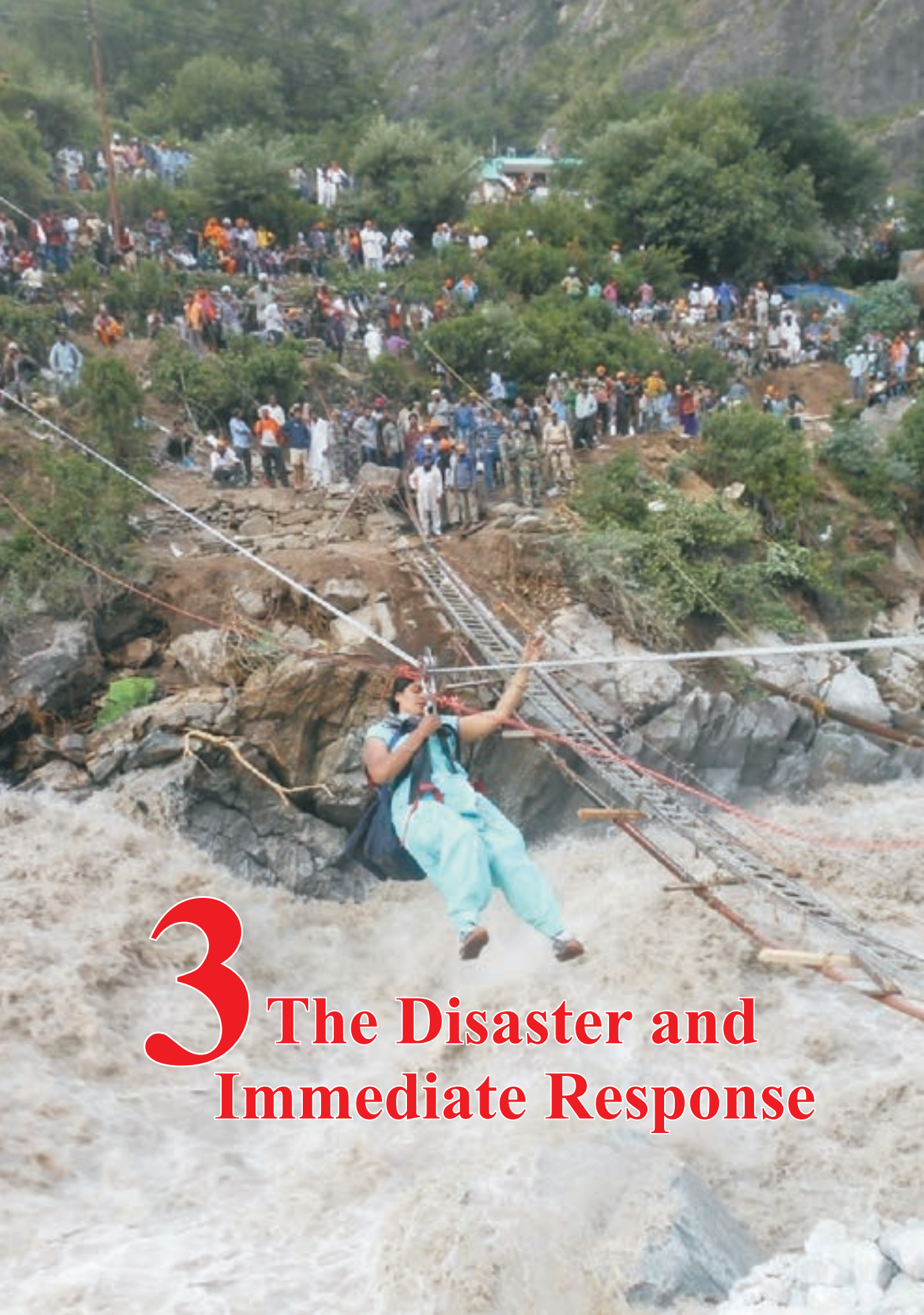

3 The Disaster and Immediate Response

3

THE DISASTER AND IMMEDIATE RESPONSE

3.1 The Disaster

On 16 and 17 June 2013, the State of Uttarakhand was severely hit by widespread heavy rainfall leading to flash floods and associated landslides resulting in huge loss of life, property, and damage to the ecosystem. Bageshwar, Chamoli, Pithoragarh, Rudraprayag and Uttarkashi were the most affected districts. Uttarakhand being foremost among the country's popular summer pilgrimage destinations, the disaster coincided with peak tourist and pilgrimage season. This significantly aggravated the situation resulting in casualties and huge number of people being stranded at various places. People in the hill districts of the State were cut off from supplies of essential commodities for a period ranging from a few days to several weeks.

In the month of June 2013, the monsoon arrived almost two weeks earlier than expected in the State. Possibly due to collision of western disturbances with monsoon easterlies, unusually high rainfall - heavy (64.5 - 124.4 mm) to very heavy (124.5 – 244.4 mm) - on three consecutive days (15 to 17 June) above tree line resulted in heavy runoff with loads of debris, moraine and boulders. This caused huge devastation in the area. Sudden increase in water levels in the rivers and streams gave rise to flash floods in Mandakini, Alaknanda, Bhagirathi, Pindar and Kali among other river basins. Rainfall induced extensive fresh landslides besides aggravating existing landslides at various locations[1]. Several villages and

settlements of Kedarnath shrine area, Gaurikund, Rambara, Harsil, Uttarkashi, Guptkashi, Sonprayag, Srinagar, Gobindghat, Narayanbaggar , etc. suffered heavy damage.

Incidences of landslides along with erosion by the sediment loaded rivers, breached roads, and highways at many locations and washed away several bridges (steel girder bridges, beam bridges, suspension/cable bridges). Besides disruption of telecommunication lines, traffic was disrupted along all national highways and many link roads, affecting relief and rescue efforts adversely.

The areas adjacent to Kedarnath Shrine and Mandakini valley were the worst affected. Heavy rain and rapid snow melt of the Chorabari glacier probably lead to the breach of moraine dammed Chorabari Lake, which is approximately 400 m long, 200 m wide and 15–20 m deep, located about 2 km upstream of Kedarnath town[2]. The collapse of the weak moraine barrier of the lake released a huge quantity of water, which rushed towards Kedarnath with high velocity, carrying along rocks and boulders, devastating Kedarnath town. Downstream, Rambara was completely destroyed (Figure 3.1). All habitations next to the river course of the Mandakini were severely affected by the fury of the river.

In the Chamoli district, areas of Ghagharia, Pulna, Govindghat, and Badrinath were the most severely affected. All roads from Joshimath upstream towards Badrinath were washed away. This resulted in a large number of pilgrims and locals being stranded in and around the Badrinath Shrine and the Govindghat area, which is the start point for the mule track leading to the Hemkund Sahib Shrine.

Due to landslides, large stretches of road at Govindghat, Pandukeshwar and Lambagarh were washed away. Pilgrims at the Hemkund Sahib were stranded across River Alaknanda as the bridge connecting the national highway to Ghagharia was washed away. A large number of pilgrims were also stranded along the foot track to Ghagharia due to many landslides (Figure 3.1).

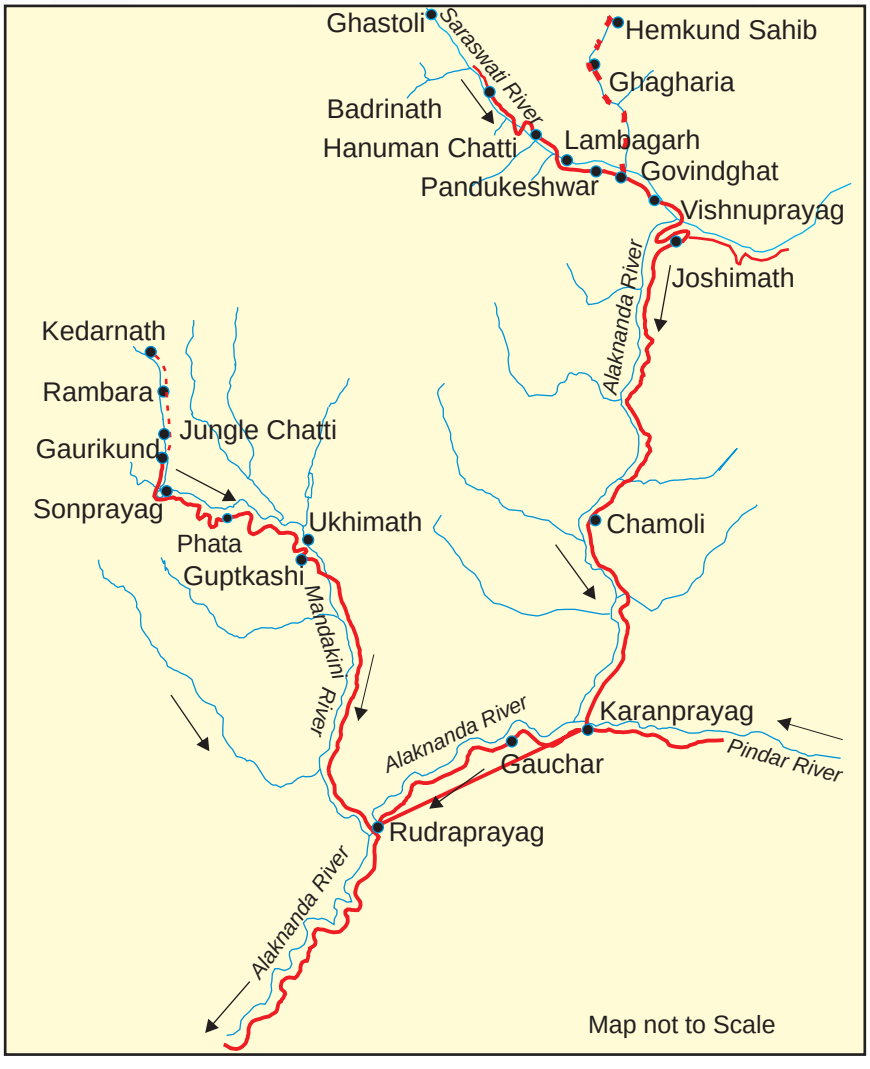

Figure 3.1: Important Locations of Chamoli and Rudraprayag Districts

In the Uttarkashi District, areas beyond Gangani were cut off as all upstream roads were washed away. The road between Bhatwari and Gangani was severely damaged. Villages around Harsil, where many Gangotri pilgrims were stranded, were also badly affected. The road from Harsil to Gangotri and from Harsil to Uttarkashi was blocked at Dharali and Sukhi respectively (Figure 3.2). Because of landslides and damage to roads, the pilgrims to Yamunotri were similarly trapped at various locations adjacent to the temple area.

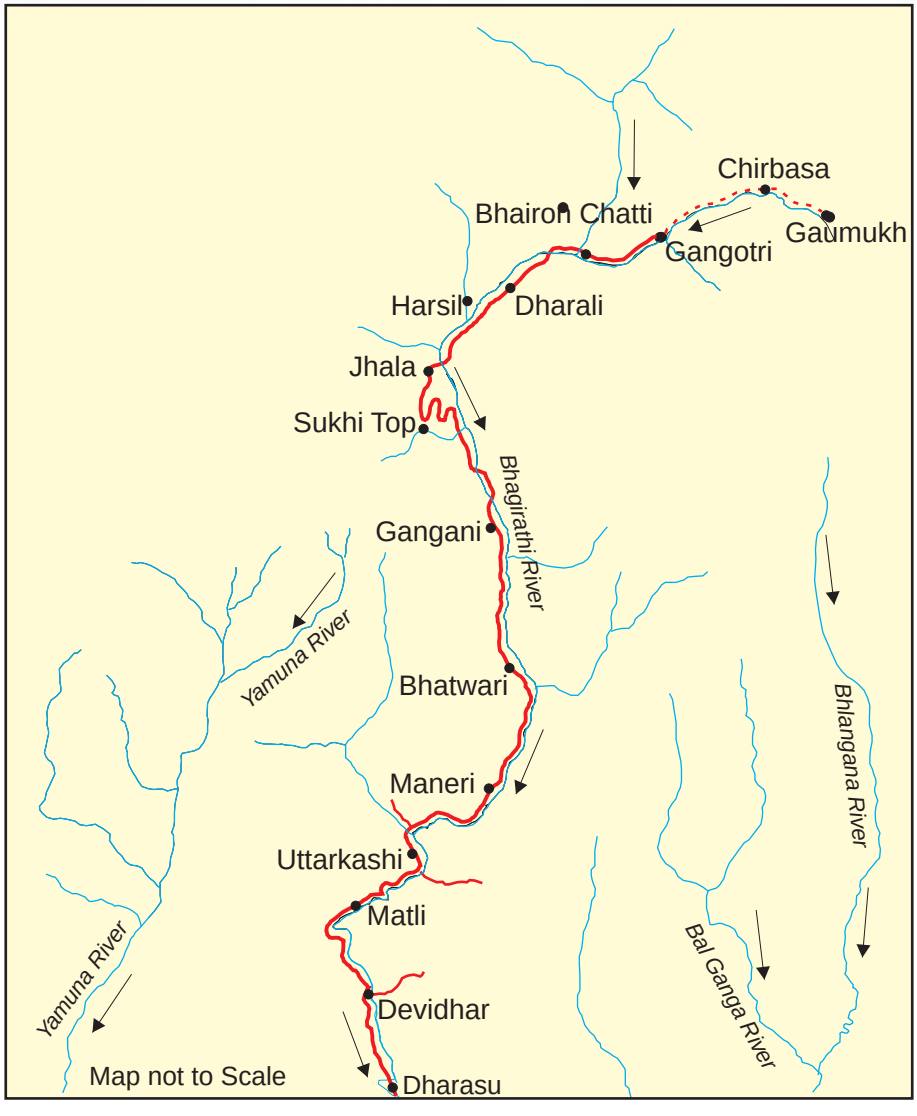

Figure 3.2: Important Locations in Harsil Sector of Uttarkashi District

In the Pithoragarh District, Munsyari and Dharchula Tehsil areas were the most affected. Roads in these areas were severely damaged and several villages were cut off. The road between Tawaghat and Mangti was washed away. The road between Lilam and Martoli had many landslides, besides several important bridges were washed away[3]. River Kali was in spate in Tawaghat Sector, where several villages were virtually cut off due to landslides and bridges having been washed away. Dharchula was cut off from Pithoragarh at a number of locations (Figure 3.3).

