

NIDM

# Uttarakhand

*National Disaster Risk Reduction Portal*



Map of Uttarakhand State<sup>1</sup>

## 1. STATE PROFILE

### 1.1 General<sup>2</sup>

Uttarakhand was formed on the 9<sup>th</sup> November 2000 as the 27<sup>th</sup> State of India, when it was carved out of northern Uttar Pradesh. Located at the foothills of the Himalayan mountain ranges, it is largely a hilly State, having international boundaries with China (Tibet) in the north and Nepal in the east. On its north-west lies Himachal Pradesh, while on the south is Uttar Pradesh. It is rich in natural resources especially water and forests with many glaciers, rivers, dense forests and snow-clad mountain peaks. Char-Dhams, the four most sacred and revered Hindu temples of Badrinath, Kedarnath, Gangotri and Yamunotri are nestled in the mighty mountains. It's truly God's Land (Dev Bhoomi). Dehradun is the Capital of Uttarakhand. It is one of the most

beautiful resorts in the sub mountain tracts of India, known for its scenic surroundings. The town lies in the Dun Valley, on the watershed of the Ganga and Yamuna Rivers.

## 1.2 Geography<sup>2,3</sup>

Geographical Area of the state is 53,483 sq. km (93% is mountainous and 64% is covered by Forest) Uttarakhand is the 27th state of the Republic of India.

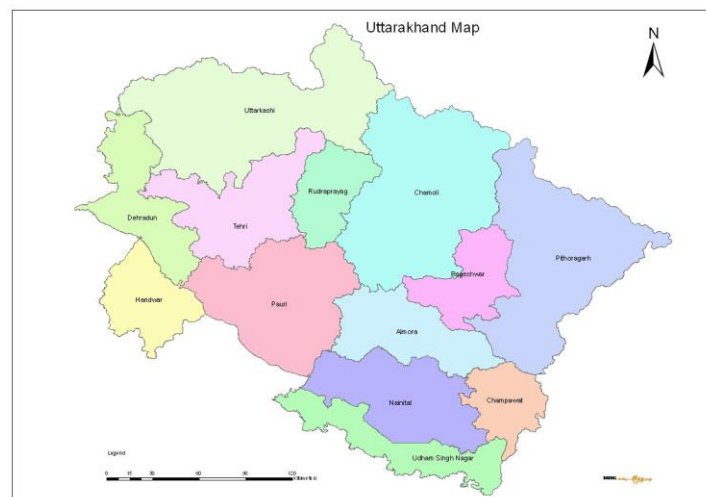
The state is blessed with a rare bio-diversity, inter-alia, 175 rare species of aromatic & medicinal plants are found in the State. It has almost all major climatic zones, making it amenable to a variety of commercial opportunities in horticulture, floriculture and agriculture. It has a vast tourism potential in adventure, leisure, and eco-tourism.

The State is rich in mineral deposits like limestone, marble, rock phosphate, dolomite, magnesite, copper, gypsum, etc. The number of small scale industries is 25,294 providing employment to 63,599 persons. As many as 1802 heavy and medium industries with an investment of Rs 20,000 crore employ 5 lakh persons. Most of the industries are forest-based. There is a total of 54,047 handicraft units in the state.

## 1.3 Administration<sup>3</sup>

The State has 2 Divisions i.e. Garhwal and Kumaun. It has 13 Districts and Dehradun is the capital city. Uttarakhand consists of 13 districts i.e., Almora, Pauri Garhwal, Tehri Garhwal, Bageshwar, Chamoli, Haridwar, Champawat, Nainital, Dehradun, Udham Singh Nagar, Uttarkashi, Pithoragarh, Rudrapur.

The state has 78 Tehsils, 6 Up-Tehsils, 95 Blocks and 7541 Gram/Nyay Panchayats. The state has a total of 16,826 villages, 86 cities/towns, 01 Nagar Nigam, 32 Nagar Palika Parishad, 30 Nagar Panchayat, 09 Cantonment, 06 Development Authority and only five are major cities with population over 1 lakh. It has 5 Lok Sabha, 3 Rajya Sabha constituencies and 70 Vidhan Sabha constituencies.



## 1.4 Geology<sup>3</sup>

The Uttarakhand Himalayas is divided into following regions:

- (1) Trans Himalayas
- (2) Higher Himalayas
- (3) Lower Himalayas
- (4) Shivalik Himalayas
- (5) Bhavar & Tarai

## 1.5 Climate<sup>3</sup>

The state has two distinct climatic regions: mainly the hills and the relatively smaller plain region. The climatic condition of the plain region is very similar to plains. The hilly region has cold winters with snowfall for quite a long time, good rainfall in the monsoon, and mild summers. This climate attracts tourists for simply scenic beauty, adventure or even looking for a spiritual environment.

### Rainfall

The State is bestowed with a relatively high average annual rainfall of 1229mm.

- Source: Meteorological Department

Normally rain starts in the State in late April and continues up to September. However, the intensity of rainfall increases during the months of June to September. Higher rainfall occurring during first week of July. Rain continues through August until the first week of September.

### Temperature

Summers are extremely hot with temperatures going above the **40°C mark** and with a lot of humidity. Winters can be very cold with temperatures going **below 5°C**. The lowest temperature recorded is -5 to -7°C and highest is between 40 to 45°C.

