ASSESSING CLIMATE-INDUCED NON-ECONOMIC LOSS AND DAMAGE IN THE SUNDARBANS

A REPORT

CANSA South Asia

EnGIO

Center for Participatory Research & Development CPRD

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ASSESSING CLIMATE-INDUCED NON-ECONOMIC LOSS AND DAMAGE IN THE SUNDARBANS: A REPORT

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EXECUTIVE SUMMARY

Mapping Non-Economic Loss and Damage in the Climate-Vulnerable Sundarbans Region

Spanning over 19,000 sq km across southwest Bangladesh and southern West Bengal, India, the Sundarbans is the world's largest contiguous mangrove forest and unique habitat for the Royal Bengal tiger. Known for its rich biodiversity and cultural heritage, this transboundary region is one of the planet's most climate-vulnerable zones. Its low-lying geography, dense population, and ecological sensitivity expose communities to frequent cyclones, tidal surges, riverbank erosion, salinity intrusion, flooding, and sea-level rise. These hazards, amplified by unsustainable human practices and governance gaps, cause not only economic damage but profound Non-Economic Loss and Damage (NELD), including loss of life, mental health, cultural identity, education, and ecological stability.

This study comprehensively documents climate-induced NELDs across the Sundarbans (Bangladesh's Shyamnagar and Koyra Upazilas and India's Gosaba and nearby blocks). It draws from household surveys, Focus Group Discussions, and Key Informant Interviews, aligned with the five NELD categories defined by the UNFCCC to promote policy relevance and global coherence.

Key Findings

1. Climate and Non-Climate Drivers of Loss

In both Bangladesh and India, climate hazards such as cyclones, flooding, riverbank erosion, and salinity intrusion cause widespread damage. In Bangladesh, 73% of households were affected by cyclones, 51% by flooding, 29% by riverbank erosion, and 25% by salinity intrusion. India has witnessed increased frequency and intensity of cyclones, including Cyclone Amphan (2020), causing immediate destruction and prolonged psychosocial harm. Vulnerability in both countries is amplified by unsustainable shrimp farming, unplanned land use, poverty, and inadequate infrastructure.

2. Displacement and Migration

Forced migration is a recurrent impact, with 15% of Bangladeshi families displaced at least three times and 3% displaced four or more times. In India's Sundarbans, Ghoramara island has shrunk to less than a quarter of its original size over 40 years, displacing thousands. Cyclone Amphan alone displaced 2.4 million people in India, with many experiencing long-term displacement due to destroyed homes. Displacement results in loss of ancestral land, overcrowding, community breakdown, and erosion of cultural identity in both countries.

3. Health and Psychosocial Impacts

Post-disaster trauma, limited access to healthcare, and environmental stressors severely impact physical and mental health. In Bangladesh, 79% of affected populations reported diarrhoeal diseases, 73% skin infections, and 47% skin burns, with 52% experiencing menstrual complications. A poignant case from India's Sundarbans highlighted the psychological impact: a pregnant woman forced to deliver in a cycle-van due to destroyed infrastructure survived, but the trauma endured. These health challenges underscore the invisible and lasting effects of Non-Economic Loss and Damage (NELDs).

4. Water and Food Insecurity

Climate-driven water stress and declining agricultural productivity exacerbate food insecurity. In Bangladesh, 74% of households report salinity intrusion, 64% heatwaves, and 85% a decline in fish and crop production. Safe drinking water is inaccessible for 71% of families, disproportionately burdening women who often walk long distances facing harassment (84%), mental stress, and physical strain. In both regions, these pressures deepen dependence on unstable markets and threaten livelihoods.

5. Education and Child Protection

Disasters disrupt education and child well-being. In Bangladesh, 17% of households reported school dropouts linked to disasters, and 6% reported increased child marriages, driven by poverty, insecurity, and family pressures after displacement. Similar patterns emerge in India's Sundarbans where displacement disrupts schooling, increases domestic responsibilities for girls, and diminishes future prospects for youth.

6. Cultural and Spiritual Erosion

Losses extend beyond physical damage to spiritual and cultural domains. In Bangladesh, 44% reported loss of sacred sites, ritual objects, and traditional practices. In the Indian Sundarbans, displacement and environmental degradation prevent indigenous and forest-dependent communities from performing ancestral rituals, eroding identity and connection to the land.

7. Biodiversity Decline

Biodiversity in the Sundarbans is under severe threat, with 85% reporting aquatic species loss, 83% wildlife decline, and 43% disappearance of traditional medicinal plants. Climate impacts like heat stress and salinity disrupt both livelihoods and spiritual ties to the forest. Even housing adaptations, such as replacing thatch with corrugated metal, increase heat exposure and contribute to new vulnerabilities.

Key Recommendations

1. Institutional Recognition of NELDs

- Integrate Non-Economic Loss and Damage into national climate adaptation, disaster risk reduction, and recovery frameworks in both Bangladesh and India.
- Strengthen cross-border cooperation under the UNFCCC Loss and Damage mechanism to address shared challenges.

2. Resilient Infrastructure and Services

- Enhance access to climate-resilient housing, healthcare, and education in disaster-prone areas.
- Prioritise infrastructure to ensure safe drinking water access, with special focus on women and vulnerable populations.

3. Livelihood Diversification

- Promote sustainable and climate-resilient livelihoods beyond shrimp farming and vulnerable agriculture, particularly targeting women and indigenous communities.

4. Rainwater Harvesting and Water Management

- Invest in community-scale rainwater harvesting across the delta to alleviate salinity intrusion and water scarcity.

5. Cross-Border Collaboration on the Sundarbans

- Recognize the Sundarbans as an integrated transboundary ecological and socio-cultural landscape.
- Facilitate joint knowledge exchange, risk assessments, and people-centred climate actions between Bangladesh and India.

Conclusion

The climate crisis in the Sundarbans transcends environmental degradation to threaten the identity, dignity, and justice of millions. Non-Economic Loss and Damage, though often overlooked, profoundly affects the social fabric and spiritual life of affected communities. Meaningful climate resilience demands recognising and addressing these intangible, yet deeply felt, dimensions. This is not only a policy and scientific imperative but a fundamental moral responsibility for all stakeholders.

01 INTRODUCTION

1.1 NELD – global to local dynamics

Non-Economic Loss and Damage (NELD) refers to the adverse impacts of climate change that are not directly measurable in monetary terms or captured by market transactions. While economic losses – such as those involving infrastructure, assets, and income – often dominate disaster assessments and policy responses, NELDs encompass a range of intangible and often irreversible damages. These include loss of life, health, cultural heritage, biodiversity, sense of place, education, and human dignity, many of which remain unrecognized in mainstream disaster response mechanisms.

NELDs represent a critical component of climate-induced loss and damage (L&D), situated within the broader cost of climate change. This cost can be broadly categorized into three domains:
(I) **mitigation costs**, related to reducing greenhouse gas emissions;
(ii) **adaptation costs**, linked to preparing for and adjusting to climate impacts; and
(iii) **residual losses**, which persist despite mitigation and adaptation, and include both economic and non-economic dimensions. NELDs constitute a vital subset of these residual impacts, particularly in regions where socio-cultural and ecological systems are deeply intertwined with human well-being and cannot be captured through market-based evaluations.

According to the UNFCCC, NELDs occur across individual, societal, and environmental levels and can result from both **slow-onset processes** (such as sea-level rise or salinity intrusion) and **extreme events** (like cyclones or coastal floods). In climate-vulnerable areas like the Sundarbans – shared almost equally between Bangladesh and India – these losses often cascade across multiple spheres, with damage in one domain triggering further harms in others. For instance, environmental degradation may lead to loss of livelihoods, which in turn can drive forced displacement, erode cultural identity, and deteriorate mental health.

Beyond the measurable economic costs, climate change inflicts non-economic loss and damage (NELD) – irreversible impacts on lives, health, culture, and ecosystems –

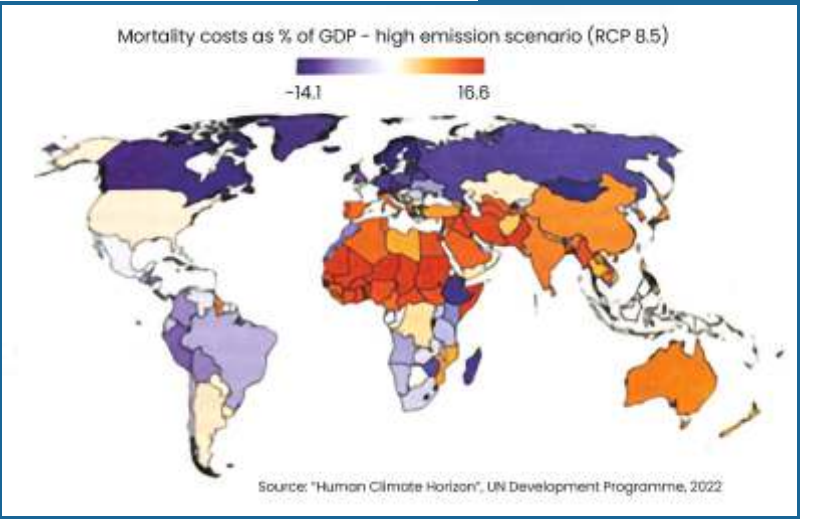
which are increasingly recognized as critical in global climate negotiations, as outlined below:

Adverse impacts of climate change

According to a report published in London School of Economics in 2023,[1] loss and damage (also being referred to as 'losses and damages') refers broadly to the adverse impacts of climate change on human societies and the natural environment that cannot be minimised through climate adaptation efforts or by reducing global greenhouse gas emissions. The report claims that these impacts have already been experienced sharply by several climate-vulnerable developing countries, especially small island developing states (SIDS). Sundarbans, an ecosystem being split between India and Bangladesh, also stands as a major example of incurring 'Loss and Damage' (L&D).

