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Enhancing Disaster preparedness for effective response: A case study of Uttarakhand

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Abstract: Himalaya which is called "third pole of world "and" water tower of Asia " contain 13 % of world population and is a hub of vast biodiversity and is spread in eight countries of the world. The Himalayas are most disaster prone due to varying reasons and it is imperative to understand them for mitigation purpose. State's disaster management department data shows that since 2000, at least 5,731 people have died and more than 2,000 have been injured as a result of natural disasters, usually caused by flash floods and landslides, in Uttarakhand. By being prepared, we can mitigate the impact that a disaster has on our lives and property. An efficient disaster management strategy should be prepared in Uttarakhand so that the state should have the ability to deal with unanticipated calamities. The youngest mountain range in the world, the Himalayas, is inherently prone to disasters. High erosion, earthquakes, and deep river cuts make it vulnerable to these natural disasters. Rainstorms and cloud bursts also batter these mountains often. Uttarakhand is home to many pilgrims' places. As a result, lakhs of people from all over the world visit here each year. This also puts population pressure on the region. Ignoring nature's warning can be disastrous we have seen that in case of Uttarakhand. The evaluation of the pilgrimage route's landslide risk must be conducted by geological teams with the necessary training and expertise. This paper will try to highlights some of the problems the state of Uttarakhand facing due to disaster and also the new innovative methods used in disaster mitigation activities by the state.

Keywords: Disaster, Uttarakhand, Disaster Management, USDMA, Warning System, Natural Hazards

Introduction

Disasters are defined as events that severely disrupt society to an extent that it cannot recover using only its own resources. Many things can put a community at risk or increase its resilience in the face of a disaster, including environmental, technical, and man-made risks. Disasters are mainly divided into two types: Natural and Man-Made disaster. Monsoon cycle is prone to large variation and every year regional factors gets accentuated which leads to extreme climate events. India is one of the world's most disaster-prone nations. The nation is vulnerable to a variety of disasters due to its geo-climatic and socio-economic characteristics. Floods, earthquakes, tsunamis, landslides, and cyclones are examples of natural catastrophes.[1]

Over the last two decades, India's policy towards disaster management has evolved from a focus on relief and rehabilitation to a more all-encompassing strategy. This new policy strategy takes into account both pre- and post-disaster considerations, such as preparedness, prevention, and mitigation. One of India's major disaster management challenges is unsafe building practices in fast developing urban populations.[2]

The management of catastrophe risk in India is profoundly affected by climate change. A recent research by the World Bank found that India is responsible for around one-fifth of all global deaths from floods and climate change is only expected to make things worse.

A research conducted by the United Nations Office for Disaster Risk Reduction (UNISDR) found that the death toll from natural disasters was seven times higher in poor and medium income nations than in richer countries. According to the United Nations Office for Disaster Relief (UNISDR), during the last two decades, natural disasters have claimed the lives of 1.3 million people and impacted another 4.4 billion. More than 2 trillion dollars has been lost and damaged as a result of natural catastrophes worldwide. Understanding disaster risk, in addition to hazards, is important. The possibility of loss of life, injury, destruction, damage, or disturbance of a community's or society's physical, economic, or social assets or activities is referred to as risk.[3] However, it is critical to understand the current pattern of hazards. The assessment of disaster risk and the underlying risk factors varies according to the society's or community's socioeconomic situation. There are external elements that may create disasters, also there are internal factors like vulnerabilities that makes disasters more likely to occur. Hazards may be aggravated by poorly designed and executed development programs and projects. Poor quality of construction of buildings and other infrastructure, using inferior quality building materials and not adhering to architectural and laid down engineering norms, will make the community more vulnerable to meteorological hazards. Risk interpretation is a difficult subject, particularly in the aftermath of disasters, risk might be viewed differently by various individuals or groups of individuals. Hazards may be exacerbated by poorly designed and implemented developmental initiatives and programs.

India is one of the most disaster-prone nations in the world because of its unique geographical and geological position.[4] As a result of the tectonic movements in the area, the Himalayan region is prone to earthquakes as well as landslides. Aside from floods, the nearby alluvial plain region is vulnerable to earthquakes since it is an extension of the Himalayan Range. Rapid and ill-planned industrialization as also consequent enhanced energy need have enhanced the probability of chemical, biological, radiological, and nuclear emergencies/disasters. A comprehensive awareness of disaster risk is critical to a successful planning effort. Vulnerability Atlas of India claims that the Indian Subcontinent is one of the most disaster-prone places on Earth. An alarming 59% of the land is at risk from earthquakes, with 11% especially at risk from very destructive tremors. Earthquakes are characterized by two parameters, i.e., magnitude and intensity.