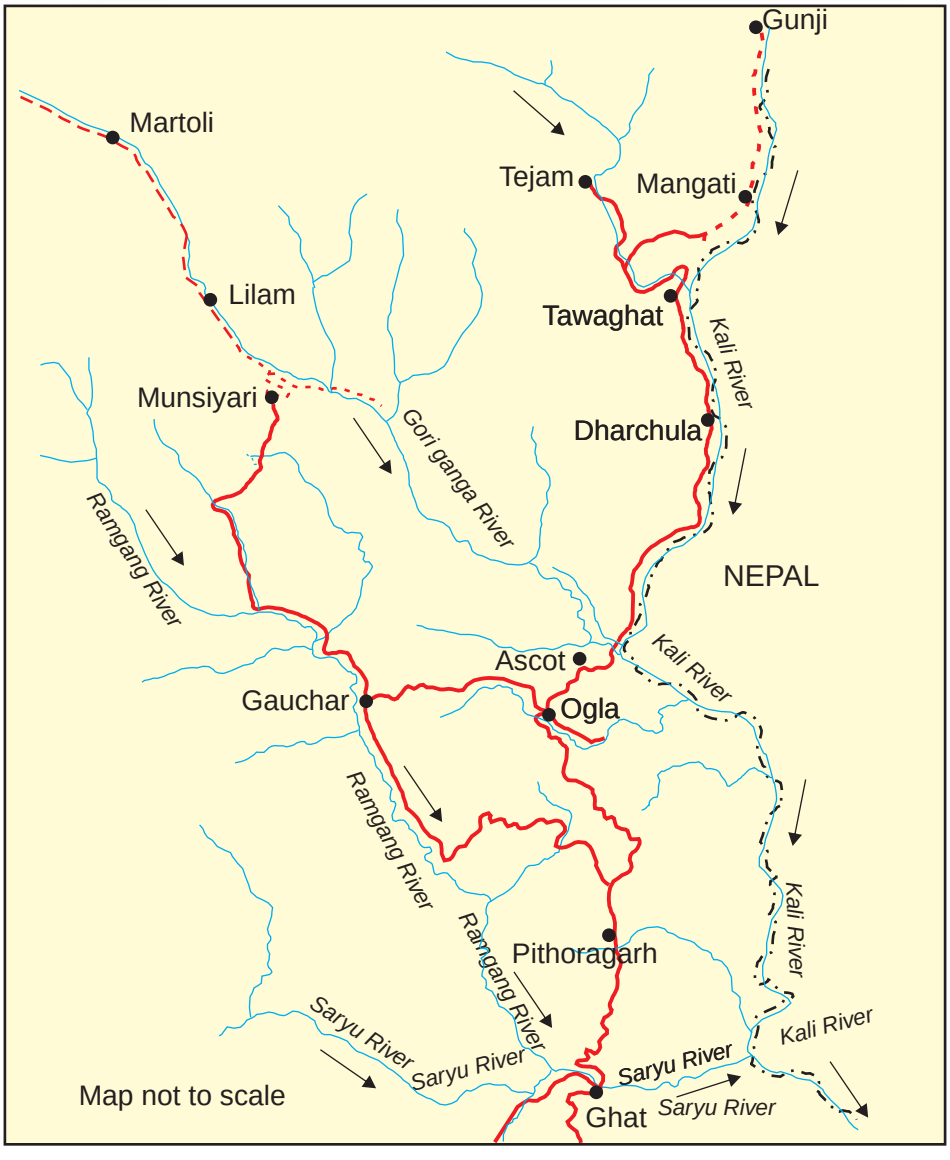

Figure 3.3: Important Locations in Tawaghat Sector of Pithoragarh District

3.2 The Build up and Response

On 14 June, the India Meteorological Department (IMD) issued an alert about likely heavy rains during the next 48 hours[4]. Anticipating an emergency, the Government of Uttarakhand issued directions to all the District Magistrates to manage any emergency arising out of the anticipated heavy rainfall[5].

On 15 June, IMD (Dehradun), Regional Weather Forecasting Centre (RWFC), New Delhi and National Weather Forecasting Centre (NWFC), New Delhi issued alert about heavy rains during the next 48 to 72 hours. Same morning, Meteorological Centre at Dehradun issued an advisory to postpone the *Char Dham Yatra* by four days. On behalf of the IMD, this note was issued on 15 June to the District Magistrate of Rudraprayag and ITBP, requesting them to shift *yatris* to safer places[6]. The alert turned out to be right as the region received continuous heavy rainfall of 325 mm throughout 15 and16 June.

On 16 June, IMD repeated its alert about 'heavy' to 'very heavy' rainfall at few places during next 36 to 48 hours. The *Char Dham Yatra* weather forecast issued in the morning of 16 June advised for postponement of the yatra by three days. Advisory note was issued to the Chief Secretary of Uttarakhand; the Executive Director, Disaster Management and Mitigation Centre (DMMC), District Magistrates of respective districts and Indo-Tibetan Border Police (ITBP) suggesting that people may be shifted to safer places and prevented from entering higher reaches of the hills[7]. Accordingly, movement of pilgrims to Kedarnath and Badrinath was restricted by the district administrations of Rudraprayag and Chamoli.

On 17 June, IMD - Dehradun, Regional Weather Forecasting Centre (RWFC), New Delhi and National Weather Forecasting Centre (NWFC), New Delhi issued yet another alert, warning isolated 'heavy' to 'very heavy' rainfall during the next 24 to 48 hours.

According to the then Chief Resident Commissioner (CRC) of Uttarakhand at Delhi, the first inkling of disaster came from a garbled message from the Civil Police Outpost at Gaurikund in the evening of 16 June. Report informed incidence of a very strong current in the River Mandakini carrying a large amount of debris. Based on this sketchy input, the Chief Secretary decided to call for help from the Central Government and requisitioned the assistance of the Indian Army, the Indian Air Force (IAF), National Disaster Response Force (NDRF) and Indo Tibetan Border Police (ITBP).

Another short wireless message at 7:55 AM on 17 June, this time from the Police Outpost at Kedarnath Temple, reported devastation at the Kedarnath Shrine area due to flooding. Thereafter, because of disruption in wireless communication, it was not possible to know what had happened in the Kedarnath pilgrimage route. Besides, incessant heavy rains prevented air approach to the area while landslides prevented the approach by road. By this time, the entire machinery of State Government became active. Since the brunt of the rescue and relief operation was to be borne by the Armed Forces, the Central Para Military Forces and the Border Roads Organisation (BRO), the Ministry of Home Affairs in the Government of India assumed charge of coordinating the deployment of Central Forces and convened daily meetings with Indian Army, IAF, ITBP and NDRF. Whilst ITBP and BRO were already present in the State, the NDRF teams of 7th and 8th battalion were mobilised in a very short time and moved to Haridwar and Dehradun respectively, for moving to the affected areas as per requirement of the State Government.

Meanwhile, on 17 June, the General Officer Commanding (GOC), Uttarakhand Sub Area met the Chief Secretary, Uttarakhand to review the situation. The reconnaissance column of the army unit located at Rudraprayag could not move beyond Rudraprayag as landslides had blocked road access at several places. The Indian Air Force deployed eight helicopters at Dehradun, but due to bad weather conditions, operations could not take place. All available resources of the State Government were also immediately deployed for relief and rescue operations.

By 18 June, rescue and relief operations were in full swing with the help of Indian Army, IAF, NDRF, ITBP, BRO, and BSF. Helicopters were deployed extensively for search and evacuation operations. An Army rescue team was inducted by helicopter to Sersi near Badasu. The Army also established contact with its Animal Transport column at *Mundkatiya Ganesh*[8]. The Deputy GOC of the Uttarakhand Sub Area carried out aerial reconnaissance of Kedarnath, Rambara, Gaurikund and Sonprayag and also interacted with civilians. The gravity of the situation was now coming to the fore as dead bodies were reportedly lying between Sonprayag and Kedarnath.

With the widespread damage and destruction in the State and break down of surface communication coupled with damage to telecommunication infrastructure, particularly in the remote areas, correct estimates of the dead and stranded pilgrims and the affected local population were difficult to arrive at. As per the media reports, on June 19, the death toll due to the flash floods had by then reached 23 with more than 50 pilgrims and tourists missing. More than 30,000 tourists and pilgrims were reported stranded in the Garhwal Hills[9].

The Army Advanced Landing Ground (ALG) at Gaucher was converted by the Army into a major aviation base for civil, Army and IAF helicopters. As the relief operations progressed over following days, the location was developed into the main administrative base.

The estimates on 19 June put the death toll at 102 and it was feared that loss of lives could eventually be much higher. By that time, more than 10,000 people were reported to be rescued, and provided food, clothing, and shelter. It was then evident that the maximum damage was at the Kedarnath and its vicinity. The main shrine of the Kedarnath, however, was only slightly damaged. Local residents of Kedarnath highlighted that 17 people died in a stampede inside the shrine and around 1,000 people were missing in Rudraprayag[10]. As per the media reports, over 60,000 people were stranded across Uttarakhand[11]. The NDRF was deployed for rescuing pilgrims stranded in the Kedarnath pilgrimage area using air support provided by civil helicopters engaged by the State Government and the Indian Air Force. The Army and ITBP rescue and relief efforts continued on the Badrinath axis. Small Mountain Rescue Teams (MRT) were dropped by helicopters at Ghastoli, Ghagharia, Hanuman Chatti and Lambagarh (Figure 3.1) to assist pilgrims in crossing difficult areas. One MRT was also dropped at Arwa Nala, which successfully evacuated a foreign mountaineering expedition team. Meanwhile, reconnaissance and rescue missions were launched by ITBP in the Dharchula area.

In view of the catastrophic impact of the disaster which then started to emerge clearly, on 19 June, the then Prime Minister at the time, Dr. Manmohan Singh as Chairperson of the National Advisory Council along with the Chairperson of United Progressive Alliance Ms. Sonia Gandhi, carried out an aerial survey of the affected

areas, accompanied by the Chief Resident Commissioner (CRC) of Uttarakhand. The CRC briefed them on various aspects of the ongoing rescue and relief operations. The Prime Minister announced an ad hoc assistance of Rs. 1,000 Crores towards disaster relief for Uttarakhand[12]. He assured the State for all necessary assistance to meet the crisis. The National Crisis Management Committee (NCMC) also met regularly under the chairmanship of the Cabinet Secretary. Among others, meetings were attended by the Secretaries of various ministries like, Home, Health, Defence, Food & Civil Supplies, Petroleum, Telecommunication; the Chief of Army Staff or the Director General Military Operations, Chief of Air Staff or Director General Air Operations; Director General, India Meteorological Department; and Director General BRO and Chief Resident Commissioner of Uttarakhand. The meetings of the National Crisis Management Committee continued until the major part of the rescue and relief operations were completed.

On 19 June, the Chief Minister of Uttarakhand also visited affected areas of Kedarnath, Guptkashi, Phata, Gauchar (Figure 3.1) and many other places and roughly assessed the damage and losses caused by the flash flood[13].

By 19 June, the Army Unit located at Narendranagar had opened the route up to Dharasu in the Harsil Sector. The unit located at the Harsil sent out columns along Gangotri and Uttarkashi axes, which were blocked at Dharali and Sukhi and rescued stranded pilgrims by evacuating them to the Army location at Harsil (Figure 3.2).

The road to Gangotri was opened by 20 June and all stranded vehicles at Gangotri were brought to Harsil. Approximately 7,000 civilians along with 1,000 to1,500 vehicles were rescued in the Harsil Sector (Figure 3.2). Army also established six information hubs for civilians - three each at Rishikesh and Haridwar. The Rishikesh - Joshimath road was also opened up to Govindghat by 20 June facilitating moving of pilgrims by road to safe places on the Badrinath axis (Figure 3.1).

On 21 June, the thenUnion Home Minister and the Chief Minister of Uttarakhand jointly reviewed the situation of ongoing rescue and relief work at Dehradun[14]. As per media reports, approximately 556 people, including tourists and pilgrims

succumbed in the flash floods and landslides. However, number of casualties was expected to be much higher. As per locals and those involved in rescue operations, thousands of people remained missing and more than 32,000 people were still stranded[15]. The military and para-military forces assisted by local administration continued with their operations relentlessly.

On the same day itself, the army paratroopers were deployed in the Kedarnath Valley. They were assigned the task of preparing suitable landing areas for helicopters along the axes of Sonprayag-Gaurikund, Gaurikund-Jungle Chatti and between Jungle Chatti and Rambara, as a large number of pilgrims were stranded enroute. With no footbridge or mule track existing, pilgrims were stranded in these areas for more than 5 to 6 days without sufficient food and shelter, under harsh weather conditions. Rescue operations by the Army as well as civil helicopters commenced soon thereafter. People were rescued to safer places along the Sonprayag-Guptakashi road (Figure 3.1) through makeshift helipads. Rescue and relief operations were further speeded up by the IAF due to indications of bad weather likely in next 48 hours. By now, IAF had deployed 37 helicopters (23 MLH, 11 ALH and 02 Cheetah aircrafts) into search, rescue and relief operations[16]. By 21 June, BRO had successfully opened Rishikesh-Joshimath-Mana road up to Govindghat and the Rishikesh-Dharashu road.