$16 million loss per hour

A 2023 analysis[2] found that, between 2000 and 2019, the world suffered at least $2.8 trillion in loss and damage from climate change – costing around $16 million per hour. According to Human Climate Horizon data, UN Development Programme 2022 by[3] 2040-59, several countries in the globe, especially in Asia and African continents, may suffer mortality related costs under worst emission release scenario (RCP 8.5) which may be as high as 16 percent of their respective GDPs.



1 "What is 'non-economic' loss and damage (NELD)?" 20 June 2023; an explainer written by Alejandra Padin-Dujon with review by Denyse Dookie and Georgina Kyriacou hthttps://www.lse.ac.uk/granthaminstitute/explainers/what-is-non-economic-loss-and-damage-neld/.

2 tps://www.nature.com/articles/s41467-023-41888-1

3 https://horizons.hdr.undp.org/

Driven by both immediate and slow onset events

Extreme weather loss and damage can be driven by extreme weather events like cyclones, droughts and heatwaves; as well as from slow-onset changes such as sea level rise, desertification, glacial retreat, land degradation, ocean acidification and salinization. In some cases, damages may permanently alter places; for example, rising seas encroaching on low-lying islands, or drought shrinking water supplies or turning once-productive farmland into barren land.

As per the report, loss and damage can either be economic or non-economic.

Economic loss and damage

These are quantifiable impacts, those affecting resources, goods and services commonly traded in markets, such as damage to critical infrastructure and property or supply chain disruptions. This can play out at an international or national scale as well as locally, such as impacts on individual farmers or communities.[4]

Non-economic loss and damage

Non-economic losses occur in three distinct areas: private individuals, society and the environment. More specifically, non-economic losses can be understood as losses of life, health, displacement and human mobility, territory, cultural heritage, indigenous/local knowledge, biodiversity and ecosystem services, among other things.[5]

NELD may be more significant than economic loss and damage

A UN Technical Paper [6] says that "... In many developing countries, non-economic losses may well be more significant than economic losses. Recognizing and managing the risk of non-economic loss should therefore be a central aspect of climate change policy". According to the UN Technical Paper, the total costs of climate change can be categorized as follows: Mitigation costs: "the cost of reducing greenhouse gas emissions to limit the extent of climate change"; Adaptation costs: "the cost of dealing with the consequences of unavoidable climate change"; loss and damage: "the residual costs, which are not avoided through adaptation and mitigation", and which, as stated, can be further split into: (i) Economic loss; (ii) Non-economic loss.

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4 For example, in Mousuni, Namkhana, about 90% families having their houses partially / fully damaged in subsequent cyclones.

5 In Lahiripur, Gosaba tribals losing part of their culture; and even titles!

6 "Non-economic losses in the context of the work programme on loss and damage: technical paper" (FCCC/TP/2013/2)

Non-economic loss and damage (NELD) also has a cost element

As explained above, non-economic losses are therefore one of the cost elements that constitute the total cost of climate change. There is a link between the magnitude of adaptation cost, mitigation cost, and loss and damage. Increasing the mitigation effort (higher mitigation costs) would reduce loss and damage and make adaptation cheaper. For example, greater mitigation should result in a smaller increase in sea levels and so less protection from sea level.

Valuing NELD cost

While valuation in common parlance is associated with money and therefore economic methods, a broader interpretation of the act of valuation is simply to "compare the relative merits of actions or objects"; several global examples are available.

Loss and Damage negotiation including NELD

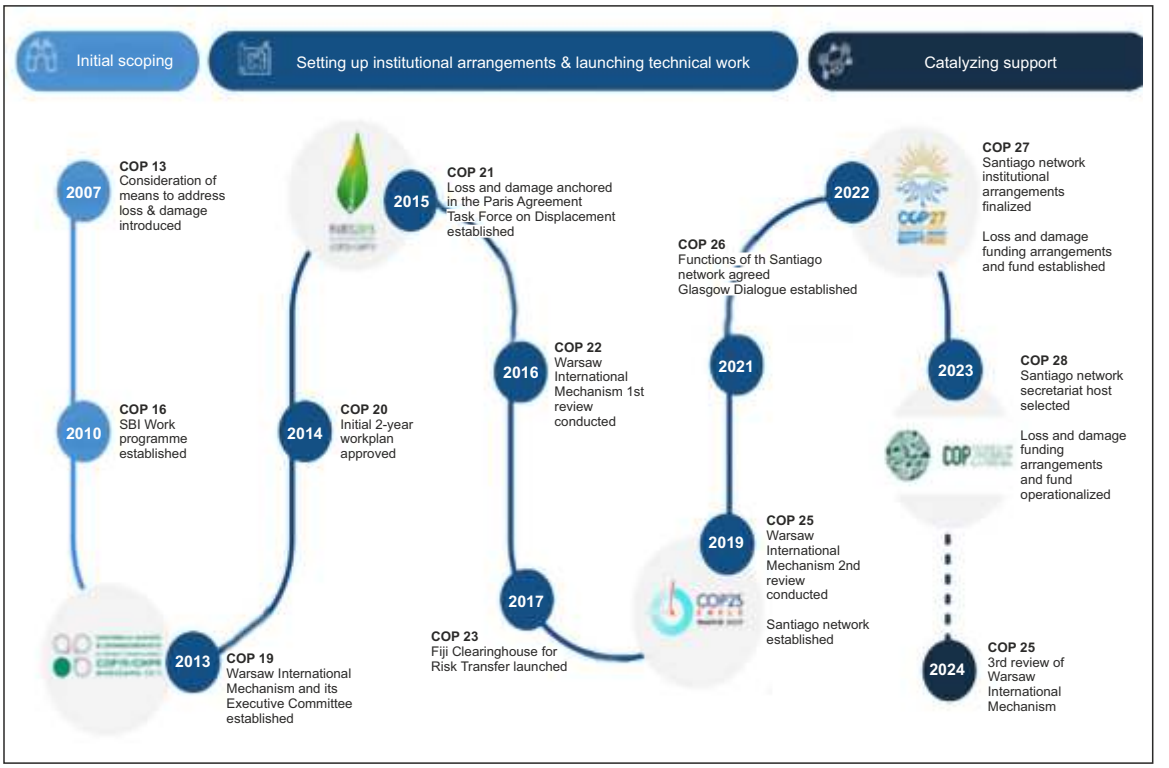

Diagram: UNFCCC's Loss and Damage Online Guide.
https://unfccc.int/sites/default/files/resource/loss_and_damage_online_guide.pdf?utm_

The term 'loss and damage' has been used in international climate negotiations since the 1990s:

- **1991** - Representatives from Vanuatu proposed that developed countries help pay for the financial burden of loss and damage.

- **2007** - The Bali Action Plan included a call for disaster reduction strategies and means to address loss and damage.

- **2013** - The Warsaw International Mechanism on Loss and Damage was established to share knowledge, strengthen dialogues, and mobilize expertise.

- **2015** - The Paris Agreement included Article 8, which focuses on the need to avert, minimize, and address loss and damage.

- **2019** - The Santiago Network for Loss and Damage was established to provide technical support to countries in need.

- **2022** - At COP27, member nations agreed in principle that a Loss and Damage (L&D) fund should exist.

- **2023** - At COP28, countries agreed to operationlize the Loss and Damage Fund, which will provide financial assistance to climate-vulnerable countries. The World Bank was invited to host the Fund secretariat and to operationalize the Fund as a financial intermediary fund (FIF) for an interim period of 4 years.

- **2024** – At COP29, significant Loss and Damage (L&D) negotiations took place, focusing on operationalizing the Fund for Responding to Loss and Damage (FRLD) and broader funding arrangements. A decsion was taken to operationalize the FRLD from 1 January 2025. In 2024 , COP 29, the loss and damage fund got about USD 730 million.

  In 2024, discussions around non-economic loss and damage (NELD) gained momentum, particularly within the context of climate change and disaster risk reduction. The Paris Agreement and the Sendai Framework for Disaster Risk Reduction both emphasize the importance of addressing these non-financial impacts, which can be devastating to individuals, communities, and ecosystems.

Adaptation planning, tailoring to local contexts key to NELD assessment

Evaluation and prediction of NELD also include accounting linked non-climate factors that determine the extent of loss and damage; for example, consideration of linked adaptation planning. Evaluations of NELD must be flexible enough to account for human capacity to adapt both before and after damaging impacts have occurred, and needs to be highly tailored to local contexts, given the diversity of local impacts.

