



Natural disaster preparedness and response in Uttarakhand: A case study of Joshimath and Kedarnath

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Abstract

Because of its rough terrain and climate, Uttarakhand, an Indian state that is tucked away in the Himalayan area, is vulnerable to a variety of natural calamities. The infrastructure and people of the area are particularly at risk from earthquakes, landslides, and flash floods. The cities of Joshimath and Kedarnath, which have recently experienced terrible effects from natural disasters, are the subject of this case study. The study looks at the reaction and preparation systems put in place in Joshimath and Kedarnath to lessen the effects of natural disasters. It looks into how effective early warning systems, evacuation strategies, resilient infrastructure, community involvement, and government actions are in lowering vulnerability and raising resilience. The study evaluates the advantages and disadvantages of the current disaster management systems using a combination of qualitative and quantitative analysis, including surveys, interviews, and field observations. It emphasises the essential elements of effective disaster preparedness and response, including proactive planning, stakeholder cooperation, infrastructure investment, and public awareness initiatives.

Keywords – Infrastructure investment, proactive planning, effectiveness of early warning system, raising resilience.

Introduction

➤ Geography of Uttarakhand

The latitude and longitude of Uttarakhand's global extension are 28°43 "to 31°27" in the north and 77°34 "to 81°02" in the east. Uttarakhand has latitudinal spans of 2°44' and longitudinal expanses of 3°28'. The state is nearly rectangular in shape, with a total size of 53,483 km², the state of Uttarakhand makes up roughly 1.69% of the entire nation. It is the eighteenth largest state in India by land area; 46035 KM² of the state's total territory is mountainous, while 7448 sq. km, or 13.93% of the total, is plain. Uttarakhand shares borders with Himachal Pradesh to the west, Nepal to the east, and the Himalayas and Tibet, and to the south by Uttar Pradesh. Nepal shares a border with three districts of Uttarakhand: Pithoragarh, Champawat, and Udham Singh Nagar. Additionally, Tibet's (China) international border is shared by the three districts of Pithoragarh, Chamoli, and Uttarkashi. The borders of Uttar Pradesh are shared by the districts of Udham Singh Nagar, Nainital, Dehradun, Pauri Garhwal, and Haridwar; the borders of Himachal Pradesh are touched by the districts of Dehradun and Uttarkashi. Pithoragarh, Uttarakhand state's easternmost district, Western District Dehradun, Uttarkashi is the district in the north, and Udham Singh Nagar is the district in the south. Seven districts in the state—Nainital, Almora, Chamoli, Rudraprayag, Tehri, Dehradun, and Haridwar—are bordered by the Pauri district. Sixteen district boundaries are touched by Chamoli and Almora. Almora, Rudraprayag, Bageshwar, and Tehri are the only four districts in the state that do not border any other state or nation. The district with the longest international boundary is Pithoragarh.

➤ Methodology

• Literature Review (Secondary Data)

Conducted a thorough review of relevant scientific literature and research papers published by other organizations. Searched for existing data of Joshimath and Kedarnath for natural disaster preparedness and response.

• Data Collection (Mixed Data)

The data was collected from various articles, magazines, research papers. The data which is collected is qualitative as well as quantitative data.

➤ Current Issues:

Joshimath has been dealing with land subsidence issues lately, which could endanger infrastructure and buildings. The Indian government is working to find a solution for this problem.

