

JUSTICE-BASED ADAPTATION: RETHINKING CLIMATE ACTION IN THE SUNDARBANS

MEHDI HUSSAIN 

International Studies Association (USA) 
mehdihuss55@gmail.com

Abstract: This article analyses adaptive resilience in the Sundarbans, a vulnerable deltaic region in India and Bangladesh, and how it is influenced by international climate finance and multilateral initiatives. It focuses on Sustainable Development Goal (SDG) 13.1 – “Strengthen resilience and adaptive capacity to climate-related hazards” – to assess the varied impacts of adaptation projects in Gosaba, India, and Khulna, Bangladesh, funded by multilateral organisations. The article highlights a key limitation of climate action: the frequent neglect of structural vulnerabilities related to class, gender, and ecological uncertainty. It calls for locally grounded, equity-based strategies in the Sundarbans’ climate transition, especially as the 2030 SDG deadline approaches.

Keywords: climate change, climate justice, multilateralism, vulnerable communities, Sundarbans.

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BACKGROUND

Transitioning to a low-emission world requires addressing climate justice, particularly the challenges faced by vulnerable communities most affected by the climate crisis. The Sundarbans, the world's largest contiguous mangrove forest, spans the coastal borders of India and Bangladesh and is home to over 4.1 million people (World Bank 2018). This region faces increasingly severe climate hazards, including cyclones, tidal surges, and salinity intrusion, making it among the most vulnerable regions globally to climate change (IPCC 2022). Efforts to achieve the Sustainable Development Goals (SDGs) are hindered by droughts, floods, storms, and heatwaves, which threaten food and water security and endanger both people and ecosystems. Globally, the poor are disproportionately affected by 11,000 weather, climate, and water-related disasters reported between 1970 and 2019, resulting in over 2 million deaths and USD 3.64 trillion in losses (World Meteorological Organization 2022).

Vulnerable communities in India and other Commonwealth countries are increasingly affected by climate disasters, which are compounded by “inequitable social impacts and the responsibilities and fairness of institutions, as well as policy and practical responses” (Gomez 2024: 319). Gomez also notes that climate finance is a key climate justice issue shaped by global politics. In response, multilateral institutions such as the Green Climate Fund (GCF), World Bank, and UNDP (United Nations Development Programme) have launched adaptation programmes. However, questions remain about whether these efforts are truly just and inclusive, or if they perpetuate systemic inequalities under the label of resilience. The importance of climate action was highlighted by the *Declaration on Climate Justice* (Mary Robinson Foundation 2013), which emphasised that climate action should be rooted at the local level.

This article examines SDG 13.1, which calls for strengthened adaptive capacity and resilience. As part of the 2030 Agenda for Sustainable Development, this target seeks to ensure that all communities, especially the most vulnerable, can anticipate, cope with, and recover from climate shocks. Using a

climate justice framework, this study assesses the justice dimensions of climate adaptation in two Sundarbans communities: Gosaba village in West Bengal, India, and Khulna in Bangladesh. Khulna is among the most vulnerable regions in Bangladesh.

CLIMATE JUSTICE

Vulnerable communities face limited development resources, financing, and mechanisms to address debt, compounded by structural economic, social, and environmental challenges. Climate justice highlights these disparities by focusing on the resilience and adaptation needs of those unable to afford them. The *Declaration on Climate Justice* is significant because it centres on people, their rights, opportunities, and fairness.

Climate justice recognises that climate change is not just an environmental challenge but a moral, social, and political issue rooted in historic and systemic inequalities. Lahiri-Dutt (2014) argues that climate justice is based on an understanding of climate change that emphasises social contexts and inequity. It connects human rights to climate action, highlighting differential responsibilities and vulnerabilities within and between nations (Roberts, Parks 2006). According to the Mary Robinson Foundation (2015), climate justice aims to protect the rights of the most vulnerable populations and to distribute the burdens and benefits of climate change in an equitable and fair manner, emphasising the importance of collective action. Shue (2014) considers climate justice to be about addressing issues associated with the morality of climate change (causes and consequences), including denying people with low incomes their rights to a decent living and their resources for adapting to climate change. Shue's argument lies in determining the scale of the needs and sufferings of the affected communities of the Global South vis-à-vis the developed world, which is responsible for much of the cause of climate change. The responsibility lies with rich countries to protect vulnerable communities.

Haque (2024), along these lines, argues that the concept of climate justice is contextual and should be emphasised in three outcome dimensions – procedural, material, and policy.

