



After Disaster Strikes: A Comprehensive Analysis of Post- Disaster Impacts in Rudraprayag District of Uttarakhand

Arvind Singh Rawat* • Vidushi Dobhal Naithani • MM Semwal

Department of Political Science, Hemvati Nandan Bahuguna University, Srinagar Garhwal, Uttarakhand

*Corresponding Author Email id: arvindsinghrawat10@gmail.com

Received: 28.04.2024; Revised: 20.06.2024; Accepted: 21.06.2024

©Society for Himalayan Action Research and Development

Abstract: Over the years the majestic yet extremely fragile Himalayan region has undergone extreme climatic, political as well as social changes which affect the people residing in the region as well as those dependent on it. According to a UN report, natural disasters have cost India \$80 billion in last 20 years. The Himalayan region of Uttarakhand has always been very fragile due to its topography. In addition, the ISRO Landslides Atlas of India report suggests that Rudraprayag in Uttarakhand, has the highest landslide density in India. The district also has the highest exposure to total population, working population, literacy, and houses. The Ukhimath Landslides of 1998 and 2012, as well as the Kedarnath Floods of 2013, are some major disasters that have occurred in this district in the past. Economic loss is the most visible form of disaster impact but the social, psychological impact of disaster cannot be ruled out. According to a World Bank and Asian Development Bank assessment, \$700 million was lost due to damage to public infrastructure. The paper traces the trajectory of the lives of the people of Rudraprayag over the last two decades with a continuous looming fear of unforeseen and sudden disastrous events. It also aims to provide valuable suggestions for policy reform so that a broader and multi-dimensional approach can be undertaken at the decision-making level for a better and resilient future. The study undertakes a quantitative as well as qualitative approach in assessing the post-disaster impact through the lens of the well-being approach to development. The paper aims to assess the socio-economic and political impacts of natural disasters in the region.

Keywords: Rudraprayag • post- disaster impacts • natural disaster • Kedarnath floods • Himalayas • migration • sustainable development • Uttarakhand

Introduction

Disasters result in many levels of losses, including both tangible and intangible dimensions. Economic loss is the most visible form of disaster impact and it depends on the macro-economic structure of the affected areas. The loss of life and property as well as the depletion of natural resources are examples of direct disaster losses. When a natural disaster interrupts the normal flow of products and services, it may lead to indirect losses, such as a drop in production or income or an effect on people's well-being. Along with the economic dimension of loss, the social, psychological impact of disaster cannot be ruled out. In terms of political impact, the dilution of political trust and response of the bureaucracy in mitigating

and handling disaster risk is also essential. The after-effects of disasters have a significant impact on people's social and psychological health. A short-term experience of a disaster event leads to long-term lifetime implications for individuals. Even after decades there is need to bridge the gap between the government and local people especially in case of disaster management. In order to comprehensively assess the impact of heavy construction on the Eco-sensitive region, it is essential to dig deeper into the concept of carrying capacity.

A disaster's impact is the way it affects individuals, structures, and the larger community. Disasters may be measured in terms of losses, which are the consequences of being deprived of something, whether those losses can



be defined or not. However, a disaster's effects might extend well beyond the immediate area. The social and economic consequences in areas like health, education, productivity, and the macroeconomy, which have longer-term repercussions, are examples of broader implications (UNDRR, 2015). Individuals may be impacted directly, either through property damage or as a danger to their lives or loved ones. Disasters can also impact citizens through changing their thought processes. They may influence how citizens view their neighbors who helped them during a flood. In the aftermath of a disaster, people's perceptions of others can change, especially when witnessing the outpouring of support through donations to help those impacted. Disasters can impact public perception of the government, depending on how well the government responds to the situation. Regarding potential social and political impacts of disasters, they can arise from both direct and indirect exposure to the events. People may be impacted by disasters through indirect exposure. In today's world, this happens mainly through traditional news media, and more recently through new forms of media like online news reporting and social media (Albrecht, 2017).

