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A Critical Analysis of Possible Natural Disasters in the Himalayan Region and a Detailed Study of the Consequences Thereof

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ABSTRACT

The Himalayan Mountainous region is the world's newest, fastest, and most enormous crumpled mountainous range. It is highly volatile because of the continuous geological process. The entire Himalayas range has been responding to devastating natural hazards, which reflects its fragility and susceptibility. The temperature ranges from low-lying hills and mountains to high-altitude, continuously snow-capped mountainous ranges. According to studies, the temperature revolution had a profound effect on the Mountains, and as a result, weather patterns and disasters have changed substantially. The Mountainous terrain's high frequency magnifies weather hazards, bringing everyone else in the area at risk.

Humans are no strangers to disasters. Since the beginning of civilization, they have been persistent, though unpleasant, companions of humans, leaving trails of rage and disaster of incredible magnitude.

Uttarakhand is susceptible to disasters, glaciers, river flooding, forest fires, cloudbursts, and land degradation, among other disasters.

Keywords- Himalaya Mountainous, mountainous range, Temperature revolution, Uttarakhand, weather hazards, devastating natural, temperature ranges.

I. INTRODUCTION

Extreme environmental disasters have become a significant consequence of environmental considerations. Most individuals harmed by environmental disasters such as rainfall, river flooding, popular movements, landslide, and rainfall have risen drastically over the years. Extreme weather events may well be a component of these disasters.

1.1. Statement of the Problem

Uttarakhand is one of the country's highest states regarding natural dangers, such as disasters, flash floods, landslides, and habitat destruction, according to a depiction of disaster-prone places. Human lives, the natural environment, and property have all been destroyed due to these disaster events. Landslides are widespread, especially during the wet season. It results in the deaths of people and the destruction of roads, agricultural land, buildings, dwellings, and other infrastructure.

Landslides have a multi-faceted impact on the state since they disrupt people's daily life. This is because Uttarakhand is a hilly country with no other modes of transportation besides roads. Almost every year, large landslides strike the state, wreaking havoc on society in various ways, shown in fig. 1.

Because of the region's diverse geography and geo-climatic parameters, the prevalence of landslides has grown in recent years. Apart from the state's geographical conditions, haphazard anthropogenic activities such as massive deforestation, road construction without regard for the region's fragility, power station or groundwater construction, multi-story hospitality construction for visitors, and pseudo-scientific natural resources are the most significant factors of the predicament.

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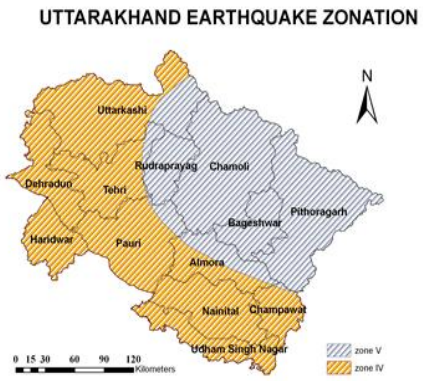

Figure 1: Uttarakhand Earthquake Zone

Figure 2: Uttarakhand Landslide Zone

A variety of hazards heavily impact the area. In Hindu Holy Scriptures and historical research, the country is known as the Himalayas, a designation from the Sanskrit language for "Uttarakhand." Uttarakhand is sensitive to immense environmental challenges regarding its geographical and geomorphic location.

The Himalayas is a massive mountain range that stretches through eight developing countries in Asia: Pakistan, Afghanistan, India, Bangladesh, Bhutan, China, Myanmar, and Nepal. Due to the Himalayan range, India is known as a mega range of bio variety of flora and fauna and one of the world's ten most noticeably wooded locations. It comprises only 18% of India's overall geographical territory. However, it is home to more than 50% of the country's biodiversity and forest cover and 40% of the Indian subcontinent's endemic species.

Uttarakhand has the highest disaster risk of any of the states. Because of its unique geo-climatic circumstances, the Garhwal region of Uttarakhand has historically been exposed to environmental threats. Cloudbursts, floods, and droughts are all examples of natural disasters. Cyclones, earthquakes, and landslides have all happened in the past. The fragility of the Hazards and tragedies are frequently depicted in the Garhwal Himalayan environment.

1.2. Scope of the Study

The present research is confined to an increased awareness of natural disasters, their control, and the legal system surrounding disasters on a national and international level. The goal was to assess the international framework for natural disasters and disaster risk management, which captures disaster prevention, adaptation options, adaptability, and rescue.