Gardiner (2004) and Caney (2012) define climate justice in normative terms, linking it to the “common but differentiated responsibilities” principle in international law and to intergenerational equity. This principle is crucial for Bangladesh, which contributes only 0.1% of global greenhouse gas emissions (World Bank 2000). Mark Pelling (2011) applies Rawlsian justice to climate adaptation, advocating for the inclusion of vulnerable communities in decision-making (procedural justice) and fair distribution of resources (distributive justice). These frameworks help analyse the causes and effects of climate change, raise awareness, and address local inequalities.

The core principles of climate justice offer a practical framework for assessing how adaptation policies impact different social groups. Schlosberg (2012) advocates for integrating justice into adaptation frameworks to ensure local inclusion and fairness in allocating emissions and rights, including developmental, human, and environmental rights. He also notes that climate justice often overlooks social and political misrecognition and the basic needs of individuals. Schlosberg’s bottom-up approach, moving from local to State and international levels, highlights the importance of political, social, and cultural contexts. This perspective enriches discussions on adaptation. Bulkeley, Edwards and Fuller (2014) describe climate justice as “recognition in addition to existing framings in terms of rights and responsibilities”.

However, critics such as Pelling (2011) argue that “justice” can become a normative label without operational clarity, risking policy paralysis. Climate justice remains incomplete if it does not address contextual risks and the specific social, economic, political, and environmental needs on the ground. For example, women in Bangladesh experience climate-related vulnerabilities in poverty, health, and food security that current policies do not adequately address (Lahiri-Dutt 2014; UN Women 2015). Newell and Mulvaney (2013) add that distributive justice must be considered within broader political-economic and power dynamics, as these structures shape how benefits and burdens are allocated during the transition to a low-

carbon economy. translate global justice discourses into top-down bureaucratic programmes that marginalise people with low incomes. They say that environmental development is exclusive to the Indigenous population, which is usually dominated by richer countries. Counterarguments emphasise that multilateral frameworks – though imperfect – provide necessary financial and institutional support that local systems alone cannot sustain. This article engages these debates empirically through the Sundarbans cases.

Climate change adaptation is primarily directed by global experts and institutions, leaving affected communities with little influence over decision-making and subject to externally imposed frameworks. These processes are often led by actors from wealthier countries, further marginalising vulnerable populations in coastal and deltaic regions. As a result, adaptation often takes the form of top-down, project-based interventions that may dispossess or displace local people and reinforce market-driven development priorities. These approaches obscure local adaptation practices and knowledge, making them invisible (Sen 2023).

Sen argues that focusing on everyday voices shifts power from institutions to local communities. Informal and fragmented individual or household-level adjustments can challenge dominant authority and offer alternative understandings of adaptation beyond neoliberal development models. This approach addresses calls for research that better connect community experiences with State and corporate actions.

Sen further contends that drawing direct causal links between everyday behaviours and climate change is misleading, as complex social, political, and ecological factors influence these relationships. Attributing all local change to climate risks oversimplifies and obscures other drivers, such as development projects, governance failures, and environmental changes. Focusing on everyday adaptation enables closer examination of hyperlocal responses to overlapping harms and reveals the varied ways climate change interacts with local conditions.

METHODOLOGY

The article uses a comparative qualitative case study approach, drawing on secondary sources including policy papers, project evaluations, and climate finance data. Analysis is guided by the Intergovernmental Panel on Climate Change (IPCC) risk model – risk equals hazard multiplied by exposure and vulnerability (Cardona et al. 2012) – and the capability approach, which examines how local communities address disaster vulnerabilities and hazards through adaptation. This article focuses on adaptation-related hazards such as floods, droughts, and heat extremes, which directly influence local exposure and vulnerability. It emphasises the need for context-specific institutional, social, and knowledge-based responses. By prioritising adaptation over mitigation, the analysis aligns with SDG 13.1 and examines the gap between communities’ awareness of climate risks and their ability to plan, implement, and maintain effective adaptation and early-warning measures.

The IPCC defines climate risk through three dimensions: *a*) hazard, *b*) exposure, *c*) vulnerability. This model separates the physical hazard posed by climatic events from the social factors that shape community impacts: *a*) “hazard” refers to events like cyclones or floods; *b*) “exposure” is the presence of people and assets in high-risk areas; *c*) “vulnerability” considers the capacity to cope and recover. In the Sundarbans, risk is shaped by environmental, social, and political factors. Effective adaptation is necessary to achieve climate justice.