Shri V. K. Duggal, then Member, National Disaster Management Authority was nominated as the nodal officer to coordinate relief and rescue operations in Uttarakhand by the Government of India, on 21 June, which further facilitated coordination among various Central and State government agencies engaged in rescue operations[17].

In Badrinath area, Army's rescue teams reached Lambagarh on 22 June and established a Burma Bridge (temporary rope bridge) across the water channel, enabling those fit to walk to cross over and walk down to safety to Joshimath. The Army aviation helicopters were used to establish a helicopter bridge at Govindghat,

which fast tracked evacuation operation to Joshimath. Remarkably, only with the carrying capacity of 2-3 persons, more than 1,000 pilgrims were evacuated in a single day.

As per the Chief Secretary Uttarakhand, the Kedarnath Valley was completely evacuated by 23 June, while more than 3,000 stranded people were moved to safer places from Badrinath, Jungle Chatti and Harsil areas by the security forces[18]. The region received a fresh spell of moderate to heavy rains from 23 to 25 June affecting the air operations, particularly in the afternoon.

In the Uttarkashi District, pilgrims at Gangotri were rescued and shifted to Harsil Army Camp. Around 2,000 pilgrims were housed in the Army barracks and local schools, waiting to be airlifted from the Harsil helipad[19]. As on 23 June, massive rescue and relief operations continued in the region. As per the media reports, various agencies, including Indian Army, Indian Air Force, ITBP, and NDRF had rescued and shifted about 80,000 stranded people to safer places[20]. The delays experienced in relief and rescue measures were due to difficult terrain, bad weather conditions, and lack of road connectivity[21].

By 24 June, all civilians stranded in Jungle Chatti in Kedarnath area had been evacuated by helicopters[22]. But, more than 8,000 people were still stuck and stranded across the State and about another 5,000 people were yet to be evacuated from the Badrinath area. The Unmanned Aerial Vehicles (UAVs) were deployed to scan the whole area of Kedarnath, mainly to identify the presence of survivors in the inaccessible areas. Nearly fifty sorties were carried out by UAVs, helping rescuers to locate stranded people in forests, hills, and other isolated areas far away from Badrinath and Kedarnath[23].

On 25 June, an IAF helicopter (Russian-built Mi-17V5) crashed near Gaurikund due to bad weather, while dropping loads in the area[24]. The chopper went down North

of Gaurikund, at around 12.30 PM. All the 20 rescuers (05 from IAF, 06 from ITBP and 09 from NDRF) died in the accident. On the same day, a team of "GARUD" (The Indian Air Force Commandos) was deployed in the area, which recovered the mortal remains of the personnel killed in the accident. Names of the martyrs who sacrificed their lives during the rescue and relief operation are as follows:

(a) Indian Air Force

- Wing Commander Darryl Castelino, Pilot
- Flight Lieutenant K. Praveen, Co-Pilot
- Flight Lieutenant Tapan Kapoor
- Junior Warrant Officer Akhilesh Kumar Singh
- Sergeant Sudhakar Yadav

(b) ITBP

- Sub Inspector Jayendra Prasad
- Constable Nand Kumar
- Constable Sarvesh Kumar
- Constable Jomon PG
- Constable Bibhuti Roy
- Constable Ajay Lal

(c) NDRF- All personnel were from the 8th Battalion of NDRF

- Commandant Nitya Nand Gupta, Second-in-Command
- Inspector Bhim Singh
- Sub Inspector Satish Kumar
- Constable K. Vinaygan
- Constable Basavaraj Yaragatti
- Constable Santosh Kumar Paswan

- Constable Sanjiva Kumar
- Constable Pawar Shashi Kant Ramesh
- Constable Ahir Rao Ganesh

Figure 3.4: Homage to martyrs

The situation remained grim even on 26 June, notwithstanding the immense rescue and relief operations. As per media reports, more than 2,000 villages in Uttarkashi, Chamoli and Rudraprayag districts were affected - fully or partially. At least 2,000 people were reported missing from Rudraprayag District. In addition, several unidentified bodies were strewn across the region, and decaying bodies were lying in Kedarnath Temple[25]. On 26 June, the State administration commenced mass cremations in the Kedarnath Valley[26].

On 26 June, an unit of Army Engineers was inducted in the Harsil Sector, which improved the track from Maneri to Bhatwari. Army engineers also launched an aluminium foot bridge across River Alaknanda on the same day, to facilitate speedy evacuation on the Badrinath axis. Evacuation of pilgrims from Badrinath continued by air for the old, sick, women and children, while those found physically fit were motivated to walk down to Govindghat.

As on 27 June, more than 3,000 people were stranded and about 3,000 people remained missing in Uttarakhand. Nearly 1.04 lakh people were evacuated by

various agencies till date. Fourty three foreigners from USA, UK, Sri Lanka and other countries were rescued by the villagers from Didsari near Uttarkashi. By 28 June, all pilgrims stranded at Gangotri in Uttarkashi area had been evacuated, leaving behind only the locals. On 28 June, during the rescue operations, one Pawan Hans helicopter crash landed at Harsil with damage to its tail rotor[27].

The Chief of Army Staff visited Gaucher on 28 June. Meanwhile a team of Marine Commandos also carried out aerial reconnaissance of the Kedarnath area to ascertain if there were any survivors on the Kedarnath axis. Air evacuation continued from Guptkashi to Dehradun. An alternate axis from Guptkashi to Tehri and onwards to Rishikesh was opened for evacuation of pilgrims. In total, approximately 5,768 pilgrims were evacuated from the Kedarnath Axis[28].

On 1 July, the District Magistrate of Uttarkashi derequisitioned the Army columns deployed in the district. A total of 3,490 Yatris were evacuated by air by employing MI -17 Helicopters, Advanced Light Helicopters (ALH), Cheetah Helicopters and C-130 aircraft in the Uttarkashi District. However, civil helicopters continued to provide rations and relief material till July 10[29].

As per the official report of the State Government, about 1,10,000 pilgrims and tourists were evacuated despite inhospitable terrain and hostile weather conditions. Indian Air Force carried out about 2,616 sorties and evacuated around 21,961 persons. 2,000 sorties were undertaken by civil helicopters hired by the State Government to evacuate the stranded persons. 12,000 persons were thus evacuated by civil helicopters. More than 5,000 vehicles were arranged by the State Government and approximately 90,000 persons were evacuated by road. The State Government had made all arrangements and ensured that the evacuated persons reached their respective destinations safely[30].

It is noteworthy that despite the gigantic magnitude of the disaster, there was no outbreak of any disease/epidemic in the region. Medical teams comprising of 313 physicians along with 4,977 paramedical staffs were deployed to provide medical care in the affected areas[31].

3.3 Evacuation and Immediate Relief: Highlights

Search, rescue and relief operations during Uttarakhand disaster were the most difficult operations carried out in India's recent history of disaster management. Despite the difficult terrain, adverse weather conditions, disrupted roads and lack of telecom connectivity various agencies of Central and State Government, non-government organizations and corporate bodies, played an important role in making this operation successful. The air effort of the Indian Air Force, the Aviation Corps of the Indian Army and the civil helicopters engaged by the Civil Aviation Department of the State Government played a stellar role in the rescue operations.

3.3.1 Government of India Initiatives

Ministry of Home Affairs provided necessary support in managing Uttarakhand Disaster in an effective and efficient manner. All the relevant Central Ministries were mobilized as soon as the matter came to the notice. The NDRF was asked to send teams to Uttarakhand on 16 June itself. During 17-19 June, the Home Secretary took series of meetings with senior officers of NDRF, ITBP, BRO, Ministry of Defence and other ministries to review rescue and relief operations. In addition, National Crisis Management Committee also took review of the situation on a day-to-day basis. The National Executive Committee meetings were also held frequently to review the status of ongoing rescue and relief operations.

Tenure of Shri V.K. Duggal, Member of NDMA, who was entrusted to coordinate with the State and National agencies involved in rescue and relief operations by Government of India, was extended for another three months, with the additional responsibilities of assisting and advising the State Government in developing its rehabilitation, re-construction and re-building plans.

Government of India supported the State Government in carrying out its rescue and relief operations by providing support of Armed Forces and Para-Military Forces, including NDRF. Fourteen teams of the NDRF, 8,000 personnel of the Indian Army and 1,200 personnel of the ITBP were deployed in the shortest possible time to carry out one of the most difficult rescue operations in the history of the disaster

management in India. In addition to human resources, the Government of India provided necessary support in the form of deployment of 45 helicopters of IAF and 12 helicopters of the Indian Army. The supply of Aviation Turbine Fuel (ATF) for the air operations was a challenge, which was successfully met by the combined efforts of the Indian Air Force and the Ministry of Petroleum and Natural Gas.

In order to facilitate and restore communication, 105 satellite phones were distributed to various Central and State agencies by the Central Government. In addition, continuous efforts of BSNL to restore their communication infrastructure were monitored by the National Crisis Management Committee.

To assist the State Government, Government of India deputed a high level team of medical personnel to visit the State and review / advise the State Government on all preventive measures required in the situation. It also supported the State Government by providing support of 80 medical doctors, 11 psychiatrists and 5 public health teams with necessary equipment.

The Government of India released an amount of Rs. 145 crores from State Disaster Response Fund (SDRF) and Rs. 250 crores from National Disaster Response Fund (NDRF) to the State Government. In addition, an amount of Rs. 1187.87 Crores of assistance from NDRF was also approved for the Uttarakhand Government subject to adjustment of 90% of balance available in SDRF. Apart from this, as a special component of National Rural Drinking Water Programme, Rs. 20 Crores were also approved for the State[32].

For long-term re-construction and rehabilitation, the Government of India constituted a Cabinet Committee chaired by the Prime Minister for providing broad guidelines for re-construction and rehabilitation to disaster affected areas of the State. An inter-ministerial group was also set up which was chaired by the Cabinet Secretary for drawing up a time-bound National Plan for supporting rehabilitation and re-construction work. The Planning Commission coordinated with the State Government for developing a comprehensive reconstruction and rehabilitation package. In addition to the above, the World Bank and the Asian Development Bank were also engaged to provide technical and financial assistance towards re-construction of the disaster affected areas of Uttarakhand.

As *ex-gratia* relief payment to the victims, the Central Government extended assistance to the State Government by providing an amount of Rs. 1 lakh from NDRF and Rs. 2 lakhs from the Prime Minister's National Relief Fund for each victim.

3.3.2 Government of Uttarakhand Initiatives

During the entire crisis period, the Uttarakhand Government did its best to manage the calamity notwithstanding the enormous proportion of the disaster occurring in a difficult terrain and in face of inclement weather conditions. The efforts made by State Government, despite number of constraints, need appreciation. Soon after the disaster struck, the State Government initiated massive rescue and evacuation operations with the help of various Central and State Government agencies including Armed Forces, Paramilitary Forces, NDRF among others.

During the initial stages, advisories were sent to all the concerned districts and announcements were made by police personnel stationed at Kedarnath, Rambara and Gaurikund alerting the general public. The State administration stopped further movement of pilgrims from Rishikesh to higher areas. State Government requisitioned the services of the Army, Air Force and Central Paramilitary Forces on 16 June itself.

A Coordination Committee was formed under the guidance of Chief Secretary, consisting of Government of India officials, Principal Secretaries/Relief Commissioners of other States, and other officers associated with disaster relief functions, for conducting daily reviews. The entire rescue and evacuation operation was a joint effort by the Central and the State Government agencies. Other State Government agencies such as the Police Department, District Authorities, NGOs and volunteers were also part of these rescue operations.

Despite the most arduous and difficult terrain, inclement weather and lack of connectivity, approximately 1,10,000 persons stranded or trapped in different locations were safely rescued by airlifting, transported by ponies/mules or moved by foot and taken to the relief camps. Thereafter the pilgrims were helped to board

trains, buses or take their private transport/taxies to go to their home stations**.** The major part of the evacuation was accomplished in less than a fortnight making it one of the largest, swiftest, and safest rescue and evacuation operations by the administration.

All the essential supplies like food, drinking water, medicines, kerosene oil, solar lamps, etc. were continuously provided by air dropping as well as by surface means wherever connectivity was available. A total of 69 relief camps were organized where 1,51,629 pilgrims/local residents were sheltered. Some camps continued operating beyond the emergency phase for the local residents. Approximately, 900 trucks of relief material were received from other States and dispatched to the affected districts from a nodal/central relief centre which was set up at Dehradun[33].

A good number (43) of medical teams comprising of 313 doctors and 4,977 para-medical staff were deployed and essential medicines, bleaching powder and chlorine tablets were regularly supplied to the affected areas[34, 35]. The Health Department coordinated efforts to prevent outbreak of epidemics. As a result, there was no incidence of any epidemic or infectious disease in the State in spite of the mass cremation of dead bodies and disposal of animal carcasses, or breakdown of potable water supplies in some areas.

In view of the enormity of the disaster, the State Government proactively raised the norms of ex-gratia, prescribed by the National Disaster Response Fund (NDRF) for affected people, and also provided ex-gratia for many categories which were not even covered by the NDRF norms.

In addition, the State Government also initiated other relief measures as mentioned below:

- Sanctioned Rs. two lakh or proportionately higher amount for the loss of commercial properties
- Provided free ration to the disaster affected families for a period of 3 months or untill restoration of regular supplies

- Payment of rent at the rate of Rs. 2,000 per month (later revised to Rs. 3,000) for all those rendered homeless by the disaster
- Exempted payment of water tax, electricity dues and interest on agriculture-loans given by co-operative banks for the remaining part of the financial year
- Gave a moratorium of one year for repayment of loans to the State credit agencies.

