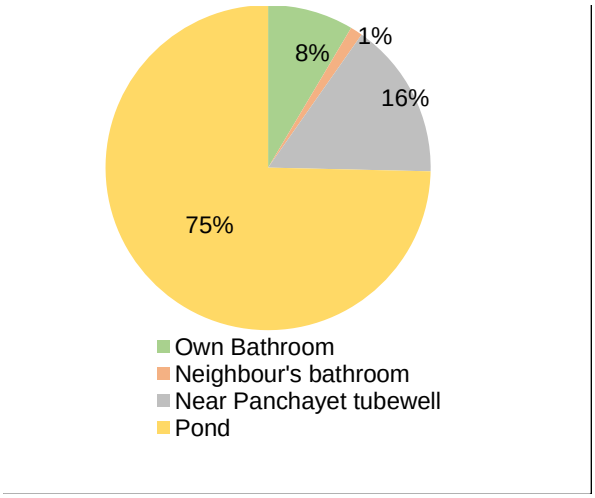


Photo 5.3: A polluted pond, Boyar Mari Village, Sandeshkhali

Source: Fieldwork, SaciWATERs, 2022

As cyclones occur and sea levels rise, these ponds, along with their land, become get inundated with saltwater, and the quality of water declines massively (Photo 5.3). This brings a lot of health challenges like- skin allergy, and skin ailments for those including children and women who use this water for bathing. From the interviews with doctors, ASHA, ANM, and NGO workers we find that saltwater intrusion brings additional health risks for the women and children. 8 out of 10 ASHA workers from villages across the Sundarbans region report that saltwater ingression during floods increases the incidence of diarrheal disease and skin-related problems among children and women. *"We had to distribute ORS among the households during that time"* (ASHA, Patharpratima). Those who take baths in the saltwater pond on a regular basis suffer from diseases, like pelvic inflammatory diseases, white discharge, and other gynaecological problems. All 10 AHSA workers from different villages of Sundarbans whom we interviewed confirmed that many women in the Sundarbans region reported a problem of white discharge.

Photo 5.4: Women trawl nets through the saline river for seed prawns

Source: Fieldwork, SaciWATERs, 2022

(e) River water salinity and health problems

Climate change impacts have increased the river water salinity in the Sundarbans region. Women spend long hours in the saline water during low tide and trawl nets through the saline river for seed prawns, locally known as "meen" (Photo 5.4). This is a common practice among the women of Sundarbans which brings some earnings to their households. However, it brings health risks including dermatitis, urinary tract infections, genital tract infections, alteration in the pH balance of vaginal secretions, and bacterial infection, all leading to increased susceptibility to cervical cancer for the women.

5.2.2.2 Food Insecurity

Climate-related disruptions in the food system can indirectly impact human health by diminishing food security, which is a key determinant of health. Researchers highlighted that children of the Sundarbans region are most vulnerable to health shocks due to unacceptable levels of under-nutrition. It is important to mention here that the relationship between climate change, the food system, food security, and human health is complex, dynamic, and multi-sectoral. It is also found that massive increases in child undernutrition do not always occur after a major extreme weather event.[34] This section focuses on the impacts of climate change on food security and nutrition and its probable effects on child health.

(a) Extreme weather events directly impact food security

As previously established (Chapter 4), cyclones and floods are occurring at a persistently high frequency, with more than triple the number of annual occurrences in recent years. These extreme weather events may result in interruptions in the normal food supply coupled with inefficiencies in food systems, ultimately causing conditions of food insecurity in the Sundarbans region.

> *"It took us 15-20 days to start cooking food after the floodwater receded. We need a stove for cooking food, but we don't have it after the flood. We make some temporary arrangements for preparing food. Firewood becomes wet. During those days we spend our days like the people of the primitive age. However, we received food relief from various organizations for about 10-15 days". (Villagers, Muriganga, Sagar)*

(b) Decline in agricultural and fish productivity

[34] A. J. McMichael and E. Lindgren, "Climate Change: Present and Future Risks to Health, and Necessary Responses," *Journal of Internal Medicine* 270, no. 5 (2011): 401–13, https://doi.org/10.1111/j.1365-2796.2011.02415.x.

It is already discussed in Chapter 4 that agricultural production systems in the Sundarbans region are coming under multiple stresses – from increasing temperature, frequent cyclones, inundation, untimely rainfall, water shortage, and water and soil salinization directly or indirectly linked to climate change (Figure 4.6). Frequent cyclones and floods also bring damage to livestock production. Households reports that a large number of livestock perished in floodwater and those who survived were threatened by inadequate feed and lack of shelter. Flood also kills tonnes of freshwater fish as the saltwater ingress into the ponds. In the case of river fishing, it is found that as river water temperatures rise, various fish populations are anticipated to move to higher latitudes. Such changes in production can affect supplies of dietary nutrients and can also have indirect impacts on health. Table 5.5 shows that there is a positive correlation between increased soil and water salinity with a decline in agriculture and fish productivity. Households who have reported problems of increasing levels of salinity in water and soil, many of them also reported decreasing agricultural and fish productivity.

Table 5.5: Correlation between salinity and productivity

		Increased soil salinity	Increased river water salinity	Increased pond water salinity
Decline in agricultural productivity	Pearson Correlation	.292**	.155**	.085
	Sig. (2-tailed)	.000	.002	.084
	N	410	410	410
Decline in fish productivity	Pearson Correlation	.178**	.129**	.111*
	Sig. (2-tailed)	.000	.009	.024
	N	410	410	410
****. Correlation is significant at the 0.01 level (2-tailed).**				
***. Correlation is significant at the 0.05 level (2-tailed).**				

Source: Calculated based on the field data, SaciWATERs, 2022.

Table 5.6: Correlation between declining productivity and food insecurity

		Households reported inadequate food supply
Decline in agricultural productivity	Pearson Correlation	-.049
	Sig. (2-tailed)	.322
	N	410
Decline in fish productivity	Pearson Correlation	-.034
	Sig. (2-tailed)	.495
	N	410
****. Correlation is significant at the 0.01 level (2-tailed).**		
***. Correlation is significant at the 0.05 level (2-tailed).**		

Source: Calculated based on the field data, SaciWATERs, 2022.

Table 5.7: Correlation between food insecurity and illness

		Frequent illness
Households reported inadequate food supply	Pearson Correlation	.359**
	Sig. (2-tailed)	.000
	N	410
****. Correlation is significant at the 0.01 level (2-tailed).**		

***. Correlation is significant at the 0.05 level (2-tailed).**

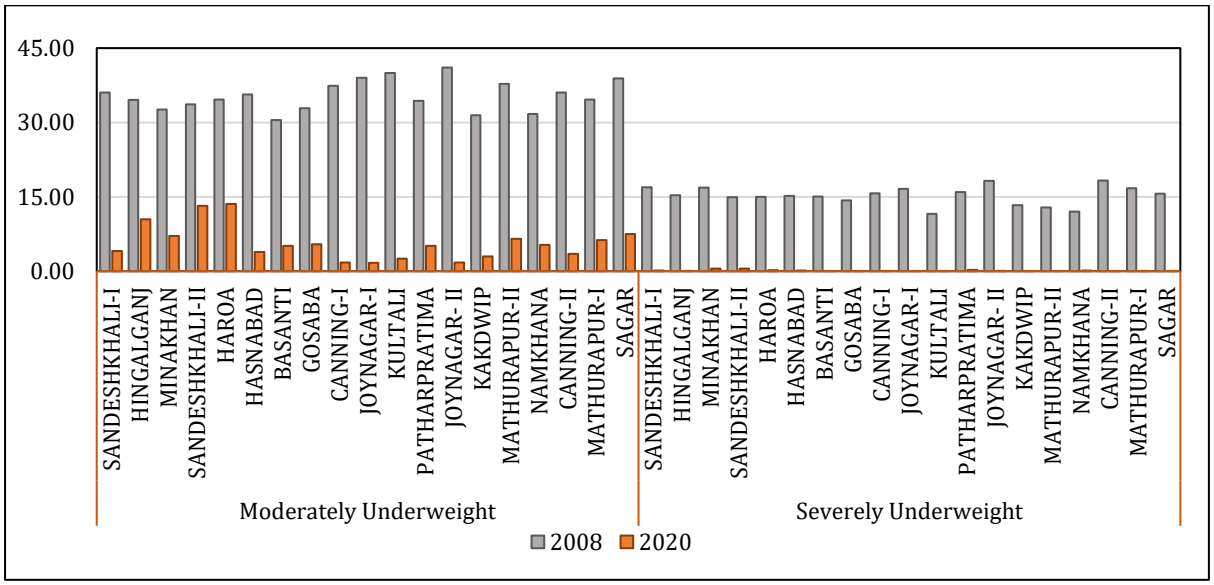
Source: Calculated based on the field data, SaciWATERs, 2022.

Quantification of the nutritional value of agricultural, fish, and livestock production loss provides insight into the potential impact of climate change events on human nutrition through increasing food insecurity. This is a proxy indicator and does not provide evidence of the actual trends in diets. It is worth mentioning that whether lost production leads to malnutrition depends on multiple factors, such as food safety considerations, public distribution system, storage capacity, relief and aid received, etc. It is found that there is no correlation between declining productivity with food insecurity as reported by the households (Table 5.5). However, it is quite evident that food insecurity has a positive correlation with illness (Table 5.6).

Nutritional Level among the children in Sundarbans region

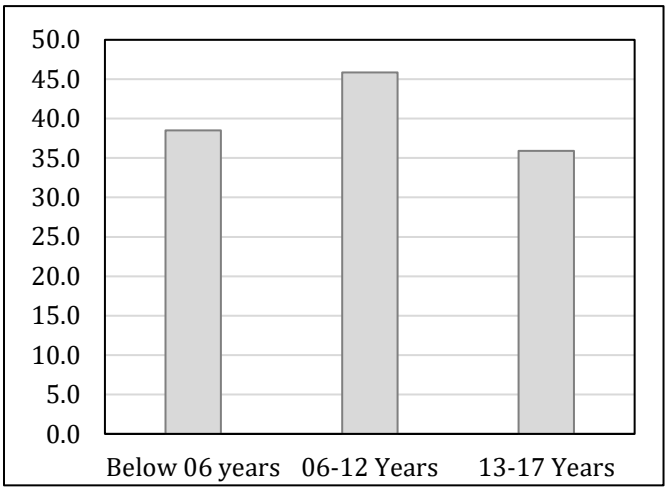
Malnutrition has a long-term impact on health as it can greatly reduce physical and cognitive development among children and is strongly associated with severe illness, sometimes leading to morbidity and mortality. It is found in the literature that malnutrition and micronutrient deficiencies among children are major public health challenges in the Sundarbans. However, our analysis based on the data of Monthly Progress Report data of ICDS shows reduced incidents of severely underweight and moderately underweight cases of malnutrition among children below 6 years of age in Sundarbans (Figure 5.14). Although the prevalence of malnutrition among children has decreased in recent years, however micronutrient deficiency is still common among children in the Sundarbans region.

Figure 5.13: Changing scenario of nutrition status among the children (0-6 years) in Sundarbans



Source: Monthly Progress Report, ICDS, West Bengal

Figure 5.14: Reported inadequate food consumption

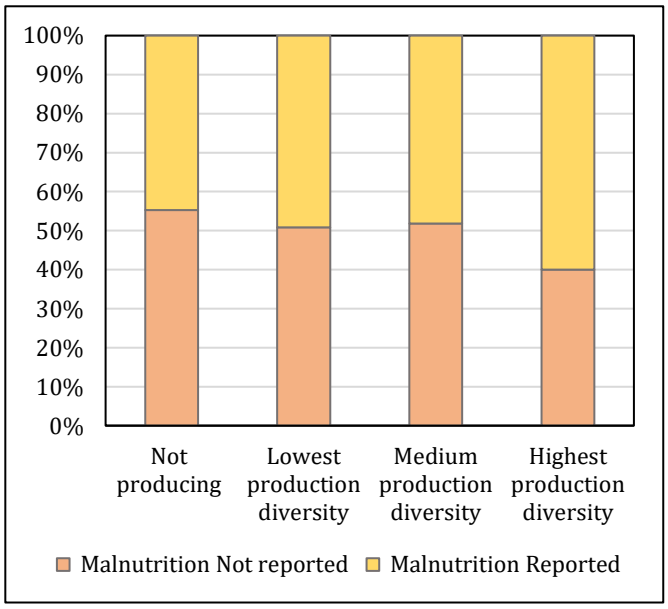


Source: Fieldwork, SaciWATERs, 2022

While the secondary data shows a declining trend in malnutrition, our field data finds that around 38.5 households report inadequate food intake as one of the major problems among children below 6 years. The field data also indicates an intergenerational cycle of undernutrition and micronutrient deficiency as inadequate food and nutrition intake is reported as a problem for all three age groups (Figure 5.15). In the qualitative interviews, the community health workers have also mentioned the malnutrition and anaemia problems among the ANC mothers. It works a vicious cycle, as the young mothers, who are stunted by chronic malnutrition give birth to low birth weight babies. These children then have a poor start in life and are more likely to have growth failure which, when combined with inadequate food intake and caring practices, leads to stunting and being underweight as a child and a teenager. The high rate of adolescent pregnancies further exacerbates the situation as they are more likely to result in a low-weight baby.

Studies suggest that dietary diversity plays an important role in determining nutrition status among children. It is found from the field that in the Sundarbans region households are not much dependent on market-based products for food as they grow a variety of crops and vegetables on their land. There is only 18.5 percent of households are dependent on market-based products for daily consumption.

Figure 5.15: Malnutrition status based on production diversity



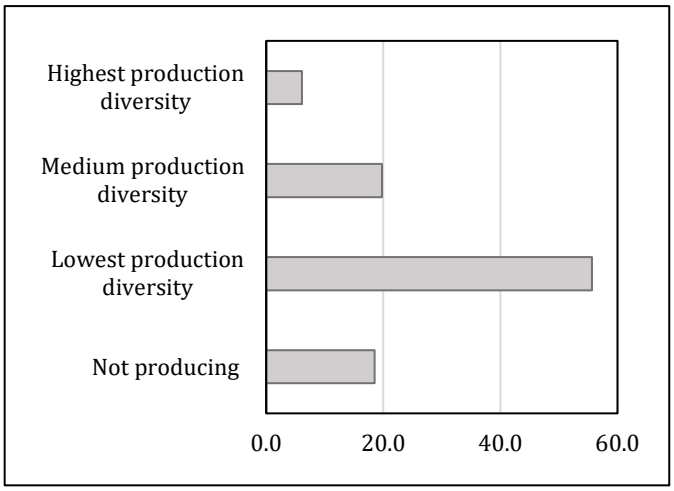
Source: Fieldwork, SaciWATERs, 2022

We have calculated a production diversity index as a proxy for dietary diversity in order to understand the impact of dietary diversity on the nutritional status of the children. The cross-tabulation between the product diversity of the households and those reported inadequate food consumption shows that there are hardly any differences in nutritional status among the children across different production diversity groups. One of the major reasons for malnutrition among the children is a lack of knowledge among the caregivers regarding a balanced diet.

"You will not find food scarcity in all the households in Sundarbans. Many households grow a lot of vegetables in their kitchen gardens. In many cases, children in this region are suffering from nutritional deficiencies due to a lack of a

balanced diet. They have adequate food but they do not know when to eat and what to eat." (NGO worker, Patharpratima)

Figure 5.16: Production diversity of the household



Source: Fieldwork, SaciWATERs, 2022

"In the villages of Sundarban, most of the households eat rice and mashed potato in their dinner almost on a daily basis." (Resident, Patharpratima)

The field narratives show that there found a relation between saltwater intrusion and dietary diversity among the population of Sundarbans. Dietary diversity often decreases post-flood period. It is already discussed in the earlier section that fish and agricultural production decreases with the increasing salinity of soil and pond water. As a result of this, protein and vegetable intake decrease among the affected population. It was reported by the villagers of both Patharpratima and Gosaba blocks.

Overall, the average micronutrient intake could be significantly low among rural children in Sundarbans due to more inclination toward carbohydrate-enriched food and lack of dietary diversity. However, it is worth mentioning that micro-nutrient deficiency in children can only be measured through clinical testing.

We find spatial variation in malnutrition cases among the children in the Sundarbans region. Malnutrition cases are relatively less in the villages of Sagar Island, while such cases are frequently found in Kakdwip, especially in the villages which have more internally displaced population living in temporary camps with low economic status. A doctor at a rural hospital has confirmed that there are very few children who are brought to the hospital with the problem of malnutrition in them. *"Around 5 children were brought to me today for treatment. However, none of them are having malnutrition problems."*

5.2.3 Direct and Indirect Mental health impacts brought by Climate change

Childhood and adolescence are critical stages of life for mental health. Children and adolescents acquire cognitive and social-emotional skills that shape their future mental health and are important for assuming adult roles in society. We find that 7 percent of mothers reported deterioration in the mental wellbeing of their children. The data shows that mental health problems are more prominent among the adolescent group than the children group.

Table 5.8: Mental health problems among the children in relation to exposure to climatic shock

Children Group	High exposure to climatic shocks	Low to moderate exposure to climatic shocks
6-12 Years	10.1% (11)	--
13-17 Years	15.6% (9)	5.9% (6)

Source: Field data, 2022

Table 5.8 shows that households located in the blocks having high exposure to climatic shocks have reported more cases of mental health problems among the children than those located in low to moderate exposure regions. It is important to mention here that these are not clinically diagnosed cases but reported based on the subjective understanding of the mothers based on the changing physical behaviour, cognition, emotional well-being of the children, and also how they interact with others around them. Earlier studies tried to link mental health issues with climate change impacts and it notes that extreme weather events bring eco-stress trauma among the children. However, the anecdotal evidence is unable to establish any direct link between climate change and the mental health of children. While mental health problems are important, it is not the consequence of single events, but rather the results of a very complex process.

It is evident that extreme weather events bring stress and fear among children.

> *"Yes, I get scared what if I die from drowning." (Student, 4th Standard, a School in Pathar Pratima)*

On the other hand, we also find that disruption in normal ways of life due to extreme weather events brings emotional trauma and disorders to the children. In the Sundarbans region, a lot of people (especially males) have opted for migration to other places in order to diversify and increase their income leaving their children and other family members back at home. It is found that 52 percent of children (6-12 years) get primary care from both their parents. Sometimes both the parents leave for work. This psycho-social situation brings loneliness, depression, stress, and anxiety to the children. Studies suggest that a lack of parental support during childhood is associated with increased levels of depressive symptoms. The rural areas of Sundarbans also portray a similar situation. It will become clearer from the following statement:

> *"If the father does not work, it is impossible to take care of the family. Now a day we have only nuclear families. I am telling you what happened today during the prayer time, we have a student here, whose parents are vegetable sellers. We follow a high standard in our school. If you are not completing your homework, you will get punishment for that. The girl is unable to complete her homework. Therefore, she does not want to come to school. Both parents are busy and cannot give enough time to the child. She is a good student. But sending the child to the tuition teacher is not enough for the children. One needs to spend more time with their children. You will find many such cases here. Even there are instances where the mother goes out for work keeping the child locked in the house alone." (School teacher, Primary school, Durbachati, Patharpratima)"*

Extreme climatic events also create a lot of stress among pregnant mothers, especially for those who live in island villages surrounded by rivers. As reported by an ANM of Patharpratima block, The expecting mothers get scared as accessibility to health facilities is very poor in some villages of the Sundarbans region. *"If the delivery of the baby happens on the way to the hospital, what will happen to them? It is life-threatening for both the mother and the child"*

It is important to mention that the mental health outcomes vary among the children due to positive resilience factors and moderators, including the family context, genetic background, support of other family members, individual coping skills, and stage of development. Moreover, it can be said that the climate change impacts on mental health still is a grey area in the case of Sundarbans and it requires detailed clinical studies for better understanding.

5.3 Poor health system and Climate Change impacts

A health system is a way in which all health services are provided. A strong health system is that which ensures that everyone is able to access high-quality healthcare without financial difficulty. It is often noted that healthcare facilities do not exist where they are most needed. This is especially true in rural and remote areas where the distance to travel to a facility or the cost to do so is too high. The Sundarbans region is not an exception in this regard. Surround by the network of rivers in the rural areas of the Sundarbans the healthcare system is extremely fragile and inadequate to mitigate the need of the local population.

