

## Geospatial Multi-Criteria Evaluation to Predict Landslide Hazard Potential in the Catchment of Lake Naivasha, Kenya

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**Abstract :** This paper describes a multi-criteria geospatial model for prediction of landslide hazard zonation (LHZ) for Lake Naivasha catchment (Kenya), based on spatial analysis of integrated datasets of location intrinsic parameters (slope stability factors) and external landslides triggering factors (natural and man-made factors). The intrinsic dataset included: lithology, geometry of slope (slope inclination, aspect, elevation, and curvature) and land use/land cover. The landslides triggering factors included: rainfall as the climatic factor, in addition to the destructive effects reflected by proximity of roads and drainage network to areas that are susceptible to landslides. No published study on landslides has been obtained for this area. Thus, digital datasets of the above spatial parameters were conveniently acquired, stored, manipulated and analyzed in a Geographical Information System (GIS) using a multi-criteria grid overlay technique (in ArcGIS 10.2.2 environment). Deduction of landslide hazard zonation is done by applying weights based on relative contribution of each parameter to the slope instability, and finally, the weighted parameters grids were overlaid together to generate a map of the potential landslide hazard zonation (LHZ) for the lake catchment. From the total surface of 3200 km<sup>2</sup> of the lake catchment, most of the region (78.7 %; 2518.4 km<sup>2</sup>) is susceptible to moderate landslide hazards, whilst about 13% (416 km<sup>2</sup>) is occurring under high hazards. Only 1.0% (32 km<sup>2</sup>) of the catchment is displaying very high landslide hazards, and the remaining area (7.3 %; 233.6 km<sup>2</sup>) displays low probability of landslide hazards. This result confirms the importance of steep slope angles, lithology, vegetation land cover and slope orientation (aspect) as the major determining factors of slope failures. The information provided by the produced map of landslide hazard zonation (LHZ) could lay the basis for decision making as well as mitigation and applications in avoiding potential losses caused by landslides in the Lake Naivasha catchment in the Kenya Highlands.

**Keywords :** decision making, geospatial, landslide, multi-criteria, Naivasha

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