

### Session Three: Invited Papers

Session Three was chaired by Professor S.R. Chalise. In this session, three of the invited papers were presented. Additional papers were presented in Session Five.

*o A Statistical Study of Landslide Disasters in the Snowy Regions of Japan -- T. Ito*

**Professor T. Ito** from Akita National College of Technology, Japan, in his presentation described the methodology and techniques used for the preparation of potential landslide hazard maps and highlighted the differences in the processes of landslide occurrences in hot, humid, and cold regions. He pointed out that frequent landslides had been taking place during specific seasons and in specific geological areas. In snowy regions, the occurrence of landslides was specifically in the snow melting season (mainly March to April). He also observed that the frequency of landslides in the study area had been increasing gradually in recent years, especially near big cities, due to the changes in land use practices.

*o Risk Mapping for Landslide Hazard Management in Sukhidang Area, Kumaon Himalayas, India -- Dr. Anbalagan*

In his paper, **Dr. Anbalagan**, from the University of Roorkee, India, highlighted the importance of slope instability and landslide hazard maps for sustainable development, particularly in such a geologically and ecologically fragile ecosystem as that of the Hindu Kush-Himalayas. He described the procedure and rating schemes used for the preparation of landslide hazard zonation maps (LHZ) and risk assessment. "Risk is a function of hazard probability ( $H_p$ ), which is mainly based on the basic causative factors of slope instability and the damage potential ( $D_p$ ), i.e., the nature of the damage likely to occur." Damage might be in the form of loss of life and injuries and/or loss of land and properties. He pointed out that the risk assessment exercise would help to identify the priority areas of hazard management. He presented the case of the Sukhidang area in the Kumaon Himalayas. He also presented a risk assessment matrix based on the degree of potential hazard and damage. He suggested different short-term and long-term remedial and control measures for mitigation of the risk of natural hazards. He recommended focussing research work on protective measures such as biotechnical, soil nailing, chemical grating, reinforced earth, and geotextiles.

He recommended that terrain, or the geology, would be more appropriate units of measurement rather than slope facets for the assessment of landslide hazards and risks.

*o Status of Landslide Hazard Management in Nepal -- A. Dixit*

**Mr. A. Dixit** from Nepal briefly described the general causes of increased landslide hazards in the country. Due to high relief, intense neo-tectonic activities, highly anisotropic and fractured geology, poor engineering design and lack of maintenance of infrastructures, and increasing human activities on mountain slopes, the incidence of landslide occurrences had been increasing. He briefly discussed the availability of a database for landslide hazard mapping and the efforts experienced so far by the government on landslide inventory and mapping. He focussed on the work of government and non-government organisations related to the mitigation of natural hazards in the country. Lack of pre-disaster mitigation activities, lack of coordination among various agencies, and lack of programmes for creating public awareness were some of the problems associated with effective hazard management and control. He also discussed potential target groups and types of training required for better management and effective control of landslide hazards. These included decision-makers, middle-level administrators, and senior and junior technical manpower. He also highlighted the role to be played by regional and international agencies such as ICIMOD and UNDP<sup>1</sup> in strengthening government capabilities through training programmes and workshops.

Concluding the session from the chair, Professor Chalise highlighted the need for coordination and collaborative work. He also emphasised the need to reach agreement on rating schemes and methods for the preparation of landslide hazard mapping, and the need for field verifications of such maps and their practical usefulness. He also briefly introduced the activities of ICIMOD in the field of landslide hazard management control in the Hindu Kush-Himalayan region.

Professor T. Ito from Akita National College of Technology, Japan, in his presentation described the methodology and techniques used for the preparation of potential landslide hazard maps and highlighted the differences in the processes of landslide occurrences in hot, humid, and cold regions. He pointed out that frequent landslides had been taking place during specific seasons and in specific geological areas. In snowy regions, the occurrence of landslides was specifically in the snow melting season (mainly March to April). He also observed that the frequency of landslides in the study area had been increasing gradually in recent years, especially near big cities, due to the changes in land use practices.

Concluding the session, the Chairperson, Dr. M. Banerjee, presented a paper on "Landslide Hazard Management in Subtropical Area: Himalayan Himalayas". In his paper, Dr. Banerjee, from the University of Koorap, India, highlighted the importance of slope instability and landslide hazard maps for sustainable development, particularly in such a geologically and ecologically fragile ecosystem as that of the Hindu Kush-Himalayas. He described the procedure and rating schemes used for the preparation of landslide hazard zonation maps (LHZ) and risk assessment. "Risk is a function of hazard probability (Hp), which is mainly based on the basic causative factors of slope instability and the damage potential (Dp), i.e., the nature of the damage likely to occur." Damage might be in the form of loss of life and injuries and/or loss of land and properties. He pointed out that the risk assessment exercise would help to identify the priority areas of hazard management. He presented the case of the Subtropical area in the Himalayas. He also presented a risk assessment matrix based on the degree of potential hazard and damage. He suggested different short-term and long-term remedial and control measures for mitigation of the risk of natural hazards. He recommended focusing research work on protective measures such as biotechnical, soil nailing, chemical grouting, reinforced earth, and geotextiles.

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