Bangladesh Journal of Bioethics

Published by: Bangladesh Bioethics Society
https://bjbio.bioethics.org.bd/index.php/BJBio/about
ISSN: p2226-9231 e 2078-1458
BJBio 2025; 16 (23): 21-25
Submitted:10.04.2025
Accepted: 10.05.2025
Published:01.07.2025

Review Article

Vulnerability and Climate Change

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: https://doi.org/10.62865/bjbio.v16i2.164

Abstract: Climate change has emerged as a significant threat to global development, disproportionately affecting vulnerable populations, particularly in developing countries like Bangladesh. This paper explores the complex relationship between vulnerability and climate change, highlighting how geographic exposure, socio-economic conditions, and gender disparities increase susceptibility to climate-induced hazards such as floods, cyclones, and salinity intrusion. Vulnerability is not solely steadfast to environmental factors but is deeply influenced by poverty, limited access to resources, and systemic inequality. The discussion emphasizes the gendered nature of vulnerability, with women facing additional barriers to adaptation due to traditional roles and social constraints. Institutional and policy responses are reviewed, underscoring the need for inclusive governance, education, and long-term financial support. The study recommends a holistic and equity-focused approach to climate adaptation that prioritizes empowerment, gender inclusion, and localized solutions. Strengthening institutional capacities, increasing climate finance, and integrating climate change into education and policy frameworks are vital for sustainable adaptation.

Key words: Climate Change, vulnerability, Gender Inequality, Bangladesh, Climate Adaptation, Environmental Hazards, Climate Policy

Introduction: Climate change is a defining global challenge of the 21st century, exerting profound impacts on both natural and human systems. One of the most critical dimensions of these impacts is vulnerability, which refers to the degree to which a system, community, or individual is likely to experience harm due to exposure to climate-related risk, sensitivity to these risks, and the capacity to adapt or respond[1]. Vulnerability is not uniformly distributed; it is influenced by a complex interplay of environmental, socioeconomic, political, and cultural factors, often

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disproportionately affecting marginalized populations [1].

Vulnerable populations typically include those with limited access to resources, such as the poor, indigenous communities, women, the elderly, and those living in high-risk areas like low-lying coastal zones or drought-prone regions [2]. These groups are often more exposed to climate risks, such as floods, droughts, sea-level rise, and extreme weather events and are less equipped to recover from their impacts [2].

Recent scholarly work emphasizes that climate-induced displacement is a significant manifestation of vulnerability. Jayawardhan (2017) highlights that in regions such as the US, Gulf Coast, Bangladesh, and Somalia, communities facing poverty, political marginalization, and environmental degradation are more likely to be displaced due to extreme weather events [3]. These populations often lack legal recognition or institutional support, making them doubly vulnerable, first to the climate risks themselves, and second to the sociopolitical neglect that follows displacement [3]. This calls for a rethinking of policies around climate justice and protection for displaced persons.

Furthermore, vulnerability is not a static condition. It evolves over time due to both climatic and non-climatic drivers. Ford et al. (2018) argue that vulnerability research has undergone a significant transformation in recent decades. While early studies often treated vulnerability as a fixed outcome, more recent frameworks recognize its dynamic nature and the importance of agency, governance, and social capital [1]. Despite some criticism for being fragmented across disciplines, vulnerability remains a key lens for evaluating differential impacts and informing targeted climate adaptation efforts [1].

A concrete example of climate vulnerability is evident in Bangladesh, one of the countries most at risk from climate change. Sea-level rise and increased salinity intrusion into coastal areas have severely affected agricultural productivity, undermining food security and rural livelihoods[4]. Small-scale farmers, particularly those lacking access to adaptive technologies or alternative income sources, are the most vulnerable [4].

Moreover, gender plays a significant role in shaping vulnerability to climate change. Women often face greater exposure and fewer resources to cope with climate-related disruptions. Islam and Sultana (2014) note that women in coastal Bangladesh bear the brunt of climate-induced disasters, not only because of their traditional caregiving roles but also due to limited mobility, lack of access to information, and exclusion from decision-making processes [5]. Despite the growing emphasis on resilience in recent climate policy discourse, vulnerability remains central to understanding how and why certain populations are more at risk than others. It serves as a diagnostic tool that helps policymakers, researchers, and practitioners identify priority areas for intervention. However, addressing vulnerability requires more than technical solutions; it demands systemic change. This review article searches for the root causes of vulnerability and the adaptation process. It also highlights how vulnerability assessments can guide practical interventions to reduce risk and build resilience.

Methodology: This study employed a qualitative research approach of literature review to examine the multifaceted nature of vulnerability to climate change. A systematic literature review was conducted using peer-reviewed journal articles, reports from international organizations (e.g., IPCC, UNDP), and relevant grey literature. Databases such as Google Scholar, JSTOR, Science Direct, and Springer Link were used to identify key sources using search terms like “climate vulnerability,” “adaptive capacity,” “climate-induced displacement,” and “gender and climate change.”

Inclusion criteria focused on studies published between 2010 and 2024, emphasizing case studies from climate-vulnerable regions such as Bangladesh, sub-Saharan Africa, and small island developing states (SIDS). Sources were

selected based on relevance, methodological rigor, and geographic representation. Thematic analysis was used to identify patterns related to vulnerability drivers, adaptive strategies, and policy interventions.