The State Government established a "Missing Persons Information Cell" on 27 June at the Disaster Mitigation and Management Centre (DMMC), Dehradun. The missing persons' data was managed with the support of International Business Machines Corporation (IBM) professionals. Facebook and Twitter accounts were opened, where State-wise photographs and other information were posted which provided a very successful feedback. Based upon the mobile phone calls data of the pilgrims for the period 14-19 June, received from the Department of Telecommunications, nearly 43,000 calls were made. State-wise lists of missing persons were sent to Chief Secretaries of the concerned States and follow up was done to validate the information. As a result, after sifting the information through multiple filters, the Missing Persons Cell provided name-wise information of missing persons, which became the basis of issuing death certificates, as per procedure prescribed by the Government.

3.3.3 Role of the Armed Forces in Rescue and Relief Operations[36]

The Armed Forces carried out all conceivable tasks whether chartered or not, from saving human lives to evacuation of stranded people, providing immediate succour, food, clothing, restoring and facilitating communications, connecting people to their near and dear ones and facilitating the rescue operations in every possible way. While doing so, the most important task was to trudge every trail and comb the entire area of responsibility, find survivors, lift and assist the fellow citizens and shift them to relief centres.

Rescue operations in Uttarakhand were like a war against nature's fury that was inflicted on pilgrims and residents of the State who were caught unprepared and

were not equipped to deal with it. The impediments in this task were several, like, there was no definitive count of victims which the rescue troops needed to save or look for; grim condition of victims as having already faced ravage for several hours; no indication of extent of medical assistance required; and more importantly to trudge every trail across a vast area by foot to locate such victims who in desperation had simply fled through any available route.

Figure 3.5: Evacuation in progress by Army

An overwhelmingly large number of victims were native of plains, who were unaccustomed to the physical stress of sustained walking or climbing in the mountains. The other daunting factor was the inclement weather that continued throughout the operations in long or short spells, disrupting the efforts.

Activation of Defence Crisis Management Group (DCMG)

Operational Logistics Directorate of the Operations Branch in the Head Quarters Integrated Defence Staff (IDS) is the Nodal Directorate responsible for coordinating the tri-services response in any natural or man-made disasters within or outside the country. The Directorate also liaises with MoD, MEA, MHA, NDMA, NIDM and respective Service HQs for the same. The communication to activate the DCMG was received by HQ, IDS from MoD on 17 June.

The DCMG was activated on 17 June and its first meeting was held at 10AM on 18 June. The meeting was chaired by Assistant Chief IDS (Joint Operations), and attended by representatives of Army, Navy and Air Force Operations Directorates,

Medical Branch of HQ IDS, Ministry of Defence, ITBP, NDRF and Resident Commissioners of Uttarakhand, Himachal Pradesh and Uttar Pradesh. Regular 'situation updates' were monitored from the sites of disaster. Allocation of resources was planned and realized to optimize their employment, prevent duplication of effort and harmonize the overall effort to assist the State Government to bring the situation under control. The meetings were held on daily basis till 17 July. The forum also provided the opportunity to carry forward the thought process of National Crisis Management Committee (NCMC) and National Executive Committee (NEC) meetings into an Action Plan by the Armed Forces.

3.3.3.1 The Indian Army Operations

On 17 June morning, forward troops in Tilwara, Harsil, Kedarnath, Badrinath and Dharchula Sectors reported heavy rains and cloud bursts. Reconnaissance parties of Army were moved forward proactively and immediately to assess the situation. No headway could be made as the bridges had been washed away and the parties were stuck. This necessitated launching additional parties. Weather did not allow flying of helicopters on reconnaissance missions. Since inputs started arriving piecemeal, it was decided to prepare an intelligence matrix of the situation and preliminary estimates were made. Simultaneously, local administration also started making assessment of damage with the help of limited police network that remained functional. Inputs from local administration were obtained and fused into the matrix.

Picture started becoming clearer by the afternoon of 17 June. By the evening, DM Rudraprayag formally requisitioned the local Army Formation / Units for assistance. The severity of the overall disaster was initially not known. But as the inputs started to be collated on 17-18 June regarding threats to human lives, damage to bridges, formation breaches and cut off roads, it became possible to build initial and preliminary estimates of the overall damage and put in place an adaptive planning process and ***Operation Surya Hope*** was launched by the Army.

On 18 June, all formations of Central Command were simultaneously mobilized and then deployed without awaiting formal orders of requisition. The aim was to

cover each of the four axes leading to forward area where damage had been reported and inputs were being received about the threat or loss of human lives as early as possible. GOC, Uttar Bharat Area was tasked to move from his permanent Headquarters at Bareilly to Dehradun with his Forward Headquarters. He attended the first meeting of State Crisis Management Committee on 18 June and ensured coordination and close cooperation with civil administration. His anchoring at Dehradun provided order and coherence to the overall plan. On 19 June, GOC-in-C, Central Command met the Chief Minister and assured him of every possible help from Army.

The basic concept was to save every human life, evacuate all pilgrims; provide medical aid/ relief to the injured, establish relief and medical camps; provide food to people who were stuck in these areas and establish communication links so that rearward evacuation could be made possible. The Army plan comprised of five phases which were not sequential but ran concurrently:

(a) **Phase 1**. Intelligence collection, reconnaissance, preparation of estimates and deployment of advance parties. It also included deployment of forward logistics and administrative node at Gauchar.

(b) **Phase 2**. Deployment of troops / columns and evacuation along with insertion of troops in the area of Kedarnath Valley. Preparation of area and shaping of land routes for ground evacuation.

(c) **Phase 3**. Continued evacuation through alternate land route as well as land and air means.

(d) **Phase 4**. Facilitate security and handing back of areas to civil administration.

(e) **Phase 5**. Restoration and consolidation of military posture.

18 June onward, mobilization, rescue and relief operations were coordinated by the Brigade Headquarters and the evacuation, rescue and relief work was

Figure 3.6 : Aviation base for rescue & relief

monitored and supervised by a Flag Rank officer on each of the four axes (Gangotri, Kedarnath, Badrinath and Dharchula). Control centres were established at Dehradun, Uttarkashi, Rudraprayag and Chamoli / Joshimath. At the commencement of operations, about 5,600 troops were deployed but two days later strength was reinforced to approximately 8,000 troops. On 21 June, 150 Special Forces Paratroopers were deployed to undertake search and rescue operations in valleys, gorges and inaccessible areas.

Fourteen helicopters of Army Aviation Corps were deployed and these flew 737 sorties and transported about 30 tons of relief material. Army aviation helicopters were used to establish a helicopter bridge at Govindghat which fast tracked evacuation operation to Joshimath considerably.

Additional Engineering Task Forces were deployed along each axis to clear off

Figure 3.7: Army Aviators flying in hazardous condition

landslides and breaches. The troops were tasked to construct ropeways, makeshift rope bridges and foot bridges.

Figure 3.8: Army opening tracks and assisting in crossing river

Twenty four medical teams were deployed by the Army in the affected areas from Military Hospitals located at Dehradun and other parts of Uttarakhand. Two psychologists from Military Hospital Bareilly and Jabalpur were also employed to counsel the pilgrims. Medical aid was provided by Army to more than 30,000 people. Medical officers were tasked to give advisories to locals and pilgrims on hygiene and preventive measures against outbreak of any diseases. Seven Medical

Camps were established by the Army units operating at the Harsil, Rudraprayag, Joshimath, Govindghat, Gothi, Dharchula and Gwaldam areas. Veterinary teams of Army were pressed into service for providing aid to wounded and injured cattle and animals.

Figure 3.9: First aid to animals

Figure 3.10: Army Medical camp for victims

Radio sets, motorola sets, mobiles, INMARSATS, audio and video means were used for communication. The forward presence of commanders ensured close coordination with local administration. Mobile communication was used to the maximum limits. Satellite communication was also very effective. Radio sets could not be used as generators could not be moved and charging facilities were scanty.

With a large footprint on the entire affected area, innovative employment of Special Forces personnel, continuous interaction between military commanders and civil administration and reassurances to the affected people, the loss of life was contained considerably. The soldiers were able to bring back people stuck in valleys and gorges to safe areas. More than 45,500 people were rescued by the Army.

3.3.3.2 The Indian Air Force Operations

The unprecedented magnitude of destruction caused by the flash floods in Uttarakhand called for immediate and large-scale rescue and relief efforts. IAF

responded to this enormous challenge with characteristic speed, resolve and fortitude. Launching '***Operation Rahat***', IAF resources were marshalled from different corners of the country, and up to 45 helicopters were involved during the major part of the operations.

The entire IAF team, be it the men or women who flew the helicopters in a difficult environment marred by frequent spells of bad weather or the transport crew, pitched in with all the resolve. The C-130J Hercules provided innovative solution and was used as mobile weather platform as well as an Airborne Command Post. The Hercules was also used as an *'Air Bridge'* to ferry fuel and rescue people between Dharasu and Delhi. Bridging equipment from distant locations was airlifted by AN-32 aircraft to Jolly Grant air field of Dehradun to support BRO efforts.

Figure 3.11: The IAF - Evacuation of victims in difficult terrain

For first 24 hours, there was no clarity on the extent of damage caused by flash floods and relief requirements. Piecemeal requests were received from local civil authorities, which were met. A census of all available resources was carried out and units were put on standby. The civil authorities were informed of requirements of operating surface and fuel for relief operations; however they expressed their inability to provide fuel at remote locations.

Majority of the rotary wing assets available in Western Air Command area of responsibility were moved to the Air Force Base located at Sarsawa in Saharanpur, Uttar Pradesh. Additionally, all available men, hoist and cradle equipment were airlifted to Saraswa to undertake the task. Assets from Eastern, Central and Southern Air Commands were allocated by Air HQs which fetched up by 20 June and augmented the relief operations. During the peak of the operations, a total of 45 helicopters were deployed and this was augmented by 13 transport aircraft, including the latest acquisition, the C-130.

Figure 3.12: The Indian Air Force in action

As in the case of aircraft, aircrew was augmented from various units of the Air Force. Permission was granted to fly mix crew so as to undertake familiarization sorties for out of area aircrew. Special attention was paid to crew combination so as to ensure correct cockpit gradient. Effective supervision by Command HQ and Detachment Commanders ensured that the fatigue limitation of individuals was never reached.

Limited amount of parking space was available at Jolly Grant, Dharasu, Gauchar and Rampur. Frequent towing had to be resorted to at Jolly Grant for take off and landings. At Dharasu and Gauchar, aircraft had to be parked on Advanced Landing Grounds (ALG) itself. During peak operations, 28 helicopters operated from Gauchar which required careful tarmac management. Fixed Wing Aircraft operations had to be restricted to block timings to cater for civil aircraft movements at Jolly Grant as parking space was not enough to accommodate all at the same time. Most of the helipads at Kedarnath, Badrinath and Guptkashi were washed away and operations had to be undertaken from make shift helipads. Here too, innovative solutions and sheer determination to ensure accomplishment of mission allowed the IAF to deliver. At locations, personnel were winched down, so that they could create some clear areas for landing. Once created, these makeshift landing sites were used, even though at certain sites carriage of payload was restricted to Out of Ground Effect (OGE) configuration. Further, most of the helipads could accommodate single helicopter only forcing staggering of missions to the affected areas. Advanced Landing Ground at Dharasu was unfit to undertake fixed wing operations due to thick vegetation along the edges of the runway and dispersal. IAF personnel mustered ITBP and BRO services to make it fit for C-130 J landing.

The fast changing weather in valleys was a cause of concern. C-130J was innovatively used to carry out weather check early morning at 0530 hours and pass it on Radio to Jolly Grant and other helicopters in valleys. This provided a clear picture of prevailing weather and flying was regulated to avoid unnecessary "Duty Not Carried Out" sorties. Meteorological Assistants were positioned at forward locations for reporting of weather.

Kedarnath, Badrinath and Harsil valleys are extremely narrow valleys. The traffic

density was high in these valleys as number of civil helicopters were also operating in these areas. The traffic was regulated by formulating local Standing Operating Procedures (SOPs) among the operators. Air Traffic Control (ATC) officers were positioned at Jolly Grant Airport for close liaison for prioritizing IAF helicopter and fixed wing aircraft movement. ATC officers were also positioned at Dharasu and Gauchar for providing Air Traffic Services.

The sheer scale of rescue effort to save lives was compressed into a very tight time frame whilst operating in difficult mountainous terrain and that too under some very hostile weather conditions. IAF flew 3,702 sorties, evacuated and airlifted 24,260 passengers and lifted 894.89 tons of valuable relief supplies - a herculean effort indeed by any standards. This unprecedented and prompt response has already been recorded as the largest relief operation ever in India. Above all, this operation was a most effective demonstration of the core values and motto of IAF *'People First, Mission Always'* to the countrymen.

As the evacuation process completed, IAF shifted gears and moved into Phase-II of Operation RAHAT. With a different approach and new strategy, IAF stepped forward to support Government of Uttarakhand in rebuilding roads, communication links and shelter for the locals, resuscitating their sources of livelihood and sustenance.

3.3.3.3 The Indian Navy Operations

From 25 June onwards, two Marine Commando (MARCOS) teams were deployed at Dehradun. The teams undertook search and rescue operations at Haridwar and along the Rudraprayag - Guptkashi axis in conjunction with NDRF and local authorities. On successful completion of tasks given by the Disaster Mitigation and Management Centre Uttarakhand, the teams were de-inducted on 4 July 2013. Subsequently, as part of rehabilitation effort, a community kitchen was set up at Augustmuni, Rudraprayag catering for about 400-500 pilgrims every day.

Challenges Faced by Armed Forces during Rescue and Relief operations[37]

• Terrain and Weather Restrictions

Difficult mountainous terrain and incessant rains were a major challenge for rescue & relief operations. Landslides at many locations along the National Highways further delayed the movement of rescue columns. Breakdown of communication lines was a major hindrance in coordination of rescue efforts. Due to inclement weather and disruption of roads, problems were faced in staging forward the relief material to affected areas. Army patrols were employed for ferrying of important supplies across the landslides. Carriage of heavy stores was extremely difficult especially at locations where foot tracks had got washed away.

