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Modeling landslide susceptibility by using GIS-analysis and multivariate adaptive regression splines

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Landslide susceptibility may be evaluated by defining statistical relationships between the spatial distribution of past slope failures and the variability of landslide triggering factors. In this research, susceptibility to landsliding was assessed by employing multivariate adaptive regression splines (MARS), a statistical model that has been rarely used to this aim. The experiment was carried out in an area of central Sicily (Italy), which is severely affected by shallow landslides mainly occurring during the wet autumn-winter semester. Bedrock lithology and a set of primary and secondary topographic attributes were exploited as proxies of main landslide driving factors. The robustness of the procedure and the predictive skill of the susceptibility models were evaluated by calibrating and validating the models on different samples of raster cells. Stable cells (absence of landslides) of these samples were selected using two different methods: i) a random selection of individual stable cells; ii) a selection of cells intersecting circles randomly distributed within the stable sectors of the study area. The fit of the models to calibration and validation samples was quantitatively assessed by drawing receiver operating characteristic (ROC) curves and by calculating the area under the ROC curve (AUC). The validation results indicate high accuracy and stability of the models, demonstrating the ability of MARS to effectively predict the spatial distribution of landslides. Moreover, a better performance was observed for models trained and tested using circular groups of stable cells.

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