Discussion: Several factors contribute to the vulnerability of populations to climate change. The key drivers of vulnerability are:

1. Geographical Exposure: Regions located in low-lying coastal areas, arid zones, or areas prone to extreme weather events are more susceptible to the impacts of climate change]. For instance, Bangladesh, situated on the Ganges-Brahmaputra Delta, faces frequent flooding, cyclones, and rising sea levels, threatening its agricultural productivity and displacing communities [6,7].
2. Socio-Economic Factors: Poverty, lack of education, and limited access to healthcare and infrastructure increase vulnerability [6,8].
3. Health and Livelihoods: Climate change affects health through the spread of diseases, heat stress, and malnutrition. It also impacts livelihoods, particularly in sectors like agriculture, fisheries, and tourism [6,9,10].

Impacts of Climate Change on Vulnerable Populations: The effects of climate change are multifaceted and disproportionately affect vulnerable populations:

1. Food and Water Security: Changes in precipitation patterns, droughts, and floods disrupt food production and water availability. Small-scale farmers and rural communities, especially women-headed households, face challenges in maintaining food security [6,7]. The UN's Food and Agriculture Organization reports that female-headed households in poor countries lose more income during climate-induced events compared to their male counterparts [6.11.12].
2. Health Risks: Rising temperatures and changing weather patterns contribute to the spread of vector-borne diseases like malaria and dengue fever [6.9]. Heatwaves and extreme weather events also lead to direct health impacts, including heat stress and injuries from disasters [6.9].
3. Displacement and Migration: Climate change-induced disasters, such as floods, storms, and sea-level rise, force communities to migrate [6,13,14]. This displacement often leads to overcrowded living conditions, loss of livelihoods, and social tensions in receiving areas.
4. Economic Losses: Vulnerable populations often lack insurance and financial safety nets, making them more susceptible to economic losses from climate-related disasters [6,9,15]. The destruction of assets and infrastructure can set back development gains and deepen poverty [16.17].

Adaptation Strategies to Enhance Resilience: Addressing vulnerability requires comprehensive adaptation strategies that consider the unique needs of different communities:

1. Community-Based Adaptation (CBA): Empowering local communities to identify risks and develop solutions ensures that adaptation measures are context-specific and culturally appropriate. CBA promotes local ownership and increases the effectiveness of interventions [18.19].
2. Ecosystem-Based Adaptation (EbA): Utilizing natural systems to buffer against climate impacts, such as restoring mangroves to protect coastal areas from storm surges, can be cost-effective and sustainable. EbA integrates biodiversity conservation with climate adaptation [20,21,22].
3. Gender-Responsive Approaches: Recognizing and addressing the specific vulnerabilities of women and marginalized groups is essential. Gender-responsive adaptation ensures that these groups have equal access to resources, decision-making processes, and benefits from adaptation initiatives [23,24,25].

4. Policy and Institutional Development: Strengthening governance structures and creating policies that integrate climate change considerations into development planning are critical. This includes developing early warning systems, improving infrastructure, and ensuring equitable access to resources.
5. International Support and Cooperation: Climate change is a global issue that requires collective action. Developed countries have a responsibility to support vulnerable nations through financial assistance, technology transfer, and capacity-building initiatives.

Vulnerability and Climate Change in Bangladesh: Bangladesh is one of the most climate-vulnerable countries globally due to its low-lying geography, dense population, and high dependency on natural resources. Nearly 80% of the country lies on floodplains, with over 10% of land less than one meter above sea level, making it highly exposed to sea-level rise and cyclones. Cyclones like Sidr in 2007 and Amphan in 2020 have caused significant damage, displacing thousands and disrupting livelihoods.

Socio-economic factors worsen this vulnerability. Poor communities reliant on agriculture face crop failure due to salinity intrusion and erratic rainfall. Women, children, and people with disabilities suffer the most, often excluded from decision-making and lacking access to resources and information. Addressing these challenges requires gender-sensitive, community-based, and well-financed adaptation strategies to build long-term resilience.

Conclusion: Climate change poses severe threats to vulnerable populations, especially in countries like Bangladesh, where geographic risks, poverty, and inequality converge. Vulnerability is shaped not only by environmental exposure but also by limited adaptive capacity and social exclusion. Addressing this requires inclusive policies, gender-responsive adaptation, and empowerment of marginalized communities. Building resilience involves investing in education, health, governance, and access to financial and technical resources. Strengthening institutions and promoting community-driven solutions are essential. A justice-oriented, holistic approach ensures no one is left behind, making climate resilience not only a development priority but also a moral obligation for a sustainable future.

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Acknowledgement:
I would like to express my sincere gratitude to the Bangladesh Bioethics Society (BBS) for providing me with the opportunity to submit a reviewed article for publication in their esteemed journal. I would also like to extend my heartfelt thanks to the Secretariat of BBS, Prof. Shamima Parvin Lasker for her continuous support, coordination, and professionalism throughout the submission and review process.

Author Contributions: Dr. Farhana Zaman: Conceptualized the work area, prepared the whole article, revised the draft manuscript, and coordinated the writing exercise among the authors. Prof Dr. Rowshan Ara: Revised the draft manuscript and contributed writing with other authors. Prof Dr. Fazlul Karim: Revised the draft manuscript and contributed writing with other authors.

Conflict of interest: The author declares no conflict of interest. All efforts have been made to ensure objectivity, transparency, and academic integrity in the analysis of vulnerability and climate change impacts in developing countries, particularly Bangladesh.

Funding: Non

Data availability: All data are within the article. No data is retained for further writing.