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Multi-criteria GIS based methodology used for landslide vulnerability evaluation, case study Prahova County, Romania

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Landslides are complex phenomena defined as movements of a mass of rock, debris or earth down a slope under the direct influence of gravity. Due to the unexpected occurence and its significant potential of damage, it is regarded as a natural hazard and consequently landslide vulnerability assessments are fundamental in building risk management strategies. This paper aims to establish a multi-criteria evaluation methodology of the vulnerability to landslides in a certain area in order to produce vulnerability assessment maps based on a GIS database. A case study of Prahova county is carried out to verify the model.

The causative parameters taken into consideration when evaluating the vulnerability of the area are lithology (rock types and age), slope, slope aspect, precipitation, distribution of hydrographic network, and land use. Each causative parameter was assigned a ranking value according to its relative influence on the landslide vulnerability. The parameters were integrated as GIS database, in different spatial thematic layers. The main data used in this study were extracted from the 1:200 000 national geological maps of Romania, the national hydrographic network, a land use model generated from the Corine Land Cover 2012 data set, a digital elevation model (DEM), and also a climate model to determine the precipitation distribution. The vulnerability assessment model was created in QGIS 2.18 in order to generate polygons characterized by different landslide susceptibility degrees that were determined by applying the proposed multi-criteria technique. The prediction accuracy is influenced mainly by the spatial resolution of the raster data used in this study, aproximately 20 m.

Based on the algorithm proposed in this paper to calculate the landslide susceptibility index, the resulted polygons were categorized into three zones of vulnerability: low, moderate, and high areas. In order to validate the results, they were compared to spatial and temporal distribution of landslides recorded in Prahova county.