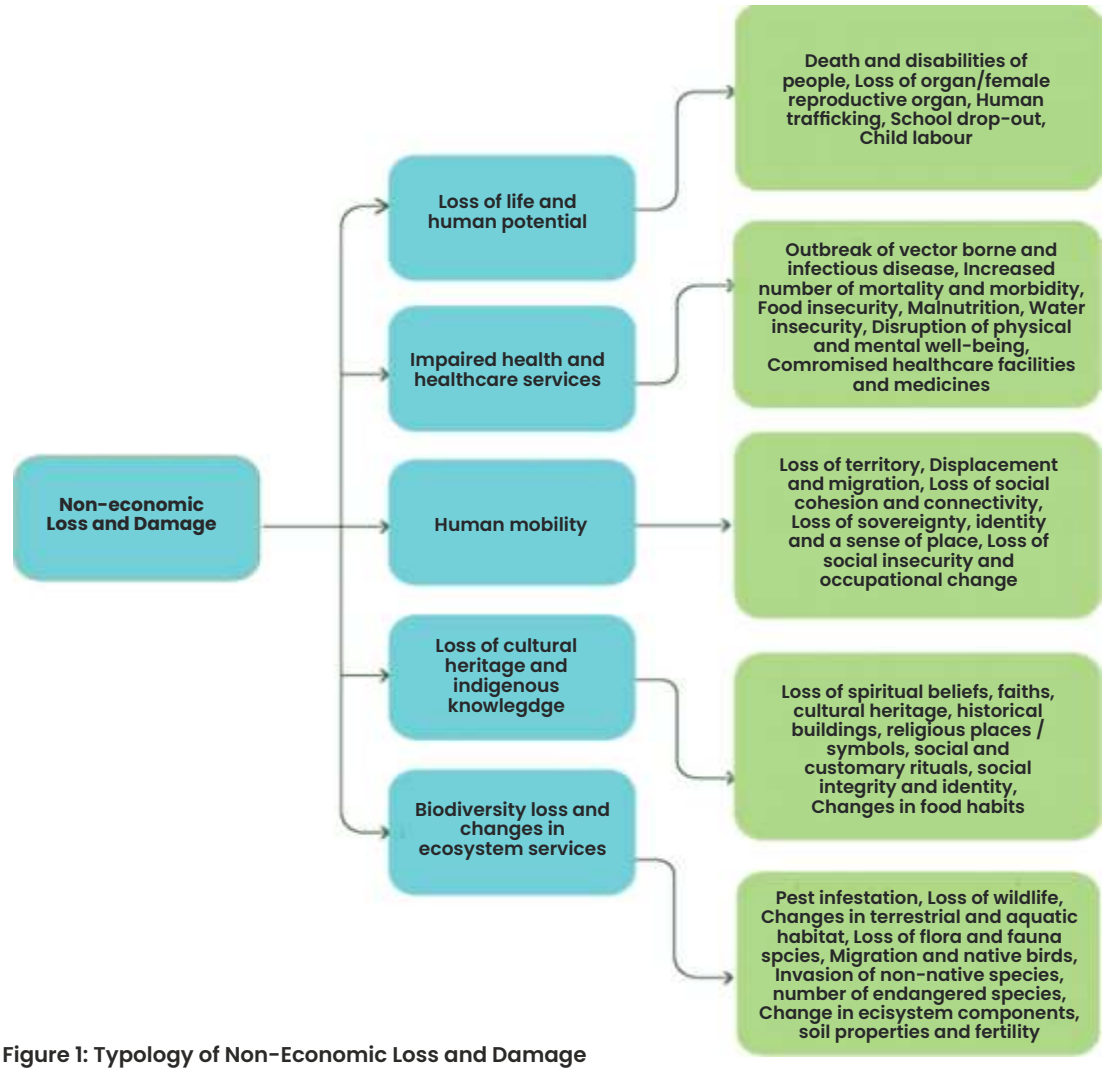

Figure 1: Typology of Non-Economic Loss and Damage

1.2 Non-Economic Loss and Damage in the Sundarbans

The Sundarbans, the world's largest contiguous mangrove delta and a globally significant socio-ecological system, is uniquely exposed to such climate-related NELDs. Spanning over 19,000 sq km – about 60% in Bangladesh and the remainder in the Indian state of West Bengal – the delta is home to more than **13 million people**. Both parts of the delta are facing increasing frequency and intensity of cyclones, sea-level rise, soil and water salinization, and ecosystem degradation.

Despite their scale and significance, non-economic losses in the Sundarbans are often overlooked in post-disaster responses and development planning. In **Bangladesh**, regions like Khulna and Satkhira are frequently affected by disasters such as Cyclone Aila (2009) and Cyclone Amphan (2020), which have led to deep psychological trauma, educational disruption, displacement, and loss of social networks – none of which are adequately addressed by existing compensation mechanisms. Similarly, in **India,** island communities in the South and North 24 Parganas districts continue to suffer the aftermath of cyclones and flooding, with stories such as that of a woman giving birth on a cycle van during Amphan epitomizing the silent suffering that eludes conventional metrics.

Recognizing this gap, the present study seeks to map and analyse the **non-economic dimensions of climate-induced loss and damage** experienced across the transboundary Sundarbans. This report combines field-based insights and institutional perspectives from both countries to generate an integrated understanding of NELDs in one of the world's most climate-vulnerable regions.

1.3 Objectives of the Study

The overarching aim of this study is to assess the nature, drivers, and implications of Non-Economic Loss and Damage (NELD) resulting from climate change in the Indian and Bangladeshi Sundarbans, with a view to informing more holistic climate risk reduction and justice frameworks.

Specifically, the study seeks to:

- **Identify and document the spectrum of climate-induced NELDs** – including loss of life and health, displacement, erosion of cultural heritage, biodiversity decline, and disruption of social cohesion – across both the Indian and Bangladeshi Sundarbans, aligning with the five major categories defined by the UNFCCC.

- **Examine contributory and compounding drivers** – assessing both climatic hazards (cyclones, salinity intrusion, flooding, erosion) and non-climatic pressures (systemic marginalization, governance gaps, livelihood dependence, ecological degradation) that exacerbate these losses.

- **Assess differential impacts on vulnerable groups** – analysing how NELDs disproportionately affect women, children, the elderly, persons with disabilities, and indigenous or forest-dependent communities.

- **Explore the interlinkages between non-economic and economic losses –** investigating how intangible losses such as mental health deterioration, forced displacement, and biodiversity loss translate into or intensify material and livelihood deprivations over time.

- **Analyse and amplify community responses to NELDs –** Document household and community coping strategies and adaptive capacities, with special attention to gender-specific experiences, psychosocial well-being, and resilience-building measures. By centring lived experiences and narratives that are often absent in formal loss and damage assessments, the study ensures that affected voices shape more inclusive, just, and context-specific policy frameworks.

- **Generate policy-relevant evidence** to support the integration of NELDs into national adaptation plans, disaster risk reduction strategies, and international climate negotiations, advocating for formal recognition and resources under the UNFCCC framework.

02
METHODOLOGY

2.1 Rationale for Study Area Selection

The study was conducted in carefully selected locations across both the Indian and Bangladeshi Sundarbans, representing regions with **high exposure and sensitivity to climate-induced hazards** and **deep socio-ecological interdependencies**. These areas have been repeatedly affected by cyclones, storm surges, saline intrusion, tidal flooding, and gradual ecosystem degradation – leading to extensive yet under-acknowledged Non-Economic Loss and Damage (NELD).

In **Bangladesh,** the upazilas of **Shyamnagar (Satkhira District)** and **Koyra (Khulna District)** were selected due to their recurring disaster impacts, high forest dependency, socio-cultural diversity (including indigenous communities like the Munda and Mahato), and observable limits of existing adaptation mechanisms.

In **India**, fieldwork was focused on blocks from both **central Sundarbans (Gosaba and Basanti)** and **western Sundarbans (Sagar, Namkhana, Kakdwip, Patharpratima)** in South 24 Parganas district, West Bengal. These areas have similarly witnessed repeated extreme weather events, compounded vulnerabilities, forest dependency, and ongoing cultural and ecological erosion.

Together, the selected locations offer a **transboundary socio-ecological lens**, capturing the varied yet interconnected impacts of climate stressors across the Sundarbans delta.

2.2 Description of Study Areas

In **Bangladesh,** six unions were selected:

- **Shyamnagar Upazila**: Burigoalini, Munshiganj, Gabura
- **Koyra Upazila**: Moharajpur, Uttar Bedkashi, Dakshin Bedkashi

These unions represent diverse livelihood profiles, ethnic demographics, and disaster exposure levels. The area is crisscrossed by rivers and canals and has significant depen-

dence on the Sundarbans for fishing, wood, honey, and golpata (mangrove palm leaves used for housing) collection.

In **India,** field studies were conducted in:

- **Gosaba and Basanti** (central Sundarbans)
- **Sagar, Namkhana, Patharpratima, and Kakdwip** (western Sundarbans)

These regions are representative of various climate risks, such as embankment erosion, saline water intrusion, biodiversity loss, and forced displacement.

An integrated socio-demographic and ecological summary of the areas is presented in Table 1 (Bangladesh side) and supplemented by contextual findings from the Indian Sundarbans.

