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Global Climate Change and its Impact on Human Security of Gilgit-Baltistan

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Abstract

The current study explores the impact of global climate change on human security in the Gilgit-Baltistan region of Pakistan. With its unique mountainous geography and reliance on glacial ecosystems, Gilgit-Baltistan faces disproportionate vulnerabilities to climate-induced threats. The study aimed to investigate the multidimensional impacts of climate change on environmental, economic, social, and political dimensions of human security in this vulnerable region. A mixed-methods approach was employed, combining comprehensive literature review with qualitative analysis of historical disaster data and policy documents from 2010-2021. Thematic analysis revealed significant climate-related threats including glacial lake outburst floods, water scarcity, agricultural disruptions, and increased natural disasters. Findings indicate that climate change poses critical threats to human security in Gilgit-Baltistan through direct environmental impacts and cascading socio-economic consequences. The study highlights the urgent need for integrated adaptation strategies, enhanced disaster management systems, and international cooperation to address these climate-induced security challenges in vulnerable mountainous regions.

Keywords: Climate Change, Human Security, Gilgit-Baltistan, Vulnerability, Adaptation Strategies, Disaster Management

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Introduction

Climate change has emerged as one of the most significant global challenges of the 21st century, with far-reaching implications for human security worldwide (IPCC, 2022). The concept of human security has evolved beyond traditional military concerns to encompass environmental, economic, and social dimensions, recognizing that climate change poses fundamental threats to human wellbeing and survival (Gregoratti, 2018). Nowhere are these threats more pronounced than in vulnerable mountainous regions like Gilgit-Baltistan, where climate change impacts are already manifesting with alarming intensity. Gilgit-Baltistan, located in the northernmost part of Pakistan within the Karakoram-Himalaya-Hindu Kush mountain ranges, represents a region of exceptional environmental sensitivity and socio-economic vulnerability (National Disaster Management Authority, 2011). The region hosts some of the world's largest non-polar glaciers and serves as a crucial water source for millions downstream, earning it the designation of the "Third Pole" (Farooqi et al., 2005). However, this unique geographical positioning also makes it disproportionately vulnerable to climate change impacts, including accelerated glacial melting, changing precipitation patterns, and increased frequency of extreme weather events.

Previous research has established the broad linkages between climate change and human security at global and national levels (O'Brien & Barnett, 2013). However, there remains a significant gap in region-specific studies examining how these global phenomena manifest in unique local contexts like Gilgit-Baltistan. The complex interplay between climate change and human security in this region encompasses multiple dimensions: environmental security through glacial retreat and water resource changes; economic security through impacts on agriculture and livelihoods; social security through displacement and health impacts; and political security through resource conflicts and governance challenges.

Studies by Chaudhry (2017) and Mahmood (2022) have highlighted Pakistan's particular vulnerability to climate change, but few have focused specifically on the mountainous northern regions. Research by Mustafa (2015) and Saeed-ur-Rahman (2010) has documented general climate trends in Pakistan, but comprehensive analysis of human security implications in Gilgit-Baltistan remains limited. This study addresses this research gap by providing a focused examination of climate change impacts on human security dimensions specific to Gilgit-Baltistan.

The current study aims to: (1) analyze the specific climate change vulnerabilities of Gilgit-Baltistan's unique geographical context; (2) examine the multidimensional impacts on human security; (3) document historical climate-related disasters and their human security implications; and (4) propose context-specific adaptation and policy recommendations. Through this focused investigation, the study contributes to both academic understanding and practical policy formulation for climate resilience in vulnerable mountainous regions

Methodology

Objectives

The current study has the following objectives:

1. To analyze the geographical vulnerabilities of Gilgit-Baltistan to climate change
2. To examine the multidimensional impacts of climate change on human security in the region

Vol. 3 No. 12 (2025)

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3. To document historical climate-related disasters and their consequences
4. To propose adaptation strategies and policy recommendations

Research Design

This study employed a qualitative research design, that is descriptive analytical methodology with a deductive approach, with document analysis as the primary methodological approach. The research utilized a comprehensive review of existing literature, policy documents, and historical records to examine the complex relationship between climate change and human security in Gilgit-Baltistan.

Data Sources

Primary data sources included:

1. Government reports from the Gilgit-Baltistan Disaster Management Authority (2010-2021)
2. Pakistan Meteorological Department assessments of glacial lake outburst floods
3. National disaster management reports and vulnerability assessments
4. United Nations Development Programme climate change assessments for Pakistan

Secondary data sources included peer-reviewed journal articles, books, and research papers on climate change, human security, and regional environmental studies.

