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CLIMATE CHANGE AND NON-TRADITIONAL SECURITY CHALLENGES: A STUDY OF THE SUNDARBANS, WEST BENGAL

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RESEARCH ARTICLE

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Abstract

Climate change has emerged as a significant non-traditional security threat, particularly in ecologically fragile regions. This study examines the multidimensional impacts of climate change on non-traditional security in the Sundarbans, located in West Bengal. By applying the framework of non-traditional security, the paper explores how environmental changes translate into challenges related to food security, water scarcity, health risks, livelihood instability, and migration. The study is based on a qualitative analysis of secondary data, including reports, academic literature, and policy documents. The findings reveal that climate change acts as a "threat multiplier," intensifying existing socio-economic vulnerabilities in the region. Sea-level rise, increased cyclone frequency, salinity intrusion, and coastal erosion have significantly disrupted agricultural productivity, reduced access to safe drinking water, and weakened livelihood systems. These environmental stresses have led to food insecurity, health problems, and large-scale distress migration. Furthermore, the study highlights the interconnected nature of non-traditional security challenges, where one form of insecurity reinforces another, creating a complex cycle of vulnerability. It also identifies gaps in policy implementation and the need for a more integrated and community-focused approach to climate adaptation.

The paper concludes that addressing climate change in the Sundarbans requires a shift from a purely environmental perspective to a broader human security approach. Strengthening resilience through sustainable development strategies, inclusive policies, and effective governance is essential to mitigate risks and ensure long-term security for vulnerable populations.

Keywords: *Climate Change, Non-Traditional Security, Sundarbans, Livelihood Vulnerability, Salinity Intrusion, Coastal Erosion, Human Security*

Introduction

Climate change has emerged as one of the most critical global challenges of the 21st century, posing significant threats not only to the environment but also to human societies and their security. Rising global temperatures, sea-level rise, and the increasing frequency of extreme weather events have intensified vulnerabilities, particularly in ecologically fragile regions. In recent years, the discourse on security has expanded beyond traditional military concerns to include non-traditional dimensions such as food security, water security, health, and human livelihood. These emerging concerns are collectively understood under the framework of non-traditional security. The Sundarbans, located in the eastern part of India in the state of West Bengal, represents one of the most climate-vulnerable regions in the world. As the largest mangrove ecosystem, the Sundarbans is highly susceptible to environmental changes such as sea-level rise, coastal erosion, salinity intrusion, and recurrent cyclones. Over the past few decades, the region has witnessed significant ecological degradation, leading to adverse impacts on agriculture, fisheries, and freshwater availability. These environmental stresses have directly affected the livelihoods of millions of people who depend on the fragile ecosystem for survival. In this context, climate change acts as a "threat multiplier," exacerbating existing socio-economic vulnerabilities and creating new forms of insecurity. The disruption of agricultural productivity due to soil salinization, the scarcity of potable water, and the increasing intensity of natural disasters have contributed to food insecurity, economic instability, and forced migration in the region. These challenges highlight the growing relevance of non-traditional security in understanding the human consequences of climate change.

Despite the increasing recognition of climate-induced vulnerabilities, there remains a gap in integrating the concept of non-traditional security into regional climate studies, particularly in the context of the Sundarbans. Most existing studies tend to focus on environmental degradation or economic loss, often overlooking the broader security implications for human populations. Therefore, this study seeks to bridge this gap by examining climate change through the lens of non-traditional security challenges.

The primary objective of this research is to analyze how climate change impacts various dimensions of non-traditional security in the Sundarbans region of West Bengal. Specifically, the study aims to explore the interconnections between environmental change and issues such as food insecurity, livelihood disruption, water scarcity, health risks, and migration. By adopting a multidisciplinary approach, this paper attempts to provide a comprehensive understanding of climate-induced vulnerabilities and their implications for human security.