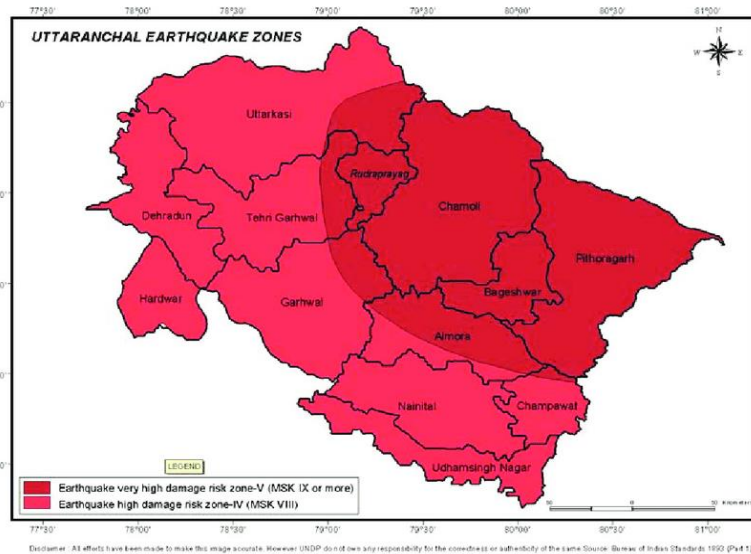
➤ Geographical Division of Uttarakhand

Uttarakhand's geographical division is made up of eight regions based on the way its surface is arranged.

1. The Trans Himalayan Area
2. The region of the Greater Himalayas
3. The Central Himalayan Small Area
4. The Doon Region
5. The Shivalik Region
6. The Bhabar Region
7. The Tarai Lowland Area
8. The Gangetic Plains.

- The Greater Himalayan Region This mountain range, known as the Maha or Main Himalaya, has the tallest peaks and is situated south of the Trans Himalayan region. This mountain range in Uttarakhand is between 4500 and 7817 metres high. Its breadth also varies, spanning 15 to 30 km. In six districts of the state Pithoragarh, Uttarkashi, Tehri Garhwal, Rudraprayag, Chamoli, and Bageshwar the range is dispersed from east to west. Major peaks like Nanda Devi, Panchachuli, Doonagiri, etc. are located in this region, as are rivers like Bhagirathi, Alaknanda, Dhuli, and Gori Ganga. They are also known as the Himadri, Inner Himalayas, and Central Himalayas. These mountains are composed of Archaean rocks, such as granite, gneisses, and ancient schist. The orientation of the Greater Himalayas varies by region, as the following illustrates: They extend south eastward throughout the northern regions of India, Nepal, and Pakistan. They then curve to the east, passing through Sikkim and Bhutan. Finally, they pass via Arunachal Pradesh's northern region and move northeast.

➤ Understanding the tectonic plate distribution beneath the state of Uttarakhand



The State of Uttarakhand which lies in high to veritably high seismic zone corresponding to Zone IV and V, comprises of thirteen sections (stated by Amit Kumar)

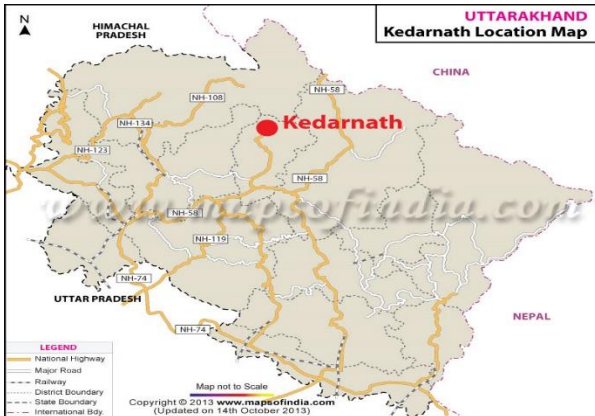
- ✚ The Indian Plate and the Eurasian Plate, two major monumental plates, collide directly where the state of Uttarakhand is located. roughly 50 million times ago, this collision started, and it's still running strong now the Himalayas, one of the youthful and most active mountain ranges in the world, are the outgrowth. Then's the breakdown of the monumental plate distribution beneath Uttarakhand Here is the breakdown of the tectonic plate distribution beneath Uttarakhand.

- Indian Plate – At a pace of roughly 5 cm each year, the Indian Plate is shifting northward. It subducts, or plunges beneath, the Eurasian Plate as it collides with it, following a region called the Main Himalayan Thrust (MHT).
- The Eurasian Plate forms the Northern boundary of Uttarakhand. Due the collision with the Indian Plate, the Eurasian Plate is being deformed and pushed upwards, resulting in the high peaks of the Himalayas.
- Main Boundary Thrust (MBT)- A significant tectonic fault zone that divides the Indian Plate from the Lesser Himalayas is called the Main Boundary Thrust. It is an important geological structure in Uttarakhand that delineates the southern edge of the Lesser Himalayas.

