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Uttarakhand Disaster: Lessons and way forward

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November 2014

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The paper is a part of a study on Impact Assessment of Disaster and Trends in Sustaining Recovery in Uttarakhand

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Abstract

Mountainous regions are susceptible to natural disasters and environmental degradation primarily because of their bio-physical attributes and fragility. Fragility occurs due to excessive use or exploitation of resources neglecting resource conservation, management and recycling. All this has an adverse impact on the land and forest resources that makes them economically unsustainable. Floods, landslides, earthquakes and forest fires are common natural hazards causing heavy loss of life, property and resources. Most of the hill states in India have witnessed numerous natural and manmade disasters that have had devastating impacts on the people of the region.

Uttarakhand state has a long history of frequent disasters, particularly landslides and earthquakes that have taken toll on life, infrastructure and property. Since the last century this part of the region has experienced recurrent disasters. The biggest flash flood in mid-June 2013, which has had colossal devastation of lives and property has taken toll of over 10,000 lives and caused heavy damage to property and this is a grim reminder of huge tragedy and structural devastation in the region due to insensitivity of the government while chalking out development trajectory for the region.

The paper analyses the impacts of disaster and points to the fact that lack of disaster preparedness and lacunae in the disaster management system have been vital factors behind the occurrence of disasters. The paper emphatically argues that disaster management never formed a part of development agenda in the state. There is, therefore, a need for incorporation of disaster management component in the development agenda within mountain development framework. The paper concludes by suggesting policy measures from short, medium and long term perspectives, which, if taken a note of, may significantly help in the disaster management of the State of Uttarakhand.

Uttarakhand Disaster: Lessons and way forward

I.C.Awasthi, G.S.Mehta, R.P.Mamgain[1]

I. Introduction

The mountain habitats share certain similar bio-climatic features and concerns across the world, be it Alps mountain regions of European countries or Andean mountain ranges in the South America (Venezuela, Columbia, Ecuador, Peru, Bolivia, Chile and Argentina) or Hindu Kush Himalayan (HKH) region countries in the South Asia (Afghanistan, Pakistan, India, China, Nepal, Bhutan, Bangladesh and Myanmar). These features and concerns relate primarily to the changing mountain environment due to degradation of resources as a consequence to their excessive use. This has caused reduction in biomass production, marginalisation and low human welfare. Many of these mountain regions are prone to natural hazards–landslides, earthquakes, avalanches, diseases etc. (Li Tianchi et al., 2001). Human conflict and wars have also concentrated in many of the poor regions (Libiszewski and Bachler, 1997) making life of the mountain people more vulnerable. The minority inhabitants in certain mountain regions suffered not only from the resources exploitation but also from ethnic conflict, violence and wars (Ives et al., 1997). But then, there are major differences between the mountain economies of the developed countries of Europe and that of Andean regions and HKH regions in respect of their development trajectories.

Mountain regions of European countries (Alps) had much similar situations during the 18th Century to what exists today in the mountain regions of Andean or HKH regions. These Alpine inhabitants, for instance, had witnessed high poverty, out-migration, malnutrition and even outright starvation during Little Ice Age (1500 to 1850 AD) (Ives, 1997). European mountain regions developed fast mainly because of their strong external linkages with the developed regions that were experiencing industrial revolution, thereby benefitting significantly from this strong linkage effect (Messerli and Ives, 1997). Development of transports – both navigation and railways – had facilitated long-distance trade. Large-scale out-migration helped in reducing the demographic pressure, and unlike most developing countries today, Europe at that time experienced faster growth of income than the population, thereby improving their standard of living. The potato, rail connectivity after the mid-19th Century and later mass tourism and large-scale winter sports helped these economies to transform rapidly (Ives, 1997). Industrialization in the Alps region has been closely related to the development of hydropower-based industries, and today, more than 50 per cent of the population of the region lives in urban areas. Tourism industry in Alps is most dynamic and competitive. Also, mountain-peasants in these countries receive large sum of subsidies from the governments and other institutions to meet up the limited incomes from mountain agriculture. Many countries (Austria, Switzerland, Germany, France, UK and Norway, for example) have some sort of institutional mechanisms and state protection in place with considerable political will to ameliorate the in-built inequalities in the mountain economies. The strong linkages with the economically growing areas have thus been the main driving force for development of these mountain economies; and it is argued that, further boost in linkages would have far-reaching positive impacts on these regions.

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Territory-specific approach and exact instruments have been clearly recognized for sustainable development of the Alps mountain region. As aptly described "… a territorial framework has been developed through the Alpine Convention in order to set up common approaches, transnational instruments and regional cooperation in the Alps beyond national borders" (Alpine Convention, 2011). European Union's macro-regional strategies are pioneering experiments in fostering greater territorial cohesion and European Parliament has adopted a resolution on a macro-regional strategy for the Alps in 2013, with a view to addressing the common challenges such as protection of the environment, investment in competitiveness and innovation, agriculture and forestry, water, energy, environmental and climate issues and transport (epthinktank.eu., 2013).

The other mountain regions have, by and large, embraced the development model that neglected the specific character of mountain regions which was entirely different than the plain regions. The main reasons behind disregarding the mountain perspectives are defined as "explicit or implicit consideration of specific mountain conditions and characteristics and their operational implications while conceiving, designing, implementing and assessing interventions in mountain areas" (Jodha et al., 1992). There are evidences of large infrastructural projects (dam and hydro-power projects, mineral exploration, for instance) coming up in the region particularly in HKH region disregarding the fragility and associated environmental hazards. Whenever mountain perspective is disregarded in development planning and execution of projects and programmes, it has severe implications on ecology, environment and livelihoods of people in the region. The frequent incidences of landslides, earthquakes, floods and its aftermath such as destruction of human and animal lives and loss of livelihoods is a testimony of the development trajectory underway in the HKH region.