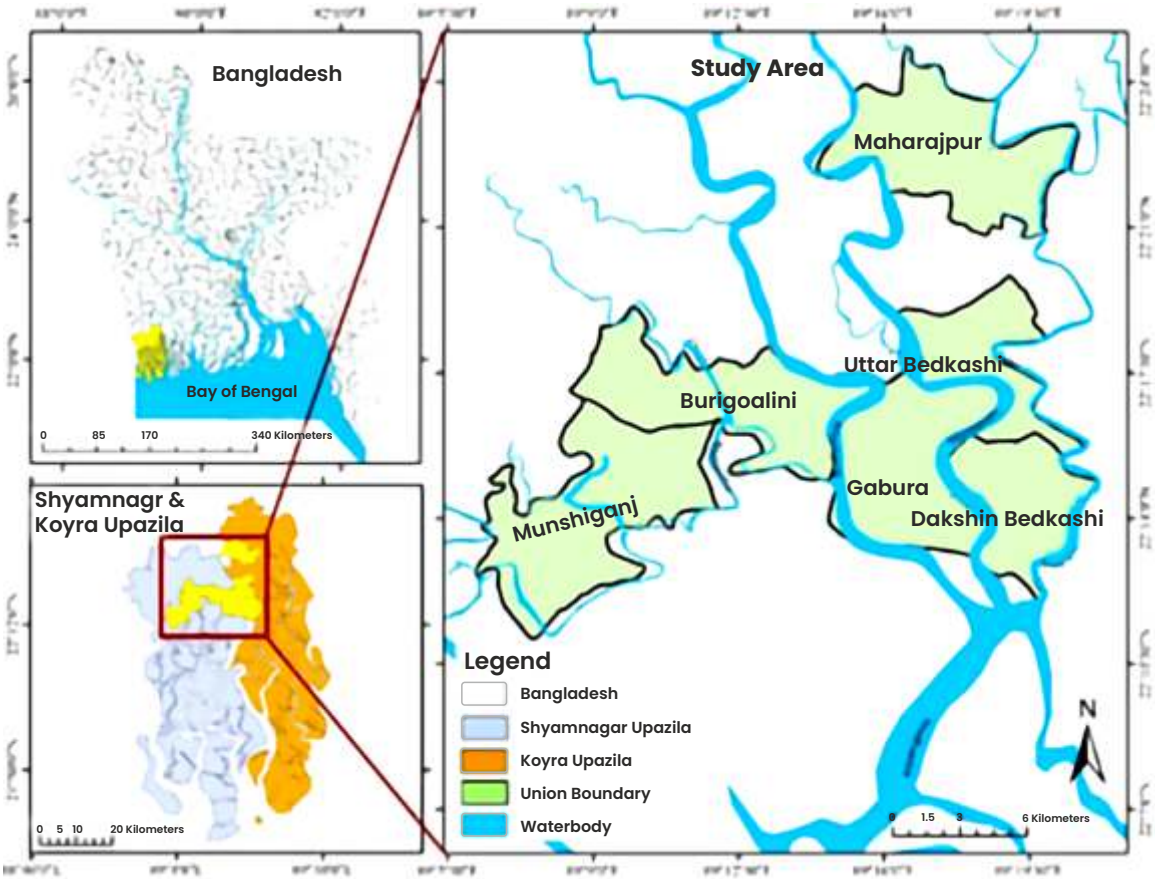

Figure 1: Study Area of the Bangladeshi Sundarbans

Table 1: Demographic Information and Climate Disaster Vulnerability of Study Area

Upazila	Climate Disaster Vulnerability	Union	Area (Sq. km)	Population	Literacy rate
Shyamnagar	High	Gabura	33	**38,825**	
		Munsigonj	49.00	**49,678**	66.25%
		Burigoalini	17	**34,445**	74%
Koyra	Moderate	Uttar Bedkashi	22.22	20,528	48%
		Dakshin Bedkashi	16.24	28,700	75.09%
		Moharajpur	42.38	**41,917**	

Source: Government of Bangladesh, 2025; Filho et al., 2022; and Tashmin & Islam, 2023

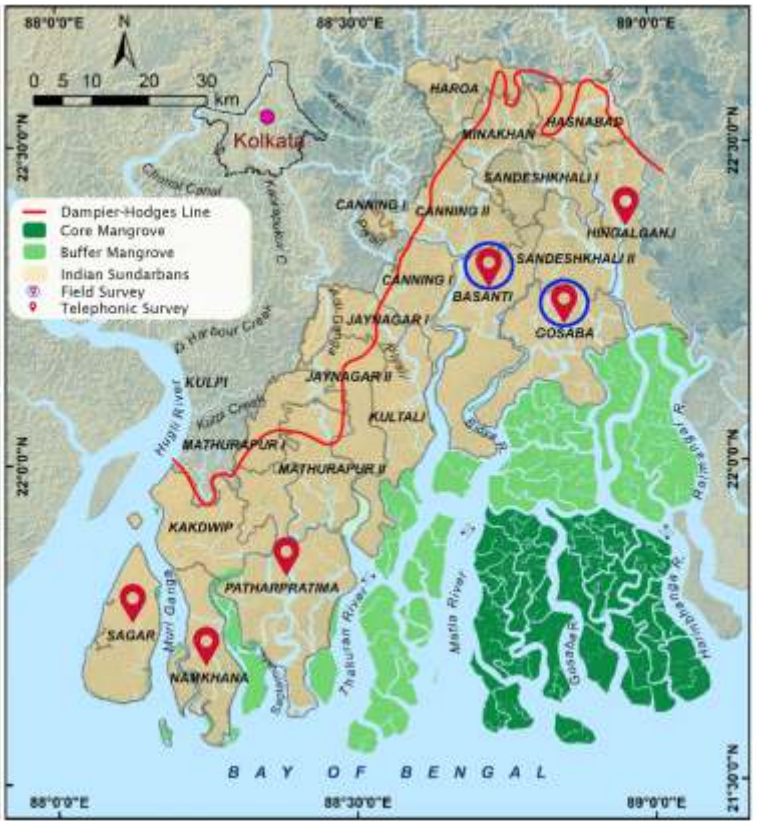

Figure 2: Study Area of the Indian Sundarbans, specifically Gosaba and Basanti Blocks. Source: https://doi.org/10.3390/rs13244957, modified by EnGIO

Table 2: Demographic Information and Climate Disaster Vulnerability of Study Area in Indian Sundarbans

Block	Climate Disaster Vulnerability	Gram Panchayat	Area (Sq. km)	Population	Literacy rate
Gosaba	High	15 Gram Panchayats (Amtali, Bali-I, Bali-II, Bipradaspur, Chhota Mollakhali, Gosaba, Kachukhali, Kumirmari, Lahiripur, Pathankhali, Radhanagar, Taranagar, Rangabelia, Satjelia, Shambhunagar)	297	246,598, 100% Rural	78.98%
Basanti	High	13 Gram Panchayats (Amjhara, Basanti, Bharatgarh, Charabidya, Chunakhali, Foolmalancha, Jharkhali, Jyotishpur, Kanthalberia, Maszidb2ti, Nafarganj, Ramchandrakhali, Uttar Mokamberia)	478.91	336,717, mostly rural	68.32%

Source: Census of India (2011). District Census Handbook; Government of West Bengal (2013). District Human Development Report: South 24 Parganas.

2.3 Sampling Strategy and Respondent Profile

To ensure inclusivity and representativeness, both countries employed a **stratified purposive sampling** approach that considered **occupation, gender, ethnicity, and forest-dependency**. In Bangladesh, 150 household-level respondents were selected across six occupational strata:

- Forest-dependent collectors (wood, honey, golpata)
- Fisherfolk (fishing, crab/shrimp/fingerling harvesting)
- Day labourers and seasonal migrants
- Formal/informal job holders
- Business operators (small traders, middlemen)
- Miscellaneous occupations (housemaids, van drivers, etc.)

Table 3: The distribution of respondents across different survey areas

Upazila	Union	Participant number	Gender Male Female		Persons with disaility	Total respondents
Shyamnagar	Burigoalini	35	42	48	5	90
	Gabura	23				
	Munsiganj	32				
Koyra	Dakshin Bedkashi	18	29	31	4	60
	Moharajpur	15				
	Uttar Bedkashi	27				
					Total	**150**

In India, approximately **200 individuals** were engaged using a **mix of stratified and snowball sampling**, across community members, youth, forest users, and climate-affected households. Participants included:

- 2 large focus group discussions (FDGs); one each in Gosaba and Basanti, with 40–60 participants
- 100+ individuals interviewed directly or in small groups (including approximately 50 children and youth)
- Informants from state and local governments, NGOs, and climate experts

Special attention was given in both contexts to ensure **gender parity, inclusion of indigenous voices**, and representation of **persons with disabilities**.

2.4 Data Collection Methods

The study employed a mixed-methods approach, combining **questionnaire surveys** with climate-vulnerable households, **focus group discussions** with diverse community groups, and **key informant interviews** with officials, NGOs, activists, and experts. It also included **in-depth narrative interviews** with groups such as schoolchildren, the elderly, and displaced people. These primary methods were complemented by an **extensive review of policy documents, media reports, and academic literature**, along with **photographic, video, and audio documentation** carried out with informed consent.

2.5 Thematic Scope of Inquiry

Both field instruments and interviews were designed to investigate multiple domains of NELD. These included:

- Demographic and ethnographic dynamics
- Livelihood shifts and economic distress
- Disaster exposure and coping experiences
- Health, sanitation, and psycho-social impacts
- Migration, displacement, and relocation patterns
- Cultural and spiritual losses
- Forest and biodiversity decline
- Food insecurity and service disruptions
- Adaptation practices and gaps
- Community perception of justice, dignity, and resilience

Both in India and Bangladesh, an **indicative UN questionnaire framework** was used as the basis for developing interview guides and FGD questions, which were then **contextually adapted to local realities, respondent categories, and cultural sensitivities.**

2.6 Data Processing and Analysis

The study combined **quantitative and qualitative approaches**, with a stronger emphasis on quantitative survey data, whereas qualitative methods, using thematic and narrative analyses enriched by field documentation and triangulation, were also used.

2.7 Ethical Considerations

Across both study locations:

- **Informed consent** was obtained verbally or in writing prior to each interaction.
- Participation was voluntary, and respondents were informed of their right to withdraw at any time.
- Sensitive information (particularly around trauma, displacement, or identity) was handled with discretion, and data anonymization protocols were followed where applicable.
- All visual/audio content was captured with explicit permission.

2.8 Limitations

- In some cases, there were challenges of physical access due to poor infrastructure and recent cyclone impacts occasionally limited field mobility.
- Some respondents expressed hesitance discussing sensitive issues such as displacement or mental health due to fear of stigma or reprisal.
- Cross-country comparative analysis is constrained by methodological asymmetry (structured vs. narrative-heavy data).