4-Main Central Thrust (MCT)- Another significant tectonic structure in Uttarakhand is the Main Central Thrust. It symbolises the thrust fault where the Lesser Himalayas are overlaid by the Indian Plate. The Higher Himalayas have been raised as a result of this thrust fault.

5-Main Frontal Thrust (MFT)- The southernmost front of the Himalayan Mountain range is home to the Main Frontal Thrust. It symbolises the tectonic meeting point of the Siwalik Range and the Lesser Himalayas. The Siwalik Hills' elevation is the MFT's fault.

6- The Earthquake Zoning Map of India (IS 1893 (Part 1), 2002) splits the Indian mainland into four different threat zones, from Zone II to Zone V, and the entire Himalayan region is located in Zones V and IV.



➤ Area and Profile of Kedarnath

The city of Kedarnath is positioned in the Uttarakhand state of India. Given that it's home to the well-known Kedarnath Temple, one of the twelve Jyotirlingas a group of Hindu sanctuaries devoted to Lord Shiva it's well-known for its religious significance. The city is a well-liked passage point for addicts and is located in the Himalayas close to the Mandakini River. Kedarnath is a well-liked sightseer magnet because it's girdled by stirring natural beauty, similar as snow-limited peaks and green surroundings.

➤ Discussing about the early warning system of 2013 Kedarnath flash flood

1. Early Warning system failure

According to (Sridharan et al.,8) Close coordination between IMD and regional state bodies ought to be absolutely necessary. On June 13, 2013, the Indian Meteorological Centre warned of exceptionally heavy rain (more than 244.5 mm) in higher portions of Uttarakhand. Maximum rains that caused the disaster occurred in Uttarkashi and the Chamoli area on June 15 and 16, 2013. But IMD didn't clearly specify the areas that would be affected due to heavy rains by that time, but a senior IMD official said that it is an inherently natural fact that the most affected areas of Uttarakhand due to rain are Uttarkashi, Chamoli and Rudraprayag, but the state administration ignored the warning proclaiming that this much heavy amount of rainfall was not expected. Now, the question arises why the IMD warning was not clear or even approximate about the areas that would be affected due to heavy rains by that time in the Uttarakhand when technology is available quite easily to predict or forecast any condition of heavy rain in any region in the form of Doppler weather radar (DWR). Another question that arises is what amount of rainfall should be considered as 'heavy rainfall' by the state administration on the warning of IMD so as to immediately evacuate the areas that are expected to be affected due to heavy rain. Now, the question is why, at that point in time, the IMD warning in Uttarakhand was not specific or even close to identifying the areas that would be impacted by heavy rain, given that Doppler weather radar (DWR) technology is readily available and can be used to predict or forecast any situation involving heavy rain in any region. Another topic that comes up is how much rain should be deemed "heavy rainfall" by the state administration in response to an IMD warning so that people can evacuate the regions that are predicted to be affected right away.

2-Poor Coordination system between Agencies

There was a lack of coordination between the rescue troops and the local officials despite the fact that the National Disaster Response Force and the military forces mobilised rapidly to save the pilgrimage town of Kedarnath and its surrounding areas from floods. After having different enquiries in the local areas, it got to know that a large

amount of food was wasted due to the poor communication between the NGO'S (Non-Governmental Organisations) and the rescue forces that were responsible for the distribution of the food in the impacted areas. This all happened due to the poor transportation and rescue teams were tasked with managing any disaster-like situation in the city on hilly.

3-Logistics Management Issue

(J. Adv. Res. Alt. Energ. Env. Eco. 2016; 3(3&4) ISSN: 2455-3093)

In Uttarakhand's hilly regions, there is typically just one route to go to and from every location. Following the tragedy, huge traffic volumes caused these roads to become congested. Numerous organisations got involved in supplying the afflicted area with humanitarian goods, which resulted in regular traffic jams. Even vehicles that were supposed to deliver medical aid to the affected community experienced multiple delays because different, less important vehicles were sharing the same route because there was a lack of a logistical framework. Four days after the catastrophe had occurred, the afflicted neighbourhood began receiving supplies and the rescue team could arrive.