Table 5.9: Villages having health care faculities

	Within the village	*< 5 Kms*	*5-10 Kms*	*+10 Kms*
Community Health Centre	0.38	6.59	15.24	33.96
Public Health Centre	6.49	21.73	31.70	20.13
Public Health Sub-centre	51.36	28.97	4.89	2.07
Mother and Child Welfare Centre	7.15	10.91	16.27	35.65

Source: Census of India, 2011(Village directory)

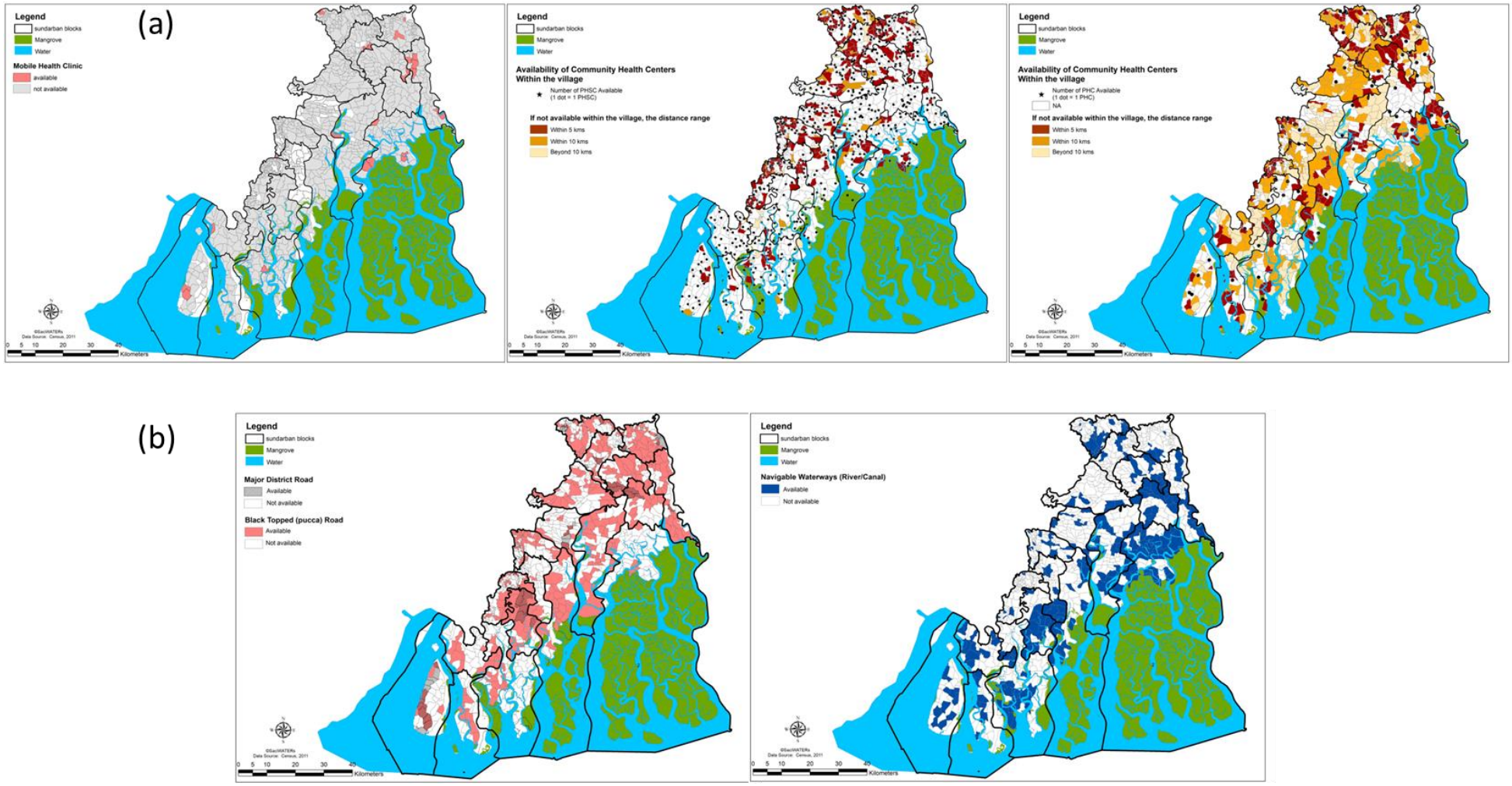
The data table (Table 5.9, Figure 5.17 (a)) shows that in the Sundarbans region only 4 villages (.38 percent) have a community health centre. Around 51 percent of villages have public health subcentres within the village. Villagers of 34 percent of villages need to travel more than 10 kilometers to avail treatment in community health centres. It is also reported by health professionals during the field survey that:

- Facilities that do exist do not have adequate medical staff and are also under-resourced. This means they are unable to provide high-quality health care services.
- Poor quality services increase the dependency on rural medical practitioners and many times they don't have the proper training to treat critical cases.
- Apart from that the distance of the health centres sometimes deter people from seeking healthcare when it is needed. Mental health facilities are even poorer in this region. Counseling is only available at the block hospitals.

Accessibility to healthcare facilities is especially poor in the village disconnected from the mainland and surrounded by rivers. It is reported that mothers who have given birth in the last 5 years, among them around 30 percent had to reach the hospital crossing rivers by boat.

It is reported by ASHA and ANMs of Patharpratima village that it is the pregnant women who face a lot of problems due to poor accessibility. *"Villages- like G-plot, Heramba Gopalpur are really very far from the mainland and surrounded by rivers. The mothers get scared as accessibility to health facilities is very poor. If the delivery of the baby happens on the way to the hospital, what will happen to them? It is life-threatening for both the mother and the child."*

Figure 5.17: (a) Spatial distribution of health care facilities in the villages of Indian Sundarbans (b) Road and waterways connectivity of the villages in Sundarbans region



Source: Prepared by Saciwaters based on Census of India, 2011 data.

A similar problem of accessibility to health facilities has been reported by a group of ICDS workers of Lahiripur Gram Panchayat of Gosaba block. According to them, the village is having only one sub-center with very few facilities. Sub-centre is only for basic treatment. One needs to go to Gosaba to see a doctor if having any serious health problems. It takes almost 1.30 hrs to 2hrs to reach Gosaba hospital from Lahiripur. Another ASHA worker reported that *"Bali Gram panchayat does not have ambulance services. The expecting mothers had to face a lot of challenges due to that. Roads are not in good condition. Therefore, we also face a lot of challenges"*

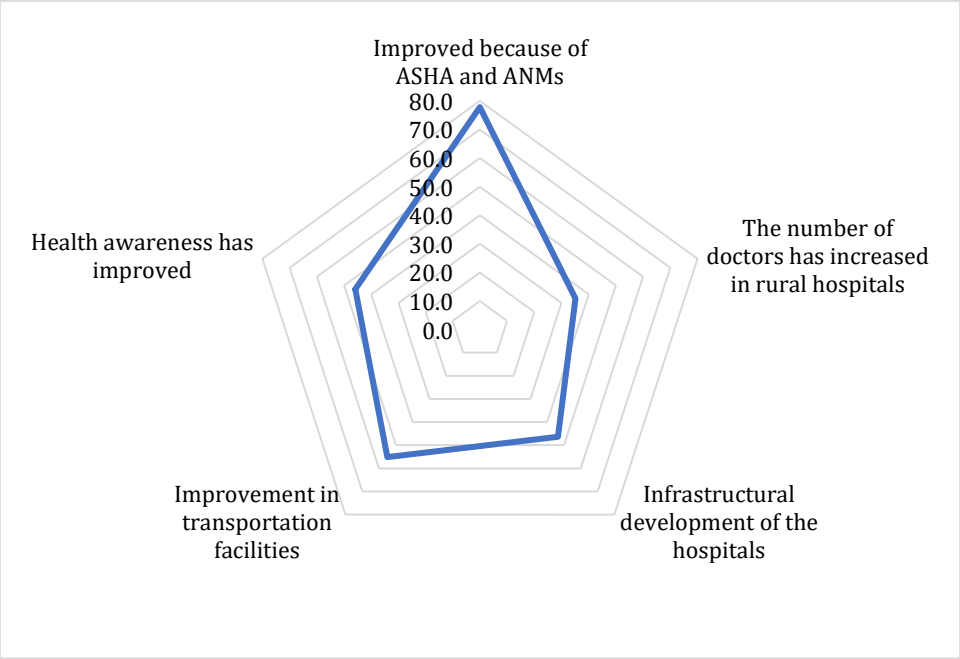
The accessibility problem further intensified during floods and cyclones. " *It is impossible to avail medical facilities during the cyclone. Roads get blocked by big uprooted trees. The entire area gets inundated with flood water"* (ASHA, Bali 2, Gosaba Block).

"When all the roads get inundated during floods, we cannot visit the ANC mothers and children at their homes. We can only visit them once the flood water level receded. During the last flood, all the roads of the village were inundated for almost 3 days" (ASHA, Durbachati village, Patharpratima)

While the health care facilities are still inadequate in the Sundarbans region, it has improved in the last 10 years. Around 72 percent of the respondent has reported that medical facilities have improved in the last 10 years.

Medical Facilities	
Improved	72.44
No Change	17.56
Degraded	7.32
No idea	2.68

Figure 5.18: Reasons behind improvement in healthcare facilities



Those who reported that healthcare facilities have improved in last year, among them around 80 percent respondents feels that it is due to the improvement in services provided by the

community health workers, like -ASHA and ANM. Other reasons include an increase in the number of doctors in the rural hospital, infrastructural development of the rural hospitals, and improvement in the road network and transport facilities. Apart from that health awareness has also increased among the people.

5.4 Insulating Layers

The above discussion shows that the impact of climate change on child health covers a vast spectrum and it is a complex process. There is increasing recognition that certain adaptive strategies such as improvement in public health infrastructure, disease surveillance, immunization, etc. tend to reduce the negative impacts of climate change on child and maternal health.

a. Childcare and welfare schemes

There are several national and state-level programmes and schemes that are aimed at the welfare and safety of children. Many of these are piloted by the frontline workers such as AWWs, ASHAs, auxiliary nurse midwives (ANMs), multi-purpose health workers (MPW), and primary school teachers at community levels. The ICDS, a flagship programme launched by the Government of India (GoI) aimed at delivering a comprehensive set of services for early childhood care and development, covering health, nutrition, and education aspects. Other initiatives such as the appointment of ASHAs and ANMs under the National Rural Health Mission (NRHM) also focus on the health and well-being of children. For every 1000 population, 1 ASHA worker has been appointed. These schemes have positive impacts on the child and maternal health of the Sundarbans region.

- Home delivery has reduced drastically
- Immunisation of children has improved
- Health awareness has increased among the parents

b. Water Supply Schemes

Water scarcity due to groundwater depletion and degradation of water quality due to saltwater intrusion is a concern in the Sundarbans region. Water resources, already under stress due to growing water demand in relation to a finite supply, will be under even greater pressure in the future. Reliable access to water is important not only for drinking but also for sanitation and hygiene (WASH) services which is a critical component of early childhood health and development. Inadequate quality piped water supply is one of the main reasons for high instances of diarrhoea and other waterborne diseases in Sunderbans. The Public Health Engineering Department (PHED) and Sundarban Development Board (SDB) of the Govt. of West Bengal have taken important steps to improve the availability and accessibility of potable water in Sundarban blocks. While the SDB has installed 505 deep tubewells across 19 blocks in Sundarbans[35], the PHED through Jal Swapna Mission[36] installing piped water systems with a yard or house taps to distribute relatively large quantities of water to a conveniently close location. The transition to

[35] https://www.sundarbanaffairswb.in/home/page/initiatives
[36] https://wbphed.gov.in/en/home

these systems is expected to improve access to safe drinking water and increase handwashing frequency and thoroughness.

c. Nirmal Bangla Mission

The Government of West Bengal initiated 'Mission Nirmal Bangla' in the Panchayats & Rural Development Department to accelerate the sanitation movement under Swachh Bharat Mission. Through the Mission at the State level with all its field units, the Government of West Bengal endeavours to achieve the larger objective of reduction in child mortality and morbidity, by reducing the risk of waterborne and faecal borne diseases due to the prevalence of open defecation. This mission aims to behaviour change communication for the elimination of open defecation as a result it expects to reduce the loss of active workdays due to the prevalence of diarrheal diseases among the children; reduce the school dropout of children, especially girls due to lack of appropriate toilet facilities in schools; improve overall cleanliness in the villages thereby contributing to improved environmental conditions. The overall goal of the Mission is to bring about changes in the quality of life of the people in the villages by promoting cleanliness, hygiene, and elimination of open defecation.

d. Infrastructure Development for Improvement of Transport & Communication Network

The marked backwardness of the Sundarban regions, especially the island parts, is attributed to the lack of road connectivity and transportation among other infrastructure shortcomings. A large section of Sundarban's population faces a lot of challenges accessing medical facilities due to poor connectivity. The Sundarban Development Board was created to increase road and bridge connectivity and other infrastructure of civil nature. In the past, patients and their families living in these remote areas faced insurmountable problems when they had to rush to hospitals in Canning or Kolkata for treatment. Arranging a vehicle for transportation was next to impossible and rudimentary surface transport conditions made the journey during such emergency conditions even more difficult. It is found that with the introduction of the water ambulance, save a lot of time as patients are rushed to the Godkhali jetty by this water ambulance. From there, they can be easily taken to Canning Subdivision Hospital or elsewhere by surface transport or ambulance. As a result, it will be possible to provide treatment to the patient on time in specialized hospitals.

Although, the above-mentioned adaptive strategies are acting positively to reduce climate change impacts on child and maternal health, however, these initiatives have their challenges as well at implementation level.

5.1 Responses

There are certain measures taken by different stakeholders to deal with the risks and threats posed by climate change to diminish the related health burden.

5.1.1 Preparedness

a. Early Warning System

Climate-informed surveillance can enhance the preparedness of health systems via early warning systems. Early warning systems aim to anticipate risks and trigger early warning responses to avoid or reduce impact and prepare for effective response. In the context of a rapidly changing environment and risk landscape, early warning systems are a valuable tool for building the

adaptive capacity and climate resilience of health systems. It is found that the government has taken certain measures as mentioned below:

- Make-shift infrastructure facilities, stock of essential medicines, a tentative week-wise roster of doctors, nurses and MPHWs, etc. (at the block level, Department of Health & Family Welfare)
- Trauma care ambulance (The Fire & Emergency Services Department)
- emergency toll-free number 1077 at the district level
- SMS based Early Warning System to alert all the mobile users of the State of the advent of any natural calamity

b. Evacuation of the communities to cyclone center

Cyclone shelters and local schools throughout the regions are used to evacuate communities during extreme weather events, like flood, cyclone. While cyclone centres were established in order to provide a safe place to the communities, in absence of adequate space and basic amenities, like-bathroom, water has become further vulnerable to the spread of communicable diseases.

5.1.2 Coping

a. Migrating out to avail advanced treatment facilities

In absence of adequate treatment facilities, a large number of people choose to migrate out (short term most of the time) of the Sundarbans region to avail better treatment. However, many times they face challenges in unknown places with limited financial resources.

b. Dependence on Quack doctors

In the absence of an adequate healthcare system in the vulnerable islands of Sundarbans, a large number of parents take their children to quacks for treatment. It is important to mention here that with getting better services from the frontline workers, like-ASHA, ANM, dependence on quacks/Rural Medical Practitioners (RMPs) has started declining in last few years.

5.1.3 Adaptation

a. Internal ability of the child

A child's own internal ability to cope is often central to his or her chance of surviving and even thriving. With sufficient resilience, many children facing the effects of extreme weather events will survive and adapt, and many will even thrive. There are few interventions to reduce or treat the effects specifically of extreme weather events on child health. For instance, a share of drowning deaths in association with floods is likely preventable through building physical skills such as swimming as mentioned by NGO workers during an interview.

b. Elevated public tubewells

To avoid the submergence of tubewells into the flood water, the West Bengal government has implemented a programme to raise the height of tube wells. Apart from that, some pilot projects have successfully implemented recharging aquifers with rainwater to reduce the salinity. As per a government published document (2015), Govt of West Bengal has commissioned Rural Water

Supply Schemes in 372 villages covering 12.60 lakh populations in North 24 Parganas and South Parganas Districts.

c. Waiting hub for the pregnant mothers

The West Bengal government has set up hubs in the remote islands of the Sundarbans where pregnant women can wait for a few days till they are taken to the hospital for delivery. This initiative has been found to be especially effective during extreme weather events. The aim was to overcome the challenge of providing safe motherhood in geographically remote locations in the Sundarbans. Under this initiative, expecting mothers are kept in these hubs 7 to 10 days ahead of their expected delivery date and move to the hospital when delivery time advances. The concept of waiting hubs for expecting mothers has given a boost to institutional delivery, and reduce infant mortality rate and maternal morbidity.

5.2 Gaps and Recommendations

The findings from the study show that interventions and actions are required across a number of areas to address the vulnerabilities in communities, and specifically among children, to increase their adaptive capacity. Enhancing climate resilience requires a multi-sectoral approach that is contextual to the communities and geographies. The key recommendations are listed below:

- There is a need for better provision of sufficient nutrition through a balanced diet for the children in these regions. In this regard, capacity building / training of the caregivers of the children by engaging various NGOs and humanitarian organizations could be helpful.
- Strengthening the implementation of existing child protection and welfare schemes through regular training of the frontline workers (ASHA, ANM, ICDS).
- The availability of healthcare services, infrastructure, number of specialized doctors and accessibility needs to be improved to ensure seamless delivery of health services. This is especially important for the island parts badly affected by disruption of services due to damage to infrastructure during extreme cyclones and floods.
- Enabling delivery of health services through information and communications technology (ICT) would be meaningful, especially in remote areas.
- A safe physical environment with adequate basic amenities is a critical need during or after emergency situations. It should ensure that the basic needs of children such as shelter, health, sanitation facilities, and food are met.
- Damage to infrastructure due to extreme weather events is a serious concern, increasing the resilience of roads, bridges, jetties, hospitals, etc., using appropriate technology is critical. Disruption to services due to infrastructure damage can affect emergency response activities, as well as the ability of the affected to access safe places, healthcare and other basic needs.
- Reusable menstrual products could help mitigate “period poverty,” Period poverty is highly prevalent in the Sundarbans region as single-used menstrual products (Sanitary pads) are not always financially viable.
- Basic environmental health education should be disseminated on management and personal hygiene practice to increase knowledge and change their behavior through display (or demonstrate), poster and regular announcement.

- Toilets need to be constructed on raised platforms to ensure access even during flood conditions. The height of the toilets should be determined on the basis of the highest flood water levels anticipated in the area. Proper flood-adaptive technology has to be used to reduce the risk of groundwater contamination and successive infections.
- Environmental health surveillance should be conducted including inspection of drinking water, food safety, and general safety and sanitation after every extreme events for better mitigation planning.
- Dead animals or birds if noticed should be brought to the notice of the Panchayat officials, and disposed of by deep burial and spreading of different disinfectants in order to decrease the worm infestation and respiratory diseases among the children.
- It is found that quacks do not have adequate medical degrees but practice medicine, predominantly in rural areas of Sundarbans, from their practical experience. With a shortage of adequate doctors and ANMs, quakes can be trained and tagged with health workers to help in surveillance so that the patients can get treatment at the earliest.

6 CLIMATE CHANGE IMPACT ON MIGRATION IN SUNDARBANS

Migration has been an age old phenomenon predominant in the Sundarbans region. With a geography susceptible to cyclonic storms, poor groundwater availability and access, lack of irrigation, and single cropping season, this region has long had processes of migration ingrained into its socioeconomic fabric. The factors involved in migration related decision are usually multidimensional, each providing either incentives and need or incapacity and obstacles for migration. Black et.al (2011) considers five broad and mutually connected drivers that impact decision making around migration - social, environmental, economic, demographic, and political. Rather than working unilaterally, climate change impacts migration by impacting and modifying these drivers. This chapter will look at the general incidence of migration in the study area, reasons reported by households for migration, and consider some complex linkages that create unsafe migration and factors that have affected these. Following the integrated analytical framework of this study, this chapter will look at the migration outcomes, some emerging insulating factors and responses from communities.

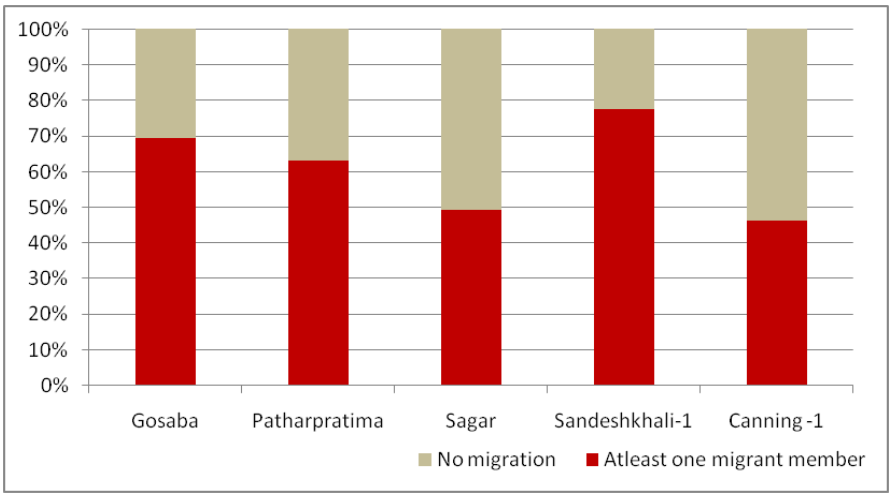
6.1 Migration Outcomes in the Sundarbans region

For this study as directed by the existing literature we considered different forms of migration, their interlinkages. These included labour migration, marriage migration, and trafficking as well as their associated processes and considerations for safety, particularly for the youth.