Data Analysis

Thematic analysis was conducted on the collected documents to identify recurring patterns and themes related to climate change impacts and human security implications. The analysis followed a systematic approach:

1. Familiarization with the data through repeated reading of documents
2. Generation of initial codes capturing key concepts
3. Search for themes by collating related codes
4. Review and refinement of themes
5. Definition and naming of final themes
6. Production of the final analysis

The analysis focused on identifying themes related to: (a) environmental vulnerabilities, (b) disaster patterns and trends, (c) socio-economic impacts, and (d) adaptation needs.

Ethical Considerations

As a document-based study, ethical considerations primarily involved proper attribution of sources and accurate representation of data. All sources have been properly cited, and efforts have been made to present data objectively without misrepresentation.

Analytical Framework

The study employed Green Theory as an analytical framework for understanding the relationship between environmental changes and human security (Dyer, 2018). This theoretical perspective emphasizes the interconnectedness of ecological systems and human wellbeing, providing a suitable lens for examining climate change impacts on human security dimensions.

Results

The thematic analysis revealed several significant themes related to climate change impacts on human security in Gilgit-Baltistan. The findings are organized into two main thematic categories:

1. Climate Change Vulnerabilities and Threats
2. Human Security Implications.

Vol. 3 No. 12 (2025)

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Climate Change Vulnerabilities and Threats

Accelerated Glacial Retreat and GLOF Risks

Analysis of meteorological data and disaster records revealed that Gilgit-Baltistan is experiencing accelerated glacial melting, with significant implications for water security and disaster risks. The region contains approximately 5,000 glaciers spanning 15,000 square kilometers, with at least 36 glacial lakes identified as potentially dangerous (GBDMA, 2021). Historical records from 2010-2021 document multiple Glacial Lake Outburst Floods (GLOFs) causing substantial damage to infrastructure, agriculture, and human settlements.

The melting of glaciers is causing floods, landslides, and avalanches, which in turn, are damaging infrastructure, destroying crops, and endangering the lives of people in the region."* (National Disaster Management Authority, 2011)

Changing Precipitation Patterns and Water Scarcity

Document analysis indicated significant changes in precipitation patterns, with increasing variability and extreme weather events. Historical data shows a trend toward more intense rainfall events interspersed with prolonged drought periods, creating challenges for water management and agricultural planning.

Increased Frequency of Climate-Related Disasters

Analysis of disaster records from 2010-2021 revealed a concerning pattern of increasing climate-related disasters:

Year	Major Disasters	Casualties	Key Impacts
2010	Attabad landslide, earthquakes	20+ deaths	River blocking, infrastructure damage
2011	Floods, landslides, GLOFs	80+ deaths	Widespread destruction, displacement
2012	Flash floods, earthquake	40+ deaths	Major destruction, displacement
2013	Avalanches, floods, earthquake	400+ deaths	Major destruction, displacement
2014	Floods, landslides	Multiple deaths	Infrastructure damage
2015	Earthquake, GLOFs, floods	200+ deaths	Widespread damage
2016	GLOFs, landslides	20+ deaths	Village destruction
2017	Avalanches, floods, earthquake	13+ deaths	Avalanches, floods, earthquake
2018	Snowstorms, GLOFs, earthquake	Multiple deaths	Disruption, damage
2019	Snowstorms, GLOFs, floods	Multiple deaths	Displacement, damage
2020	Avalanches, floods, GLOFs	Dozens killed	Infrastructure damage
2021	Landslides, GLOFs, earthquakes	17+ deaths	Property destruction

Human Security Implications

Environmental Security Threats

The analysis revealed significant threats to environmental security through multiple pathways:

1. Water security challenges due to glacial retreat and changing precipitation
2. Biodiversity loss from habitat changes and ecosystem disruption

Vol. 3 No. 12 (2025)

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3. Soil erosion and land degradation from extreme weather events

Economic Security Impacts

Climate change poses substantial threats to economic security in Gilgit-Baltistan:

1. Agricultural disruptions affecting 80% of the population dependent on farming
2. Tourism industry vulnerabilities due to infrastructure damage and safety concerns
3. Livelihood losses from natural disasters and resource depletion

"The majority of the population depends on agriculture and livestock for their livelihoods and their livelihoods are being threatened by erratic weather patterns, which cause crop failure, loss of livestock, and reduced grazing lands."