Conceptual Framework: Non-Traditional Security

The concept of security has undergone a significant transformation in recent decades. Traditionally, security was primarily understood in terms of military threats and the protection of state sovereignty. However, with the end of the Cold War and the emergence of new global challenges, the scope of security has expanded to include a wide range of non-military threats. This broader understanding is encapsulated in the concept of non-traditional security, which emphasizes the protection of individuals and communities rather than just the state. Non-traditional security refers to threats that are non-military in nature but have serious implications for human survival and well-being. These include issues such as food insecurity, water scarcity, health risks, environmental degradation, and forced migration. Unlike traditional security threats, which are often sudden and conflict-driven, non-traditional security challenges are typically gradual, complex, and interconnected. They often arise from structural vulnerabilities and are intensified by processes such as globalization and climate change. One of the key frameworks associated with non-traditional security is the idea of human security, which shifts the focus from state-centric security to people-centric concerns. Human security encompasses multiple dimensions, including economic security, food security, health security, environmental security, and personal security. This approach recognizes that threats to human well-being can arise from a variety of sources beyond armed conflict, including environmental and climatic changes.

In this context, climate change has emerged as a major non-traditional security threat. It acts as a "threat multiplier" by exacerbating existing vulnerabilities and creating new risks for human populations. For instance, rising temperatures and changing precipitation patterns can reduce agricultural productivity, leading to food insecurity. Similarly, sea-level rise and salinity intrusion can contaminate freshwater resources, creating water scarcity and health hazards. Extreme weather events such as cyclones and floods can destroy infrastructure, disrupt livelihoods, and force people to migrate. The relevance of non-traditional security is particularly evident in ecologically fragile regions such as the Sundarbans. Here, the impacts of climate change are not limited to environmental degradation but extend to multiple aspects of human life. The loss of arable land due to salinization, declining fish stocks, and increasing disaster frequency directly affect food and livelihood security. At the same time, inadequate access to safe drinking water and healthcare services further compounds human insecurity. These interconnected challenges demonstrate how environmental change can translate into broader security concerns.

Thus, the concept of non-traditional security provides a useful analytical framework for understanding the complex and multidimensional impacts of climate change. By moving beyond a narrow focus on environmental issues, it allows for a more comprehensive examination of how climate change affects human lives, livelihoods, and overall well-being. This framework is particularly relevant for analyzing the situation in the Sundarbans, where environmental vulnerability and socio-economic challenges are deeply intertwined.

Study Area: Sundarbans

The Sundarbans, located in the delta region formed by the confluence of the Ganges, Brahmaputra, and Meghna rivers, is one of the largest mangrove ecosystems in the world. Spanning across India and Bangladesh, the Indian part of the Sundarbans lies in the southern region of West Bengal. This region is characterized by a complex network of tidal waterways, mudflats, and low-lying islands, making it highly dynamic and ecologically fragile. Geographically, the Sundarbans is highly vulnerable to climatic and environmental changes due to its low elevation and proximity to the Bay of Bengal. A significant portion of the land lies just a few meters above sea level, which makes it extremely susceptible to sea-level rise, coastal flooding, and storm surges. The region frequently experiences cyclones and tidal floods, which have intensified in both frequency and magnitude over the past few decades. These environmental conditions make the Sundarbans one of the most climate-sensitive regions in India. The socio-economic profile of the Sundarbans further amplifies its vulnerability. The region is home to millions of people who primarily depend on natural resources for their livelihoods. Agriculture, fishing, and forest-based activities such as honey collection and wood gathering constitute the main sources of income. However, these livelihood activities are highly dependent on climatic conditions and are therefore extremely sensitive to environmental changes. Soil salinity, erratic rainfall, and frequent flooding have significantly reduced agricultural productivity, while changes in aquatic ecosystems have affected fish availability.

