

Disaster Dynamics in Himachal Pradesh: Understanding Natural and Human-induced Factors

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ABSTRACT

This study aims to comprehensively investigate the disaster dynamics in Himachal Pradesh, focusing on both natural and human-induced factors contributing to various types of disasters prevalent in the region. The research utilizes a secondary data-based approach to analyze historical records, statistical data, and existing literature on disasters in Himachal Pradesh. The methodology involves a systematic review and synthesis of available secondary data from governmental and non-governmental sources, including disaster management reports, environmental assessments, socio-economic surveys, and academic publications. Data pertaining to natural disasters such as earthquakes, landslides, floods, and avalanches, as well as human-induced disasters like forest fires, industrial accidents, and infrastructure failures, will be examined. The findings of this research are expected to contribute to the development of evidence-based disaster management strategies, policy recommendations, and community resilience initiatives tailored to the specific challenges faced by Himachal Pradesh. By elucidating the interplay of natural and human-induced factors in shaping disaster dynamics, this study seeks to enhance preparedness, mitigation, and adaptation efforts aimed at reducing the impact of disasters and safeguarding the well-being of the population in Himachal Pradesh.

Keywords: disaster, disaster dynamics, landslides, environmental assessments,

Introduction

Disaster Management Act, 2005 “Disaster” means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes or by incident or negligence which results in substantial loss of life or human suffering or damage to and destruction of property, or damage to, or degradation of environment and is of such nature or magnitude to be beyond the coping capacity of the community affected. Himachal Pradesh, nestled in the heart of the Himalayas, boasts breathtaking landscapes, diverse flora and fauna, and a rich cultural heritage. However, this serene region is not immune to the wrath of natural disasters. From landslides and flash floods to forest fires and earthquakes, Himachal Pradesh experiences a wide array of calamities, often exacerbated by human activities. Understanding the dynamics of these disasters is crucial for effective mitigation and preparedness efforts.

