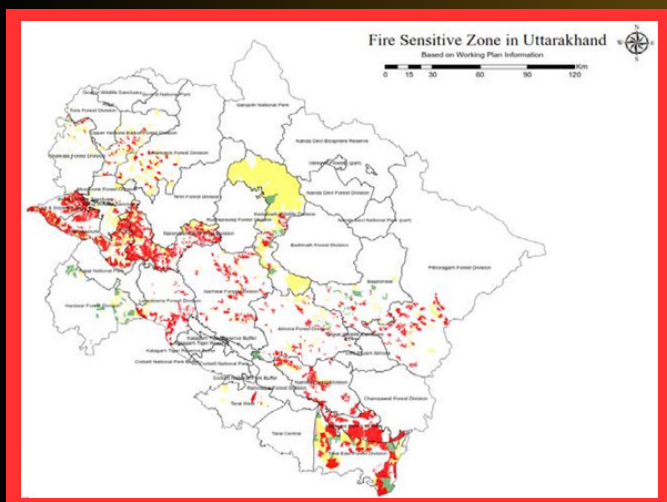


# UTTARAKHAND FOREST FIRES



**Course: Natural & Man Made Disasters**



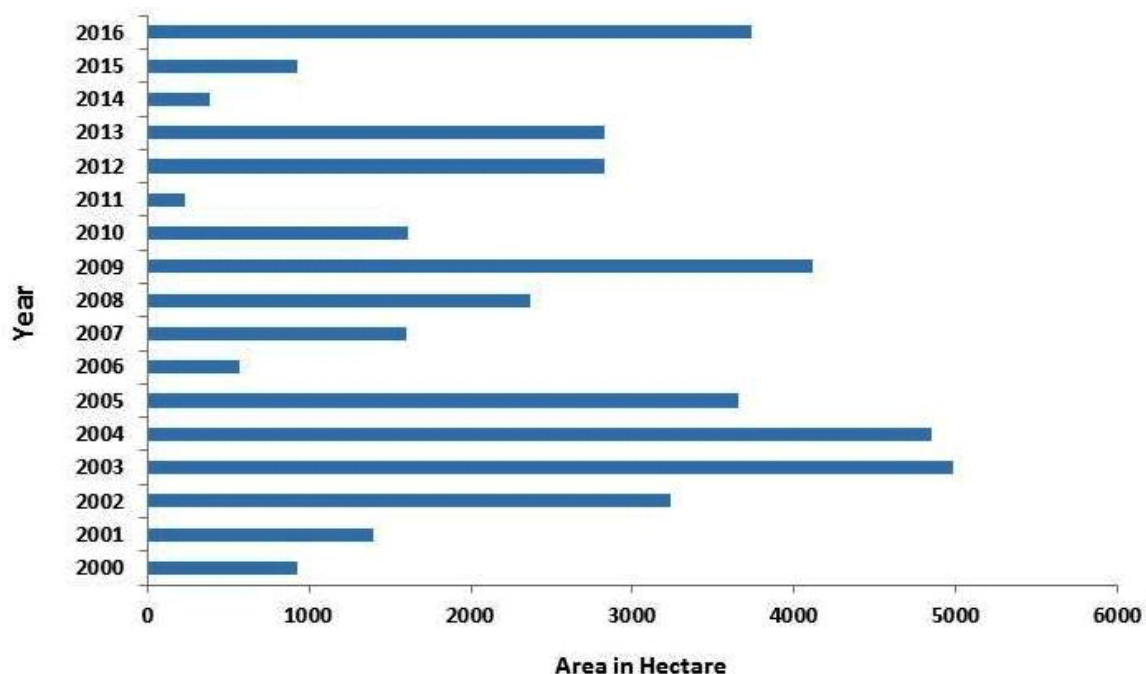
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**"A forest fire, like any other disaster, doesn't just scorch the land; it leaves scars on the hearts of those who witness its fury."**



