

*Meeting Report***Natural Disasters and Human Tragedy in the Context of Himalayan States**R C SUNDRIYAL, P GHOSH\* , G C S NEGI, S AIRI and P P DHYANI*G B Pant Institute of Himalayan Environment and Development, Kosi - Katarmal, Almora 263 643, Uttarakhand, India*

The Himalayan region is situated in one of the most geo-tectonically active and ecologically sensitive zones of the world that comprises of young-fold mountains having several faults and fractures with high seismic activity. It is perennially ravaged by high intensity earthquakes, massive landslides, cloud bursts and flash floods. For example, the June 2013 tragedy of Kedarnath (Uttarakhand) is a case in point where heavy rainfall (which was 375% more than the normal rainfall) and cloud burst caused devastating flash floods and landslides in Mandakini river valley and reportedly took a toll of several thousand casualties and loss of roads, buildings and other infrastructure. The frequent occurrence of natural calamities have signalled towards unscientific developmental activities all across Himalayan region. Therefore, it is essential to understand the basic geology of the region for appropriate developmental planning. To seek an answer to some of the basic questions such as why the intensity of natural calamities have increased in recent years with particular emphasis on the state of Uttarakhand and how it can be minimized, GB Pant Institute of Himalayan Environment & Development, Almora organized a keynote lecture by Professor K S Valdiya, FNA on "Natural Disasters and Human Tragedy" followed by brainstorming session among several stakeholders under the aegis of Himalayan Popular lecture series. Approximately hundred participants attended the meet representing central and state governments, NGOs, scientists, defence personnel, local residents and peoples' representatives.

In his talk Professor Valdiya highlighted that the fragility of the Himalayan arc is due to the Main Boundary Thrust (MBT) and Main Central Thrust (MCT) which runs across the entire Himalayan belt.

The thrusts in the Himalayan region are very long and 25-30 km deep and many run parallel and vertical to each other. The movement of Indian plate into rest of the Asian continent at the rate of 67 mm/year and subsequent rise of the Himalayan mountains at the rate of 5 mm/year builds up frictional tension due to friction and results into earthquakes of smaller magnitude which are beneficial as they relieve tension in such eco-sensitive zones. Therefore, the adjoining areas of these thrusts are more prone to earthquakes, landslides and land slumps related hazards.

Professor Valdiya also narrated the relevance of cloud formation and erratic rainfall pattern on natural disasters and explained that rainfall distribution pattern over the Himalayas and hydrological balance has got disturbed beyond a threshold limit both in terms of duration and intensity of rainfall. The winter rain and snow fall is likely to reduce. As a result cloud formation has reduced to smaller patches over small pockets. This leads to very high intensity rainfall in short duration over small areas, a phenomenon popularly known as "cloud burst", which is happening all over Himalayas for quite some time and is gradually taking shape of disaster in densely populated areas causing heavy damage. He also explained with extensive diagrams and actual pictures how commercial buildings, townships and human settlements have come up on the river floodway, old river channels and glacial floodway. As a river changes its course within its own floodway after a certain period of time it may retrace its old course within the floodway therefore the floodways need to be left unaltered and human activities should be avoided on floodways. For example, in Kedarnath where the temple and township is built on the abandoned channel

of river Mandakini got devastated due to flash flood in June 2013. The temple was saved due to large boulders/blocks (lying just behind the temple) abandoned by a glacier that prevented the water force to directly hit the temple. In addition the temple architecture was sound and strongly built (1-2 m wide stone walls joined with iron chains) in comparison to the newly built houses around the temple which were weakly constructed. He also pointed out that based on extensive geological research in the region in 1965, geohazard prone zones have already been mapped around Guptakashi, Gaurikund, Rambara in the Kedarnath valley and these areas need careful human interventions. There are several examples within Uttarakhand like Joshimath town which is always sinking because it is situated between two geological faults.