This army misdirection, which the state government established, demonstrates the breakdown in the channels of communication between state government representatives and local authorities in the community affected by the tragedy in the hilly areas. This also shows how incorrect and inefficient analysis was conducted to assess the loss and harm brought on by tragedy.



Figure 1. Relief Material Lying at Govind Ghat [After Hindustan Times 2013]

4-Communication Failure

The army's arrival three days later revealed to the state government the full scope of the damage caused by the Kedarnath tragedy. The National Disaster Response Force (NDRF) and Indo-Tibetan Border Police (ITBP) were assigned to handle the situation in Kedarnath, while the army was then sent to two additional disaster-affected areas, Uttarkashi and Chamoli. This indicates that the impact of planned and ongoing hydropower development on the richness of terrestrial life in the Indian Himalaya has already resulted in a significant amount of loss.

➤ Upgradation of critical Infrastructure

The upgradation of critical infrastructure in Kedarnath, a significant pilgrimage site in the Indian state of Uttarakhand, has been a priority following the devastating floods and landslides in 2013. Several initiatives have been undertaken to enhance infrastructure resilience, improve visitor facilities, and ensure better disaster preparedness. Here are some key aspects of the upgradation:

1-Reconstruction and Strengthening: In order to make vital infrastructure—such as buildings, bridges, retaining walls, and roads—withstanding natural disasters like landslides and floods, a significant effort was made to rebuild and fortify it following the 2013 disaster.

2-Road Connectivity: Improving Kedarnath's road accessibility has been a top priority. This includes building new roads, widening the ones that already exist, and making sure they remain stable in inclement weather. Enhancing accessibility for emergency response teams and pilgrims is the goal.

3-Airstrips and Helipads: The construction of airstrips and helipads in and near Kedarnath enables quicker access for relief and emergency evacuation operations during calamities. These offer pilgrims an additional option for transit.

4-Communication Infrastructure: For efficient coordination during emergencies and for informing pilgrims, it is essential to strengthen communication networks, which include internet and mobile access.

➤ Briefing about the effective disaster response and management

‘Dr. Anil K. Gupta, Head, Divn. of Policy Planning, Tapash Saha Roy, Consultant, National Institute of Disaster Management New Delhi’

The 2013 Kedarnath disaster was a terrible occurrence that left the Kedarnath valley in Uttarakhand, India, completely destroyed. The catastrophe, which was mostly brought on by intense rain and the ensuing flooding, took thousands of lives and severely damaged homes, businesses, and infrastructure. This is a summary of the Kedarnath disaster's efficient response and management tactics: The 2013 Kedarnath disaster was a terrible occurrence that left the Kedarnath valley in Uttarakhand, India, completely destroyed. The catastrophe, which was mostly brought on by intense rain and the ensuing flooding, took thousands of lives and severely damaged homes, businesses, and infrastructure. This is a summary of the Kedarnath disaster's efficient response and management tactics:

1- Preparedness and Early Warning Systems:

Improve early warning systems to deliver prompt notifications about approaching calamities, like intense downpours and flash floods. To determine high-risk regions and populations, regularly conduct vulnerability assessments and risk assessments. bolster communication networks, emergency shelters, and evacuation routes as part of your preparedness infrastructure.

2- Coordination and Collaboration:

Establish a unified command structure involving multiple stakeholders, including government agencies, local authorities, NGOs, and the military. Foster collaboration and coordination among different levels of government and across sectors to ensure a cohesive response. Engage with affected communities and leverage local knowledge and resources in disaster response and recovery efforts.

3-Response and Rescue Operations

Organise search and rescue teams to remove stranded people and offer medical aid. These teams should include qualified persons and equipment. Helicopters and other resources should be used for relief supply transportation, rescue missions, and aerial reconnaissance. When further assistance and resources are required, coordinate with agencies at the federal, state, and local levels.

4-Logistics and Supply Chain Management:

To expedite the acquisition, warehousing, and distribution of relief goods, establish distribution and logistical hubs. Make sure that access points and transportation networks are effective so that relief can reach affected communities on time. Supply chains should be watched over and managed to avoid bottlenecks and guarantee fair resource distribution.

