Chapter 3

Natural Disaster Management

Himachal Pradesh is exposed to various concrete realities. Frequent natural disasters of various intensity and their impact on society and land is one of such problems, which hamper the development of the state. Earthquakes, landslides, cloudbursts, flash floods, avalanches, forest fires, droughts, etc. have caused tremendous loss to the state. Besides loss of life, these disasters also strain the state exchequer.

Landslide is the most common disaster in Himachal Pradesh which causes immense loss of life and property. The Luggar Bhatti landslide on 12 September, 1995, buried 65 persons in the Kullu valley. The state is also avalanche prone. In March 1978, about 30 persons lost their lives in Lahaul and Spiti district. Another avalanche in March 1979, besides causing widespread damage to roads and property, also buried 237 persons.

Frequent flash floods in the last few years have baffled both the meteorologist and the common man equally. The flash flood of 1 August, 2000, in the Satluj left a trail of destruction in Shimla and Kinnaur districts killing more than 150 persons and washing away 14 bridges. The estimated loss to public and private property in this calamity was Rs. 1000 crore. The water level rose suddenly from 12 to 20 metres, damaging a 320 km stretch of the National Highway and the 1500 MW Nathpa Jhakri power project.

In 1995, 114 lives were lost and public property worth Rs. 7552 lakh was damaged in various disasters. Loss to agriculture and horticulture was Rs. 13,251 lakh and Rs. 10,108.29 lakh respectively. Similarly in 1997, 223 lives were lost and private property worth Rs. 8146 lakh was damaged.

On the basis of the damage caused by disasters and their widespread nature, Himachal Pradesh can be called one of the most unstable and disaster-prone states of the country. Although the state is endowed with rich natural resources, the geology, the general topography, the physical features, the climate and active geographic changes have made the area vulnerable to various natural disasters. In addition to the natural causes, various anthropogenic activities have had a multiplier effect and created an imbalance in the overall ecology of the area. All these factors have combined to turn this state into a unique region affected by almost all types of natural disasters. A brief description of the common disasters and their impact is discussed in the succeeding paragraphs.

Earthquakes

Earthquake, quite devastating and sudden in nature, is one of the most common type of disasters that hits the State. This natural disaster has caused immense loss to the state. Lying in the sensitive Himalayan belt, at the juncture of two active tectonic plates, the state is prone to severe seismic activity. Seismologists have categorised Himachal Pradesh in seismic zones IV & V, highly prone to earthquakes. Statistically, more than 250 earthquakes of magnitude above 4.0 on the Richter scale, including 51 with magnitude above 5.0 have rocked the state during the last century. (Table 3.1)

TABLE 3.1

Earthquake (M>5.0) Occurrence in the Region (1897-1991)

Return Period	*No. of Earthquake having Magnitude*			
	5.0-5.9	6.0-6.9	7.0-7.9	>8.0
2.5-3.0 years	25	7	2	1

Source: National Centre for Disaster Management, New Delhi.

Scientific investigations reveal that most of the earthquakes in the region are the result of movement along thrusts/faults and are located along three major thrust zones i.e.:

1. The Main Boundary Thrust (MBT), demarcating the Shivalik Foothills from the rest of the Himalayas.
2. The Main Central Thrust (MCT), demarcating the Lesser and Central Himalayas.
3. The Central Counter Thrust (CCT), separating the Central Himalayas from the Tibetan Himalayas.

As far as geographic distribution of earthquakes is concerned, the area falling in the districts of Kangra, Bilaspur, Chamba, Kullu and Manali falls in the highest seismic zone i.e. Zone V and is most prone to disastrous earthquakes. Blockwise, the Kangra block is most sensitive to earthquakes, followed by Garhwal, Chamba and Shimla blocks. The Kangra earthquake of 4 April, 1904 measuring 8.0 on the Richter scale, the Kinnaur earthquake of Jan 19, 1975 measuring 6.7 on the Richter scale and the Dharamshala earthquake of 26 April, 1986 measuring of 5.7 on the Ritcher scale indicate that the Kangra block is the most sensitive, as far as seismicity is concerned (Table 3.2). The existence of major active thrust sheets is the probable cause of this high vulnerability of the area to earthquakes. The movement of large rock blocks along the thrust planes resulting in the release of stored energy is the basic cause of the earthquakes in this region.

TABLE 3.2

Major Earthquakes in Himachal Pradesh

Date	*Intensity*	*Place*
4th April, 1905	8.0	Kangra
19th January, 1975	6.7	Kinnaur, Lahaul and Spiti
26th April, 1986	5.7	Dharamshala
15th June, 1978	5.0	Dharamshala
1991		Uttaranchal

Source: National Centre for Disaster Management, New Delhi

Kangra Earthquake-1905 (brief description)

Magnitude: 8.0

Time: 06.20 hrs

Epicentre: Near Kangra-Dharamshala

MM intensity observed: X

Lives lost: 20,000

- The earthquake was felt over an area of four lakh square km.
- Kangra town was completely razed to the ground.
- Many houses, buildings, bridges, and roads were damaged.