6.1.1 Incidence and types of Migration:

There is widespread incidence of labour migration among households in the study area. The houselisting analysis from 3840 households revealed a pattern of migration across the study blocks. The spatial pattern is found to be very strongly aligned with the salinity mapping presented earlier in Figure 4.2. Further, since the study blocks selection was based on climate change exposure and sensitivity (ref. Figure 3.2) the spatial alignment of this pattern indicates to migration linkages with climate change. We find that the blocks with high/very high climate exposure have high percentage of households (above 60% hhs) with migration while those with low exposure or have relatively lower (below 50% hhs) incidence of migration. Sagar block, despite having high exposure, has low water salinity levels and high adaptive capacities developed with tourism and infrastructure development in the region. It thus shows relatively lower incidence of migration. While Sandeshkhali block does have high climate exposure it has the highest migration rates also due to the declining livelihood opportunities in agriculture with the increase in aquaculture requiring many to migrate to brick kilns or the city for alternative employment options.

Figure 6.1: *Incidence of migration among households by study blocks*



Further, we assessed this incidence of migration across various types of migration. We find migration reported to be highest for temporary cyclic labour migration across all the study blocks followed by marriage migration. This is in line with earlier literature as well which has predominantly seen this pattern emerging (Mistry and Das, 2020)[37].

Table 6.1*: Incidence of various types of migration in the past 5 years by study blocks*

Block	Temporary labourmigration	Permanent labourmigration	Marriage	Education
Gosaba	59.32	2.20	10.71	3.41
Patharpratima	55.38	1.60	12.79	3.49
Sagar	37.14	1.86	12.71	3.57
Sandeshkhali-1	68.10	5.36	7.19	2.09
Canning -1	17.13	1.16	9.58	0.29

At the level of sample villages as well there were variations within the study blocks which provoked a simple spatial correlation exercise to understand the village level factors that may affect decisions to migrate since the houselisting exercise gave us large samples over 200 hhs per village to look at percentage of migrant households at the village level.

For some broad explanatory factors however we had to depend on the sample survey data at the village level (albeit within very small samples of 20 hhs per village). This correlation exercise (Table 6.2) revealed that percentage of migrating households at the village level has significant positive correlations with reporting of changes in salinity in the last 10-20 years by households as well as percentage households reporting decline in agriculture productivity in the village. Reporting of inundation after hazards also had a positive correlation.

[37]Mistri, A., & Das, B. (2020). *Environmental change, livelihood issues and migration*. Springer Singapore.

Table 6.2: Spatial correlation between percentage of migrant households and other village level factors

Sample Village level indicators	Correlation co-ef.	Significance value
Percentage HHs with migrants (*Key village level variable for correlation*)	1	
HHs reporting River erosion	.089	.709
HHs reporting increase in salinity (soil and ponds)	.486*	.030
HHs reporting Inundation after hazards	.329	.156
HHs reporting Decline in agriculture productivity	.456*	.043
HHs reporting low income after hazards	-.339	.144
Landless HHs	-.072	.763

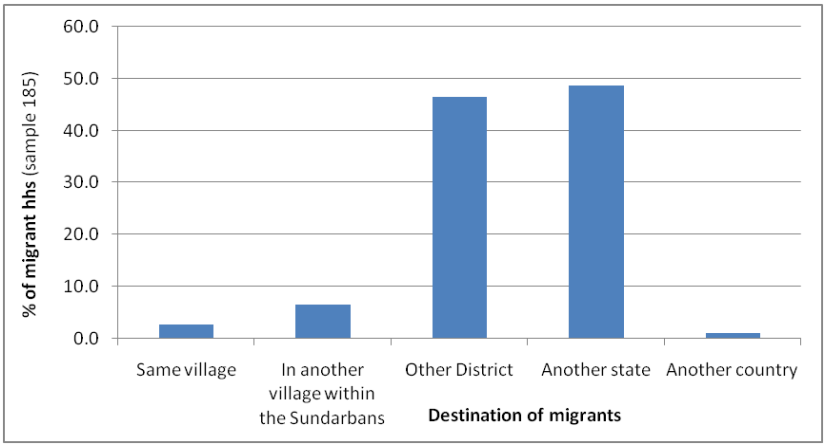
6.1.2 Labour migration

Temporary cyclic migration was found to be the major form of migration in the region overall. Majority of the households have reported male selective migration and predominantly by those above 18 years of age (43.9% hhs). Maximum labour migration takes place to areas outside of the Sundarbans region - other districts within the state and to other states in the country.

Table 6.3: Incidence of labour migration in sample households by gender and age categories

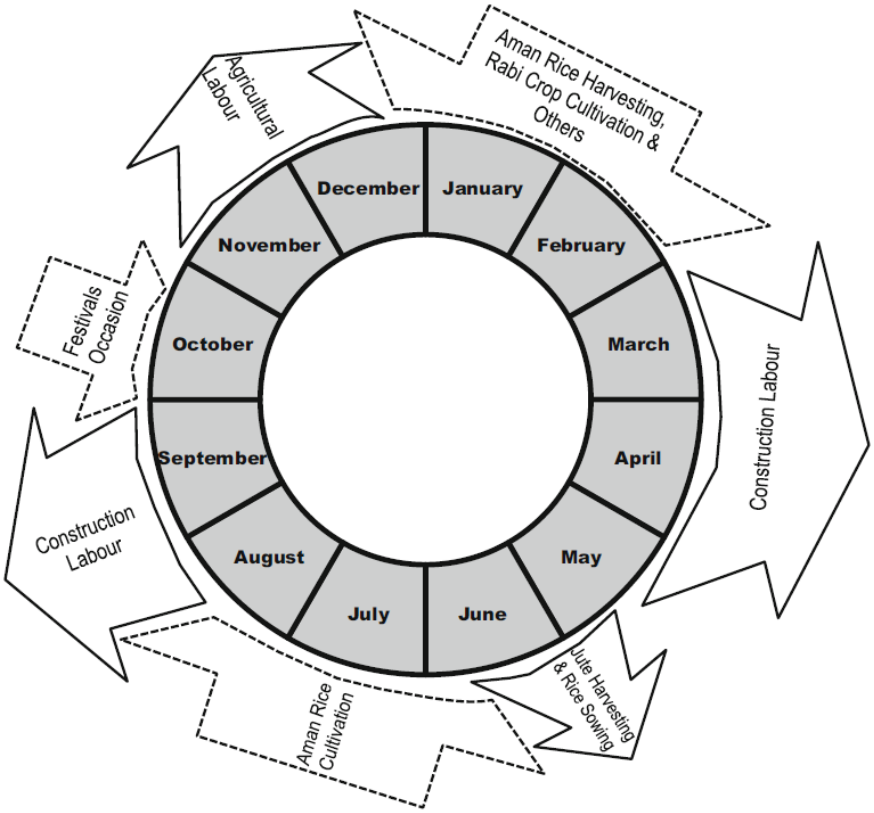
Migrant age group	% total hhs
Male below 18yrs	1.7
Male above 18yrs	43.9
Female below 18yrs	0.2
Female above 18yrs	2.4

Figure 6.2: Destination of migration among migrant households



Mistry and Das (2020) have provided a schematic visual presentation of annual cycle of temporary migration from the Sundarbans region.

***Figure 6.3**: Annual pattern on temporary migration in Sundarbans: sourced as is from Mistry and Das (2020)*



Source: Mistry and Das (2020)

Labour migration in the region is facilitated through highly informal processes by independent contractors, familial connections and social networks. Mistry and Das (2020) find that familial networks primarily facilitate inter-district migrations whereas contractors/middlemen facilitate majority of the interstate migrations. Migration facilitated through contractors generally involves a group of migrants mobilized for a particular employer or job. They negotiate wage rates with the migrants and often provide small loans for enabling migration costs. On the other hand inter-district migration facilitated most often by close familial and friend networks is for individual needs and opportunities. The long history of migration from this region enables strong contractor-employee-worker networks and information channels for migration opportunities.

An assessment of the reasons for migration as reported by households we find a close alignment with this aspiration overlapped with climate change related vulnerabilities as observed in the spatial correlation earlier. Over 90% households have reported that there was no scope of work within the village that had led to the decision to migrate. A comparable percentage of households also simultaneously reported migrating to seek better opportunities of earning in other places. While these may be separately considered as push and pull factors, it is found that these factors are perceived relative to one another and therefore are difficult to compartmentalize distinctively. FGDs with men and women in the 18-24 yrs age group revealed immense concerns around the lack of opportunity and frequent damage caused to traditional livelihoods in the village. This compels the men to leave the village in search of earning opportunities despite the uncertainties and safety concerns related to being uprooted from their local ties and social

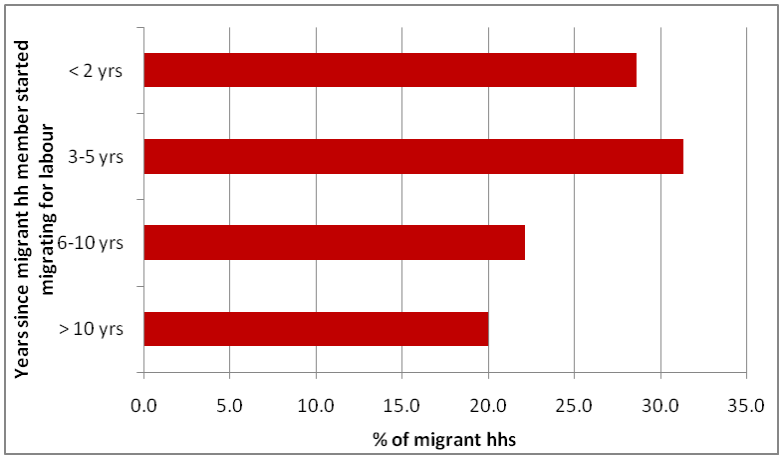
networks. Women on the other hand, who would like to work, are unable to as they cannot leave the village because of social and economic marital responsibilities and disproportionately bear the burden of climate change. Many households have also specifically identified sources of livelihood insecurity in terms of general decline in earnings from agriculture, landlessness, erosion and loss of agriculture land, and inundation of agriculture land with saline water. Therefore climate change processes leading to declining agriculture/fish productivity through erosion and inundation can impact migration decisions. However high incidence of landlessness anyway creates labour migration streams from this region. With declining agriculture, the scope for employment as agriculture labouralso reduces.

***Table 6.4:** Reasons cited by migrant households for decision to migrate*

Reasons for migration	% of migrant hhs
Decline in earnings from agriculture/fishing	39.46
Landlessness	47.57
Erosion of agricultural land	11.89
Inundation of agricultural land or pond by saltwater intrusion	14.59
No scope of work within the village	94.60
Better opportunities of earning in other places	85.40
To get opportunities specifically in the cities	22.20

Field observations as well as community engagements also revealed an emerging vicious cyclic impact labour migration is having on local agriculture for some households in the past few years. As increased frequency of cyclonic storms in recent years have reduced agriculture production and thereby demand for agriculture labour, most of this labour is now migrating outside creating a shortage of agriculture labour in the region. As male selective outmigration leaves much of the agricultural responsibility on the women in the household, a shortage of availability of agriculture labour is compelling households to further reduce their cropping areas as women are unable to bear the work load for larger cropped areas alone. This has been observed particularly over the past year as COVID lockdowns opened up creating a stream of migration to compensate for the struck down household incomes, compounded by repeated cyclones that ravaged the region in the past 3 years reducing agriculture. Labour migration has steadily increased over the past 10 years in the region reducing only marginally in the last 2 years owing to COVID lockdowns. The significant rise in migration over the past 5 years aligns with the increased incidence of severe cyclonic disasters over this period.

***Figure 6.4:** Period of initiating migration reported by migrant hh*



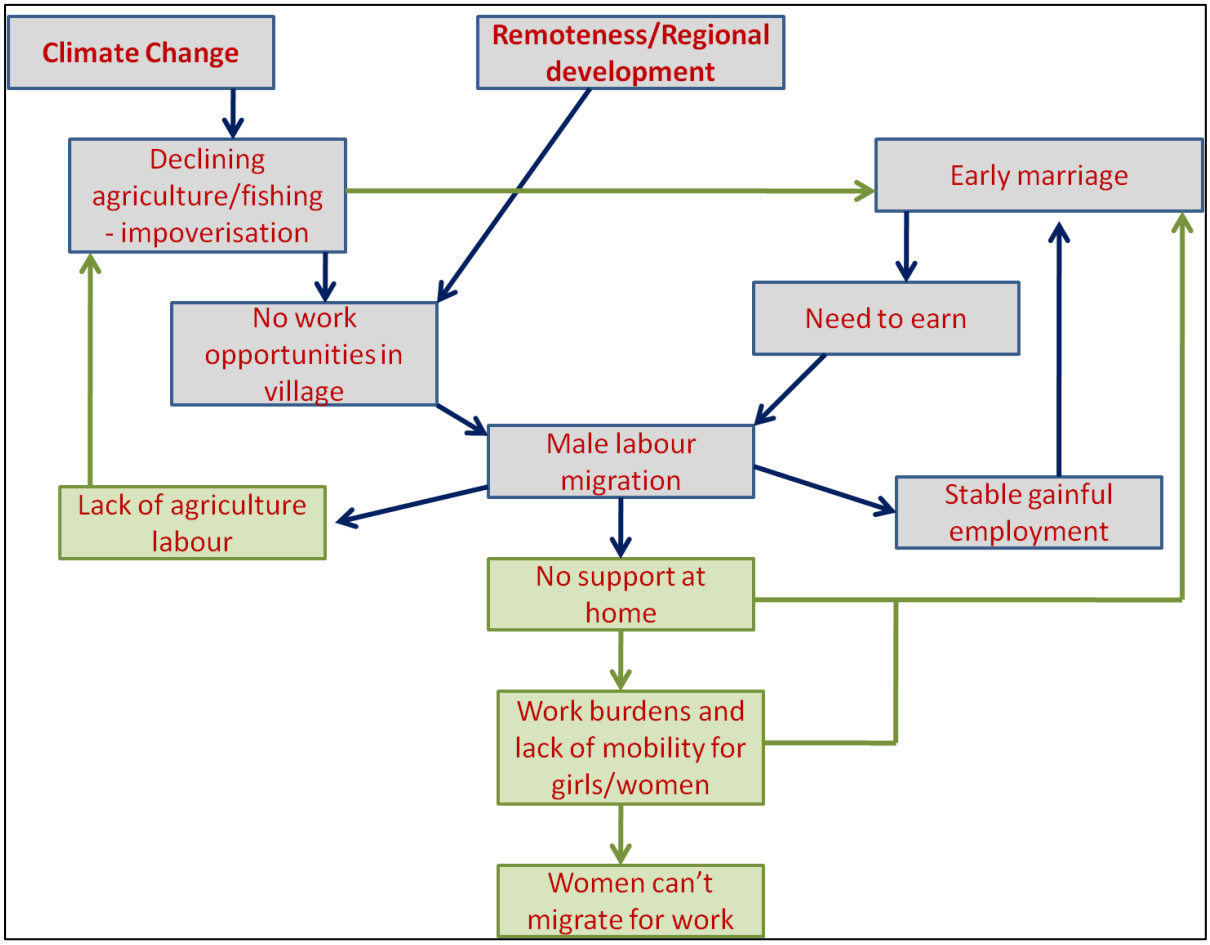
Children/youth (male) in age groups 13-17yrs and 18-24yrs expressed larger aspirations for business, government jobs, and other skilled jobs such engineer/doctor etc, but their wish to continue to live in or near the village was evident. They

considered migration to distant states and countries as being fraught with insecurities as they felt they would not know the place or their way back home. In case of any crisis like Covid 19 lockdown, it would be difficult to travel home easily and their mobility and work conditions would be determined entirely by their employers. They have to leave their ageing parents at home with burdens of child and elderly care on their wives and are unable to support their families from far-off areas. The social roots of family and land are strong, but the ravages of climate change on traditional livelihoods and lack of alternative employment options have become major push factors. The general age at marriage in the region ranging between 15 – 22 for both men and women, the financial burdens of supporting a family for men and increased demand for financial earning pushes the male youth to migrate early to seek out work with higher wages. On the corollary, men are also concerned that if they do not find gainful employment and stable source of earning they may not be considered a suitable match for girls for marriage and further if they delay marriage they may not find any unmarried girls in marriageable age. One of their key aspirations from marriage was that they would be able to find support for their parents and domestic livelihood responsibilities when they migrated for long periods of work.

Women in the same age groups, due to their gender roles and norms, all expected to leave the village for marriage but not for work. Married women specifically mentioned that as a daughter-in-law they had immense work burdens in the household for livestock rearing, agriculture, water collection and other domestic chores, along with child care and care of elderly in-laws. Therefore they did not have the freedom to travel beyond the village for any paid work. Some of them did home-based paid work such as knitting and bidi-rolling. Since their husbands migrated out of the region to work, they had to take care of all responsibilities within the village. Unmarried women were also faced with household work burdens to support their mothers and other elders in conditions of men migrating out for work.

Therefore we see social norms and practices around marriage and economic conditions emerging from climatic impacts, geographic remoteness, and regional development, linked in complex mutually reinforcing ways to condition migration decisions among men. Male migration also itself becomes a determinant of women's migration in a cyclic mutually reinforcing manner. We see both migration as well as non-migration to be driven by socioeconomic stress factors rather than aspirations. In the lower age groups of 13-17yrs we do find some aspirational narratives towards work and future employment, but these aspirations are found to be constrained by their awareness of their gender norms, impoverished conditions of their families and parents' inability to earn enough to fulfill their educational aspirations.

Figure 6.5: *Visualisation of linkages between ecological, economic, social, and cultural factors driving labour migration in the study area*



6.1.3 Child labour

Qualitative interviews with community and civil society based key informants provided insights on the issue of child labour and associated migration. Given that the household survey for this study was designed to cover multiple inquiries, child age groups and migrant household categories there was inadequate sample for assessing depths and trends in child labour and migration. Some indicators provided broad patterns on the issue. We find that a total of 1.9% of the total households reported migrations of male or female members below the age of 18 yrs (Table 6.3). While the migration percentages among children are low, their early involvement in the labour market sets the stage for their migration for work in their early youth.

Among households with 13-17 yrs children, 6% of the households reported children not attending school, 13% of reported the children of this age group as engaged in agriculture/fishing and 10% households reported them being involved in other paid employment/business contributing to household earning. In the age group of 6-12 yrs these percentages are much lower. Households also reported strong involvement of children in household activities such as cleaning, washing, cooking, and fetching water, particularly among the older age group children (Table 6.5)[38]. School dropouts are however sensitive issues of reporting and therefore tend to be underreported by households. Secondary government data from Unified District Information

[38] In India the legal age to engage in labour is 15 years and above.

System for Education (UDISE 2019-20) reported by schools shows that in South 24 Paraganas district the dropout rates are overall 16.4% among secondary school students. In North 24 Paraganas district the dropout rates for this level of students is 4.42%.

***Table 6.5:** Child dropout and involvement in productive employment*

Indicators related to child labour	**% HHs with child age group**	
	6-12 yrs children *(sub-sample: 194 hhs)*	13-17 yrs children *(sub-sample: 128 hhs)*
Reported migration below 18yrs	2.1	3.9
Not attending school	1.5	6.3
Involved in agriculture/fishing	3	13
Involved in paid employment	1	10.2
Involvement in unpaid hh work		
Fetching water	20.1	50.0
Cooking	4.1	30.5
Cleaning	6.2	25.0
Childcare (siblings)	9.3	12.5
Kitchen gardening	0.0	7.0

Qualitative engagements revealed that over the past 3 years school dropouts had increased due to school closure and many children in the age group of 13-17 yrs had moved into paid employment or had become engaged in their traditional livelihoods of agriculture/fishing. Four linked factors emerged to explain these dropouts and engagement in labour employment within and outside the village:

- ***Economic marginalities and impoverisation:***

Through focused group discussions with children we found that the income related struggles of their households led boys to consider employment and earning as a greater priority over education since they needed to support their parents. While we find aspirations for high end skilled work in the future both among boys and girls, their concerns for the economic conditions of their families created both economic and moral constraints for their capability to pursue these aspirations. High end skilled jobs require higher education which was expensive and needed them to leave the region for specialized education in the city or other states. Children therefore considered this aspiration to not only be financially unviable for their families but would also reduce their ability to support their parents in the village, both in domestic and economic terms. Therefore climate change impact on livelihoods and household incomes can go on to impact the sense of compulsion among children, especially boys to drop out of education and turn towards early employment.