Infrastructure and development indicators in the Sundarbans remain relatively poor compared to other regions. Limited access to healthcare, safe drinking water, education, and transportation increases the vulnerability of local communities. Additionally, embankments constructed to protect agricultural land from tidal flooding are often weak and prone to breaches during cyclones, leading to large-scale displacement and economic loss. Another critical aspect of the region is its ecological significance. The Sundarbans is recognized as a UNESCO World Heritage Site and is home to diverse flora and fauna, including the iconic Bengal tiger. However, this ecological richness is increasingly threatened by climate change and human activities, creating a complex interaction between environmental conservation and human survival. Given its unique geographical location, ecological importance, and socio-economic challenges, the Sundarbans serves as an ideal case study for examining the impacts of climate change through the lens of non-traditional security. The region vividly illustrates how environmental changes can translate into multiple forms of human insecurity, making it highly relevant for this study.

Climate Change Impacts in the Sundarbans

The Sundarbans has emerged as one of the most climate-vulnerable regions in the world due to its fragile ecosystem and geographical location. The impacts of climate change in this region are multifaceted, affecting both the natural environment and human settlements. These impacts are increasingly visible in the form of sea-level rise, intensifying cyclones, salinity intrusion, and coastal erosion.

1. Sea-Level Rise and Coastal Erosion: One of the most significant consequences of climate change in the Sundarbans is the gradual rise in sea level. Due to its low-lying topography, even a slight increase in sea level has severe implications for the region. Large areas of land have already been submerged, and several islands have either shrunk significantly or disappeared entirely over the past few decades. Coastal erosion further exacerbates this problem by reducing habitable and cultivable land. As riverbanks and coastal embankments erode, local communities are forced to relocate, leading to displacement and loss of livelihood. The combined effects of sea-level rise and erosion pose a serious threat to the long-term sustainability of human settlements in the region.

2. Increased Frequency and Intensity of Cyclones: The Sundarbans frequently experiences tropical cyclones originating from the Bay of Bengal, and recent trends indicate an increase in both their frequency and intensity. Notable cyclones such as Amphan (2020) and Yaas (2021) have caused widespread devastation in the region.

These cyclones lead to:

- Destruction of homes and infrastructure
- Breaching of embankments
- Loss of crops and livestock
- Contamination of freshwater sources

The recurring nature of such disasters has created a cycle of vulnerability, where communities struggle to recover before being hit by the next event.

3. Salinity Intrusion and Water Crisis: Salinity intrusion is another major impact of climate change in the Sundarbans. Rising sea levels and frequent storm surges allow saline water to enter agricultural fields and freshwater sources. This has significantly reduced soil fertility and made traditional farming increasingly difficult. In addition to agricultural challenges, salinity has also affected access to safe drinking water. Many communities rely on limited freshwater sources, which are often contaminated, leading to water scarcity and health issues. This growing water crisis has become a critical concern for the region.

4. Loss of Biodiversity and Ecosystem Degradation: The ecological balance of the Sundarbans is under severe threat due to climate change. Changes in temperature, salinity, and water availability have disrupted the natural habitat of various species. The iconic Bengal tiger, along with numerous other species, faces increasing habitat stress. Mangrove forests, which act as natural barriers against storms and coastal erosion, are also being degraded. The loss of mangrove cover not only threatens biodiversity but also reduces the region's resilience to climate impacts, making both ecosystems and human populations more vulnerable.

5. Flooding and Embankment Failure: Frequent flooding has become a common occurrence in the Sundarbans due to a combination of heavy rainfall, high tides, and weak embankment systems. Embankments, which are crucial for protecting agricultural land and settlements, are often unable to withstand the pressure of storm surges and tidal waves. When these embankments fail, large areas are inundated with saline water, causing long-term damage to agriculture and forcing people to abandon their homes. This recurring problem highlights the inadequacy of existing infrastructure in coping with the growing impacts of climate change.

Non-Traditional Security Challenges in the Sundarbans

The impacts of climate change in the Sundarbans extend far beyond environmental degradation and translate into multiple dimensions of non-traditional security challenges. These challenges are deeply interconnected and directly affect the survival, well-being, and dignity of local communities. By applying the non-traditional security framework, it becomes evident that climate change acts as a catalyst for various forms of human insecurity in the region.