After a brief discussion on the development trajectories around the mountain regions in the first section, the second section deals with Indian Himalayan states which have similar bio-physical attributes yet presents diversity in socio-economic aspects and have witnessed major disasters – mainly landslides and earthquakes – causing enormous loss of human and animal lives and devastation of property and infrastructure. The third section discusses the major disasters that have taken place in the state of Uttarakhand which include landslides, earthquakes and other kinds of disasters (forest fire, flash flood, cloud burst and drought). The fourth section analyzes the impacts of disasters and the last section suggests policy measures from short, medium and long term perspectives.

II. The Indian Himalayan Region: Diversities in Development Patterns

The Himalayan region in the country covers 11 states, namely, Jammu & Kashmir (J&K), Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya and Karbi Anglong and North Cachar districts of Assam.

Despite having similar bio-physical characteristics, the development patterns vary across the hill states in terms of various development indicators. Himachal Pradesh provides a notable example of the transformation process from a traditional cereal crop producing region to one of the leading horticulture producing regions. Himachal Pradesh has made considerable progress in terms of high literacy rates, almost universal enrolments at primary level, availability of schooling facilities, expansion of health care facilities and physical infrastructure. In several aspects, the state has become the role model for the other hill states of the country. Focused public interventions, greater participation of women, strong local institutions and political support are some of the helpful policy measures despite the state

having issues of concerns that need to be addressed. It has huge potential for hydro-power, tourism, and has excellent agro-climatic diversity for value adding agro-business. The state has formulated comprehensive framework for creating investor-friendly environment to ensure sustainable industrial development.

Jammu & Kashmir has the third lowest poverty ratio (after Himachal Pradesh and Nagaland) as compared to the other hill states and relatively better natural resource base, but it lags in industrial development. The social indicators, in particular, gender discrimination in education and infant mortality are still high. The state has immense potential for tourism and hydel power. It offers vast scope for horticulture production and has unique climate for cultivation of saffron. It also has suitable climatic condition for floriculture, aromatic and medicinal plants. But these resources have not been harnessed to the extent desired. There are also good potential in the state for promoting handicrafts and handlooms industry. However, strained Indo-Pak relations and continued insurgency in the state has been a major setback in the development goal of the state.

North East region has remained industrially the most backward region. Decadal population growth is still very high in majority of the states (Nagaland, Mizoram, Meghalaya, Arunachal Pradesh and Manipur) as compared to all-India average. Per capita income is lower than the national average. Poverty ratio in some states is very high and above the national average, particularly in Arunachal Pradesh (37.4%), Assam (40.9%) and Manipur (46.3%). North East region continues to be the net importer of food-grains. Bulk of the labour force is engaged in agriculture and allied activities with high unemployment rates, particularly among youth.

Uttarakhand has recorded remarkable economic growth and witnessed a faster decline of its poverty (17.8%) which is comparatively lower among all the hill states. Literacy rate has been impressive with relatively lower gender gap. Although there are good potentials for hydro-electricity, tourism & amenities, horticulture, wool processing, forest produce, yet these resources could not be explored due to lack of economic infrastructure and institutional support. Even, there are regions that are rich in petroleum and natural gas resources, which, if harnessed, may change the development path of the region. However, recent economic indicators show a much better performance in terms of sectoral growth and other development indicators in the state. Nonetheless, despite having the good resource base, the hill region lags far behind as compared to plain region in terms of various economic indicators.

At the outset, there are urgent needs for creating institution building capacity in order to spur development activities, keeping in mind the fragility and other associated hill specificities that make these Himalayan states vulnerable to various disasters.

Himalayas are the world's youngest mountain ranges and are susceptible to erosion and landslides, seismic activity, rainstorm and cloudbursts. Clearly, disasters are inevitable outcomes if the mountain perspective is neglected in the process of development. Few hill stations and pilgrimage centres are over-populated and have crossed the carrying capacity of such a big population pressure. These centres provide opportunities for livelihoods and employment and thereby attract a huge floating population to enter the labour markets. But, this has had adverse implications on the ecology and environment. Also, over the years rapid growth of population has been putting increasing pressure on the limited cultivable land necessitated by increasing demand for food. Growing demand for food crops led extension from the hitherto cultivated areas on to the marginal and forestland (Papola, 1996). One of the important features of mountain economies is fragility which is attached to the delicate economic system, resources and livelihood

patterns. Fragility occurs due to excessive use or exploitation of resources neglecting resource conservation, management and recycling. All this has had adverse impact on the land and forest resources making them economically unsustainable leading to environmental degradation. Floods, landslides, earthquakes and forest fires are common natural hazards resulting in heavy loss of life, property and resources in this region.

Majority of the hill states suffer from numerous natural and manmade disasters that have had devastating impacts causing deaths and destructions.

The main disasters witnessed in Himachal Pradesh are earthquakes, landslides, flash floods, snow storms, avalanches and draughts. However, the biggest threat to the state is the earthquake hazard that causes huge damage to both life and property. The state also suffers from landslides and floods during monsoon season due to torrential rains.

The most common disasters in J&K are earthquakes, floods, landslides, avalanches and snow storms. The Kashmir earthquake in 2005 and the Leh cloud burst in 2010 are rated as the worst disasters in recent times.

