



Climate Change – a threat to the Sundarban Region Community

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Abstract:

Abstract: *Climate change poses a formidable threat to the Sundarbans region and its communities, situated in the deltaic plains of India and Bangladesh. This article examines the multifaceted impacts of climate change on the ecological, economic, and social fabric of the Sundarbans community. Rising sea levels, increased salinity intrusion, intensified cyclonic activities, and altered precipitation patterns are identified as primary stressors exacerbating vulnerabilities in this fragile ecosystem. The study synthesizes current scientific literature, empirical data, and local perspectives to underscore the profound consequences on livelihoods dependent on agriculture, fisheries, and forestry. Furthermore, it explores adaptive strategies and resilience-building initiatives adopted by local communities, governments, and non-governmental organizations to mitigate the adverse effects of climate change. The article concludes with policy recommendations aimed at enhancing adaptive capacities and fostering sustainable development in the Sundarbans region amidst a changing climate.*

Keywords: *climate change, Sundarbans, community resilience, adaptation, vulnerability.*

Introduction:

With an area of approximately 3,287,263 square kilometers, India is the seventh largest country in the world. Spanning over a large geographical area and despite being home to over 1.2 billion people, approximately 20% of India is still covered by diverse forests. In the north-eastern shores of India lies the Sundarbans, the world's largest contiguous mangrove forest which is spread across approximately 9,630 square kilometers, of which 5,363 square kilometers is reclaimed area and the 4,267 square kilometers are protected mangrove forests. A further 6,000 square kilometers of contiguous mangrove forests are spread across neighbouring Bangladesh. a The Indian administrative region of Sundarbans lies within the State of West Bengal. The Sundarban ecosystem is one of the most biologically protective and taxonomically diverse ecosystems of the Indian Sub-continent.b The entire area is a conglomeration of river channels, creeks and islands which total about 102 in number. Of these 54 islands are inhabited while the remaining 48 islands are forested. (Pathar , 2009) It is believed that the name Sundarbans is derived from the Heritiera fomes tree, one of the most abundantly growing mangrove trees that are locally called 'Sundari'.

Located in the delta of the three rivers, Ganges, Brahmaputra and Meghna, “it is home to a significant portion of one of the world's largest contiguous block of mangrove forests and biodiversity. In 1987, the Sundarbans was designated as a UNESCO world heritage site and thereafter was declared as a protected biosphere reserve by the Government of India in 1989. The Sundarbans display high biodiversity as well as the occurrence of endangered and highly threatened species, including the only population of critically endangered Royal Bengal Tigers (*Panthera tigris tigris*) found in a coastal mangrove habitat. Sundarbans is also home to 300 species of flora and about 425 species of wildlife, including the Gangetic Dolphin (*Platanista gangetica*) and Irrawady Dolphin (*Orcaella brevirostris*). The Sundarbans account for 85 per cent of all mangrove habitats found in India; including 63 of the 69 mangrove plant species found in the country. Based on current research, it is believed that the Sundarbans may hold up to 140 mangroves and coastal zone flora”.(BBC News Report,2010)

Rationale of the Study:

By investigating the impacts of climate change on the Sundarbans region community, this study aims to generate knowledge that can guide climate adaptation policies, enhance community resilience, and foster sustainable development practices. Protecting the Sundarbans ecosystem and its communities not only safeguards biodiversity but also ensures the well-being and livelihoods of millions who depend on its resources. Thus, the rationale for this study lies in its potential to inform strategies that promote environmental conservation, mitigate climate risks, and promote equitable development in the face of global environmental challenges.

Objectives:

This article examines the multifaceted impacts of climate change on the ecological, economic, and social fabric of the Sundarbans community. The study explores adaptive strategies and resilience-building initiatives adopted by local communities, governments, and non-governmental organizations to mitigate the adverse effects of climate change

Importance of the mangrove ecosystem and biodiversity in Sundarban: The Sundarbans, located in West Bengal, India, and Bangladesh, is the largest contiguous mangrove forest ecosystem in the world and holds immense ecological, economic, and cultural significance. Here’s an exploration of the importance of the mangrove ecosystem and biodiversity in the Sundarbans:

Rich Faunal Diversity: The Sundarbans mangrove forests support a diverse array of flora and fauna, including several endangered species such as the Bengal tiger (*Panthera tigris tigris*), estuarine crocodile (*Crocodylus porosus*), and Gangetic dolphin (*Platanista gangetica*). It is also home to numerous bird species, including migratory birds.

