ICIMOD

Landslide Hazard Management and Control in Pakistan

A Review

M.H. Malik
and
S. Farooq

International Centre for Integrated Mountain Development
Kathmandu, Nepal
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Cover Photograph: Plane failure in schists at Lower Gali, Muzaffarabad

Inset: Movement of scree slope blocking the road between Muzaffarabad and Garhi Habib Ullah.

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Preface

The inherently unstable nature of mountain areas of the Hindu Kush-Himalayas is well recognised. The steep slopes, unstable geology, and intense monsoon rains combine to make the Hindu Kush-Himalayas one of the most hazard-prone areas in the world. Although natural hazards of varying intensity have occurred frequently in the past in Hindu Kush-Himalayan countries, more recently there has been an increase in human settlement of hazard-prone areas as a result of population pressure, as well as improvements in accessibility by road and the onset of other infrastructural developments. Consequently, natural and man-made disasters are on the increase and each event affects an even greater number of people than before. Floods and landslides during the monsoon season are the most common natural disasters affecting this region, often resulting in substantial economic and environmental losses and causing great suffering to many people.

Despite all this the present levels of understanding and systematic analysis of these disastrous events are very poor and data bases are non-existent. No monitoring activities are carried out even in cases where such monitoring can be of direct benefit to project-related management activities. Investments in developing practical guidelines for managing such events as well as in forecasting them have been inadequate.

Since its inception, ICIMOD has been promoting the development of a better understanding of natural hazards. Various activities have been undertaken so far. These include several training programmes dealing with mountain risk engineering, focussing on improving road construction along unstable mountain slopes, a review of landslide hazard management activities in China, and field assessment of landslides and flood events in south central Nepal following the extreme climatic events that took place in July 1993.

One of the goals set by ICIMOD in its Mountain Natural Resources' programme is to "Improve the conditions of mountain resources and environments by halting and eventually reversing their degradation." Programme activities envisaged to achieve the above goal are directed to:

- identification of measures to mitigate different types of natural hazards which result in the loss of natural resources;
- promotion of skills and methodologies for natural hazard assessment; and
- improvement of public awareness for better disaster preparedness in mountain areas.

ICIMOD's programme on "Landslide Hazard Management and Control" focusses on these concerns to help protect valuable natural resources from different types of natural hazards. This programme is based on activities already introduced at ICIMOD in 1994 with support from the Government of Japan.

This programme is concerned not only with examining the types and extent of landslide events but also with measures for their mitigation and control; and in addition the skills and methodologies needed for natural hazard assessment.

To improve the knowledge base on Landslide Hazard Management and Control, state-of-the-art reviews were commissioned in four countries of the Hindu Kush-Himalayan Region. These countries are China, India, Nepal, and Pakistan.

Suresh Raj Chalise of the Mountain Natural Resources' Division at ICIMOD coordinated the work carried out on these reviews and the current document entitled "**Landslide Hazard Management and Control in Pakistan : A Review**" was prepared by M.H. Malik, and Saeed Farooq of the Institute of Geology, Punjab University. Mr. Malik and Mr. Farooq have produced a comprehensive document on a topic that is crucial to the development of mountain areas and the well-being of mountain inhabitants.

Abstract

This country review on landslides in Pakistan deals with all the aspects of landslides, their types; causative factors; their relation to geology, earthquakes, monsoons, and deforestation; their impact; and possible studies to overcome disasters and control. This paper systematically identifies the problem areas and gives details of the historical background clearly establishing the connection with certain natural (earthquakes, lithology) and man-made (excavations and indiscriminate construction) causative factors.

The northern parts of Pakistan, i.e., the mountainous regions of the Himalayas, the Karakoram, and the Hindu Kush, have a high incidence of landslides. Though this part of the country is not highly-populated, nevertheless, the impact of landslides is felt severely. More so, because this part of the country is bordered by China, India, and Afghanistan and is, therefore, of considerable strategic importance.

The extent of the impacts of landslides depends upon various factors such as the depth and rate of movement, stresses from the environment, volume of materials involved, and, most importantly, the proximity to settlements and structures. The author quotes instances where more than half a village has been wiped out or where powerhouses/dams have been damaged.

Dealing with the diversity of causes, the author scientifically enumerates aspects of geology, such as lithological distribution, bedding, joints, foliation, and schistosity, that lead to landslides. Causative factors relating to surface and groundwater and the effect of saturation on strength, temperature variations, earthquakes and vibrations, and effects of vegetation and deforestation have been dealt with in the context of Pakistan.

The text is further substantiated with figures, tables, and photographs.

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Acronyms

K.K.H.	Karakoram Highway
C	Cohesion
MC	Moisture Content %
LL	Liquid Limit
PL	Plasticity Limit
PI	Plasticity Index
rb	Bulk Density
rd	Dry density
_	Angle of Internal Friction
Gs	Specific Gravity
p	Density
JRC	Joint Roughness Coefficient
JCS	Joint Wall Compressive Strength
_r	Angle of Residual Friction
n	Normal Load