During the discussion it was strongly emphasized by Geologists, Dr. R C Upadhaya and Dr. Lakshmi Kant that the core of the soil and earth is weak in the river floodways, and when high intensity rain falls in such places it brings large boulder and rocks that often block or change the river course. Dr. Balwant Kumar and Dr. Sobha Rawat from Department of Botany, Kumaon University emphasized that a good forest cover in such areas reduce negative impacts of high rainfall. Dr. Lalit Pandey, Padmashree, Director, Uttarakhand Seva Nidhi, Almora, desired that the roads should be built after careful survey based on geological know-how of the region. Although network of roads and bridges/pools are required for development all over Indian Himalayan region, however, they need to be built in proper scientific manner following basic standards. Most roads are constructed along the rivers in their floodway to save cost of construction. Moreover the road excavation debris are dumped in the river as well as along the hill slopes that obstruct river flow leading to change in the river course and toe cutting on the river bank's opposite side. It leads to a destructive chain reaction. Rain water seeps into the construction debris left beside the road and therefore the road starts sinking gradually.

Dr. A K Pant and Professor S D Sharma, Dean and Head, Faculty of Law, Kumaon University argued that the unscientific road and bridge construction is not because of dearth of knowledge or paucity of funds but due to lack of will power at all levels. Such

callous attitude and gross negligence lead to "human tragedy". It was also deliberated that in olden days people may have lacked information and knowledge but they had higher wisdom which is evident as most of the old settlements (villages) are situated on top of hills than beside the river. Thus, damage due to floods were avoided. Therefore, there is a strong need to integrate traditional wisdom in new construction activities.

Nagar Palika Chairman Shri P C Joshi and MLA (Member of Legislative Assembly) from Almora, Shri Manoj Tiwari were of the opinion that there is a need to generate more awareness on geological sensitivities and instabilities of the Indian Himalayan region among the stakeholders, particularly, the planners/policy makers. Extensive hazard zonation mapping of the Indian Himalayan region should be carried out and accordingly satellite township development be taken up avoiding sensitive zones. Dr. J S Mehta, Silviculture Department, Government of Uttarakhand and Mr. S V Sharma, Conservator of Forest, Almora emphasized that river flood paths should be free from any construction. The road lengths can be reduced if a road gradient of more than 1:20 is adopted and adequate drainage along roads should be maintained. A Geologist's advice should always be enforced for any mountain construction activities. There should be strict law for buildings, roads and dam constructions in the Himalayan region in view of its geo-sensitivity.

It was also agreed upon by all that each one of us is contributing to the severity of natural disasters in one way or the other. Strict monitoring of road, bridge and dam construction should come up with proper geological survey of area. It was suggested by Shri P C Joshi and Mr. Manoj Tiwari that alternative options like tunnels, ropeways and smaller air bases may be considered to reduce traffic load on the roads in fragile Himalayan mountains. Dr. P P Dhyani and Dr. R C Sundriyal remarked that carrying capacity of tourism sectors also needs to be strictly monitored and tourists and pilgrim flow may be regulated accordingly to reduce casualties due to nature's fury.

The following key messages/lessons were learnt:

1. We should learn to read signs and signals given by nature

2. Rainfall warning system should be strengthened and made efficient
3. Need for identification and delineation on topographic maps, the zones of endemic landslides and floodways
4. In identified hazard zones following measures should be taken:
  - a) No felling of trees: deforestation should be stopped completely
  - b) Mining and quarrying should be banned
  - c) No expansion of habitation, no heavy construction
  - d) If roads are essential, then they should be constructed as per appropriate scientific technology.
5. Road construction to be avoided in zones of landslide debris deposits and floodways
6. No construction of buildings should be allowed

on lower riverine terraces i.e. within floodways.

This newly instituted “ Popular Lecture Series” event is one of the initiatives of the outcome of a workshop on “Mountain Specific Research in the Context of Himalaya” jointly organized by GB Pant Institute of Himalayan Environment & Development, International Centre for Integrated Mountain Development (ICIMOD) and Indian National Science Academy (INSA) during 19-20 November 2013, after extensive deliberations on possibilities for promoting research culture in the Himalayas. The initiative aims at admiring the actions and opinions of many renowned practitioners, grassroots-level workers, specialists, artists, activists, planners and community leaders who have high competence and have earned wide recognition in specialized areas. Their viewpoints on pertinent, thought provoking and inspirational issues are reflected in the lectures delivered. The institute will utilize such inputs for advanced understanding on environment and development and relevant contemporary issues for sustainable development of the region.