Social Security Consequences

The analysis documented several social security implications:

1. Health risks from heat-related illnesses and waterborne diseases
2. Displacement and migration due to environmental factors
3. Educational disruptions from infrastructure damage

Political Security Dimensions

Emerging political security concerns include:

1. Resource conflicts over diminishing water supplies
2. Governance challenges in disaster response and adaptation planning
3. Transboundary implications of climate-induced migration

Discussion

The findings of this study reveal a complex and multifaceted relationship between climate change and human security in Gilgit-Baltistan. The results demonstrate that climate change is not merely an environmental issue but a comprehensive human security challenge affecting all dimensions of human wellbeing in this vulnerable region.

The accelerated glacial retreat documented in this study aligns with global patterns of climate change impacts in mountainous regions (IPCC, 2022). However, the specific vulnerabilities of Gilgit-Baltistan are particularly acute due to its geographical characteristics and socio-economic context. The region's dependence on glacial meltwater for agriculture, drinking water, and hydropower creates unique vulnerabilities that require specialized adaptation strategies. The increasing frequency and severity of climate-related disasters from 2010-2021 represents a significant threat to human security. This trend is consistent with global patterns of intensifying climate impacts but manifests in particularly severe forms in Gilgit-Baltistan's fragile mountainous environment. The cumulative impact of repeated disasters undermines community resilience and development gains, creating a cycle of vulnerability that is difficult to break.

The multidimensional impacts on human security identified in this study support the theoretical framework of Green Theory (Dyer, 2018), which emphasizes the interconnectedness of environmental and human systems. The findings demonstrate how environmental changes cascade through economic, social, and political systems, creating complex security challenges that require integrated responses. The economic security impacts are particularly concerning given the region's dependence on climate-sensitive sectors. Agriculture, which employs the majority of the population, faces multiple threats from changing precipitation patterns, water scarcity, and extreme weather events. These challenges are compounded by limited adaptive capacity and infrastructure constraints.

Social security implications, including health risks and displacement, represent growing concerns. The documented increase in climate-related diseases and mental health impacts

Vol. 3 No. 12 (2025)

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from repeated disasters indicates the need for enhanced health system preparedness and psychosocial support services.

Political security dimensions, while less immediately apparent, represent important emerging concerns. Resource conflicts, particularly around water access, have already been documented in the region and may intensify as climate impacts worsen. Effective governance and conflict prevention mechanisms will be crucial for maintaining social stability.

The findings highlight the urgent need for comprehensive adaptation strategies that address all dimensions of human security. Current approaches often focus on discrete sectors or immediate disaster response, but the interconnected nature of climate impacts requires more integrated approaches.

Limitations and Future Research Directions

This study has several limitations that suggest directions for future research. The reliance on documentary sources limits the inclusion of community perspectives and lived experiences. Future research should incorporate participatory methods to capture local knowledge and adaptation practices. Additionally, more detailed quantitative analysis of climate trends and their socio-economic impacts would strengthen the evidence base for policy formulation.

Conclusion

This study provides comprehensive evidence of the significant threats that climate change poses to human security in Gilgit-Baltistan. The findings demonstrate that climate change impacts extend far beyond environmental changes to encompass fundamental threats to economic livelihoods, social wellbeing, and political stability in this vulnerable region.

The analysis reveals several critical insights. First, Gilgit-Baltistan's unique geographical characteristics make it disproportionately vulnerable to climate change impacts, particularly through glacial retreat and associated disasters. Second, climate impacts manifest across all dimensions of human security, creating complex, interconnected challenges that require integrated responses. Third, historical disaster patterns show an alarming trend of increasing frequency and severity, undermining community resilience and development progress. The study highlights the urgent need for enhanced adaptation strategies that address the specific vulnerabilities of mountainous regions. Short-term priorities include strengthening early warning systems, improving disaster preparedness, and building climate-resilient infrastructure. Long-term strategies must focus on sustainable development pathways that reduce dependency on climate-sensitive sectors while enhancing adaptive capacity.

Policy recommendations emerging from this study emphasize the need for:

1. Integrated climate adaptation planning that addresses all dimensions of human security
2. Enhanced investment in climate-resilient infrastructure and early warning systems
3. Community-based adaptation approaches that leverage local knowledge
4. Strengthened governance mechanisms for climate risk management
5. Increased international cooperation and support for vulnerable regions

The human security implications of climate change in Gilgit-Baltistan represent both a critical challenge and an opportunity for innovative adaptation approaches. By addressing these interconnected challenges through comprehensive, integrated strategies, it is possible to enhance resilience and protect human security in the face of ongoing climate changes. The findings of this study contribute to both academic understanding and

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practical policy development for climate adaptation in vulnerable mountainous regions worldwide.

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