Stochastic assessment of landslide susceptibility by using five different instability datasets: a case study from the southern sector of the "Via al Llano" highway (Colombia)

Laura Paola Calderon-Cucunuba, German Vargas-Cuervo & Christian Conoscenti

In this study, the ability of stochastic models to predict landslide susceptibility in the southern sector of the "Via al Llano" highway (Colombia) was assessed. To this aim, an inventory of landslides occurred in the area was prepared by analyzing images available in Google Earth. Multivariate Adaptive Regression Splines (MARS) was employed to model the spatial distribution of the following five data sets of unstable cells selected within each landslide: i) the highest cell (data set MAX), ii) the highest 10% of cells (data set SUP), iii) the lowest cell (data set MIN), iv) the lowest 10% of cells (data set INF), and v) the entire landslide area (data set BODY). The goal of our experiment was to identify which of the calibration data set produces the best prediction of the landslide areas (BODY data set). The data sets were divided into calibration and validation groups of cells by randomly selecting 75% and 25% of the mapped landslides, respectively. In order to evaluate the robustness of the results, ten calibration and validation samples were extracted for each instability data set.
The analysis revealed that the most important predictors were Normalized Difference Vegetation Index (NDVI), slope steepness, vertical distance to channel network, elevation and aspect. The receiver operating characteristic (ROC) curves and the area under the ROC curve (AUC), calculated for each of the five instability data sets, indicated that calibrating the models with the lowest landslide pixels (MIN or INF data sets) allows to obtain the most accurate prediction of the validation landslide bodies (BODY data set), achieving AUC values ranging between 0.80 and 0.85.