03

UNDERSTANDING NON-ECONOMIC LOSS AND DAMAGE

3.1 Demographic and Socio-economic Profile of Respondents in the Sundarbans

The study engaged a diverse cross-section of communities across the transboundary Sundarbans, covering the southwest coastal Upazilas of Bangladesh (Shyamnagar and Koyra) and multiple islands and blocks of the Indian Sundarbans (including Gosaba, Basanti, Sagar, Patharpratima, Namkhana, and Kakdwip). Respondents were drawn from both forest-fringe and non-forest areas, capturing the experiences of populations directly dependent on fragile ecosystems as well as those engaged in non-forest-based livelihoods. Special attention was given to the inclusion of women, elderly persons, youth, schoolchildren, and migrant families to ensure representation of the social groups most affected by climate change and its non-economic losses.

Gender and age diversity was a deliberate focus. Households included both male- and female-headed families, with women often managing households in the absence of migrant men. Children and adolescents formed a significant segment, especially in assessing impacts on education, health, and psychosocial well-being. Age distribution across the sample highlighted a predominance of working-age adults, with younger respondents providing critical insights into disrupted schooling and aspirations, while the elderly reflected on long-term changes to culture, livelihood, and identity.

Caste, class, and ethnic representation in India, along with varied livelihood groups in Bangladesh, underscored the socio-economic heterogeneity of the delta. Respondents included Scheduled Castes, Other Backward Classes, marginal farmers, landless labourers, fishers, crab collectors, and forest-dependent groups harvesting resources such as honey, wood, and golpata. Across both countries, the majority of households were low-income and climate-vulnerable, heavily reliant on natural resources, daily wage labour, small-scale agriculture, or fishing, supplemented increasingly by migration and remittances.

Education levels reflected widespread vulnerability. A large share of respondents, particularly in Bangladesh, reported no formal schooling or only primary-level education, while in India dropout rates among boys surged following cyclones and eco-

nomic migration. Girls displayed relatively higher retention, aided by government incentive schemes, though their education was often interrupted by domestic responsibilities or early marriage.

Livelihoods across the Sundarbans revealed overlapping patterns of precarity. Fishing, crab collection, and day labour were dominant, supplemented by small businesses, agriculture, and remittance-dependent incomes. Seasonal livelihoods were frequently disrupted by cyclones, saline intrusion, and flooding, pushing many families toward migration or relief dependency. Women in migrant households bore dual responsibilities for domestic and economic survival, while youth and children faced uncertain futures shaped by shifting roles, loss of opportunity, and psychosocial trauma.

Health and well-being emerged as major concerns. Malnutrition among children, poor access to healthcare, rising incidences of respiratory disease, and widespread trauma linked to repeated extreme weather events were reported across both regions. Human-animal conflict, particularly tiger attacks in forest-fringe villages, further compounded physical and mental distress. Migration – predominantly male-dominated – reshaped family structures and social dynamics, but also created new vulnerabilities, including child marriage, trafficking, and heightened risks for women left behind.

Taken together, the demographic and socio-economic profile of Sundarbans communities reflects a complex web of vulnerabilities shaped by climate exposure, socio-economic marginalization, and shifting household dynamics. The study highlights how non-economic loss and damage cuts across gender, age, caste, class, and livelihood groups, eroding not only material security but also education, health, cultural identity, and social cohesion across this fragile transboundary ecosystem.

3.2 Factors Impacting Loss and Damage (Economic and Non-Economic): Interplay between Climatic and Non-Climatic Drivers

Climate change in the Sundarbans does not act in isolation. It intersects with entrenched socio-economic vulnerabilities, governance challenges, and shifting livelihood patterns to generate both economic and non-economic losses and damages (NELDs). Together, these climatic and non-climatic drivers create a cycle of livelihood insecurity, displacement, and psychosocial stress across the India–Bangladesh delta.

Climatic Stressors and Disasters

Communities across the Sundarbans identified cyclones as the most frequent and devastating hazard over the last two decades, followed closely by flooding from heavy rain, tidal surges, salinity intrusion, and riverbank erosion. Major cyclones – Sidr (2007),

Aila (2009), Amphan (2020), Yaas (2021), and Remal (2024) – were repeatedly cited as turning points, causing extensive damage to homes, embankments, agricultural fields, and fisheries.

FGD participants in both countries emphasized that tidal heights and storm surges have increased over time, often surpassing the capacity of embankments and drainage systems. Sea level rise, currently advancing at more than 5 mm annually, compounds risks of inundation, saline intrusion, and displacement. Intensified heatwaves, erratic rainfall patterns, shortened winters, and unpredictable monsoons have further undermined agricultural cycles and seasonal livelihoods.

These climatic disruptions directly erode household assets, reduce cultivable land, wipe out aquaculture ponds, and destroy essential tools such as nets and boats. They also produce non-economic losses: trauma from repeated displacements, breakdown of family networks, and the erosion of cultural rhythms once tied to the six traditional Bengali seasons, now largely compressed into two.

Agricultural Decline and Food Insecurity

Salinity and flooding are the most significant drivers of agricultural decline across the delta, rendering once-fertile lands unproductive. Boro rice cultivation has been sharply reduced, and even canal water is often saline. Farmers report rising production costs, recurrent seedling loss from untimely rains, and heat-stressed crop failures. Cash crops like sunflower, betel leaf, and winter vegetables face reduced yields and market value. Livestock and poultry farming are equally stressed by fodder shortages and freshwater scarcity.

This decline in farm productivity forces communities into fragile alternatives: seasonal shrimp aquaculture, honey collection, crab fishing, or daily wage labour. Yet, each of these is highly climate-sensitive, with productivity regularly disrupted by salinity, heat stress, or cyclones.

Migration, Gender Shifts, and Social Strain

Faced with declining agricultural opportunities, male migration from both sides of the Sundarbans has sharply increased since Aila (2009). Men seek work in Kolkata, Surat, Chennai, Dhaka, or further afield, leaving women to shoulder domestic, caregiving, and farming responsibilities. While this sometimes enhances women's decision-making roles, it also leads to overwork, stress, and heightened vulnerability.

Remittances serve as a survival mechanism but create dependency and family separation. Children grow up in single-parent or elder-headed households, often with reduced educational opportunities. Teachers across the region reported high dropout

rates among boys (due to migration pressure) and intermittent attendance among girls, whose schooling is frequently disrupted by early marriage or caregiving responsibilities post-disaster.

Child Marriage, Trafficking, and Protection Risks

Recurrent disasters have also driven a surge in child marriage and trafficking. Families coping with economic loss often marry off daughters to reduce household burdens, while traffickers exploit post-cyclone desperation. NGOs in both countries have recorded spikes in trafficking cases after major storms, with adolescent girls lured into exploitative labour or early marriage. This represents a profound non-economic loss: the erosion of childhood, safety, and dignity.

Human-Wildlife Conflict and Psychosocial Trauma

As riverine and marine livelihoods decline, more people venture deeper into forests for crabs, honey, and fish. This has intensified encounters with tigers, leaving families fearful for loved ones' safety. Each attack generates long-lasting psychological trauma, not only for victims' households but for entire villages.

Anthropogenic and Non-Climatic Stressors

Beyond climate change, several human-driven and governance-related factors amplify vulnerability:

- **Land use change**: The widespread conversion of croplands into shrimp ponds since Aila has created a high-salinity landscape, reducing soil fertility and drastically lowering labour demand.
- **Lack of livelihood alternatives**: Vocational training and income diversification remain scarce, pushing households back into climate-sensitive and exploitative work.
- **Weak governance and exclusion**: Communities describe restrictions on forest access without adequate alternatives, corruption in relief distribution, and neglect of Sundarbans blocks from mainstream development programs.
- **Inadequate infrastructure**: Embankments, cyclone shelters, and drainage systems are poorly built or poorly maintained, often failing during disasters. Gender-responsive shelters and resilient housing remain rare, forcing many to stay in unsafe homes during storms.
- **Geographical isolation**: Remote locations like Gabura, Kumirmari, and island villages on both sides face physical inaccessibility, limiting investment, relief access, and political attention.

Fragile Transport System

3.3 Non-economic Loss and Damages: Direct and Derived Vulnerabilities

While structural factors provide a macro-view, the lived realities of individuals and communities in the Sundarbans bring the depth and nuance necessary to understand Non-Economic Loss and Damage (NELD) in full. Across this shared ecosystem, climate change-induced disasters are unravelling the social fabric, eroding cultural identity, and inflicting deep, lasting psycho-social wounds.