- ***Values held around education and aspirations:***

Another factor that affected school dropouts and tendency among the youth to seek or take on paid labour activities early on was the attachment of value of education merely to its potential for creating employment opportunities. With general perceived (and experiential) lack of

employment opportunities, it was seen that even after completing school and in some cases higher education, youth were unemployed. Whereas those who had started engagement in the market through wage labour, business, or any other forms of paid employment were in a better position to be financially stable by the same time. This narrative was found among parents and community elders in trying to explain the general lack of interest in education among children and tendency towards early entry into the labour market.

- ***Socio- technology and smart phones:***

One of the most dominant narratives emerging from this region with regard to disinterest in education and seeking of employment among children and youth was the proliferation of smart phones and easy access to the internet. The COVID lockdown period has marked a sharp shift in this trend since students were provided smart phones by the government to enable online classes and training for students. Compounded by school closure and inability of many to afford tuitions, many respondents find that the internet access and online gaming has provided them an easy distraction from lives structured by climatic vagaries, economic distress, and employment insecurity.

- ***Post marital income burdens***

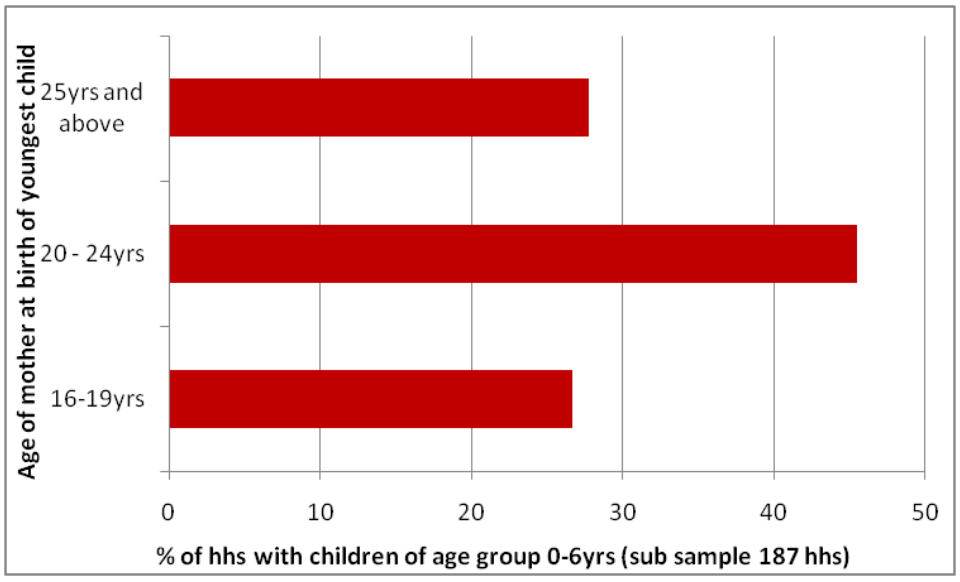
As discussed in the earlier section, early marriage practices of the region have an impact on the pressures on young boys to earn and settle financially early on.Over the past 2 years there has been an overwhelming observation from among all respondents of qualitative interviews that marriage of children below the age of 18yrs has sharply increased. This has been owed mostly to school closures and the proliferation of smart phones and internet use which has enabled platforms to meet other adolescent youth and communicate freely without adult supervision and monitoring.Narratives have also revealed that the extreme impoverisation of the community caused by the overlapping crises of COVID lockdowns and repeated incidence of cyclones every year since 2018, has led parents in some cases to allow or even support this trend. As a result of such early marriages, children, especially boys, have to move to the labour market to support their wives and children at a very early age. On the other hand while girls held strong educational and career aspirations at younger age-groups, they tended to resign to their gender roles in marriages and showed lesser involvement in the labour market outside the household labour they had to provide for agriculture/fishing etc.

6.1.4 Marriage Migration

The other significant form of migration in the region is related to marriage migration. Given the prevalence of early marriage in the region this form of migration holds relevance for the youth, their capabilities and vulnerabilities. The household survey showed 9.3% of households reporting marriage related migration in the past 5 years in the region. However, as child marriage has also been a prevalent age old practice in this region, the actual extent of marriage migration is not easy to ascertain since most households do not reveal cases of child marriage for a fear of administrative/punitive action. In recent years with the spread of awareness about the issue in the region and particularly its restriction under legal sanction, a political wariness has set in especially among parents and other family members. Therefore some proxies and perceptions with regard to child marriage were ascertained through in the household survey (Table 6.6).

One effective proxy variable with adequate sample size was in the form of as query about the mother's age on the youngest child's birth among households having children in the 0-6yrs age group. This provided us an indicator of early (and child) marriage as well as incidence of teenage pregnancies among girls in the region. While this variable was related to girls married into the village rather than migrating out, it gave an indication of the trend of child marriages. We find that 26.7% households reported mother's age at birth of the youngest child to be 19yrs or below indicating at their age at marriage being approximately below or only just above 18yrs.This value could ofcourse be an underestimation as women reporting birth of child between 20-24yrs age may also have been married earlier, but this limited proxy does not permit us to compute that with certainty. 45.5% had their youngest child before the age of 24 yrs indicating a *maximum* age at marriage in this group to be around 23yrs. Thus over 70% households had girls who were married latest by the age of 23.

Figure 6.6: *Age of mother at birth at youngest child in the household as a proxy variable to indicate early/child marriage in the Sundarbans*



Qualitative interviews with key informants in the villages corroborated this finding through their observations that child marriage was highly prevalent in the region. However, since the KanyasreePrakalpa Scheme of the West Bengal government was initiated in 2013, families waited for the girl child to reach the age of 18 before marriage. This program was initiated providing direct cash transfer of Rs 25,000/- as incentives to families when their daughters reach the age of 18yrs. However this scheme was able to delay child marriage by only a little since parents often waited for the girl to reach 18yrs and married her off within a few months after. There were also some cases narrated by respondents where parents had bribed officials to increase the age of the girl child on official documents to enable early marriage without a legal sanction.

Further, perceptions about child marriage were asked. We find that majority of the households reported perceiving/observing an increase in tendency for child marriages. The most dominant perceived reason for this increase was the access to smart mobile phones among the youth, followed by lack of awareness among guardians, and increasing poverty (Table 6.6). Qualitative interviews revealed that while child marriage is not a new practice in the region but it has very sharply increased in the past 2 years. There is a widespread incidence of cases of eloping among

the youth, particularly among children below in the 15-18yrs age group. Access to smart mobile phones with internet access was overwhelmingly blamed for this trend. Internet enabled smart phones were provided by the government to support digital access to online classrooms for students during the lockdown. It was considered that access to these phones and easy communication over the internet allowed discreet and direct contact between girls and boys which created conducive situations for eloping. As elaborated in the previous section, narratives expressed that school closures and lack of productive work engagement of children during the lockdown compounded by the impoverisation of families from COVID lockdowns and high frequency of cyclone impacts, has led to this increase. In many cases parents themselves supported such marital engagements for a lack of financial resources in the household for supporting basic necessities for children and paying for a daughter's wedding.

***Table 6.6**: Perceptions around child marriage among sample households*

Perceptions around changes in incidence of child marriage in the region *(sample hhs total = 410)*	% of hhs
Increased	54.9
Declined	12
No change	21
No idea	12.4
Perceptions around reasons for increased incidence of child marriage *(sub sample hhs perceiving increase = 225)*	**% of hhs**
Increasing poverty	33.8
Access to mobile phone among the youth	92.0
Many girl children	14.7
Lack of awareness among guardians	58.2
Lack of counseling for children	23.6

Child marriage was stated to have significant implications for child vulnerability both for boys and girls. Boys were compelled to provide an earning and livelihood for a family and pushed into a precarious labour market at a very young age. On the other hand girls marrying at that age were faced with problems of teenage pregnancies and associated health dangers, burdens of child rearing, at a very early age, pressures of domestic responsibilities, and consequent limitations on their mobility and educational aspirations. We find in the field survey that, there is a rise of children marrying outside the Sundarbans region. Around 73.3 percent girls are staying in other districts after their marriage.

6.1.5 Trafficking

Qualitative narratives revealed a high incidence of girl child trafficking reported in the Sundarbans region by civil society and government stakeholders. Community narratives also bring out a general awareness about the concept and cases. The concept called in Bengali as "meye pachar" (girl trafficking) often holds a connotation of violent abduction, and coerced transportation on individuals through fraudulent promises of job opportunities. This connotation has continued to hold strong in narratives of the community and children/youth groups. However, engagements with civil society organizations intervening in areas of trafficking and child protection in the region reveal a more nuanced process of trafficking that has been emerging in recent years. Trafficking cases are now often linked to labour and marriage migrations in the

area in a stepwise manner wherein clean differentiations between forced and voluntary migrations are difficult.

Various pathways of trafficking found in the region include:

- *Through marriage migration (particular vulnerability for early marriages):* young girls who elope and move for marriage from the village are left highly vulnerable to risks of being sold or pushed into sex work or other forms of exploitative contracts of domestic labour. These are facilitated by husbands or in-laws and may be done for bringing in financial gain at the cost of the girl. In many cases girls may not be aware of the exploitative nature of the arrangement and consider it as a norm or just a form of employment. Being physically and socially away from their social networks and kinship roots they would find it difficult to voice out or find a way out of such arrangements.

- *Connections through smart phones and the "Missed call" phenomenon*: As previously mentioned, the proliferation of internet enabled digital media access has increased the vulnerability and risk of trafficking among young girls as it enables their unsupervised communication with strangers. Community and civil society narratives spoke of the phenomena of "Missed calls" wherein strangers would often call from unknown numbers and engage with young girls and entice them into promises of marriage or jobs. This is compounded by the aspirations of girls towards love marriages, and material charms of city life fuelled by the access to social media and flow of information and imageries from beyond theirknown surroundings.Further the work burdens and lack of mobility of girls within the village held back by gender roles, poverty, male selective migration, and lack of parental care consider these aspirations and opportunities as means of freedom and social mobility. Informal network and channels of perpetrators exploit these social aspirations and poor household conditions.

- *Through labour migration among women/girls*: As girls at a younger age group of 13-17yrs and before marriage hold educational and employment aspirations, these are often exploited. Fraudulent employment agents, and many a times people within one's own kin and friend networks, offer employment opportunities in the city to girls. These are supported by families which are impoverished and in search of earning opportunities to supplement household incomes.

- *Through relief camps and emerging tourism belts*: post-cyclone relief camps/centres after a major cyclonic event have become potential areas of trafficking exploiting the desperation of families for relief and earning opportunities. Emerging regions of tourism in the region, particularly around areas of eco-tourism in the east and religious tourism in the west, have led to emergence of resorts, hotels, and cruises. These belts have also become demand sources for sex trafficking as well as forced labour.

Finding quantitative data on the issue proved to be difficult as the highly sensitive nature of the issues both socially and politically for respondent households. Additionally, since pathways of trafficking are now often through other accepted forms of migration, it is difficult to ascertain a case of migration as trafficking unless reported by household members and investigated by law enforcement systems.

In most cases due to the sensitive nature of the issue, pecuniary and judicial complications, and challenges of rehabilitation of victims, many of these cases are not recorded officially and attempts are made to negotiate the matter internally with family and kin. 1098 child helpline run and facilitated by a network of civil society organizations in the region are contacted by the police upon rescue of victims for support of shelter, care, and rehabilitation. Many areas of the Sundarbans being extremely remote requiring many hours of travel by road and river can make immediate arrangements of safe shelter and care for victims through institutional support difficult. This further strengthens attempts of local law enforcement stations to negotiate the matter unofficially.

Cases for trafficking are booked under various penal codes and constitutional acts:

- Procurement of minor girls (Section 366A IPC)
- Importation of girls from foreign countries (Section 366 B IPC)
- Buying of minors for prostitution (Section 373 IPC)
- Selling of minors for prostitution (Section 372 IPC)
- Immoral Traffic (Prevention) Act
- Human Trafficking (Section 370 & 370A IPC)

National Crime Records Bureau gives state level data for various crimes reported in the country. The data shows that cases reported for trafficking in West Bengal increased from 427 in 2010 to 2687 in 2016. Table 6.7 below provides some data estimates of child helpline calls received in the years 2015 and 2020. While the spatial scope of the data is inadequate in delineating the specific figures for the Sundarbans region, it provides an estimate for the two districts that encompass the Sundarbans region. It shows that between 2015 and 2020 the total number of helpline calls had increased drastically and much of this increase came from issues around COVID and Protection from abuse.

***Table 6.7:** 1098 Child helpline calls by purpose of calls 2015 - 2020*

Purpose of 1098 child helpline calls	No. of calls **(2015)**		No. of calls **(2020)**	
	North(24) Paraganas	South(24) Paraganas	North(24) Paraganas	South(24) Paraganas
Medical	151	63	32	9
Shelter	171	469	162	**517**
Restoration	64	39	44	**107**
Protection from abuse	**496**	**210**	**1289**	**970**
Child in conflict with law	1	0	0	0
Sponsorship	219	69	24	2
Child lost	148	45	33	35
Parents asking for help	260	200	159	202
Emotional support & guidance	118	21	**126**	**48**
Covid – 19			177	191
Other intervention	82	36	0	0

Total	**1710**	**1152**	**2046**	**2081**
Rate of increase			**19.65%**	**80.64%**

Interviews with civil society organizations working on child protection mentioned the following concerns and challenges around intervening (reporting, rescuing, and rehabilitating victims) in trafficking issues in the region:

- Involvement of close family and kin networks
- Climate change and impoverisation of the region that create circumstances wherein family and kin are themselves compelled to sell the girl for financial gain
- Unsupervised and uninformed digital media access affecting aspirations among the youth
- Difficulties in identifying cases of trafficking until it is reported
- Slow progress of investigation of cases (with police and judicial systems)
- Rehabilitation concerns of the victim especially where families are themselves involved in the trafficking
- Stigma in society upon return of victim to familial home
- Skill development training for victims inadequate in getting them to provide themselves financial stability and rehabilitation

6.2 Insulating Layers

Migration itself is considered as a coping and adaptive strategy among communities in response to climate change. As such migration practices prevalent across the Sundarbans have been seen as climate resilience building action (DECCMA 2018)[39]. However, broader lenses towards understanding of migration reveal incidence of both safe and unsafe migration. With the increased incidence of climatic impacts on livelihoods, resources, and income, compounded by lack of alternative opportunities and sociocultural practices and structures, the vulnerability to unsafe migration[40] will increase.There are several initiatives from government, NGOs, schools, and panchayats which are directed towards reducing the vulnerabilities that lead to unsafe migration for the local youth.

6.2.1 Individual level

- *Developing self efficacy and empowerment*: Individual level protection and insulating layers would emerge from growing self efficacy, empowerment and capabilities of the individual and the household. Unfortunately this self-capability is compromised immensely through prevalent social norms in the region which construct certain age groups and gendered roles as burdens for the household's honor and economic conditions. Restrictions on their mobility for work for fulfilling domestic roles, 'damaging household honor' through any subversive behavior, and financial burdens of a girl's marriage on the family – construct the girl child as a burden. This social construct is well ingrained in the girl child's upbringing in the region which tend to make girls resign to their traditional roles and restrictions. One NGO stakeholder Praajok, therefore emphasized on empathetic methods of training and building

[39] DECCMA, 2018. Climate change, migration and adaptation in deltas. Key findings from the DECCMA project.

[40] "This Global Compact recognizes that safe, orderly and regular migration works for all when it takes place in a well-informed, planned and consensual manner. Migration should never be an act of desperation. When it is, we must cooperate to respond to the needs of migrants in situations of vulnerability, and address the respective challenges."

the self image and internal capabilities for girls through innovative practices such as sports. Their goal has been bottom-up and inside-out development of children and breaking of traditional gendered imaginations.

- *Role models*: It was seen that when some girls from the community were able to push out of traditional cultural constraints of the region and fulfill professional and personal aspirations, they were able to inspire other girls from the community to build self belief and capability to do the same. These role models were most effective when they emerged from the same context so that girls from the community could see their own challenges reflected, understood, and overcome. NGO workers at the community levels became such role models who could impact the self efficacy of adolescent girls to protect and build themselves. Working with communities, including with girls and women affected by unsafe migration themselves, via a peer to peer approach, would help to contribute to that.

6.2.2 Relational level

- *Support from kin and friends networks*: While in some cases familial networks have played a role in creating and facilitating risks of unsafe migration, in others they have also played a role in bringing trafficking cases to the notice of the law enforcement institutions. Friends networks play a role in providing information to assist rescue of trafficking victims and effective rehabilitation of victims in the village. Strengthening these networks can thus be directed towards preventing unsafe migration by providing string social capital for potential victims and provide them with relevant information as well as raise their awareness on how to support safer migration.

- *Role of school teachers:* School teachers are seen to be important stakeholders in identifying and preventing school dropouts and child marriage. Training workshops are held by teachers for students on issues of child marriage. However these are infrequent, scattered, and non-institutionalized. These initiatives can be scaled.

6.2.3 Community level:

- *Village Child Protection Committees*: While this initiative was introduced by a policy direction, village child protection committees have integrated various nodal stakeholders with different roles around child protection and development. These committees include panchayat members, school teachers,anganwadi workers, ASHA workers, community members, girl child representatives, and local NGOs. These committees are further institutionalized through Block level Child Protection Committees and Ward level Child Protection Committees. Through these committees various trainings, efforts to block child marriages, facilitating trafficking victim rescue, counseling for children, and discussions on child protection issues in the village gram sabha may be/are organized.The level of initiative, participation, and efficacy of these committees could vary from village to village. However, after COVID related lockdowns and school closures these committees have weakened or become completely inactive. Revival and strengthening of these committees would form important insulating layers to reduce negative outcomes of migration among the youth.

- *Training and awareness generation*: Many NGOs are located or functioning in the region with a focus on training and awareness generation among the adolescent youth on risks of child

marriage and school dropout. Such trainings are also conducted at schools and anganwadi centres.

6.2.4 Policy

- *Criminal justice systems*: As mentioned in the previous section, several criminal codes exist to enable punitive and judicial action against such forced exploitative migration as well as child marriage, However these systems have not been effective given the long drawn processes of punitive action, safety concerns for the victim, and the close involvement of politically influential individuals or the victim's kin in the trafficking. These create low rates of filing of cases and out-of-court reconciliation arrangements.
  These justice systems include various provisions such as:
  - Immoral Traffic (Prevention) Act
  - Various provisions of the IPC against trafficking, procurement, buying or selling of minors
  - Prohibition of Child Marriage Act, 2006
  - The Commission for Protection of Child Rights Act. 2005
  - The Protection of Children from Sexual Offences Act, 2012

- *Kanyasree Prakalpa Scheme* initiated in 2013 by the West Bengal government to disincentive child marriage and school dropouts for girl children. The scheme provides an annual scholarship of Rs 1,000/- for girls aged 13-18yrs for continuing their school education and a one-time grant of Rs 25000/- when they turn 18yrs if they are still engaged in academic or occupational pursuit. This scheme has found to be effective in delaying child marriage, but not by much, as most households now wait only a few months after 18yrs to marry off girls. This indicates that underlying causes of child marriage rooted in cultural practices and poverty, need to be addressed.

- *Programmes for skill development and rehabilitation:* State Schemes like Swawalamban and Muktir Alo have been launched which are comprehensive schemes for rehabilitation and skill development of sex workers and victims of sex trafficking, and economic empowerment of socially marginalized women who are vulnerable to trafficking. However skill development without market linkages is reported to have limited translation into sustained livelihood outcomes.

- *Child helpline through NGO partnerships*: 1098 Child helpline initiated by networks of NGOs in the country with regional representation has been an effective tool for collaboration with law enforcement institutional setup for providing shelter and rehabilitation initiatives for victims of trafficking. However there are gaps and constraints in timely access and provision of services given the remoteness of many areas in the region.

- *Shelter homes and rehabilitation initiatives*: Shelter homes are set up either by the state government or in partnerships with NGOs to provide a safe space for trafficking rescue victims. Here they are provided counseling, skill development, and awareness trainings. However these initiatives are mostly challenged by the difficulties of rehabilitating victims due to stigma, harsh living conditions in the village for poor families, and involvement of families themselves in the trafficking.

- *Livelihood and income guarantee schemes:* Policies that provide livelihood or basic income guarantee can provide for important insulating layers against the poverty-driven unsafe

migration. One such programme at the national level is the MNREGS (National Rural Employment Guarantee which guarantees upto a 100 days of demand-based wage work to every rural household. This has been found to be an important disaster-coping mechanism across the country in situations where traditional livelihoods are adversely impacted by climatic shocks. Unfortunately in the Sundarbans region it is seen that while this policy is active on paper, significant informality and local power nexus has created siphoning off of funds and severe gaps in access to the policy by the community.

