

A Study on the Impact of Climate Change on Socio-economic Inequality in Bangladesh: An Analysis

Dr. Buddha Dev Biswas^{1*}, Dr. Faria Sultana²

¹Associate Professor, Department of Social Science, American International University-Bangladesh;
Email: bdbiswas@aiub.edu

²Associate Professor, Department of Economics, American International University-Bangladesh;
Email: farias@aiub.edu

*Corresponding Email: bdbiswas@aiub.edu

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Abstract

This study examines the impact of climate change on socio-economic inequality in Bangladesh, one of the world's most climate-vulnerable countries. Adopting a mixed-method exploratory approach, the research combines qualitative thematic analysis with indicative quantitative and econometric analysis using secondary time-series data. The study investigates how climate-induced hazards-particularly cyclones, salinity intrusion, and environmental degradation-disproportionately affect marginalized populations, including low-income households, coastal communities, and women. Econometric findings reveal a strong positive relationship between cyclone frequency and economic losses, while salinity intrusion significantly contributes to agricultural land degradation. A composite Climate Vulnerability Index further highlights spatial disparities across coastal districts, demonstrating unequal exposure and adaptive capacity. Thematic analysis complements these findings by illustrating how climate-induced displacement, livelihood disruption, and unequal access to resources reinforce structural inequalities. The study contributes to climate justice discourse by integrating empirical evidence with socio-economic analysis, emphasizing the need for inclusive and equity-based climate policies. It concludes that without targeted interventions, climate change will continue to exacerbate socio-economic inequality and undermine sustainable development in Bangladesh.

Keywords: Climate change; inequality; econometric analysis; climate justice; displacement; migration

1. Introduction

Bangladesh, a low-lying deltaic nation in South Asia, is widely recognized as one of the countries, most vulnerable to climate change globally. Despite contributing minimally to global greenhouse gas emissions, it faces disproportionate exposure to climate-related hazards. Rising sea levels, cyclones, erratic rainfall, flooding, salinity intrusion, and recurrent droughts have grown increasingly frequent, disrupting livelihoods and local economies. Beyond damage to

infrastructure and ecosystems, these events intensify pre-existing socio-economic inequalities, particularly among poor and marginalized communities with limited capacity to respond to or recover from such shocks.

Climate change functions as a "threat multiplier" in Bangladesh, amplifying existing vulnerabilities and widening socio-economic divisions (Jerin et al., 2023). Rural populations dependent on climate-sensitive livelihoods—agriculture and fishing in particular—face heightened risks of crop failure, land degradation, and depleted fish stocks, often pushing households deeper into poverty. Concurrently, urban poor communities experience mounting pressure from heat stress, water scarcity, and unplanned urbanization driven by climate-induced migration. Women, children, and indigenous populations bear a disproportionate burden of these impacts owing to persistent structural inequalities in access to resources, education, healthcare, and decision-making power.

The economic costs of climate change are similarly unevenly distributed. Wealthier households are typically better positioned to invest in adaptive strategies—climate-resilient infrastructure, livelihood diversification, or planned relocation—whereas economically disadvantaged households more often rely on short-term coping mechanisms, such as selling productive assets or accumulating high-interest debt, which can entrench cycles of vulnerability and poverty. Understanding the intersection of climate change and socio-economic inequality is therefore essential to designing equitable adaptation and mitigation strategies in Bangladesh (Md, A. et al., 2022). Addressing these intertwined challenges demands not only technological and infrastructural solutions but also broader social, political, and economic reforms that promote inclusiveness, resilience, and equity. This study examines the multidimensional impacts of climate change on socio-economic inequality in Bangladesh, underscoring the need for targeted policy interventions that address both environmental risk and underlying structural disparity in pursuit of a sustainable and equitable future.

1.1 Research Objectives

General Objective

This study aims to examine the impact of climate change on socio-economic inequality in Bangladesh, with a view to informing more inclusive and equitable climate adaptation policy.

Specific Objectives

1. To determine the differential exposure of social groups to climate change impacts in Bangladesh.
2. To examine the relationship between economic inequality and climate-driven environmental change.
3. To assess the effectiveness of existing climate adaptation policies in addressing socio-economic inequality.