According to United Nations, "Migration is changes over places for more than one year." The Intergovernmental Panel on Climate Change (IPCC) predicts that climate change would result in population displacements due to the decreased habitability of specific regions, heightened uncertainty in food and water availability, and an escalation in the occurrence and intensity of floods and storms. An impending storm or other natural hazard is not considered a "natural disaster" unless it poses an exceptionally high risk to a population that is already at risk. If there isn't an early warning system, people aren't prepared, and dwellings aren't well-built, a tropical typhoon, for instance, may become a

devastating calamity. Consequently, a community's susceptibility to disasters depends on its adaptive capacity, which is defined as its ability to endure and recover from extreme weather events, and its exposure to certain climate variables, such a coastal position. The UN High Commissioner for Refugees estimates that 24 million people have sought refuge elsewhere due to natural disasters such as floods and famine (climate refugees). Human migration is a widely observed phenomenon wherein individuals. Temporary or permanent migration is a crucial survival strategy in the face of natural disasters, and its prevalence has been on the rise in climate-vulnerable developing nations in recent years (Ida, 2021). Environmental changes have a significant impact on human migration and the factors driving migration tend to differ based on the kind and severity of natural disasters (Coelho, 2017). According to the World Migration Report 2022, more people are being forced to leave their homes as a result of climate change-related disasters than violent conflicts. The disintegration of social structures that follows a disaster makes it more difficult to secure food and humanitarian supplies. Because of this, abduction, sexual exploitation, and trafficking are all too common among children and women (Goel, 2022). The victims of disaster also sometimes trap into the trafficking for example the human trafficking incidents spiked in Nepal after the 2015 earthquake, which killed 206 people and injured countless more. In most of these instances, women and girls were victims of sexual exploitation. The 2005 U.S. hurricane Katrina also left a trail of victims, including Hindu males, who were trafficked and exploited for their work

The Indian subcontinent is prone to natural disasters like earthquakes, wind storms and hurricanes, landslides, floods, and rains because of its geography and climate. India has been hit by a number of disasters that have caused



damage to property and lost lives that can't be replaced. India, is amongst the most vulnerable country in the world for Natural Disaster due to its geographical position, climate and geological setting. According to a report by the United Nations' Office for Disaster Risk Reduction (UNISDR), India lost \$80 billion in GDP due to natural disasters between 1998 and 2017 (Thakur, 2018). India is among the top five countries in terms of absolute economic losses. It is estimated that worldwide disaster losses during this period was around \$3 trillion.

India Key Vulnerabilities

- Coastal States, particularly in the east coast and Gujarat are vulnerable to cyclones.
- 4 crore hectare land mass is vulnerable to floods.
- 68 percent of net sown area is vulnerable to drought
- 60% of Indian Land is vulnerable to earthquake
- Sub-Himalayan/Western Ghats is vulnerable to Landslides.

The political impact also includes strengthening disaster management. Disaster preparation, mitigation, and resilience-building initiatives are crucial in minimizing the human, economic, and environmental costs associated with natural catastrophes, since their effect highlights the need of these measures. The key elements of successful initiatives to reduce catastrophe risk are community participation, early warning systems, sustainable development practices, and prevention (ILO, 2024). Disaster Management Act was passed in 2005 because of how vulnerable the Indian subcontinent is. It was followed by the National Policy for Disaster Management in 2009 and the National Disaster Management Plan in 2016. The UN General Assembly also named 1990–2000 the International Decade for Natural Disaster Reduction (IDNDR). This was followed by the Yokohama Strategy for a Safer World in 1994,

the Hygo Framework for Action from 2005–2015, and the Sendai Framework for Disaster Risk Reduction from 2015–2030. All of these policy structures caused a change in the way disaster risk management was done, from focusing on aid after a disaster to taking proactive steps to avoid disasters before they happen. The likelihood that a natural hazard may escalate into a major disaster can only be described by the presence of both exposure to the hazard and susceptibility to its occurrence

Disaster risk = Hazard*Exposure*Vulnerability

Disasters impact communities and individuals annually, causing significant disruptions to their mental health and overall well-being. Global economic and social progress is often impeded by occurrences of disasters caused by nature (Kreimer,2001). Economic opportunities and environmental constraints may not be as important as place attachment and social and communal connections in explaining why people do not migrate. Climate change is one of several hazards that disproportionately affect women and girls. Disasters disproportionately affect women, leading to greater loss of life and livelihoods and lengthier recovery times as a result of gender-specific hurdles and inequities. Women and girls bear a disproportionate share of the burden as compared to males in all areas of life expectancy, education, housing, health, safety, employment, and nutrition. However, policies, tactics, and programs aimed at reducing catastrophe risk and building resilience are mostly shaped by males. According to a survey women and children are 14 times more likely than men to die we have seen that in case of Tsunami (Okai ,2022). The vulnerability of women increases when they belong to a low socio-economic group.