Income guarantee: A state level income guarantee scheme was initiated by the West Bengal government in 2021 - *Lakshmir Bhandar Prakalpa*. This scheme is designed as an income assurance scheme for women household members between the age of 25-60yrs age providing Rs 500 per month to general category families and Rs 1000 per month to SC/ST families. The scheme provides income support and therefore is relevant for income challenged households of the Sundarbans region. However, as this amount covers no more than 10% - 20% of the average monthly household income of West Bengal, the scheme is limited in potential for poverty alleviation and its implications for crisis-driven migration.

Micro-credit and livelihood support: Under the National Rural Livelihoods Mission (NRLM) of the central government the West Bengal government initiated the *Anandadhara* scheme in 2012. The scheme mobilizes the rural poor and vulnerable people into self-managed, federated institutions or self-help groups and supports them for livelihood collectives and low interest loans.

Employment assistance: A state government scheme named *Yuvasree* has been initiated to provide financial assistance for the youth of Rs.1,500/- per month for first one lakh jobseekers enrolled in an Employment Bank to enable them to enhance their employability by undergoing some education or training within the period of assistance.

While these numerous interventions are found on the ground, these initiatives are either scattered and require scaling, or have implementation challenges that provide for a weak insulating layer against the risks of unsafe migration. Further as climate change impacts create intensifying incidence of poverty, these risks may be further aggravated as income burdens along with sociocultural context form the foundations for tendency towards unsafe migrations.

6.3 Responses:

While insulating layers play a role in increasing adaptive capacity of households to climate change impacts, they are not directly a response to climate change vulnerability. Direct responses to climate change vulnerability and impact in the Sundarbans region with implications for migration outcomes emanate from general disaster preparedness, coping, adaptation and mitigation measures. Migration itself is a major coping mechanism used by households to respond to livelihood loss and reduced incomes from climatic shocks.

Preparedness:

- *Early warning systems*: Improved early warning systems developed have led to improved capacity of local governance systems to inform the communities in advance of impending cyclonic storms. This enables the communities to prepare for shelter and preserving dry food stocks either at higher levels of their own houses, pucca buildings like schools and

other government centres, neighbouring pucca houses, or government cyclone shelters. This reduces the loss of life and enables basic food supplies for households for the flood period.

- *Cyclone shelters and relief*: Cyclone shelters were set up by the government throughout the region after the impacts of Aila. One shelter services a number of villages in a sub-division and are centres of relief service provided by the government. However such collective relief areas have also been seen as pathway facilitating ease in trafficking and child marriage. Climate change response thus can have dis-benefits for unsafe migration.

Coping:

- *Labour Migration:* Migration for employment as elaborated under section 6.1.2 is an important coping mechanism in response to impacts on traditional livelihoods in the region. This is particularly in the aftermath of major or frequent disasters that can impact traditional livelihoods for one or more years. However, as previously discussed, such labour migration can itself become pathways for unsafe migration for the youth and therefore offer a dis-benefit for climate impacts.

- *Dependence on alternate livelihoods in the village*: Farm and non-farm labour are major alternative employment options in the region. Home based work such as bidi-making, tailoring, and knitting and basket weaving are some of the other alternative means of income that some households engage in to cope with reduced incomes from farming and fishing.

Adaptation:

- *Seed Banks*: Increased dependence on chemical fertilizers and high yielding varieties of crops have led to reduced soil productivity and increased susceptibility of crops to flood damage. Local traditional varieties of crops, being taller in heights, are more resistant to flood damage. However as use of high yielding varieties of crops has spread in the region, these traditional varieties of crops are gradually lost reducing the biodiversity. As a response, an NGO built on a farmer's collective has initiated interventions in creating a seed bank for traditional crop varieties and have been promoting the use of local traditional variety of crops among farmer collectives in the region. As a bottom-up initiative this intervention has seen very positive response from local farmers in the village and farmers have volunteered to support the seed bank in return.

- *Strengthening embankments*: The entire Sundarbans island network is made habitable by embankments to hold back the river tides enabling agriculture and settlement in the region. Low earth embankments are predominantly found as the embankments setup of the region. Since the widespread damage this region saw in the aftermath of the cyclone Aila in 2009, development of higher concrete embankments have been taken on in many areas. This is particularly seen around the main ferry ghats connecting islands, block headquarters, and tourism sites. These concrete embankments are less prone to damage and breaching, therefore protecting agriculture lands in close proximity of these embankments. Embankment construction and maintenance are the responsibility of the state department of Irrigation and Waterways. This development is still very sparse and

requires greater focus and priority as they would reduce the cost burdens of frequent livelihood and infrastructure damage within the islands from storms.

- *Roadways, ferries, and bridges*: An important institution for the development of the region is the Department of Sundarbans Affairs which implements initiatives through the Sundarbans Development Board. The key implementation carried out is civil works for improving roads and jetties in order to improve transportation facilities. Physical access is a major source of vulnerability for the communities in the region which also impact ease of travel for migrants. Improving transport facilities enables ease of daily travel to nearby towns and cities for work, education, and for basic services. It also facilitates easier return of migrants to their villages during intermittent periods.

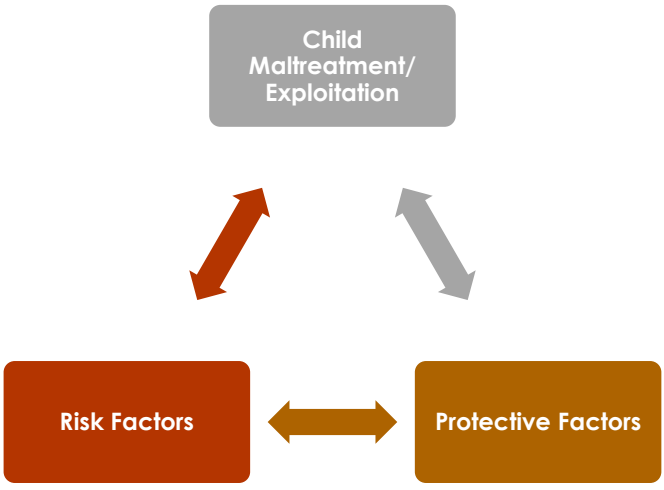
- *Aquaculture*: Brackishwater aquaculture has developed in many stretches across this region in response to increased salinity levels of soil and water making agriculture and freshwater fishing less productive. Therefore many farmers as well as commercial agents from outside the region have started to convert lands adjacent to the river and embankments into brackishwater aquaculture tanks. This livelihood alternative has become an important longer term adaptive strategy for some, especially in narrow river-side belts. However, the widespread conversion to aquaculture in some areas such as Minakhan and Sandeshkhaali blocks has led to severe dis-benefits. Land appropriation by rich aquaculture farmers, increased inland soil salinity, and land degradation has led to further loss of traditional livelihoods, especially for marginal farmers compelling more migration for work.

7 CLIMATE CHANGE AND CHILD PROTECTION

The discussion so far has revealed that high-intensity natural hazards, like- cyclones and floods, and climate change are having drastic impacts on the children constituting a large proportion of Sundarban's population. The increasing frequency and intensity of climate-related extreme events are likely to increase the protection risks to children in the form of increased child labour, child marriage, teenage pregnancy, abduction, recruitment into fighting forces, sexual violence and labour migration (Chapter 6). The literature suggests that children are more vulnerable than adults given their physical and psychosocial vulnerability, disruption of services, high dependency on parents or other caregivers, and limited scope of representation and voice. Climate change is causing child rights to become even more difficult to safeguard, as adults, communities and governments do not fully appreciate the threats to their children's future or are reluctant to fulfil their responsibilities to protect them.

The UN Convention on the Rights of the Child (CRCs) signed by the majority of the world's countries in 1990, recognizes and reaffirms the absolute right of children to live in a decent environment with all it entails: enjoying good health, accessing nutritious food and living in safety (UNICEF 2020). Environmental degradation and climate change pose a threat to these rights, particularly 15 of those found in the CRC. Child Protection experts use specific assessment tools to determine if a child is at risk of maltreatment/ abuse using both risk and protective factors. Risk factors increase the probability of children experiencing child abuse or neglect. Protective factors serve as safeguards, which can help parents find resources or support and can encourage coping strategies that allow them to parent effectively, even under difficult circumstances. Therefore, understanding the risk and protective factors for child abuse and neglect and the ways they interact is useful when developing effective prevention and early intervention strategies, and identifying families who are most likely to benefit from additional support. It is essential to keep in mind that while certain risk factors may exist within the households where child abuse and neglect occur, this does not mean that the presence of these factors necessarily leads to child abuse and neglect (Goldman, Salus, Wolcott, & Kennedy, 2003). While risk factors increase the chance of child abuse or neglect, they are not causes of child abuse and violence. Therefore, the presence of one or more risk factors will not necessarily result in child abuse and neglect, just as the presence of protective factors does not guarantee that children will be kept safe.

Figure 7.1: Child Protection Framework



This chapter of the need assessment study aims to focus on three important issues:

(a) Climate change impacts the child protection vulnerabilities for girls and boys and enablers for a protective environment considering the Social-Ecological Framework and through a gender lens in the Indian Sundarbans region;
(b) The role of existing informal and formal actors, service and care mechanisms and their capacities to prevent and respond to violence, abuse and exploitation against children and women (with a specific focus on MHPSS and Case Management) can be improved, and
(c) Effectiveness of response and prevention mechanism of government in preventing trafficking and areas of improvement.

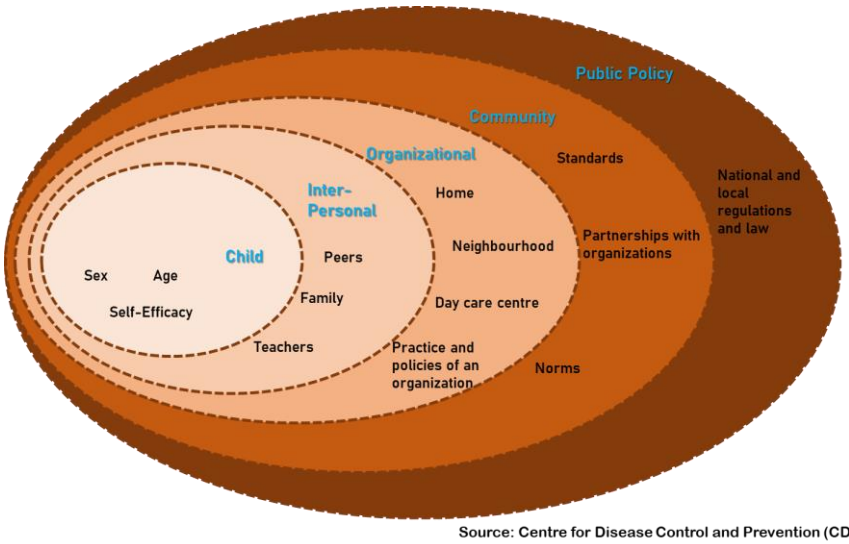
This chapter also intended to draw prevention and intervention strategies and recommendations for practitioners and for policy-makers.

This study used household survey and participatory action research approaches to understand regular problems for children and youth, and and general issues related to marriage and migration. Focus group discussions, semi-structured interviews, Key informant interviews, and participant observations were also used to understand children's understanding of risks related to child protection. The indepth interviews were recorded using digital voice recorders, video recorders, photographs, and handwritten notes.

7.1 Child Protection Vulnerabilities: Social-Ecological Approach

In the Sundarbans region, many children are deprived of their basic rights and vulnerable to different forms of abuse and exploitation. Climate change can amplify and accelerate pre-existing risk factors of vulnerability. While it is difficult to identify the exact causes of child abuse and neglect, researchers have used the "social-ecological" theoretical approach (Bronfenbrenner, 1979) to understand and explain the pathways through which child, parental, familial, neighbourhood and wider social factors interact to increase or decrease a child's vulnerability to abuse and exploitation (e.g., Irenyi, Bromfield, Beyer, & Higgins, 2006). The social-ecological model for understanding child vulnerability to abuse and exploitation is organised into 4 layers:

- ***Figure 7.2: Social-Ecological Framework***



Source: Centre for Disease Control and Prevention (CDC)

- the individual's own characteristics and developmental stage.
- family environment (microsystem);
- neighbourhood and community settings (exosystem);
- cultural beliefs and values (macrosystem)

In the Social-ecological model, child development is seen as a process in which child characteristics (biological and psychological) interact mutually with the surrounding environment over the course of life. When certain biological and psychological characteristics of the children combined with a specific type of environment may predispose an individual to abuse or to be abused.

The microsystem includes the structure and function of the family, its emotional environment and stability, the level of social isolation or support as well as the patterns of interaction to create an environment which significantly influences a child's predisposition to abuse or to be abused. Though the family is the most significant influence on a child, other environmental influences (exosystem), such as peers, the school environment and the neighbourhood are also important for shaping children's development.

The mesosystem is based on the context in which the individual (child) and family live. A central principle of the social-ecological model is that the individual and the family are embedded in a social setting and a cultural environment which bring considerable influence upon their development and functioning. At the macrosystem level, emphasis is placed on stress generating social factors which may increase abuse and neglect, and on the availability of formal and informal support systems which mediate both the social factors and the predispositions stemming from the individual and family systems. Thus, emphasis is placed on an analysis of socioeconomic indicators, economic resources, cultural capital, social capital (social networks, and social support) as well as on more prevalent social variables (for example, government policy, social change, etc.).

A number of risk factors and protective factors for child abuse and neglect are identified both from the literature and from the ground level evidence in the context of the Indian Sundarbans region. The most common risk and protective factors for child maltreatment are listed in Table 7.2, and are divided according to the ecological levels of the social-ecological model as discussed above.

Table 7.1: Risk and protective factors of child abuse and exploitation

Ecological Level	Risk Factors	Protective Factors
Individual Child Factors	• Age and education • Less experience with skills that could mitigate risks • Lack of understanding • Attention deficit • High dependence on caregivers	• Good health • Social skills • Secure attachment with parents • Awareness
Family/ Parental factors	• Domestic responsibilities for care activities • Domestic responsibilities for household chores	• Positive parent-child relationship • Supportive family environment • Concrete support from parents • Awareness of stages of child development

	• Exclusion from the decision-making process • Low Socioeconomic status of the household • Single parent • Lack of care within the household • Poor parent-child interaction • Low-level parental education	
Neighbouring and community factors	• Poor safety in public places • Child marriage practices • Child labour practices • Weak communication • Poor education system	• Increases awareness regarding child marriage and child labour • Increasing safety in public places • Strengthening the education system
Social/environmental factors	• Poverty • Gender inequalities • Social Isolation • Lack of access to social support (child care and social services)	• Increasing income security • Housing • Strong social network

7.2 Child abuse and neglect in the Sundarbans region

This section aims to present the impact of climate change on child protection issues, such as violence occurring in the private and public spaces, the separation of children from their caregivers, mental health and psycho-social well-being of caregivers and children, child labour, child marriage and online safety and child protection support and services.

7.2.1 Violence against children at home

Violence at home by parents/caregivers is the most common form of violence experienced by children of the Indian Sundarbans region. It is expected that stressors related to extreme climatic events, including concerns over the shelter, health, food security and income, could exacerbate this violence against children, both increasing the risk to children already in abusive and neglectful households, as well as increasing the potential for over-stressed parents/caregivers to become violent or abusive. It is important to mention here that the accurate reporting of violence in the private space is problematic due to the sensitive nature of the issue and the risks associated with reporting.

During the field survey, it is reported by one respondent of Choto Mollakhali village of Gosaba block that physical violence is occurring in the home at least in 5 out of 40 households in their neighbourhood. Similar incidents were also recorded in Paschim Radhanagar village of Gosaba. Violence at home is more common among children aged between 10-12 years and gradually decreases with the increasing age of the child. It is worth mentioning that harsh disciplinary measures are generally recognized as common and normal practice among the parents in India in general and in the Sundarbans region in particular. The most common forms of violence include corporal punishment administered by hand or with aid of sticks; verbal abuse, including rebukes, humiliating statements and curses; or a combination of corporal punishment and verbal assault. While such actions are recognized as common and normal, this may increase the risk among the children. One such incident was also reported by one of the civic police of Sundarban Coastal Thana (Gosaba), where an adolescent girl from Amtoli village (Gosaba Block) committed suicide as she had an affair with a boy from a neighbouring village. When her parents got to know about it, the girl was beaten up very badly by them to keep her from running away and eventually after

that incident the girl committed suicide. Many such cases exist in the Sundarbans regions, while only a few cases brought to public attention either by media reporting or as officially reported to the police. Those children who face harsh physical or verbal punishment on a day-to-day basis at home do not get much attention.

Contrary to this, during the fieldwork, we have come across cases where the parents reported that while corporal punishment and verbal assault at home are quite common in the Indian society, however, nowadays these kinds of practices have reduced drastically as the self-harming tendency has massively increased among the children, especially among the adolescents.

Another form of child maltreatment exists in the Sundarbans region in the form of child neglect. Child neglect includes physical neglect (failing to provide food, clothing, shelter, or other physical necessities), emotional neglect (not providing love, comfort, or affection), and medical or educational neglect (not providing access to needed medical care or education) or supervisory neglect (failure to appropriately supervise).

Table 7.3 shows that around 20-30 percent of mothers have reported the incidence of child neglect at home.

Table 7.2: Households reported child neglect

Migration status	6-12 Years	13-17 Years
Migrant	24.69	19.23
Non-migrant	23.01	31.58

Source: Fieldwork, SaciWATERs, 2022

A number of parent or caregiver factors potentially contributing to the maltreatment of the children were identified during the field study. These include lack of patience, the young age of a parent, absence of one parent, lack of education, household responsibility, and poverty.

(a) There is a significant association between the migration status of the parents and child violence in the home. During the field interactions, both male and female respondents stated that the female-headed households having migrant husbands are a common phenomenon in Sundarbans. It is stated by at least 10-12 respondents that in absence of the husband at home, the wife takes on a lot of household responsibilities along with the care burden of the elderly persons and the children (Chapter 6). Table 7.4 shows that for the migrant households, the mother is the sole caregiver for almost 60 per cent of the children.

"In our village, almost 80 per cent of male members stay outside the village. Whatever is required to do for the children, mothers are only responsible for it. If we need to take them anywhere, we only do it. As children are going to school, parents generally get calls for guardian's meetings. But fathers can't attend them. As I applied for the birth certificate and other documents for my daughter, I only signed the papers. Not her father. Her father does not stay with us……As fathers are staying away from the family, all responsibility comes to the mother. After completing all the household chores, it is not possible for the mother to spend much time with their children" (A resident, Durbachati Village, Patharpratima).

Respondents also stated that these responsibilities increase their work burden, especially during the post-disaster period. It is stated by many respondents that with increasing work pressure and lack of family/ social support sometimes the mothers get rage with or without any reason and start treating their children badly because they lose patience.

Table 7.3: Households reported responsibilities of children only with the mother

Migration status	6-12 Years	13-17 Years
Migrant	61.73	63.46
Non-migrant	38.05	36.84

Source: Fieldwork, SaciWATERs, 2022

(b) There also found a significant association between violence against children at home and school closure. It is reported during field interactions, that parents are under stress as the COVID-19 has brought a lot of changes to their lives. During Covid lockdown, children were out of school and did not have access to group activities, team sports, or playgrounds. While many lost interest in studies and became addicted to mobile phones. This situation continued even when the schools reopened. Parents have to keep them busy with studies as well as safe while at the same time performing household chores. These kinds of pressure have also increased the risks of violence against children at home.

(c) Violence in the home is also reported where there is a lack of access to parenting support and a communication gap. Studies suggest that the communication gap between a parent and a child is very harmful to the development of a child. It is very important to talk to kids freely to develop a sense of security and trust in them. It is severely lacking in the rural areas of the Sundarbans region. It is reported by young girls and boys that they can't share their feelings with their parents. *"A friendly relationship between parents and children is uncommon in the rural areas of Sundarbans. Adolescent girls do not share their feeling with their parents"* (ASHA, Patharpratima) puts the children at risk as they take some wrong steps in their life at a very early age.

Table 7.4: Children do not share their problems with parents

Migration status	6-12 Years	13-17 Years
Migrant	13.6%	21.2%
Non-migrant	11.5%	6.6%

Source: Fieldwork, SaciWATERs, 2022

7.1.1 Migration of parents and associated risks

In the Sundarbans region, parents who migrate for work often do so as a survival strategy as mentioned in Chapter 6. The migration of parents negatively affects children and adolescents in two ways as discussed below:

(a) Migration of children with parents and its impact on child rights

It is reported during focus group discussions in Snadeshkhali and Patharpratima that parents often migrate out of state along with their children mostly those below 6 years. Upon arrival at

the destination state, their children are often excluded from basic social services, such as education, and health care, thus increasing the risk of child labour. Those children essentially live with their parents at the worksites, where the parents leave them at home during their working hours. This situation not only deprives the child of their rights to education, and health but also increases the risks of physical and sexual violence.

