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# Integrating Pixel and Slope Units for Spatial Prediction of Tropical Storm-Induced Landslides in El Salvador

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In landslide susceptibility mapping, the selection of terrain partitioning units critically influences susceptibility zonation and the spatial distribution of predicted landslide-prone areas. Two primary approaches are commonly employed: pixel-based units and slope units. Pixel-based mapping, derived from high-resolution digital elevation models (DEMs), captures detailed local variability of environmental predictors such as slope, curvature, and elevation. However, this method often lacks the spatial continuity and geomorphological context necessary to fully represent the processes driving landslide occurrences. Conversely, slope units provide a coherent geomorphological framework that reflects the overall dynamics of slope stability. Despite their relevance, slope units may oversimplify local variations by averaging out critical details, potentially leading to less precise predictions.

To address these limitations, this research proposes an integrated methodological approach that combines the strengths of both pixel- and slope-units. Environmental variables are extracted from high-resolution Digital Elevation Model (DEM) and available thematic maps. Predictor values are computed at the pixel level, while key statistical descriptors (e.g., mean, standard deviation, quantiles) are aggregated within corresponding slope units. This dual-level analysis captures fine-scale heterogeneities alongside broader geomorphological trends, enhancing the predictive performance of landslide susceptibility assessments.

The methodology is applied to a study area in El Salvador, significantly impacted by tropical storms—such as Hurricane IDA in 2009, Amanda and Cristobal in 2020, and Julia in 2022—that have caused extensive flooding and triggered thousands of landslides. Preliminary results indicate that the integrated mapping strategy improves model accuracy and provides insights into how different terrain partitioning schemes influence susceptibility assessments. This approach serves as a robust tool for disaster risk management and land-use planning.

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**KEYWORDS** Landslide Susceptibility, Pixel-based Units, Slope Units, Tropical Storms, El Salvador

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