

### Session One: Country Review Papers/Country Reports

The first session was chaired by Dr. M. Banskota, Deputy Director General, ICIMOD. In this session four country review papers and two country reports were presented.

#### *Introduction to the Workshop -- S. R. Chalise*

Welcoming the delegates on behalf of the ICIMOD Director General, Mr. Egbert Pelinck, who was unable to attend this session, **Professor S.R. Chalise** mentioned that the workshop brochure provided a brief background on the ICIMOD programme activities on Landslide Hazard Management and Control, that was launched in 1994 with the support from the Government of Japan. State-of-the-art reviews on landslides were prepared during 1994 by, eminent experts from China, India, Pakistan and Nepal, he said. He expressed happiness that Professor Takeshi Ito, who had played a key role in the formulation of the project, was present at the workshop.

Explaining the ICIMOD plan, Professor Chalise stated that one of the major activities envisaged for 1995 was to develop and organise a Regional Collaborative Training Programme for Landslide Hazard Management and Control in order to help develop the necessary capabilities in the countries of the HKH. He emphasised that ICIMOD could be the link institution to establish collaboration between institutions from the regional countries and developed world so that state-of-the-art knowledge and tools could be made accessible to deal with the most commonly-faced disaster of landslides in this region.

The main objective of the workshop, he said, was to identify the priority issues and key elements for a Regional Collaborative Training Programme which complemented national initiatives in the field by establishing close collaboration between national institutions from regional as well as developed countries such as Japan and the Netherlands. Undoubtedly, he said, the experiences of the eminent experts present would help to achieve this objective. He thanked ITC Netherlands for their interest, and noted that Dr. Niek Rengers, the Vice Rector of ITC was a participant at the workshop.

Professor Chalise outlined the programme as follows: the first day-presentation of four state-of-the-art reviews from China, by Professor Li Tianchi; India, by Dr. V. C. Thakur; Nepal, by Drs. Upreti and Dhital; Pakistan, by Drs. Malik & Farooq and country reports from Bangladesh, by Col. Rahim; and Myanmar, by Maj. T. S. Tun. A few invited papers were also to be presented. This was expected to help identify critical issues in landslide hazard management and control in the HKH, he said.

During the second day, discussions would be continued to identify priorities for the Regional Collaborative Training Programme with a paper by Professor Li Tianchi and two other papers on this theme to familiarise participants with the field realities and practical problems. A field trip had also been organised in collaboration with the Water Induced Disaster Prevention Technical Centre of HMG Nepal on the same day.

On the third day there would be a plenary session to help identify the key issues for group discussion and specific recommendations. These recommendations would provide the substance and basis for the Regional Collaborative Training Programme. He concluded by stating that the final and most important output of the workshop was the recommendations which would shape and guide future activities.

## Presentations of Country Review Papers

### *o Li Tianchi, China*

Presenting the country paper **Professor Li Tianchi** highlighted the frequency and magnitude of landslides and economic losses due to them in China. Annually, damage worth approximately two billion USD was caused by landslides and mass movement activities in China. He also described the processes and effects of landslides by presenting slides taken from different parts of China. Different types of mass movement caused by torrential rains and earthquakes and damage to infrastructure, e.g., railway lines, roads, irrigation canals, dams, and buildings, was shown. He pointed out that not all landslides were dangerous, but some were really dangerous depending upon the speed and distance travelled. Once landslides occurred, they were very costly to control.

The techniques adopted for mapping landslides in China depended upon the purpose of the exercise: ranging from large-scale landslide susceptibility mapping for land use and city planning to regional landslide mapping for roads and water resource development. Professor Li emphasised the need to adopt an **integrated area approach and bio-engineering methods** to deal with the mitigation of landslides. He described the model and parameters used to predict landslide occurrences, rates of movement, and retrogression. He concluded that landslide damage can be minimised if proper attention was given to avoidance and preventive work for landslide stabilisation.

### *o V.C. Thakur, India*

Presenting the country report for India, **Dr. V.C. Thakur** suggested that the frequency of landslide occurrence had been increasing in recent years due to increasing anthropogenic activities and infrastructural development in mountain areas. He further pointed out that removal of forest cover and unplanned development activities were the major human-induced causes behind the increased incidence of landslides. Assessment of physical parameters, such as geology, rainfall, seismic activities, and vegetation cover in landslide occurrences, showed that there was a strong relationship between frequency of landslides and heavy monsoon precipitation, geological faults, and earthquakes. Many landslides and extensive damage occurred at the time of heavy precipitation in various years, e.g., 1911, 1914, 1968, and 1973. It had been observed that more landslides had occurred along two major thrust lines. A large number of landslides were initiated and reactivated in 1905 in Kangra when an earthquake with a magnitude of 8 on the Richter scale occurred. Similarly, an earthquake with a magnitude of 6.6 on the Richter scale in 1991 in Uttarkashi activated more than 47 landslides and reactivated more than 16 old landslides.

