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Impacts of Climate Change on Disasters in Jammu and Kashmir: A Review

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Abstract

The susceptibility of Jammu and Kashmir (J&K) to the ramifications of climate change is significantly pronounced owing to its distinctive geographical and climatic characteristics, which amplify the effects of environmental alterations. The region is confronted with escalating temperatures, modified precipitation patterns, and intensified probabilities of natural calamities. Furthermore, the area is susceptible to seismic activities, flooding, landslides, and avalanches, all of which are aggravated by the consequences of climate change. The evolving climatic conditions jeopardize agricultural productivity and water resources, thereby affecting the livelihoods and resilience of local communities. Although the primary emphasis is on the detrimental impacts of climate change, some scholars contend that adaptive strategies and community resilience may alleviate these vulnerabilities, underscoring the critical role of local governance and institutional frameworks in managing climate-related risks.

Key Words: ramifications, escalating, susceptible, resilience, climate-related risks, calamities

Introduction

The paper seeks to review the impacts of climate change on the natural disasters affecting Jammu and Kashmir, providing insights into how the region's environment and population are being affected. It will also explore potential strategies for mitigation and adaptation. Jammu and Kashmir has been listed among the states with the highest vulnerability to climate change with regard to the potential impact on the disasters. There is the need to understand the complex interactions between climate change and the disasters. As per UNEP report some parts of the state are moderate to highly vulnerable. The Kashmir Valley's susceptibility to various disasters can be attributed to a combination of geographical, geological, and climatic factors.

Jammu and Kashmir's unique geological and geomorphic characteristics make it prone to various disasters, including earthquakes, floods, and landslides (Romshoo et al., 2020). The increasing frequency and intensity of disasters in Jammu and Kashmir can be attributed to a combination of environmental, climatic, and anthropogenic factors. These elements interact to heighten vulnerability and exposure to natural hazards, leading to more severe disaster outcomes. Rising temperatures and variable precipitation patterns have intensified

climate-related disasters, such as floods and landslides (Thomas et al., 2015).

The region's fragile landscape exacerbates the impact of extreme weather events, particularly during the monsoon season when cloudbursts can trigger devastating flash floods (Sati, 2013). Increased population density in vulnerable areas has heightened exposure to disasters, as more people reside in high-risk zones like riverbanks and unstable slopes (Thomas et al., 2015). Urbanization without adequate infrastructure has further increased susceptibility to disasters, as seen in the aftermath of the 2005 Kashmir earthquake, which caused widespread landslides (Das et al., 2007). These factors contribute to disaster frequency; some argue that improved disaster preparedness and community resilience could mitigate these risks, emphasizing the need for proactive measures in disaster management.

Study Area

Jammu and Kashmir is a union territory in northern India, bounded by the Himalayan mountain range to the north and the fertile plains of Punjab to the south (Figure 1). The region's geographic diversity includes lush valleys in Kashmir, and mountainous terrain in Jammu. Its climate varies from subtropical in Jammu to temperate in the Kashmir valley. The region is characterized by significant seasonal variations, with heavy monsoonal rains during the summer months and snow in winter.

Jammu and Kashmir's complex topography and location make it particularly vulnerable to the impacts of climate change. It experiences frequent natural disasters like floods, landslides, forest fires, windstorms, and avalanches, often exacerbated by erratic weather patterns linked to global warming.

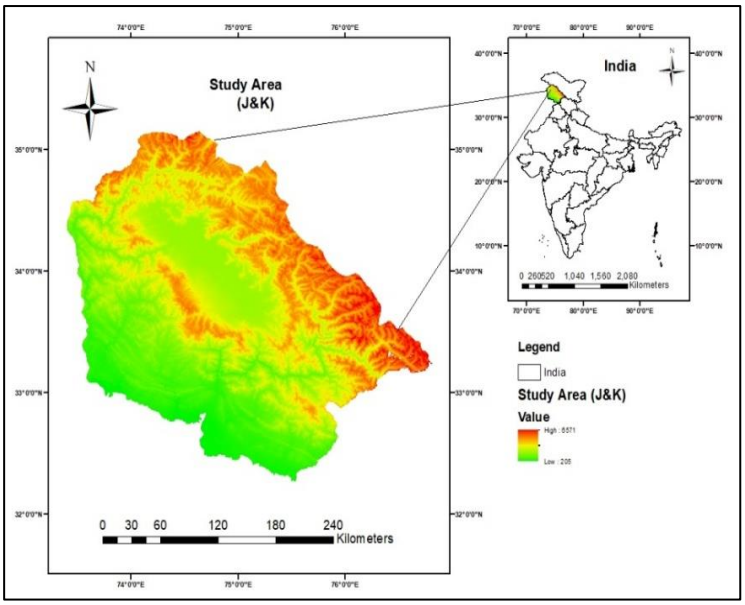

Figure 1: Study area Map

Results and Discussion

Climate change profoundly influences the occurrence and severity of disasters, intensifying the vulnerabilities faced by communities globally. Understanding the relationship between extreme climatic events and socio-economic conditions is essential for comprehending these effects. The phenomenon of climate change has resulted in a rise in extreme meteorological occurrences, including floods and droughts, which can coalesce to produce catastrophic