• Unity of Command and Effort

Compartmentalization of individual agencies for rescue effort during initial stages led to piecemeal response. Too many organisations were working independently with limited coordination among them. However the situation improved for better as the operations progressed due to joint coordination among the different agencies.

• Air Effort

Air effort, both civil and military was quite substantial. However, bad weather precluded smooth conduct of air operations. Limitations of helicopters in terms of lift capability, operational ceiling and weather constraints were restricting factors for air operations. The main challenges faced were:-

- Reduction in load carrying capacity with increase in altitude.
- Limited capacity as compared to heavy lift helicopters.
- Limitations with respect to flying in bad weather conditions.

• Specialized Equipment

Lack of specialized equipment like skid steer, hauling cables, pulleys, rope bridges, mountaineering equipment also impacted the progress of operations adversely.

3.3.4 Indo-Tibetan Border Police (ITBP)

Being the sentinel of the Himalayas, ITBP are deployed all along the border and have been the first responders during several natural and anthropogenic disasters. On receipt of weather alerts from IMD, directions were issued to Sector Head Quarters (SHQ) and units under their command to take appropriate steps. Units were advised to keep their radio sets on for receiving any distress messages, report any eventuality, and establish lookouts at all vulnerable points. All units were directed to be ready for disaster response.


Figure 3.13: ITBP rescuing survivors of flash floods from risky mountain terrain

ITBP commenced its operations under guidance of the Inspector General, Northern Frontier in the Uttarkashi - Dehradun axis and the Tawaghat – Dharchula axis on 16 June, Badrinath axis on 17 June, Kedarnath axis on 18 June, and Ghagaria – Hemkund axis on 19 June onwards. The ITBP deployed 1,600 personnel - 1,000 from Garhwal region and 600 from Kumaon region[38].

On the Joshimath-Govindghat-Badrinath axis, Govindghat-Hemkund and Niti axis, the ITBP personnel evacuated about 24,056 stranded people. They also extended support and help for helicopter evacuation to 5,664 stranded people; provided medical treatment to 1,313 people and food and shelter to 1,769 affected people on this axis. On the Rudraprayag–Kedarnath axis, ITBP rescued 4,401 stranded people by surface and provided assistance for evacuation by helicopter to 3,038 affected people. They also provided medical treatment and food & shelter to several people in the affected area. Along Uttarkashi-Harsil-Gangotri and Uttarkashi-Dharasu-

Yamnotri axis, ITBP evacuated 3,763 people by surface route and provided assistance for evacuation of 316 people by helicopters. In addition, they also provided medical treatment to 115 sick people and provided food and shelter to 615 affected people.

3.3.5 National Disaster Response Force (NDRF) [39]

National Disaster Response Force has been constituted for the purpose of specialist response to an impending disaster situation or disaster. NDRF is the only dedicated disaster response force in the world. This is the only agency with comprehensive response capabilities having multi-disciplinary, multi-skilled and highly technically trained personnel.

Considering the fact that NDRF is a specialized response force, Ministry of Home Affairs decided to send NDRF to Kedarnath valley and handed them the primary responsibility of response in this disaster. This valley was completely cut off from all land routes. The only mode of reaching the valley was through air. The NDRF team was airdropped at Kedarnath. In extremely harsh weather conditions and with almost no support structure at Kedarnath, the NDRF personnel exhibited tremendous dedication to duty. They carried out search and rescue operations in Kedarnath-Jungle Chatti, Gaurikund-Rambada and Bhairav Chatti, Guptkashi-Phata-Sonprayag-Gaurikund, Badrinath and Harshil-Sukhi top areas.

NDRF made a quick assessment of the situation in coordination with disaster management officials of Uttarakhand. They deployed and airlifted their equipment for rescue operation in Kedarnath area, moved to Rudraprayag and established a base camp for rescue and relief operations for the pilgrims and tourists.

During its 15 days operation from 18 June to 02 July, NDRF personnel successfully rescued 9,044 people from different affected areas including Kedarnath (1,053), Jungle Chatti (907), Gaurikund (756), Guptkashi (1,281), Sonprayag (2,000), Sukhitop (120), and Badrinath (2,927). In addition, NDRF also rescued 14 Singapore nationals. The team provided medical aid to 881 pilgrims and tourists. NDRF helped in setting up helipad and evacuating stranded people at Jungle Chatti area[40]. It removed several dead bodies from Kedarnath Temple and surrounding

areas of Kedarnath Shrine. Apart from the rescue efforts, the NDRF was also able to retrieve a huge cache of looted money from some anti-social elements. NDRF was the only force, which continued its deployment up to November 2013 at Kedarnath.

Figure 3.14: NDRF providing basic amenities to survivors during emergency search & rescue operations

An overview of Rescue Operations[41]

- NDRF deployed 14 teams for the operation and rescued more than 9,044 persons
- ITBP deployed about 1,200 personnel and rescued more than 33,000 persons
- IAF deployed about 45 helicopters and rescued more than 23,500 persons
- Indian Army deployed 8,000 personnel including 150 Special Forces and rescued more than 38,500 persons. 12 army helicopters were deployed
- Twenty civil aircrafts were utilized by the State Government in the operations and approximately 12,000 persons were evacuated
- Nehru Institute of Mountaineering, Uttarkashi, formed 5 rescue teams of

20 instructors and local youth, and they evacuated more than 6,500 stranded persons

- More than 1,10,000 persons were evacuated from the affected areas in the shortest possible time, notwithstanding widespread destruction of roads, difficult terrain and extremely hostile weather.
- There may be overlapping in number of persons rescued by agencies mentioned above, as the same person could have been rescued by different agencies through road, bridge and air before reaching final destination

References

1 Government of Uttarakhand, 2013. Uttarakhand Disaster Recovery Project (P146653) (The World Bank Assisted), Environment and Social Management Framework. Draft Report, October 2013. http://dmmc.uk.gov.in/files/pdf/Final_ESMF_2.pdf

2 Dobhal, D. P; Gupta, A. K.; Mehta, Manish; and Khandelwal, D. D., 2013. Kedarnath disaster: facts and plausible causes, Scientific Correspondence, Current Science, Vol. 105, No. 2, 25 July 2013. http://www.currentscience.ac.in /Volumes/105/02/0171.pdf

3, 8, 22, 28, 29 Operation Sahayata - Final Report 2013. Integrated Headquarters of MoD (Army).

4, 6, 7 Govt. of India, Ministry of Earth Science, IMD, 2013. A preliminary report on heavy rainfall over Uttarakhand during 16-18 June 2013. Indian Meteorological Department, Lodi Road, New Delhi, July 2013. http://www.imd.gov.in/doc/uttrakhand_report_04_09_2013.pdf

5 Press Release, Govt. of Uttarakhand, 14 June 2013. http://www.cm.uk.gov.in/pressrelease

9 *"23 die, more than 50 missing in U'khand" and "Killer rain claims 47 in North, Delhi in disarray"*, E-news, Hindustan Times, 18 June 2013. http://paper.hindustantimes.com/epaper/viewer.aspx#

10 "*Floods take 54 lives in U'khand*", E-news, Hindustan Times, 19 June 2013. http://paper.hindustantimes.com/epaper/viewer.aspx#

11 "*Rain toll rises to 313, over 73,000 stranded in north, Casualties in Thousand, Claims VHP*", E-news, Times of India, 19 June 2013. http://epaper.timesofindia.com/Daily/Skins/Ascent/section.asp

12 Press Release, Govt. of India, 19 June 2013. http://pib.nic.in/ newsite/ pmreleases.aspx?mincode=3

13 Press Release, Govt. of Uttarakhand, 19 June 2013. http://www.cm.uk.gov.in /pressrelease

14 Press Release, Govt. of Uttarakhand, 22 June 2013. http://www.cm.uk.gov.in /pressrelease

15 "*Till now 556; after rain, hunger begins to kill. Uttarakhand Horror, Survivor says he saw a thousand corpses*", E-news, Hindustan Times, 22 June 2013. http://paper.hindustantimes.com/epaper/viewer.aspx#

16 Nair, S. R. K., Air Vice Marshal, AVSM VM, IAF, 2013. "Uttarakhand Disaster Response – Operation Rahat, June – July 2013", presented in the National Workshop on "Uttarakhand Disaster 2013: Lessons Learnt", 19 August 2013, organized by National Institute of Disaster Management, New Delhi.

17 *"Ex-home secretary made nodal office for rescue ops"*, E-news, Hindustan Times, 22 June 2013. http://paper.hindustantimes.com/epaper/viewer.aspx#

18, 20 "*Rain hits rescue, thousand stuck*", E-news, Hindustan Times, 24 June 2013. http://paper.hindustantimes.com/epaper/viewer.aspx#

19 "*Tiny village shows big heart & rain hits rescue, thousand stuck*", E-news, Hindustan Times, 24 June 2013. http://paper.hindustantimes.com /epaper/viewer. aspx#

21 "*NDMA ramps up efforts, says govt caught off-guard*", E-news, Hindustan Times, 24 June 2013. http://paper.hindustantimes.com/epaper/viewer.aspx#.

23 "*Drones in rescue act*", E-news, Hindustan Times, 25 June 2013. http://paper.hindustantimes.com/epaper/viewer.aspx#.

24 "*20 feared dead in copter crash as more rain punishes U'Khand*", E-news, Hindustan Times, 26 June 2013. http://paper.hindustantimes.com /epaper/viewer. aspx#

25 "*Govt braces for DNA profiling as hope fades for the missing*", E-news, Hindustan Times, 26 June 2013. http://paper.hindustantimes.com/ epaper/viewer.aspx#.

26 "*A Desperate cry for help - Mass cremations Begin*", E-news, Hindustan Times, 27 June 2013. http://paper.hindustantimes.com/epaper/viewer.aspx#

27 "*Focus locals, Target Rehab – Officials say cremations on course, no fear of epidemics*", E-news, Times of India, 28 June 2013. http://epaper. timesofindia.com/index.asp

30 Govt. of Uttarakhand, 2013. "Disaster Relief Memorandum for Central Assistance, Department of Disaster Management", Govt. of Uttarakhand

31, 35 JRDNA Report, 2013. India - Uttarakhand Disaster, June 2013 (82643). Joint Rapid Damage and Needs Assessment Report. Jointly submitted by Govt. of Uttarakhand, ADB and the World Bank, August, 2013. (http://www-wds.worldbank.org/external/ default/WDSContentServer/ WDSP/IB/2013/ 11/15/000333037_20131115110208/Rendered/PDF/826430WP0P146600 Box379864B00PUBLIC0.pdf)

32, 33, 34, 41 Rajya Sabha Secretariat Report, 2014. Parliament of India, Rajya Sabha, Department related Parliamentary Standing Commitee on Home Affairs, Report No. 178, on disaster Management in the Country. Presented to

Rajya Sabha on 19 February, 2014. http://164.100.47.5/newcommitte/reports/englishcommittees/committee%20on%20home%20affiars/178.pdf

36, 37 "Role of Armed Forces in Uttarakhand Disaster Relief Operations", vide Government of India, Ministry of Defence, letter No. 1(07)2013/D(GS-III) dated 30 April, 2013.

38 Headquarter Northern Frontier, ITBP- "Brief on Tasks carried out during UKD rescue & relief ops".

39 NDRF Report, 2013. Article on Uttarakhand Disaster and Rescue & search Ops carried by NDRF.

40 Rathore, S. R., I. G., National Disaster Response Force (NDRF), 2013. "Uttarakhand Disaster – 2013", presented in the National workshop on "Uttarakhand Disaster 2013: Lessons Learnt", 19 August 2013, organized by National Institute of Disaster Management, New Delhi.

4 Impact and Damage Assessment

4

IMPACT AND DAMAGE ASSESSMENT

4.1 Introduction

The Uttarakhand Disaster of year 2013 caused irreparable losses in terms of human lives, damage to private properties and public infrastructure, damage to landscape and ecosystems, livelihoods and local entrepreneurships. The impact of this disaster was far reaching because many of those who died or affected in this disaster were tourists. More than nine million people were affected by flash floods disaster. Five districts of Uttarakhand namely - Bageshwar, Chamoli, Pithoragarh, Rudraprayag and Uttarkashi - were the worst affected. In terms of human casualties, a total of 169 people died and over 4,021 people were reported missing (presumed to be dead)[1]. In total, 4,200 villages were affected[2]; 11,091 livestock were lost and 2,513 houses completely damaged[3]. More than 70,000 tourists and 1,00,000 local residents were stranded in the difficult mountain terrain of the upper reaches of the Himalaya[4]. The damage caused by disaster was so enormous and extensive that it was also termed as the Himalayan Tsunami by the media. The damage as reported by the State Government is shown in Table 4.1.

Table 4.1: Damage as reported by the State Government[5]

S. No	Item	Details
1.	Number of affected districts	13
2.	Number of dead and missing persons (presumed to be dead)	169 + 4021
3.	**No. of houses damaged :**	
	(i) Fully damaged pucca houses	2119
	(ii) Severely damaged pucca houses	3001

	(iii) Partially damaged pucca houses	11759
	(iv) Fully damaged kuchha houses	394
	(v) Severely damaged kuchha houses	360
	(vi) Partially damaged kuchha houses	1676
	(vii) Number of damaged huts	471
	(viii) Number of damaged cowsheds	361
4.	**Animals lost :**	
	(a) Number of big animals lost	3280
	(b) Number of small animals lost	7811

The assessment of physical damage and impact was carried out by the State Government in various sectors i.e. housing, public buildings, roads & bridges, urban infrastructure (water supply, roads, drains and sewerage), rural water supply & sanitation, irrigation, livelihoods (agriculture, livestock, fisheries, tourism; micro, small & medium enterprises), tourism infrastructure, energy and forests. This chapter gives a glimpse of the damage caused due to the disaster, including loss of human lives. The data presented in this book is based upon information provided in various documents and correspondence of the State Government.