The Gosaba region in the Indian Sundarbans is frequently hit by cyclones, storm surges, and salinity intrusion, which threaten livelihoods and housing. Cyclones (Mukherjee et al. 2024) cause lasting ecological and economic damage. Exposure is high, as settlements and farmlands are located on low-lying islands with fragile embankments. Increased male out-migration leaves women, elderly residents, and children more exposed to flooding and food insecurity. Vulnerability is rooted in historical land inequality, social marginalisation, and dependence on single-crop agriculture, all of which limit adaptation. Projects under the National Adaptation Fund for Climate Change (NAFCC) and Integrated Coastal Zone Management Project (ICZMP) focused on embankment strengthening and

water harvesting but relied on technocratic, top-down planning. Without community participation or gender inclusion, adaptive capacity remains limited. In Gosaba, social vulnerability is as significant as climatic exposure. Even with infrastructure improvements, adaptation remains unjust and incomplete due to unequal distribution of decision-making power and benefits.

Khulna, in coastal Bangladesh, faces cyclones, tidal flooding, and salinity intrusion, further intensified by land subsidence. Exposure is high because of dense settlements and reliance on shrimp aquaculture, which is sensitive to salinity changes. Community-based adaptation initiatives supported by the Green Climate Fund (GCF) have helped reduce vulnerability. The Enhancing Adaptive Capacities of Coastal Communities project introduced mangrove restoration, freshwater pond rehabilitation, and the cultivation of salt-tolerant crops. Increased participation of women in adaptation committees and savings cooperatives has improved preparedness and reduced social vulnerability.

However, elite capture and limited accountability remain, as politically influential families continue to receive disproportionate benefits. This does not reflect the economic hardship faced by the bottom 48% of Bangladesh's population (World Bank 2000). Women and children are particularly affected by the country's social structure. Despite these challenges, participatory design and NGO facilitation have reduced vulnerability compared to Gosaba, showing that procedural inclusion can lower overall risk even in hazardous contexts. In Gosaba, institutional corruption and political interference in climate change efforts are evident (Mukherjee et al. 2024). For example, government-issued fishing boat licenses are monopolised by wealthy agricultural elites and middlemen, disadvantaging fishermen. The authors stress that strengthening local adaptive capacity is essential for disaster management. This requires planning and implementation that build on local skills and scale these efforts. Training should embed existing adaptation knowledge within local contexts (Taylor et al. 2025), enabling communities to act as systems of social adaptation during climate emergencies, rather than relying on externally imposed, irregular State-led strategies.

Both Gosaba and Khulna face high levels of hazard exposure due to their deltaic landscapes. However, differences in vulnerability, shaped by inclusion, governance, and equity, lead to different risk outcomes.

Gosaba in India and Khulna in Bangladesh both experience frequent and intense cyclones, flooding, and salinity intrusion. In Gosaba, events such as Cyclones Sidr (2007), Aila (2009), Bulbul (2019) and Amphan (2020) have caused repeated devastation. In Khulna, cyclones are intensified by land subsidence, which increases tidal flooding and sea-level rise. Both areas have high exposure, but it manifests differently: Gosaba's residents rely on agriculture and live in low-lying, flood-prone areas, while Khulna's economy depends on shrimp aquaculture and densely populated settlements, both of which are vulnerable to storm surges (BSS 2025).

The main difference is in vulnerability. In Gosaba, vulnerability is very high due to social exclusion, unequal land ownership, and weak institutions that limit participation in adaptation programmes. In contrast, Khulna's vulnerability is moderate to high, reduced by participatory mechanisms from Green Climate Fund-supported projects and strong local NGO involvement, although elite capture still limits equity.

As a result, the climate risk profiles differ: Gosaba faces severe risk due to a top-down adaptation approach that overlooks social inclusion. Khulna's risk is high but comparatively lower, thanks to its participatory model and partial progress toward justice-oriented adaptation. This comparison shows that reducing hazard and exposure alone is not enough; addressing vulnerability through equity, participation, and local empowerment is essential for true climate resilience.

IMPLICATIONS FOR CLIMATE JUSTICE AND THE 2030 AGENDA

The comparative analysis shows that climate risks in the Sundarbans are socially constructed, arising from governance, development, and conservation decisions (Ghosh 2018). For example, Anju, a farmer in Gosaba, India, has seen her family's

farmland become increasingly waterlogged and saline after embankments were built to control floods. These measures, though well-intentioned, often overlook valuable local knowledge about seasonal water management. While the region faces similar threats such as sea-level rise, cyclones, and salinity intrusion, differences in vulnerability result mainly from institutional choices rather than natural factors. The Sixth Assessment Report of the IPCC highlights that adaptation outcomes depend on governance quality, inclusion, and equity, framing its approach as a tool for justice rather than a neutral assessment (IPCC 2022).