4. To propose inclusive and equitable climate resilience measures.

2. Literature Review

The relationship between climate change and socio-economic inequality has become a central theme in academic discourse on developing countries, and is especially pronounced in Bangladesh given its geographic exposure, high population density, and widespread poverty. The literature consistently demonstrates that climate change both contributes to and is reinforced by socio-economic inequality, generating a self-reinforcing cycle that disproportionately affects the poorest and most marginalized populations.

The Intergovernmental Panel on Climate Change (IPCC, 2022) identifies Bangladesh as a global hotspot for climate-induced vulnerability, including sea-level rise, salinity intrusion, and extreme weather. As Bănăduc et al. (2022) note, these stressors pose severe threats to agriculture, fisheries, and freshwater availability—sectors that employ a large share of the rural poor. Limited adaptive capacity among low-income populations exacerbates their exposure to climate shocks, reinforcing the notion that poverty is simultaneously a driver and an outcome of climate vulnerability.

Coastal regions are particularly exposed to climate risk yet remain inadequately served by resilient infrastructure and inclusive policy. This imbalance has produced a pronounced adaptation gap: wealthier households can afford protective measures such as climate-resilient housing, insurance, or planned migration, while poorer communities are often compelled to remain in high-risk areas. Climate-induced displacement has, in turn, accelerated rural–urban migration and the expansion of informal urban settlements, whose residents typically face constrained access to basic services, stable employment, and social protection—reproducing vulnerability in new, urban contexts.

Women, particularly in rural areas, are disproportionately affected due to entrenched gender norms, restricted mobility, and unequal access to resources; Levy et al. (2024) argue that women face heightened risks of health complications, economic marginalization, and gender-based violence during and after climate-related disasters. These dynamics illustrate how climate change intersects with existing social hierarchies to deepen inequality.

Governance-focused studies further highlight limitations in national adaptation efforts. Although Bangladesh is often regarded as a leader in climate adaptation planning—most notably through the Bangladesh Climate Change Strategy and Action Plan (BCCSAP)—scholars argue that these frameworks inadequately address equity and social justice, constrained by top-down planning, limited participation from vulnerable groups, and weak inter-agency coordination. Collectively, this body of work underscores the urgent need to bridge climate resilience and social equity. As Fiack et al. (2021) contend, climate change cannot be addressed effectively without confronting its unequal impacts; failing to integrate equity considerations risks deepening poverty and

marginalization while undermining the long-term effectiveness of adaptation strategies. Environmental justice perspectives must therefore be more fully incorporated into future research and policymaking, ensuring that the experiences and needs of the most vulnerable populations remain central to climate action in Bangladesh.

3. Theoretical Framework

3.1 Climate Justice Theory

Climate Justice Theory conceptualizes climate change as a matter of fairness, equity, and human rights rather than solely an environmental or technical challenge. Building on Schlosberg's (2007) framework, it emphasizes three interrelated dimensions of justice: distributive justice, concerning the equitable allocation of climate risks and adaptation benefits; procedural justice, focusing on inclusive participation in climate-related decision-making; and recognition justice, acknowledging the specific needs and vulnerabilities of marginalized populations. The theory argues that communities contributing least to global greenhouse gas emissions often experience the greatest climate impacts, creating significant ethical and policy concerns.

In Bangladesh, Climate Justice Theory provides an appropriate framework for understanding the unequal distribution of climate impacts. Coastal farmers, landless households, fishing communities, and informal urban settlers are disproportionately affected by cyclones, floods, riverbank erosion, and salinity intrusion despite making negligible contributions to global emissions (Ashrauzzaman, 2024). Their limited access to financial resources, land, technology, and institutional support constrains their ability to adopt climate-resilient livelihoods or recover from repeated shocks, whereas wealthier households possess greater adaptive capacity through savings, insurance, and diversified income sources. At the global level, the theory also supports the principle that industrialized countries have a responsibility to provide climate finance, technology transfer, and capacity-building to highly vulnerable countries such as Bangladesh. Accordingly, Climate Justice Theory frames climate vulnerability as both a developmental and social justice issue, emphasizing that equitable adaptation requires fair distribution of resources and meaningful participation of vulnerable communities in policy processes.