4.2 Human Casualties

In this flash flood disaster, 169 people were killed and 4,021 people were reported missing (presumed to be dead) as informed by the state Government on 09 May 2014[6]. Out of total missing persons, 846 people were from the State of Uttarakhand and 3,175 from the other States[7]. Maximum number of people reported missing were from Uttar Pradesh followed by Uttarakhand and Madhya Pradesh, accounting for more than half of the total number of people reported missing (Table 4.2).

Table 4.2: State wise list of missing persons (presumed to be dead)[8]

S. No	State	Number of persons
1.	Uttar Pradesh	1,150
2.	Uttarakhand	846
3.	Madhya Pradesh	542
4.	Rajasthan	511
5.	Delhi	216
6.	Maharashtra	163
7.	Gujarat	129
8.	Haryana	112

9.	Andhra Pradesh	86
10.	Bihar	58
11.	Jharkhand	40
12.	West Bengal	36
13.	Punjab	33
14.	Chattishgarh	28
15.	Odisha	26
16.	Tamil Nadu	14
17.	Karnataka	14
18.	Meghalaya	6
19.	Chandigarh	4
20.	Jammu & Kashmir	3
21.	Kerala	2
22.	Puducherry	1
23.	Assam	1
	Total	**4,021**

The suddenness of the flash flood coupled with high velocity of flow loaded with heavy sediment, including boulders washed away those who came into its path - pilgrims and locals. Apart from flash floods, people were also reported to be killed by landslides, which buried them alive under huge debris and rock falls. The difficult terrain and blockage of roads made it difficult to provide necessary relief to the survivors stranded at isolated locations. The harsh weather conditions, i.e., continuous rainfall, chilling cold, and non-availability of proper shelter and clothes contributed to the crisis endured by the survivors of the disaster.

4.3 Housing

The human settlement in the State, like elsewhere, is concentrated along the rivers. Over the time, people moved closer and built houses near rivers encroaching into flood plains. Due to the disaster the houses were damaged in both urban and rural areas. Table 4.3 shows number of houses damaged in the urban areas. Damage to the houses in rural area is presented in Table 4.4. The maximum number of pucca houses are reported to be damaged in Rudraprayag (57%), followed by Uttarkashi (22%) and Chamoli (20%) (Figure 4.1).

Table 4.3: Damage to Urban Housing[9]

District	Building typology	Number of units		
		Total	Partially Damaged	Fully Damaged
Bageshwar	Pucca	5	-	5
Chamoli	Pucca	132	118	14
Pithoragarh	Pucca	-	-	-
Rudraprayag	Pucca	382	88	294
Uttarkashi	Pucca	150	117	33
	Total	**669**	**323**	**346**

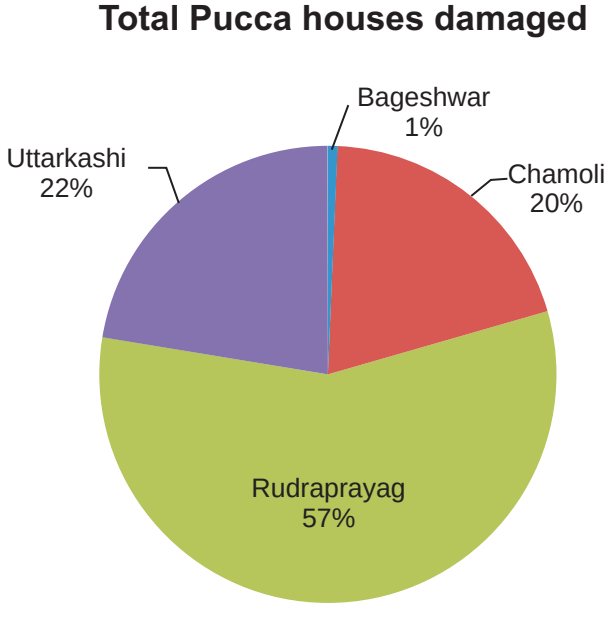

Figure 4.1: District-wise percentage of total pucca houses damaged under Urban Housing[10]

Table 4.4: Damage to Rural Housing[11]

District	Building typology	Number of units		
		Total	Partially Damaged	Fully Damaged
Bageshwar	Pucca	145	135	10
	Kuchha	1	-	1
	Total	**146**	**135**	**11**
Chamoli	Pucca	511	-	511
	Kuchha	47	-	47
	Total	**558**	**-**	**558**
Pithoragarh	Pucca	477	37	440
	Kuchha	-	-	-
	Total	**477**	**37**	**440**
Rudraprayag	Pucca	386	56	330
	Kuchha	-	-	-
	Total	**386**	**56**	**330**
Uttarkashi	Pucca	841	533	308
	Kuchha	-	-	-
	Total	**841**	**533**	**308**
	Total	**2,408**	**761**	**1,647**

The maximum number of rural houses reported damaged were from Uttarkashi (35%), followed by Chamoli (23%), Pithoragarh (20%), Rudraprayag (16%) and Bageshwar (6%) (Figure 4.2).

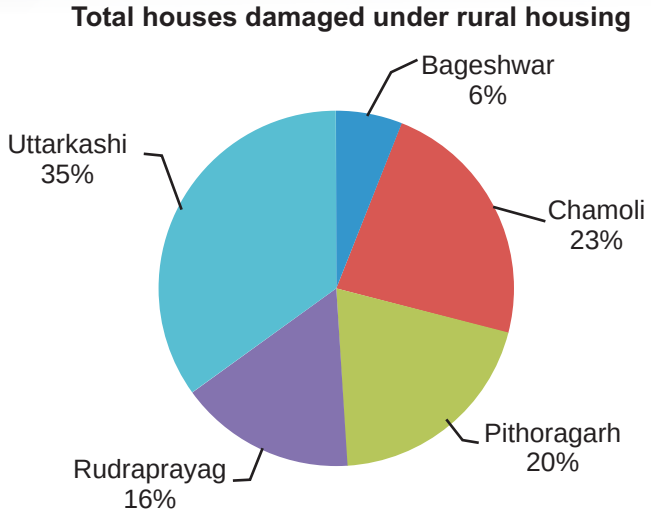

Figure 4.2: District-wise total rural houses damaged[12]

As more information became available, figures of damage to houses were revised upwards - 2,119 pucca and 394 kuchha houses were fully damaged, while 3,001 pucca and 360 kuchha houses were severely damaged and 11,759 pucca and 1,676 kuchha houses were partially damaged[13]. The maximum damage to houses was reported from Rudraprayag, Chamoli, Uttarakashi and Pithoragarh districts.

Buildings were damaged due to various reasons but primarily many buildings were washed away either by rising water levels or by erosion of the foundations and sudden shock caused by the forceful water currents. At few locations, entire settlements were washed away, while many buildings were damaged either partially or fully, becoming unsafe for habitation.

Figure 4.3: Damaged houses in Vijaynagar (Augustmuni), Rudraprayag District

Damage to houses forced the affected people to move either to Government shelters or to their relatives. Impact was more severe for the poor people, who were economically more vulnerable; most of them lost their belongings and faced harsh weather conditions too.

4.4 Public Buildings

In addition to private houses, several public buildings belonging to various government departments (education, health services, women & children centres and block offices) were also damaged. Tables 4.5, 4.6, 4.7 and 4.8, present details of damaged government buildings.

Table 4.5: Damaged Educational Buildings[14]

Description	Bageshwar	Chamoli	Pithoragarh	Rudraprayag	Uttarkashi	Other districts	Total
Partially Damaged							
Primary	49	60	13	30	63	217	432
Upper Primary	15	22	3	7	30	67	144
Sec./Sr. Sec	15	26	8	7	3	53	112
Block/Cluster Res.	0	0	0	0	0	4	4
Higher/Vocational Inst.	0	1	0	0	1	3	5
Total	**79**	**109**	**24**	**44**	**97**	**344**	**697**
Fully Damaged							
Primary	3	38	5	4	57	28	135
Upper Primary	0	5	0	4	12	9	30
Sec./Sr. Sec	0	0	1	2	1	0	4
Block/Cluster Res.	0	2	2	0	0	1	5
Higher/Vocational Inst.	0	0	0	0	0	2	2
Total	**3**	**45**	**8**	**10**	**70**	**40**	**176**
Grand Total	**82**	**154**	**32**	**54**	**167**	**384**	**873**

Table 4.6: Damaged Health Services Buildings[15]

Description	Bageshwar	Chamoli	Pithoragarh	Rudraprayag	Uttarkashi	Other districts	Total
Partially Damaged							
CHC	1	0	0	0	1	9	11
Sub Centre	0	0	0	0	2	6	8
PHC	0	1	0	0	1	10	12

SAD	0	3	0	2	1	6	12
Other facilities	0	0	1	2	0	4	7
Total	**1**	**4**	**1**	**4**	**5**	**35**	**50**
Fully Damaged							
CHC	0	0	0	0	0	0	0
Sub Centre	0	0	0	0	0	1	1
PHC	0	0	0	0	0	0	0
SAD	0	1	0	1	0	2	4
Other facilities*	0	1	0	0	0	0	1
Total	**0**	**2**	**0**	**1**	**0**	**3**	**6**
Grand Total	**1**	**6**	**1**	**5**	**5**	**38**	**56**

***Note: The other facilities include administrative buildings for the health facilities and hospitals. Child Health Centre (CHC), Primary Health Centres (PHC); State Allopathic Dispensary (SAD).**

Table 4.7: Damaged Women & Children Centres[16]

Description	Bageshwar	Chamoli	Pithoragarh	Rudraprayag	Uttarkashi	Other districts	Total
Partially Damaged							
Office Buildings	0	0	0	0	0	1	1
Anganwadi	0	2	5	0	8	7	22
Total	**0**	**2**	**5**	**0**	**8**	**8**	**23**
Fully Damaged							
Office Buildings	0	1	0	0	0	0	1
Anganwadi	0	3	0	4	6	12	25
Total	**0**	**4**	**0**	**4**	**6**	**12**	**26**
Grand Total	**0**	**6**	**5**	**4**	**14**	**20**	**49**

Table 4.8: Damaged Block Offices & Residences[17]

Description	Chamoli	Other districts	Total
Partially Damaged			
Block Office	4	3	7
Residential	4	2	6
Total	**8**	**5**	**13**

Fully Damaged			
Block Office	0	0	0
Residential	1	3	4
Total	**1**	**3**	**4**
Grand Total	**9**	**8**	**17**

Damage to public buildings resulted into disruption of the functions of the education, health services, women & children care and block offices. People living in the affected area were deprived of basic services and were stuck due to damaged roads and bridges. The school children were severely affected due to damage to the school buildings. Schools remained closed for a long period of time till alternative temporary shelters were put in place. Due to the damaged Primary Health Centres, people in the affected areas could not get health facilities.

Figure 4.4: Damaged Police Chowki and Information Centre at Kedarnath

4.5 Roads and Bridges

In Uttarakhand, the road sub-sector consists of road infrastructure, which is administered by the Public Works Department (PWD) and Border Roads Organisation (BRO). While major roads are mostly with BRO, State highways and district roads are maintained by the PWD. PWD also maintains parts of the National Highways of National Highways Authority of India (NHAI).


Figure 4.5: Damaged National Highway No-109 and Bridge at Rudraprayag District

The overall road network in Uttarakhand covered a length of 31,929 km. The road network administered by the PWD comprises of 1,151 km of National Highways (NH); 3,788 km of State Highways (SH); 3,290 km of Major District Roads (MDR); 2,945 km of Other District Roads (ODR); and 15,402 km of Village Roads (VR). PWD also looks after 3,736 km of bridle roads/tracks and 1,073 bridle bridges. BRO manages about 1,623 km of NHs, SHs, MDRs, and ODRs, mainly in difficult terrain.

Flash floods caused intense erosion of the river banks and washed away large sections of roads and a number of bridges at many places. The disaster damaged about 2,174 roads[18], 85 motor bridges, and 140 bridle bridges. A large number of vehicles were - washed away, buried under debris, fallen off the hill, or stranded at cut-off locations. Summary of affected roads with BRO, National Highway and State Highway is provided in the Table 4.9. A brief about other roads and bridges damaged by the disaster is given in the Table 4.10.