Uttarakhand Govt. report of 2014 recognizes “Uttarakhand as most vulnerable due to climate-mediated risks. There is also an increase in rainfall by 2030 in comparison to 1970 in the



state (Govt. of Uttarakhand, 2014). It has been ten years after the devastating disaster at Kedarnath. The memory of the calamity is indelibly marked by the immense anguish, agony, and multitude of lifeless bodies. Almost a decade has passed since the Kedarnath Floods, and the families of several victims are still awaiting the recovery of their deceased relatives. The official estimates fluctuate from 5000-10000 on the number of fatalities in this catastrophe (Rawat and Semwal, 2023). Historical evidence has shown that although we are unable to prevent natural disasters, we may indeed mitigate the resulting damages. Post the Kedarnath havoc the government has shifted its focused-on preparedness and stringing the DM. The immediate steps post Kedarnath disaster include creation of new alternative routes, SMS alert projects started and construction of new helipad etc. The district was divided into a total of 27 sectors and each sector had a nodal officer to provide daily reports on district emergency operations.

Methodology

The study uses both primary as well as secondary data sets to analyse the multi-faceted impact of disaster on the people of Rudraprayag. It undertakes a quantitative as well as qualitative approach in assessing the post-disaster impact through the lens of the well-being approach to development. The relevant data pertaining to the individuals who experienced loss of their productive assets and the corresponding relief measures provided were systematically gathered from the local administration and also with the help of interview schedule. The study also aims to use both primary as well as secondary data sets to analyse the multi-faceted impact of disaster on the people of Rudraprayag.

Study Area: The district of Rudraprayag was constituted on September 16, 1997. It is situated at the confluence of the Alkananda and

Mandakini rivers. It is located at 30.28°N 78.98°E. The district of Rudraprayag has a population of 2,42,285, of which 52.77 percent are females. 95.9% of the population resides in its 653 villages, and 46.7% of the population is employed, with 76.4% engaged in agriculture. Rudraprayag has 89.42% literacy, above of the state average of 78.82%. Male literacy in Rudraprayag is 93.43 percent and female literacy is 84.24 percent. The district has emerged as home to Hindu religious center with three of the Panch Kedar in the district including the most famous Kedarnath temple. The district comprises of three tehsils namely Rudraprayag, Ukhimath, Basukedar and Jakholi. There are three development blocks namely Ukhimath, Agastmuni and Jakholi.

Disaster Vulnerability of Rudraprayag:

Rudraprayag District, located in the Indian state of Uttarakhand, is vulnerable to various natural disasters, including floods, landslides, and earthquakes, due to its topography and proximity to the Himalayas. Disasters can cause significant environmental damage, including soil erosion, deforestation, and contamination of water sources. This can have long-term consequences for ecosystem health, biodiversity, and water quality in Rudraprayag.

In the context of social organization, it is observed that there exist distinct settlements corresponding to different castes within a given geographical area for example in the region, the village of Devli Bani Gram is known for its significant role as panditai, a position of religious authority. Conversely, the Rajput and other classes in the same area is engaged in diverse occupations. Some are employed as mule drivers, while others are involved in various entrepreneurial ventures, operating their own shops or businesses. Majority of the population of the district is engaged in agriculture activities and also relies on tourism directly or indirectly.