5-Communication and Information Management:

Make use of platforms and communication technology to provide decision-makers, the general public, and first responders with accurate and timely information. Create channels of communication with stakeholders to share important updates and coordinate reaction efforts. Reach a variety of people, including those with limited literacy or disabilities, by providing accessible information in their native tongues and formats.

6-Recovery and Rehabilitation:

Create comprehensive plans that address livelihood support, infrastructure repair, psychosocial services, and other aspects of the affected communities' long-term recovery and rehabilitation. Implement strategies including watershed management, ecological restoration, and land use planning to lower the likelihood of future disasters. Involve stakeholders in collaborative decision-making procedures to guarantee that recovery initiatives take impacted populations' needs and interests into account.

7-Monitoring and Evaluation:

Provide systems, such as feedback loops and performance indicators, for tracking and assessing the success of disaster response and management initiatives. To determine best practices, areas for improvement, and lessons learned, conduct post-disaster assessments. Apply evaluation results to practice and policy to improve the overall efficacy and efficiency of disaster management systems.

➤ Knowing about the environmental conservation of Kedarnath

1-Biodiversity Conservation

Established in 1972, the Kedarnath Wildlife Sanctuary safeguards a wide variety of flora and animals, including uncommon and threatened species like the Himalayan tahr, snow leopard, and musk deer. In order to monitor biodiversity and put conservation measures into place, government organisations and conservation organisations carry out research and surveys. Afforestation and habitat restoration initiatives are used to repair damaged ecosystems, stop poaching and the illegal wildlife trade, and save vital habitats.

2-Water Resource Management:

Water from the region's rivers and glaciers is essential for ecosystems and communities downstream. Watershed management is the main emphasis of these initiatives, which also include promoting sustainable water use practices, controlling river flow, and protecting wetlands. The goals of conservation efforts are to preserve the quality of the water, lessen pollution caused by human activity, and deal with the consequences of climate change on water supply and glacier retreat.

3-Forest Conservation: Forests are essential for preserving the stability of the soil, controlling the flow of water, and giving wildlife habitat. The goals of conservation initiatives are to stop illicit logging and encroachment, encourage sustainable forest management techniques, and stop deforestation. The goals of afforestation and reforestation initiatives are to improve the resilience of forest ecosystems to natural disturbances and climate change, as well as to rehabilitate damaged forest regions.

4-Tourism Management

Even if it offers economic benefits, if tourism is not handled properly, it may also put pressure on the environment. Thus, in order to ensure the long-term conservation of Kedarnath's environment, sustainable tourism practises are essential. These practises include encouraging responsible tourism, limiting tourist numbers, and minimising the ecological footprint of tourism operations.

5-Climate Change Adaptation

Kedarnath and the Himalayan region are susceptible to the effects of climate change, which include increased frequency of natural disasters, irregular weather patterns, and glacial retreat. Thus, in order to reduce vulnerabilities and increase the region's resilience, adaption measures such as the creation of early warning systems and the promotion of resilient agricultural practices are crucial.

6- Waste Management

The influx of pilgrims and tourists to Kedarnath necessitates effective waste management practices to prevent pollution and maintain the pristine environment. Initiatives such as waste segregation, recycling, and proper disposal are implemented to keep the region clean and preserve its natural beauty.

➤ Foster collaboration with national and international organizations

1-Identify Needs and Gaps

Conduct a thorough assessment of the situation in Joshimath to identify the most pressing needs and gaps in areas like disaster management, rehabilitation, infrastructure development, and environmental protection. This will help tailor collaboration efforts towards specific goals.

2- Reach Out

Contact possible partners by phone, email, or by setting up a meeting. Express the goals and advantages of cooperation in a clear and concise manner, highlighting shared values and ambitions.

3- Engage Locally

Establish connections with local authorities, including leaders of the community, government representatives, and grassroots groups. They can offer insightful information and encouragement for joint endeavours.