- ***Uttarakhand Landslide Zone***

Disasters are connected with economic and property loss, human life, and psyche. If disasters cannot be prevented, minimizing disaster-related losses becomes a key consideration in developing disaster management policies. So far, since 1990, the hill state has gone through two significant transformations.

The first earthquake (magnitude >6) occurred in Uttarkashi in 1991, while the second occurred in Chamoli in 1992. (1999), Malpa (1998), near Kedarnath, Ukhimath, and a sequence of landslides/cloud bursts. KhetGaon (2002), Budhakedar (1998), Fata (2001), Gona (2001), KhetGaon (2002), Fata (2001), Gona (2001), Gona (2001), Gona (2001), Gon (2002), Bhatwari (2002), Uttarkashi (2003), Amparav (2003), Lambagar (2003), Govindghat (2003), Bhatwari (2002), Uttarkashi (2003), Amparav (2003), Amparav (2003), Lambagar, Agastyamuni (2005), Ramolsari (2005), and a slew of others.

II. REVIEW OF LITERATURE

Jui et al. (2017). analyzed the disaster ex-post performances at the past and present preventive measures followed in Taipei. Structural equation modeling (SEM) clarifies the relation of different construction materials and evaluates the effects of constructive interactions.

Katherine et al. (2018). Framework analysis-based protection motivation concept is used to analyze flood perception and take measures to assist the people affected due to flood in Ouagadougou.

Caicedo et al. (1994). fine establishment and retrofitting processes significantly reduce earthquake risks of cultural heritages. Apart from preserving the cultural heritage centers to last over time from normal decaying, they must also be taken care of to endure natural risk situations with high structural performance. It relates to the cultural heritage being open to visitors and guaranteeing a satisfactory structural safety level.

Giancarlo et al. (2017). To mitigate the disastrous phenomenon of natural hazards like floods, a pattern of CubeSats comprising payloads and autonomy is enabled, allowing the remote areas of Brazil to be accessed. Notably, the quantity of Cuestas and orbit planes requisite for minimizing the revisit time are defined concerning the requirement.

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Aliakbar & Hadi (2018). an actual situation of disaster control in Iran, has inspired the development of a combined integer linear programming system to minimize the overall network control expense. In addition, the effectiveness and performance of the implemented relief network are increased due to these disaster restorative approaches.

Chandana et al. (2018). The workability of the prevailing disaster management structure in Sri Lanka is analyzed with that of the Sri Lanka National Disaster Management Policy (SLNDMP). Plans are carried out to check whether SLNDMP is accurately employed. Besides, a broad global framework similar to Sendai Codes is also analyzed simultaneously to determine whether it can be used with global standards.

Merz et al. (2010). Al-Nofai (2010). reported the method of flood risk management, which can be adapted to mention uncertain future changes. The aim of problem identification, multiple hazards, river basin functions, uncertain non-stationary quantities representation, and promoting adaptive capacity by social and organizational characteristics are identified for flood management. They studied to promote the security of life and property from natural disasters through sustainable, environment-friendly development.

McEntire (2005). James Lee Witt of FEMA presented 'Task Impact-the debacle safe local area' during the 1990s, intending to support moderation for further developed designing, better land-use arranging, and other gamble decrease measures. Another change in perspective happened in the last part of the 1990s when the interest in opposition got redirected to the idea of versatility to catch social, monetary, political, and mental factors connected with debacles. Simultaneously when the discussion of obstruction and versatility (Mileti, 1999; McEntire, 2005) was going on, another idea arose inside catastrophe studies and acquired unmistakable quality called an economical turn of events or supportable peril alleviation. With the expansion in several catastrophes throughout the long term, risk the board acquired noticeable quality as proactive and reasonability, diminishing the remarkable ascent in a fiasco misfortune (McEntire, 2005).

As indicated by the World Bank Report 2012, during the last part of the Twentieth Century, more than 200 catastrophic events happened all over the planet, with more than 2.5 million individuals passed on somewhere the range of 1980 and 2011, adding up to about US$ 3.5 trillion of financial misfortune across the world (worldbank.org). 2011 was the costliest year for regular debacles, with a deficit of US$380 billion. From 1960 to 1990, there have been multiple debacle increments and a nine-time expansion in their expenses (Moin, 2012; Goodyear, 2001). Kobe Quake of Japan in 1995 was viewed as the world's costliest catastrophic event with US$ 100 billion, killing 5300 individuals, causing 120,000 structures being fallen, helping offices (power, water, gas supply, and others) having been obliterated, alongside incapacitating of transportation organization and prompting the quick departure of around 230,000 inhabitants. Nonetheless, 1999 Taiwan tremor, the expense was at US$ 57 billion, where 2400 individuals were killed (Pricovic, 2002).