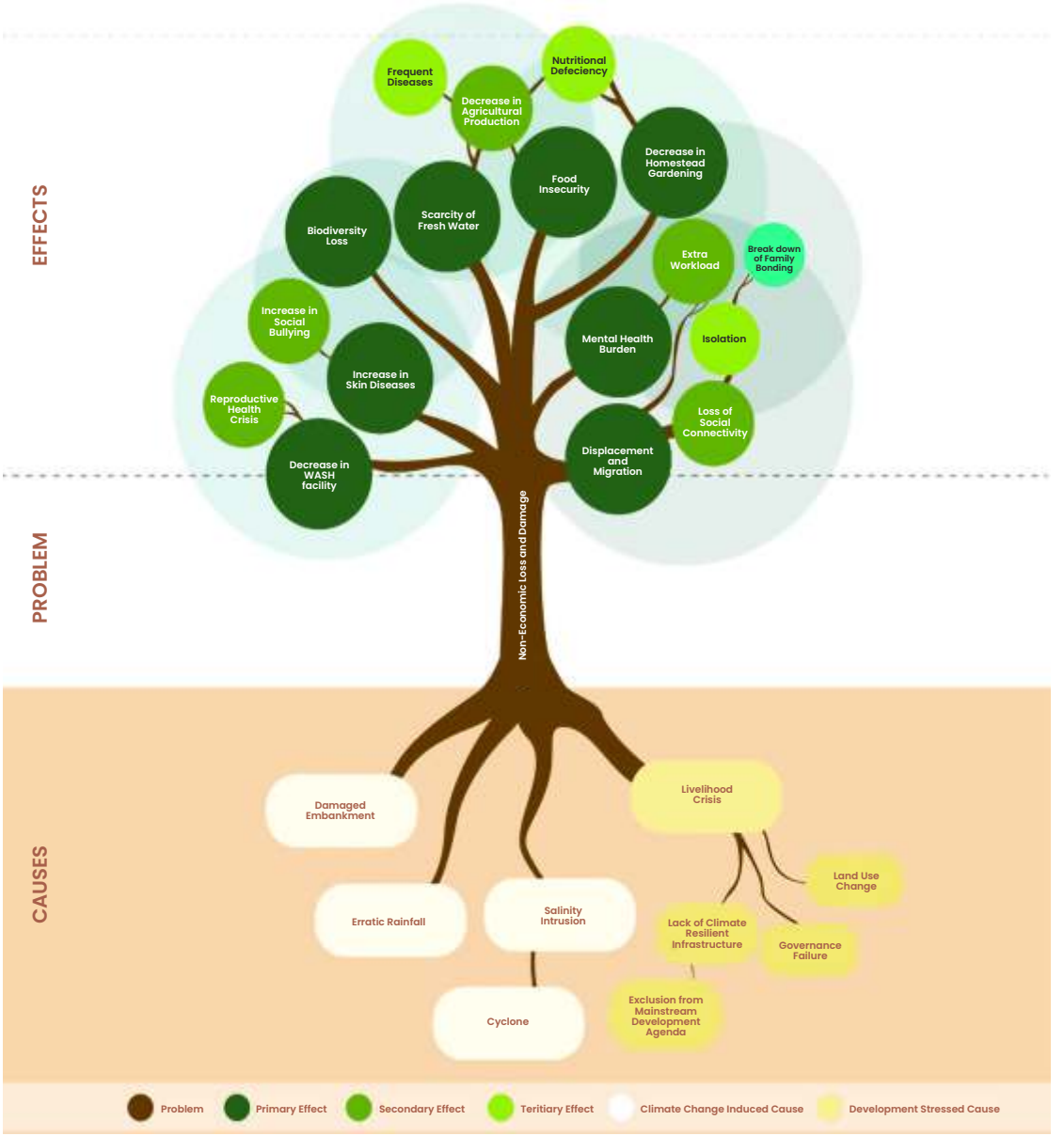

Figure 3: Causes, problem and effects of climate change on local communities

Loss of life, physical injury and disability

Climate change-induced disasters pose severe risks to human health, safety, and physical well-being. Among households surveyed in the Bangladesh study area, 8% and 13% of families respectively reported loss of life and physical injuries or disabilities due to frequent natural disasters. The onset of natural hazards, cyclones and compounding floods in particular, have devastating impacts on the physical safety of the most vulnerable groups, including the elderly, pregnant women, and children. These disasters not only leave little time to prepare or move to a safe place, but also pose severe physical risks, as collapsing homes, flying debris, and uprooted trees often injure those seeking shelter. Lack of climate-resilient housing structures and impaired healthcare systems considerably increase the likelihood of severe wounds and injuries, often resulting in long-term disabilities.

Displacement and Migration

Migration for livelihood remains a constant, dominant feature of life across the Sundarbans. In the last twenty years, approximately 30% of families in the Bangladesh study area faced displacement. A mass-scale migration from the Indian Sundarbans following Cyclone Aila in 2009 was remarkable in its number after saline water rendered much of the soil unfit for agriculture and fishery for years. While sudden-onset events like riverbank erosion and cyclonic floods are key drivers, cases of forced migration are growing due to slow-onset processes such as the gradual salinization of soil and water, undermining agriculture and overall habitability.

Displaced persons and migrants face a complex web of vulnerabilities. Research showed that sanitation challenges (67%), economic instability (60%), and exclusion from decision-making processes (53%) are the most pressing issues. Vulnerabilities are compounded by social exclusion and marginalization, as new settlers are often perceived as outsiders. The breakdown of social networks leaves people feeling isolated and alienated. With utmost despair, a displaced woman from Gabura expressed, **"Since we lost our home, I don't feel like myself anymore. We're surrounded by many here, but I feel completely alone."**

On the Frontlines: Displacement and Migration

Name: Nasia Khatun
Place of Residence: Gabura, Shyamnagar Upazila in Satkhira District, Khulna Division, Bangladesh
Age: 30 years
Climate crisis: Riverbank erosion

Nasia Khatun, a 30-year-old woman from Gabura, Satkhira, had been living contentedly with her husband and three children. However, in 2024, a sudden hit by riverbank erosion in the middle of the night destroyed everything. By morning, the erosion had completely submerged her home. She lost two houses along with 4 decimals of land. **"We stood there in the morning and saw the river where our home used to be,"** she says. **"It was like watching a part of ourselves disappear."**

Following the incident, she had to move to her parental home, a small two-room house already shared by four families. With no space for a bed, she sleeps on the floor, leading to constant discomfort. The absence of conjugal privacy intensifies her emotional distress. Even basic needs like bathing are compromised, as she must share a single pond with 18 others. **"I wait until it's dark or very early morning to take a bath,"** she was saying quietly. **"It's humiliating. I don't feel like myself anymore."** Her husband became paralyzed from working in brick kilns, exhausting their savings. Trapped in a cycle of deprivation, relocation seems impossible.

An Altered Social Fabric: The Fallout of Migration

One of the strongest impacts of climate change-induced migration is felt in the altered family structure. In what is described as an "Absent Parents Syndrome," children are often left with elderly grandparents or other relatives. Teachers across the Sundarbans stressed that this has directly impacted children's education. With parents away, children experience less care and control.

In the Bangladesh study area, children from 17% of families were forced to abandon schooling. In the Indian Sundarbans, teachers reported that young boys begin to drop out before the secondary level. “A class VII student from our school left for Surat (in Gujarat in west India) for work,” says Shibshankar Haldar, a teacher in Basanti. For adolescent girls, the crisis is compounded. Minor girls are often forced into early marriage, seen as a coping strategy to deal with financial instability or a form of risk transfer. “We had no one to stay with my daughter after we left. Marriage seemed like the only way,” shared a mother in Dakshin Bedkashi.

Shibshankar Haldar

On the Frontlines: School Dropout and Child Marriage

Name: Sabikun Nahar
Age: 19 years
Address: Number 9 Shora, Gabura, Shyamnagar Upazila in Satkhira District, Khulna Division, Bangladesh

Sabikun Nahar, from a village beside the Kholpetua River, is one whose dreams were derailed by disaster-induced poverty. She excelled in school, always securing first place. “Seeing my report card was the only time my parents smiled,” she recalled. However, her family's fortunes collapsed after Cyclone Aila in 2009. Repeated cyclones forced them to take high-interest loans, and the debt became unmanageable. Despite her parents' wishes, Sabikun was forced to stop studying after achieving GPA 5 in SSC. “My parents cried when they told me I couldn't go back to school,” she said softly.

Under relentless economic pressure, her parents accepted a marriage proposal when she was 17. She was married to a local fisherman and brick-field worker. Now she endures physical and mental abuse. Mother to a 13-month-old son, Sabikun deeply regrets leaving school. **“If I could complete my education, I could at least earn some money and contribute to my family. I would have a voice here. What I dreamt to be and where I am now!”** she exclaimed with grave frustration.

Climate change-induced trafficking

It has been proved time and again that every time a cyclone hits the Sundarbans, trafficking of girls and child marriage go up. As families are impacted severely, they may accept a 'marriage' against receiving a hefty sum, or allow a young girl to migrate for a job which often turns out to be trafficking. "Trafficking went up significantly after Amphan, during the pandemic," says Nihar Ranjan Raptan, founder of Goranbose Gram Bikash Kendra. "When the family income suffers, women and girls suffer most." Traffickers target impoverished families, luring them with false promises. Often, outsiders push for early marriages knowing that families are socio-economically vulnerable just after disasters and, hence, easier to be manipulated.

Compounded Crises of Health and Well-being

Water and Sanitation Crisis

A gradual rise of salinity in freshwater sources has significantly restricted access to safe drinking water. Households primarily rely on open ponds, shallow tube wells, and rainwater harvesting, but these sources are often contaminated or only seasonally available. Accessing safe water is a pressing challenge, with women primarily responsible for its collection. They often walk 1-1.5 km, spending hours that could be used for income generation, and face physical strain and verbal harassment.

Declined production of homestead vegetables due to increased soil salinity

On the Frontlines: Drinking Water Crisis

Name: Moyna Khatun
Place of Residence: Dakshin Bedkashi, Koyra Upazila, Khulna District, Bangladesh
Age: 32 years
Climate crisis: Increase of Salinity

Moyna Khatun, a 32-year-old mother of four, was abandoned by her husband. To support her family, she collects fish fry[7] and works as a labourer, earning only BDT 5,000-6,000 per month. The rising salinity has created an acute drinking water crisis. The nearest source of potable water is 4 kilometres away, requiring over two hours to fetch a small amount. Each trip for water means a loss of income. As a result, her family often relies on polluted local sources, which frequently cause waterborne diseases. "When my daughters get sick from dirty water, I feel helpless. I can't afford the money to visit a doctor."

