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Evaluation the influence of Landslide Density in the Constructed Landslide Susceptibility Models: An Example from Lao-Nong River Watershed, Taiwan

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In landslide susceptibility analysis, landslide inventories and causative factors are utilized to build a susceptibility model by using a statistical approach for future landslides prediction. In this study, the Lao-Nong River watershed which covered an area 1367 Km2 in southern Taiwan is selected as the study area. The study area has suffered severe landslides and debris flows during past five years. Therefore, it provides enough datasets to study the influence of landslide density in the constructed susceptibility model. The Weight-of-Evidence method which is a bivariate statistical approach is selected for the statistical analysis of this study. The Weight-of-Evidence approach uses the concept of Bayes' theorem and odds ratio to calculate the weighting of each causative factors in the model. For each causative factor, a weighting value for landslide susceptibility is derived, and the weight values of all causative factors are then summed to represent the final landslide susceptibility. Five landslide inventories with landslide density in the range of 0.30% to 7.22% are used as datasets to construct the susceptibility model. These inventories are mapped from 8 m resolution Formosat-2 satellite images that taken after major rainfalls induced by typhoons and covered the period from 2007 to 2009. The slope gradient, slope aspect, slope geometry, elevation, rock types, normalize difference vegetation index (NDVI), the distance from geological structure, and the distance from stream are selected as causative factors to construct the model. The study results show that a better susceptibility model is constructed by using a dataset with a lower landslide density. In models constructed by using datasets with a landslide density 0.30% and 0.48%, the area under the success rate curves (AUC) reaches 93.3% and 88.8%, respectively. However, only 65.7 % of the area is under the success rate curve in the model constructed by using a dataset with 7.22 % landslide density. In addition, using the landslide inventory with a density 1.19% to test the constructed model, the area under the prediction rate curve for the model with a landslide density 0.30% and 0.48% reach 0.80 and 0.84, respectively which are much higher than 0.58 that obtained from the model with a landslide density 7.22%.