Northeastern states including Assam are prone to natural disasters like earthquake, floods, landslides, cyclone and occasional draught. The whole region falls in the ambit of one of the seismically most active regions of the world. The region witnesses heavy and prolonged rainfall that causes destabilization of hill slopes resulting in flash floods and large landslides. Huge infrastructure build-up (construction of roads, dams, etc.), deforestation and structural interventions on delicate natural systems are some of the major reasons for the frequent devastation. For instance, Sikkim witnessed most horrifying earthquakes in September 2011 that caused massive damage to the lives and property of the people. Over 100 people died, houses severely damaged, roads splintered in addition to huge losses to property. Landslide is yet another major natural hazard in the region that causes huge loss of life, agricultural and forest land in the state.

III. Disasters in Uttarakhand

Uttarakhand has a long history of frequent disasters, particularly landslides and earthquakes that have taken toll on lives, infrastructure and property. Since the last century it has experienced recurrent disasters. Some of the major disasters in the state are discussed below.

(i) Landslides

Uttarakhand is one of the most landslide prone zones in the world. Several studies have been conducted in the field of landslides by environmentalists, geographers, geologists, scholars at local, national and international levels. Valdiya (1985) defined the causes, consequences and solutions of accelerated erosion and landslides prone zones in the Himalayan region. Gupta and Joshi (1990) evolved a factor called Landslide Nominal Risk Factor (LNRF) index for hazard zoning of a part of Ramganga catchment using land use, lithology, distance from tectonic features and azimuth direction. Saha et al. (2002) showed an approach for Geographic Information System (GIS) based statistical landslide susceptibility zonation with a case study in Himalayas. Remote sensing and geographic information system were found to be very useful in the input database preparation, data integration and analysis stages. The coefficients of the predictor variable are estimated using binary logistic regression analysis and are used to calculate the landslide susceptibility for the entire study within a GIS environment (Mathew, Jha and Rawat, 2005).

Disasters due to earthquakes, cloud bursts, flash floods and heavy rains are chronic phenomena in Uttarakhand region that have had profound adverse implications on human and animal lives, losses of property and livelihoods. As a consequence, the state has faced heavy casualties and widespread damages to the houses, roads, buildings, forests, plantation, and agriculture fields. In recent years, the intensive construction activity has crossed the carrying capacity thereby destabilizing ecosystem of the already fragile region. This has been further aggravated by upcoming hydro-electric projects, large scale construction of dams, roads, tunnels, buildings, towers, ropeways, tanks and other public utility works, and above all, indiscriminate mining and quarrying activities that have disturbed the equilibrium of the hill region which was never witnessed earlier.

The worst kind of landslide occurred on 18th September, 1880 – the catastrophe of Sher ka Danda landslide in Nainital that killed 151 persons including 43 Europeans and Eurasians due to excessive rains (DMMC, 2011). In the decade of 1990s, four major landslides struck – first in 1990, second in 1998 and the third in 1999 that together killed over 460 people and caused extensive damage to property. Landslides occurred in the decade of 2000s, 2002 and 2009 are grim reminders of devastation which took the life of 72 people and wiped several villages and latter culminated in the worst ever disaster of June 2013 which has had colossal devastation of lives and property (Annexure-I). The 2013 disaster has ended over 10,000 lives and caused heavy damages to property, though official figures put the loss of lives far below the actual number. Preliminary assessment shows huge losses of different kinds indicating the enormity of challenge that needs to be met (Annexure-III). United Nations Disaster Management Team (UNDMT) has helped in assessing the initial damage in the disaster-affected districts and supported the district administration by preparing social sector plan and status of social sector recovery plan covering health, education, food security, livelihood and shelter; and coordinated the response and rehabilitation initiatives. These district reports have been useful in assessing the damage and recovery initiatives undertaken by the different stakeholders (http://dmmc.uk.gov.in/pages/display/57-reports-published).

(ii) Earthquakes

Earthquake is the most devastating disaster out of all the natural disasters because it is almost totally unpredictable and occurs without warning. The Himalayas are one of the most active seismic intercontinental regions where devastating earthquakes occur due to continued inter-continent collision between India and Asia. The earthquake technology was developed in India and at the international level mainly after the Koyna earthquake of 1967. In Himalayas some works on earthquakes have also been attempted by few scholars.

Much of the large scale earth movement is concentrated along faults, or breaks in the earth's crust, e.g., the Himalayan belt of Uttarakhand. When movement occurs suddenly along a fault, energy is released in the form of an earthquake. The northeastern part of the Uttarakhand Himalayas (Dharchula-Kapkot belt) and adjoining northwestern Nepal (Bajang) are frequently rocked by earthquakes of magnitudes between 5 and 6. The quantitative seismicity map of the Himalaya, Kalia and Narain (1976) shows that this part of the Himalaya has the highest seismicity anywhere in the Himalayan arc with a value of above 6.

Not only is the number of earthquakes higher but the depth of foci is also comparatively greater (33 to 60 km) in the Bajang-Dharchula area. The Bajang-Dharchula zone is cut by a number of transverse and oblique faults such as the one along the Gori River from Baram to Baikot and near Baluwakot in the Kali valley. It is significant that this

area lies along the line of the active Moradabad-Dataganj faults in the basement of the Ganga Basin which was the point of December 1966 earthquake, originating in Dharchula area, in which the townships of Moradabad and Pilibhit were severely affected. The occurrence of earthquakes is less frequent in the outer belt of the Himalaya. However, their magnitude is comparatively higher. In the whole of outer Himalayas the movement is mainly dip-slip. The seismicity of the Himalayan region is related also to the strike-slip movement along some of the transverse faults of these two litho-tectonic provinces (Valdiya, 1976).