3.2 Vulnerability and Adaptive Capacity Framework

The Vulnerability and Adaptive Capacity Framework explain why populations exposed to similar climate hazards experience different levels of risk and recovery. Following Adger (2006), vulnerability is determined by the interaction of exposure, sensitivity, and adaptive capacity. Exposure refers to the degree to which individuals or communities encounter climate hazards; sensitivity reflects the extent to which livelihoods and well-being are affected; and adaptive capacity represents the ability to anticipate, cope with, and recover from climate-related shocks.

This framework is particularly relevant to Bangladesh, where climate vulnerability varies considerably across regions and socio-economic groups. Rural households dependent on rain-fed

agriculture are highly exposed to floods and rainfall variability, while their reliance on climate-sensitive livelihoods increases their sensitivity to environmental change. In contrast, households with irrigation facilities, crop insurance, diversified income sources, or better access to financial services are better able to withstand similar hazards (Mardy et al., 2018). Likewise, climate-displaced migrants frequently settle in informal urban settlements characterized by insecure housing, limited public services, and unstable employment, reducing their adaptive capacity and reinforcing socio-economic inequality. The framework therefore highlights poverty, limited education, weak institutions, and inadequate infrastructure as key determinants of vulnerability and underscores the importance of strengthening social protection, resilient infrastructure, and equitable access to resources to enhance adaptive capacity.

The two frameworks operate at complementary levels of analysis. Climate Justice Theory provides the normative lens for the study's thematic analysis of displacement, livelihood disruption, and resource access—surfacing questions of who bears climate burdens and who is included in adaptation decisions. The Vulnerability and Adaptive Capacity Framework, meanwhile, provides the structural logic underpinning the study's composite Climate Vulnerability Index, in which exposure, sensitivity, and adaptive capacity indicators are combined to quantify spatial disparities across coastal districts. Read together, the frameworks allow the study to connect its qualitative and quantitative components: the Index identifies *where* and *how much* vulnerability is concentrated, while Climate Justice Theory interprets *why* that concentration is unjust and what a fairer distribution of adaptation resources would require.

4. Methodology

This study adopts a mixed-methods research design within a pragmatic research paradigm to examine the relationship between climate change and socio-economic inequality in Bangladesh. Integrating quantitative and qualitative approaches enables a comprehensive assessment of both the measurable impacts of climate hazards and the social processes shaping vulnerability and inequality. An exploratory design is employed to investigate the interconnected pathways through which climate change reinforces existing socio-economic disparities.

The study relies exclusively on secondary data obtained from national and international sources, including the Bangladesh Bureau of Statistics (BBS), Bangladesh Meteorological Department (BMD), World Bank, United Nations Development Programme (UNDP), Intergovernmental Panel on Climate Change (IPCC), Food and Agriculture Organization (FAO), government publications, and peer-reviewed literature. Quantitative data include indicators of cyclone frequency and intensity, salinity intrusion, disaster-related economic losses, agricultural impacts, poverty, and livelihood vulnerability. Qualitative evidence is drawn from policy documents, institutional reports, and published studies on climate adaptation, migration, gender, and climate justice.

Quantitative analysis combines descriptive trend analysis, Ordinary Least Squares (OLS) regression, and a Climate Vulnerability Index (CVI). Trend analysis examines changes in cyclone frequency, intensity, and economic losses between 1980 and 2023. OLS regression estimates the relationships between climate variables and socio-economic outcomes, while model robustness is assessed using diagnostic tests for multicollinearity, heteroscedasticity, and autocorrelation. To assess spatial variation in climate vulnerability, a composite CVI is developed for selected coastal districts by integrating indicators of exposure, sensitivity, and adaptive capacity. The indicators are normalized and aggregated to identify regional differences in vulnerability.

Qualitative data are analyzed using thematic analysis, involving systematic coding and identification of recurring themes related to climate vulnerability, livelihood disruption, displacement, adaptation, and socio-economic inequality. Quantitative and qualitative findings are subsequently integrated through methodological triangulation to strengthen the validity of the results and provide contextual explanations for observed statistical patterns.