Coastal Protection: The dense mangrove roots and trees act as natural barriers against coastal erosion, storm surges, and tidal waves, thereby protecting inland areas, agricultural lands, and human settlements from natural disasters like cyclones and tsunamis.

Carbon Sequestration: Mangroves are highly effective carbon sinks, sequestering carbon dioxide from the atmosphere and helping mitigate climate change impacts. They store carbon in their biomass and sediment, playing a crucial role in global carbon cycling.

Regulating Microclimate: Mangroves moderate local temperatures and humidity levels, creating a microclimate that supports diverse flora and fauna adapted to saline conditions. They stabilize soil and prevent erosion, maintaining the integrity of coastal ecosystems and supporting agricultural productivity in nearby areas.

Scientific Research: The Sundarbans serve as a living laboratory for researchers studying mangrove ecology, biodiversity conservation, climate change impacts, and sustainable development practices. Research findings from the region contribute to global understanding of coastal ecosystems and adaptation strategies in the face of environmental change.

Climate change as a global challenge:

“Climate change represents one of the most pressing global challenges of our time, characterized by significant and pervasive alterations in Earth's climate systems. This phenomenon is primarily driven by human activities, particularly the emission of greenhouse gases (GHGs) such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), which trap heat in the atmosphere and lead to global warming”.(Bhattacharya,2012) The consequences of climate change are multifaceted and extend far beyond environmental concerns, profoundly impacting socio-economic dynamics, human health, and ecosystems worldwide.

One of the most conspicuous effects of climate change is the steady increase in global average temperatures. This warming trend manifests in more frequent and intense heatwaves, altered precipitation patterns, and shifts in seasonal cycles, disrupting agricultural productivity, water availability, and natural habitats.

“Climate change intensifies the frequency and severity of extreme weather events such as hurricanes, typhoons, droughts, floods, and wildfires. These events lead to loss of lives, displacement of communities, destruction of infrastructure, and economic upheavals, particularly affecting vulnerable populations in developing countries with limited adaptive capacity. As global temperatures rise, thermal expansion of seawater and melting ice caps and glaciers contribute to rising sea levels. Coastal communities and low-lying regions face increased risks of inundation, saltwater intrusion into freshwater sources, and erosion of coastal habitats, posing significant threats to livelihoods and infrastructure”.(Nitin Sethi,2012)

Increased CO₂ absorption by the oceans leads to acidification, adversely affecting marine ecosystems such as coral reefs and fisheries. This phenomenon jeopardizes food security for millions of people reliant on marine resources and disrupts ecological balances within marine habitats. Climate change accelerates species extinctions and alters distribution patterns of flora and fauna. Ecosystems face challenges in adapting to rapid environmental changes, resulting in habitat loss, disruptions in ecological services, and diminished resilience against invasive species and diseases.

Climate change and Vulnerabilities of Sundarbans Communities

Climate change poses significant vulnerabilities to the communities residing in the Sundarbans, a deltaic region straddling the coastlines of India and Bangladesh. These vulnerabilities stem from the region's unique ecological setting, socio-economic characteristics, and exposure to various climate-related hazards. Here's an exploration of how climate change impacts and exacerbates vulnerabilities in the Sundarbans communities:

Sea Level Rise and Coastal Erosion:

The Sundarbans are highly susceptible to sea level rise due to their low-lying topography and proximity to the Bay of Bengal. Rising sea levels lead to increased salinization of freshwater sources, inundation of agricultural lands, and erosion of coastal embankments. Coastal communities dependent on agriculture, aquaculture, and fishing face threats to their livelihoods and housing. Loss of arable land reduces agricultural productivity, exacerbating poverty and food insecurity among vulnerable populations.

Cyclones and Extreme Weather Events:

The Sundarbans region is prone to cyclones and severe storms, which are becoming more frequent and intense due to climate change. These events result in widespread devastation of infrastructure, loss of lives, and displacement of communities. Poorly constructed housing, inadequate disaster preparedness, and limited access to early warning systems heighten the vulnerability of local communities. Vulnerable groups, including women, children, and elderly individuals, are disproportionately affected by cyclone impacts.

