Evaluation of Sensitivity of the WAA and SINMAP Models (Static) for Landslide Susceptibility Risk Mapping in Sri Lanka

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Abstract

Shallow landslides are one of the most common types of failures occurring frequently in steep slopes, overburden soil and landscapes in different climatic zones. The effect of topography, slope angle, slope drainage, vicinity of road and infrastructure, overburden soil depth and geology are important factors for the interpretation of the recurrence of shallow landslides. Data, although insufficient in number, has stimulated the debate about the effect of geology and topography on the susceptibility of shallow landsliding. An Analytical Hierarchical Process is applied in order to derive the weights associated with attribute map layers. Based on these weights, GIS datasets are combined by weighted Average Analysis (WAA) and the landslide susceptibility map of the study area is created. The resulting information was compared with the landslide susceptibility map derived through the Stability Index Mapping (SINMAP) model. Both outputs are useful for a better understanding of landslide susceptibility and their origins and prioritization of efforts for the reduction and mitigation of future landslide hazards. Sensitivity of both approaches was fine tuned with the overburden soil strength parameters, geomorphological evidences and field verification techniques.

Keywords

Landsides • AHP • Susceptibility • SINMAP

Introduction

Natural instabilities and movement of material on hill slopes have induced researchers to model and predict the behavior of landslide movements. The most common slope instabilities in Sri Lanka represented by an initiatial shallow rotational or translational slides followed by a flowage mass (Cooray 1994). The infiltration of heavy downpours within relatively short periods of time creates the development of excessive pore water pressure at shallow depths of the slope almost parallel to the morphology. Contact with less permeable bedrock tends to increase the pore water pressure and cause significant reduction of shear strength or causes the soil to reach a maximum permissible strain leading to downward and outward movement of the slope (Bhandari et al. 1992). Such regional scale destabilisations are, therefore, necessary to evaluate the landslide susceptibility through an appropriate spatial analysis model to interpret the potentially hazardous conditions.

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