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Disaster Management–Uttarakhand Floods in India a Case Study

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Abstract—*The developing world will continue to be hardest hit by the cascading effects of human–driven climate change, environmental degradation, and population pressures. India has been traditionally vulnerable to natural disaster on account of its geo-climatic conditions, floods, droughts, cyclones, earthquakes, and landslides have been a recurrent phenomena. Uttarakhand has been notable for aplethora of such disasters in recent decades, including floods and landslides in almost every monsoon season. Early arrival of the annual monsoon that accelerated snow melting, produced higher than normal rainfall and the cloudburst, caused the collapse of the banks that retained the waters of Chorabari Lake, The loss in terms of private, community and public assets has been astronomical. There has been considerable concern over natural disaster. Although substantial scientific and material progress is made, the loss of life and property due to disaster has not decreased. In fact human toll and economic losses have mounted. India has adopted mitigation and prevention as essential components of their development strategies. The need is to build up capabilities to meet the challenges of disasters*

Keywords: *Disaster, Management, Mitigation, Rehabilitation, Prevention, Relief*

1. INTRODUCTION

Uttarakhand is a land of religious pilgrimage. The Ganges River, India's most sacred, forms where the Alaknanda and Bhagirathi rivers tumble off the snowy peaks of the Himalayas and meet in Devaprayag, 35 kilometers downriver from Srinagar, a university and tourist city of 150,000 residents. Upriver, at elevations that are snow-covered and frozen most of the year, are the 1,000-year-old Badrinath and Kedarnath temples. They are situated in the headwater floodplains of the Alaknanda and Mandakini rivers. Tens of thousands of people were in the Mandakini flood plain at the height of the annual pilgrimage to Kedarnath temple. The hotels and shops in the villages leading up to the shrine were filled with Hindu pilgrims. Pilgrims also jammed Rambara, and the long footpath from that Mandakini River town to Kedarnath. In addition, some 7,000 to 10,000 workers were in the area carrying pilgrims to the shrine on their mules, serving in the restaurants and hotels, working in the hundreds of religious stalls along the way. Sonprayag, a tourist village just downstream from the Kedarnath shrine, was swept nearly clean away by floodwaters and boulders. The Himalayas are still forming, still rising — producing one of the most active earthquake zones in the world. The fierce drenching from annual summer monsoons erupt in regular flash floods that undermine the soils of vertical slopes, cause monstrous landslides, and episodically lay waste to big stretches of the region's serpentine one-way-in, one-way-out highways,and dozens of people drown, are buried, or swept away by floods in India's Himalayan states. , according to the Wadia Institute for Himalayan Geology and other scientific agencies,first was the early arrival of the annual monsoon that accelerated snow melting, produced higher than normal rainfall, and then unleashed a cloudburst that dumped at least 300 millimeters (12 inches) of rain on June 16 on the Himalayan ridges that fed the Alaknanda and Bhagirathi river basins. The second event, a direct result of the cloudburst, was the collapse of the banks that retained the waters of Chorabari Lake, a glacial lake fed by rain and snowmelt that was located at 3,960 meters (13,000 feet) and two kilometers (1.2 miles) upsteam of Kedarnath, in the Mandakini River floodplain. Chorabari Lake, 400 meters long by 200 meters wide and up to 20 meters deep (1,300 feet long, 660 feet wide and 60 feet deep) released all of its water in 10 minutes, floodwaters tore down the steep valleys, bounded out of the river channels, and lashed at everything in their path. Kedarnath, Rambara, Gaurikund, much of Sonprayag, and other villages disappeared under the deluge of water, boulders and mud. The rivers clawed at the banks and bluffs, causing over 100 landslides that brought down or damaged more than 1,000 kilometers of highways and caused an unknown number of hotels, homes, shops, and government buildings to fall into the torrent. The Indian Army and emergency and rescue crews transported tens of thousands of stranded people to safety, many by helicopter. Under rolling masses of clouds, it was dangerous work. A joint study by the World Bank and the Asian Development Bank estimated that damage to public infrastructure — roads, water transport, buildings — amounted to nearly $700 million. There has been