## Introduction and Background Information

In 2016, Uttarakhand, a beautiful state in northern India known for its forests and mountains, faced a big challenge. During the hot months of April and May, the area was hit by severe forest fires. This wasn't just a small problem; it turned out to be one of the worst fire disasters the region had ever seen. The fires burned down over 11,000 acres of forest, which is a lot of trees, plants, and homes for wildlife. Sadly, seven people also lost their lives because of these fires. Firefighters worked very hard, fighting against more than 1,600 fires, and finally, some rain came, which helped a lot in controlling the situation. This wasn't a one-time thing, though. The number of forest fires in Uttarakhand has been going up over the years. Back in 2002, there were about 922 fires, but by 2019, this number had shot up to 41,600. That's a huge increase and it shows that something big is changing, making these fires more common (Mina et al., 2023). Below is the graph showing area affected due to forest fire in Uttarakhand over the years:



*Figure 1. Area affected due to forest fire in Uttarakhand (Source: Chief Conservator of Forest, Vigilance & Law Cell, Haldwani).*

Table 1: Summary of district wise fire incidents reported till 5 June 2016 in Uttarakhand (Source: Forest Department, Govt. of Uttarakhand)

District (Circle)	Number of fire incidents			Affected forest area (ha)			Plantation affected (ha)	Resin tapping blaze affected	Value of loss (Rs.)
	Reserve Forest	Civil Soyam / VanPanchayat	Total	Reserve Forest	Civil Soyam / VanPanchayat	Total			
Dehradun	175	25	200	316.75	58.65	375.40	0.00	400	320200.00
Haridwar	52	0	52	132.58	0.00	132.58	12.50	0	66665.00
Chamoli	109	112	221	251.85	222.60	474.45	1.00	0	566000.00
Pauri	179	223	402	537.65	494.10	1031.75	39.50	0	898975.00
Tehri	165	82	247	248.70	101.75	350.45	3.50	0	222625.00
Uttarkashi	127	45	172	167.80	72.50	240.30	28.50	0	260125.00
Rudraprayag	39	43	82	68.70	91.00	159.70	2.00	0	221050.00
Almora	117	78	195	331.90	194.25	526.15	12.00	0	694825.00
Pithoragarh	43	54	97	125.00	163.60	288.60	0.00	0	372650.00
Bageshwar	33	27	60	108.90	106.45	215.35	0.00	0	321025.00
Champawat	33	26	59	67.01	52.00	119.01	0.00	0	130755.00
Nainital	239	27	266	451.26	43.60	494.86	3.05	0	545930.00
UdhamSingh Nagar	16	0	16	14.75	0.00	14.75	1.40	0	9000.00
Grand Total	1327	742	2069	2822.85	1600.50	4423.35	103.45	400	4629825.00

Figure 2

This situation in 2016 made a lot of people think more about forest fires – why they're happening more often, how they affect us, the forests, and the animals living there, and what we can do to stop them or at least control them better. This study is all about that. It looks closely at the fires in 2016, trying to understand everything from how they started, what damage they did, to how people tried to stop them. It also talks about how we can learn from what happened to get better at dealing with fires in the future, including how the government and different groups can help, and how new technology might warn us before things get too bad. In the next section we will discuss about the nature of the fire.

## The Nature of Uttarakhand's Forest Fires

These fires can be seen as a type of disaster, and it's interesting to think about whether they're more natural or caused by people. Forest fires can happen in different ways. Some burn on the surface of the ground and don't do too much damage, while others can burn the tops of trees and spread quickly, which is really dangerous. There are also fires that burn slowly deep in the ground. When we talk about natural disasters, we're looking at things that happen because of the weather or the environment. In Uttarakhand, the forest fires could be considered a natural

disaster because the hot weather, low rain, and dry plants all come together to make a big risk for fires. It's tricky to say exactly when a fire might start or how bad it will be because the weather and the environment can change in ways we can't always guess, even though scientists are getting better at making predictions. On the other hand, there are disasters that happen because of things people do, which we call man-made disasters. These can be things like not being careful with fire near the forest or cutting down too many trees. So, looking at the forest fires in Uttarakhand, it's a mix. The weather and the environment play a big part, but so do the things people do.

### **Causes and Consequences**

The 2016 Uttarakhand forest fires were a significant environmental disaster, with causes rooted in both natural and human factors. The fires were amplified by unusually high temperatures that were 4 to 5 degrees higher than the average for that time of year, affecting nearly 180 hectares of green land across 111 districts. A total of 1,857 incidents destroyed approximately 4,048 hectares of land. The severity of these fires prompted large-scale efforts to combat them, involving the National Disaster Response Force and helicopters to douse the flames. To address the root causes and mitigate future risks, the World Bank allocated substantial funds for research and afforestation efforts in Uttarakhand and across India (Gcs, 2021).

