Landslide Susceptibility Mapping (LSM) at Kota Kinabalu, Sabah, Malaysia using Factor Analysis Model (FAM)

Abstract

The aim of this study was to prepare a landslide susceptibility level (LSL) map for the Kota Kinabalu area in Sabah, Malaysia. For this purpose, a statistical approach based on factor analysis model (FAM) integrated with a GIS environment, was applied to assess the LSL of the area. FAM is a data reduction technique used to reduce a large number of variables into a smaller set of underlying factors that summarizes the essential information contained in the variables. This model consists of a statistical comparison between landslide distribution as the dependant variable and a number of separate instability factors (input parameters). Specific attribute data are attributed to the grid cells, resulting in specific raster data layers for each input parameter. Ratings of different spatial factors from the best models calculated with the FAM were then derived. The results showed that the slope angle (β) (29% variance), lithology (17% variance), soil types (14% variance), rainfall (12% variance), effective cohesion (c') (11% variance), compressive strength value (9% of variance) and land use (8% of variance) play important roles. The data layers, in which each factor was subdivided into a convenient number of classes, were separately overlain and statistically compared with the landslide distribution map (LDM). Subsequently, the landslide density was calculated and the weighted value/rating as determined for each individual class. The final LSL was expressed as the sum of all parameter classes ranked according to the calculated landslide density for each class. In conclusion, the FAM results showed that two factors were extracted as the causative factors causing landslides; triggering factors (TF) and physical factors (PF). In addition, about 39.65% of the areas have stable conditions, 59.57% was basically unstable and 0.78% was strictly not recommended to be developed. This FAM had higher prediction accuracy of 83.90%. The resulting LSL map can be used by local administrator or developers to locate areas prone to landslides, determine the land use suitability area as well as to organize more detailed analysis of the identified "hot spot" areas.