All the districts of Uttarakhand lie in active seismic zone and almost every year the region faces earthquake in high or low magnitude scale. One major earthquake struck in the recorded history as far as back on 1st September, 1803 that killed hundreds of people. In the recent past, Uttarakhand faced two major earthquakes – the earthquake of 6.6 M at Pilang-Bhatwari (Uttarkashi-Chamoli) region in 20th October, 1991 and the earthquake of 6.8 M at Chamoli-Pipalkoti earthquake in 29th March, 1999 – resulting in more than 850 casualties, above 5,000 injuries, and damages of 68,000 houses and buildings. Near about three thousands villages were affected by the earthquake causing a massive destruction of infrastructure, agriculture and economy etc. (Annexure-II). As said earlier, the occurrence of earthquakes is less frequent in the outer belt of the Himalaya, though their magnitude is comparatively higher. In the whole of outer Himalaya the movement is mainly dip-slip.

(iii) Other disasters

Beside landslides, earthquake, forest fire, flash flood, cloud burst and drought, other disasters that occur in the region are avalanches, environmental degradation, wildfire, hailstorm, road accidents, industrial fire and chemical disasters etc.

The most common hazard in forests is forest fire. Forest fires are as old as the forests themselves. They pose threat not only to the forest wealth but also to the entire regime of flora and fauna, seriously disturbing the bio-diversity and ecology of the region. A very commendable study on the forest fire planning, management and principles of fire has been carried out by Shafi (1950). It stressed upon the role of forest in national economy and focused attention on the need for proper planning in forest utilization. Ballabh and Singh (1988) explained about people's participation in forest management through Vanpanchayat in Uttarakhand.

The principal reasons for occurrence of disaster in the Uttarakhand are unscrupulous and indiscriminate construction, illegal mining, long and huge tunnels, blasting and construction of numerous hydropower projects and dams and also crossing the carrying capacity of tourists in the pilgrimage centres. All these together have caused unsustainably of ecosystem in the region. It is estimated that in the past decade number of tourists have risen to over 155 per cent and construction of 200 big and small hydro power projects was planned. Adding to this, the state government has diverted 15,072 ha forest land for roads, irrigation, power transmission and hydel projects (Chakravartty and Paliwal, 2013). Recently, Supreme Court panel headed by Mr. Ravi Chopra has recommended that no new hydro projects should be started in the state till the cumulative impact assessment is done for the projects already developed or being developed on local ecology and environment (Hindustan Times, 2014). The other reasons for devastation in the state are attributed to gradual global warming and climate change that have been adversely affecting the ecosystem and thereby resulting in occurrence of disasters. Also, neglect or lack of compliance with environmental safeguards in infrastructural projects has escalated ecological disasters (Balasubramanian and Kumar, 2014).

IV. Impacts of Disasters

The Uttarakhand region has seen numerous disasters in the form of earthquakes, landslides, droughts, cloudbursts, floods etc. that have taken heavy toll on life, property, livelihoods and severely damaged the ecology of the region (Annexure I and II). The region is frequently visited by incessant rain that caused cloud burst and flash floods due to which the region is heavily fraught with landslides causing huge damage of property and human and animal lives (Arora and Anbalagan, 2010). Uttarakhand has witnessed over 1600 landslides in the recent past and some were major ones that occurred due to earthquakes, heavy rains, cloud bursts and flash flood leaving devastating impacts on the region which wiped out towns and villages, killed thousands of people, and destroyed numerous livestock and damaged infrastructure and property. Similarly, when earthquake rocked the region, hundreds of villages were affected by its devastating impacts on the people and communities. This had far reaching implications in terms of trauma and psychological disorder that the people had to undergo. People lost their sources of livelihoods and entitlements. The main sources of living i.e., land and animal husbandry were either completely or partially destroyed. The inaccessibility to some of the pockets of the regions, particularly in far flung areas, made the situation even worse and made people vulnerable and endangered.

The most affected sections are women, children, aged, handicapped and SCs/STs who lost their assets and livelihoods and live amidst uncertainty and livelihood insecurity. Those who lose their entitlements can hardly withstand or cope with the trauma and therefore become more vulnerable. Earthquakes and floods have volatile and sudden occurrence that cause large scale property and livestock losses which have profound bearing on socio-economic factors, institutions and structures (Parasuraman and Acharya, 2000). The psychological impacts are intense which are often neglected by relief agencies and psychological needs are rarely incorporated in disaster management plans (Pande et al., 2000). Mental health aspects of disasters are widely recognized and studied across the countries including India. Mental health care principles have been identified that needs interventions in different phases (Murthy, 2000).

There are cases where effective disaster reduction strategy employed through collective efforts of community and local government has successfully mitigated the crisis (Pilgrim, 1997). Similarly, stronger local participation in a decentralized framework (Yokohama Strategy of 1994) has numerous successful examples (viz., Germany, 1997; Bangladesh, 1970, 1997; Orissa, 1999, 2001) of tackling the natural disasters (Sahoo, undated). On the contrary, there are instances where lack of coordination in response to natural disasters such as governance structures, local capacities for response, funding, timeliness of coordination efforts, stakeholder partnerships, composition of the coordination mechanism and information management systems have had deep implications on the management of disaster efficiently (Chatterjee et al., 2010).