Landslides

The fragile nature of the rocks forming the mountains, along with climatic condition and various anthropogenic activities have made the state vulnerable to the vagaries of nature. Besides earthquakes, landslides are the other geological hazards that are common and peculiar to this state.

Landslides are the downslide movement of soil, debris or rocks, resulting from natural causes, vibrations, overburden of rock material, removal of lateral supports, change in the water content of rock or soil bodies, blocked drainage etc. In Himachal Pradesh, the mass movement varies in magnitude from soil creep to landslides. Solifluction (form of creep in which snow or water saturated rocks move down the slope) is another type of mass movement that is common on the higher snow covered ranges of the state.

The problem of landslides is common and frequent in Himachal Pradesh. Almost every year the state is affected by one or more major landslides affecting society in many ways. Loss of life, damage to houses, roads, means of communication, agricultural land, and floods are some of the the major consequences of landslides in the region.

Flash floods, particularly in narrow river gorges are the cause of some of the major landslides in Himachal Pradesh. These flash floods trigger landslides in the region, eventually jeopardising the stability of the hill as a whole. Some of these landslides have often created landslide-dams in various river gorges.

The vulnerability of the geologically young, unstable and fragile rocks of the state has increased many times in the recent past due to various unscientific developmental activities. Deforestation, unscientific road construction, terracing and water intensive agricultural practices, encroachment on steep hill slopes are the anthropogenic activities which have increased the intensity and frequency of landslides.

Among the man-induced causes, road construction in the hilly terrain is more responsible for landslides. The quantum of the damage by unscientific road construction may be judged by scientific research, which states that one kilometer of road construction in

the Himalayas needs removal of 60,000 cubic meters of debris. Due to this and other anthropogenic activities, landslides have become a regular occurrence in the state, specially during the rainy season. Malling, Nathpa, Powai in the Spiti and Sutluj valleys in Kinnaur district and Marlu, Bhang, Chhayal and Mandh in the Beas catchment are the areas where landslides occur almost every year.

At present, according to gross yet reliable estimates, landslides occupy about 1 per cent of the land surface in five central districts of Himachal Pradesh. They have a total volume of more than 2.2×10^6 m^3 and a mean age of 6.5 years. This helps to evaluate the denudation rate, which is about 12 mm/year (all erosive processes). Landslides have about 2.5 mm/year denudation rate.

Flash Floods and Cloud Bursts

Flash floods, short-lived extreme events, which usually occur under slowly moving or stationary thunderstorms, lasting less than 24 hours are a common disaster in the state. As a result of the high velocity of the current which can wash away all obstacles in its way, this phenomenon has resulted in enormous loss of life and property in various parts of the region. Recent flash flood of 1 August, 2000, in the Sutlej is one such example in which more than 150 persons were killed and enormous loss was caused to various infrastructure like roads, bridges and power plants so the estimated loss to property due to this flash flood was above Rs. 1000 crore.

Glacial melting due to global warming is another major cause of flash floods in Himachal Pradesh. The major glaciers in the higher hill tops are receding at an alarming rate due to anthropogenic activities. Intensive industrialisation is one of such major causes of global warming. As per the Defence Research Development Organisation (DRDO) estimates, the receding rate of famous Himalyan glaciers has been as follows (Table 3.3).

TABLE 3.3

Receding Rate of Glacier

S. No.	*Name of Glacier*	*State*	*Receding Rate (m/year)*
1.	Barashingri	Himachal Pradesh	44.3
2.	Gangotri	Uttaranchal	17.5
3.	Milam	Uttaranchal	13.3
4.	Pindar	Uttaranchal	23.5
5.	Dokriani	Uttaranchal	17.0
6.	Zemu	Sikkim	13.2

Source: DRDO

Along with glacial receding, the bursting of natural or man-made dams, and cloudbursts are other main causes of flash floods. "Cloudbursts, very common in Himachal Pradesh, are basically excessive rain in a short period, resulting in flash floods that wash away every obstacle in the way.

Avalanches

Avalanches, river-like flow of snow or ice descending from mountain tops are common in the high ranges of the Himalayas. Lahaul & Spiti, Drass, Badrinath are areas which are frequently hit by this phenomenon. As per the Snow and Avalanches Study Establishment (SASE) of the DRDO, on an average 30 persons are killed every year due to this disaster in the Himalayas. Beside claiming lives, avalanches also damage roads and other property falling in their way.

Some specific features associated with avalanches are:-

- They are common in elevation of more than 3500 m.
- Very frequent on slopes of 30-45°
- Convex slopes are more prone to this form of disaster
- North-facing slopes have avalanches in winter and south facing during summer
- Slopes covered with grass are also more prone to avalanches

The high ranges of Himachal Pradesh are frequently hit by this snow-related disaster. The major avalanches that hit the area in last two decades are:

TABLE 3.4

Major Avalanches

Time	*Area*	*Loss*
March, 1978	Lahaul & Spiti	30 people killed
March 1979	Lahaul & Spiti	237 people killed
1988	Shimla	Blocking of Districts of Kinnaur, Lahaul & Spiti and Solan
March 1991	Himachal Pradesh	Road blockage for 40 days
September 1995	Himachal Pradesh	Devastating Floods

Source: DRDO

Like floods, avalanches also cause great damage to life and property. The villages at high altitudes and army and para-military camps are frequently hit by this form of natural calamity.