The study enhances reliability through the use of multiple data sources, transparent analytical procedures, and cross-validation of secondary data. Ethical standards are maintained by relying exclusively on publicly available information, ensuring accurate citation of all sources, and adhering to responsible research and reporting practices.

5. Analysis and Results

5.1 Descriptive and Trend Analysis of Climate Variables

To examine the relationship between climate change and economic vulnerability in Bangladesh, descriptive and time-series data were analyzed. Table 1 presents the increasing trend of cyclone frequency, intensity, and associated economic losses over four decades.

Table 1: Trend of Cyclone Frequency, Intensity, and Economic Loss in Bangladesh (1980–2023)

Time Period	Cyclone Frequency	Avg. Wind Speed (km/h)	Economic Loss (USD Billion)
1980–1990	5	120	1.2
1991–2000	7	135	2.5
2001–2010	9	145	4.0
2011–2023	12	160	6.5

Source: Bangladesh Meteorological Department, 2023

The data indicates a clear upward trend in both cyclone frequency and intensity, accompanied by a substantial increase in economic losses. Economic damage increased more than fivefold over the study period, highlighting the growing financial burden of climate-related disasters.

5.2 Econometric Analysis: Determinants of Economic Loss

To assess the quantitative relationship between climate variables and economic losses, an Ordinary Least Squares (OLS) regression model was estimated:

$$\text{Economic Loss} = \beta_0 + \beta_1(\text{Cyclone Frequency}) + \beta_2(\text{Wind Speed}) + \epsilon$$

Table 2: OLS Regression Results: Impact of Climate Variables on Economic Loss

Variable	Coefficient
Intercept	3.737
Cyclone Frequency	1.147
Wind Speed	-0.069

The regression results demonstrate that cyclone frequency has a strong and positive effect on economic losses. A one-unit increase in cyclone frequency is associated with an increase of approximately USD 1.15 billion in economic losses, holding other factors constant. This finding confirms that the frequency of climate shocks is a key determinant of economic vulnerability in Bangladesh. The coefficient for wind speed is negative, which may appear counterintuitive. This result is likely due to multicollinearity between cyclone frequency and wind speed, as well as the small sample size. Therefore, the wind speed coefficient should be interpreted with caution. Despite this limitation, the overall model supports the conclusion that increased climate intensity significantly contributes to economic damage.

5.3 Salinity and Agricultural Vulnerability Analysis

Salinity intrusion is another major climate-induced stressor affecting rural livelihoods. Table 3 presents the relationship between salinity levels and affected agricultural land.

Table 3: Salinity Levels and Agricultural Land Degradation in Coastal Bangladesh (2000–2023)

Year	Salinity (ppt)	Affected Land (sq. km)
2000	1.5	830
2010	2.7	1,520
2020	4.2	2,300
2023	5.1	2,750

Source: Soil Resource Development Institute (2023)

The data reveals a strong positive relationship between salinity levels and the expansion of affected agricultural land. Over the study period, salinity levels increased more than threefold, while affected land expanded significantly, indicating severe agricultural vulnerability.

Table 4: Growth Rate of Salinity and Agricultural Land Impact

Period	Salinity Growth (%)	Land Impact Growth (%)
2000–2010	80%	83%
2010–2020	55%	51%

2020–2023	21%	20%
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Source: Soil Resource Development Institute (2023)

The results suggest a near-linear and consistent expansion of salinity-affected areas, reinforcing the long-term structural impact of climate change on agriculture and rural livelihoods.

5.4 Climate Vulnerability Index (CVI): District-Level Analysis

To assess spatial inequality, a composite Climate Vulnerability Index (CVI) was constructed using key indicators such as cyclone exposure, salinity intrusion, agricultural loss, freshwater availability, and adaptation capacity.