## 1.6 Geographical Features/Topography<sup>3</sup>

The Himalayan state of Uttarakhand is located between 28° 43' - 31° 27' N latitude and 77° 34' - 81° 02' E longitude. The State includes 320 km long stretch of the mountains between the Kali River forming the Indo-Nepal border in the east and the Tons-Pabar valleys forming the eastern border of Himachal Pradesh in the west.

The geomorphology of the State is completely defined by the Himalayas, being completely land locked. The State has a wide range of geomorphic features like cliffs, rocky slopes, waterfalls, major and minor ridges, river valleys, highly dissected denudation hills, moderate and low dissected denudation hills, river terraces, and various fluvial geomorphic features like point bar, meandering scars, and natural levees.

The State is completely affixed by the complex geological setting. In this area, a large variety of rocks are developed in the central crystalline complex of the Greater Himalayas and the Lesser

Himalayas, as well as the sub-Himalayas. The area is very sensitive towards mass wasting process.

Several rivers which are lifelines to one of the most densely populated areas in the world (the Gangetic Plains of India) originate in this region. Rivers Ganga and Yamuna, which originate at Gangotri and Yamunotri respectively, are the most important rivers of the region.

Based on the topography of the area and its geographical location, the temperature varies throughout the region. The average temperature in the State varies from  $-1.7^{\circ}\text{C}$  to  $42^{\circ}\text{C}$ . The State is bestowed with a relatively high average annual rainfall of  $1229\text{ mm}^3$ .

The ecology of Uttarakhand mostly comprises of forest covers and grasslands. A large variety of flora and fauna found here are usually the rarest species in the world. The diversity in topography, climate, vegetation, life, culture, etc. depicts varied and complex characteristics of the region and hence, the state of Uttarakhand has rich cultural, physical and favorable ecological support for wildlife sanctuaries and endangered plant and animal species.

Being a hilly terrain, the roadways are the only means of surface communication with the national railway network extending to rail head at Dehradun, Rishikesh, Ramnagar, Kotdwar, Kathgodam and Tanakpur. The total road length in the region is about 31,929 km. Mainly the road network is administered by the PWD and comprises of 1,151 km of national highways, 3,788 km of state highways, 3,290 km of major district roads, 2,945 km of other district roads, 15,402 km of village roads and 1,773 km of motor bridges.

## 1.7 Demographic & Socio-economic Profile<sup>3</sup>

As per census 2011, the state has a population of 101 million with average density of 189 persons per sq km.

S. No.	Item	Year	Uttarakhand
1.	Total population (Census) (in lakhs)	2011	101
2.	Crude Birth Rate (SRS ) '000 of Population	2007	19.7
3.	Crude Death Rate (SRS) Per '000 of Population	2007	6.8
4.	Infant Mortality Rate (SRS ) '000 of Live Births	2009	41
5.	Sex Ratio (Census ) /'000 of males	2011	963
6.	Male Literacy Rate (Census) (%)	2011	88.33
7.	Female Literacy Rate (Census) (%)	2011	70.70
8.	Sex Ratio (Census ) /'000 of males(0-6)Years	2011	886
9.	Population Density (Per Square Kms.)	2011	189
10.	Decennial growth rate	(2001-2011)	19.17
11.	Rural Population	2001	6310275
12.	Urban Population	2001	2179074

## **2. DISASTER RISK PROFILE**

### **2.1 Vulnerability of the State<sup>3</sup>**

The State is prone to severe earthquakes, landslides. In addition, the state is also affected by disaster like floods, epidemics, fire, hailstorm, lightening, road accidents, etc. The state of is highly vulnerable to multihazards viz. earthquake, landslides, flash-floods, avalanches, Dam Burst, drought, but particularly Earthquake, as the state falls in the highest seismic risk zones of the country i.e. Zone V and IV.

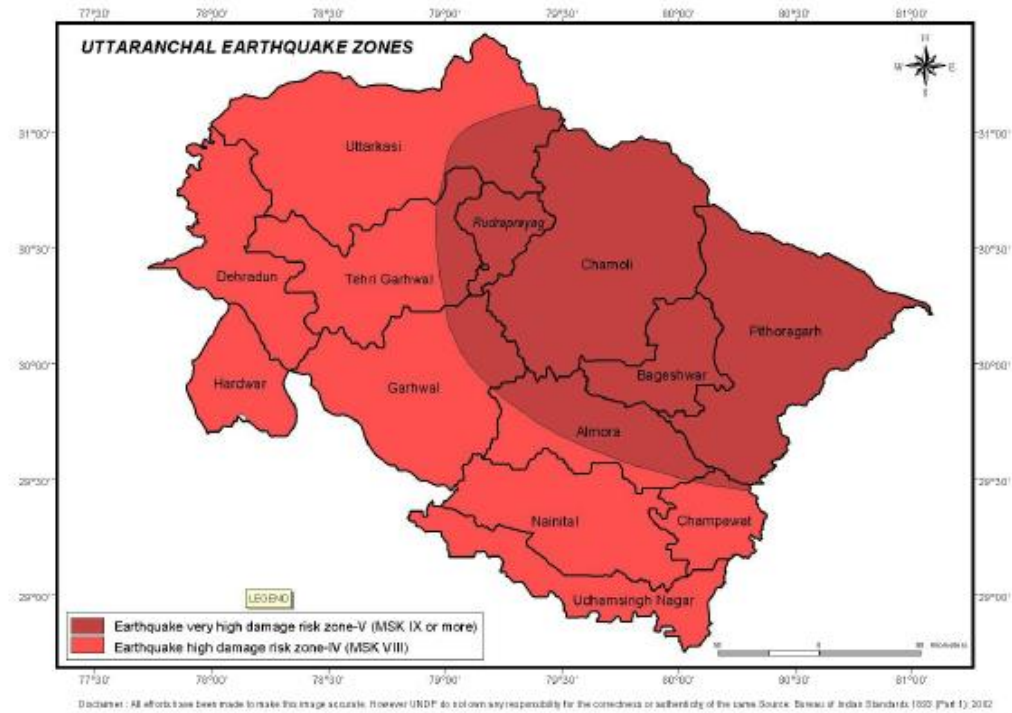
In the disaster prone map of the country, Uttarakhand has attained its position among first five states in respect of natural hazards, i.e., earthquakes, flash floods triggered by cloud burst, landslides, avalanches and forest fires & frequent droughts in summers. These disasters have caused immense loss of property, natural wealth, and human lives.