no formal estimate of the financial damage to the state's hydropower projects. On June 16 and June 17, 2013 the mountains unleashed two days of monstrous floods that killed about 6,000 people, according to estimates from the Uttarakhand government. Survivors and researchers at the Wadia Institute for Himalayan Geology put the death toll at 30,000. Some 800 battered bodies were recovered and 5,200 others were declared missing. The need to build up capabilities to meet the challenges of disasters

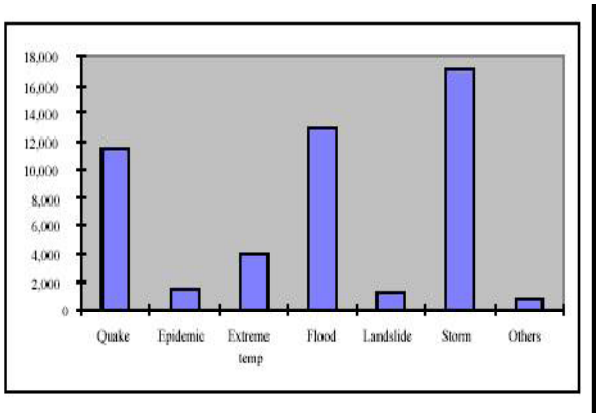

Fig. 1: Mortality due to natural hazards (1990-2000)[2]

Causes of floods:

The recent floods of Uttarakhand are a combination of both natural and manmade causes.

(i)Natural causes:

The floods were essentially caused by heavy rainfall in Uttarakhand with the monsoon having entered the state about a fortnight earlier than usual, that may have accentuated the floods. The early onset of monsoon caught people unawares hence causing significant damage to life and property.High rainfall magnitudes are not very rare in Uttarakhand. The rainfall events before and during the above floods occurred widely over the catchments of Alaknanda, Bhagirathi and other rivers, thereby sending high runoff into these rivers .In the present case, however, the monsoons entered the State with a bang, rains caused landslides/landslips due to unstable slopes and loose rocks/boulders, which tend to (partially) block the stream paths; and when these blockages get blown away, the dammed up water disgorges with high flood peaks. Thus, whereas in previous years minor landslides would occur at the start of monsoon, and their blockages get dismantled before the onset of heavy rains, in the present case both minor and major landslides would have occurred simultaneously in mid-June, thereby producing dam-burst like floods.[3]

(ii)Man made Causes:

Local anthropogenic factors were certainly a crucial reason for the devastating flood peaks. A large number of commentaries have highlighted several factors of significance - rampant deforestation, slope cutting, blasting of rocks, haphazard disposal of debris, and riverbank constructions. These activities invariably tend to enhance landslides (through weakened rock structures and soil stabilities), increase the runoff rates, and/or disrupt river flows. Such activities are largely related to extensive and growing pilgrimage and tourism in the State. But the increasing number of dams (and barrages) in the region is also considered by many to be a key factor. In our opinion dams do have significant adverse effects on river health, but they do not cause or accentuate floods by their mere existence (except when floodgates are operated irresponsibly). The conventional manner of constructing dams–involving rock blasting, careless disposal of debris, deforestation, etc.–may be major factors that promoted the high flood waves in Uttarakhand, but not the dams themselves. In fact, dams may actually provide safety against floods, the Managing Director of Uttarakhand Jal Vidyut Nigam Limited had in fact pointed out that Tehri Dam had actually absorbed the flood wave of Bhagirathi river on June 16th, thereby preventing downstream flood damage Floodwaters tore down the steep valleys, bounded out of the river channels, and lashed at everything in their path.[3] Kedarnath, Rambara, Gaurikund, much of Sonprayag, and other villages disappeared under the deluge of water, boulders and mud. The rivers clawed at the banks and bluffs, causing over 100 landslides that brought down or damaged more than 1,000 kilometers of highways and caused an unknown number of hotels, homes, shops, and government buildings to fall into the torrent. On June 16 and June 17, 2013 the mountains unleashed two days of monstrous floods that killed about 6,000 people, according to estimates from the Uttarakhand government. Survivors and researchers at the Wadia Institute for Himalayan Geology put the death toll at 30,000. Some 800 battered bodies were recovered and 5,200 others were declared missing. India's Supreme Court reached essentially the same conclusion. August 13, eight weeks after the flood, two Supreme Court judges, ruling in a case involving the 330-megawatt Alaknanda Hydro Power Project, issued an order that indefinitely prohibited the Central and state governments from granting any more permits for hydroelectric projects in Uttarakhand. The order essentially shut down new hydropower development in India's 27th state.