Changes in Precipitation Patterns:

Climate change alters monsoon patterns, leading to erratic rainfall, prolonged droughts, or intense precipitation events. These changes affect agricultural cycles, water availability, and freshwater resources essential for drinking and irrigation. Agricultural communities reliant on rain-fed farming face reduced crop yields, income losses, and food insecurity during periods of drought or flooding. Dependence on natural resources for livelihoods exacerbates vulnerabilities to climate variability.

Biodiversity Loss and Ecosystem Degradation:

Climate change contributes to habitat loss and degradation of mangrove ecosystems in the Sundarbans. Rising temperatures and sea levels, along with increased salinity, threaten the biodiversity and ecological services provided by mangrove forests. Fishing communities dependent on mangrove resources for livelihoods and subsistence face declining fish stocks, loss of habitat for aquatic species, and reduced resilience against environmental changes. Disruption of ecosystem services affects food security and economic stability.

Health Risks and Disease Burden:

Climate change influences the spread of vector-borne diseases such as malaria, dengue fever, and waterborne illnesses. Increased temperatures and changing precipitation patterns create conducive environments for disease vectors to proliferate. Poor sanitation infrastructure, inadequate healthcare facilities, and limited access to clean water exacerbate health risks in Sundarbans communities. Vulnerable populations, including children and the elderly, are at heightened risk of morbidity and mortality from climate-related diseases.

Climate change amplifies vulnerabilities in the Sundarbans communities by exacerbating existing socio-economic disparities, environmental pressures, and exposure to climate-related hazards. Addressing these vulnerabilities requires integrated adaptation strategies that enhance community resilience, promote sustainable livelihoods, and strengthen socio-economic safety nets. Collaboration among governments, non-governmental organizations, researchers, and local communities is essential to mitigate climate risks and build a sustainable future for Sundarbans residents in a changing climate.

Adaptation Strategies and Resilience Building in Sundarban:

Adaptation strategies and resilience building are critical for communities in the Sundarbans to cope with and thrive in the face of climate change impacts. Located in a vulnerable deltaic region shared by India and Bangladesh, the Sundarbans face challenges such as sea level rise, extreme weather events, biodiversity loss, and socio-economic vulnerabilities.

Protecting and restoring mangrove forests serve as natural buffers against coastal erosion, storm surges, and sea level rise. Community-based initiatives can involve local stakeholders in mangrove planting and conservation efforts. Constructing and maintaining robust embankments, tidal barriers, and flood shelters to protect coastal communities from cyclones and tidal inundation. Incorporating climate resilience into infrastructure planning and development. Promoting diversified livelihood options such as aquaculture, poultry farming, and eco-tourism to reduce dependence on climate-sensitive sectors like agriculture and fishing. Introducing climate-resilient crop varieties, rainwater harvesting techniques, and improved irrigation systems to cope with erratic rainfall patterns and salinity intrusion.

Enhancing local capacity for early detection and response to cyclones, floods, and other extreme weather events through community-led early warning systems and evacuation plans. Providing training and resources to community members, local authorities, and first responders on disaster preparedness, search and rescue operations, and post-disaster recovery. Implementing vector control measures, improving access to clean water and sanitation facilities, and enhancing healthcare services to reduce the incidence of climate-related diseases such as malaria and diarrheal illnesses. Promoting the construction of climate-resilient housing that can withstand cyclonic winds and flooding, incorporating local building materials and traditional architectural knowledge.

Developing and implementing integrated coastal zone management plans that incorporate climate change considerations, biodiversity conservation, and sustainable development goals. Advocating for policies at local, national, and international levels that support climate resilience, biodiversity conservation, and equitable socio-economic development in the Sundarbans region.

Conclusion:

Climate change amplifies vulnerabilities in the Sundarbans communities by exacerbating existing socio-economic disparities, environmental pressures, and exposure to climate-related hazards. Addressing these vulnerabilities requires integrated adaptation strategies that enhance community resilience, promote sustainable livelihoods, and strengthen socio-economic safety nets. Collaboration among governments, non-governmental organizations, researchers, and local communities is essential to mitigate climate risks and build a sustainable future for Sundarbans residents in a changing climate.

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Citation: Khatan.K,(2024) “Climate Change – a threat to the Sundarban Region Community”*Bharati International Journal of Multidisciplinary Research & Development (BIJMRD)*, Vol-2, Issue-4 May-2024.