### **2.2 Vulnerability to Earthquakes<sup>3</sup>**

As per earthquake zoning map of India, the entire State can be divided into two zones, i.e. Zone V and Zone IV. The State has experienced many earthquakes of small and large scale with their epicenters located within the Himalayan region. These earthquakes have demonstrated that the seismic vulnerability of the building stocks in the region is primarily responsible for a large number of human casualties. The State has witnessed two major earthquakes in the recent past i.e. the Uttarkashi earthquake in 1991 and the Chamoli earthquake in 1999. About 768 people died in Uttarkashi and 106 died in Chamoli earthquake. The districts of Bageshwar, Chamoli, Pithoragarh, Rudraprayag and Uttarkashi, which were most severally affected in the 2013 flash flood, also fall within the Seismic Zone V.

As shown in the map four of the thirteen districts of the state (Pithoragarh, Chamoli, Bageshwar and Rudraprayag) fall completely in Zone V (representing damage risk of  $\geq$  IX on MSK scale), while five other districts (Uttarkashi, Tehri-Garhwal, Pauri, Almora and Rampur) fall partially in Zone V and partially in Zone IV (damage risk of VIII on MSK scale) and the rest (Dehradun, Haridwar, Nainital and Udham Singh Nagar) fall totally in Zone IV (of the seismic risk map of India).

The vulnerability of the region to earthquakes is characterized by the fact that during the last century, the region had experienced 11 earthquakes of magnitude greater than 6.0 on the Richter scale. As per IMD, there have been 65 earthquakes of varying intensity since 1803.



**Uttarakhand earthquake hazard zonation map<sup>3</sup>**

#### **Earthquakes of Uttarakhand<sup>4,5</sup>**

S No	Date of occurrence	Magnitude	Affected area
1	1 <sup>st</sup> September 1803	9.0	Badrinath
2	1809	9.0	Garhwal
3	26 May 1816	7.0	Gangotri
4	25 July 1869	6.0	Nainital
5	28 October 1916	7.5	Dharchula
6	28 October 1937	8.0	Dehradun
7	27 July 1966	6.3	Kapkot, Dharchula
8	28 August 1968	7.0	Dharchula
9	29 July 1980	6.5	Dharchula
10	20 October 1991	6.6	Uttarkashi
11	29 March 1999	6.8	Chamoli
12	1 February /2006	5.2	Indo - China Border
13	14 March 2006	5.0	Indo - China Border

14	27 October 2006	3.8	Bageshwar
15	31 March 2006	3.1	Chamoli
16	5 August 2006	5.0	Indo - Nepal Border
17	26 September 2006	4.1	Indo - Nepal Border
18	27 October 2006	3.8	Bageshwar
19	5 February 2007	3.5	Indo - Nepal Border
20	27 March 2007	3.2	Uttarkashi
21	22 July 2007	5.0	Uttarkashi
22	7 August 2007	3.5	Uttarkashi
23	3 November 2007	2.7	Uttarkashi
24	25 January 2008	3.5	Rudraprayag
25	13 August 2008	3.6	Bageshwar
26	4 September 2008	5.1	Indo –Tibet Border
27	25 February 2009	3.7	Uttarakhand
28	18 March 2009	3.3	Uttarkashi
29	15 May 2009	4.5	Chamoli
30	27 August 2009	3.9	Uttarakhand
31	18 September 2009	3.4	Uttarakhand
32	21 September 2009	4.7	Uttarkashi
33	3 October 2009	4.3	Bageshwar
34	11 January 2010	3.9	Pithoragarh
35	22 February 2010	4.7	Bageshwar
36	3 May 2010	3.5	Uttarakhand
37	31 May 2010	3.6	Almora
38	22 June 2010	4.7	Pithoragarh
39	10 July 2010	4.1	Almora
40	14 March 2011	3.3	Chamoli
41	20 June 2011	4.6	Chamoli
42	24 June 2011	3.2	Indo – Nepal Border



43	4 July 2011	3.4	Chamoli & Almora
44	21 September 2011	3.1	Uttarkashi
45	24 September 2011	3.0	Uttarkashi
46	6 September 2011	3.8	Indo - China Border
47	20 November 2011	3.2	Uttarkashi
48	14 December 2011	3.2	Chamoli
49	9 February 2012	5.0	Uttarkashi
50	10 May 2012	3.9	Chamoli
51	1 June 2012	3.7	Chamoli
52	26 October 2012	3.5	Chamoli
53	12 November 2012	2.5	Uttarkashi
54	15 November 2012	3.0	Pithoragarh & Bageshwar
55	26 November 2012	2.8	Bageshwar
56	27 November 2012	4.8	Uttarkashi
57	30 January 2013	2.6	Bageshwar
58	11 February 2013	4.3	Uttarkashi
59	17 February 2013	3.2	Uttarkashi
60	25 February 2013	3.1	Uttarkashi
62	6 March 2013	3.2	Indo - Nepal Border
63	24 March 2013	2.9	Indo - Nepal Border
64	6 April 2013	4.3	Rudraprayag
65	5 September 2013	3.5	Uttarkashi