As already discussed in chapter 4, Climate change is causing drastic livelihood changes in the agricultural fields and water bodies of Sundarbans. As agriculture and fishing become increasingly unviable on the island due to extreme weather events and saltwater ingression, a sizeable number of agricultural labourers are turning into migrant labours and are forced to work in the hundreds of brick kilns that have mushroomed in the blocks of Minakhan and Sandeshkhali. The seasonal nature of the work attracts the dispossessed farmers to work in brick kilns. It is reported by a group of young women of Minakhan block that the entire family of the labourers including the husband, wife and children move to the work site for 6 months. The children neither get access to school nor any kind of health services, while they start contributing their labour at the worksite. Engaging children below 14 years is a clear violation of child rights. It increases the chances of school dropout and also puts them at risk of violence in an unknown place.

(b) The separation of children from their caregivers and associated risks

Parent migration negatively affects school attendance, especially among adolescent girls between 14 and to 18-year, and studies point out this as a substitution effect between housework and schooling[41]. The migration of parents increases the household responsibility of the young girls. We find during the FDG in Gosaba that young girls take over a lot of household activities, like-caring for livestock, obtaining drinking water from the tube wells, collecting firewood from the forest, taking care of their younger brothers and sisters, and undertaking typical household chores such as cleaning the home.

> *Whatever time I get I help my parents with handicraft work, clean utensils, help with cooking, clean the house, and take care of my siblings because my parents work outside and hardly get time to stay at home (12 years old girl, Gosaba Block)*

Parental migration may also impact the well-being of children in other ways. left-behind children were more likely to have emotional problems as they do not get their parents around them with whom they can share their problems. Sometimes, they are left in the care of grandparents who find it difficult to care for them and often get neglected. The majority of children said they miss their parents a lot. It is reported by a group of ICDS workers during a focus group discussion that in Lahiripur village of Gosaba block there are many such families where the parents migrate out for work leaving their children to their old parents.

> *"See this girl..the parents have left this girl and her brother to their grandparents as they do not stay here. She does not get food on time. Earlier she used to cry a lot for her parents. But as she is growing up, she has stopped crying. But definitely, she fills bad as she does not get the proper care…..after a certain age sometimes they even make the decision to elope and get married to someone whom they do not even know properly. This tendency has increased many times."*

[41] https://ecommons.cornell.edu/bitstream/handle/1813/101442/ILO_MigrationandChildLabour.pdf?sequence=1

It is also found that children's well-being and safety issues under the inadequate care environment at home usually led to parents' concerns. A daughter who has achieved sexual maturity is exposed to sexual attacks and transgressions by boys and men in the community, as well as within her own family, and she is – or perceived to be – no longer safe at home, especially during the long hours she remains unattended when her mother and other elderly women are away at work. With increasing concerns, sometimes parents adopt child marriage as an ultimate act of care and responsibility to protect the honour of their daughters in an insecure environment and consequently put their child in the discriminatory practice of abuse and neglect and also increases the chance of sexual exploitation. A young girl from a village in Gosaba described the situation:

> *"I have studied till 9th standard. I could not study further due to some family issues. Parents were not at home as they were working outside. My parents took the decision of my marriage thinking of my safety. I was not willing to get married so early, but there was no one at home to take care of me."*

Such cases are quite common in the rural areas of Sundarbans.

7.1.2 Child labour migration and associated risks

Socializing children into the world of work by increasing their roles in productive activity is common in rural communities in Sundarbans. Children participate in family agriculture, household activities and food production according to their ability from as early as 6-7 years of age. This activity is not seen as work but as "training," and the child acquires a sense of competence from performing such tasks successfully.

Exploitative child labour goes far beyond these situations. When a child work outside the family context, it is more likely to be exploitative.

Picture 7.1: **A girl walking on ropes in Chunakhali Market, Gosaba, Sundarbans**

Source: Fieldwork, 2022

Independent child migration may also be part of a family's survival strategy as the migration of a child decreases the dependency ratio in the household, even when the child does not earn enough to save (because there is a decrease in household consumption demand). In addition, some children are able to save and send remittances. A resident reported:

"When young girls and boys find the financial problem at home, they only take the decision to migrate out for work."

The available data indicate that a child is as likely to be engaged in exploitative child labour by his own parent.

Children who migrate without their parents are especially vulnerable to exploitation, coercion, deception, and violence – particularly if they are below the minimum age of employment, cross a border illegally and do not speak the language of their destination. The children receive very low wages over which, in many cases, they have no control. Civic police of Gosaba

Sundarban Coastal police station shared an incident, where a young boy was brutally killed by some people as he went out of state for work. According to the family members of that boy, he was killed as he was asking for the payments for the daily labour which was due for a long time.

While schools should take an active role to stop child labour, schools are quite reluctant. The child protection committee is not very active in all villages of the Sundarbans region.

7.1.3 Increasing risks of exploitation with underage elopement and Marriage

Of all the categories of child abuse, neglect and violence in the Sundarbans region, exploitative child marriage has received perhaps the greatest attention as mentioned in chapter 6. Child marriage is formal or informal union before age 18. It is a violation of children's human rights and a form of gender-based violence that takes away childhood from children. It is already reported in chapter 6 (Table 6.6) that the tendency of underage marriage has massively increased in the last 10 years in the Sundarbans region.

During the interview with civic police of Sundarbans Coastal police station, Gosaba area it was reported that the police station has filed around 42 cases of child marriage in 2019, 14 cases in 2021, and 20 cases till April 2022. It did not receive any such cases in 2020, probably due to Covid 19 lockdown restrictions. The occurrence of these cases is especially high in remote islands like- Satjelia, and Kumirmari.

The survey found that child marriage has been found to increase a woman's chances of being abused. Child brides often show signs symptomatic of child sexual abuse and post-traumatic stress. Such symptoms include feelings of hopelessness, helplessness and severe depression. It was mentioned during an in-depth interview that the Sundarbans (Gosaba) Coastal Thana receives around 25-30 cases of domestic violence every year, out of which around 10-12 cases get solved after discussion.

Due to the economic disasters that have hit the families located in the islands of Sunderbans the families tried to push their adolescent girls, aged 14-15 years old, into marriage. Marriage is viewed by parents as a way to protect their daughters and sometimes as an opportunity to economically unburden themselves of the responsibility of providing for a child who is ultimately meant to contribute to another household. Many times, these marriages were conducted hurriedly and without background checks on the boys and their families.

During the focus group discussion in Patharpratima, a group of young women reported that they know many of these girls who are facing problems in their marriages and some of them have also returned to their parents. An ASHA worker reports that *"these adolescent girls most of the time don't even get adequate food on a daily basis. They generally do not share these problems with anyone as long it is reaching an extreme situation. If we get to know that they are facing mental health problems, we generally send them to Madhabnagar hospital for counselling. The Madhabnagar hospital has a female counsellor.*

It is also reported by a school teacher that the number of children attending school has dropped drastically in the villages of Sundarbans due to increasing cases of child marriage.

Underage marriage also increases the chance of health risks among adolescent girls. Adolescent girls who are falling into the trap of underage marriage, many of them get pregnant at the age of 16-18 years. An ASHA worker notes, *"It has become impossible to stop the adolescent marriage and*

teenage pregnancy in this region. We provide them with contraceptive measures, however, in many cases it is the husband who does not want to use any kind of contraception method."

7.2.2 Digital environment and associated risks

Exposure to the digital world has increased the likelihood of exploitation among children in two ways.

(a) Under lockdown, the children were using social media. Many children were falling prey to these criminal elements of the darknet. Excessive use of mobile and the internet has a negative impact on the mental health and well-being of children. A large number of respondents claimed that children have become addicted to games and lost interest in studies. The children have even lost their interest in outdoor games. *"You will not find many children playing on the ground these days. When we come back from work in the evening, we find many children are sitting on the roadside and playing videogames in the mobile"(ICDS workers, Gosaba Block)*

It is an increasing concern among many parents in the Sundarbans region that with addiction to online video games sometimes the children spend a lot of money from their parent's accounts without their knowledge. While such incidents have become very frequent in the villages of the Sundarbans region, however, reporting these cases to the police station is not very common. It is also reported by some parents that many children even had arguments with their parents for money to recharge their mobile phones. An NGO personnel reports that some of the online games are very violent in nature and therefore, have negative impacts on the mental health of the children.

(b) Because of the natural disasters, Covid and loss of livelihood, families had to face a lot of challenges in the Sundarbans region and parents were mostly busy with day-to-day activities to rebuild their lives. In absence of proper care and attention from parents, many young girls of the Sundarbans region started using social media and sought friendships with strangers. Sometimes they even make the decision of getting married without their parent's knowledge and acknowledgement. That was the trap. Many girls, barely coming of adult age, also faced threats of releasing their private photographs on the internet by strangers. It is also found that during the Covid lockdown even schools were equipping their students with phones for online classes. These are adolescent girls, their sexuality is developing, and the internet is bringing them closer to sexual exposure. It is already mentioned in chapter 6 that with the increasing use of phones and the internet, many adolescents have fallen prey to underage marriage by eloping and sometimes child trafficking.

7.2 Role of different actors in preventing child violence and its effectiveness

There are several protective measures from the government, NGOs, schools, and panchayats which are directed toward reducing the risks of child abuse and violence.

7.2.1 Individual level

(a) Self-Efficacy

It is already mentioned in the chapter 6 that at the individual level child protection risks can be reduced through increasing self-efficacy, however, self-efficacy is compromised massively due to existing socio-cultural norms.

7.2.2 Relational Level

(a) Role of parents

It is already discussed that children with negative parenting are more at risk for their own relationship troubles, depression, anxiety, and aggression, among other negative outcomes. However, it is also found that there are cases where parents' support and proper communication with children reduce the risks of exploitation.

(b) Role of schools

School teachers are the important stakeholders in preventing child abuse and neglect as a child spends a considerable amount of time in school. Schools play an important role in monitoring students at risk of dropping out. However, it is reported during the field survey that many times the teachers do not want to take the responsibility of monitoring as it increases their workload.

7.2.3 Community Level

(a) Child Protection Committee

A CPC is a community-based group including duty-bearers who are primarily responsible for creating and promoting a child-friendly and safe community environment wherein all children's well-being, safety and rights are protected. CPCs will be responsible for monitoring, reporting and responding to the issues of child protection in the community. The CPCs will also plan and take up innovative activities to raise awareness in the community about the issues of local child protection concerns. The CPCs will work in close coordination with the District Child Protection Unit for activities in the community on child protection issues. The CPC will develop Annual action plans to address issues of child protection, CPCs will refer and report cases to higher-level protection committees. The CPCs will be at two levels, one at the village and the second at the block/ward level. However, it is reported that the government child protection mechanism remains as namesake only in most regions of Sundarbans.

(b) Role of NGOs

NGOs, like- Digambarpur Angikar, Swapnapuron, SPAN strengthens the VLCPCs at local levels through engaging with trained community cadres, gram panchayats, Anganwadi workers and children.

7.2.4 Policy

(a) Criminal justice system

As mentioned in the previous chapter (6.2.4), several criminal codes exist to enable punitive and judicial action against such forced exploitative migration as well as child marriage and child labour. However, these systems have not been effective given the long-drawn processes of punitive action, safety concerns for the victim, and the close involvement of politically influential individuals or the victim's kin in the trafficking. These create low rates of filing of cases and out-of-court reconciliation arrangements.

(b) Swayangsiddha initiative

The police department and the West Bengal government trying to reach out to various schools through the Swayangsiddha initiative to empower young girls and boys with knowledge and skills to make them less vulnerable to violation and abuse of their rights. But the campaign has not reached everywhere. It was restricted to schools in some pockets of Sundarbans. But it needs to reach the interiors, right up to the most interior and remote locations.

(c) Anwesha Clinic

In West Bengal, Anwesha Clinic is an initiative to provide counselling and medical facilities to adolescents relating to menstrual problems, puberty, unwanted pregnancy, and depression among others. The program focuses on making adolescents participative towards healthy development by identifying the problem and creating awareness. While counselling children is extremely important in reducing the risks like- depression, and self-harming, the spatial reach of this initiative is extremely inadequate.

Other initiatives like- Kanyasree Scheme, Yuvashree scheme, Child help-line 1098 initiative, Shelter homes and rehabilitation, and income generation schemes are already discussed in the previous chapter (Chapter 6). While these numerous interventions are found on the ground, these initiatives are either scattered and require scaling, or have implementation challenges that provide for a weak insulating layer against the risks of unsafe migration.

7.3 Recommendations

The findings of this study indicate specific vulnerability factors linked to absence from school, to loss of household income (poverty), migration, social origin, gender, mental health status of children and their parents/caregivers, and use of digital technology. This informs the following specific and tangible recommendations for governments, policymakers, donors, and civil society organisations to inform policies, programmes strategies and investment to keep children (both girls and boys) safe from harm in homes and communities. Key recommendations to protect children from neglect, abuse and violence in the context of climate change in the Sundarbans region include:

- Listening to children of all genders, ensuring dialogue and further research, to take the experience of the impact of climate change on children and households into account in designing response plans.
- Committing to prioritising child protection within climate change response plans
- Intensifying the role of the social service workforce (both formal and informal) as essential workers, with support to adapt responses to continue safely providing essential services to children and households in areas of origin, transit and destination.
- Allotment of funding for child protection programmes, including for children's and caregivers' mental health and psycho-social support, and gender-based violence response services
- Ensuring that child protection risk factors are understood and integrated into social protection and child benefit programmes, with the aim of helping prevent and mitigate violence against children, exploitation and family separation and promote adequate care to the children. ,
- Ensuring that education sector (schools) and child protection sectors are enabled to proactively work together to put child-friendly, effective protection response mechanisms in place to transition children back to school/education safely.
- It is crucial that school teachers have to take responsibility, and panchayats and parents have to be taught the importance of internet safety.
- Strengthening the integration of high-quality mental health and psycho-social well-being programmes with gender-sensitive child protection systems and services to prevent and address gender-based violence.

8 CHILD PARTICIPATION IN DISASTER RISK REDUCTION UNDER CLIMATE CHANGE

The discussion so far has revealed that higher intensity natural hazards, like- cyclones and floods, and climate change are having drastic impacts on the health, wellbeing, and potential (both directly and indirectly) of the children constituting a large proportion of Sundarban's population. The literature suggests that children are most affected by natural disasters given their physical and psychosocial vulnerability, disruption of services, high dependency on parents or other caregivers, and limited scope of representation and voice. In many studies, children have been considered as a mere socio-demographic category and victims of climate change-related disasters. As children are often overlooked in disaster management and planning, ignorance further amplifies their vulnerability (Mort et al, 2020; Peek et al, 2018).

However, very recently a number of humanitarian organizations (i.e., United Nations Convention of the Rights of the Child, UNICEF, PLAN International, CARITAS) started positioning children and the youth as climate change agents and potential future leaders at local, national, and international levels who will obviously contribute to reducing vulnerabilities in families and communities and transfer knowledge to them. Scientific studies also show that children can advocate for climate change mitigation. In the long term, the participation of children in climate change mitigation programmes may lead to long-term development after a disaster and, consequently, less risk to their health. Children and youth have unique skills, perspectives, and knowledge to preparedness as well as resilience-building within their home space and community space.

In recent years, children and young people have led peaceful appeals to governments to take effective action to address the climate crisis. However, on several occasions those children participating in demonstrations have suffered arrest and criminalization instead of calling for dialogue.[42] Children's rights to share their thoughts freely, to form or join groups and to gather peacefully, must be respected and protected.

During the 2021 World Congress on Justice with Children,[43]organized by Terre des hommes and partners, child's rights practitioners, decision-makers, civil society and children with lived experiences discussed the most pressing issues related to children in contact and conflict with the law.[44] Following the presentation of a strategic foresight research on the Future of Child Justice, attention was brought to the issue of climate crises and what are their impacts on child justice.

[42] Boyle, L., 2022. *Climate activists, aged nine and 12, detained by police in India for protesting over air pollution*. [online] The independent. Available at: <https://www.independent.co.uk/climate-change/news/climate-change-india-children-protest-demonstrate-police-b1184668.html> [Accessed 17 May 2022].

[43] For more information visit justicewithchildren.org

[44] The principal outcome of the World Congress was the Global Declaration on Justice With Children with the theme of "Ensuring access to justice for all children: towards non-discriminatory and inclusive child justice systems". Consult it at: https://justicewithchildren.org/online-2021/global-declaration/

According to the conclusions of the World Congress on Justice With Children, children may face many challenges when trying to claim environmental rights through justice systems. Indeed, on one hand, the lack of independence and legal status is a common barrier for children exercising justice, regardless of the issue. Nevertheless, almost universally, children can bring, to court, cases in their names. What is less clear is how they can do so and the role they are allowed to play in legal proceedings. Blanket provisions requiring people under a certain age to act exclusively through a litigation guardian are prevalent, and the individual capacity is also taken into account. In fact, during the Indian preparatory meeting to the World Congress, Justice Madan Lokur, former Judge of the Supreme Court of India, appointed that during crises legal assistance or legal advice to children was completely missing.[45] All these setbacks applies similarly to children's access to courts claiming environmental rights.

On the other hand, the burden and standard of proof are generally placed on victims to prove a cause or link between their exposure to harmful chemicals or pollution and the actions of the alleged polluter.

However, with the advancement of environmental movements and rights, the recognition of child organisations and movements to bring claims can become an agile way of allowing large-scale challenges to children's and environmental rights to be brought without placing the burden of doing so on individuals or requiring a specific interest.[46]

The specific aims of this research were three-fold: ***first,*** to explore how do girls and boys (children and youth) perceive the impact of climate change in their lives and what capacities do they think they have in managing these impacts and what more do they think is needed; ***second***, to investigate the roles of children as agents of change in support of risk reduction and climate change adaptation and ***third***, the challenges and constraints girls, and boys are facing in the Sundarbans region to take part in discussions on climate change effects on their lives through a gender lens. The research was also intended to understand the local level issues related to climate change that can bring children to become the voice for evidence-based advocacy.

8.1 Methodological Approach and tools

This study used participatory action research approaches and community risk assessment methods (Van Aalst, Cannon, and Burton 2008) such as modified participatory rural appraisals; child-friendly ice breaker exercises to engage the participants and accumulate basic demographic information; mental mapping; social and resource mapping; risk identification and ranking of priorities; mapping of risks, risk reduction measures, and key actors. Focus group discussions, semi-structured interviews, Key informant interviews, and participant observations were also used to understand children's understanding of risks as well as their involvement and contribution to risk reduction and resilience-building activities. These sessions were recorded using digital voice recorders, video recorders, photographs, and handwritten notes.

[45] Lokur, M., 2021. In: *Global Initiative on Justice With Children Preparatory meeting report India*, 5.

[46] Ratledge, L., 2022. In: *International Day of Dialogue: Justice with Children challenges in the 21st century Act now!*. Justice With Children

The group discussions were conducted in schools or local community buildings/ Anganwadi centers at a central location in the villages. PRA sessions were facilitated by the core research team with the help of local community members with whom the children and adults were familiar. Sessions were conducted in Bangla and the local dialects, where possible. All the activities were carried out in small groups divided by gender so that the responses of male and female participants could be compared to ensure that all participants felt comfortable contributing to the discussions. Before the start of the activities, the research aims and objectives were clearly explained to all the participants by the researchers. Children were asked for their consent orally. Consent was also sought from the children's parents and guardians with the help of the local community members. For the school-based research, permission was also sought from the headmasters of the school involved.

Children are not a homogenous group. As children move towards adulthood, their logical understanding, and reasoning skills started developing. Additionally, memory develops and they started acquiring a better grasp of language and social skills. Given the heterogeneous nature of the children's group, data were collected separately from three age groups: middle childhood (7-12), early adolescence (13-17), and late adolescence/ youth (18-25).

Given the nature of the participatory research, spatial coverage, time constraints, and the different community dynamics in every village, not every participatory method was exercised in every selected village. Table 8.1 shows the participants' demographic details and Table 8.2 shows the methods used with different participants in the villages. Despite time constraints, the research team was able to extract detailed information from the research participants.