Gilbert (in Quarantelli, 1998:11) proposed a way to deal with the different conceptualizations of calamity and ordered it into three standards. The first compares debacles to war. The second makes sense of a debacle as the consequence of social weaknesses, and the third considers a catastrophe regarding vulnerability. During the time of the virus war, US government establishments gave assets to concentrate on the responses of individuals towards war, though, in France, debacle research came from the common security and safeguard offices made during the universal conflicts. These investigations zeroed in primarily on the job of outside specialists as opposed to inside elements or designs. The focal point of catastrophe research is frequently unequivocally connected with the idea of the establishment that requires the examination. The significant lacuna of these orders was the shortfall of the thought of what catastrophes meant for the financial status of the concerned populace. These inquiries raised new foci for fiasco research approaches which depended on the investigation of networks and their connection with damaging outer specialists (Gilbert, 1995; Quarantelli, 1998).

Albala-Bertrand (1993) says that "the seriousness of the calamities relies upon the extent of the occasion and the resistance of human settlement to such an occasion." As per Tobin and Montz (1997), "a debacle is a risky occasion which upsets the working of society and has an extreme financial effect." Blaikie, Cannon, Davis, and Wisner (1994) expressed that "calamities are a perplexing blend of cataclysmic event and human activity. They are the interruption of financial and human improvement at the family level".

These definitions exhibit that debacles manage an outrageous occasion influencing the populace's climate and financial states. Calamities disturb the ordinary working of the financial framework. The collaboration between an outrageous occasion and human culture decides the effect of a calamity. The limit of the impacted populace to adapt to debacles gives a proportion of its seriousness. Regular outrageous occasions have consistently existed. These geophysical occasions had an effect on widely varied vegetation over various timeframes. Such occasions transform into debacles through their connection with financial frameworks and related weaknesses. That is what it demonstrates perils are regular while calamities are not, with financial circumstances ready for perils to become catastrophes.

Du Plessis (1988) expressed that South Africa's cultivating area had been especially hit by the

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progressive surges of 1983, 1984, and 1985. Different cultivating items must be imported to supply the homegrown market. Further, the brushing limit had been decreased, and some stock must be diminished until, as it were, the studs remained. The result was that ranchers acquired no pay in specific regions and unyieldingly developed obligations. The contracting pay of ranchers implied that they had put less into cultivating executes, decreased their planting, and bought less manure. This prompted the over-creation of certain cultivating imperatives and synthetics that required defense in those businesses.

Kaniasty, K and Norris, F.H. (1993) inspected pressure interceding possibilities of 3 sorts of social help: social embeddedness saw support from nonkin and saw support from family; it demonstrated that post debacle declines in friendly embeddedness and non-family support interceded quickly and postponed effect of catastrophe stress. No proof was found for the meditational job of family support. Discoveries were as per conceptualizations of social support as an element reflecting unique exchanges among people, their informal communities, and ecological tensions.

Norris, F.H., Perilla, J.L., Ibañez, G.E., and Murphy, A.D. (2001) showed that Mexican culture intensified while African American culture lessened, contrasting the posttraumatic stress of male and female debacle casualties.

Kulkarni's (2001) article is a firsthand record of the writer's visit to Anjar after the Gujarat quake of 2001. The creator endeavored to loan backing to NGOs participating in the help work. The article features the heartlessness concerning the public authority in not allowing help material to be carried liberated from cost except if it was steered through the alleviation magistrate. While help was being delivered, there was a noticeable shortfall of coordination among different organizations. The help bundle was likewise intelligent, with an extraordinary accentuation on material products and slight accentuation on offering profound help to the impacted families. The accentuation of the help organizations is additionally on exhibiting their endeavors through exposure which appears to be unexpected in case of a catastrophe of such greatness.

Bankoff (2003) expressed that flooding is not a new peril in the Philippines yet, one that has happened throughout written history. On the one hand, it is connected with a more extensive worldwide biological emergency with environmental change and rising ocean levels. However, it is also the impact of more-restricted human exercises. An entire scope of financial factors, for example, land use rehearses, expectations for everyday comforts, and strategy reactions that progressively affect the recurrence of common perils, for example, floods and the comparing event of catastrophes. Specifically, the motivation behind why flooding has come to posture such an unavoidable gamble to the occupants of Metropolitan Manila has its premise in a complex hazard of between relating factors that underline how the idea of weakness is built through the absence of commonality among climate and human action over the long run. Measurable patterns recommend that floods have become more varied and seriously obliterating as of late. Absolutely the recurrence of occasions and the number of individuals impacted have expanded consistently as human-related exercises like deforestation, overgrazing, and urbanization disturb natural circumstances, making networks more defenseless (Bankoff, 2003).