### 2.3 Vulnerability to Landslides<sup>3</sup>

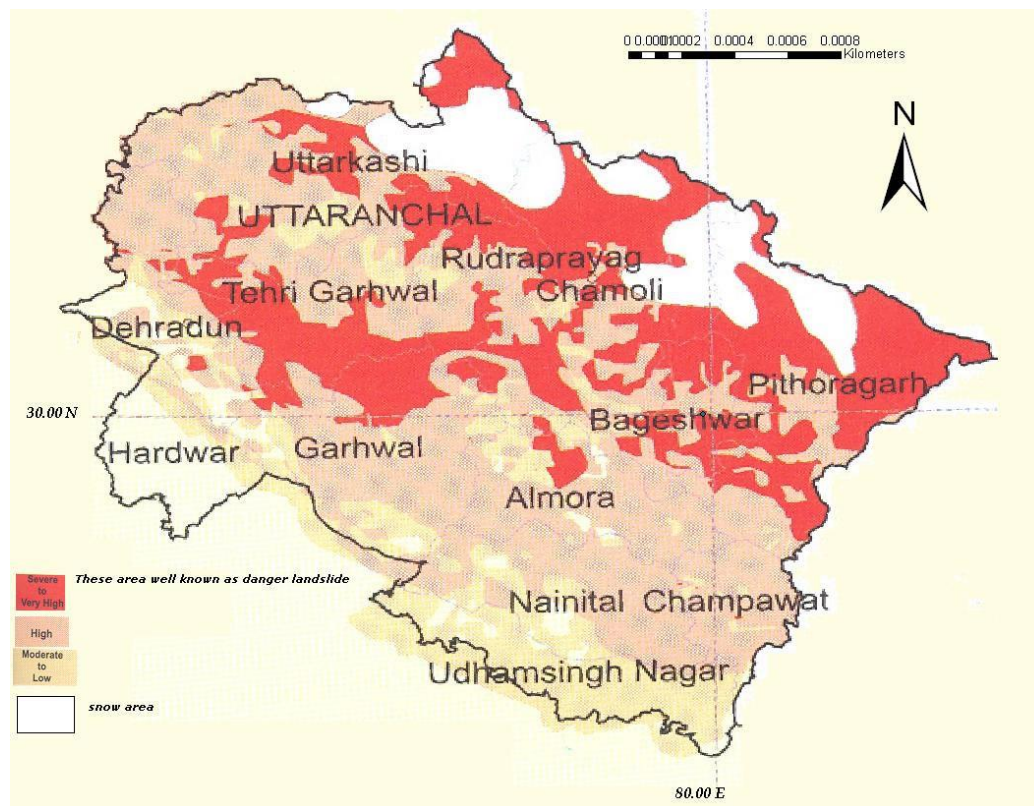
During the rainy season, the landslides are very common and frequent, which take a considerable toll of human lives and cause irreparable loss to roads, agricultural land and damages to buildings, houses and other built-up structures. For this, the state is affected as because there is no other means of transport except roads. Problem of landslide is very common and frequent in Uttarakhand. Almost every year the state is affected by one or more major landslides affecting the society in many ways.

The frequency of landslides has increased in the recent past due to extensive road construction and other haphazard developmental activities.

According to geological, topographical and climatic conditions of the area and human factors such as deforestation, unscientific road construction (blastings carried out for road cuttings), constructions of dams or reservoirs, housing schemes, roads, terracing and water intensive agricultural practices on steep slopes etc., implemented without proper environmental impact assessments have increased the intensity and frequency of landslides.<sup>3</sup>

Landslides in the state are particularly common along two zones lying in close proximity of two major tectonic discontinuities i.e. Main Boundary Thrust (MBT) and Main Central Thrust (MCT).

In 2010, the State was beleaguered with landslides, flash floods and floods during the monsoon period. At many places road connectivity was disrupted and pilgrims and tourists were stranded at various locations across the state. During this disaster human death toll was 220 and massive efforts were made to restore normalcy. During the Monsoon period 2012 again Uttarkashi and Rudraprayag districts were hit by flash floods, debris flow and landslides that took toll of almost 164 human lives. Thus, during the monsoon season, due to heavy rains, every year the state faces massive losses, from cloudburst, landslides and flash floods. Besides road connectivity, water supply, communication, power and other infrastructure get disrupted, many small and marginal farmers lost substantial portion of their productive agricultural lands and other valuable movable and immovable assets permanently in these events. Landslide hazards zonation map of the State showing areas vulnerable to landslides is given below.<sup>7</sup>