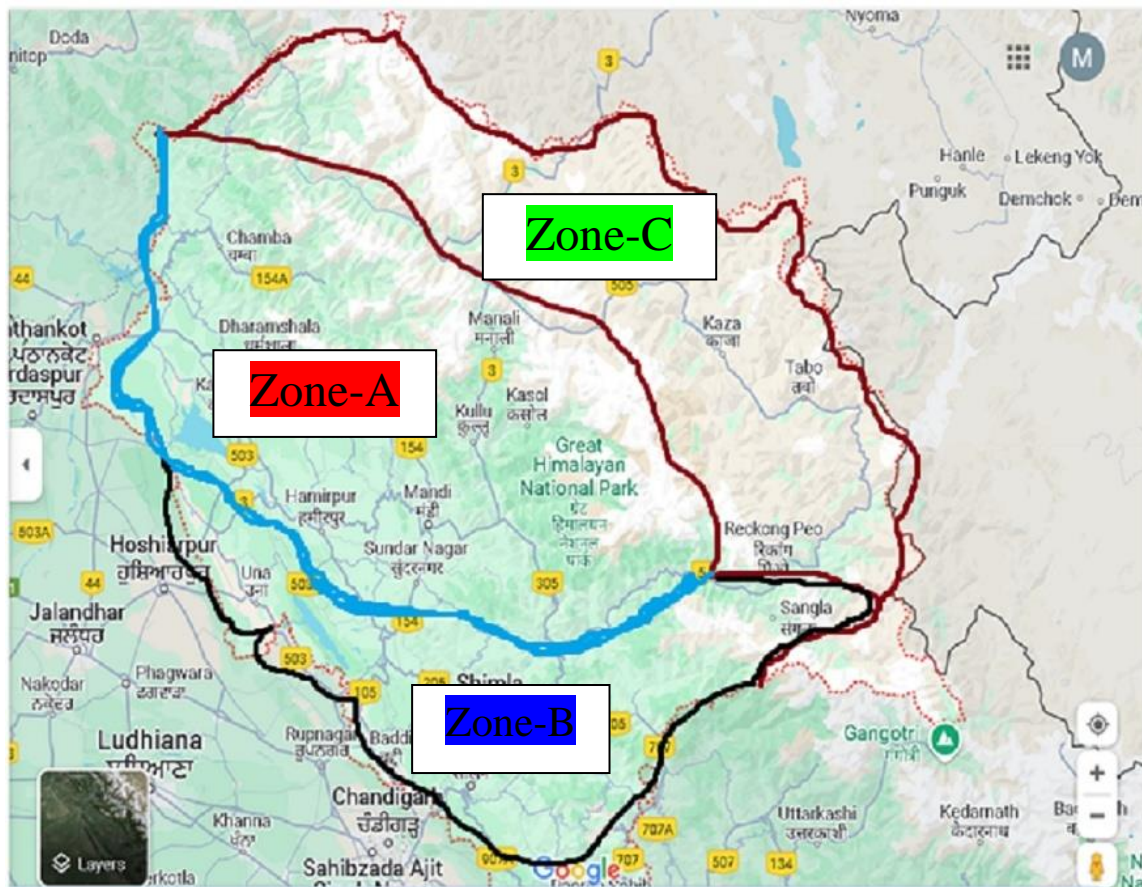
Natural Factors

- **Geological Vulnerabilities:** Himachal Pradesh's rugged terrain renders it susceptible to geological hazards such as landslides and earthquakes. The state falls under seismic Zone IV and V, making it prone to moderate to high-intensity earthquakes. The fragile mountain slopes are predisposed to landslides, especially during the monsoon season when heavy rainfall destabilizes the soil.

- **Hydrological Hazards:** The state's numerous rivers and their tributaries pose a constant risk of flash floods, particularly in the monsoon months. Melting glaciers and snowmelt contribute to the swelling of river channels, leading to inundation of low-lying areas. Gushing waters can cause extensive damage to infrastructure and settlements along riverbanks.
- **Climatic Variability:** Climate change has accentuated the frequency and intensity of extreme weather events in Himachal Pradesh. Erratic rainfall patterns, prolonged droughts, and unseasonal snowfall disrupt normal life and exacerbate vulnerabilities in the agrarian sector. Additionally, rising temperatures have accelerated glacier retreat, heightening the risk of glacial lake outburst floods (GLOFs) in the higher reaches.