disasters. Projections indicate an increase in both the frequency and severity of these events, impacting ecosystems and human livelihoods on a global scale. Populations that are particularly vulnerable, especially in low- and middle-income nations, are at an elevated risk due to poverty and insufficient infrastructure. Disasters frequently arise from a confluence of climatic elements and socio-economic weaknesses, suggesting that climate change in isolation does not dictate disaster outcomes. International initiatives, such as the Sendai Framework and the Paris Agreement, underscore the necessity for cohesive strategies in disaster risk reduction and climate adaptation. Efficient disaster management must intertwine humanitarian assistance with climate adaptation efforts to bolster resilience and safeguard livelihoods. Although climate change serves as a significant catalyst for escalating disaster risk, addressing fundamental vulnerabilities is imperative for effective disaster risk reduction and the pursuit of sustainable development.

1. Floods

Flooding has emerged as one of the most recurrent and catastrophic natural calamities in the region of Jammu and Kashmir. The disastrous inundations of September 2014, which impacted millions of individuals and resulted in extensive damage to infrastructure, are frequently referenced as an illustration of the evolving characteristics of hydrological disasters in this locale. Climate change has played a significant role in the heightened severity of the monsoon season, resulting in extreme precipitation within condensed timeframes. The phenomenon of glacial melting, which is linked to escalating global temperatures, further intensifies river levels, especially during the warmer months. Unregulated urban expansion in proximity to floodplains has additionally heightened flood risks, diminishing the land's inherent capacity for natural absorption.

2. Cloudbursts

Cloudburst phenomena, characterized by abrupt and intense precipitation occurring over a brief temporal span, have exhibited an increased prevalence in the Himalayan region, notably in Jammu and Kashmir. These phenomena are frequently localized; however, they can engender severe flash flooding and landslides, thereby threatening both human lives and critical infrastructure. Empirical research suggests that escalating temperatures and alterations in atmospheric moisture levels are correlated with the rising incidence of cloudbursts. The cloudburst event in Leh in 2010, along with more recent occurrences in Kashmir, serves as compelling evidence of an evolving climatic paradigm that exacerbates short-duration, high-intensity precipitation events.

3. Landslides

Landslides are a prevalent phenomenon in the region of Jammu and Kashmir, particularly within the rugged landscapes of the Pir Panjal and Himalayan mountain ranges. The heightened frequency of landslides observed in recent years can be ascribed to unpredictable meteorological conditions, encompassing severe precipitation and accelerated snowmelt resulting from climate change. These natural phenomena, in conjunction with human-induced activities such as deforestation and haphazard construction practices, intensify the vulnerability to landslides in this area. The socio-economic repercussions of landslides, notably in rural communities reliant on agriculture, are profound, frequently culminating in loss of life, disruption of livelihoods, and damage to infrastructure.

4. Snow Avalanches

Avalanches occurring in the Jammu and Kashmir region, especially in locales characterized by substantial snowfall, have been notably affected by the phenomenon of climate change. Elevated temperatures result in irregular snowpack development, thereby rendering snowfields increasingly vulnerable to failure. Accelerated snowmelt, instigated by rising thermal conditions, intensifies the likelihood of avalanches, particularly during the early spring months when the snowpack exhibits instability. The occurrence of avalanches presents considerable hazards to both civilian inhabitants and military forces, particularly in light of the region's strategic significance.

5. Forest Fires

The incidence and severity of forest fires in Jammu and Kashmir have escalated in both frequency and intensity in recent years, particularly during the arid summer months. The combination of rising temperatures and extended periods of dryness has rendered forest ecosystems increasingly vulnerable to fire outbreaks. Notably, both the Pir Panjal range and the Kashmir Valley have experienced numerous large-scale conflagrations that have resulted in the destruction of vital forest cover and significant repercussions for biodiversity. Climate change, through its effects on the moisture content of vegetation and the reduction of precipitation levels, has played a pivotal role in heightening the probability of such incidents. Furthermore, anthropogenic activities, including uncontrolled grazing, deforestation, and agricultural practices within forested regions, have exacerbated the risks associated with wildfires.