**Landslide zones of Uttarakhand<sup>3</sup>**

### Major landslides in Uttarakhand<sup>6</sup>

Date/Year	Location	Remarks
1867 and 1880	Nainital	Two major landslides on the Sher-ka-Danda slope in Nainital. The 1880 landslide took place due to rainfall and an earth tremor, destroying buildings, and permanently filled a portion of the Naini lake.
1893	Alaknanda	Floods in the Birehi Ganga river near its confluence with the Alaknanda river triggered landslides, causing major blockage of the river with a 10-13 m afflux. A girder bridge was bypassed and another one was destroyed.
1968	Rishi-Ganga	The Rishi Ganga river in Garhwal was blocked due to landslide at Reni village.
July 1970	Patal Ganga,	The Patal Ganga (a tributary of the Alaknanda river) got choked and a reservoir was created. The bursting of this choked reservoir resulted in flash floods in the Alaknanda river, triggering many landslides.
1971	Kanauldia gad	A major landslide on the bank of the Kanauldia gad, a tributary of the Bhagirathi river upstream from Uttarkashi formed a debris cone which impounded water to a height of 30 m. Its breaching caused flash floods downstream.
August 1978	Uttarkashi	The Kanauldia Gad, a tributary joining the Bhagirathi river upstream from Uttarkashi in the Uttarakhand formed a debris cone across the main river, impounding the river to a height of 30 m. Its breaching caused flash floods, creating havoc. A 1.5 km long and 20 m deep lake was left behind as a result of the partial failure of the landslide dam.
1920, 1952, 1963, 1964, 1965, 1968, 1969, 1970, 1971, 1972 and 1985	Kaliasaur	Kaliasaur is one of the most persistent and regularly occurring landslides areas, located along the Rishikesh-Badrinath road. Landslides in this region results into frequent road blockage and land damage.
August 1998	Okhimath	Sixty nine people were killed due to several landslides near Madhmaheshwar valley. The landslides caused huge devastation in villages.

18 August 1998	Malpa, Kali river	More than 210 people were killed. The heap of debris created was about 15 m high. The village was wiped out in the event.
24 September 2003	Varunavat Parvat Uttarkashi,	Incessant rains triggered massive landslide in the area, causing the burial of numerous buildings, hotels, and government offices located at the foot of the hill slopes.
5 July 2004	Badrinath, Chamoli	Sixteen persons killed, 200 odd pilgrims stranded, 800 shopkeepers and 2,300 villagers trapped as cloudburst triggered massive landslides washed away nearly 200metre of road on the Joshimath-Badrinath road cutting off Badrinath area.
29-30 June 2005	Govindghat, Chamoli,	A cloudburst/landslide occurred in which a huge quantity of debris and rock boulders were brought down along a seasonal nala. Eleven people were killed and property lost.
6 September 2007	Village Baram/Sialdhar,Dharchula, Pithoragarh	A landslide due to excessive rainfall resulted in 15 fatalities and loss of livestock.
2008	Amru Band	Total 17 people killed huge damages to roads and houses.
8 August 2009	Berinag-Munsiyari road, Pithoragarh	Forty three people died due to landslide triggered by cloud burst
18-21 September 2010.	Ganga- Alaknanda valley	About 220 people died 170 major and minor roads severely damaged.
14 September 2012	Okhimath, Rudraprayag	Sixty eight people killed in the landslides, which caused extensive damages to the buildings, agricultural lands and roads at several places.
2013	Uttarakhand	Flash flood induced landslide. 680 people died, and 4,117 missing. Huge devastation to infrastructures and other properties mainly in 5 districts of Uttarakhand i.e. Bageshwar, Chamoli, Pithoragarh, Rudraprayag and Uttarkashi

## 2.4 Vulnerability to Avalanches<sup>3</sup>

Snow avalanches are the sudden slide of large mass of snow down a mountain. There are several factors, which can affect the occurrence of avalanche, including local weather, slope, atmospheric temperature, vegetation; terrain and general snow pack conditions. Different combinations of these factors can create low, moderate and extreme weather conditions. Most

avalanches are very dangerous and cause huge loss of life and property. The temperature variation and wind speed are directly proportional to avalanches.

Generally, avalanches are common in Himalayan region with altitude more than 3500 m and slope more than 30 degree. Convex slopes are generally more prone to avalanches. North facing slope have avalanches in winter and south facing slopes during spring. Especially areas near the holy shrines of Hemkund, Badrinath, Kedarnath, Yamunotri and Gangotri are more prone to avalanches. In the recent past, few avalanches occurred in Uttarakhand which are shown in table below.<sup>8</sup>

#### **Major avalanches in Uttarakhand<sup>7,8,9</sup>**

<b>Date/Year</b>	<b>Location</b>	<b>Remarks</b>
June 2008	Gomukh Glacier nearby Gangotri, Uttarakashi	One person died and 9 injured
June 2008	Hemkund Shahib, Chamoli	Six died and more than 12 people injured
September 2008	Kalindi-Badrinath track in the Garhwal Himalaya, Chamoli	Three persons were killed and 37 persons were rescued
21 September, 2010	Ghastoli, Chamoli	Two army officers were killed in an avalanche
12 June 2013	Kedarkharak, Uttarkashi	One person killed
1 July 2013	Uttarkashi District	Three Army personnel injured and 1 killed

## **2.5 Floods and Flash Floods<sup>3,10</sup>**

The average rainfall in the State is 1229 mm, with rainy season normally from late April to September. Higher rainfall during the periods varying from June to September results into floods in low lying areas and erosion of land. Increase in soil erosion in hilly region of the state has reduced the carrying capacity of rivers resulting into swallowing of river beds leading floods in the plain. The low lying areas are more prone to both flood and flash flood hazard.