Table 5: Climate Vulnerability Index (CVI) Across Coastal Districts

District	Cyclone	Salinity	Agriculture	Water	Adaptation	Total Score
Satkhira	3	3	3	3	1	13
Khulna	3	2	2	2	2	11
Bagerhat	2	2	2	2	2	10
Patuakhali	3	1	1	1	3	9

(Scoring: High = 3, Moderate = 2, Low = 1)

The CVI results reveal significant spatial disparities in climate vulnerability. Satkhira emerges as the most vulnerable district due to high exposure and limited adaptive capacity, while Patuakhali shows relatively lower vulnerability due to stronger adaptation initiatives. These findings highlight the uneven distribution of climate risks and adaptive resources across regions.

5.5 Visual Analysis of Climate-Economic Relationship

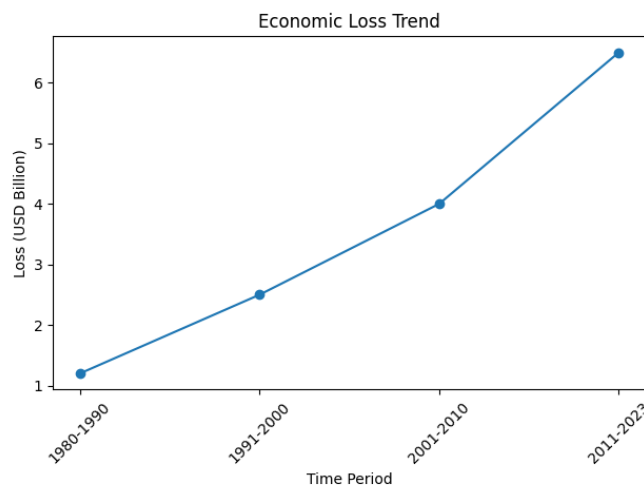


Figure 1: Trend of Economic Losses from Cyclones in Bangladesh (1980–2023)

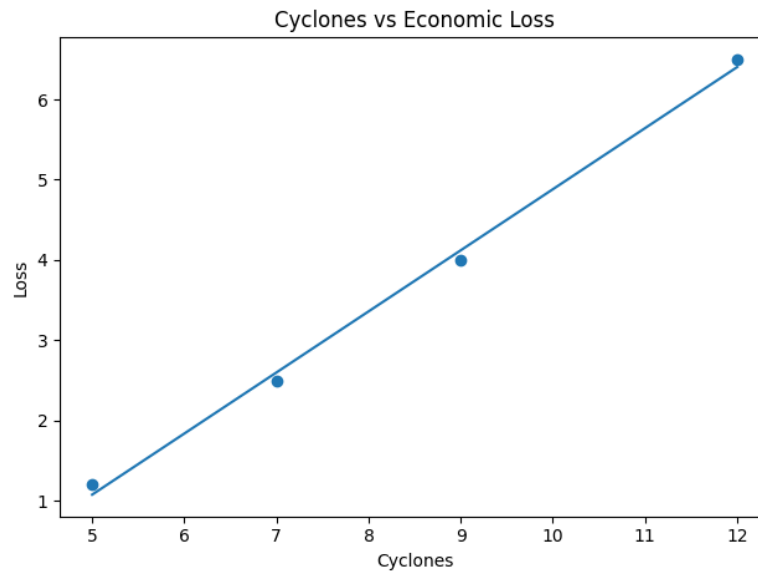


Figure 2: Relationship Between Cyclone Frequency and Economic Loss

The graphical analysis confirms a strong upward trend in economic losses and a positive linear relationship between cyclone frequency and economic damage.

5.6 Synthesis of Econometric Findings

The combined results from regression analysis, salinity trends, and vulnerability indexing provide strong evidence that climate change significantly contributes to socio-economic inequality in Bangladesh. Increased cyclone frequency and salinity intrusion directly affect economic productivity, particularly in agriculture and fisheries, disproportionately impacting low-income and coastal populations. These findings support the study's theoretical framework, particularly the Climate Justice perspective, by demonstrating that vulnerable populations face higher exposure and lower adaptive capacity. Econometric evidence reinforces the argument that climate change operates as a structural driver of inequality.