In Gosaba, India, technical adaptation strategies such as embankment construction and centralised land-use planning often increase vulnerability by disregarding local knowledge and coping practices. Research in the Indian Sundarbans shows that poorly constructed embankments can worsen waterlogging and salinity, threatening agrarian livelihoods and primarily benefiting those with political influence (Ghosh 2018; Mukherjee et al. 2025). These approaches also exclude alternative perspectives and the lived experiences of local actors. Sen's study demonstrates that land inequalities and exclusionary practices turn climate change impacts into daily realities of illness, displacement, and precarious livelihoods, exposing adaptation failures at the community level rather than just in infrastructure (Sen 2023). These dynamics reveal a lack of procedural justice, as the most affected communities are often excluded from decisions that shape their risk and adaptive capacity.

In Khulna, Bangladesh, community-driven and participatory adaptation initiatives have reduced risk despite poverty and ecological challenges. Strategies such as community forestry, co-management of water resources, and livelihood diversification enhance social learning and adaptive capacity (Ayeb-Karlsson et al. 2016). However, participatory governance does not always ensure equal benefit distribution, as elite capture and resource disparities persist (Islam, Shamsuddoha 2018). To close this justice gap, adaptation mechanisms must be managed more equitably.

These case studies show that achieving SDG 13.1 by 2030 requires moving beyond infrastructure-focused adaptation to

approaches that incorporate procedural and distributive justice. The Bangladeshi government acknowledges the value of Indigenous and local knowledge for effective adaptation, especially in complex environments like deltas and mangrove forests (Poudel et al. 2024). Therefore, empowering communities, decentralising decision-making, and addressing land and resource inequalities are essential for building resilience. The Sundarbans case demonstrates that without justice, adaptation can perpetuate risk, while partial justice makes resilience possible but not guaranteed.

The following “justice checklist” provides policymakers with a practical tool to ensure that adaptation efforts are both effective and equitable: 1) empowerment, by strengthening community voices by incorporating local knowledge and perspectives into decision-making processes; 2) decentralisation, by promoting local governance structures that allow for flexible, context-appropriate management of adaptation strategies; 3) equitable land access, by ensuring fair distribution of land and resources to prevent inequalities in adaptive capacity and benefit distribution.

UNEVEN RESILIENCE AND THE POLITICS OF ADAPTATION

This article explores uneven resilience through a transformational lens, emphasising how adaptive processes can fundamentally alter existing social norms and power structures. The comparative findings from Gosaba (India) and Khulna (Bangladesh) highlight that resilience is not evenly distributed, even under similar climatic hazards. While both areas face high exposure to cyclones, salinity intrusion, and tidal flooding, the divergence in outcomes stems from governance structures and the inclusivity of adaptation planning.

In Gosaba, adaptation initiatives under the National Adaptation Fund for Climate Change (NAFCC) and the Integrated Coastal Zone Management Project (ICZMP) focused on strengthening infrastructure such as embankments and water management rather than social inclusion. Consequently, although there have been clear physical improvements, adaptation

outcomes remain unjust and exclusionary. In contrast, Khulna's community-driven adaptation, supported by the Green Climate Fund (GCF), has encouraged stronger local participation and modest empowerment for women and marginalized communities. For instance, in Garuikhali and Kumkhali, Khulna district, communities address cyclones, flooding, salinity, and water scarcity through locally organised strategies, as shown in ICCCAD's *Paani Jibon* research (ICCCAD 2019). Households share rainwater harvesting tanks, use cyclone shelters during emergencies, and join NGO-supported sanitation and livelihood programmes. Government embankments, canals, and shelters provide essential protection but are often poorly maintained. Adaptation results differ: shrimp farming in Garuikhali raises salinity, while agriculture and canal access in Kumkhali reduce exposure. Although these collective efforts lower immediate vulnerability, they are mostly temporary and reveal a lack of institutional support, finance, and planning, which are central to SDG 13.1.

These findings reinforce the IPCC's argument that vulnerability is socially and institutionally constructed rather than merely a function of environmental exposure (IPCC 2022). Adaptation models that treat resilience as a technical process risk reproducing existing hierarchies instead of dismantling them.