1. Food Security: Food security in the Sundarbans has been severely affected by climate change. Agricultural productivity has declined due to increasing soil salinity, erratic rainfall, and frequent flooding. Traditional crops such as paddy are no longer viable in many areas, leading to reduced food availability. In addition, damage to fisheries caused by changes in water salinity and ecosystem imbalance has further reduced access to food. As a result, many households face chronic food shortages and nutritional insecurity, making food security a major concern in the region.

2. Livelihood Security: Livelihood insecurity is one of the most immediate consequences of climate change in the Sundarbans. A majority of the population depends on climate-sensitive occupations such as agriculture, fishing, and forest-based activities. Environmental degradation, declining fish stocks, and repeated crop failures have significantly reduced income opportunities. Many families are forced to adopt alternative and often unstable livelihood strategies, including daily wage labor and informal sector work. This economic instability increases poverty and reduces resilience to future shocks.

3. Water Security: Access to safe drinking water has become increasingly difficult in the Sundarbans due to salinity intrusion and contamination of freshwater sources. Tube wells and ponds, which are the primary sources of drinking water, are often

rendered unusable. Women and children, in particular, bear the burden of collecting potable water from distant sources. The scarcity of safe water not only affects daily life but also contributes to health problems, thereby linking water security with broader human security concerns.

4. Health Security: Climate change has led to the emergence and spread of various health risks in the Sundarbans. Waterborne diseases, skin infections, and vector-borne diseases such as malaria have become more prevalent due to poor water quality and changing environmental conditions. Malnutrition resulting from food insecurity further weakens the health status of the population. Limited healthcare infrastructure and lack of accessibility worsen the situation, making health security a critical issue in the region.

5. Migration and Human Security: One of the most visible outcomes of climate-induced insecurity in the Sundarbans is large-scale migration. Loss of livelihoods, repeated disasters, and declining living conditions have forced many people to migrate to urban areas in search of work.

This migration is often distress-driven and unplanned, leading to various forms of exploitation and social vulnerability. Migrants frequently end up in informal sectors with poor working conditions and lack of social protection. Thus, climate change not only displaces populations but also exposes them to new forms of insecurity.

Interconnected Nature of Security Challenges

An important aspect of non-traditional security in the Sundarbans is the interlinkage between different forms of insecurity. For example:

Salinity intrusion → agricultural decline → food insecurity
Food insecurity → poverty → migration
Water scarcity → health problems → reduced productivity

This interconnectedness demonstrates that climate change does not create isolated problems but rather a complex web of vulnerabilities that reinforce each other.

Discussion and Analysis

The analysis of climate change impacts in the Sundarbans clearly demonstrates that environmental changes are not isolated phenomena but are deeply intertwined with broader socio-economic and security concerns. By applying the framework of non-traditional security, it becomes evident that climate change functions as a "threat multiplier," intensifying existing vulnerabilities and generating new forms of human insecurity. One of the key findings of this study is the interconnected nature of various security challenges. Climate-induced factors such as sea-level rise, salinity intrusion, and extreme weather events have a cascading effect on different aspects of human life. For instance, the intrusion of saline water into agricultural land reduces crop productivity, which in turn leads to food insecurity and loss of income. This economic instability often forces households to adopt coping strategies such as migration, thereby transforming environmental stress into social and demographic challenges.

Furthermore, the recurring impact of cyclones and flooding has created a cycle of vulnerability in the Sundarbans. Communities repeatedly suffer losses of homes, livelihoods, and infrastructure, with limited capacity for recovery. This cyclical pattern not only weakens resilience but also deepens poverty and marginalization. The inadequacy of embankments and disaster preparedness measures further exacerbates the situation, highlighting structural weaknesses in regional planning and governance. Another critical aspect that emerges from the analysis is the uneven distribution of vulnerability. Marginalized groups, including small farmers, landless laborers, women, and children, are disproportionately affected by climate change. Limited access to resources, education, and institutional support increases their exposure to risks and reduces their adaptive capacity. This indicates that climate change is not only an environmental issue but also a question of social justice and equity. In addition, the study reveals significant gaps in policy responses and institutional mechanisms. While various government initiatives have been introduced to address climate change and disaster management, their implementation at the grassroots level remains inadequate. Lack of coordination between agencies, insufficient infrastructure, and limited community participation hinder effective adaptation and resilience-building efforts.