According to a report by the United Nations office for disaster risk reduction (UNISDR), there were nearly 1.3 million deaths and over 4.4 billion people seriously impacted by geophysical and climate-related events during 1998-2017, who needed immediate help.[5] Even though earthquakes and tsunamis were responsible for the vast majority of fatalities, 91 percent of the catastrophes that occurred during this time were climate-related. During this period, India suffered $79.5 billion due to flood damage only. About 80 percent of the disasters were related to extreme weather conditions. Developing nations, particularly India, are more vulnerable to disasters, and disaster-related losses in these countries are much less covered than in industrialized ones. The devastating Uttarakhand Flood of 2013 killed approximately 6,000 people, destroyed 3,320 houses completely, affected 4,200 villages and over nine million people, resulted in the loss of over 9000 livestock, washed away hundreds of kilometers of roads and hundreds of bridges, and left over 170,000 tourists and locals stranded in the mountains.[6] According to a World Bank and Asian Development Bank assessment, $700 million was lost due to damage to public infrastructure. The total cost of the destruction was expected to be at Rs 30 billion. The Uttarakhand floods had a negative effect on people's physical and mental health, especially for people who were older. They had symptoms of anxiety, depression, and sleeplessness, which got worse because of the lack of medical facilities. The socioeconomic impact study of most of India's significant earthquakes demonstrates that the primary and secondary effects of the earthquake cause massive damage to buildings and infrastructure.

Methodology

The research will summarise its main findings and provide suggestions for further policy ramifications in this area. The study will examine both primary and secondary sources of data preferably the main emphasis is on secondary data which includes: USDMA reports, research article, and RTI etc. In this paper data have been analyzed and the systematic approach has been adopted for the analysis of the study done. The Researcher has used both qualitative and quantitative methods for the data analysis.

Objectives Of The Study

*To study the losses due to natural disaster in Uttarakhand
*To study the various preparedness measures taken by the Government in tackling Disasters.

Disaster in Uttarakhand

The Himalayan state of Uttarakhand is already prone to natural calamities. However, changes in land usage have rendered the area even more susceptible to disaster. Floodplain development is another state-wide trend that is contributing to an increase in natural catastrophes such as flash flooding. There is a lot of illegal riverbed material mining in the state, which is causing disasters. Overflow was caused in part by the watershed being severely concretized. After the rains, houses constructed in landslide-prone locations in the town were at risk. Data from the last decade reveals that Uttarakhand has had a greater number of severe rainfall events than other Indian Himalayan states. As a result of climate change, the frequency of intense rainfall events in the area has increased significantly. According to the Uttarakhand Disaster Mitigation and Management Centre (DMMC), between 2015 and mid-2021, the state had 7,750 incidents of very heavy rains and cloudbursts.

Even though experts have seen an increase in severe weather occurrences in the state, the DMMC data on heavy rainfall and cloudbursts is untrustworthy because of discrepancies in data collecting.[7] Due to insufficient data its sometimes difficult to decide whether a event is a cloudburst or an extreme rainfall related event. It is not always possible for the districts disaster management control centers to measure rain and register it as a cloudburst or an extraordinary occurrence of rainfall. Even though there is no way to determine whether the volume of rainfall was over 100 mm per hour to qualify as a cloudburst, district control rooms routinely report a cloudburst if a short period of heavy rainfall that causes damage is detected.

When it comes to data collecting, one of the main issues is a shortage of weather stations that can accurately record rainfall occurrences that can vary between different kinds of rainfall.

The State Disaster Management Authority i.e., Uttarakhand State Disaster Management Authority (USDMA) is a nodal organization for planning, coordinating, and monitoring activities relating to disaster prevention, mitigation, preparation, and management in Uttarakhand. Individuals whose lives are depending on tourism and the Chardham Yatra should have economic security, according to the Center.

Anthropogenic activities such as improper building and road construction are causing slopes to become unstable. People throw debris alongside waterways when constructing buildings. This debris subsequently joins streams during rainstorms, causing flooding in downstream places.

It is also seen that sometimes one disaster triggered other disasters. For Example – Earthquake trigger landslides which trigger floods etc.[8] Because of the particular geographical structure of the state, it is prone to natural calamities annually especially during monsoon season, which results in financial losses for the state government. This is something that we have seen in the past as well. The state is

prone to a variety of natural disasters, the most significant of which are earthquakes, landslides, overflow, cloudbursts, floods, snowfall, and snowfall calamities.