Table 8.1: Child and youth participation by age and gender

Block	Village	Group (Gender)	Average age	Oldest	Youngest	Number of participants
Patharpratima	Mahendranagar	Female	15	16	14	6
	Durgagobindapur	Female	9	10	8	12
		Male	9	10	7	15
	Radhakrishna Nagar	Female	22	25	18	9
		Male	22	25	19	8
Gosaba	Gobindapur	Female	14	16	13	7
	Gobindapur	Male	15	17	13	8
	Lahiripur	Female	13	17	11	11

Source: Field Data, SaciWATERs, 2022

Table 8.2: Different methods used for different groups

Selected Methods	Issues	Middle childhood	Early adolescence	Youth	Young mothers	ASHA and ICDS	Child Protection Committee, Panchayet	School teachers	West Bengal Disaster Management and Civil defense department
Basic information	1. Basic demographic data (age, gender, marital status)								
Problem sharing/ice-breaking method	1. Problem sharing (their feelings and other subjective issues) 2. Aspiration of the participants								

Perception/ mental mapping	1. risk identification and ranking 2. what girls and boys can do to reduce risk 3. decision making in households								
Risk identification matrix and ranking	1. risk identification and ranking 2. vulnerability and capacity of boys and girls								
Semi-structured interviews	1. DRR policy, practice and implication on boys and girls								
Matrix exercise	1. what do children can do to reduce risk 2. DRR stakeholder and power mapping 3. village vision over 25 years								
Participatory Resource and risk mapping	1. village risk mapping 2. local disaster history (matrix) 3. local disaster calendar (matrix)								

Source: Field Data, SaciWATERs, 2022

Understanding Child-centred DRR planning and research requires a participatory approach whereby the children are treated as stakeholders in the process of understanding risks and identifying and undertaking preventative measures. Parents, community members, and members of government departments should also be included in this process as each of these stakeholder groups will have clear views and beliefs about the priorities for childhood and the types of DRR activities their children should be involved in. Given there are likely to be multiple perspectives on priorities for childhood within a community, the content and process of child-centred DRR planning should be flexible and directed by informed negotiation amongst stakeholders, including the children, their parents, and other key decision-makers and leaders within the community.

8.2 Gendered vulnerabilities and Perceptions

8.2.1 Children and Adult's risk priorities (Perceptions)

The Children were quite aware of the increasing risks to the local communities due to natural hazards, like- cyclones and floods in the region. Of those who participated in the study, almost all of them have seen the Kaccha houses collapse, ponds get filled with saltwater, uprooting of trees due to cyclones and floods. Children described their experiences during cyclones and floods as a time when houses and roads get inundated, rivers overflow, they take shelter either in nearby Pacca houses or flood centres, houses get filled with slush, important papers and books wash away, trees get uprooted, damages to power infrastructure and power supply gets disrupted, food and drinking water becomes scares, wash away fishes from the ponds.

Risk perceptions are gained from the lived experience of individuals and further developed by the socio-economic conditions and geographic context within which they are living. It also varies based on factors, such as age, gender, educational attainment, and occupation.

As shown in Table 6.3 there are visible differences in risk priorities linked to gender, age differences, and geographical locations. When questioned about the justification underlying their prioritising of risks, interesting gender differences between the girls and boys became apparent, especially among the adolescent group. While on the other hand, in Radhakrishna Nagar village both genders considered cyclones as the riskiest issue in the ranking exercise. Table 8.3 illustrate examples from two different villages of the Sundarbans.

Table 8.3: Risk ranking for the children (13-17 years)

Location	**Gobindapur village, Gosaba**		**Radhakrishna Nagar village, Patharpratima**	
Age Group	**13-17 years**		**18-25 years**	
Ranking	**Boys**	**Girls**	**Boys**	**Girls**
1	Drinking water problem	Flood	Cyclone	Cyclone
2	Erosion of embankment	Cyclone	Flood	Erosion of embankment
3	Cyclone	Virus infection	Erosion of embankment	Flood
4	Flood	Lack of education	Degradation of agricultural land	Loss of harvest
5	Declining fertility of the land	Child marriage	Water scarcity	Water scarcity
6	Deforestation	Superstition	Disruption of electricity supply	Disruption of electricity supply
7	Lack of quality education	Malnutrition	Loss of harvest	--
8	Child marriage	Water scarcity	Saltwater intrusion into freshwater ponds	--
9	--	Lack of earning opportunities	Loss of livestock	--
10			Absence of flood centre	--

Source: Field Data, SaciWATERs, 2022

(a) Children between 7 and 12 years of age

For children aged between 7 and 12, memory capacity and cognitive ability are still in the developing stage. It is found during the group discussion that they are unable to recollect events clearly. The children focused mainly on two main hazards: cyclones, excessive rainfall, and flood. The Amphan and Yaas Cyclone became a focal point for discussion. Both girls and boys discussed their lived experiences during floods. Stress, fear, and worry are also noted among the children in the Sundarbans region. Children experience emotional distress due to the fear of drowning when the entire area gets inundated. On the other hand, boys shared that they sleep on the house roof during floods. They emphasized that those having concrete houses (pucca houses) provide shelters to those whose houses are completely or partially submerged under the water.

A common theme in the response of this age group was saltwater inundation into the freshwater ponds and how it causes the death of hundreds of thousands of fish. It is found from the discussion that disasters put pressure on children (directly or indirectly) to help families with the negative impacts of disasters. A number of children helped their parents to reorganize their houses post-flood with their labour. The water crisis is an everyday risk for the people of the Sundarbans region and it is also found that almost all the girls help their mothers in fetching water throughout the year and especially during the dry season.

(b) Children between 13-17 years of age

The adolescent groups identified both immediate risks to hazards in their communities (such as drinking water problems, erosion of embankment, viral infection), and social risks such as child marriage, school dropout, and superstition– which may be overlooked by adults. To prioritise risks, the girls' group (13 -17 years) concentrated both on physical and social risks the region is having whereas the boys (13 -17 years) focused more on the physical damages posed by the hazard.

Both adult and children's groups discussed 'everyday risks', however, in Gobinda Nagar village, the adolescent groups were more concerned with everyday threats and prioritised lack of education, child marriage, viral infection, superstition, and poverty as the most important. Boys have kept the drinking water problem at the top of their priority list. The possible reason for this could be both boys and girls help their mothers in fetching water from distant sources and spend a lot of time on this.

There was an interesting difference between girls and boys regarding risk priorities in the village. Based on our judgement, the ranking exercise shows that the gender division of roles affects the prioritisation of risk. For instance, boys were more sensitive to environmental risks (such as floods, cyclones, declining fertility of land) while girls were more sensitive to health, social risks, and wellbeing (child marriage, illiteracy, malnutrition, etc).

(c) Adults between 18- 24 years of age

In Radhakrishna Nagar village, adults irrespective of their gender were more concerned with seasonal risks, such as floods, cyclones, and saltwater intrusion. For them, the cyclone was the top priority. They have absolutely overlooked the social risks associated with the communities.

8.2.2 Causes and Solutions: What children and adults can do

In both the villages, children and adults were asked to discuss the causes and consequences, possible prevention strategies, the people responsible for reducing the risks, and the channels of communication used between them in relation to each hazard.

As shown in Table 8.4, the boys stated that increasing the height of the embankments will reduce the risks of flood and land degradation; tree plantation and awareness creation among the communities were suggested for embankment management. Girls suggested a more specific set of actions mostly related to physical infrastructures to reduce the risks of the flood (Table 8.4). For the girls, flood is caused by a lack of maintenance of the embankments rather than an increasing water levels of the rivers as was suggested by the boys.

When asked who are the responsible stakeholders, girls mostly ignored the role of the communities compared to the boys who discussed important roles of the communities along with other actors like- village local bodies, government departments, NGOs, schools, etc.

Table 8.4: Causes and consequences: as identified by the participants

Age group	Gender	Risks	Cause	Consequences	Prevention and mitigation	Responsible actors
13-17 years	Boys	Drinking water problem	Lowering of the water table	Scarcity of drinking water during summer	Frugally use water	Panchayet and community
		Erosion of embankment	Tidal waves and deforestation	Flooding of the entire region	Increase the height of embankments	Irrigation department, Panchayet and community
		Cyclone		Damage to kaccha houses Disruption of power supply	Tree plantation Create awareness	Meteorology department, Panchayet
		Flood	Increase in the water level of rivers and broken embankments	Submergence of houses, roads Harvest loss	Increase the height of embankments	Panchayet, BDO
		Declining fertility of the land	Intrusion of saltwater	Loss of crops	Increase fertility of the land	Farmers, Panchayet
		Deforestation	Cyclone, flood, anthropogenic	Soil erosion	Tree plantation	Panchayet, Community, NGO
		Lack of quality education	Poor education facilities	Lack of awareness	Create awareness	Teachers, Educated people within the community
		Child marriage	Lack of awareness	Illness, domestic violence	Awareness, education, Courage	Parents, NGO, Police, BDO

	Girls	Flood	Problem with embankment structure (construction quality)	Loss of crops, trees, fish, etc	Speed up the process of embankment repairing	Panchayet, Gram Sabha committee
		Cyclone	Deforestation and other natural reasons	Damage to houses, trees	Construction of pucca houses, tree plantation	Panchayet
		Virus infection	Lack of sincerity with hygiene	Illness and sometimes it can be fatal	Maintain hygiene	Doctors
		Lack of education	Personal problem, poverty	Superstition	Create awareness among the community regarding the importance of education, universal education for all	Teachers
		Child marriage	Girl children are considered as burden to the family	Negative impact on physical and mental health	Take help from the police, create awareness among the parents	Mahila Samiti
		Superstition	Lack of proper education and awareness	A barrier to doing anything good	Create community awareness	Educated people
		Malnutrition among the children	Early pregnancy and children do not get the proper care	Illness, lack of energy	Take care of the pregnant mothers, provide vitamin supplements to them	ICDS workers
		Water scarcity	Excessive extraction of groundwater	Water scarcity and lowering of groundwater	Create awareness among the community regarding water conservation	Panchayet, BDO, NGOs

		Lack of earning opportunities	No scope of work in the villages apart from agriculture	Decreasing access to cash	Create work opportunities with different organizations, work through different committees, self-help groups (livestock rearing, kitchen garden)	Panchayet, NGOs
18-25 years	**Boys**	Cyclone	Climate change	Damage to houses, Destruction of electricity poles Damage to betel vines	Concrete house, flood centre	Government, Community
		Flood	Climate change	Loss of crops, loss of livestock	Tree plantation, Concrete structure of the embankments	Government, Community, Panchayet, NGOs
		Erosion of embankment	Cutting down trees	Inundation	Tree plantation, Concrete structure of embankments	Government, Community, Panchayet, NGOs
		Degradation of agricultural land	Saltwater inundation, use of plastic	Low productivity	Tree plantation, Concrete structure of the embankments	Government, Community, Panchayet, NGOs
		Water scarcity	Saltwater	Community experience water scarcity, water-borne diseases	Frugally use water	Community
		Disruption of electricity supply	Cyclone	Community experience problem due to lack of electricity supply		

		Loss of harvest	Flood	Food scarcity	The concrete structure of the embankments, Tree plantation	Government, Community, Panchayet, NGOs
		Saltwater intrusion into freshwater ponds	Increase in water level in the river and flooding	Community gets diseases like- Malaria, typhoid, and skin diseases.	Concrete structure of the embankments	Government
		Loss of livestock	Flood		Concrete structure of the embankments	Government
		Absence of flood centre		The community faces problems with shelter	Construction of flood centre	Government
	Girls	Cyclone	Broken embankments	Damages to houses, Damage to the electricity polls	Every household should get concrete house	Panchayet and other government departments
		Erosion of embankment	Deforestation		Concrete structure of the embankments	
		Flood	Broken embankments	Loss of livestock, loss of pond fish	Flood centre, Tree plantation on riverbanks	
		Loss of harvest	Flood	Food scarcity, loss of crops		
		Water scarcity	Flood	Diseases	Elevated tube wells	
		Disruption of electricity supply	Cyclone			

Source: ***Field data, 2022***

8.3 Child Agency (capacities, challenges, supporting environment)

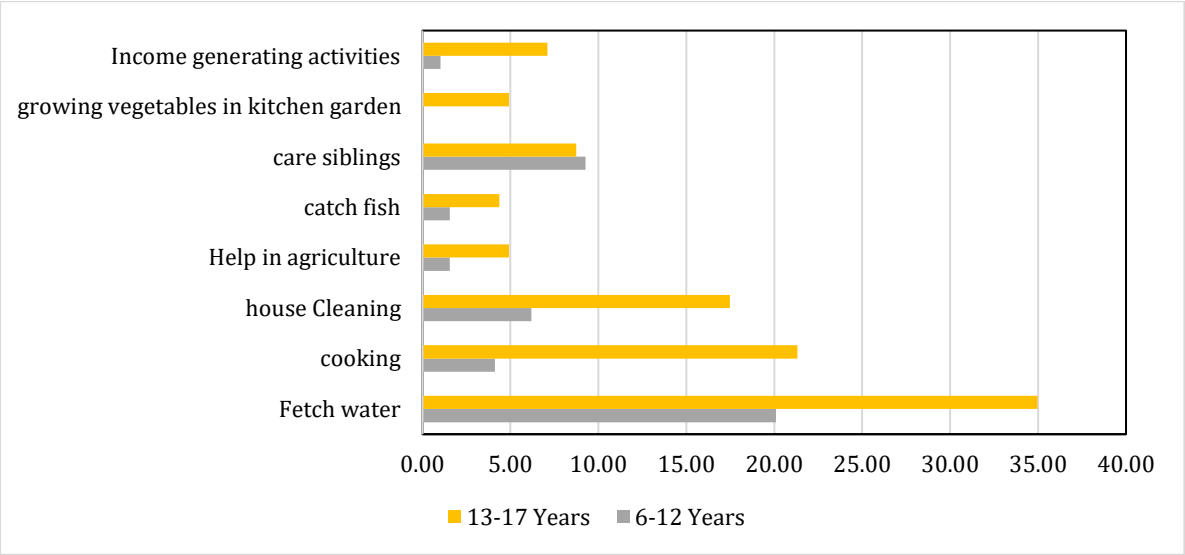
8.3.1 Capacities of the children in climate change related risk reduction

researchers found that younger children tend to work more on preventative measures, passing on information and understanding from training received from outside agencies to others. Several studies suggest that children can play an important role in communicating about risk and climate change within and beyond the community. Children have their own ways of conceptualising and understanding risks (such as flood, water scarcity, or harvest loss). They often relate their own understanding with technical information received from external information sources such as the intergenerational knowledge transfer, media, school curricula, and training sessions. The research aimed to understand children's roles as risk reducers using participatory and child-friendly processes, asking children what they could do to reduce risks. At the beginning of the activities, many of the children were unable to identify their roles in reducing the risks, however, through further interactions it identified that children of all ages irrespective of their gender played significant roles in risk reduction and resilience building, especially within the home space through caring for livestock, obtaining drinking water from the tube wells, collecting firewood from the forest, taking care of their younger brothers and sisters and undertaking typical household chores such as cleaning the home.

> *Whatever time I get I help my parents with handicraft work, clean utensils, help with cooking, clean the house, and take care of my siblings because my parents work outside and hardly get time to stay at home (12 years old girl, Gosaba Block)*

Scholars suggest that children already play an important role within their households and community and the risk reduction activities would be a simple extension of this responsibility (Heynes et al., 2010; Mudavanhu et al., 2015).

Figure 8.1: Children's participation in daily activities



Source: Fieldwork, SaciWATERs (February-March 2022)

When asked to brainstorm activities that they could carry out to reduce risks, children came up with a number of actions. While many are related to preparing and responding to disasters, many are also related to reducing risk in the long term (Table 8.5 and Table 8.6).

Gender differences between girls and boys were noted in these activities in terms of their roles in preparedness, prevention, and risk reduction and response. Based on the understanding, the capacity exercise shows that the gender division of roles plays a major role in deciding the roles in risks reduction.

Table 8.5: children's (13-17 years) views of what boys and girls can do to reduce disasters

What boys can do to reduce disasters		**What girls can do to reduce disasters**	
According to girls	**According to boys**	**According to girls**	**According to boys**
1. Work closely with other community members to fix the broken embankments 2. Stop cutting down trees 3. Help the victims in relocation to safe places during flood 4. report to the community about risks 5. Report to local government 6. Rainwater harvesting, stop wastage of water	1. report to the community about risks 2. Increasing soil load of the embankments and help in the maintenance of it 3. Increasing awareness regarding the use of organic manure 4. Stop cutting down trees and tree plantation 5. Create awareness to stop child marriage	1. Tree plantation 2. Create awareness among the locals 3. Help others in keeping physically and mentally fit 4. Create awareness about the importance of education 5. Report to the community about the risks of child marriage 6. Create awareness regarding water conservation and why it is important to stop wasting water	1. Water conservation 2. Create awareness among the locals through postering 3. Help the victims, especially those who are unwell, the elderly, and children 4. Plant trees 5. Help siblings in their studies 6. Discuss with the peer group so that they don't take in wrong steps

Table 8.5 presents remarks showing how children's groups view the roles of girls and boys in relation to disaster risk reduction. Both girls and boys have focused on the physical capacity of

the boys and according to them, the boys can actively participate in the work of increasing the height of the embankments and their maintenance. Boys think that girls have a major role in water conservation as women and girls bear most of the responsibility of fetching water.

Table 8.6: 18-25 years

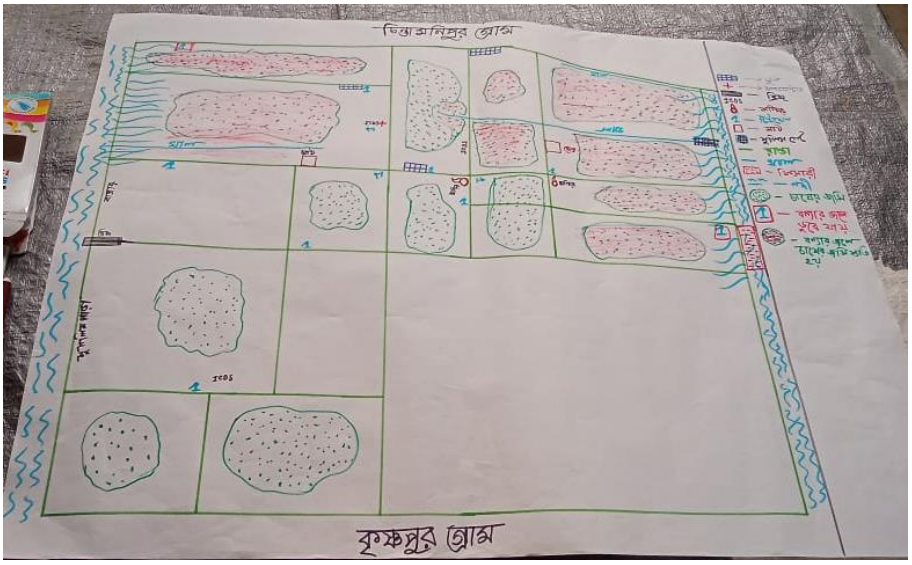
What boys can do to reduce disasters		**What girls can do to reduce disasters**	
According to girls	**According to boys**	**According to girls**	**According to boys**
1. Help in the construction of embankments	1. Plantation of saplings 2. Write an application to the local panchayet 3. Look after the saplings so that cows/ goats cannot eat those 4. Awareness creation among local communities 5. Stop using plastic products 6. Help in the construction of embankments	1. Plant trees along river banks 2. Look after the saplings so that cows/ goats cannot eat those	1. Plant trees along river banks 2. Look after the saplings so that cows/ goats cannot eat those 3. Take a leadership role in reducing deforestation 4. Create awareness among local communities

Table 8.6 presents remarks showing how adult men and women view the roles of girls and boys in relation to disaster risk reduction. No visible gender differences between young men and women were noted in these activities identifying equal roles in preparedness, prevention, and risk reduction and response.

This research highlights the potential of keeping children at the center of community-based efforts to reduce risks (hazard risks and social risks). Children constitute a central part of the community yet their potential as agents of change has largely been bypassed in many community-based adaptation programmes. A number of studies point out that as the generation inherits disaster risks, they have a right to be included in decision-making affecting their future.

Both the children's groups (girls and boys- 13-17 years) produced resources cum risk maps (Photo 8.1) that show flooded and non-flooded areas. They also identified safe zones in case of an emergency like- a cyclone or flood. Thus, children's risk knowledge can provide important inputs for the risk reduction efforts, and can help to identify adaptation measures.

Photo 8.1: Resource cum disaster risks map of Gobindapur Village prepared by girls group



Source: Fieldwork, 2022

Earlier studies have shown that children can make significant contributions to reducing risks (Mitchell et al. 2008) and strengthening community resilience. It begins in the household space as children take part in a lot of daily household chores when they are as young as 6 years old. For instance, girls fetch water, cook food, clean the house, and even help their parents and other household members in growing vegetables in the kitchen garden. Boys, on the other hand, herd cattle, catch fish, and some help in fetching water. Children also drop out of school in order to help their parents in farming activities and participate in paid labour to contribute to family income. Older children take younger siblings to and from school, help them to learn to swim and warn them about some of the impacts of flooding such as drowning.

