

Instability hazard mapping and risk assessment in Himalayan watersheds: case studies from Nepal.

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Abstract

Every year landslides cause extensive loss of life and property in the Nepal Himalaya. Landslides also seriously degrade the mountain environment and add enormous sediment loads to the streams and rivers. As a first step towards mitigating or controlling such problems, it is necessary to identify landslide-prone areas. Different methodologies have been developed and applied for landslide susceptibility mapping and hazard assessment in the Nepal Himalaya.

This doctoral research investigates the causative factors of landslides in different physiographic zones in the Nepal Himalaya: Kulekhani watershed, Tinau watershed, Kankai watershed and Ghurmi-Dhad Khola watershed. Inventories of past landslides in the study areas are obtained from areal photographs, satellite images and field reconnaissance. Causative factors triggering and controlling landslides are investigated and digitally mapped, including topography, geology, soil types, land-use, precipitation and distances from faults, streams and roads. Various techniques are applied to derive landslide susceptibility maps from the causative factor maps, such as GIS-based heuristic methods (expert opinion), bivariate statistical methods (statistical index, frequency ratio, weights-of-evidence), multivariate statistical methods (multiple linear regression) and fuzzy logical analysis. The predictive capacity of the landslide susceptibility maps is evaluated and verified, using different techniques such as landslide density analysis, success rate analysis, and agreed area analysis.

Based upon the research results, it can be concluded that geological and hydrological factors cause most of the instabilities in the investigated areas, and the same factors will also be responsible for triggering landslides in the future in analogous geomorphic settings. The output of this research will help to increase awareness and to mitigate and control landslides at regional and community level. The obtained maps can also be used as guidelines to assist land-use planners, geologists and engineers in making decisions related to landslide-prone areas.