Some of the major Disasters Uttarakhand has faced in past were:

*1991 Uttarakashi Earthquake- killing around 768 people

*1998 Malpa Landslide- killing around 255 people including 55 Kailash Mansarovar pilgrims

*1998 Chamoli Earthquake- over 100 people killed

*2013 North India Floods (Kedarnath Floods)- different agency have given different data on the total number of people killed but one thing is common in all reports that more than 5000 people were killed.

*2021 Hanging glacier avalanche (Raunthigad–Rishiganga) Uttarakhand Flood-More than 200 people were killed.

It is important to note that the region is visited by large number of persons, particularly during the yatra season that coincides with the monsoon period; Yatra being locally referred to as pilgrimage to Badrinath, Kedarnath, Gangotri and Yamunotri

Following the 2013 disaster, government authorities classified five districts as the most sensitive: Rudraprayag, Pithoragarh, Chamoli, Uttarkashi, and Bageshwar.

People in Uttarakhand have traditionally lived in settlements that are higher up the hill, away from the streams. There is a popular saying that 'water never forgets its path' as highways were built along streams, the population started shifting downwards. In an effort to make a living, residents built new homes and businesses along the highways. For example, the recent floods in Oct 2021 devastated several such hamlets in Khairna and Garampani region of Nainital district. In its study on the Uttarakhand Disaster of 2013, the National Institute of Disaster Management identifies dam construction as one of the causes of the region's growing flash floods.[9]

Losses due to Natural Disaster in Uttarakhand

Table 1: Data from 1 Jan 2021 to 31 Dec 2021

S.No	Natural Disaster	Human Losses
1	Flood	-
2	Landslide	24
3	Cloudburst/Heavy rainfall/Flash Flood	84
4	Lightning	01
5	Thunderstorm/Hail Strom	01
6	Others	193
Total		303

Table 2: Data of Yearly Human Losses In Uttarakhand due to Natural Disasters:

Year	Human Losses
2007	90
2008	77
2009	66
2010	220
2011	68
2012	176
2013	4218*
2014	66
2015	53

2016	107
2017	111
2018	101
2019	100

*Data is not accurate for the year 2013. Both the data of state and central govt is different for the total number of people died in Kedarnath Floods.

***Data collected through RTI**

Disaster Management In Constitution

From managing disaster occurrences to controlling disaster risks, disaster management has advanced significantly. Disaster preparedness means being ready to respond quickly and effectively so that lives can be saved and human suffering can be kept to a minimum as much as possible, through things like evacuation, search, rescue and humanitarian aid.

There is no direct reference to disaster or disaster management in any article of the Constitution. Also, it's wrong to say that the constitution didn't even think of disaster or emergency situations.

Article 21 of Indian constitution says that every person has the fundamental rights given by the constitution to life and personal liberty. This article ensures that no person other than the arrangement established by law should be deprived of life and personal liberty.

Supreme Court explained this article very liberally and covers health, food, privacy, describing pollution free environment and security as essential for life. In many decisions of SC, all of them have been given life and personal rights by Article 21. Therefore, this article gives power to the people on the state also includes the right to freedom. It lays out a clear responsibility of providing protection against disasters.

Simultaneously, Article 38 of the Constitution empowers the state to act for public welfare. Protection from impacts is certainly a matter of public welfare. It gives instructions on how to establish a proper social order in the event of a disaster.

Article 245 of the Constitution gives rights to the center and state to make financial arrangements for the geographical area under their jurisdiction. Under the state list, under entry 14 and 17, farming and embankment and water resource systems are mentioned respectively, including protection from pests and diseases. Both these subjects come under disaster management, but the scenario of disaster management is certainly not limited to them only.[10]

Due to non-availability of hypothesis of indirect damage caused by disasters, the effects of disasters are often assessed on the basis of physical damages. Due to non-availability of disasters, the effects of disasters are often assessed on the basis of physical damages.

According to the traditional system, in most situations, disasters are limited only to floods and droughts.

The concept of disaster management was slowly evolving in the 1990s.The pre-disaster planned interventions to reduce the damage caused by the disaster was gradually being established as an effective tool of reduction. To bring awareness in this regard United Nations declared the 1990s as International Decade for Natural Disaster Reduction. The nature of the effects varies widely according to the type of natural hazard.

At present, climate change is becoming a matter of concern for the whole world. Scientists predict that due to this, while on the one hand there will be a change in the frequency and intensity of natural hazards, on the other hand it will also change the geographical extent of disasters, due to which new disasters can be seen in many areas in future. The impact of these disasters will be very severe. This will result in displacement of the population on a large scale.