Having access to disaster information increases their ability to assist in risk awareness. Children can interpret and relay messages to communities (Lopez et al. 2012). Many school children act as risk communicators in Mahendranagar village of Patharpratima. In the patharpratima block, a group of children (13-17 years) took the initiative to clean a football ground and informed the village panchayat after cleaning, so that it can stay clean even in the future. After seeing the initiative taken by the youth, the panchayat has given the responsibility of the waste management in the village to the youth volunteers. Children are given the responsibility of distributing waste management-related materials, such as pamphlets and flyers, to educate the community. This was confirmed by NGO workers in this study, who indicate that in a meeting with the Panchayat head they were informed about this initiative.

Children are also found to be involved in village-level child protection committees at the Gram Samsad level[47]. Contrary to this, it is also found that the school safety plan (part of the district disaster management plan) does not provide any space for the children, while it includes their parents.

[47] http://wbscps.in/link/pdf/guideline/CPC_Modified_Guideline_070915_Final.pdf

8.3.2 Challenges and constraints to taking part in discussions on climate change effects on their lives

The study demonstrates the participation of children in the DRR depends on a number of factors. On the one hand, it depends on the ability of the children to conceptualize and analyze the risks, their communication skills, and innovative ways through which they can improve their current and future wellbeing in a changing climate. On the other hand, it depends on a range of interpersonal, community level, organization level, and public policy factors.

Although children seem to be involved in part of the community services, this research noted that the community does not always take active roles during disasters. The community to some extent has become dependent on external assistance and resources provided by various humanitarian agencies and by the government and has become quite reluctant to prepare for or to mitigate disaster situations. The experts, NGO workers, and community members interviewed blamed this on the lack of resources, widespread poverty, lack of unity, and increasing rate of outmigration among the youth male in the community. They also highlighted that most of the external assistance provided was for survival purposes immediately after a disaster, such as the provision of food, freshwater, cooking oil, medicines, etc. While these types of immediate response aid are essential, however, it limits people's capacity for resilience or creates their own survival strategy. This situation makes children's long-term participation in DRR difficult to realize.

Despite the many risks faced by children and their readily acknowledged limited roles in society, disaster outcomes often represent children as passive victims in need of rescue by outsiders. Yet children can demonstrate resilience in the face of disaster. Adolescent girls in Mahendranagar want to be engaged. The children say that they want to help the local panchayet in reducing the water scarcity the region is having by increasing awareness of the local community regarding stopping the wastage of groundwater. Children felt that since they were actively involved in farming and provide most of the labour in household activities they could also contribute to reducing the disaster impacts. The children believed that their active involvement in DRR activities would help to reduce the community's risk of natural hazards.

Although children indicated their willingness to be involved in DRR activities, scholars argue that their involvement is limited to having their opinions being considered but it is adults who make the final decision about what is in a child's best interest. Adults proved that they rarely seek children's views and do not provide space for children to participate. There were no structures in place or steps taken to ensure that children affected by disasters participate in DRR activities. Despite the information that children had about disaster, there was no evidence of the provision of options from which children might choose to express their views or participate in DRR.

Adolescent girls' group in Mahendranagar village of Patharpratima demonstrate that they do not have a say in decision making even in issues that affect their lives such as wastage of water. Discussion with the girls notes that they were often not listened to, taken seriously, or respected, rarely allowing children, especially girls to speak out even on issues that matter and affect their lives. Adults had all the power and had a tendency to announce what they want the children to do without any consultation. Thus, children's participation suffers from a lack of support. Decision-making in all issues is the domain of the adults.

Although children are sometimes assigned and informed depending on their age, they are neither involved nor invited into the decision-making process. Children have very limited space in which to voice their concerns. In Mahendranagar children claimed that adults do not understand and do not give them space to be heard, which also is the case in Gobindapur, Gosaba. Participation of children in community meetings was not a common practice in the study area, however, different NGOs, like- SPAN have taken initiative to engage youth volunteers in the development planning of the Sundarbans region. For discussion on issues, like- child marriage, school dropout adults find it important to involve the children in order to assist with ideas to reduce the vulnerability of young girls.

Studies have shown that there are a number of factors that cause barriers to effective participation among children in risk reduction activities. These factors can be divided into five interrelated categories:

(a) ***Children as individuals:*** Interest level for children varies based on various factors, like- gender, socio-cultural background, etc. As a result, not all children have the same strengths or abilities. It is found that some may show interest whereas others are unsure and may lack support from adults to continue. It is important to mention that the right to participation is complex and there are many socio-cultural factors that affect the realization of such rights among the children and their caregivers. Children might find it difficult to work on their own, they constantly look for a supportive environment. A number of organizations trying to address children's needs, while very few among them are effectively practicing these on the ground. There are organizations like- SPAN, PRAJOK trying to strengthen the individual capacity among the children through different sports and leadership training.

(b) ***The commitment and support of parents for children's participation*** is also found to be low in the Sundarbans region. It is already noted in chapter 7 that the communication gap between children and parents is quite prevalent in the rural areas of Sundarbans. A number of reasons were identified during the fieldwork for the low level of support. A number of parents (especially mothers) indicated that it is an adult's responsibility to protect children from the physical risks of extreme climatic events and do not want their child to be part of it as it could bring traumatic experiences. As a result, parents are reluctant to encourage their children to become involved. However, many parents think that children can be part of activities and planning that are related to social risks, like- eloping and child marriage.

(c) ***Poor perceptions about the role of children*** in DRR has been identified as a common issue among adult. Parents have a tendency not to trust children's views and this tendency has increased in the last 5 years as many adolescent girls have taken the decision to elope and get married at a very early age. Therefore, the adults have a tendency to doubt children's motivation and activities if done without parental guidance. This results in a parental belief that they alone are responsible for giving orders and that the role of children is to receive and carry out those directives. Parents fear losing control over their children when the children become more confident and assertive. 7 out of 10 mothers have indicated this in Lahiripur village of Gosaba Block during a focus group discussion.

(d) ***Socio-Cultural factors*** also hinder participation by children in DRR. Different cultures have different ways of relating with children, and not all cultures favour a proactive role for children. Sundarban region is not an exception in this regard. Children are traditionally regarded as having a lower social status than adults and their participation is viewed as challenging in the existing power dynamics, which portray children as passive agents in the

society. This limits the opportunities for children to be heard in DRR. It is already mentioned in the earlier section that problems stated by the children are not taken seriously many times. There is a belief the community members that listening to children's views is an urbanised concept and listening to children may create problem in the future. Gender inequality and lack of security is another factor that restricts especially girls to participate in any public discussion forum. *"Even while we go to fetch water, it feels like if someone accompanies us it would be better for us. When we go there to fetch water, local boys pass comments on us. We feel afraid all the time."*

(e) ***Children's right to express their views in decision making is ignored in policy making***. As a result, it is difficult to apply a systematic approach to children's participation in DRR without a policy commitment to do so and a real shift in cultural values. The majority of Sundarban's children are not aware of their rights, such as the right to education, health, information, and participation.

With these factors working against the rights of children to express their views in DRR, children in our survey noted that they would appreciate being asked for their opinion before decisions are made, especially on issues that are of interest to them. The children feel that with adult support they can express their views freely.

8.4 Recommendations

Despite the roles performed by children in the community as thoroughly described in chapter 7 and chapter 8, the most important concern raised by children is their limited roles in DRR. Children's views are not being asked for and they are rarely consulted and their opinions are not taken into consideration most of the time. It is found that there are no DRR activities for the affected communities and specifically for children. There is hardly any scope for children to talk about disaster-related risks (physical as well as social) in the area and their collective voice is not heard in any action plans. It is found that an initiative was Caritas India in 2016 to include the children in DRR activities, however, any such initiatives have been taken at the policy level. The well-being of children is assumed to be the responsibility of parents and caregivers and therefore is not considered in DRR planning. Yet children's practical and creative ideas and their unique knowledge and experiences of their local environment can provide important input to DRR efforts as has been reflected during the focus group discussion.

It is argued by Peek (2017) that when children are included in decision-making, vulnerability can be reduced and resilience to disaster risks can be enhanced. However, children need to have proper access to resources and information for that.

Based on this study, we recommend a number of measures so that children's suggestions can be considered in DRR in the Sundarbans region. Since the main aim is children's meaningful participation, the government and local community can act together with non-governmental organizations to make sure that:

(1) children's views are heard

(2) there should be a platform where the children will be able to express their views freely; and

(3) there are necessary steps taken to ensure that all children affected by disasters take part in action plans.

In this case, all the stakeholders need to follow a child-friendly method where the disaster-affected children are asked for their views on the issues that affect them and have a chance to say how they would want to be involved in order to reduce disaster impacts on their lives. Children need to be asked for their consent to participate; they should not be included or excluded forcefully, but they should be encouraged to engage themselves in the activities.

Children's views can be meaningful when children have access to right information about events that affect them, and are given the opportunity to express their experiences. The expression of children's views also depends on their cognitive ability based on their knowledge base and should not be based on their age, cultural background, and/or socioeconomic status. Stakeholders can achieve this through the provision of enough time to understand children's views, issues, and perceptions, and can make available child-friendly information on community-based DRR so children can act responsibly. To facilitate children's participation, the government, should be working together with organizations that deal with children and can educate the community on the importance of children's participation in DRR. Very recently, the National Institute of Disaster Management has started a training programme on Child Centric disaster risk reduction. The education sector can also consider including DRR in the education curriculum, which could be formal or informal. Parents can also provide the emotional and intellectual resources (intergenerational resources) needed for children to express their views freely.

Including children's suggestions in the DRR plan is a complex issue. Listening to children does not mean that their opinions should be automatically recommended, but it does imply inclusion and an ability to influence decisions. Children are different from adults and face a different kinds of problems during disasters. However, engaging children cause adult opposition. Since these children are under the custodianship of the adults, the family and community context in which they live can present barriers to their engagement.

There is a need for child-frindly activities and role models for greater involvement of children. There is also a need for further context-specific research on how children's views can be considered by the policymakers.

9 RECOMMENDATIONS AND WAY FORWARD

The understanding of climate change impact child health, wellbeing and protection and their adaptation needs helped in making recommendations as part of the study. It is to be noted here that while recommendations related to adaptation measures specific to issues like child health, migration, child protection and disaster risk reduction are already presented in Chapter 5, 6, 7 and 8, this chapter discusses more on the cross-cutting recommendations in order to develop and strengnthen policies, institutional roles and financial strategies to enable implementation of the proposed adaptation needs, along with a time frame for an implementation plan for proposed adaptation measures.

This chapter is divided in three parts. The first section focuses on the key impact of climate change on child health, migration and protection in the Indian Sundarbans region. The section section discusses the strategies to mainstream climate change adaptation needs in the existing plans and policy framework, and the third section concludes the chapter with way forward.

9.1 Key Findings

The key impact of climate change on children in the Sundarbans region is summarised below:

- As a low lying deltaic region at the edge of the Bay of Bengal, the Sundarbans region has historically and geographically been a cyclone affected region.
- Sundarbans regions shows a high prevalence of child marriage and adolescent pregnancy.
- climate change is one of the determining factors for the health outcomes for this region. While the incidences of death, injury, and drowning resulting from the direct exposure to extreme weather events have declined massively in the last few years due to better preparedness and risk management strategies in the Indian Sundarbans region. Contrary to this, the disease burden among the children is still quite overwhelming followed by extreme weather events.
- With the increasing frequency of cyclones, floods, and drought events there are chances of increased incidences and epidemic outbreaks of infectious diseases.
- The increasing cases of anemia (low hemoglobin) among the reproductive age group women have been identified as another major public health problem post-disaster period in Indian Sundarbans region.
- The indirect impacts of climate change on child and maternal health mediate through two pathways, i.e. through water insecurity caused by a disruption in freshwater services due to depletion of groundwater, increasing level of salinity in groundwater and surface water; and through food insecurity caused by the decrease in farm production, crop failure, the decline in fish production, etc.
- Disruption in normal ways of life due to extreme weather events brings emotional trauma and disorders to the children. Extreme climatic events also create a lot of stress among pregnant mothers, especially for those who live in island villages surrounded by rivers.
- With a geography susceptible to cyclonic storms, poor groundwater availability and access, lack of irrigation, and single cropping season, this region has long had processes of migration ingrained into its socioeconomic fabric.

- The blocks with high/very high climate exposure have high percentage of households (above 60% hhs) with migration while those with low exposure or have relatively lower (below 50% hhs) incidence of migration.
- Temporary cyclic migration was found to be the major form of migration in the region overall. Labour migration in the region is facilitated through highly informal processes by independent contractors, familial connections and social networks.
- It is found that while the migration percentages among children are low, their early involvement in the labour market sets the stage for their migration for work in their early youth.
- Given the prevalence of early marriage in the region, marriage migration holds relevance for the youth, their capabilities and vulnerabilities. As child marriage has also been a prevalent age old practice in this region, the actual extent of marriage migration is not easy to ascertain since most households do not reveal cases of child marriage for a fear of administrative/punitive action.
- Child marriage was stated to have significant implications for child vulnerability both for boys and girls.
- A high incidence of girl child trafficking reported in the Sundarbans region by civil society and government stakeholders.
- The increasing frequency and intensity of climate-related extreme events are likely to increase the protection risks to children in the form of increased child labour, child marriage, teenage pregnancy, abduction, recruitment into fighting forces, sexual violence and labour migration.
- Violence at home by parents/caregivers is the most common form of violence experienced by children of the Indian Sundarbans region.
- It is expected that stressors related to extreme climatic events, including concerns over the shelter, health, food security and income, could exacerbate this violence against children, both increasing the risk to children already in abusive and neglectful households, as well as increasing the potential for over-stressed parents/caregivers to become violent or abusive.
- A number of parent or caregiver factors potentially contributing to the maltreatment of the children were identified during the field study. These include lack of patience, the young age of a parent, absence of one parent, lack of education, household responsibility, and poverty.
- Of all the categories of child abuse, neglect and violence in the Sundarbans region, exploitative child marriage has received perhaps the greatest attention. It is reported that the tendency of underage marriage has massively increased in the last 10 years in the Sundarbans region. The survey found that child marriage has been found to increase a woman's chances of being abused.
- Exposure to the digital world has increased the likelihood of exploitation among children in Sundarbans region.
- While children are most affected by natural disasters given their physical and psychosocial vulnerability, disruption of services, high dependency on parents or other caregivers, and limited scope of representation and voice.
- There are no DRR activities for the affected communities and specifically for children. There is hardly any scope for children to talk about disaster-related risks (physical as well as social) in the area and their collective voice is not heard in any action plans.

9.2 Mainstreaming Climate Change Adapatation Strategies in the context of Child Protection

It is already discussed that the outcomes of changing climate, such as greater frequency and severity of extreme weather events, changes to average temperature and precipitation, and sea level rise, etc. have implications for a region's geo-environmental and socio-economic situation. As climate change poses a risk to development and wellbeing of the communities, the development planning should take account of the anticipated impacts of climate change. However, it is reported that the efforts to mainstream climate change adaptation into national development planning are still at a relatively early stage in India, while it is the utmost need of the present hour. Given the cross-cutting nature of climate change impacts, it is crucial that adaptation policies or strategies are formulated as part of broader policies for development. Some broader issues are recommended here in that respect:

Decentralized planning:

Inclusive planning by involving the stakeholders from different sectors and different levels should be one of the underlying principles of climate change adaptation in India. Given the diverse socio-economic setting of the country, it is very important. It has been reported during the survey that most of the times the communites has very limited participation and little voice in any kind decision making process. The key to addressing this issue is ensuring participatory planning and continuous dialogue between communities, policymakers and implementing agencies. There should be adequate platforms and processes that enable all sections of the communities, especially the marginalised and the vulnerable including children, to voice their needs and concerns. Also, the investment framework for any plans and strategies should focus on a decentralised process that delegates the power to plan and implement to the communities in the given context.

Convergence with existing policies and actions:

In the past few decades, substantial public investments has benn made towards socio-economic development through implementation of various schemes. There area some remarkable initiatives implemented in the country for the child and maternal health, like- Mid-day Meal, ICDS, ASHA, ANM, etc. Apart from that there are others schemes, like- MGNREGS, RKVY, NRLM, for the overall socio-economic development. To undertake the proposed specific and cross-cutting adaptation strategies, it is important to converge or integrate with existing government policies and actions. This will help in optimising the efforts through bringing in collaborations between different policies/actions and different sectors by converging funds, institutional technical expertise, social mobilisation or other aspects related to planning and implementation.

Allocation of funds for climate centric initiatives:

While both the central and state government has allocated funds for the initiatives, like- disaster manangement in the budget plans, however, it is often insufficient for effective climate interventions. Therefore, there is a need to identify and gather funding from different sources. Apart from government sources, there are different financing instruments like grants and loans that can be explored. Pooling of financial resources and blending of funds with the existing funds could be one of the focus areas of the investment framework.

Multi-sectoral planning:

It is already seen while discussing the insulating layers that a number of stakeholders from multiple sector play roles in environmental and climate action and child development and protection in India. This includes different levels of government (national, state, district and local government institutions), international development agencies (donor and funding agencies, etc.) and the private sector (corporates, philanthropic institutions, civil society organisations, academics, etc.). These stakeholders undertake different roles of varying capacities at a larger or limited geographic scope. It is important that the framework identifies the current and potential roles of these stakeholders in climate action planning and collaboration strategies for larger impact. A roadmap has be to prepared based on the existing gaps in order to facilitates integration and cooperative collaboration among stakeholders. An ingrated framework should bring together and promote interdisciplinary and multisectoral planning.

Baseline data on climate change impacts:

It is already mentioned in chapter 3 that the availability of time series secondary data has been a bottleneck for the climate change impact study. There is a need of proper geo-referenced database for researchers and planning agencies to carry out extensive climate-vulnerability assessments and policymakers to take informed decisions based on such assessments. A geographic information system (GIS) based dash board can be developed as a support system for planning and monitoring of adaptation interventions.

Ensuring livelihood security, poverty alleviation and social protection:

It has been already discussed that a number of child protection and wellbeing related issues of the Sundarbans region are directly and indirectly linked to the livelihood insecurity and poor economic conditions of the households. This further intensifies due to the impact of frequent extreme climatic events in this region. Therefore, formal and informal social protection and safety net programmes, including microfinancing, SHGs, social insurance and community-led initiatives (e.g. grain banks, seed banks and tool banks), are important to absorb the effects of climate change on livelihoods. A special attention has to be taken for the marginalized section. Bringing new safety net programmes and linking them with existing programmes such as the MGNREGS and crop insurance programmes is important. There should be a specific formal financial policy to cater to the rural economy of India, including simple terms and conditions for a labourer to access credit at a nominal rate. Ensuring village-level availability and accessibility of basic livelihood services to all people, irrespective of their caste, class and gender, especially post-disaster period is critical. The availability of quality services, such as farmer extension centres, FPOs will help communities to avail information and support in a timely manner, without disrupting their work.

Building knowledge and awareness of climate change and its impact:

There is a need to build capacities among the locals regarding climate change, its impact on communities and the implications for children. Stakeholders from multiple levels and multiple sectors including policymakers, government institutions (especially local government bodies), civil society and community organisations, NGOs, among others – should be sensitised through customised awareness-building activities. Schools can take active roles in imparting knowledge and awareness to children. Disaster and climate risk education can be integrated into the formal education curriculum. Local governance and service providers at the field level should be trained on specific risks and impacts of climate change especially in their local context. Media reporting can play a key role in spreading awareness. The capacity of the media to cover climate-related

reporting and focusing on social, economic and environmental issues should be strengthened. It is important that the needs of the marginalised and vulnerable population are taken into consideration in the awareness-building initiatives.

9.3 Way Forward

As repoted in the study, children bear the burden of climate change disproportionately as it affects their fundamental rights of survival, protection, development and participation. They are particularly susceptible to health impacts and physical injuries due to their limited capacity to deal with the extreme weather events and dependency on their caregivers. The impact is not physical but they also face emotional distress and trauma in the aftermath of climate-related disasters due to high rates eco-stress, loss of life and property, and other psycho-social issues. Children are also more susceptible to water and vector borne diseases. Their daily lives are affected as a result of extreme weather events like floods and droughts. In extreme cases, they are forced to drop out of school to support their households by offering their labour and time. Girl are more sometimes more vulnerable as sometimes they are pushed into child marriage. It is highlighted that the communities, especially the ones that are marginalized (low class, landless, women), are severely impacted.

This need assessment study tried to identify and analyse the threats to the children interms of health, protection and wellbeing induced by climate change by assessing climate-related hazards as well as the sensitivity and adaptive capacity of communities and children. Since climate change a continuous process, it is expected that the impacts of climate change will get more severe and devastating in the future, the children are constantly under a vulnerable situation. The study therefore by identifying the existing gaps in plans and policies suggests building resilience amongst communities and children through adaptive strategies and by mainstreaming climate change in policy formulation and decision making. A child-centred participatory approach to policies and widespread planning to protect child rights as mentioned in UNCRC is required at different levels of administration in India.

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