Chir Pine (*Pinus Roxburghe*) forests, which cover about 16% of Uttarakhand's total forest area, were particularly vulnerable due to the accumulation of resin-rich leaf litter on the forest floor, making them highly susceptible to fires. The year 2016 saw a major outbreak, with 2,069 forest fire incidents affecting 4,423 hectares of forests. This prompted a comprehensive response, including a visit by the Parliamentary Standing Committee on Science & Technology, Environment & Forests to Uttarakhand, leading to the adoption of several remedial measures. The immediate consequences of the fires included significant loss of biodiversity, with direct destruction of plant and animal habitats. The fires also posed a risk to human health due to

deteriorated air quality and threatened economic activities, particularly tourism, which is a crucial part of Uttarakhand's economy (Gcs, 2021).

### **Applying Disaster Management Framework (DMF)**

The disaster management framework for the 2016 Uttarakhand Forest Fires can be examined through the phases of preparedness, response, recovery, and prevention:

**Preparedness:** This phase includes planning and training to improve the response to forest fires. Despite regular occurrences of forest fires in Uttarakhand, the extensive damage caused in 2016 indicates a need for better preparedness. This could involve training local communities and forest officials in early detection methods, creating firebreaks, and ensuring that there are clear protocols for evacuating vulnerable areas.

**Response:** The response involved deploying helicopters and the National Disaster Response Force to combat the flames, although visibility issues hampered the effectiveness of aerial firefighting. Rangers and Divisional Forest Officers were also rushed to the affected areas to extinguish the fires. The scale of the disaster shows that the response capabilities were stretched, and there was a need for more coordinated efforts between local, state, and national agencies.

**Recovery:** The recovery phase focuses on restoring the affected areas and communities. Following the fires, the World Bank granted significant funds to the Uttarakhand forest department for research into the causes of the fires and to support afforestation efforts across the state. The Indian central government also announced substantial funding for afforestation across Uttarakhand and the country. However, recovery is not just about replanting trees; it also involves restoring the livelihoods of affected communities, addressing long-term environmental impacts, and implementing measures to prevent future fires (Gcs, 2021).

**Prevention:** The Uttarakhand fires highlighted the need for a more accessible approach to forest management to prevent such disasters. The accumulation of resin-rich leaf litter in Chir

Pine forests, which cover about 16% of Uttarakhand's total forest area, made these areas particularly prone to fires. To mitigate future risks, ecologists suggest rebuilding the forest ecosystem as it was before 1984, promoting the growth of broadleaf humid evergreen forests over the dry stands of Chir Pine which are more susceptible to fires (Joshi, 2016).

### **Evaluating the Effectiveness of the DMF**

The effectiveness of the disaster management cycle in addressing this Forest Fires reveals a mix of strengths and weaknesses across its various stages. The state of Uttarakhand experiences forest fires annually, but the 2016 fires were more widespread, partially due to drier conditions. This indicates a gap in preparedness, as the scale of the fires overwhelmed existing measures. A lack of early warning systems, public education on fire prevention, and local involvement in fire management were evident shortcomings. Where preparedness was effective, local knowledge of traditional farming practices and ecological balances could have been better integrated into fire management strategies. Talking about the response, rapid deployment of rangers and the use of helicopters were key response strategies, yet the efforts managed to extinguish only 70% of the fires, partly due to poor visibility affecting aerial operations. The post-fire recovery saw financial investments from the World Bank and the Indian government for research and afforestation. However, the recovery phase was not just about financial input; it required rebuilding ecosystems and community livelihoods. While funds were allocated for these purposes, the actual on-ground recovery efforts needed to focus on restoring the diverse forest ecosystem that existed prior to the dominance of fire-prone pine forests.

The proliferation of pine over oak forests, due to British-era policies and continued post-independence, has altered the forest composition, making it more fire-prone. Migration leading to abandoned agriculture and the build-up of flammable shrubs, along with the drying up of traditional water sources due to pine needles, were significant contributors to the fires.