The intensity of increasing natural hazards as a result of climate change, as well as the loss of resources as a result of these hazards, has pointed out the fact to the international community that disaster risk management is deeply intertwined to development. It is a topic and it is not a problem related to any one country or region.

It was created specifically for earthquakes, tsunamis, floods, landslides, and volcanoes. Along with the loss of life and property, the disruption to the social and economic system had to be minimized to the greatest extent possible. In order to better cope with disasters with adequate preparedness and to recover from the effects of the disaster, the Yoka Hama Strategy focused on strengthening the measures to be used to cope with the disaster.

PM Modi has said that “India’s motto is 'Reform, Perform, Transform. India was the first nation to develop a national strategy in accordance with the Sendai Framework. As part of the 3rd United Nations World Conference on Disaster Risk Reduction, held in Sendai, Japan, India signed the Sendai Framework for Disaster Risk Reduction (SFDRR). The Sendai Framework (2015-2030) serves as a supporting document for the other accords that make up the 2030 Agenda, including the Paris Climate Agreement, the Addis Ababa Action Agenda on Financing for Development, the New Urban Agenda, and the Sustainable Development Goals. The government is held accountable for disaster preparedness, but it is acknowledged that other entities, including local governments, corporations, and others, should also bear some of the duty. A replacement for the Hyogo Framework for Action (HFA) 2005-2015: Building National and Community Resilience to Disasters, the Sendai Framework aims to improve disaster preparedness and response worldwide. The Conference promoted a deliberate and methodical approach to decreasing hazards' vulnerability. It emphasized hazard resilience development and suggested strategies.[11]

Preparedness of Uttarakhand:

With the formation of Uttarakhand as a state in year 2000, a separate Disaster Management Department was also established here. At that time Uttarakhand was the first state in the country to do so.

There are various steps in Disaster Management

The Pre-Disaster Stage: It includes preparedness and a warning mechanism before the disaster so that the loss can be minimized.

During Disaster and Post Disaster Stage- It is critical that as soon as a disaster is suspected, information about its occurrence should reach the entire danger-prone region. There must be an equal emphasis on making sure that the state can return to its pre-disaster condition as quickly as possible. Assistance, rehabilitation, and rebuilding are all part of the process of recovery. Conceptual modeling, site assessments, and cost estimation all these elements should be taken care of during construction in the disaster-prone region.[12]

At present time the state government has taken various steps in disaster mitigations. Some of the technological advancement in coping disaster are-

Early Warning

Early Warning System for flood in the downstream of Tehri Dam- It can predict and prevent natural, man-made disasters and other undesired events.

Earthquake Early Warning System- To create early earthquake warning in the case of a significant earthquake in the area. EEW sirens have been installed in Dehradun and Haldwani. A total of 167 sensors and 76 sirens has been installed in Uttarakhand.

Sustainable Reduction in Disaster Risk- It includes formation of DM teams at Village, Block, and District level, conduct of awareness campaigns, conduct of mock drills, training and documentation etc.

Weather Forecast : The Indian Metrological Department gives weather forecast in different color code. The basic goal is to inform relevant authorities and the disaster management authority "about the effect of the weather forecast so as to keep them ready for essential action connected to disaster risk reduction" by providing them with advance warning.

a- Green- No Action needed
b- Yellow- Watch and stay updated
c- Orange- Be prepared
d- Red- Take action

Flood Warning: The Central Water Commission gives daily reports of the Flood Warning:

Low Flood: When the river's level approaches or exceeds the warning level but is still below the critical level.

Moderate Flood: This occurs when the water level rises over the warning level but is still less than 0.50 meters from the Highest Flood Level (HFL).

High Flood: If the water level is lower than the HFL but within 0.50 m of the HFL.

Unprecedented flood: When the water level crosses its HFL recorded previously.

Eeathquake Warning: Seismic alert sirens were installed in the Uttarakhand area to alert in the event of an earthquake. An App named **Uttarakhand Bhookamp Alert** was created by IIT Roorkee. Its first of its kind in India. This app notifies those stranded during an earthquake of its impending arrival and provide them with the time they need to evacuate.[13] This app is the only app in the world that locates individuals who are stranded after a natural disaster and provides their location to the Disaster Response Force. This application notifies users of earthquakes in Uttarakhand with magnitudes greater than 5. It alerts 10 to 30 seconds prior to the devastating wave. The lifeguarding smartphone application will accomplish the goal of detecting the beginning of earthquakes in real time, which is an important goal to have in light of the fact that the state of Uttarakhand is particularly susceptible to earthquakes. As its name implies, Earthquake Early Warning (abbreviated EEW) is a real-time earthquake information distribution system that will issue warnings before any major tremors take hold of any place.