Her daily battle between collecting water and earning an income represents a loss of agency and choice. **"When I have to earn money, I have to drink dirty and salty water, there is no choice,"** says Moyna. **"Water has become heavier than anything I carry. Not just in weight, but in the way it steals my time, my strength, my peace,"** she says, her eyes fixed on the cracked floor of her one-room house.

Disease, health burdens and feminine health crises

Disease prevalence is alarmingly high, with diarrhoea/dysentery (79%), fever/cold/cough (73%), and skin diseases (73%) being most common. A significant percentage (33%) of women suffer from uterine problems, potentially due to prolonged exposure to saline water and lack of sanitary hygiene. In Gabura, a female UP member[8] reported that approximately 60–65% of women have undergone uterus removal surgery.

7 Fish fry are the juvenile or larval stage of fish, particularly those collected from wild estuarine waters for use in aquaculture ponds.

8 A "female UP member" is an elected female representative on the Union Parishad council in Bangladesh.

Mental stress and compromised psycho-social well-being

The mental well-being of communities is significantly eroded by the compounded effects of climate change. Major factors include lack of safe drinking water (71%), loan burden (65%), and lack of family security (62%). The trauma of losing hard-earned financial resources leaves long-term scars, and the constant fear of future displacement exhibits a continuous, heavy psychological burden. This is especially acute for children. Interviews with nearly 50 students across the Indian Sundarbans on their experiences of disasters evoked a common response: scare. Nearly 90 percent of young respondents suffer from this fear.

Death of livestock immediately after consuming contaminated saline water

On the Frontlines: Where the mind is with fear

Name: Youth
Place of Residence: Different islands in Gosaba and Basanti blocks, South 24 Parganas district, West Bengal, India
Age: 12-16 years
Climate crisis: Loss of home and school leading to mental stress

Voice 1:
"Our mud house was almost fully devastated... since then I always feel building up of fear in my mind whenever black clouds gathered on the horizon; the trauma just refuses to go away." -
Mallika Mukhopadhyay, 16 years, from Amtali island in Gosaba block.

Voice 2:
"All my books and study materials got swept away. It was like hell and I still feel the fear." - **Bristi Jana, 14 years, from Satjelia island of Gosaba.**

Voice 3:
"I have seen three cyclones so far... I always fear when the next cyclone will come." - **Soumojit Naskar; 12-year-old, from Basanti island.**

Voice 4:
"My father and my uncle have gone to Kerala in search of a job... I feel terrified for them [my siblings] thinking about the next disaster." - **Rajdeep Mondal, 14-year-old, from Taranagar island, Gosaba block.**

School premises destroyed due to cyclone

Loss of Religious and Cultural Practices & Biodiversity

Climate change has deeply affected the religious and cultural practices of the Sundarbans communities. Riverbank erosion has wiped out many traditional worship sites. Cyclone Aila destroyed the abundance of the Karam tree, an essential element of Karam Puja, forcing the Munda communities to refrain from performing this ritual. "Without the tree, it's not the same puja. We do it, but we no longer find comfort in it anymore," shared a Munda elderly person. This erosion of identity is tied to the loss of ancestral land and sacred spaces.

On the Frontlines: Fear of loss of prayer place

Name: Niranjan Bishwash
Place of Residence: Kolbari, Burigoalini, Shyamnagar Upazila, Satkhira District, Khulna Division, Bangladesh
Age: 36 years
Climate crisis: Riverbank Erosion

In the forest-adjacent village of Kolbari Jelepara, a fragile temple dedicated to Bonbibi, the revered forest goddess, is on the brink of destruction. For over two decades, fourteen families have centered their spiritual life around Bonbibi. But worsening riverbank erosion has brought the river frighteningly close. As temple caretaker Niranjan Bishwash shared, **"The temple has gone into the river's belly. Soon, our houses will follow."** The community lacks the land or funds to relocate the temple. **"Our lives and livelihoods depend entirely on the forest, and Bonbibi, the forest goddess, is our protector. If the temple is washed away, who will protect us then?"** This is not just the loss of a building. It is the erosion of belief, identity, and collective memory.

Biodiversity is also declining at an alarming rate, with communities perceiving that 85% of fish and aquatic species and 83% of wildlife are facing extinction. Salinity rise

has dramatically altered plant physiology, with Sundari trees facing a high incidence of top-dying disease. A 60-year-old fisherman said, "In my days, dragging a net in the Khulpetua River offered plenty of fish. Now, even after hauling nets all day, I can't catch enough for a single meal."

Tiger Widows of the Sundarbans

Among the many challenges, that the fragile deltaic ecosystem of mangroves and tidal rivers has, is human–wildlife conflict for its vulnerable human communities. Its geography has created a particularly heartbreaking social phenomenon known as the **"Tiger Widows."**

In this region, many men venture into the dense mangrove forests or rivers to fish, collect honey, or gather wood – livelihoods that expose them to the danger of Bengal tiger attacks. When these men are killed, their wives are left behind, often ostracized by society and burdened with stigma, poverty, and insecurity. Known locally as *"Bagh Bidhoba"* (tiger widows), these women face compounded vulnerabilities: loss of income, social exclusion, and limited access to land or resources due to patriarchal norms.

The plight of the tiger widows is not just a story of tragic encounters with wildlife but also one of **non-economic loss and damage** – the erosion of dignity, social identity, and community belonging. Their lives reveal how climate vulnerability, fragile ecosystems, and traditional livelihoods intersect to create cycles of suffering that cannot be measured in purely economic terms.

On the Frontlines: Tiger Widowhood and Climate-Driven Livelihood Risks

Name: Nilima Sarkar and Kuntala Sarkar
Age: 30 years
Place of Residence: Dayapur, Gosaba Block, South 24 Parganas district, West Bengal
Climate Crisis: Salinity intrusion reducing fish catch, forcing deeper entry into tiger habitats

Nilima Sarkar and her sister-in-law Kuntala lost their husbands to tiger attacks within just five years. Their village, Baghedhora – literally "the place where tiger caught" – is infamous for such tragedies**. "What is my fault? What is the fault of my sister-in-law? Or my mother-in-law? All of us lost our husbands to tiger attacks,"** Nilima asked, her voice trembling.

Researchers confirm that rising river salinity due to sea-level rise and reduced freshwater flows has drastically reduced safe fishing options. Fishermen are compelled to spend longer hours in narrow canals near dense forests, particularly during low tide, where tiger encounters are common. EnGIO researchers found that around 85% of tiger attacks happen under such conditions.

The impact is both economic and deeply social. Families lose breadwinners, widows are denied government compensation on technical grounds, and many face stigma as "ill omen." "There has been hardly any support from the government or the society at large," said a villager. Estimates suggest nearly 20 tiger deaths annually, though official counts remain much lower.

Loss of Tribal Lives and Livelihoods, Language and Culture

In the fragile and climate-vulnerable landscape of the Sundarbans, the tribal communities – Munda, Santhal, Bhumij, and Oraon – stand at the intersection of environmental crisis and cultural erosion. As the earliest settlers of the region, their history is interwoven with the forests, rivers, and mangroves they helped cultivate and protect. Yet, the combined pressures of climate change, poverty, and social marginalisation are erasing not only their means of survival but also the intangible heritage that defines them.

Increasingly frequent cyclones, rising salinity, and dwindling fish stocks are pushing these communities deeper into precarity. Many have lost family members to tiger attacks while venturing into forests for honey or fish – a long-standing occupational hazard now compounded by extreme weather events that reduce safer livelihood options. At the same time, the gradual shift towards mainstream Bengali language, customs, and surnames signals a deeper, quieter loss: the fading of tribal identity.

Climate change, often measured in economic terms, here manifests in the loss of traditional knowledge, oral traditions, and cultural practices – forms of non-economic loss that are seldom compensated and rarely reversed. This case study from the Sundarbans reveals how climate impacts are not only destroying homes and livelihoods but also dismantling the social and cultural fabric of some of its most vulnerable inhabitants.

On the Frontlines: Tribals Losing Lives, Livelihoods, and Cultural Identity

Name: Tribal women of Tipligheri village (collective narrative)
Age: 18–80 years
Place of Residence: Tipligheri, Satjelia Island, Gosaba Block, South 24 Parganas district, West Bengal
Climate Crisis: Cyclones, rising salinity, shrinking livelihoods, and cultural erosion

In a mud hut in Tipligheri, tribal women shared stories of losing husbands to tiger attacks and of their youth gradually losing tribal identity under climate stress. "The rest of the Sundarbans hardly cares about us. We are kept at the fringe. Our youth now speak more in Bengali than in our native tongue," explained Shanti Sardar, an elderly widow. Many families are changing surnames from *Sardar* to *Sarkar* to align with Bengali norms.

The Munda, Santhal, Bhumij, and Oraon – Sundarbans' earliest settlers – face compounded marginalisation. They cleared forests during colonial settlement drives, and generations later, continue to face disproportionate losses from tigers &

climate disasters. Low education levels restrict migration opportunities, forcing reliance on shrinking agriculture, fishery, and forest-based livelihoods.

Cultural losses are profound: Oral traditions, folk practices, cockfights, and even traditional beverages are disappearing. Experts identify this as a form of non-economic loss rarely addressed in policy. "Climate impacts are not only shrinking land and livelihoods but eroding identities and cultures," said a local researcher.

Priorities of Communities to Tackle Climate Change

In the face of these challenges, community priorities are clear. Access to food and safe drinking water, disaster-resilient infrastructure, and forest conservation have been identified as top priorities. Sustainable and alternative income opportunities, employment, and the cultivation of disaster-tolerant crops are ranked as highly important. Tackling the devastating impacts of climate change and resulting NELDs requires community-driven solutions that strengthen climate-resilient livelihoods, protect cultural and ecological assets, and ensure access to financial and institutional support for enabling long-term adaptation.