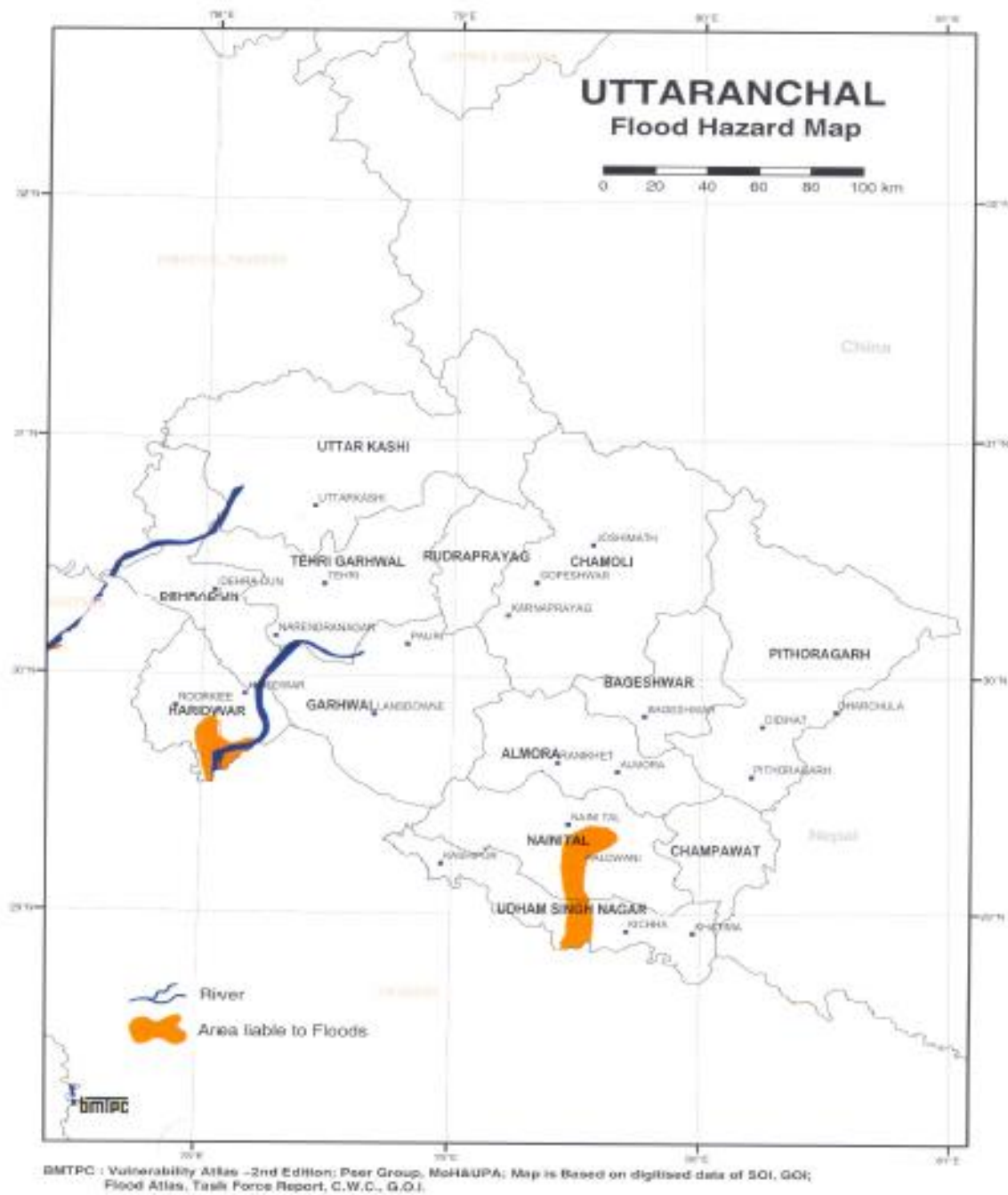
Flash Floods are very common hydro-meteorological hazards due to excessive rainfall or snowmelt, bursting of dams, cloudburst, etc. Such floods are common due to the high velocity of water with much energetic capacity to carry away everything in its way.

Deforestation in the Himalayas has increased the severity of floods during the rainy season and reduced steam flows and dried up springs during dry seasons. The increase of soil erosion has

reduced the water carrying capacity of the rivers resulting into swallowing of riverbeds leading to floods in the plains.

Flood Hazard Map based on the Flood Atlas of India prepared by the Central Water Commission. Shows areas likely to flood, other low lying areas are as shown below:-