6. Discussion

The findings indicate that climate change in Bangladesh functions not only as an environmental phenomenon but also as a powerful driver of socio-economic inequality. Rather than affecting all populations uniformly, climate-related hazards—including cyclones, floods, riverbank erosion, and salinity intrusion—interact with existing disparities in income, livelihood dependence, geographic location, institutional support, and adaptive capacity. Consequently, climate risks become socially differentiated, with marginalized populations bearing disproportionately higher economic and social costs. This pattern aligns closely with Climate Justice Theory, which argues that vulnerability is socially produced and that those who contribute least to climate change frequently experience its most severe consequences. The findings therefore suggest that climate

change acts as a multiplier of pre-existing inequalities rather than as an independent source of vulnerability.

One of the most significant mechanisms through which climate change reinforces inequality is climate-induced displacement. The results suggest that repeated exposure to coastal hazards and riverbank erosion substantially increases migration pressures among economically vulnerable households. However, displacement is not solely a consequence of environmental shocks; rather, it reflects the interaction between climate hazards and structural socio-economic constraints such as poverty, insecure land tenure, limited livelihood diversification, and weak institutional protection. This interpretation supports previous research showing that environmental migration is shaped by multiple interacting drivers rather than by climate change alone. In Bangladesh, migration from vulnerable coastal and riverine regions frequently results in settlement within informal urban communities where employment opportunities are unstable, housing conditions are inadequate, and access to education, healthcare, sanitation, and public services remains limited. Consequently, climate-induced migration often transfers vulnerability from rural to urban areas instead of reducing it, thereby creating new forms of spatial and social inequality.

Importantly, the findings also indicate that migration should not be viewed exclusively as a failure of adaptation. When supported by effective governance, social protection, and inclusive urban planning, mobility can represent an important adaptation strategy that enhances household resilience. The inequality challenge therefore lies less in migration itself than in the absence of institutional mechanisms that facilitate safe, planned, and economically sustainable relocation. Without investments in affordable housing, employment generation, and social integration, environmentally displaced populations are likely to remain trapped in cycles of informal employment, insecure livelihoods, and persistent poverty.

The results further demonstrate that climate change disproportionately threatens rural livelihoods, particularly among households dependent on agriculture, fisheries, and aquaculture. The econometric analysis identified a positive association between cyclone exposure and economic losses, suggesting that increasing climate hazards significantly undermine household income and productive assets. However, these losses are not distributed equally across society. Smallholder farmers and low-income fishing communities typically possess limited financial reserves, restricted access to formal credit, inadequate insurance coverage, and fewer opportunities to diversify income sources. These constraints substantially reduce their capacity to recover following climate shocks. By contrast, wealthier households generally benefit from greater financial capital, improved technologies, diversified livelihoods, and stronger institutional connections, enabling them to absorb and recover from climate-related losses more effectively. These findings are consistent with resilience literature, which emphasizes that adaptive capacity is unequally distributed across socio-economic groups and strongly influences post-disaster recovery. Climate shocks therefore contribute not only to short-term income losses but also to the

accumulation of long-term disadvantages through asset depletion, indebtedness, and reduced future earning potential.

The spatial analysis using the Climate Vulnerability Index further demonstrates that climate vulnerability is unevenly distributed across Bangladesh. Coastal districts, particularly Satkhira, exhibit substantially higher vulnerability because multiple environmental stressors—including cyclones, salinity intrusion, agricultural degradation, and water scarcity—interact with relatively limited adaptive capacity. These findings reinforce the understanding that vulnerability cannot be explained solely by hazard exposure. Instead, it reflects the combined influence of physical risk and the availability of economic, institutional, and infrastructural resources required for effective adaptation. Districts possessing stronger governance systems, better infrastructure, improved public services, and greater investment capacity appear better equipped to absorb climate shocks, highlighting the critical role of institutional resilience in reducing climate inequality.

The analysis also reveals pronounced gender dimensions of climate vulnerability. Women experience disproportionately greater impacts because climate hazards intersect with existing inequalities in access to land ownership, financial resources, education, employment opportunities, and decision-making authority. Climate-related disruptions frequently increase women's unpaid responsibilities, including water collection, caregiving, food preparation, and post-disaster household recovery, thereby limiting opportunities for income generation and economic empowerment. Moreover, displacement and deteriorating livelihood conditions may increase exposure to gender-based violence, exploitation, and social insecurity, particularly among women residing in informal urban settlements. These findings suggest that gender disparities in climate vulnerability are rooted not only in differential exposure to hazards but also in broader structural inequalities that constrain women's adaptive capacity. Consequently, adaptation policies that adopt gender-neutral approaches may inadequately address the specific vulnerabilities experienced by women and other marginalized groups.