Vulnerability & Risk Zone of Himachal Pradesh

Source: Google Map

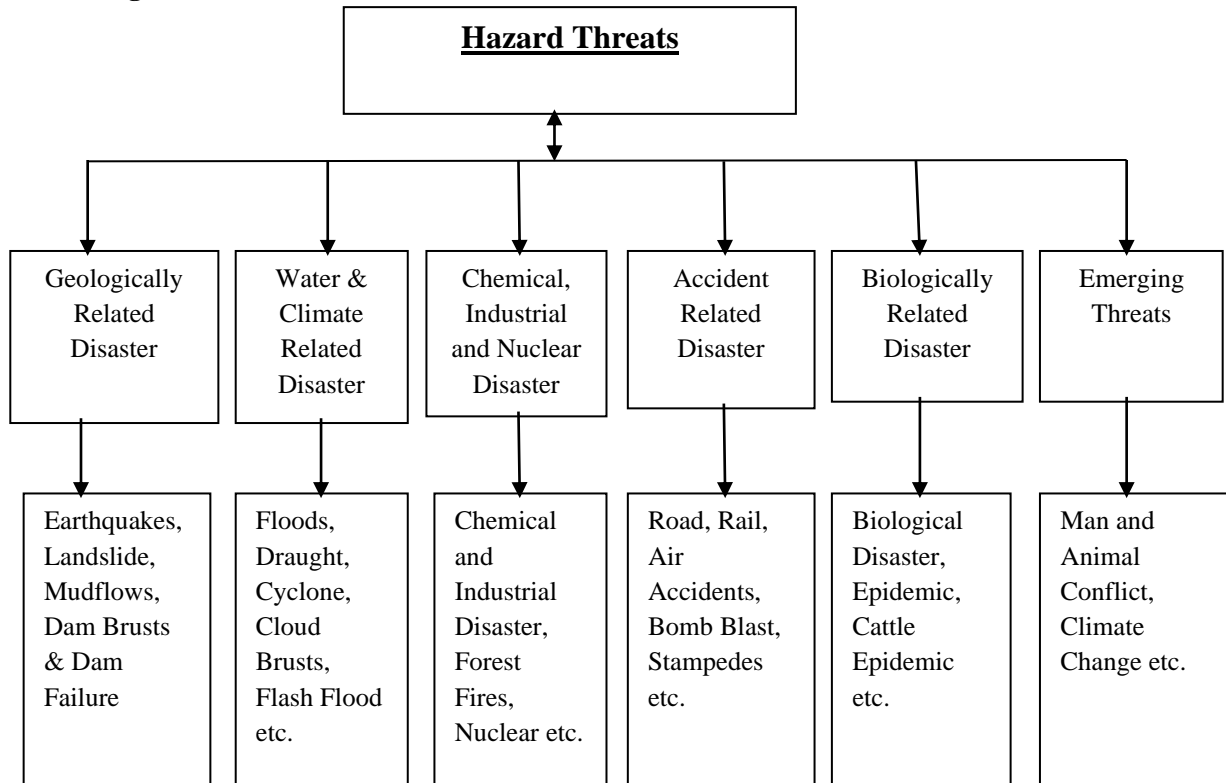


Zone-A	Very High
Zone-B	High
Zone-C	Moderate

As shown in the above map Himachal Pradesh is geographically divided into Shivalik Hills, Outer Himalayas, Great Himalayas and Trans-Himalayas. Vulnerability and Risk zone are divided into Zone-A which is majorly around outer Himalayas and it has very high risk of vulnerability. Further Zone-B and Zone-C which are situated in

shivalik hills and greater Himalayas respectively and they have high to moderate level of vulnerability and risk pertaining to disaster.

Figure-1.1



Human-Induced Factors

- **Deforestation and Slope Modification:** Rampant deforestation, often driven by unsustainable logging and infrastructure development, weakens the natural resilience of the ecosystem. Tree cover acts as a natural barrier against soil erosion and landslides. Deforestation, coupled with indiscriminate slope modification for construction activities, increases the likelihood of slope failure, amplifying the impact of landslides and flash floods.
- **Urbanization and Infrastructure Development:** Rapid urbanization and infrastructure expansion in Himachal Pradesh have altered the landscape, disrupting natural drainage patterns and exacerbating flood risk. Unplanned construction along riverbanks and in landslide-prone areas exposes communities to heightened vulnerability. Moreover, inadequate infrastructure maintenance and improper land-use planning further compound the risk of disasters.
- **Tourism Pressure:** Himachal Pradesh's picturesque landscapes attract a large influx of tourists each year. However, unchecked tourism activities, including trekking, camping, and adventure sports, contribute to environmental degradation and ecosystem disturbance. Overcrowding in ecologically sensitive areas increases the likelihood of accidents and exacerbates the strain on emergency response mechanisms during disasters.

Mitigation and Preparedness Strategies

- Effective disaster risk reduction requires a multi-faceted approach that addresses both natural and human-induced factors. Key strategies include:
- **Early Warning Systems:** Implementing robust early warning systems for floods, landslides, and earthquakes can facilitate timely evacuation and minimize loss of life.
- **Ecosystem Restoration:** Promoting afforestation initiatives and sustainable land-use practices can bolster ecosystem resilience and mitigate the impact of disasters.

- **Infrastructure Resilience:** Incorporating disaster-resilient design principles into infrastructure projects and enforcing strict building codes can enhance structural integrity and minimize damage during disasters.
- **Community Preparedness:** Conducting awareness campaigns and capacity-building programs at the community level can empower residents to respond effectively to emergencies and mitigate risks.
- **Policy Interventions:** Enforcing stringent regulations to control deforestation, regulate construction activities, and promote sustainable tourism practices is imperative for reducing vulnerability to disasters.

Government and International Agencies are Involved in Addressing Natural Disasters and Climate Change.

a) State Government Agencies-Role and Responsibilities

1-State Disaster Management Authority (SDMA)-The apex body responsible for disaster management in Himachal Pradesh. It formulates policies, plans, and guidelines for disaster management at the state level.

2-District Disaster Management Authority (DDMA)-Each district in Himachal Pradesh has its own DDMA, which is responsible for implementing disaster management plans and coordinating response efforts at the district level.

3-State Disaster Response Force (SDRF)-This force is responsible for undertaking response and relief operations during disasters. It is equipped with specialized equipment and trained personnel for search, rescue, and relief operations.

4-Himachal Pradesh State Disaster Management Cell-This cell operates under the SDMA and serves as the operational arm for coordinating disaster management activities in the state.