04
CONCLUSION AND POLICY RECOMMENDATIONS

The Sundarbans – spanning Bangladesh and India – is one of the most climate-vulnerable, ecologically sensitive, and socially complex regions in the world. It is home to millions who live at the frontlines of intersecting crises: environmental degradation, recurring disasters, poverty, marginalization, and weak infrastructure. Through this study, we have sought to shed light on an often-overlooked dimension of climate impacts – **Non-Economic Loss and Damage (NELD)** – and its profound implications on the lives, cultures, and ecosystems of the people of the Sundarbans.

Across both countries, the findings reveal a striking pattern: **non-economic losses are deeply felt, long-lasting, and intimately tied to people's sense of identity, belonging, and dignity**. These losses go far beyond what conventional economic assessments can measure. They include the trauma of displacement, the anguish of broken social networks, the silence of disrupted education, the grief of cultural erosion, and the unseen suffering of psychological distress.

In the **Bangladesh Sundarbans**, recurrent cyclones and tidal floods have not only displaced communities but severed their access to education, health, and livelihoods. The spiritual and emotional toll – evident in the loss of sacred spaces like the Bonbibi temples, the erosion of intergenerational knowledge, and the rise of early marriages due to prolonged hardship – illustrates how deeply NELD is woven into the social fabric. These losses often remain unacknowledged by institutional frameworks and compensation mechanisms.

Similarly, in the **Indian Sundarbans**, communities face repeated cycles of disaster, recovery, and precarity. The impacts are especially stark for women, children, and the elderly – such as in stories of childbirth during evacuations or the educational discontinuity faced by girls. The irreversible loss of native flora, biodiversity, and soil fertility, combined with the crumbling of community resilience, reflects an ongoing erosion of ecological and emotional safety nets.

A shared challenge across the delta is the **lack of systemic recognition and institutional accountability** for non-economic losses. Compensation systems, adaptation policies,

and disaster relief often prioritize tangible damages – overlooking the intangible and yet deeply consequential impacts that affect people's well-being, identities, and futures.

This study emphasises that **non-economic loss is not secondary or optional**; it is central to the lived experience of climate change in the Sundarbans. Recognizing **NELD is essential to achieving climate justice. It requires a paradigm shift: from metrics and infrastructure to stories and solidarity; from reactive aid to proactive care; from siloed departments to integrated, people-centred policies.**

As the global community debates the contours of the Loss and Damage Fund and mechanisms under the UNFCCC, the voices and experiences from the Sundarbans offer an urgent and grounded reminder: that climate action must centre the invisible, the emotional, the cultural, and the irretrievable. Only then can we move towards just and compassionate adaptation pathways for communities on the edge – of the land, of survival, and of global attention.

The Non-Economic Loss and Damage in the Sundarbans is not an abstract policy issue – it is a lived reality. From lost childhoods to eroded cultural traditions, from fractured families to unacknowledged trauma, the impacts are vast and layered.

Policies must recognise that rebuilding infrastructure is not enough. Healing communities, restoring dignity, and preventing further erosion of social and cultural fabrics is essential. This demands cross-border cooperation, investment in mental health and education, and – most importantly – amplifying the voices of those living on the frontlines.

Only then can we truly begin to address the full cost of climate change.

REFERENCES AND BIBLIOGRAPHY

1. Refugees International (2020). *Complex Road to Recovery: COVID-19, Cyclone Amphan, Monsoon Flooding Collide in Bangladesh and India.* Washington, DC. Available at: https://www.refugeesinternational.org/reports/2020/11/24/complex-road-to-recovery

2. World Meteorological Organization (2021). *Weather and climate extremes in Asia killed thousands, displaced millions and cost billions in 2020.* WMO Report, Geneva. Available at: https://public.wmo.int/en/media/press-release/weather-and-climate-extremes-asia-killed-thousands-displaced-millions-and-cost

3. Hindustan Times (2021). *Cyclone Amphan was the largest source of displacement in 2020: UN report.* Hindustan Times, 23 September. Available at: https://www.hindustantimes.com/india-news/cyclone-amphan-was-the-largest-source-of-displacement-in-2020-un-report-101632392589273.html

4. Al Jazeera (2024). *The Sundarbans dilemma: Islands swallowed by water and nowhere else to go.* Al Jazeera, 27 January. Available at: https://www.aljazeera.com/features/2024/1/27/the-sundarbans-dilemma-islands-swallowed-by-water-and-nowhere-else-to-go

5. Hossain, M.S., Dearing, J.A., Rahman, M.M., Salehin, M., & Rahman, M.R. (2016). Water salinity investigations in the Sundarbans rivers of Bangladesh. *Environmental Science and Pollution Research,* 23(20), pp. 20434–20445.

6. Khan, A.E., Ireson, A., Kovats, S., Mojumder, S.K., Khusru, A., Rahman, A., & Vineis, P. (2011). Impacts of salinity intrusion in community health: A review of experiences from coastal Bangladesh. *Environmental Health Perspectives,* 119(9), pp. 1328–1334. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC6473225

7. Chatterjee, A., Banerjee, S., & Ghosh, R. (2023). Epidemic dynamics post-cyclone and tidal surge events in the Bay of Bengal: Health outcomes and shelter effectiveness in the Sundarbans, India. *Annals of Global Health,* 89(1), pp. 68–82. Available at: https://annalsofglobalhealth.org/en/articles/10.5334/aogh.4751

8. International Rescue Committee (2020). *Climate crisis increases risks of child marriage and school dropouts in Bangladesh.* New York. Available at: https://www.rescue.org/press-release/climate-crisis-increases-risks-child-marriage-and-school-dropouts-bangladesh

9. Terre des Hommes (2022). *Climate change, displacement and child marriage in South Asia.* TdH Report, Geneva. Available at: https://www.tdh.ch/en/news/climate-change-displacement-and-child-marriage-south-asia

10. Rahman, M.M. (2023). *Impact of Climate Change: Whispering from the Sundarbans Mangrove of Bangladesh.* ResearchGate preprint. Available at: https://www.researchgate.net/publication/370831587

11. Zero Carbon Analytics (2022). *Loss and Damage in the Sundarbans.* London. Available at: https://zerocarbon-analytics.org/wp-content/uploads/2022/11/Loss-and-Damage-in-the-Sundarbans_Nov-2022_ZCA.pdf

12. UNFCCC (2013). *Non-Economic Losses in the Context of the Work Programme on Loss and Damage.* Technical paper FCCC/TP/2013/2, Bonn. Available at: https://unfccc.int/documents/7923

13. ENGAGE4Sundarbans Project (2023). *Household survey results from Gosaba block, Indian Sundarbans.* Project documentation. Available at: https://www.engage4sundarbans.org

14. Alejandra Padin-Dujon, with review by Denyse Dookie and Georgina Kyriacou (2023). *What is 'non-economic' loss and damage (NELD)?* London School of Economics Grantham Research Institute, 20 June 2023. Available at: https://www.lse.ac.uk/granthaminstitute/explainers/what-is-non-economic-loss-and-damage-neld/

15. COAST Trust (Shamsuddoha, M., & Chowdhury, R.K.) (2007). *Climate change impact and disaster vulnerabilities in the coastal areas of Bangladesh.* Dhaka, pp. 40–48.

16. Nature (2023). *Non-economic loss and damage: new research insights.* Available at: https://www.nature.com/articles/s41467-023-41888-1

17. UNDP (2023). *Human Development Horizons.* Available at: https://horizons.hdr.undp.org/

18. UNFCCC (2013). *Non-economic losses in the context of the work programme on loss and damage: Technical paper (FCCC/TP/2013/2),* 9 October 2013. Available at: https://unfccc.int/resource/docs/2013/tp/02.pdf

19. UNFCCC (n.d.). *Loss and Damage Online Guide.* Available at: https://unfccc.int/sites/default/files/resource/loss_and_damage_online_guide.pdf

20. World Bank (2021). *Climate Risk Country Profile: Bangladesh.* Washington, DC. Available at: https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/16813-WB_Bangladesh%20Country%20Profile-WEB.pdf

PARTNERS:

Climate Action Network South Asia (CANSA)

Asia's largest coalition of NGOs addressing the climate crisis. With over 250 member organisations from eight South Asian countries, CANSA promotes sustainable climate, energy and development policies in India, Nepal, Bhutan, Bangladesh, Sri Lanka, Maldives, Pakistan and Afghanistan. **www.cansouthasia.net**

Center for Participatory Research and Development (CPRD)

An independent, non-profit, and progressive policy, research, and implementation institute. CPRD aims to promote alternative development ideas and policies at local, national, regional and global levels through its interactive activities like research, innovation, advocacy, solidarity and action. CPRD also engages itself in campaigning on social development issues and tailoring capacity building programs through identifying capacity gaps, organizing training for different development stakeholders. Apart from the core activities of socio-economic development of the disadvantaged population, policy research, policy literacy, policy advocacy, campaign and mobilization etc also are the focus areas of CPRD's work. **cprdbd.org**

Environment Governed Integrated Organisation (EnGIO)

A non-profit organisation working in various social sectors over two decades. The organisation, registered under West Bengal Society Registration Act, 1961 since 1999, works extensively in the urban and peri-urban areas of West Bengal, particularly Kolkata Metropolitan Area. EnGIO's focus areas are environment, climate change, public health, especially that of women and children, disaster mitigation especially capacity building, social and media communication, documentation and advocacy regarding the same. **www.engio.org**

ASSESSING CLIMATE-INDUCED NON-ECONOMIC LOSS AND DAMAGE IN THE SUNDARBANS

A REPORT

CANSA

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