Different parameters and rating techniques used by different offices for hazard zonation were also described in the presentation, and it was pointed out that there was a need for the various institutions involved in landslide study and management to coordinate. Different control measures such as surface and subsurface drainage, retaining walls, and self supporting and soil stabilisation techniques adopted by concerned authorities were also described. Dr. Thakur also emphasised the need for an integrated interdisciplinary approach to dealing with the problems associated with landslides.

### Discussions

During the discussions, **Dr. Anbalagan** from the University of Roorkee stated that India had been developing an Indian Standard Code (ISC) to rate different parameters for preparation of a hazard zonation map at least on a regional scale of 1: 50,000.

**Dr. Rengers** from ITC highlighted the fact that the parameters and rating technique for hazard zonation depended upon the objectives and the scale of mapping. Detailed maps (large-scale) of slope instabilities and landslide hazards needed specific input data on various aspects and from specific localities and might not be valid for the whole areas there was a wide diversity in geology, lithology, and climate. It was suggested that the weighted rating system developed by the United States Geological Survey (USGS) for hazard zonation be adopted.

Presenting the country report for Pakistan, **Dr. M. H. Malik** highlighted the complexity of environmental conditions due to diverse geology, lithology, climate, and tectonic activities. He pointed out that geological factors, including structural discontinuity, i.e. orientation and roughness, were the major controlling factors in landslide occurrence. Beside these, seismic activities, heavy precipitation, and over use of dynamite at the time of road construction, mining, and quarrying were other factors responsible for triggering slope instability. He pointed out that landslides mostly occurred in late monsoon (July and August) when soils became fully saturated. He also highlighted the fact that social pressure had been increasing in the region due to an increase in frequency of landslides in recent years.

**Professor Qasim Jan** from Pakistan also described both the natural and human-induced causes of mass movements in the country. He pointed out that landslides had increased substantially in the past 30 years in Pakistan. He noticed that the Nangaparbat massive is rising by more than five mm/yr causing intense rockfalls and a subsequent increase in the damming of rivers.

Presenting the country report for Nepal, **Dr. B. N. Upreti and Dr. M. Dhital**, briefly described the geology, geomorphology, climate, seismic activities, and spatial distribution of landslides in the country. They explained the parameters and rating technique applied in hazard zonation. They stated that the hazard rating technique suggested in the Manual for Risk Engineering published by ICIMOD had been followed for the study. They emphasised the need for field verification of hazard maps and for updating rating scores based on the field situation. It was pointed out that both hazard mapping and landslide stabilisation activities had just started in the country. It was also suggested that priorities should be given to areas of high infrastructural development, and those that threatened human settlements, while preparing hazard maps.

## Country Report Presentations

**Col. M.A. Rahim** from Bangladesh, presenting the Bangladesh country report, pointed out that since the hill region accounted for seven per cent of the total area of Bangladesh, landslides were not the prominent natural hazard compared to other natural hazards such as floods, droughts, cyclone, and tidal surges. However, small-scale landslides were quite common in these hills.

He briefly described the geology, geomorphology, and climate of the country. The studies related to landslides and their management aspects were still in a primary state in Bangladesh. Three types of slope failure such as lateral spreading (bulge), rotational and transnational slides, and block failure had been identified. He pointed out that the main causes of such failure included geology, relief, rainfall, wind action, vegetation, and human activities; and remedial measures consisted of structural measures for slope retention and drainage, slope flattening/terracing, and plantation. Three types of institutions involved in landslides control and management are research organisations, academic institutions, and development agencies such as military engineers, local government authorities, road and highway departments, local government engineering departments, and the Bangladesh Water Development Board.

He concluded that, due to the increase in human activities and rapid deforestation in the hilly regions, the problems of landslide hazards were gradually becoming serious and the current workshop would provide opportunities to share the experiences of countries prone to landslide hazards. He further recommended that there be a focus on research activities in order to avoid landslide hazards and promote training activities for disaster management personnel in rescue operations.

**Major Tun**, in his country statement, described the topography, hydrology, forestry, and geological conditions of Myanmar.

He mentioned that in Myanmar too, as in the other countries of the region, most landslides occurred during the rainy season in mountainous areas. Damage due to landslides in rural residential areas were minimal but usually they interrupted local communication systems and affected railroads and motor roads, thus causing a lot of economic damage and hardship to the local people. Engineering measures, such as retaining walls, were built in potentially dangerous areas and biological control of landslides through plantation of trees on mountain slopes were also used. In mountain areas, slash-and-burn agriculture was discouraged, especially in landslide susceptible areas.

### Discussions

During the discussions, it was expressed that slope instability and landslide hazard maps were essential for sustainable development of mountain areas. However, mapping was still in the preliminary stages and confined only to selected localities. Moreover, hazard maps were produced only after a major disaster and mainly for academic exercise. It was rarely used as a tool by planners, designers, decision-makers, and construction engineers. So, there is a need to make the users aware of the usefulness of hazard maps.

Concluding the session, the Chairperson, **Dr. M. Banskota**, raised some issues concerning landslide control and management and opined that due attention should be given to economic aspects such as cost and benefit analysis of the activities; use of indigenous knowledge and bio-engineering or ethno-engineering practices; and training for sensitisation of the local people to hazards while designing programmes for landslide control and management.