### Flood hazard map of Uttarakhand<sup>3</sup>



**List of major flash flood events in the Uttarakhand<sup>10</sup>**

<b>Date</b>	<b>Locations</b>	<b>Damage</b>
05-09-1989	Karanprayag, Chamoli	Three people died and 2 injured
26-12-1991	Uttarkashi, Uttarkashi	Three people died
30-07-1994	Chaukhutia , Almora	Four people died
02-08-1997	Near Neelkanth, Haridwar	Eighteen people died
17-07-2001	Near Meykunda, Rudraprayag	Twenty seven people died
20-07-2003	Didihat, Pithoragarh	Four people died
21-05-2004	Kapkot, Bageshwar	Three people died
09-06-2004	Kapkot, Bageshwar	Three people died
21-07-2005	Vijaynagar, Rudraprayag	Four people died
13-08-2007	Didihat, Pithoragarh	Four people died
25-07-2009	Joshimath, Chamoli	Three people died
2009	Munisyari, Pithoragarh	Forty Three lives lost due to massive cloudburst induced flash flood
19-07-2010	Kot, Pauri	Six people died
20-07-2010	Khatima, Rudrapur, Udham Singh Nagar	Three people died
31-07-2010	Dehradun	Five people died and 2 missing
18-08-2010	Dhari, Nainital	Thirteen people died and 3 injured
24-08-2010	Jasipur, Udham Singh Nagar	Four people died
08-09-2010	Karanprayag, Chamoli	Three people died
08-09-2010	Karanprayag, Chamoli	Three people died
11-09-2010	Nyalgarh, Pauri	Three people died
18-09-2010	Belbandgoth, Champawat	Four people died
18-09-2010	Jwalapur Kasim, Haridwar	Five people died and 2 injured
20-09-2010	Dhari, Nainital	Five people died and 12 injured
22-09-2010	Kot, Pauri	Five people died
06-05-2011	Raipur, Dehradun	Three people died
15-08-2011	Tuneda, Bageshwar	Twenty one people died and 1 injured
03-08-2012	Asi Ganga Valley, Uttarkashi District	The worst affected areas were Gangotri, Sangam Chatti and Bhatwari. About 7,389 people from 1,159 families in 85 villages were affected. Nearly 28 people were killed in flash floods and landslides

June, 2013	Uttarakhand	Flash flood induced landslide 680 people died and 4117 missing. Hung devastation to infrastructure and other properties mainly in 5 districts of Uttarakhand i.e. Bageshwar, Chamoli, Pithoragarh, Rudraprayag and Uttarkashi
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## 2.6 Vulnerability to Cloudbursts

Cloudburst is an extreme amount of precipitation, sometime with hail and thunder storm, which normally lasts for minutes and usually cause huge sudden flash floods. Occasional cloud bursts in the state result into devastation due to flash floods, breaching of river banks and overflowing of dams in hilly parts of the state. The major cloudbursts in Uttarakhand are shown in table below.

**List of major cloudbursts in Uttarakhand<sup>3</sup>**

Year	Location	Damages
2002	Khetgaon	Four people died
2004	Ranikhet	One people died
2007	Pithoragarh and Chamoli	Twenty three people died
2008	Pithoragarh	One people died
2009	Munsiyari Tehsil, Pithoragarh	Forty three people died
18 August 2010	Kapkot, Bageshwar	Eighteen school children were buried alive and 8 injured due to massive cloudburst
21 July 2010	Almora	Thirty six people died in cloud burst induced flash flood
13 September 2012	Chwanni, Mangoli and Kimana villages of Okhimath block in Rudraprayag	Completely inundated over four villages and eroded two more villages

## 2.7 Soil Erosion

Soil erosion by water, poses a serious threat to people in the state of Uttarakhand, which is drained by a large network of river systems, mainly Ganga, and Kali river systems. The erosion rate in the State has amplified due to various man-made reasons. Mining, grazing, developmental



activities (construction of roads, canals, buildings), installation of hydroelectric power stations, deforestation, unscientific agricultural activities etc. are upto some extent responsible for increase in the soil erosion in hilly terrain of Uttarakhand. Increase in soil erosion results into more silt inflow in river bed, turning the shallow and reducing their water carrying capacity.

## **2.8 Forest Fire**

Due to various factors including the vulnerability of species, climate, poor training and awareness of the people and the administration, lack of equipment etc. the forests of Uttarakhand are every year badly affected by forest fires. During 1990 several forest fires occurred in Uttarakhand and Himachal Pradesh. Between the years 1995 and 1999, many forest fire incidences occurred in these two states, which affected an area of around 6,77,700 ha. Besides the direct loss, the other damage due to these fires are loss of soil fertility, soil erosion, loss of employment, drying up of water resources and loss of bio-diversity. These fires also brought a major change in the microclimate of the region in the form of soil moisture balance and increased evaporation. In the hills of Uttarakhand fire season starts late and most of the fire occurrences are reported between April and June. Implications of forest fire on hill slope vegetation and land-stability have significant bearing on the occurrence and severity of hydro-meteorological disasters (floods), geological risks (landslides) and effects of seismic events on landscape and stability of the hill slopes.

## **2.9 Drought**

In context of Uttarakhand causes of drought are natural and human activities both. Several types of weather changes have also altered the normal rainfall pattern in an area and cause drought. And in last few years, it has been observed that human activities like soil erosion, deforestation, excessive use of ground water, pollution etc have also caused drought.

## **2.10 Hailstorms**

Hailstorms cause heavy damage to crops and vegetation. Secondary hazards like snapping of electric poles due to uprooting of trees, disruption of communication links etc are also attributed to hailstorms.

# **3. INSTITUTIONAL SETUP<sup>11</sup>**

## **3.1 Disaster Mitigation & Management Centre**

At present Disaster Mitigation & Management Centre is working as autonomous institute under aegis of Department of Disaster Management Government of Uttarakhand and Disaster Mitigation and Management Centre(DMMC) is the apex center in the field of Disaster Mitigation & Management in Uttarakhand, to protection of the community and the environment from the over whelming obliteration caused by disasters. DMMC, located in the Uttarakhand secretariat compound, is to generate the sense of worth amongst common people and the government authorities in formulating appropriate policies and strengthening their capabilities to cope up with all aspects of disaster management.