SOCIALLY PRODUCED RISK AND JUSTICE DEFICITS

Application of the IPCC risk model to the Indian and Bangladeshi Sundarbans demonstrates that climate risk is not solely the result of environmental hazards, but is actively shaped by social relations, governance structures, and political-economic inequalities. In both contexts, hazards such as cyclones, sea-level rise, and salinity intrusion are broadly comparable. However, exposure and vulnerability are structured differently due to variations in land tenure, participation, and access to adaptation resources. This comparison reveals two distinct yet interconnected justice deficits: procedural injustice in India and distributive injustice in Bangladesh. Collectively, these cases highlight deeper shortcomings in regional adaptation governance that impede progress toward achieving SDG 13.1.

The IPCC's risk framework conceptualises climate risk as the interaction of hazard, exposure, and vulnerability, with vulnerability shaped by social, economic, and political conditions. Recent IPCC assessments emphasise that these dimensions are not neutral or purely technical, but instead reflect power relations, institutional arrangements, and historical inequalities. When applied comparatively to Gosaba in the Indian Sundarbans and Khulna in coastal Bangladesh, the model serves less as a predictive tool and more as a diagnostic for justice, revealing how unequal access to decision-making and resources shapes differentiated vulnerability and adaptation outcomes (Paavola, Adger 2006; Ribot 2017).

In Gosaba, hazard exposure remains high due to cyclonic activity, embankment failure, and increasing salinity. However, persistent vulnerability cannot be attributed solely to environmental factors. Despite substantial public investment in embankments, disaster preparedness, and climate-resilient infrastructure, vulnerability remains entrenched, particularly among landless labourers, lower-caste groups, and forest-dependent households (Ghosh 2018). The IPCC framework clarifies this dynamic: while hazards are addressed through technocratic interventions, exposure and vulnerability are perpetuated by structural exclusion.

Landholding patterns in Gosaba concentrate ownership among relatively powerful households, while landless labourers depend on precarious agricultural and forest-based livelihoods. These groups are frequently excluded from formal planning processes, local governance forums, and compensation mechanisms following climate shocks (Mukherjee et al. 2025). Consequently, adaptation spending disproportionately benefits those with land, political connections, or bureaucratic literacy, rather than those most at risk. This dynamic exemplifies what Ribot (2017) describes as “unequal access to authority”, where participation is nominal but substantively restricted.

Sen's (2023) ethnographic research further demonstrates how bureaucratic adaptation processes in the Indian Sundarbans systematically overlook local voices and lived experiences. State-led adaptation often frames residents as passive beneficiaries rather than active agents, reinforcing dependency

on external interventions. For instance, salinity intrusion is addressed as a technical problem requiring engineering solutions. At the same time, its lived impacts – chronic illness, loss of dignity, and gendered labour burdens – remain unaddressed in policy design. This disconnect underscores a significant procedural justice deficit, as those most affected by climate risk are excluded from defining both the problem and the solution (Schlosberg 2007).

From the perspective of the IPCC risk framework, Gosaba's vulnerability persists not due to a lack of adaptation, but because adaptation is imposed through top-down governance that fails to recognise local knowledge, Indigenous practices, and social differentiation. Comparable patterns have been observed across coastal West Bengal, where technocratic adaptation can inadvertently increase exposure by disrupting informal coping systems and social networks (Misra et al. 2017; Gupta, Bavinck 2016). In Gosaba, therefore, risk is socially produced through exclusionary procedures that determine participation, the valuation of knowledge, and the distribution of adaptation benefits. Pal and Bandyopadhyay (2024) argue that access to schemes provided by different institutions remains limited. This can be attributed to factors such as low awareness of available programmes, geographic and administrative constraints, eligibility criteria that do not align with local realities, weak government-community linkages, and the limited presence of NGOs responsible for implementing or facilitating these schemes.

In Khulna, Bangladesh, the governance landscape contrasts markedly with that of Gosaba. Over time, adaptation has been shaped by NGOs, donor agencies, and large-scale climate finance mechanisms such as the Green Climate Fund (GCF). Participatory approaches, including community-based adaptation, co-management of natural resources, and livelihood diversification, have demonstrably reduced specific dimensions of vulnerability, particularly by enhancing adaptive capacity and social learning (Ayeb-Karlsson et al. 2016). Communities in Khulna generally possess greater formal opportunities to participate in adaptation programmes. According to Islam and Islam (2026), a significant barrier to effective adaptation in Bang-

ladesh is the slow and highly centralised structure of State institutions. This centralisation results in approval bottlenecks, delays in fund disbursement, and rigid administrative procedures, which collectively hinder rapid disaster response. Although the Bangladesh Climate Change Trust Fund is central to climate finance delivery, it has faced criticism regarding transparency gaps, political influence, and project delays.

