Assessing the spatial variability of weights of landslide causal factors in different regions from Romania, using logistic regression

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Landslides represent a significant natural hazard in hilly areas of Romania which cause important damages. The scientific interest for landslide susceptibility mapping is quite recent and standardized through legislation. However, there is need for improving the methodology, in order for the susceptibility maps to constitute a sound basis for territorial planning.

The logistic regression is one of the main statistical methods used for assessing terrain susceptibility for landsliding. There are different degrees of weighting the landslide causal factors mentioned in the scientific literature, but with large variations. This study aims to identify the range of variation of landslide causal factors for different regions in Romania. The following factors were taken into consideration: slope angle, terrain altitude, terrain curvature (mean, plan and profile), soil type, lithologic class, land use, distance from drainage network and roads, mean annual precipitations. Four square perimeters of 15x15 km were chosen from representative regions in terms of spatial extent of landslides: two situated in the central-northern part of the Moldavian Plateau, one in the Transylvania Depression and one in the Moldavian Subcarpathians.

The logistic regression was applied separately for the four sectors. In order to monitor the differences in the final results, numerous attempts have been made, starting from landslides polygons acquired from both the topographic maps at scale 1:25.000 (1984-1985 edition) and the ortophotoimages (2005-2006). The other elements were acquired from cartographic materials at appropriate scales, according the international methodology. The data integration was accomplished in the georeferenced environment provided by TNTMips 6.9 ArcGIS 9.3 and SAGA 2.0.8 software packages, while the statistical analysis was performed using Excel 2003 and XLSTAT 2010 trial version. Maps for all landslide causal factors were achieved for each perimeter. The logistic regression was validated using the ROC curve and AUC parameter, for which values over 0.85 were obtained. The factor weightings are generally placed within the limits specified by the scientific literature. In all cases, slope angle and land use proved to be the prevailing factors. There are, however, important variations, which exceed even 0.2 in the case of the normalized factor weights. This fact proves that the logistic regression is capable to reveal some regional characteristics in landslides manifestation.