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Landslide hazard management practices in the world

In 1997 a Workshop on Landslide Risk Assessment organised by the IUGS Working Group on Landslides, was held in Honolulu, Hawaii, USA. The goal of this Workshop was to provide a framework for carrying out Quantitative Risk Assessment (QRA) for landslides, to highlight its actual limitations and to disseminate the available tools for evaluating the different components of risk. Since then, the interest for QRA has significantly increased: the International Conferences on Instability Planning and Management held in Ventnor, UK in 2002; the Conference on Fast Slope Movements: Prediction and Prevention for Risk Mitigation, held in Naples, Italy in 2003; the IXth International Symposium on Landslides, held in Rio de Janeiro, Brazil in 2004; and above all the International Conference on Landslide Risk Management held in Vancouver, B.C., Canada in 2005 demonstrate such interest. Moreover, the increasing number of papers in scientific journals and books constitute excellent examples of the research activity in this fundamental topic.

The study of landslides has however some specific features. Landslides are local phenomena occurring in different geomorphic contexts; they can be triggered by a variety of mechanisms, some of which are not well known yet; they affect a wide range of lithologies (earth materials) while displaying complex run-out behavior and subsequent damaging capability. On the other hand, landslide risk management strategies differ from country to country. The way how the society is organized, its economic strength and traditional or historical rules, among other factors, condition the type of response to the threat caused by landslides. These facts might explain the difficulties found to date as far as standardization of the terminology and of the procedures for quantitative hazard and risk assessment and management are concerned.

During the last International Symposium on Landslides held in Rio de Janeiro, several colleagues discussed about the convenience of putting together the experiences of landslide hazard management practices that have been recently carried out in different countries and about the interest of publishing them in a scientific journal. Various topics were found of particular interest, among them: the criteria used for assessing landslide intensity; the inclusion of the travel distance in landslide hazard maps; the techniques developed in determining the probability of failure or the landslide frequency; the criteria used in the definition of landslide hazard classes; the evaluation of vulnerability and its incorporation in the quantitative risk assessment; the available procedures for the assessment of the residual risk; as well as the criteria for proposed restrictions to development and planning measures. The Editorial Office of *Landslides* welcomed the initiative and asked us to prepare a special issue including a set of invited papers covering experiences all over the world in this field of landslide hazard and risk management.

The issue includes 11 papers derived from a variety of geographical and morpho-climatic contexts, from New Zealand to United States, Canada and several European countries. These papers are presented according to the main phases of the landslide risk assessment and management. A special interest has been put forward in showing the detailed methodological procedures for determining the components of landslide hazard in a quantitative way. One of these components deals with the magnitude of the hazardous event. Magnitude is usually expressed by the size (or volume) of an individual landslide but seldom the magnitude of the corresponding disastrous event is quantified. In this issue, Crozier gives some clues for defining and evaluating the magnitude of the Multiple-Occurrence Regional Landslide Events. The establishment of magnitude–frequency relationships is fundamental for the quantitative assessment of hazard. Van Dine et al. present an example from the Canadian Rocky Mountains for estimating the magnitude–frequency debris-flows characteristics based on both historical and dendrochronological records. Both landslide susceptibility and hazard maps are nowadays routine tools and available methods for preparing them seem unlimited. The landslide hazard mapping of the Seattle area is presented by Baum et al., who combine statistical treatment and hydrological modeling to compute safety factors of the slopes, in order to quantify short-term hazard potential. However, the validation of landslide susceptibility and hazard maps is still a pending issue. Chau and Chan show in their paper how regional bias in the landslide dataset affects the results of the maps and warn about the indiscriminate use of the statistical data. The importance of checking the reliability of the information contained in the landslide dataset and the need for its continuous maintenance has been highlighted by Colombo et al., who have also shown how landslide databases are fundamental tools for hazard management.

On the other hand, this issue has gathered a set of papers dealing with both landslide hazard and risk management. In every country and even in the same country, the fight against natural hazards has developed in an independent way. The strategies adopted and measures undertaken differ from one country or region to another depending on the specific socioeconomic, legal, and political contexts. Assessing of probability of reactivation of dormant landslides has been one of the key issues for both landslide hazard management and urban development policies in the Emilia–Romagna region in Italy, as shown by Bertolini et al. The whole hazard and risk assessment framework in Switzerland has been reviewed by Lateltin et al. The criteria for ranking of hazard factors such as landslide intensity and probability of occurrence that define hazard levels are discussed in the paper. Special sections are devoted to hazardous events with low probability of occurrence (residual hazard) and to the criteria used in preparing land management plans and in the evaluation of the necessary protection works.

Few experiences exist on landslide risk analysis and assessment. To quantify risk it is indispensable to evaluate the vulnerability of the exposed elements. Remondo et al. and Catani et al., using examples

from Spain and Italy respectively, discuss the framework for evaluating potential losses of the infrastructures in their papers, due to the landsliding activity, in monetary terms. The risk due to rockfall activity in an urban area of Andorra is evaluated by Corominas et al. who also quantify both individual and societal risk after the construction of protection fences. Finally, the risk management constraints in the Guadeloupe archipelago is analysed by Leroi, who has highlighted the importance of communication and participation of local communities in designing risk reduction and management strategies.

We hope that the reader will find an interest and a potential use in the contents of this special issue. Indeed the objective of such a collection of experiences is not to derive a universal hybrid approach, but to illustrate the variety of concepts and methodologies that represent a potential for new and creative hazard and risk assessment procedures.

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