

Landslide hazard and risk analyses at a landslide prone catchment area using statistical based geospatial model.

ABSTRACT

This paper presents the application of remote sensing techniques, digital image analysis and Geographic Information System tools to delineate the degree of landslide hazard and risk areas in the Balik Pulau area in Penang Island, Malaysia. Its causes were analysed through various thematic attribute data layers for the study area. Firstly, landslide locations were identified in the study area from the interpretation of aerial photographs, satellite imageries, field surveys, reports and previous landslide inventories. Topographic, geologic, soil and satellite images were collected and processed using Geographic Information System and image processing tools. There are 12 landslide-inducing parameters considered for the landslide hazard analyses. These parameters are: topographic slope, topographic aspect, plan curvature, distance to drainage and distance to roads, all derived from the topographic database; geology and distance to faults, derived from the geological database; landuse/landcover, derived from Landsat satellite images; soil, derived from the soil database; precipitation amount, derived from the rainfall database; and the vegetation index value, derived from SPOT satellite images. In addition, hazard analyses were performed using landslide-occurrence factors with the aid of a statistically based frequency ratio model. Further, landslide risk analysis was carried out using hazard map and socio-economic factors using a geospatial model. This landslide risk map could be used to estimate the risk to population, property and existing infrastructure like transportation networks. Finally, to check the accuracy of the success-rate prediction, the hazard map was validated using the area under curve method. The prediction accuracy of the hazard map was 89%. Based on these results the authors conclude that frequency ratio models can be used to mitigate hazards related to landslides and can aid in land-use planning.

Keyword: Remote sensing; Gis; Landslide; Geospatial model; Landslide risk.