The findings also emphasize the need to move beyond a purely environmental perspective and adopt a more integrated approach to climate change. By framing climate change as a non-traditional security threat, it becomes possible to better understand its multidimensional impacts and design more comprehensive policy responses. This approach highlights the importance of linking environmental sustainability with human development and security. Overall, the Sundarbans serves as a critical example of how climate change can reshape the nature of security in vulnerable regions. The region illustrates that the consequences of climate change extend beyond ecological degradation to encompass economic instability, social disruption, and human insecurity. Therefore, addressing climate change in such contexts requires not only environmental interventions but also a broader focus on strengthening human security and resilience.

Policy Recommendations

Addressing the complex and interconnected non-traditional security challenges in the Sundarbans requires a comprehensive and multi-dimensional policy approach. Given the region's high vulnerability to climate change, effective strategies must integrate environmental sustainability with human security and socio-economic development.

1. Strengthening Climate-Resilient Infrastructure: The construction and maintenance of durable embankments should be prioritized to protect coastal areas from flooding and storm surges. Investment in climate-resilient housing and infrastructure can significantly reduce the impact of recurrent cyclones and disasters.

2. Promoting Sustainable Livelihoods: Alternative livelihood opportunities should be developed to reduce dependence on climate-sensitive sectors. Skill development programs, eco-tourism, and small-scale industries can provide more stable sources of income for local communities.

3. Ensuring Food and Water Security: Government initiatives should focus on promoting salt-tolerant crop varieties and sustainable agricultural practices. Rainwater harvesting, desalination techniques, and improved water management systems are essential to ensure access to safe drinking water.

4. Strengthening Healthcare Systems: Improved healthcare infrastructure and services are necessary to address the growing health risks associated with climate change. Awareness programs, mobile health units, and better disease surveillance systems can enhance health security in the region.

5. Managing Migration and Enhancing Human Security: Policies should be designed to support climate migrants through social protection measures, employment opportunities, and access to basic services. Planned and safe migration strategies can help reduce vulnerability and exploitation.

6. Community Participation and Awareness: Local communities should be actively involved in planning and decision-making processes. Enhancing awareness about climate change and disaster preparedness can strengthen community resilience and adaptive capacity.

7. Integrated Policy Approach: There is a need for better coordination between various government agencies, non-governmental organizations, and local institutions. A holistic policy framework that integrates climate adaptation with development planning is essential for long-term sustainability.

Conclusion

The study of climate change and non-traditional security challenges in the Sundarbans highlights the profound and multifaceted impacts of environmental change on human societies. The findings demonstrate that climate change is not merely an ecological issue but a critical driver of human insecurity, affecting food, water, health, and livelihoods. By applying the framework of non-traditional security, this research has shown how climate change acts as a "threat multiplier," intensifying existing vulnerabilities and creating new challenges for already marginalized communities. The interconnected nature of these challenges underscores the need for a comprehensive and integrated approach to addressing climate-induced risks. The Sundarbans serves as a powerful example of how environmental degradation can translate into broader socio-economic and security concerns. The increasing frequency of cyclones, rising sea levels, and salinity intrusion have significantly disrupted the lives and livelihoods of the local population, leading to displacement, poverty, and social instability.

While various policy measures have been introduced, the study reveals significant gaps in implementation and effectiveness. Addressing these challenges requires not only infrastructural and technological solutions but also a strong focus on human security, social equity, and community resilience. In conclusion, tackling climate change in vulnerable regions like the Sundarbans demands urgent and sustained action at multiple levels. A shift towards inclusive, adaptive, and sustainable development strategies is essential to mitigate risks and ensure long-term security for affected populations. Future research should further explore localized adaptation strategies and strengthen the integration of non-traditional security perspectives into climate policy frameworks.

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