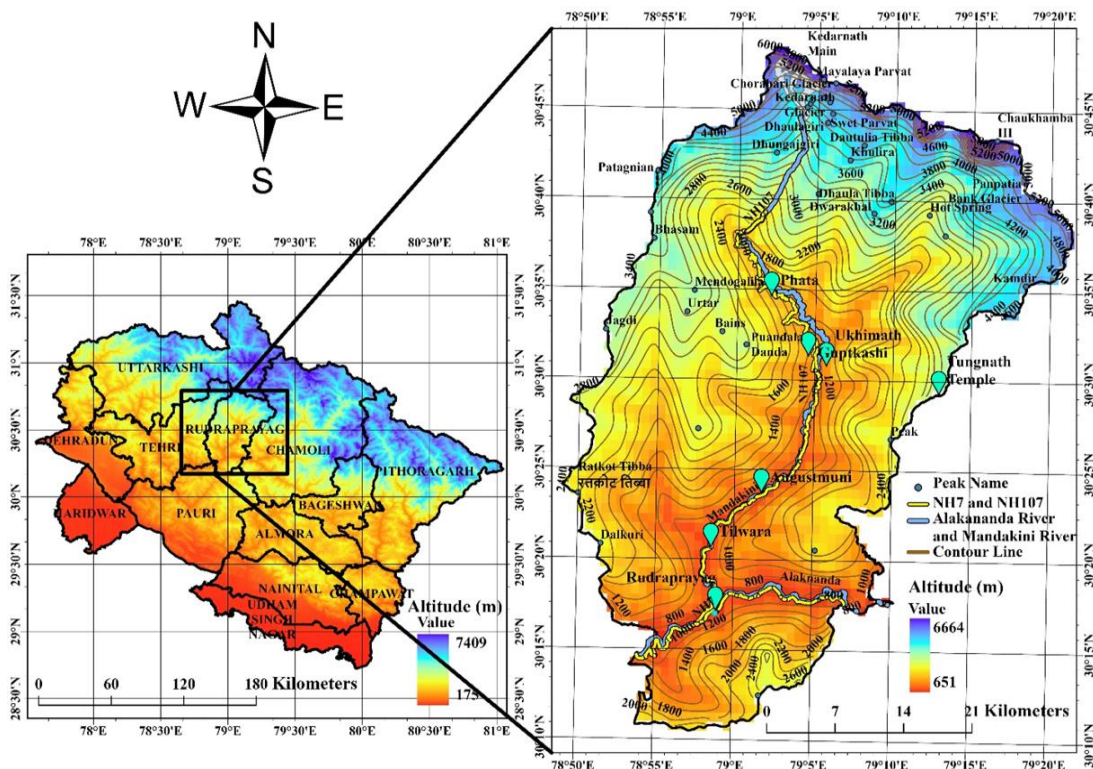


Fig 1: Elevation Map of Rudraprayag District

Tourism plays a significant role in promoting economic growth and enhancing livelihood opportunities in Rudraprayag. This region has gained popularity among tourists primarily because of its attractions such as Panch Prayag, Kedarnath Temple, the city, Business Hub, Local Market, and Char Dham Road. Recently, Rudraprayag district became a fully organic district in Uttarakhand. Nowadays people are willing to spend a handsome amount of money for organic products. This will enhance the livelihood opportunities of the people. Before the 1990s, the concepts of nature conservation, ecological restoration, sustainable development, and organic farming were not widely embraced and did not serve as prominent subjects of scholarly and political discourse. After the 1990s, the global awareness of nature and natural resources led to discussions and conferences on the topic. People are producing cash crops and pulses, leading to soil

conservation and increased household incomes. Eco-tourism, medical tourism, naturopathy, yoga, and meditation facilities might all flourish here, boosting the region's profile and economy. This community and its environs have enormous economic potential as a destination for eco-villages, eco-hut vacation homes, and an organic and traditional food center. Increasing the number of available jobs via a variety of means would help to ensure people's financial stability, reducing the need to relocate. This jungle supports several socio-economic aspects, including feed and fuel wood production, livelihood generating, and organic farming. The forest is ecologically significant for preserving flora and animals, recharging groundwater and streams, restoring soil, and mitigating geo hazards and forest fires. The potential socio-economic and ecological benefits of this area are underappreciated and need adequate assessment. If correctly analyzed, it might benefit local communities and mankind.



Post- Disaster Impacts in Rudraprayag:

District Rudraprayag is highly sensitive from disasters point of view. In terms of earthquake,

this district falls in zone five. On the basis of intensity in the district following are the dangers

- Earthquake - It can happen anytime and anywhere; entire district is sensitive to it.
- Landslides - From June 15 to September 15, the entire district is sensitive.
- Cloud burst - high altitude areas, sharp valleys and mountain slopes.
- Heavy rains,- In the entire district, these types of incidents keep happening in the months of April and October.
- Avalanche - Kedarnath-Madhya Maheshwar, Tung Nath pilgrimage area, from January to April.
- Drought - According to the crop production cycle, due to lack of timely rain or irregular rainfall in the district Drought conditions also arise.
- Thunderbolt - Areas adjacent to midland pine forests.