Furthermore, political considerations often influence the allocation of climate and disaster resources, undermining perceptions of fairness and eroding community trust. These institutional limitations have allowed non-governmental organisations (NGOs) to assume a critical role in adaptation governance. The local presence, operational flexibility, and rapid mobilisation capacity of NGOs facilitate the timely delivery of early warnings, emergency relief, resilient livelihood support, water services, and cyclone shelter infrastructure.

However, the IPCC model again reveals more profound inequities. While participation reduces exposure for some, benefits are unevenly distributed due to elite capture and entrenched social hierarchies. Islam and Shamsuddoha (2018) conceptualise this as “hierarchies of adaptation”, describing how local elites mediate aid flows, control project committees, and influence beneficiary selection. In this system, adaptation resources – such as saline-resistant crops, housing grants, or alternative livelihoods – are filtered through existing power relations, reproducing inequality even within ostensibly participatory frameworks.

Empirical studies from coastal Bangladesh indicate that women, landless households, and minority groups often receive fewer benefits from community-based projects, despite being highly exposed to climate hazards (Assaduzzaman et al. 2023). Although procedural mechanisms are in place, distributive outcomes remain inequitable. This distinction is significant: whereas exclusion in Gosaba occurs primarily at the level of participation, in Khulna, injustice is rooted in the distribution of adaptation benefits.

The IPCC has increasingly warned that adaptation finance, if not governed transparently, can exacerbate inequality and undermine long-term resilience (IPCC 2022). Bangladesh exemplifies this risk. Although adaptation has reduced immediate

vulnerability – by improving housing, water access, and disaster preparedness – it has not fundamentally altered the structural conditions that shape exposure, such as land tenure insecurity and labour precarity (Ayeb-Karlsson et al. 2016). Thus, vulnerability is reduced but not eliminated, and resilience remains uneven.

Collectively, the Gosaba and Khulna cases illustrate how distinct justice deficits can produce similar risk outcomes. In India, procedural injustice restricts meaningful participation and voice, while in Bangladesh, distributive injustice constrains equitable benefit sharing. Both cases indicate a broader failure of regional adaptation governance, characterised by partial institutional inclusivity and weak accountability mechanisms.

From a justice-oriented reading of the IPCC risk model, this suggests that reducing hazard alone – through embankments, early warning systems, or infrastructure – will be insufficient to meet SDG 13.1. Political choices about land, representation, and resource allocation shape exposure and vulnerability. Without reforms that democratise decision-making and address inequality, adaptation risks becoming a tool for managing symptoms rather than transforming underlying causes (Schlosberg 2007). The capabilities approach emphasises the importance of social and political recognition of context-specific vulnerabilities and the ways in which climate change influences basic human needs. This framework facilitates a comprehensive understanding of vulnerability and impacts, clarifies the requirements of adaptation, and establishes normative benchmarks for evaluating the fairness and effectiveness of climate policies (Schlosberg 2012).

Both cases further underscore the importance of recognition justice, defined as the acknowledgement of diverse identities, knowledges, and lived experiences. In Gosaba, Indigenous and local knowledge remains marginalised, while in Khulna, it is selectively incorporated but unevenly valued. The IPCC increasingly identifies such recognition as central to effective adaptation, particularly in socially complex environments such as deltas and mangrove systems (Poudel et al. 2024).

Achieving SDG 13.1 by 2030 requires strengthening resilience and adaptive capacity “in all countries”, but the

Sundarbans cases show that resilience should necessarily be engineered with justice. Empowering marginalised groups, decentralising decision-making, and establishing robust accountability mechanisms are not ethical luxuries – they are structural conditions for reducing risk. As the IPCC risk model demonstrates, when vulnerability is socially produced, it can only be socially transformed.

EVALUATING ADAPTATION THROUGH THE 2030 SUSTAINABLE DEVELOPMENT AGENDA

Evaluating Gosaba (India) and Khulna (Bangladesh) against the Sustainable Development Goals – particularly SDG 13.1, which calls for strengthened adaptive capacity and resilience – shows partial and uneven progress across key indicators. The adaptive capacity remains low in Gosaba, where communities rely heavily on State-led adaptation schemes and have limited livelihood diversification, constraining their ability to respond to climate shocks (Baidya et al. 2023; Mitra et al. 2025). Gosaba's adaptation efforts have minimal participation of women and landless groups, reinforcing social hierarchies, while Khulna records higher inclusivity, with women's cooperatives actively involved in decision-making and resource management (Gayen 2025). In contrast, Khulna demonstrates a moderate ACI, reflecting the influence of local initiatives such as facilitated livelihood diversification, localised training programmes, and community-based adaptation initiatives, which have modestly enhanced adaptive capacity, though coverage remains uneven (Gayen 2025; Chowdhury et al. 2023; Maniruzzaman et al. 2024).