Effective prevention required a shift in forest management to reduce pine dominance and revive broadleaf forests, which help retain soil moisture and reduce fire risk.

### **Recommended Improvements**

After reading and going through the multiple articles on 2016 Uttarakhand Forest Fires, we come up with a set of strategic recommendations to disaster management practices. Firstly, we propose the organization of regular fire management workshops to educate local communities on prevention, early detection, and safe response tactics. Upgrading infrastructure is crucial—improving roads and access points in forested regions will ensure swift firefighting crew responses. The establishment of advanced early warning systems, integrating satellite monitoring and ground sensors, will enable the immediate detection of fires. A dedicated quick-response team, replete with appropriate firefighting equipment and aircrafts capable of water bombing under poor visibility conditions, is recommended for rapid mobilization. A seamless coordination protocol between various government tiers and NGOs will support resource mobilization efficiency. Utilizing media and technology for public communication will keep citizens informed about fire statuses, evacuation protocols, and safety precautions.

Post-disaster assessments should be conducted to gauge the efficacy of the response and ongoing recovery, providing insights for future actions. Establishing economic support funds will aid local economies, such as tourism, which suffer in the wake of such fires, encouraging businesses to engage in recovery efforts. Forest management strategies need revaluation, particularly the promotion of biodiversity through the replacement of monoculture pine plantations with mixed-species forests. Controlled burning practices during safe periods will naturally diminish combustible material and forestall extensive fires. Our work advocates for investment in understanding evolving forest fire patterns and developing advanced firefighting techniques tailored to the unique regional topography and ecology. These enhancements,



integrated into an adaptive and dynamic disaster management framework, will ensure continually evolving approach, ready to meet future challenges with greater efficacy.

## **The Role of Governmental and Non-Governmental Organizations in Response and Recovery**

Effective response and recovery from disasters depend heavily on the involvement of the government and non-governmental organizations (NGOs) in disaster management. National preparedness, reaction, and recovery from disasters are normally the responsibility of the government. This include creating and putting into practice disaster management plans, organising emergency response activities, giving impacted areas resources and assistance, and carrying out recovery and post-disaster planning. The Government of India enacted the Disaster Management Act, which led to the creation of “ National Disaster Management Authority”(NDMA) and “National Disaster Response Force”(NDRF). The NDRF has to provide training to local police, district authorities, teachers and others to prepare for a situation of disaster. They have to increase community awareness and preparedness amongst people. During disaster they have to deploy themselves to search and rescue operations and try to provide relief to people through their presence and post the disaster they have to assist the states in recovery process.

NGOs, on the other hand, frequently assist government initiatives. In addition to long-term support for the reconstruction of infrastructure and communities, they might offer emergency humanitarian relief in the form of food, shelter, and medical attention. Additionally, NGOs frequently concentrate on the particular needs of marginalized groups and can offer resources and expertise to support government initiatives. NGOs have played a crucial role in India's disaster management cycle since the freedom struggle, supporting critical sectors such as health, education, water supply, sanitation, shelter, livelihood restoration, food security, and environment. Given India's multi-hazard risk and vulnerability to natural and man-made



disasters, NGOs have provided humanitarian assistance to disaster-affected people in severe disasters like Latur earthquake in 1993, Orissa super cyclone in 1999, Bhuj earthquake in 2001, Indian Ocean tsunami in 2004, Kashmir earthquake in 2005, Barmer floods in 2006, Kosi floods in 2008, cyclones Aila and Laila, and the recent cloud burst in Leh in 2010. In recent years, NGOs have started strengthening pre-disaster preparedness and mitigation through capacity building, public awareness campaigns, mock exercises, workshops, and conferences. They have also started collaborating with corporate entities in Public-Private Partnership (PPP) projects and Corporate Social Responsibility (CSR) initiatives.