According to ISRO Landslides Atlas of India report Rudraprayag, Uttarakhand, has the highest landslide density in India and is also having highest exposure to total population, working population, literacy, and houses. The report's risk analysis highlights the potential implications of these landslides on humans by taking into account the density of both human and animal populations. Between 1988 and

2022, 11,219 landslides occurred in Uttarakhand (Maurya, 2023). Some of the major natural disaster this region has faced in past were:1803 Garhwal Earthquake,1942 Earthquake,1979 Mandakini Floods,1986 Jakholi Landslide,1991 Uttarkashi Earthquake,1998 Ukhimath Landslide,1999 Chamoli Earthquake,2001 Phata Cloudburst,2012 Ukhimath Cloudburst,2013 Kedarnath Floods (DDMC Rudraprayag,2022)

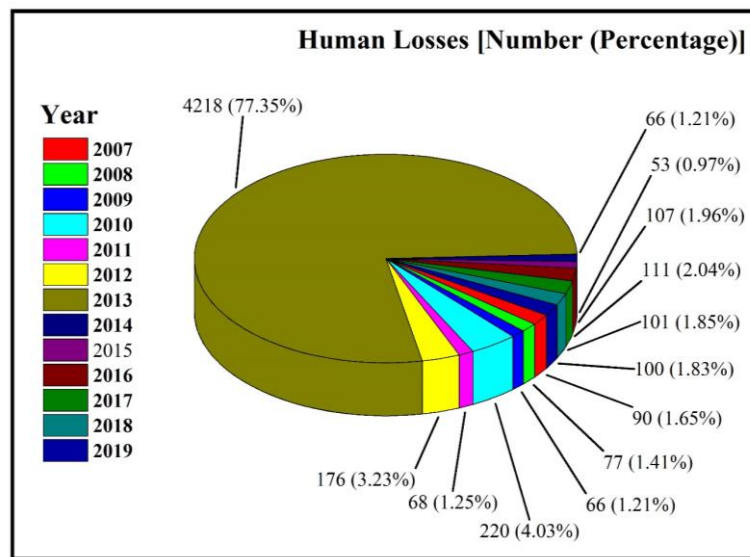


Fig 2: Losses due to Natural Disaster in Uttarakhand (Data Collected from RTI)

In the Rudraprayag district, a total of 202 families residing in 17 villages are facing displacement as a result of the devastating

events that have occurred in recent years. The district of Rudraprayag has a significant proportion of inactive Self-Help Groups (SHGs),



with 678 SHGs classified as inactive compared to 714 active SHGs.

Attachment to a place, cultural ties, historical significance, a strong sense of belonging, social capital, and emotional attachments to specific places influence the likelihood that tends people to remain in a place even if it is risky. Joshimath is a prime example of this. People fear that if they migrate from a place maybe they will lose their identity. Rehabilitation is the not upmost solution, the prime example of tala village in Ukhimath show this trend. Due to sinking of the land of the village the entire village have to displace from their places. The environment sensitive assessment of the region is required in such a case, without proper geological survey. The land of this village also benefitted the villagers by giving them high profit from their agricultural land. these people grow medicinal plants in their land whose values are very high in international markets. The villages situated along the route leading to various religious or tourism destinations have shown a relatively low level of migration in the aftermath of the disaster. This can be attributed to the fact that tourism serves as a crucial means of livelihood for these communities.

Socio-Economic and Political Impact

The socio-economic consequences of disasters encompass various dimensions, including their effects on livelihoods and poverty, as well as on health and education. Furthermore, these disasters have distinct implications for specific vulnerable groups such as women, children, individuals with disabilities, and the elderly.

Disaster always effects livelihoods and reduce people's ability in a prolonged future. The per capita income of all the other hill districts was found to be lower than the per capita income of the state, with Rudraprayag district having the lowest value at Rs. 83,521. (Economic Survey 2018-19, GoU). A survey of more than 400 disaster effected people was taken in the region.

60% of those surveyed said that the natural disaster had an impact on their means of livelihood. Approximately 40% of the population has changed their source of livelihood. Post disaster disruption to livelihoods takes years to recover and its impact is felt more in region of frequent disaster. People having limited livelihood opportunities suffer more and disaster further pushes them into poverty which increases their vulnerability to future disasters. Most of the people depend on the yatra season for their livelihood. The male members of the family work as mule driver. According to the survey 80% of the respondents admit disaster is the most important concern for them. During the survey 30% of the respondents have accepted that they changed their livelihoods after disaster. For Example -those who work as mule worker and shopkeeper have left that after facing the disaster. The major impact post -disaster in the region includes:

a) **Loss of Agriculture Land:** Reduced production is one of the most direct ways in which natural disasters impact agriculture. This results in direct economic losses for producers, which can have repercussions throughout the entire value chain, even influencing the development of the sector or national economies. Damage to crops and animals as a consequence of natural catastrophes cost billions of euros between 2008 and 2018. The Asian region lost USD\$49 billion in the past decade due to natural catastrophes. Rudraprayag district has an area of 2,34,796 hectares of which the total agriculture land is around 19983 hectares. Recently it has been declared as the first organic district of the state. A total of 411 hectares were affected by the 2012 Ukhimath Landslide while 2707.00 hectares of irrigated and non-irrigated agricultural land was destroyed due to 2013 Kedarnath disaster (Kunwar, 2013). During the survey



around 80% of the people confirm that disaster has resulted in washout of their agriculture land or reduction in agriculture. The soil is of poor quality, consisting of brown forest soil and residual sandy loam, and is acidic, stony, composed of stones and gravel, and has a low moisture content. Farmers in the area own small pieces of farmland in different places, which makes it hard for them to keep track of everything.

b) Psychological Impact

Many people's mental health might take a hit when a tragedy strikes, and the repercussions of such events can be devastating. Mental instability, which may lead to PTSD, anxiety, and depression, is experienced by both people and communities in addition to economic and social losses. The psychological repercussions of the disaster are more severe among the elderly, dependent children, and women. Disasters disproportionately affect women, leading to greater loss of life and livelihoods and lengthier recovery times as a result of gender-specific hurdles and inequities. The vulnerability of women increases when they belong to a low socio-economic group. The degree of the impact of disaster varies in women. The Curious Case of Women of Devli Banigram and The Chunni Mangoli village is a prime example of these post disaster impact. The women of Chunni, Mangoli and Kimana villages who themselves have faced disaster still after many years live in the fearful memories of that disaster. It's so dreadful that even during monsoon these women sleeps with their doors open at nights. It's because if some mishaps happen, they can run so that they can save their lives. The Kedarnath tragedy affects the entire mankini region but the most painful effects was felt by the women of the Lamgoni, Devli banigram

region. More than 52 women of this region lost their husbands in this disaster and people used to call these villages as (Village of Widows) Vidwao ka Gaon. This dent was not enough and suddenly they lost their family breadwinner. Most of the male worker of this region do panditai in the Kedarnath and its their family main source of livelihood. The havoc created in the life of these women is not easy to cure. The first challenges in the life of these women are their source of livelihood. After the disaster govt. with the help of NGOs started the Mandakini Bunkar Samiti for the employment of these women. These women were paid around 3000 per month and during Covid -19 this institute has also been shut down and these women once again became unemployed. Those having a son will send their son for panditai but those having only girl child or having no child are the ones worst affected by this disaster. These effected women and child become vulnerable to traffickers.

c) Migration (Trapped Population)

Disasters can have significant impacts on migration patterns, both internally within affected regions and externally across borders. Disasters can have significant psychosocial impacts on affected communities, including trauma, loss of social support networks, and increased stress. These factors may contribute to migration decisions as people seek to rebuild their lives in environments perceived as safer or more supportive. Environmental and climatic factors have a significant impact on migratory flows migration decisions are influenced by risk perception and the availability or scarcity of economic opportunities. Disaster triggered the migration patterns and it varies in a population, there are those who want to

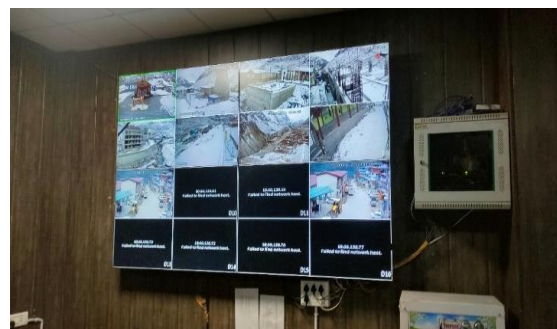


migrate and also have the resources to do so; there are those who refuse to relocate owing to location bonds or employ alternative survival techniques and the most vulnerable and impacted are those who wanted to migrate but can't do so due to a lack of resources, referred to as the "trapped population. The trapped group here referred to those group of persons who lack the ability to migrate due to detreating conditions (Zickgraf, 2023). These people face challenges of multiple vulnerability: whereas they live in the most environment risk areas such as steep slope and flood plains and also have the fewest resources to improve their conditions. One cannot imagine the psychological trauma these people have to go through.