Although, institutional mechanism is in place for management of disasters from the national level to district and sub-district level, yet there are severe lacunae in the management of disasters in its holistic perspective. Disaster Management Act was enacted in 2005 and created the National Disaster Management Authority (NDMA) as a framework to provide for effective management and coordination of disaster response. Often, disaster mitigation elements are not incorporated into the development plans pursued at the national, state, district and local levels. Disaster management should not be seen as emergency measures but needs to be viewed as a regular phenomenon.

There are many instances where these natural disasters have not been handled adequately and administration was found ill-equipped to tackle the situation through effective mitigation and preparedness measures (Das, 2005; Joshi, 2014). Clearly, there are lessons to be learnt both from success and failures in order to make disaster management as an effective instrument of public policy.

V. The Way Forward

The framework of disaster typically involves four distinct stages namely, risk reduction, relief, early recovery, and recovery and reconstruction. Risk reduction entails risk assessment, prevention, preparedness and early warning. The relief measures primarily include life saving (search rescue, medical care and basic needs). Early recovery consists of basic facilities such as health and education and recovery and reconstruction comprises of infrastructure, livelihoods and other basic needs (Goyet, 2008).

It is also necessary to build information system on disasters in each phase that essentially should collect data at disaggregated levels. The data collection should primarily be aimed at better management of disaster and successful policy response. Technology plays an important role in forecasting, accessing and sharing information on disaster related data. Good institutional and community based organizations is often critical for mitigating disasters at different levels (Tolia, 2013). It is observed that even poor countries have successfully mitigated the affects of disaster deaths (severe cyclone of 2007 in Bangladesh, for example) while developed countries have failed to manage efficiently (Hurricane Katrina of 2005 in USA). It must also be obligatory to have monitoring and evaluation system in place to reduce the hiatus between intents and outcomes of disaster management.

Joint Rapid Damage Needs Assessment (JRDNA) was conducted in partnership with the Government of Uttarakhand and the Asian Development Bank, the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) that made assessment and provided sector-specific analysis with an effective recovery and reconstruction efforts in order to reduce risks. The assessment focused on 10 specific sectors – housing, public buildings, roads and bridges, urban and rural infrastructure, livelihoods, irrigation, tourism, energy, and environmental – enabling rapid and effective recovery efforts (www.worldbank.org/content/.../gfdrr-stories-of-impact-uttarakhand.pdf).

Disasters have profound bearings on human lives and the impacts of devastation due to disasters has been colossal in terms of human losses, losses of animals, livelihoods, property and all kinds of infrastructures including land and forests resources. Such kind of natures' fury brings insurmountable losses to the people and community that take long time to regain from the wrath of nature. But, it is argued that prevention is often possible and cost effective and effective prevention requires positive role of government and institutions (World Bank, 2010).

The performance of the state has been below satisfactory in tackling natural disasters and mitigating recurrences even after creating State Disaster Management Authority (SDMA) in 2007. The role of state has been severely criticized by Comptroller and Auditor General (CAG) of India in dealing with such disasters. The CAG report clearly brings out the fact in what follows, "The performance audit of Disaster Management revealed the State Government's lackadaisical approach towards implementation of important aspects of disaster prevention, mitigation and preparedness. The State Government had yet to frame the guidelines, policies and rules as envisaged in the

Disaster Management Act, 2005. Further, the State Disaster Management Authority was virtually non-functional since its inception in October 2007" (CAG, 2010). Disaster management never formed a part of development agenda in the state nor the disaster information system proved to be reliable and it remained highly inadequate. There is, therefore, a clear need for incorporation of disaster management component in the development agenda of the state.

Lack of disaster preparedness resulted in flash flood in mid-June, 2013 in the upper reaches of the state. The flash flood had primarily occurred due to unprecedented 72-hour rain across the Himalayas. The most terribly hit zone was Rudraprayag district (Kedarnath Valley) that saw the wreckage of Uttarakhand. As per official records, 5000 pilgrims and locals lost their lives. In addition, in many villages bridges, roads collapsed, houses crumpled, and huge agricultural land – over 20,000 hectares – got completely washed away. Losses of property and lives have been massive and estimated to be in billions (Planning Commission, 2014). The Statement from India Climate Justice demanded for an action plan which is most pertinent and timely for sustainable development of the region (Climate Justice, 2013).

The rehabilitation and reconstruction is the primary task of the state government with a view to bringing normalcy in the lives of people that requires a short, medium and long term strategy and action plan.

(i) Short-term Measures

Immediate relief such as evacuating people in safer places and providing necessary help in terms of food, water and medicine is critical for saving lives. In most cases it is experienced that delay in immediate relief resulted in huge loss of lives (human as well as animals) which could have otherwise been averted through immediate provision of relief. Large number of people has either lost their lives or went missing since June 2013. Disaster Mitigation and Management Center (DMMC), Uttarakhand has reported that "580 human lives were lost; over 5,400 people are still reported missing; 4,200 villages were affected; 9,200 cattle/livestock lost; and 3,220 houses were fully damaged (DMMC, 2013)".

Provision of immediate relief becomes challenging because occurrence of such a catastrophe does not forewarn nor do we have appropriate technological wherewithal to assess such disaster in advance. However, in the case of recent disaster in the state, India Meteorological Department had issued warning about the likely excessive rainfall in the affected areas but it was not taken seriously by the state administration. Delay in providing rescue and relief measures to the people as warranted by the disastrous situation is attributed to human factor that can be surmounted with efficient administrative set up and institutional mechanism. However, the hilly terrain and inaccessibility makes it somewhat difficult to reach instantaneously to the far-flung disaster affected locations. This inevitably leads to chalking out an action plan with all seriousness to evolve medium and long term strategy of development within the framework of mountain economy.