In addition to offering an extensive range of training programs, gearing-up to providing advance information about likely disaster through latest technologies available for the purpose, maintaining a network of experienced experts working in the field and institutions of excellence, DMMC will also provide consultancy services to all levels of government, international agencies and non-government organizations. The center has also undertaken the responsibility of training communities and community based organizations and through them develop a strong regional knowledge base towards disaster policy, prevention mechanisms, mitigation measures, preparedness, and response plans. The center has also undertaken the responsibility of training communities and community based organizations and through them develop a strong regional knowledge base towards disaster policy, prevention mechanisms, mitigation measures, preparedness, and response plans. Perhaps the most important need at the State level is to strengthen and develop capacity to undertake disaster mitigation strategies. Disaster vulnerability assessment is to be incorporated in the state development process so that projects and future investments reduce, rather than increase vulnerability. In order to overcome resource constraints and to be effective and sustainable, the action plan for disaster reduction is to be incorporated in the overall economic and social development plans. No matter what loss-reduction strategy is used, major reductions in losses of life and property come only when the emphasis shifts from reaction to anticipation. That is, the emphasis must be on proactive pre-disaster measures rather than post-disaster response.

Disaster Mitigation and Management Centre (DMMC) expected to function as a think-tank for the Ministry/Department, will look into, and incorporate prevention, preparedness and mitigation aspects for all projects.

#### **Institutional Setup at State level**

<b>Chief Secretary, Govt. of Uttarakhand</b>	<b>President</b>
<b>Principal Secretary, Finance, Govt of Uttarakhand</b>	<b>Member</b>
<b>Principal Secretary, Home, Govt of Uttarakhand</b>	<b>Member</b>
<b>Principal Secretary, Revenue, Govt of Uttarakhand</b>	<b>Member</b>
<b>Principal Secretary, Disaster Management, Govt of Uttarakhand</b>	<b>Member</b>
<b>Principal Secretary, Irrigation, Govt of Uttarakhand</b>	<b>Member</b>
<b>Director, UAA, Nainital</b>	<b>Member</b>
<b>Relief Commissioner, Govt. of Uttarakhand</b>	<b>Member</b>
<b>Executive Director, Disaster Mitigation &amp; Management Centre</b>	<b>Secretary/Member</b>

#### **District Disaster Management Authority (DDMA)-Haridwar**

The Government has made institutional arrangements and set up District Disaster Management Authority (DDMA) at the district level under the Chairmanship of District Magistrate by the notification dated 4<sup>th</sup> Dec, 2007 accordance the provisions made in Disaster Management Act, 2005. District Emergency Control Room (DEOC) has recently been Set - Up at the district headquarter, Roshnabad. Appointment of District Disaster Management Officer to rapid up the

Disaster mitigation & Management process in coordination with other institutions in the district has been done. GoI - UNDP supported Urban Risk Reduction Programme in city of Haridwar is also running in the district.

The Haridwar Disaster Management Authority has already been created and First meeting of the authority is conducted on 20<sup>th</sup> Oct 2010 Under the Chairmanship of Dr. R. Meenkashi Sundram, District Magistrate Haridwar. The need to upgrade Disaster Management Action Plan and formation of Departmental Disaster Management Action Plan of Haridwar was felt by the members in the meeting.

**District Disaster Management Authority (DDMA)-Uttarkashi**

<http://uttarkashi.nic.in/pages/display/241-district-disaster-management-authority%28ddma%29>

**District Disaster Management Authority (DDMA)-Dehradun**

<http://dehradun.nic.in/pages/display/151-district-disaster-management-authority>

**District Disaster Management Authority (DDMA)- Champawat**

<http://champawat.nic.in/pages/display/127-disaster-management>

**District Disaster Management Authority (DDMA)-Chamoli**

<http://chamoli.nic.in/pages/display/129-district-disaster-management-authority>

### **3. INITIATIVES**

State Disaster Management Action Plan (SDMAP)

[State Disaster Management Action Plan- Draft SDMAP](#)

## References:

<sup>1</sup><http://www.mapsofindia.com/maps/uttaranchal/uttaranchal.htm>

<sup>2</sup><http://uk.gov.in/pages/display/115-state-profile>

<sup>3</sup>[http://dmmc.uk.gov.in/files/pdf/complete\\_sdmap.pdf](http://dmmc.uk.gov.in/files/pdf/complete_sdmap.pdf)

<sup>4</sup>Satendra, 2003. Disaster Management in the Hills. Concept Publishing Company, New Delhi.

<sup>5</sup><http://www.imd.gov.in/section/seismo/dynamic/welcome.htm>

<sup>6</sup><http://ndma.gov.in/ndma/guidelines/LandslidesSnowAvalanches.pdf>

<sup>7</sup><http://saarc-sdmc.nic.in/pdf/Publications/SDR%202008/avalanche.pdf>.

<sup>8</sup><http://www.news18.com/news/trekker-from-west-bengal-killed-in-snow-avalanche-66190.html>

<sup>9</sup>[http://www.news24online.com/snow-avalanche-kills-one-in-uttarakhand\\_LatestNews24\\_10837.aspx#](http://www.news24online.com/snow-avalanche-kills-one-in-uttarakhand_LatestNews24_10837.aspx#). Accessed on 11 December 2013.

<sup>10</sup>SEOC Data, 2011. State Emergency Operation Centre, Disaster Management and Mitigation Centre, Govt. of Uttarakhand.

<sup>11</sup><http://dmmc.uk.gov.in/pages/display/2-about-us>