4-Target Relevant Organizations

Find national and international organisations that have the know-how and track record to deal with kedarnath's particular problems by doing some research. Among the possible partners are:

National:

- Geological Survey of India (GSI)
- National Disaster Response Force (NDRF)
- University of Technology, India (IIT) (many campuses)

Global:

- 1- (UNDRR) United Nations Office for Disaster Risk Reduction
- 2- (ICIMOD) International Centre for Integrated Mountain Development
- 3- (ADB) Asian Development Bank

5-Establish Communication Channels

Make an effort to get in touch with the targeted organisations and open lines of communication. This may be going to the seminars, workshops, or webinars they host, or it could be writing formal letters expressing your willingness to engage with Joshimath and describing his needs.

6-Develop Proposals and Applications

Develop collaborative applications and proposals for financial or technical support from national and international organisations in conjunction with technical specialists and local stakeholders. These suggestions ought to specify the difficulties, suggested fixes, and roles of all involved parties.

Additionally:

Government Advocacy: Collaborate with representatives of the local administration to promote Joshimath on a national and worldwide scale. This may entail making requests for aid from the federal government and taking part in global conferences pertaining to mountain development and catastrophe management.

Community Engagement: Make sure the neighbourhood is included in all phases of joint endeavours. Their viewpoints and expertise are essential for creating long-lasting solutions.

1. **Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India:** <https://moef.gov.in/moef/index.html>
2. **International Centre for Integrated Mountain Development (ICIMOD):** <https://www.icimod.org/>
3. **ICIMOD's Climate Change Adaptation Programme:** <https://www.icimod.org/>
4. **International Union for Conservation of Nature (IUCN):** <https://www.iucn.org/>
5. **United Nations Environment Programme (UNEP):** <https://www.unep.org/>

➤ **Develop and maintain a trained and well-equipped search and rescue team**

1-Team Formation and Training:**Recruitment**

Organise outreach initiatives in neighbouring communities to find suitable team members who possess excellent mountaineering abilities, knowledge of the area, and physical health.

To find qualified employees, collaborate with organisations like
(IISM) Indian Institute of Skiing & Mountaineering or
(NIM) Nehru Institute of Mountaineering

Training:

Give them intensive instruction in search and rescue (including flood and mountain rescue) tactics.

- Emergency medical attention and first aid
- Navigation using a GPS and a map
- Using equipment for search and rescue
- Rescue from avalanches (if applicable)
- Regularly carry out training exercises in Kedarnath's unique surroundings that mimic real-life events.

Equipment:

Basic: Warm clothes and appropriate shoes for the altitude

- Kits for first aid
- Headlamps and searchlights
- Instruments of communication (long-range radios)
- Sleeping bags and tents for makeshift housing

Advanced:

- Stretchers and additional tools for evacuation
- Equipment for avalanche rescue (probe, shovel, beacon)
- Look for canines

Using drones for aerial search

medical supplies (splints, oxygen cylinders, etc.)

Training Resources:

- Nehru Institute of Mountaineering (NIM): <https://www.nimindia.net/>
- Indian Institute of Skiing and Mountaineering (IISM): <https://www.iismgulmarg.in/>



JOSHIMATH

Location and Geography:

Located in Uttarakhand's Chamoli district at an altitude of roughly 6,131 metres (20,112 feet). tucked away in the Ganges tributary of the Alaknanda River valley. Surrounded by magnificent mountains that provide stunning views, such as Nanda Devi, Badrinath, and Nar Parvat. Located in Central Himalaya, Chamoli was created in 1960 as a separate revenue district from the former Garhwal district. It is a part of the renowned "Kedar Kshetra." Uttarkashi lies to the north-west, Pithoragarh to the south-west, Almora to the south-east, Rudrapur to the south-west, and Tehri Garhwal to the west encircle the District Chamoli. The District occupies a land area of approximately 7520 square kilometres.

Profile:

Population:

roughly fifteen thousand people (approximate figure)

Climate:

Pleasant summers (May–June) with temperature between 10°C and 25°C

Monsoon season (July - September): Mild rainfall, possible landslip risk.

Winters: December through February are bitterly cold, covered in snow, and with lows below freezing.

Economy: Dependent on pilgrimage and tourism.

Accommodations: Provides travellers with a range of hotels, lodges, and guesthouses.