(ii) Medium-term Measures

The disaster causes enormous loss of livelihoods, entitlements and sources of income in the affected locations that make people threatened and vulnerable. The massive loss occurred along with devastation of infrastructure made people crippled and incapacitated for life.

a. Restoration of infrastructure

It is necessary to restore the infrastructure (houses, roads, culverts, bridges, irrigation channels, schools, health centres, community buildings, communication infrastructures, cultivable land etc.) on priority basis. Owing to hill specificities, infrastructure is the lifeline of the hill people and without rebuilding and restoring the infrastructure, making provision of livelihoods for the people will remain a distant dream. Therefore, restoration of infrastructure must remain an overriding priority in the medium term development strategy. It is extremely important to use technology and material that is compatible with the specific nature of hill region in view of its fragility. For instance, construction of eco-friendly and disaster-resistant housing and other infrastructures needs to be taken up without compromising with the bio-climatic specificities. Construction of green buildings to green roads by using cold mix technology, for instance, is an innovative experience in Assam. This technology is a very useful option to solve the problems of road connectivity in view of heavy rainfall that often puts impediment in the construction and maintenance of roads (Papola, 2014).

b. Provision of livelihood

Uttarakhand hill region is characterised by subsistence agriculture where cultivation is done on terraced type fields which has obvious limitations to expand its land-based activities. Hill agriculture is an integrated activity that combines with animal husbandry and land & forest resources. In the last catastrophe, huge cultivable lands have washed away and enormous loss of animals has made the livelihoods options sparse. Immense loss of other livelihood options in which people were engaged in, such as household and tiny-enterprises, small shops, roadside restaurants (dhabas), jajmani occupations, have left people helpless and fragile. In particular, on Kedarnath-Badrinath yatra route the devastation was indeed massive. Thousands of people lost their livelihoods who were solely dependent on service related occupations (performing ceremonies and rituals), operating small restaurants (dhabas), lodges, motor transport, animal transport (ponies, horses) and palanquin on their shoulders for carrying people. It is unlikely to restore the huge livelihood losses in the short run in view of colossal devastation occurred that will take long time to bring back normalcy. So, it becomes important to restore and generate livelihoods in agriculture and non-agriculture sector in the medium run. When cultivable lands are washed away and cattle are dead then it becomes extremely difficult to restore cultivation and animal husbandry related activities in the short run. An effective medium term strategy is needed to initiate such activities through bringing more land under cultivation; if available in the original locations or by relocating the people in other areas where such land is available that could be brought under cultivation.

(iii) Long-term Measures

Huge damage caused by the disaster has profound adverse impacts on social and economic infrastructure that is critical for revival of agriculture, industry and services. The route to reviving the economic activities is often guided by usual development strategy neglecting the regional specificities (Papola, 2014, Chopra, 2013). Long term measures essentially looks into the mountain development framework for sustainable development that harmonizes the environment with that of social and economic development. The main reason behind this is disregarding the mountain perspectives which have been defined as “explicit or implicit consideration of specific mountain conditions and characteristics and their operational implications while conceiving, designing, implementing and assessing interventions in mountain areas” (Jodha et al., 1992).

Planning Commission has eloquently recognized that "the Himalayan region has a very fragile geomorphology and provides valuable ecosystem services to the nation in general and to the people living in Indo-Gangetic Plain in particular. Therefore, sustainable development ought to be central to developmental activities in this region. This is essential to maintain a balance between environment and economic development while striving for faster and inclusive growth, as also emphasized in Twelfth Plan document" (Planning Commission, 2013). Despite the clear recognition of symbiotic relationship between environment and development, the region suffers from ill effects of so-called indiscriminate development activities causing enormous loss to the region.

a. Utilization and management of natural resources

The state is supposed to have an advantage in terms of hydro-electricity, forest resources, horticulture, tourism & amenities and other hill-specific products (such as fruits, vegetables, flowers, medicinal plants, seeds etc.). However, many of these activities could not be developed primarily due to lack of appropriate development strategy. It is commonly observed that there has been unscrupulous exploitation of forests, mining and water resources that has had serious implications on ecology and environment. Government policies, large development projects and commercial interests implemented without taking into account the environmental aspects, have also added to environmental degradation. All these factors have serious repercussions on the sustainability of environment as well as on the livelihood of the mountain population.

All this is leading to various kinds of disasters in the state in the form of landslides, earthquake, flash flood, cloud burst and drought etc. which are directly related to environmental disturbances that have strong influences on human lives. It is therefore argued that resources should be optimally managed by the community itself taking into consideration the conservation, management and recycling aspects so as to lead a sustainable development and management of resource use and activities, even though with low productivity and low pay-offs. There is a need for capacity building of community and local bodies of governance with strong institutional foundation for utilization, conservation and regeneration of resources. Alongside, suitable environment monitoring mechanism needs to be developed and implemented regularly for every project and programme.

b. Environment friendly infrastructural build up

There are evidences of large infrastructural projects (dam and hydro-power projects, mineral exploration, for instance) coming up in the region disregarding the fragility and associated environmental hazards. Also, owing to lack of linkages (ancillary activities) in such projects, most of the benefits (water, irrigation facilities, power etc.) have flown to the lowland areas without making major improvements in highland agriculture and other non-agricultural activities. Timber being the most important forest produce from the point of view of commercial purposes, cutting of trees by the unscrupulous traders and contractors or even by the government agencies has taken a heavy toll on forest resources. Upstream damage as a result of reckless deforestation severely affected the downstream habitats as well (e.g., floods). Recurrent disasters like flash floods, landslides, cloud burst and excessive rainfall, earthquakes, forest fires and other hazards have been increasing in the mountain regions. Large-scale unplanned construction activities have serious environmental consequences owing to lack of understanding of mountain specific construction approaches. Government policies, large development projects and commercial interests implemented without taking into account the environmental aspects, have also added to environmental degradation (Chopra, 2014). All these

factors have serious repercussions on the sustainability of environment and on the livelihood of hill population. The interaction between economic growth and natural environment that supports it lies at the core of sustainable development (Papola, 2014).