- d) **Long-Term Recovery Challenges:** Recovering from a disaster can be a lengthy and challenging process, requiring significant resources, coordination, and support from government agencies, humanitarian organizations, and the international community. Rudraprayag may face obstacles in rebuilding infrastructure, restoring livelihoods, and addressing the needs of affected populations.
- e) **Strengthening Disaster Management.** Making a better policy for disaster management is a major political impact post - disaster. One such positive impact is strengthened of disaster management. In India some states have performed very well post disaster. Their disaster management has performed very well as compared to others. Kerala is one such example. Post 2013 Kedarnath havoc disaster management of the district have improved . The Preparedness Prevention and Mitigation measures includes setting Early Warning Systems like AWS.Doppler Radar, Identification and marking of Flood Zones,

Aapda Mitra (100 Volunteers for Rudraprayag District), creation of SDRF and DDRF in the district. There is Surveillance cameras, Yatra Management Team (YMT) for smooth conducting of Char Dham Yatra in the region. Implementation of Building Codes and retrofitting of building is one positive response in infrastructure post disaster in the region. Building regulations have been more stringent in recent years, particularly in terms of seismic requirements.

- f) **Sinking of Land:** Rudraprayag and other parts of Uttarakhand are susceptible to land subsidence caused by a mix of natural and man-made causes. Property, infrastructure, and the environment are still under danger from ground subsidence, even if it is not as often mentioned as landslides and floods. In 2013, the Kedarnath Disaster caused significant ground subsidence in the area which includes Tala Village, Semi Village, Khat, Phata Village etc. The Tala village in Ukhimath area has been completely rehabilitation as a result of land subsidence.



Kedarnath Monitoring Room DDMO Rudraprayag



Mandakini Bunkar Samiti Devlibanigram



Agriculture Land Devastation Ukhimath Flood 2012



Paudhar Village repopulated post 1998 Ukhimath Landslide

Conclusion

Disasters can cause significant environmental damage, including soil erosion, deforestation, and contamination of water sources. This can have long-term consequences for ecosystem health, biodiversity, and water quality in Rudraprayag. Health, both physical and mental, as well as education are evidently disrupted during a disaster. The post-disaster effects lead to driving migration patterns, changing livelihood, increased school dropouts, and depletion of agricultural land in the region. Understanding the specific dynamics of how disasters affect migration in Rudraprayag district is essential for effective disaster preparedness, response, and recovery efforts. It requires comprehensive risk assessment, community engagement, and targeted interventions to address the needs of affected populations and build resilience to future disasters. Periodic assessment of the disaster affected people is needed. It showcases even after decades of

research and witnessing multiple forms of disasters in the Himalayas, there is need to bridge the gap between the government and local people for effective management. Further it emphasizes on the importance of technological intervention and awareness in mitigating disaster. The study also suggests that as responsible stakeholders, the masses as well as the government need to adopt a multi-variate approach while formulating disaster management policies. The changing in the political leadership post disaster is also a direct cause of disaster. Political willpower plays a crucial role in driving positive change and achieving sustainable development outcomes. When political leaders demonstrate genuine commitment and determination to address pressing challenges, they can mobilize support, overcome resistance, and drive transformative change for the benefit of society as a whole. Sustainable Development in Rudraprayag District must take into account the region's



vulnerability to natural disasters while addressing socio-economic needs and environmental conservation. Sustainable development initiatives should begin with a comprehensive assessment of disaster risks in the region. This involves identifying hazards such as floods, landslides, and earthquakes, as well as vulnerabilities and exposure of communities and infrastructure. Based on this assessment, plans and policies can be developed to reduce risks and enhance resilience.

In the famous *Dehradun Vs. State of U.P* case Hon'ble Supreme Court has recognized the principle of sustainable development as a basis for balancing ecological imperatives with development goals. The Supreme Court highlighted the need of balancing progress and preservation for the overall benefit of the nation. Moreover, it has been recognised that ecological security, economic efficiency, and social equality are essential prerequisites for attaining sustainable development (GBPNIHE,2019).