6. Windstorms

Windstorms, while occurring with less frequency than various other natural disasters, have exhibited a notable escalation in intensity within the region, particularly in the Kashmir Valley. These meteorological

phenomena, frequently accompanied by substantial precipitation and hail, inflict considerable harm on infrastructure, agricultural systems, and electrical power lines. The phenomenon of climate change has been associated with the modification of wind patterns and the augmentation of atmospheric energy, which may exacerbate the severity of such storms. The presence of strong winds in urban environments frequently results in the uprooting of trees and the infliction of damage on structures, thereby presenting significant hazards to human safety.

7. Lightning

The incidence of lightning strikes has escalated in Jammu and Kashmir, particularly in the elevated terrains of the Himalayas. This phenomenon can be ascribed to alterations in atmospheric dynamics induced by climate change, which engenders increasingly erratic meteorological conditions. Lightning not only results in immediate human casualties but also ranks among the predominant catalysts for forest conflagrations in the region. The escalating frequency of lightning strikes poses a significant challenge for both human habitats and the ecological framework, as it influences both safety parameters and the stability of ecosystems.

8. Socio-Economic and Ecological Impacts

The consequences of disasters induced by climate change transcend immediate physical devastation. In Jammu and Kashmir, such occurrences have undermined livelihoods, particularly within the agricultural domain, where alterations in weather patterns have adversely influenced crop yields. Tourism, recognized as a critical economic catalyst, is similarly jeopardized, as erratic weather conditions dissuade potential visitors. Furthermore, the ecological repercussions, encompassing biodiversity loss, degradation of forest cover, and alterations in water resources, pose enduring ramifications for the region's environmental integrity and sustainability.

9. Adaptation and Mitigation Strategies

Efforts aimed at alleviating the repercussions of climate change in Jammu and Kashmir necessitate a comprehensive approach, incorporating both technological advancements and policy reforms. Enhanced early warning systems, improved land-use planning, and the advocacy for sustainable agricultural and forestry management methodologies represent critical measures for diminishing the susceptibility of local communities. Initiatives such as reforestation, watershed management, and the implementation of sustainable forest fire management strategies can significantly contribute to the reduction of forest fires and landslides. Furthermore, there exists a pressing requirement for the establishment of

climate-resilient infrastructure and an intensified emphasis on community-oriented disaster risk reduction initiatives.

Conclusion

In the present study, an intensive literature review was carried out to understand the impacts of climate change on disasters in Jammu and Kashmir. The unique geological, geomorphic, and climatic features were analyzed in detail, which act as push factors for increasing the frequency and the intensity of disasters in the study area. The major conclusions based on this study are briefly deliberated as below:

a. Jammu and Kashmir's unique geological and geomorphic characteristics make it prone to various disasters, including earthquakes, floods, and landslides.
b. Jammu and Kashmir has seen a notable increase in temperatures, with maximum temperatures rising by 0.04 to 0.05°C/year in Kashmir and 0.03 to 0.08°C/year in Jammu.
c. Urbanization without adequate infrastructure has further increased susceptibility to disasters, as seen in the aftermath of the 2005 Kashmir earthquake, which caused widespread landslides.
d. Increased population density in vulnerable areas has heightened exposure to disasters, as more people reside in high-risk zones like riverbanks and unstable slopes.
e. Rising temperatures and variable precipitation patterns have intensified climate-related disasters, such as floods and landslides.
f. The region's fragile landscape exacerbates the impact of extreme weather events, particularly during the monsoon season when cloudbursts can trigger devastating flash floods.
g. The combination of rising temperatures and decreasing rainfall intensifies the likelihood of disasters, such as floods and landslides, which have historically affected the region.
h. This shift in precipitation patterns contributes to droughts and water scarcity, increasing the vulnerability of local communities.
i. Projections indicate a further increase of 0.36–1.48°C in mean maximum temperatures by the 2080s under high greenhouse gas scenarios.
j. Annual precipitation is expected to decrease by 2.09–6.61% by the 2080s, with significant reductions in winter and spring.

The escalating frequency and severity of natural calamities in the region of Jammu and Kashmir are intrinsically associated with the alterations in climatic patterns. The occurrences of floods, cloudbursts,

landslides, avalanches, wildfires, windstorms, and lightning strikes are on the rise, thereby presenting considerable threats to both the ecological system and the resident populace. In order to effectively confront these adversities, a synergistic approach that encompasses climate adaptation, disaster risk mitigation, and sustainable development methodologies is imperative. It is crucial for policymakers to emphasize the enhancement of resilience against climate change through strategic investments in infrastructure, the promotion of sustainable land use practices, and the assurance that at-risk communities are adequately equipped to handle prospective climate-induced disasters.

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