### **Control Measures**

The 2016 Forest Fires showed us how important it is to have a good plan to stop fires from starting, fight them quickly when they do, and fix the damage after it. The first step would be to make sure fires don't start in the first place. This means making rules about what people can and can't do in the forests, like not allowing open fires and being careful with activities that could start a fire. We can also make safe areas around the most important parts of the forest so fires can't spread easily. Teaching local people how to look after the forests and telling them about the risks can help a lot. Using technology like satellites to watch the forests and find risky areas early can also help stop fires before they start. When a fire does start, it's important to have a team ready to go quickly. This team should have the right tools and know how to fight fires in difficult places, using helicopters or drones to reach places they can't get to by walking. It's also important to have a plan to tell people what to do and where to go if a fire starts near them. After the fire, we need to work on bringing the forest back to life and fixing any damage. This could mean planting new trees and taking care of the land so it doesn't get worse. Watching how the forest grows back and learning more about how fires affect everything can help us make better plans for the future.

By doing these things, using both new technology and using our heuristics, we can better protect our forests and communities from big fires. Innovative solutions, such as the integration of traditional ecological knowledge with modern science, can offer sustainable ways to manage forest resources, reduce fire risks, and ensure rapid recovery, thereby significantly mitigating the impact of similar disasters in the future.

### **Suggested Policy Changes for Effective Disaster Management**

This 2016 Forest Fires highlighted critical areas for improvement in disaster management. To enhance disaster preparedness and response, a approach involving legislative, infrastructural, and community-based reforms is essential. These recommendations aim to build a more resilient and responsive disaster management system.

**Enact Comprehensive Fire Management Laws:** Develop and enforce laws focusing on fire prevention, management, and recovery. This includes regulations on land use, fire safety norms for forest-adjacent communities, and penalties for illegal activities leading to fires.

**Establish a National Forest Fire Management Agency:** A dedicated agency would coordinate efforts across states, ensuring standardization of protocols and effective mobilization of resources.

**Upgrade Firefighting Infrastructure:** Invest in modern firefighting equipment suitable for diverse terrains of Uttarakhand. This includes aerial firefighting capabilities and advanced surveillance technology for early detection.

**Develop Infrastructure for Rapid Response:** Enhance accessibility to remote forest areas through improved roads and communication networks, facilitating quicker response times during emergencies.

**Strengthen Community Engagement:** Implement programs to educate communities living near forests on fire prevention techniques and establish local volunteer fire brigades. This ensures local stakeholders are prepared and can act swiftly in case of fires.

**Promote Participatory Forest Management:** Encourage community involvement in forest management decisions, leveraging local knowledge for sustainable practices and enhancing forest resilience.

**Integrated Approach:** Ensure coordination among governmental agencies, non-governmental organizations, and communities for a unified response mechanism.

**Capacity Building:** Conduct regular training and drills for emergency responders and community members, improving skills in firefighting, evacuation, and first aid.