In both regions, local communities deploy traditional, place-based practices to manage environmental risks and strengthen resilience. In the Sundarbans, households use pond-based water systems to harvest monsoon rainwater, recharge coastal aquifers, and reduce salinity intrusion, ensuring drinking water, irrigation, and livelihood security. These practices are low-cost, community-managed, and rooted in Indigenous ecological knowledge. Similarly, watershed projects demon-

strate that effective outcomes depend on collective local participation, where community organisations share planning, monitoring, and resource management functions. Together, the chapters show that traditional practices combined with participatory governance enhance adaptive capacity and offer sustainable alternatives to purely technocratic climate interventions.

Regarding local knowledge integration, Gosaba often excludes traditional ecological knowledge in favour of technocratic approaches, while Khulna incorporates Indigenous mangrove management and local coping practices, enhancing contextual relevance (Chowdhury et al. 2023). Resilience outcomes in Gosaba remain infrastructure-focused, resulting in prolonged recovery after climatic events, whereas in Khulna, recovery is faster and local planning capacities are improved. Overall, both sites show partial alignment with SDG 13.1, underscoring the importance of embedding justice, inclusion, and local knowledge for genuine resilience.

CLIMATE JUSTICE AS A GOVERNANCE PARADIGM

This discussion from Gosaba, India, and Khulna, Bangladesh, highlights the need to shift climate justice from a moral ideal to a governance paradigm. Adaptation policies must embed justice in design, funding, and evaluation rather than treat it as an outcome.

Procedural justice requires institutionalising community participation, especially for women and marginalised groups, ensuring adaptation reflects local priorities and lived experiences. Distributive justice demands that benefits – such as protective infrastructure and livelihood support – be allocated according to vulnerability, not political visibility or institutional influence. Epistemic justice calls for recognising and incorporating local and Indigenous knowledge, including community-based mangrove management and seasonal water-sharing practices, into formal planning.

Embedding these three dimensions transforms adaptation from a technical intervention into a governance model that promotes equity, resilience, and empowerment. In the Sundarbans, this justice-centred approach ensures that multilateral climate

finance and adaptation efforts genuinely reach those most exposed to climate risks, making resilience both practical and socially sustainable.

These align with the “Leave no one behind” principle of the 2030 Sustainable Development Agenda (UN System Chief Executives Board for Coordination 2017) and the Global Goal on Adaptation (GGA) endorsed under the United Nations Framework Convention on Climate Change (UNFCCC), which emphasise context-sensitive, inclusive, and locally led adaptation strategies.

A CRITIQUE OF MULTILATERAL ENGAGEMENT

In the Sundarbans, the gap between multilateral climate finance objectives and local realities is starkly visible in the design and evaluation of adaptation interventions financed or influenced by the World Bank, the Green Climate Fund (GCF) and UNDP. Climate finance in this region has primarily been operationalised through technocratic, output-oriented metrics, particularly the construction and rehabilitation of embankments, mangrove coverage targets, and rates of fund disbursement, which align well with donor accountability frameworks but poorly with justice-centred outcomes. Critical scholarship shows that embankments have become the dominant symbol of “successful” adaptation in the Sundarbans, despite long-standing evidence that they disrupt sediment flows, exacerbate salinity intrusion, undermine fisheries, and increase long-term vulnerability for marginalised communities (Dewan 2021). Dewan shows that climate change discourse, widely adopted by development agencies and State actors, simplifies complex socio-ecological processes and legitimises technocratic solutions such as reinforcing embankments. This framing marginalises local knowledge and masks governance failures, historical land-use decisions, and unequal power relations. The chapter calls for ethnographically grounded and historically informed approaches to climate adaptation that recognise infrastructure as a driver of risk, rather than treating the Sundarbans solely as a passive victim of climate change.