"We are very much concerned about the mushrooming of a large number of hydroelectric projects in Uttarakhand and its impact on the Alaknanda and Bhagirathi river basins," wrote Justices K.S. Radhakrishnan and Dipak Misra. "Various studies also indicate that in the upper Ganga area, there are large and small hydropower projects. The cumulative impact of those project components like dams, tunnels, blasting, muck disposal, mining, deforestation, etc. on the ecosystem has yet

to be scientifically examined." The Supreme Court's intervention also came with a directive to the Ministry of Environment and Forests, the principal regulatory agency, to form a special commission to study the safety and merits of continuing with constructing dams in India's most important hydropower state. "The Uttarakhand disaster has shown how operating and under construction hydropower projects can increase the vulnerability of the already disaster-vulnerable area," said Himanshu Thakkar, coordinator of the South Asia Network on Dams, Rivers and People. "That hydropower projects are not clean, green, cheap and renewable source of energy was known to any discerning observer. The disaster has only strengthened that case. It has shown how much more careful we need to be before taking up any more such projects. If we do not learn these lessons, the price is going to keep climbing. These lessons, incidentally, are valid across the Himalayas, not just for Uttarakhand."

Destruction by floods:

Along with the operational hydropower projects damaged by the 2013 flood, a number of big projects under construction were bullied by the furious waters, some so badly they may never be built.

The 520-megawatt Tapovan-Vishnugad dam, under construction on an Alaknanda River tributary and seriously damaged last year by a flash flood, was hit again. The tunnel carrying water to the powerhouse, finished in April 2013, was washed away in June, according to a report in a hydropower trade magazine.

Just upriver, the 171-megawatt Lata Tapovan project, under construction and approaching its 2017 opening, was overrun by floodwaters that damaged concrete work and forced at least a year-long delay in its commissioning. The delay could grow longer because the highway network is so broken and unstable it is unsafe to transport heavy equipment that is needed for repairs.

Both of the Maneri Bhali projects on the Bhagirathi River were damaged. The 25-year-old Maneri I dam, with a 99-megwatt generating capacity, and the 304-megawatt dam that opened in 2008, were hit hard enough for walls to collapse.

Heavy rains also affected dams in other regions of Uttarakhand including the Banbasa project on the Sarda River in eastern Uttrakhand near Nepal. Half a million people in Uttar Pradesh also were driven from their homes by the flood. Sonprayag, a tourist village just downstream from the Kedarnath shrine, was swept nearly clean away by flood waters and boulders. More than 500 cars were carried into the Mandakini River. At least 25 people who were hiking down from Kedarnath and crossing a hillside just upriver were buried when it slipped into the river.[3] The floods on June 16 and 17 tore through Kedarnath, a sacred Hindu site high in the Himalayas. Hundreds of buiidngs in the Mandakini River floodplain were washed away. The Kedarnath temple survived, guarded by a big trailer-size boulder that washed down the mountain and lodged in front, directing flood waters and boulders around the 1,200-year-old shrine.[3] More than 5,000 buildings were seriously damaged or destroyed by the Uttarakhand flood on June 16 and 17, 2014[3]

Image from http://www.google.com

Global Confrontation Over Water and Energy:

Intense national programs designed to meet growing global demand for energy are creating a number of mammoth and dangerous energy production zones. As Circle of Blue and the Wilson Center have reported since 2010 in our Global Choke Point Project, tapping those zones yields urgent contests over fresh water supplies, environmental and economic security, and public safety.