5-Himachal Pradesh Fire and Emergency Services-This agency is responsible for fire prevention, fire suppression, and rescue operations during emergencies, including natural disasters.

6-Himachal Pradesh Police-The police force plays a crucial role in disaster management, including search and rescue operations, maintaining law and order during emergencies, and facilitating relief efforts.

7-Forest Department: The Forest Department is involved in disaster management efforts, especially in the context of forest fires and landslides.

8-Health Department: The Health Department plays a significant role in providing medical assistance, emergency healthcare services, and disease control during disasters.

9-Department of Revenue and Rehabilitation: This department plays a key role in assessing the damage caused by disasters, distributing relief funds, and coordinating rehabilitation efforts for affected communities.

10-Public Works Department (PWD): PWD is involved in restoring infrastructure such as roads, bridges, and buildings damaged by disasters.

b) Central Government Agencies-Role and Responsibilities

1-Ministry of Environment, Forest and Climate Change (MoEFCC)-Responsible for the formulation and implementation of policies and programs relating to the conservation of the country's natural resources, including climate change mitigation and adaptation.

2-National Disaster Management Authority (NDMA)-Coordinates response to natural and man-made disasters and implements policies and plans for disaster management.

3-India Meteorological Department (IMD):-Monitors and forecasts weather, including extreme events like cyclones, floods, and droughts.

4-National Disaster Response Force (NDRF)-Specialized force for disaster response and relief operations.

5-Ministry of Earth Sciences (MoES)-Responsible for understanding weather, climate, oceans, and seismology to provide services for disaster management and climate change adaptation.

6-National Institute of Disaster Management (NIDM):-Conducts research, training, and education programs related to disaster management.

7-Central Water Commission (CWC):-Responsible for water resource management, including flood forecasting and reservoir operations.

c) International Agencies-Role and Responsibilities

1-United Nations Framework Convention on Climate Change (UNFCCC)-Facilitates international cooperation on climate change, including the negotiation of agreements such as the Paris Agreement.

2-Intergovernmental Panel on Climate Change (IPCC)-Provides scientific assessments on climate change and its impacts.

3-United Nations Office for Disaster Risk Reduction (UNDRR):-Works to reduce disaster risk and build resilience worldwide.

4-World Meteorological Organization (WMO)-Coordinates international cooperation on weather, climate, and water issues, including disaster risk reduction.

5-Asian Disaster Preparedness Center (ADPC):-Promotes regional cooperation and capacity building for disaster risk reduction in Asia.

6-World Bank:-Provides funding and technical assistance for projects related to disaster risk management and climate change adaptation in India and other countries.

These agencies play vital roles in policy formulation, disaster response, capacity building, and scientific research to address the challenges posed by natural disasters and climate change in India and globally.

According to the Intergovernmental Panel on Climate Change (IPCC-VI) report, India's coastal regions and the Himalayas will be the most severely affected by climate change. According to the study, the Himalayas are receiving more precipitation in shorter amounts of time, which causes torrential downpours and flooding. The area received 926.9 mm of rain in 2018 compared to over 888 mm in 2010. The southwest monsoon and western disturbances combined to produce the current precipitation. Additionally, the reports find out that the mountain regions are at a heightened risk of experiencing significant rainfall events, which can result in flooding, landslides, and soil erosion. In comparison to the long-term average for the years 1981–2010, the average annual mean land surface air temperature in Himachal Pradesh in 2022 was 1.2 °C higher rainfall that doesn't stop soaking the topsoil causes flash floods, severe erosion, and building collapse.

Conclusion

Himachal Pradesh, a region prone to natural disasters like landslides, flash floods, and earthquakes, requires a multifaceted approach to disaster mitigation. Strengthening infrastructure is crucial; this includes constructing landslide-resistant roads, bridges, and buildings, especially in vulnerable areas. Additionally, afforestation and soil conservation programs can help stabilize slopes and reduce the risk of landslides. Effective early warning systems and disaster preparedness plans are essential for timely evacuation and reducing casualties. Engaging local communities through education and training on disaster response can enhance resilience at the grassroots level. Moreover, integrating traditional knowledge with modern technology, such as GIS mapping for risk assessment and real-time monitoring, can improve disaster management strategies. Finally, enforcing strict regulations on construction activities and land use in ecologically sensitive zones will help minimize human-induced risks, ensuring that development is sustainable and in harmony with the natural environment.

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