Table 4.9: Details of disaster affected roads under Border Road Organization (BRO), National Highway (NH) and State Highway (SH) [19]

Districts	Roads with BRO (in Km)	National Highway (in Km)	State Highway (in Km)
Part A-Worst affected Districts			
Bageshwar	0.00	0.00	101.00
Chamoli	280.00	7.00	50.00
Rudraprayag	100.00	0.00	19.00
Uttarkashi	175.00	54.18	10.00
Uttarkashi	175.00	54.18	10.00
Pithoragarh	380.00	0.00	73.00
Total	**935.00**	**61.18**	**253.00**

Part B-The other Eight Districts			
Almora	0.00	73.00	294.40
Champawat	50.00	0.45	0.00
Dehradun	0.00	29.00	135.00
Haridwar	0.00	31.80	11.00
Nainital	0.00	53.00	121.00
Pauri	15.00	21.00	106.00
Tehri	96.00	15.00	93.00
Udham Singh Nagar	0.00	25.00	27.00
Total	**161.00**	**248.25**	**787.40**
Grand Total- Part A and Part B	**1,096.00**	**309.43**	**1,040.40**

Table 4.10: Summary of other roads affected by the disaster[20]

Districts	MDR (km)	ODR (km)	Village Roads PWD (km)	Village Roads-PMGSY (km)	Bridle Roads (km)	Motor bridges (Nos.)	Bridle Bridges (Nos.)
Part A-Worst affected Districts							
Bageshwar	75.00	55.00	79.09	25.50	6.00	1.00	18.00
Chamoli	86.00	124.00	253.61	69.86	76.40	1.00	26.00
Rudraprayag	27.00	24.00	143.38	81.47	31.15	4.00	25.00
Uttarkashi	81.00	12.00	389.91	49.33	49.30	7.00	12.00
Pithoragarh	17.00	-	250.61	20.77	108.50	2.00	26.00
Total	**286.00**	**215.00**	**1116.60**	**246.93**	**271.35**	**15.00**	**107.00**
Part B-The other Eight Districts							
Almora	169.00	17L8.50	66.91	23.56	-	-	3.00
Champawat	12.00	7.00	261.38	20.65	-	-	-
Dehradun	79.60	47.60	439.52	30.02	-	31.00	2.00
Haridwar	47.00	17.30	49.00	-	-	2.00	-
Nainital	37.00	6.00	180.48	22.51	27.00	-	-
Pauri	88.00	120.00	964.14	101.57	5.60	2.00	7.00
Tehri	82.00	79.00	769.39	40.39	132.40	35.00	21.00
U. S. Nagar	6.00	1.00	215.55	-	-	-	-
Total	**520.60**	**456.40**	**2946.37**	**238.70**	**165.00**	**70.00**	**33.00**
Grand Total- Part A and Part B	**806.60**	**671.40**	**4062.97**	**485.63**	**436.35**	**85.00**	**140.00**

Disruption of the roads and bridges in the Uttarakhand disaster affected all sections of the local people including tourists and pilgrims. Road connectivity to approximately 4,200 villages was lost and people remained stranded, disconnected and isolated for days and weeks following disastrous flash flood

events. Impact of this calamity had reached further downstream areas throughout the State, where damage to roads were caused by inundation and overtopping of roads resulting from downstream floods. Damaged roads would require realignment at number of locations and the widened rivers would require new longer bridges.

4.6 Urban Infrastructure (Water Supply, Roads, Drainage and Sewerage)

Nearly one third of the State's population lives in urban areas. According to the census data of 2011, the state's urban population is 3.05 million, out of a total population of 10.1 million. Urban settlements in Uttarakhand include 75 statutory towns with a total population of 2.56 million. These include Municipal Corporation of Dehradun, 32 *Nagar Palikas / Parishads,* 31 *Nagar Panchayats,* 9 Cantonment Boards, and 2 industrial towns. About 74% of the State's urban population lives in the plains of southern Uttarakhand, including Dehradun, the state capital. About 80% of the urban population of Uttarakhand has access to piped water supply.

Figure 4.6: Road Construction en-route to Kedarnath and Damaged Helipad near Sonprayag-Triyuginarayan road

Urban infrastructure in 41 out of total 75 towns was seriously affected by flash floods. Scouring and heavy deposition of silt caused damage to intake wells and treatment plants of the water supply schemes in the mountainous districts of Chamoli, Rudraprayag, Pauri, Tehri, and Uttarkashi. As a result, about 1,12,000 people were directly affected in terms of reduced coverage of municipal water supply systems. Almost 50 raw water intake stations and tube wells and 40 km of pipelines were severely damaged in this incident. Besides damaging the water supply network, floods also washed away nearly 20 km of roadside drains in different areas. District-wise figures of damage to urban water supply schemes is presented in Table 4.11. The brief about damage to urban roads and drains is given in Table 4.12.

Table 4.11: Details of Damaged Urban Water Supply Infrastructure[21]

Districts	No. of Affected towns	People directly affected	urban population of the district (%age)	Reduction in level of supply(in lpcd) (Avg.)	Potable water production capacity reduced (in MLD)	No. of damaged intakes & Tubewells	Damaged Pipeline (in km)
Bageshwar	1	2000	8	20	0.50	1	0.2
Chamoli	9	26900	23	20	2.20	24	12.5
Pithoragarh	2	-	-	-	-	-	0.3
Rudraprayag	2	2,900	10	27	1.00	8	9.1
Uttarkashi	2	9,900	13	55	3.60	-	3.5
Almora	1	-	-	-	0.30	-	-
Champawat	2	-	-	-	-	-	0.1
Dehradun	4	-	-	-	6.00	4.00	1.00
Haridwar	3	42,535	5	3	10.50	4	0.2
Nainital	6	-	-	1	0.80	-	0.4
Pauri	4	14,440	12	40	6.60	8	7.65
Tehri	5	13,430	16	17	1.20	1.00	5.5
Total	**41**	**1,12,105**	**-**	**-**	**-**	**50**	**40.45**

Table 4.12: Details of damaged Urban Roads and Drains[22]

Districts	No. of towns affected	Damaged Road (in km)	Damaged Drains (in km)
Chamoli	5	2.20	9.80
Pithoragarh	2	0.20	0.10
Rudraprayag	1	-	0.05
Uttarkashi	4	11.00	7.20
Almora	1	0.60	1.00
Champawat	2	1.40	0.30
Pauri	2	3.30	-
Tehri	6	-	2.00
Haridwar	3	0.90	2.10
Dehradun	2	1.20	1.70
Total	**28**	**20.80**	**24.25**

4.7 Rural Water Supply and Sanitation

4.7.1 Rural Water Supply

Water Supply and Sanitation services to rural areas were drastically affected and damaged by the floods, particularly in the five worst affected districts - Bageshwar, Chamoli, Rudraprayag, Uttarkashi and Pithoragarh. In addition to this, remaining eight districts (Almora, Champawat, Dehradun, Haridwar, Nainital, Pauri, Tehri and Udham Singh Nagar) also suffered losses and huge damage of assets due to the spiral downstream floods and heavy rains. More than 8,728 habitations and 1.29 million people were affected due to partly or fully damaged water supply and sanitation. Details of damage to piped water supply schemes and its impacts in rural areas is given in Table 4.13.

Table 4.13: District-wise status and impact of damaged piped water supply schemes[23]

Districts	Total No. of Existing Schemes	No. of damaged schemes			Affected habitation / population / household		
		Fully	Partially	Total	Habitation	Population	Household
Part A - Five worst affected Districts							
Bageshwar	658	2	61	63	199	29296	5859
Chamoli	955	7	239	246	445	83274	16655
Rudraprayag	604	8	127	135	317	72913	14583
Uttarkashi	1068	52	407	459	515	140887	28177
Pithoragarh	1908	8	130	138	304	35773	7155
Sub Total : A	**5193**	**77**	**964**	**1041**	**1780**	**362143**	**72429**
Part B - Other eight affected Districts							
Almora	1583	1	251	252	767	141435	28287
Champawat	676	5	57	62	185	21770	4354
Dehradun	947	45	340	385	728	177130	35426
Haridwar	106	0	3	3	55	133761	26752
Nainital	816	0	179	179	572	34081	6816
Pauri	1185	0	288	288	867	152486	30497
Tehri	1641	212	281	493	3774	267408	53482
U. S. Nagar	35	0	0	0	0	0	0
Sub Total : B	**6,989**	**263**	**1,399**	**1,662**	**6,948**	**9,28,071**	**1,85,614**
Grand Total Part A + Part B	**12,182**	**340**	**2,363**	**2,703**	**8,728**	**12,90,214**	**2,58,043**

4.7.2 Sanitation

Damage to sanitation facilities and services were relatively less tangible than water supply schemes. However due to flash floods, which resulted in piling up of huge

waste in the form of debris, boulders, stones, mud, sand, etc., people faced potential health hazards, especially in the villages. About 930 household toilets were washed away in the five worst affected districts, including 893 soak pits and 14,526 meters of drains. In the other eight less affected districts, about 2,408 toilets, 2,435 soak pits and 27,244 meters of drains were washed away. The district-wise sanitation damage assessment is shown in the Table 4.14.

Table 4.14: District-wise Sanitation damage assessment[24]

Districts	Total no. of (HHs) accessing toilets before calamity	Total no. of damaged Household (HH) toilets	Damaged Solid Liquid Waste Management (SLWM) Infrastructure	
			Soak Pit	Drains (m)
Part A - Five Worst Affected Districts				
Bageshwar	37,138	45	60	3,080
Chamoli	53,047	398	369	5,080
Rudraprayag	31,760	296	224	1,332
Uttarkashi	46,920	51	110	1,454
Pithoragarh	67,392	140	130	3,580
Total	**2,36,257**	**930**	**893**	**14,526**
Part B- Other eight affected Districts				
Almora	72,126	229	260	3,910
Champawat	33,513	863	765	3,507
Dehradun	57,866	84	90	2,509
Haridwar	1,17,706	69	70	4,312
Nainital	48,001	164	170	2,503
Pauri	81,089	185	205	5,511
Tehri	82,084	165	185	2,112
Udham Singh Nagar	91,514	649	690	2880
Total	**5,83,899**	**2,408**	**2,435**	**27,244**
Grand Total A and B	**8,20,156**	**3,338**	**3,328**	**41,770**

4.8 Irrigation Infrastructure

Uttarakhand State Irrigation Department is involved in the construction and maintenance of irrigation channels and tube wells in hilly areas. It is also involved in flood protection and drainage works. The disaster damaged canals, flood protection works, lift canals, lakes, barrages, tubewells and associated buildings. Out of total 11,702 km canal works across the State, disaster damaged 495 km of canal works. In five most affected districts, the total damage to the canal works was about 205 km. Out of 395 km of flood protection works, 74 km was washed away with floodwaters. The details of damage to irrigation infrastructure are given in the Table 4.15.

Table 4.15: Details of the damage to irrigation infrastructure[25]

Name of the works	Total no. Of Works	Damaged No.	Total Length (km)	Damaged length (km)	Total Command Area (ha)	Affected command area (ha)
Canals	2,740	1,542	11,702	495	2,09,502	33,181
Flood Protection Works	891	508	394	74	-	-
Lift Canal	166	60	-	-	5,041	1,999
Lakes	9	2	-	-	-	-
Barrages	5	1	-	-	-	-
Tube wells	1,248	53	-	-	30,683	3,151
Buildings	-	12	-	–	-	-

Out of total command area 3,33,800 ha under irrigation, about 38,330 ha was affected by the flash floods. Damage to lift canal irrigation schemes affected about 1,999 ha of the land. About 3,151 ha of land under tube well irrigation was also adversely affected.

4.9 Livelihoods

Economy and livelihood of Uttarakhand hills is primarily based on tourism, agriculture and horticulture. Tourism contributes about 22.5% of Uttarakhand's Gross Domestic Product (GDP) and livelihoods of about 100,000 people is dependent on it. Agriculture has been a key sector in the State's economy, which contributes around 23.4% to the State Gross Domestic Product. About 75% of the State's population depends on agriculture and associated occupations. As a result of the disaster, nearly 2,00,000 people engaged in agriculture, horticulture and livestock management are reported to have lost their livelihood. Table 4.16 summarizes damage to various livelihood sources in the State.

Table 4.16: Summarized damages to livelihoods[26]

Sector	Damages (Area/length)
Agriculture	20,401 ha of cultivable land eroded, washed away or inundated
Horticulture	15,536 ha affected
Fisheries	42 fish ponds affected

Livestock	17,700 animals (cows, buffaloes, bullocks, equines, sheep, goats, poultry etc.) killed
Tourism linked livelihoods	Hotels, restaurants assets washed away. Taxis, small traders are out of business and youth unemployed.
Small and micro-enterprises	80% of the 80,000 registered and unregistered enterprises affected

4.9.1 Agriculture

Agriculture is main source of livelihood for most of the people in the affected areas, where farmers mostly belong to the small and marginal category. The impact of disaster on agriculture sector was quite severe. Heavy rains severely eroded agricultural lands mainly on slopes in many villages and in the plain areas, the crops were damaged due to inundation by flood water.

The damage to the agriculture was result of washing away of lands, damage to the agriculture infrastructure, siltation in agricultural fields, damage to crop and loss of productivity. In the five worst affected districts, total 2,010 ha cropped area was affected, whereas 1,206 ha of land was completely washed away. Total silted land area was reported to be 944 ha. Details of affected agricultural land in five worst affected districts are shown in Table 4.17.

Figure 4.7: Agriculture Land washed away by Alaknanda River in Chamoli District of Uttarakhand.

Table 4.17: Agricultural lands affected in the five districts[27]

Districts	Total Affected Crop Area (ha)	Total Silted Area (ha)	Total Area Washed Away
Bageshwar	6	7	5
Chamoli	445	314	205
Pithoragarh	364	173	190
Rudraprayag	1,040	450	650
Uttarkashi	155	-	155
Total	**2,010**	**944**	**1,206**

4.9.2 Horticulture

State of Uttarakhand is known for its horticultural crops, which primarily include fruits, vegetables, spices, medicinal, and aromatic plants. Out of a total 5.35 million hectares of geographical area, about 7,50,000 ha is under agriculture, of which horticulture accounts for 3,00,000 hectares. About 1,20,000 farmers are associated with the occupation and among these 88% are small and medium farmers. The total revenue of the horticulture sector is around Rs. 20,000 million per annum.

Various horticulture crops suffered damage over an area of about 15,537.30 ha. Most of the damage was reported to be of fruits, vegetable & spices, aromatic plants, medicinal plants, and tea cultivation. Potato and apple went waste and were rotten because transportation from the growing areas was not possible. Table 4.18 shows the damage to horticultural crops area in all the districts of Uttarakhand.

Table 4.18: Horticultural crops area damaged in all districts[28]

Category of horticultural crops	Area affected (ha)
Fruits	5,692.00
Vegetables & Spices	7,289.00
Aromatic Plants	2,518.00
Medicinal Plants	38.00
Tea cultivation	0.30
Total	**15,537.30**

In five worst affected districts, horticulture sector suffered a loss of Rs. 11,880 lakh. Loss of horticulture badly affected the livelihood of the farmers involved in these activities. Table 4.19 presents the impact on horticulture in the worst affected districts of Uttarakhand.