India is a player in the swirl of these new global energy, water, and food trends. Last year, in our first reports from the Choke Point: India project, Circle of Blue described how India's policy of providing free energy and water to farmers produced massive grain surpluses that rot in storage facilities in the northwest Punjab region. Meanwhile, so much energy is wasted moving water with electric pumps that the country is unable to mine enough coal in its eastern states, causing fuel shortages in thermal electrical power industry. Uttarakhand emerged as the most important state for new dams and power stations. In 2005 and 2006, three big hydropower facilities opened, with generating capacity of 1,680 megawatts, or more than a fifth of the country's new hydro capacity. The size of the projects, the extent of land needed for water storage, the numbers of people to be moved, along with the considerable harm to fisheries and local ecology, generated a fierce civic opposition movement, particularly in Uttarakhand and in Arunachal Pradesh. Flash floods wrecked construction schedules and added costs. Landslides buried equipment. It has taken years for engineers and designers to fully understand and deal with the exceptionally high concentrations of mud, silt, and grit carried by Himalayan rivers. The load of ragged-edged grains of quartz and feldspar constantly overwhelm settling basins, and chew up pipes and turbines.

In 1996, a report on the Himalaya's changing ecology by the Center for Science and Environment, the New Delhi-based research group, said: "The Himalayan mountains constitute an ecological system naturally primed for disaster. The deep gorges through which the Himalayan rivers flow convey the impression that the Himalayan valleys would never face floods. Yet these very channels often fail to contain the fury of disastrous floods. Among the most affected valleys are the Alaknanda and Bhagirathi valleys of the Garhwal Himalaya."[3]

Uttarakhand also is the site of India's most aggressive plan for future hydropower development. Five other big dams and 35 projects fewer than 25 megawatts each are under construction. If completed, they'll add 1,866 megawatts of capacity from large dams, and 180 megawatts from small projects. Moreover, India's newest Five-Year plan (2012 – 2017) for energy development urges Uttarakhand to build 24 more big dams by 2017 to generate 6,858 megawatts of electricity[3]

Weakness in disaster management:

Pre-disaster Preparedness:. There was not planned information system as to what needs to be done when faced with calamity. Floods are frequent in uttrakhand there should be a plan in place to tackle the disaster and reduce its impact. On the contrary, people are caught unaware again and again. Official could not visit people before disaster to warn but after floods large number of officials visit the affected people with food, tents, medicine, cloths and compensation funding to the relatives of the dead. At the same time when warning had been given could not been taken seriously. "The Uttarakhand disaster has shown how operating and under construction hydropower projects can increase the vulnerability of the already disaster-vulnerable area," said Himanshu Thakkar, coordinator of the South Asia Network on Dams, Rivers and People. "That hydropower projects are not clean, green, cheap and renewable source of energy was known to any discerning observer. The disaster has only strengthened that case. It has shown how much more careful we need to be before taking up any more such projects. If we do not learn these lessons, the price is going to keep climbing. These lessons, incidentally, are valid across the Himalayas, not just for Uttarakhand."

(ii)Early Warning System: The forecasting, and warning mechanisms had not been enough ,could not reach all those likely to be affected and reduce damage to life ,

(iii Relif operation:

Relief **operation** is an important aspect of the disaster management to provide help to the affected people. The relief operations as to provide food, medicine, to reduce the suffering of the affected people become slow because of adverse conditions caused by disaster. Such a scenario gives rise to law and order problem- looting of the relief materials and outbreak of the epidemic due to rotting dead bodies on the other hand.