World Bank-style results frameworks have also shaped GCF-supported projects, privileging auditable indicators over social transformation and reinforcing top-down project governance (Majumdar, Matsui 2025). The GCF, established to finance climate adaptation in vulnerable countries, has allocated approximately USD 7,5 billion across 187 single-country projects from 2016 to 2023 and among these, forest and land-use projects received substantial funding, demonstrating strong cost-effectiveness in delivering local benefits and reducing CO₂ emissions. However, only six mangrove-focused projects were funded globally, and none directly target the Sundarbans despite its ecological significance as the world's largest mangrove forest and its potential for carbon sequestration. The analysis shows that forest and land-use initiatives generally deliver stronger outcomes per dollar for both climate adaptation and emissions reduction than sectors such as infrastructure or energy. While energy projects achieve slightly lower costs per ton of CO₂ reduced, they offer fewer direct benefits to local communities. Although limited in number, mangrove projects have supported ecosystem restoration and reached millions of beneficiaries in countries including India, Vietnam, and Senegal. In Bangladesh, recent GCF-funded projects focus on strengthening coastal resilience near the Sundarbans through improved water security, salinity-tolerant agriculture, housing support, and community capacity-building initiatives.

Studies further demonstrate that community participation in World Bank and UNDP-linked interventions is often procedural rather than substantive, with affected populations consulted late in project cycles and excluded from decisions over risk redistribution, land use, and compensation (Bose, Joshi 2024). As a result, projects may meet formal effectiveness criteria while reproducing procedural and distributional injustices, protecting certain areas and livelihoods while exposing others to heightened climate risk (Chakraborty et al. 2024). From a climate justice perspective, this output fixation depoliticises climate harm in the Sundarbans by framing vulnerability as a technical problem to be solved through infrastructure rather than as a product of historical marginalisation, ecological degradation, and unequal power relations (Ashrafuzzaman et al. 2022). Consequently, multilateral climate finance in the Sundarbans

often achieves administrative success without delivering meaningful justice-centred resilience for those most affected by climate change.

JUSTICE AS THE FOUNDATION OF RESILIENCE

The Sundarbans, a highly vulnerable deltaic region spanning India and Bangladesh, highlight the complexities of building adaptive resilience in the context of international climate finance and multilateral initiatives. While global efforts aim to strengthen adaptive capacity under SDG 13.1, the experiences of Gosaba in West Bengal and Khulna in Bangladesh demonstrate that adaptation outcomes are uneven and often fail to address structural vulnerabilities related to class, gender, and ecological uncertainty. Projects that prioritise measurable outputs, such as embankment construction or fund disbursement, may achieve administrative success while leaving the most marginalised communities at heightened risk.

This underscores that resilience cannot be measured solely through technical or infrastructural metrics. Procedural justice, distributive justice, and epistemic justice must be central to adaptation strategies: communities must participate meaningfully in decision-making; risks and benefits must be equitably shared; and local ecological knowledge and lived experience must inform project design. Without these justice-centred approaches, climate action risks reproducing existing inequalities and creating new vulnerabilities.

As the 2030 SDG deadline approaches, the Sundarbans illustrate the urgency of shifting from project-based interventions to equity-focused, locally grounded adaptation strategies. Integrating justice at the core of climate finance and adaptation planning transforms resilience from a technical goal into a transformative process that promotes both social equity and environmental security. In this region, and in similarly exposed contexts globally, adaptation will remain incomplete unless justice serves as the foundation for all climate action.

CONCLUSION

Adaptation in the Sundarbans should not be viewed solely as a technical response to climate hazards; rather, it constitutes a fundamentally political and justice-oriented process. Comparative analysis of the Gosaba and Khulna regions indicates that although adaptation initiatives aligned with SDG 13.1 have improved resilience, these benefits are uneven and are significantly influenced by pre-existing social, economic, and ecological inequalities. In Gosaba, where adaptation is primarily State-led and infrastructure-focused, adaptive capacity remains limited, inclusivity is restricted, and local knowledge is often overlooked. Conversely, Khulna demonstrates that local initiatives such as livelihood diversification, participatory governance, and community-based practices can incrementally enhance resilience, even within institutional constraints.

This analysis highlights the necessity of advancing climate justice from a normative ideal to a foundational principle guiding adaptation. Institutionalising procedural justice requires the meaningful participation of women, landless populations, and other marginalised groups in adaptation decision-making processes. Distributive justice entails allocating adaptation benefits based on vulnerability rather than political prominence or administrative expediency. Epistemic justice necessitates the central integration of local and Indigenous knowledge systems into adaptation planning, rather than treating them as peripheral or informal contributions.

A justice-centred approach to climate action in the Sundarbans demonstrates that resilience depends not only on infrastructure but also on inclusive governance, equitable resource allocation, and the integration of diverse knowledge systems. With the 2030 SDG deadline approaching, prioritising justice within adaptation strategies provides a means to shift climate action from short-term project implementation to a sustainable process that effectively addresses vulnerability and enhances long-term resilience in one of the world's most climate-exposed regions.

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