Activities: Well-liked for hiking, climbing, camping, and discovering beautiful places.

Current Issues:

Joshimath has been dealing with land subsidence issues lately, which could endanger infrastructure and buildings. The Indian government is working to find a solution for this problem.

➤ Construction of Calamities in the Uttarakhand Himalaya

1-It has been demonstrated that hydropower projects on the rivers of Uttarakhand exacerbate the intensity of floods, rendering them catastrophic. Furthermore, these projects have created an unpleasant everyday life and a spiralling effect for the mountain inhabitants, making them more vulnerable to calamities. Even though the distinction between natural and man-made catastrophes has become increasingly hazy, projects have strategically claimed that these are *devi aapda*, or natural calamities, in order to avoid accountability and responsibility for them. Expectant chants of "**company gaya**" and "**company is gone**" can be heard in the footage as the high-altitude villagers watch the "**toofan**," a towering surge of sludgy waters travelling through the gorges of the Rishi Ganga River towards the Rishi Ganga Power Project. The villagers could see that any form of barrier placed in its route would be destroyed by the tsunami. The Tapovan Vishnu gad project's barrage was washed away by the waves racing through the Daruli Ganga, approximately 8 km downstream in the Chamoli region of Uttarakhand, close to Joshimath town. This project was completely destroyed in a matter of seconds. The residents of the villages did not want these businesses—hydropower plants, of which there are 450 in the mountains of Uttarakhand—to Page 1 of 2 have ever been close to their houses.

2-**Tapovan Vishnugad Project**- Has spent more than fifteen years building this hydroelectric facility. Its actions have remained largely careless and demonstrate a lack of diligence in evaluating the area's geological conditions. Additionally, it has subcontracted out many private companies to handle various tasks, such as tunnel excavation and barrage building, allowing it to avoid accountability to these smaller players. A tunnel boring machine (TBM), which has been stranded at one end of the tunnel since 2009, was used during the first phase of the project. The corporation decided to excavate the tunnel from the opposite side in the interim. The 520 MW Tapovan Vishnugad

project, which is being built in the villages of Tapovan and Dhaak, some 14–15 km uphill from Joshimath, was completely destroyed by the floods in February 2021. The tunnels hundreds of labourers were working in were clogged with debris. The company had no policies in place to keep track of how many workers there were, alert them to potential danger, or ensure their safety. The thermal power company NTPC has been funding the construction of this hydropower project for more than 15 years. Its operations have remained mainly negligent and show a lack of vigilance in assessing the geological characteristics of the area. It has also contracted out a lot of work to numerous private companies for things like barrage. The Auli oak trees may have stored water over years, but when the TBM damaged an aquifer, "about 60–70 million litres per day, enough to sustain 2-3 million people," was waste.

➤ Impact of Joshimath's sinking on local women

Devender Singh and Shailja DOI: <https://doi.org/10.33545/26646021.2024.v6.i1a.293>

The women's experience in the Joshimath catastrophe the girls of the Saklani family in Joshimath, Neha and Sunaina Saklani, were the first to notice fractures in their home. The Saklani family's girls say, "We are watching our house slowly falling apart as the cracks widen with each passing day(<https://www.journalofpoliticalscience.com/uploads/archives/5-2-64-750.pdf>) according to the family the officials did not take any strict action until and unless there was no media coverage . After media coverage started higher officials came and shifted their family to a local hotel but for cooking food and grazing there cattle's they have to come to the sunken house . The family is not demanding for the compensation, they are requesting to shift their house to a better and a safer place.

Dhaneshwari Rana, a 70-year-old woman, shared, "I operate a women's sewing education centre, and I am landless; I don't own any property. The land on which my house stands was also generously donated to me by someone. The entire house in front of mine is on the verge of collapsing, and I am left wondering where I should go. Earning a livelihood at my age seems daunting. Who will give me a shelter now? We are so desperately poor that we can hardly make ends meet. A major component of Joshimath's economy is tourism." "The government suggested that ladies in our neighbourhood begin house stays. We put our money in starting the homestay and obtained a bank loan. But, we find it difficult to pay back the bank loan given the current situation. We discover that we are unable to meet our demands of the government. We are still very enthusiastic in spite of everything."