As argued in earlier section, infrastructure should be built keeping in view the ecological complexity of the hill region such as green buildings to green roads, disaster resistant housing and development of environmentally sensitive hydro and other major projects. Environment clearance in terms of its implications must be made mandatory for every project in order to ward off adverse impacts on ecology and biodiversity.

c. Agro-climatic suitability for industrial activities

There are numerous opportunities for development, particularly in the niche segments where the state has comparative advantages and agro-climatic suitability (viz., tourism, power generation, and cultivation of horticultural, medicinal plants and herbs, etc.). Enterprise-based activities are critical for sustainable employment generation and enhancement of income levels which in turn can help improving the living standard of the people. Factors such as typical hill specificities (inaccessibility, fragility and marginality), limited and thinly spread resource base, lack of infrastructural facilities, distant markets, low entrepreneurial base, and lack of appropriate policy support severely constrict enterprise-based activities, particularly in the hilly region. Also, ecological and environmental considerations act as major limitations in the way of large-scale enterprise development. As a result, entrepreneurial activity is mostly concentrated in the plane districts, which do not have such handicaps that are usually associated with the hilly region.

In the context of hill region, enterprise-based activity can take different forms – diversification from cereal-based products to high value horticultural products to simple processing, and other enterprise-based activities such as livestock, forest (non-timber), artisan and tourism & amenities services to pollution-free and precision-based enterprises (e.g. electronics).

Such a strategy for hill development, accommodating the hill perspective, will go a long way for sustainable development that will protect not only against reduction in biomass production and occurrence of natural disasters but also guard against marginalization and low human welfare.

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Annexure-I

Some Major Landslides in Uttarakhand

Year	Area	Triggered cause	Community related damage
8th Sept., 1803	Srinagar, Pauri Garhwal	Earthquake	Wiped out the whole Srinagar town.
1857	Mandakini river	Cloud burst	Blocked the flow of the river.
1868	Birahi ganga, Chamoli.	Slope failure, flash flood	Blocked the Birahi river. It made an artificial lake. Suddenly lake burst and flood claimed the lives of 75 people.
19th Sept., 1880	Sher-kaDanda, Nainital	Rainfall	151 killed; out of them 42 were Europeans.
6th Sept.,1893	Birahi Ganga, Chamoli	Rainfall	Blocked the Birahi river and an artificial lake, 'Gauna Tal' was formed.
7th Aug., 1898	Balia, Nainital	Rainfall	29 killed in Kailakhan.
20th July, 1970	Belakuchi, Alaknanda river	Flash flood	55 people killed, 142 animals perished, 101 village affected.
14th Aug., 1977	Tawaghat, Pithoragarh	Rainfall	44 people including 25 soldiers killed.
14th Aug., 1978	Rikhari, Bageshwar	-	4 people killed.
6th Aug., 1978	Bhagirathi, Gangnani	Flash flood	25 people were killed.
1979	Khela, Dharchula	Rainfall	Destroyed area near Tawaghat.
1979	Kontha village Chamoli	-	50 residents killed.
23rd June, 1980	Gyansu, Uttarkashi	Flash flood	45 people dead.
9 Sept., 1980	Kanodia gad, Uttarkashi		15 government officials died.
1983	Kurmi, Bageshwar	Cloud burst	37 people killed.
1984	Jagthana-Kanyalikot Bageshwar	Flash flood	9 people killed.
1986	Jakholi, Tehri Garhwal	-	32 people killed.
1990	Mahadev, Rishikesh.	-	100 pilgrims died.
16th Aug., 1991	Deor-khadura-Paduli-Koj-Pepalkoti	Rainfall	29 people killed.
17th July, 1996	Raintoli village in Pithoragarh	Cloud burst	18 people lost life and 20 were severely injured.
11th Aug., 1998	Ukhimath-Rudraprayag	Cloud burst	109 people were killed.
17th Aug., 1998	Malpa, Pithoragarh	Rainfall	207 persons died including 60 pilgrims, 10 houses badly affected.
29th March,1999	Chamoli	Earthquake	Numerous small landslides in the region.
20th Oct., 1999	Uttarkashi	Earthquake	47 landslides, more than 100 people died and extensive damage to property.