Water Resources Monitoring System: The project will help with the installation of monitoring systems and the civil work necessary to set up these systems. Measurements may be performed manually or automatically using these technologies. Meteorological, hydrological (surface and groundwater), and water quality observations will all be part of the hydromet networks. Some of the type of water resource monitoring system in Uttarakhand are

Automated Rain Gauge
Surface Field Observatory
Automated Snow Gauge
Automated Weather Station[14]

Doppler Weather Radars: Changes in the Himalayan climate can be tracked with the help of Doppler weather radars. The radar is based on the Doppler concept and is used for long-range weather forecasting and surveillance. It was at the Institute of Temperate Horticulture (ITH) at Mukteshwar, Nainital, that the first Doppler Weather Radar (DWR) in Uttarakhand was erected; this radar measures the speed and direction of raindrops in the air to predict the likelihood of storms and other forms of extreme precipitation. In addition to determining the position of a storm's epicenter and the speed and direction of a tornado or gust front, it also monitors the amount of rain that has fallen. The radar was set up as part of the Ministry of Earth Sciences' Integrated Himalayan Meteorological Project (IHMP).[15]

At present three Doppler Radar have been setup in Uttarakhand

Nainital: DWR is in working state
Tehri: Civil work is going on.
Pauri: Site development is going on.
The 15th finance commission has recommended Rs 89,845 crore to the Centre for Uttarakhand. Of which the commission has allocated an amount of Rs 1041Cr to State Disaster and Relief Fund (SDRMF). The Center Share is 90% around 937Cr while the State Share is 10% around 104 Cr.
The State Disaster and Relief Fund (SDRMF) consists of State Disaster Relief Fund (SDRF) and State Disaster Mitigation Fund (SDMF). The SDMF was created as per the recommendation of the 15th Finance Commission. Presently the allocation of fund between SDRF and SDMF is 80% and 20% respectively.
As per the 14th Finance commission and the guidelines issued by the govt.
40% of the SDRMF fund will be used for Response and Relief
30% of the fund will be used for Recovery and Reconstruction
10% of the fund will be used for Capacity Building and the remaining fund for the Disaster Mitigation purpose.
Recently, govt issued norms to use 50% of the SDRF fund to tackle COVID-19 Emergency in the state.
"APDA MITRA"[16] Flood Preparedness
This is a center scheme to involve community in Disaster Mitigation activities. Currently it is working in more than 350 districts of the country.It is a 12 days residential training programme for community volunteers run by NDMA. Its aims is to impart training to the community volunteers in context of disaster response in the most flood prone districts of Uttarakhand. An Aapda Mitra trainee is trained to answer the first emergency call and assist those in need in the event of a calamity. Volunteers will receive training in disaster response, coordination, assistance, and personal protective equipment (PPE) and a first responder medical kit as part of the programmes. Basic search and rescue equipment, medical first aid kit, etc., will be stored in a community emergency stockpile at the district/block level.
QDA System- Uttarakhand is the first Indian state to launch the Quick Deployable Antenna (QDA) technology, which will allow for improved connectivity in border and other distant locations where mobile phone signals are unavailable. QDAs help to communicate in no-signal areas. The 1.2-metre QDA antenna terminal and 1.2-metre static antenna terminal enable video conferencing and data transfer.
Conclusion:
It is not possible to prevent natural calamities, and the effects of global warming only make the situation worse. However, we may mitigate their effects by working together, particularly for the most poor and vulnerable among us. An adaptive response to disasters is essential for coping, recovering quickly, and avoiding long-term damage. Increased planning, reduced effects, and a robust recovery are all things we can work on right now. Governments should prepare for long-term climate hazards and avoid confining people and investments to high-risk locations. The severity of certain natural disasters may increase as a consequence of global climate change, but the loss of life, property, and financial resources due to a calamity will be determined by the ability of the area's residents to respond. Unless social systems fail to cope with the social, physical, and economic impacts, natural disasters such as floods, earthquakes, and hurricanes do not necessarily result in devastating consequences. It also depends upon the earlier development choices and their capacity to reduce and mitigate known risks. Role of social media is very important in awaring peoples about the disasters and their mitigation techniques. Even after all these mitigation methods. It requires

Political Willpower to make Uttarakhand less prone to natural disasters. Not a single political party has considered the issue of disaster management in its manifesto. The Center and the State govt. should develop a policy to provide economic security to individuals whose livelihoods are dependent on tourism and the Chardham Yatra[17]. Time has come for us to return to our traditional methods of protecting the environment, and we should do so. Until or unless we ourselves as a state's citizens will not address this issue, we will face more dire consequences of the disasters.

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