Discussion

1-Economic Impact

A woman's financial independence encourages women throughout society to be self-sufficient, whereas a man's financial independence gives strength to a family. In this area, the majority of people rely on small food stores, housing rentals, farming, and animal husbandry. As Joshimath is a popular tourist destination, tourism is the primary source of income for the local population. Tourism drives the local economy. Regarding the Joshimath women's economic impact, it was well-known that they maintain their existence despite external factors. The majority of the women present have a direct connection to work. The majority of the women in this area have always worked in business, and the calamity has claimed both their homes and their businesses. The ladies here used to build their dwellings and support themselves on the rent they obtained because they were on the travel queue with shopkeeping. However, their collapse has prompted concerns about women's livelihoods. Women claim that the structures that were destroyed in the disaster served as our capital. Even though our means of support has already ceased, they are starting to worry about whether they will be able to recoup the money spent on creating those structures. A few of the ladies in this area made their living through farming and animal husbandry. Although agriculture has already suffered greatly from climate change in mountainous areas, the women in this area were making economic equipment and producing local goods in line with the changing climate. In addition, she was operating a small business as part of her livelihood, which included a milk business from cattle and poultry farms. However, the calamity has made it difficult for them to pursue their livelihood-related goals The status of women in society is already far from ideal. However, Joshimath's women were attempting to carve out a position for themselves in the community by learning to support themselves. This has

led to a predicament, as they would need to find a new home to live and work when their community moves. It is a significant question because there won't be any tourist movement like to Joshimath in the new location where those people will settle.

2-Social Impact

Natural catastrophes disproportionately impact the poor, according to studies. Wealthy people frequently construct homes and other structures with the intention of preventing disasters; but the case of the Joshimath disaster area, this does not appear to be the case, as landslides harm the entire Joshimath region, even though the wealthy are able to avoid it. The impoverished were relocated to safer areas as soon as they became impacted, but they lack the funds to stay elsewhere and pay for their ongoing needs the less wealthy classes are nonetheless compelled to live in disaster-prone areas and are ill-equipped to deal with the financial and social fallout from such events.

3-Psychological Impact - (According to Atul Sati), A calamity is brewing, says the president of Joshimath Bachao Sangarsh Samiti and environmental campaigner. In the days ahead, a number of its effects will manifest, such as a mental health epidemic sweeping the area. Research indicates that women are more prone than men to experience psychological issues. Women may be more prone to experience severe mental illnesses than men since they typically reside in worse socioeconomic environments (Kumar et al., 2007, pp. 99–101)

➤ Recommendations

Invest in cutting- Edge technologies to enhance early warning systems and monitor potential natural disasters, such as earthquakes, landslides, and flash floods. Make sure that alerts are sent across a variety of channels to communities that are at risk in a timely and efficient manner.

Enhance Infrastructure Resilience: Make essential infrastructure like buildings, bridges, and roads more resilient to natural disasters by retrofitting them. In new infrastructure projects, use building methods and designs that are resilient to disasters. To reduce disruptions during emergencies, make lifeline systems such as the water supply, energy, and communication networks more resilient.

Boost Community Preparedness: Hold frequent training and awareness campaigns for the local populace on emergency communication, evacuation plans, first aid, and catastrophe.

➤ Conclusion

In conclusion, all parties involved government departments, businesses, local communities, and civil society organizations must work together to address the intricate issues surrounding Uttarakhand's readiness and response to natural disasters. Uttarakhand can improve its resilience and lessen the negative effects of natural disasters on the lives and livelihoods of its citizens by implementing the lessons learned from the case study of Joshimath and Kedarnath into future disaster management policies and practices.

Uttarakhand should strengthen its resistance to natural disasters and guarantee the security of its citizens, pilgrims, and visitors by applying thorough preparation plans and learning from previous mistakes. The main takeaways from the case studies are emphasised in this conclusion, which also suggests a future plan of action for Uttarakhand. You may fortify it even further by: a brief discussion on the employment of technology (such as drone use and satellite monitoring) in preparedness and response. highlighting the significance of cooperation in disaster management between local populations, NGOs, and government organisations.

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