Table 4.19: Impact on Horticultural in five worst affected districts[29]

Districts	Total damage and losses (in million INR)
Bageshwar	12
Chamoli	264
Uttarkashi	486
Rudraprayag	174
Pithoragarh	252
Total	**1,188**

4.9.3 Livestock

Livestock rearing is an integral part of the farming system in the hills, supporting livelihoods of about 70% rural households partially or fully. Farmers are dependent on livestock for milk, meat, eggs, wool, skins, manure for fertilizer and for all agricultural operations in hills. Mules play an important role in the tourism sector for commuting people and transporting goods to the pilgrimage sites of Kedarnath, Yamunotri and Hemkund that are inaccessible by road. Table 4.20 gives the number of animals dead in the five worst affected districts.

Table 4.20: Number of dead animals in the five worst affected districts[30]

Districts	Cow	Buffalo	Bullock	Sheep/Goat	Poultry	Equines (Horses, Mules, Donkeys)	Other	Total
Bageshwar	4	3	3	440	-	3	1	454
Chamoli	12	26	23	743	-	128	-	932
Pithoragarh	290	61	94	3,459	-	234	88	4,226
Rudraprayag	19	57	24	2,741	300	1,160	-	4,301
Uttarkashi	34	21	9	1,063	-	7	-	1,134
Total	**359**	**168**	**153**	**8,446**	**300**	**1,532**	**89**	**11,047**

Floods and landslides had major impact on livestock in Uttarakhand. The total number of animals dead in the five worst affected districts reported as of 29 July 2013 account for 62% of the total animals dead in the State. Estimated value of the dead animals was about Rs. 144 million.

4.9.4 Fisheries

The fisheries resources of Uttarakhand consist of fishes naturally available or grown in fast flowing rivers and tributaries, high and low altitude natural lakes and ponds. Out of total 2,600 km stream, about 725 km is suitable for fish production. The area of natural lakes available for fishing in the State is about 297 ha. The fishery activities in Chamoli, Uttarkashi, Rudraprayag, Bageshwar and Pithoragarh districts were severely affected due to the disaster. Floods and landslides affected fish farms of both the Fisheries Department and of communities in the districts of Chamoli and Uttarkashi.

Table 4.21 gives the account of damage to fisheries sector in the five worst affected districts of the State.

Table 4.21: Damage to fisheries in the five worst affected districts[31]

Districts	No. of available ponds	No. of damaged ponds
Bageshwar	217	-
Chamoli	202	10
Pithoragarh	315	29
Rudraprayag	80	-
Uttarkashi	201	3
Total	**1,013**	**42**

4.9.5 Tourism Linked Livelihoods

Tourism is a major driver of economic growth and livelihood in Uttarakhand. Tourism contributes about 22.5% to the State Gross Domestic Product. Nearly 83,320 households from the most affected five districts were dependent on the tourism as a source of livelihood. This sector included small businesses like hotels and restaurants, petty traders, such as road side tea stalls and roadside eateries

(*dhabas*), fruit and vegetable vendors, handicraft vendors, taxi and bus drivers, palanquin bearers (*dandikathi*) who carry pilgrims and goods up the steep slopes of the *Dhams*.

Due to loss of livelihoods, particularly in tourism sector, forced migration is a concern now. As per the estimates, a large number of the petty traders, hotels and restaurants, bus and taxis operators lost their livelihoods[32]. The impact is expectedly worse on those petty traders who were already in debt. Hotels and restaurants have suffered huge damage to their assets, and many of them faced sizeable business losses.

In addition to huge damage to private tourism infrastructures, the government owned tourism infrastructure, which are in good number, also suffered due to the disaster. Damage to the government tourism infrastructure is presented in Table 4.22.

Table 4.22: District-wise damage to Government owned tourism infrastructures[33]

Districts	Destination Development/ Site and Services	Ghat Development	Night shelters	Misc.	Tourism Information/ Convenience Centre	Toilets Blocks/ Complexes	Tourist Rest Houses	Grand Total
	Nos	Nos	Nos	Nos	Nos	Nos	Nos	Nos
Bageshwar	1							1
Chamoli	1	2			4	7	6	20
Pithoragarh	1				1		5	7
Rudraprayag	3	1	4			10	9	27
Uttarkashi				1	2	7	16	26
Almora				2	1		3	6
Dehradun	2					2		4
Haridwar				1				1
Nainital						1	2	3
New Tehri	3	4				4	1	12
Pauri Garhwal		1	4	1		1		7
General				1				1
Total	**11**	**8**	**8**	**6**	**8**	**32**	**42**	**115**

4.10 Micro, Small and Medium Enterprises

Small-scale industries played a crucial role in economy of the Uttarakhand State. This sector employed about 0.442 million individuals. Most of the registered micro and small enterprises located in the State are largely engaged in the manufacture of food products, and in services i.e. hotels and restaurants, repair and maintenance services, agro-based activities, wool, silk, and artificial thread based clothes, ready-made garments and embroidery, wooden furniture, leather products, paper products, metal based fabrications, etc.

Out of total 42,340 registered micro, small and medium enterprises in the State, 10,171 were situated in the five worst affected districts employing about 20,000 people with an asset of total about Rs. 1,932 million. In addition to registered enterprises, there were about 60,000 unregistered enterprises as well. It is estimated that around 80% of them (including the unregistered units) have been adversely affected and have lost their stocks due to the disaster. In the five worst affected districts, about ten Government buildings owned by the *Khadi Gramodyog Board* and the Directorate of Industries are also damaged badly.

4.11 Energy Sector

The State's hydropower potential is estimated to be about 20,000 megawatts (MW). So far only 3,164 MW (16% of the estimated potential) has been tapped through 45 Hydro Electric Projects (HEPs) of varying capacities, implemented jointly by the State and Central government agencies and public and private sectors.

The flash flood disaster resulted in heavy damage to the on-going HEPs and the existing power distribution system in the State, which also includes Uttaranchal Jal Vidyut Nigam's 17 small hydro projects under operation and construction. Most of the access roads to these HEP sites were washed away. Major parts of the distribution systems, owned and operated by the Uttarakhand Power Corporation Limited (UPCL) in the flood-affected areas of Rudraprayag, Uttarkashi, Chamoli and Bageshwar were also damaged.

Figure 4.8: Devastated Vishnuprayag Hydro-power Project in Chamoli District of Uttarakhand

All the 33/11 KV substations, 33 KV lines, 11 KV lines, Low Tension (LT) lines & distribution substations were also damaged. The damaged distribution systems resulted in the disruption of power supply to about 3,758 villages. Besides these, one Solar Power Plant (at Kedarnath) was also damaged.

4.12 Forest Sector

Forests of Uttarakhand are socially and economically associated with the people and their livelihood in the hills. Thus, forests play important role in the general economy and development of the region.

The disaster resulted in landslides and other associated incidents leading to damage and loss of natural infrastructure, including forests and the associated Non Timber Forest Produces (NTFP), primarily characterized by firewood, thatch grass, fodder, local fruits, medicinal plants and other extractable forest resources. Such losses had great impact on the ability of people to manage their daily needs of cooking, heating and lighting. In the long term, livelihood of people dependent on these resources, particularly on the pilgrim circuit, is understood to be severely affected.

Some forest areas including tree cover, grasslands, and high altitude pastures were washed away and there were also intermittent losses to forest patches in the worst affected districts. As per the estimates, there was a loss of forest area of about 80 ha along river courses.

The preliminary damage to this physical infrastructure, as estimated by the State Forest Department is presented in Table 4.23. Almost 1,000 km of forest road (inside forests) and about 2,500 km of bridle paths are reported to be damaged. Several residential and office buildings / structures (about 200), log bridges, other temporary bridges and culverts (totalling about 76), soil and moisture conservation structures like check dams, retaining walls, gully plugs, river training works, etc. and nurseries (63 ha) and plantations (247 ha) were damaged[34].

Table 4.23: Damage to the Forest Infrastructure[35]

Districts	Residential Bldgs. (no.)	Non-Residential Bldgs. (no.)	Forest Motor Roads (km.)	Bridle	Bridge / paths (km.)	Nurseries Culverts (no.)	Plantations (Ha.)	Other Works (Soil & Water Conservation) (no.)
Bageshwar	-	-	-	2.00	-	-	7.00	-
Chamoli	24	12		434.40	5	17	4.00	209
Pithoragarh	5	-	18.93	77.01		-	9.50	-
Rudraprayag	18	0	5.15	229.50	3	0	-	4
Uttarkashi	35	10	93.00	1308.30	47	28	43.00	44
Almora	-	-	24.50	9.00	-	-	2.50	-
Champawat	-	-	28.00	121.00	-	-	-	
Dehradun	37	4	271.50	28.00	4	0	85.50	500
Haridwar	13	0	137.60	0	4	2	13.00	492
Nainital	0	0	150.00	0	0	0	-	0
Pauri	4	9	198.10	111.50	0	4	-	450
Tehri	12	15	26.00	223.90	12	12	83.00	88
U. S. Nagar	1	-	45.50	-	1	-	-	-
Total	**149**	**50**	**998.28**	**2,544.61**	**76**	**63**	**247.50**	**1,787**

Local people in the affected areas whose income was based on forest produce have lost their livelihood. Many people who were in the forest area got stuck because of damage to forest motor roads, bridle paths, and bridge culverts, caused by the flash flood.

4.13 Recovery and Reconstruction: Initiatives by the Uttarakhand Government.

The flood and associated disasters caused huge devastation to people and public property. There is a need of extensive and serious efforts by all sectors to facilitate

early recovery and reconstruction in the region. In this context, the Government of Uttarakhand has taken several important measures, as mentioned in the succeeding text[36].

- Ex-gratia payment of Rs. 5 Lakh to the families of deceased / missing persons.
- Ex-gratia payment of Rs. 2 Lakh to the disabled persons.
- Payment of Rs. 30 thousand to the injured persons.
- In addition to Rs. 2 Lakh each for the construction of 2,500 residential houses, grant of Rs. 5 lakh for rehabilitation. Thus, there is a grant of Rs. 7lakh for each house.
- Ex-gratia of Rs. 8 thousand per *nali* in case of damage of the land.
- Payment of Rs. 20 thousand per animal, in case of the death of milch animal such as cow/buffalo/heifer (young cow).
- Payment of Rs. 50 thousand for the loss of each horse/mule.
- The amount for the compensation for the damage of all types of animal sheds and studs has been sanctioned.
- Additional 60 percent relief amount has been provided as compensation for the damage of sugarcane harvest in natural disaster.
- Amount of Rs. 50 thousand to Rs. 1 lakh has been sanctioned to the motels and shops damaged in the disaster.
- Damaged hotels have been provided hundred percent help up to the damage of Rs. 2 lakh.
- In the disaster-affected areas, amount of Rs. 500 to each student upto class 12 and amount of Rs 1,000 to each student studying in higher technical institutes is paid.
- The Government is bearing the cost of nourishment of the orphaned children.

- The electricity bills and water charges of the disaster-affected families have been waived off up to year 2015.
- The instalments of loans borrowed by disaster-affected people from the co operative banks have been postponed for 2 years and the instalments of loans borrowed from nationalized banks have been postponed for 1 year.
- An amount of Rs. 3 thousand per month is being paid to the destitute people for affording house on rent.
- The Government has provided relief for the damage to property located on personal land, similarly, the relief for damage of personal /commercial properties located on Government land has also been sanctioned.
- Commercial units located on the way from Tilwada to Sri Kedarnath Dham have been given compensation amount based on their self-assessment from the Chief Minister Relief Fund and grant from Veer Chandra Singh Garhwali scheme.
- Decision for assistance of Rs. 10 thousand per damaged palanquin up to the damage of 10 palanquins.
- Amount of RS. 10 thousand for the workers bearing palanquins and walking with horses/mules and workers registered with distinct Panchyat of Rudraparyag.
- The owners of the vehicles swept/struck in the rivers at various places have been given the help of Rs.50 thousand and their drivers have been given help of Rs. 50 thousand and the conductors have been given the help of Rs.40 thousand.
- For the girls who lost their mother or father in the disaster, a Fixed Deposit (FD) of Rs.1 lakh has been maintained for their marriage which will be payable at the time of their marriage.
- Amount of Rs.35 crore has been sanctioned for more than 200 single rural water schemes.
- The process of the reconstruction of the water works damaged in the

disaster costing Rs. 216 crore has been initiated.

- Sanctioning of flood protection action worth Rs.879.50 crore.
- The process of construction/reconstruction of 6,553 km of rural and district roads has been initiated.
- The process of reconstruction of about 2,183 km state highways and major district roads has been initiated.
- The power supply of 4,350 villages/habitations out of 4,377village / habitations cut off during the disaster has been restored.
- The facility of biometric registration for the pilgrims has been initiated.
- Deployment of State Disaster Response Force (SDRF) on the way to Chardham Yatra for the convenience / security of the piligrims.
- Construction of 52 helipads on the way to Chardham Yatra for the immediate safe exit in case of disaster.

References

1, 3, 5, 6, 7, 8, 13 - Government of Uttarakhand , Department of Disaster Management and Rehabilitation report sent vide letter no. 99/DMMC/ XIV/183 (2014) dated 09 May 2014

2, 4, 9 to 12, 14 to 35 - JRDNA Report, 2013. India - Uttarakhand Disaster, June 2013 (82643). Joint Rapid Damage and Needs Assessment Report. Jointly submitted by Govt. of Uttarakhand, ADB and the World Bank, August, 2013. (http://www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/11/15/000333037_20131115110208/Rendered/PDF/826430WP0P146600Box379864B00PUBLIC0.pdf)

36. "Govt. Of Uttarakhand with you at the time of disaster, Dedicated attempts by the Govt. Of Uttarakhand towards Reconstruction...", Published by Department of Information and Public Administration, Govt. of Uttarakhand, E-new, Hindustan Times, 17 June 2014