Mirza et al. (2003) expressed that flood debacle affects people, families, and networks. Individuals adapt in various ways. Those who have the limit after being hit by a catastrophe arise quicker, while those without such limit sink further into the twisting of impoverishment. Adapting systems incorporate activities, for example, movement from floods impacted regions, flood estimating, flood protection of creatures and yields, food-storing, giving crisis well-being administrations, and building flood covers. Be that as it may, they have not been woven deliberately into the way to deal with accomplishing security from flooding. Assuming the methodologies expand on ways of dealing with stress and look to distinguish new ones, they could address the social effects of flood issues at a lower social, financial, and ecological expense than approaches that endeavor to oversee or control the asset base itself.

Dixit (2003) expressed that in Southern Nepal, flooding prompts enormous disturbances in social and financial lives. The streams bring enormous residue whose testimony on horticultural terrains hurts efficiency. The primarily poor live in these floodplains (weak zones) since they have no open the door to living in less unstable regions. In Nepal, floods consistently cause the demise of developed fields, water systems, and scaffolds and influence the provincial foundations. He contends that strategy creators, contributors, and help and improvement offices treat flood catastrophes as disengaged occasions that break the progression of the everyday lifestyle. Most intercessions to moderate calamities are Adhoc reactions made under the presumption that crisis support as alleviation will help survive the circumstance of difficulty. Such help targets reestablishing what is happening to what it was before the debacle. When a flood debacle consistently influences a similar local area, government, benefactors, and Non-administrative associations answer by giving similar help and recovery estimates each time. This approach does not consider the circumstances of the general public during typical times between the events of two risk occasions. Debacles are thought of as a happenstance when a danger slows down society. As indicated by Dixit (2003), research shows that fiascos are the result of regular dangers as well as of financial designs and political interactions that make people and families powerless.

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III. OBJECTIVES OF THE STUDY

Natural disasters are becoming a widespread occurrence around the earth, impacting and affecting individual countries and their cultures. Human efforts to deal with natural disasters with policy standards are increasing and significantly reducing the suffering caused by natural disasters worldwide.

1. Gain a basic understanding of disaster management concepts such as hazard, disaster, susceptibility, hazard, prevention, mitigation, recovery, and rehabilitation, as well as other relevant topics.
2. To gain fresh insights into the features of various natural calamities and their causes and processes within the study area.
3. To thoroughly understand and review the current disaster management methods and strategies in the studied area.
4. Compile a spatial inventory of disaster and risk zones in the research region.
5. Propose a development plan considering the region's fragility and susceptibility and potential solutions.

IV. HAZARDS AND DISASTERS: A STUDY

Individuals, society, investigators, organizations, and others can classify disasters and disasters based on their interests and reasons, such as accidental or synthetic, sudden onset or slow frequent occurrence, direct or indirect, longer or shorter, chemical or comprehensive, and so on.

Catastrophes are classed as "natural disasters" or "human-made disasters" based on the elements that cause them. However, a more modern and social perspective of catastrophes sees this distinction as artificial because most disasters are caused by people and their social and economic systems acting or not acting. For example, the flash flood of June 16-17, 2013, in Uttarakhand was most likely caused by uncontrolled mining along riverbanks and indiscriminate hydropower project building.

Table: 1 Categorizations of Disasters in India

S.N.	Sub-Group I – Water and Climate-Related Disasters
1	Flood and Drainage Management
2	Cyclones
3	Tornadoes & Hurricanes
4	Hailstorm
5	Cloud Burst
6	Heat Wave & Cold Wave
7	Snow Avalanche 8 Drought
8	Sea Erosion
9	Thunder & Lightning

V. NATURAL HAZARD SECURITY TESTING DESCRIPTION

Uttarakhand lies amid one of the country's most geologically active geomorphological zones. As a result, several internal and external factors interact in this area, resulting in various natural events and dangers. However, not all of them occur in the same way in the studied area, nor do they have the same impact on society. As a result, the most prevalent natural hazards in Uttarakhand have been chosen for this study. Earthquakes, landslides, floods, and forest fires are examples.