(iv) Lack of Co-ordination:

Disaster management requires concerted efforts from Central Government, State Government, NGOs, International agencies and private sectors etc. Because of the lack of the co-ordination, relief material is not property distributed among the people. Even worst happens when they are mis-utilized and are not distributed uniformly.

(v) Slow Post-disaster Relief:

While immediately after a disaster strikes, there is hectic relief and rescue mission, mainly aimed at feeding the people and stalling the outbreak of an epidemic, relief and rescue can not go on endlessly and rehabilitation and reconstruction should be given proper attention. However, this is an area which is often ignored and progressed is slow once the initial attention fades away. Restoration of infrastructure, hospitals, schools, houses, and sources of living of the people needs to be given proper attention.

(vi) Rehabilitation and Reconstruction:

A quick assessment of the extent of the damage is necessary so that relief and rehabilitation work can be properly planned. Relief and rehabilitation work suffers from the lack of co-ordination, proper management, and supervision at all levels and indicated the absence of adequate planning and preparedness to meet any emergency. Consequently, relief measures become inadequate, providing scope for pilferage of relief and rehabilitation remained unutilized and there is huge shortfall in distribution of emergency relief, shelter material cloths, house building assistance etc. The disaster is a costly wake-up call," said Peter Bosshard, the policy director at International Rivers, a California based non-profit research and river protection group that primarily operates in Asia, Africa, and Latin America. "It shows that nature will strike back if we disregard the ecological limits of fragile regions like the Himalayas through reckless dam building and other infrastructure development. We can only expect such disasters to happen more frequently under a changing climate."

Need of disaster Management:

In the view of the frequency of disaster striking India, there is a need for continued vigilance, preparedness and conscious efforts to reduce the occurrence and for mitigation of impact of natural disaster. A planned approach to disaster management is required. Disaster management is a fundamental component of sustainable development because the reduction of disaster equivalent to increased development. (i) There should be a proper multi-layer organizational structure in a co-ordinated manner responsible for the overall management at national, state, districts and village levels.

(ii) Disaster management should consist of planned co-ordinate efforts in following important areas:
Identification and prediction, Early warning system, Evacuation, Relief, Rescue, Rehabilitation, Compensation
(iii) There is a need to share the expertise and experiences so that states, districts and village can learn from each other.
(iv)There is also a need for training personnel likely to face natural disaster and those who deal with the relief operations.

The purpose of this Pre–Service Training (PST) is to provide an introduction to and an overview of disaster management to minimize the risk of loss of life, negative economic impacts, and other potential effects of disasters. Training aims to help provide Volunteers with information that they can use during their service to help protect themselves and others. Written materials should be provided to volunteers that will help not only for those whose jobs focus on environmental work but also for health workers, farmers,teachers, and others who might benefit in natural disaster–prone communities basic information, knowledge building, and safety.

Volunteers may be useful before and after a natural disaster occurs. Pre–Service Training should be provided to them to increase Volunteers ability to:

(i) Maintain their own safety and security during emergency and natural disaster situations.
(ii) Help communities to develop preliminary preparedness plans, institute mitigation measures, and increase their capacity to cope with disaster situations.

(iii)Strengthen the ability of Volunteers to maintain their own safety and security during emergency and disaster situations, Identify the elements of the disaster cycle and key actions to take at its various phases.

(iv) Increase Volunteers with regard to specific types of hazards/disasters.

The natural and manmade disasters like the Uttarakhand floods are inevitable. Natural causes cannot be waived away, but we can prepare to face them. Thus, knowing that monsoon period tourists and valuable assets, may be removed from hazard-prone regions before monsoon,and locals can be alerted and evacuated at short notice through early warning systems. At the same time manmade causes are eminently preventable by adopting suitable preventive measures using latest technology. We believe that the government has already been embarked on such important issues. All facts and data will be reviewed with expert consultations, taking account of people's concern, and sustainable development of the region.

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