Soil Erosion

Soil erosion is a slow phenomenon, causing extensive loss to soil fertility and damage to the land basin. Though the process of soil erosion is natural and has been continuing on the surface of the earth since its origin, recently, due to various human induced activities, its rate has accelerated to dangerous proportions.

In Himachal Pradesh which is drained by a large network of river systems, soil erosion by water has become a serious problem. Besides causing great loss to soil fertility, the huge quantity of eroded material carried by water channels causes floods in downstream regions.

The problem becomes alarming, considering the average sediment delivery ratio of 525, and an annual silt yield of 11.2 million tonnes. The siltation rate of the reservoirs is higher, by almost 180 per cent, than the originally projected rates of 4.29 million t/year.

Along with other development activities, deforestation, road construction, forest fires etc. are the basic reasons for the high soil erosion rate in the state.

Forest Fires

Forest fires are not new to forests. They have raged across the earth for millions of years. But in the recent past, forest fires have increased enormously due to human-induced factors.

In comparison with other parts of the country, the forests of the Himalayan region, due to various biotic and geographic reasons are more prone to forest fires. Being ecologically very sensitive, the impact of fire on the forests of the Himalayas is more serious and beyond repair. The severity of the problem may be judged from the forest fire of 1995 in two states–Uttaranchal and Himachal Pradesh in which along with direct loss of Rs.1750 million worth of forests, the impact of the fire and its scars on the local environment are still visible prominently.

Approximately, 90 per cent of the forest fires are human-induced, both intentional or unintentional. Most of the forest fires are caused by negligence and poor knowledge of the people. Collection of forest produce, shifting cultivation, throwing smouldering *bidis*, cooking food in the forest etc. are the basic anthropogenic causes that ignite forest fires.

The adverse ecological, economic and social impact of forest fires may be summarised as follows:

- Loss of valuable timber and minor forest produce resources.
- Loss of livelihood for tribal population living within or near the forest.
- Loss of human life (Four women grass cutters were killed in February, 2001 in Gwar village of Uttaranchal)
- Depletion of carbon sinks, deteriorating the environmental conditions.
- Loss of bio-diversity and extinction of plant and animal species.
- Soil erosion resulting in loss of soil productivity and flooding of downstream valleys.
- Loss of agricultural land due to erosion and landslides.
- Degradation of watersheds resulting in low rainfall and fall in the water table.
- Damage to wild life habitat and their death.
- Damage to natural regeneration and reduction in forest vegetation.
- Increase in the percentage of carbon dioxide in the atmosphere.
- Degradation of the microclimate of the area making it unhealthy for living.
- Increase in the incidence of respiratory diseases.

Recommendations

General

- To envisage development by a holistic approach designed to manage disasters on a more proactive basis, the state should have a comprehensive policy on all phases of disaster management that addresses the entire gamut of disasters arising from natural and man-made causes. This policy should take full cognizance of other related policies and initiatives at both the national and state level.
- Himachal Pradesh should develop advance, specific hazard mitigation plans and should provide a strong and stable administrative set-up for disaster mitigation, prepareness and relief.
- All development projects in vulnerable areas should be formulated carefully to minimise the adverse effects of natural disasters and should be linked with disaster mitigation.

- The economic impact of a natural disaster should receive adequate attention and cost-benefit analysis should incorporate the probable disaster events and mitigation programmes to undertake work in disaster prone areas.
- Linkages between environment, natural disasters and development need to be clearly established to mitigate disasters and to improve the environment.

Floods/Landslide Mitigation

- Deforestation/clear felling of trees on mountain slopes and river catchments should be stopped or kept to the minimum.
- Afforestation/vegetation cover on hilly regions and flood prone areas should be given priority.
- Area flood mapping should be prepared to make future preparedness plans.
- Forecast and warning systems should be improved.
- There should be proper river bank protection by constructing embankments and using anti-erosion measures.
- In flood prone areas, evacuation capabilities should be enhanced.

Earthquakes

- Public buildings should be earthquake resistant by using the code of Bureau of Indian Standards (BIS) for earthquake-resistant design.
- Measures should be taken to make houses using gasoline, oil and gas stoves houses resistant to earthquakes.
- In city planning, the load bearing capacity studies of the ground should be undertaken and risk zones should be identified.
- For important transport and communication segments, standby facilities should be provided in earthquake prone areas.

Forest Fires

- Fire prevention may be done by education, enforcement and by reducing the hazard.
- Fire prevention education can be given by training, signs and poster display, exhibition, circulation of literature and visual aids etc.
- Restrictive regulations such as prohibiting smoking in forests, regulation of visitors to certain forest areas and on certain activities may be imposed.
- Agricultural practices including weeding, cleaning, removal of dead leaves, use of chemicals as weed killers and by constructing firebreaks to work as a barrier for preventing fires crossing from one area to another may be adopted.

Soil Erosion

- Afforestation and soil conservation measures should be undertaken on micro-watershed basis in the catchment areas of all the rivers in the state.