Table 2: Selected Variables to Assess Hazard Vulnerability

X1	**Earthquake hazard**
X2	Flood hazard
X3	Landslide hazard
X4	Forest fire hazard

VI. DESCRIPTION OF VULNERABILITY ASSESSMENT OF ELEMENTS AT RISK

Ten variables were chosen to determine the most significant quantity of components exposed to dangers. The variables were chosen based on the data that was available at the time. Human life is the most crucial element that is endangered. After human life, the most critical element at risk during disasters is livestock, an essential source of income and livelihood for most developing cultures.

VII. UTTARAKHAND'S NATURAL DISASTERS OVER THE LAST 3 DECADES

The natural disaster brought back memories of the disastrous Uttarakhand Flood disaster of 2013, which erupted in the region and injured over 1.5 million people.

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On Sunday, a section of the Nanda Devi glacier broke off in Uttarakhand's Chamoli district, causing a major flood in the Dhauli Ganga River. A spokeswoman for the Indo-Tibetan Border Police reported that about 150 workers at a power project in Tapovan-Reni are believed dead, citing the projects in charge.

- ***1991 Uttarkashi Earthquake***

In October 1991, a 6.8 magnitude earthquake struck the undivided state of Uttar Pradesh, killing at least 768 people and destroying thousands of dwellings.

- ***1998 Malpa Landslide***

The 1998 Malpa landslide, which killed 255 people, including 55 Kailash Mansarovar pilgrims, was one of the world's worst natural disasters. The Sharda River was partially obstructed as a result of the debris.

- ***1999 Chamoli earthquake***

In 1999, the Chamoli district was struck by a 6.8 magnitude earthquake. Over 100 people were killed, and the Rudraprayag district was severely impacted. Several ground deformations, as well as landslides and changes in water flow, were observed due to the earthquake. Roads and the ground were found to have cracks.

- ***2013 North India Floods***

A multi-day cloudburst in June 2013 resulted in disastrous floods and landslides. More than 5,700 individuals are believed to have died as a result of the disaster, according to the state administration. More than 3 lakh people were stuck in the valleys leading to the Char Dham pilgrimage sites when bridges and roads were destroyed. A multi-day cloudburst centered on Uttarakhand in June 2013 resulted in disastrous floods and landslides.

VIII. RESULTS

The analysis reveals that the landslide studies in the region are quite biased towards the Uttarakhand region, while there are few to no studies in the northeast Indian region.

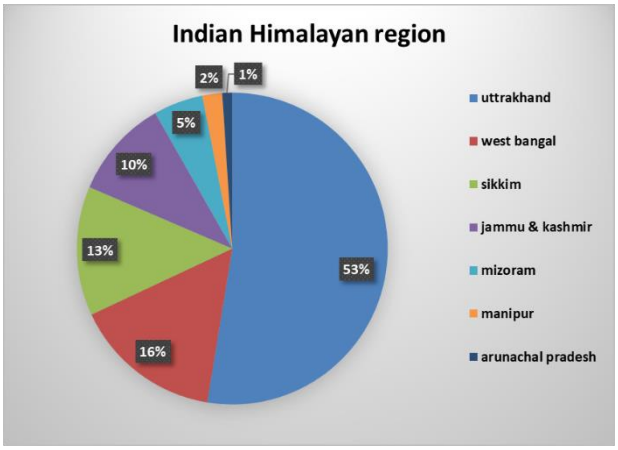

Figure 5: Distribution of landslide studies across the states in the Indian Himalayan region

The high population density can explain this bias in the western Himalayan region, which results in a higher number of casualties and a greater danger of landslides assessed the number of landslide-related deaths from 2007 to 2015, reaching 5228, accounting for 82.9 percent of all regional catastrophe deaths. We categorized the studies into seven general categories to better understand the research types: description of significant events, identification, forecasting, monitoring and investigation, river damming, extreme events and climate change, and susceptibility mapping.

IX. CONCLUSION

Is climate change to blame for the rise in environmental disasters in the Himalayan region? It is helpful to give credit to the source. Every weather event is the natural result of arbitrary and predictable influences. On the other hand, environmental degradation fosters more extreme symptoms for more weather extremes. More powerful storms, with more excellent energy weather conditions and Lighter weight rainfall, is a foregone conclusion.

The purpose of this review study is to gain a better understanding of the studies being undertaken in the Indian Himalayan region, which accounts for over 15% of global rainfall-induced landslides. Because it represents a substantial fraction of landslides in the Indian Himalayas and is the only typology that early warnings and forecasting models may manage, the study concentrates solely on landslide activity produced by rainfall.

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