



Title: Enhancing Pixel-Based Landslide Susceptibility Mapping with Slope-Unit Descriptors: A Case Study from Ilopango Caldera, El Salvador

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Abstract (max 300 words)

Reliable landslide susceptibility mapping is increasingly important as climate change intensifies extreme rainfall. Mapping units govern both model behavior and the resulting cartography. Among available options, pixels and slope units (SU) are the most widely used: pixel-based models capture local controls but often yield speckled outputs, whereas SU frameworks enforce geomorphic consistency at the risk of over-smoothing. A key challenge is to retain the benefits of both while limiting their drawbacks.

This study adopts two predictor groups. A baseline group comprises lithology and a set of pixel-level predictors drawn from standard topographic variables commonly employed for susceptibility modelling. An enhanced group augments the baseline by appending SU summary descriptors—means, 10th/90th percentiles, standard deviations of the topographic variables, and lithological proportions—thereby providing each pixel with its hillslope context. Baseline and enhanced models are trained with Multivariate Adaptive Regression Splines and Random Forests and evaluated through spatial k-fold cross-validation. Performance is measured using Area Under the ROC curve (*AUC*) and Cohen's kappa (κ), while spatial coherence is assessed with Moran's *I*.

The case study covers the northern Ilopango Caldera, El Salvador, affected by extensive landsliding during Tropical Storms Amanda and Cristóbal (29 May–7 June 2020).

Enhanced models consistently outperform baseline models in *AUC* and κ and produce maps with higher Moran's *I*, indicating reduced speckle while preserving pixel-scale detail. The enhanced Random Forests configuration achieves the best overall performance. A concise R script implementing the pixel-plus-SU workflow will be released in a public repository to support reproducibility.