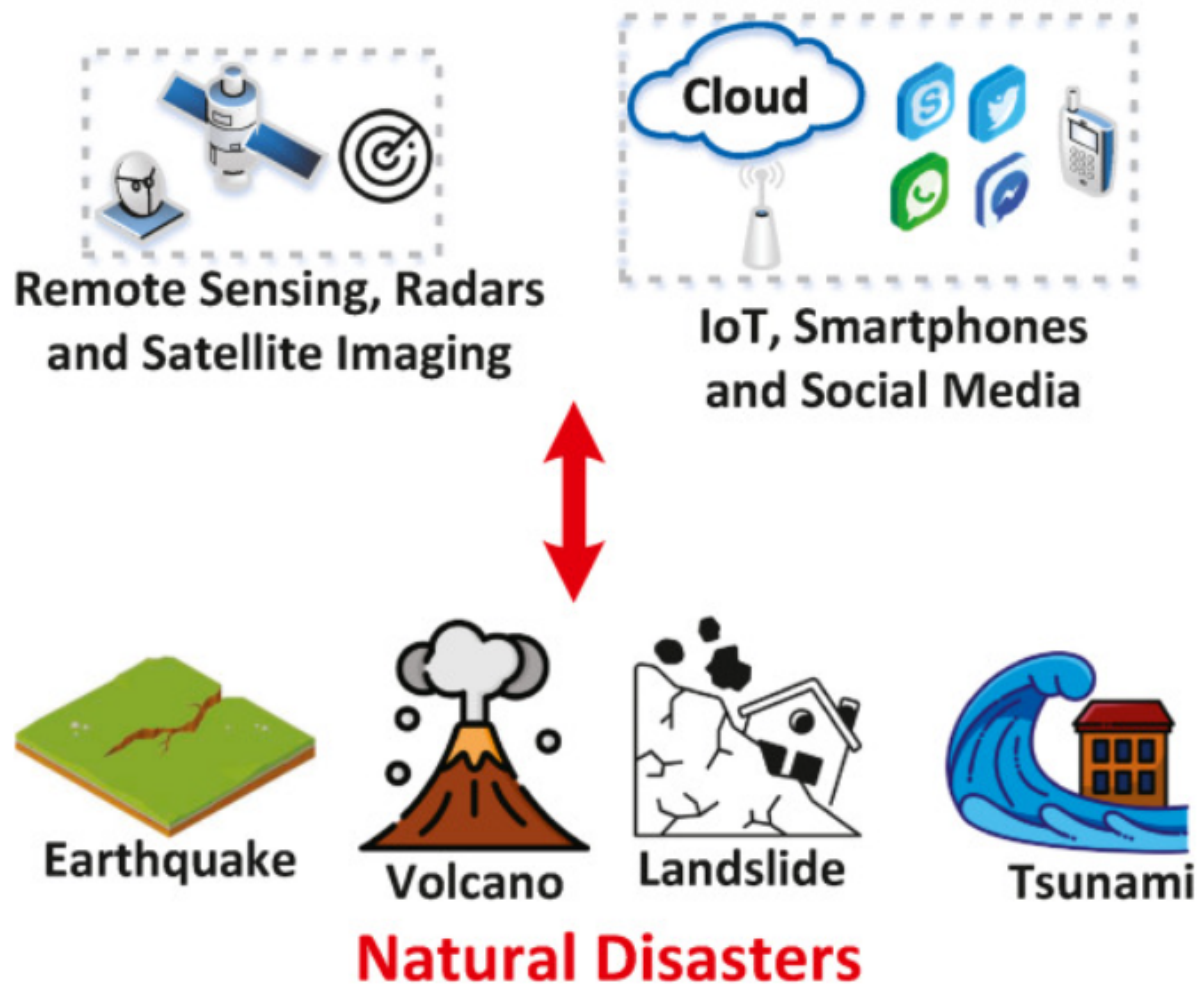
**Investment in Research and Development:** Support research on fire behaviour, climate change impacts, and best practices in fire management, adapting strategies as needed.

These reforms, by addressing the shortcomings revealed by the 2016 disaster, pave the way for a disaster management system capable of effectively mitigating risks, responding to emergencies, and ensuring rapid recovery, thus enhancing overall disaster resilience.

### **Utilising Science and Technology in the Disaster Prediction**

In the recent years the increasing frequency and severity of natural disasters have highlighted the need for more effective and efficient disaster management strategies and better understanding of the causes of these disasters. Disaster Management is the process of planning, coordinating, and executing actions to reduce the impact of a disaster. Here, we look at how different technologies, such as Remote Sensing, radars, satellite imaging, and many others, can be used to predict and manage disasters.

# Modern Technologies



*Figure 3*

For example while preparing for disaster tools like computer modeling can be used to predict the path for the spread of a forest fire. Remote sensing plays a significant role in wildfire detection and monitoring. It involves the use of satellite imagery, aerial photography, and other sensor technologies to capture data about fire occurrences, smoke plumes, and burned areas. During a disaster, satellite imagery can be used to assess the damage. GPS tracking can be used to locate people who are stranded or lost. After the disaster, we can use GIS to map the damage caused in various areas. And at the end we can use science and technologies to mitigate the effects of future disasters. For example engineering can be used to design structures that are resistant to disasters like earthquakes or hurricanes.

Unmanned Aerial Vehicles (UAVs) are increasingly used in forest fire fighting, providing real-time data, monitoring fire progression, and aiding in search and rescue efforts. Equipped with thermal cameras and sensors, UAVs detect hotspots, carry payloads, and are cost-effective compared to traditional aerial surveillance methods.

There are some other useful technology resources like weather forecast systems and early warning systems that might help in getting informed about the impending disaster and, accordingly, taking precautions and evacuating. With the increasing technological and scientific developments we should move onto how to significantly reduce disasters. We must implement some International Disaster Reduction Strategy to make this earth safer to live.

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