Encouraging sustainable development projects in Rudraprayag district should begin with a thorough evaluation of disaster risks. This entails the identification of various hazards, including floods, landslides, and earthquakes, along with the assessment of vulnerabilities and exposure of people and infrastructure. Plans and strategies may be established based on this evaluation to mitigate risks and strengthen resilience. Establishing sustainable infrastructure is essential for mitigating the effects of natural disasters in Rudraprayag. This encompasses the construction of buildings, roads, and bridges that are specifically engineered to endure natural disasters. Enhancing the resilience of current infrastructure via retrofitting may effectively reduce the impact of catastrophes and guarantee the uninterrupted provision of vital services. Efforts towards sustainable development in Rudraprayag must additionally give precedence to adaptation measures. This may encompass

ecosystem-based approaches to adaptation, climate-resilient agricultural practices, and water management strategies. Effective conservation of ecological assets like as forests, water bodies, and land is vital for reducing the likelihood of calamities in Rudraprayag. Forests serve as natural barriers against landslides and floods, while effective watershed management may reduce the likelihood of sudden floods. Implementing sustainable land-use strategies may effectively reduce both soil erosion and landslide concerns. The primary objective of sustainable development initiatives in Rudraprayag should be to broaden the range of livelihood options, hence reducing the dependence on sectors that are susceptible to natural calamities, such as agriculture and tourism. This may include advocating for alternate sources of income, providing assistance to small businesses, and improving possibilities for skills development and education.

References

- Albrecht, F. (2017). Natural hazard events and social capital: the social impact of natural disasters. *Disasters*, 42(2), 336–360.
- Disaster Mitigation and Management Cell, District Collectorate, Rudraprayag. (2022). District Disaster Management Action Plan Rudraprayag.
- GBPNIHE. (2019). DISTRICT ENVIRONMENTAL PLAN (As per the Hon'ble National Green Tribunal (NGT) vide Order O.A. No. 360/2018 dated 26.09.2019) RUDRAPRAYAG. GBPNIHE.Draft
- Govt. of Uttarakhand. (2014). Uttarakhand Action Plan on Climate Change. Uttarakhand Action Plan on Climate Change.
- Coelho, S. (2017, March 30). Why does vulnerability to human trafficking increase in disaster. OIM Oficina Regional para



- Centroamérica, Norteamérica y el Caribe. <https://rosanjose.iom.int/en/blogs/why-does-vulnerability-human-trafficking-increase-disaster-situations>
- Direct & indirect losses. (2021, June 9). <https://www.preventionweb.net/understanding-disaster-risk/key-concepts/direct-indirect-losses>
- Goel, T. (2022, May 23). How disasters, poverty fuel human trafficking. Down To Earth. <https://www.downtoearth.org.in/news/climate-change/how-disasters-poverty-fuel-human-trafficking-82965>
- Ida, T. (2021, June 18). Climate refugees – the world’s forgotten victims. World Economic Forum. <https://www.weforum.org/agenda/2021/06/climate-refugees-the-world-s-forgotten-victims/>
- Kreimer, A. (2001). Social and economic impacts of natural disasters. International Geology Review, 43(5), 401–405.
- Kunwar, D. (2013, August 5). 18,228 cattle killed, 20,000 hectares of agriculture land damaged in Uttarakhand: India News - Times of India. The Times of India. <https://timesofindia.indiatimes.com/india/18228-cattle-killed-20000-hectares-of-agriculture-land-damaged-in-Uttarakhand/articleshow/21610001.cms>
- Maurya, L. (2023, March 7). ISRO data shows Uttarakhand’s Rudraprayag and Tehri Gharwal most prone to landslides in India. Down To Earth. <https://www.downtoearth.org.in/news/natural-disasters/isro-data-shows-uttarakhand-s-rudraprayag-and-tehri-gharwal-most-prone-to-landslides-in-india-88112>
- Okai, A. (2022, March 24). Women are hit hardest in disasters, so why are responses too often gender-blind?. UNDP. <https://www.undp.org/blog/women-are-hit-hardest-disasters-so-why-are-responses-too-often-gender-blind>
- Rawat, Arvind Singh and Semwal, M.M “A decade after the Kedarnath havoc”. the pioneer (dehradun edition), May 08,2023, pp-2
- Thakur, P. (2018, October 11). Natural disasters cost India \$80 billion in 20 years: UN Report: India News - Times of India. The Times of India. <https://timesofindia.indiatimes.com/india/natural-disasters-cost-india-80-billion-in-20-years-un-report/articleshow/66156074.cms#:~:text=countries%20like%20India.>
- The importance of early warning systems in disaster risk reduction. International Labour Organization. (2024, February 1). <https://www.ilo.org/resource/article/importance-early-warning-systems-disaster-risk-reduction>
- Zickgraf, C. (2023, October 4). Where Are All the Climate Migrants? Explaining Immobility amid migrationpolicy.org. <https://www.migrationpolicy.org/article/climate-change-trapped-populations#:~:text=While%20trapped%20populations%20are%20defined,and%20irreversible%20environmental%20events%20occur>