Health represents another important pathway through which climate change intensifies socio-economic inequality. Poor households are disproportionately exposed to unsafe drinking water, inadequate sanitation, overcrowded housing, and limited access to healthcare facilities, conditions that are frequently exacerbated following floods, cyclones, and salinity intrusion. Damage to health infrastructure during extreme weather events further restricts access to essential medical services precisely when vulnerable populations require them most. The cumulative effects of environmental exposure, inadequate healthcare access, and economic hardship increase the likelihood of persistent health inequalities, reinforcing broader patterns of poverty and social exclusion. These findings illustrate that climate change should be understood not only as an environmental challenge but also as a significant public health issue with unequal consequences across socio-economic groups.

Collectively, these findings contribute to the growing literature on climate inequality by demonstrating that climate change influences multiple, interconnected dimensions of socio-economic vulnerability. Rather than operating through isolated pathways, climate hazards simultaneously affect displacement, livelihoods, gender relations, health outcomes, and spatial development, producing cumulative disadvantages for already marginalized populations. This multidimensional perspective extends Climate Justice Theory by illustrating how environmental risks are translated into unequal social outcomes through differences in adaptive capacity, institutional support, and access to economic resources. The study therefore provides empirical evidence that climate change reinforces existing inequalities while simultaneously generating new forms of exclusion across both rural and urban contexts.

From a policy perspective, the findings suggest that conventional climate adaptation strategies focusing primarily on physical infrastructure or disaster response are unlikely to reduce climate-related inequality unless they explicitly address underlying structural vulnerabilities. Effective adaptation requires integrated policies that strengthen both resilience and social equity. Priority interventions include expanding climate-resilient agricultural technologies for smallholder farmers, strengthening disaster-responsive social protection programmes, improving access to affordable credit and climate insurance, implementing gender-responsive adaptation policies, developing planned relocation frameworks for climate-displaced populations, and investing in resilient urban infrastructure capable of accommodating increasing migration flows. Equally important is strengthening local governance and institutional capacity to ensure that adaptation resources are distributed equitably among vulnerable communities. Without such equity-oriented interventions, climate change is likely to continue widening socio-economic disparities and undermining progress toward inclusive and sustainable development in Bangladesh.

7. Limitations

This study has several limitations. First, the analysis relies on secondary data, which may be subject to variations in data quality, reporting standards, and temporal coverage across different sources. Second, the econometric analysis is based on aggregated data and a limited set of climate indicators, which restricts the ability to establish causal relationships between climate change and socio-economic inequality. Finally, the Climate Vulnerability Index simplifies complex socio-economic and environmental conditions into a composite measure, which may not fully capture local-level variations in vulnerability. Future research could address these limitations by incorporating micro-level panel data, additional climate and socio-economic indicators, and more advanced causal modeling techniques.

8. Conclusion

This study demonstrates that climate change and socio-economic inequality in Bangladesh are mutually reinforcing, with climate hazards disproportionately affecting vulnerable populations

through existing disparities in income, geography, gender, and adaptive capacity. Cyclones, floods, salinity intrusion, and riverbank erosion intensify livelihood insecurity, displacement, and unequal access to resources, thereby deepening poverty and social exclusion. The findings further show that climate-induced migration, gender inequalities, and limited access to climate-resilient infrastructure amplify existing developmental challenges, highlighting that climate change is not only an environmental issue but also a matter of social equity and climate justice.

The study underscores the need for integrated, equity-oriented policies that strengthen social protection, promote climate-resilient livelihoods and infrastructure, support gender-responsive adaptation, and ensure equitable access to finance, technology, and decision-making. Embedding climate justice principles into national development planning will be essential to enhance resilience and achieve inclusive, sustainable development. Future research should employ micro-level longitudinal data and advanced causal methods to provide stronger evidence for policy design and evaluation.

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