27th July, 2001	Khetgaon, Pithoragarh	Cloud burst	5 people killed.
16th July, 2001	Phata-Byung gad	Cloud burst	21 persons died & several houses damaged.
2001	Gohna	-	Seven persons dead.
10th Aug., 2002	Balganga, Tehri Garhwal	Cloud burst	29 people died.
12th July, 2002	Khetgaon, Pithoragarh	Flash flood	5 members of a family died.
8th Aug., 2002	Bhatwari-Dunda, Uttarkashi	-	Five people and 26 cattle died together.
7-9th July, 2003	Didihat, Pithoragarh	Rainfall	4 people killed and 10 animals perished.
2003	Gadoli, Almora	Rainfall	4 people killed.
21-24th Aug., 2003	Varunavat, Uttarkashi	Rainfall	Numerous buildings, hotels and offices and 3,000 people were affected.
23th Sept., 2004	Amaparav, Nainital	Rainfall	3 people killed.
2004	Sundardhunga, Bageshwar	Avalanches	5 people killed while trekking in the mountains.
2004	Lambagar chatti, Chamoli	Cloud burst	7 killed and another 9 went missing.
2004	Kalindi, Uttarkashi	Rainfall	6 people killed.
2005	Govindghat, Chamoli	Cloud burst	11 people killed & heavy damage occurred to property.
2005	Agastyamuni, Rudraprayag	-	4 people killed.
2007	Baram, Pithoragarh	Rainfall	15 fatality and loss of livestock.
8th Aug., 2009	Jhakhla-Lah, Pithoragarh	Cloud burst	Wiped out two villages namely Jhakhla-Lah, claiming 43 lives.
19th Sept., 2010	Bari- Devli, Almora	Cloud burst	18 people killed.
2011	Different areas of Uttarakhand	Rainfall	15 people killed.
5th July, 2012	Chamoli	Cloud burst	1 woman died and four people injured.
4th Aug., 2012	Gangori, Uttarakashi flash flood	Heavy rainfall,	34 people were killed including three jawans of fire services.
14th to 17th June,	Different parts of	Heavy rainfall,	13 district, 1603 villages were affected,
2013. Total 1604 landslides	Uttarakhand (including Kedarnath)	cloud burst, flash flood	estimated 70,000 pilgrims and tourists stranded, number of fatalities is close to 5000 (Officials number), 4700 people went missing, heavy damage to roads, bridges, houses, schools, administrative buildings, health centers etc.

Sources: Indo Asian News Service, The Times of India, Hindustan Times, Amar Ujala, The Indian Express, National Remote Sensing Centre, National Institute of Disaster Management

Annexure-II

Some Major Earthquakes in Uttarakhand

Year	Area	Magnitude	Community related damage
01st Sept., 1803	Kumaun-Garhwal	M>7.0	200-300 people were killed and several villages were buried under landslides and rock falls.
26th May, 1816	Gangotri	Ms 6.5	Affected the areas surrounding Badrinath peak.
16th June, 1902	Pokhra-Kainur	Mw 6.0	Affected whole south-east of Pauri.
13th June, 1906	Gangotri	Mw 6.1	Affected the areas surrounding Badrinath peak.
27th July, 1926	Near Changabang Peak	Mw 6.5	N.A.
04th June, 1945	Near Nanda Devi Peak	Mw 6.5	N.A.
28th Dec., 1958	Rameshwar-Devi Dhura	Mw 6.1	N.A.
27th June, 1966	Athpali-Dhung	Mw 6.2	N.A.
29th July, 1980	Bajhang-Ghoghda, Nepal	Mw 6.5	13 persons were killed in Pithoragarh and 40 were injured.
20th Oct., 1991	Pilang-Bhatwari, Uttarkashi district	Mw 6.6	768 people were killed, 5,000 injured and 18,000 buildings were destroyed in Uttarkashi-Chamoli region.
05th Jan., 1997	Dharchula, Pithoragarh	Mw 5.6	Window panes were broken and many people ran outdoors in panic.
29th Mar., 1999	Chamoli-Pipalkoti	Mw 6.8	115 people killed, 50,000 houses were damaged. Over 2000 villages were affected by the earthquake.
30th Mar., 1999	Chamoli-Pipalkoti	Ml 4.9	50 people were injured, 24 houses c ollapsed while 96 developed cracks.
31th Mar., 1999	Chamoli-Pipalkoti	Mb 3.0	1 person was killed and several injured when a house collapsed at Hat Pipalkot in Chamoli.
27th May, 2003	Bangina region	Mb 5.0	A moderate earthquake struck the Garhwal.
08 Oct., 2005	Kashmir-Kohistan, Pakistan-India	Mw 7.6	10 people died in north India (including 1 person in the Dehradun).
14th Dec., 2005	Pokhri-Gopeshwar	Mb 5.0	Minor damage to property.
05th Aug., 2006	Thal, Pithoragarh	Mb 4.4	A light earthquake struck at the Nepal-India border; caused damage to property in parts of eastern Uttarakhand.
22th July, 2007	Surka Ridge, Yamunotri region in Uttarkashi district	Mb 5.0	A moderate earthquake struck at the Yamunotri region in Uttarkashi, few injuries and minor damage to property recorded.
23th June, 2010	Ranchan Dhura, NW of Dharchula, Pithoragarh	Mb 5.1	Mild earthquake in Uttarakhand recorded, no damage reported.

Sources: Amateur Seismic Centre (Uttarakhand), Daily News, Zee News, *The Times of India, Hindustan Times, Amar Ujala*
N.A.: Not applicable

Annexure-III

Preliminary Assessment of Disaster Damage in 2013

Sl. No.	Nature of damage	Number
1.	Persons affected	5 lakhs (approx)
2.	Villages affected	4,200
3.	Villages severely affected	over 300
4.	Persons injured	4,463
5.	Persons dead	over 900
6.	Persons missing	5,748
7.	Pukka houses damaged	2,679
8.	Kuccha houses damaged	681
9.	Animals lost	8,716
10.	Roads destroyed	2,302
11.	Bridges washed away	145
12.	Drinking water schemes damaged	1,418
13.	Villages without power	3,758

Source: Chopra (2014), p.14.